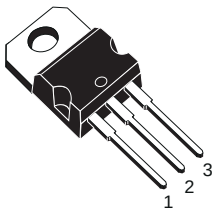
# STGP20NB60K
# STGW20NB60K

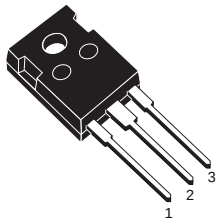
## N-CHANNEL 20A - 600V - TO-220/TO-247
## SHORT CIRCUIT PROOF PowerMESH™ IGBT

| TYPE | $V_{CES}$ | $V_{CE(sat)}$ | $I_C$ |
|---|---|---|---|
| STGP20NB60K | 600 V | < 2.8 V | 20 A |
| STGW20NB60K | 600 V | < 2.8 V | 20 A |

- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP ($V_{cesat}$)
- LOW ON-LOSSES
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- VERY HIGH FREQUENCY OPERATION
- SHORT CIRCUIT RATED
- LATCH CURRENT FREE OPERATION

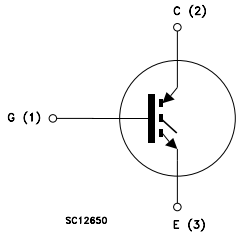



**TO-220**




**TO-247**

**INTERNAL SCHEMATIC DIAGRAM**




### DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix “K” identifies a family optimized for high frequency motor control applications with short circuit withstand capability.

### APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- U.P.S.
- WELDING EQUIPMENTS

### ORDERING INFORMATION

| SALES TYPE | MARKING | PACKAGE | PACKAGING |
|---|---|---|---|
| STGP20NB60K | GP20NB60K | TO-220 | TUBE |
| STGW20NB60K | GW20NB60K | TO-247 | TUBE |

## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage ($V_{GS}$ = 0) | 600 | V |
| $V_{ECR}$ | Emitter-Collector Voltage | 20 | V |
| $V_{GE}$ | Gate-Emitter Voltage | ± 20 | V |
| $I_C$ | Collector Current (continuous) at $T_C$ = 25°C | 40 | A |
| $I_C$ | Collector Current (continuous) at $T_C$ = 100°C | 20 | A |
| $I_{CM}$ (▪) | Collector Current (pulsed) | 80 | A |
| Tsc | Short Circuit Withstand | 10 | µs |
| $P_{TOT}$ | Total Dissipation at $T_C$ = 25°C | 150 | W |
| | Derating Factor | 1.2 | W/°C |
| $T_{stg}$ | Storage Temperature | – 55 to 150 | °C |
| $T_j$ | Max. Operating Junction Temperature | | |

## THERMAL DATA

| | | TO-220 | TO-247 | |
|---|---|---|---|---|
| Rthj-case | Thermal Resistance Junction-case Max | 0.83 | | °C/W |
| Rthj-amb | Thermal Resistance Junction-ambient Max | 62.5 | 50 | °C/W |

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

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{BR(CES)}$ | Collectro-Emitter Breakdown Voltage | $I_C$ = 250 µA, $V_{GE}$ = 0 | 600 | | | V |
| $I_{CES}$ | Collector cut-off ($V_{GE}$ = 0) | $V_{CE}$ = Max Rating, $T_C$ = 25 °C | | | 10 | µA |
| | | $V_{CE}$ = Max Rating, $T_C$ = 125 °C | | | 100 | µA |
| $I_{GES}$ | Gate-Emitter Leakage Current ($V_{CE}$ = 0) | $V_{GE}$ = ±20V , $V_{CE}$ = 0 | | | ±100 | nA |

ON (1)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{CE}$ = $V_{GE}$, $I_C$ = 250µA | 5 | | 7 | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$ = 15V, $I_C$ = 20 A | | 2.3 | 2.8 | V |
| | | $V_{GE}$ = 15V, $I_C$ = 20 A, Tj =125°C | | 1.9 | | V |

