

## AM40P20-150PCFM-VB Datasheet

### P-Channel 60-V (D-S) MOSFET

#### PRODUCT SUMMARY

| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )   | $I_D$ (A) | $Q_g$ (Typ) |
|--------------|-----------------------------|-----------|-------------|
| - 60         | 0.100 at $V_{GS} = - 10$ V  | - 20      | 12.5        |
|              | 0.120 at $V_{GS} = - 4.5$ V | - 15      |             |

#### FEATURES

- TrenchFET® Power MOSFET
- 100 % UIS Tested

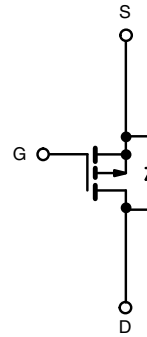
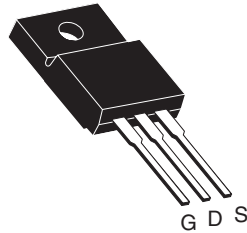
#### APPLICATIONS

- Load Switch



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

TO-220 FULLPAK



P-Channel MOSFET

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

| Parameter                                              |                           | Symbol         | Limit           | Unit             |
|--------------------------------------------------------|---------------------------|----------------|-----------------|------------------|
| Gate-Source Voltage                                    |                           | $V_{GS}$       | $\pm 20$        | V                |
| Continuous Drain Current ( $T_J = 175^\circ\text{C}$ ) | $T_C = 25^\circ\text{C}$  | $I_D$          | - 20            | A                |
|                                                        | $T_C = 100^\circ\text{C}$ |                | - 12            |                  |
| Pulsed Drain Current                                   |                           | $I_{DM}$       | - 60            |                  |
| Continuing Source Current (Diode Conduction)           |                           | $I_S$          | - 12            |                  |
| Avalanche Current                                      |                           | $I_{AS}$       | - 12            |                  |
| Single Pulse Avalanche Energy                          | $L = 0.1$ mH              | $E_{AS}$       | 7.2             | mJ               |
| Maximum Power Dissipation                              | $T_C = 25^\circ\text{C}$  | $P_D$          | 30 <sup>a</sup> | W                |
|                                                        | $T_A = 25^\circ\text{C}$  |                | 2 <sup>b</sup>  |                  |
| Operating Junction and Storage Temperature Range       |                           | $T_J, T_{stg}$ | - 55 to 175     | $^\circ\text{C}$ |

#### THERMAL RESISTANCE RATINGS

| Parameter                        |                 | Symbol     | Typical | Maximum | Unit               |
|----------------------------------|-----------------|------------|---------|---------|--------------------|
| Junction-to-Ambient <sup>b</sup> | $t \leq 10$ sec | $R_{thJA}$ | 20      | 25      | $^\circ\text{C/W}$ |
|                                  | Steady State    |            | 62      | 75      |                    |
| Junction-to-Case                 |                 | $R_{thJC}$ | 5       | 6       |                    |

Notes:

a. See SOA curve for voltage derating.

b. Surface Mounted on 1" x 1" FR-4 board.

