

## N-Channel 20-V (D-S) 175 °C MOSFET

### PRODUCT SUMMARY

$V_{(BR)DSS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>
20	0.0045 at $V_{GS} = 10$ V	60
	0.0065 at $V_{GS} = 4.5$ V	60

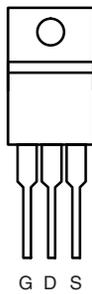
### FEATURES

- TrenchFET<sup>®</sup> Power MOSFET
- 175 °C Junction Temperature
- 100 %  $R_g$  Tested
- 100 % UIS Tested


**RoHS**  
COMPLIANT

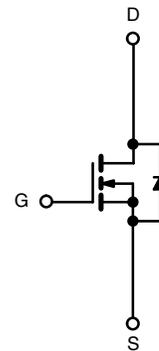
### APPLICATIONS

- OR-ing

**TO-220AB**


Top View

DRAIN connected to TAB



N-Channel MOSFET

**Ordering Information:** SUP60N02-4m5P-E3 (Lead (Pb)-free)

### ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	$V_{DS}$	20	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$		
Continuous Drain Current ( $T_J = 175$ °C)	$I_D$	$T_C = 25$ °C	60 <sup>a</sup>	A
		$T_C = 100$ °C	60 <sup>a</sup>	
Pulsed Drain Current	$I_{DM}$	120		
Single Pulse Avalanche Current	$I_{AS}$	50	mJ	
Single Pulse Avalanche Energy	$E_{AS}$	125		
Maximum Power Dissipation <sup>b</sup>	$P_D$	$T_C = 25$ °C	120 <sup>c</sup>	W
		$T_A = 25$ °C <sup>d</sup>	3.75	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 175	°C	

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Limit	Unit
Junction-to-Ambient (PCB Mount) <sup>d</sup>	$R_{thJA}$	40	°C/W
Junction-to-Case	$R_{thJC}$	1.25	

Notes:

- Package limited.
- Duty cycle  $\leq 1$  %.
- See SOA curve for voltage derating.
- When mounted on 1" square PCB (FR-4 material).



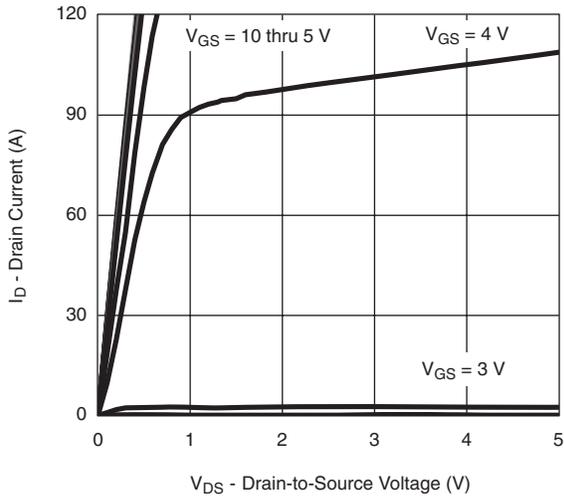
<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{DS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	20			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.0		3	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$			50	
		$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^\circ\text{C}$			250	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	100			A
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		0.0036	0.0045	$\Omega$
		$V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 125\text{ }^\circ\text{C}$			0.0068	
		$V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 175\text{ }^\circ\text{C}$			0.008	
		$V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$		0.0052	0.0065	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 20\text{ A}$		95		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 10\text{ V}, f = 1\text{ MHz}$		5950		$\text{pF}$
Output Capacitance	$C_{oss}$			985		
Reverse Transfer Capacitance	$C_{rss}$			365		
Total Gate Charge <sup>b</sup>	$Q_g$	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 50\text{ A}$		33	50	nC
Gate-Source Charge <sup>b</sup>	$Q_{gs}$			18		
Gate-Drain Charge <sup>b</sup>	$Q_{gd}$			7		
Gate Resistance	$R_g$		0.75	1.5	2.3	$\Omega$
Turn-On Delay Time <sup>b</sup>	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 0.2\text{ }\Omega$ $I_D \cong 50\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1.0\text{ }\Omega$		15	25	ns
Rise Time <sup>b</sup>	$t_r$			7	11	
Turn-Off Delay Time <sup>b</sup>	$t_{d(off)}$			35	55	
Fall Time <sup>b</sup>	$t_f$			8	12	
<b>Source-Drain Diode Ratings and Characteristics</b> $T_C = 25\text{ }^\circ\text{C}^c$						
Continuous Current	$I_S$				60	A
Pulsed Current	$I_{SM}$				100	
Forward Voltage <sup>a</sup>	$V_{SD}$	$I_F = 20\text{ A}, V_{GS} = 0\text{ V}$		0.85	1.5	V
Reverse Recovery Time	$t_{rr}$	$I_F = 20\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		45	90	ns
Peak Reverse Recovery Current	$I_{RM}$			1.7	3.4	A
Reverse Recovery Charge	$Q_{rr}$			0.039	0.155	$\mu\text{C}$

