



# STGW38IH130D, STGWT38IH130D

33 A - 1300 V - very fast IGBT

Datasheet – production data

## Features

- Low saturation voltage
- High current capability
- Low switching loss
- Low static and peak forward voltage drop free-wheeling diode

## Applications

- Induction cooking, microwave ovens
- Soft-switching applications

## Description

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

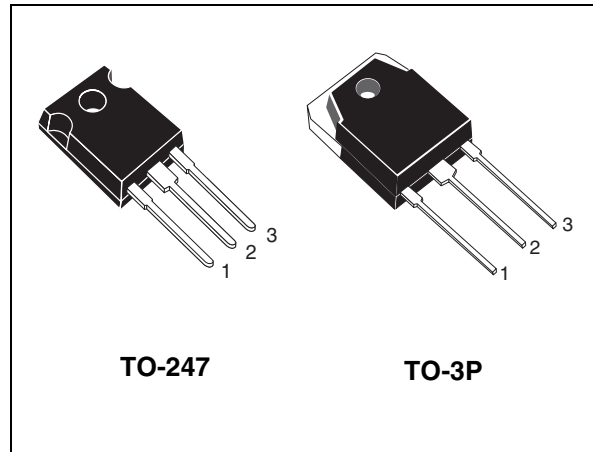


Figure 1. Internal schematic diagram

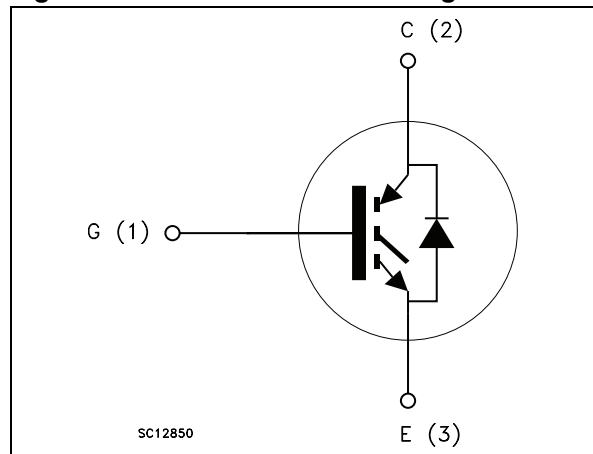


Table 1. Device summary

| Order codes   | Marking    | Package           | Packaging |
|---------------|------------|-------------------|-----------|
| STGW38IH130D  | GW38IH130D | TO-247 long leads | Tube      |
| STGWS38IH130D |            | TO-247            |           |
| STGWT38IH130D |            | TO-3P             |           |

# Contents

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>Electrical ratings</b> .....               | <b>3</b>  |
| <b>2</b> | <b>Electrical characteristics</b> .....       | <b>4</b>  |
|          | 2.1 Electrical characteristics (curves) ..... | 6         |
| <b>3</b> | <b>Test circuits</b> .....                    | <b>9</b>  |
| <b>4</b> | <b>Package mechanical data</b> .....          | <b>10</b> |
| <b>5</b> | <b>Revision history</b> .....                 | <b>16</b> |

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol         | Parameter   | Value                       |        | Unit |
|----------------|---|-----------------------------|--------|------|
|                |   | TO-3P, TO-247<br>long leads | TO-247 |      |
| $V_{CES}$      | Collector-emitter voltage ( $V_{GE} = 0$ )                              | 1300                        |        | V    |
| $I_C^{(1)}$    | Continuous collector current at $T_C = 25\text{ °C}$                    | 63                          | 55     | A    |
| $I_C^{(1)}$    | Continuous collector current at $T_C = 100\text{ °C}$                   | 33                          | 25     | A    |
| $I_{CL}^{(2)}$ | Turn-off latching current   | 40                          |        | A    |
| $I_{CP}^{(3)}$ | Pulsed collector current  | 125                         |        | A    |
| $V_{GE}$       | Gate-emitter voltage  | ±25                         |        | V    |
| $P_{TOT}$      | Total dissipation at $T_C = 25\text{ °C}$                               | 250                         | 180    | W    |
| $I_F$          | Diode RMS forward current at $T_C = 25\text{ °C}$                       | 30                          |        | A    |
| $I_{FSM}$      | Surge non repetitive forward current<br>$t_p = 10\text{ ms}$ sinusoidal | 100                         |        | A    |
| $T_j$          | Operating junction temperature  | -55 to 150                  |        | °C   |

1. Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{j(max)} - T_C}{R_{thj-c} \times V_{CE(sat)(max)}(T_{j(max)}, I_C(T_C))}$$

2.  $V_{clamp} = 960\text{ V}$ ,  $T_j = 150\text{ °C}$ ,  $R_G = 10\text{ }\Omega$ ,  $V_{GE} = 15\text{ V}$

