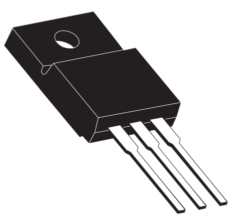
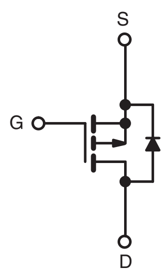
Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	- 60	
$R_{DS(on)}$ (Ω)	V_{GS} = - 10 V	0.14
Q_g (Max.) (nC)	34	
Q_{gs} (nC)	9.9	
Q_{gd} (nC)	16	
Configuration	Single	

TO-220 FULLPAK



G D S



P-Channel MOSFET

FEATURES

- Isolated Package
- High Voltage Isolation = 2.5 kV_{RMS} (t = 60 s; f = 60 Hz)
- Sink to Lead Creepage Distance = 4.8 mm
- P-Channel
- 175 °C Operating Temperature
- Dynamic dV/dt Rating
- Low Thermal Resistance
- Lead (Pb)-free Available

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. This 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	IRFI9Z34GPbF
	SiHFI9Z34G-E3
SnPb	IRFI9Z34G
	SiHFI9Z34G

ABSOLUTE MAXIMUM RATINGS T_C = 25 °C, unless otherwise noted

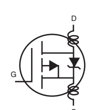
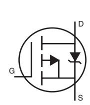
PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V_{DS}	- 60	V
Gate-Source Voltage			V_{GS}	± 20	
Continuous Drain Current	V_{GS} at - 10 V	T_C = 25 °C	I_D	- 12	A
		T_C = 100 °C		- 8.5	
Pulsed Drain Current[a]			I_{DM}	- 48	
Linear Derating Factor				0.28	W/°C
Single Pulse Avalanche Energy[b]			E_{AS}	370	mJ
Repetitive Avalanche Current[a]			I_{AR}	- 12	A
Repetitive Avalanche Energy[a]			E_{AR}	4.2	mJ
Maximum Power Dissipation	T_C = 25 °C		P_D	42	W
Peak Diode Recovery dV/dt[c]			dV/dt	- 4.5	V/ns
Operating Junction and Storage Temperature Range			T_J, T_{stg}	- 55 to + 175	°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

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. V_{DD} = - 25 V, starting T_J = 25 °C, L = 3.0 mH, R_G = 25 Ω, I_{AS} = - 12 A (see fig. 12).
c. $I_{SD} \le$ - 12 A, dI/dt $\le$ 170 A/µs, $V_{DD} \le V_{DS}$, $T_J \le$ 175 °C.
d. 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}	-	3.6	

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		- 60	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = - 1 mA		-	- 0.060	-	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} = - 60 V, V_{GS} = 0 V		-	-	- 100	µA
		V_{DS} = - 48 V, V_{GS} = 0 V, T_J = 150 °C		-	-	- 500	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = - 10 V	I_D = - 7.2 A[b]	-	-	0.14	Ω
Forward Transconductance	g_{fs}	V_{DS} = - 25 V, I_D = - 7.2 A[b]		5.4	-	-	S
Dynamic							
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = - 25 V, f = 1.0 MHz, see fig. 5		-	1100	-	pF
Output Capacitance	C_{oss}			-	620	-	
Reverse Transfer Capacitance	C_{rss}			-	100	-	
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} = - 48 V, see fig. 6 and 13[b]	-	-	34	nC
Gate-Source Charge	Q_{gs}			-	-	9.9	
Gate-Drain Charge	Q_{gd}			-	-	16	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = - 30 V, I_D = - 18 A, R_G = 12 Ω, R_D= 1.5 Ω, see fig. 10[b]		-	18	-	ns
Rise Time	t_r			-	120	-	
Turn-Off Delay Time	$t_{d(off)}$			-	20	-	
Fall Time	t_f			-	58	-	
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		-	-	- 12	A
Pulsed Diode Forward Current[a]	I_{SM}			-	-	- 48	
Body Diode Voltage	V_{SD}	T_J = 25 °C, I_S = - 12 A, V_{GS} = 0 V[b]		-	-	- 6.3	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = - 18 A, dI/dt = 100 A/µs[b]		-	100	200	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	0.28	0.52	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 %.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

