

# P-Channel 30 V (D-S) MOSFET with Schottky Diode

## MOSFET PRODUCT SUMMARY

| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )   | $I_D$ (A) <sup>a</sup> | $Q_g$ (Typ.) |
|--------------|-----------------------------|------------------------|--------------|
| - 30         | 0.068 at $V_{GS} = - 10$ V  | - 4.6                  | 4.6          |
|              | 0.110 at $V_{GS} = - 4.5$ V | - 3.4                  |              |

## SCHOTTKY PRODUCT SUMMARY

| $V_{KA}$ (V) | $V_F$ (V)<br>Diode Forward Voltage | $I_D$ (A) <sup>a</sup> |
|--------------|------------------------------------|------------------------|
| 30           | 0.44 V at 1 A                      | 2                      |

## FEATURES

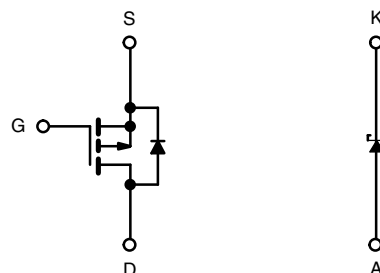
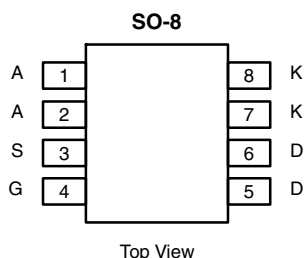
- Halogen-free According to IEC 61249-2-21 Definition
- LITTLE FOOT<sup>®</sup> Plus Power MOSFET
- 100 %  $R_g$  Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

## APPLICATIONS

- Battery Management in Notebook PC
- Non-synchronous Buck Converter in HDD



**Ordering Information:** Si4833BDY-T1-GE3 (Lead (Pb)-free and Halogen-free)

P-Channel MOSFET

## ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

| Parameter                                           |               | Symbol         | Limit                 | Unit |  |
|-----------------------------------------------------|---------------|----------------|-----------------------|------|--|
| Drain-Source Voltage (MOSFET)                       |               | $V_{DS}$       | - 30                  | V    |  |
| Reverse Voltage (Schottky)                          |               | $V_{KA}$       | - 30                  |      |  |
| Gate-Source Voltage (MOSFET)                        |               | $V_{GS}$       | $\pm$ 20              |      |  |
| Continuous Drain Current ( $T_J = 150$ °C) (MOSFET) | $T_C = 25$ °C | $I_D$          | - 4.6                 | A    |  |
|                                                     | $T_C = 70$ °C |                | - 3.6                 |      |  |
|                                                     | $T_A = 25$ °C |                | - 3.8 <sup>b, c</sup> |      |  |
|                                                     | $T_A = 70$ °C |                | - 3 <sup>b, c</sup>   |      |  |
| Pulsed Drain Current (MOSFET) (t = 300 $\mu$ s)     |               | $I_{DM}$       | - 20                  |      |  |
| Continuous Source Current (MOSFET Diode Conduction) | $T_C = 25$ °C | $I_S$          | - 2                   |      |  |
|                                                     | $T_A = 25$ °C |                | - 1.4 <sup>b, c</sup> |      |  |
| Average Forward Current (Schottky)                  |               | $I_F$          | - 1.4 <sup>b</sup>    |      |  |
| Pulsed Forward Current (Schottky)                   |               | $I_{FM}$       | - 2                   |      |  |
| Maximum Power Dissipation (MOSFET and Schottky)     | $T_C = 25$ °C | $P_D$          | 2.75                  | W    |  |
|                                                     | $T_C = 70$ °C |                | 1.75                  |      |  |
|                                                     | $T_A = 25$ °C |                | 1.75 <sup>b, c</sup>  |      |  |
|                                                     | $T_A = 70$ °C |                | 1.10 <sup>b, c</sup>  |      |  |
| Operating Junction and Storage Temperature Range    |               | $T_J, T_{stg}$ | - 55 to 150           | °C   |  |

