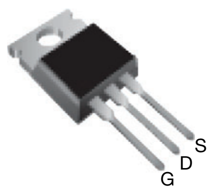
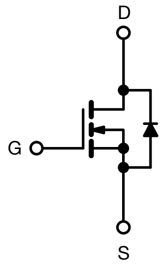
Power MOSFET

TO-220AB





N-Channel MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	60	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	0.018
Q_g (Max.) (nC)	110	
Q_{gs} (nC)	29	
Q_{gd} (nC)	36	
Configuration	Single	

FEATURES

- Advanced process technology
- Ultra low on-resistance
- Dynamic dV/dt rating
- 175 °C operating temperature
- Fast switching
- Fully avalanche rated
- Drop in replacement of the SiHFZ48 for linear / audio applications
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Available
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

Advanced power MOSFETs from Vishay utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that Power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

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	IRFZ48RPbF

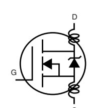
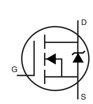
ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)

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	50	A
		T_C = 100 °C		50	
Pulsed drain current [a]			I_{DM}	290	
Linear derating factor				1.3	W/°C
Single pulse avalanche energy [b]			E_{AS}	100	mJ
Repetitive avalanche current [a]			I_{AR}	50	A
Repetitive avalanche energy [a]			E_{AR}	19	mJ
Maximum power dissipation	T_C = 25 °C		P_D	190	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) [d]	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 = 22 µH, R_g = 25 Ω I_{AS} = 72 A (see fig. 12)
c. $I_{SD} \leq$ 72 A, dI/dt ≤ 200 A/ms, $V_{DD} \leq V_{DS}$, T_J £ 175 °C
d. 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}	-	0.8	

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	-	-	± 100	nA
Zero gate voltage drain current	I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V	-	-	25	μA
		V_{DS} = 48 V, V_{GS} = 0 V, T_J = 150 °C	-	-	250	
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS} = 10 V; I_D = 43 A[b]	-	-	0.018	Ω
Forward transconductance	g_{fs}	V_{DS} = 25 V, I_D = 43 A[b]	27	-	-	S
Dynamic						
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5	-	2400	-	pF
Output capacitance	C_{oss}		-	1300	-	
Reverse transfer capacitance	C_{rss}		-	190	-	
Total gate charge	Q_g	V_{GS} = 10 V; I_D = 72 A, V_{DS} = 48 V, see fig. 6 and 13[b]	-	-	110	nC
Gate-source charge	Q_{gs}		-	-	29	
Gate-drain charge	Q_{gd}		-	-	36	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 30 V, I_D = 72 A, R_g = 9.1 Ω, R_D = 0.34 Ω, see fig. 10[b]	-	8.1	-	ns
Rise time	t_r		-	250	-	
Turn-off delay time	$t_{d(off)}$		-	210	-	
Fall time	t_f		-	250	-	
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 	-	-	50	A
Pulsed diode forward current [a]	I_{SM}		-	-	290	
Body diode voltage	V_{SD}	T_J = 25 °C, I_S = 72 A, V_{GS} = 0 V[b]	-	-	2.0	V
Body diode reverse recovery time	t_{rr}	T_J = 25 °C, I_F = 72 A, dI/dt = 100 A/μs[b]	-	120	180	ns
Body diode reverse recovery charge	Q_{rr}		-	0.50	0.80	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)

