

# Power MOSFET

**TO-220AB**


N-Channel MOSFET

## FEATURES

- Low gate charge  $Q_g$  results in simple drive requirement
- Improved gate, avalanche, and dynamic  $dV/dt$  ruggedness
- Fully characterized capacitance and avalanche voltage and current
- Effective  $C_{oss}$  specified
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS\***  
Available

## Note

\* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

## APPLICATIONS

- Switch mode power supply (SMPS)
- Uninterruptable power supply
- High speed power switching

## TYPICAL SMPS TOPOLOGIES

- Single transistor flyback Xfmr. reset
- Single transistor forward Xfmr. reset (both for US line input only)

## PRODUCT SUMMARY

$V_{DS}$ (V)	400	
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10\text{ V}$	0.55
$Q_g$ (Max.) (nC)	36	
$Q_{gs}$ (nC)	9.9	
$Q_{gd}$ (nC)	16	
Configuration	Single	

## ORDERING INFORMATION

Package	TO-220AB
Lead (Pb)-free	IRF740APbF
Lead (Pb)-free and halogen-free	IRF740APbF-BE3

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

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V <sub>DS</sub>	400	V
Gate-source voltage			V <sub>GS</sub>	± 30	
Continuous drain current	V <sub>GS</sub> at 10 V	T <sub>C</sub> = 25 °C	I <sub>D</sub>	10	A
		T <sub>C</sub> = 100 °C		6.3	
Pulsed drain current <sup>a</sup>			I <sub>DM</sub>	40	
Linear derating factor				1.0	W/°C
Single pulse avalanche energy <sup>b</sup>			E <sub>AS</sub>	630	mJ
Repetitive avalanche current <sup>a</sup>			I <sub>AR</sub>	10	A
Repetitive avalanche energy <sup>a</sup>			E <sub>AR</sub>	12.5	mJ
Maximum power dissipation		T <sub>C</sub> = 25 °C	P <sub>D</sub>	125	W
Peak diode recovery dV/dt <sup>c</sup>			dV/dt	5.9	V/ns
Operating junction and storage temperature range			T <sub>J</sub> , T <sub>stg</sub>	- 55 to + 150	°C
Soldering recommendations (peak temperature) <sup>d</sup>		For 10 s		300 <sup>d</sup>	
Mounting torque	6-32 or M3 screw			10	lbf · in
				1.1	N · m

## Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 12.6\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 10\text{ A}$  (see fig. 12)
- $I_{SD} \leq 10\text{ A}$ ,  $dV/dt \leq 330\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$
- 1.6 mm from case

