Precision Adjustable Current-Limited Switch Evaluation Board

General Description

The RTQ9728W is a precision adjustable current-limited power-distrilbution switches. Its input voltage range is from 2.5V to 6V and provides an adjustable current limited from 0.1A to 2.5A. This document explains the function and use of the RTQ9728W evaluation board (EVB), and provides information to enable operation, modification of the evaluation board and circuit to suit individual requirements.

Table of Contents

Performance Specification Summary

Summary of the RTQ9728WGQW(2) Evaluation Board performance specificiaiton is provided in Table 1. The ambient temperature is 25°C.

Table 1. RTQ9728WGQW(2) Evaluation Board Performance Specification Summary

Specification	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	Default = 5V	2.5	--	6	V
Output Current		--	1.9	--	A
Default Output Voltage		--	5	--	V
Current Limit	R_{ILIM} = 13kΩ	1.8	2	2.2	A
Undervoltage Lockout Threshold		--	2.3	2.6	V
Quescent Curent	I_{OUT} = 0A	--	120	300	μA
Shutdown Current	V_{EN} = 0V, I_{OUT} = 0A	--	1	10	μA

Power-up Procedure

Suggestion Required Equipments

- RTQ9728WGQW Evaluation Board
- DC power supply capable of at least 6V and 3A
- Electronic load capable of 6A
- Function Generator
- Oscilloscope

Quick Start Procedures

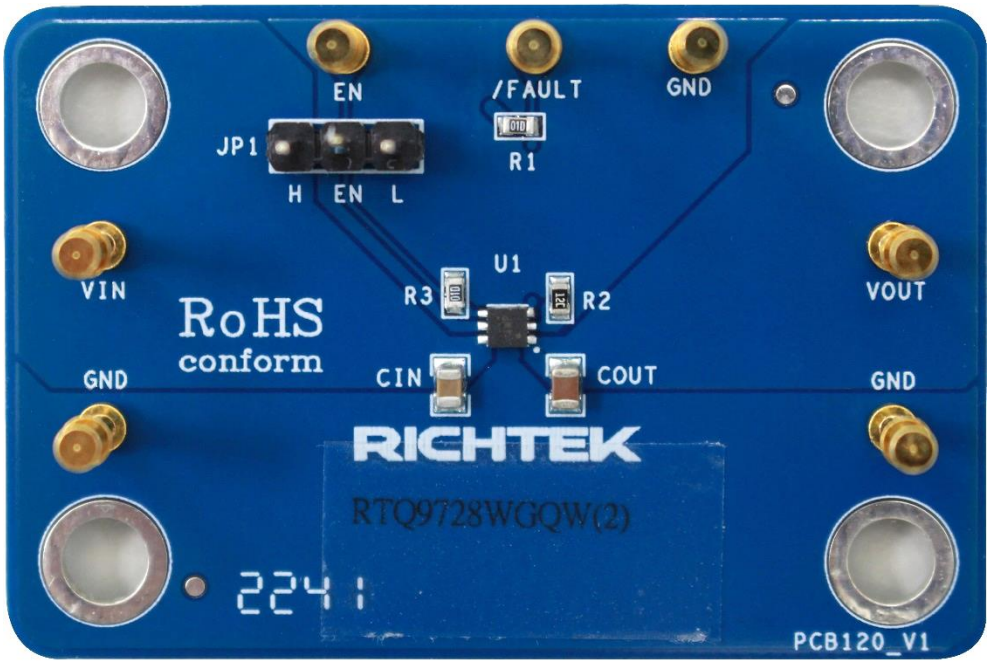
The Evaluation Board is fully assembled and tested. Follow the steps below to verify board operation. Do not turn on supplies until all connections are made. When measuring the output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip and ground ring directly across the last output capacitor.

Proper measurement equipment setup and follow the procedure below.

1) With power off, connect the input power supply to VIN and GND pins.
2) With power off, connect the electronic load between the VOUT and nearest GND pins.
3) Turn on the power supply at the input. Make sure that the input voltage does not exceeds 5.5V on the Evaluation Board.
4) Check for the proper output voltage using a voltmeter.
5) Once the proper output voltage is established, adjust the load within the operating ranges and observe the output voltage regulation, ripple voltage, efficiency and other performance.

