



CSD18501Q5A 40 V N-Channel NexFET™ Power MOSFET

1 Features

- Ultra low Q_g and Q_{gd}
- Low Thermal Resistance
- Avalanche Rated
- Logic Level
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 5-mm × 6-mm Plastic Package

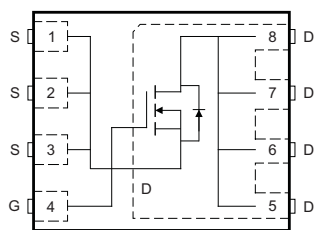
2 Applications

- DC-DC Conversion
- Secondary Side Synchronous Rectifier
- Battery Motor Control

3 Description

This 40 V, 2.5 mΩ, SON 5 × 6 mm NexFET™ power MOSFET has been designed to minimize losses in power conversion applications.

Top View



P0093-01

Product Summary

$T_A = 25^\circ\text{C}$		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	40		V
Q_g	Gate Charge Total (4.5 V)	20		nC
Q_{gd}	Gate Charge Gate-to-Drain	5.9		nC
$R_{DS(on)}$	Drain-to-Source On-Resistance	$V_{GS} = 4.5\text{ V}$	3.3	mΩ
		$V_{GS} = 10\text{ V}$	2.5	mΩ
$V_{GS(th)}$	Threshold Voltage	1.8		V

Ordering Information⁽¹⁾

Device	Qty	Media	Package	Ship
CSD18501Q5A	2500	13-Inch Reel	SON 5 mm × 6 mm Plastic Package	Tape and Reel
CSD18501Q5AT	250	7-Inch Reel		

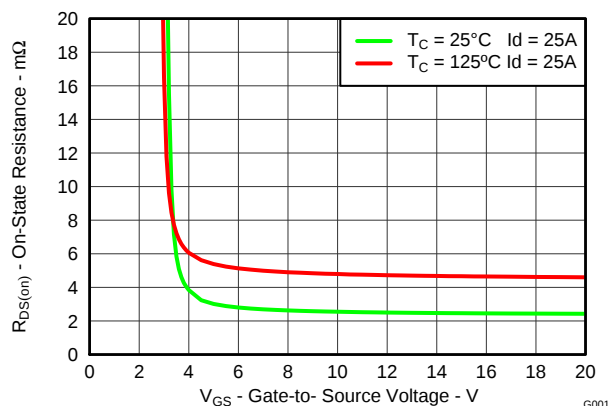
(1) For all available packages, see the orderable addendum at the end of the data sheet.

Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage	40	V
V_{GS}	Gate-to-Source Voltage	±20	V
I_D	Continuous Drain Current (Package limited)	100	A
	Continuous Drain Current (Silicon limited), $T_C = 25^\circ\text{C}$	161	
	Continuous Drain Current ⁽¹⁾	22	
I_{DM}	Pulsed Drain Current ⁽²⁾	400	A
P_D	Power Dissipation ⁽¹⁾	3.1	W
	Power Dissipation, $T_C = 25^\circ\text{C}$	150	
T_J , T_{stg}	Operating Junction and Storage Temperature Range	–55 to 150	°C
E_{AS}	Avalanche Energy, Single Pulse $I_D = 68\text{ A}$, $L = 0.1\text{ mH}$, $R_G = 25\ \Omega$	231	mJ

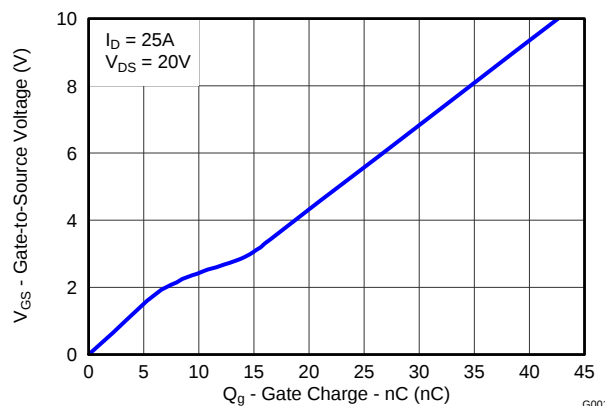
(1) Typical $R_{\theta JA} = 40^\circ\text{C/W}$ on a 1-inch², 2-oz. Cu pad on a 0.06-inch thick FR4 PCB.

