# LM2623-Q1 ゲート付きオシレータ・ベースの車載用DC/DC昇圧コンバータ

## 1 特長

- 車載アプリケーション用にAEC-Q100認定済み:
  - デバイス温度グレード 1:–40°C～125°C 周囲動作温度
  - デバイスHBM ESD分類レベル2
  - デバイスCDM ESD分類レベルC4A
- 非常に広い負荷範囲で優れた効率を維持
- 非常に低い出力電圧リップル
- 最大2MHzのスイッチング周波数
- 0.9V～14Vの動作電圧
- 1.1Vのスタートアップ電圧
- 出力電圧は1.24V～14Vまで可変
- 0.17Ωの内蔵MOSFET
- 最高90%のレギュレータ効率
- 標準動作電流80µA (電源の$V_{DD}$ピンに対して)
- 低いシャットダウン電流($I_Q$ < 2.5µA)
- 4mm×4mmの熱的に強化されたWSONパッケージ・オプション

## 2 アプリケーション

- 車載用 カメラ
- 車載用レーダー
- 車載用GPS
- フラッシュ・メモリのプログラミング
- 白色LEDの駆動

## 3 概要

LM2623-Q1は、車載システム用の高効率の汎用昇圧型DC/DCスイッチング・レギュレータです。このデバイスは、0.9V～14Vの入力電圧を受け付け、1.24V～14Vのレギュレートされた出力電圧に変換します。

各種のアプリケーションに適合できるよう、LM2623-Q1は設計者により出力電圧、動作周波数(300kHz～2MHz)、デューティ・サイクル(17%～90%)をプログラム可能で、最適な性能が得られます。選択された値は固定にも、入力電圧や入力と出力の電圧比に応じて変動するようにも設定できます。LM2623-Q1は非常に単純なオン/オフのレギュレーション・モードを使用し、広い動作範囲にわたって優れた効率と安定した動作を実現しています。このデバイスは通常、レギュレーションの限界に達したとき、スイッチング・サイクルをスキップしてレギュレートを行います(パルス幅変調(PFM))。

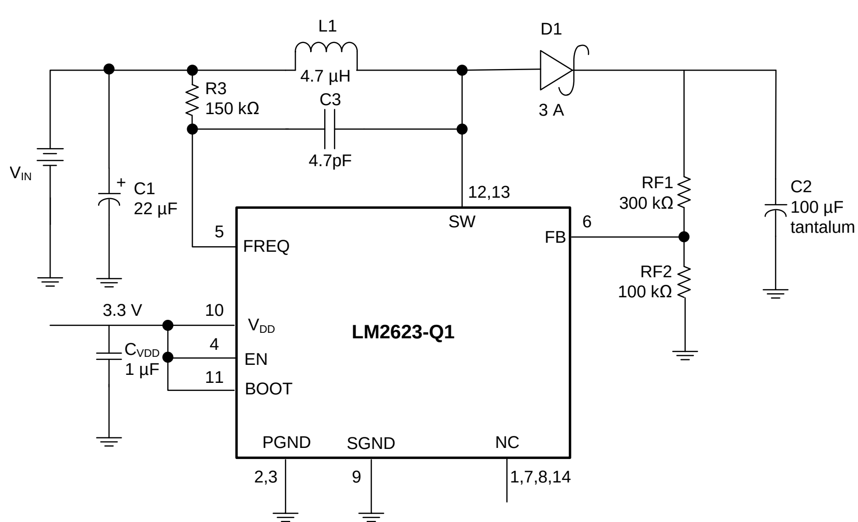
基板設計を最終的に確定する前に設計課題を解決する方法については、「*Non-Linear Effect*」および「*Choosing the Correct C3 Capacitor*」を参照してください。

**製品情報(1)**

| 型番 | パッケージ | 本体サイズ(公称) |
|---|---|---|
| LM2623-Q1 | WSON (14) | 4.00mm×4.00mm |

(1) 提供されているすべてのパッケージについては、巻末の注文情報を参照してください。

**代表的なアプリケーション**



# 目次

1 特長 ... 1
2 アプリケーション ... 1
3 概要 ... 1
4 改訂履歴 ... 2
5 **Pin Configuration and Functions** ... 3
6 **Specifications** ... 4
  6.1 Absolute Maximum Ratings ... 4
  6.2 ESD Ratings ... 4
  6.3 Recommended Operating Conditions ... 4
  6.4 Thermal Information ... 4
  6.5 Electrical Characteristics ... 5
  6.6 Typical Characteristics ... 6
7 **Detailed Description** ... 8
  7.1 Overview ... 8
  7.2 Functional Block Diagram ... 8
  7.3 Feature Description ... 9
  7.4 Device Functional Modes ... 10
8 **Applications and Implementation** ... 11
  8.1 Application Information ... 11
  8.2 Typical Application ... 11
9 **Power Supply Recommendations** ... 13
10 **Layout** ... 14
  10.1 Layout Guidelines ... 14
  10.2 Layout Example ... 15
  10.3 WSON Package Devices ... 15
11 デバイスおよびドキュメントのサポート ... 16
  11.1 デバイス・サポート ... 16
  11.2 ドキュメントのサポート ... 16
  11.3 ドキュメントの更新通知を受け取る方法 ... 16
  11.4 コミュニティ・リソース ... 16
  11.5 商標 ... 16
  11.6 静電気放電に関する注意事項 ... 16
  11.7 Glossary ... 16
12 メカニカル、パッケージ、および注文情報 ... 16

