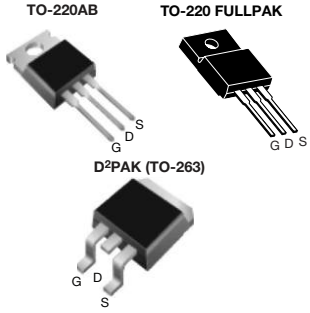
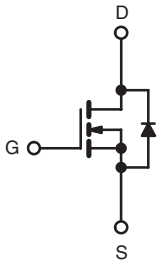
Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V) at T_J max.	560 V	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	0.555
Q_g (Max.) (nC)	48	
Q_{gs} (nC)	12	
Q_{gd} (nC)	15	
Configuration	Single	





N-Channel MOSFET

FEATURES

- Low Figure-of-Merit R_{on} x Q_g
- 100 % Avalanche Tested
- Gate Charge Improved
- T_{rr}/Q_{rr} Improved
- Compliant to RoHS Directive 2002/95/EC

Available
RoHS* COMPLIANT

ORDERING INFORMATION			
Package	TO-220AB	D²PAK (TO-263)	TO-220 FULLPAK
Lead (Pb)-free	SiHP12N50C-E3	SiHB12N50C-E3	SiHF12N50C-E3

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

PARAMETER			SYMBOL	LIMIT TO220-AB D²PAK (TO-263)	LIMIT TO-220 FULLPAK	UNIT
Drain-Source Voltage			V_{DS}	500		V
Gate-Source Voltage			V_{GS}	± 30		V
Continuous Drain Current (T_J = 150 °C)[a]	V_{GS} at 10 V	T_C = 25 °C	I_D	12		A
		T_C = 100 °C		7.5		A
Pulsed Drain Current[c]			I_{DM}	28		A
Linear Derating Factor				1.67	0.28	W/°C
Single Pulse Avalanche Energy[b]			E_{AS}	180		mJ
Maximum Power Dissipation			P_D	208	36	W
Operating Junction and Storage Temperature Range			T_J, T_{stg}	- 55 to + 150		°C
Soldering Recommendations (Peak Temperature)[d]	for 10 s			300		°C

Notes
a. Limited by maximum junction temperature.
b. V_{DD} = 50 V, starting T_J = 25 °C, L = 2.5 mH, R_g = 25 Ω, I_{AS} = 12 A.
c. Repetitive rating; pulse width limited by maximum junction temperature.
d. 1.6 mm from case.

* Pb containing terminations are not RoHS compliant, exemptions may apply

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TO220-AB D²PAK (TO-263)**	**TO-220 FULLPAK**	**UNIT**
Maximum Junction-to-Ambient	R_{thJA}	62	65	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	0.6	3.5	
Junction-to-Ambient (PCB mount)[a]	R_{thJA}	40	-	

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material).

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	500	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA	-	0.6	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	3.0	-	5.0	V
Gate-Source Leakage	I_{GSS}	V_{GS} = ± 30 V	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 500 V, V_{GS} = 0 V	-	-	50	µA
		V_{DS} = 400 V, V_{GS} = 0 V, T_J = 125 °C	-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 4 A	-	0.46	0.555	Ω
Forward Transconductance	g_{fs}	V_{DS} = 50 V, I_D = 3 A	-	3	-	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz	-	1375	-	pF
Output Capacitance	C_{oss}		-	165	-	
Reverse Transfer Capacitance	C_{rss}		-	17	-	
Total Gate Charge	Q_g	V_{GS} = 10 V, I_D = 10 A, V_{DS} = 400 V	-	32	48	nC
Gate-Source Charge	Q_{gs}		-	12	-	
Gate-Drain Charge	Q_{gd}		-	15	-	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 250 V, I_D = 10 A, R_g = 4.3 Ω, V_{GS} = 10 V	-	18	-	ns
Rise Time	t_r		-	35	-	
Turn-Off Delay Time	$t_{d(off)}$		-	23	-	
Fall Time	t_f		-	6	-	
Gate Input Resistance	R_g	f = 1 MHz, open drain	-	1.1	-	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	I_{SM}		-	-	28	
Body Diode Voltage	V_{SD}	T_J = 25 °C, I_S = 10 A, V_{GS} = 0 V	-	-	1.8	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = I_S, dI/dt = 100 A/µs, V_R = 20 V	-	580	-	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	4.3	-	µC
Body Diode Reverse Recovery Current	I_{RRM}		-	13	-	A

