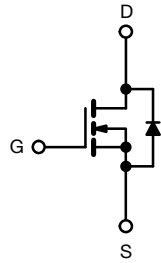
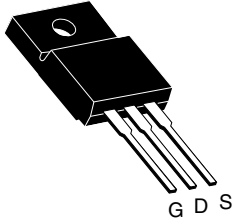


## Power MOSFET

**TO-220 FULLPAK**


N-Channel MOSFET

### FEATURES

- Low figure-of-merit  $R_{on} \times Q_g$
- 100 % avalanche tested
- Gate charge improved
- $t_{rr}/Q_{rr}$  improved
- 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.

### PRODUCT SUMMARY

|                            |                 |   |
|----------------------------|-----------------|---|
| $V_{DS}$ (V) at $T_J$ max. | 560             |   |
| $R_{DS(on)}$ ( $\Omega$ )  | $V_{GS} = 10$ V | 1 |
| $Q_g$ max. (nC)            | 34              |   |
| $Q_{gs}$ (nC)              | 7.8             |   |
| $Q_{gd}$ (nC)              | 10.4            |   |
| Configuration              | Single          |   |

### ORDERING INFORMATION

|                |                |
|----------------|----------------|
| Package        | TO-220 FULLPAK |
| Lead (Pb)-free | SiHF8N50L-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 <sup>a</sup>                     | $V_{GS}$ at 10 V | $T_C = 25$ °C | $I_D$          | 8           | A    |
| Pulsed Drain Current <sup>b</sup>                         |                  |               | $I_{DM}$       | 22          |      |
| Linear Derating Factor                                    |                  |               |                | 0.32        | W/°C |
| Single Pulse Avalanche Energy <sup>c</sup>                |                  |               | $E_{AS}$       | 180         | mJ   |
| Maximum Power Dissipation                                 |                  | $T_C = 25$ °C | $P_D$          | 40          | W    |
| Peak Diode Recovery $dV/dt$ <sup>d</sup>                  |                  |               | $dV/dt$        | 24          | V/ns |
| Operating Junction and Storage Temperature Range          |                  |               | $T_J, T_{stg}$ | -55 to +150 | °C   |
| Soldering Recommendations (Peak temperature) <sup>e</sup> |                  | For 10 s      |                | 300         |      |
| Mounting Torque   |                  | M3 screw      |                | 0.6         | Nm   |


### 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,  $L = 10$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 6$  A.
- $I_{SD} \leq 8$  A,  $dI/dt \leq 460$  A/ $\mu$ s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150$  °C.
- 1.6 mm from case.

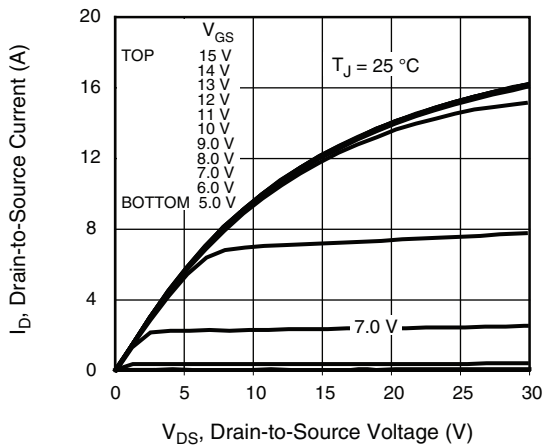
### THERMAL RESISTANCE RATINGS

| PARAMETER                        | SYMBOL     | TYP. | MAX. | UNIT |
|----------------------------------|------------|------|------|------|
| Maximum Junction-to-Ambient      | $R_{thJA}$ | -    | 65   | °C/W |
| Maximum Junction-to-Case (Drain) | $R_{thJC}$ | -    | 3.1  |      |

