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March 2015

# FDMS7678

## N-Channel Power Trench<sup>®</sup> MOSFET 30 V, 26 A, 5.5 mΩ

### Features

- Max  $r_{DS(on)}$  = 5.5 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 17.5\text{ A}$
- Max  $r_{DS(on)}$  = 6.8 mΩ at  $V_{GS} = 4.5\text{ V}$ ,  $I_D = 15\text{ A}$
- High Performance Technology for Extremely Low  $r_{DS(on)}$
- Termination is Lead-Free
- RoHS Compliant

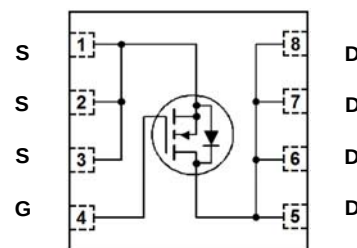
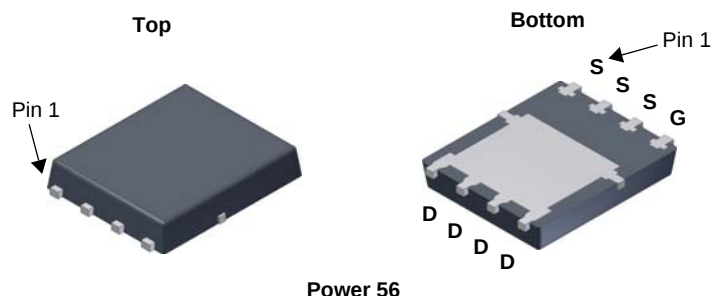


### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced Power Trench<sup>®</sup> process that has been especially tailored to minimize the on-state resistance. This device is well suited for Power Management and load switching applications common in Notebook Computers and Portable Battery Packs.

### Applications

- DC - DC Buck Converters
- Notebook Battery Power Management
- Load Switch in Notebook



### MOSFET Maximum Ratings $T_A = 25\text{ }^{\circ}\text{C}$ unless otherwise noted.

| Symbol         | Parameter                                                                      | Ratings     | Units              |
|----------------|--------------------------------------------------------------------------------|-------------|--------------------|
| $V_{DS}$       | Drain to Source Voltage                                                        | 30          | V                  |
| $V_{GS}$       | Gate to Source Voltage (Note 3)                                                | $\pm 20$    | V                  |
| $I_D$          | Drain Current -Continuous (Package limited) $T_C = 25\text{ }^{\circ}\text{C}$ | 26          | A                  |
|                | Drain Current -Continuous (Silicon limited) $T_C = 25\text{ }^{\circ}\text{C}$ | 72          |                    |
|                | -Continuous $T_A = 25\text{ }^{\circ}\text{C}$ (Note 1a)                       | 17.5        |                    |
|                | -Pulsed                                                                        | 70          |                    |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 4)                                         | 54          | mJ                 |
| $P_D$          | Power Dissipation $T_C = 25\text{ }^{\circ}\text{C}$                           | 41          | W                  |
|                | Power Dissipation $T_A = 25\text{ }^{\circ}\text{C}$ (Note 1a)                 | 2.3         |                    |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range                               | -55 to +150 | $^{\circ}\text{C}$ |

### Thermal Characteristics

|                 |                                                   |    |                      |
|-----------------|---------------------------------------------------|----|----------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case              | 3  | $^{\circ}\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 50 |                      |

### Package Marking and Ordering Information

| Device Marking | Device   | Package  | Reel Size | Tape Width | Quantity   |
|----------------|----------|----------|-----------|------------|------------|
| FDMS7678       | FDMS7678 | Power 56 | 13 "      | 12 mm      | 3000 units |

**Electrical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|--------|-----------|-----------------|------|------|------|-------|
|--------|-----------|-----------------|------|------|------|-------|