## THERMAL RESISTANCE RATINGS

| Parameter                                                            | Symbol     | Typical | Maximum | Unit |
|----------------------------------------------------------------------|------------|---------|---------|------|
| Maximum Junction-to-Ambient (MOSFET and Schottky) <sup>b, c, d</sup> | $R_{thJA}$ | 60      | 71.5    | °C/W |
| Maximum Junction-to-Foot (Drain) (MOSFET and Schottky)               | $R_{thJF}$ | 35      | 45      |      |

Notes:

- Based on  $T_C = 25$  °C.
- Surface mounted on FR4 board.
- $t \leq 10$  s.
- Maximum under steady state conditions is 120 °C/W.

| MOSFET SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted) |                                      |                                                                                                                            |      |        |       |       |
|------------------------------------------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------|--------|-------|-------|
| Parameter                                                              | Symbol                               | Test Conditions                                                                                                            | Min. | Typ.   | Max.  | Unit  |
| Static                                                                 |                                      |                                                                                                                            |      |        |       |       |
| Drain-Source Breakdown Voltage                                         | V <sub>DS</sub>                      | V <sub>DS</sub> = 0 V, I <sub>D</sub> = - 250 μA                                                                           | - 30 |        |       | V     |
| V <sub>DS</sub> Temperature Coefficient                                | ΔV <sub>DS</sub> /T <sub>J</sub>     | I <sub>D</sub> = - 250 μA                                                                                                  |      | - 20   |       | mV/°C |
| V <sub>GS(th)</sub> Temperature Coefficient                            | ΔV <sub>GS(th)</sub> /T <sub>J</sub> |                                                                                                                            |      | 3.9    |       |       |
| Gate Threshold Voltage                                                 | V <sub>GS(th)</sub>                  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA                                                              | - 1  | - 1.8  | - 2.5 | V     |
| Gate-Body Leakage                                                      | I <sub>GSS</sub>                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V                                                                            |      |        | ± 100 | nA    |
| Zero Gate Voltage Drain Current                                        | I <sub>DSS</sub>                     | V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = 0 V                                                                            |      |        | - 1   | μA    |
|                                                                        |                                      | V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 75 °C                                                    |      |        | - 10  |       |
| On-State Drain Current <sup>a</sup>                                    | I <sub>D(on)</sub>                   | V <sub>DS</sub> ≥ - 5 V, V <sub>GS</sub> = - 10 V                                                                          | - 5  |        |       | A     |
| Drain-Source On-State Resistance <sup>a</sup>                          | R <sub>DS(on)</sub>                  | V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 3.6 A                                                                         |      | 0.055  | 0.068 | Ω     |
|                                                                        |                                      | V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 2.8 A                                                                        |      | 0.092  | 0.110 |       |
| Forward Transconductance <sup>a</sup>                                  | g <sub>fs</sub>                      | V <sub>DS</sub> = - 15 V, I <sub>D</sub> = - 3.6 A                                                                         |      | 6.5    |       | S     |
| Dynamic <sup>b</sup>                                                   |                                      |                                                                                                                            |      |        |       |       |
| Input Capacitance                                                      | C <sub>iss</sub>                     | V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz                                                                 |      | 350    |       | pF    |
| Output Capacitance                                                     | C <sub>oss</sub>                     |                                                                                                                            |      | 75     |       |       |
| Reverse Transfer Capacitance                                           | C <sub>rss</sub>                     |                                                                                                                            |      | 63     |       |       |
