

K2977-VB Datasheet

N-Channel 30-V (D-S) MOSFET

| PRODUCT SUMMARY | | | |
|---------------------|-----------------------------------|------------------------------------|----------------------|
| V _{DS} (V) | R _{DS(on)} (Ω) | I _D (A) ^{a, e} | Q _g (Typ) |
| 30 | 0.0010 at V _{GS} = 10 V | 68 | 82 nC |
| | 0.0014 at V _{GS} = 4.5 V | 62 | |

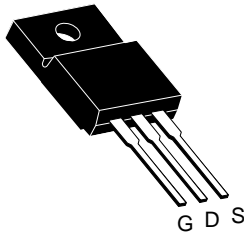
FEATURES

- TrenchFET[®] Power MOSFET
- 100 % R_g and UIS Tested
- Compliant to RoHS Directive 2011/65/EU

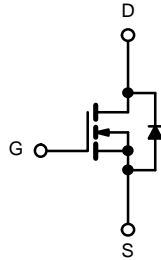

RoHS
 COMPLIANT

APPLICATIONS

- OR-ing
- Server
- DC/DC

TO-220 FULLPAK


Top View



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C, unless otherwise noted) | | | | |
|---|-----------------------------------|------------------------|----------------------|---|
| Parameter | Symbol | Limit | Unit | |
| Drain-Source Voltage | V _{DS} | 30 | V | |
| Gate-Source Voltage | V _{GS} | ± 20 | | |
| Continuous Drain Current (T _J = 175 °C) | I _D | T _C = 25 °C | 68 ^{a, e} | A |
| | | T _C = 70 °C | 62 ^e | |
| | | T _A = 25 °C | 68.8 ^{b, c} | |
| | | T _A = 70 °C | 57 ^{b, c} | |
| Pulsed Drain Current | I _{DM} | 90 | | |
| Avalanche Current Pulse | I _{AS} | 36 | L = 0.1 mH | V |
| Single Pulse Avalanche Energy | | | | |
| Continuous Source-Drain Diode Current | I _S | T _C = 25 °C | 90 ^{a, e} | A |
| | | T _A = 25 °C | 3.13 ^{b, c} | |
| Maximum Power Dissipation | P _D | T _C = 25 °C | 250 ^a | W |
| | | T _C = 70 °C | 175 | |
| | | T _A = 25 °C | 3.75 ^{b, c} | |
| | | T _A = 70 °C | 2.63 ^{b, c} | |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | - 55 to 175 | °C | |

THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Typ. | Max. | Unit |
|---|-------------------|------|------|------|
| Maximum Junction-to-Ambient ^{b, d} | R _{thJA} | 32 | 40 | °C/W |
| Maximum Junction-to-Case | R _{thJC} | 0.5 | 0.6 | |

Notes:

 a. Based on T_C = 25 °C.

b. Surface mounted on 1" x 1" FR4 board.

c. t = 10 sec.

d. Maximum under steady state conditions is 90 °C/W.

e. Calculated based on maximum junction temperature. Package limitation current is 90 A.

