May 2010

# FDMA1032CZ

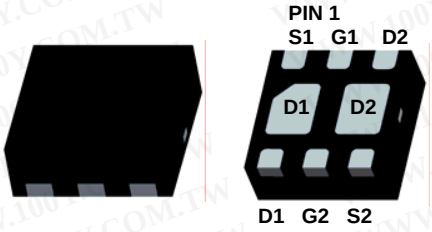
## 20V Complementary PowerTrench® MOSFET

### General Description

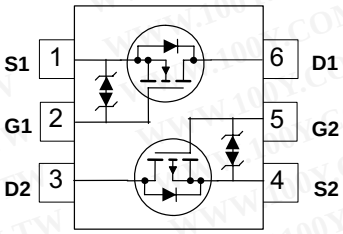
This device is designed specifically as a single package solution for a DC/DC 'Switching' MOSFET in cellular handset and other ultra-portable applications. It features an independent N-Channel & P-Channel MOSFET with low on-state resistance for minimum conduction losses. The gate charge of each MOSFET is also minimized to allow high frequency switching directly from the controlling device. The MicroFET 2x2 package offers exceptional thermal performance for its physical size and is well suited to switching applications.

### Features

- Q1: N-Channel
  3.7 A, 20V. $R_{DS(ON)}$ = 68 mΩ @ $V_{GS}$ = 4.5V
  $R_{DS(ON)}$ = 86 mΩ @ $V_{GS}$ = 2.5V
- Q2: P-Channel
  –3.1 A, –20V. $R_{DS(ON)}$ = 95 mΩ @ $V_{GS}$ = –4.5V
  $R_{DS(ON)}$ = 141 mΩ @ $V_{GS}$ = –2.5V
- Low profile – 0.8 mm maximum – in the new package MicroFET 2x2 mm
- HBM ESD protection level > 2 kV (Note 3)
- RoHS Compliant
- Free from halogenated compounds and antimony oxides




MicroFET 2x2




## Absolute Maximum Ratings

$T_A$=25°C unless otherwise noted

| Symbol | Parameter | | Q1 | Q2 | Units |
|---|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | | 20 | –20 | V |
| $V_{GS}$ | Gate-Source Voltage | | ±12 | ±12 | V |
| $I_D$ | Drain Current – Continuous | (Note 1a) | 3.7 | –3.1 | A |
| | – Pulsed | | 6 | –6 | |
| $P_D$ | Power Dissipation for Single Operation | (Note 1a) | 1.4 | | W |
| | | (Note 1b) | 0.7 | | |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | | –55 to +150 | | °C |

## Thermal Characteristics

| | | | | |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1a) | 86 (Single Operation) | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1b) | 173 (Single Operation) | |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1c) | 69 (Dual Operation) | |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1d) | 151 (Dual Operation) | |

## Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape width | Quantity |
|---|---|---|---|---|
| 032 | FDMA1032CZ | 7” | 8mm | 3000 units |

