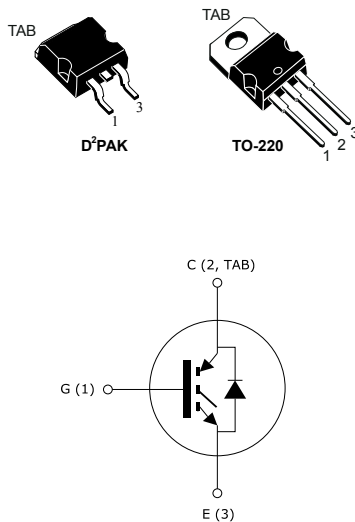


## Trench gate field-stop 600 V, 30 A high speed HB series IGBT



### Features

- Maximum junction temperature:  $T_J = 175\text{ }^{\circ}\text{C}$
- High speed switching series
- Minimized tail current
- Low saturation voltage:  $V_{CE(sat)} = 1.55\text{ V (typ.) @ } I_C = 30\text{ A}$
- Tight parameter distribution
- Safe paralleling
- Positive  $V_{CE(sat)}$  temperature coefficient
- Low thermal resistance
- Very fast soft recovery antiparallel diode

### Applications

- Photovoltaic inverters
- High frequency converters

### Description

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



#### Product status link

[STGB30H60DFB](#)

[STGP30H60DFB](#)

## 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol         | Parameter                                      | Value       | Unit |
|----------------|------------------------------------------------|-------------|------|
| $V_{CES}$      | Collector-emitter voltage ( $V_{GE} = 0$ V)    | 600         | V    |
| $I_C$          | Continuous collector current at $T_C = 25$ °C  | 60          | A    |
|                | Continuous collector current at $T_C = 100$ °C | 30          |      |
| $I_{CP}^{(1)}$ | Pulsed collector current                       | 120         |      |
| $V_{GE}$       | Gate-emitter voltage                           | ±20         | V    |
|                | Transient gate-emitter voltage                 | ±30         |      |
| $I_F$          | Continuous forward current at $T_C = 25$ °C    | 60          | A    |
|                | Continuous forward current at $T_C = 100$ °C   | 30          |      |
| $I_{FP}^{(1)}$ | Pulsed forward current                         | 120         |      |
| $P_{TOT}$      | Total power dissipation at $T_C = 25$ °C       | 260         | W    |
| $T_{STG}$      | Storage temperature range                      | - 55 to 150 | °C   |
| $T_J$          | Operating junction temperature range           | - 55 to 175 |      |

1. Pulse width limited by maximum junction temperature.

**Table 2. Thermal data**

| Symbol     | Parameter                              | Value | Unit |
|------------|----------------------------------------|-------|------|
| $R_{thJC}$ | Thermal resistance junction-case IGBT  | 0.58  | °C/W |
| $R_{thJC}$ | Thermal resistance junction-case diode | 2.08  |      |
| $R_{thJA}$ | Thermal resistance junction-ambient    | 62.5  |      |

## 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  | $V_{GE} = 0\text{ V}$ , $I_C = 2\text{ mA}$                          | 600  |      |           | V             |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE} = 15\text{ V}$ , $I_C = 30\text{ A}$                         |      | 1.55 | 2         | V             |
|               |                                      | $V_{GE} = 15\text{ V}$ , $I_C = 30\text{ A}$ , $T_J = 125\text{ °C}$ |      | 1.65 |           |               |
|               |                                      | $V_{GE} = 15\text{ V}$ , $I_C = 30\text{ A}$ , $T_J = 175\text{ °C}$ |      | 1.75 |           |               |
| $V_F$         | Forward on-voltage                   | $I_F = 30\text{ A}$                                                  |      | 2    | 2.6       | V             |
|               |                                      | $I_F = 30\text{ A}$ , $T_J = 125\text{ °C}$                          |      | 1.7  |           |               |
|               |                                      | $I_F = 30\text{ A}$ , $T_J = 175\text{ °C}$                          |      | 1.6  |           |               |
| $V_{GE(th)}$  | Gate threshold voltage               | $V_{CE} = V_{GE}$ , $I_C = 1\text{ mA}$                              | 5    | 6    | 7         | V             |
| $I_{CES}$     | Collector cut-off current            | $V_{GE} = 0\text{ V}$ , $V_{CE} = 600\text{ V}$                      |      |      | 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            | $V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GE} = 0\text{ V}$                                                             | -    | 3659 | -    | pF   |
| $C_{oes}$ | Output capacitance           |                                                                                                                                 | -    | 101  | -    |      |
| $C_{res}$ | Reverse transfer capacitance |                                                                                                                                 | -    | 76   | -    |      |
| $Q_g$     | Total gate charge            | $V_{CC} = 520\text{ V}$ , $I_C = 30\text{ A}$ , $V_{GE} = 0\text{ to }15\text{ V}$<br>(see Figure 28. Gate charge test circuit) | -    | 149  | -    | nC   |
| $Q_{ge}$  | Gate-emitter charge          |                                                                                                                                 | -    | 25   | -    |      |
| $Q_{gc}$  | Gate-collector charge        |                                                                                                                                 | -    | 62   | -    |      |

