Ultra-Low Quiescent Current HCOT Buck Converter

General Description
The RT5707/A is a high efficiency synchronous step-down converter featuring typ. 360nA quiescent current. It provides high efficiency at light load down to 10mA. Its input voltage range is from 2.2V to 5.5V. The RT5707 provides eight programmable output voltage 1.2V to 3.3V while delivering output current up to 600mA, peak to 1A. The RT5707A provides eight programmable output voltage 0.7V to 3.1V while delivering output current up to 400mA, peak to 0.5A.

The Hysteretic Constant-On-Time (HCOT) operation with internal compensation allow the transient response to be optimized over a wide range of loads and output capacitors.

The RT5707/A is available in WL-CSP-8B 0.9x1.6 (BSC) package.

Features
- Input Voltage Range : 2.2V to 5.5V
- Programmable Output Voltage 8-Level
  - RT5707 1.2V to 3.3V
  - RT5707A 0.7V to 3.1V
- Typ. 360nA Quiescent Current
- PSM Operation
- Up to 94% Efficiency
- Internal Compensation
- Output Voltage Discharge
- Over-Current Protection
- Over-Temperature Protection
- Output Current
  - RT5707 600mA, Peak to 1A
  - RT5707A 400mA, Peak to 0.5A
- Automatic Transition to 100% Duty Cycle Operation

Ordering Information
- RT5707/A
  - Package Type
    - WSC : WL-CSP-8B 0.9x1.6 (BSC)

Note:
- Richtek products are:
  - RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
  - Suitable for use in SnPb or Pb-free soldering processes.

Applications
- Hand-Held Devices
- Portable Information
- Battery Powered Equipment
- Wearable Devices
- Internet of Things
- Smart Watch

Simplified Application Circuit
## Functional Pin Description

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Pin Name</th>
<th>Pin Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>SW</td>
<td>This pin is the connection between two build-in switches in the chip, which should be connected to the external inductor. The inductor should be connected to this pin with the shortest path.</td>
</tr>
<tr>
<td>A2</td>
<td>VIN</td>
<td>Supply input. A minimum of 10µF (RT5707) and 4.7µF (RT5707A) ceramic capacitor should be connected to this pin with the shortest path.</td>
</tr>
<tr>
<td>B1</td>
<td>EN</td>
<td>Chip enable input pin. High level voltage enables the device while low level voltage turns the device off. This pin must be terminated.</td>
</tr>
<tr>
<td>B2</td>
<td>GND</td>
<td>Device ground pin. This pin should be connected to input and output capacitors with the shortest path.</td>
</tr>
<tr>
<td>C1</td>
<td>VSEL1</td>
<td>Output voltage selection pin. This pin must be terminated.</td>
</tr>
<tr>
<td>C2</td>
<td>VOUT</td>
<td>Output voltage feedback pin. This pin should be connected close to the output capacitor terminal for better voltage regulation. A minimum of 10µF ceramic capacitor should be connected to this pin with the shortest path.</td>
</tr>
<tr>
<td>D1</td>
<td>VSEL2</td>
<td>Output voltage selection pin. This pin must be terminated.</td>
</tr>
<tr>
<td>D2</td>
<td>VSEL3</td>
<td>Output voltage selection pin. This pin must be terminated.</td>
</tr>
</tbody>
</table>
**Operation**

The RT5707/A is a hysteretic constant on time (HCOT) switching buck converter. The RT5707/A provides Over-Temperature Protection (OTP) and Over-Current Protection (OCP) mechanisms to prevent the device from damage with abnormal operations. When the EN voltage is logic low, the IC will be shut down with low input supply current less than 1μA.

**Enable**

The device can be enabled or disabled by the EN pin. When the EN pin is higher than the threshold of logic-high IC goes to normal operation. EN pin High transfer Low into shutdown mode, the converter stops switching, internal control circuitry is turned off and trigger discharge function. That discharge function will close after count 10ms (typ.). If systems need EN toggle operation that EN turn off time must larger than 100μs for internal circuit reset time.

**UVLO Protection**

To protect the chip from operating at insufficient supply voltage, the UVLO is needed. When the input voltage is lower than the UVLO falling threshold voltage, the device will be lockout.

