



# CSD17577Q5A 30-V N-Channel NexFET™ Power MOSFET

## 1 Features

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

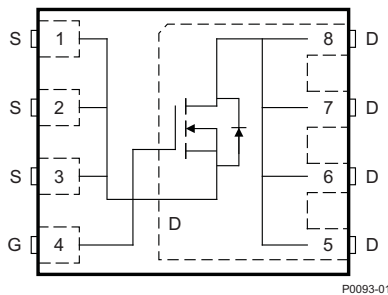
## 2 Applications

- Point of Load Synchronous Buck in Networking, Telecom, and Computing Systems
- Optimized for Control, and Sync FET Applications

## 3 Description

This 30 V, 3.5 mΩ, SON 5 mm × 6 mm NexFET™ power MOSFET is designed to minimize resistance in power conversion applications.

Top Icon



P0093-01

### Product Summary

$T_A = 25^\circ\text{C}$		TYPICAL VALUE		UNIT
$V_{DS}$	Drain-to-Source Voltage	30		V
$Q_g$	Gate Charge Total (4.5 V)	13		nC
$Q_{gd}$	Gate Charge Gate-to-Drain	2.8		nC
$R_{DS(on)}$	Drain-to-Source On-Resistance	$V_{GS} = 4.5\text{ V}$	4.8	mΩ
		$V_{GS} = 10\text{ V}$	3.5	mΩ
$V_{GS(th)}$	Threshold Voltage	1.4		V

### Ordering Information<sup>(1)</sup>

Device	Qty	Media	Package	Ship
CSD17577Q5A	2500	13-Inch Reel	SON 5 × 6 mm Plastic Package	Tape and Reel
CSD17577Q5AT	250	7-Inch Reel		

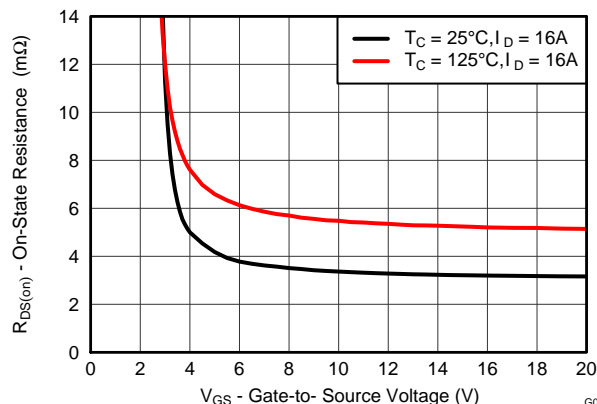
(1) For all available packages, see the orderable addendum at the end of the data sheet.

### Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$		VALUE	UNIT
$V_{DS}$	Drain-to-Source Voltage	30	V
$V_{GS}$	Gate-to-Source Voltage	±20	V
$I_D$	Continuous Drain Current (Package limited)	60	A
	Continuous Drain Current (Silicon limited), $T_C = 25^\circ\text{C}$	83	
	Continuous Drain Current <sup>(1)</sup>	22	
$I_{DM}$	Pulsed Drain Current <sup>(2)</sup>	280	A
$P_D$	Power Dissipation <sup>(1)</sup>	3	W
	Power Dissipation, $T_C = 25^\circ\text{C}$	53	
$T_J$ , $T_{stg}$	Operating Junction and Storage Temperature Range	–55 to 150	°C
$E_{AS}$	Avalanche Energy, single pulse $I_D = 28$ , $L = 0.1\text{ mH}$ , $R_G = 25\ \Omega$	39	mJ

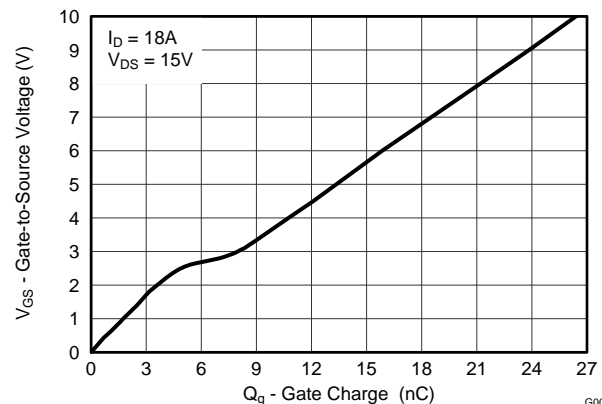
(1) Typical  $R_{\theta JA} = 40^\circ\text{C/W}$  on a 1-inch<sup>2</sup>, 2-oz. Cu pad on a 0.06-inch thick FR4 PCB.

