

N-channel PowerMESH™ 600 V, 14 A very fast IGBT

Datasheet - obsolete product

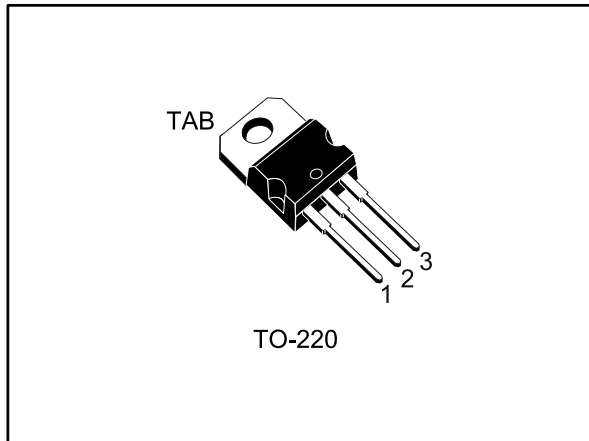
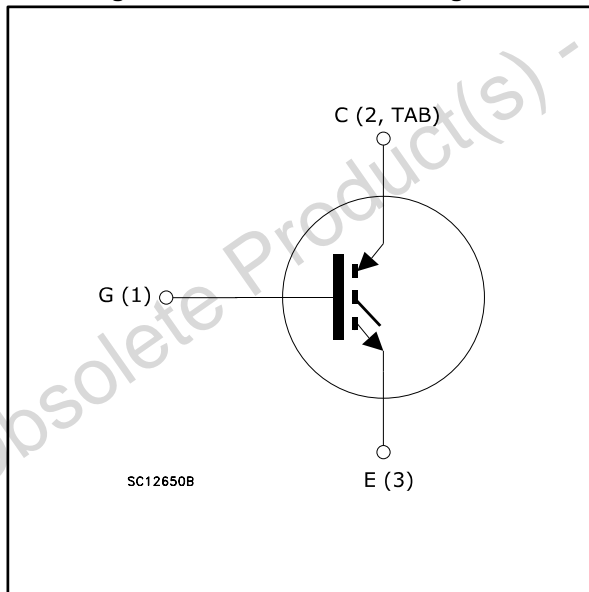


Figure 1: Internal schematic diagram



Features

| Order code | V _{CEs} | V _{CE(sat)} max @ 25°C | I _c @ 100°C |
|------------|------------------|---------------------------------|------------------------|
| STGP7NC60H | 600 V | < 2.5 V | 14 A |

- Low on-voltage drop (V_{CE(sat)})
- High frequency operation up to 70 kHz

Applications

- High frequency inverters
- SMPS and PFC in both hard switch and resonant topologies
- Motor drivers

Description

This device is a very fast IGBT developed using advanced PowerMESH™ technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior. This device is well-suited for resonant or soft-switching applications.

Table 1: Device summary

| Order code | Marking | Package | Packing |
|------------|----------|---------|---------|
| STGP7NC60H | GP7NC60H | TO-220 | Tube |

Contents

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Obsolete Product(s) - Obsolete Product(s)

1 Electrical ratings

Table 2: Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------------------------------|--|-------------|------|
| V _{CES} | Collector-emitter voltage (V _{GE} = 0) | 600 | V |
| V _{GE} | Gate-emitter voltage | ±20 | V |
| I _C | Continuous collector current at T _C = 25 °C ⁽¹⁾ | 25 | A |
| | Continuous collector current at T _C = 100 °C ⁽¹⁾ | 14 | A |
| I _{CM} ⁽²⁾ | Collector current (pulsed) | 50 | A |
| P _{TOT} | Continuous forward current at T _C = 25 °C | 80 | W |
| T _{stg} | Storage temperature range | - 55 to 150 | °C |
| T _J | Operating junction temperature range | | |

Notes:

⁽¹⁾Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{JMAX} - T_C}{R_{THJ-C} \times V_{CESAT(MAX)}(T_{J(max)}) \times I_C(T_C)}$$

⁽²⁾Pulse width limited by maximum junction temperature.

