

## 30V N-Channel NexFET™ Power MOSFETs

Check for Samples: [CSD17559Q5](#)

### FEATURES

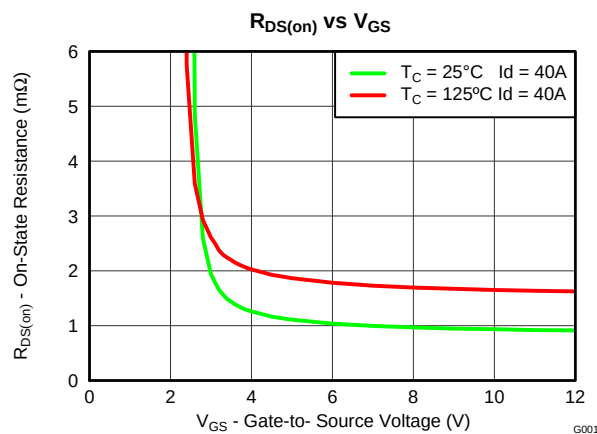
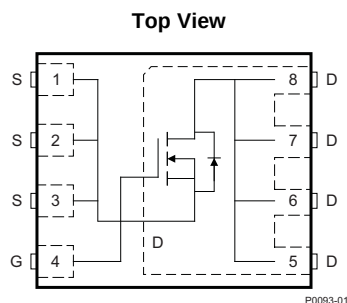
- Extremely Low Resistance
- Ultralow  $Q_g$  and  $Q_{gd}$
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free
- SON 5-mm × 6-mm Plastic Package

### APPLICATIONS

- Point-of-Load Synchronous Buck in Networking, Telecom, and Computing Systems
- Synchronous Rectification
- Active ORing and Hotswap Applications

### DESCRIPTION

The NexFET™ power MOSFET has been designed to minimize losses in synchronous rectification and other power conversion applications.



### PRODUCT SUMMARY

| $T_A = 25^\circ\text{C}$ unless otherwise stated |                               | TYPICAL VALUE          | UNIT    |
|--------------------------------------------------|-------------------------------|------------------------|---------|
| $V_{DS}$                                         | Drain to Source Voltage       | 30                     | V       |
| $Q_g$                                            | Gate Charge Total (4.5V)      | 39                     | nC      |
| $Q_{gd}$                                         | Gate Charge Gate to Drain     | 9.3                    | nC      |
| $R_{DS(on)}$                                     | Drain to Source On Resistance | $V_{GS} = 4.5\text{V}$ | 1.15 mΩ |
|                                                  |                               | $V_{GS} = 10\text{V}$  | 0.95 mΩ |
| $V_{GS(th)}$                                     | Threshold Voltage             | 1.4                    | V       |

### ORDERING INFORMATION

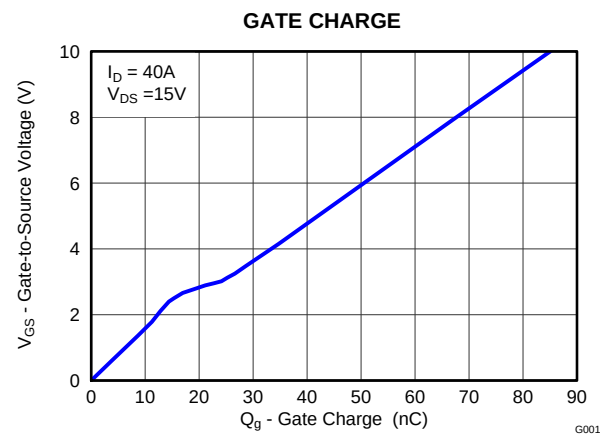
| Device     | Package                         | Media        | Qty  | Ship          |
|------------|---------------------------------|--------------|------|---------------|
| CSD17559Q5 | SON 5-mm × 6-mm Plastic Package | 13-Inch Reel | 2500 | Tape and Reel |

### ABSOLUTE MAXIMUM RATINGS

| $T_A = 25^\circ\text{C}$ unless otherwise stated |                                                                                               | 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), $T_C = 25^\circ\text{C}$                          | 100        | A    |
|                                                  | Continuous Drain Current (Silicon limited), $T_C = 25^\circ\text{C}$                          | 257        |      |
|                                                  | Continuous Drain Current <sup>(1)</sup>                                                       | 40         | A    |
| $I_{DM}$                                         | Pulsed Drain Current, $T_A = 25^\circ\text{C}$ <sup>(1)(2)</sup>                              | 250        | A    |
| $P_D$                                            | Power Dissipation <sup>(1)</sup>                                                              | 3.2        | W    |
| $T_J, T_{STG}$                                   | Operating Junction and Storage Temperature Range                                              | –55 to 150 | °C   |
| $E_{AS}$                                         | Avalanche Energy, single pulse<br>$I_D = 104\text{A}$ , $L = 0.1\text{mH}$ , $R_G = 25\Omega$ | 541        | mJ   |