**100% Duty Cycle Operation**

The converter enters 100% duty cycle operation once the input voltage decrease and the difference voltage between input and output is lower than $V_{TH\_100-}$. The output voltage follows the input voltage minus the voltage drop across the internal P_MOSFET and the inductor. Once the input voltage increases and trips the 100% mode exit threshold, $V_{TH\_100+}$, the converter backs to normal switching again. See Figure 1.
Over-Temperature Protection

When the junction temperature exceeds the OTP threshold value, the IC will shut down the switching operation. Once the junction temperature cools down and is lower than the OTP lower threshold, the converter will automatically resume switching.

Over-Current Protection

The OCP function is implemented by UGATE and LGATE. When the inductor current reaches the UGATE current limit threshold, the high-side MOSFET will be turned-off. The low-side MOSFET turns on to discharge the inductor current until the inductor current trips below the LGATE current limit threshold. After UGATE current limit triggered, the max inductor current is decided by the inductor current rising rate and the response delay time of the internal network.

During OCP period, the output voltage drops below the setting threshold (typ. 0.4V) and the current limit value is reduced for lowering the devices loss, reducing the heat and preventing further damage of the chip.

Output Voltage Selection

The RT5707/A provides 8 level output voltages which can be programmed via the volatage select pin VSEL1 to VSEL3. Table 1 indicates the setting to individual output voltage.

<table>
<thead>
<tr>
<th>Device</th>
<th>VOUT (V)</th>
<th>VSEL3</th>
<th>VSEL2</th>
<th>VSEL1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT5707</td>
<td>1.2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1.8</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2.1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2.5</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2.8</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3.3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>RT5707A</td>
<td>0.7</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1.6</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1.9</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2.9</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3.1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Absolute Maximum Ratings  (Note 1)

- VIN, SW, EN, VSEL1, VSEL2, VSEL3, VOUT .............................................................. −0.3V to 6V
- Power Dissipation, \( P_D @ T_A = 25°C \)
  WL-CSP-8B 0.9x1.6 (BSC) .................................................................................. 0.84W
- Package Thermal Resistance  (Note 2)
  WL-CSP-8B 0.9x1.6 (BSC), \( \theta_{JA} \) ................................................................. 118.5°C/W
- Lead Temperature (Soldering, 10 sec.) .................................................................. 260°C
- Junction Temperature Range .......................................................................... −150°C
- Storage Temperature Range ............................................................................ −65°C to 150°C
- ESD Susceptibility  (Note 3)
  HBM (Human Body Model) ............................................................................. 2kV

Recommended Operating Conditions  (Note 4)

- Supply Input Voltage ......................................................................................... 2.2V to 5.5V
- RT5707 Output Current \( (5.5V \geq V_IN \geq (V_{OUT\_NOM} + 0.7V) \geq 3V) \) ............................................. 0mA to 600mA
- RT5707A Output Current \( (5.5V \geq V_IN \geq (V_{OUT\_NOM} + 0.7V) \geq 3V) \) .................................. 0mA to 400mA
- Junction Temperature Range ...................................................................... −40°C to 125°C
- Ambient Temperature Range .......................................................................... −40°C to 85°C