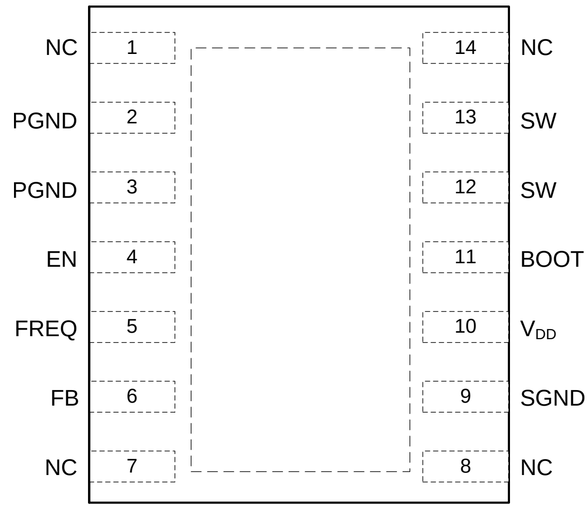
## 4 改訂履歴

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。

| 日付 | 改訂内容 | 注 |
|---|---|---|
| 2017年10月 | * | 初版 |

# 5 Pin Configuration and Functions

**NHL Package**
**14-Pin WSON**
**Top View**




## Pin Functions

| PIN | | TYPE | DESCRIPTION |
|---|---|---|---|
| NO. | NAME | | |
| 1 | NC | — | No connect |
| 2, 3 | PGND | GND | Power ground (pins 2 and 3 *must* be shorted together) |
| 4 | EN | Digital | Active-low shutdown input |
| 5 | FREQ | Analog | Frequency adjust; connect an external resistor between this pin and a voltage source sets the switching frequency of the LM2623-Q1. |
| 6 | FB | Analog | Output voltage feedback |
| 7 | NC | — | No connect |
| 8 | NC | — | No connect |
| 9 | SGND | GND | Signal ground |
| 10 | $V_{DD}$ | Power | Power supply for internal circuitry |
| 11 | BOOT | Analog | Bootstrap supply for the gate drive of internal MOSFET power switch |
| 12, 13 | SW | Analog | Drain of the internal MOSFET power switch (pins 12 and 13 *must* be shorted together) |
| 14 | NC | — | No connect |
| DAP | DAP | Thermal | Solder to board for enhanced thermal dissipation; must be electrically isolated/floating. |

# 6 Specifications

## 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1) (2)

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| Input pins | SW pin voltage | –0.5 | 14.5 | V |
| | BOOT, VDD, EN, and FB pins | –0.5 | 10 | V |
| | FREQ pin | | 100 | µA |
| Power dissipation ($T_A$ = 25°C)(3) | | | 500 | mW |
| $T_{J\_MAX}$ (3) | | | 150 | °C |
| Storage temperature, $T_{stg}$ | | –55 | 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 Texas Instruments Sales Office / Distributors for availability and specifications.
(3) The maximum power dissipation must be derated at elevated temparters and is dictated by $T_{J\text{-}MAX}$ (maximum junction temperature), $R_{\Theta JA}$ (junction to ambient thermal resistance), and $T_A$ (ambient temperature). The maximum allowable power dissipation at any temperature is $P_{D\text{-}MAX} = (T_{J\text{-}MAX} – T_A)/R_{\Theta JA}$ or the number given in the Absolute Maximum Rating, whichever is lower.

## 6.2 ESD Ratings

| | | | | VALUE | UNIT |
|---|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per AEC Q100-002(1) | All pins except 12 and 13 | ±2000 | V |
| | | | Pins 12 and 13 | ±1000 | |
| | | Charged device model (CDM), per AEC Q100-011 | | ±500 | |

(1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

## 6.3 Recommended Operating Conditions

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

| | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| Input pins | $V_{DD}$ pin | 3 | | 5 | V |
| | FB and EN pins | 0 | | $V_{DD}$ | V |
| | BOOT pin | 0 | | 10 | V |
| Operating junction temperature range, $T_J$ | | –40 | | 125 | °C |

## 6.4 Thermal Information

| THERMAL METRIC(1) | | LM2623-Q1 | UNIT |
|---|---|---|---|
| | | NHL (WSON) | |
| | | 14 PINS | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 37.6 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 26.9 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 15.0 | °C/W |
| $\psi_{JT}$ | Junction-to-top characterization parameter | 0.3 | °C/W |
| $\psi_{JB}$ | Junction-to-board characterization parameter | 4.7 | °C/W |

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

## 6.5 Electrical Characteristics

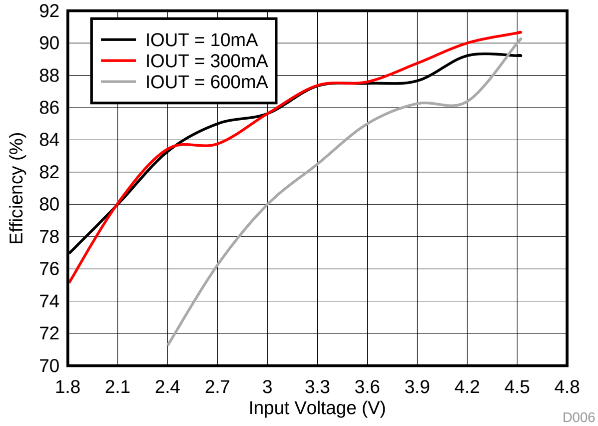
Limits apply for $T_J$ = 25°C and $V_{DD}$ = $V_{OUT}$ = 3.3 V, unless otherwise specified.

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **GENERAL** | | | | | | |
| $V_{DD\_ST}$ | Start-up supply voltage 25°C | $I_{LOAD}$ = 0 mA(1) | | | 1.1 | V |
| $V_{IN\_OP}$ | Minimum operating supply voltage (once started) | $I_{LOAD}$ = 0 mA | | 0.65 | 0.9 | V |
| $V_{FB}$ | FB pin voltage | | | 1.24 | | V |
| | | –40°C to 85°C | 1.2028 | | 1.2772 | |
| | | –40°C to 125°C | 1.2028 | | 1.2772 | |
| $V_{OUT\_MAX}$ | Maximum output voltage | | | 14 | | V |
| η | Efficiency | $V_{IN}$ = 3.6 V; $V_{OUT}$ = 5 V, $I_{LOAD}$ = 500 mA | | 87% | | |
| | | $V_{IN}$ = 2.5 V; $V_{OUT}$ = 3.3 V, $I_{LOAD}$ = 200 mA | | 87% | | |
| D | Switch duty cycle | | | 17% | | |
| $I_{DD}$ | Operating quiescent current(2) | FB pin > 1.3 V, EN pin at $V_{DD}$ | | 80 | | µA |
| | | FB pin > 1.3 V, EN pin at $V_{DD}$ , –40°C to 85°C | | | 110 | |
| | | FB pin > 1.3 V, EN pin at $V_{DD}$, –40°C to 125°C | | | 110 | |
| $I_{SD}$ | Shutdown quiescent current(3) | $V_{DD}$, BOOT, and SW pins at 5 V, EN pin < 200 mV | | 0.01 | | µA |
| | | $V_{DD}$, BOOT, and SW pins at 5 V, EN pin < 200 mV, –40°C to 85°C | | | 2.5 | |
| | | $V_{DD}$, BOOT, and SW pins at 5 V, EN pin < 200 mV, –40°C to 125°C | | | 2.5 | |
| $I_{CL}$ | Switch peak current limit | | 2.2 | 2.85 | | A |
| $R_{DSON}$ | MOSFET switch on resistance | | | 0.17 | | Ω |
| | | –40°C to 85°C | | | 0.26 | |
| | | –40°C to 125° | | | 0.26 | |
| **ENABLE SECTION** | | | | | | |
| $V_{EN\_LO}$ | EN pin voltage low(4) | –40°C to 85°C | | | 0.15 $V_{DD}$ | V |
| | | –40°C to 125°C | | | 0.15 $V_{DD}$ | |
| $V_{EN\_HI}$ | EN pin voltage high(4) | –40°C to 85°C | 0.7 $V_{DD}$ | | | V |
| | | –40°C to 125°C | 0.7 $V_{DD}$ | | | |

