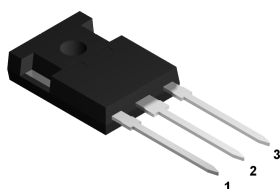
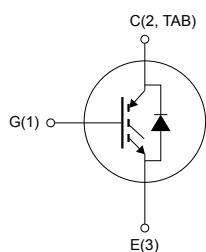


## Trench gate field-stop 1600 V, 30 A, soft-switching IH2 series IGBT in a TO-247 long leads package



TO-247 long leads



NG1E3C2T

### Features

- Designed for soft-commutation
- Maximum junction temperature:  $T_J = 175\text{ }^{\circ}\text{C}$
- $V_{CE(sat)} = 1.77\text{ V (typ.)}$  at  $I_C = 30\text{ A}$
- Minimized tail current
- Tight parameter distribution
- Low thermal resistance
- Very low drop and soft recovery co-packaged diode
- Positive  $V_{CE(sat)}$  temperature coefficient

### Applications

- Induction heating
- Microwave ovens
- Resonant converters

### Description

The newest IGBT 1600 V IH2 series has been developed using an advanced proprietary trench gate field-stop structure, whose performance is optimized both in conduction and switching losses for soft commutation. A freewheeling diode with a low drop forward voltage is included. The result is a product specifically designed to maximize efficiency for any resonant and soft-switching applications.



#### Product status link

[STGWA30IH160DF2](#)

#### Product summary

|            |                   |
|------------|-------------------|
| Order code | STGWA30IH160DF2   |
| Marking    | G30IH160DF2       |
| Package    | TO-247 long leads |
| Packing    | Tube              |

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol         | Parameter                                                                            | Value             | Unit |
|----------------|--------------------------------------------------------------------------------------|-------------------|------|
| $V_{CES}$      | Collector-emitter voltage ( $V_{GE} = 0\text{ V}$ )                                  | 1600              | V    |
| $I_C$          | Continuous collector current at $T_C = 25\text{ °C}$                                 | 85                | A    |
|                | Continuous collector current at $T_C = 100\text{ °C}$                                | 55                |      |
| $I_{CP}^{(1)}$ | Pulsed collector current ( $t_p \leq 1\text{ }\mu\text{s}$ , $T_J < 175\text{ °C}$ ) | 120               | A    |
| $V_{GE}$       | Gate-emitter voltage                                                                 | $\pm 20$          | V    |
| $I_F$          | Continuous forward current at $T_C = 25\text{ °C}$                                   | 70 <sup>(2)</sup> | A    |
|                | Continuous forward current at $T_C = 100\text{ °C}$                                  | 44                |      |
| $I_{FP}^{(1)}$ | Pulsed forward current                                                               | 120               | A    |
| $P_{TOT}$      | Total power dissipation at $T_C = 25\text{ °C}$                                      | 395               | W    |
| $T_{STG}$      | Storage temperature range                                                            | - 55 to 150       | °C   |
| $T_J$          | Operating junction temperature range                                                 | - 55 to 175       |      |

1. Defined by  $R_{thJC}$  and limited by maximum junction temperature, not tested in production.

2. Limited by bonding wires.

**Table 2. Thermal data**

| Symbol     | Parameter                                   | Value | Unit |
|------------|---------------------------------------------|-------|------|
| $R_{thJC}$ | Thermal resistance, junction-to-case, IGBT  | 0.36  | °C/W |
|            | Thermal resistance, junction-to-case, diode | 0.81  |      |
| $R_{thJA}$ | Thermal resistance, junction-to-ambient     | 50    | °C/W |

## 2 Electrical characteristics

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

**Table 3. Static characteristics**

| Symbol        | Parameter                            | Test conditions                                                      | Min. | Typ. | Max.      | Unit          |
|---------------|--------------------------------------|----------------------------------------------------------------------|------|------|-----------|---------------|
| $V_{(BR)CES}$ | Collector-emitter breakdown voltage  | $V_{GE} = 0\text{ V}$ , $I_C = 1\text{ mA}$                          | 1600 | -    | -         | V             |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE} = 15\text{ V}$ , $I_C = 30\text{ A}$                         | -    | 1.77 | 2.2       | V             |
|               |                                      | $V_{GE} = 15\text{ V}$ , $I_C = 30\text{ A}$ , $T_J = 125\text{ °C}$ | -    | 2.1  | -         |               |
|               |                                      | $V_{GE} = 15\text{ V}$ , $I_C = 30\text{ A}$ , $T_J = 175\text{ °C}$ | -    | 2.2  | -         |               |
| $V_F$         | Forward on-voltage                   | $I_F = 30\text{ A}$                                                  | -    | 1.27 | -         | V             |
|               |                                      | $I_F = 30\text{ A}$ , $T_J = 125\text{ °C}$                          | -    | 1.3  | -         |               |
|               |                                      | $I_F = 30\text{ A}$ , $T_J = 175\text{ °C}$                          | -    | 1.33 | -         |               |
| $V_{GE(th)}$  | Gate threshold voltage               | $V_{CE} = V_{GE}$ , $I_C = 1\text{ mA}$                              | 5    | 6    | 7         | V             |
| $I_{CES}$     | Collector cut-off current            | $V_{GE} = 0\text{ V}$ , $V_{CE} = 1600\text{ V}$                     | -    | -    | 25        | $\mu\text{A}$ |
| $I_{GES}$     | Gate-emitter leakage current         | $V_{CE} = 0\text{ V}$ , $V_{GE} = \pm 20\text{ V}$                   | -    | -    | $\pm 250$ | nA            |