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

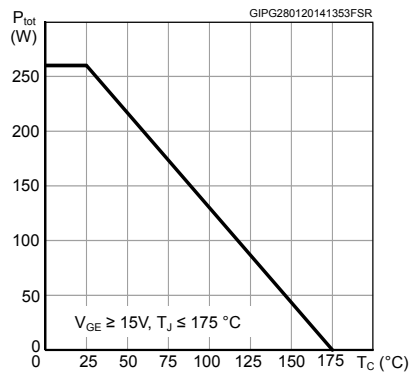
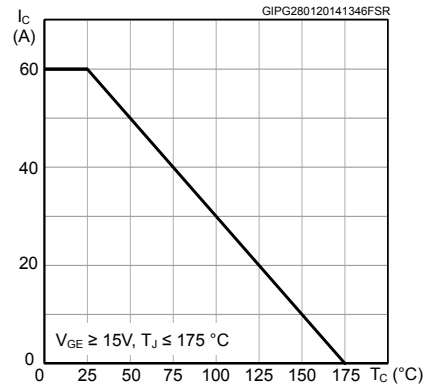
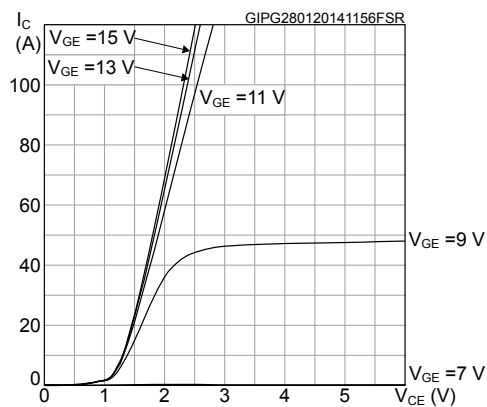
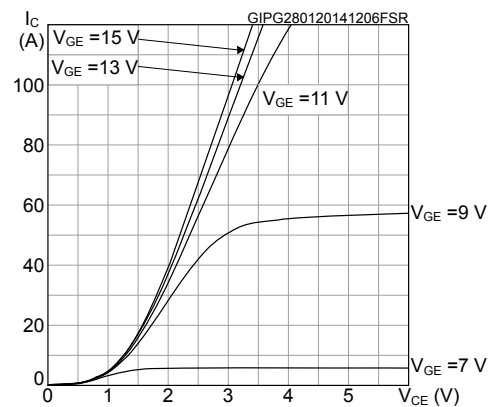
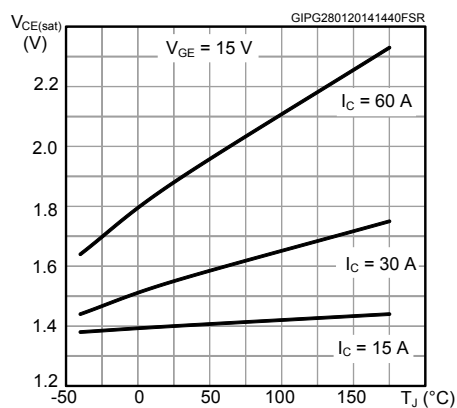
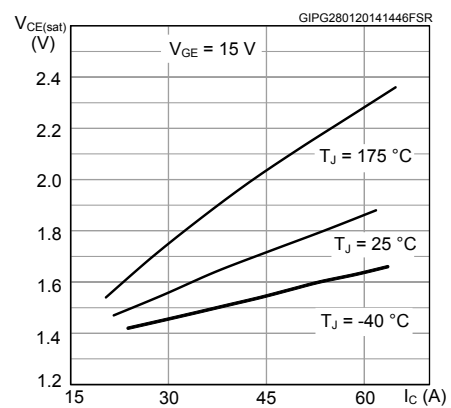
| Symbol          | Parameter                 | Test conditions                                                                                                                                                                               | Min. | Typ. | Max. | Unit       |
|-----------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------------|
| $t_{d(on)}$     | Turn-on delay time        | $V_{CE} = 400\text{ V}$ , $I_C = 30\text{ A}$ , $V_{GE} = 15\text{ V}$ ,<br>$R_G = 10\ \Omega$ (see Figure 27. Test circuit for inductive load switching)                                     | -    | 37   | -    | ns         |
| $t_r$           | Current rise time         |                                                                                                                                                                                               | -    | 14.6 | -    |            |
| $(di/dt)_{on}$  | Turn-on current slope     |                                                                                                                                                                                               | -    | 1643 | -    | A/ $\mu$ s |
| $t_{d(off)}$    | Turn-off-delay time       |                                                                                                                                                                                               | -    | 146  | -    | ns         |
| $t_f$           | Current fall time         |                                                                                                                                                                                               | -    | 23   | -    |            |
| $E_{on}^{(1)}$  | Turn-on switching energy  |                                                                                                                                                                                               | -    | 383  | -    | $\mu$ J    |
| $E_{off}^{(2)}$ | Turn-off switching energy |                                                                                                                                                                                               | -    | 293  | -    |            |
| $E_{ts}$        | Total switching energy    |                                                                                                                                                                                               | -    | 676  | -    |            |
| $t_{d(on)}$     | Turn-on delay time        | $V_{CE} = 400\text{ V}$ , $I_C = 30\text{ A}$ , $V_{GE} = 15\text{ V}$ ,<br>$R_G = 10\ \Omega$ , $T_J = 175\text{ }^\circ\text{C}$ (see Figure 27. Test circuit for inductive load switching) | -    | 35   | -    | ns         |
| $t_r$           | Current rise time         |                                                                                                                                                                                               | -    | 16.1 | -    |            |
| $(di/dt)_{on}$  | Turn-on current slope     |                                                                                                                                                                                               | -    | 1496 | -    | A/ $\mu$ s |
| $t_{d(off)}$    | Turn-off-delay time       |                                                                                                                                                                                               | -    | 158  | -    | ns         |
| $t_f$           | Current fall time         |                                                                                                                                                                                               | -    | 65   | -    |            |
| $E_{on}^{(1)}$  | Turn-on switching energy  |                                                                                                                                                                                               | -    | 794  | -    | $\mu$ J    |
| $E_{off}^{(2)}$ | Turn-off switching energy |                                                                                                                                                                                               | -    | 572  | -    |            |
| $E_{ts}$        | Total switching energy    |                                                                                                                                                                                               | -    | 1366 | -    |            |

