



STGB10NB40LZ

N-CHANNEL CLAMPED 20A - D²PAK INTERNALLY CLAMPED PowerMESH™ IGBT

| TYPE | V _{CES} | V _{CE(sat)} | I _C |
|--------------|------------------|----------------------|----------------|
| STGB10NB40LZ | CLAMPED | < 1.8 V | 20 A |

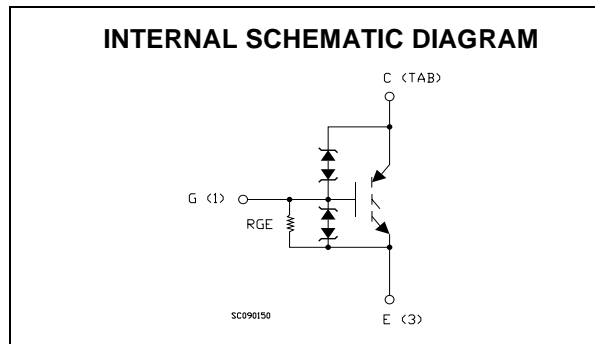
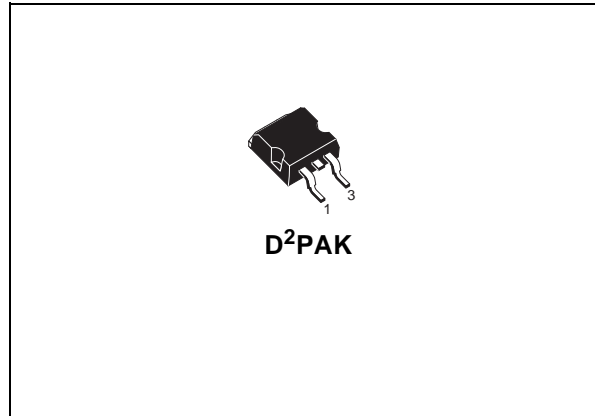
- POLYSILICON GATE VOLTAGE DRIVEN
- LOW THRESHOLD VOLTAGE
- LOW ON-VOLTAGE DROP
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- HIGH VOLTAGE CLAMPING FEATURE

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 built in collector-gate zener exhibits a very precise active clamping while the gate-emitter zener supplies an ESD protection.

APPLICATIONS

- AUTOMOTIVE IGNITION



ORDERING INFORMATION

| SALES TYPE | MARKING | PACKAGE | PACKAGING |
|----------------|------------|--------------------|-------------|
| STGB10NB40LZT4 | GB10NB40LZ | D ² PAK | TAPE & REEL |

STGB10NB40LZ

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|--------------|---|-------------|------|
| V_{CES} | Collector-Emitter Voltage ($V_{GS} = 0$) | CLAMPED | V |
| V_{ECR} | Emitter-Collector Voltage | 18 | V |
| V_{GE} | Gate-Emitter Voltage | CLAMPED | V |
| I_C | Collector Current (continuous) at $T_C = 25^\circ\text{C}$ | 20 | A |
| I_C | Collector Current (continuous) at $T_C = 100^\circ\text{C}$ | 10 | A |
| I_{CM} (■) | Collector Current (pulsed) | 40 | A |
| E_{as} | Single Pulse Energy $T_c = 25^\circ\text{C}$ | 300 | mJ |
| P_{TOT} | Total Dissipation at $T_C = 25^\circ\text{C}$ | 150 | W |
| | Derating Factor | 1 | W/°C |
| E_{SD} | ESD (Human Body Model) | 4 | KV |
| T_{stg} | Storage Temperature | - 55 to 175 | °C |
| T_j | Operating Junction Temperature | | |

(■) Pulse width limited by safe operating area

THERMAL DATA

| | | | |
|----------------|---|------|------|
| $R_{thj-case}$ | Thermal Resistance Junction-case Max | 1 | °C/W |
| $R_{thj-amb}$ | Thermal Resistance Junction-ambient Max | 62.5 | °C/W |

