



## STP80NF03L

N-CHANNEL 30V - 0.004  $\Omega$  - 80A TO-220

STripFET™ II MOSFET

| TYPE       | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|------------|------------------|---------------------|----------------|
| STP80NF03L | 30 V             | < 0.0045 $\Omega$   | 80 A           |

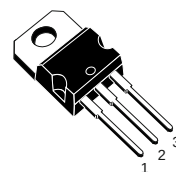
- TYPICAL R<sub>DS(on)</sub> = 0.004  $\Omega$
- EXCEPTIONAL dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- LOW THRESHOLD DRIVE

### DESCRIPTION

This Power MOSFET is the latest development of ST-Microelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

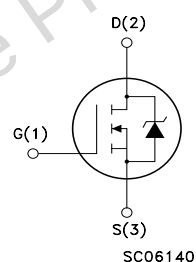
### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- MOTOR CONTROL, AUDIO AMPLIFIERS
- DC-DC & DC-AC CONVERTERS
- AUTOMOTIVE ENVIRONMENT  
(INJECTION, ABS, AIR-BAG, LAMP DRIVERS  
Etc.)



TO-220

### INTERNAL SCHEMATIC DIAGRAM



### ORDERING INFORMATION

| SALES TYPE | MARKING  | PACKAGE | PACKAGING |
|------------|----------|---------|-----------|
| STP80NF03L | P80NF03L | TO-220  | TUBE      |

## STP80NF03L

### ABSOLUTE MAXIMUM RATINGS

| Symbol       | Parameter                                               | Value      | Unit                |
|--------------|---------------------------------------------------------|------------|---------------------|
| $V_{DS}$     | Drain-source Voltage ( $V_{GS} = 0$ )                   | 30         | V                   |
| $V_{DGR}$    | Drain-gate Voltage ( $R_{GS} = 20 \text{ k}\Omega$ )    | 30         | V                   |
| $V_{GS}$     | Gate-source Voltage                                     | $\pm 20$   | V                   |
| $I_D$ (#)    | Drain Current (continuous) at $T_C = 25^\circ\text{C}$  | 80         | A                   |
| $I_D$ (#)    | Drain Current (continuous) at $T_C = 100^\circ\text{C}$ | 80         | A                   |
| $I_{DM}$ (●) | Drain Current (pulsed)                                  | 320        | A                   |
| $P_{TOT}$    | Total Dissipation at $T_C = 25^\circ\text{C}$           | 300        | W                   |
|              | Derating Factor                                         | 2.0        | W/ $^\circ\text{C}$ |
| $dv/dt$ (1)  | Peak Diode Recovery Voltage Slope                       | 2.0        | V/ns                |
| $T_{stg}$    | Storage Temperature                                     | -65 to 175 | $^\circ\text{C}$    |
| $T_j$        | Max. Operating Junction Temperature                     | 175        | $^\circ\text{C}$    |

(#) Current Limited by Package.

(●) Pulse width limited by safe operating area.

(1)  $I_{SD} \leq 80\text{A}$ ,  $di/dt \leq 240 \text{ A}/\mu\text{s}$ ,  $V_{DD} = 24\text{V}$ ;  $T_j \leq T_{JMAX}$ .

### THERMAL DATA

|                |                                                    |      |                           |
|----------------|----------------------------------------------------|------|---------------------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case Max               | 0.5  | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$  | Thermal Resistance Junction-ambient Max            | 62.5 | $^\circ\text{C}/\text{W}$ |
| $T_l$          | Maximum Lead Temperature For Soldering Purpose Typ | 300  | $^\circ\text{C}$          |

### AVALANCHE CHARACTERISTICS

| Symbol   | Parameter                                                                                                     | Max Value | Unit |
|----------|---------------------------------------------------------------------------------------------------------------|-----------|------|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max)                            | 40        | A    |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j = 25^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 20 \text{ V}$ ) | 2.3       | J    |

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

OFF/ON

| Symbol        | Parameter                                        | Test Conditions                                                                                   | Min. | Typ.            | Max.             | Unit                           |
|---------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------|------|-----------------|------------------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage                   | $I_D = 250 \mu\text{A}$ , $V_{GS} = 0$                                                            | 30   |                 |                  | V                              |
| $I_{DSS}$     | Zero Gate Voltage Drain Current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max Rating}$<br>$V_{DS} = \text{Max Rating}$ , $T_C = 125^\circ\text{C}$          |      |                 | 1<br>10          | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate-body Leakage Current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20\text{V}$                                                                         |      |                 | $\pm 100$        | nA                             |
| $V_{GS(th)}$  | Gate Threshold Voltage                           | $V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$                                                       | 1    | 1.5             | 2.5              | V                              |
| $R_{DS(on)}$  | Static Drain-source On Resistance                | $V_{GS} = 10 \text{ V}$ , $I_D = 40 \text{ A}$<br>$V_{GS} = 4.5 \text{ V}$ , $I_D = 40 \text{ A}$ |      | 0.004<br>0.0045 | 0.0045<br>0.0065 | $\Omega$<br>$\Omega$           |

