

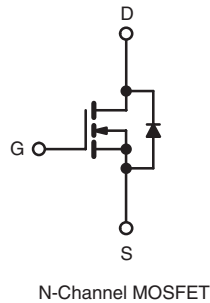
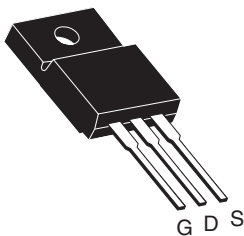


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# Power MOSFET

PRODUCT SUMMARY		
V <sub>DS</sub> (V)	200	
R <sub>DS(on)</sub> (Ω)	V <sub>GS</sub> = 10 V	0.18
Q <sub>g</sub> (Max.) (nC)	70	
Q <sub>gs</sub> (nC)	13	
Q <sub>gd</sub> (nC)	39	
Configuration	Single	

TO-220 FULLPAK



## FEATURES

- Isolated Package
- High Voltage Isolation = 2.5 kV<sub>RMS</sub> (t = 60 s; f = 60 Hz)
- Sink to Lead Creepage Distance = 4.8 mm
- Dynamic dV/dt Rating
- Low Thermal Resistance
- Lead (Pb)-free Available



RoHS\* COMPLIANT

## 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 TO-220 FULLPAK eliminates the need for additional insulating hardware in commercial-industrial applications. The molding compound used provides a high isolation capability and a low thermal resistance between the tab and external heatsink. The isolation is equivalent to using a 100 micron mica barrier with standard TO-220 product. The FULLPAK is mounted to a heatsink using a single clip or by a single screw fixing.

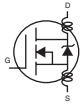

ORDERING INFORMATION	
Package	TO-220 FULLPAK
Lead (Pb)-free	IRFI640GPbF SiHFI640G-E3
SnPb	IRFI640G SiHFI640G

ABSOLUTE MAXIMUM RATINGS T <sub>C</sub> = 25 °C, unless otherwise noted				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	V <sub>DS</sub>	200	V	
Gate-Source Voltage	V <sub>GS</sub>	± 20		
Continuous Drain Current	V <sub>GS</sub> at 10 V	T <sub>C</sub> = 25 °C	9.8	A
		T <sub>C</sub> = 100 °C	6.2	
Pulsed Drain Current <sup>a</sup>	I <sub>DM</sub>	39		
Linear Derating Factor		0.32	W/°C	
Single Pulse Avalanche Energy <sup>b</sup>	E <sub>AS</sub>	430	mJ	
Repetitive Avalanche Current <sup>a</sup>	I <sub>AR</sub>	9.8	A	
Repetitive Avalanche Energy <sup>a</sup>	E <sub>AR</sub>	4.0	mJ	
Maximum Power Dissipation	T <sub>C</sub> = 25 °C	P <sub>D</sub>	40	W
Peak Diode Recovery dV/dt <sup>c</sup>	dV/dt	5.0	V/ns	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to + 150	°C	
Soldering Recommendations (Peak Temperature)	for 10 s	300 <sup>d</sup>		
Mounting Torque	6-32 or M3 screw		10	lbf · in
			1.1	N · m

### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- V<sub>DD</sub> = 50 V, starting T<sub>J</sub> = 25 °C, L = 6.7 mH, R<sub>G</sub> = 25 Ω, I<sub>AS</sub> = 9.8 A (see fig. 12).
- I<sub>SD</sub> ≤ 18 A, di/dt ≤ 150 A/μs, V<sub>DD</sub> ≤ V<sub>DS</sub>, T<sub>J</sub> ≤ 150 °C.
- 1.6 mm from case.

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	65	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	3.1	

SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		200	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$		-	0.29	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.0	-	4.0	V
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$		-	-	25	$\mu\text{A}$
		$V_{DS} = 160\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 5.9\text{ A}^b$	-	-	0.18	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 50\text{ V}, I_D = 5.9\text{ A}^b$		5.2	-	-	S
<b>Dynamic</b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V},$ $V_{DS} = 25\text{ V},$ $f = 1.0\text{ MHz}$ , see fig. 5		-	1300	-	pF
Output Capacitance	$C_{oss}$			-	400	-	
Reverse Transfer Capacitance	$C_{rss}$			-	130	-	
Drain to Sink Capacitance	$C$	$f = 1.0\text{ MHz}$		-	12	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$	$I_D = 18\text{ A}, V_{DS} = 160\text{ V},$ see fig. 6 and 13 <sup>b</sup>	-	-	70	nC
Gate-Source Charge	$Q_{GS}$			-	-	13	
Gate-Drain Charge	$Q_{GD}$			-	-	39	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 100\text{ V}, I_D = 18\text{ A},$ $R_G = 9.1\text{ }\Omega, R_D = 5.4\text{ }\Omega,$ see fig. 10 <sup>b</sup>		-	14	-	ns
Rise Time	$t_r$			-	51	-	
Turn-Off Delay Time	$t_{d(off)}$			-	45	-	
Fall Time	$t_f$			-	36	-	
Internal Drain Inductance	$L_D$	Between lead, 6 mm (0.25") from package and center of die contact 		-	4.5	-	nH
Internal Source Inductance	$L_S$			-	7.5	-	
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	9.8	A
Pulsed Diode Forward Current <sup>a</sup>	$I_{SM}$			-	-	39	
Body Diode Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 9.8\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	2.0	V
Body Diode Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = 18\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$		-	300	610	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			-	3.4	7.1	$\mu\text{C}$
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  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2$



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**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