Note

- The information shown here is a preliminary product proposal, not a commercial product data sheet. Vishay Siliconix is not committed to produce this or any similar product. This information should not be used for design purposes, nor construed as an offer to furnish or sell such products.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

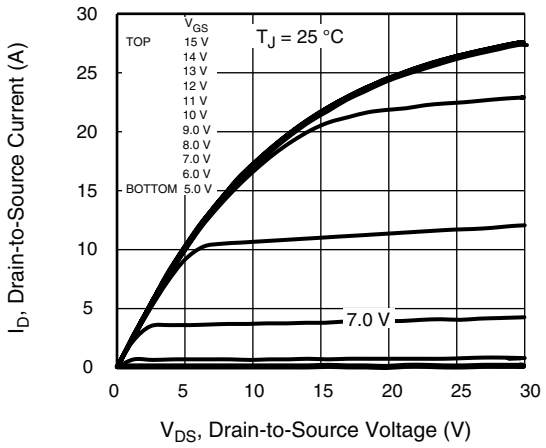


Fig. 1 - Typical Output Characteristics (TO-220)

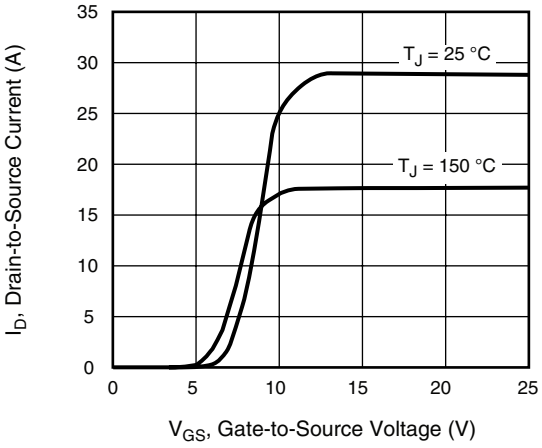


Fig. 3 - Typical Transfer Characteristics

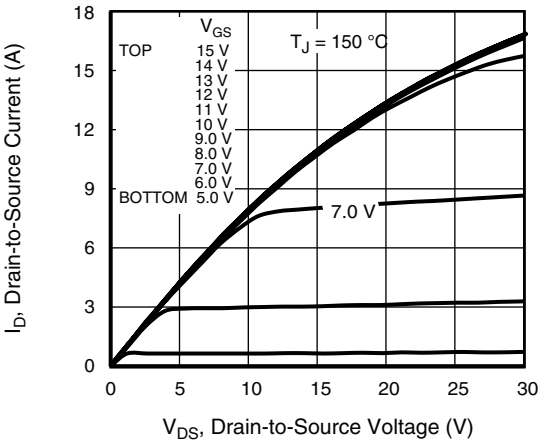


Fig. 2 - Typical Output Characteristics (TO-220)

