

30W Stereo, Inductor-Less Digital Audio, Closed-Loop System with 96kHz Extended Audio Processing

1 General Description

The RT9125 is a high-efficiency, I²S-input, stereo channel audio power amplifier delivering 2x30W into 8Ω BTL (Bridge Tied Load) speaker loads. It can deliver over 94% power efficiency and eliminate the need for heat-sink.

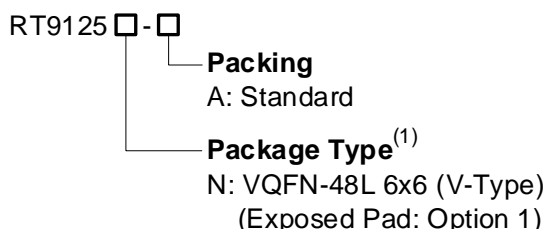
Built-in protection circuits provide over-temperature, overcurrent, overvoltage, DC, and undervoltage protections, and report error status.

The RT9125 is an I²S device receiving all clocks from external sources. A fully programmable datapath routes these channels to the internal speaker drivers.

The RT9125 features three band DRC (Dynamic Range Compression) and flexible multi-band biquads for anti-clipping, power limiting, and speaker equalization.

The recommended junction temperature range is -40°C to 150°C, and the ambient temperature range is -40°C to 85°C.

2 Ordering Information



Note 1.

Richtek products are Richtek Green Policy compliant and marked with ⁽¹⁾ indicates compatible with the current requirements of IPC/JEDEC J-STD-020.

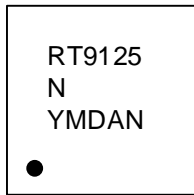
3 Features

- **Flexible Power Supply Range**
 - PVDD from 4.5V to 26.4V
 - DVDD and I/O: 1.8V or 3.3V
- **Support Wide Range Audio Format**
 - Bit Resolution up to 32 Bits
 - Support TDM (Time-Division Multiplexing) up to 32 Bits
 - Sampling Frequency from 8kHz to 96kHz
- **Excellent Audio Performance**
 - 2x30W into 8Ω BTL at 24V
 - SNR ≥ 110dB
 - Efficiency ≥ 94%
 - Built-In Programmable DSP (Digital Signal Processor) Function
 - 36 Programmable Biquads for Speaker Equalization
 - Programmable Coefficients for DRC Filters and Supporting Multi-Compression Ratios
 - Programmable 128-Tap FIR
- **Excellent Self-Protection**
 - UVLO, OVP, OCP, Thermal Foldback, OTP, and DCP
 - Built-In DC Blocking Filters
- **Filter-Less Application**
- **VQFN-48L Thermally-Enhanced Package**

4 Applications

- LCD-TV
- Monitors
- Home Audio
- Amusement Equipment
- Electronic Music Equipment

5 Marking Information



RT9125N: Product Code
YMDAN: Date Code

6 Simplified Application Circuit

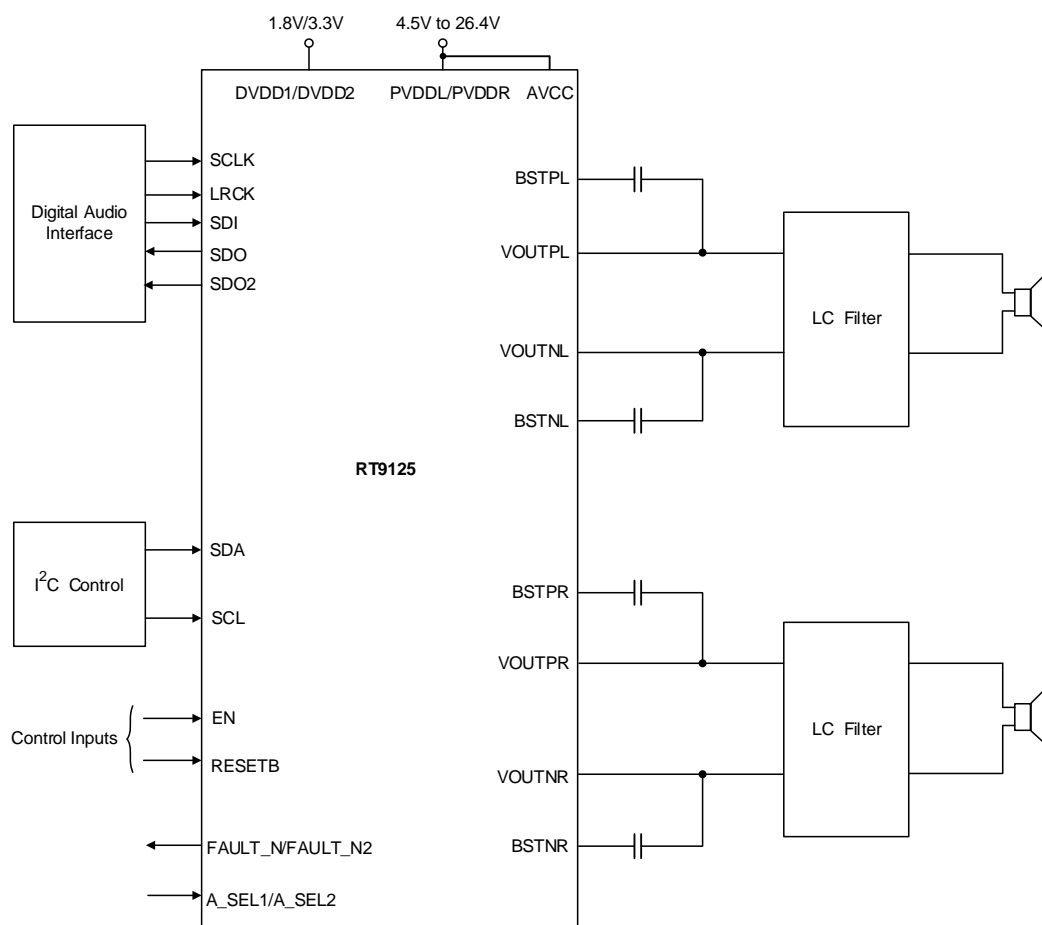
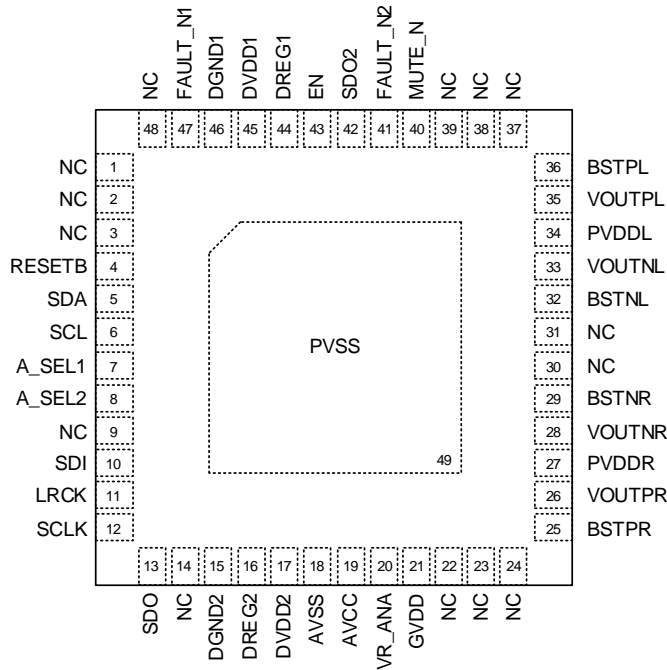


Table of Contents

1	General Description	1	17.18	DRC Timing Equation	60
2	Ordering Information	1	17.19	Peak Mode RMS Mode (Control Page).....	62
3	Features	1	17.20	DRC Enable (Control Page)	63
4	Applications	1	17.21	Multi Band DRC EQ.....	64
5	Marking Information	2	17.22	MBDRC/Output Mixer (Change to DRC Page).....	66
6	Simplified Application Circuit	2	17.23	Post-Gain (Change to DRC Page)	68
7	Pin Configuration	4	17.24	Volume Ramp.....	69
8	Functional Pin Description	4	17.25	Compensate Filter.....	70
8.1	IO Type Definition	5	17.26	Data Output (Control Page).....	71
9	Functional Block Diagram	6	17.27	Amplification Gain	74
10	Absolute Maximum Ratings	7	17.28	Master Volume Gain	75
11	Recommended Operating Conditions	7	17.29	Hard Clip Function.....	75
12	Electrical Characteristics.....	8	17.30	PBTL Function	76
13	Typical Application Circuit	12	17.31	Mono PBTL Application Circuit.....	76
13.1	3.3V I/O Application (BTL).....	12	17.32	Mono Configuration.....	77
13.2	1.8V I/O Application (BTL).....	13	18	Operation	80
13.3	3.3V I/O Application (PBTL)	14	18.1	Error Reporting	80
13.4	1.8V I/O Application (PBTL)	15	18.2	Clock Detection.....	80
14	Timing Diagram	16	18.3	Volume Control.....	80
14.1	Turn-On Timing Diagram (1).....	17	18.4	Overvoltage Protection.....	80
14.2	Turn-On Timing Diagram (2).....	18	18.5	Over-Temperature Protection.....	80
14.3	Turn-On Timing Diagram (3).....	19	18.6	Dynamic Range Enhancement	80
14.4	Turn-Off Timing Diagram (1).....	20	18.7	Built-In Anti-POP Function	80
14.5	Turn-Off Timing Diagram (2).....	21	18.8	Overcurrent Protection	80
14.6	Turn-Off Timing Diagram (3).....	22	18.9	Undervoltage Protection.....	80
14.7	Initial Sequence (BTL Mode)	23	18.10	OLD/SLD Function.....	81
14.8	Initial Sequence (PBTL Mode).....	24	18.11	CRC Check Function.....	81
14.9	Command to Access AMP Portion.....	25	18.12	Multi Signal Path Option.....	81
15	Typical Operating Characteristics.....	26	18.13	Common Mode Hopping Mode	81
15.1	BTL, PWM = 768kHz.....	26	18.14	Spread Spectrum.....	82
15.2	PBTL, PWM = 768kHz.....	31	18.15	PWM Phase Change	83
16	Overall Signal Path	35	18.16	UVP Speaker Fade Out Function	84
17	Detailed Signal Path	36	19	Application Information	85
17.1	When SRC Enable	36	19.1	I ² C Bus Specification	85
17.2	When SRC Disable.....	37	19.2	Communication Protocol.....	85
17.3	DC Protection Function (Amp Portion).....	38	19.3	Boost Capacitor Selection.....	85
17.4	Protection Behavior (FAULT_N1, Digital Portion).....	38	19.4	Device Addressing.....	85
17.5	Protection Behavior (FAULT_N2, AMP Portion)	39	19.5	LC Filter Selection.....	86
17.6	Fault Behavior Type Select (FAULT_N2).....	40	19.6	I ² C Write Control.....	86
17.7	Input Mixer (Change to SDO_Mixer_Page).41		19.7	I ² C Read Control	86
17.8	FIR Filter (When SRC Disable)	43	19.8	Thermal Considerations	86
17.9	Input High Pass Filter (Control Page).....	44	19.9	Layout Guide.....	88
17.10	EQ Link and Bypass (Control Page).....	45	20	Functional Register Description	90
17.11	EQ	46	21	Outline Dimension	140
17.12	Smooth Bi-Quad.....	47	22	Footprint Information.....	141
17.13	DPEQ.....	49	23	Packing Information	142
17.14	Surround (Spatializer).....	51	23.1	Tape and Reel Data	142
17.15	CCS (Cross Talk Cancellation System).....	53	23.2	Tape and Reel Packing.....	143
17.16	Master Volume and Ch1/Ch2 Volume (Control Page).....	55	23.3	Packing Material Anti-ESD Property	144
17.17	Multi-Band DRC (Change to DRC Page).....	56	24	Datasheet Revision History.....	145

7 Pin Configuration

(TOP VIEW)



VQFN-48L 6x6

8 Functional Pin Description

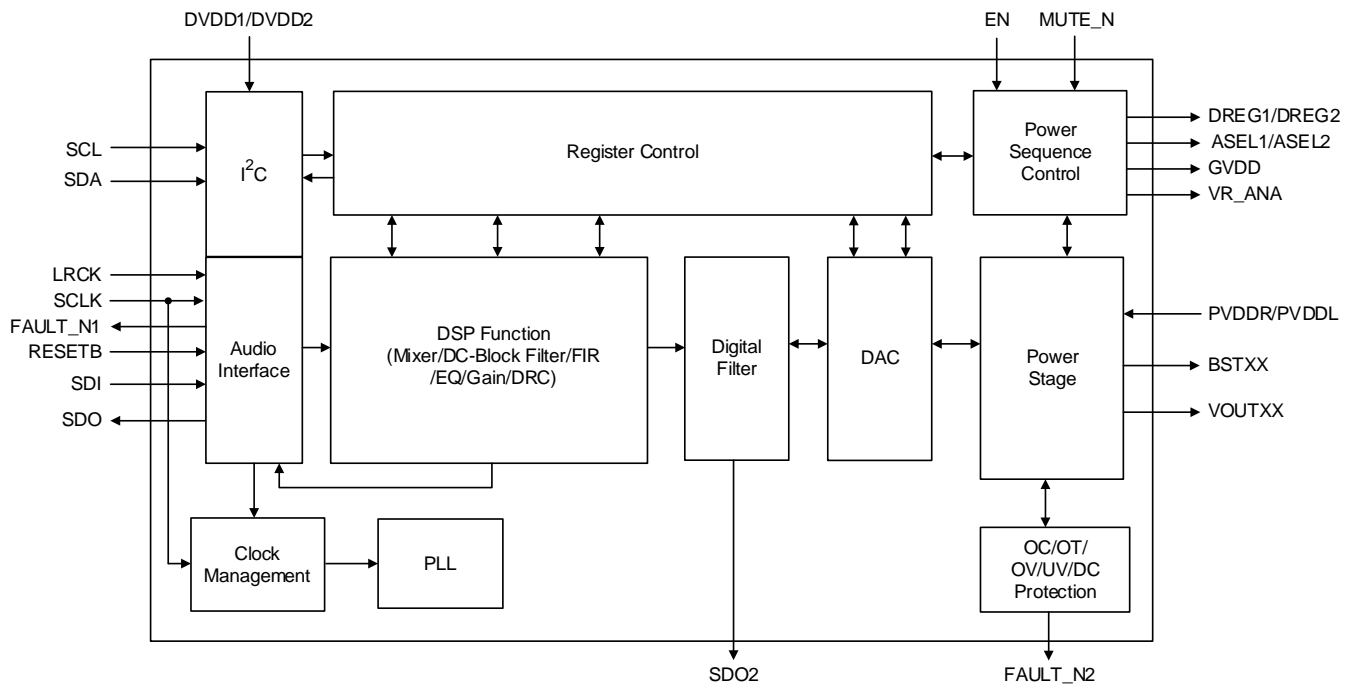
Pin No.	Pin Name	IO	Pin Function
1, 9, 14, 22, 23, 24, 30, 31, 37, 38, 39, 48	NC	P	Tied to main GND.
2, 3	NC	P	Test pin, floating.
4	RESETB	DI	RESET, low active.
5	SDA	DIO	I ² C data input/output.
6	SCL	DI	I ² C clock input.
7	A_SEL1	DI	Slave address selection 1.
8	A_SEL2	DI	Slave address selection 2.
10	SDI	DI	I ² S data input.
11	LRCK	DI	I ² S L/R clock input.
12	SCLK	DI	I ² S bit clock input.
13	SDO	DO	I ² S data output for DSP.
15	DGND2	P	Digital GND.
16	DREG2	P	1.8V LDO output.
17	DVDD2	P	1.8V or 3.3V power supply for I/O. Connect to DVDD1.
18	AVSS	P	Ground for analog circuits.

Pin No.	Pin Name	IO	Pin Function
19	AVCC	P	26.4V power supply for analog circuits.
20	VR_ANA	P	Analog reference voltage. The typical current is about 11.6mA, and the maximum current is about 12mA.
21	GVDD	P	Internal power supply generated by LDO. The typical current is about 4.2mA, and the maximum current is about 5mA.
25	BSTPR	P	Bootstrap supply for VOUTPR.
26	VOUTPR	AO	Positive output of RCH.
27	PVDDR	P	26.4V power supply for RCH.
28	VOUTNR	AO	Negative output of RCH.
29	BSTNR	P	Bootstrap supply of VOUTNR.
32	BSTNL	P	Bootstrap supply of VOUTNL.
33	VOUTNL	AO	Negative output of LCH.
34	PVDDL	P	26.4V power supply for LCH.
35	VOUTPL	AO	Positive output of LCH.
36	BSTPL	P	Bootstrap supply for VOUTPL.
40	MUTE_N	DI	Mute pin, low active.
41	FAULT_N2	DO	Fault indication for AMP portion.
42	SDO2	DO	I ² S data output for AMP portion.
43	EN	DI	RESET function, low active.
44	DREG1	P	1.2V LDO output.
45	DVDD1	P	1.8V or 3.3V power supply for DSP portion and I/O. Connect to DVDD2.
46	DGND1	P	Digital GND.
47	FAULT_N1	DO	Fault indication for DSP portion.
49 (Exposed Pad)	PVSS	P	Ground.

8.1 IO Type Definition

- P: Power Pin
- DI: Digital Input Pin
- DO: Digital Output Pin
- DIO: Digital Input and Output Pin
- AO: Analog Output Pin

9 Functional Block Diagram



10 Absolute Maximum Ratings

(Note 2)

- Supply Voltage, AVCC, PVDDL, PVDDR -----0.3V to 31.6V
- Supply Voltage, DVDD1, DVDD2 -----0.3V to 6V
- Speaker Amplifier Output Voltage, VOUTPR, VOUTNR, VOUTNL, VOUTPL -----0.3V to 31V
- BSTPR, BSTNR, BSTNL, BSTPL (Note 3) -----0.3V to 36V
- RESETB, SDA, SCL, FAULT_N2, FAULT_N1 -----0.3V to 6V
- A_SEL1, A_SEL2, LRCK, SCLK, SDI, MUTE_N, EN -----0.3V to DVDD + 0.5V
- VOUTPR, VOUTNR, VOUTPL, VOUTNL (Note 4) -----10V to 37V
- SDO, SDO2 -----0.3V to 6V
- DREG2 -----0.3V to 4V
- VR_ANA, GVDD -----0.3V to 6V
- DREG1 -----0.3V to 1.7V
- Power Dissipation, PD @ TA = 25°C
VQFN-48L 6x6 -----3.7W
- Package Thermal Resistance (Note 5)
VQFN-48L 6x6, θ_{JA} -----27°C/W
VQFN-48L 6x6, θ_{JC} -----6.8°C/W
- Lead Temperature (Soldering, 10sec.) -----260°C
- Junction Temperature -----150°C
- Storage Temperature Range -----65°C to 150°C
- ESD Susceptibility (Note 6)
HBM (Human Body Model) -----2kV

Note 2. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions may affect device reliability.

Note 3. The result is defined when the cross voltage between BST and VOUT is 5V.

Note 4. The switching terminal should be used within AC peak limits. Overshoot and undershoot must be less than 100ns.

Note 5. θ_{JA} is simulated under natural convection (still air) at TA = 25°C with the component mounted on a high effective-thermal-conductivity four-layer test board on a JEDEC 51-7 thermal measurement standard. θ_{JC} is simulated at the exposed pad of the package.

Note 6. Devices are ESD sensitive. Handling precautions are recommended.

11 Recommended Operating Conditions

(Note 7)

- Supply Input Voltage, DVDD1 DVDD2 -----3V to 3.6V
- Supply Input Voltage (For 1.8V I/O), DVDD1, DVDD2, DREG2 (Note 8) -----1.74V to 1.98V
- Supply Input Voltage, PVDDL, PVDDR, AVCC -----4.5V to 26.4V
- Ambient Temperature Range -----40°C to 85°C
- Junction Temperature Range -----40°C to 150°C

Note 7. The device is not guaranteed to function outside its operating conditions.

Note 8. In 1.8V I/O application, 1.8V is needed to be supplied from an external voltage source to DVDD1, DVDD2 and VREG2.

12 Electrical Characteristics

(PVDDL = PVDDR = AVCC = 12.7V, DVDD = 3.3V, $R_L = 6\Omega$, $T_A = 25^\circ\text{C}$, $f_{sw} = 384\text{kHz}$, $L = 8.2\mu\text{H}$, $C = 0.47\mu\text{F}$, unless otherwise specified.) (Note 9)

Parameter		Symbol	Test Conditions		Min	Typ	Max	Unit	
EN, RESETB, MUTE_N	VIH: High-Level-Input Voltage	VIH			DVDD x 0.7	--	--	V	
	VIL: Low-Level-Input Voltage	VIL			--	--	DVDD x 0.3		
FAULT_N1, FAULT_N2	VOL: Low-Level-Output Voltage	VOL	IPULLUP = 3mA		--	--	0.4	V	
DVDD1+DVDD2 Quiescent Current (Normal Mode)		IQ_DVDD	EN = 3.3V, for DVDD		--	8.5	--	mA	
DVDD1+DVDD2 Shutdown Current		IDVDD_STBY	EN = 0V, no load, no LC filter		--	5	15	μA	
PVDDL/R+AVCC Quiescent Current (CMH Mode)		IQ_P	EN = 3.3V, switch 25% duty, no load, no LC filter, PWM = 384kHz		17.5	20.5	23.5	mA	
			EN = 3.3V, switch 25% duty, L = 8.2μH, C = 0.47μF, PWM = 384kHz		--	20	--		
			EN = 3.3V, switch 25% duty, L = 6.8μH, C = 0.22μF, PWM = 768kHz		--	20	30		
			PVDD = 12.7V, EN = 3.3V, switch 25% duty, no load, no LC filter, PWM = 768kHz		30.5	34	37.5		
PVDDL/R+AVCC Shutdown Current		ISD_P	EN = 0V, no load, no LC filter		--	10	20	μA	
Drain-Source On-State Resistance		RDSOn	PVDD = 12V, IO = 500mA, TJ = 25°C		High-Side	--	95	--	mΩ
					Low-Side	--	85	--	
AMP Gain Variation		ΔAV(SPK_AMP)	AMP to AMP gain difference		-0.5	--	0.5	dB	
Speaker Gain Variation		ΔAV(L/R Ch)	L/R channel gain difference		--	--	0.4	dB	
Startup Time from Shutdown		tON			--	45	--	ms	
Volume Ramp Up			The ramp up time depends on the setting of register 0x0A. Note: The default setting for register 0x0A is 01.		4.33	--	34.65	ms	
PWM Shutdown Time from EN Set to Low		tOFF	Timing between from EN set to low to the PWM stop output		--	--	200	μs	
Volume Ramp Down Time			The amp down time depends on the setting of register 0x0A. Note: The default setting for 0x0A is 01.		4.33	--	34.65	ms	

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
PWM Switching Frequency	fsw	384kHz mode	--	384	--	kHz
		768kHz mode	--	768	--	
RMS Output Power BD Modulation	Po	THD + N = 10%, (BTL), PVDD = 18V, RL = 6Ω	--	27	--	W
		THD + N = 1%, (BTL), PVDD = 18V, RL = 6Ω	--	23	--	
Total Harmonic Distortion + Noise	THD+N	Po = 1W (BTL)	--	0.03	--	%
Output Integrated Noise	Vn	20Hz to 20kHz, A-weighted	--	35	--	μV
Output Offset Voltage	Vos	PVDD = 12V with offset calibration enable	-5	--	5	mV
		PVDD = 24V with offset calibration enable	-5	--	5	
Cross-Talk	XTALK	Output power = 1W, 1kHz with none shielding choke	--	-75	--	dB
		Output power = 1W, 1kHz with shielding choke	--	-100	--	
Signal-to-Noise Ratio	SNR	PVDD = 24V, 1% THD + N, RL = 4Ω	--	113	--	dB
Power Supply Rejection Ratio	PSRR	Frequency @1kHz with 200mVpp ripple	--	75	--	dB
Dynamic Range	DR	Input level -60dBFS	--	113	--	dB
Efficiency	η	PVDD = 12V, output power = 10W + 10W, Load = 8Ω	--	94	--	%
		PVDD = 18V, output power = 1.25W + 1.25W, Load = 6Ω	--	70	--	
Over-Temperature Protection	TOTP	Guaranteed by design	150	160	175	°C
Over-Temperature Protection Hysteresis	TOTP_HYS		--	20	--	°C
Overcurrent Protection	IOCP		6	7	--	A
PVDDL/PVDDR Overvoltage Protection	VOVP		28	--	30	V
PVDDL/PVDDR Undervoltage Protection	VUVP	The PVDD UVP threshold can be programmed, and set from 4V to 20V. Refer to register 0x6C for detailed settings.	3.98	4	--	V
OLD	OLD		16	--	--	Ω
SLD	SLD		--	--	2	Ω
Minimum Load						
PVDD Range (Note 10)		BTL, R = 4Ω (Note 11)	--	--	21	V
		BTL, R ≥ 5Ω (Note 11)	--	--	26.4	
		PBTL, R = 2Ω	--	--	21	
		PBTL, R ≥ 3Ω	--	--	26.4	

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
I²C Interface Electrical Characteristics							
High-Level Input Voltage (Belongs to the internal 1.8V domain)		V _{IH_I2C}		DVDD x 0.7	--	--	V
Low-Level Input Voltage (Belongs to the internal 1.8V domain)		V _{IL_I2C}		--	--	DVDD x 0.3	V
Digital Output Low (SDA)		V _{OL_I2C}	IPULLUP = 3mA	--	--	0.4	V
Clock Operating Frequency		f _{SCL}		--	--	400	kHz
Bus Free Time Between Stop and Start Condition		t _{BUF}		1.3	--	--	μs
Hold Time After (Repeated) Start Condition		t _{HD;STA}		0.6	--	--	μs
Repeated Start Condition Setup Time		t _{SU;STA}		0.6	--	--	μs
Stop Condition Time		t _{SU;STO}		0.6	--	--	μs
Input Data Hold Time		t _{HD;DAT (IN)}		0	--	900	ns
Data Setup Time		t _{SU;DAT}		100	--	--	ns
Clock Low Period		t _{LOW}		1.3	--	--	μs
Clock High Period		t _{HIGH}		0.6	--	--	μs
Clock Data Fall Time		t _F		20	--	300	ns
Clock Data Rise Time		t _R		20	--	300	ns
Spike Suppression Time		t _{SP}		--	--	20	ns
Slave Mode I²S Interface Electrical Characteristics							
High-Level Input Voltage		V _{IH_I2S}		DVDD x 0.7	--	--	V
Low-Level Input Voltage		V _{IL_I2S}		--	--	DVDD x 0.3	V
SDO	VOH: High-Level Output Voltage	V _{OH_I2S}		0.7 x DVDD	--	--	V
	VOL: Low-Level Output Voltage	V _{OL_I2S}		--	0.4	--	
High-Level Input Voltage		V _{IH_I2S}	DVDD = 1.8V	1.4	--	--	V
Low-Level Input Voltage		V _{IL_I2S}	DVDD = 1.8V	--	--	0.5	V
SDO	VOH: High-Level Output Voltage	V _{OH_I2S}	DVDD = 1.8V	0.7 x DVDD	--	--	V
	VOL: Low-Level Output Voltage	V _{OL_I2S}	DVDD = 1.8V	--	0.2	--	V
Frequency		f _{SCLKIN}		1.024	--	12.288	MHz
Setup Time, LRCK to SCLK Rising Edge		t _{su1}		10	--	--	ns

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Hold Time, LRCK from SCLK Rising Edge	th1		10	--	--	ns
Setup Time, SDI to SCLK Rising Edge	tsu2		10	--	--	ns
Hold Time, SDI from SCLK Rising Edge	th2		10	--	--	ns
Rise/Fall Time for SCLK/LRCK	trs/tfs		--	--	10	ns
I ² S Duty Cycle	%		40	--	60	%

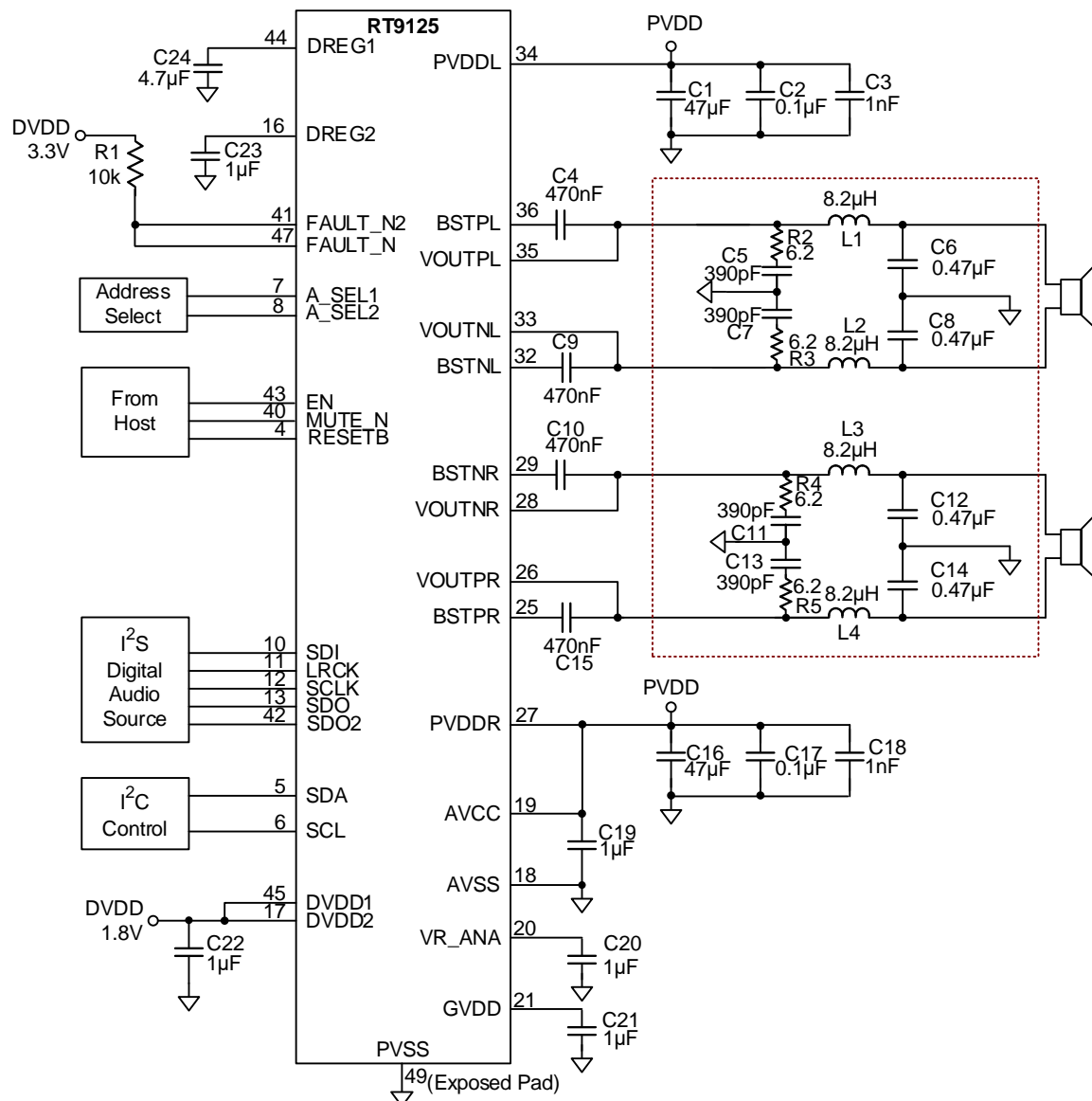
Note 9. Measurements were made using the RT9125 evaluation board and Audio Precision System 2722 with an AUX-0025 low-pass filter.

Note 10. If the maximum output power does not exceed the OCP value, there is no need to consider the minimum load.

Note 11. Add a snubber if the output power is over 15W for 4Ω, or 25W for 6Ω. Refer to page 12 and 13 for the BTL snubber circuit, and page 14 and 15 for the PBTL snubber circuit.

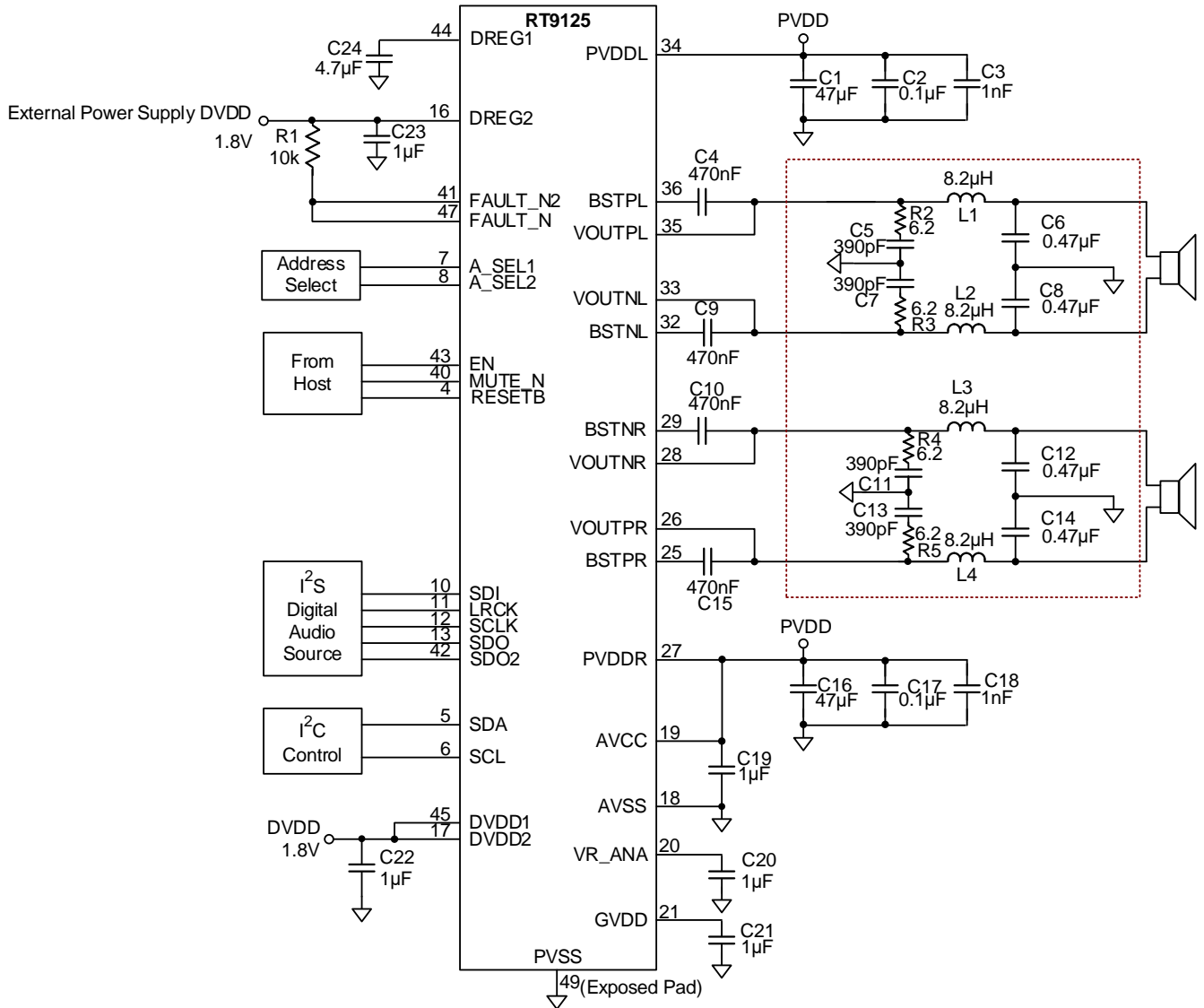
13 Typical Application Circuit

13.1 3.3V I/O Application (BTL)



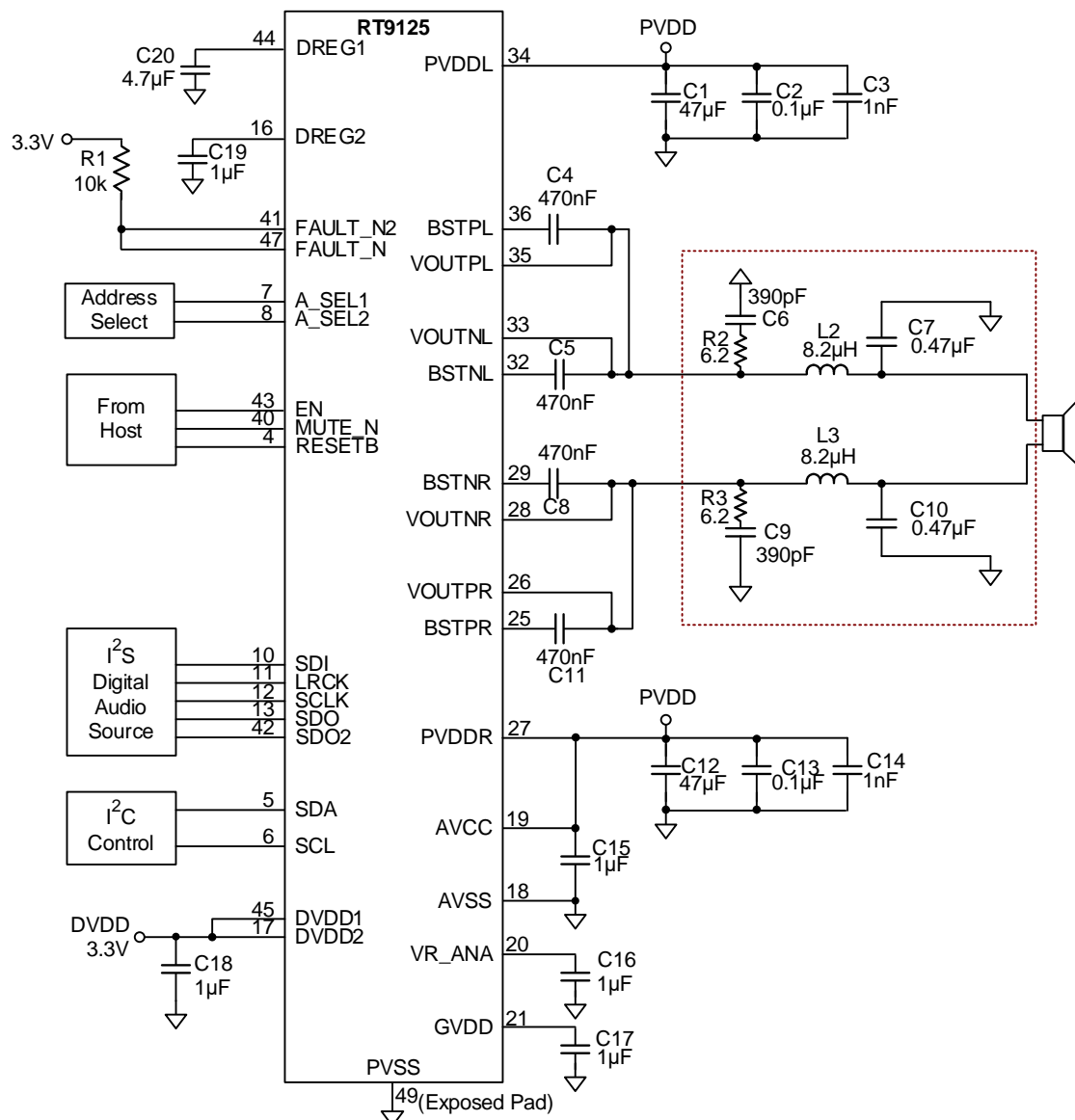
Note 12. For different PWM frequency and LC filter combinations, refer to the [Application Information](#) section.

