FAIRCHILD SEMICONDUCTOR®

November 2006

# FDB2710
# 250V N-Channel PowerTrench MOSFET

## General Description

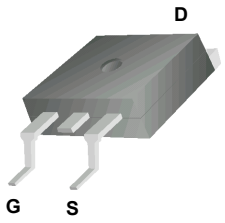
This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

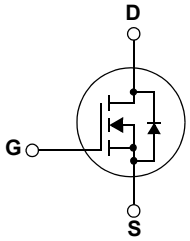
## Application

- PDP application

## Description

- 50A, 250V, $R_{DS(on)}$ = 36.3mΩ @$V_{GS}$ = 10 V
- Fast switching speed
- Low gate charge
- High performance trench technology for extremely low $R_{DS(on)}$
- High power and current handling capability




## Absolute Maximum Ratings

| Symbol | Parameter | Ratings | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 250 | V |
| $V_{GS}$ | Gate-Source voltage | ± 30 | V |
| $I_D$ | Drain Current - Continuous ($T_C$ = 25°C)<br>- Continuous ($T_C$ = 100°C) | 50<br>31.3 | A<br>A |
| $I_{DM}$ | Drain Current - Pulsed (Note 1) | See Figure 9 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy (Note 2) | 145 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | 4.5 | V/ns |
| $P_D$ | Power Dissipation ($T_C$ = 25°C)<br>- Derate above 25°C | 260<br>2.1 | W<br>W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | -55 to +150 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds | 300 | °C |

## Thermal Characteristics

| Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | -- | 0.48 | °C/W |
| $R_{\theta JA}$* | Thermal Resistance, Junction-to-Ambient* | -- | 40 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -- | 62.5 | °C/W |

*When mounted on the minimum pad size recommended (PCB Mount)

## Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDB2710 | FDB2710 | D2-Pak | 330mm | 24mm | 800 |

## 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, $I_D$ = 250μA, $T_J$ = 25°C | 250 | -- | -- | V |
| $\Delta BV_{DSS}$ / $\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250μA, Referenced to 25°C | -- | 0.25 | -- | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 250V, $V_{GS}$ = 0V<br>$V_{DS}$ = 250V, $V_{GS}$ = 0V,$T_C$ = 125°C | --<br>-- | --<br>-- | 1<br>500 | μA<br>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 | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | 3.0 | 4.0 | 5.0 | V |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = 10V, $I_D$ = 25A | -- | 36.3 | 42.5 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10V, $I_D$ = 25A (Note 4) | -- | 63 | -- | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1.0MHz | -- | 5470 | 7280 | pF |
| $C_{oss}$ | Output Capacitance | | -- | 426 | 570 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 97 | 146 | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 125V, $I_D$ = 50A<br>$V_{GS}$ = 10V, $R_{GEN}$ = 25Ω | -- | 80 | 170 | ns |
| $t_r$ | Turn-On Rise Time | | -- | 252 | 515 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 112 | 235 | ns |
| $t_f$ | Turn-Off Fall Time | (Note 4, 5) | -- | 154 | 320 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 125V, $I_D$ = 50A<br>$V_{GS}$ = 10V | -- | 78 | 101 | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 34 | -- | nC |
| $Q_{gd}$ | Gate-Drain Charge | (Note 4, 5) | -- | 18 | -- | nC |
| **Drain-Source Diode Characteristics and Maximum Ratings** | | | | | | |
| $I_S$ | Maximum Continuous Drain-Source Diode Forward Current | | -- | -- | 50 | A |
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current | | -- | -- | 150 | A |
| $V_{SD}$ | Drain-Source Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = 50A | -- | -- | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0V, $I_S$ = 50A<br>$dI_F/dt$ =100A/μs (Note 4) | -- | 163 | -- | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | -- | 1.3 | -- | μC |

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 1mH, $I_{AS}$ = 17A, $V_{DD}$ = 50V, $R_G$ = 25Ω, Starting $T_J$ = 25°C
3. $I_{SD}$ ≤ 50A, di/dt ≤ 100A/μs, $V_{DD}$ ≤ $BV_{DSS}$, Starting $T_J$ = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

