VOLTAGE PROTECTION FOR 2-, 3-, OR 4-CELL Li-Ion BATTERIES (2nd-LEVEL PROTECTION)

Check for Samples: bq29410, bq29411, bq29412, bq29413, bq29414, bq29415, bq29419

FEATURES

- **2-, 3-, or 4-Cell Secondary Protection**
- **Low Power Consumption I_{CC} < 2 µA [$VCELL_{(ALL)}$ < $V_{(PROTECT)}$]**
- **Fixed High Accuracy Overvoltage Protection Threshold**
  - **bq29410 = 4.35 V**
  - **bq29411 = 4.40 V**
  - **bq29412 = 4.45 V**
  - **bq29413 = 4.50 V**
  - **bq29414 = 4.55 V**
  - **bq29415 = 4.60 V**
  - **bq29419 = 4.30 V**
- **Programmable Delay Time of Detection**
- **High Power Supply Ripple Rejection**
- **Stable During Pulse Charge Operation**

APPLICATIONS

- **2nd-Level Overvoltage Protection in Li-Ion Battery Packs in:**
  - **Notebook Computers**
  - **Portable Instrumentation**
  - **Portable Equipment**

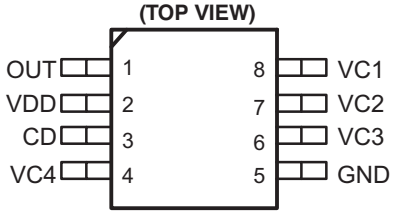
DESCRIPTION

The bq2941x is a secondary overvoltage protection IC for 2-, 3-, or 4-cell lithium-ion battery packs that incorporates a high-accuracy precision overvoltage detection circuit. It includes a programmable delay circuit for overvoltage detection time.

FUNCTION

Each cell in a multiple-cell pack is compared to an internal reference voltage. If one cell reaches an overvoltage condition, the protection sequence begins. The bq2941x device starts charging an external capacitor through the CD pin. When the CD pin voltage reaches 1.2 V, the OUT pin changes from a low level to a high level.

DCT PACKAGE
(TOP VIEW)



PW PACKAGE
(TOP VIEW)

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

ORDERING INFORMATION(1)

T_A	$V_{(PROTECT)}$ (2)	PACKAGE(3)			
		MSOP (DCT)	SYMBOL	SSOP (PW)	
–40°C to 110°C	4.30 V	bq29419DCTR	CJQ	bq29419PWG4	bq29419PWRG4
		bq29419DCTT			
	4.35 V	bq29410DCT3R	CJG	bq29410PW bq29410PWG4	bq29410PWR bq29410PWRG4
		bq29410DCTR			
		bq29410DCTT			
	4.40 V	bq29411DCT3R	CJH	bq29411PW bq29411PWG4	bq29411PWR bq29411PWRG4
		bq29411DCTR			
		bq29411DCTT			
	4.45 V	bq29412DCT3R	CJJ	bq29412PW bq29412PWG4	bq29412PWR bq29412PWRG4
		bq29412DCTR			
		bq29412DCTT			
	4.50 V	bq29413DCTR	CJk	bq29413PW	bq29413PWR
		bq29413DCTT			
	4.55 V	bq29414DCTR	CJL	bq29414PW	bq29414PWR
		bq29414DCTT			
	4.60 V	bq29415DCTR	CJM	bq29415PW	bq29415PWR
		bq29415DCTT			

(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) Contact your local Texas Instruments representative or sales office for alternative overvoltage threshold options.
(3) The "R" suffix indicates tape-and-reel packaging.

ABSOLUTE MAXIMUM RATINGS

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

		UNIT
Supply voltage range	VDD	–0.3 V to 28 V
Input voltage range	VC1, VC2, VC3, VC4	–0.3 V to 28 V
	VC1 TO VC2, VC2 TO VC3, VC3 TO VC4, VC4 TO GND	–0.3 V to 8 V
Output voltage range	OUT	–0.3 V to 28 V
	CD	–0.3 V to 28 V
Continuous total power dissipation		See Dissipation Rating Table
Storage temperature range, T_{stg}		–65°C to 150°C
Lead temperature (soldering, 10 s)		300°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) All voltages are with respect to ground of this device except the differential voltage of VC1-VC2, VC2-VC3, VC3-VC4, and VC4-GND.

PACKAGE DISSIPATION RATINGS

PACKAGE	T_A = 25°C POWER RATING	DERATING FACTOR ABOVE T_A = 25°C	T_A = 70°C POWER RATING	T_A = 85°C POWER RATING
DCT	412 mW	3.3 mW/°C	264 mW	214 mW
PW	525 mW	4.2 mW/°C	336 mW	273 mW

RECOMMENDED OPERATING CONDITIONS

			MIN	NOM	MAX	UNIT
V_{DD}	Supply voltage		4		25	V
V_I	Input voltage range	VC1, VC2, VC3, VC4	0		25	V
		VCn – VC (n=1), (n=1, 2, 3), VC4 – GND	0		5	
$t_{d(CD)}$	Delay time capacitance			0.22		µF
R_{IN}	Voltage-monitor filter resistance		100	1k		Ω
C_{IN}	Voltage-monitor filter capacitance		0.01	0.1		µF
R_{VD}	Supply-voltage filter resistance		0		1	kΩ
C_{VD}	Supply-voltage filter capacitance			0.1		µF
T_A	Operating ambient temperature range		–40		110	°C

ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITION	MIN	NOM	MAX	UNIT
$V_{(OA)}$	Overvoltage detection accuracy	T_A = 25°C		25	35	mV
		T_A = –20°C to 85°C		25	50	
		T_A = –40°C to 110°C			80	
$V_{(PROTECT)}$	Overvoltage detection voltage	bq29410		4.35		V
		bq29411		4.40		
		bq29412		4.45		
		bq29413		4.50		
		bq29414		4.55		
		bq29415		4.60		
		bq29419		4.30		
V_{hys}	Overvoltage detection hysteresis	bq29410/11/12/13/14/15		320		mV
		bq29419	250	320	450	
I_{IN}	Input current	V2, V3 , VC4 input ,V_{DD} = VC1 VC1 = VC2 = VC3 = VC4 = 3.5 V (see Figure 1)			0.3	µA
t_{D1}	Overvoltage detection delay time	V_{DD} = VC1, CD = 0.22 µF	1	1.5	2	S
$I_{(CD\_dis)}$	CD GND clamp current	V_{DD} = VC1, CD = 1 V	5	12		µA
I_{CC}	Supply current	V_{DD} = VC1, VC1–VC2 = VC2–VC3 = VC3–VC4 = VC4–GND = 3.5 V (see Figure 1)		2	3	µA
		V_{DD} = VC1, VC1–VC2 = VC2–VC3 = VC3–VC4 = VC4–GND = 2.3 V (see Figure 1)		1.5	2.5	
$V_{(OUT)}$	OUT pin drive voltage	VC1–VC2 = VC2–VC3 = VC3–VC4 = VC4–GND = $V_{(PROTECT)}$Max, V_{DD} = 14 V, I_{OH} = 0 mA		7		V
		VC1 = VC2 = VC3 = VC4 = $V_{(PROTECT)}$Max, V_{DD} = 4.3 V, T_A = 0°C to 70°C, I_{OH} = 40 µA	1.5	2	2.5	
I_{OH}	High-level output current	OUT = 3 V, VC1–VC2 = VC2–VC3 = VC3–VC4 = VC4–GND = $V_{(PROTECT)}$Max, V_{DD} = 14 V			–1	mA
I_{OL}	Low-level output current	OUT = 0.1 V, V_{DD} = VC1, VC1–VC2 = VC2–VC3 = VC3–VC4 = VC4–GND = 3.5 V	5			µA

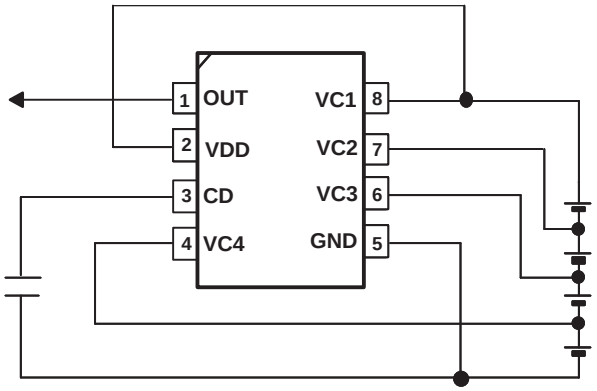
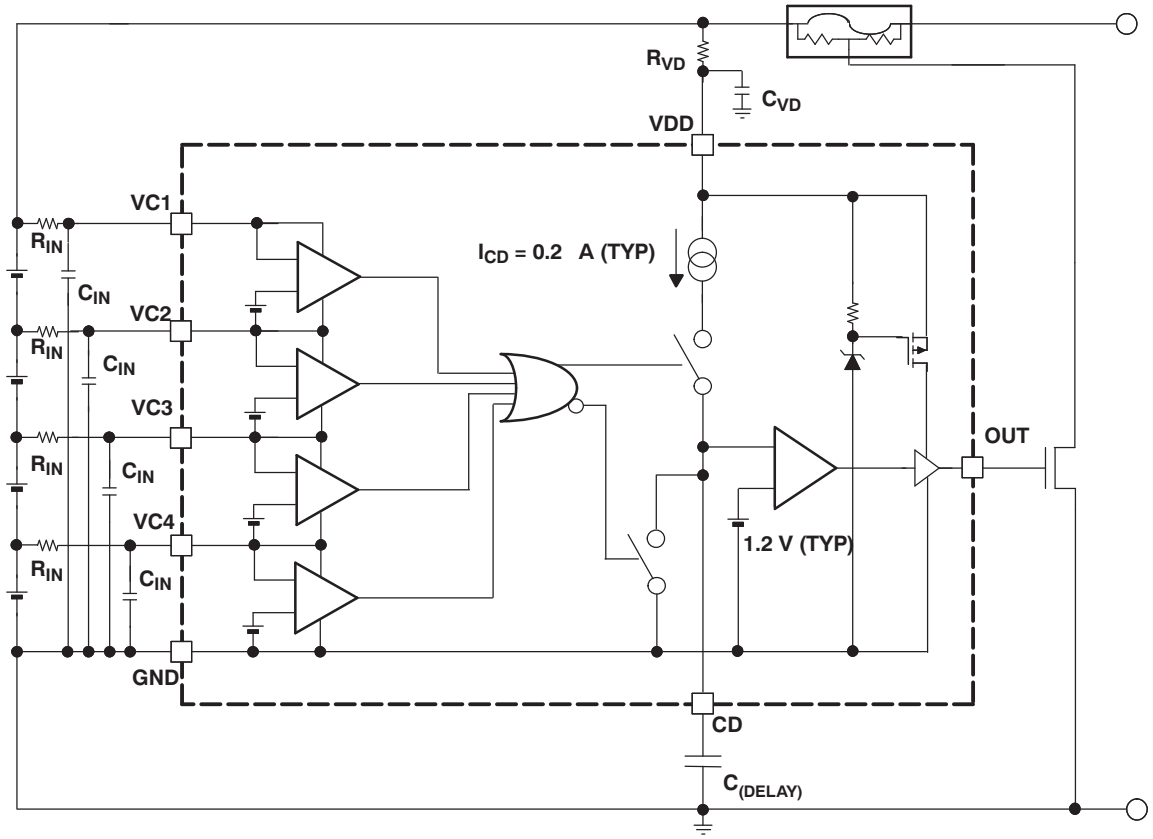