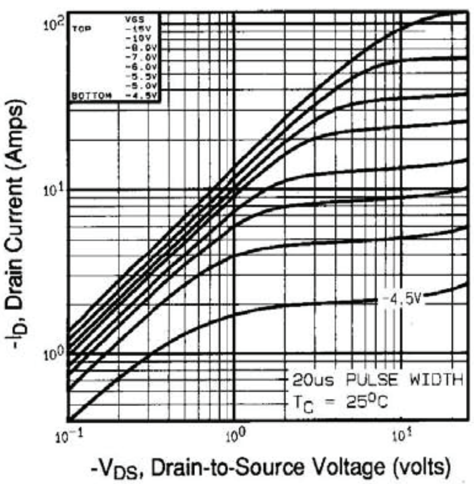


Fig. 1 - Typical Output Characteristics, T_C= 25 °C

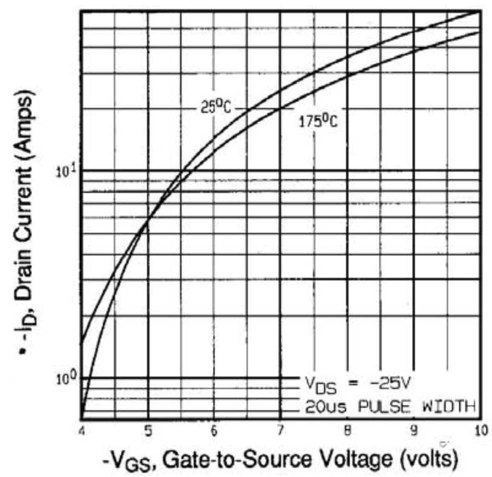


Fig. 3 - Typical Transfer Characteristics

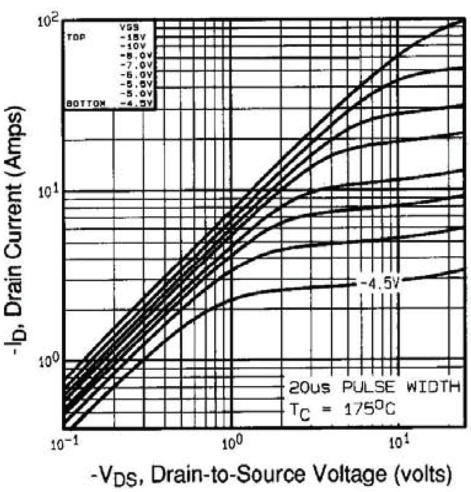


Fig. 2 - Typical Output Characteristics, T_C= 175 °C

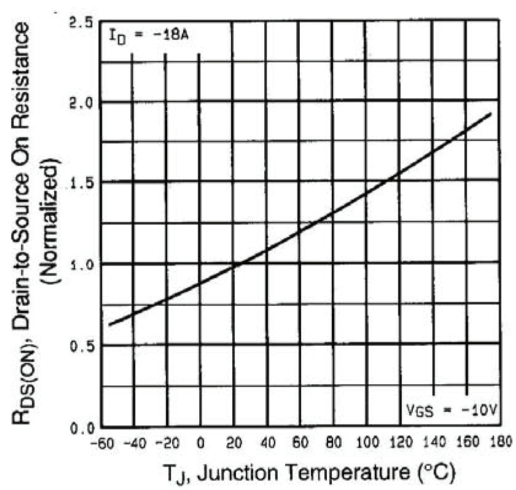


Fig. 4 - Normalized On-Resistance vs. Temperature

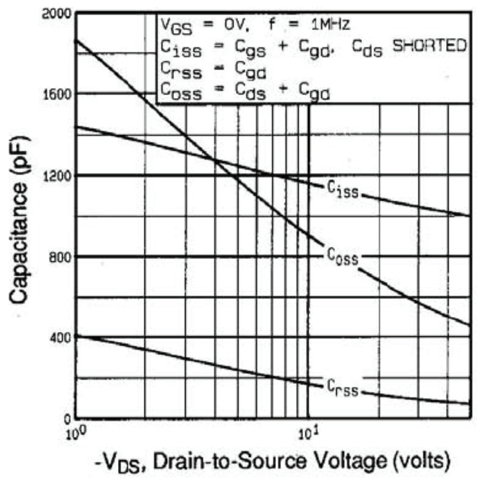


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

