
**Is Now Part of**


**ON Semiconductor®**

**To learn more about ON Semiconductor, please visit our website at**
**www.onsemi.com**

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

March 2015

# FDD8796/FDU8796
# N-Channel PowerTrench® MOSFET
## 25V, 35A, 5.7mΩ



## General Description

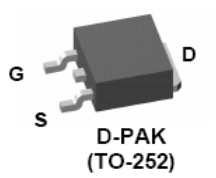
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(on)}$ and fast switching speed.

## Application

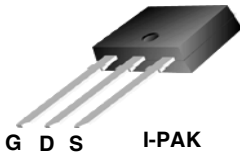
- Vcore DC-DC for Desktop Computers and Servers
- VRM for Intermediate Bus Architecture

## Features

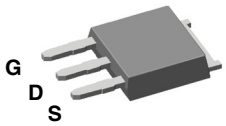
- Max $r_{DS(on)}$ = 5.7mΩ at $V_{GS}$ = 10V, $I_D$ = 35A
- Max $r_{DS(on)}$ = 8.0mΩ at $V_{GS}$ = 4.5V, $I_D$ = 35A
- Low gate charge: $Q_{g(10)}$ = 37nC(Typ), $V_{GS}$ = 10V
- Low gate resistance
- Avalanche rated and 100% tested
- RoHS Compliant



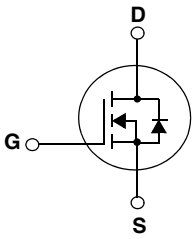
D-PAK
(TO-252)



I-PAK
(TO-251AA)



Short Lead I-PAK




## MOSFET Maximum Ratings $T_C$= 25°C unless otherwise noted

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | | 25 | V |
| $V_{GS}$ | Gate to Source Voltage | | ±20 | V |
| $I_D$ | Drain Current -Continuous (Package Limited) | | 35 | A |
| | -Continuous (Die Limited) | | 98 | |
| | -Pulsed | (Note 1) | 305 | |
| $E_{AS}$ | Single Pulse Avalanche Energy | (Note 2) | 91 | mJ |
| $P_D$ | Power Dissipation | | 88 | W |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature | | -55 to 175 | °C |

## Thermal Characteristics

| | | | |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case TO_252, TO_251 | 1.7 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient TO_252, TO_251 | 100 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient TO-252,1in$^2$ copper pad area | 52 | °C/W |

## Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDD8796 | FDD8796 | TO-252AA | 13” | 16mm | 2500 units |
| FDU8796 | FDU8796 | TO-251AA | N/A (Tube) | N/A | 75 units |
| FDU8796 | FDU8796_F071 | TO-251AA | N/A (Tube) | N/A | 75 units |

## Electrical Characteristics $T_J$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $B_{VDSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250μA, $V_{GS}$ = 0V | 25 | | | V |
| $\frac{\Delta B_{VDSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250μA, referenced to 25°C | | 7 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 20V, $V_{GS}$ = 0V | | | 1 | μA |
| | | $V_{DS}$ = 20V, $V_{GS}$ = 0V, $T_J$ = 150°C | | | 250 | |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±20V | | | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA | 1.2 | 1.8 | 2.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = 250μA, referenced to 25°C | | -6.7 | | mV/°C |
| $r_{DS(on)}$ | Drain to Source On Resistance | $V_{GS}$ = 10V, $I_D$ = 35A | | 4.5 | 5.7 | mΩ |
| | | $V_{GS}$ = 4.5V, $I_D$ = 35A | | 6.0 | 8.0 | |
| | | $V_{DS}$ = 10V, $I_D$ = 35A, $T_J$ = 175°C | | 6.9 | 9.5 | |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 13V, $V_{GS}$ = 0V, f = 1MHz | | 1960 | 2610 | pF |
| $C_{oss}$ | Output Capacitance | | | 455 | 605 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 315 | 475 | pF |
| $R_G$ | Gate Resistance | f = 1MHz | | 1.1 | | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ =13V, $I_D$ = 35A, $V_{GS}$ = 10V, $R_{GS}$ = 20Ω | | 10 | 20 | ns |
| $t_r$ | Rise Time | | | 24 | 39 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 99 | 158 | ns |
| $t_f$ | Fall Time | | | 57 | 91 | ns |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0 to10V, $V_{DD}$ =13V, $I_D$ = 35A, $I_g$ = 1.0mA | | 37 | 52 | nC |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0 to 5V | | 19 | 27 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | | 6 | | nC |
| $Q_{gd}$ | Gate to Drain Charge | | | 6 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Voltage | $V_{GS}$ = 0V, $I_S$ = 35A | | 0.9 | 1.25 | V |
| | | $V_{GS}$ = 0V, $I_S$ = 15A | | 0.8 | 1.0 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 35A, di/dt = 100A/μs | | 30 | 45 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | $I_F$ = 35A, di/dt = 100A/μs | | 23 | 35 | nC |

