

CSD18532Q5B 60-V N-Channel NexFET™ Power MOSFETs

1 Features

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

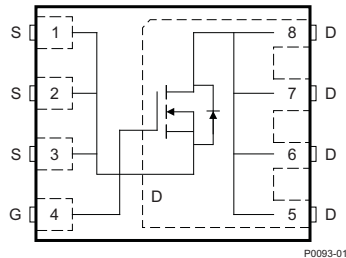
2 Applications

- DC-DC Conversion
- Secondary Side Synchronous Rectifier
- Isolated Converter Primary Side Switch
- Motor Control

3 Description

This 2.5-m Ω , 60-V SON 5-mm × 6-mm NexFET™ power MOSFET is 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 | 60 | V |
| Q_g | Gate Charge Total (10 V) | 44 | nC |
| Q_{gd} | Gate Charge Gate-to-Drain | 6.9 | nC |
| $R_{DS(on)}$ | Drain-to-Source On-Resistance | $V_{GS} = 4.5\text{ V}$ | 3.3 |
| | | $V_{GS} = 10\text{ V}$ | 2.5 |
| $V_{GS(th)}$ | Threshold Voltage | 1.8 | V |

Device Information⁽¹⁾

| DEVICE | QTY | MEDIA | PACKAGE | SHIP |
|--------------|------|--------------|---|---------------------|
| CSD18532Q5B | 2500 | 13-Inch Reel | SON 5.00-mm × 6.00-mm Plastic Package | Tape and Reel |
| CSD18532Q5BT | 250 | 13-Inch Reel | | |

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

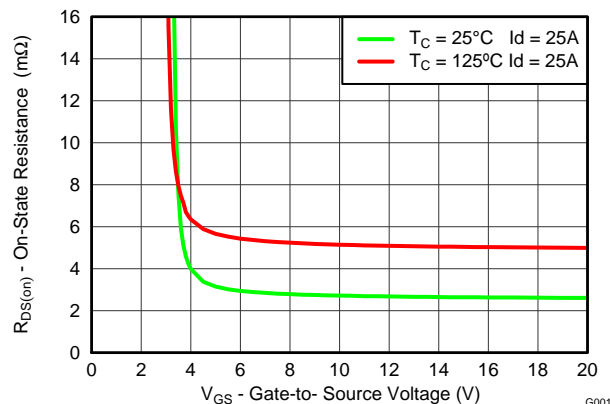
Absolute Maximum Ratings

| $T_A = 25^\circ\text{C}$ | | VALUE | UNIT |
|--------------------------|--|------------|------------------|
| V_{DS} | Drain-to-Source Voltage | 60 | V |
| V_{GS} | Gate-to-Source Voltage | ± 20 | V |
| I_D | Continuous Drain Current (Package Limited) | 100 | A |
| | Continuous Drain Current (Silicon Limited), $T_C = 25^\circ\text{C}$ | 172 | |
| | Continuous Drain Current ⁽¹⁾ | 23 | |
| I_{DM} | Pulsed Drain Current ⁽²⁾ | 400 | A |
| P_D | Power Dissipation ⁽¹⁾ | 3.2 | W |
| | Power Dissipation, $T_C = 25^\circ\text{C}$ | 156 | |
| T_J , T_{stg} | Operating Junction Temperature, Storage Temperature | -55 to 150 | $^\circ\text{C}$ |
| E_{AS} | Avalanche Energy, Single Pulse $I_D = 80\text{ A}$, $L = 0.1\text{ mH}$, $R_G = 25\ \Omega$ | 320 | mJ |

(1) Typical $R_{\theta JA} = 40^\circ\text{C/W}$ on a 1-in², 2-oz Cu pad on a 0.06-in thick FR4 PCB.

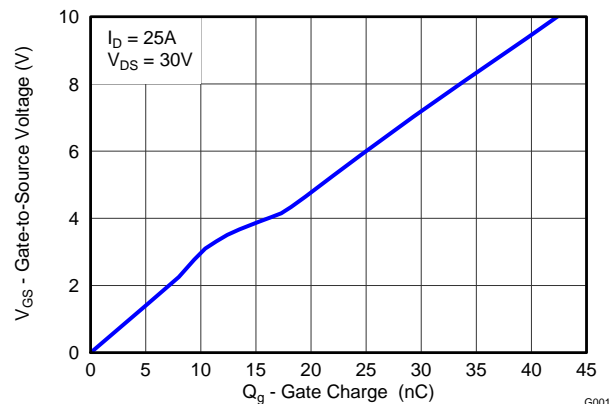
(2) Max $R_{\theta JC} = 0.8^\circ\text{C/W}$, pulse duration $\leq 100\ \mu\text{s}$, duty cycle $\leq 1\%$.

