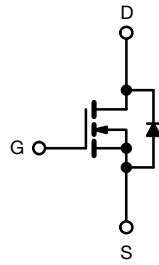
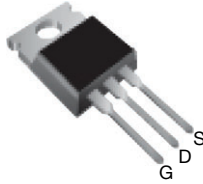


## Power MOSFET

TO-220AB



N-Channel MOSFET

### FEATURES

- Low figure-of-merit  $R_{on} \times Q_g$
- 100 % avalanche tested
- High peak current capability
- $dv/dt$  ruggedness
- Improved  $t_{rr}/Q_{rr}$
- Improved gate charge
- High power dissipations capability
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### PRODUCT SUMMARY

$V_{DS}$ (V) at $T_J$ max.	560	
$R_{DS(on)}$ ( $\Omega$ )	$V_{GS} = 10$ V	0.225
$Q_g$ max. (nC)	76	
$Q_{gs}$ (nC)	21	
$Q_{gd}$ (nC)	29	
Configuration	Single	

### 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

### ORDERING INFORMATION

Package	TO-220AB
Lead (Pb)-free and halogen-free	SiHP18N50C-E3

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	$V_{DS}$	500	V
Gate-source voltage	$V_{GS}$	$\pm 30$	
Continuous drain current ( $T_J = 150$ °C) <sup>a</sup>	$V_{GS}$ at 10 V	$T_C = 25$ °C	18
		$T_C = 100$ °C	11
Pulsed drain current <sup>b</sup>	$I_{DM}$	72	A
Linear derating factor		1.8	W/°C
Single pulse avalanche energy <sup>c</sup>	$E_{AS}$	361	mJ
Maximum power dissipation	$P_D$	223	W
Reverse diode $dv/dt$ <sup>d</sup>	$dv/dt$	5	V/ns
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +150	°C
Soldering recommendations (peak temperature) <sup>d</sup>	For 10 s	300	


### Notes

- Drain current limited by maximum junction temperature
- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 50$  V, starting  $T_J = 25$  °C,  $L = 2.5$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 17$  A
- $I_{SD} \leq 18$  A,  $di/dt \leq 380$  A/ $\mu$ s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150$  °C
- 1.6 mm from case

### THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	62	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	-	0.56	



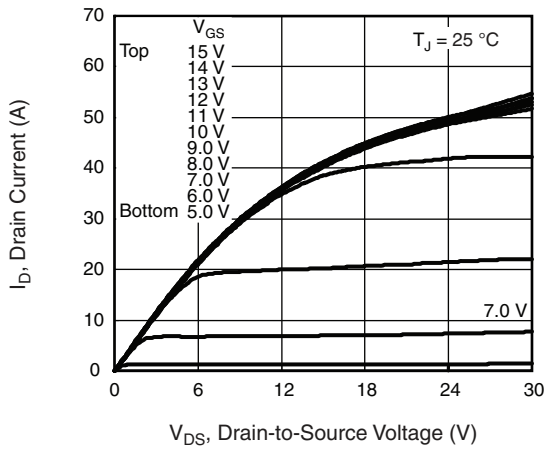
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$	500	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$	-	0.6	-	$\text{V}/^\circ\text{C}$
Gate-source threshold voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	3.0	-	5.0	V
Gate-source leakage	$I_{GSS}$	$V_{GS} = \pm 30\text{ V}$	-	-	$\pm 100$	nA
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 500\text{ V}$ , $V_{GS} = 0\text{ V}$	-	-	25	$\mu\text{A}$
		$V_{DS} = 400\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$	-	-	250	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$ , $I_D = 10\text{ A}$	-	0.225	0.270	$\Omega$
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 50\text{ V}$ , $I_D = 10\text{ A}$	-	6.4	-	S
<b>Dynamic</b>						
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$	-	2451	2942	pF
Output capacitance	$C_{oss}$		-	300	360	
Reverse transfer capacitance	$C_{riss}$		-	26	32	
Total gate charge	$Q_g$	$V_{GS} = 10\text{ V}$ , $I_D = 18\text{ A}$ , $V_{DS} = 400\text{ V}$	-	65	76	nC
Gate-source charge	$Q_{gs}$		-	21	-	
Gate-drain charge	$Q_{gd}$		-	29	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 250\text{ V}$ , $I_D = 18\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_g = 7.5\text{ }\Omega$	-	80	-	ns
Rise time	$t_r$		-	27	-	
Turn-off delay time	$t_{d(off)}$		-	32	-	
Fall time	$t_f$		-	44	-	
Gate input resistance	$R_g$	$f = 1\text{ MHz}$ , open drain	-	1.1	-	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>						
Continuous source-drain diode current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	18	A
Pulsed diode forward current	$I_{SM}$		-	-	72	
Diode forward voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_S = 18\text{ A}$ , $V_{GS} = 0\text{ V}$	-	-	1.5	V
Reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$ , $I_F = I_S$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 35\text{ V}$	-	503	-	ns
Reverse recovery charge	$Q_{rr}$		-	6.7	-	$\mu\text{C}$
Reverse recovery current	$I_{RRM}$		-	30	-	A

