



# 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

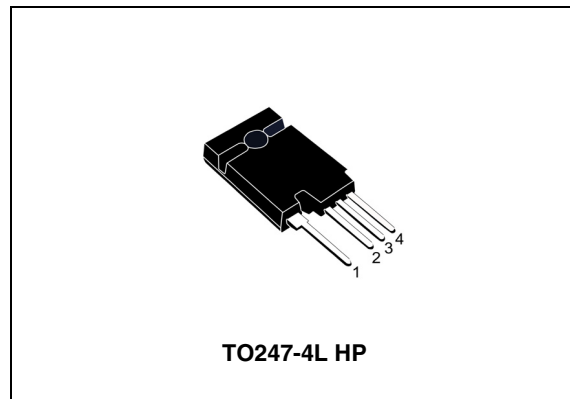
- High voltage / high current cascode configuration
- Low equivalent ON resistance
- Very fast-switch, up to 150 kHz
- Squared RBSOA, up to 1700 V
- Very low  $C_{ISS}$  driven by  $R_G = 47 \Omega$
- Very low turn-off cross over time

## Application

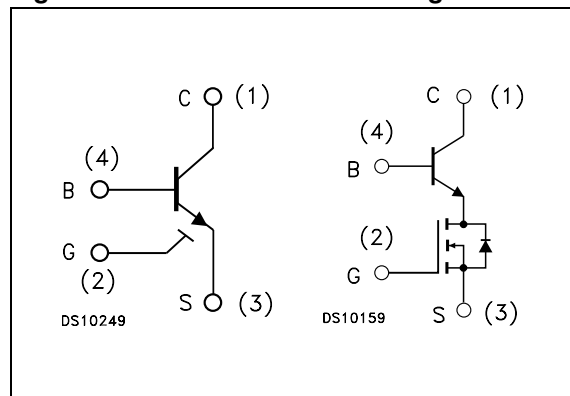
- Aux SMPS for three-phase mains

## 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.



**Figure 1. Internal schematic diagrams**



**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	$\pm 17$	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 $T_c \leq 25^\circ\text{C}$	50	W
$T_{stg}$	Storage temperature	-40 to 150	$^\circ\text{C}$
$T_J$	Max. operating junction temperature	150	$^\circ\text{C}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance junction-case	2.5	$^\circ\text{C}/\text{W}$

