



# STC03DE170HP

Hybrid emitter switched bipolar transistor

ESBT<sup>®</sup> 1700V - 3A - 0.55 Ω

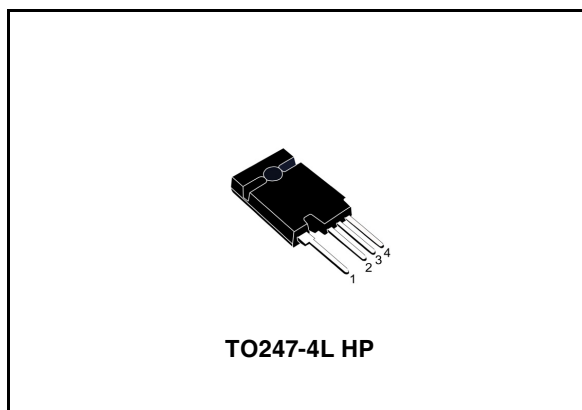
Preliminary Data

## General features

Table 1. General features

| $V_{CS(ON)}$ | $I_C$ | $R_{CS(ON)}$ |
|--------------|-------|--------------|
| 1V           | 1.8A  | 0.55Ω        |

- Low equivalent on resistance
- Very fast-switch, up to 150 kHz
- Squared RBSOA, up to 1700 V
- Very low  $C_{ISS}$  driven by  $R_G = 47 \Omega$
- In compliance with the 2002/93/EC European Directive



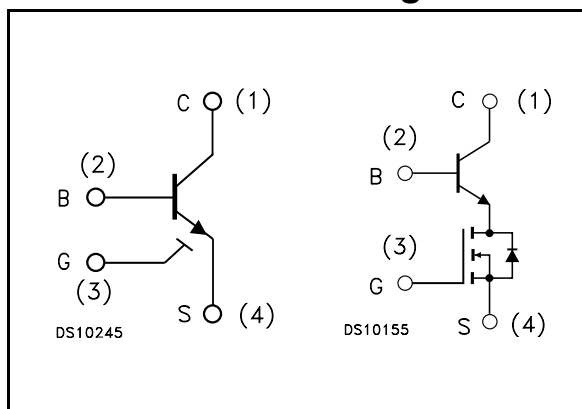
## Description

The STC03DE170HP is manufactured in a hybrid structure, using dedicated high voltage Bipolar and low voltage MOSFET technologies, aimed to providing the best performance in ESBT topology. The STC03DE170HP is designed for use in aux flyback smps for any three phase application.

## Applications

- Aux SMPS for three phase mains

## Internal schematic diagrams



## Order codes

| Part Number  | Marking    | Package     | Packing |
|--------------|------------|-------------|---------|
| STC03DE170HP | C03DE170HP | TO247-4L HP | Tube    |

## Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol       | Parameter   | Value      | Unit       |
|--------------|---|------------|------------|
| $V_{CS(SS)}$ | Collector-source voltage ( $V_{BS} = V_{GS} = 0V$ ) | 1700       | V          |
| $V_{BS(OS)}$ | Base-source voltage ( $I_C = 0, V_{GS} = 0V$ )      | 30         | V          |
| $V_{SB(OS)}$ | Source-base voltage ( $I_C = 0, V_{GS} = 0V$ )      | 9          | V          |
| $V_{GS}$     | Gate-source voltage                                 | $\pm 20$   | V          |
| $I_C$        | Collector current                                   | 3          | A          |
| $I_{CM}$     | Collector peak current ( $t_P < 5ms$ )              | 6          | A          |
| $I_B$        | Base current  | 2          | A          |
| $I_{BM}$     | Base peak current ( $t_P < 1ms$ )                   | 4          | A          |
| $P_{tot}$    | Total dissipation at $T_C \leq 25^\circ C$          | 35.7       | W          |
| $T_{stg}$    | Storage temperature                                 | -40 to 150 | $^\circ C$ |
| $T_J$        | Max. operating junction temperature                 | 125        | $^\circ C$ |

**Table 3. Thermal data**

| Symbol         | Parameter                               | Value | Unit         |
|----------------|---|-------|--------------|
| $R_{thj-case}$ | Thermal resistance junction-case<br>max | 2.8   | $^\circ C/W$ |

## 2 Electrical characteristics

( $T_{\text{case}} = 25^{\circ}\text{C}$  unless otherwise specified)