13.2 1.8V I/O Application (BTL)



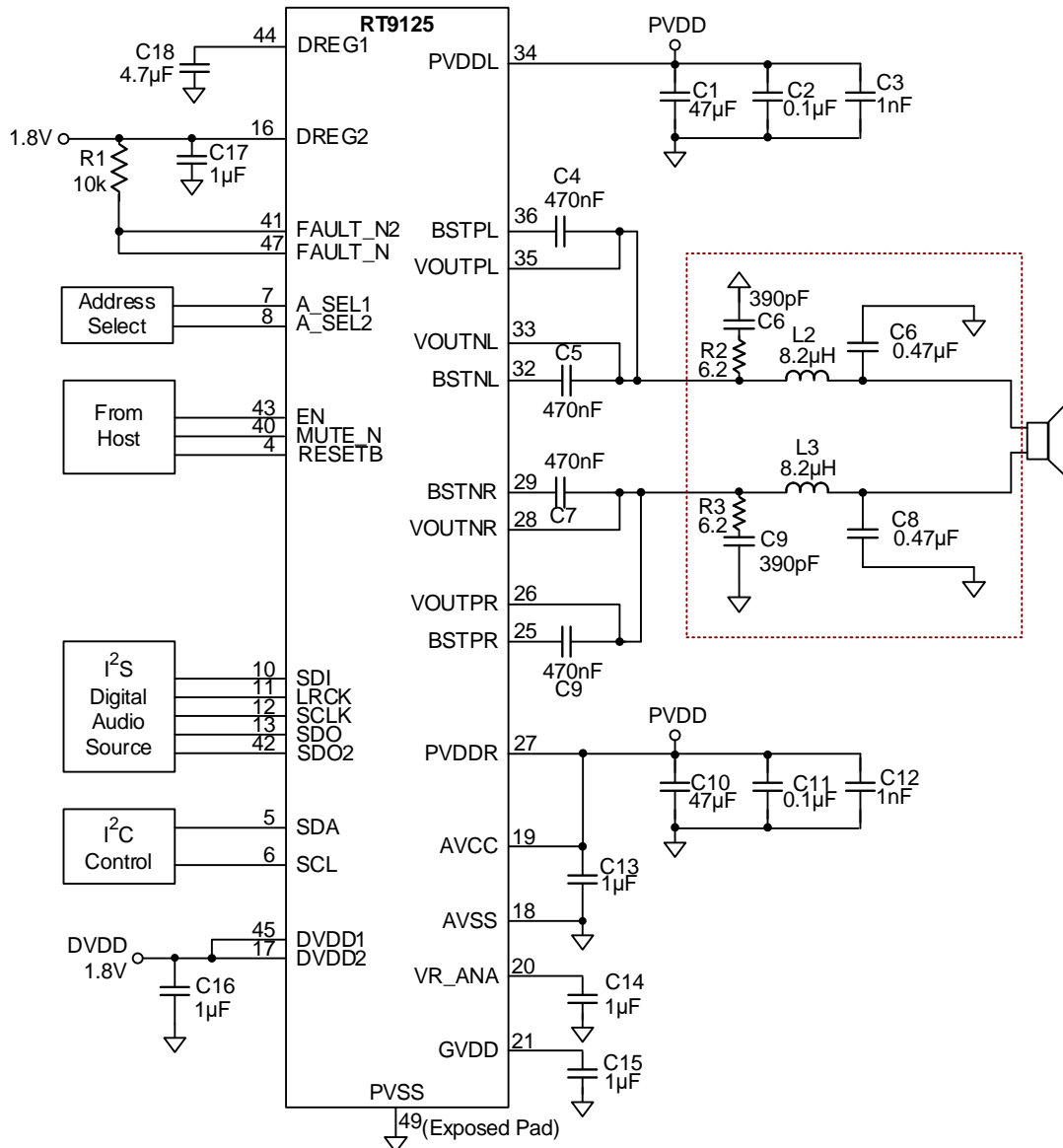
Note 13. For different PWM frequency and LC filter combinations, refer to the [Application Information](#) section.

13.3 3.3V I/O Application (PBTL)



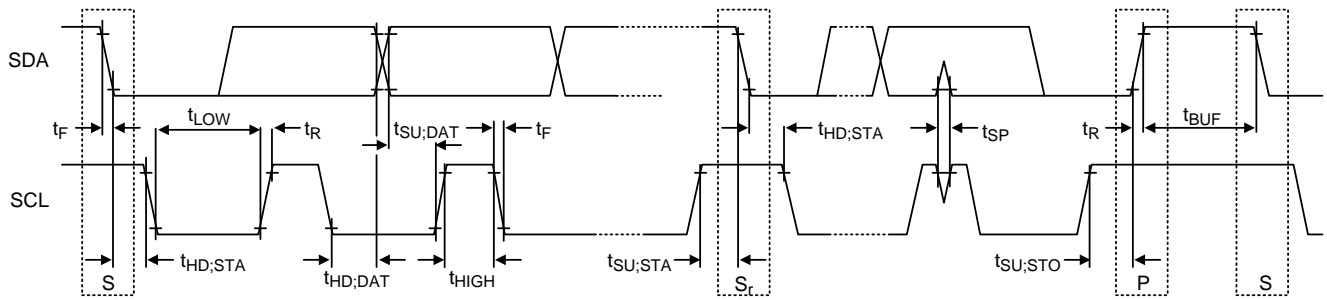
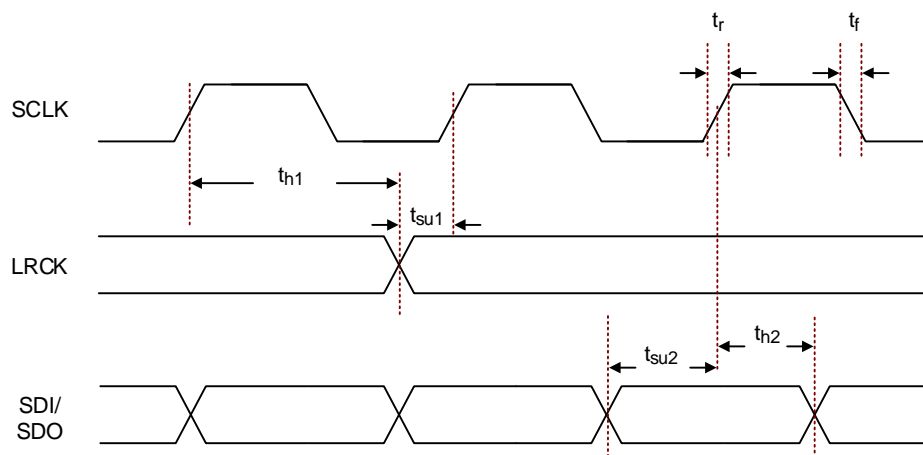
Note 14. For different PWM frequency and LC filter combinations, refer to the [Application Information](#) section.

13.4 1.8V I/O Application (PBTL)

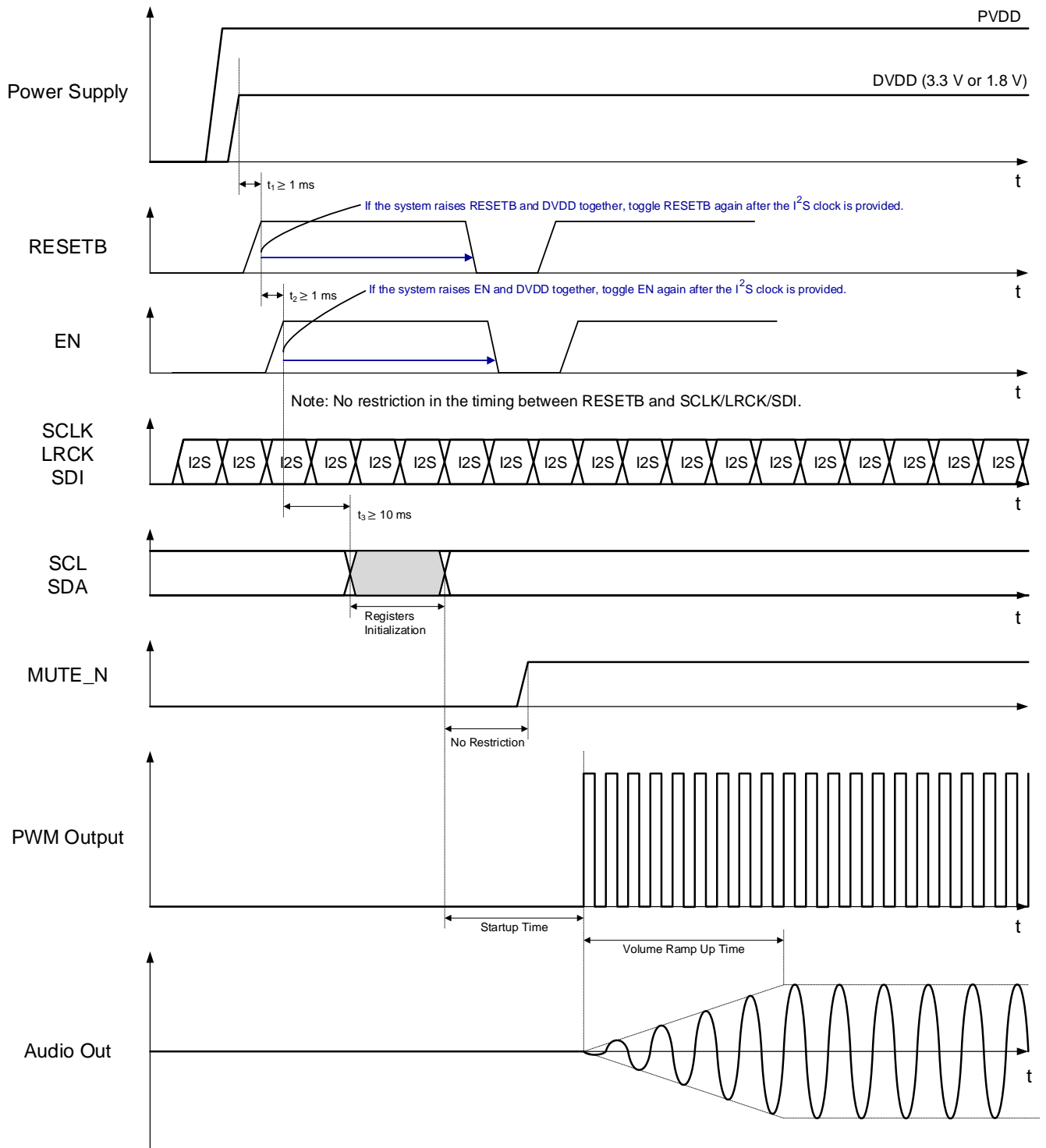


Note 15. For different PWM frequency and LC filter combinations, refer to the [Application Information](#) section.

14 Timing Diagram

Figure 1. I²C Interface Timing DiagramFigure 2. Timing Diagram of Slave Mode I²S Interface

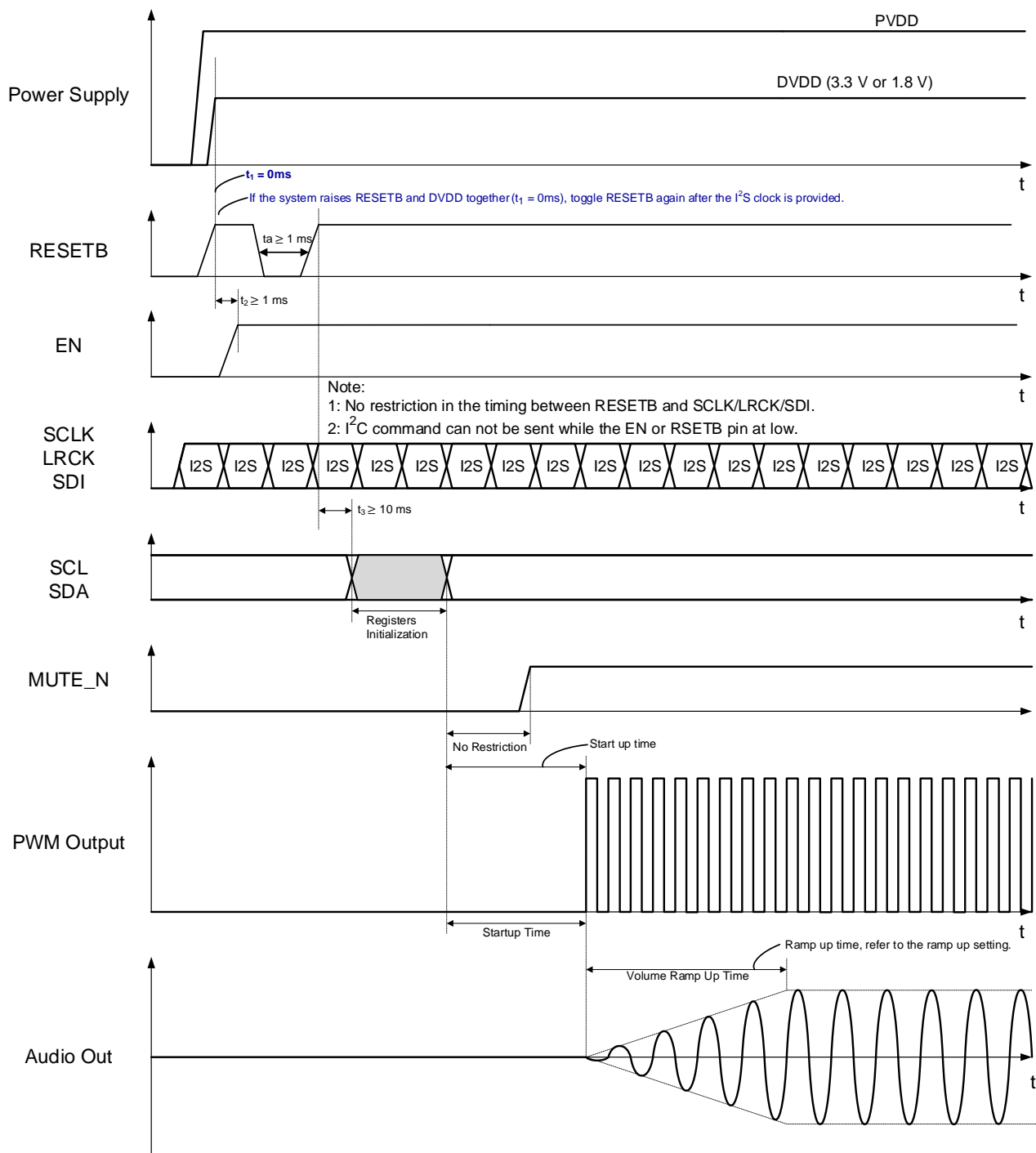
14.1 Turn-On Timing Diagram (1)



Note 16. Follow the timing sequence exactly. Any violation of the sequence is not allowed.

14.2 Turn-On Timing Diagram (2)

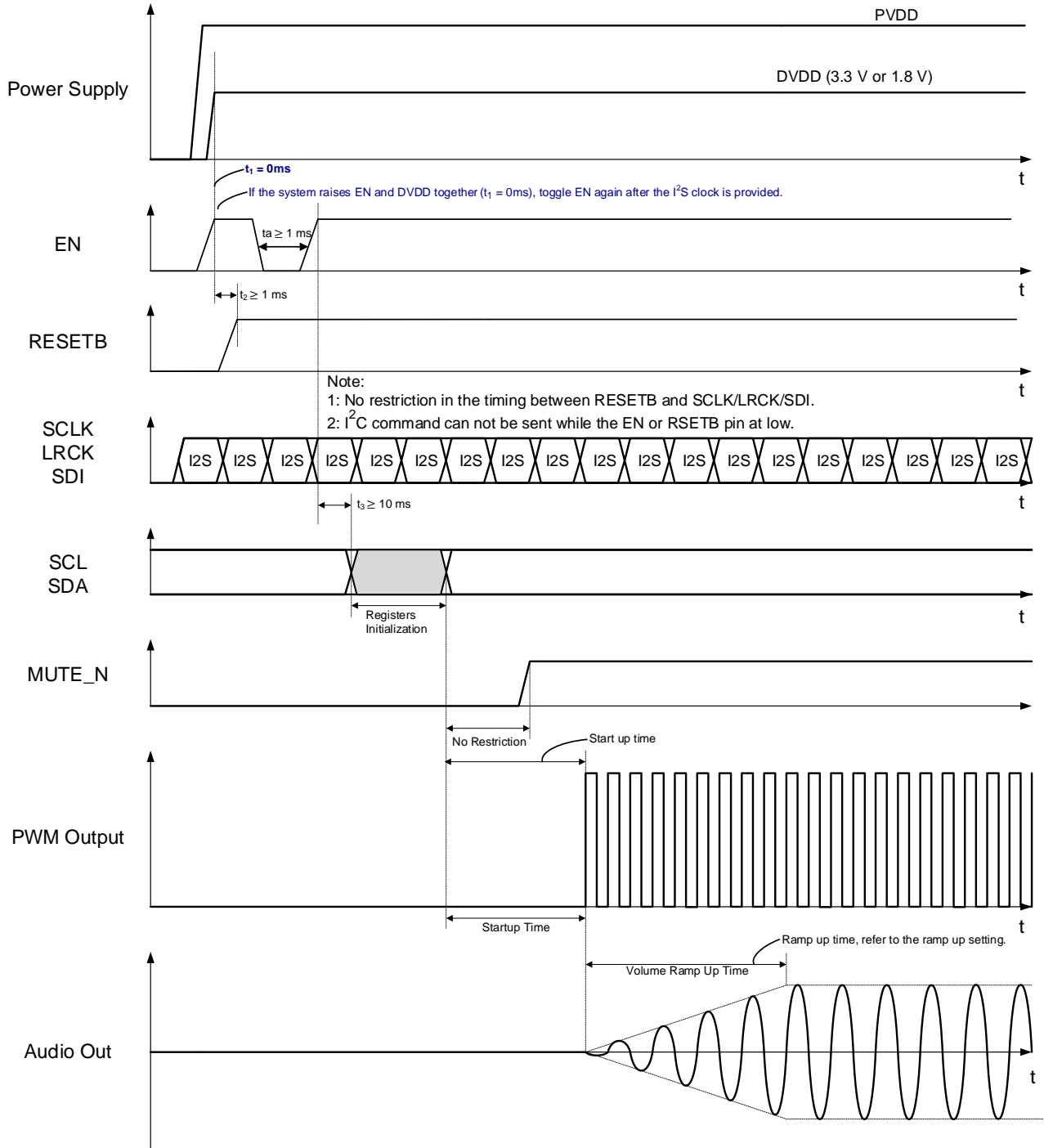
If the system raises RESETB and DVDD together, follow the sequence below.



Note 17. Follow the timing sequence exactly. Any violation of the sequence is not allowed.

14.3 Turn-On Timing Diagram (3)

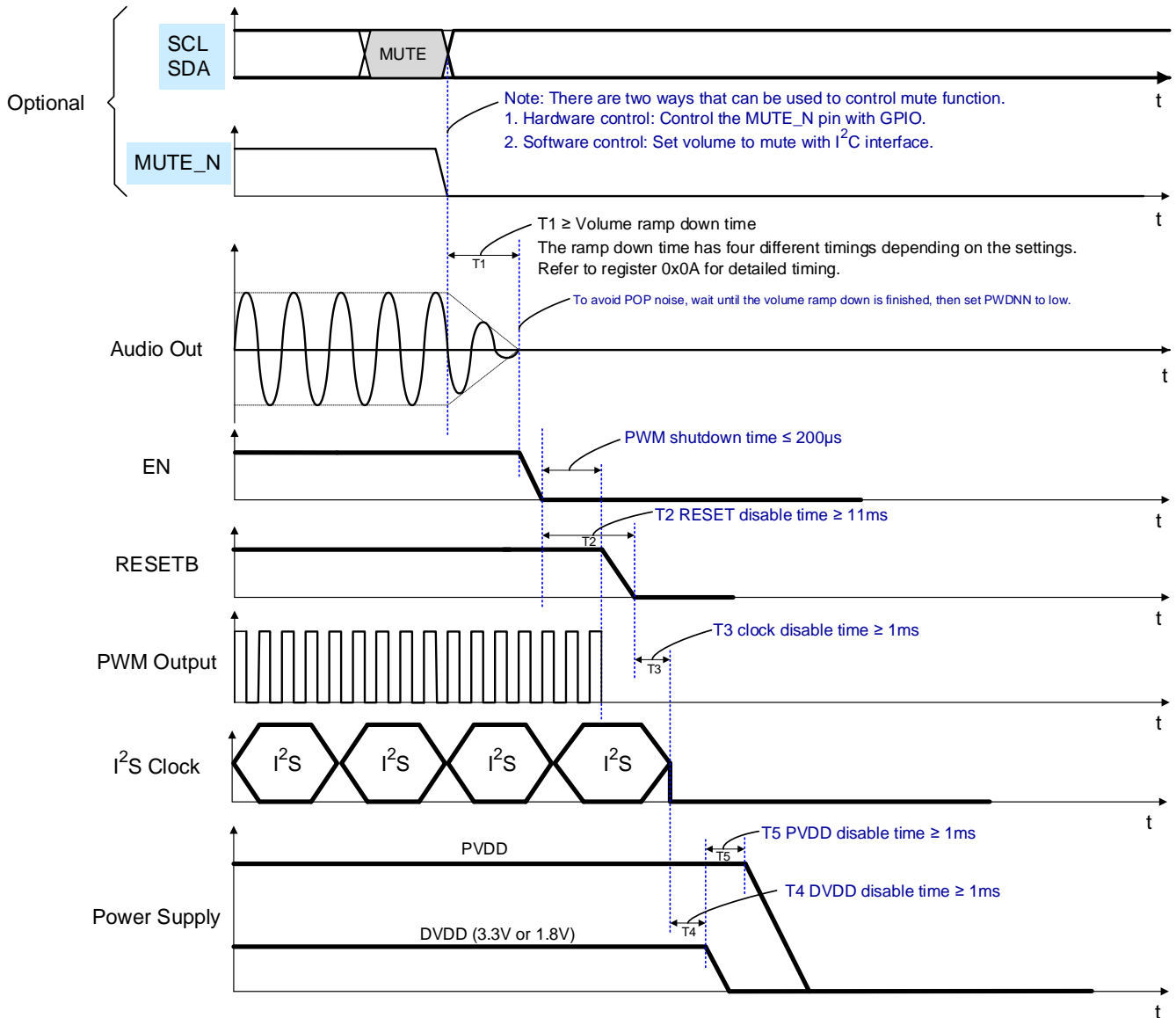
If the system raises EN and DVDD together, follow the sequence below.



Note 18. Follow the timing sequence exactly. Any violation of the sequence is not allowed.

14.4 Turn-Off Timing Diagram (1)

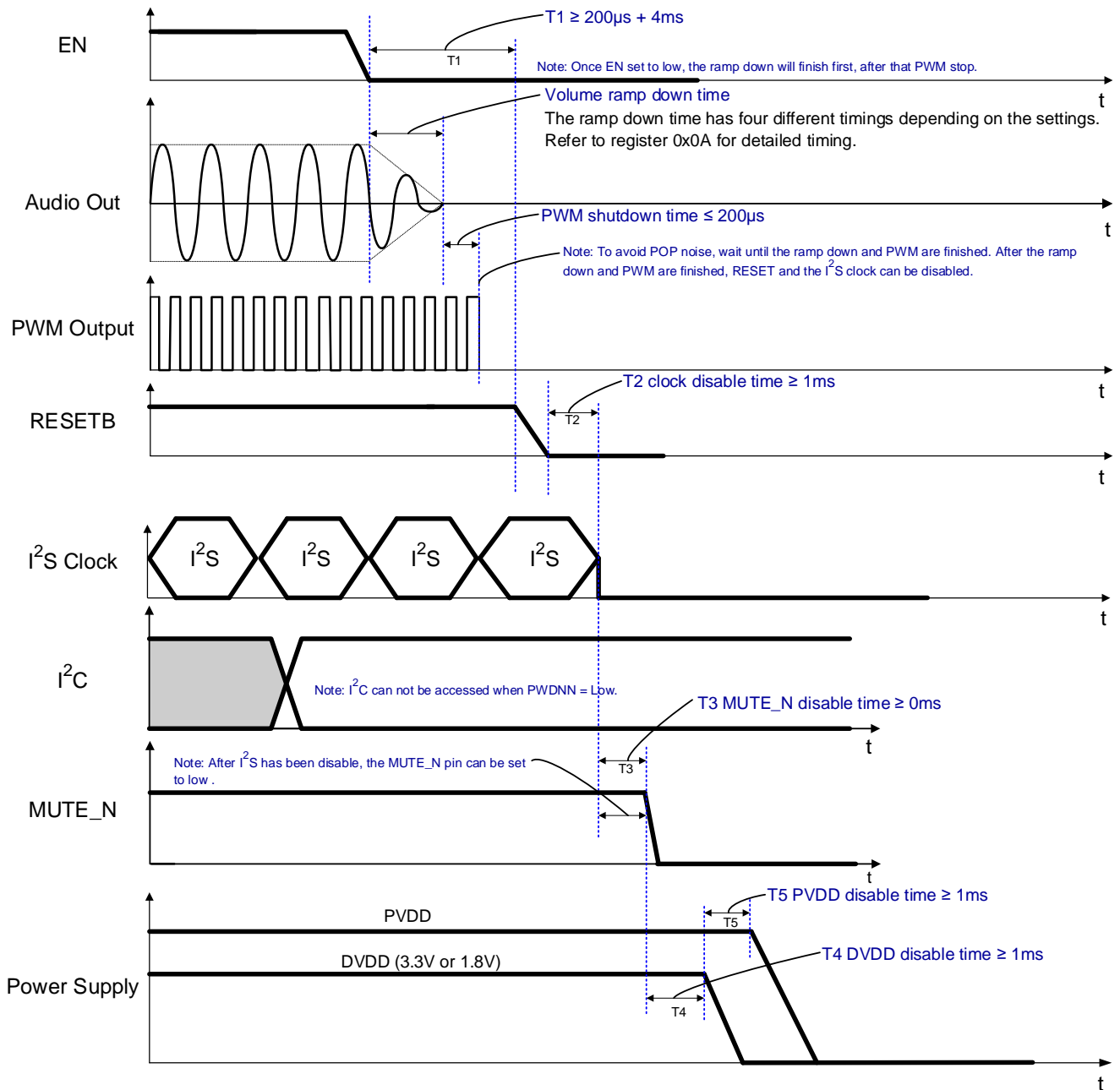
The control flow is as follows: MUTE_N/I²C → Ramp down finished → EN → RESET → PWM → I²S Clock → DVDD/PVDD.



Note 19. Follow the T1 to T5 timing sequence exactly. Any violation of the T1 to T5 timing sequence is not allowed. For AC off, also follow the T1 to T5 sequence.

14.5 Turn-Off Timing Diagram (2)

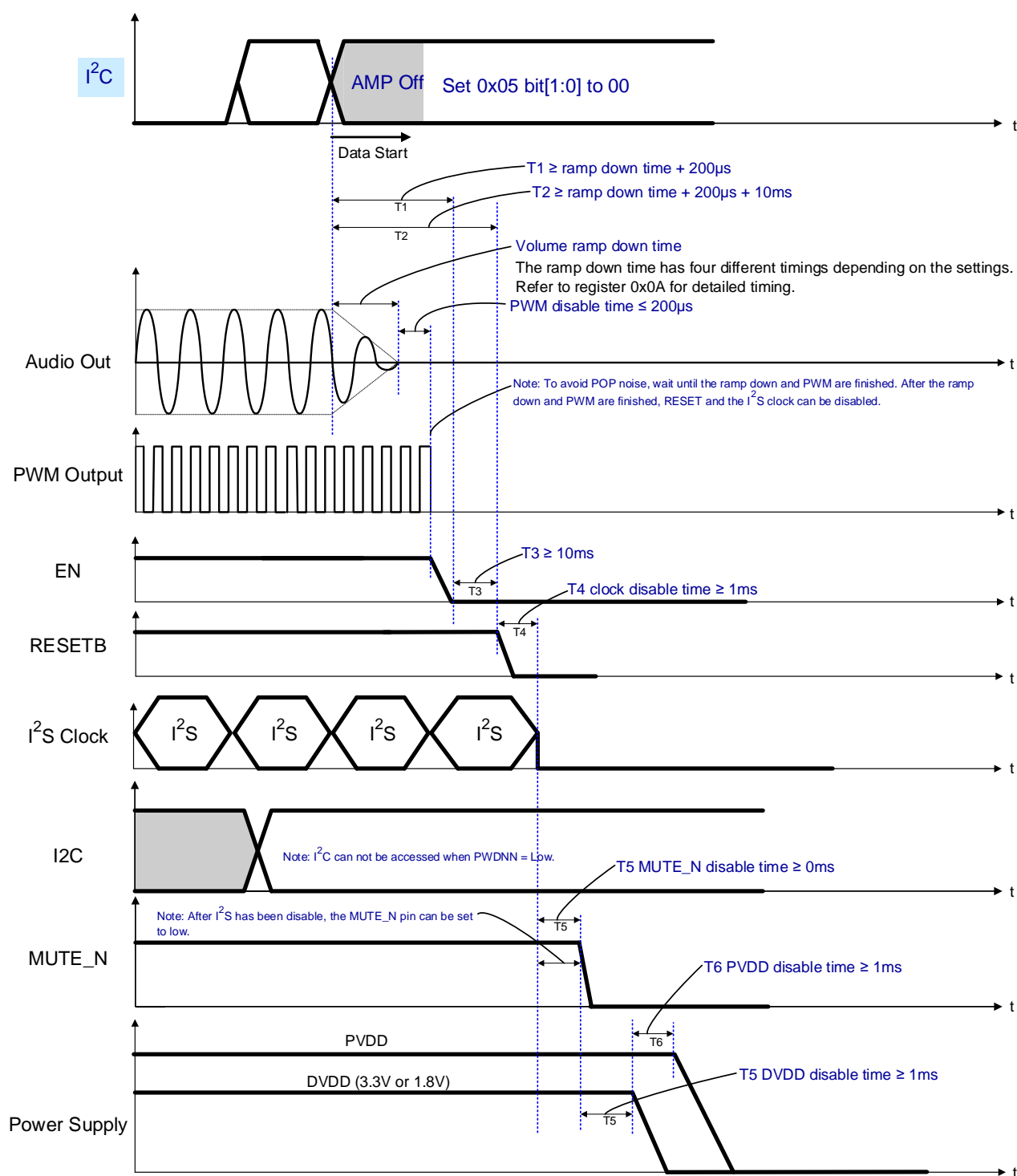
The control flow is as follows: EN → Ramp down and PWM finished → I²S Clock → DVDD/PVDD.



Note 20. Follow the T1 to T5 timing sequence exactly. Any violation of the T1 to T5 timing sequence is not allowed. For AC off, also follow the T1 to T5 sequence.

14.6 Turn-Off Timing Diagram (3)

The control flow is as follows: Use I²C to set AMP off → Ramp down and PWM finished → I²S Clock → DVDD/PVDD.



Note 21. Follow the T1 to T6 timing sequence exactly. Any violation of the T1 to T6 timing sequence is not allowed. For AC off, also follow the T1 to T6 sequence.

14.7 Initial Sequence (BTL Mode)

Sequence	reg_addr	reg_size	reg_value	Description	Note
1	0x27	1	0x30	Analog gain	
	0x26	1	0x07		
	0x25	1	0x17		
	0x28	1	0x4E		
2	0x27	1	0x30	Internal setting	
	0x26	1	0x64		
	0x25	1	0xA9		
	0x28	1	0x4E		
3	0x27	1	0x30	Internal setting	
	0x26	1	0x95		
	0x25	1	0xD0		
	0x28	1	0x4E		
4	0x27	1	0x30	CMH threshold. Threshold is 12.5W with 6Ω load.	
	0x26	1	0x94		
	0x25	1	0x65		
	0x28	1	0x4E		
5	0x27	1	0x30	Set the volume from mute to 0dB	
	0x26	1	0x20		
	0x25	1	0x01		
	0x24	1	0x80		
	0x28	1	0x4F		
6	0x08	1	0xF5	Digital Amp on (SRC on) Note: If SRC is enabled, set 0xF5.	Digital Amp turns on
	0x08	1	0xD5	Digital Amp on (SRC off) Note: If SRC is disabled, set 0xD1.	Digital Amp turns on
7	0x27	1	0x30	Analog Amp on	Amp turns on
	0x26	1	0x05		
	0x25	1	0xE5		
	0x28	1	0x4E		

14.8 Initial Sequence (PBTB Mode)

Sequence	reg_addr	reg_size	reg_value	Description	Note
1	0x27	1	0x30	Analog gain	
	0x26	1	0x07		
	0x25	1	0x17		
	0x28	1	0x4E		
2	0x27	1	0x30	Internal setting	
	0x26	1	0x64		
	0x25	1	0xA9		
	0x28	1	0x4E		
3	0x27	1	0x30	Internal setting	
	0x26	1	0x95		
	0x25	1	0xD0		
	0x28	1	0x4E		
4	0x27	1	0x30	CMH threshold. Threshold is 21W with 4Ω load.	
	0x26	1	0x94		
	0x25	1	0x6C		
	0x28	1	0x4E		
5	0x27	1	0x30	Set the volume from mute to 0dB	
	0x26	1	0x20		
	0x25	1	0x01		
	0x24	1	0x80		
	0x28	1	0x4F		
6	0x08	1	0xF5	Digital Amp on (SRC on) Note: If SRC is enabled, set 0xF5.	Digital Amp turns on
	0x08	1	0xD5	Digital Amp on (SRC off) Note: If SRC is disabled, set 0xD1.	Digital Amp turns on
7	0x27	1	0x30	Analog Amp on	Amp turns on
	0x26	1	0x05		
	0x25	1	0xF5		
	0x28	1	0x4E		

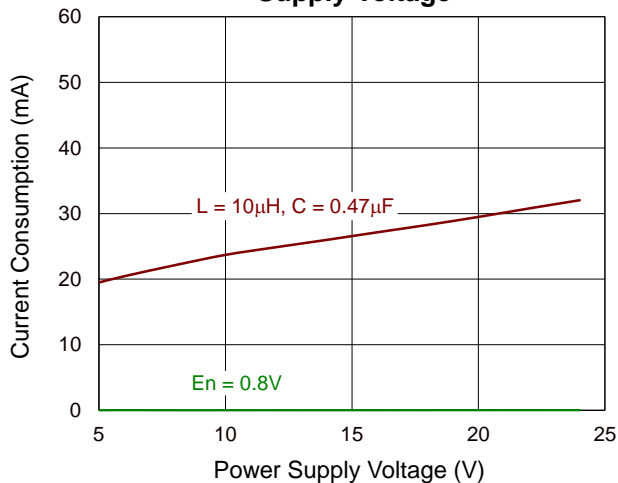
14.9 Command to Access AMP Portion

Description
<p>→ Step 1: Set 0x27 to 0x30 to select the AMP address. → Step 2: Set 0x26 to the AMP portion address where the address is to be set. → Step 3: Set 0x25 to the AMP portion setting. → Step 4: Send the writing command to 0x28.</p> <p>For example (Write): To set address 0x05 to 0x81: I2CW(0x27,{0x30}) I2CW(0x26,{0x05}) I2CW(0x25,{0x81}) I2CW(0x28,{0x4E})</p> <p>For example (Read): To read address 0x10: I2CW(0x27,{0x30}) I2CW(0x26,{0x6D}) I2CW(0x28,{0x49}) I2CW(0x27,{0x31}) I2CW(0x28,{0x48}) I2CW(0x28,{0x54})</p> <p>Note: These 4 commands form a set, and are required to access the AMP portion.</p>

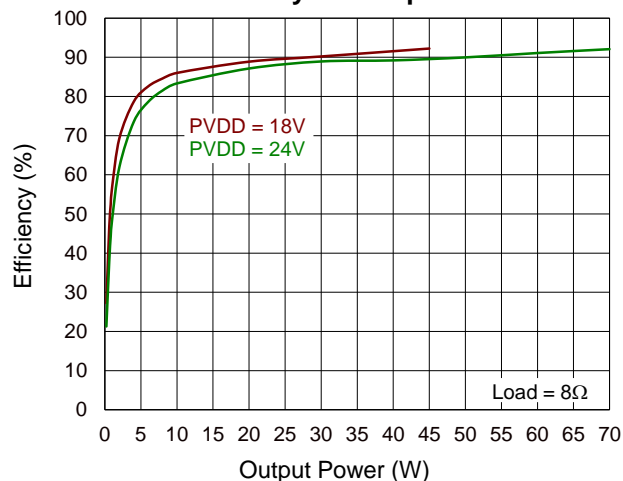
15 Typical Operating Characteristics

15.1 BTL, PWM = 768kHz

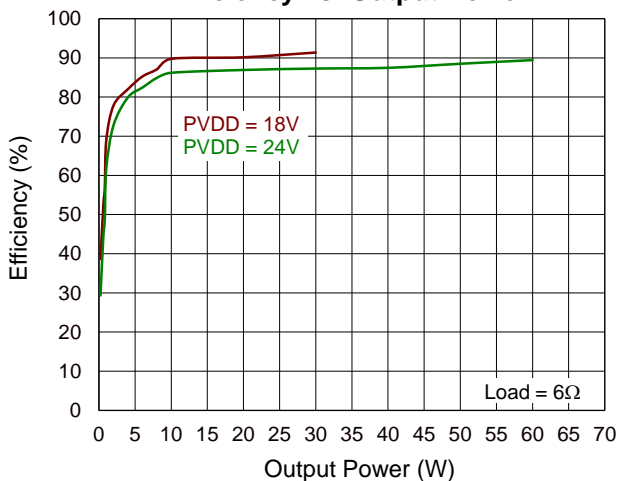
Current Consumption vs. Power Supply Voltage



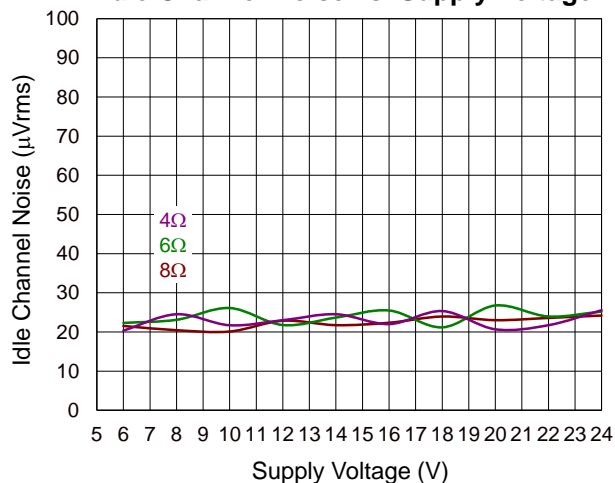
Efficiency vs. Output Power



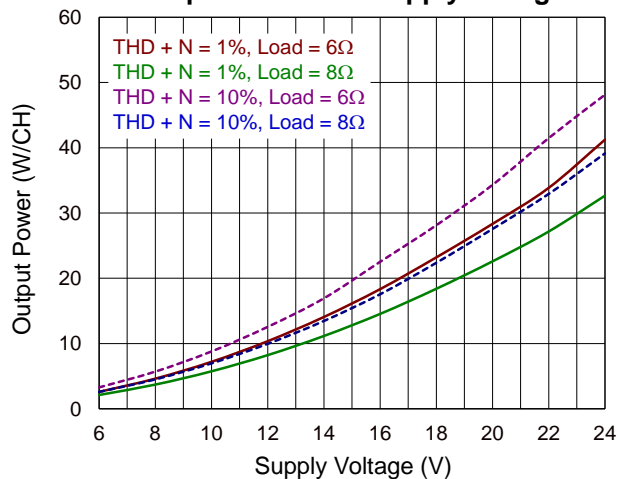
Efficiency vs. Output Power



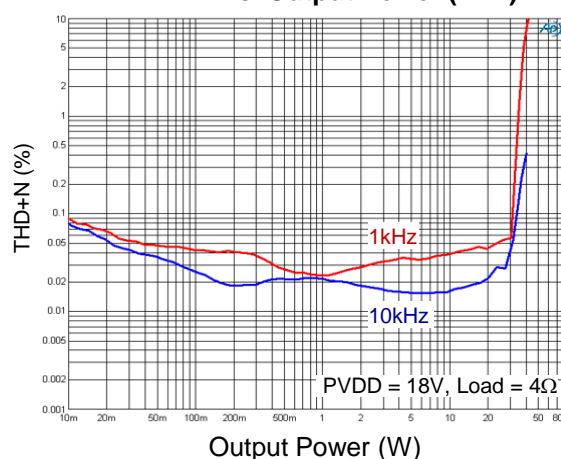
Idle Channel Noise vs. Supply Voltage

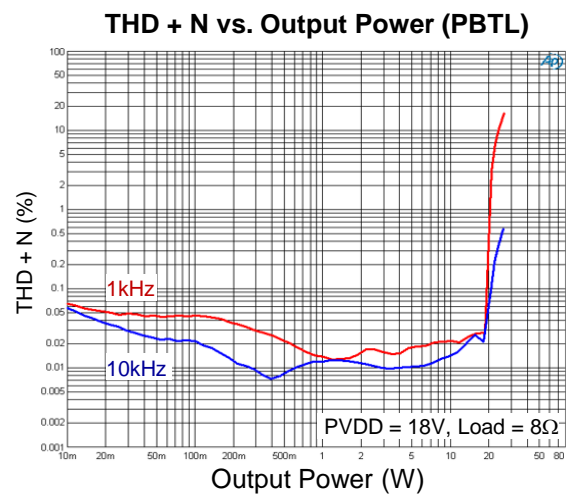
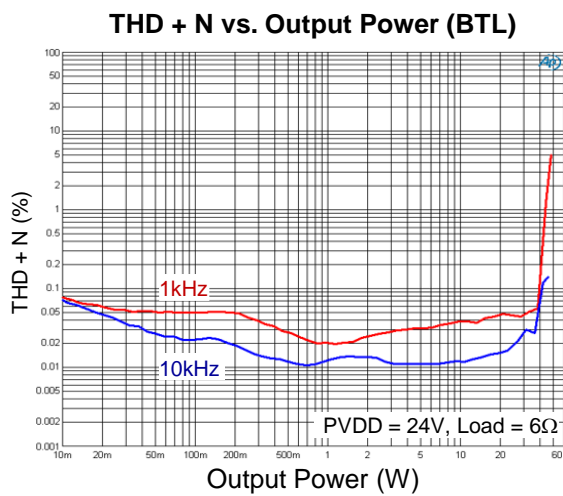
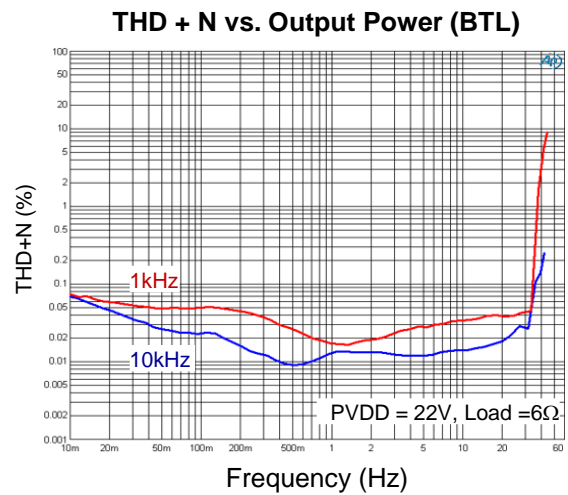
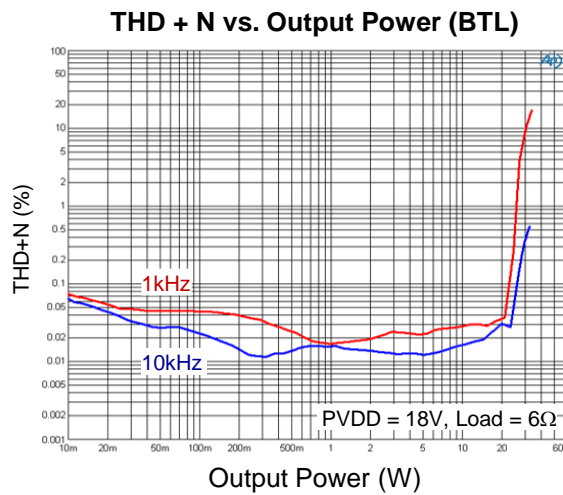
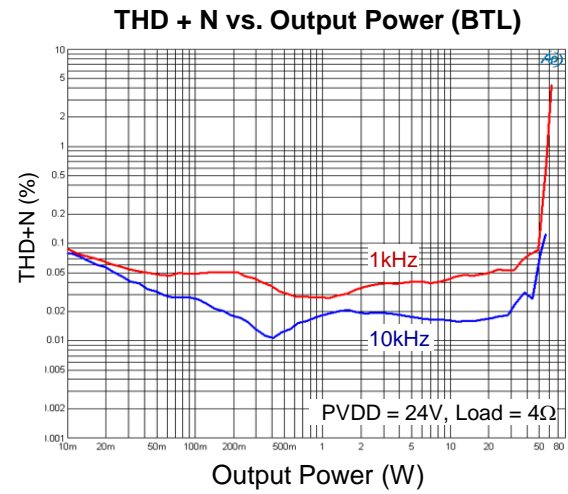
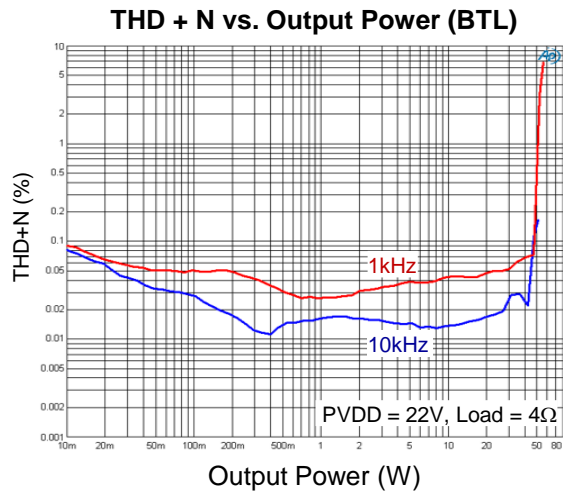


