

QML CLASS V, CURRENT-MODE PWM CONTROLLER

Check for Samples: [UC1843-SP](#)

FEATURES

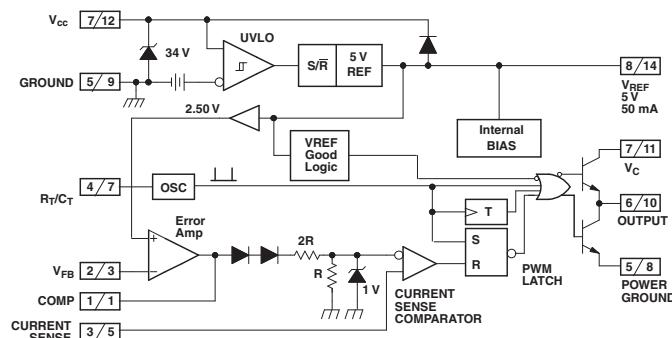
- QML-V Qualified, SMD 5962-86704
- Rad-Tolerant: 50 kRad (Si) TID (ELDRS Free) ⁽¹⁾
- Controlled Baseline
- Optimized For Off-line and DC-to-DC Converters
- Low Start-Up Current (<1 mA)
- Automatic Feed Forward Compensation
- Pulse-by-Pulse Current Limiting
- Enhanced Load Response Characteristics
- 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

(1) Radiation tolerance is a typical value based upon initial device qualification with dose rate = 10 mrad/sec. Radiation Lot Acceptance Testing is available - contact factory for details.

DESCRIPTION

The UC1843 family of control devices provides the necessary features to implement off-line or dc-to-dc fixed frequency current mode control schemes with a minimal external parts count. Internally implemented circuits include under-voltage lockout featuring start up current less than 1 mA, a precision reference trimmed for accuracy at the error amp input, logic to insure latched operation, a PWM comparator which also provides current limit control, and a totem pole output stage designed to source or sink high peak current. The output stage, suitable for driving N-Channel MOSFETs, is low in the off state. The under-voltage lockout threshold is 8.4 V and maximum duty cycle range is around 100%.

BLOCK DIAGRAM



Note 1: **A/B** A = DIL-8 Pin Number B = SO-14 and CFP-14 Pin Number



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.

ORDERING INFORMATION⁽¹⁾

T _A	PACKAGE ⁽²⁾	ORDERABLE PART NUMBER	TOP-SIDE MARKING
-55°C to 125°C	KGD	5962-8670410V9A ⁽³⁾	NA
	JG	5962-8670410VPA ⁽³⁾	8670410VPA / UC1843-SP
	JG	5962-8670402VPA	8670402VPA / UC1843
	FK	5962-8670402VXA	5962-8670402VXA / UC1843LQMLV

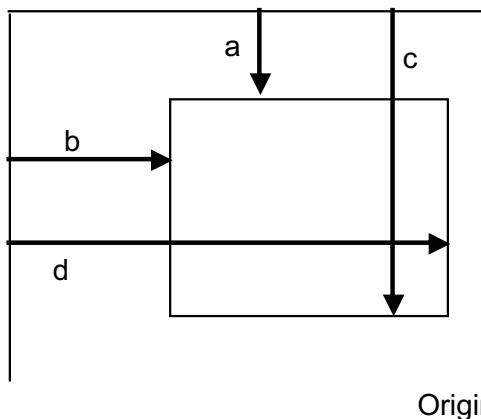
(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.

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

(3) Radiation tolerant version

BARE DIE INFORMATION

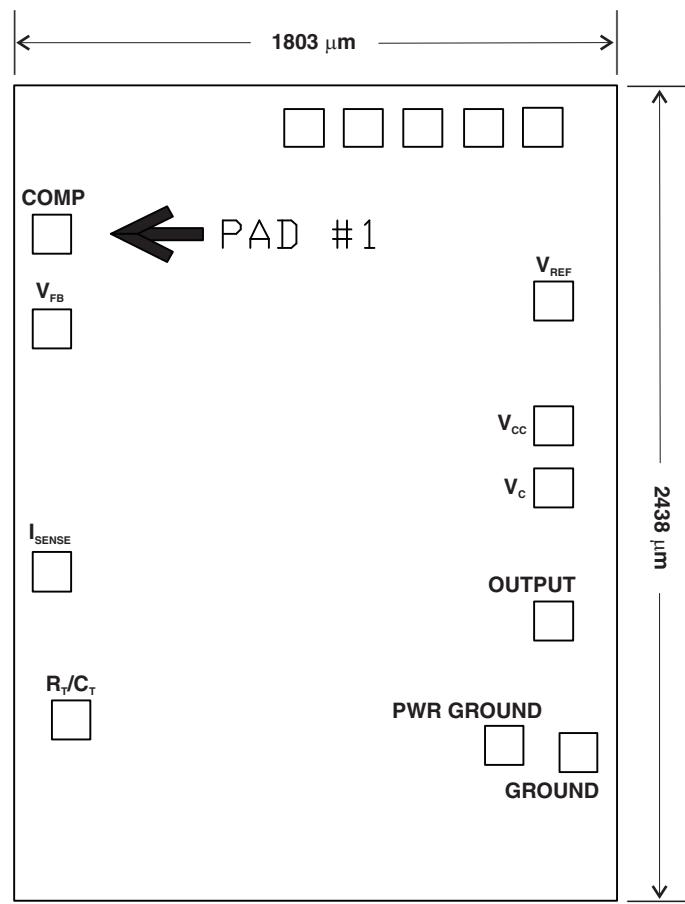
DIE THICKNESS	BACKSIDE FINISH	BACKSIDE POTENTIAL	BOND PAD METALLIZATION COMPOSITION
15 mils.	Silicon with backgrind	Insulated	AlCu (0.5%)



Origin

Table 1. BOND PAD COORDINATES (in Mils)

DESCRIPTION	PAD NUMBER	a	b	c	d
COMP	1	78.70	63.40	82.90	67.60
V _{FB}	2	70.60	63.40	74.80	67.60
I _{SENSE}	3	39.40	63.40	43.60	67.60
R _T /C _T	4	18.60	61.20	22.60	65.60
PWR GROUND	5	17.80	11.70	22.00	15.90
GROUND	6	17.40	3.90	21.80	8.10
OUTPUT	7	32.60	6.40	36.80	10.60
V _C	8	47.50	6.40	51.70	10.60
V _{CC}	9	54.60	6.40	58.80	10.60
V _{REF}	10	68.70	6.40	72.90	10.60
NC	TESTPAD	87.10	6.30	90.80	10.30
NC	TESTPAD	87.10	12.60	90.80	16.60
NC	TESTPAD	87.10	18.00	90.80	22.00
NC	TESTPAD	87.10	24.30	90.80	28.30
NC	TESTPAD	87.10	30.60	90.80	34.60