Table 3: Thermal data

| Symbol | Parameter | Value | Unit |
|-----------------------|---|-------|------|
| R _{thj-case} | Thermal resistance junction-case max | 1.56 | °C/W |
| R _{thj-amb} | Thermal resistance junction-ambient max | 62.5 | °C/W |

2 Electrical characteristics

$T_C = 25\text{ °C}$ unless otherwise specified

Table 4: Static characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--------------------------------------|---|------|------|-----------|---------------|
| $V_{(BR)CES}$ | Collector-emitter breakdown voltage | $V_{GE} = 0\text{ V}$, $I_C = 1\text{ mA}$ | 600 | | | V |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE} = 15\text{ V}$, $I_C = 7\text{ A}$ | | 1.85 | 2.5 | V |
| | | $V_{GE} = 15\text{ V}$, $I_C = 7\text{ A}$, $T_J = 125\text{ °C}$ | | 1.7 | | |
| $V_{GE(th)}$ | Gate threshold voltage | $V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$ | 3.75 | | 5.75 | V |
| I_{CES} | Collector cut-off current | $V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$ | | | 10 | μA |
| | | $V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$, $T_C = 125\text{ °C}$ ⁽¹⁾ | | | 1 | mA |
| I_{GES} | Gate-emitter leakage current | $V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$ | | | ± 100 | nA |

Notes:

⁽¹⁾Defined by design, not subject to production test.

Table 5: Dynamic characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------------|------------------------------|---|---|------|------|------|
| g_{fs} ⁽¹⁾ | Forward transconductance | $V_{CE} = 15\text{ V}$, $I_C = 7\text{ A}$ | | 4.30 | | S |
| C_{ies} | Input capacitance | $V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$ | | 720 | | pF |
| C_{oes} | Output capacitance | | | 81 | | pF |
| C_{res} | Reverse transfer capacitance | | | 17 | | pF |
| Q_g | Total gate charge | | $V_{CE} = 390\text{ V}$, $I_C = 7\text{ A}$, $V_{GE} = 15\text{ V}$ (see Figure 18: "Gate charge test circuit") | | 35 | 48 |
| Q_{ge} | Gate-emitter charge | | | 7 | | |
| Q_{gc} | Gate-collector charge | | | 16 | | |
| I_{CL} | Turn-off SOA minimum current | $V_{clamp} = 480\text{ V}$, $T_J = 150\text{ °C}$, $R_G = 10\text{ }\Omega$, $V_{GE} = 15\text{ V}$ | 50 | | | A |

Notes:

⁽¹⁾Pulsed: Pulse duration= 300 μs , duty cycle 1.5%

Table 6: IGBT switching characteristics (inductive load)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|---------------------------|---|---|------|------|------------|
| $t_{d(on)}$ | Turn-on delay time | $V_{CC} = 390\text{ V}$, $I_C = 7\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$ (see Figure 16: "Ic vs frequency" and Figure 17: "Test circuit for inductive load switching") | - | 18.5 | | ns |
| $t_{r(on)}$ | Turn-on rise time | | - | 8.5 | | ns |
| $di/dt_{(on)}$ | Turn-on current slope | | - | 1060 | | A/ μ s |
| $t_{r(off)}$ | Turn-off rise time | | - | 27 | | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 72 | | ns |
| t_f | Fall time | | - | 60 | | ns |
| $E_{on}^{(1)}$ | Turn-on switching energy | | - | 95 | 125 | μ J |
| $E_{off}^{(2)}$ | Turn-off switching energy | | - | 115 | 150 | μ J |
| E_{ts} | Total switching energy | | - | 210 | 275 | μ J |
| $t_{d(on)}$ | Turn-on delay time | | $V_{CE} = 390\text{ V}$, $I_C = 7\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$ $T_J = 125\text{ }^\circ\text{C}$ (see Figure 17: "Test circuit for inductive load switching") | - | 18.5 | |
| $t_{r(on)}$ | Turn-on rise time | - | | 7 | | ns |
| $di/dt_{(on)}$ | Turn-on current slope | - | | 1000 | | A/ μ s |
| $t_{r(off)}$ | Turn-off rise time | - | | 56 | | ns |
| $t_{d(off)}$ | Turn-off delay time | - | | 116 | | ns |
| t_f | Fall time | - | | 105 | | ns |
| $E_{on}^{(1)}$ | Turn-on switching energy | - | | 140 | | μ J |
| $E_{off}^{(2)}$ | Turn-off switching energy | - | | 215 | | μ J |
| E_{ts} | Total switching energy | - | | 355 | | μ J |

Notes:⁽¹⁾Including the reverse recovery of the diode.⁽²⁾Including the tail of the collector current.