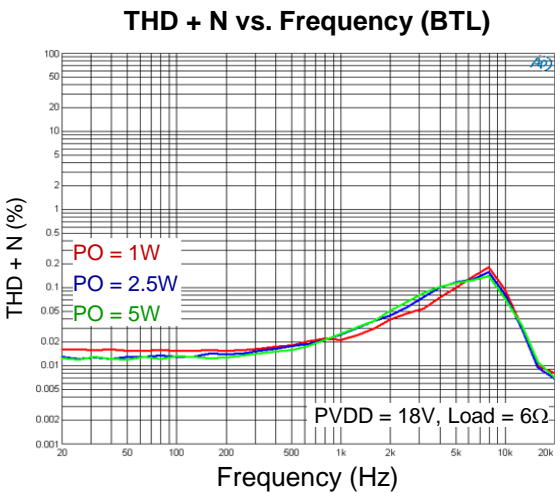
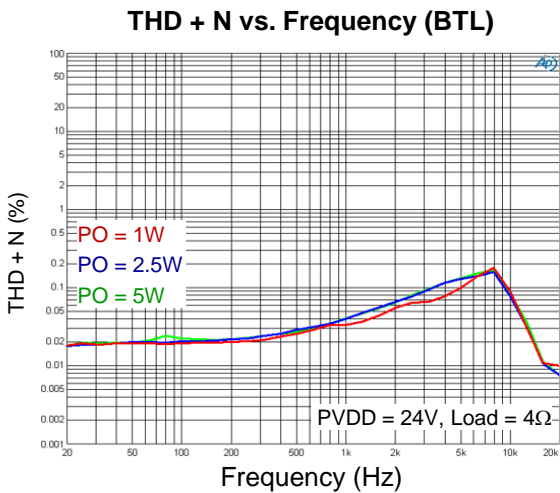
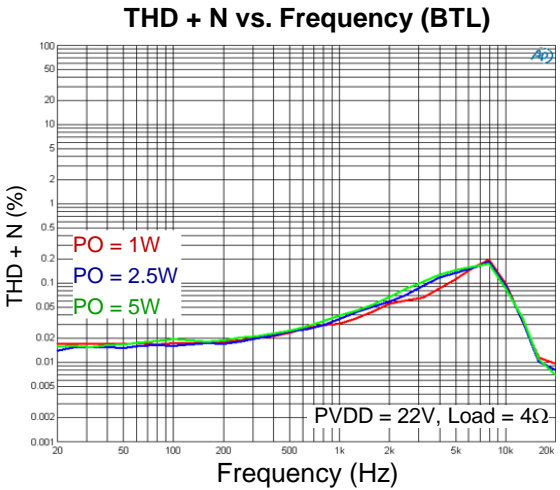
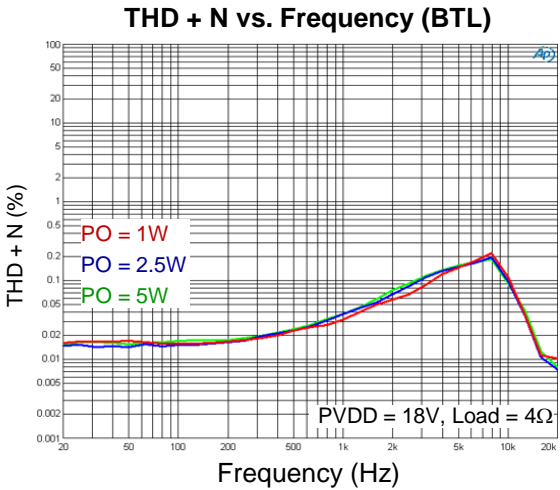
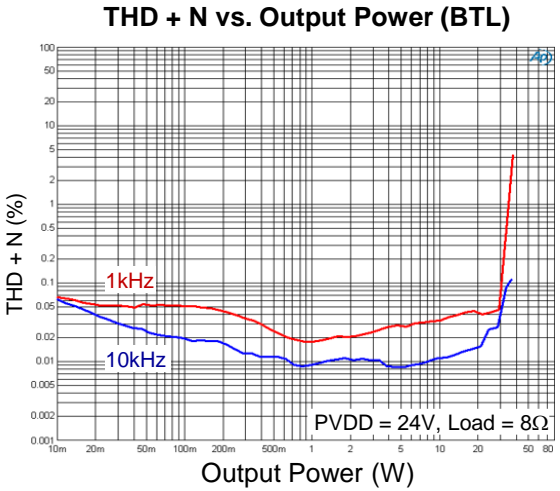
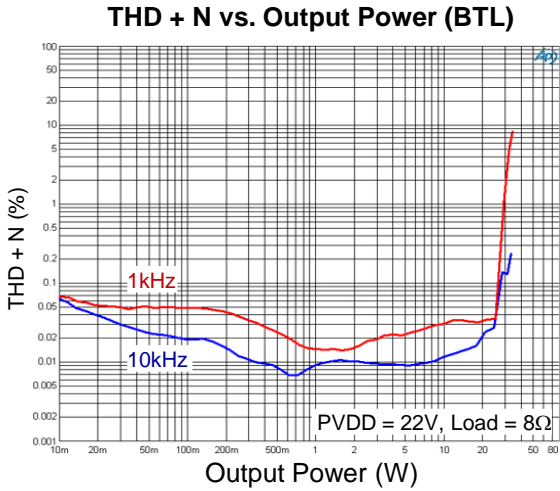
Output Power vs. Supply Voltage



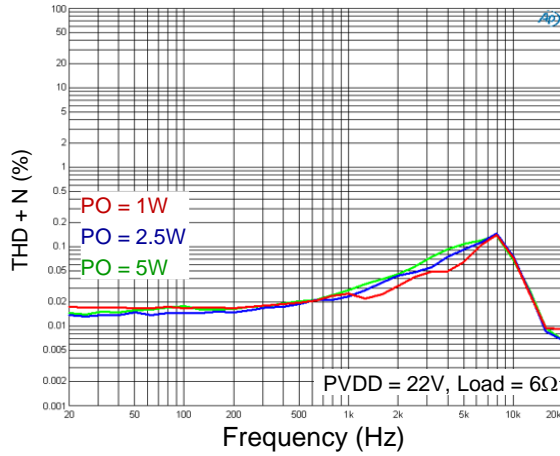
THD + N vs. Output Power (BTL)



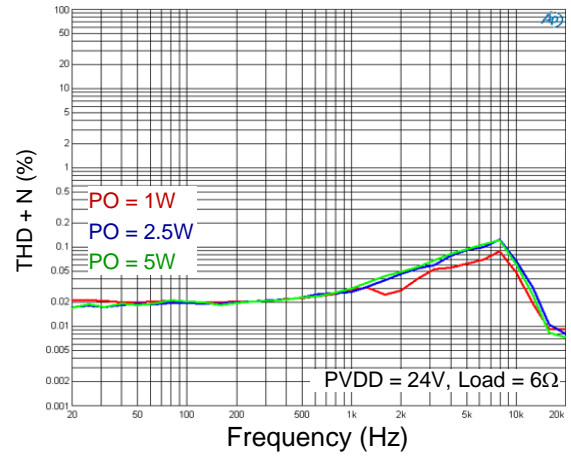




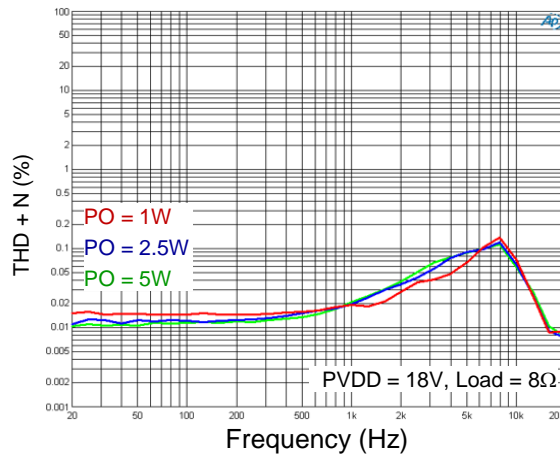
THD + N vs. Frequency (BTL)



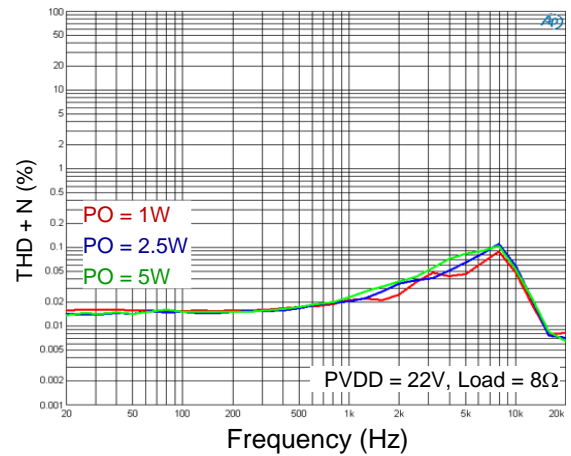
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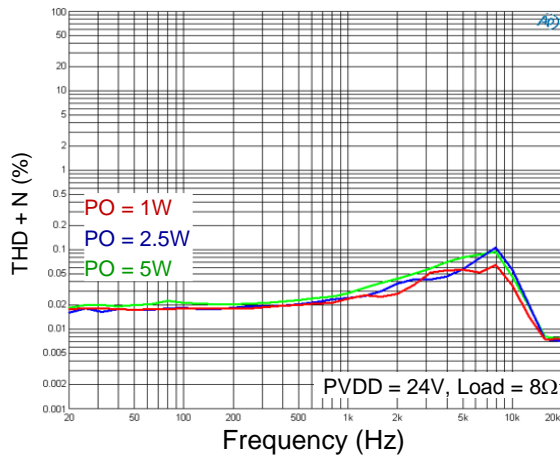
THD + N vs. Frequency (BTL)



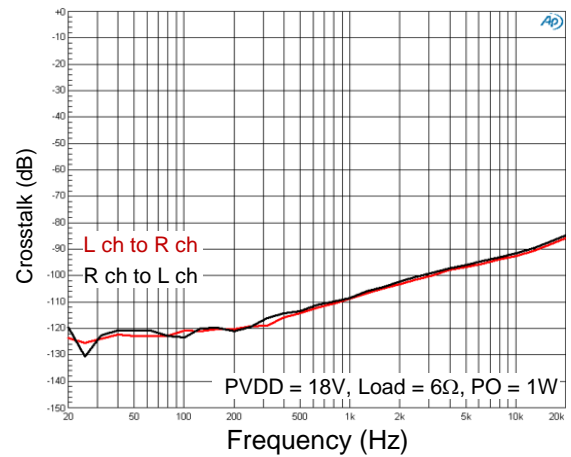
THD + N vs. Frequency (BTL)

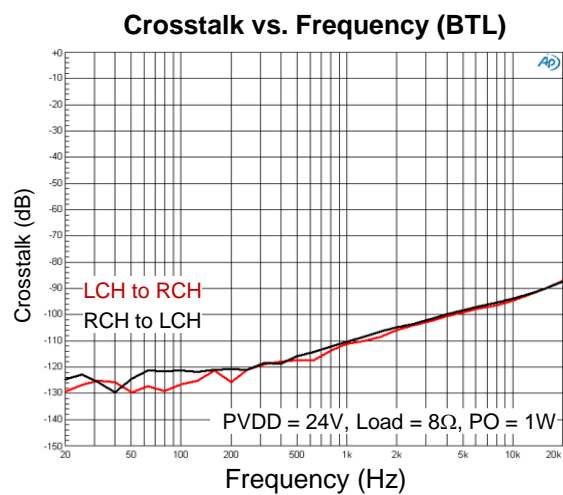
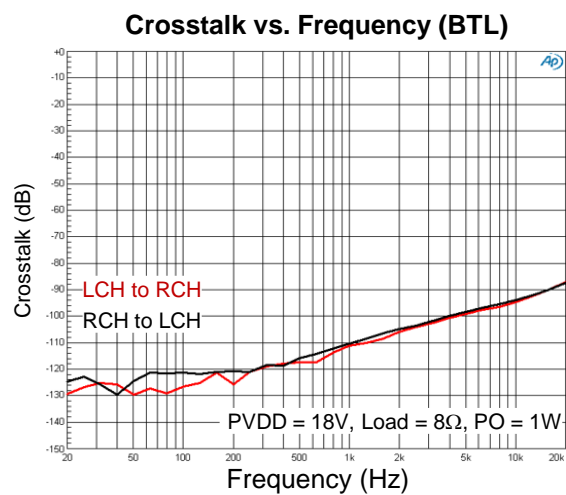
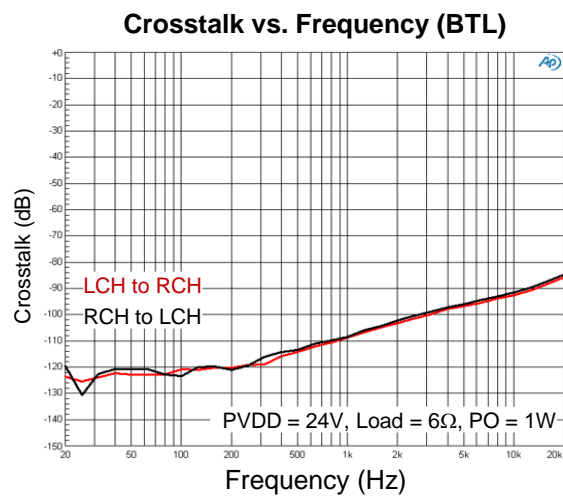
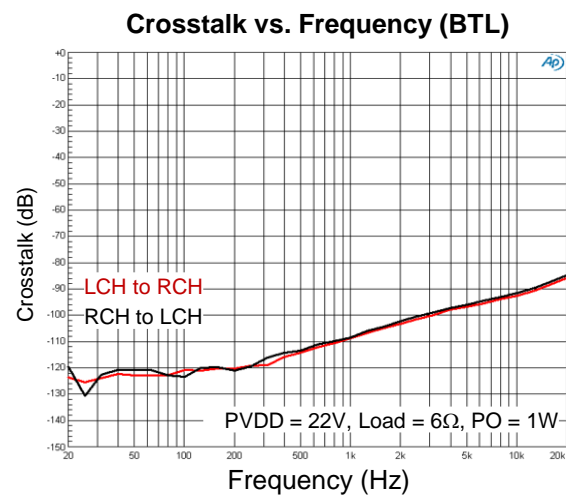


THD + N vs. Frequency (BTL)



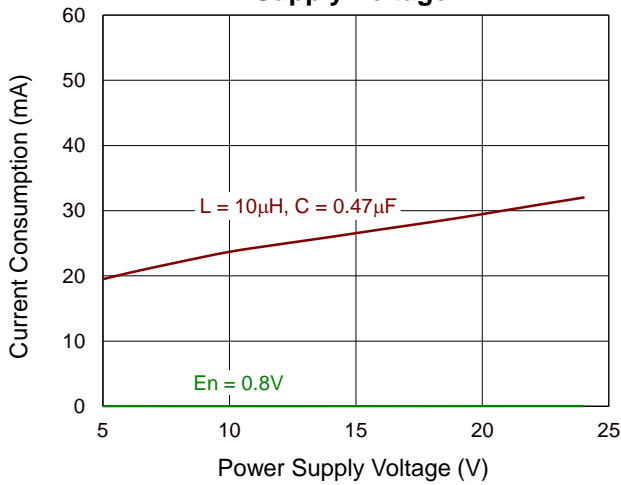
Crosstalk vs. Frequency (BTL)



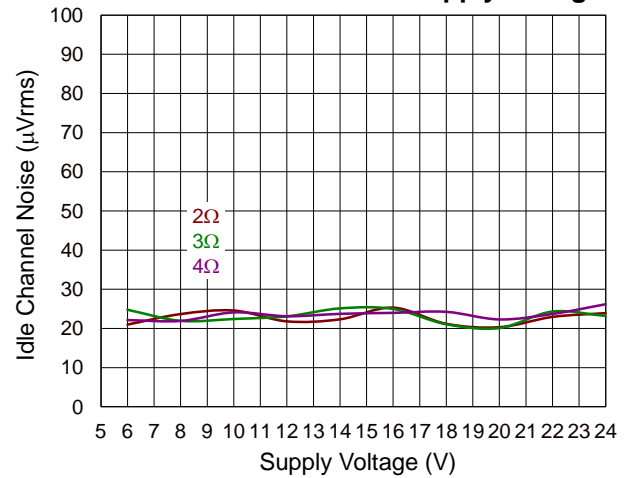


15.2 PBTL, PWM = 768kHz

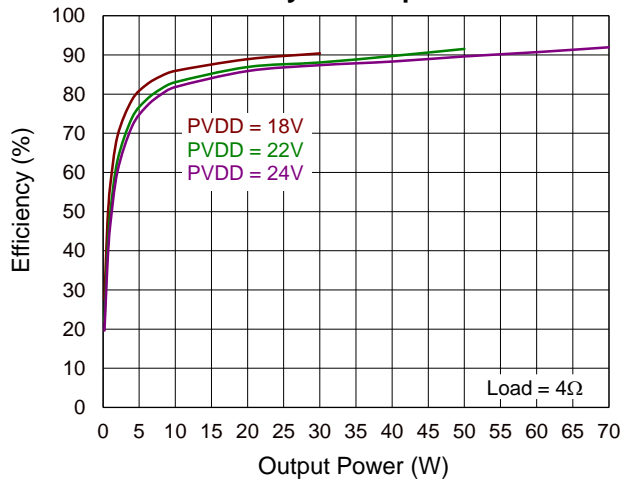
Current Consumption vs. Power Supply Voltage



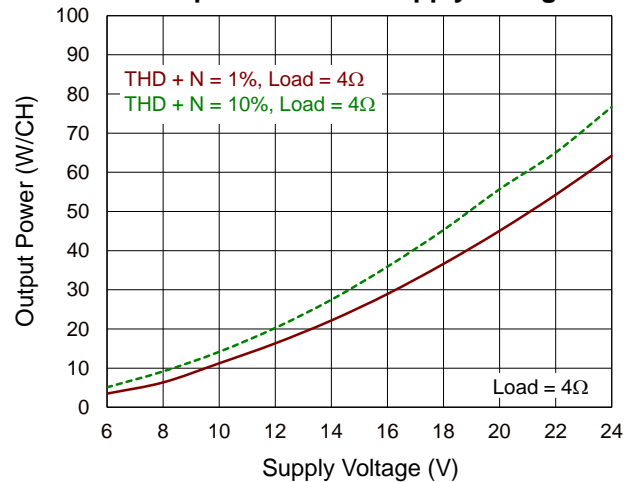
Idle Channel Noise vs. Supply Voltage



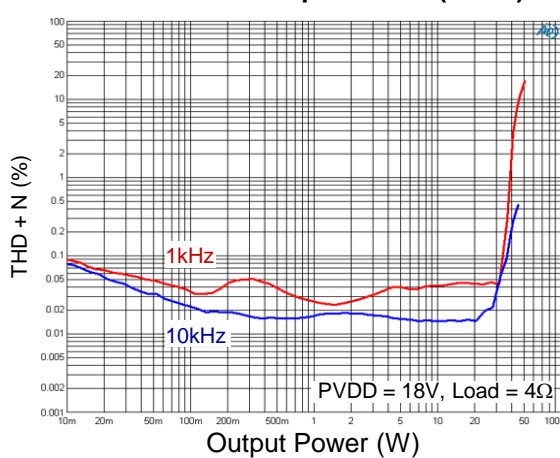
Efficiency vs. Output Power



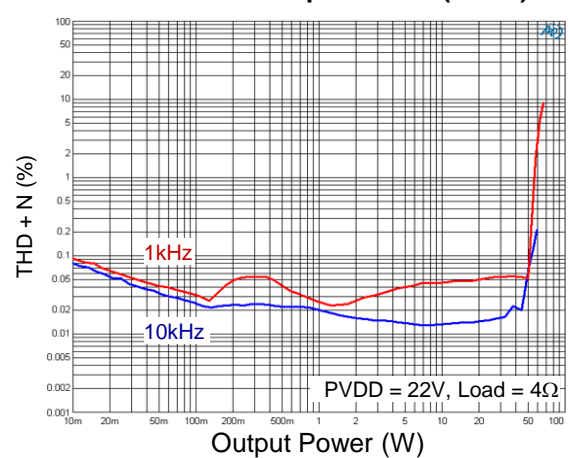
Output Power vs. Supply Voltage



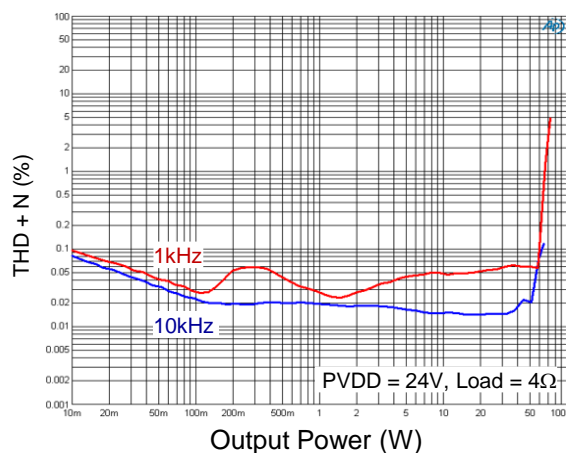
THD + N vs. Output Power (PBTL)



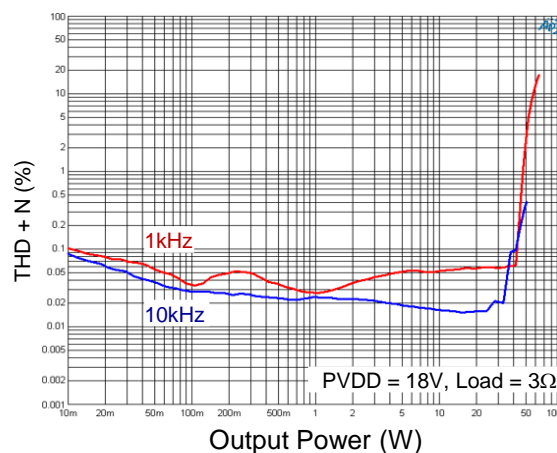
THD + N vs. Output Power (PBTL)



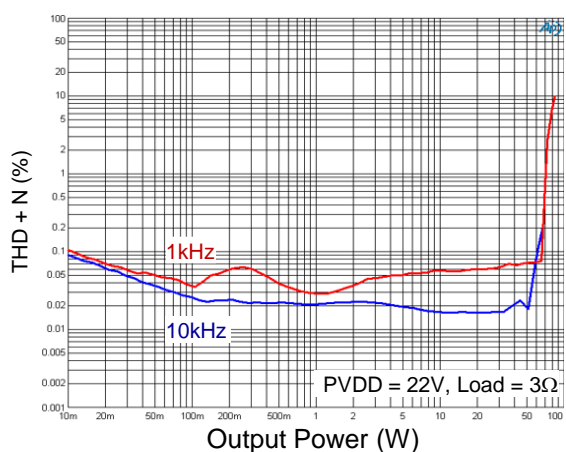
THD + N vs. Output Power (PBTL)



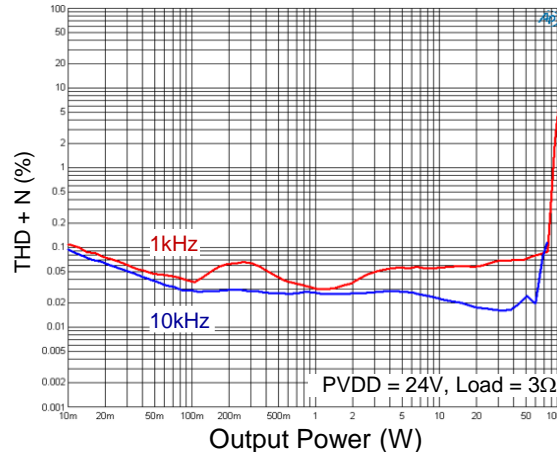
THD + N vs. Output Power (PBTL)



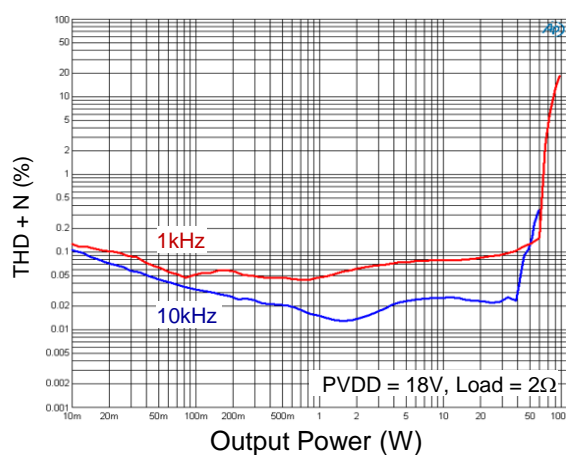
THD + N vs. Output Power (PBTL)



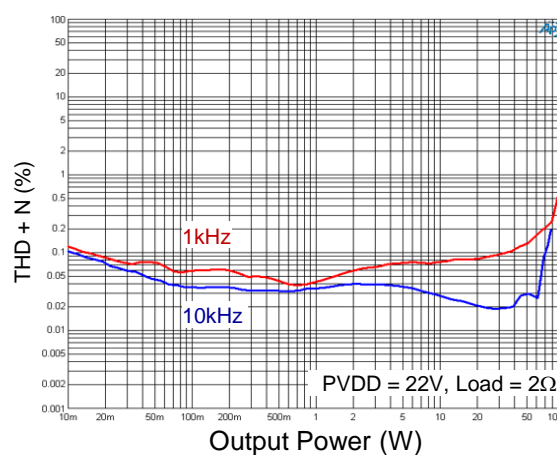
THD + N vs. Output Power (PBTL)

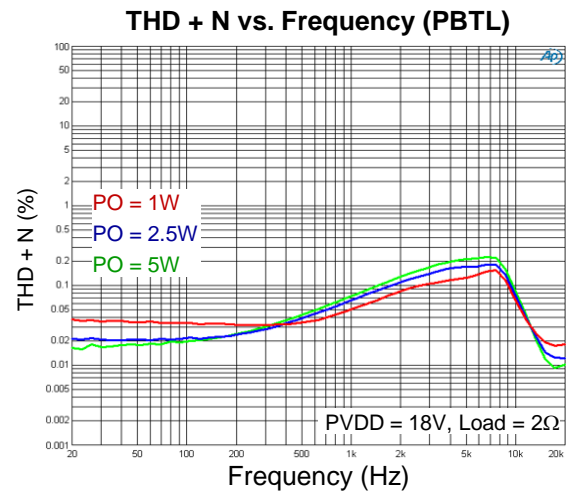
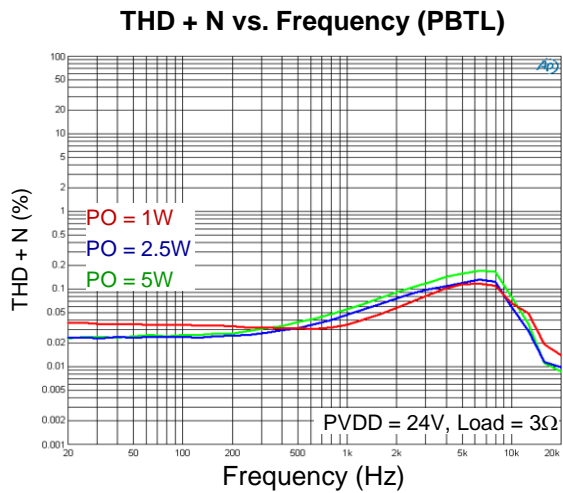
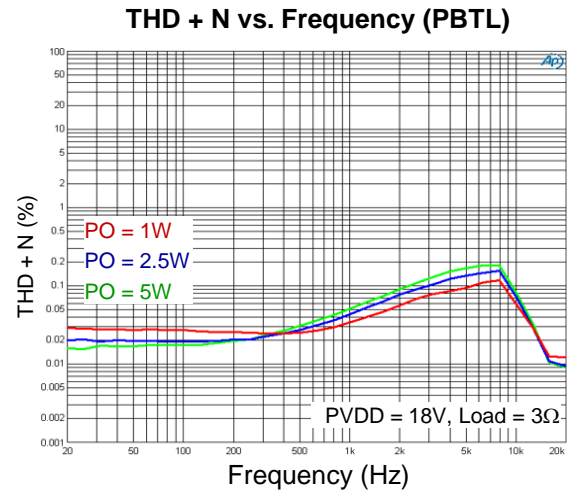
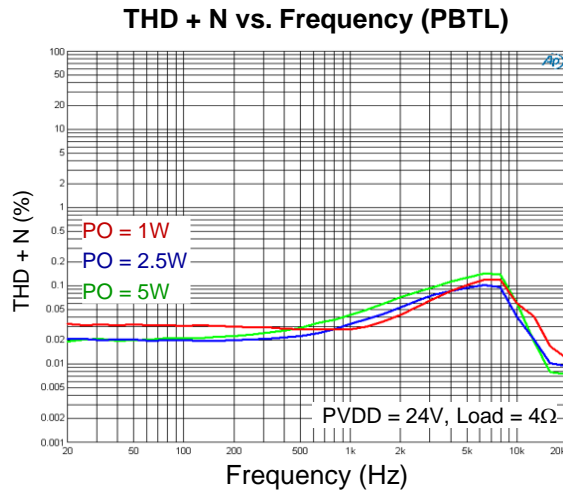
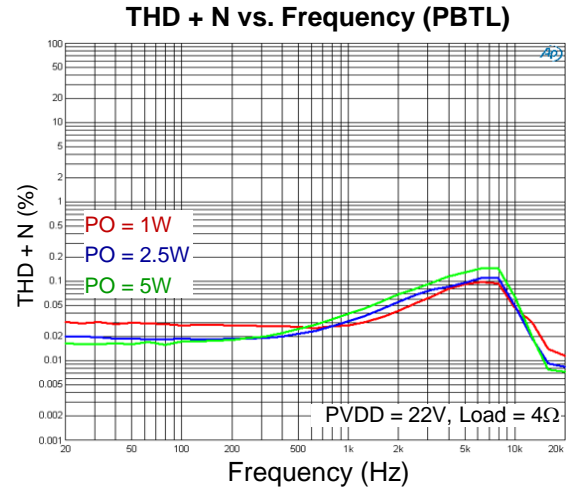
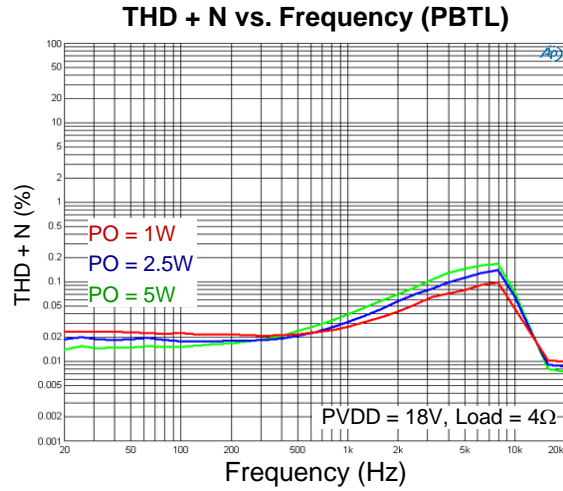


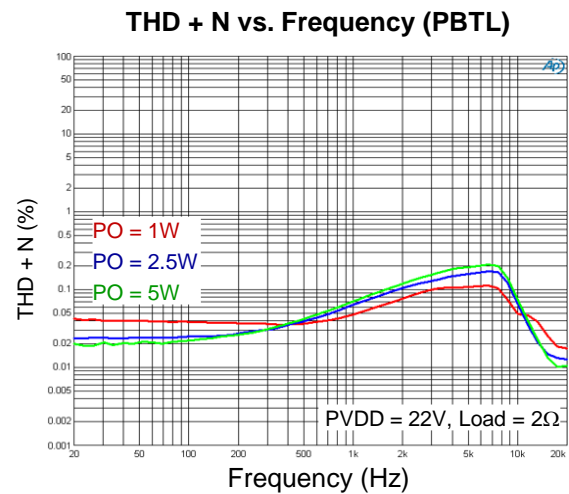
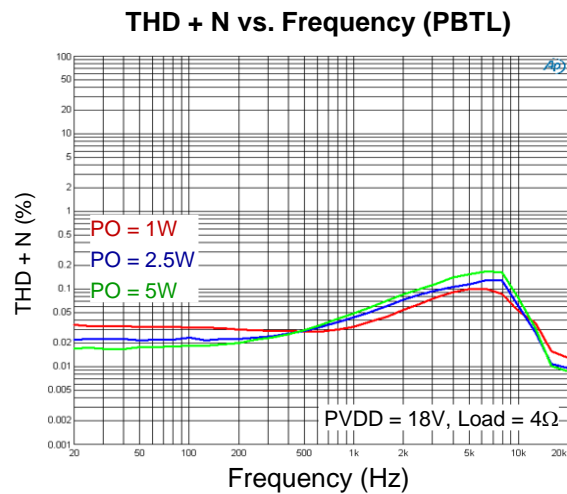
THD + N vs. Output Power (PBTL)



THD + N vs. Output Power (PBTL)

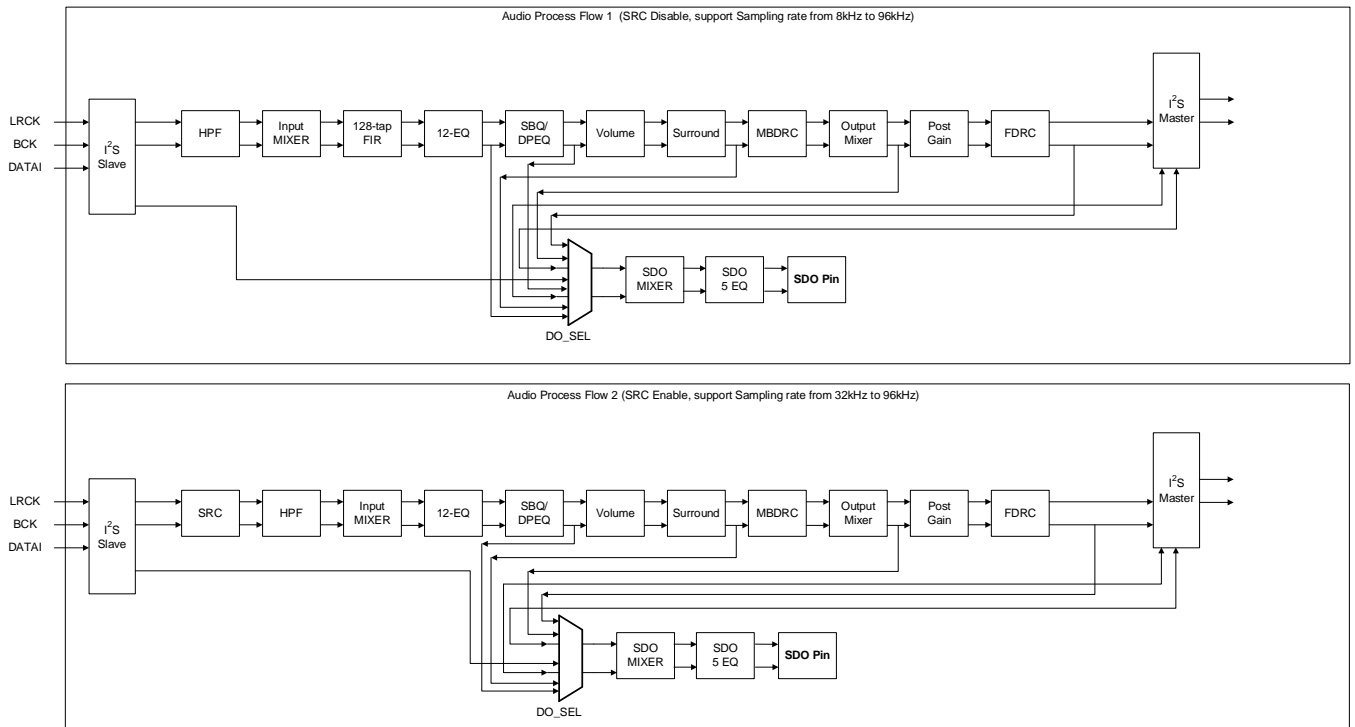






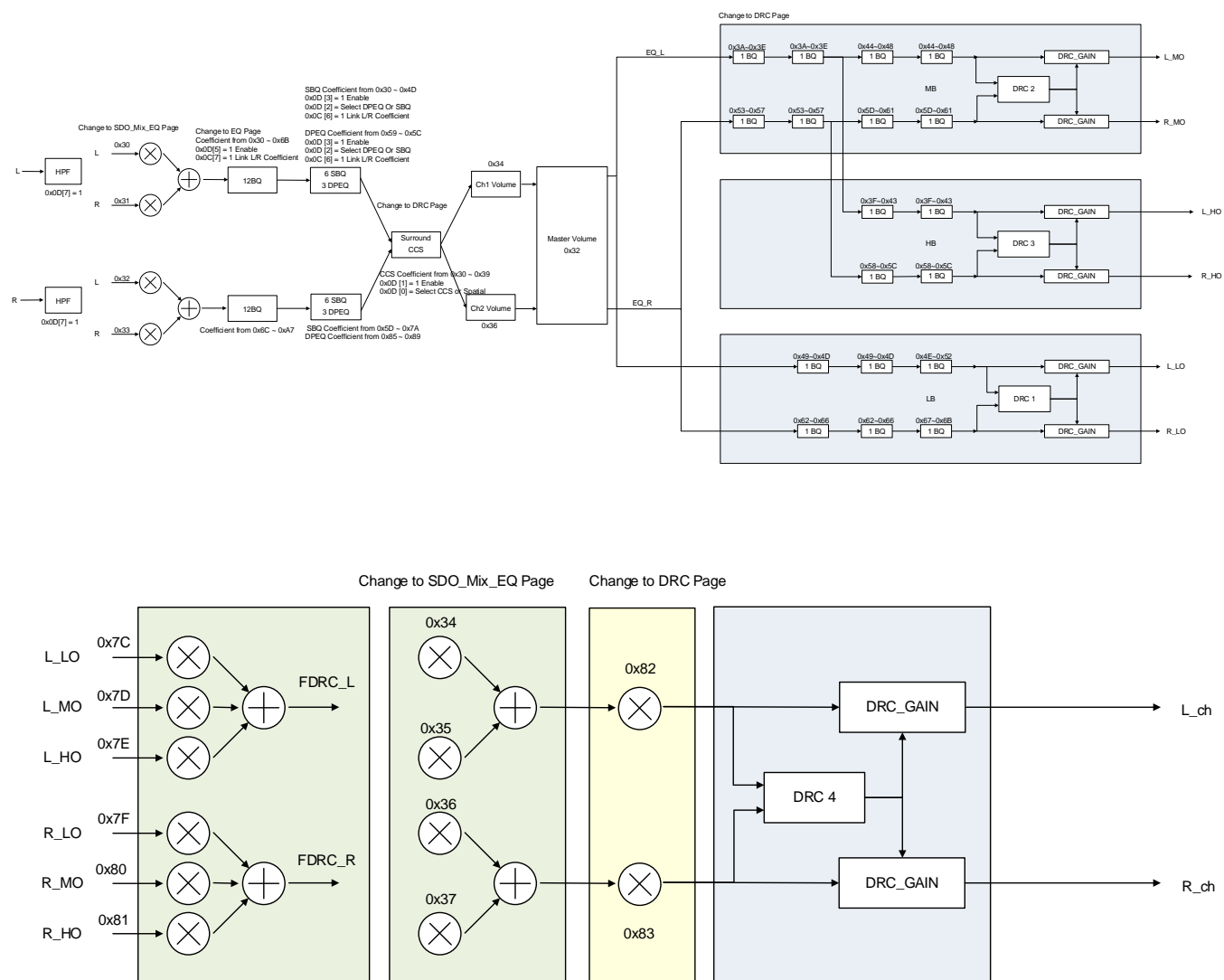
Note 22. Measurements were made using the RT9125 evaluation board and Audio Precision System 2722 with an AUX0025 low-pass filter. All measurements were taken at 1kHz.

