



STC03DE170HP

Hybrid emitter switched bipolar transistor

ESBT[®] 1700V - 3A - 0.33 Ω

Features

| $V_{CS(ON)}$ | I_C | $R_{CS(ON)}$ |
|--------------|-------|--------------|
| 1 V | 3 A | 0.33 Ω |

- Low equivalent on resistance
- Very fast-switch, up to 150 kHz
- Squared RBSOA, up to 1700V
- Very low C_{ISS} driven by $R_G = 47 \Omega$

Applications

- Aux SMPS for three phase mains

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

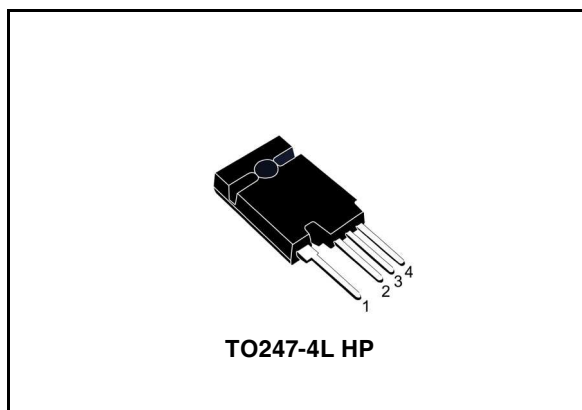


Figure 1. Internal schematic diagrams

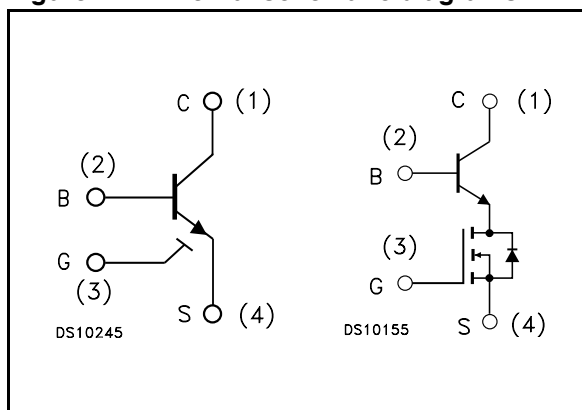


Table 1. Device summary

| Order code | Marking | Package | Packaging |
|--------------|------------|-------------|-----------|
| STC03DE170HP | C03DE170HP | TO247-4L HP | Tube |

