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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

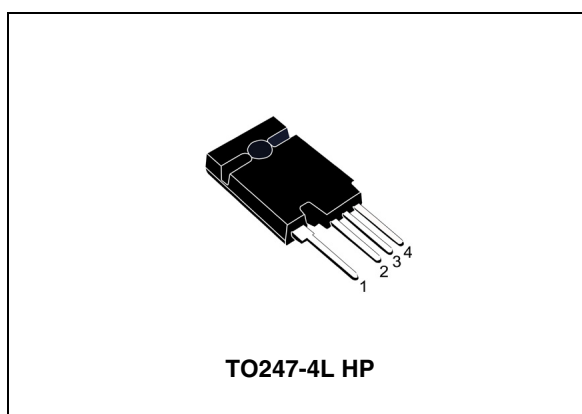
- High voltage / high current cascode configuration
- Low equivalent ON resistance
- Very fast-switch, up to 150 kHz
- Squared RBSOA, up to 1700 V
- Very low  $C_{ISS}$  driven by  $R_G = 47 \Omega$
- Very low turn-off cross over time

## Application

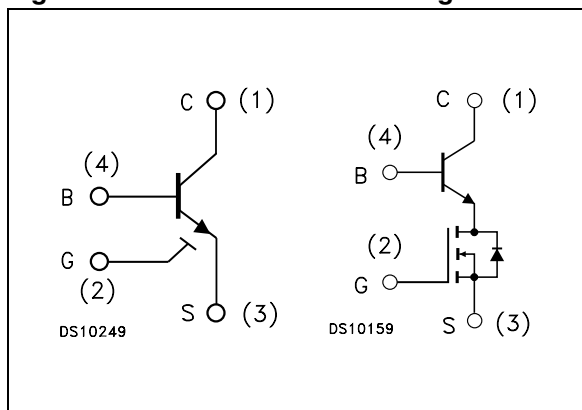
- Aux SMPS for three-phase mains

## 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

Electrical ratings

STC04IE170HP

# 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	$^\circ\text{C/W}$

STC04IE170HP

Electrical characteristics

## 2 Electrical characteristics

(T<sub>case</sub> = 25 °C unless otherwise specified)

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I <sub>CS(SS)</sub>	Collector cut-off current (V <sub>BS</sub> = V <sub>GS</sub> = 0)	V <sub>CS</sub> = 1700 V			100	μA
I <sub>BS(OS)</sub>	Base cut-off current (I <sub>C</sub> = 0, V <sub>GS</sub> = 0)	V <sub>BS</sub> = 30 V			10	μA
I <sub>SB(OS)</sub>	Source cut-off current (I <sub>C</sub> = 0, V <sub>GS</sub> = 0)	V <sub>SB</sub> = 17 V			100	μA
I <sub>GS(OS)</sub>	Gate-source leakage current (V <sub>BS</sub> = 0)	V <sub>GS</sub> = ± 17V			100	nA
V <sub>CS(ON)</sub>	Collector-source ON voltage	V <sub>GS</sub> = 10 V I <sub>C</sub> = 4 A I <sub>B</sub> = 0.8 A V <sub>GS</sub> = 10 V I <sub>C</sub> = 1.5 A I <sub>B</sub> = 0.15 A		0.7 0.6	1.5 1.4	V V
h <sub>FE</sub> (1)	DC current gain	V <sub>CS</sub> = 1 V V <sub>GS</sub> = 10 V I <sub>C</sub> = 4 A V <sub>CS</sub> = 1 V V <sub>GS</sub> = 10 V I <sub>C</sub> = 1.5 A	4 7	5.5 11		
V <sub>BS(ON)</sub>	Base-source ON voltage	V <sub>GS</sub> = 10 V I <sub>C</sub> = 4 A I <sub>B</sub> = 0.8 A V <sub>GS</sub> = 10 V I <sub>C</sub> = 1.5 A I <sub>B</sub> = 0.15 A		1.3 0.9	1.5 1.1	V V
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>BS</sub> = V <sub>GS</sub> I <sub>B</sub> = 250 μA	2	3	4	V
C <sub>iss</sub>	Input capacitance (V <sub>GS</sub> = V <sub>CB</sub> = 0)	V <sub>CS</sub> = 25 V f = 1 MHz		510		pF
Q <sub>GS(tot)</sub>	Gate-source charge (V <sub>CB</sub> = 0)	V <sub>GS</sub> = 10 V		3.9		nC
t <sub>s</sub> t <sub>f</sub>	Inductive load Storage time Fall time	V <sub>GS</sub> = 10 V R <sub>G</sub> = 47 Ω V <sub>Clamp</sub> = 1360 V t <sub>p</sub> = 4 μs I <sub>C</sub> = 2 A I <sub>B</sub> = 0.4 A		770 10		ns ns
t <sub>s</sub> t <sub>f</sub>	Inductive load Storage time Fall time	V <sub>GS</sub> = 10 V R <sub>G</sub> = 47 Ω V <sub>Clamp</sub> = 1360V t <sub>p</sub> = 4 μs I <sub>C</sub> = 2 A I <sub>B</sub> = 0.2 A		410 10		ns ns
V <sub>CS(dyn)</sub>	Collector-source dynamic voltage (0.5 μs)	V <sub>CC</sub> = V <sub>Clamp</sub> = 400 V V <sub>GS</sub> = 10 V I <sub>C</sub> = 1.5 A I <sub>B</sub> = 0.3 A t <sub>peak</sub> = 500 ns R <sub>G</sub> = 47 Ω I <sub>Bpeak</sub> = 3 A (2 I <sub>C</sub> )		5.36		V
V <sub>CS(dyn)</sub>	Collector-source dynamic voltage (1 μs)	V <sub>CC</sub> = V <sub>Clamp</sub> = 400 V V <sub>GS</sub> = 10 V I <sub>C</sub> = 1.5 A I <sub>B</sub> = 0.3 A t <sub>peak</sub> = 500 ns R <sub>G</sub> = 47 Ω I <sub>Bpeak</sub> = 3 A (2I <sub>C</sub> )		4.32		V
V <sub>CSW</sub>	Maximum collector-source voltage at turn-off without snubber	R <sub>G</sub> = 47 Ω h <sub>FE</sub> = 5 I <sub>C</sub> = 4 A	1700			V