**Off Characteristics**

|                                      |                                               |                                                                                                                              |    |    |     |                      |
|--------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|----|----|-----|----------------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage             | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$                                                                            | 30 |    |     | V                    |
| $BV_{DSS(t)}$                        | Drain to Source Breakdown Voltage (transient) | $V_{GS} = 0\ \text{V}$ , $I_{D(aval)} = 14.2\ \text{A}$ ,<br>$T_{case} = 25^\circ\text{C}$ , $t_{transient} = 10\ \text{ns}$ | 34 |    |     | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient     | $I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$                                                                  |    | 21 |     | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current               | $V_{DS} = 24\ \text{V}$ , $V_{GS} = 0\ \text{V}$                                                                             |    |    | 1   | $\mu\text{A}$        |
| $I_{GSS}$                            | Gate to Source Leakage Current, Forward       | $V_{GS} = 20\ \text{V}$ , $V_{DS} = 0\ \text{V}$                                                                             |    |    | 100 | nA                   |

**On Characteristics**

|                                        |                                                          |                                                                              |     |     |     |                      |
|----------------------------------------|----------------------------------------------------------|------------------------------------------------------------------------------|-----|-----|-----|----------------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}$ , $I_D = 250\ \mu\text{A}$                                 | 1.2 | 1.5 | 3.0 | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$                  |     | -5  |     | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = 10\ \text{V}$ , $I_D = 17.5\ \text{A}$                             |     | 4.7 | 5.5 | m $\Omega$           |
|                                        |                                                          | $V_{GS} = 4.5\ \text{V}$ , $I_D = 15\ \text{A}$                              |     | 5.6 | 6.8 |                      |
|                                        |                                                          | $V_{GS} = 10\ \text{V}$ , $I_D = 17.5\ \text{A}$ , $T_J = 125^\circ\text{C}$ |     | 6.3 | 7.4 |                      |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DD} = 5\ \text{V}$ , $I_D = 17.5\ \text{A}$                              |     | 90  |     | S                    |

**Dynamic Characteristics**

|           |                              |                                                                         |     |      |      |          |
|-----------|------------------------------|-------------------------------------------------------------------------|-----|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 15\ \text{V}$ , $V_{GS} = 0\ \text{V}$<br>$f = 1\ \text{MHz}$ |     | 1810 | 2410 | pF       |
| $C_{oss}$ | Output Capacitance           |                                                                         |     | 620  | 820  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                         |     | 75   | 110  | pF       |
| $R_g$     | Gate Resistance              |                                                                         | 0.1 | 0.7  | 2.5  | $\Omega$ |

**Switching Characteristics**

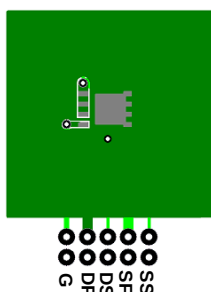
|              |                               |                                                                                                     |                                                   |     |    |    |
|--------------|-------------------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------|-----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 15\ \text{V}$ , $I_D = 17.5\ \text{A}$<br>$V_{GS} = 10\ \text{V}$ , $R_{GEN} = 6\ \Omega$ |                                                   | 10  | 19 | ns |
| $t_r$        | Rise Time                     |                                                                                                     |                                                   | 4   | 10 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |                                                                                                     |                                                   | 26  | 41 | ns |
| $t_f$        | Fall Time                     |                                                                                                     |                                                   | 3   | 10 | ns |
| $Q_{g(TOT)}$ | Total Gate Charge             | $V_{GS} = 0\ \text{V}$ to $10\ \text{V}$                                                            | $V_{DD} = 15\ \text{V}$<br>$I_D = 17.5\ \text{A}$ | 28  | 39 | nC |
|              | Total Gate Charge             | $V_{GS} = 0\ \text{V}$ to $4.5\ \text{V}$                                                           |                                                   | 14  | 19 | nC |
| $Q_{gs}$     | Gate to Source Charge         |                                                                                                     |                                                   | 4.4 |    | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                                                     |                                                   | 3.9 |    | nC |

**Drain-Source Diode Characteristics**

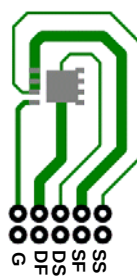
|          |                                       |                                                              |  |     |     |    |
|----------|---------------------------------------|--------------------------------------------------------------|--|-----|-----|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\ \text{V}$ , $I_S = 1.9\ \text{A}$ (Note 2)      |  | 0.7 | 1.2 | V  |
|          |                                       | $V_{GS} = 0\ \text{V}$ , $I_S = 17.5\ \text{A}$ (Note 2)     |  | 0.8 | 1.2 |    |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 17.5\ \text{A}$ , $di/dt = 100\ \text{A}/\mu\text{s}$ |  | 30  | 49  | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |                                                              |  | 13  | 23  | nC |

## NOTES:

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 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  $R_{\theta CA}$  is determined by the user's board design.



a.  $50^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b.  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0 %.

