

FDD6N50/FDU6N50

500V N-Channel MOSFET

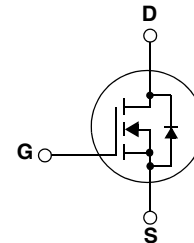
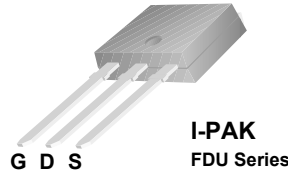
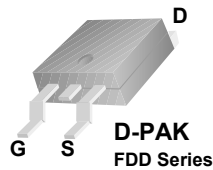
Features

- 6A, 500V, $R_{DS(on)} = 0.9\Omega$ @ $V_{GS} = 10V$
- Low gate charge (typical 12.8 nC)
- Low C_{rss} (typical 9 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficient switched mode power supplies and active power factor correction.



Absolute Maximum Ratings

| Symbol | Parameter | FDD6N50/FDU6N50 | Unit |
|----------------|--|--|------------------|
| V_{DSS} | Drain-Source Voltage | 500 | V |
| I_D | Drain Current | - Continuous ($T_C = 25^\circ\text{C}$) | 6 |
| | | - Continuous ($T_C = 100^\circ\text{C}$) | 3.8 |
| I_{DM} | Drain Current - Pulsed (Note 1) | 24 | A |
| V_{GSS} | Gate-Source voltage | ± 30 | V |
| E_{AS} | Single Pulsed Avalanche Energy (Note 2) | 270 | mJ |
| I_{AR} | Avalanche Current (Note 1) | 6 | A |
| E_{AR} | Repetitive Avalanche Energy (Note 1) | 8.9 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | 4.5 | V/ns |
| P_D | Power Dissipation ($T_C = 25^\circ\text{C}$) | - Derate above 25°C | 89 |
| | | | 0.71 |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to +150 | $^\circ\text{C}$ |
| T_L | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds | 300 | $^\circ\text{C}$ |

Thermal Characteristics

| Symbol | Parameter | Min. | Max. | Unit |
|-----------------|---|------|------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | -- | 1.4 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -- | 83 | $^\circ\text{C}/\text{W}$ |

Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|-----------|---------|-----------|------------|----------|
| FDD6N50 | FDD6N50TM | D-PAK | 380mm | 16mm | 2500 |
| FDD6N50 | FDD6N50TF | D-PAK | 380mm | 16mm | 2000 |
| FDU6N50 | FDU6N50TU | I-PAK | - | - | 70 |

Electrical Characteristics T_C = 25°C unless otherwise noted

| Symbol | Parameter | Conditions | Min. | Typ. | Max | Units |
|---|---|--|-------------|------|---------|--------------------|
| Off Characteristics | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0V, I_D = 250\mu A$ | 500 | -- | -- | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\mu A$, Referenced to 25°C | -- | 0.5 | -- | V/°C |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 500V, V_{GS} = 0V$ $V_{DS} = 400V, T_C = 125^\circ C$ | -- | -- | 1 10 | μA μA |
| I_{GSSF} | Gate-Body Leakage Current, Forward | $V_{GS} = 30V, V_{DS} = 0V$ | -- | -- | 100 | nA |
| I_{GSSR} | Gate-Body Leakage Current, Reverse | $V_{GS} = -30V, V_{DS} = 0V$ | -- | -- | -100 | nA |
| On Characteristics | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\mu A$ | 3.0 | -- | 5.0 | V |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10V, I_D = 3A$ | -- | 0.76 | 0.9 | Ω |
| g_{FS} | Forward Transconductance | $V_{DS} = 40V, I_D = 3A$ (Note 4) | -- | 2.5 | -- | S |
| Dynamic Characteristics | | | | | | |
| C_{iss} | Input Capacitance | $V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0MHz$ | -- | 720 | 940 | pF |
| C_{oss} | Output Capacitance | | -- | 95 | 190 | pF |
| C_{rss} | Reverse Transfer Capacitance | | -- | 9 | 13.5 | pF |
| Switching Characteristics | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 250V, I_D = 6A$ $R_G = 25\Omega$ | -- | 6 | 20 | ns |
| t_r | Turn-On Rise Time | | -- | 55 | 120 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 25 | 60 | ns |
| t_f | Turn-Off Fall Time | | (Note 4, 5) | -- | 35 | 80 |
| Q_g | Total Gate Charge | $V_{DS} = 400V, I_D = 6A$ $V_{GS} = 10V$ | -- | 12.8 | 16.6 | nC |
| Q_{gs} | Gate-Source Charge | | -- | 3.7 | -- | nC |
| Q_{gd} | Gate-Drain Charge | | (Note 4, 5) | -- | 5.8 | -- |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I_S | Maximum Continuous Drain-Source Diode Forward Current | | -- | -- | 6 | A |
| I_{SM} | Maximum Pulsed Drain-Source Diode Forward Current | | -- | -- | 24 | A |
| V_{SD} | Drain-Source Diode Forward Voltage | $V_{GS} = 0V, I_S = 6A$ | -- | -- | 1.4 | V |
| t_{rr} | Reverse Recovery Time | $V_{GS} = 0V, I_S = 6A$ $di_f/dt = 100A/\mu s$ | -- | 275 | -- | ns |
| Q_{rr} | Reverse Recovery Charge | | (Note 4) | -- | 1.7 | -- |