**ELECTRICAL CHARACTERISTICS (CONTINUED)****DYNAMIC**

| Symbol       | Parameter                    | Test Conditions                                            | Min. | Typ. | Max. | Unit |
|--------------|------------------------------|------------------------------------------------------------|------|------|------|------|
| $g_{fs}$ (1) | Forward Transconductance     | $V_{DS} = 15\text{ V}$ , $I_D = 15\text{ A}$               |      | 50   |      | S    |
| $C_{iss}$    | Input Capacitance            | $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$ |      | 5500 |      | pF   |
| $C_{oss}$    | Output Capacitance           |                                                            |      | 1670 |      | pF   |
| $C_{rss}$    | Reverse Transfer Capacitance |                                                            |      | 290  |      | pF   |

**SWITCHING ON**

| Symbol      | Parameter          | Test Conditions                                                                                                           | Min. | Typ. | Max. | Unit |
|-------------|--------------------|---------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 15\text{ V}$ , $I_D = 40\text{ A}$<br>$R_G = 4.7\Omega$ , $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, Figure 3) |      | 30   |      | ns   |
| $t_r$       | Rise Time          |                                                                                                                           |      | 270  |      | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 24\text{ V}$ , $I_D = 80\text{ A}$ ,<br>$V_{GS} = 4.5\text{ V}$                                                 |      | 85   | 110  | nC   |
| $Q_{gs}$    | Gate-Source Charge |                                                                                                                           |      | 23   |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |                                                                                                                           |      | 40   |      | nC   |

**SWITCHING OFF**

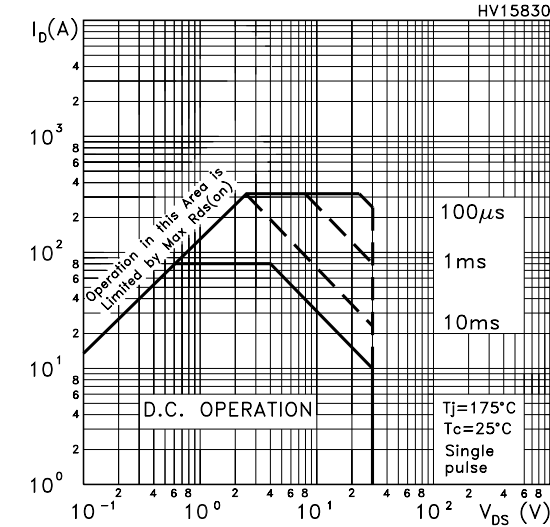
| Symbol        | Parameter             | Test Conditions                                                                                                                | Min. | Typ. | Max. | Unit |
|---------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(off)}$  | Turn-off-Delay Time   | $V_{DD} = 15\text{ V}$ , $I_D = 40\text{ A}$ ,<br>$R_G = 4.7\Omega$ , $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, Figure 3)    |      | 110  |      | ns   |
| $t_f$         | Fall Time             |                                                                                                                                |      | 95   |      | ns   |
| $t_{r(Voff)}$ | Off-Voltage Rise Time | $V_{clamp} = 24\text{ V}$ , $I_D = 80\text{ A}$ ,<br>$R_G = 4.7\Omega$ , $V_{GS} = 4.5\text{ V}$<br>(Inductive Load, Figure 5) |      | 125  |      | ns   |
| $t_f$         | Fall Time             |                                                                                                                                |      | 75   |      | ns   |
| $t_c$         | Cross-over Time       |                                                                                                                                |      | 125  |      | ns   |

