



# STB160NF03L

N-CHANNEL 30V - 0.0021Ω - 160A D2PAK

STripFET™ POWER MOSFET

| TYPE        | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-------------|------------------|---------------------|----------------|
| STB160NF03L | 30 V             | < 0.0030 Ω          | 160 A          |

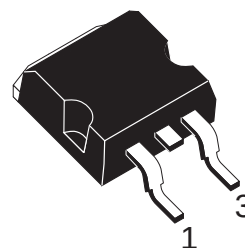
- TYPICAL R<sub>DS(on)</sub> = 0.0021Ω
- LOW THRESHOLD DRIVE
- ULTRA LOW ON-RESISTANCE
- VERY LOW GATE CHARGE
- 100% AVALANCHE TESTED

## DESCRIPTION

This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density with ultra low on-resistance, superior switching characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility. This device is particularly suitable for high current, low voltage switching application where efficiency is crucial.

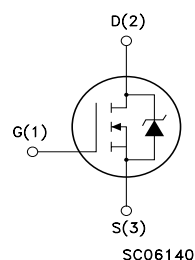
## APPLICATIONS

- BUCK CONVERTERS IN HIGH PERFORMANCE TELECOM AND VRMS
- DC-DC CONVERTERS



**D<sup>2</sup>PAK  
(TO-263)**

## INTERNAL SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                            | Value      | Unit |
|---------------------|------------------------------------------------------|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)           | 30         | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 30         | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                 | ±15        | V    |
| I <sub>D(1)</sub>   | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 160        | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C | 113        | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                               | 640        | A    |
| P <sub>TOT</sub>    | Total Dissipation at T <sub>C</sub> = 25°C           | 300        | W    |
|                     | Derating Factor                                      | 2          | W/°C |
| E <sub>AS</sub> (2) | Single Pulse Avalanche Energy                        | 2          | J    |
| T <sub>stg</sub>    | Storage Temperature                                  | -65 to 175 | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                  | 175        | °C   |

(●) Pulse width limited by safe operating area

(1) Limited by Package

(2) I<sub>SD</sub> ≤ 100A, di/dt ≤ 300A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.

## STB160NF03L

### THERMAL DATA

|                |                                                |      |      |
|----------------|------------------------------------------------|------|------|
| Rthj-case      | Thermal Resistance Junction-case Max           | 0.5  | °C/W |
| Rthj-amb       | Thermal Resistance Junction-ambient Max        | 62.5 | °C/W |
| T <sub>I</sub> | Maximum Lead Temperature For Soldering Purpose | 300  | °C   |

### ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

| Symbol               | Parameter                                             | Test Conditions                                                                       | Min. | Typ. | Max.    | Unit     |
|----------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------|------|------|---------|----------|
| V <sub>(BR)DSS</sub> | Drain-source Breakdown Voltage                        | I <sub>D</sub> = 250 µA, V <sub>GS</sub> = 0                                          | 30   |      |         | V        |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = Max Rating<br>V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C |      |      | 1<br>10 | µA<br>µA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ±15V                                                                |      |      | ±100    | nA       |

ON (1)

| Symbol              | Parameter                         | Test Conditions                                                                               | Min. | Typ.             | Max.             | Unit   |
|---------------------|-----------------------------------|-----------------------------------------------------------------------------------------------|------|------------------|------------------|--------|
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA                                    | 1    |                  |                  | V      |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 80 A<br>V <sub>GS</sub> = 5 V, I <sub>D</sub> = 80 A |      | 0.0021<br>0.0042 | 0.0030<br>0.0070 | Ω<br>Ω |
| I <sub>D(on)</sub>  | On State Drain Current            | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> ,<br>V <sub>GS</sub> = 10V      | 160  |                  |                  | A      |

### DYNAMIC

| Symbol              | Parameter                    | Test Conditions                                                                          | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|------------------------------------------------------------------------------------------|------|------|------|------|
| g <sub>fs</sub> (1) | Forward Transconductance     | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> ,<br>I <sub>D</sub> = 80 A |      | 210  |      | S    |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0                                    |      | 5600 |      | pF   |
| C <sub>oss</sub>    | Output Capacitance           |                                                                                          |      | 1720 |      | pF   |
| C <sub>rss</sub>    | Reverse Transfer Capacitance |                                                                                          |      | 310  |      | pF   |