3. As an N-ch device, the negative  $V_{GS}$  rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

4.  $E_{AS}$  of 54 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.3\ \text{mH}$ ,  $I_{AS} = 19\ \text{A}$ ,  $V_{DD} = 27\ \text{V}$ ,  $V_{GS} = 10\ \text{V}$ .

# Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted.

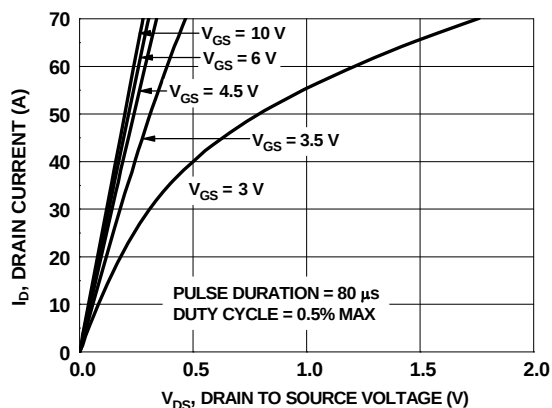


Figure 1. On Region Characteristics

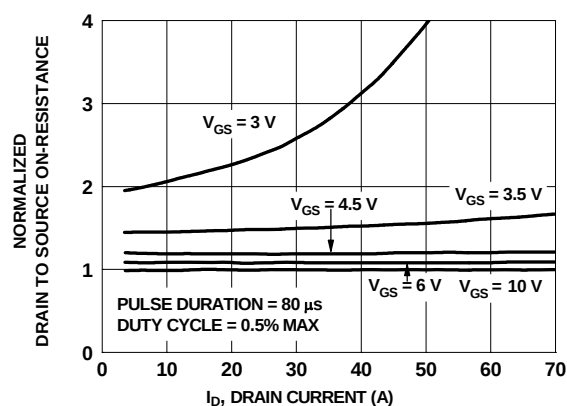


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

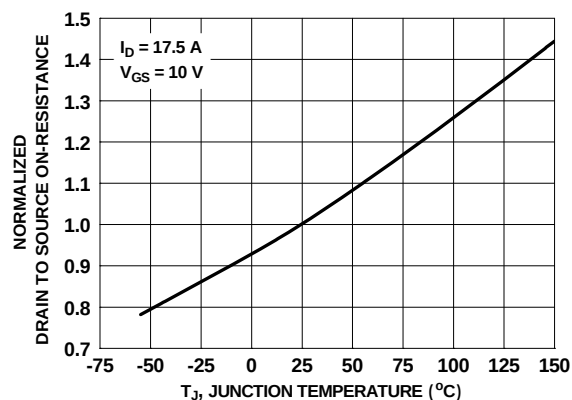


Figure 3. Normalized On Resistance vs. Junction Temperature

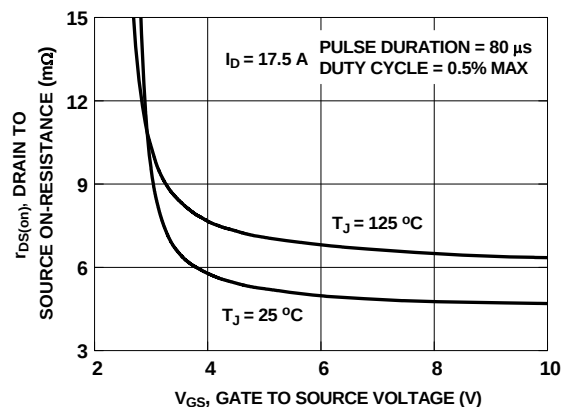


Figure 4. On-Resistance vs. Gate to Source Voltage

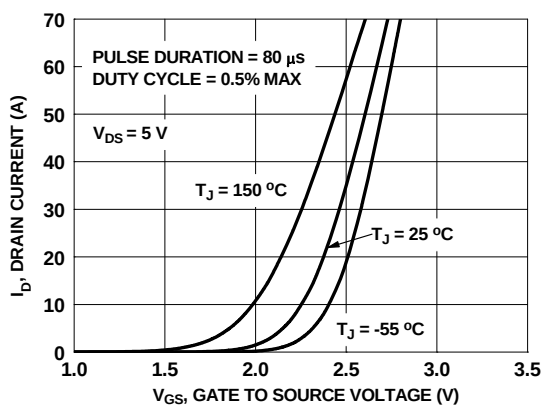


Figure 5. Transfer Characteristics

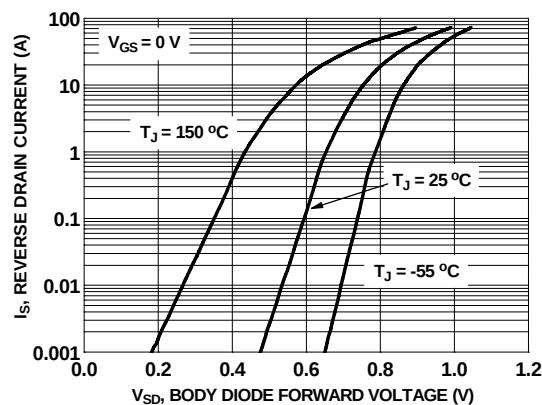


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

# Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted.

