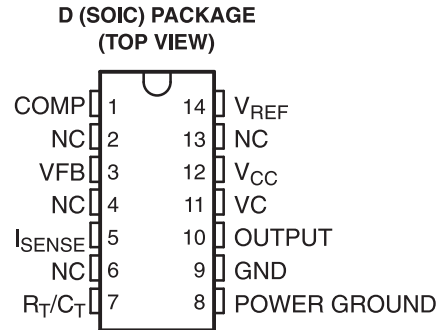


高性能电流模式脉宽调制 (PWM) 控制器

 查询样品: [TL2843B-Q1](#)

特性

- 符合汽车应用要求
- 低启动电流 (**< 0.5mA**)
- 修整的振荡器放电电流
- **500kHz** 电流模式运行
- 自动前馈补偿
- 用于逐周期电流限制的锁存 **PWM**
- 具有欠压闭锁的内部修整基准
- 具有迟滞的高电流图腾柱输出欠压闭锁
- 双脉冲抑制



NC – No internal connection

说明

TL284xB 系列控制集成电路提供了实现离线式或者直流到直流 (dc/dc) 固定频率电流模式控制方案所需的功能，且只采用了极少的外部组件。内部实现的电路包括一个欠压闭锁 (UVLO) 和一个经过修整以在误差放大器输入端上提供高准确度的高精度基准。其它内部电路包括用于确保闭锁操作的逻辑电路、一个负责提供限流控制的脉宽调制 (PWM) 比较器，和一个专为供应或吸收高峰值电流而设计的图腾柱输出级。当处于关闭状态时，此适于驱动 N-通道金属氧化物半导体场效应晶体管 (MOSFET) 的输出级为低电平。

TL284xB 系列产品与标准 TL284x 引脚兼容并具有下列改进。额定启动电流为 0.5mA (最大值)，同时振荡器放电电流被修整为 8.3 mA (典型值)。此外，在欠压闭锁情况下，输出具有一个 1.2V 的最大饱和电压，同时吸收 10mA 的电流 ($V_{CC} = 5V$)。

这些系列的成员之间的主要差异是 UVLO 阈值及最大占空比范围。TL2842B 和 TL2844B 上的 16V (开启) 和 10V (关闭) 的典型 UVLO 阈值使得它们非常适合于离线应用。TL2843B 和 TL2845B 器件相应的典型阈值为 8.4V (开启) 和 7.6V (关闭)。TL2842B 和 TL2843B 器件可在占空比接近 100% 的情况下运行。借助于附加的内部 T 触发器，TL2844B 和 TL2845B 可获得 0% 至 50% 的占空比范围，此附加的内部 T 触发器可每隔一个时钟周期封锁输出。TL284xB 系列器件额定运行温度为 -40°C 至 125°C 。

Table 1. ORDERING INFORMATION⁽¹⁾

| T _A | PACKAGE ⁽²⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------------------|--------------|-----------------------|------------------|
| -40°C to 125°C | SOIC – D | Reel of 2500 | TL2842BQDRQ1 | Product Preview |
| | | | TL2843BQDRQ1 | TL2843BQ |
| | | | TL2844BQDRQ1 | Product Preview |
| | | | TL2845BQDRQ1 | Product Preview |

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.