Detailed Description of Hardware

Headers Description and Placement



Carefully inspect all the components used in the EVB according to the following Bill of Materials table, and then make sure all the components are undamaged and correctly installed. If there is any missing or damaged component, which may occur during transportation, please contact our distributors or e-mail us at evb_service@richtek.com.

Test Points

The EVB is provided with the test points and pin names listed in the table below.

Test Point/ Pin Name	Function
VOUT	Output voltage.
ILIM	Current limit threshold setting pin.
/Fault	Open drain output pin. Asserted during overcurrent, over-temperature or reverse-voltage conditions.
EN	Enable control input.
GND	Ground.
VIN	Supply voltage input.

Power-up & Measurement Procedure

1. Apply a 5V nominal input power supply (2.5V < V_{IN} < 6V) to the VIN and GND terminals.
2. Set the jumper at JP1 to connect terminals 1 and 2, connecting EN to VIN. The Enable pin can connected to VIN directly as well to enable operation.
3. Verify the output voltage (approximately 5V) between VOUT and GND.
4. Connect an external load up to 1.9A to the VOUT and GND terminals and verify the output voltage and current.

Current Limit Setting

Set the current limit with the resistive divider (R2) between ILIM and GND. The current limit is set by the following below data:

Desired Nominal Current Limit (mA)	Ideal Resistor (kΩ)	Closet 1% Resistor (kΩ)	Actual Limits (Include R Tolerance)		
			IOS Min (mA)	IOS Nom (mA)	IOS Max (mA)
120	226.1	226.0	101.3	120.0	142.1
200	134.0	133.0	173.7	201.5	233.9
300	88.5	88.7	262.1	299.4	342.3
400	65.9	66.5	351.1	396.7	448.7
500	52.5	52.3	443.9	501.6	562.4
600	43.5	43.2	535.1	604.6	674.1
700	37.2	37.4	616.0	696.0	776.0
800	32.4	32.4	708.7	800.8	892.9
900	28.7	28.7	797.8	901.5	1005.2
1000	25.8	26.1	875.4	989.1	1102.8
1100	23.4	23.2	982.1	1109.7	1237.3
1200	21.4	21.5	1057.9	1195.4	1332.9
1300	19.7	19.6	1158.0	1308.5	1459.0
1400	18.5	18.7	1225.7	1385.0	1544.3
1500	17.3	17.4	1317.3	1488.5	1659.7
1600	16.2	16.2	1414.8	1598.7	1782.6
1700	15.2	15.0	1528.1	1726.7	1925.3
1800	14.4	14.3	1602.9	1811.2	2019.5
1900	13.6	13.7	1673.1	1890.5	2107.9
2000	12.9	13.0	1763.2	1992.3	2221.4
2100	12.3	12.4	1848.5	2088.7	2328.9
2200	11.8	11.8	1942.6	2195.0	2447.4
2300	11.3	11.3	2028.4	2292.0	2555.6
2400	10.8	10.7	2141.7	2420.0	2698.3
2500	10.3	10.0	2292.2	2590.0	2887.9

The placement of the resistive divider should be within 5mm of the ILIM pin. For better output current limit accuracy, divider resistors (R2) should have tolerance of ±1% tolerance.

