1 Features

- Small VSSOP8 Package (Half the Footprint of Standard 8-Pin SOIC Package)
- 1.09-mm Package Height
- Up to 2-MHz Switching Frequency
- 1.2-V to 14-V Input Voltage
- 1.24-V to 14-V Adjustable Output Voltage
- Up to 1A Load Current
- 0.17-Ω Internal MOSFET
- Up to 90% Regulator Efficiency
- 80-µA Typical Operating Current
- < 2.5-µA Specified Supply Current In Shutdown

2 Applications

- PDAs, Cellular Phones
- 2-Cell and 3-Cell Battery-Operated Equipment
- PCMCIA Cards, Memory Cards
- Flash Memory Programming
- TFT/LCD Applications
- 3.3-V to 5.0-V Conversion
- GPS Devices
- Two-Way Pagers
- Palmtop Computers
- Hand-Held Instruments

3 Description

The LM2621 is a high efficiency, step-up DC-DC switching regulator for battery-powered and low input voltage systems. It accepts an input voltage between 1.2 V and 14 V and converts it into a regulated output voltage. The output voltage can be adjusted between 1.24 V and 14 V. It has an internal 0.17-Ω N-Channel MOSFET power switch. Efficiencies up to 90% are achievable using the LM2621.

The high switching frequency (adjustable up to 2 MHz) of the LM2621 allows for tiny surface mount inductors and capacitors. Because of the unique constant-duty-cycle gated oscillator topology very high efficiencies are realized over a wide load range. The supply current is reduced to 80 µA because of the BiCMOS process technology. In the shutdown mode, the supply current is less than 2.5 µA.

The LM2621 is available in a VSSOP-8 package. This package uses half the board area of a standard 8-pin SOIC and has a height of just 1.09 mm.

Device Information

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>PACKAGE</th>
<th>BODY SIZE (NOM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM2621</td>
<td>VSSOP (8)</td>
<td>3.00 mm x 3.00 mm</td>
</tr>
</tbody>
</table>

(1) For all available packages, see the orderable addendum at the end of the datasheet.
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4 Revision History

Changes from Revision C (November 2012) to Revision D

• Added Pin Configuration and Functions section, Handling Rating table, Feature Description section, Device Functional Modes, Application and Implementation section, Power Supply Recommendations section, Layout section, Device and Documentation Support section, and Mechanical, Packaging, and Orderable Information section .......................................................... 1
5 Pin Configuration and Functions

DGK Package
8-Pin VSSOP
Top View

<table>
<thead>
<tr>
<th>PIN</th>
<th>TYPE(1)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGND</td>
<td>1</td>
<td>GND</td>
</tr>
<tr>
<td>EN</td>
<td>2</td>
<td>I</td>
</tr>
<tr>
<td>FREQ</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>FB</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>SGND</td>
<td>5</td>
<td>GND</td>
</tr>
<tr>
<td>V\textsubscript{DD}</td>
<td>6</td>
<td>PWR</td>
</tr>
<tr>
<td>BOOT</td>
<td>7</td>
<td>PWR</td>
</tr>
<tr>
<td>SW</td>
<td>8</td>
<td>PWR</td>
</tr>
</tbody>
</table>

(1) I = Input, O = Output, PWR = Power, GND = Ground, A = Analog

6 Specifications

6.1 Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Pin</th>
<th>MIN</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW Pin Voltage</td>
<td>-0.5</td>
<td>14.5</td>
<td>V</td>
</tr>
<tr>
<td>BOOT, V\textsubscript{DD}, EN and FB Pins</td>
<td>-0.5</td>
<td>10</td>
<td>V</td>
</tr>
<tr>
<td>FREQ Pin</td>
<td>0</td>
<td>100</td>
<td>µA</td>
</tr>
<tr>
<td>Power Dissipation (T\textsubscript{A}=25°C) (^{(3)})</td>
<td>100</td>
<td>500</td>
<td>mW</td>
</tr>
<tr>
<td>T\textsubscript{Jmax} (^{(3)})</td>
<td>100</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>Lead Temp. (Soldering, 5 sec)</td>
<td>260</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature, T\textsubscript{stg}</td>
<td>-65</td>
<td>150</td>
<td>°C</td>
</tr>
</tbody>
</table>

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.