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

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------|---|--|------|------|-----------|---------------|
| $BV_{(CES)}$ | Clamped Voltage | $I_C = 2\text{ mA}$, $V_{GE} = 0$, $T_j = -40^\circ\text{C}$ to 150°C | 380 | 410 | 440 | V |
| $BV_{(ECR)}$ | Emitter Collector Break-down Voltage | $I_C = 75\text{ mA}$, $T_j = 25^\circ\text{C}$ | 18 | | | V |
| BV_{GE} | Gate Emitter Break-down Voltage | $I_G = \pm 2\text{ mA}$ | 12 | | 16 | V |
| I_{CES} | Collector cut-off Current ($V_{GE} = 0$) | $V_{CE} = 15\text{ V}$, $V_{GE} = 0$, $T_j = 150^\circ\text{C}$ | | | 10 | μA |
| | | $V_{CE} = 200\text{ V}$, $V_{GE} = 0$, $T_j = 150^\circ\text{C}$ | | | 100 | μA |
| I_{GES} | Gate-Emitter Leakage Current ($V_{CE} = 0$) | $V_{GE} = \pm 10\text{ V}$, $V_{CE} = 0$ | | | ± 700 | μA |
| R_{GE} | Gate Emitter Resistance | | | 20 | | K Ω |

ON (1)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------|--------------------------------------|--|------|------|------|------|
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{CE} = V_{GE}$, $I_C = 250\ \mu\text{A}$, $T_C = -40^\circ\text{C}$ to 150°C | 0.6 | | 2.2 | V |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | $V_{GE} = 4.5\text{ V}$, $I_C = 10\text{ A}$, $T_j = 25^\circ\text{C}$ | | 1.2 | 1.8 | V |
| | | $V_{GE} = 4.5\text{ V}$, $I_C = 20\text{ A}$, $T_j = 25^\circ\text{C}$ | | 1.3 | | V |

ELECTRICAL CHARACTERISTICS (CONTINUED)
DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|------|
| g_{fs} | Forward Transconductance | $V_{CE} = 15 \text{ V}$, $I_C = 10 \text{ A}$ | | 18 | | S |
| C_{ies} | Input Capacitance | $V_{CE} = 25 \text{ V}$, $f = 1 \text{ MHz}$, $V_{GE} = 0$ | | 1300 | | pF |
| C_{oes} | Output Capacitance | | | 105 | | pF |
| C_{res} | Reverse Transfer Capacitance | | | 12 | | pF |
| Q_g | Gate Charge | $V_{CE} = 328 \text{ V}$, $I_C = 10 \text{ A}$, $V_{GE} = 5 \text{ V}$ | | 28 | | nC |

FUNCTIONAL CHARACTERISTICS

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------|-------------------------------------|---|------|------|------|------|
| II | Latching Current | $V_{Clamp} = 328 \text{ V}$, $T_C = 125 \text{ }^\circ\text{C}$ $R_{GOFF} = 1 \text{ K}\Omega$, $V_{GE} = 5 \text{ V}$ | | 40 | | A |
| U.I.S. | Functional Test Open Secondary Coil | $R_{GOFF} = 1 \text{ K}\Omega$, $L = 1 \text{ mH}$, $T_C = 125 \text{ }^\circ\text{C}$ | 13 | | | A |

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------|--------------------------|--|------|------------|------|------------------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CC} = 328 \text{ V}$, $I_C = 10 \text{ A}$ $R_G = 1 \text{ K}\Omega$, $V_{GE} = 5 \text{ V}$ | | 1300 | | ns |
| t_r | Rise Time | | | 270 | | ns |
| $(di/dt)_{on}$ | Turn-on Current Slope | $V_{CC} = 328 \text{ V}$, $I_C = 10 \text{ A}$ $R_G = 1 \text{ K}\Omega$, $V_{GE} = 5 \text{ V}$ | | 60 | | A/ μs |
| E_{on} | Turn-on Switching Losses | $V_{CC} = 328 \text{ V}$, $I_C = 10 \text{ A}$, $T_C = 25 \text{ }^\circ\text{C}$ $R_G = 1 \text{ K}\Omega$, $V_{GE} = 5 \text{ V}$, $T_C = 125 \text{ }^\circ\text{C}$ | | 2.4 2.6 | | mJ mJ |