(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

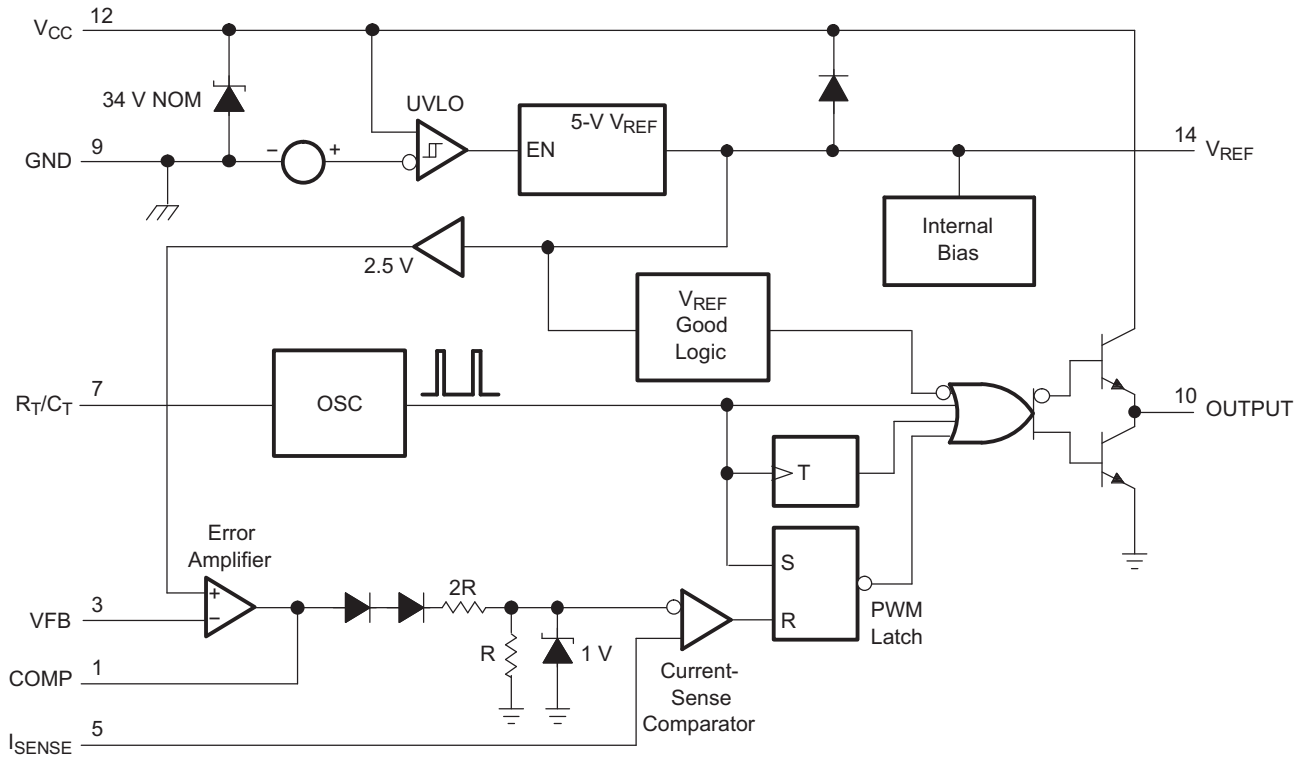


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



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.

FUNCTIONAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS^{(1) (2)}

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

| | | MIN | MAX | UNIT |
|----------------------|--|----------------------------|------|---------------|
| V _{CC} | Supply voltage | Low impedance source | | 30 |
| | | I _{CC} < 30 mA | | Self limiting |
| V _I | Analog input voltage range | VFB and I _{SENSE} | -0.3 | 6.3 |
| I _{CC} | Supply current | | 30 | mA |
| I _O | Output current | | ±1 | A |
| I _{O(sink)} | Error amplifier output sink current | | 10 | mA |
| θ _{JA} | Package thermal impedance ^{(3) (4)} | D package | 97 | °C/W |
| | Output energy | Capacitive load | 5 | μJ |
| T _J | Virtual junction temperature | | 150 | °C |
| T _{stg} | Storage temperature range | | -65 | 150 |

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltages are with respect to the device GND terminal.
- (3) Maximum power dissipation is a function of T_{J(max)}, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is P_D = (T_{J(max)} - T_A)/θ_{JA}. Operating at the absolute maximum T_J of 150°C can impact reliability.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS

| | | MIN | NOM | MAX | UNIT |
|---------------------|------------------------------------|--------------------------------|-----|------|------|
| V _{CC} | Supply voltage | V _{CC} | | 30 | V |
| | | VC ⁽¹⁾ | | 30 | |
| V _I | Input voltage | R _T /C _T | | 0 | V |
| | | VFB and I _{SENSE} | | 0 | |
| V _O | Output voltage | OUTPUT | | 0 | V |
| | | POWER GROUND ⁽¹⁾ | | -0.1 | |
| I _{CC} | Supply current, externally limited | | | 25 | mA |
| I _O | Average output current | | | 200 | mA |
| I _{O(ref)} | Reference output current | | | -20 | mA |
| f _{osc} | Oscillator frequency | | 100 | 500 | kHz |
| T _A | Operating free-air temperature | -40 | | 125 | °C |

- (1) The recommended voltages for VC and POWER GROUND apply only to the 14-pin D package.

REFERENCE SECTION ELECTRICAL CHARACTERISTICS

$V_{CC} = 15\text{ V}^{(1)}$, $R_T = 10\text{ k}\Omega$, $C_T = 3.3\text{ nF}$, over recommended operating free-air temperature range (unless otherwise specified)

| PARAMETER | TEST CONDITIONS | TL284xB | | | UNIT |
|---|--|---------|--------------------|------|---------------|
| | | MIN | TYP ⁽²⁾ | MAX | |
| Output voltage | $I_O = 1\text{ mA}$, $T_J = 25^\circ\text{C}$ | 4.95 | 5 | 5.05 | V |
| Line regulation | $V_{CC} = 12\text{ V to } 25\text{ V}$ | | 6 | 20 | mV |
| Load regulation | $I_O = 1\text{ mA to } 20\text{ mA}$ | | 6 | 25 | mV |
| Average temperature coefficient of output voltage | | | 0.2 | 0.4 | mV/°C |
| Output voltage, worst-case variation | $V_{CC} = 12\text{ V to } 25\text{ V}$, $I_O = 1\text{ mA to } 20\text{ mA}$ | 4.9 | | 5.1 | V |
| Output noise voltage | $f = 10\text{ Hz to } 10\text{ kHz}$, $T_J = 25^\circ\text{C}$ | | 50 | | μV |
| Output-voltage long-term drift | After 1000 h at $T_J = 25^\circ\text{C}$ | | 5 | 25 | mV |
| Short-circuit output current | | -30 | -100 | -180 | mA |

(1) Adjust V_{CC} above the start threshold before setting it to 15 V.

(2) All typical values are at $T_J = 25^\circ\text{C}$.