**Notes:**
**1:** Pulse time < 300μs, Duty cycle = 2%.
**2:** Starting $T_J$ = 25°C, L = 0.3mH, $I_{AS}$ = 24.7A, $V_{DD}$ = 23V, $V_{GS}$ = 10V.

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

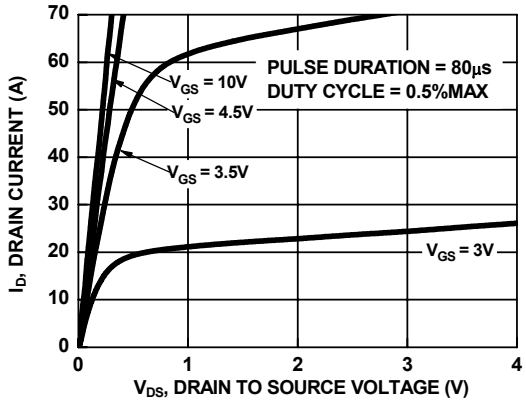



Figure 1. On Region Characteristics

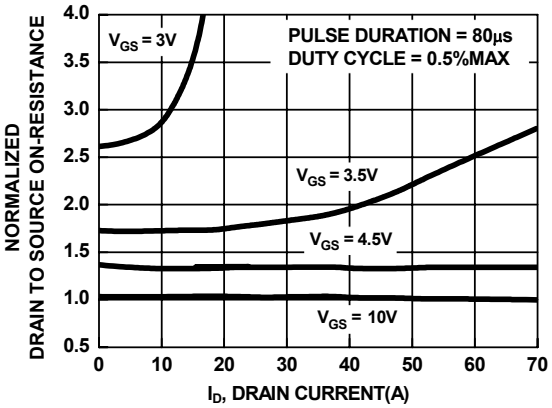



Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

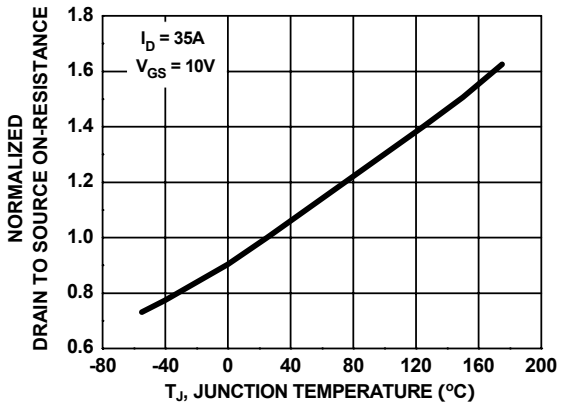



Figure 3. Normalized On Resistance vs Junction Temperature

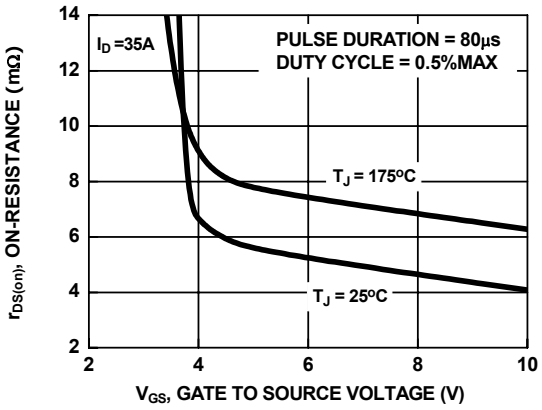



