

## LM2705 Micropower昇圧型DC/DCコンバータ、ピーク電流制限150mA

### 1 特長

- 入力電圧範囲: 2.2V~7V
- 150mA、0.7Ωの内部スイッチ
- 最大20Vの可変出力電圧
- 入力低電圧誤動作防止
- シャットダウン時電流: 0.01μA
- 小型の表面実装部品を使用
- 小型の5ピンSOT-23パッケージ

### 2 アプリケーション

- LCDバイアス電源
- 白色LEDのバックライト
- ハンドヘルド機器
- デジタル・カメラ
- 携帯用アプリケーション

### 3 概要

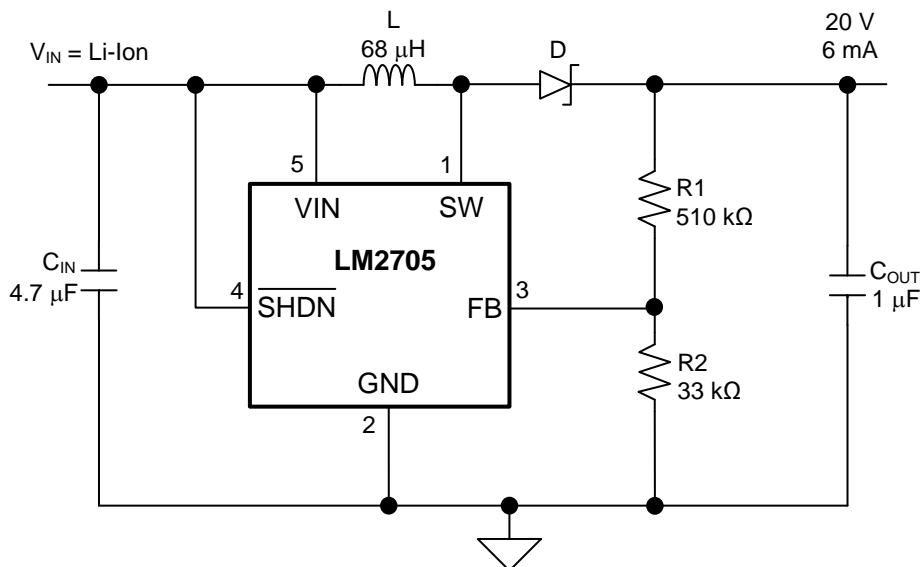
LM2705はMicropower昇圧型DC/DCコンバータで、小型の5ピンSOT-23パッケージで供給されます。電流制限付き、固定オフ時間の制御方式により、動作電流が削減され、広い範囲の負荷条件にわたって高い効率が維持されます。21Vのスイッチにより、最高20Vの電圧を出力できます。オフ時間がわずか400nsであるため、小型で低プロファイルのインダクタやコンデンサを使用でき、容積の限られている携帯用アプリケーションにおいて占有面積とコストを最小化できます。LM2705は、低電流と高効率が要求されるLCDパネルや、携帯電話のバックライトに使用される白色LEDアプリケーションに理想的です。LM2705デバイスは、単一のリチウムイオン・バッテリーにより、最大3つの白色LEDを駆動できます。LM2705はピーク・インダクタ電流が低いいため、USBアプリケーションに理想的です。

#### 製品情報<sup>(1)</sup>

型番	パッケージ	本体サイズ(公称)
LM2705	SOT-23 (5)	2.90mmx1.60mm

(1) 提供されているすべてのパッケージについては、データシートの末尾にある注文情報を参照してください。

#### 代表的な20Vのアプリケーション



Copyright © 2016, Texas Instruments Incorporated



## 目次

<b>1</b>	<b>特長</b> .....	<b>1</b>	<b>8</b>	<b>Application and Implementation</b> .....	<b>9</b>
<b>2</b>	<b>アプリケーション</b> .....	<b>1</b>	8.1	Application Information.....	9
<b>3</b>	<b>概要</b> .....	<b>1</b>	8.2	Typical Application.....	9
<b>4</b>	<b>改訂履歴</b> .....	<b>2</b>	8.3	Additional Applications.....	12
<b>5</b>	<b>Pin Configuration and Functions</b> .....	<b>3</b>	<b>9</b>	<b>Power Supply Recommendations</b> .....	<b>15</b>
<b>6</b>	<b>Specifications</b> .....	<b>4</b>	<b>10</b>	<b>Layout</b> .....	<b>15</b>
6.1	Absolute Maximum Ratings.....	4	10.1	Layout Guidelines.....	15
6.2	ESD Ratings.....	4	10.2	Layout Example.....	15
6.3	Recommended Operating Conditions.....	4	<b>11</b>	<b>デバイスおよびドキュメントのサポート</b> .....	<b>16</b>
6.4	Thermal Information.....	4	11.1	デバイス・サポート.....	16
6.5	Electrical Characteristics.....	5	11.2	ドキュメントの更新通知を受け取る方法.....	16
6.6	Typical Characteristics.....	6	11.3	コミュニティ・リソース.....	16
<b>7</b>	<b>Detailed Description</b> .....	<b>8</b>	11.4	商標.....	16
7.1	Overview.....	8	11.5	静電気放電に関する注意事項.....	16
7.2	Functional Block Diagram.....	8	11.6	Glossary.....	16
7.3	Feature Description.....	8	<b>12</b>	<b>メカニカル、パッケージ、および注文情報</b> .....	<b>16</b>
7.4	Device Functional Modes.....	8			

## 4 改訂履歴

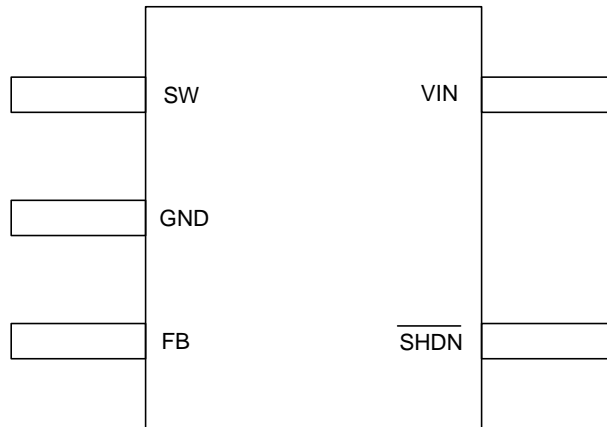
資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

