3A, 18V, 800kHz Synchronous Step-Down Converter

General Description
The RT7297C is a high efficiency, monolithic synchronous step-down DC/DC converter that can deliver up to 3A output current from a 4.5V to 18V input supply. The RT7297C’s current mode architecture and external compensation allow the transient response to be optimized over a wide input voltage range and loads. Cycle-by-cycle current limit provides protection against shorted outputs, and soft-start eliminates input current surge during start-up. The RT7297C also provides under voltage protection and thermal shutdown protection. The low current (<3µA) shutdown mode provides output disconnection, enabling easy power management in battery-powered systems. The RT7297C is available in an SOP-8 (Exposed Pad) package.

Features
- ±1.5% High Accuracy Reference Voltage
- 4.5V to 18V Input Voltage Range
- 3A Output Current
- Integrated N-MOSFET Switches
- Current Mode Control
- Fixed Frequency Operation : 800kHz
- Output Adjustable from 0.8V to 12V
- Up to 95% Efficiency
- Programmable Soft-Start
- Stable with Low ESR Ceramic Output Capacitors
- Cycle-by-Cycle Current Limit
- Input Under Voltage Lockout
- Output Under Voltage Protection
- Thermal Shutdown Protection
- RoHS Compliant and Halogen Free

Applications
- Wireless AP/Router
- Set-Top-Box
- Industrial and Commercial Low Power Systems
- LCD Monitors and TVs
- Green Electronics/Appliances
- Point of Load Regulation of High-Performance DSPs
### Functional Pin Description

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Pin Name</th>
<th>Pin Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BOOT</td>
<td>Bootstrap for High Side Gate Driver. Connect a 0.1µF or greater ceramic capacitor from BOOT to SW pins.</td>
</tr>
<tr>
<td>2</td>
<td>VIN</td>
<td>Power Input. The input voltage range is from 4.5V to 18V. Must bypass with a suitable large ceramic capacitor.</td>
</tr>
<tr>
<td>3</td>
<td>SW</td>
<td>Switch Node. Connect this pin to an external L-C filter.</td>
</tr>
<tr>
<td>4, 9 (Exposed Pad)</td>
<td>GND</td>
<td>Ground. The exposed pad must be soldered to a large PCB and connected to GND for maximum power dissipation.</td>
</tr>
<tr>
<td>5</td>
<td>FB</td>
<td>Feedback Input. It is used to regulate the output of the converter to a set value via an external resistive voltage divider.</td>
</tr>
<tr>
<td>6</td>
<td>COMP</td>
<td>Compensation Node. COMP is used to compensate the regulation control loop. Connect a series RC network from COMP to GND. In some cases, an additional capacitor from COMP to GND is required.</td>
</tr>
<tr>
<td>7</td>
<td>EN</td>
<td>Enable Input. A logic high enables the converter; a logic low forces the converter into shutdown mode reducing the supply current to less than 3µA. Attach this pin to VIN with a 100kΩ pull up resistor for automatic startup.</td>
</tr>
<tr>
<td>8</td>
<td>SS</td>
<td>Soft-Start Control Input. SS controls the soft-start period. Connect a capacitor from SS to GND to set the soft-start period. A 0.1µF capacitor sets the soft-start period to 13.5ms.</td>
</tr>
</tbody>
</table>
Function Block Diagram

Operation

Shutdown Comparator
Activate internal regulator once EN input level is larger than the target level. Force IC to enter shutdown mode when the EN input level is lower than 0.4V.

Internal Regulator
Provide internal power for logic control and switch gate drivers.

Lockout Comparator
Activate the current comparator, release lock-out logic, and enable the switches as EN input level is larger than lockout voltage. Otherwise, the switches still locks out.

Oscillator
The oscillator provides internal clock and controls the converter's switching frequency.

Foldback Control
Dynamically adjust the internal clock. It provides a slower frequency as a lower FB voltage.

UV Comparator
As FB voltage is lower than the UV voltage, it will activate a UV protect scheme.

Error Amplifier
The output voltage COMP of the error amplifier is adjusted comparing FB signal with the internal reference voltage and SS signal.