**Figure 1. On-Region Characteristics**

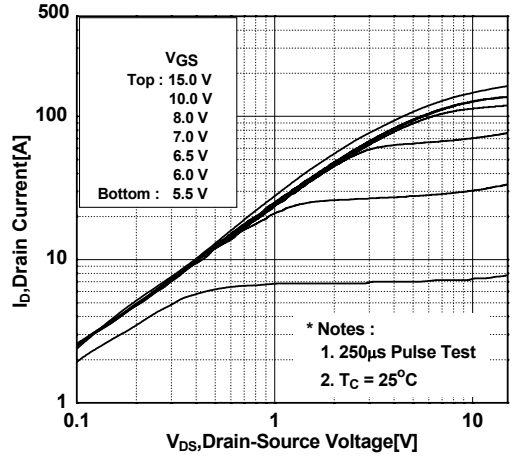



**Figure 2. Transfer Characteristics**

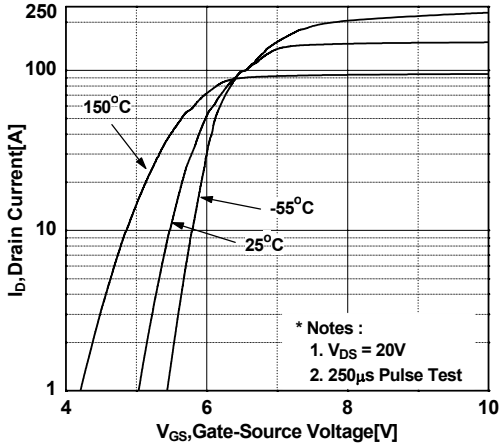



**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**

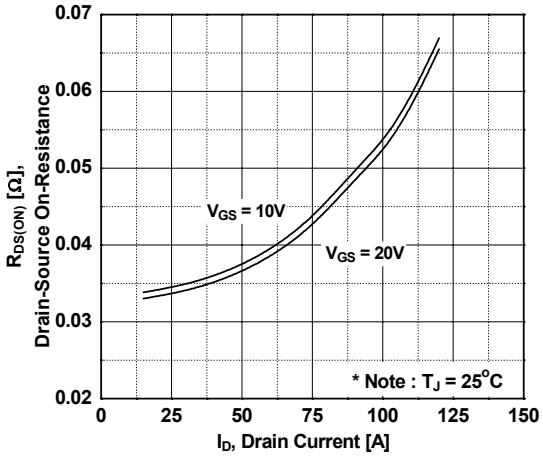



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue**

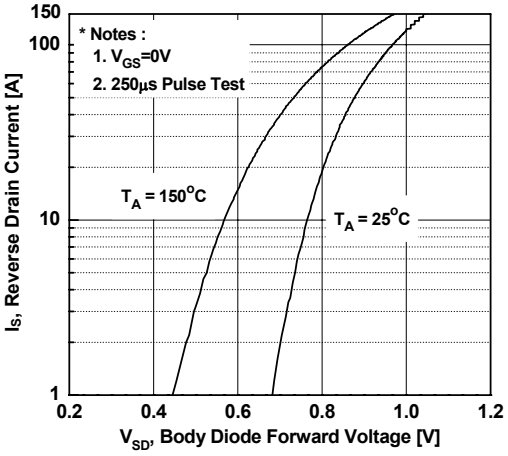



**Figure 5. Capacitance Characteristics**

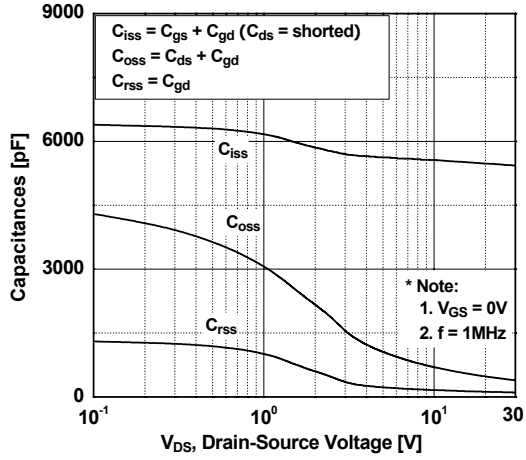
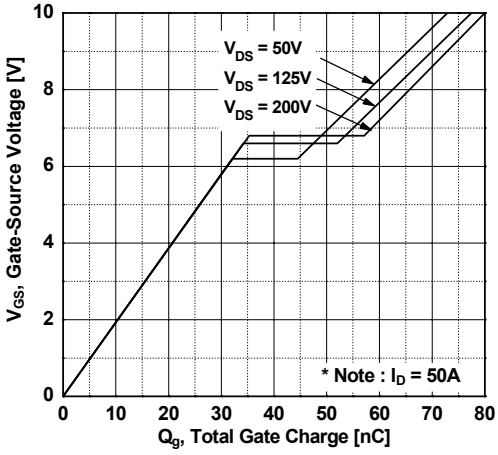