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 6A, V_{DD} = 50V, L = 13.5mH, R_G = 25\Omega$, Starting $T_J = 25^\circ C$
3. $I_{SD} \leq 6A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ C$
4. Pulse Test: Pulse width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

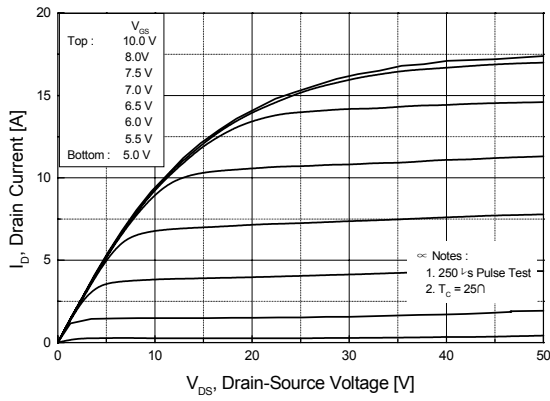


Figure 2. Transfer Characteristics

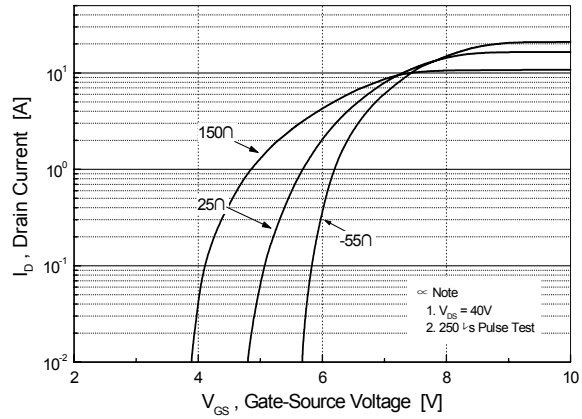


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

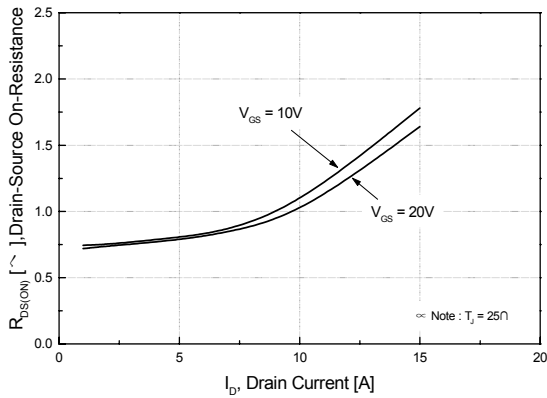


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

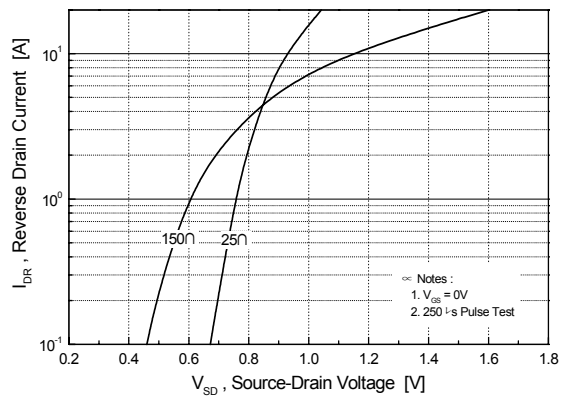


Figure 5. Capacitance Characteristics

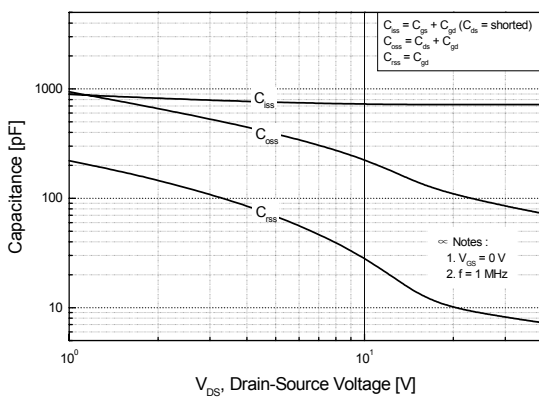
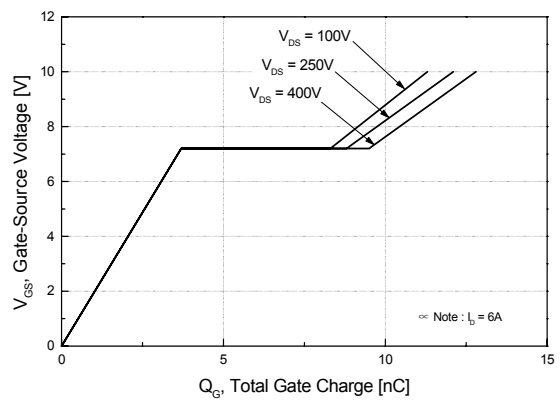


