



STGD5NB120SZ-1

N-CHANNEL 5A - 1200V IPAK INTERNALLY CLAMPED PowerMESH™ IGBT

| TYPE | V _{CES} | V _{CE(sat)} | I _C |
|----------------|------------------|----------------------|----------------|
| STGD5NB120SZ-1 | 1200 V | < 2.0 V | 5 A |

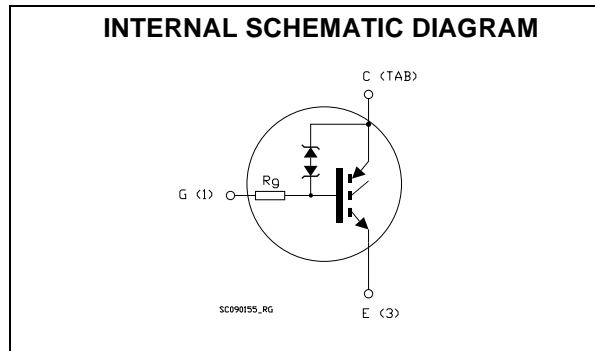
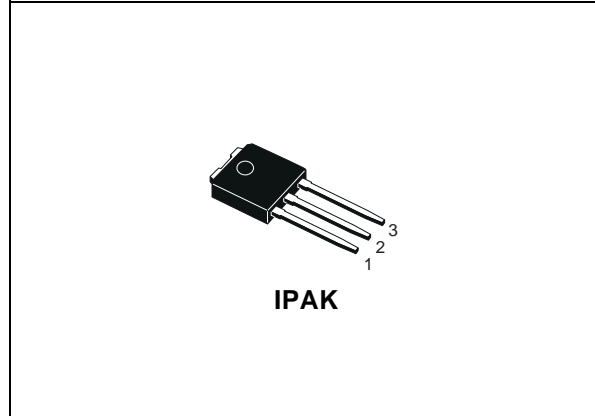
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V_{CE(sat)})
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- HIGH VOLTAGE CLAMPING FEATURES

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 "S" identifies a family optimized achieve minimum on-voltage drop for low frequency applications (<1kHz). The built in collector-gate zener exhibits a very precise active clamping.

APPLICATIONS

- LIGHT DIMMER
- INRUSH CURRENT LIMITATION



ORDERING INFORMATION

| SALES TYPE | MARKING | PACKAGE | PACKAGING |
|----------------|------------|---------|-----------|
| STGD5NB120SZ-1 | GD5NB120SZ | IPAK | TUBE |

STGD5NB120SZ-1

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-------------------------|---|------------|---------------------|
| V_{CES} | Collector-Emitter Voltage ($V_{GS} = 0$) | 1200 | V |
| V_{ECR} | Emitter-Collector Voltage | 20 | V |
| V_{GE} | Gate-Emitter Voltage | ± 20 | V |
| I_C | Collector Current (continuous) at $T_C = 25^\circ\text{C}$ | 10 | A |
| I_C | Collector Current (continuous) at $T_C = 100^\circ\text{C}$ | 5 | A |
| $I_{CM} (\blacksquare)$ | Collector Current (pulsed) | 20 | A |
| P_{TOT} | Total Dissipation at $T_C = 25^\circ\text{C}$ | 55 | W |
| | Derating Factor | 0.4 | W/ $^\circ\text{C}$ |
| $E_{as} (1)$ | Single Pulse Avalanche Energy at $T_j = 25^\circ\text{C}$ | 10 | mJ |
| | Single Pulse Avalanche Energy at $T_j = 100^\circ\text{C}$ | 7 | mJ |
| T_{stg} | Storage Temperature | -65 to 150 | $^\circ\text{C}$ |
| T_j | Operating Junction Temperature range | 150 | $^\circ\text{C}$ |

(\blacksquare) Pulse width limited by safe operating area

(1) $V_{CE} = 50\text{ V}$, $I_{AV} = 3.3\text{ A}$

THERMAL DATA

| | | | |
|-----------|---|------|---------------------------|
| Rthj-case | Thermal Resistance Junction-case Max | 2.27 | $^\circ\text{C}/\text{W}$ |
| Rthj-amb | Thermal Resistance Junction-ambient Max | 100 | $^\circ\text{C}/\text{W}$ |