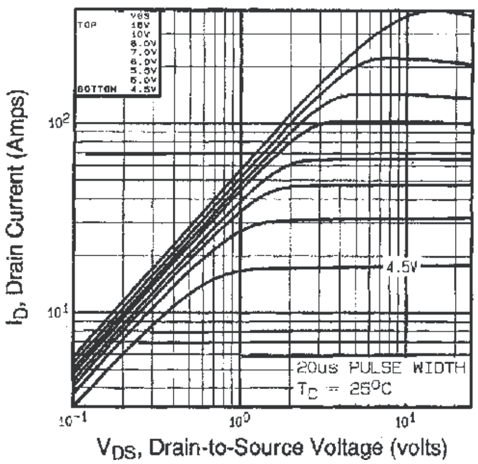


Fig. 1 - Typical Output Characteristics

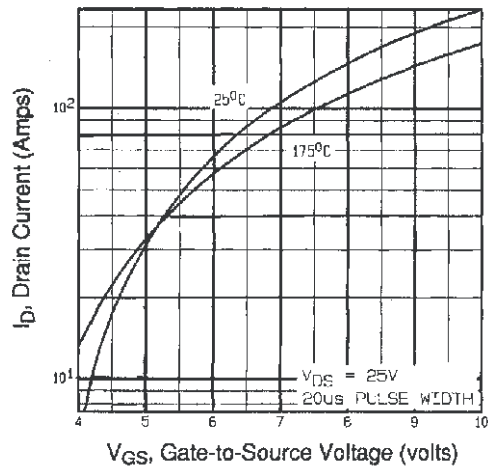


Fig. 3 - Typical Transfer Characteristics

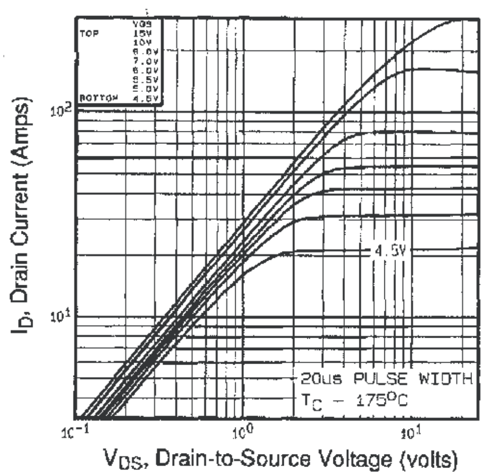


Fig. 2 - Typical Output Characteristics

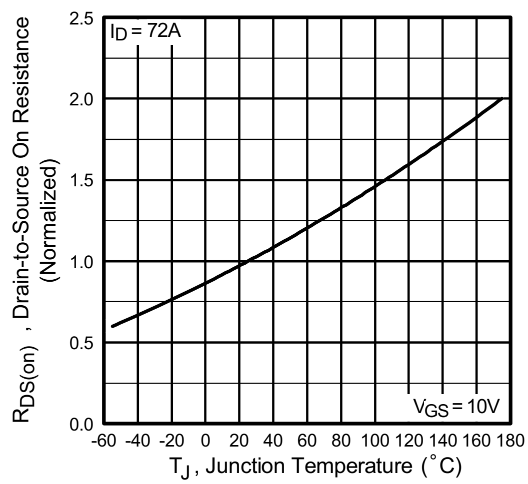


Fig. 4 - Normalized On-Resistance vs. Temperature

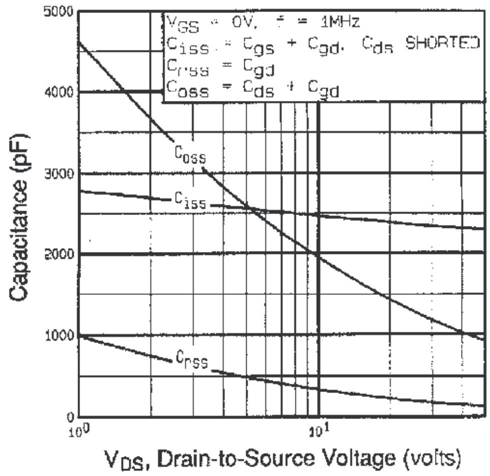


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

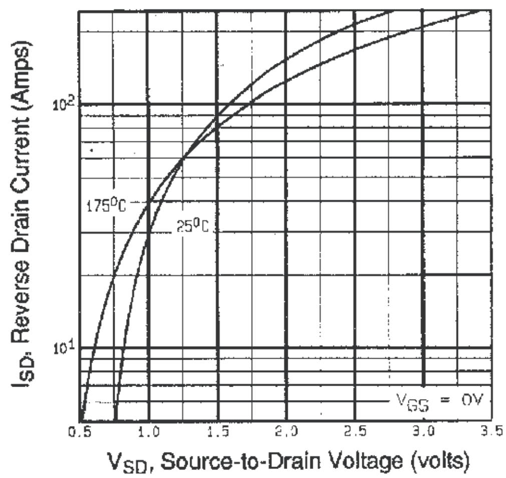