(1) $V_{DD}$ tied to BOOT and EN pins. Frequency pin tied to $V_{DD}$ through 121-KΩ resistor. $V_{DD\_ST}$ = $V_{DD}$ when start-up occurs. $V_{IN}$ is $V_{DD}$ + D1 voltage (usually 10 mV to 50 mV at start-up).
(2) This is the current into the $V_{DD}$ pin.
(3) This is the total current into pins $V_{DD}$, BOOT, SW, and FREQ.
(4) 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.

## 6.6 Typical Characteristics




$V_{OUT}$ = 5 V

**図 1. Efficiency vs Supply Voltage**

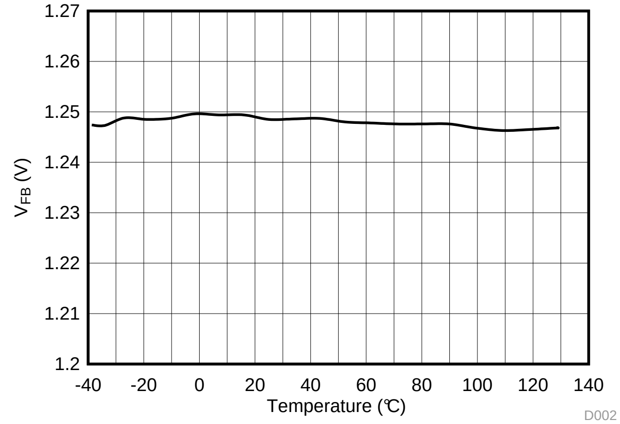



**図 2. $V_{FB}$ vs Temperature**

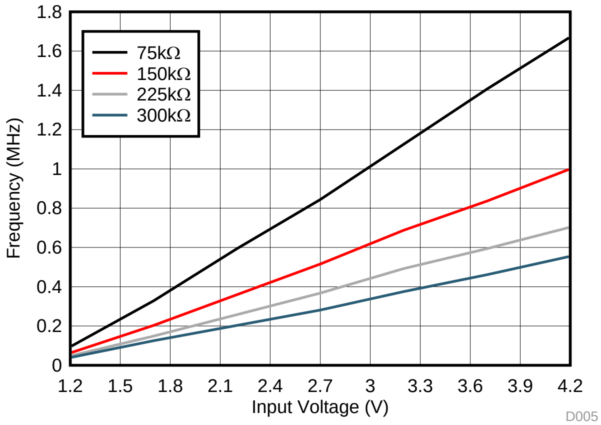



**図 3. Frequency vs $V_{IN}$**

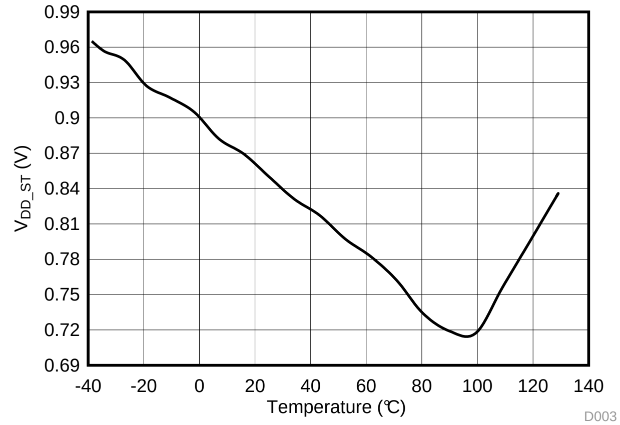



**図 4. Maximum Start-Up Voltage vs Temperature**

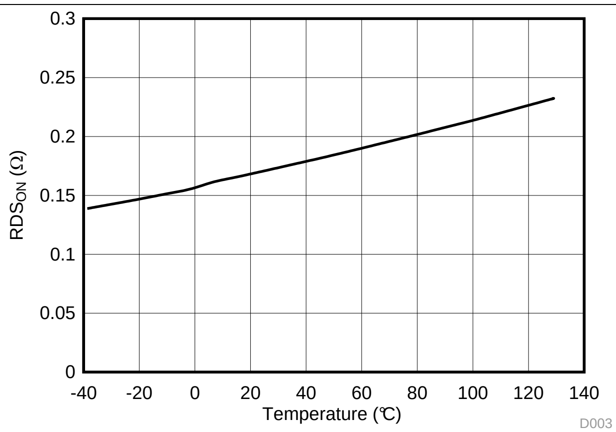



**図 5. Typical $R_{DS(ON)}$ vs Temperature**

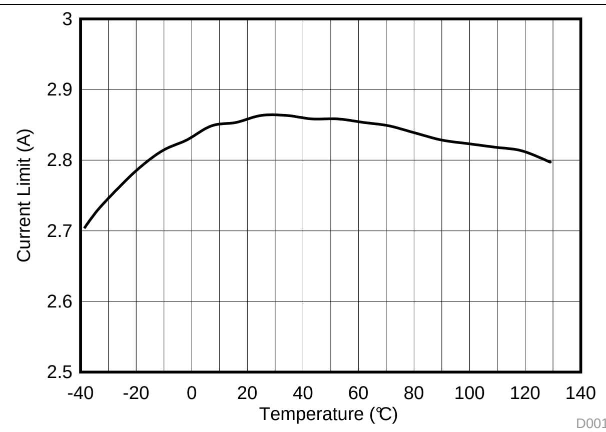
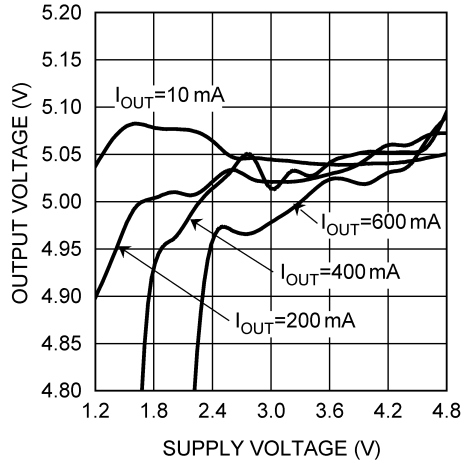