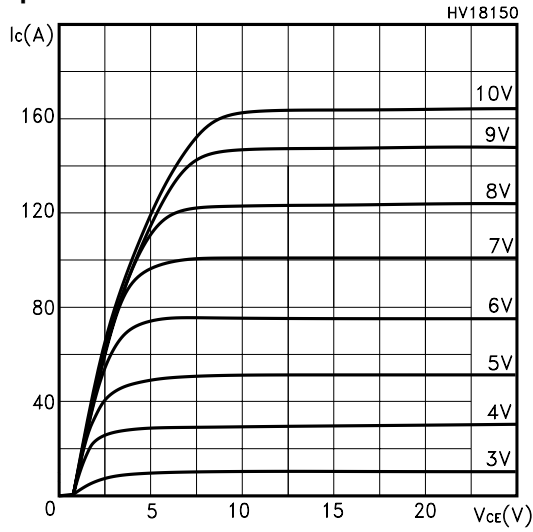
SWITCHING OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------|-------------------------|--|------|------|------|---------------|
| t_c | Cross-over Time | $V_{CC} = 328 \text{ V}$, $I_C = 10 \text{ A}$, $R_{GE} = 1 \text{ K}\Omega$, $V_{GE} = 5 \text{ V}$ | | 3.6 | | μs |
| $t_r(V_{off})$ | Off Voltage Rise Time | | | 2 | | μs |
| $t_{d(off)}$ | Delay Time | | | 8 | | μs |
| t_f | Fall Time | | | 1.4 | | μs |
| $E_{off(**)}$ | Turn-off Switching Loss | | | 5 | | mJ |
| t_c | Cross-over Time | $V_{CC} = 328 \text{ V}$, $I_C = 10 \text{ A}$, $R_{GE} = 1 \text{ K}\Omega$, $V_{GE} = 5 \text{ V}$ $T_j = 125 \text{ }^\circ\text{C}$ | | 5.7 | | μs |
| $t_r(V_{off})$ | Off Voltage Rise Time | | | 2.7 | | μs |
| $t_{d(off)}$ | Delay Time | | | 9.2 | | μs |
| t_f | Fall Time | | | 2.8 | | μs |
| $E_{off(**)}$ | Turn-off Switching Loss | | | 8.7 | | mJ |

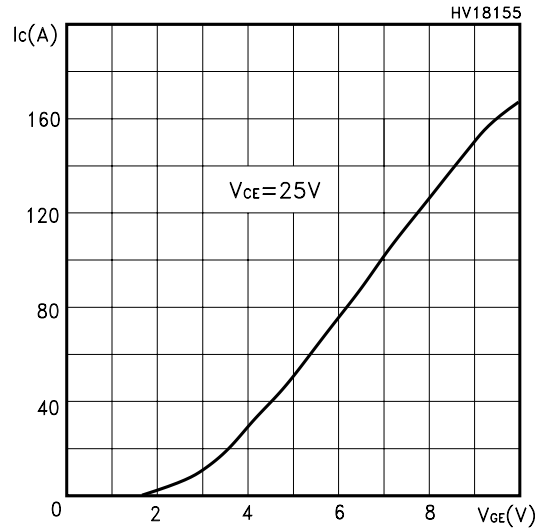
(1) Pulse width limited by max. junction temperature.

