

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)}$                   | $I_D$<br>$T_A = 25^\circ C$ |
|---------------|--------------------------------|-----------------------------|
| 20V           | 21m $\Omega$ @ $V_{GS} = 10V$  | 17.0A                       |
|               | 27m $\Omega$ @ $V_{GS} = 4.5V$ | 15.0A                       |
|               | 40m $\Omega$ @ $V_{GS} = 2.5V$ | 12.3A                       |

## Description and Applications

This new generation MOSFET has been designed to minimize the on-state resistance ( $R_{DS(on)}$ ) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Backlighting
- DC-DC Converters
- Power management functions

## Features and Benefits

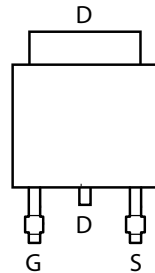
- Low on-resistance
- Fast switching speed
- Low gate drive
- "Green" component and RoHS compliant (Note 1)

## Mechanical Data

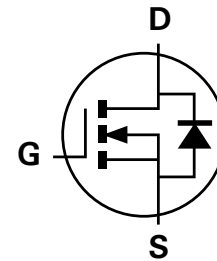
- Case: TO252-3L
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0 (Note 1)
- Moisture Sensitivity: Level 1 per J-STD-020D
- Terminals Connections: See Diagram
- Terminals: Matte Tin Finish annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208
- Marking Information: See Below
- Ordering Information: See Below
- Weight: 0.33 grams (approximate)



TOP VIEW



PIN OUT -TOP VIEW



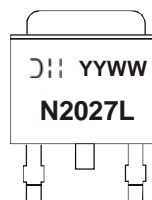
Equivalent Circuit

## Ordering Information (Note 1)

| Product       | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|---------------|---------|--------------------|-----------------|-------------------|
| DMN2027LK3-13 | N2027L  | 13                 | 16              | 2,500             |

Note: 1. Diodes, Inc. defines "Green" products as those which are Eu RoHS compliant and contain no halogens or antimony compounds; further information about Diodes Inc.'s "Green" Policy can be found on our website. For packaging details, go to our website.

## Marking Information



$\text{D}|||$  = Manufacturer's Marking  
 N2027L = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 09 = 2009)  
 WW = Week (01-52)

