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March 2015

# FDD6637

## 35V P-Channel PowerTrench<sup>®</sup> MOSFET

### General Description

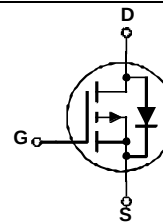
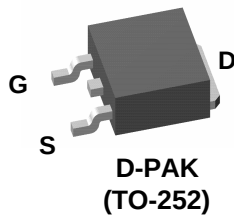
This P-Channel MOSFET has been produced using Fairchild Semiconductor's proprietary PowerTrench technology to deliver low  $R_{DS(on)}$  and optimized  $BV_{DS}$  capability to offer superior performance benefit in the applications.

### Applications

- Inverter
- Power Supplies

### Features

- 55 A, –35 V  $R_{DS(ON)} = 11.6 \text{ m}\Omega$  @  $V_{GS} = -10 \text{ V}$   
 $R_{DS(ON)} = 18 \text{ m}\Omega$  @  $V_{GS} = -4.5 \text{ V}$
- High performance trench technology for extremely low  $R_{DS(ON)}$
- RoHS Compliant



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

| Symbol              | Parameter                                                                                                                          | Ratings     | Units            |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------|
| $V_{DS}$            | Drain-Source Voltage                                                                                                               | –35         | V                |
| $V_{DS(Avalanche)}$ | Drain-Source Avalanche Voltage (maximum) (Note 4)                                                                                  | –40         | V                |
| $V_{GS}$            | Gate-Source Voltage                                                                                                                | $\pm 25$    | V                |
| $I_D$               | Continuous Drain Current $@T_C = 25^\circ\text{C}$ (Note 3)<br>$@T_A = 25^\circ\text{C}$ (Note 1a)<br>Pulsed (Note 1a)             | –55         | A                |
|                     |                                                                                                                                    | –13         |                  |
|                     |                                                                                                                                    | –100        |                  |
| $P_D$               | Power Dissipation $@T_C = 25^\circ\text{C}$ (Note 3)<br>$@T_A = 25^\circ\text{C}$ (Note 1a)<br>$@T_A = 25^\circ\text{C}$ (Note 1b) | 57          | W                |
|                     |                                                                                                                                    | 3.1         |                  |
|                     |                                                                                                                                    | 1.3         |                  |
| $T_J, T_{STG}$      | Operating and Storage Junction Temperature Range                                                                                   | –55 to +150 | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |                                                   |     |                    |
|-----------------|---------------------------------------------------|-----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1)     | 2.2 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 40  |                    |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1b) | 96  |                    |

### Package Marking and Ordering Information

| Device Marking | Device  | Package        | Reel Size | Tape width | Quantity   |
|----------------|---------|----------------|-----------|------------|------------|
| FDD6637        | FDD6637 | D-PAK (TO-252) | 13"       | 16mm       | 2500 units |