**Table 4. Electrical characteristics**

| Symbol                           | Parameter   | Test Conditions  | Min.     | Typ.      | Max.       | Unit          |
|----------------------------------|---|--|----------|-----------|------------|---------------|
| $I_{\text{CS(SS)}}$              | Collector-source current<br>( $V_{\text{BS}} = V_{\text{GS}} = 0\text{V}$ ) | $V_{\text{CS(SS)}} = 1700\text{V}$   |          |           | 100        | $\mu\text{A}$ |
| $I_{\text{BS(OS)}}$              | Base-source current<br>( $I_{\text{C}} = 0, V_{\text{GS}} = 0\text{V}$ )    | $V_{\text{BS(OS)}} = 30\text{V}$   |          |           | 10         | $\mu\text{A}$ |
| $I_{\text{SB(OS)}}$              | Source-base current<br>( $I_{\text{C}} = 0, V_{\text{GS}} = 0\text{V}$ )    | $V_{\text{SB(OS)}} = 9\text{V}$  |          |           | 100        | $\mu\text{A}$ |
| $I_{\text{GS(OS)}}$              | Gate-source leakage<br>( $V_{\text{BS}} = 0\text{V}$ )                      | $V_{\text{GS}} = \pm 20\text{V}$   |          |           | 500        | nA            |
| $V_{\text{CS(ON)}}$              | Collector-source ON<br>voltage  | $V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 1.8\text{A}$ $I_{\text{B}} = 0.36\text{A}$<br>$V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 0.7\text{A}$ $I_{\text{B}} = 70\text{mA}$  |          | 1<br>1    | 1.5<br>1.3 | V<br>V        |
| $h_{\text{FE}}$                  | DC current gain   | $V_{\text{CS}} = 1\text{V}$ $V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 1.8\text{A}$<br>$V_{\text{CS}} = 1\text{V}$ $V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 0.7\text{A}$   | 3.5<br>6 | 5<br>10   |            |               |
| $V_{\text{BS(ON)}}$              | Base-source ON<br>voltage   | $V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 1.8\text{A}$ $I_{\text{B}} = 0.36\text{A}$<br>$V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 0.7\text{A}$ $I_{\text{B}} = 70\text{mA}$  |          | 1<br>0.8  | 1.2<br>1   | V<br>V        |
| $V_{\text{GS(th)}}$              | Gate threshold voltage  | $V_{\text{BS}} = V_{\text{GS}}$ $I_{\text{B}} = 250\mu\text{A}$  | 1.5      | 2.2       | 3          | V             |
| $C_{\text{iss}}$                 | Input capacitance   | $V_{\text{CS}} = 25\text{V}$ $f = 1\text{MHz}$<br>$V_{\text{GS}} = 0\text{V}$  |          | 750       |            | pF            |
| $Q_{\text{GS(tot)}}$             | Gate-source Charge  | $V_{\text{CS}} = 15\text{V}$ $V_{\text{GS}} = 10\text{V}$<br>$V_{\text{CB}} = 0\text{V}$ $I_{\text{C}} = 1.8\text{A}$  |          | 12.5      |            | nC            |
| $t_{\text{s}}$<br>$t_{\text{f}}$ | INDUCTIVE LOAD<br>Storage time<br>Fall time                                 | $V_{\text{GS}} = 10\text{V}$ $R_{\text{G}} = 47\Omega$<br>$V_{\text{Clamp}} = 1200\text{V}$ $t_{\text{p}} = 4\mu\text{s}$<br>$I_{\text{C}} = 1.8\text{A}$ $I_{\text{B}} = 0.36\text{A}$  |          | 760<br>14 |            | ns<br>ns      |
| $t_{\text{s}}$<br>$t_{\text{f}}$ | INDUCTIVE LOAD<br>Storage time<br>Fall time                                 | $V_{\text{GS}} = 10\text{V}$ $R_{\text{G}} = 47\Omega$<br>$V_{\text{Clamp}} = 1200\text{V}$ $t_{\text{p}} = 4\mu\text{s}$<br>$I_{\text{C}} = 0.7\text{A}$ $I_{\text{B}} = 70\text{mA}$   |          | 690<br>32 |            | ns<br>ns      |
| $V_{\text{CS(dyn)}}$             | Collector-source<br>dynamic voltage<br>(500ns)                              | $V_{\text{CC}} = V_{\text{Clamp}} = 400\text{V}$<br>$V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 0.5\text{A}$<br>$I_{\text{B}} = 0.1\text{A}$ $R_{\text{G}} = 47\Omega$<br>$t_{\text{peak}} = 500\text{ns}$ $I_{\text{Bpeak}} = 1\text{A}$ |          | 3.9       |            | V             |