**Electrical Characteristics** (continued)

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ | Forward Transconductance | $V_{CE}$ = 25 V , $I_C$ =20 A | | 8 | | S |
| $C_{ies}$ | Input Capacitance | $V_{CE}$ = 25V, f = 1 MHz, $V_{GE}$ = 0 | | 1560 | | pF |
| $C_{oes}$ | Output Capacitance | | | 190 | | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | | 38 | | pF |
| $Q_g$<br>$Q_{ge}$<br>$Q_{gc}$ | Total Gate Charge<br>Gate-Emitter Charge<br>Gate-Collector Charge | $V_{CE}$ = 480V, $I_C$ = 20 A,<br>$V_{GE}$ = 15V | | 85<br>14.4<br>51 | 115 | nC<br>nC<br>nC |
| tscw | Short Circuit Withstand Time | $V_{ce}$ = 0.5 BVces , $V_{GE}$ = 15 V,<br>Tj = 125°C , $R_G$ = 10 Ω | 10 | | | µs |

SWITCHING ON

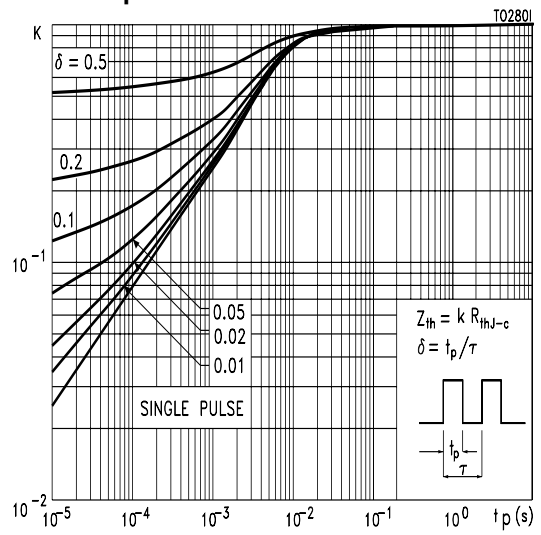
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CC}$ = 480 V, $I_C$ = 20 A<br>$R_G$ = 10Ω , $V_{GE}$ = 15 V | | 40 | | ns |
| $t_r$ | Rise Time | | | 36 | | ns |
| $(di/dt)_{on}$ | Turn-on Current Slope | $V_{CC}$= 480 V, $I_C$ = 20 A $R_G$=10Ω<br>$V_{GE}$ = 15 V,Tj = 125°C | | 350 | | A/µs |
| Eon | Turn-on Switching Losses | | | 650 | | µJ |

SWITCHING OFF

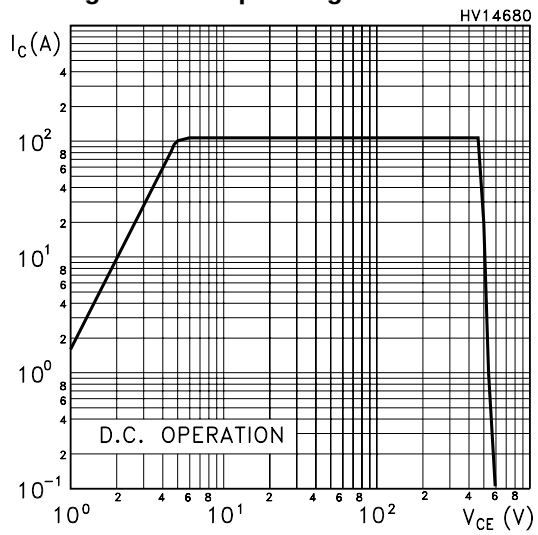
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_c$ | Cross-over Time | $V_{cc}$ = 480 V, $I_C$ = 20 A,<br>$R_{GE}$ = 10 Ω , $V_{GE}$ = 15 V | | 130 | | ns |
| $t_r(V_{off})$ | Off Voltage Rise Time | | | 25 | | ns |
| $t_{d(off)}$ | Delay Time | | | 105 | | ns |
| $t_f$ | Fall Time | | | 95 | | ns |
| $E_{off}$(**) | Turn-off Switching Loss | | | 0.5 | | mJ |
| $E_{ts}$ | Total Switching Loss | | | 0.6 | | mJ |
| $t_c$ | Cross-over Time | $V_{cc}$ = 480 V, $I_C$ = 20 A,<br>$R_{GE}$ = 10 Ω , $V_{GE}$ = 15 V<br>Tj = 125 °C | | 175 | | ns |
| $t_r(V_{off})$ | Off Voltage Rise Time | | | 46 | | ns |
| $t_{d(off)}$ | Delay Time | | | 130 | | ns |
| $t_f$ | Fall Time | | | 150 | | ns |
| $E_{off}$(**) | Turn-off Switching Loss | | | 0.70 | | mJ |
| $E_{ts}$ | Total Switching Loss | | | 1.05 | | mJ |