(1) Typical  $R_{\theta JA} = 40^\circ\text{C/W}$  on 1-inch<sup>2</sup> (6.45-cm<sup>2</sup>), 2-oz. (0.071-mm thick) Cu pad on a 0.06-inch (1.52-mm) thick FR4 PCB.

(2) Pulse duration ≤300μs, duty cycle ≤2%



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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<sub>A</sub> = 25°C unless otherwise stated)

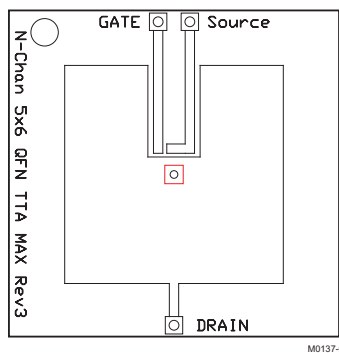
| PARAMETER               |                                  | TEST CONDITIONS                                                                           | MIN  | TYP | MAX  | UNIT |
|-------------------------|----------------------------------|-------------------------------------------------------------------------------------------|------|-----|------|------|
| Static Characteristics  |                                  |                                                                                           |      |     |      |      |
| BV <sub>DSS</sub>       | Drain to Source Voltage          | V <sub>GS</sub> = 0V, I <sub>DS</sub> = 250μA                                             | 30   |     |      | V    |
| I <sub>DSS</sub>        | Drain to Source Leakage Current  | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 24V                                               |      |     | 1    | μA   |
| I <sub>GSS</sub>        | Gate to Source Leakage Current   | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 20V                                               |      |     | 100  | nA   |
| V <sub>GS(th)</sub>     | Gate to Source Threshold Voltage | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>DS</sub> = 250μA                               | 1.2  | 1.4 | 1.7  | V    |
| R <sub>DS(on)</sub>     | Drain to Source On Resistance    | V <sub>GS</sub> = 4.5V, I <sub>DS</sub> = 40A                                             | 1.15 |     | 1.5  | mΩ   |
|                         |                                  | V <sub>GS</sub> = 10V, I <sub>DS</sub> = 40A                                              | 0.95 |     | 1.15 | mΩ   |
| g <sub>fs</sub>         | Transconductance                 | V <sub>DS</sub> = 15V, I <sub>DS</sub> = 40A                                              | 235  |     |      | S    |
| Dynamic Characteristics |                                  |                                                                                           |      |     |      |      |
| C <sub>iss</sub>        | Input Capacitance                | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 15V, f = 1MHz                                     | 7070 |     | 9200 | pF   |
| C <sub>oss</sub>        | Output Capacitance               |                                                                                           | 1780 |     | 2314 | pF   |
| C <sub>rss</sub>        | Reverse Transfer Capacitance     |                                                                                           | 87   |     | 113  | pF   |
| R <sub>G</sub>          | Series Gate Resistance           | V <sub>DS</sub> = 15V, I <sub>DS</sub> = 40A                                              | 1.2  |     | 2.4  | Ω    |
| Q <sub>g</sub>          | Gate Charge Total (4.5V)         |                                                                                           | 39   |     | 51   | nC   |
| Q <sub>gd</sub>         | Gate Charge Gate to Drain        |                                                                                           | 9.3  |     |      | nC   |
| Q <sub>gs</sub>         | Gate Charge Gate to Source       |                                                                                           | 14.4 |     |      | nC   |
| Q <sub>g(th)</sub>      | Gate Charge at V <sub>th</sub>   |                                                                                           | 8.3  |     |      | nC   |
| Q <sub>oss</sub>        | Output Charge                    | V <sub>DS</sub> = 15V, V <sub>GS</sub> = 0V                                               | 50   |     |      | nC   |
| t <sub>d(on)</sub>      | Turn On Delay Time               | V <sub>DS</sub> = 15V, V <sub>GS</sub> = 4.5V, I <sub>DS</sub> = 40A, R <sub>G</sub> = 2Ω | 20   |     |      | ns   |
| t <sub>r</sub>          | Rise Time                        |                                                                                           | 41   |     |      | ns   |
| t <sub>d(off)</sub>     | Turn Off Delay Time              |                                                                                           | 32   |     |      | ns   |
| t <sub>f</sub>          | Fall Time                        |                                                                                           | 14   |     |      | ns   |
| Diode Characteristics   |                                  |                                                                                           |      |     |      |      |
| V <sub>SD</sub>         | Diode Forward Voltage            | I <sub>SD</sub> = 40A, V <sub>GS</sub> = 0V                                               | 0.8  |     | 1    | V    |
| Q <sub>rr</sub>         | Reverse Recovery Charge          | V <sub>DD</sub> = 15V, I <sub>F</sub> = 40A, di/dt = 300A/μs                              | 80   |     |      | nC   |
| t <sub>rr</sub>         | Reverse Recovery Time            |                                                                                           | 37   |     |      | ns   |