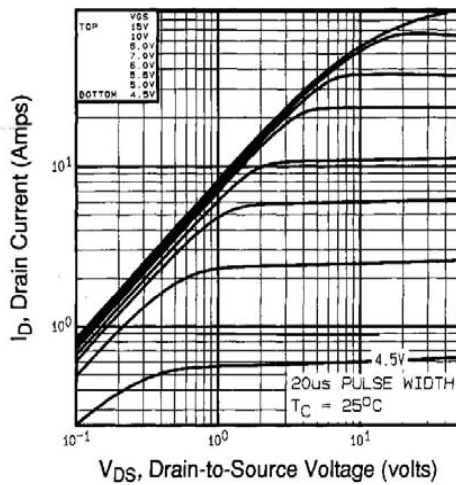


Fig. 1 - Typical Output Characteristics, T<sub>C</sub> = 25 °C

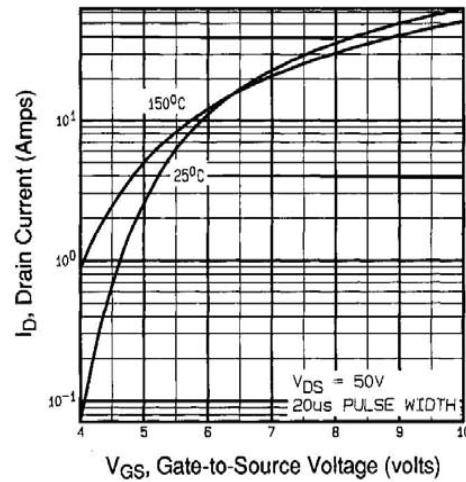


Fig. 3 - Typical Transfer Characteristics

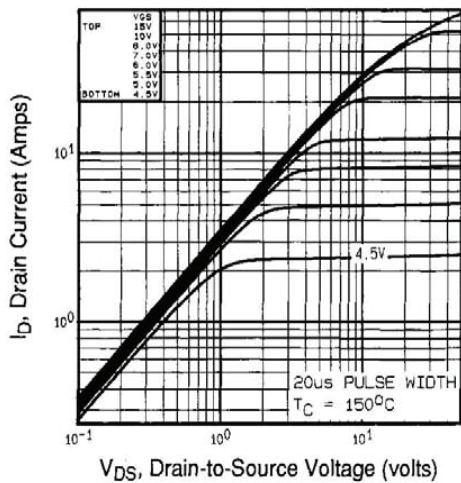


Fig. 2 - Typical Output Characteristics, T<sub>C</sub> = 150 °C

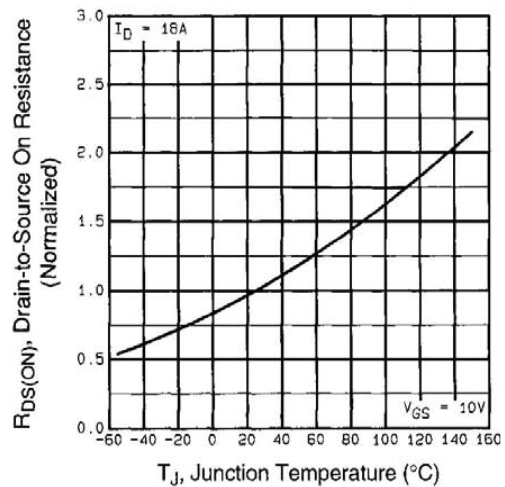


Fig. 4 - Normalized On-Resistance vs. Temperature

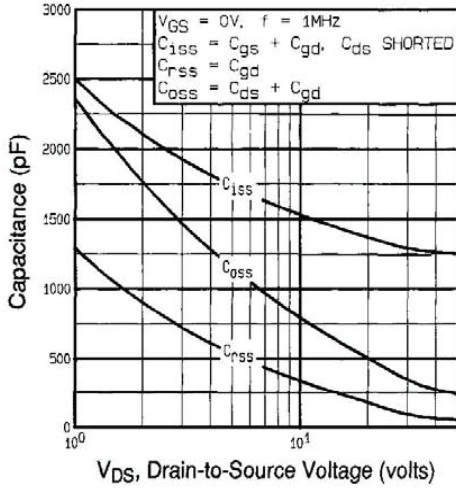


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

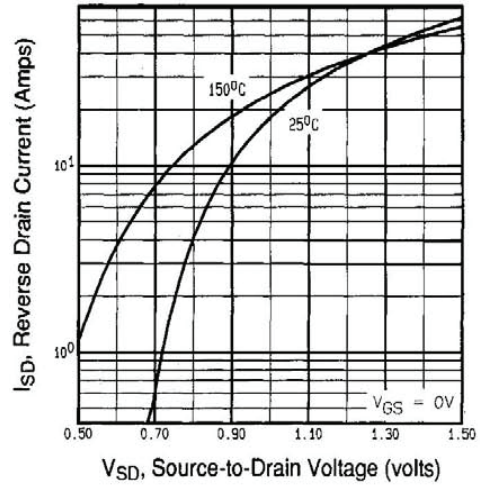


Fig. 7 - Typical Source-Drain Diode Forward Voltage

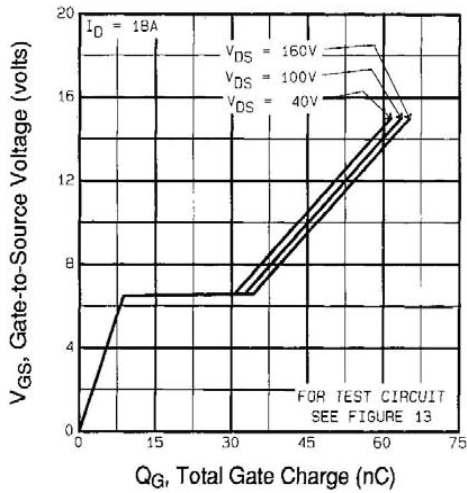


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

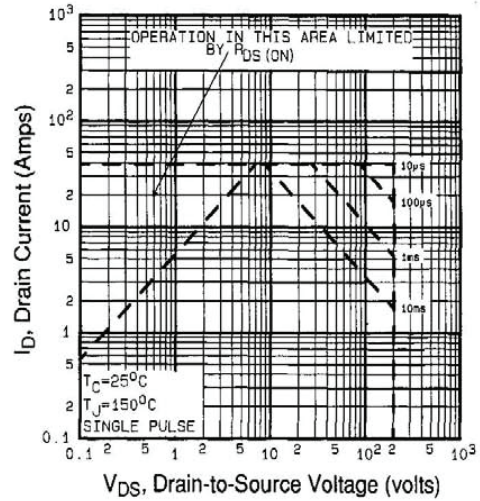
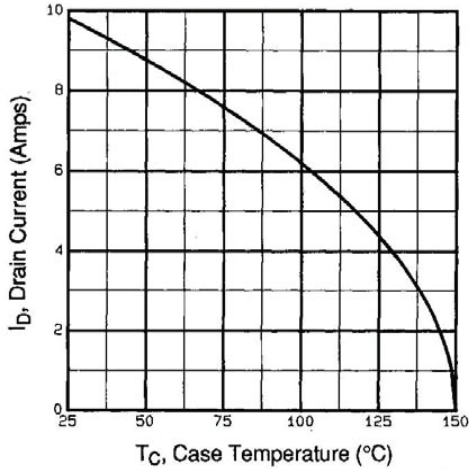
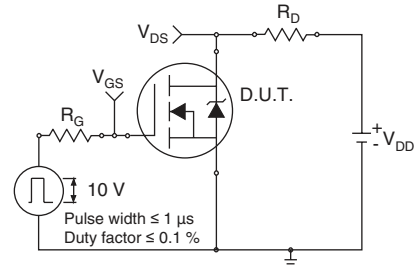


