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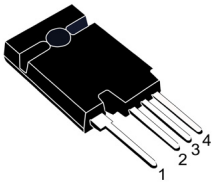
# STC04IE170HP

## Monolithic emitter switched bipolar transistor
## ESBT® 1700 V - 4 A - 0.17 Ω

## Features

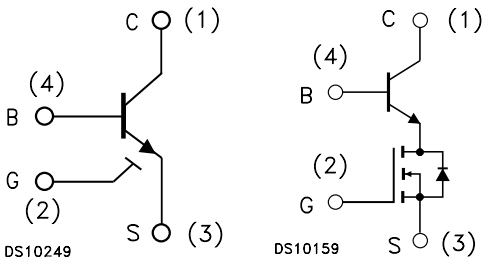
| $V_{CS(ON)}$ | $I_C$ | $R_{CS(ON)}$ |
|---|---|---|
| 0.7 V | 4 A | 0.17 Ω |

- High voltage / high current cascode configuration
- 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 Ω
- Very low turn-off cross over time




TO247-4L HP

**Figure 1. Internal schematic diagrams**




## Application

- Aux SMPS for three-phase mains

## Description

The STC04IE170HP is manufactured in Monolithic ESBT technology, aimed at providing the best performance in high frequency / high voltage applications. It is designed for use in gate driven based topologies.

**Table 1. Device summary**

| Order code | Marking | Package | Packing |
|---|---|---|---|
| STC04IE170HP | C04IE170HP | TO247-4L HP | Tube |

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CS(SS)}$ | Collector-source voltage ($V_{BS}$ = $V_{GS}$ = 0) | 1700 | V |
| $V_{BS(OS)}$ | Base-source voltage ($I_C$ = 0, $V_{GS}$ = 0) | 30 | V |
| $V_{SB(OS)}$ | Source-base voltage ($I_C$ = 0, $V_{GS}$ = 0) | 17 | V |
| $V_{GS}$ | Gate-source voltage | ± 17 | V |
| $I_C$ | Collector current | 4 | A |
| $I_{CM}$ | Collector peak current ($t_P$ < 5 ms) | 8 | A |
| $I_B$ | Base current | 4 | A |
| $I_{BM}$ | Base peak current ($t_P$ < 1 ms) | 8 | A |
| $P_{tot}$ | Total dissipation at $T_c \leq 25°C$ | 50 | W |
| $T_{stg}$ | Storage temperature | -40 to 150 | °C |
| $T_J$ | Max. operating junction temperature | 150 | °C |

**Table 3. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thJC}$ | Thermal resistance junction-case | 2.5 | °C/W |

# 2 Electrical characteristics

($T_{case}$ = 25 °C unless otherwise specified)

