



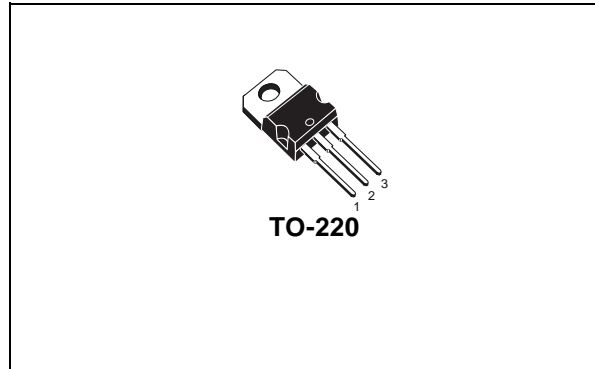
STGP12NB60HD

N-CHANNEL 12A - 600V TO-220

PowerMESH™ IGBT

| TYPE | V _{CES} | V _{CE(sat)} | I _C |
|--------------|------------------|----------------------|----------------|
| STGP12NB60HD | 600 V | < 2.8 V | 12 A |

- HIGH INPUT IMPEDANCE
- LOW ON-VOLTAGE DROP (V_{cesat})
- OFF LOSSES INCLUDE TAIL CURRENT
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- CO-PACKAGED WITH TURBOSWITCHT
- ANTIPARALLEL DIODE



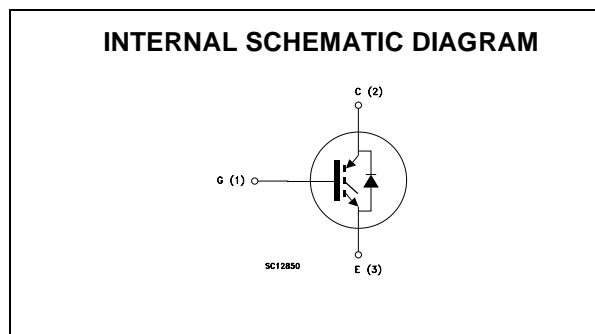
DESCRIPTION

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 "H" identifies a family optimized for high frequency applications (up to 50kHz) in order to achieve very high switching performances (reduced f_{fall}) maintaining a low voltage drop.

APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- SMPS and PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES
- UPS



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 | 24 | A |
| I _C | Collector Current (continuous) at T _C = 100°C | 12 | A |
| I _{CM} (■) | Collector Current (pulsed) | 96 | A |
| P _{TOT} | Total Dissipation at T _C = 25°C | 100 | W |
| | Derating Factor | 0.8 | W/°C |
| T _{stg} | Storage Temperature | -65 to 150 | °C |
| T _j | Max. Operating Junction Temperature | 150 | °C |

(■) Pulse width limited by safe operating area

STGP12NB60HD

THERMAL DATA

| | | | |
|-----------|---|------|------|
| Rthj-case | Thermal Resistance Junction-case Max | 1.25 | °C/W |
| Rthj-amb | Thermal Resistance Junction-ambient Max | 62.5 | °C/W |
| Rthc-sink | Thermal Resistance Case-sink Typ | 0.5 | °C/W |

ELECTRICAL CHARACTERISTICS (T_{CASE} = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------|--|---|------|------|-----------|----------|
| V _{BR(CES)} | Collector-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 V _{CE} = Max Rating, T _C = 125 °C | | | 10 100 | μA 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 = 250 μA | 3 | | 5 | V |
| V _{CE(sat)} | Collector-Emitter Saturation Voltage | V _{GE} = 15V, I _C = 12 A V _{GE} = 15V, I _C = 12 A, T _J = 125°C | | 2.0 1.7 | 2.8 | V V |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--|---|---|------|----------------|------|----------------|
| g _{fs} | Forward Transconductance | V _{CE} = 15 V, I _C = 12 A | | 10 | | S |
| C _{ies} | Input Capacitance | V _{CE} = 25V, f = 1 MHz, V _{GE} = 0 | | 920 | | pF |
| C _{oes} | Output Capacitance | | | 120 | | pF |
| C _{res} | Reverse Transfer Capacitance | | | 27 | | pF |
| Q _g Q _{ge} Q _{gc} | Total Gate Charge Gate-Emitter Charge Gate-Collector Charge | V _{CE} = 480V, I _C = 12 A, V _{GE} = 15V | | 68 10 30 | | nC nC nC |
| I _{CL} | Latching Current | V _{clamp} = 480 V, T _J = 150°C R _G = 10 Ω | 48 | | | A |