## ELECTRICAL CHARACTERISTICS (CONTINUED)

## SWITCHING ON

| Symbol      | Parameter          | Test Conditions                                                    | Min. | Typ. | Max. | Unit |
|-------------|--------------------|--------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 15V$ , $I_D = 80A$                                       |      | 28   |      | ns   |
| $t_r$       | Rise Time          | $R_G = 4.7\Omega$ , $V_{GS} = 10V$<br>(see test circuit, Figure 3) |      | 285  |      | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 24V$ , $I_D = 160A$ ,                                    |      | 123  |      | nC   |
| $Q_{gs}$    | Gate-Source Charge | $V_{GS} = 10V$                                                     |      | 21   |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |                                                                    |      | 40   |      | nC   |

## SWITCHING OFF

| Symbol       | Parameter             | Test Conditions                                                    | Min. | Typ. | Max. | Unit |
|--------------|-----------------------|--------------------------------------------------------------------|------|------|------|------|
| $t_{d(off)}$ | Turn-off-Delay Time   | $V_{DD} = 15V$ , $I_D = 80A$ ,                                     |      | 110  |      | ns   |
| $t_f$        | Fall Time             | $R_G = 4.7\Omega$ , $V_{GS} = 10V$<br>(see test circuit, Figure 5) |      | 65   |      | ns   |
| $t_{d(off)}$ | Off-voltage Rise Time | $V_{clamp} = 24V$ , $I_D = 40A$                                    |      | 110  |      | ns   |
| $t_f$        | Fall Time             | $R_G = 4.7\Omega$ , $V_{GS} = 10V$                                 |      | 35   |      | ns   |
| $t_c$        | Cross-over Time       |                                                                    |      | 70   |      | ns   |

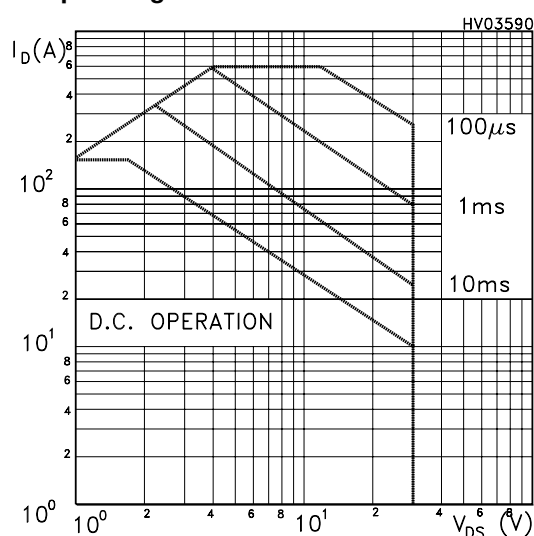
## SOURCE DRAIN DIODE

| Symbol        | Parameter                     | Test Conditions                         | Min. | Typ. | Max. | Unit |
|---------------|-------------------------------|-----------------------------------------|------|------|------|------|
| $I_{SD}$      | Source-drain Current          |                                         |      |      | 160  | A    |
| $I_{SDM} (1)$ | Source-drain Current (pulsed) |                                         |      |      | 640  | A    |
| $V_{SD} (2)$  | Forward On Voltage            | $I_{SD} = 160A$ , $V_{GS} = 0$          |      |      | 1.3  | V    |
| $t_{rr}$      | Reverse Recovery Time         | $I_{SD} = 80A$ , $di/dt = 100A/\mu s$ , |      | 80   |      | ns   |
| $Q_{rr}$      | Reverse Recovery Charge       | $V_{DD} = 15V$ , $T_J = 25^\circ C$     |      | 180  |      | nC   |
| $I_{RRM}$     | Reverse Recovery Current      | (see test circuit, Figure 5)            |      | 4.5  |      | A    |

