

Power MOSFET

PRODUCT SUMMARY	
V _{DS} (V)	200
R _{DS(on)} (Ω)	V _{GS} = 10 V 0.09
Q _g (Max.) (nC)	70
Q _{gs} (nC)	13
Q _{gd} (nC)	39
Configuration	Single

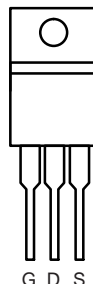
FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Surface Mount
- Low-Profile Through-Hole
- Available in Tape and Reel
- Dynamic dV/dt Rating
- 150 °C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Compliant to RoHS Directive 2002/95/EC

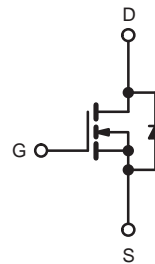


RoHS*
COMPLIANT
HALOGEN
FREE
Available

TO-220AB



G D S
Top View



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted)					
PARAMETER		SYMBOL	LIMIT	UNIT	
Drain-Source Voltage		V _{DS}	200	V	
Gate-Source Voltage		V _{GS}	± 20		
Continuous Drain Current	V _{GS} at 10 V	I _D	T _C = 25 °C	20	A
			T _C = 100 °C	13	
Pulsed Drain Current ^{a, e}		I _{DM}	72		
Linear Derating Factor			1.0	W/°C	
Single Pulse Avalanche Energy ^{b, e}		E _{AS}	580	mJ	
Avalanche Current ^a		I _{AR}	20	A	
Repetitive Avalanche Energy ^a		E _{AR}	13	mJ	
Maximum Power Dissipation	T _C = 25 °C	P _D	3.1	W	
	T _A = 25 °C		130		
Peak Diode Recovery dV/dt ^{c, e}		dV/dt	5.0	V/ns	
Operating Junction and Storage Temperature Range		T _J , T _{stg}	- 55 to + 150	°C	
Soldering Recommendations (Peak Temperature)	for 10 s		300 ^d		

Notes


- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- V_{DD} = 50 V, starting T_J = 25 °C, L = 2.7 mH, R_g = 25 Ω, I_{AS} = 18 A (see fig. 12).
- I_{SD} ≤ 20 A, di/dt ≤ 150 A/μs, V_{DD} ≤ V_{DS}, T_J ≤ 150 °C.
- 1.6 mm from case.

* Pb containing terminations are not RoHS compliant, exemptions may apply

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient (PCB Mounted, Steady-State) ^a	R _{thJA}	-	40	°C/W
Maximum Junction-to-Case (Drain)	R _{thJC}	-	1.0	

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material).

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		200	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA ^c		-	0.29	-	V/°C
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2.0	-	4.0	V
Gate-Source Leakage	I _{GSS}	V _{GS} = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 200 V, V _{GS} = 0 V		-	-	25	μA
		V _{DS} = 160 V, V _{GS} = 0 V, T _J = 125 °C		-	-	250	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 11 A ^b	-	-	0.09	Ω
Forward Transconductance	g _{fs}	V _{DS} = 50 V, I _D = 11 A ^d		6.7	-	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5 ^d		-	1300	-	pF
Output Capacitance	C _{oss}			-	430	-	
Reverse Transfer Capacitance	C _{rss}			-	130	-	
Total Gate Charge	Q _g	V _{GS} = 10 V	I _D = 20 A, V _{DS} = 160 V, see fig. 6 and 13 ^{b, c}	-	-	70	nC
Gate-Source Charge	Q _{gs}			-	-	13	
Gate-Drain Charge	Q _{gd}			-	-	39	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 100 V, I _D = 20 A, R _g = 9.1 Ω, R _D = 5.4 Ω, see fig. 10 ^{b, c}		-	14	-	ns
Rise Time	t _r			-	51	-	
Turn-Off Delay Time	t _{d(off)}			-	45	-	
Fall Time	t _f			-	36	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	20	A
Pulsed Diode Forward Current ^a	I _{SM}			-	-	72	
Body Diode Voltage	V _{SD}	T _J = 25 °C, I _S = 20 A, V _{GS} = 0 V ^b		-	-	2.0	V
Body Diode Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = 20 A, di/dt = 100 A/μs ^{b, c}		-	300	610	ns
Body Diode Reverse Recovery Charge	Q _{rr}			-	3.4	7.1	μC
Forward Turn-On Time	t _{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L _S and L _D)					

