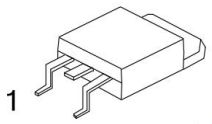
P-Channel 60-V(D-S) Enhancement Mode Field Effect Transistor

V(BR)DSS	RDS(on)MAX	ID
-60 V	200mΩ@ -10 V	-8.8A

Equivalent Circuit:



TO-252

1.GATE
2.DRAIL
3.SOURCF

General Description:

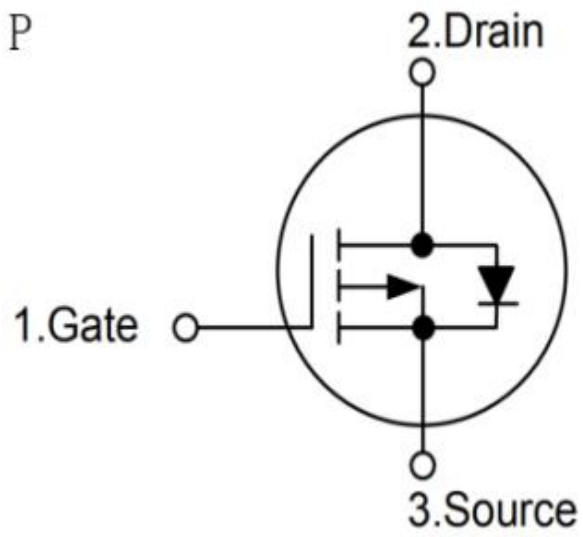
Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The is designed for surface mounting using vapor phase, infrared, or wave soldering techniques. The straight lead version (IRFR series) is for through-hole mounting applications. Power dissipation levels up to 1.5 W are possible in typical surface mount applications.

FEATURE:

※ Surface Mount
※ Straight Lead
※ Available in Tape and Reel
※ Fast Switching
※ Repetitive Avalanche Rated
※ Simple Drive Requirements
※ Lead (Pb)-free Available.
※ Dynamic dV/dt Rating
※ Ultra Low On-Resistance

SYMBOL :



Maximum ratings (Ta=25℃ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	**VDS**	**-60**	V
Gate-Source Voltage	**VGS**	**±20**	
Continuous Drain Current	**ID**	**-8.8**	A
Pulsed Diode Curren	**IDM**	**-35**	
Linear Derating Factor		**0.33**	W/°C
Linear Derating Factor (PCB Mount)		**0.02**	W/°C
Power Dissipation	**PD**	**50**	W
Thermal Resistance from Junction to Ambient (t≤10s)	**RθJA**	**45**	℃/W
Single Pulse Avalanche Energy	**EAS**	**300**	mJ
Repetitive Avalanche Current	**I AR**	**-8.8**	A
Repetitive Avalanche Energy	**EAR**	**5.0**	mJ
Peak Diode Recovery dV/dt	**dV/dt**	**-4.5**	V/ns
Maximum Junction-to-Ambient	**RthJA**	**110**	℃/W
Operating Junction	**TJ**	**150**	℃
Storage Temperature	**TSTG**	**-55~+155**	

Notes：

1.Repetitive rating; pulse width limited by maximum junction temperature

2.VDD = 25 V, starting TJ = 25 °C, L = 4.5 μH, RG = 25 Ω, IAS = -8.8 A

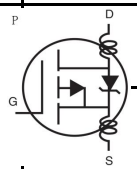
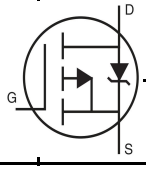
3.ISD ≤ -11 A, dI/dt ≤ 140 A/μs, VDD ≤ VDS,

4.1.6 mm from case.