## Electrical Characteristics

$T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Type | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 250 μA<br>$V_{GS}$ = 0 V, $I_D$ = –250 μA | Q1<br>Q2 | 20<br>–20 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, Referenced to 25°C<br>$I_D$ = –250 μA, Referenced to 25°C | Q1<br>Q2 | | 15<br>–12 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 16 V, $V_{GS}$ = 0 V<br>$V_{DS}$ = –16 V, $V_{GS}$ = 0 V | Q1<br>Q2 | | | 1<br>–1 | μA |
| $I_{GSS}$ | Gate-Body Leakage | $V_{GS}$ = ±12 V, $V_{DS}$ = 0 V | All | | | ±10 | μA |
| **On Characteristics** (Note 2) | | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 μA<br>$V_{DS}$ = $V_{GS}$, $I_D$ = –250 μA | Q1<br>Q2 | 0.6<br>–0.6 | 1.0<br>–1.0 | 1.5<br>–1.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D$ = 250 μA, Referenced to 25°C<br>$I_D$ = –250 μA, Referenced to 25°C | Q1<br>Q2 | | –4<br>4 | | mV/°C |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = 4.5 V, $I_D$ = 3.7 A<br>$V_{GS}$ = 2.5 V, $I_D$ = 3.3 A<br>$V_{GS}$ = 4.5 V, $I_D$ = 3.7 A, $T_J$ = 125°C | Q1 | | 37<br>50<br>53 | 68<br>86<br>90 | mΩ |
| | | $V_{GS}$ = –4.5V, $I_D$ = –3.1 A<br>$V_{GS}$ = –2.5 V, $I_D$ = –2.5 A<br>$V_{GS}$ = –4.5 V, $I_D$ = –3.1 A, $T_J$ = 125°C | Q2 | | 60<br>88<br>87 | 95<br>141<br>140 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10 V, $I_D$ = 3.7 A<br>$V_{DS}$ = –10 V, $I_D$ = –3.1 A | Q1<br>Q2 | | 16<br>–11 | | S |
| **Dynamic Characteristics** | | | | | | | |
| $C_{iss}$ | Input Capacitance | Q1<br>$V_{DS}$ = 10 V, $V_{GS}$ = 0 V, f = 1.0 MHz | Q1<br>Q2 | | 340<br>540 | | pF |
| $C_{oss}$ | Output Capacitance | Q2<br>$V_{DS}$ = –10 V, $V_{GS}$ = 0 V, f = 1.0 MHz | Q1<br>Q2 | | 80<br>120 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | Q1<br>Q2 | | 60<br>100 | | pF |
| **Switching Characteristics** (Note 2) | | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | Q1<br>$V_{DD}$ = 10 V, $I_D$ = 1 A,<br>$V_{GS}$ = 4.5 V, $R_{GEN}$ = 6 Ω | Q1<br>Q2 | | 8<br>13 | 16<br>24 | ns |
| $t_r$ | Turn-On Rise Time | | Q1<br>Q2 | | 8<br>11 | 16<br>20 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | Q2<br>$V_{DD}$ = –10 V, $I_D$ = –1 A,<br>$V_{GS}$ = –4.5 V, $R_{GEN}$ = 6 Ω | Q1<br>Q2 | | 14<br>37 | 26<br>59 | ns |
| $t_f$ | Turn-Off Fall Time | | Q1<br>Q2 | | 3<br>36 | 6<br>58 | ns |
| $Q_g$ | Total Gate Charge | Q1<br>$V_{DS}$ = 10 V, $I_D$ = 3.7 A, $V_{GS}$ = 4.5 V | Q1<br>Q2 | | 4<br>7 | 6<br>10 | nC |
| $Q_{gs}$ | Gate-Source Charge | Q2 | Q1<br>Q2 | | 0.7<br>1.1 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | $V_{DS}$ = –10 V, $I_D$ = –3.1 A,<br>$V_{GS}$ = –4.5 V | Q1<br>Q2 | | 1.1<br>2.4 | | nC |

## Electrical Characteristics

$T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Type | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **Drain–Source Diode Characteristics and Maximum Ratings** | | | | | | | |
| $I_S$ | Maximum Continuous Source-Drain Diode Forward Current | | Q1<br>Q2 | | | 1.1<br>–1.1 | A |
| $V_{SD}$ | Source-Drain Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 1.1 A (Note 2)<br>$V_{GS}$ = 0 V, $I_S$ = –1.1 A (Note 2) | Q1<br>Q2 | | 0.7<br>–0.8 | 1.2<br>–1.2 | V |
| $t_{rr}$ | Diode Reverse Recovery Time | Q1<br>$I_F$ = 3.7 A, $dI_F/dt$ = 100 A/µs | Q1<br>Q2 | | 11<br>25 | | ns |
| $Q_{rr}$ | Diode Reverse Recovery Charge | Q2<br>$I_F$ = –3.1 A, $dI_F/dt$ = 100 A/µs | Q1<br>Q2 | | 2<br>9 | | nC |

**Notes:**

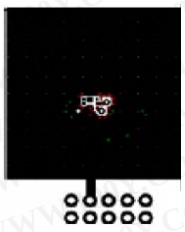
1. $R_{\theta JA}$ is determined with the device mounted on a 1 $in^2$ oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.

(a) $R_{\theta JA}$ = 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. For single operation.

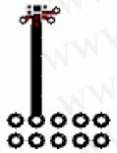
(b) $R_{\theta JA}$ = 173 °C/W when mounted on a minimum pad of 2 oz copper. For single operation.