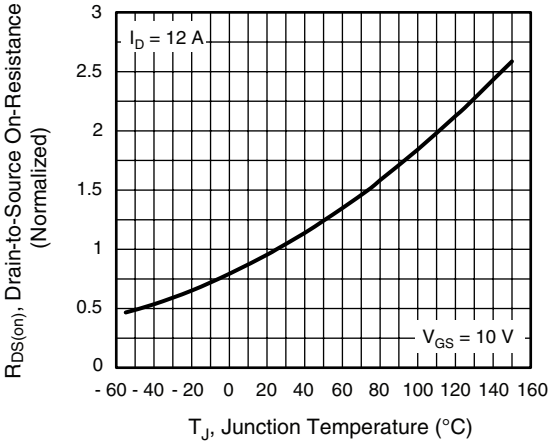


Fig. 4 - Normalized On-Resistance vs. Temperature

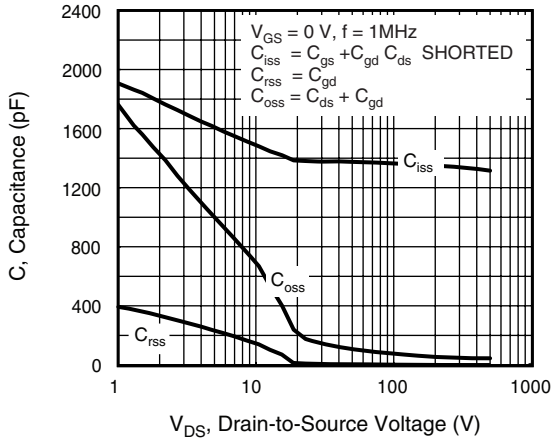


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

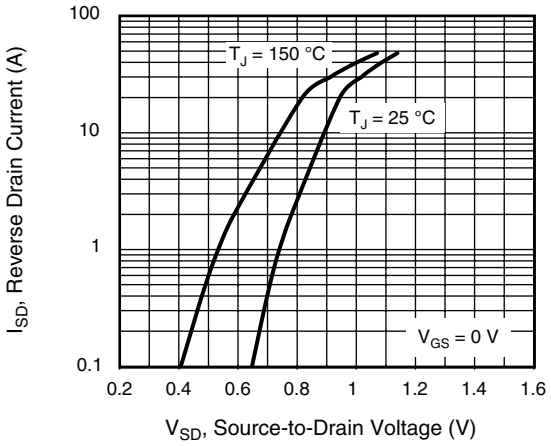


Fig. 7 - Typical Source-Drain Diode Forward Voltage

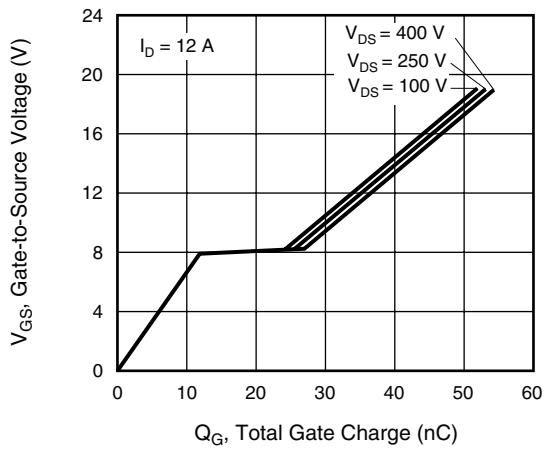


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

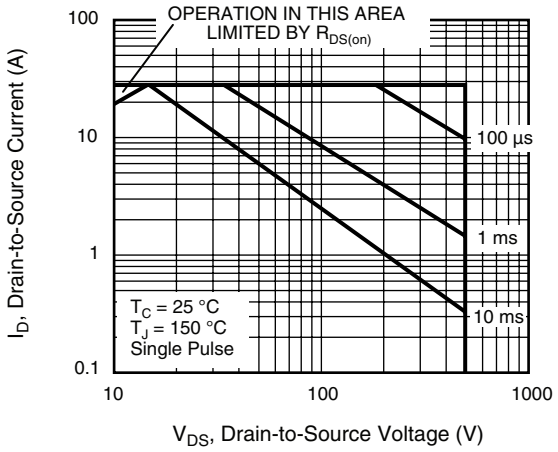


Fig. 8 - Maximum Safe Operating Area (TO-220AB, D^2PAK)

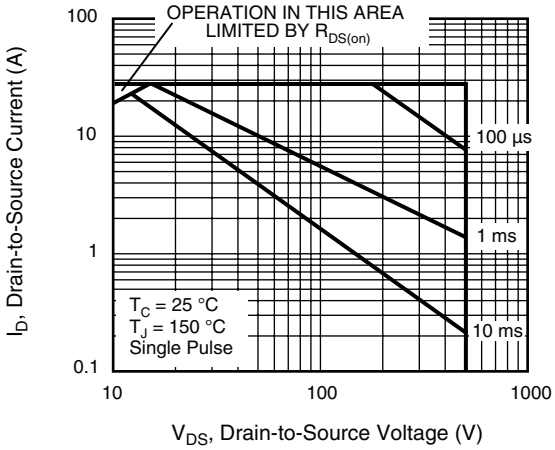


Fig. 9 - Maximum Safe Operating Area (TO-220 FULLPAK)

