

P-Channel 40 V (D-S) MOSFET

PRODUCT SUMMARY

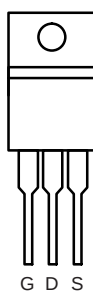
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a
- 40	0.012 at $V_{GS} = - 10$ V	± 65
	0.012 at $V_{GS} = - 4.5$ V	± 60

FEATURES

- Compliant to RoHS Directive 2002/95/EC


 Available
RoHS*
 COMPLIANT

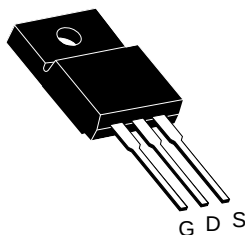
TO-220AB



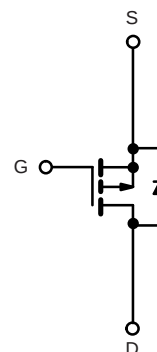
Top View

VBM2412

TO-220 FULLPAK



Top View

VBMB2412

P-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Gate-Source Voltage	V_{GS}	± 40	V
Continuous Drain Current ($T_J = 175$ °C)	I_D	$- 65^a$	A
		$- 62$	
Pulsed Drain Current	I_{DM}	$- 60$	
Avalanche Current	I_{AR}	$- 60$	
Repetitive Avalanche Energy ^b	E_{AR}	180	mJ
Power Dissipation	P_D	187^d	W
		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	R_{thJA}	40	°C/W
		62.5	
Junction-to-Case	R_{thJC}	0.8	

Notes:

a. Package limited.

b. Duty cycle ≤ 1 %.

c. When mounted on 1" square PCB (FR-4 material).

d. See SOA curve for voltage derating.

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

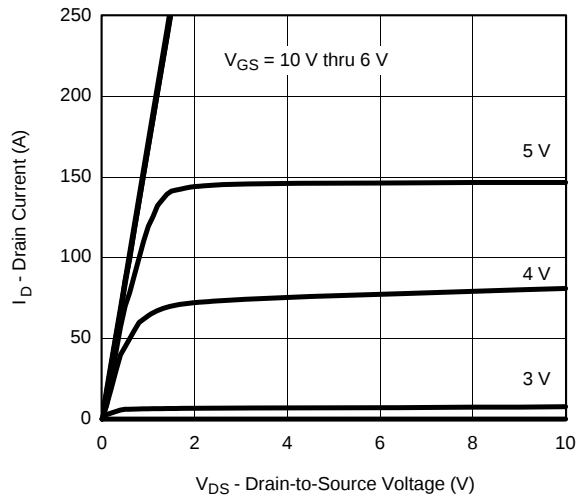
SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = - 250 μA	- 40			V
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = - 250 μA	- 1.5		- 1.7	
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = - 30 V, V _{GS} = 0 V			- 1	μA
		V _{DS} = - 30 V, V _{GS} = 0 V, T _J = 125 °C			- 50	
		V _{DS} = - 30 V, V _{GS} = 0 V, T _J = 175 °C			- 250	
On-State Drain Current ^a	I _{D(on)}	V _{DS} = - 5 V, V _{GS} = - 10 V	- 120			A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = - 10 V, I _D = - 30 A		0.012		Ω
		V _{GS} = - 10 V, I _D = - 30 A, T _J = 125 °C		0.010		
		V _{GS} = - 10 V, I _D = - 30 A, T _J = 175 °C		0.013		
		V _{GS} = - 4.5 V, I _D = - 20 A		0.012		
Forward Transconductance ^a	g _{fs}	V _{DS} = - 15 V, I _D = - 75 A	20			S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = - 25 V, f = 1 MHz		9000		pF
Output Capacitance	C _{oss}			1565		
Reversen Transfer Capacitance	C _{rss}			715		
Total Gate Charge ^c	Q _g	V _{DS} = - 15 V, V _{GS} = - 10 V, I _D = - 75 A		160	240	nC
Gate-Source Charge ^c	Q _{gs}			32		
Gate-Drain Charge ^c	Q _{gd}			30		
Turn-On Delay Time ^c	t _{d(on)}	V _{DD} = - 15 V, R _L = 0.2 Ω I _D ≐ - 75 A, V _{GEN} = - 10 V, R _g = 2.5 Ω		25	40	ns
Rise Time ^c	t _r			225	360	
Turn-Off Delay Time ^c	t _{d(off)}			150	240	
Fall Time ^c	t _f			210	340	
Source-Drain Diode Ratings and Characteristics ^b (T _C = 25 °C)						
Continuous Current	I _S				- 80	A
Pulsed Current	I _{SM}				- 240	
Forward Voltage ^a	V _{SD}	I _F = - 75 A, V _{GS} = 0 V		- 1.2	- 1.5	V
Reverse Recovery Time	t _{rr}	I _F = - 75 A, dI/dt = 100 A/μs		55	100	ns
Peak Reverse Recovery Current	I _{RM(REC)}			2.5	5	A
Reverse Recovery Charge	Q _{rr}			0.07	0.25	μC