Figure 4. On-Resistance vs Gate to Source Voltage

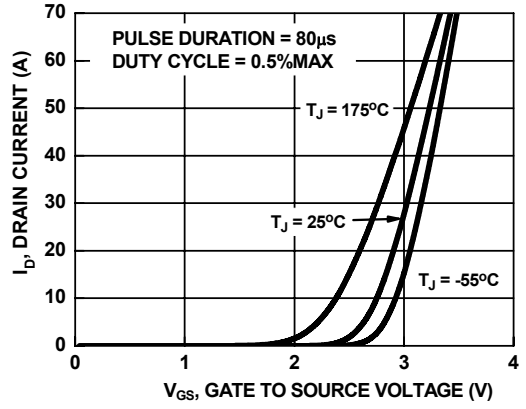



Figure 5. Transfer Characteristics

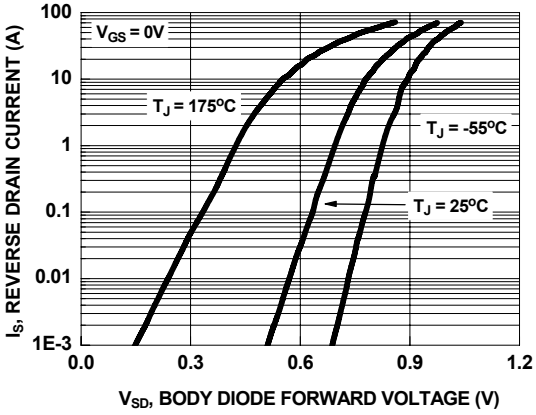



Figure 6. Source to Drain Diode Forward Voltage vs Source Current

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

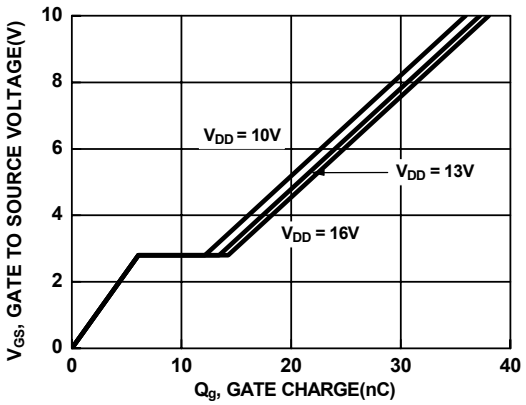



Figure 7. Gate Charge Characteristics

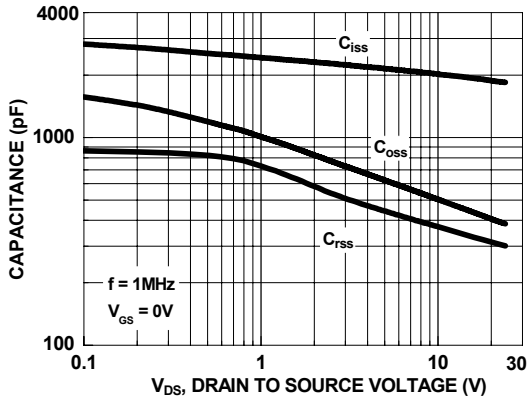



Figure 8. Capacitance vs Drain to Source Voltage

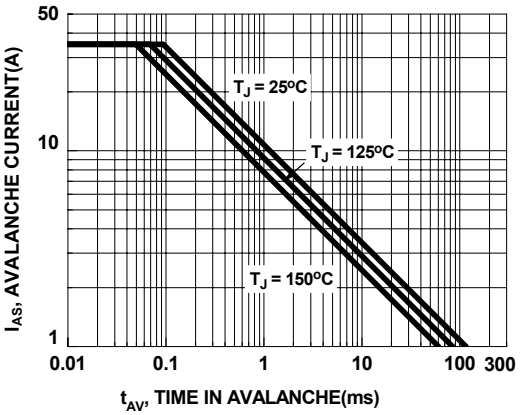