Figure 1. I_{CC}, I_{IN} Measurement (DCT Package)

Terminal Functions

TERMINAL			DESCRIPTION
MSOP (DCT)	TSSOP (PW)	NAME	
8	1	VC1	Sense voltage input for most positive cell
7	2	VC2	Sense voltage input for second most positive cell
6	3	VC3	Sense voltage input for third most positive cell
5	4	GND	Ground pin
4	5	VC4	Sense voltage input for least positive cell
3	6	CD	An external capacitor is connected to determine the programmable delay time
2	7	VDD	Power supply
1	8	OUT	Output

FUNCTIONAL BLOCK DIAGRAM



OVERVOLTAGE PROTECTION

When one of the cell voltages exceeds $V_{(PROTECT)}$, an internal current source begins to charge the capacitor, $C_{(DELAY)}$, connected to the CD pin. If the voltage at the CD pin, $V_{CD,}$ reaches 1.2 V, the OUT pin is activated and transitions high. An externally connected NCH FET is activiated and blows the external fuse in the positive battery rail; see the functional block diagram.

If all cell voltages fall below $V_{(PROTECT)}$ before the voltage at pin CD reaches 1.2 V, the delay time does not run out. An internal switch clamps the CD pin to GND and discharges the capacitor, $C_{(DELAY)}$, and secures the full delay time for the next occurring overvoltage event.

Once the pin OUT is activated, it transitions back from high to low after all battery cells reach $V_{(PROTECT)} - V_{hys.}$

DELAY TIME CALCULATION

The delay time is calculated as follows:

$$t_d = \frac{\left[1.2\ V \times C_{(DELAY)}\right]}{I_{CD}}$$

$$C_{(DELAY)} = \frac{\left[t_d \times I_{CD}\right]}{1.2\ V}$$

Where $I_{(CD)}$ = CD current source = 0.18 µA

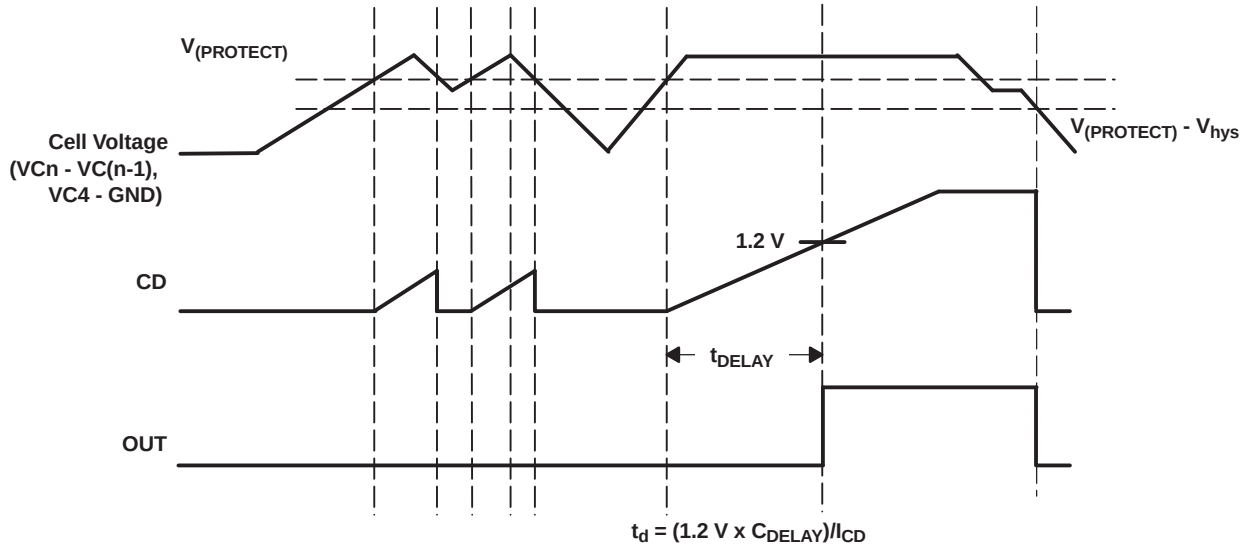


Figure 2. Timing for Overvoltage Sensing

APPLICATION INFORMATION

BATTERY CONNECTIONS

The following diagrams show the DCT package device in different cell configurations.

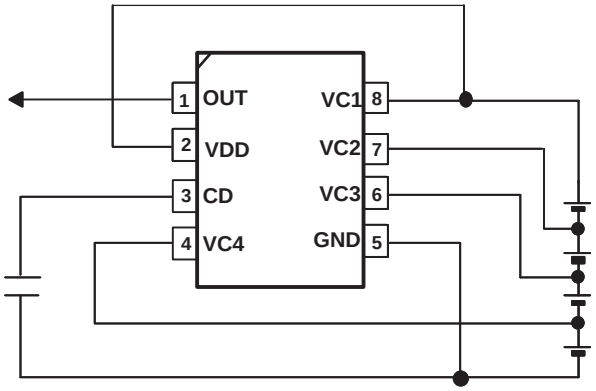


Figure 3. 4-Series Cell Configuration

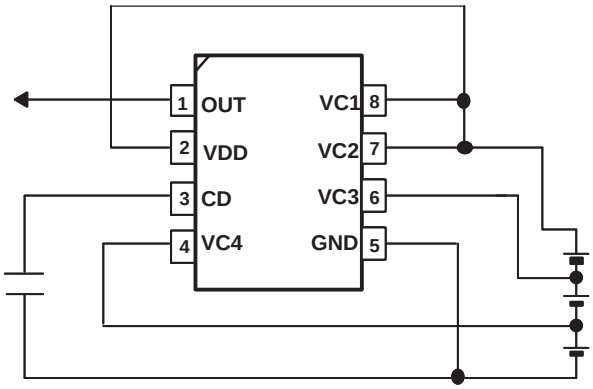


Figure 4. 3-Series Cell Configuration (Connect together VC1 and VC2)

