



STGW20NB60KD

N-CHANNEL 20A - 600V - TO-247

SHORT CIRCUIT PROOF PowerMESH™ IGBT

| TYPE | V _{CES} | V _{CE(sat)} | I _C |
|--------------|------------------|----------------------|----------------|
| STGW20NB60KD | 600 V | < 2.8 V | 20 A |

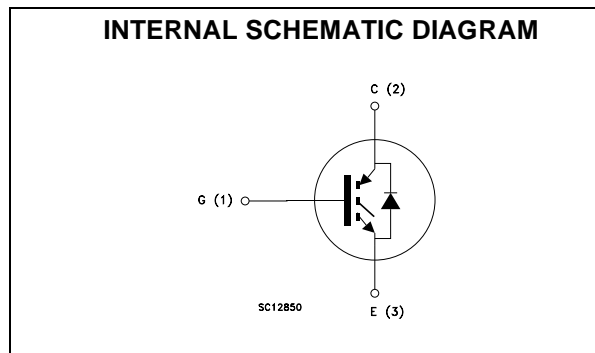
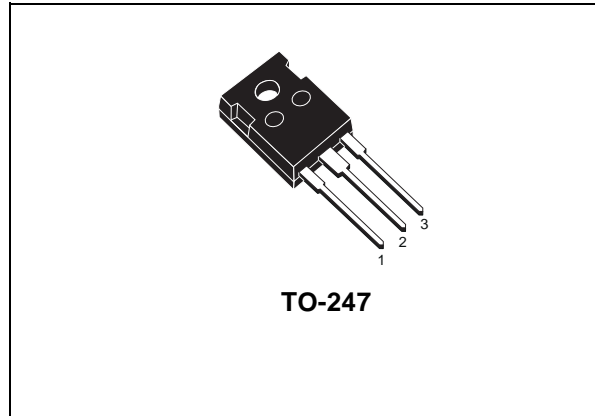
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V_{cesat})
- LOW ON-LOSSES
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- VERY HIGH FREQUENCY OPERATION
- SHORT CIRCUIT RATED
- LATCH CURRENT FREE OPERATION

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 |
|--------------|------------|---------|-----------|
| STGW20NB60KD | GW20NB60KD | TO-247 | TUBE |

STGW20NB60KD

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 $T_C = 25^\circ\text{C}$ | 40 | A |
| I_C | Collector Current (continuous) at $T_C = 100^\circ\text{C}$ | 20 | A |
| $I_{CM} (\Delta)$ | Collector Current (pulsed) | 80 | A |
| T_{sc} | Short Circuit Withstand | 10 | μs |
| P_{TOT} | Total Dissipation at $T_C = 25^\circ\text{C}$ | 150 | W |
| | Derating Factor | 1.2 | $\text{W}/^\circ\text{C}$ |
| T_{stg} | Storage Temperature | - 55 to 150 | $^\circ\text{C}$ |
| T_j | Max. Operating Junction Temperature | | |

THERMAL DATA

| | | | |
|----------------|---|------|---------------------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case Max | 0.83 | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$ | Thermal Resistance Junction-ambient Max | 50 | $^\circ\text{C}/\text{W}$ |

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

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

ON (1)

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

DYNAMIC

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

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------|--------------------------|---|------|------|------|------------------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CC} = 480\text{ V}, I_C = 20\text{ A}$ $R_G = 10\ \Omega, V_{GE} = 15\text{ V}$ | | 40 | | ns |
| t_r | Rise Time | | | 36 | | ns |
| $(di/dt)_{on}$ | Turn-on Current Slope | $V_{CC} = 480\text{ V}, I_C = 20\text{ A}, R_G = 10\ \Omega$ $V_{GE} = 15\text{ V}, T_j = 125^\circ\text{C}$ | | 350 | | A/ μs |
| E_{on} | Turn-on Switching Losses | | | 650 | | μJ |