**Maximum Ratings** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

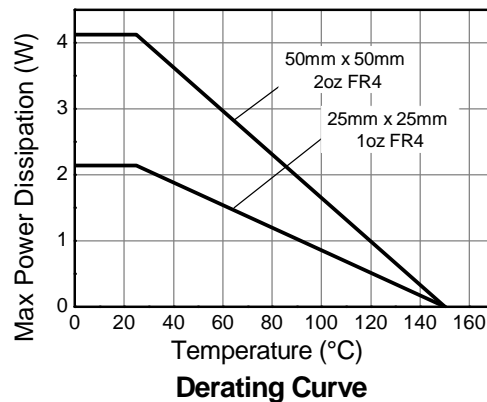
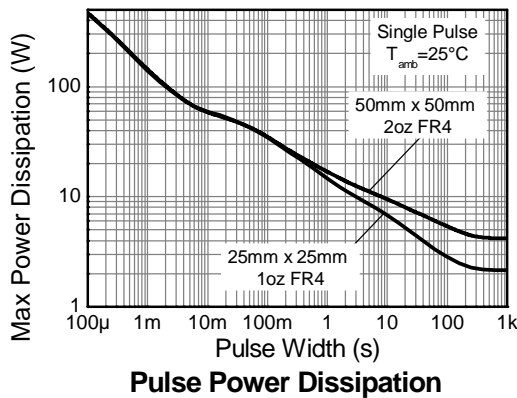
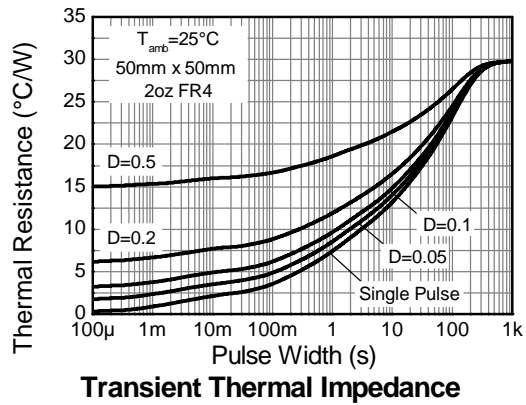
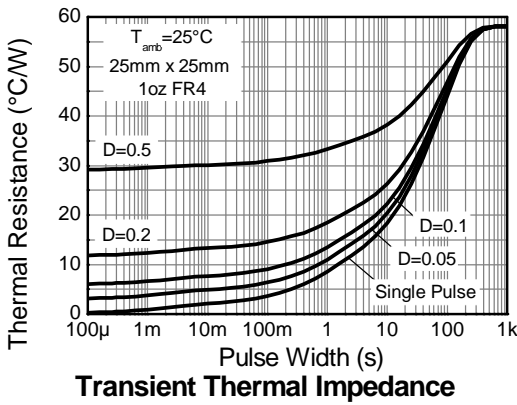
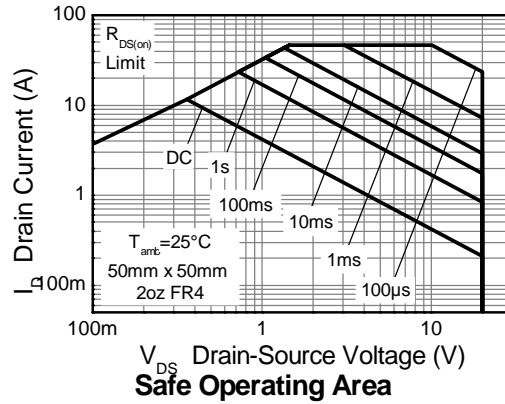
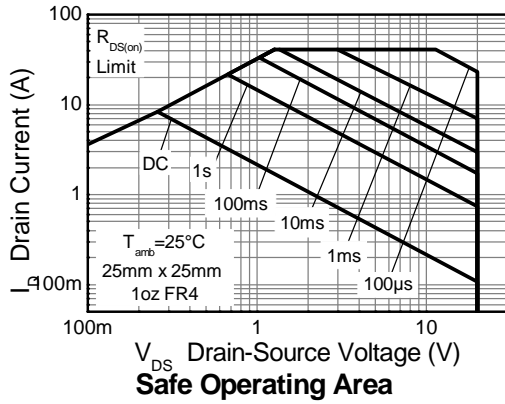
| Characteristic                         |                       |                                   | Symbol    | Value    | Unit |   |
|--|-----------------------|-----------------------------------|-----------|----------|------|---|
| Drain-Source voltage                   |                       |                                   | $V_{DSS}$ | 20       | V    |   |
| Gate-Source voltage                    |                       |                                   | $V_{GS}$  | $\pm 12$ | V    |   |
| Continuous Drain current               | $V_{GS} = 10\text{V}$ | (Note 3)                          | $I_D$     | 17.0     | A    |   |
|  |                       | $T_A = 70^\circ\text{C}$ (Note 3) |           | 13.6     |      |   |
|  |                       | (Note 2)                          |           | 11.6     |      |   |
| Pulsed Drain current                   | $V_{GS} = 10\text{V}$ | (Note 4)                          | $I_{DM}$  | 46.8     | A    |   |
| Continuous Source current (Body diode) |                       |                                   | (Note 3)  | $I_S$    | 11.9 | A |
| Pulsed Source current (Body diode)     |                       |                                   | (Note 4)  | $I_{SM}$ | 46.8 | A |

**Thermal Characteristics** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

| Characteristic                              |          |      | Symbol          | Value      | Unit                      |
|---|----------|------|-----------------|------------|---------------------------|
| Power dissipation<br>Linear derating factor | (Note 2) |      | $P_D$           | 4.18       | W<br>mW/ $^\circ\text{C}$ |
|   |          |      |                 | 33.44      |                           |
|   | (Note 3) |      |                 | 8.9        |                           |
|   |          |      |                 | 71.4       |                           |
|   | (Note 5) |      |                 | 2.14       |                           |
|   |          | 17.1 |                 |            |                           |
| Thermal Resistance, Junction to Ambient     | (Note 2) |      | $R_{\theta JA}$ | 29.9       | $^\circ\text{C/W}$        |
|   | (Note 3) |      |                 | 14.0       |                           |
|   | (Note 5) |      |                 | 58.4       |                           |
| Thermal Resistance, Junction to Lead        | (Note 6) |      | $R_{\theta JL}$ | 2.46       |                           |
| Operating and storage temperature range     |          |      | $T_J, T_{STG}$  | -55 to 150 | $^\circ\text{C}$          |

- Notes:
2. For a device surface mounted on 50mm x 50mm x 1.6mm FR4 PCB with high coverage of single sided 2oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  3. Same as note 2, except the device is measured at  $t \leq 10$  sec.
  4. Same as note 2, except the device is pulsed with  $D = 0.02$  and pulse width 300  $\mu\text{s}$ . The pulse current is limited by the maximum junction temperature.
  5. For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  6. Thermal resistance from junction to solder-point (at the end of the drain lead).