Note: 1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
2. Pulse width limited by max. junction temperature.
(**)Losses include Also the Tail (Jedec Standardization)

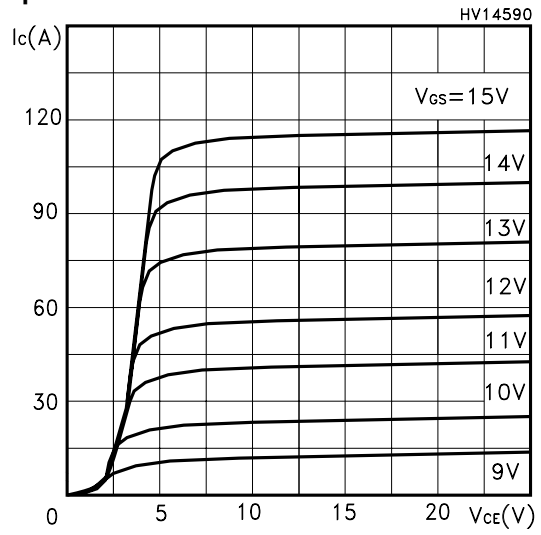
### Thermal Impedance



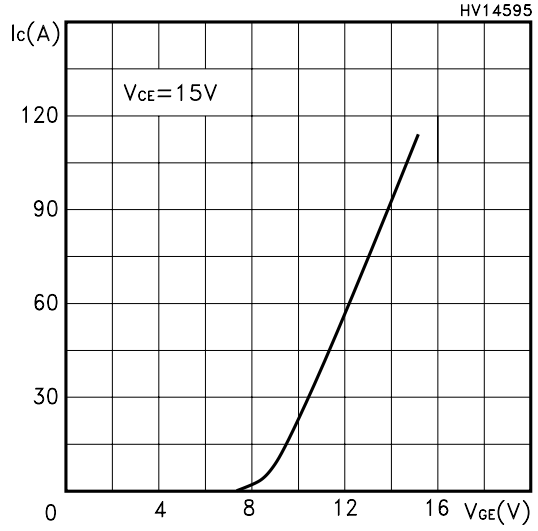

### Switching Off Safe Operating Area



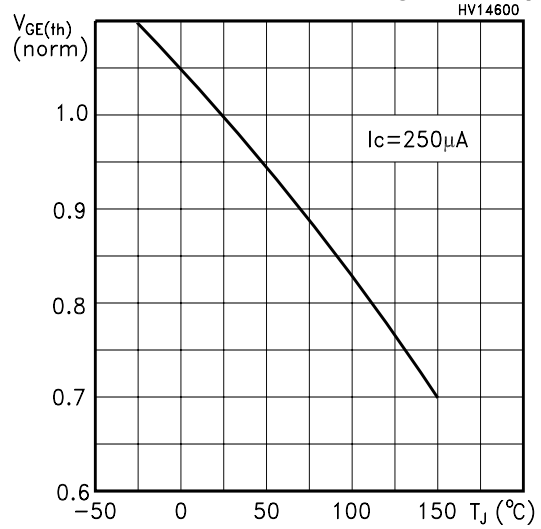