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



G001

Gate Charge



G001



Table of Contents

| | | | |
|---|----------|---|-----------|
| 1 Features | 1 | 6.2 Community Resources..... | 7 |
| 2 Applications | 1 | 6.3 Trademarks | 7 |
| 3 Description | 1 | 6.4 Electrostatic Discharge Caution | 7 |
| 4 Revision History | 2 | 6.5 Glossary | 7 |
| 5 Specifications | 3 | 7 Mechanical, Packaging, and Orderable Information | 8 |
| 5.1 Electrical Characteristics..... | 3 | 7.1 Q5B Package Dimensions | 8 |
| 5.2 Thermal Information | 3 | 7.2 Recommended PCB Pattern..... | 9 |
| 5.3 Typical MOSFET Characteristics..... | 4 | 7.3 Recommended Stencil Pattern | 9 |
| 6 Device and Documentation Support | 7 | 7.4 Q5B Tape and Reel Information | 10 |
| 6.1 Receiving Notification of Documentation Updates.... | 7 | | |

4 Revision History

Changes from Revision C (May 2017) to Revision D Page

| | |
|--|----------|
| • Extended the V_{DS} on Figure 5 to 60 V..... | 4 |
|--|----------|

Changes from Revision B (July 2014) to Revision C Page

| | |
|--|----------|
| • Added the <i>Receiving Notification of Documentation Updates</i> and <i>Community Resources</i> sections to <i>Device and Documentation Support</i> | 7 |
| • Changed the dimension between pads 3 and 4 from 0.028 inches: to 0.050 inches in the <i>Recommended PCB Pattern</i> section diagram | 9 |

Changes from Revision A (May 2014) to Revision B Page

| | |
|---|----------|
| • Changed "7-Inch Reel" to state "13-Inch Reel". | 1 |
|---|----------|

Changes from Original (Nov 2012) to Revision A Page

| | |
|--|----------|
| • Updated the device description. | 1 |
| • Specified Q_g at 10 V. | 1 |
| • Added small reel option. | 1 |
| • Increased pulsed drain current to 400 A. | 1 |
| • Added line for max power dissipation with case temperature held to 25°C. | 1 |
| • Updated the pulsed drain current conditions. | 1 |
| • Eliminated Q_g at 4.5 V. | 3 |
| • Changed Figure 1 from a normalized $R_{\theta JA}$ curve to a $R_{\theta JC}$ curve..... | 4 |
| • Updated the safe operating area in Figure 10 | 6 |
| • Updated the mechanical drawing. | 8 |

5 Specifications

5.1 Electrical Characteristics

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

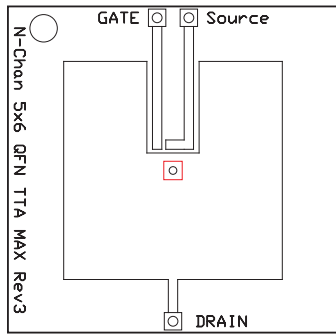
| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT | |
|-------------------------|----------------------------------|---|------|-----|-----|------|----|
| STATIC CHARACTERISTICS | | | | | | | |
| BV _{DSS} | Drain-to-source voltage | V _{GS} = 0 V, I _D = 250 μA | 60 | | | V | |
| I _{DSS} | Drain-to-source leakage current | V _{GS} = 0 V, V _{DS} = 48 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 | 1.5 | 1.8 | 2.2 | V | |
| R _{DS(on)} | Drain-to-source on-resistance | V _{GS} = 4.5 V, I _D = 25 A | 3.3 | | | mΩ | |
| | | V _{GS} = 10 V, I _D = 25 A | 2.5 | | | | |
| g _{fs} | Transconductance | V _{DS} = 30 V, I _D = 25 A | 143 | | | S | |
| DYNAMIC CHARACTERISTICS | | | | | | | |
| C _{iss} | Input capacitance | V _{GS} = 0 V, V _{DS} = 30 V, f = 1 MHz | 3900 | | | 5070 | pF |
| C _{oss} | Output capacitance | | 470 | | | 611 | pF |
| C _{rss} | Reverse transfer capacitance | | 13 | | | 17 | pF |
| R _G | Series gate resistance | | 1.2 | | | 2.4 | Ω |
| Q _g | Gate charge total (10 V) | V _{DS} = 30 V, I _D = 25 A | 44 | | | 58 | nC |
| Q _{gd} | Gate charge gate-to-drain | | 6.9 | | | | nC |
| Q _{gs} | Gate charge gate-to-source | | 10 | | | | nC |
| Q _{g(th)} | Gate charge at V _{th} | | 6.3 | | | | nC |
| Q _{oss} | Output charge | V _{DS} = 30 V, V _{GS} = 0 V | 52 | | | | nC |
| t _{d(on)} | Turnon delay time | V _{DS} = 30 V, V _{GS} = 10 V, I _{DS} = 25 A, R _G = 0 Ω | 5.8 | | | | ns |
| t _r | Rise time | | 7.2 | | | | ns |
| t _{d(off)} | Turnoff delay time | | 22 | | | | ns |
| t _f | Fall time | | 3.1 | | | | ns |
| DIODE CHARACTERISTICS | | | | | | | |
| V _{SD} | Diode forward voltage | I _{SD} = 25 A, V _{GS} = 0 V | 0.8 | | | 1 | V |
| Q _{rr} | Reverse recovery charge | V _{DS} = 30 V, I _F = 25 A, di/dt = 300 A/μs | 111 | | | | nC |
| t _{rr} | Reverse recovery time | | 49 | | | | ns |