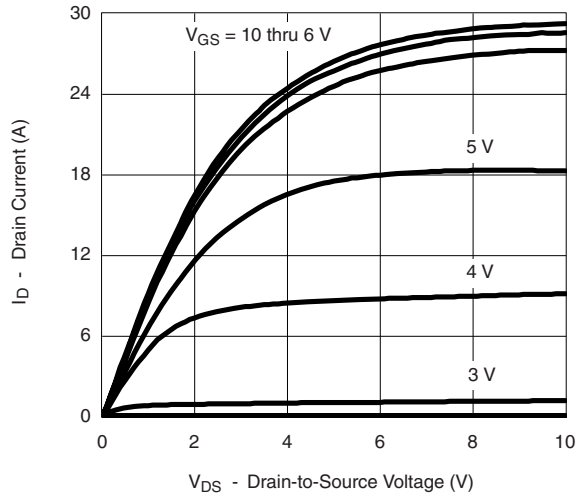
| SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted                         |               |                                                                                                                                 |       |                  |           |               |
|----------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------|-------|------------------|-----------|---------------|
| Parameter                                                                                          | Symbol        | Test Conditions                                                                                                                 | Min   | Typ <sup>a</sup> | Max       | Unit          |
| Static                                                                                             |               |                                                                                                                                 |       |                  |           |               |
| Drain-Source Breakdown Voltage                                                                     | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$                                                                            | - 60  |                  |           | V             |
| Gate Threshold Voltage                                                                             | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$                                                                                | - 1.0 | - 2.0            | - 3.0     |               |
| Gate-Body Leakage                                                                                  | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$                                                                                 |       |                  | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current                                                                    | $I_{DSS}$     | $V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$                                                                                    |       |                  | - 1       | $\mu\text{A}$ |
|                                                                                                    |               | $V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^{\circ}\text{C}$                                                 |       |                  | - 50      |               |
|                                                                                                    |               | $V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^{\circ}\text{C}$                                                 |       |                  | - 150     |               |
| On-State Drain Current <sup>b</sup>                                                                | $I_{D(on)}$   | $V_{DS} = -5\text{ V}, V_{GS} = -10\text{ V}$                                                                                   | - 10  |                  |           | A             |
| Drain-Source On-State Resistance <sup>b</sup>                                                      | $r_{DS(on)}$  | $V_{GS} = -10\text{ V}, I_D = -5\text{ A}$                                                                                      |       | 0.100            |           | $\Omega$      |
|                                                                                                    |               | $V_{GS} = -10\text{ V}, I_D = -5\text{ A}, T_J = 125\text{ }^{\circ}\text{C}$                                                   |       | 0.150            |           |               |
|                                                                                                    |               | $V_{GS} = -10\text{ V}, I_D = -5\text{ A}, T_J = 175\text{ }^{\circ}\text{C}$                                                   |       | 0.200            |           |               |
|                                                                                                    |               | $V_{GS} = -4.5\text{ V}, I_D = -2\text{ A}$                                                                                     |       | 0.120            |           |               |
| Forward Transconductance <sup>b</sup>                                                              | $g_{fs}$      | $V_{DS} = -15\text{ V}, I_D = -5\text{ A}$                                                                                      |       | 8                |           | S             |
| Dynamic                                                                                            |               |                                                                                                                                 |       |                  |           |               |
| Input Capacitance                                                                                  | $C_{iss}$     | $V_{DS} = -25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$                                                                  |       | 550              |           | pF            |
| Output Capacitance                                                                                 | $C_{oss}$     |                                                                                                                                 |       | 95               |           |               |
| Reverse Transfer Capacitance                                                                       | $C_{rss}$     |                                                                                                                                 |       | 60               |           |               |
| Total Gate Charge                                                                                  | $Q_g$         | $V_{DS} = -30\text{ V}, V_{GS} = -10\text{ V}, I_D = -8.4\text{ A}$                                                             |       | 12.5             | 19        | nC            |
| Gate-Source Charge                                                                                 | $Q_{gs}$      |                                                                                                                                 |       | 2.3              |           |               |
| Gate-Drain Charge                                                                                  | $Q_{gd}$      |                                                                                                                                 |       | 3.2              |           |               |
| Gate Resistance                                                                                    | $R_g$         | $f = 1\text{ MHz}$                                                                                                              |       | 8.0              |           | $\Omega$      |
| Turn-On Delay Time <sup>c</sup>                                                                    | $t_{d(on)}$   | $V_{DD} = -30\text{ V}, R_L = 3.57\text{ }\Omega$<br>$I_D \cong -8.4\text{ A}, V_{GEN} = -10\text{ V}, R_G = 2.5\text{ }\Omega$ |       | 5                | 10        | ns            |
| Rise Time <sup>c</sup>                                                                             | $t_r$         |                                                                                                                                 |       | 14               | 25        |               |
| Turn-Off Delay Time <sup>c</sup>                                                                   | $t_{d(off)}$  |                                                                                                                                 |       | 15               | 25        |               |
| Fall Time <sup>c</sup>                                                                             | $t_f$         |                                                                                                                                 |       | 7                | 12        |               |
| Source-Drain Diode Ratings and Characteristics ( $T_C = 25\text{ }^{\circ}\text{C}$ ) <sup>b</sup> |               |                                                                                                                                 |       |                  |           |               |
| Pulsed Current                                                                                     | $I_{SM}$      |                                                                                                                                 |       |                  | - 20      | A             |
| Forward Voltage <sup>b</sup>                                                                       | $V_{SD}$      | $I_F = -2\text{ A}, V_{GS} = 0\text{ V}$                                                                                        |       | - 0.9            | - 1.3     | V             |
| Reverse Recovery Time                                                                              | $t_{rr}$      | $I_F = -8\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$                                                                           |       | 50               | 80        | ns            |
| Reverse Recovery Time                                                                              | $Q_{rr}$      |                                                                                                                                 |       | 80               | 120       | nC            |