**図 6. Typical Current Limit vs Temperature**

## Typical Characteristics (continued)




$V_{OUT}$ = 5 V

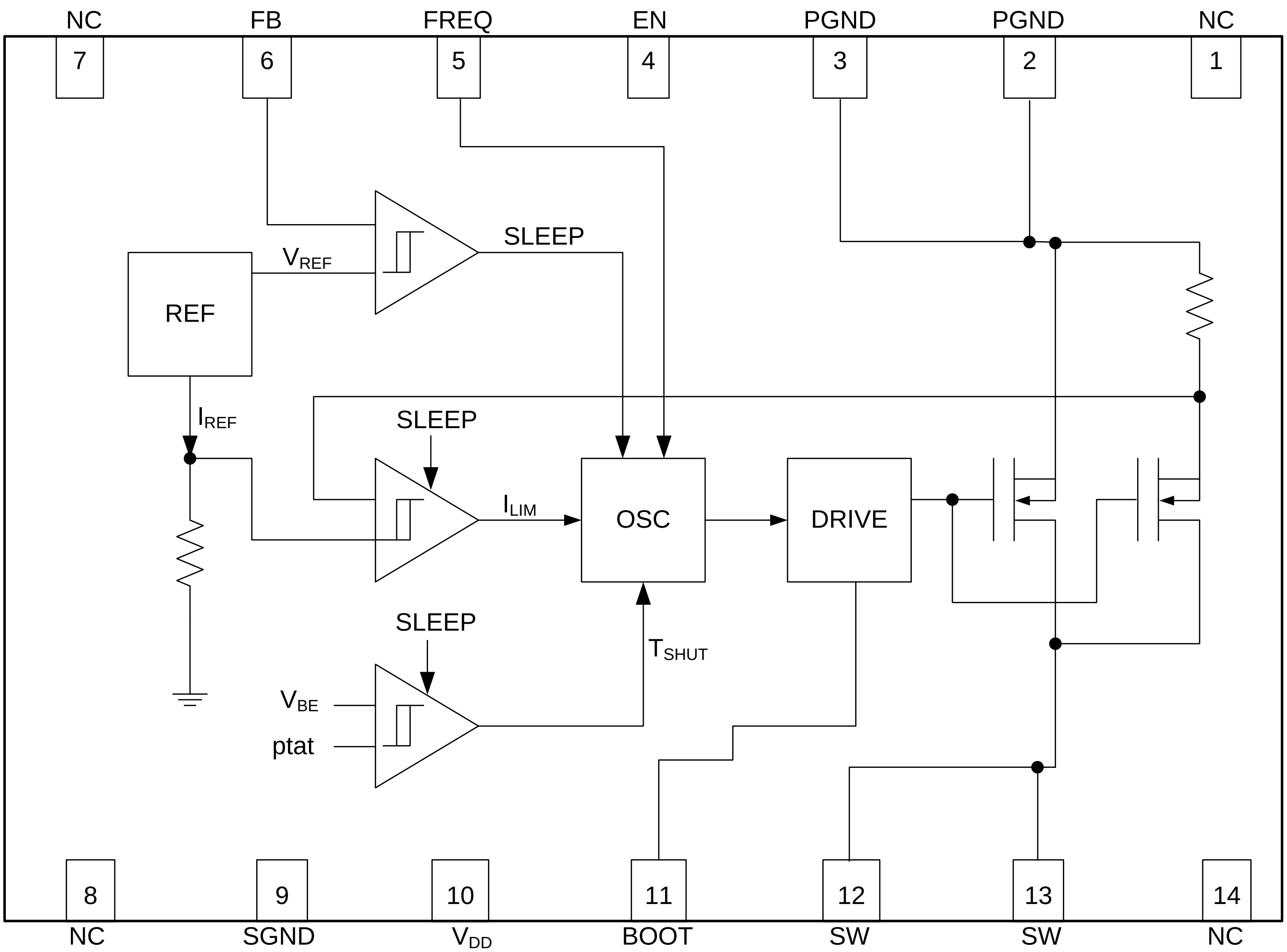
**図 7. Output Voltage vs Supply Voltage**

# 7 Detailed Description

## 7.1 Overview

The LM2623-Q1 device is designed to provide step-up DC-DC voltage regulation in battery-powered and low-input voltage systems. The device combines a step-up switching regulator, N-channel power MOSFET, built-in current limit, thermal limit, and voltage reference in a single 14-pin WSON package (see *Functional Block Diagram*). The switching DC-DC regulator boosts an input voltage between 0.9 V and 14 V to a regulated output voltage between 1.24 V and 14 V. The LM2623-Q1 starts from a low 1.1-V input and remains operational down to below 0.9 V. A high-efficiency gated-oscillator topology offers an output of up to 2 A at low step-up ratios.

## 7.2 Functional Block Diagram



## 7.3 Feature Description

### 7.3.1 Gated Oscillator Control Scheme

The on/off regulation mode of the LM2623-Q1, along with its ultra-low quiescent current, results in good efficiency over a very wide load range. The internal oscillator frequency can be programmed using an external resistor to be constant or vary with the battery voltage. Adding a capacitor to program the frequency allows the designer to adjust the duty cycle and optimize it for the application. Adding a resistor in addition to the capacitor allows the duty cycle to dynamically compensate for changes to the input/output voltage ratio. This is called a *ratio-adaptive gated-oscillator circuit*. See the *Typical Application* for a sample application circuit. Using the correct RC components to adjust the oscillator allows the device to run with low ripple and high efficiency over a wide range of loads and input/output voltages.