**Table 4. Electrical characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CS(SS)}$ | Collector cut-off current ($V_{BS}$ = $V_{GS}$ = 0) | $V_{CS}$ = 1700 V | | | 100 | µA |
| $I_{BS(OS)}$ | Base cut-off current ($I_C$ = 0, $V_{GS}$ = 0) | $V_{BS}$ = 30 V | | | 10 | µA |
| $I_{SB(OS)}$ | Source cut-off current ($I_C$ = 0, $V_{GS}$ = 0) | $V_{SB}$ = 17 V | | | 100 | µA |
| $I_{GS(OS)}$ | Gate-source leakage current ($V_{BS}$ = 0) | $V_{GS}$ = ± 17V | | | 100 | nA |
| $V_{CS(ON)}$ | Collector-source ON voltage | $V_{GS}$ = 10 V $I_C$ = 4 A $I_B$ = 0.8 A<br>$V_{GS}$ = 10 V $I_C$ = 1.5 A $I_B$ = 0.15 A | | 0.7<br>0.6 | 1.5<br>1.4 | V<br>V |
| $h_{FE}$ (1) | DC current gain | $V_{CS}$ = 1 V $V_{GS}$ = 10 V $I_C$ = 4 A<br>$V_{CS}$ = 1 V $V_{GS}$ = 10 V $I_C$ = 1.5 A | 4<br>7 | 5.5<br>11 | | |
| $V_{BS(ON)}$ | Base-source ON voltage | $V_{GS}$ = 10 V $I_C$ = 4 A $I_B$ = 0.8 A<br>$V_{GS}$ = 10 V $I_C$ = 1.5 A $I_B$ = 0.15 A | | 1.3<br>0.9 | 1.5<br>1.1 | V<br>V |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{BS}$ = $V_{GS}$ $I_B$ = 250 µA | 2 | 3 | 4 | V |
| $C_{iss}$ | Input capacitance ($V_{GS}$ = $V_{CB}$ = 0) | $V_{CS}$ = 25 V f = 1 MHz | | 510 | | pF |
| $Q_{GS(tot)}$ | Gate-source charge ($V_{CB}$ = 0) | $V_{GS}$ = 10 V | | 3.9 | | nC |
| $t_s$<br>$t_f$ | Inductive load<br>Storage time<br>Fall time | $V_{GS}$ = 10 V $R_G$ = 47 Ω<br>$V_{Clamp}$ = 1360 V $t_p$ = 4 µs<br>$I_C$ = 2 A $I_B$ = 0.4 A | | <br>770<br>10 | | <br>ns<br>ns |
| $t_s$<br>$t_f$ | Inductive load<br>Storage time<br>Fall time | $V_{GS}$ = 10 V $R_G$ = 47 Ω<br>$V_{Clamp}$ = 1360V $t_p$ = 4 µs<br>$I_C$ = 2 A $I_B$ = 0.2 A | | <br>410<br>10 | | <br>ns<br>ns |
| $V_{CS(dyn)}$ | Collector-source dynamic voltage (0.5 µs) | $V_{CC}$ = $V_{Clamp}$ = 400 V<br>$V_{GS}$ = 10 V $I_C$ = 1.5 A<br>$I_B$ = 0.3 A $t_{peak}$ = 500 ns<br>$R_G$ = 47 Ω $I_{Bpeak}$ = 3 A (2 $I_C$) | | 5.36 | | V |
| $V_{CS(dyn)}$ | Collector-source dynamic voltage (1 µs) | $V_{CC}$ = $V_{Clamp}$ = 400 V<br>$V_{GS}$ = 10 V $I_C$ = 1.5 A<br>$I_B$ = 0.3 A $t_{peak}$ =500 ns<br>$R_G$ = 47 Ω $I_{Bpeak}$ = 3 A (2$I_C$) | | 4.32 | | V |
| $V_{CSW}$ | Maximum collector-source voltage at turn-off without snubber | $R_G$ = 47 Ω $h_{FE}$ = 5 $I_C$ = 4 A | 1700 | | | V |

