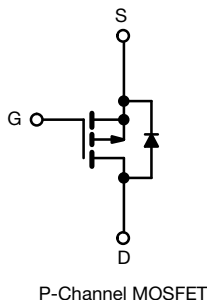
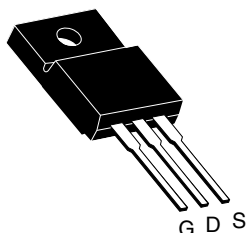


Power MOSFET

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



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
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS*
Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details.

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	$T_C = 25\text{ }^{\circ}\text{C}$	I_D	-12	A
		$T_C = 100\text{ }^{\circ}\text{C}$		-8.5	
Pulsed Drain Current ^a			I_{DM}	-48	
Linear Derating Factor				0.28	W/ $^{\circ}\text{C}$
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		$T_C = 25\text{ }^{\circ}\text{C}$	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	$^{\circ}\text{C}$
Soldering Recommendations (Peak temperature) ^d		for 10 s		300	
Mounting Torque	6-32 or M3 screw			10	lbf · in
				1.1	N · m

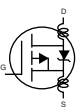
Notes

- 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. $I_{SD} \leq -12$ A, $dI/dt \leq 170$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 175$ °C.
d. 1.6 mm from case.

**THERMAL RESISTANCE RATINGS**

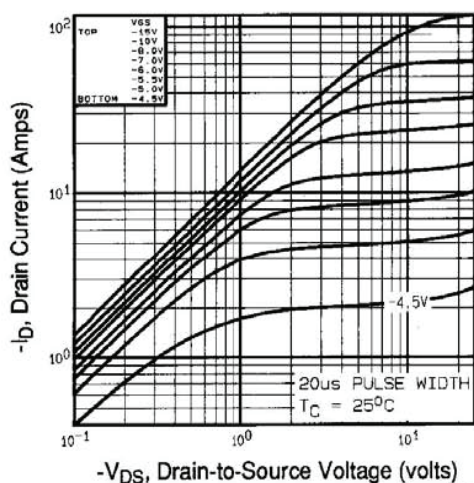
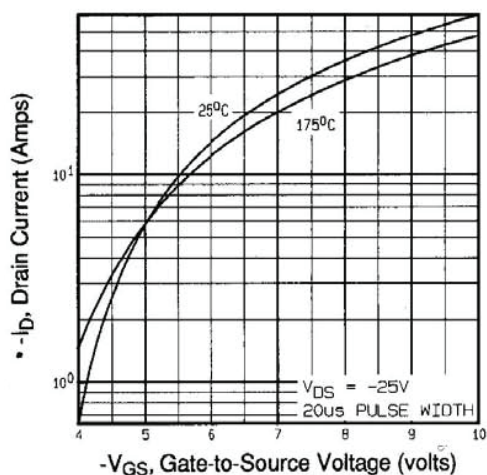
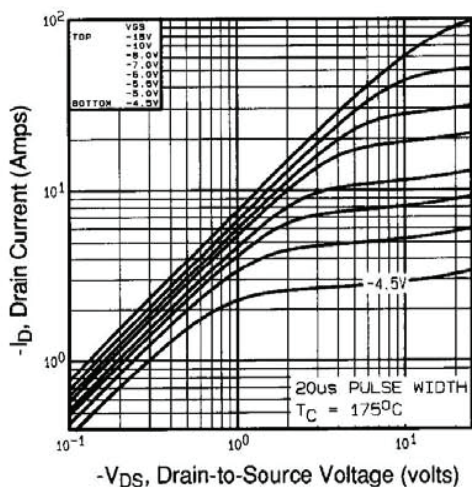
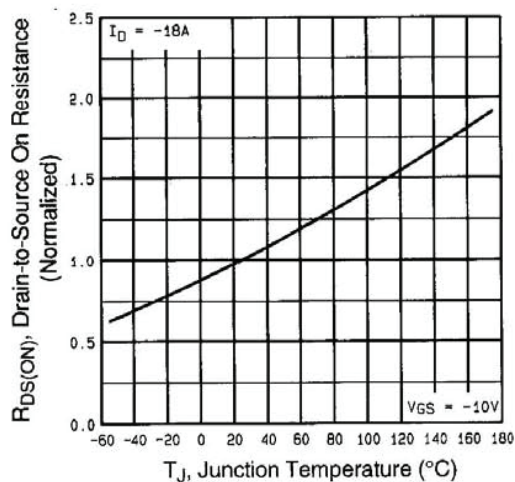
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	65	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	3.6	