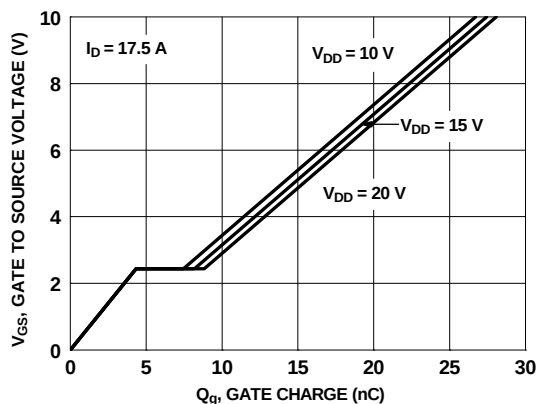


Figure 7. Gate Charge Characteristics

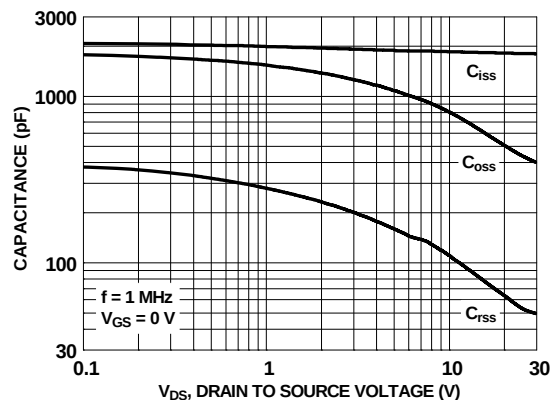


Figure 8. Capacitance vs. Drain to Source Voltage

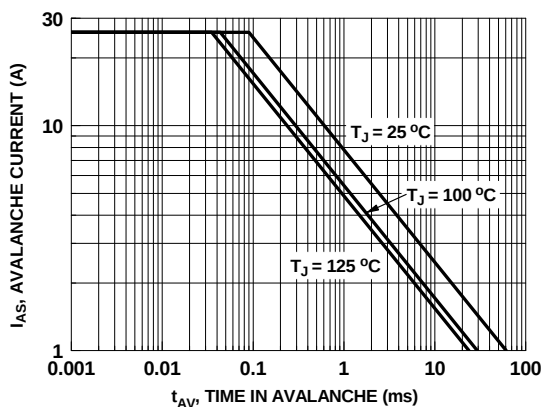


Figure 9. Unclamped Inductive Switching Capability

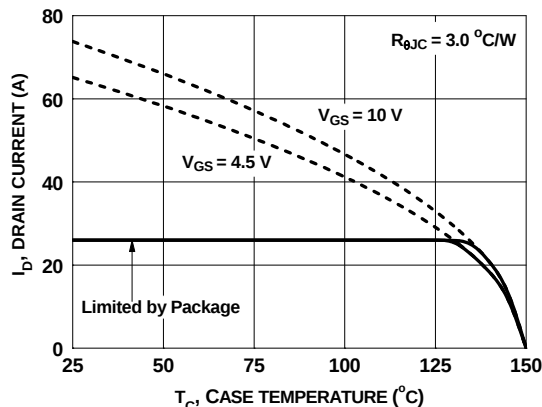


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