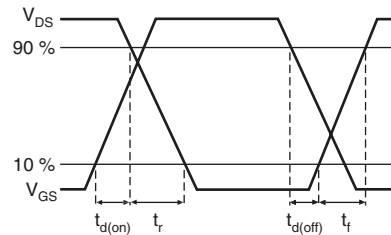
Fig. 8 - Maximum Safe Operating Area



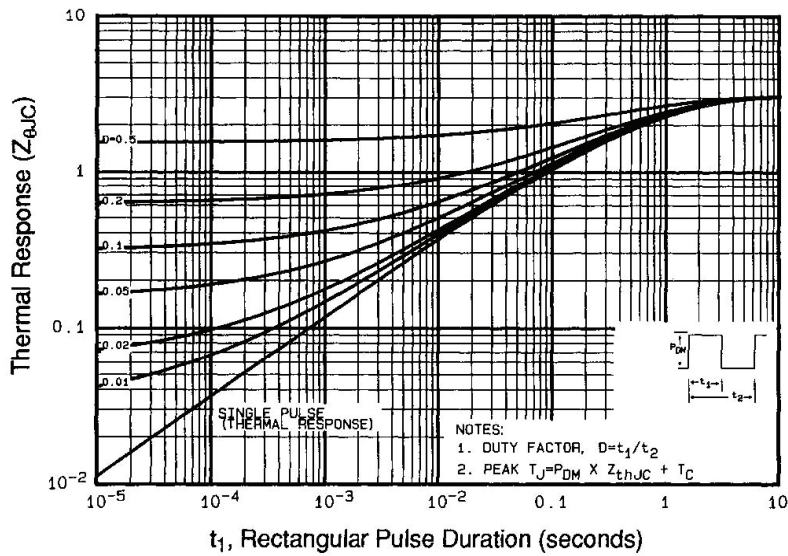
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



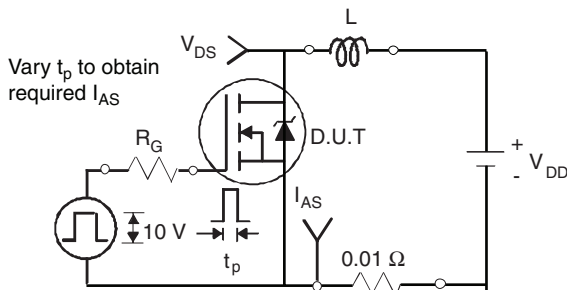
**Fig. 10a - Switching Time Test Circuit**