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 | ± 20 | V |
| I_C | Collector current | 3 | A |
| I_{CM} | Collector peak current ($t_P < 5ms$) | 6 | A |
| I_B | Base current | 1 | A |
| I_{BM} | Base peak current ($t_P < 1ms$) | 3 | 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 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 ($V_{\text{BS}} = V_{\text{GS}} = 0\text{V}$) | $V_{\text{CS(SS)}} = 1700\text{V}$ | | | 100 | μA |
| $I_{\text{BS(OS)}}$ | Base-source current ($I_{\text{C}} = 0, V_{\text{GS}} = 0\text{V}$) | $V_{\text{BS(OS)}} = 30\text{V}$ | | | 10 | μA |
| $I_{\text{SB(OS)}}$ | Source-base current ($I_{\text{C}} = 0, V_{\text{GS}} = 0\text{V}$) | $V_{\text{SB(OS)}} = 9\text{V}$ | | | 100 | μA |
| $I_{\text{GS(OS)}}$ | Gate-source leakage ($V_{\text{BS}} = 0\text{V}$) | $V_{\text{GS}} = \pm 20\text{V}$ | | | 500 | nA |
| $V_{\text{CS(ON)}}$ | Collector-source ON voltage | $V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 3\text{A} \quad I_{\text{B}} = 0.6\text{A}$ $V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 1\text{A} \quad I_{\text{B}} = 100\text{mA}$ | | 1 0.3 | 1.2 0.6 | V V |
| h_{FE} | DC current gain | $V_{\text{GS}} = 10\text{V} \quad V_{\text{CS}} = 1\text{V} \quad I_{\text{C}} = 3\text{A}$ $V_{\text{GS}} = 10\text{V} \quad V_{\text{CS}} = 1\text{V} \quad I_{\text{C}} = 1\text{A}$ | 10 | 5 14 | | |
| $V_{\text{BS(ON)}}$ | Base-source ON voltage | $V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 3\text{A} \quad I_{\text{B}} = 0.6\text{A}$ $V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 1\text{A} \quad I_{\text{B}} = 100\text{mA}$ | | 1 1 | 1.2 | V V |
| $V_{\text{GS(th)}}$ | Gate threshold voltage | $V_{\text{BS}} = V_{\text{GS}} \quad I_{\text{B}} = 250\mu\text{A}$ | 1.5 | | 3 | V |
| C_{iss} | Input capacitance | $V_{\text{CS}} = 25\text{V} \quad f = 1\text{MHz}$ $V_{\text{GS}} = 0\text{V}$ | | 750 | | pF |
| $Q_{\text{GS(tot)}}$ | Gate-source Charge | $V_{\text{CS}} = 15\text{V} \quad V_{\text{GS}} = 10\text{V}$ $V_{\text{CB}} = 0\text{V} \quad I_{\text{C}} = 4\text{A}$ | | 12.5 | | nC |
| t_{s} t_{f} | INDUCTIVE LOAD Storage time Fall time | $V_{\text{GS}} = 10\text{V} \quad R_{\text{G}} = 47\Omega$ $V_{\text{Clamp}} = 1360\text{V} \quad t_{\text{p}} = 4\mu\text{s}$ $I_{\text{C}} = 3\text{A} \quad I_{\text{B}} = 0.6\text{A}$ | | 1000 15 | | ns ns |
| t_{s} t_{f} | INDUCTIVE LOAD Storage time Fall time | $V_{\text{GS}} = 10\text{V} \quad R_{\text{G}} = 47\Omega$ $V_{\text{Clamp}} = 1360\text{V} \quad t_{\text{p}} = 4\mu\text{s}$ $I_{\text{C}} = 3\text{A} \quad I_{\text{B}} = 0.3\text{A}$ | | 590 15 | | ns ns |
| $V_{\text{CS(dyn)}}$ | Collector-source dynamic voltage (500ns) | $V_{\text{CC}} = V_{\text{Clamp}} = 400\text{V}$ $V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 1.5\text{A}$ $I_{\text{B}} = 0.1\text{A} \quad R_{\text{G}} = 47\Omega$ $t_{\text{peak}} = 500\text{ns} \quad I_{\text{Bpeak}} = 3\text{A}$ | | 9.5 | | V |

Table 4. Electrical characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------|---|--|------|------|------|------|
| $V_{CS(dyn)}$ | Collector-source dynamic voltage (1 μ s) | $V_{CC} = V_{Clamp} = 400V$ $V_{GS} = 10V$ $I_C = 1.5A$ $I_B = 0.1A$ $R_G = 47\Omega$ $t_{peak} = 500ns$ $I_{Bpeak} = 3A$ | | 9.5 | | V |
| V_{CSW} | Maximum collector-source voltage switched without snubber | $R_G = 47\Omega$ $h_{FE} = 5$ $I_C = 4A$ | 1700 | | | V |