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

MOSFET ELECTRICAL CHARACTERISTICS

Static Electrical Characteristics (Ta = 25 ℃ Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static						
Drain-source breakdown voltage	**V(BR)DSS**	VGS = 0V, ID = - 250μA	**-60**			V
Gate-source threshold voltage	**VGS(th)**	VDS =VGS, ID = -250μA	**-2**		**-4**	V
Gate-source leakage	**IGSS**	VDS =0V, VGS = ±20V			**±100**	nA
Zero gate voltage drain current	**IDSS**	VDS = -60V, VGS =0V			**-100**	μA
Drain-source on-state resistancea	**RDS(on)**	VGS = -10V, ID = -5.3A		**75**	**200**	mΩ
Forward transconductancea	**gfs**	VDS = -25V, ID = -5.3A	**2.9**			S
Diode forward voltage	**VSD**	IS= -7.2A, VGS=0V			**-1.8**	V
Dynamic						
Input capacitance	**Ciss**	VDS = -25V, VGS =0V, f=1MHz		**570**		pF
Output capacitance	**Coss**			**360**		pF
Reverse transfer capacitanceb	**Crss**			**65**		pF
Total gate charge	**Qg**	VDS = -48V, VGS = -10V, ID = -11A			**19**	nC
Gate-source charge	**Qgs**				**5.4**	nC
Gate-drain charge	**Qgd**				**11**	nC
Gate resistance	**Rg**	f=1MHz				Ω
Switchingb						
Turn-on delay time	**td(on)**	VDD= -30V RD=3Ω, ID = -11A, VGEN= -10V,Rg= 18Ω		**13**		ns
Rise time	**tr**			**68**		ns
Turn-off delay time	**td(off)**			**15**		ns
Fall time	**tf**			**29**		ns
Internal Drain Inductance	**LD**	Between lead, 6 mm (0.25") from package and center of die contact 		**4.5**		nH
Internal Source Inductance	**LS**			**7.5**		nH
Drain-Source Diode Characteristics						
Reverse Recovery Time	**trr**	IF= -11A, dI/dt=100A/s		**100**	**200**	ns
Reverse Recovery Charde	**Qrr**	IF= -11A, dI/dt=100A/s		**0.32**	**0.64**	μC
Continuous Source-Drain Diode Curre	**IS**	MOSFET symbol showing the integral reverse p - n junction diode 			**-8.8**	A
Pulsed Diode Forward Current	**ISM**				**-35**	A

TYPICAL CHARACTERISTICS :