**Table 4. Dynamic characteristics**

| Symbol    | Parameter                    | Test conditions                                                                                                                                       | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $C_{ies}$ | Input capacitance            | $V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GE} = 0\text{ V}$                                                                                   | -    | 2900 | -    | pF   |
| $C_{oes}$ | Output capacitance           |                                                                                                                                                       | -    | 102  | -    | pF   |
| $C_{res}$ | Reverse transfer capacitance |                                                                                                                                                       | -    | 61   | -    | pF   |
| $Q_g$     | Total gate charge            | $V_{CC} = 1280\text{ V}$ , $I_C = 30\text{ A}$ , $V_{GE} = 0\text{ to }15\text{ V}$<br>(see the <a href="#">Figure 24. Gate charge test circuit</a> ) | -    | 211  | -    | nC   |
| $Q_{ge}$  | Gate-emitter charge          |                                                                                                                                                       | -    | 19   | -    | nC   |
| $Q_{gc}$  | Gate-collector charge        |                                                                                                                                                       | -    | 104  | -    | nC   |

**Table 5. IGBT switching characteristics (inductive load)**

| Symbol          | Parameter                 | Test conditions                                                                                                              | Min. | Typ. | Max. | Unit          |
|-----------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $t_{d(off)}$    | Turn-off delay time       | $V_{CC} = 600\text{ V}$ , $I_C = 30\text{ A}$ ,<br>$V_{GE} = 15\text{ V}$ , $R_G = 10\text{ }\Omega$                         | -    | 331  | -    | ns            |
| $t_f$           | Current fall time         |                                                                                                                              | -    | 143  | -    | ns            |
| $E_{off}^{(1)}$ | Turn-off switching energy | (see the <a href="#">Figure 22. Test circuit for inductive load switching</a> )                                              | -    | 1830 | -    | $\mu\text{J}$ |
| $t_{d(off)}$    | Turn-off delay time       | $V_{CC} = 600\text{ V}$ , $I_C = 30\text{ A}$ ,<br>$V_{GE} = 15\text{ V}$ , $R_G = 10\text{ }\Omega$ , $T_J = 175\text{ °C}$ | -    | 376  | -    | ns            |
| $t_f$           | Current fall time         |                                                                                                                              | -    | 325  | -    | ns            |
| $E_{off}^{(1)}$ | Turn-off switching energy |                                                                                                                              | -    | 3000 | -    | $\mu\text{J}$ |

