

Buck Pulse Width Modulator Stepdown Voltage Regulator

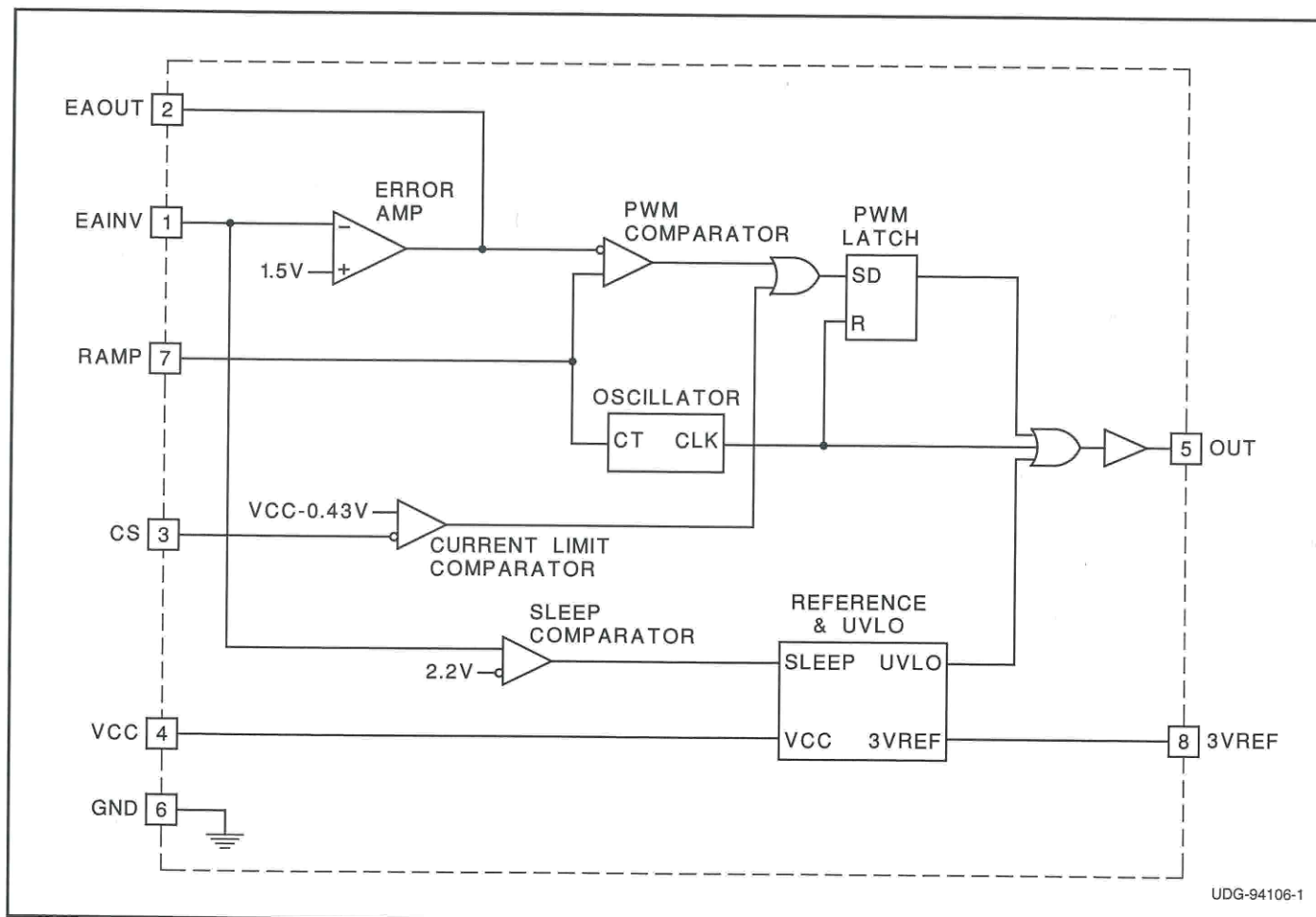
FEATURES

- Simple Single Inductor Buck PWM Stepdown Voltage Regulation
- Drives External PMOS Switch
- Contains UVLO Circuit
- Includes Pulse-by-Pulse Current Limit
- Low 50 μ A Sleep Mode Current