OSCILLATOR SECTION⁽¹⁾ ELECTRICAL CHARACTERISTICS

$V_{CC} = 15\text{ V}^{(2)}$, $R_T = 10\text{ k}\Omega$, $C_T = 3.3\text{ nF}$, over recommended operating free-air temperature range (unless otherwise specified)

| PARAMETER | TEST CONDITIONS | TL284xB | | | UNIT |
|----------------------------------|---|---------|--------------------|-----|------|
| | | MIN | TYP ⁽³⁾ | MAX | |
| Initial accuracy | $T_J = 25^\circ\text{C}$ | 49 | 52 | 55 | kHz |
| | $T_A = T_{\text{low}} \text{ to } T_{\text{high}}$ | 48 | | 56 | |
| | $T_J = 25^\circ\text{C}$, $R_T = 6.2\text{ k}\Omega$, $C_T = 1\text{ nF}$ | 225 | 250 | 275 | |
| Voltage stability | $V_{CC} = 12\text{ V to } 25\text{ V}$ | | 0.2 | 1 | % |
| Temperature stability | | | 5 | | % |
| Amplitude | Peak to peak | | 1.7 | | V |
| Discharge current ⁽⁴⁾ | $T_J = 25^\circ\text{C}$, $R_T/C_T = 2\text{ V}$ | 7.8 | 8.3 | 8.8 | mA |
| | $R_T/C_T = 2\text{ V}$ | 7.5 | | 8.8 | |

(1) Output frequency equals oscillator frequency for the TL2842B and TL2843B. Output frequency is one-half the oscillator frequency for the TL2844B and TL2845B.

(2) Adjust V_{CC} above the start threshold before setting it to 15 V.

(3) All typical values are at $T_J = 25^\circ\text{C}$.

(4) Specified by design. Not production tested.

ERROR-AMPLIFIER SECTION ELECTRICAL CHARACTERISTICS

$V_{CC} = 15\text{ V}^{(1)}$, $R_T = 10\text{ k}\Omega$, $C_T = 3.3\text{ nF}$, over recommended operating free-air temperature range (unless otherwise specified)

| PARAMETER | TEST CONDITIONS | TL284xB | | | UNIT |
|---------------------------------|---|---------|--------------------|------|---------------|
| | | MIN | TYP ⁽²⁾ | MAX | |
| Feedback input voltage | COMP = 2.5 V | 2.45 | 2.5 | 2.55 | V |
| Input bias current | | | -0.3 | -1 | μA |
| Open-loop voltage amplification | $V_O = 2\text{ V to }4\text{ V}$ | 65 | 90 | | dB |
| Gain-bandwidth product | | 0.7 | 1 | | MHz |
| Supply-voltage rejection ratio | $V_{CC} = 12\text{ V to }25\text{ V}$ | 60 | 70 | | dB |
| Output sink current | VFB = 2.7 V, COMP = 1.1 V | 2 | 6 | | mA |
| Output source current | VFB = 2.3 V, COMP = 5 V | -0.5 | -0.8 | | mA |
| High-level output voltage | VFB = 2.3 V, $R_L = 15\text{ k}\Omega$ to GND | 5 | 6 | | V |
| Low-level output voltage | VFB = 2.7 V, $R_L = 15\text{ k}\Omega$ to GND | | 0.7 | 1.1 | V |

(1) Adjust V_{CC} above the start threshold before setting it to 15 V.

(2) All typical values are at $T_J = 25^\circ\text{C}$.

CURRENT-SENSE SECTION ELECTRICAL CHARACTERISTICS

$V_{CC} = 15\text{ V}^{(1)}$, $R_T = 10\text{ k}\Omega$, $C_T = 3.3\text{ nF}$, over recommended operating free-air temperature range (unless otherwise specified)

| PARAMETER | TEST CONDITIONS | TL284xB | | | UNIT |
|---|---------------------------------------|---------|--------------------|------|---------------|
| | | MIN | TYP ⁽²⁾ | MAX | |
| Voltage amplification ^{(3) (4)} | | 2.85 | 3 | 3.15 | V/V |
| Current-sense comparator threshold ⁽³⁾ | COMP = 5 V | 0.9 | 1 | 1.1 | V |
| Supply-voltage rejection ratio ⁽³⁾ | $V_{CC} = 12\text{ V to }25\text{ V}$ | | 70 | | dB |
| Input bias current | | | -2 | -10 | μA |
| Delay time to output ⁽⁵⁾ | VFB = 0 V to 2 V | | 150 | 300 | ns |

(1) Adjust V_{CC} above the start threshold before setting it to 15 V.

(2) All typical values are at $T_J = 25^\circ\text{C}$.

(3) Measured at the trip point of the latch, with VFB at 0 V.

(4) Measured between I_{SENSE} and COMP, with the input changing from 0 V to 0.8 V.

(5) Specified by design. Not production tested.

Output Section Electrical Characteristics

$V_{CC} = 15\text{ V}^{(1)}$, $R_T = 10\text{ k}\Omega$, $C_T = 3.3\text{ nF}$, over recommended operating free-air temperature range (unless otherwise specified)

| PARAMETER | TEST CONDITIONS | TL284xB | | | UNIT |
|--------------------------------|--|---------|--------------------|-----|------|
| | | MIN | TYP ⁽²⁾ | MAX | |
| High-level output voltage | $I_{OH} = -20\text{ mA}$ | 13 | 13.5 | | V |
| | $I_{OH} = -200\text{ mA}$ | 12 | 13.5 | | |
| Low-level output voltage | $I_{OL} = 20\text{ mA}$ | | 0.1 | 0.4 | V |
| | $I_{OL} = 200\text{ mA}$ | | 1.5 | 2.2 | |
| Rise time ⁽³⁾ | $C_L = 1\text{ nF}$, $T_J = 25^\circ\text{C}$ | | 50 | 150 | ns |
| Fall time ⁽³⁾ | $C_L = 1\text{ nF}$, $T_J = 25^\circ\text{C}$ | | 50 | 150 | ns |
| UVLO saturation ⁽³⁾ | $V_{CC} = 5\text{ V}$, $I_{OL} = 1\text{ mA}$ | | 0.7 | 1.2 | V |

(1) Adjust V_{CC} above the start threshold before setting it to 15 V.

