



# STW26NM60

N-CHANNEL 600V - 0.125Ω - 30A TO-247

MDmesh™ MOSFET

**Table 1: General Features**

| TYPE      | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-----------|------------------|---------------------|----------------|
| STW26NM60 | 600 V            | < 0.135 Ω           | 30 A           |

- TYPICAL R<sub>DS(on)</sub> = 0.125 Ω
- HIGH dv/dt AND AVALANCHE CAPABILITIES
- IMPROVED ESD CAPABILITY
- LOW INPUT CAPACITANCE AND GATE CHARGE
- LOW GATE INPUT RESISTANCE

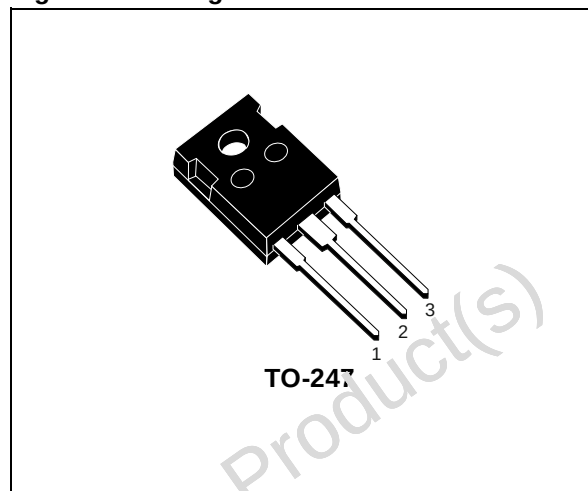
## DESCRIPTION

The MDmesh™ is a new revolutionary MOSFET technology that associates the Multiple Drain process with the Company's PowerMESH™ horizontal layout. The resulting product has an outstanding low on-resistance, impressively high dv/dt and excellent avalanche characteristics. The adoption of the Company's proprietary strip technique yields overall dynamic performance that is significantly better than that of similar competition's products.

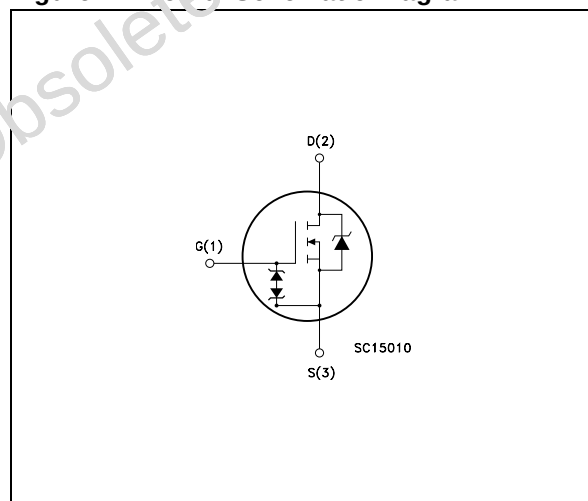
## APPLICATIONS

The MDmesh™ family is very suitable for increasing power density of high voltage converters allowing system miniaturization and higher efficiencies.

**Figure 1: Package**



**Figure 2: Internal Schematic Diagram**



**Table 2: Order Codes**

| SALES TYPE | MARKING | PACKAGE | PACKAGING |
|------------|---------|---------|-----------|
| STW26NM60  | W26NM60 | TO-247  | TUBE      |

Table 3: Absolute Maximum ratings

| Symbol             | Parameter                                               | Value      | Unit                |
|--------------------|---------------------------------------------------------|------------|---------------------|
| $V_{DS}$           | Drain-source Voltage ( $V_{GS} = 0$ )                   | 600        | V                   |
| $V_{DGR}$          | Drain-gate Voltage ( $R_{GS} = 20\text{ k}\Omega$ )     | 600        | V                   |
| $V_{GS}$           | Gate- source Voltage                                    | $\pm 30$   | V                   |
| $I_D$              | Drain Current (continuous) at $T_C = 25^\circ\text{C}$  | 30         | A                   |
| $I_D$              | Drain Current (continuous) at $T_C = 100^\circ\text{C}$ | 18.9       | A                   |
| $I_{DM}(\bullet)$  | Drain Current (pulsed)                                  | 120        | A                   |
| $P_{TOT}$          | Total Dissipation at $T_C = 25^\circ\text{C}$           | 313        | W                   |
|                    | Derating Factor                                         | 2.5        | W/ $^\circ\text{C}$ |
| $V_{ESD(G-S)}$     | Gate source ESD(HBM-C=100pF, R=1.5K $\Omega$ )          | 6000       | V                   |
| $dv/dt(1)$         | Peak Diode Recovery voltage slope                       | 15         | V/ns                |
| $T_j$<br>$T_{stg}$ | Operating Junction Temperature<br>Storage Temperature   | -55 to 150 | $^\circ\text{C}$    |