ABSOLUTE MAXIMUM RATINGS

		UNIT
Supply voltage	Low impedance source	30 V
	I _{cc} < 30 mA	Self Limiting
Output current		± 1 A
Output energy (capacitive load)		5 μJ
Analog inputs (Pins 2, 3)		-0.3 V to 6.3 V
Error amp output sink current		10 mA
Storage temperature range		-65°C to 150°C
Junction temperature range		-55°C to 150°C

ELECTRICAL CHARACTERISTICS

Unless otherwise stated, these specifications apply for $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$; $V_{CC} = 15 \text{ V}^{(1)}$; $R_T = 10 \text{ kW}$; $C_T = 3.3 \text{ nF}$, $T_A = T_J$.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
REFERENCE SECTION					
Output Voltage ⁽²⁾	$T_J = 25^\circ\text{C}$, $I_O = 1 \text{ mA}$	For SMD device option 10	4.94	5.00	5.06
		For SMD device option 02	4.95	5.00	5.05
Line Regulation	$12 \text{ V} \leq V_{IN} \leq 25 \text{ V}$		6	20	
Load Regulation	$1 \text{ mA} \leq I_O \leq 20 \text{ mA}$		6	25	mV
Temperature Stability	See ⁽³⁾ (4)		0.2	0.4	mV/°C
Total Output Variation	Line, load, temperature ⁽³⁾	4.9	5.1		V
Output Noise Voltage	$10 \text{ Hz} \leq f \leq 10 \text{ kHz}$, $T_J = 25^\circ\text{C}$ (3)		50		μV
Long Term Stability	$T_A = 125^\circ\text{C}$, 1000 Hrs ⁽³⁾		5	25	mV
Output Short Circuit		-30	-100	-180	mA
OSCILLATOR SECTION					
Initial Accuracy	$T_J = 25^\circ\text{C}$ ⁽⁵⁾	47	52	57	kHz
Voltage Stability	$12 \text{ V} \leq V_{CC} \leq 25 \text{ V}$		0.2	1	%
Temperature Stability	$T_{MIN} \leq T_A \leq T_{MAX}$ ⁽³⁾				%
Amplitude	$V_{PIN 4}$ peak-to-peak ⁽³⁾		1.7		V
ERROR AMP SECTION					
Input Voltage	$V_{PIN 1} = 2.5 \text{ V}$	2.45	2.50	2.55	V
Input Bias Current			-0.3	-1	μA
A_{VOL}	$2 \text{ V} \leq V_O \leq 4 \text{ V}$	65	90		dB
Unity Gain Bandwidth	$T_J = 25^\circ\text{C}$ (3)	0.7	1		MHz
PSRR	$12 \text{ V} \leq V_{CC} \leq 25 \text{ V}$	60	70		dB
Output Sink Current	$V_{PIN 2} = 2.7 \text{ V}$, $V_{PIN 1} = 1.1 \text{ V}$	2	6		
Output Source Current	$V_{PIN 2} = 2.3 \text{ V}$, $V_{PIN 1} = 5 \text{ V}$	-0.5	-0.8		mA
V_{OUT} High	$V_{PIN 2} = 2.3 \text{ V}$, $R_L = 15 \text{ k}\Omega$ to ground	5	6		
V_{OUT} Low	$V_{PIN 2} = 2.7 \text{ V}$, $R_L = 15 \text{ k}\Omega$ to Pin 8	0.7	1.1		V
CURRENT SENSE SECTION					
Gain	See ⁽⁶⁾ (7)	2.85	3	3.15	V/V
Maximum Input Signal	$V_{PIN 1} = 5 \text{ V}$ ⁽⁶⁾	0.9	1	1.1	V
PSRR	$12 \text{ V} \leq V_{CC} \leq 25 \text{ V}$ (3) (6)	70			dB
Input Bias Current		-2	-10		μA
Delay to Output	$V_{PIN 3} = 0 \text{ V}$ to 2 V ⁽³⁾	150	300		ns
OUTPUT SECTION					
Output Low Level	$I_{SINK} = 20 \text{ mA}$		0.1	0.4	
	$I_{SINK} = 200 \text{ mA}$		1.5	2.2	
Output High Level	$I_{SOURCE} = 20 \text{ mA}$	13	13.5		
	$I_{SOURCE} = 200 \text{ mA}$	12	13.5		

- (1) Adjust V_{CC} above the start threshold before setting at 15 V.
- (2) V_{REF} parameter is sensitive to very high temperature die attach/die assembly processes. Processing conditions should not exceed $170^\circ\text{C}/24$ hours or $245^\circ\text{C}/40$ seconds.
- (3) These parameters, although specified, are not 100% tested in production.
- (4) Temperature stability, sometimes referred to as average temperature coefficient, is described by the equation:

$$\text{Temp Stability} = \frac{V_{REF(max)} - V_{REF(min)}}{T_J(max) - T_J(min)}$$

$V_{REF(max)}$ and $V_{REF(min)}$ are the maximum and minimum reference voltages measured over the appropriate temperature range. Note that the extremes in voltage do not necessarily occur at the extremes in temperature.

- (5) Output frequency equals oscillator frequency.
- (6) Parameter measured at trip point of latch with $V_{PIN 2} = 0$.
- (7) Gain defined as: $A = \frac{\Delta V_{PIN 1}}{\Delta V_{PIN 3}}$, $0 \leq V_{PIN 3} \leq 0.8 \text{ V}$

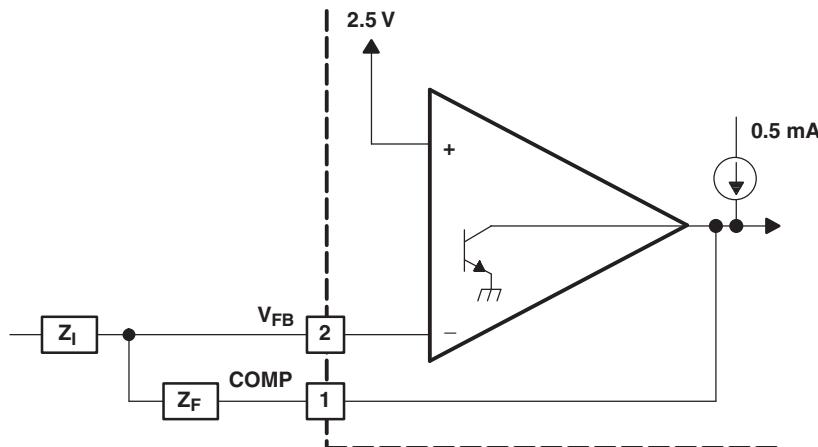
ELECTRICAL CHARACTERISTICS (continued)

