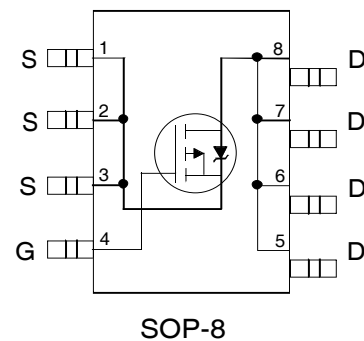


## Features

- $V_{DS} = -55V$
- $R_{DS(ON)} < 40\ m\Omega$  ( $V_{GS} = -4.5V$ )
- $R_{DS(ON)} < 60\ m\Omega$  ( $V_{GS} = -2.7V$ )
- Generation V Technology
- Ultra Low On-Resistance
- Surface Mount
- Dynamic  $dv/dt$  Rating
- Fast Switching
- Lead-Free



## Description

The SOP-8 has been modified through a customized eadframe for enhanced thermal characteristics and multiple-die capability making it ideal in a variety of power applications. With these improvements, multiple devices can be used in an application with dramatically reduced board space. The package is designed for vapor phase, infra red, or wave soldering techniques. Power dissipation of greater than 0.8W is possible in a typical PCB mount application.

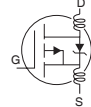
## Absolute Maximum Ratings

|                            | Parameter                                      | Max.         | Units         |
|----------------------------|------------------------------------------------|--------------|---------------|
| $I_D$ @ $T_A = 25^\circ C$ | 10 Sec. Pulsed Drain Current, $V_{GS} @ -4.5V$ | -7.7         | A             |
| $I_D$ @ $T_A = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ -4.5V$     | -6.7         |               |
| $I_D$ @ $T_A = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ -4.5V$     | -5.4         |               |
| $I_{DM}$                   | Pulsed Drain Current ①                         | -27          |               |
| $P_D$ @ $T_A = 25^\circ C$ | Power Dissipation                              | 2.5          | W             |
|                            | Linear Derating Factor                         | 0.02         | W/ $^\circ C$ |
| $V_{GS}$                   | Gate-to-Source Voltage                         | $\pm 12$     | V             |
| $dv/dt$                    | Peak Diode Recovery $dv/dt$ ②                  | -5.0         | V/ns          |
| $T_J, T_{STG}$             | Junction and Storage Temperature Range         | -55 to + 150 | $^\circ C$    |

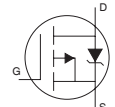
## Thermal Resistance Ratings

|                 | Parameter                     | Typ. | Max. | Units        |
|-----------------|-------------------------------|------|------|--------------|
| $R_{\theta JA}$ | Maximum Junction-to-Ambient ④ |      | 50   | $^\circ C/W$ |

### Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

|                                 | Parameter                            | Min.  | Typ.   | Max.        | Units               | Conditions                                                                                                                      |
|---------------------------------|--------------------------------------|-------|--------|-------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | -20   |        |             | V                   | $V_{GS} = 0V, I_D = -250\mu A$                                                                                                  |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  |       | -0.012 |             | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}$ , $I_D = -1\text{mA}$                                                                           |
| $R_{DS(ON)}$                    | Static Drain-to-Source On-Resistance |       |        | 40<br>60    | $m\Omega$           | $V_{GS} = -4.5V, I_D = -3.2A$ ③<br>$V_{GS} = -2.7V, I_D = -2.7A$ ③                                                              |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | -0.70 |        |             | V                   | $V_{DS} = V_{GS}, I_D = -250\mu A$                                                                                              |
| $g_{fs}$                        | Forward Transconductance             | 6.8   |        |             | S                   | $V_{DS} = -15V, I_D = -3.2A$                                                                                                    |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      |       |        | -1.0<br>-25 | $\mu A$             | $V_{DS} = -16V, V_{GS} = 0V$<br>$V_{DS} = -16V, V_{GS} = 0V, T_J = 125^\circ\text{C}$                                           |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       |       |        | -100        | nA                  | $V_{GS} = -12V$                                                                                                                 |
|                                 | Gate-to-Source Reverse Leakage       |       |        | 100         | nA                  | $V_{GS} = 12V$                                                                                                                  |
| $Q_g$                           | Total Gate Charge                    |       |        | 50          | nC                  | $I_D = -3.2A$                                                                                                                   |
| $Q_{gs}$                        | Gate-to-Source Charge                |       |        | 5.5         | nC                  | $V_{DS} = -16V$                                                                                                                 |
| $Q_{gd}$                        | Gate-to-Drain ("Miller") Charge      |       |        | 21          | nC                  | $V_{GS} = -4.5V$ , See Fig. 6 and 12 ③                                                                                          |
| $t_{d(on)}$                     | Turn-On Delay Time                   |       | 14     |             | ns                  | $V_{DD} = -10V$<br>$I_D = -3.2A$<br>$R_G = 6.0\Omega$<br>$R_D = 3.1\Omega$ , See Fig. 10 ③                                      |
| $t_r$                           | Rise Time                            |       | 32     |             | ns                  |                                                                                                                                 |
| $t_{d(off)}$                    | Turn-Off Delay Time                  |       | 100    |             | ns                  |                                                                                                                                 |
| $t_f$                           | Fall Time                            |       | 65     |             | ns                  |                                                                                                                                 |
| $L_D$                           | Internal Drain Inductance            |       | 2.5    |             | nH                  | Between lead tip and center of die contact  |
| $L_S$                           | Internal Source Inductance           |       | 4.0    |             | nH                  |                                                                                                                                 |
| $C_{iss}$                       | Input Capacitance                    |       | 1500   |             | pF                  | $V_{GS} = 0V$                                                                                                                   |
| $C_{oss}$                       | Output Capacitance                   |       | 730    |             | pF                  | $V_{DS} = -15V$                                                                                                                 |
| $C_{rss}$                       | Reverse Transfer Capacitance         |       | 340    |             | pF                  | $f = 1.0\text{MHz}$ , See Fig. 5                                                                                                |

### Source-Drain Ratings and Characteristics

|          | Parameter                              | Min. | Typ. | Max. | Units   | Conditions                                                                                                                                           |
|----------|----------------------------------------|------|------|------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current (Body Diode) |      |      | -3.1 | A       | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   |      |      | -27  | A       |                                                                                                                                                      |
| $V_{SD}$ | Diode Forward Voltage                  |      |      | -1.0 | V       | $T_J = 25^\circ\text{C}, I_S = -2.0A, V_{GS} = 0V$ ③                                                                                                 |
| $t_{rr}$ | Reverse Recovery Time                  |      | 69   | 100  | ns      | $T_J = 25^\circ\text{C}, I_F = -3.2A$                                                                                                                |
| $Q_{rr}$ | Reverse Recovery Charge                |      | 71   | 110  | $\mu C$ | $di/dt = 100A/\mu s$ ③                                                                                                                               |
| $t_{on}$ | Forward Turn-On Time                   |      |      |      |         | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ )                                                                          |

#### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )
- ②  $I_{SD} \leq -3.2A$ ,  $di/dt \leq -65A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 150^\circ\text{C}$
- ③ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ④ Surface mounted on FR-4 board,  $t \leq 10\text{sec}$ .