(2) Max $R_{\theta JC} = 1.0^\circ\text{C/W}$, Pulse duration ≤100μs, duty cycle ≤1%

 $R_{DS(on)}$ vs V_{GS} 

G001

Gate Charge



G001



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4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision B (October 2012) to Revision C	Page
• Added part number to title	1
• Added 7-inch reel to Ordering Information table	1
• Increased silicon limited continuous drain current to 161 A	1
• Increased pulsed drain current to 400 A	1
• Added line for max power dissipation with case temperature held to 25° C	1
• Updated pulsed current conditions	1
• Updated Figure 1 to a normalized $R_{\theta JC}$ curve	4
• Updated the SOA in Figure 9	6
• Added Recommended Stencil Opening	9

Changes from Revision A (June 2012) to Revision B	Page
• Changed the Transconductance TYP value From: 142 S To: 118 S	3
• Changed the Turn On and Turn Off Delay Time, Rise and Fall Time Test Conditions From: $I_{DS} = 25\text{ A}$, $R_G = 2\ \Omega$ To: $I_{DS} = 25\text{ A}$, $R_G = 0\ \Omega$	3
• Changed the Q_{rr} Reverse Recovery Charge TYP value From: 21 nC To: 70 nC	3

Changes from Original (June 2012) to Revision A	Page
• Added " $T_A = 25^\circ\text{C}$ " to the Product Summary table	1

5 Specifications

5.1 Electrical Characteristics

(T_A = 25°C unless otherwise stated)

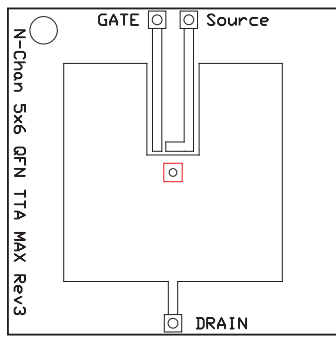
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT	
STATIC CHARACTERISTICS							
BV _{DSS}	Drain-to-Source Voltage	V _{GS} = 0 V, I _D = 250 μA	40			V	
I _{DSS}	Drain-to-Source Leakage Current	V _{GS} = 0 V, V _{DS} = 32 V	1			μA	
I _{GSS}	Gate-to-Source Leakage Current	V _{DS} = 0 V, V _{GS} = 20 V	100			nA	
V _{GS(th)}	Gate-to-Source Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	1.4	1.8	2.3	V	
R _{DS(on)}	Drain-to-Source On-Resistance	V _{GS} = 4.5 V, I _D = 25 A	3.3			4.3	mΩ
		V _{GS} = 10 V, I _D = 25 A	2.5			3.2	mΩ
g _{fs}	Transconductance	V _{DS} = 20 V, I _D = 25 A	118			S	
DYNAMIC CHARACTERISTICS							
C _{iss}	Input Capacitance	V _{GS} = 0 V, V _{DS} = 20 V, f = 1 MHz	3200			3840	pF
C _{oss}	Output Capacitance		725			870	pF
C _{rss}	Reverse Transfer Capacitance		18			23	pF
R _G	Series Gate Resistance		1.2			2.4	Ω
Q _g	Gate Charge Total (4.5 V)	V _{DS} = 20 V, I _D = 25 A	20			24	nC
Q _g	Gate Charge Total (10 V)		42			50	
Q _{gd}	Gate Charge Gate-to-Drain		5.9				nC
Q _{gs}	Gate Charge Gate-to-Source		8.1				nC
Q _{g(th)}	Gate Charge at V _{th}		5.7				nC
Q _{oss}	Output Charge	V _{DS} = 20 V, V _{GS} = 0 V	48				nC
t _{d(on)}	Turn On Delay Time	V _{DS} = 20 V, V _{GS} = 10 V, I _{DS} = 25 A, R _G = 0	4.7				ns
t _r	Rise Time		10				ns
t _{d(off)}	Turn Off Delay Time		20				ns
t _f	Fall Time		3.4				ns
DIODE CHARACTERISTICS							
V _{SD}	Diode Forward Voltage	I _{DS} = 25 A, V _{GS} = 0 V	0.8			1	V
Q _{rr}	Reverse Recovery Charge	V _{DS} = 20 V, I _F = 25 A, di/dt = 300 A/μs	70				nC
t _{rr}	Reverse Recovery Time		40				ns

5.2 Thermal Information

(T_A = 25°C unless otherwise stated)

