

## High performance low voltage NPN transistor

### Features

- Very low collector to emitter saturation voltage
- DC current gain,  $h_{FE} > 100$
- 3 A continuous collector current
- 40 V breakdown voltage  $V_{(BR)CER}$

### Applications

- Power management in portable equipment
- Voltage regulation in bias supply circuits
- Switching regulator in battery charger applications
- Heavy load driver

### Description

The device is manufactured in low voltage NPN planar technology by using a "Base Island" layout. The resulting transistor shows exceptional high gain performance coupled with very low saturation voltage.

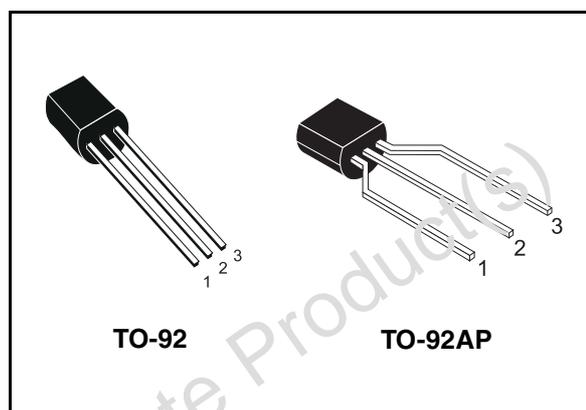


Figure 1. Internal schematic diagram

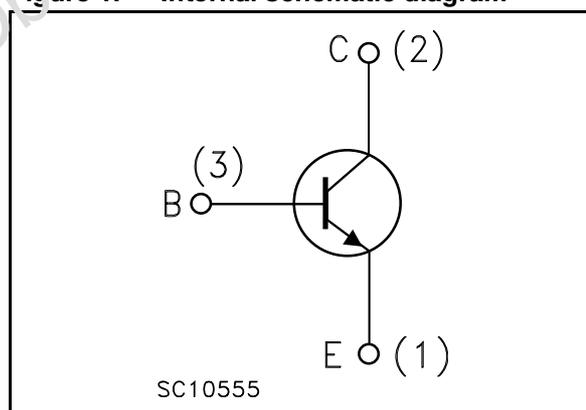


Table 1. Device summary

Order code	Marking	Package	Packaging
STX690A	X690A	TO-92	Bulk
STX690A-AP	X690A	TO-92 AP	Ammopack

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CBO}$	Collector-base voltage ( $I_E = 0$ )	40	V
$V_{CER}$	Collector-emitter voltage ( $R_{BE} = 47 \Omega$ )	40	V
$V_{CEO}$	Collector-emitter voltage ( $I_B = 0$ )	30	V
$V_{EBO}$	Emitter-base voltage ( $I_C = 0$ )	5	V
$I_C$	Collector current	3	A
$I_{CM}$	Collector peak current ( $t_p < 5$ ms)	6	A
$P_{tot}$	Total dissipation at $T_{amb} = 25$ °C	0.9	W
$T_{stg}$	Storage temperature	-65 to 150	°C
$T_J$	Max. operating junction temperature	150	°C

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-amb}$	Thermal resistance junction-ambient max	139	°C/W