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

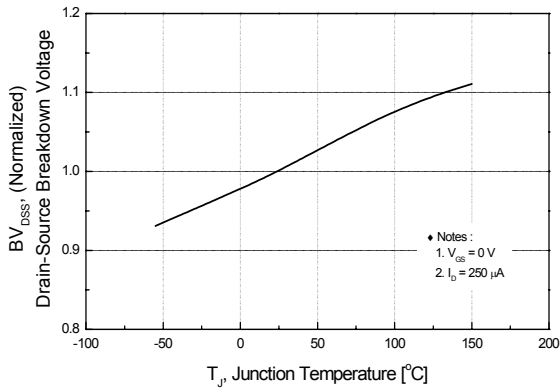


Figure 8. On-Resistance Variation vs. Temperature

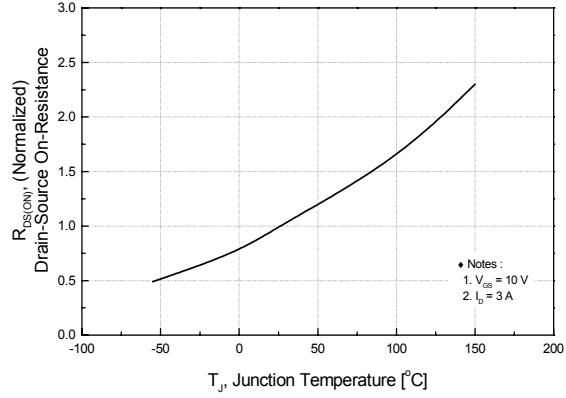


Figure 9. Maximum Safe Operating Area