Notes:

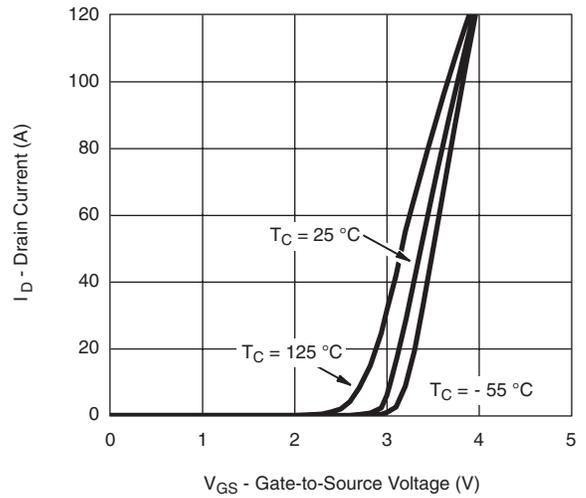
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$
- b. Independent of operating temperature.
- c. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

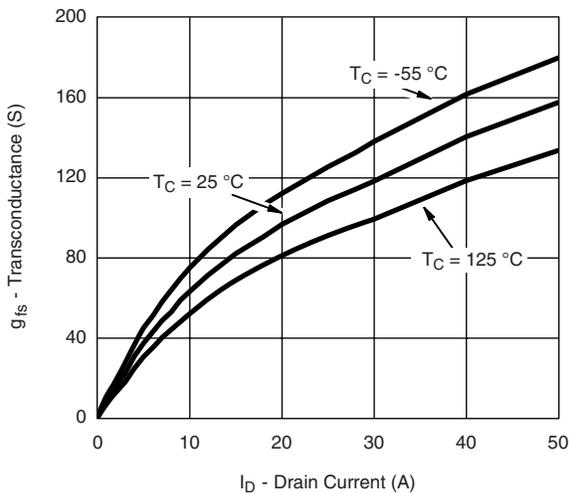
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