Current Sense Amplifier
R_{SENSE} detects the peak current of the high side switch. This signal is amplified by the current sense amplifier and added with a slope compensation signal. Then, It controls the switches by comparing this signal with the COMP voltage.
Absolute Maximum Ratings (Note 1)

- Supply Input Voltage, VIN: −0.3V to 20V
- Switch Voltage, SW: −0.3V to (VIN + 0.3V)
- VBOOT − VSW: −0.3V to 6V
- Other Pins Voltage: −0.3V to 20V
- Power Dissipation, PD @ TA = 25°C: SOP-8 (Exposed Pad) 1.333W
- Package Thermal Resistance (Note 2)
  - SOP-8 (Exposed Pad), θJA: 75°C/W
  - SOP-8 (Exposed Pad), θJC: 15°C/W
- Lead Temperature (Soldering, 10 sec.): 260°C
- Junction Temperature: 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, VIN: 4.5V to 18V
- Junction Temperature Range: −40°C to 125°C
- Ambient Temperature Range: −40°C to 85°C

Electrical Characteristics
(VIN = 12V, TA = 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>Shutdown Supply Current</td>
<td>VEN = 0V</td>
<td>--</td>
<td>0.5</td>
<td>3</td>
<td>--</td>
<td>µA</td>
</tr>
<tr>
<td>Supply Current</td>
<td>VEN = 3V, VFB = 0.9V</td>
<td>--</td>
<td>0.8</td>
<td>1.2</td>
<td>--</td>
<td>mA</td>
</tr>
<tr>
<td>Reference Voltage</td>
<td>VREF</td>
<td>4.5V ≤ VIN ≤ 18V</td>
<td>0.788</td>
<td>0.8</td>
<td>0.812</td>
<td>V</td>
</tr>
<tr>
<td>Error Amplifier Transconductance</td>
<td>GEA</td>
<td>ΔIC = ±10µA</td>
<td>--</td>
<td>940</td>
<td>--</td>
<td>µA/V</td>
</tr>
<tr>
<td>High Side Switch On-Resistance</td>
<td>RDS(ON)1</td>
<td>--</td>
<td>110</td>
<td>--</td>
<td>--</td>
<td>mΩ</td>
</tr>
<tr>
<td>Low Side Switch On-Resistance</td>
<td>RDS(ON)2</td>
<td>--</td>
<td>90</td>
<td>--</td>
<td>--</td>
<td>mΩ</td>
</tr>
<tr>
<td>High Side Switch Leakage Current</td>
<td>VEN = 0V, VSW = 0V</td>
<td>--</td>
<td>0</td>
<td>10</td>
<td>--</td>
<td>µA</td>
</tr>
<tr>
<td>Upper Switch Current Limit</td>
<td>Min. Duty Cycle, VBOOT − VSW = 4.8V</td>
<td>--</td>
<td>5.1</td>
<td>--</td>
<td>--</td>
<td>A</td>
</tr>
<tr>
<td>COMP to Current Sense Transconductance</td>
<td>GCS</td>
<td>--</td>
<td>5.1</td>
<td>--</td>
<td>--</td>
<td>A/V</td>
</tr>
<tr>
<td>Oscillation Frequency</td>
<td>fOSC1</td>
<td>--</td>
<td>800</td>
<td>--</td>
<td>--</td>
<td>kHz</td>
</tr>
<tr>
<td>Short Circuit Oscillation Frequency</td>
<td>fOSC2</td>
<td>VFB = 0V</td>
<td>270</td>
<td>--</td>
<td>--</td>
<td>kHz</td>
</tr>
<tr>
<td>Maximum Duty Cycle</td>
<td>DMAX</td>
<td>VFB = 0.7V</td>
<td>84</td>
<td>--</td>
<td>--</td>
<td>%</td>
</tr>
<tr>
<td>Minimum On-Time</td>
<td>tON</td>
<td>--</td>
<td>100</td>
<td>--</td>
<td>--</td>
<td>ns</td>
</tr>
<tr>
<td>Parameter</td>
<td>Symbol</td>
<td>Test Conditions</td>
<td>Min</td>
<td>Typ</td>
<td>Max</td>
<td>Unit</td>
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<tr>
<td>-----------------------------------------------</td>
<td>--------</td>
<td>------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>------</td>
</tr>
<tr>
<td>Output Enable Threshold (Rising)</td>
<td>V&lt;sub&gt;EN_H&lt;/sub&gt;</td>
<td></td>
<td>2.3</td>
<td>2.52</td>
<td>2.7</td>
<td>V</td>
</tr>
<tr>
<td>Output Enable Hysteresis</td>
<td>V&lt;sub&gt;EN_Hys&lt;/sub&gt;</td>
<td></td>
<td>--</td>
<td>210</td>
<td>--</td>
<td>mV</td>
</tr>
<tr>
<td>Input Under Voltage Lockout Threshold</td>
<td>V&lt;sub&gt;UVLO&lt;/sub&gt;</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt; Rising</td>
<td>3.8</td>
<td>4.2</td>
<td>4.5</td>
<td>V</td>
</tr>
<tr>
<td>Input Under Voltage Lockout Hysteresis</td>
<td>ΔV&lt;sub&gt;UVLO&lt;/sub&gt;</td>
<td></td>
<td>--</td>
<td>320</td>
<td>--</td>
<td>mV</td>
</tr>
<tr>
<td>Soft-Start Current</td>
<td>I&lt;sub&gt;SS&lt;/sub&gt;</td>
<td>V&lt;sub&gt;SS&lt;/sub&gt; = 0V</td>
<td>--</td>
<td>6</td>
<td>--</td>
<td>µA</td>
</tr>
<tr>
<td>Soft-Start Period</td>
<td>t&lt;sub&gt;SS&lt;/sub&gt;</td>
<td>C&lt;sub&gt;SS&lt;/sub&gt; = 0.1µF</td>
<td>--</td>
<td>13.5</td>
<td>--</td>
<td>ms</td>
</tr>
<tr>
<td>Thermal Shutdown</td>
<td>T&lt;sub&gt;SD&lt;/sub&gt;</td>
<td></td>
<td>--</td>
<td>150</td>
<td>--</td>
<td>°C</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.** θ<sub>JA</sub> is measured at T<sub>A</sub> = 25°C on a high effective thermal conductivity four-layer test board per JEDEC 51-7. θ<sub>JC</sub> is measured at the exposed pad of the package.