Electrical Characteristics

\( (V_{IN} = 3.6V, C_{IN} = C_{OUT} = 10\mu F, L_1 = 2.2\mu H, T_A = 25°C, \) unless otherwise specified)
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Discharge Resistor</td>
<td>$R_{DIS}$</td>
<td>$EN = GND$, $I_{OUT} = -10mA$</td>
<td>--</td>
<td>10</td>
<td>--</td>
<td>$\Omega$</td>
</tr>
<tr>
<td>$V_{OUT}$ Pin Input Leakage</td>
<td>$I_{VOUT}$</td>
<td>$V_{OUT} = 2V$, $EN = V_{IN}$</td>
<td>--</td>
<td>100</td>
<td>--</td>
<td>nA</td>
</tr>
<tr>
<td>$V_{OUT}$ Minimum Off Time</td>
<td>$t_{OFF_MIN}$</td>
<td></td>
<td>--</td>
<td>80</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>$V_{OUT}$ Minimum On Time</td>
<td>$t_{ON_MIN}$</td>
<td>$V_{OUT} = 1.8V$, $V_{IN} = 3.6V$</td>
<td>--</td>
<td>420</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>Line Regulation</td>
<td>$V_{OUT_LineReg}$</td>
<td>$V_{OUT} = 1.8V$, $I_{OUT} = 100mA$, $V_{IN} = 2.2V$ to 5.5V</td>
<td>--</td>
<td>0.1</td>
<td>--</td>
<td>%/V</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>$V_{OUT_LoadReg1}$</td>
<td>$V_{OUT} = 1.8V$, including PFM operation</td>
<td>--</td>
<td>0.001</td>
<td>--</td>
<td>%/mA</td>
</tr>
<tr>
<td></td>
<td>$V_{OUT_LoadReg2}$</td>
<td>$V_{OUT} = 1.8V$, only CCM operation</td>
<td>--</td>
<td>0.0005</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Over-Temperature Protection</td>
<td>$TOTP$</td>
<td></td>
<td>--</td>
<td>150</td>
<td>--</td>
<td>°C</td>
</tr>
<tr>
<td>Over-Temperature Protection Hysteresis</td>
<td>$TOTP_HYS$</td>
<td></td>
<td>--</td>
<td>20</td>
<td>--</td>
<td>°C</td>
</tr>
<tr>
<td>Auto 100% Duty Cycle Leave Detection Threshold</td>
<td>$V_{TH_100^+}$</td>
<td>Rising $V_{IN}$. 100% mode is left with $V_{IN} = V_{OUT} + V_{TH_100^+}$</td>
<td>150</td>
<td>250</td>
<td>350</td>
<td>mV</td>
</tr>
<tr>
<td>Auto 100% Duty Cycle Enter Detection Threshold</td>
<td>$V_{TH_100^-}$</td>
<td>Falling $V_{IN}$. 100% mode is entered with $V_{IN} = V_{OUT} + V_{TH_100^-}$</td>
<td>85</td>
<td>200</td>
<td>290</td>
<td>mV</td>
</tr>
<tr>
<td><strong>Timing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulator Start Up Delay Time</td>
<td>$t_{SS_EN}$</td>
<td>$I_{OUT} = 0mA$, $EN = GND$ to $V_{IN}$, $V_{OUT}$ starts rising</td>
<td>--</td>
<td>0.1</td>
<td>--</td>
<td>ms</td>
</tr>
<tr>
<td>Regulator Soft Start Time</td>
<td>$t_{SS}$</td>
<td>$V_{OUT} = 1.8V$, $I_{OUT} = 10mA$, $EN = V_{IN}$</td>
<td>--</td>
<td>0.7</td>
<td>--</td>
<td>ms</td>
</tr>
<tr>
<td>Logic Input (EN, VSEL1, VSEL2 and VSEL3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input High Threshold</td>
<td>$V_{IH}$</td>
<td>$V_{IN} = 2.2V$ to 5.5V</td>
<td>1.2</td>
<td>--</td>
<td>--</td>
<td>V</td>
</tr>
<tr>
<td>Input Low Threshold</td>
<td>$V_{IL}$</td>
<td>$V_{IN} = 2.2V$ to 5.5V</td>
<td>--</td>
<td>--</td>
<td>0.4</td>
<td>V</td>
</tr>
<tr>
<td>Input Pin Bias Current</td>
<td>$I_{IN}$</td>
<td></td>
<td>--</td>
<td>10</td>
<td>--</td>
<td>nA</td>
</tr>
</tbody>
</table>

**Note 1.** Stresses beyond those listed "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 2.** $\theta_{JA}$ is measured under natural convection (still air) at $T_A = 25^\circ\text{C}$ with the component mounted on a high effective-thermal-conductivity four-layer test board on a JEDEC 51-7 thermal measurement standard.