(2) Max  $R_{\theta JC} = 2.8^\circ\text{C/W}$ , pulse duration ≤100 μs, duty cycle ≤1%

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

G001

Gate Charge



G001



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## 4 Revision History

DATE	REVISION	NOTES
August 2014	*	Initial release.

## 5 Specifications

### 5.1 Electrical Characteristics

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

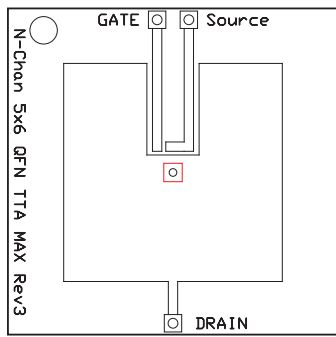
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
STATIC CHARACTERISTICS						
BV <sub>DSS</sub>	Drain-to-Source Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	30			V
I <sub>DSS</sub>	Drain-to-Source Leakage Current	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 24 V			1	μA
I <sub>GSS</sub>	Gate-to-Source Leakage Current	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 20 V			100	nA
V <sub>GS(th)</sub>	Gate-to-Source Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.1	1.4	1.8	V
R <sub>DS(on)</sub>	Drain-to-Source On-Resistance	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A	4.8		5.8	mΩ
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 18 A	3.5		4.2	mΩ
g <sub>fs</sub>	Transconductance	V <sub>DS</sub> = 3 V, I <sub>D</sub> = 18 A	79			S
DYNAMIC CHARACTERISTICS						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 15 V, f = 1 MHz	1780		2310	pF
C <sub>oss</sub>	Output Capacitance		208		270	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		79		102	pF
R <sub>G</sub>	Series Gate Resistance		1.4		2.8	Ω
Q <sub>g</sub>	Gate Charge Total (4.5 V)	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 18 A	13		17	nC
Q <sub>g</sub>	Gate Charge Total (10 V)		27		35	nC
Q <sub>gd</sub>	Gate Charge Gate-to-Drain		2.8			nC
Q <sub>gs</sub>	Gate Charge Gate-to-Source		5.1			nC
Q <sub>g(th)</sub>	Gate Charge at V <sub>th</sub>		2.5			nC
Q <sub>oss</sub>	Output Charge	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V	6			nC
t <sub>d(on)</sub>	Turn On Delay Time	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>DS</sub> = 18 A, R <sub>G</sub> = 0 Ω	3			ns
t <sub>r</sub>	Rise Time		12			ns
t <sub>d(off)</sub>	Turn Off Delay Time		18			ns
t <sub>f</sub>	Fall Time		2			ns
DIODE CHARACTERISTICS						
V <sub>SD</sub>	Diode Forward Voltage	I <sub>SD</sub> = 18 A, V <sub>GS</sub> = 0 V	0.8		1	V
Q <sub>rr</sub>	Reverse Recovery Charge	V <sub>DS</sub> = 15 V, I <sub>F</sub> = 18 A, di/dt = 300 A/μs	8.2			nC
t <sub>rr</sub>	Reverse Recovery Time		9.3			ns

### 5.2 Thermal Information

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

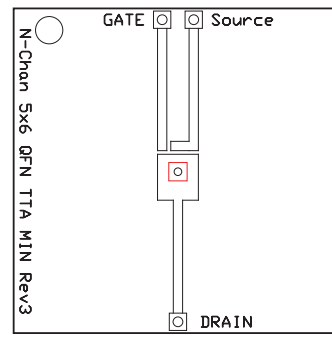
THERMAL METRIC		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance <sup>(1)</sup>			2.8	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance <sup>(1)(2)</sup>			50	

- (1)  $R_{\theta JC}$  is determined with the device mounted on a 1-inch<sup>2</sup> (6.45-cm<sup>2</sup>), 2-oz. (0.071-mm thick) Cu pad on a 1.5-inches  $\times$  1.5-inches (3.81-cm  $\times$  3.81-cm), 0.06-inch (1.52-mm) thick FR4 PCB.  $R_{\theta JC}$  is specified by design, whereas  $R_{\theta JA}$  is determined by the user's board design.
- (2) Device mounted on FR4 material with 1-inch<sup>2</sup> (6.45-cm<sup>2</sup>), 2-oz. (0.071-mm thick) Cu.