**Thermal Characteristics**

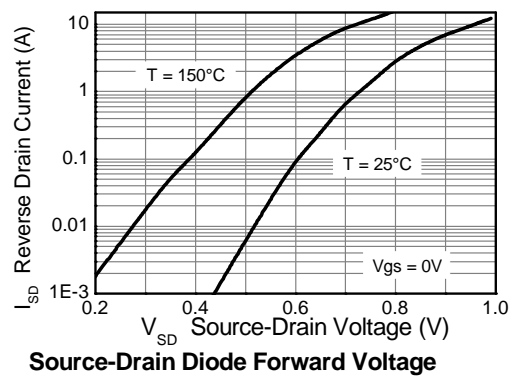
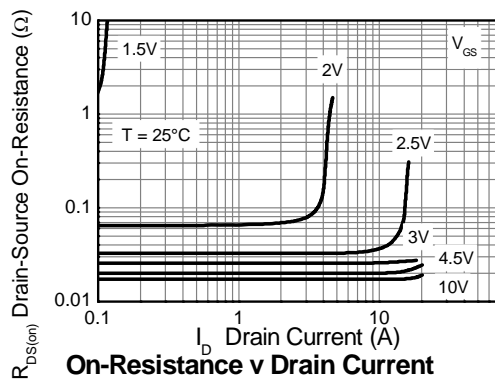
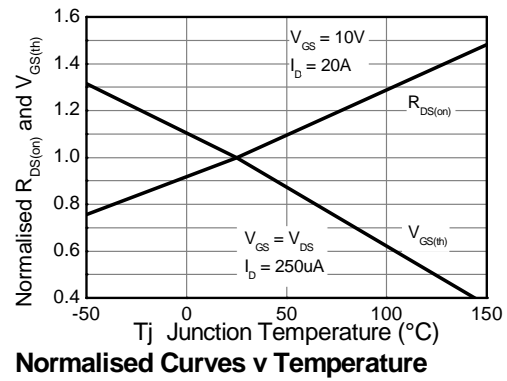
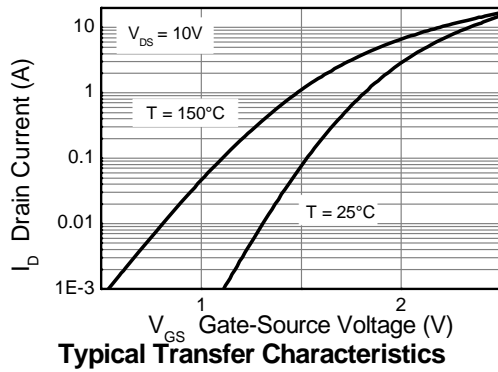
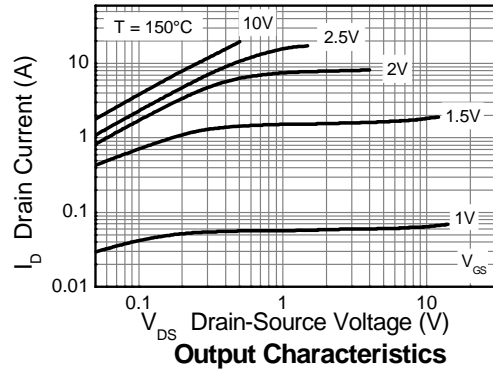
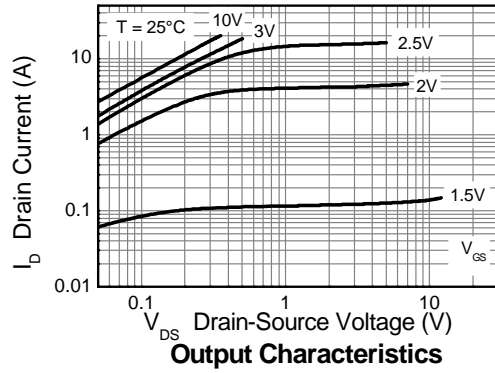