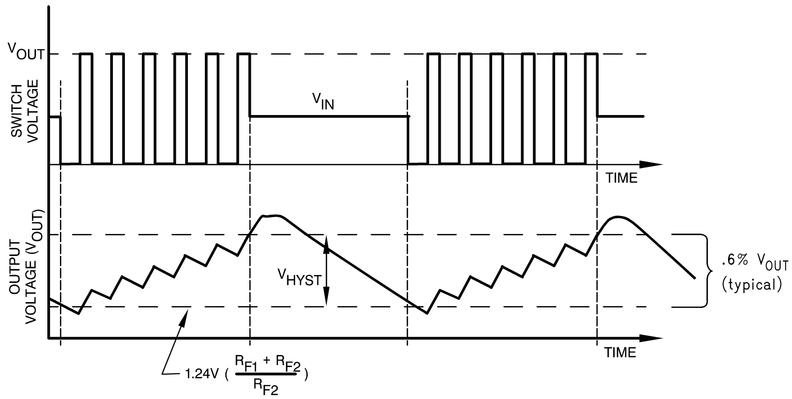



**図 8. Typical Step-Up Regulator Waveforms**

### 7.3.2 Cycle-To-Cycle PFM

When the load does not vary over a wide range, ratio adaptive circuit techniques can be used to achieve cycle to cycle PFM regulation and lower ripple (or smaller output capacitors). The key to success is matching the duty cycle of the circuit closely to what is required by the input-to-output voltage ratio. This ratio then must be dynamically adjusted for input voltage changes (usually caused by batteries running down). The chosen ratio must allow most of the energy in each switching cycle to be delivered to the load and only a small amount to be stored. When the regulation limit is reached, the overshoot is small, and the system settles at an equilibrium point where it adjusts the off time in each switching cycle to meet the current requirements of the load. The off-time adjustment is done by exceeding the regulation limit during each switching cycle and waiting until the voltage drops below the limit again to start the next switching cycle. The current in the coil never goes to zero like it frequently does in the hysteretic operating mode of circuits with wide load variations or duty cycles that are not matched to the input/output voltage ratio. Optimizing the duty cycle for a given set of input/output voltages conditions can be done by referencing the circuit values in *AN-1221 LM2623 General Purpose, Boost Converter Circuit*.

.

### 7.3.3 Shutdown

The LM2623-Q1 features a shutdown mode that reduces the quiescent current to less than an ensured 2.5 µA over temperature. This extends the life of the battery in battery-powered applications. During shutdown, all feedback and control circuitry is turned off. The output voltage of the regulator 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 4). When the logic input to this pin is pulled below 0.15 $V_{DD}$, the device goes into shutdown mode. The logic input to this pin must be above 0.7 $V_{DD}$ for the device to work in normal step-up mode. If EN is pulled above 0.7 $V_{DD}$ the SW pin switches continuously for experimentally tested 5 µs period, regardless of the output voltage. Once this time period is expired the feedback and gated oscillator scheme take over to regulate the output voltage.

## Feature Description (continued)

### 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 it does not come into effect during normal operating conditions. An internal thermal protection circuit 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 Pulse Frequency Modulation (PFM)

Pulse frequency modulation is typically accomplished by switching continuously until the voltage limit is reached and skipping cycles after that to just maintain it. This results in a somewhat hysteretic mode of operation. The coil stores more energy each cycle as the current ramps up to high levels. When the voltage limit is reached, the system usually overshoots to a higher voltage than required, due to the stored energy in the coil (see 図 8). The system also undershoots somewhat when it starts switching again because it has depleted all the stored energy in the coil and must store more energy to reach equilibrium with the load. Larger output capacitors and smaller inductors reduce the ripple in these situations. The frequency being filtered, however, is not the basic switching frequency. It is a lower frequency determined by the load, the input/output voltage and the circuit parameters. This mode of operation is useful in situations where the load variation is significant. Power-managed computer systems, for instance, may vary from zero to full load while the system is on, and this is usually the preferred regulation mode for such systems.

### 7.4.2 Low Voltage Start-Up

The LM2623-Q1 can start up from voltages as low as 1.1 V. On start-up, the control circuitry switches the N-channel MOSFET continuously until the output reaches 3 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 0.9 V input, because the internal power for the device can be boot-strapped from the output using the $V_{DD}$ pin.

# 8 Applications and Implementation

注

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 LM2623-Q1 is suitable for automotive applications, and supports shutdown mode for low quiescent current when EN input is low. Output voltage level can be adjusted by changing feedback resistor divider values from 1.24-V to 14-V range. The maximum switching frequency is 2MHz.

## 8.2 Typical Application

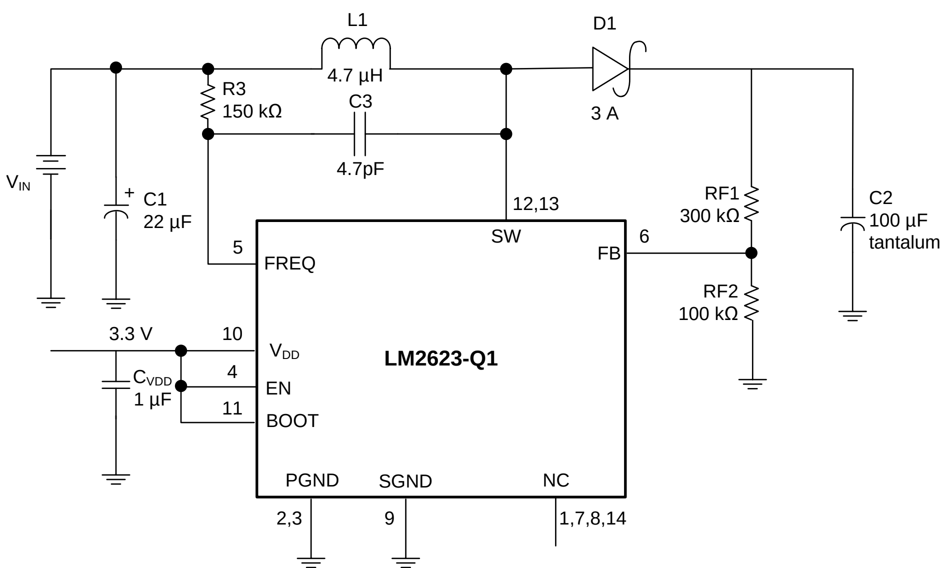





図 9. LM2623-Q1 Typical Application

### 8.2.1 Design Requirements

The LM2623-Q1 allows the designer to vary output voltage, operating frequency and duty cycle to optimize device performance (see *Detailed Design Procedure* for details).

