

## Medium current, high performance, low voltage PNP 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 devices are manufactured in low voltage PNP planar technology by using a "Base Island" layout. The resulting transistor shows exceptional high gain performance coupled with very low saturation voltage. The STX790AG-AP is supplied using halogen-free molding compound.

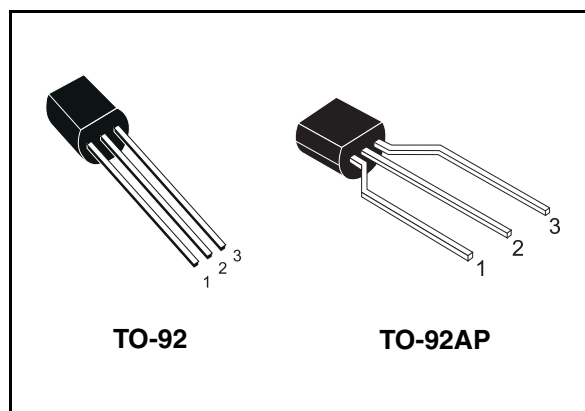


Figure 1. Internal schematic diagram

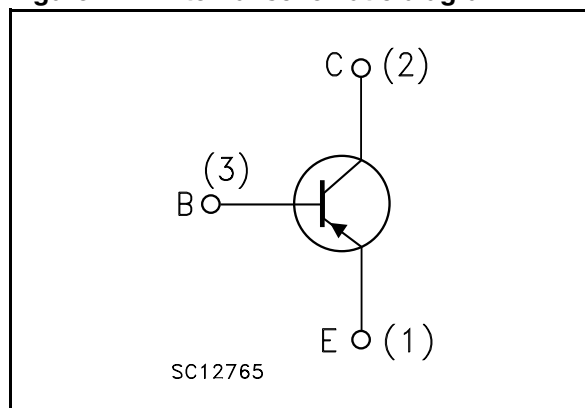


Table 1. Device summary

| Order codes | Marking | Packages | Packaging |
|-------------|---------|----------|-----------|
| STX790A     | X790A   | TO-92    | Bulk      |
| STX790A-AP  | X790A   | TO-92 AP | Ammopack  |
| STX790AG-AP | X790AG  | 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 ( $t_P < 5\text{ ms}$ )      | -6         | A                |
| $P_{tot}$ | Total dissipation at $T_{amb} = 25\ ^\circ\text{C}$ | 0.9        | W                |
| $T_{stg}$ | Storage temperature                                 | -65 to 150 | $^\circ\text{C}$ |
| $T_J$     | Max. operating junction temperature                 | 150        | $^\circ\text{C}$ |

**Table 3. Thermal data**

| Symbol         | Parameter                               | Value | Unit               |
|----------------|-----------------------------------------|-------|--------------------|
| $R_{thj-case}$ | Thermal resistance junction-case max    | 44.6  | $^\circ\text{C/W}$ |
| $R_{thj-amb}$  | Thermal resistance junction-ambient max | 139   | $^\circ\text{C/W}$ |

