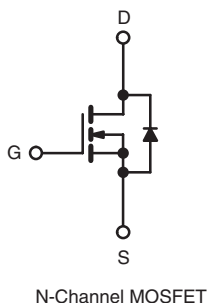
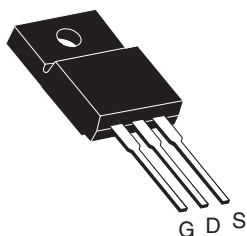


Power MOSFET

PRODUCT SUMMARY

V_{DS} (V)	200	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10$ V	0.18
Q_g (Max.) (nC)	70	
Q_{gs} (nC)	13	
Q_{gd} (nC)	39	
Configuration	Single	

TO-220 FULLPAK


FEATURES

- Isolated Package
- High Voltage Isolation = 2.5 kV_{RMS} (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 $T_C = 25$ °C, unless otherwise noted

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V_{DS}	200	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current	I_D	$T_C = 25$ °C	A
		$T_C = 100$ °C	
Pulsed Drain Current ^a	I_{DM}	39	
Linear Derating Factor		0.32	W/°C
Single Pulse Avalanche Energy ^b	E_{AS}	430	mJ
Repetitive Avalanche Current ^a	I_{AR}	9.8	A
Repetitive Avalanche Energy ^a	E_{AR}	4.0	mJ
Maximum Power Dissipation	P_D	40	W
Peak Diode Recovery dV/dt ^c	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	
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).
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, L = 6.7 mH, $R_G = 25$ Ω , $I_{AS} = 9.8$ A (see fig. 12).
- $I_{SD} \leq 18$ A, $dI/dt \leq 150$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °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	R_{thJA}	-	65	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	3.1	

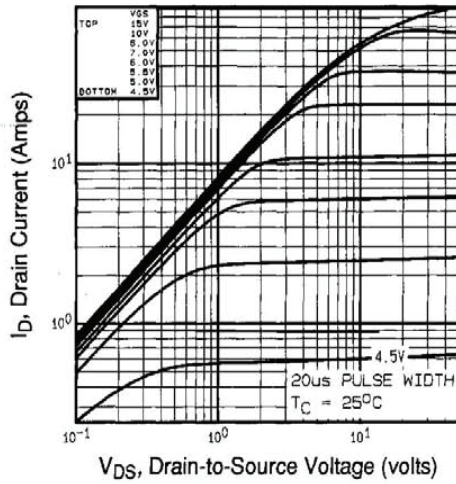
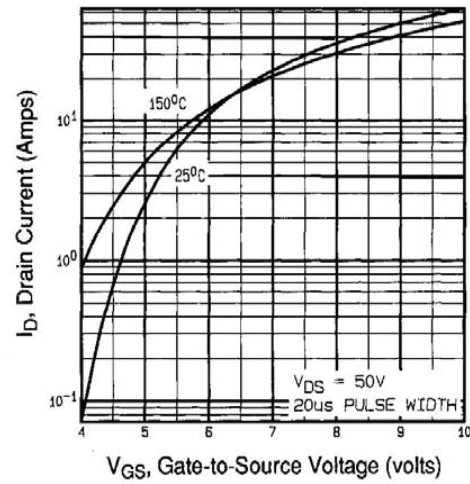
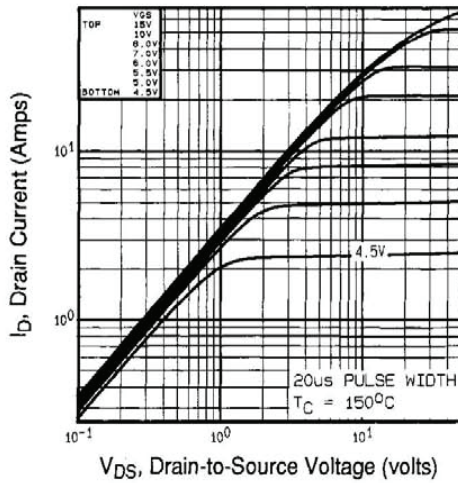
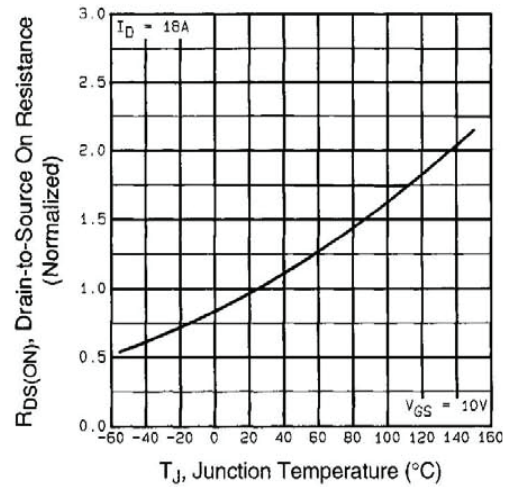
SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
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		-	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 = 5.9 A ^b	-	-	0.18	Ω
Forward Transconductance	g _{fs}	V _{DS} = 50 V, I _D = 5.9 A ^b		5.2	-	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 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 MHz		-	12	-	
Total Gate Charge	Q _g	V _{GS} = 10 V	I _D = 18 A, V _{DS} = 160 V, see fig. 6 and 13 ^b	-	-	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 = 18 A, R _G = 9.1 Ω, R _D = 5.4 Ω, see fig. 10 ^b		-	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	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	MOSFET symbol showing the integral reverse p - n junction diode		-	-	9.8	A
Pulsed Diode Forward Current ^a	I _{SM}			-	-	39	
Body Diode Voltage	V _{SD}	T _J = 25 °C, I _S = 9.8 A, V _{GS} = 0 V ^b		-	-	2.0	V
Body Diode Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = 18 A, dI/dt = 100 A/μs ^b		-	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 $\leq 300\text{ }\mu\text{s}$; duty cycle ≤ 2