For typical boost-converter applications, use the parameters listed in 表 1.

表 1. Design Parameters

| DESIGN PARAMETER | EXAMPLE VALUE |
|---|---|
| Input voltage | 0.9 V to 14 V |
| Output voltage | 1.24 V to 14 V (adjustable) |
| Output current | 2 A (maximum) |

### 8.2.2 Detailed Design Procedure

#### *8.2.2.1 Non-Linear Effect*

The LM2623-Q1 takes advantage of a non-linear effect, allowing for the duty cycle to be programmable. C3 in 図 9 allows for the duty cycle to be programable.

#### *8.2.2.2 Choosing the Correct C3 Capacitor*

The duty cycle of the internal oscillator is programmable with the C3 capacitor. Choosing the correct C3 capacitor to obtain the appropriate duty cycle for a particular application circuit is a trial-and-error process. The non-linear effect that C3 produces is dependent on the input voltage and output voltage values. The correct C3 capacitor for specific input and output voltage values cannot be calculated. Choosing the correct C3 capacitance is best done by trial and error, in conjunction with the checking of the inductor peak current to make sure it is not too close to the current limit of the device. As the C3 capacitor value increases, so does the duty cycle; conversely, as the C3 capacitor value decreases, the duty cycle decreases. An incorrect choice of the C3 capacitor can result in the device prematurely tripping the current limit and/or double pulsing, which could lead to the output voltage not being stable. Optimizing the duty cycle for a given set of input/output voltages conditions can be done by referencing the component values in *AN-1221 LM2623 General Purpose, Boost Converter Circuit*.

#### *8.2.2.3 Setting the Output Voltage*

The output voltage of the step-up regulator can be set by connecting a feedback resistive divider made of $R_{F1}$ and $R_{F2}$. The resistor values are selected as follows:

$$R_{F1} = R_{F2} \times [(V_{OUT} / 1.24) - 1] \tag{1}$$

A value of 50 kΩ to 100 kΩ is suggested for $R_{F2}$. $R_{F1}$ can be selected using 式 1.

#### *8.2.2.4 $V_{DD}$ Supply*

The $V_{DD}$ supply must be between 3 V to 5 V for the LM2623-Q1 device. This voltage can be bootstrapped from a much lower input voltage by simply connecting the $V_{DD}$ pin to $V_{OUT}$. In the event that the $V_{DD}$ supply voltage is not a low-ripple voltage source (less than 200 mV), it may be advisable to use an RC filter to clean it up. Excessive ripple on $V_{DD}$ may reduce the efficiency.

#### *8.2.2.5 Setting the Switching Frequency*

The switching frequency of the oscillator is selected by choosing an external resistor (R3) connected between $V_{IN}$ and the FREQ pin. See 図 3 in the *Typical Characteristics* for choosing the R3 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. TI recommends a switching frequency between 300 kHz and 2 MHz.

#### *8.2.2.6 Output Diode Selection*

Use a Schottky diode for the output diode. The forward current rating of the diode must be higher than the peak input current, and the reverse voltage rating must be higher than the output voltage. Do not use ordinary rectifier diodes, because slow switching speeds and long recovery times cause the efficiency and the load regulation to suffer.

### 8.2.3 Application Curves

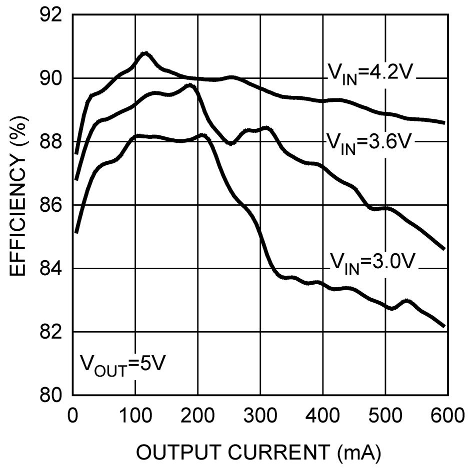
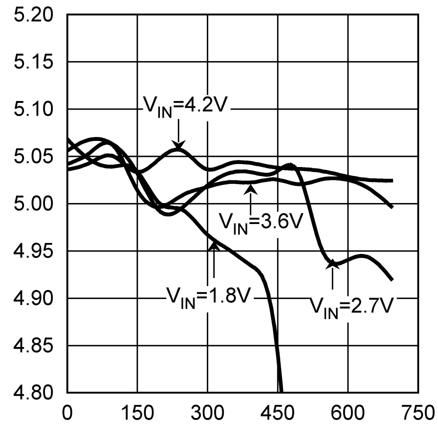



**図 10. Efficiency vs Output Current**




$V_{OUT}$ = 5 V

**図 11. Output Voltage vs Output Current**

## 9 Power Supply Recommendations

The LM2623-Q1 can start up from voltages as low as 1.1 V. On start-up, the control circuitry switches the N-channel MOSFET continuously until the output reaches 3 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 below 0.9 V input, because the internal power for the device can be boot-strapped from the output using the $V_{DD}$ pin.

# 10 Layout

## 10.1 Layout Guidelines

図 12 follows proper layout guidelines — use as a guide for laying out the LM2623-Q1 circuit. The LM2623-Q1 inductive boost converter sees a high switched voltage at the SW pin and a step current through the Schottky diode and output capacitor each switching cycle. The high switching voltage can create interference into nearby nodes due to electric field coupling (I = C × dV/dt). The large step current through the diode and the output capacitor can cause a large voltage spike at the SW and BOOST pins due to parasitic inductance in the step current conducting path (V = L × di/dt). Board layout guidelines are geared towards minimizing this electric field coupling and conducted noise.

*Boost Output Capacitor Placement*, *Schottky Diode Placement*, and *Boost Input / $V_{DD}$ Capacitor Placement* detail the main (layout sensitive) areas of the LM2623-Q1 inductive boost converter in order of decreasing importance:

### 10.1.1 Boost Output Capacitor Placement

Because the output capacitor is in the path of the inductor current discharge path, it experiences a high-current step from 0 A to the peak inductor current each time the switch turns off, and the Schottky diode turns on. Any inductance along this series path from the diodes cathode, through $C_{OUT}$, and back into the LM2623-Q1 GND pin contributes to voltage spikes at SW. These spikes can potentially overvoltage the SW and BOOST pins, or feed through to GND. To avoid this, COUT+ must be connected as close as possible to the cathode of the Schottky diode, and COUT− must be connected as close as possible to the LM2623-Q1 GND bumps. The best placement for $C_{OUT}$ is on the same layer as the LM2623-Q1 to avoid any vias that can add excessive series inductance.