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

**Note 4.** The device is not guaranteed to function outside its operating conditions.
Table 1. Suggested Component Selection

<table>
<thead>
<tr>
<th>VOUT (V)</th>
<th>R1 (kΩ)</th>
<th>R2 (kΩ)</th>
<th>RC (kΩ)</th>
<th>CC (nF)</th>
<th>L (µH)</th>
<th>COUT (µF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>27</td>
<td>3</td>
<td>35</td>
<td>3.3</td>
<td>10</td>
<td>22 x 2</td>
</tr>
<tr>
<td>5</td>
<td>62</td>
<td>11.8</td>
<td>20</td>
<td>3.3</td>
<td>6.8</td>
<td>22 x 2</td>
</tr>
<tr>
<td>3.3</td>
<td>75</td>
<td>24</td>
<td>15</td>
<td>3.3</td>
<td>3.6</td>
<td>22 x 2</td>
</tr>
<tr>
<td>2.5</td>
<td>25.5</td>
<td>12</td>
<td>10</td>
<td>3.3</td>
<td>3.3</td>
<td>22 x 2</td>
</tr>
<tr>
<td>1.8</td>
<td>15</td>
<td>12</td>
<td>7</td>
<td>3.3</td>
<td>2.2</td>
<td>22 x 2</td>
</tr>
<tr>
<td>1.2</td>
<td>12</td>
<td>24</td>
<td>5</td>
<td>3.3</td>
<td>1.5</td>
<td>22 x 2</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>12</td>
<td>4</td>
<td>3.3</td>
<td>1.5</td>
<td>22 x 2</td>
</tr>
</tbody>
</table>
Typical Operating Characteristics

**Efficiency vs. Output Current**

- Efficiency (%)
  - Output Current (A)
  - \(V_{\text{OUT}} = 3.3\text{V}\)
- \(V_{\text{IN}} = 12\text{V}\)
- \(V_{\text{IN}} = 17\text{V}\)