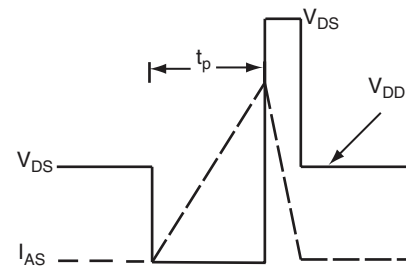
**Fig. 10b - Switching Time Waveforms**



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



**Fig. 12a - Unclamped Inductive Test Circuit**



**Fig. 12b - Unclamped Inductive Waveforms**

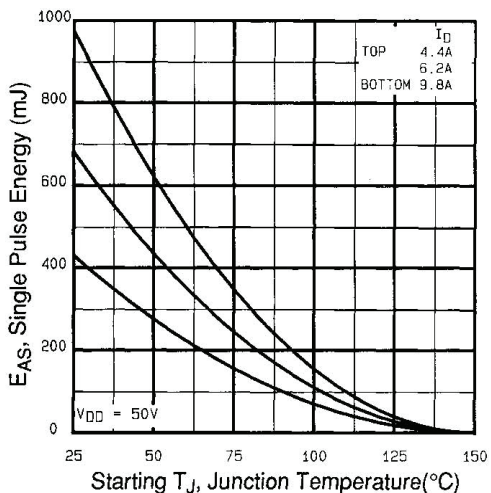


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

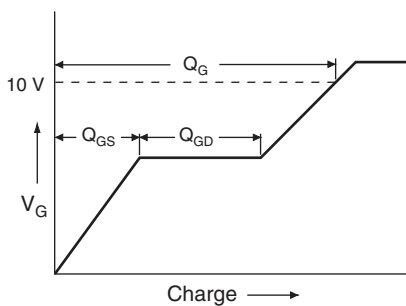


Fig. 13a - Basic Gate Charge Waveform

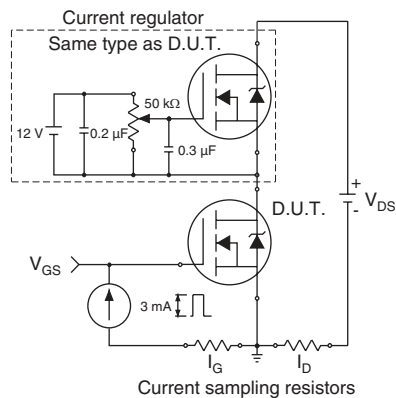


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

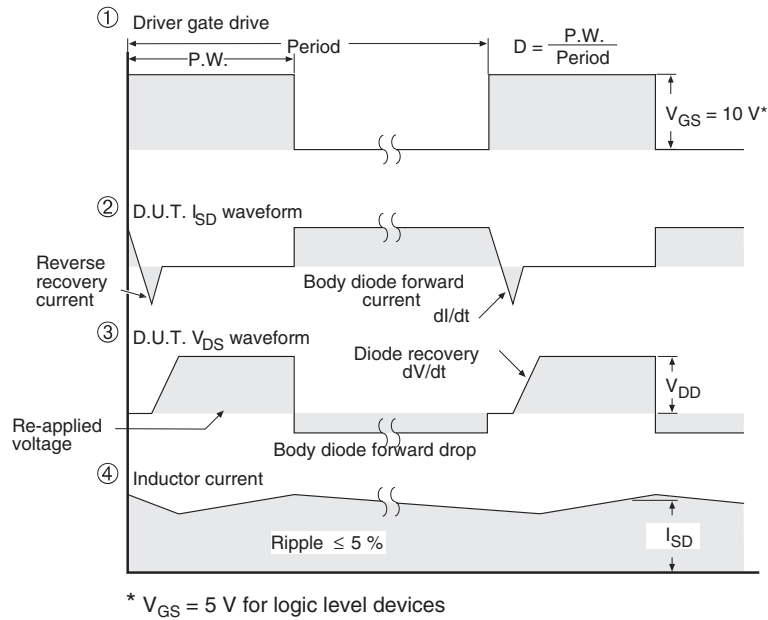
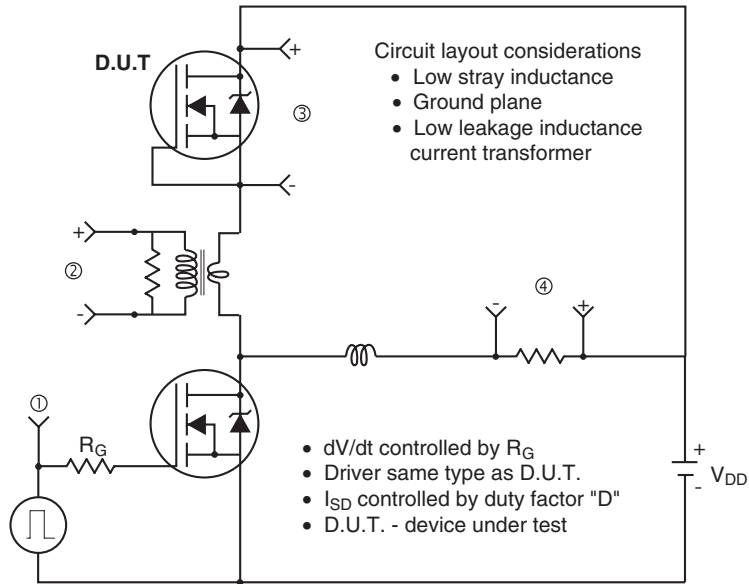


Fig. 14 - For N-Channel