### 10.1.2 Schottky Diode Placement

In the LM2623-Q1 device boost circuit the Schottky diode is in the path of the inductor current discharge. As a result the Schottky diode detects a high-current step from 0 A to the peak inductor current each time the switch turns off, and the diode turns on. Any inductance in series with the diode causes a voltage spike at SW. This can potentially overvoltage the SW pin, or feed through to VOUT and through the output capacitor, into GND. Connecting the anode of the diode as close as possible to the SW pin, and connecting the cathode of the diode as close as possible to $C_{OUT}$ reduces the parasitic inductance and minimizes these voltage spikes.

### 10.1.3 Boost Input / $V_{DD}$ Capacitor Placement

The LM2623-Q1 input capacitor filters the inductor current ripple and the internal MOSFET driver currents. The inductor current ripple can add input voltage ripple due to any series resistance in the input power path. The MOSFET driver currents can add voltage spikes on the input due to the inductance in series with the VIN/$V_{DD}$ and the input capacitor. Place the input capacitor close to the inductor and minimize the current-loop area. Close placement of the $V_{DD}$ capacitor to the $V_{DD}$ and GND pins is critical because any series inductance can create voltage spikes that could appear on the VIN/$V_{DD}$ supply line.

## 10.2 Layout Example

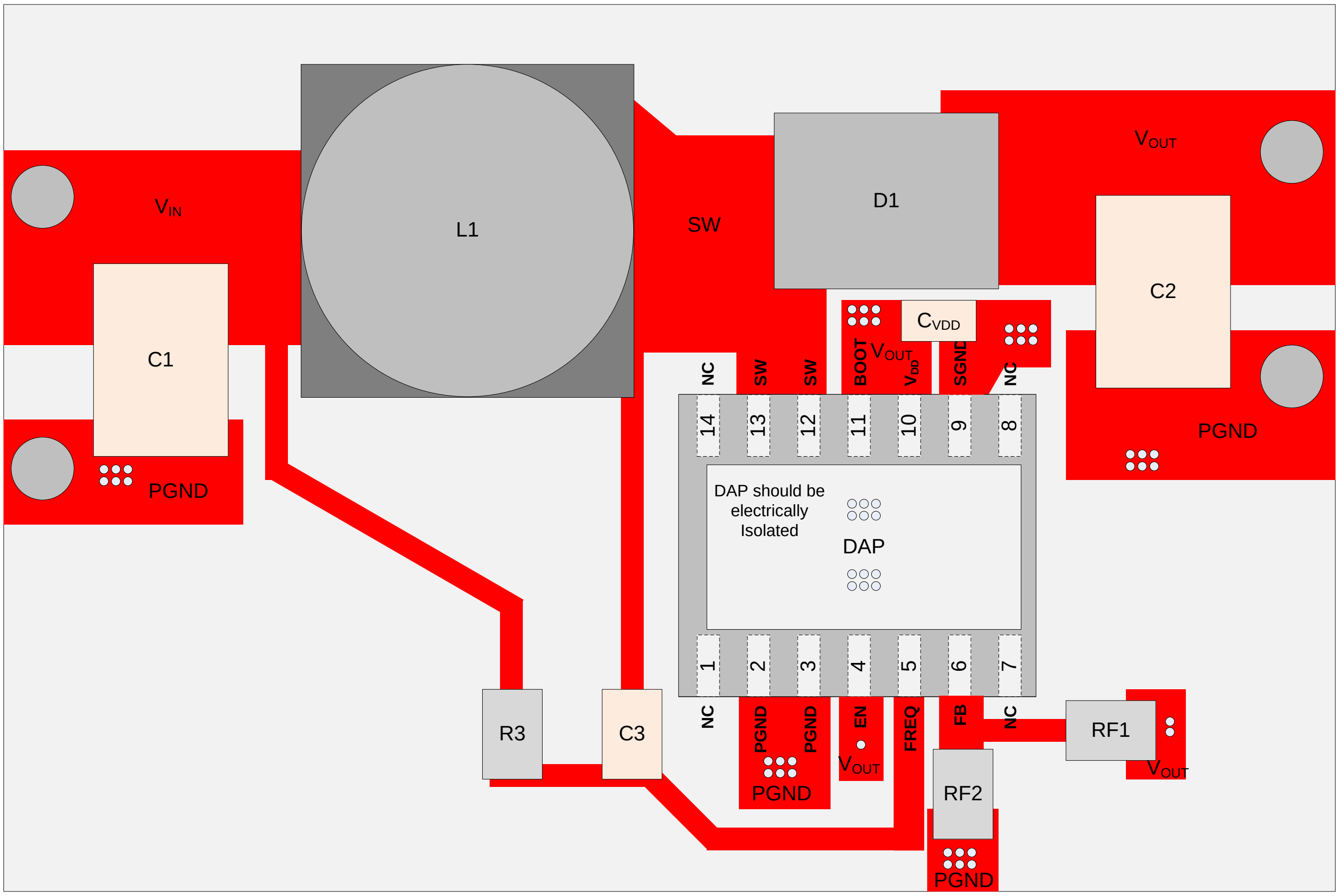



**図 12. LM2623-Q1 Layout Example**

## 10.3 WSON Package Devices

The LM2623-Q1 is offered in the 14-pin WSON surface mount package — for details of the thermal performance as well as mounting and soldering specifications, refer to *Leadless Leadframe Package (LLP)*.

