

To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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SWITCHING N-CHANNEL POWER MOS FET

DESCRIPTION

The 2SK3640 is N-channel MOS FET device that features a low on-state resistance and excellent switching characteristics, and designed for low voltage high current applications such as DC/DC converter with synchronous rectifier.

FEATURES

- Low on-state resistance
 $R_{DS(on)1} = 21 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 9 \text{ A)}$
 $R_{DS(on)2} = 40 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 9 \text{ A)}$
- Low C_{iss} : $C_{iss} = 570 \text{ pF TYP.}$
- Built-in gate protection diode

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)

| | | | |
|--|----------------|------------------------|------------------|
| Drain to Source Voltage ($V_{GS} = 0 \text{ V}$) | V_{DSS} | 30 | V |
| Gate to Source Voltage ($V_{DS} = 0 \text{ V}$) | V_{GSS} | ± 16 | V |
| Drain Current (DC) ($T_C = 25^\circ\text{C}$) | $I_{D(DC)}$ | ± 19 | A |
| Drain Current (pulse) ^{Note1} | $I_{D(pulse)}$ | ± 76 | A |
| Total Power Dissipation ($T_C = 25^\circ\text{C}$) | P_{T1} | 20 | W |
| Total Power Dissipation | P_{T2} | 1.0 | W |
| Channel Temperature | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | $-55 \text{ to } +150$ | $^\circ\text{C}$ |
| Single Avalanche Current ^{Note2} | I_{AS} | 10 | A |
| Single Avalanche Energy ^{Note2} | E_{AS} | 10 | mJ |

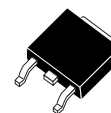
Notes 1. $PW \leq 10 \mu\text{s}$, Duty Cycle $\leq 1\%$

2. Starting $T_{ch} = 25^\circ\text{C}$, $V_{DD} = 15 \text{ V}$, $R_G = 25 \Omega$, $L = 100 \mu\text{H}$, $V_{GS} = 20 \rightarrow 0 \text{ V}$

ORDERING INFORMATION

| PART NUMBER | PACKAGE |
|-------------|-----------------|
| 2SK3640-ZK | TO-252 (MP-3ZK) |

(TO-252)



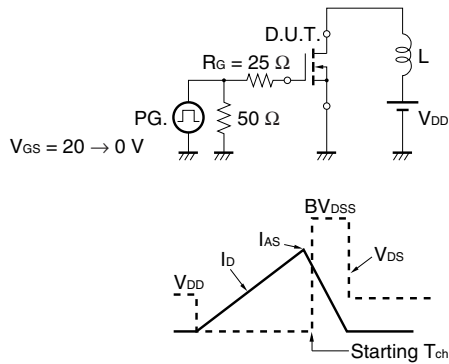
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ELECTRICAL CHARACTERISTICS (Ta = 25°C)