DESCRIPTION

The UC3573 is a Buck pulse width modulator which steps down and regulates a positive input voltage. The chip is optimized for use in a single inductor buck switching converter employing an external PMOS switch. The block diagram consists of a precision reference, an error amplifier configured for voltage mode operation, an oscillator, a PWM comparator with latching logic, and a 0.5A peak gate driver. The UC3573 includes an undervoltage lockout circuit to insure sufficient input supply voltage is present before any switching activity can occur, and a pulse-by-pulse current limit. Input current can be sensed and limited to a user determined maximum value. In addition, a sleep comparator interfaces to the UVLO circuit which turns the chip off when the input voltage is below the UVLO threshold. This reduces the supply current to only 50 μ A, making the UC3573 ideal for battery powered applications.

BLOCK DIAGRAM



UDG-94106-1

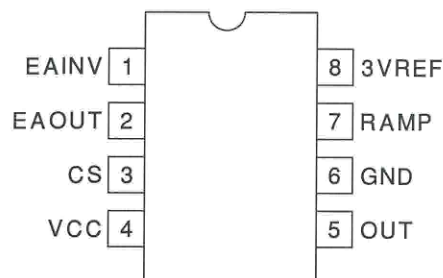
ABSOLUTE MAXIMUM RATINGS

VCC	35V
EAINV	-0.6V to VCC
EAOUT	25mA
RAMP	-0.3V to 4V
CS	-0.3V to VCC
I _{OUT}	-0.7A to 0.7A
I _{3VREF}	-15mA
Storage Temperature	-65°C to +150°C
Junction Temperature	-65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C

Currents are positive into, negative out of the specified terminal. Consult Packaging Section of Databook for thermal limitations and considerations of packages.

CONNECTION DIAGRAMS

DIL-8, SOIC-8 (TOP VIEW)
J or N, D Packages



ELECTRICAL CHARACTERISTICS: Unless otherwise specified, these parameters apply for $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$ for the UC1573, -40°C to $+85^\circ\text{C}$ for the UC2573, and 0°C to $+70^\circ\text{C}$ for the UC3573, $V_{CC} = 5\text{V}$, $C_T = 680\text{pF}$, $T_A = T_J$.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Reference Section					
3VREF		2.94	3	3.06	V
Line Regulation	$V_{CC} = 4.75$ to 30V		1	10	mV
Load Regulation	$I_{3VREF} = 0$ to -5mA		1	10	mV
Oscillator Section					
Frequency	$V_{CC} = 5\text{V}, 30\text{V}$	85	100	115	kHz
Error Amp Section					
EAINV	EAOUT = 2V	1.45	1.5	1.55	V
I _{EAINV}	EAOUT = 2V		-0.2	-1	μA
AVOL	EAOUT = 0.5V to 3V	65	90		dB
EAOUT High	EAINV = 1.4V	3.6	4	4.4	V
EAOUT Low	EAINV = 1.6V		0.1	0.2	V
I _{EAOUT}	EAINV = 1.4V, EAOUT = 2V	-350	-500		μA
	EAINV = 1.6V, EAOUT = 2V	7	20		mA
Unity Gain Bandwidth	$T_J = 25^\circ\text{C}, F = 10\text{kHz}$	0.6	1		MHz
Current Sense Comparator Section					
Threshold (referred to VCC)		-0.39	-0.43	-0.47	V
Input Bias Current	CS = VCC		150	800	nA
CS Propagation Delay			400		ns
Gate Drive Output Section					
OUT High Saturation	$I_{OUT} = 0$		0	0.3	V
	$I_{OUT} = -10\text{mA}$		0.7	1.5	V
	$I_{OUT} = -100\text{mA}$		1.5	2.5	V
OUT Low Saturation	$I_{OUT} = 10\text{mA}$		0.1	0.4	V
	$I_{OUT} = 100\text{mA}$		1.5	2.2	V
Rise Time	$T_J = 25^\circ\text{C}, C_{LOAD} = 1\text{nF} + 3.3\text{ Ohms}$		30	80	ns
Fall Time	$T_J = 25^\circ\text{C}, C_{LOAD} = 1\text{nF} + 3.3\text{ Ohms}$		30	80	ns
Pulse Width Modulator Section					
Maximum Duty Cycle	EAINV = 1.4V		92	96	%
Minimum Duty Cycle	EAINV = 1.6V			0	%
Modulator Gain	EAOUT = 1.5V to 2.5V	25	35	45	%/V
Undervoltage Lockout Section					
Start Threshold		3.5	4.2	4.5	V
Hysteresis		100	200	300	mV