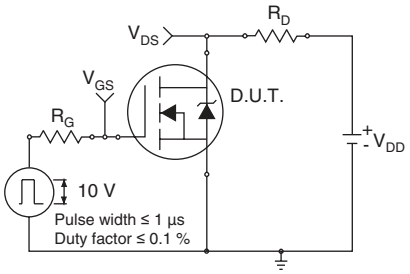


Fig. 10a - Switching Time Test Circuit

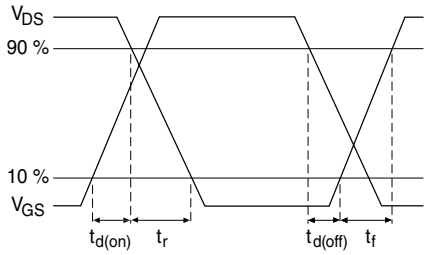


Fig. 10b - Switching Time Waveforms

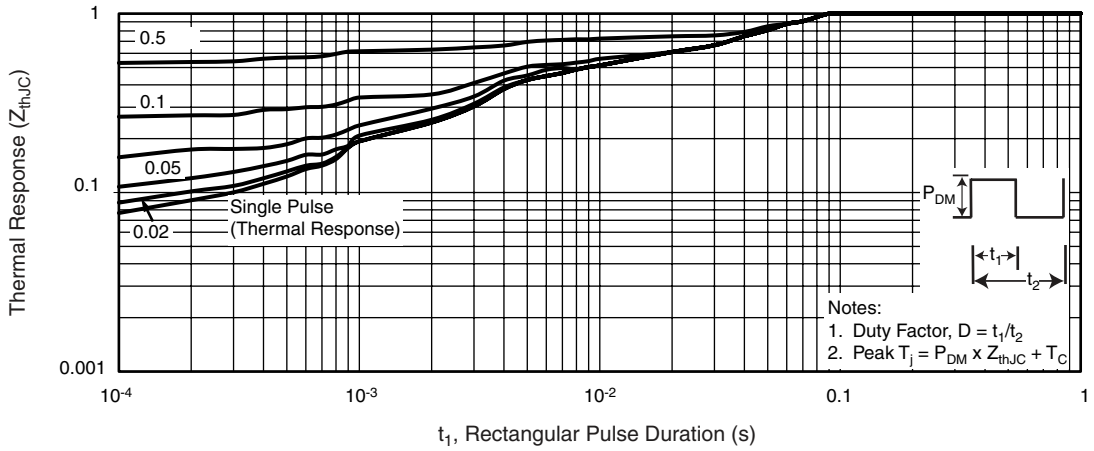


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case (TO-220AB, D^2PAK)

