



# STC20DE90HP

Hybrid emitter switched bipolar transistor

ESBT® 900 V - 20 A - 0.06 Ω

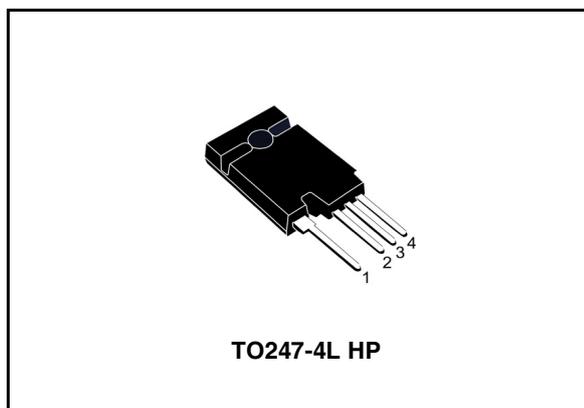
Preliminary Data

## General features

Table 1. General features

$V_{CS(ON)}$	$I_C$	$R_{CS(ON)}$
1.2 V	20 A	0.06 Ω

- Low equivalent on resistance
- Very fast-switch, up to 150 kHz
- Squared RBSOA, up to 900 V
- Very low  $C_{ISS}$  driven by  $R_G = 47 \Omega$
- In compliance with the 2002/93/EC European Directive



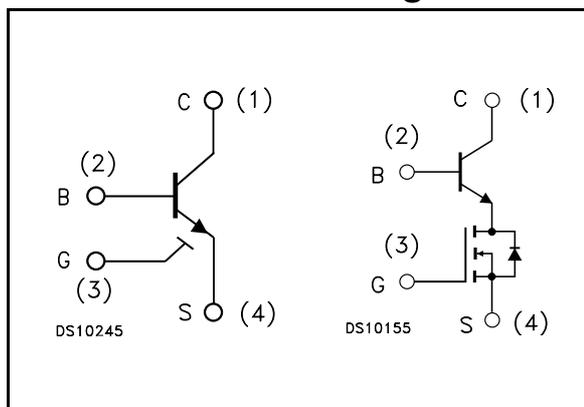
## Description

The STC20DE90HP 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 STC20DE90HP is designed for use in power supply forward converter and three-phase power factor corrector applications.

## Applications

- SMPS forward converter
- Three-phase power factor corrector

## Internal schematic diagrams



## Order codes

Part Number	Marking	Package	Packing
STC20DE90HP	C20DE90HP	TO247-4L HP	Tube

## Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CS(SS)}$	Collector-source voltage ( $V_{BS} = V_{GS} = 0V$ )	900	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	20	A
$I_{CM}$	Collector peak current ( $t_P < 5ms$ )	60	A
$I_B$	Base current	5	A
$I_{BM}$	Base peak current ( $t_P < 1ms$ )	20	A
$P_{tot}$	Total dissipation at $T_C \leq 25^\circ C$	46	W
$T_{stg}$	Storage temperature	-40 to 150	$^\circ C$
$T_J$	Max. operating junction temperature	150	$^\circ C$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	2.7	$^\circ C/W$

