# E4MS018120J2

## Automotive Silicon Carbide Power MOSFET

### Features

- Industry compatible drive voltage 15 V ...18 V/-4 V ...0 V
- Low $R_{DS(on)}$ at high operating temperatures
- Improved device capacitance ratio ($C_{iss}/C_{rss}$)
- Halogen free, RoHS compliant
- Automotive Qualified (AEC-Q101) and PPAP Capable

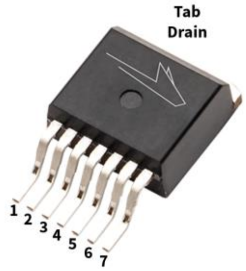
### Benefits

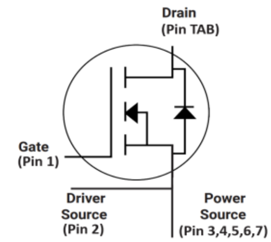
- Higher efficiency with lower switching losses and EMI
- Faster switching operation enabling high power density
- Enables system level price performance optimization
- Reduction in system level cooling requirements

### Typical Applications

- Onboard charger
- High voltage DC/DC converters
- HVAC compressors
- Battery management systems

### Package




| Orderable Part Number | Package Type | Marking |
|---|---|---|
| E4MS018120J2-TR | TO-263-7 XL | E4MS018120J2 |

### Absolute Maximum Ratings

Stress beyond those listed under absolute maximum ratings may damage the device.

| Symbol | Parameter | Min. | Max. | Unit | Conditions | Note |
|---|---|---|---|---|---|---|
| $V_{DS(max)}$ | Drain-Source Voltage | | 1200 | V | | |
| $V_{GS(max)}$ | Maximum Gate – Source Voltage (Transient) | -10 | +23 | V | | Note 1 |
| $I_D$ | DC Continuous Drain Current | | 116 | A | $V_{GS}$ = 18 V, $T_c$ = 25 °C, $T_J \leq$ 175 °C | Note 2 |
| | | | 82 | A | $V_{GS}$ = 18 V, $T_c$ = 100 °C, $T_J \leq$ 175 °C | |
| $I_{DM}$ | Pulsed Drain Current | | 369 | A | $V_{GS}$ = 18 V, $T_c$ = 25 °C, $t_{Pmax}$ limited by $T_{jmax}$ | |
| $P_D$ | Power Dissipation | | 454 | W | $T_c$ = 25 °C, $T_J$ = 175 °C | Note 3 |
| $T_J$, $T_{stg}$ | Operating Junction and Storage Temperature | -55 | +175 | °C | | |
| $T_L$ | Solder Temperature | | 260 | °C | According to JEDEC J-STD-020 | |

Note (1): Refer to AN PRD-09634
Note (2): Current limit calculated by $I_{D(max)} = \sqrt{(P_D / R_{DS(typ)}(T_{J(max)}, I_{D(max)}))}$
Note (3): $P_D = (T_J - T_C) / R_{th(JC,Max)}$

## Electrical Characteristics ($T_C$ = 25 °C unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions | Note |
|---|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain – Source Breakdown Voltage | 1200 | | | V | $V_{GS}$ = 0 V, $I_D$ =100 µA | |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | 2.6 | 3.9 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 14.5 mA | Fig. 11, Note 1 |
| | | | 2.0 | | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 14.5 mA, $T_J$ = 175 °C | |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | | 1 | 50 | µA | $V_{DS}$ = 1200 V, $V_{GS}$ = 0 V | |
| $I_{GSS}$ | Gate-Source Leakage Current | | 10 | 250 | nA | $V_{GS}$ = 18 V, $V_{DS}$ = 0 V | |
| $V_{GS(op)}$ | Recommended Turn on Gate-Source Voltage | | +15…+18 | | V | | Note 4 |
| | Recommended Turn off Gate-Source Voltage | | -4…0 | | | | |
| $R_{DS(on)}$ | Drain-Source On-State Resistance | | 18 | 23.4 | mΩ | $V_{GS}$ = 18 V, $I_D$ = 52.7 A | Fig. 4, 5, 6 |
| | | | 33.8 | | | $V_{GS}$ = 18 V, $I_D$ = 52.7 A, $T_J$ = 175 °C | |
| | | | 21 | | | $V_{GS}$ = 15 V, $I_D$ = 52.7 A | |
| $g_{fs}$ | Transconductance | | 39 | | S | $V_{DS}$ = 20 V, $I_D$ = 52.7 A | Fig. 7 |
| | | | 38 | | | $V_{DS}$ = 20 V, $I_D$ = 52.7 A, $T_J$ = 175 °C | |
| $R_{DS(on)Tempco}$ | On Resistance Temperature Coefficient | | 1.88 | | | $V_{GS}$ = 18 V, $I_D$ = 52.7 A | Note 5 |
| $C_{iss}$ | Input Capacitance | | 4105 | | pF | $V_{GS}$ = 0 V, $V_{DS}$ = 1000 V<br>$f$ = 100 kHz<br>$V_{AC}$ = 25 mV | Fig. 17, 18 |
| $C_{oss}$ | Output Capacitance | | 148 | | | | |
| $C_{rss}$ | Reverse Transfer Capacitance | | 6.5 | | | | |
| $C_{iss}/C_{rss}$ | Capacitance Ratio | | 630 | | | | Note 6 |
| $E_{oss}$ | $C_{OSS}$ Stored Energy | | 96 | | µJ | | Fig. 16 |
| $C_{o(er)}$ | Effective Output Capacitance (Energy Related) | | 215 | | pF | $V_{GS}$ = 0 V, $V_{DS}$ = 0 V … 800 V | Note 7 |
| $C_{o(tr)}$ | Effective Output Capacitance (Time Related) | | 350 | | | | |
| $E_{on}$ | Turn-On Switching Energy (Body Diode FWD)<br>$T_j$ = 25 °C<br>$T_j$ = 175 °C | | <br>347<br>343 | | µJ | $V_{DS}$ = 800 V, $V_{GS}$ = -4 V / 18 V,<br>$I_D$ = 52.7 A, $R_{G(ext)}$ = 2 Ω, $L_σ$ = 14 nH | Fig. 25, 27, 29 |
| $E_{off}$ | Turn-Off Switching Energy (Body Diode FWD)<br>$T_j$ = 25 °C<br>$T_j$ = 175 °C | | <br>133<br>130 | | | | Fig. 25, 28, 29 |
| $t_{d(on)}$ | Turn-On Delay Time | | 14 | | ns | $V_{DS}$ = 800 V, $V_{GS}$ =-4 V / 18 V,<br>$I_D$ = 52.7 A, $R_{G(ext)}$ = 2 Ω, $L_σ$ = 14 nH<br>Timing relative to $I_{DS}$ Inductive load | Fig. 26, 27, 29 |
| $t_r$ | Rise Time | | 5 | | | | |
| $t_{d(off)}$ | Turn-Off Delay Time | | 34 | | | | Fig. 26, 28, 29 |
| $t_f$ | Fall Time | | 12 | | | | |
| $R_{G(int)}$ | Internal Gate Resistance | | 1.2 | | Ω | $f$ = 1 MHz | |
| $Q_{gs}$ | Gate to Source Charge | | 47 | | nC | $V_{DS}$ = 800 V, $V_{GS}$ = -4 V/ 18 V<br>$I_D$ = 52.7 A | Fig. 12 |
| $Q_{gd}$ | Gate to Drain Charge | | 50 | | | | |
| $Q_g$ | Total Gate Charge | | 172 | | | | |

