

Dual 30-V N-Channel NexFET™ Power MOSFETs

FEATURES

- Common Source Connection
- Ultra Low Drain to Drain On-Resistance
- Space Saving SON 3.3 x 3.3mm Plastic Package
- Optimized for 5V Gate Drive
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free

APPLICATIONS

- Adaptor/USB Input Protection for Notebook PCs and Tablets

DESCRIPTION

The CSD87312Q3E is a 30V common-source, dual N-channel device designed for adaptor/USB input protection. This SON 3.3 x 3.3mm device has low drain to drain on-resistance that minimizes losses and offers low component count for space constrained multi-cell battery charging applications.

PRODUCT SUMMARY

$T_A = 25^\circ\text{C}$		TYPICAL VALUE		UNIT
V_{DS}	Drain to Source Voltage	30		V
Q_g	Gate Charge Total (4.5V)	6.3		nC
Q_{gd}	Gate Charge Gate to Drain	0.7		nC
$R_{DD(on)}$	Drain to Drain On Resistance (Q1+Q2)	$V_{GS} = 4.5\text{V}$	31	m Ω
		$V_{GS} = 8\text{V}$	27	m Ω
$V_{GS(th)}$	Threshold Voltage	1.0		V

ORDERING INFORMATION

Device	Package	Media	Qty	Ship
CSD87312Q3E	SON 3.3 x 3.3mm Plastic Package	13-Inch Reel	2500	Tape and Reel

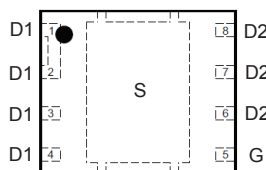
ABSOLUTE MAXIMUM RATINGS

$T_A = 25^\circ\text{C}$		VALUE	UNIT
V_{DS}	Drain to Source Voltage	30	V
V_{GS}	Gate to Source Voltage	+10/-8	V
I_D	Continuous Drain Current, $T_C = 25^\circ\text{C}^{(1)}$	27	A
I_{DM}	Pulsed Drain Current ⁽²⁾	45	A
P_D	Power Dissipation	2.5	W
T_J, T_{STG}	Operating Junction and Storage Temperature Range	-55 to 150	$^\circ\text{C}$
E_{AS}	Avalanche Energy, single pulse $I_D = 24\text{A}, L = 0.1\text{mH}, R_G = 25\Omega$	29	mJ

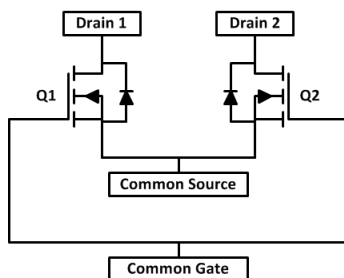
(1) Typical $R = 63^\circ\text{C/W}$ on 1in^2 (2 oz.) on 0.060" thick FR4PCB

(2) Pulse duration $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$

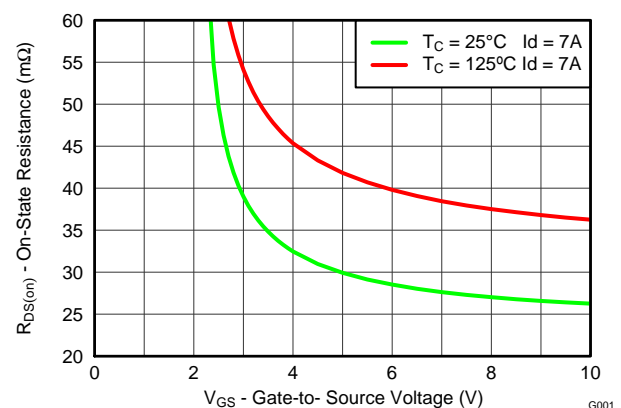
Top View



Circuit Image



V_{GS} vs. R_{DDon}



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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.

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Static Characteristics						
BV _{DSS}	Drain to Source Voltage	V _{GS} = 0V, I _D = 250μA	30			V
I _{DSS}	Drain to Source Leakage Current	V _{GS} = 0V, V _{DS} = 24V			1	μA
I _{GSS}	Gate to Source Leakage Current	V _{DS} = 0V, V _{GS} = +10/-8V			100	nA
V _{GS(th)}	Gate to Source Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	0.8	1.0	1.3	V
R _{DD(on)}	Drain to Drain On Resistance (Q1 + Q2)	V _{GS} = 4.5V, I _D = 7A		31	38	mΩ
		V _{GS} = 8V, I _D = 7A		27	33	mΩ
g _{fs}	Transconductance	V _{DS} = 15V, I _D = 7A		39		S
Dynamic Characteristics ⁽¹⁾						
C _{iss}	Input Capacitance	V _{GS} = 0V, V _{DS} = 15V, f = 1MHz		960	1250	pF
C _{oss}	Output Capacitance			190	247	pF
C _{rss}	Reverse Transfer Capacitance			12	16	pF
R _G	Series Gate Resistance			5	10	Ω
Q _g	Gate Charge Total (4.5V)	V _{DS} = 15V, I _D = 7A		6.3	8.2	nC
Q _{gd}	Gate Charge Gate to Drain			0.7		nC
Q _{gs}	Gate Charge Gate to Source			1.9		nC
Q _{g(th)}	Gate Charge at V _{th}			1.0		nC
Q _{oss}	Output Charge	V _{DS} = 15V, V _{GS} = 0V		4.0		nC
t _{d(on)}	Turn On Delay Time	V _{DS} = 15V, V _{GS} = 4.5V, I _{DS} = 7A, R _G = 2Ω		7.8		ns
t _r	Rise Time			16		ns
t _{d(off)}	Turn Off Delay Time			17		ns
t _f	Fall Time			2.9		ns
Diode Characteristics ⁽¹⁾						
V _{SD}	Diode Forward Voltage	I _{SD} = 7A, V _{GS} = 0V		0.8	1	V
Q _{rr}	Reverse Recovery Charge	V _{DS} = 15V, I _F = 7A, di/dt = 300A/μs		5.3		nC
t _{rr}	Reverse Recovery Time			12.2		ns