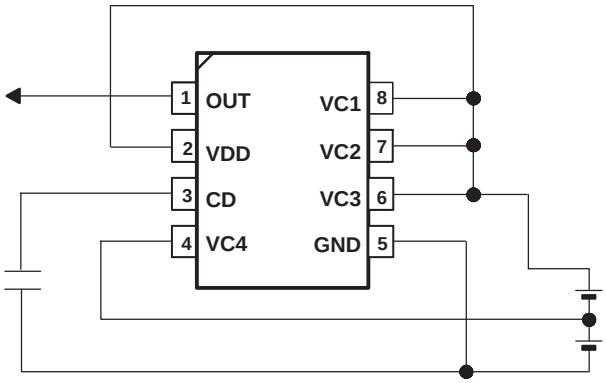


Figure 5. 2-Series Cell Configuration

CELL CONNECTIONS

To prevent incorrect output activation, the following connection sequences must be used.

4-Series Cell Configuration

- VC1(=VDD) → VC2 → VC3 → VC4 → GND or
- GND → VC4 → VC3 → VC2 → VC1(=VDD)

3-Series Cell Configuration

- VC1(=VC2=VDD) → VC3 → VC4 → GND or
- GND → VC4 → VC3 → VC1(=VC2=VDD)

2-Series Cell Configuration

- VC1(=VC2=VC3=VDD) → VC4 → GND or
- GND → VC4 → VC1(=VC2=VC3=VDD)

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
BQ29410DCT3R	ACTIVE	SM8	DCT	8	3000	RoHS & Non-Green	SNBI	Level-1-260C-UNLIM	-40 to 110	CJG W	Samples
BQ29410DCT3RE6	ACTIVE	SM8	DCT	8	3000	RoHS & Non-Green	SNBI	Level-1-260C-UNLIM	-40 to 110	CJG W	Samples
BQ29410DCTR	ACTIVE	SM8	DCT	8	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	CJG W	Samples
BQ29410DCTRG4	ACTIVE	SM8	DCT	8	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	CJG W	Samples
BQ29410DCTT	ACTIVE	SM8	DCT	8	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	CJG W	Samples
BQ29410PW	ACTIVE	TSSOP	PW	8	150	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	29410	Samples
BQ29410PWR	ACTIVE	TSSOP	PW	8	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	29410	Samples
BQ29410PWRG4	ACTIVE	TSSOP	PW	8	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 110	29410	Samples
BQ29411DCT3R	ACTIVE	SM8	DCT	8	3000	RoHS & Non-Green	SNBI	Level-1-260C-UNLIM	-40 to 110	CJH W	Samples
BQ29411DCTR	ACTIVE	SM8	DCT	8	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	CJH W	Samples
BQ29411DCTRG4	ACTIVE	SM8	DCT	8	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	CJH W	Samples
BQ29411DCTT	ACTIVE	SM8	DCT	8	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	CJH W	Samples
BQ29411PW	ACTIVE	TSSOP	PW	8	150	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	29411	Samples
BQ29411PWRG4	ACTIVE	TSSOP	PW	8	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 110	29411	Samples
BQ29412DCT3R	ACTIVE	SM8	DCT	8	3000	RoHS & Non-Green	SNBI	Level-1-260C-UNLIM	-40 to 110	CJJ W	Samples
BQ29412DCTR	ACTIVE	SM8	DCT	8	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	CJJ W	Samples
BQ29412DCTRG4	ACTIVE	SM8	DCT	8	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	CJJ W	Samples

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
BQ29412DCTT	ACTIVE	SM8	DCT	8	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	CJJ W	Samples
BQ29412PWR	ACTIVE	TSSOP	PW	8	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		29412	Samples
BQ29412PWRG4	ACTIVE	TSSOP	PW	8	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR		29412	Samples
BQ29413DCTR	ACTIVE	SM8	DCT	8	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	CJK W	Samples
BQ29413DCTRG4	ACTIVE	SM8	DCT	8	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 110	CJK W	Samples
BQ29413PWR	ACTIVE	TSSOP	PW	8	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 110	29413	Samples
BQ29415PWR	ACTIVE	TSSOP	PW	8	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 110	2915	Samples
BQ29419PW	ACTIVE	TSSOP	PW	8	150	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 110	29419	Samples
BQ29419PWG4	ACTIVE	TSSOP	PW	8	150	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 110	29419	Samples
BQ29419PWR	ACTIVE	TSSOP	PW	8	2000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 110	29419	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.

