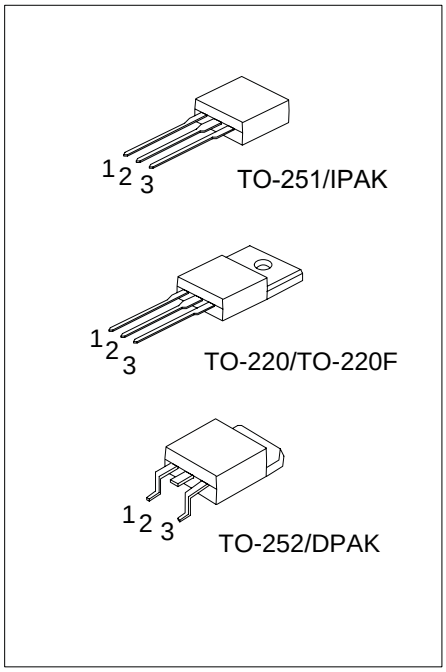
Pb Free Plating Product

# 55NF06

## N-CHANNEL POWER MOSFET TRANSISTOR

## 50 AMPERE 60 VOLT
## N-CHANNEL POWER MOSFET




### ■ DESCRIPTION

Thinkisemi **50N06** is three-terminal silicon device with current conduction capability of about 50A, fast switching speed. Low on-state resistance, breakdown voltage rating of 60V, and max threshold voltages of 4 volt.

It is mainly suitable electronic ballast, and low power switching mode power appliances.

### ■ FEATURES

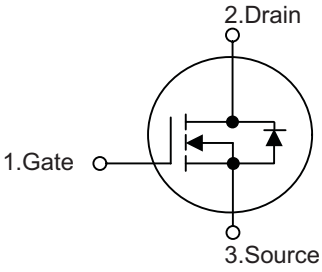
* $R_{DS(ON)}$ = 23mΩ@$V_{GS}$ = 10 V
* Ultra low gate charge ( typical 30 nC )
* Low reverse transfer capacitance ( $C_{RSS}$ = typical 80 pF )
* Fast switching capability
* 100% avalanche energy specified
* Improved dv/dt capability

### ■ SYMBOL

U55NF06 TO-251/IPAK
P55NF06 TO-220
F55NF06 TO-220F
D55NF06 TO-252/DPAK

### ■ APPLICATION

Auotmobile Convert System
Networking DC-DC Power System
Power Supply etc..




### ■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 60 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current | $T_C$ = 25°C | $I_D$ | 50 | A |
| | $T_C$ = 100°C | | 35 | A |
| Pulsed Drain Current (Note 2) | | $I_{DM}$ | 200 | A |
| Avalanche Energy | Single Pulsed (Note 3) | $E_{AS}$ | 480 | mJ |
| | Repetitive (Note 2) | $E_{AR}$ | 13 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 7 | V/ns |
| Power Dissipation ($T_C$=25°C) | TO-220 | $P_D$ | 120 | W |
| | TO-251 | | 90 | W |
| | TO-252 | | 136 | W |
| Junction Temperature | | $T_J$ | +150 | °C |
| Operation and Storage Temperature | | $T_{STG}$ | -55 ~ +150 | °C |

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating: Pulse width limited by $T_J$
3. L=0.38mH, $I_{AS}$=50A, $V_{DD}$=25V, $R_G$=20Ω, Starting $T_J$=25°C
4. $I_{SD}$≤50A, di/dt≤300A/μs, $V_{DD}$≤$BV_{DSS}$, Starting $T_J$=25°C

## ■ THERMAL DATA

| PARAMETER | | SYMBOL | RATING | UNIT |
|---|---|---|---|---|
| Junction to Ambient | TO-220 | $\theta_{JA}$ | 62 | °C/W |
| | TO-251 | | 62 | °C/W |
| | TO-252 | | 100 | °C/W |
| Junction to Case | TO-220 | $\theta_{JC}$ | 1.24 | °C/W |
| | TO-251 | | 1.28 | °C/W |
| | TO-252 | | 1.1 | °C/W |