Unless otherwise stated, these specifications apply for $-55^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$; $V_{CC} = 15\text{ V}$ ⁽¹⁾; $R_T = 10\text{ kW}$; $C_T = 3.3\text{ nF}$; $T_A = T_J$.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Rise Time	$T_J = 25^{\circ}\text{C}$, $C_L = 1\text{ nF}$ ⁽³⁾		50	150	
Fall Time	$T_J = 25^{\circ}\text{C}$, $C_L = 1\text{ nF}$ ⁽³⁾		50	150	ns
UNDER-VOLTAGE LOCKOUT SECTION					
Start Threshold		7.8	8.4	9.0	
Min. Operating Voltage After Turn On		7.0	7.6	8.2	V
PWM SECTION					
Maximum Duty Cycle	For SMD device option 10	94	97	100	%
	For SMD device option 02	93	97	100	%
Minimum Duty Cycle				0	%
TOTAL STANDBY CURRENT					
Start-Up Current		0.5	1		
Operating Supply Current	$V_{PIN\ 2} = V_{PIN\ 3} = 0\text{ V}$	11	17		mA
V_{CC} Zener Voltager	$I_{CC} = 25\text{ mA}$	30	34		V

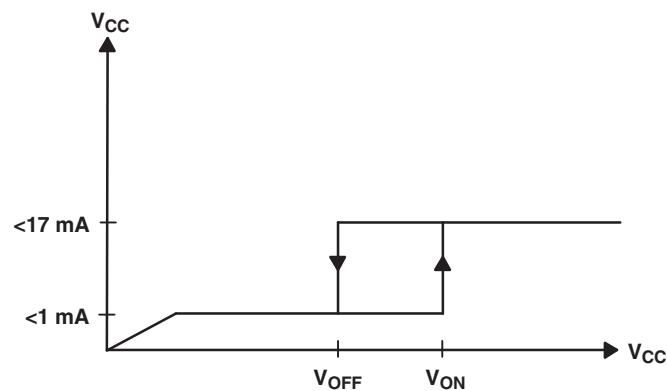
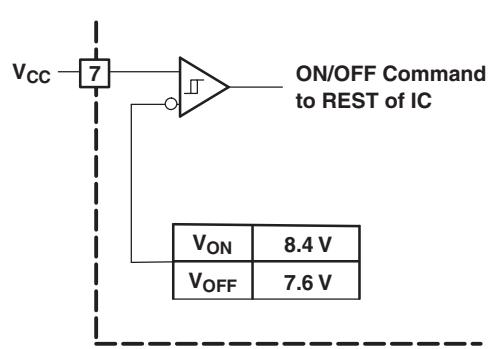
ERROR AMP CONFIGURATION

Error amp can source or sink up to 0.5 mA.



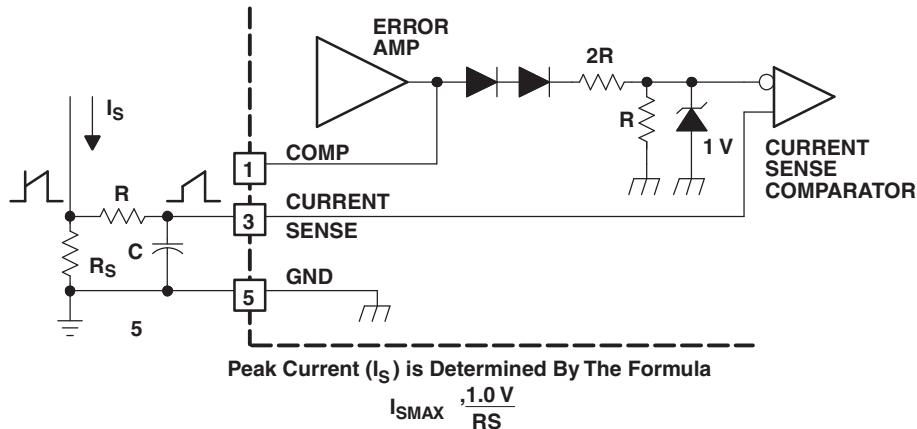
UNDER-VOLTAGE LOCKOUT

During under-voltage lock-out, the output drive is biased to sink minor amounts of current. Pin 6 should be shunted to ground with a bleeder resistor to prevent activating the power switch with extraneous leakage currents.

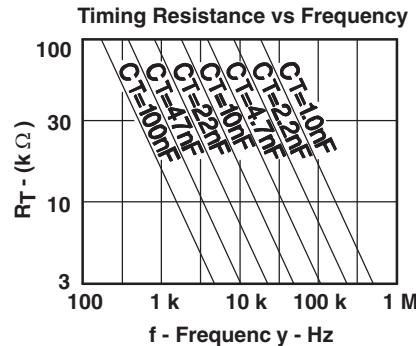
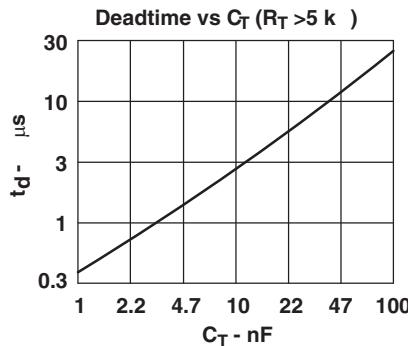
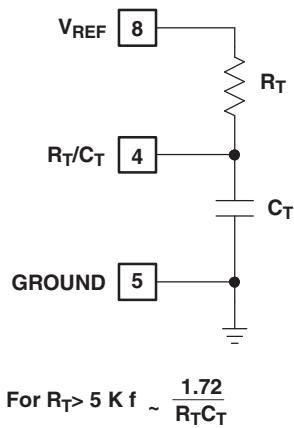


CURRENT SENSE CIRCUIT

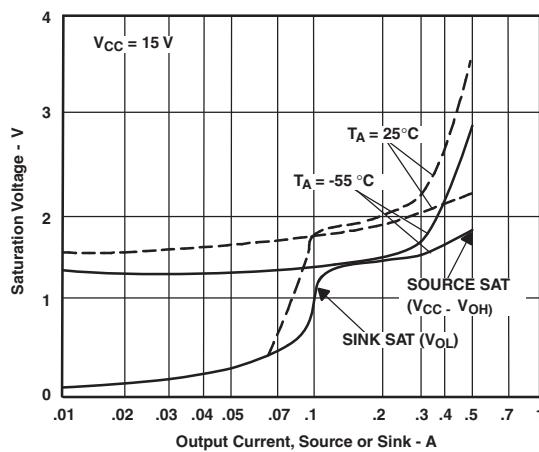
A small RC filter may be required to suppress switch transients.