(3) The maximum power dissipation must be derated at elevated temperatures and is dictated by P\textsubscript{dmax} = (T\textsubscript{Jmax} - T\textsubscript{A})/T\textsubscript{JA} or the number given in the Absolute Maximum Ratings, whichever is lower.
6.2 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>MIN</th>
<th>NOM</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DD}$</td>
<td>2.5</td>
<td>5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>FB</td>
<td>0</td>
<td>$V_{DD}$</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>EN</td>
<td>0</td>
<td>$V_{DD}$</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>BOOT</td>
<td>0</td>
<td>10</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Ambient Temperature, $T_A$</td>
<td>$-40$</td>
<td>85</td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>

6.3 Thermal Information

<table>
<thead>
<tr>
<th>THERMAL METRIC$^{(1)}$</th>
<th>LM2621 DGK (VSSOP)</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{JA}$ (Junction-to-ambient thermal resistance $^{(2)}$)</td>
<td>160</td>
<td>°C/W</td>
</tr>
<tr>
<td>$R_{JC(top)}$ (Junction-to-case (top) thermal resistance)</td>
<td>52.7</td>
<td>°C/W</td>
</tr>
<tr>
<td>$R_{JB}$ (Junction-to-board thermal resistance)</td>
<td>80.1</td>
<td>°C/W</td>
</tr>
<tr>
<td>$\psi_{JT}$ (Junction-to-top characterization parameter)</td>
<td>5.5</td>
<td>°C/W</td>
</tr>
<tr>
<td>$\psi_{JB}$ (Junction-to-board characterization parameter)</td>
<td>78.8</td>
<td>°C/W</td>
</tr>
<tr>
<td>$R_{JC(bot)}$ (Junction-to-case (bottom) thermal resistance)</td>
<td>N/A</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

(1) For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report, SPRA953.

(2) The maximum power dissipation must be derated at elevated temperatures and is dictated by $T_{j,max}$ (maximum junction temperature), $\theta_{JA}$ (junction to ambient thermal resistance), and $T_A$ (ambient temperature). The maximum allowable power dissipation at any temperature is $P_{d,max} = (T_{j,max} - T_A)/\theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower.

6.4 Electrical Characteristics

Unless otherwise specified: $V_{DD} = V_{OUT} = 3.3$ V, $T_J = 25$ °C.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{IN,ST}$ (Minimum Start-Up Supply Voltage$^{(1)}$)</td>
<td>$I_{LOAD} = 0$ mA</td>
<td>1.1</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$I_{LOAD} = 0$ mA, –40°C to 85°C</td>
<td>1.2</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{IN,OP}$ (Minimum Operating Supply Voltage (once started))</td>
<td>$I_{LOAD} = 0$ mA</td>
<td>0.65</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{FB}$ (FB Pin Voltage)</td>
<td>–40°C to 85°C</td>
<td>1.24</td>
<td>V</td>
<td>1.2028</td>
<td>1.2772</td>
</tr>
<tr>
<td>$V_{OUT,MAX}$ (Maximum Output Voltage)</td>
<td>–40°C to 85°C</td>
<td>14</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{HYST}$ (Hysteresis Voltage$^{(2)}$)</td>
<td>–40°C to 85°C</td>
<td>30</td>
<td>mV</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>$\eta$ (Efficiency)</td>
<td>$V_IN = 3.6$ V; $V_{OUT} = 5$ V; $I_{LOAD} = 500$ mA</td>
<td>87%</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 2.5$ V; $V_{OUT} = 3.3$ V; $I_{LOAD} = 200$ mA</td>
<td>87%</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D$ (Switch Duty Cycle)</td>
<td>–40°C to 85°C</td>
<td>70%</td>
<td>60%</td>
<td>80%</td>
<td>μA</td>
</tr>
<tr>
<td>$I_{DD}$ (Operating Quiescent Current$^{(3)}$)</td>
<td>FB Pin &gt; 1.3 V; EN Pin at $V_{DD}$</td>
<td>80</td>
<td>μA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FB Pin &gt; 1.3 V; EN Pin at $V_{DD}$, –40°C to 85°C</td>
<td>110</td>
<td>μA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{SD}$ (Shutdown Quiescent Current$^{(4)}$)</td>
<td>$V_{DD}$, BOOT and SW Pins at 5.0 V; EN Pin &lt; 200 mA</td>
<td>0.01</td>
<td>μA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$V_{DD}$, BOOT and SW Pins at 5.0 V; EN Pin &lt; 200 mA, –40°C to 85°C</td>
<td>2.5</td>
<td>μA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{CL}$ (Switch Peak Current Limit)</td>
<td>–40°C to 85°C</td>
<td>2.85</td>
<td>A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Output in regulation, $V_{OUT} = V_{OUT \text{ (NOMINAL)}} \pm 5\%$

(2) This is the hysteresis value of the internal comparator used for the gated-oscillator control scheme.