## ■ ELECTRICAL CHARACTERISTICS ($T_C$ = 25°C, unless otherwise specified)

| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 μA | 60 | | | V |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$ = 60 V, $V_{GS}$ = 0 V | | | 10 | μA |
| Gate-Source Leakage Current | Forward | $I_{GSS}$ | $V_{GS}$ = 20V, $V_{DS}$ = 0 V | | | 100 | nA |
| | Reverse | | $V_{GS}$ = -20V, $V_{DS}$ = 0 V | | | -100 | nA |
| Breakdown Voltage Temperature Coefficient | | $\triangle BV_{DSS}/\triangle T_J$ | $I_D$ = 250 μA, Referenced to 25°C | | 0.07 | | V/°C |
| **ON CHARACTERISTICS** | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 μA | 2.0 | | 4.0 | V |
| Static Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$ = 10 V, $I_D$ = 25 A | | 18 | 23 | mΩ |
| **DYNAMIC CHARACTERISTICS** | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 25 V f = 1MHz | | 900 | 1220 | pF |
| Output Capacitance | | $C_{OSS}$ | | | 430 | 550 | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | | 80 | 100 | pF |

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

| | | | | | | |
|---|---|---|---|---|---|---|
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Turn-On Delay Time | $t_{D(ON)}$ | $V_{DD}$ = 30V, $I_D$ =25 A, $R_G$ = 50Ω (Note 1, 2) | | 40 | 60 | ns |
| Turn-On Rise Time | $t_R$ | | | 100 | 200 | ns |
| Turn-Off Delay Time | $t_{D(OFF)}$ | | | 90 | 180 | ns |
| Turn-Off Fall Time | $t_F$ | | | 80 | 160 | ns |
| Total Gate Charge | $Q_G$ | $V_{DS}$ = 48V, $V_{GS}$ = 10 V $I_D$ = 50A (Note 1, 2) | | 30 | 40 | nC |
| Gate-Source Charge | $Q_{GS}$ | | | 9.6 | | nC |
| Gate-Drain Charge | $Q_{GD}$ | | | 10 | | nC |
| **DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS** | | | | | | |
| Drain-Source Diode Forward Voltage | $V_{SD}$ | $I_S$ = 50A, $V_{GS}$ = 0 V | | | 1.5 | V |
| Maximum Continuous Drain-Source Diode Forward Current | $I_S$ | | | | 50 | A |
| Maximum Pulsed Drain-Source Diode Forward Current | $I_{SM}$ | | | | 200 | A |
| Reverse Recovery Time | $t_{RR}$ | $I_S$ = 50A, $V_{GS}$ = 0 V $dI_F$ / dt = 100 A/μs | | 54 | | ns |
| Reverse Recovery Charge | $Q_{RR}$ | | | 81 | | μC |

Notes: 1. Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%
2. Essentially independent of operating temperature