## THERMAL CHARACTERISTICS

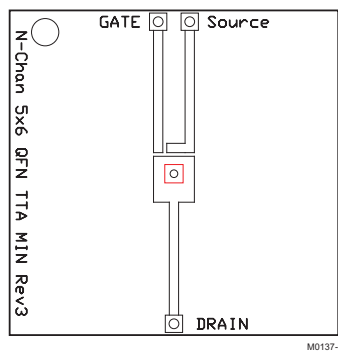
(T<sub>A</sub> = 25°C unless otherwise stated)

| PARAMETER        |                                                          | MIN | TYP | MAX | UNIT |
|------------------|----------------------------------------------------------|-----|-----|-----|------|
| R <sub>θJC</sub> | Thermal Resistance Junction to Case <sup>(1)</sup>       |     |     | 1.2 | °C/W |
| R <sub>θJA</sub> | Thermal Resistance Junction to Ambient <sup>(1)(2)</sup> |     |     | 50  | °C/W |

- (1) R<sub>θJC</sub> 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-inch × 1.5-inch (3.81-cm × 3.81-cm), 0.06-inch (1.52-mm) thick FR4 PCB. R<sub>θJC</sub> is specified by design, whereas R<sub>θJA</sub> 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.



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.



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

## TYPICAL MOSFET CHARACTERISTICS

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

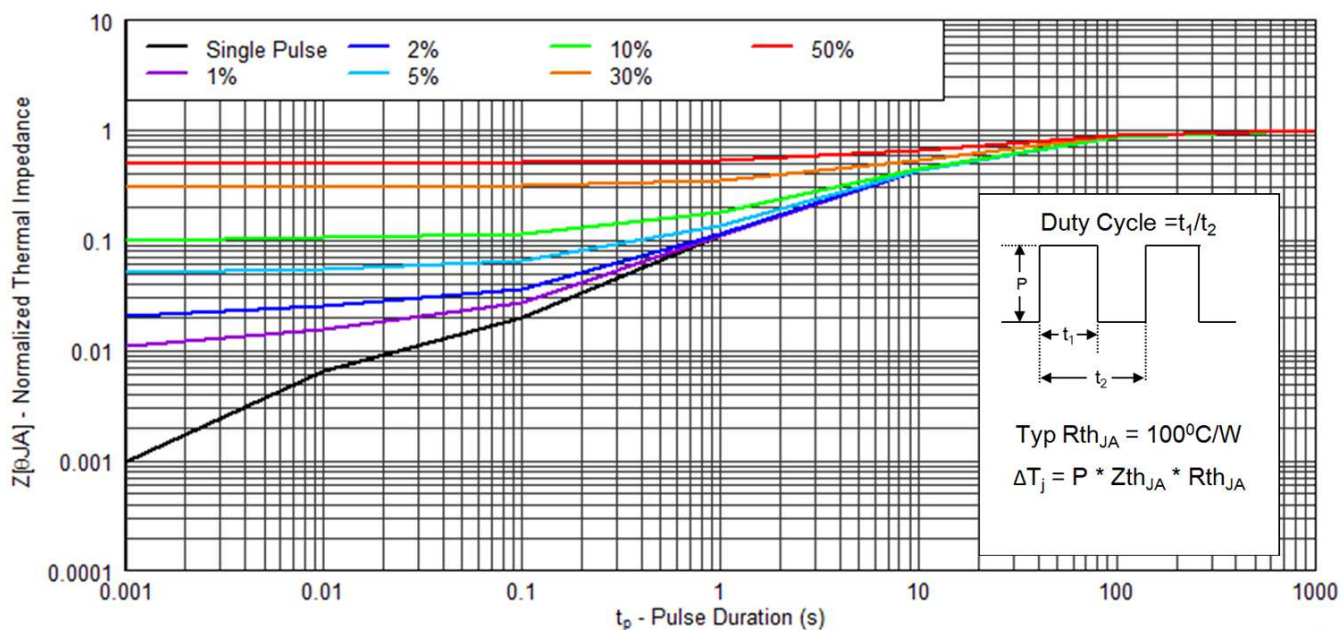


Figure 1. Transient Thermal Impedance

## TYPICAL MOSFET CHARACTERISTICS (continued)

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

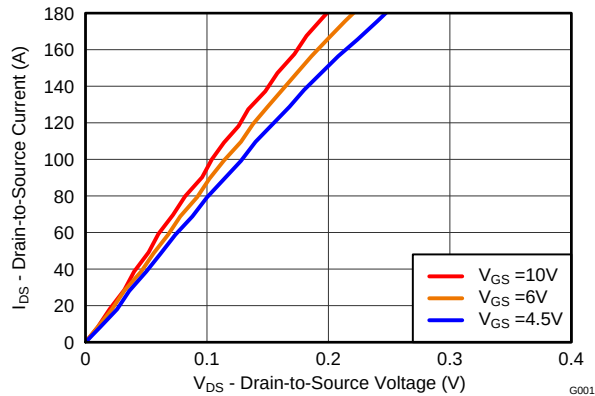


Figure 2. Saturation Characteristics

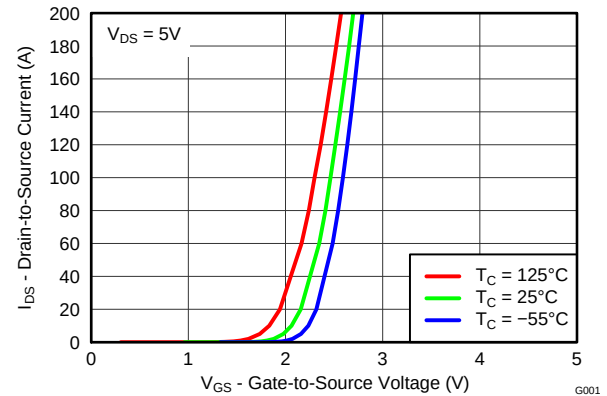


Figure 3. Transfer Characteristics

