

## GENERAL DESCRIPTION

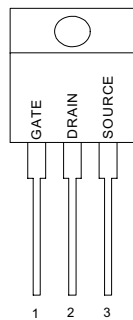
This high voltage MOSFET uses an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. In addition, this advanced MOSFET is designed to withstand high energy in avalanche and commutation modes. The new energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for high voltage, high speed switching applications in power supplies, converters and PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional and safety margin against unexpected voltage transients.

## FEATURES

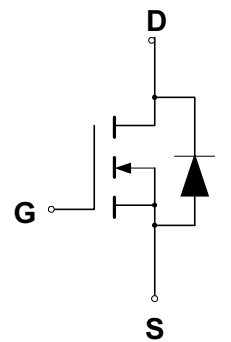
- ◆ Robust High Voltage Termination
- ◆ Avalanche Energy Specified
- ◆ Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- ◆ Diode is Characterized for Use in Bridge Circuits
- ◆  $I_{DSS}$  and  $V_{DS(on)}$  Specified at Elevated Temperature

## PIN CONFIGURATION

TO-220  
Front View



## SYMBOL



N-Channel MOSFET

## ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain to Current — Continuous	$I_D$	6.0	A
— Pulsed	$I_{DM}$	18	
Gate-to-Source Voltage — Continue	$V_{GS}$	$\pm 20$	V
— Non-repetitive	$V_{GSM}$	$\pm 40$	V
Total Power Dissipation	$P_D$	125	W
Derate above 25°C		1.0	W/°C
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	°C
Single Pulse Drain-to-Source Avalanche Energy — $T_J = 25^\circ\text{C}$ ( $V_{DD} = 100\text{V}, V_{GS} = 10\text{V}, I_L = 20\text{A}, L = 10\text{mH}, R_G = 25\Omega$ )	$E_{AS}$	405	mJ
Thermal Resistance — Junction to Case	$\theta_{JC}$	1.0	°C/W
— Junction to Ambient	$\theta_{JA}$	62.5	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	260	°C

(1)  $V_{DD} = 50\text{V}, I_D = 10\text{A}$

(2) Pulse Width and frequency is limited by  $T_{J(max)}$  and thermal response

## ELECTRICAL CHARACTERISTICS

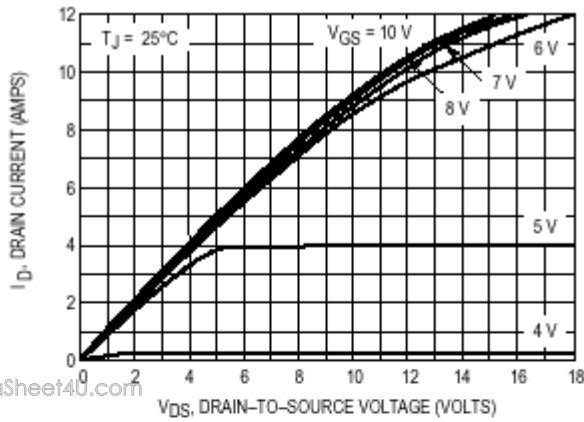
Unless otherwise specified,  $T_J = 25^\circ\text{C}$ .

Characteristic	Symbol	Min	Typ	Max	Units	
Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{ V}$ , $I_D = 250\ \mu\text{A}$ )	$V_{(BR)DSS}$	600			V	
Drain-Source Leakage Current ( $V_{DS} = 600\text{ V}$ , $V_{GS} = 0\text{ V}$ ) ( $V_{DS} = 600\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125^\circ\text{C}$ )	$I_{DSS}$			1.0 50	$\mu\text{A}$	
Gate-Source Leakage Current-Forward ( $V_{gsf} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$ )	$I_{GSSF}$			100	nA	
Gate-Source Leakage Current-Reverse ( $V_{gsr} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$ )	$I_{GSSR}$			100	nA	
Gate Threshold Voltage ( $V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$ )	$V_{GS(th)}$	2.0	3.0	4.0	V	
Static Drain-Source On-Resistance ( $V_{GS} = 10\text{ V}$ , $I_D = 3.0\text{A}$ ) *	$R_{DS(on)}$		0.94	1.2	$\Omega$	
Drain-Source On-Voltage ( $V_{GS} = 10\text{ V}$ ) ( $I_D = 6.0\text{ A}$ )	$V_{DS(on)}$		6.0	8.6	V	
Forward Transconductance ( $V_{DS} = 15\text{ V}$ , $I_D = 3.0\text{A}$ ) *	$g_{FS}$	2.0	5.5		S	
Input Capacitance	$(V_{DS} = 25\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{iss}$		1498	2100	pF
Output Capacitance		$C_{oss}$		158	220	pF
Reverse Transfer Capacitance		$C_{rss}$		29	60	pF
Turn-On Delay Time	$(V_{DD} = 300\text{ V}$ , $I_D = 6.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 9.1\Omega$ ) *	$t_{d(on)}$		14	30	ns
Rise Time		$t_r$		19	40	ns
Turn-Off Delay Time		$t_{d(off)}$		40	80	ns
Fall Time		$t_f$		26	55	ns
Total Gate Charge	$(V_{DS} = 300\text{ V}$ , $I_D = 6.0\text{ A}$ , $V_{GS} = 10\text{ V}$ ) *	$Q_g$		35.5	50	nC
Gate-Source Charge		$Q_{gs}$		8.1		nC
Gate-Drain Charge		$Q_{gd}$		14.1		nC
Internal Drain Inductance (Measured from the drain lead 0.25" from package to center of die)	$L_D$		4.5		nH	
Internal Drain Inductance (Measured from the source lead 0.25" from package to source bond pad)	$L_S$		7.5		nH	
<b>SOURCE-DRAIN DIODE CHARACTERISTICS</b>						
Forward On-Voltage(1)	$(I_S = 6.0\text{ A}$ , $dI_S/dt = 100\text{A}/\mu\text{s}$ )	$V_{SD}$		0.83	1.2	V
Forward Turn-On Time		$t_{on}$		**		ns
Reverse Recovery Time		$t_{rr}$		266		ns

