



# STP12IE90F4

Emitter Switched Bipolar Transistor  
ESBT® 900 V - 12 A - 0.083 Ω

## General features

$V_{CS(ON)}$	$I_C$	$R_{CS(ON)}$
1V	12A	0.083 Ω

- High voltage / high current Cascode configuration
- Low equivalent on resistance
- Very fast-switch up to 150 kHz
- Squared RBSOA up to 900V
- Very low  $C_{iss}$  driven by  $R_G = 47\Omega$
- Very low turn-off cross over time

## Applications

- Flyback SMPS for adapter
- Flyback / forward SMPS for desktop

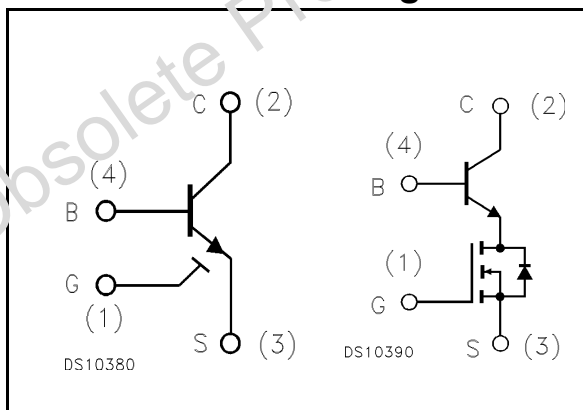
## Description

The STP12IE90F4 is manufactured in Monolithic ESBT Technology, aimed to provide best performances in high frequency / high voltage applications.

It is designed for use in Gate Driver, based topologies.



## Internal schematic diagrams



## Order codes

Part Number	Marking	Package	Packing
STP12IE90F4	P12IE90F4	TO220FP-4L	Tube

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# 1 Electrical ratings

**Table 1. Absolute maximum rating**

Symbol	Parameter	Value	Unit
$V_{CS(SS)}$	Collector-source voltage ( $V_{BS} = V_{GS} = 0\text{ V}$ )	900	V
$V_{BS(OS)}$	Base-source voltage ( $I_C = 0, V_{GS} = 0\text{ V}$ )	30	V
$V_{SB(OS)}$	Source-base voltage ( $I_C = 0, V_{GS} = 0\text{ V}$ )	17	V
$V_{GS}$	Gate-source voltage	$\pm 17$	V
$I_C$	Collector current	12	A
$I_{CM}$	Collector peak current ( $t_P < 5\text{ms}$ )	36	A
$I_B$	Base current	6	A
$I_{BM}$	Base peak current ( $t_P < 5\text{ms}$ )	10	A
$P_{tot}$	Total dissipation at $T_c = 25^\circ\text{C}$	21	W
$T_{stg}$	Storage temperature	-40 to 150	$^\circ\text{C}$
$T_J$	Max. operating junction temperature	150	$^\circ\text{C}$