3. Pulse width limited by maximum permissible junction temperature and turn-off within RBSOA

**Table 3. Thermal data**

| Symbol         | Parameter                              | Value                       |        | Unit |
|----------------|--|-----------------------------|--------|------|
|                |  | TO-3P, TO-247<br>long leads | TO-247 |      |
| $R_{thj-case}$ | Thermal resistance junction-case IGBT  | 0.5                         | 0.7    | °C/W |
| $R_{thj-case}$ | Thermal resistance junction-case diode | 2                           | 2.1    | °C/W |
| $R_{thj-amb}$  | Thermal resistance junction-ambient    | 50                          |        | °C/W |

## 2 Electrical characteristics

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

**Table 4. Static**

| Symbol         | Parameter  | Test conditions  | Min. | Typ.       | Max.       | Unit     |
|----------------|--|--|------|------------|------------|----------|
| $V_{(BR)CES}$  | Collector-emitter breakdown voltage ( $V_{GE} = 0$ ) | $I_C = 1\text{ mA}$  | 1300 |            |            | V        |
| $V_{CE(sat)}$  | Collector-emitter saturation voltage                 | $V_{GE} = 15\text{ V}$ , $I_C = 20\text{ A}$<br>$V_{GE} = 15\text{ V}$ , $I_C = 20\text{ A}$ , $T_J = 125\text{ °C}$ |      | 2.1<br>2.0 | 2.8        | V<br>V   |
| $V_{GE(th)}$   | Gate threshold voltage                               | $V_{CE} = V_{GE}$ , $I_C = 1\text{ mA}$  | 3.75 |            | 5.75       | V        |
| $I_{CES}$      | Collector-cut-off current ( $V_{GE} = 0$ )           | $V_{CE} = 1300\text{ V}$<br>$V_{CE} = 1300\text{ V}$ , $T_J = 125\text{ °C}$   |      |            | 1<br>10    | mA<br>mA |
| $I_{GES}$      | Gate-emitter leakage current ( $V_{CE} = 0$ )        | $V_{GE} = \pm 20\text{ V}$   |      |            | $\pm 100$  | nA       |
| $g_{fs}^{(1)}$ | Forward transconductance                             | $V_{CE} = 25\text{ V}$ , $I_C = 20\text{ A}$   |      | 20         |            | S        |
| $V_F$          | Diode forward voltage                                | $I_F = 20\text{ A}$<br>$I_F = 20\text{ A}$ , $T_J = 125\text{ °C}$   |      | 1.3        | 1.9<br>1.7 | V<br>V   |

1. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

**Table 5. Dynamic**

| Symbol    | Parameter                    | Test conditions   | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|------|
| $C_{ies}$ | Input capacitance            | $V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GE} = 0$                | -    | 2900 | -    | pF   |
| $C_{oes}$ | Output capacitance           |   |      | 155  |      | pF   |
| $C_{res}$ | Reverse transfer capacitance |   |      | 30   |      | pF   |
| $Q_g$     | Total gate charge            | $V_{CE} = 960\text{ V}$ ,<br>$I_C = 20\text{ A}$ , $V_{GE} = 15\text{ V}$ | -    | 127  | -    | nC   |
| $Q_{ge}$  | Gate-emitter charge          |   |      | 18   |      | nC   |
| $Q_{gc}$  | Gate-collector charge        |   |      | 50   |      | nC   |

**Table 6. Inductive load switching times**

| Symbol         | Parameter             | Test conditions   | Min. | Typ. | Max. | Unit |
|----------------|-----------------------|---|------|------|------|------|
| $t_r(V_{off})$ | Off voltage rise time | $V_{CC} = 960\text{ V}$ , $I_C = 20\text{ A}$<br>$R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ ,<br>(see Figure 16)                       | -    | 102  | -    | ns   |
| $t_d(off)$     | Turn-off delay time   |   |      | 284  |      | ns   |
| $t_f$          | Current fall time     |   |      | 180  |      | ns   |
| $t_r(V_{off})$ | Off voltage rise time | $V_{CC} = 960\text{ V}$ , $I_C = 20\text{ A}$<br>$R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ ,<br>$T_J = 125\text{ °C}$ (see Figure 16) | -    | 200  | -    | ns   |
| $t_d(off)$     | Turn-off delay time   |   |      | 424  |      | ns   |
| $t_f$          | Current fall time     |   |      | 316  |      | ns   |

**Table 7. Switching energy (inductive load)**

| Symbol                 | Parameter                 | Test conditions   | Min. | Typ. | Max. | Unit |
|------------------------|---------------------------|---|------|------|------|------|
| $E_{\text{off}}^{(1)}$ | Turn-off switching losses | $V_{\text{CC}} = 960 \text{ V}$ , $I_{\text{C}} = 20 \text{ A}$<br>$R_{\text{G}} = 10 \ \Omega$ , $V_{\text{GE}} = 15 \text{ V}$ ,<br>(see Figure 16)   | -    | 3.4  | -    | mJ   |
| $E_{\text{off}}^{(1)}$ | Turn-off switching losses | $V_{\text{CC}} = 960 \text{ V}$ , $I_{\text{C}} = 20 \text{ A}$<br>$R_{\text{G}} = 10 \ \Omega$ , $V_{\text{GE}} = 15 \text{ V}$ ,<br>$T_{\text{J}} = 125 \text{ }^{\circ}\text{C}$ (see Figure 16) | -    | 6.4  | -    | mJ   |