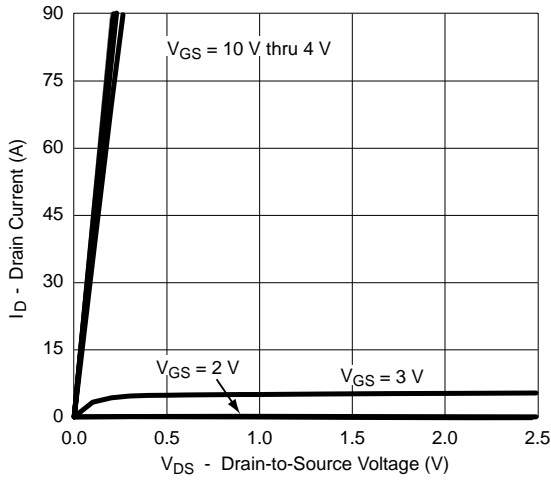
| SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | | | | |
|--|-------------------------|--|------|--------|-----------|----------------------|
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 30 | | | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | $I_D = 250\text{ }\mu\text{A}$ | | 35 | | mV/ $^\circ\text{C}$ |
| $V_{GS(th)}$ Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | | | -7.5 | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 1.5 | | 2.5 | V |
| Gate-Source Leakage | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$ | | | 1 | μA |
| | | $V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$ | | | 10 | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$ | 90 | | | A |
| Drain-Source On-State Resistance ^a | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 28.8\text{ A}$ | | 0.0010 | | Ω |
| | | $V_{GS} = 4.5\text{ V}, I_D = 27\text{ A}$ | | 0.0014 | | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = 15\text{ V}, I_D = 28.8\text{ A}$ | | 160 | | S |
| Dynamic^b | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | | 12065 | | pF |
| Output Capacitance | C_{oss} | | | 1725 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 970 | | |
| Total Gate Charge | Q_g | $V_{DS} = 15\text{ V}, V_{GS} = 10\text{ V}, I_D = 28.8\text{ A}$ | | 171 | 257 | nC |
| | | | | 81.5 | 123 | |
| Gate-Source Charge | Q_{gs} | $V_{DS} = 15\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 28.8\text{ A}$ | | 34 | | |
| Gate-Drain Charge | Q_{gd} | | | 29 | | |
| Gate Resistance | R_g | $f = 1\text{ MHz}$ | | 1.4 | 2.1 | Ω |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 15\text{ V}, R_L = 0.625\text{ }\Omega$ $I_D \cong 24\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$ | | 18 | 27 | ns |
| Rise Time | t_r | | | 11 | 17 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 70 | 105 | |
| Fall Time | t_f | | | 10 | 15 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 15\text{ V}, R_L = 0.67\text{ }\Omega$ $I_D \cong 22.5\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$ | | 55 | 83 | |
| Rise Time | t_r | | | 180 | 270 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 55 | 83 | |
| Fall Time | t_f | | | 12 | 18 | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Source-Drain Diode Current | I_S | $T_C = 25\text{ }^\circ\text{C}$ | | | 90 | A |
| Pulse Diode Forward Current ^a | I_{SM} | | | | 90 | |
| Body Diode Voltage | V_{SD} | $I_S = 22\text{ A}$ | | 0.8 | 1.2 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $I_F = 20\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$ | | 52 | 78 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | 70.2 | 105 | nC |
| Reverse Recovery Fall Time | t_a | | | 27 | | ns |
| Reverse Recovery Rise Time | t_b | | | 25 | | |

Notes:

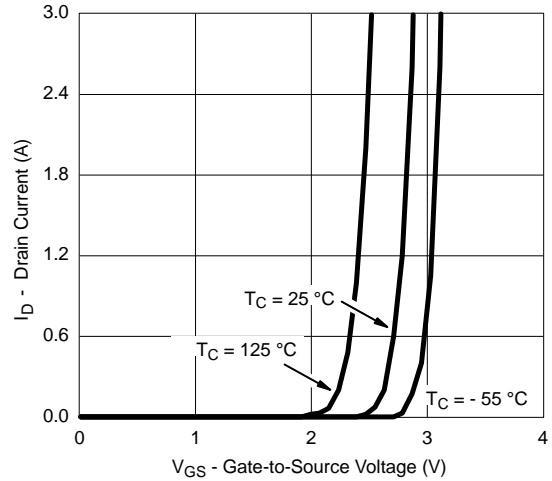
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
 b. Guaranteed by design, not subject to production testing.

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.

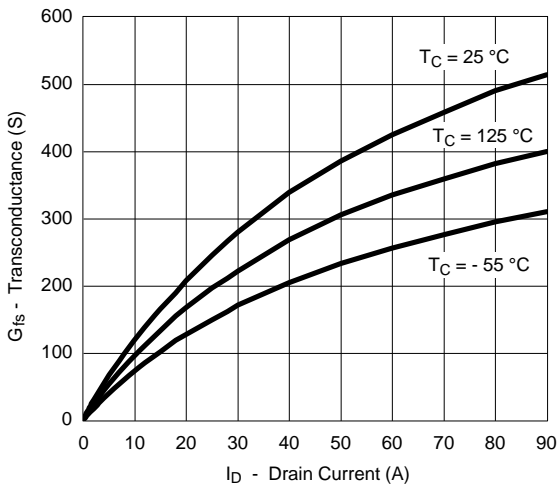
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