(2) All typical values are at $T_J = 25^\circ\text{C}$.

(3) Specified by design. Not production tested.

UNDERVOLTAGE-LOCKOUT SECTION ELECTRICAL CHARACTERISTICS

$V_{CC} = 15\text{ V}^{(1)}$, $R_T = 10\text{ k}\Omega$, $C_T = 3.3\text{ nF}$, over recommended operating free-air temperature range (unless otherwise specified)

| PARAMETER | TEST CONDITIONS | TL284xB | | | UNIT |
|--|-----------------|---------|--------------------|-----|------|
| | | MIN | TYP ⁽²⁾ | MAX | |
| Start threshold voltage | | 7.8 | 8.4 | 9 | V |
| Minimum operating voltage after start-up | | 7 | 7.6 | 8.2 | V |

(1) Adjust V_{CC} above the start threshold before setting it to 15 V.

(2) All typical values are at $T_J = 25^\circ\text{C}$.

PULSE-WIDTH MODULATOR SECTION ELECTRICAL CHARACTERISTICS

$V_{CC} = 15\text{ V}^{(1)}$, $R_T = 10\text{ k}\Omega$, $C_T = 3.3\text{ nF}$, over recommended operating free-air temperature range (unless otherwise specified)

| PARAMETER | TEST CONDITIONS | TL284xB | | | UNIT |
|-----------------------------------|-----------------|---------|--------------------|-----|------|
| | | MIN | TYP ⁽²⁾ | MAX | |
| Maximum duty cycle ⁽³⁾ | | 94 | 96 | 100 | % |
| Minimum duty cycle | | | | 0 | % |

(1) Adjust V_{CC} above the start threshold before setting it to 15 V.

(2) All typical values are at $T_J = 25^\circ\text{C}$.

(3) Specified by design. Not production tested.

SUPPLY VOLTAGE ELECTRICAL CHARACTERISTICS

$V_{CC} = 15\text{ V}^{(1)}$, $R_T = 10\text{ k}\Omega$, $C_T = 3.3\text{ nF}$, over recommended operating free-air temperature range (unless otherwise specified)

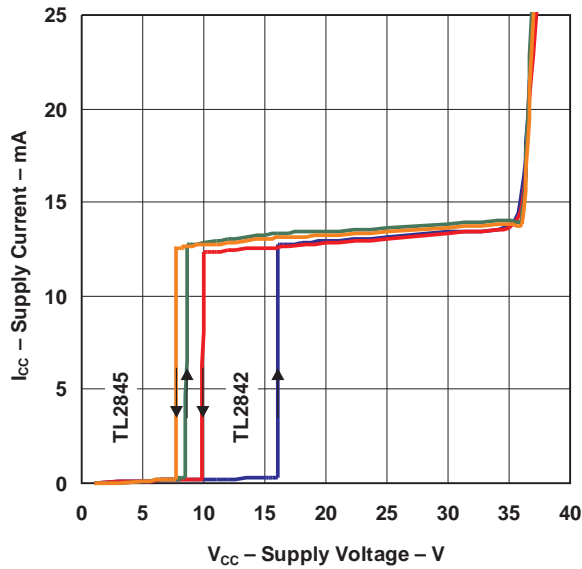
| PARAMETER | TEST CONDITIONS | TL284xB | | | UNIT |
|--------------------------|----------------------------|---------|--------------------|-----|------|
| | | MIN | TYP ⁽²⁾ | MAX | |
| Start-up current | | | 0.3 | 0.5 | mA |
| Operating supply current | VFB and I_{SENSE} at 0 V | | 11 | 17 | mA |
| Limiting voltage | $I_{CC} = 25\text{ mA}$ | 30 | 34 | | V |

(1) Adjust V_{CC} above the start threshold before setting it to 15 V.

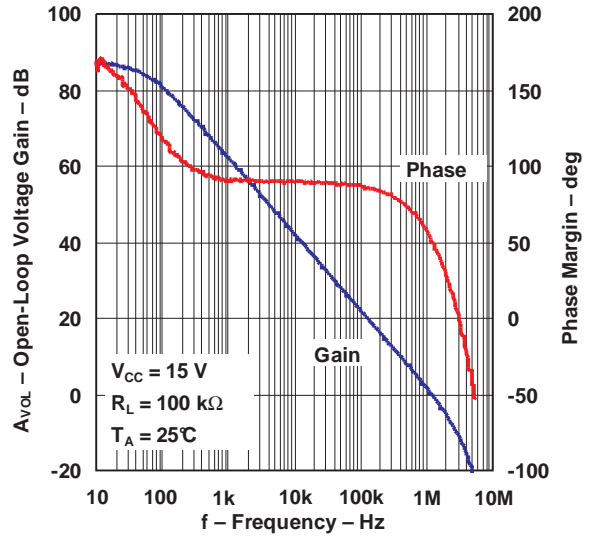
(2) All typical values are at $T_J = 25^\circ\text{C}$.