(c) $R_{\theta JA}$ = 69 °C/W when mounted on a 1 $in^2$ pad of 2 oz copper, 1.5 " x 1.5 " x 0.062 " thick PCB. For dual operation.

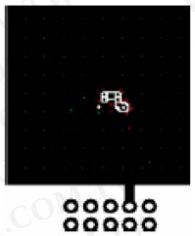
(d) $R_{\theta JA}$ = 151 °C/W when mounted on a minimum pad of 2 oz copper. For dual operation.



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)69 °C/W when mounted on a 1 $in^2$ pad of 2 oz copper.

d)151 °C/W when mounted on a minimum pad of 2 oz copper.

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

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

## Typical Characteristics Q1 (N-Channel)

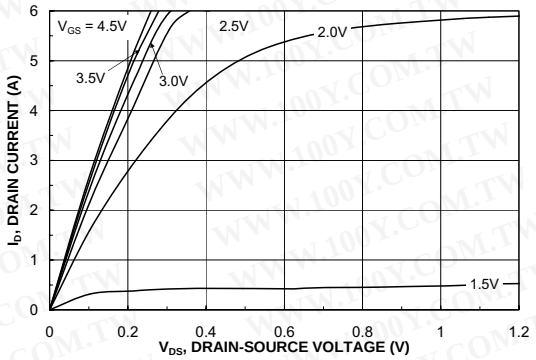



**Figure 1. On-Region Characteristics.**

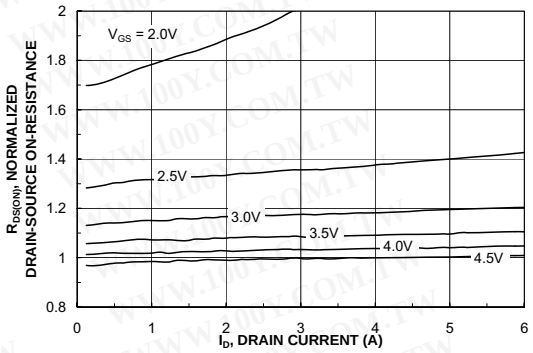



**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**

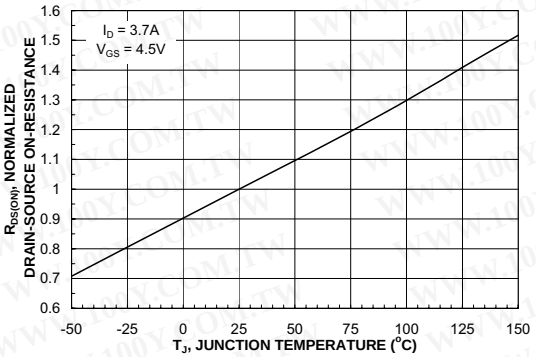