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

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------|---|--|------|------|-----------|--------------------------------|
| $V_{BR(CES)}$ | Collector-Emitter Breakdown Voltage | $I_C = 10\text{ mA}$, $V_{GE} = 0\text{ V}$ | 1200 | | | V |
| I_{CES} | Collector cut-off Current ($V_{GE} = 0$) | $V_{CE} = 900\text{ V}$ $V_{CE} = 900\text{ V}$, $T_j = 125\text{ }^\circ\text{C}$ | | | 50 250 | μA μA |
| I_{GES} | Gate-Emitter Leakage Current ($V_{CE} = 0$) | $V_{GE} = \pm 20\text{ V}$, $V_{CE} = 0\text{ V}$ | | | ± 100 | nA |

ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------|--------------------------------------|--|------|------|------|--------|
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$ | 2 | | 5 | V |
| V_{GE} | Gate Emitter Voltage | $V_{CE} = 2.5\text{ V}$, $I_C = 2\text{ A}$, $T_j = 25\div 125^\circ\text{C}$ | | | 6.5 | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$, $T_j = 125^\circ\text{C}$ | | 1.3 | 2.0 | V V |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------|------------------------------|--|------|------|------|------------|
| g_{fs} | Forward Transconductance | $V_{CE} = 25 \text{ V}$, $I_C = 5 \text{ A}$ | | 5 | | S |
| $C_{ies}^{(*)}$ | Input Capacitance | $V_{CE} = 25 \text{ V}$, $f = 1 \text{ MHz}$, $V_{GE} = 0 \text{ V}$ | | 430 | | pF |
| $C_{oes}^{(*)}$ | Output Capacitance | | | 40 | | pF |
| $C_{res}^{(*)}$ | Reverse Transfer Capacitance | | | 7 | | pF |
| R_g | Gate Resistance | | | 4 | | K Ω |

Note: (*) Without R_g Gate Resistance

FUNCTIONAL TEST

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------|---------------------------------------|--|------|------|------|------|
| I_{as} | Unclamped inductive switching current | $V_{CC} = 50 \text{ V}$, $L = 1.8 \text{ mH}$ $T_{start} = 25^\circ\text{C}$, $R_{drive} = 1 \text{ K}\Omega$ | 3.3 | | | A |
| I_{CL} | Latching Current | $V_{CLAMP} = 960 \text{ V}$, $T_j = 125^\circ\text{C}$ $R_{drive} = 1 \text{ K}\Omega$ | | 10 | | A |

ELECTRICAL CHARACTERISTICS

SWITCHING ON

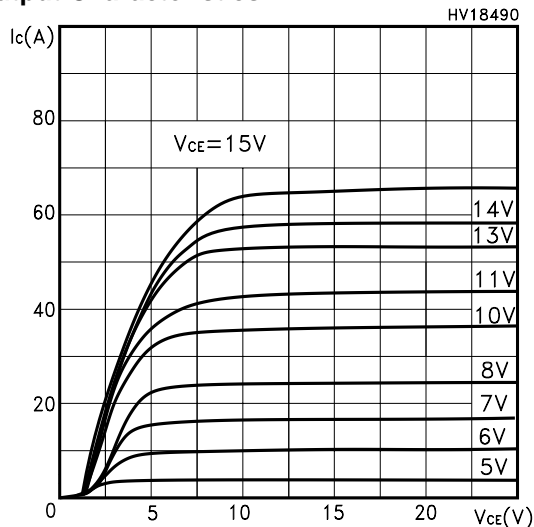
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------------|---|---|------|------------|------|------------------------|
| $t_{d(on)}$ t_r | Delay Time Rise Time | $I_C = 5 \text{ A}$, $V_{CC} = 960 \text{ V}$ $V_{GE} = 15 \text{ V}$, $R_{drive} = 1 \text{ K}\Omega$ $T_j = 25^\circ\text{C}$ | | 690 160 | | ns ns |
| $(di/dt)_{on}$ E_{on} | Turn-on Current Slope Turn-on Switching Losses | $I_{CC} = 5 \text{ A}$, $V_{CC} = 960 \text{ V}$ $V_{GE} = 15 \text{ V}$, $R_{drive} = 1 \text{ K}\Omega$ $T_j = 125^\circ\text{C}$ | | 39 2.64 | | A/ μs mJ |

