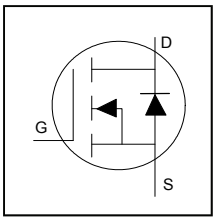
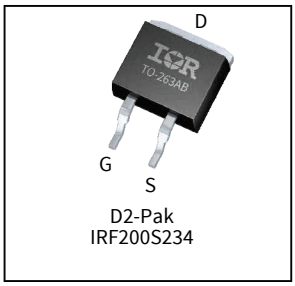
# IR MOSFET - StrongIRFET™




| | |
|---|---|
| $V_{DSS}$ | 200V |
| $R_{DS(on)}$ typ. | 14mΩ |
| max | 16.9mΩ |
| $I_D$ | 90A |

## Applications

- Brushed Motor drive applications
- BLDC Motor drive applications
- Battery powered circuits
- Half-bridge and full-bridge topologies
- Synchronous rectifier applications
- Resonant mode power supplies
- OR-ing and redundant power switches
- DC/DC and AC/DC converters
- DC/AC Inverters




## Benefits

- Improved Gate, Avalanche and Dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche SOA
- Enhanced body diode dv/dt and di/dt Capability
- Pb-Free ; RoHS Compliant ; Halogen-Free

| G | D | S |
|---|---|---|
| Gate | Drain | Source |

Halogen-Free RoHS

| Base part number | Package Type | Standard Pack | | Orderable Part Number |
|---|---|---|---|---|
| | | Form | Quantity | |
| IRF200S234 | D2-PAK | Tape and Reel | 800 | IRF200S234 |

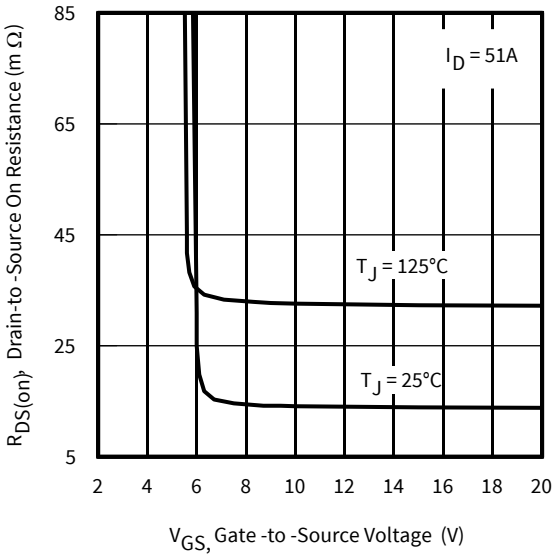



**Figure 1 Typical On-Resistance vs. Gate Voltage**

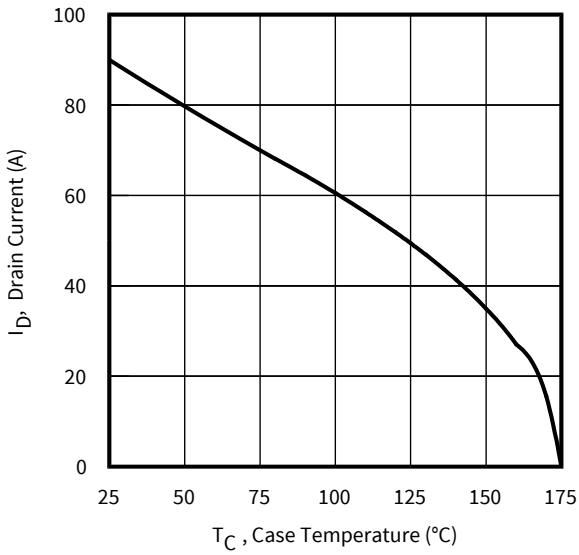



**Figure 2 Maximum Drain Current vs. Case Temperature**

## Table of Contents

# 1 Parameters

**Table1 Key performance parameters**

| Parameter | Values | Units |
|---|---|---|
| $V_{DS}$ | 200 | V |
| $R_{DS(on)\ max}$ | 16.9 | mΩ |
| $I_D$ | 90 | A |

# 2 Maximum ratings and thermal characteristics

**Table 2 Maximum ratings (at $T_J$=25°C, unless otherwise specified)**

| Parameter | Symbol | Conditions | Values | Unit |
|---|---|---|---|---|
| Continuous Drain Current | $I_D$ | $T_C$ = 25°C, $V_{GS}$ @ 10V | 90 | A |
| Continuous Drain Current | $I_D$ | $T_C$ = 100°C, $V_{GS}$ @ 10V | 61 | |
| Pulsed Drain Current ① | $I_{DM}$ | $T_C$ = 25°C | 312 | |
| Maximum Power Dissipation | $P_D$ | $T_C$ = 25°C | 417 | W |
| Linear Derating Factor | | $T_C$ = 25°C | 2.8 | W/°C |
| Gate-to-Source Voltage | $V_{GS}$ | - | ± 20 | V |
| Operating Junction and Storage Temperature Range | $T_J$ $T_{STG}$ | - | -55 to + 175 | °C |
| Soldering Temperature, for 10 seconds (1.6mm from case) | - | - | 300 | |

**Table 3 Thermal characteristics**

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Junction-to-Case ⑦ | $R_{\theta JC}$ | $T_J$ approximately 90°C | - | - | 0.36 | °C/W |
| Case-to-Sink, Flat Greased Surface | $R_{\theta CS}$ | - | - | 0.50 | - | |
| Junction-to-Ambient ⑧ | $R_{\theta JA}$ | (PCB Mount) (D2-Pak) | - | - | 40 | |

**Table 4 Avalanche characteristics**

| Parameter | Symbol | Values | Unit |
|---|---|---|---|
| Single Pulse Avalanche Energy ② | $E_{AS\ (Thermally\ limited)}$ | 574 | mJ |
| Single Pulse Avalanche Energy ⑨ | $E_{AS\ (Thermally\ limited)}$ | 693 | |
| Avalanche Current ① | $I_{AR}$ | See Fig 16, 17, 23a, 23b | A |
| Repetitive Avalanche Energy ① | $E_{AR}$ | | mJ |

***Notes:***

*① Repetitive rating; pulse width limited by max. junction temperature.*

*② Limited by $T_{Jmax}$, starting $T_J$ = 25°C, L = 0.436µH, $R_G$ = 50Ω, $I_{AS}$ = 51A, $V_{GS}$ = 10V.*

*③ $I_{SD}$ ≤ 51A, di/dt ≤1899A/µs, $V_{DD}$ ≤ $V_{(BR)DSS}$, $T_J$ ≤175°C.*

*④ Pulse width ≤400µs; duty cycle ≤2%.*

*⑤ $C_{oss}$ eff. (TR) is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$.*

*⑥ $C_{oss}$ eff. (ER) is a fixed capacitance that gives the same energy as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$.*

*⑦ $R_\theta$ is measured at $T_J$ approximately 90°C.*

*⑧ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.:*

*⑨ Limited by $T_{Jmax}$, starting $T_J$ = 25°C, L = 1mH, $R_G$ = 50Ω, $I_{AS}$ = 37A, $V_{GS}$ = 10V*

# 3 Electrical characteristics

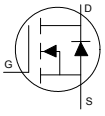
**Table 5 Static characteristics**

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = 250µA | 200 | - | - | V |
| Breakdown Voltage Temp. Coefficient | $\Delta V_{(BR)DSS}/\Delta T_J$ | Reference to 25°C, $I_D$ = 3.0mA ① | - | 0.18 | - | V/°C |
| Static Drain-to-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10V, $I_D$ = 51A | - | 14 | 16.9 | mΩ |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA | 3.0 | - | 5.0 | V |
| Drain-to-Source Leakage Current | $I_{DSS}$ | $V_{DS}$ = 200V, $V_{GS}$ =0V | - | - | 20 | µA |
| | | $V_{DS}$ = 200V,$V_{GS}$ = 0V,$T_J$ =125°C | - | - | 250 | |
| Gate-to-Source Forward Leakage | $I_{GSS}$ | $V_{GS}$ = 20V | - | - | 100 | nA |
| Gate-to-Source Reverse Leakage | $I_{GSS}$ | $V_{GS}$ = -20V | - | - | -100 | nA |
| Gate Resistance | $R_G$ | | - | 2.4 | - | Ω |