2.2 Electrical characteristics (curves)

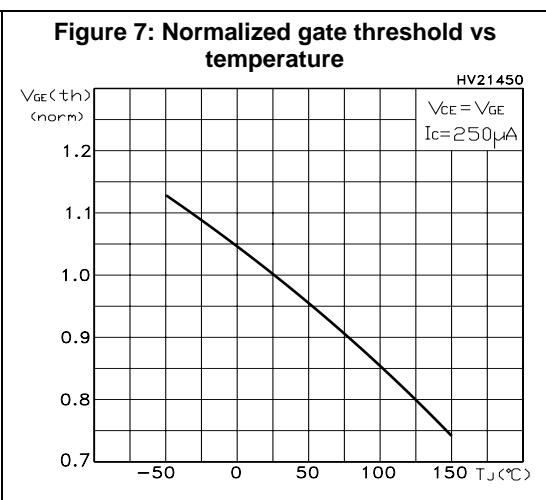
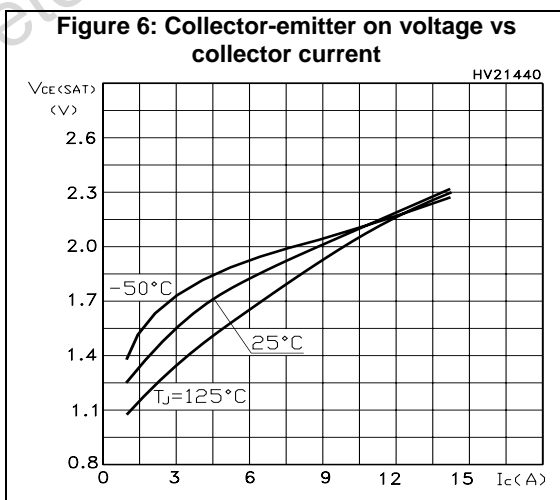
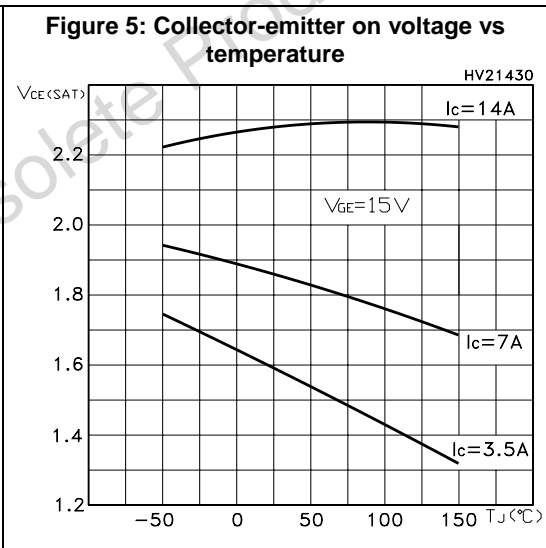
