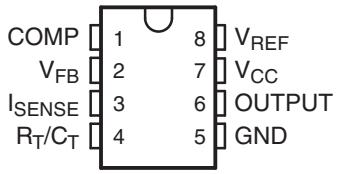
CURRENT-MODE PWM CONTROLLER

FEATURES

- **Qualified for Automotive Applications**
- **Extended Temperature Performance of –40°C to 125°C**
- **Optimized for Off-Line and DC-to-DC Converters**
- **Low Start-Up Current (<0.5 mA)**
- **Trimmed Oscillator-Discharge Current**
- **Automatic Feed-Forward Compensation**
- **Pulse-by-Pulse Current Limiting**
- **Enhanced Load-Response Characteristics**
- **Under-Voltage Lockout With Hysteresis**
- **Double-Pulse Suppression**
- **High-Current Totem-Pole Output**
- **Internally Trimmed Bandgap Reference**
- **500-kHz Operation**
- **Low R_O Error Amp**

D PACKAGE
(TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

The UC2843A control IC is a pin-for-pin compatible improved version of the UC2843. Providing the necessary features to control current mode switched mode power supplies, this device has the following improved features. Start up current is specified to be less than 0.5 mA. Oscillator discharge is trimmed to 8.3 mA. During undervoltage lockout, the output stage can sink at least 10 mA at less than 1.2 V for V_{CC} over 5 V.

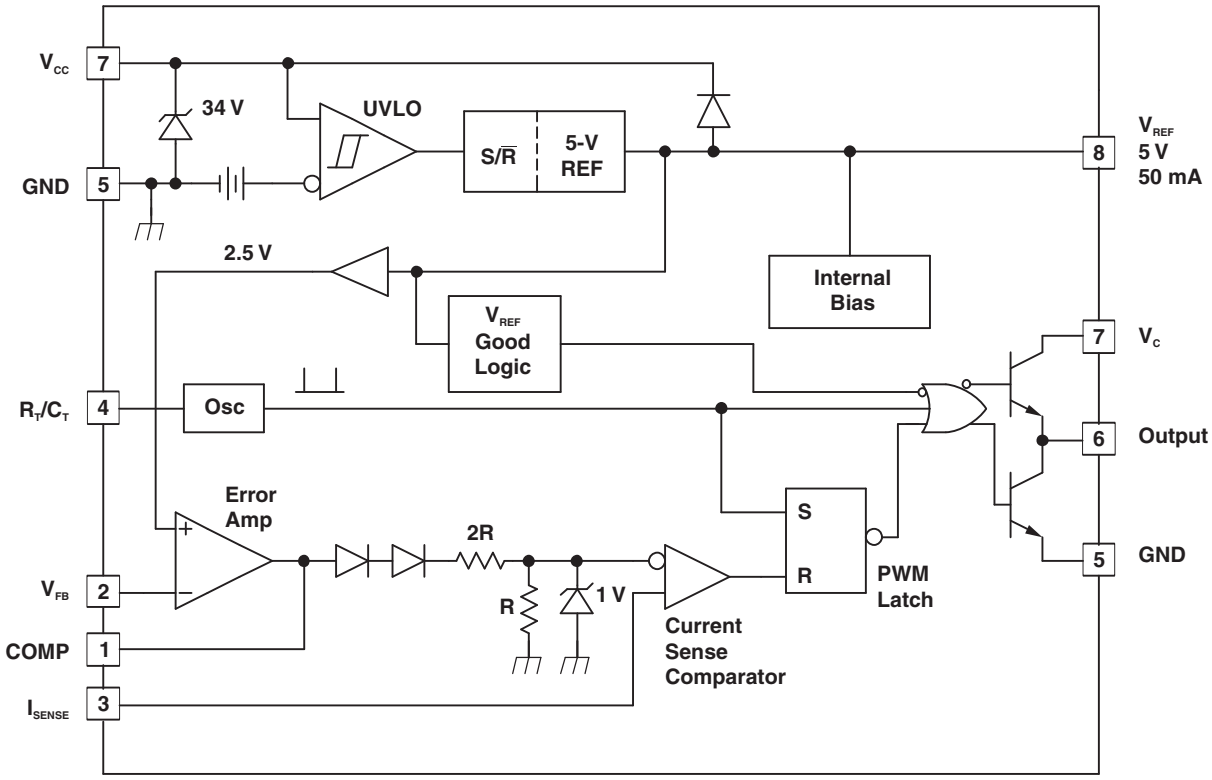
PART NUMBER	UVLO ON	UVLO OFF	MAXIMUM DUTY CYCLE
UC2843A	8.5 V	7.9 V	<100%

ORDERING INFORMATION(1)