# Electrical Characteristics

 $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol                                    | Parameter                                    | Test Conditions                                                                                                                                                               | Min | Typ                 | Max              | Units            |
|-------------------------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------------|------------------|------------------|
| <b>Drain-Source Avalanche Ratings</b>     |                                              |                                                                                                                                                                               |     |                     |                  |                  |
| $E_{AS}$                                  | Drain-Source Avalanche Energy (Single Pulse) | $V_{DD} = -35\text{ V}$ , $I_D = -11\text{ A}$ , $L=1\text{mH}$                                                                                                               |     | 61                  |                  | mJ               |
| $I_{AS}$                                  | Drain-Source Avalanche Current               |                                                                                                                                                                               |     | -14                 |                  | A                |
| <b>Off Characteristics</b> (Note 2)       |                                              |                                                                                                                                                                               |     |                     |                  |                  |
| $BV_{DSS}$                                | Drain-Source Breakdown Voltage               | $V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$                                                                                                                       | -35 |                     |                  | V                |
| $I_{DSS}$                                 | Zero Gate Voltage Drain Current              | $V_{DS} = -28\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                                                               |     |                     | -1               | $\mu\text{A}$    |
| $I_{GSS}$                                 | Gate-Body Leakage                            | $V_{GS} = \pm 25\text{ V}$ , $V_{DS} = 0\text{ V}$                                                                                                                            |     |                     | $\pm 100$        | nA               |
| <b>On Characteristics</b> (Note 2)        |                                              |                                                                                                                                                                               |     |                     |                  |                  |
| $V_{GS(th)}$                              | Gate Threshold Voltage                       | $V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$                                                                                                                           | -1  | -1.6                | -3               | V                |
| $R_{DS(on)}$                              | Static Drain-Source On-Resistance            | $V_{GS} = -10\text{ V}$ , $I_D = -14\text{ A}$<br>$V_{GS} = -4.5\text{ V}$ , $I_D = -11\text{ A}$<br>$V_{GS} = -10\text{ V}$ , $I_D = -14\text{ A}$ , $T_J=125^\circ\text{C}$ |     | 9.7<br>14.4<br>14.7 | 11.6<br>18<br>19 | $\text{m}\Omega$ |
| $g_{FS}$                                  | Forward Transconductance                     | $V_{DS} = -5\text{ V}$ , $I_D = -14\text{ A}$                                                                                                                                 |     | 35                  |                  | S                |
| <b>Dynamic Characteristics</b>            |                                              |                                                                                                                                                                               |     |                     |                  |                  |
| $C_{iss}$                                 | Input Capacitance                            | $V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$f = 1.0\text{ MHz}$                                                                                                     |     | 2370                |                  | pF               |
| $C_{oss}$                                 | Output Capacitance                           |                                                                                                                                                                               |     | 470                 |                  | pF               |
| $C_{rss}$                                 | Reverse Transfer Capacitance                 |                                                                                                                                                                               |     | 250                 |                  | pF               |
| $R_G$                                     | Gate Resistance                              | $f = 1.0\text{ MHz}$                                                                                                                                                          |     | 3.6                 |                  | $\Omega$         |
| <b>Switching Characteristics</b> (Note 2) |                                              |                                                                                                                                                                               |     |                     |                  |                  |
| $t_{d(on)}$                               | Turn-On Delay Time                           | $V_{DD} = -20\text{ V}$ , $I_D = -1\text{ A}$ ,<br>$V_{GS} = -10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$                                                                      |     | 18                  | 32               | ns               |
| $t_r$                                     | Turn-On Rise Time                            |                                                                                                                                                                               |     | 10                  | 20               | ns               |
| $t_{d(off)}$                              | Turn-Off Delay Time                          |                                                                                                                                                                               |     | 62                  | 100              | ns               |
| $t_f$                                     | Turn-Off Fall Time                           |                                                                                                                                                                               |     | 36                  | 58               | ns               |
| $Q_g$                                     | Total Gate Charge, $V_{GS} = -10\text{V}$    | $V_{DS} = -20\text{ V}$ , $I_D = -14\text{ A}$                                                                                                                                |     | 45                  | 63               | nC               |
| $Q_g$                                     | Total Gate Charge, $V_{GS} = -5\text{V}$     |                                                                                                                                                                               |     | 25                  | 35               | nC               |
| $Q_{gs}$                                  | Gate-Source Charge                           |                                                                                                                                                                               |     | 7                   |                  | nC               |
| $Q_{gd}$                                  | Gate-Drain Charge                            |                                                                                                                                                                               |     | 10                  |                  | nC               |

## Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol                                    | Parameter                          | Test Conditions                                             | Min | Typ  | Max  | Units |
|-------------------------------------------|------------------------------------|-------------------------------------------------------------|-----|------|------|-------|
| <b>Drain–Source Diode Characteristics</b> |                                    |                                                             |     |      |      |       |
| $V_{SD}$                                  | Drain–Source Diode Forward Voltage | $V_{GS} = 0\text{ V}$ , $I_S = -14\text{ A}$ (Note 2)       |     | –0.8 | –1.2 | V     |
| $t_{rr}$                                  | Diode Reverse Recovery Time        | $I_F = -14\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ |     | 28   |      | ns    |
| $Q_{rr}$                                  | Diode Reverse Recovery Charge      |                                                             |     | 15   |      | 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.



- $R_{\theta JA} = 40^\circ\text{C/W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



- $R_{\theta JA} = 96^\circ\text{C/W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

- Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%

- Maximum current is calculated as: 
$$\sqrt{\frac{P_D}{R_{DS(ON)}}}$$

where  $P_D$  is maximum power dissipation at  $T_C = 25^\circ\text{C}$  and  $R_{DS(on)}$  is at  $T_{J(max)}$  and  $V_{GS} = 10\text{V}$ . Package current limitation is 21A

- BV(avalanche) Single-Pulse rating is guaranteed if device is operated within the UIS SOA boundary of the device.