1. Turn-off losses include also the tail of the collector current

## 2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

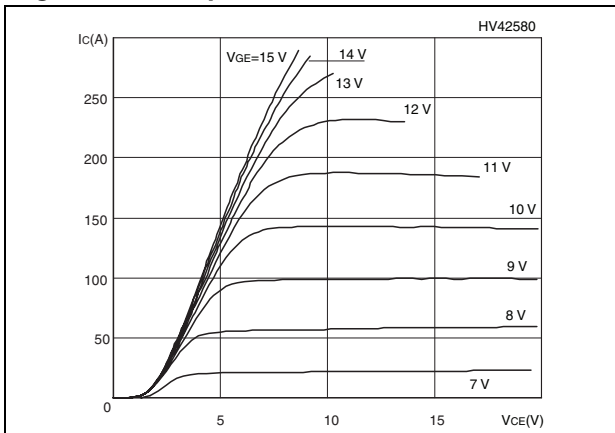


Figure 3. Transfer characteristics

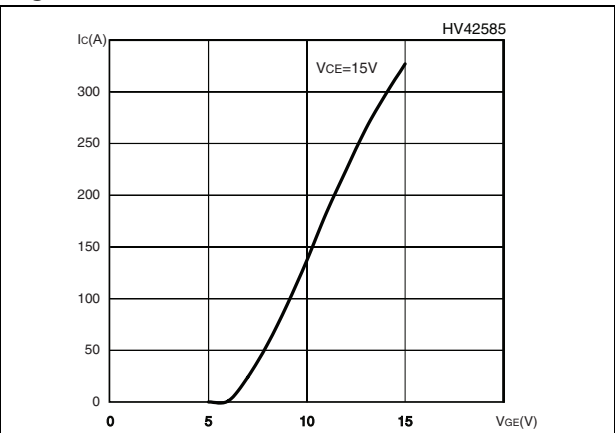


Figure 4. Transconductance

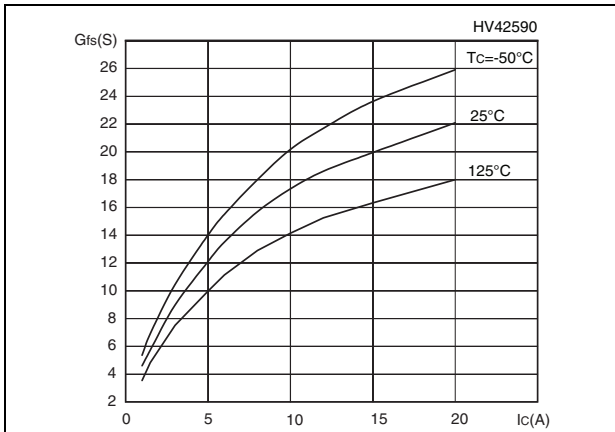


Figure 5. Collector-emitter on voltage vs. temperature

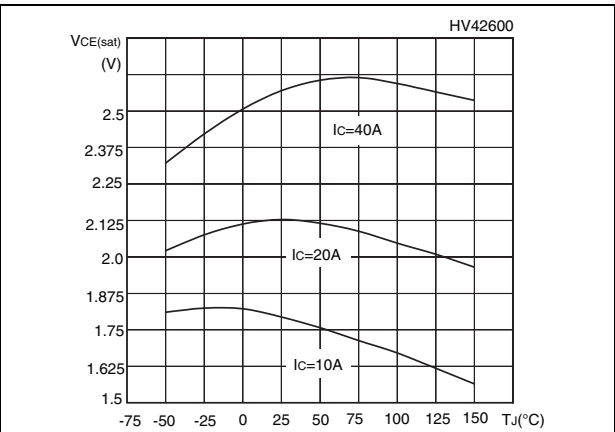


Figure 6. Normalized breakdown voltage vs. temperature

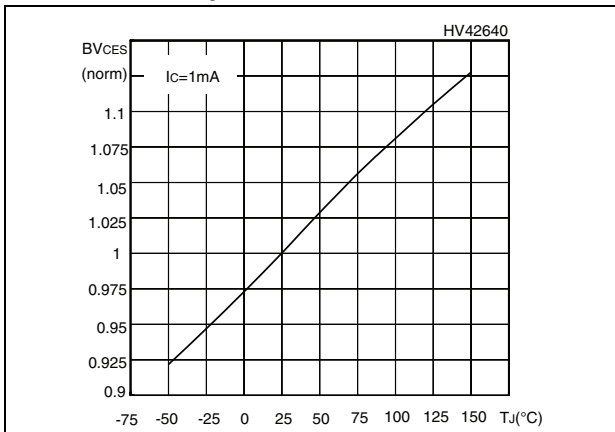


Figure 7. Gate-charge vs. gate-emitter

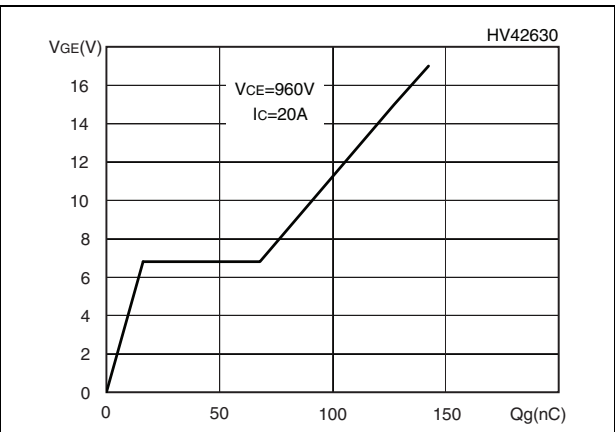


Figure 8. Normalized gate threshold voltage vs. temperature