5.2 Thermal Information

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

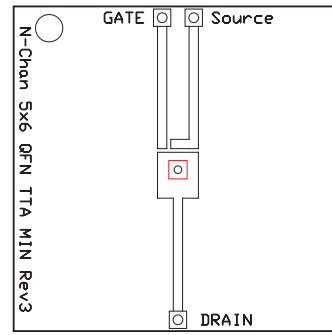
| THERMAL METRIC | | MIN | TYP | MAX | UNIT |
|-----------------|--|-----|-----|-----|---------------------------|
| $R_{\theta JC}$ | Junction-to-case thermal resistance ⁽¹⁾ | | | 0.8 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance ⁽¹⁾⁽²⁾ | | | 50 | $^\circ\text{C}/\text{W}$ |

- (1) $R_{\theta JC}$ is determined with the device mounted on a 1-in² (6.45-cm²), 2-oz. (0.071-mm) thick Cu pad on a 1.5-in × 1.5-in (3.81-cm × 3.81-cm), 0.06-in (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-in² (6.45-cm²), 2-oz (0.071-mm) thick Cu.



M0137-01

Max $R_{\theta JA} = 50^{\circ}\text{C/W}$
when mounted on 1 in²
(6.45 cm²) of
2-oz (0.071-mm) thick
Cu.