M0137-01

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

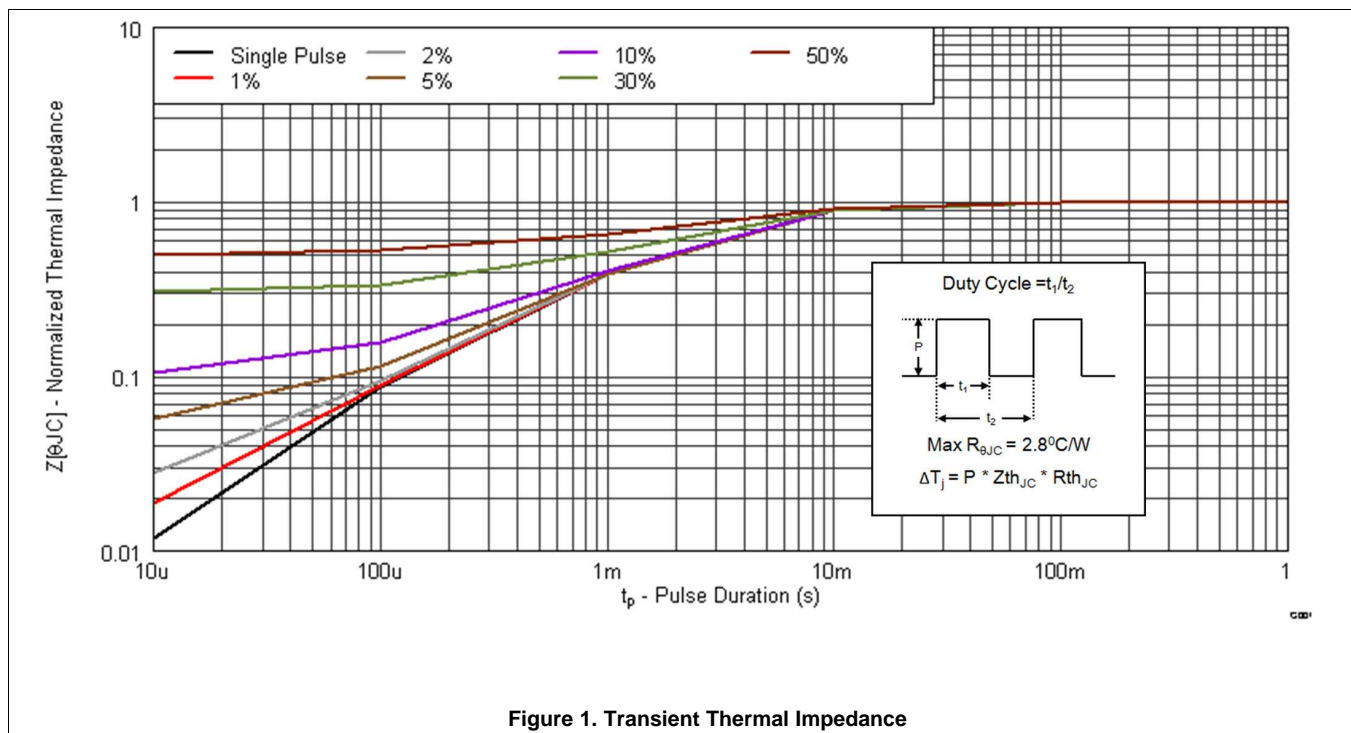


M0137-02

Max  $R_{\theta JA} = 140^{\circ}\text{C/W}$   
when mounted on a  
minimum pad area of  
2-oz. (0.071-mm thick)  
Cu.