**Switching Frequency vs. Input Voltage**

- Switching Frequency (kHz)
  - Input Voltage (V)
  - \(V_{\text{OUT}} = 3.3\text{V}\), \(I_{\text{OUT}} = 1\text{A}\)
  - \(V_{\text{IN}} = 12\text{V}\)
  - \(V_{\text{IN}} = 17\text{V}\)
  - \(V_{\text{IN}} = 5\text{V}\)

**Switching Frequency vs. Temperature**

- Switching Frequency (kHz)
  - Temperature (°C)
  - \(V_{\text{OUT}} = 3.3\text{V}\), \(I_{\text{OUT}} = 1\text{A}\)
  - \(V_{\text{IN}} = 12\text{V}\)
  - \(V_{\text{IN}} = 5\text{V}\)

**Output Voltage vs. Input Voltage**

- Output Voltage (V)
  - Input Voltage (V)
  - \(V_{\text{OUT}} = 3.3\text{V}\), \(I_{\text{OUT}} = 0\text{A}\)
  - \(V_{\text{IN}} = 4.5\text{V}\) to 17V

**Output Voltage vs. Output Current**

- Output Voltage (V)
  - Output Current (A)
  - \(V_{\text{OUT}} = 3.3\text{V}\)
  - \(V_{\text{IN}} = 12\text{V}\)
  - \(V_{\text{IN}} = 17\text{V}\)

**Output Voltage vs. Temperature**

- Output Voltage (V)
  - Temperature (°C)
  - \(V_{\text{IN}} = 12\text{V}\), \(V_{\text{OUT}} = 3.3\text{V}\), \(I_{\text{OUT}} = 0\text{A}\)

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Power On from $V_{IN}$

Power Off from $V_{IN}$

Power On from $EN$

Power Off from $EN$
Application Information

Output Voltage Setting
The resistive divider allows the FB pin to sense the output voltage as shown in Figure 1.

\[
V_{\text{OUT}} = V_{\text{REF}} \left( 1 + \frac{R1}{R2} \right)
\]

Where \( V_{\text{REF}} \) is the reference voltage (0.8V typ.).

External Bootstrap Diode
Connect a 0.1\( \mu \)F low ESR ceramic capacitor between the BOOT pin and SW pin. This capacitor provides the gate driver voltage for the high side MOSFET.

It is recommended to add an external bootstrap diode between an external 5V and BOOT pin for efficiency improvement when input voltage is lower than 5.5V or duty ratio is higher than 65%. The bootstrap diode can be a low cost one such as IN4148 or BAT54. The external 5V can be a 5V fixed input from system or a 5V output of the RT7297C. Note that the external boot voltage must be lower than 5.5V.

Soft-Start
The RT7297C provides soft-start function. The soft-start function is used to prevent large inrush current while converter is being powered-up. The soft-start timing can be programmed by the external capacitor between SS and GND. An internal current source \( I_{\text{SS}} \) (6\( \mu \)A) charges an external capacitor to build a soft-start ramp voltage. The \( V_{\text{FB}} \) voltage will track the internal ramp voltage during soft-start interval. The typical soft-start time is calculated as follows:

\[
t_{\text{SS}} = \frac{0.8 \times C_{\text{SS}}}{I_{\text{SS}}}, \text{ if } C_{\text{SS}} \text{ capacitor is } 0.1\mu\text{F}, \text{ then soft-start time } = \frac{0.8 \times 0.1\mu}{6\mu} \approx 13.5\text{ms}
\]

Chip Enable Operation
The EN pin is the chip enable input. Pulling the EN pin low (<0.4V) will shut down the device. During shutdown mode, the RT7297C quiescent current drops to lower than 3\( \mu \)A. Driving the EN pin high (>2.5V, <18V) will turn on the device again. For external timing control, the EN pin can also be externally pulled high by adding a \( R_{\text{EN}} \) resistor and \( C_{\text{EN}} \) capacitor from the VIN pin (see Figure 3).