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	6	$^\circ\text{C/W}$

## 2 Electrical characteristics

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

**Table 3. Electrical characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{\text{CS(SS)}}$	Collector-source current ( $V_{\text{BS}} = V_{\text{GS}} = 0$ )	$V_{\text{CE}} = 900\text{V}$			100	$\mu\text{A}$
$I_{\text{BS(OS)}}$	Base-source current ( $I_{\text{C}} = 0, V_{\text{GS}} = 0$ )	$V_{\text{BS(OS)}} = 30\text{V}$			10	$\mu\text{A}$
$I_{\text{SB(OS)}}$	Source-base current ( $I_{\text{C}} = 0, V_{\text{GS}} = 0$ )	$V_{\text{SB(OS)}} = 17\text{V}$			100	$\mu\text{A}$
$I_{\text{GS(OS)}}$	Gate-source leakage	$V_{\text{GS}} = \pm 17\text{V}$			100	nA
$V_{\text{CS(ON)}}$	Collector-source ON voltage	$V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 12\text{A}$ $I_{\text{B}} = 2.4\text{A}$ $V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 6\text{A}$ $I_{\text{B}} = 0.6\text{A}$		1 0.6		V V
$h_{\text{FE}}$	DC current gain	$V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 12\text{A}$ $V_{\text{CS}} = 1\text{V}$ $V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 6\text{A}$ $V_{\text{CS}} = 1\text{V}$		5 15		
$V_{\text{BS(ON)}}$	Base Source ON voltage	$V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 12\text{A}$ $I_{\text{B}} = 2.4\text{A}$ $V_{\text{GS}} = 10\text{V}$ $I_{\text{C}} = 6\text{A}$ $I_{\text{B}} = 0.6\text{A}$		1.5 1.2		V V
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{BS}} = V_{\text{GS}}$ $I_{\text{B}} = 250\mu\text{A}$	2	3	4	V
$C_{\text{iss}}$	Input capacitance	$V_{\text{CS}} = 25\text{V}$ $f = 1\text{MHz}$ $V_{\text{GS}} = 0\text{V}$		520		pF
$Q_{\text{GS(tot)}}$	Gate-source Charge	$V_{\text{CS}} = 25\text{V}$ $V_{\text{GS}} = 10\text{V}$ $V_{\text{CB}} = 0\text{V}$ $I_{\text{C}} = 4\text{A}$		21.3		nC
$t_{\text{s}}$ $t_{\text{f}}$	INDUCTIVE LOAD Storage time Fall time	$V_{\text{GS}} = 10\text{V}$ $R_{\text{G}} = 47\Omega$ $V_{\text{Clamp}} = 720\text{V}$ $t_{\text{p}} = 4\mu\text{s}$ $I_{\text{C}} = 6\text{A}$ $I_{\text{B}} = 1.2\text{A}$		610 10		ns ns
$t_{\text{s}}$ $t_{\text{f}}$	INDUCTIVE LOAD Storage time Fall time	$V_{\text{GS}} = 10\text{V}$ $R_{\text{G}} = 47\Omega$ $V_{\text{Clamp}} = 720\text{V}$ $t_{\text{p}} = 4\mu\text{s}$ $I_{\text{C}} = 6\text{A}$ $I_{\text{B}} = 0.6\text{A}$		360 10		ns ns
$V_{\text{CSW}}$	Maximum collector-source voltage switched without snubber	$R_{\text{G}} = 47\Omega$ $h_{\text{FE}} = 5$ $I_{\text{C}} = 12\text{A}$	900			V

Table 3. Electrical characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CS(dyn)}$	Collector-source dynamic voltage (500ns)	$V_{CC} = V_{Clamp} = 400V$ $V_{GS} = 10V$ $I_C = 6A$ $I_B = 1.2A$ $t_{peak} = 500ns$ $R_G = 47\Omega$ $I_{Bpeak} = 6A (I_C)$		3.37		V
$V_{CS(dyn)}$	Collector-source dynamic voltage (1 $\mu$ s)	$V_{CC} = V_{Clamp} = 400V$ $V_{GS} = 10V$ $I_C = 6A$ $I_B = 1.2A$ $t_{peak} = 500ns$ $R_G = 47\Omega$ $I_{Bpeak} = 6A (I_C)$		1.75		V