**Figure 6. Gate Charge Characteristics**



## Typical Performance Characteristics (Continued)

**Figure 7. Breakdown Voltage Variation vs. Temperature**

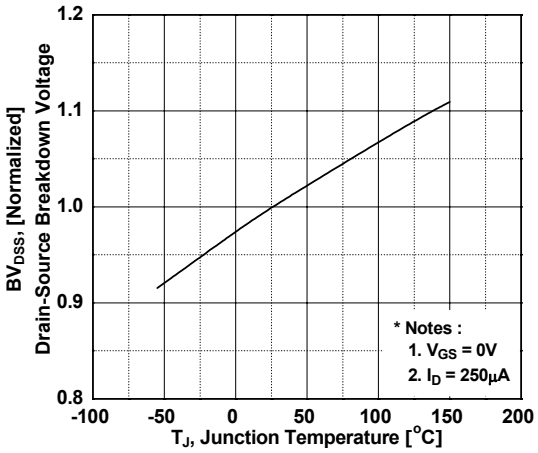



**Figure 8. On-Resistance Variation vs. Temperature**

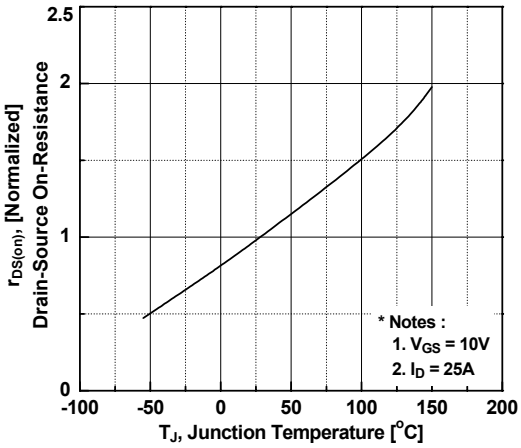



**Figure 9. Maximum Safe Operating Area**

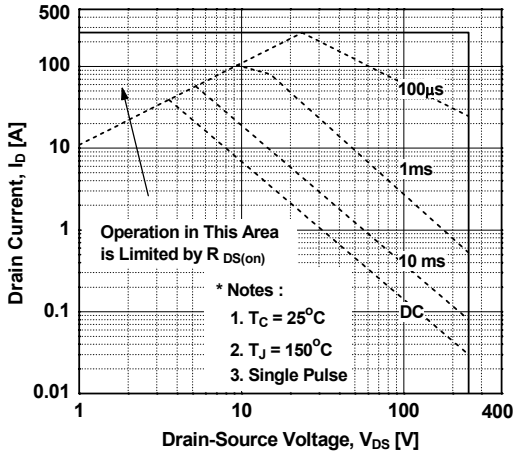



**Figure 10. Maximum Drain Current vs. Case Temperature**

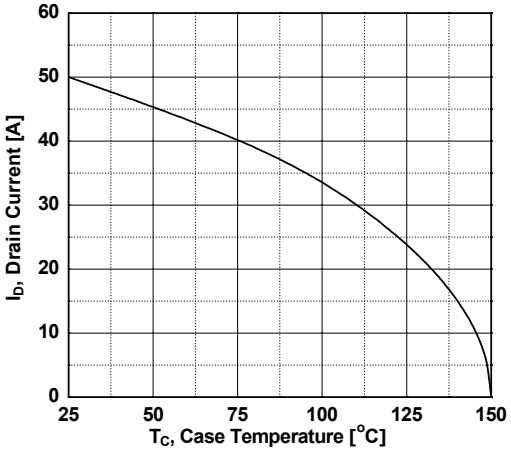
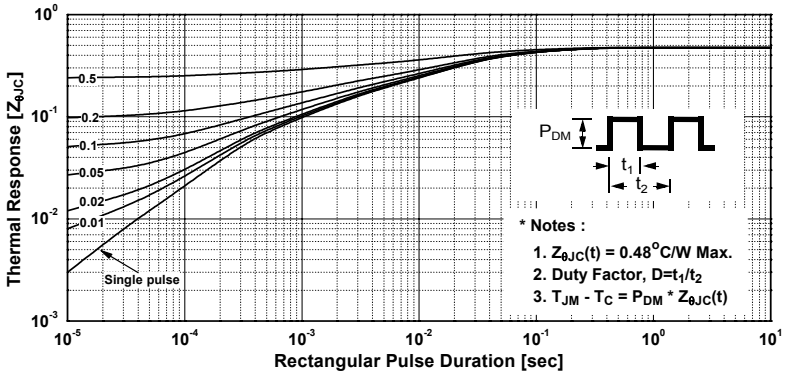
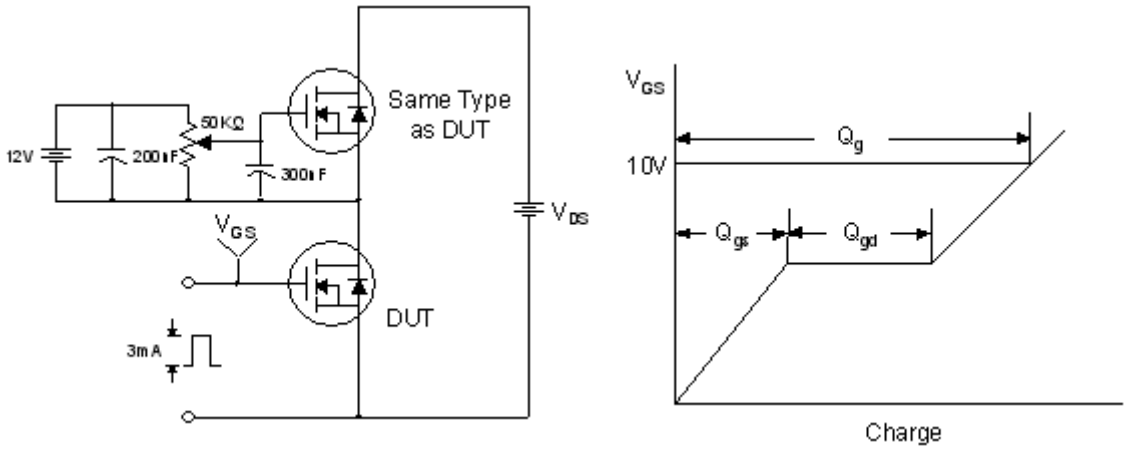