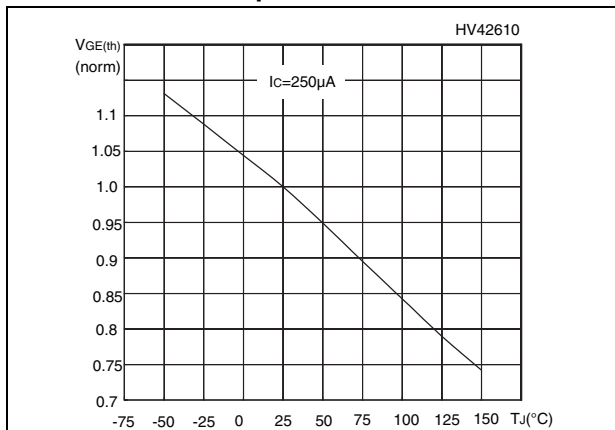


Figure 9. Collector-emitter on voltage vs. collector current

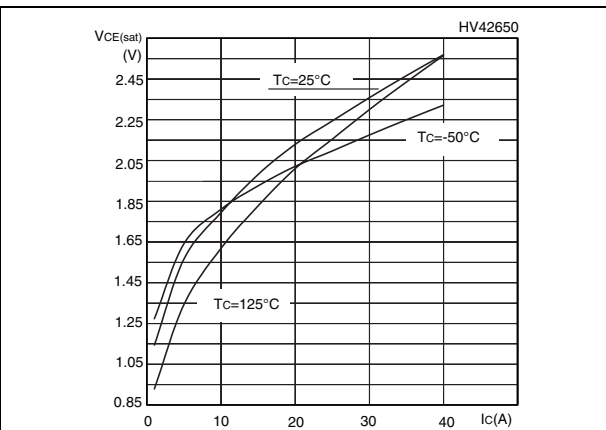


Figure 10. Switching losses vs. temperature

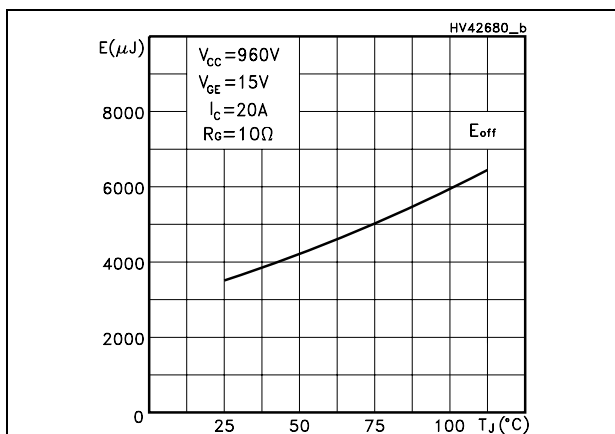


Figure 11. Switching losses vs. gate resistance

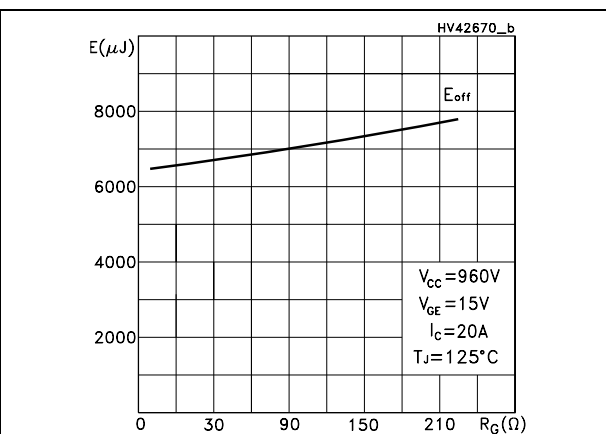


Figure 12. Switching losses vs. collector current

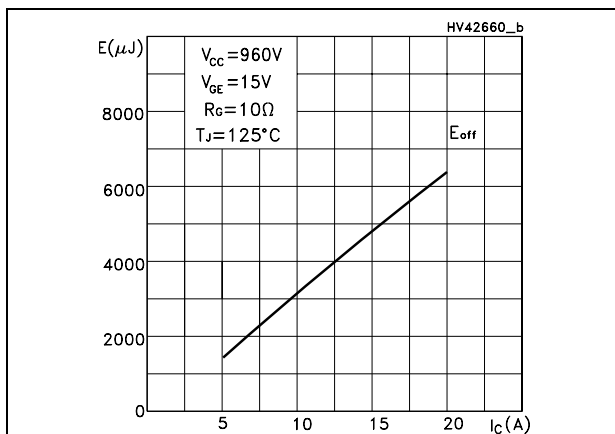


Figure 13. RBSOA

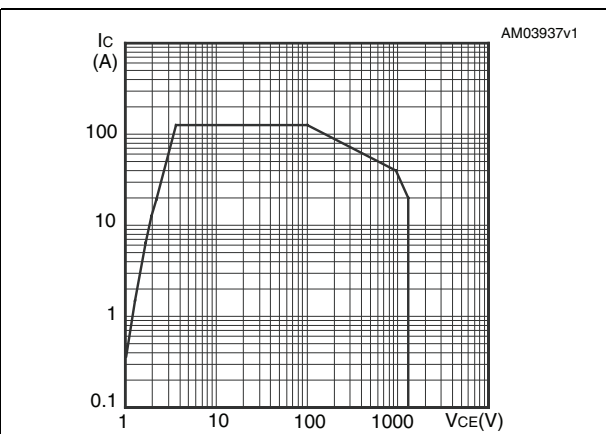


Figure 14. Emitter-collector diode characteristics

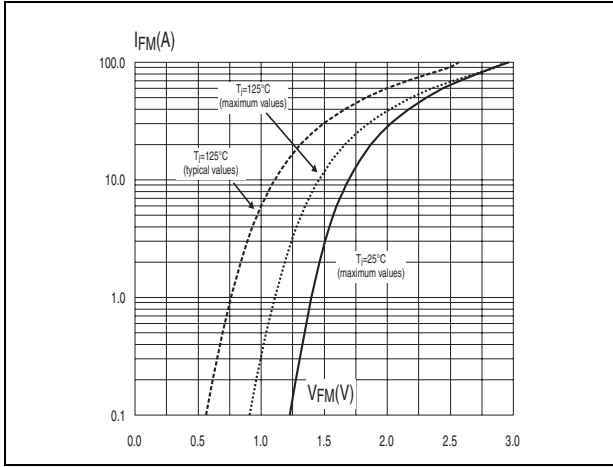
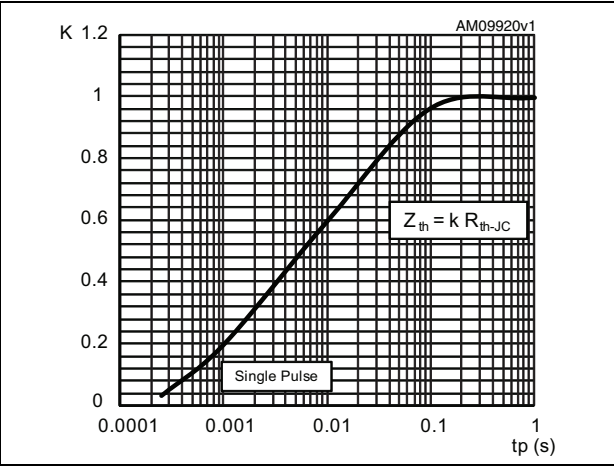