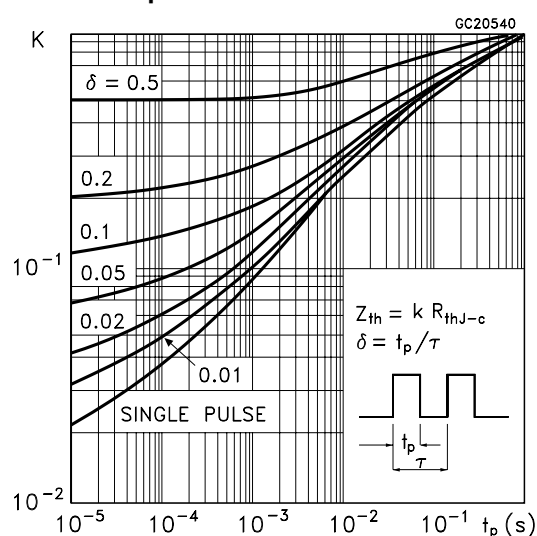
Note: 1. Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.

2. Pulse width limited by safe operating area.

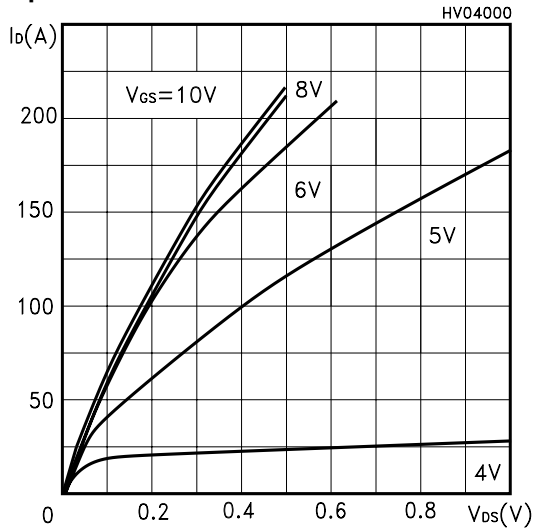
## Safe Operating Area



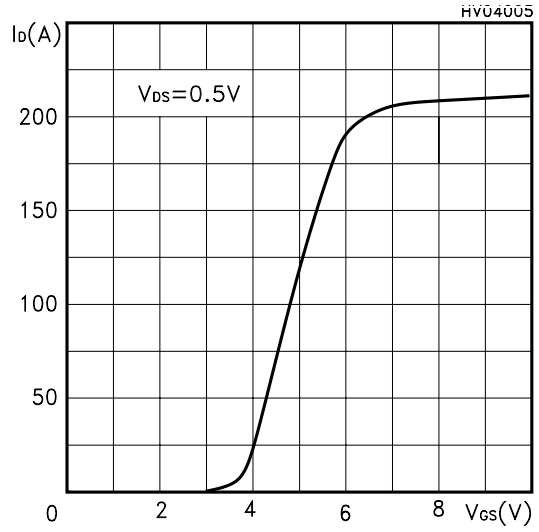
## Thermal Impedance



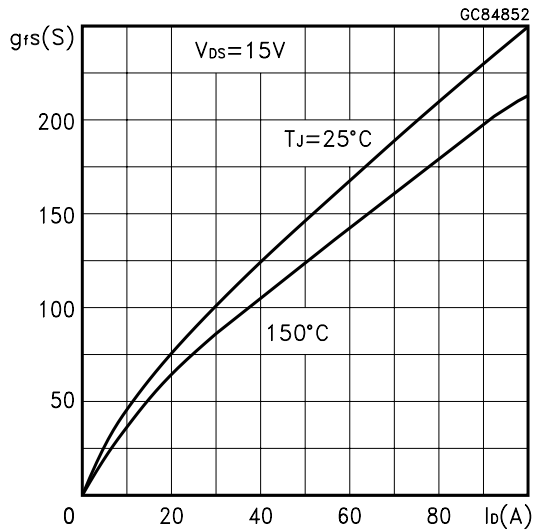
Output Characteristics



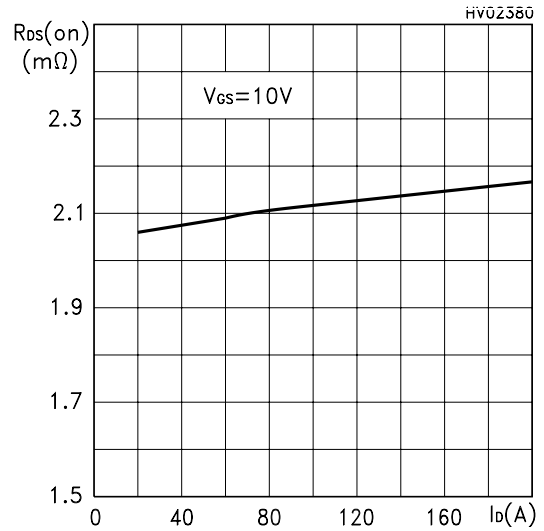
Transfer Characteristics



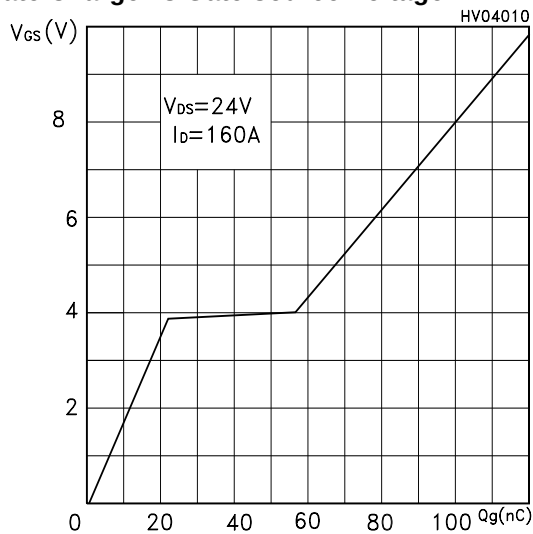
Transconductance