## 2.1 Electrical characteristics (curves)

Figure 1. DC current gain

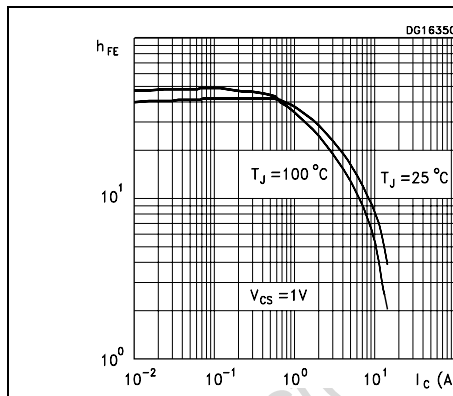


Figure 2. Collector-source On voltage

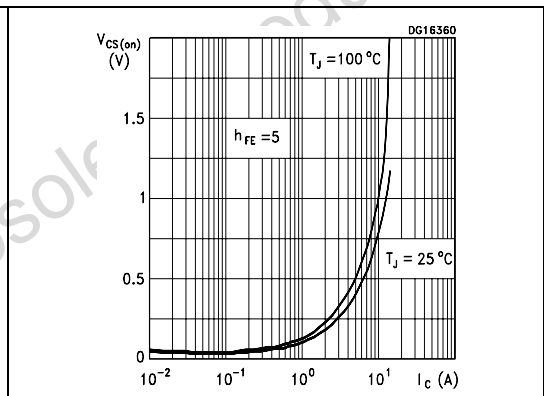


Figure 3. Collector-source On voltage

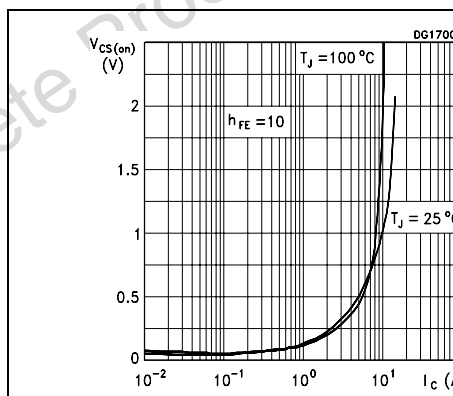


Figure 4. Base-source On voltage

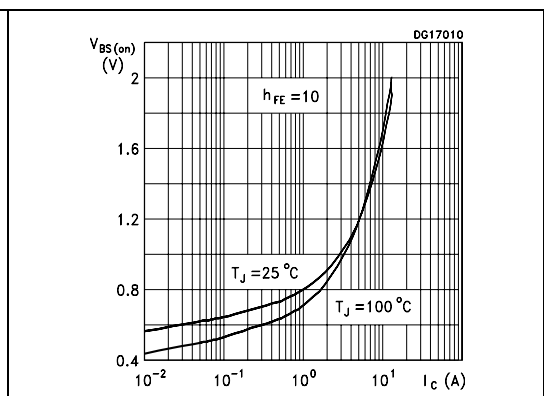


Figure 5. Reverse biased SOA

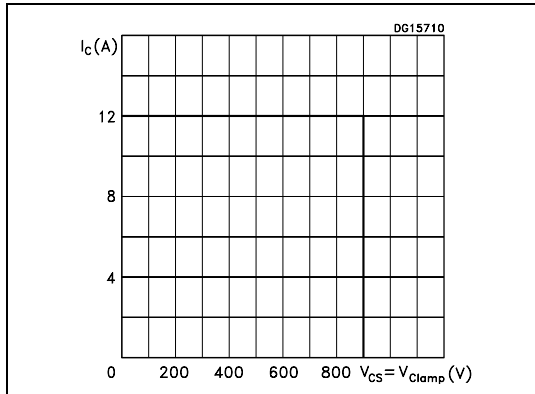