## ■ TEST CIRCUITS AND WAVEFORMS

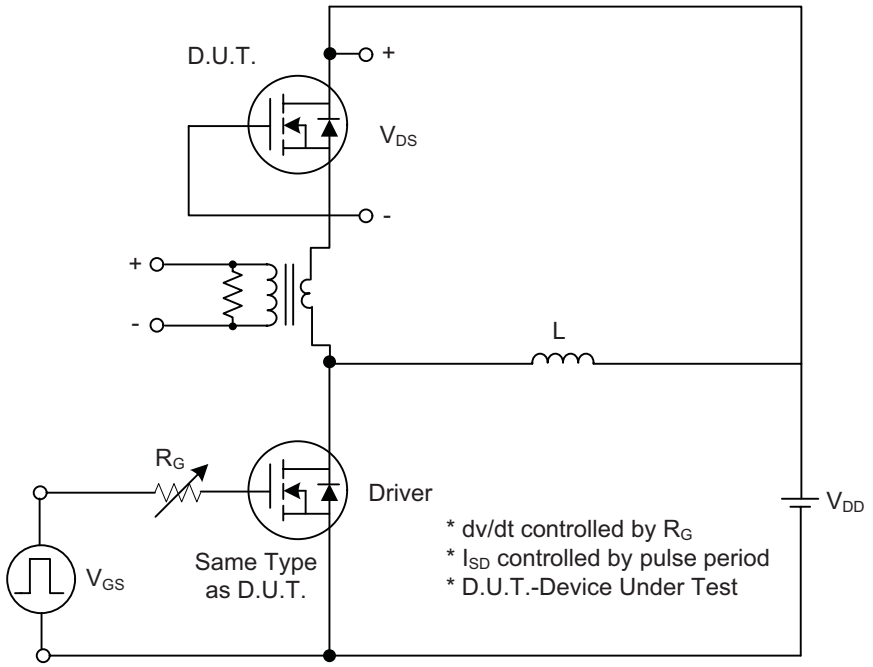



**Fig. 1A Peak Diode Recovery dv/dt Test Circuit**

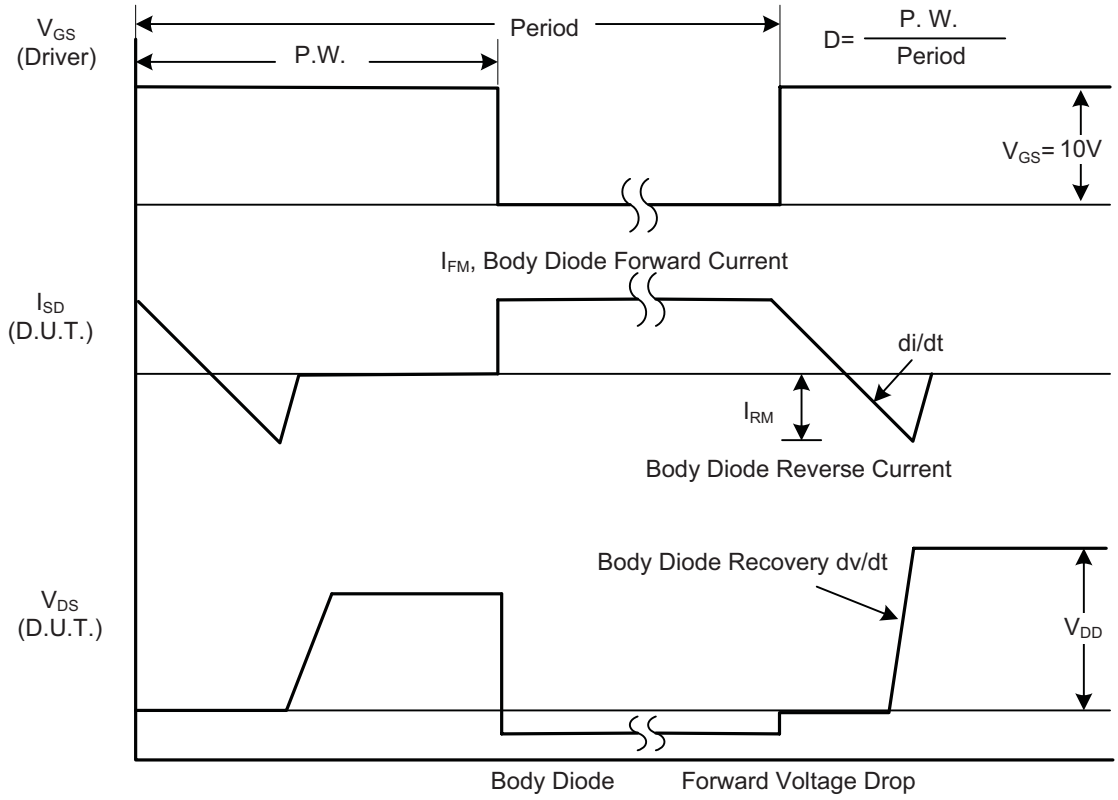



**Fig. 1B Peak Diode Recovery dv/dt Waveforms**

## ■ TEST CIRCUITS AND WAVEFORMS (Cont.)

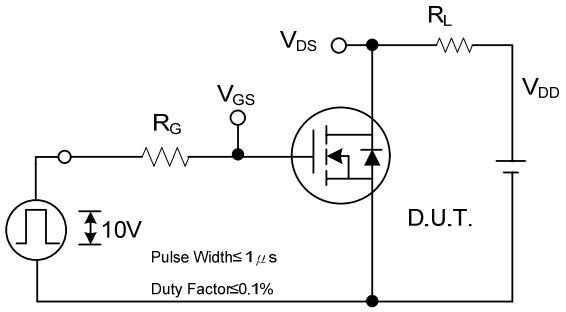



Fig. 2A Switching Test Circuit

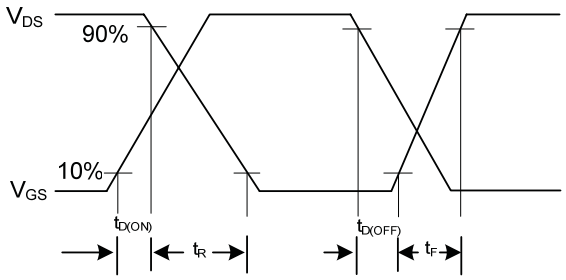



