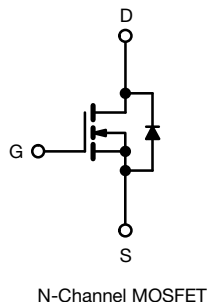
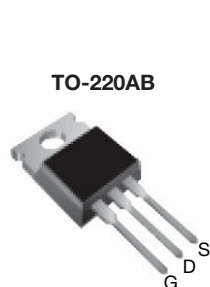


Power MOSFET

PRODUCT SUMMARY

V_{DS} (V)	60	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	0.10
Q_g max. (nC)	25	
Q_{gs} (nC)	5.8	
Q_{gd} (nC)	11	
Configuration	Single	



FEATURES

- Dynamic dV/dt rating
- 175 °C operating temperature
- Fast switching
- Ease of paralleling
- Simple drive requirements
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



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-220AB package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 W. The low thermal resistance and low package cost of the TO-220AB contribute to its wide acceptance throughout the industry.

ORDERING INFORMATION

Package	TO-220AB
Lead (Pb)-free	IRFZ24PbF

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^{\circ}\text{C}$, 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	$T_C = 25\text{ }^{\circ}\text{C}$	A
		$T_C = 100\text{ }^{\circ}\text{C}$	
Pulsed Drain Current ^a	I_{DM}	68	
Linear Derating Factor		0.40	W/ $^{\circ}\text{C}$
Single Pulse Avalanche Energy ^b	E_{AS}	100	mJ
Maximum Power Dissipation	P_D	60	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

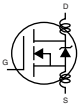

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 25\text{ V}$, starting $T_J = 25\text{ }^{\circ}\text{C}$, $L = 403\text{ }\mu\text{H}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 17\text{ A}$ (see fig. 12).
- $I_{SD} \leq 17\text{ A}$, $dI/dt \leq 140\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 175\text{ }^{\circ}\text{C}$.
- 1.6 mm from case.

**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Case-to-Sink, Flat, Greased Surface	R_{thCS}	0.50	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	2.5	

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 $25\text{ }^{\circ}\text{C}$, $I_D = 1\text{ mA}$		-	0.061	-	V/ $^{\circ}\text{C}$		
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}	$V_{DS} = 60\text{ V}$, $V_{GS} = 0\text{ V}$		-	-	25	μA		
		$V_{DS} = 48\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$		-	-	250			
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 10\text{ A}^b$	-	-	0.10	Ω		
Forward Transconductance	g_{fs}	$V_{DS} = 25\text{ V}$, $I_D = 10\text{ A}$		5.5	-	-	S		
Dynamic									
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5		-	640	-	pF		
Output Capacitance	C_{oss}			-	360	-			
Reverse Transfer Capacitance	C_{rss}			-	79	-			
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 17\text{ A}$, $V_{DS} = 48\text{ V}$, see fig. 6 and 13 ^b	-	-	25	nC		
Gate-Source Charge	Q_{gs}			-	-	5.8			
Gate-Drain Charge	Q_{gd}			-	-	11			
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}$, $I_D = 17\text{ A}$, $R_g = 18\text{ }\Omega$, $R_D = 1.7\text{ }\Omega$, see fig. 10 ^b		-	13	-	ns		
Rise Time	t_r			-	58	-			
Turn-Off Delay Time	$t_{d(off)}$			-	25	-			
Fall Time	t_f			-	42	-			
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				-	-	17	A
Pulsed Diode Forward Current ^a	I_{SM}					-	-	68	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_S = 17\text{ A}$, $V_{GS} = 0\text{ V}^b$		-	-	1.5	V		
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_F = 17\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}$		-	88	180	ns		
Body Diode Reverse Recovery Charge	Q_{rr}			-	0.29	0.64	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)