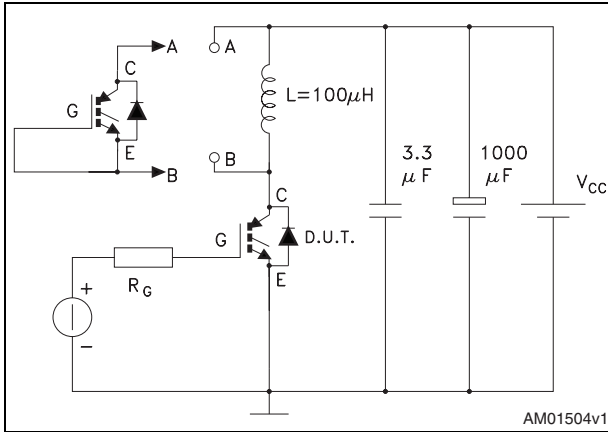
Figure 15. Thermal impedance



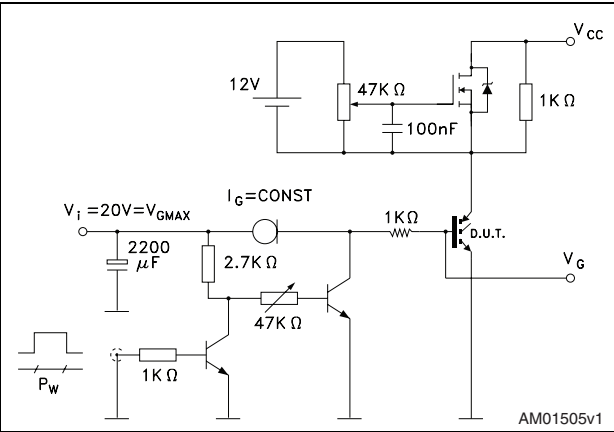


### 3 Test circuits

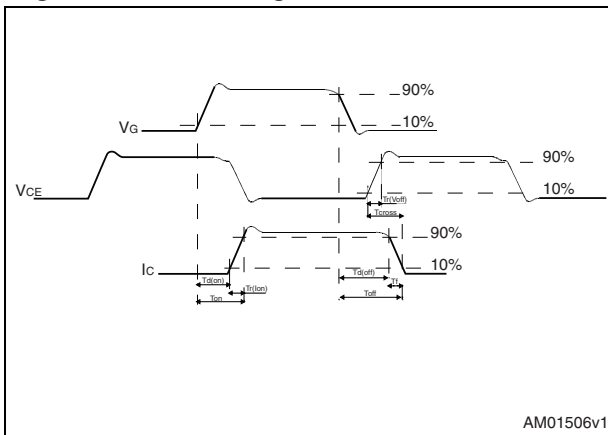
**Figure 16. Test circuit for inductive load switching**



