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# FDC8884

## N-Channel Power Trench<sup>®</sup> MOSFET

30 V, 6.5 A, 23 mΩ

### Features

- Max  $r_{DS(on)}$  = 23 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 6.5\text{ A}$
- Max  $r_{DS(on)}$  = 30 mΩ at  $V_{GS} = 4.5\text{ V}$ ,  $I_D = 6.0\text{ A}$
- High performance trench technology for extremely low  $r_{DS(on)}$
- Fast switching speed
- RoHS Compliant

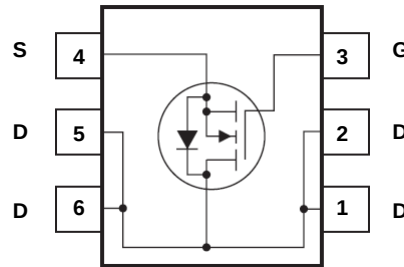
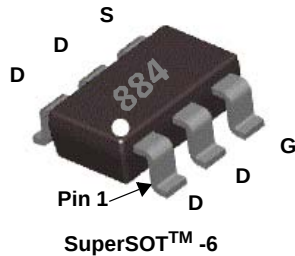


### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced Power Trench<sup>®</sup> process that has been optimized for  $r_{DS(on)}$  switching performance.

### Application

- Primary Switch



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

| Symbol         | Parameter                                                        | Ratings     | Units |
|----------------|------------------------------------------------------------------|-------------|-------|
| $V_{DS}$       | Drain to Source Voltage                                          | 30          | V     |
| $V_{GS}$       | Gate to Source Voltage (Note 3)                                  | ±20         | V     |
| $I_D$          | Drain Current -Continuous (Package limited) $T_C = 25\text{ °C}$ | 8.0         | A     |
|                | -Continuous $T_A = 25\text{ °C}$ (Note 1a)                       | 6.5         |       |
|                | -Pulsed                                                          | 25          |       |
| $P_D$          | Power Dissipation (Note 1a)                                      | 1.6         | W     |
|                | Power Dissipation (Note 1b)                                      | 0.8         |       |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range                 | -55 to +150 | °C    |

### Thermal Characteristics

|                 |                                                   |    |      |
|-----------------|---------------------------------------------------|----|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case              | 30 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 78 |      |

### Package Marking and Ordering Information

| Device Marking | Device  | Package | Reel Size | Tape Width | Quantity   |
|----------------|---------|---------|-----------|------------|------------|
| .884           | FDC8884 | SSOT-6  | 7"        | 8 mm       | 3000 units |

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

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

**Off Characteristics**

|                                      |                                           |                                                                             |    |    |     |                        |
|--------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------|----|----|-----|------------------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$                      | 30 |    |     | V                      |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^{\circ}\text{C}$ |    | 18 |     | 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                         | $V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$                                  | 1.2 | 1.9 | 3.0 | V                      |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^{\circ}\text{C}$         |     | -6  |     | mV/ $^{\circ}\text{C}$ |
| $r_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = 10\text{ V}$ , $I_D = 6.5\text{ A}$                                       |     | 19  | 23  | m $\Omega$             |
|                                        |                                                          | $V_{GS} = 4.5\text{ V}$ , $I_D = 6.0\text{ A}$                                      |     | 25  | 30  |                        |
|                                        |                                                          | $V_{GS} = 10\text{ V}$ , $I_D = 6.5\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$ |     | 25  | 30  |                        |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DD} = 5\text{ V}$ , $I_D = 6.5\text{ A}$                                        |     | 24  |     | S                      |

**Dynamic Characteristics**

|           |                              |                                                                        |  |     |     |          |
|-----------|------------------------------|------------------------------------------------------------------------|--|-----|-----|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 15\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$f = 1\text{ MHz}$ |  | 348 | 465 | pF       |
| $C_{oss}$ | Output Capacitance           |                                                                        |  | 135 | 180 | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                        |  | 16  | 25  | pF       |
| $R_g$     | Gate Resistance              |                                                                        |  | 1.2 |     | $\Omega$ |