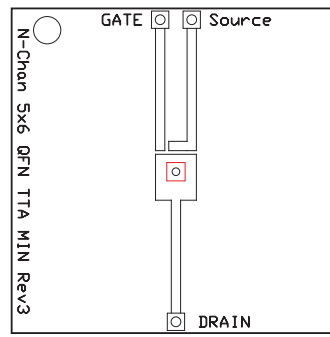
THERMAL METRIC		MIN	TYP	MAX	UNIT
R _{θJC}	Junction-to-Case Thermal Resistance ⁽¹⁾			1.0	°C/W
R _{θJA}	Junction-to-Ambient Thermal Resistance ⁽¹⁾⁽²⁾			50	

- (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-inches × 1.5-inches (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.



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Max $R_{\theta JA} = 50^{\circ}\text{C/W}$
 when mounted on
 1 inch² (6.45-cm²) of
 2-oz. (0.071-mm thick)
 Cu.

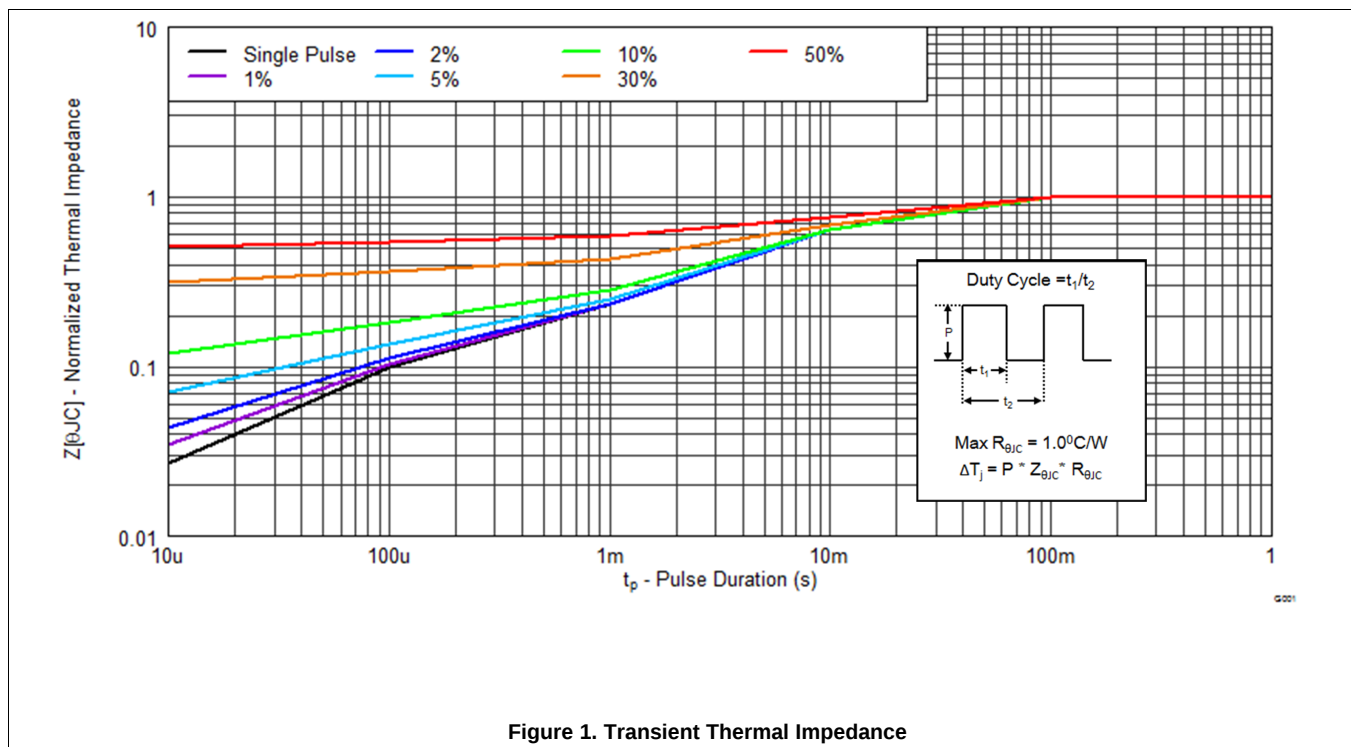


M0137-02

Max $R_{\theta JA} = 125^{\circ}\text{C/W}$
 when mounted on a
 minimum pad area of
 2-oz.
 (0.071-mm thick) Cu.