**THERMAL RESISTANCE RATINGS**

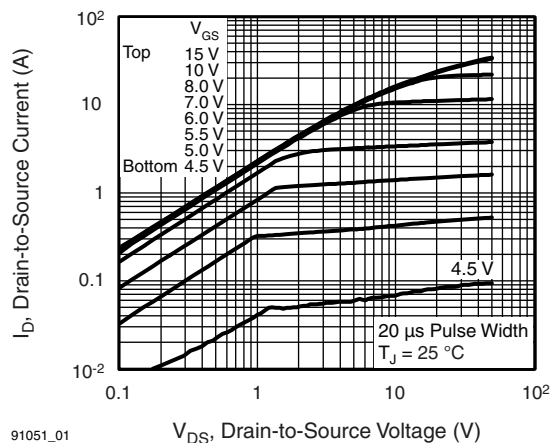
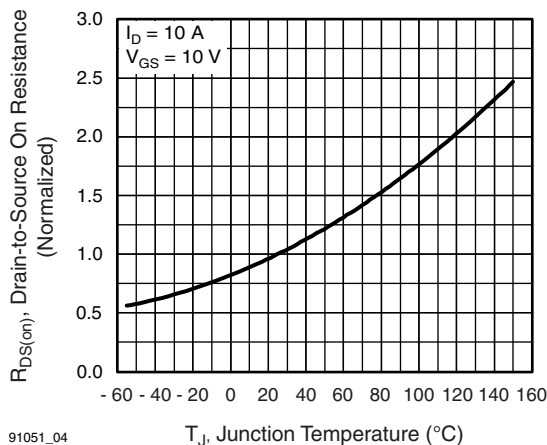
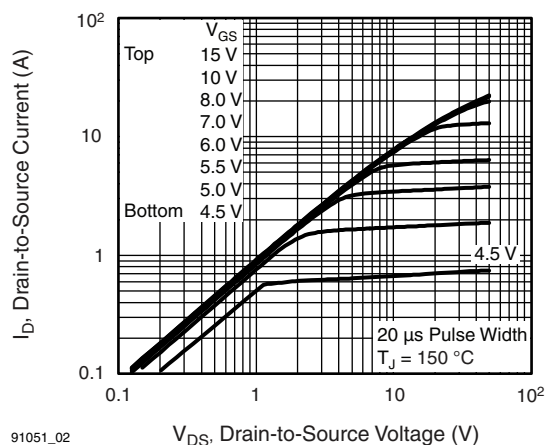
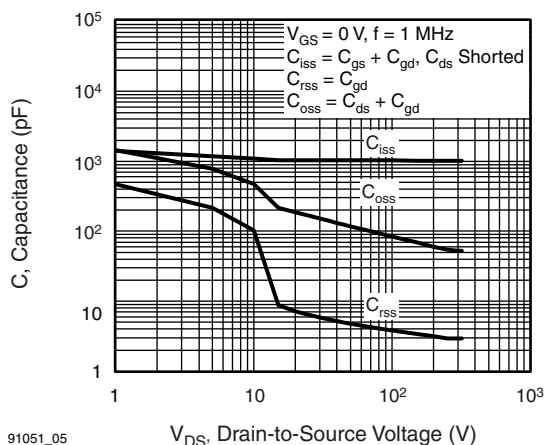
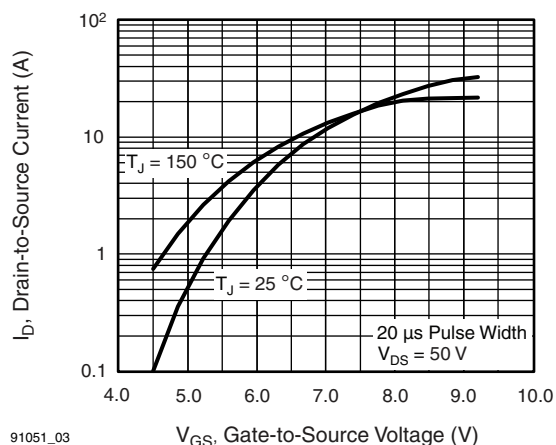
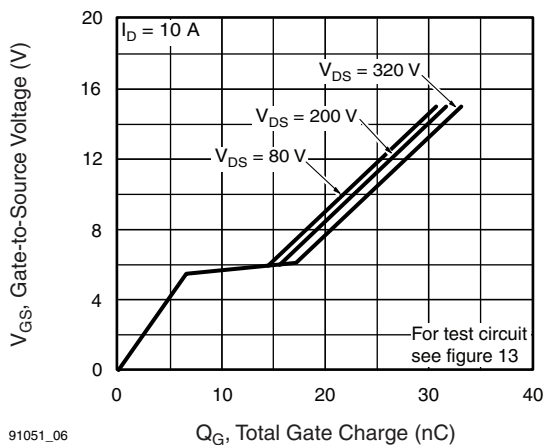
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	62	°C/W
Case-to-sink, flat, greased surface	$R_{thCS}$	0.50	-	
Maximum junction-to-case (drain)	$R_{thJC}$	-	1.0	