( $\bullet$ ) Pulse width limited by safe operating area

(1)  $I_{SD} \leq 26\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{JMAX}$ .

Table 4: Thermal Data

|                |                                                |      |                           |
|----------------|------------------------------------------------|------|---------------------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case Max           | 0.4  | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$  | Thermal Resistance Junction-ambient Max        | 62.5 | $^\circ\text{C}/\text{W}$ |
| $T_I$          | Maximum Lead Temperature For Soldering Purpose | 300  | $^\circ\text{C}$          |

Table 5: Avalanche Characteristics

| Symbol   | Parameter                                                                                                    | Max Value | Unit |
|----------|--------------------------------------------------------------------------------------------------------------|-----------|------|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max)                           | 13        | A    |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j = 25^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ ) | 740       | mJ   |

## ELECTRICAL CHARACTERISTICS ( $T_{CASE} = 25^\circ\text{C}$ UNLESS OTHERWISE SPECIFIED)

Table 6: Gate-Source Zener Diode

| Symbol     | Parameter                     | Test Conditions                         | Min. | Typ. | Max. | Unit |
|------------|-------------------------------|-----------------------------------------|------|------|------|------|
| $BV_{GSO}$ | Gate-Source Breakdown Voltage | $I_{gss} = \pm 1\text{mA}$ (Open Drain) | 30   |      |      | V    |

## PROTECTION FEATURES OF GATE-TO-SOURCE ZENER DIODES

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

Table 7: On /Off

| Symbol        | Parameter                                        | Test Conditions                                                                 | Min. | Typ.  | Max.      | Unit               |
|---------------|--------------------------------------------------|---------------------------------------------------------------------------------|------|-------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage                   | $I_D = 250 \mu A, V_{GS} = 0$                                                   | 600  |       |           | V                  |
| $I_{DSS}$     | Zero Gate Voltage Drain Current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max Rating}$<br>$V_{DS} = \text{Max Rating}, T_C = 125^\circ C$ |      |       | 10<br>100 | $\mu A$<br>$\mu A$ |
| $I_{GSS}$     | Gate-body Leakage Current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20 V$                                                             |      |       | $\pm 10$  | $\mu A$            |
| $V_{GS(th)}$  | Gate Threshold Voltage                           | $V_{DS} = V_{GS}, I_D = 250 \mu A$                                              | 3    | 4     | 5         | V                  |
| $R_{DS(on)}$  | Static Drain-source On Resistance                | $V_{GS} = 10 V, I_D = 13 A$                                                     |      | 0.125 | 0.135     | $\Omega$           |

Table 8: Dynamic

| Symbol                                        | Parameter                                                               | Test Conditions                                                                       | Min. | Typ.                 | Max. | Unit                 |
|-----------------------------------------------|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------|----------------------|------|----------------------|
| $g_{fs} (1)$                                  | Forward Transconductance                                                | $V_{DS} = 15 V, I_D = 13 A$                                                           |      | 20                   |      | S                    |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$           | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | $V_{DS} = 25 V, f = 1 \text{ MHz},$<br>$V_{GS} = 0$                                   |      | 2900<br>900<br>40    |      | pF<br>pF<br>pF       |
| $C_{oss \text{ eq}} (3)$                      | Equivalent Output Capacitance                                           | $V_{GS} = 0 V, V_{DS} = 0 \text{ to } 400 V$                                          |      | 300                  |      | pF                   |
| $t_{d(on)}$<br>$t_r$<br>$t_{d(off)}$<br>$t_f$ | Turn-on Delay Time<br>Rise Time<br>Turn-off-Delay Time<br>Fall Time     | $V_{DD} = 300 V, I_D = 13 A,$<br>$R_G = 4.7 \Omega, V_{GS} = 10 V$<br>(see Figure 15) |      | 35<br>22<br>14<br>20 |      | ns<br>ns<br>ns<br>ns |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$                 | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge            | $V_{DD} = 480 V, I_D = 26 A,$<br>$V_{GS} = 10 V$<br>(see Figure 18)                   |      | 73<br>20<br>37       | 102  | nC<br>nC<br>nC       |