ELECTRICAL CHARACTERISTICS: Unless otherwise specified, these parameters apply for $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$ for the UC1573, -40°C to $+85^\circ\text{C}$ for the UC2573, and 0°C to $+70^\circ\text{C}$ for the UC3573, $V_{CC} = 5\text{V}$, $C_T = 680\text{pF}$, $T_A = T_J$.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Sleep Mode Section					
Threshold		1.8	2.2	2.6	V
Supply Current Section					
I_{VCC}	$V_{CC} = 30\text{V}$		9	12	mA
I_{VCC}	$V_{CC} = 30\text{V}$, $E_{AINV} = 3\text{V}$		50	150	μA

PIN DESCRIPTIONS

3VREF: Precision 3V reference. Bypass with 100nF capacitor.

CS: Peak current limit sense pin. Senses the current across a current sense resistor placed between V_{CC} and source of the PMOS Buck switch. OUT will be held high (PMOS buck switch off) if $V_{CC} - CS$ exceeds 0.4V.

EAINV: Inverting input to error amplifier. VOUT sense feedback connected to this pin. The non-inverting input of the error amplifier is internally connected to:

$$\frac{3V_{REF}}{2} \text{ Volts.}$$

Connecting the EAINV pin to an external voltage greater than 2.6V commands the chip to go into a low current sleep mode.

EAOUT: Output of error amplifier. Use EAOUT and EAINV for loop compensation components.

GND: Circuit Ground.

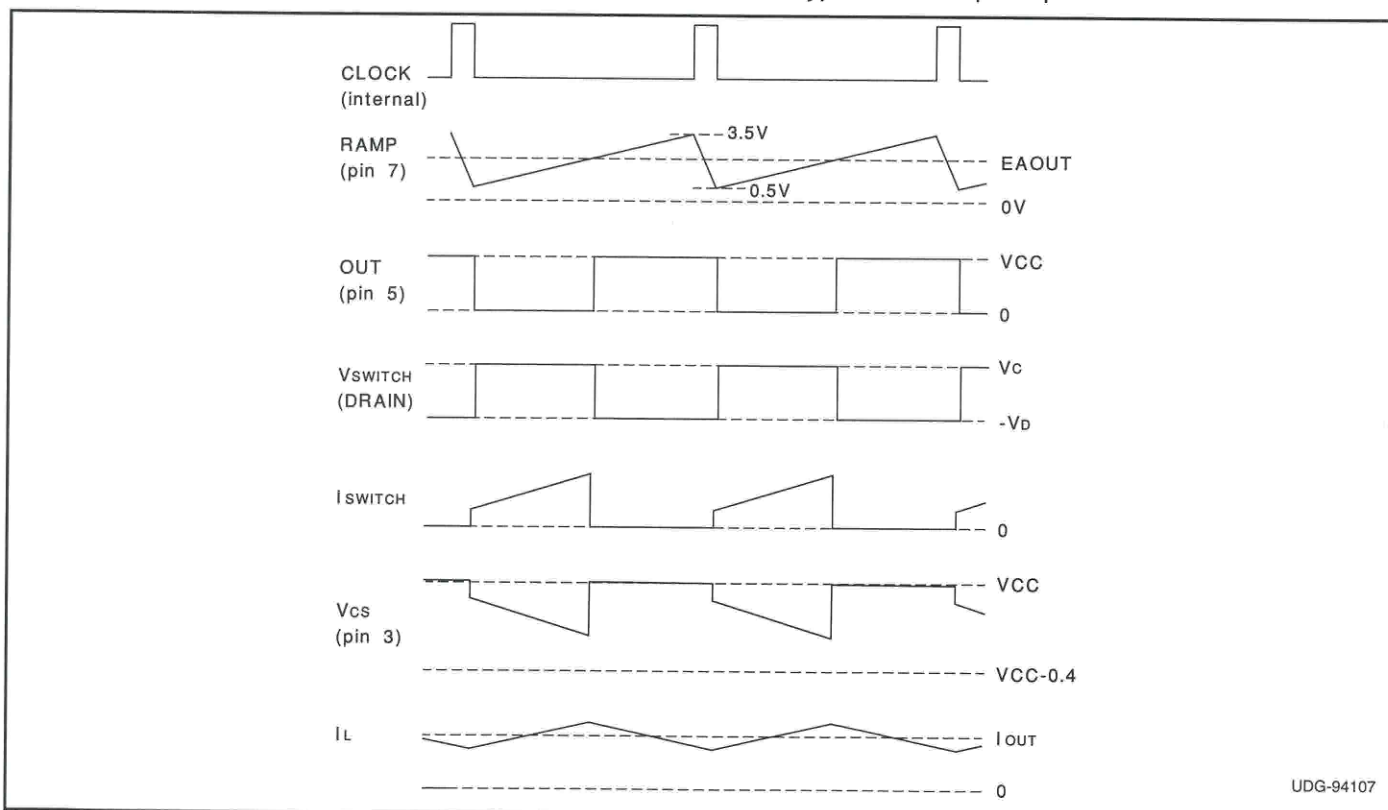
OUT: Gate drive for external PMOS switch connected between V_{CC} and the flyback inductor. OUT drives the gate of the PMOS switch between V_{CC} and GND.