Figure 9. Unclamped Inductive Switching Capability

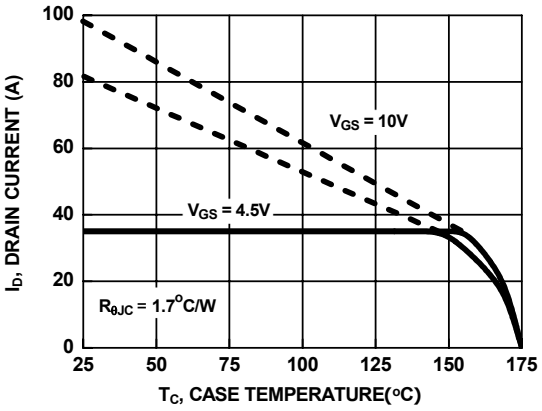



Figure 10. Maximum Continuous Drain Current vs Case Temperature

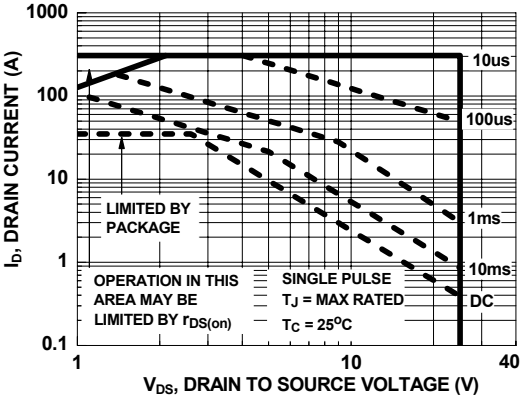



Figure 11. Forward Bias Safe Operating Area

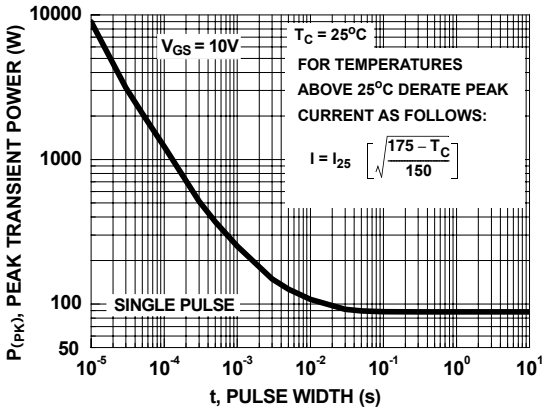



Figure 12. Single Pulse Maximum Power Dissipation

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

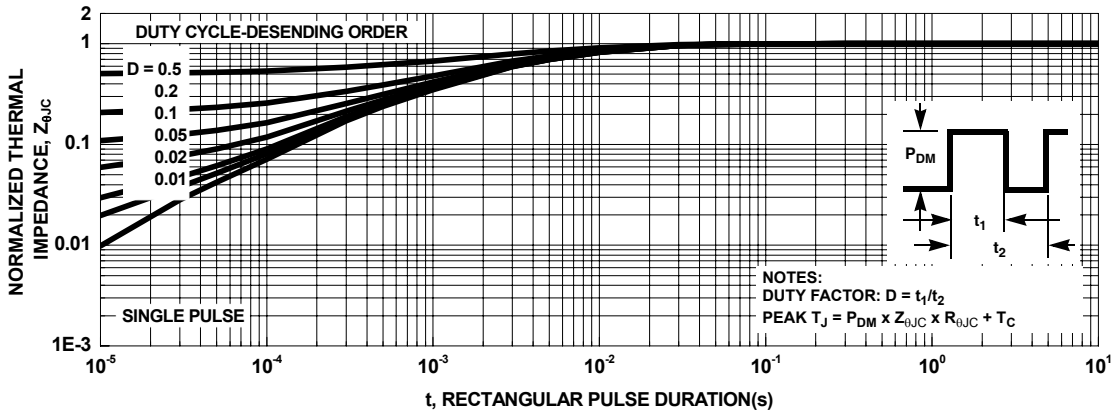
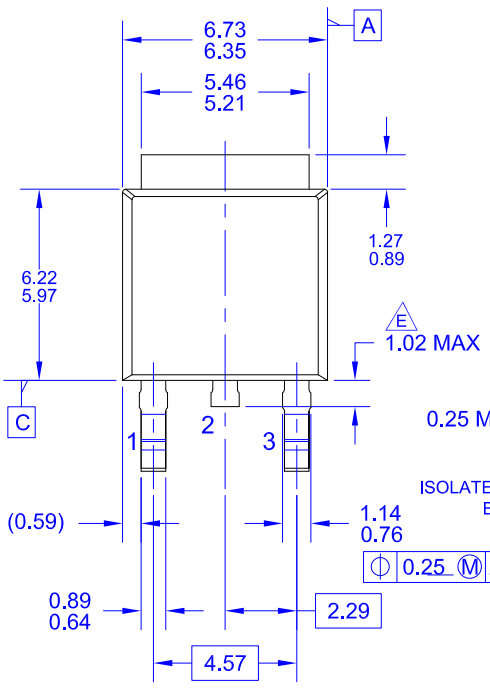
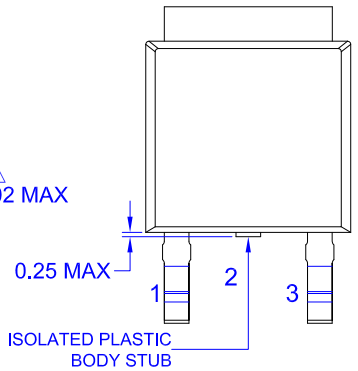


