

## FU120N-VB Datasheet

### N-Channel 100-V (D-S) MOSFET

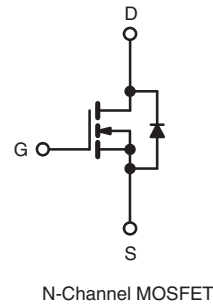
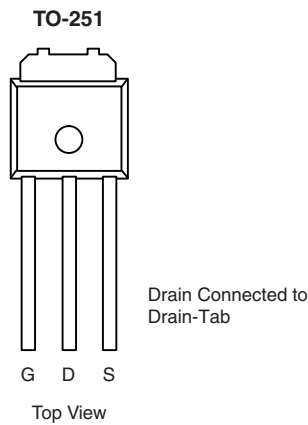
| PRODUCT SUMMARY           |                        |      |
|---------------------------|------------------------|------|
| $V_{DS}$ (V)              | 100                    |      |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 0.20 |
| $Q_g$ (Max.) (nC)         | 16                     |      |
| $Q_{gs}$ (nC)             | 4.4                    |      |
| $Q_{gd}$ (nC)             | 7.7                    |      |
| Configuration             | Single                 |      |

#### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Available in Tape and Reel
- Dynamic  $dV/dt$  Rating
- Repetitive Avalanche Rated
- 175 °C Operating Temperature
- Fast Switching
- Ease of Paralleling



**RoHS\***  
Available  
**HALOGEN**  
**FREE**  
Available



| ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted) |                         |                         |                                   |                  |      |
|---------------------------------------------------------------------------|-------------------------|-------------------------|-----------------------------------|------------------|------|
| PARAMETER                                                                 |                         |                         | SYMBOL                            | LIMIT            | UNIT |
| Drain-Source Voltage                                                      |                         |                         | V <sub>DS</sub>                   | 100              | V    |
| Gate-Source Voltage                                                       |                         |                         | V <sub>GS</sub>                   | ± 20             |      |
| Continuous Drain Current                                                  | V <sub>GS</sub> at 10 V | T <sub>C</sub> = 25 °C  | I <sub>D</sub>                    | 12               | A    |
|                                                                           |                         | T <sub>C</sub> = 100 °C |                                   | 7.5              |      |
| Pulsed Drain Current <sup>a</sup>                                         |                         |                         | I <sub>DM</sub>                   | 37               |      |
| Linear Derating Factor                                                    |                         |                         |                                   | 0.40             |      |
| Linear Derating Factor (PCB Mount)                                        |                         |                         |                                   | 0.025            |      |
| Single Pulse Avalanche Energy <sup>b</sup>                                |                         |                         | E <sub>AS</sub>                   | 200              | mJ   |
| Avalanche Current <sup>a</sup>                                            |                         |                         | I <sub>AR</sub>                   | 9.2              | A    |
| Repetitive Avalanche Energy <sup>a</sup>                                  |                         |                         | E <sub>AR</sub>                   | 6.0              | mJ   |
| Maximum Power Dissipation                                                 | T <sub>C</sub> = 25 °C  |                         | P <sub>D</sub>                    | 60               | W    |
| Maximum Power Dissipation (PCB Mount)                                     | T <sub>A</sub> = 25 °C  |                         |                                   | 3.7              |      |
| Peak Diode Recovery dV/dt <sup>c</sup>                                    |                         |                         | dV/dt                             | 5.5              | V/ns |
| Operating Junction and Storage Temperature Range                          |                         |                         | T <sub>J</sub> , T <sub>stg</sub> | - 55 to + 175    | °C   |
| Soldering Recommendations (Peak Temperature)                              | For 10 s                |                         |                                   | 300 <sup>d</sup> |      |

#### Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).  
 b.  $V_{DD} = 25\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 3.5\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 9.2\text{ A}$  (see fig. 12).  
 c.  $I_{SD} \leq 9.2\text{ A}$ ,  $dI/dt \leq 110\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 175\text{ }^\circ\text{C}$ .