**Switching Characteristics**

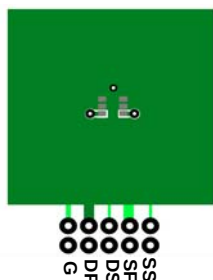
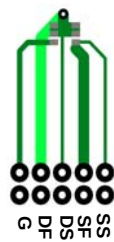
|              |                               |                                                                                                         |                                                  |     |     |    |
|--------------|-------------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 15\text{ V}$ , $I_D = 6.5\text{ A}$ ,<br>$V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$ |                                                  | 5   | 10  | ns |
| $t_r$        | Rise Time                     |                                                                                                         |                                                  | 1   | 10  | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |                                                                                                         |                                                  | 11  | 19  | ns |
| $t_f$        | Fall Time                     |                                                                                                         |                                                  | 1   | 10  | ns |
| $Q_{g(TOT)}$ | Total Gate Charge             | $V_{GS} = 0\text{ V to }10\text{ V}$                                                                    | $V_{DD} = 15\text{ V}$ ,<br>$I_D = 6.5\text{ A}$ | 5.3 | 7.4 | nC |
|              | Total Gate Charge             | $V_{GS} = 0\text{ V to }4.5\text{ V}$                                                                   |                                                  | 2.5 | 3.5 | nC |
| $Q_{gs}$     | Total Gate Charge             |                                                                                                         |                                                  | 1.0 |     | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                                                         |                                                  | 0.8 |     | nC |

**Drain-Source Diode Characteristics**

|          |                                       |                                                           |  |      |     |    |
|----------|---------------------------------------|-----------------------------------------------------------|--|------|-----|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}$ , $I_S = 6.5\text{ A}$ (Note 2)     |  | 0.86 | 1.2 | V  |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 6.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ |  | 14   | 22  | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |                                                           |  | 3    | 10  | nC |

## NOTES:

- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.

a. 78  $^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copperb. 175  $^{\circ}\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0 %.