**Notes**

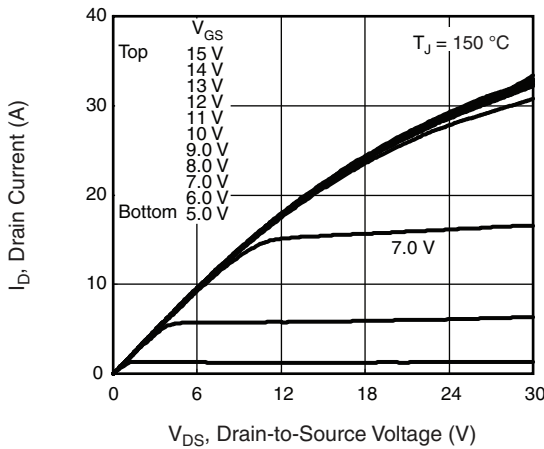
- a. Repetitive rating; pulse width limited by maximum junction temperature

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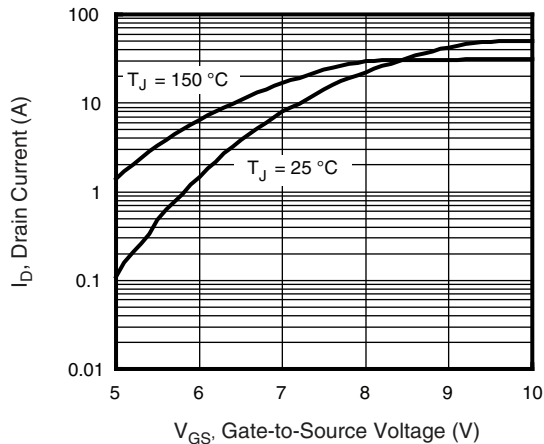
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



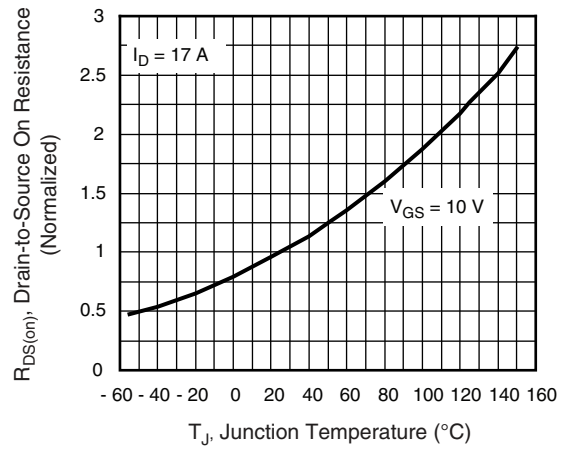
**Fig. 1 - Typical Output Characteristics,  $T_C = 150\text{ }^\circ\text{C}$**



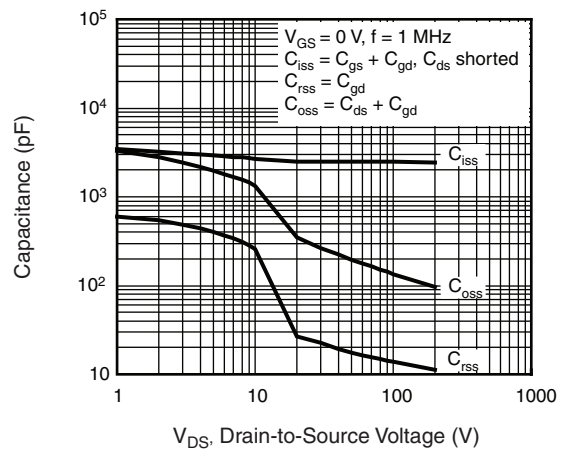
**Fig. 2 - Typical Output Characteristics,  $T_C = 150\text{ }^\circ\text{C}$**