Fig. 2B Switching Waveforms

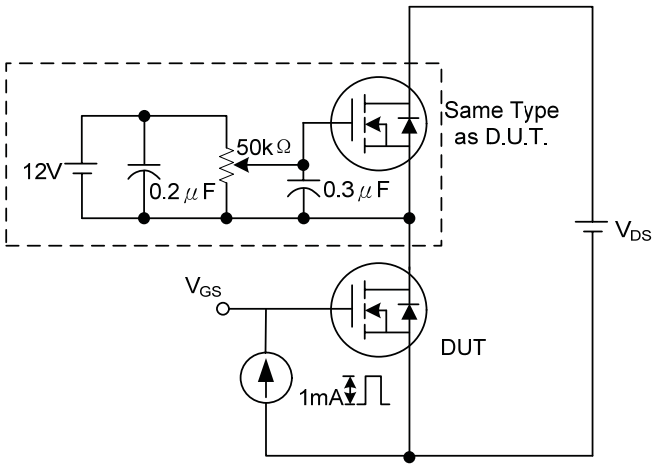



Fig. 3A Gate Charge Test Circuit

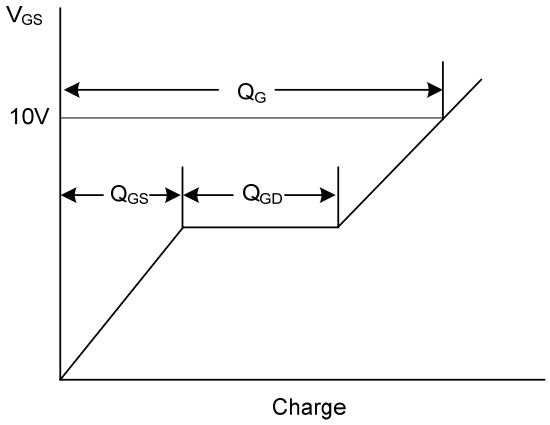



Fig. 3B Gate Charge Waveform

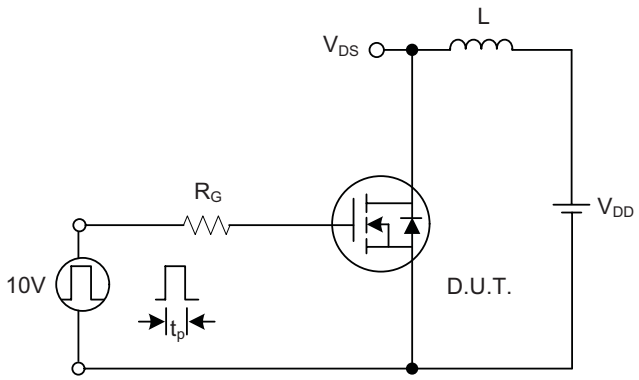



Fig. 4A Unclamped Inductive Switching Test Circuit

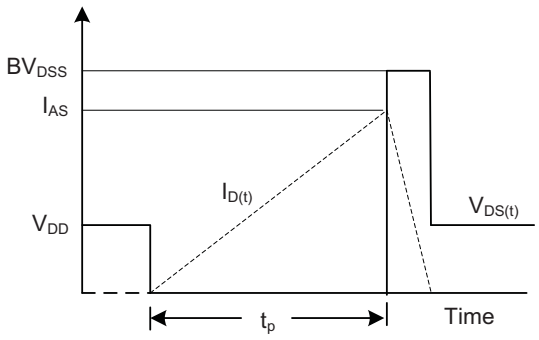
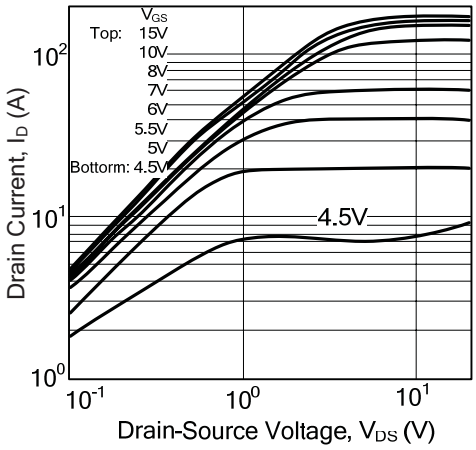