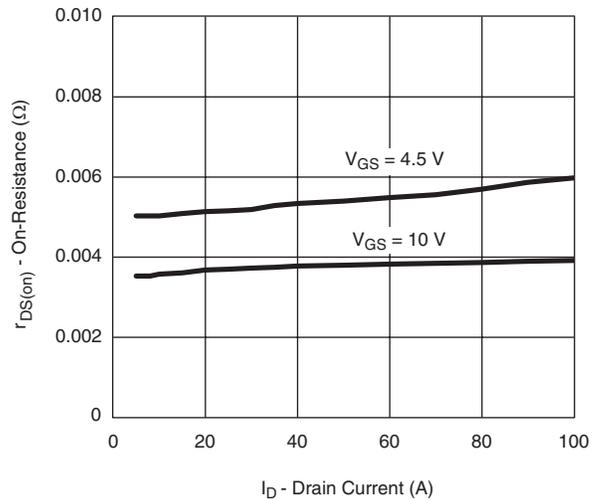
**Output Characteristics**



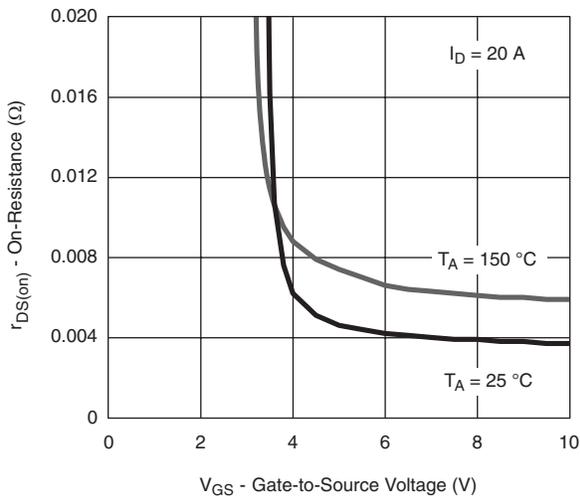
**Transfer Characteristics**



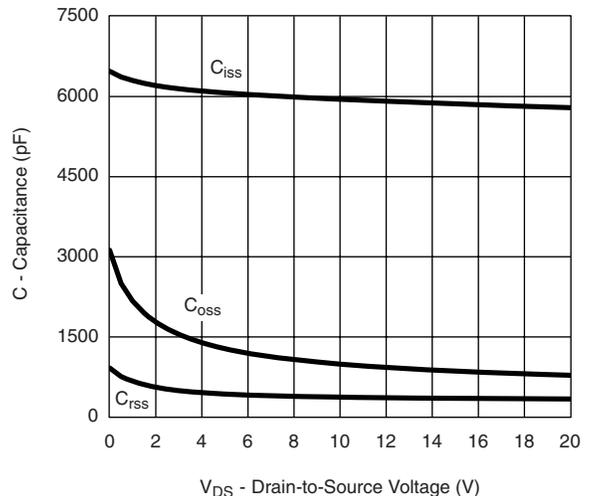
**Transconductance**



**On-Resistance vs. Drain Current**