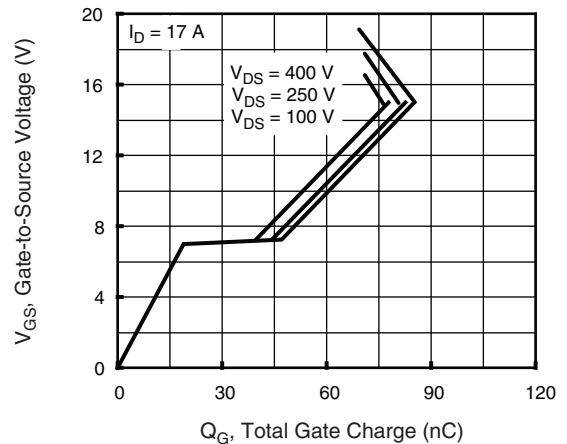
**Fig. 3 - Typical Transfer Characteristics**



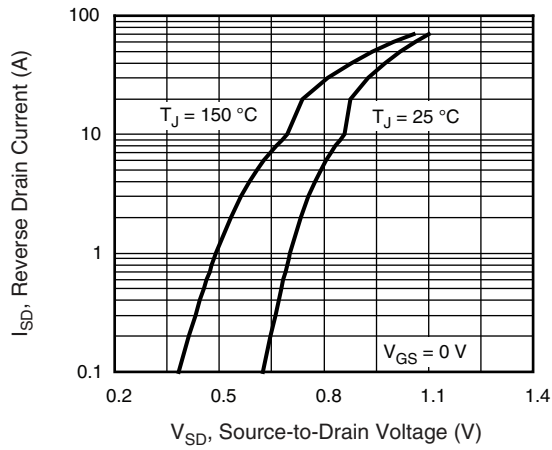
**Fig. 4 - Normalized On-Resistance vs. Temperature**



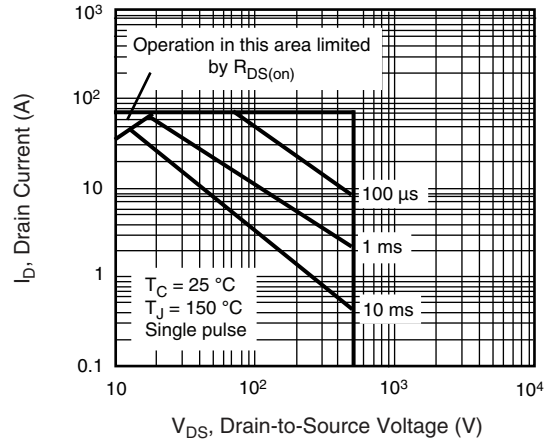
**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**



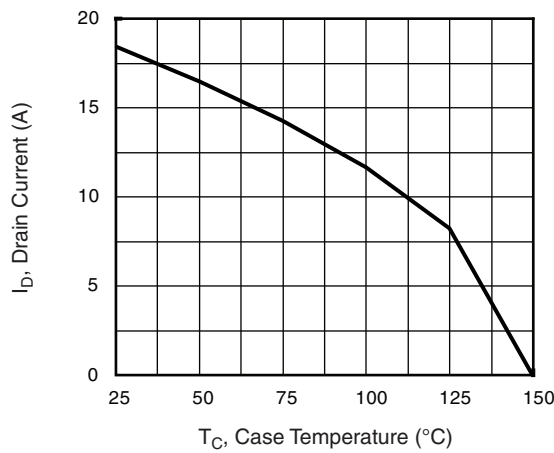
**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**