**Figure 3. On-Resistance Variation with Temperature.**

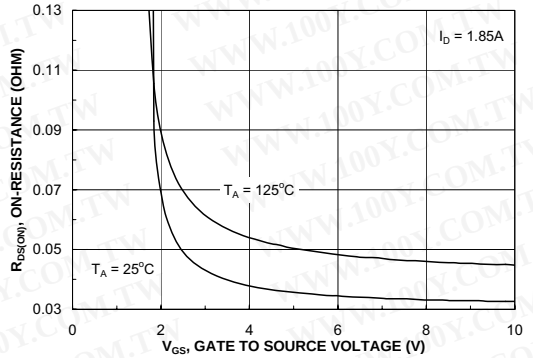



**Figure 4. On-Resistance Variation with Gate-to-Source Voltage.**

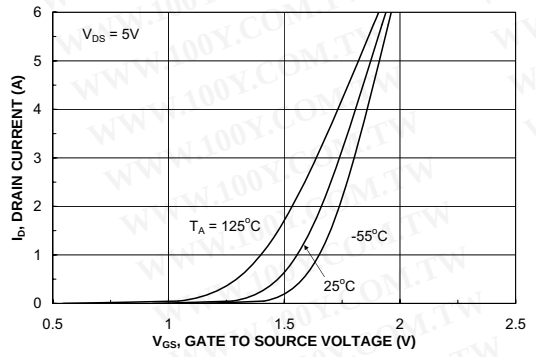



**Figure 5. Transfer Characteristics.**

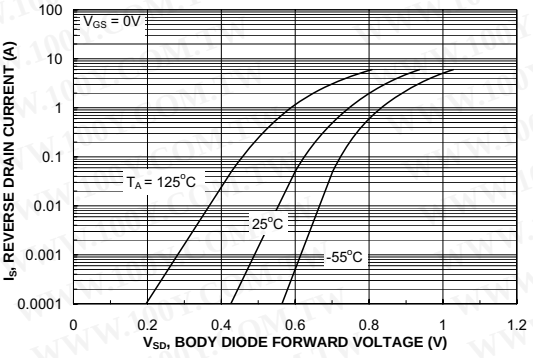



**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.**

## Typical Characteristics Q1 (N-Channel)

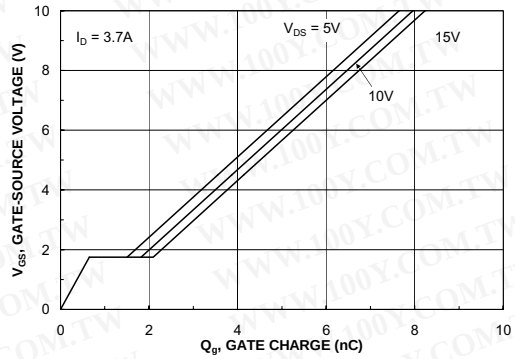



Figure 7. Gate Charge Characteristics.

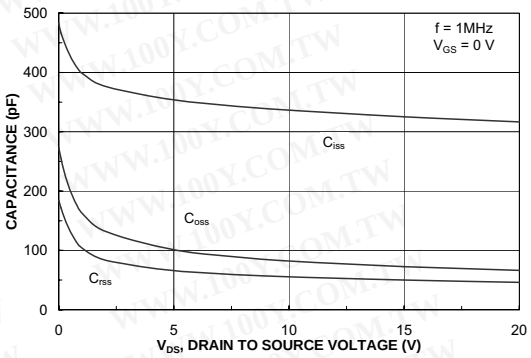



Figure 8. Capacitance Characteristics.

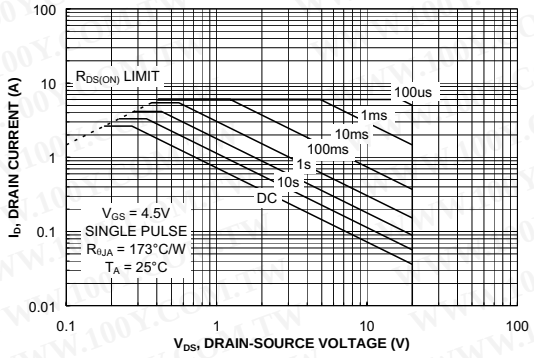



Figure 9. Maximum Safe Operating Area.

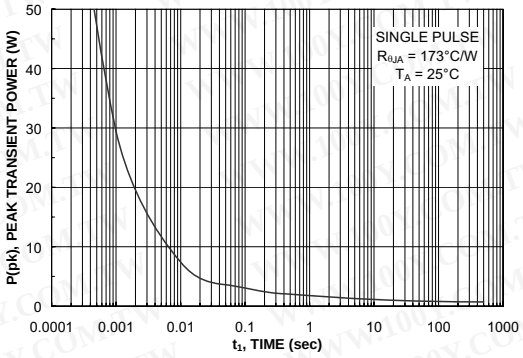



Figure 10. Single Pulse Maximum Power Dissipation.

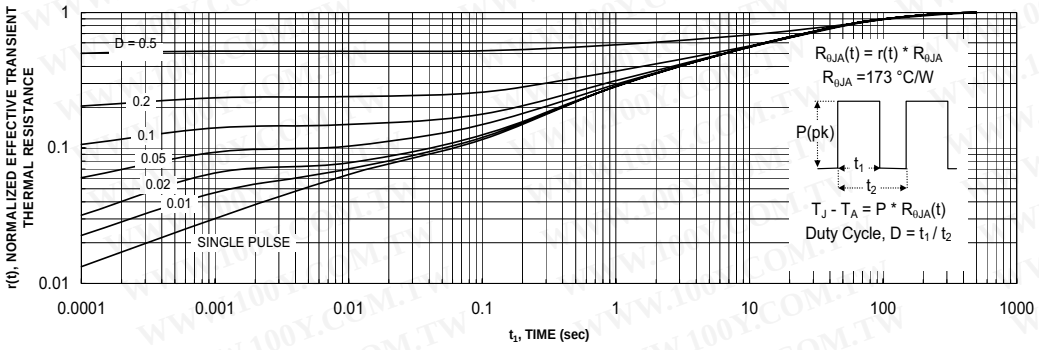



Figure 11. Transient Thermal Response Curve.