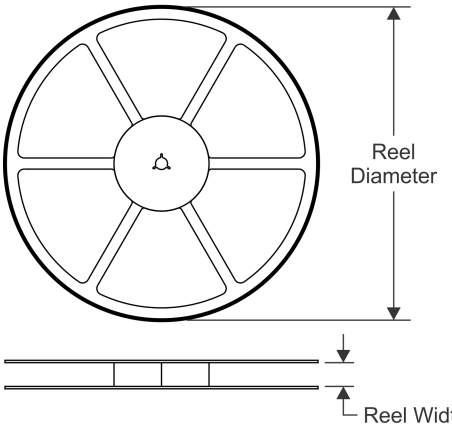
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

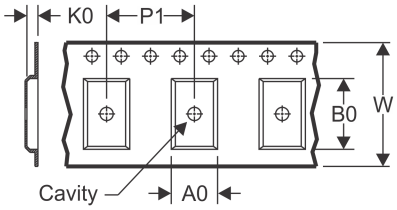
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

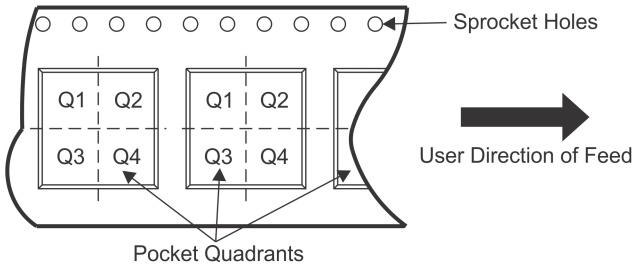


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

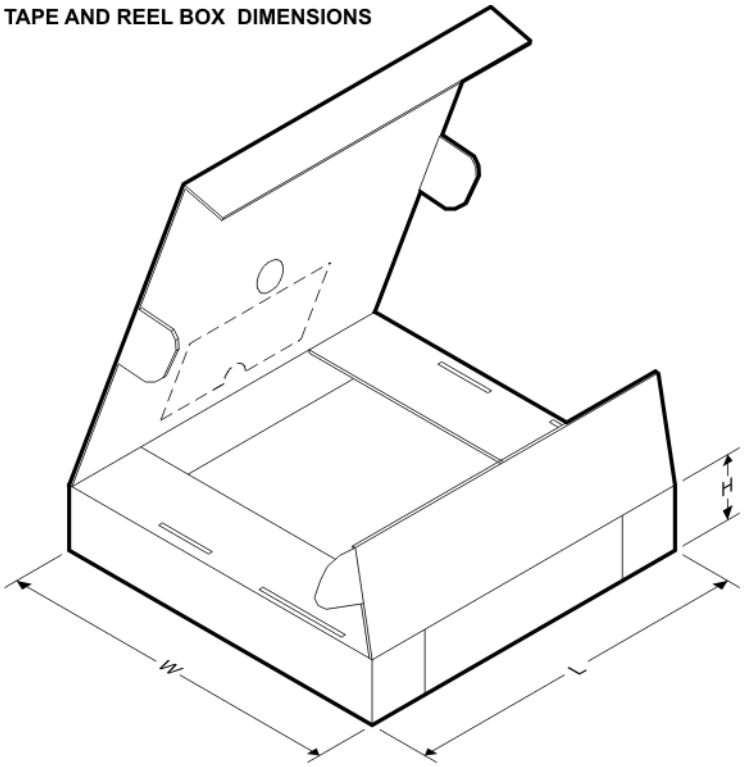
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
BQ29410DCT3R	SM8	DCT	8	3000	180.0	13.0	3.35	4.5	1.55	4.0	12.0	Q3
BQ29410DCTR	SM8	DCT	8	3000	180.0	13.0	3.35	4.5	1.55	4.0	12.0	Q3
BQ29410DCTT	SM8	DCT	8	250	180.0	13.0	3.35	4.5	1.55	4.0	12.0	Q3
BQ29410PWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
BQ29410PWRG4	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
BQ29411DCT3R	SM8	DCT	8	3000	180.0	13.0	3.35	4.5	1.55	4.0	12.0	Q3
BQ29411DCTR	SM8	DCT	8	3000	180.0	13.0	3.35	4.5	1.55	4.0	12.0	Q3
BQ29411DCTT	SM8	DCT	8	250	180.0	13.0	3.35	4.5	1.55	4.0	12.0	Q3
BQ29411PWRG4	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
BQ29412DCTR	SM8	DCT	8	3000	180.0	13.0	3.35	4.5	1.55	4.0	12.0	Q3
BQ29412DCTT	SM8	DCT	8	250	180.0	13.0	3.35	4.5	1.55	4.0	12.0	Q3
BQ29412PWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
BQ29412PWRG4	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
BQ29413DCTR	SM8	DCT	8	3000	180.0	13.0	3.35	4.5	1.55	4.0	12.0	Q3
BQ29413PWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
BQ29415PWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
BQ29419PWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1