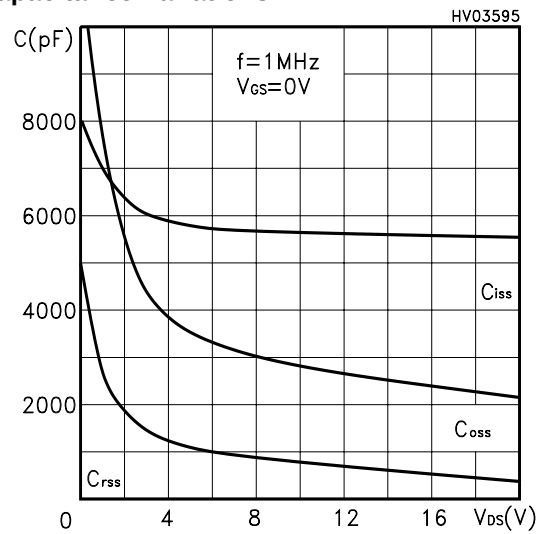
Static Drain-Source On Resistance



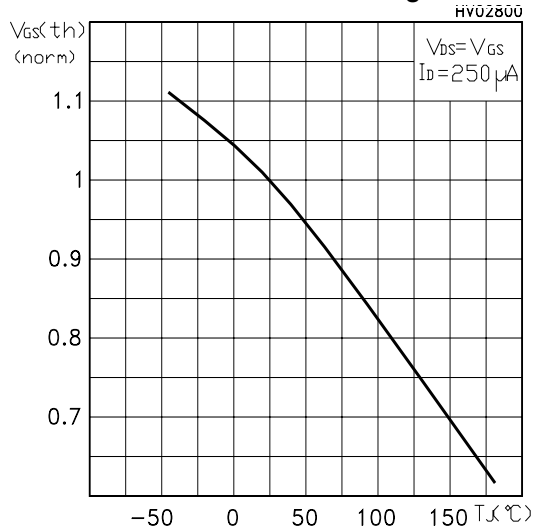
Gate Charge vs Gate-source Voltage



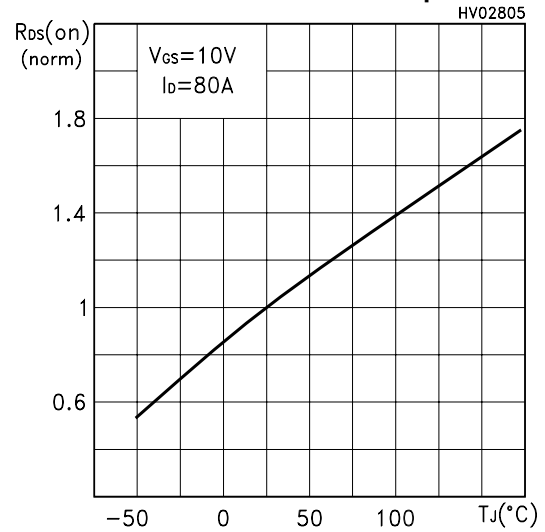
Capacitance Variations



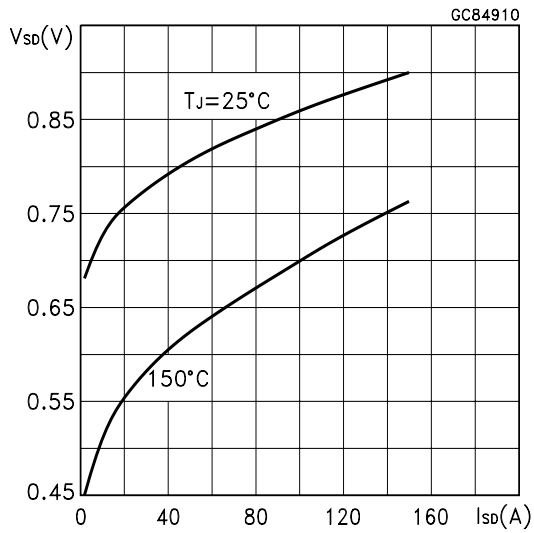
Normalized Gate Threshold Voltage vs Temp.



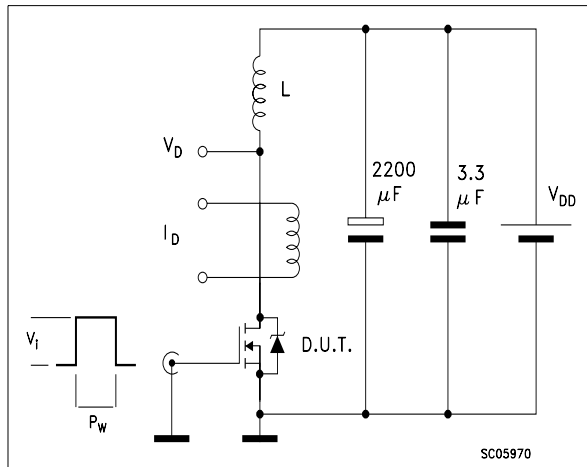
Normalized On Resistance vs Temperature



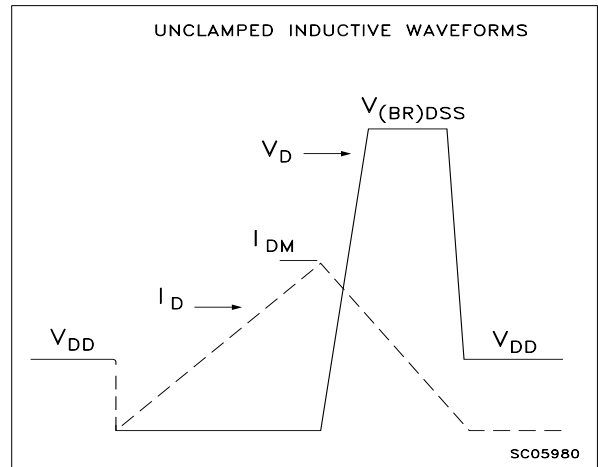
Source-drain Diode Forward Characteristics