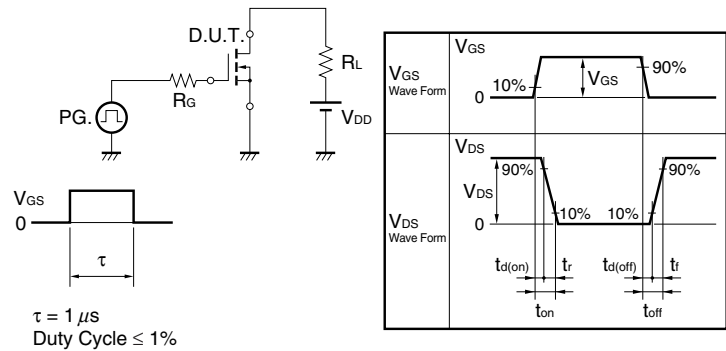
| CHARACTERISTICS | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---------------|---|------|------|----------|------------------|
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$ | | | 10 | μA |
| Gate Leakage Current | I_{GSS} | $V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$ | | | ± 10 | μA |
| Gate Cut-off Voltage | $V_{GS(off)}$ | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$ | 1.5 | | 2.5 | V |
| Forward Transfer Admittance ^{Note} | $ y_{fs} $ | $V_{DS} = 10\text{ V}, I_D = 9\text{ A}$ | 3.7 | 7.4 | | S |
| Drain to Source On-state Resistance ^{Note} | $R_{DS(on)1}$ | $V_{GS} = 10\text{ V}, I_D = 9\text{ A}$ | | 15 | 21 | $\text{m}\Omega$ |
| | $R_{DS(on)2}$ | $V_{GS} = 4.5\text{ V}, I_D = 9\text{ A}$ | | 24 | 40 | $\text{m}\Omega$ |
| Input Capacitance | C_{iss} | $V_{DS} = 10\text{ V}$ | | 570 | | pF |
| Output Capacitance | C_{oss} | $V_{GS} = 0\text{ V}$ | | 160 | | pF |
| Reverse Transfer Capacitance | C_{rss} | $f = 1\text{ MHz}$ | | 100 | | pF |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD} = 15\text{ V}, I_D = 9\text{ A}$ | | 7.7 | | ns |
| Rise Time | t_r | $V_{GS} = 10\text{ V}$ | | 4.7 | | ns |
| Turn-off Delay Time | $t_{d(off)}$ | $R_G = 10\ \Omega$ | | 24 | | ns |
| Fall Time | t_f | | | 7 | | ns |
| Total Gate Charge | Q_G | $V_{DD} = 24\text{ V}$ | | 14 | | nC |
| Gate to Source Charge | Q_{GS} | $V_{GS} = 10\text{ V}$ | | 2.4 | | nC |
| Gate to Drain Charge | Q_{GD} | $I_D = 19\text{ A}$ | | 4.3 | | nC |
| Body Diode Forward Voltage ^{Note} | $V_{F(S-D)}$ | $I_F = 19\text{ A}, V_{GS} = 0\text{ V}$ | | 0.95 | | V |
| Reverse Recovery Time | t_{rr} | $I_F = 19\text{ A}, V_{GS} = 0\text{ V}$ | | 21 | | ns |
| Reverse Recovery Charge | Q_{rr} | $di/dt = 100\text{ A}/\mu\text{s}$ | | 12 | | nC |