## Typical Characteristics

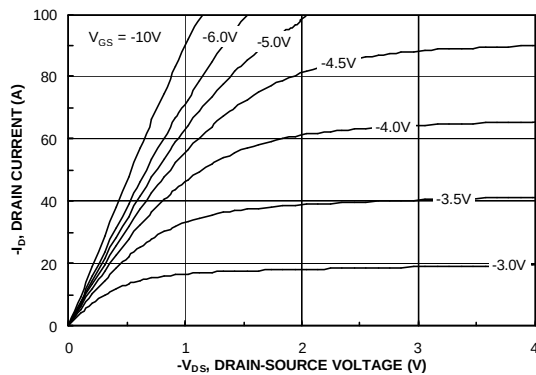


Figure 1. On-Region Characteristics

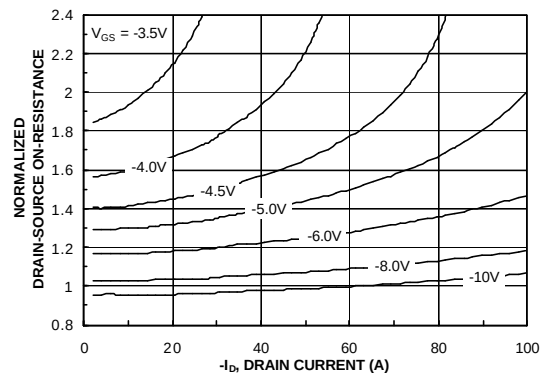


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

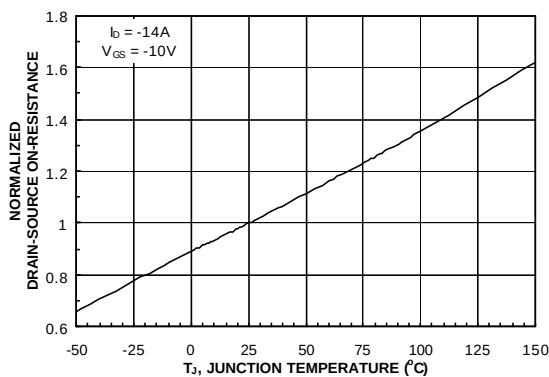


Figure 3. On-Resistance Variation with Temperature

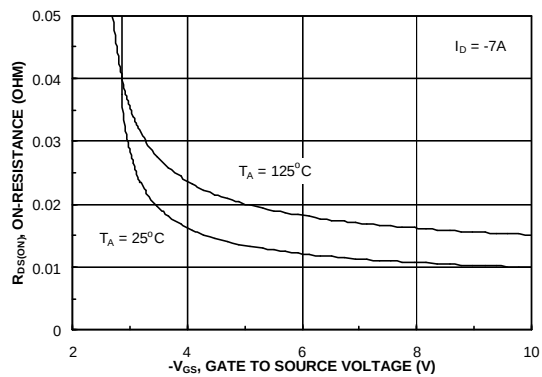


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

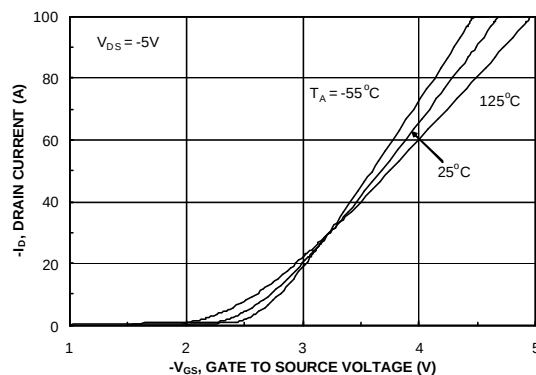


Figure 5. Transfer Characteristics

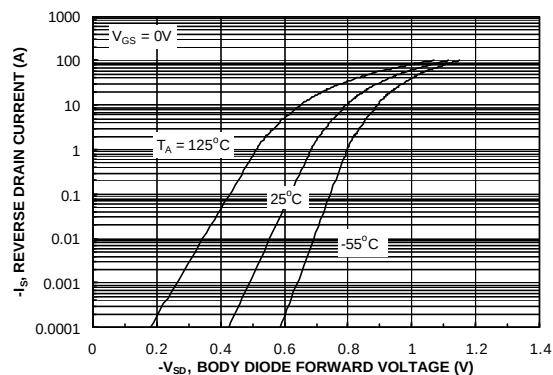


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