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

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

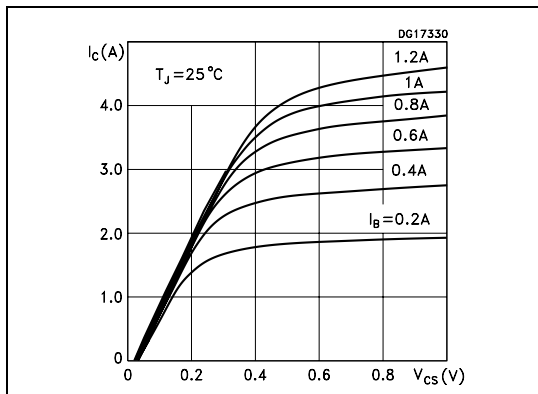


Figure 3. Dynamic collector-source saturation voltage

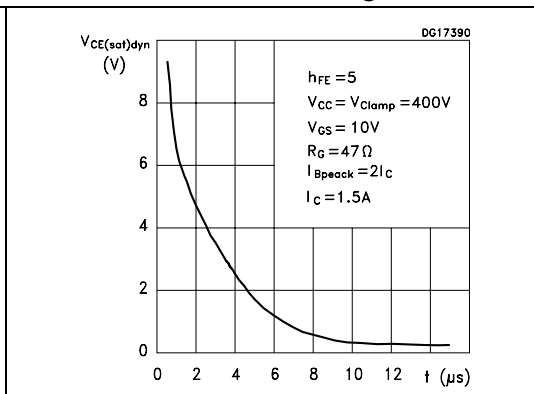


Figure 4. Reverse biased safe operating area

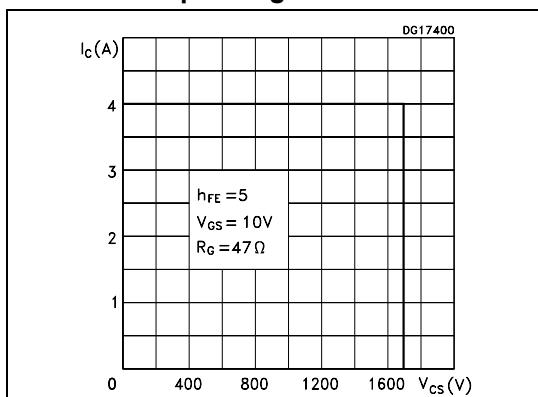


Figure 5. Gate threshold voltage vs temperature

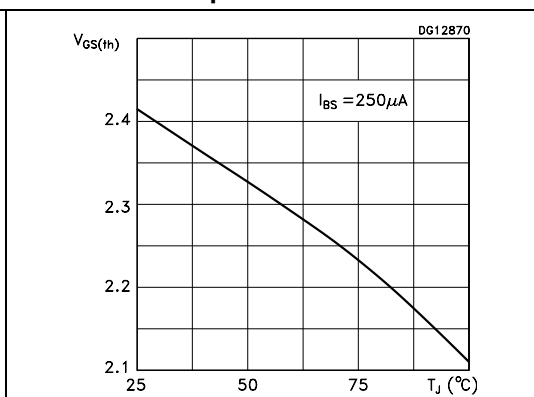


Figure 6. DC current gain

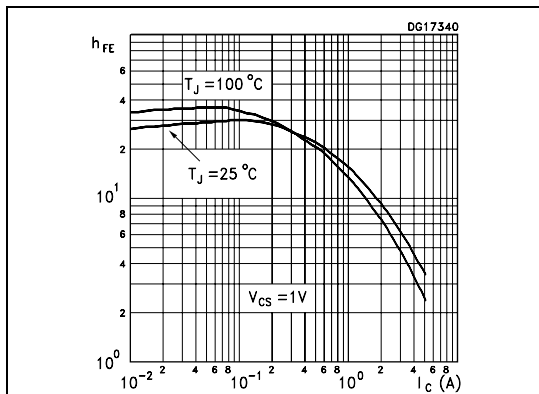


Figure 7. Collector-source On voltage

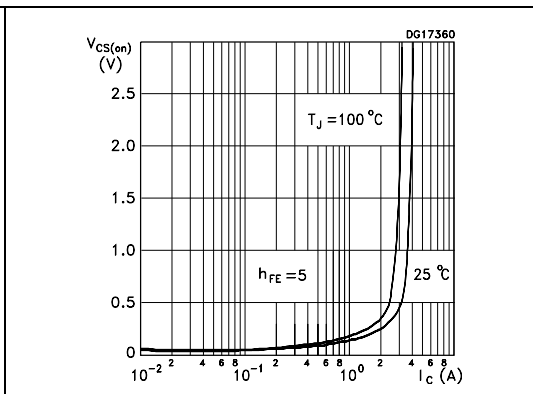