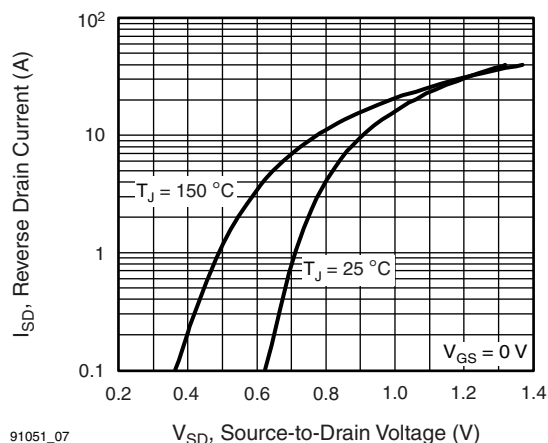
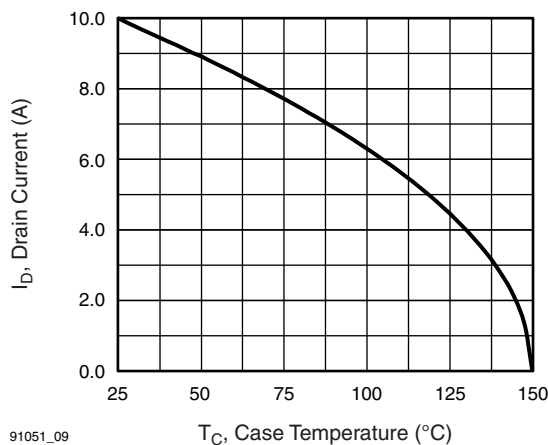
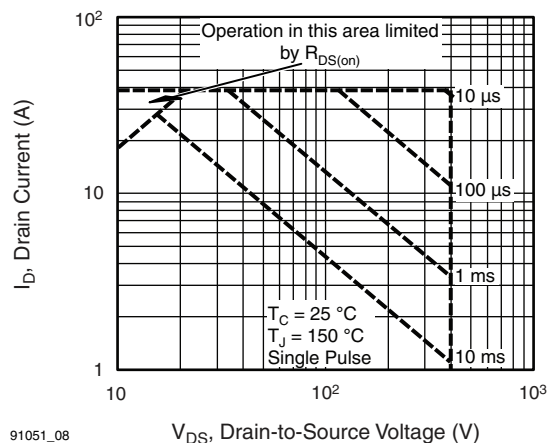
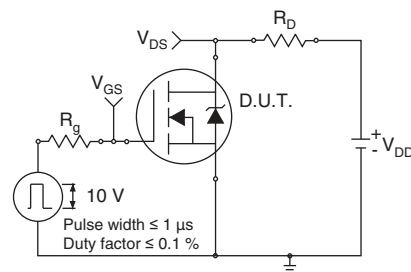
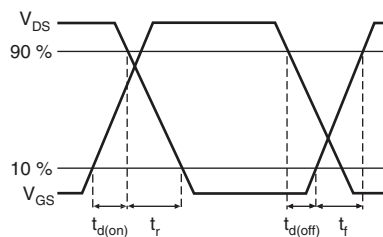
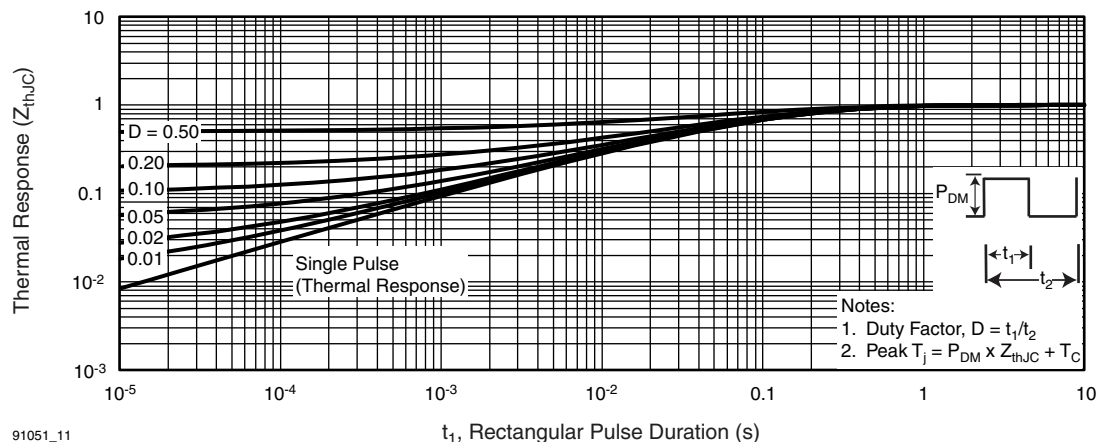
**SPECIFICATIONS** ( $T_J = 25\text{ °C}$ , unless otherwise noted)

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		400	-	-	V
V <sub>DS</sub> temperature coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	Reference to 25 °C, I <sub>D</sub> = 1 mA		-	0.48	-	V/°C
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA		2.0	-	4.0	V
Gate-source leakage	I <sub>GSS</sub>	V <sub>GS</sub> = ± 30 V		-	-	± 100	nA
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V		-	-	25	μA
		V <sub>DS</sub> = 320 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C		-	-	250	
Drain-source on-state resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 6.0 A <sup>b</sup>	-	-	0.55	Ω
Forward transconductance	g <sub>fs</sub>	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 6.0 A <sup>b</sup>		4.9	-	-	S
Dynamic							
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1.0 MHz, see fig. 5		-	1030	-	pF
Output capacitance	C <sub>oss</sub>			-	170	-	
Reverse transfer capacitance	C <sub>rss</sub>			-	7.7	-	
Output capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 1.0 V, f = 1.0 MHz		-	1490	-	
		V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 320 V, f = 1.0 MHz		-	52	-	
Effective output capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 0 V to 320 V		-	61	-	
Total gate charge	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 10 A, V <sub>DS</sub> = 320 V, see fig. 6 and 13 <sup>b</sup>	-	-	36	nC
Gate-source charge	Q <sub>gs</sub>			-	-	9.9	
Gate-drain charge	Q <sub>gd</sub>			-	-	16	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 200 V, I <sub>D</sub> = 10 A, R <sub>g</sub> = 10 Ω, R <sub>D</sub> = 19.5 Ω, see fig. 10 <sup>b</sup>		-	10	-	ns
Rise time	t <sub>r</sub>			-	35	-	
Turn-off delay time	t <sub>d(off)</sub>			-	24	-	
Fall time	t <sub>f</sub>			-	22	-	
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	I <sub>S</sub>	MOSFET symbol showing the integral reverse p - n junction diode		-	-	10	A
Pulsed diode forward current <sup>a</sup>	I <sub>SM</sub>			-	-	40	
Body diode voltage	V <sub>SD</sub>	T <sub>J</sub> = 25 °C, I <sub>S</sub> = 10 A, V <sub>GS</sub> = 0 V <sup>b</sup>		-	-	2.0	V
Body diode reverse recovery time	t <sub>rr</sub>	T <sub>J</sub> = 25 °C, I <sub>F</sub> = 10 A, dI/dt = 100 A/μs <sup>b</sup>		-	240	360	ns
Body diode reverse recovery charge	Q <sub>rr</sub>			-	1.9	2.9	μC
Forward turn-on time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )					