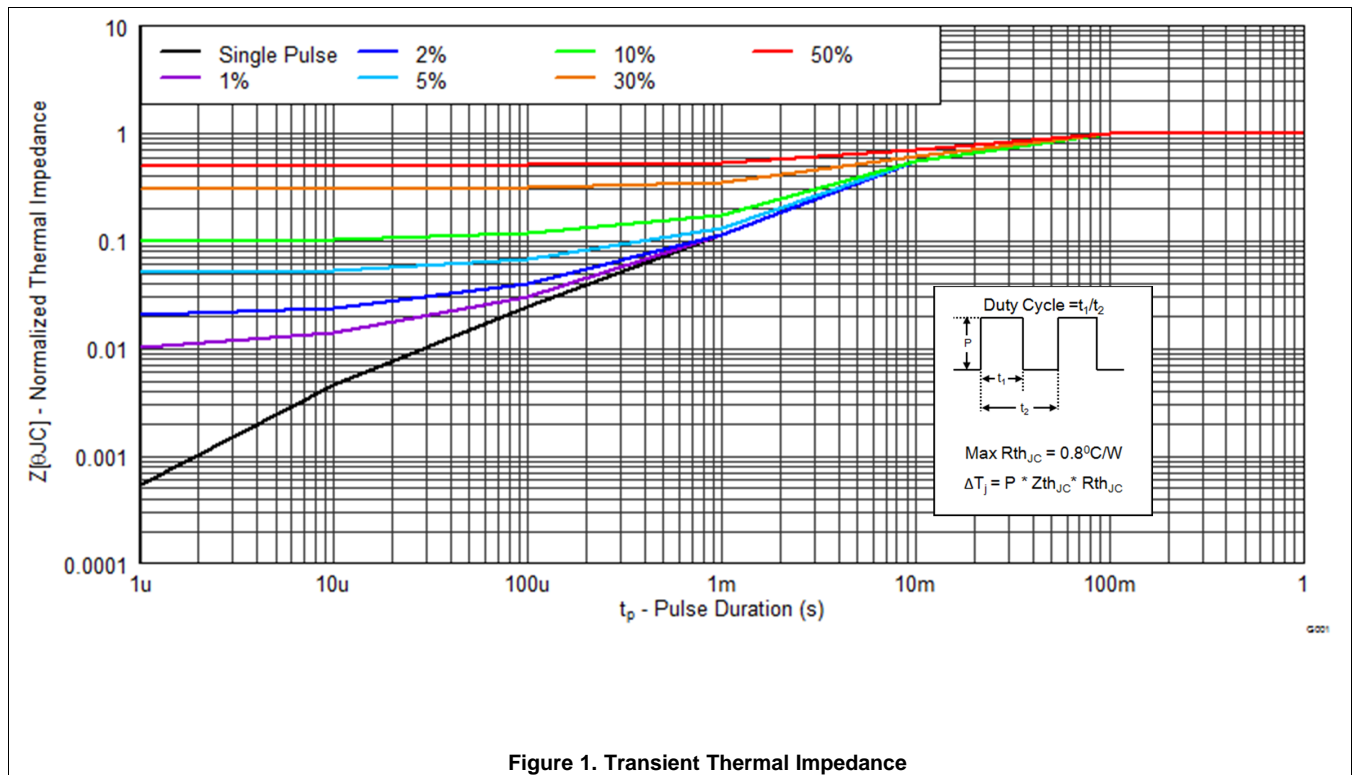


M0137-02

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

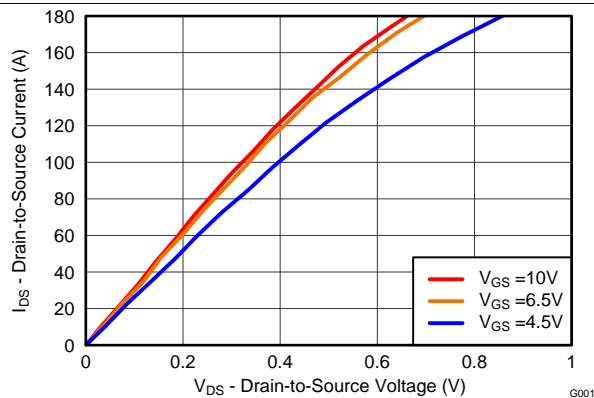


Figure 2. Saturation Characteristics

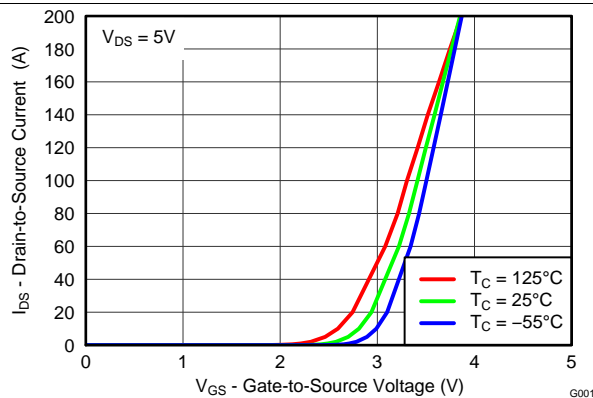


Figure 3. Transfer Characteristics

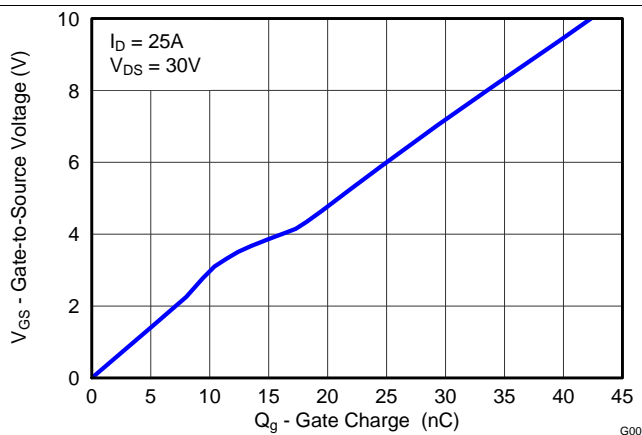