T_A	PACKAGE(2)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 125°C	SOIC-8 – D8	Reel of 2500	UC2843AQD8RQ1	UC2843AQ

(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, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTIONAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS(1)(2)

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

		VALUE	UNIT
	V_{CC} voltage (low impedance source)	30	V
	V_{CC} voltage (I_{CC} mA)	Self limiting	
I_O	Output current	±1	A
	Output energy (capacitive load)	5	µJ
	Analog inputs (pins 3 and 5)	–0.3 to 6.3	V
	Error amplifier output sink current	10	mA
	Power dissipation at T_A < 25°C (14-pin D package)	1	W
θ_{JA}	Package thermal impedance(3)	97	°C/W
T_{stg}	Storage temperature range	–65 to 150	°C
	Lead temperature soldering 1,6 mm (1/16 inch) from case for 10 seconds	260	°C

(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) Unless otherwise indicated, voltages are reference to ground, and currents are positive into and negative out of the specified terminals.
(3) Long-term high-temperature storage and/or extended use at maximum recommended operating conditions may result in a reduction of overall device life. See http://www.ti.com/ep_quality for additional information on enhanced plastic packaging.

ELECTRICAL CHARACTERISTICS

T_A = –40°C to 125°C, V_{CC} = 15 V(1), R_T = 10 kΩ, C_T = 3.3 nF, T_A = T_J (unless otherwise stated)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Reference Section						
Output voltage	T_J = 25°C, I_O = 1 mA		4.95	5.0	5.05	V
Line regulation voltage	V_{IN} = 12 V to 25 V			6	20	mV
Load regulation voltage	I_O = 1 mA to 20 mA			6	25	mV
Temperature stability(2)(3)				0.2	0.4	mV/°C
Total output variation voltage	Line, load, temperature		4.9		5.1	V
Output noise voltage	f = 10 Hz to 10 kHz	T_J = 25°C		50		μV
Long term stability	1000 hours	T_A = 125°C		5	25	mV
Output short-circuit current			–30	–100	–180	mA
Oscillator Section						
Initial accuracy(4)		T_J = 25°C	47	52	57	kHz
Voltage stability	V_{CC} = 12 V to 25 V			0.2	1	%
Temperature stability	T_A = MIN to MAX			5		%
Amplitude peak-to-peak	V pin 7			1.7		V
Discharge current(5)	V pin 7 = 2 V	T_J = 25°C	7.8	8.3	8.8	mA
		T_J = Full range	7.5		8.8	
Error Amplifier Section						
Input voltage	COMP = 2.5 V		2.45	2.5	2.55	V
Input bias current				–0.3	–1	μA
Open loop voltage gain (AVOL)	V_O = 2 V to 4 V		65	90		dB
Unity gain bandwidth(3)		T_J = 25°C	0.7	1		MHz
PSRR	V_{CC} = 12 V to 25 V		60	70		dB
Output sink current	FB = 2.7 V, COMP = 1.1 V		2	6		mA
Output source current	FB = 2.3 V, COMP = 5 V		–0.5	–0.8		mA
VOUT high	FB = 2.3 V, RL = 15 kΩ to GND		5	6		V
VOUT low	FB = 2.7 V, RL = 15 kΩ to V_{REF}			0.7	1.1	V
Current Sense Section						
Gain(6)(7)			2.85	3	3.15	V/V
Maximum input signal(6)	COMP = 5 V		0.9	1	1.1	V
PSRR(6)	V_{CC} = 12 V to 25 V			70		dB
Input bias current				–2	–10	μA
Delay to output(3)	I_{SENSE} = 0 V to 2 V			150	300	ns

(1) Adjust V_{CC} above the start threshold before setting at 15 V.
(2) Temperature stability, sometimes referred to as average temperature coefficient, is described by the equation:
Temperature Stability = (V_{REF} (max) – V_{REF} (min))/(T_J (max) – T_J (min)). V_{REF} (max) and V_{REF} (min) are the maximum and minimum reference voltage measured over the appropriate temperature range. Note that the extremes in voltage do not necessarily occur at the extremes in temperature.
(3) Specified by design.
(4) Output frequency equals oscillator frequency for the UC2843A.
(5) This parameter is measured with R_T = 10 kΩ to V_{REF}. This contributes approximately 300 μA of current to the measurement. The total current flowing into the R_T/R_C pin is approximately 300 μA higher than the measured value.
(6) Parameter measured at trip point of latch with V_{FB} at 0 V.
(7) Gain is defined by: A = $\Delta V_{COMP}/\Delta V_{SENSE}$; 0 ≤ V_{SENSE} ≤ 0.8 V.