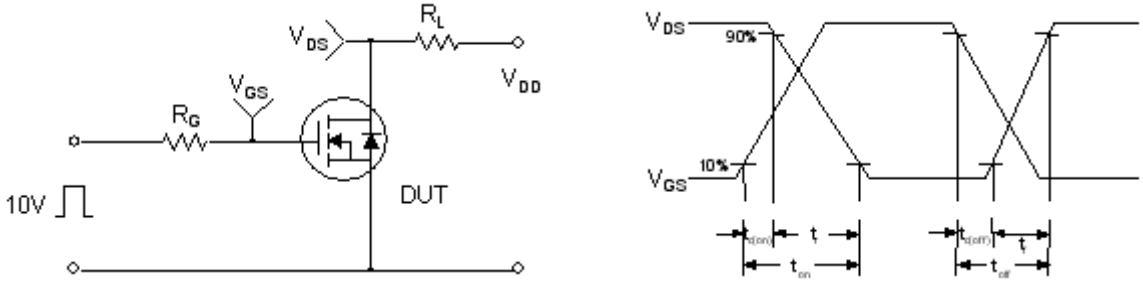

**Figure 11. Transient Thermal Response Curve**



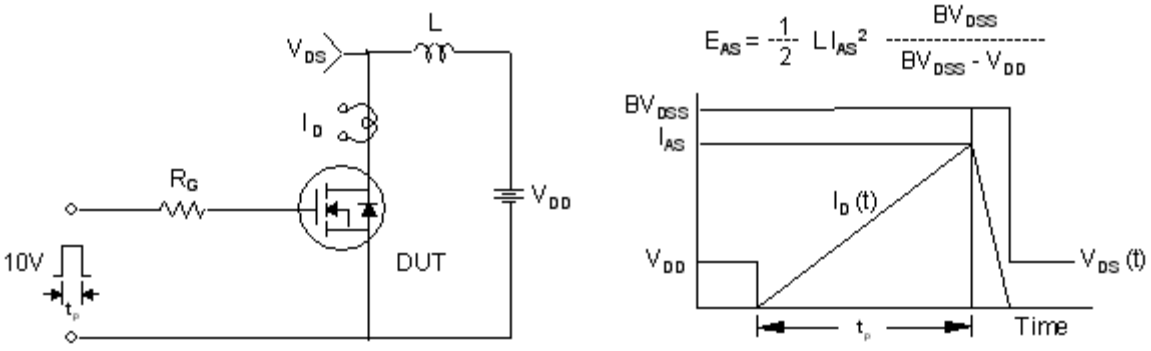
**Gate Charge Test Circuit & Waveform**



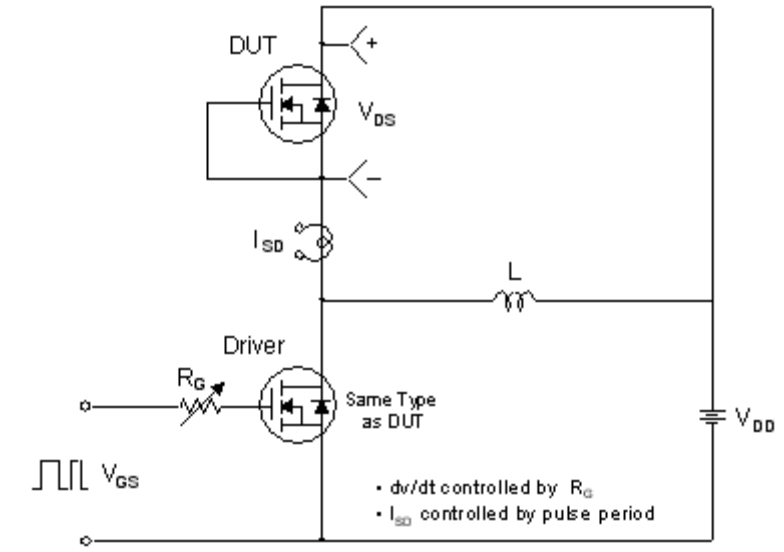