**Electrical Characteristics** @T<sub>A</sub> = 25°C unless otherwise specified

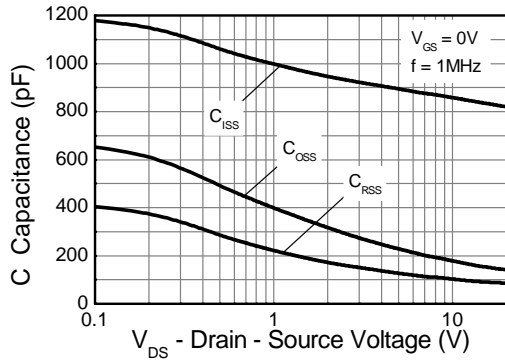
| Characteristic                             | Symbol              | Min | Typ  | Max   | Unit | Test Condition  |
|--|---------------------|-----|------|-------|------|---|
| <b>OFF CHARACTERISTICS</b>                 |                     |     |      |       |      |   |
| Drain-Source Breakdown Voltage             | BV <sub>DSS</sub>   | 20  | —    | —     | V    | I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V  |
| Zero Gate Voltage Drain Current            | I <sub>DSS</sub>    | —   | —    | 0.5   | μA   | V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V   |
| Gate-Source Leakage                        | I <sub>GSS</sub>    | —   | —    | ±100  | nA   | V <sub>GS</sub> = ±12V, V <sub>DS</sub> = 0V  |
| <b>ON CHARACTERISTICS</b>                  |                     |     |      |       |      |   |
| Gate Threshold Voltage                     | V <sub>GS(th)</sub> | 0.6 | —    | 2.0   | V    | I <sub>D</sub> = 250μA, V <sub>DS</sub> = V <sub>GS</sub>                                   |
| Static Drain-Source On-Resistance (Note 7) | R <sub>DS(on)</sub> | —   | —    | 0.021 | Ω    | V <sub>GS</sub> = 10V, I <sub>D</sub> = 20A   |
|  |                     |     |      | 0.027 |      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 10A  |
|  |                     |     |      | 0.040 |      | V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 4A   |
| Forward Transconductance (Notes 7 & 8)     | g <sub>fs</sub>     | —   | 31.7 | —     | S    | V <sub>DS</sub> = 15V, I <sub>D</sub> = 10A   |
| Diode Forward Voltage (Note 7)             | V <sub>SD</sub>     | —   | 0.89 | 1.0   | V    | I <sub>S</sub> = 10A, V <sub>GS</sub> = 0V  |
| Reverse recovery time (Note 8)             | t <sub>rr</sub>     | —   | 121  | —     | ns   | I <sub>S</sub> = 10A, di/dt = 100A/μs   |
| Reverse recovery charge (Note 8)           | Q <sub>rr</sub>     | —   | 583  | —     | nC   |   |
| <b>DYNAMIC CHARACTERISTICS (Note 8)</b>    |                     |     |      |       |      |   |
| Input Capacitance                          | C <sub>iss</sub>    | —   | 857  | —     | pF   | V <sub>DS</sub> = 10V, V <sub>GS</sub> = 0V<br>f = 1MHz                                     |
| Output Capacitance                         | C <sub>oss</sub>    | —   | 177  | —     | pF   |   |
| Reverse Transfer Capacitance               | C <sub>rss</sub>    | —   | 102  | —     | pF   |   |
| Total Gate Charge                          | Q <sub>g</sub>      | —   | 5.2  | —     | nC   | V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 4A   |
| Total Gate Charge                          | Q <sub>g</sub>      | —   | 9.1  | —     | nC   | V <sub>GS</sub> = 4.5V<br>I <sub>D</sub> = 10A  |
| Gate-Source Charge                         | Q <sub>gs</sub>     | —   | 1.9  | —     | nC   |   |
| Gate-Drain Charge                          | Q <sub>gd</sub>     | —   | 3.2  | —     | nC   |   |
| Turn-On Delay Time (Note 9)                | t <sub>D(on)</sub>  | —   | 5.4  | —     | ns   | V <sub>DD</sub> = 10V, V <sub>GS</sub> = 10V<br>I <sub>D</sub> = 10A, R <sub>G</sub> ≅ 6.0Ω |
| Turn-On Rise Time (Note 9)                 | t <sub>r</sub>      | —   | 22.3 | —     | ns   |   |
| Turn-Off Delay Time (Note 9)               | t <sub>D(off)</sub> | —   | 18.7 | —     | ns   |   |
| Turn-Off Fall Time (Note 9)                | t <sub>f</sub>      | —   | 12.6 | —     | ns   |   |

- Notes:
7. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%
  8. For design aid only, not subject to production testing.
  9. Switching characteristics are independent of operating junction temperatures.