5.3 Typical MOSFET Characteristics

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



Typical MOSFET Characteristics (continued)

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

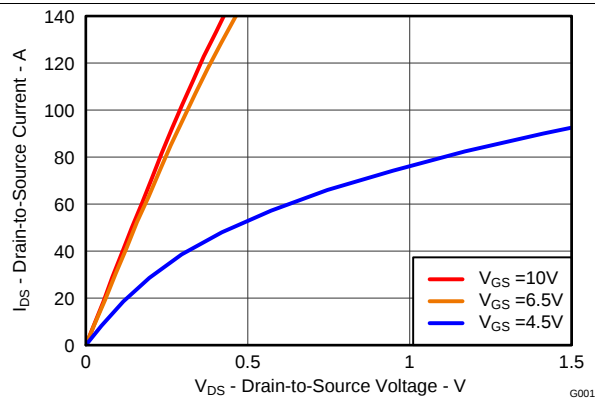


Figure 2. Saturation Characteristics

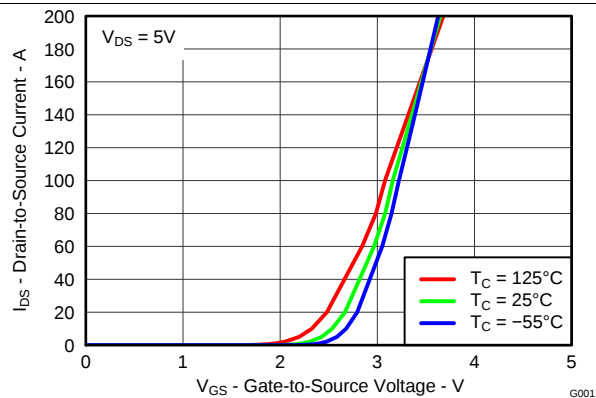


Figure 3. Transfer Characteristics

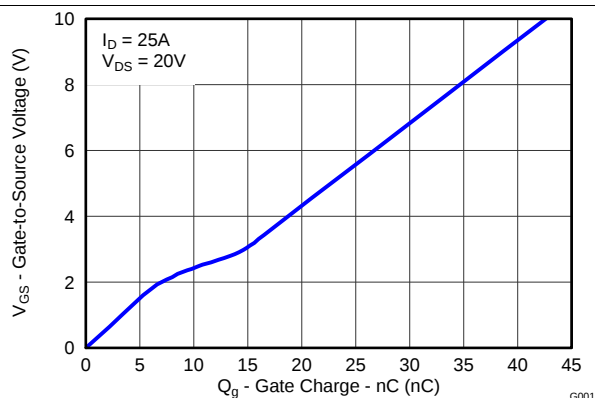


Figure 4. Gate Charge

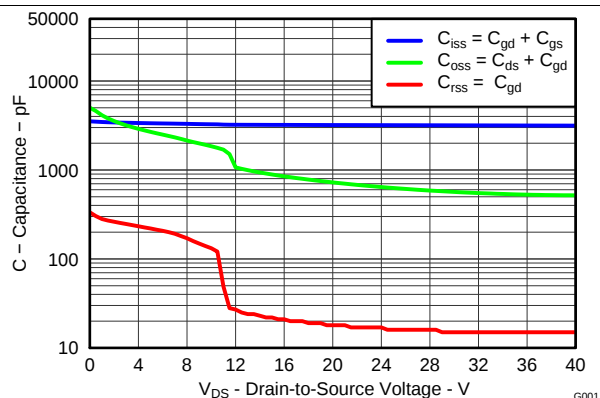


Figure 5. Capacitance

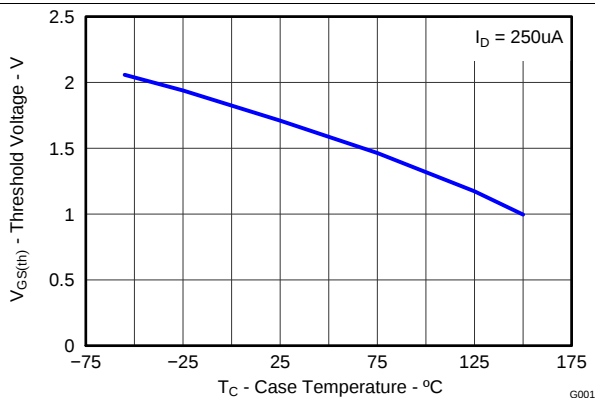


Figure 6. Threshold Voltage vs Temperature

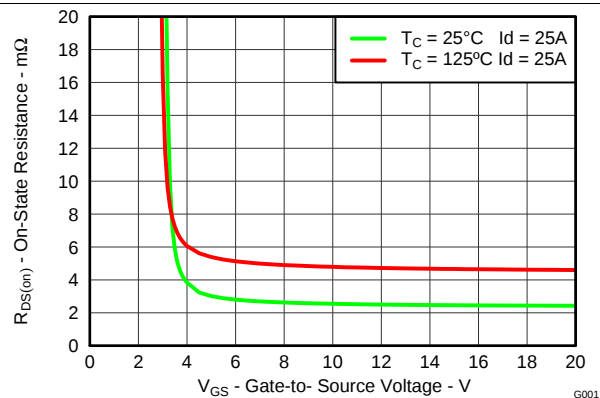


Figure 7. On-State Resistance vs Gate-to-Source Voltage

Typical MOSFET Characteristics (continued)