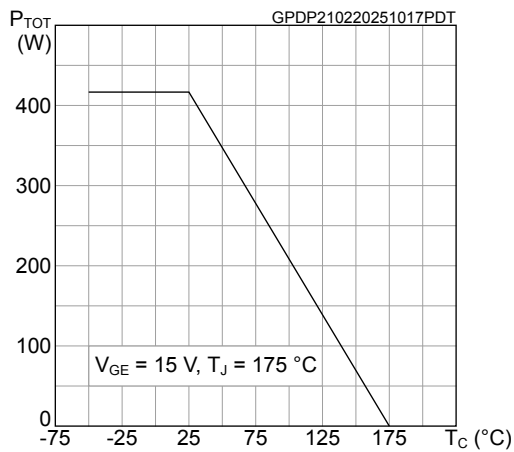
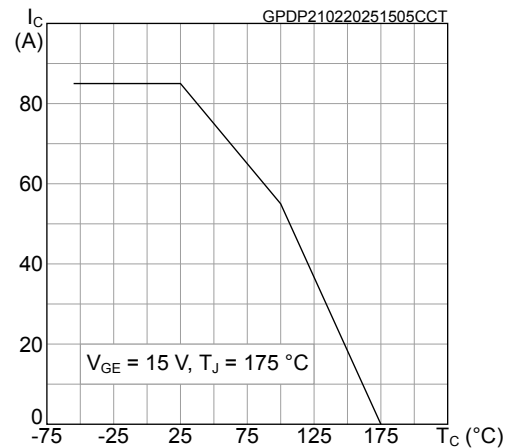
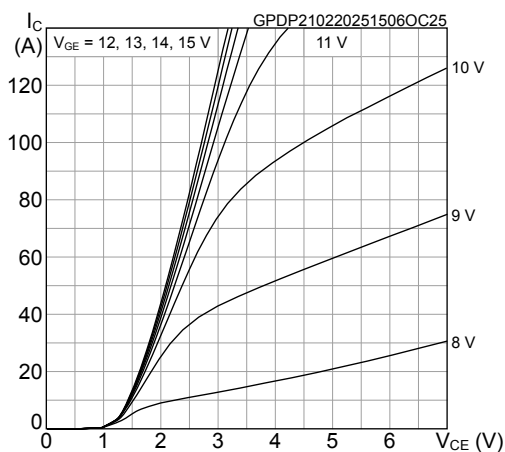
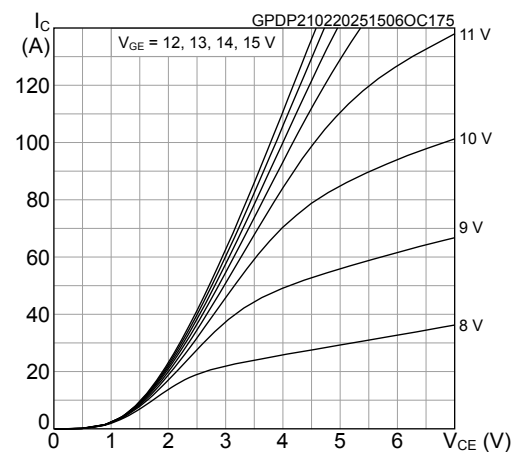
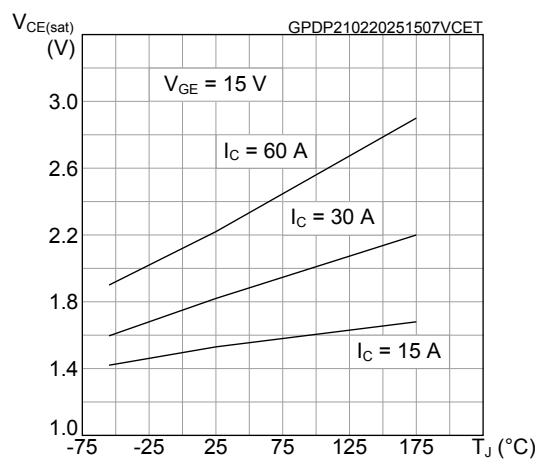
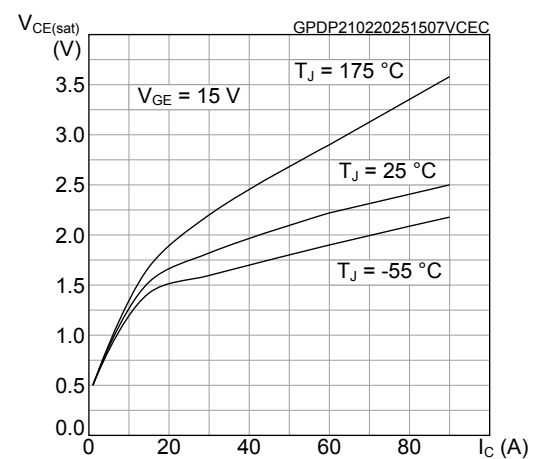
1. Including the tail of the collector current.