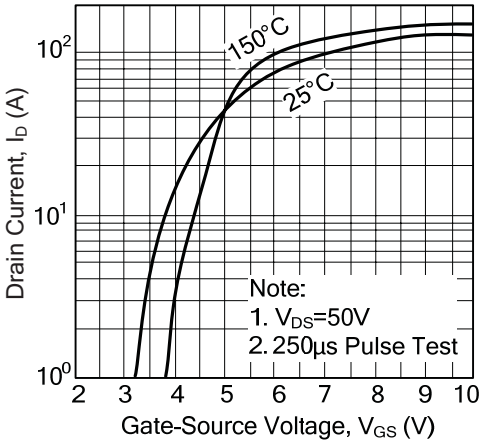

Fig. 4B Unclamped Inductive Switching Waveforms

## ■ TYPICAL CHARACTERISTICS

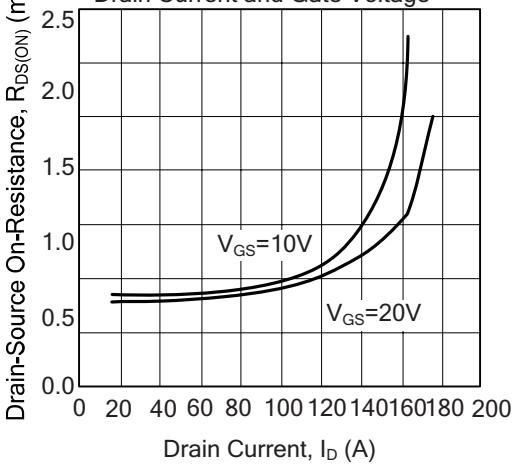
On-State Characteristics



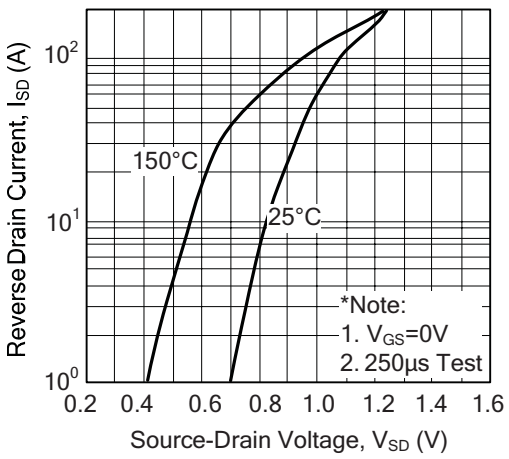

Transfer Characteristics



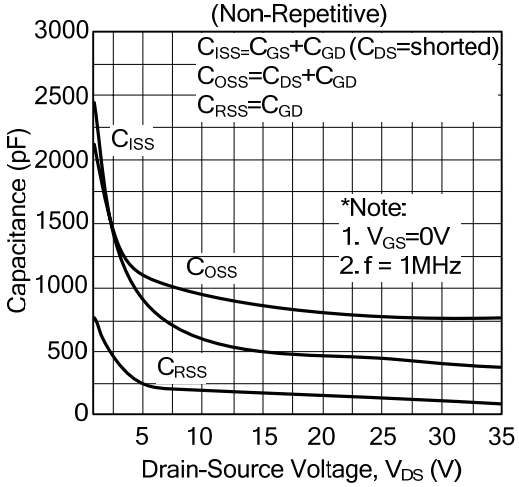

On-Resistance Variation vs. Drain Current and Gate Voltage



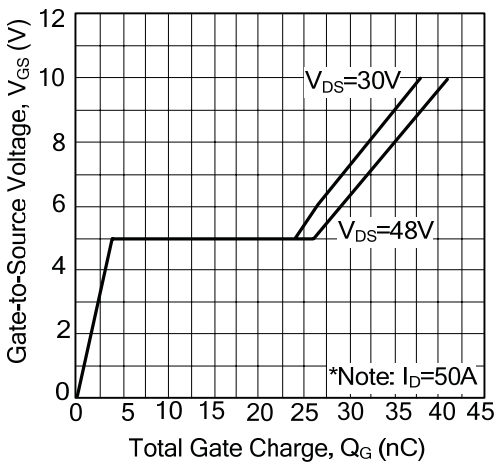

On State Current vs. Allowable Case Temperature




Capacitance Characteristics (Non-Repetitive)