SWITCHING OFF

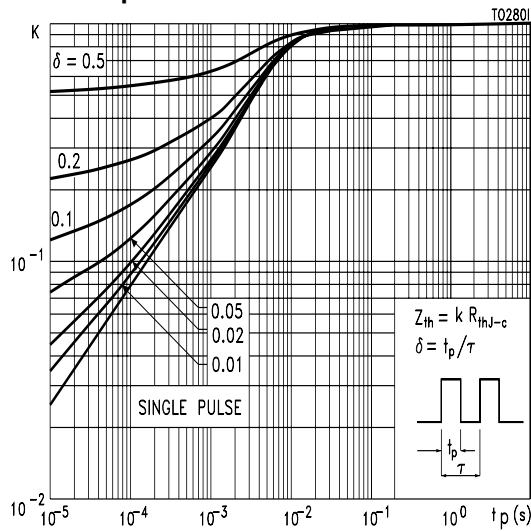
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------|-------------------------|---|------|------|------|------|
| t_c | Cross-over Time | $V_{CC} = 480\text{ V}, I_C = 20\text{ A},$ $R_{GE} = 10\ \Omega, V_{GE} = 15\text{ V}$ | | 130 | | ns |
| $t_r(V_{off})$ | Off Voltage 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 | $V_{CC} = 480\text{ V}, I_C = 20\text{ A},$ $R_{GE} = 10\ \Omega, V_{GE} = 15\text{ V}$ $T_j = 125^\circ\text{C}$ | | 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 |

COLLECTOR-EMITTER DIODE

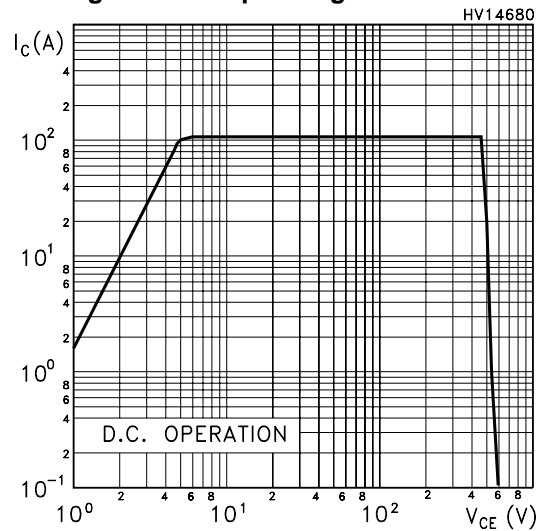
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------|--------------------------|--|------|-----------|------|--------|
| I_f | Forward Current | | | | 20 | A |
| I_{fm} | Forward Current pulsed | | | | 80 | A |
| V_f | Forward On-Voltage | $I_f = 10\text{ A}$ $I_f = 10\text{ A}, T_j = 125^\circ\text{C}$ | | 1.27 1 | 2.0 | V V |
| t_{rr} | Reverse Recovery Time | $I_f = 10\text{ A}, V_R = 27\text{ V},$ $T_j = 125^\circ\text{C}, di/dt = 100\text{ A}/\mu\text{s}$ | | 80.5 | | ns |
| Q_{rr} | Reverse Recovery Charge | | | 181 | | nC |
| I_{rrm} | Reverse Recovery Current | | | 4.5 | | 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)