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

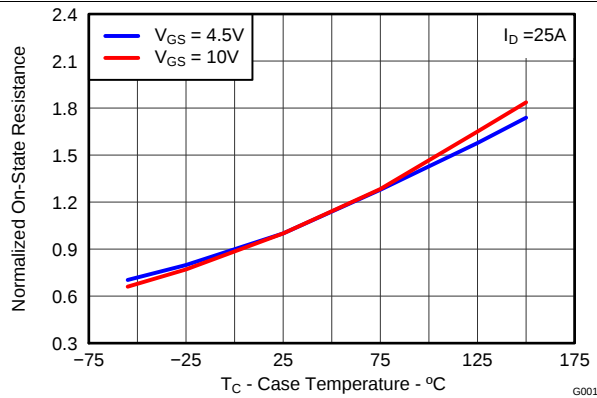


Figure 8. Normalized On-State Resistance vs Temperature

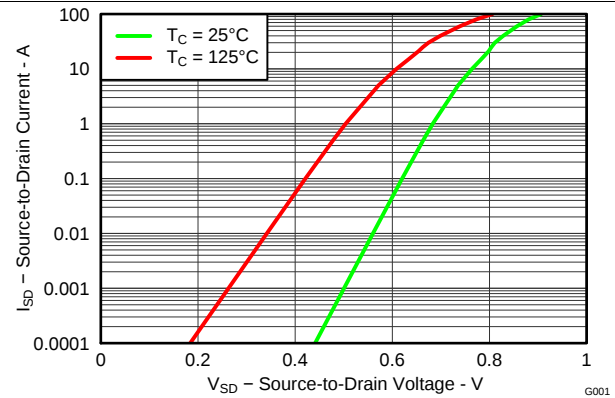


Figure 9. Typical Diode Forward Voltage

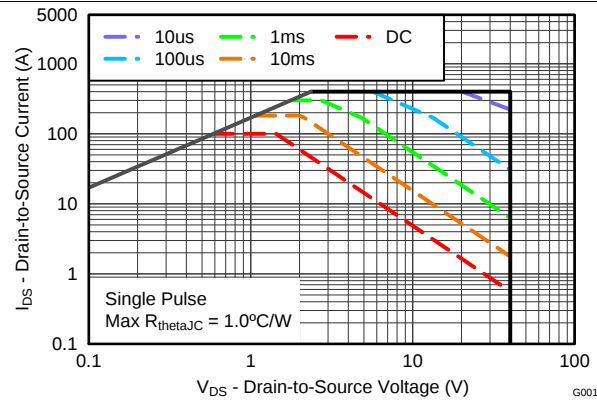


Figure 10. Maximum Safe Operating Area

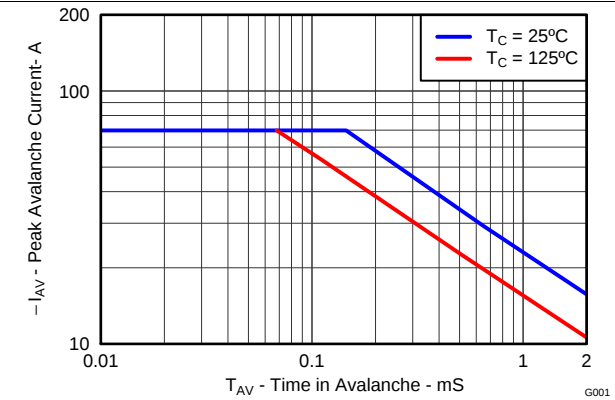


Figure 11. Single Pulse Unclamped Inductive Switching