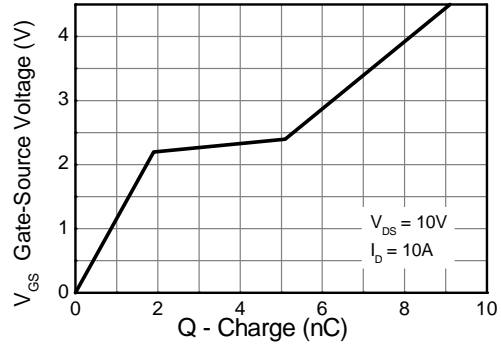
**Typical Characteristics**



**Typical Characteristics - continued**

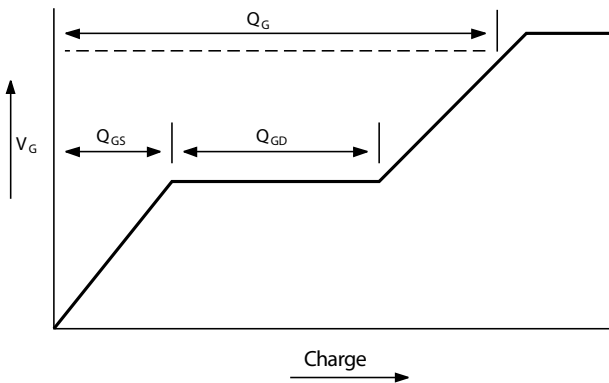


**Capacitance v Drain-Source Voltage**

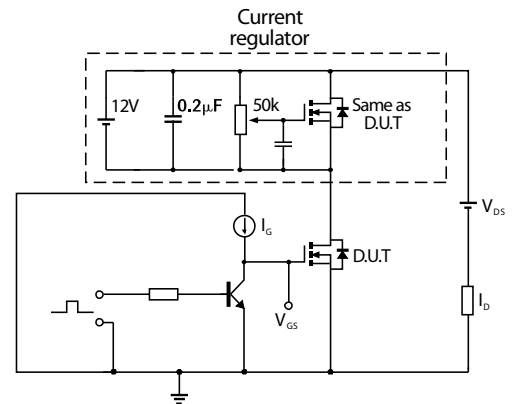


**Gate-Source Voltage v Gate Charge**

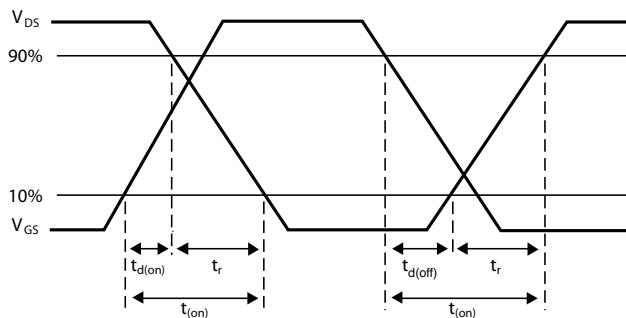
**Test Circuits**



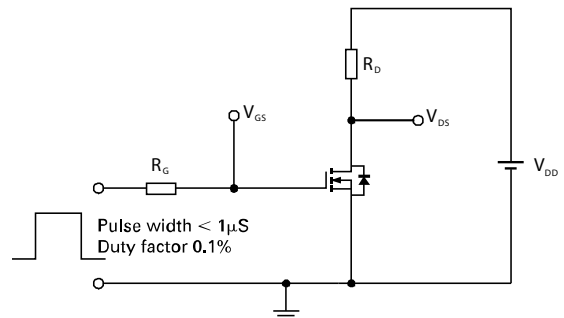
**Basic gate charge waveform**



**Gate charge test circuit**

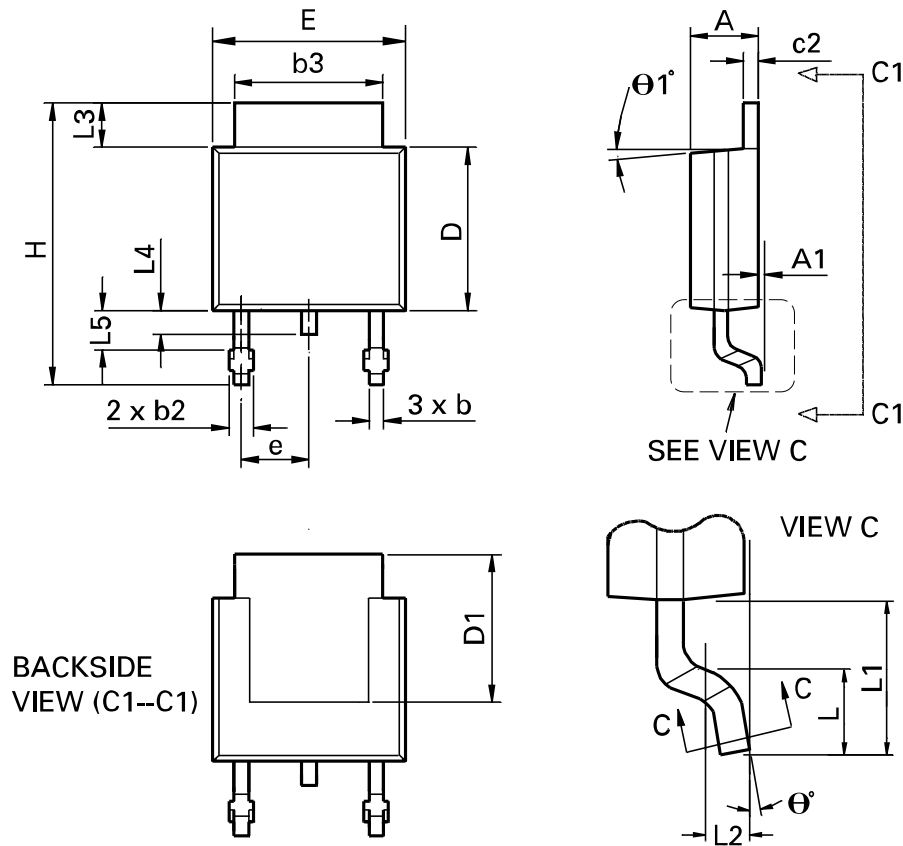


**Switching time waveforms**



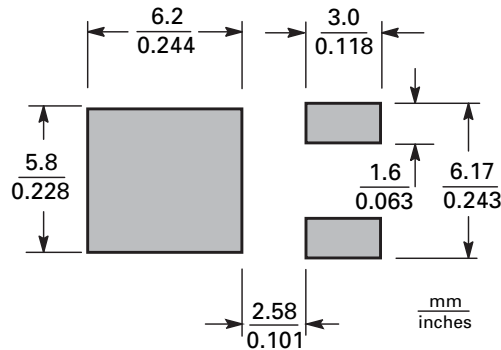
**Switching time test circuit**

**Package Outline Dimensions**



| DIM | Inches |       | Millimeters |       | DIM              | Inches    |       | Millimeters |       |
|-----|--------|-------|-------------|-------|------------------|-----------|-------|-------------|-------|
|     | Min    | Max   | Min         | Max   |                  | Min       | Max   | Min         | Max   |
| A   | 0.086  | 0.094 | 2.18        | 2.39  | e                | 0.090 BSC |       | 2.29 BSC    |       |
