

## 4P04L04-VB TO220 Datasheet

### P-Channel 40-V (D-S) MOSFET

#### PRODUCT SUMMARY

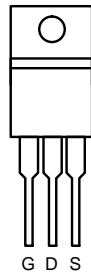
$V_{DS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
- 40	0.0041 at $V_{GS} = - 10$ V	- 110	185 nC

#### FEATURES

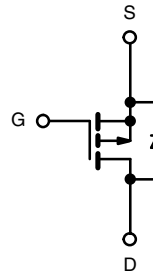
- Trench Power MOSFET


**RoHS**  
 COMPLIANT

TO-220AB



Top View



P-Channel MOSFET

#### ABSOLUTE MAXIMUM RATINGS $T_A = 25^\circ\text{C}$ , unless otherwise noted

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	- 40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 175^\circ\text{C}$ )	$I_D$	$T_C = 25^\circ\text{C}$	A
		$T_C = 70^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
		$T_A = 70^\circ\text{C}$	
Pulsed Drain Current	$I_{DM}$	240	mJ
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
Avalanche Current	$I_{AS}$	75	
Single-Pulse Avalanche Energy	$E_{AS}$	281	
Maximum Power Dissipation	$P_D$	$T_C = 25^\circ\text{C}$	W
		$T_C = 70^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
		$T_A = 70^\circ\text{C}$	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 175	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260	

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, d</sup>	$R_{thJA}$	8	10	$^\circ\text{C/W}$
Maximum Junction-to-Case (Drain)	$R_{thJC}$	0.33	0.4	

Notes:

a. Package limited.

b. Surface Mounted on 1" x 1" FR4 board.

c.  $t = 10$  s.

d. Maximum under Steady State conditions is  $40^\circ\text{C/W}$ .

SPECIFICATIONS T <sub>J</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 V, I <sub>D</sub> = - 250 μA	- 40			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = - 250 μA		- 40		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			- 5.5		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA	- 2	- 3	- 4	V
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>DS</sub> = - 40 V, V <sub>GS</sub> = 0 V			- 1	μA
		V <sub>DS</sub> = - 40 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			- 10	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = - 10 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> = - 20 A		0.0041		Ω
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = - 15 V, I <sub>D</sub> = - 20 A		75		S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = - 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz		11300		pF
Output Capacitance	C <sub>oss</sub>			1510		
Reverse Transfer Capacitance	C <sub>rss</sub>			1000		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = - 20 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 110 A		185	280	nC
Gate-Source Charge	Q <sub>gs</sub>			48		
Gate-Drain Charge	Q <sub>gd</sub>			42		
Gate Resistance	R <sub>g</sub>	f = 1 MHz		4.0		Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = - 20 V, R <sub>L</sub> = 0.18 Ω I <sub>D</sub> ≅ - 110 A, V <sub>GEN</sub> = - 10 V, R <sub>g</sub> = 1 Ω		25	40	ns
Rise Time	t <sub>r</sub>			290	440	
Turn-Off Delay Time	t <sub>d(off)</sub>			110	165	
Fall Time	t <sub>f</sub>			35	55	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			- 110	A
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				- 240	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = - 20 A		- 0.8	- 1.5	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = - 20 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C		70	105	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			130	200	nC
Reverse Recovery Fall Time	t <sub>a</sub>			37		ns
Reverse Recovery Rise Time	t <sub>b</sub>			33		