Table 9: Source Drain Diode

| Symbol                            | Parameter                                                                    | Test Conditions                                                                               | Min. | Typ.             | Max.      | Unit               |
|-----------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------|------------------|-----------|--------------------|
| $I_{SD}$<br>$I_{SDM} (2)$         | Source-drain Current<br>Source-drain Current (pulsed)                        |                                                                                               |      |                  | 26<br>104 | A<br>A             |
| $V_{SD} (1)$                      | Forward On Voltage                                                           | $I_{SD} = 26 A, V_{GS} = 0$                                                                   |      |                  | 1.5       | V                  |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 26 A, di/dt = 100 A/\mu s$<br>$V_{DD} = 100V$<br>(see Figure 16)                    |      | 450<br>7<br>30.5 |           | ns<br>$\mu C$<br>A |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 26 A, di/dt = 100 A/\mu s$<br>$V_{DD} = 100V, T_j = 150^\circ C$<br>(see Figure 16) |      | 560<br>9<br>32.5 |           | ns<br>$\mu C$<br>A |

(1) Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.

(2) Pulse width limited by safe operating area.

(3)  $C_{oss \text{ eq}}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$ .

Figure 3: Safe Operating Area

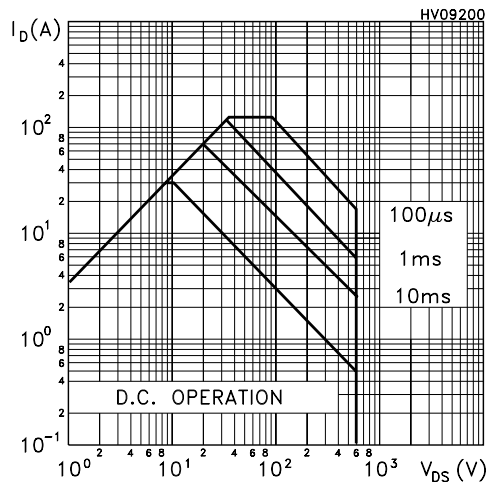