Figure 4. Gate Charge

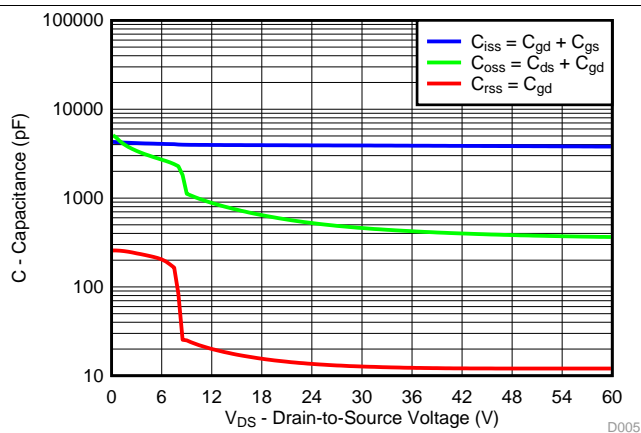


Figure 5. Capacitance

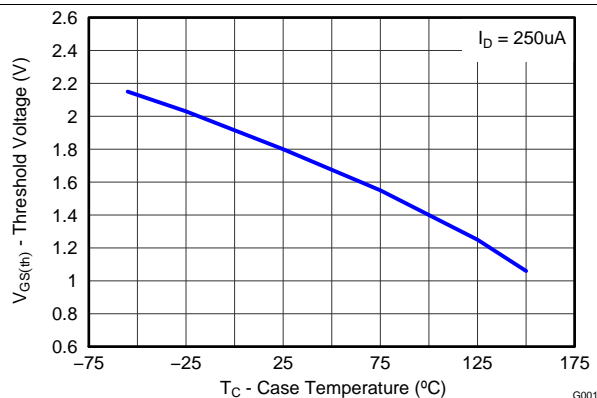


Figure 6. Threshold Voltage vs Temperature

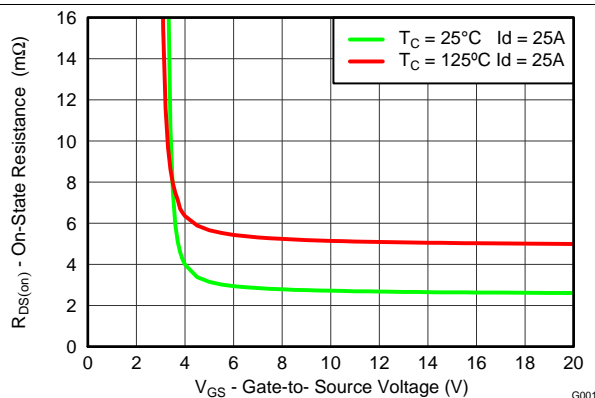


Figure 7. On-State Resistance vs Gate-to-Source Voltage

Typical MOSFET Characteristics (continued)