| Total Gate Charge                                                      | Q <sub>g</sub>                       | V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 5 A                                                 |      | 9      | 14    | nC    |
| Gate-Source Charge                                                     | Q <sub>gs</sub>                      | V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 5 A                                                |      | 4.6    | 7     |       |
| Gate-Drain Charge                                                      | Q <sub>gd</sub>                      |                                                                                                                            |      | 1.3    |       |       |
| Gate Resistance                                                        | R <sub>g</sub>                       |                                                                                                                            |      | 2.1    |       |       |
| Gate Resistance                                                        | R <sub>g</sub>                       | f = 1 MHz                                                                                                                  | 1.5  | 7.3    | 14.5  | Ω     |
| Turn-On Delay Time                                                     | t <sub>d(on)</sub>                   | V <sub>DD</sub> = - 15 V, R <sub>L</sub> = 3 Ω<br>I <sub>D</sub> ≅ - 5 A, V <sub>GEN</sub> = - 4.5 V, R <sub>g</sub> = 1 Ω |      | 28     | 50    | ns    |
| Rise Time                                                              | t <sub>r</sub>                       |                                                                                                                            |      | 73     | 140   |       |
| Turn-Off Delay Time                                                    | t <sub>d(off)</sub>                  |                                                                                                                            |      | 12     | 24    |       |
| Fall Time                                                              | t <sub>f</sub>                       |                                                                                                                            |      | 8      | 16    |       |
| Turn-On Delay Time                                                     | t <sub>d(on)</sub>                   | V <sub>DD</sub> = - 15 V, R <sub>L</sub> = 3 Ω<br>I <sub>D</sub> ≅ - 5 A, V <sub>GEN</sub> = - 10 V, R <sub>g</sub> = 1 Ω  |      | 6      | 12    |       |
| Rise Time                                                              | t <sub>r</sub>                       |                                                                                                                            |      | 9      | 18    |       |
| Turn-Off Delay Time                                                    | t <sub>d(off)</sub>                  |                                                                                                                            |      | 12     | 24    |       |
| Fall Time                                                              | t <sub>f</sub>                       |                                                                                                                            |      | 6      | 12    |       |
| Drain-Source Body Diode Characteristics                                |                                      |                                                                                                                            |      |        |       |       |
| Continous Source-Drain Diode Current                                   | I <sub>S</sub>                       | T <sub>C</sub> = 25 °C                                                                                                     |      |        | - 4.6 | A     |
| Pulse Diode Forward Current <sup>a</sup>                               | I <sub>SM</sub>                      |                                                                                                                            |      |        | - 20  |       |
| Body Diode Voltage                                                     | V <sub>SD</sub>                      | I <sub>S</sub> = - 2 A, V <sub>GS</sub> = 0 V                                                                              |      | - 0.83 | - 1.2 | V     |
| Body Diode Reverse Recovery Time                                       | t <sub>rr</sub>                      | I <sub>F</sub> = - 2 A, dI/dt = 100 A/μs, T <sub>J</sub> = 25 °C                                                           |      | 12     | 24    | ns    |
| Body Diode Reverse Recovery Charge                                     | Q <sub>rr</sub>                      |                                                                                                                            |      | 6      | 12    | nC    |
| Reverse Recovery Fall Time                                             | t <sub>a</sub>                       |                                                                                                                            |      | 8      |       | ns    |
| Reverse Recovery Rise Time                                             | t <sub>b</sub>                       |                                                                                                                            |      | 4      |       |       |