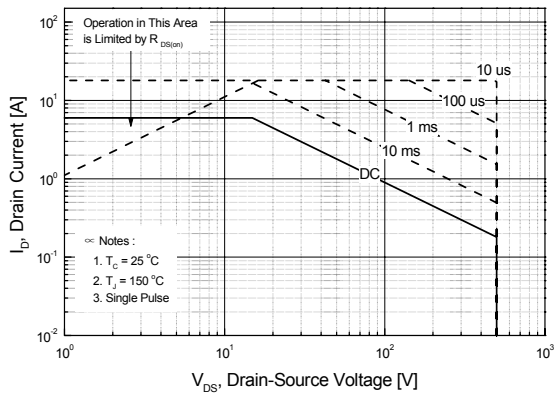


Figure 10. Maximum Drain Current vs. Case Temperature

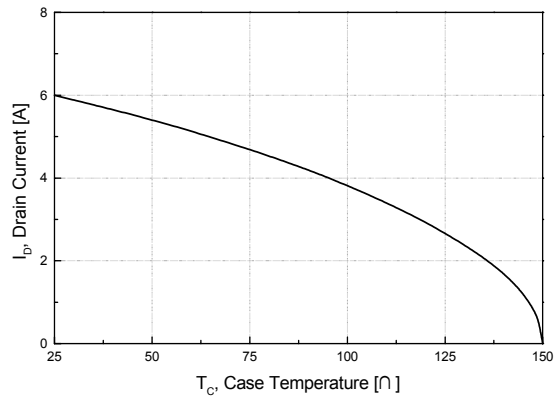
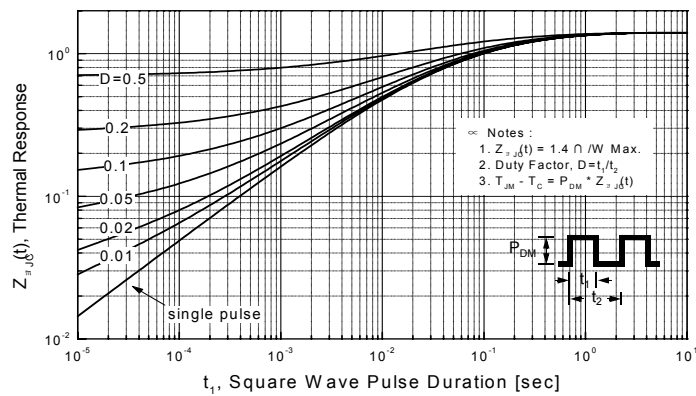
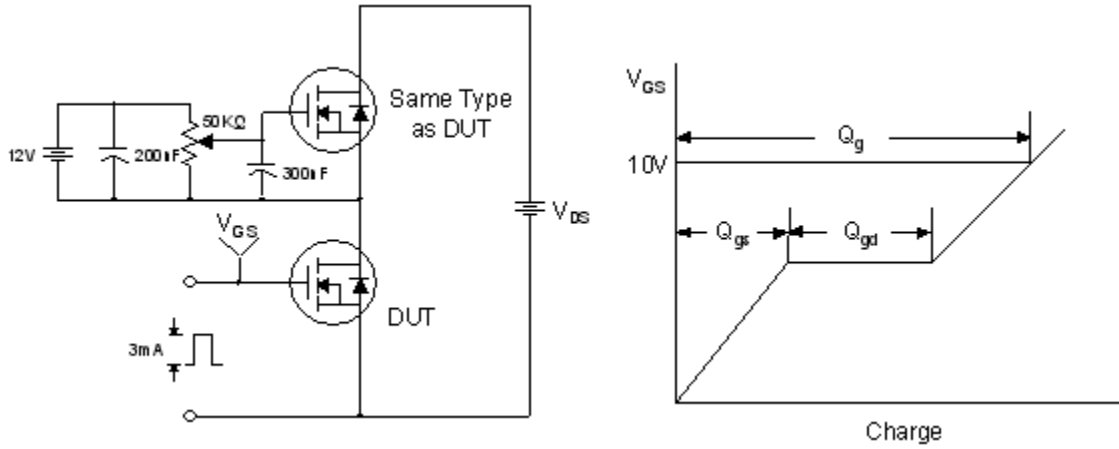