Fig. 7 - Typical Source-Drain Diode Forward Voltage

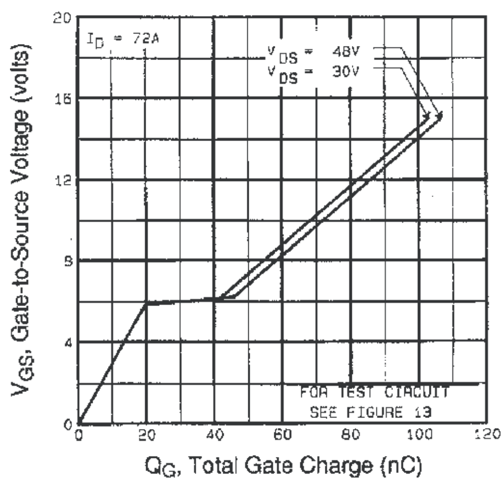


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

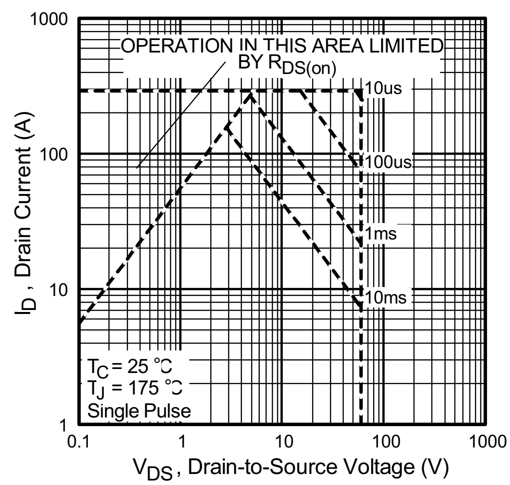


Fig. 8 - Maximum Safe Operating Area

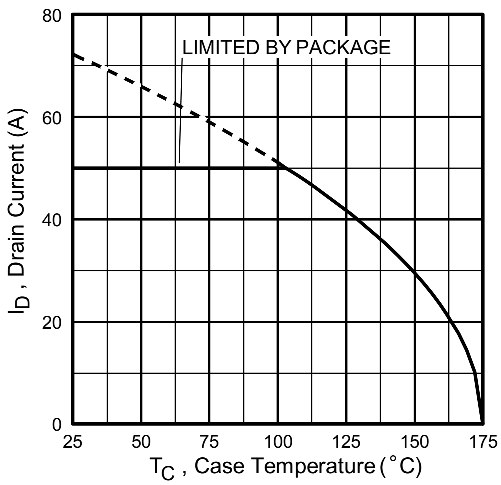


Fig. 9 - Maximum Drain Current vs. Case Temperature

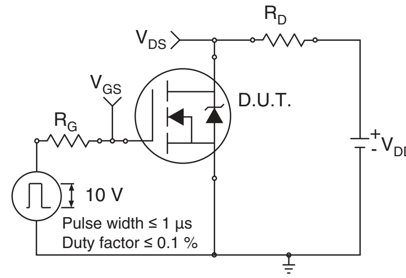


Fig. 10a - Switching Time Test Circuit

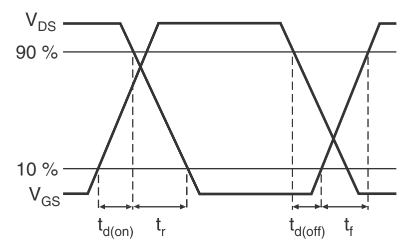


Fig. 10b - Switching Time Waveforms