**SOURCE DRAIN DIODE**

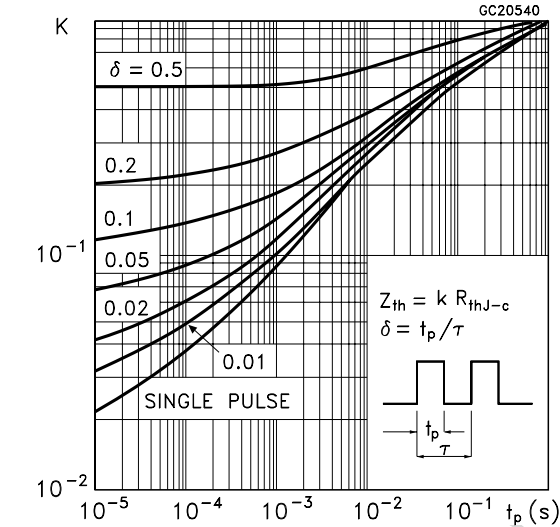
| Symbol        | Parameter                     | Test Conditions                                                                                                                                     | Min. | Typ. | Max. | Unit          |
|---------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $I_{SD}$      | Source-drain Current          |                                                                                                                                                     |      |      | 80   | A             |
| $I_{SDM}$ (1) | Source-drain Current (pulsed) |                                                                                                                                                     |      |      | 320  | A             |
| $V_{SD}$ (2)  | Forward On Voltage            | $I_{SD} = 80\text{ A}$ , $V_{GS} = 0$                                                                                                               |      |      | 1.5  | V             |
| $t_{rr}$      | Reverse Recovery Time         | $I_{SD} = 80\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 20\text{ V}$ , $T_j = 150^\circ\text{C}$<br>(see test circuit, Figure 5) |      | 75   |      | ns            |
| $Q_{rr}$      | Reverse Recovery Charge       |                                                                                                                                                     |      | 0.15 |      | $\mu\text{C}$ |
| $I_{RRM}$     | Reverse Recovery Current      |                                                                                                                                                     |      | 4    |      | A             |

Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

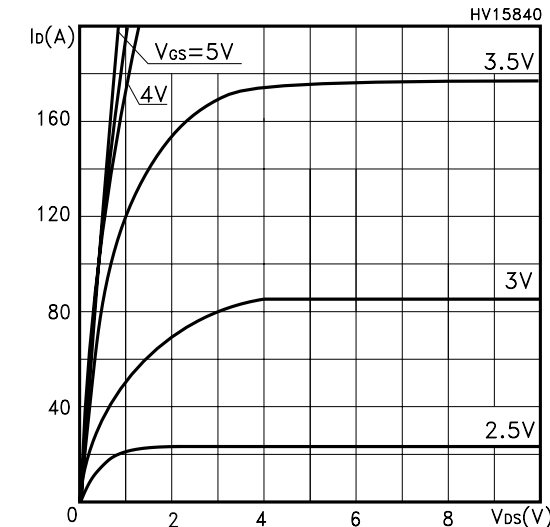
Safe Operating Area



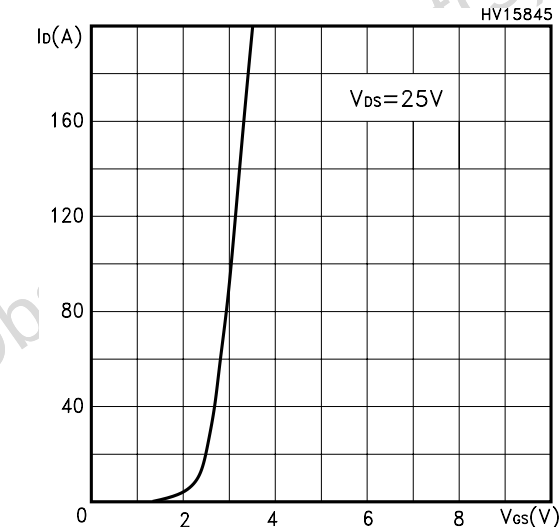
Thermal Impedance



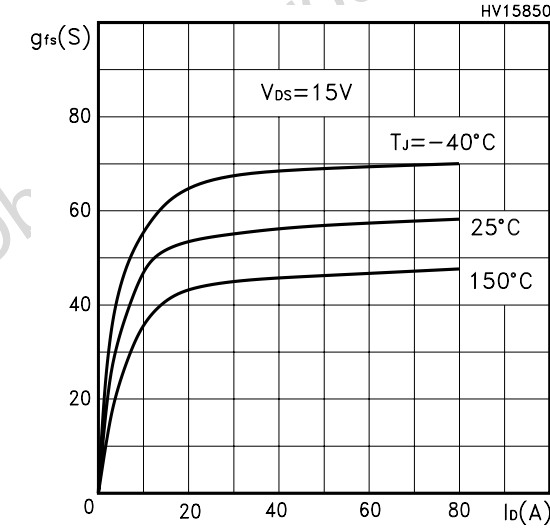
Output Characteristics



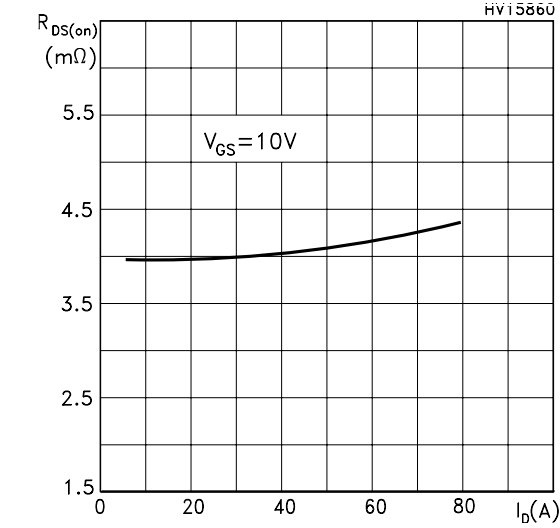
Transfer Characteristics



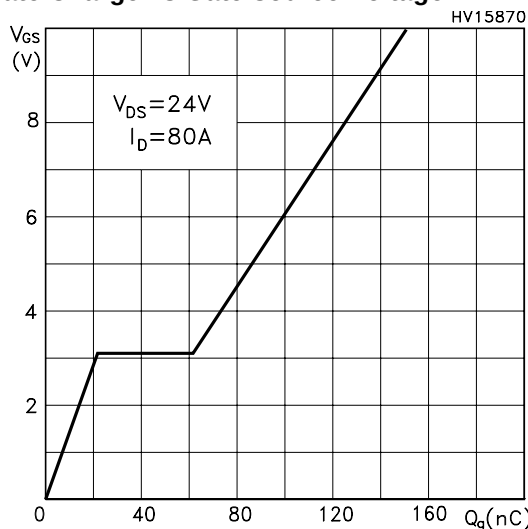
Transconductance



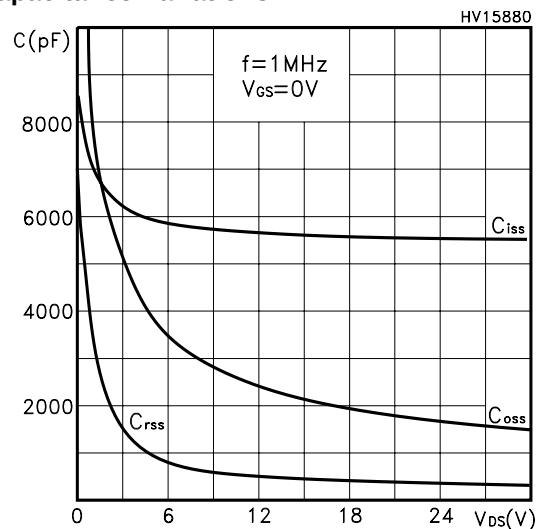
Static Drain-source On Resistance