RAMP: Oscillator and ramp for pulse width modulator. Frequency is set by a capacitor to GND by the equation

$$F = \frac{1}{15k \cdot C_{RAMP}}$$

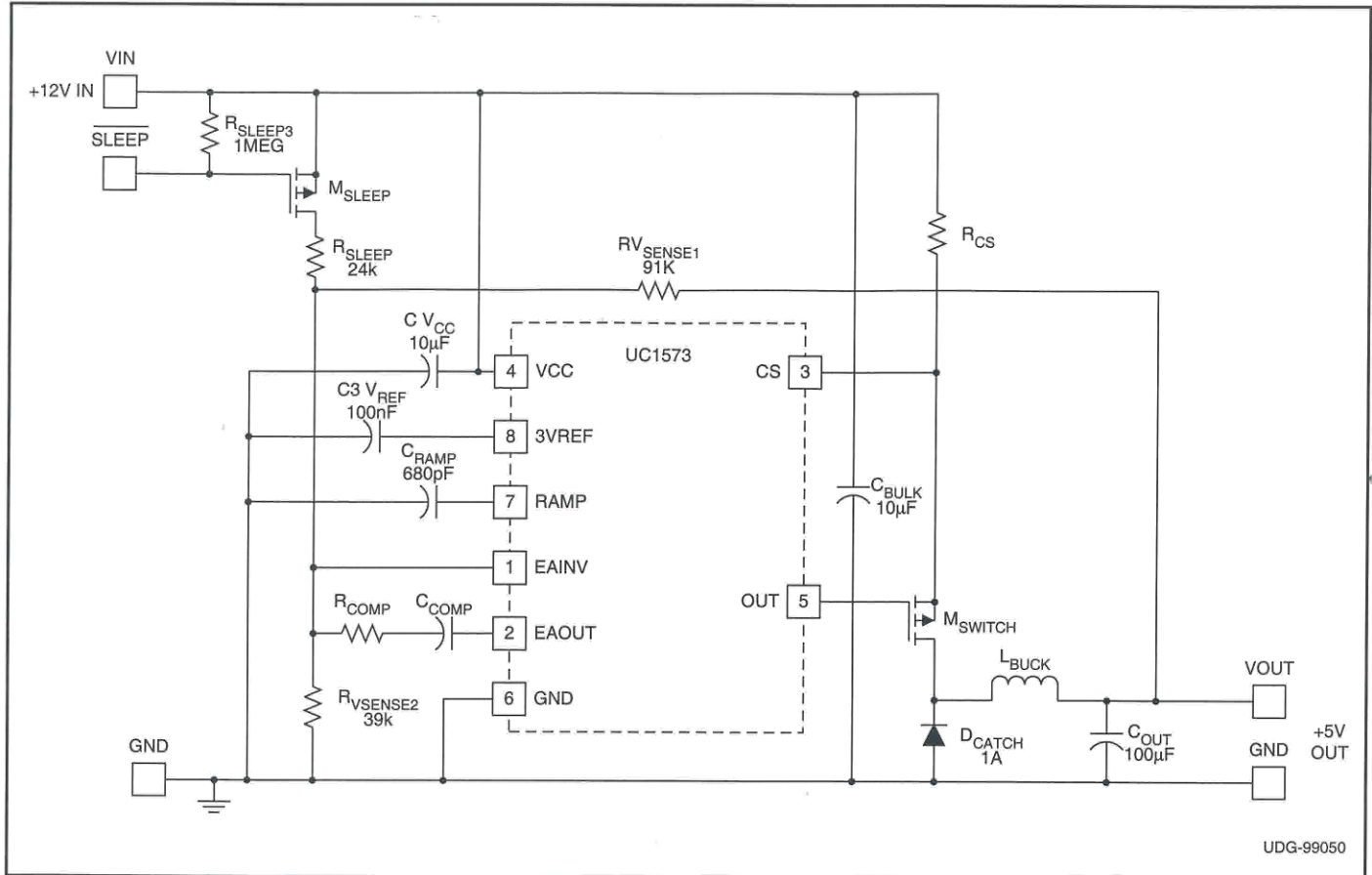
Recommended operating frequency range is 10kHz to 200kHz.