Figure 4: Output Characteristics

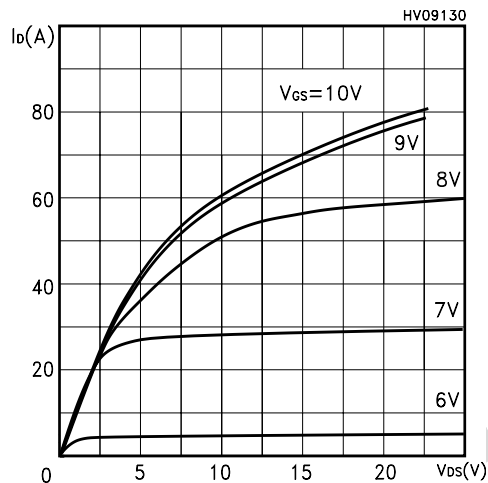


Figure 5: Transconductance

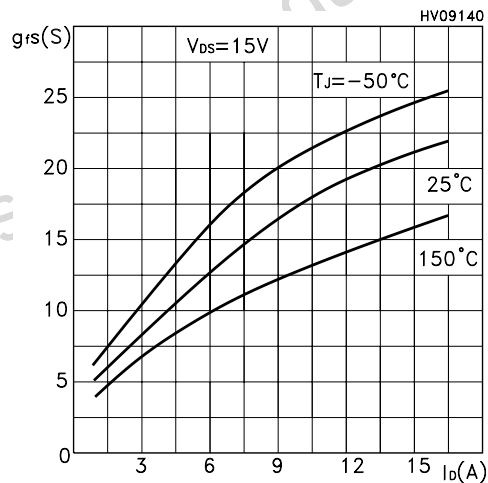


Figure 6: Thermal Impedance

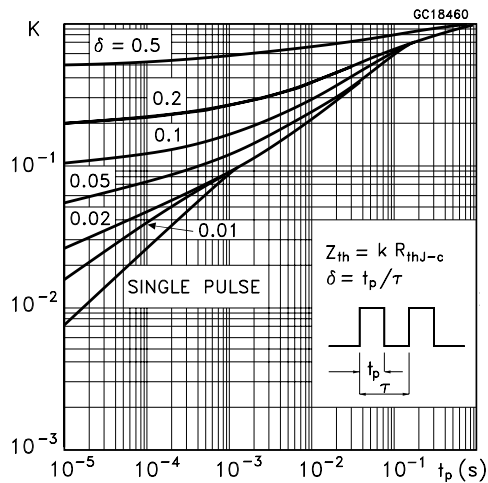


Figure 7: Transfer Characteristics

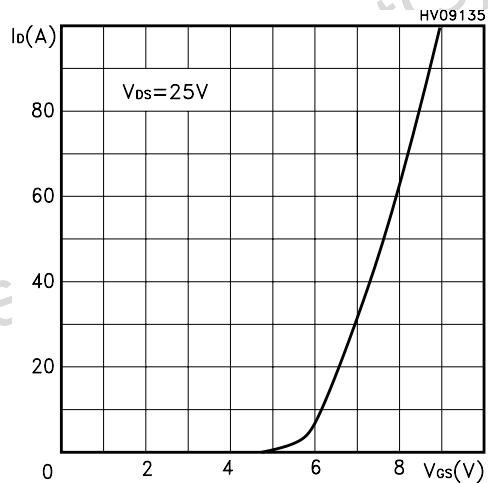


Figure 8: Static Drain-source On Resistance

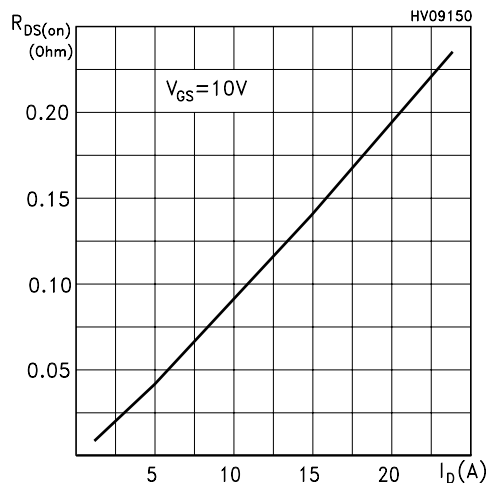


Figure 9: Gate Charge vs Gate-source Voltage

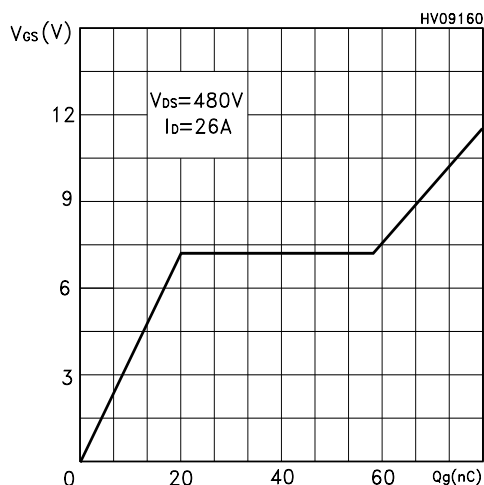


Figure 10: Normalized Gate Threshold Voltage vs Temperature

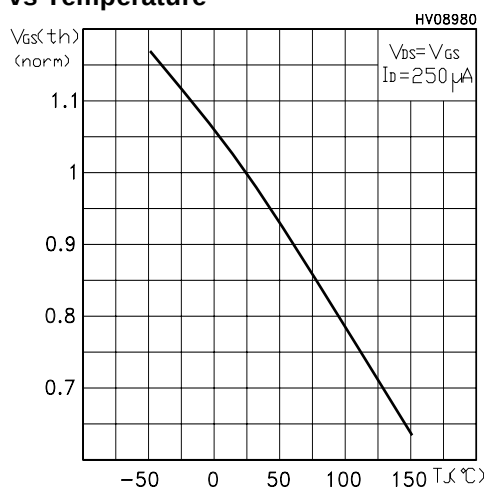


Figure 11: Dource-Drain Diode Forward Characteristics

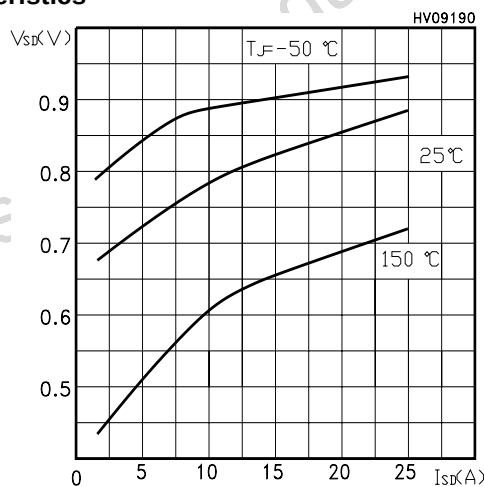


Figure 12: Capacitance Variations

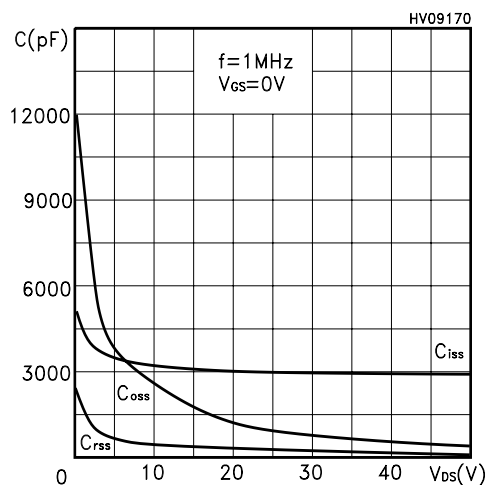
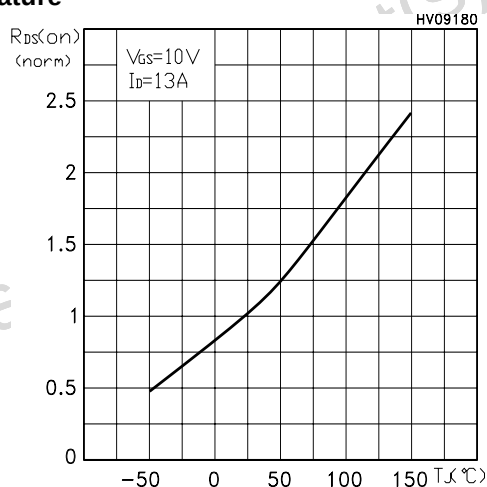
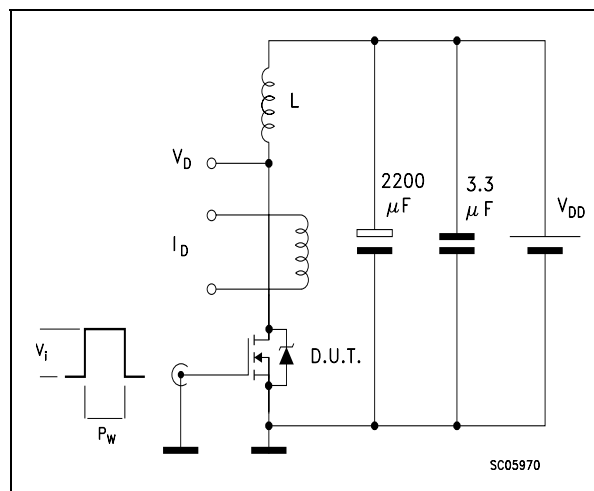