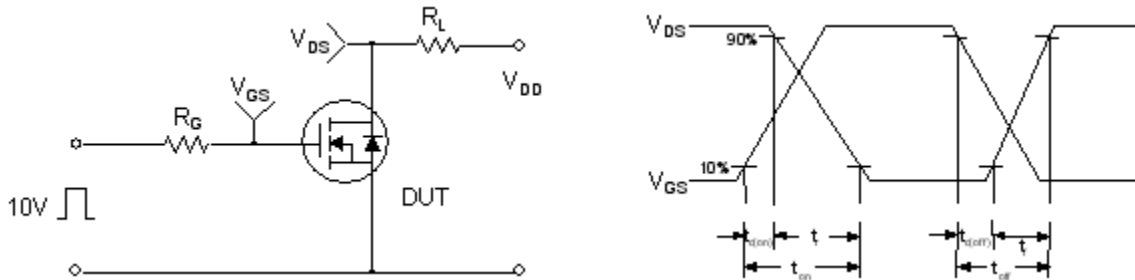
Figure 11. Transient Thermal Response Curve



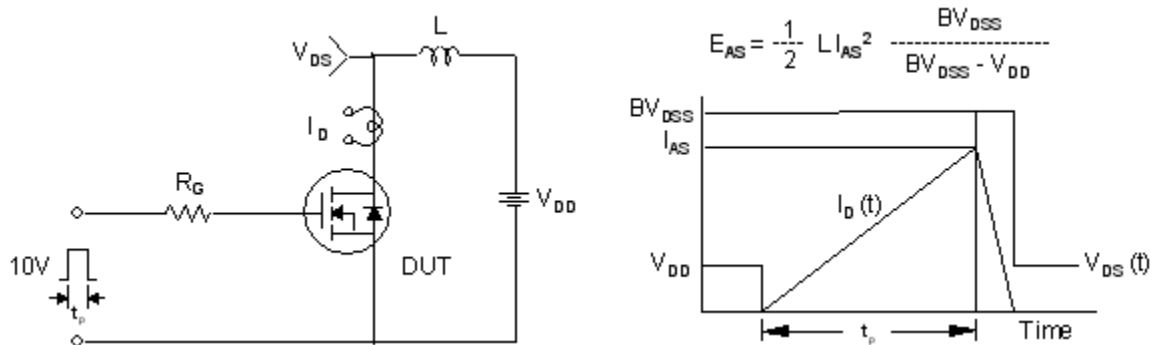
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

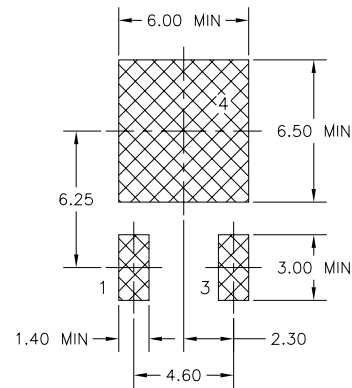
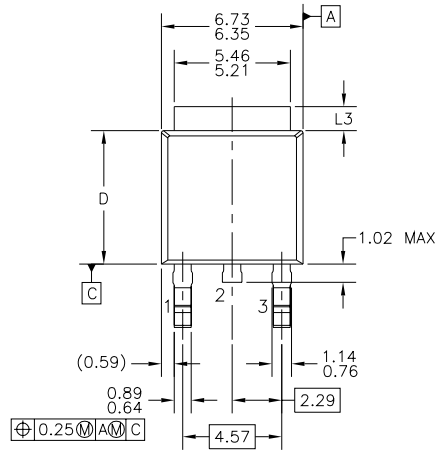