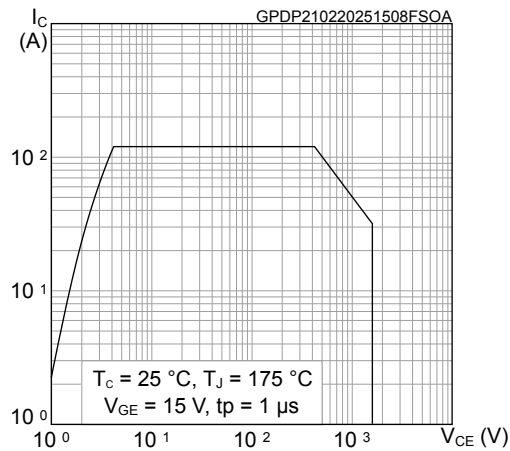
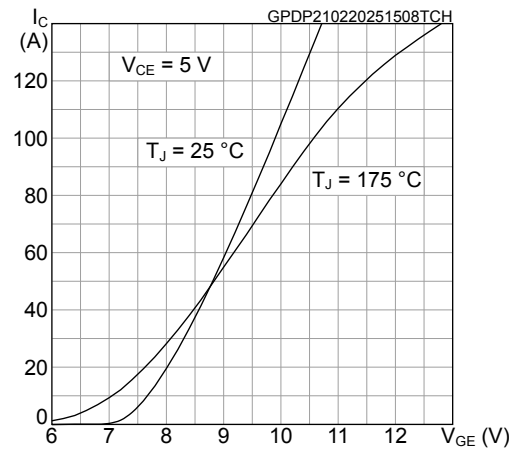
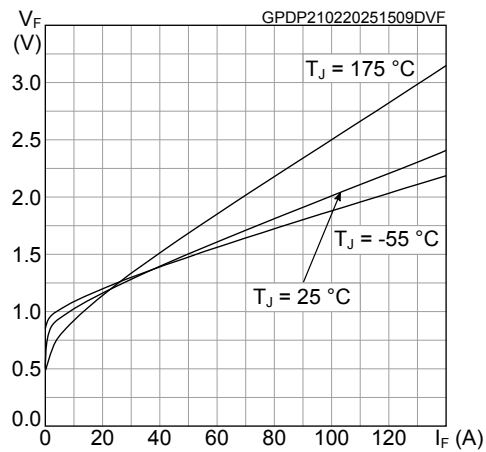
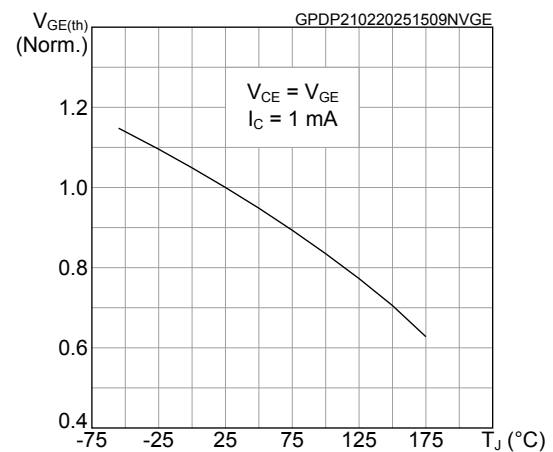
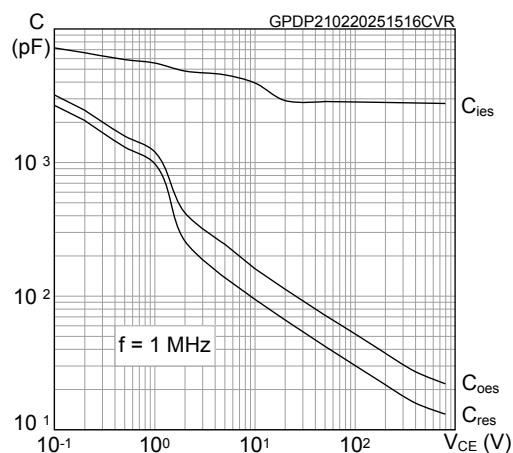
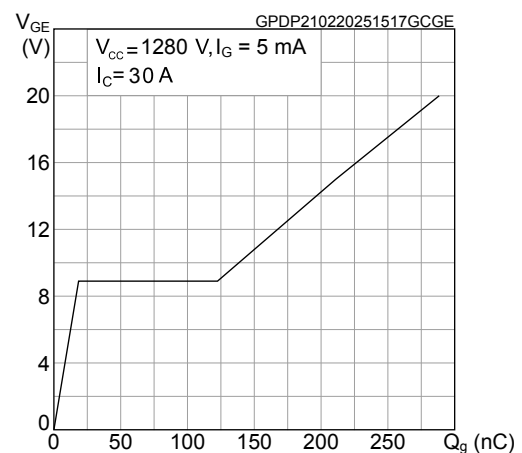
**Table 6. IGBT switching characteristics (capacitive load)**