1. Pulsed duration = 300 µs, duty cycle ≤ 1.5%.

## 2.1 Electrical characteristics (curves)

**Figure 2. Output characteristics**

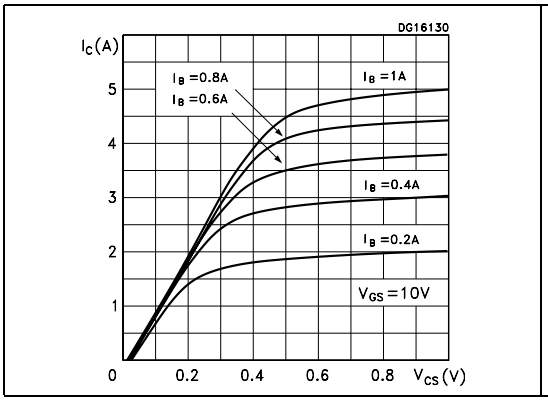



**Figure 3. Collector-source dynamic voltage**

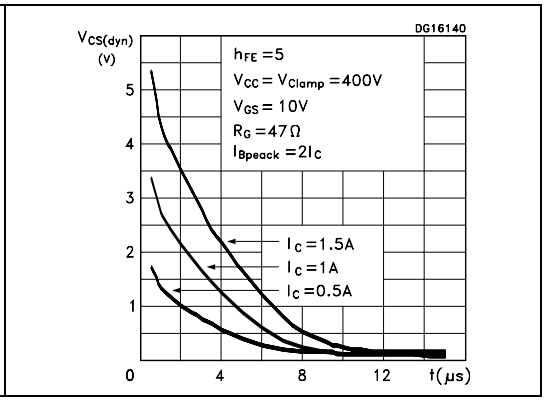



**Figure 4. DC current gain**

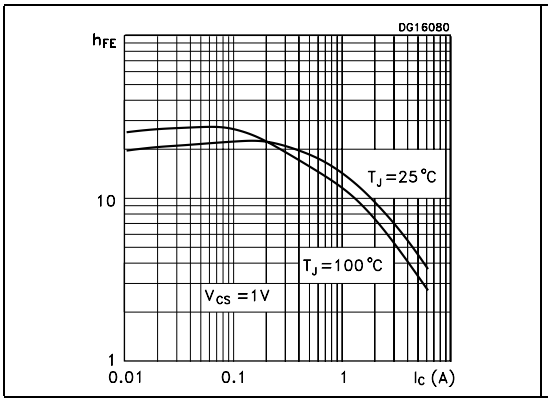



**Figure 5. Gate threshold voltage vs temperature**

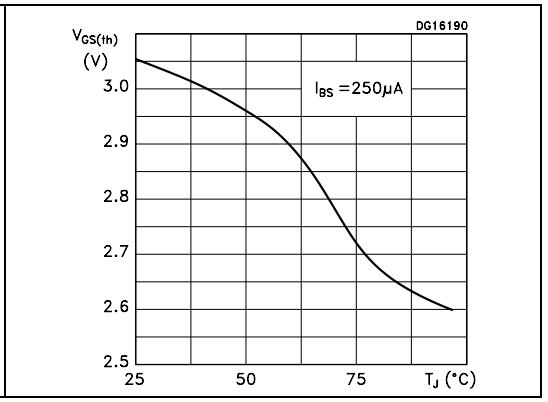



**Figure 6. Collector-source ON voltage ($h_{FE}$ = 5)**

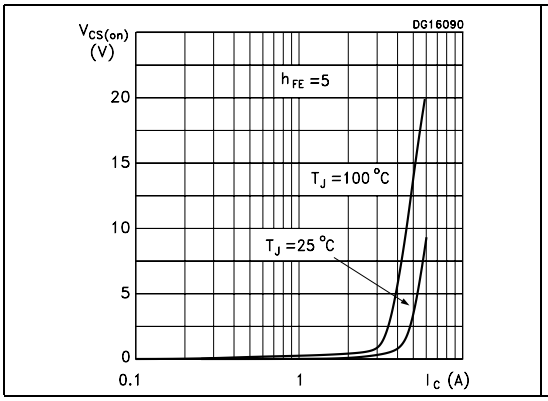



**Figure 7. Collector-source ON voltage ($h_{FE}$ = 10)**

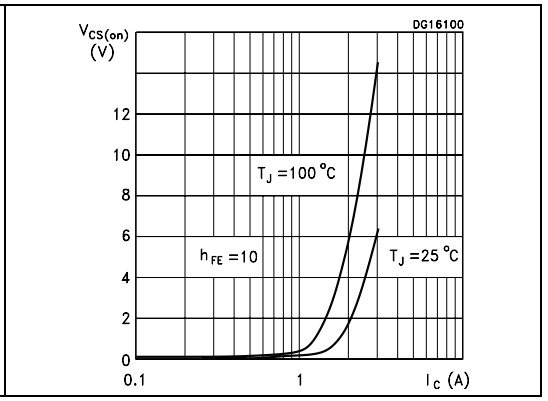


**Figure 8. Base-source ON voltage ($h_{FE}$ = 5)**

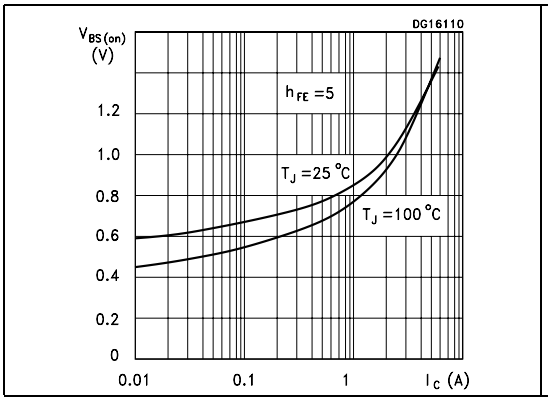



**Figure 9. Base-source ON voltage ($h_{FE}$ = 10)**

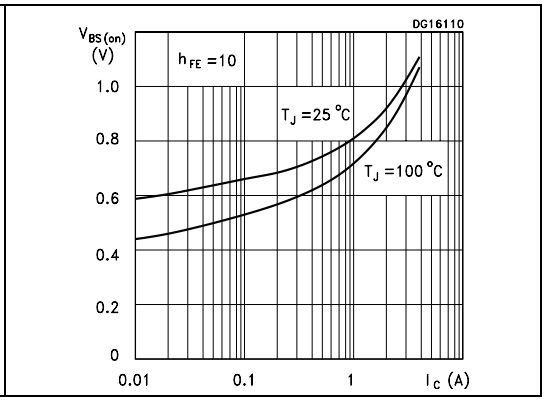