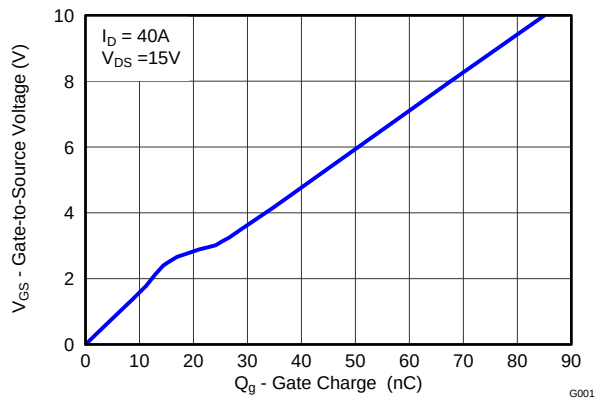


Figure 4. Gate Charge

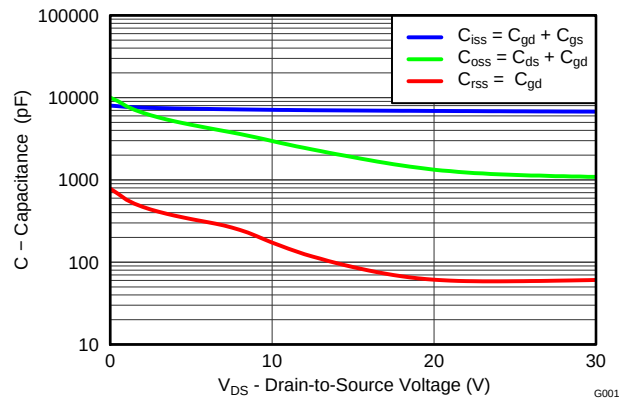


Figure 5. Capacitance

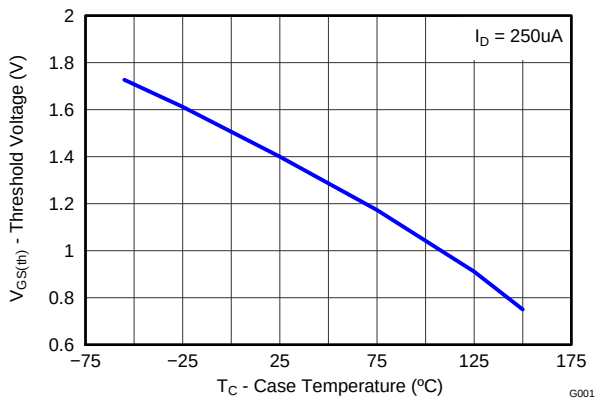


Figure 6. Threshold Voltage vs. Temperature

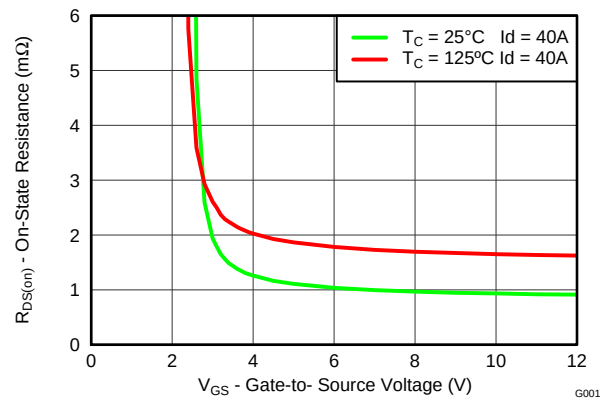
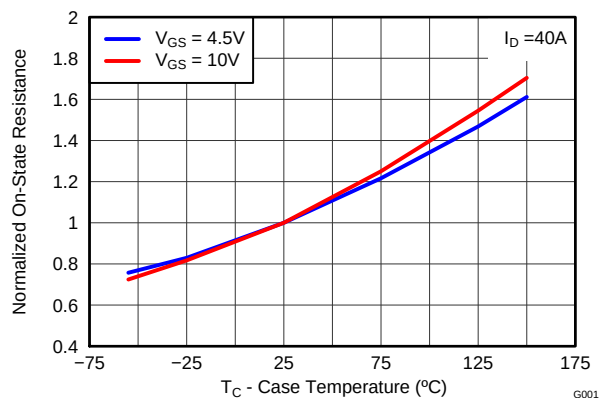


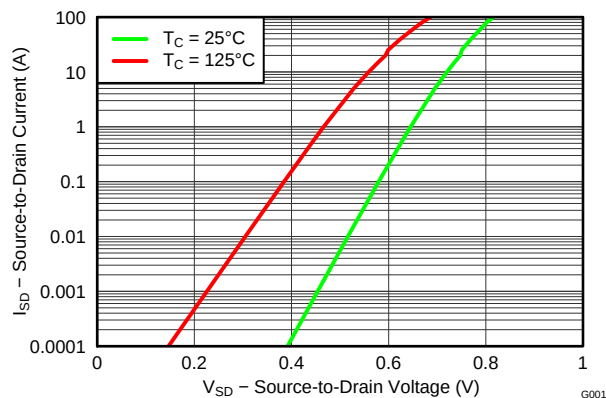
Figure 7. On-State Resistance vs. Gate-to-Source Voltage

## TYPICAL MOSFET CHARACTERISTICS (continued)

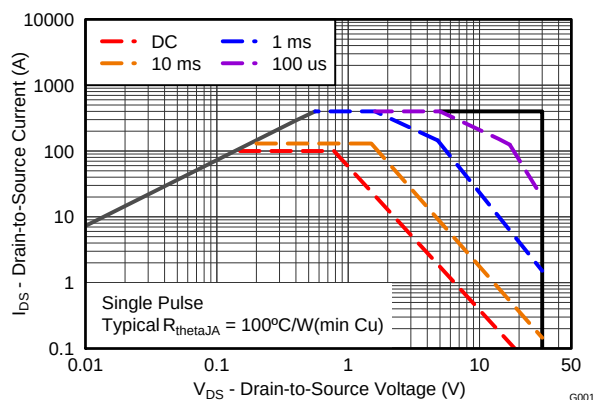
( $T_A = 25^\circ\text{C}$  unless otherwise stated)



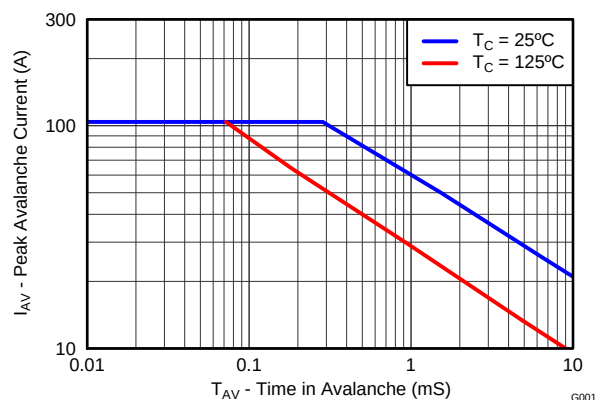
**Figure 8. Normalized On-State Resistance vs. Temperature**