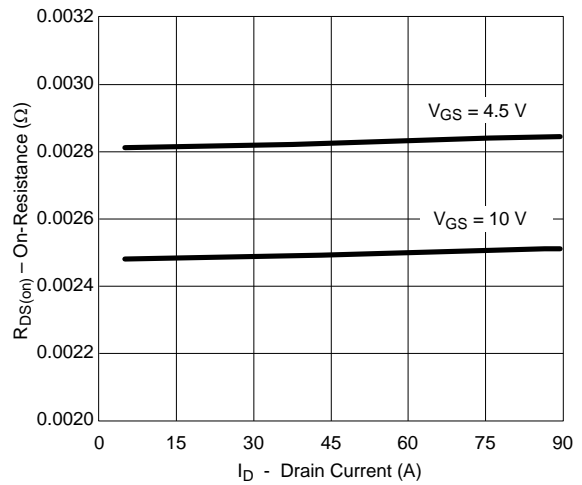
Output Characteristics



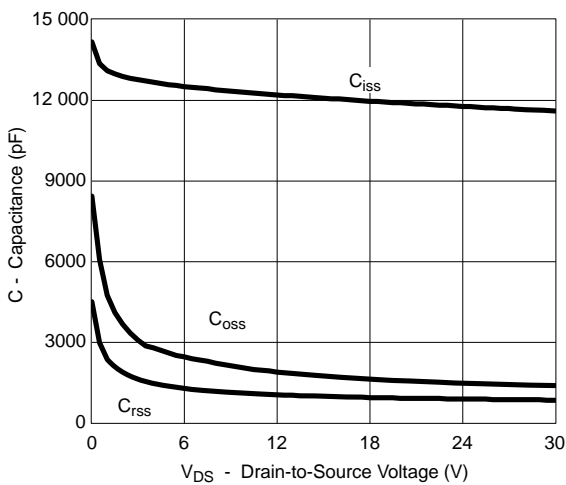
Transfer Characteristics



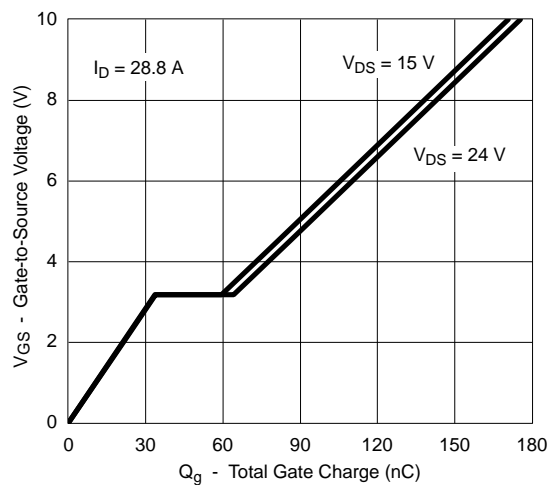
Transconductance



$R_{DS(on)}$ vs. Drain Current

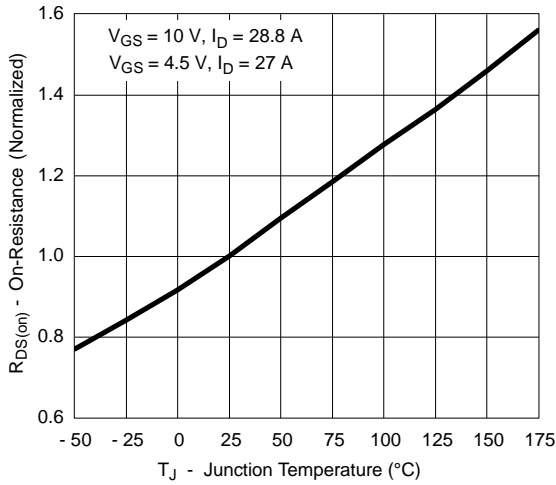


Capacitance

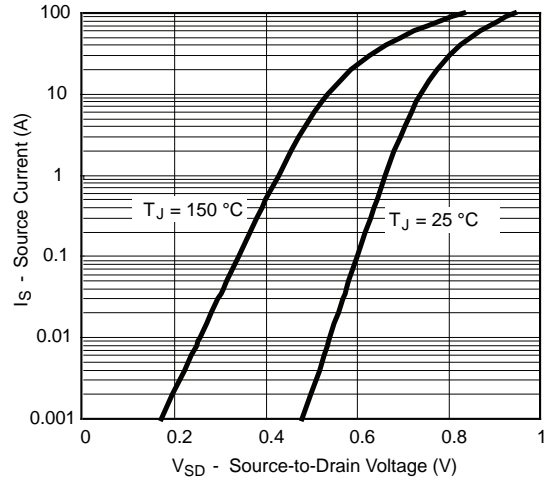


Gate Charge

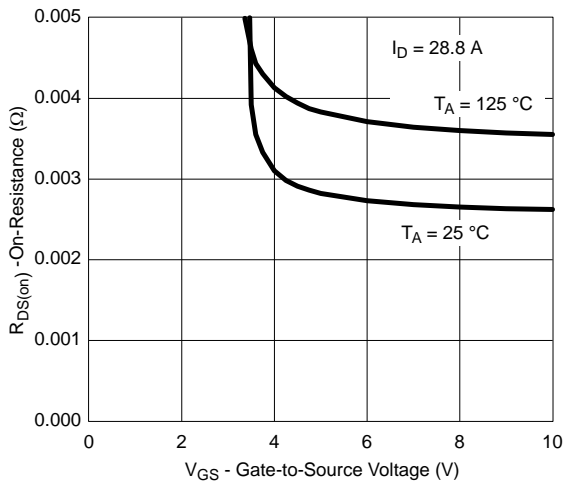
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