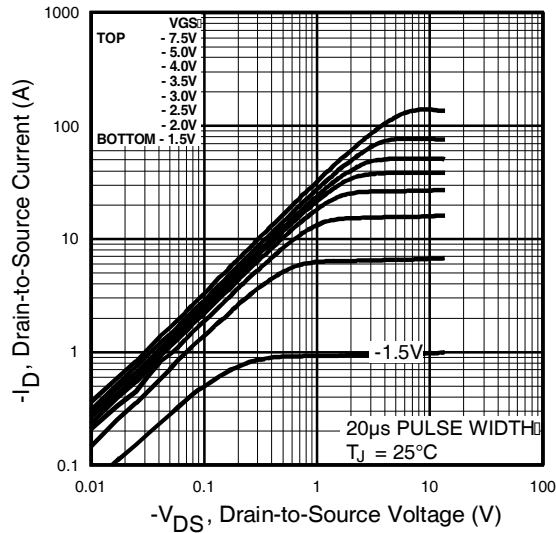


Fig 1. Typical Output Characteristics

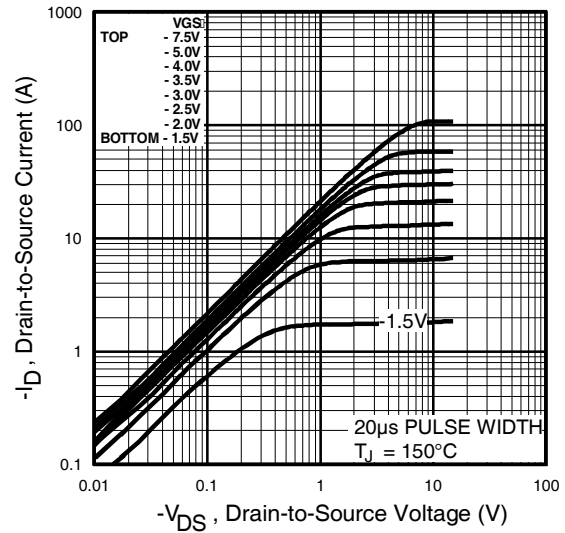


Fig 2. Typical Output Characteristics

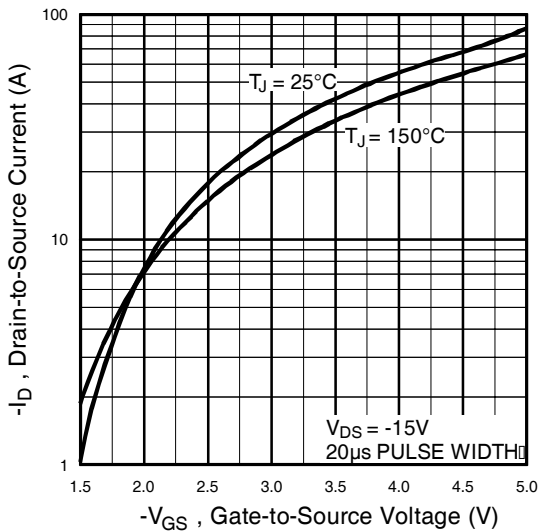


Fig 3. Typical Transfer Characteristics