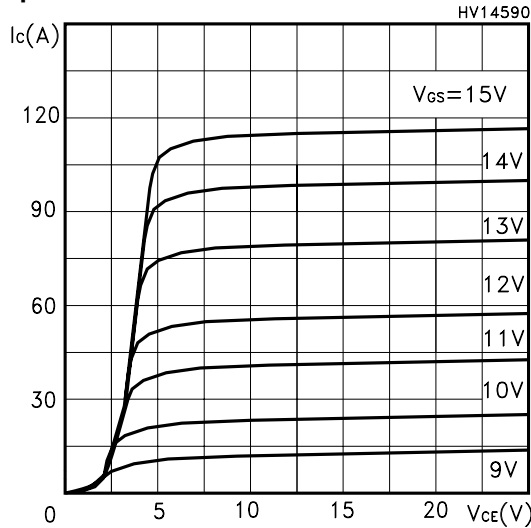
Thermal Impedance



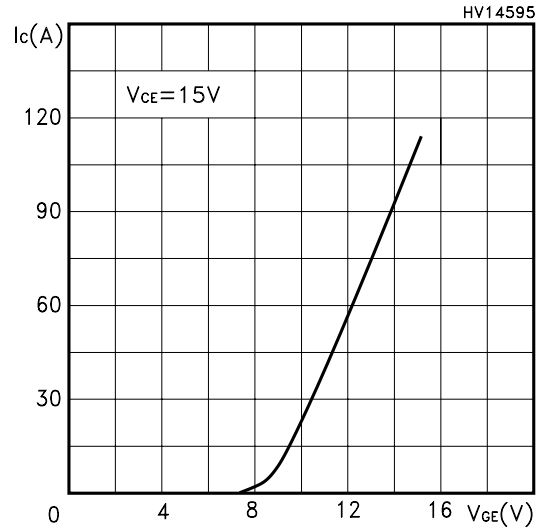
Switching Off Safe Operating Area



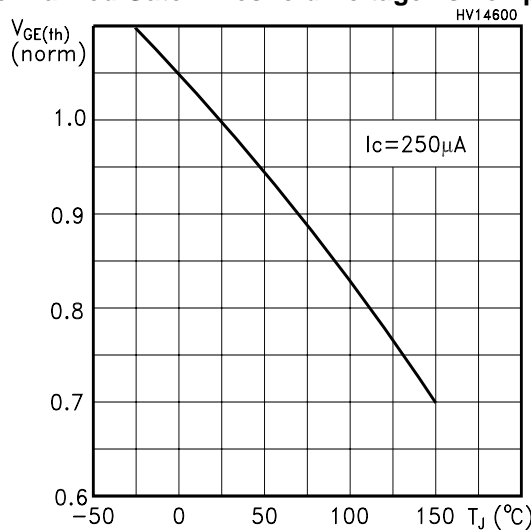
Output Characteristics



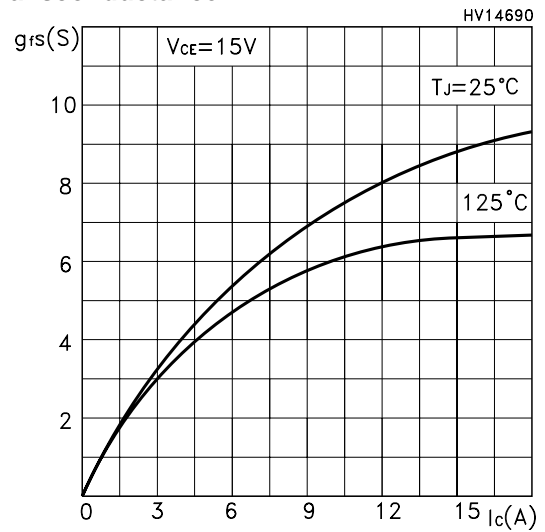
Transfer Characteristics



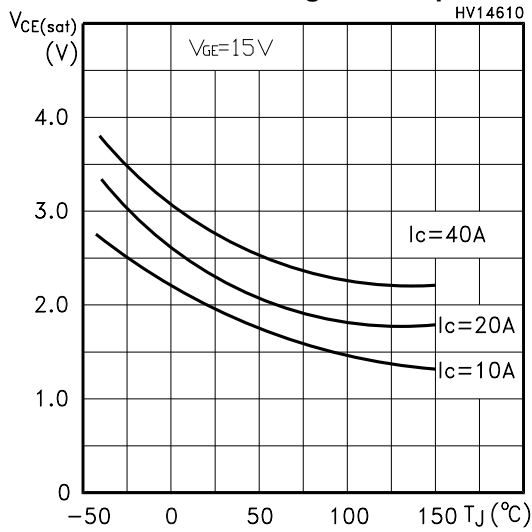
Normalized Gate Threshold Voltage vs Temp.