**Table 6 Dynamic characteristics**

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Forward Trans conductance | gfs | $V_{DS}$ = 50V, $I_D$ = 51A | 96 | - | - | S |
| Total Gate Charge | $Q_g$ | $I_D$ = 51A<br>$V_{DS}$ = 100V<br>$V_{GS}$ = 10V | - | 108 | 162 | nC |
| Gate-to-Source Charge | $Q_{gs}$ | | - | 26 | - | |
| Gate-to-Drain Charge | $Q_{gd}$ | | - | 37 | - | |
| Total Gate Charge Sync. (Qg– Qgd) | $Q_{sync}$ | | - | 71 | - | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 100V<br>$I_D$ = 51A<br>$R_G$ = 2.7Ω<br>$V_{GS}$ = 10V | - | 21 | - | ns |
| Rise Time | $t_r$ | | - | 58 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 67 | - | |
| Fall Time | $t_f$ | | - | 37 | - | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0V<br>$V_{DS}$ = 50V<br>$f$ = 1.0MHz, See Fig.7 | - | 6484 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 462 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 142 | - | |
| Effective Output Capacitance (Energy Related) | $C_{oss\ eff.(ER)}$ | $V_{GS}$ = 0V, $V_{DS}$ = 0V to 160V ⑥ | - | 356 | - | |
| Output Capacitance (Time Related) | $C_{oss\ eff.(TR)}$ | $V_{GS}$ = 0V, $V_{DS}$ = 0V to 160V ⑤ | - | 491 | - | |

**Table 7 Reverse Diode**

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Continuous Source Current (Body Diode) | $I_S$ | MOSFET symbol showing the integral reverse p-n junction diode.  | - | - | 90 | A |
| Pulsed Source Current (Body Diode) ① | $I_{SM}$ | | - | - | 312 | |
| Diode Forward Voltage | $V_{SD}$ | $T_J$ = 25°C, $I_S$ = 51A,$V_{GS}$ = 0V ④ | - | - | 1.3 | V |
| Peak Diode Recovery dv/dt ③ | dv/dt | $T_J$ = 175°C, $I_S$ = 51A,$V_{DS}$ = 200V | - | 26 | - | V/ns |
| Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25°C<br>$V_{DD}$ = 170V<br>$I_F$ = 51A,<br>di/dt = 100A/µs ④ | - | 117 | - | ns |
| | | $T_J$ = 125°C | - | 140 | - | |
| Reverse Recovery Charge | $Q_{rr}$ | $T_J$ = 25°C | - | 563 | - | nC |
| | | $T_J$ = 125°C | - | 801 | - | |
| Reverse Recovery Current | $I_{RRM}$ | $T_J$ = 25°C | - | 8.7 | - | A |