<b>Revision E (May 2013) から Revision F に変更</b>	<b>Page</b>
• 「製品情報」セクション、「ピン構成および機能」セクション、「ESD定格」表、「熱に関する情報」セクション、「機能説明」セクション、「デバイスの機能モード」セクション、「アプリケーションと実装」セクション、「電源に関する推奨事項」セクション、「レイアウト」セクション、「デバイスおよびドキュメントのサポート」セクション、「メカニカル、パッケージ、および注文情報」のセクション 追加.....	1
• Deleted pin definition list - added content to <i>Pin Functions</i> .....	3
• Changed R <sub>θJA</sub> value from "220°C/W" to "164.9°C/W" .....	4

<b>Revision D (May 2013) から Revision E に変更</b>	<b>Page</b>
• Changed layout of National Semiconductor data sheet to TI format.....	14

## 5 Pin Configuration and Functions

**DBV Package  
5-Pin SOT-23  
Top View**



**Pin Functions**

PIN		TYPE	DESCRIPTION
NO.	NAME		
1	SW	Input	Power switch input. This is the drain of the internal NMOS power switch. Minimize the metal trace area connected to this pin to minimize EMI.
2	GND	—	Ground - tie directly to ground plane.
3	FB	Input	Output voltage feedback input — set the output voltage by selecting values for R1 and R2 using: $R1 = R2 \times (V_{OUT} / 1.237 \text{ V}) - 1$
4	$\overline{\text{SHDN}}$	Input	Active low shutdown - drive this pin to > 1.1 V to enable the device. Drive this pin to < 0.3 V to lase the device in a low-power shutdown.
5	VIN	Input	Analog and power input supply pin

## 6 Specifications

### 6.1 Absolute Maximum Ratings

 over operating free-air temperature range (unless otherwise noted)<sup>(1)(2)</sup>

		MIN	MAX	UNIT
VIN			7.5	V
SW voltage			21	V
FB voltage			2	V
SHDN voltage			7.5	V
Maximum junction temperature, T <sub>J</sub> <sup>(3)</sup>			150	°C
Lead temperature	Soldering (10 seconds)		300	°C
	Vapor phase (60 seconds)		215	°C
	Infrared (15 seconds)		220	°C
Storage temperature, T <sub>stg</sub>		-65	150	°C

- (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, contact the TI Sales Office/Distributors for availability and specifications.
- (3) The maximum allowable power dissipation is a function of the maximum junction temperature, T<sub>J(MAX)</sub>, the junction-to-ambient thermal resistance, R<sub>θJA</sub>, and the ambient temperature, T<sub>A</sub>. See *Thermal Information* for the thermal resistance. The maximum allowable power dissipation at any ambient temperature is calculated using: P<sub>D(MAX)</sub> = (T<sub>J(MAX)</sub> - T<sub>A</sub>) / R<sub>θJA</sub>. Exceeding the maximum allowable power dissipation will cause excessive die temperature.

### 6.2 ESD Ratings

		VALUE	UNIT
V <sub>(ESD)</sub> Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	±2000	V
	Machine model <sup>(2)</sup>	±200	

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) ESD susceptibility using the machine model is 150 V for SW pin.

### 6.3 Recommended Operating Conditions

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

	MIN	NOM	MAX	UNIT
Supply voltage	2.2		7	V
SW voltage, maximum			20.5	V
Junction temperature <sup>(1)</sup>	-40		125	°C

- (1) All limits specified at room temperature and at *temperature extremes*. All room temperature limits are 100% production tested or specified through statistical analysis. All limits at temperature extremes are specified via correlation using standard statistical quality control (SQC) methods. All limits are used to calculate average outgoing quality level (AOQL).

### 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		LM2705	UNIT
		DBV (SOT-23)	
		5 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	164.9	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	116.8	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	27.8	°C/W
ψ <sub>JT</sub>	Junction-to-top characterization parameter	13.6	°C/W
ψ <sub>JB</sub>	Junction-to-board characterization parameter	27.3	°C/W

- (1) For more information about traditional and new thermal metrics, see *Semiconductor and IC Package Thermal Metrics*.

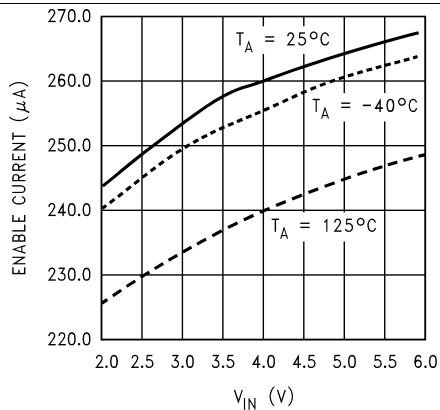
## 6.5 Electrical Characteristics

Unless otherwise specified, specifications apply for  $T_J = 25^\circ\text{C}$  and  $V_{IN} = 2.2\text{ V}$ .

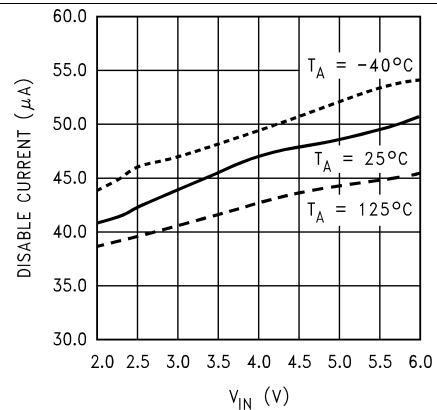
PARAMETER		TEST CONDITIONS	MIN <sup>(1)</sup>	TYP <sup>(2)</sup>	MAX <sup>(1)</sup>	UNIT
$I_Q$	Device disabled	FB = 1.3 V		40		$\mu\text{A}$
		FB = 1.3 V, $-40^\circ\text{C}$ to $125^\circ\text{C}$			70	
	Device enabled	FB = 1.2 V		235		
		FB = 1.2 V, $-40^\circ\text{C}$ to $125^\circ\text{C}$			300	
Shutdown	$\overline{\text{SHDN}} = 0\text{ V}$		0.01	2.5		
$V_{FB}$	Feedback trip point			1.237		V
		$-40^\circ\text{C}$ to $125^\circ\text{C}$	1.189		1.269	
$I_{CL}$	Switch current limit			150		mA
		$-40^\circ\text{C}$ to $125^\circ\text{C}$	100		180	
$I_B$	FB pin bias current	FB = 1.23 V <sup>(3)</sup>		30		nA
		FB = 1.23 V, $-40^\circ\text{C}$ to $125^\circ\text{C}$ <sup>(3)</sup>			120	
$V_{IN}$	Input voltage	$-40^\circ\text{C}$ to $125^\circ\text{C}$	2.2		7	V
$R_{DSON}$	Switch $R_{DSON}$			0.7		$\Omega$
		$-40^\circ\text{C}$ to $125^\circ\text{C}$			1.6	
$T_{OFF}$	Switch off time			400		ns
$I_{SD}$	$\overline{\text{SHDN}}$ pin current	$\overline{\text{SHDN}} = V_{IN}$ , $T_J = 25^\circ\text{C}$		0	80	nA
		$\overline{\text{SHDN}} = V_{IN}$ , $T_J = 125^\circ\text{C}$		15		
		$\overline{\text{SHDN}} = \text{GND}$		0		
$I_L$	Switch leakage current	$V_{SW} = 20\text{ V}$		0.05	5	$\mu\text{A}$
UVP	Input undervoltage lockout	ON/OFF threshold		1.8		V
$V_{FB}$ hysteresis	Feedback hysteresis			8		mV
$\overline{\text{SHDN}}$ threshold	$\overline{\text{SHDN}}$ low			0.7		V
		$-40^\circ\text{C}$ to $125^\circ\text{C}$			0.3	
	$\overline{\text{SHDN}}$ high			0.7		
		$-40^\circ\text{C}$ to $125^\circ\text{C}$	1.1			