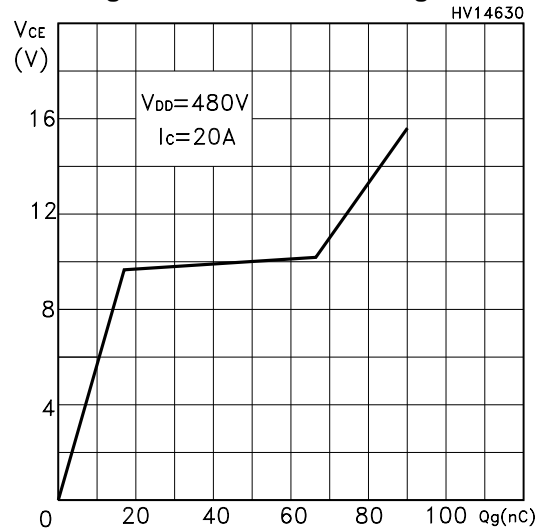
Transconductance



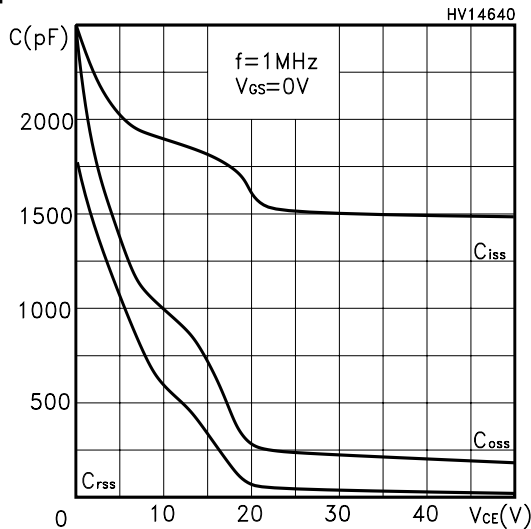
Collector-Emitter On Voltage vs Temperature



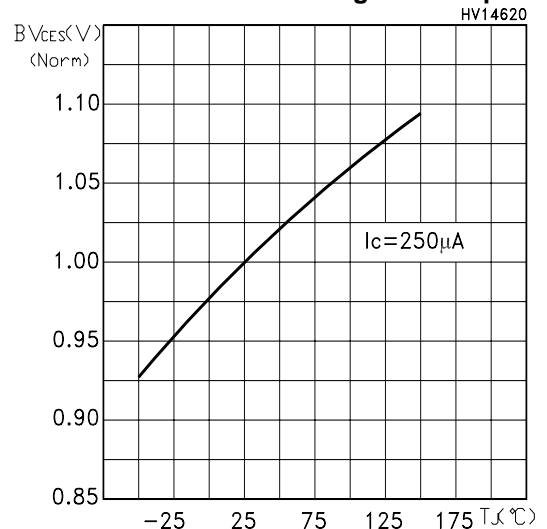
Gate-Charge vs Gate-Emitter Voltage



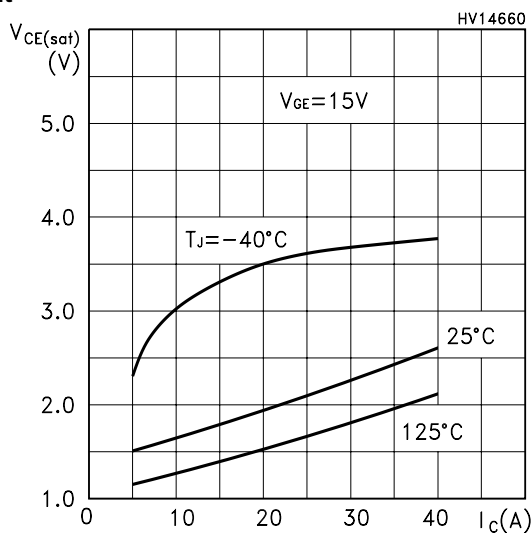
Capacitance Variations



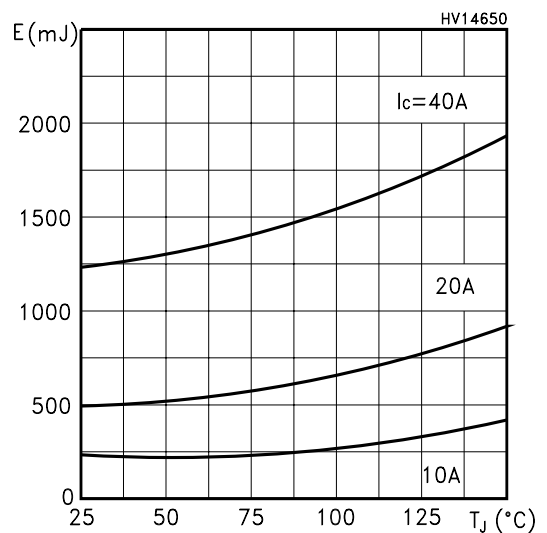
Normalized Break-down Voltage vs Temp.