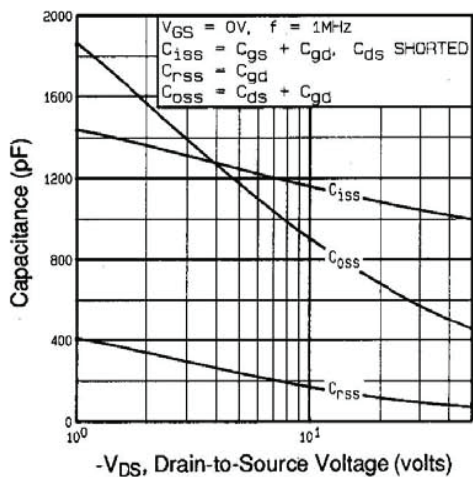
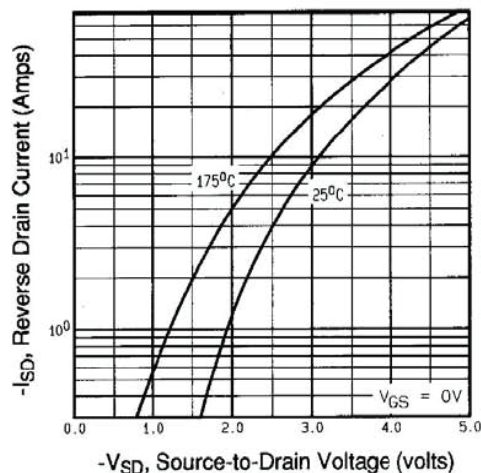
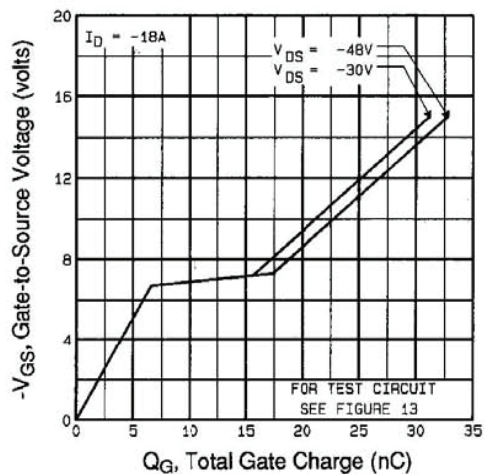
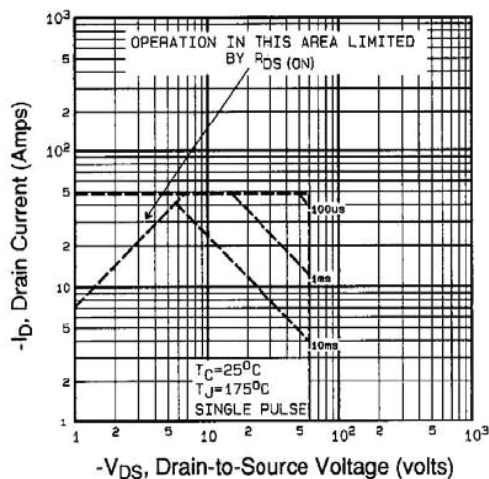
SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	-60	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^{\circ}\text{C}$, $I_D = -1\text{ mA}$	-	-0.060	-	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}	$V_{GS} = \pm 20\text{ V}$	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -60\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	-100	μA
		$V_{DS} = -48\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	-	-500	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$, $I_D = -7.2\text{ A}^b$	-	-	0.14	Ω
Forward Transconductance	g_{fs}	$V_{DS} = -25\text{ V}$, $I_D = -7.2\text{ A}^b$	5.4	-	-	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = -25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5	-	1100	-	pF
Output Capacitance	C_{oss}		-	620	-	
Reverse Transfer Capacitance	C_{rss}		-	100	-	
Drain to Sink Capacitance	C	$f = 1.0\text{ MHz}$	-	12	-	
Total Gate Charge	Q_g	$V_{GS} = -10\text{ V}$, $I_D = -18\text{ A}$, $V_{DS} = -48\text{ V}$, 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	$t_{d(on)}$	$V_{DD} = -30\text{ V}$, $I_D = -18\text{ A}$, $R_G = 12\text{ }\Omega$, $R_D = 1.5\text{ }\Omega$, 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	-	
Gate Input Resistance	R_g	$f = 1\text{ MHz}$, open drain	0.7	-	3.9	Ω
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}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_S = -12\text{ A}$, $V_{GS} = 0\text{ V}^b$	-	-	-6.3	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_F = -18\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$	-	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 $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.