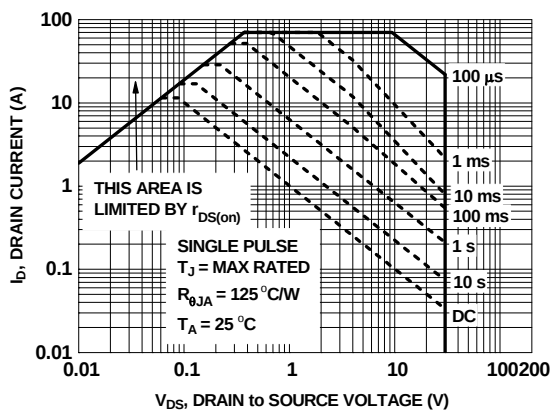


Figure 11. Forward Bias Safe Operating Area

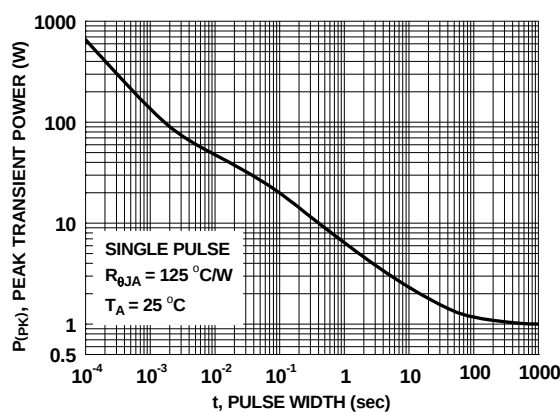


Figure 12. Single Pulse Maximum Power Dissipation

# Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted.

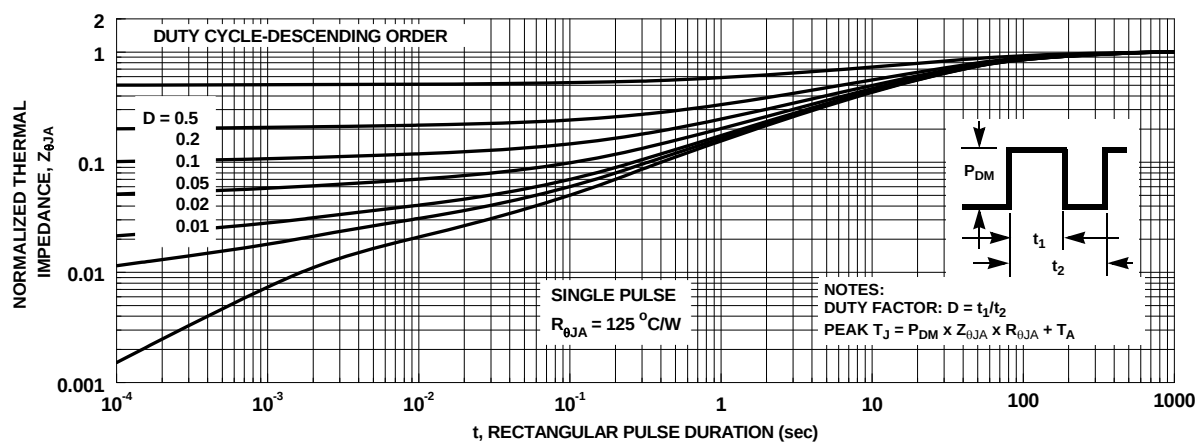
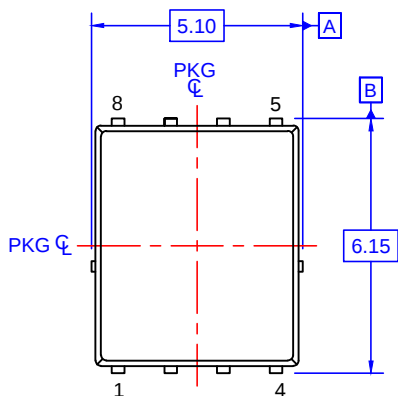
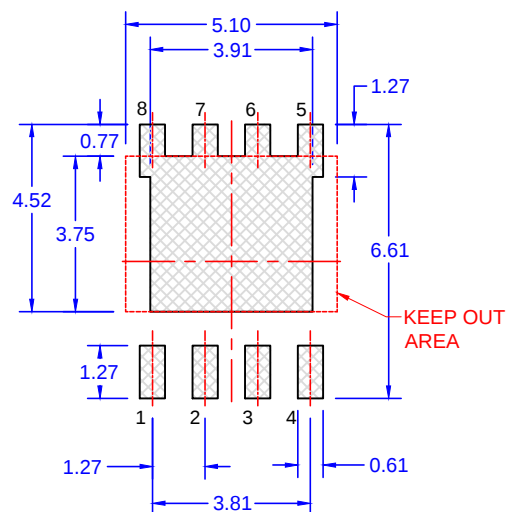
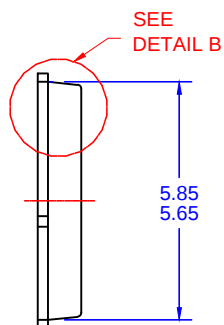