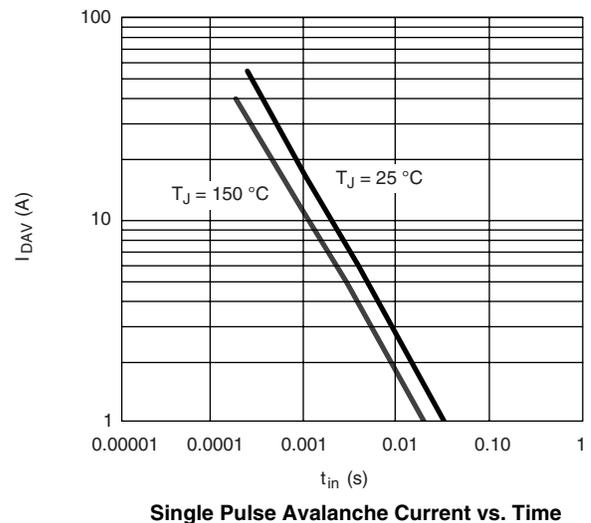
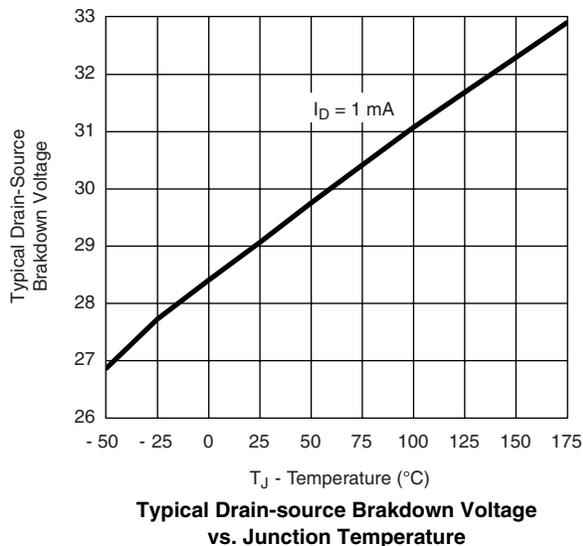
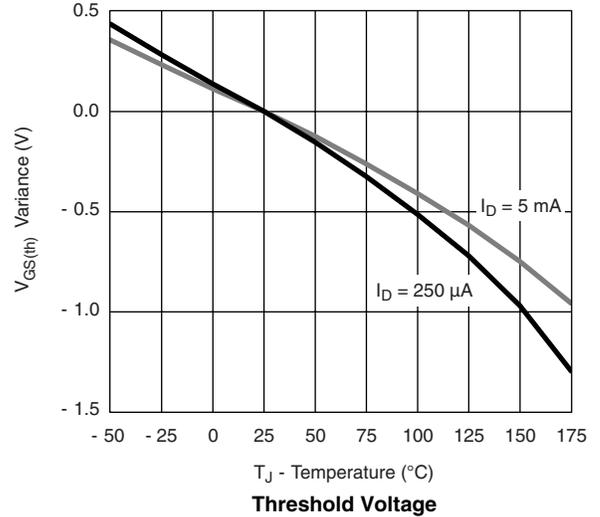
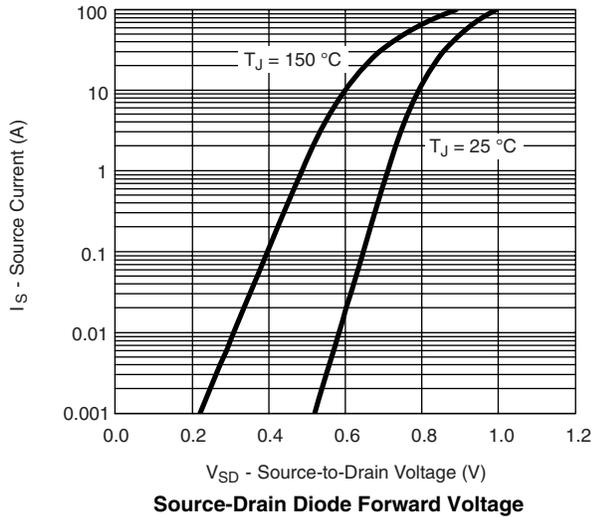
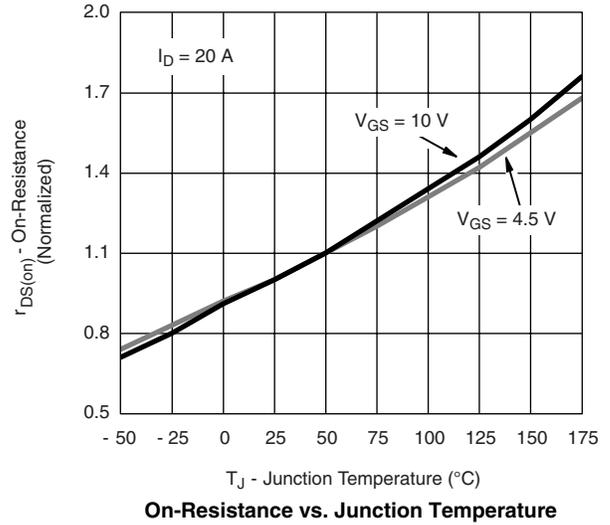
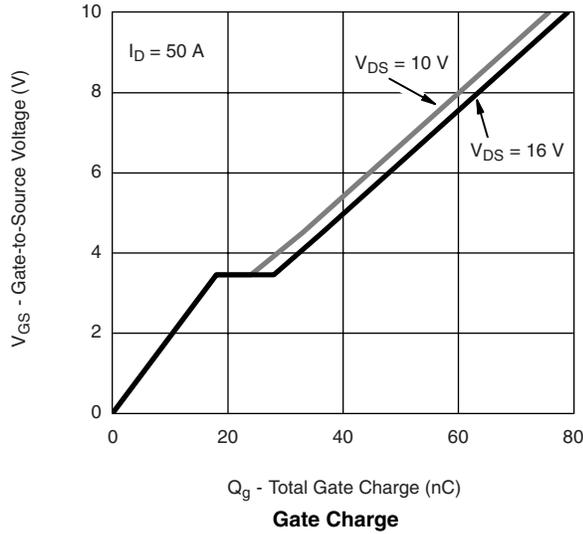