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CBO}}$	Collector cut-off current ( $I_{\text{E}} = 0$ )	$V_{\text{CB}} = 30\text{ V}$			10	$\mu\text{A}$
		$V_{\text{CB}} = 30\text{ V}; T_{\text{C}} = 100\text{ °C}$			100	$\mu\text{A}$
$I_{\text{EBO}}$	Emitter cut-off current ( $I_{\text{C}} = 0$ )	$V_{\text{EB}} = 4\text{ V}$			10	$\mu\text{A}$
$V_{(\text{BR})\text{CEO}}^{(1)}$	Collector-emitter breakdown voltage ( $I_{\text{B}} = 0$ )	$I_{\text{C}} = 10\text{ mA}$	30			V
$V_{(\text{BR})\text{CER}}^{(1)}$	Collector-emitter breakdown voltage ( $R_{\text{BE}} = 47\ \Omega$ )	$I_{\text{C}} = 10\text{ mA}$	40			V
$V_{(\text{BR})\text{CBO}}$	Collector-base breakdown voltage ( $I_{\text{E}} = 0$ )	$I_{\text{C}} = 100\ \mu\text{A}$	40			V
$V_{(\text{BR})\text{EBO}}$	Emitter-base breakdown voltage ( $I_{\text{C}} = 0$ )	$I_{\text{E}} = 100\ \mu\text{A}$	5			V
$V_{\text{CE}(\text{sat})}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 5\text{ mA}$		0.08	0.15	V
		$I_{\text{C}} = 1.2\text{ A}$ $I_{\text{B}} = 20\text{ mA}$		0.1	0.22	V
		$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 20\text{ mA}$		0.175	0.35	V
		$I_{\text{C}} = 3\text{ A}$ $I_{\text{B}} = 100\text{ mA}$		0.2	0.4	V
		$I_{\text{C}} = 3\text{ A}$ $I_{\text{B}} = 100\text{ mA}$ $T_{\text{C}} = 100\text{ °C}$		0.3		V
$V_{\text{BE}(\text{sat})}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 10\text{ mA}$		0.8	1	V
$V_{\text{BE}(\text{on})}^{(1)}$	Base-emitter on voltage	$I_{\text{C}} = 1\text{ A}$ $V_{\text{CE}} = 2\text{ V}$		0.8	1	V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 10\text{ mA}$ $V_{\text{CE}} = 2\text{ V}$	100	200	400	
		$I_{\text{C}} = 500\text{ mA}$ $V_{\text{CE}} = 2\text{ V}$	100	200	400	
		$I_{\text{C}} = 1\text{ A}$ $V_{\text{CE}} = 2\text{ V}$	100			
		$I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 1\text{ V}$	100	160		
		$I_{\text{C}} = 3\text{ A}$ $V_{\text{CE}} = 1\text{ V}$	90	130		

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$f_t$	Transition frequency	$I_C = 50 \text{ mA}$ $V_{CE} = 5 \text{ V}$ $f = 50 \text{ MHz}$		100		MHz
$t_d$	Resistive load Delay time	$I_C = 3 \text{ A}$ $V_{CC} = 20 \text{ V}$		50		ns
$t_r$	Rise time	$I_{B1} = -I_{B2} = 60 \text{ mA}$		120		ns
$t_s$	Storage time	see <a href="#">Figure 8</a>		465		ns
$t_f$	Fall time			80		ns