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--|---|---|------|------------|------|------------|
| t _{d(on)} t _r | Turn-on Delay Time Rise Time | V _{CC} = 480 V, I _C = 12 A R _G = 10Ω, V _{GE} = 15 V | | 5 46 | | ns ns |
| (di/dt) _{on} E _{on} | Turn-on Current Slope Turn-on Switching Losses | V _{CC} = 480 V, I _C = 12 A R _G = 10Ω, V _{GE} = 15 V, T _J = 125°C | | 800 290 | | A/μs μJ |

ELECTRICAL CHARACTERISTICS (CONTINUED)

SWITCHING OFF

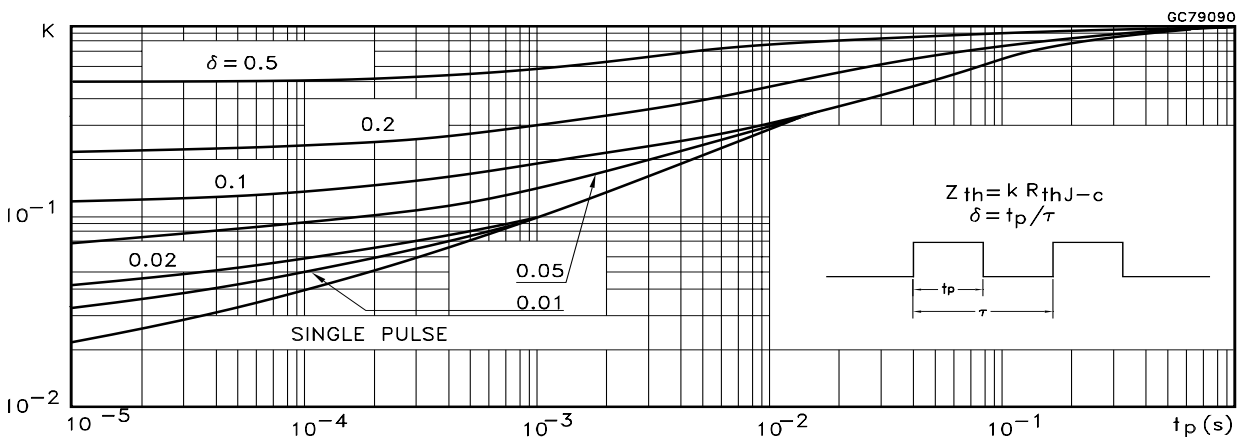
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------|-------------------------|---|------|------|------|------|
| t_c | Cross-over Time | $V_{CC} = 480\text{ V}, I_C = 12\text{ A},$ $R_{GE} = 10\ \Omega, V_{GE} = 15\text{ V}$ | | 150 | | ns |
| $t_r(V_{off})$ | Off Voltage Rise Time | | | 27 | | ns |
| $t_{d(off)}$ | Delay Time | | | 76 | | ns |
| t_f | Fall Time | | | 92 | | ns |
| $E_{off(**)}$ | Turn-off Switching Loss | | | 0.21 | | mJ |
| E_{ts} | Total Switching Loss | | | 0.49 | | mJ |
| t_c | Cross-over Time | $V_{CC} = 480\text{ V}, I_C = 12\text{ A},$ $R_{GE} = 10\ \Omega, V_{GE} = 15\text{ V}$ $T_j = 125\text{ }^\circ\text{C}$ | | 230 | | ns |
| $t_r(V_{off})$ | Off Voltage Rise Time | | | 76 | | ns |
| $t_{d(off)}$ | Delay Time | | | 95 | | ns |
| t_f | Fall Time | | | 200 | | ns |
| $E_{off(**)}$ | Turn-off Switching Loss | | | 0.45 | | mJ |
| E_{ts} | Total Switching Loss | | | 0.74 | | mJ |