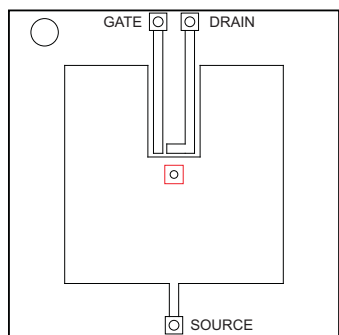
(1) All Dynamic and Diode Characteristics were measured with respect to one of the two drains, with the other left floating.

THERMAL CHARACTERISTICS

(T_A = 25°C unless otherwise stated)

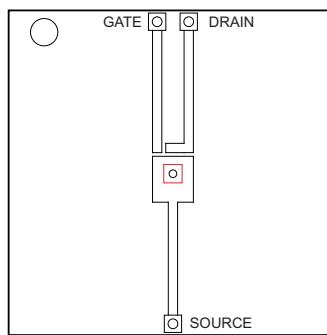
PARAMETER		MIN	TYP	MAX	UNIT
R _{θJC}	Thermal Resistance Junction to Case ⁽¹⁾			4.2	°C/W
R _{θJA}	Thermal Resistance Junction to Ambient ⁽¹⁾⁽²⁾			63	°C/W

- (1) R_{θJC} is determined with the device mounted on a 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu pad on a 1.5-inch × 1.5-inch (3.81-cm × 3.81-cm), 0.06-inch (1.52-mm) thick FR4 PCB. R_{θJC} is specified by design, whereas R_{θJA} is determined by the user's board design.
- (2) Device mounted on FR4 material with 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu.



Max $R_{\theta JA} = 63^{\circ}\text{C/W}$
when mounted on
1 inch² (6.45 cm²) of 2-
oz. (0.071-mm thick)
Cu.

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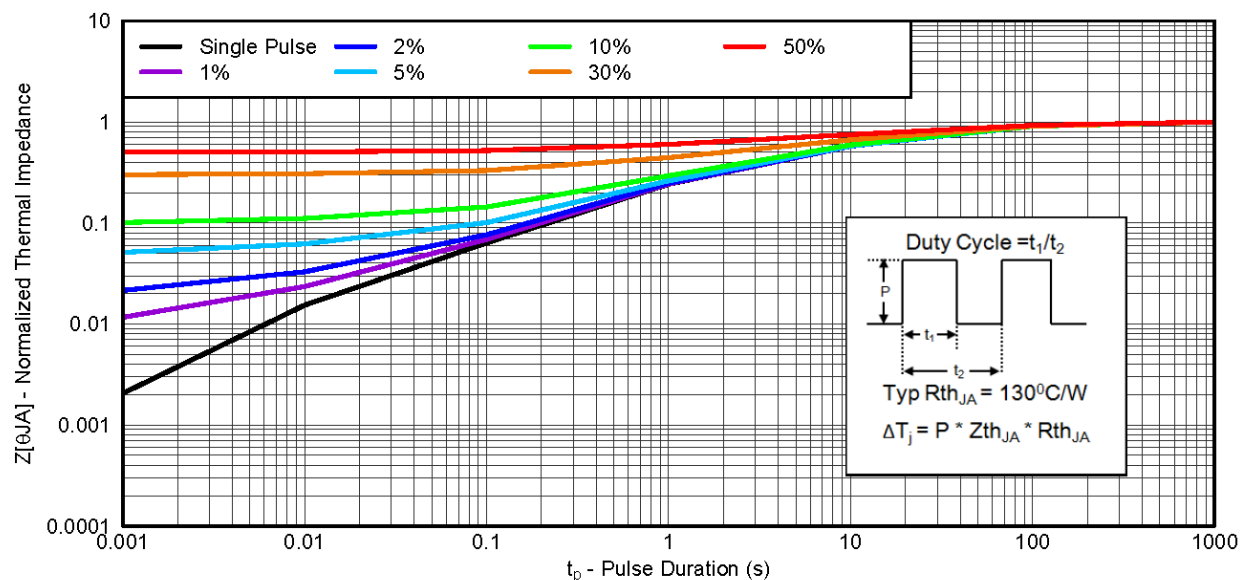


Max $R_{\theta JA} = 165^{\circ}\text{C/W}$
when mounted on a
minimum pad area of
2-oz. (0.071-mm thick)
Cu.