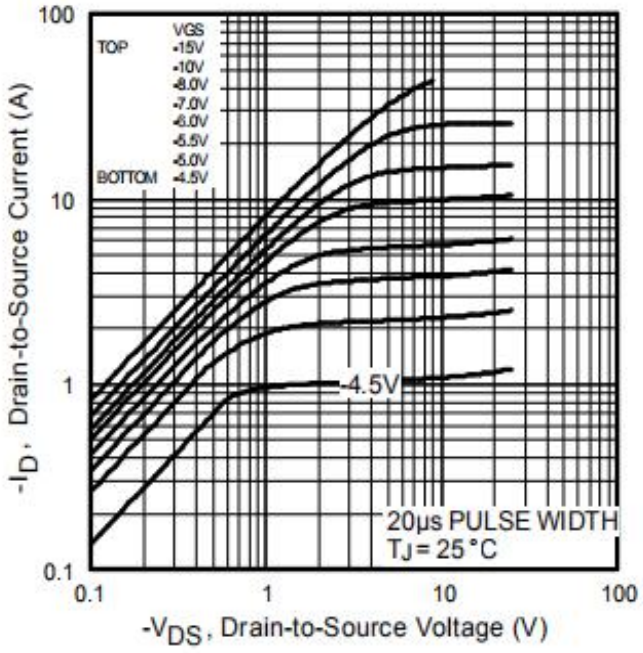


Fig 1. Typical Output Characteristics

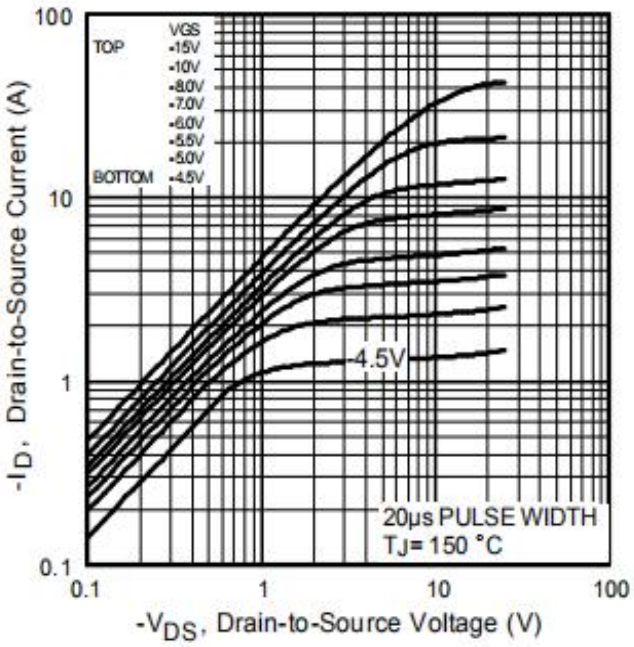


Fig 2. Typical Output Characteristics

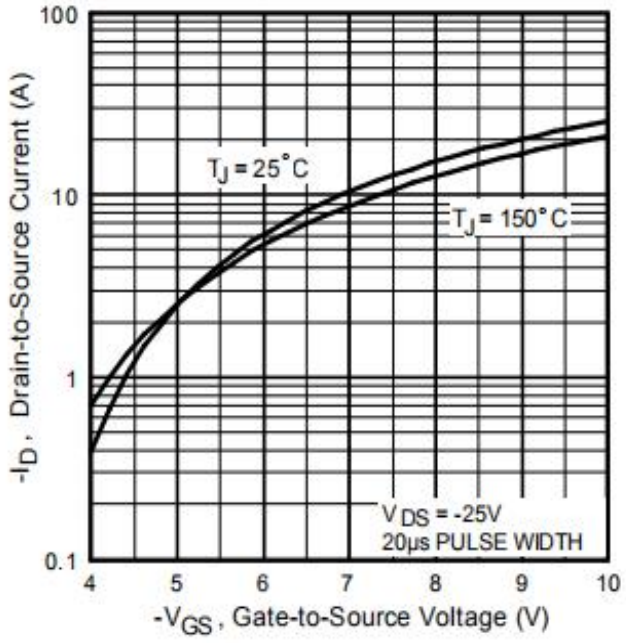


Fig 3. Typical Transfer Characteristics

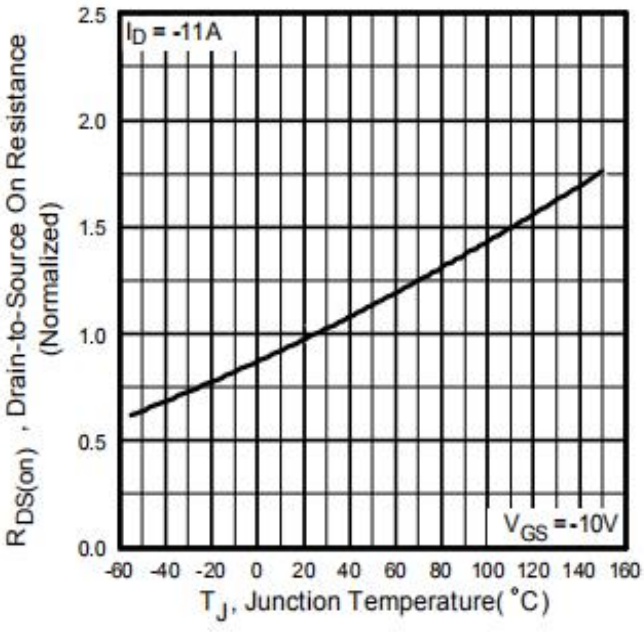


Fig 4. Normalized On-Resistance Vs. Temperature

TYPICAL CHARACTERISTICS :