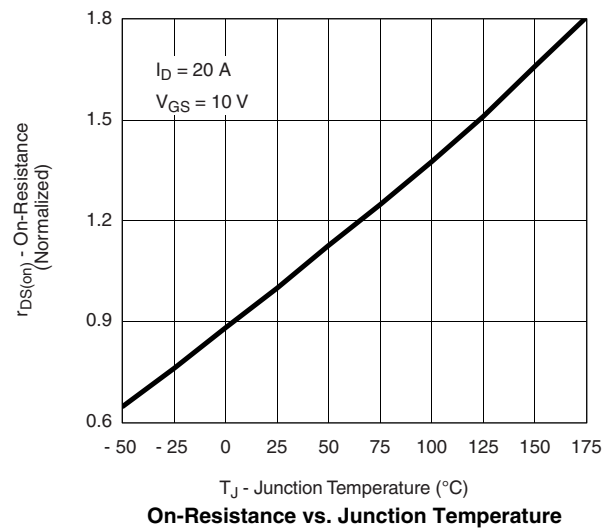
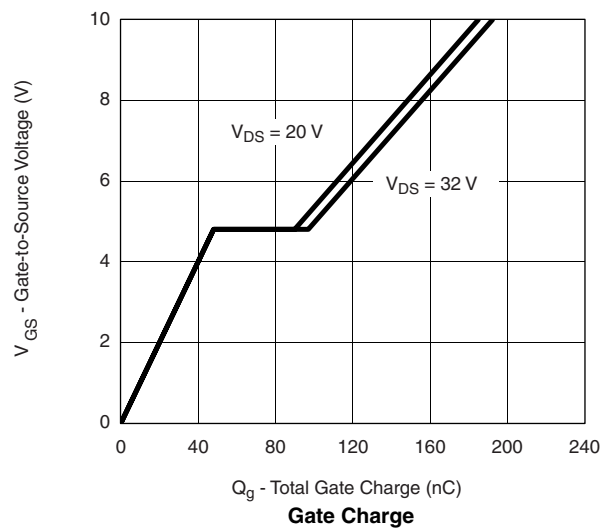
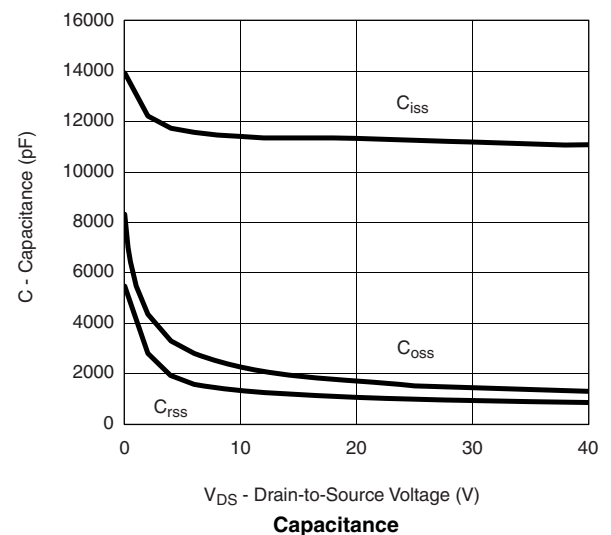