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

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

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

## 2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

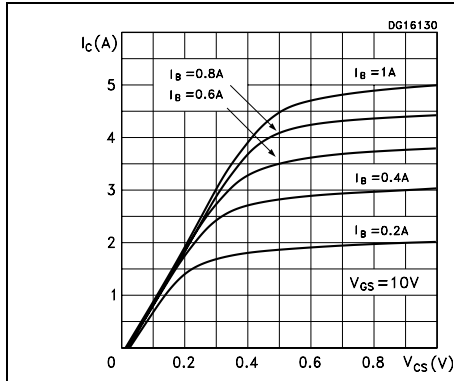


Figure 3. Collector-source dynamic voltage

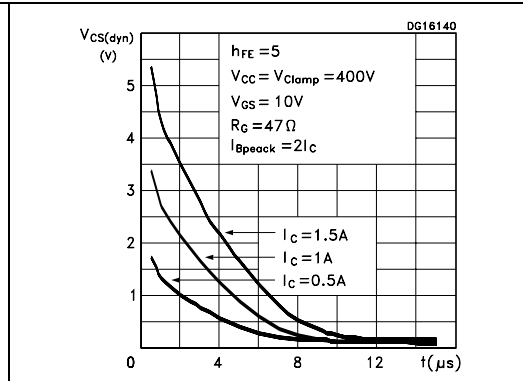


Figure 4. DC current gain

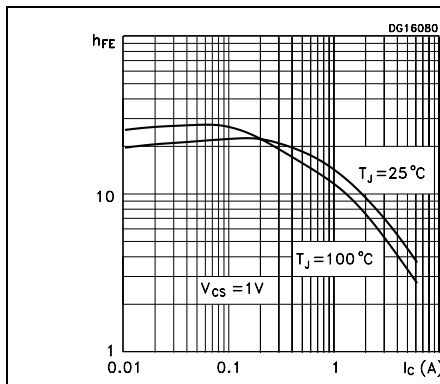


Figure 5. Gate threshold voltage vs temperature

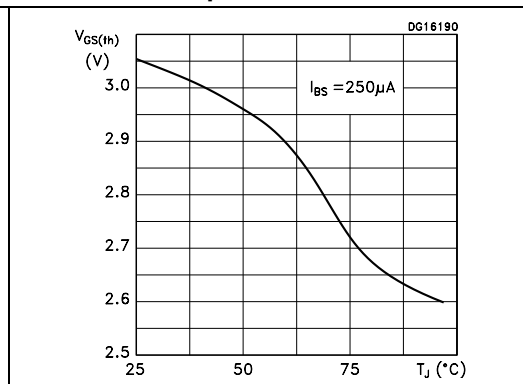


Figure 6. Collector-source ON voltage ( $h_{FE} = 5$ )

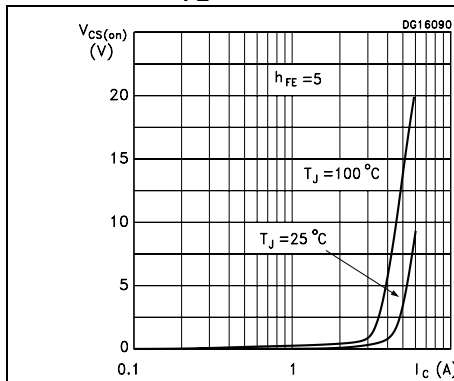
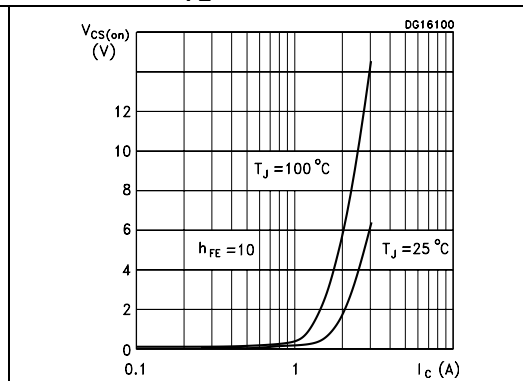
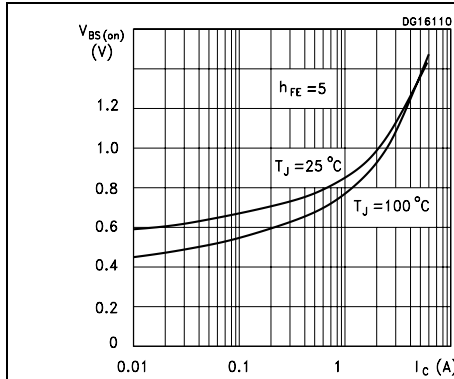


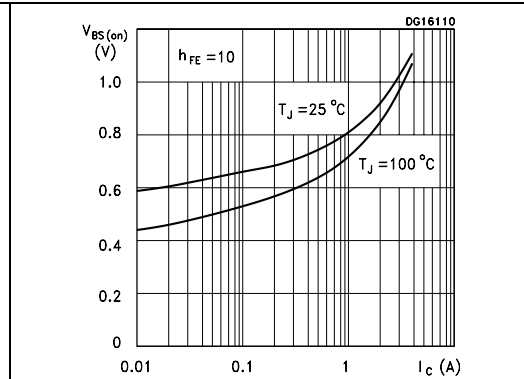
Figure 7. Collector-source ON voltage ( $h_{FE} = 10$ )



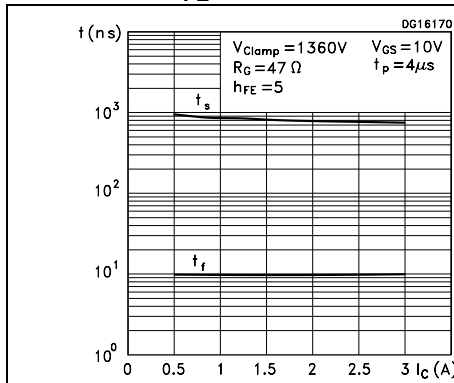
**Figure 8. Base-source ON voltage ( $h_{FE} = 5$ )**