(3) This is the current into the $V_{DD}$ pin.

(4) This is the total current into pins $V_{DD}$, BOOT, SW and FREQ.
Electrical Characteristics (continued)

Unless otherwise specified: $V_{DD} = V_{OUT} = 3.3\, \text{V}$, $T_J = 25^\circ\text{C}$.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{DS_ON}$ MOSFET Switch On Resistance</td>
<td></td>
<td>0.17</td>
<td></td>
<td></td>
<td>$\Omega$</td>
</tr>
</tbody>
</table>

**ENABLE SECTION**

- $V_{EN\_LO}$ EN Pin Voltage Low\(^\text{(5)}\) $-40^\circ\text{C}$ to $85^\circ\text{C}$ $0.15V_{DD}$ V
- $V_{EN\_HI}$ EN Pin Voltage High\(^\text{(5)}\) $-40^\circ\text{C}$ to $85^\circ\text{C}$ $0.7V_{DD}$ V

\(^{\text{(5)}}\) When the EN pin is below $V_{EN\_LO}$, the regulator is shut down; when it is above $V_{EN\_HI}$, the regulator is operating.

### 6.5 Typical Characteristics

- Figure 1. Efficiency vs Load Current
- Figure 2. Efficiency vs Load Current
- Figure 3. $V_{FB}$ vs Temperature
- Figure 4. $I_{OP}$ vs Temperature
Typical Characteristics (continued)

Figure 5. $I_{SD}$ vs Temperature

![Graph showing $I_{SD}$ vs Temperature.]

Figure 6. $I_{SD}$ vs $V_{DD}$

![Graph showing $I_{SD}$ vs $V_{DD}$.]

Figure 7. $I_{OP}$ vs $V_{DD}$

![Graph showing $I_{OP}$ vs $V_{DD}$.]

Figure 8. $V_{IN\_ST}$ vs Load Current

![Graph showing $V_{IN\_ST}$ vs Load Current.]

Figure 9. Switching Frequency vs $R_{FQ}$

![Graph showing Switching Frequency vs $R_{FQ}$.]

Figure 10. Peak Inductor Current vs Load Current

![Graph showing Peak Inductor Current vs Load Current.]

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Typical Characteristics (continued)

Figure 11. Maximum Load Current vs Input Voltage

V_{OUT} = 12V
V_{OUT} = 5.0V
V_{OUT} = 3.3V
7 Detailed Description

7.1 Overview

The LM2621 is designed to provide step-up DC-DC voltage regulation in battery-powered and low-input voltage systems. It combines a step-up switching regulator, N-channel power MOSFET, built-in current limit, thermal limit, and voltage reference in a single 8-pin VSSOP package. The switching DC-DC regulator boosts an input voltage between 1.2 V and 14 V to a regulated output voltage between 1.24 V and 14 V. The LM2621 starts from a low 1.1-V input and remains operational down to 0.65 V.

This device is optimized for use in cellular phones and other applications requiring a small size, low profile, as well as low quiescent current for maximum battery life during stand-by and shutdown. A high-efficiency gated-oscillator topology offers an output of up to 1 A.

Additional features include a built-in peak switch current limit, and thermal protection circuitry.

7.2 Functional Block Diagram

![Functional Block Diagram](image)

7.3 Feature Description

7.3.1 Gated Oscillator Control Scheme

A unique gated oscillator control scheme enables the LM2621 to have an ultra-low quiescent current and provides a high efficiency over a wide load range. The switching frequency of the internal oscillator is programmable using an external resistor and can be set between 300 kHz and 2 MHz.