Notes:

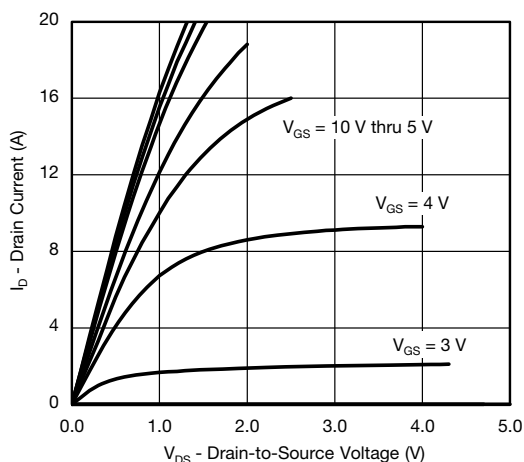
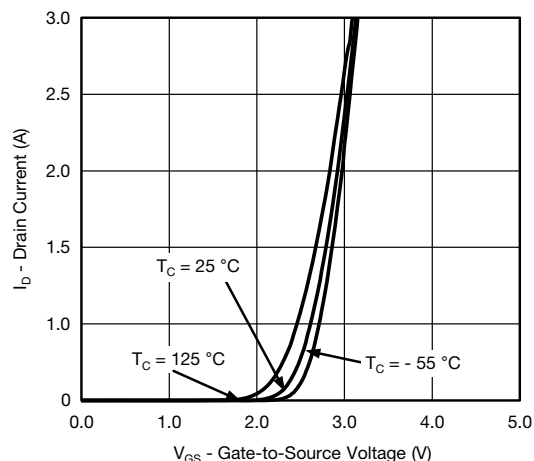
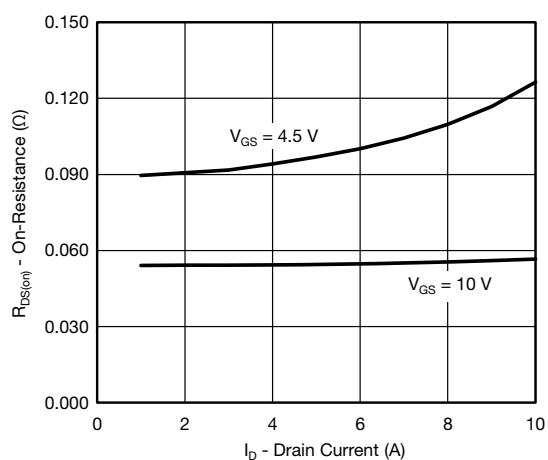
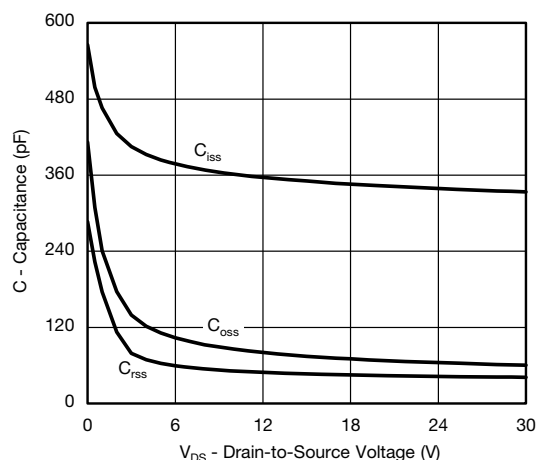
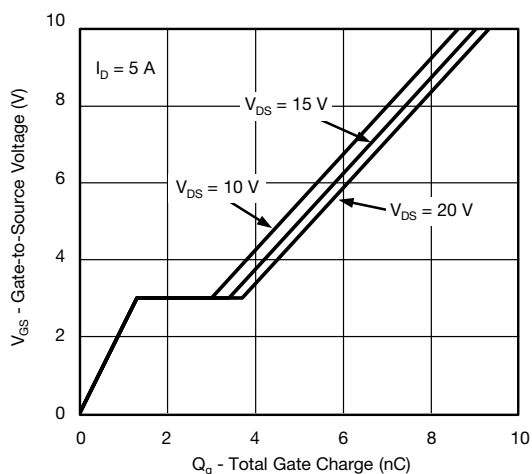
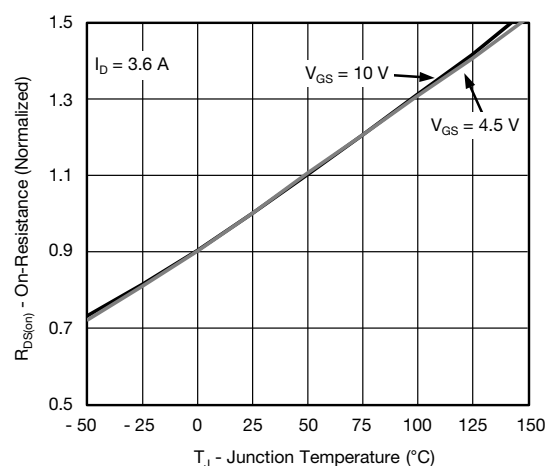
a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

b. Guaranteed by design, not subject to production testing.