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- b. Pulse width ≤ 300 μs; duty cycle ≤ 2 %.
- c. Uses IRF640/SiHF640 data and test conditions.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

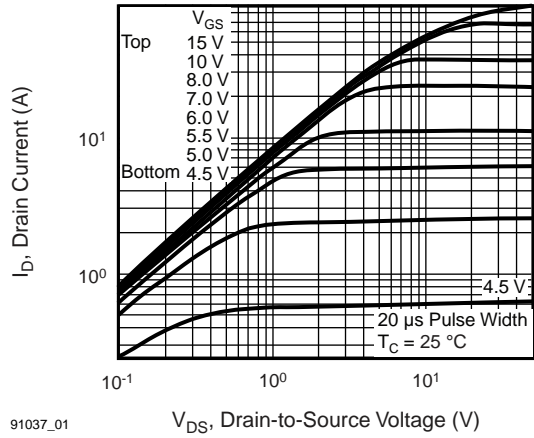


Fig. 1 - Typical Output Characteristics, $T_J = 25\text{ }^\circ\text{C}$

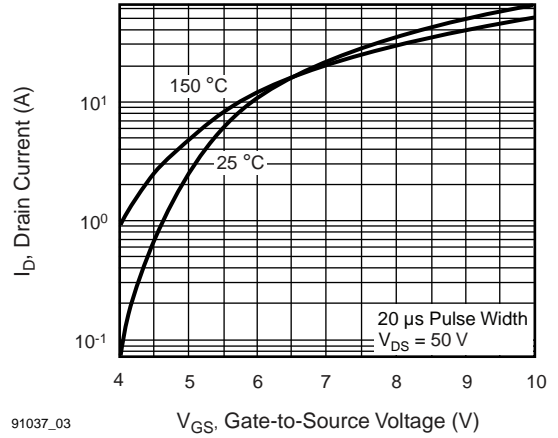


Fig. 3 - Typical Transfer Characteristics

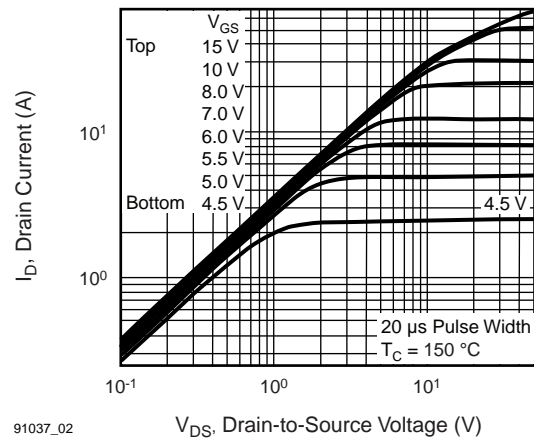


Fig. 2 - Typical Output Characteristics, $T_J = 175\text{ }^\circ\text{C}$

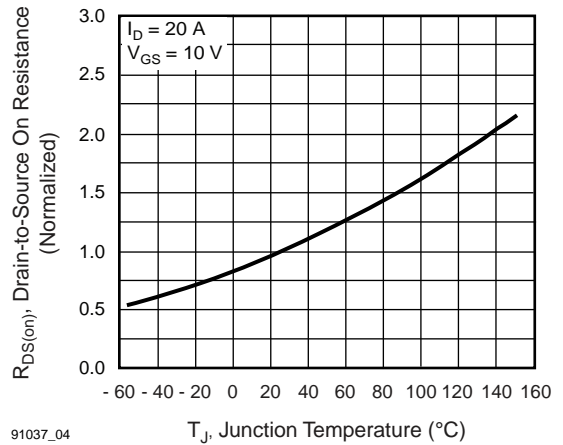