**Resistive Switching Test Circuit & Waveforms**

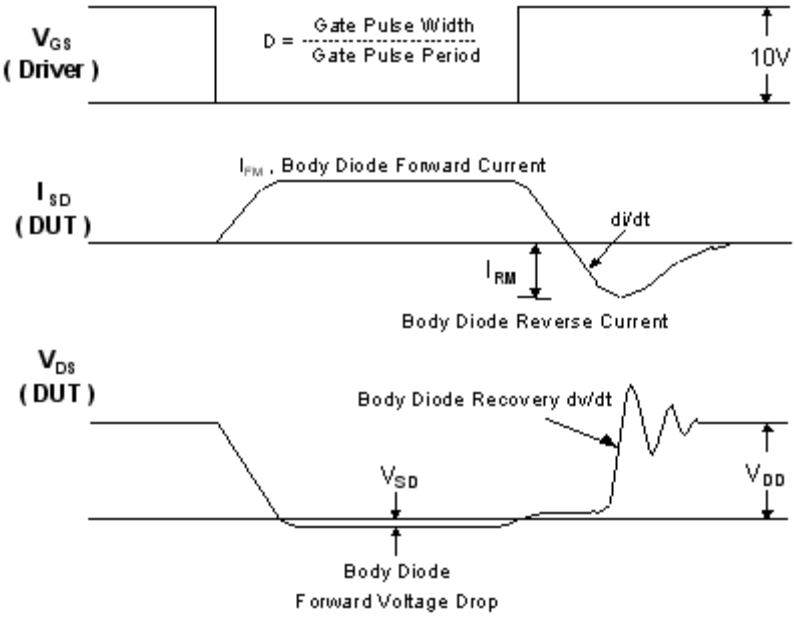



**Unclamped Inductive Switching Test Circuit & Waveforms**



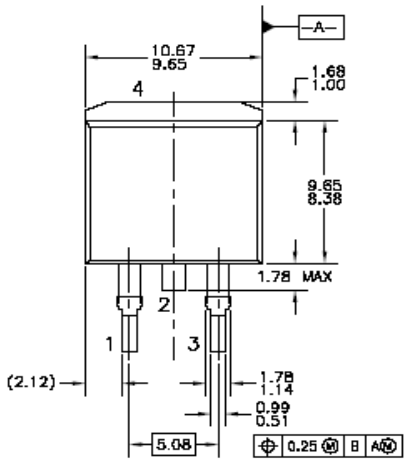
**Peak Diode Recovery dv/dt Test Circuit & Waveforms**

