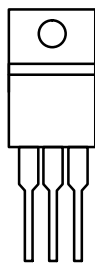
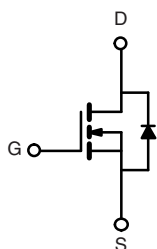


# Automotive N-Channel 60 V (D-S) 175 °C MOSFET

## PRODUCT SUMMARY

$V_{DS}$ (V)	60
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10$ V	0.006
$I_D$ (A)	119
Configuration	Single

**TO-220AB**

**G D S**  
Top View


N-Channel MOSFET

## FEATURES

- TrenchFET® Power MOSFET
- Package with Low Thermal Resistance
- AEC-Q101 Qualified<sup>d</sup>
- 100 %  $R_g$  and UIS Tested
- Material categorization:  
For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

AUTOMOTIVE  
GRADE

**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

## ORDERING INFORMATION

Package	TO-220
Lead (Pb)-free and Halogen-free	SQP120N06-06-GE3

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

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V <sub>DS</sub>	60	V
Gate-Source Voltage		V <sub>GS</sub>	± 20	
Continuous Drain Current	T <sub>C</sub> = 25 °C	I <sub>D</sub>	119	A
	T <sub>C</sub> = 125 °C		68	
Continuous Source Current (Diode Conduction) <sup>a</sup>		I <sub>S</sub>	120	
Pulsed Drain Current <sup>b</sup>		I <sub>DM</sub>	480	
Single Pulse Avalanche Current	L = 0.1 mH	I <sub>AS</sub>	65	
Single Pulse Avalanche Energy		E <sub>AS</sub>	211	mJ
Maximum Power Dissipation <sup>b</sup>	T <sub>C</sub> = 25 °C	P <sub>D</sub>	175	W
	T <sub>C</sub> = 125 °C		56	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	- 55 to + 175	°C

## THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-Ambient	$R_{thJA}$	40	°C/W
Junction-to-Case (Drain)	$R_{thJC}$	0.88	

### Notes

- Package limited.
- Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %.
- When mounted on 1" square PCB (FR-4 material).
- Parametric verification ongoing.



SPECIFICATIONS (T <sub>C</sub> = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0, I <sub>D</sub> = 250 μA		60	-	-	V
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA		2.5	3.0	3.5	
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 60 V	-	-	1	μA
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 60 V, T <sub>J</sub> = 125 °C	-	-	50	
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 60 V, T <sub>J</sub> = 175 °C	-	-	250	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>GS</sub> = 10 V	V <sub>DS</sub> ≥ 5 V	120	-	-	A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 30 A	-	0.0045	0.0060	Ω
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 30 A, T <sub>J</sub> = 125 °C	-	-	0.0104	
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 30 A, T <sub>J</sub> = 175 °C	-	-	0.0129	
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 30 A		-	94	-	S
Dynamic <sup>b</sup>							
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 25 V, f = 1 MHz	-	5196	6495	pF
Output Capacitance	C <sub>oss</sub>			-	708	885	
Reverse Transfer Capacitance	C <sub>rss</sub>			-	336	420	
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	V <sub>DS</sub> = 30 V, I <sub>D</sub> = 75 A	-	96.5	145	nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			-	24.6	-	
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			-	27.2	-	
Gate Resistance	R <sub>g</sub>	f = 1 MHz		0.6	1.2	1.7	Ω
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 30 V, R <sub>L</sub> = 0.4 Ω I <sub>D</sub> ≅ 75 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		-	16	24	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			-	14	21	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			-	34	51	
Fall Time <sup>c</sup>	t <sub>f</sub>			-	9	14	
Source-Drain Diode Ratings and Characteristics <sup>b</sup>							
Pulsed Current <sup>a</sup>	I <sub>SM</sub>			-	-	480	A
Forward Voltage	V <sub>SD</sub>	I <sub>F</sub> = 75 A, V <sub>GS</sub> = 0		-	0.9	1.5	V