### Output Characteristics



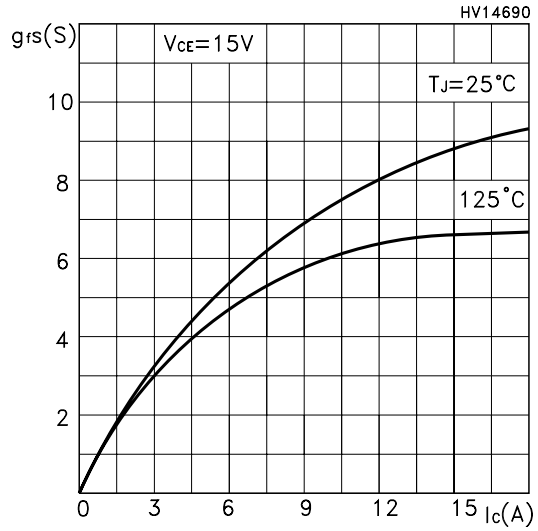

### Transfer Characteristics



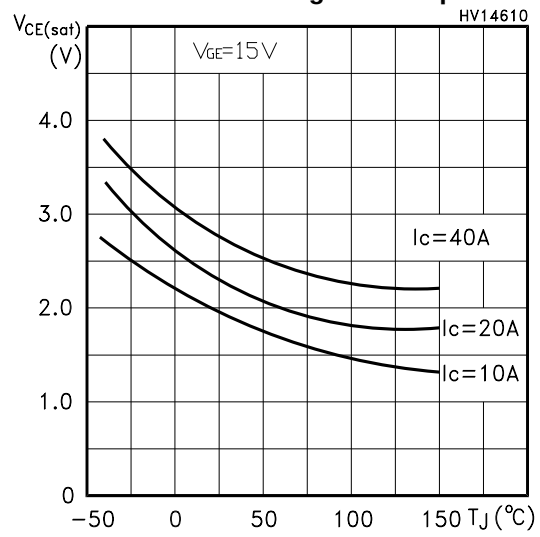

### Normalized Gate Threshold Voltage vs Temp.



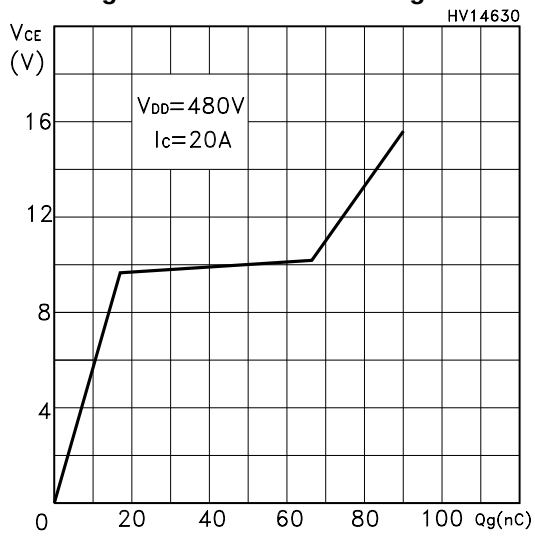

### Transconductance



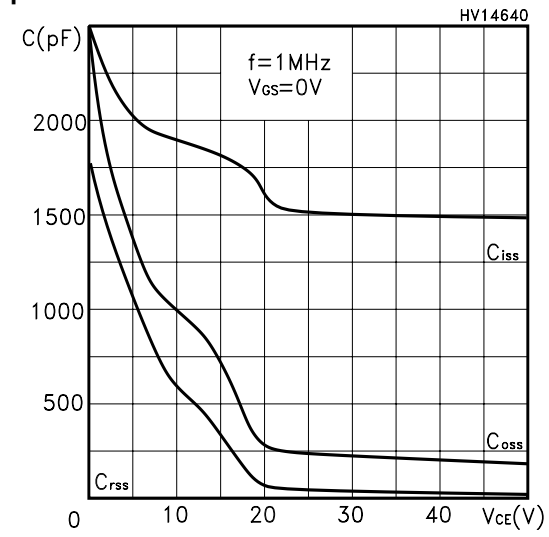
**Collector-Emitter On Voltage vs Temperature**