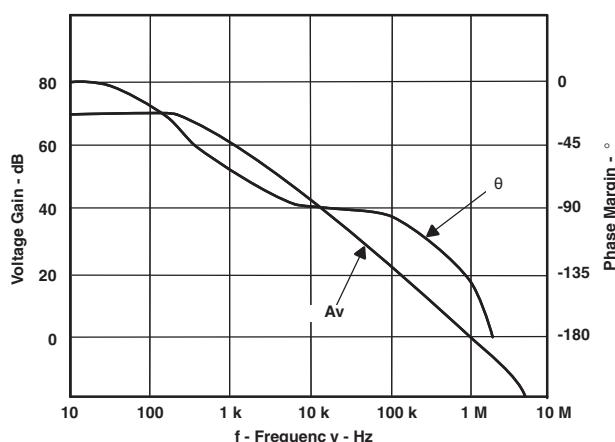
OSCILLATOR SECTION



OUTPUT SATURATION CHARACTERISTICS

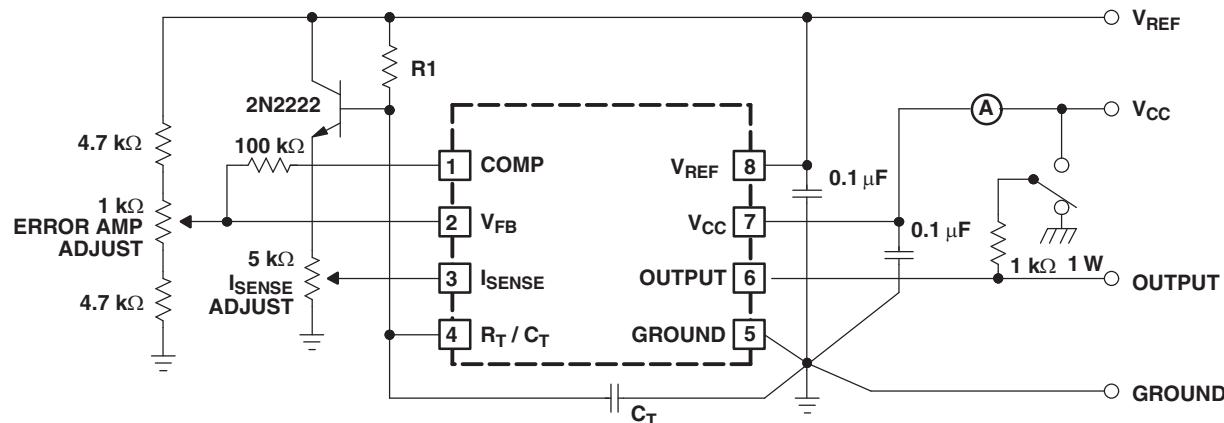


ERROR AMPLIFIER OPEN-LOOP FREQUENCY RESPONSE



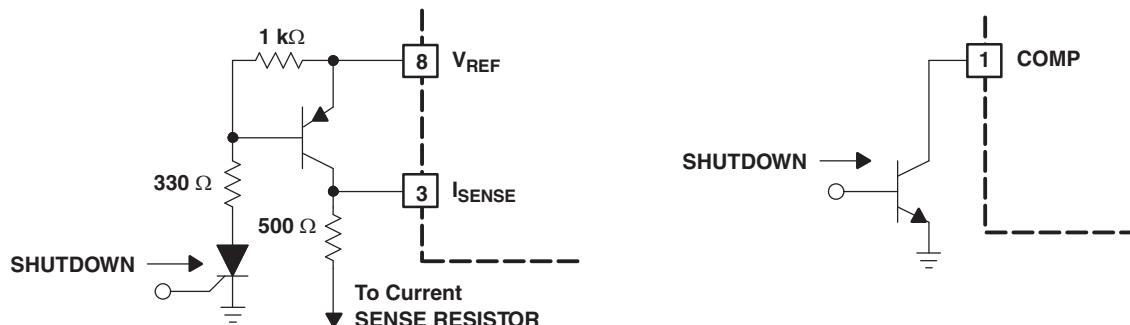
OPEN-LOOP LABORATORY FIXTURE

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.

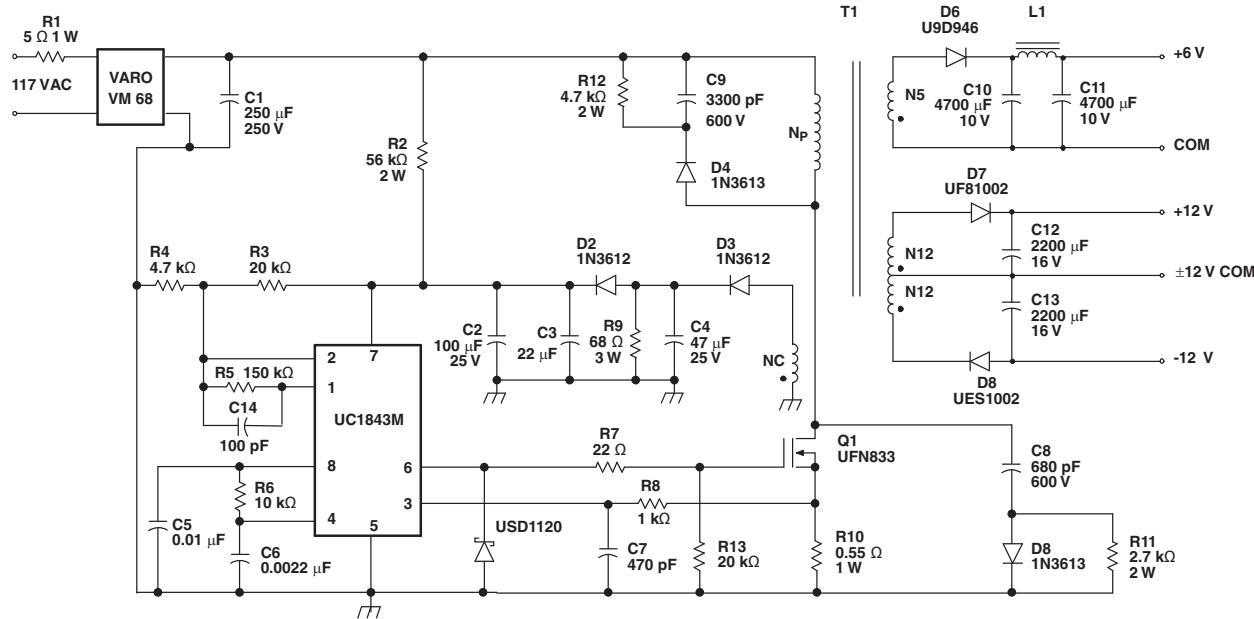


SHUTDOWN TECHNIQUES

Shutdown of the UC1843 can be accomplished by two methods; either raise pin 3 above 1 V or pull pin 1 below a voltage two diode drops above ground. Either method causes the output of the PWM comparator to be high (refer to block diagram). The PWM latch is reset dominant so that the output will remain low until the next clock cycle after the shutdown condition at pin 1 and/or 3 is removed. In one example, an externally latched shutdown may be accomplished by adding an SCR which will be reset by cycling V_{CC} below the lower UVLO threshold. At this point the reference turns off, allowing the SCR to reset.