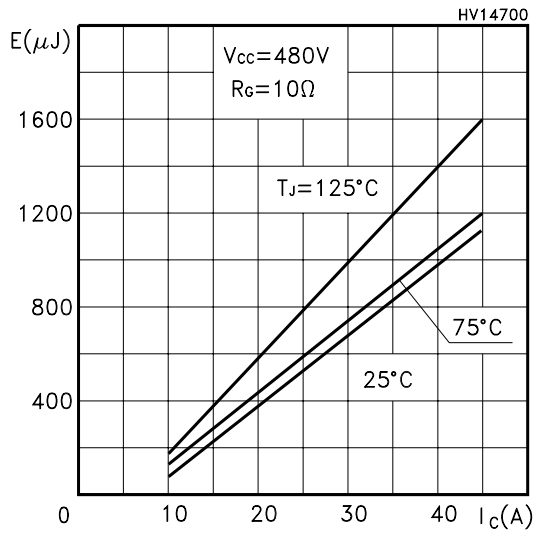
Collector-Emitter on Voltage vs Collector Current



Turn-Off Energy Losses vs Temperature



Total Switch Losses vs Collector Current



Diode Forward Voltage

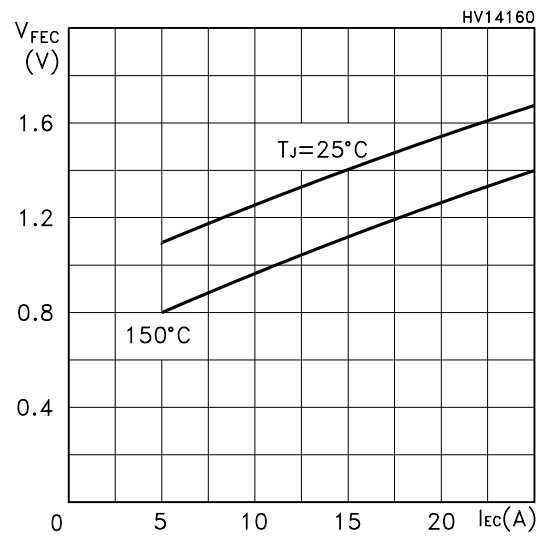


Fig. 1: Gate Charge test Circuit

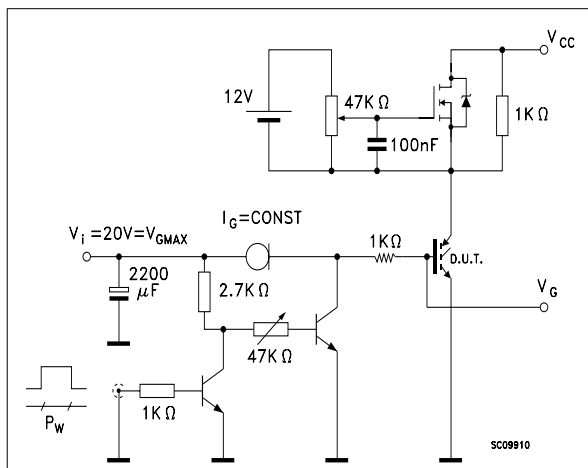