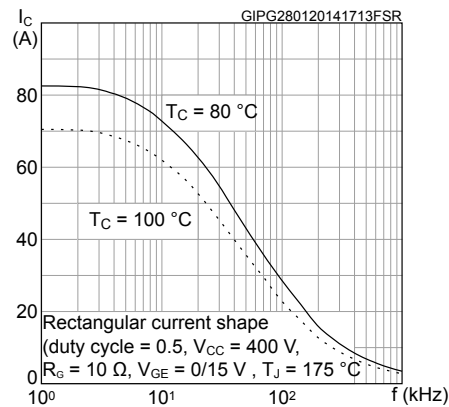
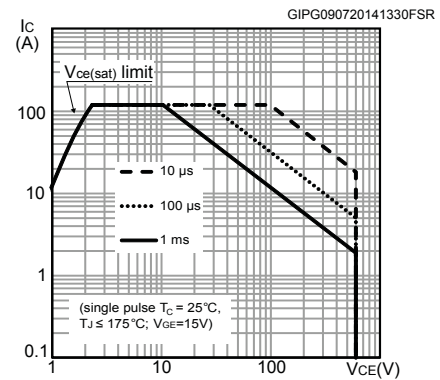
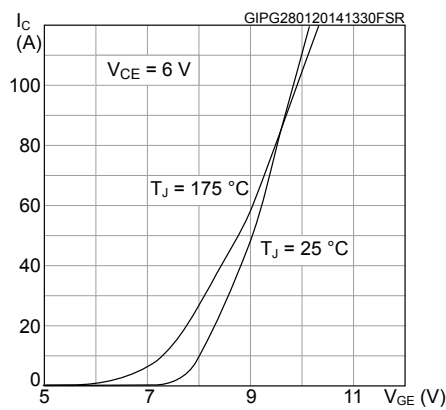
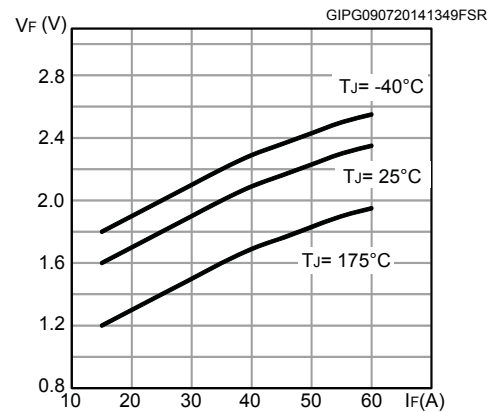
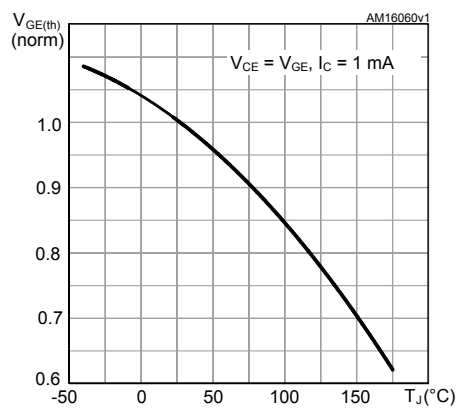
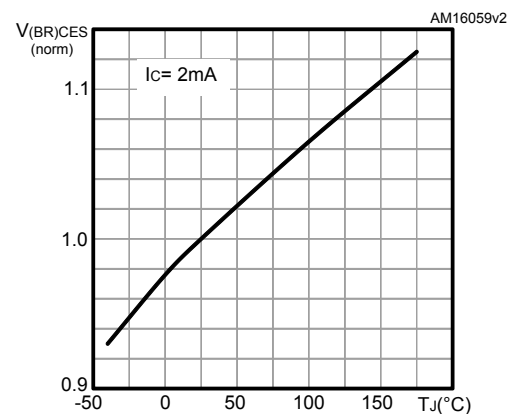
1. Including the reverse recovery of the diode.
2. Including the tail of the collector current.

**Table 6. Diode switching characteristics (inductive load)**

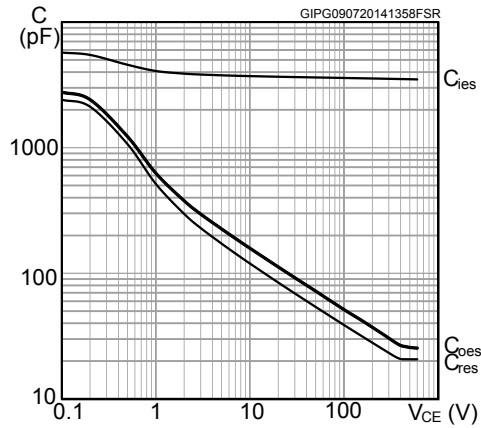
| Symbol       | Parameter                                                  | Test conditions                                                                                                                                                                                             | Min. | Typ. | Max. | Unit       |
|--------------|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------------|
| $t_{rr}$     | Reverse recovery time                                      | $I_F = 30\text{ A}$ , $V_R = 400\text{ V}$ , $V_{GE} = 15\text{ V}$ ,<br>$di/dt = 1000\text{ A}/\mu\text{s}$ (see Figure 27. Test circuit for inductive load switching)                                     | -    | 53   | -    | ns         |
| $Q_{rr}$     | Reverse recovery charge                                    |                                                                                                                                                                                                             | -    | 384  | -    | nC         |
| $I_{rrm}$    | Reverse recovery current                                   |                                                                                                                                                                                                             | -    | 14.5 | -    | A          |
| $di_{rr}/dt$ | Peak rate of fall of reverse recovery current during $t_b$ |                                                                                                                                                                                                             | -    | 788  | -    | A/ $\mu$ s |
| $E_{rr}$     | Reverse recovery energy                                    |                                                                                                                                                                                                             | -    | 104  | -    | $\mu$ J    |
| $t_{rr}$     | Reverse recovery time                                      | $I_F = 30\text{ A}$ , $V_R = 400\text{ V}$ , $V_{GE} = 15\text{ V}$ ,<br>$di/dt = 1000\text{ A}/\mu\text{s}$ , $T_J = 175\text{ }^\circ\text{C}$ (see Figure 27. Test circuit for inductive load switching) | -    | 104  | -    | ns         |
| $Q_{rr}$     | Reverse recovery charge                                    |                                                                                                                                                                                                             | -    | 1352 | -    | nC         |
| $I_{rrm}$    | Reverse recovery current                                   |                                                                                                                                                                                                             | -    | 26   | -    | A          |
| $di_{rr}/dt$ | Peak rate of fall of reverse recovery current during $t_b$ |                                                                                                                                                                                                             | -    | 310  | -    | A/ $\mu$ s |
| $E_{rr}$     | Reverse recovery energy                                    |                                                                                                                                                                                                             | -    | 407  | -    | $\mu$ J    |

