ON Semiconductor®

# FDFMA2P029Z

## Integrated P-Channel PowerTrench® MOSFET and Schottky Diode

### –20V, –3.1A, 95mΩ

## Features

### MOSFET

- Max $r_{DS(on)}$ = 95mΩ at $V_{GS}$ = –4.5V, $I_D$ = –3.1A
- Max $r_{DS(on)}$ = 141mΩ at $V_{GS}$ = –2.5V, $I_D$ = –2.5A
- HBM ESD protection level > 2.5kV (Note 3)

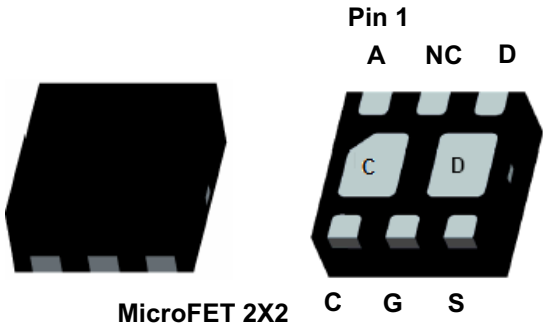
### Schottky

- $V_F$ < 0.37V @ 500mA
- Low profile - 0.8 mm maximum - in the new package MicroFET 2x2 mm
- RoHS Compliant

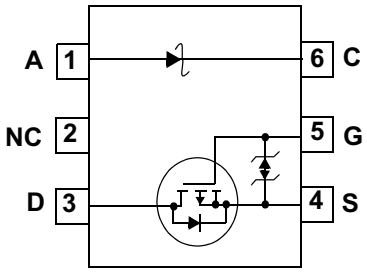
## General Description

This device is designed specifically as a single package solution for the battery charge switch in cellular handset and other ultra-portable applications. It features a MOSFET with very low on-state resistance and an independently connected low forward voltage schottky diode allows for minimum conduction losses.

The MicroFET 2X2 package offers exceptional thermal performance for its physical size and is well suited to linear mode applications.




MicroFET 2X2




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

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | | –20 | V |
| $V_{GS}$ | Gate to Source Voltage | | ±12 | V |
| $I_D$ | Drain Current -Continuous | (Note 1a) | –3.1 | A |
| | -Pulsed | | -6 | |
| $P_D$ | Power Dissipation | (Note 1a) | 1.4 | W |
| | | (Note 1b) | 0.7 | |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | –55 to +150 | °C |
| $V_{RRM}$ | Schottky Repetitive Peak Reverse Voltage | | 20 | V |
| $I_O$ | Schottky Average Forward Current | | 2 | A |

### Thermal Characteristics

| | | | | |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1a) | 86 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1b) | 173 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1c) | 86 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1d) | 140 | |

### Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| .P29 | FDFMA2P029Z | MicroFET 2X2 | 7” | 8mm | 3000 units |


October-2017, Rev.2



Publication Order Number:
FDFMA2P029Z/D

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = –250μA, $V_{GS}$ = 0V | –20 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = –250μA, referenced to 25°C | | –12 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = –16V, $V_{GS}$ = 0V | | | –1 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±12V, $V_{DS}$ = 0V | | | ±10 | μA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = –250μA | –0.6 | –1.0 | –1.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = –250μA, referenced to 25°C | | 4 | | mV/°C |
| $r_{DS(on)}$ | Static Drain to Source On-Resistance | $V_{GS}$ = –4.5V, $I_D$ = –3.1A | | 60 | 95 | mΩ |
| | | $V_{GS}$ = –2.5V, $I_D$ = –2.5A | | 88 | 141 | |
| | | $V_{GS}$ = –4.5V, $I_D$ = –3.1A,$T_J$ =125°C | | 87 | 140 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = –10V, $I_D$ = –3.1A | | –11 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = –10V, $V_{GS}$ = 0V, f = 1MHz | | 540 | 720 | pF |
| $C_{oss}$ | Output Capacitance | | | 120 | 160 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 100 | 150 | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = –10V, $I_D$ = –1A, $V_{GS}$ = –4.5V, $R_{GEN}$ = 6Ω | | 13 | 24 | ns |
| $t_r$ | Rise Time | | | 11 | 20 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 37 | 59 | ns |
| $t_f$ | Fall Time | | | 36 | 58 | ns |
| $Q_{g(TOT)}$ | Total Gate Charge | $V_{DD}$ = –10V, $I_D$ = –3.1A, $V_{GS}$ = –4.5V | | 7 | 10 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | | 1.1 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | | 2.4 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $I_S$ | Maximum Continuous Drain-Source Diode Forward Current | | | | –1.1 | A |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = –1.1A (Note 2) | | –0.8 | –1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = –3.1A, di/dt = 100A/μs | | 25 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 9 | | nC |