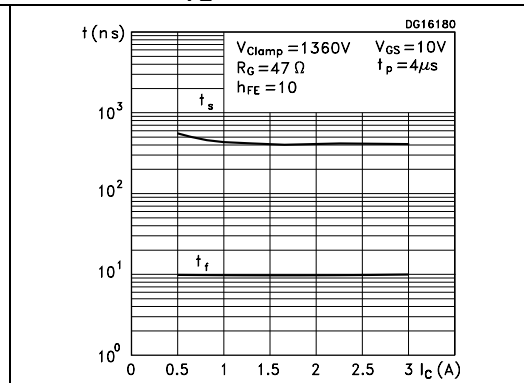
**Figure 9. Base-source ON voltage ( $h_{FE} = 10$ )**



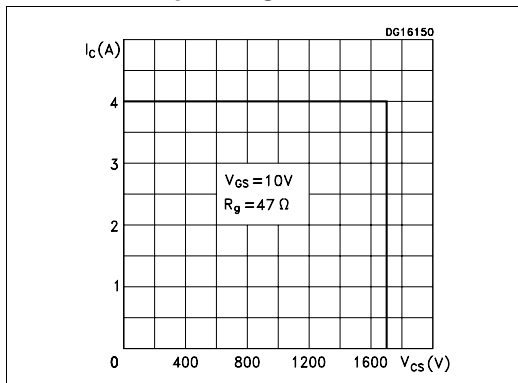
**Figure 10. Inductive load switching time ( $h_{FE} = 5$ )**



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



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

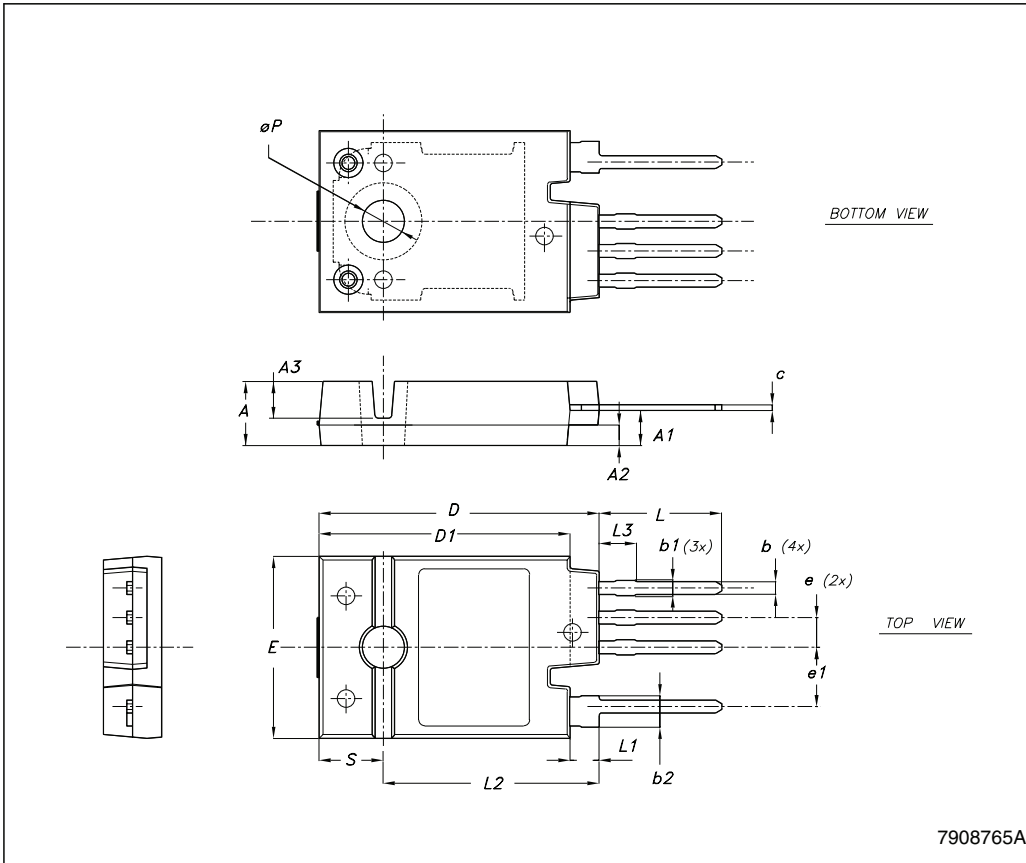


### 3 Package mechanical data

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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 <a href="#">Figure 2 on page 4</a> and mechanical data.



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