OFFLINE FLYBACK REGULATOR

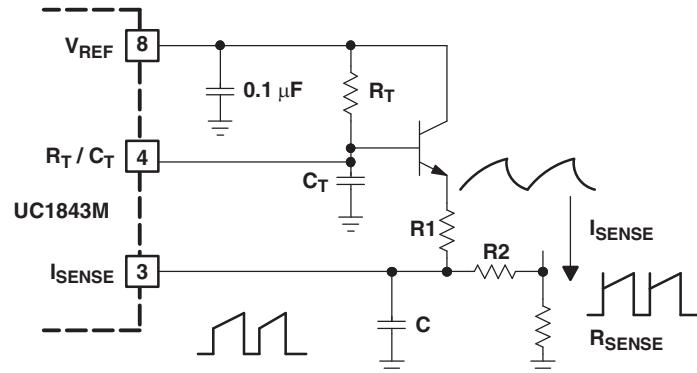


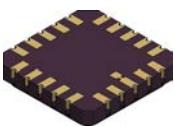
Power Supply Specifications

1. Input Voltages
 - (a) 5VAC to 130VA (50 Hz/60 Hz)
2. Line Isolation: 3750 V
3. Switchng Frequency: 40 kHz
4. Efficiency at Full Load 70%
5. Output Voltage:
 - (a) +5 V, ±5%; 1A to 4A load
Ripple voltage: 50 mV P-P Max
 - (b) +12 V, ±3%; 0.1A to 0.3A load
Ripple voltage: 100 mV P-P Max
 - (c) -12 V, ±3%; 0.1A to 0.3A load
Ripple voltage: 100 mV P-P Max

SLOPE COMPENSATION

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%.



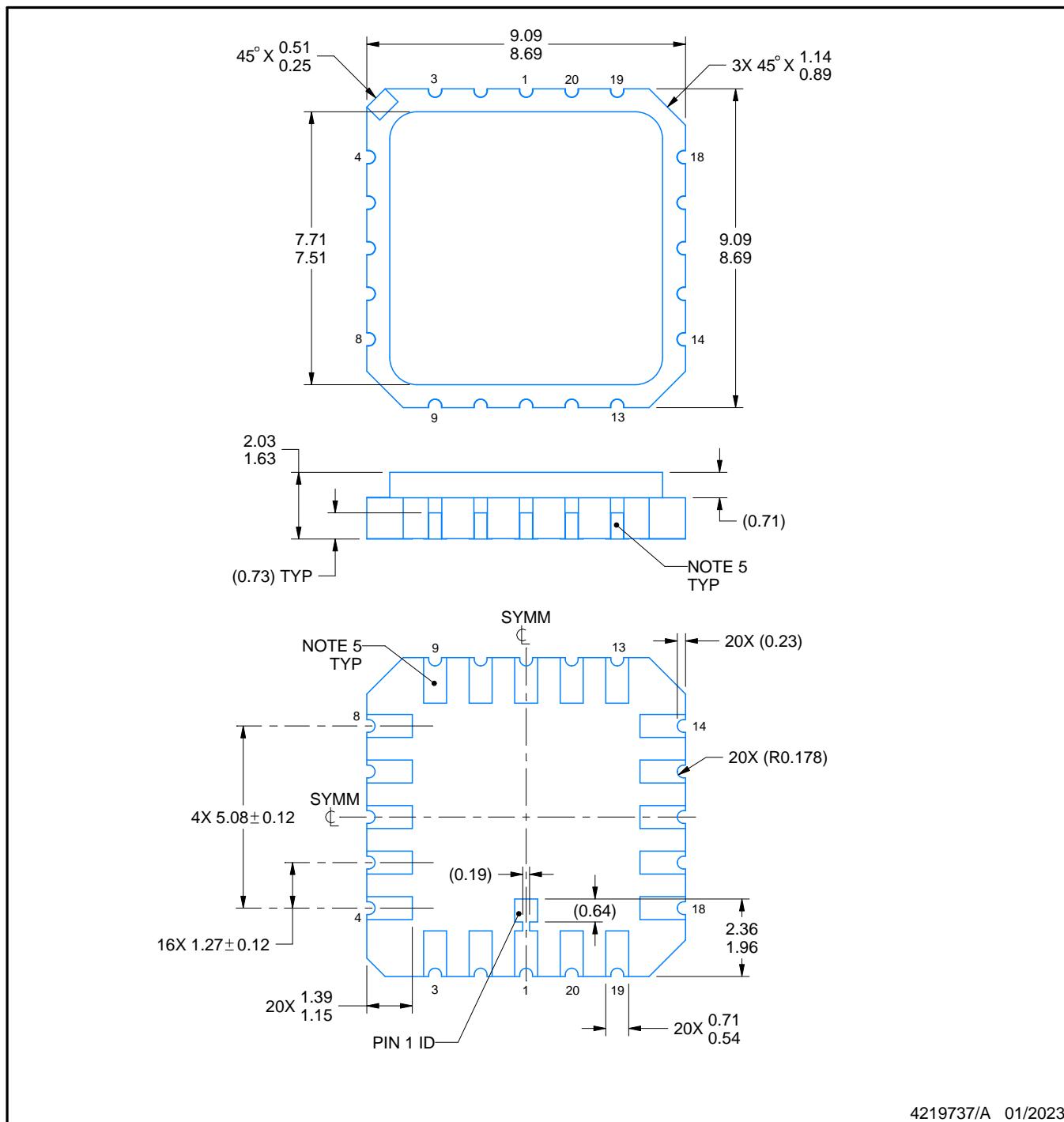


PACKAGE OUTLINE

FK0020A

LCCC - 2.03 mm max height

LEADLESS CERAMIC CHIP CARRIER



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NOTES:

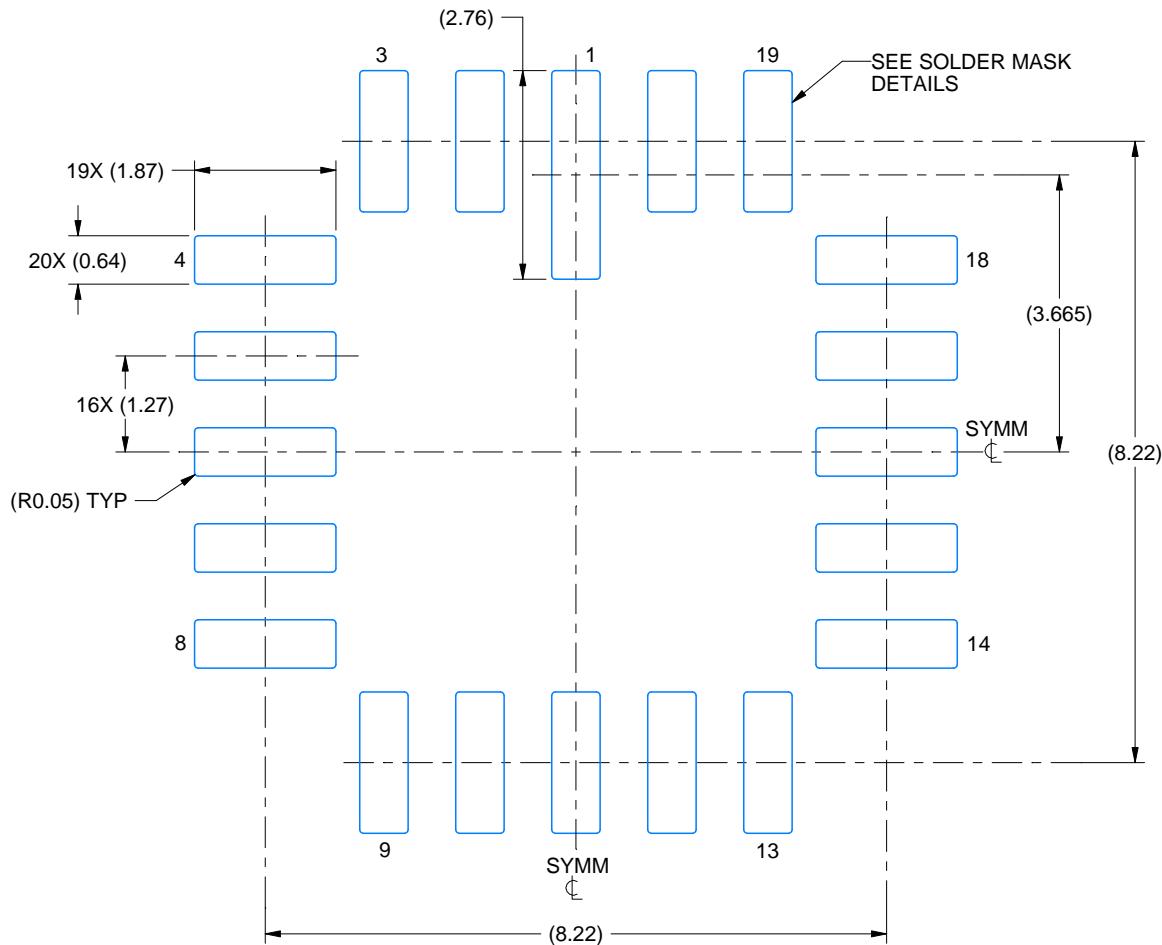
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package can be hermetically sealed with a metal lid.
4. Reference JEDEC Registration MS-004.
5. The terminals are gold-plated.

EXAMPLE BOARD LAYOUT

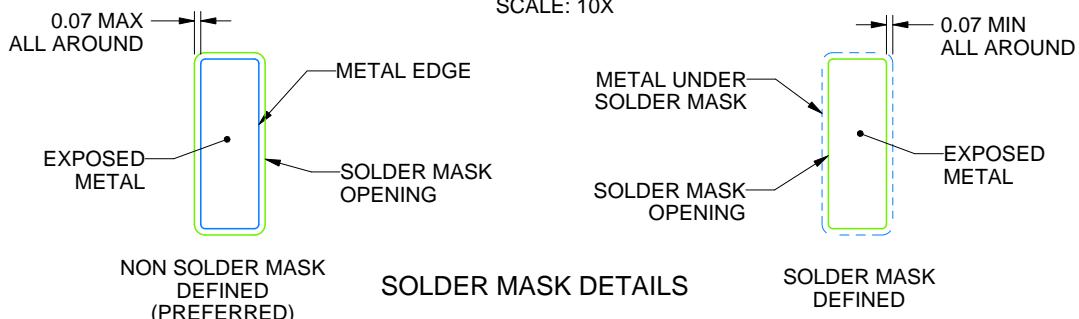
FK0020A

LCCC - 2.03 mm max height

LEADLESS CERAMIC CHIP CARRIER



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4219737/A 01/2023

NOTES: (continued)

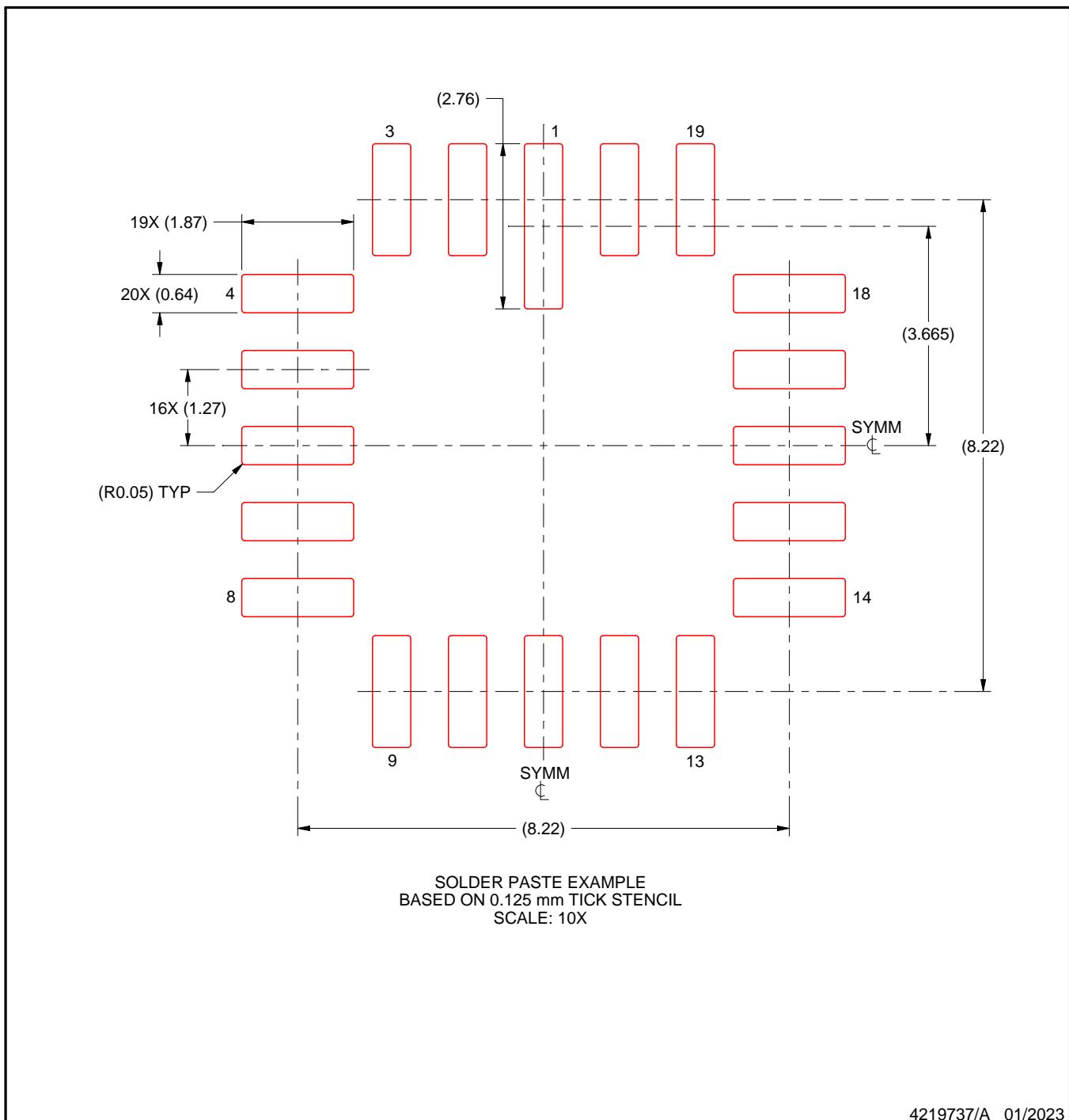
6. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