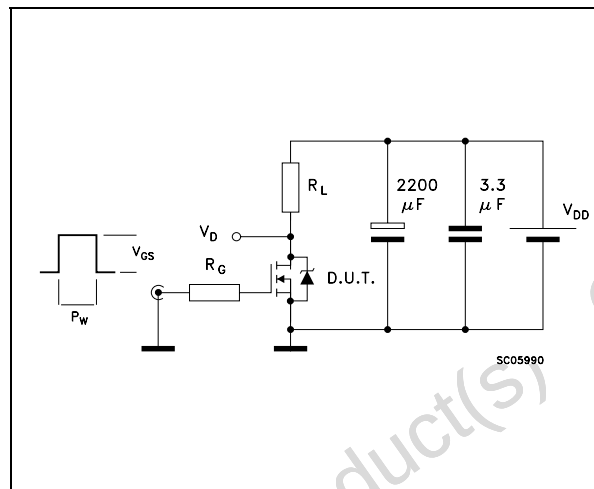
Figure 13: Normalized On Resistance vs Temperature



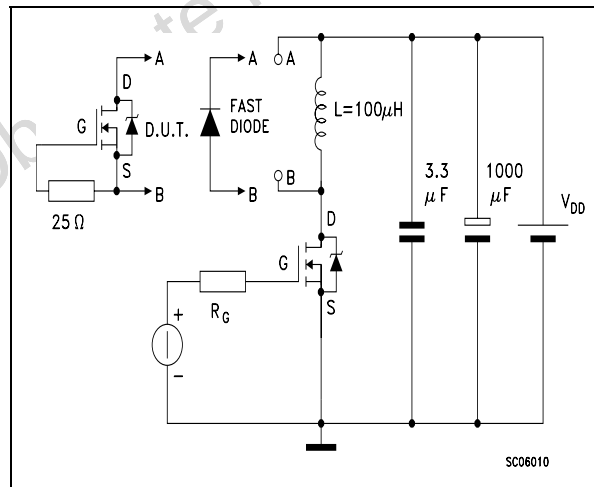
**Figure 14: Unclamped Inductive Load Test Circuit**



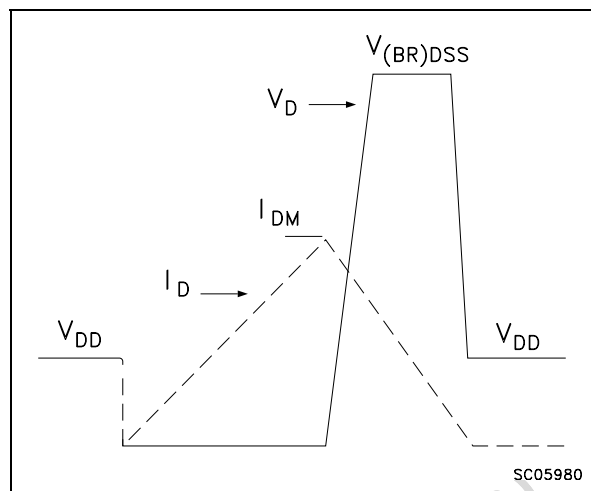
**Figure 15: Switching Times Test Circuit For Resistive Load**



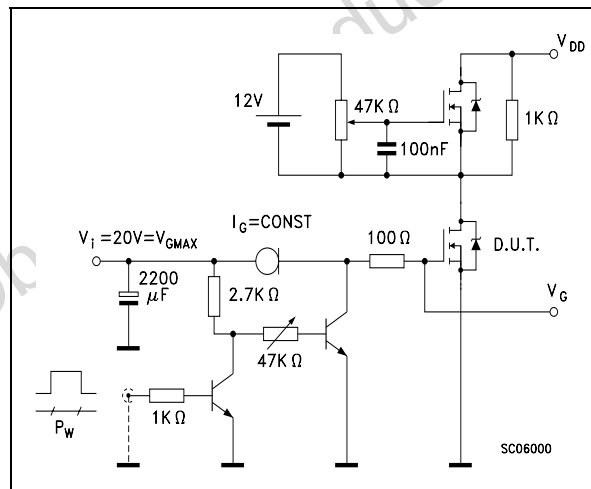
**Figure 16: Test Circuit For Inductive Load Switching and Diode Recovery Times**