Note (4): Refer to AN PRD-08999.
Note (5): $R_{DS(on)Tempco}$ refers to $R_{DS(on)}$ at 175 °C / $R_{DS(on)}$ at 25 °C. This is a E4MS 1200 V product family value.
Note (6): Capacitance ratio is a FOM for partial turn-on immunity AN PRD-06933. This is a E4MS 1200 V product family value.
Note (7): $C_{o(er)}$, a lumped capacitance that gives the same stored energy as $C_{oss}$ while $V_{DS}$ is rising from 0 V to 800 V.
$C_{o(tr)}$, a lumped capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 V to 800 V.

## Reverse Diode Characteristics ($T_C$ = 25 °C unless otherwise specified)

| Symbol | Parameter | Typ. | Max. | Unit | Test Conditions | Note |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | 5.1 | | V | $V_{GS}$ = -4 V, $I_{SD}$ = 26.4 A, $T_J$ = 25 °C | Fig. 8, 9, 10 |
| | | 4.5 | | | $V_{GS}$ = -4 V, $I_{SD}$ = 26.4 A, $T_J$ = 175 °C | |
| $I_S$ | Continuous Diode Forward Current | | 71 | A | $V_{GS}$ = -4 V, $T_C$ = 25 °C | |
| $I_{SM}$ | Diode Pulse Current | | 369 | | $V_{GS}$ = -4 V, pulse width $t_p$ limited by $T_{jmax}$ | |
| $t_{rr}$ | Reverse Recovery Time | 17 | | ns | $V_{GS}$ = -4 V, $I_{SD}$ = 52.7 A, $V_R$ = 800 V, $T_J$ = 175 °C, $di_f/dt$ = 16694 A/µs | Fig. 30 |
| $Q_{rr}$ | Reverse Recovery Charge | 1099 | | nC | | |
| $I_{RRM}$ | Peak Reverse Recovery Current | 104 | | A | | |
| $E_{RR}$ | Reverse Recovery Energy<br>$T_j$ = 25 °C<br>$T_j$ = 175 °C | <br>439<br>720 | | µJ | $V_{DS}$ = 800 V, $I_{DS}$ = 52.7 A, $V_{GS}$ = -4 V / 18 V, $R_{G(ext)}$ = 2 Ω, $L_\sigma$ = 14 nH | |

## Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit | Test Conditions | Note |
|---|---|---|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance from Junction to Case | 0.25 | 0.33 | °C/W | | |