COLLECTOR-EMITTER DIODE

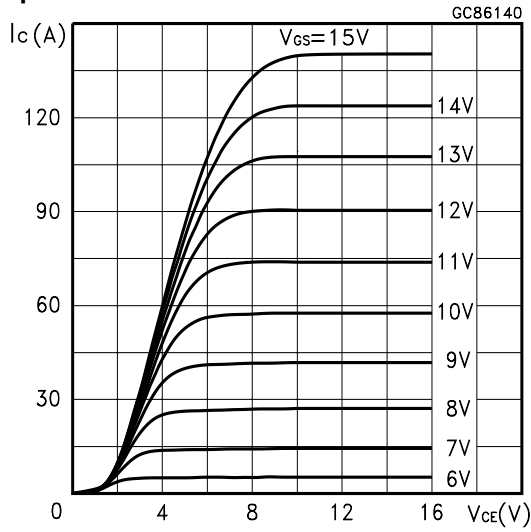
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------|--------------------------|---|------|------|------|------|
| I_f | Forward Current | | | | 12 | A |
| I_{fm} | Forward Current pulsed | | | | 48 | A |
| V_f | Forward On-Voltage | $I_f = 6\text{ A}$ $I_f = 6\text{ A}, T_j = 125\text{ }^\circ\text{C}$ | | 1.3 | 1.9 | V |
| | | | | 1.1 | | V |
| t_{rr} | Reverse Recovery Time | $I_f = 6\text{ A}, V_R = 50\text{ V},$ $T_j = 125\text{ }^\circ\text{C}, di/dt = 100\text{ A}/\mu\text{s}$ | | 80 | | ns |
| Q_{rr} | Reverse Recovery Charge | | | 240 | | nC |
| I_{rrm} | Reverse Recovery Current | | | 5.5 | | A |

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)