EXAMPLE STENCIL DESIGN

FK0020A

LCCC - 2.03 mm max height

LEADLESS CERAMIC CHIP CARRIER



NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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)
5962-8670402VPA	Active	Production	CDIP (JG) 8	50 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8670402VPA UC1843
5962-8670402VPA.A	Active	Production	CDIP (JG) 8	50 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8670402VPA UC1843
5962-8670402VXA	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 8670402VXA UC1843L QMLV
5962-8670402VXA.A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 8670402VXA UC1843L QMLV
5962-8670410V9A	Active	Production	XCEPT (KGD) 0	100 OTHER	Yes	Call TI	N/A for Pkg Type	0 to 0	
5962-8670410V9A.A	Active	Production	XCEPT (KGD) 0	100 OTHER	Yes	Call TI	N/A for Pkg Type	0 to 0	
5962-8670410VPA	Active	Production	CDIP (JG) 8	50 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8670410VPA UC1843-SP
5962-8670410VPA.A	Active	Production	CDIP (JG) 8	50 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8670410VPA UC1843-SP

⁽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.

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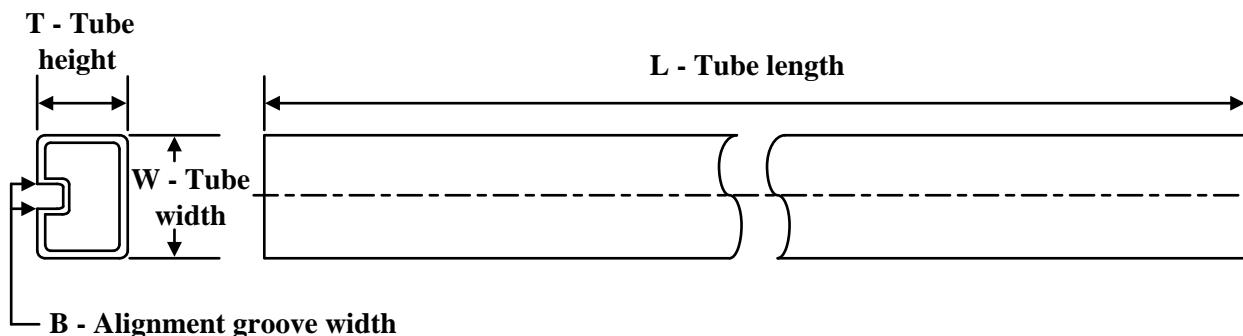
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF UC1843-SP :

- Catalog : [UC1843](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-8670402VXA	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-8670402VXA.A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-8670410VPA	JG	CDIP	8	50	506.98	15.24	13440	NA
5962-8670410VPA.A	JG	CDIP	8	50	506.98	15.24	13440	NA