**Figure 17: Unclamped Inductive Waform**

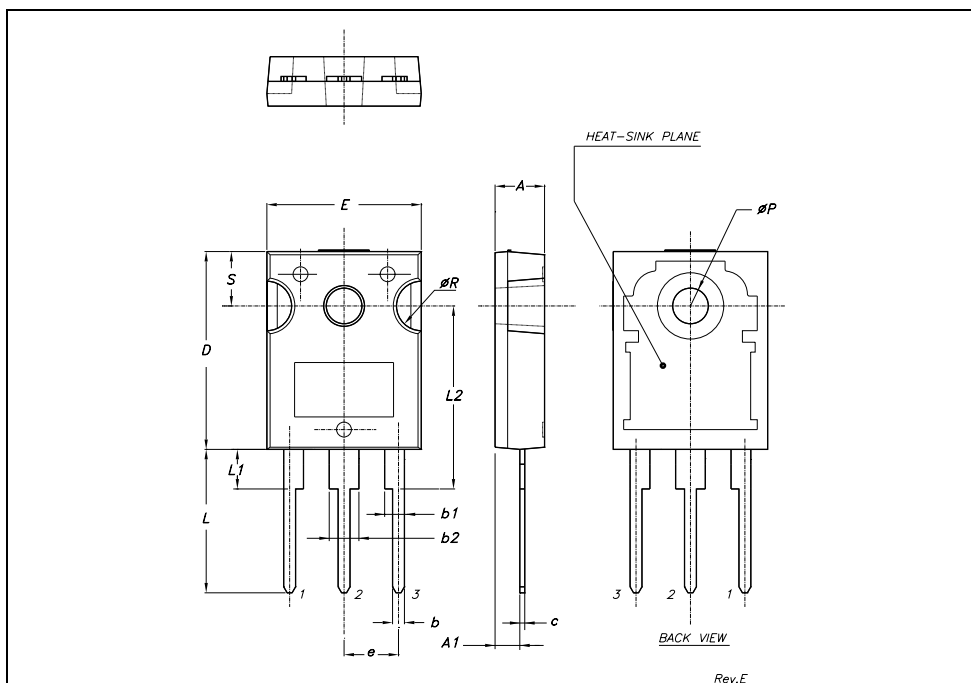


**Figure 18: Gate Charge Test Circuit**



## TO-247 MECHANICAL DATA

| DIM. | mm.   |       |       | inch  |       |       |
|------|-------|-------|-------|-------|-------|-------|
|      | MIN.  | TYP.  | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.85  |       | 5.15  | 0.19  |       | 0.20  |
| A1   | 2.20  |       | 2.60  | 0.086 |       | 0.102 |
| b    | 1.0   |       | 1.40  | 0.039 |       | 0.055 |
| b1   | 2.0   |       | 2.40  | 0.079 |       | 0.094 |
| b2   | 3.0   |       | 3.40  | 0.118 |       | 0.134 |
| c    | 0.40  |       | 0.80  | 0.015 |       | 0.03  |
| D    | 19.85 |       | 20.15 | 0.781 |       | 0.793 |
| E    | 15.45 |       | 15.75 | 0.608 |       | 0.620 |
| e    |       | 5.45  |       |       | 0.214 |       |
| L    | 14.20 |       | 14.80 | 0.560 |       | 0.582 |
| L1   | 3.70  |       | 4.30  | 0.14  |       | 0.17  |
| L2   |       | 18.50 |       |       | 0.728 |       |
| ØP   | 3.55  |       | 3.65  | 0.140 |       | 0.143 |
| ØR   | 4.50  |       | 5.50  | 0.177 |       | 0.216 |
| S    |       | 5.50  |       |       | 0.216 |       |



**Table 10: Revision History**

| Date         | Revision | Description of Changes                |
|--------------|----------|---------------------------------------|
| 24-June-2004 | 4        | New Stylesheet. No Content Change     |
| 04-Feb-2004  | 5        | New Id current on title in first page |

Obsolete Product(s) - Obsolete Product(s)



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