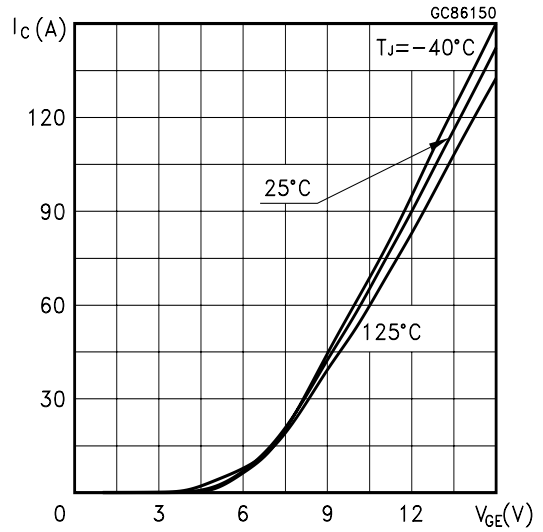
Thermal Impedance



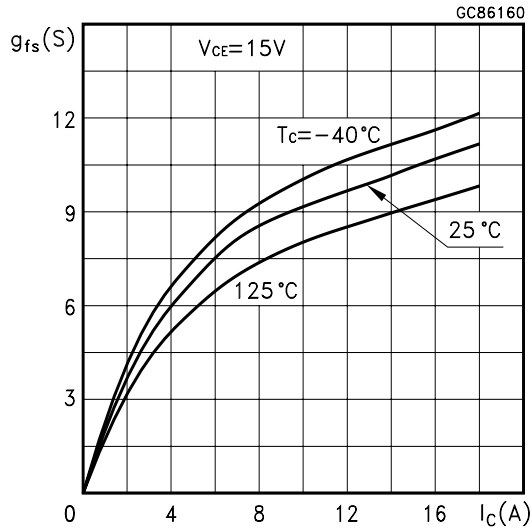
Output Characteristics



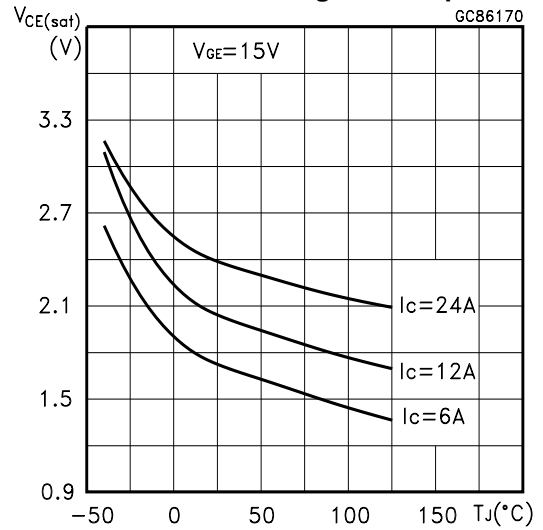
Transfer Characteristics



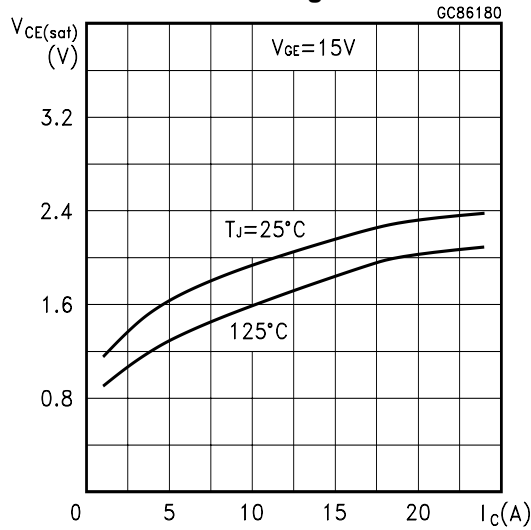
Transconductance



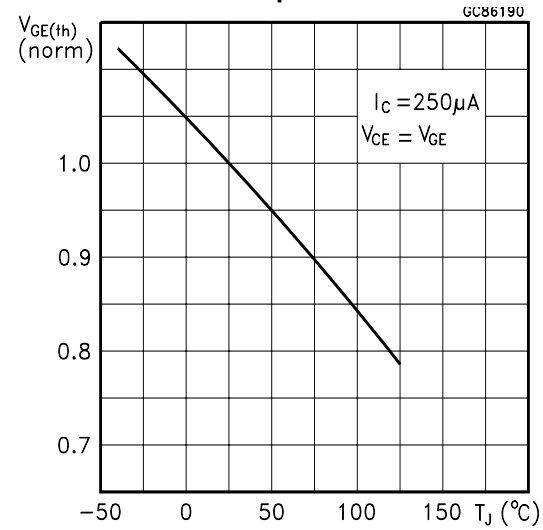
Collector-Emitter On Voltage vs Temperature



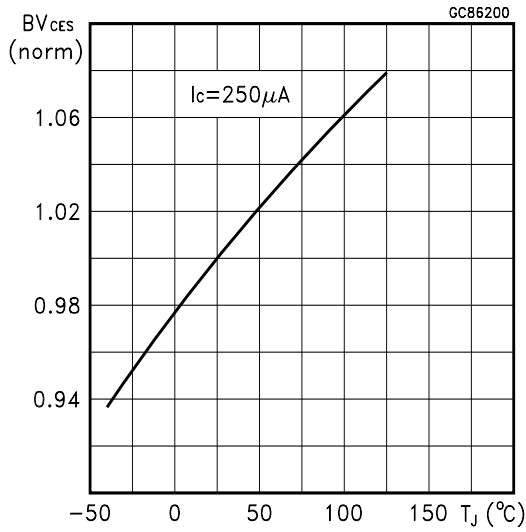
Collector-Emitter On Voltage vs Collector Current