# 4 Electrical characteristic diagrams

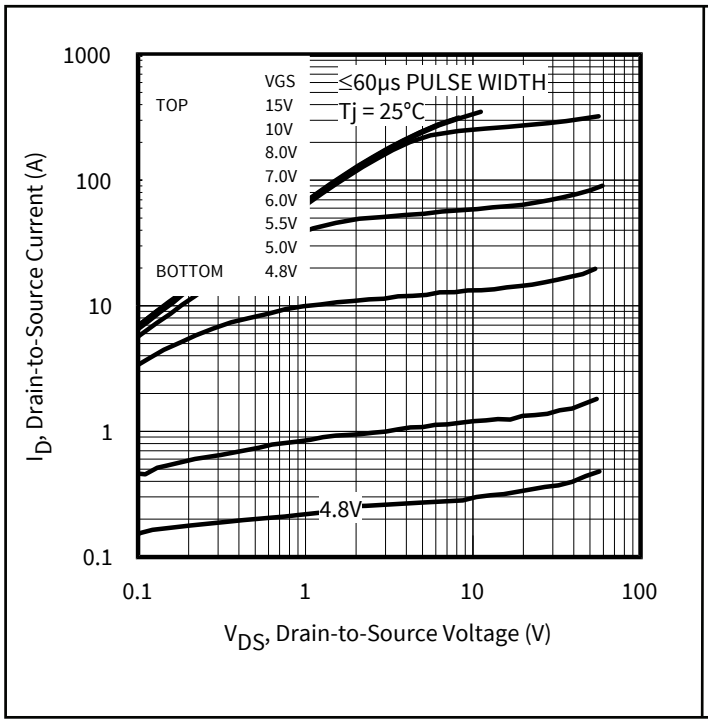



**Figure 3 Typical Output Characteristics**

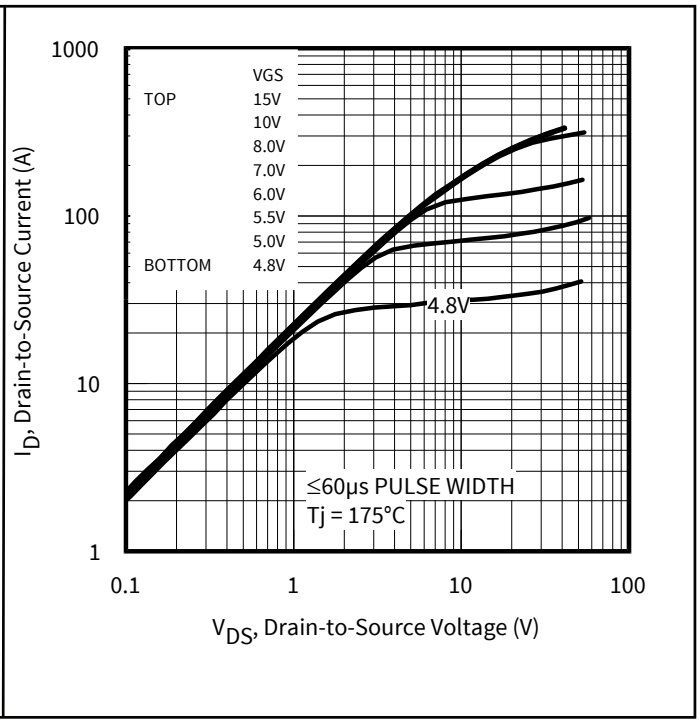



**Figure 4 Typical Output Characteristics**

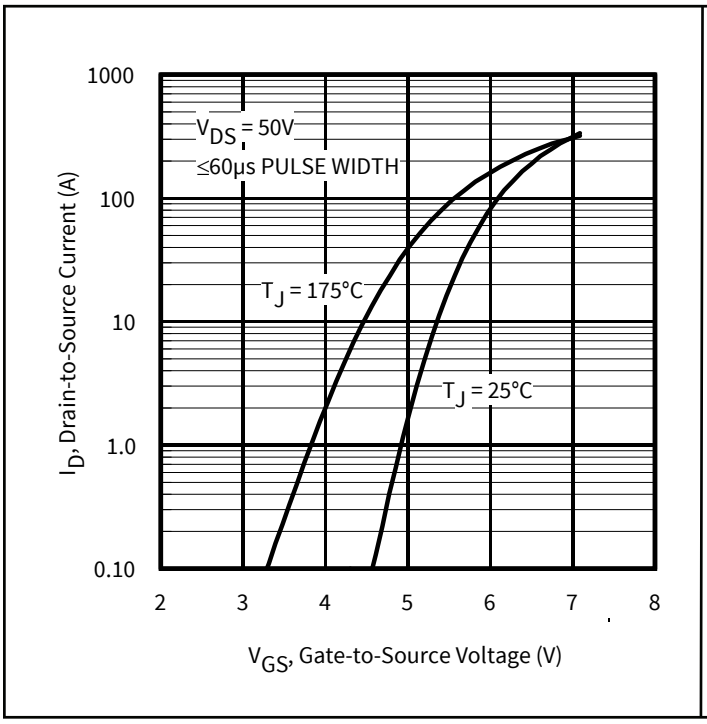



**Figure 5 Typical Transfer Characteristics**

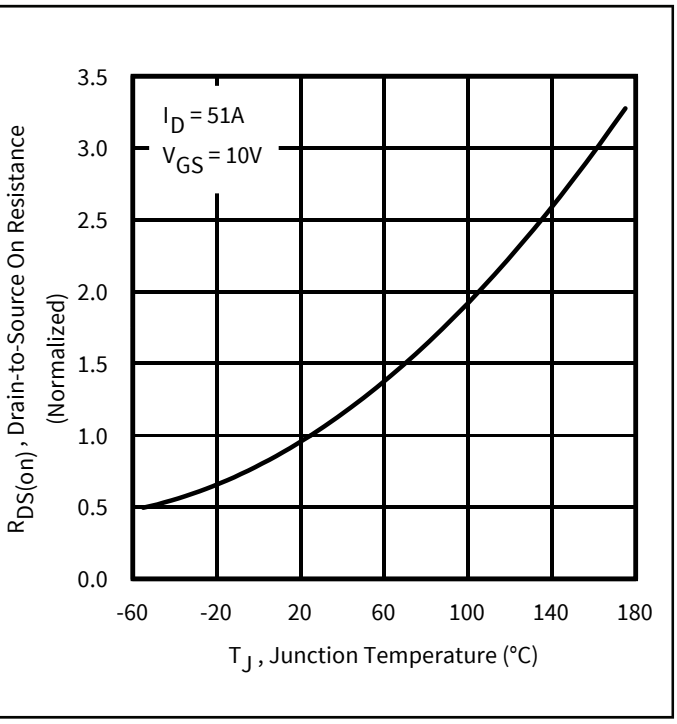



**Figure 6 Normalized On-Resistance vs. Temperature**

## Electrical characteristic diagrams

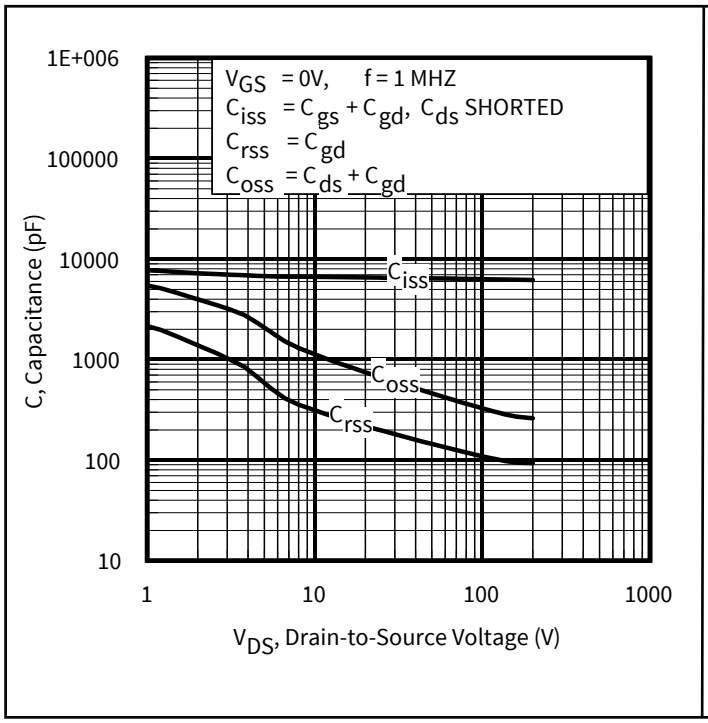



**Figure 7 Typical Capacitance vs. Drain-to-Source Voltage**

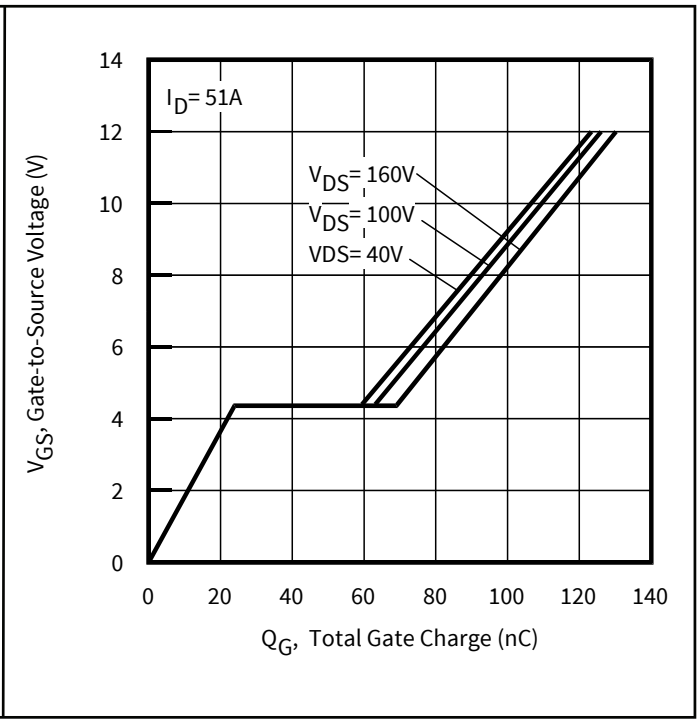



**Figure 8 Typical Gate Charge vs. Gate-to-Source Voltage**

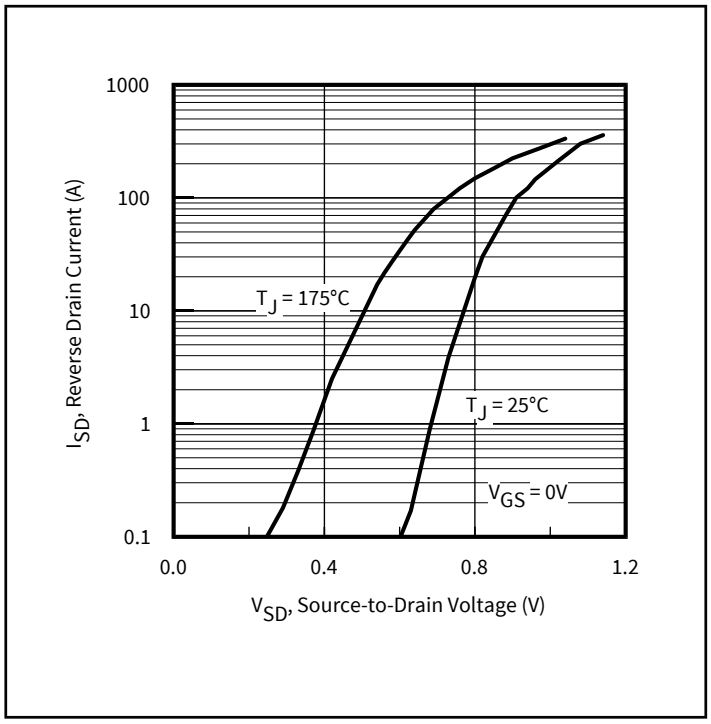



**Figure 9 Typical Source-Drain Diode Forward Voltage**

## Electrical characteristic diagrams

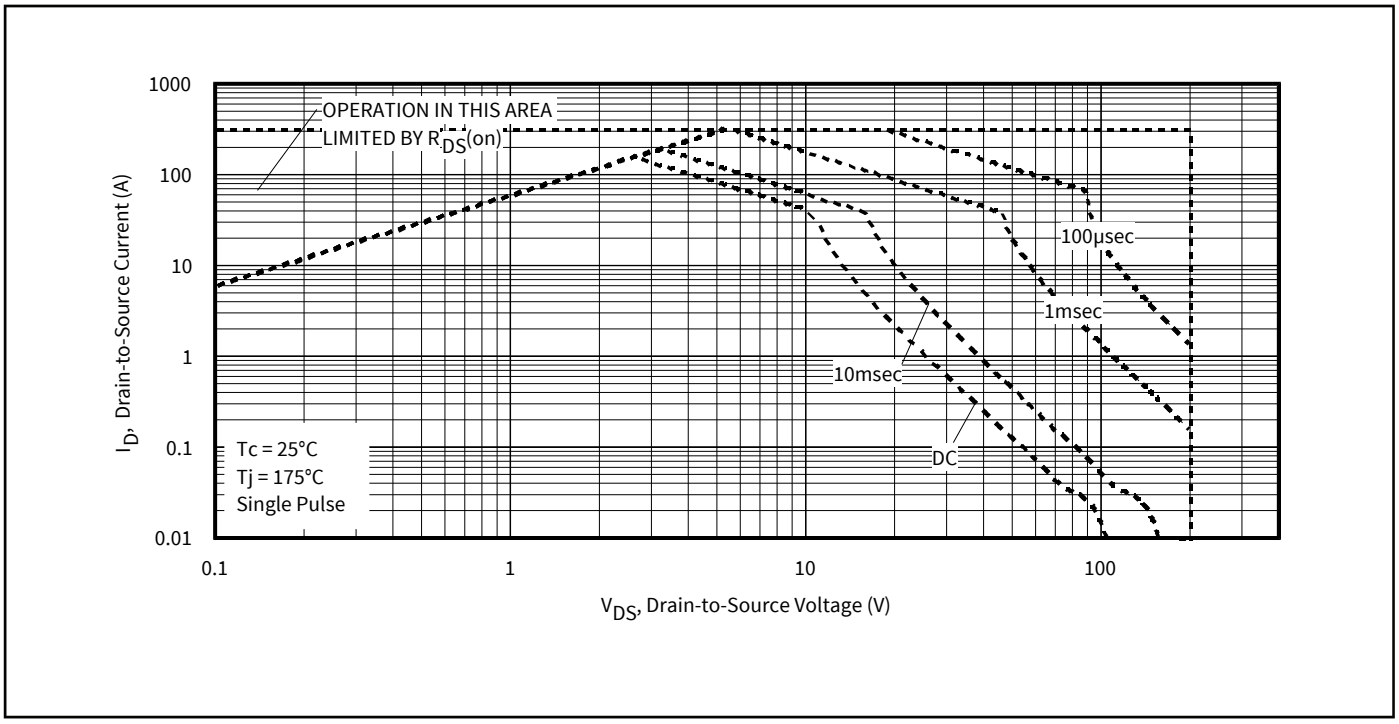