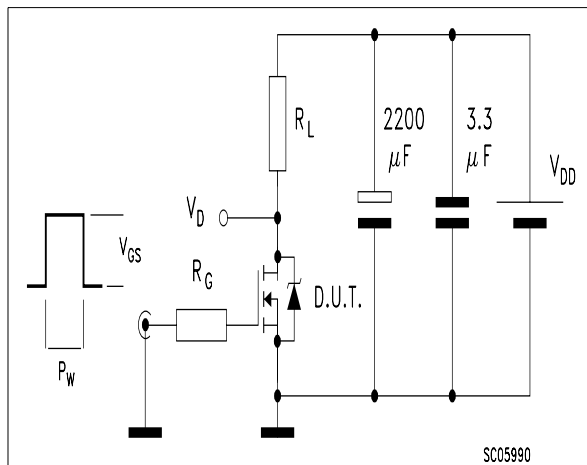
**Fig. 1: Unclamped Inductive Load Test Circuit**



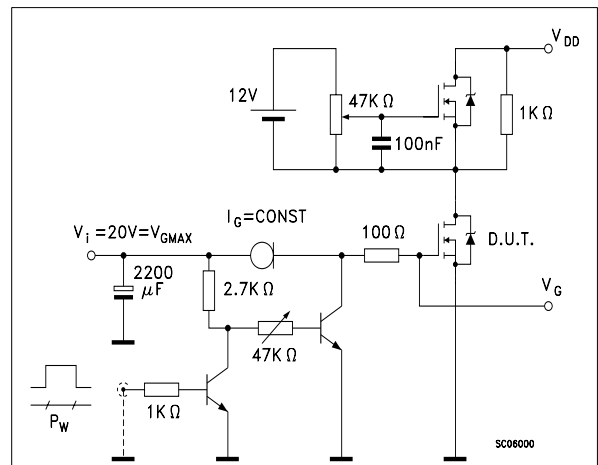
**Fig. 2: Unclamped Inductive Waveform**



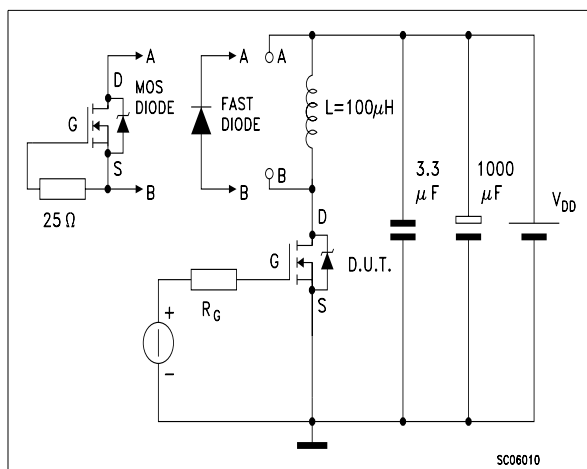
**Fig. 3: Switching Times Test Circuit For Resistive Load**