This control scheme uses a hysteresis window to regulate the output voltage. When the output voltage is below the upper threshold of the window, the LM2621 switches continuously with a fixed duty cycle of 70% at the switching frequency selected by the user. During the first part of each switching cycle, the internal N-channel MOSFET switch is turned on. This causes the current to ramp up in the inductor and store energy. During the second part of each switching cycle, the MOSFET is turned off. The voltage across the inductor reverses and forces current through the diode to the output filter capacitor and the load. Thus when the LM2621 switches continuously, the output voltage starts to ramp up. When the output voltage hits the upper threshold of the hysteresis window, the LM2621 stops switching completely. This causes the output voltage to droop because the energy stored in the output capacitor is depleted by the load. When the output voltage hits the lower threshold of the hysteresis window, the LM2621 starts switching continuously again causing the output voltage to ramp up towards the upper threshold. Figure 12 shows the switch voltage and output voltage waveforms.

Because of this type of control scheme, the quiescent current is inherently very low. At light loads the gated oscillator control scheme offers a much higher efficiency compared to the conventional PWM control scheme.
Feature Description (continued)

7.3.2 Low Voltage Start-Up

The LM2621 can start-up from input voltages as low as 1.1 V. On start-up, the control circuitry switches the N-channel MOSFET continuously at 70% duty cycle until the output voltage reaches 2.5 V. After this output voltage is reached, the normal step-up regulator feedback and gated oscillator control scheme take over. Once the device is in regulation it can operate down to a 0.65-V input, since the internal power for the IC can be bootstrapped from the output using the \( V_{\text{DD}} \) pin.

7.3.3 Output Voltage Ripple Frequency

A major component of the output voltage ripple is due to the hysteresis used in the gated oscillator control scheme. The frequency of this voltage ripple is proportional to the load current. The frequency of this ripple does not necessitate the use of larger inductors and capacitors however, since the size of these components is determined by the switching frequency of the oscillator which can be set up to 2 MHz using an external resistor.

7.3.4 Internal Current Limit and Thermal Protection

An internal cycle-by-cycle current limit serves as a protection feature. This is set high enough (2.85 A typical, approximately 4 A maximum) so as not to come into effect during normal operating conditions. An internal thermal protection circuitry disables the MOSFET power switch when the junction temperature \( T_J \) exceeds about 160°C. The switch is re-enabled when \( T_J \) drops below approximately 135°C.

7.4 Device Functional Modes

7.4.1 Shutdown

The LM2621 features a shutdown mode that reduces the quiescent current to less than a specified 2.5-µA overtemperature. This extends the life of the battery in battery powered applications. During shutdown, all feedback and control circuitry is turned off. The regulator's output voltage drops to one diode drop below the input voltage. Entry into the shutdown mode is controlled by the active-low logic input pin EN (Pin 2). When the logic input to this pin pulled below 0.15 \( V_{\text{DD}} \), the device goes into shutdown mode. The logic input to this pin should be above 0.7 \( V_{\text{DD}} \) for the device to work in normal step-up mode.
8 Application and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI’s customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

8.1 Application Information

The LM2621 is primarily used as a Boost type step-up converter. The following section provides information regarding connection and component choices to build a successful boost converter. Examples of typical applications are also provided including a SEPIC step-up/step-down topology. More details on designing a SEPIC converter can be found here: SLYT309.

8.2 Typical Applications

8.2.1 Step-Up DC-DC Converter Typical Application Using LM2621

8.2.1.1 Design Requirements

In order to successfully build an application, the designer should have the following parameters:

• Output voltage to set the feedback voltage divider and to assess the source for biasing the V\textsubscript{DD} pin.
• Input voltage range (min and max) to ensure safe operation within absolute max. rating of the IC.
• Output current to ensure that the system will not hit the internal peak current limit of the IC (2.85 A typical) during normal operation.

8.2.1.2 Detailed Design Procedure

8.2.1.2.1 Setting the Output Voltage

The output voltage of the step-up regulator can be set between 1.24 V and 14 V by connecting a feedback resistive divider made of R\textsubscript{F1} and R\textsubscript{F2}. The resistor values are selected as follows:

\[
R_{F_2} = R_{F_1} \times \left(\frac{V_{OUT}}{1.24} - 1\right)
\]

A value of 150 kΩ is suggested for R\textsubscript{F1}. Then, R\textsubscript{F2} can be selected using the above equation. A 39-pF capacitor (C\textsubscript{F1}) connected across R\textsubscript{F1} helps in feeding back most of the AC ripple at V\textsubscript{OUT} to the FB pin. This helps reduce the peak-to-peak output voltage ripple as well as improve the efficiency of the step-up regulator, because a set hysteresis of 30 mV at the FB pin is used for the gated oscillator control scheme.
Typical Applications (continued)