## Typical Characteristics

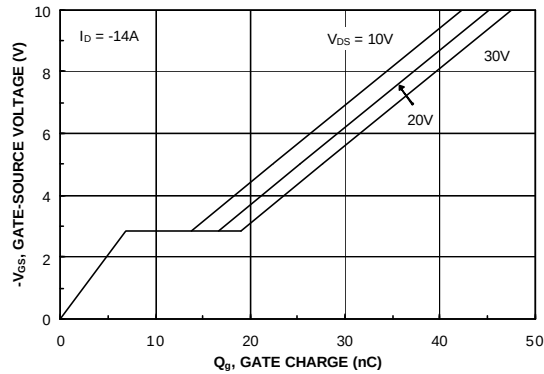


Figure 7. Gate Charge Characteristics

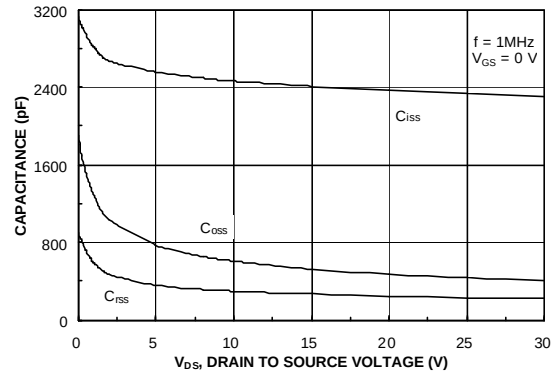


Figure 8. Capacitance Characteristics

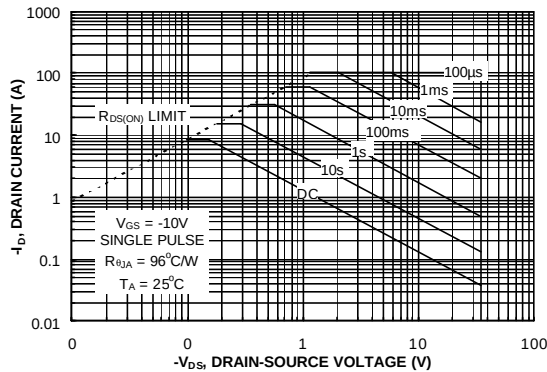


Figure 9. Maximum Safe Operating Area

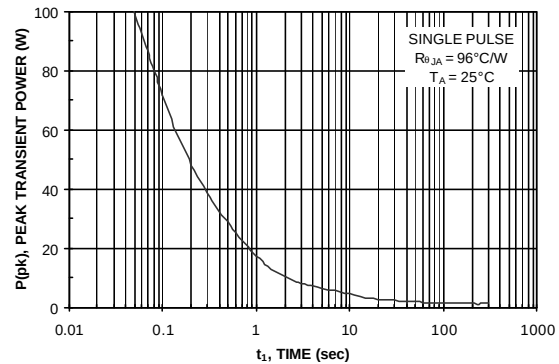


Figure 10. Single Pulse Maximum Power Dissipation

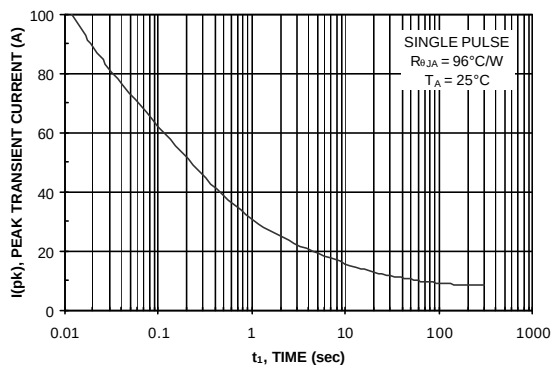


Figure 11. Single Pulse Maximum Peak Current

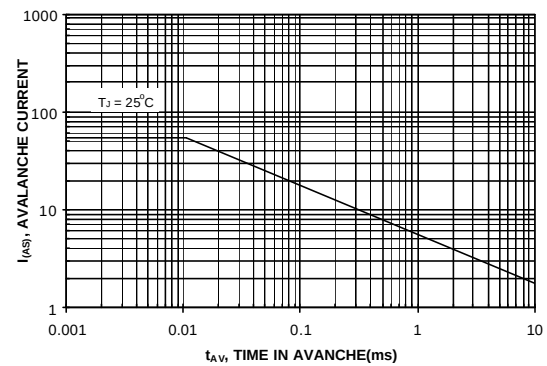
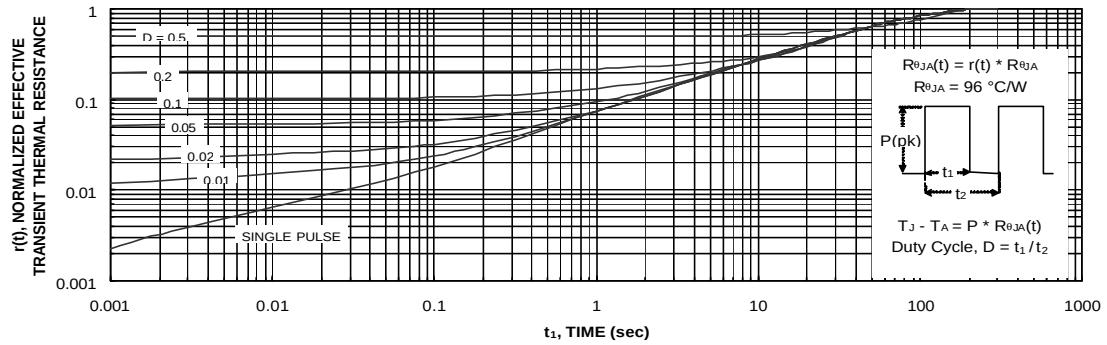