(**) Losses Include Also the Tail

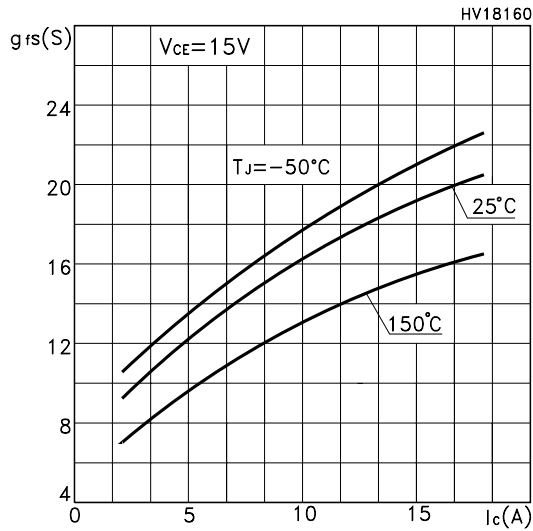
Output Characteristics



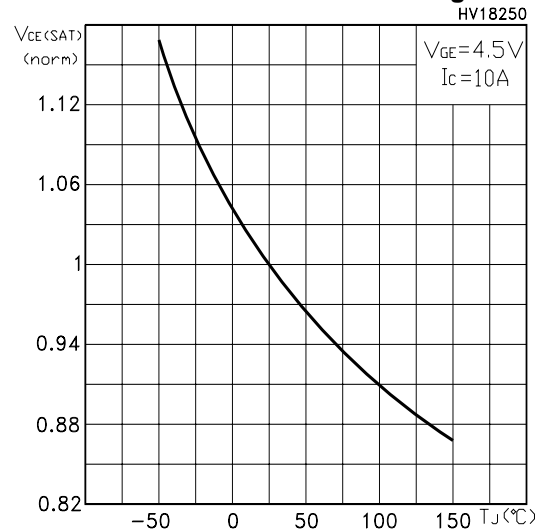
Transfer Characteristics



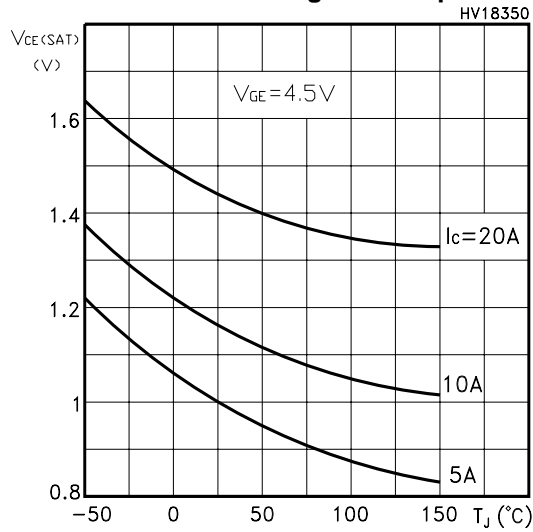
Transconductance



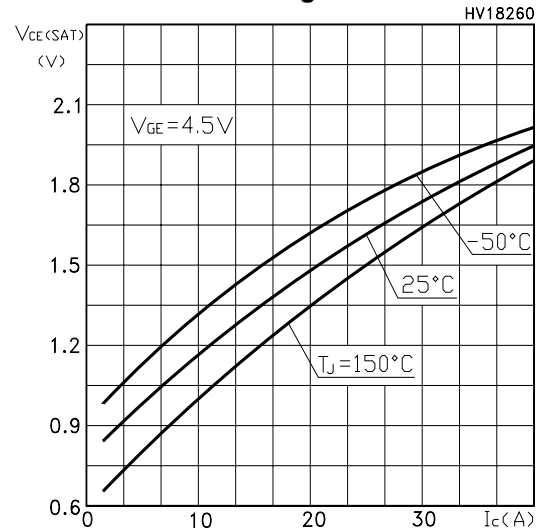
Normalized Collector-Emitter On Voltage vs Temp.



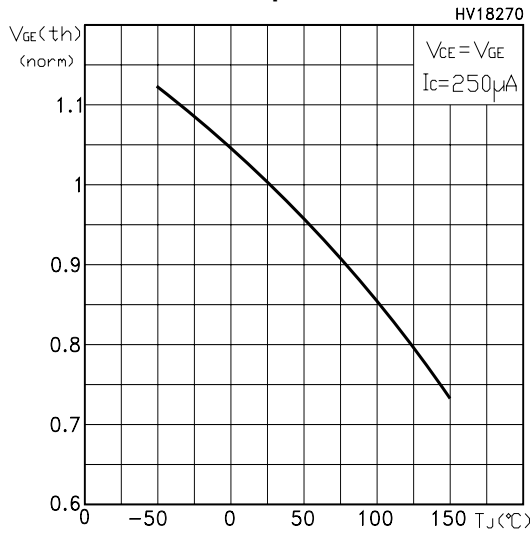
Collector-Emitter On Voltage vs Temperature



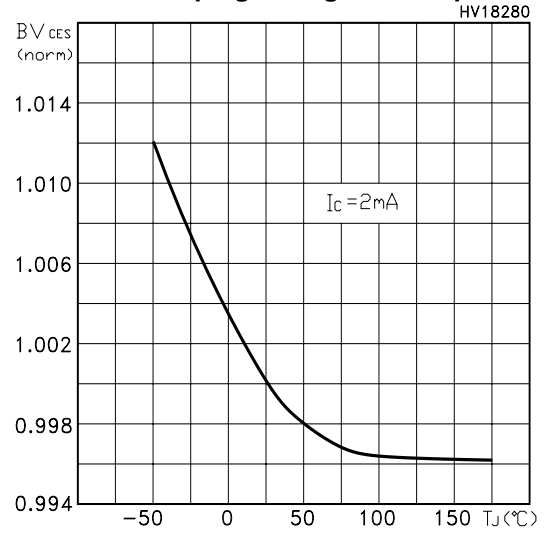
Collector-Emitter On Voltage vs Collector Current