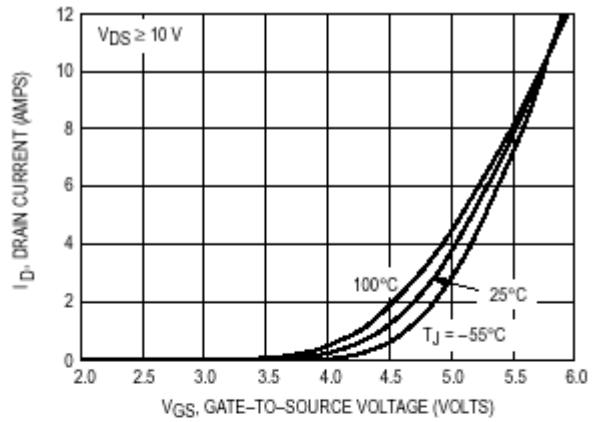
\* Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$

\*\* Negligible, Dominated by circuit inductance

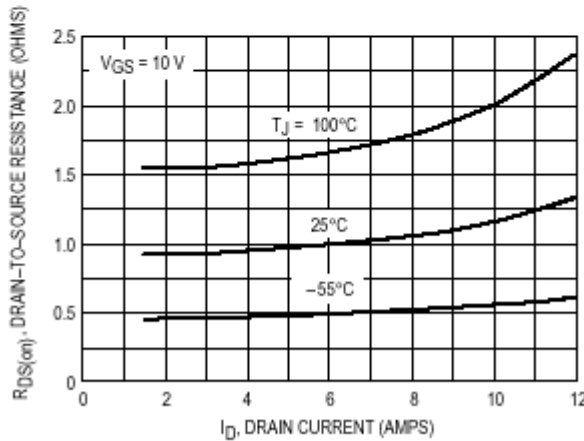
**TYPICAL ELECTRICAL CHARACTERISTICS**



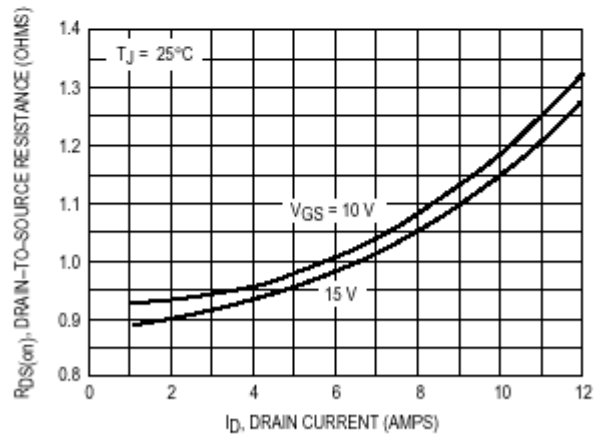
**Figure 1. On-Region Characteristics**



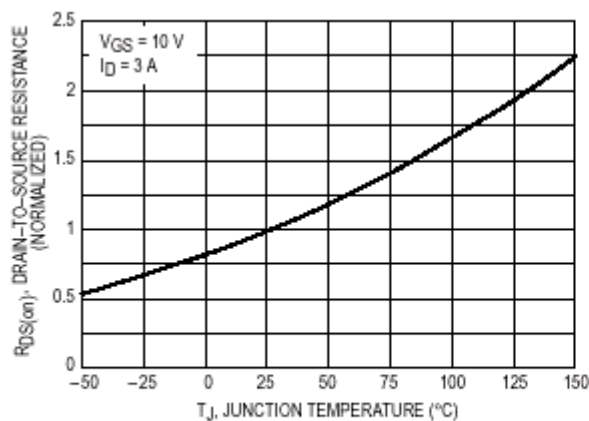
**Figure 2. Transfer Characteristics**



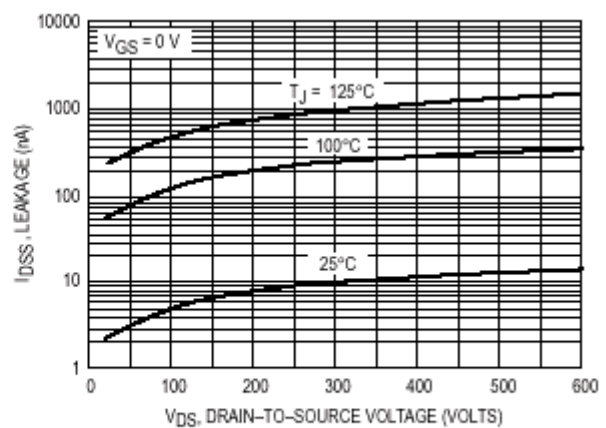
**Figure 3. On-Resistance versus Drain Current and Temperature**



**Figure 4. On-Resistance versus Drain Current and Gate Voltage**



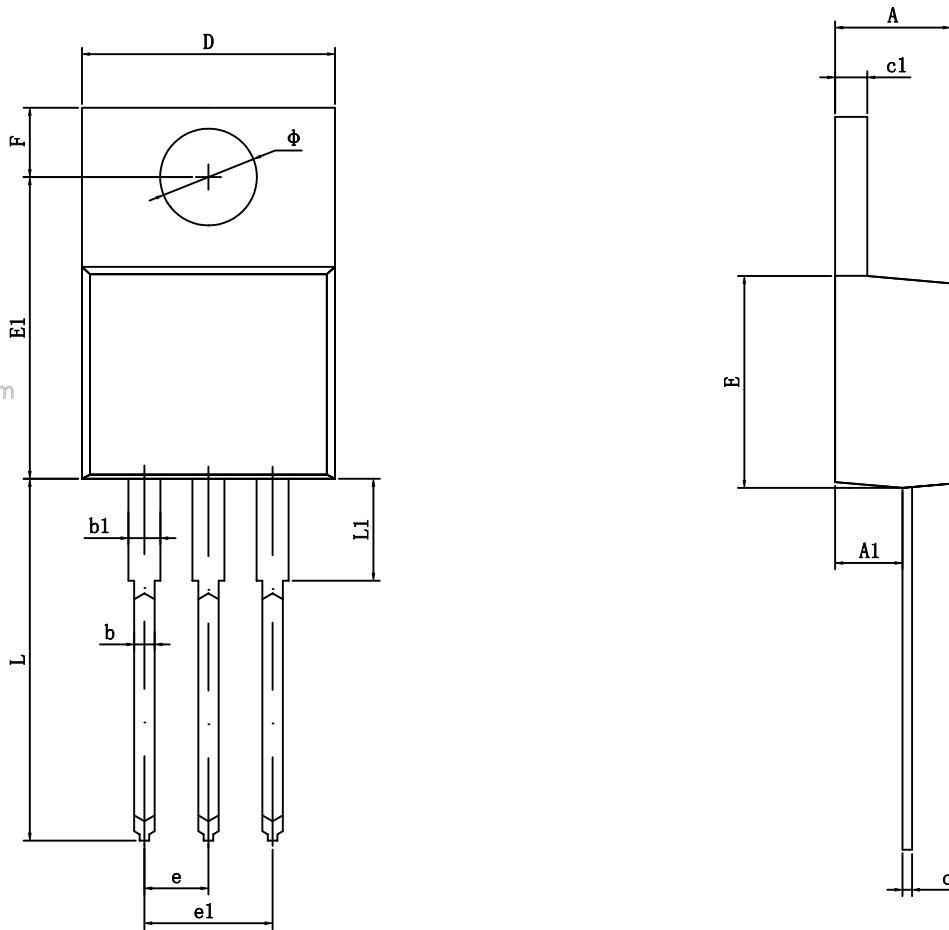
**Figure 5. On-Resistance Variation with Temperature**



**Figure 6. Drain-To-Source Leakage Current versus Voltage**

**TO-220 PACKAGE OUTLINE DIMENSIONS**

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Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.470	4.670	0.176	0.184
A1	2.520	2.820	0.099	0.111
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
E1	12.060	12.460	0.475	0.491
e	2.540TYP		0.100TYP	
e1	4.980	5.180	0.196	0.204
F	2.590	2.890	0.102	0.114
L	13.400	13.800	0.528	0.543
L1	3.560	3.960	0.140	0.156
Φ	3.790	3.890	0.149	0.153