

## N-Channel 60-V (D-S) MOSFET

### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)	$Q_g$ (Typ.)
60	0.006 at $V_{GS} = 10$ V	90 <sup>d</sup>	78.5

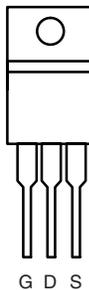
### FEATURES

- TrenchFET<sup>®</sup> Power MOSFET
- 175 °C Junction Temperature
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS Directive 2002/95/EC

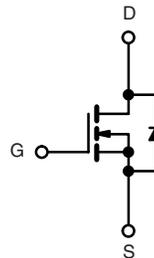

**RoHS**  
COMPLIANT

### APPLICATIONS

- Power Supply
  - Secondary Synchronous Rectification
- Industrial

**TO-220AB**


Top View

**Ordering Information:** SUP90N06-6m0P-E3 (Lead (Pb)-free)


N-Channel MOSFET

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

Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	$V_{DS}$	60	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$		
Continuous Drain Current ( $T_J = 175$ °C)	$I_D$	$T_C = 25$ °C	90 <sup>d</sup>	A
		$T_C = 70$ °C	90 <sup>d</sup>	
Pulsed Drain Current	$I_{DM}$	240		
Avalanche Current	$I_{AS}$	50		
Single Avalanche Energy <sup>a</sup>	$E_{AS}$	125	mJ	
Maximum Power Dissipation <sup>a</sup>	$P_D$	$T_C = 25$ °C	272 <sup>b</sup>	W
		$T_A = 25$ °C <sup>c</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>c</sup>	$R_{thJA}$	40	°C/W
Junction-to-Case (Drain)	$R_{thJC}$	0.55	

Notes:

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

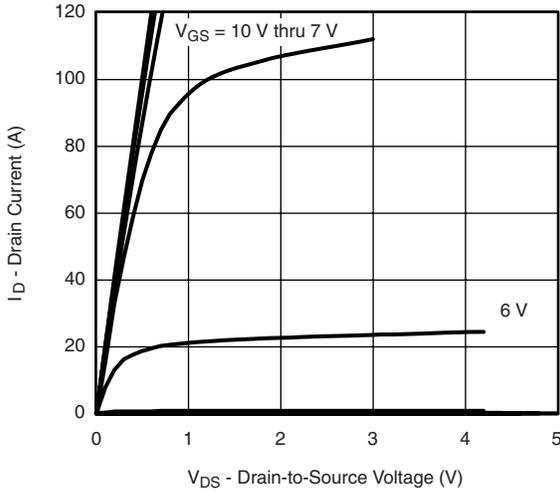
<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{DS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.5		4.5	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 250$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$			50	
		$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$			250	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 10\text{ V}, V_{GS} = 10\text{ V}$	70			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		0.005	0.006	$\Omega$
		$V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 125\text{ }^\circ\text{C}$		0.008	0.010	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 20\text{ A}$		58		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 30\text{ V}, f = 1\text{ MHz}$		4700		$\mu\text{F}$
Output Capacitance	$C_{oss}$			620		
Reverse Transfer Capacitance	$C_{rss}$			250		
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{DS} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 50\text{ A}$		78.5	120	nC
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			28		
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$			20.6		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		1.2	2.4	$\Omega$
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 0.6\text{ }\Omega$ $I_D \cong 50\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		16	30	ns
Rise Time <sup>c</sup>	$t_r$			10	20	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			25	40	
Fall Time <sup>c</sup>	$t_f$			8	15	
<b>Source-Drain Diode Ratings and Characteristics</b> $T_C = 25\text{ }^\circ\text{C}$ <sup>b</sup>						
Continuous Current	$I_S$				85	A
Pulsed Current	$I_{SM}$				240	
Forward Voltage <sup>a</sup>	$V_{SD}$	$I_F = 20\text{ A}, V_{GS} = 0\text{ V}$		0.83	1.5	V
Reverse Recovery Time	$t_{rr}$	$I_F = 75\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		62	100	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$			3.8	5.7	A
Reverse Recovery Charge	$Q_{rr}$			118	180	nC

**Notes:**

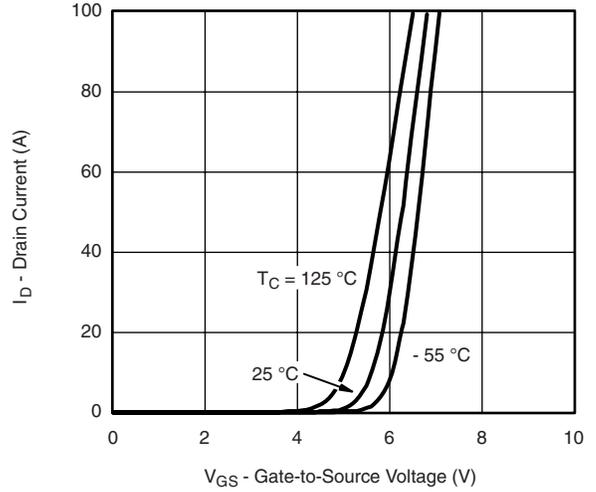
- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

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.