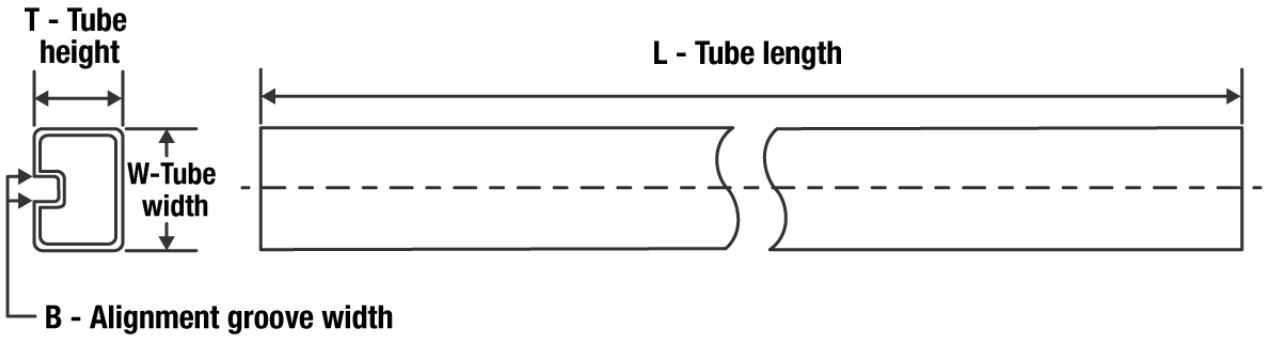
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
BQ29410DCT3R	SM8	DCT	8	3000	182.0	182.0	20.0
BQ29410DCTR	SM8	DCT	8	3000	182.0	182.0	20.0
BQ29410DCTT	SM8	DCT	8	250	182.0	182.0	20.0
BQ29410PWR	TSSOP	PW	8	2000	367.0	367.0	35.0
BQ29410PWRG4	TSSOP	PW	8	2000	367.0	367.0	35.0
BQ29411DCT3R	SM8	DCT	8	3000	182.0	182.0	20.0
BQ29411DCTR	SM8	DCT	8	3000	182.0	182.0	20.0
BQ29411DCTT	SM8	DCT	8	250	182.0	182.0	20.0
BQ29411PWRG4	TSSOP	PW	8	2000	367.0	367.0	35.0
BQ29412DCTR	SM8	DCT	8	3000	182.0	182.0	20.0
BQ29412DCTT	SM8	DCT	8	250	182.0	182.0	20.0
BQ29412PWR	TSSOP	PW	8	2000	367.0	367.0	35.0
BQ29412PWRG4	TSSOP	PW	8	2000	367.0	367.0	35.0
BQ29413DCTR	SM8	DCT	8	3000	182.0	182.0	20.0
BQ29413PWR	TSSOP	PW	8	2000	367.0	367.0	35.0
BQ29415PWR	TSSOP	PW	8	2000	367.0	367.0	35.0
BQ29419PWR	TSSOP	PW	8	2000	367.0	367.0	35.0

TUBE



*All dimensions are nominal

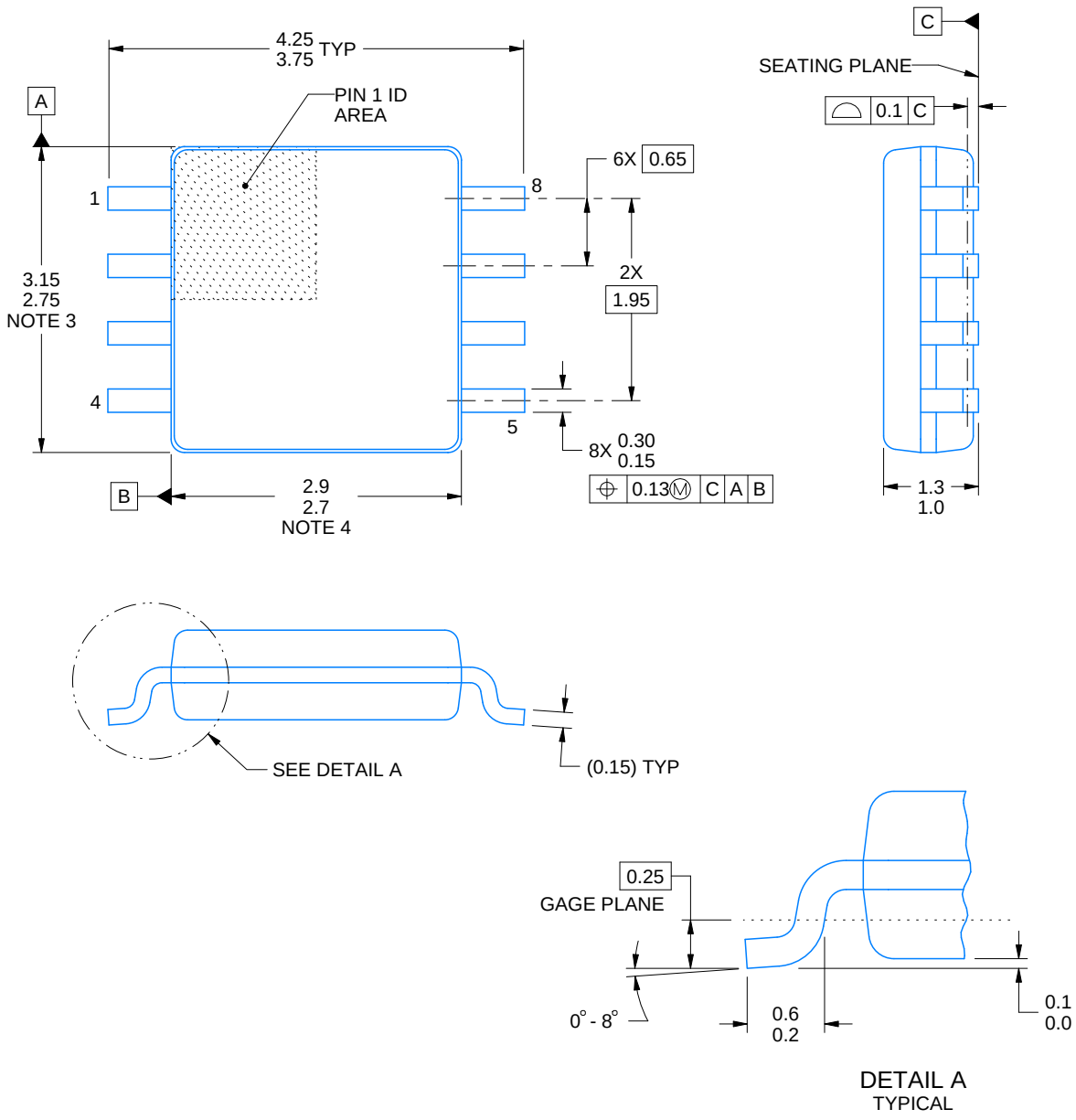
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
BQ29410PW	PW	TSSOP	8	150	530	10.2	3600	3.5
BQ29411PW	PW	TSSOP	8	150	530	10.2	3600	3.5
BQ29419PW	PW	TSSOP	8	150	508	8.5	3250	2.8
BQ29419PWG4	PW	TSSOP	8	150	508	8.5	3250	2.8