TYPICAL CHARACTERISTICS

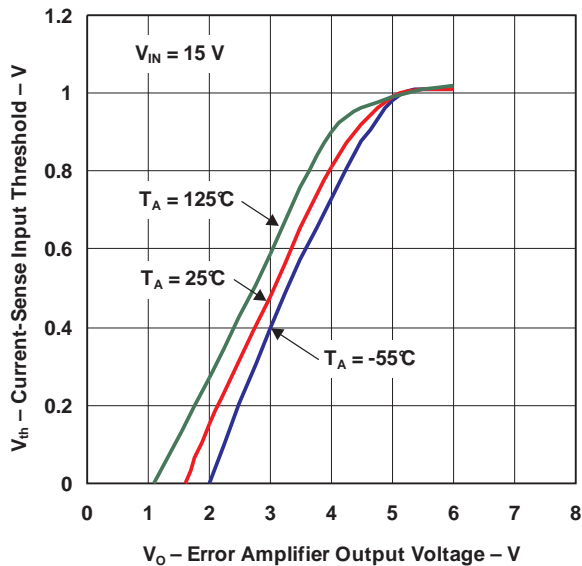
SUPPLY CURRENT
vs
SUPPLY VOLTAGE



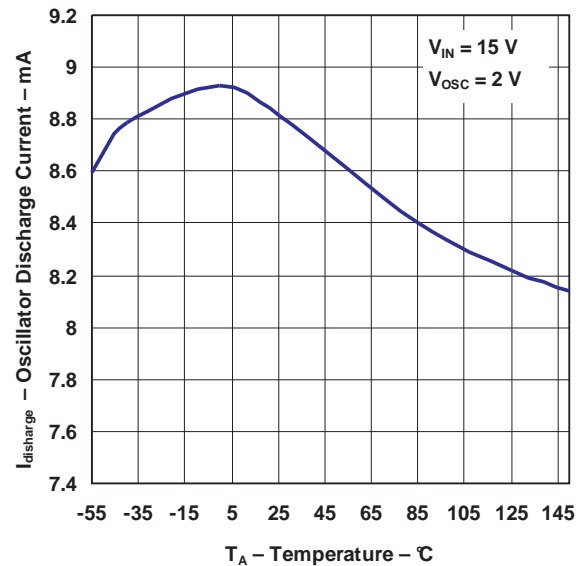
ERROR AMPLIFIER OPEN-LOOP
GAIN AND PHASE
vs
FREQUENCY



CURRENT-SENSE INPUT THRESHOLD
vs
ERROR AMPLIFIER OUTPUT VOLTAGE

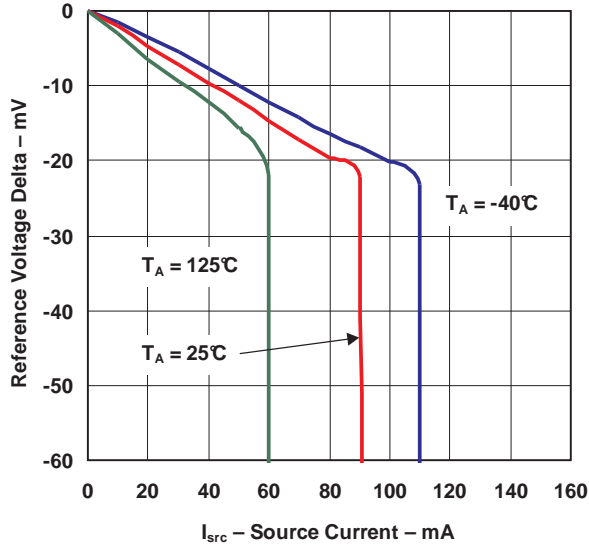


OSCILLATOR DISCHARGE CURRENT
vs
TEMPERATURE

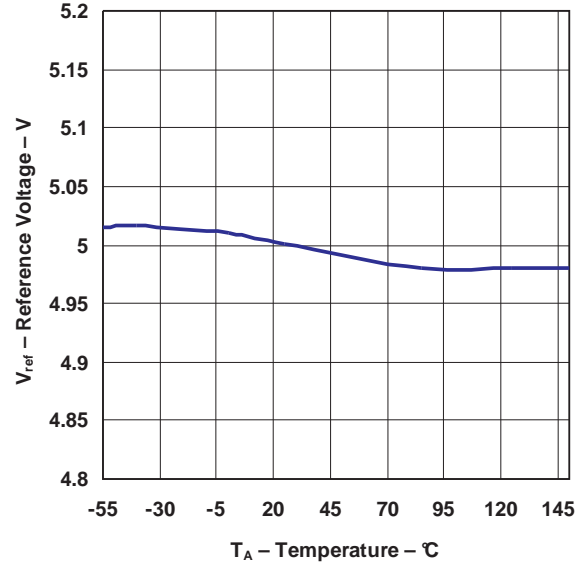


TYPICAL CHARACTERISTICS (continued)