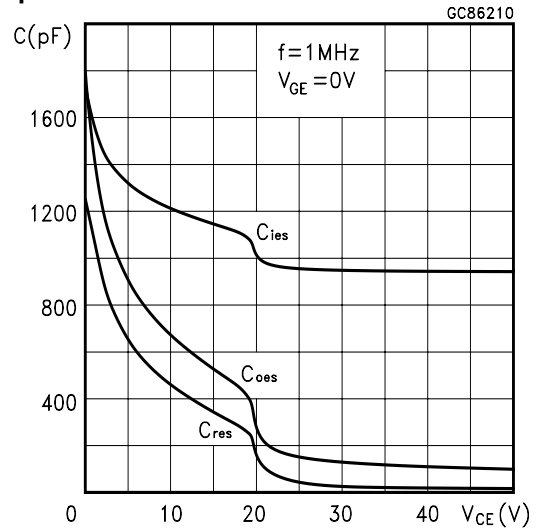
Gate Threshold vs Temperature



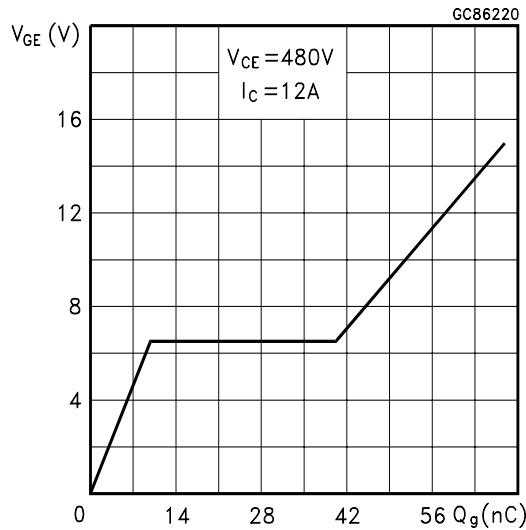
Normalized Breakdown Voltage vs Temperature



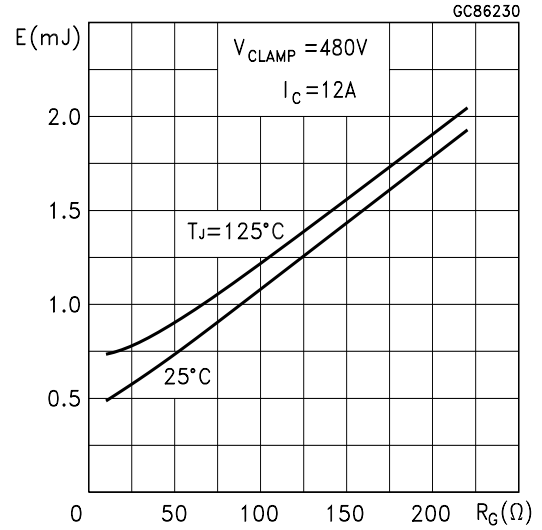
Capacitance Variations



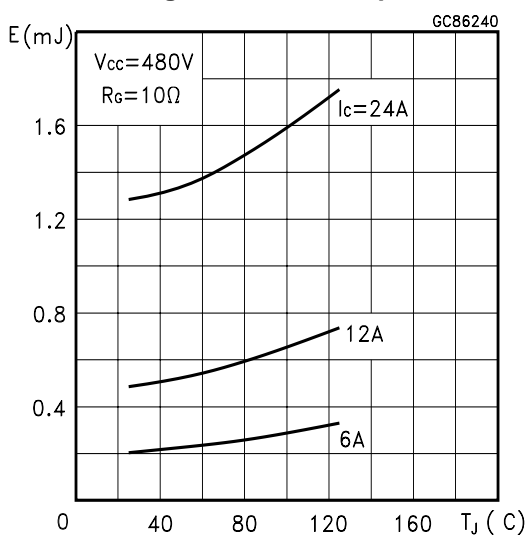
Gate Charge vs Gate-Emitter Voltage



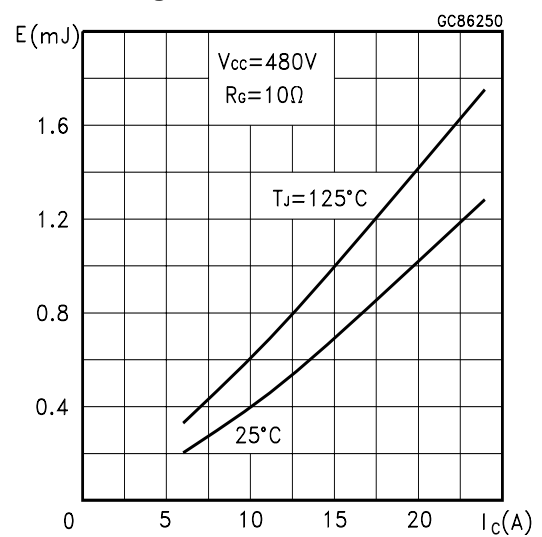
Total Switching Losses vs Gate Resistance