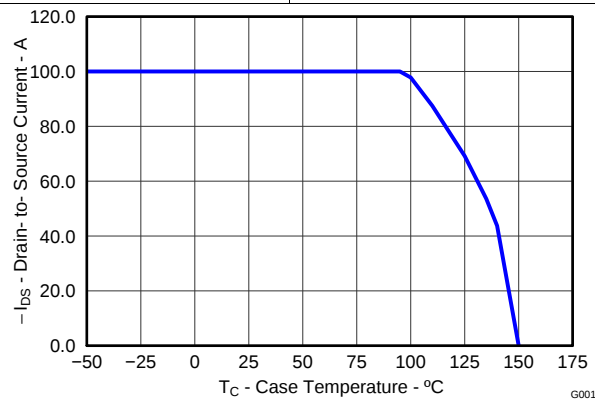


Figure 12. Maximum Drain Current vs Temperature

6 Device and Documentation Support

6.1 Trademarks

NexFET is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

6.2 Electrostatic Discharge Caution



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.

6.3 Glossary

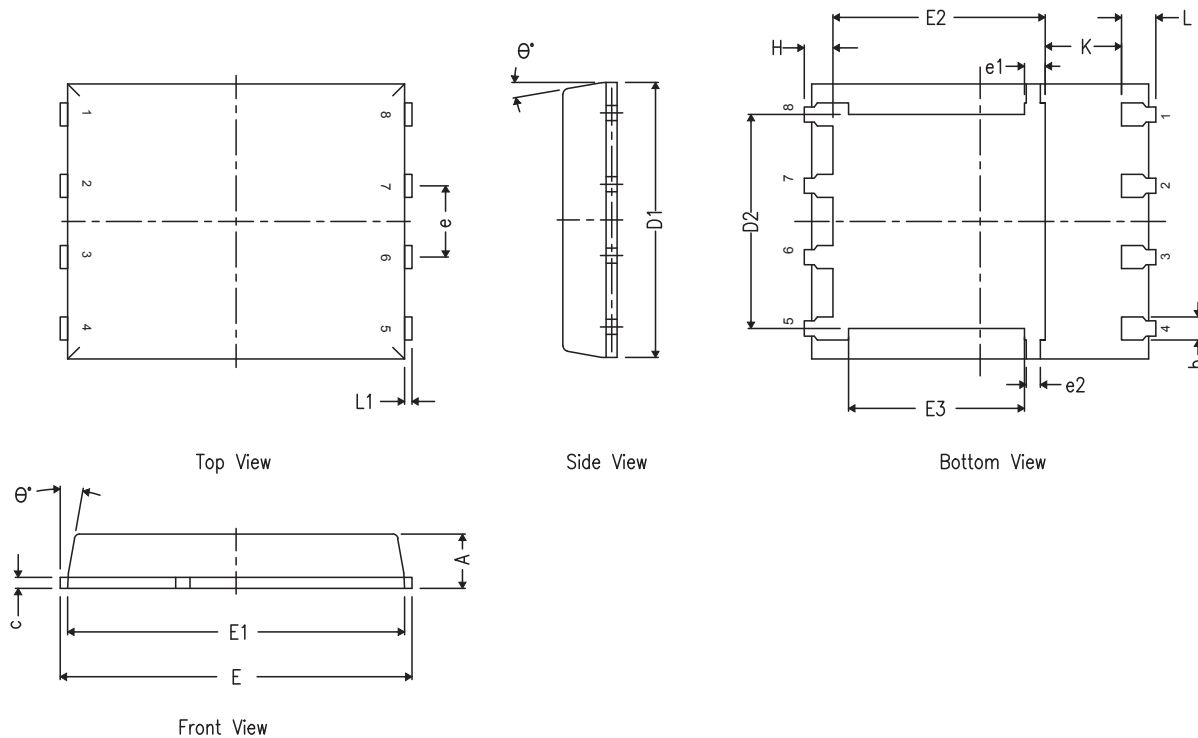
[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