Figure 6. Dynamic collector-emitter voltage

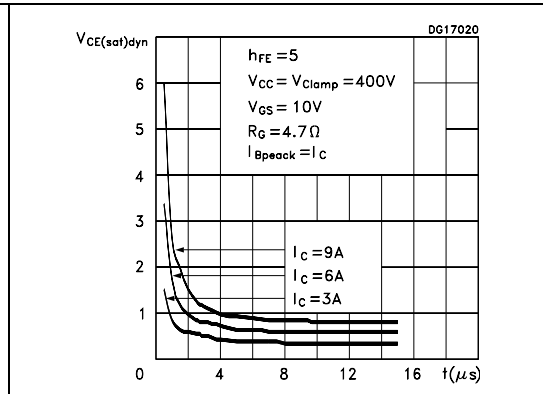
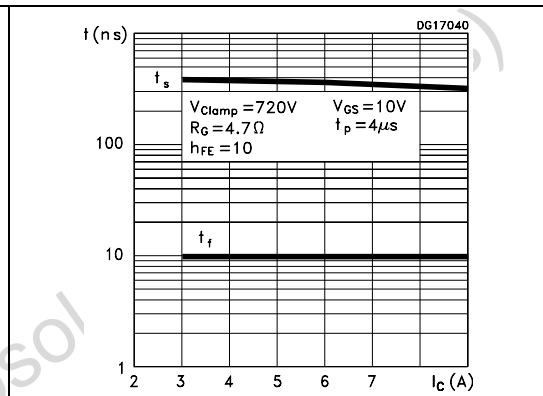
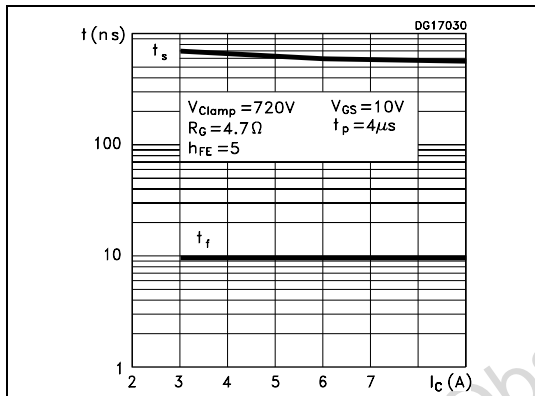


Figure 7. Inductive load switching time Figure 8. Inductive load switching time



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## 2.2 Test circuits

Figure 9. Static  $V_{CS(ON)}$  test circuits

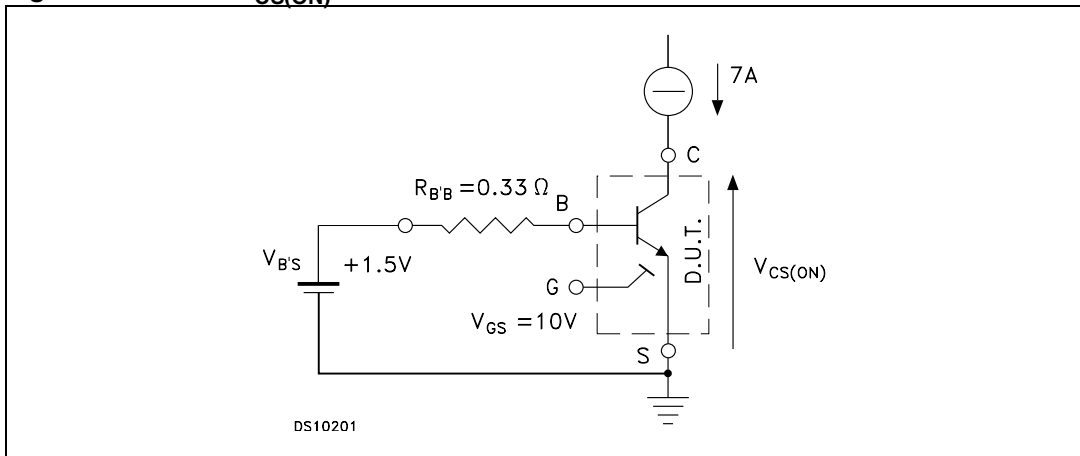
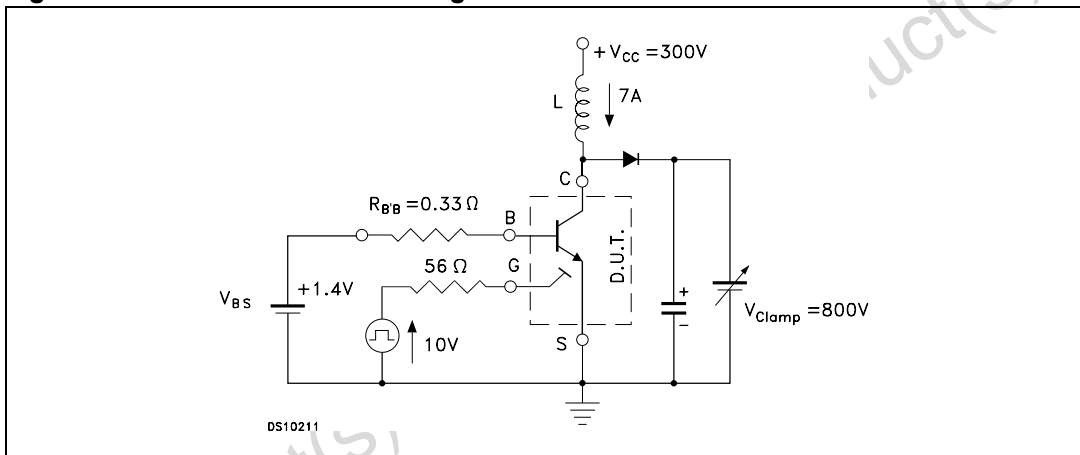