Figure 12. Unclamped Inductive Switching Capability

## Typical Characteristics



**Figure 13. 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.

## Test Circuits and Waveforms

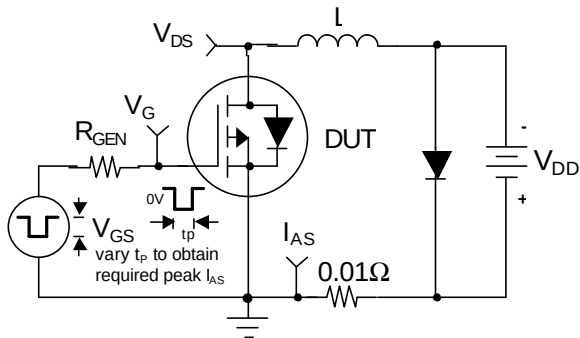


Figure 14. Unclamped Inductive Load Test Circuit

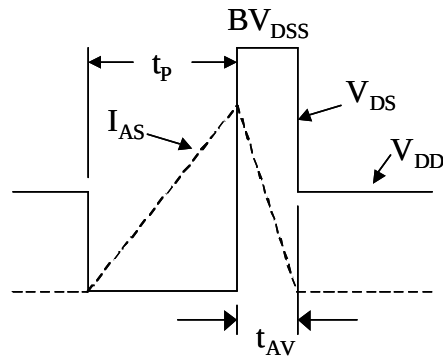


Figure 15. Unclamped Inductive Waveforms

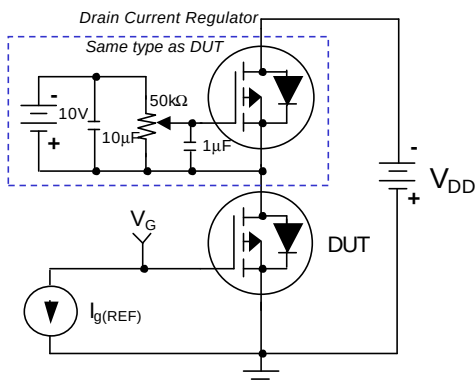


Figure 16. Gate Charge Test Circuit

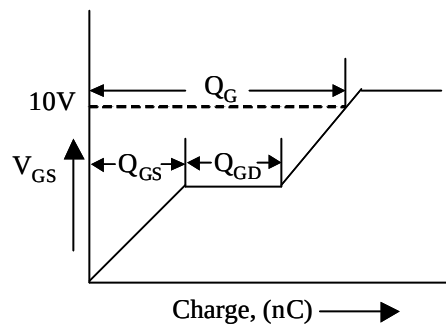