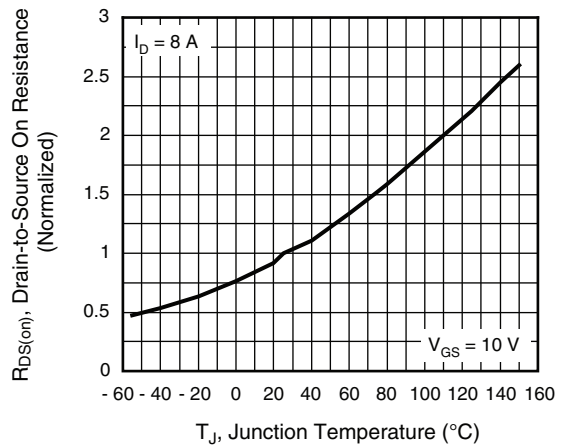


| SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted) |                                  |   |      |      |       |      |
|---|----------------------------------|---|------|------|-------|------|
| PARAMETER   | SYMBOL                           | TEST CONDITIONS   | MIN. | TYP. | MAX.  | UNIT |
| <b>Static</b>   |                                  |   |      |      |       |      |
| Drain-Source Breakdown Voltage                                  | V <sub>DS</sub>                  | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA  | 500  | -    | -     | 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   | -    | 0.5  | -     | 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   | 3.0  | -    | 5.0   | 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> = 500 V, V <sub>GS</sub> = 0 V  | -    | -    | 50    | μA   |
|   |                                  | V <sub>DS</sub> = 400 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> = 4.0 A   | -    | 0.85 | 1     | Ω    |
| Forward Transconductance  | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 3 A  | -    | 2    | -     | S    |
| <b>Dynamic</b>  |                                  |   |      |      |       |      |
| Input Capacitance   | C <sub>iss</sub>                 | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 25 V,<br>f = 1.0 MHz  | -    | 873  | -     | pF   |
| Output Capacitance  | C <sub>oss</sub>                 |   | -    | 105  | -     |      |
| Reverse Transfer Capacitance                                    | C <sub>rss</sub>                 |   | -    | 11   | -     |      |
| Total Gate Charge   | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V   I <sub>D</sub> = 6 A, V <sub>DS</sub> = 400 V  | -    | 22   | 34    | nC   |
| Gate-Source Charge  | Q <sub>gs</sub>                  |   | -    | 7.8  | -     |      |
| Gate-Drain Charge   | Q <sub>gd</sub>                  |   | -    | 10.4 | -     |      |
| Turn-On Delay Time  | t <sub>d(on)</sub>               | V <sub>DD</sub> = 250 V, I <sub>D</sub> = 6 A<br>R <sub>G</sub> = 14 Ω, V <sub>GS</sub> = 10 V  | -    | 17.3 | -     | ns   |
| Rise Time   | t <sub>r</sub>                   |   | -    | 35   | -     |      |
| Turn-Off Delay Time   | t <sub>d(off)</sub>              |   | -    | 23.6 | -     |      |
| Fall Time   | t <sub>f</sub>                   |   | -    | 17   | -     |      |
| Gate Input Resistance   | R <sub>g</sub>                   | f = 1 MHz, open drain   | -    | 0.7  | -     | Ω    |
| <b>Drain-Source Body Diode Characteristics</b>                  |                                  |   |      |      |       |      |
| Continuous Source-Drain Diode Current                           | I <sub>S</sub>                   | MOSFET symbol showing the integral reverse p - n junction diode  | -    | -    | 8     | A    |
| Pulsed Diode Forward Current                                    | I <sub>SM</sub>                  |   | -    | -    | 22    |      |
| Body Diode Voltage  | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 8 A, V <sub>GS</sub> = 0 V   | -    | -    | 1.5   | V    |
| Body Diode Reverse Recovery Time                                | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = I <sub>S</sub> , dI/dt = 100 A/μs,<br>V <sub>R</sub> = 15 V  | -    | 63   | -     | ns   |
| Body Diode Reverse Recovery Charge                              | Q <sub>rr</sub>                  |   | -    | 114  | -     | nC   |
| Body Diode Reverse Recovery Current                             | I <sub>RRM</sub>                 |   | -    | 3.3  | -     | A    |

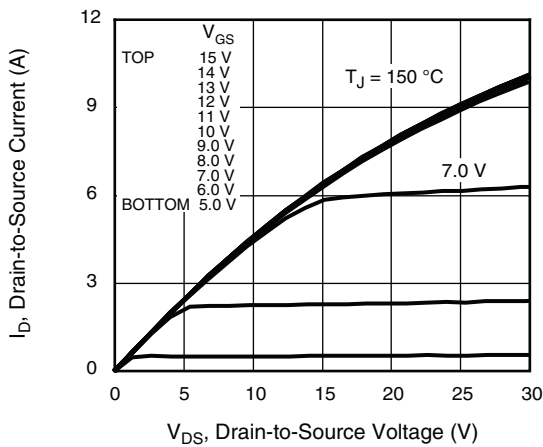
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