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

| Symbol                            | Parameter                                                                        | Test conditions                                                                                                                                                                                                                                                                                                                                                              | Min.                           | Typ.                     | Max.                                   | Unit                           |
|-----------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------|----------------------------------------|--------------------------------|
| $I_{\text{CBO}}$                  | Collector cut-off current<br>( $I_{\text{E}} = 0$ )                              | $V_{\text{CB}} = -30\text{ V}$<br>$V_{\text{CB}} = -30\text{ V}; T_{\text{C}} = 100\text{ }^{\circ}\text{C}$                                                                                                                                                                                                                                                                 |                                |                          | -10<br>-100                            | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{\text{EBO}}$                  | Emitter cut-off current<br>( $I_{\text{C}} = 0$ )                                | $V_{\text{EB}} = -4\text{ V}$                                                                                                                                                                                                                                                                                                                                                |                                |                          | -10                                    | $\mu\text{A}$                  |
| $V_{(\text{BR})\text{CEO}}^{(1)}$ | Collector-emitter<br>breakdown voltage<br>( $I_{\text{B}} = 0$ )                 | $I_{\text{C}} = -10\text{ mA}$                                                                                                                                                                                                                                                                                                                                               | -30                            |                          |                                        | V                              |
| $V_{(\text{BR})\text{CER}}^{(1)}$ | Collector-emitter<br>breakdown voltage<br>( $R_{\text{BE}} = 47\text{ }\Omega$ ) | $I_{\text{C}} = -10\text{ mA}$                                                                                                                                                                                                                                                                                                                                               | -40                            |                          |                                        | V                              |
| $V_{(\text{BR})\text{CBO}}$       | Collector-base<br>breakdown voltage<br>( $I_{\text{E}} = 0$ )                    | $I_{\text{C}} = -100\text{ }\mu\text{A}$                                                                                                                                                                                                                                                                                                                                     | -40                            |                          |                                        | V                              |
| $V_{(\text{BR})\text{EBO}}$       | Emitter-base breakdown<br>voltage ( $I_{\text{C}} = 0$ )                         | $I_{\text{E}} = -100\text{ }\mu\text{A}$                                                                                                                                                                                                                                                                                                                                     | -5                             |                          |                                        | V                              |
| $V_{\text{CE(sat)}}^{(1)}$        | Collector-emitter<br>saturation voltage                                          | $I_{\text{C}} = -0.5\text{ A}$ $I_{\text{B}} = -5\text{ mA}$<br>$I_{\text{C}} = -1.2\text{ A}$ $I_{\text{B}} = -20\text{ mA}$<br>$I_{\text{C}} = -2\text{ A}$ $I_{\text{B}} = -20\text{ mA}$<br>$I_{\text{C}} = -3\text{ A}$ $I_{\text{B}} = -100\text{ mA}$<br>$I_{\text{C}} = -3\text{ A}$ $I_{\text{B}} = -100\text{ mA}$<br>$T_{\text{C}} = 100\text{ }^{\circ}\text{C}$ |                                |                          | -0.15<br>-0.25<br>-0.5<br>-0.7<br>-0.9 | V<br>V<br>V<br>V<br>V          |
| $V_{\text{BE(sat)}}^{(1)}$        | Base-emitter saturation<br>voltage                                               | $I_{\text{C}} = -1\text{ A}$ $I_{\text{B}} = -10\text{ mA}$                                                                                                                                                                                                                                                                                                                  |                                | -0.8                     | -1                                     | V                              |
| $V_{\text{BE(on)}}^{(1)}$         | 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                                                                  | $I_{\text{C}} = -10\text{ mA}$ $V_{\text{CE}} = -2\text{ V}$<br>$I_{\text{C}} = -500\text{ mA}$ $V_{\text{CE}} = -2\text{ V}$<br>$I_{\text{C}} = -1\text{ A}$ $V_{\text{CE}} = -2\text{ V}$<br>$I_{\text{C}} = -2\text{ A}$ $V_{\text{CE}} = -1\text{ V}$<br>$I_{\text{C}} = -3\text{ A}$ $V_{\text{CE}} = -1\text{ V}$                                                      | 100<br>100<br>100<br>100<br>90 | 200<br>200<br>160<br>130 | 400<br>400                             |                                |

Table 4. Electrical characteristics (continued)

| Symbol | Parameter                    | Test conditions                                                     | Min. | Typ. | Max. | Unit |
|--------|------------------------------|---------------------------------------------------------------------|------|------|------|------|
| $f_t$  | Transition frequency         | $I_C = -50\text{ mA}$ $V_{CE} = -5\text{ V}$<br>$f = 50\text{ MHz}$ |      | 100  |      | MHz  |
| $t_d$  | Resistive load<br>Delay time | $I_C = -3\text{ A}$ $V_{CC} = -20\text{ V}$                         |      | 180  | 220  | ns   |
| $t_r$  | Rise time                    | $I_{B1} = -I_{B2} = -60\text{ mA}$                                  |      | 160  | 210  | ns   |
| $t_s$  | Storage time                 | see <a href="#">Figure 8</a>                                        |      | 250  | 300  | ns   |
| $t_f$  | Fall time                    |                                                                     |      | 80   | 100  | ns   |