16 Overall Signal Path



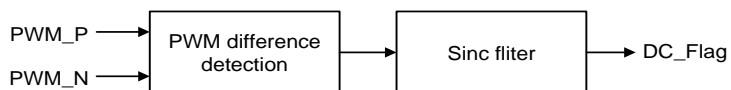
17 Detailed Signal Path

17.1 When SRC Enable



17.3 DC Protection Function (Amp Portion)

This function protects the loudspeaker when there are some DC at the output. The method is to detect DC at final stage (PWM), calculate the difference of the PWM and a Sinc filter to decide the DC level. The IC will shut down when detecting the DC.



Address	BITS	Name	Description
0x14	7:4	Reserved	
	3:2	DC_TH[1:0]	DC threshold for DC detection 00: No available 01: 12.5% 10: 18.75% (default) 11: 25%
	1	DC_TIME_SEL	Detection time 0: 342ms (default) 1: 684ms
	0	DC_EN	0: DC Protection disable 1: DC protection enable

17.4 Protection Behavior (FAULT_N1, Digital Portion)

If the protection behavior happened, the IC will automatically start detection, the error condition can be checked by the register or the FAULT_N1 pin.

17.4.1 Protection Flag

Address	BITS	Name	Description
0x10	1	INT_I2S_FAULT	LRCK/BCK error 1'b0: Normal (default) 1'b1: Fault (write 1 to clear)

17.5 Protection Behavior (FAULT_N2, AMP Portion)

If the protection behavior happened, the IC will automatically start detection, the error condition can be checked by the register or the FAULT_N2 pin.

17.5.1 Protection Flag

Address	BITS	Name	Description
0x10	7	Reserved	
	6	DC_ERR	DC flag report 0: No DC error (default) 1: DC error
	5	SCLK_ERR	0: No SCLK error (default) 1: SCLK error, write 0 to clear flag
	4	LRCK_ERR	0: No LRCK clock error (default) 1: LRCK clock error, write 0 to clear flag
	3	OC_ERR	0: No OC error (default) 1: OC, write 0 to clear flag
	2	OV_ERR	0: No OV error (default) 1: OV, write 0 to clear flag
	1	OT_ERR	0: No OT error (default) 1: OT, write 0 to clear flag
	0	UV_ERR	0: No UV error (default) 1: UV, write 0 to clear flag

17.5.2 Protection Type

Protection	Auto-Recovery	Shutdown Amp (Latch Type)	Fault Pin Pull Low
DC Protection	No	Yes	Yes
OC ERROR	Yes. The default setting is Auto-recovery.	Yes, it can be configured by the 0x12 bit[3]	Yes, but the MASK can be configured by the 0x11 bit[3]
OV ERROR	Yes. The default setting is Auto-recovery.	Yes, it can be configured by the 0x12 bit[2]	Yes, but the MASK can be configured by the 0x11 bit[2]
OT ERROR	Yes. The default setting is Auto-recovery.	Yes, it can be configured by the 0x12 bit[1]	Yes, but the MASK can be configured by the 0x11 bit[1]
UV ERROR	Yes. The default setting is Auto-recovery.	Yes, it can be configured by the 0x12 bit[0]	Yes, but the MASK can be configured by the 0x1 bit[0]

When protection happened, there are 2 types of the protection behaviors to:

1. Latch type: Will shut down the AMP directly.
2. Auto-recovery type: The AMP will enter the auto recovery mode, until the protection behavior stops, the AMP will continue to work.
3. The DC protection only has the latch type.

17.6 Fault Behavior Type Select (FAULT_N2)

If the protection behavior happened, the IC will automatically start detection, there are some error types to be configured as the following list.

Address	BITS	Name	Description
0x12	3	OC_ERROR_FAULT_TYPE	Fault behavior type select. 0: Auto-recovery 1: Latch
	2	OV_ERROR_FAULT_TYPE	Fault behavior type select. 0: Auto-recovery 1: Latch
	1	OT_ERROR_FAULT_TYPE	Fault behavior type select. 0: Auto-recovery 1: Latch
	0	UV_ERROR_FAULT_TYPE	Fault behavior type select. 0: Auto-recovery 1: Latch

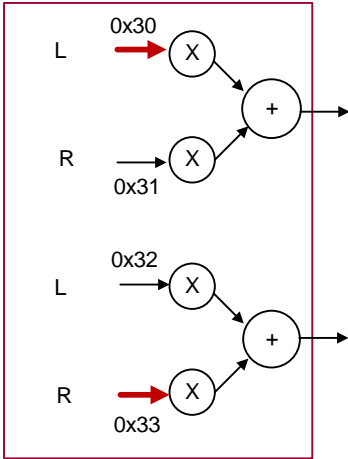
17.6.1 Fault Mask

Address	BITS	Name	Description
0x11	6	DC_ERROR_MASK	Fault mask for 0x10 DC error
	5	SCLK_ERROR_mask	Fault mask for 0x10 SCLK error
	4	LRCK_ERROR_mask	Fault mask for 0x10 LRCK error
	3	OC_ERROR_mask	Fault mask for 0x10 OC error
	2	OV_ERROR_mask	Fault mask for 0x10 OV error
	1	OT_ERROR_mask	Fault mask for 0x10 OT error
	0	UV_ERROR_mask	Fault mask for 0x10 UV error

17.7 Input Mixer (Change to SDO_Mixer_Page)

Block Diagram and Description

→Input mixer range is from mute to 24dB, 1 step is 0.0625dB.



17.7.1 Input Mixer Control Flow

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	3'b011: DSP signal process (IN/OUT MIXER SDO MIXER/EQ) → Set 0x0A Bit[2:0] with 3'b011, then set below value.
2	0x30	31:0	CH1_IN_MIX_0	Input mixer for L ch
3	0x31	31:0	CH1_IN_MIX_1	Input mixer for R ch
4	0x32	31:0	CH2_IN_MIX_0	Input mixer for L ch
5	0x33	31:0	CH2_IN_MIX_1	Input mixer for R ch
6	0x0A	2:0	REG_PAGE_SEL	3'b000: sys ctrl → After setting finished, set 0x0A Bit[2:0] with 3'b000 to control page.

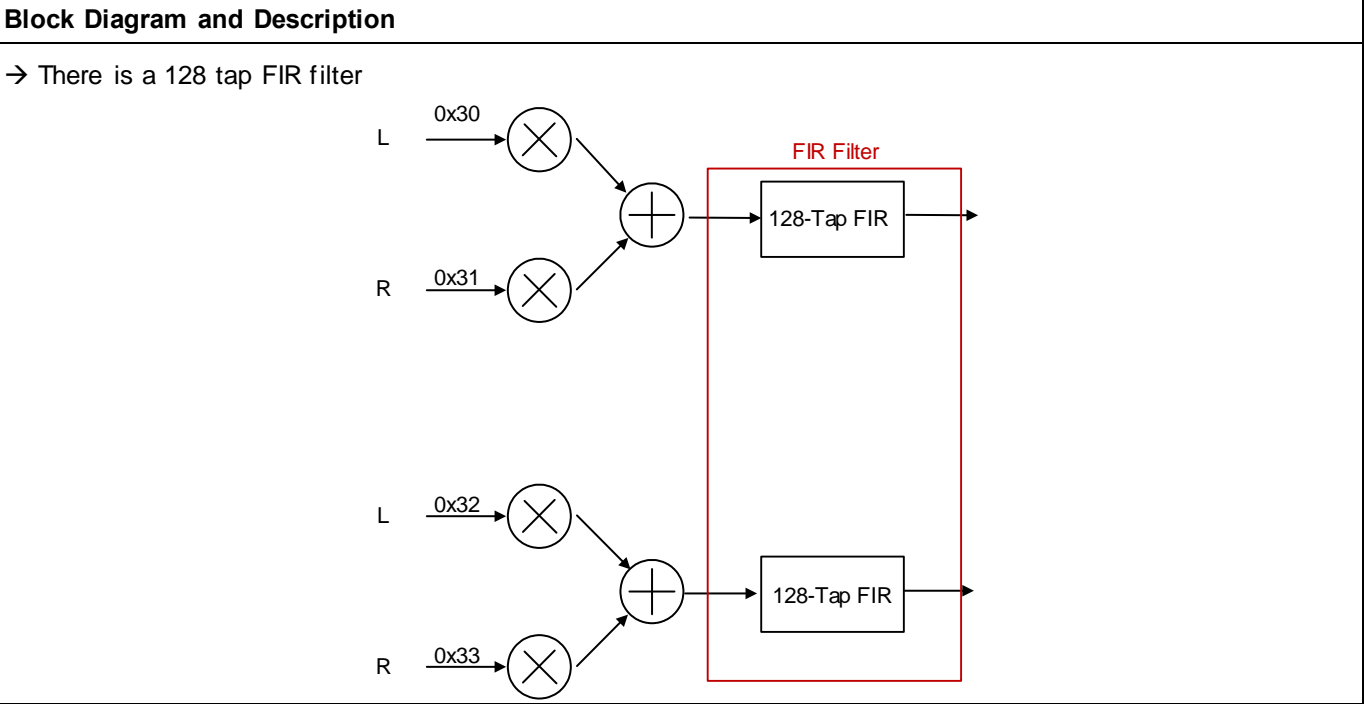
17.7.2 Mixer Gain Setting

Address	BITS	Name	Equation																					
0x30, 0x31, 0x32, 0x33	31:0	mix_1[31:0] mix_0[31:0]	Equation: $20\text{Log} (\text{Dec} / 67108864)$																					
			Range: 24dB (0X3F654E69) to Mute (0x00000000)																					
			Example: 6dB, Gain = $20\text{Log} (133899787 / 67108864)$ = 6dB																					
			Hex = 0x7FB260B																					
			Dec = 133899787																					
			<table><tr><th>Gain</th><th>Dec</th><th>Hex</th></tr><tr><td>6dB</td><td>133899787</td><td>0X7FB260B</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>0</td><td>67108864</td><td>0X04000000</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr></table>	Gain	Dec	Hex	6dB	133899787	0X7FB260B	0	67108864	0X04000000
			Gain	Dec	Hex																			
			6dB	133899787	0X7FB260B																			
.	.	.																						
.	.	.																						
0	67108864	0X04000000																						
.	.	.																						
.	.	.																						
.	.	.																						
.	.	.																						

17.7.3 Mixer Gain Inverse Setting

Address	BITS	Name	Equation																					
0x30, 0x31, 0x32, 0x33	31:0	mix_1[31:0] mix_0[31:0]	Equation: $20\text{Log} (\text{Dec} / 67108864)$																					
			Range: 24dB (0X3F654E69) to Mute (0x00000000)																					
			Example: 6dB, Gain = $20\text{Log} (133899787 / 67108864)$ = 6dB																					
			Hex = 0xF804D9F5																					
			Dec = -133899787																					
			<table><tr><th>Gain</th><th>Dec</th><th>Hex</th></tr><tr><td>6dB</td><td>-133899787</td><td>0X F804D9F5</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>0</td><td>-67108864</td><td>0XFC000007</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr></table>	Gain	Dec	Hex	6dB	-133899787	0X F804D9F5	0	-67108864	0XFC000007
			Gain	Dec	Hex																			
6dB	-133899787	0X F804D9F5																						
.	.	.																						
.	.	.																						
0	-67108864	0XFC000007																						
.	.	.																						
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17.8 FIR Filter (When SRC Disable)



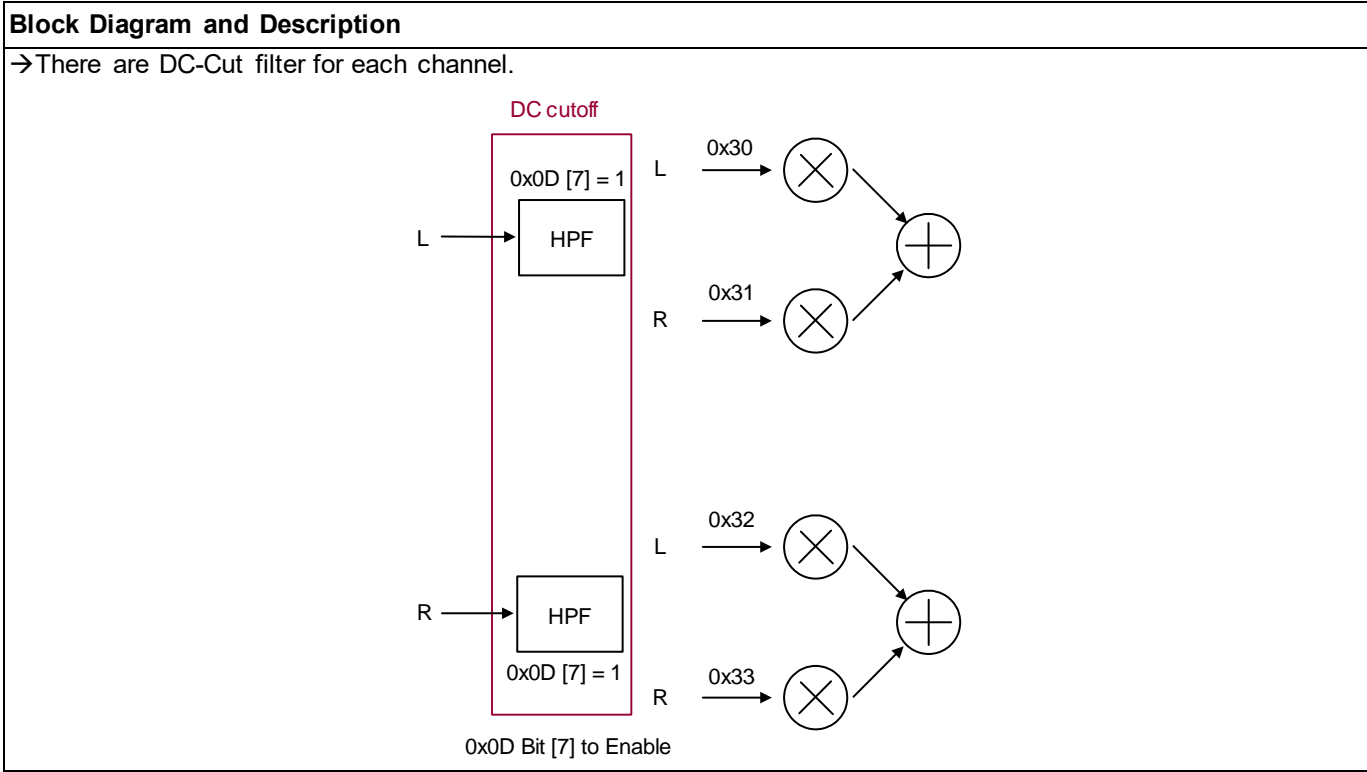
17.8.1 FIR Control Flow

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	3'b000: sys ctrl → Set 0x0A Bit[2:0] with 3'b000 to to 0x08, and 0x0D control
2	0x08	5	SSRC_EN	Sampling rate converter enable internal process with 88.2k/96kHz sampling rate (support input fs = 32kHz, 44.1k/48kHz) 0: Disable 1: Enable
3	0x0D	6	FIR_EN	0: Bypass 1: Enable
4	0x0A	2:0	REG_PAGE_SEL	3'b101: DSP signal process (FIR) → Set 0x0A Bit[2:0] with 3'b101, then set the coefficient.

17.8.2 FIR Coefficient

Address	BITS	Name	Description
0x30 to 0xAF	31:0	FIR_TAP1 to FIR TAP128	FIR Coefficient

17.9 Input High Pass Filter (Control Page)

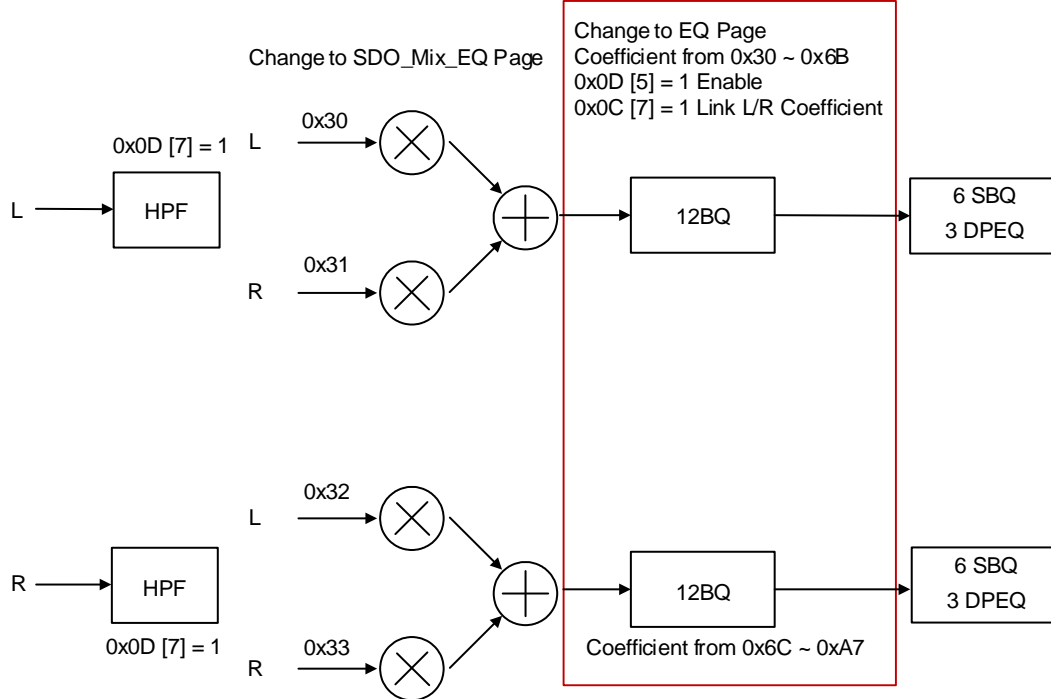


Address	BITS	Name	Description
0x0A	2:0	REG_PAGE_SEL	3'b000: sys ctrl → Select this page to set.
0x0D	7	HPF_EN	0: Input high-pass filter disable 1: Input high-pass filter enable

17.10 EQ Link and Bypass (Control Page)

Block Diagram and Description

- Link L/R channel EQ parameter automatically and using the same parameter.
- EQ_BYPASS can bypass the EQ path in signal path. Each EQ band has disable bit.
- EQ link and bypass control will be controlled at control page.



17.10.1 EQ Function Control

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	3'b000: sys ctrl → Select this page to control the 0x0C bit 5, and bit 7.
2	0x0C	5	EQ_Link_All	EQ filter enable 0: Bypass 1: Enable
3	0x0C	7	EQ_Link_All	EQ1 to EQ12 0: CH1, CH2 independent 1: Take CH1 coefficients to CH2
4	0x0A	2:0	REG_PAGE_SEL	001: DSP signal process (EQ) →Select this page to control the EQ coefficient.

17.10.2 EQ Coefficient

Address	BITS	Name	Description
0x30 to 0x6B	4	CH1_EQ1_B0 to CH1_EQ12_A2	Coefficient for Ch1 EQ1 to Ch1 EQ 12
0x6C to 0xA7	4	CH2_EQ1_B0 to CH2_EQ12_A2	Coefficient for Ch2 EQ1 to Ch2 EQ 12

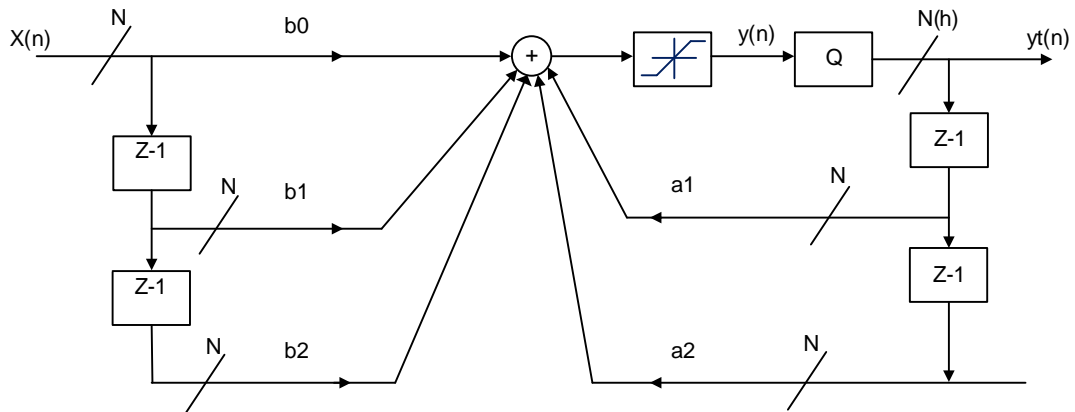
17.11 EQ

Block Diagram and Description

→ There are 12 Bands of Bi-Quad filter for each Channel. So there are 18 bands of the Bi-Quad can be used including the smooth Bi-Quad.

EQ parameter: $b_0/b_1/b_2/a_1/a_2$

Update coefficient after writing 5 coefficients

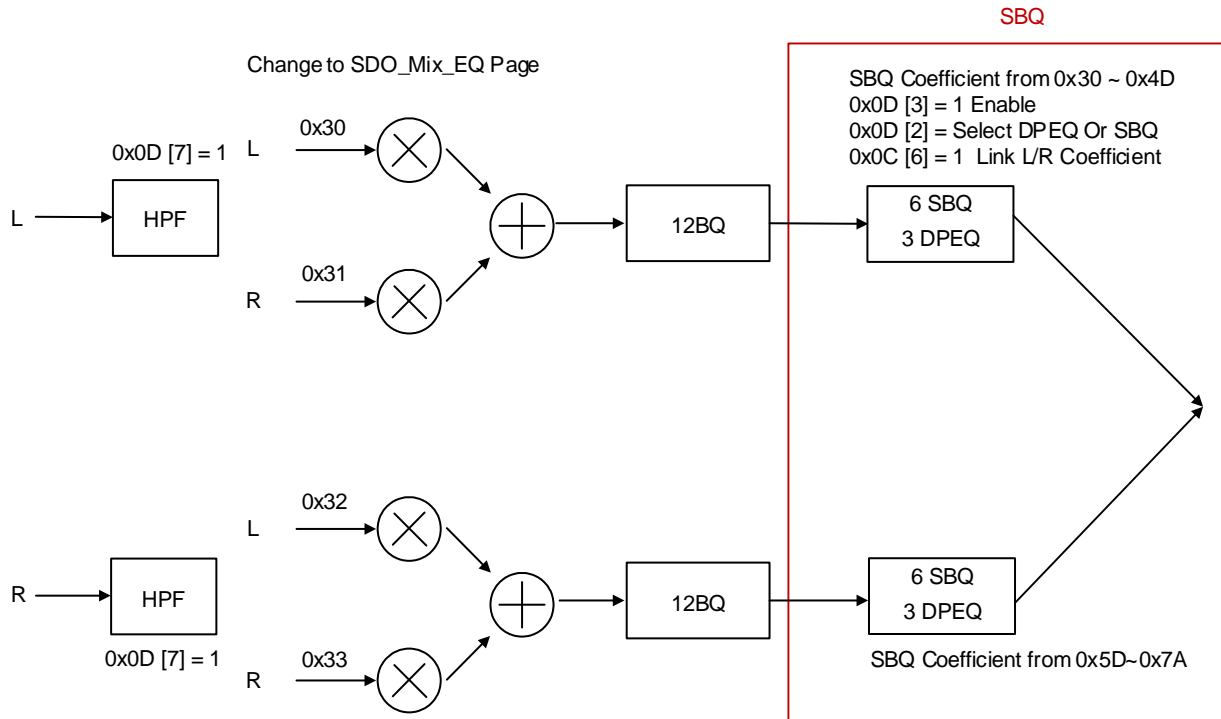


17.12 Smooth Bi-Quad

Block Diagram and Description

→Smooth biquad is identical biquad filter with coefficient updated smoothly.

→New coefficient update linearly/exponentially to avoid undesirable sound during setting new coefficient for biquad.



→One smooth-BQ consists of 2 BQs to process the same audio signal in parallel. One of the BQs uses current coefficients and the other one uses updating coefficients to generate the outputs, BQ_1_output and BQ_2_output, respectively.

→For a-filter smooth, the output of smooth-BQ is the summation of BQ_1_output and BQ_2_output using the below equations.

$$SBQ_output[n] = a_1[n] * BQ_1_output[n] + a_2[n] * BQ_2_output[n]$$

$$a_1[n] = (1-AS) + AS * a_1[n-1], \text{ if BQ_1 is the current active BQ and } a_1[0] = 1$$

$$a_2[n] = (1-AS) + AS * a_2[n-1], \text{ if BQ_2 is the updating BQ and } a_2[0] = 0$$

If SBQ_UPDATE is triggered, $a_1[n] = 0$ and $a_2[n] = 1$ after TS samples

→For linear smooth, the equations for smooth-BQ are listed below.

$$a_1[n] = a_1[n-1] - 1/TS, \text{ if BQ_1 is the active BQ and } a_1[0] = 1$$

$$a_2[n] = a_2[n-1] + 1/TS, \text{ if BQ_2 is the updating BQ and } a_2[0] = 0$$

If SBQ_UPDATE is triggered, $a_1[n] = 0$ and $a_2[n] = 1$ after TS samples. When linear smooth is used, the TS shall be the power of 2 for design simplicity.

Note: When using SMBQ, DPEQ cannot be used.

17.12.1 Smooth EQ Function Control (Control Page)

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	000: sys ctrl → Select this page to control the 0x0D, and 0x30.
2	0x0D	3	SMEQ_DPEQ_EN	Smooth EQ filter enable 0: Bypass 1: Enable
3	0x0D	2	SMEQ_DPEQ_SEL	SMEQ DPEQ select 0: Smooth EQ 1: Dynamic EQ
4	0x0C	6	SMEQ_DPEQ_LINK	Write coefficient option for SMEQ/DPEQ 0: L/R independent 1: L/R write the same data
5	0x30	1:0	SBQ_UPDATE	Trigger smooth BQ coefficients update: 00: No update 01: SBQ_BK1 to SBQ13, SBQ_BK2 to SBQ14 10: SBQ_BK1 to SBQ15, SBQ_BK2 to SBQ16 11: SBQ_BK1 to SBQ17, SBQ_BK2 to SBQ18
6	0x30	3	SMOOTH_DONE	Report status of smooth transition (after TS), 1 = done
7	0x30	6:4	SMOOTH_BQ_TS	SBQ smooth time select 3'b000: 8 samples 3'b001: 16 samples 3'b010: 32 samples 3'b011: 64 samples 3'b100: 128 samples 3'b101: 256 samples 3'b110: 512 samples 3'b111: 1024 samples (Recommended)
8	0x0A	2:0	REG_PAGE_SEL	010: DSP signal process (SBQ/DPEQ) → Select this page to control the EQ coefficient.

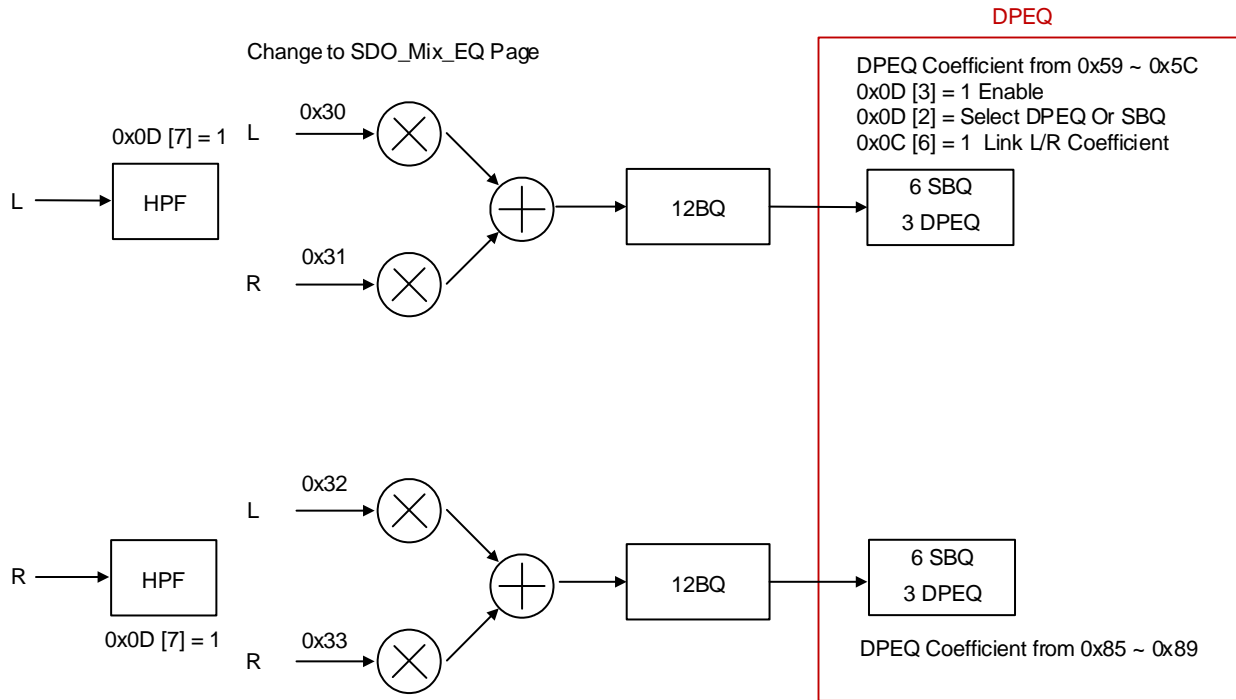
17.12.2 Smooth EQ Coefficient (Change to SBQ_DPEQ_Page)

Address	BITS	Name	Description
0x30to 0x4D	4	CH1_SEQ13 to CH1_SEQ18	Coefficient for Ch1 SEQ13 to Ch1 SEQ18 coefficient
0x5D to 0x7A	4	CH2_SEQ13 to CH2_SEQ18	Coefficient for Ch2 SEQ13 to Ch2 SEQ18 coefficient
0x4E to 0x57	4	CH1_SEQ_BK1 to CH1_SEQ_BK2	Coefficient for Ch1 SEQ13 to Ch18 SEQ update coefficient
0x7B to 0x84	4	CH2_SEQ_BK1 to CH2_SEQ_BK2	Coefficient for Ch2 SEQ13 to Ch18 SEQ update coefficient

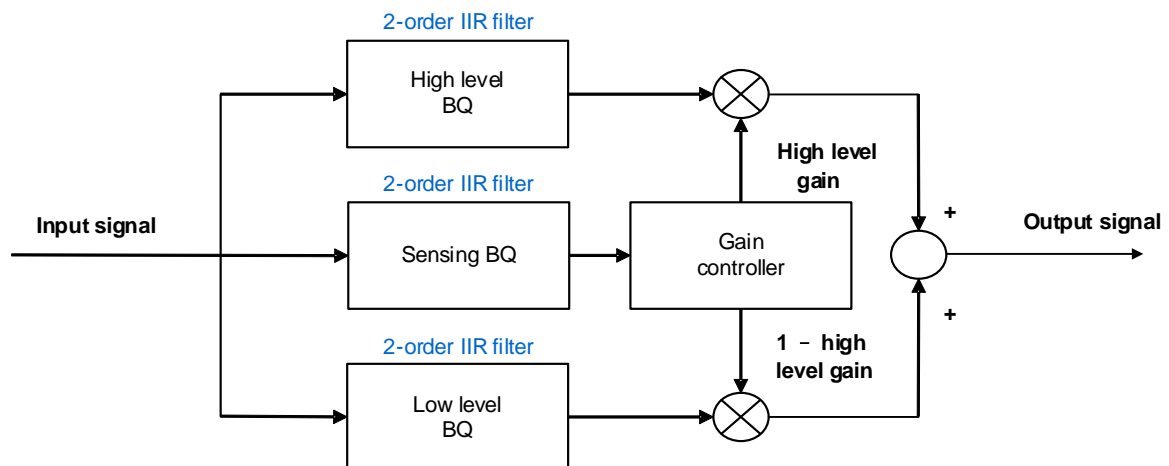
17.13 DPEQ

Block Diagram and Description

→The dynamic equalizer provides the ballistic control of a dynamic range compressor to the conventional equalizer allowing time-varying adjustment of equalization curve.



→Flow Chart



Note: When using DPBQ, SMBQ cannot be used.

17.13.1 DPEQ Function Control (Control Page)

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	000: sys ctrl → Select this page to control the 0x0D, and 0x0C.
2	0x0D	3	SMEQ_DPEQ_EN	0: Bypass 1: Enable
3	0x0D	2	SMEQ_DPEQ_SEL	SMEQ DPEQ select 0: Smooth EQ 1: Dynamic EQ
4	0x0C	6	SMEQ_DPEQ_SEL	Write coefficient option for SMEQ/DPEQ 0: L/R independent 1: L/R write the same data
5	0x0A	2:0	REG_PAGE_SEL	010: DSP signal process (SBQ/DPEQ) → Select this page to control the EQ coefficient.

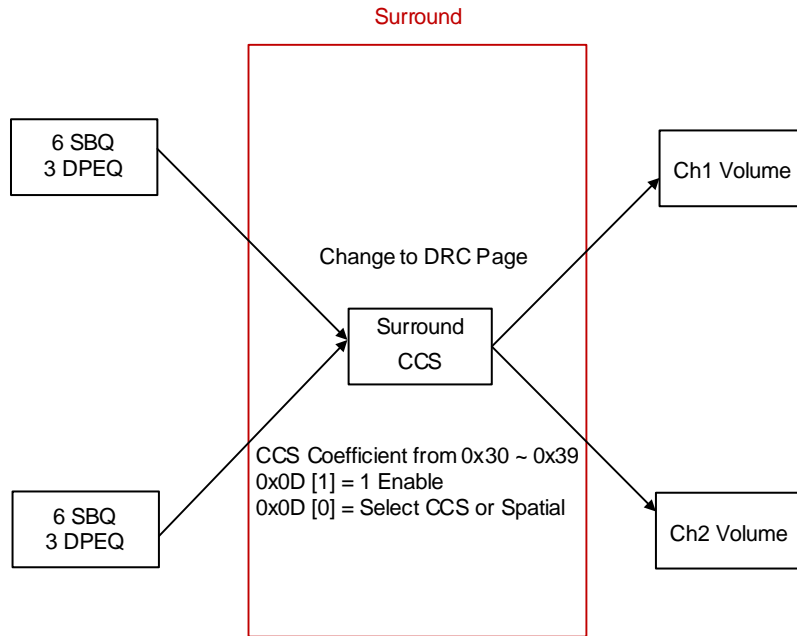
17.13.2 DPEQ Coefficient (Change to SBQ_DPEQ_Page)

Address	BITS	Name	Description
0x30 to 0x5C	4	CH1_DPEQ1 to CH1_DPEQ3	Coefficient for Ch1 DPEQ1 to Ch1 DPEQ3
0x5D to 0x89	4	CH2_DPEQ1 to CH2_DPEQ3	Coefficient for Ch2 DPEQ1 to Ch2 DPEQ3

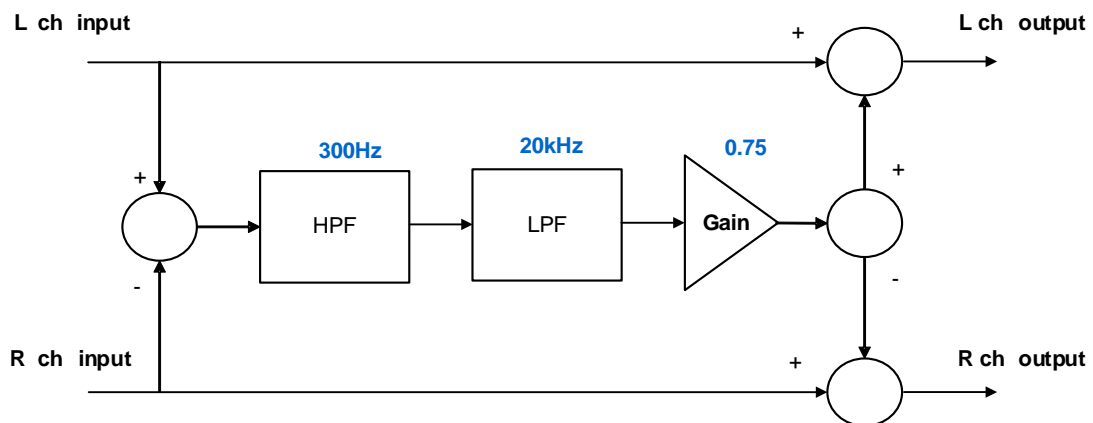
17.14 Surround (Spatializer)

Block Diagram and Description

→Spatializer is a method to increase the field of sound for a broader and more encompassing audio experience.



→Flow Chart



Note: When using Surround, CCS cannot be used.

17.14.1 Surround Function Control (Control Page)

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	000: sys ctrl → Select this page to control the 0x0D, and 0x0C.
2	0x0D	1	SURROUND_EN	Surround enable 0: Bypass 1: Enable
3	0x0D	0	SURROUND_SEL	Select Surround (Spatializer) or CCS 0: Spatializer 1: CCS
4	0x0C	5	Surround_LINK	Write coefficient option for SURROUND EQ 0: L/R independent 1: L/R write the same data
5	0x0A	2:0	REG_PAGE_SEL	100: DSP signal process (SBQ/DPEQ) → Select this page to control the surround coefficient.

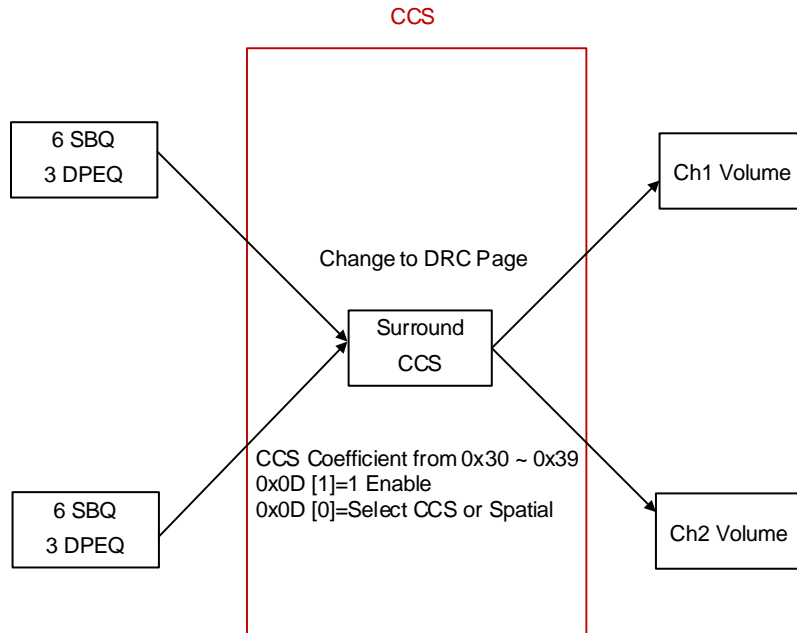
17.14.2 Surround Coefficient (Change to DRC Page)

Address	BITS	Name	Description
0x30 to 0x39	4	SURROUND_H1_B0 to SURROUND_H2_A2	Surround Bi-Quad Coefficient setting

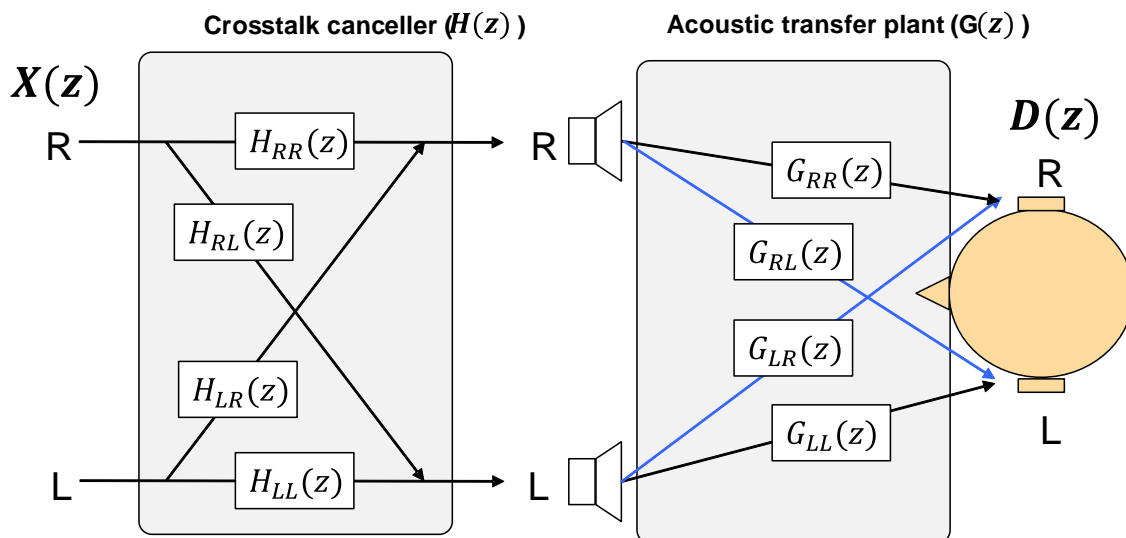
17.15 CCS (Cross Talk Cancellation System)

Block Diagram and Description

→ In general terms, any unwanted leakage between parallel information channels is considered crosstalk.