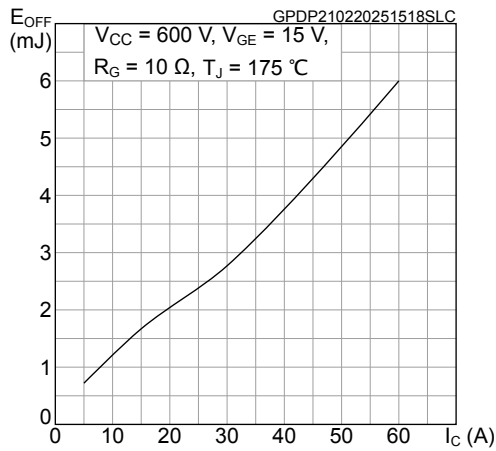
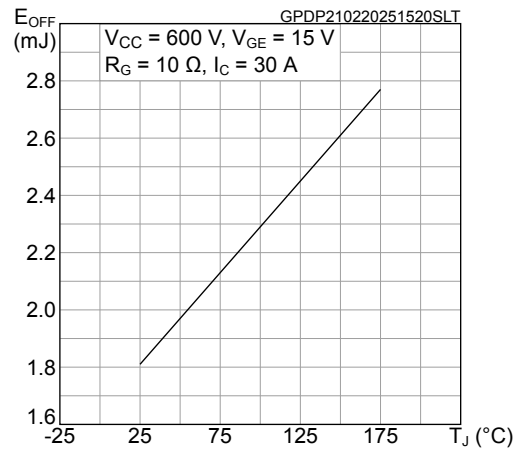
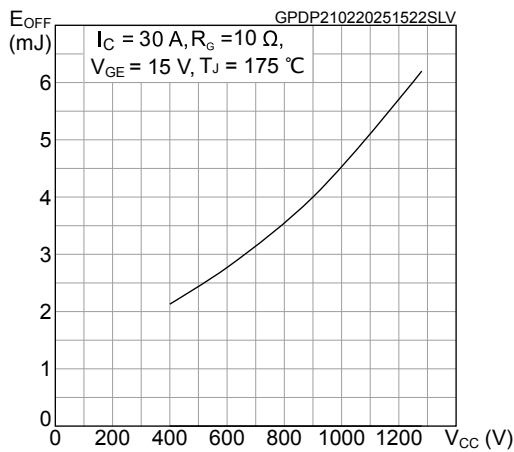
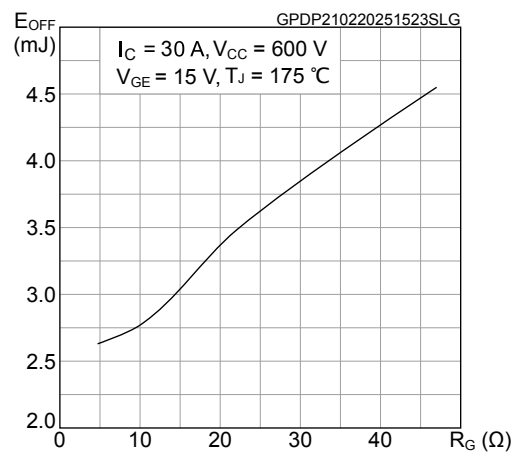
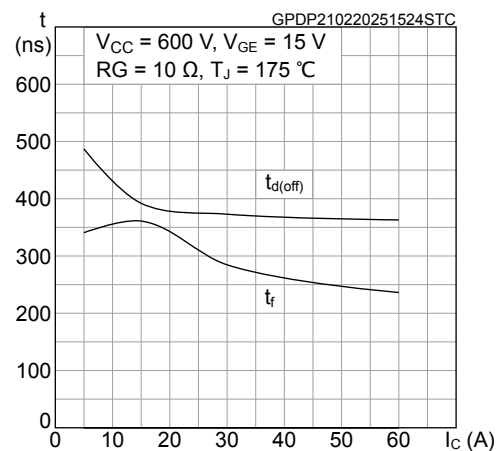
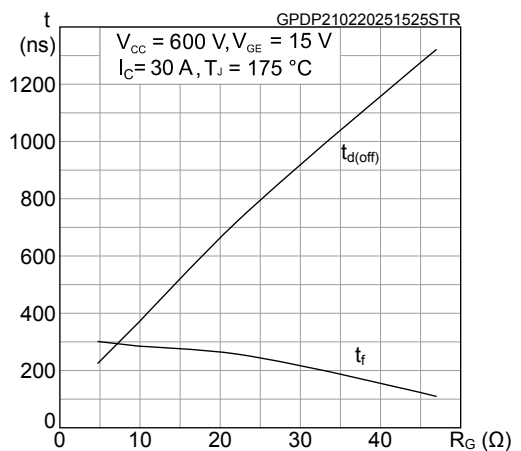
| Symbol             | Parameter                 | Test conditions                                                                                                                                                                                                                                                     | Min. | Typ. | Max. | Unit          |
|--------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $E_{off}^{(1)}$    | Turn-off switching energy | $V_{CC} = 900\text{ V}$ , $V_{GE} = 15\text{ V}$ ,<br>$R_G = 10\ \Omega$ , $I_C = 60\text{ A}$ , $L = 500\ \mu\text{H}$ ,<br>$C_{sn} = 330\text{ nF}$<br>(see the Figure 23. Test circuit for snubbed inductive load switching)                                     | -    | 1000 | -    | $\mu\text{J}$ |
|                    |                           | $V_{CC} = 900\text{ V}$ , $V_{GE} = 15\text{ V}$ ,<br>$R_G = 10\ \Omega$ , $I_C = 60\text{ A}$ , $L = 500\ \mu\text{H}$ ,<br>$C_{sn} = 330\text{ nF}$ , $T_J = 175\text{ }^\circ\text{C}$<br>(see the Figure 23. Test circuit for snubbed inductive load switching) | -    | 2000 | -    |               |
| $t_{d(off)}^{(1)}$ | Turn-off delay time       | $V_{CC} = 900\text{ V}$ , $V_{GE} = 15\text{ V}$ ,<br>$R_G = 10\ \Omega$ , $I_C = 60\text{ A}$ , $L = 500\ \mu\text{H}$ ,<br>$C_{sn} = 330\text{ nF}$<br>(see the Figure 23. Test circuit for snubbed inductive load switching)                                     | -    | 185  | -    | ns            |
|                    |                           | $V_{CC} = 900\text{ V}$ , $V_{GE} = 15\text{ V}$ ,<br>$R_G = 10\ \Omega$ , $I_C = 60\text{ A}$ , $L = 500\ \mu\text{H}$ ,<br>$C_{sn} = 330\text{ nF}$ , $T_J = 175\text{ }^\circ\text{C}$<br>(see the Figure 23. Test circuit for snubbed inductive load switching) | -    | 188  | -    |               |
| $t_f^{(1)}$        | Fall time                 | $V_{CC} = 900\text{ V}$ , $V_{GE} = 15\text{ V}$ ,<br>$R_G = 10\ \Omega$ , $I_C = 60\text{ A}$ , $L = 500\ \mu\text{H}$ ,<br>$C_{sn} = 330\text{ nF}$<br>(see the Figure 23. Test circuit for snubbed inductive load switching)                                     | -    | 99   | -    | ns            |
|                    |                           | $V_{CC} = 900\text{ V}$ , $V_{GE} = 15\text{ V}$ ,<br>$R_G = 10\ \Omega$ , $I_C = 60\text{ A}$ , $L = 500\ \mu\text{H}$ ,<br>$C_{sn} = 330\text{ nF}$ , $T_J = 175\text{ }^\circ\text{C}$<br>(see the Figure 23. Test circuit for snubbed inductive load switching) | -    | 120  | -    |               |