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

## 2.1 Electrical characteristics (curves)

Figure 2. DC current gain

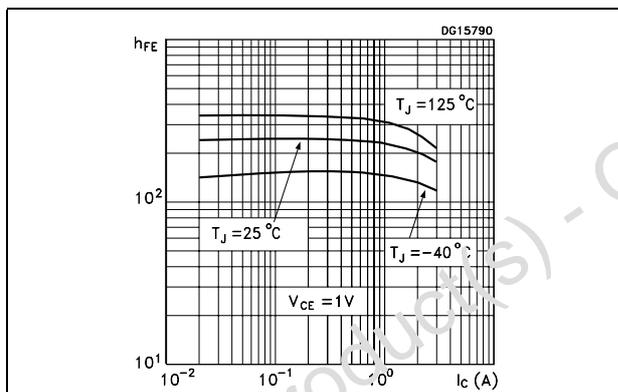


Figure 3. DC current gain

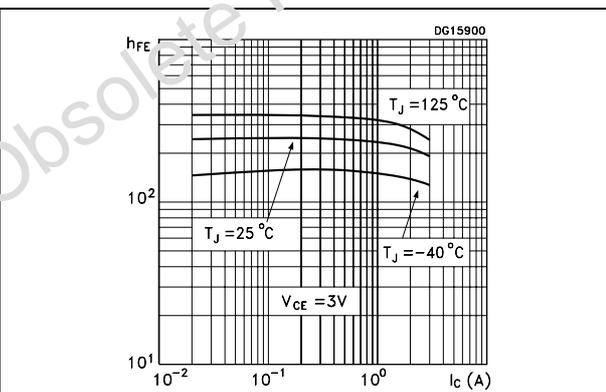


Figure 4. Collector-emitter saturation voltage