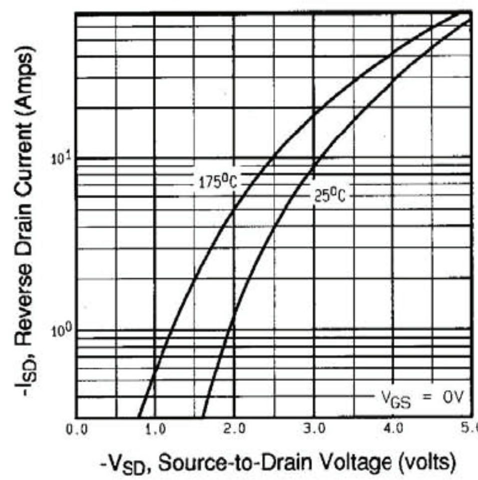


Fig. 7 - Typical Source-Drain Diode Forward Voltage

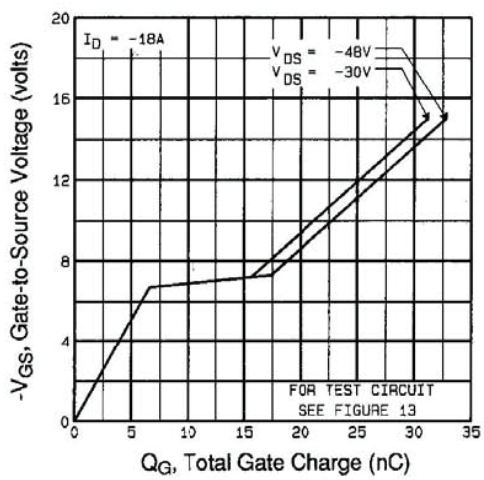


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

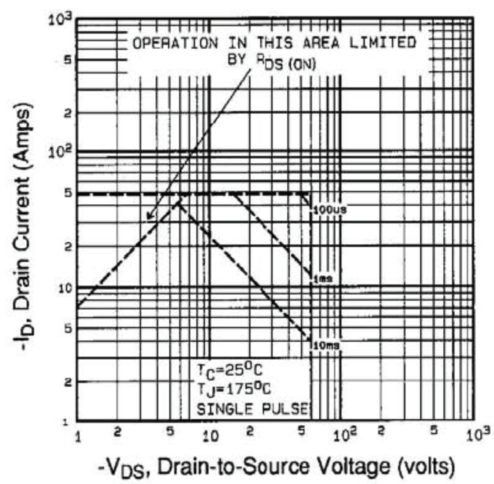


Fig. 8 - Maximum Safe Operating Area

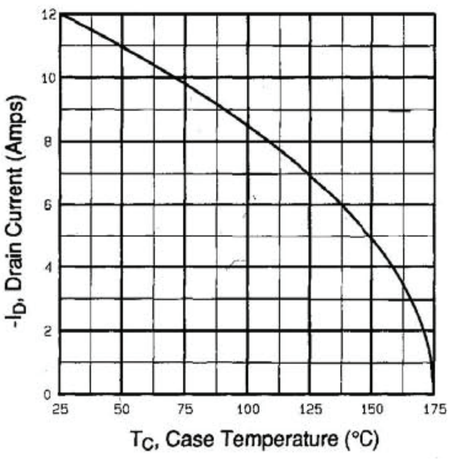


Fig. 9 - Maximum Drain Current vs. Case Temperature

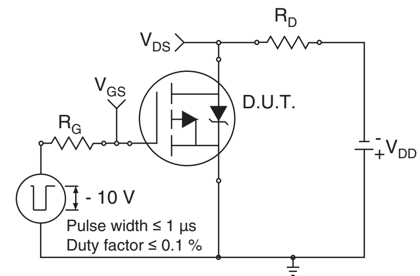