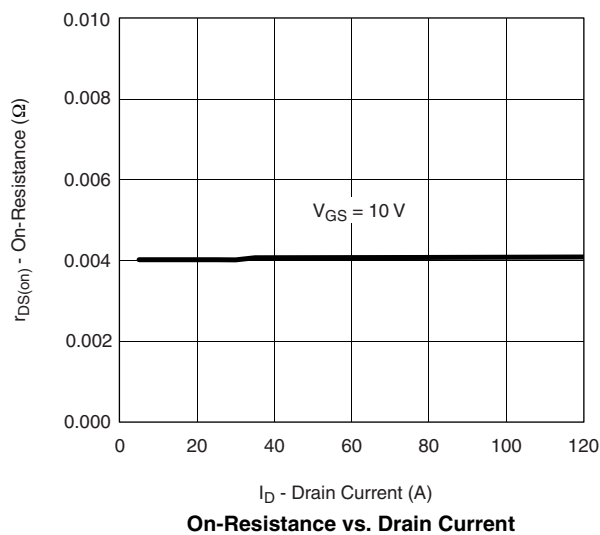
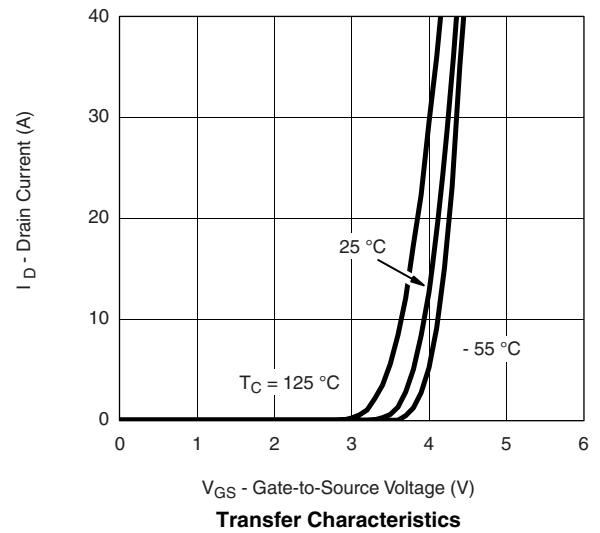
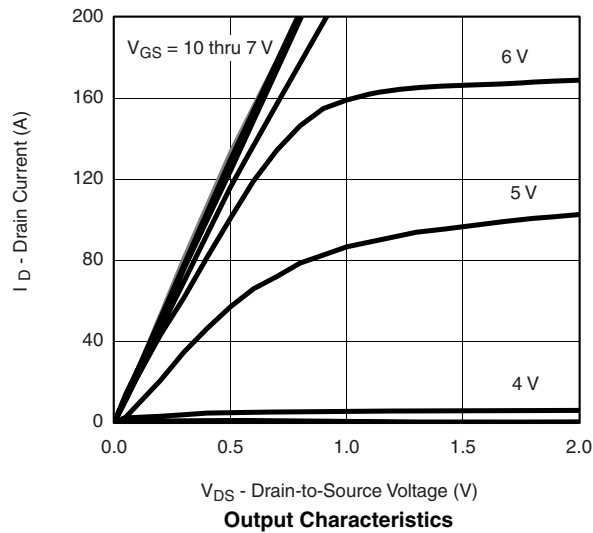
Notes:

a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

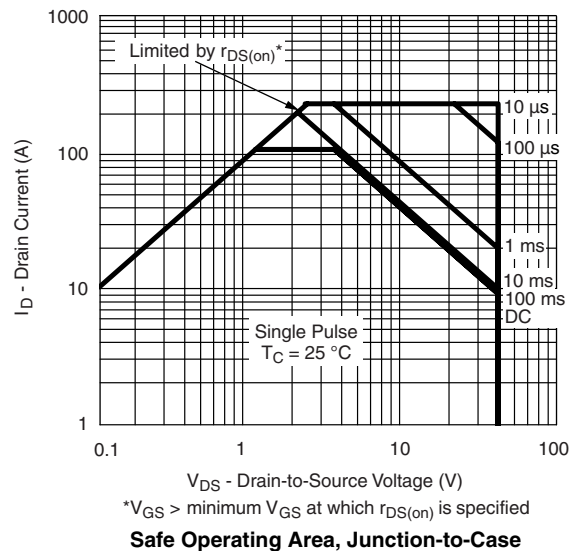
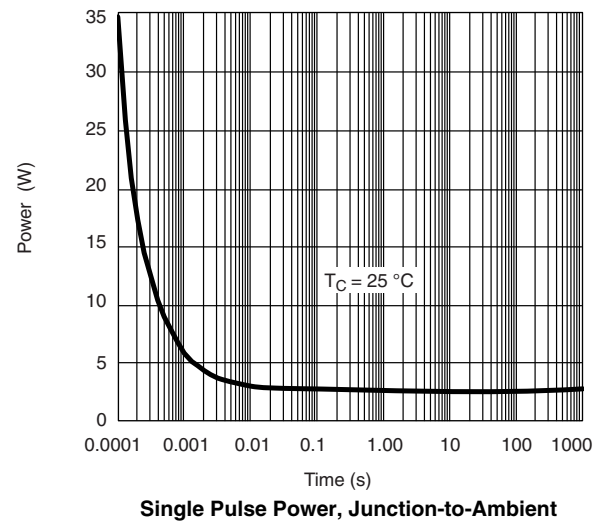
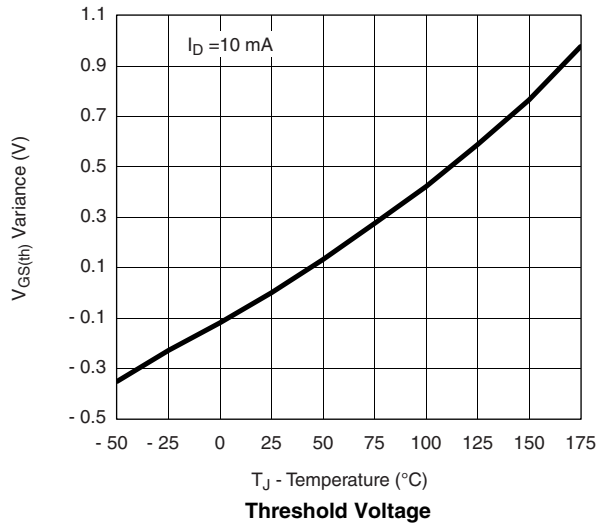
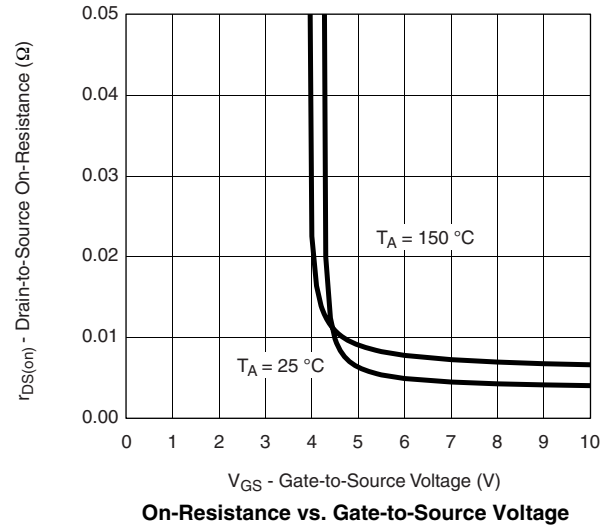
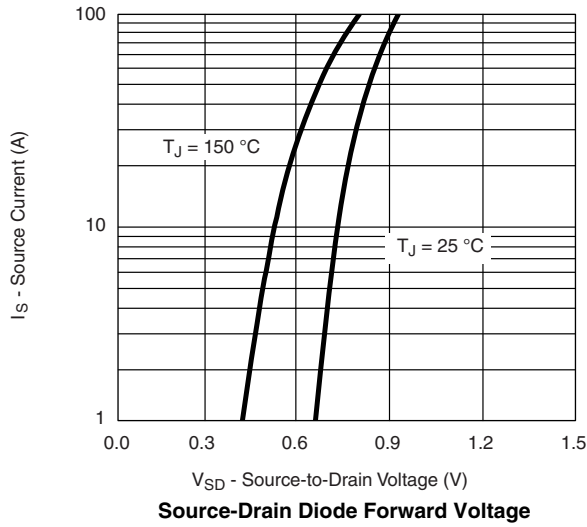
b. Guaranteed by design, not subject to production testing.