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, $T_C = 175^\circ\text{C}$

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

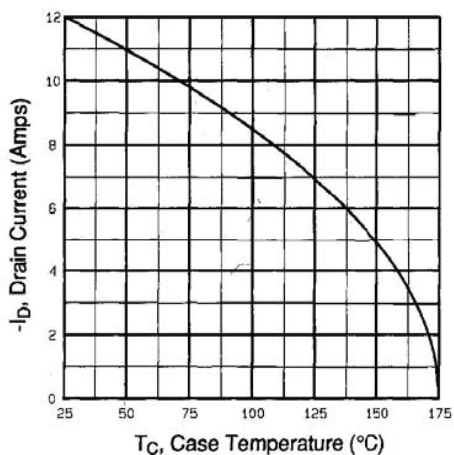
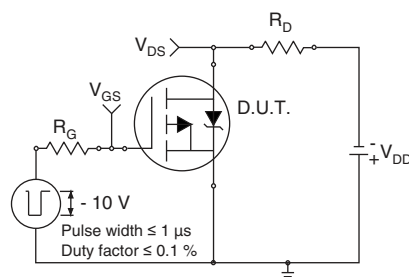
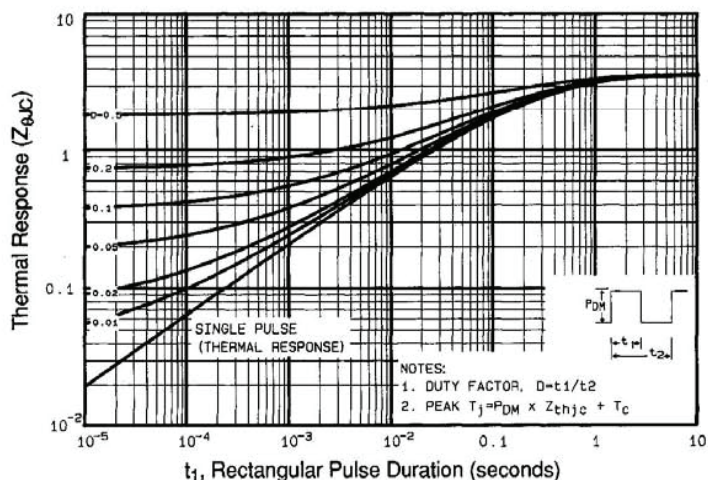
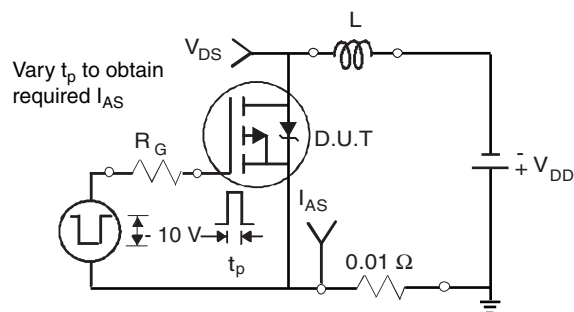
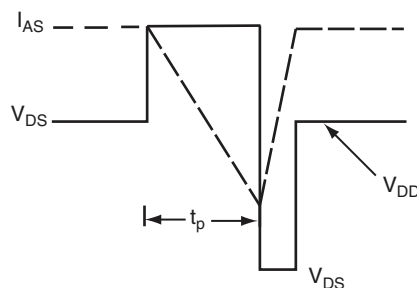
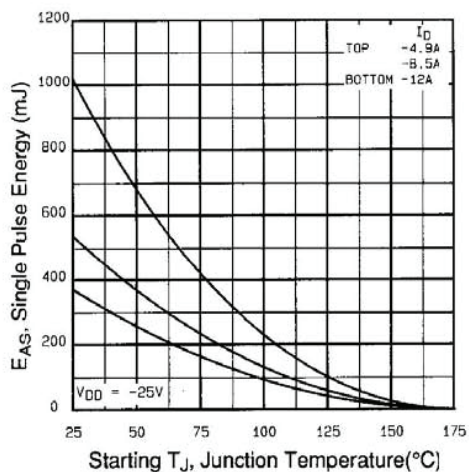