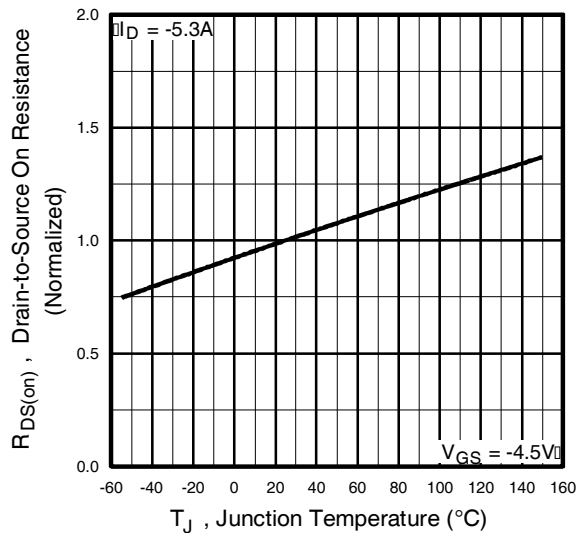
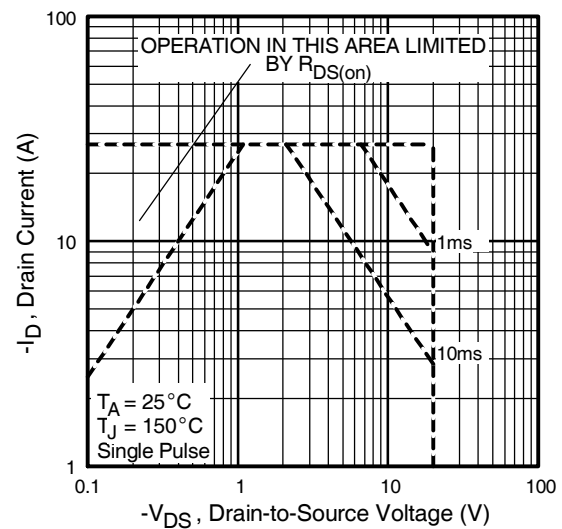
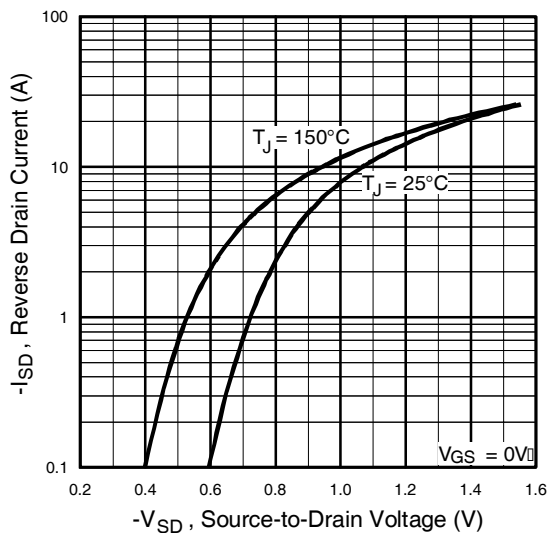
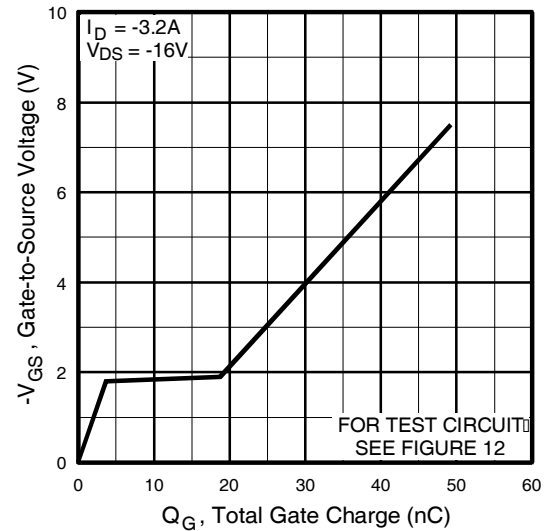
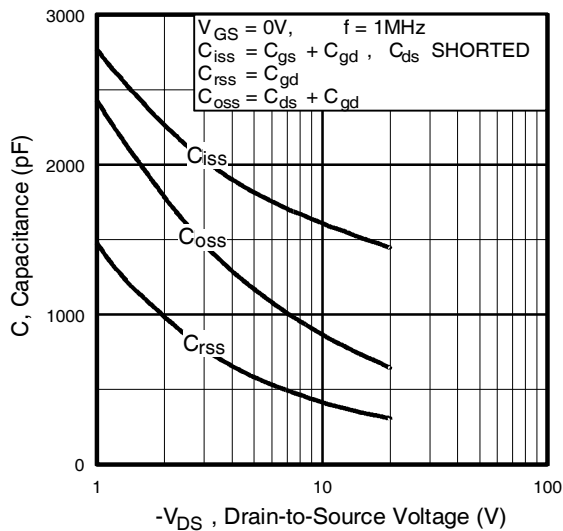
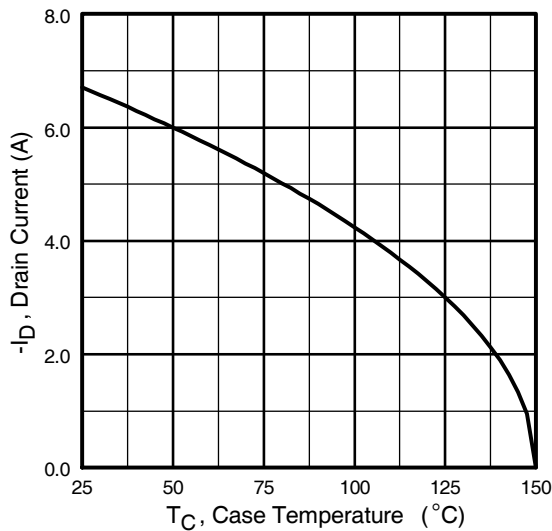
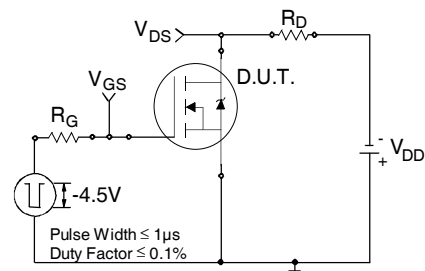