3. As an N-ch device, the negative Vgs rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

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

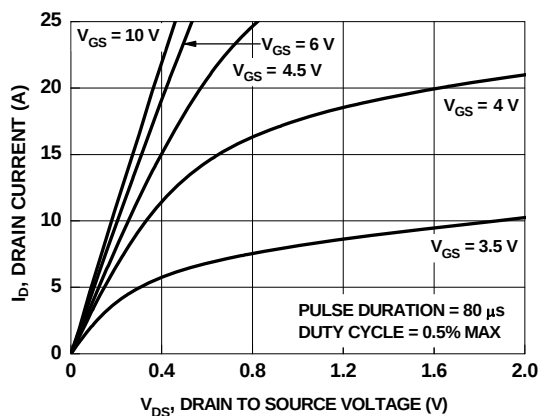


Figure 1. On Region Characteristics

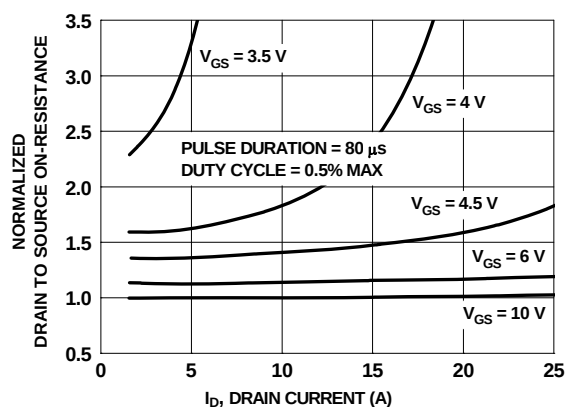


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

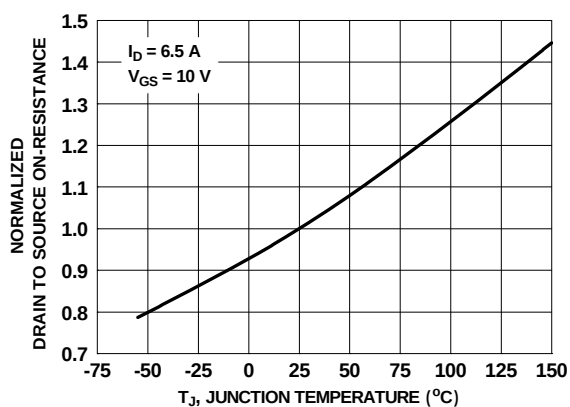


Figure 3. Normalized On Resistance vs Junction Temperature

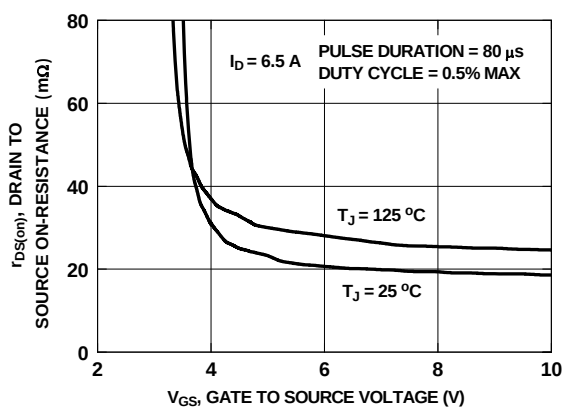


Figure 4. On-Resistance vs Gate to Source Voltage

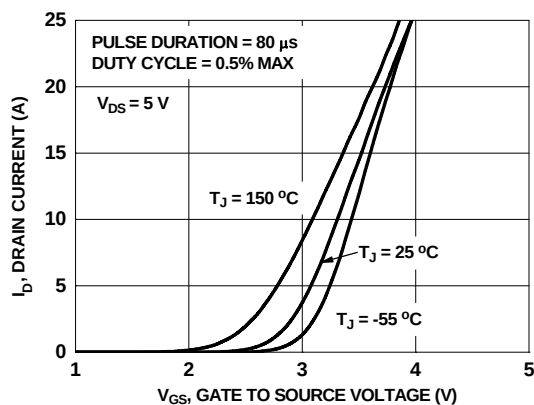


Figure 5. Transfer Characteristics

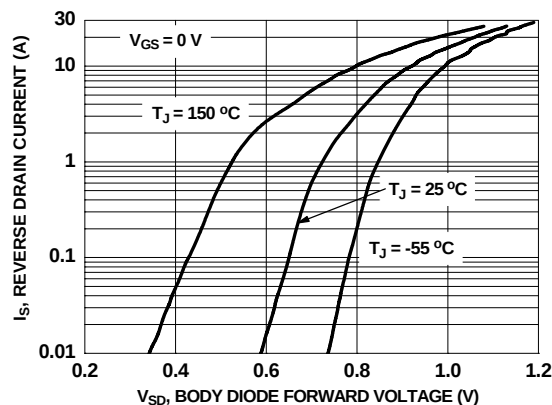


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

