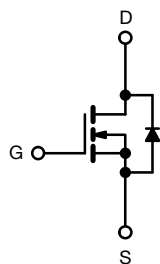
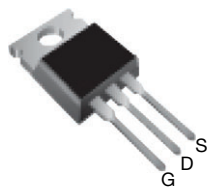


## Power MOSFET

**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)


**RoHS\***  
Available

### 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  | A    |
|                                                           |                  | $T_C = 100$ °C |      |
| Pulsed drain current <sup>b</sup>                         | $I_{DM}$         | 72             |      |
| 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 |      |

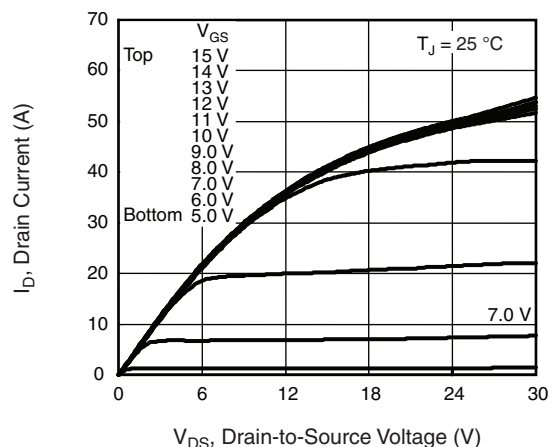
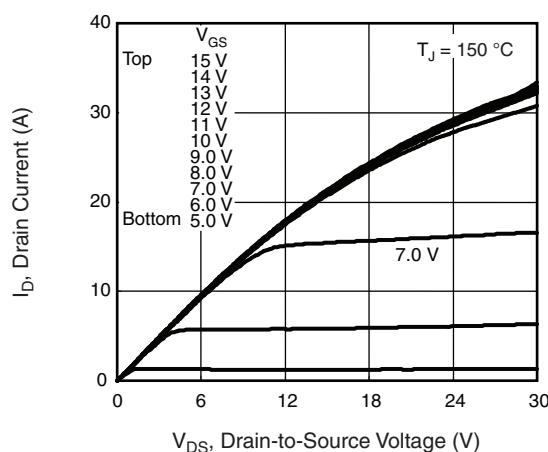
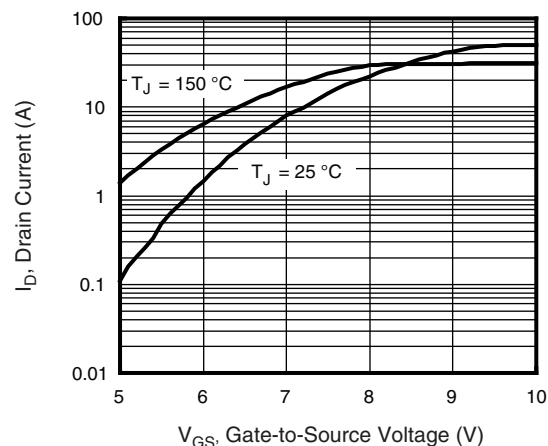
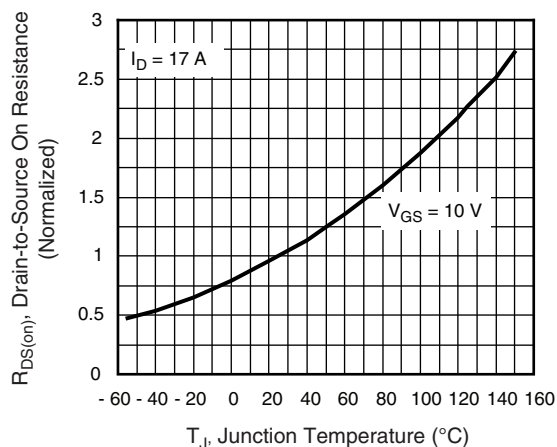
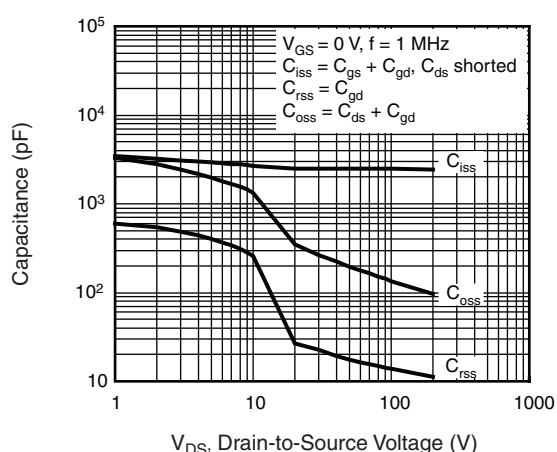
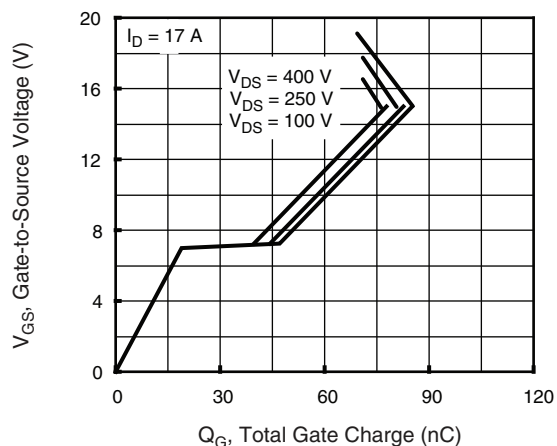