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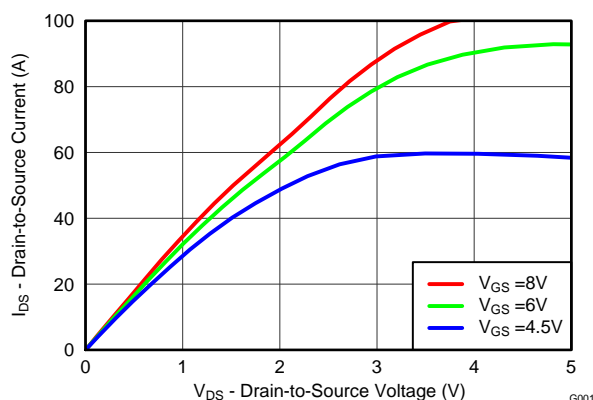
TYPICAL MOSFET CHARACTERISTICS

($T_A = 25^{\circ}\text{C}$ unless otherwise stated)



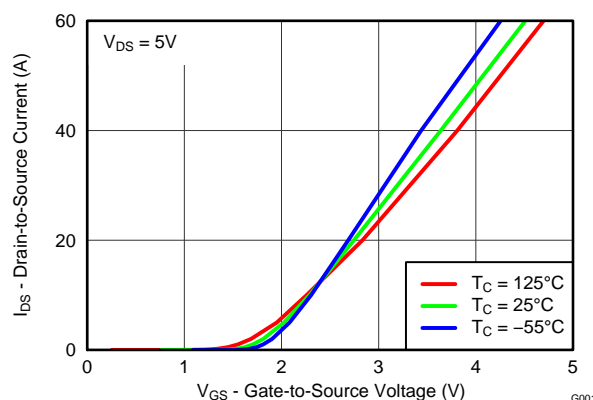
G001

Figure 1. Transient Thermal Impedance



G001

Figure 2. Saturation Characteristics



G001

Figure 3. Transfer Characteristics

TYPICAL MOSFET CHARACTERISTICS (continued)

($T_A = 25^\circ\text{C}$ unless otherwise stated)