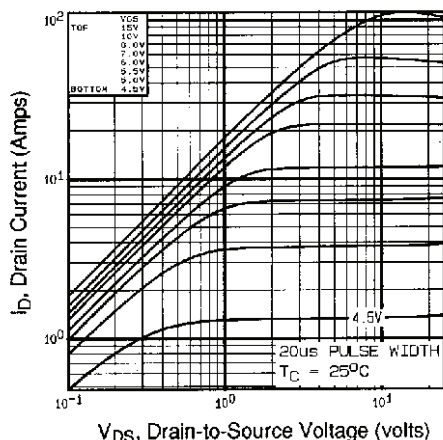


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^{\circ}\text{C}$

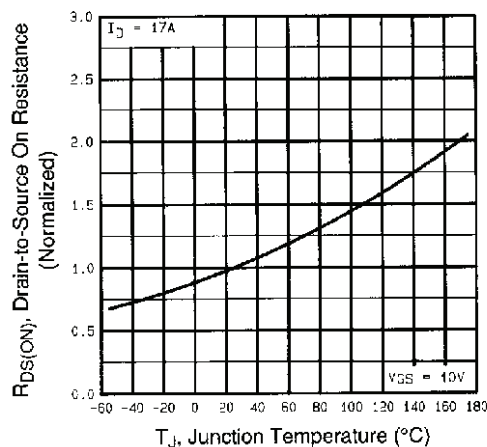


Fig. 4 - Normalized On-Resistance vs. Temperature

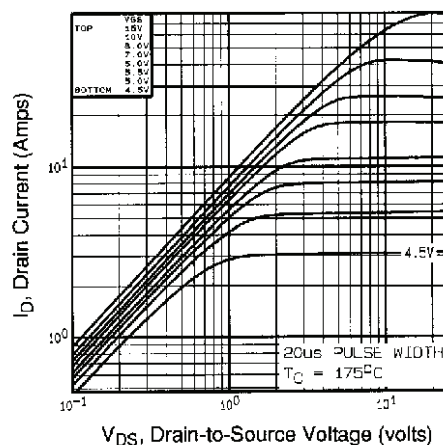


Fig. 2 - Typical Output Characteristics, $T_C = 175\text{ }^{\circ}\text{C}$

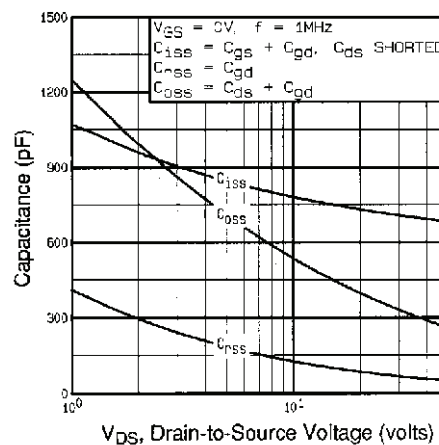


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

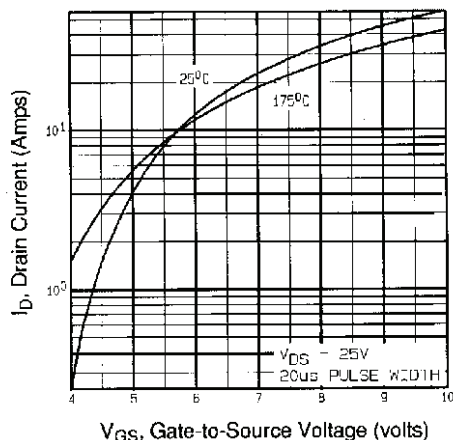


Fig. 3 - Typical Transfer Characteristics

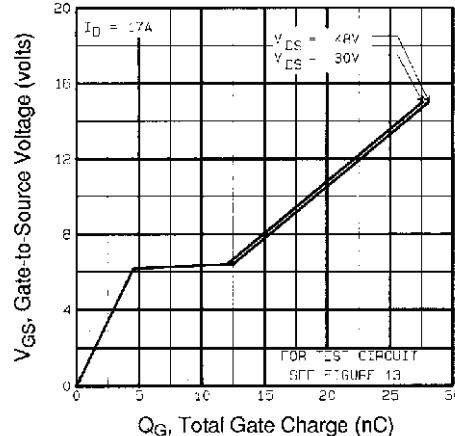
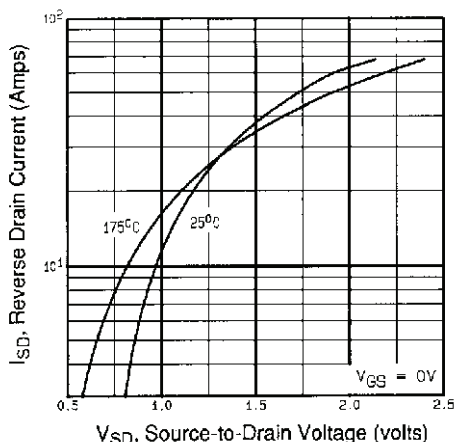
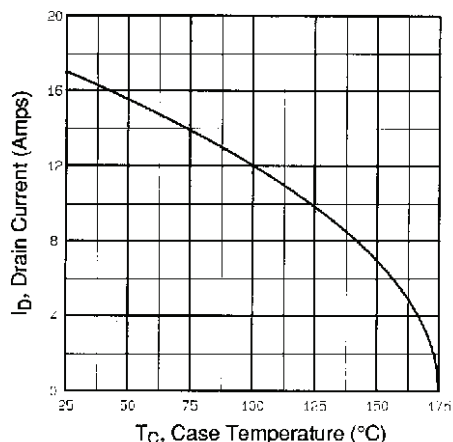
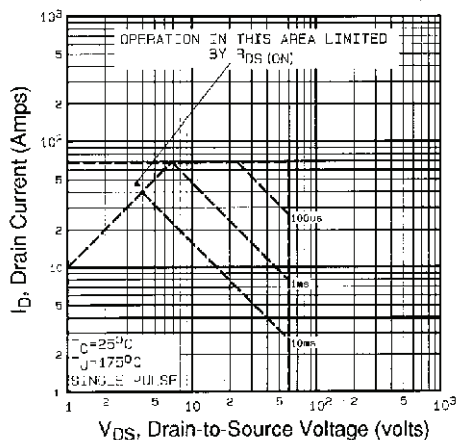