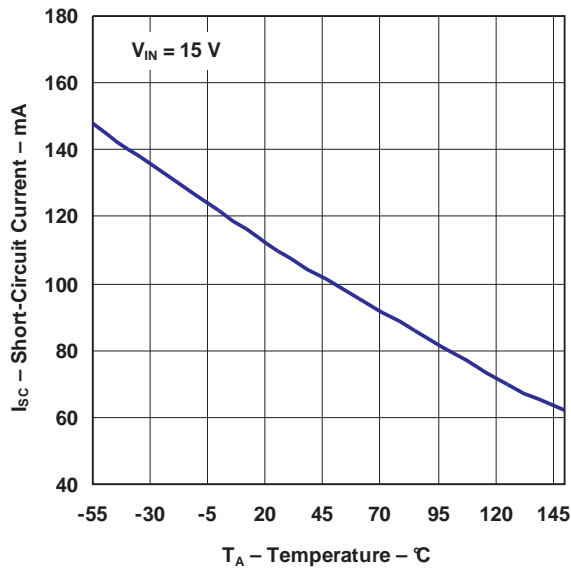
**REFERENCE VOLTAGE
vs
SOURCE CURRENT**



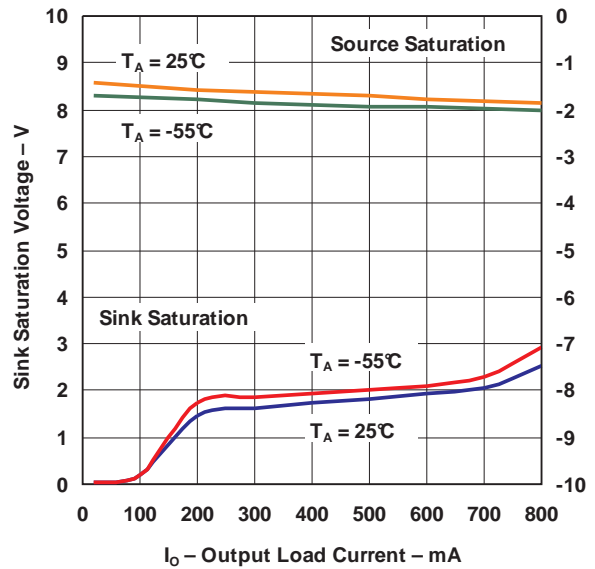
**REFERENCE VOLTAGE
vs
TEMPERATURE**



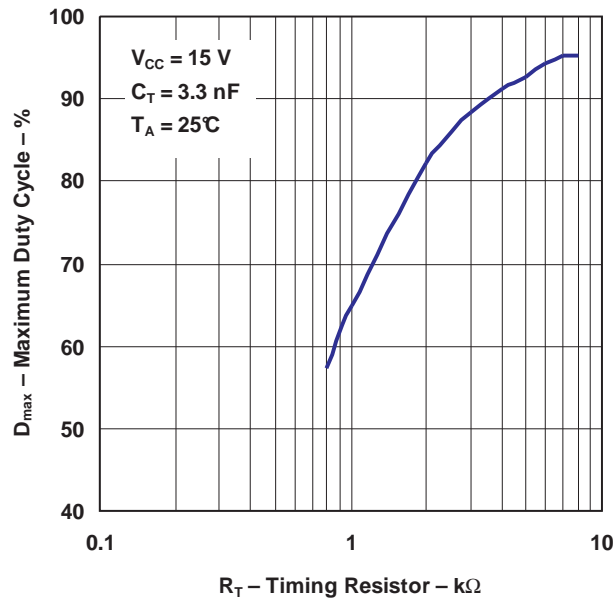
**REFERENCE SHORT-CIRCUIT CURRENT
vs
TEMPERATURE**



**OUTPUT SATURATION VOLTAGE
vs
LOAD CURRENT**

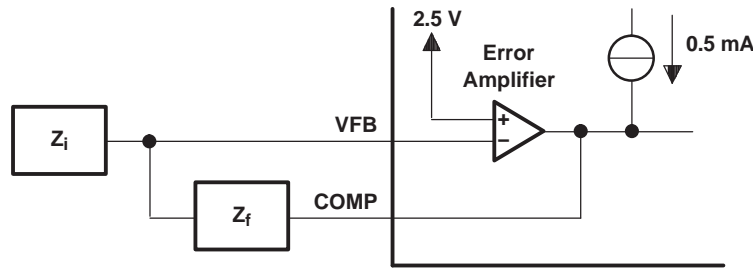


TYPICAL CHARACTERISTICS (continued)
MAXIMUM OUTPUT DUTY CYCLE
vs
TIMING RESISTOR



APPLICATION INFORMATION

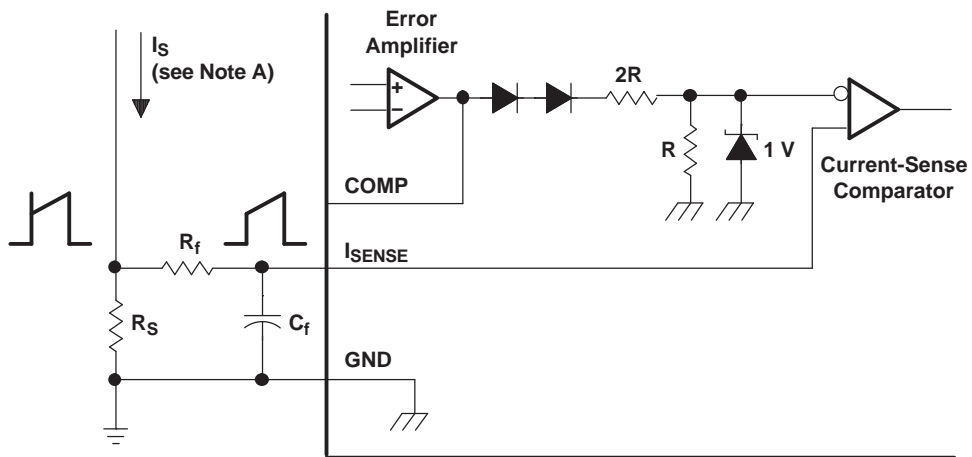
The error-amplifier configuration circuit is shown in Figure 1.