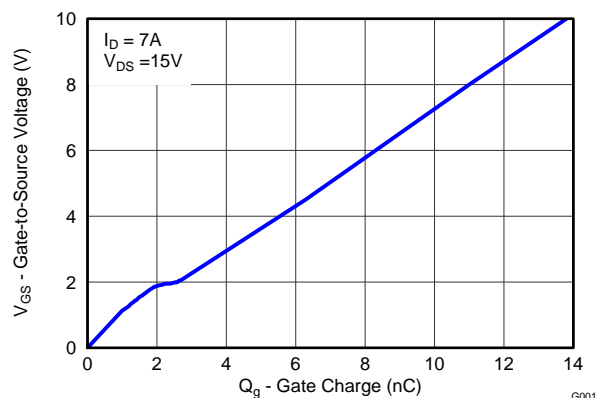


Figure 4. Gate Charge

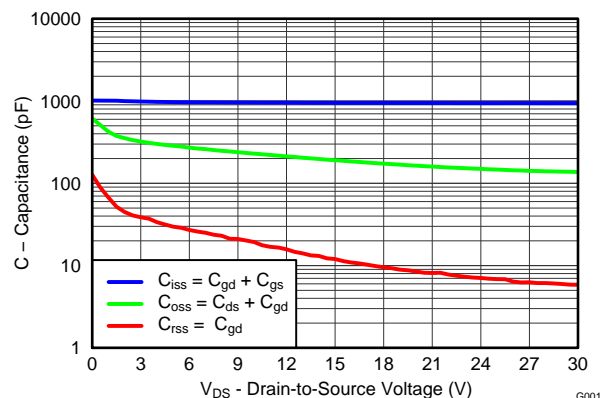


Figure 5. Capacitance

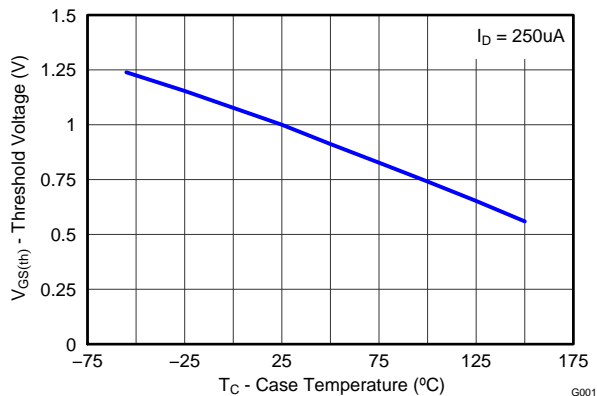


Figure 6. Threshold Voltage vs. Temperature

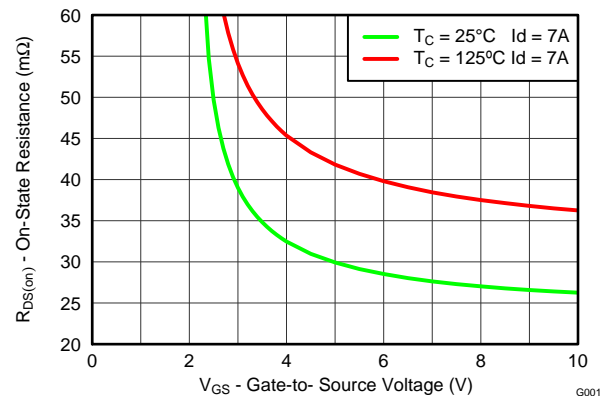


Figure 7. On-State Resistance vs. Gate-to-Source Voltage

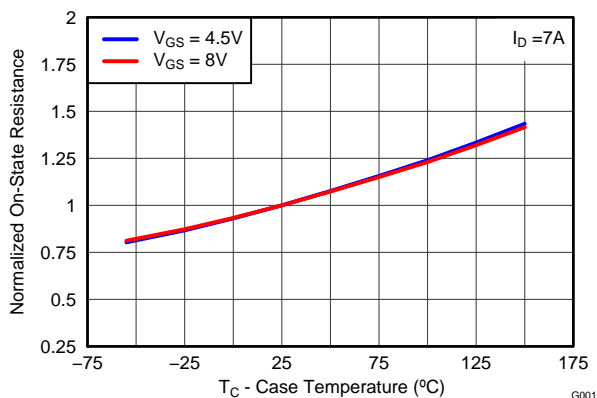


Figure 8. Normalized On-State Resistance vs. Temperature

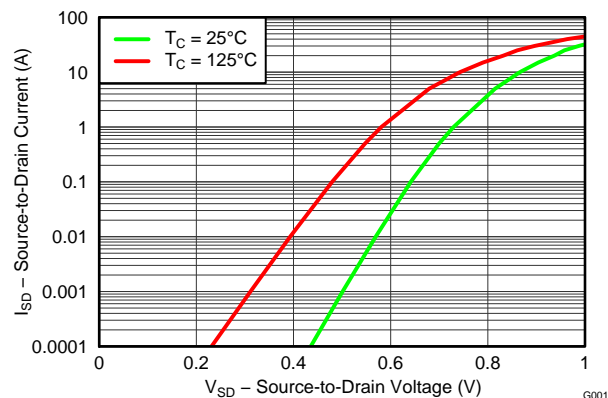


Figure 9. Typical Diode Forward Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

($T_A = 25^\circ\text{C}$ unless otherwise stated)

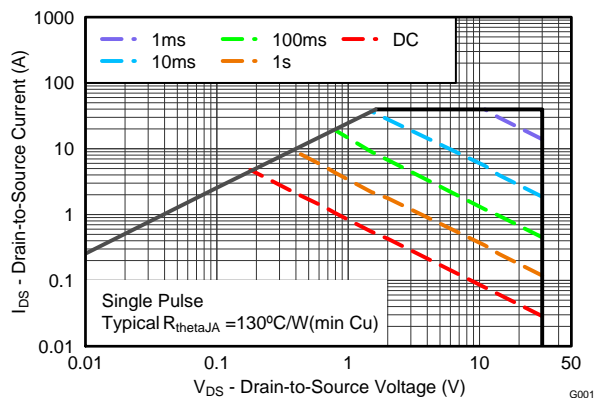


Figure 10. Maximum Safe Operating Area

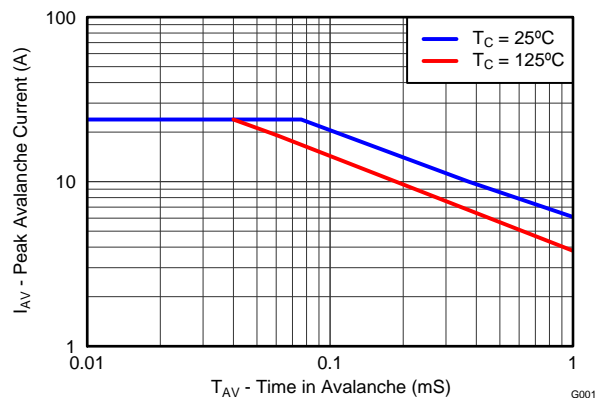


Figure 11. Single Pulse Unclamped Inductive Switching

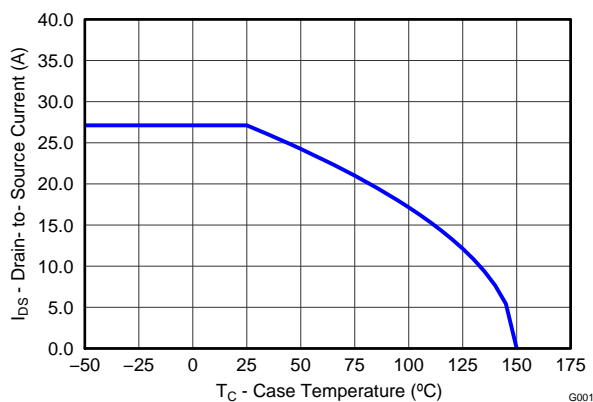
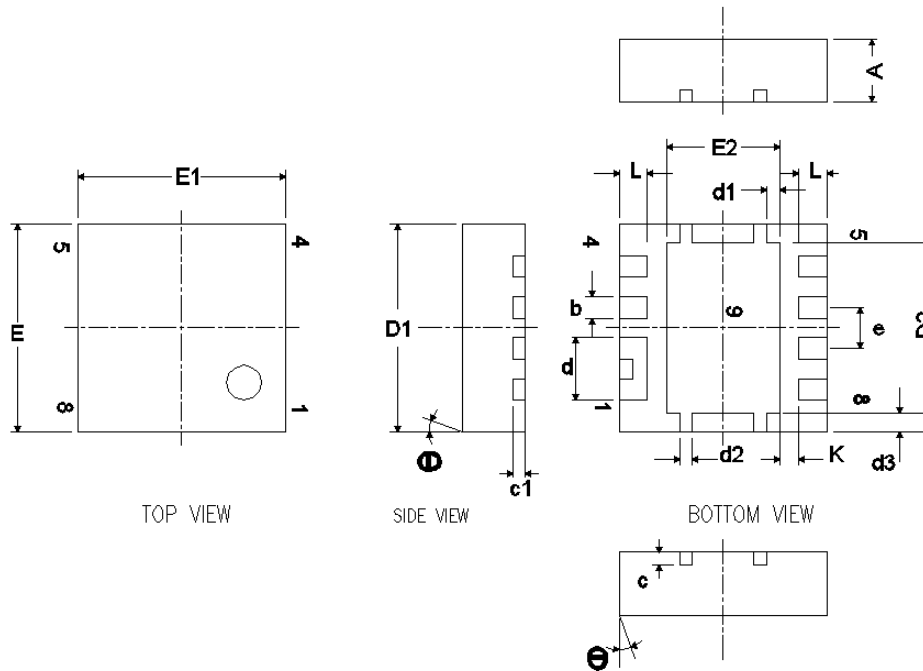