**THERMAL RESISTANCE RATINGS**

| PARAMETER                                            | SYMBOL     | TYP. | MAX. | UNIT |
|------------------------------------------------------|------------|------|------|------|
| Maximum Junction-to-Ambient                          | $R_{thJA}$ | -    | 62   | °C/W |
| Maximum Junction-to-Ambient (PCB Mount) <sup>a</sup> | $R_{thJA}$ | -    | 40   |      |
| Maximum Junction-to-Case (Drain)                     | $R_{thJC}$ | -    | 2.5  |      |

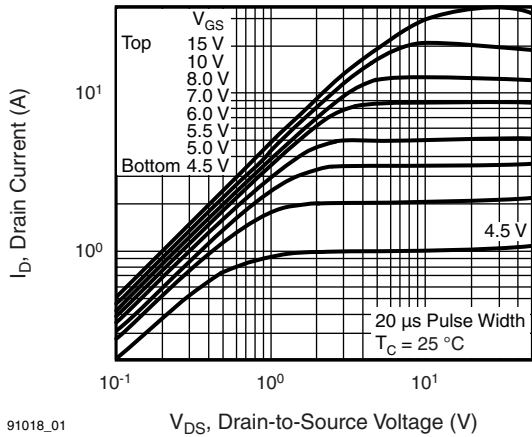
**SPECIFICATIONS** ( $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

| PARAMETER                                 | SYMBOL                           | TEST CONDITIONS                                                                                                            |                                                                                   | MIN. | TYP. | MAX.  | UNIT |
|-------------------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|------|-------|------|
| Static                                    |                                  |                                                                                                                            |                                                                                   |      |      |       |      |
| Drain-Source Breakdown Voltage            | V <sub>DS</sub>                  | V <sub>GS</sub> = 0, I <sub>D</sub> = 250 μA                                                                               |                                                                                   | 100  | -    | -     | V    |
| V <sub>DS</sub> Temperature Coefficient   | ΔV <sub>DS</sub> /T <sub>J</sub> | Reference to 25 °C, I <sub>D</sub> = 1 mA                                                                                  |                                                                                   | -    | 0.13 | -     | V/°C |
| Gate-Source Threshold Voltage             | V <sub>GS(th)</sub>              | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                                |                                                                                   | 1.0  | -    | 3.0   | V    |
| Gate-Source Leakage                       | I <sub>GSS</sub>                 | V <sub>GS</sub> = ± 20 V                                                                                                   |                                                                                   | -    | -    | ± 100 | nA   |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>                 | V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V                                                                             |                                                                                   | -    | -    | 25    | μA   |
|                                           |                                  | V <sub>DS</sub> = 80 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150 °C                                                     |                                                                                   | -    | -    | 250   |      |
| Drain-Source On-State Resistance          | R <sub>DS(on)</sub>              | V <sub>GS</sub> = 10 V                                                                                                     | I <sub>D</sub> = 5.5 A <sup>b</sup>                                               | -    | 0.20 | -     | Ω    |
| Forward Transconductance                  | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 5.5 A <sup>b</sup>                                                                |                                                                                   | 2.7  | -    | -     | S    |
| Dynamic                                   |                                  |                                                                                                                            |                                                                                   |      |      |       |      |
| Input Capacitance                         | C <sub>iss</sub>                 | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 25 V,<br>f = 1.0 MHz, see fig. 5                                               |                                                                                   | -    | 360  | -     | pF   |
| Output Capacitance                        | C <sub>oss</sub>                 |                                                                                                                            |                                                                                   | -    | 150  | -     |      |
| Reverse Transfer Capacitance              | C <sub>rss</sub>                 |                                                                                                                            |                                                                                   | -    | 34   | -     |      |
| Total Gate Charge                         | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V                                                                                                     | I <sub>D</sub> = 9.2 A, V <sub>DS</sub> = 80 V,<br>see fig. 6 and 13 <sup>b</sup> | -    | -    | 16    | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>                  |                                                                                                                            |                                                                                   | -    | -    | 4.4   |      |
| Gate-Drain Charge                         | Q <sub>gd</sub>                  |                                                                                                                            |                                                                                   | -    | -    | 7.7   |      |
| Turn-On Delay Time                        | t <sub>d(on)</sub>               | V <sub>DD</sub> = 50 V, I <sub>D</sub> = 9.2 A,<br>R <sub>g</sub> = 18 Ω, R <sub>D</sub> = 5.2 Ω, see fig. 10 <sup>b</sup> |                                                                                   | -    | 8.8  | -     | ns   |
| Rise Time                                 | t <sub>r</sub>                   |                                                                                                                            |                                                                                   | -    | 30   | -     |      |
| Turn-Off Delay Time                       | t <sub>d(off)</sub>              |                                                                                                                            |                                                                                   | -    | 19   | -     |      |
| Fall Time                                 | t <sub>f</sub>                   |                                                                                                                            |                                                                                   | -    | 20   | -     |      |
| Internal Drain Inductance                 | L <sub>D</sub>                   | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact                                                 |                                                                                   | -    | 4.5  | -     | nH   |
| Internal Source Inductance                | L <sub>S</sub>                   |                                                                                                                            |                                                                                   | -    | 7.5  | -     |      |
| Drain-Source Body Diode Characteristics   |                                  |                                                                                                                            |                                                                                   |      |      |       |      |
| Continuous Source-Drain Diode Current     | I <sub>S</sub>                   | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode                                                   |                                                                                   | -    | -    | 9.2   | A    |
| Pulsed Diode Forward Current <sup>a</sup> | I <sub>SM</sub>                  |                                                                                                                            |                                                                                   | -    | -    | 37    |      |
| Body Diode Voltage                        | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 9.2 A, V <sub>GS</sub> = 0 V <sup>b</sup>                                         |                                                                                   | -    | -    | 1.8   | V    |
| Body Diode Reverse Recovery Time          | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 9.2 A, dI/dt = 100 A/μs <sup>b</sup>                                              |                                                                                   | -    | 110  | 260   | ns   |
| Body Diode Reverse Recovery Charge        | Q <sub>rr</sub>                  |                                                                                                                            |                                                                                   | -    | 0.53 | 1.3   | μC   |
| Forward Turn-On Time                      | t <sub>on</sub>                  | Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )                          |                                                                                   |      |      |       |      |