## Typical Performance

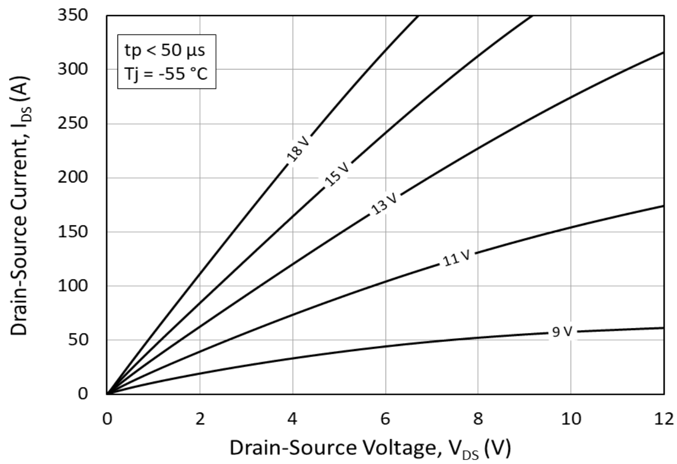



**Figure 1.** Output Characteristics $T_{VJ}$ = -55 °C

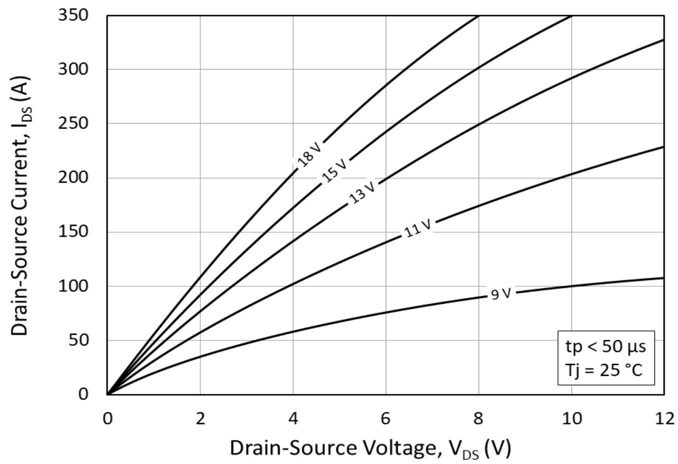



**Figure 2.** Output Characteristics $T_{VJ}$ = 25 °C

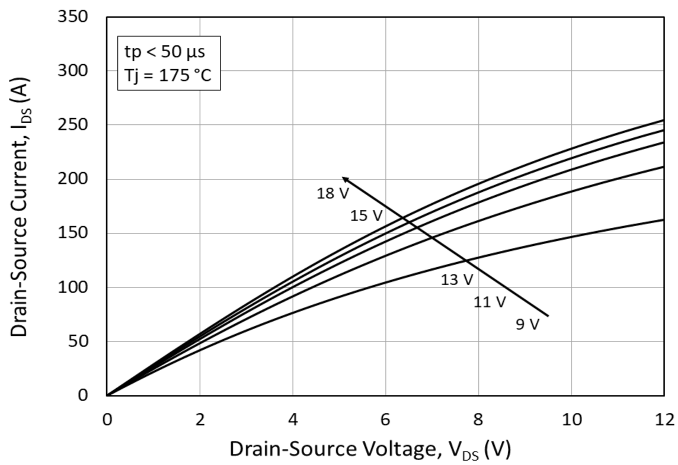



**Figure 3.** Output Characteristics $T_{VJ}$ = 175 °C

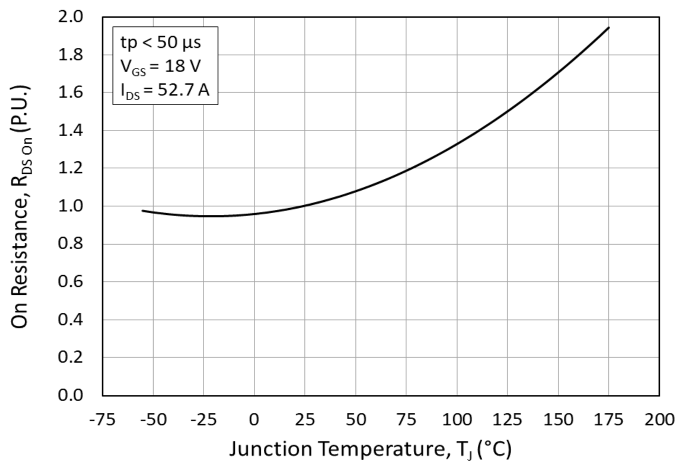



**Figure 4.** Normalized On-Resistance vs. Temperature

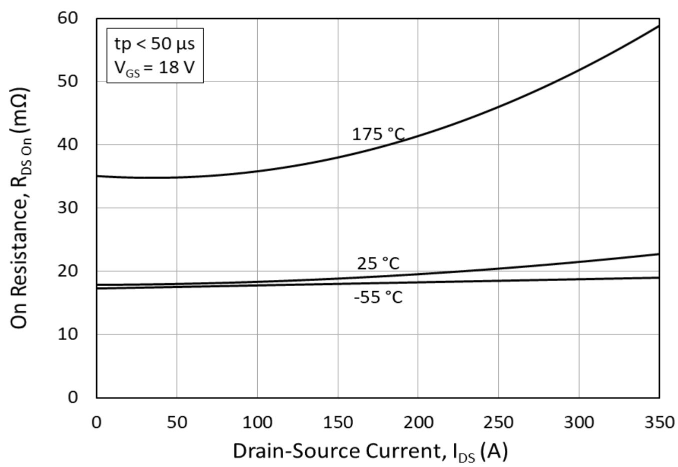



**Figure 5.** On-Resistance vs. Drain Current for Various Temperatures

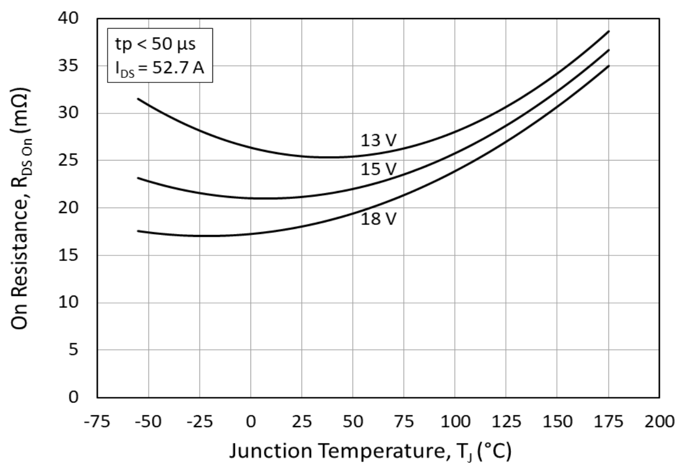