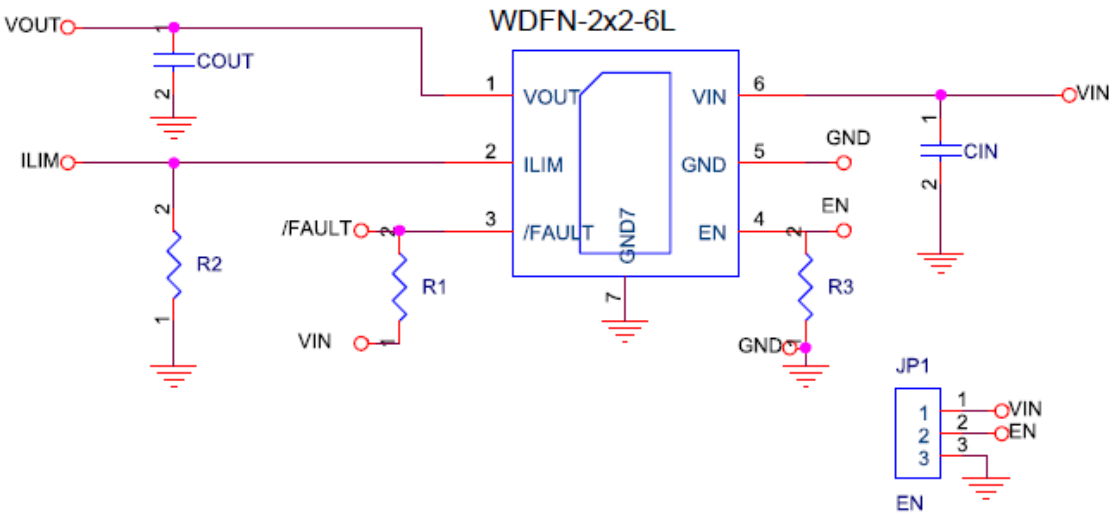
Bill of Materials

V_{IN} = 5V, V_{OUT} = 5V, I_{OUT} = 0.5A						
Reference	Count	Part Number	Value	Description	Package	Manufacturer
U1	1	RTQ9728WGQW(2)	RTQ9728WGQW(2)	Switches	WDFN-6SL 2x2	RICHTEK
CIN	1	GRM21BR71A106KE51L	10µF	Capacitor, Ceramic, 10V, X7R	0805	MURATA
COUT	1	0805X226M250CT	22µF	Capacitor, Ceramic, 25V, X5R	0805	WALSIN
R1, R3	2	WR06X1003FTL	100kΩ	Resistor, Chip, 1/10W, 1%	0603	WALSIN
R2	1	WR06X1302FTL	13kΩ	Resistor, Chip, 1/10W, 1%	0603	WALSIN

Typical Applications

EVB Schematic Diagram

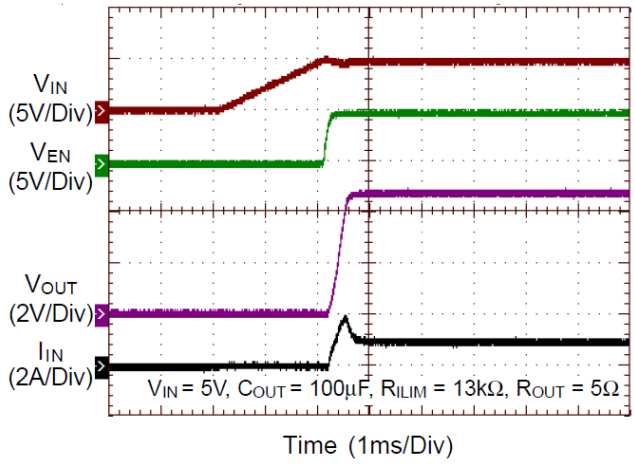
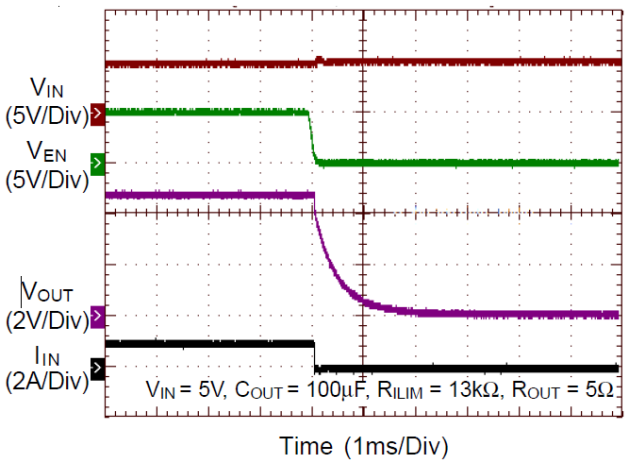
VIN 5V, VOUT 5V/1.9A