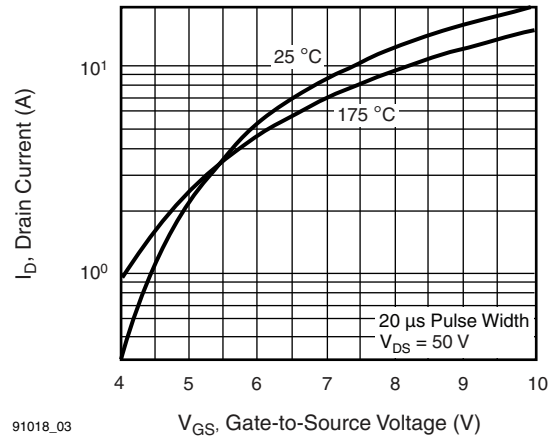
**Notes**

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).  
 b. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\text{ }\%$ .

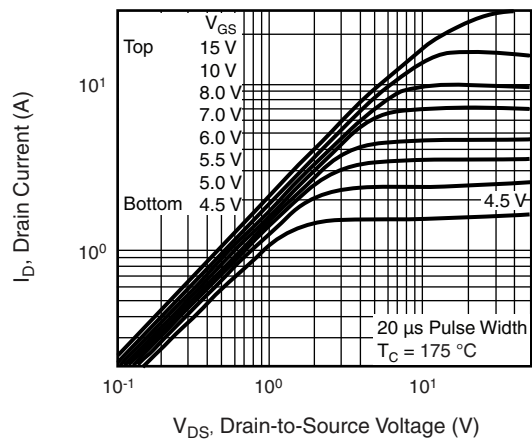
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



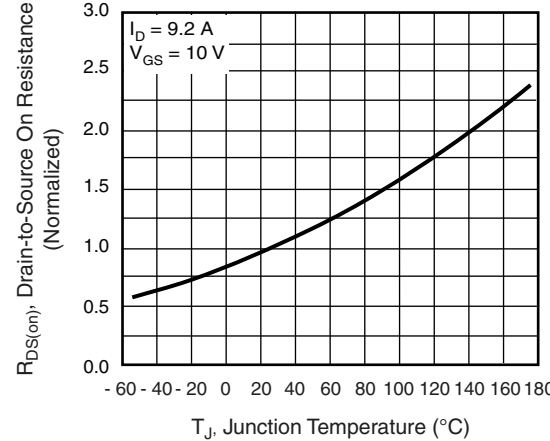
**Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ }^{\circ}\text{C}$**