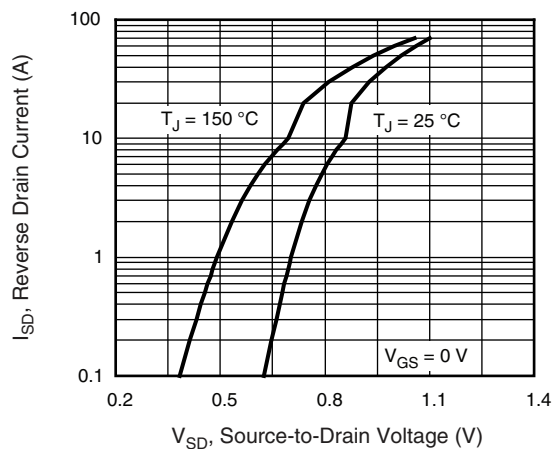
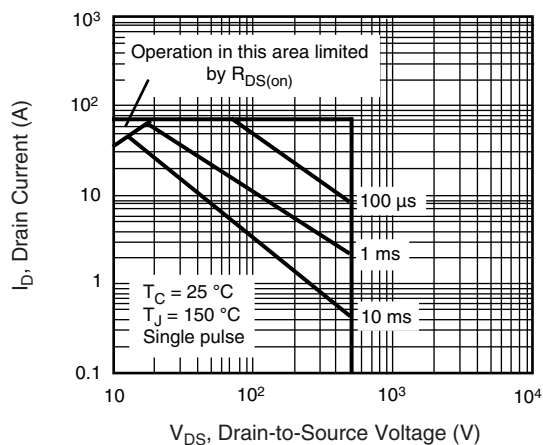
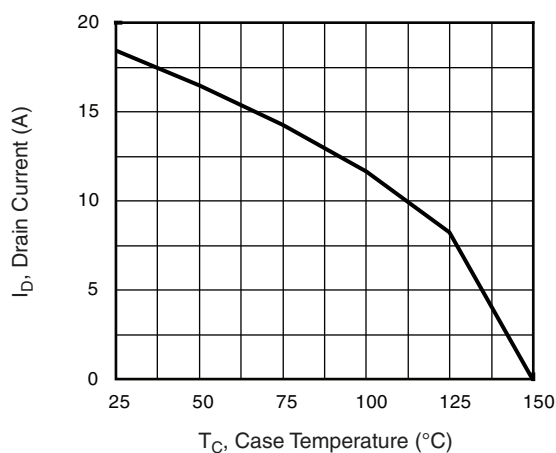
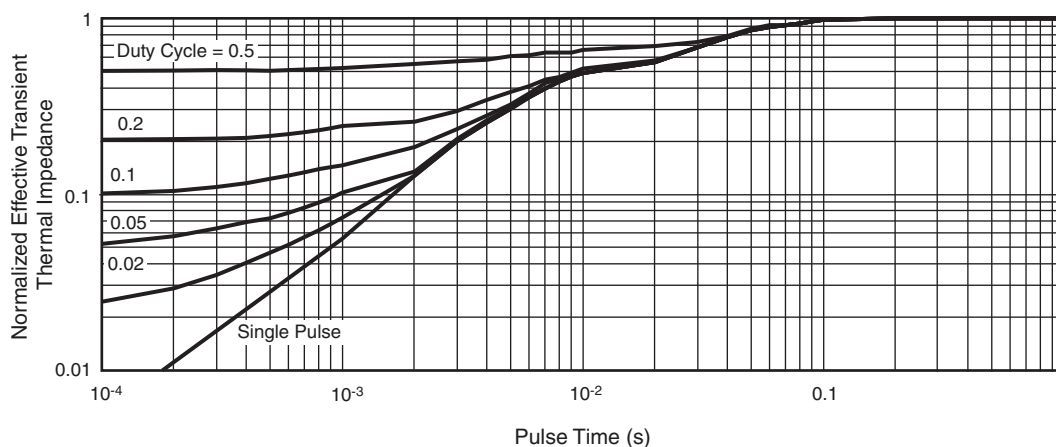
| SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted) |                                  |                                                                                                                                                      |                                                |      |       |       |      |
|-----------------------------------------------------------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------|-------|-------|------|
| 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                                                                                                       |                                                | 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                                                                                                            |                                                | -    | 0.6   | -     | V/°C |
| Gate-source threshold voltage (N)                               | 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                                                                                                       |                                                | -    | -     | 25    | 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> = 10 A                          | -    | 0.225 | 0.270 | Ω    |
| Forward transconductance <sup>a</sup>                           | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 10 A                                                                                                        |                                                | -    | 6.4   | -     | S    |
| Dynamic                                                         |                                  |                                                                                                                                                      |                                                |      |       |       |      |
| Input capacitance                                               | C <sub>iss</sub>                 | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 25 V,<br>f = 1 MHz                                                                                       |                                                | -    | 2451  | 2942  | pF   |
| Output capacitance                                              | C <sub>oss</sub>                 |                                                                                                                                                      |                                                | -    | 300   | 360   |      |
| Reverse transfer capacitance                                    | C <sub>rss</sub>                 |                                                                                                                                                      |                                                | -    | 26    | 32    |      |
| Total gate charge                                               | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V                                                                                                                               | I <sub>D</sub> = 18 A, V <sub>DS</sub> = 400 V | -    | 65    | 76    | nC   |
| Gate-source charge                                              | Q <sub>gs</sub>                  |                                                                                                                                                      |                                                | -    | 21    | -     |      |
| Gate-drain charge                                               | Q <sub>gd</sub>                  |                                                                                                                                                      |                                                | -    | 29    | -     |      |