→ Flow Chart



Note: When using CCS, Surround cannot be used.

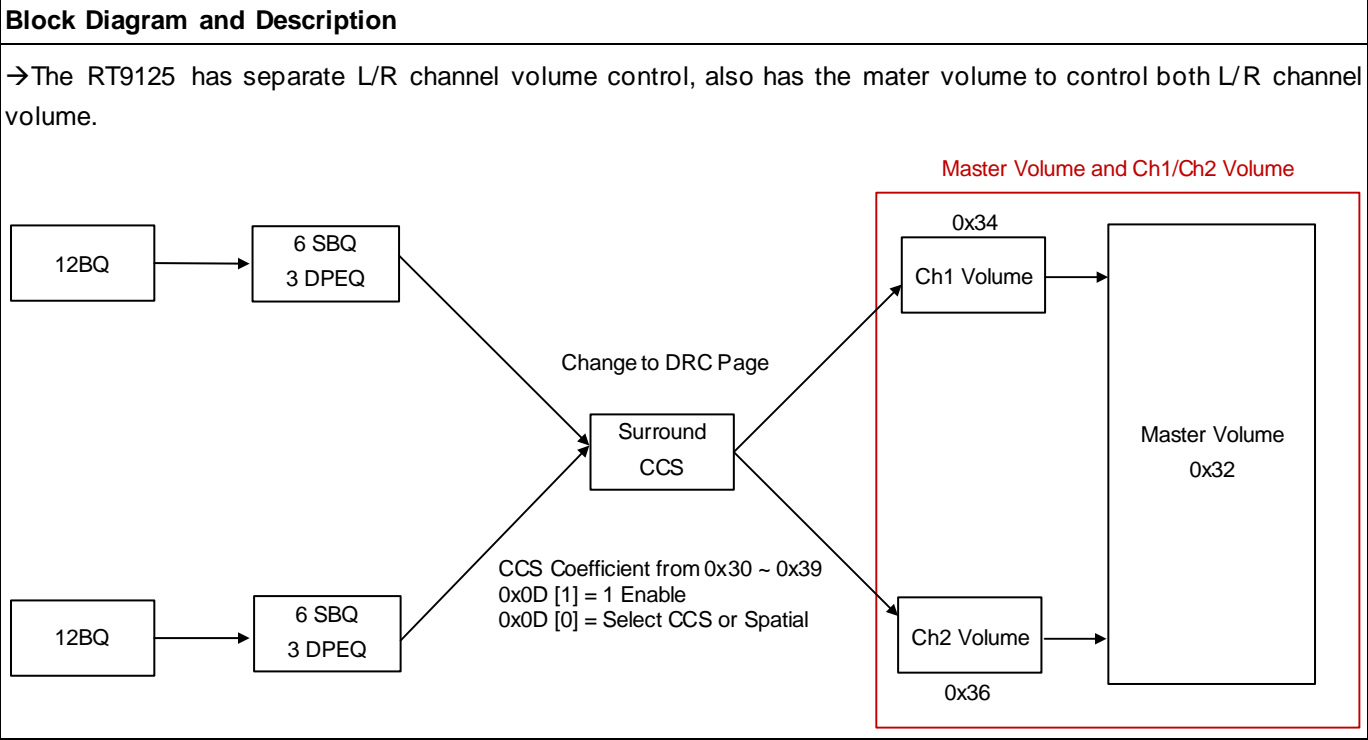
17.15.1 CCS Function Control (Control Page)

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	000: sys ctrl → Select this page to control the 0x0D, and 0x0C.
2	0x0D	1	SURROUND_EN	Surround enable 0: Bypass 1: Enable
3	0x0D	0	SURROUND_SEL	Select Surround (Spatializer) Or CCS 0: Spatializer 1: CCS
4	0x0C	5	Surround_LINK	Write coefficient option for SURROUND EQ 0: L/R independent 1: L/R write the same data
5	0x0A	2:0	REG_PAGE_SEL	100: DSP signal process (DRC) → Select this page to control the surround coefficient.

17.15.2 CCS Coefficient (Change to DRC Page)

Address	BITS	Name	Description
0x30 to 0x39	4	CCS_H1_B0 to CCS_H2_A2	CCS Bi-Quad Coefficient setting

17.16 Master Volume and Ch1/Ch2 Volume (Control Page)



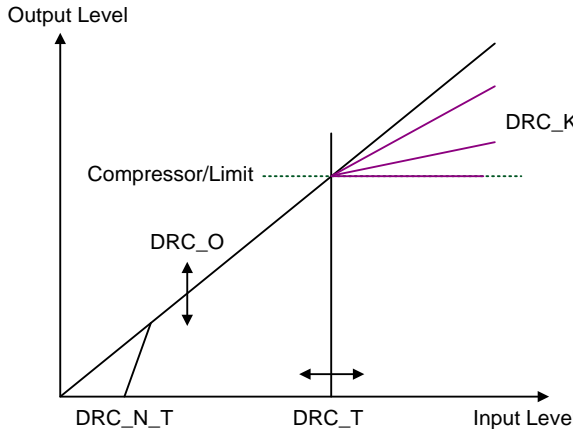
17.16.1 Volume Function Control

Address	BITS	Name	Description
0x32	10:0	MS_VOL	24dB to –103.9375dB, 0.0625dB per step
0x34	26:16	CH1_VOL	24dB to –103.9375dB, 0.0625dB per step
0x36	10:0	CH2_VOL	24dB to –103.9375dB, 0.0625dB per step

17.16.2 Master Volume and Ch1/Ch2 Gain Equation

Equation		
Equation: 24dB - (Dec * 0.0625) Range: 24dB (0X000) to mute (0x7ff) Example : 10dB, Hex = 0xE0 Dec = 224 Gain = 24dB - (224 * 0.0625) = 10dB		
Gain	Dec	Hex
24dB	0	0x00
10dB	224	0XE0
.	.	.
.	.	.
.	.	.
0dB	384	0x180
.	.	.
.	.	.
.	.	.

17.17 Multi-Band DRC (Change to DRC Page)

DRC Description	Address	Description
DRC_T: Threshold	0x98, 0x99, 0x9A, 0x9B	
DRC_K: Compress ratio	0x94, 0x95, 0x96, 0x97	
DRC_O: Make up gain	0xA0, 0xA1, 0xA2, 0xA3	
DRC_N_T: Noise gate threshold	0x9C, 0x9D, 0x9E, 0x9F	
Noise Gate Enable (Control Page)	0x0F	

17.17.1 DRC Noise Gate Control Flow

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	000: sys ctrl → Select this page to control the 0x0F
2	0x0F	3	DRC4_N_EN	1: DRC4 Noise gate enable 0: DRC4 Noise gate disable
		2	DRC3_N_EN	1: DRC3 Noise gate enable 0: DRC3 Noise gate disable
		1	DRC2_N_EN	1: DRC2 Noise gate enable 0: DRC2 Noise gate disable
		0	DRC1_N_EN	1: DRC1 Noise gate enable 0: DRC1 Noise gate disable

17.17.2 DRC Coefficient Control Flow (Change to DRC Page)

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	100: DSP signal process (DRC) → Select this page to control the below coefficient.

Address	BITS	Name	Description
Coefficient 1			
0x6C	31:0	DRC1_RMS_AE	DRC 1 AE
0x6D	31:0	DRC1_RMS_1_AE	DRC 1 1-AE
0x6E	31:0	DRC1_GAIN_AA	DRC 1 attack time AA
0x6F	31:0	DRC1_GAIN_AD	DRC 1 release time AD
0x98	31:0	DRC1_T	DRC1 threshold
0x94	31:0	DRC1_K	DRC1 compression ratio
0xA0	31:0	DRC1_O	DRC1 make up gain
0x70	31:0	DRC2_RMS_AE	DRC 2 AE
0x71	31:0	DRC2_RMS_1_AE	DRC 2 1-AE
0x72	31:0	DRC2_GAIN_AA	DRC 2 attack time AA
0x73	31:0	DRC2_GAIN_AD	DRC 2 release time AD
0x99	31:0	DRC2_T	DRC2 threshold
0x95	31:0	DRC2_K	DRC2 compression ratio
0xA1	31:0	DRC2_O	DRC2 make up gain
0x74	31:0	DRC3_RMS_AE	DRC 3 AE
0x75	31:0	DRC3_RMS_1_AE	DRC 3 1-AE
0x76	31:0	DRC3_GAIN_AA	DRC 3 attack time AA
0x77	31:0	DRC3_GAIN_AD	DRC 3 release time AD
0x9A	31:0	DRC3_T	DRC3 threshold
0x96	31:0	DRC3_K	DRC3 compression ratio

Address	BITS	Name	Description
0xA2	31:0	DRC3_O	DRC3 make up gain
0x78	31:0	DRC4_AE	DRC 4 AE
0x79	31:0	DRC4_1_AE	DRC 4 1-AE
0x7A	31:0	DRC4_AA	DRC 4 attack time AA
0x7B	31:0	DRC4_AD	DRC 4 release time AD
0x9B	31:0	DRC4_T	DRC4 threshold
0x97	31:0	DRC4_K	DRC4 compression ratio
0xA3	31:0	DRC4_O	DRC4 make up gain
0x9C	31:0	DRC1_N_T	DRC1 noise gate of the DRC
0x9D	31:0	DRC2_N_T	DRC2 noise gate of the DRC
0x9E	31:0	DRC3_N_T	DRC3 noise gate of the DRC
0x9F	31:0	DRC4_N_T	DRC4 noise gate of the DRC
0xB4	7:0	DRC4_DELAY	DRC4 delay 2
Coefficient 2			
0x84	31:0	DRC1_RMS_AE_2	DRC 1 AE 2
0x85	31:0	DRC1_RMS_1_AE_2	DRC 1 1-AE 2
0x86	31:0	DRC1_GAIN_AA_2	DRC 1 attack time AA 2
0x87	31:0	DRC1_GAIN_AD_2	DRC 1 release time AD 2
0xA8	31:0	DRC1_T_2	DRC1 threshold 2
0xA4	31:0	DRC1_K_2	DRC1 compression ratio 2
0xB0	31:0	DRC1_O_2	DRC1 make up gain 2
0x88	31:0	DRC2_RMS_AE_2	DRC 2 AE 2
0x89	31:0	DRC2_RMS_1_AE_2	DRC 2 1-AE 2
0x8A	31:0	DRC2_GAIN_AA_2	DRC 2 attack time AA 2
0x8B	31:0	DRC2_GAIN_AD_2	DRC 2 release time AD 2
0xA9	31:0	DRC2_T_2	DRC2 threshold 2
0xA5	31:0	DRC2_K_2	DRC2 compression ratio 2
0xB1	31:0	DRC2_O_2	DRC2 make up gain 2
0x8C	31:0	DRC3_RMS_AE_2	DRC 3 AE 2
0x8D	31:0	DRC3_RMS_1_AE_2	DRC 3 1-AE 2
0x8E	31:0	DRC3_GAIN_AA_2	DRC 3 attack time AA 2
0x8F	31:0	DRC3_GAIN_AD_2	DRC 3 release time AD 2
0xAA	31:0	DRC3_T_2	DRC3 threshold 2
0xA6	31:0	DRC3_K_2	DRC3 compression ratio 2
0xB2	31:0	DRC3_O_2	DRC3 make up gain 2
0x90	31:0	DRC4_AE_2	DRC 4 AE 2
0x91	31:0	DRC4_1_AE_2	DRC 4 1-AE 2

Address	BITS	Name	Description
0x92	31:0	DRC4_AA_2	DRC 4 attack time AA 2
0x93	31:0	DRC4_AD_2	DRC 4 release time AD 2
0xAB	31:0	DRC4_T_2	DRC4 threshold 2
0xA7	31:0	DRC4_K_2	DRC4 compression ratio 2
0xB3	31:0	DRC4_O_2	DRC4 make up gain 2
0xAC	31:0	DRC1_N_T_2	DRC1 noise gate of the DRC 2
0xAD	31:0	DRC2_N_T_2	DRC2 noise gate of the DRC 2
0xAE	31:0	DRC3_N_T_2	DRC3 noise gate of the DRC 2
0xAF	31:0	DRC4_N_T_2	DRC4 noise gate of the DRC 2
0xB5	7:0	DRC4_DELAY_2	DRC4 delay 2

17.18 DRC Timing Equation

DRC Description	Equation																											
AA/AE/AD Timing, 6.26 Format	<p>Equation: $AA = (1 - e^{-2.2 / (ta \cdot fs)}) \cdot 6710864$ Ta = AA/AD/AE timing Fs = sampling rate Example: ta = 0.1ms, fs = 96k $AA = (1 - e^{-2.2 / (0.0001 \cdot 96000)}) \cdot 6710864 = 13744156$ DEC = 1577592 HEX = 0xD1B81C</p> <table><tr><th>Timing</th><th>T_Dec</th><th>T_Hex</th></tr><tr><td>0.1ms</td><td>13744156</td><td>0xD1B81C</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>1000ms</td><td>1536</td><td>0x601</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr></table>	Timing	T_Dec	T_Hex	0.1ms	13744156	0xD1B81C	1000ms	1536	0x601
Timing	T_Dec	T_Hex																										
0.1ms	13744156	0xD1B81C																										
.	.	.																										
.	.	.																										
.	.	.																										
1000ms	1536	0x601																										
.	.	.																										
.	.	.																										
.	.	.																										
1-AE	<p>Equation: $1-AE = (e^{-2.2 / (ta \cdot fs)}) \cdot 6710864$ ta = 1-AE timing fs = sampling rate Example: ta = 0.1ms, fs = 96k $1-AE = (e^{-2.2 / (0.0001 \cdot 96000)}) \cdot 6710864 = 53364707$ DEC = 53364707 HEX = 0x32E47E3</p> <table><tr><th>Timing</th><th>T_Dec</th><th>T_Hex</th></tr><tr><td>0.1ms</td><td>13744156</td><td>0x32E47E3</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>1000ms</td><td>67107326</td><td>0x3FFF9FE</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr></table> <p>Note: For peak mode, 1-AE, must be defined by users and there is no limitation. For RMS mode, there is no need to define the omega value.</p>	Timing	T_Dec	T_Hex	0.1ms	13744156	0x32E47E3	1000ms	67107326	0x3FFF9FE
Timing	T_Dec	T_Hex																										
0.1ms	13744156	0x32E47E3																										
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1000ms	67107326	0x3FFF9FE																										
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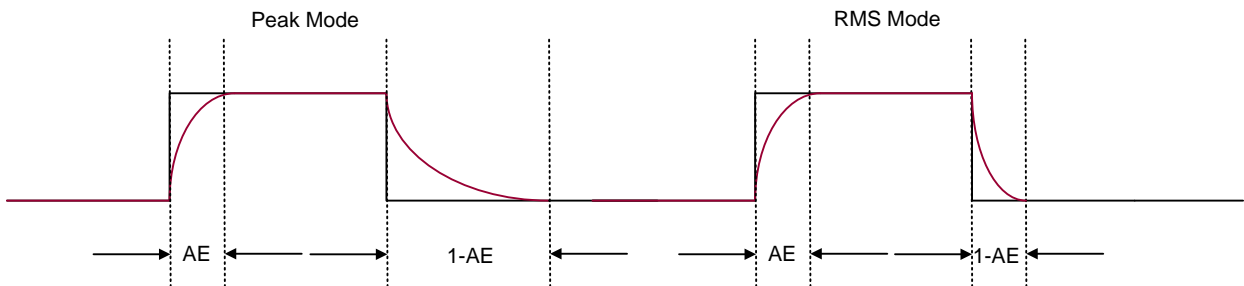
17.18.1 DRC Formula

DRC Description	Equation																											
DRC_TH/Noise Gate Threshold	<p>T is the threshold of the DRC Equation: $T = (\text{Threshold}) / 0.0625 \text{ (dB)}$ Example: Threshold = -10dB, $10/0.0625 = 160$ $T_Dec = 160$ $T_Hex = \text{DEC2HEX} (160) = 0xA0$</p> <table><tr><th>Threshold</th><th>T_Dec</th><th>T_Hex</th></tr><tr><td>-10dB</td><td>160</td><td>0x00, 0xA0</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>-20dB</td><td>320</td><td>0x01, 0x40</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr></table>	Threshold	T_Dec	T_Hex	-10dB	160	0x00, 0xA0	-20dB	320	0x01, 0x40
Threshold	T_Dec	T_Hex																										
-10dB	160	0x00, 0xA0																										
.	.	.																										
.	.	.																										
.	.	.																										
-20dB	320	0x01, 0x40																										
.	.	.																										
.	.	.																										
.	.	.																										
DRC_RATIO: Compress Ratio	<p>K is the compression ratio of the DRC Equation: $K = \text{Ratio} * 125$ Example: Ratio = 50% $50 * 125 = 64$ $K_Dec = 64$ $K_Hex = \text{DEC2HEX} (64) = 0x40$</p> <table><tr><th>Ratio</th><th>K_Dec</th><th>K_Hex</th></tr><tr><td>Full Comp</td><td>128</td><td>0x80</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>50%</td><td>64</td><td>0x40</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr></table>	Ratio	K_Dec	K_Hex	Full Comp	128	0x80	50%	64	0x40
Ratio	K_Dec	K_Hex																										
Full Comp	128	0x80																										
.	.	.																										
.	.	.																										
.	.	.																										
50%	64	0x40																										
.	.	.																										
.	.	.																										
.	.	.																										
DRC_MAKEUP: Make Up Gain	<p>O is the offset of the DRC Equation: $O = \text{ABS}[(\text{Offset}-24) / 0.0625]$ Example: Offset = 6dB $(6-24) / 0.0625 = 288$ $O_Dec = 288$ $O_Hex = \text{DEC2HEX} (288) = 0x120$</p> <table><tr><th>Offset</th><th>O_Dec</th><th>O_Hex</th></tr><tr><td>-10dB</td><td>544</td><td>0x02, 0x20</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>6dB</td><td>288</td><td>0x01, 0x20</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr></table>	Offset	O_Dec	O_Hex	-10dB	544	0x02, 0x20	6dB	288	0x01, 0x20
Offset	O_Dec	O_Hex																										
-10dB	544	0x02, 0x20																										
.	.	.																										
.	.	.																										
.	.	.																										
6dB	288	0x01, 0x20																										
.	.	.																										
.	.	.																										
.	.	.																										

17.19 Peak Mode RMS Mode (Control Page)

Block Diagram and Description

→The detecting threshold using different calculated methods.
Peak mode: AE and 1-AE is independent
RMS mode: AE + (1-AE) = 1



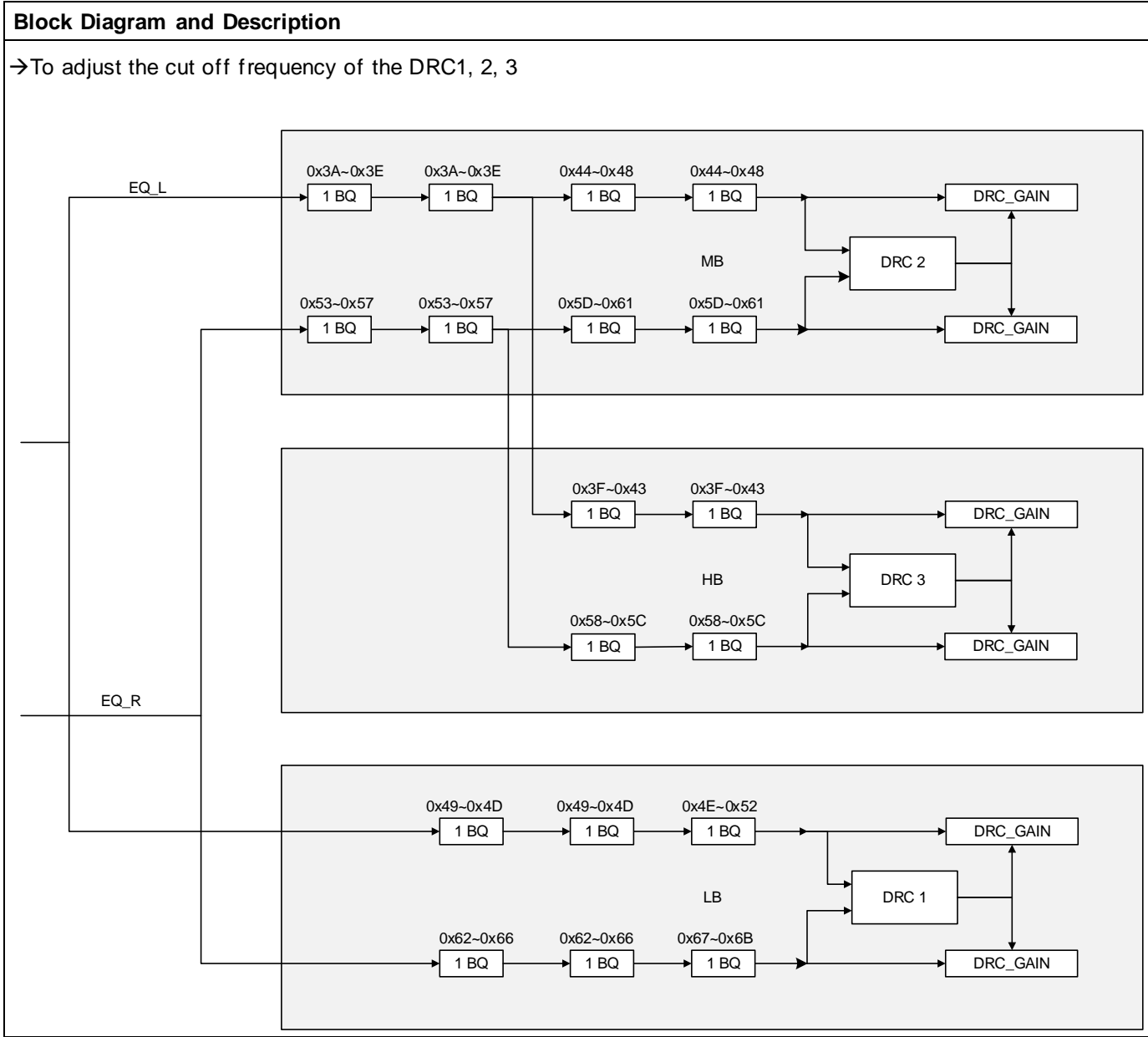
17.19.1 DRC Peak Control Flow

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	000: sys ctrl → Select this page to control the 0x0E
2	0x0E	7	DRC4_PEAK	1: Peak mode 0: RMS mode
		6	DRC3_PEAK	1: Peak mode 0: RMS mode
		5	DRC2_PEAK	1: Peak mode 0: RMS mode
		4	DRC1_PEAK	1: Peak mode 0: RMS mode

17.20 DRC Enable (Control Page)

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	000: sys ctrl → Select this page to control the 0x0F
2	0x0F	7	DRC4_EN	DRC4 Enable (Final DRC) 1: Enable 0: Disable →When disable, input signal is the same as output signal. →Final Stage DRC enable (DRC4)
		6	DRC3_EN	DRC3 Enable (H band) 1: Enable 0: Disable →When disable, input signal is the same as output signal. →Final Stage DRC enable (DRC3)
		5	DRC2_EN	DRC2 Enable (M band) 1: Enable 0: Disable →When disable, input signal is the same as output signal. →Final Stage DRC enable (DRC2)
		4	DRC1_EN	DRC1 Enable (L_band) 1: Enable 0: Disable →When disable, input signal is the same as output signal. →Final Stage DRC enable (DRC1)

17.21 Multi Band DRC EQ



17.21.1 DRC_EQ Link Control Flow (Control Page)

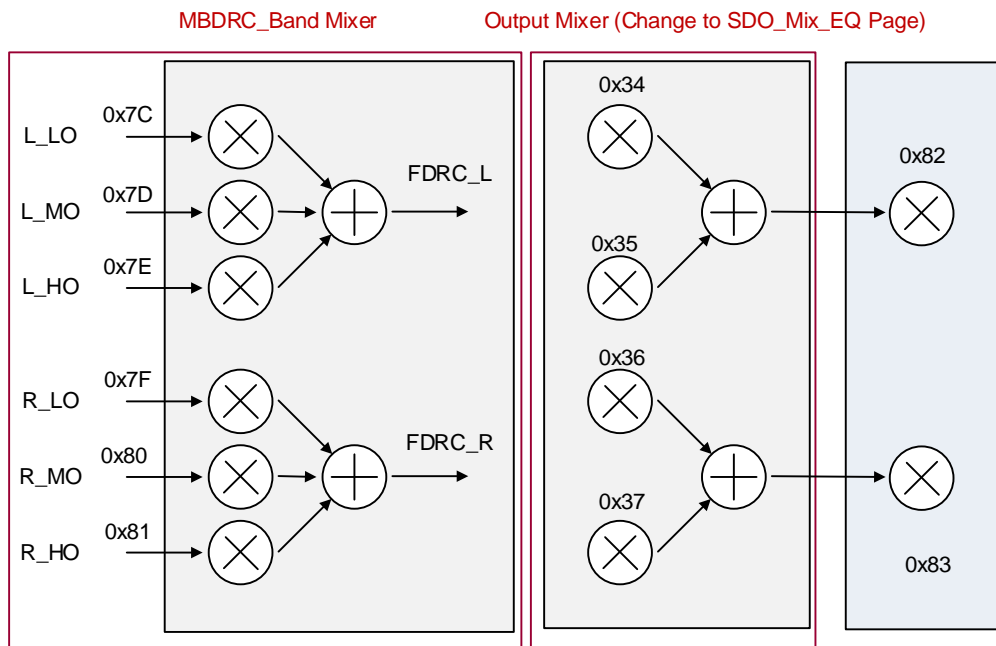
Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	000: sys ctrl → Select this page to control the 0x0F
2	0x0C	4	MBDRC_EQ_LINK	Write coefficient option for MBDRC EQ 0: L/R independent 1: L/R write the same data

17.21.2 DRC_EQ Coefficient

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	100: DSP signal process (DRC) → Select this page to control the below coefficient.
2	0x3A to 0x6B	31:0	HB_CH1_BQ1_B0	High Band Ch1 BQ1 B0
				.
		31:0	LB_CH2_BQ2_A2	Low Band Ch2 BQ2 A2

17.22 MBDRC/Output Mixer (Change to DRC Page)

Block Diagram and Description



Note: Output Mixer only available when MRDRC using same coefficient.

17.22.1 MBDRC/Band Mixer/Output Control Flow

Step	Address	BITS	Name	Description
1	0x0A	2:0	REG_PAGE_SEL	100: DSP signal process (DRC) → Select this page to control the below coefficient.
	0x7C	31:0	CH1_OUT_MIX_L	Ch1 L band output mixer
	0x7D	31:0	CH1_OUT_MIX_M	Ch1 M band output mixer
	0x7E	31:0	CH1_OUT_MIX_H	Ch1 H band output mixer
	0x7F	31:0	CH2_OUT_MIX_L	Ch2 L band output mixer
	0x80	31:0	CH2_OUT_MIX_M	Ch2 M band output mixer
	0x81	31:0	CH2_OUT_MIX_H	Ch2 H band output mixer
1	0x0A	2:0	REG_PAGE_SEL	011: DSP signal process (IN/OUT MIXER SDO MIXER/EQ) → Select this page to control the below coefficient.
	0x34	31:0	CH1_OUT_MIX_0	Ch1 1 Output Mixer 0 Note 1: Default signal flow is from CH1_OUT_MIX_0 Note 2: Change to SDO_Mix_Page
	0x35	31:0	CH1_OUT_MIX_1	Ch1 1 Output Mixer 1 Note: Change to SDO_Mix_Page
	0x36	31:0	CH2_OUT_MIX_0	Ch2 1 Output Mixer 0 Note: Change to SDO_Mix_Page
	0x37	31:0	CH2_OUT_MIX_1	Ch2 1 Output Mixer 1 Note 1: Default signal flow is from CH2_OUT_MIX_1 Note 2: Change to SDO_Mix_Page

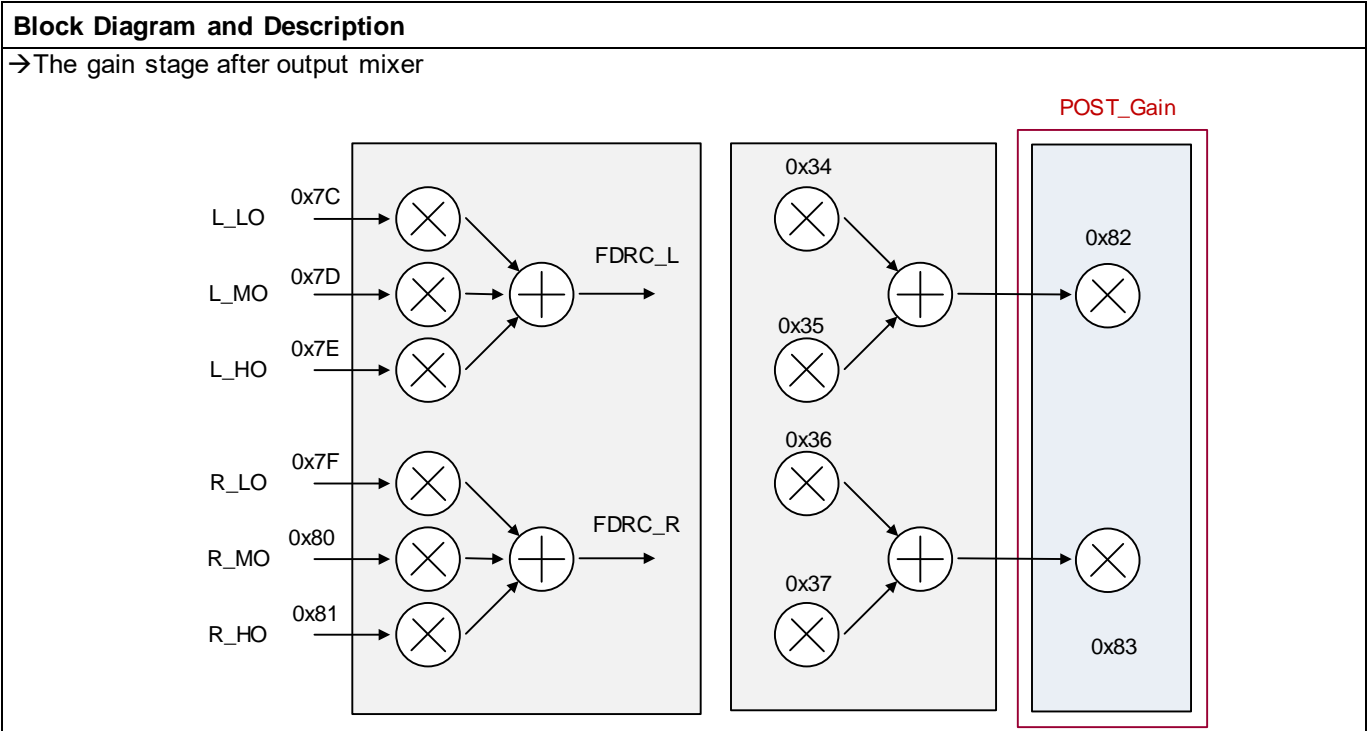
17.22.2 Output/MBDRC Mixer Gain Setting

Address	BITS	Name	Equation																		
0x7C to 0x81 For Band Mixer 0x34 to 0x37 for output mixer	31:0	mix_1[31:0] mix_0[31:0]	Equation: $20\text{Log} (\text{Dec} / 67108864)$																		
			Range: 24dB (0X3F654E69) to Mute (0x00000000)																		
			Example: 6dB, Gain = $20\text{Log} (133899787 / 67108864)$ = 6dB																		
			Hex = 0x7FB260B																		
			Dec = 133899787																		
			<table><tr><th>Gain</th><th>Dec</th><th>Hex</th></tr><tr><td>6dB</td><td>133899787</td><td>0X7FB260B</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>0</td><td>67108864</td><td>0X04000000</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr></table>	Gain	Dec	Hex	6dB	133899787	0X7FB260B	.	.	.	0	67108864	0X04000000
			Gain	Dec	Hex																
6dB	133899787	0X7FB260B																			
.	.	.																			
0	67108864	0X04000000																			
.	.	.																			
.	.	.																			

17.22.3 Mixer Gain Inverse Setting

Address	BITS	Name	Equation																					
0x7C to 0x81 For Band Mixer 0x34 to 0x37 for output mixer	31:0	mix_1[31:0] mix_0[31:0]	Equation: $20\text{Log} (\text{Dec} / 67108864)$																					
			Range: 24dB (0X3F654E69) to Mute (0x00000000)																					
			Example: 6dB, Gain = $20\text{Log} (133899787 / 67108864)$ = 6dB																					
			Hex = 0xF804D9F5																					
			Dec = -133899787																					
			<table><tr><th>Gain</th><th>Dec</th><th>Hex</th></tr><tr><td>6dB</td><td>-133899787</td><td>0X F804D9F5</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>0</td><td>-67108864</td><td>0XFC000007</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr></table>	Gain	Dec	Hex	6dB	-133899787	0X F804D9F5	0	-67108864	0XFC000007
			Gain	Dec	Hex																			
6dB	-133899787	0X F804D9F5																						
.	.	.																						
.	.	.																						
0	-67108864	0XFC000007																						
.	.	.																						
.	.	.																						

17.23 Post-Gain (Change to DRC Page)



17.23.1 Post Gain Control Flow

Address	BITS	Name	Equation																											
0x0A	2:0	REG_PAGE_SEL	100: DSP signal process (DRC) → Select this page to control the below coefficient.																											
0x82	31:0	Ch1_POST_SCALE	Equation: $10^{(((Gain/20)) + LOG(2^{26}))}$ Range: 24dB (0xFFC09AB197) to Mute (0xFFFFFFFFD61) Example: 6dB, Hex = 0xF804D9F5 Dec = −133899787 Gain = 20Log (255 / 128) = 6dB																											
0x83	31:0	Ch2_POST_SCALE	<table><tr><th>Gain</th><th>Dec</th><th>Hex</th></tr><tr><td>6dB</td><td>−133899787</td><td>0x F804D9F5</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>0dB</td><td>−67108864</td><td>0xFC000000</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr></table>	Gain	Dec	Hex	6dB	−133899787	0x F804D9F5	0dB	−67108864	0xFC000000
Gain	Dec	Hex																												
6dB	−133899787	0x F804D9F5																												
.	.	.																												
.	.	.																												
.	.	.																												
0dB	−67108864	0xFC000000																												
.	.	.																												
.	.	.																												
.	.	.																												

17.24 Volume Ramp

00: 4.33ms from mute to 0dB (0.5dB/20.83μs) (default)

01: 8.66ms from mute to 0dB (0.25dB/20.83μs)

10: 17.33ms from mute to 0dB (0.125dB/20.83μs).

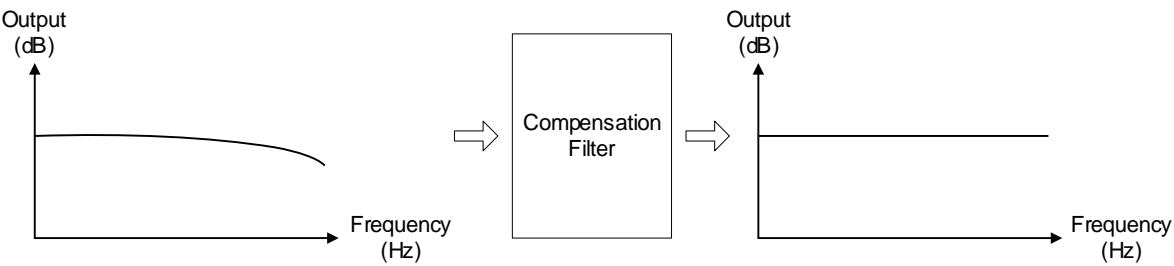
11: 34.65ms from mute to 0dB (0.0625dB/20.83μs).

Address	BITS	Name	Description
0x32	1:0	VOL_RAMP_MODE[13:12]	00: 4.33ms from mute to 0dB (0.5dB/20.83μs) (default) 01: 8.66ms from mute to 0dB (0.25dB/20.83μs) 10: 17.33ms from mute to 0dB (0.125dB/20.83μs) 11: 34.65ms from mute to 0dB (0.0625dB/20.83μs)

Note 23. The ramp time is fixed, it will not be affected by the sampling rate.

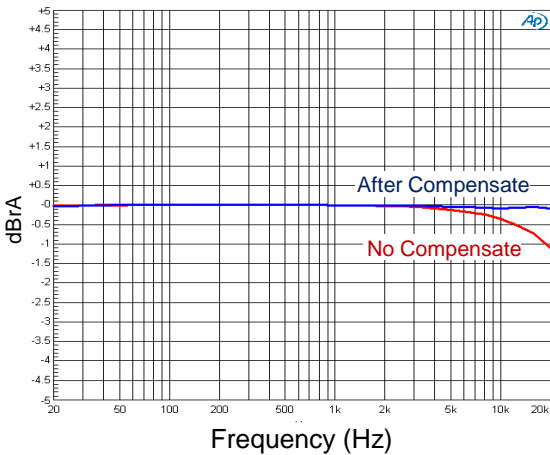
17.25 Compensate Filter

Compensation filter is aimed to compensate internal gain from DAC, this filter can also compensate the frequency response affected by LC filter. The recommended setting will be based on different application circuits to fit the curve.



Compensate Description	Equation
Compensate	$y[n] = B3 \times [n-6] + B2 \times [n-5] + B1 \times [n-4] + B0 \times [n-3] + B1 \times [n-2] + B2 \times [n-1] + B3 \times [n]$ <p>B0, B1, B2, B3: Compensate coefficient N: Input signal when applied</p>

Address	BITS	Name	Description
0x06	6	COMP_EN	1: Compensation filter enable 0: Compensation filter disable (default)
0x3A	16:0	COMP_B0	Compensate B0, B1, B2, and B3 coefficient
0x3B	16:0	COMP_B1	
0x3C	16:0	COMP_B2	
0x3D	16:0	COMP_B3	

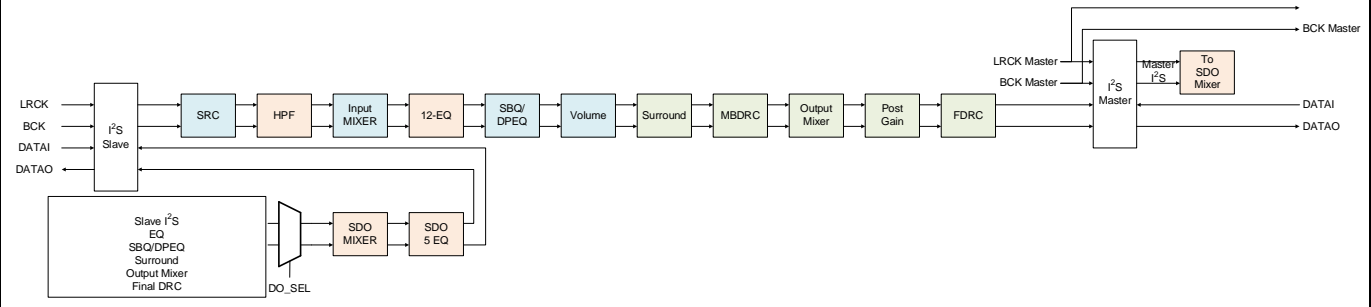


17.26 Data Output (Control Page)

Block Diagram and Description

→The RT9125 has SDO output which can configure signal output after processor.

→The SDO output consist output mixer, and 5 Bi-Quad, which can be used for sub-woofer application.



17.26.1 SDO Control Function

Address	BITS	Name	Description
0x0A	2:0	REG_PAGE_SEL	000: sys ctrl → Select this page to control the 0x03
0x03	7:4	SDO_SEL	4'b0000: No output (default) 4'b0001: i2s interface 4'b0011: 12 Band EQ 4'b0100: Smooth BQ/ DPEQ 4'b0101: Spatialier/CCS 4'b0110: Output Mixer 4'b0111: Final DRC Others: No output

17.26.2 SDO Output Mixer Control (Change to SDO_Mixer Control)

Address	BITS	Name	Description
0x0A	2:0	REG_PAGE_SEL	011: DSP signal process (IN/OUT MIXER SDO MIXER/EQ) → Select this page to control the 0x38, 0x39, 0x3A, and 0x3B.
0x38	31:0	SDO_CH1_IN_MIX_0	Ch1 SDO output mixer 0 Note: Default signal is from Ch1 SDO output mixer 0
0x39	31:0	SDO_CH1_IN_MIX_1	Ch1 SDO output mixer 1
0x3A	31:0	SDO_CH2_IN_MIX_0	Ch2 SDO output mixer 0
0x3B	31:0	SDO_CH2_IN_MIX_1	Ch2 SDO output mixer 1 Note: Default signal is from Ch2 SDO output mixer 1

17.26.3 SDO EQ Coefficient

Address	BITS	Name	Description
0x0A	2:0	REG_PAGE_SEL	011: DSP signal process (IN/OUT MIXER SDO MIXER/EQ) → Select this page to control the below EQ coefficient.
0x3C	31:0	SDO1_BQ1_B0	Ch1 SDO BQ 1 coefficient B0
			.
			.
0x6D	31:0	SDO2_BQ5_A1	Ch2 SDO BQ 5 coefficient A1

DRC4 is final stage of DRC. It can be configured as the final DRC to limit the output power. (Change to DRC page)

Block Diagram and Description

→ Make the audio output signal lately.

DRC detect compression

Threshold

Gain

Input Signal without delay

DRC detect compression

Threshold

Gain

Input Signal with delay

DRC detect compression

Threshold

Gain

Output Signal without Delay

DRC detect compression

Threshold

Gain

Output Signal with Delay

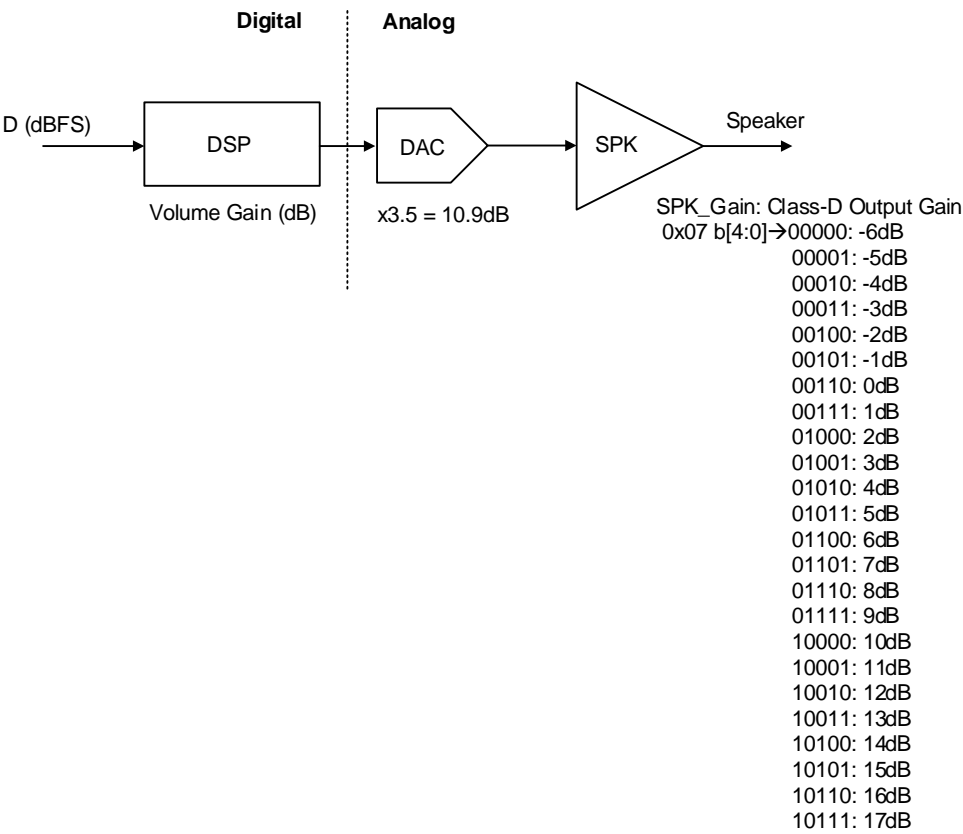
Add delay

→

Delay = (DRC4_Delay) * 1 / Sample rate

Address	BITS	Name	Description
0x0A	2:0	REG_PAGE_SEL	100: DSP signal process (DRC) → Select this page to control the below coefficient.
0xB4	7:0	DRC4_DELAY	DRC4_DELAY →DRC 4 delay for channel 1
0xB5	7:0	DRC4_DELAY 2	DRC4_DELAY 2 →DRC 4 delay for channel 2

17.27 Amplification Gain



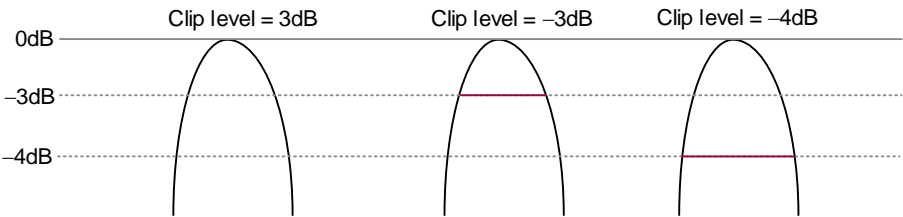
Address	BITS	Name	Description
0x07	4:0	D_SPK_GAIN[4:0]	Class-D output gain 00000: -6dB 00001: -5dB 00010: -4dB 00011: -3dB 00100: -2dB 00101: -1dB 00110: 0dB 00111: 1dB 01000: 2dB 01001: 3dB 01010: 4dB 01011: 5dB 01100: 6dB 01101: 7dB 01110: 8dB 01111: 9dB 10000: 10dB 10001: 11dB 10010: 12dB 10011: 13dB 10100: 14dB 10101: 15dB 10110: 16dB 10111: 17dB

17.28 Master Volume Gain

Address	BITS	Name	Equation																								
0x20	10:0	MS_VOL[10:0]	Equation: 24dB - (Dec x 0.0625)																								
			Range: 24dB (0X000) to mute (0x7ff)																								
			For example, 10dB, Hex = 0xE0																								
			Dec = 224																								
			Gain = 24dB - (224 x 0.0625) = 10dB																								
			<table><tr><td>Gain</td><td>Dec</td><td>Hex</td></tr><tr><td>24dB</td><td>0</td><td>0x00</td></tr><tr><td>10dB</td><td>224</td><td>0XE0</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>0dB</td><td>384</td><td>0x180</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr><tr><td>.</td><td>.</td><td>.</td></tr></table>	Gain	Dec	Hex	24dB	0	0x00	10dB	224	0XE0	.	.	.	0dB	384	0x180
			Gain	Dec	Hex																						
			24dB	0	0x00																						
			10dB	224	0XE0																						
.	.	.																									
0dB	384	0x180																									
.	.	.																									
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17.29 Hard Clip Function

To clip the signal with different threshold, operate in time domain.



Address	BITS	Name	Description
0x06	0	HARD_CLIP_EN	0: Disable hard clip (default) 1: Enable hard clip
0x27	10:0	HARD_CLIP_TH[10:0]	Hard clip threshold for Hard clip, when threshold > 0, there is no any clipping effect happened. 11'h180: 0dB 0.0625db per step Note: Due to there is -2dB at digital filter, so hard clipping only works when threshold < -2dB.

17.30 PBTL Function

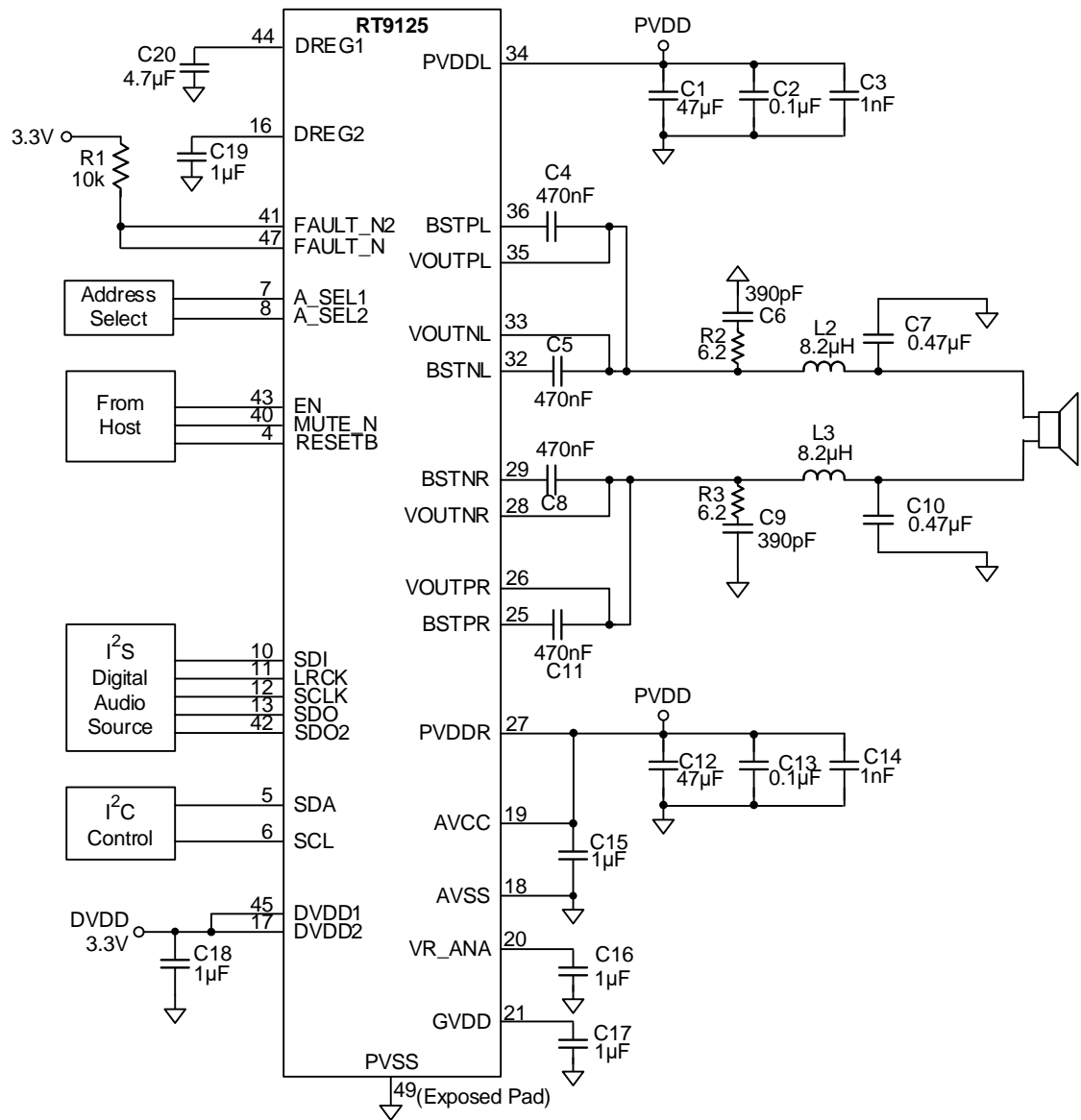
It can be configured by the hardware, and also need to change the software setting

The input signal can be configured by the input mixer, from register 0x30 to configure the input signal. The default signal for the PBTL is from 0x30 L channel signal.

Address	BITS	Name	Description
0x05	4	D_PBTL	0: BTL, 1: PBTL

Address	BITS	Name	Description
0x30	16:0	CH1_IN_MIX_0	u[23:17], mix_0[16:0] u: Unused
0x31	16:0	CH1_IN_MIX_1	u[23:17], mix_1[16:0] u: Unused

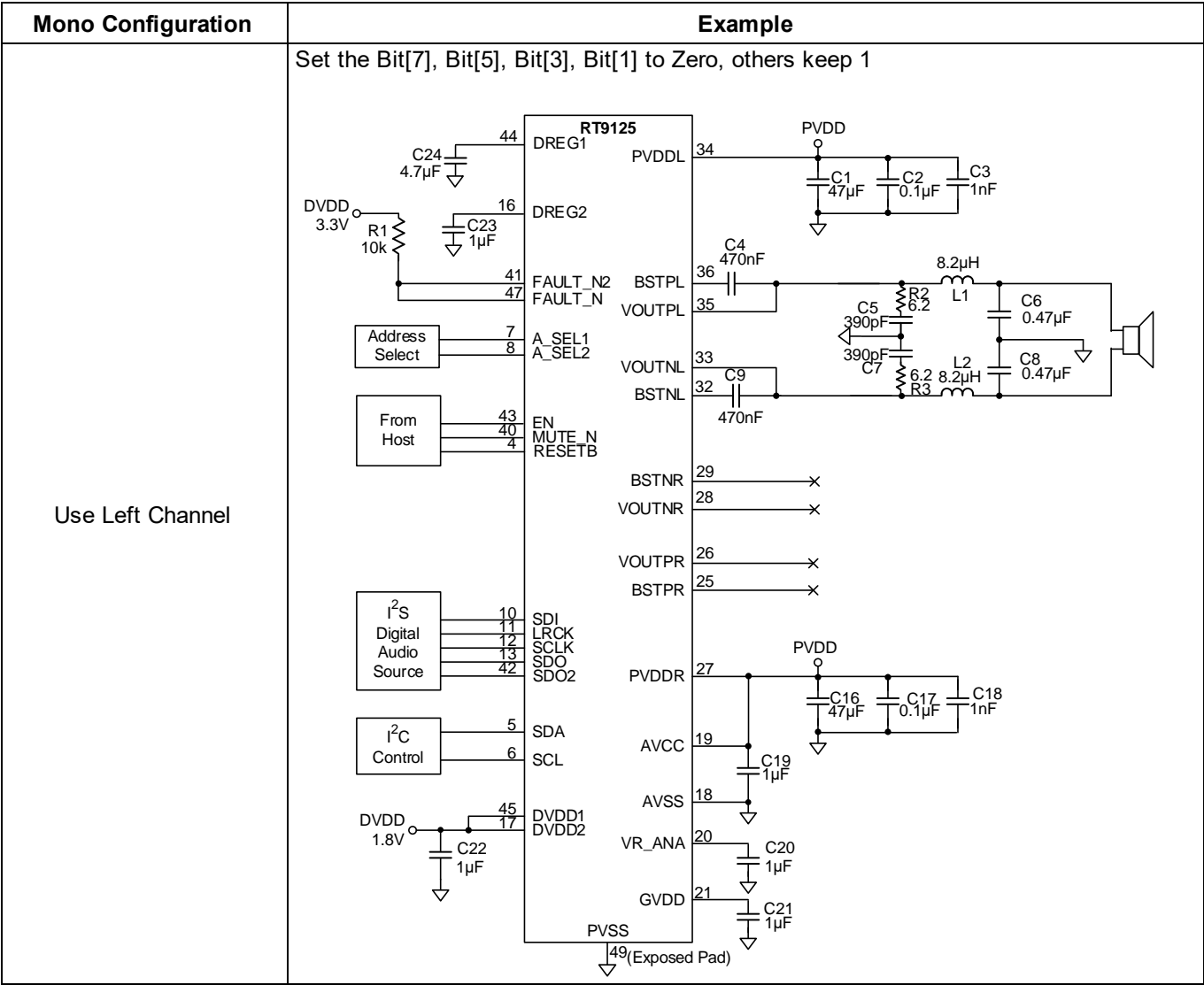
17.31 Mono PBTL Application Circuit

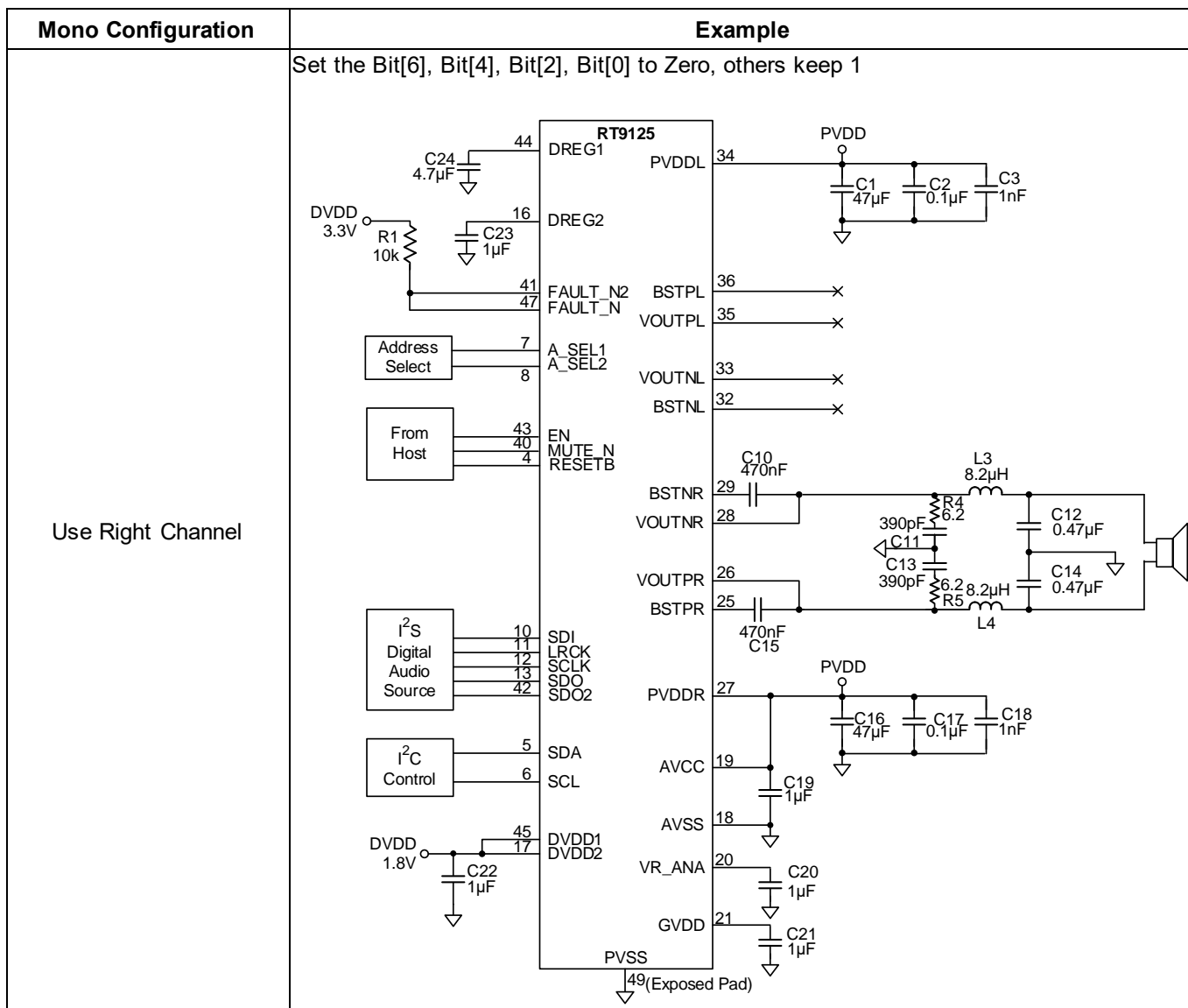


17.32 Mono Configuration

To use the mono configuration, it can be configured by register setting.

Address	BITS	Name	Description
0x15	7	D_RLPF_EN	DAC RCH LPF enable 0: Force off 1: Follow sequence (default)
	6	D_LLPF_EN	DAC LCH LPF enable 0: Force off 1: Follow sequence (default)
	5	D_EN_RCH_PWR	RCH PWR stage enable 0: Force off 1: Follow sequence (default)
	4	D_EN_LCH_PWR	LCH PWR stage enable 0: Force off 1: Follow sequence (default)
	3	D_RDAC_EN	DAC RCH enable 0: Force off 1: Follow sequence (default)
	2	D_LDAC_EN	DAC LCH enable 0: Force off 1: Follow sequence (default)
	1	D_EN_MD_RCH	MD RCH enable 0: Force off 1: Follow sequence (default)
	0	D_EN_MD_LCH	MD LCH enable 0: Force off 1: Follow sequence (default)





18 Operation

18.1 Error Reporting

The FAULT_N, and FAULT_N2 pin is for reporting error status. The FAULT_N, and FAULT_N2 go to low when protection happen. This pin is open-drain configuration, a pull-up resistor is needed.

18.2 Clock Detection

The RT9125 can accept SCLK to be as 32fs, 48fs and 64fs and support only a 1xfs LRCK. The internal oscillator will check SCLK input constantly. If clock is lost, the RT9125 will shut down the power stage automatically.

18.3 Volume Control

The RT9125 has master volume MS_VOL and each channel volume CH1_VOL, CH2_VOL control. The step of each volume is 0.0625dB per step, from 24dB to mute. CH1 and CH2 also have each mute control, CH1_MUTE and CH2_MUTE.

18.4 Overvoltage Protection

The RT9125 monitors the voltage on PVDD voltage threshold. When the voltage on PVDDL/R pin rises above the overvoltage threshold, 30V, the OVP circuit turns off the output immediately and operates in auto-recovery mode, or the latch mode can also be configured in operation.

18.5 Over-Temperature Protection

The over-temperature protection function will turn off the power MOSFET when the junction temperature exceeds 150°C (minimum). Once the junction temperature cools down by approximately 30°C, the regulator will automatically resume operation, or the latch mode can also be configured in operation.

18.6 Dynamic Range Enhancement

The dynamic range enhancement enhances the dynamic range for the application. It will optimize the noise when during operation.

18.7 Built-In Anti-POP Function

An internal soft-start function controls the duty ramp-up rate of the output PWM voltage to minimize the POP noise during start-up. Similarly, when power shuts-down, the duty also ramp-down to eliminate the POP noise. This function also acts when the PWDN_N pin turns-ON/OFF.

18.8 Overcurrent Protection

The RT9125 provides OCP function to prevent the device from damages during overload or short-circuit conditions. The current function is detected by an internal sensing circuit. Once when the inductor short to each other and to GND the OCP function is designed to operate the latch mode.

18.9 Undervoltage Protection

The RT9125 monitors the voltage on PVDD voltage threshold. When the voltage on the PVDDL/R pin falls below the undervoltage threshold, 4V (which can be programmable), the UVP circuit turns off the output immediately, or the latch mode can be configured in operation.

18.10 OLD/SLD Function

The RT9125 adapts the overload detection and short load detection, which can be used to detect the speaker terminal is short or open.

18.11 CRC Check Function

The RT9125 adapts the CRC checksum function which can check the register coefficient.

18.12 Multi Signal Path Option

The RT9125 adapts the 2-signal path which can be configured by different application.

18.13 Common Mode Hopping Mode

The RT9125 build in Common Mode Hopping (CMH) mode to reduce pulse width at small signal, inductor current ripple is reduced, and hence light load efficiency is improved.

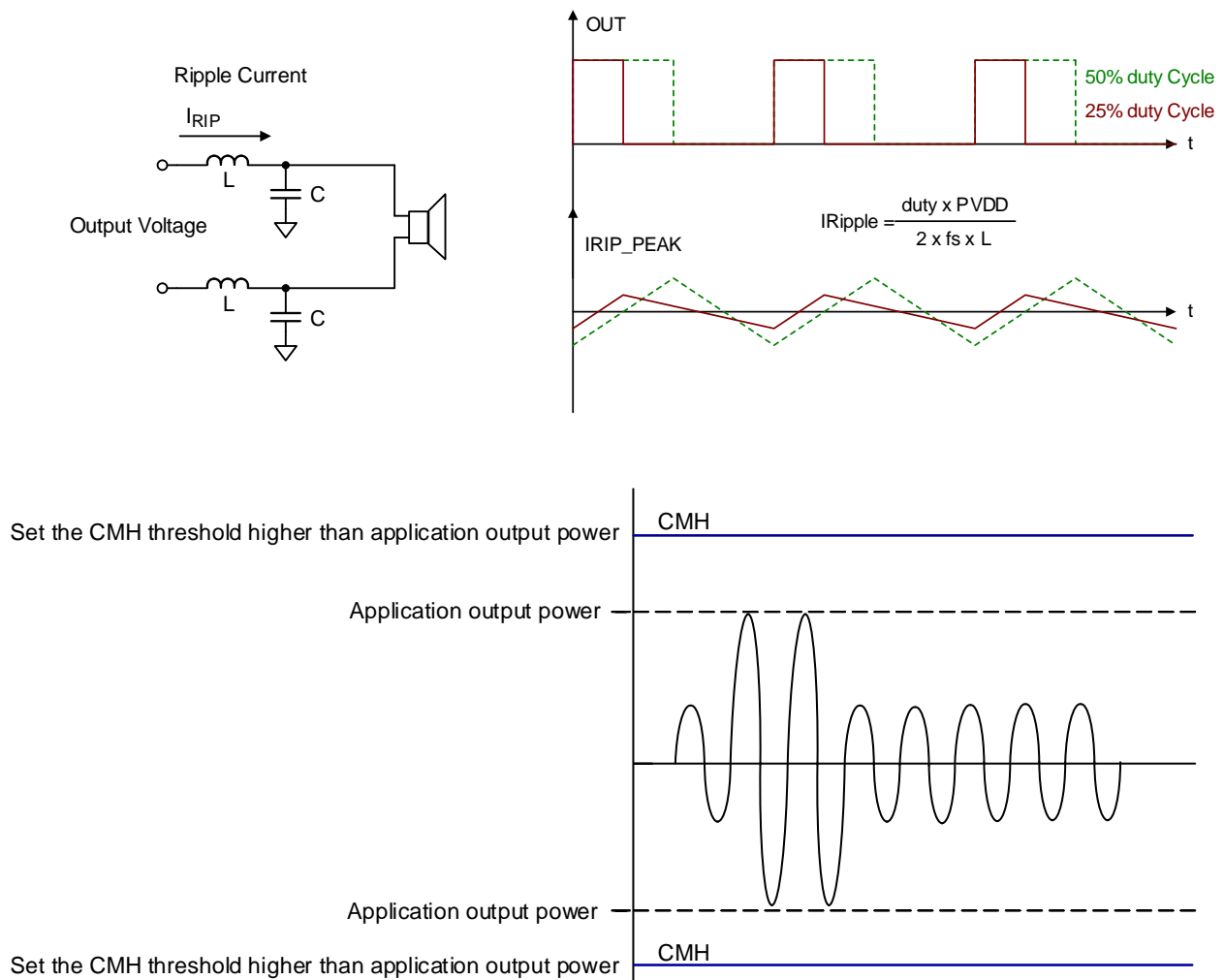


Figure 3. Current Ripple with CMH

Address	BITS	Name	Equation
0x94	7:0	D_CMH_TH [7:0]	<div>CMH threshold: $20 \times \log_{10}(\text{CMH_TH}/2^8) + 2\text{dB}$</div> <div>Output power: $10^{(\text{D} + \text{Vol_Gain})/20} \times 3.5 \times \text{Output_Gain (Vp)}$</div> <div>Use the output power to calculate the CMH threshold</div> <div>Note:</div> <div><div>1. If application output power is 12W, set the CMH threshold higher than 12W, like 13W, 14W, or 15W. By set register 0x94.</div><div>2. For the CMH threshold, recommended threshold not over 11Vp for 4 Ω.</div><div>3. For 6Ω, recommended not over 12.2Vp.</div></div>

18.14 Spread Spectrum

There are two methods, one is spread spectrum frequency, the other is added noise to triangular modulation.

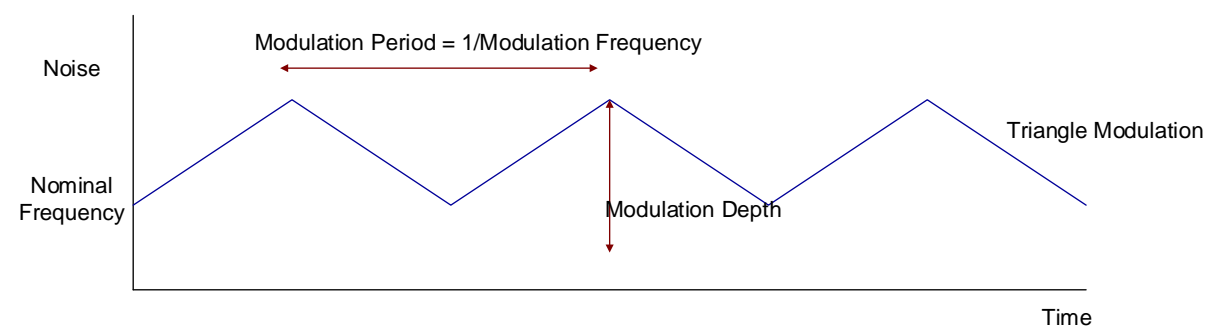


Figure 4. Current Ripple with CMH

Address	BITS	Name	Description
0x09	7	D_FSS_EN	Spread spectrum enable 0: Disable (default) 1: Enable
	6	PWM_MODEWHITE	Noise select 0: Pink noise (default) 1: White noise
	5	PWM_SELCOEF	Pink noise coefficient This will affect the noise amplitude for spread spectrum signal, not recommended to modify it. 0: 1/2 (default) 1: 1/4
	4	PWM_NOISE_EN	Add noise to TRI_GEN 0: Disable (default) 1: Enable
	3:2	D_NOISE_AMP	Noise amplitude for SSC 2'b00: 5.78% (default) 2'b01: 11.55% 2'b10: 17.33% 2'b11: 23.1%
	1:0	D_FSS_AMP	Spread spectrum frequency variation amplitude 2'b00: 16.60% 2'b01: 33.19% (default) 2'b10: 33.19% 2'b11: 49.79%

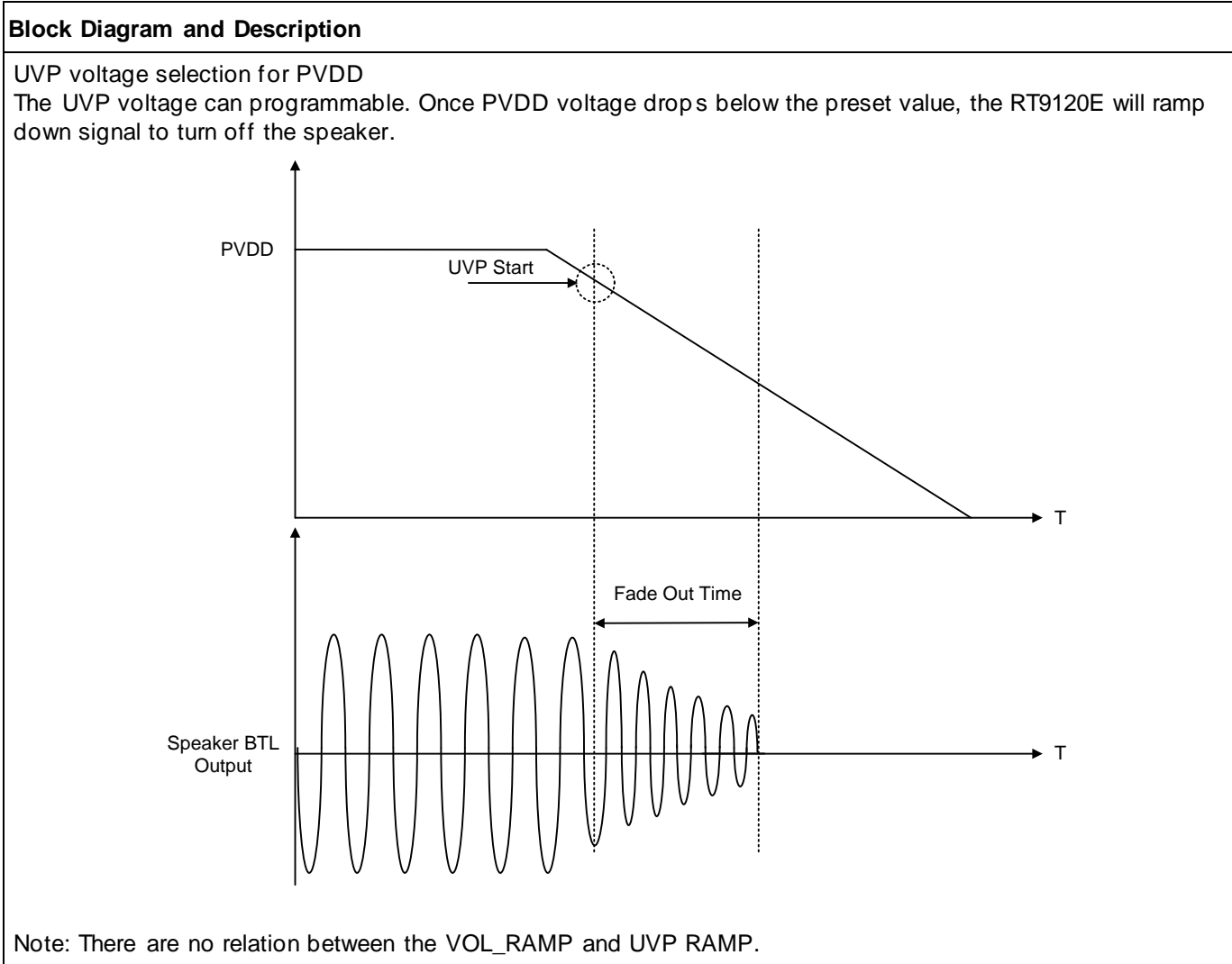
18.15 PWM Phase Change

The RT9120 has channel to channel phase control function. Channel 1 is used as a reference for other channels, and channel 2 output PWM phase can be shifted from 0 to 315 degree, each step 45 degree.

Address	BITS	Name	Description
0x07	7:5	D_PWM_PHASE	PWM output phase select 000: 0 (default) 001: 45 010: 90 011: 135 100: 180 101: 225 110: 270 111: 315

18.16 UVP Speaker Fade Out Function

The RT9125 has UVP fade function, which is used for the when suddenly AC pull off.



Address	BITS	Name	Description
0x6C	2:0	D_UVP_PVDD_SEL[2:0]	Select UVP level for PVDD power domain 000: 4.1V 001: 6V 010: 8.5V 011: 9.5V 100: 10.9V 101: 12.7V 110: 15.4V 111: 20V
0x71	1	D_OV_FAULT_RAMP	PVDD OVP protection behavior 0: HZ_PROT directly 1: Power off sequence

19 Application Information

(Note 24)

19.1 I²C Bus Specification

The RT9125 supports the I²C protocol via the input ports SCL and SDA. This protocol defines any device that sends data on to the bus as a transmitter and any device that reads the data as a receiver. The device that controls the data transfer is known as the master and the others as the slave. The master always starts the transfer and provides the serial clock for synchronization. The RT9125 is always a slave device in all of its communications. It can operate at up to 400kB/s.

19.2 Communication Protocol

Data changes on the SDA line must only occur when the SCL clock is low. SDA transition while the clock is high is used to identify a START or STOP condition. START is identified by a high to low transition of the data bus SDA signal while the clock signal SCL is stable in the high state. A START condition must precede any command for data transfer. STOP is identified by low to high transition of the data bus SDA signal while the clock signal SCL is stable in the high state. A STOP condition terminates communication between the RT9125 and the bus master. During the data input, the RT9125 samples the SDA signal on the rising edge of clock SCL. For correct device operation, the SDA signal must be stable during the rising edge of the clock and the data can change only when the SCL line is low.

19.3 Boost Capacitor Selection

For the large power output, and low frequency, the boost capacitor can be chosen from 0.47μF to 1μF. Refer to [Table 1](#) for reference.

Table 1. Boost Capacitor Select Table

Test Condition	Capacitor Value
PVDD = 24V, R = 8Ω, Output Power > 2x25W, 20Hz, BTL Mode	1μF
PVDD = 24V, R = 4Ω, Output Power > 2x20W, 20Hz, BTL Mode	0.47μF
PVDD = 24V, R = 4Ω, Output Power > 60W, 20Hz, PBTL Mode	1μF
PVDD = 24V, R = 8Ω, Output Power > 35W, 20Hz, PBTL Mode	1μF

19.4 Device Addressing

The RT9125 supports 16 I²C slave ID address, which can be configured by using different resistor (20% tolerance). Refer to [Table 2](#) for the address configuration.

Table 2. Address Select Table

SEL_1	SEL_2	Address
High	High	0x15
High	Low	0x11
Low	High	0x14
Low	Low	0x10
High+600k	High	0x17
High+600k	Low	0x13
Low+600k	High	0x16
Low+600k	Low	0x12
High	High+600k	0x1d
High	Low+600k	0x19
High+600k	High+600k	0x1f
High+600k	Low+600k	0x1b
Low	High+600k	0x1c
Low	Low+600k	0x18
Low+600k	High+600k	0x1e
Low+600k	Low+600k	0x1a

19.5 LC Filter Selection

For the different PWM switching and to avoid large current ripple, refer to [Table 3](#) to select suitable LC combination.

Table 3. LC Filter Selection Table

PWM	Inductor	Capacitor Value
384kHz	10 μ H to 8.2 μ H	0.68 μ F to 0.47 μ F
768kHz	4.7 μ F	0.47 μ F to 0.22 μ F

19.6 I²C Write Control

Following the START condition, the master sends a device select code with the RW bit set to 0. The RT9125 acknowledges this and the writes for the byte of internal address. After receiving the internal byte address, the RT9125 again responds with an acknowledgement.

19.7 I²C Read Control

Following the START condition the master sends a device select code with the RW bit set to 1. The RT9125 acknowledges this and then responds by sending one byte of data. The master then terminates the transfer by generating a STOP condition.

19.8 Thermal Considerations

The junction temperature should never exceed the absolute maximum junction temperature T_J(MAX), listed under Absolute Maximum Ratings, to avoid permanent damage to the device. The maximum allowable power dissipation depends on the thermal resistance of the IC package, the PCB layout, the rate of surrounding airflow, and the difference between the junction and ambient temperatures. The maximum power dissipation can be calculated using

the following formula:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction-to-ambient thermal resistance.

For continuous operation, the maximum operating junction temperature indicated under Recommended Operating Conditions is 150°C. The junction-to-ambient thermal resistance, θ_{JA} , is highly package dependent. For a VQFN-48L 6x6 package, the thermal resistance, θ_{JA} , is 27°C/W on a standard JEDEC 51-7 high effective-thermal-conductivity four-layer test board. The maximum power dissipation at $T_A = 25^\circ\text{C}$ can be calculated as below:

$$P_{D(MAX)} = (150^\circ\text{C} - 25^\circ\text{C}) / (27^\circ\text{C/W}) = 3.7\text{W for a VQFN-48L 6x6 package.}$$

The maximum power dissipation depends on the operating ambient temperature for the fixed $T_{J(MAX)}$ and the thermal resistance, θ_{JA} . The derating curve in [Figure 5](#) allows the designer to see the effect of rising ambient temperature on the maximum power dissipation.

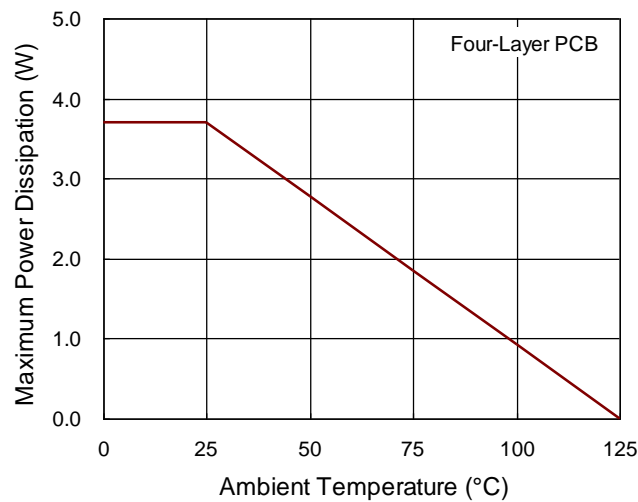
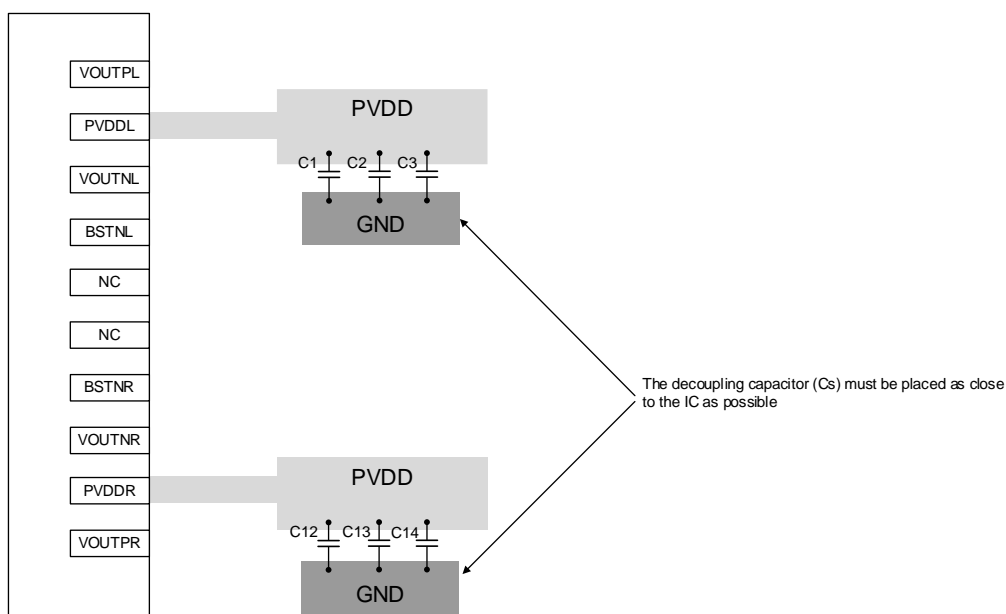


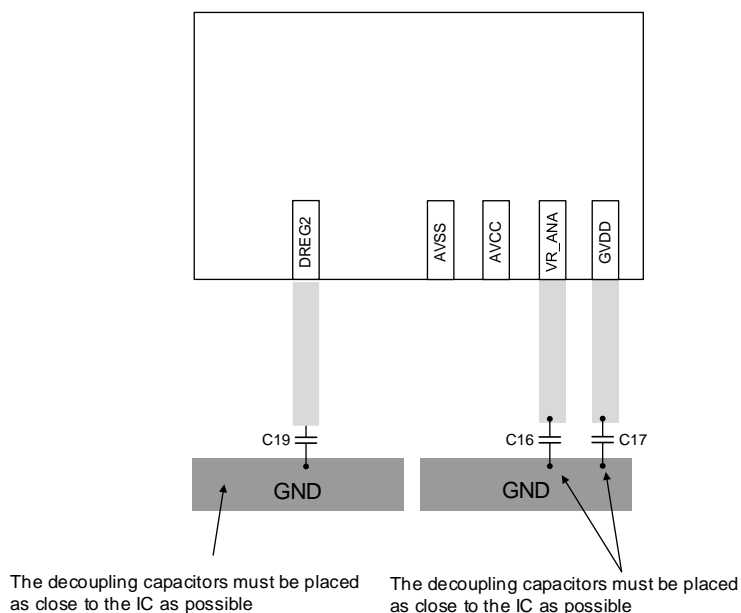
Figure 5. Derating Curve of Maximum Power Dissipation

19.9 Layout Guide

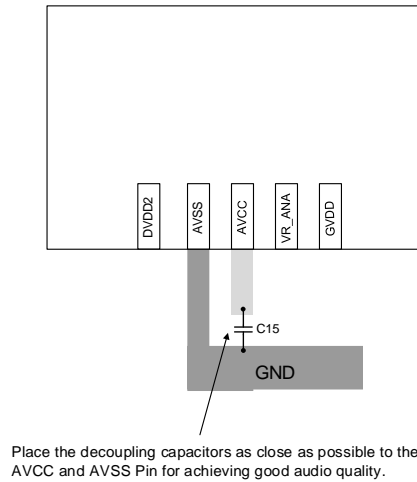
Place the decoupling capacitors as close as possible to the PVCC and GND, then use shortest trace to link these capacitors, and use more vias for GND link to GND layer to reduce parasitic inductance and resistance. The trace width is 30mil at least.