**Figure 17. Gate charge test circuit**



**Figure 18. Switching waveform**



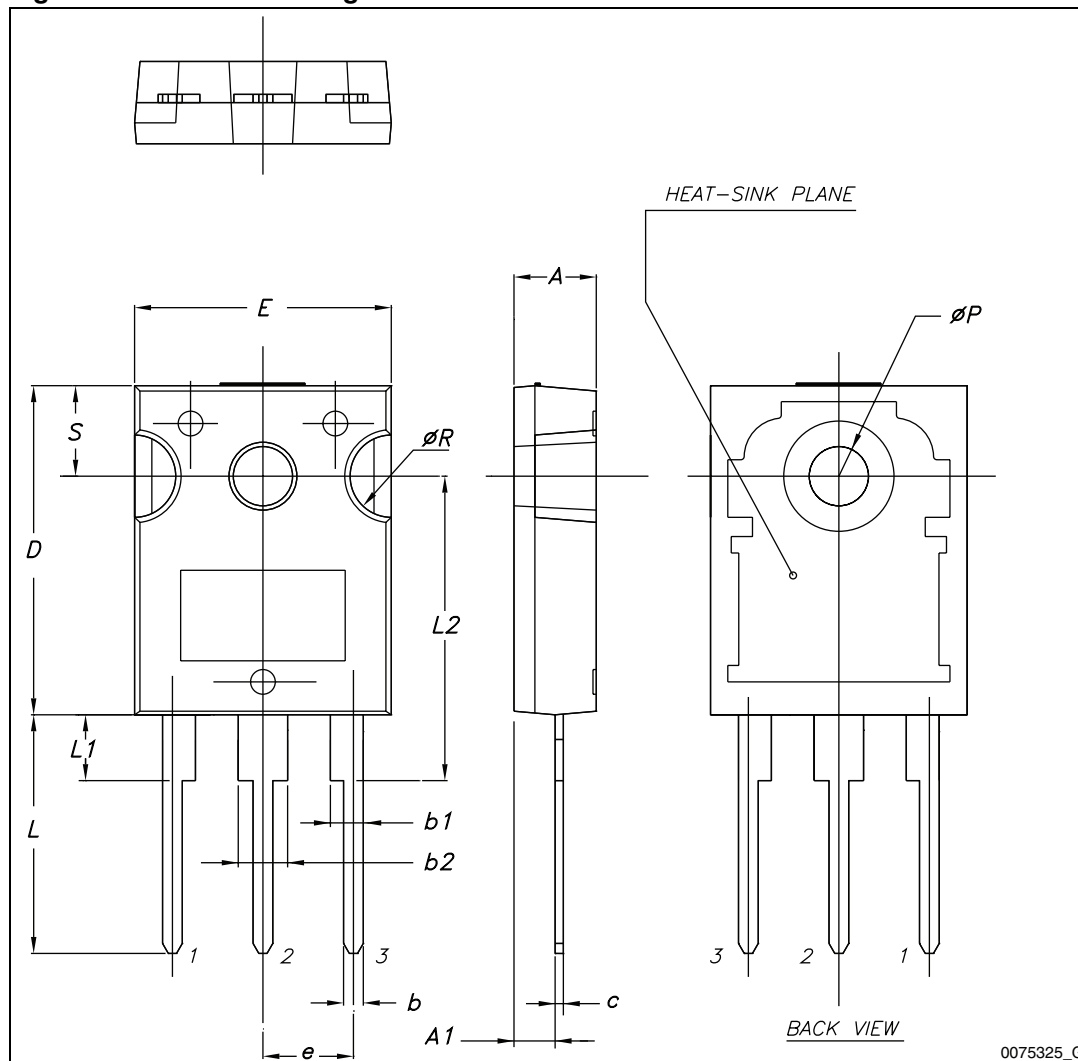
## 4 Package mechanical data

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

**Table 8. TO-247 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  |

Figure 19. TO-247 drawing



0075325\_G

Table 9. TO-247 long leads mechanical data

| Dim. | mm        |      |       |
|------|-----------|------|-------|
|      | Min.      | Typ. | Max.  |
| A    | 4.90      |      | 5.15  |
| D    | 1.85      |      | 2.10  |
| E    | 0.55      |      | 0.67  |
| F    | 1.07      |      | 1.32  |
| F1   | 1.90      |      | 2.38  |