**Figure 6.** On-Resistance vs. Temperature for Various Gate Voltages

## Typical Performance

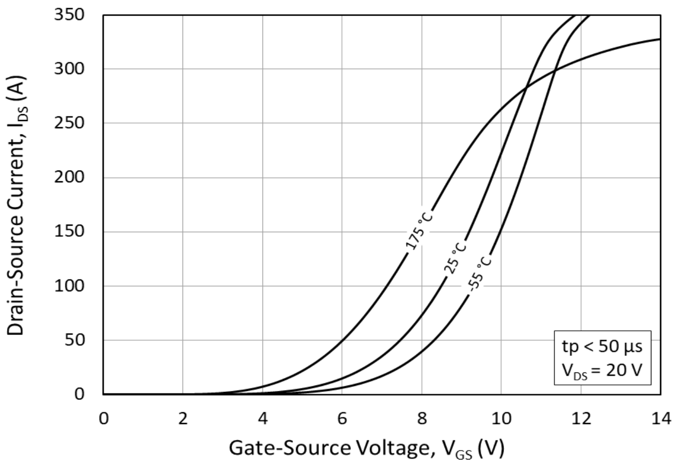



**Figure 7.** Transfer Characteristic for Various Junction Temperatures

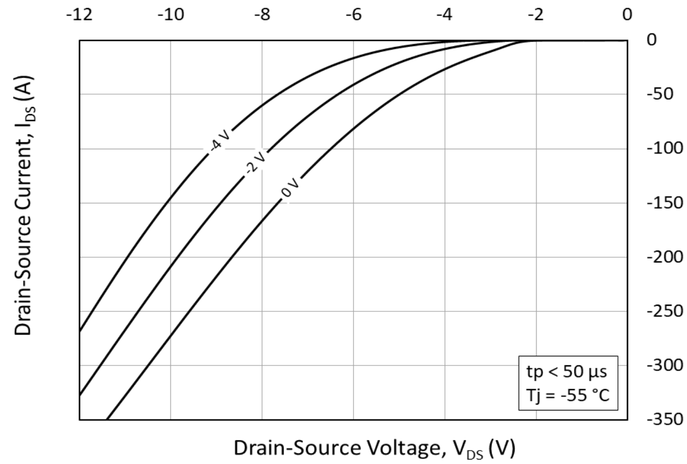



**Figure 8.** Body Diode Characteristic at $T_{VJ}$ = -55 °C

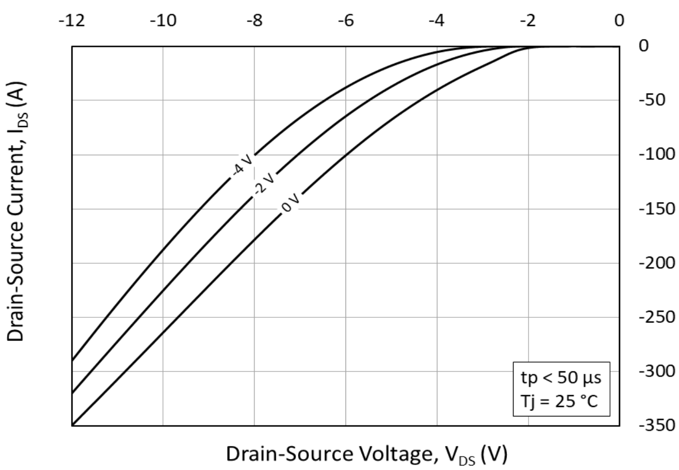



**Figure 9.** Body Diode Characteristic at $T_{VJ}$ = 25 °C

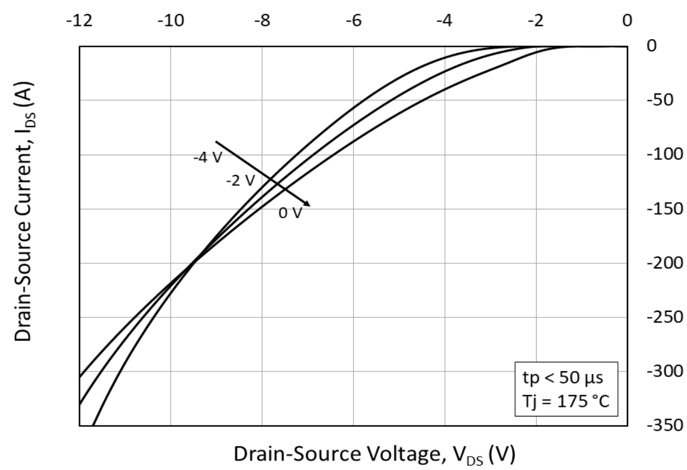



**Figure 10.** Body Diode Characteristic at $T_{VJ}$ = 175 °C

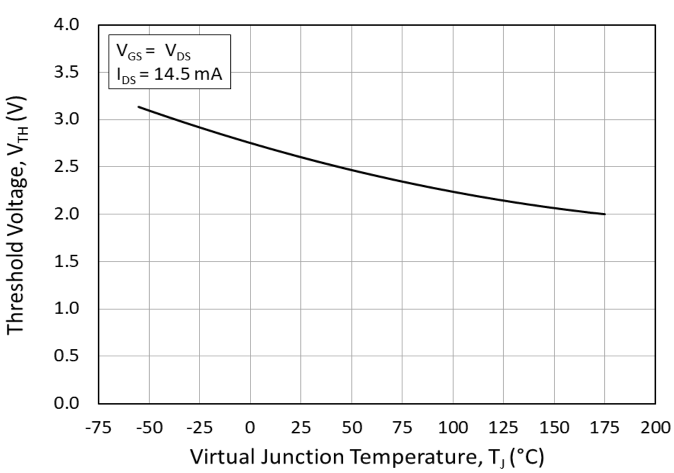



**Figure 11.** Threshold Voltage vs. Temperature

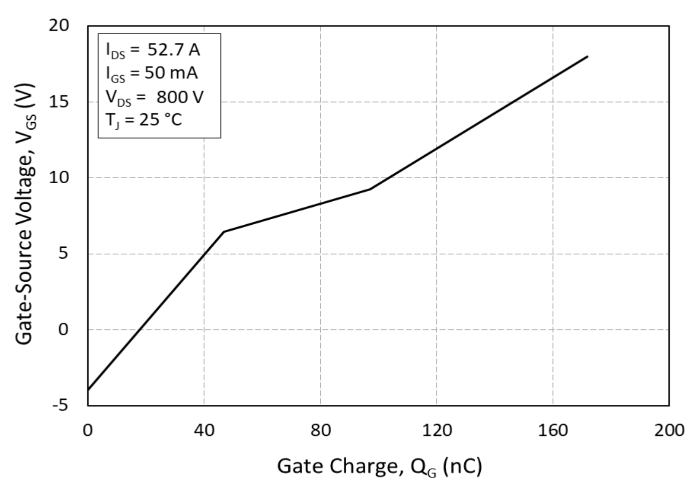