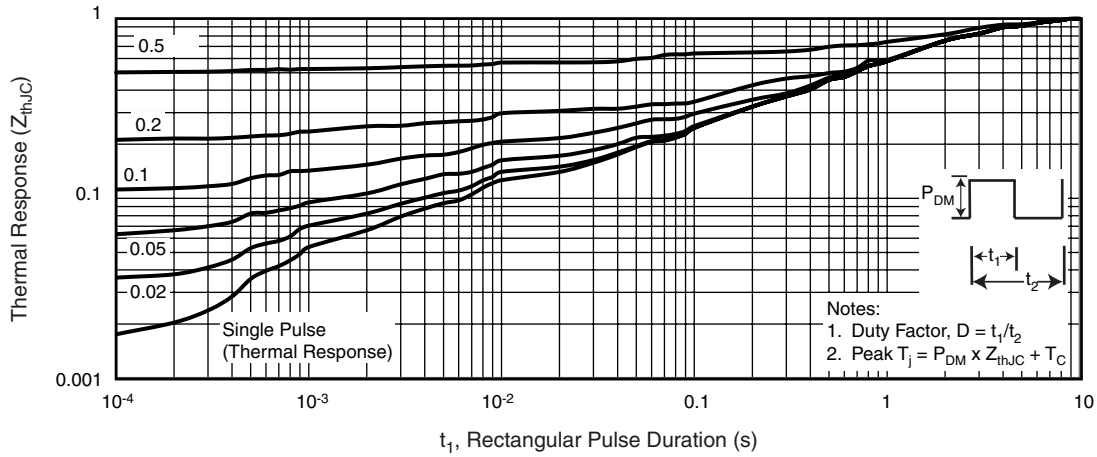


Fig. 12 - Maximum Effective Transient Thermal Impedance, Junction-to-Case (TO-220 FULLPAK)