Fig. 10a - Switching Time Test Circuit

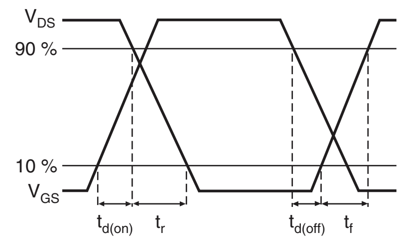


Fig. 10b - Switching Time Waveforms

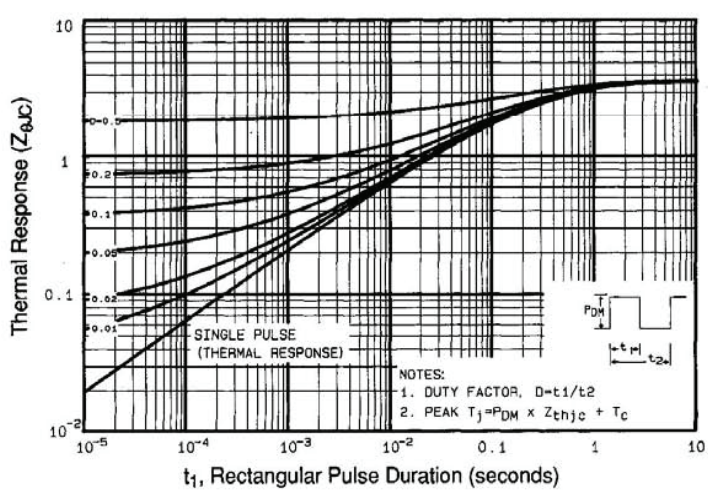


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

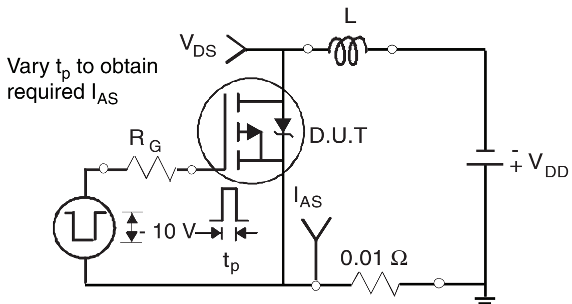


Fig. 12a - Unclamped Inductive Test Circuit

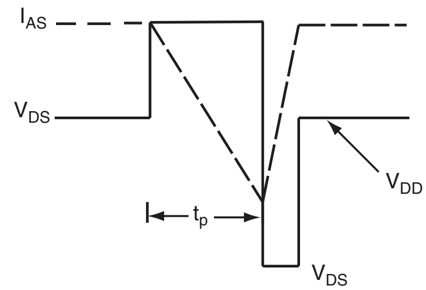


Fig. 12b - Unclamped Inductive Waveforms

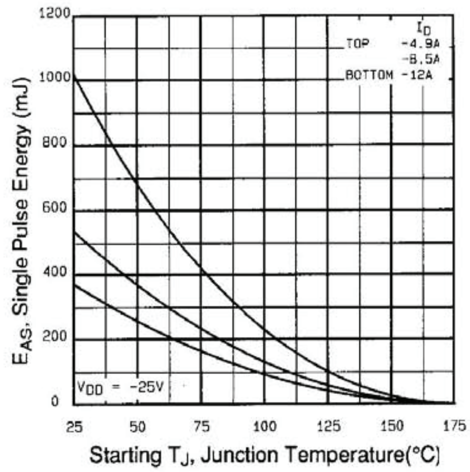