Notes:

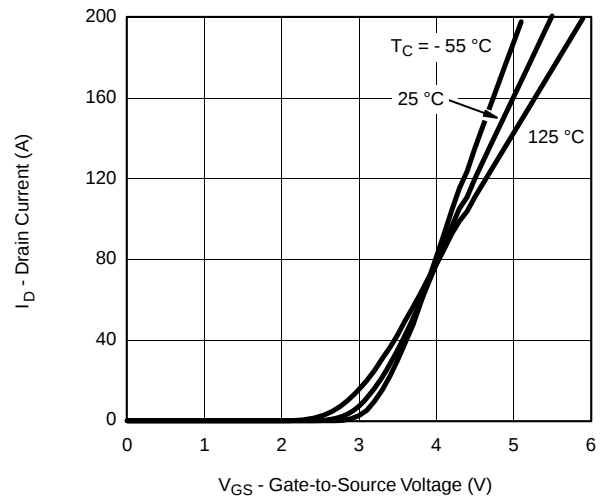
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
 b. Guaranteed by design, not subject to production testing.
 c. Independent of operating temperature.

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.

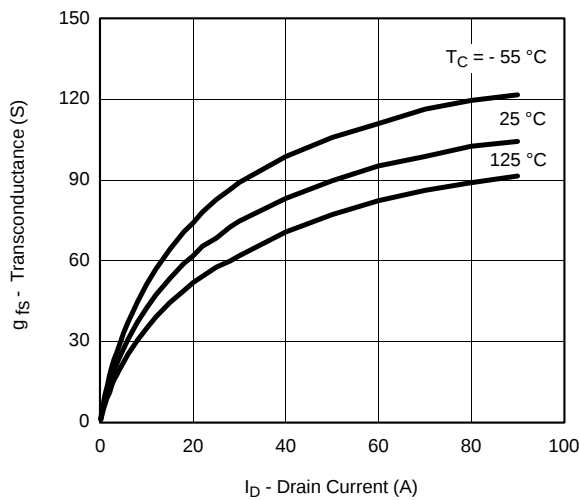
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