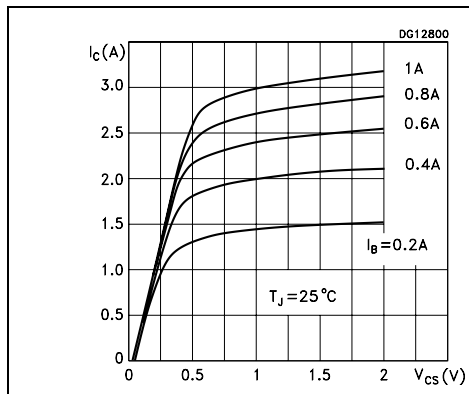
**Table 4. Electrical characteristics**

| Symbol        | Parameter   | Test Conditions  | Min. | Typ. | Max. | Unit |
|---------------|---|--|------|------|------|------|
| $V_{CS(dyn)}$ | Collector-source dynamic voltage (1 $\mu$ s)              | $V_{CC} = V_{Clamp} = 400V$<br>$V_{GS} = 10V$ $I_C = 0.5A$<br>$I_B = 0.1A$ $R_G = 47\Omega$<br>$t_{peak} = 500ns$ $I_{Bpeak} = 1A$ |      | 2.2  |      | V    |
| $V_{CSW}$     | Maximum collector-source voltage switched without snubber | $R_G = 47\Omega$ $h_{FE} = 5$ $I_C = 3A$   | 1700 |      |      | V    |

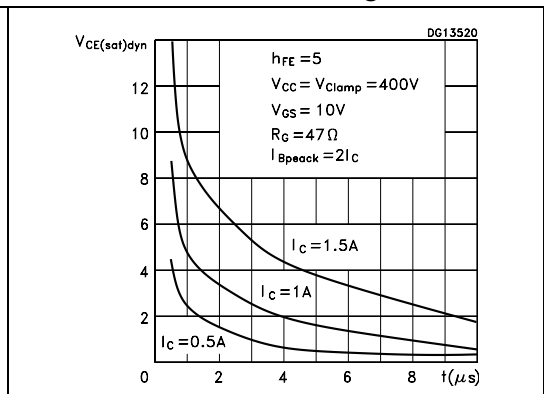
Note (1) Pulsed duration = 300  $\mu$ s, duty cycle  $\leq$  1.5%