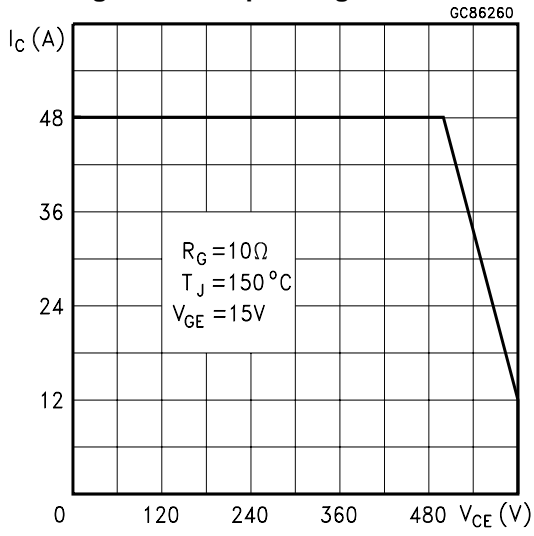
Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



Switching Off Safe Operating Area



Diode Forward Voltage

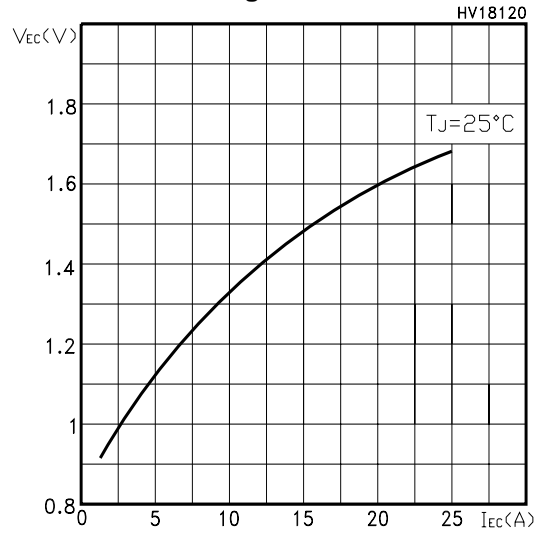


Fig. 1: Gate Charge test Circuit

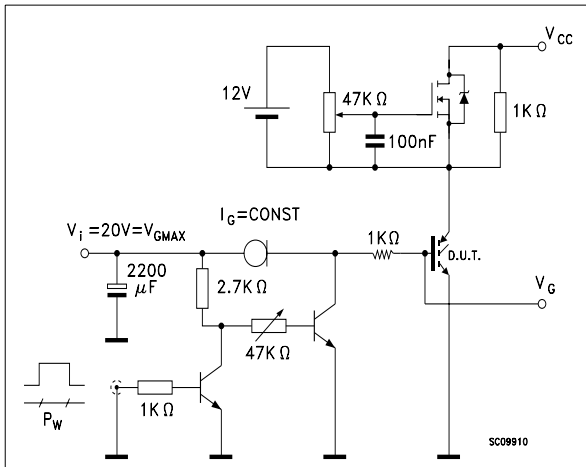