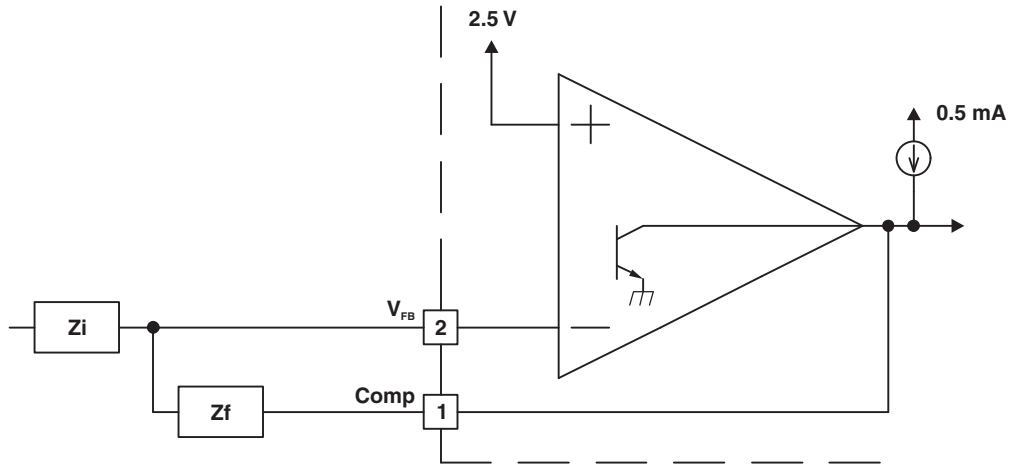
ELECTRICAL CHARACTERISTICS (continued)

T_A = –40°C to 125°C, V_{CC} = 15 V, R_T = 10 kΩ, C_T = 3.3 nF, T_A = T_J (unless otherwise stated)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Output Section (OUT)						
Low level output voltage	I_{OUT} = 20 mA			0.1	0.4	V
	I_{OUT} = 200 mA			15	2.2	
High level output voltage	I_{OUT} = –20 mA		13	13.5		V
	I_{OUT} = –200 mA		12	13.5		
Rise time(8)	C_L = 1 nF	T_J = 25°C		50	150	ns
Fall time(8)	C_L = 1 nF	T_J = 25°C		50	150	ns
UVLO saturation	V_{CC} = 5 V, I_{OUT} = 10 mA			0.7	1.2	V
Undervoltage Lockout Section (UVLO)						
Start threshold			7.8	8.4	9	V
Minimum operation voltage after turn on			7	7.6	8.2	V
PWM Section						
Maximum duty cycle			94	96	100	%
Minimum duty cycle					0	%
Total Standby Current						
Start-up current				0.3	0.5	mA
Operating supply current	FB = 0 V, SENSE = 0 V			11	17	mA
V_{CC} internal zener voltage	I_{CC} = 25 mA		30	34		V

(8) Specified by design.