## 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 ( $V_{\text{BS}} = V_{\text{GS}} = 0\text{V}$ )	$V_{\text{CS(SS)}} = 900\text{V}$			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	$V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 20\text{A} \quad I_{\text{B}} = 4\text{A}$ $V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 10\text{A} \quad I_{\text{B}} = 1\text{A}$		1.2 0.65		V V
$h_{\text{FE}}$	DC current gain	$V_{\text{CS}} = 1\text{V} \quad V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 20\text{A}$ $V_{\text{CS}} = 1\text{V} \quad V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 10\text{A}$		4 12		
$V_{\text{BS(ON)}}$	Base-source ON voltage	$V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 20\text{A} \quad I_{\text{B}} = 4\text{A}$ $V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 10\text{A} \quad I_{\text{B}} = 1\text{A}$		1.8 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	2.2	3	V
$C_{\text{iss}}$	Input capacitance	$V_{\text{CS}} = 25\text{V} \quad f = 1\text{MHz}$ $V_{\text{GS}} = V_{\text{CB}} = 0\text{V}$		750		pF
$Q_{\text{GS(tot)}}$	Gate-source Charge	$V_{\text{CS}} = 25\text{V} \quad V_{\text{GS}} = 10\text{V}$ $V_{\text{CB}} = 0\text{V} \quad I_{\text{C}} = 20\text{A}$		12.5		nC
$t_{\text{s}}$ $t_{\text{f}}$	INDUCTIVE LOAD Storage time Fall time	$V_{\text{GS}} = 10\text{V} \quad R_{\text{G}} = 47\Omega$ $V_{\text{Clamp}} = 720\text{V} \quad t_{\text{p}} = 4\mu\text{s}$ $I_{\text{C}} = 10\text{A} \quad I_{\text{B}} = 2\text{A}$		775 7		ns ns
$t_{\text{s}}$ $t_{\text{f}}$	INDUCTIVE LOAD Storage time Fall time	$V_{\text{GS}} = 10\text{V} \quad R_{\text{G}} = 47\Omega$ $V_{\text{Clamp}} = 720\text{V} \quad t_{\text{p}} = 4\mu\text{s}$ $I_{\text{C}} = 10\text{A} \quad I_{\text{B}} = 1\text{A}$		510 5		ns ns
$V_{\text{CS(dyn)}}$	Collector-source dynamic voltage (500ns)	$V_{\text{CC}} = V_{\text{Clamp}} = 400\text{V}$ $V_{\text{GS}} = 10\text{V} \quad I_{\text{C}} = 10\text{A}$ $I_{\text{B}} = 2\text{A} \quad R_{\text{G}} = 47\Omega$ $t_{\text{peak}} = 500\text{ns} \quad I_{\text{Bpeak}} = 10\text{A}$		2.3		V

Table 4. Electrical characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CS(dyn)}$	Collector-source dynamic voltage (1 $\mu$ s)	$V_{CC} = V_{Clamp} = 400V$ $V_{GS} = 10V$ $I_C = 10A$ $I_B = 2A$ $R_G = 47\Omega$ $t_{peak} = 500ns$ $I_{Bpeak} = 10A$		1		V
$V_{CSW}$	Maximum collector-source voltage switched without snubber	$R_G = 47\Omega$ $h_{FE} = 5$ $I_C = 20A$	900			V