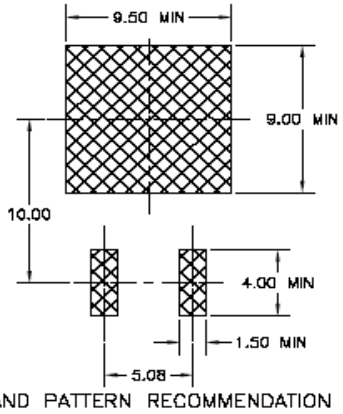


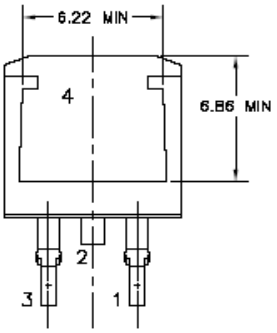
## Package Demensions

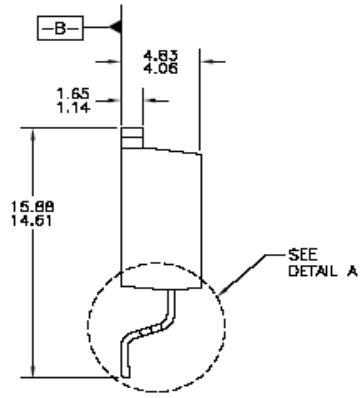
# D2-PAK

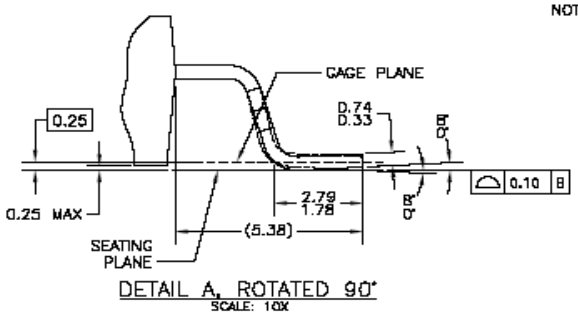



LAND PATTERN RECOMMENDATION




DETAIL A, ROTATED 90°
SCALE: 10X

NOTES: UNLESS OTHERWISE SPECIFIED
A) ALL DIMENSIONS ARE IN MILLIMETERS.
B) REFERENCE JEDEC, TO-263, ISSUE D, VARIATION AB, DATED JULY 2003.
C) DIMENSIONING AND TOLERANCING PER ANSI Y14.5M - 1982.
D) LOCATION OF THE PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE).
E) PRESENCE OF TRIMMED CENTER LEAD IS OPTIONAL.

TO263AD2REVD

Dimensions in Millimeters

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| | | | | |
|---|---|---|---|---|
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| ActiveArray™ | GlobalOptoisolator™ | OCXPro™ | SMART START™ | UltraFET® |
| Bottomless™ | GTO™ | OPTOLOGIC® | SPM™ | VCX™ |
| Build it Now™ | HiSeC™ | OPTOPLANAR™ | Stealth™ | Wire™ |
| CoolFET™ | $I^2C$™ | PACMAN™ | SuperFET™ | |
| *CROSSVOLT*™ | *i-Lo*™ | POP™ | SuperSOT™-3 | |
| DOME™ | ImpliedDisconnect™ | Power247™ | SuperSOT™-6 | |
| EcoSPARK™ | IntelliMAX™ | PowerEdge™ | SuperSOT™-8 | |
| $E^2CMOS$™ | ISOPLANAR™ | PowerSaver™ | SyncFET™ | |
| EnSigna™ | LittleFET™ | PowerTrench® | TCM™ | |
| FACT™ | MICROCOUPLER™ | QFET® | TinyBoost™ | |
| FAST® | MicroFET™ | QS™ | TinyBuck™ | |
| FASTr™ | MicroPak™ | QT Optoelectronics™ | TinyPWM™ | |
| FPS™ | MICROWIRE™ | Quiet Series™ | TinyPower™ | |
| FRFET™ | MSX™ | RapidConfigure™ | TinyLogic® | |
| | MSXPro™ | RapidConnect™ | TINYOPTO™ | |
| Across the board. Around the world.™ | | µSerDes™ | TruTranslation™ | |
| The Power Franchise® | | ScalarPump™ | UHC™ | |
| Programmable Active Droop™ | | | | |



#### PRODUCT STATUS DEFINITIONS

**Definition of Terms**

| Datasheet Identification | Product Status | Definition |
|---|---|---|
| Advance Information | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. |
| Preliminary | First Production | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
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