**On-Resistance vs. Gate-to-Source Voltage**



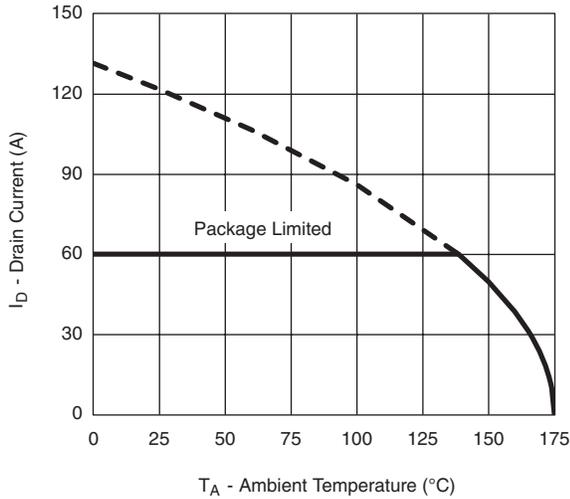
**Capacitance**

### TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

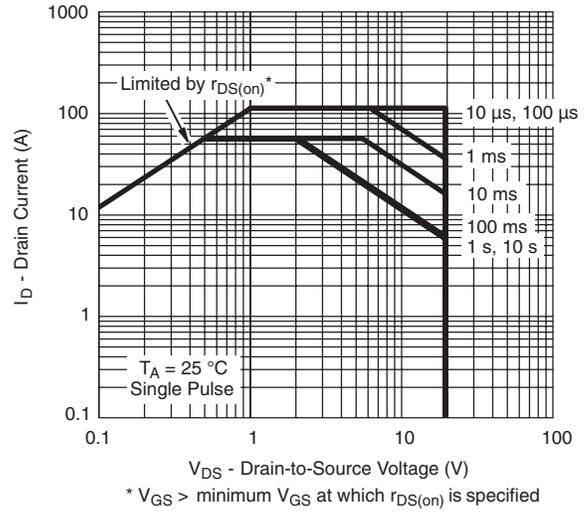




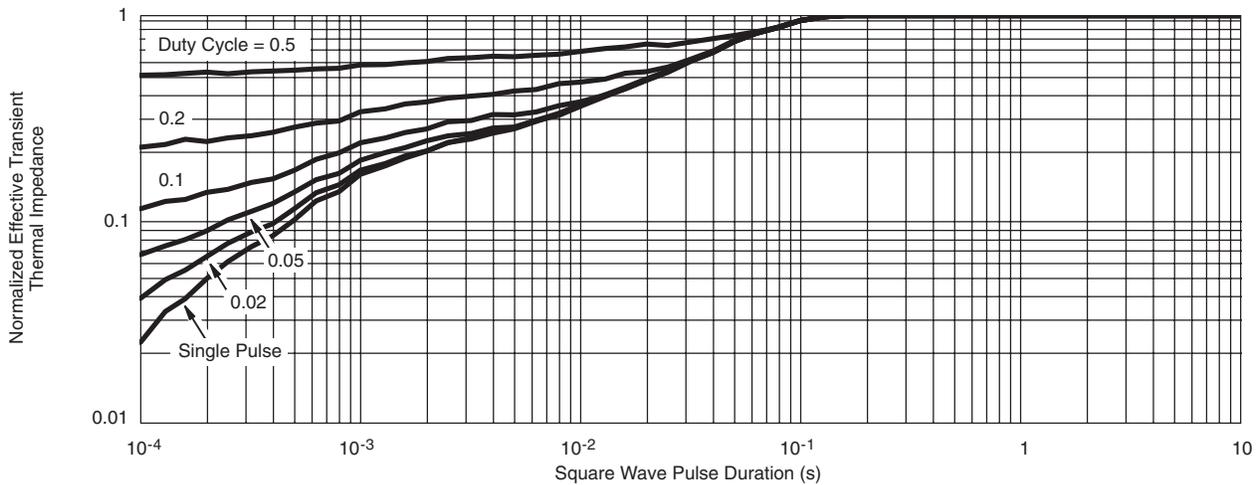
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