**Figure 12.** Gate Charge Characteristics

## Typical Performance

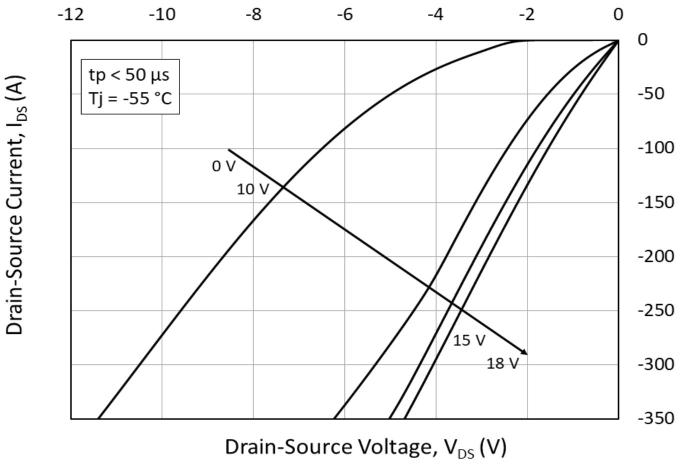



**Figure 13.** 3rd Quadrant Characteristic at $T_{VJ}$ = -55 °C

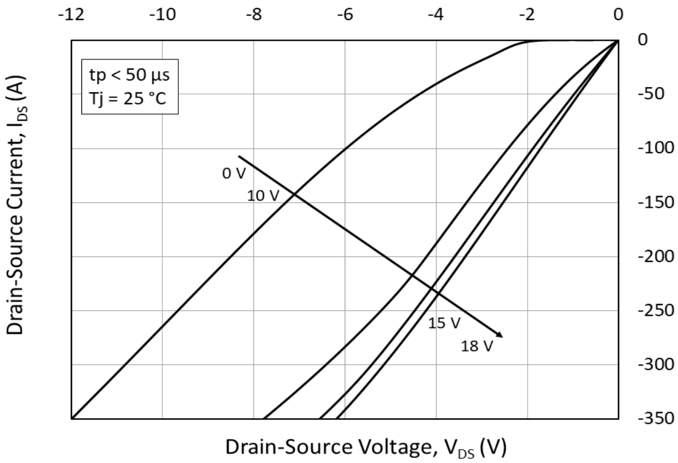



**Figure 14.** 3rd Quadrant Characteristic at $T_{VJ}$ = 25 °C

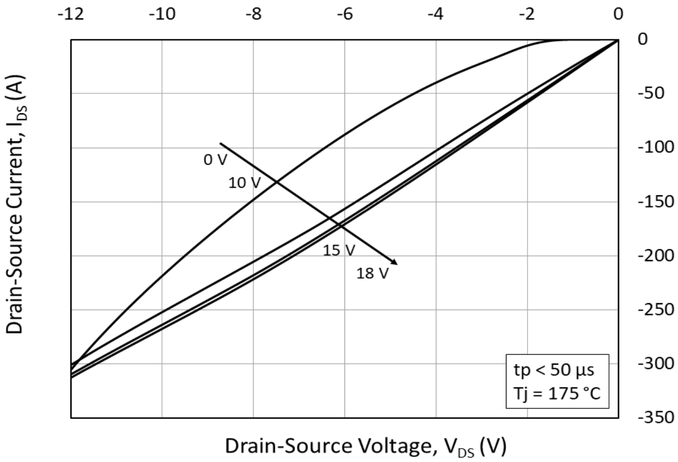



**Figure 15.** 3rd Quadrant Characteristic at $T_{VJ}$ = 175 °C

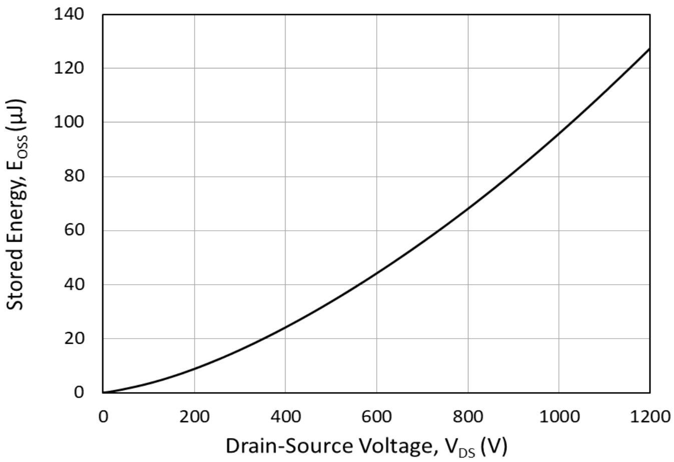



**Figure 16.** Output Capacitor Stored Energy

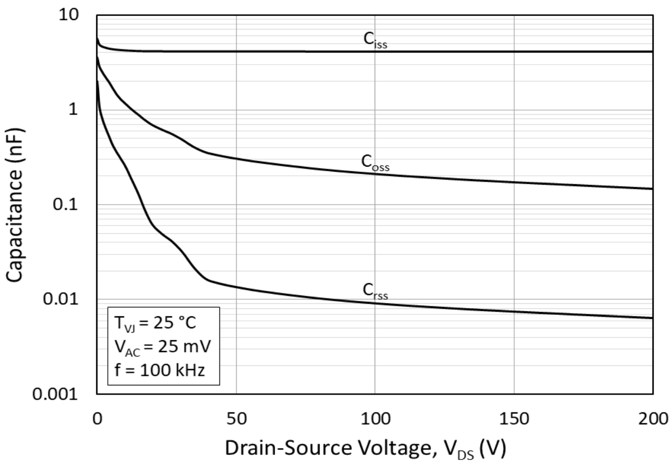



**Figure 17.** Capacitances vs. Drain-Source Voltage (0-200 V)

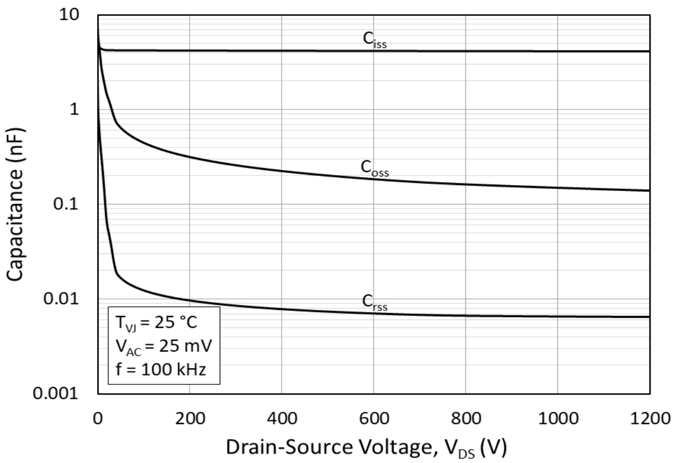