Figure 8. Collector-source On voltage Figure 9. Base-source On voltage

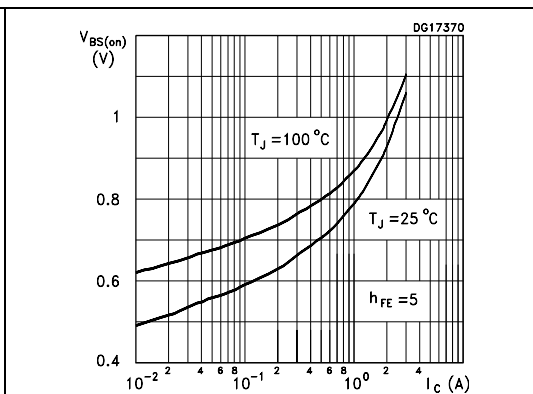
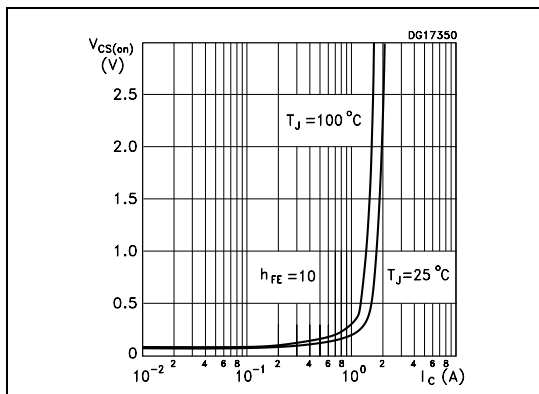
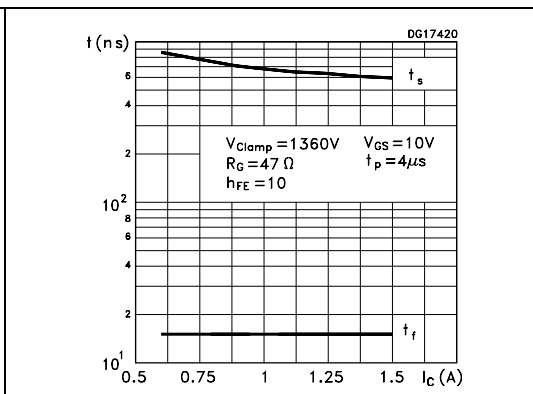
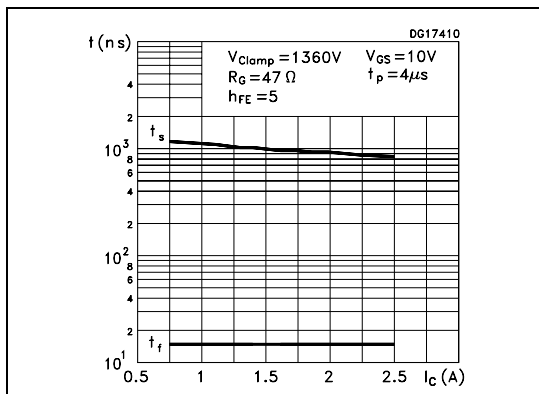


Figure 10. Inductive load switching time Figure 11. Inductive load switching time

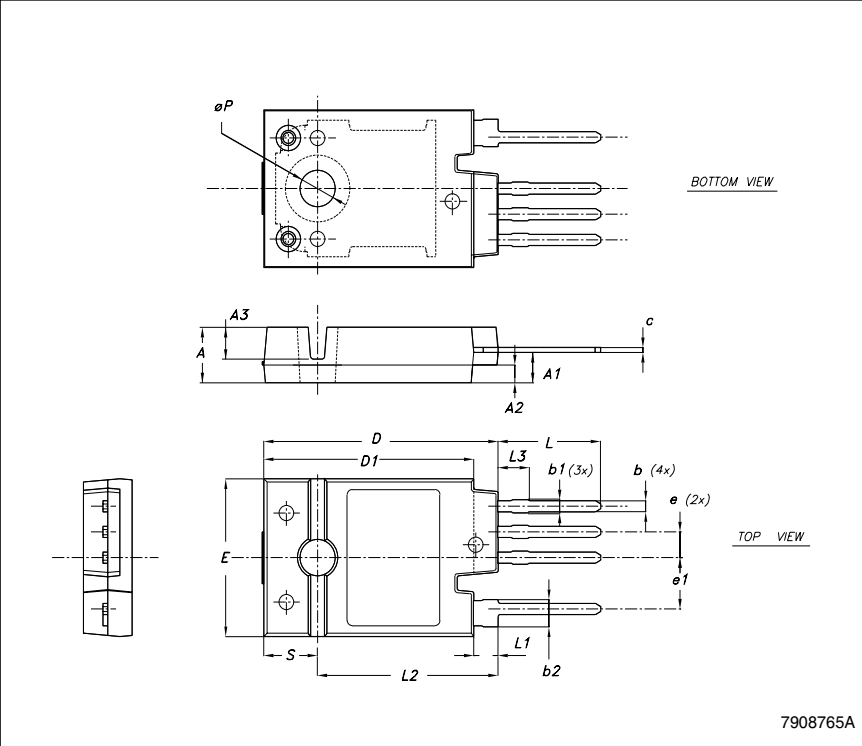


3 Package mechanical data

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

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. |
| 16-Jul-2007 | 2 | Improved electrical specification. Updated figures: 2,3,4,6,7,8,9,10 and 11. |

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