Fig. 4 - Normalized On-Resistance vs. Temperature

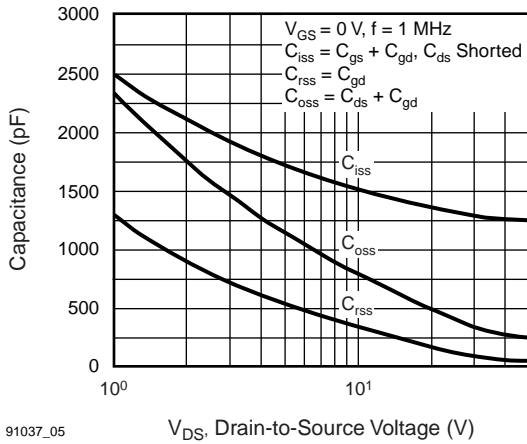


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

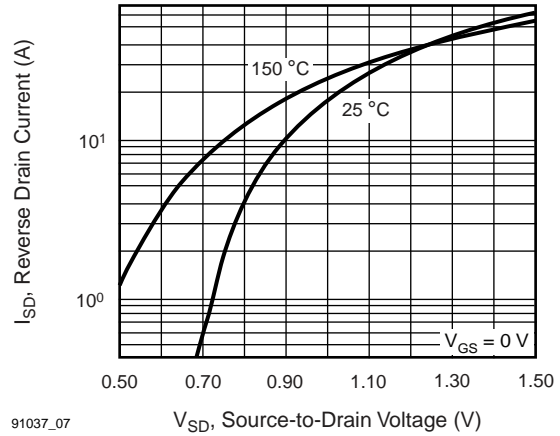


Fig. 7 - Typical Source-Drain Diode Forward Voltage



Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

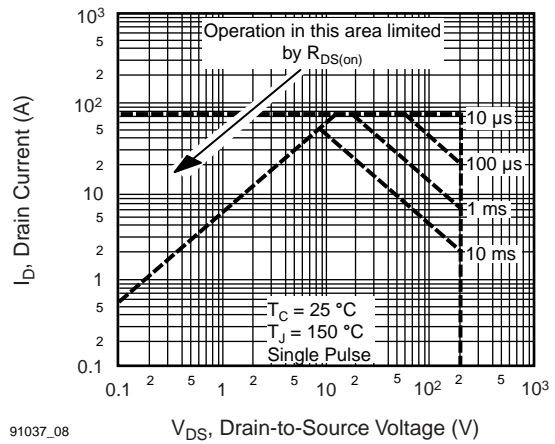
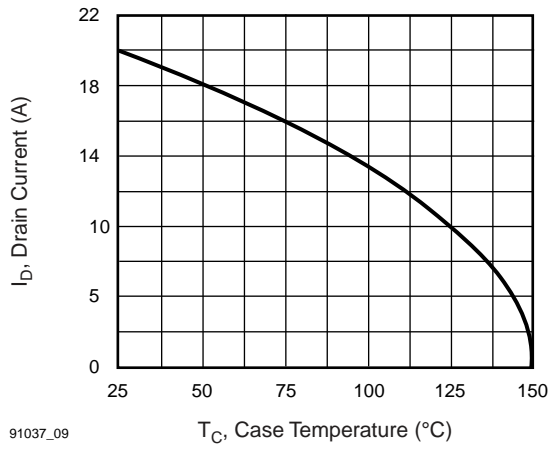


Fig. 8 - Maximum Safe Operating Area



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Fig. 9 - Maximum Drain Current vs. Case Temperature