**Note 3.** Devices are ESD sensitive. Handling precaution is recommended.

**Note 4.** The device is not guaranteed to function outside its operating conditions.
Typical Application Circuit

For the RT5707

```
RT5707

VIN
VIN or GND
VSEL1
VSEL2
VSEL3

EN

CIN

COUT

GND

SW

VOUT

2.2V to 5.5V

Main System

Reference Part Number Description Package Manufacturer

CIN, COUT GRM155R60J475ME47 4.7µF/6.3V/X5R 0402 Murata

L1 1239AS-H-2R2M 2.2µH 2520 Murata
```

Recommended components information for the RT5707 as below table:

<table>
<thead>
<tr>
<th>Reference</th>
<th>Part Number</th>
<th>Description</th>
<th>Package</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIN, COUT</td>
<td>GRM155R60J475ME47</td>
<td>4.7µF/6.3V/X5R</td>
<td>0402</td>
<td>Murata</td>
</tr>
<tr>
<td>L1</td>
<td>1239AS-H-2R2M</td>
<td>2.2µH</td>
<td>2520</td>
<td>Murata</td>
</tr>
</tbody>
</table>

For the RT5707A

```
RT5707A

VIN
VSEL1
VSEL2
VSEL3

EN

CIN

COUT

GND

SW

VOUT

2.2V to 5.5V

Main System

Reference Part Number Description Package Manufacturer

CIN GRM155R60J106ME15 10µF/6.3V/X5R 0402 Murata

COUT GRM155R60J106ME15 10µF/6.3V/X5R 0402 Murata

L1 DFE201610E-2R2M=P2 2.2µH 2016 Murata
```

Recommended components information for the RT5707A as below table:

<table>
<thead>
<tr>
<th>Reference</th>
<th>Part Number</th>
<th>Description</th>
<th>Package</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIN</td>
<td>GRM155R60J475ME47</td>
<td>4.7µF/6.3V/X5R</td>
<td>0402</td>
<td>Murata</td>
</tr>
<tr>
<td>COUT</td>
<td>GRM155R60J106ME15</td>
<td>10µF/6.3V/X5R</td>
<td>0402</td>
<td>Murata</td>
</tr>
<tr>
<td>L1</td>
<td>DFE201610E-2R2M=P2</td>
<td>2.2µH</td>
<td>2016</td>
<td>Murata</td>
</tr>
</tbody>
</table>
Typical Operating Characteristics

Efficiency vs. Load Current

- $V_{IN} = 3.6V$
- $V_{IN} = 4.2V$
- $V_{IN} = 5V$

$V_{OUT} = 3.3V$

Efficiency vs. Load Current

- $V_{IN} = 2.5V$
- $V_{IN} = 3V$
- $V_{IN} = 3.6V$

$V_{OUT} = 0.7V$

Switching Frequency vs. Load Current

- $V_{IN} = 5V$
- $V_{IN} = 4.2V$
- $V_{IN} = 3.8V$

$V_{OUT} = 3.3V$

Output Voltage Ripple

- $V_{IN} = 5.5V$
- $V_{IN} = 5V$
- $V_{IN} = 4.2V$

$V_{OUT} = 3.3V$

Output Voltage Ripple

- $V_{IN} = 2.5V$
- $V_{IN} = 3V$
- $V_{IN} = 3.6V$

$V_{OUT} = 0.7V$

Quiescent Current

- Switching
- Non-switching

$V_{OUT} = 3.3V$

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DS5707/A-03 February 2019
Quiescent Current

![Quiescent Current Graph](image)

Input Voltage (V) vs. Quiescent Current (μA)

- Switching
- Non-switching

$V_{OUT} = 1.8V$

Shutdown Current

![Shutdown Current Graph](image)

Input Voltage (V) vs. Shutdown Current (μA)

PSM Mode Operation

![PSM Mode Operation Graph](image)

Input Voltage (V) vs. Various Waveforms

- $V_{OUT\_AC}$
- $V_{SW}$
- $I_L$

PWM Mode Operation

![PWM Mode Operation Graph](image)

Input Voltage (V) vs. Various Waveforms

- $V_{OUT\_AC}$
- $V_{SW}$
- $I_L$

Power On with Resistor Load

![Power On with Resistor Load Graph](image)

Input Voltage (V) vs. Various Waveforms

- $V_{OUT}$
- $V_{EN}$
- $I_L$

VIN = 5V, VOUT = 3.3V, IOUT = 50mA

VIN = 5V, VOUT = 3.3V, IOUT = 300mA (EN enable)