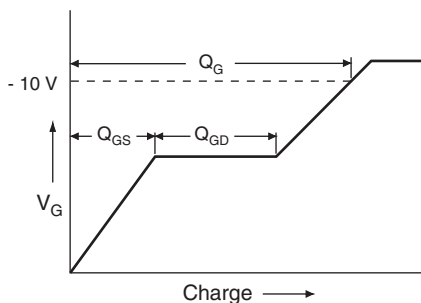
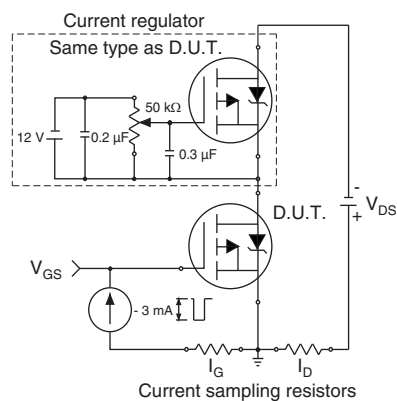
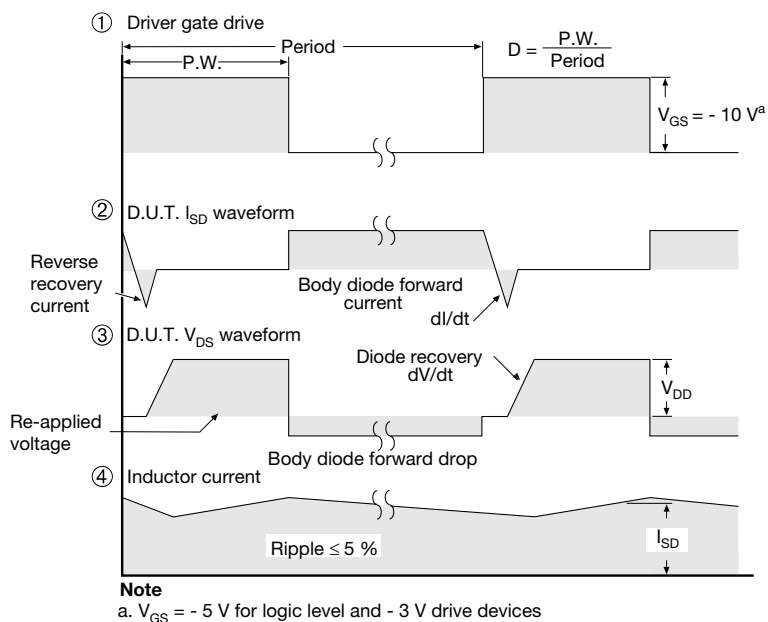
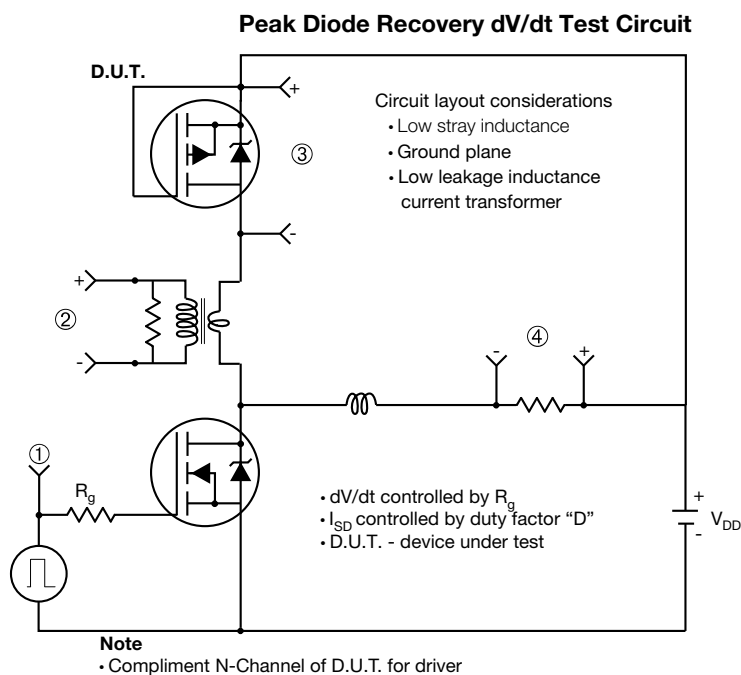

Fig. 9 - Maximum Drain Current vs. Case Temperature

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


Fig. 14 - For P-Channel

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