**Figure 10 Maximum Safe Operating Area**

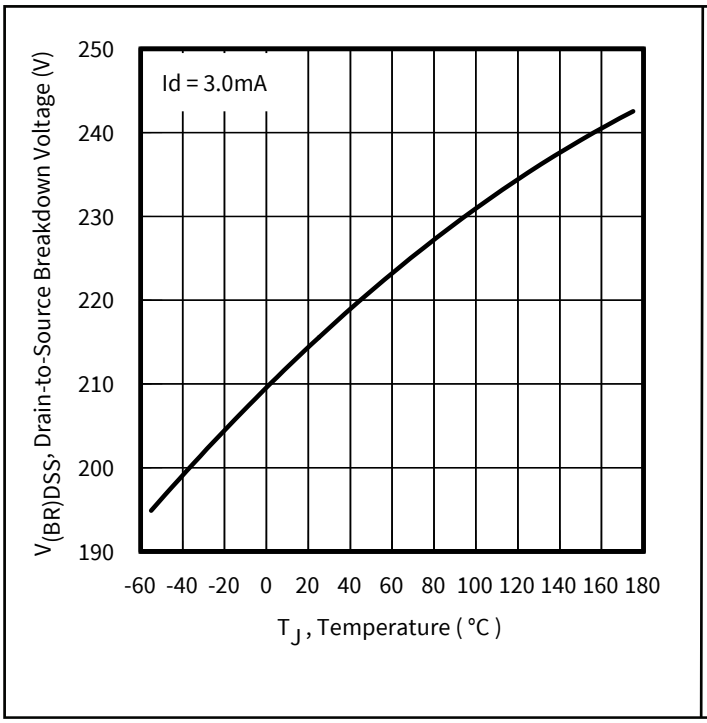



**Figure 11 Drain-to-Source Breakdown Voltage**

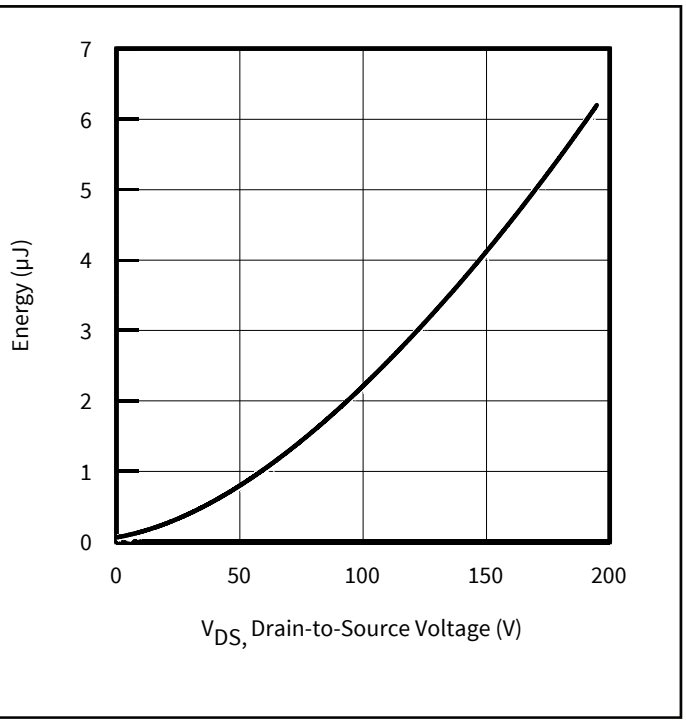



**Figure 12 Typical Coss Stored Energy**

## Electrical characteristic diagrams

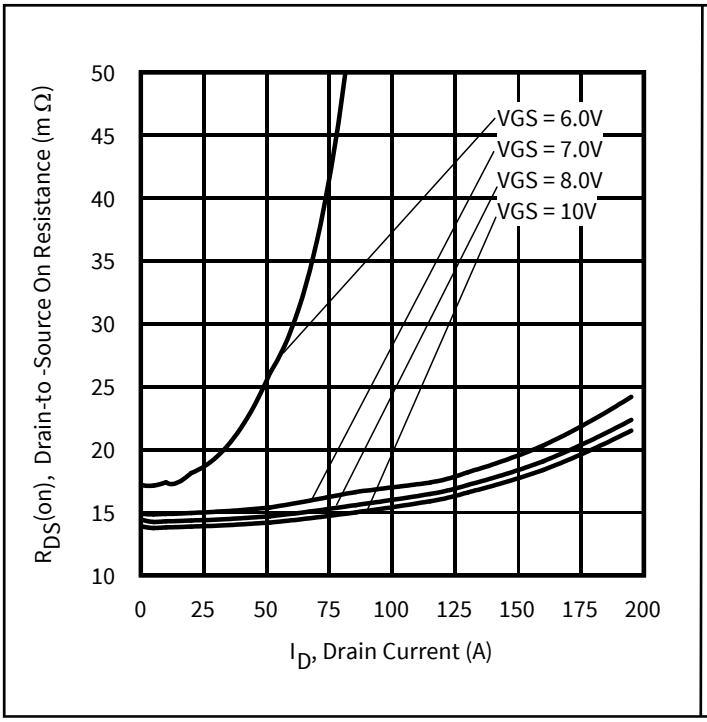



**Figure 13 Typical On-Resistance vs. Drain Current**

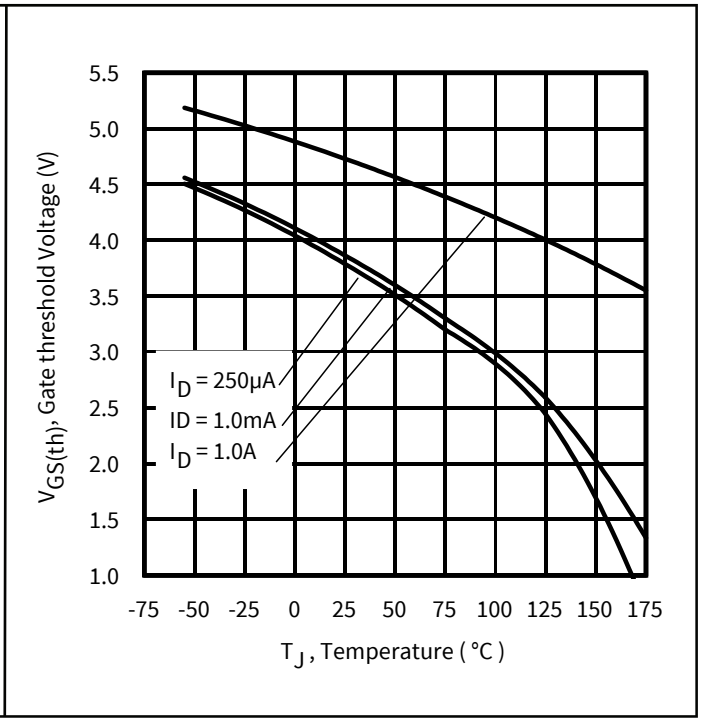



**Figure 14 Threshold Voltage vs. Temperature**

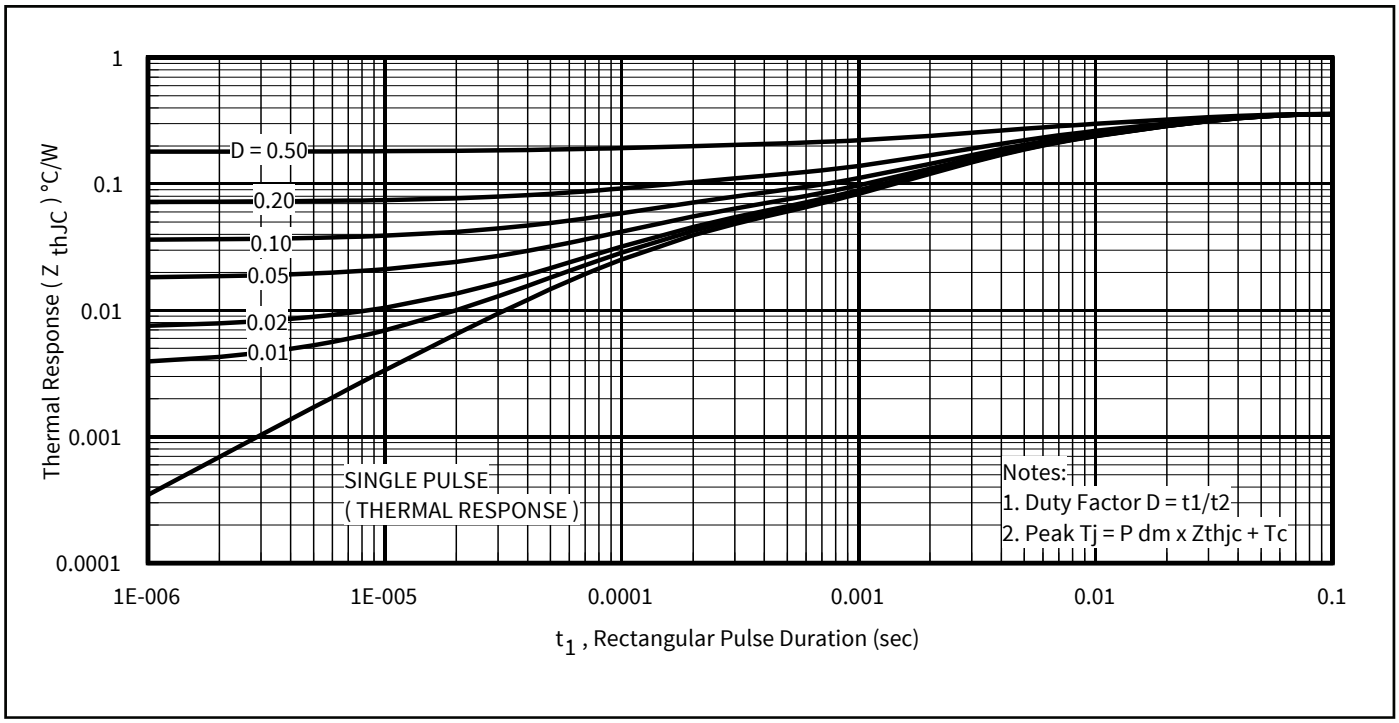



**Figure 15 Maximum Effective Transient Thermal Impedance, Junction-to-Case**

## Electrical characteristic diagrams

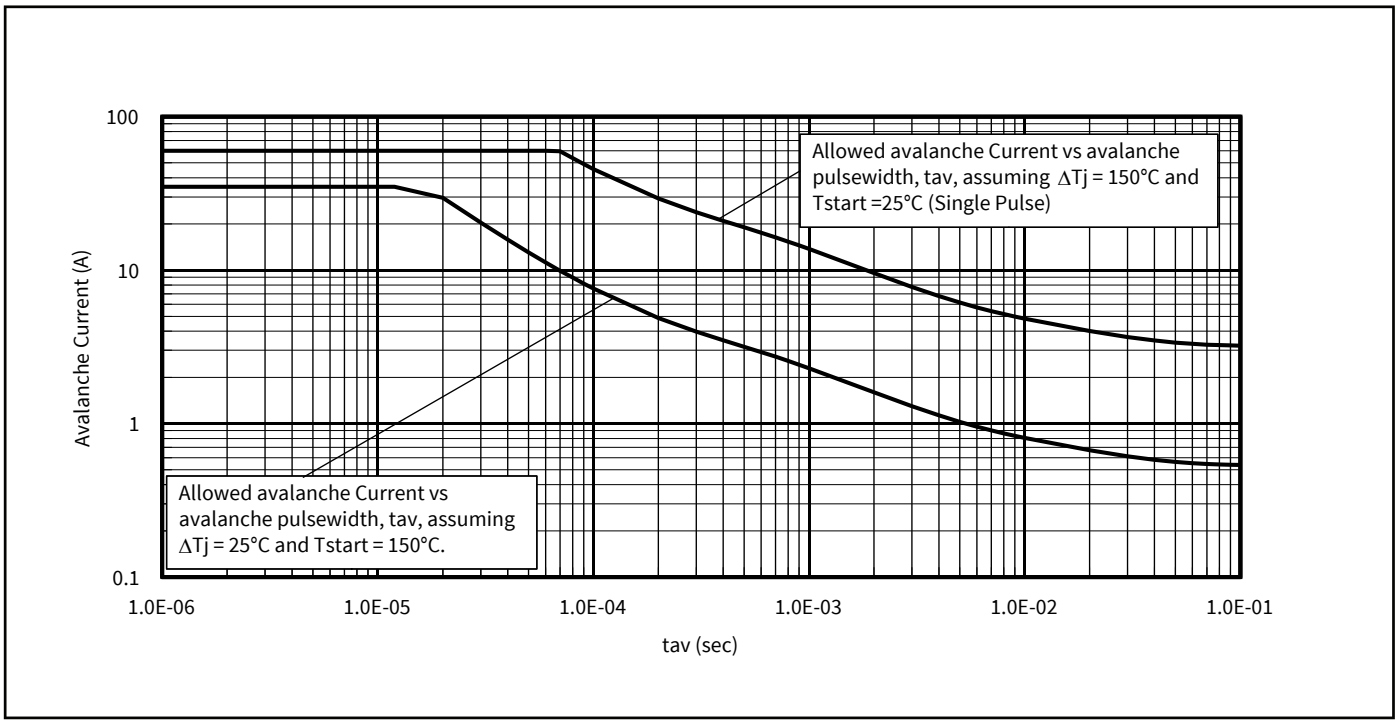



**Figure 16 Avalanche Current vs. Pulse Width**

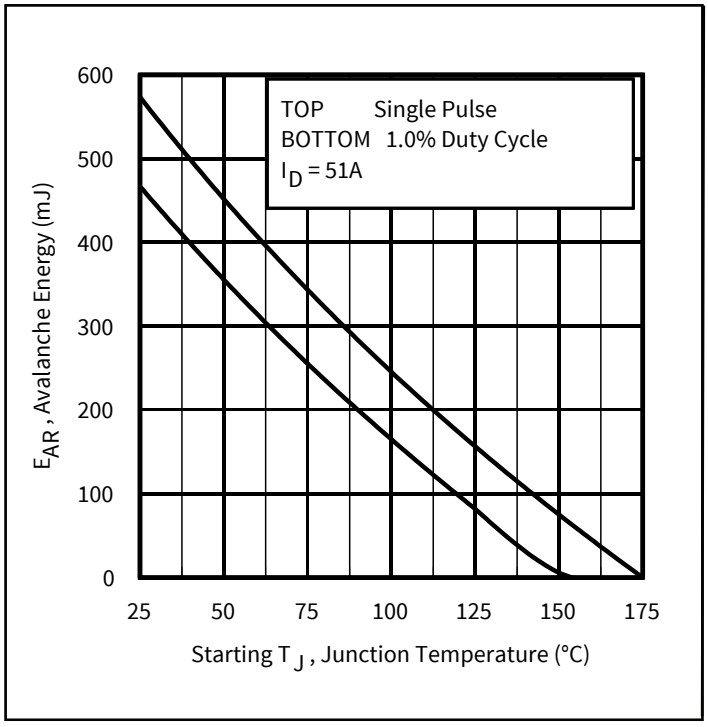



**Figure 17 Maximum Avalanche Energy vs. Temperature**

**Notes on Repetitive Avalanche Curves , Figures 16, 17:**
**(For further info, see AN-1005 at www.infineon.com)**

1.Avalanche failures assumption:
Purely a thermal phenomenon and failure occurs at a temperature far in excess of $T_{jmax}$. This is validated for every part type.

2. Safe operation in Avalanche is allowed as long as$T_{jmax}$ is not exceeded.

3. Equation below based on circuit and waveforms shown in Figures 23a, 23b.

4. $P_{D\,(ave)}$ = Average power dissipation per single avalanche pulse.

5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).

6. $I_{av}$ = Allowable avalanche current.

7. DT = Allowable rise in junction temperature, not to exceed $T_{jmax}$ (assumed as 25°C in Figure 15, 16).

$t_{av}$ = Average time in avalanche.

D = Duty cycle in avalanche = tav ·f

$Z_{thJC}(D, t_{av})$ = Transient thermal resistance, see Figures 14)