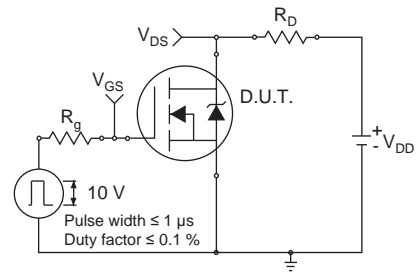


Fig. 10a - Switching Time Test Circuit

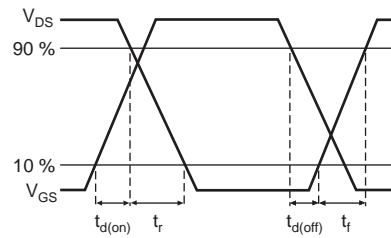
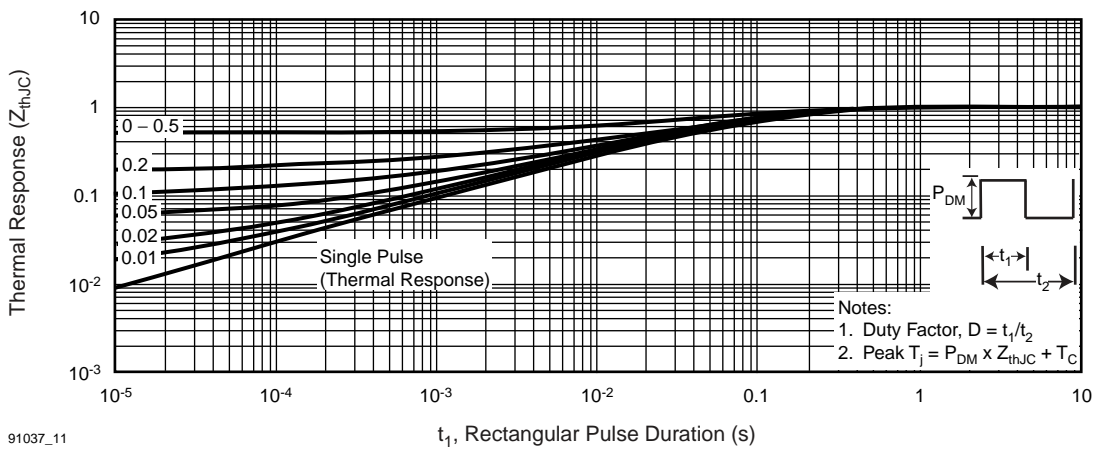


Fig. 10b - Switching Time Waveforms



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Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

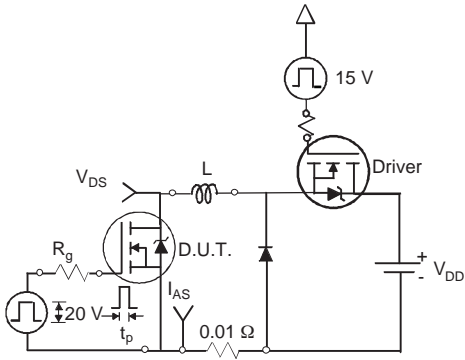
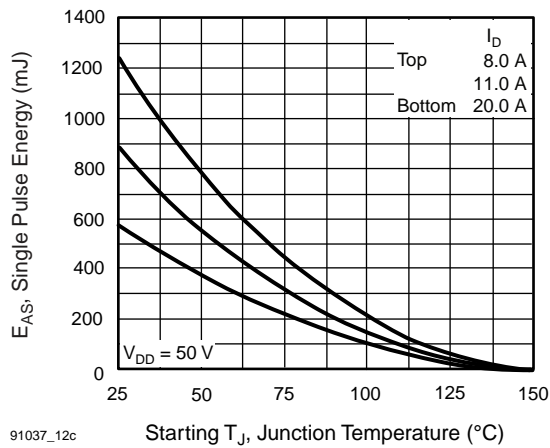