# 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 デベロッパー・ネットワークの製品に関する免責事項

デベロッパー・ネットワークの製品またはサービスに関するTIの出版物は、単独またはTIの製品、サービスと一緒に提供される場合に関係なく、デベロッパー・ネットワークの製品またはサービスの適合性に関する是認、デベロッパー・ネットワークの製品またはサービスの是認の表明を意味するものではありません。

## 11.2 ドキュメントのサポート

### 11.2.1 関連資料

関連資料については、以下を参照してください。

- *『AN-1187 リードレス・リードフレーム・パッケージ(LLP)』*
- *『AN-1221 LM2623汎用昇圧コンバータ回路』*
- *『AN-1258 LM2623昇圧コンバータ - 単純な電源』*

## 11.3 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。

## 11.4 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™オンライン・コミュニティ** ***TIのE2E（Engineer-to-Engineer）コミュニティ。*** エンジニア間の共同作業を促進するために開設されたものです。e2e.ti.comでは、他のエンジニアに質問し、知識を共有し、アイディアを検討して、問題解決に役立てることができます。

**設計サポート** ***TIの設計サポート*** 役に立つE2Eフォーラムや、設計サポート・ツールをすばやく見つけることができます。技術サポート用の連絡先情報も参照できます。

## 11.5 商標

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

## 11.6 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。

## 11.7 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 part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| LM2623QNHLRQ1 | Active | Production | WSON (NHL) \| 14 | 4500 \| LARGE T&R | Yes | SN | Level-2-260C-1 YEAR | -40 to 125 | 2623Q1 |
| LM2623QNHLRQ1.A | Active | Production | WSON (NHL) \| 14 | 4500 \| LARGE T&R | Yes | SN | Level-2-260C-1 YEAR | -40 to 125 | 2623Q1 |
| LM2623QNHLTQ1 | Active | Production | WSON (NHL) \| 14 | 250 \| SMALL T&R | Yes | SN | Level-2-260C-1 YEAR | -40 to 125 | 2623Q1 |
| LM2623QNHLTQ1.A | Active | Production | WSON (NHL) \| 14 | 250 \| SMALL T&R | Yes | SN | Level-2-260C-1 YEAR | -40 to 125 | 2623Q1 |

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

**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.

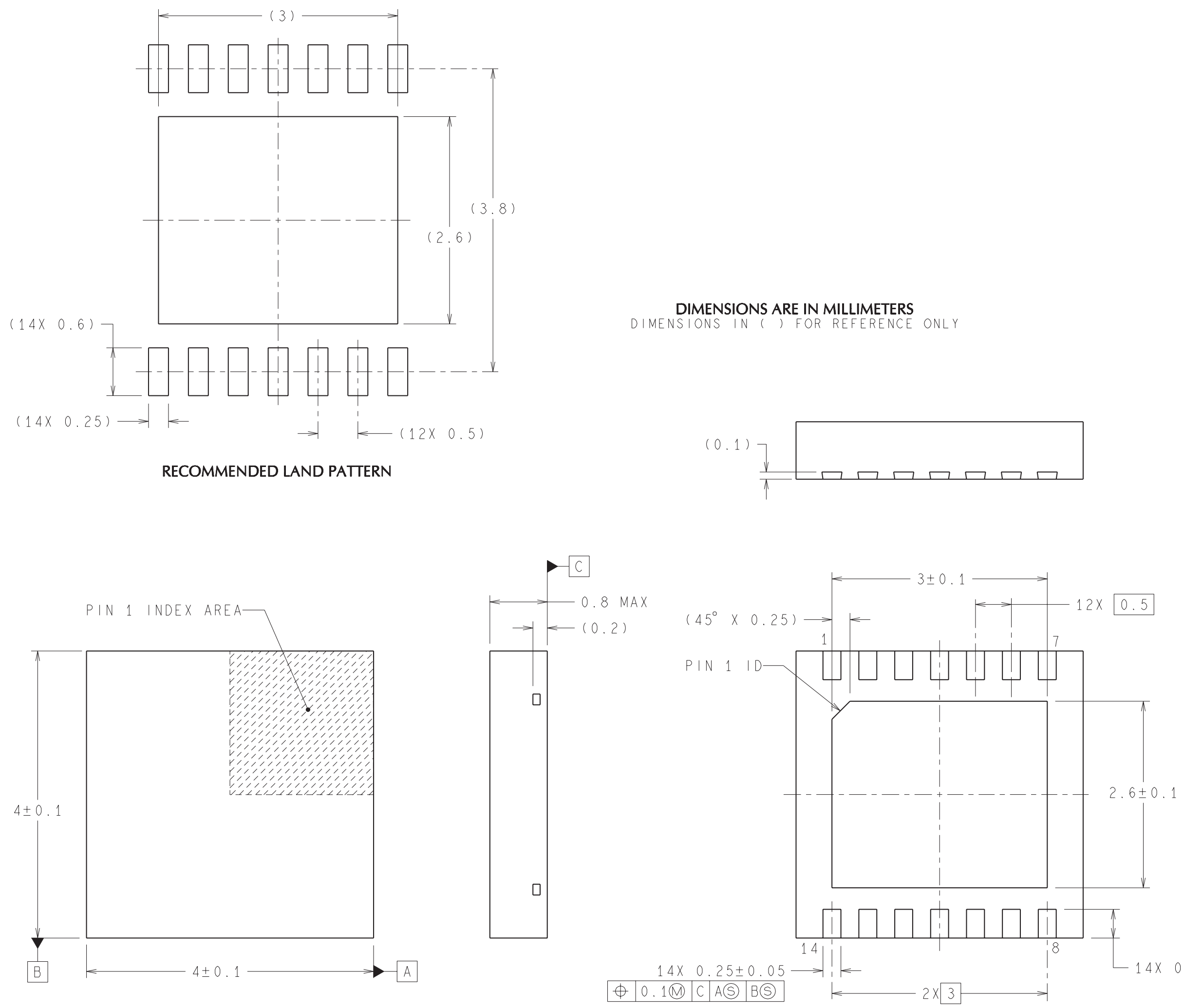
**OTHER QUALIFIED VERSIONS OF LM2623-Q1 :**

- Catalog : LM2623

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

# NHL0014B




SDA14B (Rev A)

# 重要なお知らせと免責事項

テキサス･インスツルメンツは、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、 テキサス･インスツルメンツ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 テキサス･インスツルメンツ製品の選定、(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ます。

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 テキサス･インスツルメンツ製品を使用するアプリケーションの開発の目的でのみ、 テキサス･インスツルメンツ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。 テキサス･インスツルメンツ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、 テキサス･インスツルメンツおよびその代理人を完全に補償するものとし、 テキサス･インスツルメンツは一切の責任を拒否します。

テキサス･インスツルメンツの製品は、 テキサス･インスツルメンツの販売条件、または ti.com やかかる テキサス･インスツルメンツ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。 テキサス･インスツルメンツがこれらのリソースを提供することは、適用される テキサス･インスツルメンツ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、 テキサス･インスツルメンツ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