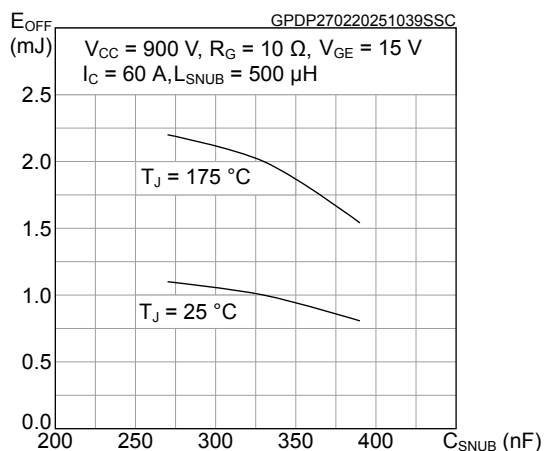
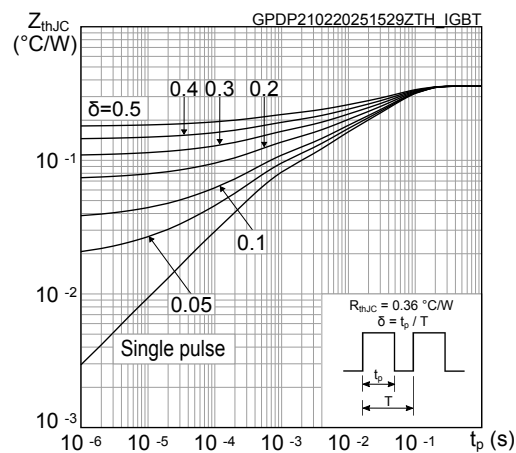
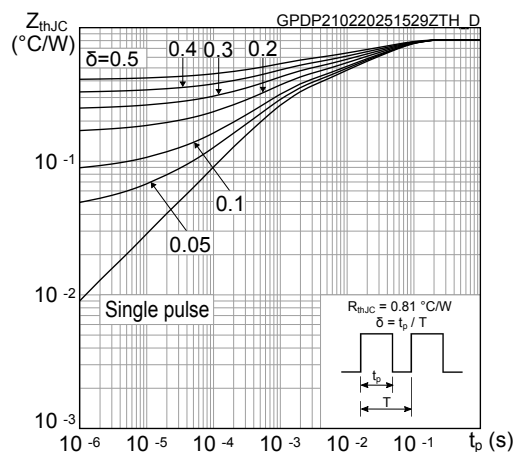
1. Including the tail of the collector current.