**Fig. 3 - Typical Transfer Characteristics**



**Fig. 2 - Typical Output Characteristics,  $T_C = 175\text{ }^{\circ}\text{C}$**



**Fig. 4 - Normalized On-Resistance vs. Temperature**

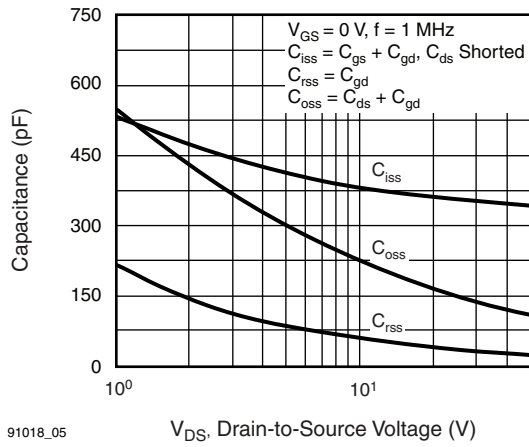


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

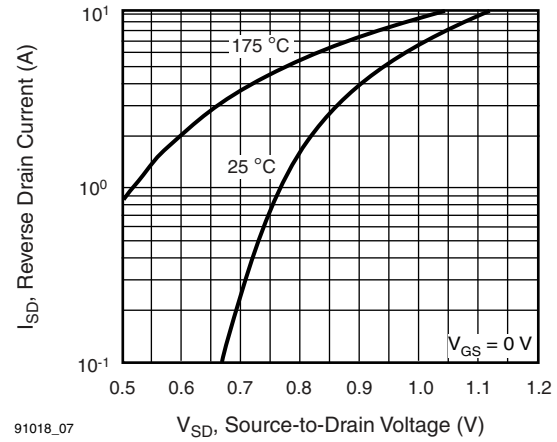


Fig. 7 - Typical Source-Drain Diode Forward Voltage

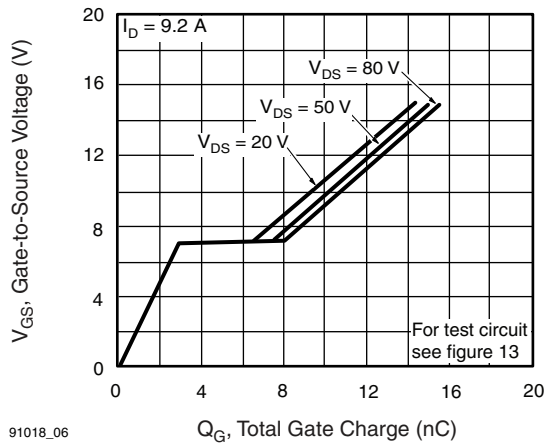


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

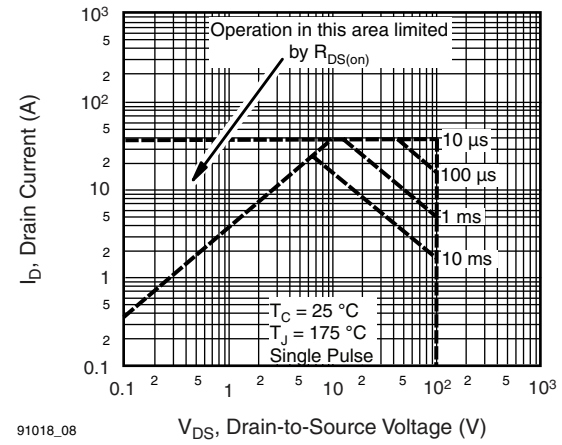


Fig. 8 - Maximum Safe Operating Area

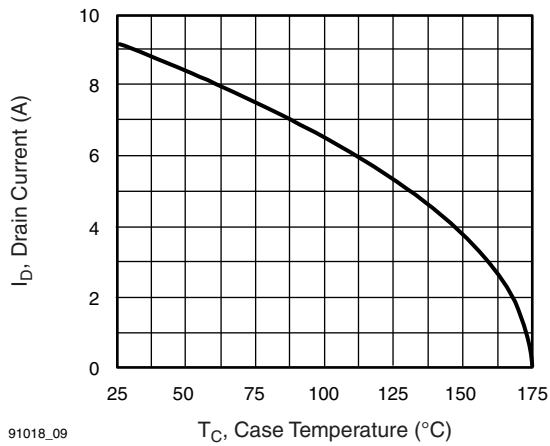


Fig. 9 - Maximum Drain Current vs. Case Temperature

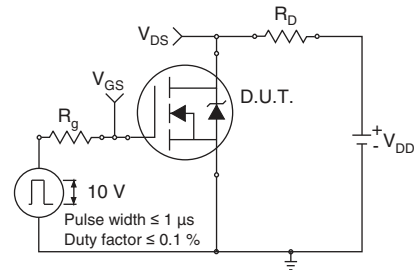


Fig. 10a - Switching Time Test Circuit

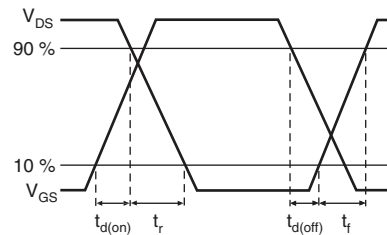