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

## 2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

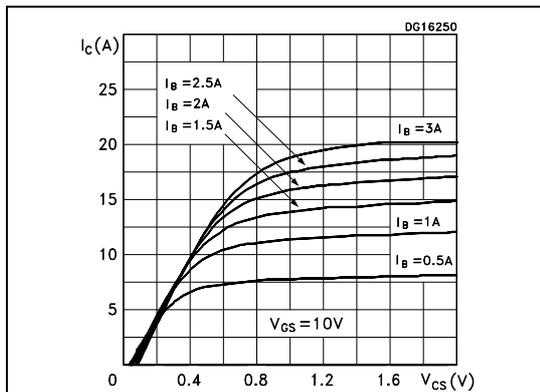


Figure 2. Dynamic collector-source saturation voltage

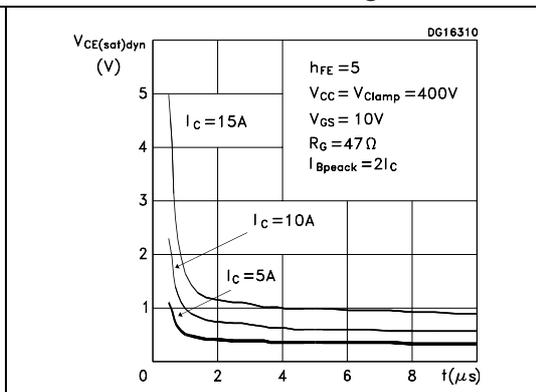


Figure 3. DC current gain

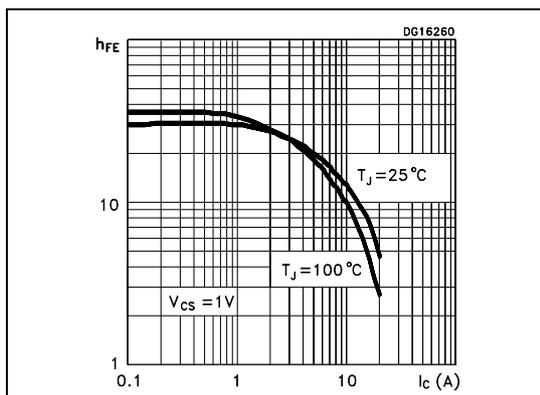


Figure 4. Gate threshold voltage vs temperature

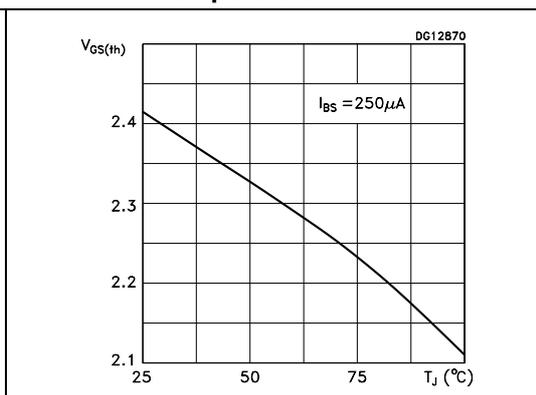


Figure 5. Collector-source On voltage Figure 6. Collector-source On voltage

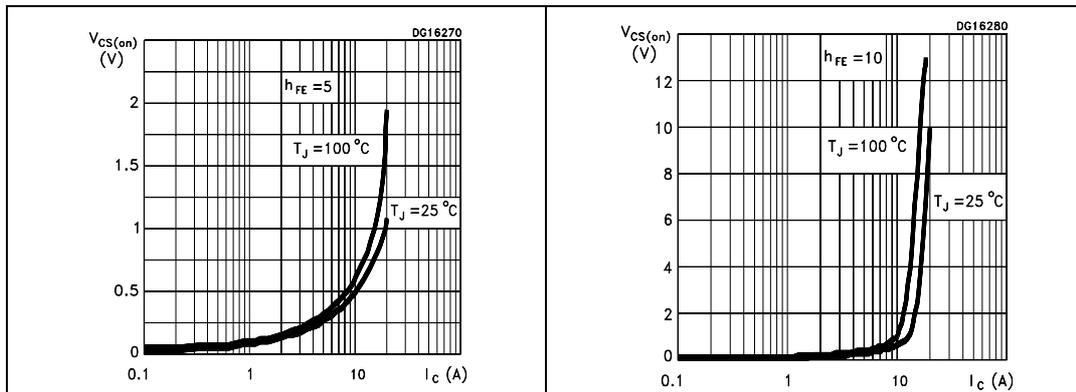


Figure 7. Base-source On voltage Figure 8. Base-source On voltage

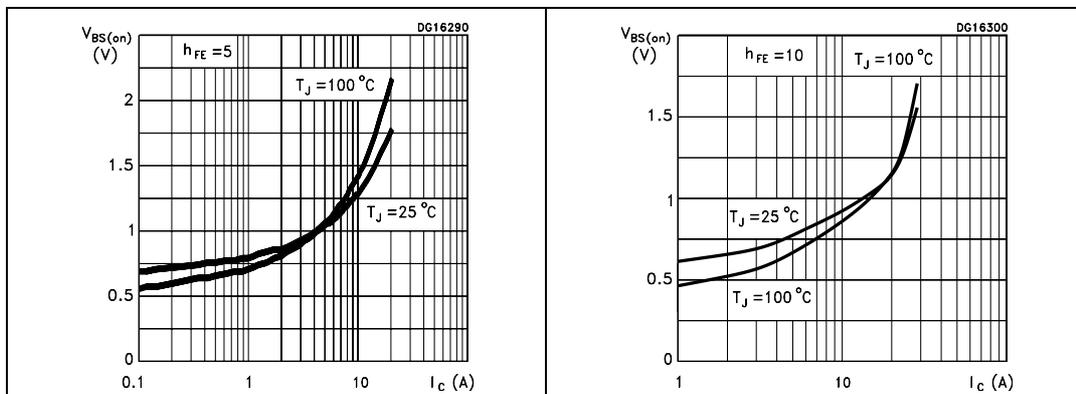
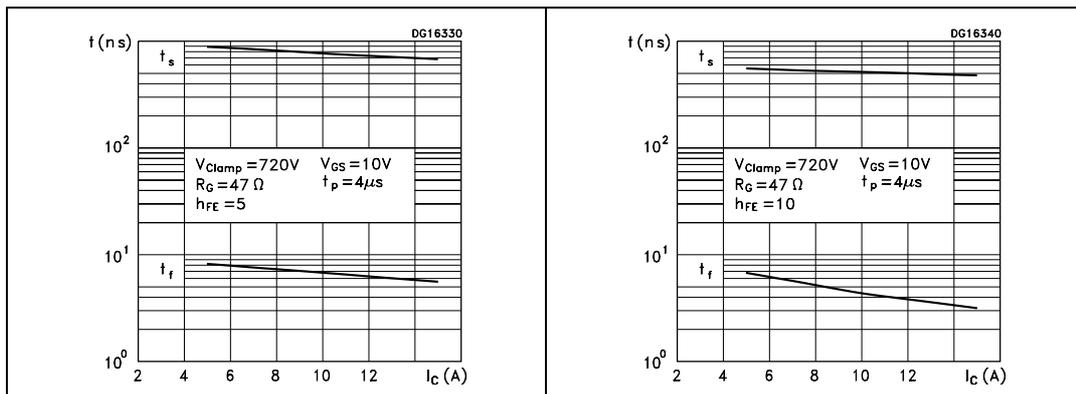
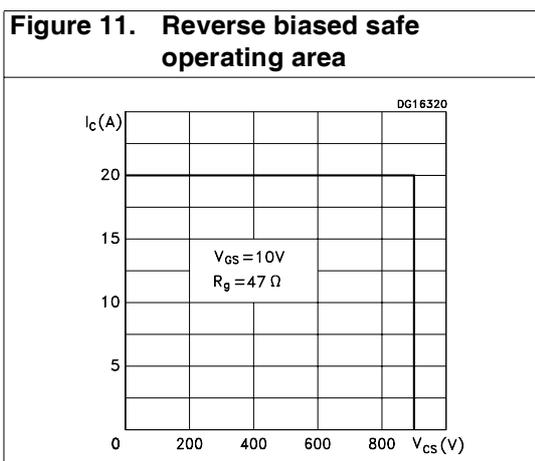