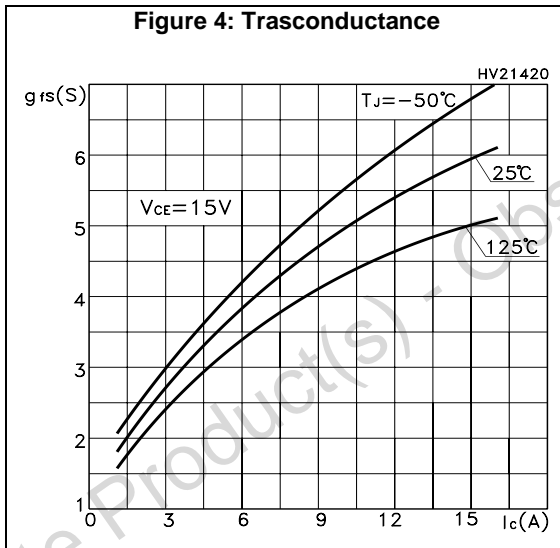
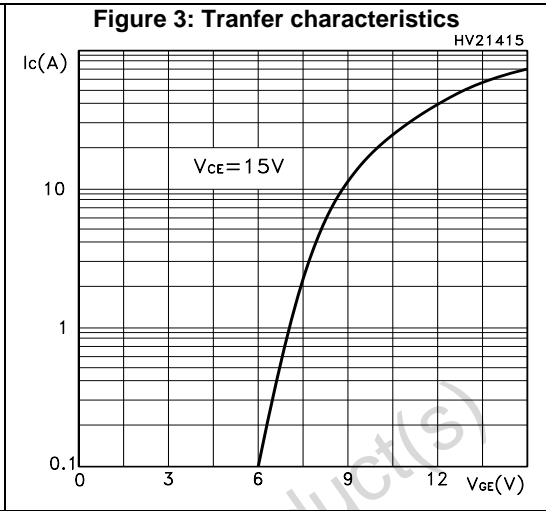
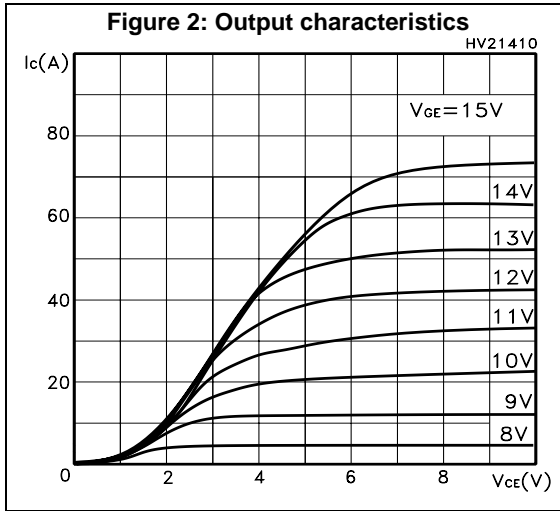