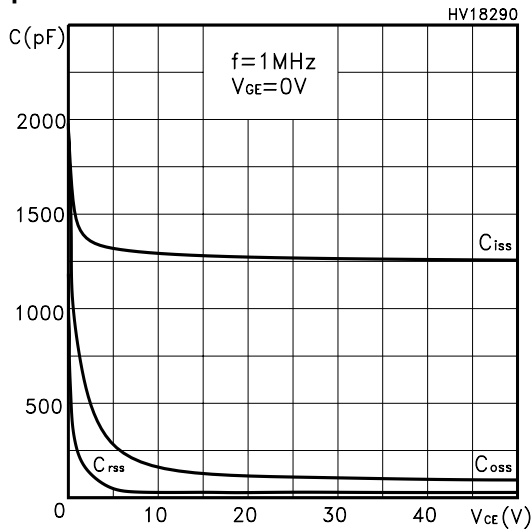
Gate Threshold vs Temperature



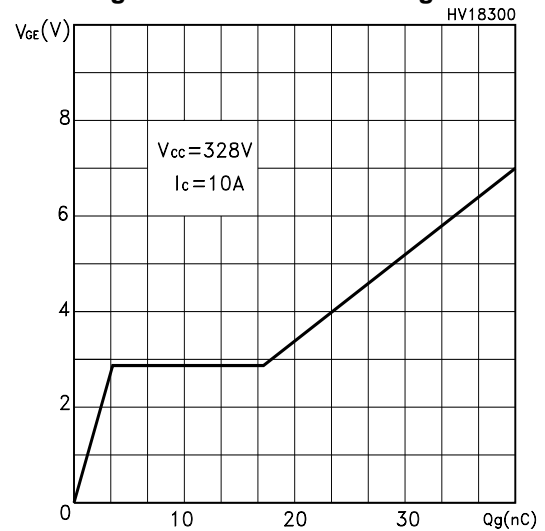
Normalized Clamping Voltage vs Temperature