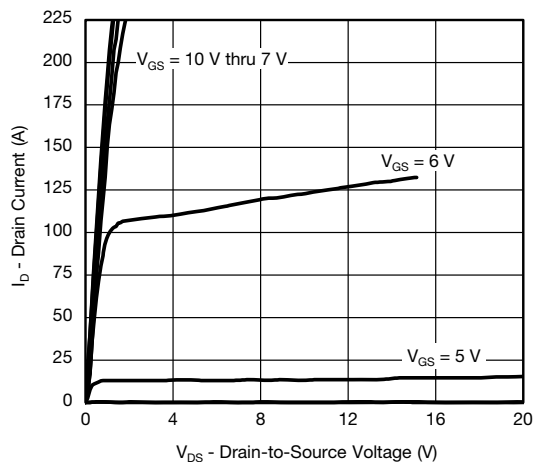
**Notes**

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

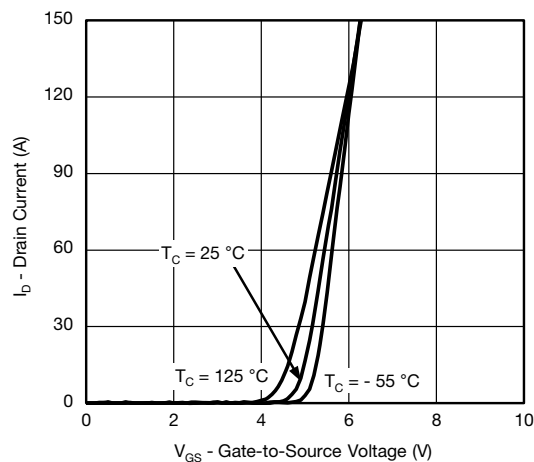
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



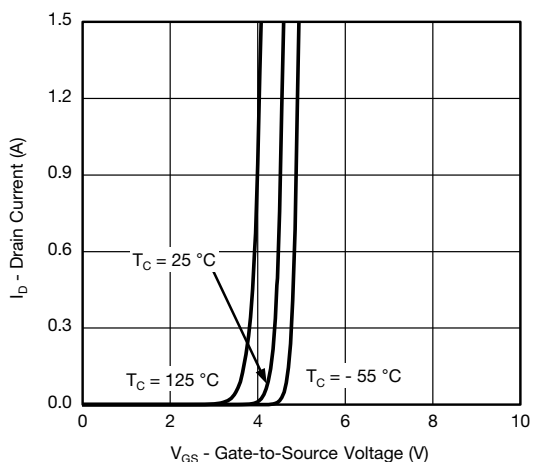
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