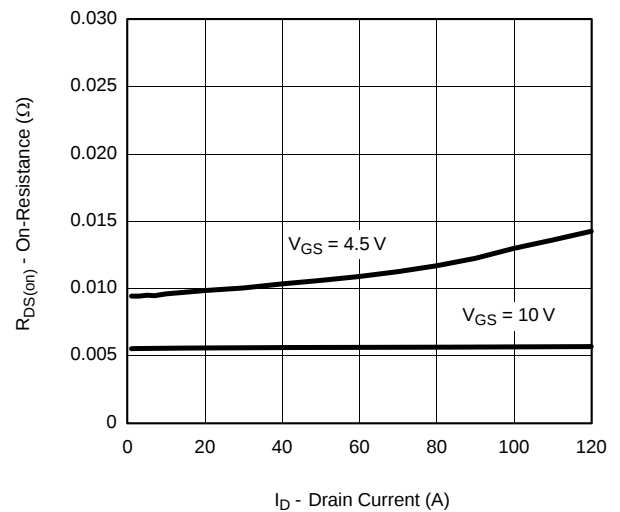
Output Characteristics



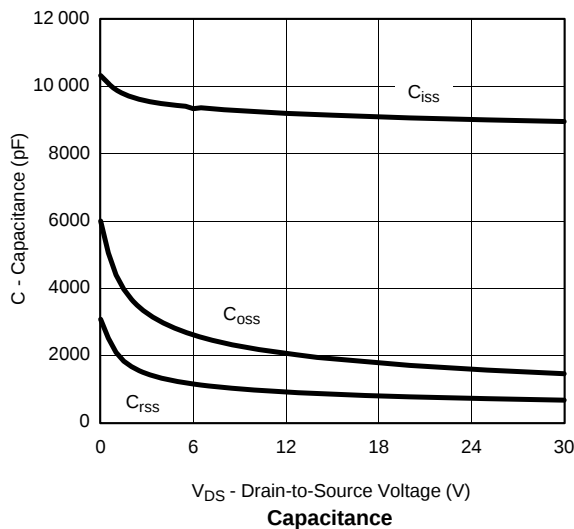
Transfer Characteristics



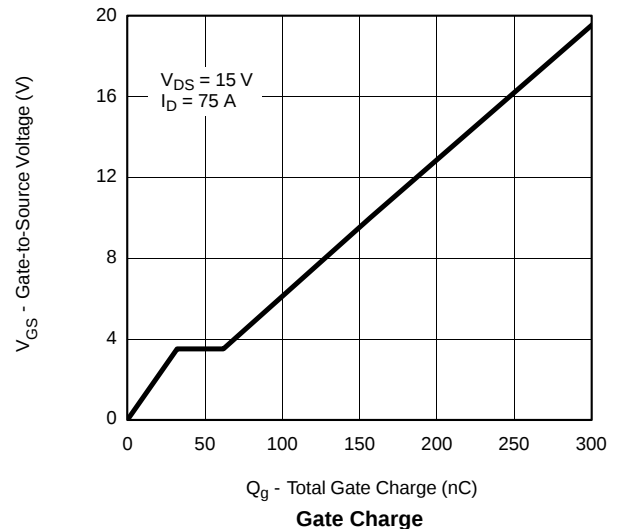
Transconductance