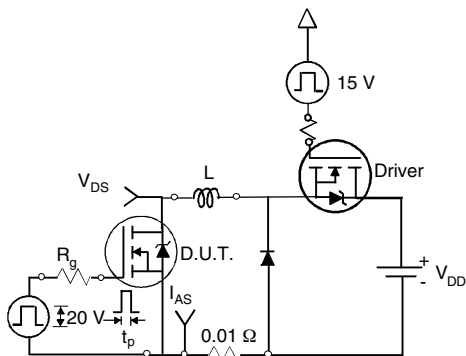
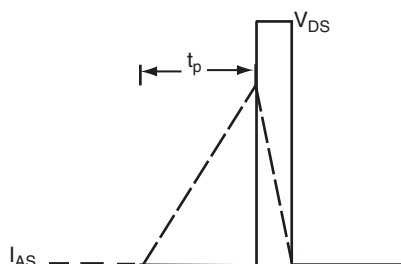
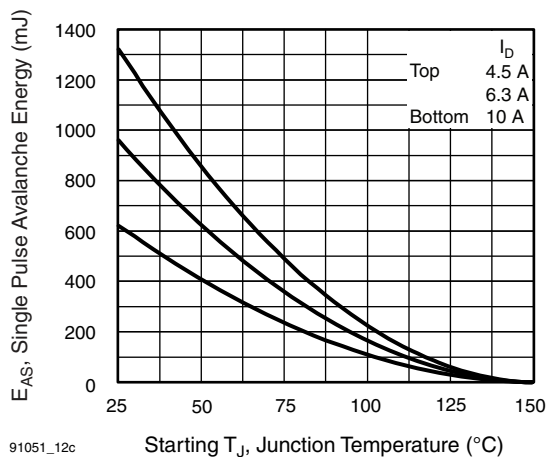
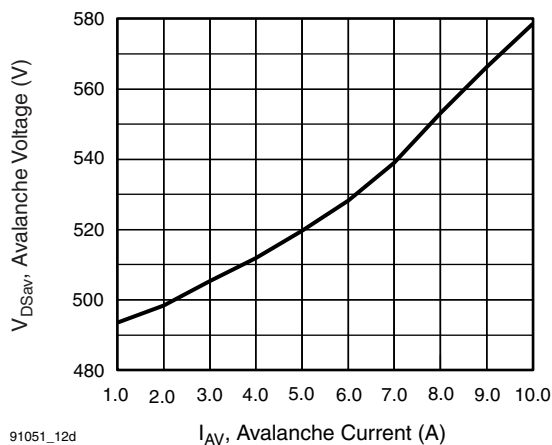
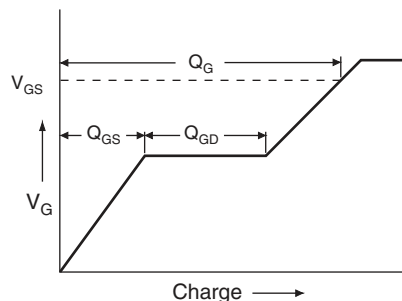
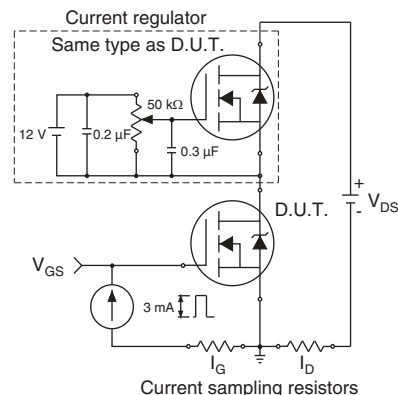
**Notes**