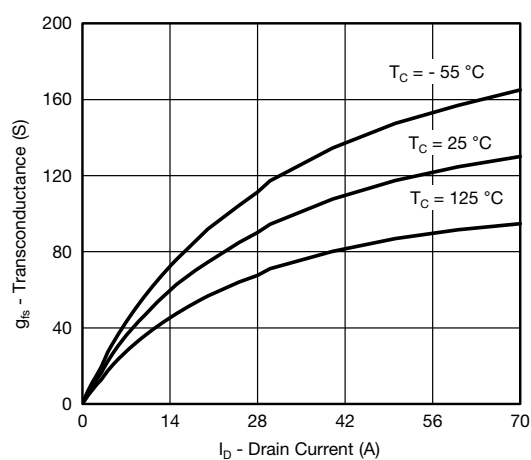
**Output Characteristics**



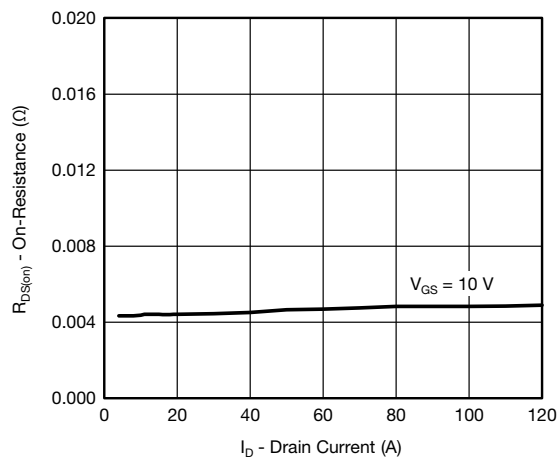
**Transfer Characteristics**



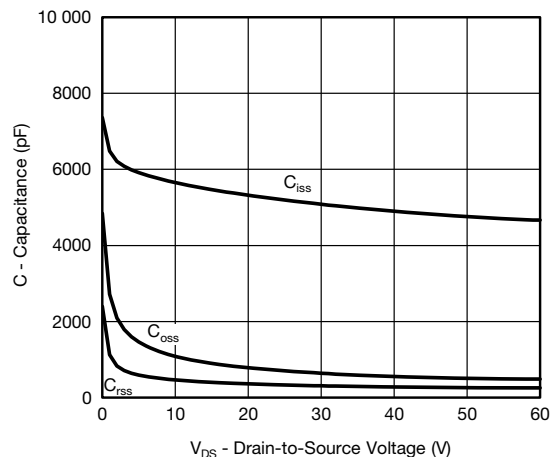
**Transfer Characteristics**



**Transconductance**



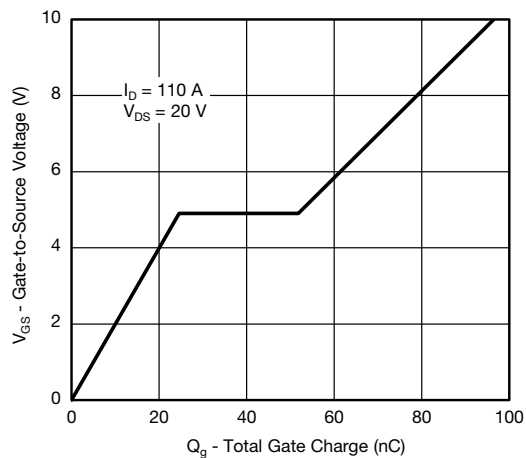
**On-Resistance vs. Drain Current**



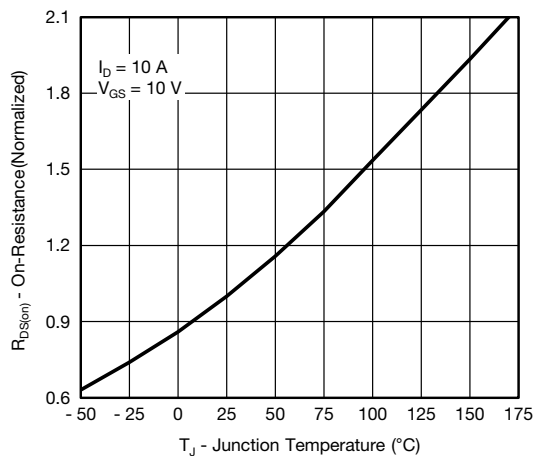
**Capacitance**



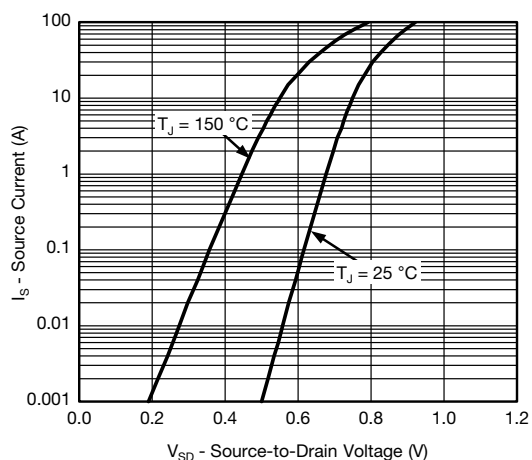
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