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.

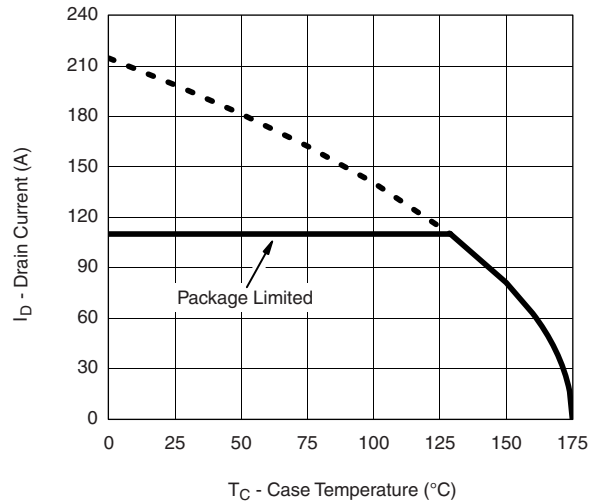
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



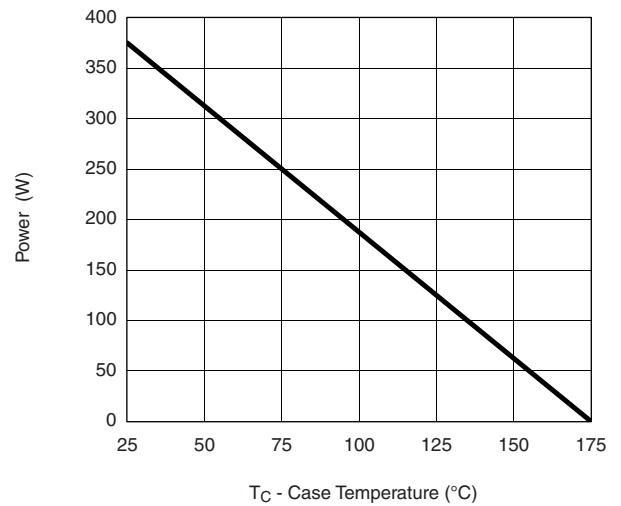
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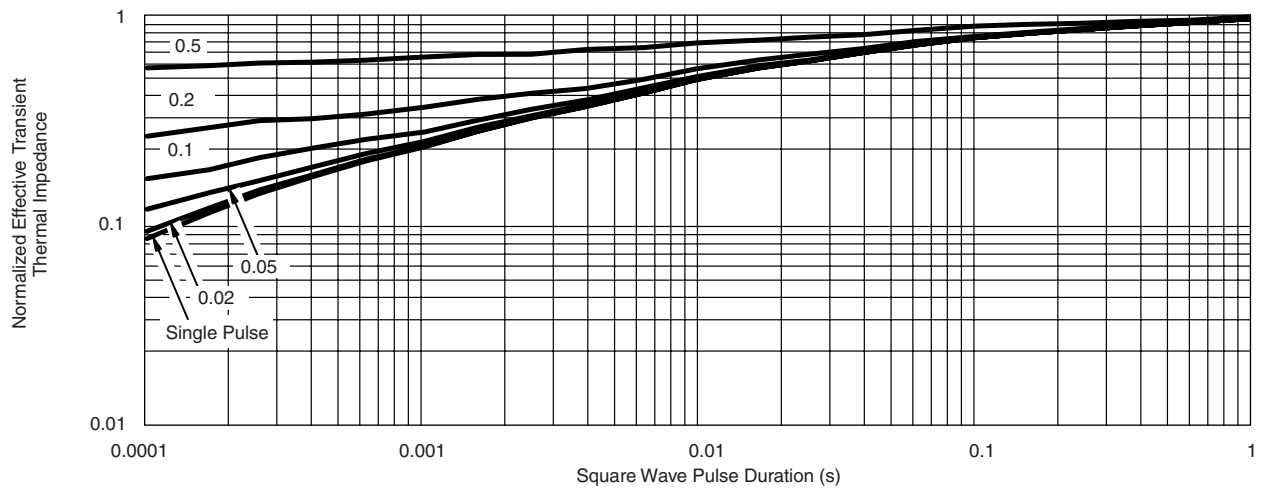
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



**Max. Avalanche and Drain Current vs. Case Temperature\***



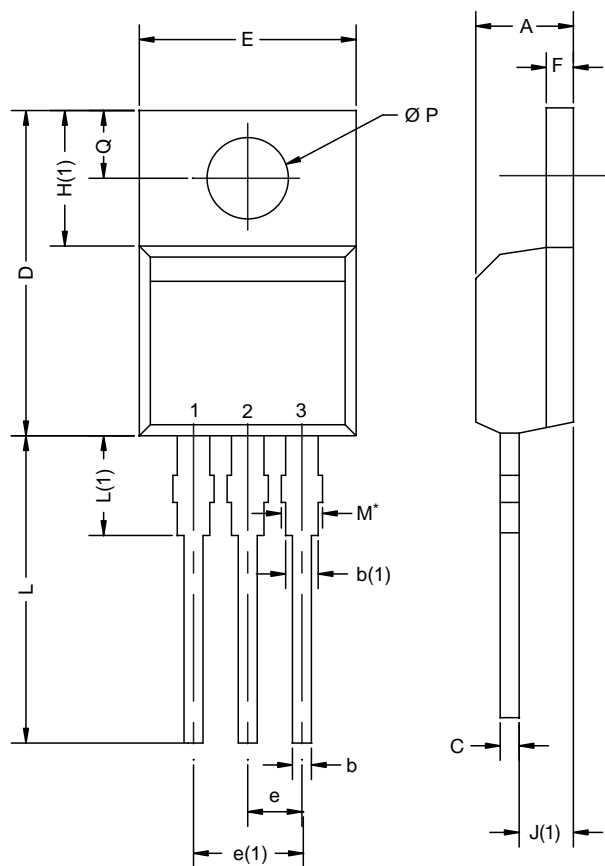
**Power Derating, Junction-to-Case**



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

\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 175$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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
Ø 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

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