## 2.1 Electrical characteristics (curves)

**Figure 1. Total power dissipation vs case temperature**

**Figure 2. Maximum continuous collector current vs case temperature**

**Figure 3. Typical output characteristics (T\_J = 25 °C)**

**Figure 4. Typical output characteristics (T\_J = 175 °C)**

**Figure 5. Typical V\_CE(sat) vs temperature**

**Figure 6. Typical V\_CE(sat) vs collector current**


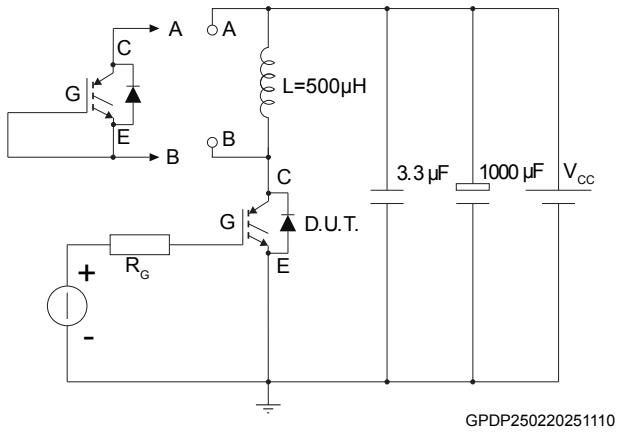
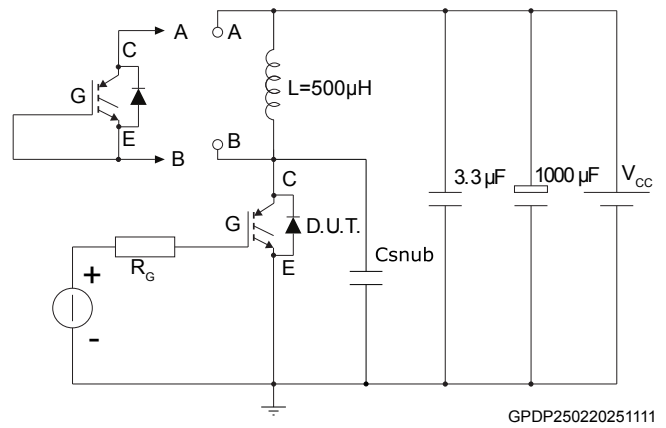
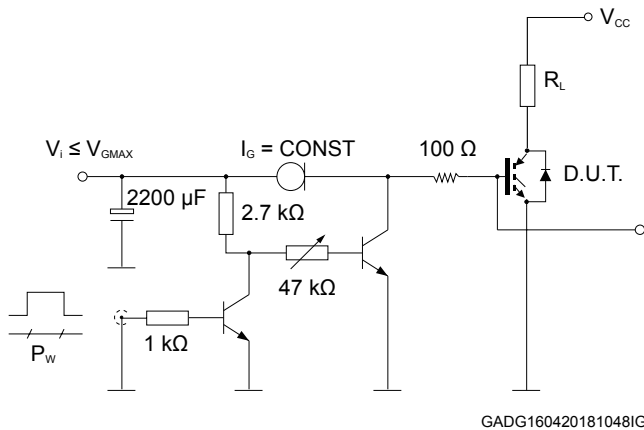
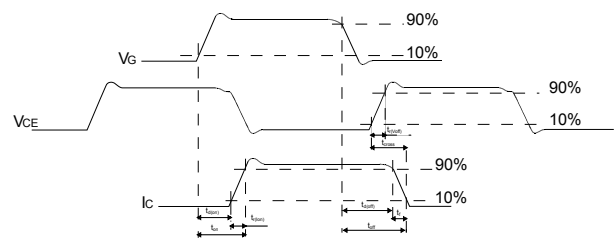
**Figure 7. Forward bias safe operating area**