### Schottky Diode Characteristics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $V_R$ | Reverse Voltage | $I_R$ = 1mA | $T_J$ = 25°C | 20 | | | V |
| $I_R$ | Reverse Leakage | $V_R$ = 20V | $T_J$ = 25°C | | 30 | 300 | μA |
| | | | $T_J$ = 125°C | | 10 | 45 | mA |
| $V_F$ | Forward Voltage | $I_F$ = 500mA | $T_J$ = 25°C | | 0.32 | 0.37 | V |
| | | | $T_J$ = 125°C | | 0.21 | 0.26 | |
| | | $I_F$ = 1A | $T_J$ = 25°C | | 0.37 | 0.435 | |
| | | | $T_J$ = 125°C | | 0.28 | 0.33 | |

**Notes:**

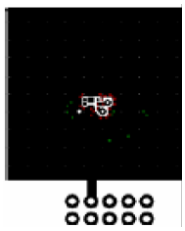
**1:** $R_{\theta JA}$ is determined with the device mounted on a 1 $in^2$ oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.

(a) MOSFET $R_{\theta JA}$ = 86°C/W when mounted on a 1$in^2$ pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB

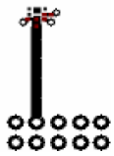
(b) MOSFET $R_{\theta JA}$ = 173°C/W when mounted on a minimum pad of 2 oz copper

(c) Schottky $R_{\theta JA}$ = 86°C/W when mounted on a 1$in^2$ pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB.

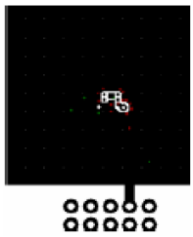
(d) Schottky $R_{\theta JA}$ = 140°C/W when mounted on a minimum pad of 2 oz copper.



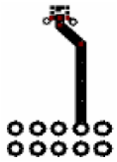
a)86°C/W when mounted on a 1$in^2$ pad of 2 oz copper.



b)173°C/W when mounted on a minimum pad of 2 oz copper.



c)86°C/W when mounted on a 1$in^2$ pad of 2 oz copper.



d)140°C/W when mounted on a minimum pad of 2 oz copper.

**2:** Pulse Test : Pulse Width < 300us, Duty Cycle < 2.0%

**3**. The diode connected between the gate and source serves only protection against ESD. No gate overvoltage rating is implied.