**Thermal characterization performed using the conditions described in Note 1b.**
**Transient thermal response will change depending on the circuit board design.**

## Typical Characteristics: Q2 (P-Channel)

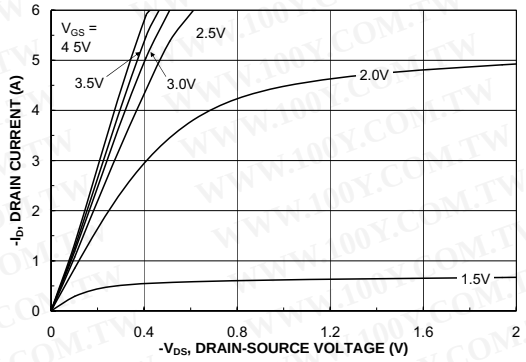



Figure 12. On-Region Characteristics.

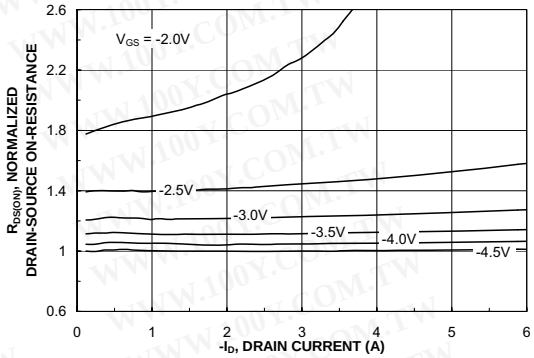



Figure 13. On-Resistance Variation with Drain Current and Gate Voltage.

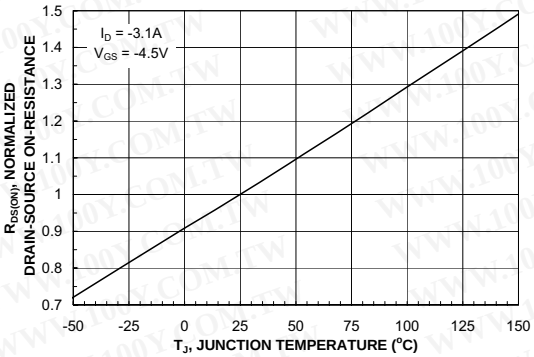



Figure 14. On-Resistance Variation with Temperature.

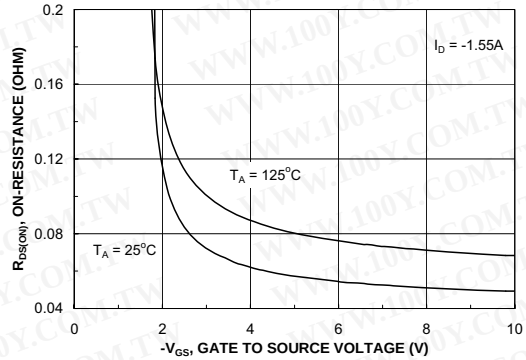



Figure 15. On-Resistance Variation with Gate-to-Source Voltage.

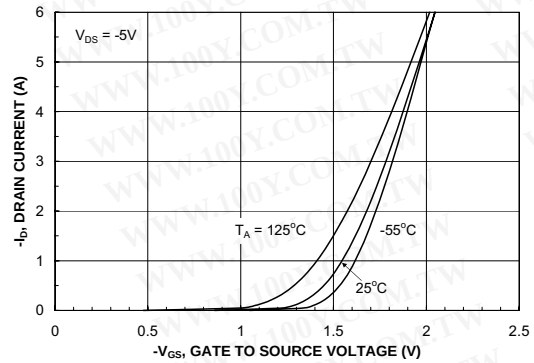



Figure 16. Transfer Characteristics.