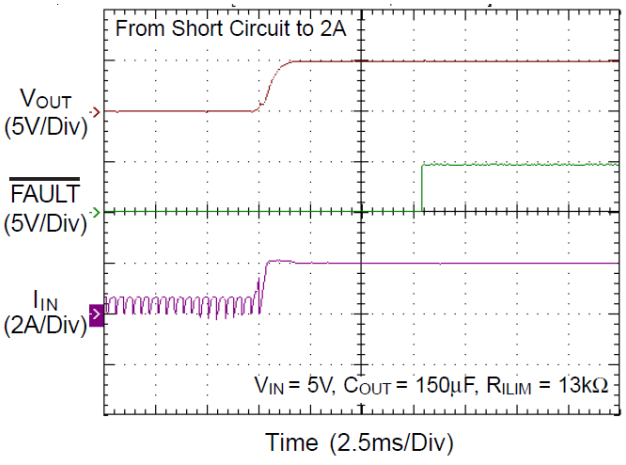
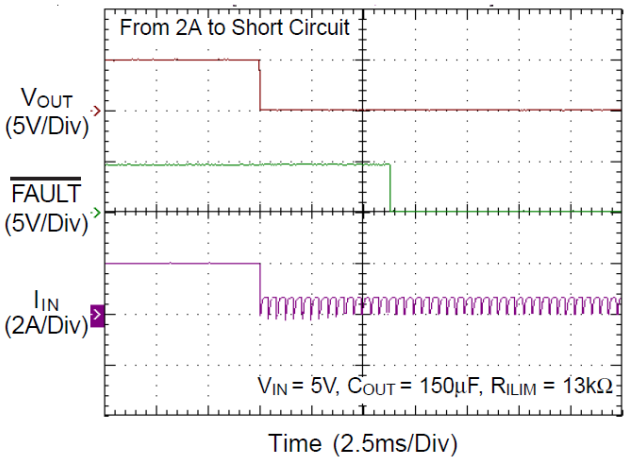


Note:

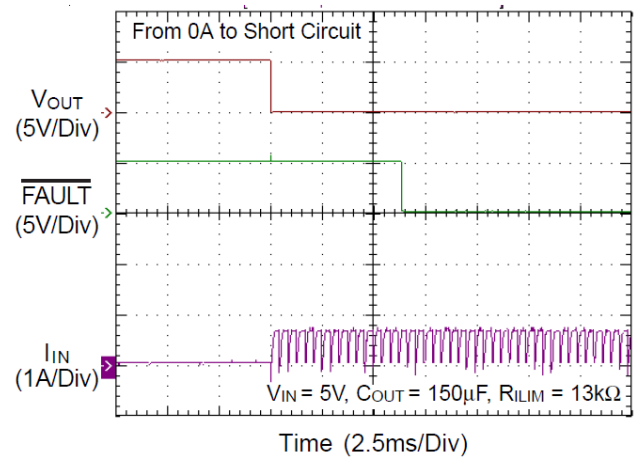
1. Do not hot-plug a live 5V supply to the board; if hot-plugging is required, add ~100μF electrolytic capacitor at the input.
2. All the stated input and output capacitor values are the effective capacitances, including any de-rating effect, like a DC Bias. The stability of the converter may be impacted when using small size MLCC output capacitors, which may have much lower capacitance at the application DC output voltage than the rated value.

Measurement Results

Power-On from EN Brown: V_{IN}; Green: V_{EN}; Purple: V_{OUT}; Black: I_{IN}.	Power-Off from EN Brown: V_{IN}; Green: V_{EN}; Purple: V_{OUT}; Black: I_{IN}.
	