8.2.1.2.2 Bootstrapping

When the output voltage (\(V_{OUT}\)) is between 2.5 V and 5.0 V a bootstrapped operation is suggested. This is achieved by connecting the \(V_{DD}\) pin (Pin 6) to \(V_{OUT}\). However if the \(V_{OUT}\) is outside this range, the \(V_{DD}\) pin should be connected to a voltage source whose range is between 2.5 V and 5 V. This can be the input voltage (\(V_{IN}\)), \(V_{OUT}\) stepped down using a linear regulator, or a different voltage source available in the system. This is referred to as non-bootstrapped operation. The maximum acceptable voltage at the BOOT pin (Pin 7) is 10 V.

8.2.1.2.3 Setting the Switching Frequency

The switching frequency of the oscillator is selected by choosing an external resistor (\(R_{FQ}\)) connected between FREQ and \(V_{DD}\) pins. See Figure 9 for choosing the \(R_{FQ}\) value to achieve the desired switching frequency. A high switching frequency allows the use of very small surface mount inductors and capacitors and results in a very small solution size. A switching frequency between 300 kHz and 2 MHz is recommended.

8.2.1.2.4 Inductor Selection

The LM2621’s high switching frequency enables the use of a small surface mount inductor. A 6.8-\(\mu\)H shielded inductor is suggested. The inductor should have a saturation current rating higher than the peak current it will experience during circuit operation (see Figure 10). Less than 100-m\(\Omega\) ESR is suggested for high efficiency.

Open-core inductors cause flux linkage with circuit components and interfere with the normal operation of the circuit. They should be avoided. For high efficiency, choose an inductor with a high frequency core material, such as ferrite, to reduce the core losses. To minimize radiated noise, use a toroid, pot core or shielded core inductor. The inductor should be connected to the SW pin as close to the IC as possible. See Table 1 for a list of the inductor manufacturers.

8.2.1.2.5 Output Diode Selection

A Schottky diode should be used for the output diode. The forward current rating of the diode should be higher than the load current, and the reverse voltage rating must be higher than the output voltage. Do not use ordinary rectifier diodes, since slow switching speeds and long recovery times cause the efficiency and the load regulation to suffer. Table 1 shows a list of the diode manufacturers.

8.2.1.2.6 Input and Output Filter Capacitors Selection

Tantalum chip capacitors are recommended for the input and output filter capacitors. A 22-\(\mu\)F capacitor is suggested for the input filter capacitor. It should have a DC working voltage rating higher than the maximum input voltage. A 68-\(\mu\)F tantalum capacitor is suggested for the output capacitor. The DC working voltage rating should be greater than the output voltage. Very high ESR values (> 3\(\Omega\)) should be avoided.

8.2.1.3 Application Curves

![Figure 14. Startup \(V_{IN}=1.2V, V_{OUT}=5V\), 10ms/div 1V/div (Ch3:Vin,Ch1:Vout)](image)

![Figure 15. Startup \(V_{IN}=3.3V, V_{OUT}=5V\), 10ms/div 1V/div (Ch3:Vin,Ch1:Vout)](image)
Typical Applications (continued)

8.2.2 5-V / 0.5-A Step-Up Regulator

Figure 16. 5-V/0.5A Step-Up Regulator

8.2.2.1 Design Requirements

Design requirement is the same to the typical application shown earlier. Components have been chosen that comply with the required maximum height. See Design Requirements for the design requirement and following sections for the detailed design procedure.

8.2.2.2 Detailed Design Procedure

Follow the detailed design procedure in Detailed Design Procedure.
Typical Applications (continued)

Table 1. Bill of Materials

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>TI, LM2621MM</td>
</tr>
<tr>
<td>C1</td>
<td>Vishay/Sprague, 595D226X06R3B2T, Tantalum</td>
</tr>
<tr>
<td>C2</td>
<td>Vishay/Sprague, 595D686X0010C2T, Tantalum</td>
</tr>
<tr>
<td>D1</td>
<td>Motorola, MBRS140T3</td>
</tr>
<tr>
<td>L</td>
<td>Coilcraft, DT1608C-682</td>
</tr>
</tbody>
</table>

8.2.3 2-mm Tall 5-V / 0.2-A Step-Up Regulator for Low Profile Applications

Figure 17. 2-mm Tall 5-V/0.2A Step-Up Regulator for Low Profile Applications

8.2.3.1 Design Requirements

Design requirement is the same to the typical application shown earlier. Components have been chosen that comply with the required maximum height. See Design Requirements for the design requirement and following sections for the detailed design procedure.