VCC: Input voltage supply to chip. Range is 4.75V to 30V. Bypass with a 1 μF capacitor.



Typical Waveforms.

TYPICAL APPLICATION: 12V TO 5V BUCK CONVERTER



REVISION HISTORY

SLUS346 to SLUS346A, July 2010:

Changed Supply Current I_{VCC} units from A to μA

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)
UC2573D	Active	Production	SOIC (D) 8	75 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	UC2573D
UC2573D.A	Active	Production	SOIC (D) 8	75 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	UC2573D
UC2573DG4	Active	Production	SOIC (D) 8	75 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	UC2573D
UC2573DTR	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	UC2573D
UC2573DTR.A	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	UC2573D
UC3573D	Active	Production	SOIC (D) 8	75 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	UC3573D
UC3573D.A	Active	Production	SOIC (D) 8	75 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	UC3573D
UC3573DTR	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	UC3573D
UC3573DTR.A	Active	Production	SOIC (D) 8	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	UC3573D

⁽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.

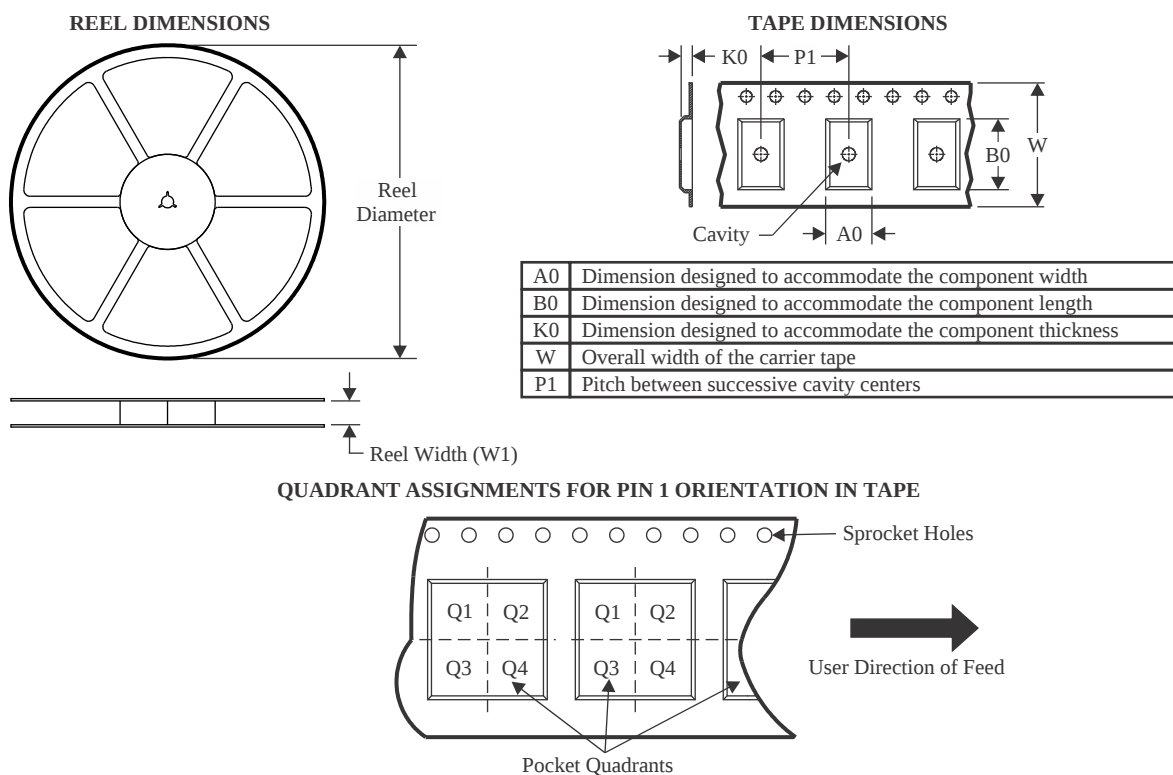
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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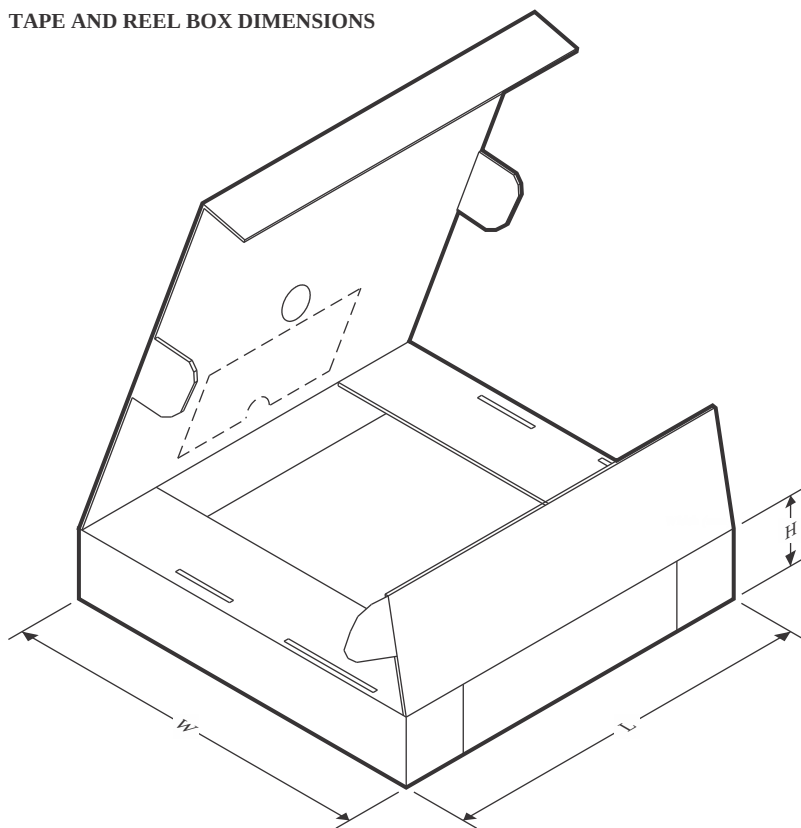
TAPE AND REEL INFORMATION



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
UC2573DTR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
UC3573DTR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



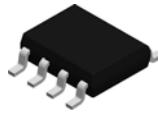
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
UC2573DTR	SOIC	D	8	2500	340.5	338.1	20.6
UC3573DTR	SOIC	D	8	2500	353.0	353.0	32.0

TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
UC2573D	D	SOIC	8	75	507	8	3940	4.32
UC2573D.A	D	SOIC	8	75	507	8	3940	4.32
UC2573DG4	D	SOIC	8	75	507	8	3940	4.32
UC3573D	D	SOIC	8	75	507	8	3940	4.32
UC3573D.A	D	SOIC	8	75	507	8	3940	4.32

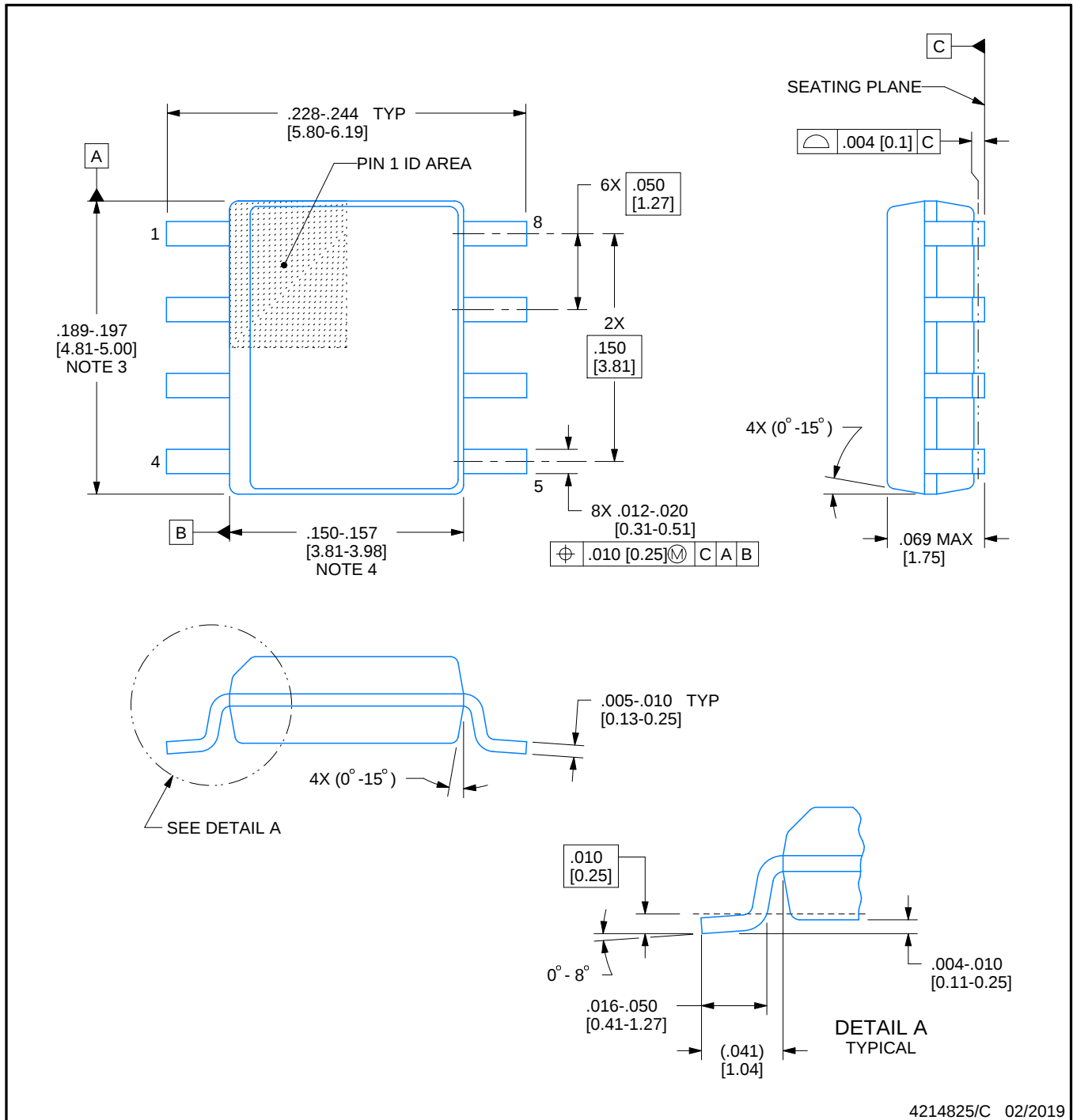


D0008A

PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



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NOTES:

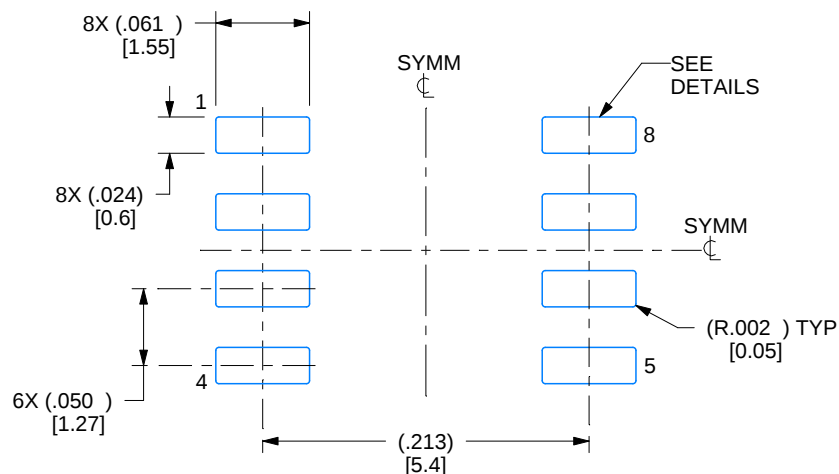
1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.

EXAMPLE BOARD LAYOUT

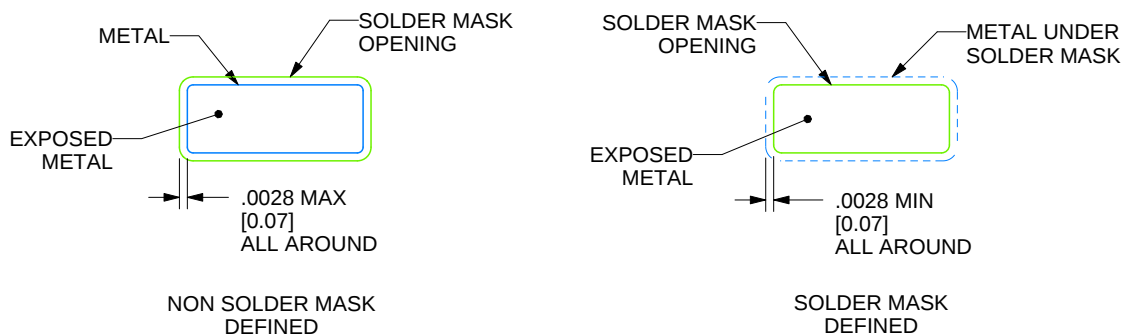
D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



SOLDER MASK DETAILS

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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

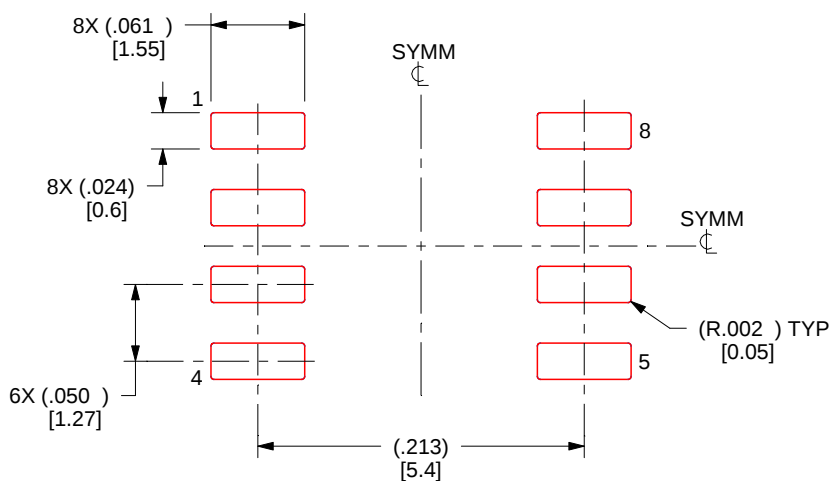
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

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NOTES: (continued)

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

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