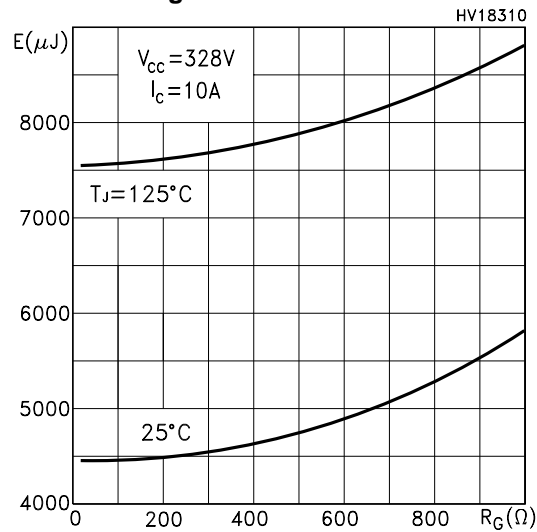
Capacitance Variations



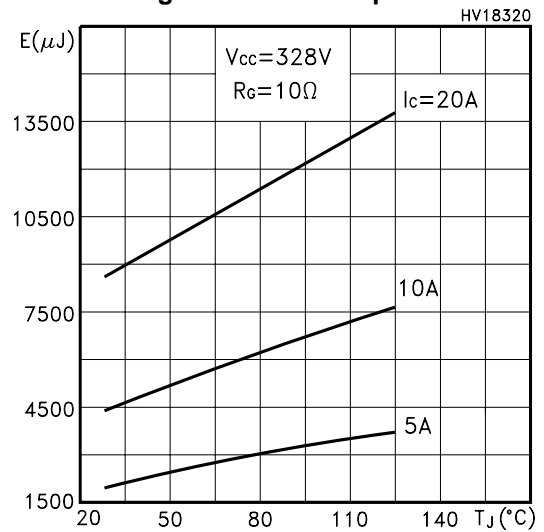
Gate Charge vs Gate-Emitter Voltage



Total Switching Losses vs Gate Resistance

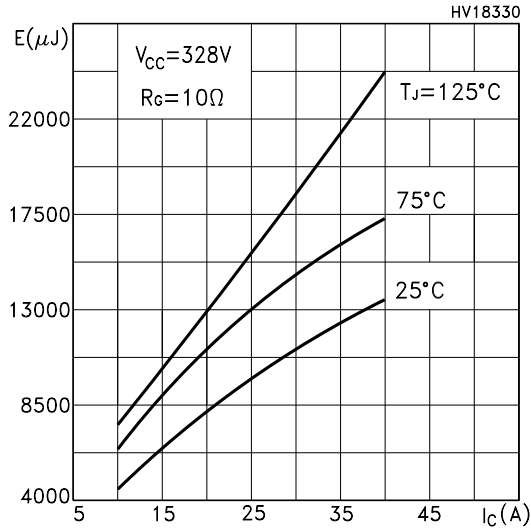


Total Switching Losses vs Temperature

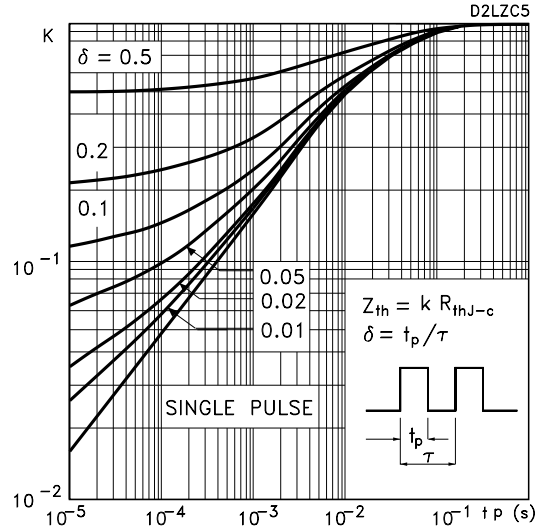


STGB10NB40LZ

Total Switching Losses vs Collector Current



Thermal Impedance



Turn-Off SOA