**Fig. 4: Gate Charge test Circuit**

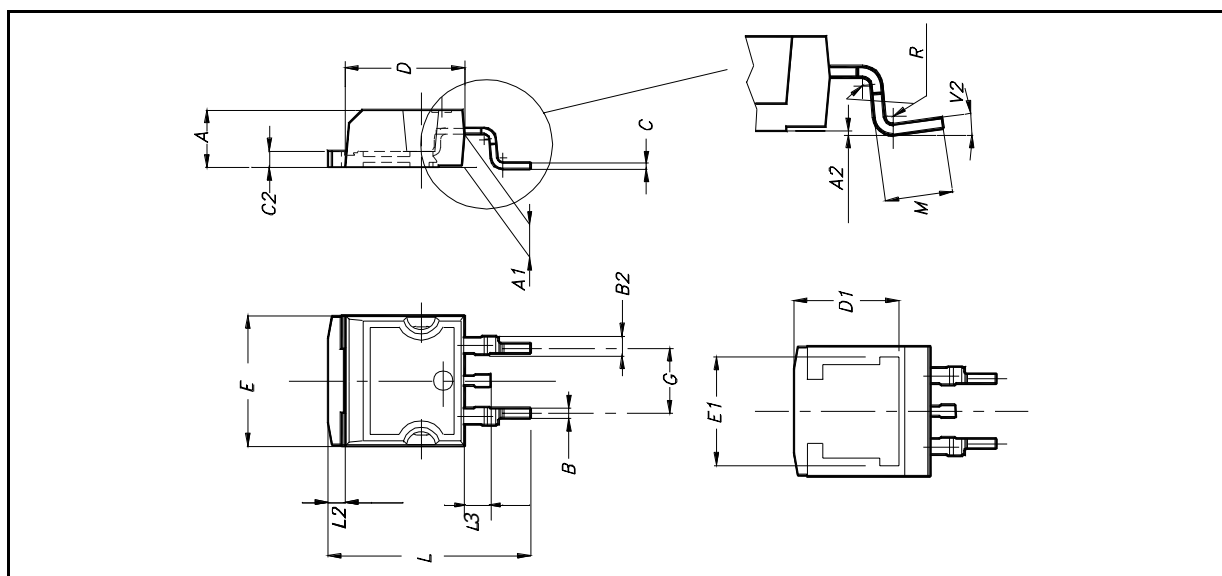


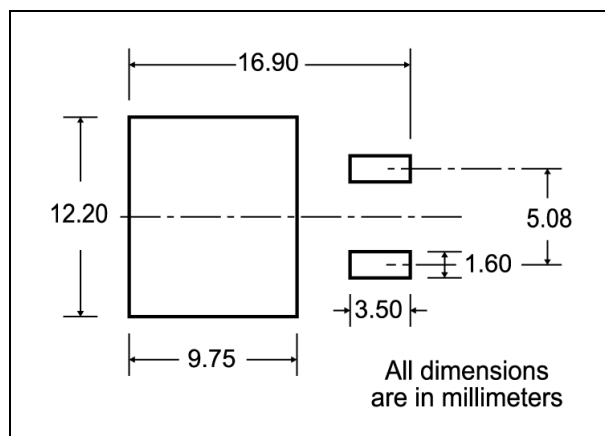