$$PD\ (ave) = 1/2\ (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$

$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

$$E_{AS\,(AR)} = P_{D\,(ave)} \cdot t_{av}$$

## Electrical characteristic diagrams

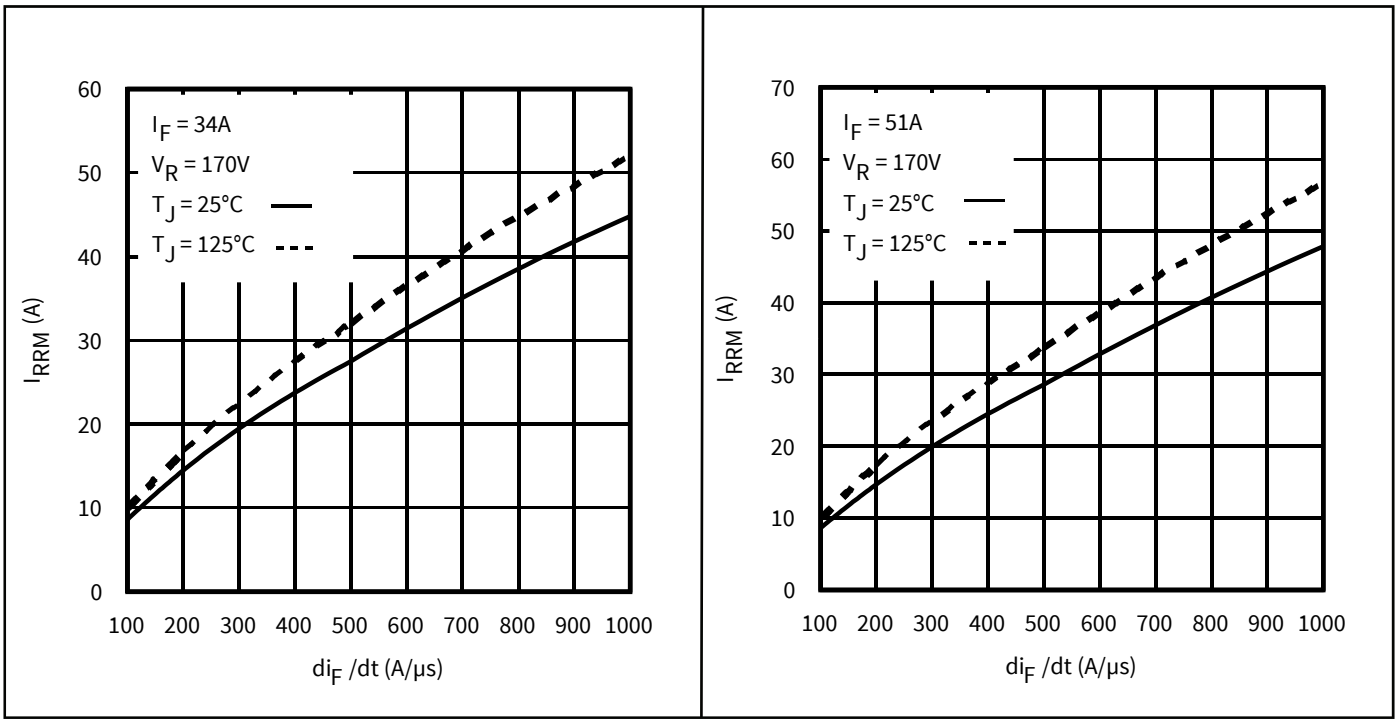



**Figure 18 Typical Recovery Current vs. dif/dt**




**Figure 19 Typical Recovery Current vs. dif/dt**

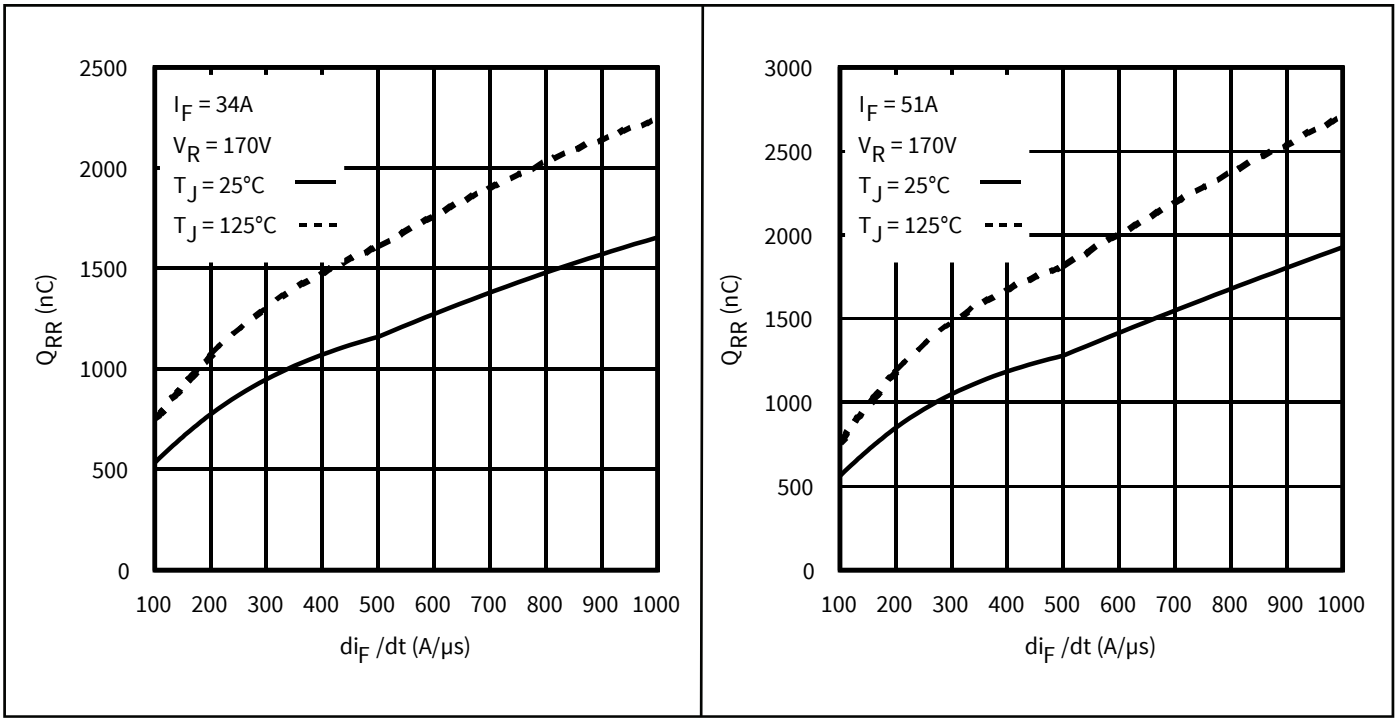



**Figure 20 Typical Stored Charge vs. dif/dt**




**Figure 21 Typical Stored Charge vs. dif/dt**

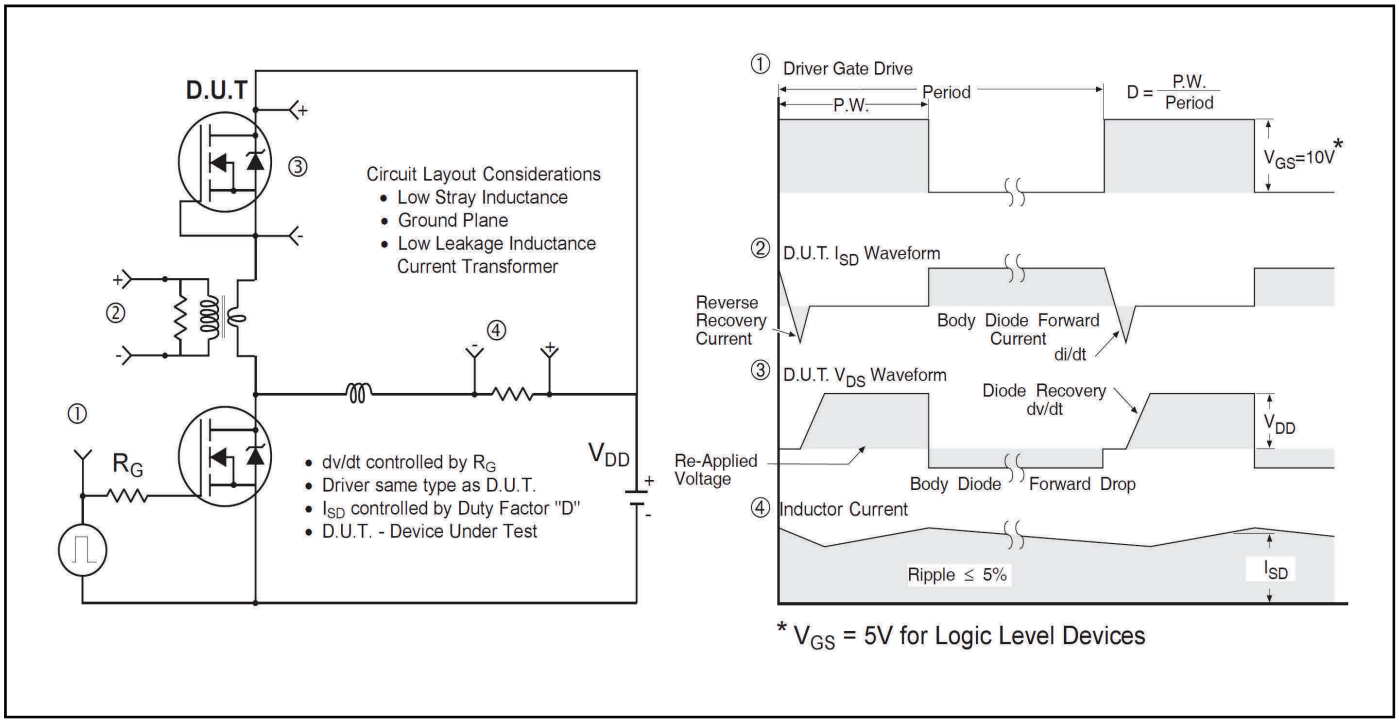



**Figure 22 Peak Diode Recovery dv/dt Test Circuit for N-Channel Power MOSFETs**

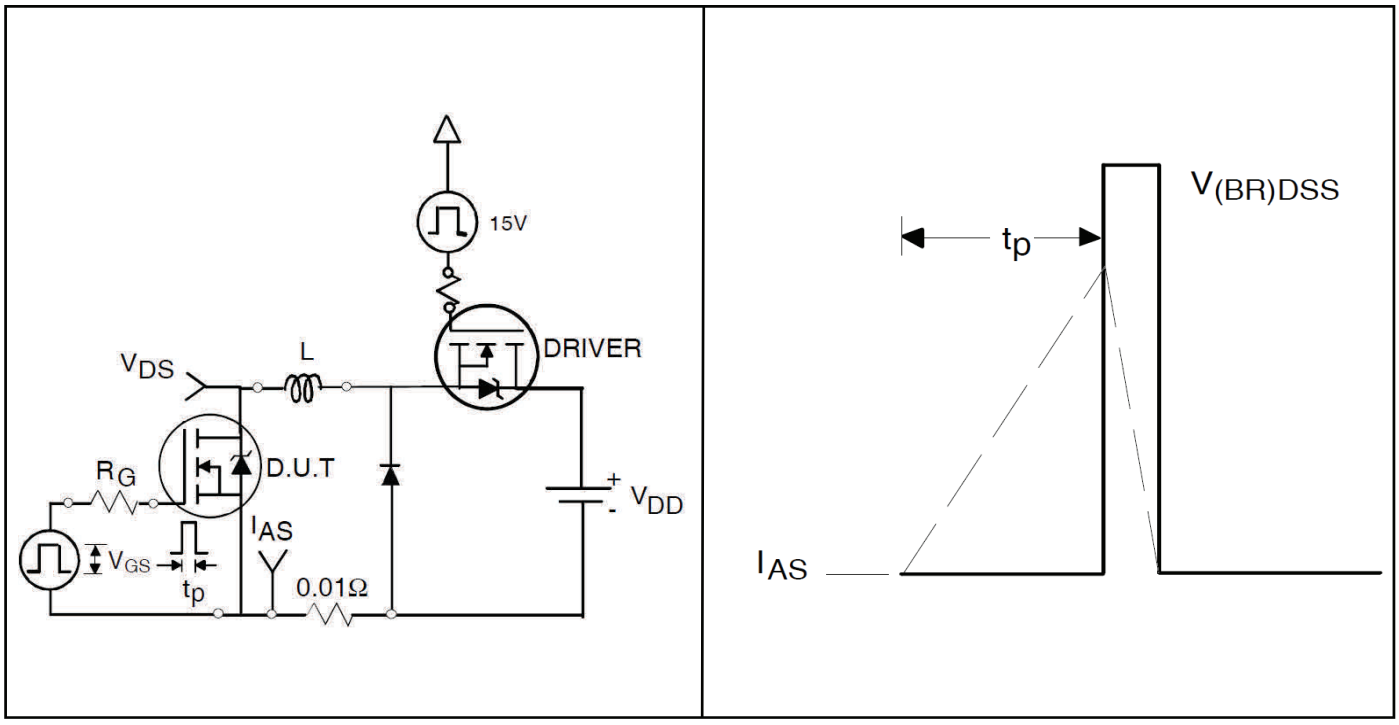



**Figure 23a Unclamped Inductive Test Circuit**

**Figure 23b Unclamped Inductive Waveforms**

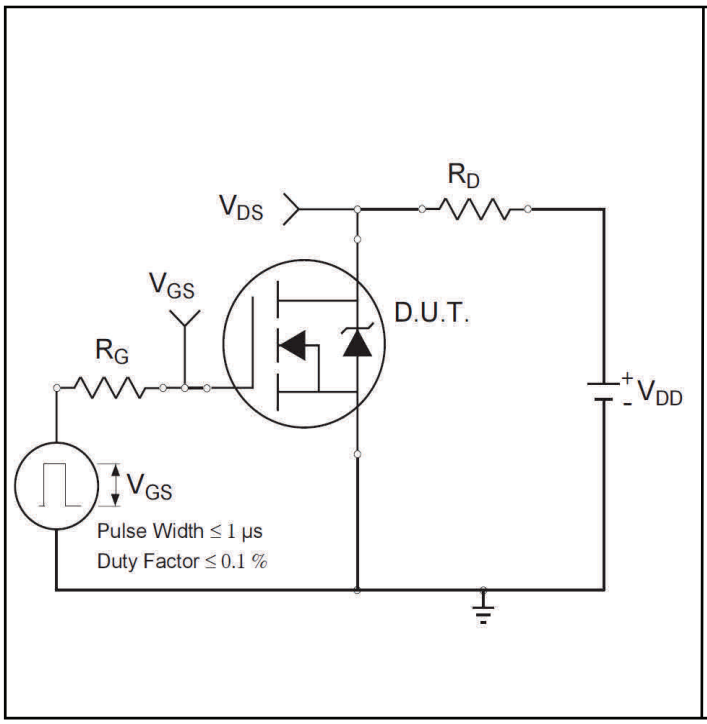



Figure 24a Switching Time Test Circuit

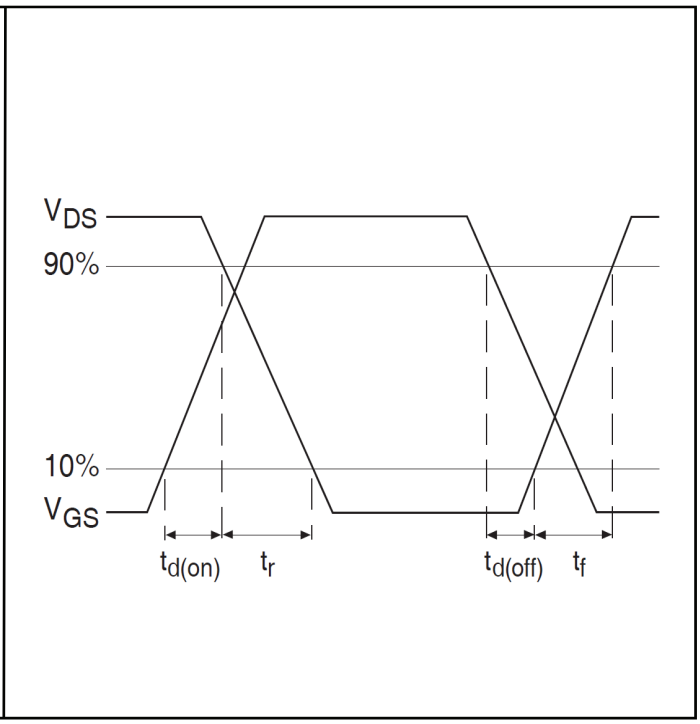



Figure 24b Switching Time Waveforms

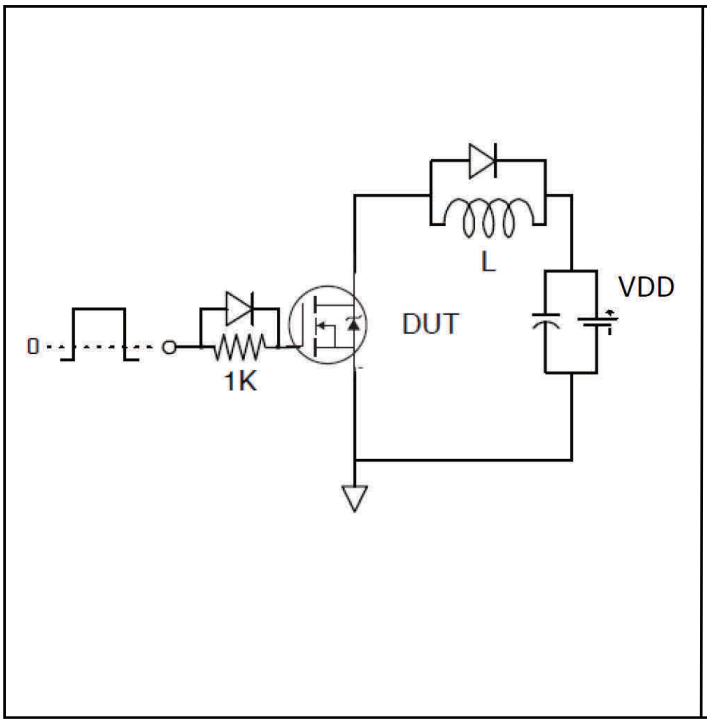



Figure 25a Gate Charge Test Circuit

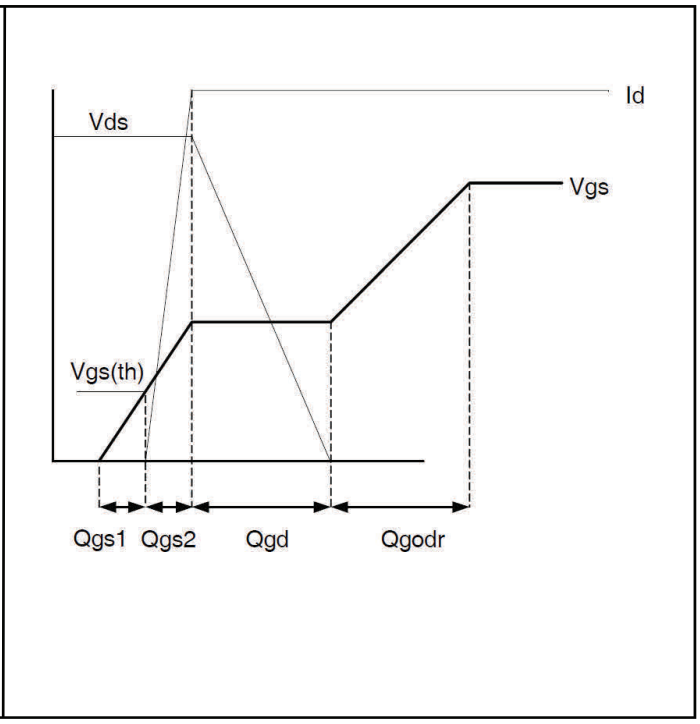
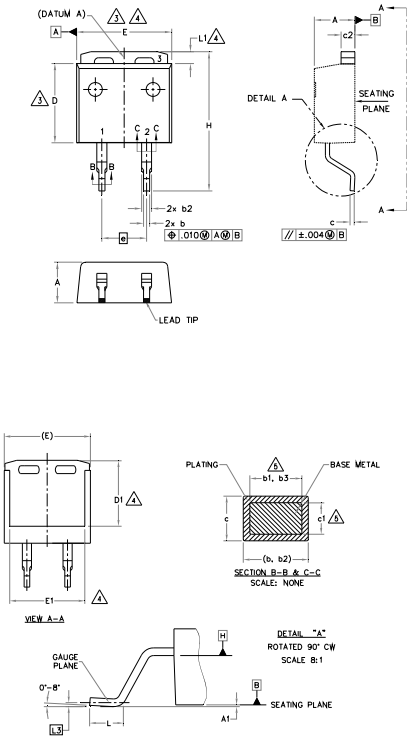



Figure 25b Gate Charge Waveform