PACKAGE OUTLINE

DCT0008A

SSOP - 1.3 mm max height

SMALL OUTLINE PACKAGE



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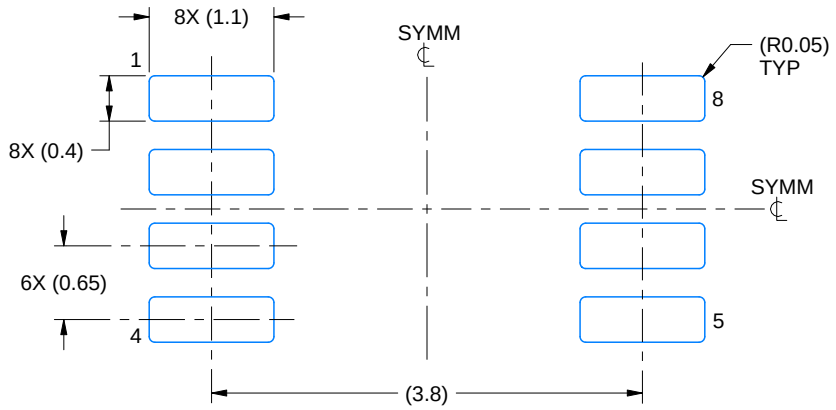
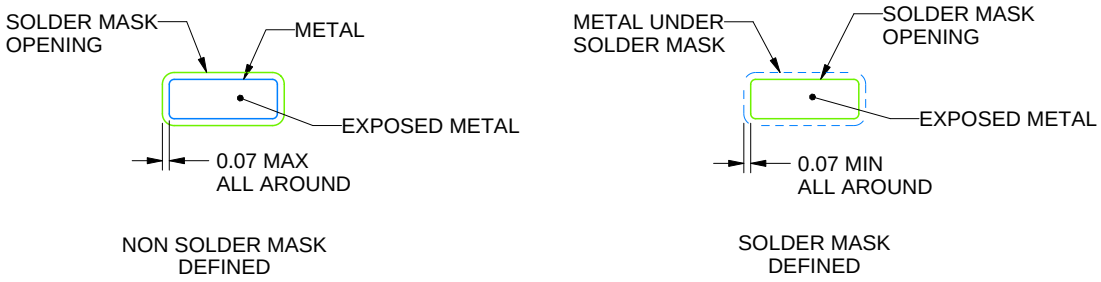
NOTES:

1. All linear dimensions are in millimeters. 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 dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X

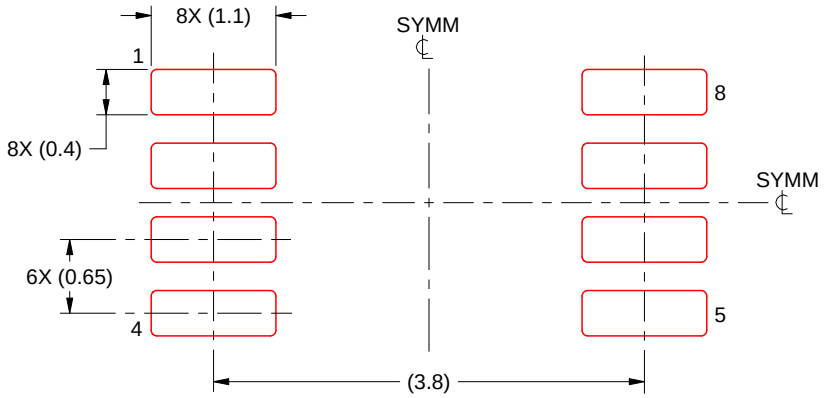


SOLDER MASK DETAILS

4220784/C 06/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

4220784/C 06/2021

NOTES: (continued)

