



# 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

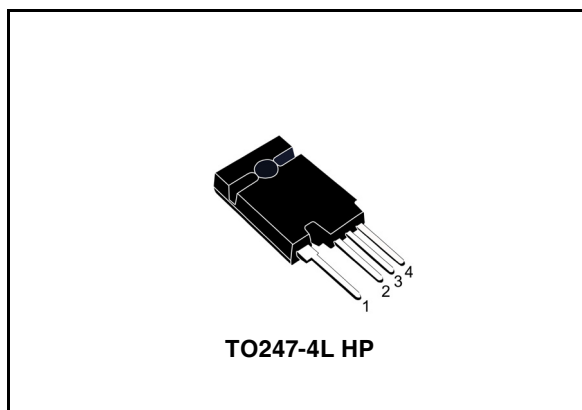


Figure 1. Internal schematic diagrams

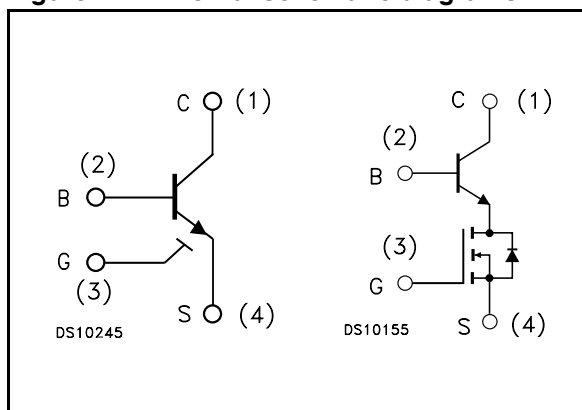


Table 1. Device summary

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

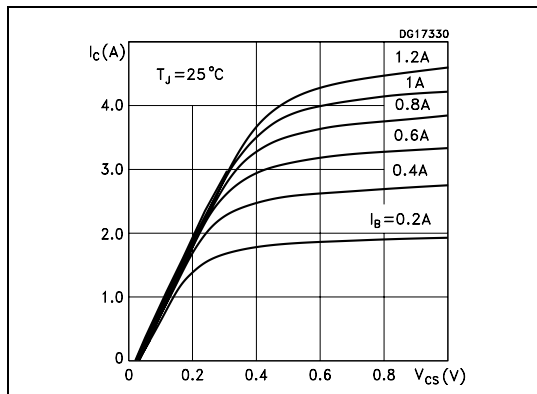
**Table 4. Electrical characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CS(dyn)}$	Collector-source dynamic voltage (1 $\mu$ 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

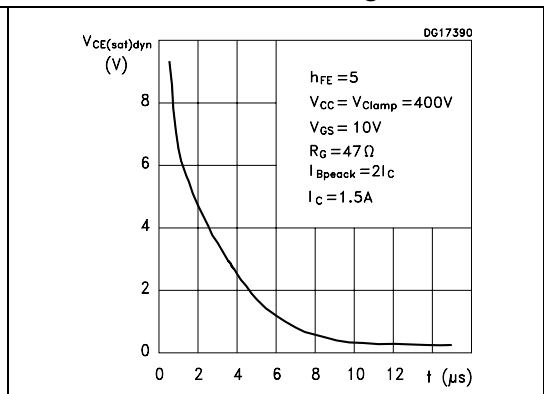
Note (1) Pulsed duration = 300  $\mu$ s, duty cycle  $\leq$  1.5%