**Figure 10. Inductive load switching time ($h_{FE}$ = 5)**

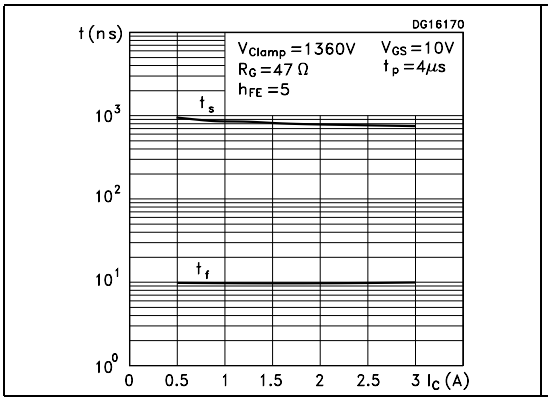



**Figure 11. Inductive load switching time ($h_{FE}$ = 10)**

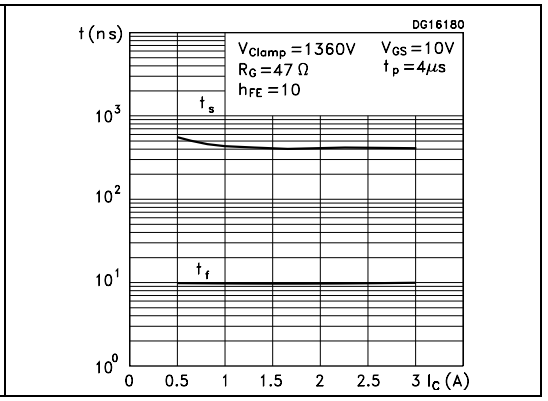
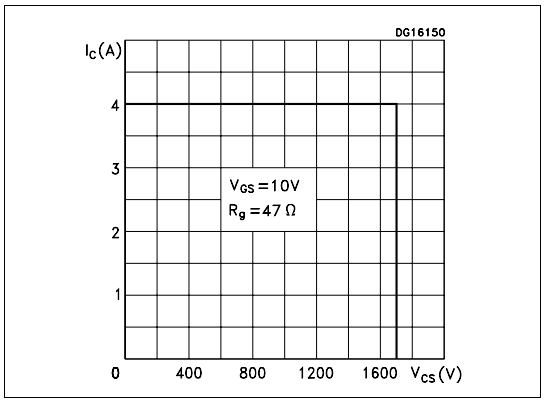



**Figure 12. Reverse biased safe operating area**



# 3 Package mechanical data

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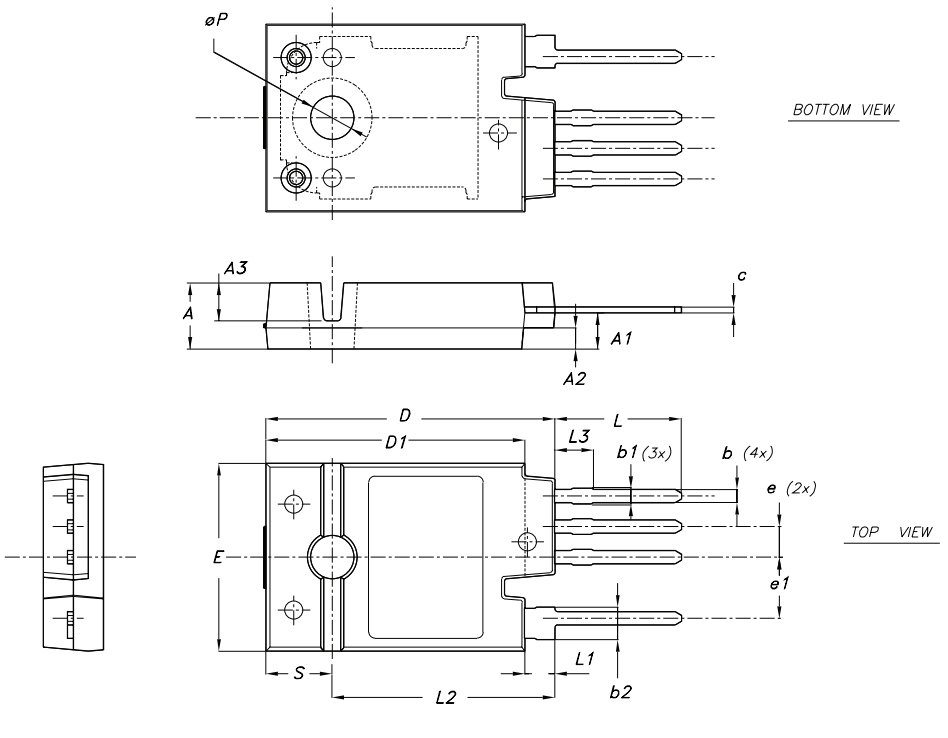
## TO247-4L HP mechanical data

| 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. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 27-Sep-2006 | 1 | First release. |
| 21-Nov-2006 | 2 | Improved application target. |
| 17-Jun-2009 | 3 | Updated *Figure 2 on page 4* and mechanical data. |

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