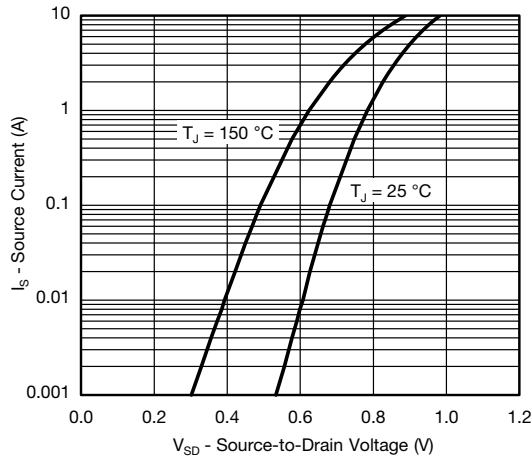


| <b>SCHOTTKY SPECIFICATIONS</b> ( $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted) |          |                                                        |      |      |      |      |
|-----------------------------------------------------------------------------------------------|----------|--------------------------------------------------------|------|------|------|------|
| Parameter                                                                                     | Symbol   | Test Conditions                                        | Min. | Typ. | Max. | Unit |
| Forward Voltage Drop                                                                          | $V_F$    | $I_F = 1\text{ A}$                                     |      | 0.36 | 0.44 | V    |
|                                                                                               |          | $I_F = 1\text{ A}, T_J = 125\text{ }^{\circ}\text{C}$  |      | 0.29 | 0.35 |      |
| Maximum Reverse Leakage Current                                                               | $I_{rm}$ | $V_R = 30\text{ V}$                                    |      | 0.03 | 0.2  | mA   |
|                                                                                               |          | $V_R = 30\text{ V}, T_J = 75\text{ }^{\circ}\text{C}$  |      | 0.6  | 5    |      |
|                                                                                               |          | $V_R = 30\text{ V}, T_J = 125\text{ }^{\circ}\text{C}$ |      | 7.5  | 60   |      |
| Junction Capacitance                                                                          | $C_T$    | $V_R = 15\text{ V}$                                    |      | 5.3  |      | pF   |

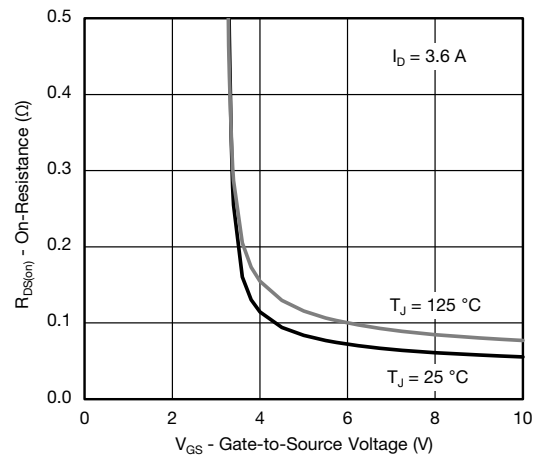
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**MOSFET TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)**Output Characteristics****Transfer Characteristics****On-Resistance vs. Drain Current and Gate Voltage****Capacitance****Gate Charge****On-Resistance vs. Junction Temperature**

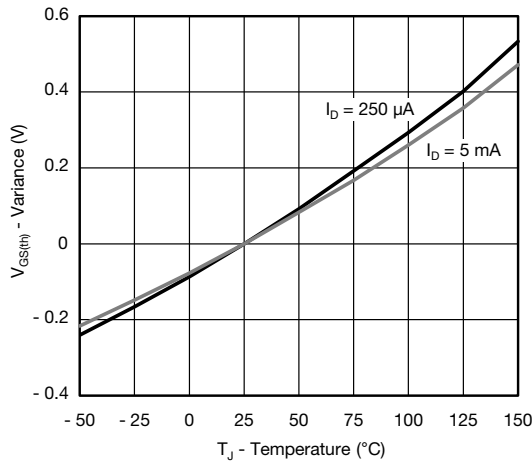
## MOSFET TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