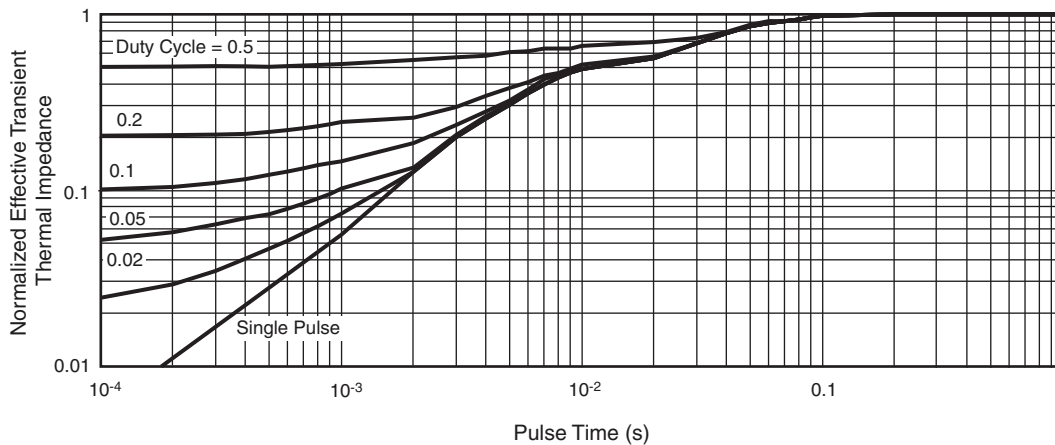
**Fig. 7 - Typical Source-Drain Diode Forward Voltage**



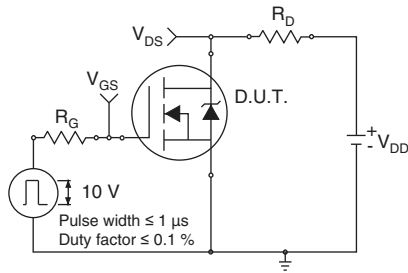
**Fig. 8 - Maximum Safe Operating Area**



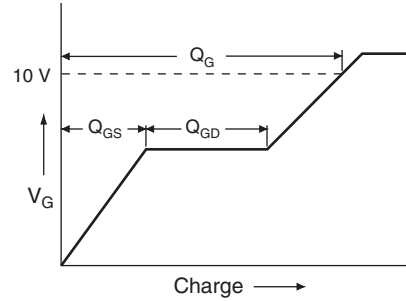
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



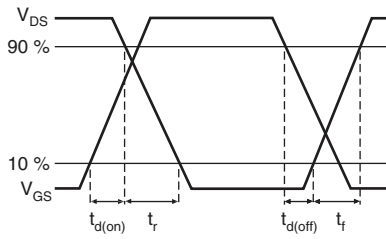
**Fig. 10 - Normalized Thermal Transient Impedance, Junction-to-Case**



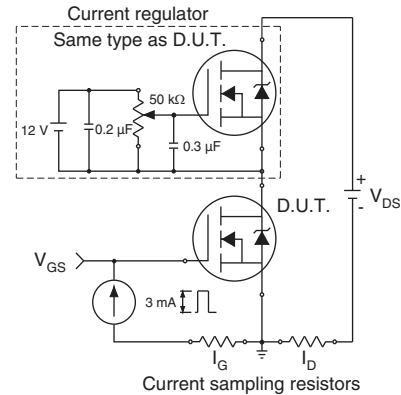
**Fig. 11 - Switching Time Test Circuit**



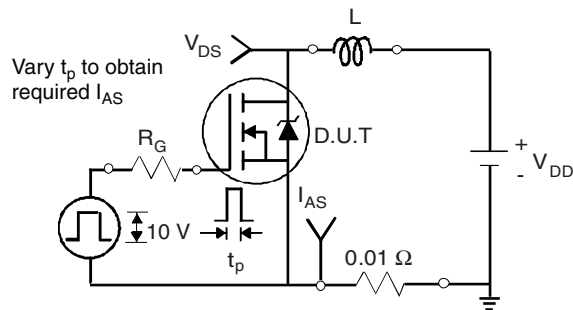
**Fig. 15 - Basic Gate Charge Waveform**