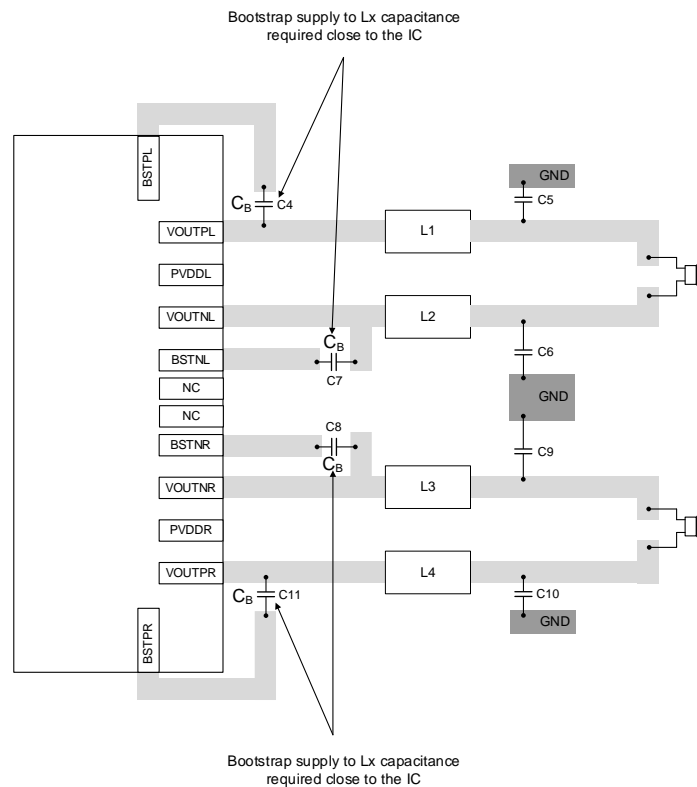
The DREG2, VR_ANA, and GVDD decoupling capacitors must be placed as close to the IC as possible.



Place the decoupling capacitors as close as possible to the AVCC and AVSS Pin for achieving good audio quality, the trace width of AVCC is 30mil at least.



The traces of VOUTPL, VOUTNL, VOUTPR, and VOUTNR should be kept as equal width and length respectively, and Bootstrap supply to Lx is capacitance required to be close to the IC.



If possible, coplanar ground fill on both sides for differential pair of speaker out shielding.

Note 24. The information provided in this section is for reference only. The customer is solely responsible for designing, validating, and testing any applications incorporating Richtek's product(s). The customer is also responsible for applicable standards and any safety, security, or other requirements.

20 Functional Register Description

(Note 25)

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
Control Page (Digital Portion)								
0x00	1	VERSION	7:4	0	4	0000	RO	D_VERSION_IED
0x01	1	I2S_CLK_FMT	7:4	5	4	0101	RW	Sampling rate (manual setting or report) If 0x04 bit 4 SR_DET_EN = 1, SR_MODE report sampling rate detection result. 4'b0000: 8kHz 4'b0001: 12kHz 4'b0010: 16kHz 4'b0011: 24kHz 4'b0100: 32kHz 4'b0101: 44.1/48kHz (default) 4'b0110: 88.2/96kHz 4'b0111: 192kHz Others: Sampling rate error report
			3:0	2	4	0010	RW	BCK OSR mode (manual setting or report) If 0x04 bit 4 SR_DET_EN = 1, BCK_MODE report BCK OSR detection result. 4'b0000: BCK = 32fs 4'b0001: BCK = 48fs 4'b0010: BCK = 64fs (default) 4'b0011: BCK = 96fs 4'b0100: BCK = 128fs 4'b0101: BCK = 192fs 4'b0110: BCK = 256fs 4'b0111: BCK = 384fs 4'b1000: BCK = 512fs Others: BCK mode error report

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x02	1	I2S_DATA_FMT	7	0	1	0	RW	I ² S data data out launch edge selection 1'b0: BCK_RX_EDGE = 0, launch with falling edge; BCK_RX_EDGE = 1, launch with rising edge (default) 1'b1: BCK_RX_EDGE = 0, launch with rising edge; BCK_RX_EDGE = 1, launch with falling edge
			6	0	1	0	RW	1'b0: RX @ BCK rising edge and TX @ BCK falling edge (default) 1'b1: RX @ BCK falling edge and TX @ BCK rising edge
			5:4	2	2	10	RW	Audio bits for signal process 2'b00: 16 bits 2'b01: 20 bits 2'b10: 24 bits (default) 2'b11: 32 bits
			3	1	1	1	RW	TDM or DSPM offset selection 1'b0: Without offset (DSPMB) 1'b1: 1 bit clock offset (DSPMA) (default)
			2:0	0	3	000	RW	I ² S format selection 3'b000: I ² S (default) 3'b001: Left Justify 3'b010: Right Justify 3'b011: DSP mode 3'b100: EIAJ Others: TDM mode

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x03	1	I2S_DIO_ SEL	7:4	0	4	0000	RW	4'b0000: No output (default) 4'b0001: I ² S interface 4'b0010: 128-tap FIR 4'b0011: EQ BQ 4'b0100: Smooth BQ/DPEQ 4'b0101: Spatializer/CCS 4'b0110: Output Mixer 4'b0111: Final DRC 4'b1000: I ² S master interface Others: No output
			3:2	0	2	00	RW	2'b00: SDIN-L to LCH (default) 2'b01: SDIN-R to LCH 2'b1X: 0 to LCH
			1:0	1	2	01	RW	2'b00: SDIN-L to RCH 2'b01: SDIN-R to RCH (default) 2'b1X: 0 to RCH
0x04	1	TDM_RX_L	5:0	0	6	000000	RW	TDM start transmitting location select for L channel 6'b000000: Start from 0+offset (default) 6'b000001: Start from 8+offset 6'b000010: Start from 16+offset 6'b000011: Start from 24+offset ... 6'b111101: Start from 488+offset 6'b111110: Start from 496+offset 6'b111111: Start from 504+offset

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x05	1	TDM_RX_R	5:0	4	6	000100	RW	TDM start transmitting location select for R channel 6'b000000: Start from 0+offset 6'b000001: Start from 8+offset 6'b000010: Start from 16+offset 6'b000011: Start from 24+offset (default) ... 6'b111101: Start from 488+offset 6'b111110: Start from 496+offset 6'b111111: Start from 504+offset
0x06	1	TDM_TX_L	5:0	0	6	000000	RW	TDM start receiving location select for L channel 6'b000000: Start from 0+offset (default) 6'b000001: Start from 8+offset 6'b000010: Start from 16+offset 6'b000011: Start from 24+offset ... 6'b111101: Start from 488+offset 6'b111110: Start from 496+offset 6'b111111: Start from 504+offset
0x07	1	TDM_TX_R	5:0	4	6	000100	RW	TDM start receiving location select for R channel 6'b000000: Start from 0+offset 6'b000001: Start from 8+offset 6'b000010: Start from 16+offset 6'b000011: Start from 24+offset (default) ... 6'b111101: Start from 488+offset 6'b111110: Start from 496+offset 6'b111111: Start from 504+offset

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x08	1	SYS_CTRL	7	1	1	1	RW	Silence detection enable 1'b0: Disable 1'b1: Enable (default)
			6	1	1	1	RW	Sampling rate and BCK OSR mode detection enable bit 1'b0: Disable, manual set SR mode and BCK mode 1'b1: Enable (default)
			5	1	1	1	RW	Sampling rate converter enable internal process with 88.2k/96kHz sampling rate (support input fs = 32kHz, 44.1k/48kHz) 0: Disable 1: Enable
			4	0	1	0	RW	DRC compress mode selection 0: Compress jointly (2.0) 1: Compress independently (1.1)
			3	0	1	0	RW	DRC predict gain enable 0: Disable 1: Enable
			2	1	1	1	RW	I ² S Master Clock generator enable 0: Bypass I ² S slave clock to I ² S master I ² S master format = I ² S when I ² S slave set as I ² S/LJ/RJ I ² S master format = DSPM_A when I ² S slave set as DSPM/TDM 1: Enable clock generator I ² S master format fix as I ² S with 64fs
			1:0	0	2	00	RW	DSP control 2'b00: amp off (default) 2'b01: amp on 2'b10: Force entry silence mode 2'b11: mute

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x09	1	PROCESS_FLOW_SEL	7:6	2	2	10	RW	Digital process flow selection 00: HPF → MIX → FIR → EQ → SBQ/DPEQ → VOL → Surround → MBDRC → Post Gain → FDRC 01: HPF → MIX → EQ → FIR → SBQ/DPEQ → VOL → Surround → MBDRC → Post Gain → FDRC 10: FIR → HPF → MIX → EQ → SBQ/DPEQ → VOL → Surround → MBDRC → Post Gain → FDRC
			3:2	2	2	10	RO	Digital process flow 00: HPF → MIX → FIR → EQ → SBQ/DPEQ → VOL → Surround → MBDRC → Post Gain → FDRC 01: HPF → MIX → EQ → FIR → SBQ/DPEQ → VOL → Surround → MBDRC → Post Gain → FDRC 10: FIR → HPF → MIX → EQ → SBQ/DPEQ → VOL → Surround → MBDRC → Post Gain → FDRC
0x0A	1	REG_PAGE_SEL	2:0	0	3	000	RW	register page select for 0x30 to 0xFF 3'b000: sys ctrl 3'b001: DSP signal process (EQ) 3'b010: DSP signal process (SBQ/DPEQ) 3'b011: DSP signal process (INOUT MIXER/SDO MIXER/EQ) 3'b100: DSP signal process (DRC) 3'b101: DSP signal process (FIR) Others: N/A

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x0B	1	SW_RST	7	0	1	0	WO	Write 1 to trigger Software reset
			1:0	0	2	00	RW	FAULTB pin type selection 2'b00: Interrupt = output low, normal = floating (default) 2'b01: Interrupt = output high, normal = floating 2'b10: Interrupt = output low, normal = output high 2'b11: Interrupt = output high, normal = output low
0x0C	1	DSP_EQ_OPT	7	1	1	1	RW	Write coefficient option for EQ 1'b0: L/R independent 1'b1: L/R write the same data
			6	1	1	1	RW	Write coefficient option for SMEQ/DPEQ 1'b0: L/R independent 1'b1: L/R write the same data
			5	1	1	1	RW	Write coefficient option for SURROUND EQ 1'b0: L/R independent 1'b1: L/R write the same data
			4	1	1	1	RW	Write coefficient option for MBDR EQ 1'b0: L/R independent 1'b1: L/R write the same data
			3	1	1	1	RW	Write coefficient option for SDO EQ 1'b0: L/R independent 1'b1: L/R write the same data
			2	0	1	0	RW	FIR coefficient option when SSRC enable @ 32kHz/44.1kHz/48kHz 0: Embedded low pass coefficient 1: Manual write coefficient
			1	1	1	1	RW	DRC AT/RT hysteresis enable 0: Disable 1: Enable

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
			0	1	1	1	RW	MBDRC EQ order select 0: 2 nd order 1: 4 th order
0x0D	1	DSP_BLK_EN	7	1	1	1	RW	0: Bypass 1: Enable
			6	0	1	0	RW	0: Bypass 1: Enable
			5	0	1	0	RW	0: Bypass 1: Enable
			4	0	1	0	RW	0: Bypass 1: Enable
			3	0	1	0	RW	0: Bypass 1: Enable
			2	0	1	0	RW	SMEQ DPEQ select 1'b0: Smooth EQ 1'b1: Dynamic EQ
			1	0	1	0	RW	0: Bypass 1: Enable
			0	0	1	0	RW	Surround select 1'b0: Spatialize 1'b1: CCS
0x0E	1	DSP_DRC_OPT	7	1	1	1	RW	1: Peak mode 0: RMS mode
			6	1	1	1	RW	1: Peak mode 0: RMS mode
			5	1	1	1	RW	1: Peak mode 0: RMS mode
			4	1	1	1	RW	1: Peak mode 0: RMS mode
			2	1	1	1	RW	0: Normal mode 1: Output 0
			1	1	1	1	RW	0: Normal mode 1: Output 0
			0	0	1	0	RW	0: Normal mode 1: Output 0

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x0F	1	DSP_DRC_EN	7	0	1	0	RW	DRC4 enable (Final DRC)
			6	0	1	0	RW	DRC3 enable (H band)
			5	0	1	0	RW	DRC2 enable (M band)
			4	0	1	0	RW	DRC1 enable (L_band)
			3	0	1	0	RW	1: DRC4 Noise Gate enable 0: DRC4 Noise Gate disable
			2	0	1	0	RW	1: DRC3 Noise Gate enable 0: DRC3 Noise Gate disable
			1	0	1	0	RW	1: DRC2 Noise Gate enable 0: DRC2 Noise Gate disable
			0	0	1	0	RW	1: DRC1 Noise Gate enable 0: DRC1 Noise Gate disable
0x12	1	ASEL_ERR	1	0	1	0	W1C	I ² C slave address pin detection error 0: Normal 1: Error
			0	0	1	0	W1C	I ² C slave address pin detection error 0: Normal 1: Error
0x13	1	CRC_REG	7:0	0	8	00000000	RO	CRC8 for register set
0x14	1	CRC_MEM	7:0	0	8	00000000	RO	CRC8 for memory set

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x30	1	SBQ_CTRL	6:4	7	3	111	RW	SBQ smooth time select 3'b000: 8 samples 3'b001: 16 samples 3'b010: 32 samples 3'b011: 64 samples 3'b100: 128 samples 3'b101: 256 samples 3'b110: 512 samples 3'b111: 1024 samples
			3	1	1	1	RO	Report status of smooth transition (after TS), 1 = done
			1:0	0	2	00	RWC	Trigger smooth BQ coefficients update: When non-zero value is written, smooth transition is triggered. After transition is done, this register automatically goes back to 00. Before transition done, any new write to this register is invalid 00: No update 01: SBQ_BK1 to SBQ13, SBQ_BK2 to SBQ14 10: SBQ_BK1 to SBQ15, SBQ_BK2 to SBQ16 11: SBQ_BK1 to SBQ17, SBQ_BK2 to SBQ18
0x31	1	DRC_INPUT_SEL	3:2	0	2	00	RW	MBDRC input select for L channel 2'b00: Surround L Channel 2'b01: Surround R Channel 2'b1X: Surround (L+R) / 2
			1:0	1	2	01	RW	MBDRC input select for R channel 2'b00: Surround L Channel 2'b01: Surround R Channel 2'b1X: Surround (L+R) / 2

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x32	2	MS_VOL_CTRL	14	0	1	0	RW	Skip volume ramp 1'b0: Ramp with ramp mode option (default) 1'b1: Skip volume ramp
			13:12	0	2	00	RW	Volume slew step control 2'b00: 4.33ms from mute to 0dB (0.5dB/20.83μs) 2'b01: 8.66ms from mute to 0dB (0.25dB/20.83μs) (default) 2'b10: 17.33ms from mute to 0dB (0.125dB/20.83μs) 2'b11: 34.65ms from mute to 0dB (0.0625dB/20.83μs)
			10:0	180	11	001_10000000	RW	Master volume control 11'h000: 24dB 11'h180: 0dB 11'h7FF: mute (default) 0.0625dB per step
0x34	2	DSP_CH_L_VOL_ADJ	10:0	180	11	001_10000000	RW	LCH volume control 11'h000: 24dB 11'h180: 0dB (default) 11'h7FF: mute 0.0625dB per step
0x36	2	DSP_CH_R_VOL_ADJ	10:0	180	11	001_10000000	RW	RCH volume control 11'h000: 24dB 11'h180: 0dB (default) 11'h7FF: mute 0.0625dB per step

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x38	1	SIL_OPT	5:4	3	2	11	RW	Silence detection threshold selection (only one threshold for 8bit) 00: -72dB (16bit)/-96dB (20bit)/-120dB (24bit)/-144dB (32bit) 01: -78dB (16bit)/-102dB (20bit)/-126dB (24bit)/-150dB (32bit) 10: -84dB (16bit)/-108dB (20bit)/-132dB (24bit)/-156dB (32bit) 11: -90dB (16bit)/-114dB (20bit)/-138dB (24bit)/-166dB (32bit)
			2:0	2	3	010	RW	Silence mode hold time selection 000: 1ms 001: 20ms 010: 40ms (default) 011: 80ms 100: 160ms 101: 320ms 110: 640ms 111: 1.28s
MBDRC_Surround Page								
0x30	4	SURROUND_BQ0_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	LB_CH1_BQ1
0x31	4	SURROUND_BQ0_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ1
0x32	4	SURROUND_BQ0_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ1
0x33	4	SURROUND_BQ0_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ1
0x34	4	SURROUND_BQ0_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ1
0x35	4	SURROUND_BQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	LB_CH1_BQ2
0x36	4	SURROUND_BQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ2
0x37	4	SURROUND_BQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ2
0x38	4	SURROUND_BQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ2

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x39	4	SURROUND_BQ1_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ2
0x3A	4	HB_CH1_BQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	HB_CH1_BQ1_B0
0x3B	4	HB_CH1_BQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH1_BQ1_B1
0x3C	4	HB_CH1_BQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH1_BQ1_B2
0x3D	4	HB_CH1_BQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH1_BQ1_A1
0x3E	4	HB_CH1_BQ1_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH1_BQ1_A2
0x3F	4	HB_CH1_BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	HB_CH1_BQ2_B0
0x40	4	HB_CH1_BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH1_BQ2_B1
0x41	4	HB_CH1_BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH1_BQ2_B2
0x42	4	HB_CH1_BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH1_BQ2_A1
0x43	4	HB_CH1_BQ2_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH1_BQ2_A2
0x44	4	MB_CH1_BQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	MB_CH1_BQ1_B0
0x45	4	MB_CH1_BQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	MB_CH1_BQ1_B1
0x46	4	MB_CH1_BQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	MB_CH1_BQ1_B2
0x47	4	MB_CH1_BQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	MB_CH1_BQ1_A1
0x48	4	MB_CH1_BQ1_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	MB_CH1_BQ1_A2
0x49	4	LB_CH1_BQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	LB_CH1_BQ1_B0
0x4A	4	LB_CH1_BQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ1_B1
0x4B	4	LB_CH1_BQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ1_B2
0x4C	4	LB_CH1_BQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ1_A1
0x4D	4	LB_CH1_BQ1_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ1_A2
0x4E	4	LB_CH1_BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	LB_CH1_BQ2_B0

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x4F	4	LB_CH1_BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ2_B1
0x50	4	LB_CH1_BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ2_B2
0x51	4	LB_CH1_BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ2_A1
0x52	4	LB_CH1_BQ2_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH1_BQ2_A2
0x53	4	HB_CH2_BQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	HB_CH2_BQ1_B0
0x54	4	HB_CH2_BQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH2_BQ1_B1
0x55	4	HB_CH2_BQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH2_BQ1_B2
0x56	4	HB_CH2_BQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH2_BQ1_A1
0x57	4	HB_CH2_BQ1_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH2_BQ1_A2
0x58	4	HB_CH2_BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	HB_CH2_BQ2_B0
0x59	4	HB_CH2_BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH2_BQ2_B1
0x5A	4	HB_CH2_BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH2_BQ2_B2
0x5B	4	HB_CH2_BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH2_BQ2_A1
0x5C	4	HB_CH2_BQ2_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	HB_CH2_BQ2_A2
0x5D	4	MB_CH2_BQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	MB_CH2_BQ1_B0
0x5E	4	MB_CH2_BQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	MB_CH2_BQ1_B1
0x5F	4	MB_CH2_BQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	MB_CH2_BQ1_B2
0x60	4	MB_CH2_BQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	MB_CH2_BQ1_A1
0x61	4	MB_CH2_BQ1_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	MB_CH2_BQ1_A2
0x62	4	LB_CH2_BQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	LB_CH2_BQ1_B0
0x63	4	LB_CH2_BQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH2_BQ1_B1
0x64	4	LB_CH2_BQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH2_BQ1_B2

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x65	4	LB_CH2_BQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH2_BQ1_A1
0x66	4	LB_CH2_BQ1_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH2_BQ1_A2
0x67	4	LB_CH2_BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	LB_CH2_BQ2_B0
0x68	4	LB_CH2_BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH2_BQ2_B1
0x69	4	LB_CH2_BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH2_BQ2_B2
0x6A	4	LB_CH2_BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH2_BQ2_A1
0x6B	4	LB_CH2_BQ2_A2	31:0	0	32	00000000_00000000_00000000_00000000	RW	LB_CH2_BQ2_A2
0x6C	4	DRC1_RMS_AE	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC1 RMS AE
0x6D	4	DRC1_RMS_1_AE	31:0	0	32	00000000_00000000_00000000_00000000	RW	DRC1 RMS 1-AE
0x6E	4	DRC1_GAIN_AA	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC1 GAIN AA
0x6F	4	DRC1_GAIN_AD	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC1 GAIN AD
0x70	4	DRC2_RMS_AE	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC2 RMS AE
0x71	4	DRC2_RMS_1_AE	31:0	0	32	00000000_00000000_00000000_00000000	RW	DRC2 RMS 1-AE
0x72	4	DRC2_GAIN_AA	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC2 GAIN AA
0x73	4	DRC2_GAIN_AD	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC2 GAIN AD
0x74	4	DRC3_RMS_AE	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC3 RMS AE
0x75	4	DRC3_RMS_1_AE	31:0	0	32	00000000_00000000_00000000_00000000	RW	DRC3 RMS 1-AE
0x76	4	DRC3_GAIN_AA	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC3 GAIN AA
0x77	4	DRC3_GAIN_AD	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC3 GAIN AD
0x78	4	DRC4_AE	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC4 AE
0x79	4	DRC4_1_AE	31:0	0	32	00000000_00000000_00000000_00000000	RW	DRC4 1-AE
0x7A	4	DRC4_AA	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC4 AA
0x7B	4	DRC4_AD	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC4 AD

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x7C	4	CH1_OUT_MIX_L	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_OUT_MIX_L
0x7D	4	CH1_OUT_MIX_M	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_OUT_MIX_M
0x7E	4	CH1_OUT_MIX_H	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_OUT_MIX_H
0x7F	4	CH2_OUT_MIX_L	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_OUT_MIX_L
0x80	4	CH2_OUT_MIX_M	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_OUT_MIX_M
0x81	4	CH2_OUT_MIX_H	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_OUT_MIX_H
0x82	4	CH1_POST_GAIN	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_POST_GAIN
0x83	4	CH2_POST_GAIN	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_POST_GAIN
0x84	4	DRC1_RMS_AE_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC1_RMS_AE_2
0x85	4	DRC1_RMS_1_AE_2	31:0	0	32	00000000_00000000_00000000_00000000	RW	DRC1_RMS_1_AE_2
0x86	4	DRC1_GAIN_AA_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC1_GAIN_AA_2
0x87	4	DRC1_GAIN_AD_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC1_GAIN_AD_2
0x88	4	DRC2_RMS_AE_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC2_RMS_AE_2
0x89	4	DRC2_RMS_1_AE_2	31:0	0	32	00000000_00000000_00000000_00000000	RW	DRC2_RMS_1_AE_2
0x8A	4	DRC2_GAIN_AA_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC2_GAIN_AA_2
0x8B	4	DRC2_GAIN_AD_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC2_GAIN_AD_2
0x8C	4	DRC3_RMS_AE_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC3_RMS_AE_2
0x8D	4	DRC3_RMS_1_AE_2	31:0	0	32	00000000_00000000_00000000_00000000	RW	DRC3_RMS_1_AE_2
0x8E	4	DRC3_GAIN_AA_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC3_GAIN_AA_2
0x8F	4	DRC3_GAIN_AD_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC3_GAIN_AD_2
0x90	4	DRC4_AE_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC4_AE_2
0x91	4	DRC4_1_AE_2	31:0	0	32	00000000_00000000_00000000_00000000	RW	DRC4_1_AE_2

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x92	4	DRC4_AA_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC4_AA_2
0x93	4	DRC4_AD_2	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	DRC4_AD_2
0x94	1	DRC1_K	7:0	80	8	10000000	RW	DRC1_K
0x95	1	DRC2_K	7:0	80	8	10000000	RW	DRC2_K
0x96	1	DRC3_K	7:0	80	8	10000000	RW	DRC3-K
0x97	1	DRC4_K	7:0	80	8	10000000	RW	DRC4_K
0x98	2	DRC1_T	10:0	0	11	000_00000000	RW	DRC1_T
0x99	2	DRC2_T	10:0	0	11	000_00000000	RW	DRC2_T
0x9A	2	DRC3_T	10:0	0	11	000_00000000	RW	DRC3-T
0x9B	2	DRC4_T	10:0	0	11	000_00000000	RW	DRC4_T
0x9C	2	DRC1_N_T	10:0	640	11	110_01000000	RW	DRC1_N_T
0x9D	2	DRC2_N_T	10:0	640	11	110_01000000	RW	DRC2_N_T
0x9E	2	DRC3_N_T	10:0	640	11	110_01000000	RW	DRC3_N_T
0x9F	2	DRC4_N_T	10:0	640	11	110_01000000	RW	DRC4_N_T
0xA0	2	DRC1_O	10:0	180	11	001_10000000	RW	DRC1_O
0xA1	2	DRC2_O	10:0	180	11	001_10000000	RW	DRC2_O
0xA2	2	DRC3_O	10:0	180	11	001_10000000	RW	DRC3-O
0xA3	2	DRC4_O	10:0	180	11	001_10000000	RW	DRC4_O
0xA4	1	DRC1_K_2	7:0	80	8	10000000	RW	DRC1_K
0xA5	1	DRC2_K_2	7:0	80	8	10000000	RW	DRC2_K
0xA6	1	DRC3_K_2	7:0	80	8	10000000	RW	DRC3-K
0xA7	1	DRC4_K_2	7:0	80	8	10000000	RW	DRC4_K
0xA8	2	DRC1_T_2	10:0	0	11	000_00000000	RW	DRC1_T
0xA9	2	DRC2_T_2	10:0	0	11	000_00000000	RW	DRC2_T
0xAA	2	DRC3_T_2	10:0	0	11	000_00000000	RW	DRC3-T
0xAB	2	DRC4_T_2	10:0	0	11	000_00000000	RW	DRC4_T
0xAC	2	DRC1_N_T_2	10:0	640	11	110_01000000	RW	DRC1_N_T
0xAD	2	DRC2_N_T_2	10:0	640	11	110_01000000	RW	DRC2_N_T
0xAE	2	DRC3_N_T_2	10:0	640	11	110_01000000	RW	DRC3_N_T
0xAF	2	DRC4_N_T_2	10:0	640	11	110_01000000	RW	DRC4_N_T
0xB0	2	DRC1_O_2	10:0	180	11	001_10000000	RW	DRC1_O
0xB1	2	DRC2_O_2	10:0	180	11	001_10000000	RW	DRC2_O
0xB2	2	DRC3_O_2	10:0	180	11	001_10000000	RW	DRC3-O
0xB3	2	DRC4_O_2	10:0	180	11	001_10000000	RW	DRC4_O
0xB4	1	DRC4_DELAY	7:0	FF	8	11111111	RW	DRC4_DELAY

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0xB5	1	DRC4_DELAY_2	7:0	FF	8	11111111	RW	DRC4_DELAY_2
EQ Page								
0x30	4	CH1_BQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ1
0x31	4	CH1_BQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ1
0x32	4	CH1_BQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ1
0x33	4	CH1_BQ1_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ1
0x34	4	CH1_BQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ1
0x35	4	CH1_BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ2
0x36	4	CH1_BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ2
0x37	4	CH1_BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ2
0x38	4	CH1_BQ2_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ2
0x39	4	CH1_BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ2
0x3A	4	CH1_BQ3_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ3
0x3B	4	CH1_BQ3_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ3
0x3C	4	CH1_BQ3_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ3
0x3D	4	CH1_BQ3_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ3
0x3E	4	CH1_BQ3_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ3
0x3F	4	CH1_BQ4_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ4
0x40	4	CH1_BQ4_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ4
0x41	4	CH1_BQ4_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ4
0x42	4	CH1_BQ4_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ4
0x43	4	CH1_BQ4_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ4
0x44	4	CH1_BQ5_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ5

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x45	4	CH1_BQ5_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ5
0x46	4	CH1_BQ5_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ5
0x47	4	CH1_BQ5_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ5
0x48	4	CH1_BQ5_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ5
0x49	4	CH1_BQ6_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ6
0x4A	4	CH1_BQ6_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ6
0x4B	4	CH1_BQ6_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ6
0x4C	4	CH1_BQ6_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ6
0x4D	4	CH1_BQ6_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ6
0x4E	4	CH1_BQ7_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ7
0x4F	4	CH1_BQ7_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ7
0x50	4	CH1_BQ7_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ7
0x51	4	CH1_BQ7_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ7
0x52	4	CH1_BQ7_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ7
0x53	4	CH1_BQ8_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ8
0x54	4	CH1_BQ8_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ8
0x55	4	CH1_BQ8_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ8
0x56	4	CH1_BQ8_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ8
0x57	4	CH1_BQ8_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ8
0x58	4	CH1_BQ9_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ9
0x59	4	CH1_BQ9_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ9
0x5A	4	CH1_BQ9_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ9

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x5B	4	CH1_BQ9_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ9
0x5C	4	CH1_BQ9_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ9
0x5D	4	CH1_BQ10_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ10
0x5E	4	CH1_BQ10_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ10
0x5F	4	CH1_BQ10_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ10
0x60	4	CH1_BQ10_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ10
0x61	4	CH1_BQ10_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ10
0x62	4	CH1_BQ11_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ11
0x63	4	CH1_BQ11_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ11
0x64	4	CH1_BQ11_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ11
0x65	4	CH1_BQ11_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ11
0x66	4	CH1_BQ11_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ11
0x67	4	CH1_BQ12_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_BQ12
0x68	4	CH1_BQ12_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ12
0x69	4	CH1_BQ12_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ12
0x6A	4	CH1_BQ12_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ12
0x6B	4	CH1_BQ12_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_BQ12
0x6C	4	CH2_BQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ1
0x6D	4	CH2_BQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ1
0x6E	4	CH2_BQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ1
0x6F	4	CH2_BQ1_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ1
0x70	4	CH2_BQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ1

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x71	4	CH2_BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ2
0x72	4	CH2_BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ2
0x73	4	CH2_BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ2
0x74	4	CH2_BQ2_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ2
0x75	4	CH2_BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ2
0x76	4	CH2_BQ3_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ3
0x77	4	CH2_BQ3_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ3
0x78	4	CH2_BQ3_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ3
0x79	4	CH2_BQ3_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ3
0x7A	4	CH2_BQ3_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ3
0x7B	4	CH2_BQ4_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ4
0x7C	4	CH2_BQ4_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ4
0x7D	4	CH2_BQ4_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ4
0x7E	4	CH2_BQ4_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ4
0x7F	4	CH2_BQ4_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ4
0x80	4	CH2_BQ5_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ5
0x81	4	CH2_BQ5_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ5
0x82	4	CH2_BQ5_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ5
0x83	4	CH2_BQ5_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ5
0x84	4	CH2_BQ5_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ5
0x85	4	CH2_BQ6_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ6
0x86	4	CH2_BQ6_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ6

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x87	4	CH2_BQ6_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ6
0x88	4	CH2_BQ6_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ6
0x89	4	CH2_BQ6_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ6
0x8A	4	CH2_BQ7_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ7
0x8B	4	CH2_BQ7_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ7
0x8C	4	CH2_BQ7_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ7
0x8D	4	CH2_BQ7_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ7
0x8E	4	CH2_BQ7_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ7
0x8F	4	CH2_BQ8_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ8
0x90	4	CH2_BQ8_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ8
0x91	4	CH2_BQ8_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ8
0x92	4	CH2_BQ8_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ8
0x93	4	CH2_BQ8_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ8
0x94	4	CH2_BQ9_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ9
0x95	4	CH2_BQ9_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ9
0x96	4	CH2_BQ9_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ9
0x97	4	CH2_BQ9_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ9
0x98	4	CH2_BQ9_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ9
0x99	4	CH2_BQ10_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ10
0x9A	4	CH2_BQ10_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ10
0x9B	4	CH2_BQ10_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ10
0x9C	4	CH2_BQ10_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ10

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x9D	4	CH2_BQ10_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ10
0x9E	4	CH2_BQ11_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ11
0x9F	4	CH2_BQ11_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ11
0xA0	4	CH2_BQ11_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ11
0xA1	4	CH2_BQ11_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ11
0xA2	4	CH2_BQ11_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ11
0xA3	4	CH2_BQ12_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_BQ12
0xA4	4	CH2_BQ12_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ12
0xA5	4	CH2_BQ12_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ12
0xA6	4	CH2_BQ12_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ12
0xA7	4	CH2_BQ12_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_BQ12
SDO_Mix_Page								
0x30	4	CH1_IN_MIX_0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_IN_MIX_0
0x31	4	CH1_IN_MIX_1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_IN_MIX_1
0x32	4	CH2_IN_MIX_0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_IN_MIX_0
0x33	4	CH2_IN_MIX_1	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_IN_MIX_1
0x34	4	CH1_OUT_MIX_0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_OUT_MIX_1
0x35	4	CH1_OUT_MIX_1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_OUT_MIX_0
0x36	4	CH2_OUT_MIX_0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_OUT_MIX_1
0x37	4	CH2_OUT_MIX_1	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_OUT_MIX_0
0x38	4	SDO_CH1_IN_MIX_0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH1_IN_MIX_1
0x39	4	SDO_CH1_IN_MIX_1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_IN_MIX_0
0x3A	4	SDO_CH2_IN_MIX_0	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_IN_MIX_1

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x3B	4	SDO_CH2_IN_MIX_1	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH2_IN_MIX_0
0x3C	4	SDO_CH1_BQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH1_BQ1
0x3D	4	SDO_CH1_BQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ1
0x3E	4	SDO_CH1_BQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ1
0x3F	4	SDO_CH1_BQ1_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ1
0x40	4	SDO_CH1_BQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ1
0x41	4	SDO_CH1_BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH1_BQ2
0x42	4	SDO_CH1_BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ2
0x43	4	SDO_CH1_BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ2
0x44	4	SDO_CH1_BQ2_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ2
0x45	4	SDO_CH1_BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ2
0x46	4	SDO_CH1_BQ3_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH1_BQ3
0x47	4	SDO_CH1_BQ3_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ3
0x48	4	SDO_CH1_BQ3_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ3
0x49	4	SDO_CH1_BQ3_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ3
0x4A	4	SDO_CH1_BQ3_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ3
0x4B	4	SDO_CH1_BQ4_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH1_BQ4
0x4C	4	SDO_CH1_BQ4_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ4
0x4D	4	SDO_CH1_BQ4_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ4
0x4E	4	SDO_CH1_BQ4_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ4
0x4F	4	SDO_CH1_BQ4_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ4
0x50	4	SDO_CH1_BQ5_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH1_BQ5

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x51	4	SDO_CH1_BQ5_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ5
0x52	4	SDO_CH1_BQ5_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ5
0x53	4	SDO_CH1_BQ5_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ5
0x54	4	SDO_CH1_BQ5_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH1_BQ5
0x55	4	SDO_CH2_BQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH2_BQ1
0x56	4	SDO_CH2_BQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ1
0x57	4	SDO_CH2_BQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ1
0x58	4	SDO_CH2_BQ1_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ1
0x59	4	SDO_CH2_BQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ1
0x5A	4	SDO_CH2_BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH2_BQ2
0x5B	4	SDO_CH2_BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ2
0x5C	4	SDO_CH2_BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ2
0x5D	4	SDO_CH2_BQ2_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ2
0x5E	4	SDO_CH2_BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ2
0x5F	4	SDO_CH2_BQ3_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH2_BQ3
0x60	4	SDO_CH2_BQ3_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ3
0x61	4	SDO_CH2_BQ3_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ3
0x62	4	SDO_CH2_BQ3_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ3
0x63	4	SDO_CH2_BQ3_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ3
0x64	4	SDO_CH2_BQ4_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH2_BQ4
0x65	4	SDO_CH2_BQ4_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ4
0x66	4	SDO_CH2_BQ4_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ4

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x67	4	SDO_CH2_BQ4_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ4
0x68	4	SDO_CH2_BQ4_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ4
0x69	4	SDO_CH2_BQ5_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	SDO_CH2_BQ5
0x6A	4	SDO_CH2_BQ5_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ5
0x6B	4	SDO_CH2_BQ5_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ5
0x6C	4	SDO_CH2_BQ5_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ5
0x6D	4	SDO_CH2_BQ5_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	SDO_CH2_BQ5
SBQ_DPEQ_Page								
0x30	4	CH1_SBQ13_DPEQ_HBQ0_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_SBQ13_DPEQ_HBQ0_B0
0x31	4	CH1_SBQ13_DPEQ_HBQ0_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ13_DPEQ_HBQ0_B1
0x32	4	CH1_SBQ13_DPEQ_HBQ0_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ13_DPEQ_HBQ0_B2
0x33	4	CH1_SBQ13_DPEQ_HBQ0_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ13_DPEQ_HBQ0_A0
0x34	4	CH1_SBQ13_DPEQ_HBQ0_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ13_DPEQ_HBQ0_A1
0x35	4	CH1_SBQ14_DPEQ_HBQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_SBQ14_DPEQ_HBQ1_B0
0x36	4	CH1_SBQ14_DPEQ_HBQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ14_DPEQ_HBQ1_B1
0x37	4	CH1_SBQ14_DPEQ_HBQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ14_DPEQ_HBQ1_B2
0x38	4	CH1_SBQ14_DPEQ_HBQ1_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ14_DPEQ_HBQ1_A0
0x39	4	CH1_SBQ14_DPEQ_HBQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ14_DPEQ_HBQ1_A1

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x3A	4	CH1_SBQ15_DPEQ_LBQ0_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_SBQ15_DPEQ_LBQ0_B0
0x3B	4	CH1_SBQ15_DPEQ_LBQ0_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ15_DPEQ_LBQ0_B1
0x3C	4	CH1_SBQ15_DPEQ_LBQ0_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ15_DPEQ_LBQ0_B2
0x3D	4	CH1_SBQ15_DPEQ_LBQ0_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ15_DPEQ_LBQ0_A0
0x3E	4	CH1_SBQ15_DPEQ_LBQ0_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ15_DPEQ_LBQ0_A1
0x3F	4	CH1_SBQ16_DPEQ_LBQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_SBQ16_DPEQ_LBQ1_B0
0x40	4	CH1_SBQ16_DPEQ_LBQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ16_DPEQ_LBQ1_B1
0x41	4	CH1_SBQ16_DPEQ_LBQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ16_DPEQ_LBQ1_B2
0x42	4	CH1_SBQ16_DPEQ_LBQ1_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ16_DPEQ_LBQ1_A0
0x43	4	CH1_SBQ16_DPEQ_LBQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ16_DPEQ_LBQ1_A1
0x44	4	CH1_SBQ17_DPEQ_SBQ0_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_SBQ17_DPEQ_SBQ0_B0
0x45	4	CH1_SBQ17_DPEQ_SBQ0_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ17_DPEQ_SBQ0_B1
0x46	4	CH1_SBQ17_DPEQ_SBQ0_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ17_DPEQ_SBQ0_B2
0x47	4	CH1_SBQ17_DPEQ_SBQ0_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ17_DPEQ_SBQ0_A0
0x48	4	CH1_SBQ17_DPEQ_SBQ0_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ17_DPEQ_SBQ0_A1
0x49	4	CH1_SBQ18_DPEQ_SBQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_SBQ18_DPEQ_SBQ1_B0