Notes:

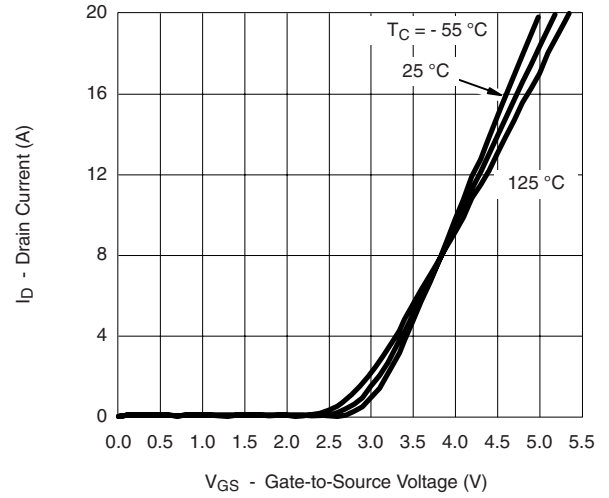
- a. Guaranteed by design, not subject to production testing.  
 b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 c. Independent of operating temperature.

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.

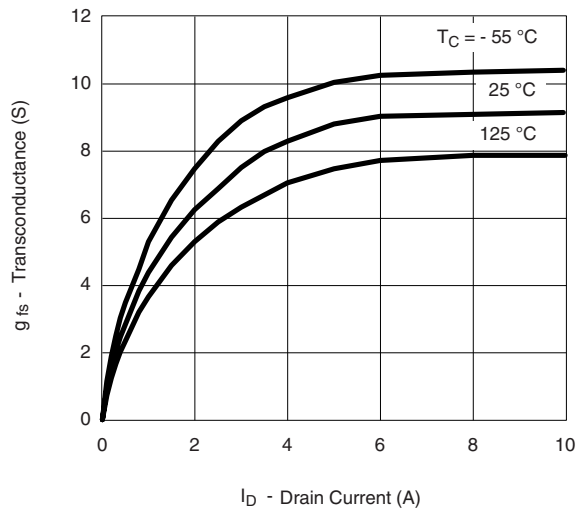
## TYPICAL CHARACTERISTICS 25 °C unless noted