Note Pulsed: $PW \leq 350\ \mu\text{s}$, Duty Cycle $\leq 2\%$

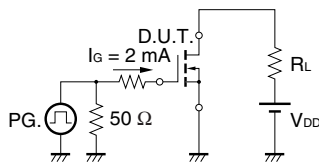
TEST CIRCUIT 1 AVALANCHE CAPABILITY



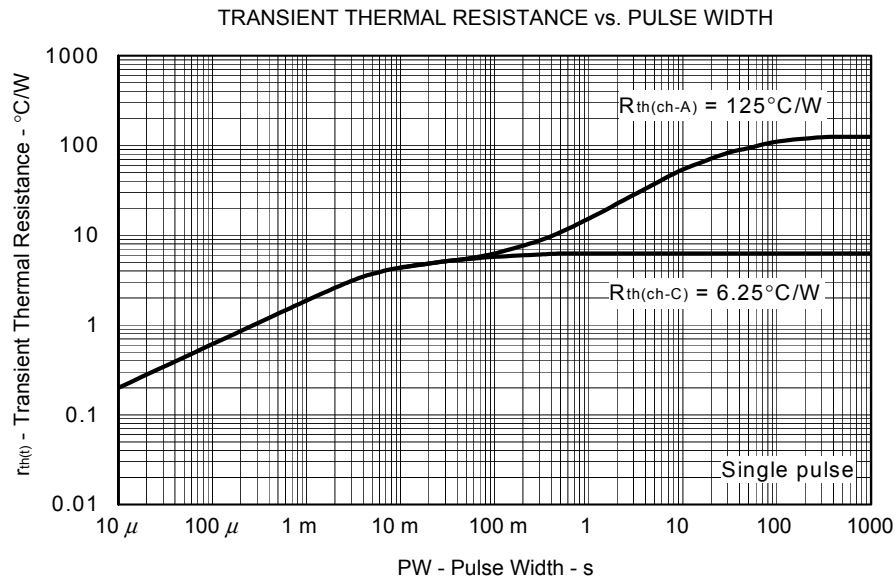
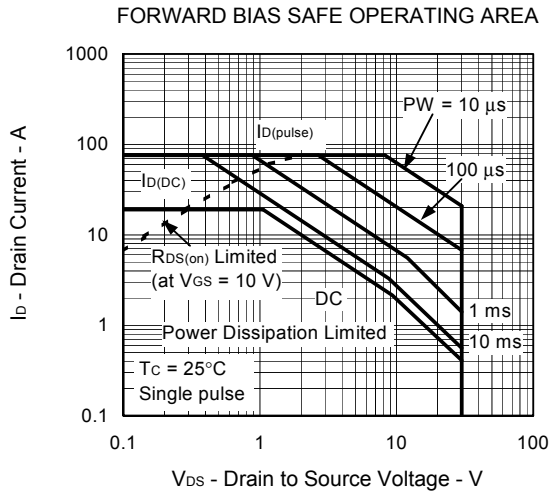
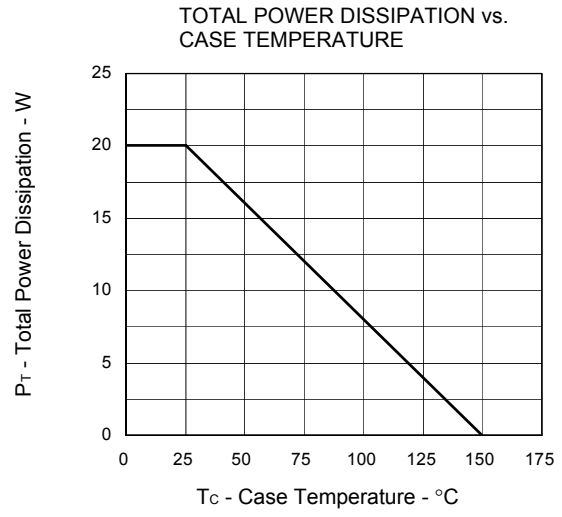
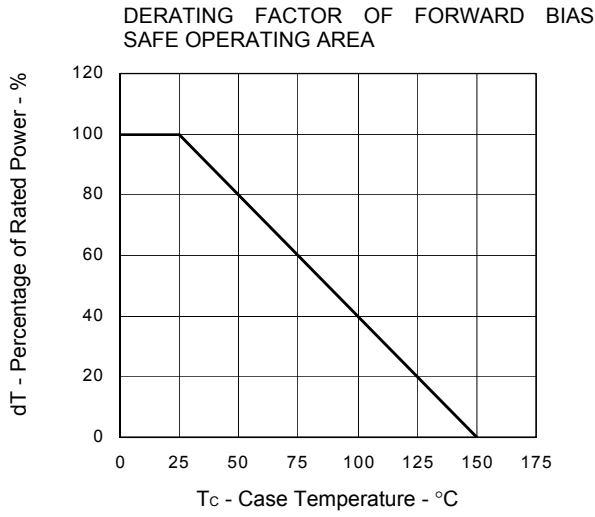
TEST CIRCUIT 2 SWITCHING TIME