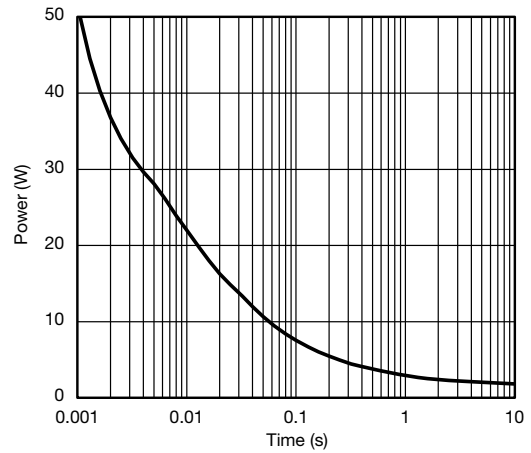
Source-Drain Diode Forward Voltage



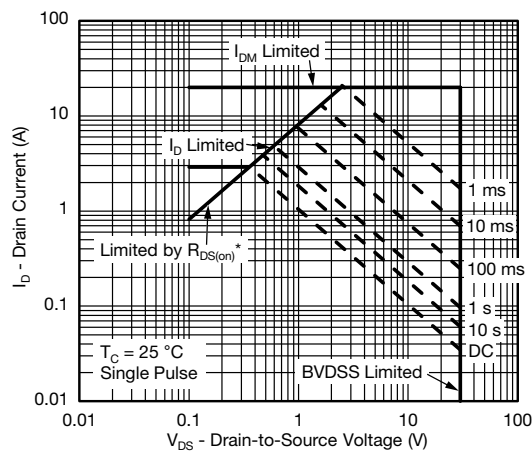
On-Resistance vs. Gate-to-Source Voltage



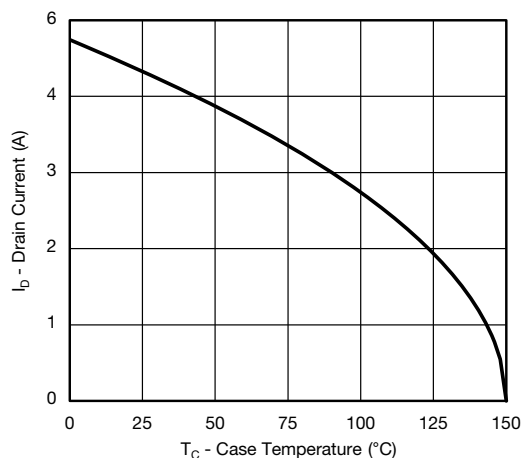
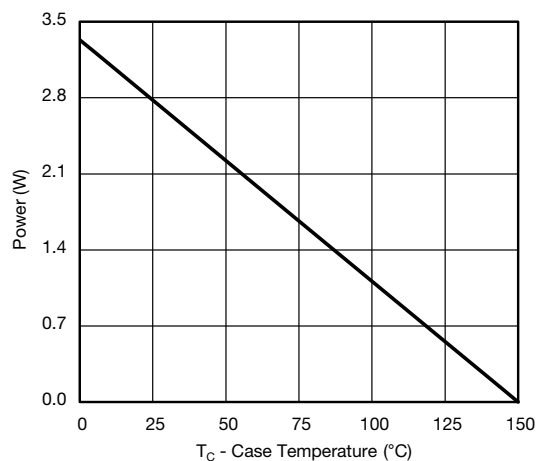
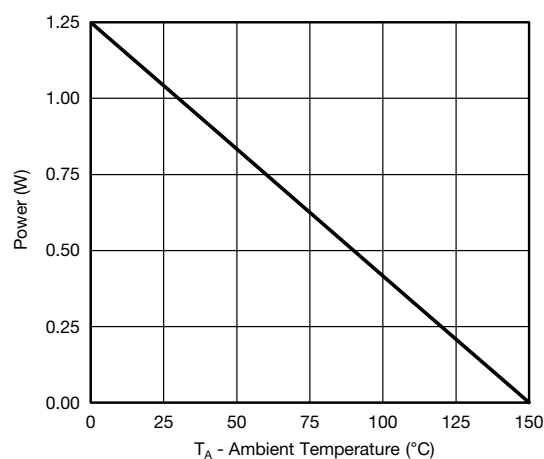
Threshold Voltage