Figure 9. Inductive load switching time Figure 10. Inductive load switching time



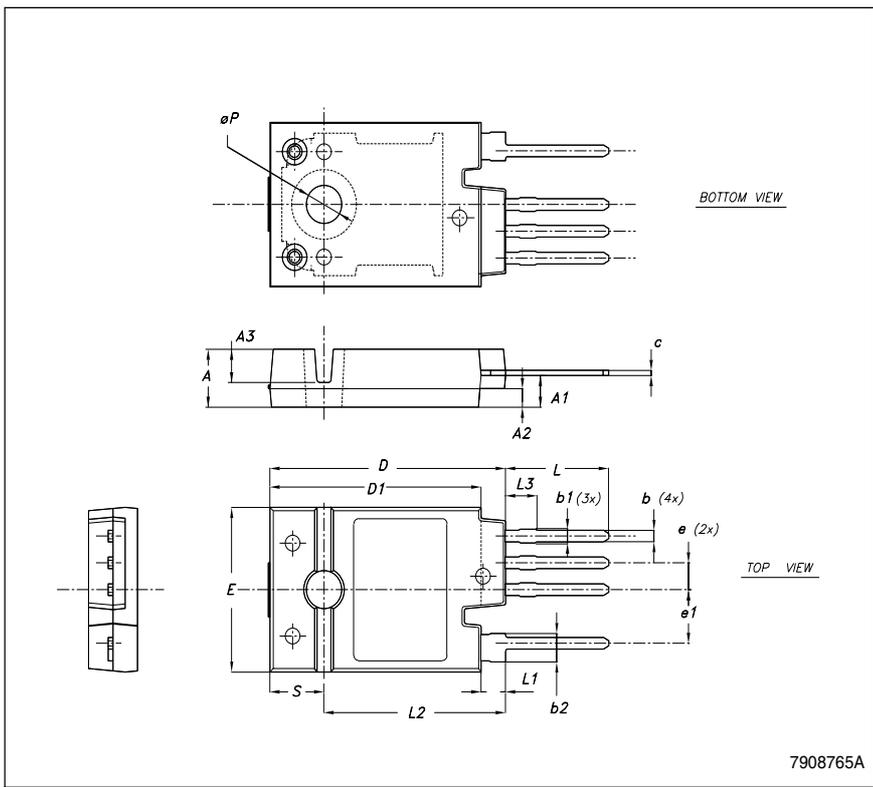


### 3 Package mechanical data

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
10-Oct-2006	1	First release.

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