**Figure 18.** Capacitances vs. Drain-Source Voltage (0-1200 V)

## Typical Performance

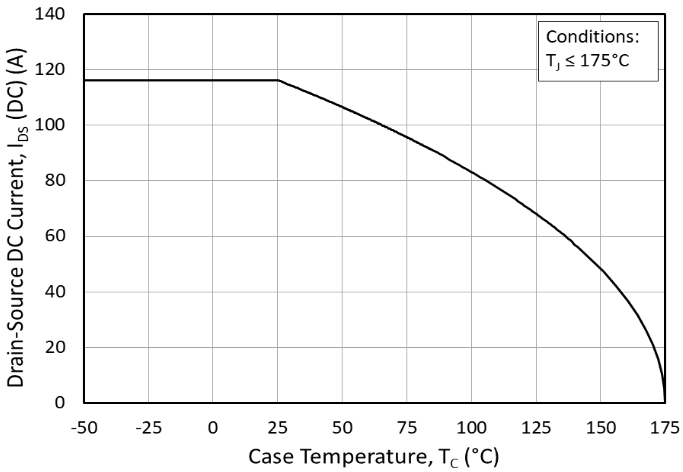



**Figure 19.** Continuous Drain Current Derating vs. Case Temperature

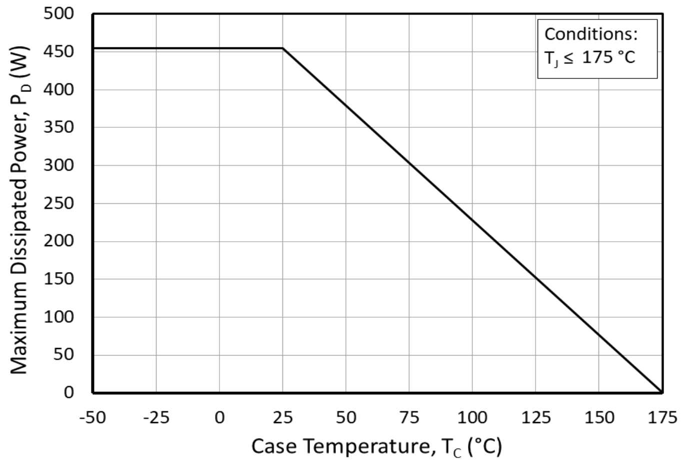



**Figure 20.** Maximum Power Dissipation Derating vs. Case Temperature

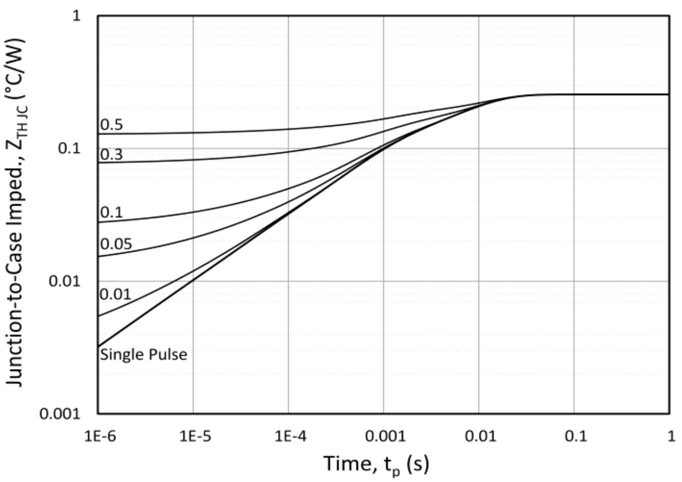



**Figure 21.** Transient Thermal Impedance (Junction - Case) °C

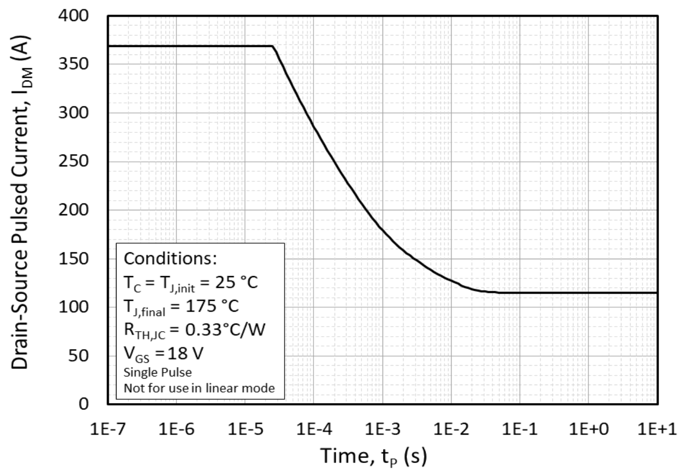



**Figure 22.** Safe Operating Area

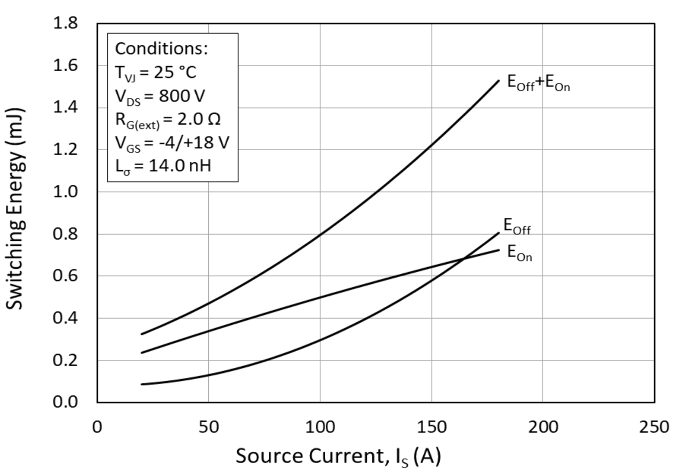



**Figure 23.** Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 800$ V)

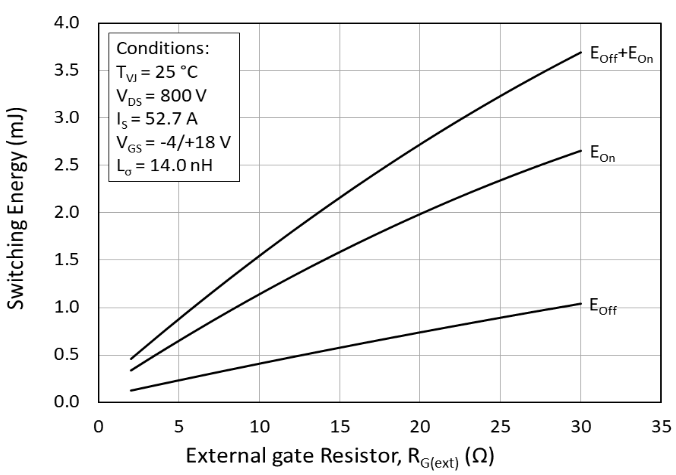