Fig 4. Normalized On-Resistance Vs. Temperature

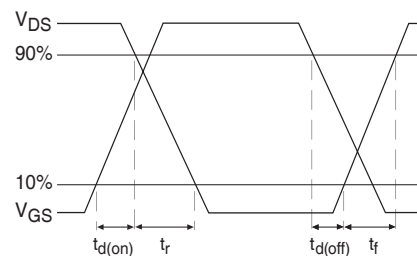




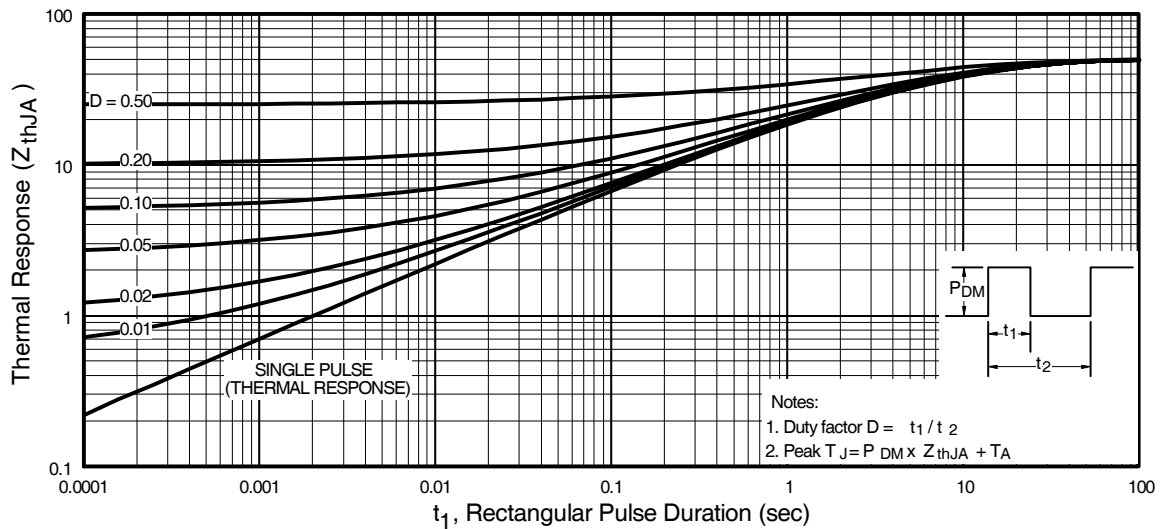
**Fig 9.** Maximum Drain Current Vs. Ambient Temperature



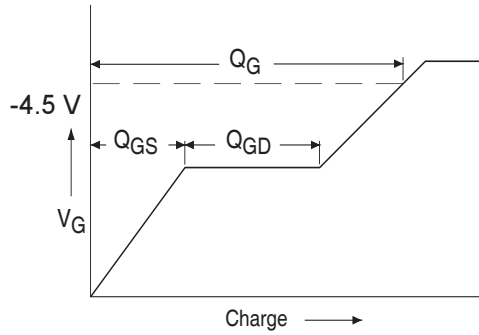
**Fig 10a.** Switching Time Test Circuit