- A. Error amplifier can source or sink up to 0.5 mA.

Figure 1. Error-Amplifier Configuration

The current-sense circuit is shown in Figure 2.



- A. Peak current (I_S) is determined by the formula: $I_{S(max)} = 1 V/R_S$
- B. A small RC filter formed by resistor R_f and capacitor C_f may be required to suppress switch transients.

Figure 2. Current-Sense Circuit

The oscillator frequency is set using the circuit shown in Figure 3. The frequency is calculated as:

$$f = 1 / R_T C_T$$

For $R_T > 5 \text{ k}\Omega$:

$$f \approx 1.72 / R_T C_T$$

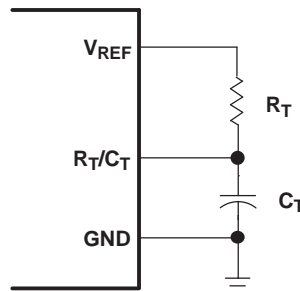
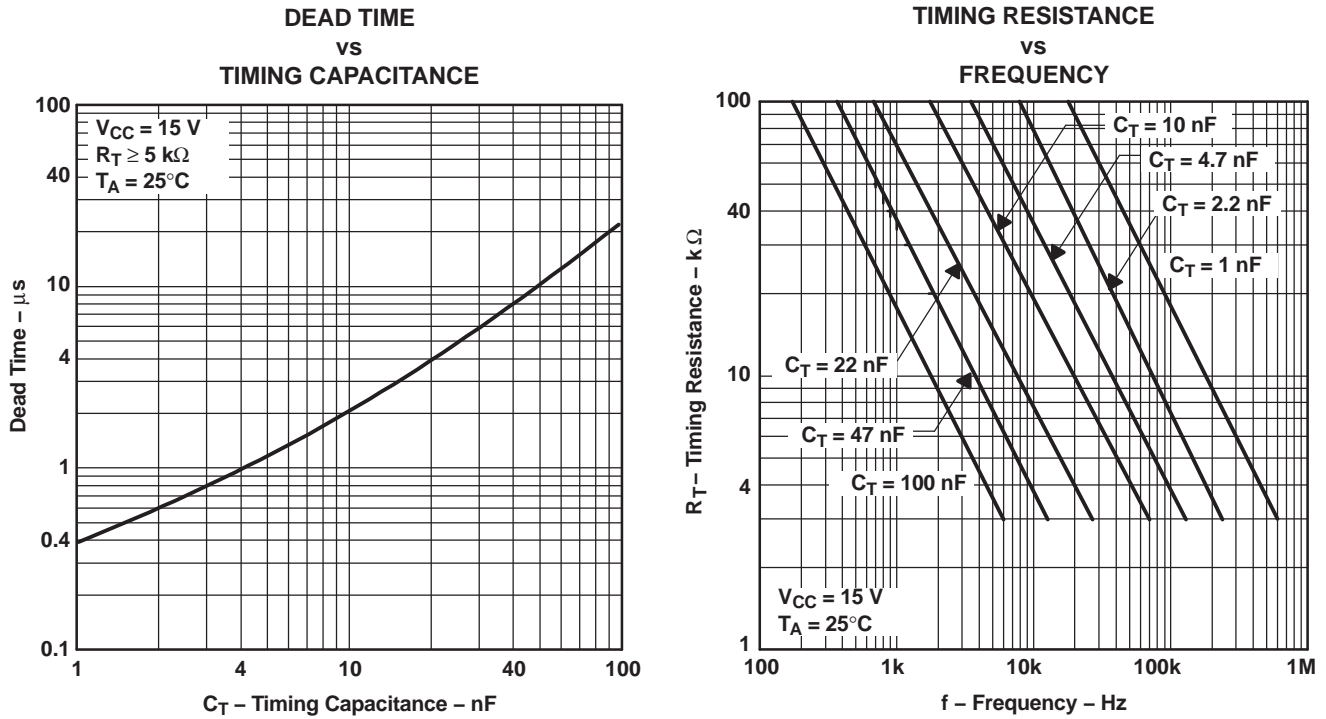


Figure 3. Oscillator Section



Open-Loop Laboratory Test Fixture

In the open-loop laboratory test fixture (see Figure 4), high peak currents associated with loads necessitate careful grounding techniques. Timing and bypass capacitors should be connected close to the GND terminal in a single-point ground. The transistor and 5-k Ω potentiometer sample the oscillator waveform and apply an adjustable ramp to the I_{SENSE} terminal.