Peak Diode Recovery dv/dt Test Circuit & Waveforms

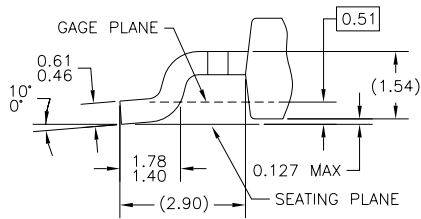
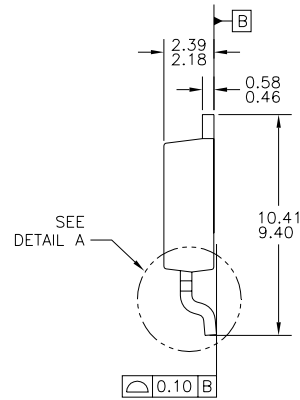
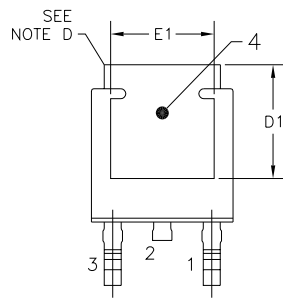


Mechanical Dimensions

D-PAK



LAND PATTERN RECOMMENDATION



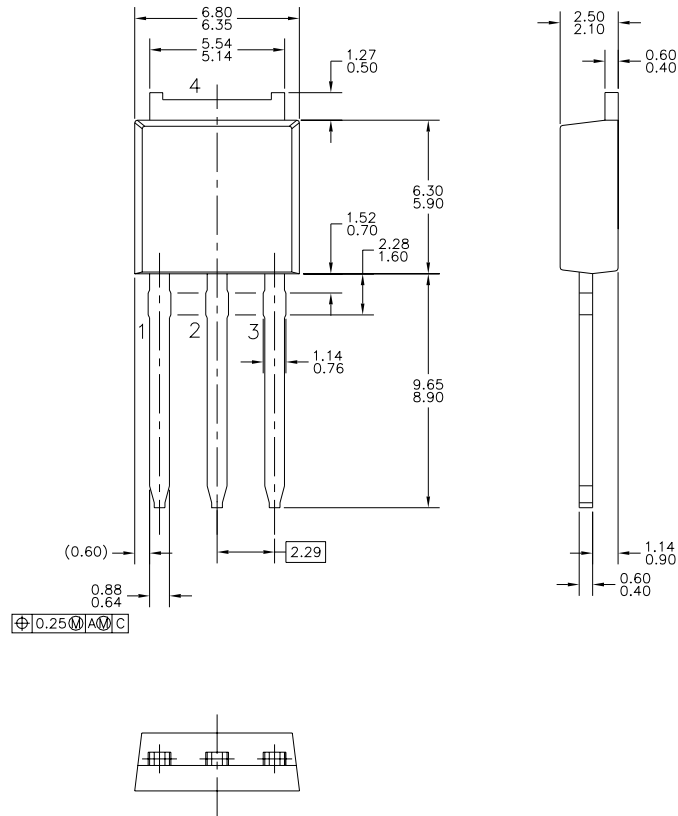
DETAIL A
(ROTATED -90°)
SCALE: 12X

- NOTES: UNLESS OTHERWISE SPECIFIED
- A) ALL DIMENSIONS ARE IN MILLIMETERS.
 - B) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA & AB, DATED NOV. 1999.
 - C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
 - D) HEAT SINK TOP EDGE COULD BE IN CHAMFERED CORNERS OR EDGE PROTRUSION.
 - E) DIMENSIONS L3,D,E1&D1 TABLE:
- | | OPTION AA | OPTION AB |
|----|-----------|-----------|
| L3 | 0.89-1.27 | 1.52-2.03 |
| D | 5.97-6.22 | 5.33-5.59 |
| E1 | 4.32 MIN | 3.81 MIN |
| D1 | 5.21 MIN | 4.57 MIN |
- F) PRESENCE OF TRIMMED CENTER LEAD IS OPTIONAL.

Dimensions in Millimeters

Mechanical Dimensions (Continued)

I-PAK



Dimensions in Millimeters

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| Bottomless™ | FPST™ | MICROCOUPLER™ | QFET® | SyncFET™ |
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| EnSigna™ | ImpliedDisconnect™ | OCXPro™ | ScalarPump™ | UniFET™ |
| FACT™ | IntelliMAX™ | OPTOLOGIC® | SILENT SWITCHER® | VCX™ |
| FACT Quiet Series™ | | OPTOPLANAR™ | SMART START™ | Wire™ |
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