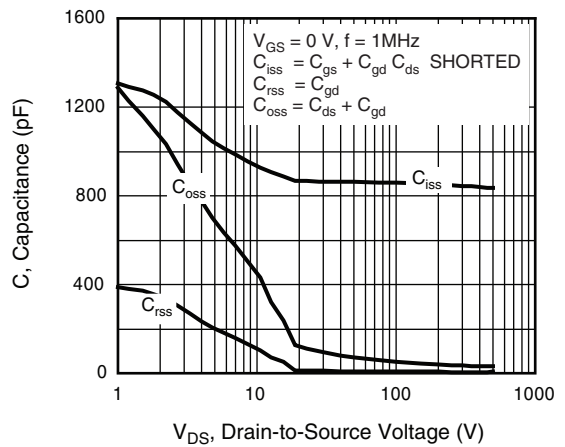
**Fig. 1 - Typical Output Characteristics**



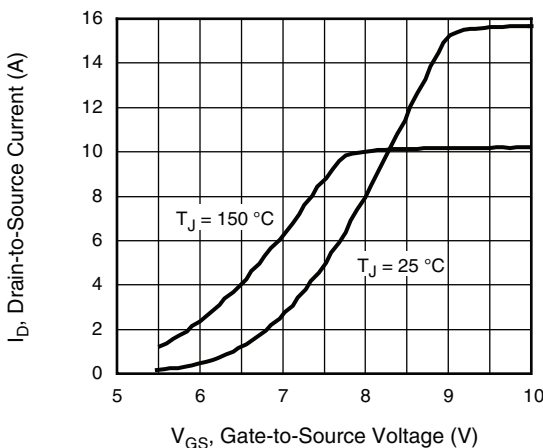
**Fig. 4 - Normalized On-Resistance vs. Temperature**



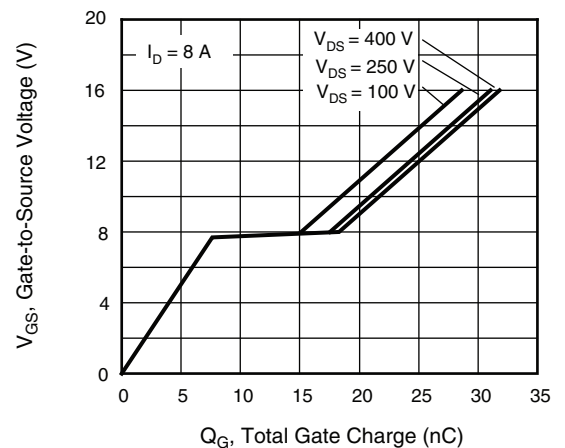
**Fig. 2 - Typical Output Characteristics**