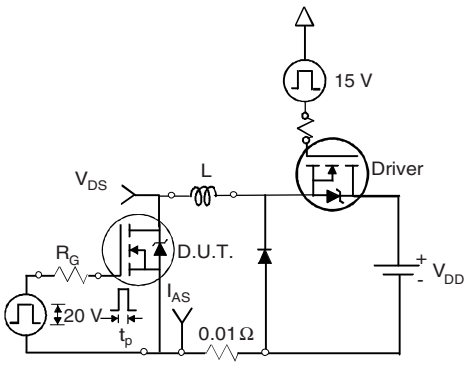


Fig. 13a - Unclamped Inductive Test Circuit

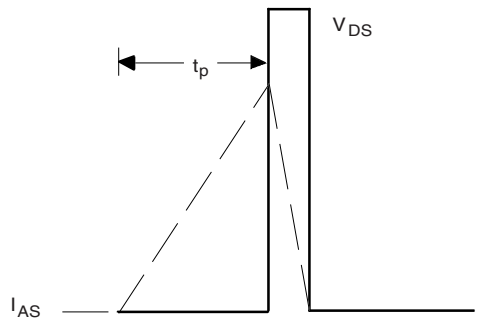


Fig. 13b - Unclamped Inductive Waveforms

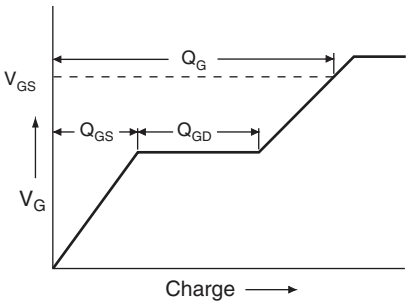


Fig. 14a - Basic Gate Charge Waveform

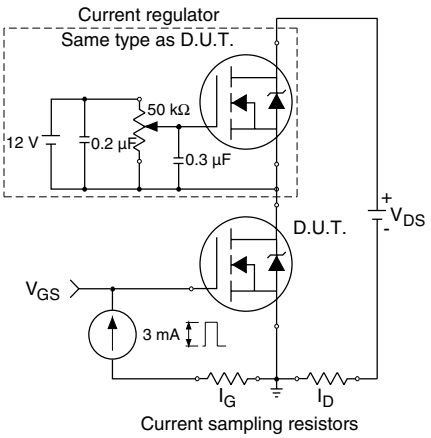


Fig. 14b - Gate Charge Test Circuit

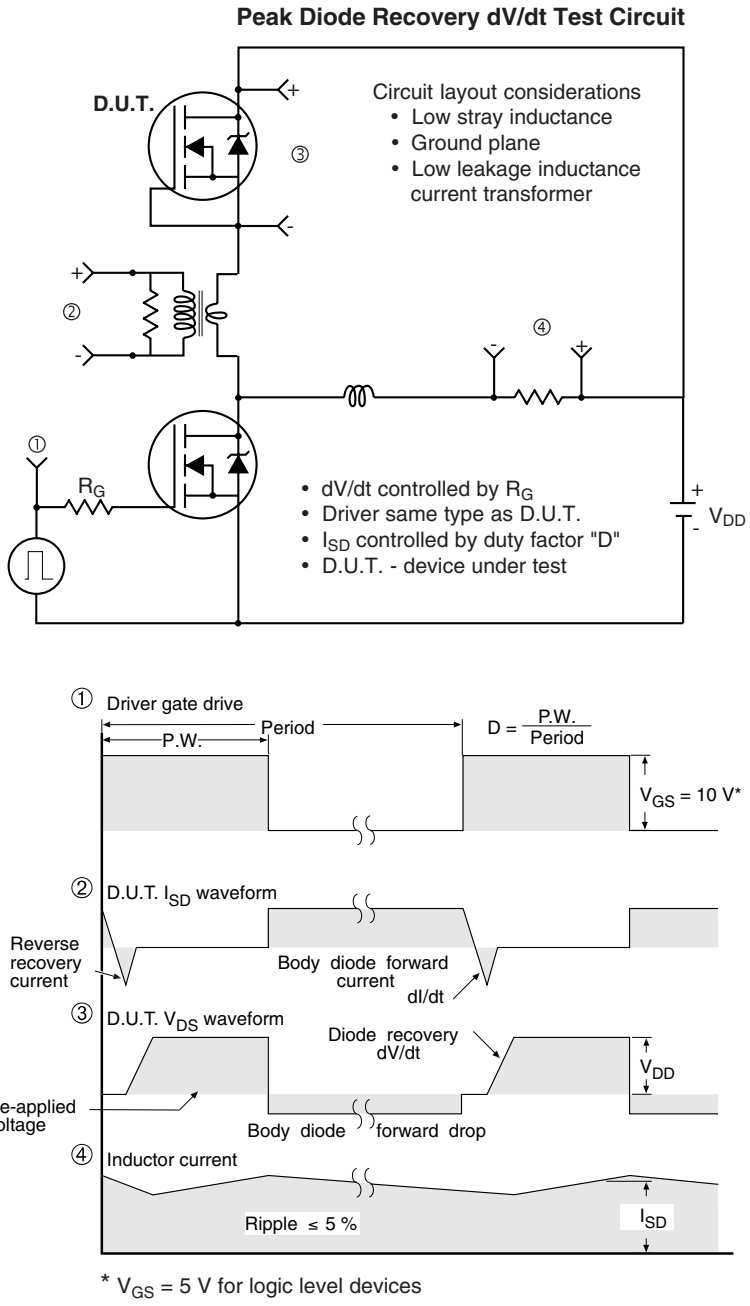
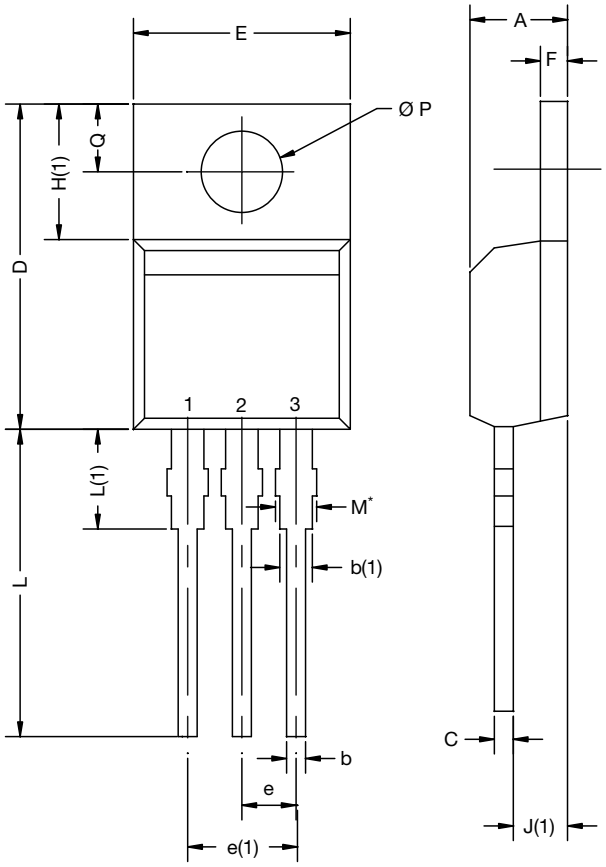


Fig. 15 - For N-Channel

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?91388.