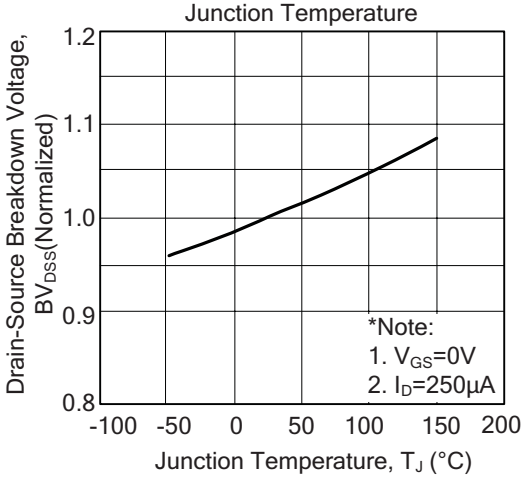



Gate Charge Characteristics

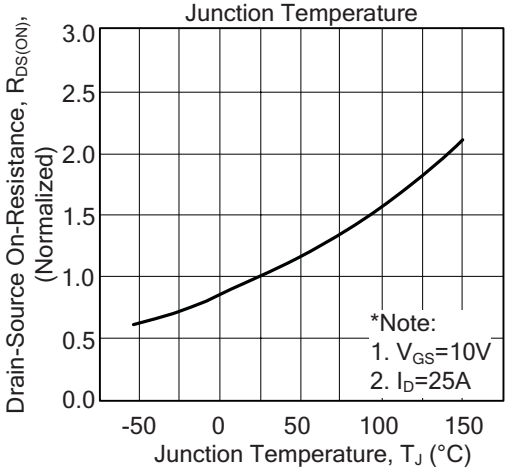


## ■ TYPICAL CHARACTERISTICS(Cont.)

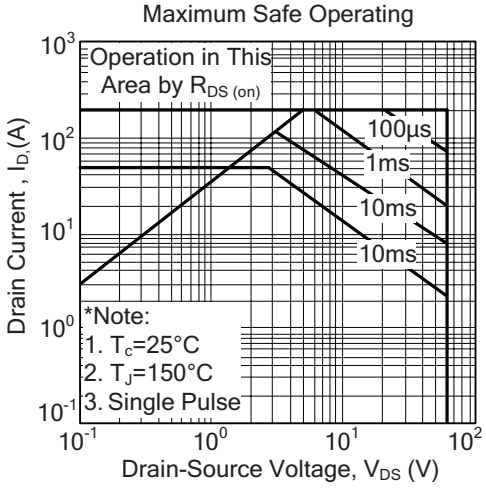
Breakdown Voltage Variation vs. Junction Temperature



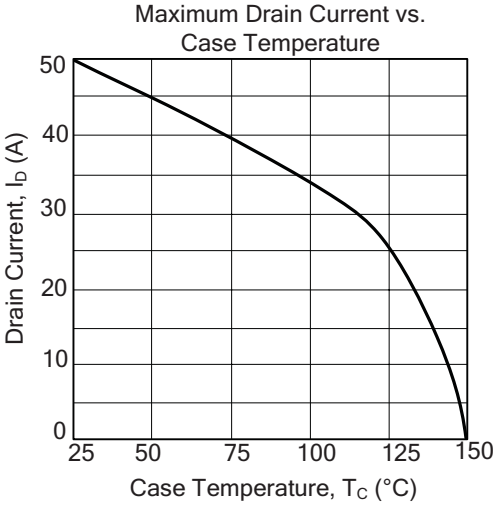

On-Resistance Variation vs. Junction Temperature




Maximum Safe Operating




Maximum Drain Current vs. Case Temperature




Transient Thermal Response Curve