## 2.1 Electrical characteristics (curves)

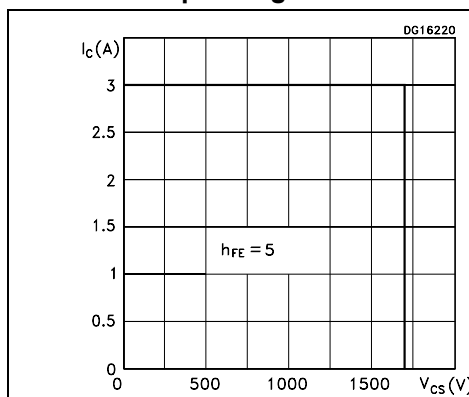
**Figure 1. Output characteristics**



**Figure 2. Dynamic collector-source saturation voltage**



**Figure 3. Reverse biased safe operating area**



**Figure 4. Gate threshold voltage vs temperature**

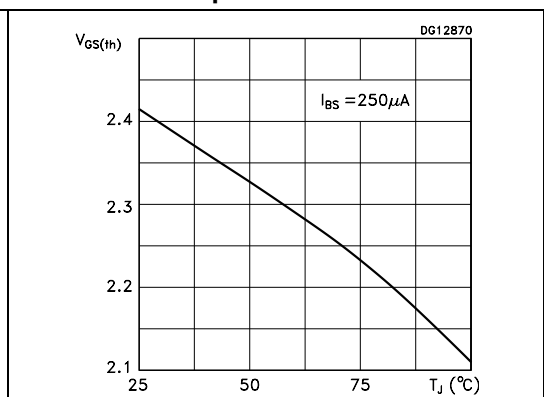


Figure 5. DC current gain

Figure 6. DC current gain

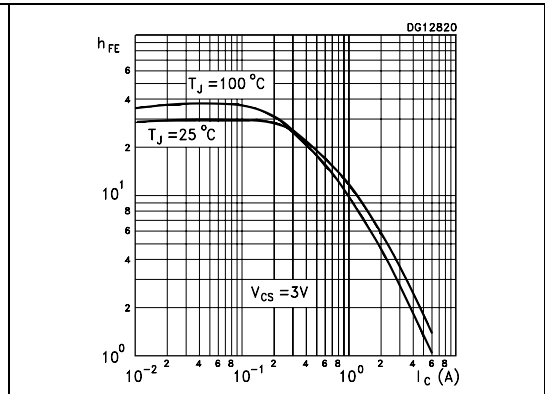
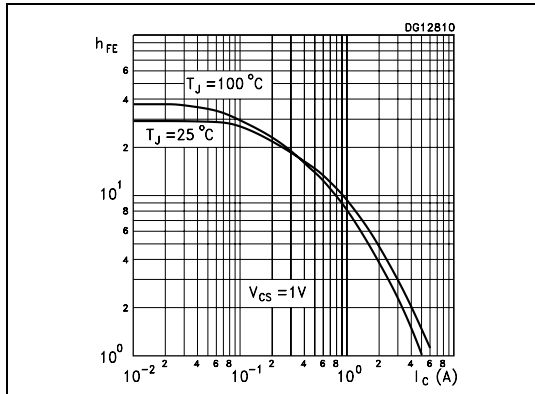


Figure 7. Collector-source On voltage

Figure 8. Collector-source On voltage

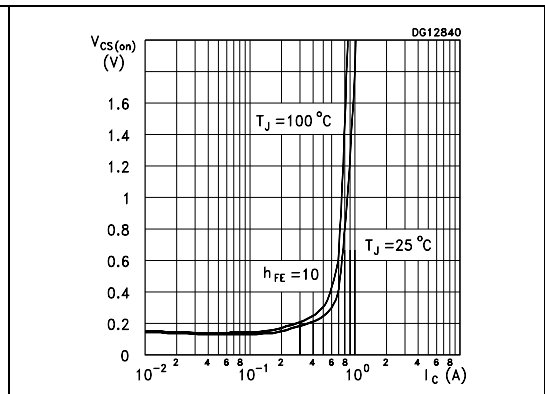
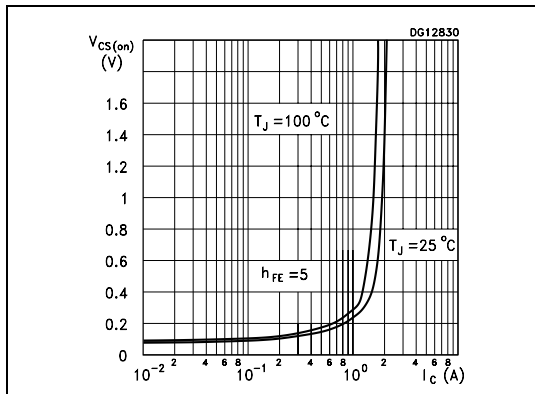


Figure 9. Base-source On voltage

Figure 10. Base-source On voltage

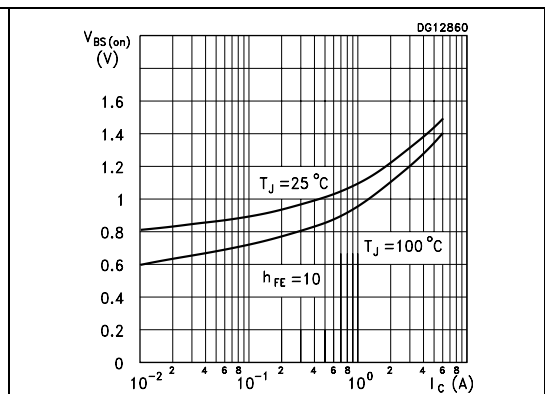
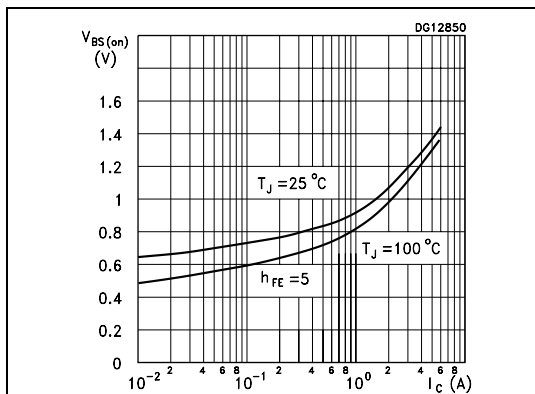