## 2.1 Electrical characteristics (curves)

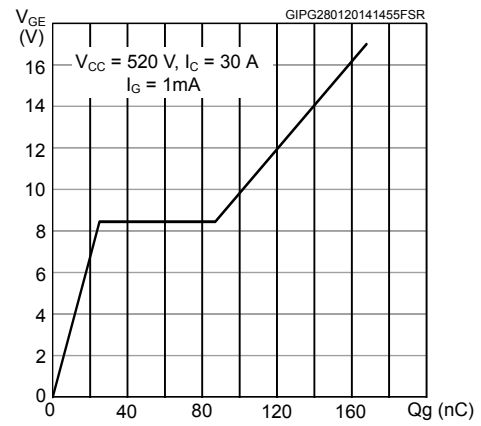
**Figure 1. Power dissipation vs case temperature**

**Figure 2. Collector current vs case temperature**

**Figure 3. Output characteristics ( $T_J = 25$  °C)**

**Figure 4. Output characteristics ( $T_J = 175$  °C)**

**Figure 5.  $V_{CE(sat)}$  vs junction temperature**

**Figure 6.  $V_{CE(sat)}$  vs collector current**


**Figure 7. Collector current vs switching frequency**

**Figure 8. Forward bias safe operating area**

**Figure 9. Transfer characteristics**

**Figure 10. Diode VF vs forward current**

**Figure 11. Normalized VGE(th) vs junction temperature**

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


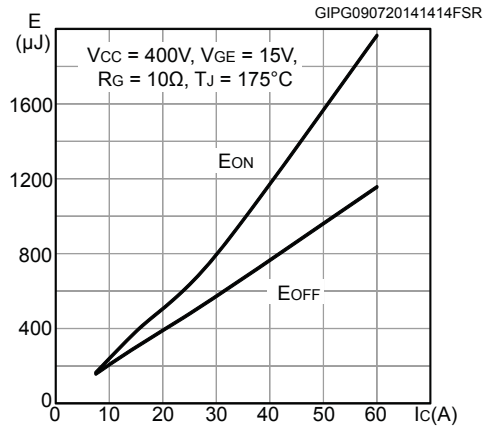
**Figure 13. Capacitance variations**



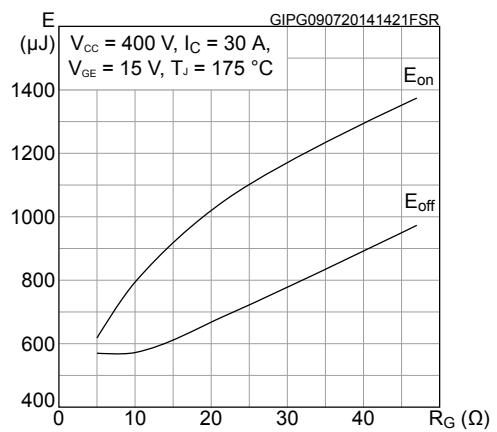
**Figure 14. Gate charge vs. gate-emitter voltage**



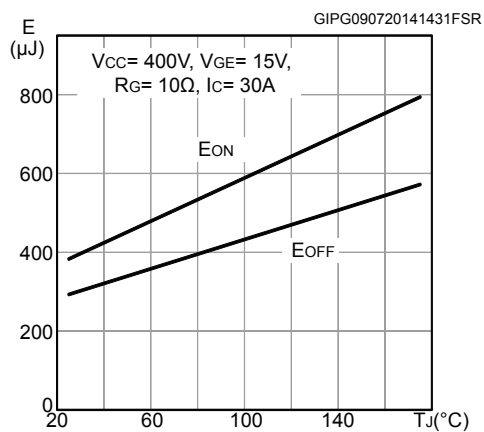
**Figure 15. Switching energy vs collector current**



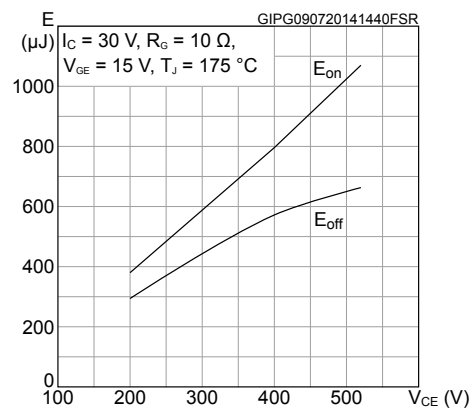
**Figure 16. Switching energy vs gate resistance**



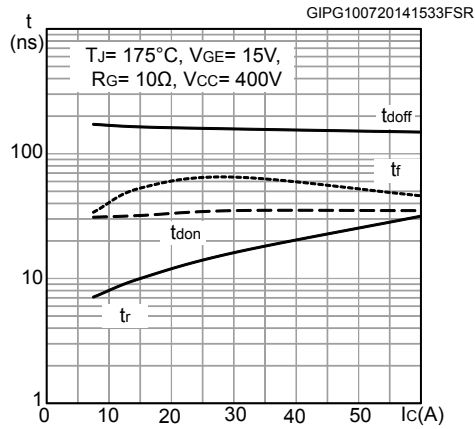
**Figure 17. Switching energy vs temperature**



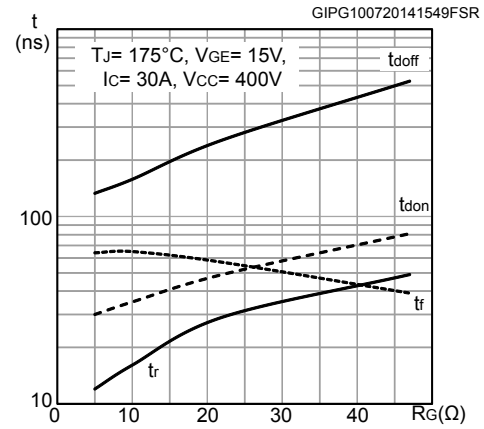
**Figure 18. Switching energy vs collector emitter voltage**