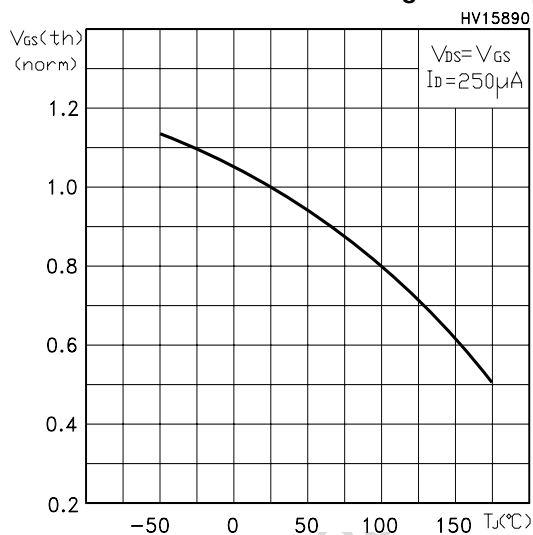
Gate Charge vs Gate-source Voltage



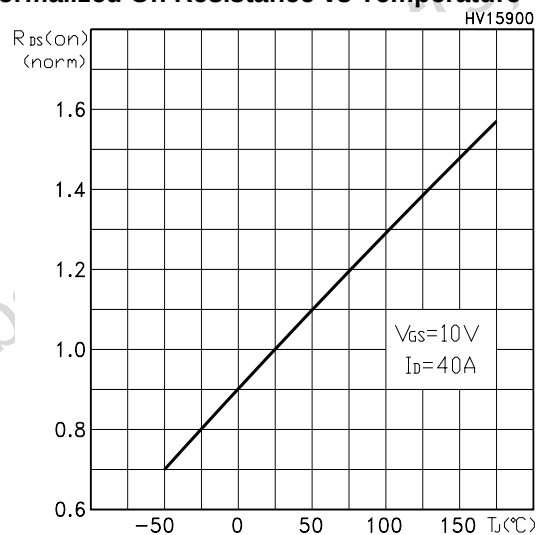
Capacitance Variations



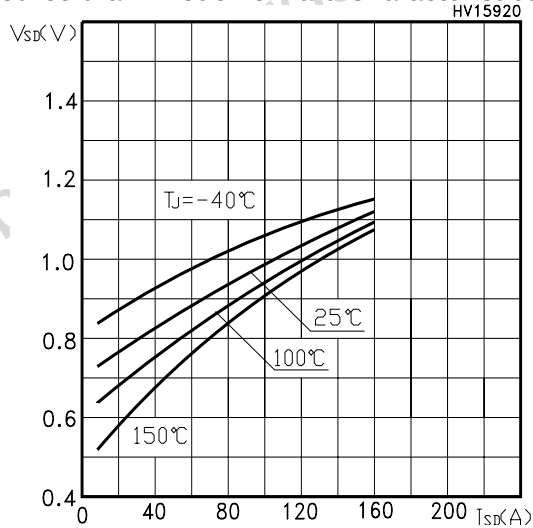
Normalized Gate Threshold Voltage vs Temp.



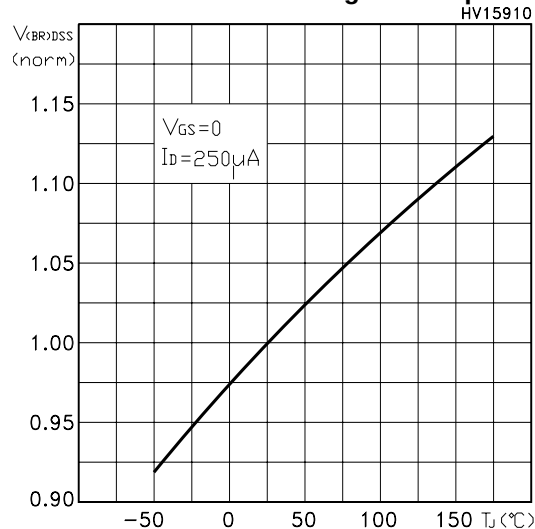
Normalized On Resistance vs Temperature



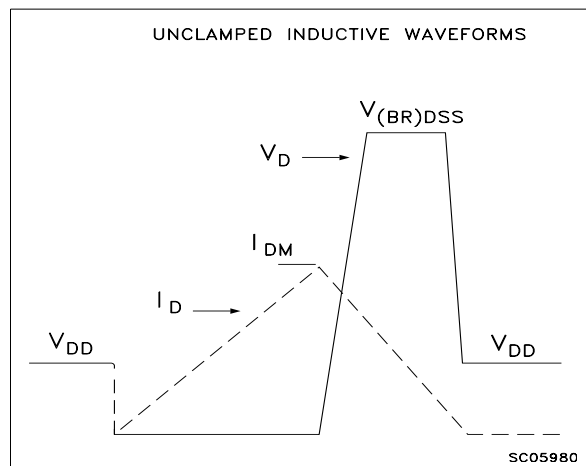
Source-drain Diode Forward Characteristics



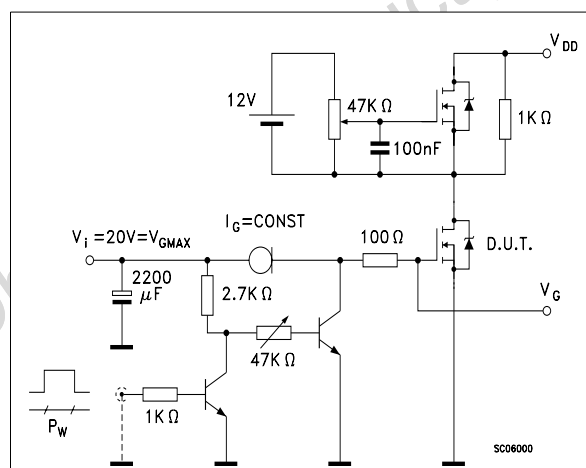
Normalized Breakdown Voltage vs Temperature