Fig. 10b - Switching Time Waveforms

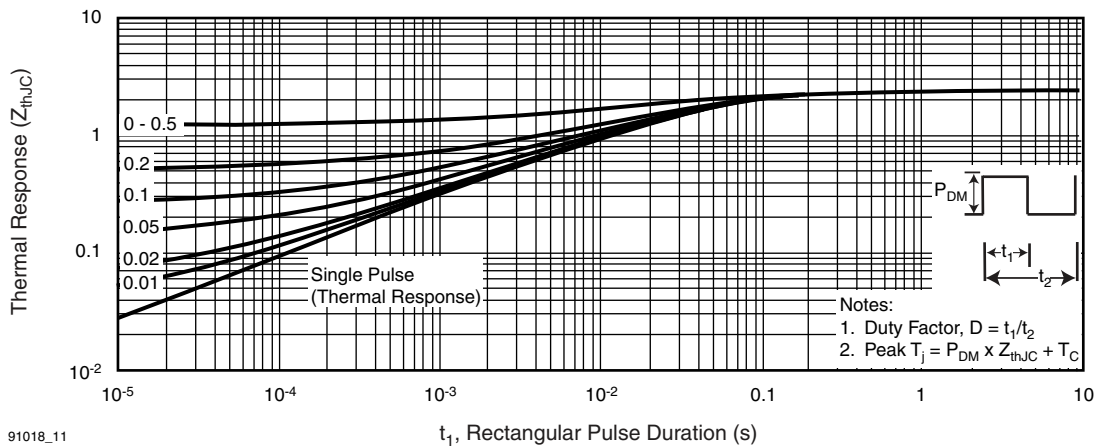


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

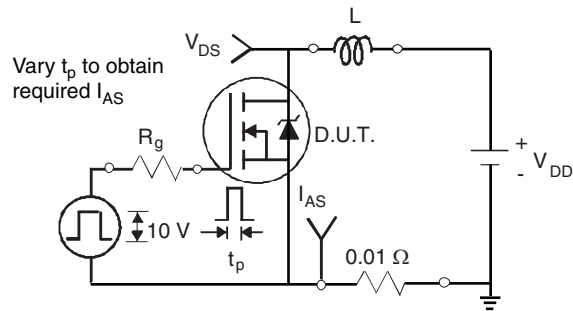


Fig. 12a - Unclamped Inductive Test Circuit

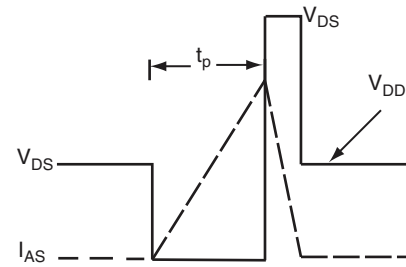


Fig. 12b - Unclamped Inductive Waveforms

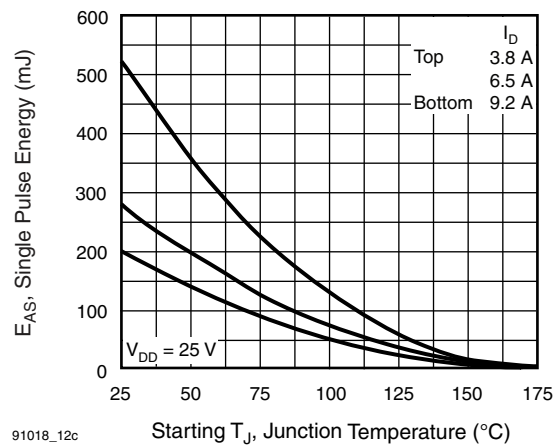


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

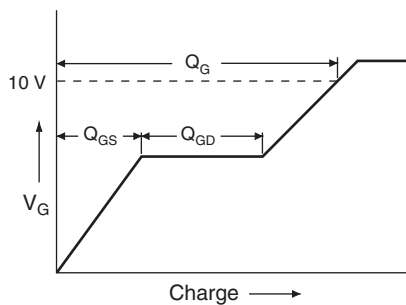


Fig. 13a - Basic Gate Charge Waveform

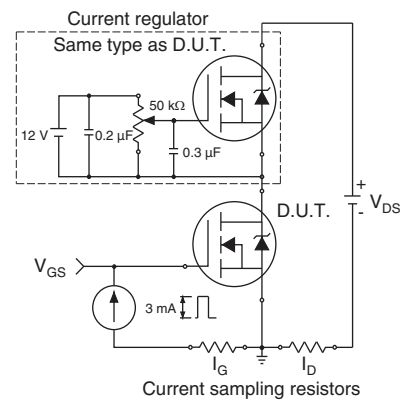
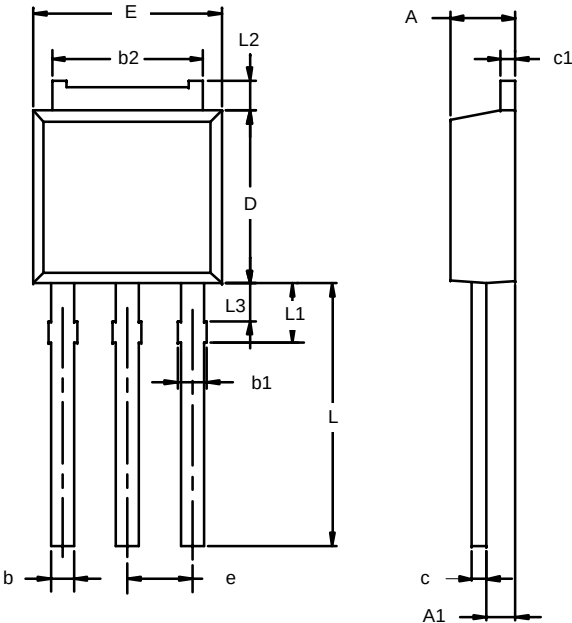


Fig. 13b - Gate Charge Test Circuit



TO-251AA



Note: Dimension L3 is for reference only.

| Dim | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | Min         | Max  | Min       | Max   |
| A   | 2.21        | 2.38 | 0.087     | 0.094 |
| A1  | 0.89        | 1.14 | 0.035     | 0.045 |
| b   | 0.71        | 0.89 | 0.028     | 0.035 |
| b1  | 0.76        | 1.14 | 0.030     | 0.045 |
| b2  | 5.23        | 5.43 | 0.206     | 0.214 |
| c   | 0.46        | 0.58 | 0.018     | 0.023 |
| c1  | 0.46        | 0.58 | 0.018     | 0.023 |
| D   | 5.97        | 6.22 | 0.235     | 0.245 |
| E   | 6.48        | 6.73 | 0.255     | 0.265 |
| e   | 2.28 BSC    |      | 0.090 BSC |       |
| L   | 3.89        | 9.53 | 0.153     | 0.375 |
| L1  | 1.91        | 2.28 | 0.075     | 0.090 |
| L2  | 0.89        | 1.27 | 0.035     | 0.050 |
| L3  | 1.15        | 1.52 | 0.045     | 0.060 |



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