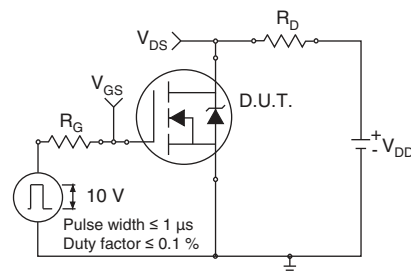
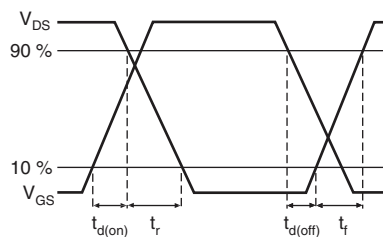
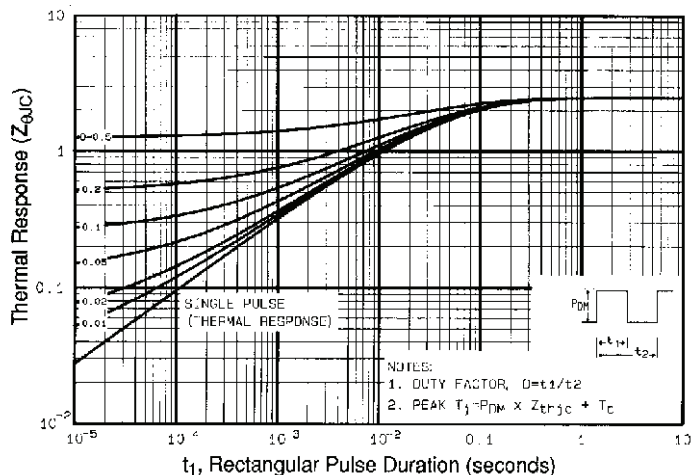
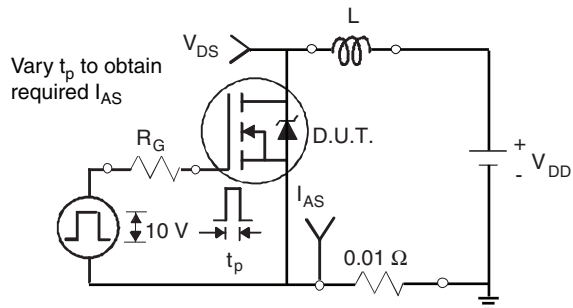
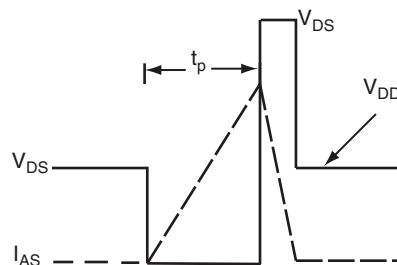
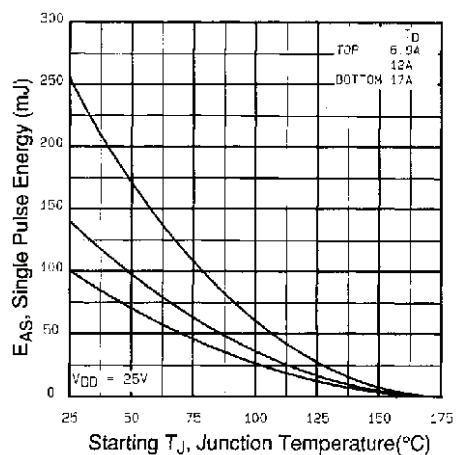
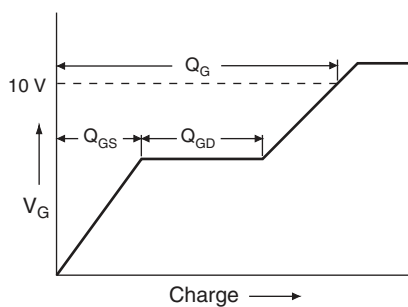
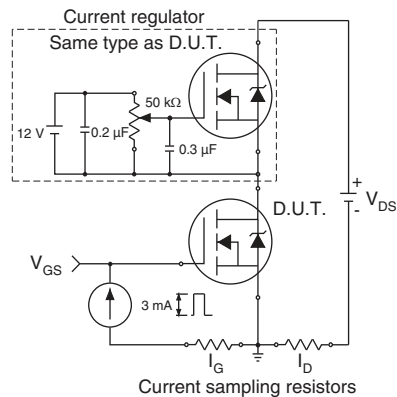
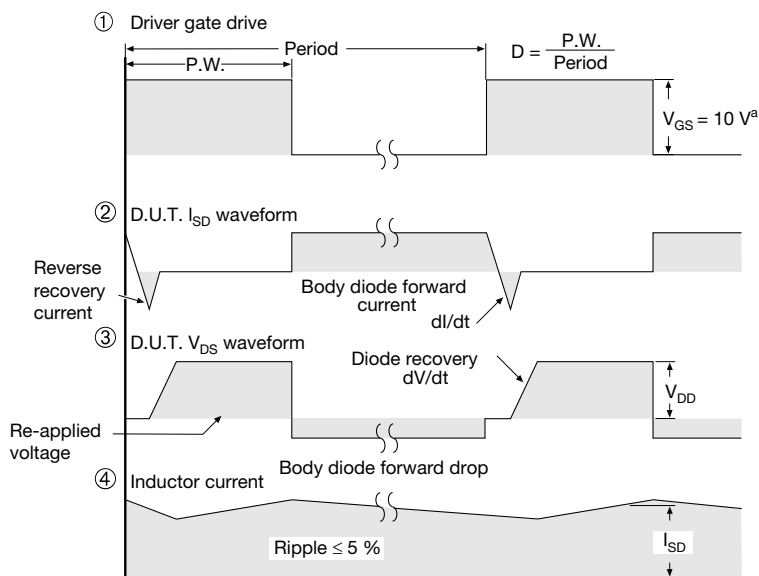
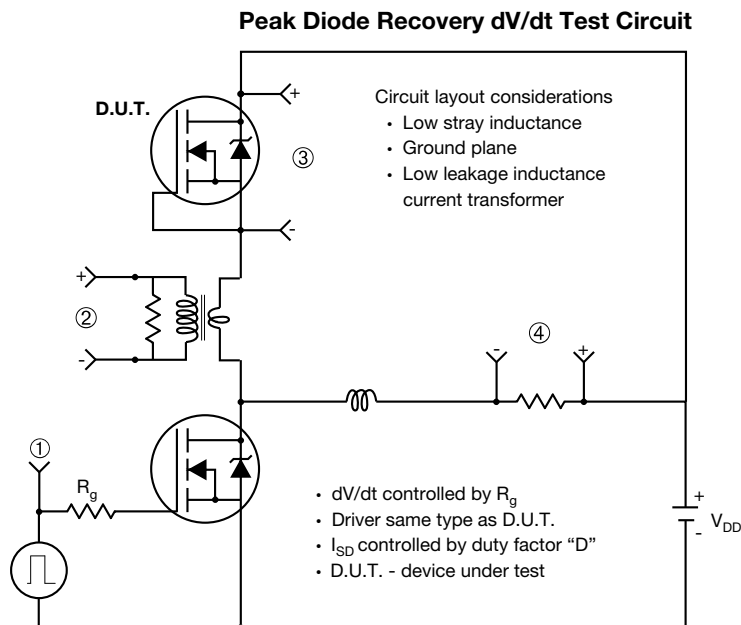


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage


Fig. 7 - Typical Source-Drain Diode Forward Voltage

Fig. 9 - Maximum Drain Current vs. Case Temperature

Fig. 8 - Maximum Safe Operating Area

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


Note

a. $V_{GS} = 5 V$ for logic level devices

Fig. 14 - For N-Channel

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?91406.

TO-220-1



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.24	4.65	0.167	0.183
b	0.69	1.02	0.027	0.040
b(1)	1.14	1.78	0.045	0.070
c	0.36	0.61	0.014	0.024
D	14.33	15.85	0.564	0.624
E	9.96	10.52	0.392	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.10	6.71	0.240	0.264
J(1)	2.41	2.92	0.095	0.115
L	13.36	14.40	0.526	0.567
L(1)	3.33	4.04	0.131	0.159
Ø P	3.53	3.94	0.139	0.155
Q	2.54	3.00	0.100	0.118

ECN: X15-0364-Rev. C, 14-Dec-15
DWG: 6031

Note

- M* = 0.052 inches to 0.064 inches (dimension including protrusion), heatsink hole for HVM





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