| A1  | -      | 0.005 | -           | 0.127 | H                | 0.370     | 0.410 | 9.40        | 10.41 |
| b   | 0.020  | 0.035 | 0.508       | 0.89  | L                | 0.055     | 0.070 | 1.40        | 1.78  |
| b2  | 0.030  | 0.045 | 0.762       | 1.14  | L1               | 0.108 REF |       | 2.74 REF    |       |
| b3  | 0.205  | 0.215 | 5.21        | 5.46  | L2               | 0.020 BSC |       | 0.508 BSC   |       |
| c   | 0.018  | 0.024 | 0.457       | 0.61  | L3               | 0.035     | 0.065 | 0.89        | 1.65  |
| c2  | 0.018  | 0.023 | 0.457       | 0.584 | L4               | 0.025     | 0.040 | 0.635       | 1.016 |
| D   | 0.213  | 0.245 | 5.41        | 6.22  | L5               | 0.045     | 0.060 | 1.14        | 1.52  |
| D1  | 0.205  | -     | 5.21        | -     | $\theta_1^\circ$ | 0°        | 10°   | 0°          | 10°   |
| E   | 0.250  | 0.265 | 6.35        | 6.73  | $\theta^\circ$   | 0°        | 15°   | 0°          | 15°   |
| E1  | 0.170  | -     | 4.32        | -     | -                | -         | -     | -           | -     |

## Suggested Pad Layout



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