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

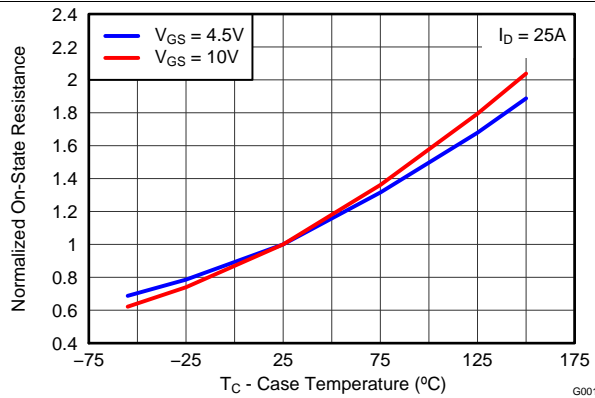


Figure 8. Normalized On-State Resistance vs Temperature

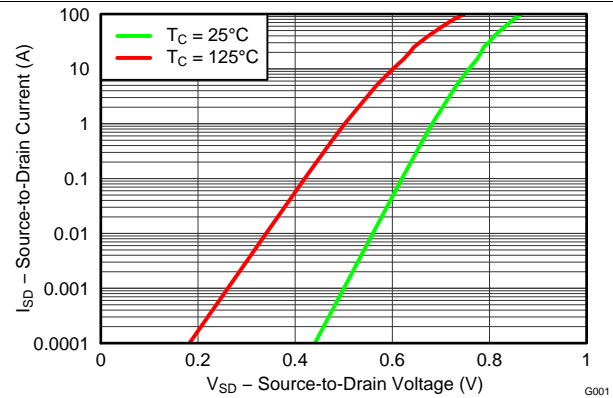


Figure 9. Typical Diode Forward Voltage

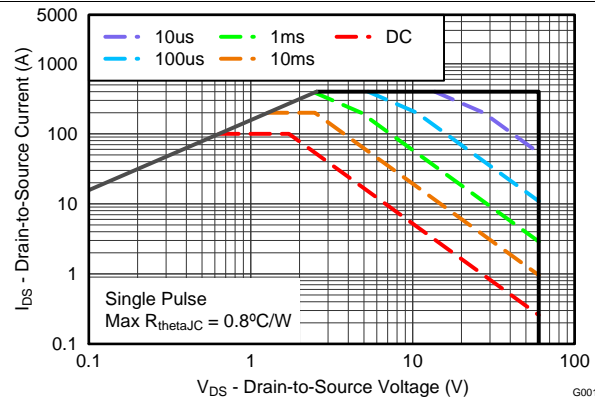


Figure 10. Maximum Safe Operating Area

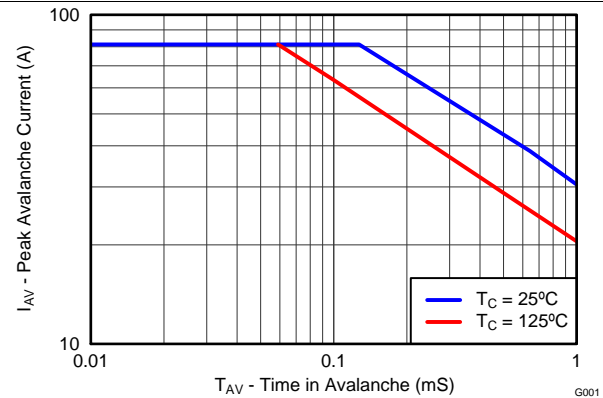


Figure 11. Single Pulse Unclamped Inductive Switching

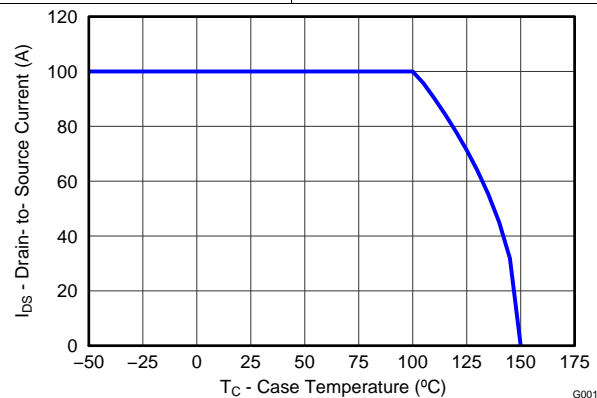


Figure 12. Maximum Drain Current vs Temperature

6 Device and Documentation Support

6.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

6.2 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

TI E2E™ Online Community *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

6.3 Trademarks

NexFET, E2E are trademarks of Texas Instruments.
All other trademarks are the property of their respective owners.

6.4 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.

6.5 Glossary

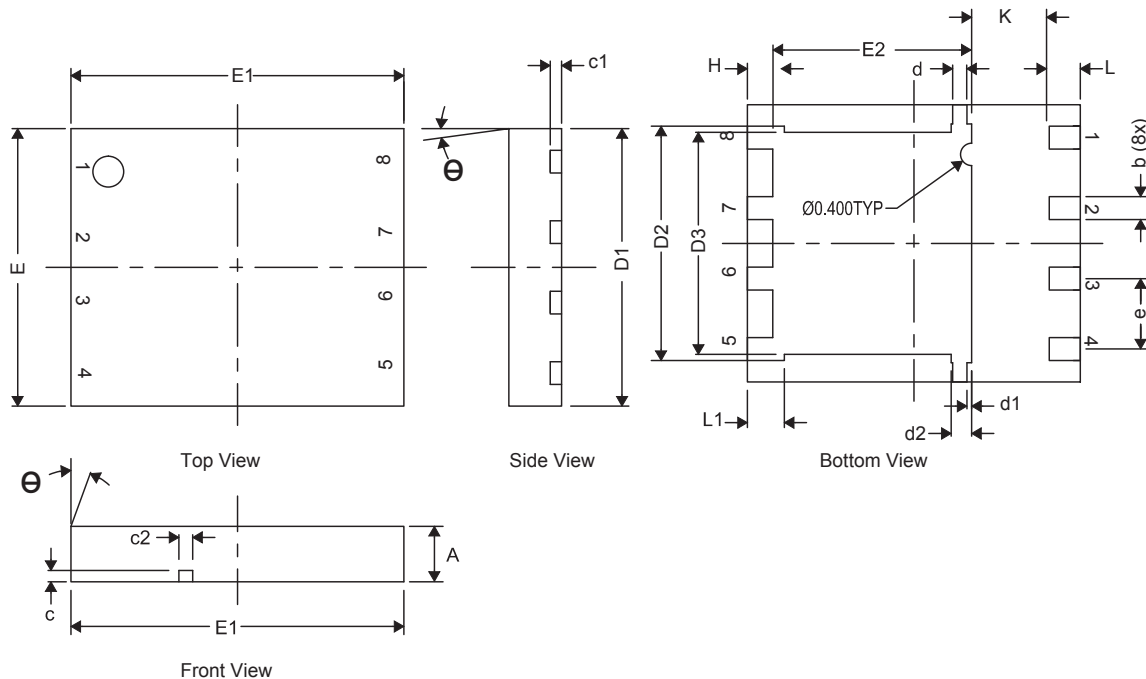
[SLYZ022](#) — *TI Glossary*.

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 Q5B Package Dimensions



| DIM | MILLIMETERS | | |
|-----|-------------|-------|-------|
| | MIN | NOM | MAX |
| A | 0.80 | 1.00 | 1.05 |
| b | 0.36 | 0.41 | 0.46 |
| c | 0.15 | 0.20 | 0.25 |
| c1 | 0.15 | 0.20 | 0.25 |
| c2 | 0.20 | 0.25 | 0.30 |
| D1 | 4.90 | 5.00 | 5.10 |
| D2 | 4.12 | 4.22 | 4.32 |
| D3 | 3.90 | 4.00 | 4.10 |
| d | 0.20 | 0.25 | 0.30 |
| d1 | 0.085 TYP | | |
| d2 | 0.319 | 0.369 | 0.419 |
| E | 4.90 | 5.00 | 5.10 |
| E1 | 5.90 | 6.00 | 6.10 |
| E2 | 3.48 | 3.58 | 3.68 |
| e | 1.27 TYP | | |
| H | 0.36 | 0.46 | 0.56 |
| L | 0.46 | 0.56 | 0.66 |
| L1 | 0.57 | 0.67 | 0.77 |
| θ | 0° | — | — |
| K | 1.40 TYP | | |

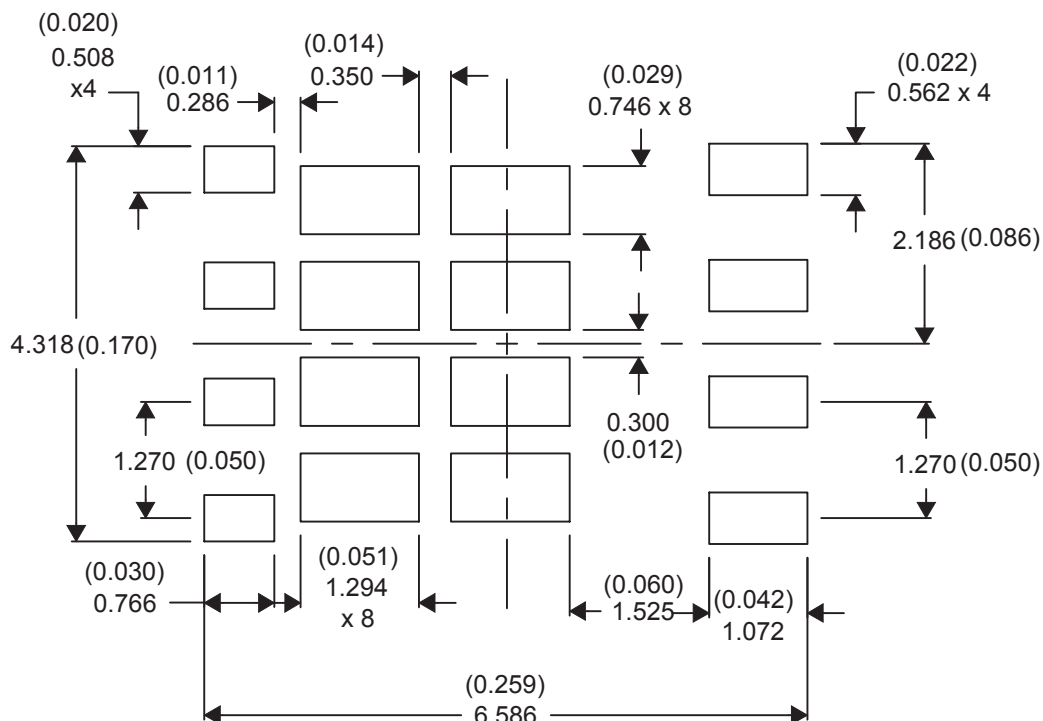
Technical drawing of a mechanical part, likely a bracket or support, showing dimensions and tolerances. The drawing includes a central vertical section with a horizontal centerline and a vertical centerline. The part has a rectangular base and a vertical section with a central hole. Dimensions are given in millimeters (mm) with tolerances in parentheses.