| Turn-on delay time                                              | t <sub>d(on)</sub>               | V <sub>DD</sub> = 250 V, I <sub>D</sub> = 18 A,<br>V <sub>GS</sub> = 10 V, R <sub>g</sub> = 7.5 Ω                                                    |                                                | -    | 80    | -     | ns   |
| Rise time                                                       | t <sub>r</sub>                   |                                                                                                                                                      |                                                | -    | 27    | -     |      |
| Turn-off delay time                                             | t <sub>d(off)</sub>              |                                                                                                                                                      |                                                | -    | 32    | -     |      |
| Fall time                                                       | t <sub>f</sub>                   |                                                                                                                                                      |                                                | -    | 44    | -     |      |
| Gate input resistance                                           | R <sub>g</sub>                   | f = 1 MHz, open drain                                                                                                                                |                                                | -    | 1.1   | -     | Ω    |
| Drain-Source Body Diode Characteristics                         |                                  |                                                                                                                                                      |                                                |      |       |       |      |
| Continuous source-drain diode current                           | I <sub>S</sub>                   | MOSFET symbol showing the integral reverse p - n junction diode  |                                                | -    | -     | 18    | A    |
| Pulsed diode forward current                                    | I <sub>SM</sub>                  |                                                                                                                                                      |                                                | -    | -     | 72    |      |
| Diode forward voltage                                           | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 18 A, V <sub>GS</sub> = 0 V                                                                                 |                                                | -    | -     | 1.5   | V    |
| Reverse recovery time                                           | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = I <sub>S</sub> ,<br>di/dt = 100 A/μs, V <sub>R</sub> = 35 V                                                 |                                                | -    | 503   | -     | ns   |
| Reverse recovery charge                                         | Q <sub>rr</sub>                  |                                                                                                                                                      |                                                | -    | 6.7   | -     | μC   |
| Reverse recovery current                                        | I <sub>RRM</sub>                 |                                                                                                                                                      |                                                | -    | 30    | -     | A    |