7 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

7.1 Q5A Package Dimensions

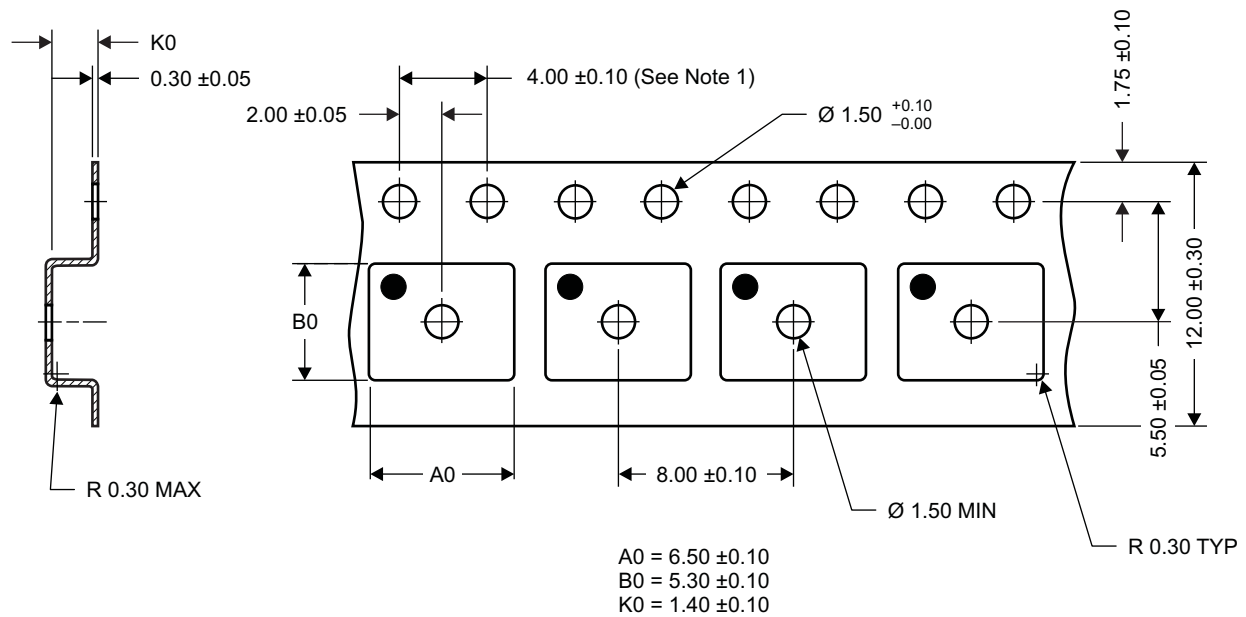


DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
b	0.33	0.41	0.51
c	0.20	0.25	0.34
D1	4.80	4.90	5.00
D2	3.61	3.81	4.02
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
E3	3.03	3.13	3.23
e	1.17	1.27	1.37
e1	0.27	0.37	0.47
e2	0.15	0.25	0.35
H	0.41	0.56	0.71
K	1.10	–	–
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
θ	0°	–	12°

Technical drawing of a mechanical part with dimensions F1 through F11. The drawing shows a side view of a component with a central rectangular body and a stepped left profile. The dimensions are defined as follows:

- F1:** Total width of the component.
- F2:** Total height of the component.
- F3:** Height of the four rectangular features on the right side.
- F4:** Width of the four rectangular features on the right side.
- F5:** Vertical spacing between the four rectangular features on the right side.
- F6:** Width of the top step on the left side.
- F7:** Width of the top rectangular feature on the right side.
- F8:** Width of the bottom step on the left side.
- F9:** Vertical distance from the top of the component to the first step on the left side.
- F10:** Width of the central rectangular body.
- F11:** Height of the central rectangular body.

7.4 Q5A Tape and Reel Information



M0138-01

Notes:

- 10-sprocket hole-pitch cumulative tolerance ± 0.2
- Camber not to exceed 1 mm in 100 mm, noncumulative over 250 mm
- Material: black static-dissipative polystyrene
- All dimensions are in mm (unless otherwise specified).
- $A0$ and $B0$ measured on a plane 0.3 mm above the bottom of the pocket.

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)
CSD18501Q5A	Active	Production	VSONP (DQJ) 8	2500 LARGE T&R	ROHS Exempt	SN	Level-1-260C-UNLIM	-55 to 150	CSD18501
CSD18501Q5A.B	Active	Production	VSONP (DQJ) 8	2500 LARGE T&R	ROHS Exempt	SN	Level-1-260C-UNLIM	-55 to 150	CSD18501

- ⁽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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