An external MOSFET can be added to implement digital control on the EN pin when no system voltage above 2.5V is available, as shown in Figure 4. In this case, a 100k\( \Omega \) pull-up resistor, \( R_{\text{EN}} \), is connected between \( V_{\text{IN}} \) and the EN pin. MOSFET Q1 will be under logic control to pull down the EN pin.
Under Voltage Protection

Hiccup Mode
For the RT7297CH, it provides Hiccup Mode Under Voltage Protection (UVP). When the VFB voltage drops below 0.4V, the UVP function will be triggered to shut down switching operation. If the UVP condition remains for a period, the RT7297CH will retry automatically. When the UVP condition is removed, the converter will resume operation. The UVP is disabled during soft-start period.

\[
V_{\text{OUT}} = 1 \times V_{\text{FB}} \times (1 - \frac{V_{\text{OUT}}}{V_{\text{IN}}})
\]

\[
I_{LX} = 1 \times \Delta I_{L}
\]

Figure 5. Hiccup Mode Under Voltage Protection

Latch-Off Mode
For the RT7297CL, it provides Latch-Off Mode Under Voltage Protection (UVP). When the FB voltage drops below half of the feedback reference voltage, VFB, UVP will be triggered and the RT7297CL will shut down in Latch-Off Mode. In shutdown condition, the RT7297CL can be reset by EN pin or power input VIN.

\[
L = \frac{V_{\text{OUT}}}{f \times \Delta I_{L(\text{MAX})}} \times \left[ 1 - \frac{V_{\text{OUT}}}{V_{\text{IN(\text{MAX})}}} \right]
\]

The inductor’s current rating (caused a 40°C temperature rising from 25°C ambient) should be greater than the maximum load current and its saturation current should be greater than the short circuit peak current limit. Please see Table 2 for the inductor selection reference.

Table 2. Suggested Inductors for Typical Application Circuit

<table>
<thead>
<tr>
<th>Component Supplier</th>
<th>Series</th>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDK</td>
<td>VLF10045</td>
<td>10 x 9.7 x 4.5</td>
</tr>
<tr>
<td>TDK</td>
<td>SLF12565</td>
<td>12.5 x 12.5 x 6.5</td>
</tr>
<tr>
<td>TAIYO YUDEN</td>
<td>NR8040</td>
<td>8 x 8 x 4</td>
</tr>
</tbody>
</table>
**C\textsubscript{IN} and C\textsubscript{OUT} Selection**

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

\[ I_{RMS} = I_{OUT(MAX)} \frac{V_{OUT}}{V_{IN}} \left( \frac{V_{IN}}{V_{OUT}} - 1 \right) \]

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. 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. For the input capacitor, two 10\( \mu \)F low ESR ceramic capacitors are suggested. For the suggested capacitor, please refer to Table 3 for more details. The selection of C\textsubscript{OUT} is determined by the required ESR to minimize voltage ripple. Moreover, the amount of bulk capacitance is also a key for C\textsubscript{OUT} selection 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:

\[ \Delta V_{OUT} \leq \Delta L \left( ESR + \frac{1}{\delta C_{OUT}} \right) \]

The output ripple will be the highest at the maximum input voltage since \( \Delta L \) increases with input voltage. Multiple capacitors placed in parallel may be needed to meet the ESR and RMS current handling requirement. Higher values, lower cost ceramic capacitors are now becoming available in smaller case sizes. Their high ripple current, high voltage rating and low ESR make them ideal for switching regulator applications. However, care must be taken when these capacitors are used at input and output. When a ceramic capacitor is used at the input and the power is supplied by a wall adapter through long wires, a load step at the output can induce ringing at the input, \( V_{IN} \). At best, this ringing can couple to the output and be mistaken as loop instability. At worst, a sudden inrush of current through the long wires can potentially cause a voltage spike at \( V_{IN} \) large enough to damage the part.

