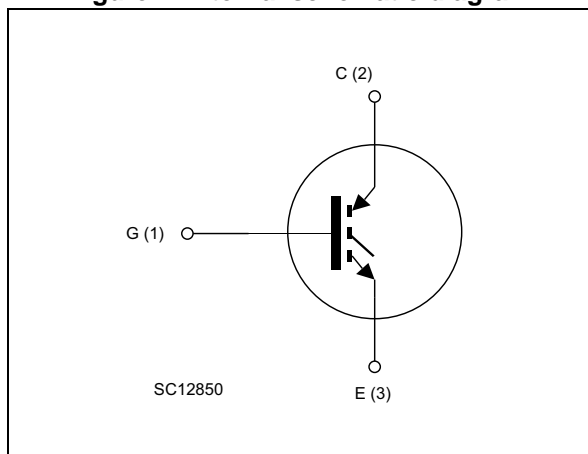


Figure 1. Internal schematic diagram



### Features

- Maximum junction temperature:  $T_J = 175\text{ °C}$
- High speed switching series
- Minimized tail current
- $V_{CE(sat)} = 2.1\text{ V (typ.) @ } I_C = 15\text{ A}$
- 5  $\mu\text{s}$  minimum short-circuit withstand time at  $T_J = 150\text{ °C}$
- Safe paralleling
- Low thermal resistance

### Applications

- Uninterruptible power supply
- Welding machines
- Photovoltaic inverters
- Power factor correction
- High frequency converters

### Description

These devices are IGBTs developed using an advanced proprietary trench gate field-stop structure. These devices are part of the improved H series of IGBTs, which represent an optimum compromise between conduction and switching loss to maximize the efficiency of high frequency converters. Furthermore, a slightly positive  $V_{CE(sat)}$  temperature coefficient and very tight parameter distribution result in safer paralleling operation.

Table 1. Device summary

| Order code    | Marking   | Package           | Packing |
|---------------|-----------|-------------------|---------|
| STGW15H120F2  | G15H120F2 | TO-247            | Tube    |
| STGWA15H120F2 | G15H120F2 | TO-247 long leads | Tube    |

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol         | Parameter   | Value      | Unit |
|----------------|---|------------|------|
| $V_{CES}$      | Collector-emitter voltage ( $V_{GE} = 0$ )            | 1200       | V    |
| $I_C$          | Continuous collector current at $T_C = 25\text{ °C}$  | 30         | A    |
| $I_C$          | Continuous collector current at $T_C = 100\text{ °C}$ | 15         | A    |
| $I_{CP}^{(1)}$ | Pulsed collector current                              | 60         | A    |
| $V_{GE}$       | Gate-emitter voltage                                  | $\pm 20$   | V    |
| $P_{TOT}$      | Total dissipation at $T_C = 25\text{ °C}$             | 259        | W    |
| $T_{STG}$      | Storage temperature range                             | -55 to 150 | °C   |
| $T_J$          | Operating junction temperature                        | -55 to 175 | °C   |

1. Pulse width limited by maximum junction temperature.

**Table 3. Thermal data**

| Symbol     | Parameter                           | Value | Unit |
|------------|-------------------------------------|-------|------|
| $R_{thJC}$ | Thermal resistance junction-case    | 0.58  | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient | 50    | °C/W |

## 2 Electrical characteristics

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

**Table 4. Static characteristics**

| Symbol        | Parameter  | Test conditions  | Min. | Typ. | Max.      | Unit          |
|---------------|--|--|------|------|-----------|---------------|
| $V_{(BR)CES}$ | Collector-emitter breakdown voltage ( $V_{GE} = 0$ ) | $I_C = 2\text{ mA}$  | 1200 |      |           | V             |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage                 | $V_{GE} = 15\text{ V}, I_C = 15\text{ A}$                          |      | 2.1  | 2.6       | V             |
|               |  | $V_{GE} = 15\text{ V}, I_C = 15\text{ A}$<br>$T_J = 125\text{ °C}$ |      | 2.4  |           |               |
|               |  | $V_{GE} = 15\text{ V}, I_C = 15\text{ A}$<br>$T_J = 175\text{ °C}$ |      | 2.5  |           |               |
| $V_{GE(th)}$  | Gate threshold voltage                               | $V_{CE} = V_{GE}, I_C = 500\text{ }\mu\text{A}$                    | 5    | 6    | 7         | V             |
| $I_{CES}$     | Collector cut-off current ( $V_{GE} = 0$ )           | $V_{CE} = 1200\text{ V}$   |      |      | 25        | $\mu\text{A}$ |
| $I_{GES}$     | Gate-emitter leakage current ( $V_{CE} = 0$ )        | $V_{GE} = \pm 20\text{ V}$   |      |      | $\pm 250$ | nA            |

**Table 5. Dynamic characteristics**

| Symbol    | Parameter                    | Test conditions  | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|--|------|------|------|------|
| $C_{ies}$ | Input capacitance            | $V_{CE} = 25\text{ V}, f = 1\text{ MHz},$<br>$V_{GE} = 0$  | -    | 1300 | -    | pF   |
| $C_{oes}$ | Output capacitance           |  | -    | 105  | -    | pF   |
| $C_{res}$ | Reverse transfer capacitance |  | -    | 32   | -    | pF   |
| $Q_g$     | Total gate charge            | $V_{CC} = 960\text{ V}, I_C = 15\text{ A},$<br>$V_{GE} = 15\text{ V},$ see <a href="#">Figure 23</a> | -    | 67   | -    | nC   |
| $Q_{ge}$  | Gate-emitter charge          |  | -    | 8    | -    | nC   |
| $Q_{gc}$  | Gate-collector charge        |  | -    | 38   | -    | nC   |

Table 6. Switching characteristics (inductive load)

| Symbol          | Parameter                    | Test conditions   | Min. | Typ. | Max. | Unit       |
|-----------------|------------------------------|---|------|------|------|------------|
| $t_{d(on)}$     | Turn-on delay time           | $V_{CE} = 600\text{ V}$ , $I_C = 15\text{ A}$ ,<br>$R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ ,<br>see <a href="#">Figure 22</a>                                     | -    | 23   | -    | ns         |
| $t_r$           | Current rise time            |   | -    | 7.4  | -    | ns         |
| $(di/dt)_{on}$  | Turn-on current slope        |   | -    | 1621 | -    | A/ $\mu$ s |
| $t_{d(off)}$    | Turn-off delay time          |   | -    | 111  | -    | ns         |
| $t_f$           | Current fall time            |   | -    | 111  | -    | ns         |
| $E_{on}^{(1)}$  | Turn-on switching loss       |   | -    | 0.38 | -    | mJ         |
| $E_{off}^{(2)}$ | Turn-off switching loss      |   | -    | 0.37 | -    | mJ         |
| $E_{ts}$        | Total switching loss         | -   | 0.75 | -    | mJ   |            |
| $t_{d(on)}$     | Turn-on delay time           | $V_{CE} = 600\text{ V}$ , $I_C = 15\text{ A}$ ,<br>$R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ ,<br>$T_J = 175\text{ }^\circ\text{C}$ , see <a href="#">Figure 22</a> | -    | 23.5 | -    | ns         |
| $t_r$           | Current rise time            |   | -    | 8    | -    | ns         |
| $(di/dt)_{on}$  | Turn-on current slope        |   | -    | 1525 | -    | A/ $\mu$ s |
| $t_{d(off)}$    | Turn-off delay time          |   | -    | 118  | -    | ns         |
| $t_f$           | Current fall time            |   | -    | 253  | -    | ns         |
| $E_{on}^{(1)}$  | Turn-on switching loss       |   | -    | 0.65 | -    | mJ         |
| $E_{off}^{(2)}$ | Turn-off switching loss      |   | -    | 0.93 | -    | mJ         |
| $E_{ts}$        | Total switching loss         | -   | 1.58 | -    | mJ   |            |
| $t_{sc}$        | Short-circuit withstand time | $V_{CE} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ ,<br>$T_J = 150\text{ }^\circ\text{C}$ ,   | 5    |      | -    | $\mu$ s    |

1. Energy loss include reverse recovery of the external diode. The diode is the same of the co-packed STGW15H120DF2
2. Turn-off loss include also the tail of the collector current.

## 2.1 Electrical characteristics (curves)

Figure 2. Power dissipation vs. case temperature

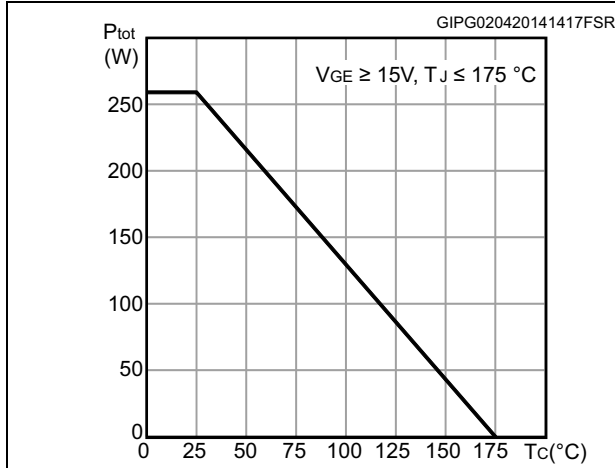


Figure 3. Collector current vs. case temperature

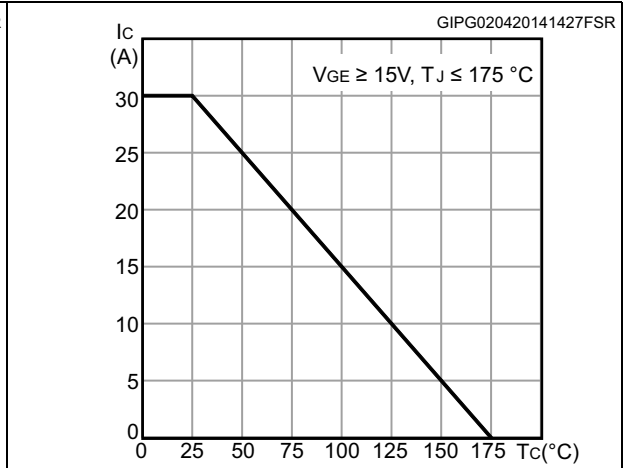


Figure 4. Output characteristics (T<sub>J</sub> = 25°C)

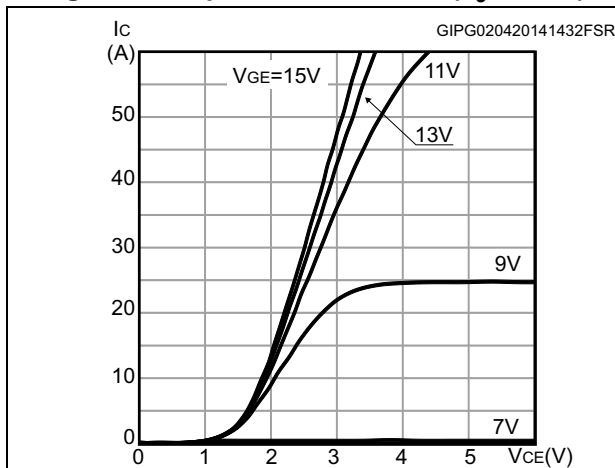


Figure 5. Output characteristics (T<sub>J</sub> = 175°C)

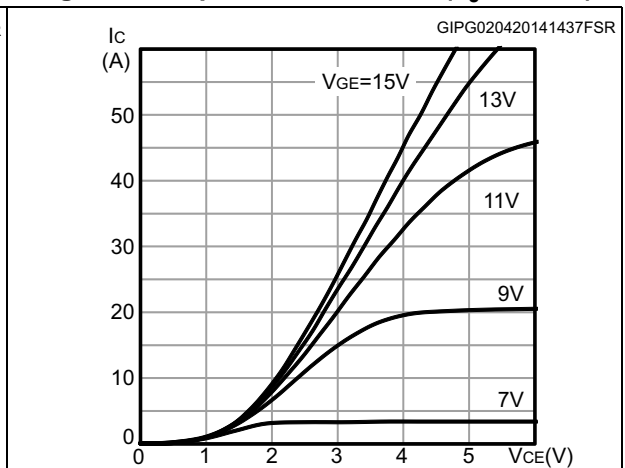


Figure 6. V<sub>CE(sat)</sub> vs. junction temperature

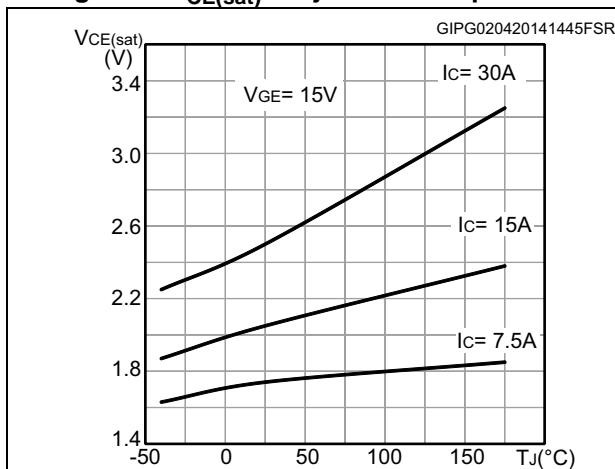


Figure 7. V<sub>CE(sat)</sub> vs. collector current

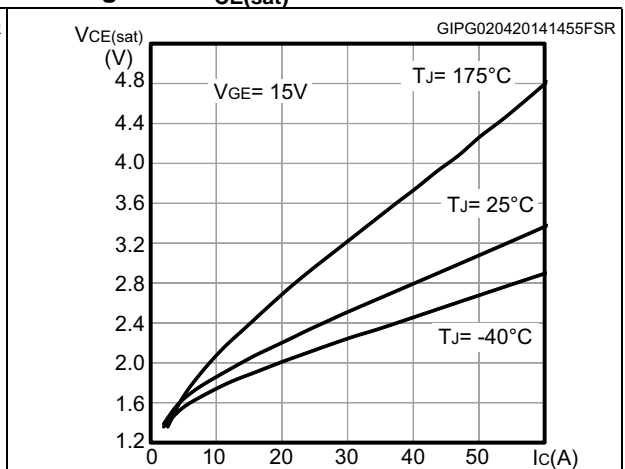


Figure 8. Collector current vs. switching frequency

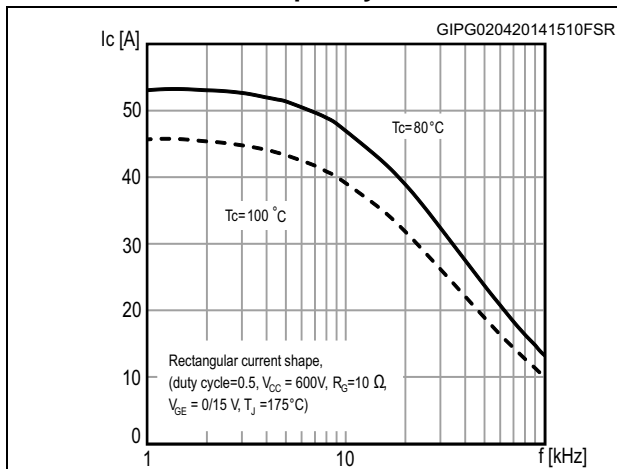


Figure 9. Forward bias safe operating area

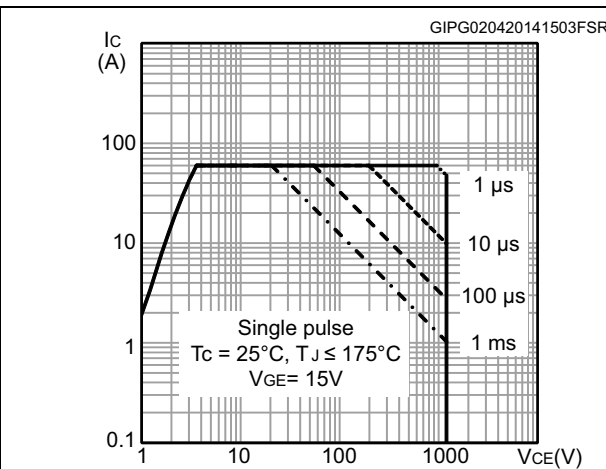


Figure 10. Transfer characteristics

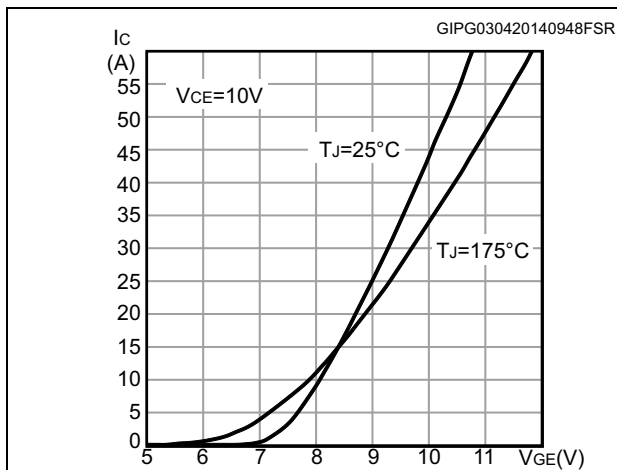


Figure 11. Normalized VGE(th) vs junction temperature

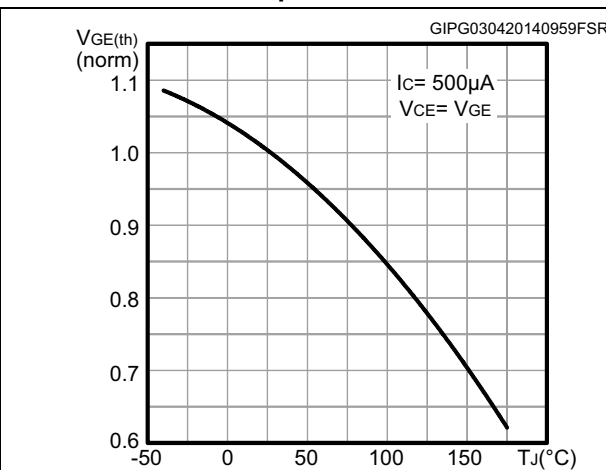


Figure 12. Normalized V(BR)CES vs. junction temperature

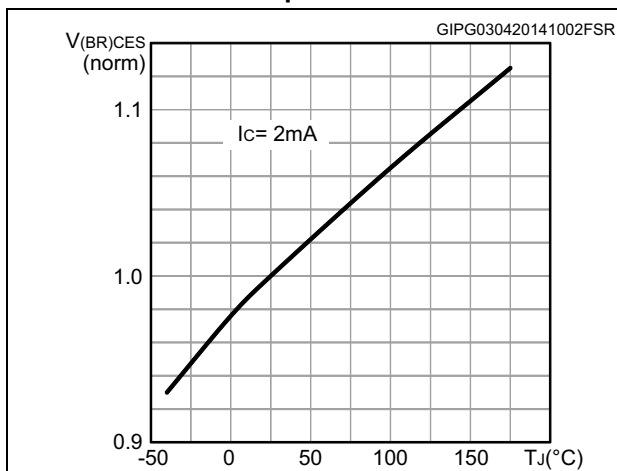


Figure 13. Capacitance variation

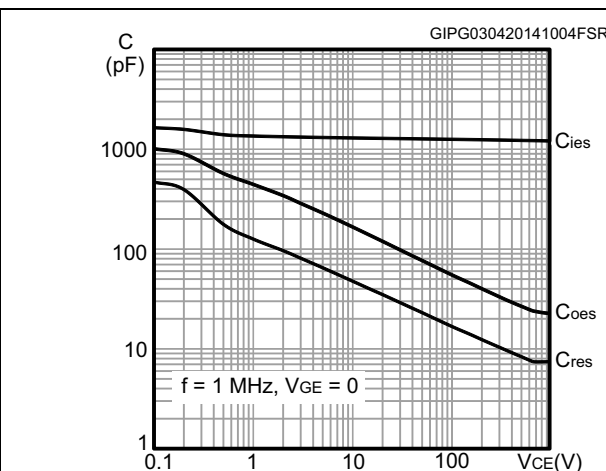


Figure 14. Gate charge vs. gate-emitter voltage

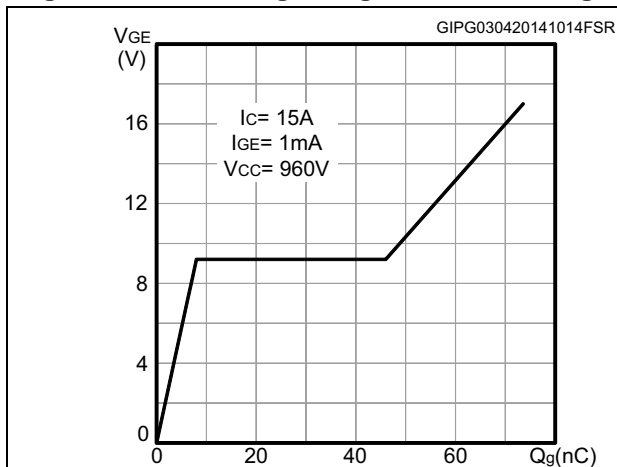


Figure 15. Switching loss vs collector current

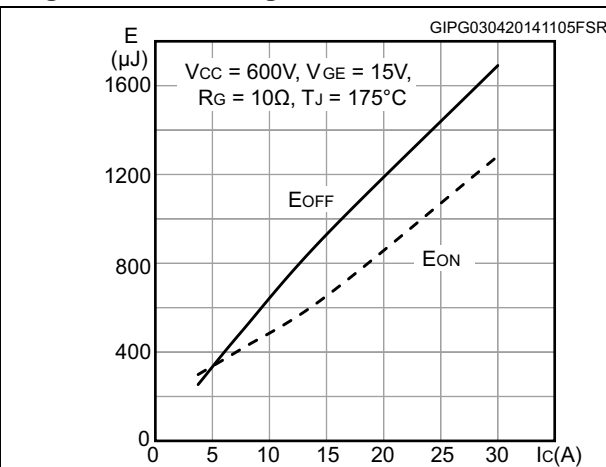


Figure 16. Switching loss vs gate resistance

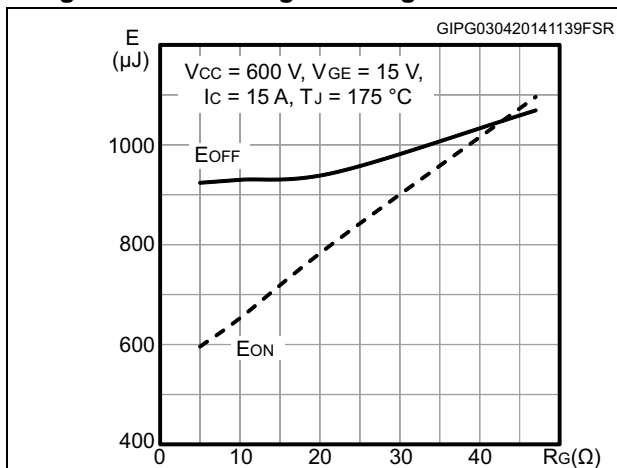


Figure 17. Switching loss vs temperature

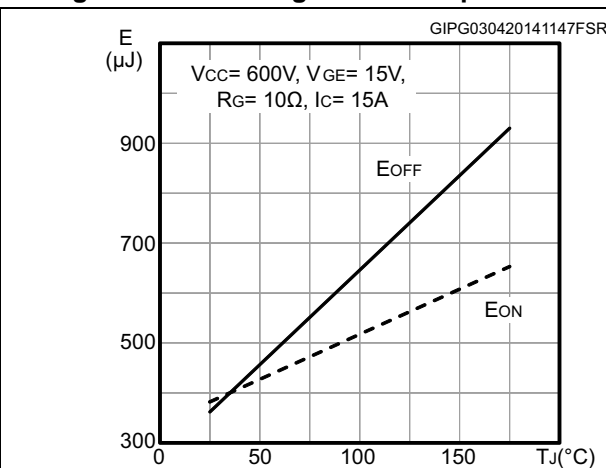


Figure 18. Switching loss vs collector-emitter voltage

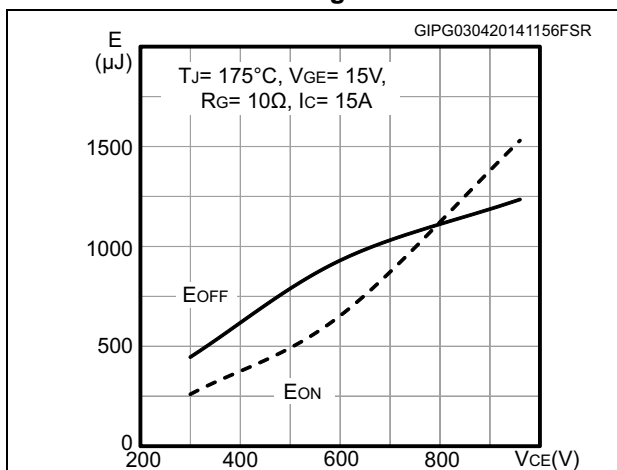


Figure 19. Switching times vs. gate resistance

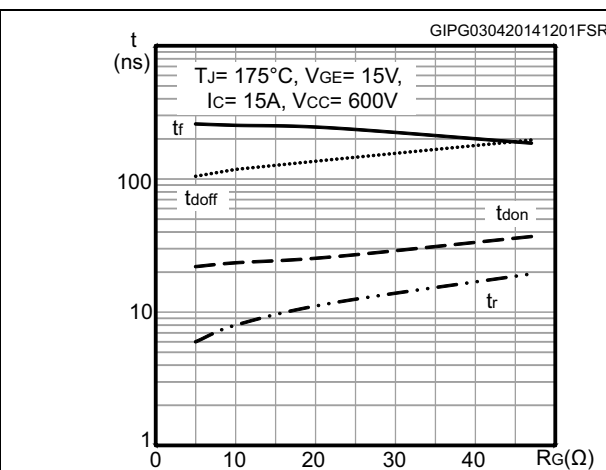




Figure 20. Switching times vs. collector current

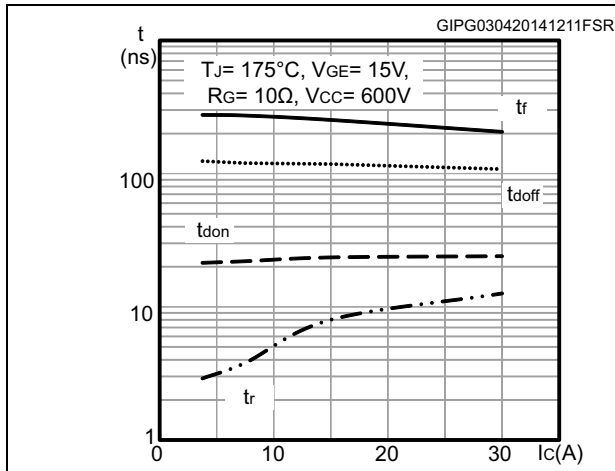
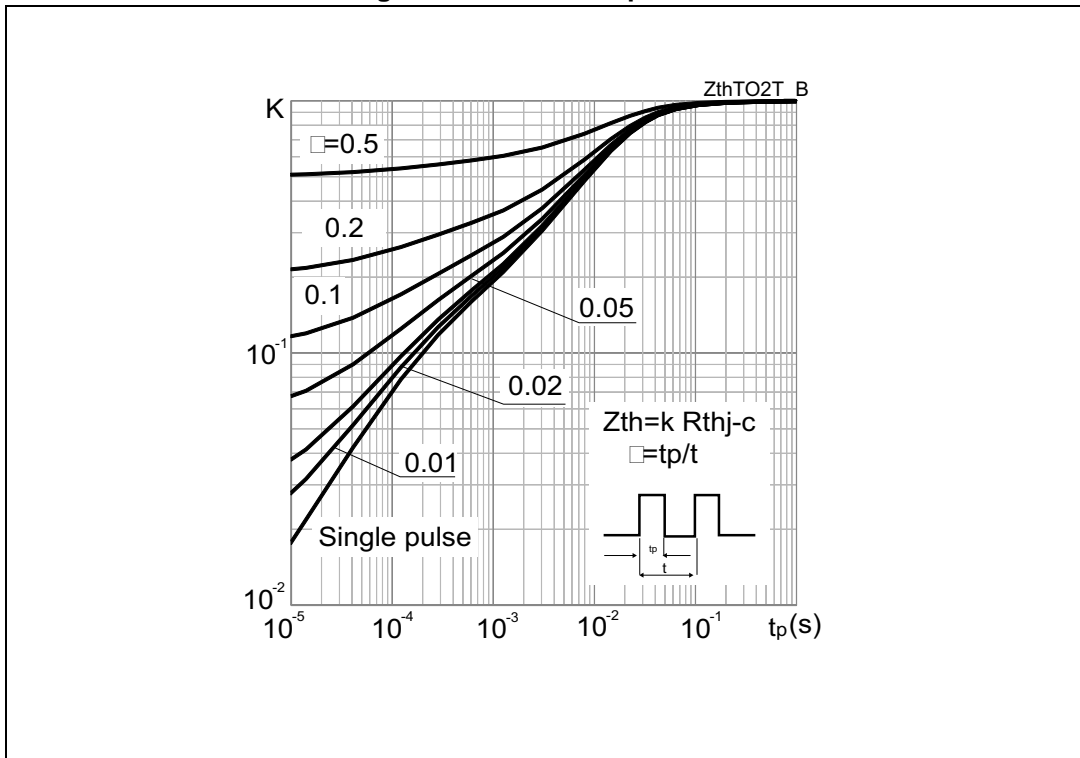


Figure 21. Thermal impedance



### 3 Test circuits

Figure 22. Test circuit for inductive load switching

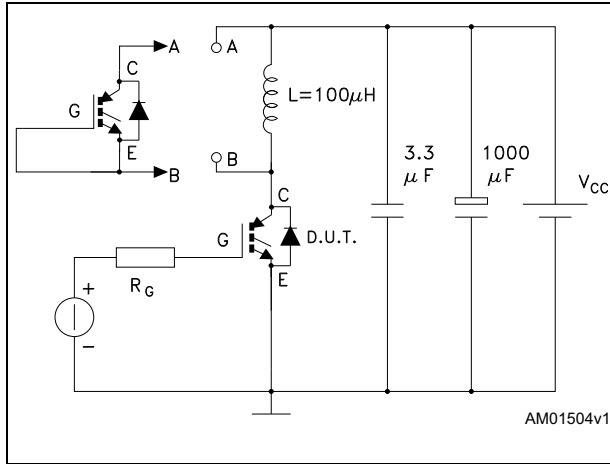


Figure 23. Gate charge test circuit

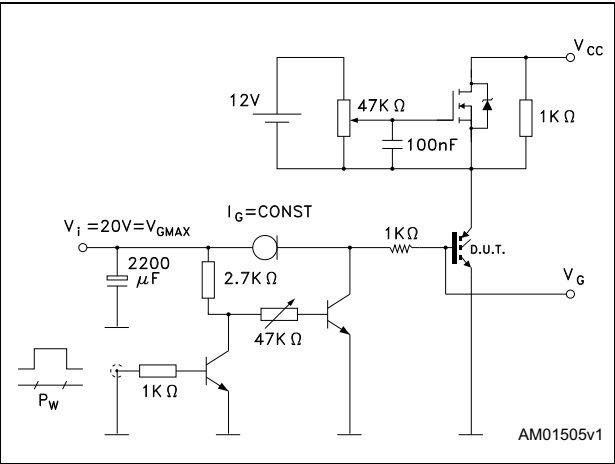
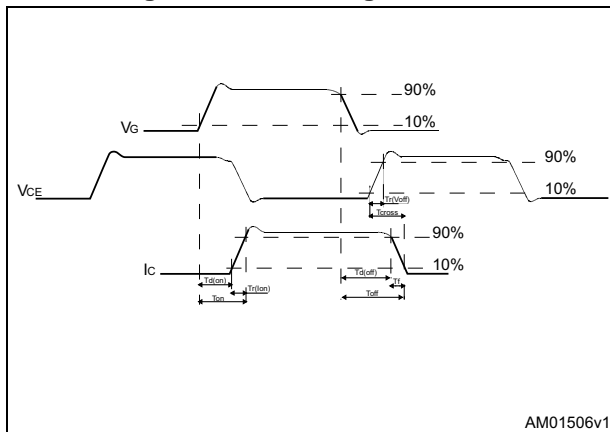


Figure 24. Switching waveform



## 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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 TO-247 package information

Figure 25. TO-247 package outline

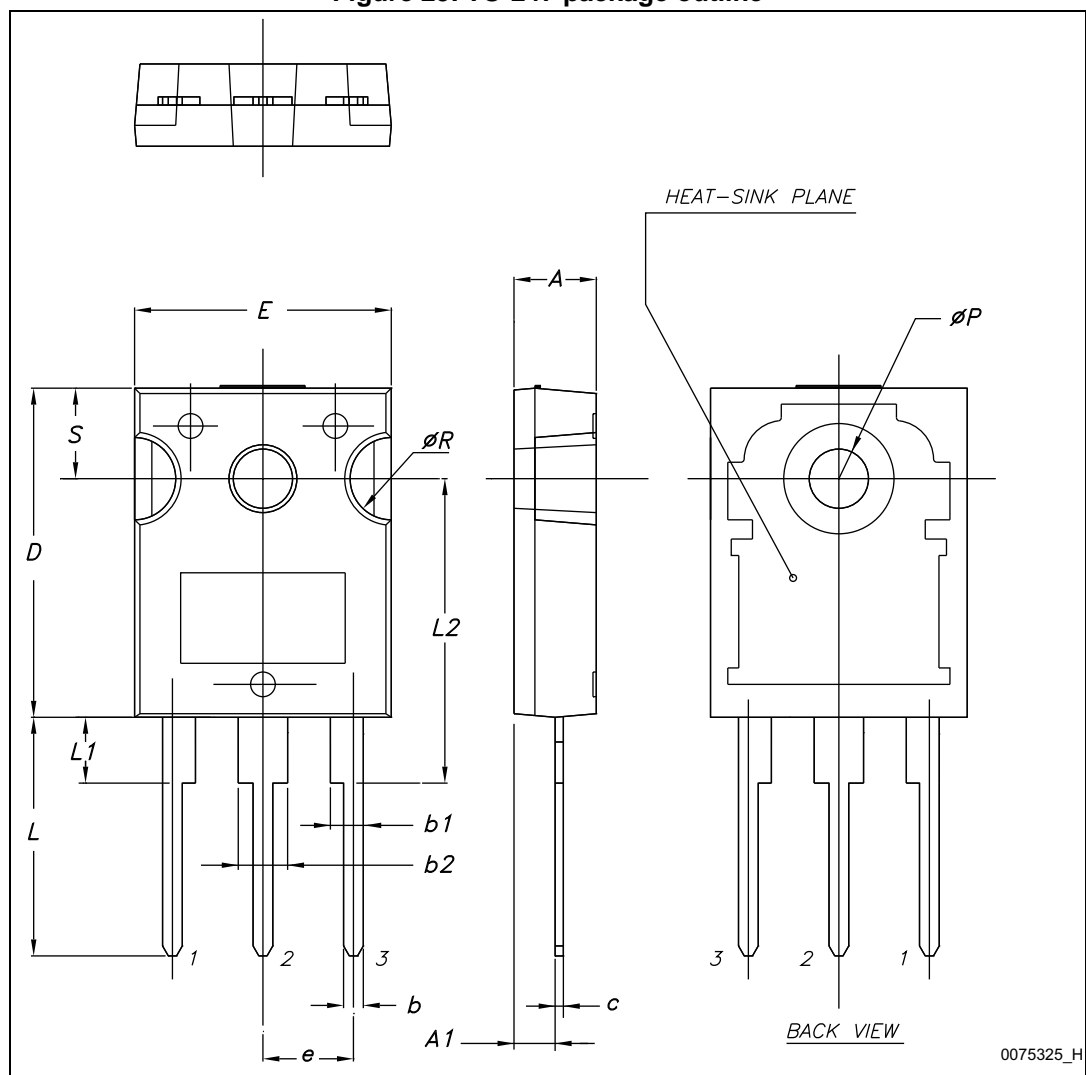
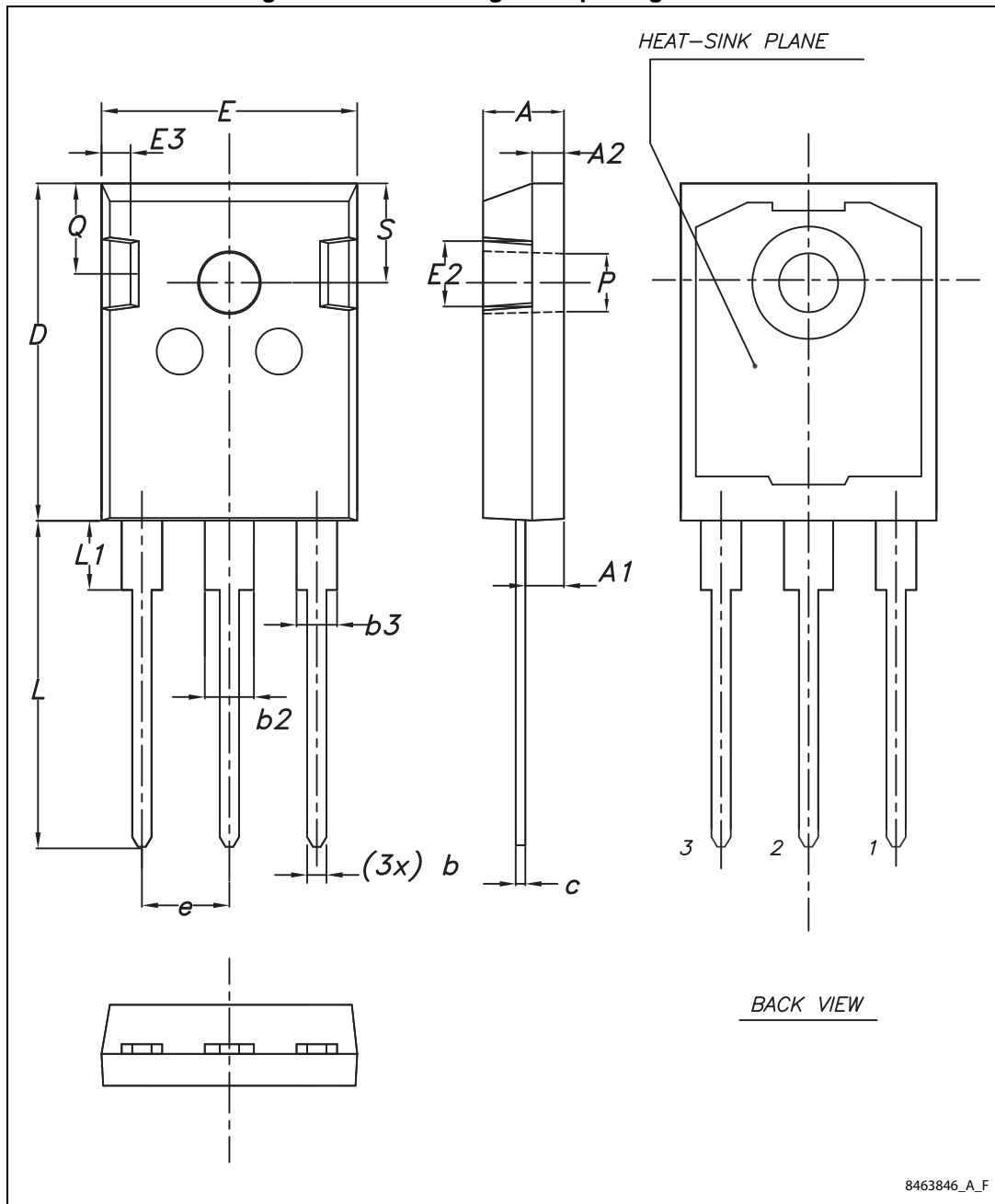


Table 7. TO-247 package mechanical data

| Dim. | mm.   |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 4.85  |       | 5.15  |
| A1   | 2.20  |       | 2.60  |
| b    | 1.0   |       | 1.40  |
| b1   | 2.0   |       | 2.40  |
| b2   | 3.0   |       | 3.40  |
| c    | 0.40  |       | 0.80  |
| D    | 19.85 |       | 20.15 |
| E    | 15.45 |       | 15.75 |
| e    | 5.30  | 5.45  | 5.60  |
| L    | 14.20 |       | 14.80 |
| L1   | 3.70  |       | 4.30  |
| L2   |       | 18.50 |       |
| ØP   | 3.55  |       | 3.65  |
| ØR   | 4.50  |       | 5.50  |
| S    | 5.30  | 5.50  | 5.70  |

### 4.2 TO-247 long leads package information

Figure 26. TO-247 long leads package outline



8463846\_A\_F

Table 8. TO-247 long leads package mechanical data

| Dim. | mm    |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 4.90  | 5.00  | 5.10  |
| A1   | 2.31  | 2.41  | 2.51  |
| A2   | 1.90  | 2.00  | 2.10  |
| b    | 1.16  |       | 1.26  |
| b2   |       |       | 3.25  |
| b3   |       |       | 2.25  |
| c    | 0.59  |       | 0.66  |
| D    | 20.90 | 21.00 | 21.10 |
| E    | 15.70 | 15.80 | 15.90 |
| E2   | 4.90  | 5.00  | 5.10  |
| E3   | 2.40  | 2.50  | 2.60  |
| e    | 5.34  | 5.44  | 5.54  |
| L    | 19.80 | 19.92 | 20.10 |
| L1   |       |       | 4.30  |
| P    | 3.50  | 3.60  | 3.70  |
| Q    | 5.60  |       | 6.00  |
| S    | 6.05  | 6.15  | 6.25  |

## 5 Revision history

Table 9. Document revision history

| Date        | Revision | Changes  |
|-------------|----------|--|
| 03-Mar-2014 | 1        | Initial release.   |
| 08-Apr-2014 | 2        | Document status promoted from preliminary to production data.<br>Added <a href="#">Section 2.1: Electrical characteristics (curves)</a> .<br>Minor text changes. |
| 28-Jan-2015 | 3        | updated <a href="#">4.1: TO-247 package information</a> and <a href="#">4.2: TO-247 long leads package information</a><br>Minor text changes                     |
| 04-Mar-2015 | 4        | Updated <a href="#">Figure 4.: Output characteristics (<math>T_J = 25^\circ\text{C}</math>)</a><br>Minor text changes.   |
| 01-Apr-2015 | 5        | Removed figure of Diode reverse recovery waveform<br>Minor text changes.   |



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