PARAMETER MEASUREMENT INFORMATION



A. The error amplifier can source up to 0.5 mA and sink up to 2 mA.

Figure 1. Error Amp Configuration

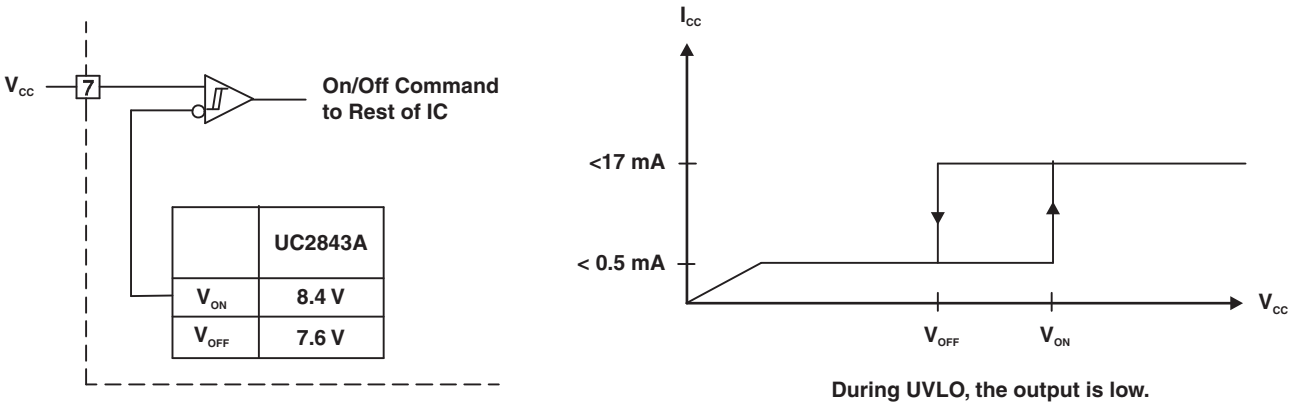
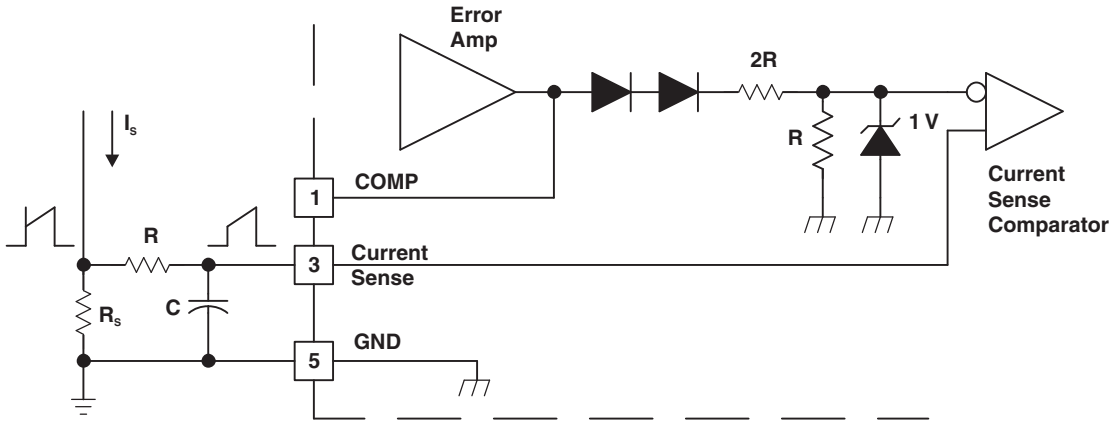


Figure 2. Undervoltage Lockout



A. Peak current (Is) is determined by the formula: Ismax = 1.0 V/R_S
A small RC filter may be required to supress switch transients.

Figure 3. Current Sense Circuit

PARAMETER MEASUREMENT INFORMATION (continued)

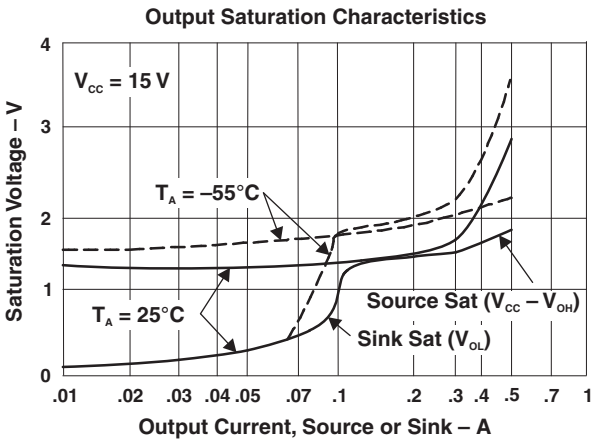


Figure 4.

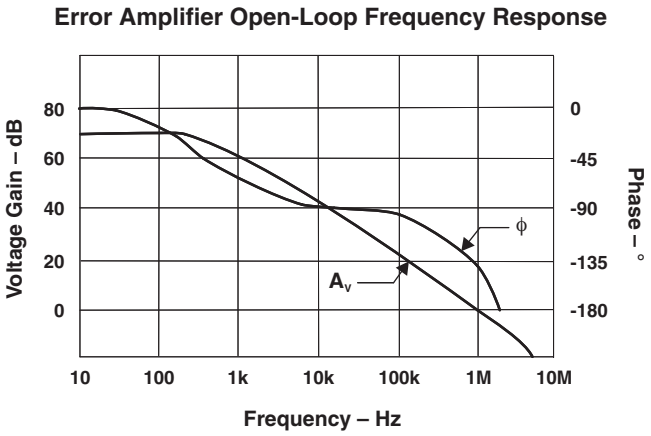


Figure 5.