Figure 12. Maximum Drain Current vs. Temperature

MECHANICAL DATA

Q3E Package Dimensions

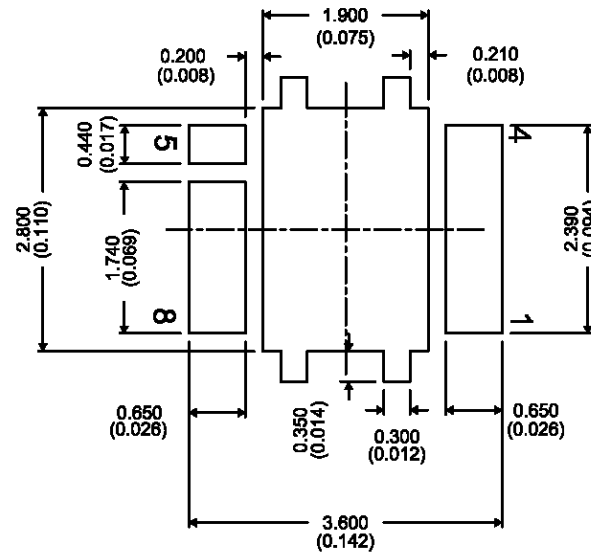


DIM	MILLIMETERS	
	MIN	MAX
A	0.850	1.050
b	0.280	0.400
c	0.150	0.250
c1	0.150	0.250
d	0.940	1.040
d1	0.160	0.260
d2	0.150	0.250
d3	0.250	0.350
D1	3.200	3.400
D2	2.650	2.750
E	3.200	3.400
E1	3.200	3.400
E2	1.750	1.850
e	0.650 TYP	
L	0.400	0.500
θ	0°	-
K	0.300 Typ	

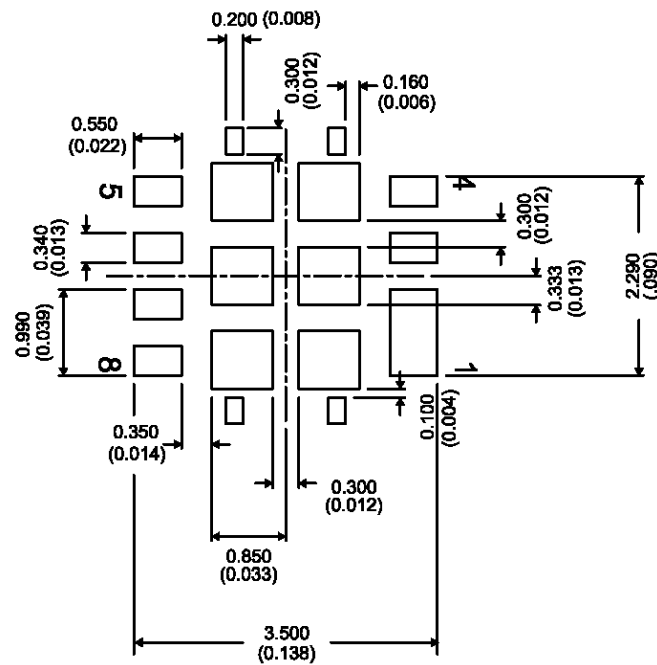
Notes:

1. Pin 1-4: Drain 1
2. Pin 5: Gate
3. Pin 6-8: Drain 2
4. Pin 9: Source

Recommended PCB Pattern

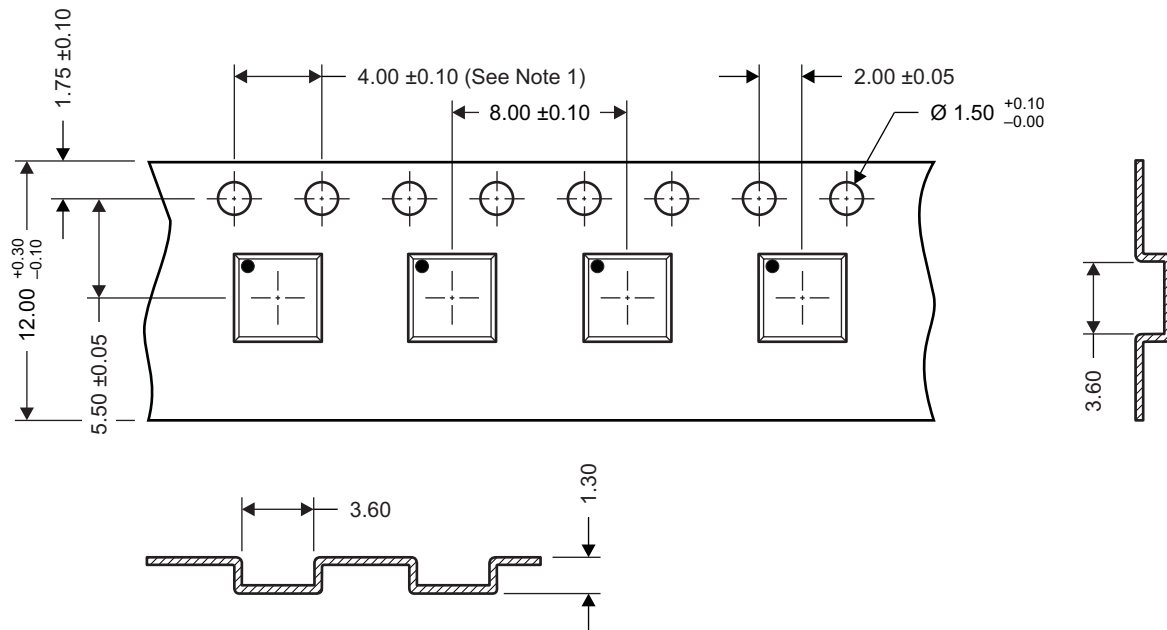


Recommended Stencil Opening



For recommended circuit layout for PCB designs, see application note [SLPA005](#) – *Reducing Ringing Through PCB Layout Techniques*.

Q3E Tape and Reel Information



M0144-01

Notes:

1. 10 sprocket hole pitch cumulative tolerance ± 0.2
2. Camber not to exceed 1mm IN 100mm, noncumulative over 250mm
3. Material: black static dissipative polystyrene
4. All dimensions are in mm (unless otherwise specified)
5. Thickness: 0.30 ± 0.05 mm
6. MSL1 260°C (IR and Convection) PbF Reflow Compatible

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)
CSD87312Q3E	Active	Production	VSON (DPA) 8	2500 LARGE T&R	ROHS Exempt	NIPDAU	Level-1-260C-UNLIM	-55 to 150	87312E
CSD87312Q3E.B	Active	Production	VSON (DPA) 8	2500 LARGE T&R	ROHS Exempt	NIPDAU	Level-1-260C-UNLIM	-55 to 150	87312E

⁽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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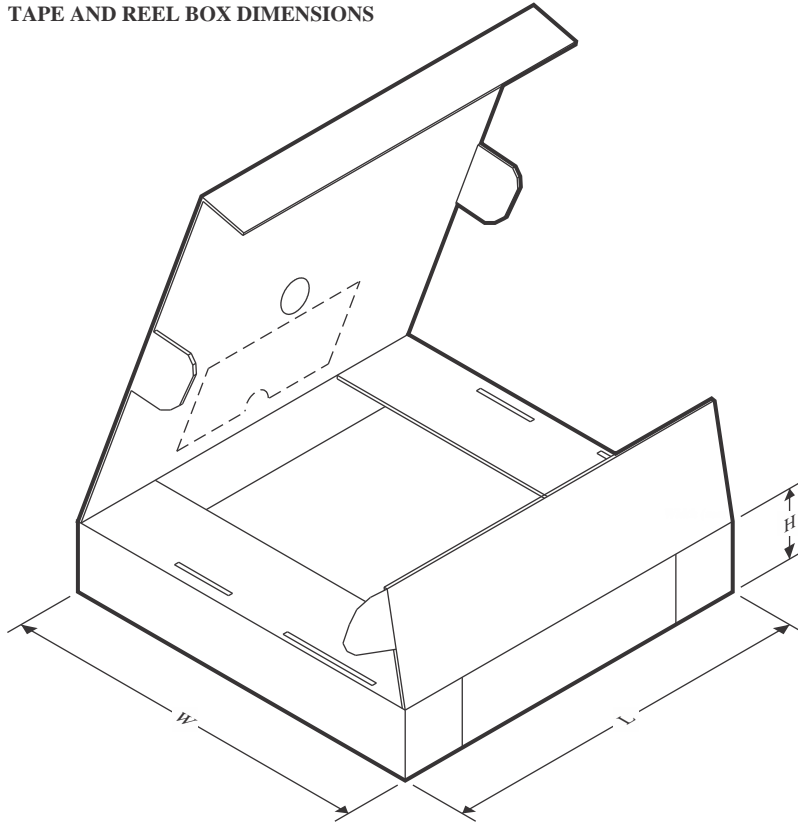
TAPE AND REEL INFORMATION