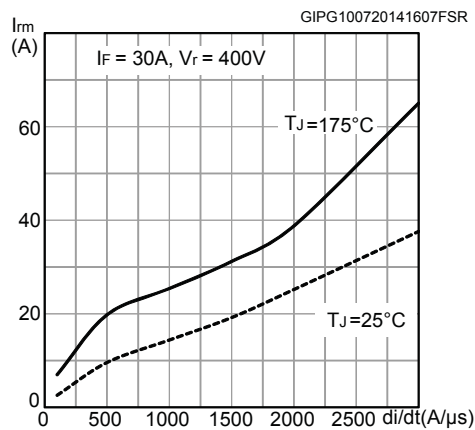
**Figure 19. Switching times vs collector current**



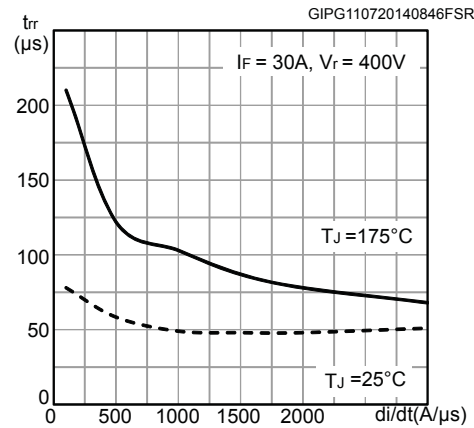
**Figure 20. Switching times vs gate resistance**



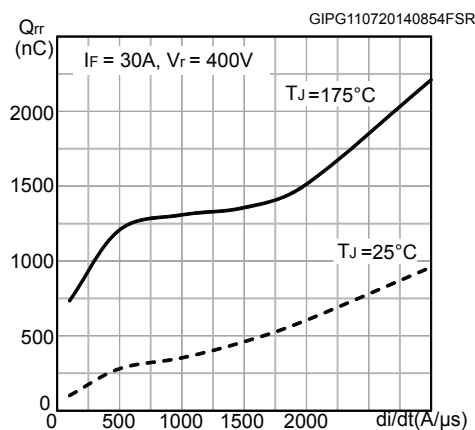
**Figure 21. Reverse recovery current vs diode current slope**



**Figure 22. Reverse recovery time vs diode current slope**



**Figure 23. Reverse recovery charge vs diode current slope**



**Figure 24. Reverse recovery energy vs diode current slope**

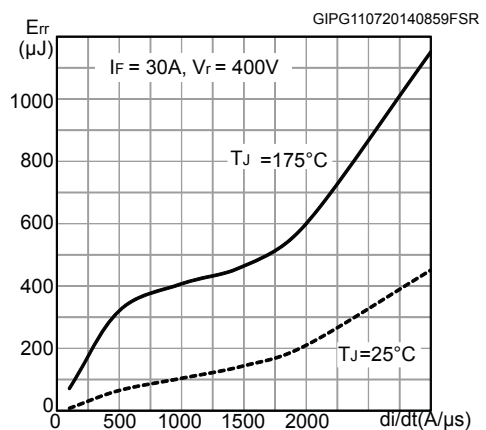




Figure 25. Thermal impedance for IGBT

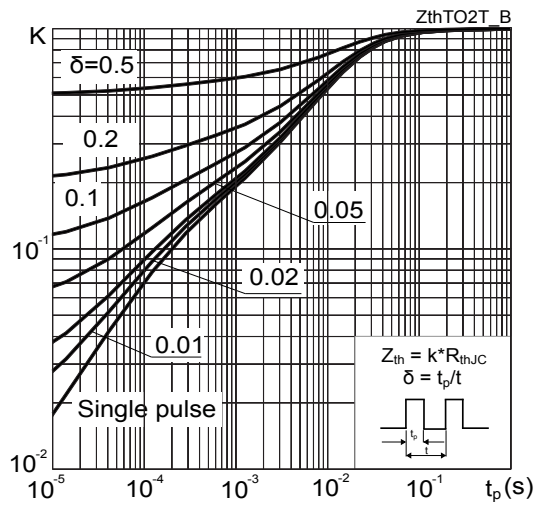
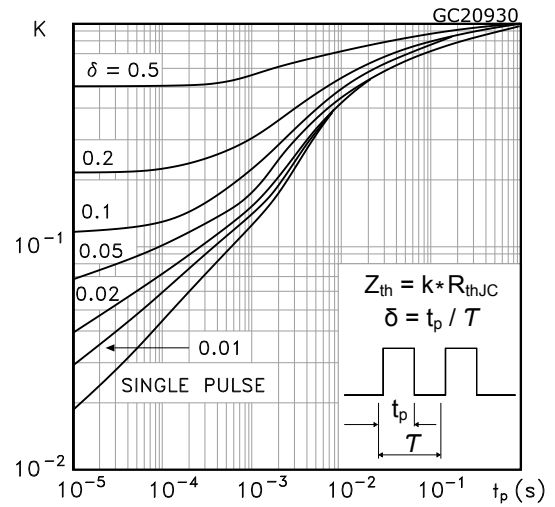
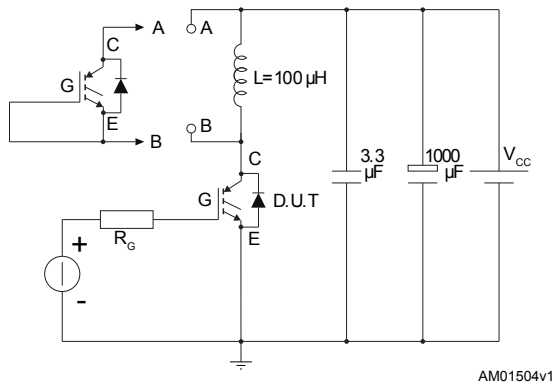
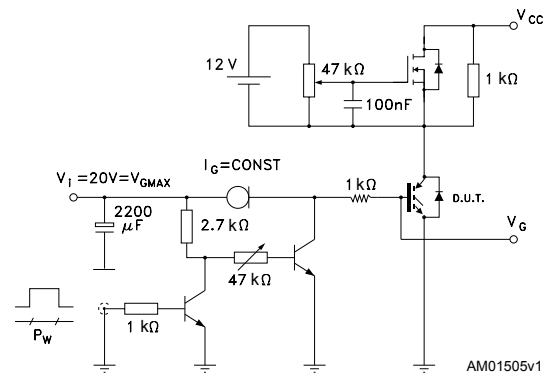
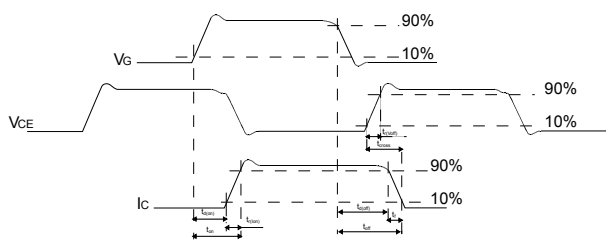
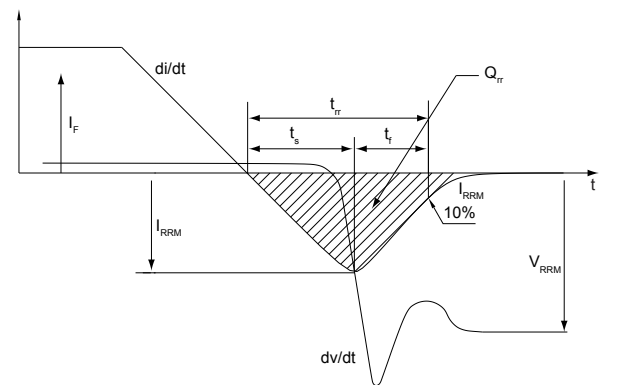


Figure 26. Thermal impedance for diode



### 3 Test circuits

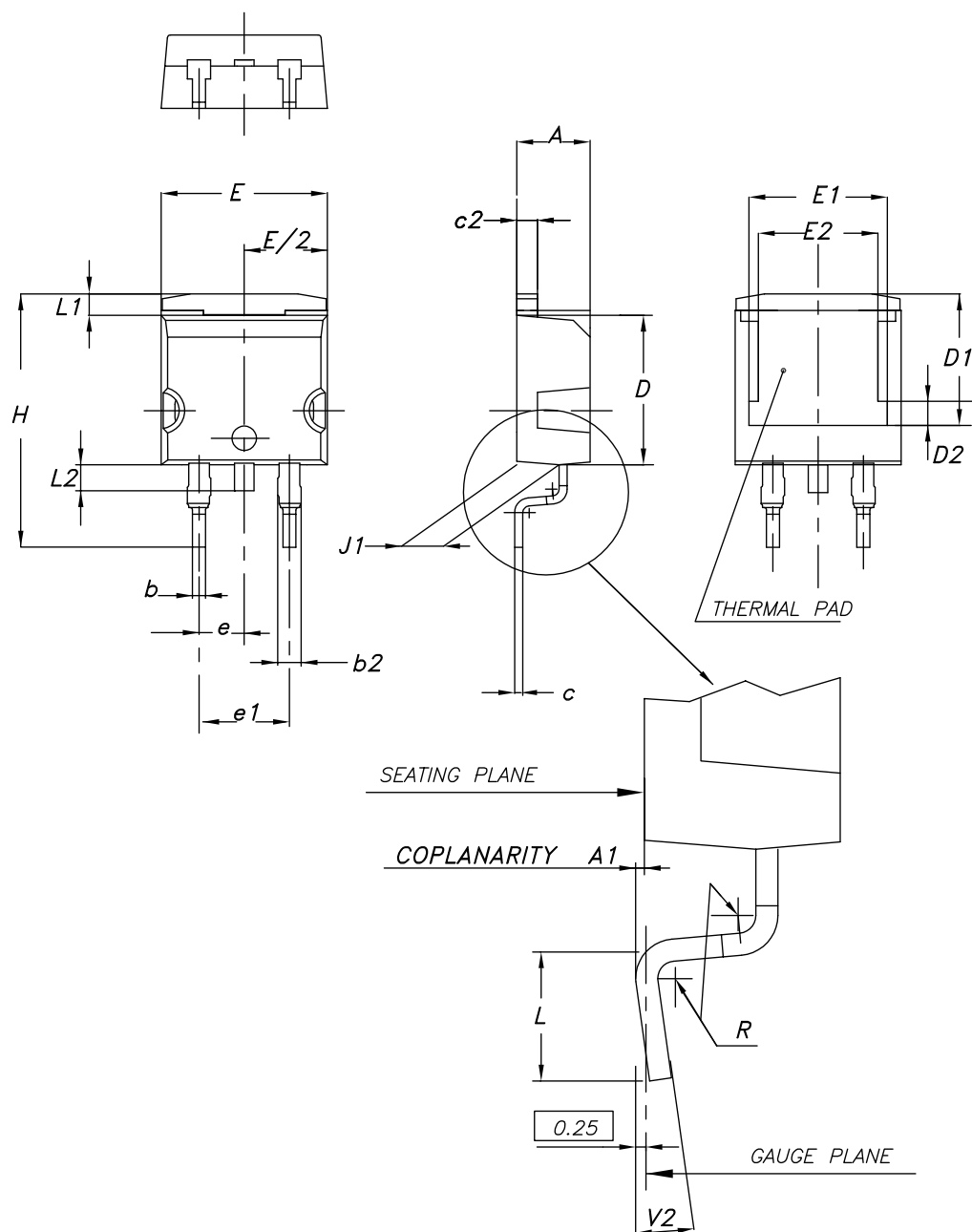
**Figure 27. Test circuit for inductive load switching**

**Figure 28. Gate charge test circuit**

**Figure 29. Switching waveform**

**Figure 30. Diode reverse recovery 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 D<sup>2</sup>PAK (TO-263) type A2 package information

**Figure 31. D<sup>2</sup>PAK (TO-263) type A2 package outline**

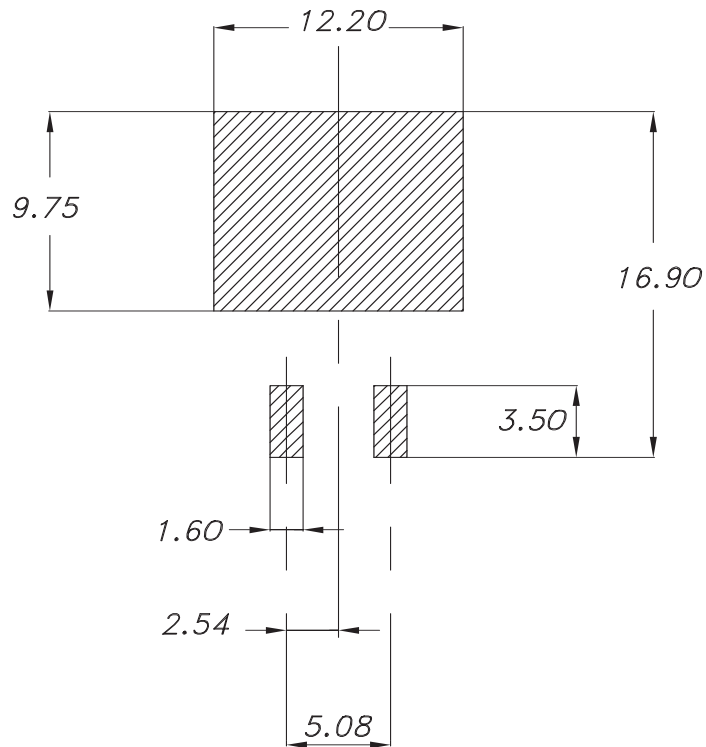


0079457\_A2\_27

**Table 7. D<sup>2</sup>PAK (TO-263) type A2 package mechanical data**

| Dim. | mm    |      |       |
|------|-------|------|-------|
|      | Min.  | Typ. | Max.  |
| A    | 4.40  |      | 4.60  |
| A1   | 0.03  |      | 0.23  |
| b    | 0.70  |      | 0.93  |
| b2   | 1.14  |      | 1.70  |
| c    | 0.45  |      | 0.60  |
| c2   | 1.23  |      | 1.36  |
| D    | 8.95  |      | 9.35  |
| D1   | 7.50  | 7.75 | 8.00  |
| D2   | 1.10  | 1.30 | 1.50  |
| E    | 10.00 |      | 10.40 |
| E1   | 8.70  | 8.90 | 9.10  |
| E2   | 7.30  | 7.50 | 7.70  |
| e    |       | 2.54 |       |
| e1   | 4.88  |      | 5.28  |
| H    | 15.00 |      | 15.85 |
| J1   | 2.49  |      | 2.69  |
| L    | 2.29  |      | 2.79  |
| L1   | 1.27  |      | 1.40  |
| L2   | 1.30  |      | 1.75  |
| R    |       | 0.40 |       |
| V2   | 0°    |      | 8°    |

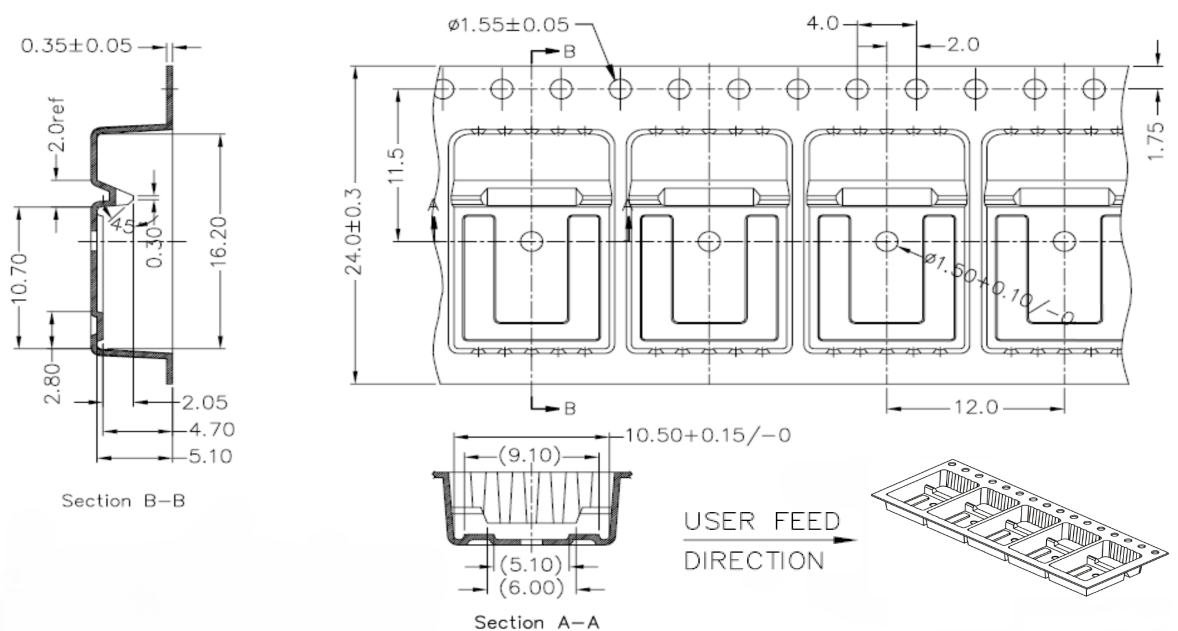
Figure 32. D<sup>2</sup>PAK (TO-263) recommended footprint (dimensions are in mm)



0079457\_Rev27\_footprint

## 4.2 D<sup>2</sup>PAK packing information

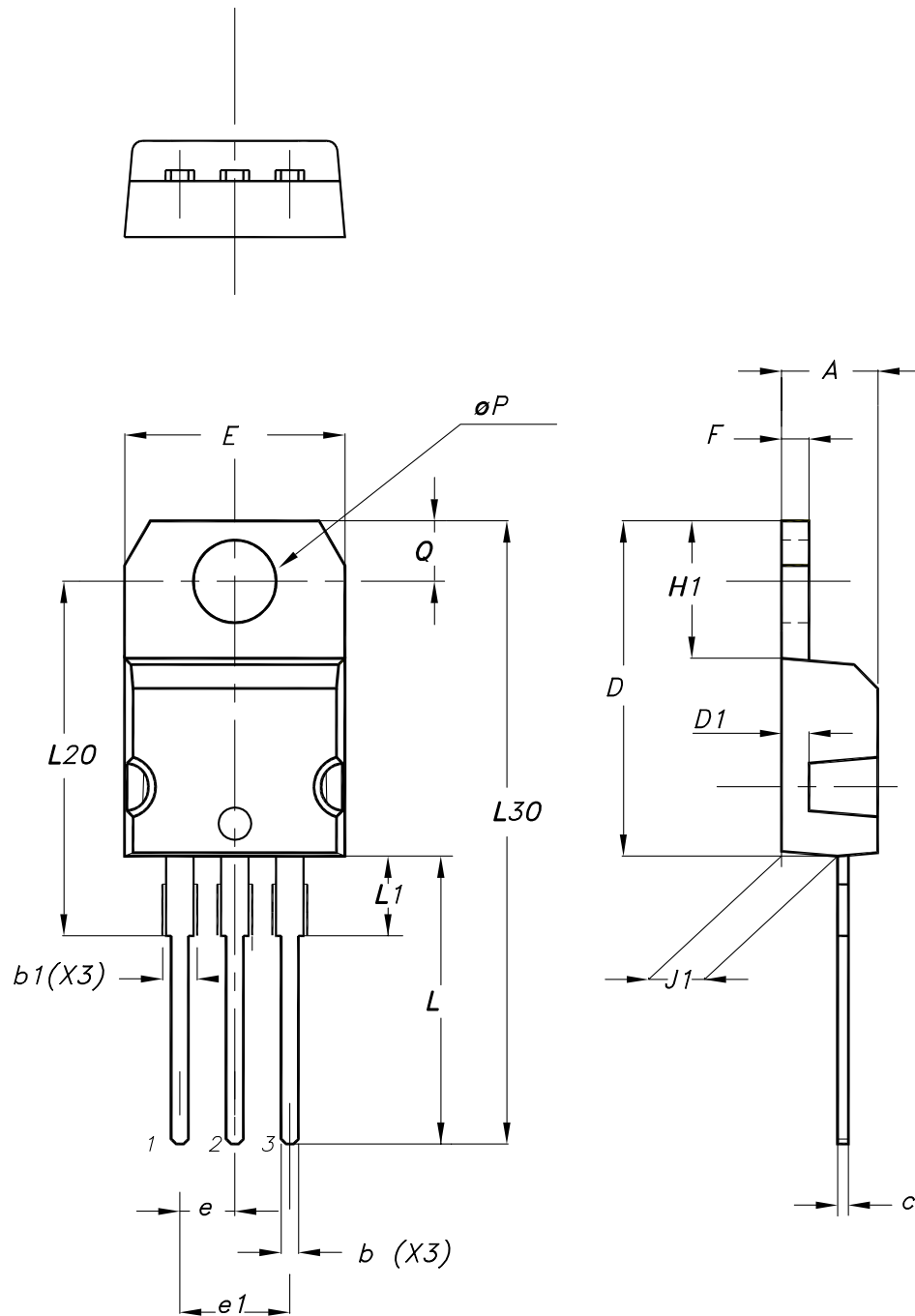
Figure 33. D<sup>2</sup>PAK tape drawing (dimensions are in mm)



DM01095771\_1

### 4.3 TO-220 type A package information

Figure 34. TO-220 type A package outline



0015988\_typeA\_Rev\_24

**Table 8. TO-220 type A package 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  |
| Slug flatness |       | 0.03  | 0.10  |

## 5 Ordering information

**Table 9. Order codes**

| Order code   | Marking    | Package            | Packing       |
|--------------|------------|--------------------|---------------|
| STGB30H60DFB | GB30H60DFB | D <sup>2</sup> PAK | Tape and reel |
| STGP30H60DFB | GP30H60DFB | TO-220             | Tube          |



## Revision history

**Table 10. Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 07-Aug-2014 | 1        | Initial release.                                                                                                                                                                                                                                                                                                                                                                               |
| 28-Oct-2015 | 2        | Updated <i>Figure 23</i> and <i>Section 5</i> .<br>Minor text changes.                                                                                                                                                                                                                                                                                                                         |
| 23-May-2019 | 3        | Modified <i>Figure 3. Output characteristics (<math>T_J = 25\text{ }^{\circ}\text{C}</math>)</i> , <i>Figure 4. Output characteristics (<math>T_J = 175\text{ }^{\circ}\text{C}</math>)</i> , <i>Figure 9. Transfer characteristics</i> , <i>Figure 7. Collector current vs switching frequency</i> , <i>Figure 18. Switching energy vs collector emitter voltage</i> .<br>Minor text changes. |
| 05-May-2025 | 4        | Updated <a href="#">Section 4: Package information</a> .                                                                                                                                                                                                                                                                                                                                       |

## 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>10</b> |
| <b>4</b> | <b>Package information.....</b>                               | <b>11</b> |
| 4.1      | D <sup>2</sup> PAK (TO-263) type A2 package information ..... | 11        |
| 4.2      | D <sup>2</sup> PAK packing information .....                  | 13        |
| 4.3      | TO-220 type A package information .....                       | 14        |
| <b>5</b> | <b>Ordering information .....</b>                             | <b>16</b> |
|          | <b>Revision history .....</b>                                 | <b>17</b> |

**IMPORTANT NOTICE – READ CAREFULLY**

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgment.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to [www.st.com/trademarks](http://www.st.com/trademarks). All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2025 STMicroelectronics – All rights reserved