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x4A	4	CH1_SBQ18_DPEQ_SBQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ18_DPEQ_SBQ1_B1
0x4B	4	CH1_SBQ18_DPEQ_SBQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ18_DPEQ_SBQ1_B2
0x4C	4	CH1_SBQ18_DPEQ_SBQ1_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ18_DPEQ_SBQ1_A0
0x4D	4	CH1_SBQ18_DPEQ_SBQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ18_DPEQ_SBQ1_A1
0x4E	4	CH1_SBQ_BK1_DPEQ_H BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_SBQ_BK1_DPEQ_HBQ2_B0
0x4F	4	CH1_SBQ_BK1_DPEQ_H BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ_BK1_DPEQ_HBQ2_B1
0x50	4	CH1_SBQ_BK1_DPEQ_H BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ_BK1_DPEQ_HBQ2_B2
0x51	4	CH1_SBQ_BK1_DPEQ_H BQ2_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ_BK1_DPEQ_HBQ2_A0
0x52	4	CH1_SBQ_BK1_DPEQ_H BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ_BK1_DPEQ_HBQ2_A1
0x53	4	CH1_SBQ_BK2_DPEQ_L BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_SBQ_BK2_DPEQ_LBQ2_B0
0x54	4	CH1_SBQ_BK2_DPEQ_L BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ_BK2_DPEQ_LBQ2_B1
0x55	4	CH1_SBQ_BK2_DPEQ_L BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ_BK2_DPEQ_LBQ2_B2
0x56	4	CH1_SBQ_BK2_DPEQ_L BQ2_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ_BK2_DPEQ_LBQ2_A0
0x57	4	CH1_SBQ_BK2_DPEQ_L BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_SBQ_BK2_DPEQ_LBQ2_A1
0x58	4	CH1_DPEQ_S BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_DPEQ_S BQ2_B0
0x59	4	CH1_DPEQ_S BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_DPEQ_S BQ2_B1
0x5A	4	CH1_DPEQ_S BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_DPEQ_S BQ2_B2

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x5B	4	CH1_DPEQ_S BQ2_A0	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH1_DPEQ_SBQ2_ A0
0x5C	4	CH1_DPEQ_S BQ2_A1	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH1_DPEQ_SBQ2_ A1
0x5D	4	CH2_SBQ13_ DPEQ_ HBQ0_B0	31:0	04000000	32	00000100_00000000_ 00000000_00000000	RW	CH2_SBQ13_DPEQ_ HBQ0_B0
0x5E	4	CH2_SBQ13_ DPEQ_ HBQ0_B1	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ13_DPEQ_ HBQ0_B1
0x5F	4	CH2_SBQ13_ DPEQ_ HBQ0_B2	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ13_DPEQ_ HBQ0_B2
0x60	4	CH2_SBQ13_ DPEQ_ HBQ0_A0	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ13_DPEQ_ HBQ0_A0
0x61	4	CH2_SBQ13_ DPEQ_ HBQ0_A1	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ13_DPEQ_ HBQ0_A1
0x62	4	CH2_SBQ14_ DPEQ_ HBQ1_B0	31:0	04000000	32	00000100_00000000_ 00000000_00000000	RW	CH2_SBQ14_DPEQ_ HBQ1_B0
0x63	4	CH2_SBQ14_ DPEQ_ HBQ1_B1	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ14_DPEQ_ HBQ1_B1
0x64	4	CH2_SBQ14_ DPEQ_ HBQ1_B2	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ14_DPEQ_ HBQ1_B2
0x65	4	CH2_SBQ14_ DPEQ_ HBQ1_A0	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ14_DPEQ_ HBQ1_A0
0x66	4	CH2_SBQ14_ DPEQ_ HBQ1_A1	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ14_DPEQ_ HBQ1_A1
0x67	4	CH2_SBQ15_ DPEQ_ LBQ0_B0	31:0	04000000	32	00000100_00000000_ 00000000_00000000	RW	CH2_SBQ15_DPEQ_ LBQ0_B0
0x68	4	CH2_SBQ15_ DPEQ_ LBQ0_B1	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ15_DPEQ_ LBQ0_B1
0x69	4	CH2_SBQ15_ DPEQ_ LBQ0_B2	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ15_DPEQ_ LBQ0_B2
0x6A	4	CH2_SBQ15_ DPEQ_ LBQ0_A0	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ15_DPEQ_ LBQ0_A0
0x6B	4	CH2_SBQ15_ DPEQ_ LBQ0_A1	31:0	0	32	00000000_00000000_ 00000000_00000000	RW	CH2_SBQ15_DPEQ_ LBQ0_A1

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x6C	4	CH2_SBQ16_DPEQ_LBQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_SBQ16_DPEQ_LBQ1_B0
0x6D	4	CH2_SBQ16_DPEQ_LBQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ16_DPEQ_LBQ1_B1
0x6E	4	CH2_SBQ16_DPEQ_LBQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ16_DPEQ_LBQ1_B2
0x6F	4	CH2_SBQ16_DPEQ_LBQ1_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ16_DPEQ_LBQ1_A0
0x70	4	CH2_SBQ16_DPEQ_LBQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ16_DPEQ_LBQ1_A1
0x71	4	CH2_SBQ17_DPEQ_SBQ0_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_SBQ17_DPEQ_SBQ0_B0
0x72	4	CH2_SBQ17_DPEQ_SBQ0_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ17_DPEQ_SBQ0_B1
0x73	4	CH2_SBQ17_DPEQ_SBQ0_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ17_DPEQ_SBQ0_B2
0x74	4	CH2_SBQ17_DPEQ_SBQ0_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ17_DPEQ_SBQ0_A0
0x75	4	CH2_SBQ17_DPEQ_SBQ0_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ17_DPEQ_SBQ0_A1
0x76	4	CH2_SBQ18_DPEQ_SBQ1_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_SBQ18_DPEQ_SBQ1_B0
0x77	4	CH2_SBQ18_DPEQ_SBQ1_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ18_DPEQ_SBQ1_B1
0x78	4	CH2_SBQ18_DPEQ_SBQ1_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ18_DPEQ_SBQ1_B2
0x79	4	CH2_SBQ18_DPEQ_SBQ1_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ18_DPEQ_SBQ1_A0
0x7A	4	CH2_SBQ18_DPEQ_SBQ1_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ18_DPEQ_SBQ1_A1
0x7B	4	CH2_SBQ_BK1_DPEQ_HBQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_SBQ_BK1_DPEQ_HBQ2_B0

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x7C	4	CH2_SBQ_BK1_DPEQ_H BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ_BK1_DPEQ_HBQ2_B1
0x7D	4	CH2_SBQ_BK1_DPEQ_H BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ_BK1_DPEQ_HBQ2_B2
0x7E	4	CH2_SBQ_BK1_DPEQ_H BQ2_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ_BK1_DPEQ_HBQ2_A0
0x7F	4	CH2_SBQ_BK1_DPEQ_H BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ_BK1_DPEQ_HBQ2_A1
0x80	4	CH2_SBQ_BK2_DPEQ_L BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_SBQ_BK2_DPEQ_LBQ2_B0
0x81	4	CH2_SBQ_BK2_DPEQ_L BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ_BK2_DPEQ_LBQ2_B1
0x82	4	CH2_SBQ_BK2_DPEQ_L BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ_BK2_DPEQ_LBQ2_B2
0x83	4	CH2_SBQ_BK2_DPEQ_L BQ2_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ_BK2_DPEQ_LBQ2_A0
0x84	4	CH2_SBQ_BK2_DPEQ_L BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_SBQ_BK2_DPEQ_LBQ2_A1
0x85	4	CH2_DPEQ_S BQ2_B0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_DPEQ_SBQ2_B0
0x86	4	CH2_DPEQ_S BQ2_B1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_DPEQ_SBQ2_B1
0x87	4	CH2_DPEQ_S BQ2_B2	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_DPEQ_SBQ2_B2
0x88	4	CH2_DPEQ_S BQ2_A0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_DPEQ_SBQ2_A0
0x89	4	CH2_DPEQ_S BQ2_A1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_DPEQ_SBQ2_A1
0x8A	4	CH1_ALPHA_0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_ALPHA_0
0x8B	4	CH1_OEMGA_0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_OEMGA_0
0x8C	4	CH1_THR1_0	10:0	7B0	11	111_10110000	RW	8.3 format Default = -10dB
0x8D	4	CH1_THR2_0	10:0	710	11	111_00010000	RW	8.3 format Default = -30dB
0x8E	4	CH1_DIF_THR_N_0	31:0	00333333	32	00000000_00110011_00110011_00110011	RW	Default = 0.05dB

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x8F	4	CH1_AT_0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_AT_0
0x90	4	CH1_RT_0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_RT_0
0x91	4	CH1_ALPHA_1	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_ALPHA_1
0x92	4	CH1_OEMGA_1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_OEMGA_1
0x93	4	CH1_THR1_1	31:0	7B0	32	01111011_01111011_01111011_10110000	RW	8.3 format Default = -10dB
0x94	4	CH1_THR2_1	31:0	710	32	01110001_01110001_01110001_00010000	RW	8.3 format Default = -30dB
0x95	4	CH1_DIF_THR_N_1	31:0	00333333	32	00000000_00110011_00110011_00110011	RW	CH1_DIF_THR_N_1
0x96	4	CH1_AT_1	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH1_AT_1
0x97	4	CH1_RT_1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH1_RT_1
0x98	4	CH2_ALPHA_0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_ALPHA_0
0x99	4	CH2_OEMGA_0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_OEMGA_0
0x9A	4	CH2_THR1_0	31:0	7B0	32	01111011_01111011_01111011_10110000	RW	8.3 format Default = -10dB
0x9B	4	CH2_THR2_0	31:0	710	32	01110001_01110001_01110001_00010000	RW	8.3 format Default = -30dB
0x9C	4	CH2_DIF_THR_N_0	31:0	00333333	32	00000000_00110011_00110011_00110011	RW	CH2_DIF_THR_N_0
0x9D	4	CH2_AT_0	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_AT_0
0x9E	4	CH2_RT_0	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_RT_0
0x9F	4	CH2_ALPHA_1	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_ALPHA_1
0xA0	4	CH2_OEMGA_1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_OEMGA_1
0xA1	4	CH2_THR1_1	10:0	7B0	11	111_10110000	RW	8.3 format Default = -10dB
0xA2	4	CH2_THR2_1	10:0	710	11	111_00010000	RW	8.3 format Default = -30dB
0xA3	4	CH2_DIF_THR_N_1	31:0	00333333	32	00000000_00110011_00110011_00110011	RW	Default = 0.05dB
0xA4	4	CH2_AT_1	31:0	04000000	32	00000100_00000000_00000000_00000000	RW	CH2_AT_1
0xA5	4	CH2_RT_1	31:0	0	32	00000000_00000000_00000000_00000000	RW	CH2_RT_1

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
Analog Portion								
0x00	2	DEV_ID	15:0	5140	16	01010001_01000000	RO	PRODUCT_ID
0x01	1	I2S_CLK_FMT	7:4	5	4	0101	RW	Sampling rate report 0000: 8kHz 0001: 11.025/12kHz 0010: 16kHz 0011: 22.05/24kHz 0100: 32KHz 0101: 44.1/48kHz (default) 0110: 88.2/96kHz 0111: 192kHz Others: Reserved
			3:0	2	4	0010	RW	BCK mode report 0000: BCK = 32fs 0001: BCK = 48fs 0010: BCK = 64fs (default) 0011: BCK = 96fs 0100: BCK = 128fs 0101: BCK = 192fs 0110: BCK = 256fs 0111: BCK = 384fs 1000: BCK = 512fs Others: Reserved

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x02	1	I2S_DATA_FMT	7	0	1	0	RW	I ² S data data out launch edge selection 1'b0: BCK_RX_EDGE = 0, launch with falling edge; BCK_RX_EDGE = 1, launch with rising edge (default) 1'b1: BCK_RX_EDGE = 0, launch with rising edge; BCK_RX_EDGE = 1, launch with falling edge
			6	0	1	0	RW	1'b0: RX @BCK rising edge and TX @BCK falling edge (default) 1'b1: RX @BCK falling edge and TX @BCK rising edge
			5:4	2	2	10	RW	Audio bits for signal process 2'b00: 16bits 2'b01: 20bits 2'b10: 24bits (default) 2'b11: 32bits
			3	1	1	1	RW	TDM or DSPM offset selection 1'b0: Without offset (DSPMB) 1'b1: 1bit clock offset (DSPMA) (default)
			2:0	0	3	000	RW	I ² S format selection 3'b000: I ² S (default) 3'b001: Left Justify 3'b010: Right Justify 3'b011: DSP mode 3'b100: EIAJ Others: TDM mode

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x03	1	SIL_CTRL	7	1	1	1	RW	Silence detection enable 1'b0: Disable 1'b1: Enable (default)
			5:4	3	2	11	RW	Silence detection threshold selection (only one threshold for 8-bit) 00: -72dB (16bit)/-96dB (20bit)/-120 dB (24bit)/-144dB (32bit) 01: -78dB (16bit)/-102dB (20bit)/-126dB (24bit)/-150dB (32bit) 10: -84dB (16bit)/-108dB (20bit)/-132dB (24bit)/-156dB (32bit) 11: -90dB (16bit)/-114dB (20bit)/-138dB (24bit)/-166dB (32bit)
			2:0	2	3	010	RW	Silence mode hold time selection 000: 1ms 001: 20ms 010: 40ms (default) 011: 80ms 100: 160ms 101: 320ms 110: 640ms 111: 1.28s
0x04	1	SDIO_SEL	5:4	0	2	00	RW	00: No output (default) 01: Interface output 10: Final output 11: Peak level detect result
			3:2	0	2	00	RW	00: SDIN-L to CH1 (default) 01: SDIN-R to CH1 1X: 0 to CH1
			1:0	1	2	01	RW	00: SDIN-L to CH2 01: SDIN-R to CH2 (default) 1X: 0 to CH2

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x05	1	SYS_CTL	7	1	1	1	RW	Sampling rate detection enable bit detect sampling rate and BCK mode 0: Disable, manual set 0x01 SR mode and BCK mode 1: Enable (default)
			6	0	1	0	RW	DRE offset calibration enable 0: Disable 1: Enable
			5	0	1	0	RW	Reserved for new feature 0: BTL mode (default) 1: CMH mode
			4	0	1	0	RW	0: BTL (default) 1: PBTL
			3:2	1	2	01	RW	VTRI frequency 00: 400kHz 01: 800kHz 10: 800kHz 11: 1600kHz
			1:0	0	2	00	RW	AMP control 2'b00: amp off (default) 2'b01: amp on 2'b10: Force entry silence mode 2'b11: mute

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x06	1	BLK_EN	6	0	1	0	RW	0: Compensation filter disable (default) 1: Compensation filter enable (not available in 96k and 192kHz sampling rate)
			5	1	1	1	RW	0: High-Pass filter disable 1: High-Pass filter enable (default)
			4	0	1	0	RW	Thermal foldback control enable 0: Disable 1: Enable (default)
			3	1	1	1	RW	DRC mode selection 0: RMS mode 1: Peak mode (default)
			2	0	1	0	RW	DRC enable 0: Disable (default) 1: Enable
			1	0	1	0	RW	DRC noise gate enable 0: Disable (default) 1: Enable
			0	0	1	0	RW	Hard clip enable 0: Disable (default) 1: Enable

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x07	1	ANA_OUT_CTRL	7:5	0	3	000	RW	PWM output phase select 000: 0 001: 45 010: 90 011: 135 100: 180 101: 225 110: 270 111: 315
			4:0	13	5	10011	RW	Class-D output gain, 5'h00: -6dB 5'h01: -5dB 5'h02: -4dB 5'h03: -3dB 5'h04: -2dB 5'h05: -1dB 5'h06: 0dB 5'h07: 1dB 5'h08: 2dB 5'h09: 3dB 5'h0A: 4dB 5'h0B: 5dB 5'h0C: 6dB 5'h0D: 7dB 5'h0E: 8dB 5'h0F: 9dB 5'h10: 10dB 5'h11: 11dB 5'h12: 12dB 5'h13: 13dB (default) 5'h14: 14dB 5'h15: 15dB 5'h16: 16dB 5'h17: 17dB Others: 17dB

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x08	1	OLSL_CTRL	7	0	1	0	RW	Reserved
			5	0	1	0	RO	Open/Short load detection finish 0: Not enable or under detection 1: Finish
			4	0	1	0	RW	Open/Short load detection enable 0: Disable 1: Enable
			3	0	1	0	RO	Open load report for channel L 0: Normal 1: Open
			2	0	1	0	RO	Open load report for channel R 0: Normal 1: Open
			1	0	1	0	RO	Short load report for channel L 0: Normal 1: Short
			0	0	1	0	RO	Short load report for channel R 0: Normal 1: Short

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x09	1	PWM_SS_OPT	7	0	1	0	RW	Spread spectrum enable 0: Disable (default) 1: Enable
			6	0	1	0	RW	Noise select 0: Pink noise (default) 1: White noise
			5	0	1	0	RW	Pink noise coefficient This will affect the noise amplitude for spread spectrum signal, not recommended to modify it. 0: 1/2 (default) 1: 1/4
			4	0	1	0	RW	Add noise to TRI_GEN 0: Disable (default) 1: Enable
			3:2	0	2	00	RW	Noise amplitude for SSC
			1:0	1	2	01	RW	Spread spectrum frequency variation amplitude 00: 20kHz 01: 40kHz (default) 10: 40kHz 11: 60kHz
0x0A	1	RAMP_CTRL	5	0	1	0	RW	1: CH2 soft mute
			4	0	1	0	RW	1: CH1 soft mute
			3	0	1	0	RW	Skip volume ramp
			1:0	1	2	01	RW	Volume slew step control 2'b00: 4.33ms from mute to 0dB (0.5dB/20.83μs) 2'b01: 8.66ms from mute to 0dB (0.25dB/20.83μs) (default) 2'b10: 17.33ms from mute to 0dB (0.125dB/20.83μs) 2'b11: 34.65ms from mute to 0dB (0.0625dB/20.83μs)

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x0B	1	TFC_CTRL	7	0	1	0	RO	Reserved
			6	0	1	0	RO	Reserved
			5:4	0	2	00	RW	Thermal foldback active threshold 00: Temp 110°C 01: Temp 120°C 10: Temp 130°C 11: Temp 140°C
			3:2	0	2	00	RW	Thermal foldback attack/release rate 00: 0.0625dB/25ms 01: 0.0625dB/50ms 10: 0.0625dB/100ms 11: 0.0625dB/200ms
			1:0	0	2	00	RW	Thermal foldback attack/release rate 00: 0.0625dB/50ms 01: 0.0625dB/100ms 10: 0.0625dB/200ms 11: 0.0625dB/400ms
0x0C	1	TDM_RX_LOC_L	5:0	0	6	000000	RW	TDM start reviving location select for left channel 00000: Start from 0+offset 00001: Start from 8+offset ... 11100: Start from 488+offset 11101: Start from 496+offset 11110: Not available 11111: Not available
0x0D	1	TDM_RX_LOC_R	5:0	3	6	000011	RW	TDM start reviving location select for left channel 00000: Start from 0+offset 00001: Start from 8+offset ... 11100: Start from 488+offset 11101: Start from 496+offset 11110: Not available 11111: Not available

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x0E	1	TDM_TX_LOC_L	5:0	0	6	000000	RW	TDM start transmitting location select for left channel 00000: Start from 0+offset 00001: Start from 8+offset ... 11100: Start from 488+offset 11101: Start from 496+offset 11110: Not available 11111: Not available
0x0F	1	TDM_TX_LOC_R	5:0	3	6	000011	RW	TDM start transmitting location select for right channel 00000: Start from 0+offset 00001: Start from 8+offset ... 11100: Start from 488+offset 11101: Start from 496+offset 11110: Not available 11111: Not available

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x10	1	ERR_RPT	7	0	1	0	W1C	Reserved
			6	0	1	0	W1C	DC flag report 0: No DC error (default) 1: DC error
			5	0	1	0	W1C	0: No SCLK error (default) 1: SCLK error, write 1 to clear flag
			4	0	1	0	W1C	0: No LRCK clock error (default) 1: LRCK clock error, write 0 to clear flag
			3	0	1	0	W1C	0: No OC error (default) 1: OC, write 1 to clear flag
			2	0	1	0	W1C	0: No OV error (default) 1: OV, write 1 to clear flag
			1	0	1	0	W1C	0: No OT error (default) 1: OT, write 1 to clear flag
			0	0	1	0	W1C	0: No UV error (default) 1: UV, write 1 to clear flag

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x11	1	ERR_MASK	6	0	1	0	RW	Reserved
			5	1	1	1	RW	Fault mask for 0x02 SCLK error 0: Not mask 1: Mask (default)
			4	1	1	1	RW	Fault mask for 0x02 LRCK error 0: Not mask 1: Mask (default)
			3	0	1	0	RW	Fault mask for 0x02 OC error 0: Not mask (default) 1: Mask
			2	0	1	0	RW	Fault mask for 0x02 OV error 0: Not mask (default) 1: Mask
			1	0	1	0	RW	Fault mask for 0x02 OT error 0: Not mask (default) 1: Mask
			0	0	1	0	RW	Fault mask for 0x02 UV error 0: Not mask (default) 1: Mask
0x12	1	ERR_TYPE	3	1	1	1	RW	Fault behavior type select. 0: Auto-recovery (default) 1: Latch
			2	0	1	0	RW	Fault behavior type select. 0: Auto-recovery (default) 1: Latch
			1	0	1	0	RW	Fault behavior type select. 0: Auto-recovery (default) 1: Latch
			0	0	1	0	RW	Fault behavior type select. 0: Auto-recovery (default) 1: Latch

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x13	1	FAULT_ CTRL	3:0	2	4	0010	RW	Power stage auto-recovery time 0010: 299ms 0011: 449ms 0100: 598ms 0101: 748ms 0110: 898ms 0111: 1047ms 1000: 1197ms 1001: 1346ms 101X: 1496ms 11XX: 1496ms
0x14	1	DC_PORT_ OPT	3:2	2	2	10	RW	DC threshold for DC detection 00: No available 01: 12.5% 10: 18.75% (default) 11: 25%
			1	0	1	0	RW	Detection time 0: 342ms (default) 1: 684ms
			0	1	1	1	RW	DC protection enable 0: Disable 1: Enable (default)
0x15	1	ANA_PWR_ CTRL1	7	1	1	1	RW	Enable DAC RCH LPF 0: Disable 1: Enable (default)
			6	1	1	1	RW	Enable DAC LCH LPF 0: Disable 1: Enable (default)
			5	1	1	1	RW	RCH PWR stage enable 0: Disable 1: Enable (default)
			4	1	1	1	RW	LCH PWR stage enable 0: Disable 1: Enable (default)
			3	1	1	1	RW	Enable DAC_RCH 0: Disable 1: Enable (default)
			2	1	1	1	RW	Enable DAC LCH 0: Disable 1: Enable (default)
			1	1	1	1	RW	Reserved
			0	1	1	1	RW	Reserved

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x16	1	ANA_PWR_CTRL2	5	0	1	0	RW	Reserved
			4	0	1	0	RW	Reserved
			3	0	1	0	RW	Reserved
			2	0	1	0	RW	Reserved
			1	0	1	0	RW	Reserved
			0	0	1	0	RW	Reserved
0x20	2	Master Volume	10:0	7FF	11	111_11111111	RW	Master volume control 11'h000: 24dB 11'h180: 0dB 11'h7FF: mute (default) 0.0625dB per step
0x21	2	Ch1 Volume	10:0	180	11	001_10000000	RW	CH1 volume control 11'h000: 24dB 11'h180: 0dB (default) 11'h7FF: mute 0.0625dB per step
0x22	2	Ch2 Volume	10:0	180	11	001_10000000	RW	CH2 volume control 11'h000: 24dB 11'h180: 0dB (default) 11'h7FF: mute 0.0625dB per step
0x23	2	DRCThreshold	10:0	0	11	000_00000000	RW	DRC threshold 11'h000: 0dB (default) 11'h180: -24dB 11'h67E: -103.875dB 11'h67F to 11'h7FF: Not available 0.0625dB per step
0x24	2	DRC Ratio	7:0	80	8	10000000	RW	DRC compress ratio 8'h00: No compression 8'h80 to 8'hFF: Full compression 1/128 per step
0x25	2	DRC Make Up Gain	10:0	180	11	001_10000000	RW	DRC make up gain (Offset) 11'h000: 24dB 11'h180: 0dB (default) 11'h7FF: -103.9375dB 0.0625dB per step
0x26	2	DRC Noise Gate	10:0	640	11	110_01000000	RW	Noise gate threshold 11'h000: 0dB 11'h180: -24dB 11'h640: -100dB (default) 11'h67E: -103.875dB 11'h67F to 11'h7FF: Not available 0.0625dB per step

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x27	2	Hard Clipping Threshold	10:0	180	11	001_10000000	RW	Hard clip threshold when HARD_CLIP_EN = 1 >0dB is not allowable for hard clip threshold setting 11'h180: 0dB (default) 0.0625dB per step
0x28	2	Volume control for open load detection	10:0	23E	11	010_00111110	RW	Volume control for open load detection 11'h000: 24dB 11'h180: 0dB 11'h23E: -11.875dB (default) 11'h7FF: mute 0.0625dB per step
0x29	2	Volume control for short load detection	10:0	310	11	011_00010000	RW	Volume control for short load detection 11'h000: 24dB 11'h180: 0dB 11'h310: -25dB (default) 11'h7FF: mute 0.0625dB per step
0x30	3	CH1_IN_MIX_0	16:0	08000	17	0_10000000_00000000	RW	CH1_IN_MIX_0
0x31	3	CH1_IN_MIX_1	16:0	0	17	0_00000000_00000000	RW	CH1_IN_MIX_1
0x32	3	CH2_IN_MIX_0	16:0	0	17	0_00000000_00000000	RW	CH2_IN_MIX_0
0x33	3	CH2_IN_MIX_1	16:0	08000	17	0_10000000_00000000	RW	CH2_IN_MIX_1
0x34	3	DRC_AE	16:0	08000	17	0_10000000_00000000	RW	DRC_AE
0x35	3	DRC_1_AE	16:0	0	17	0_00000000_00000000	RW	DRC_1_AE
0x36	3	DRC_AD	16:0	08000	17	0_10000000_00000000	RW	DRC_AD
0x37	3	DRC_AA	16:0	08000	17	0_10000000_00000000	RW	DRC_AA
0x38	3	RMS_RPT_AE	16:0	08000	17	0_10000000_00000000	RW	RMS_RPT_AE
0x3A	3	Compensation filter coefficient B0	16:0	08000	17	0_10000000_00000000	RW	Compensation filter coefficient B0
0x3B	3	Compensation filter coefficient B1	16:0	0	17	0_00000000_00000000	RW	Compensation filter coefficient B1

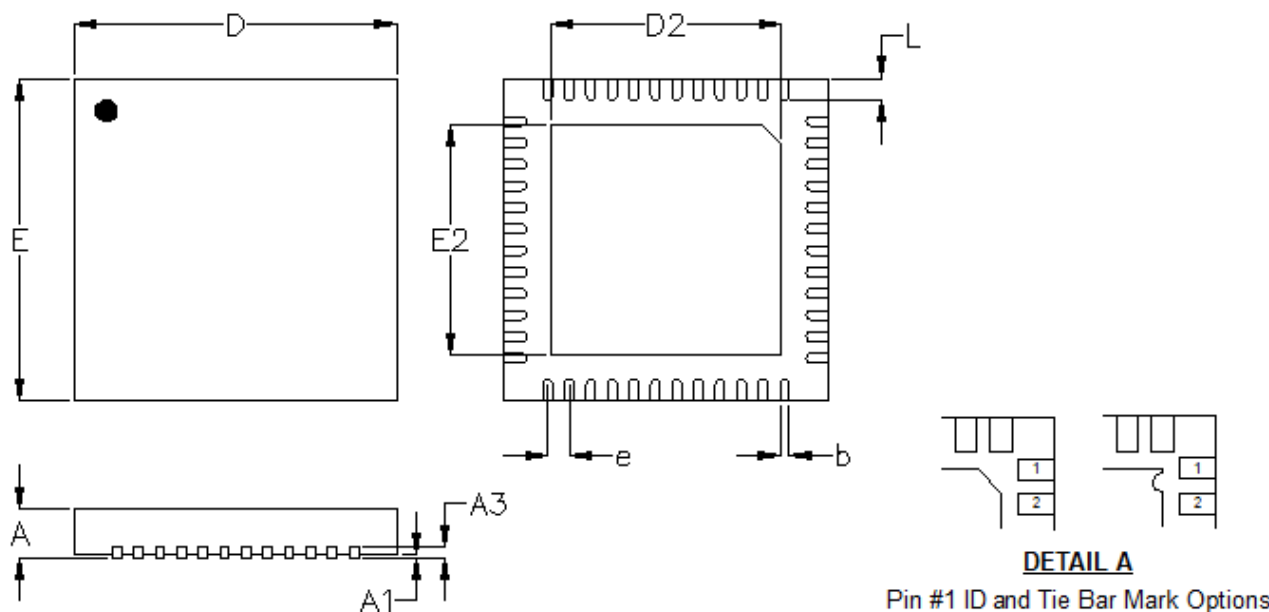
Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x3C	3	Compensation filter coefficient B2	16:0	0	17	0_00000000_00000000 0	RW	Compensation filter coefficient B2
0x3D	3	Compensation filter coefficient B3	16:0	0	17	0_00000000_00000000 0	RW	Compensation filter coefficient B3
0x3E	4	CH1_RMS_RPT	31:0	0	32	00000000_00000000_00000000_00000000	RO	Channel 1 Final RMS output
0x3F	4	CH2_RMS_RPT	31:0	0	32	00000000_00000000_00000000_00000000	RO	Channel 2 Final RMS output
0x40	1	SW_RESET	7	0	1	0	WO	Write 1 to trigger Software reset Need to wait 10ms for reset completion
0x90	1	DRE_CTRL	7	1	1	1	RW	After hold time, 0: Enter DRE at zero crossing (default) 1: Enter DRE if signal < threshold
			6	0	1	0	RW	In zero crossing stage, 1: Enter DRE at zero crossing no matter timeout or not 0: Enter DRE if zero crossing or timeout (default)
			5:4	2	2	10	RW	hold time before enter DRE 00: 16ms 01: 32ms 10: 64ms (default) 11: 128ms
			3	0	1	0	RW	Force enable analog DRE for L-ch 0: Disable (default) 1: Enable
			2	0	1	0	RW	Force enable analog DRE for R-ch 0: Disable (default) 1: Enable
			1	0	1	0	RW	DRE test mode Function enable of amplitude detection release time for D_DRE
			0	1	1	1	RW	DRE enable 1: Enable

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x91	1	TH_DRE	7:0	40	8	01000000	RW	Threshold of digital input for changing D_DRE DRE threshold = $20 * \log(\text{TH_DRE} / 2^{11})$
0x92	1	ANA_DRE_DELAY_MSB	1:0	0	2	00	RW	Analog path delay when dre_en change (= ANA_DRE_DELAY / 24.576MHz)
0x93	1	ANA_DRE_DELAY_LSB	7:0	3E	8	00111110	RW	Analog path delay when dre_en change (= ANA_DRE_DELAY / 24.576MHz)
0x94	1	CMH_TH	7:0	45	8	01000101	RW	threshold of CMH to BD mode modulation 8'h00: DRE_TH (CMH switch with DRE) Others: $20 * \log_{10}(\text{CMH_TH} / 2^{10}) \text{dB}$ 8'h45: -23.43dB (Po= 0.5W) 8'h78: -18.66dB (Po= 1.5W) 8'h8A: -17.41 (Po=2W) (Po is based on SPK Gain = 18db, RL = 6Ω)

Addr	Length	RegName	Bit	Hex Default	Bit Number	Default	Type	Description
0x95	1	CMH_CTRL	7:6	1	2	01	RW	Signal level keep under D_CMH_TH to enter CMH mode 2'b00: Without hold time 2'b01: 16ms 2'b10: 32ms 2'b11: 64ms
			5	0	1	0	RW	CMH offset delay option for CMH control 0: CMH mode → offset apply 1: Offset apply → CMH mode
			4	0	1	0	RW	1'b0: Switch when: signal level vs cmh_th" change" 1'b1: Switch at zero crossing when D_CMH_HOLD_SEL is enable (default)
			3	0	1	0	RW	switch time out enable when zero crossing enable 1'b0: Disable 1'b1: Enable
			2:0	0	3	000	RW	Offset switch delay 3'b000: PLL freq. 3'b001: PLL/2 freq. 3'b010: PLL/4 freq. 3'b011: PLL/8 freq. 3'b1xx: PLL/16 freq.
0x96	1	CMH_DLY_CNT	7:0	0	8	00000000	RW	Count delay with D_CMH_CNT_FREQ delay = D_CMH_DLY_SEL/CNT_FREQ

Note 25. The register description which is described as prohibit is not allow to be set.

21 Outline Dimension



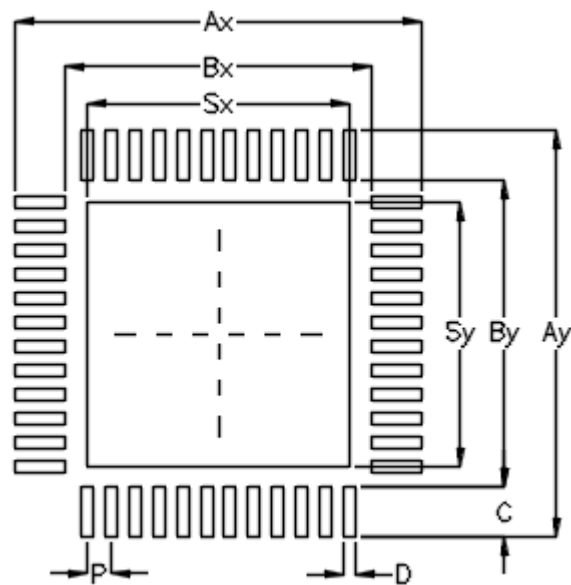
Note : The configuration of the Pin #1 identifier is optional, but must be located within the zone indicated.

Symbol		Dimensions In Millimeters		Dimensions In Inches	
		Min	Max	Min	Max
A		0.800	1.000	0.031	0.039
A1		0.000	0.050	0.000	0.002
A3		0.175	0.250	0.007	0.010
b		0.150	0.250	0.006	0.010
D		5.950	6.050	0.234	0.238
D2	Option 1	4.250	4.350	0.167	0.171
	Option 2	4.350	4.450	0.171	0.175
	Option 3	4.650	4.750	0.183	0.187
E		5.950	6.050	0.234	0.238
E2	Option 1	4.250	4.350	0.167	0.171
	Option 2	4.350	4.450	0.171	0.175
	Option 3	4.650	4.750	0.183	0.187
e		0.400		0.016	
L		0.350	0.450	0.014	0.018

V-Type 48L QFN 6x6 Package

Note 26. The package of the RT9125 uses Option 1.

22 Footprint Information

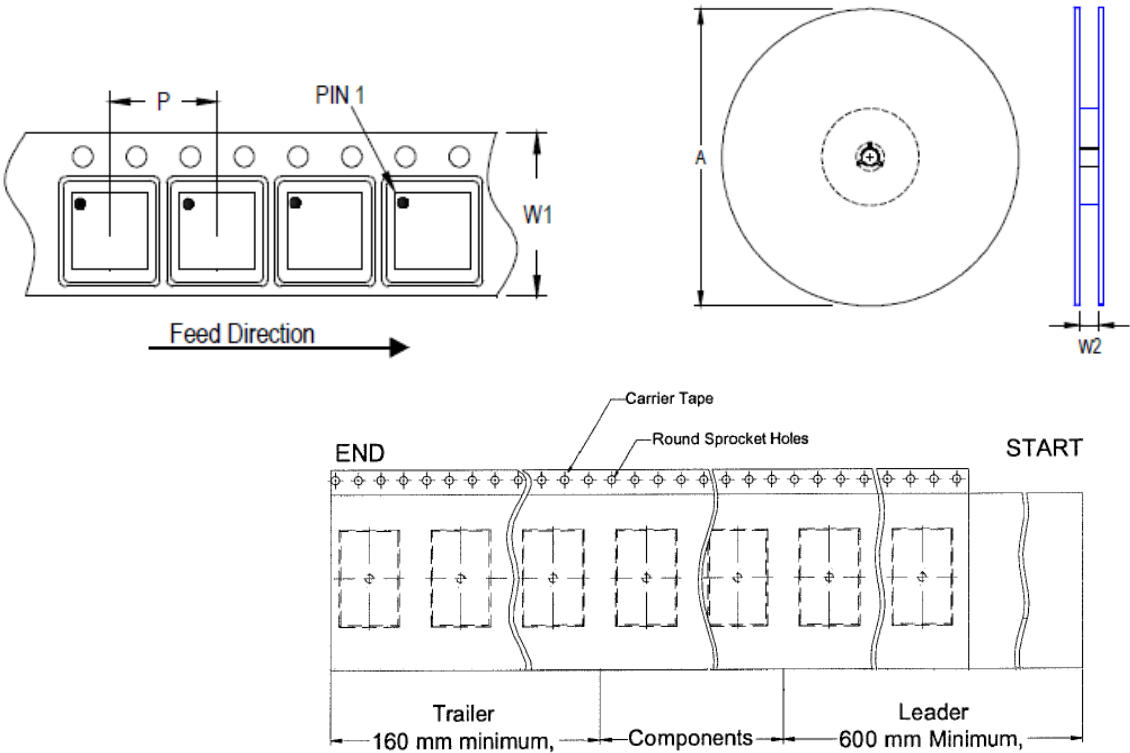


Package		Number of Pin	Footprint Dimension (mm)								Tolerance	
			P	Ax	Ay	Bx	By	C	D	Sx		Sy
V/W/U/XQFN6x6-48	Option1	48	0.40	6.80	6.80	5.10	5.10	0.85	0.20	4.40	4.40	±0.05
	Option2									4.50	4.50	
	Option3									4.70	4.70	
	Option4									4.60	4.60	

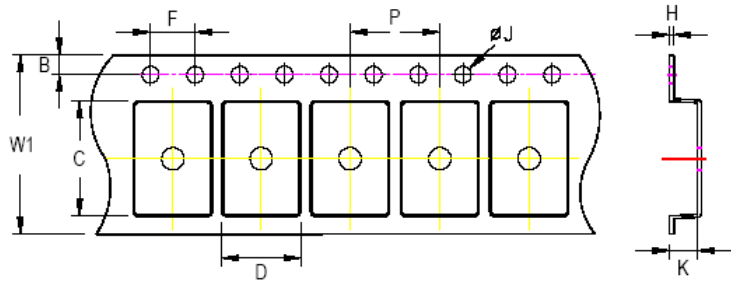
Note 27. The package of the RT9125 uses Option 1.

23 Packing Information

23.1 Tape and Reel Data









Package Type	Tape Size (W1) (mm)	Pocket Pitch (P) (mm)	Reel Size (A)		Units per Reel	Trailer (mm)	Leader (mm)	Reel Width (W2) Min/Max (mm)
			(mm)	(in)				
(V, W) QFN/DFN 6x6	16	12	330	13	2,500	160	600	16.4/18.4



C, D, and K are determined by component size. The clearance between the components and the cavity is as follows:
- For 16mm carrier tape: 1.0mm max.

Tape Size	W1	P		B		F		ØJ		K		H
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Max
16mm	16.3mm	11.9mm	12.1mm	1.65mm	1.85mm	3.9mm	4.1mm	1.5mm	1.6mm	1.0mm	1.3mm	0.6mm

23.2 Tape and Reel Packing

Step	Photo/Description	Step	Photo/Description
1	 <p>Reel 13"</p>	4	 <p>1 reel per inner box Box G</p>
2	 <p>HIC & Desiccant (2 Unit) inside</p>	5	 <p>6 inner boxes per outer box</p>
3	 <p>Caution label is on backside of Al bag</p>	6	 <p>Outer box Carton A</p>

Package	Container	Reel		Box			Carton		
		Size	Units	Item	Reels	Units	Item	Boxes	Units
(V, W) QFN and DFN 6x6		13"	2,500	Box G	1	2,500	Carton A	6	15,000

23.3 Packing Material Anti-ESD Property

Surface Resistance	Aluminum Bag	Reel	Cover tape	Carrier tape	Tube	Protection Band
Ω/cm^2	10^4 to 10^{11}	10^4 to 10^{11}	10^4 to 10^{11}	10^4 to 10^{11}	10^4 to 10^{11}	10^4 to 10^{11}

Richtek Technology Corporation

14F, No. 8, Tai Yuen 1st Street, Chupei City

Hsinchu, Taiwan, R.O.C.

Tel: (8863)5526789



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RT9125_DS-01 March 2025

24 Datasheet Revision History

Version	Date	Description	Item
00	2024/7/15	Final	General Description on P1 Features on P1 Pin Configuration on P2 Absolute Maximum Ratings on P8 Recommended Operating Conditions on P8 Electrical Characteristics on P8, 9, 10 Note 7 on P11 Timing Diagram on P21, 22 Typical Operating Characteristics on P24 to P32 Overall Signal Path on P33 Detailed Signal Path on P34 to P39, P41 to P43, P46, 48, 50, 52, 55, P60 to P64, 66, 69, 70, 71 Operation on P73, 74 Application Information on P75 Functional Register Description on P82, 84, 115, 118, 127, 129 Packing Information on P131, 132
01	2025/3/8	Modify	<i>Features on page 1</i> - Modified 128-Taps <i>Functional Pin Description on page 6</i> - Added IO Type Definition <i>Electrical Characteristics on page 8</i> - Modified PVDDL/R+AVCC Quiescent Current (CMH Mode) <i>Typical Application Circuit on page 12 to 15</i> - Modified Typical Application Circuit <i>Timing Diagram on page 17 to 25</i> - Added and modified timing diagram <i>Detailed Signal Path on page 75 to 79</i> - Added section 17.28 to 17.32 <i>Operation on page 81 to 84</i> - Modified section 18.13 - Added section 18.14 to 18.16 <i>Functional Register Description on page 139</i> - Added Note 18 <i>Packing Information on page 142</i> - Modified Tape and Reel Data