| F2   | 2.87      |      | 3.38  |
| G    | 10.90 BSC |      |       |
| H    | 15.77     |      | 16.02 |
| L    | 20.82     |      | 21.07 |
| L1   | 4.16      |      | 4.47  |
| L2   | 5.49      |      | 5.74  |
| L3   | 20.05     |      | 20.30 |
| L4   | 3.68      |      | 3.93  |
| L5   | 6.04      |      | 6.29  |
| M    | 2.27      |      | 2.52  |
| V    |           | 10°  |       |
| V1   |           | 3°   |       |
| V3   |           | 20°  |       |
| Dia. | 3.55      |      | 3.66  |

Figure 20. TO-247 long leads drawing

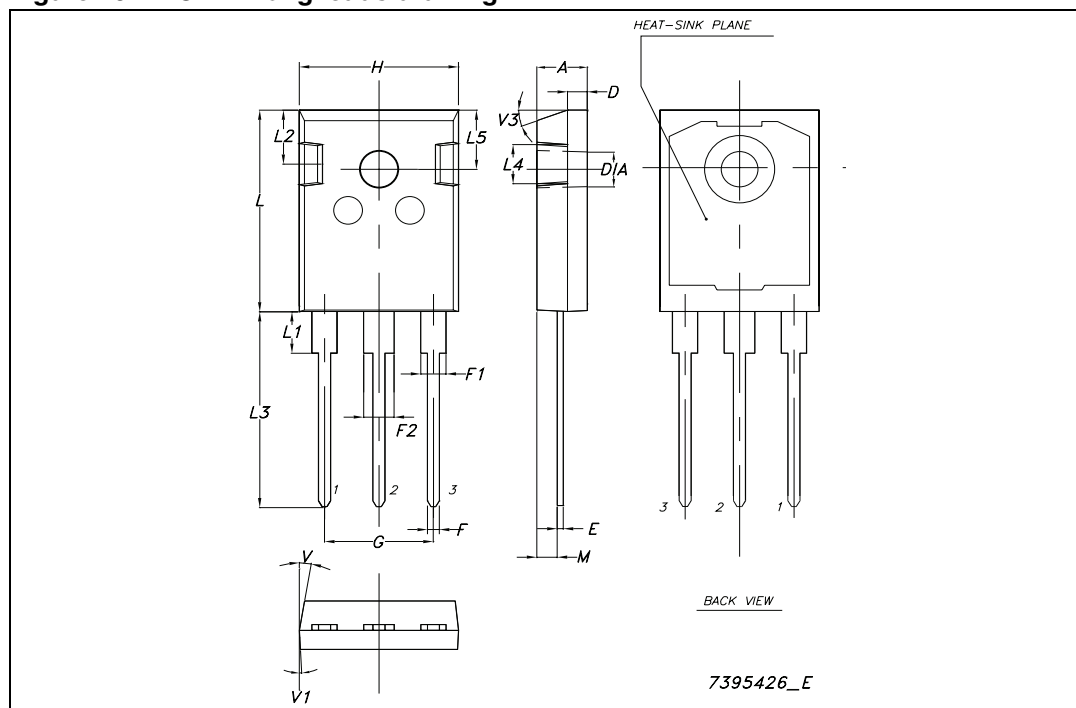
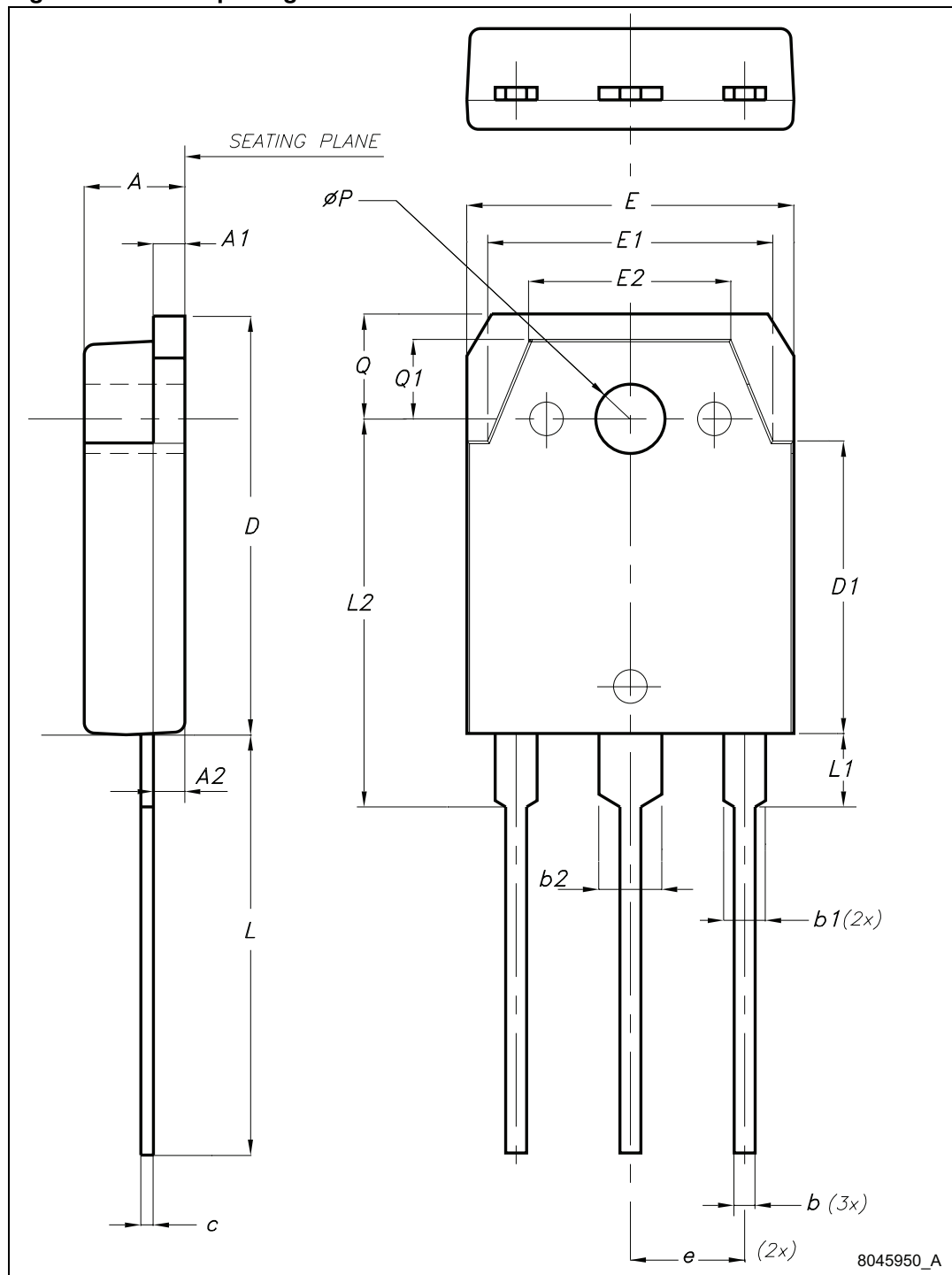