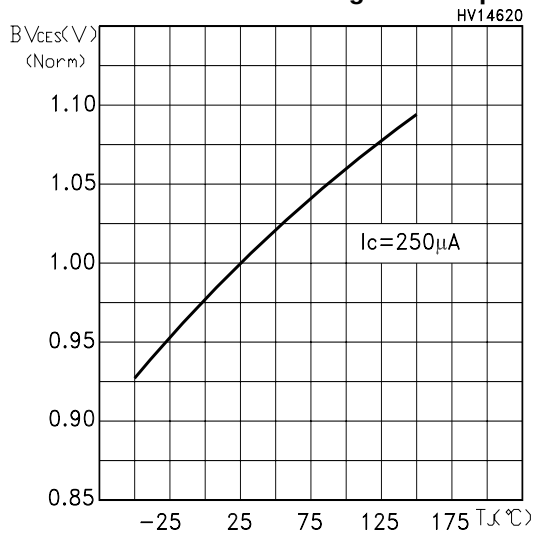

**Gate-Charge vs Gate-Emitter Voltage**



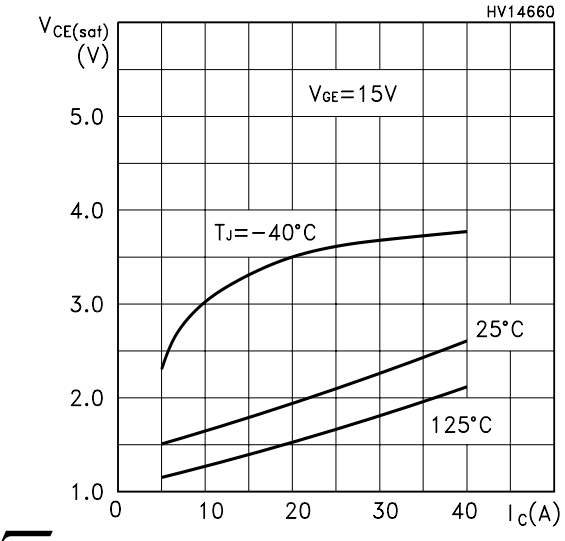

**Capacitance Variations**



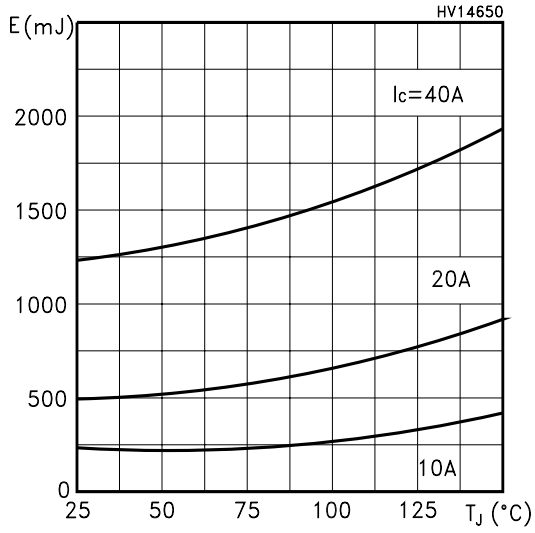

**Normalized Break-down Voltage vs Temp.**




**Collector-Emitter on Voltage vs Collector Current**