## 2.1 Electrical characteristics (curves)

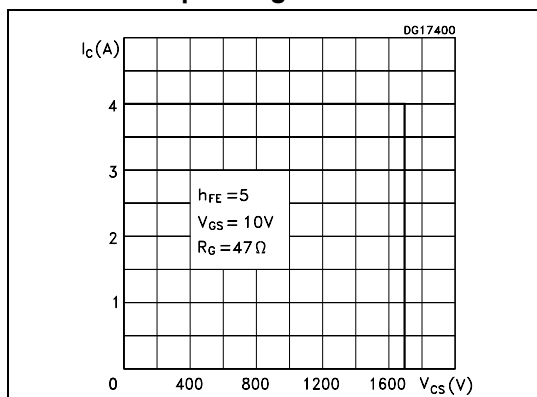
**Figure 2. Output characteristics**



**Figure 3. Dynamic collector-source saturation voltage**



**Figure 4. Reverse biased safe operating area**



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

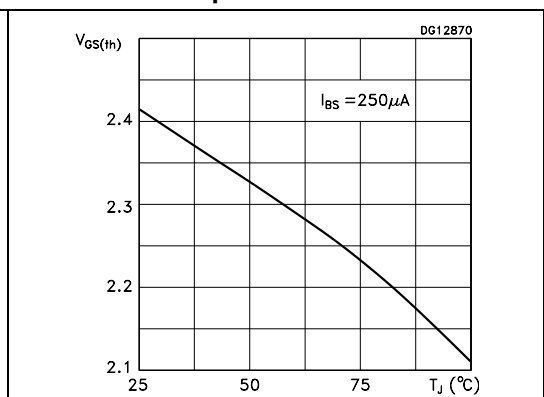


Figure 6. DC current gain

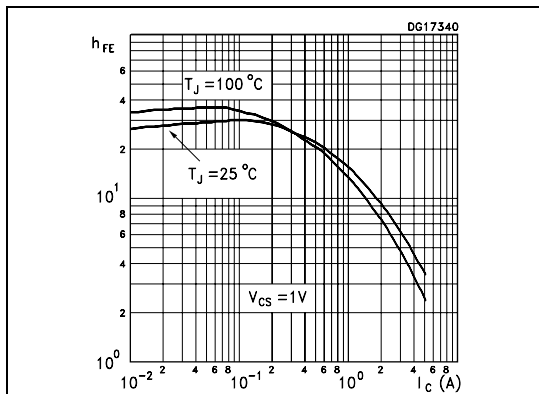


Figure 7. Collector-source On voltage

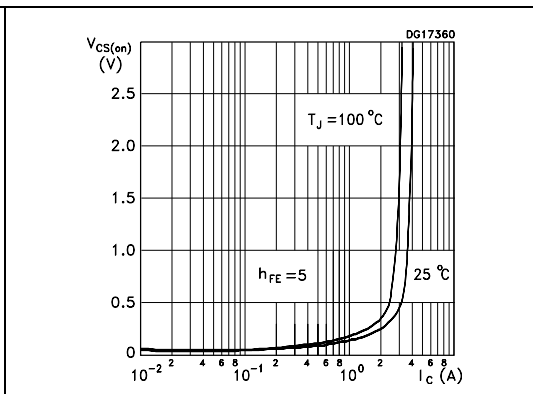