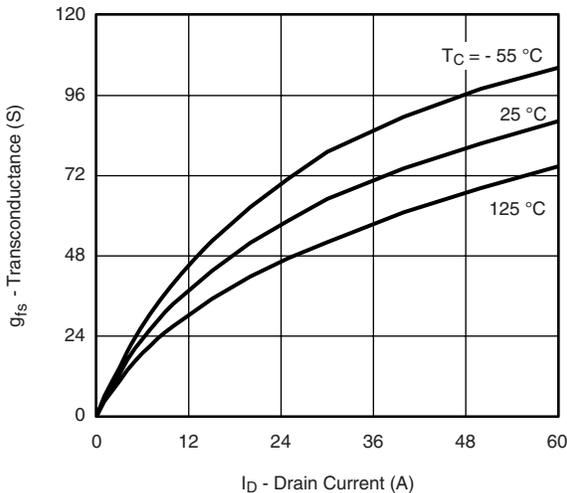
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



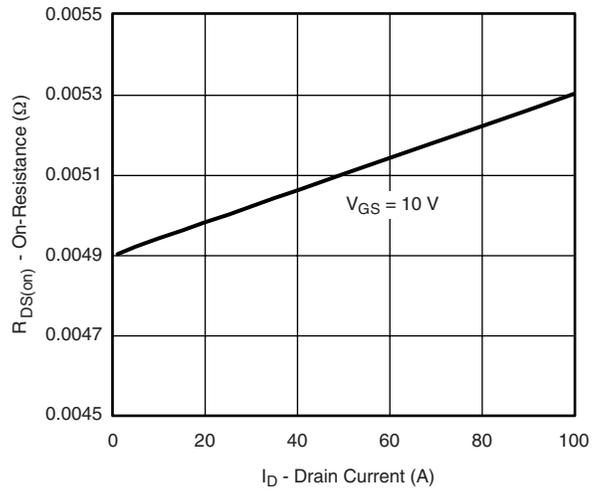
**Output Characteristics**



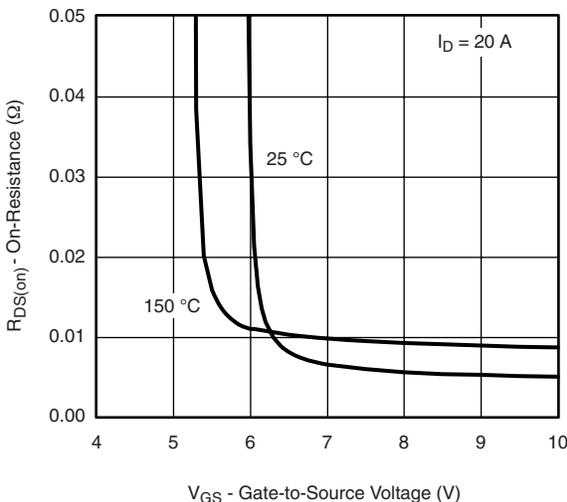
**Transfer Characteristics**



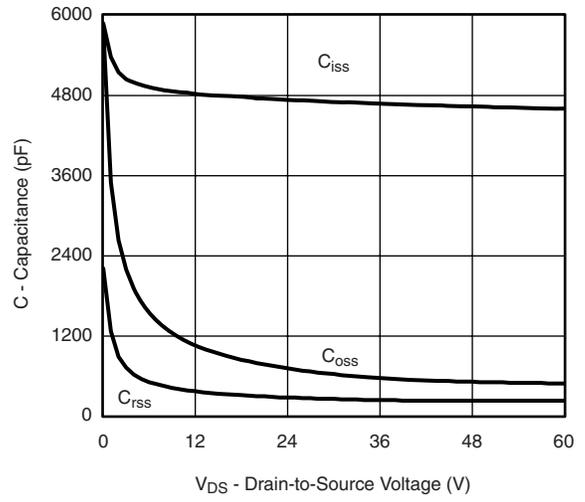
**Transconductance**



**On-Resistance vs. Drain Current**

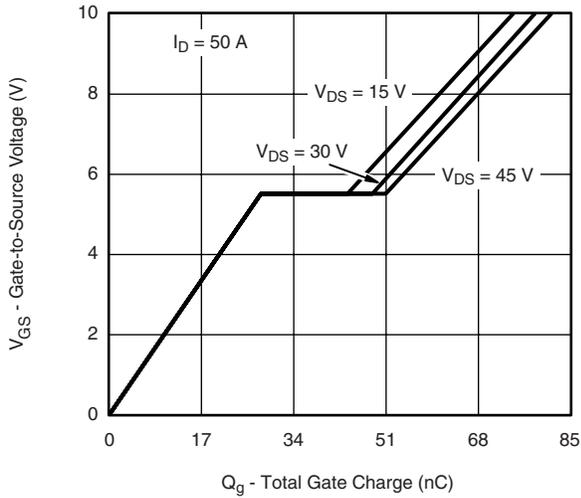