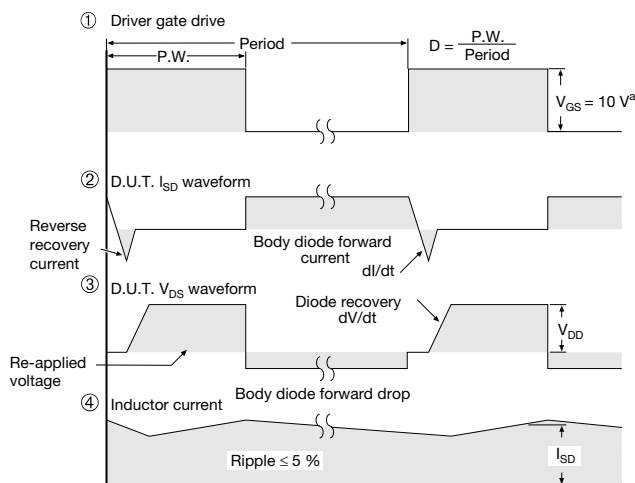
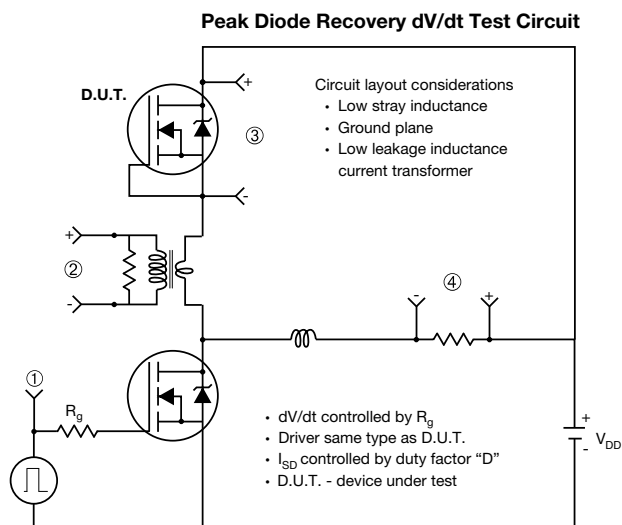
- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)  
b. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$

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

**Fig. 1 - Typical Output Characteristics,  $T_C = 25^\circ\text{C}$** 

**Fig. 3 - Normalized On-Resistance vs. Temperature**

**Fig. 1 - Typical Output Characteristics,  $T_C = 150^\circ\text{C}$** 

**Fig. 4 - Typical Capacitance vs. Drain-to-Source Voltage**

**Fig. 2 - Typical Transfer Characteristics**

**Fig. 5 - Typical Gate Charge vs. Gate-to-Source Voltage**


**Fig. 6 - Typical Source-Drain Diode Forward Voltage**

**Fig. 8 - Maximum Drain Current vs. Case Temperature**

**Fig. 7 - Maximum Safe Operating Area**

**Fig. 9 - Switching Time Test Circuit**

**Fig. 10 - Switching Time Waveforms**


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**Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case**

**Fig. 12 - Unclamped Inductive Test Circuit**

**Fig. 13 - Unclamped Inductive Waveforms**

**Fig. 14 - Maximum Avalanche Energy vs. Drain Current**

**Fig. 15 - Typical Drain-to-Source Voltage vs. Avalanche Current**

**Fig. 16 - Basic Gate Charge Waveform**

**Fig. 17 - Gate Charge Test Circuit**



### Note

a.  $V_{GS} = 5 \text{ V}$  for logic level devices

**Fig. 18 - For N-Channel**

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## TO-220-1



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.24	4.65	0.167	0.183
b	0.69	1.02	0.027	0.040
b(1)	1.14	1.78	0.045	0.070
c	0.36	0.61	0.014	0.024
D	14.33	15.85	0.564	0.624
E	9.96	10.52	0.392	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)	6.10	6.71	0.240	0.264
J(1)	2.41	2.92	0.095	0.115
L	13.36	14.40	0.526	0.567
L(1)	3.33	4.04	0.131	0.159
$\varnothing P$	3.53	3.94	0.139	0.155
Q	2.54	3.00	0.100	0.118

ECN: E21-0621-Rev. D, 04-Nov-2021  
DWG: 6031

### Note

- $M^*$  = 0.052 inches to 0.064 inches (dimension including protrusion), heatsink hole for HVM



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