VIN = 5V, VOUT = 3.3V, IOUT = 100mA (EN enable)

VIN = 3.6V, VOUT = 3.3V, IOUT = 300mA (EN enable)
Load Transient Response

VIN = 5V, VOUT = 3.3V, IOUT 100mA to 290mA, TR = TF = 1μs

Load Transient Response

VIN = 5V, VOUT = 3.3V, IOUT 5mA to 290mA, TR = TF = 1μs

Load Transient Response

VIN = 5V, VOUT = 3.3V, IOUT 5mA to 500mA, TR = TF = 1.6μs

Load Transient Response

VIN = 5V, VOUT = 3.3V, IOUT 50mA to 450mA, TR = TF = 1μs

100% Duty Cycle Entry and Leave Operation

VIN = 5V, VOUT = 3.3V, IOUT 30mA

VIN = 5V, VOUT = 3.3V, IOUT 290mA

VIN = 2.2V to 5.5V (Ramp rise), VOUT = 3.3V, IOUT = 30mA

VIN = 2.2V to 5.5V (Ramp rise), VOUT = 3.3V, IOUT = 290mA
Application Information

The RT5707/A is a synchronous low voltage step-down converter that can support the input voltage range from 2.2V to 5.5V and the output current can be up to 600mA, peak to 1A (RT5707) / 400mA, peak to 0.5A (RT5707A). Internal compensation are integrated to minimize external component count. Protection features include over-current protection, under-voltage protection and over-temperature protection.

Inductor Selection

The recommended power inductor is 2.2μH and inductor saturation current rating choose follow over current protection design consideration. In applications, it needs to select an inductor with the low DCR to provide good performance and efficiency.

C\text{IN} and C\text{OUT} Selection

The input capacitance, C\text{IN}, is needed to filter the trapezoidal current at the source of the top MOSFET. To prevent large ripple voltage, a low ESR input capacitor sized for the maximum RMS current should be used. RMS current is given by:

$$I_{RMS} = I_{OUT(MAX)} \times \frac{V_{OUT}}{V_{IN}} \times \sqrt{\frac{V_{IN}}{V_{OUT}}} - 1$$

This formula has a maximum at $V_{IN} = 2V_{OUT}$, where $I_{RMS} = I_{OUT} / 2$. This simple worst-case condition is commonly used for design because even significant deviations do not offer much relief. To choose a capacitor rated at a higher temperature than required.

Several capacitors may also be paralleled to meet size or height requirements in the design.

The selection of C\text{OUT} is determined by the Effective Series Resistance (ESR) that is required to minimize voltage ripple and load step transients, as well as the amount of bulk capacitance that is necessary to ensure that the control loop is stable. Loop stability can be checked by viewing the load transient response as described in a later section.

The output ripple, $\Delta V_{OUT}$, is determined by:

$$\Delta V_{OUT} \leq \Delta L \left[ ESR + \frac{1}{8 \times f_{SW} \times C_{OUT}} \right]$$

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:

$$P_{D(MAX)} = \frac{(T_{J(MAX)} - T_{A})}{\theta_{JA}}$$

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

For continuous operation, the maximum operating junction temperature indicated under Recommended Operating Conditions is 125°C. The junction-to-ambient thermal resistance, $\theta_{JA}$, is highly package dependent. For a WL-CSP-8B 0.9x1.6 (BSC) package, the thermal resistance, $\theta_{JA}$, is 118.5°C/W on a standard JEDEC 51-7 high effective-thermal-conductivity four-layer test board. The maximum power dissipation at $T_{A} = 25$°C can be calculated as below:

$$P_{D(MAX)} = \frac{(125°C - 25°C)}{(118.5°C/W)} = 0.84W$$

for a WL-CSP-8B 0.9x1.6 (BSC) package.

The maximum power dissipation depends on the operating ambient temperature for the fixed $T_{J(MAX)}$ and the thermal resistance, $\theta_{JA}$. The derating curves in Figure 2 allows the designer to see the effect of rising ambient temperature on the maximum power dissipation.
Layout Considerations

For high frequency switching power supplies, the PCB layout is important to get good regulation, high efficiency and stability. The following descriptions are the guidelines for better PCB layout.