**On-Resistance vs. Gate-to-Source Voltage**

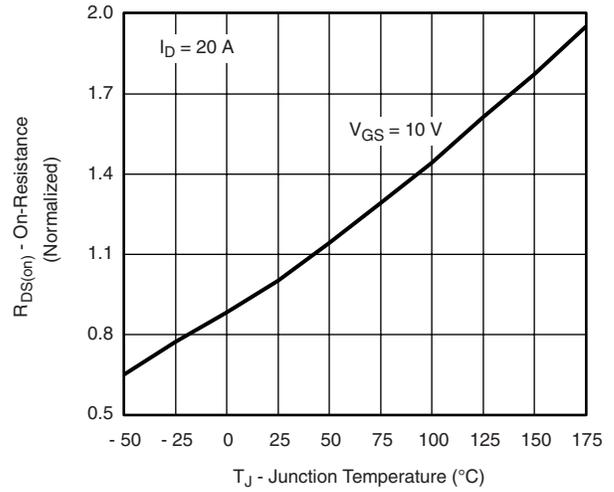


**Capacitance**

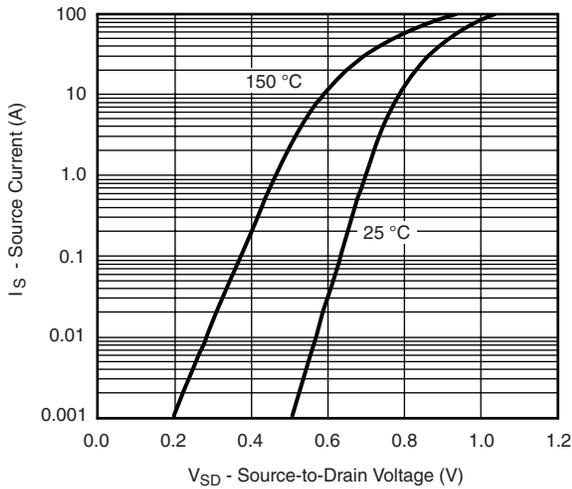
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



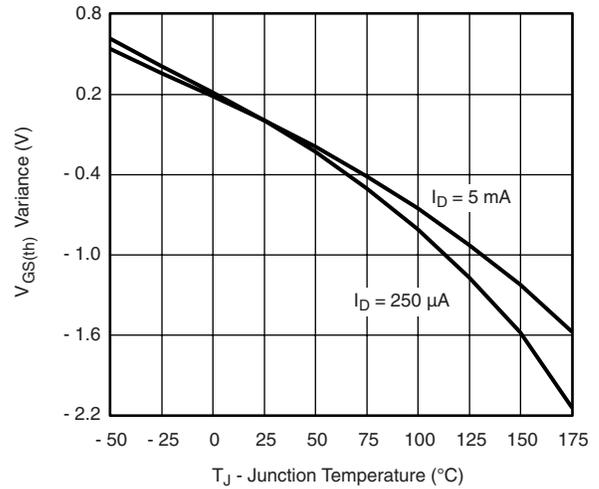
**On-Resistance vs. Junction Temperature**