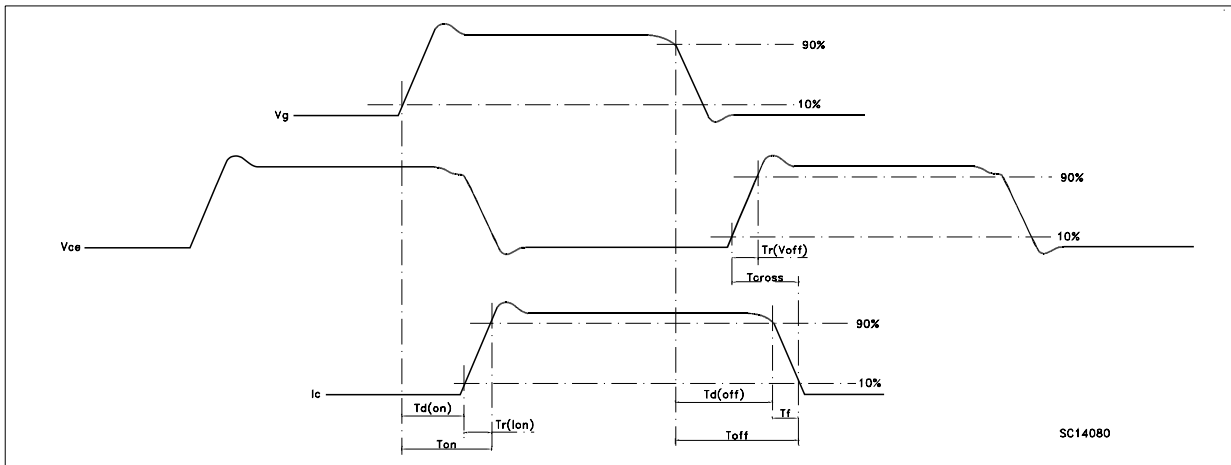
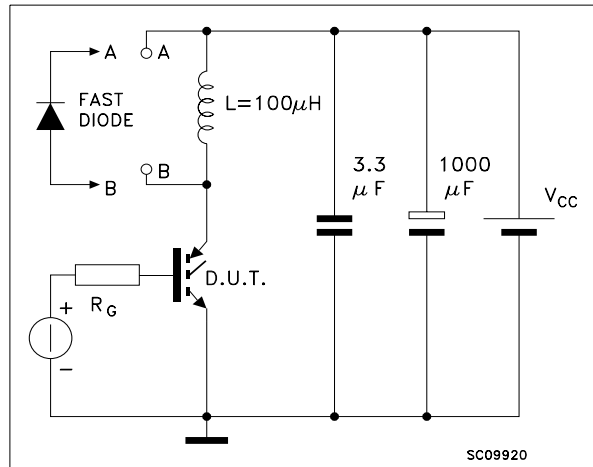
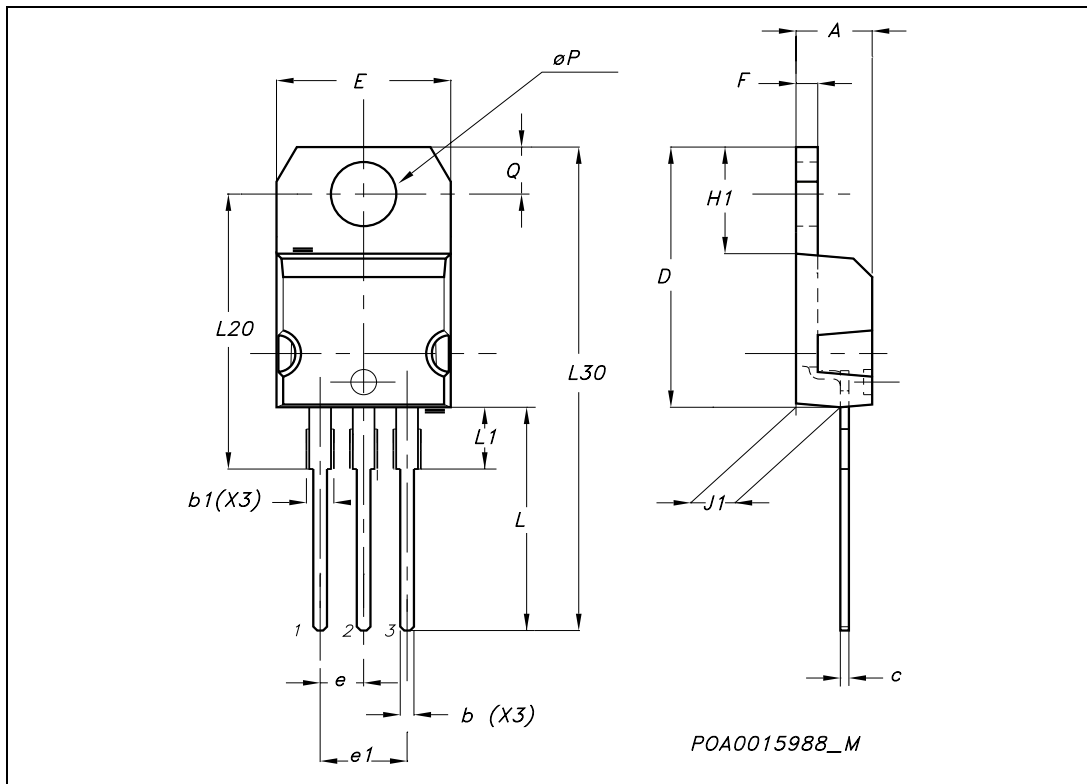


Fig. 2: Test Circuit For Inductive Load Switching



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 |



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