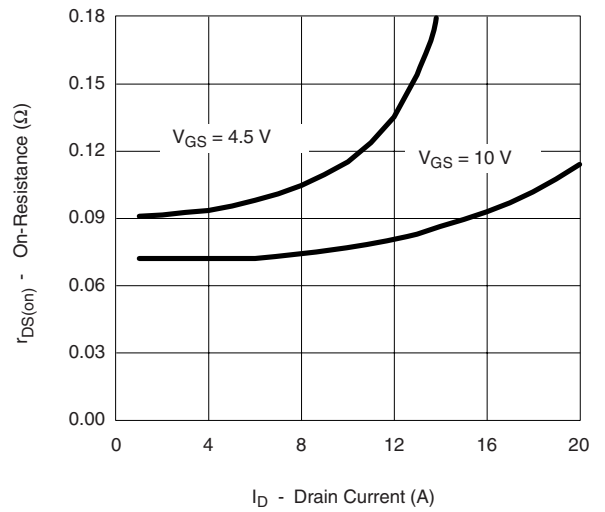
Output Characteristics



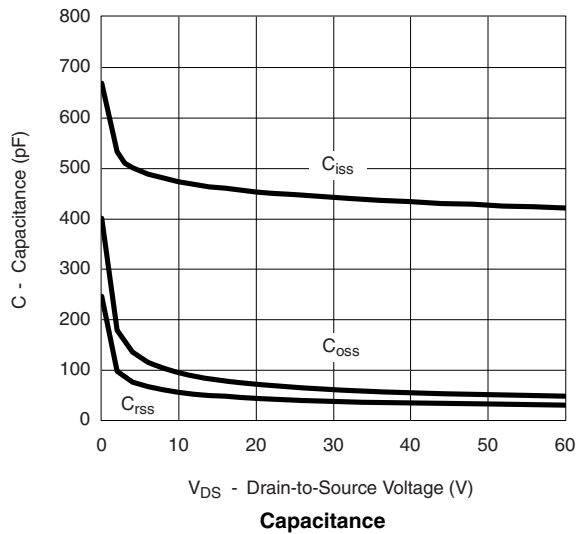
Transfer Characteristics



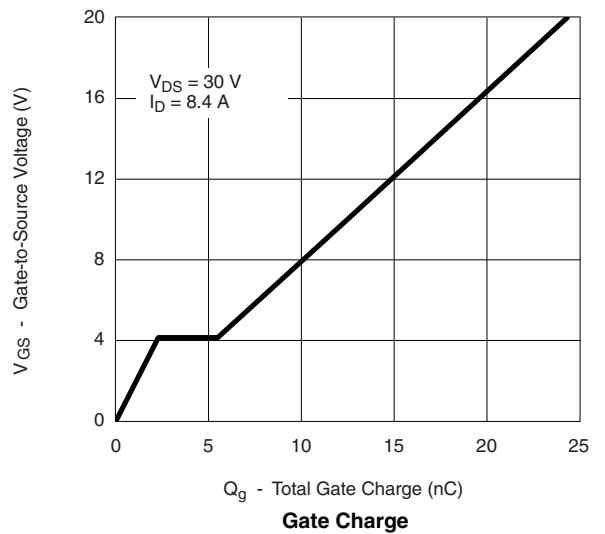
Transconductance



On-Resistance vs. Drain Current

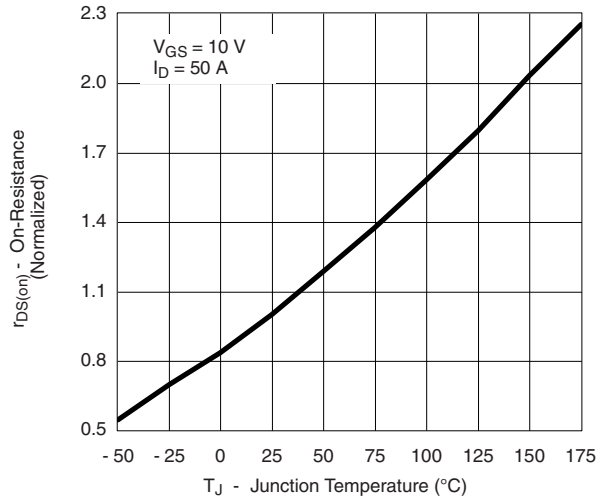


Capacitance