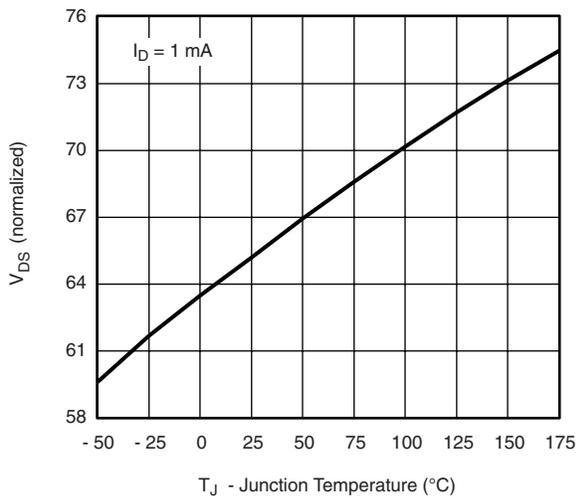
**Threshold Voltage**



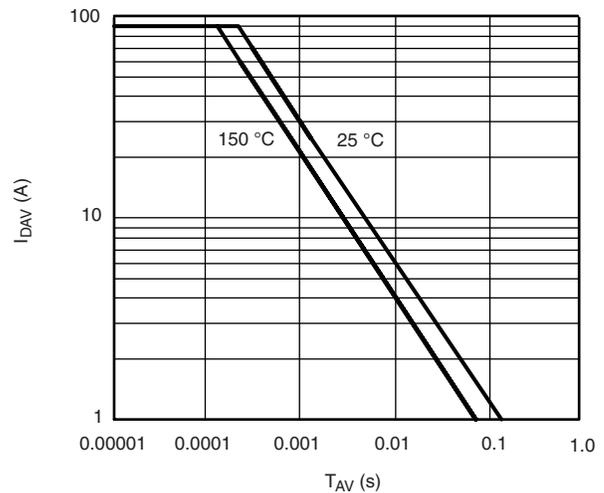
**Gate Charge**



**On-Resistance vs. Junction Temperature**

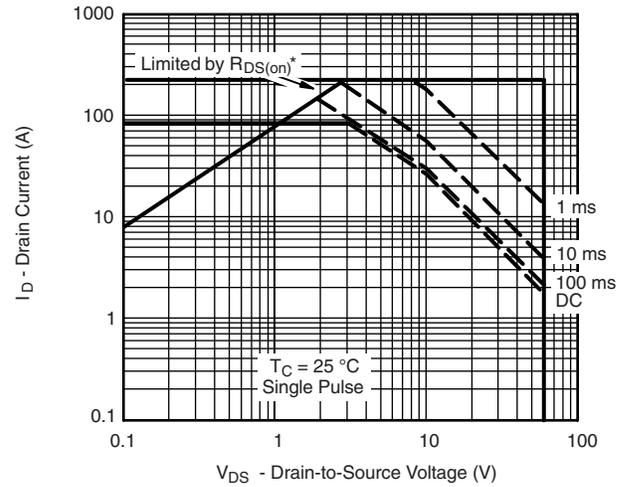
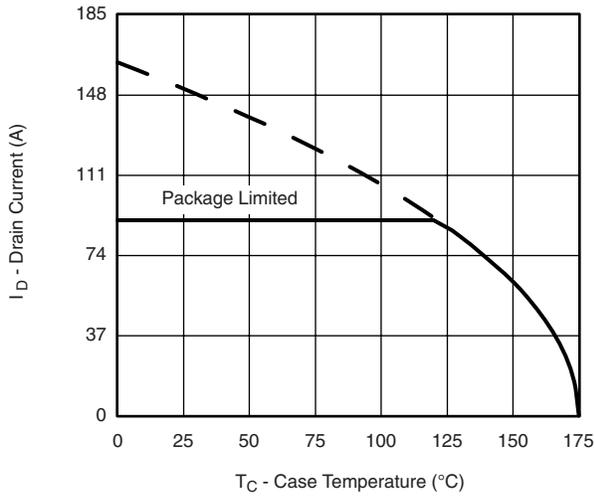