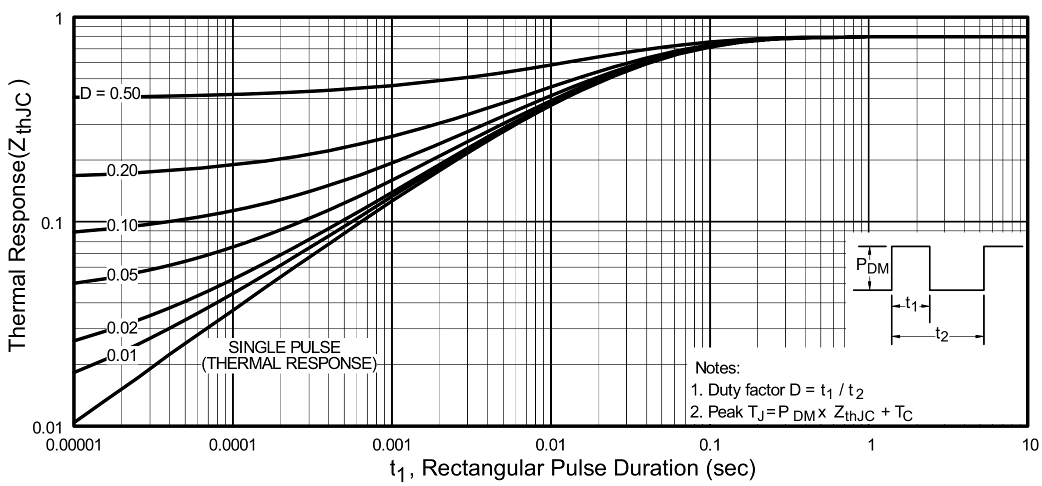


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

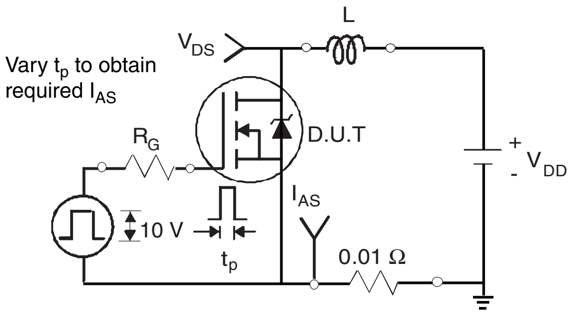


Fig. 12a - Unclamped Inductive Test Circuit

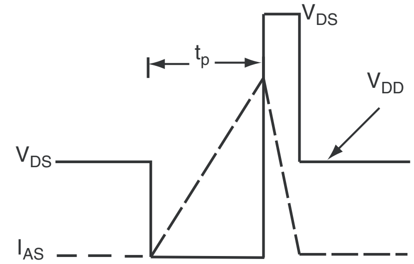


Fig. 12b - Unclamped Inductive Waveforms

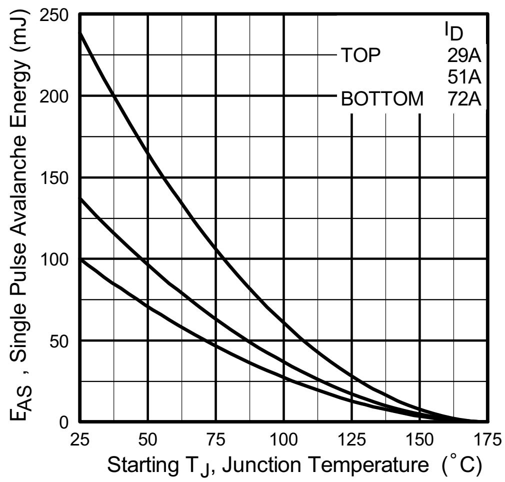


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

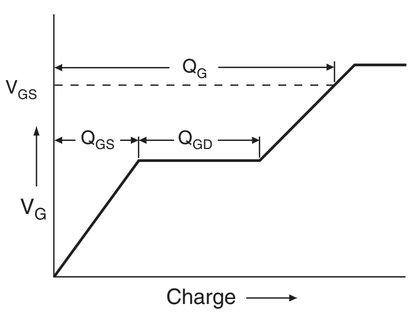


Fig. 13a - Basic Gate Charge Waveform