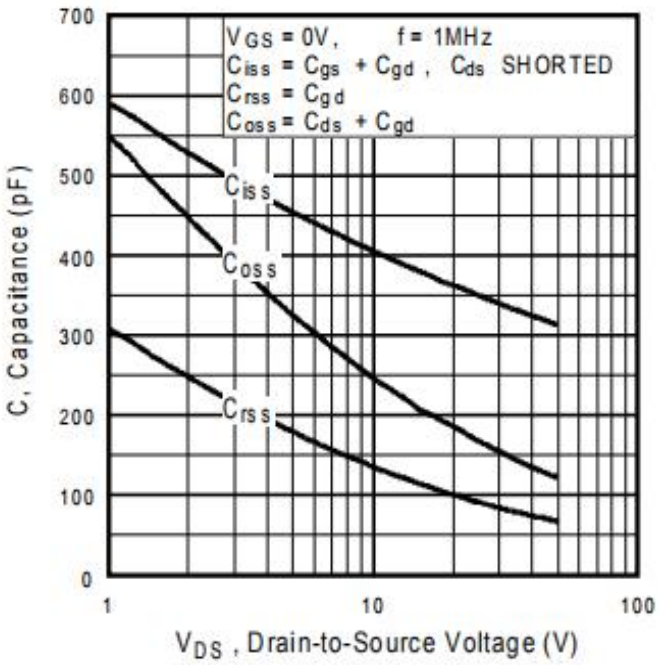


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

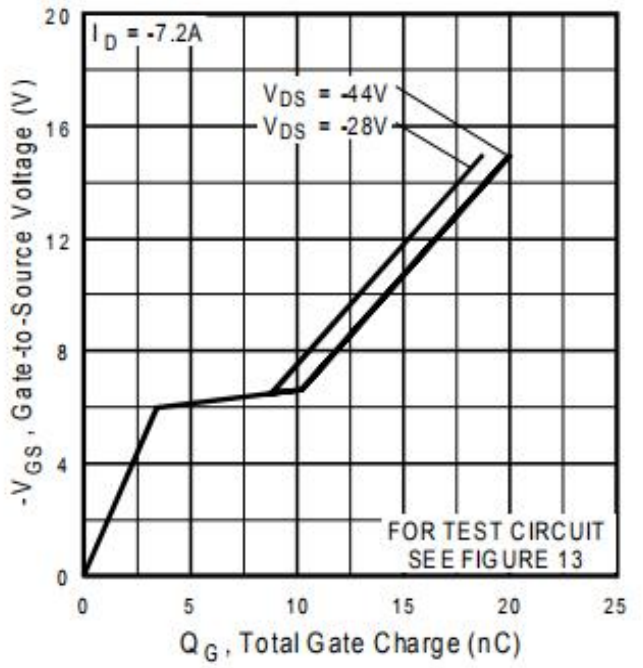


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

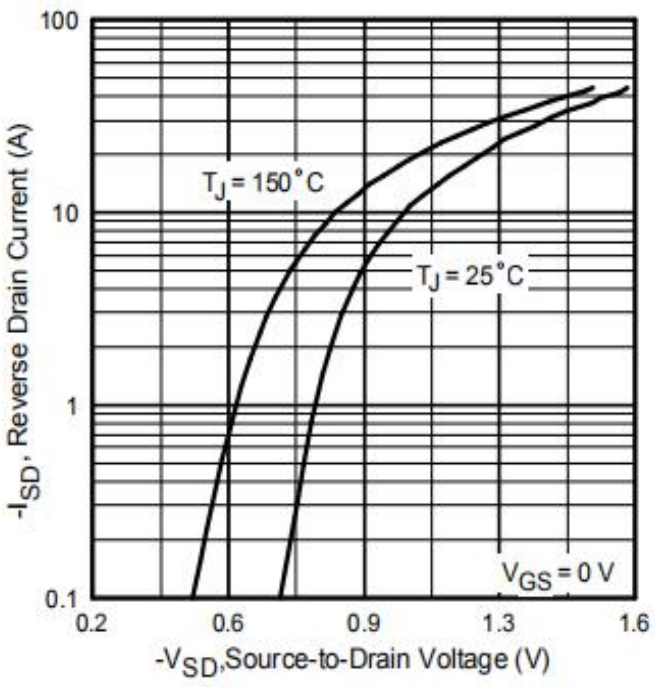


Fig 7. Typical Source-Drain Diode Forward Voltage

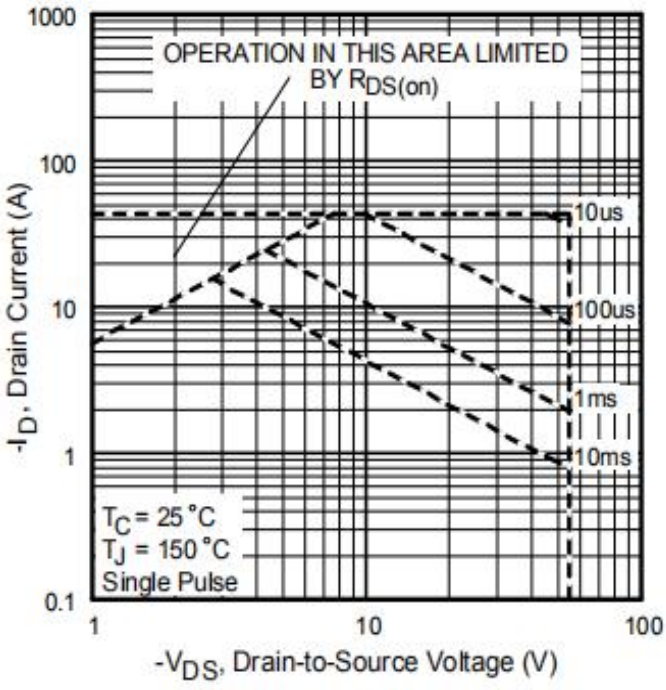


Fig 8. Maximum Safe Operating Area

TYPICAL CHARACTERISTICS :