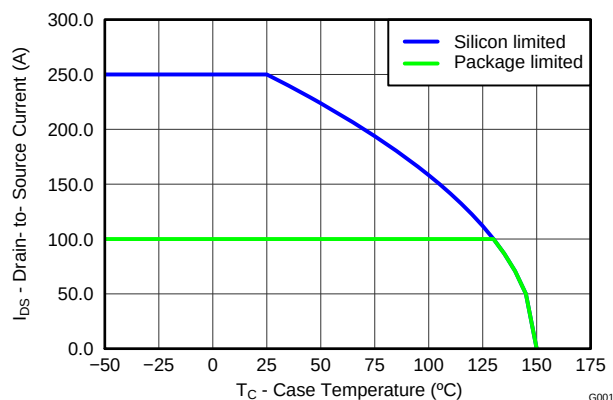
**Figure 9. Typical Diode Forward Voltage**



**Figure 10. Safety Operating Area  $T_C = 25^\circ\text{C}$**



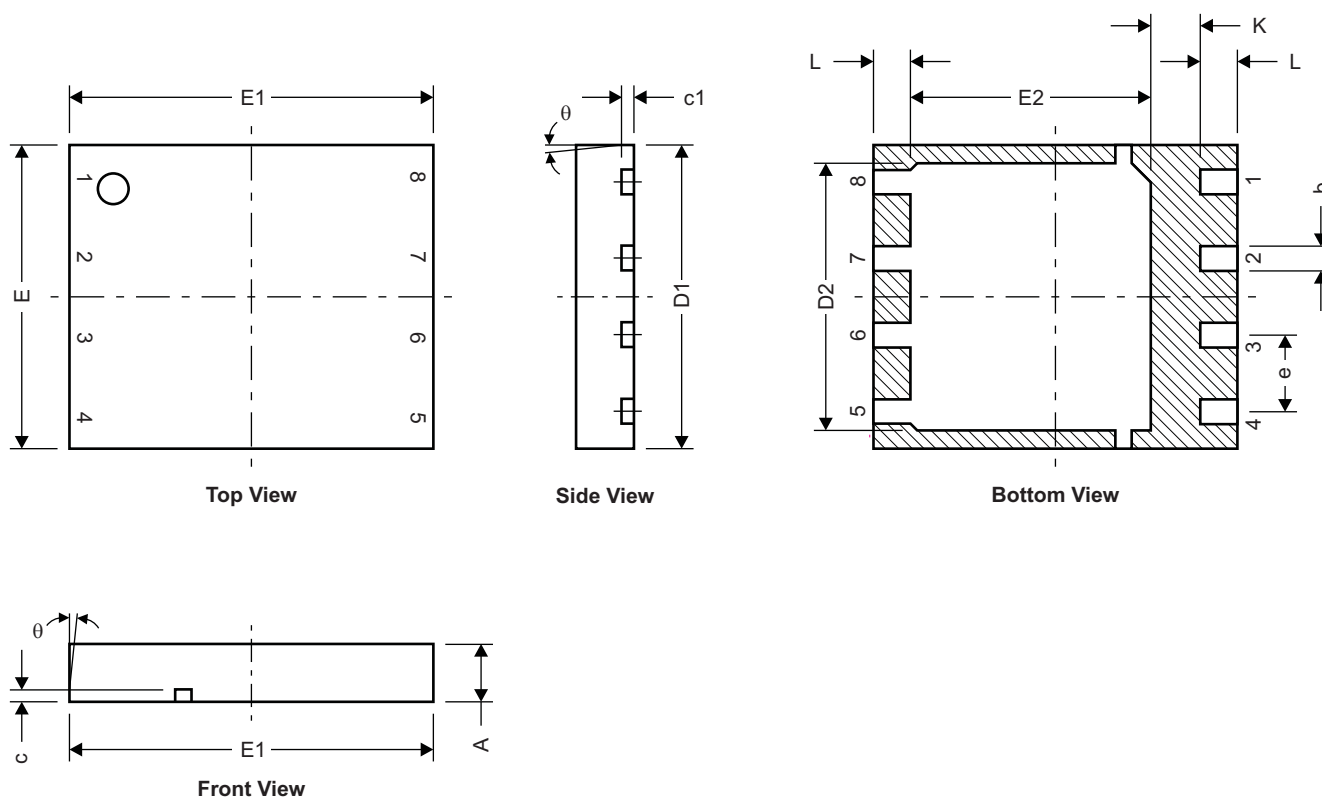
**Figure 11. Single Pulse Unclamped Inductive Switching**