SWITCHING OFF

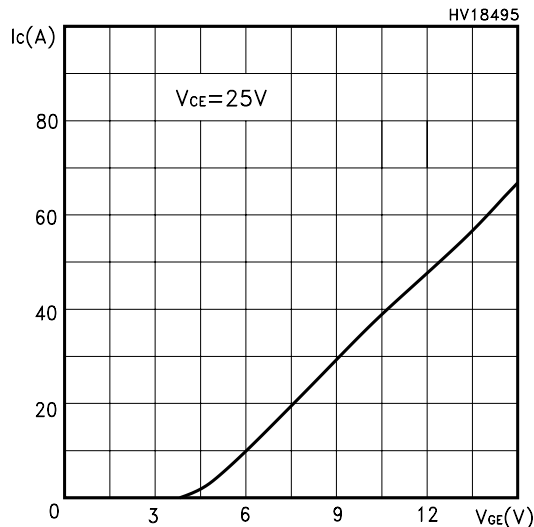
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--|--|--|------|-------------------------------|------|--|
| t_c $t_r(V_{off})$ $t_{d(off)}$ t_f $E_{off}^{(**)}$ | Cross-over Time Off Voltage Rise Time Delay Time Fall Time Turn-off Switching Loss | $I_C = 5 \text{ A}$, $V_{CC} = 960 \text{ V}$ $V_{GE} = 15 \text{ V}$, $R_{drive} = 1 \text{ K}\Omega$ $T_j = 25^\circ\text{C}$ | | 4 2.2 12.1 1.13 9 | | μs μs μs μs mJ |
| t_c $t_r(V_{off})$ $t_{d(off)}$ t_f $E_{off}^{(**)}$ | Cross-over Time Off Voltage Rise Time Delay Time Fall Time Turn-off Switching Loss | $I_C = 5 \text{ A}$, $V_{CC} = 960 \text{ V}$ $V_{GE} = 15 \text{ V}$, $R_{drive} = 1 \text{ K}\Omega$ $T_j = 125^\circ\text{C}$ | | 5 2.2 12.1 2 10.2 | | μs μs μs μs mJ |

(**) Losses include Also the Tail (Jedec Standardization)