- For good regulation, place the power components as close as possible. The traces should be wide and short enough especially for the high-current loop.
- Shorten the SW node trace length and make it wide.

Figure 2. Derating Curve of Maximum Power Dissipation

<table>
<thead>
<tr>
<th>Protection Type</th>
<th>Threshold Refer to Electrical Spec.</th>
<th>Protection Method</th>
<th>Reset Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT5707</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UGATE Current Limit</td>
<td>$I_{SW} &gt; 1.2A$ (Typ.)</td>
<td>Turn off UG MOS</td>
<td>$I_{SW} &lt; 1.2A$ (Typ.)</td>
</tr>
<tr>
<td>LGATE Current Limit</td>
<td>$I_{SW} &gt; 1.2A$ (Typ.)</td>
<td>Turn on LG MOS</td>
<td>$I_{SW} &lt; 1.2A$ (Typ.)</td>
</tr>
<tr>
<td>RT5707A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UGATE Current Limit</td>
<td>$I_{SW} &gt; 0.78A$ (Typ.)</td>
<td>Turn off UG MOS</td>
<td>$I_{SW} &lt; 0.78A$ (Typ.)</td>
</tr>
<tr>
<td>LGATE Current Limit</td>
<td>$I_{SW} &gt; 0.68A$ (Typ.)</td>
<td>Turn on LG MOS</td>
<td>$I_{SW} &lt; 0.68A$ (Typ.)</td>
</tr>
<tr>
<td>UVLO</td>
<td>$V_{UVLOF} &lt; 1.9V$ (Typ.)</td>
<td>Shutdown</td>
<td>$V_{UVLOR} &gt; 2V$ (Typ.)</td>
</tr>
<tr>
<td>OTP</td>
<td>Temperature &gt; 150°C (Typ.)</td>
<td>Shutdown</td>
<td>Temperature &lt; 130°C (Typ.)</td>
</tr>
</tbody>
</table>
The VSEL1, VSEL2, VSEL3 and EN pin should be connected to MCU or GND. Do not floating these pins.

The inductor should be connected to this pin with the shortest path.

The input capacitor Cin connected to this pin should be grounded with the shortest path.

The output capacitor Cout connected to this pin should be grounded with the shortest path.

Figure 3. RT5707 PCB Layout Guide
The VSEL1, VSEL2, VSEL3 and EN pin should be connected to MCU or GND. Do not floating these pins.

The input capacitor Cin connected to this pin should be grounded with the shortest path.

The inductor should be connected to this pin with the shortest path.

The output capacitor COUT connected to this pin should be grounded with the shortest path.

Figure 4. RT5707A PCB Layout Guide
### Outline Dimension

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Dimensions In Millimeters</th>
<th>Dimensions In Inches</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
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<tr>
<td>A</td>
<td>0.500</td>
<td>0.600</td>
</tr>
<tr>
<td>A1</td>
<td>0.170</td>
<td>0.230</td>
</tr>
<tr>
<td>b</td>
<td>0.240</td>
<td>0.300</td>
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<tr>
<td>D</td>
<td>1.560</td>
<td>1.640</td>
</tr>
<tr>
<td>D1</td>
<td>1.200</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>0.860</td>
<td>0.940</td>
</tr>
<tr>
<td>E1</td>
<td>0.400</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>0.400</td>
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</tr>
</tbody>
</table>

8B WL-CSP 0.9x1.6 Package (BSC)
Footprint Information

<table>
<thead>
<tr>
<th>Package</th>
<th>Number of Pin</th>
<th>Type</th>
<th>Footprint Dimension (mm)</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>WL-CSP0.9x1.6-8(BSC)</td>
<td>8</td>
<td>NSMD</td>
<td>e 0.400</td>
<td>A 0.240</td>
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<tr>
<td></td>
<td></td>
<td>SMD</td>
<td>e 0.270</td>
<td>A 0.240</td>
</tr>
</tbody>
</table>

Richtek Technology Corporation
14F, No. 8, Tai Yuen 1st Street, Chupei City
Hsinchu, Taiwan, R.O.C.
Tel: (8863)5526789

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