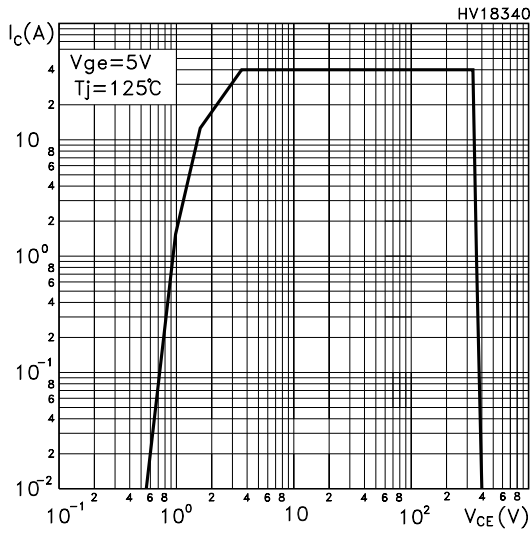


Fig. 1: Unclamped Inductive Load Test Circuit

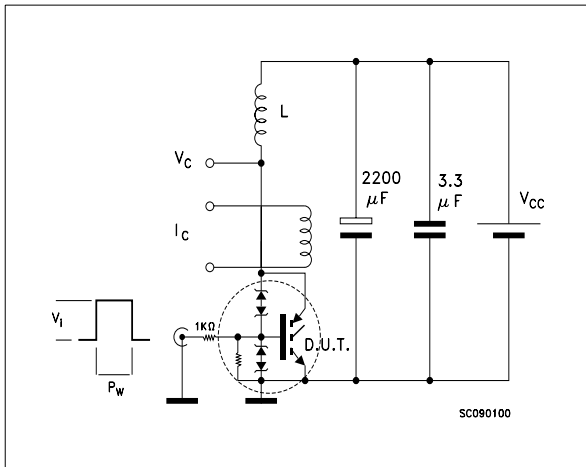


Fig. 2: Unclamped Inductive Waveform

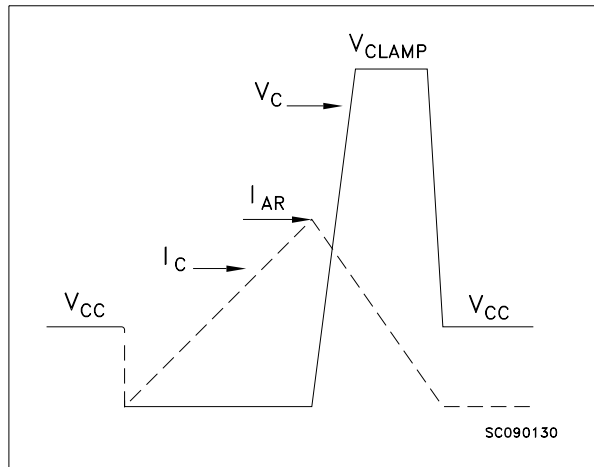


Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times

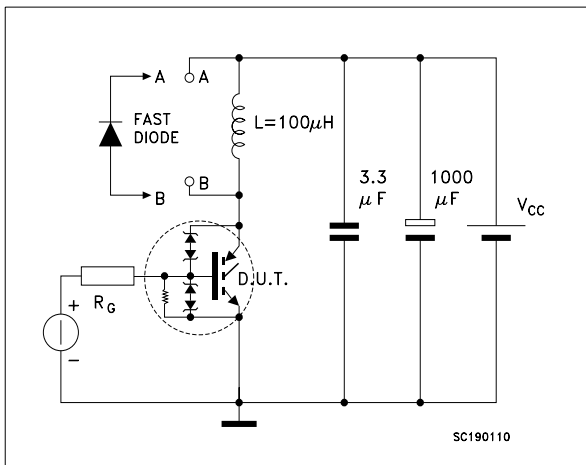
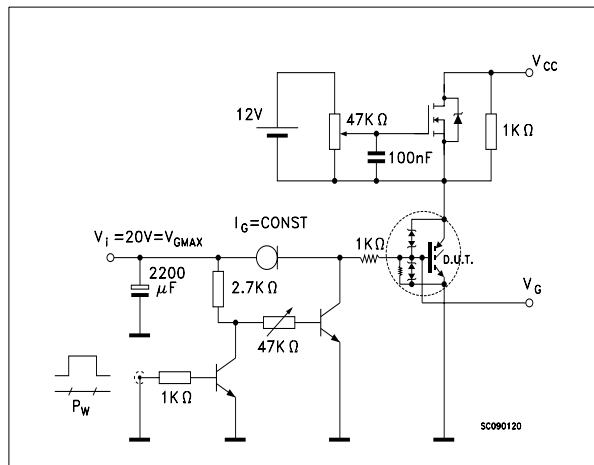
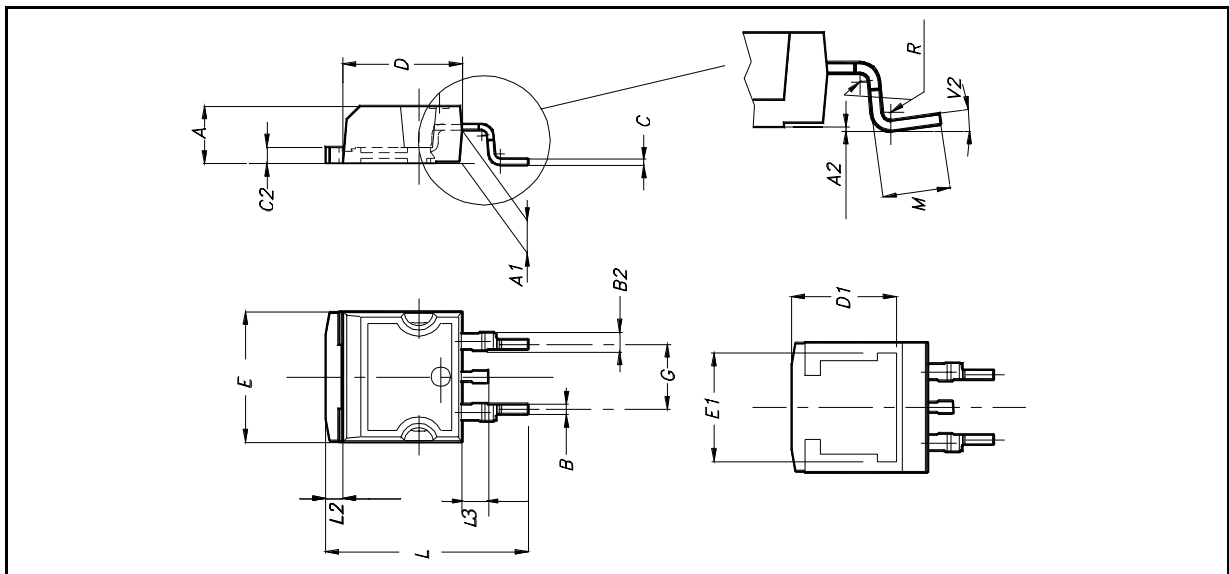