# 5 Package Information

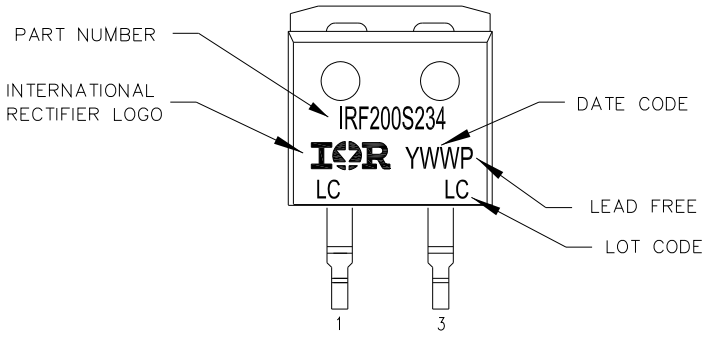
**D2Pak (TO-263AB) Package Outline** (Dimensions are shown in millimeters (inches))




| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | |
| A1 | – | 0.254 | – | .010 | |
| b | 0.51 | 0.99 | .020 | .039 | |
| b1 | 0.51 | 0.89 | .020 | .035 | 5 |
| b2 | 1.14 | 1.78 | .045 | .070 | |
| b3 | 1.14 | 1.73 | .045 | .068 | 5 |
| c | 0.38 | 0.74 | .015 | .029 | |
| c1 | 0.38 | 0.58 | .015 | .023 | 5 |
| c2 | 1.14 | 1.65 | .045 | .065 | |
| D | 8.38 | 9.65 | .330 | .380 | 3 |
| D1 | 6.86 | 7.42 | .270 | .292 | 4 |
| E | 9.65 | 10.54 | .380 | .415 | 3,4 |
| E1 | 8.00 | 9.00 | .315 | .354 | 4 |
| e | 5.08 BSC | | .200 BSC | | |
| H | 14.61 | 15.88 | .575 | .625 | |
| L | 1.78 | 2.79 | .070 | .110 | |
| L1 | – | 1.68 | – | .066 | 4 |
| L3 | 0.25 BSC | | .010 BSC | | |

NOTES:
1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M–1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1, b3 AND c1 APPLY TO BASE METAL ONLY.
6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
7. CONTROLLING DIMENSION: INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB EXCEPT FOR DIM E1.

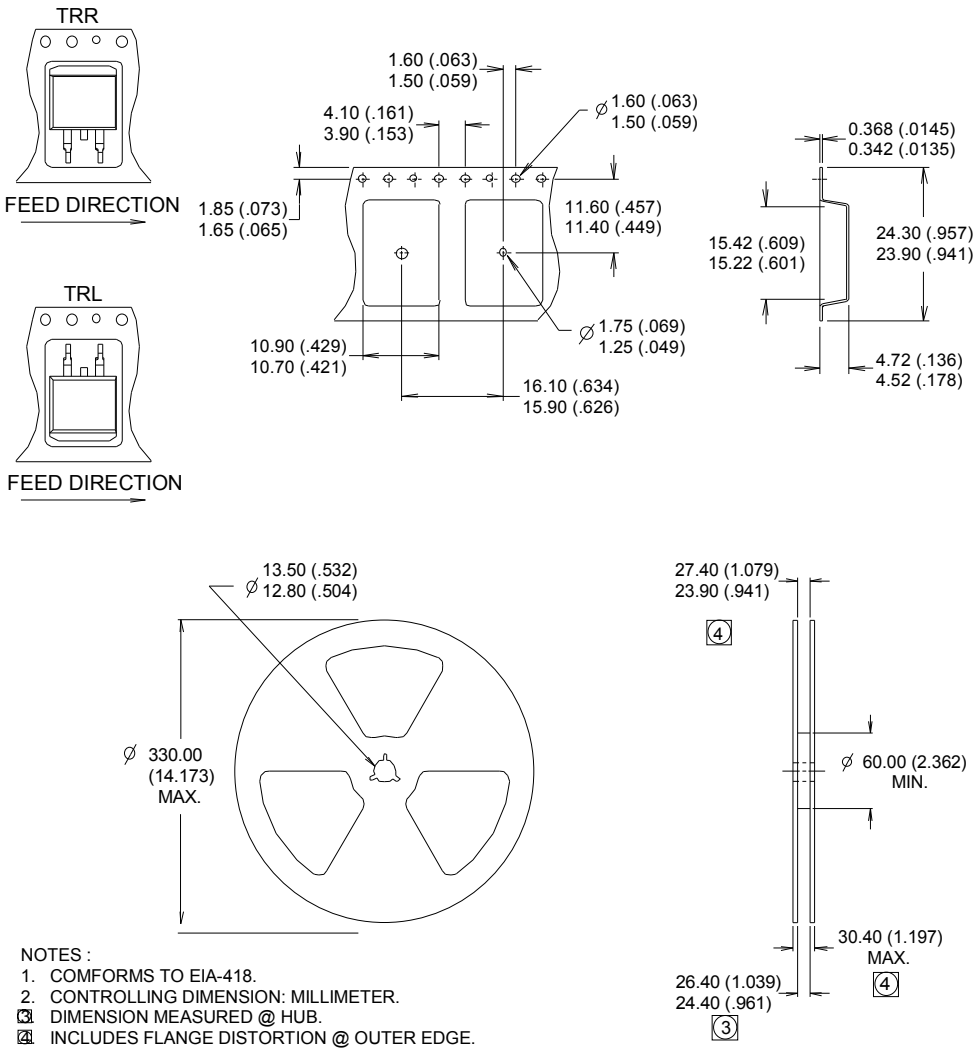
**D2Pak (TO-263AB) Part Marking Information**




TOP MARKING (LASER)

Note: For the most current drawing please refer to website at http://www.irf.com/package/

**D2Pak (TO-263AB) Tape & Reel Information** (Dimensions are shown in millimeters (inches))




NOTES :
1. COMFORMS TO EIA-418.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION MEASURED @ HUB.
4. INCLUDES FLANGE DISTORTION @ OUTER EDGE.

Note: For the most current drawing please refer to website at http://www.irf.com/package/

# 6 Qualification Information

**Qualification Information**

| | | |
|---|---|---|
| **Qualification Level** | Industrial<br>(per JEDEC JESD47F) † | |
| **Moisture Sensitivity Level** | D2Pak | MSL1<br>(per JEDEC J-STD-020D†) |
| **RoHS Compliant** | Yes | |

† Applicable version of JEDEC standard at the time of product release.

# Revision History

**Major changes since the last revision**

| Page or Reference | Revision | Date | Description of changes |
|---|---|---|---|
| All pages | 1.0 | 2016-09-23 | • First release Provisional data sheet. |
| All pages | 2.0 | 2017-06-30 | • First release Final data sheet. |

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