Figure 11. Inductive load switching time

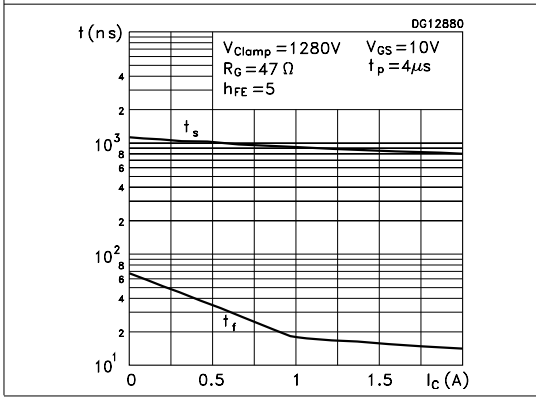
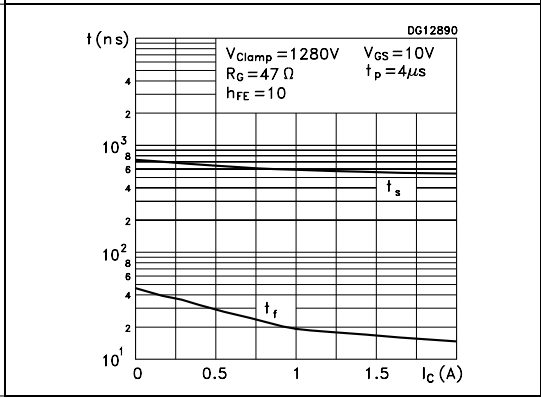


Figure 12. Inductive load switching time



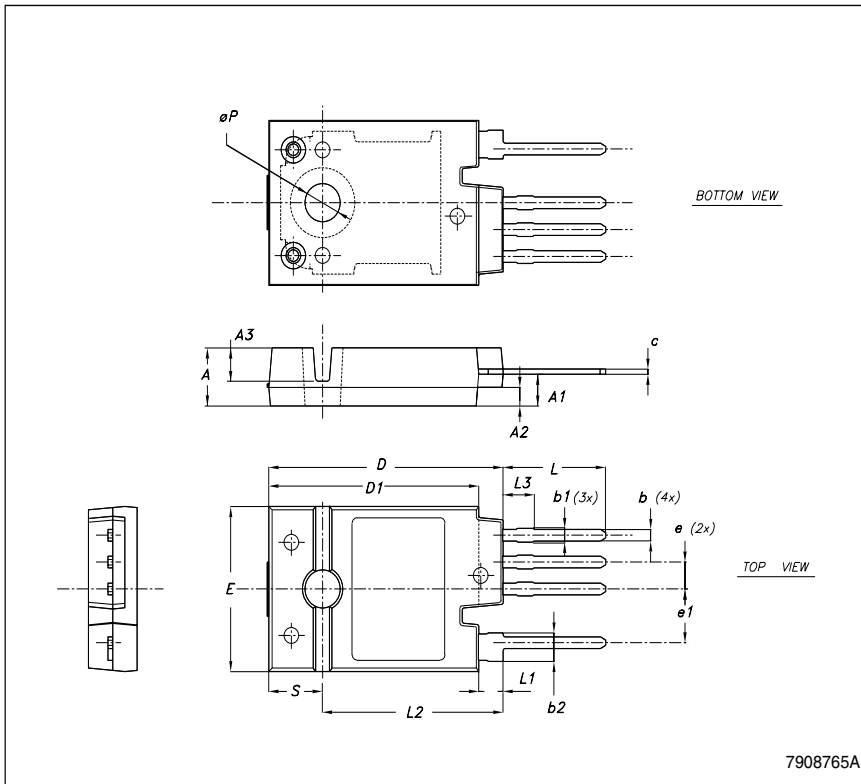
### 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)



**TO247-4LHP MECHANICAL DATA**

| DIM. | mm.   |       |       |
|------|-------|-------|-------|
|      | MIN.  | TYP   | MAX.  |
| A    | 5.50  | 5.65  | 5.80  |
| A1   | 2.85  | 3.15  | 3.25  |
| A2   |       | 1.92  |       |
| A3   |       | 3.18  |       |
| b    | 0.95  | 1.10  | 1.30  |
| b1   | 1.10  |       | 1.50  |
| b2   | 2.50  |       | 2.90  |
| c    | 0.40  |       | 0.80  |
| D    | 23.85 | 24    | 24.15 |
| D1   |       | 21.50 |       |
| E    | 15.45 | 15.60 | 15.75 |
| e    | 2.54  |       |       |
| e1   |       | 5.08  |       |
| L    | 10.20 |       | 10.80 |
| L1   | 2.20  | 2.50  | 2.80  |
| L2   |       | 18.50 |       |
| L3   |       | 3     |       |
| øP   | 3.55  |       | 3.65  |
| S    |       | 5.50  |       |



## 4 Revision history

Table 5. Revision history

| Date        | Revision | Changes        |
|-------------|----------|----------------|
| 26-Sep-2006 | 1        | First release. |

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