Fig. 12a - Unclamped Inductive Test Circuit



Fig. 12b - Unclamped Inductive Waveforms



91037_12c

Fig. 12c - Maximum Avalanche Energy vs. Drain Current

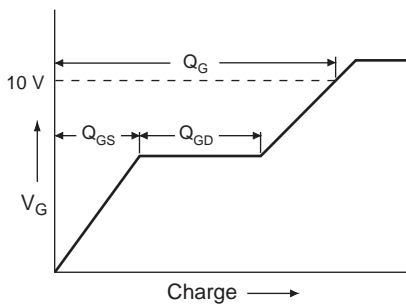


Fig. 13a - Basic Gate Charge Waveform

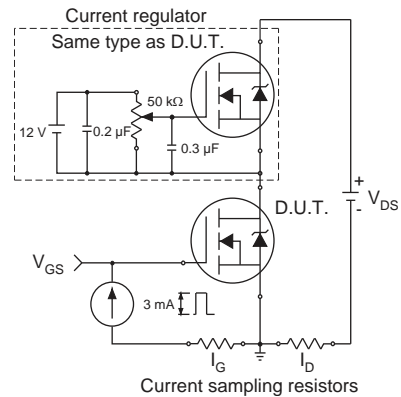
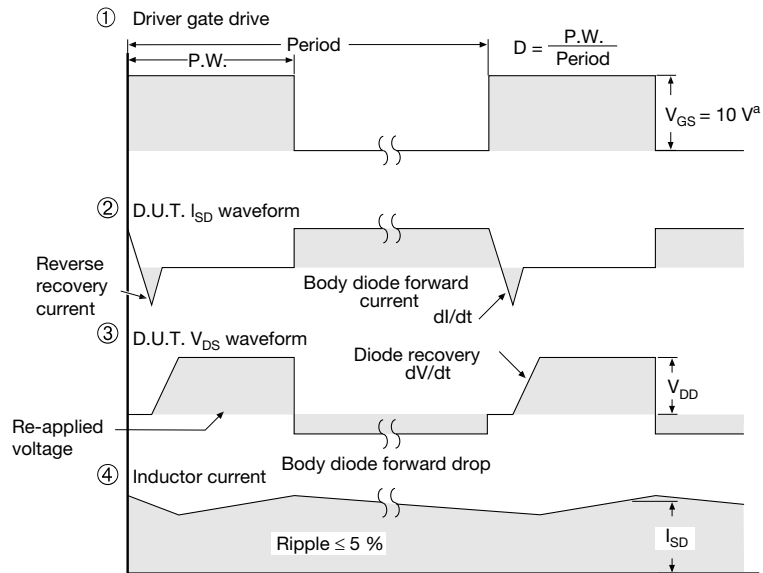


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

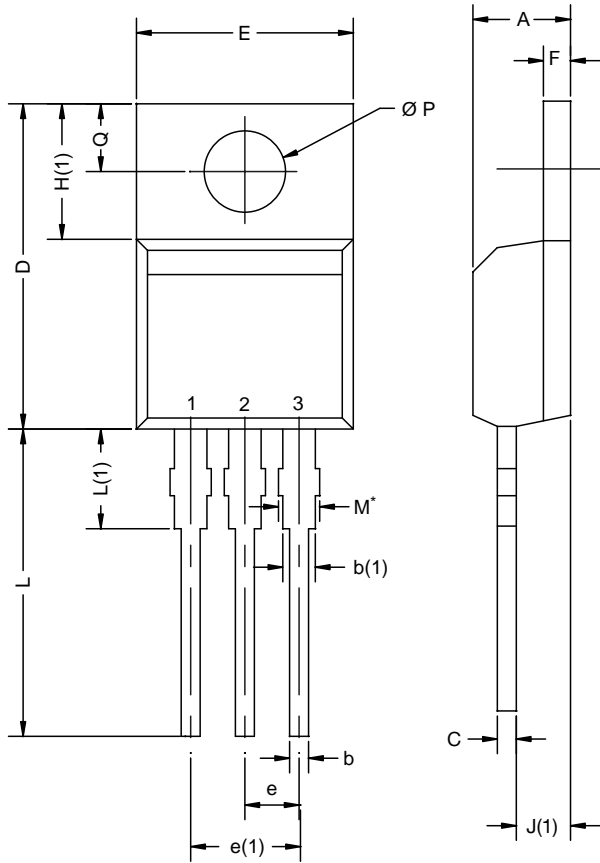


Note

a. $V_{GS} = 5 V$ for logic level devices

Fig. 14 - For N-Channel

TO-220AB



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

ECN: X12-0208-Rev. N, 08-Oct-12
DWG: 5471

Notes

* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heatsink hole for HVM

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