Figure 8: Normalized breakdown voltage vs temperature

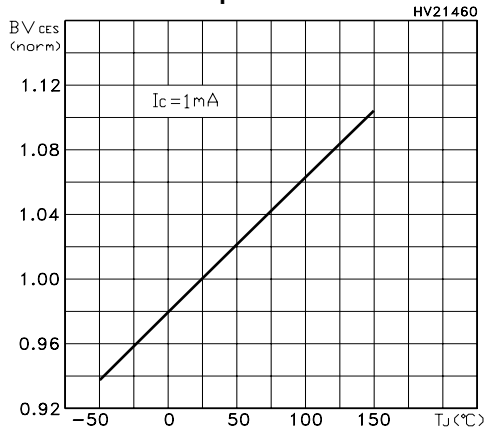


Figure 9: Gate charge vs gate-emitter voltage

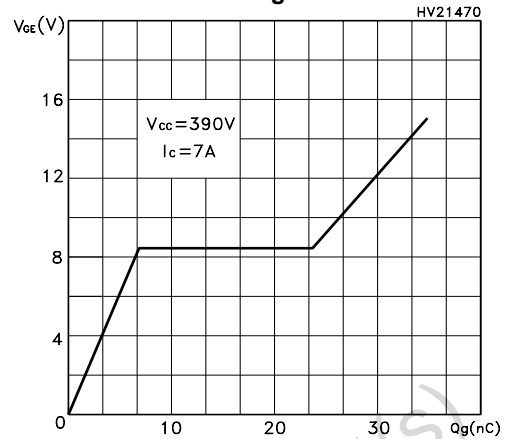


Figure 10: Capacitance variations