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

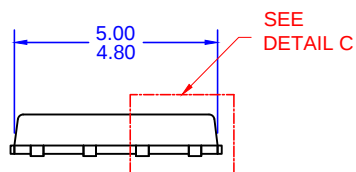
PQFN8 5X6, 1.27P  
CASE 483AE  
ISSUE A



TOP VIEW

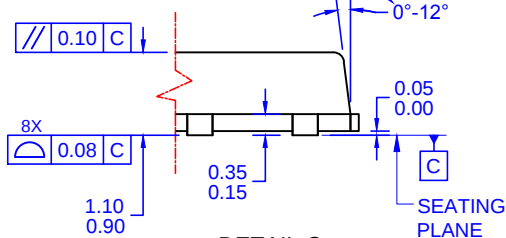


LAND PATTERN  
RECOMMENDATION



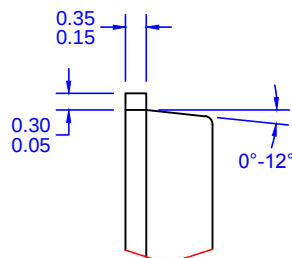
SIDE VIEW

OPTIONAL DRAFT  
ANGLE MAY APPEAR  
ON FOUR SIDES  
OF THE PACKAGE



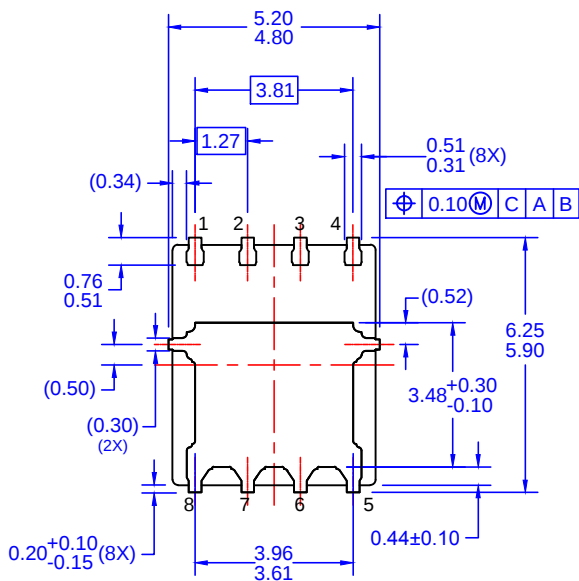
DETAIL C

SCALE: 2:1



DETAIL B

SCALE: 2:1



BOTTOM VIEW

NOTES: UNLESS OTHERWISE SPECIFIED

- PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. AA,.
- DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.

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