APPLICATION INFORMATION

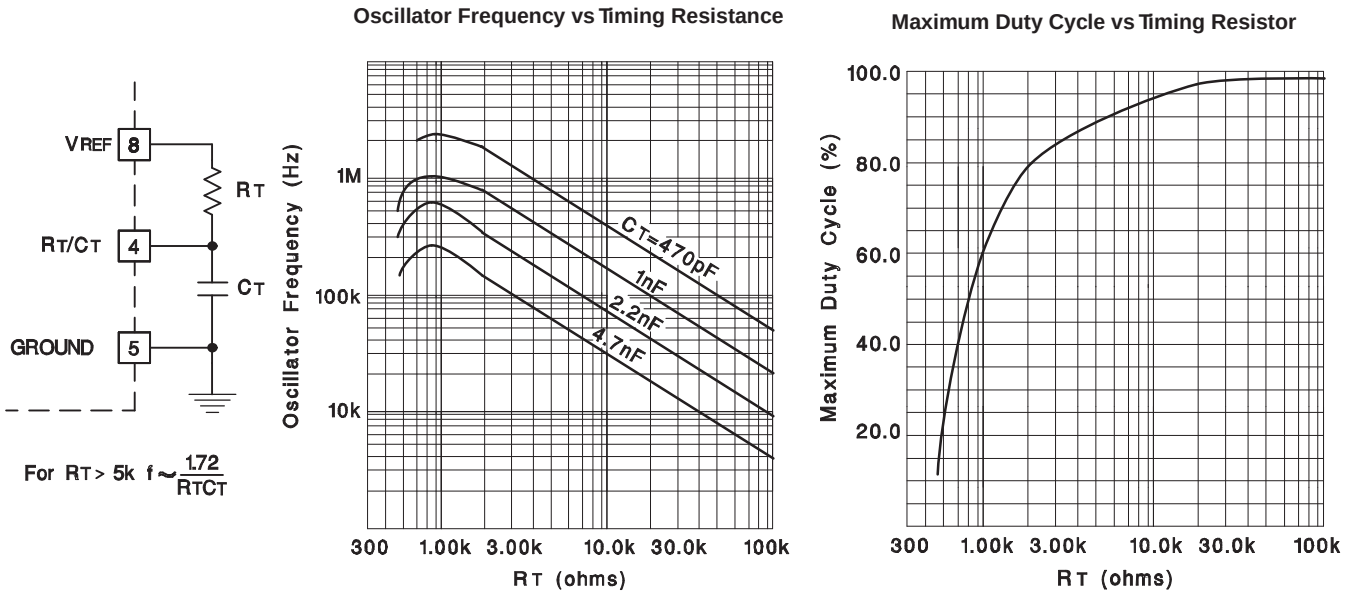
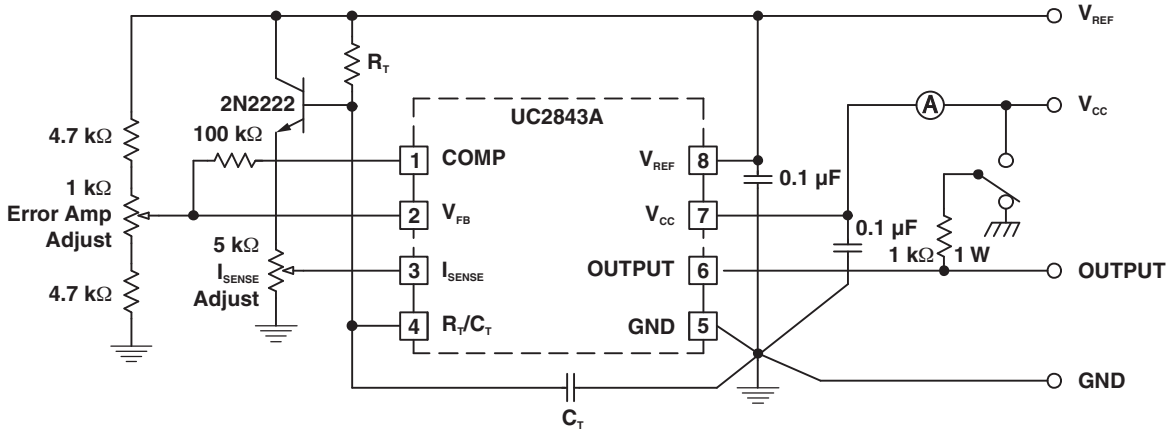
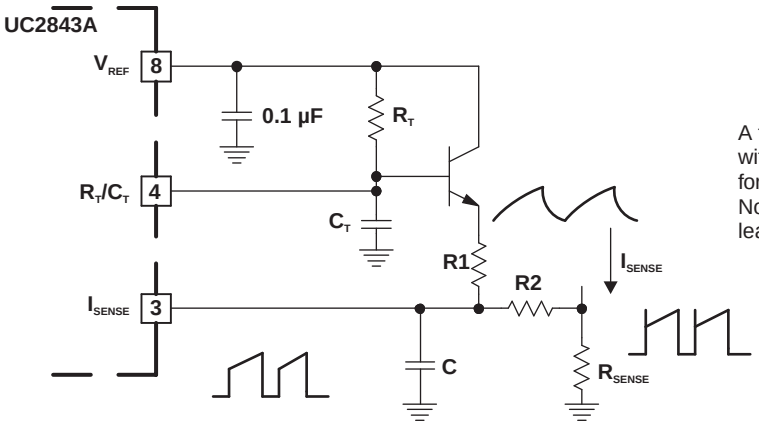