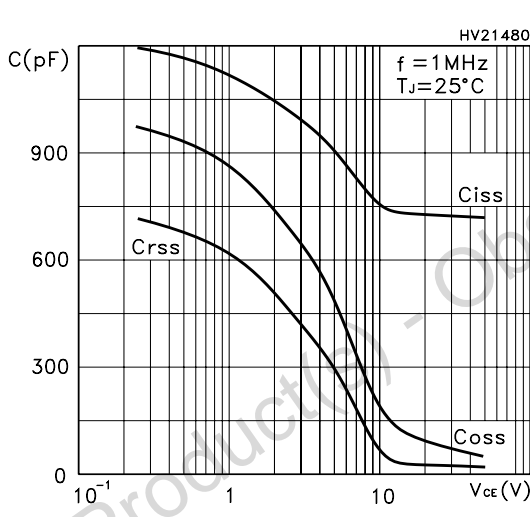


Figure 11: Total switching energy vs temperature

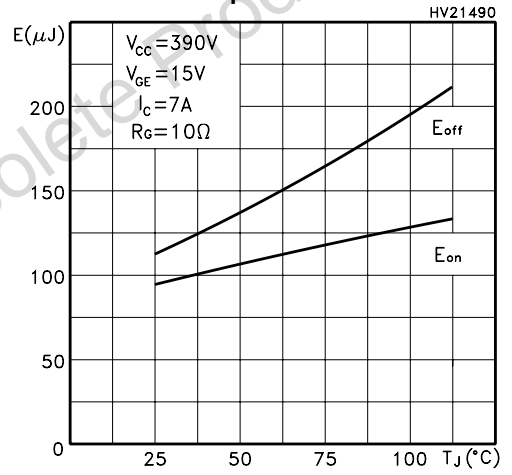


Figure 12: Total switching energy vs gate resistance

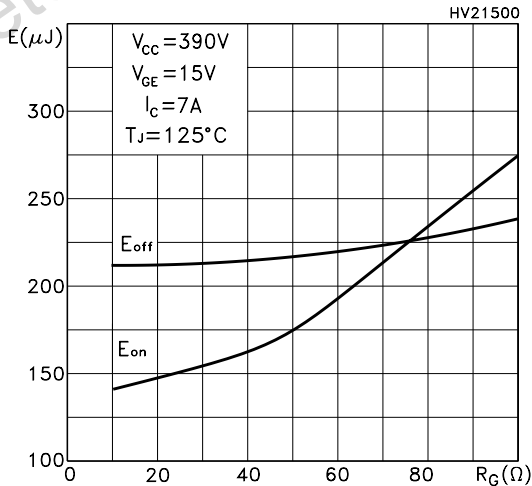
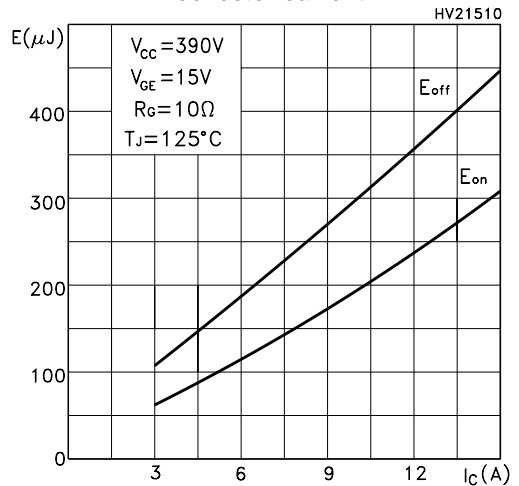
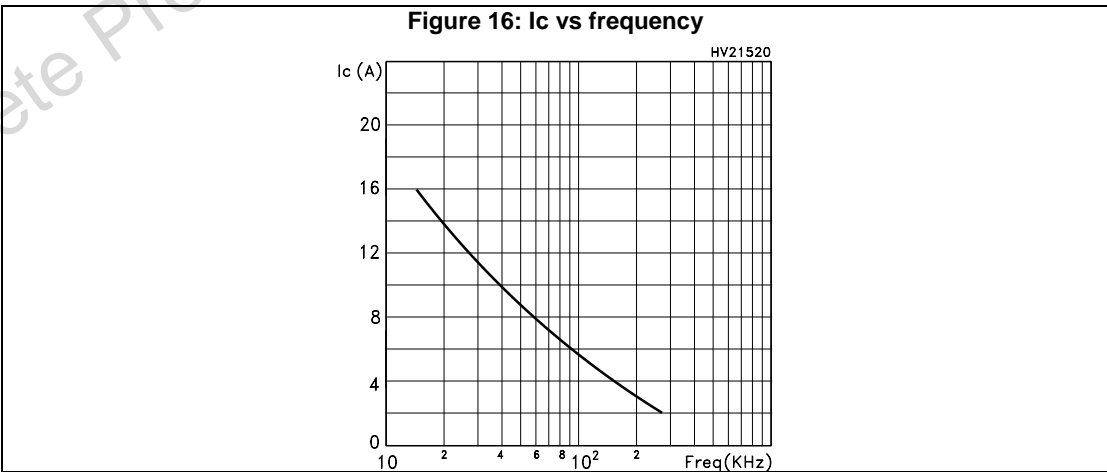
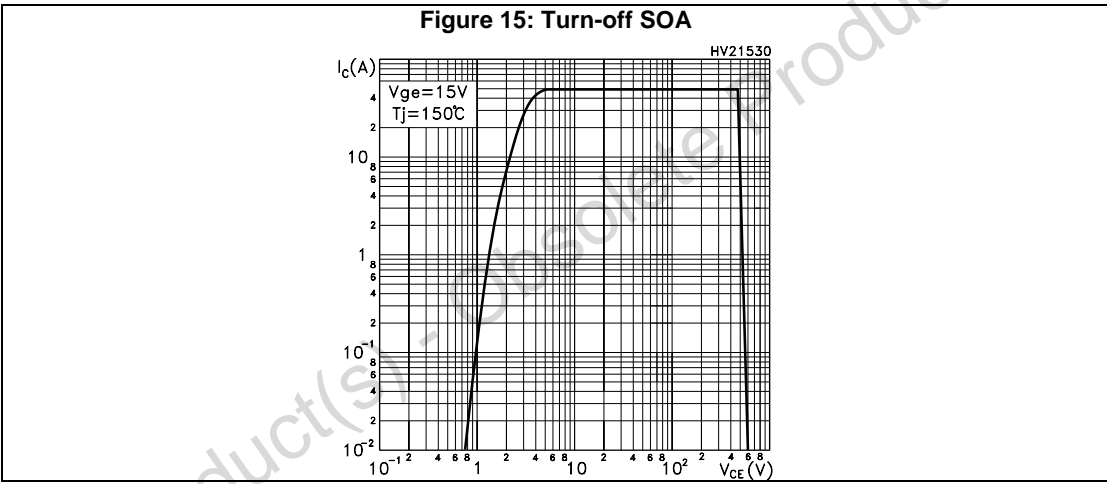
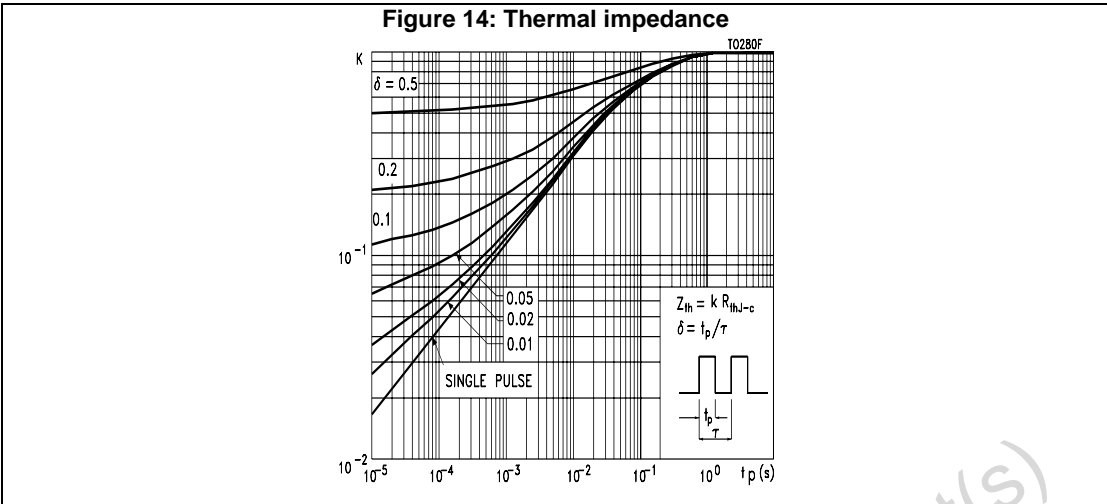
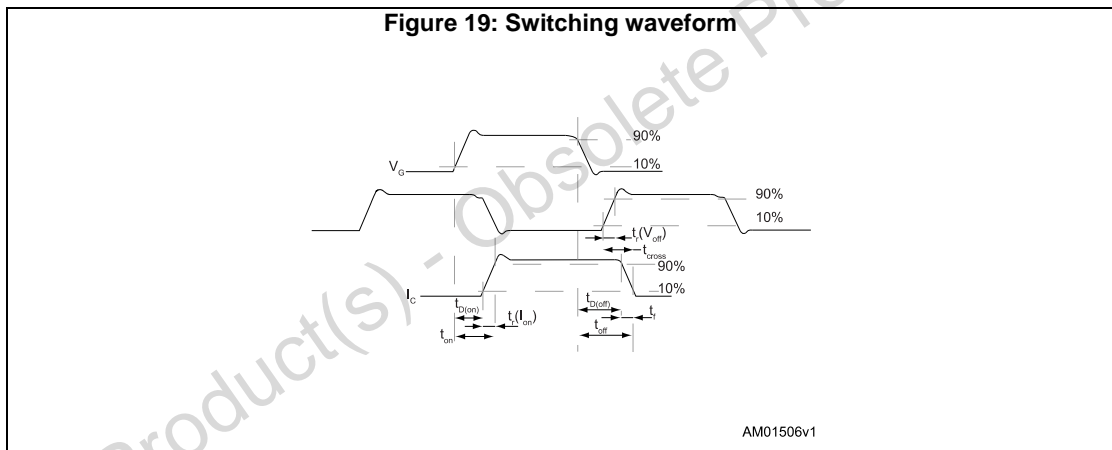
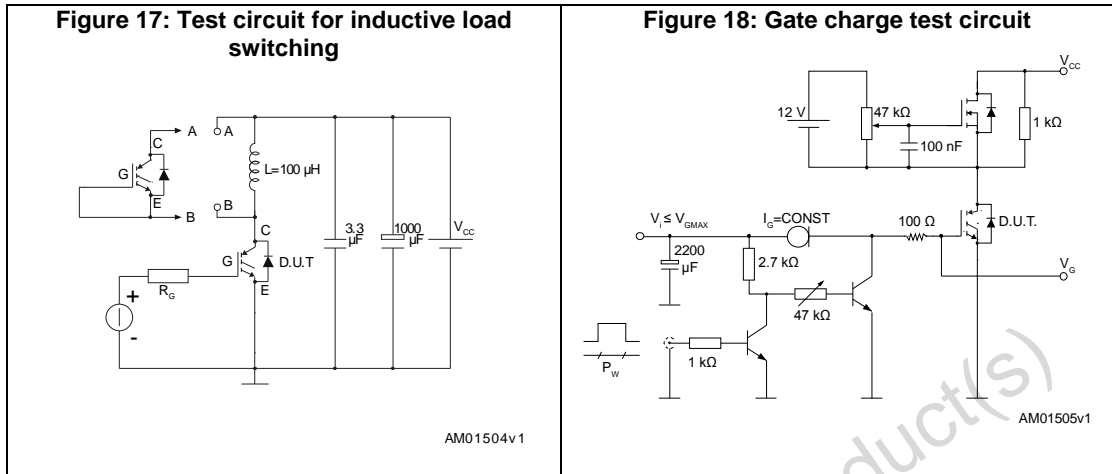


Figure 13: Total switching energy vs collector current





3 Test circuits



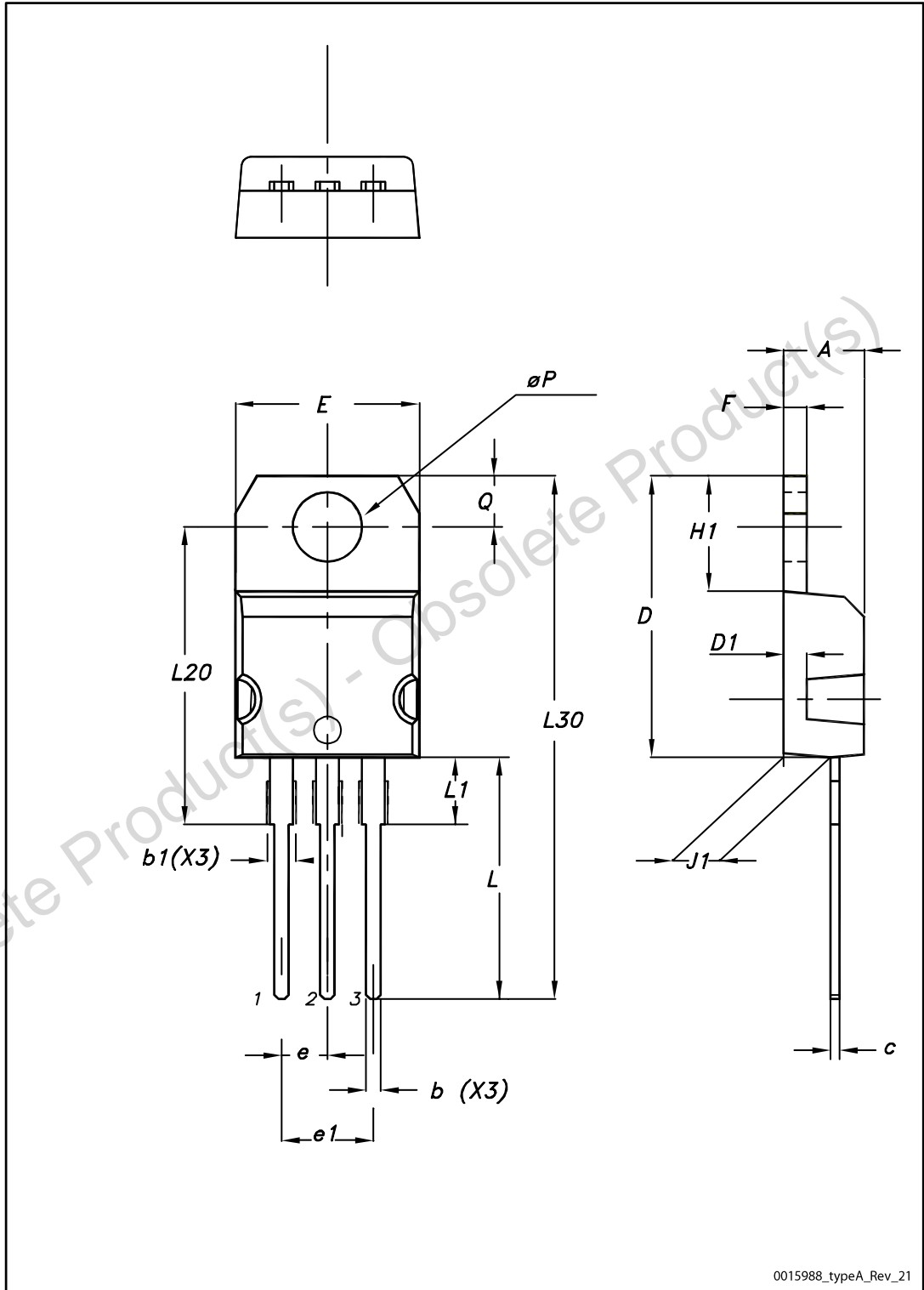
4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Obsolete Product(s) - Obsolete Product(s)

4.1 TO-220 type A package information

Figure 20: TO-220 type A package outline



0015988_typeA_Rev_21

Table 7: TO-220 type A mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.55 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10.00 | | 10.40 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| F | 1.23 | | 1.32 |
| H1 | 6.20 | | 6.60 |
| J1 | 2.40 | | 2.72 |
| L | 13.00 | | 14.00 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| øP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

5 Revision history

Table 8: Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 20-Aug-2004 | 1 | New datasheet. |
| 09-Jun-2005 | 2 | Modified title |
| 04-Jul-2016 | 3 | The part number STGD7NC60HT4 has been moved to a separate datasheet. Modified: title, features and description. Modified: <i>Table 2: "Absolute maximum ratings"</i> , <i>Table 3: "Thermal data"</i> , <i>Table 4: "Static characteristics"</i> , <i>Table 5: "Dynamic characteristics (inductive load)"</i> and <i>Table 6: "IGBT switching characteristics (inductive load)"</i> Updated: <i>Section 5.1: "TO-220 type A package information"</i> . Minor text changes. |

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