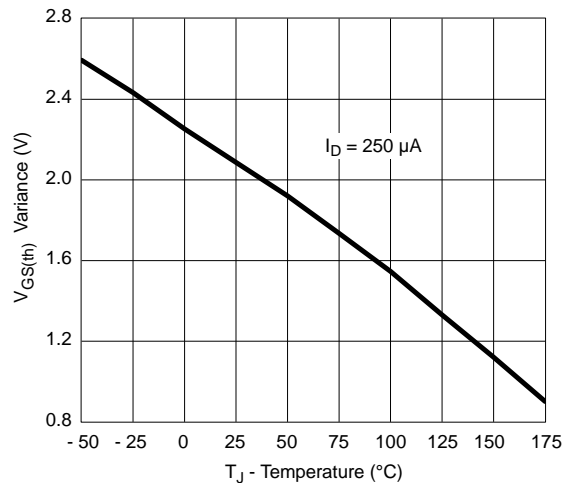
On-Resistance vs. Junction Temperature



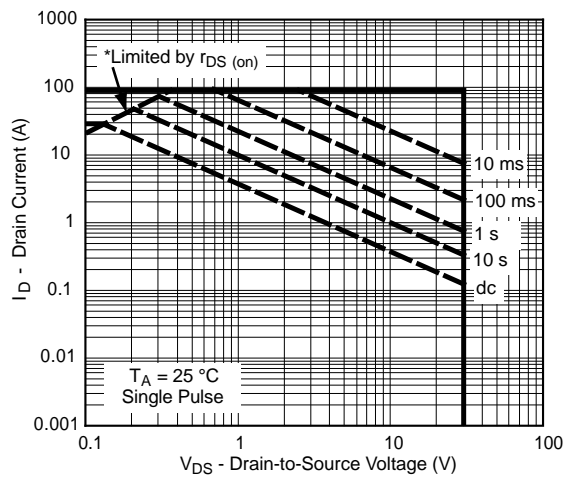
Forward Diode Voltage vs. Temperature



$R_{DS(on)}$ vs. V_{GS} vs. Temperature

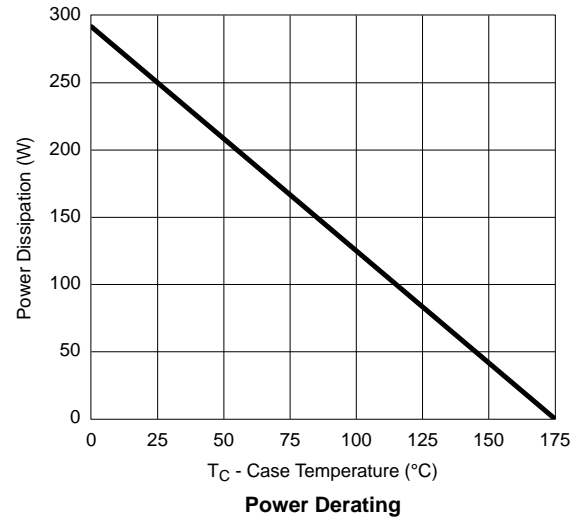
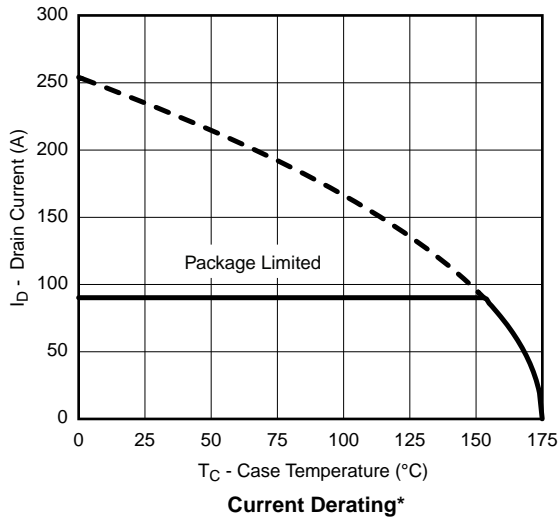