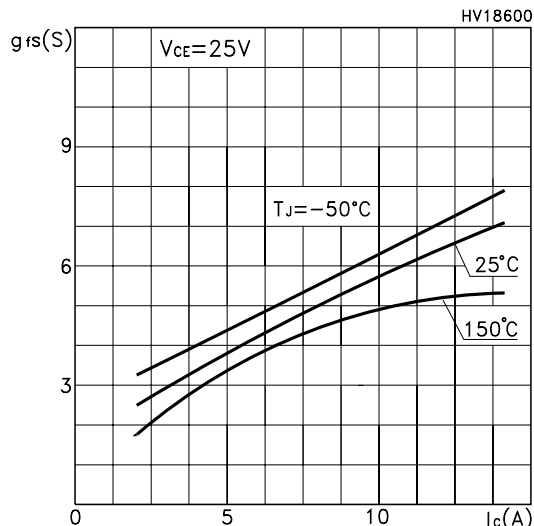
Output Characteristics



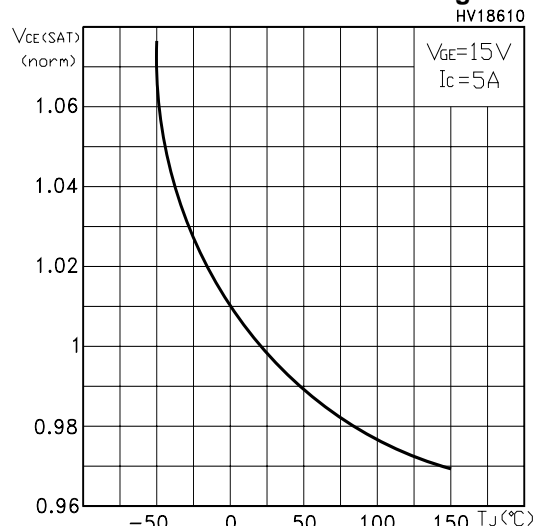
Transfer Characteristics



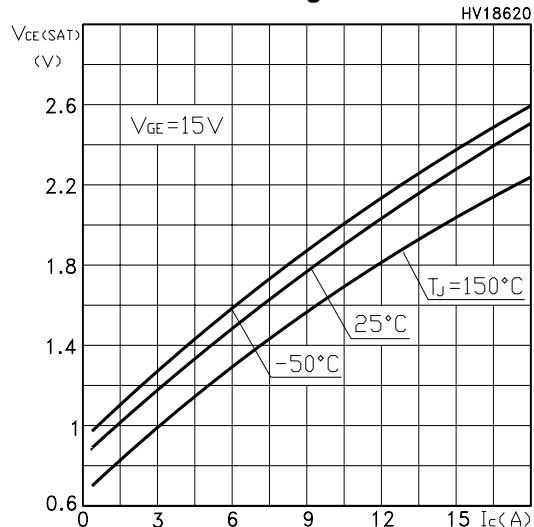
Transconductance



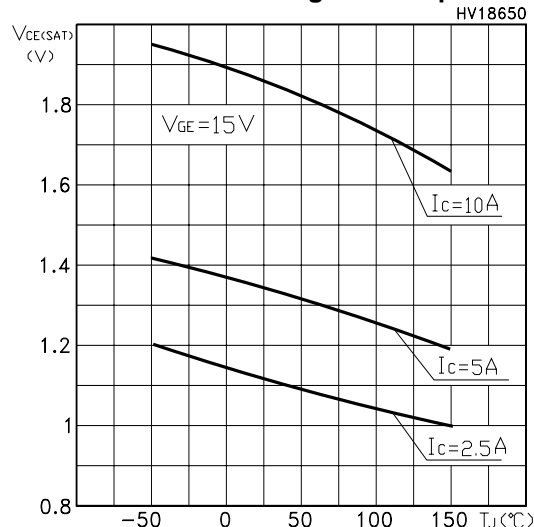
Normalized Collector-Emitter On Voltage vs Temp.



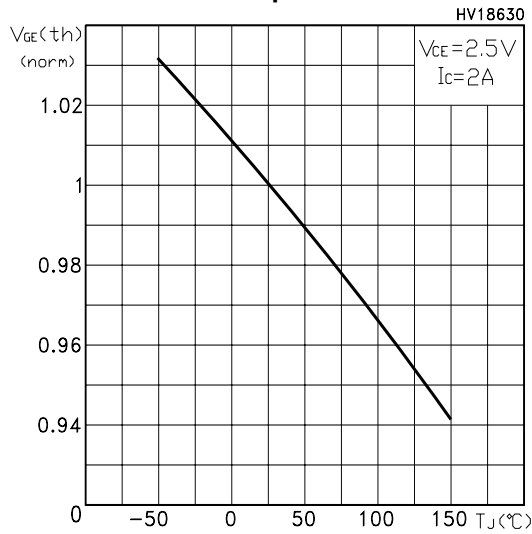
Collector-Emitter On Voltage vs Collector Current



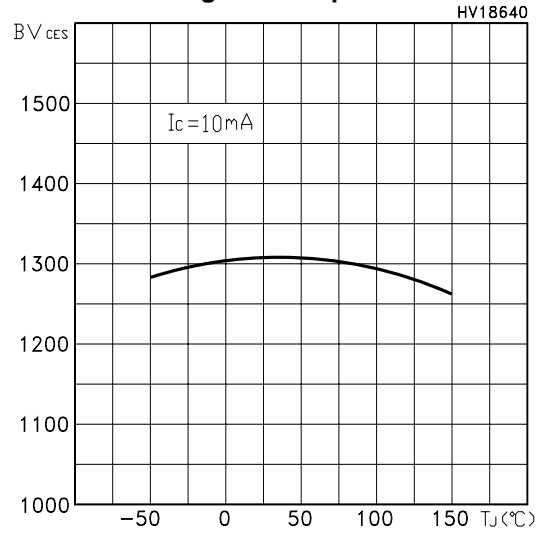
Collector-Emitter On Voltage vs Temperature