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

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

Fig. 3 - Typical Transfer Characteristics

Fig. 2 - Typical Output Characteristics, $T_C = 150^\circ\text{C}$

Fig. 4 - Normalized On-Resistance vs. Temperature

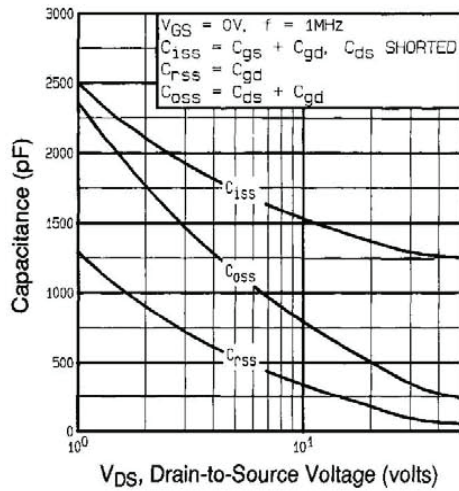


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

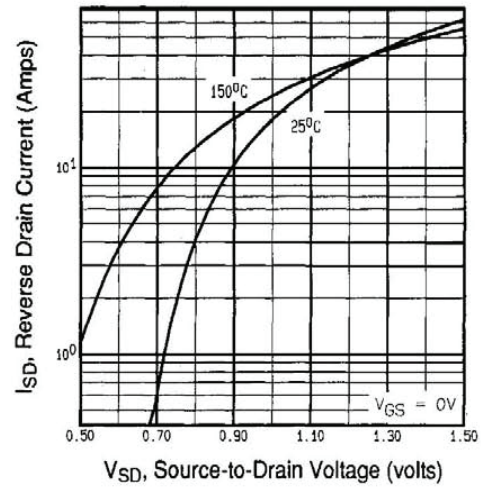


Fig. 7 - Typical Source-Drain Diode Forward Voltage

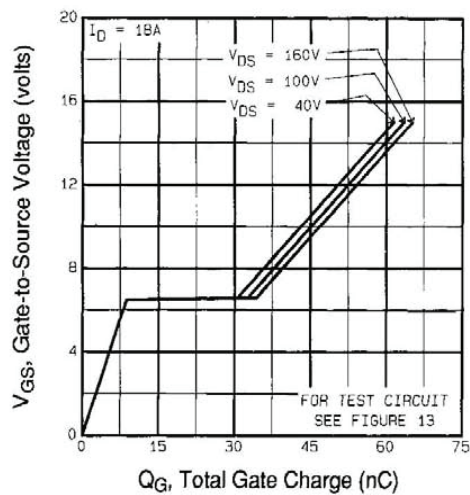


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

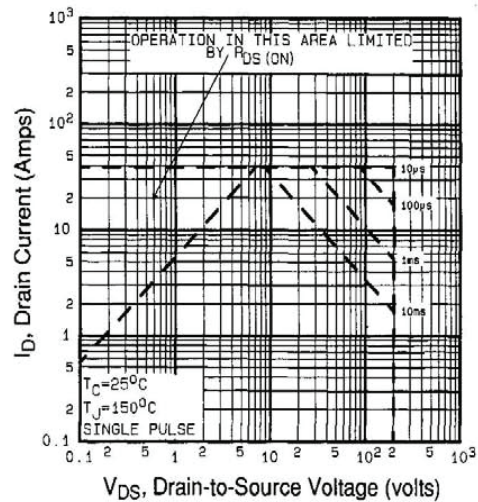


Fig. 8 - Maximum Safe Operating Area

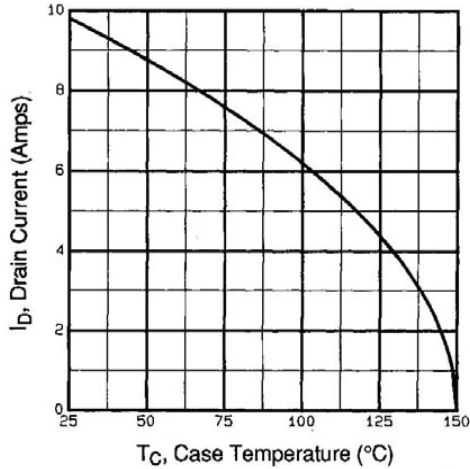


Fig. 9 - Maximum Drain Current vs. Case Temperature



Fig. 10a - Switching Time Test Circuit



Fig. 10b - Switching Time Waveforms

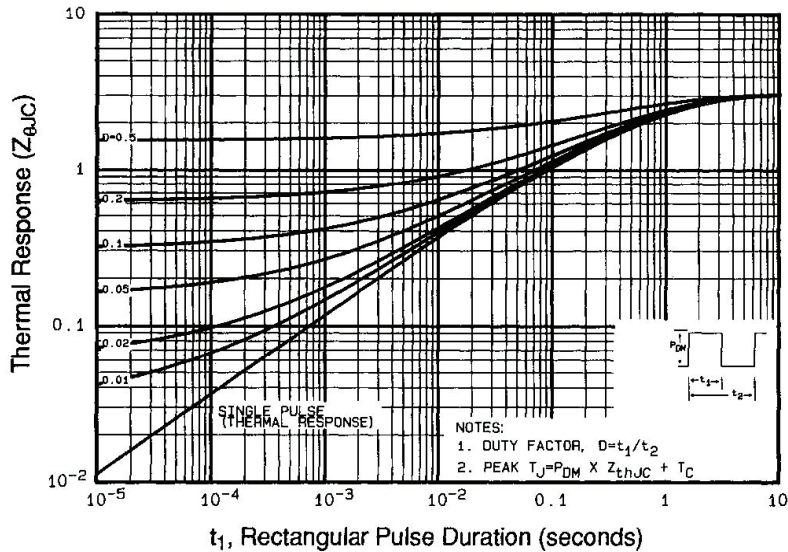