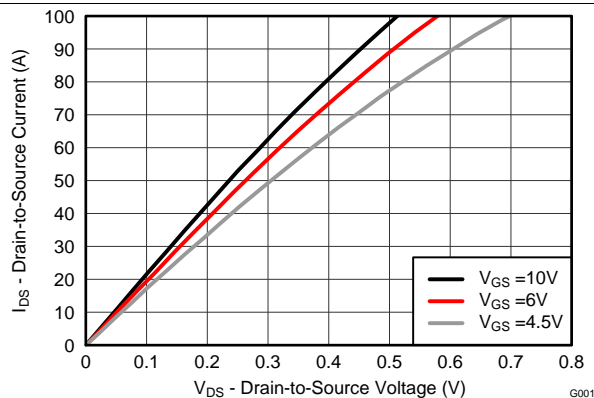
### 5.3 Typical MOSFET Characteristics

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

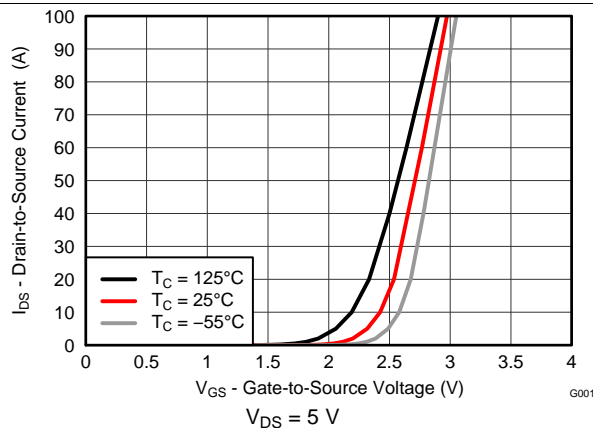


## Typical MOSFET Characteristics (continued)

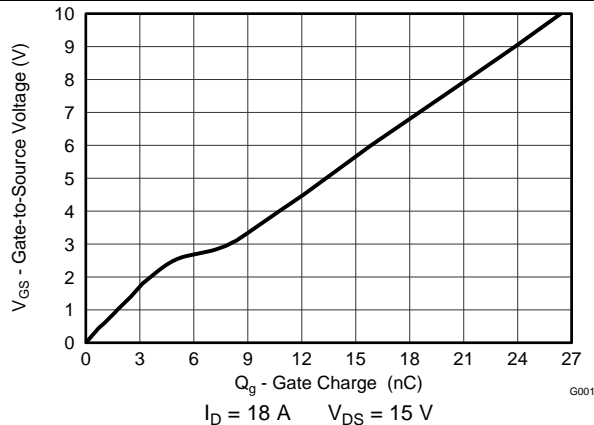
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



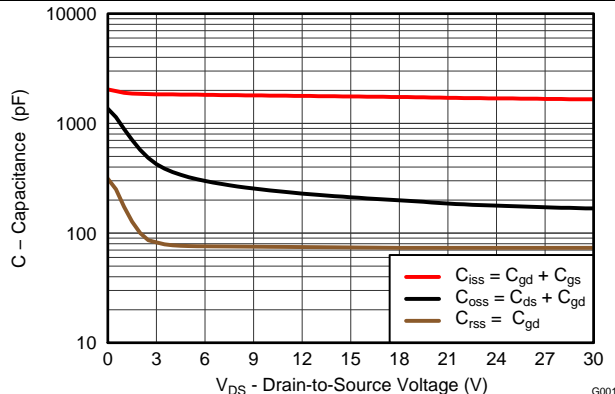
**Figure 2. Saturation Characteristics**