Output voltage measure at V_{IN} = 5V than V_{EN} = 5V, R_{ILIM} = 13kΩ, R_{OUT} = 5Ω	Output voltage measure at V_{IN} = 5V than V_{EN} = 5V, R_{ILIM} = 13kΩ, R_{OUT} = 5Ω

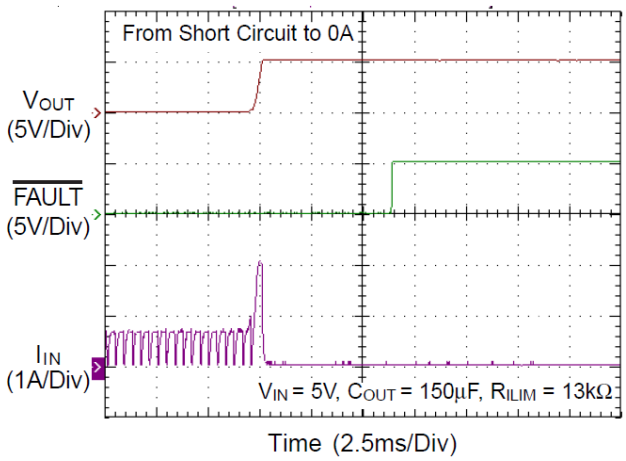
Short Circuit Protection for short circuit to 2A. Red: V_{OUT}; Green: /Fault; Purple: I_{IN}.	Short Circuit Protection for short circuit to 2A. Red: V_{OUT}; Green: /Fault; Purple: I_{IN}.
	
R_{ILIM} = 13kΩ, OC setting = 2A.	R_{ILIM} = 13kΩ, OC setting = 2A.

Short Circuit Protection for short circuit to 0A.
Red: VOUT; Green: /Fault; Purple: IIN.



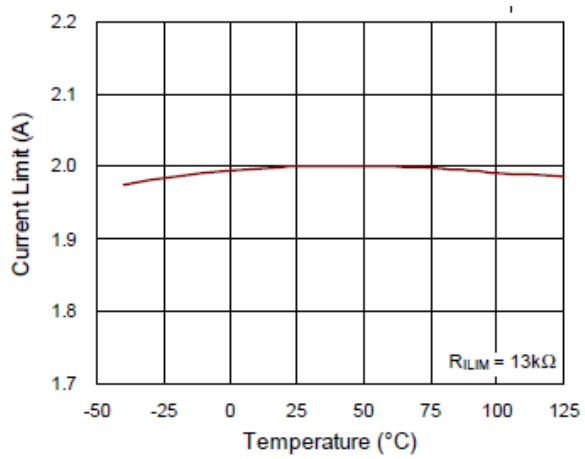
RILIM = 13kΩ, OC setting=2A.

Short Circuit Protection for short circuit to 0A.
Red: VOUT; Green: /Fault; Purple: IIN.



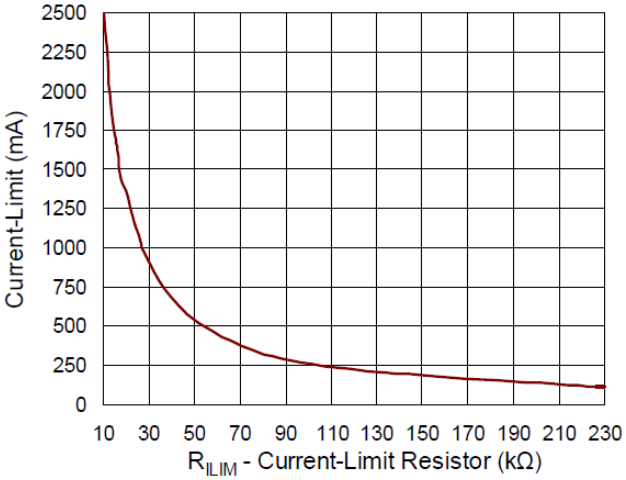
RILIM = 13kΩ, OC setting = 2A.

Current Limit vs. Temperature



RILIM = 13kΩ, OC setting = 2A.