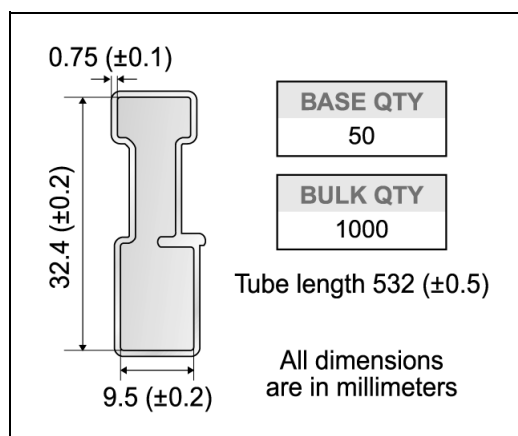
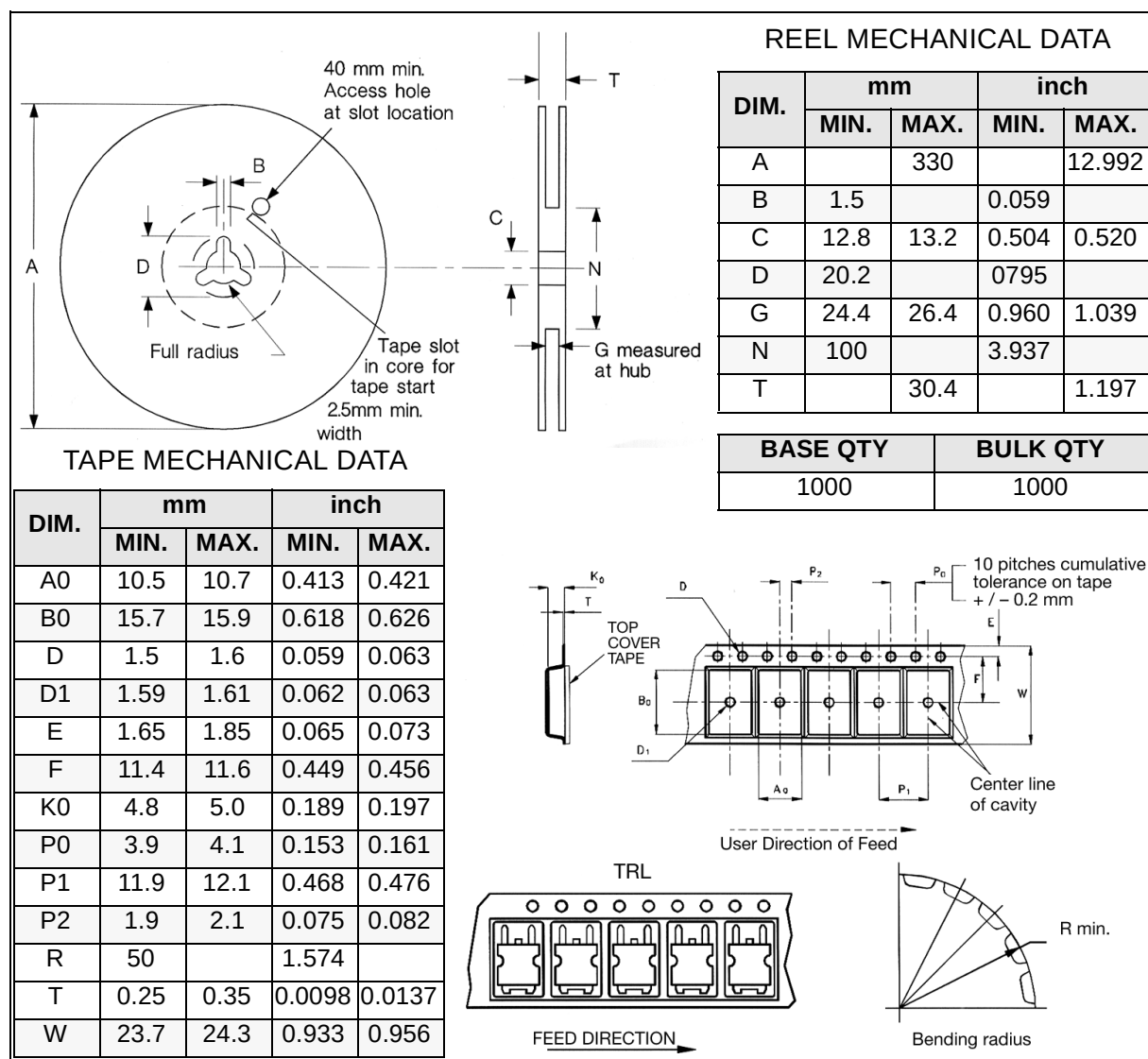
**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