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

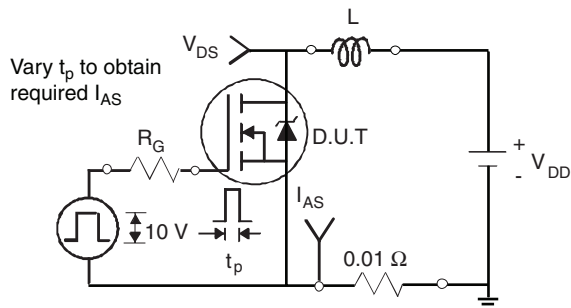


Fig. 12a - Unclamped Inductive Test Circuit



Fig. 12b - Unclamped Inductive Waveforms

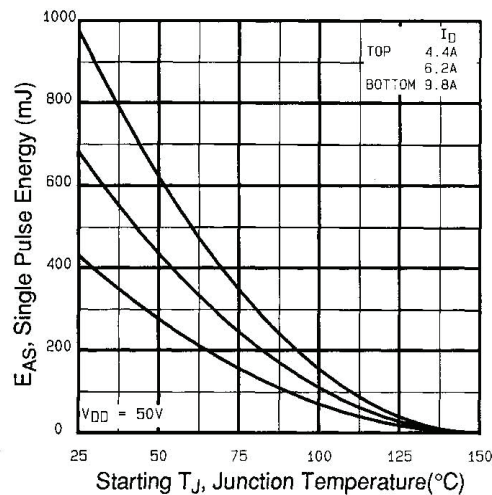


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

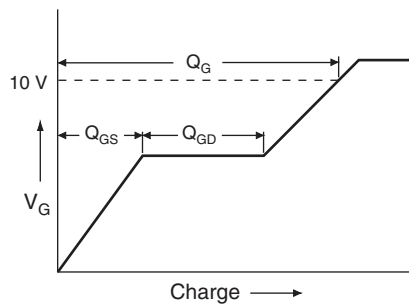


Fig. 13a - Basic Gate Charge Waveform

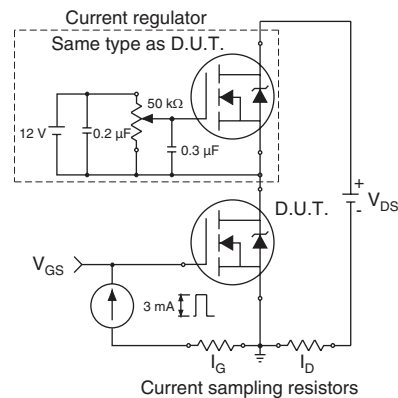


Fig. 13b - Gate Charge Test Circuit

① Driver gate drive

P.W. Period

$D = \frac{\text{P.W.}}{\text{Period}}$

$V_{GS} = 10 \text{ V}^*$

② D.U.T. I_{SD} waveform

Reverse recovery current

Body diode forward current

di/dt

③ D.U.T. V_{DS} waveform

Diode recovery dv/dt

V_{DD}

Body diode forward drop

④ Inductor current

Ripple $\leq 5\%$

I_{SD}

* $V_{GS} = 5 \text{ V}$ for logic level devices

Fig. 14 - For N-Channel

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