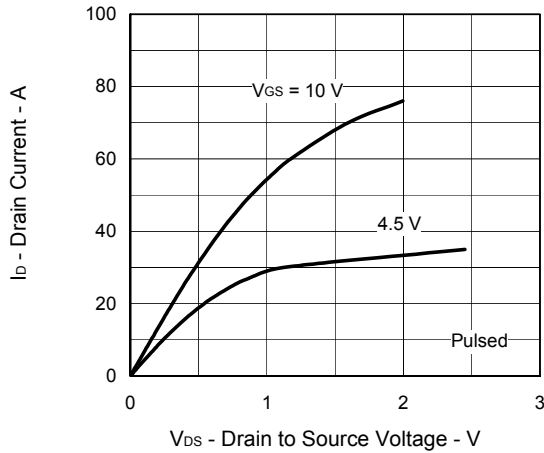
TEST CIRCUIT 3 GATE CHARGE



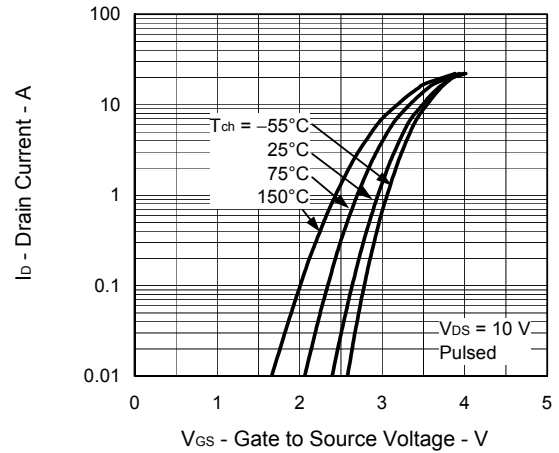
TYPICAL CHARACTERISTICS (T_A = 25°C)



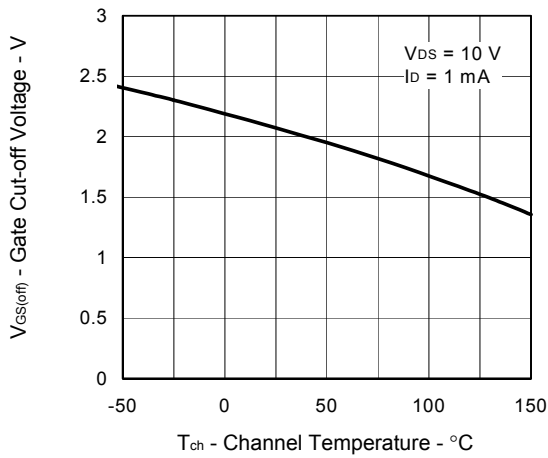
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



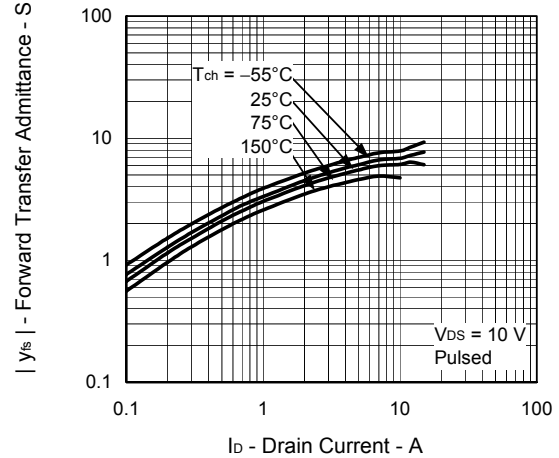
FORWARD TRANSFER CHARACTERISTICS



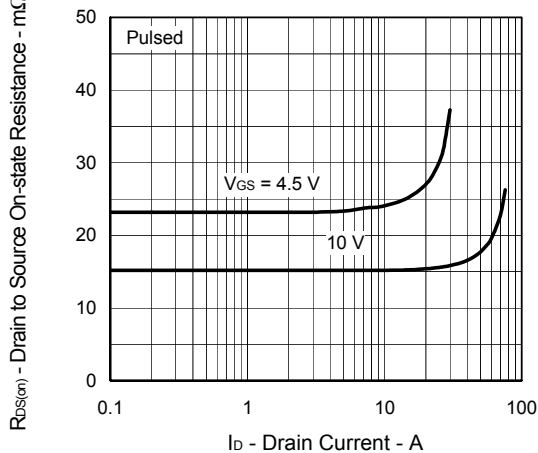
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