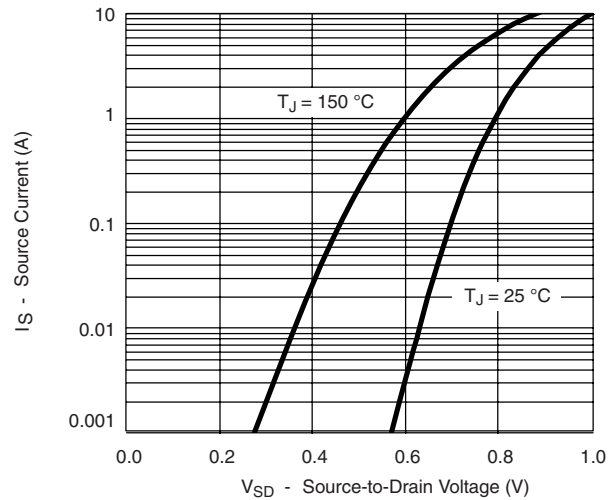


Gate Charge

**TYPICAL CHARACTERISTICS** 25 °C unless noted

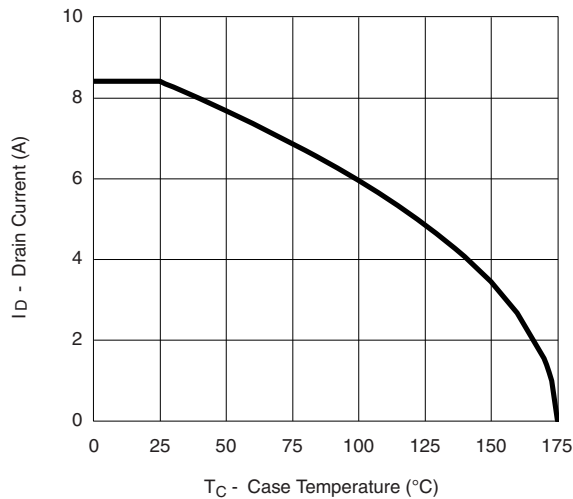


On-Resistance vs. Junction Temperature

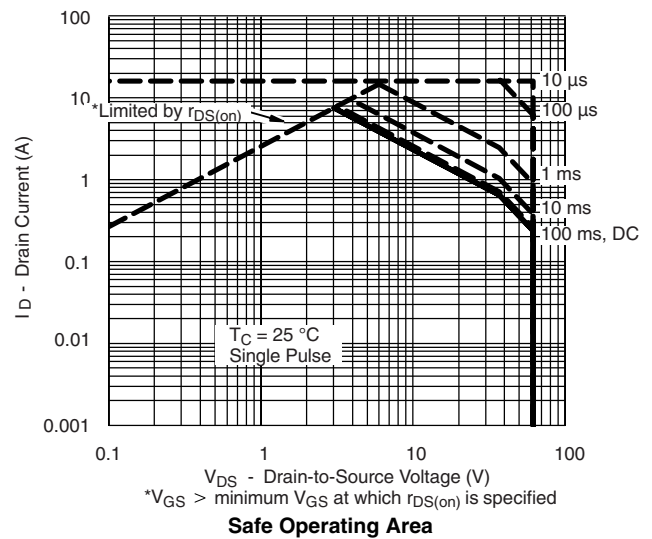


Source-Drain Diode Forward Voltage

**THERMAL RATINGS**



Drain Current vs. Case Temperature