**Figure 12. Maximum Drain Current vs. Temperature**

## MECHANICAL DATA

### Q5 Package Dimensions



M0140-01

| DIM      | MILLIMETERS |       | INCHES |       |
|----------|-------------|-------|--------|-------|
|          | MIN         | MAX   | MIN    | MAX   |
| A        | 0.950       | 1.050 | 0.037  | 0.039 |
| b        | 0.360       | 0.460 | 0.014  | 0.018 |
| c        | 0.150       | 0.250 | 0.006  | 0.010 |
| c1       | 0.150       | 0.250 | 0.006  | 0.010 |
| D1       | 4.900       | 5.100 | 0.193  | 0.201 |
| D2       | 4.320       | 4.520 | 0.170  | 0.178 |
| E        | 4.900       | 5.100 | 0.193  | 0.201 |
| E1       | 5.900       | 6.100 | 0.232  | 0.240 |
| E2       | 3.920       | 4.12  | 0.154  | 0.162 |
| e        | 1.27 TYP    |       | 0.050  |       |
| K        | 0.760       |       | 0.030  |       |
| L        | 0.510       | 0.710 | 0.020  | 0.028 |
| $\theta$ | 0.00        |       |        |       |

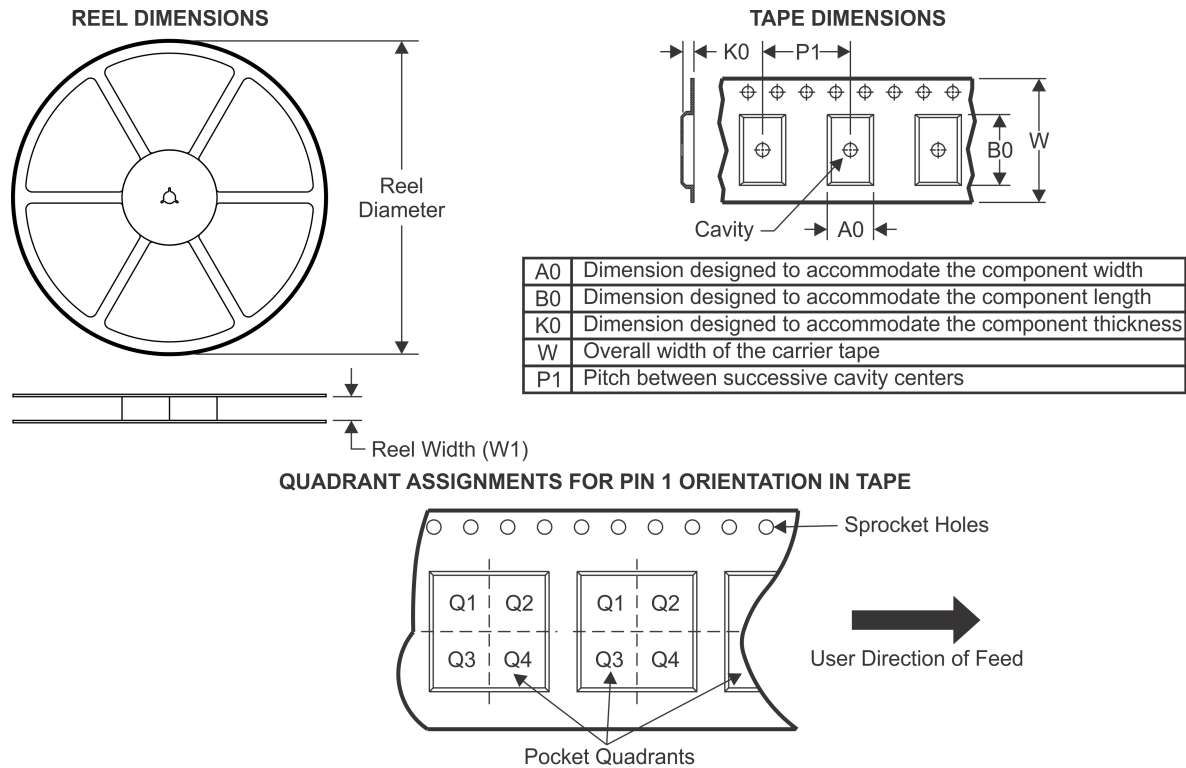
Technical drawing of a mechanical part with dimensions F1 through F11. The drawing shows a side view of a component with a central rectangular body and a series of four rectangular protrusions on the right side. The dimensions are labeled as follows:

- F1: Total width of the component.
- F2: Total height of the component.
- F3: Total height of the four rectangular protrusions.
- F4: Height of the bottom-most protrusion.
- F5: Height of the second protrusion from the bottom.
- F6: Width of the bottom-most protrusion.
- F7: Width of the second protrusion from the bottom.
- F8: Width of the central rectangular body.
- F9: Height of the third protrusion from the bottom.
- F10: Width of the central rectangular body.
- F11: Height of the central rectangular body.

| DIM | MILLIMETERS |       | INCHES |       |
|-----|-------------|-------|--------|-------|
|     | MIN         | MAX   | MIN    | MAX   |
| F1  | 6.205       | 6.305 | 0.244  | 0.248 |
| F2  | 4.460       | 4.560 | 0.176  | 0.180 |
| F3  | 4.460       | 4.560 | 0.176  | 0.180 |
| F4  | 0.650       | 0.700 | 0.026  | 0.028 |
| F5  | 0.620       | 0.670 | 0.024  | 0.026 |
| F6  | 0.630       | 0.680 | 0.025  | 0.027 |
| F7  | 0.700       | 0.800 | 0.028  | 0.031 |
| F8  | 0.650       | 0.700 | 0.026  | 0.028 |
| F9  | 0.620       | 0.670 | 0.024  | 0.026 |
| F10 | 4.900       | 5.000 | 0.193  | 0.197 |
| F11 | 4.460       | 4.560 | 0.176  | 0.180 |

[illegible]

1. 10-sprocket hole-pitch cumulative tolerance  $\pm 0.2$
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:  $0.30 \pm 0.05\text{mm}$
6. MSL1 260°C (IR and convection) PbF reflow compatible

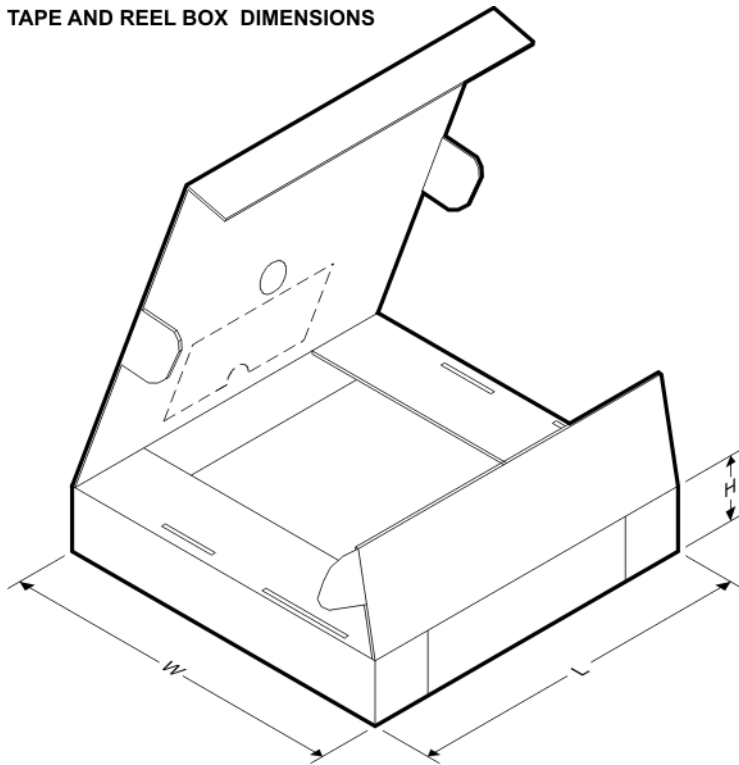
**TAPE AND REEL INFORMATION**


\*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 |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CSD17559Q5 | SON          | DQH             | 8    | 2500 | 330.0              | 12.8               | 6.5     | 5.3     | 1.4     | 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) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CSD17559Q5 | SON          | DQH             | 8    | 2500 | 335.0       | 335.0      | 32.0        |

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| 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>                             |
| Space, Avionics and Defense   | <a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a> |
| Video and Imaging             | <a href="http://www.ti.com/video">www.ti.com/video</a>                                   |

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