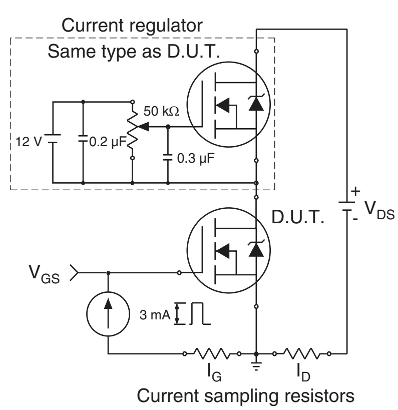
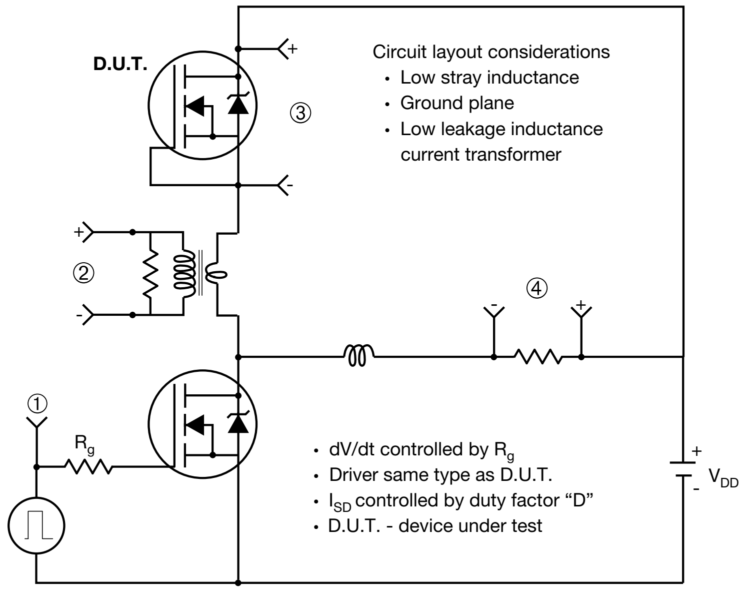
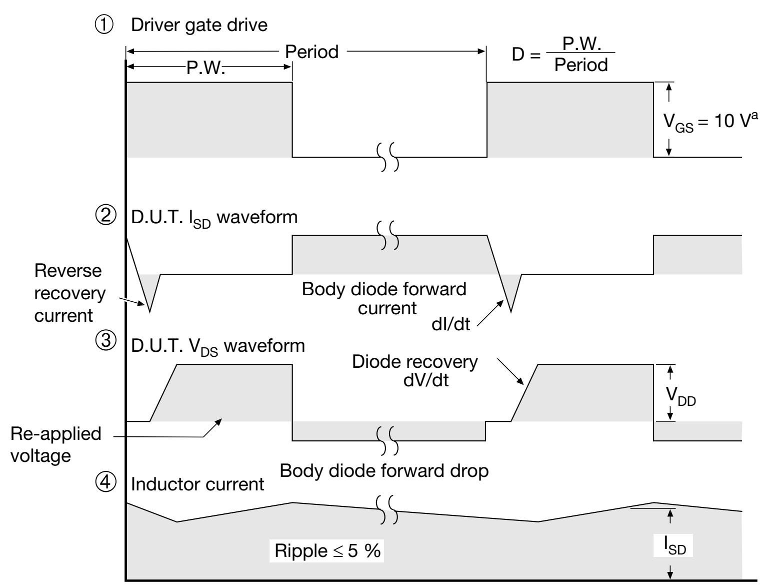


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit





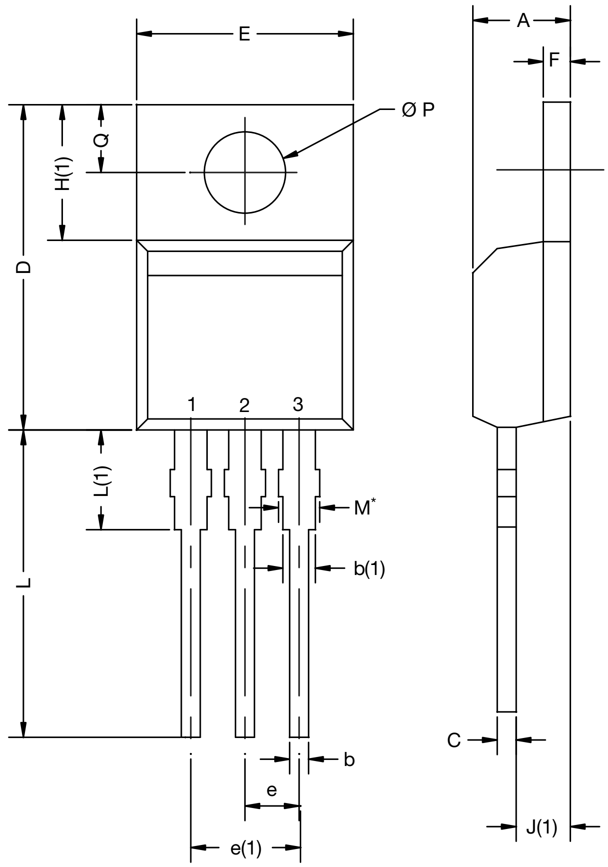
Note

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?91295.

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: E21-0621-Rev. D, 04-Nov-2021
DWG: 6031

Note

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

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