Single Pulse Power, Junction-to-Ambient

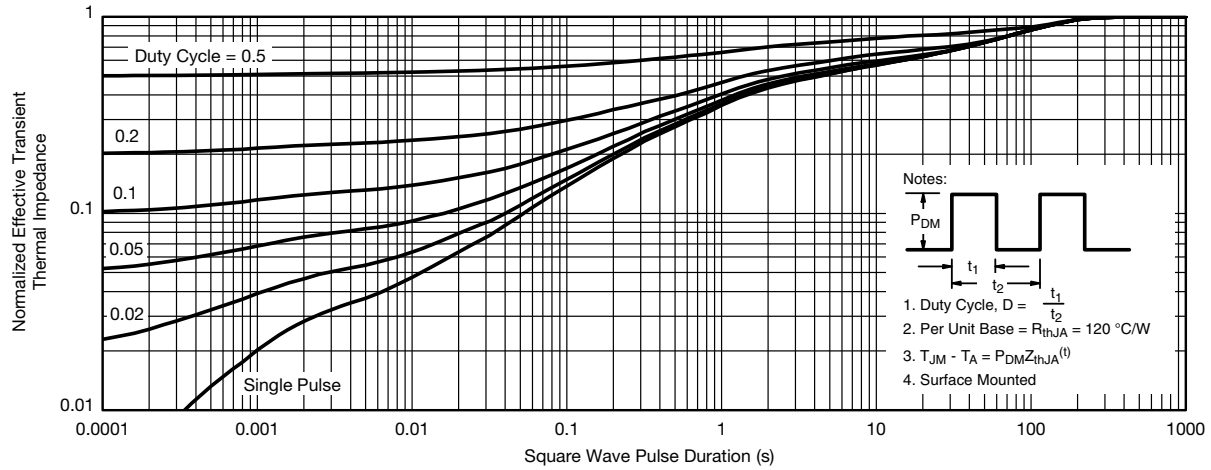


Safe Operating Area, Junction-to-Case

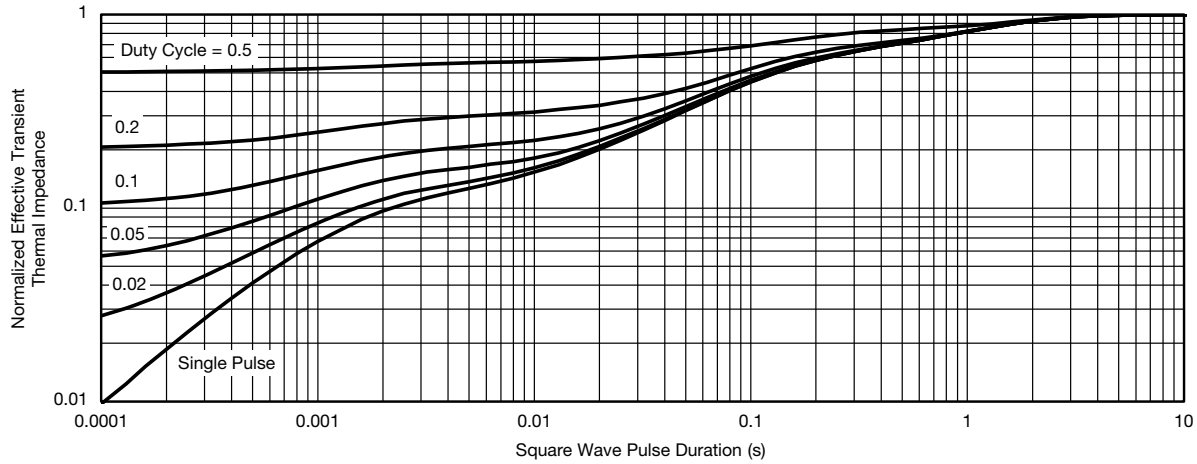
**MOSFET TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Current Derating\***