Figure 17. Gate Charge Waveform

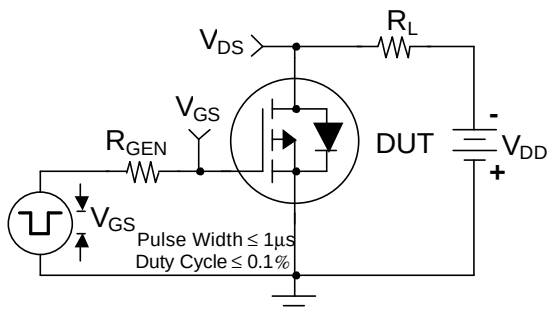


Figure 18. Switching Time Test Circuit

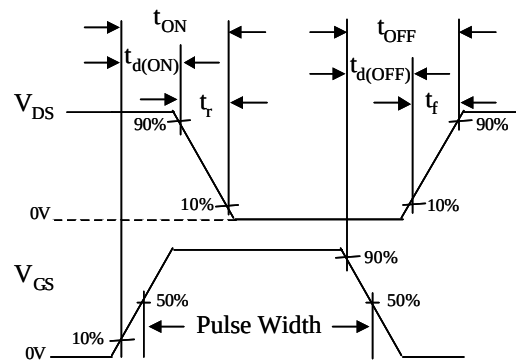
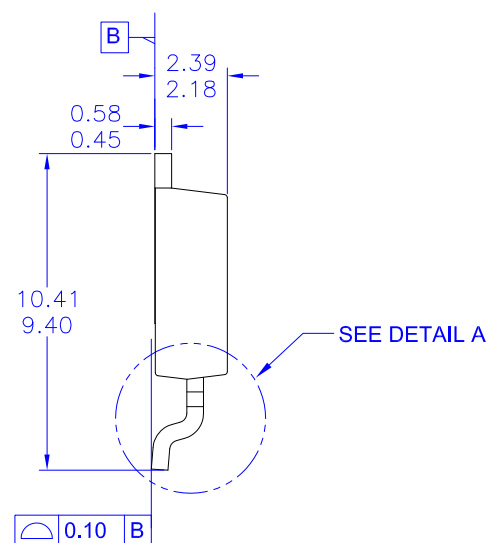
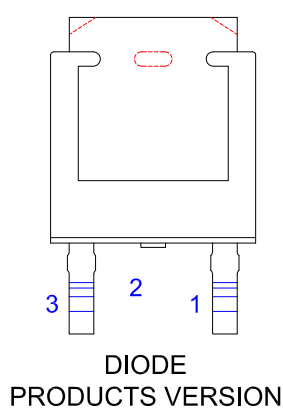
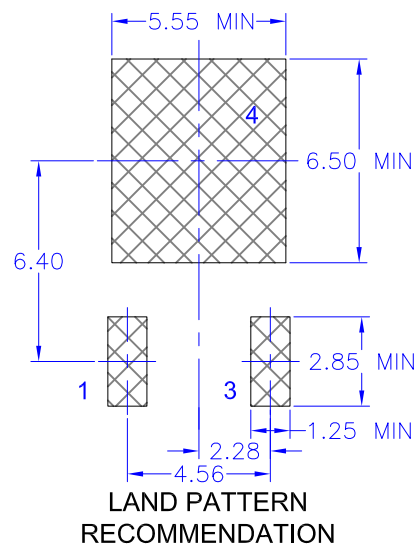
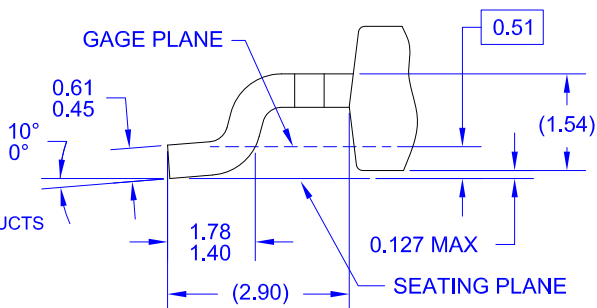


Figure 19. Switching Time Waveforms





H) DRAWING NUMBER AND REVISION: MKT-TO252A03REV11



**DETAIL A**  
(ROTATED -90°)  
SCALE: 12X



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