GENERIC PACKAGE VIEW

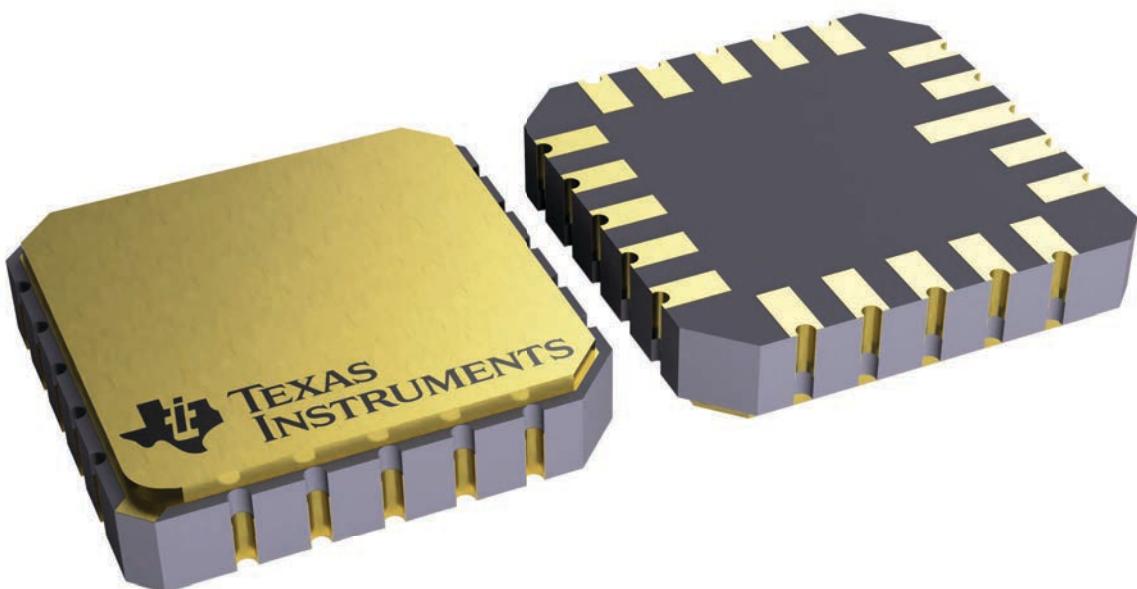
FK 20

LCCC - 2.03 mm max height

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



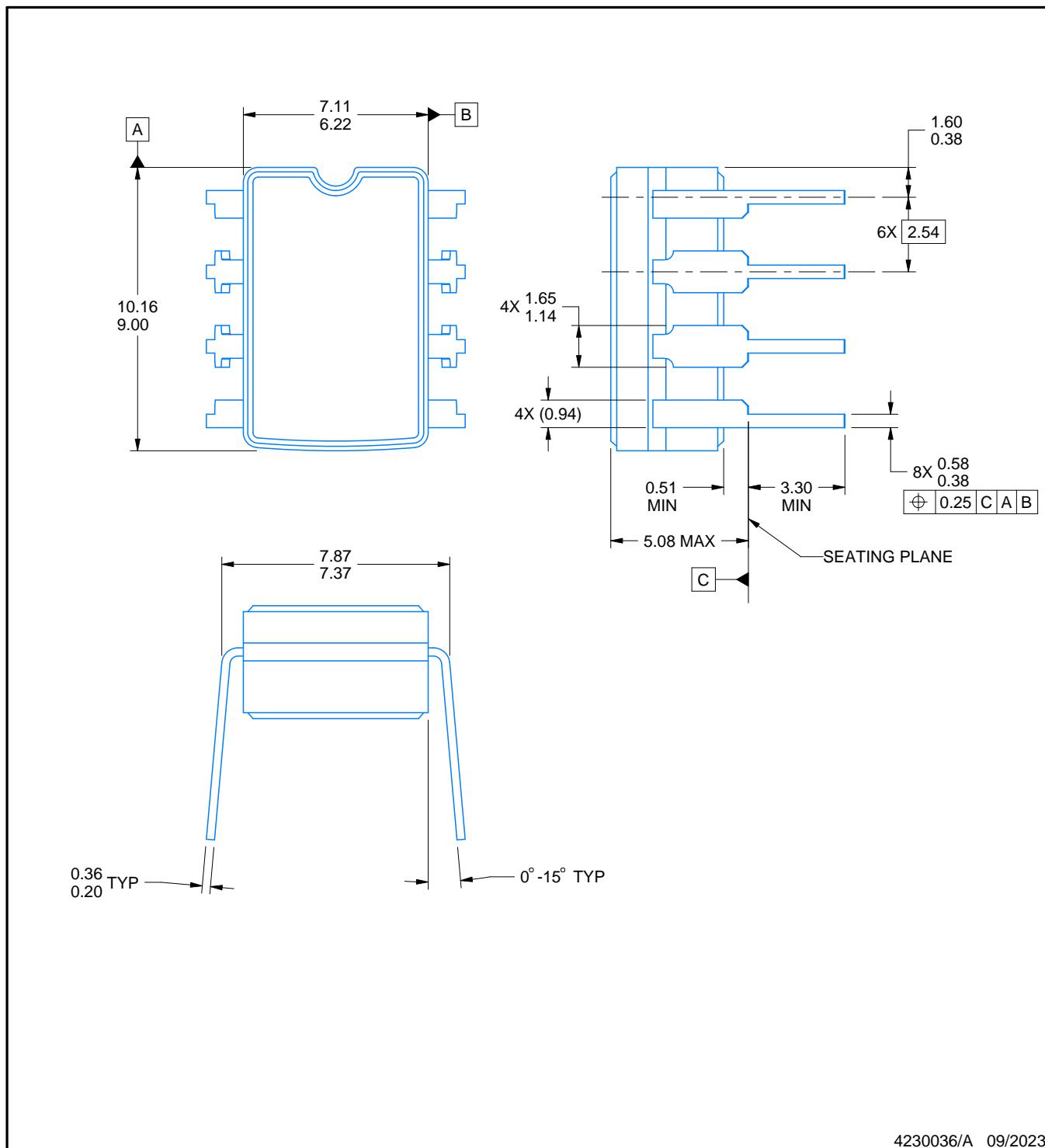
4229370VA\

PACKAGE OUTLINE

JG0008A

CDIP - 5.08 mm max height

CERAMIC DUAL IN-LINE PACKAGE



4230036/A 09/2023

NOTES:

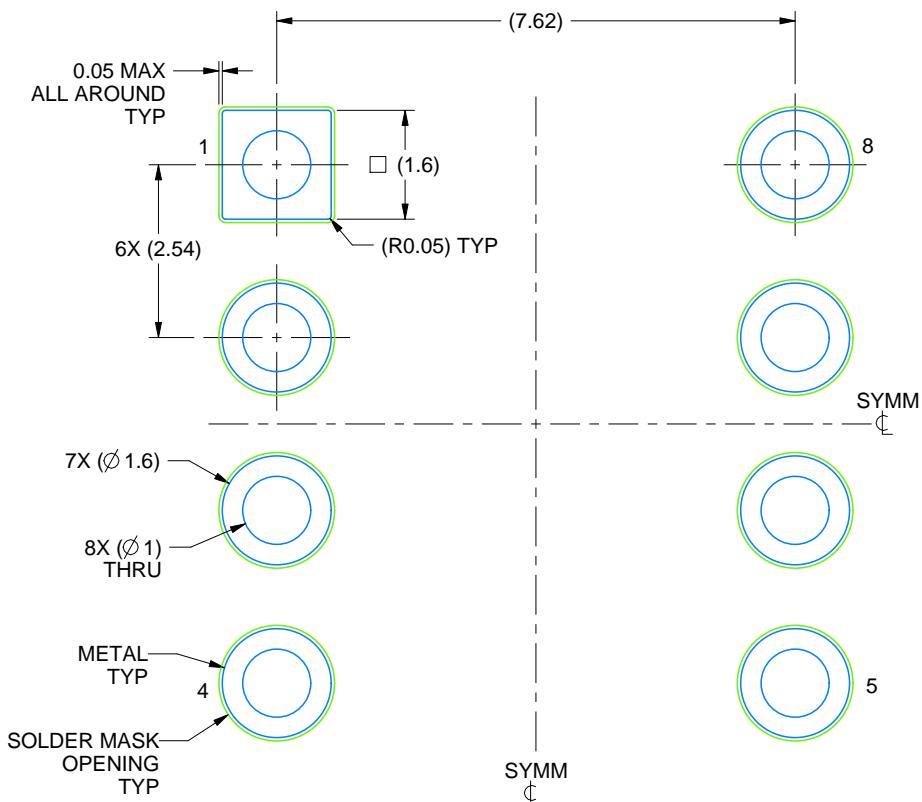
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package can be hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification.
5. Falls within MIL STD 1835 GDIP1-T8

EXAMPLE BOARD LAYOUT

JG0008A

CDIP - 5.08 mm max height

CERAMIC DUAL IN-LINE PACKAGE



LAND PATTERN EXAMPLE
NON SOLDER MASK DEFINED
SCALE: 9X

4230036/A 09/2023

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