**Drain Current vs. Ambient Temperature**



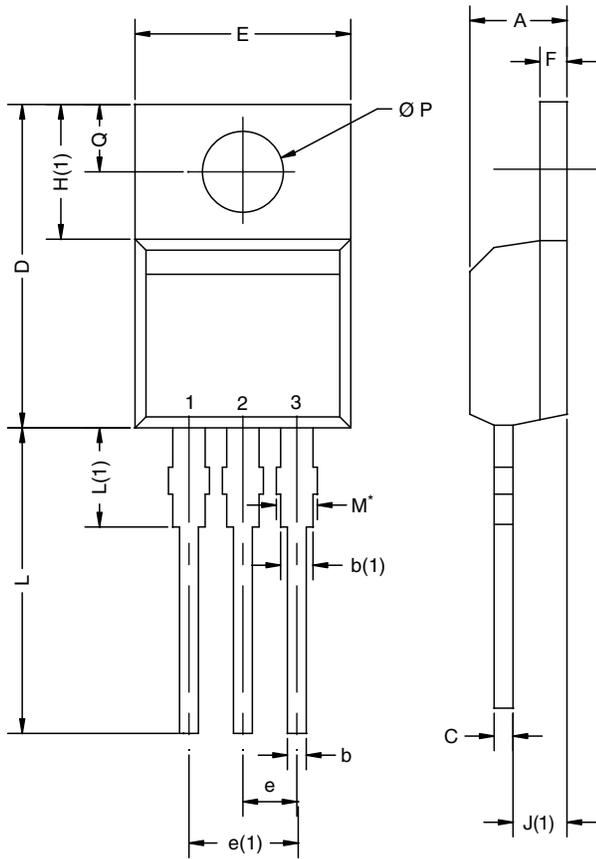
**Safe Operating Area**



**Normalized Thermal Transient Impedance, Junction-to-Case**

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 <http://www.vishay.com/ppg?69821>.

## TO-220AB

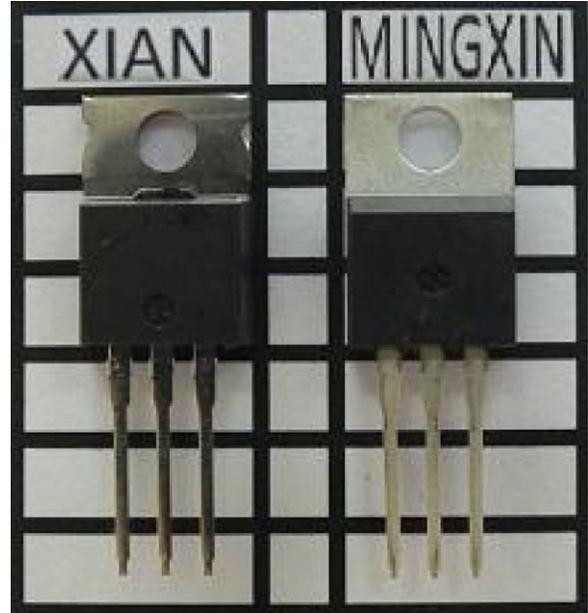


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
$\varnothing P$	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

ECN: X12-0208-Rev. N, 08-Oct-12  
DWG: 5471

### Notes

- \* M = 1.32 mm to 1.62 mm (dimension including protrusion)  
Heatsink hole for HVM
- Xi'an and Mingxin actual photo





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