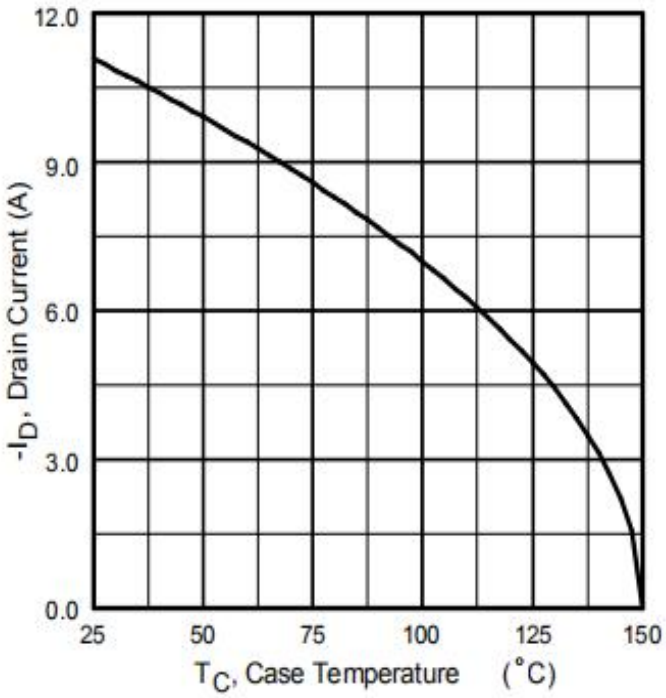


Fig 9. Maximum Drain Current Vs. Case Temperature

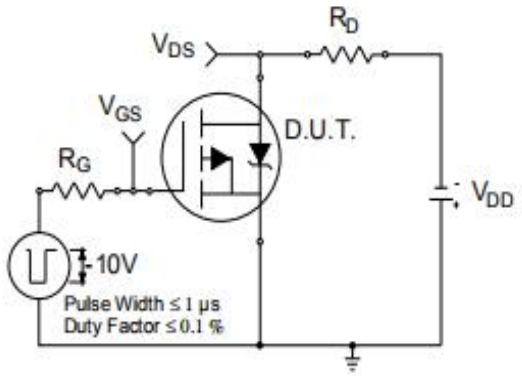


Fig 10a. Switching Time Test Circuit

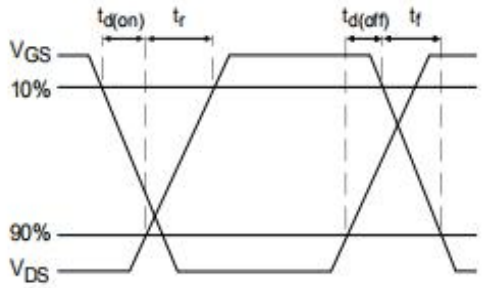


Fig 10b. Switching Time Waveforms

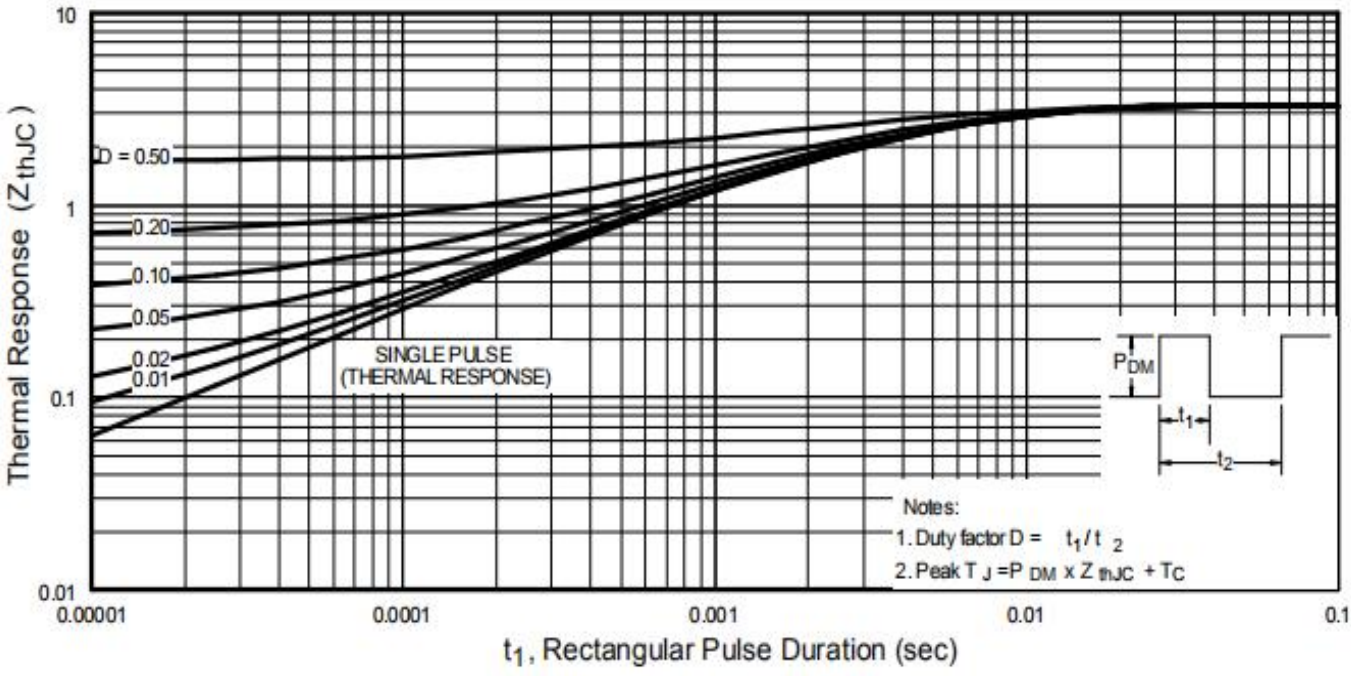


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

TYPICAL CHARACTERISTICS :