**Power Derating, Junction-to-Foot**

**Power Derating, Junction-to-Ambient**

\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

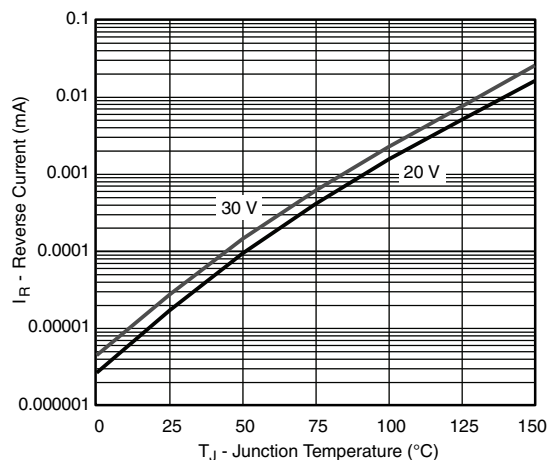
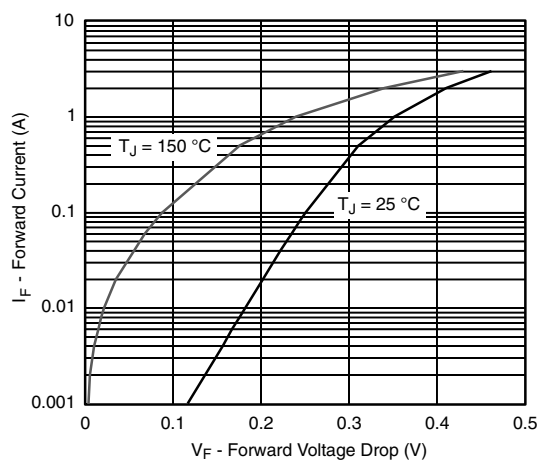
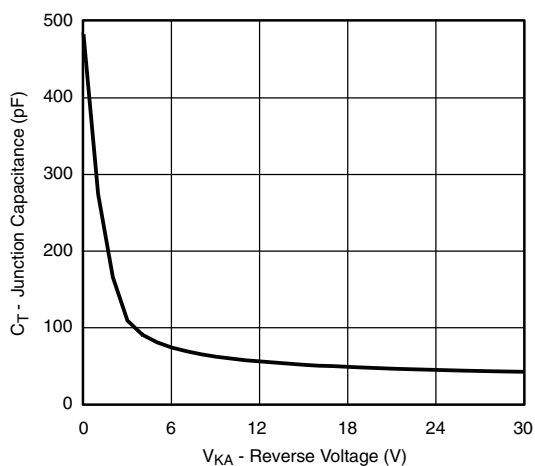
**MOSFETS TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**Normalized Thermal Transient Impedance, Junction-to-Foot**

**SCHOTTKY TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)**Reverse Current vs. Junction Temperature****Forward Voltage Drop****Capacitance**

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## SOIC (NARROW): 8-LEAD

JEDEC Part Number: MS-012



| DIM                            | MILLIMETERS |      | INCHES    |       |
|--------------------------------|-------------|------|-----------|-------|
|                                | Min         | Max  | Min       | Max   |
| A                              | 1.35        | 1.75 | 0.053     | 0.069 |
| A <sub>1</sub>                 | 0.10        | 0.20 | 0.004     | 0.008 |
| B                              | 0.35        | 0.51 | 0.014     | 0.020 |
| C                              | 0.19        | 0.25 | 0.0075    | 0.010 |
| D                              | 4.80        | 5.00 | 0.189     | 0.196 |
| E                              | 3.80        | 4.00 | 0.150     | 0.157 |
| e                              | 1.27 BSC    |      | 0.050 BSC |       |
| H                              | 5.80        | 6.20 | 0.228     | 0.244 |
| h                              | 0.25        | 0.50 | 0.010     | 0.020 |
| L                              | 0.50        | 0.93 | 0.020     | 0.037 |
| q                              | 0°          | 8°   | 0°        | 8°    |
| S                              | 0.44        | 0.64 | 0.018     | 0.026 |
| ECN: C-06527-Rev. I, 11-Sep-06 |             |      |           |       |
| DWG: 5498                      |             |      |           |       |

## RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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