**Fig. 2: Unclamped Inductive Waveform**

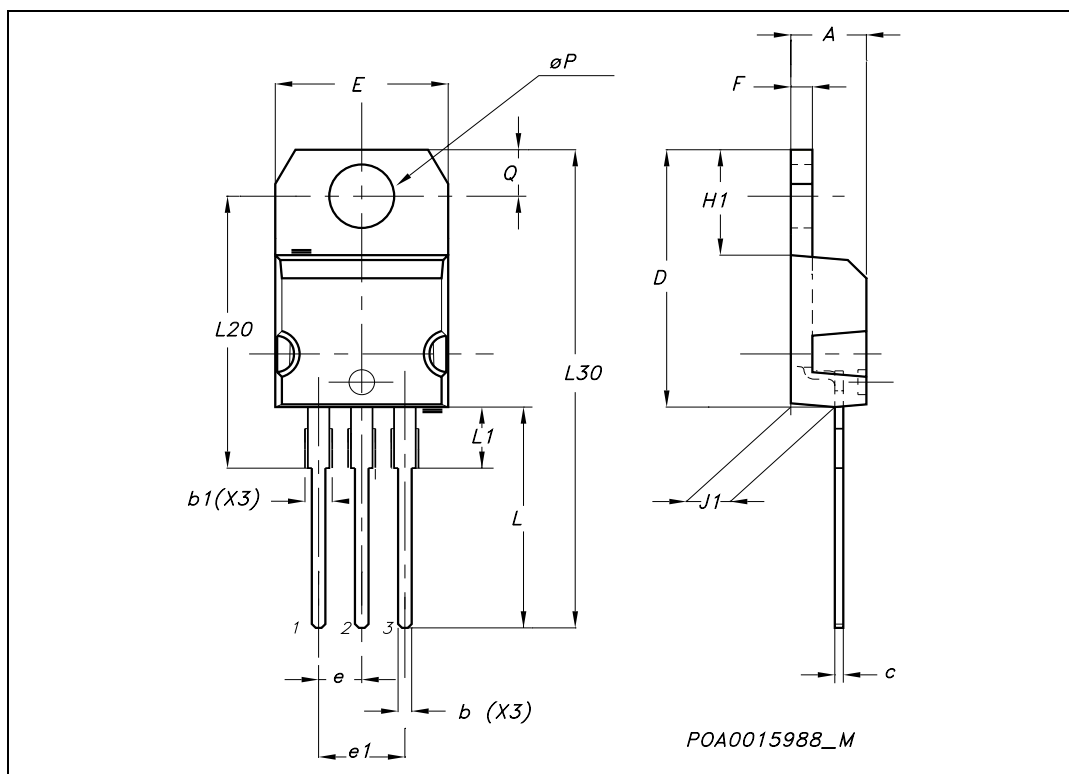


**Fig. 4: Gate Charge test Circuit**



## TO-220 MECHANICAL DATA

| DIM. | mm.   |       |       | inch  |       |       |
|------|-------|-------|-------|-------|-------|-------|
|      | MIN.  | TYP   | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.40  |       | 4.60  | 0.173 |       | 0.181 |
| b    | 0.61  |       | 0.88  | 0.024 |       | 0.034 |
| b1   | 1.15  |       | 1.70  | 0.045 |       | 0.066 |
| c    | 0.49  |       | 0.70  | 0.019 |       | 0.027 |
| D    | 15.25 |       | 15.75 | 0.60  |       | 0.620 |
| E    | 10    |       | 10.40 | 0.393 |       | 0.409 |
| e    | 2.40  |       | 2.70  | 0.094 |       | 0.106 |
| e1   | 4.95  |       | 5.15  | 0.194 |       | 0.202 |
| F    | 1.23  |       | 1.32  | 0.048 |       | 0.052 |
| H1   | 6.20  |       | 6.60  | 0.244 |       | 0.256 |
| J1   | 2.40  |       | 2.72  | 0.094 |       | 0.107 |
| L    | 13    |       | 14    | 0.511 |       | 0.551 |
| L1   | 3.50  |       | 3.93  | 0.137 |       | 0.154 |
| L20  |       | 16.40 |       |       | 0.645 |       |
| L30  |       | 28.90 |       |       | 1.137 |       |
| øP   | 3.75  |       | 3.85  | 0.147 |       | 0.151 |
| Q    | 2.65  |       | 2.95  | 0.104 |       | 0.116 |



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