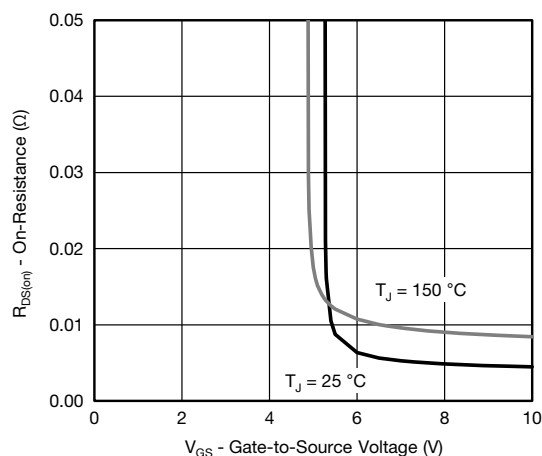
**Gate Charge**



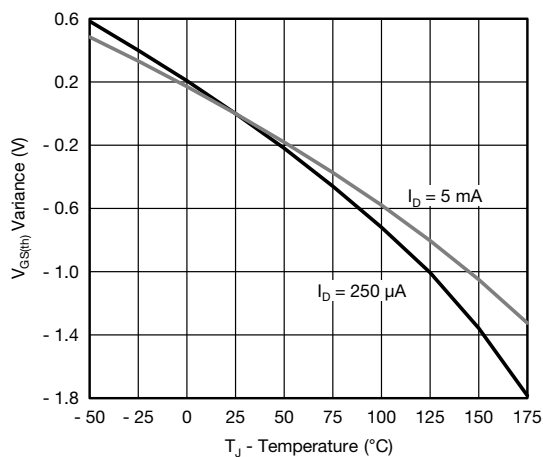
**On-Resistance vs. Junction Temperature**



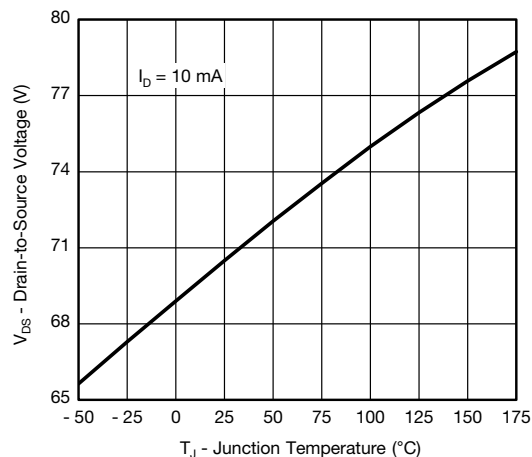
**Source Drain Diode Forward Voltage**



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



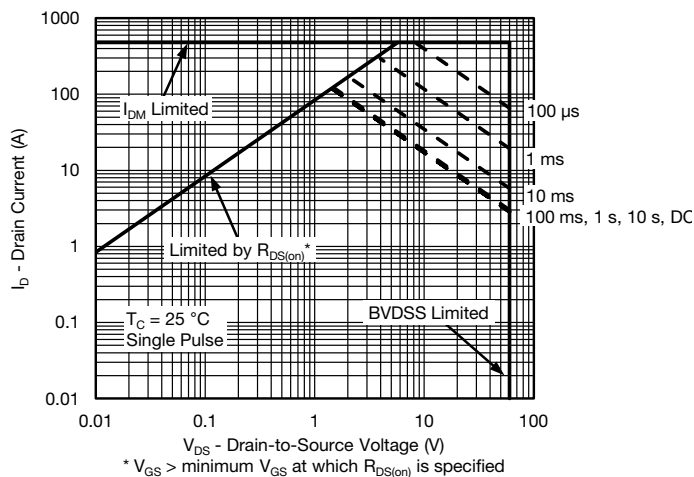
**Threshold Voltage**



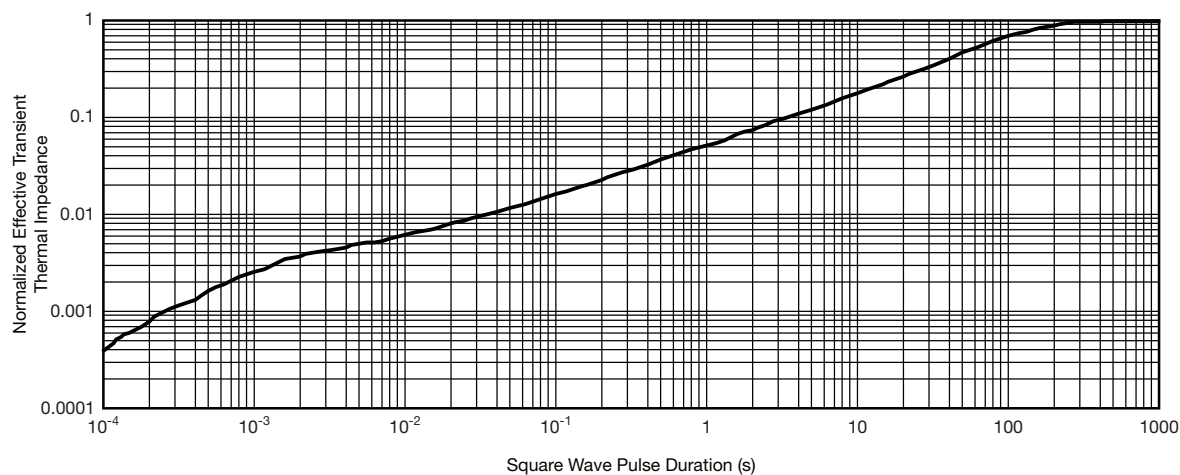
**Drain Source Breakdown vs. Junction Temperature**