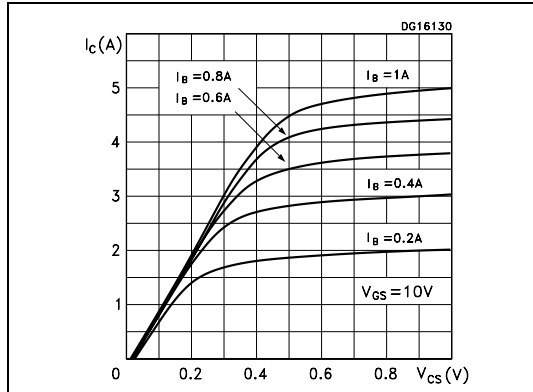
1. Pulsed duration = 300 μs, duty cycle ≤ 1.5%.

**Electrical characteristics**

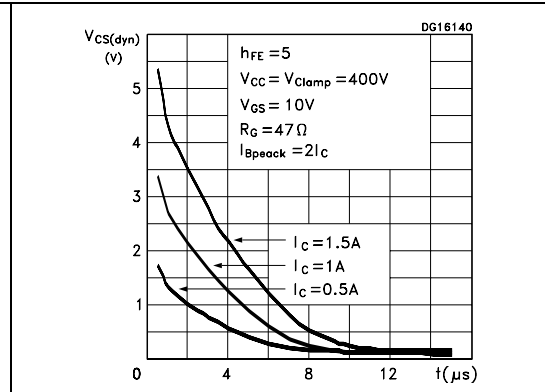
**STC04IE170HP**

**2.1 Electrical characteristics (curves)**

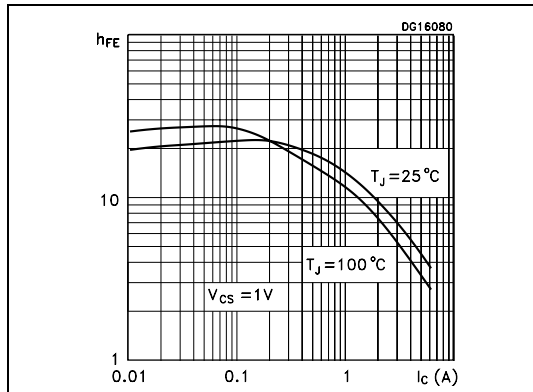
**Figure 2. Output characteristics**



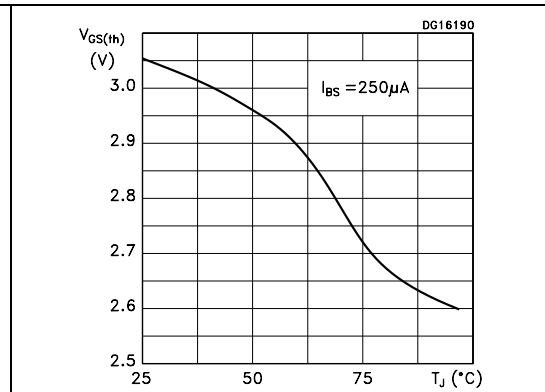
**Figure 3. Collector-source dynamic voltage**