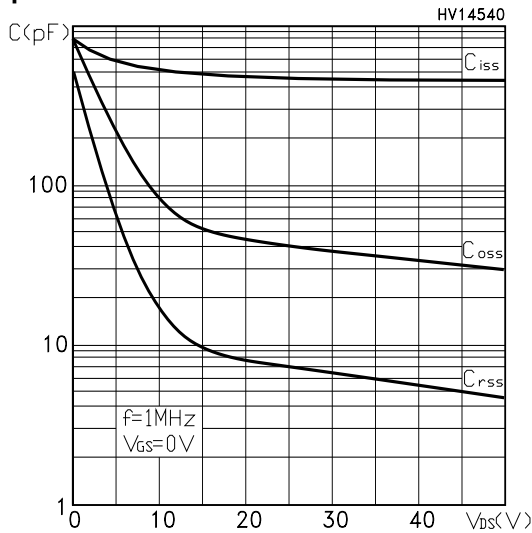
Gate Threshold vs Temperature



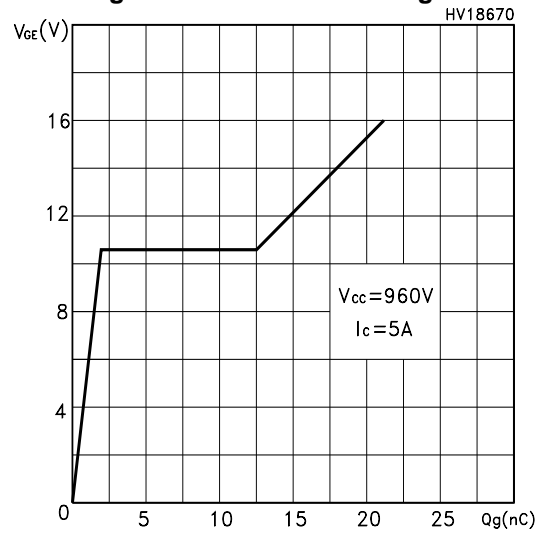
Breakdown Voltage vs Temperature



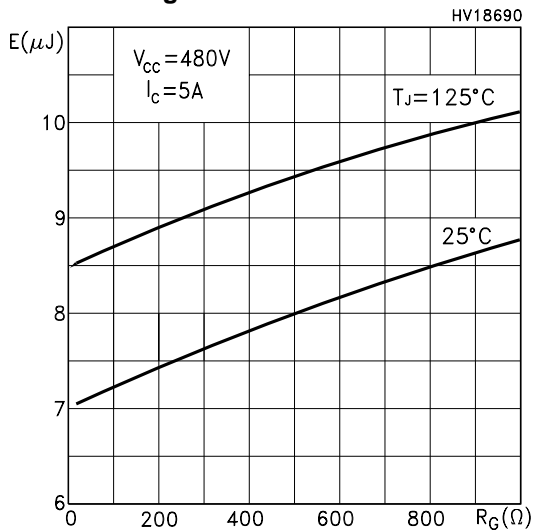
Capacitance Variations



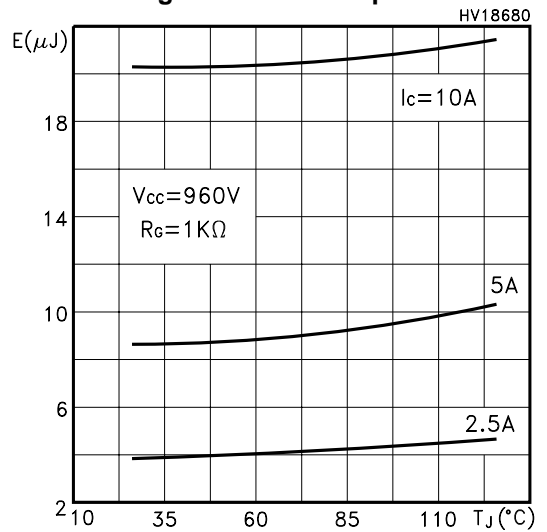
Gate Charge vs Gate-Emitter Voltage



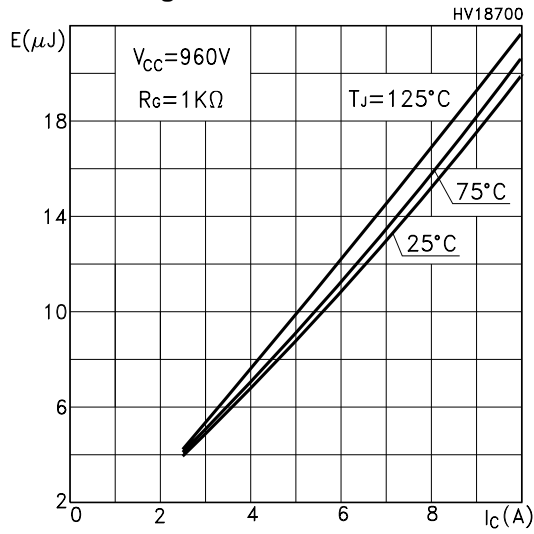
Total Switching Losses vs Gate Resistance