*All dimensions are nominal

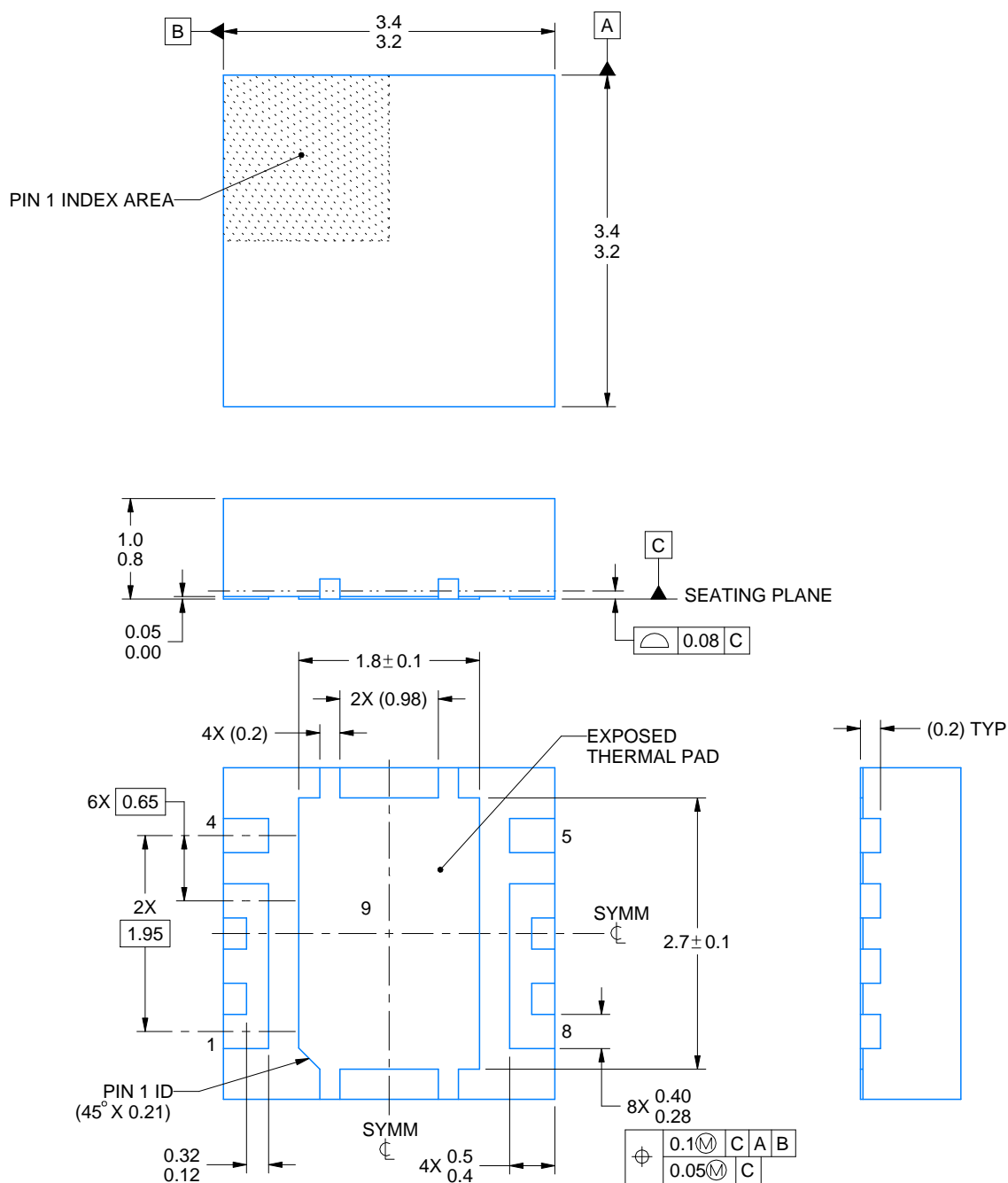
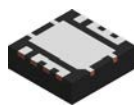
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CSD87312Q3E	VSON	DPA	8	2500	330.0	12.4	3.6	3.6	1.2	8.0	12.0	Q2

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CSD87312Q3E	VSON	DPA	8	2500	346.0	346.0	33.0



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NOTES:

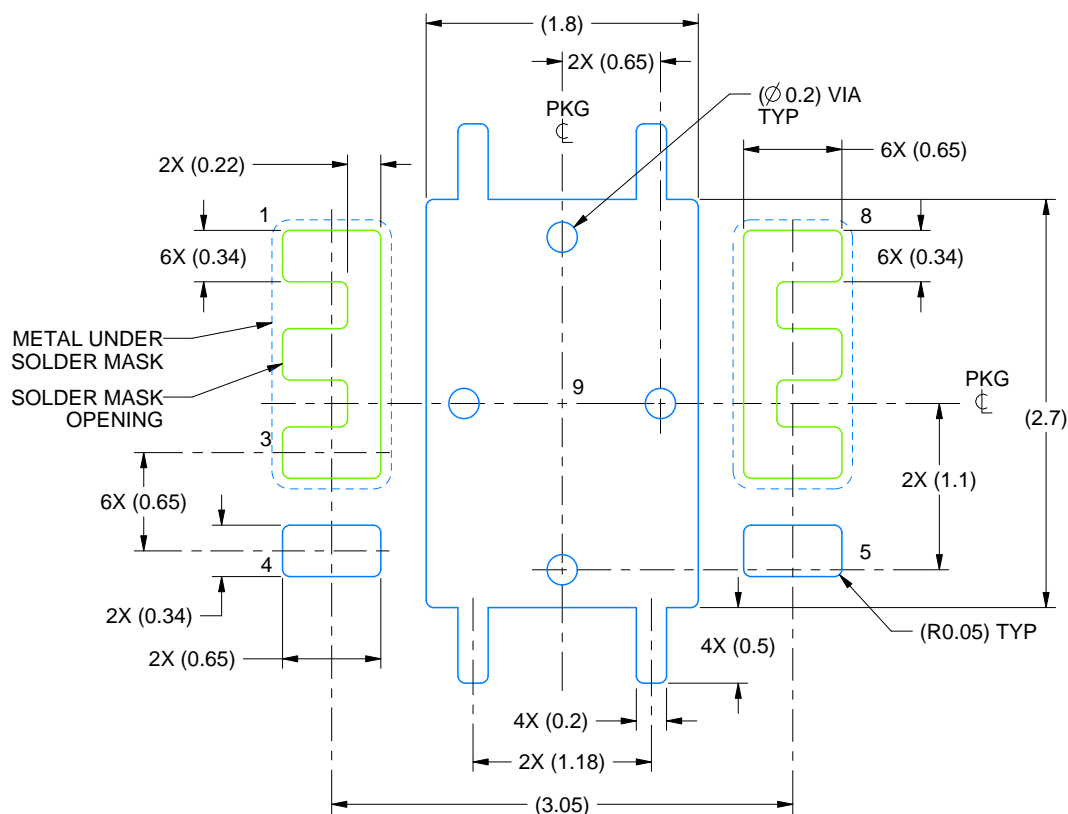
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