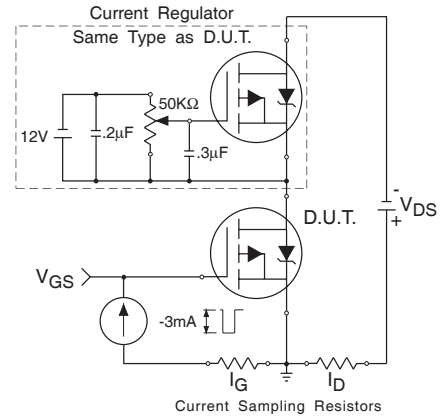
**Fig 10b.** Switching Time Waveforms



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

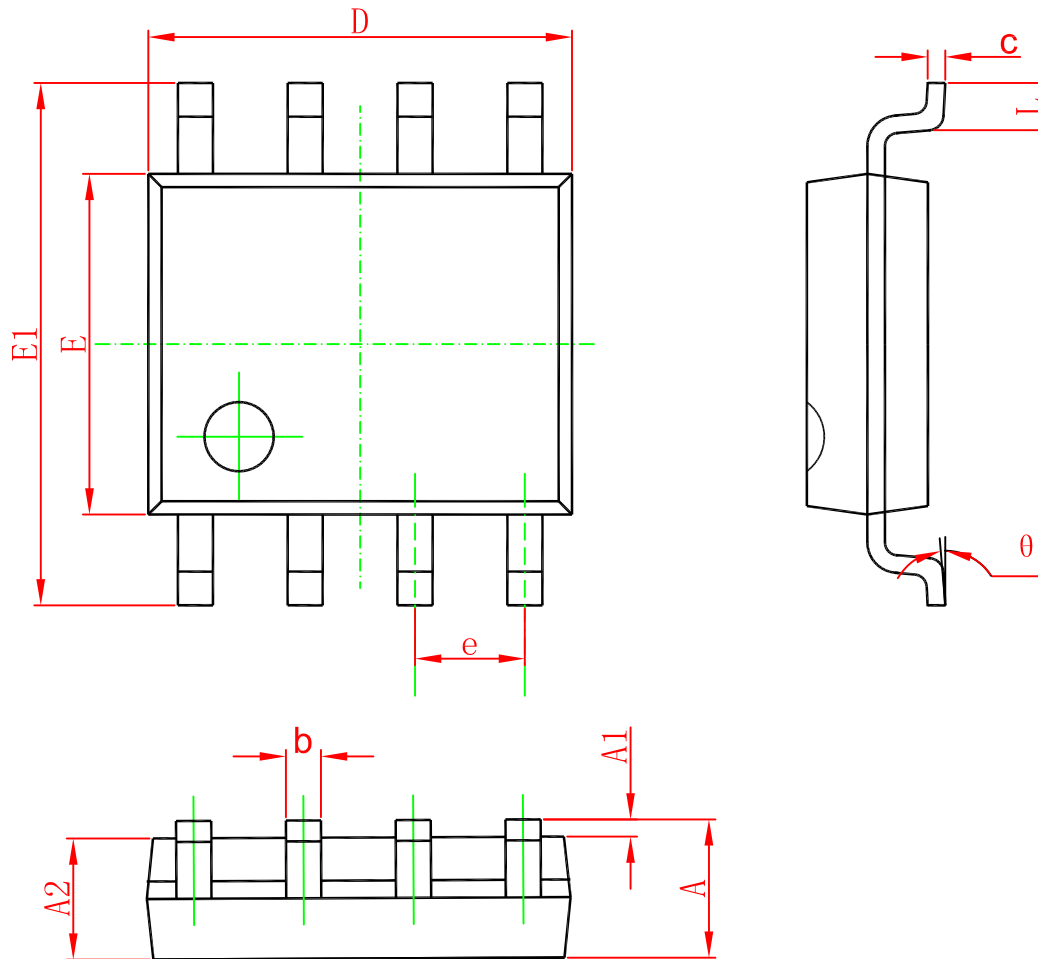


**Fig 12a.** Basic Gate Charge Waveform



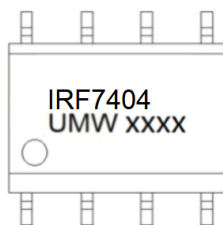
**Fig 12b.** Gate Charge Test Circuit

SOP-8



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.350                     | 1.750 | 0.053                | 0.069 |
| A1     | 0.100                     | 0.250 | 0.004                | 0.010 |
| A2     | 1.350                     | 1.550 | 0.053                | 0.061 |
| b      | 0.330                     | 0.510 | 0.013                | 0.020 |
| c      | 0.170                     | 0.250 | 0.006                | 0.010 |
| D      | 4.700                     | 5.100 | 0.185                | 0.200 |
| E      | 3.800                     | 4.000 | 0.150                | 0.157 |
| E1     | 5.800                     | 6.200 | 0.228                | 0.244 |
| e      | 1.270(BSC)                |       | 0.050(BSC)           |       |
| L      | 0.400                     | 1.270 | 0.016                | 0.050 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

## Marking



## Ordering information

| Order code    | Package | Baseqty | Deliverymode  |
|---------------|---------|---------|---------------|
| UMW IRF7404TR | SOP-8   | 3000    | Tape and reel |