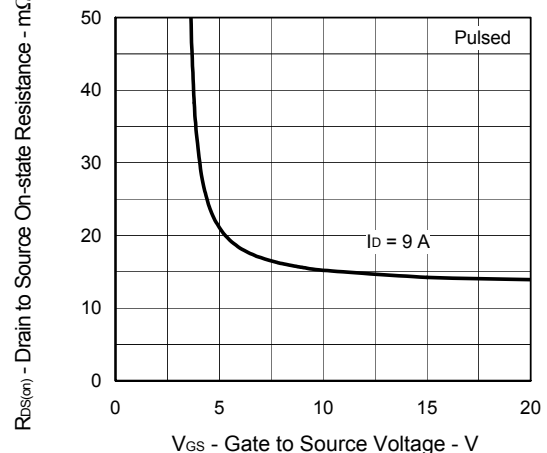
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



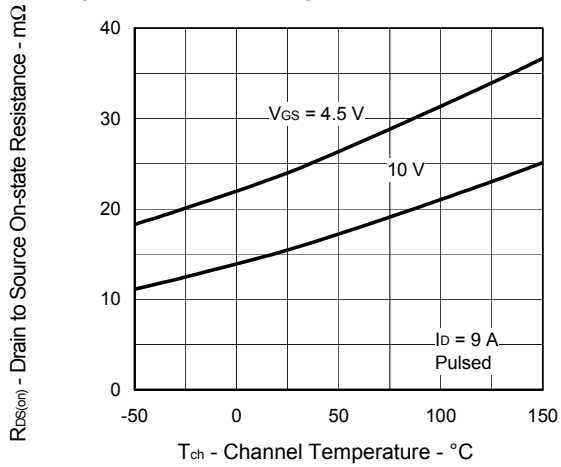
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



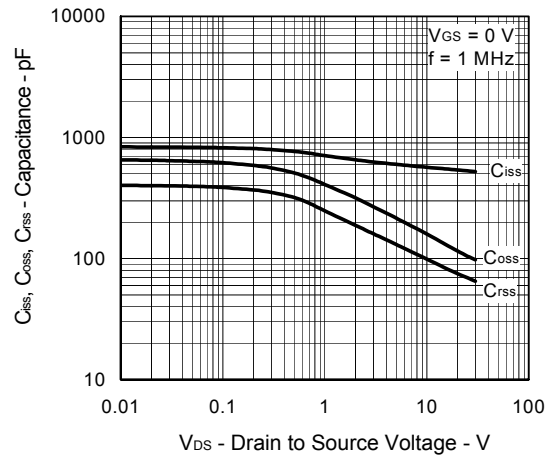
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



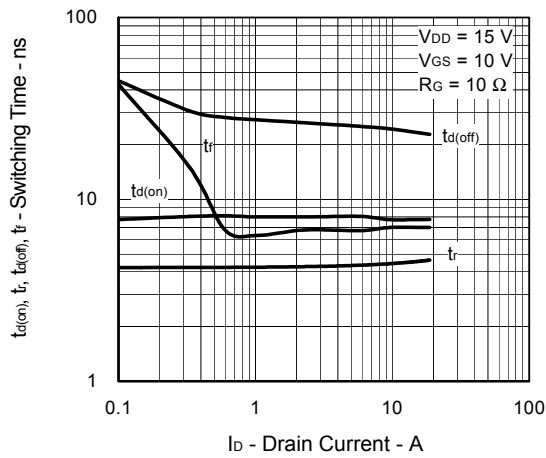
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



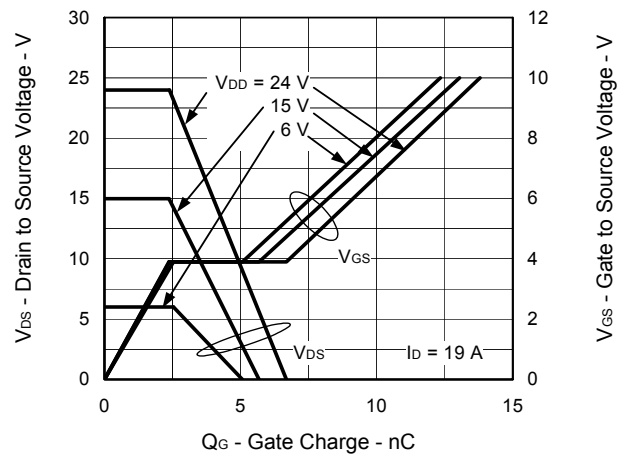
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