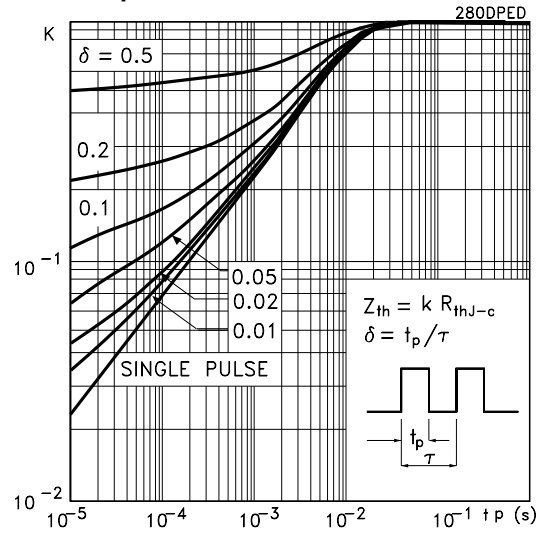
Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



Thermal Impedance



Turn-Off SOA

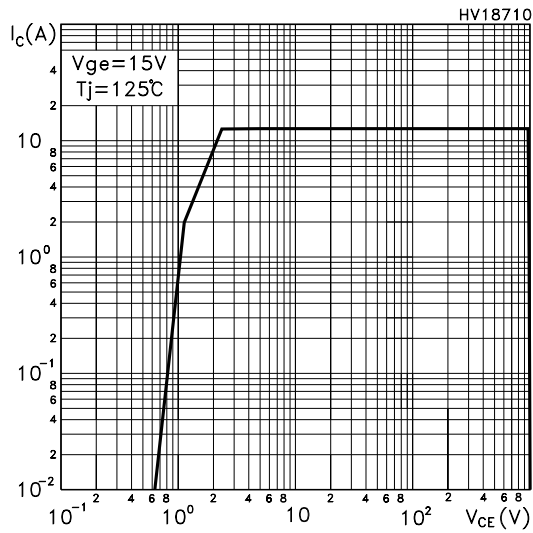


Fig. 1: Gate Charge test Circuit

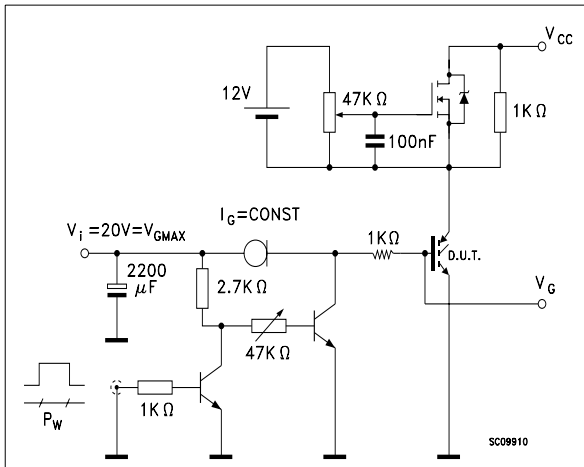
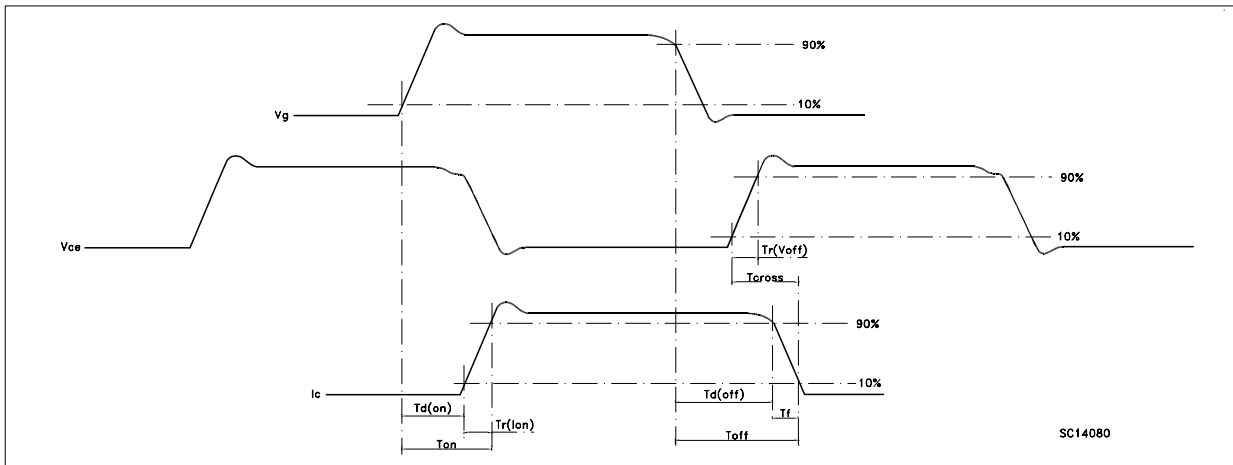
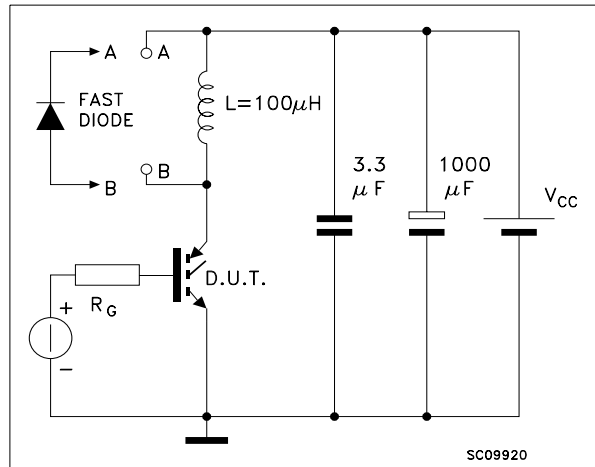
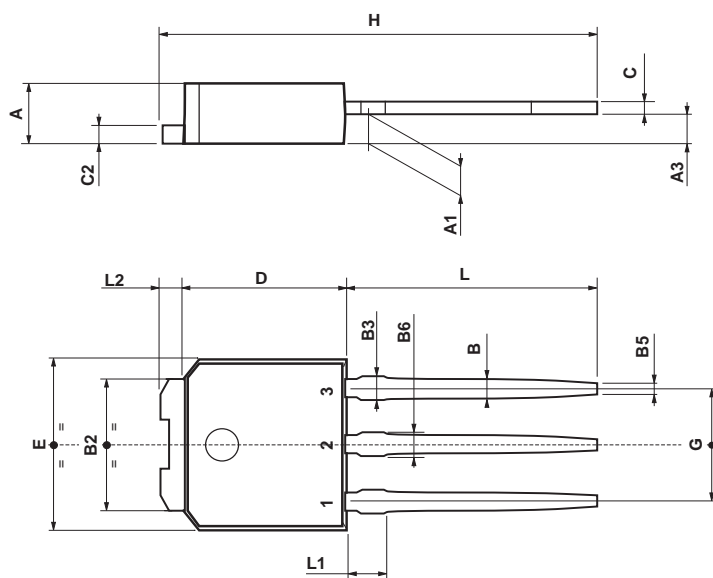


Fig. 2: Test Circuit For Inductive Load Switching (SC09920)



TO-251 (IPAK) MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 2.2 | | 2.4 | 0.086 | | 0.094 |
| A1 | 0.9 | | 1.1 | 0.035 | | 0.043 |
| A3 | 0.7 | | 1.3 | 0.027 | | 0.051 |
| B | 0.64 | | 0.9 | 0.025 | | 0.031 |
| B2 | 5.2 | | 5.4 | 0.204 | | 0.212 |
| B3 | | | 0.85 | | | 0.033 |
| B5 | | 0.3 | | | 0.012 | |
| B6 | | | 0.95 | | | 0.037 |
| C | 0.45 | | 0.6 | 0.017 | | 0.023 |
| C2 | 0.48 | | 0.6 | 0.019 | | 0.023 |
| D | 6 | | 6.2 | 0.236 | | 0.244 |
| E | 6.4 | | 6.6 | 0.252 | | 0.260 |
| G | 4.4 | | 4.6 | 0.173 | | 0.181 |
| H | 15.9 | | 16.3 | 0.626 | | 0.641 |
| L | 9 | | 9.4 | 0.354 | | 0.370 |
| L1 | 0.8 | | 1.2 | 0.031 | | 0.047 |
| L2 | | 0.8 | 1 | | 0.031 | 0.039 |



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