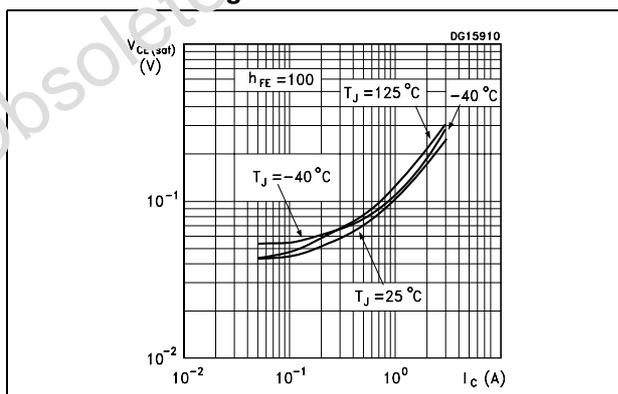


Figure 5. Base-emitter saturation voltage

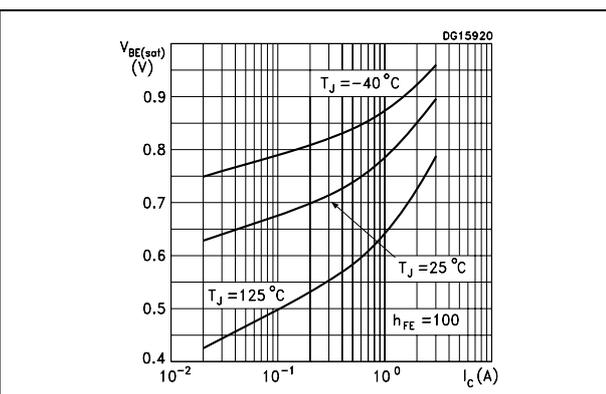


Figure 6. Switching time resistive load

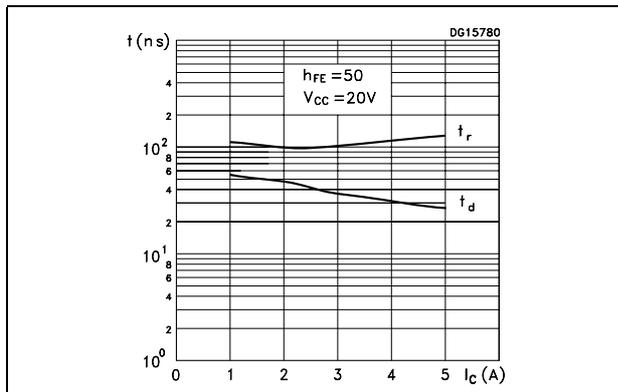
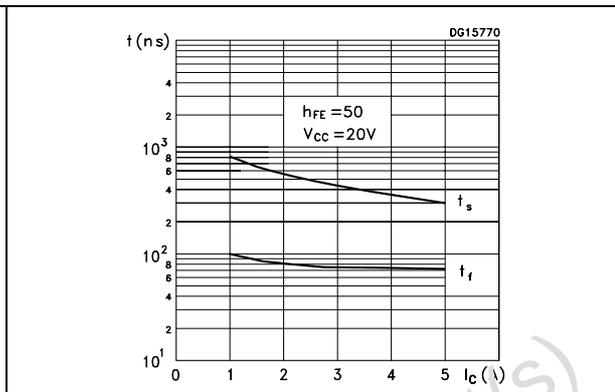
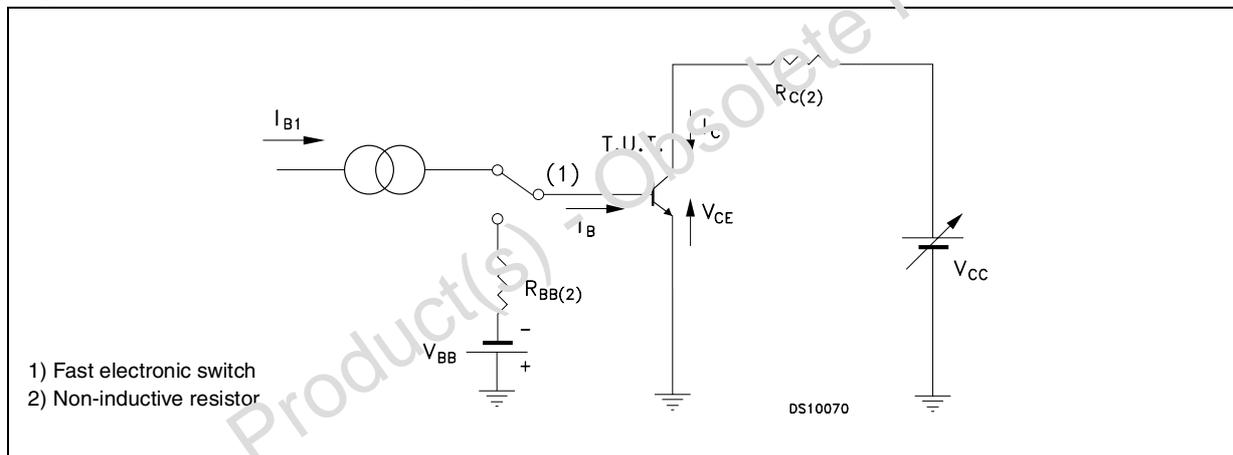