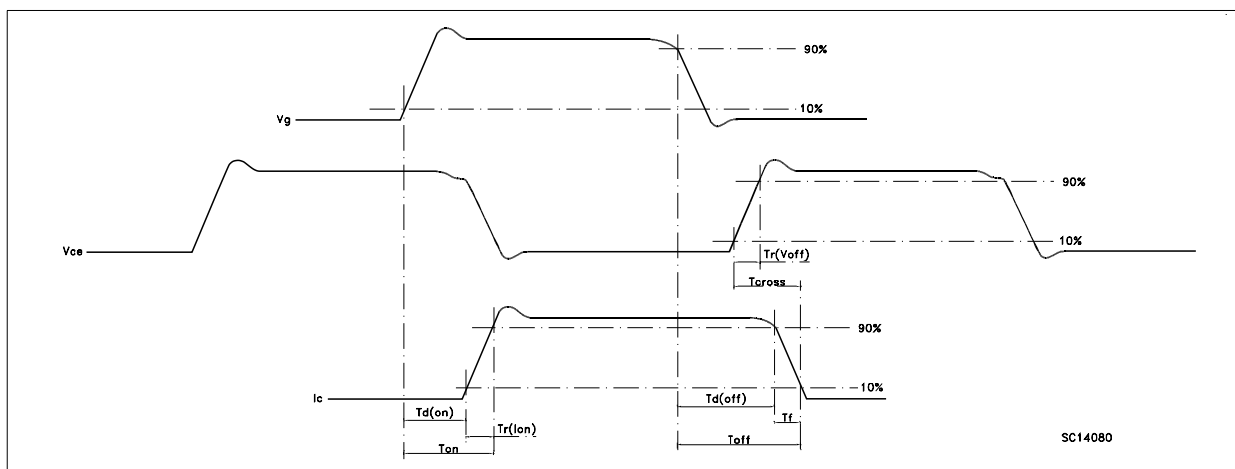
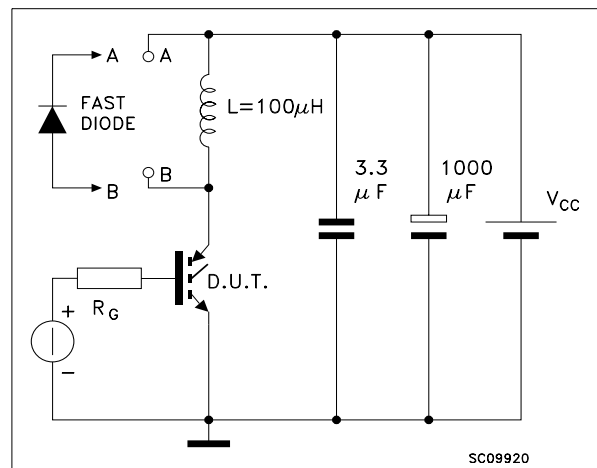
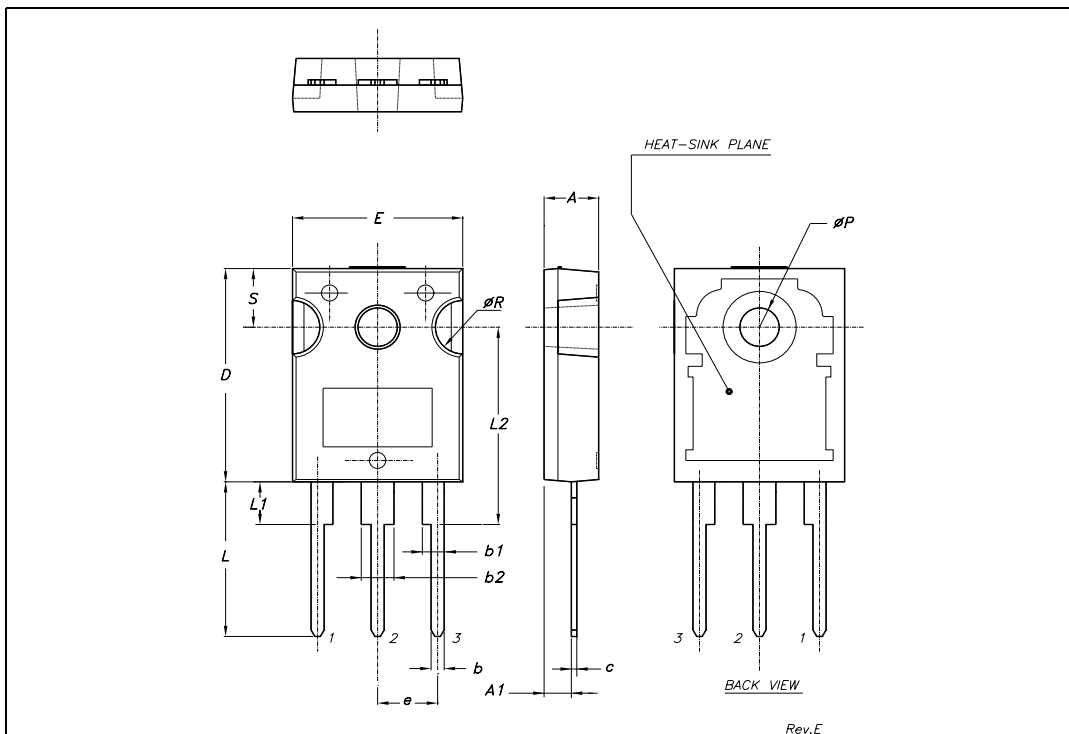


Fig. 2: Test Circuit For Inductive Load Switching



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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