Current-Limit Threshold vs. RILIM



RILIM = 226kΩ to 10kΩ; OC setting = 0.12A to 2.5A

Evaluation Board Layout

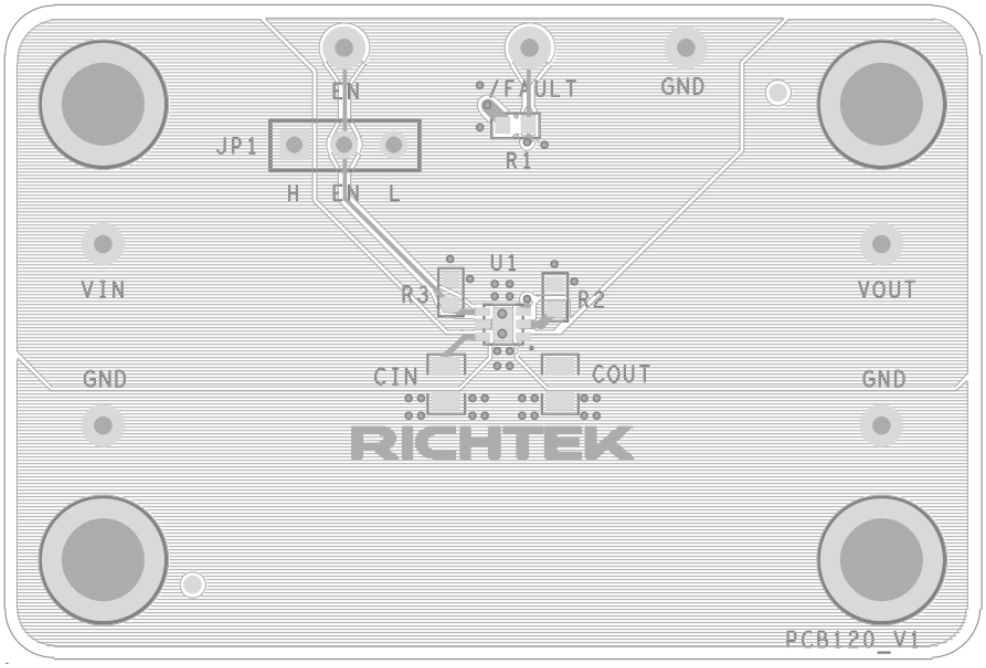


Figure 1. Top View

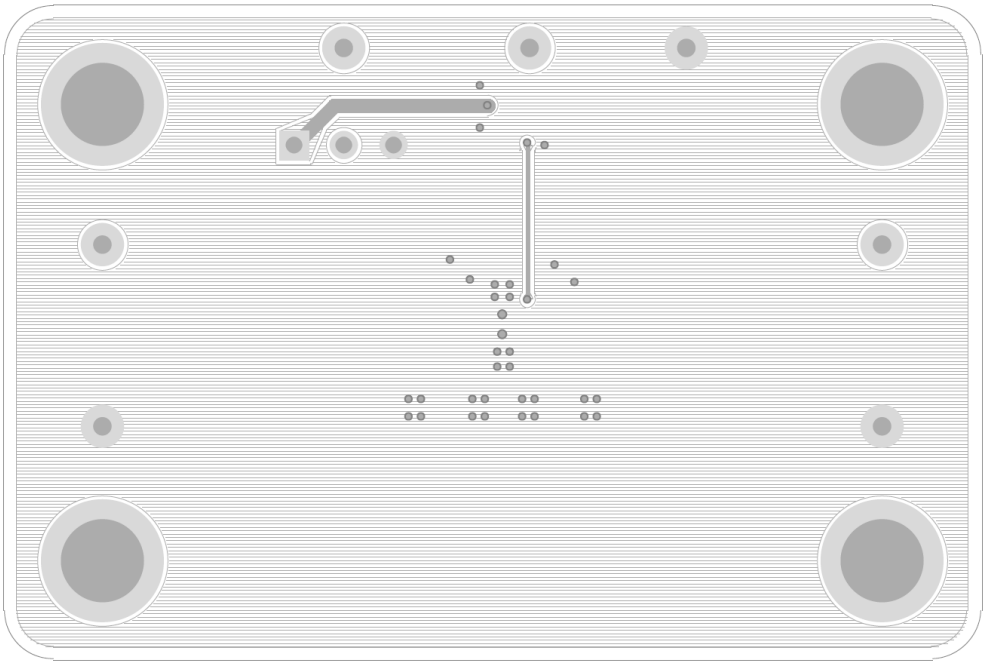


Figure 2. Bottom View

More Information

For more information, please find the related datasheet or application notes from Richtek website http://www.richtek.com.

Important Notice for Richtek Evaluation Board