## D<sup>2</sup>PAK MECHANICAL DATA

| DIM. | mm.  |     |       | inch  |       |       |
|------|------|-----|-------|-------|-------|-------|
|      | MIN. | TYP | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.4  |     | 4.6   | 0.173 |       | 0.181 |
| A1   | 2.49 |     | 2.69  | 0.098 |       | 0.106 |
| A2   | 0.03 |     | 0.23  | 0.001 |       | 0.009 |
| B    | 0.7  |     | 0.93  | 0.027 |       | 0.036 |
| B2   | 1.14 |     | 1.7   | 0.044 |       | 0.067 |
| C    | 0.45 |     | 0.6   | 0.017 |       | 0.023 |
| C2   | 1.23 |     | 1.36  | 0.048 |       | 0.053 |
| D    | 8.95 |     | 9.35  | 0.352 |       | 0.368 |
| D1   |      | 8   |       |       | 0.315 |       |
| E    | 10   |     | 10.4  | 0.393 |       |       |
| E1   |      | 8.5 |       |       | 0.334 |       |
| G    | 4.88 |     | 5.28  | 0.192 |       | 0.208 |
| L    | 15   |     | 15.85 | 0.590 |       | 0.625 |
| L2   | 1.27 |     | 1.4   | 0.050 |       | 0.055 |
| L3   | 1.4  |     | 1.75  | 0.055 |       | 0.068 |
| M    | 2.4  |     | 3.2   | 0.094 |       | 0.126 |
| R    |      | 0.4 |       |       | 0.015 |       |
| V2   | 0°   |     | 8°    |       |       |       |



**D<sup>2</sup>PAK FOOTPRINT****TUBE SHIPMENT (no suffix)\*****TAPE AND REEL SHIPMENT (suffix "T4")\***

\* on sales type



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