Figure 8. Collector-source On voltage

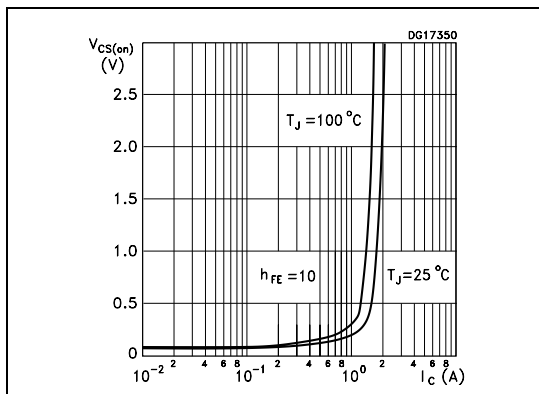


Figure 9. Base-source On voltage

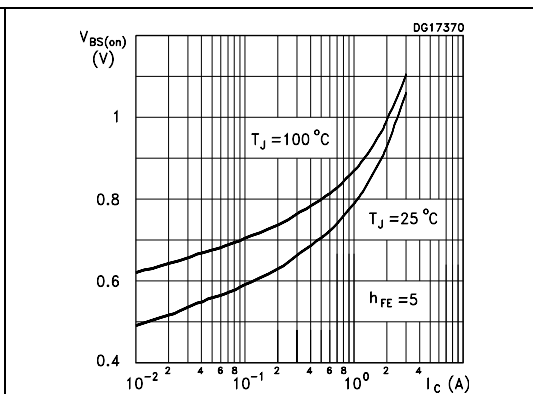


Figure 10. Inductive load switching time

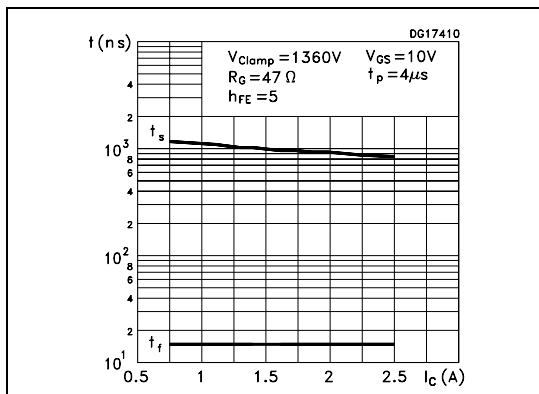
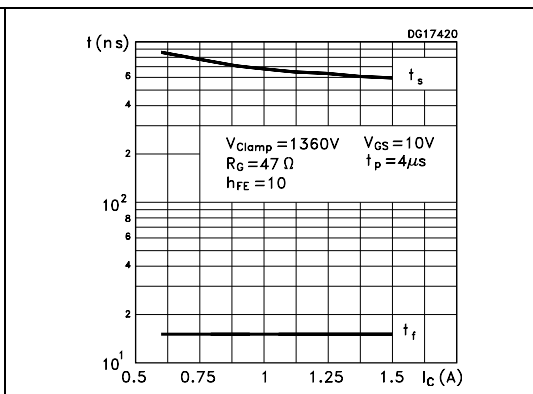


Figure 11. Inductive load switching time

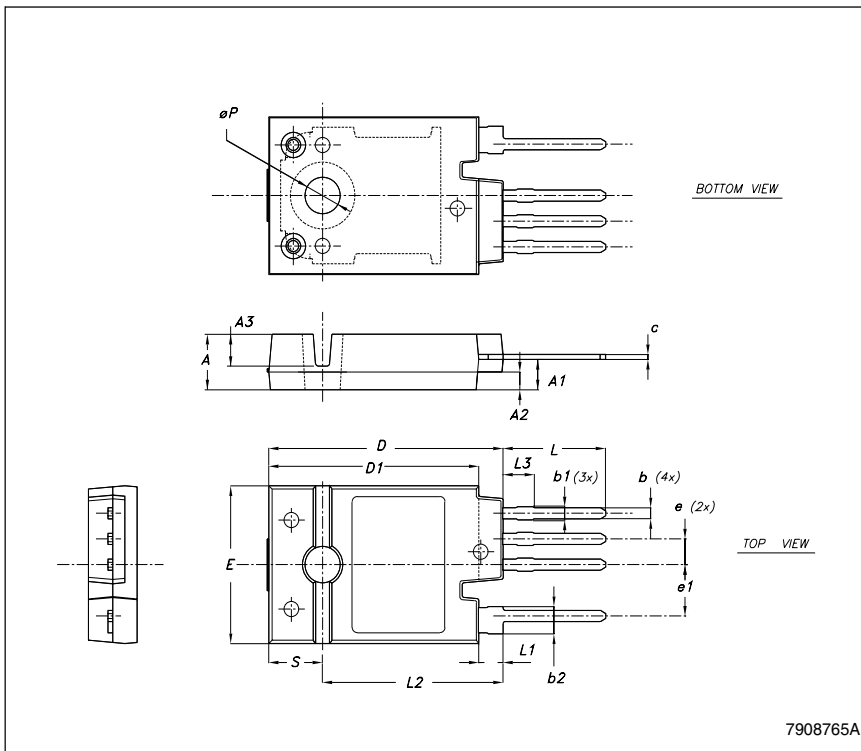


### 3 Package mechanical data

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



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