8.2.3.2 Detailed Design Procedure

Follow the detailed design procedure in Detailed Design Procedure.

Table 2. Bill of Materials

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>TI, LM2621MM</td>
</tr>
<tr>
<td>C1</td>
<td>Vishay/Sprague, 592D156X06R3B2T, Tantalum</td>
</tr>
<tr>
<td>C2</td>
<td>Vishay/Sprague, 592D336X06R3C2T, Tantalum</td>
</tr>
<tr>
<td>D1</td>
<td>Motorola, MBRS140T3</td>
</tr>
<tr>
<td>L</td>
<td>Vishay/Dale, ILS-3825-03</td>
</tr>
</tbody>
</table>
8.2.4 3.3-V / 0.5-A SEPIC Regulator

8.2.4.1 Design Requirements

Design requirement for the SEPIC is similar to that of a boost but the current flowing through the switch is the addition of the current flowing through L1 and L2. As a result, the peak current through the main switch is $I_{IN} + I_{OUT} + 0.5 \Delta I_{L1} + 0.5 \Delta I_{L2}$. See SLYT309 for detail on the specific design requirement of a SEPIC converter.

8.2.4.2 Detailed Design Procedure

Follow the detailed design procedure in Detailed Design Procedure.

Table 3. Bill of Materials

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>TI</td>
<td>LM2621MM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low Input Voltage Regulator</td>
</tr>
<tr>
<td>C1</td>
<td>Sanyo</td>
<td>10CV220AX, SMT AL-Electrolytic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>220 µF</td>
</tr>
<tr>
<td>C2</td>
<td>TDK</td>
<td>C2012X7R1C225M, MLCC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.2 µF</td>
</tr>
<tr>
<td>C3</td>
<td>Vishay</td>
<td>VJ0603A331KXXAT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>33 pF</td>
</tr>
<tr>
<td>C4</td>
<td>TDK</td>
<td>C3225X7R0J107MT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 µF</td>
</tr>
<tr>
<td>C5, C6</td>
<td>Vishay</td>
<td>VJ0603Y104KXXAT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1 µF</td>
</tr>
<tr>
<td>D1</td>
<td>Philips</td>
<td>BAT54C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VR = 1V</td>
</tr>
<tr>
<td>D2</td>
<td>Vishay</td>
<td>MBRS120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1A / VR = 20V</td>
</tr>
<tr>
<td>L1, L2</td>
<td>Coilcraft</td>
<td>DO1813P-682HC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.8 µH</td>
</tr>
<tr>
<td>R1</td>
<td>Vishay</td>
<td>CRCW08054990FRT6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>499 Ω</td>
</tr>
<tr>
<td>R2</td>
<td>Vishay</td>
<td>CRCW08051503FRT6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150 kΩ</td>
</tr>
<tr>
<td>R3</td>
<td>Vishay</td>
<td>CRCW08053923FRT6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>392 kΩ</td>
</tr>
<tr>
<td>R4</td>
<td>Vishay</td>
<td>CRCW08059092FRT6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>90.9 kΩ</td>
</tr>
</tbody>
</table>
9 Power Supply Recommendations

The power line feeding the LM2621 should have low impedance. The input capacitor of the system should be placed as close to VIN as possible. If the power supply is very noisy, an additional bulk capacitor might be necessary in the system to ensure that clean power is delivered to the IC.

10 Layout

10.1 Layout Guidelines

High switching frequencies and high peak currents make a proper layout of the PC board an important part of design. Poor design can cause excessive EMI and ground-bounce, both of which can cause malfunction and loss of regulation by corrupting voltage feedback signal and injecting noise into the control section.