- (1) All limits specified at room temperature and at *temperature extremes*. All room temperature limits are 100% production tested or specified through statistical analysis. All limits at temperature extremes are specified via correlation using standard statistical quality control (SQC) methods. All limits are used to calculate average outgoing quality level (AOQL).
- (2) Typical numbers are at  $25^\circ\text{C}$  and represent the most likely norm.
- (3) Feedback current flows into the pin.

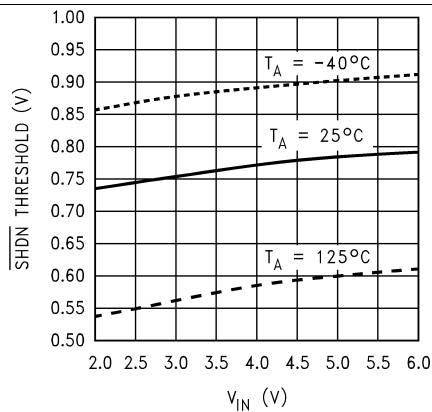
**6.6 Typical Characteristics**



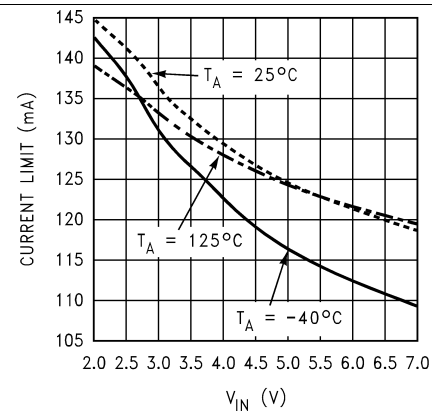
**Figure 1. Enable Current vs  $V_{IN}$  (Device Switching)**



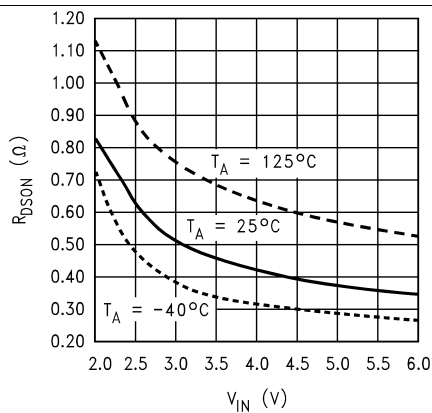
**Figure 2. Disable Current vs  $V_{IN}$  (Device Not Switching)**



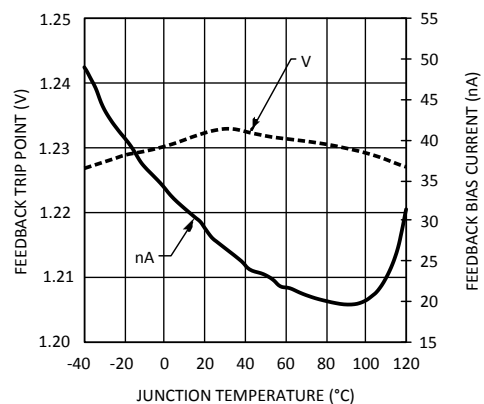
**Figure 3.  $\overline{\text{SHDN}}$  Threshold vs  $V_{IN}$**



**Figure 4. Switch Current Limit vs  $V_{IN}$**



**Figure 5. Switch  $R_{DS(on)}$  vs  $V_{IN}$**



**Figure 6. FB Trip Point and FB Pin Current vs Temperature**

Typical Characteristics (continued)

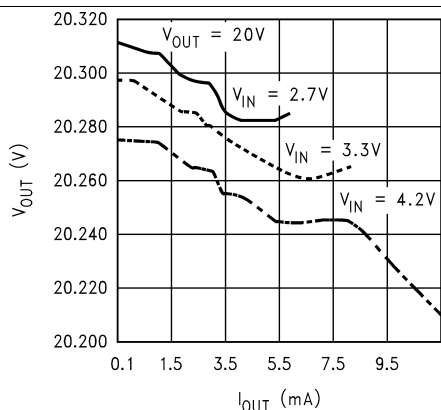


Figure 7. Output Voltage vs Load Current

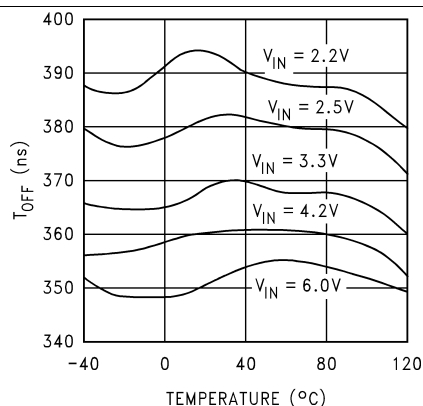
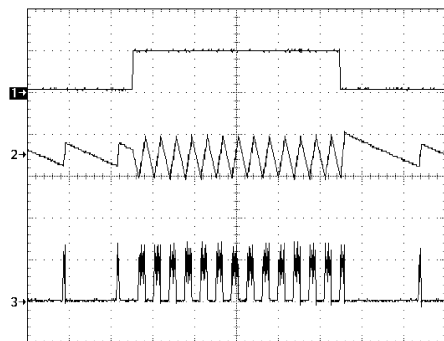
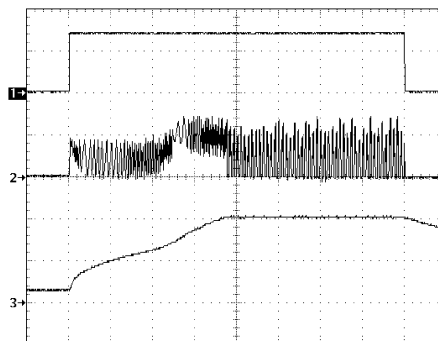