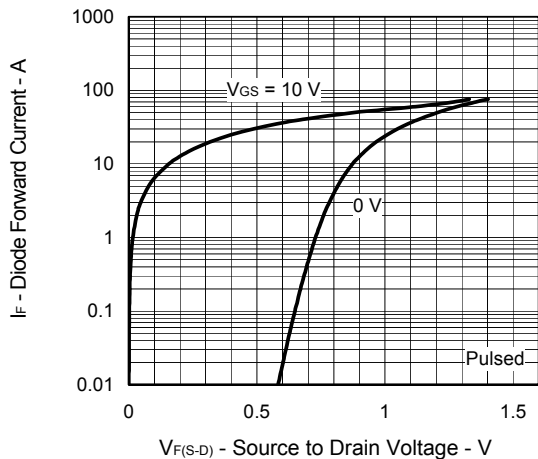
SWITCHING CHARACTERISTICS



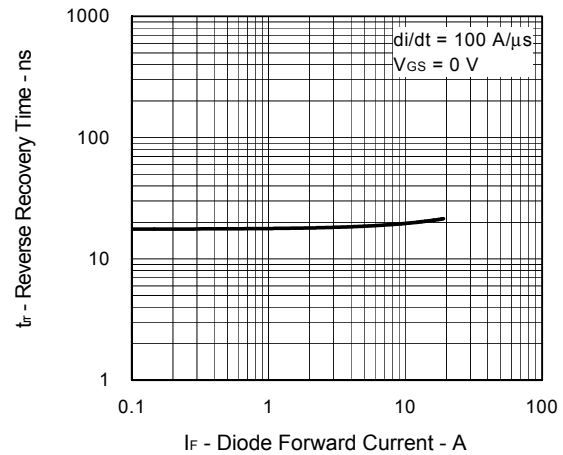
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



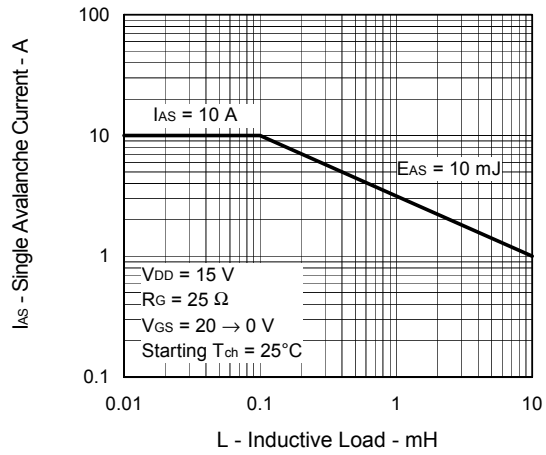
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



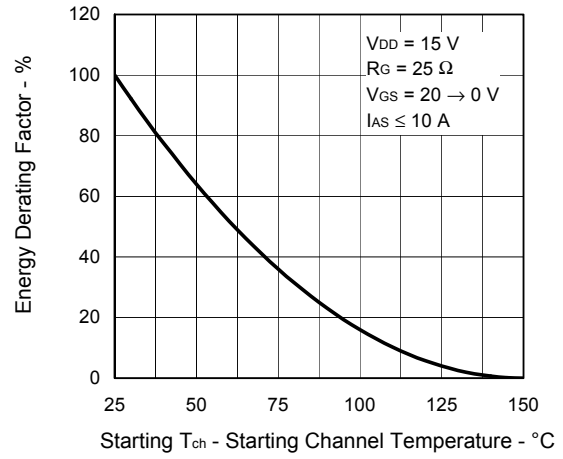
REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD



SINGLE AVALANCHE ENERGY DERATING FACTOR



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