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

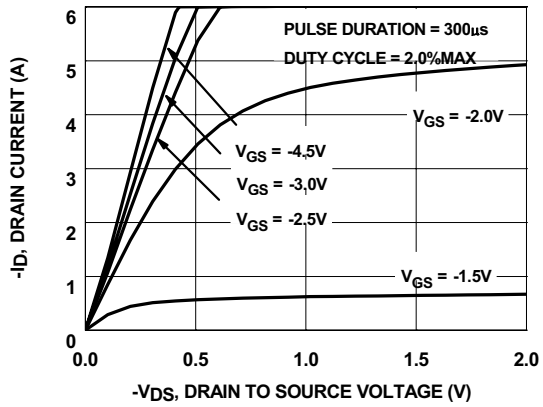



Figure 1. On Region Characteristics

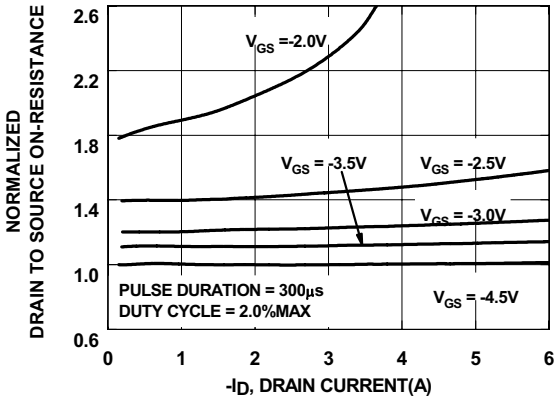



Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

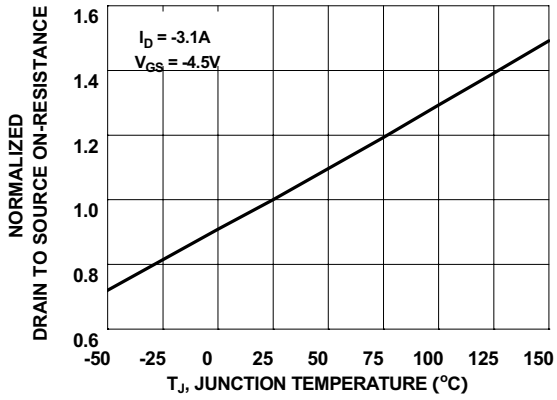



Figure 3. Normalized On-Resistance vs Junction Temperature

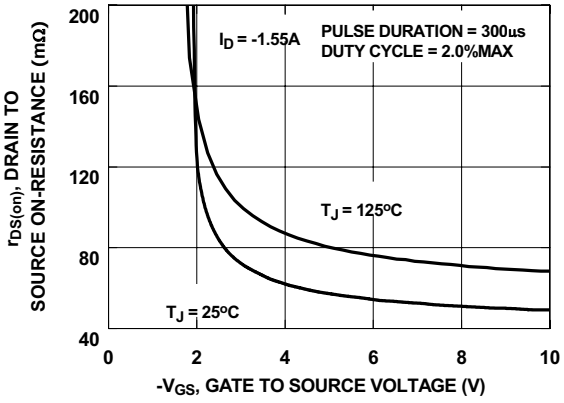



Figure 4. On-Resistance vs Gate to Source Voltage

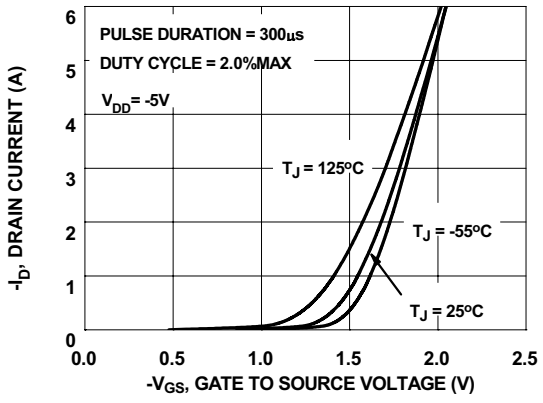



Figure 5. Transfer Characteristics

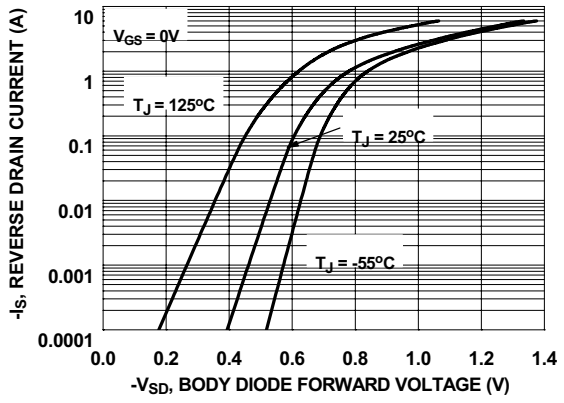



Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

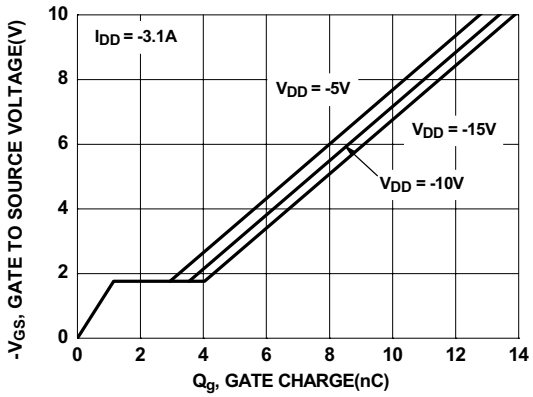



Figure 7. Gate Charge Characteristics