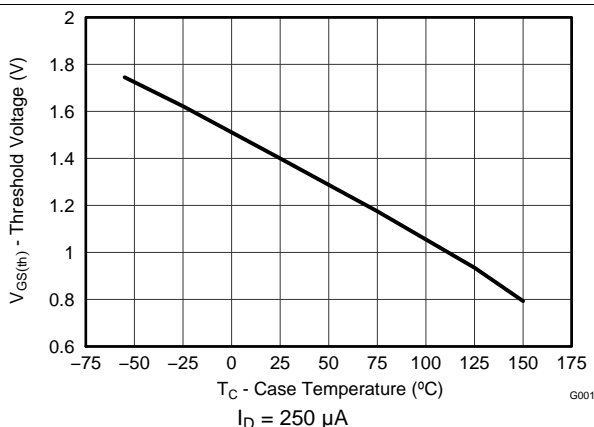
**Figure 3. Transfer Characteristics**



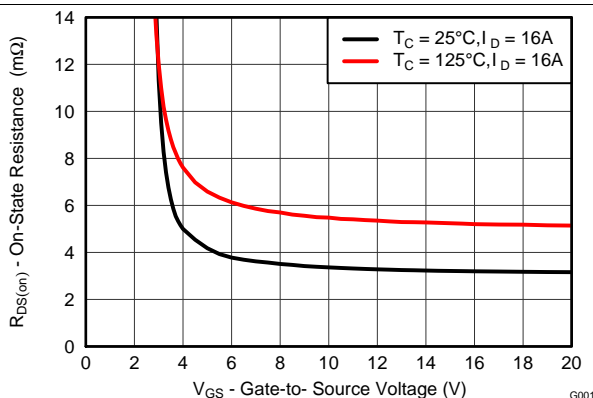
**Figure 4. Gate Charge**



**Figure 5. Capacitance**



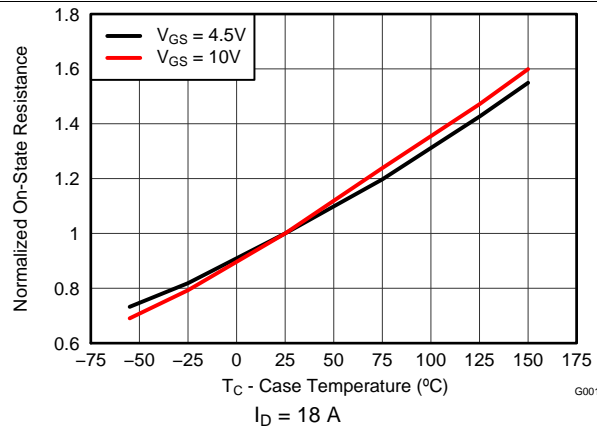
**Figure 6. Threshold Voltage vs Temperature**



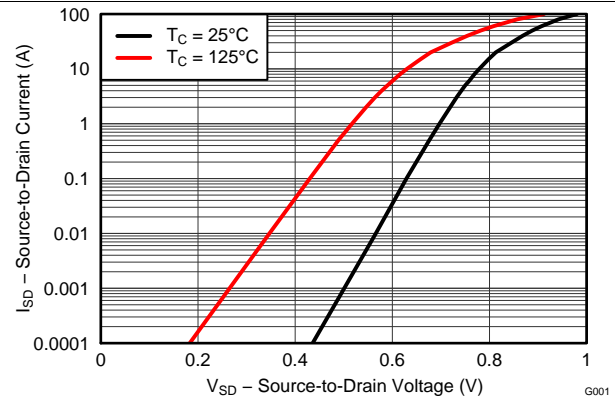
**Figure 7. On-State Resistance vs Gate-to-Source Voltage**

## Typical MOSFET Characteristics (continued)

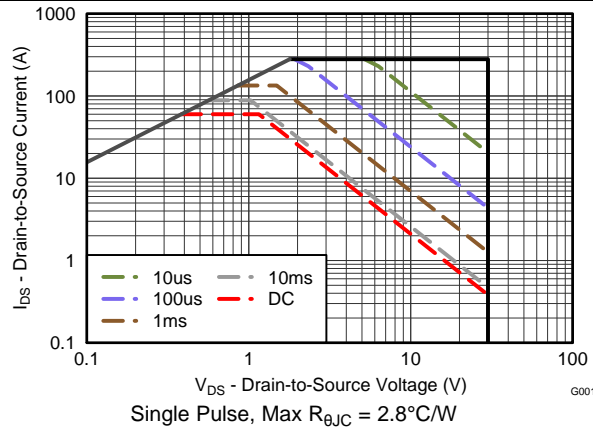
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