Figure 7. Switching time resistive load



## 2.2 Test circuit

Figure 8. Resistive load switching test circuit



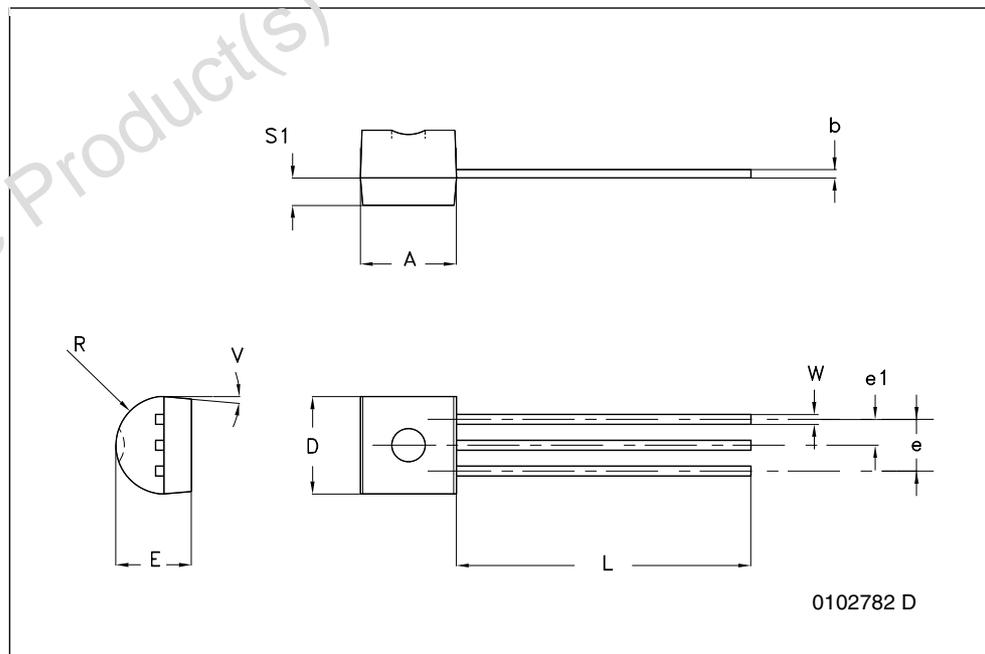
### 3 Package mechanical data

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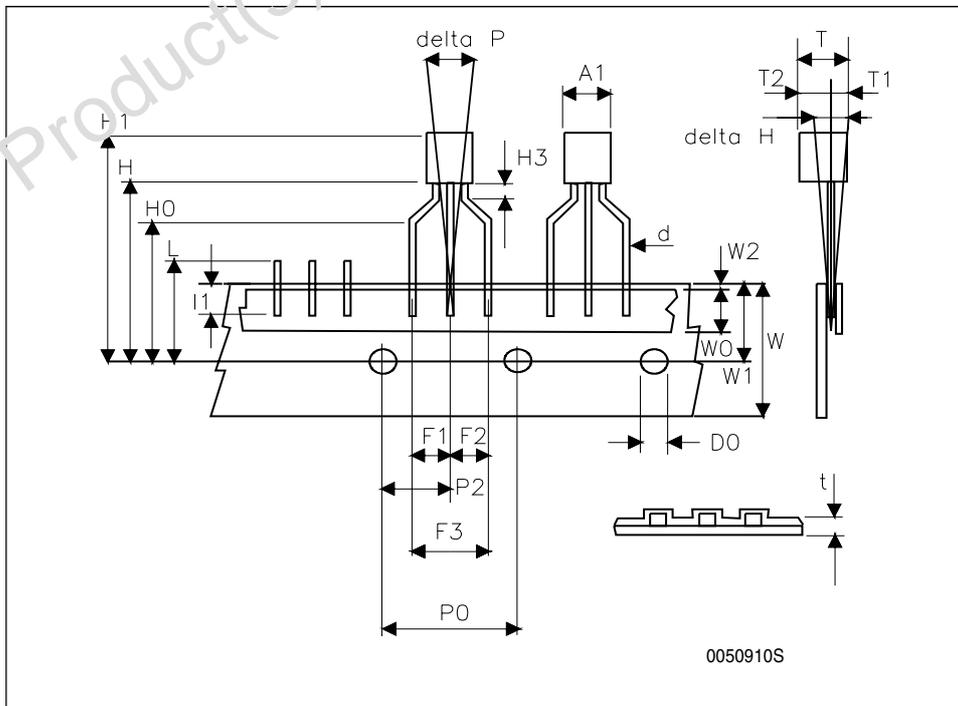
## TO-92 bulk shipment mechanical data

DIM.	mm.		
	MIN.	TYP	MAX.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
e	2.41		2.67
e1	1.14		1.40
L	12.70		15.49
R	2.16		2.41
S1	0.92		1.52
W	0.41		0.56
V		5°	



TO-92 ammpack shipment (suffix"-AP") mechanical data

Dim.	mm		
	Min	Typ	Max
A1			4.80
T			3.80
T1			1.60
T2			2.30
d			0.48
P0	12.50	12.70	12.90
P2	5.65	6.35	7.05
F1,F2	2.44	2.54	2.94
F3	4.98	5.08	5.48
delta H	-2.00		2.00
W	17.50	18.00	19.00
W0	5.70	6.00	6.30
W1	8.50	9.00	9.25
W2			0.50
H	18.50		20.50
H3	0.5		1.5
H0	15.50	16.00	16.50
H1			25.00
D0	3.80	4.00	4.20
t			0.90
L			11.00
l1	3.00		
delta P	-1.00		1.00



## 4 Revision history

Table 5. Document revision history

Date	Revision	Changes
09-Feb-2009	1	Initial release.

Obsolete Product(s) - Obsolete Product(s)

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