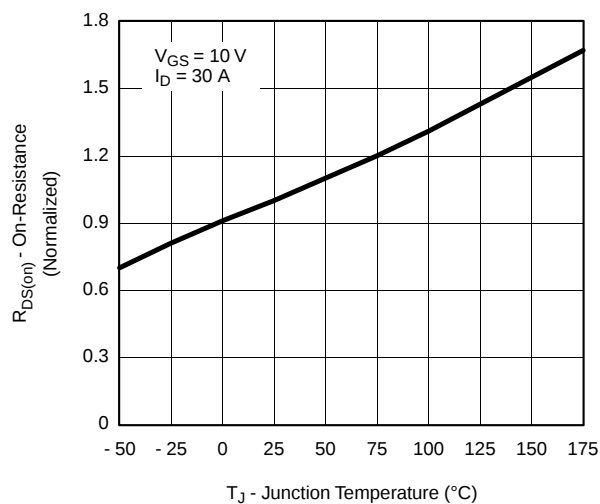
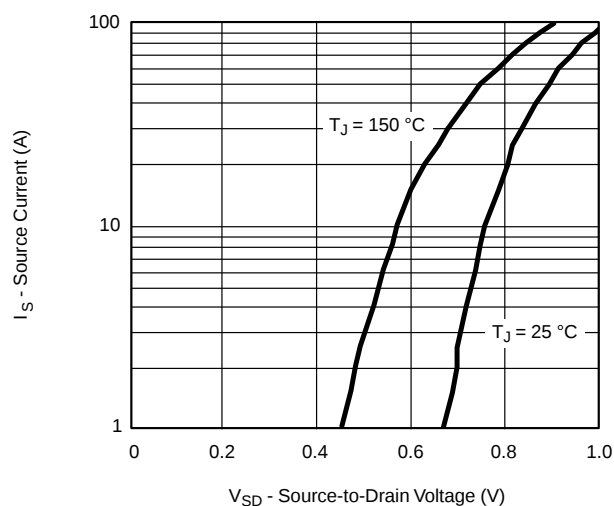
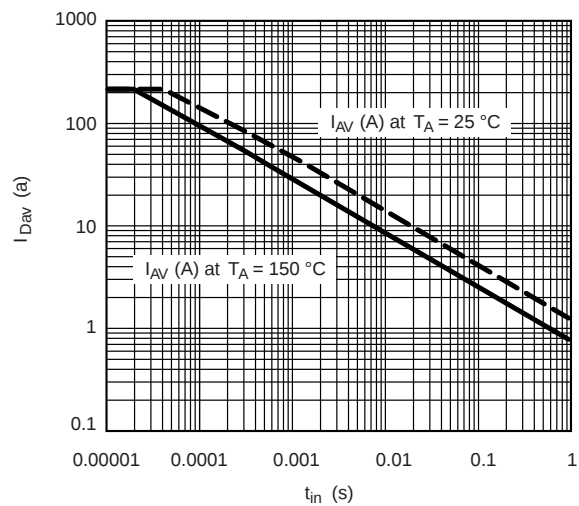
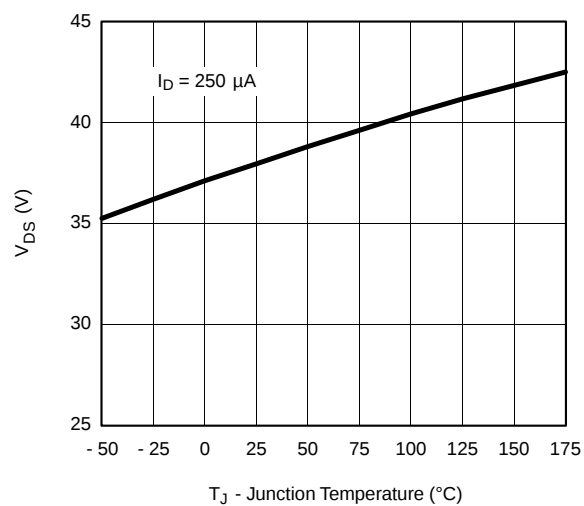
On-Resistance vs. Drain Current