**Figure 24.** Clamped Inductive Switching Energy vs. $R_{G(ext)}$

## Typical Performance

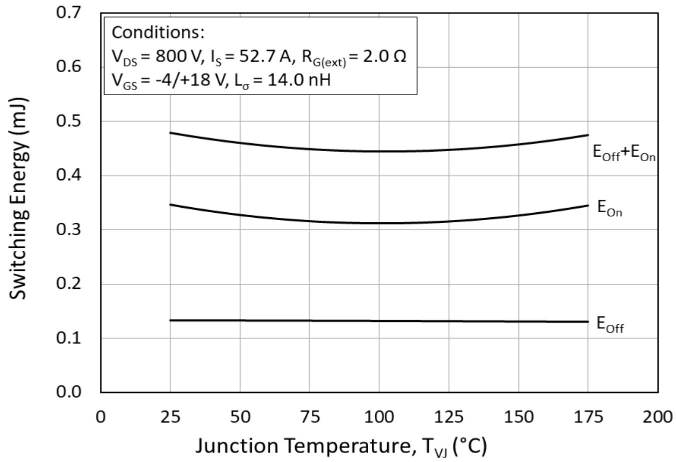



**Figure 25.** Clamped Inductive Switching Energy vs. Temperature

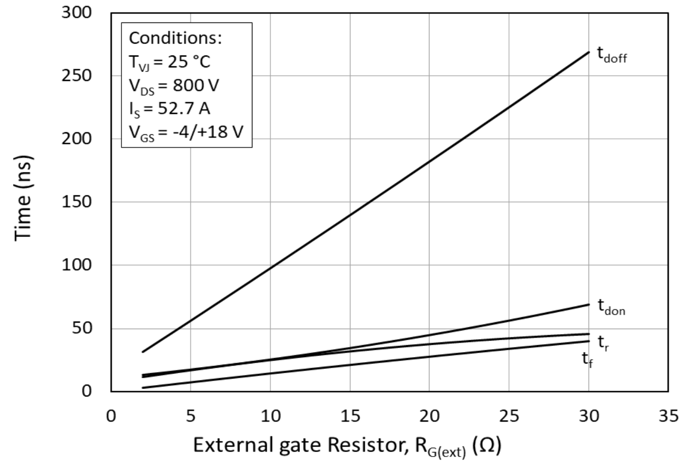



**Figure 26.** Switching Times vs. $R_{G(ext)}$

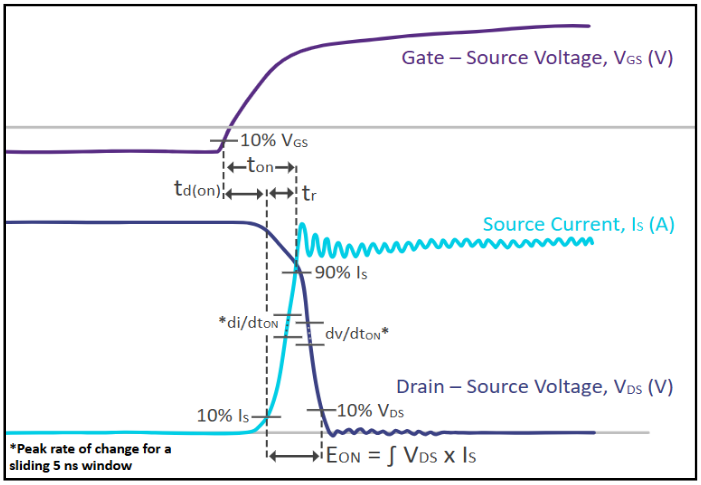



**Figure 27.** Turn On Switching Time Definition

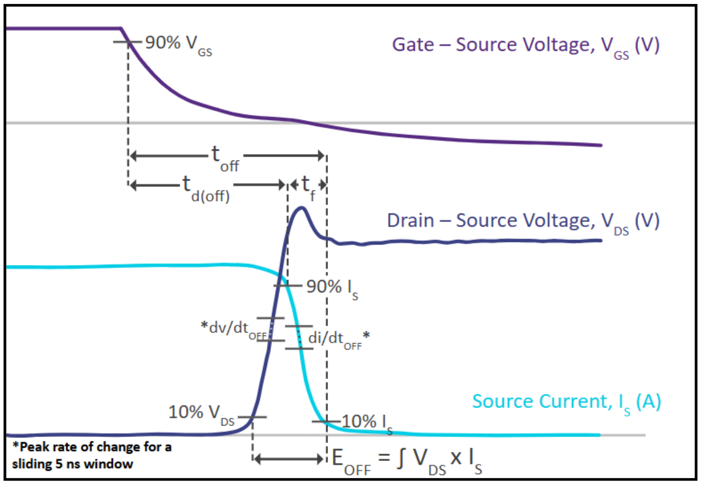



**Figure 28.** Turn Off Switching Time Definition

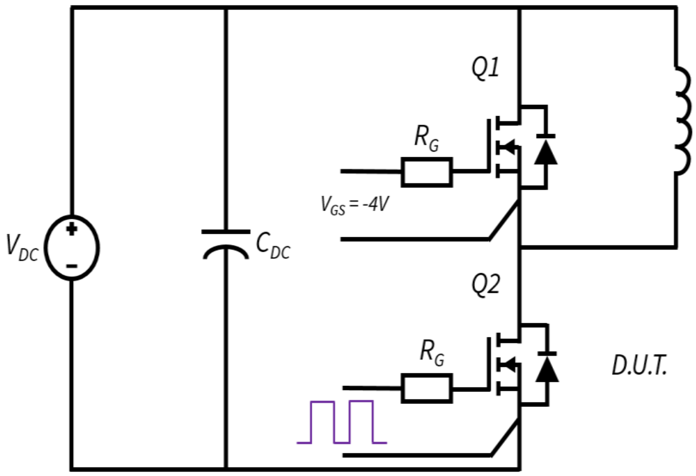



**Figure 29.** Clamped Inductive MOSFET Switching Waveform Test Circuit

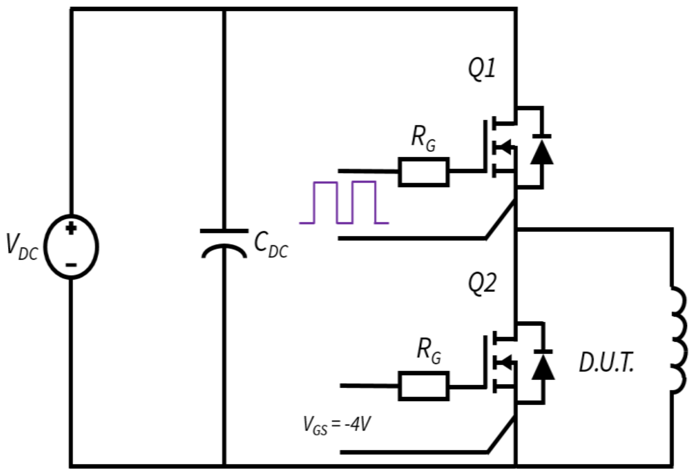
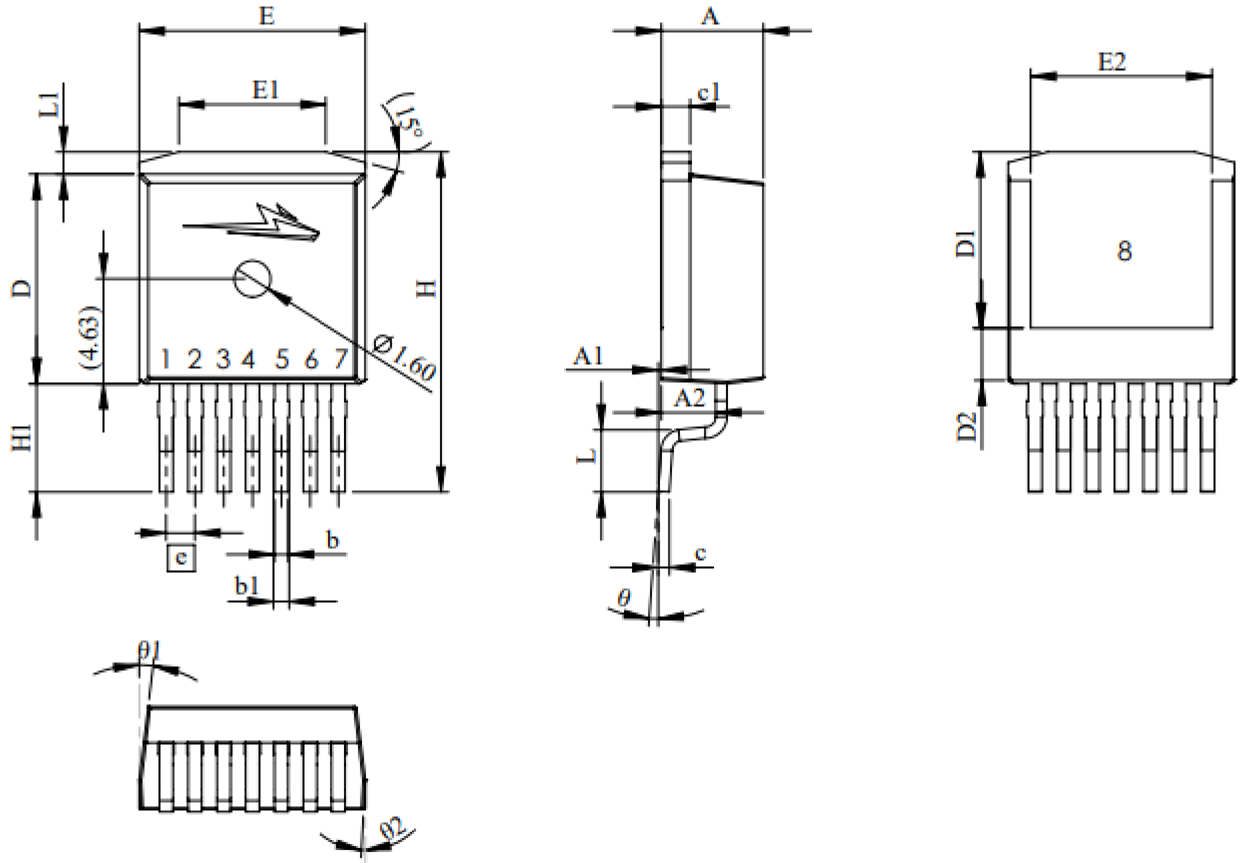