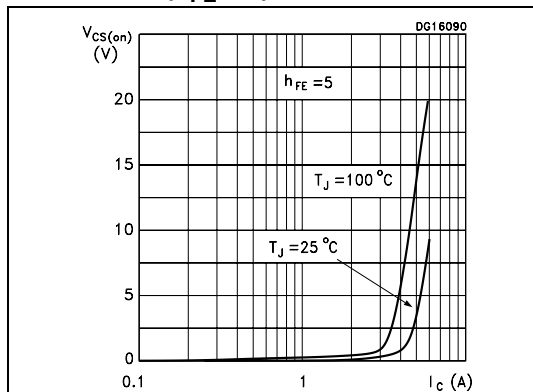
**Figure 4. DC current gain**



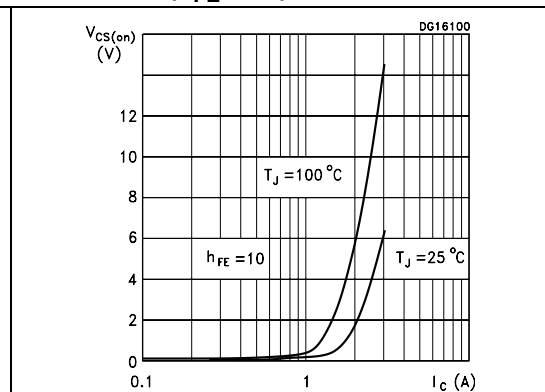
**Figure 5. Gate threshold voltage vs temperature**



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



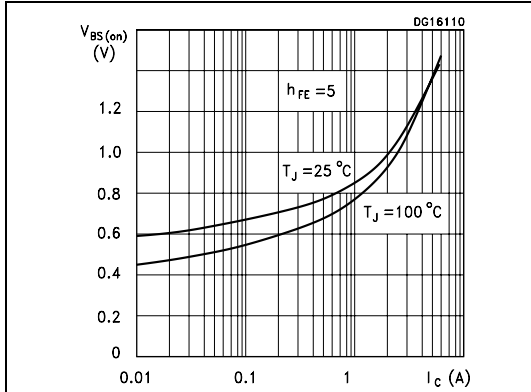
**Figure 7. Collector-source ON voltage ( $h_{FE} = 10$ )**



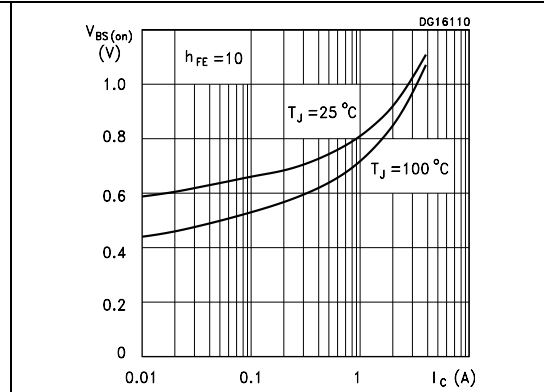
**STC04IE170HP**

**Electrical characteristics**

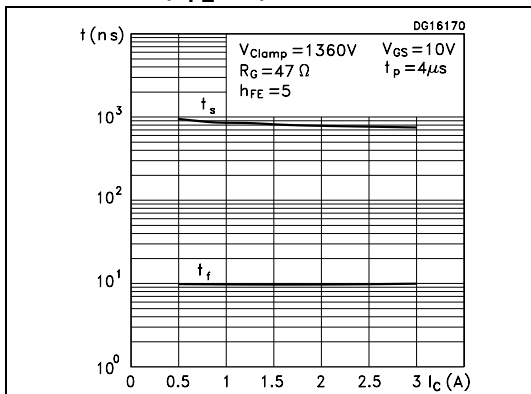
**Figure 8. Base-source ON voltage ( $h_{FE} = 5$ )**