Figure 6. Oscillator



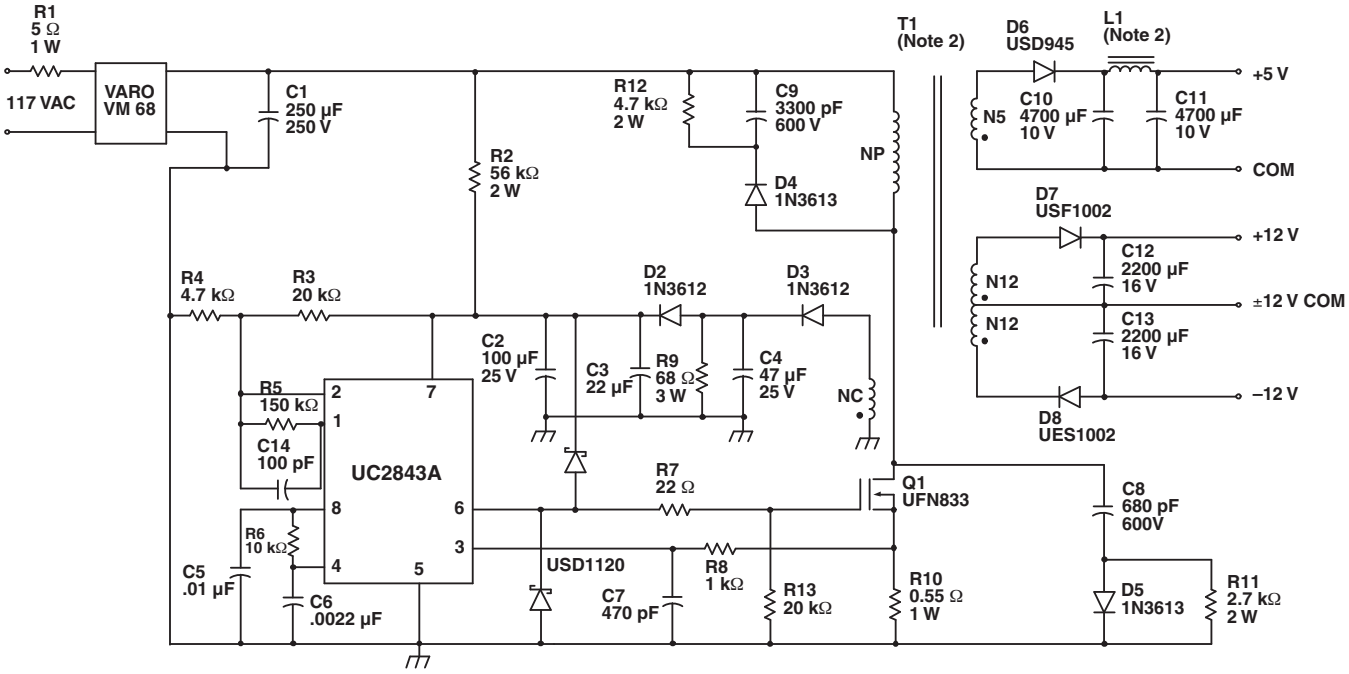
A. High peak currents associated with capacitive loads necessitate careful grounding techniques. Timing and bypass capacitors should be connected close to pin 5 in a single point ground. The transistor and 5k potentiometer are used to sample the oscillator waveform and apply an adjustable ramp to pin 3.

Figure 7. Open-Loop Laboratory Text Fixture



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

Figure 8. Slope Compression



Power Supply Specifications

1. Input Voltage 95 VAC to 130 VAC (50 Hz/60 Hz)
2. Line Isolation 3750 V
3. Switching Frequency 40 kHz
4. Efficiency, Full Load 70%
5. Output Voltage:
   A. 5 V ±5%; 1-A to 4-A Load
   B. 12 V ±3%; 0.1-A to 0.3-A Load; Ripple voltage: 100 mV P-P Max
   C. -12 V ±3%; 0.1-A to 0.3-A Load; Ripple voltage: 100 mV P-P Max

Figure 9. Off-Line Flyback Regulator

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
UC2843AQD8RG4Q1	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
UC2843AQD8RQ1	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

(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.