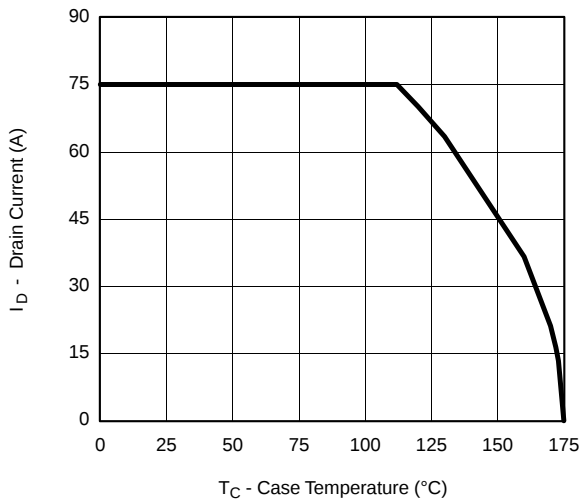
Capacitance



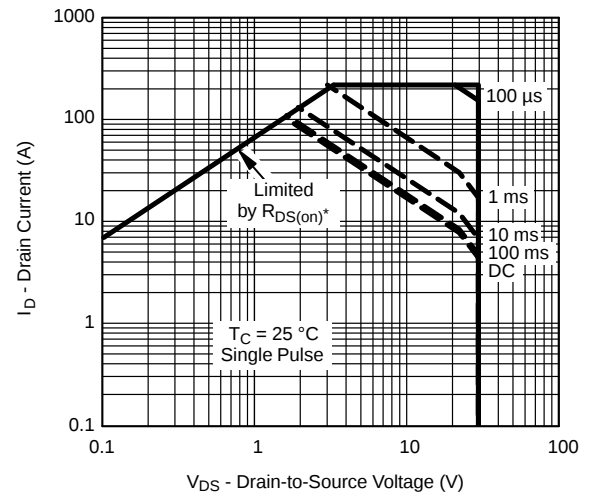
Gate Charge

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

On-Resistance vs. Junction Temperature

Source-Drain Diode Forward Voltage

Avalanche Current vs. Time

Drain Source Breakdown vs. Junction Temperature

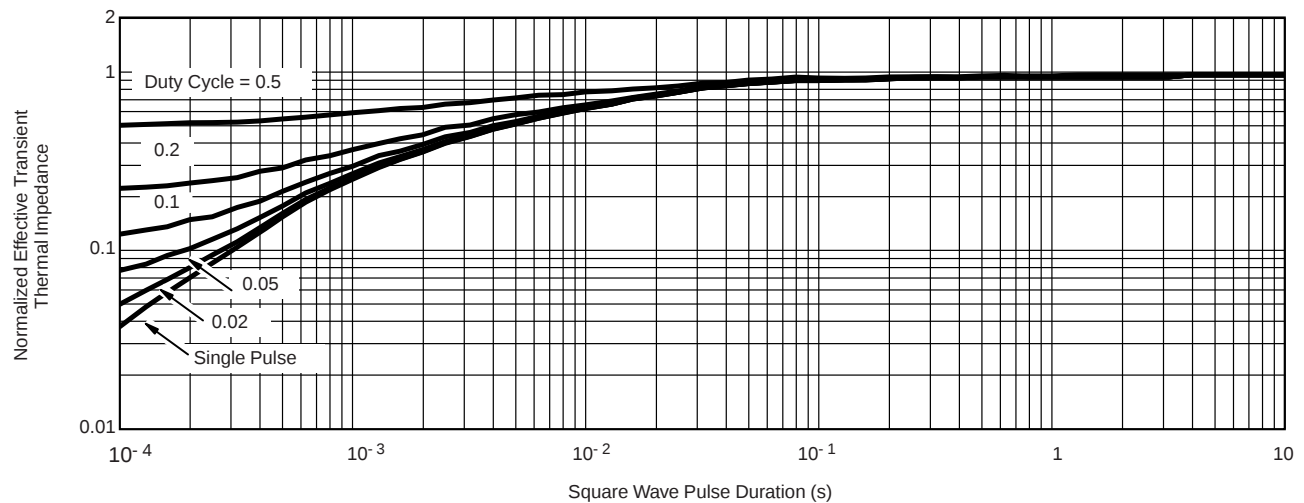
THERMAL RATINGS



**Maximum Avalanche and Drain Current
vs. Case Temperature**

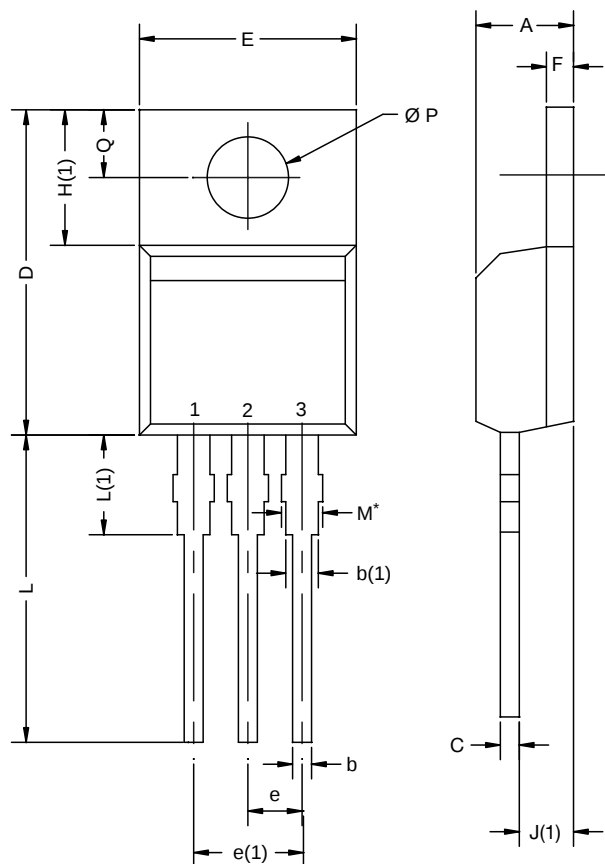


*** $V_{GS} > \text{minimum } V_{GS} \text{ at which } R_{DS(on)} \text{ is specified}$
Safe Operating Area**



Normalized Thermal Transient Impedance, Junction-to-Case

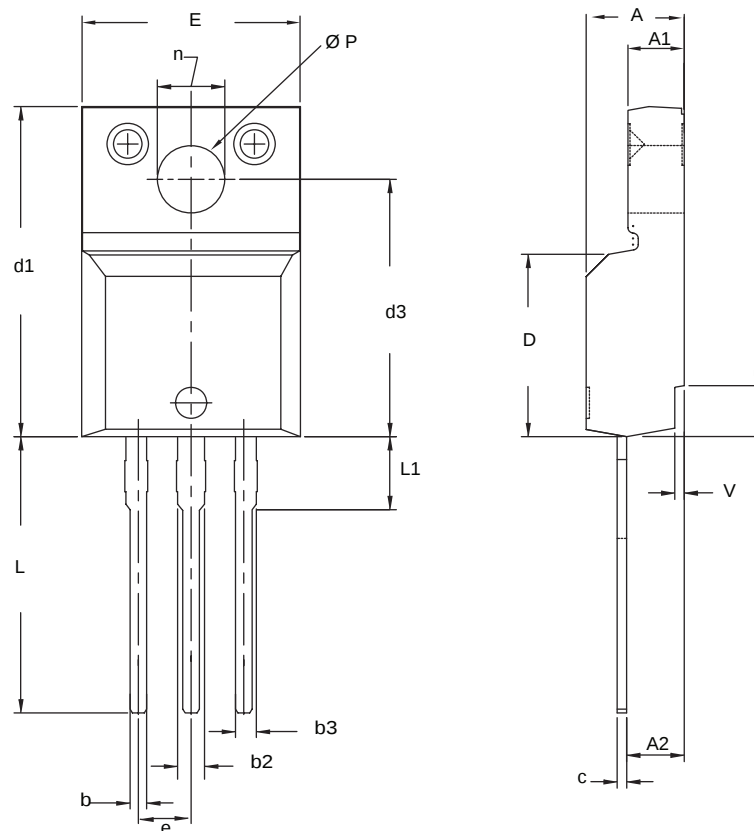
TO-220AB



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

TO-220 FULLPAK (HIGH VOLTAGE)

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.570	4.830	0.180	0.190
A1	2.570	2.830	0.101	0.111
A2	2.510	2.850	0.099	0.112
b	0.622	0.890	0.024	0.035
b2	1.229	1.400	0.048	0.055
b3	1.229	1.400	0.048	0.055
c	0.440	0.629	0.017	0.025
D	8.650	9.800	0.341	0.386
d1	15.88	16.120	0.622	0.635
d3	12.300	12.920	0.484	0.509
E	10.360	10.630	0.408	0.419
e	2.54 BSC		0.100 BSC	
L	13.200	13.730	0.520	0.541
L1	3.100	3.500	0.122	0.138
n	6.050	6.150	0.238	0.242
Ø P	3.050	3.450	0.120	0.136
u	2.400	2.500	0.094	0.098
v	0.400	0.500	0.016	0.020

ECN: X09-0126-Rev. B, 26-Oct-09
DWG: 5972

Notes

1. To be used only for process drawing.
2. These dimensions apply to all TO-220, FULLPAK leadframe versions 3 leads.
3. All critical dimensions should C meet $C_{pk} > 1.33$.
4. All dimensions include burrs and plating thickness.
5. No chipping or package damage.

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