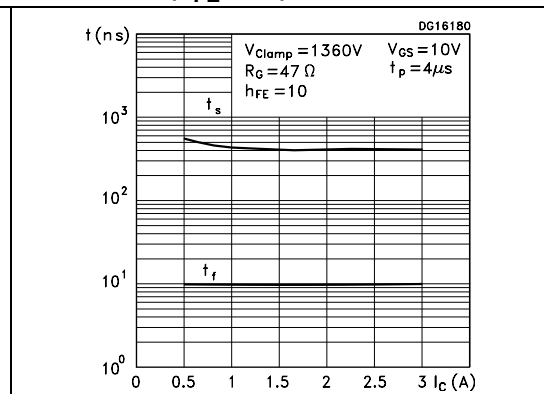
**Figure 9. Base-source ON voltage ( $h_{FE} = 10$ )**



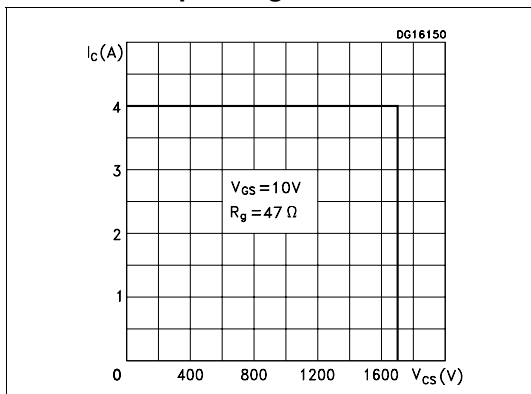
**Figure 10. Inductive load switching time ( $h_{FE} = 5$ )**



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



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



### 3 Package mechanical data

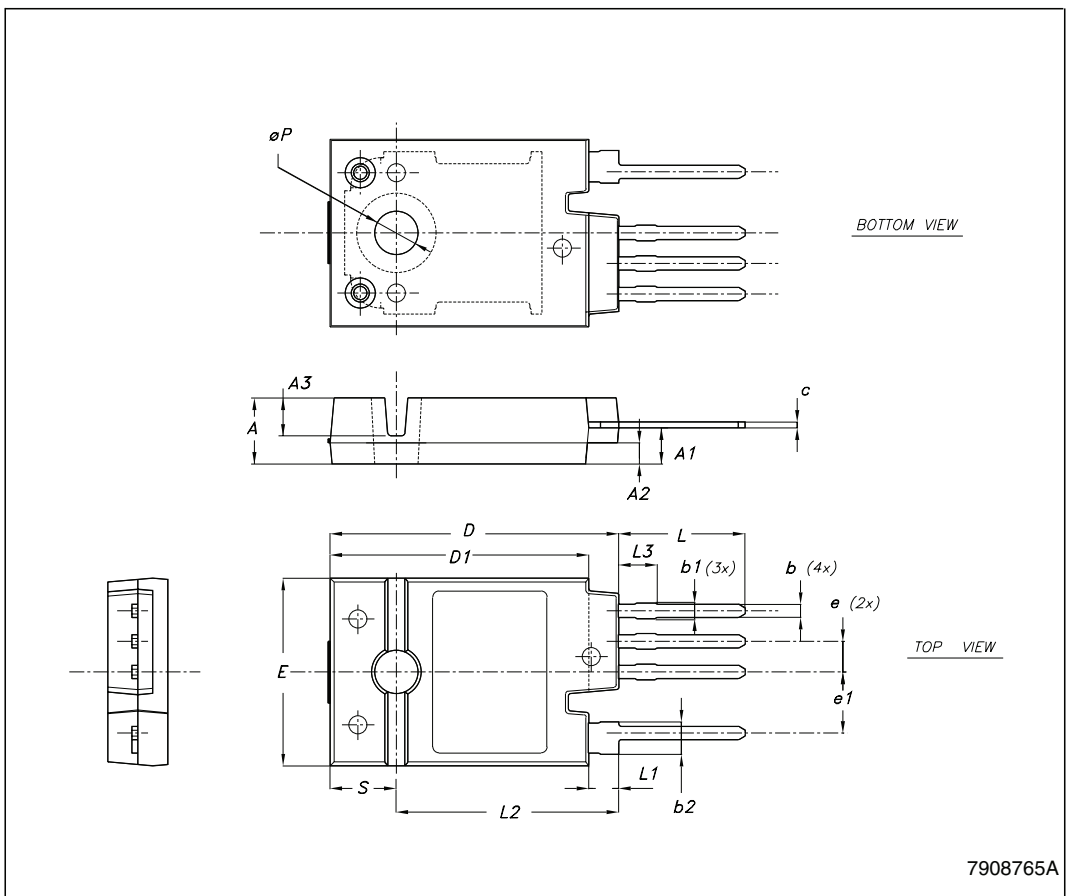
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK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

**STC04IE170HP**

**Package mechanical data**

**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.

## STC04IE170HP

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