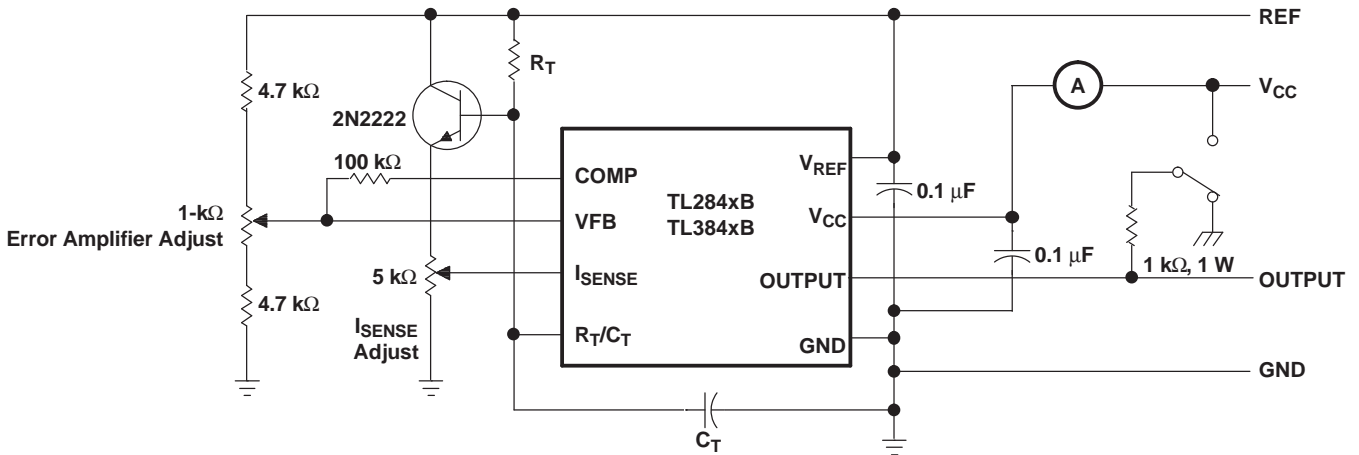


Figure 4. Open-Loop Laboratory Test Fixture

Shutdown Technique

The PWM controller (see [Figure 5](#)) can be shut down by two methods: either raise the voltage at I_{SENSE} above 1 V or pull the COMP terminal below a voltage two diode drops above ground. Either method causes the output of the PWM comparator to be high (see the *Functional Block Diagram*). The PWM latch is reset dominant so that the output remains low until the next clock cycle after the shutdown condition at the COMP or I_{SENSE} terminal is removed. In one example, an externally latched shutdown can be accomplished by adding an SCR that resets by cycling V_{CC} below the lower UVLO threshold. At this point, the reference turns off, allowing the SCR to reset.

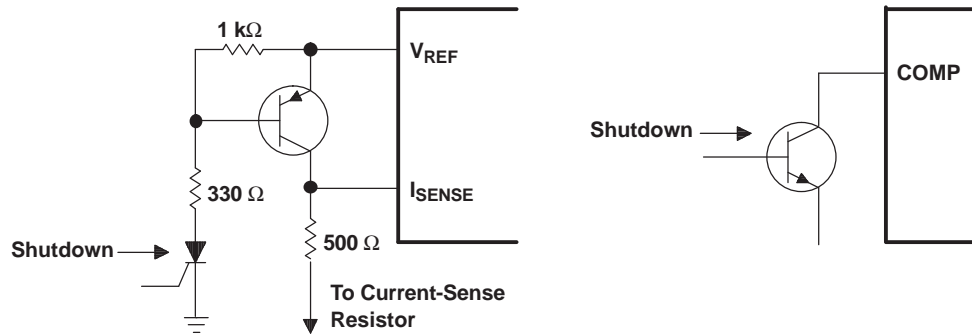


Figure 5. Shutdown Techniques

A fraction of the oscillator ramp can be summed resistively with the current-sense signal to provide slope compensation for converters requiring duty cycles over 50% (see [Figure 6](#)). Note that capacitor C forms a filter with R2 to suppress the leading-edge switch spikes.

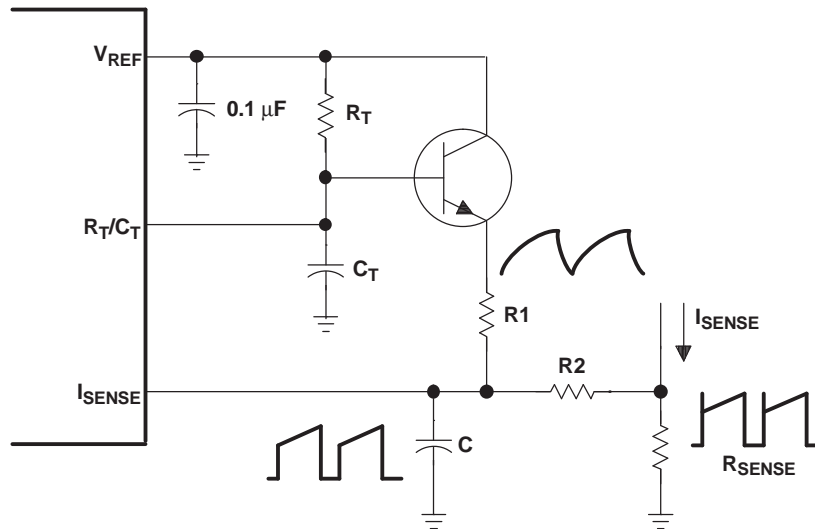


Figure 6. Slope Compensation

REVISION HISTORY

| Changes from Original (July 2012) to Revision A | Page |
|---|-------------|
| • Changed 从 8 引脚到 14 引脚封装的插脚引线 | 1 |
| • Changed the Functional Block diagram pin numbers for the 14-pin D package | 2 |

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 |
|------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|---------|
| TL2843BQDRQ1 | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TL2843BQ | Samples |

(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.

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D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 -  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - 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.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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