**Turn-Off Energy Losses vs Temperature**



### Total Switch Losses vs Collector Current

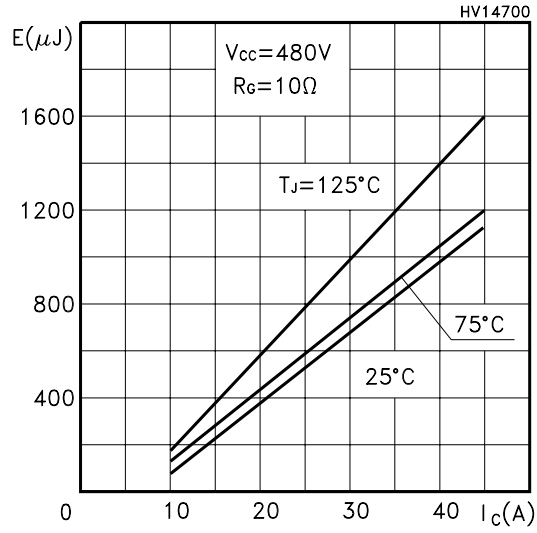



**Fig. 1:** Gate Charge test Circuit

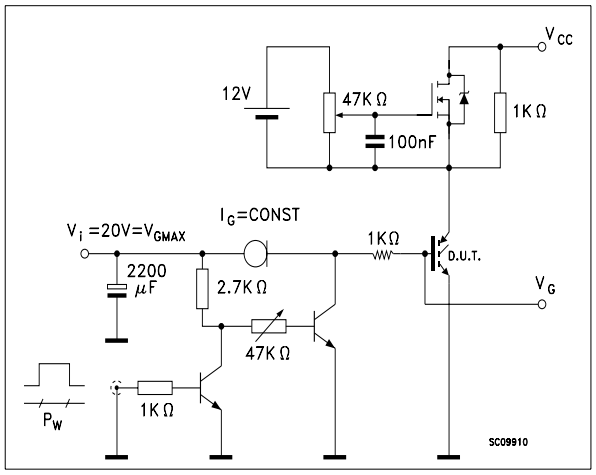
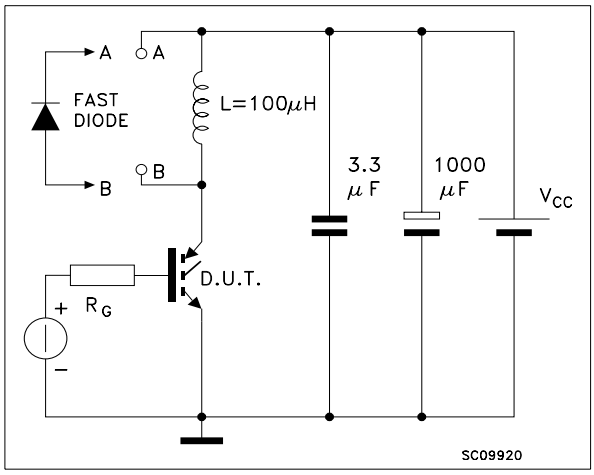
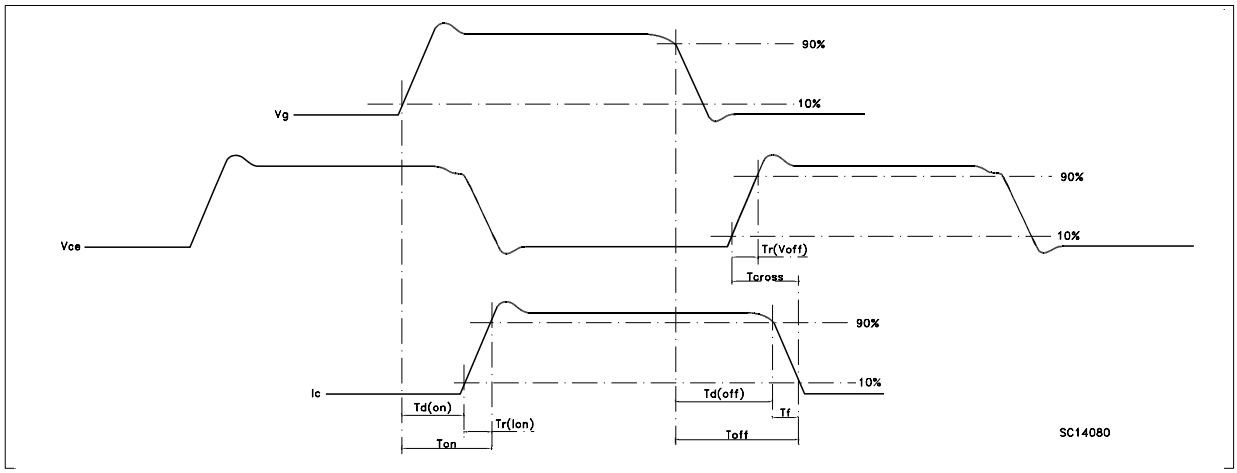