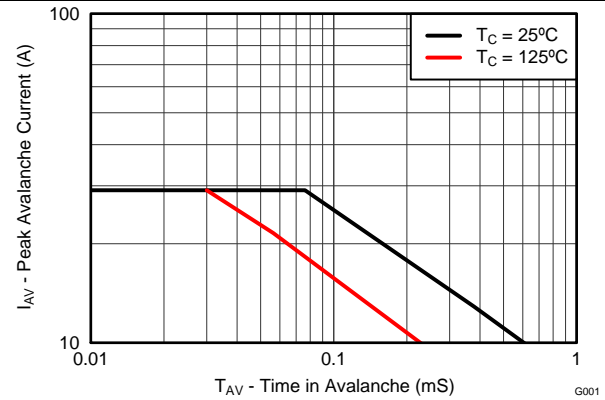
**Figure 8. Normalized On-State Resistance vs Temperature**



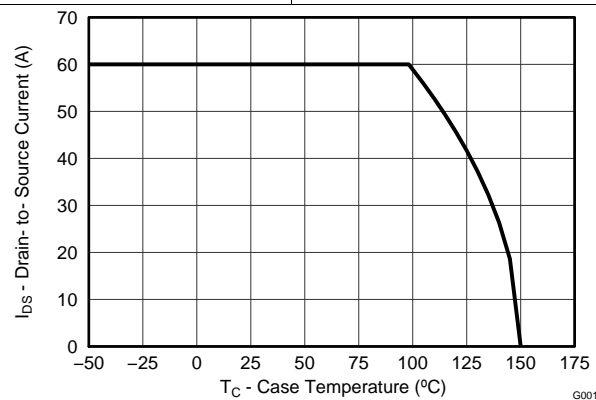
**Figure 9. Typical Diode Forward Voltage**



**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.

### 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

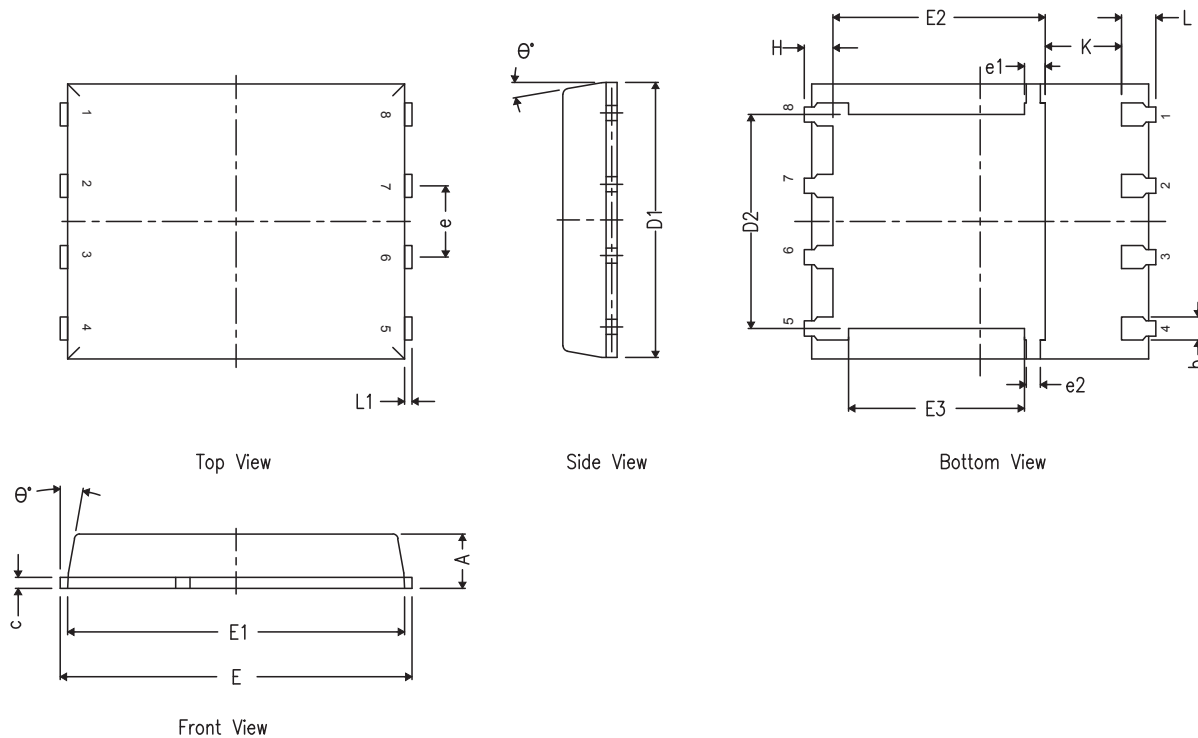
[SLYZ022](#) — *TI Glossary*.

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.

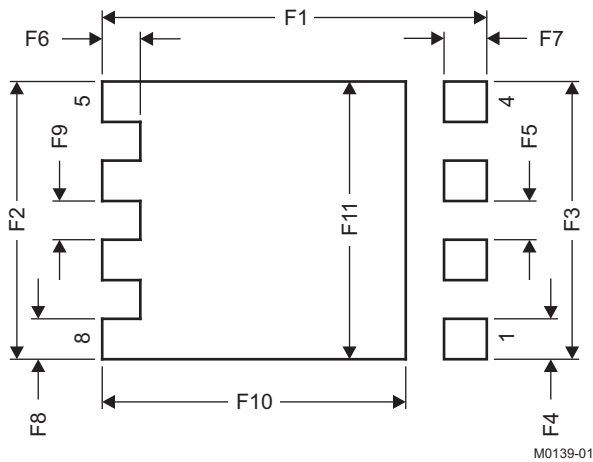
### 7.1 Q5A Package Dimensions



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
$\theta$	0°	—	12°



## 7.2 Recommended PCB Pattern

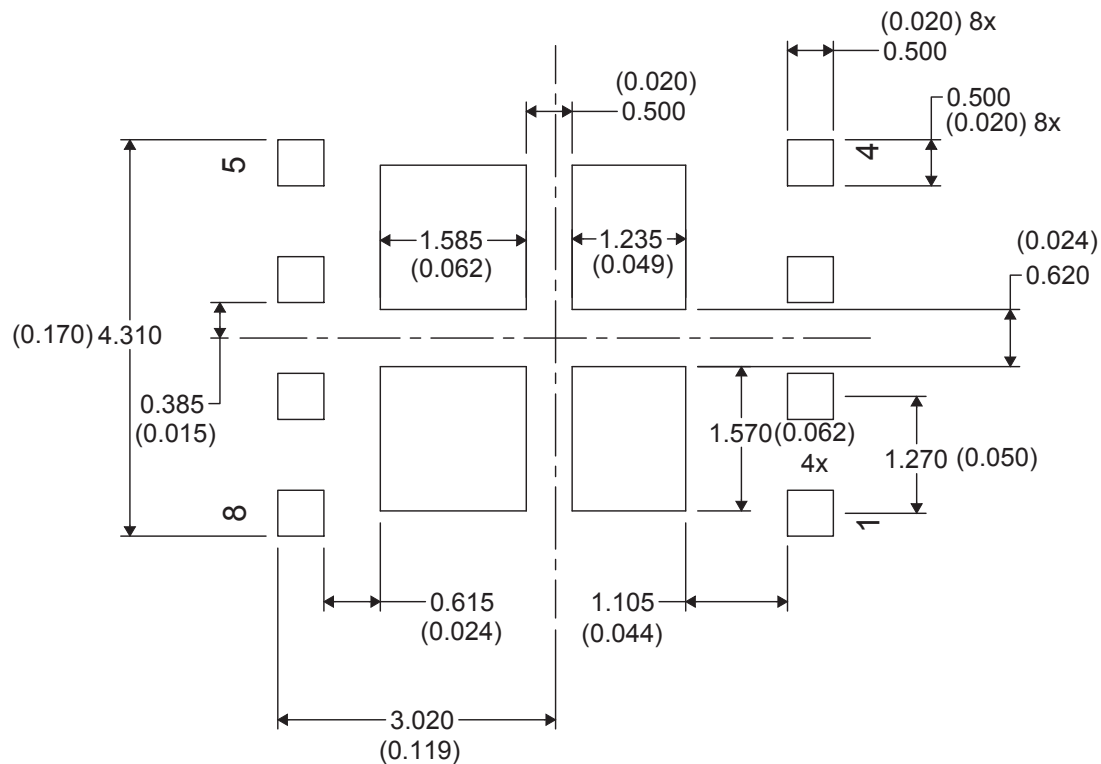


## Recommended PCB Pattern (continued)

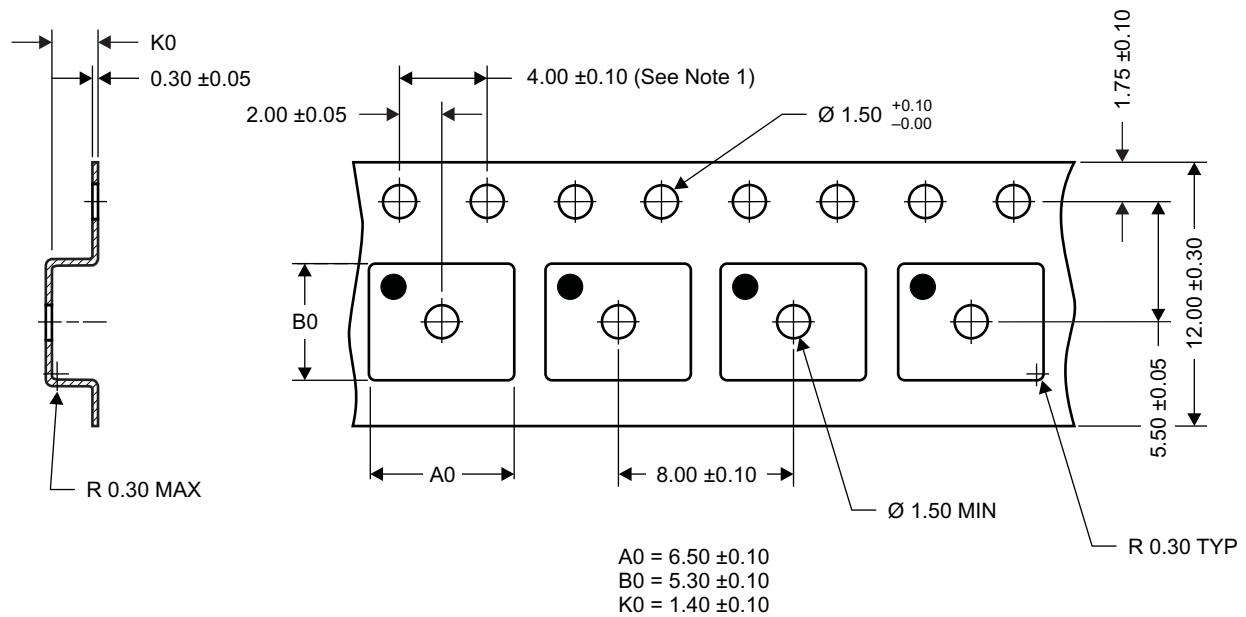
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
F1	6.205	6.305	0.244	0.248
F2	4.46	4.56	0.176	0.18
F3	4.46	4.56	0.176	0.18
F4	0.65	0.7	0.026	0.028
F5	0.62	0.67	0.024	0.026
F6	0.63	0.68	0.025	0.027
F7	0.7	0.8	0.028	0.031
F8	0.65	0.7	0.026	0.028
F9	0.62	0.67	0.024	0.026
F10	4.9	5	0.193	0.197
F11	4.46	4.56	0.176	0.18

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

## 7.3 Recommended Stencil Opening



## 7.4 Q5A Tape and Reel Information



M0138-01

### Notes:

- 10-sprocket hole-pitch cumulative tolerance  $\pm 0.2$
- 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 Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CSD17577Q5A	ACTIVE	VSONP	DQJ	8	2500	Pb-Free (RoHS Exempt)	CU SN	Level-1-260C-UNLIM	-40 to 85	CSD17577	<a href="#">Samples</a>
CSD17577Q5AT	ACTIVE	VSONP	DQJ	8	250	Pb-Free (RoHS Exempt)	CU SN	Level-1-260C-UNLIM	-40 to 85	CSD17577	<a href="#">Samples</a>

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
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