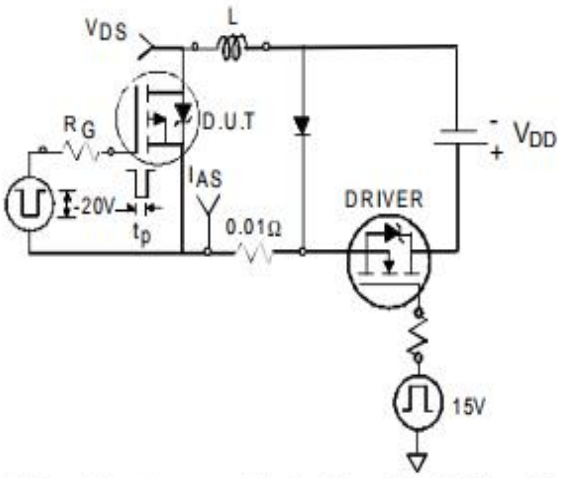


Fig 12a. Unclamped Inductive Test Circuit

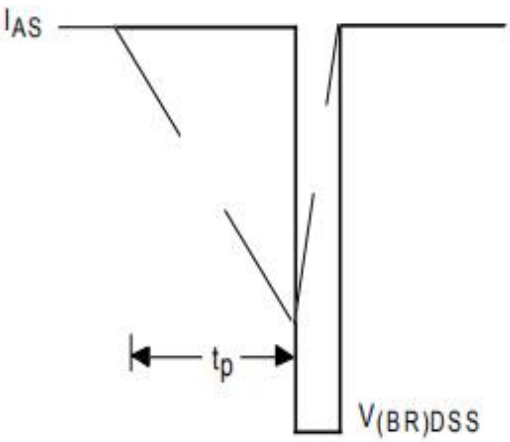


Fig 12b. Unclamped Inductive Waveforms

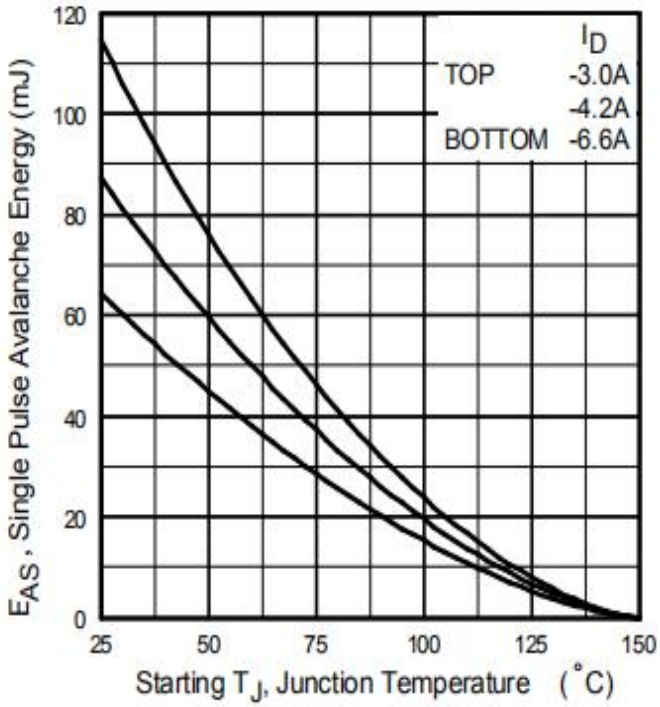


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

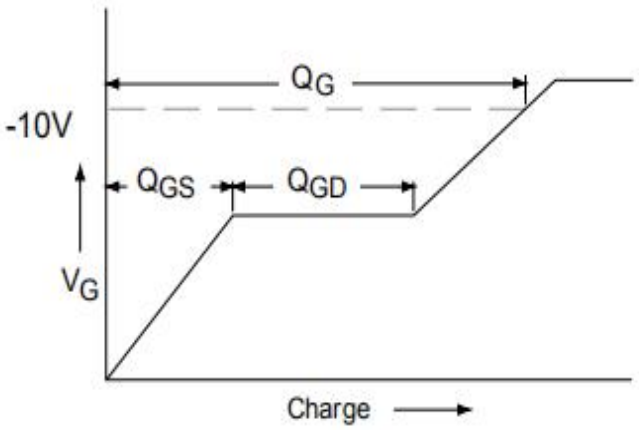


Fig 13a. Basic Gate Charge Waveform

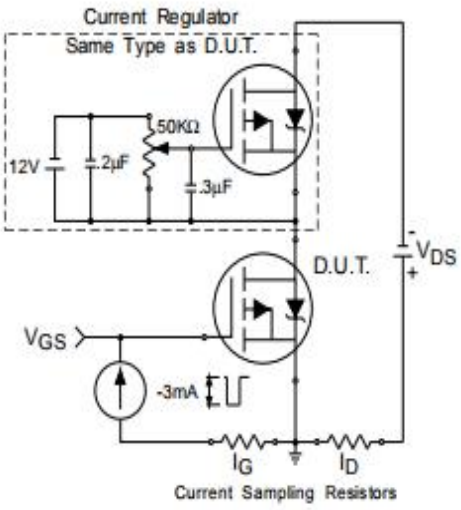


Fig 13b. Gate Charge Test Circuit

TYPICAL CHARACTERISTICS :