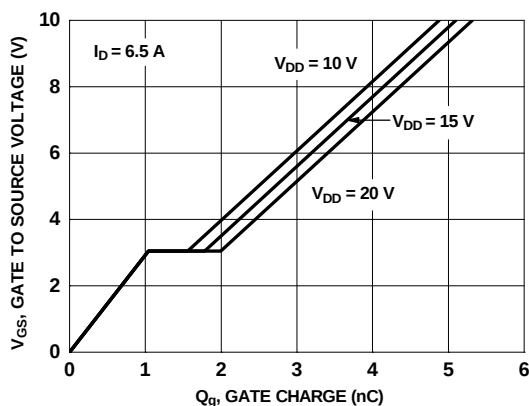


Figure 7. Gate Charge Characteristics

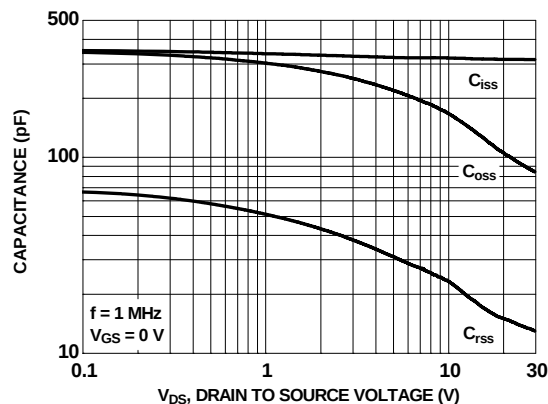


Figure 8. Capacitance vs Drain to Source Voltage

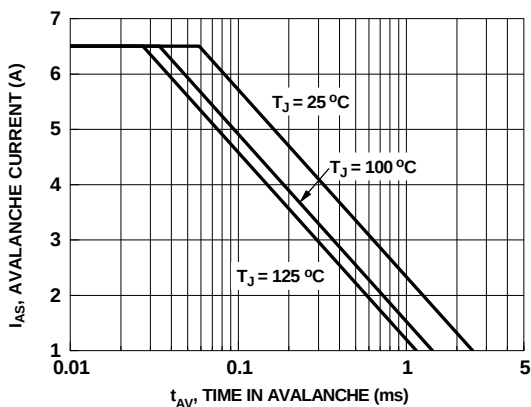


Figure 9. Unclamped Inductive Switching Capability

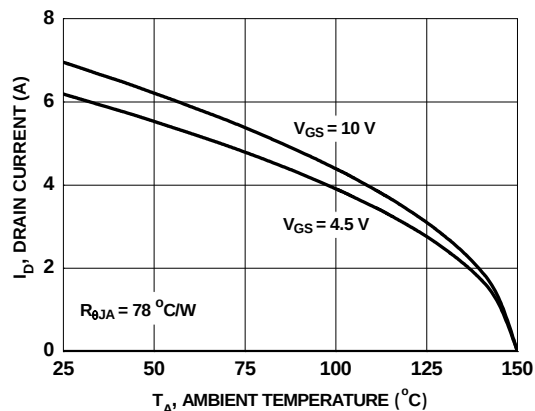


Figure 10. Maximum Continuous Drain Current vs Ambient Temperature

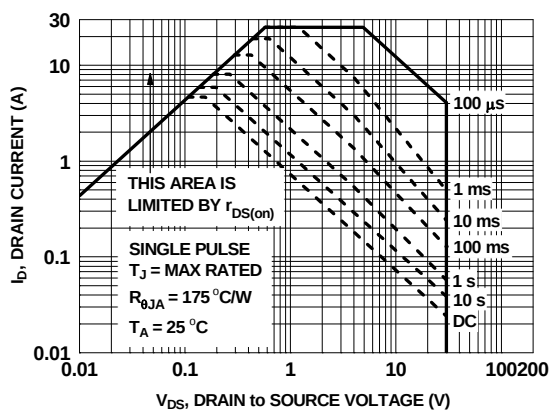


Figure 11. Forward Bias Safe Operating Area

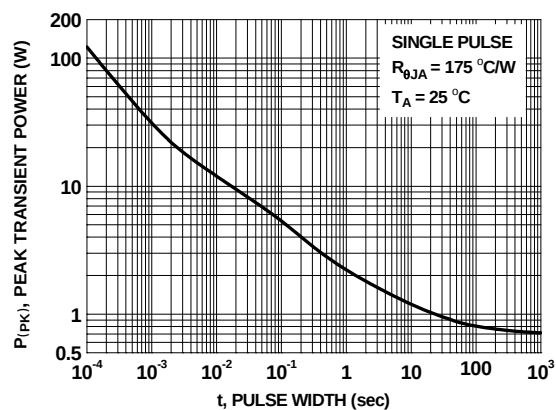


Figure 12. Single Pulse Maximum Power Dissipation

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

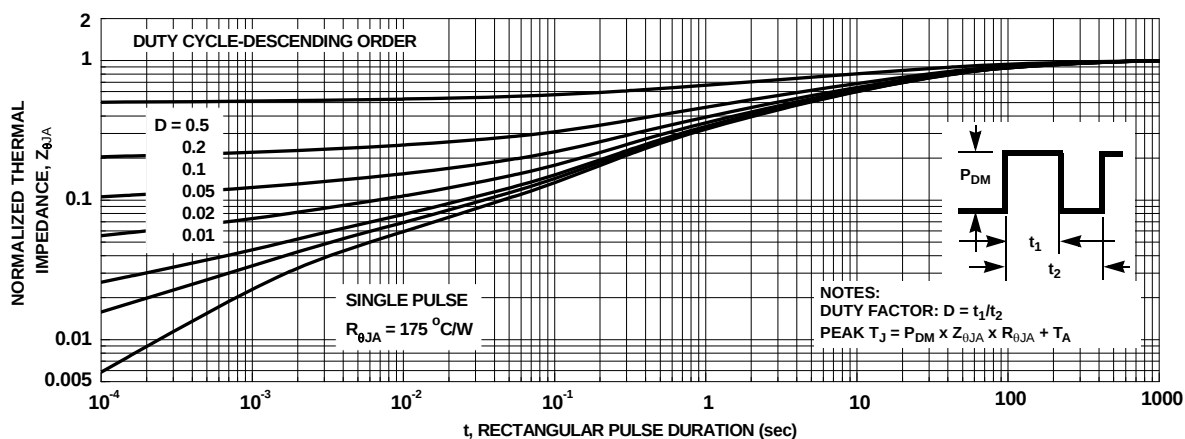
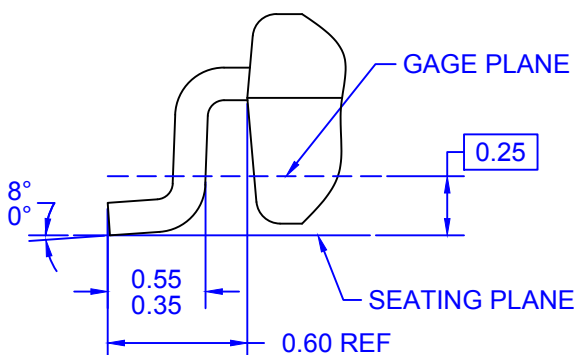