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



**Fig. 3 - Typical Transfer Characteristics**



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

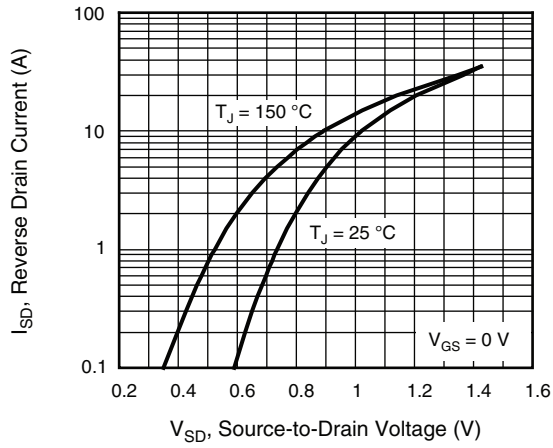


Fig. 7 - Typical Source-Drain Diode Forward Voltage

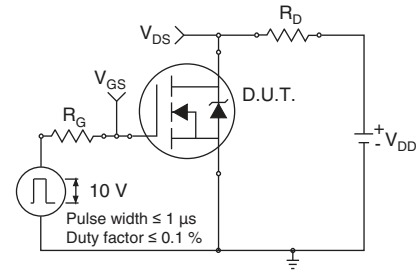


Fig. 9a - Switching Time Test Circuit

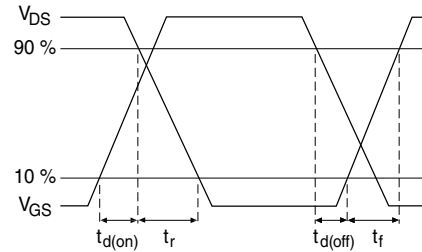


Fig. 9b - Switching Time Waveforms

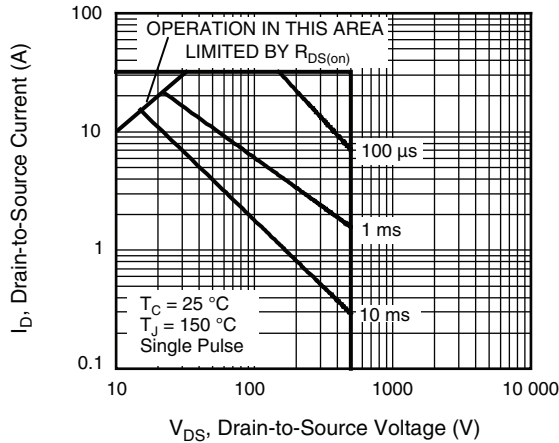


Fig. 8 - Maximum Safe Operating Area

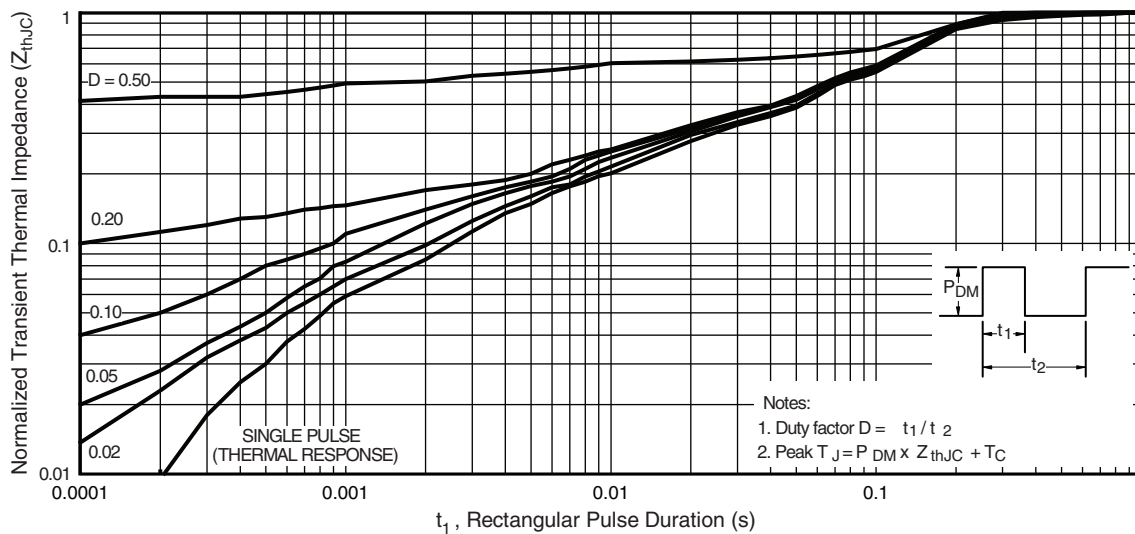
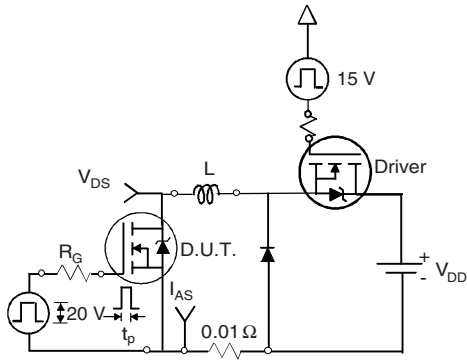
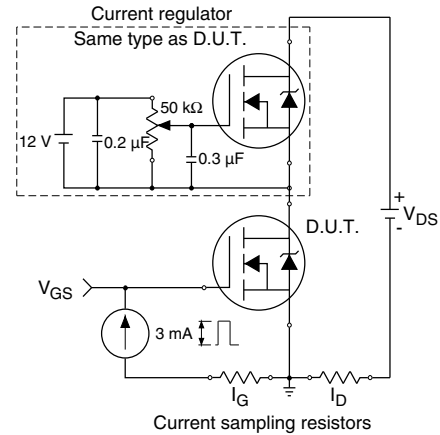