TO-220-1

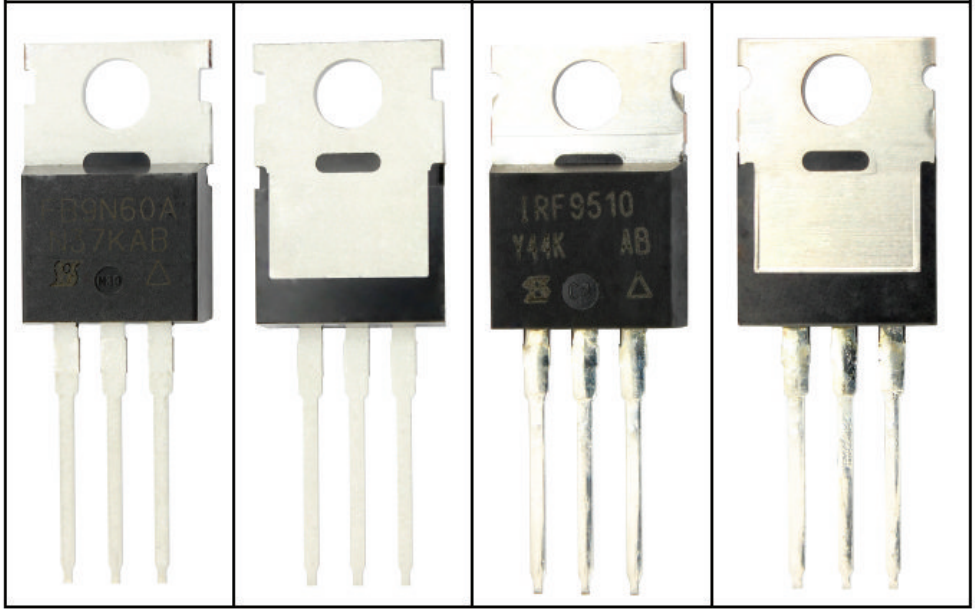


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.24	4.65	0.167	0.183
b	0.69	1.02	0.027	0.040
b(1)	1.14	1.78	0.045	0.070
c	0.36	0.61	0.014	0.024
D	14.33	15.85	0.564	0.624
E	9.96	10.52	0.392	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.10	6.71	0.240	0.264
J(1)	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				

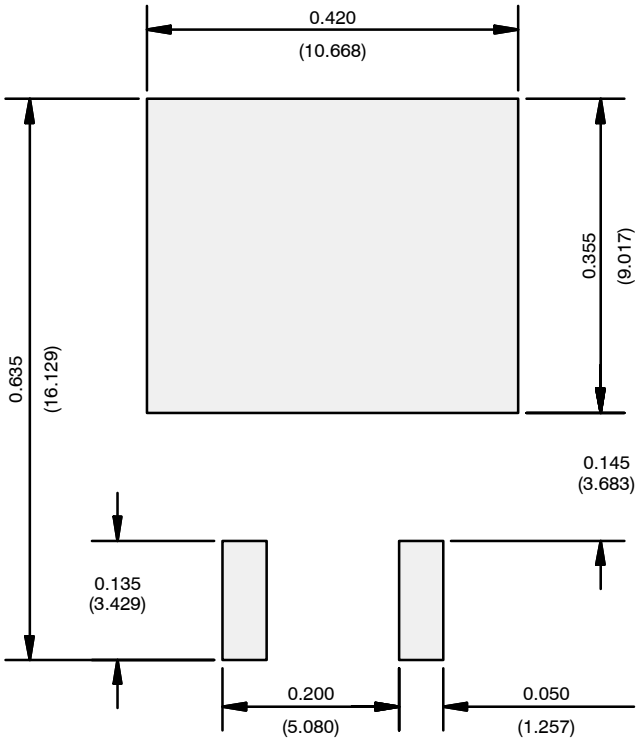
Note

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

Package Picture	
ASE	Xi'an



RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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