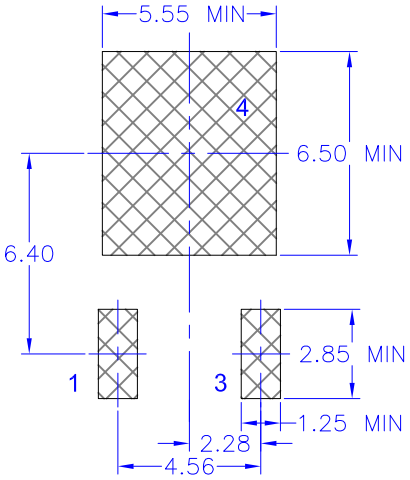

**Figure 13. Transient Thermal Response Curve**



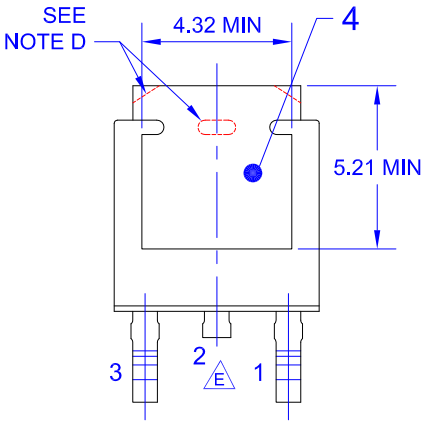

NON-DIODE PRODUCTS VERSION



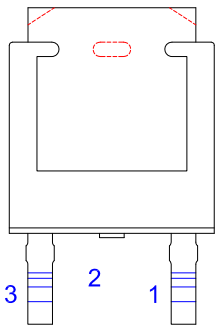

DIODE PRODUCTS VERSION



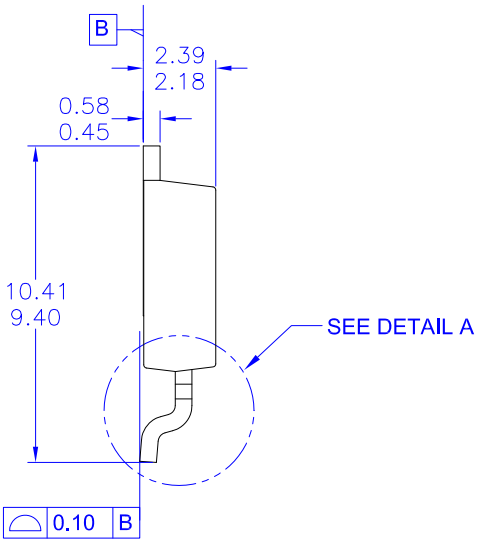

LAND PATTERN RECOMMENDATION




NON-DIODE PRODUCTS VERSION

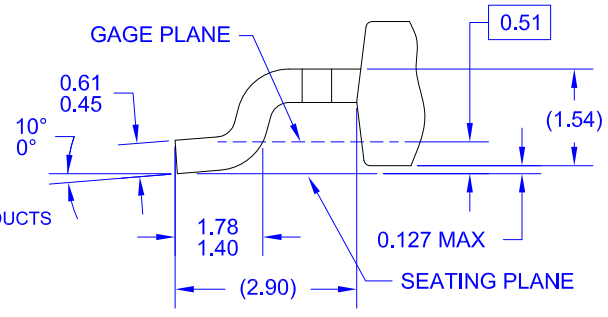



DIODE PRODUCTS VERSION




NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.
E) TRIMMED METAL CENTER LEAD IS PRESENT ON FOR NON-DIODE PRODUCTS
F) DIMENSIONS ARE EXCLUSIVE OF BURS, MOLD FLASH AND TIE BAR EXTRUSIONS.
G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.
H) DRAWING NUMBER AND REVISION: MKT-TO252A03REV11




DETAIL A
(ROTATED -90°)
SCALE: 12X

FAIRCHILD

## PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT**:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
**Phone**: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
**Fax**: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
**Email**: orderlit@onsemi.com

**N. American Technical Support**: 800−282−9855 Toll Free USA/Canada
**Europe, Middle East and Africa Technical Support:**
Phone: 421 33 790 2910
**Japan Customer Focus Center**
Phone: 81−3−5817−1050

**ON Semiconductor Website**: **www.onsemi.com**

**Order Literature**: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative