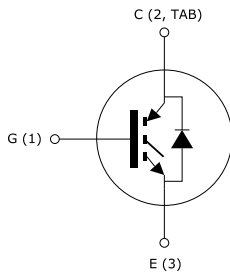
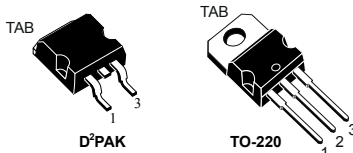


Trench gate field-stop 600 V, 30 A high speed HB series IGBT



Product status link

[STGB30H60DFB](#)
[STGP30H60DFB](#)

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.

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 | μA |
| I_{GES} | Gate-emitter leakage current | $V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$ | | | ± 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 | - | μF |
| C_{oes} | Output capacitance | | - | 101 | - | |
| C_{res} | Reverse transfer capacitance | | - | 76 | - | |
| Q_g | Total gate charge | $V_{CC} = 520\text{ V}, I_C = 30\text{ A}, V_{GE} = 0\text{ to }15\text{ V}$ (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 | $V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$ (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/ μs | |
| $t_{d(off)}$ | Turn-off-delay time | | $V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$, $T_J = 175\text{ }^\circ\text{C}$ (see Figure 27. Test circuit for inductive load switching) | - | 146 | - | ns |
| t_f | Current fall time | | | - | 23 | - | |
| $E_{on}^{(1)}$ | Turn-on switching energy | | | - | 383 | - | μJ |
| $E_{off}^{(2)}$ | Turn-off switching energy | | | - | 293 | - | |
| E_{ts} | Total switching energy | | | - | 676 | - | |
| $t_{d(on)}$ | Turn-on delay time | | | $V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$, $T_J = 175\text{ }^\circ\text{C}$ (see Figure 27. Test circuit for inductive load switching) | - | 35 | - |
| t_r | Current rise time | - | 16.1 | | - | | |
| $(di/dt)_{on}$ | Turn-on current slope | - | 1496 | | - | A/ μs | |
| $t_{d(off)}$ | Turn-off-delay time | $V_{CE} = 400\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$, $T_J = 175\text{ }^\circ\text{C}$ (see Figure 27. Test circuit for inductive load switching) | - | | 158 | - | ns |
| t_f | Current fall time | | - | | 65 | - | |
| $E_{on}^{(1)}$ | Turn-on switching energy | | - | | 794 | - | μJ |
| $E_{off}^{(2)}$ | 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 | $I_F = 30\text{ A}$, $V_R = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $di/dt = 1000\text{ A}/\mu\text{s}$ (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/ μs |
| E_{rr} | Reverse recovery energy | | - | 104 | - | μJ |
| t_{rr} | Reverse recovery time | $I_F = 30\text{ A}$, $V_R = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $di/dt = 1000\text{ A}/\mu\text{s}$, $T_J = 175\text{ }^\circ\text{C}$ (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/ μs |
| E_{rr} | Reverse recovery energy | | - | 407 | - | μJ |

2.1 Electrical characteristics (curves)

Figure 1. Power dissipation vs case temperature

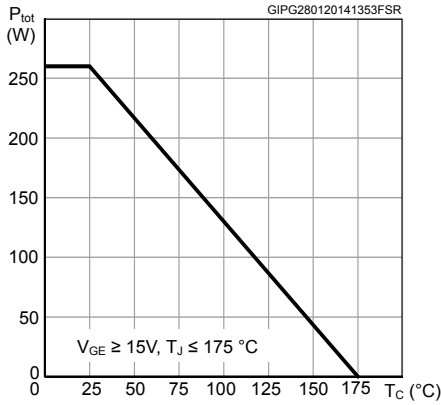


Figure 2. Collector current vs case temperature

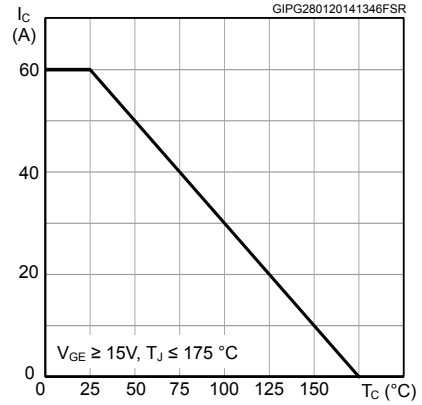


Figure 3. Output characteristics ($T_J = 25^\circ C$)

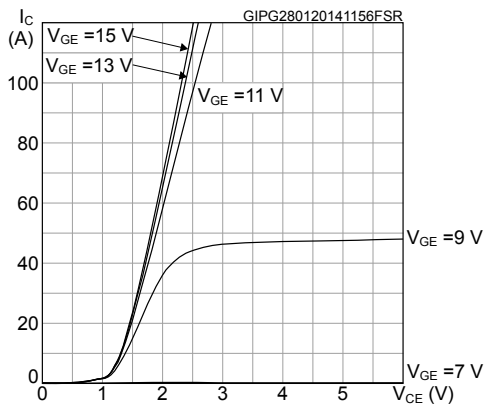


Figure 4. Output characteristics ($T_J = 175^\circ C$)

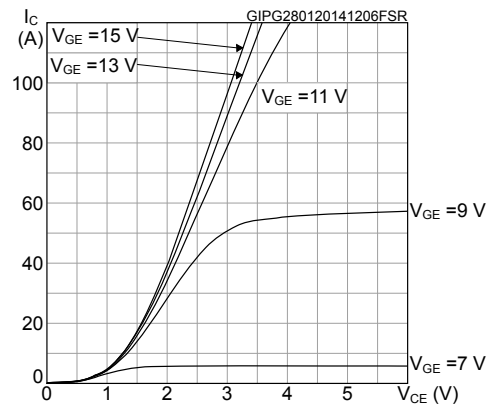


Figure 5. $V_{CE(sat)}$ vs junction temperature

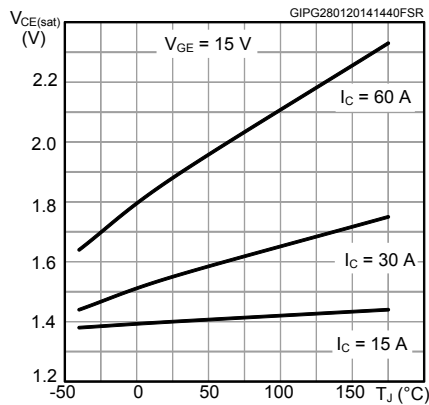


Figure 6. $V_{CE(sat)}$ vs collector current

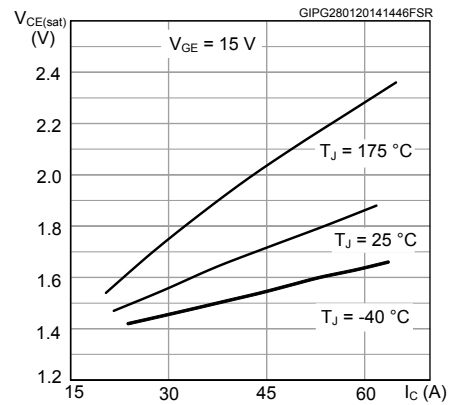


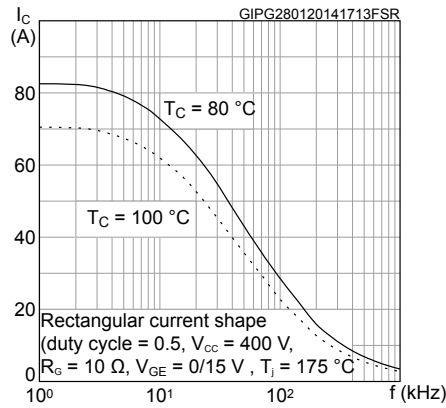
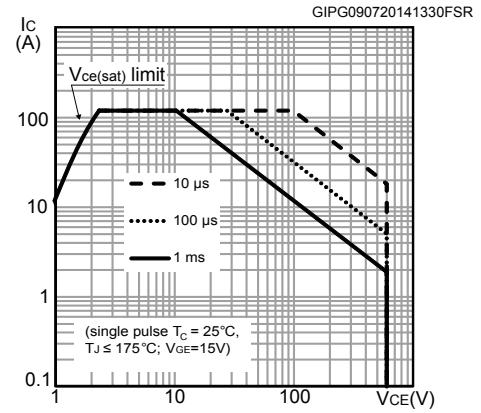
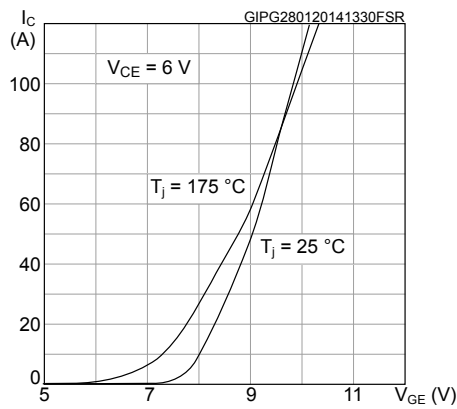
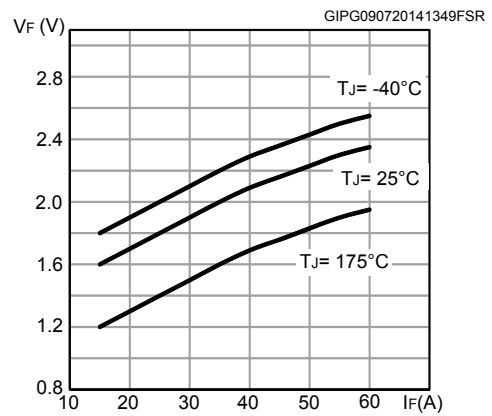
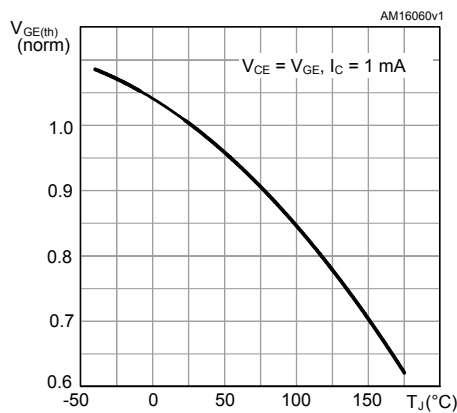
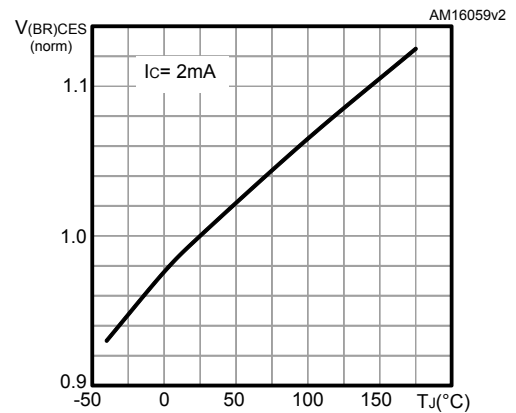
Figure 7. Collector current vs switching frequency

Figure 8. Forward bias safe operating area

Figure 9. Transfer characteristics

Figure 10. Diode V_F vs forward current

Figure 11. Normalized V_{GE(th)} vs junction temperature

Figure 12. Normalized V_{(BR)CES} vs junction temperature


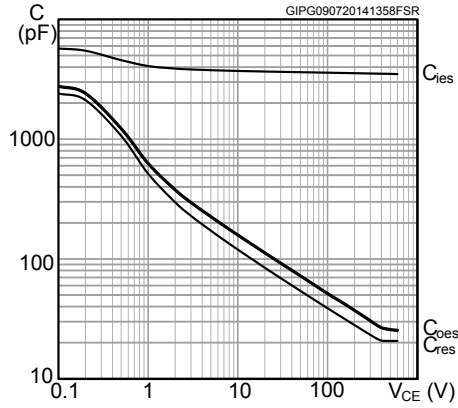
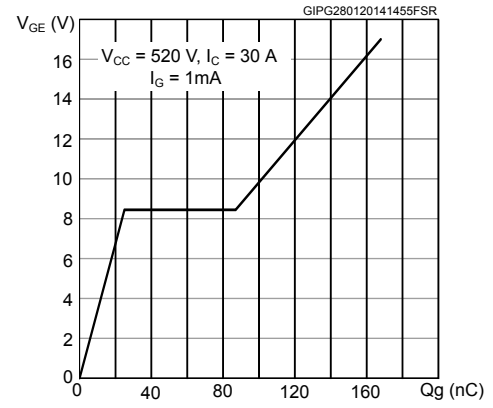
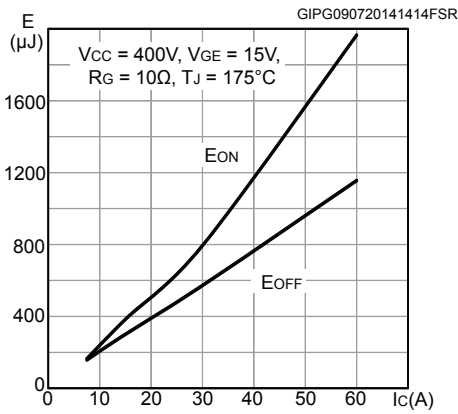
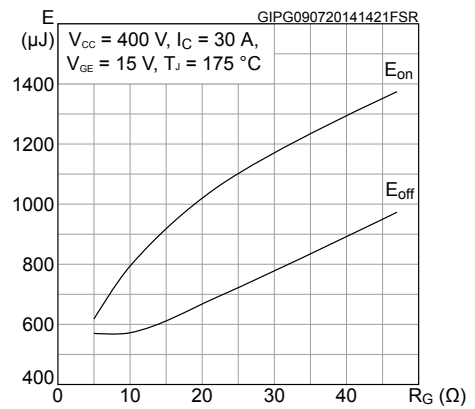
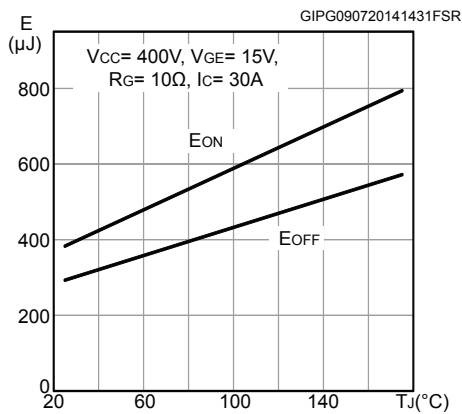
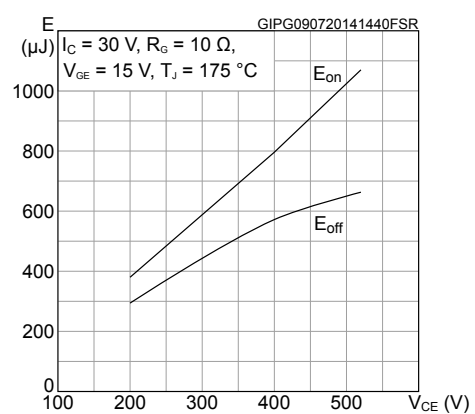
Figure 13. Capacitance variations

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


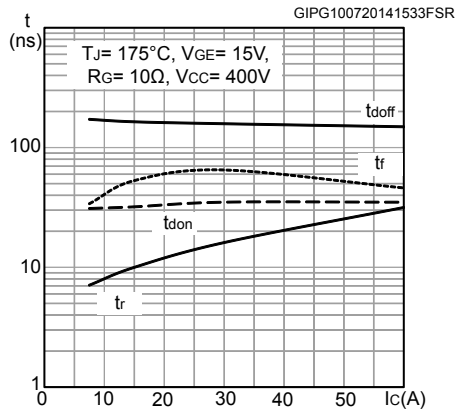
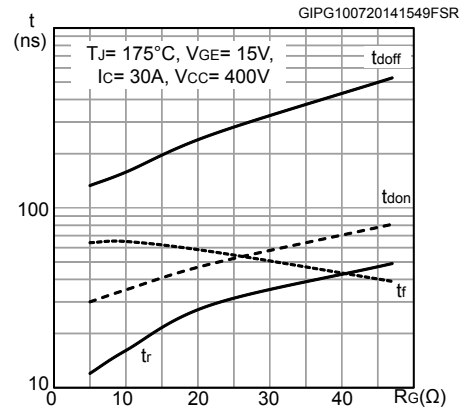
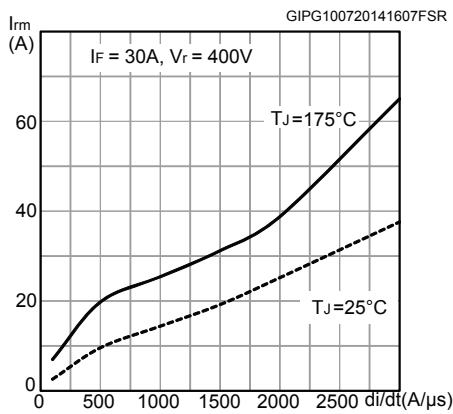
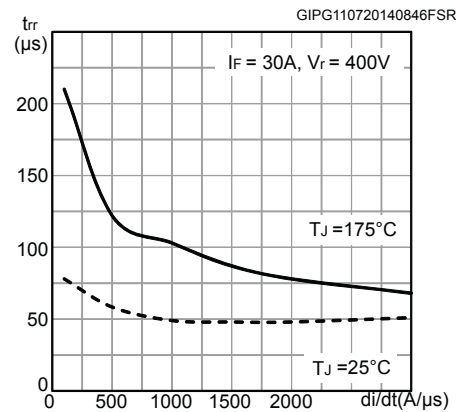
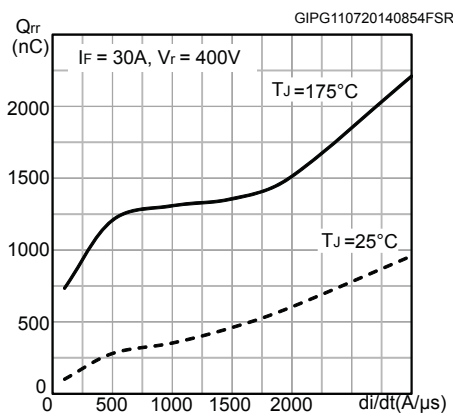
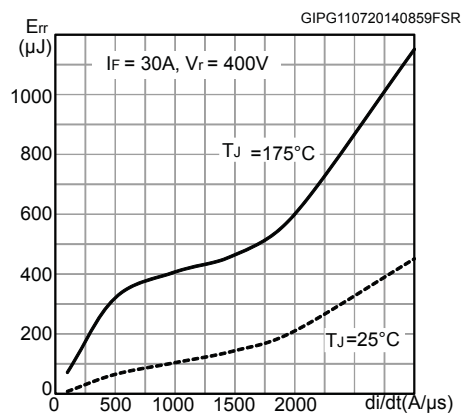
Figure 19. Switching times vs collector current

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

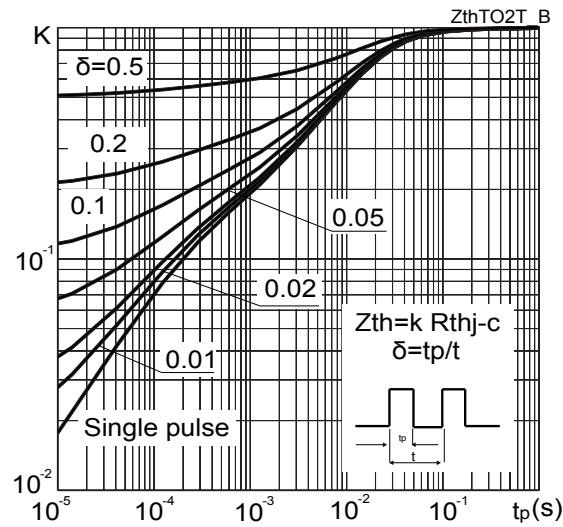
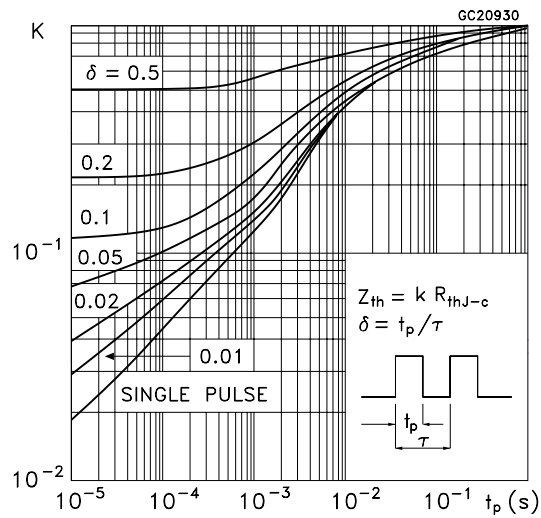
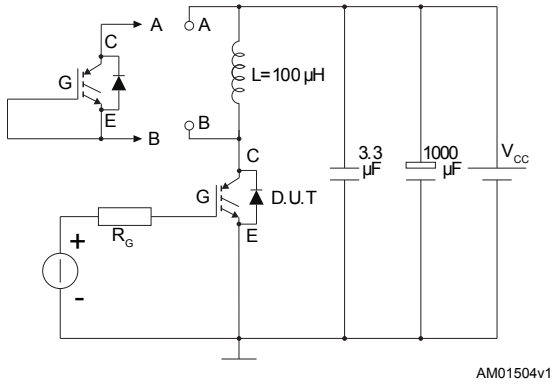
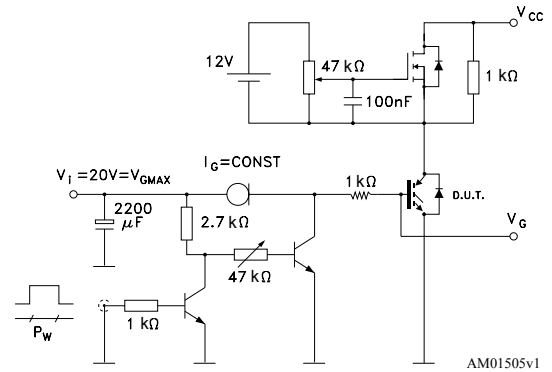
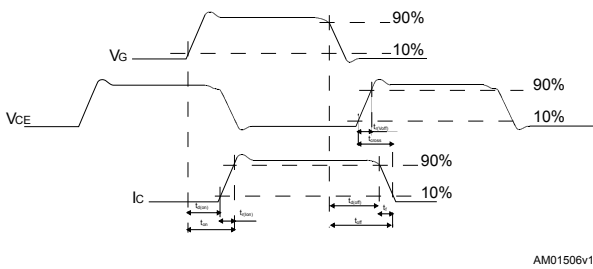
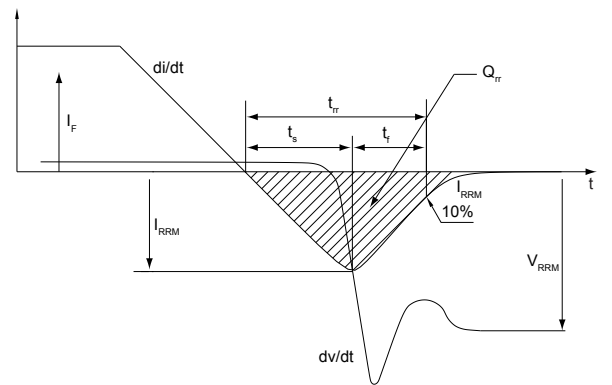


Figure 26. Thermal impedance for diode



3 Test circuits

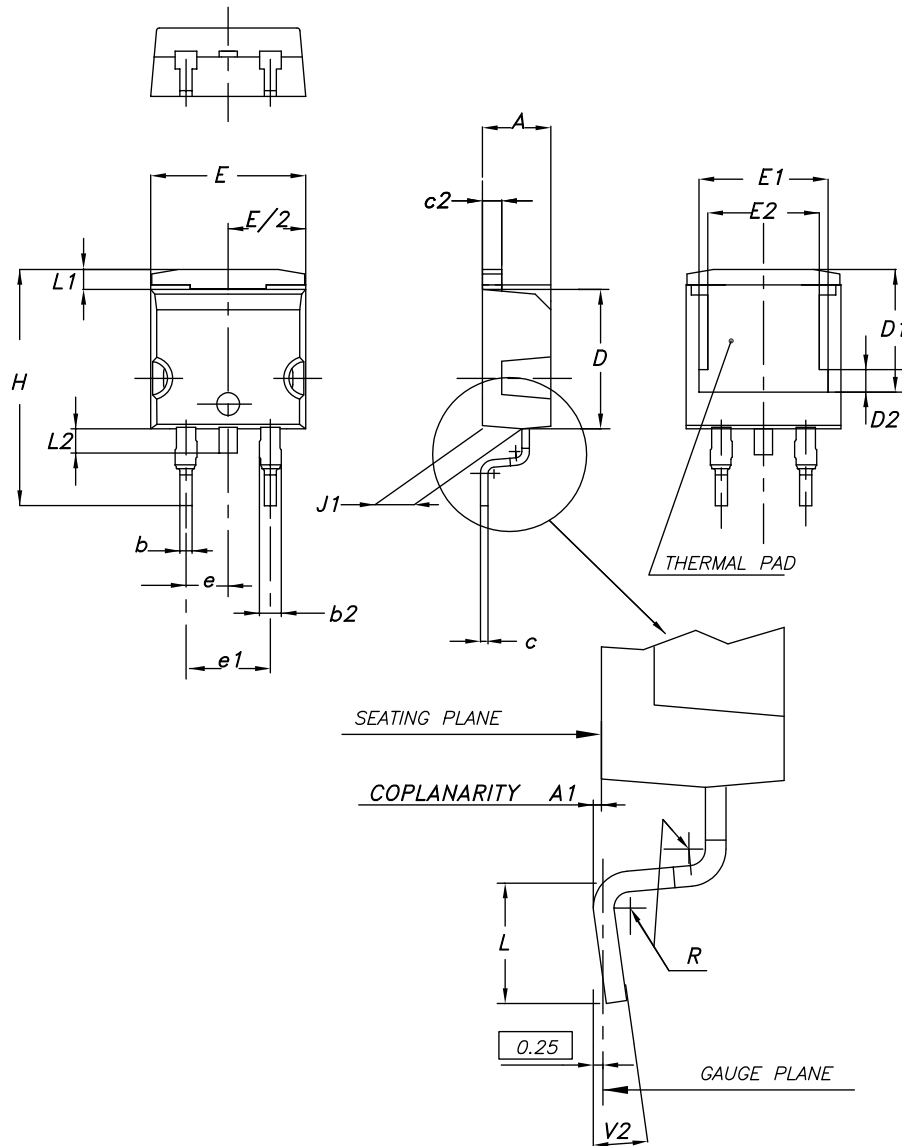
Figure 27. Test circuit for inductive load switching

Figure 28. Gate charge test circuit

Figure 29. Switching waveform

Figure 30. Diode reverse recovery waveform


4 Package information

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.

4.1 D²PAK (TO-263) type A2 package information

Figure 31. D²PAK (TO-263) type A2 package outline

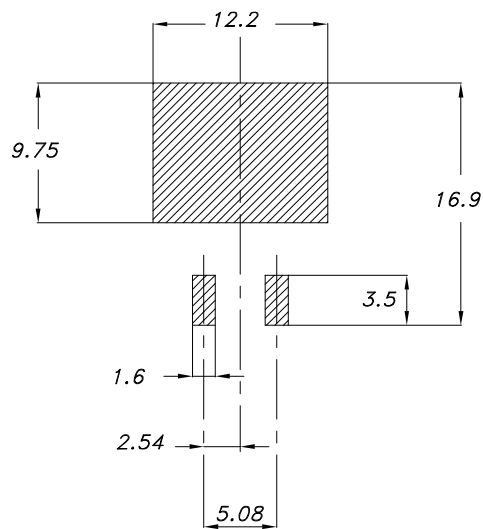


0079457_A2_26

Table 7. D²PAK (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° |

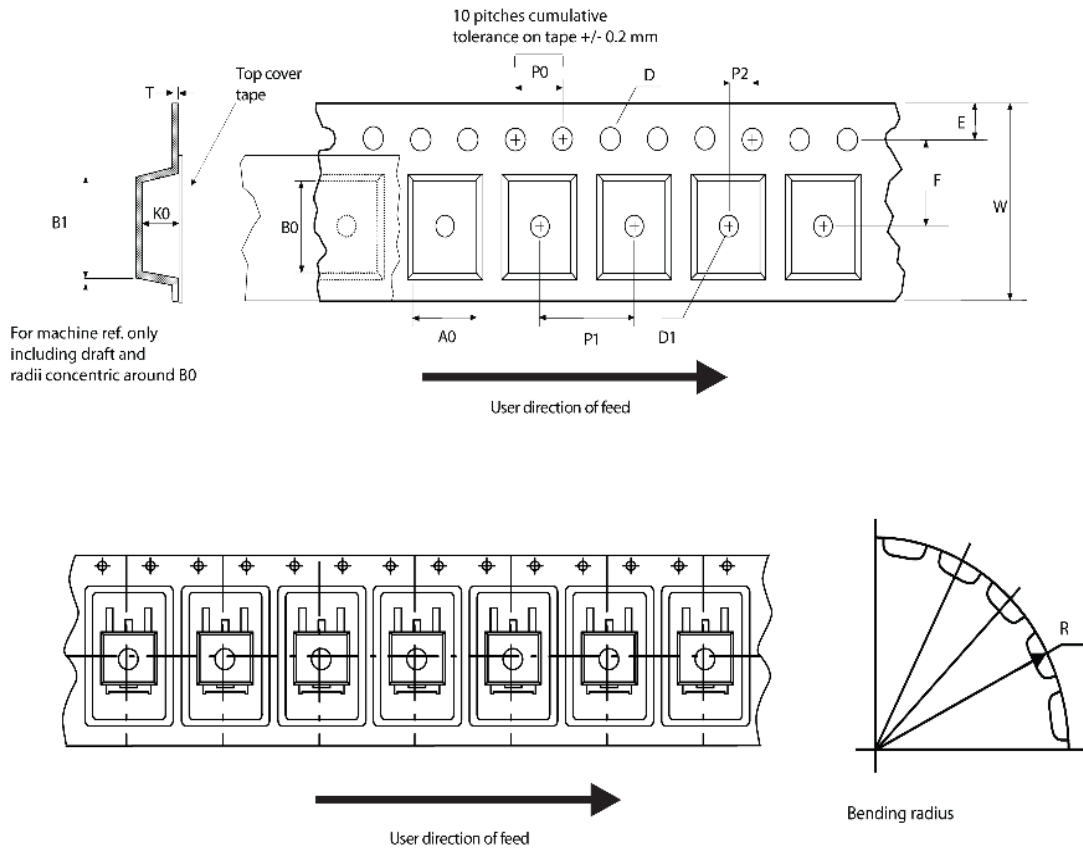
Figure 32. D²PAK (TO-263) recommended footprint (dimensions are in mm)



Footprint

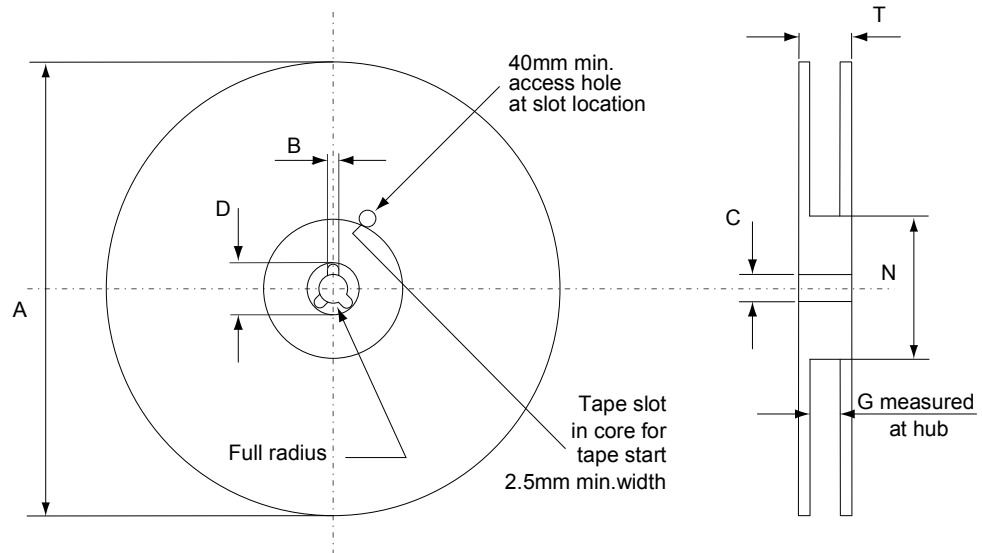
4.2 D²PAK packing information

Figure 33. D²PAK tape outline



AM08852v1

Figure 34. D²PAK reel outline



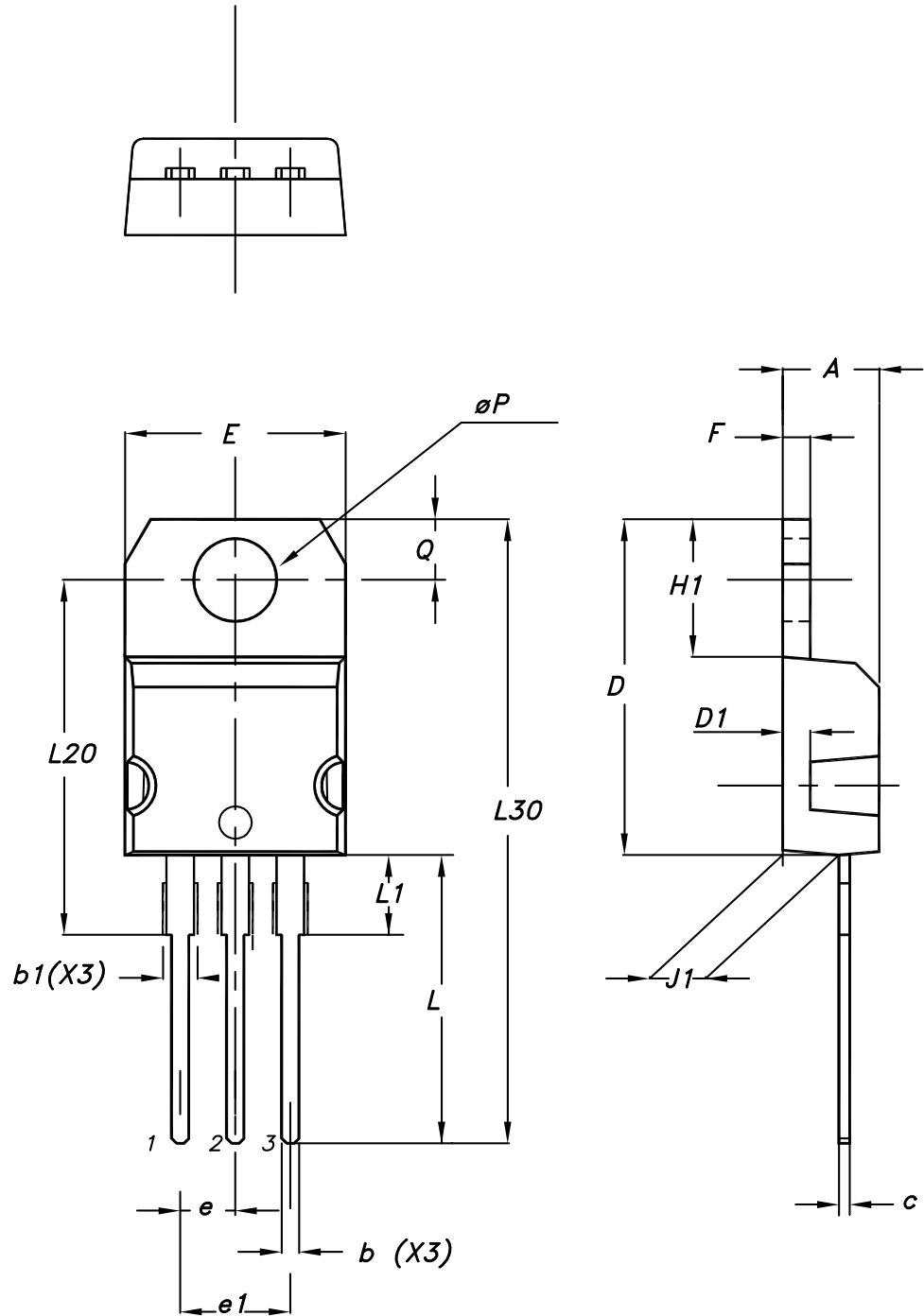
AM06038v1

Table 8. D²PAK tape and reel mechanical data

| Tape | | | Reel | | |
|------|------|------|---------------|------|------|
| Dim. | mm | | Dim. | mm | |
| | Min. | Max. | | Min. | Max. |
| A0 | 10.5 | 10.7 | A | | 330 |
| B0 | 15.7 | 15.9 | B | 1.5 | |
| D | 1.5 | 1.6 | C | 12.8 | 13.2 |
| D1 | 1.59 | 1.61 | D | 20.2 | |
| E | 1.65 | 1.85 | G | 24.4 | 26.4 |
| F | 11.4 | 11.6 | N | 100 | |
| K0 | 4.8 | 5.0 | T | | 30.4 |
| P0 | 3.9 | 4.1 | Base quantity | | |
| P1 | 11.9 | 12.1 | | | |
| P2 | 1.9 | 2.1 | Bulk quantity | | |
| R | 50 | | | | |
| T | 0.25 | 0.35 | | | |
| W | 23.7 | 24.3 | | | |

4.3 TO-220 type A package information

Figure 35. TO-220 type A package outline



0015988_typeA_Rev_22

Table 9. 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 |

5 Ordering information

Table 10. Order codes

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

Revision history

Table 11. 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> . Minor text changes. |
| 23-May-2019 | 3 | Modified <i>Figure 3</i> . Output characteristics ($T_J = 25\text{ }^\circ\text{C}$), <i>Figure 4</i> . Output characteristics ($T_J = 175\text{ }^\circ\text{C}$), <i>Figure 9</i> . Transfer characteristics, <i>Figure 7</i> . Collector current vs switching frequency, <i>Figure 18</i> . Switching energy vs collector emitter voltage. Minor text changes. |

Contents

| | | |
|------------|--|-----------|
| 1 | Electrical ratings | 2 |
| 2 | Electrical characteristics | 3 |
| 2.1 | Electrical characteristics (curves) | 5 |
| 3 | Test circuits | 10 |
| 4 | Package mechanical data | 11 |
| 4.1 | D²PAK (TO-263) type A2 package information | 11 |
| 4.2 | D²PAK packing information | 13 |
| 4.3 | TO-220 type A package information | 15 |
| 5 | Ordering information | 18 |
| | Revision history | 19 |

IMPORTANT NOTICE – PLEASE 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 acknowledgement.

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, please refer to 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.

© 2019 STMicroelectronics – All rights reserved