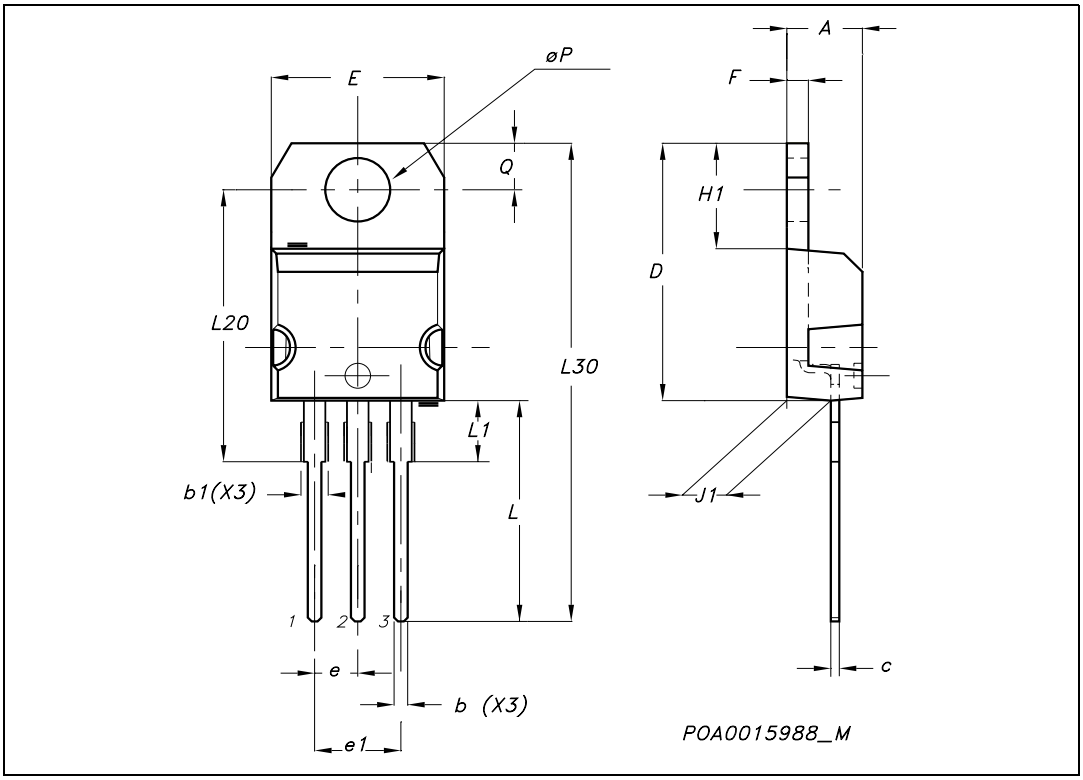

**Fig. 2:** Test Circuit For Inductive Load Switching



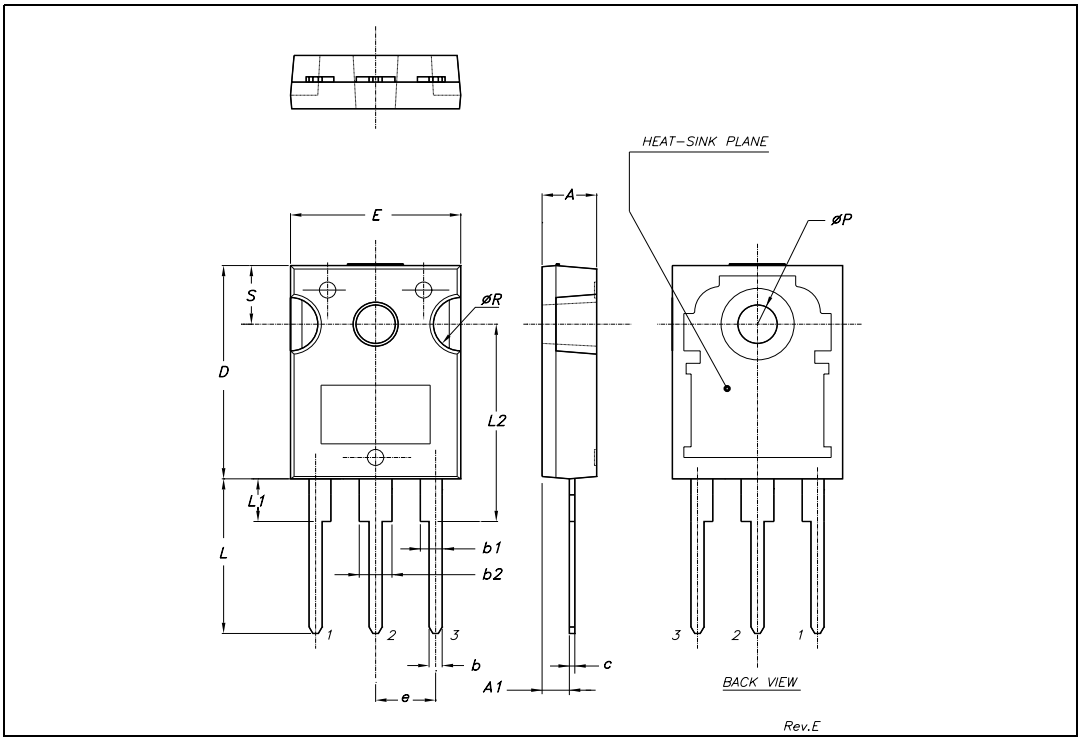
## TO-220 MECHANICAL DATA

| 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 |



## 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 | |



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