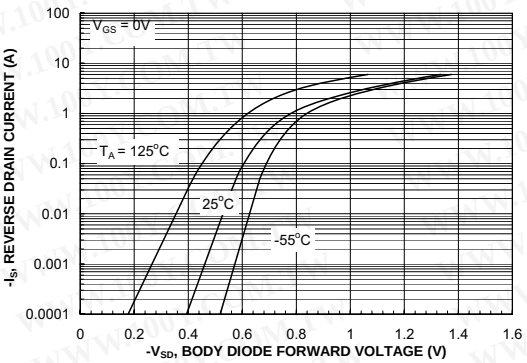



Figure 17. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics: Q2 (P-Channel)

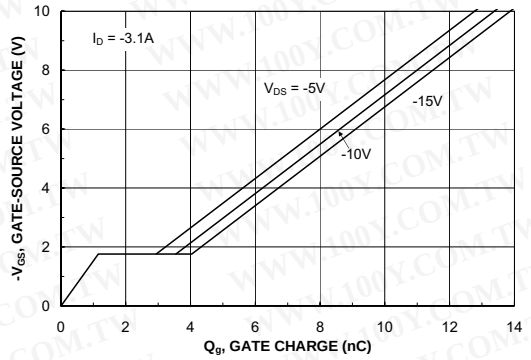



Figure 18. Gate Charge Characteristics.

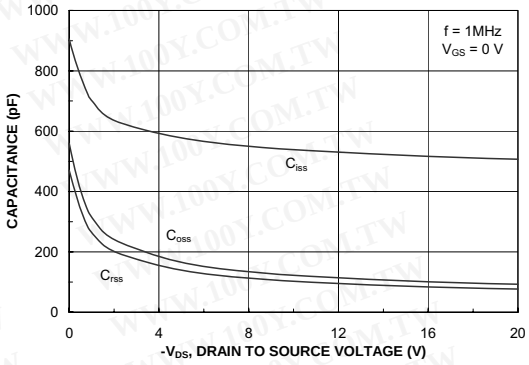



Figure 19. Capacitance Characteristics.

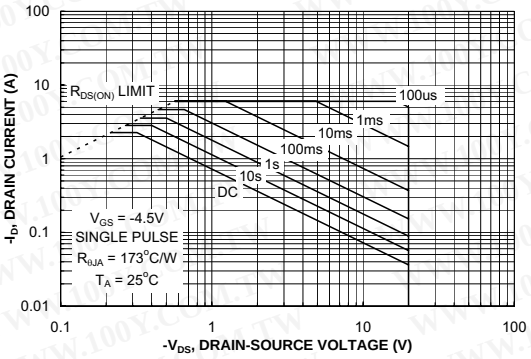



Figure 20. Maximum Safe Operating Area.

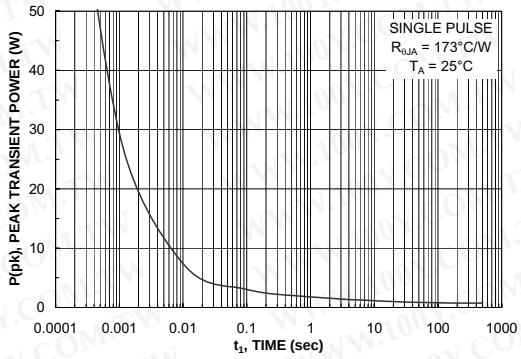



Figure 21. Single Pulse Maximum Power Dissipation.