**Figure 30.** Clamped Inductive Body Diode Switching Waveform Test Circuit

## Package Dimensions




| SYMBOL | MIN (mm) | MAX (mm) |
|---|---|---|
| A | 4.30 | 4.70 |
| A1 | 0.00 | 0.25 |
| A2 | 2.20 | 2.60 |
| b | 0.52 | 0.72 |
| b1 | 0.60 | 0.80 |
| c | 0.42 | 0.62 |
| c1 | 1.07 | 1.47 |
| D | 9.05 | 9.45 |
| D1 | 7.58 | 7.98 |
| D2 | 2.05 | 2.45 |
| E | 9.80 | 10.20 |
| E1 | 6.30 | 6.97 |
| E2 | 7.80 | 8.20 |
| e | 1.27 BSC | |
| H | 14.87 | 15.27 |
| H1 | 4.55 | 4.95 |
| L | 2.48 | 2.88 |
| L1 | 0.87 | 1.27 |
| θ | 0° | 8° |
| θ1 | 4° | 10° |
| θ2 | 0° | 6° |

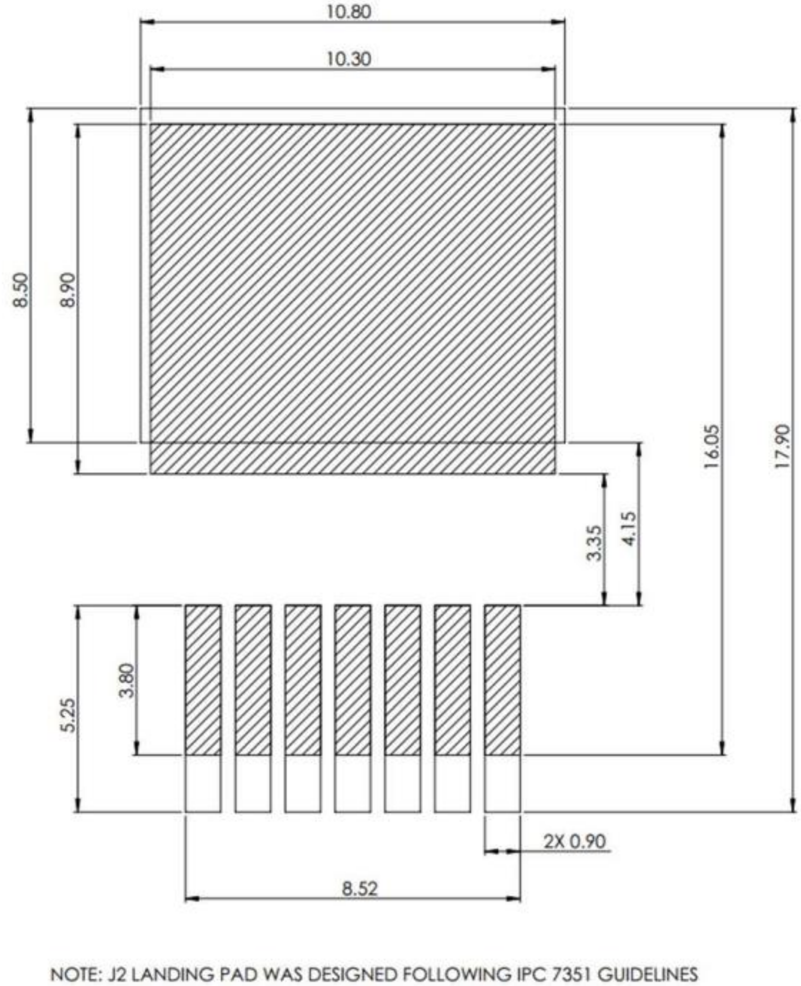
| | |
|---|---|
| 1 | GATE |
| 2 | KELVIN |
| 3 | SOURCE |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | DRAIN |

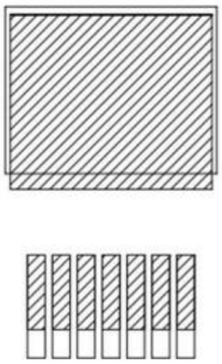
NOTE

1. ALL METAL SURFACES ARE TIN PLATED (MATTE), EXCEPT AREA OF CUT.
2. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE LISTED IN MILLIMETERS. ANGLES ARE IN DEGREES.
4. PACKAGE BURR FLASH SIZE (0.5 mm) IS NOT INCLUDED IN THE DIMENSIONS

## Recommended Solder Pad Layout

All dimensions in mm



## Revision History

| Documents Version | Date of Change | Description of Changes |
|---|---|---|
| 1 | 6/10/2026 | Initial Release |

## Appendix

| Appendix Number | Description |
|---|---|
| A1 | The following are recommendations for turning off the MOSFET with 0 V:<br>• Measure the $V_{GS}$ spike accurately using high-CMRR probes and low common mode noise measurements.<br>• For the safe operation of the device, the voltage spike shall remain < 5 V for a time duration of < 40 ns. |

## Notes & Disclaimers

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This product has not been designed or tested for use in, and is not intended for use in, any application in which failure of the product would reasonably be expected to cause death, personal injury, or property damage. For purposes of (but without limiting) the foregoing, this product is not designed, intended, or authorized for use as a critical component in equipment implanted into the human body, life-support machines, cardiac defibrillators, and similar emergency medical equipment; air traffic control systems; or equipment used in the planning, construction, maintenance, or operation of nuclear facilities. Notwithstanding any application-specific information, guidance, assistance, or support that Wolfspeed may provide, the buyer of this product is solely responsible for determining the suitability of this product for the buyer's purposes, including without limitation (1) selecting the appropriate Wolfspeed products for the buyer's application, (2) designing, validating, and testing the buyer's application, and (3) ensuring the buyer's application meets applicable standards and any other legal, regulatory, and safety-related requirements.

**RoHS Compliance**

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented January 2, 2013. RoHS Declarations for this product can be obtained from your Wolfspeed representative or from the Product Documentation sections of www.wolfspeed.com.

**REACh Compliance**

REACh substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact your Wolfspeed representative to ensure you get the most up-to-date REACh SVHC Declaration. REACh banned substance information (REACh Article 67) is also available upon request.

**Contact info:**

4600 Silicon Drive
Durham, NC 27703 USA
Tel: +1.919.313.5300
www.wolfspeed.com/power