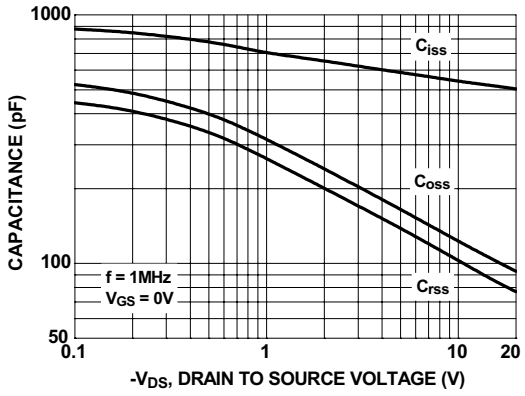



Figure 8. Capacitance Characteristics

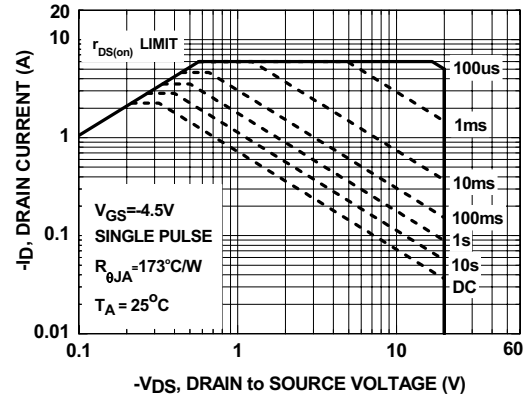



Figure 9. Forward Bias Safe Operating Area

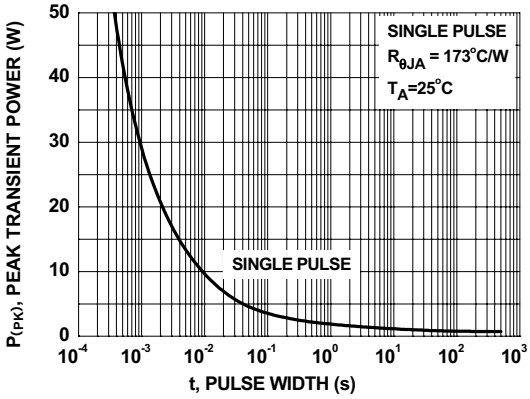



Figure 10. Single Pulse Maximum Power Dissipation

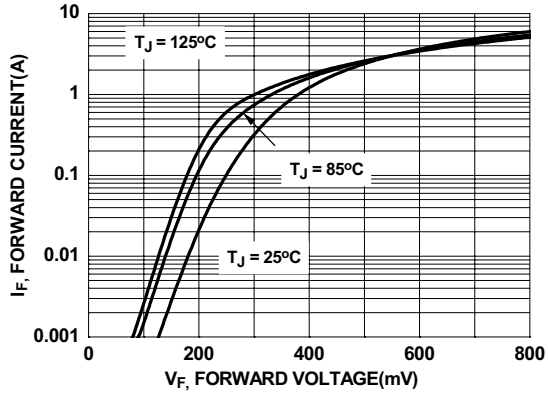



Figure 11. Schottky Diode Forward Voltage

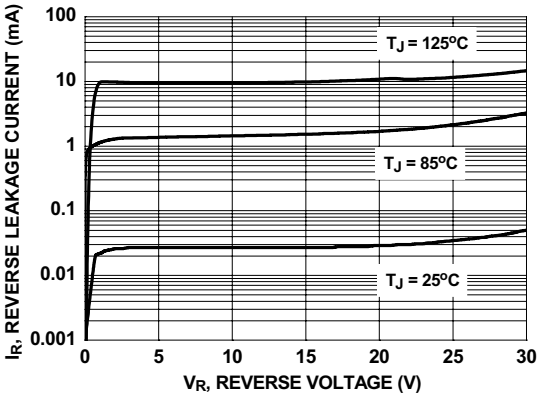



Figure 12. Schottky Diode Reverse Current

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

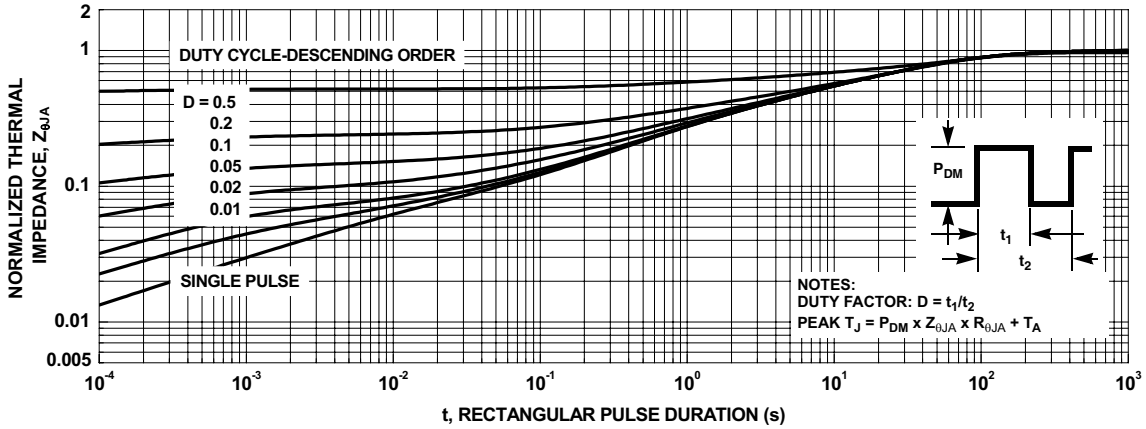
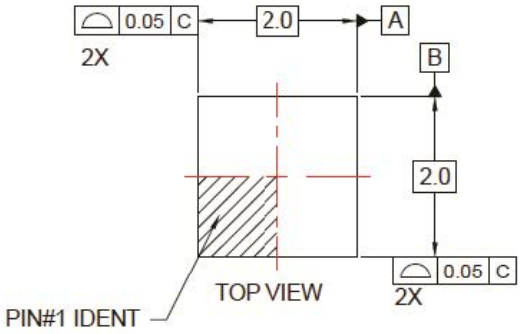
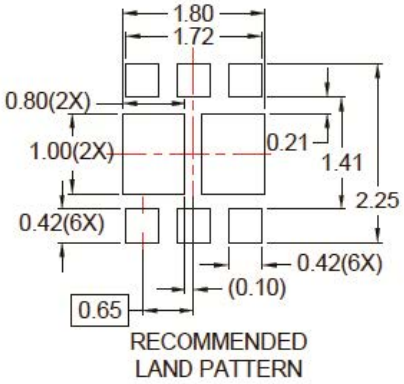
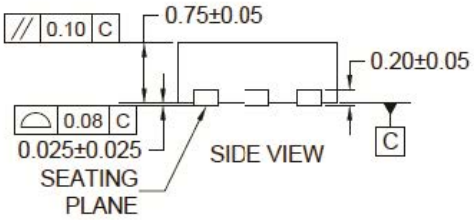



**Figure 13. Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout




NOTES:

A. CONFORM TO JADEC REGISTRATIONS MO-229, VARIATION VCCC, EXCEPT WHERE NOTED.

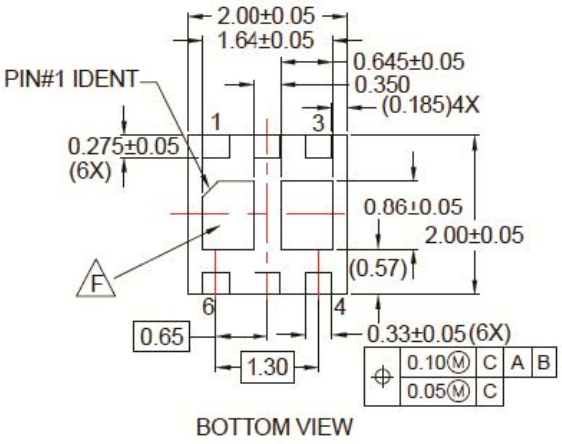
B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.

D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.

E. DRAWING FILENAME: MKT-UMLP16Erev4

F. NON-JEDEC DUAL DAP




*Package drawings are provided as a service to customers considering ON Semiconductor components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a ON Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of ON Semiconductor's worldwide terms and conditions, specifically the warranty therein, which covers ON Semiconductor products.*

## 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