**Figure 8. Typical transfer characteristics**

**Figure 9. Typical reverse diode forward characteristics**

**Figure 10. Normalized  $V_{GE(th)}$  vs temperature**

**Figure 11. Typical capacitance characteristics**

**Figure 12. Typical gate charge characteristics**


**Figure 13. Typical switching energy vs collector current**

**Figure 14. Typical switching energy vs temperature**

**Figure 15. Typical switching energy vs supply voltage**

**Figure 16. Typical switching energy vs  $R_G$** 

**Figure 17. Typical switching times vs collector current**

**Figure 18. Typical switching times vs gate resistance**


**Figure 19. Typical switching energy vs snubber capacitance**

**Figure 20. IGBT maximum transient thermal impedance**

**Figure 21. Diode maximum transient thermal impedance**




### 3 Test circuits

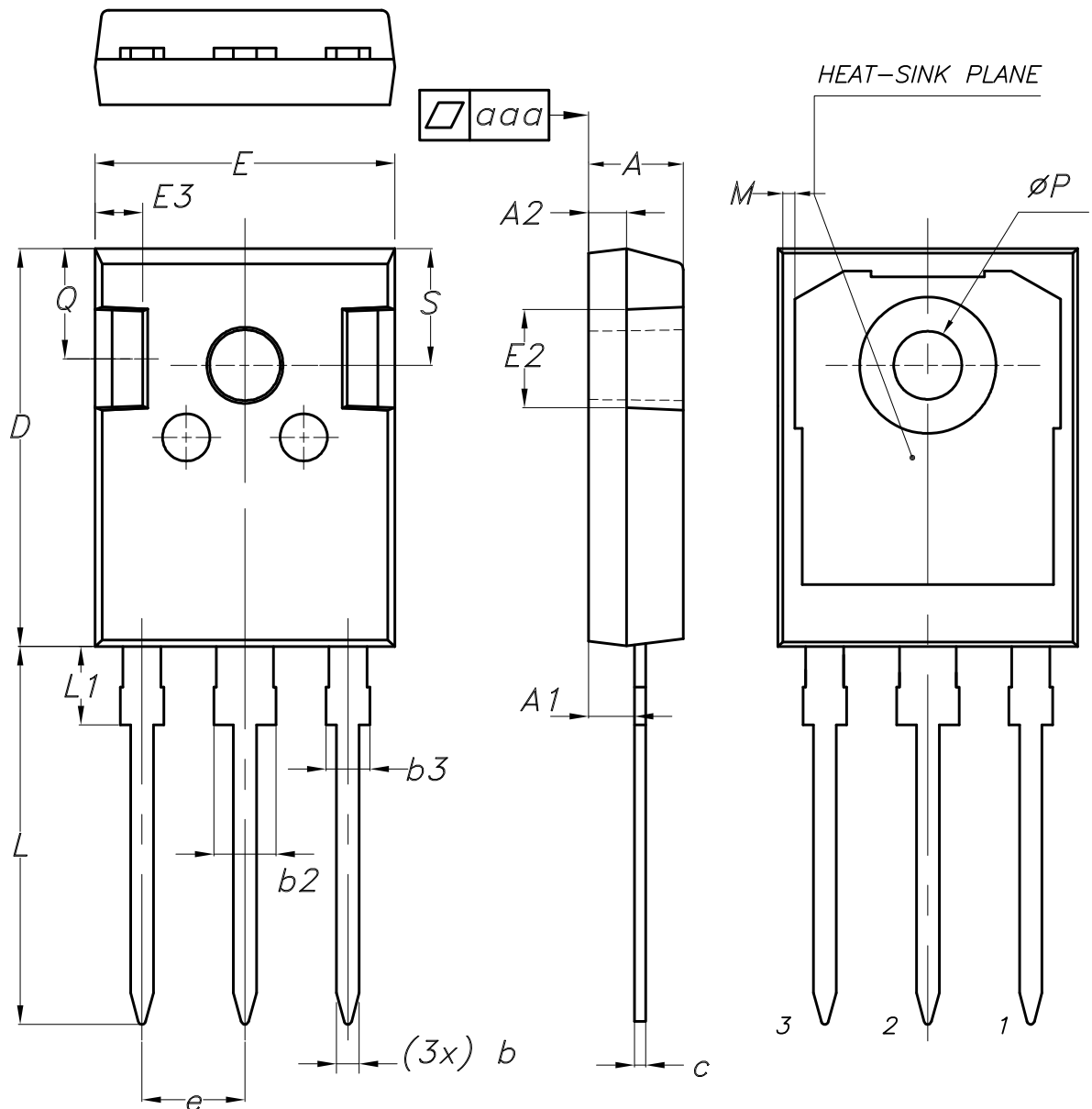
**Figure 22. Test circuit for inductive load switching**

**Figure 23. Test circuit for snubbed inductive load switching**

**Figure 24. Gate charge test circuit**

**Figure 25. Switching waveform**


## 4 Package information

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 long leads package information

Figure 26. TO-247 long leads package outline



BACK VIEW

8463846\_6

**Table 7. 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  |
| M    | 0.35  |       | 0.95  |
| P    | 3.50  | 3.60  | 3.70  |
| Q    | 5.60  |       | 6.00  |
| S    | 6.05  | 6.15  | 6.25  |
| aaa  |       | 0.04  | 0.10  |

## Revision history

Table 8. Document revision history

| Date        | Revision | Changes        |
|-------------|----------|----------------|
| 11-Mar-2025 | 1        | First release. |

## Contents

|          |                                             |           |
|----------|---------------------------------------------|-----------|
| <b>1</b> | <b>Electrical ratings .....</b>             | <b>2</b>  |
| <b>2</b> | <b>Electrical characteristics.....</b>      | <b>3</b>  |
| 2.1      | Electrical characteristics (curves) .....   | 5         |
| <b>3</b> | <b>Test circuits .....</b>                  | <b>9</b>  |
| <b>4</b> | <b>Package information.....</b>             | <b>10</b> |
| 4.1      | TO-247 long leads package information. .... | 10        |
|          | <b>Revision history .....</b>               | <b>12</b> |

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