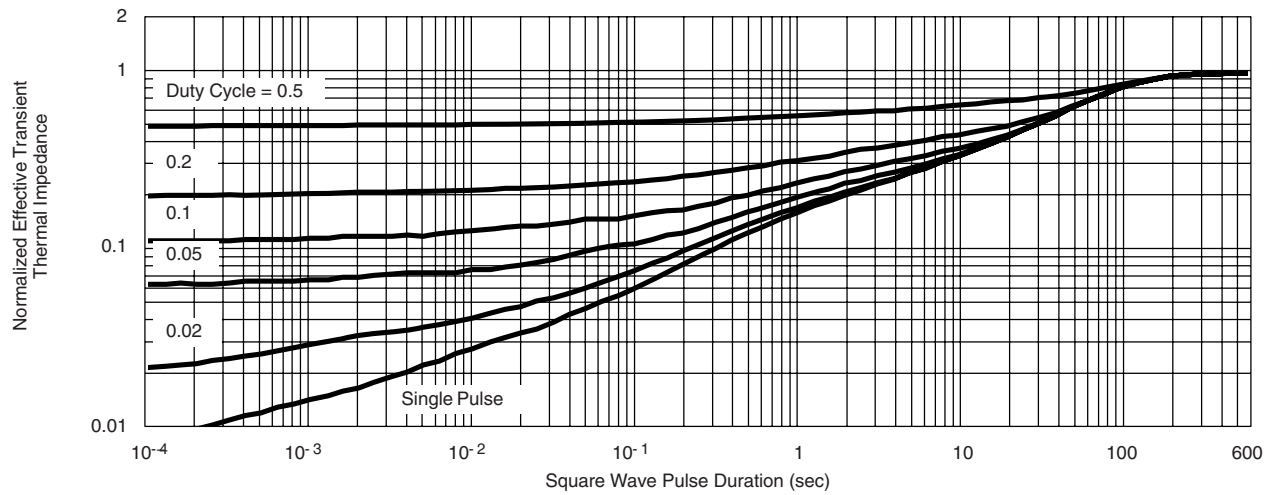


Safe Operating Area

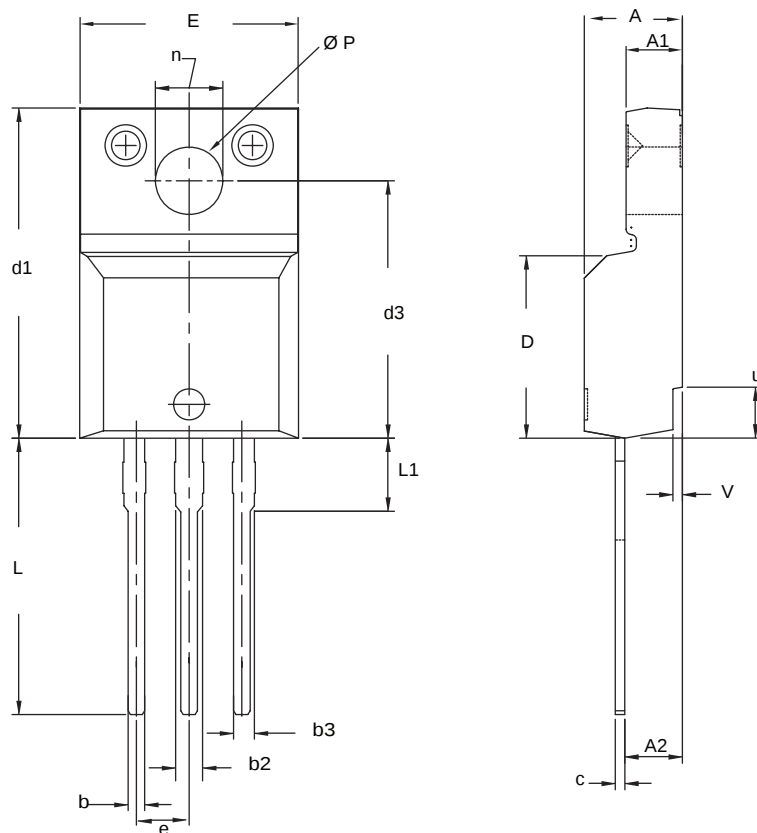
## THERMAL RATINGS



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

**TO-220 FULLPAK**

| 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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