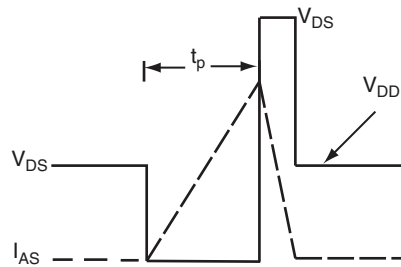
**Fig. 12 - Switching Time Waveforms**



**Fig. 16 - Gate Charge Test Circuit**

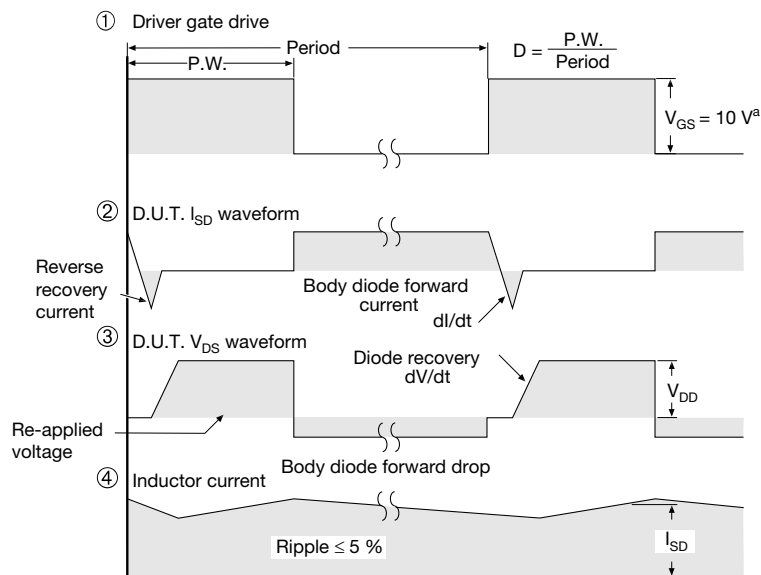
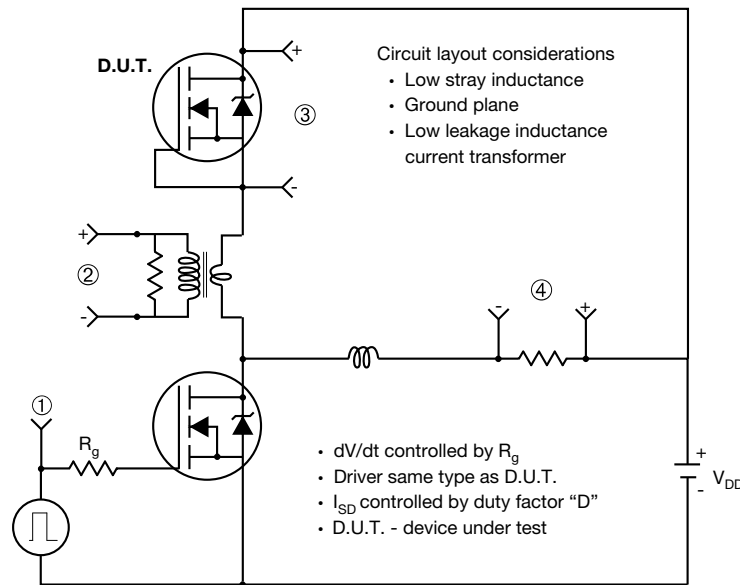


**Fig. 13 - Unclamped Inductive Test Circuit**



**Fig. 14 - Unclamped Inductive Waveforms**

### Peak Diode Recovery dV/dt Test Circuit



**Note**

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

**Fig. 17 - 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
Ø P	3.53	3.94	0.139	0.155
Q	2.54	3.00	0.100	0.118

ECN: X15-0364-Rev. C, 14-Dec-15  
DWG: 6031

**Note**

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





# TO-220 FULLPAK (High Voltage)

## OPTION 1: FACILITY CODE = 9



DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	4.60	4.70	4.80
b	0.70	0.80	0.91
b1	1.20	1.30	1.47
b2	1.10	1.20	1.30
C	0.45	0.50	0.63
D	15.80	15.87	15.97
e	2.54 BSC		
E	10.00	10.10	10.30
F	2.44	2.54	2.64
G	6.50	6.70	6.90
L	12.90	13.10	13.30
L1	3.13	3.23	3.33
Q	2.65	2.75	2.85
Q1	3.20	3.30	3.40
$\varnothing R$	3.08	3.18	3.28

### 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
6. Facility code will be the 1<sup>st</sup> character located at the 2<sup>nd</sup> row of the unit marking





OPTION 2: FACILITY CODE = Y



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: E19-0180-Rev. D, 08-Apr-2019  
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
6. Facility code will be the 1<sup>st</sup> character located at the 2<sup>nd</sup> row of the unit marking



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