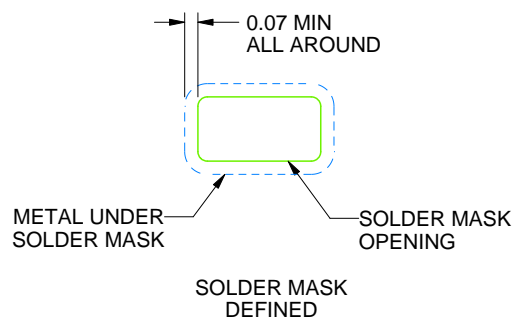
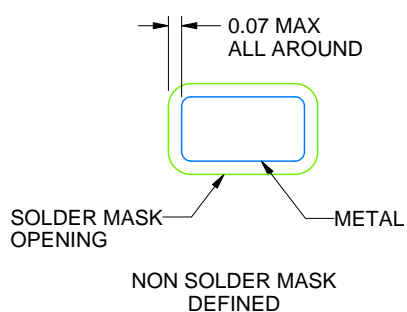
DPA0008A

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
SCALE:20X



SOLDER MASK DETAILS

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NOTES: (continued)

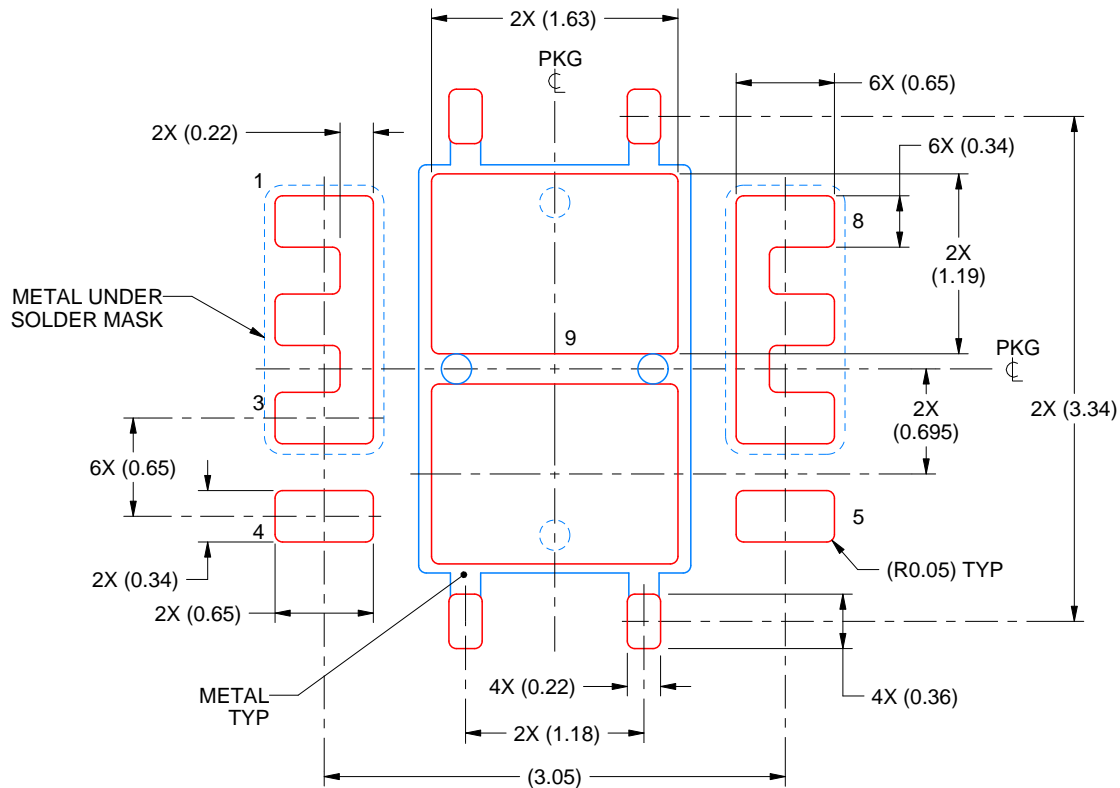
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/sluea271).
5. Vias are optional depending on application, refer to device data sheet. If some or all are implemented, recommended via locations are shown.

EXAMPLE STENCIL DESIGN

DPA0008A

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 9
76% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:20X

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NOTES: (continued)

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

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