Figure 8. Off Time vs Temperature



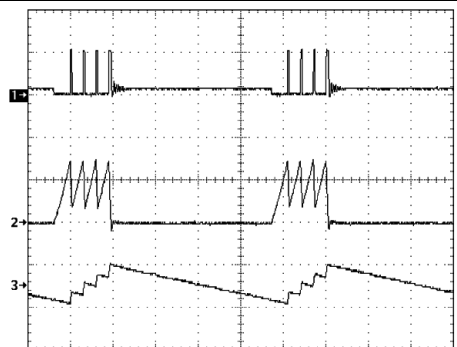
- 1) Load: 0.5 mA to 5 mA to 0.5 mA, DC
  - 2)  $V_{OUT}$ : 200 mV/div, AC
  - 3)  $I_L$ : 100 mA/div, DC
- $V_{OUT} = 20\text{ V}$   
 $V_{IN} = 3\text{ V}$   
 $T = 100\ \mu\text{s/div}$

Figure 9. Step Response



- 1) SHDN: 1 V/div, DC
  - 2)  $V_{OUT}$ : 10 V/div, AC
  - 3)  $I_L$ : 100 mA/div, DC
- $V_{IN} = 3\text{ V}$   
 $T = 100\ \mu\text{s/div}$
- $V_{OUT} = 20\text{ V}$   
 $R_L = 3.9\text{ k}\Omega$

Figure 10. Start-Up and Shutdown



- 1.  $V_{SW}$ : 20 V/div, DC
- 2. Inductor Current: 100 mA/div, DC
- 3.  $V_{OUT}$ , 200 mV/div, AC

$V_{IN} = 2.7\text{ V}$   
 $I_{OUT} = 2.5\text{ mA}$

$V_{OUT} = 20\text{ V}$

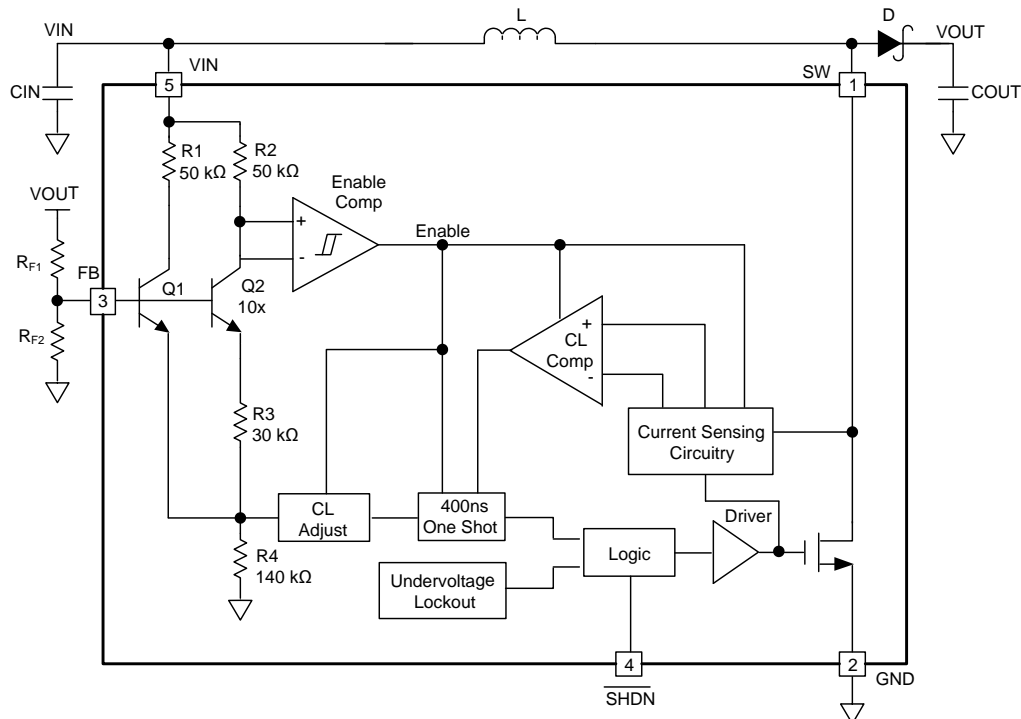
Figure 11. Typical Switching Waveform

## 7 Detailed Description

### 7.1 Overview

The LM2705 is a small boost converter utilizing a constant off time architecture. The device can provide up to 20.5 V at the output with up to 150 mA of peak switch current.

### 7.2 Functional Block Diagram



Copyright © 2016, Texas Instruments Incorporated

### 7.3 Feature Description

The LM2705 device features a constant off-time control scheme. Operation can be best understood by referring to [Functional Block Diagram](#) and [Figure 11](#). Transistors Q1 and Q2 and resistors R3 and R4 of [Functional Block Diagram](#) form a bandgap reference used to control the output voltage. When the voltage at the FB pin is less than 1.237 V, the Enable Comp in [Functional Block Diagram](#) enables the device, and the NMOS switch is turned on pulling the SW pin to ground. When the NMOS switch is on, current begins to flow through inductor L while the load current is supplied by the output capacitor C<sub>OUT</sub>. Once the current in the inductor reaches the current limit, the CL comp trips, and the 400-ns one shot turns off the NMOS switch. The SW voltage then rises to the output voltage plus a diode drop, and the inductor current begins to decrease as shown in [Figure 11](#). During this time the energy stored in the inductor is transferred to C<sub>OUT</sub> and the load. After the 400-ns off-time the NMOS switch is turned on, and energy is stored in the inductor again. This energy transfer from the inductor to the output causes a stepping effect in the output ripple as shown in [Figure 11](#).

This cycle is continued until the voltage at FB reaches 1.237 V. When FB reaches this voltage, the Enable Comp disables the device, turning off the NMOS switch and reducing the I<sub>Q</sub> of the device to 40 μA. The load current is then supplied solely by C<sub>OUT</sub> indicated by the gradually decreasing slope at the output as shown in [Figure 11](#). When the FB pin drops slightly below 1.237 V, the Enable Comp enables the device and begins the cycle described previously.

### 7.4 Device Functional Modes

The  $\overline{\text{SHDN}}$  pin can be used to turn off the LM2705 and reduce the I<sub>Q</sub> to 0.01 μA. In shutdown mode the output voltage is a diode drop lower than the input voltage.