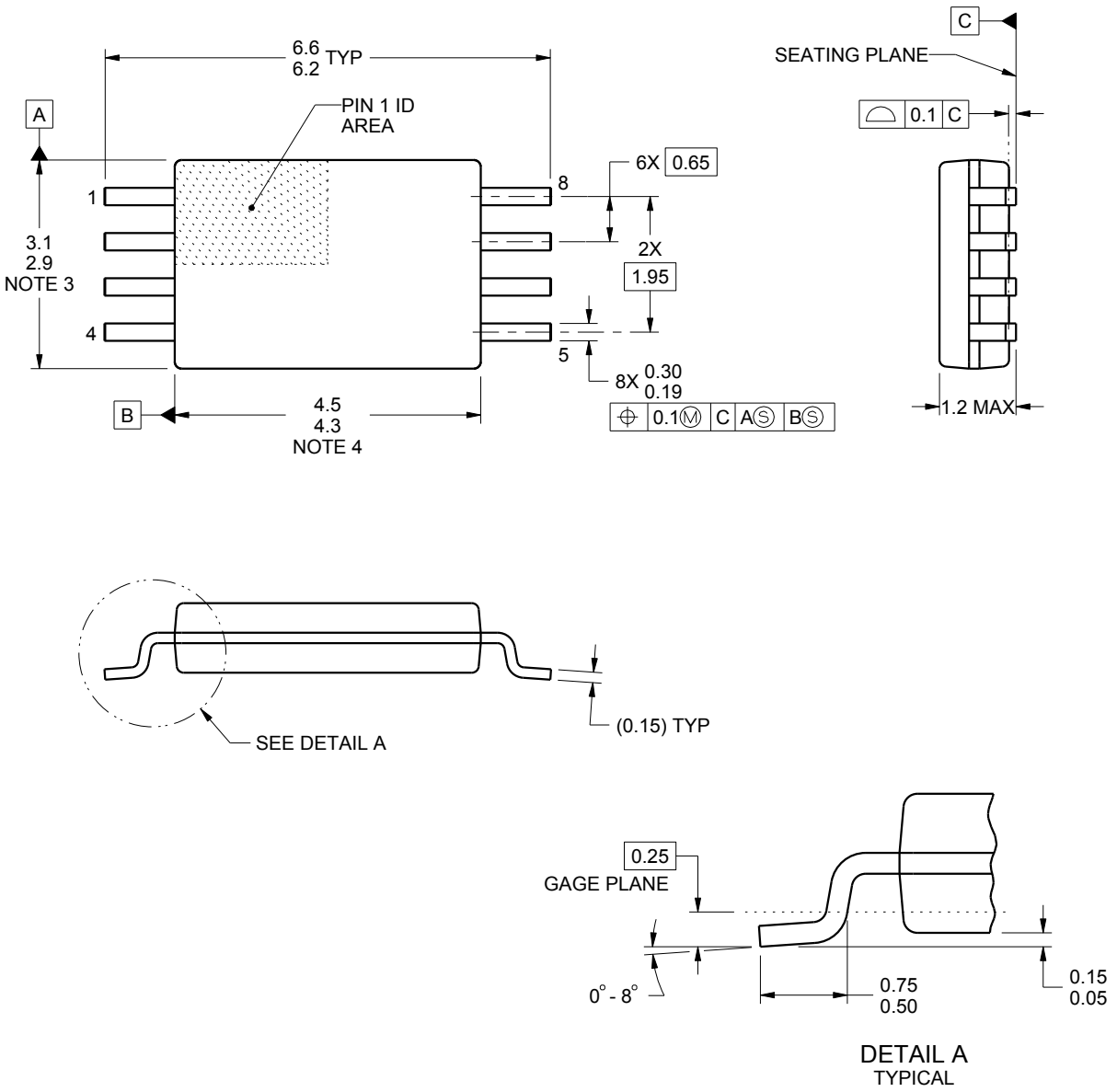
7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

PACKAGE OUTLINE

PW0008A

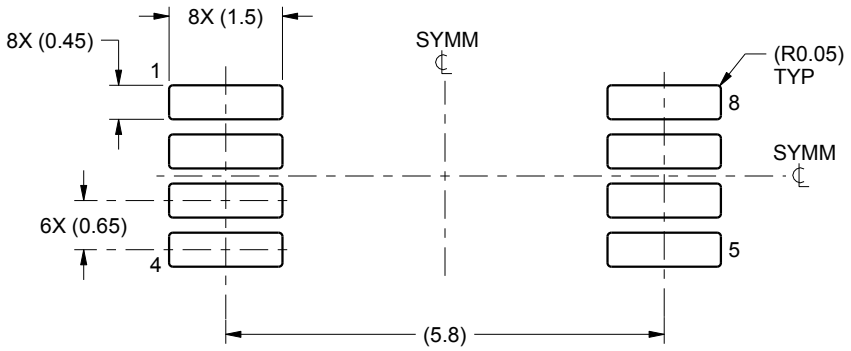
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

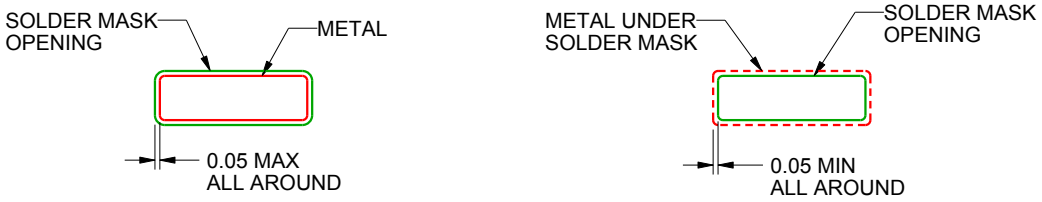


NOTES:

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 dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153, variation AA.



LAND PATTERN EXAMPLE
SCALE:10X

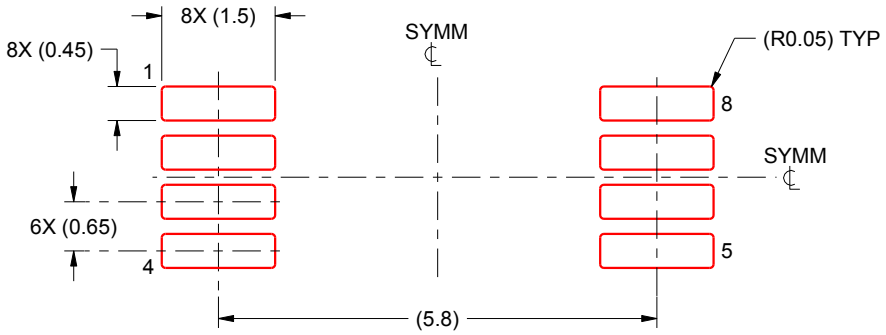


SOLDER MASK DETAILS
NOT TO SCALE

4221848/A 02/2015

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.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:10X

4221848/A 02/2015

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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