**Thermal Considerations**

For continuous operation, do not exceed the maximum operation junction temperature 125\(^\circ\)C. The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient. The maximum power dissipation can be calculated by following formula:

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

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

For recommended operating condition specifications, the maximum junction temperature is 125\(^\circ\)C. The junction to ambient thermal resistance \( \theta_{JA} \) is layout dependent. For SOP-8 (Exposed Pad) package, the thermal resistance \( \theta_{JA} \) is 75\(^\circ\)C/W on the standard JEDEC 51-7 four-layers thermal test board. The maximum power dissipation at \( T_{A} = 25^\circ\)C can be calculated by following formula:

\[ P_{D(MAX)} = \frac{(125^\circ\text{C} - 25^\circ\text{C})}{(75^\circ\text{C/W})} = 1.333\text{W} \]

(min.copper area PCB layout)

\[ P_{D(MAX)} = \frac{(125^\circ\text{C} - 25^\circ\text{C})}{(49^\circ\text{C/W})} = 2.04\text{W} \]

(70mm\(^2\) copper area PCB layout)

The thermal resistance \( \theta_{JA} \) of SOP-8 (Exposed Pad) is determined by the package architecture design and the PCB layout design. However, the package architecture design had been designed. If possible, it's useful to increase thermal performance by the PCB layout copper design. The thermal resistance \( \theta_{JA} \) can be decreased by adding copper area under the exposed pad of SOP-8 (Exposed Pad) package.

As shown in Figure 7, the amount of copper area to which the SOP-8 (Exposed Pad) is mounted affects thermal performance. When mounted to the standard SOP-8 (Exposed Pad) pad (Figure 7.a), \( \theta_{JA} \) is 75\(^\circ\)C/W. Adding copper area of pad under the SOP-8 (Exposed Pad) (Figure 7.b) reduces the \( \theta_{JA} \) to 64\(^\circ\)C/W. Even further, increasing the copper area of pad to 70mm\(^2\) (Figure 7.e) reduces the \( \theta_{JA} \) to 49\(^\circ\)C/W.

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The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance, $\theta_{JA}$. The derating curve in Figure 8 of derating curves allows the designer to see the effect of rising ambient temperature on the maximum power dissipation allowed.

**Figure 8. Derating Curve of Maximum Power Dissipation**

- (a) Copper Area = $(2.3 \times 2.3)$ mm$^2$, $\theta_{JA} = 75^\circ$C/W
- (b) Copper Area = $10$ mm$^2$, $\theta_{JA} = 64^\circ$C/W
- (c) Copper Area = $30$ mm$^2$, $\theta_{JA} = 54^\circ$C/W
- (d) Copper Area = $50$ mm$^2$, $\theta_{JA} = 51^\circ$C/W
- (e) Copper Area = $70$ mm$^2$, $\theta_{JA} = 49^\circ$C/W

**Figure 7. Thermal Resistance vs. Copper Area Layout Design**
Layout Consideration
Follow the PCB layout guidelines for optimal performance of the RT7297C.

- Keep the traces of the main current paths as short and wide as possible.
- Put the input capacitor as close as possible to the device pins (VIN and GND).

- SW node is with high frequency voltage swing and should be kept at small area. Keep analog components away from the SW node to prevent stray capacitive noise pick-up.
- Connect feedback network behind the output capacitors. Keep the loop area small. Place the feedback components near the RT7297C.
- An example of PCB layout guide is shown in Figure 9 for reference.

![Figure 9. PCB Layout Guide](image)

<table>
<thead>
<tr>
<th>Location</th>
<th>Component Supplier</th>
<th>Part No.</th>
<th>Capacitance (µF)</th>
<th>Case Size</th>
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<td>1206</td>
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<td>TDK</td>
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</table>
### Outline Dimension

8-Lead SOP (Exposed Pad) Plastic Package

<table>
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<tr>
<th>Symbol</th>
<th>Dimensions In Millimeters</th>
<th>Dimensions In Inches</th>
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<td></td>
<td>Min</td>
<td>Max</td>
</tr>
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<td>5.004</td>
</tr>
<tr>
<td>B</td>
<td>3.810</td>
<td>4.000</td>
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<tr>
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<td>1.753</td>
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<tr>
<td>D</td>
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<tr>
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<td>H</td>
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<tr>
<td>I</td>
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<td>0.152</td>
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<tr>
<td>J</td>
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<td>6.200</td>
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<tr>
<td>M</td>
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</tr>
</tbody>
</table>

Option 1
- X: 2.000 - 2.300
- Y: 2.000 - 2.300

Option 2
- X: 2.100 - 2.500
- Y: 3.000 - 3.500

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