Key dimensions and tolerances:

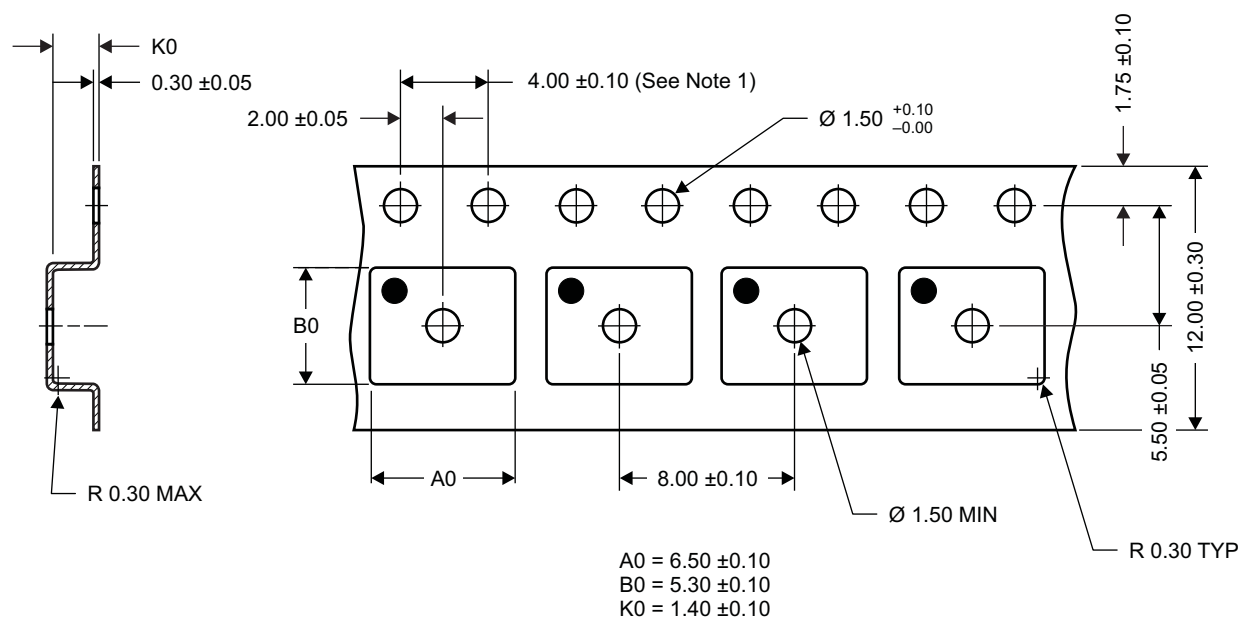
- Overall width: 4.440 mm
- Overall height: 4.520 mm (tolerance: 0.178 mm)
- Top horizontal section width: 0.590 mm (tolerance: 0.023 mm)
- Top horizontal section height: 0.710 mm (tolerance: 0.028 mm)
- Central vertical section width: 0.984 mm (tolerance: 0.039 mm)
- Central vertical section height: 0.560 mm (tolerance: 0.022 mm)
- Bottom horizontal section width: 1.372 mm (tolerance: 0.054 mm)
- Bottom horizontal section height: 0.710 mm (tolerance: 0.028 mm)
- Right side section width: 1.100 mm (tolerance: 0.043 mm)
- Right side section height: 1.270 mm (tolerance: 0.050 mm)

The drawing also includes a central vertical section with a horizontal centerline and a vertical centerline. The part has a rectangular base and a vertical section with a central hole. Dimensions are given in millimeters (mm) with tolerances in parentheses.

7.3 Recommended Stencil Pattern



7.4 Q5B 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) |
|------------------------------|---------------|----------------------|---------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| CSD18532Q5B | Active | Production | VSON-CLIP (DNK) 8 | 2500 LARGE T&R | ROHS Exempt | NIPDAU SN | Level-1-260C-UNLIM | -55 to 150 | CSD18532 |
| CSD18532Q5B.B | Active | Production | VSON-CLIP (DNK) 8 | 2500 LARGE T&R | ROHS Exempt | NIPDAU | Level-1-260C-UNLIM | -55 to 150 | CSD18532 |
| CSD18532Q5BG4 | Active | Production | VSON-CLIP (DNK) 8 | 2500 LARGE T&R | ROHS Exempt | NIPDAU | Level-1-260C-UNLIM | -55 to 150 | CSD18532 |
| CSD18532Q5BG4.B | Active | Production | VSON-CLIP (DNK) 8 | 2500 LARGE T&R | ROHS Exempt | NIPDAU | Level-1-260C-UNLIM | -55 to 150 | CSD18532 |
| CSD18532Q5BT | Active | Production | VSON-CLIP (DNK) 8 | 250 SMALL T&R | ROHS Exempt | NIPDAU SN | Level-1-260C-UNLIM | -55 to 150 | CSD18532 |
| CSD18532Q5BT.B | Active | Production | VSON-CLIP (DNK) 8 | 250 SMALL T&R | ROHS Exempt | NIPDAU | Level-1-260C-UNLIM | -55 to 150 | CSD18532 |

(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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