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

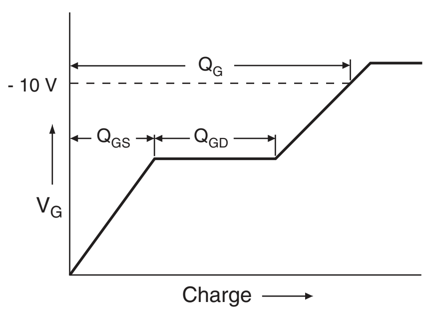


Fig. 13a - Basic Gate Charge Waveform

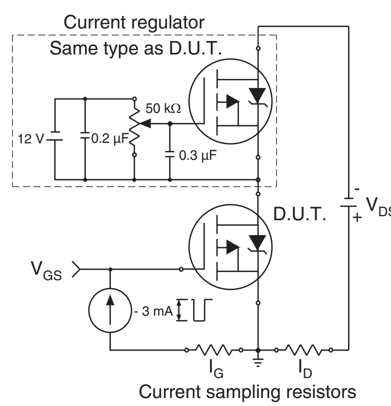
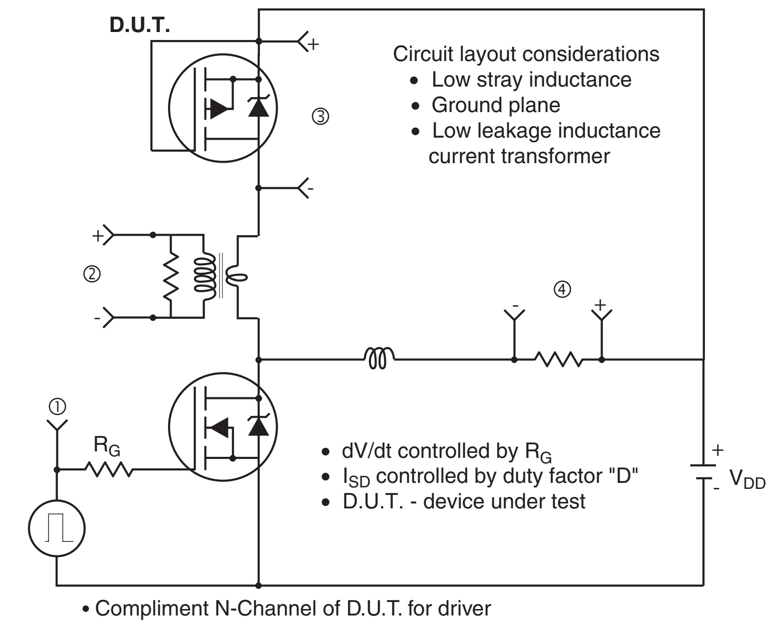
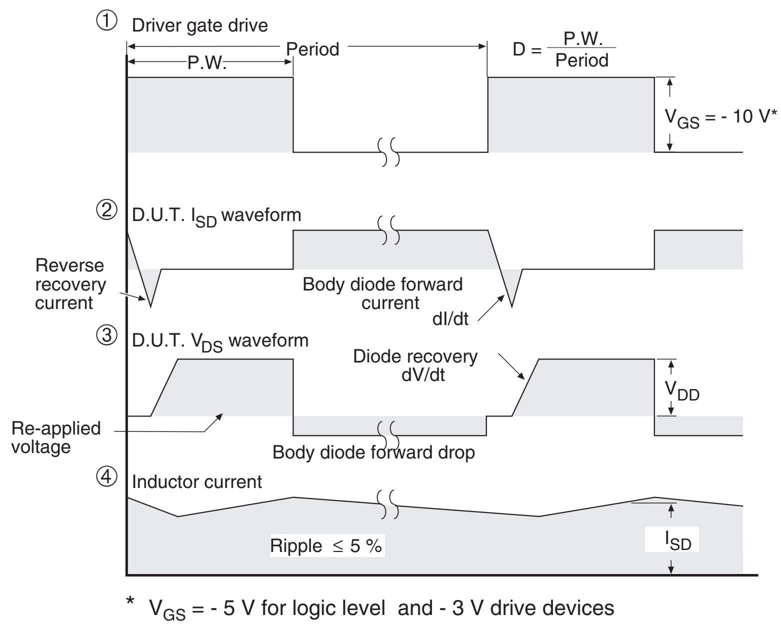


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit





* V_{GS} = - 5 V for logic level and - 3 V drive devices

Fig. 14 - For P-Channel

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