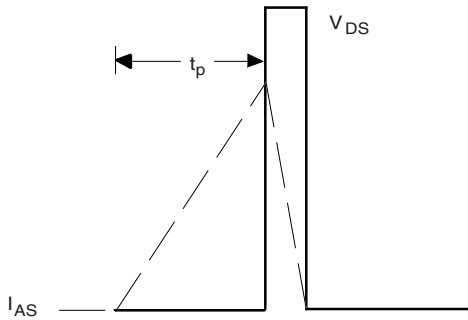
Fig. 10 - Maximum Effective Transient Thermal Impedance, Junction-to-Case



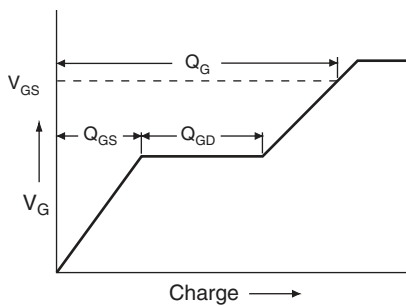
**Fig. 11a - Unclamped Inductive Test Circuit**



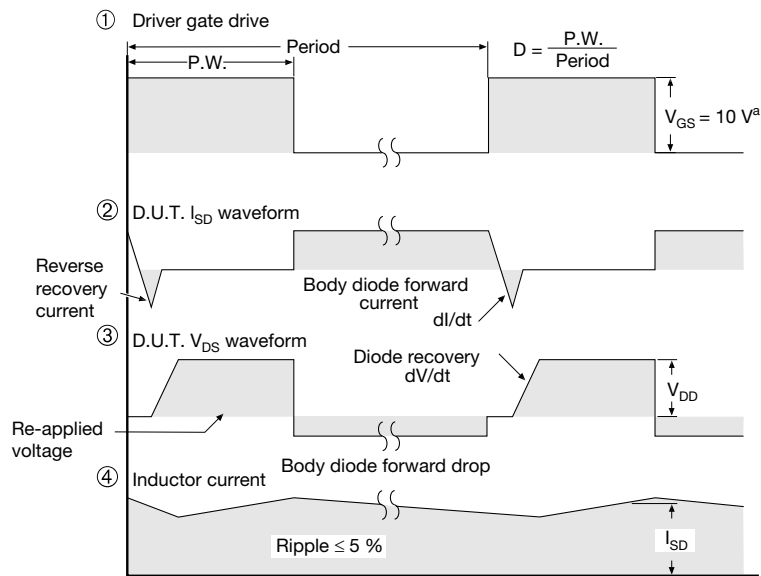
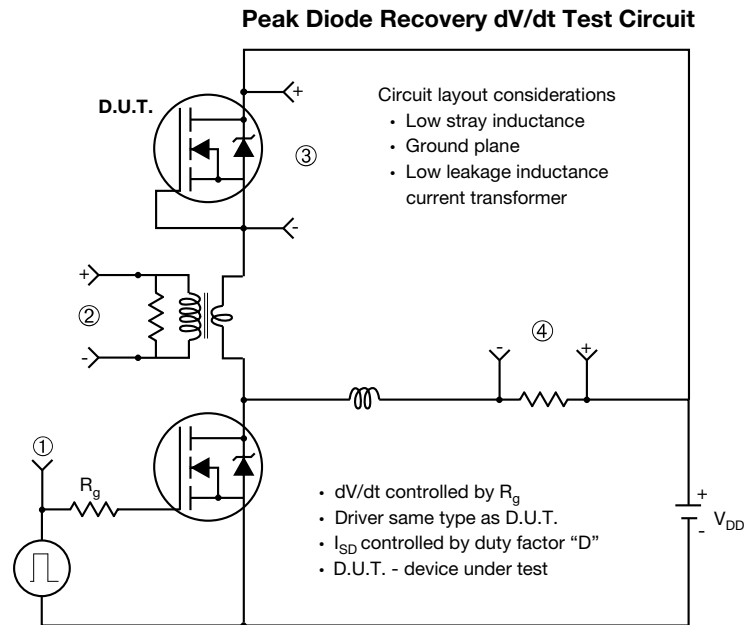
**Fig. 12b - Gate Charge Test Circuit**



**Fig. 11b - Unclamped Inductive Waveforms**



**Fig. 12a - Basic Gate Charge Waveform**



**Note**

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

**Fig. 13 - For N-Channel**

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### 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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