Fig. 4: Gate Charge test Circuit

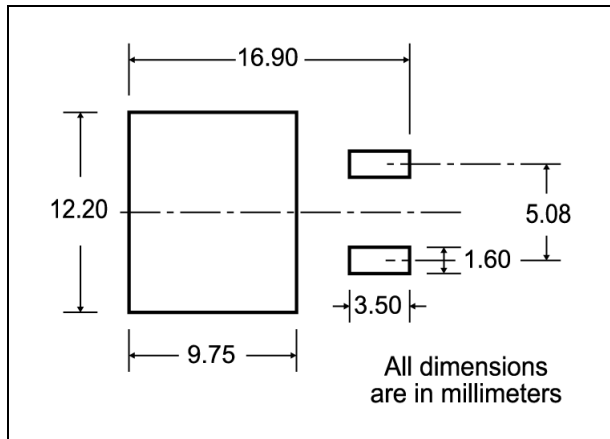


D²PAK MECHANICAL DATA

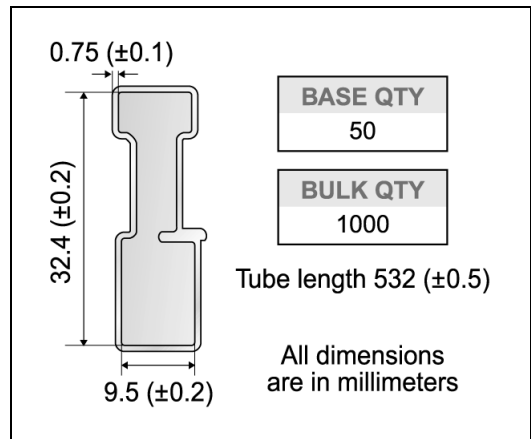
| DIM. | mm. | | | inch | | |
|------|------|-----|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.7 | | 0.93 | 0.027 | | 0.036 |
| B2 | 1.14 | | 1.7 | 0.044 | | 0.067 |
| C | 0.45 | | 0.6 | 0.017 | | 0.023 |
| C2 | 1.23 | | 1.36 | 0.048 | | 0.053 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| D1 | | 8 | | | 0.315 | |
| E | 10 | | 10.4 | 0.393 | | |
| E1 | | 8.5 | | | 0.334 | |
| G | 4.88 | | 5.28 | 0.192 | | 0.208 |
| L | 15 | | 15.85 | 0.590 | | 0.625 |
| L2 | 1.27 | | 1.4 | 0.050 | | 0.055 |
| L3 | 1.4 | | 1.75 | 0.055 | | 0.068 |
| M | 2.4 | | 3.2 | 0.094 | | 0.126 |
| R | | 0.4 | | | 0.015 | |
| V2 | 0° | | 8° | | | |



D²PAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

TAPE MECHANICAL DATA

| DIM. | mm | | inch | |
|------|------|------|--------|--------|
| | MIN. | MAX. | MIN. | MAX. |
| A0 | 10.5 | 10.7 | 0.413 | 0.421 |
| B0 | 15.7 | 15.9 | 0.618 | 0.626 |
| D | 1.5 | 1.6 | 0.059 | 0.063 |
| D1 | 1.59 | 1.61 | 0.062 | 0.063 |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 11.4 | 11.6 | 0.449 | 0.456 |
| K0 | 4.8 | 5.0 | 0.189 | 0.197 |
| P0 | 3.9 | 4.1 | 0.153 | 0.161 |
| P1 | 11.9 | 12.1 | 0.468 | 0.476 |
| P2 | 1.9 | 2.1 | 0.075 | 0.082 |
| R | 50 | | 1.574 | |
| T | 0.25 | 0.35 | 0.0098 | 0.0137 |
| W | 23.7 | 24.3 | 0.933 | 0.956 |

REEL MECHANICAL DATA

| DIM. | mm | | inch | |
|------|------|------|-------|--------|
| | MIN. | MAX. | MIN. | MAX. |
| A | | 330 | | 12.992 |
| B | 1.5 | | 0.059 | |
| C | 12.8 | 13.2 | 0.504 | 0.520 |
| D | 20.2 | | 0.795 | |
| G | 24.4 | 26.4 | 0.960 | 1.039 |
| N | 100 | | 3.937 | |
| T | | 30.4 | | 1.197 |

| BASE QTY | BULK QTY |
|----------|----------|
| 1000 | 1000 |

10 pitches cumulative tolerance on tape + / - 0.2 mm

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius R min.

* on sales type



Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

© The ST logo is a registered trademark of STMicroelectronics

© 2003 STMicroelectronics - Printed in Italy - All Rights Reserved
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco
Singapore - Spain - Sweden - Switzerland - United Kingdom - United States.

© <http://www.st.com>

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[STMicroelectronics:](#)

[STGB10NB40LZT4](#)