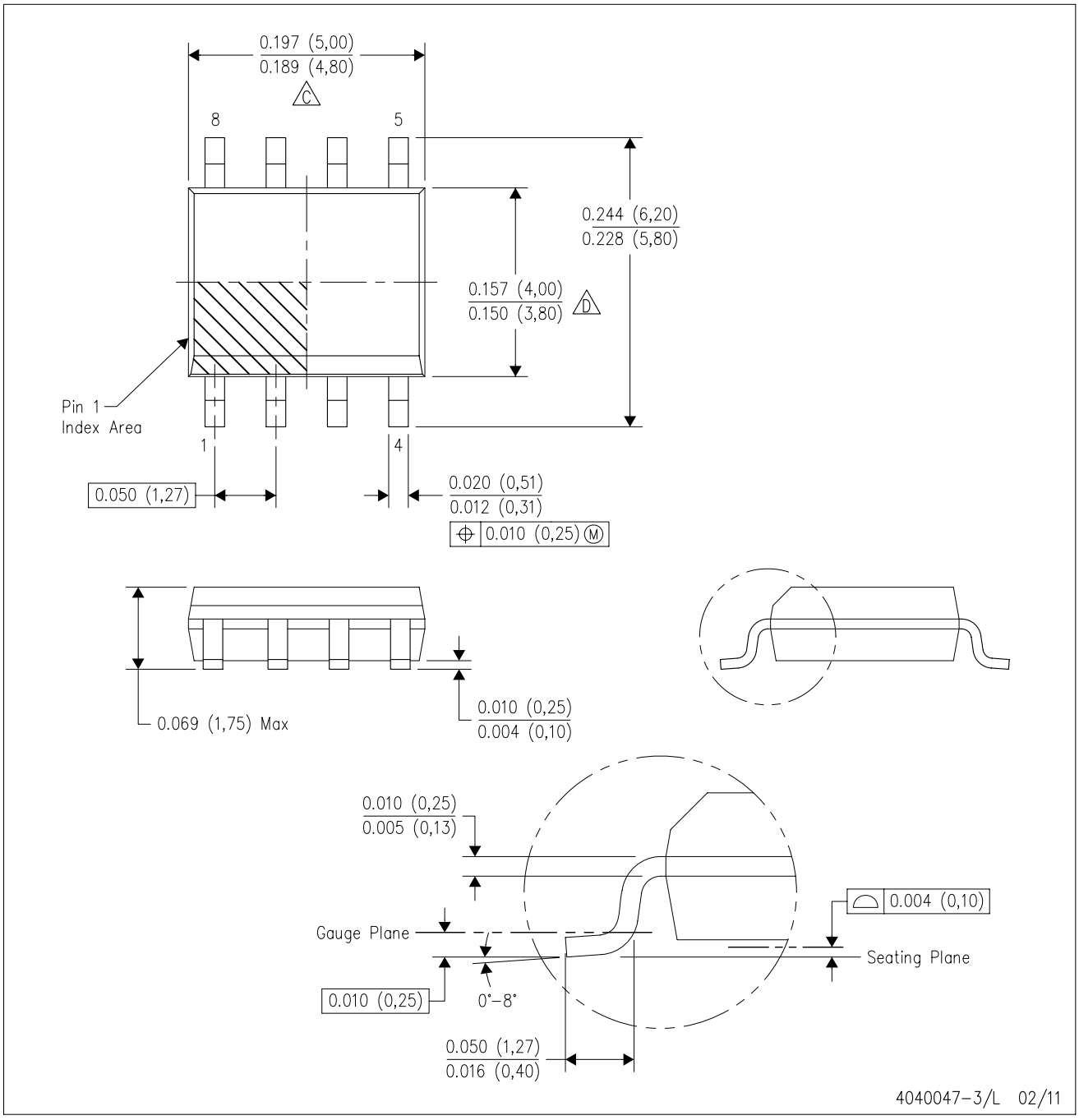
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