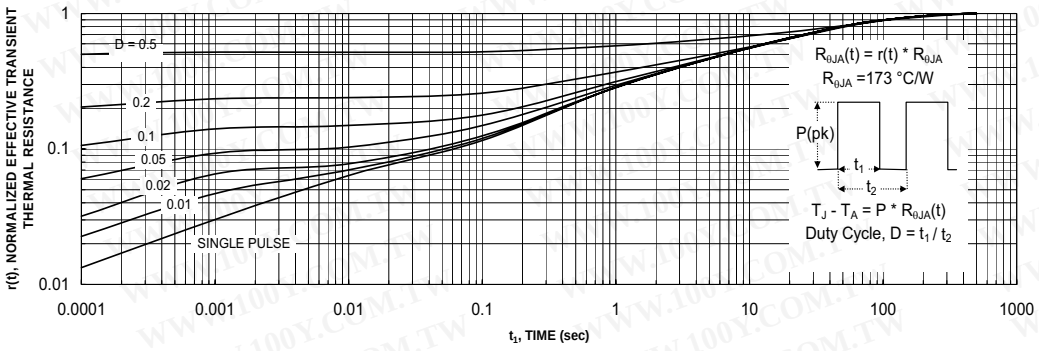
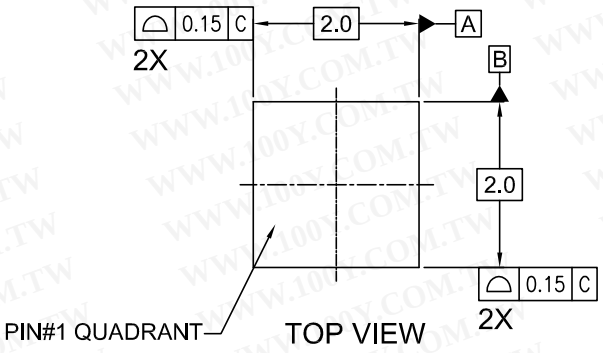
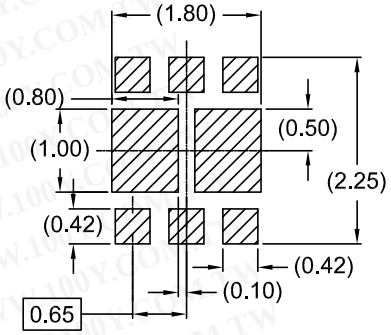



**Figure 22. Transient Thermal Response Curve.**

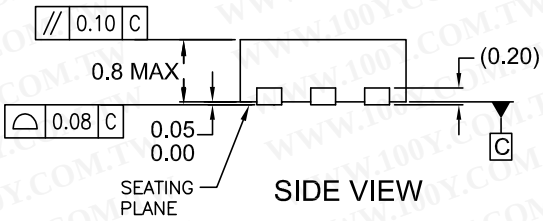
**Thermal characterization performed using the conditions described in Note 1c.**
**Transient thermal response will change depending on the circuit board design.**

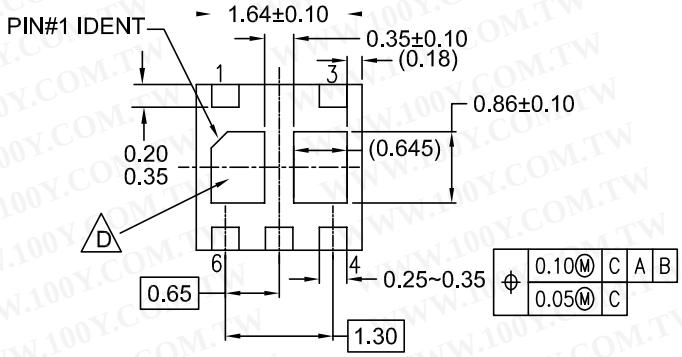
## Dimensional Outline and Pad Layout




RECOMMENDED LAND PATTERN




BOTTOM VIEW

## NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-229, VARIATION VCCC EXCEPT AS NOTED.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

D. NON-JEDEC DUAL DAP

MLP06JrevC

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EcoSPARK®
EfficentMax™
ESBC™
F®
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FlashWriter® *
FPS™
F-PFS™
FRFET®
Global Power Resource$^{SM}$
Green FPS™
Green FPS™ e-Series™
G*max*™
GTO™
IntelliMAX™
ISOPLANAR™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
Motion-SPM™
OptiHiT™
OPTOLOGIC®
OPTOPLANAR®
®
PDP SPM™
Power-SPM™
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
™
Saving our world, 1mW/W/kW at a time™
SignalWise™
SmartMax™
SMART START™
SPM®
STEALTH™
SuperFET™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS™
SyncFET™
Sync-Lock™
SYSTEM GENERAL ®*
The Power Franchise®
the power franchise®
TinyBoost™
TinyBuck™
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TriFault Detect™
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μSerDes™
SerDes
UHC®
Ultra FRFET™
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