## 8 Application and Implementation

### NOTE

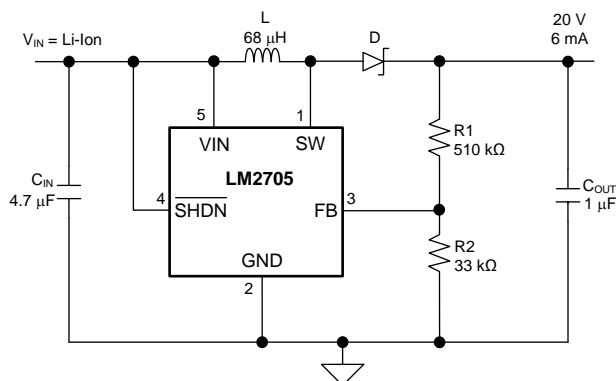
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation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

### 8.1 Application Information

The LM2705 is a 20-V boost designed for low power boost applications. Typical input voltage range makes this ideal for standard single cell Li+ batteries or 2 to 4 series alkaline batteries.

### 8.2 Typical Application

Figure 12 shows a typical Li+ voltage range to 20-V application. The 68-μH inductor allows for a low ripple current and high light-load efficiency.



Copyright © 2016, Texas Instruments Incorporated

Figure 12. Typical 20-V Application

#### 8.2.1 Design Requirements

For typical DC-DC converter applications, use the parameters listed in Table 1.

Table 1. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
Input voltage	2.5 V to 4.2 V
Output voltage	12 V
Output current	up to 8 mA
Inductor	33 μH

#### 8.2.2 Detailed Design Procedure

##### 8.2.2.1 Inductor Selection - Boost Regulator

The appropriate inductor for a given application is calculated using Equation 1:

$$L = \left( \frac{V_{OUT} - V_{IN(min)} + V_D}{I_{CL}} \right) T_{OFF}$$

where

- $V_D$  is the Schottky diode voltage
- $I_{CL}$  is the switch current limit found in the *Typical Characteristics*

- $T_{OFF}$  is the switch off time (1)

When using this equation be sure to use the minimum input voltage for the application, such as for battery powered applications. For the LM2705 constant-off time control scheme, the NMOS power switch is turned off when the current limit is reached. There is approximately a 100-ns delay from the time the current limit is reached in the NMOS power switch and when the internal logic actually turns off the switch. During this 100-ns delay, the peak inductor current increases. This increase in inductor current demands a larger saturation current rating for the inductor. This saturation current can be approximated by [Equation 2](#):

$$I_{PK} = I_{CL} + \left( \frac{V_{IN(max)}}{L} \right) 100 \text{ ns} \quad (2)$$

Choosing inductors with low ESR decrease power losses and increase efficiency.

Take care when choosing an inductor. For applications that require an input voltage that approaches the output voltage, such as when converting a Li-Ion battery voltage to 5 V, the 400-ns off time may not be enough time to discharge the energy in the inductor and transfer the energy to the output capacitor and load. This can cause a ramping effect in the inductor current waveform and an increased ripple on the output voltage. Using a smaller inductor causes the  $I_{PK}$  to increase and increases the output voltage ripple further.

For typical curves and evaluation purposes the DT1608C series inductors from Coilcraft were used. Other acceptable inductors include, but are not limited to, the SLF6020T series from TDK, the NP05D series from Taiyo Yuden, the CDRH4D18 series from Sumida, and the P1166 series from Pulse.

### 8.2.2.2 Inductor Selection - SEPIC Regulator

[Equation 3](#) can be used to calculate the approximate inductor value for a SEPIC regulator:

$$L2 = 2 \left( \frac{V_{OUT} + V_D}{I_{CL}} \right) T_{OFF} \quad (3)$$

The boost inductor, L1, can be smaller or larger but is generally chosen to be the same value as L2. See [Figure 23](#) and [Figure 24](#) for typical SEPIC applications.

### 8.2.2.3 Diode Selection

To maintain high efficiency, the average current rating of the Schottky diode should be larger than the peak inductor current,  $I_{PK}$ . Schottky diodes with a low forward drop and fast switching speeds are ideal for increasing efficiency in portable applications. Choose a reverse breakdown of the Schottky diode larger than the output voltage.

### 8.2.2.4 Capacitor Selection

Choose low equivalent series resistance (ESR) capacitors for the output to minimize output voltage ripple. Multilayer ceramic capacitors are the best choice. For most applications, a 1- $\mu$ F ceramic capacitor is sufficient. For some applications a reduction in output voltage ripple can be achieved by increasing the output capacitor. Output voltage ripple can further be reduced by adding a 4.7-pF feed-forward capacitor in the feedback network placed in parallel with RF1 (see [Functional Block Diagram](#)).

Local bypassing for the input is needed on the LM2705. Multilayer ceramic capacitors are a good choice for this as well. A 4.7- $\mu$ F capacitor is sufficient for most applications. For additional bypassing, a 100-nF ceramic capacitor can be used to shunt high frequency ripple on the input.

8.2.3 Application Curves

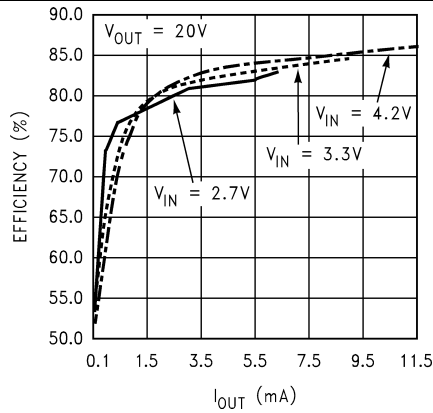


Figure 13. Efficiency vs Load Current

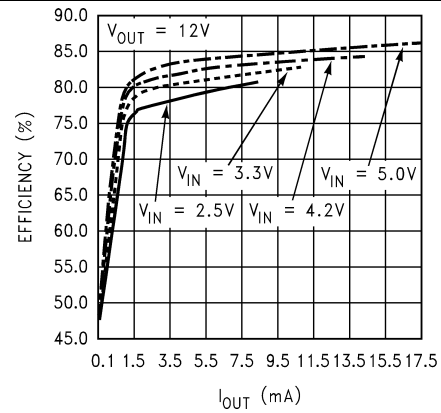


Figure 14. Efficiency vs Load Current

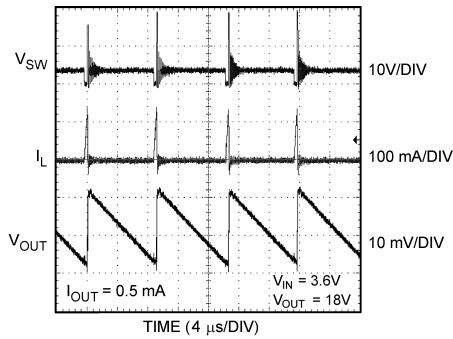


Figure 15. Output Ripple Voltage  
Copt, Ropt Included

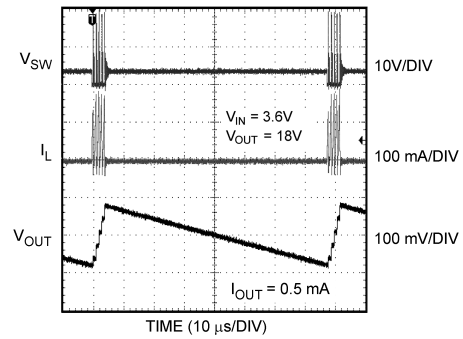


Figure 16. Output Ripple Voltage  
Copt, Ropt Excluded

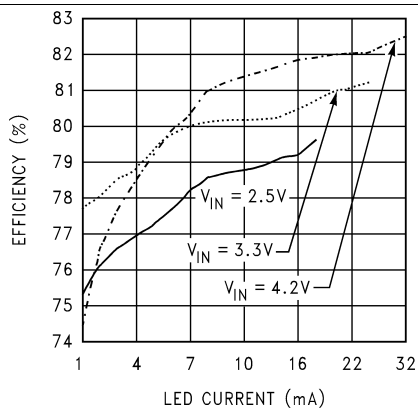


Figure 17. Two White-LED Efficiency

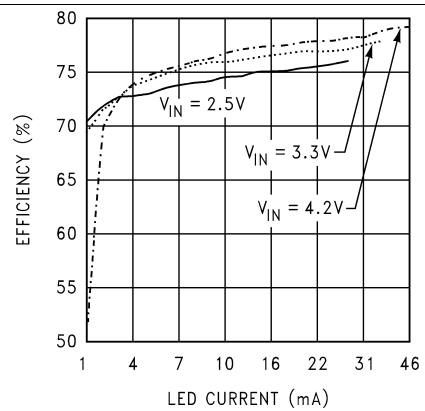
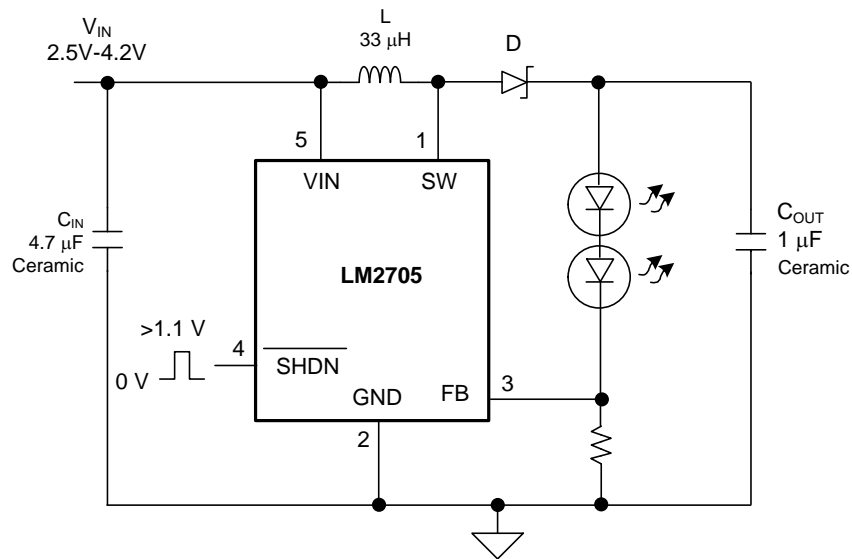


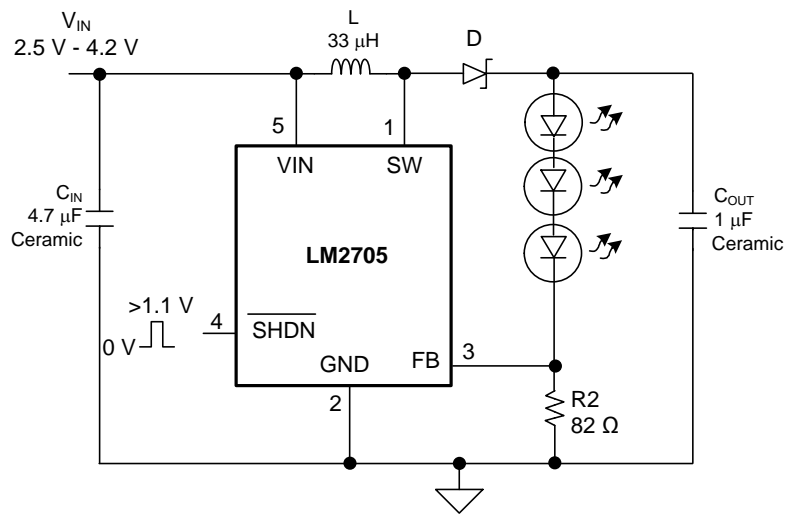
Figure 18. Three White-LED Efficiency

8.3 Additional Applications



Copyright © 2016, Texas Instruments Incorporated

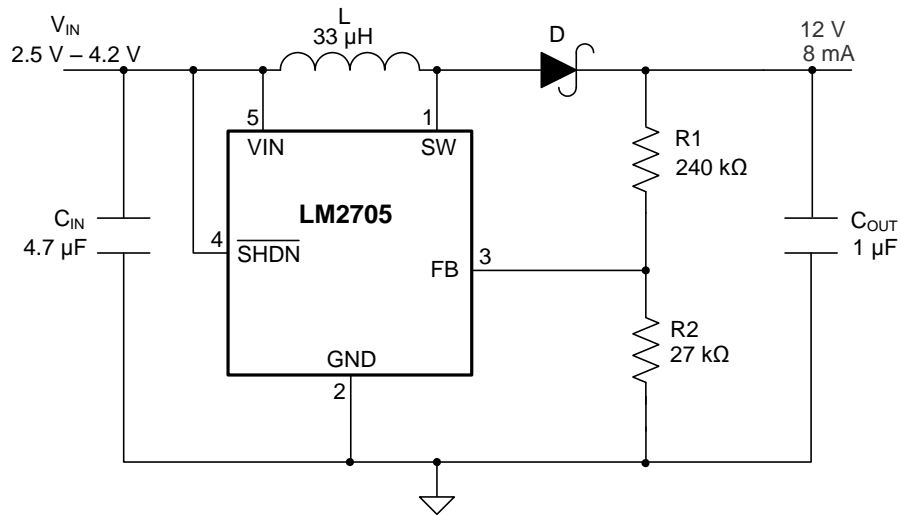
Figure 19. Two White-LED Application



Copyright © 2016, Texas Instruments Incorporated

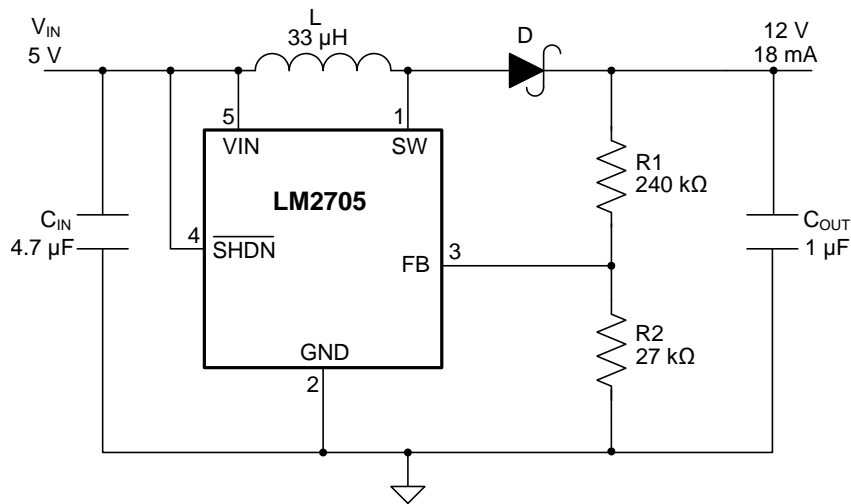
Figure 20. Three White-LED Application

**Additional Applications (continued)**



Copyright © 2016, Texas Instruments Incorporated

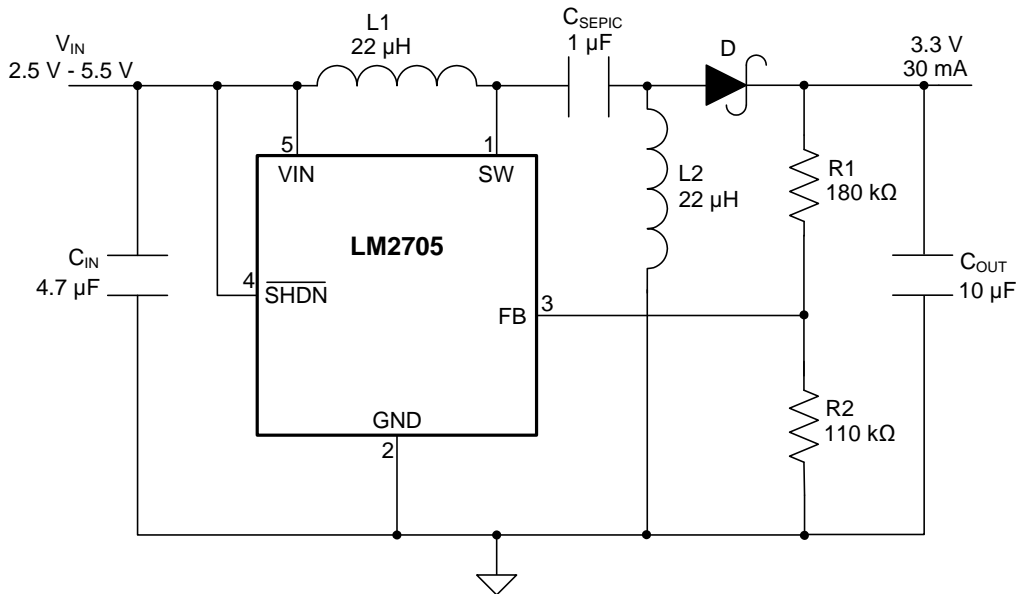
**Figure 21. Li-Ion 12-V Application**



Copyright © 2016, Texas Instruments Incorporated

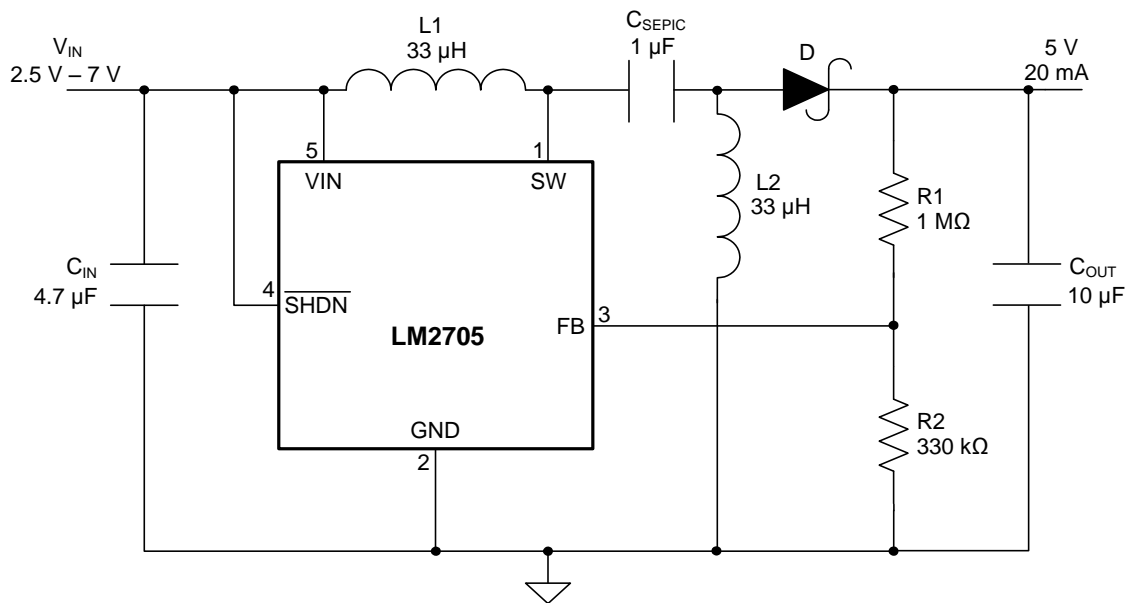
**Figure 22. 5-V to 12-V Application**

Additional Applications (continued)