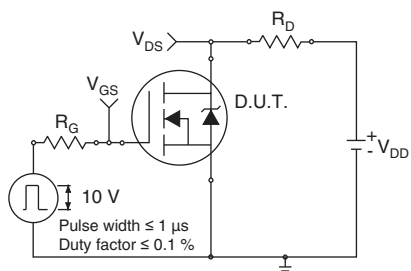
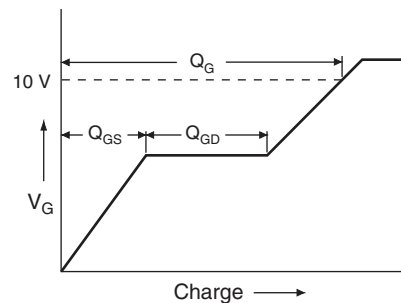
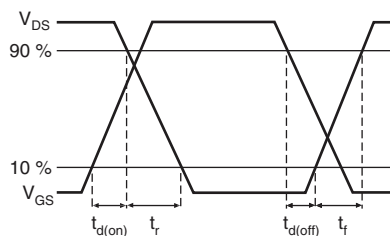
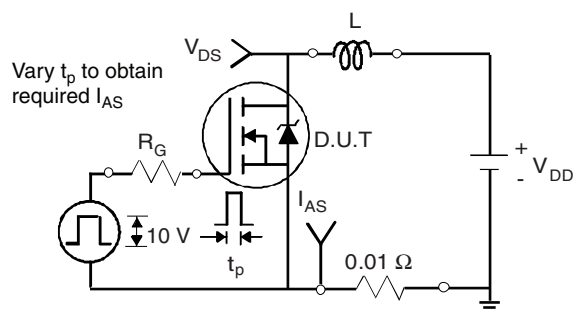
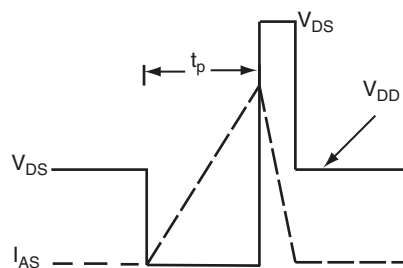
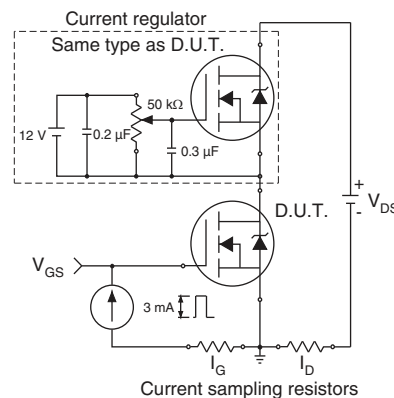
**Notes**

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,  $T_C = 150^\circ\text{C}$** 

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

**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. 13 - Unclamped Inductive Test Circuit**

**Fig. 14 - Unclamped Inductive Waveforms**

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


**Note**

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

**Fig. 17 - 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  |
| Ø 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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