Threshold Voltage

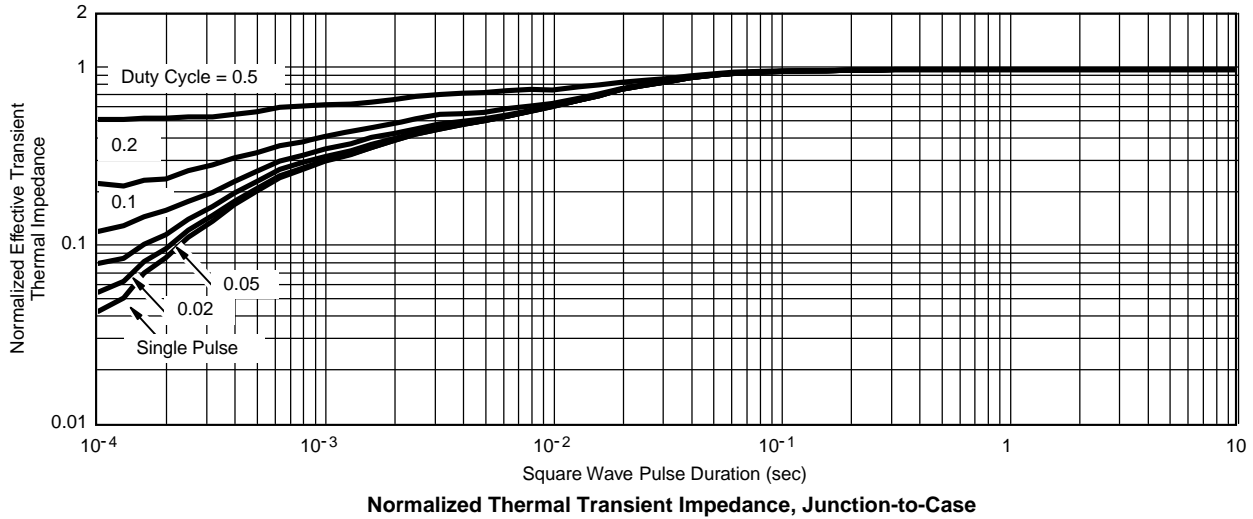


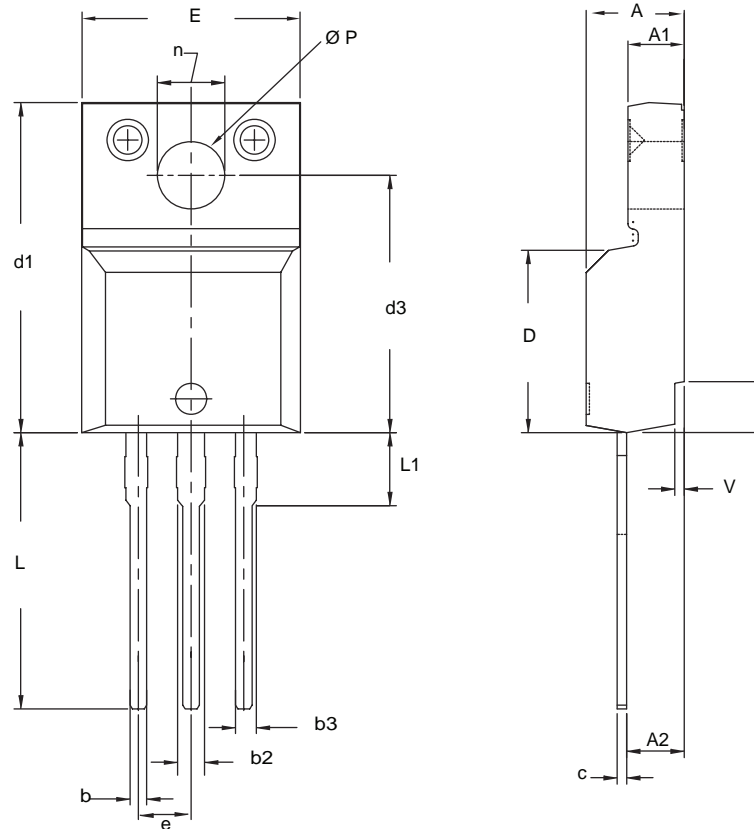
* $V_{GS} >$ minimum V_{GS} at which $r_{DS(on)}$ is specified
Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



*The power dissipation P_D is based on T_{J(max)} = 175 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



TO-220 FULLPAK (HIGH VOLTAGE)

| 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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