Table 10. TO-3P mechanical data

| Dim. | mm    |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 4.60  |       | 5     |
| A1   | 1.45  | 1.50  | 1.65  |
| A2   | 1.20  | 1.40  | 1.60  |
| b    | 0.80  | 1     | 1.20  |
| b1   | 1.80  |       | 2.20  |
| b2   | 2.80  |       | 3.20  |
| c    | 0.55  | 0.60  | 0.75  |
| D    | 19.70 | 19.90 | 20.10 |
| D1   |       | 13.90 |       |
| E    | 15.40 |       | 15.80 |
| E1   |       | 13.60 |       |
| E2   |       | 9.60  |       |
| e    | 5.15  | 5.45  | 5.75  |
| L    | 19.50 | 20    | 20.50 |
| L1   |       | 3.50  |       |
| L2   | 18.20 | 18.40 | 18.60 |
| øP   | 3.10  |       | 3.30  |
| Q    |       | 5     |       |
| Q1   |       | 3.80  |       |

Figure 21. TO-3P package dimensions



## 5 Revision history

**Table 11. Document revision history**

| Date        | Revision | Changes   |
|-------------|----------|---|
| 11-May-2009 | 1        | Initial release   |
| 16-Jul-2009 | 2        | Document status promoted from preliminary data to datasheet   |
| 05-Jul-2011 | 3        | Added: <a href="#">Figure 15 on page 8</a> and new package mechanical data <a href="#">Table 10 on page 14</a> , <a href="#">Figure 21 on page 15</a> . |
| 04-Sep-2012 | 4        | Updated: <a href="#">Table 1 on page 1</a> , TO-247 mechanical data <a href="#">Table 8 on page 10</a> and <a href="#">Figure 19 on page 11</a> .       |



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[IDW40E65D2](#) [NGTB50N60L2WG](#) [STGB10H60DF](#) [STGB20V60F](#) [STGB40V60F](#) [STGFW80V60F](#) [IGW40N120H3FKSA1](#)  
[RJH60D7BDPQ-E0#T2](#) [APT40GR120B](#)