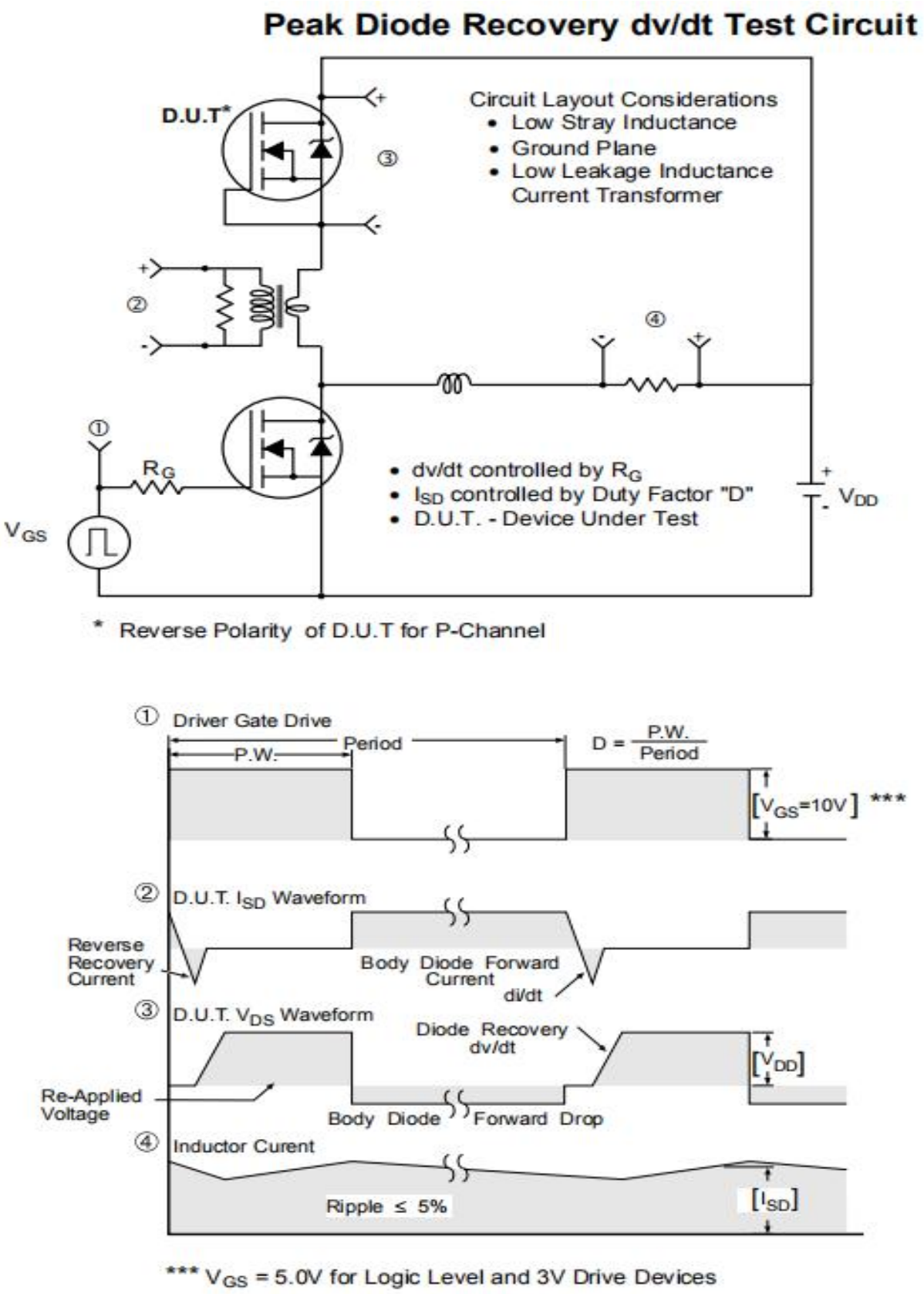
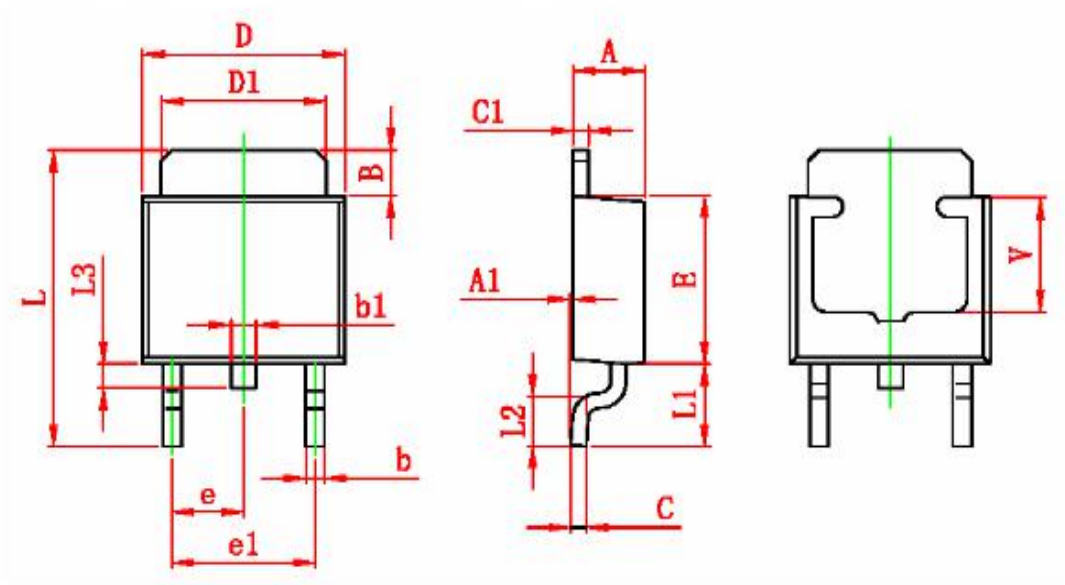


Fig 14. For P-Channel HEXFETS

PACKAGE OUTLINE DIMENSIONS :



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
B	1.350	1.650	0.053	0.065
b	0.500	0.700	0.020	0.028
b1	0.700	0.900	0.028	0.035
c	0.430	0.580	0.017	0.023
c1	0.430	0.580	0.017	0.023
D	6.350	6.650	0.250	0.262
D1	5.200	5.400	0.205	0.213
E	5.400	5.700	0.213	0.224
e	2.300 TYP		0.091 TYP	
e1	4.500	4.700	0.177	0.185
L	9.500	9.900	0.374	0.390
L1	2.550	2.900	0.100	0.114
L2	1.400	1.780	0.055	0.070
L3	0.350	0.650	0.014	0.026
V	3.80 REF		0.150 REF	

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