Copyright © 2016, Texas Instruments Incorporated

Figure 23. 3.3-V SEPIC Application



Copyright © 2016, Texas Instruments Incorporated

Figure 24. 5-V SEPIC Application

## 9 Power Supply Recommendations

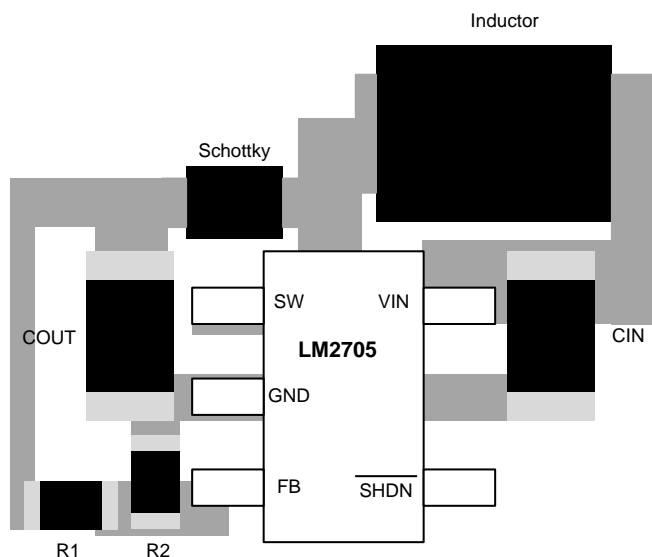
The LM2705 is designed to operate from an input voltage supply range from 2.2 V to 7 V. This input supply must be well regulated and capable to supply the required input current. If the input supply is located far from the LM2705, additional bulk capacitance may be required in addition to the ceramic bypass capacitors.

## 10 Layout

### 10.1 Layout Guidelines

The input bypass capacitor  $C_{IN}$ , as shown in Figure 25, must be placed close to the device. This reduces copper trace resistance, which effects input voltage ripple of the LM2705 device. For additional input voltage filtering, a 100-nF bypass capacitor can be placed in parallel with  $C_{IN}$  to shunt any high frequency noise to ground. The output capacitor,  $C_{OUT}$ , must also be placed close to the device. Any copper trace connections for the  $C_{OUT}$  capacitor can increase the series resistance, which directly effects output voltage ripple. Keep the feedback network, resistors R1 and R2, close to the FB pin to minimize copper trace connections that can inject noise into the system. The ground connection for the feedback resistor network must connect directly to an analog ground plane. Tie the analog ground plane directly to the GND pin. If no analog ground plane is available, the ground connection for the feedback network must tie directly to the GND pin. Minimize trace connections made to the inductor and Schottky diode to reduce power dissipation and increase overall efficiency.

### 10.2 Layout Example



**Figure 25. LM2705 Layout Example**

## 11 デバイスおよびドキュメントのサポート

### 11.1 デバイス・サポート

#### 11.1.1 Third-Party Products Disclaimer

TI'S PUBLICATION OF INFORMATION REGARDING THIRD-PARTY PRODUCTS OR SERVICES DOES NOT CONSTITUTE AN ENDORSEMENT REGARDING THE SUITABILITY OF SUCH PRODUCTS OR SERVICES OR A WARRANTY, REPRESENTATION OR ENDORSEMENT OF SUCH PRODUCTS OR SERVICES, EITHER ALONE OR IN COMBINATION WITH ANY TI PRODUCT OR SERVICE.

#### 11.2 ドキュメントの更新通知を受け取る方法

ドキュメントの更新についての通知を受け取るには、[ti.com](http://ti.com)のデバイス製品フォルダを開いてください。右上の隅にある「通知を受け取る」をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取れます。変更の詳細については、修正されたドキュメントに含まれている改訂履歴をご覧ください。

#### 11.3 コミュニティ・リソース

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

**TI E2E™ Online Community** *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At [e2e.ti.com](http://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 商標

E2E is a trademark of Texas Instruments.  
All other trademarks are the property of their respective owners.

#### 11.5 静電気放電に関する注意事項



これらのデバイスは、限定的なESD(静電破壊)保護機能を内蔵しています。保存時または取り扱い時は、MOSゲートに対する静電破壊を防止するために、リード線同士をショートさせておくか、デバイスを導電フォームに入れる必要があります。

#### 11.6 Glossary

**SLYZ022** — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 12 メカニカル、パッケージ、および注文情報

以降のページには、メカニカル、パッケージ、および注文に関する情報が記載されています。この情報は、そのデバイスについて利用可能な最新のデータです。このデータは予告なく変更されることがあり、ドキュメントが改訂される場合もあります。本データシートのブラウザ版を使用されている場合は、画面左側の説明をご覧ください。



**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM2705MF-ADJ/NOPB	ACTIVE	SOT-23	DBV	5	1000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	S59B	<a href="#">Samples</a>
LM2705MFX-ADJ/NOPB	ACTIVE	SOT-23	DBV	5	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	S59B	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.



**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM2705MF-ADJ/NOPB	SOT-23	DBV	5	1000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LM2705MFX-ADJ/NOPB	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM2705MF-ADJ/NOPB	SOT-23	DBV	5	1000	210.0	185.0	35.0
LM2705MFX-ADJ/NOPB	SOT-23	DBV	5	3000	210.0	185.0	35.0



# EXAMPLE BOARD LAYOUT

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

4214839/K 08/2024

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:15X

4214839/K 08/2024

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

## 重要なお知らせと免責事項

TI は、技術データと信頼性データ(データシートを含みます)、設計リソース(リファレンス・デザインを含みます)、アプリケーションや設計に関する各種アドバイス、Web ツール、安全性情報、その他のリソースを、欠陥が存在する可能性のある「現状のまま」提供しており、商品性および特定目的に対する適合性の黙示保証、第三者の知的財産権の非侵害保証を含むいかなる保証も、明示的または黙示的にかかわらず拒否します。

これらのリソースは、TI 製品を使用する設計の経験を積んだ開発者への提供を意図したものです。(1) お客様のアプリケーションに適した TI 製品の選定、(2) お客様のアプリケーションの設計、検証、試験、(3) お客様のアプリケーションに該当する各種規格や、その他のあらゆる安全性、セキュリティ、規制、または他の要件への確実な適合に関する責任を、お客様のみが単独で負うものとし、

上記の各種リソースは、予告なく変更される可能性があります。これらのリソースは、リソースで説明されている TI 製品を使用するアプリケーションの開発の目的でのみ、TI はその使用をお客様に許諾します。これらのリソースに関して、他の目的で複製することや掲載することは禁止されています。TI や第三者の知的財産権のライセンスが付与されている訳ではありません。お客様は、これらのリソースを自身で使用した結果発生するあらゆる申し立て、損害、費用、損失、責任について、TI およびその代理人を完全に補償するものとし、TI は一切の責任を拒否します。

TI の製品は、[TI の販売条件](#)、または [ti.com](#) やかかる TI 製品の関連資料などのいずれかを通じて提供する適用可能な条項の下で提供されています。TI がこれらのリソースを提供することは、適用される TI の保証または他の保証の放棄の拡大や変更を意味するものではありません。

お客様がいかなる追加条項または代替条項を提案した場合でも、TI はそれらに異議を唱え、拒否します。

郵送先住所 : Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2024, Texas Instruments Incorporated