Power components - such as the inductor, input and output filter capacitors, and output diode - should be placed as close to the regulator IC as possible, and their traces should be kept short, direct and wide. The ground pins of the input and output filter capacitors and the PGND and SGND pins of LM2621 should be connected using short, direct and wide traces. The voltage feedback network \( (R_{F1}, R_{F2}, \text{ and } C_{F1}) \) should be kept very close to the FB pin. Noisy traces, such as from the SW pin, should be kept away from the FB and \( V_{DD} \) pins. The traces that run between \( V_{out} \) and the FB pin of the IC should be kept away from the inductor flux. Always provide sufficient copper area to dissipate the heat due to power loss in the circuitry and prevent the thermal protection circuitry in the IC from shutting the IC down.

10.2 Layout Example

![Figure 19. LM2621 PCB Layout](image-url)
11 Device and Documentation Support

11.1 Device Support

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11.2 Documentation Support

11.2.1 Related Documentation
For related documentation, see the following:
• Designing DC/DC converters based on SEPIC topology, SLYT309

11.3 Community Resources
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among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help
solve problems with fellow engineers.

Design Support  Ti's Design Support Quickly find helpful E2E forums along with design support tools and
contact information for technical support.

11.4 Trademarks
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11.5 Electrostatic Discharge Caution
These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam
during storage or handling to prevent electrostatic damage to the MOS gates.

11.6 Glossary
SLYZ022 — Ti Glossary.
This glossary lists and explains terms, acronyms, and definitions.

12 Mechanical, Packaging, and Orderable Information
The following pages include mechanical, packaging, and orderable information. This information is the most
current data available for the designated devices. This data is subject to change without notice and revision of
this document. For browser-based versions of this data sheet, refer to the left-hand navigation.
## TAPE AND REEL INFORMATION

### REEL DIMENSIONS

![Reel Dimensions Diagram]

### TAPE DIMENSIONS

- **A0**: Dimension designed to accommodate the component width
- **B0**: Dimension designed to accommodate the component length
- **K0**: Dimension designed to accommodate the component thickness
- **W**: Overall width of the carrier tape
- **P1**: Pitch between successive cavity centers

### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

*User Direction of Feed*

*Pocket Quadrants*

*Sprocket Holes*

*All dimensions are nominal*

<table>
<thead>
<tr>
<th>Device</th>
<th>Package Type</th>
<th>Package Drawing</th>
<th>Pins</th>
<th>SPQ</th>
<th>Reel Diameter (mm)</th>
<th>Reel Width W1 (mm)</th>
<th>A0 (mm)</th>
<th>B0 (mm)</th>
<th>K0 (mm)</th>
<th>P1 (mm)</th>
<th>W (mm)</th>
<th>Pin1 Quadrant</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM2621MM/NOPB</td>
<td>VSSOP</td>
<td>DGK</td>
<td>8</td>
<td>1000</td>
<td>178.0</td>
<td>12.4</td>
<td>5.3</td>
<td>3.4</td>
<td>1.4</td>
<td>8.0</td>
<td>12.0</td>
<td>Q1</td>
</tr>
<tr>
<td>LM2621MMX/NOPB</td>
<td>VSSOP</td>
<td>DGK</td>
<td>8</td>
<td>3500</td>
<td>330.0</td>
<td>12.4</td>
<td>5.3</td>
<td>3.4</td>
<td>1.4</td>
<td>8.0</td>
<td>12.0</td>
<td>Q1</td>
</tr>
</tbody>
</table>
### TAPE AND REEL BOX DIMENSIONS

*All dimensions are nominal*

<table>
<thead>
<tr>
<th>Device</th>
<th>Package Type</th>
<th>Package Drawing</th>
<th>Pins</th>
<th>SPQ</th>
<th>Length (mm)</th>
<th>Width (mm)</th>
<th>Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM2621MM/NOPB</td>
<td>VSSOP</td>
<td>DGK</td>
<td>8</td>
<td>1000</td>
<td>210.0</td>
<td>185.0</td>
<td>35.0</td>
</tr>
<tr>
<td>LM2621MMX/NOPB</td>
<td>VSSOP</td>
<td>DGK</td>
<td>8</td>
<td>3500</td>
<td>367.0</td>
<td>367.0</td>
<td>35.0</td>
</tr>
</tbody>
</table>
DGK (S-PDSO-G8) PLASTIC SMALL-OUTLINE PACKAGE

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per end.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
E. Falls within JEDEC MO-187 variation AA, except interlead flash.
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.
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