OTHER QUALIFIED VERSIONS OF UC2843A-Q1 :
- Catalog: UC2843A

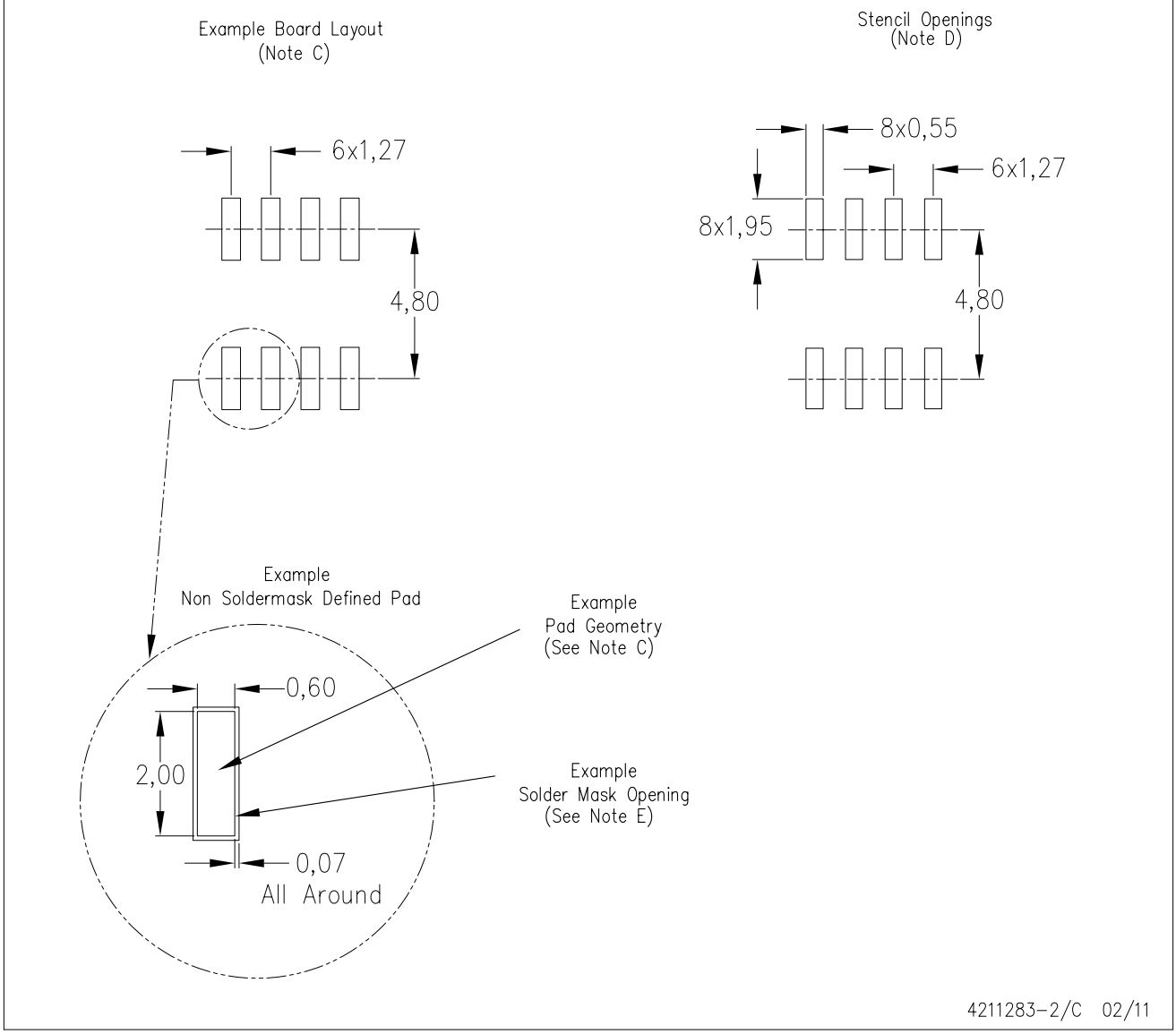
NOTE: Qualified Version Definitions:
- Catalog - TI's standard catalog product

D (R–PDSO–G8) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (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 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AA.

D (R–PDSO–G8) PLASTIC SMALL OUTLINE



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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Audio	www.ti.com/audio	Communications and Telecom	www.ti.com/communications
Amplifiers	amplifier.ti.com	Computers and Peripherals	www.ti.com/computers
Data Converters	dataconverter.ti.com	Consumer Electronics	www.ti.com/consumer-apps
DLP® Products	www.dlp.com	Energy and Lighting	www.ti.com/energy
DSP	dsp.ti.com	Industrial	www.ti.com/industrial
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Security	www.ti.com/security
Logic	logic.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Power Mgmt	power.ti.com	Transportation and Automotive	www.ti.com/automotive
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com	Wireless	www.ti.com/wireless-apps
RF/IF and ZigBee® Solutions	www.ti.com/lprf		
	TI E2E Community Home Page		e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265