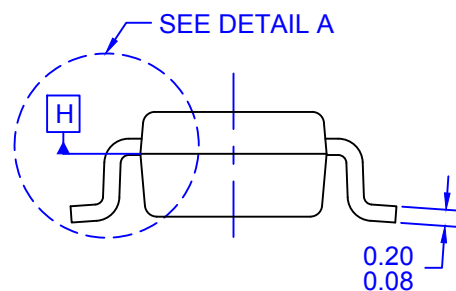
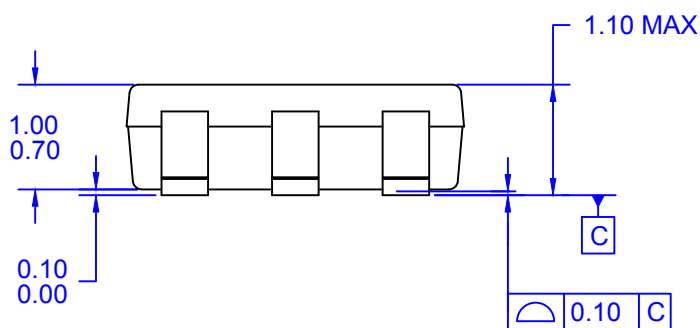
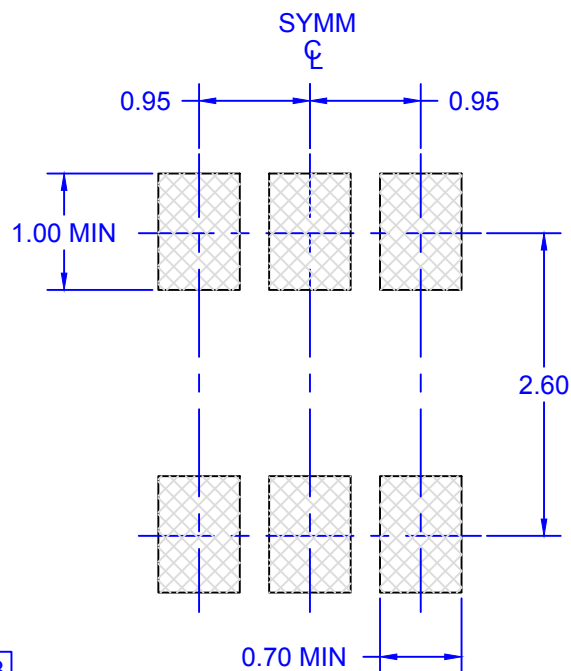
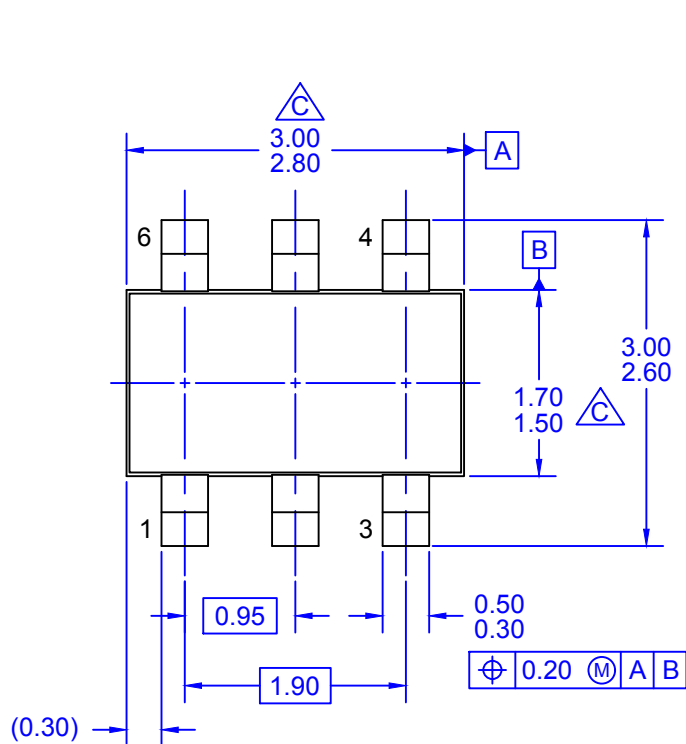


Figure 13. Junction-to-Ambient Transient Thermal Response Curve



DETAIL A  
SCALE: 50X

- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO JEDEC MO-193. VAR. AA, ISSUE E.
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - $\text{C}$  PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.25mm PER END. PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25mm PER SIDE. PACKAGE LENGTH AND WIDTH DIMENSIONS ARE DETERMINED AT DATUM H.
  - D) DRAWING FILE NAME: MKT-MA06AREVF

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