**THERMAL RATINGS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



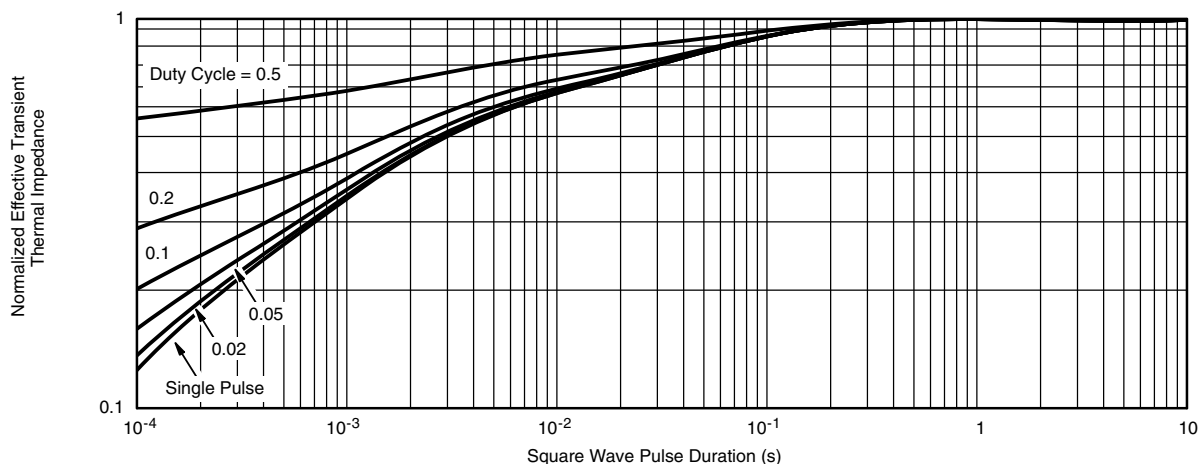
**Safe Operating Area**



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



**THERMAL RATINGS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



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

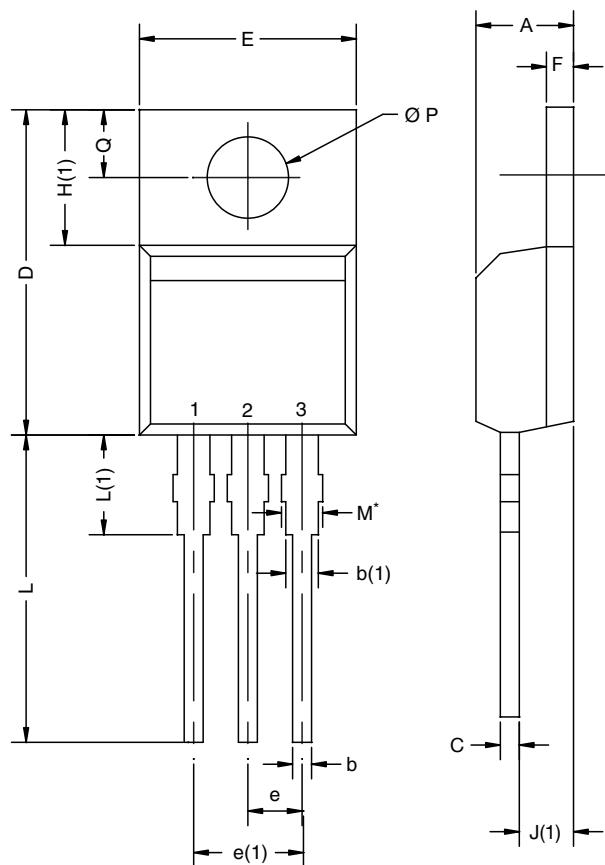
**Note**

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient ( $25\text{ }^{\circ}\text{C}$ )
  - Normalized Transient Thermal Impedance Junction-to-Case ( $25\text{ }^{\circ}\text{C}$ )are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

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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
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: T13-0724-Rev. O, 14-Oct-13  
DWG: 5471

### Note

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



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