**Source-Drain Diode Forward Voltage**



**Maximum Drain Current vs. Case Temperature**

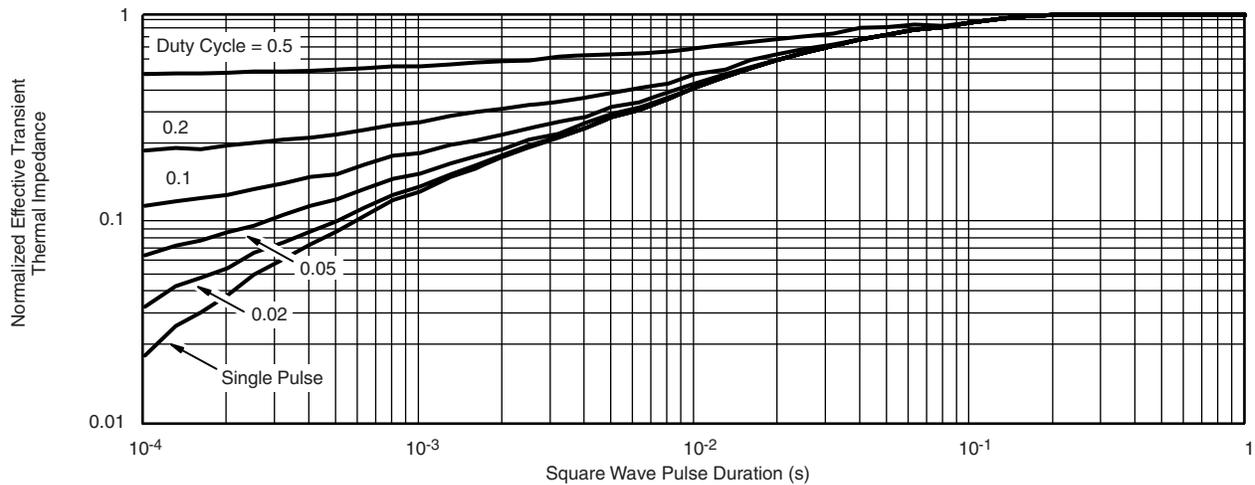
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



**Single Pulse Avalanche Current Capability vs. Time**

\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

**Safe Operating Area**

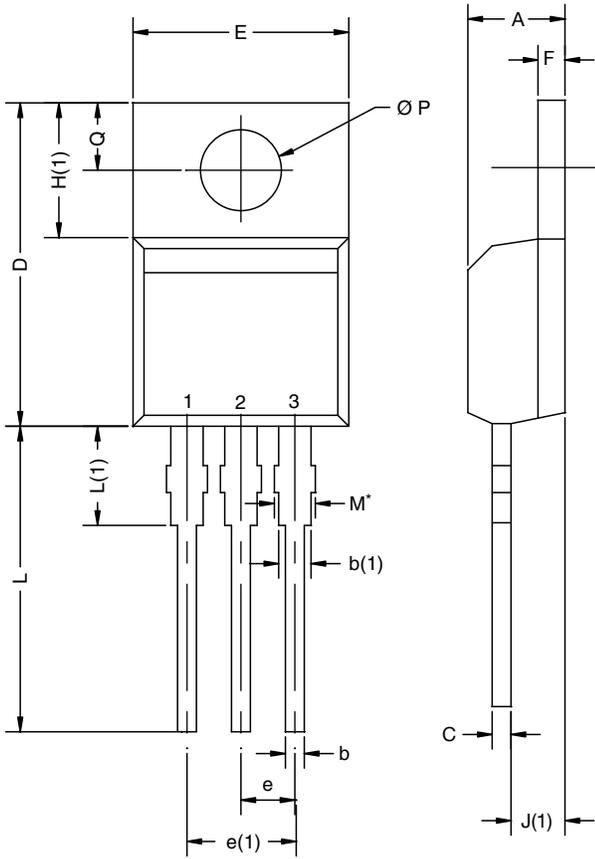


**Normalized Thermal Transient Impedance, Junction-to-Case**

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### TO-220AB

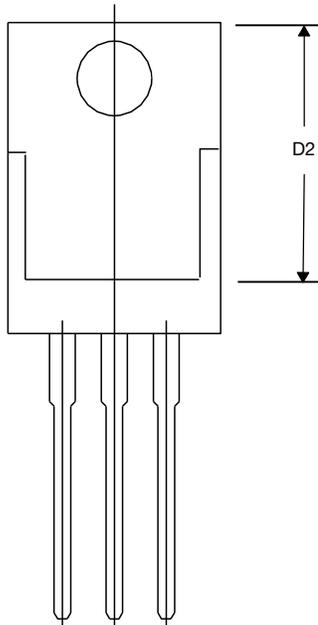


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
D2	12.19	12.70	0.480	0.500
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	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: T14-0413-Rev. P, 16-Jun-14  
DWG: 5471

**Note**

\* M = 1.32 mm to 1.62 mm (dimension including protrusion)  
Heatsink hole for HVM





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