Figure 10. Inductive load switching and RBSOA test circuit



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### 3 Package mechanical data

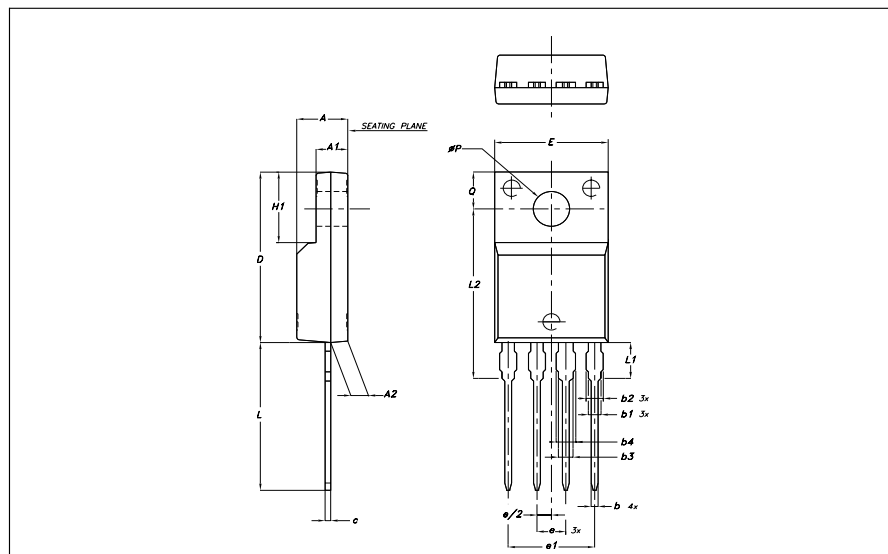
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**TO220FP-4L MECHANICAL DATA**

DIM.	mm.		
	MIN.	TYP	MAX.
A	4.30		4.70
A1	2.60		3
A2	1.30	1.50	1.70
b	0.50		0.70
b1	1.05		
b2			1.30
b3	1.25		
b4			1.50
c	0.45	0.50	0.60
D	15.50		15.90
E	9.80		10.20
e	2.29	2.54	2.79
e1		7.62	
H1	6.30		6.70
L		13.60	
L1		3.30	
L2	15.40		15.80
Dia P	3		3.40
Q	3.30		3.50



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## 4 Revision history

**Table 4. Revision history**

Date	Revision	Changes
28-Jul-2006	1	Initial release.
16-Jan-2007	2	New graphics

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