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

2.1 Electrical characteristics (curves)

Figure 2. DC current gain

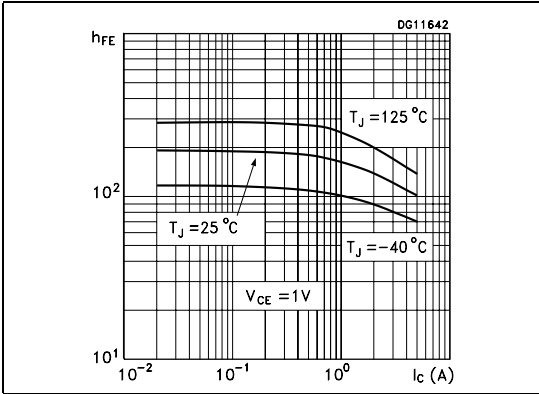


Figure 3. DC current gain

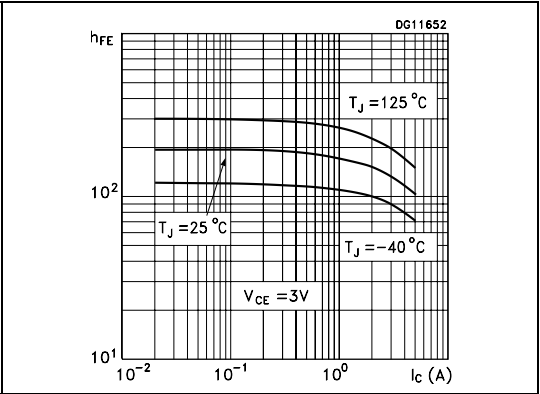


Figure 4. Collector-emitter saturation voltage

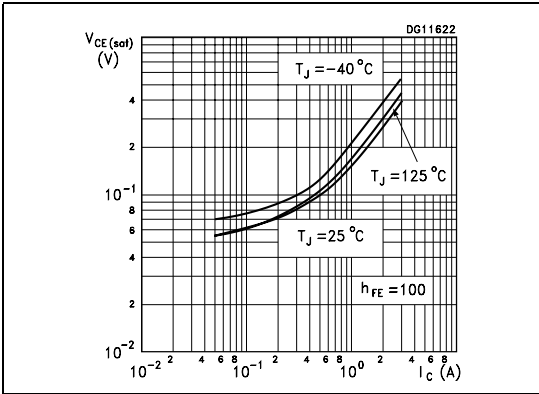


Figure 5. Base-emitter saturation voltage

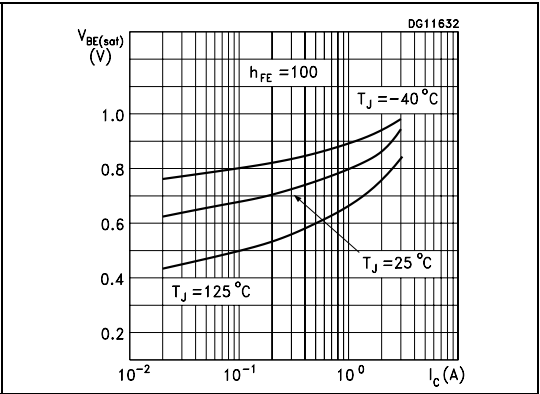
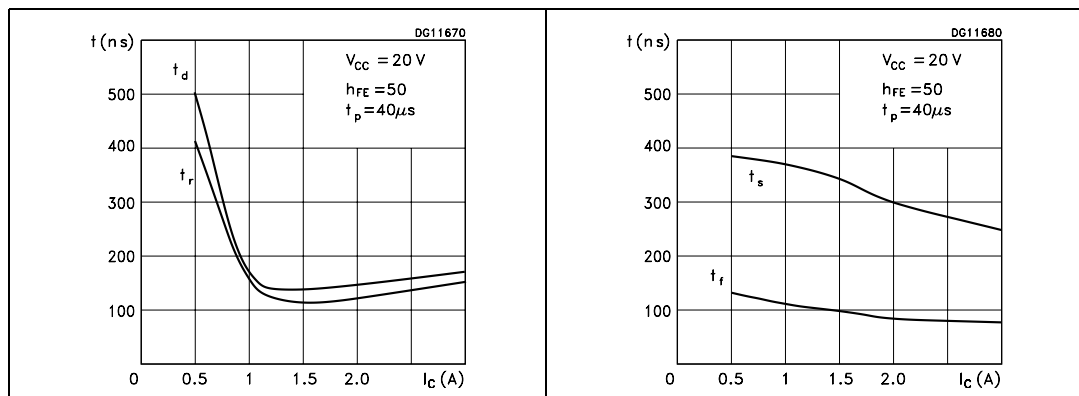
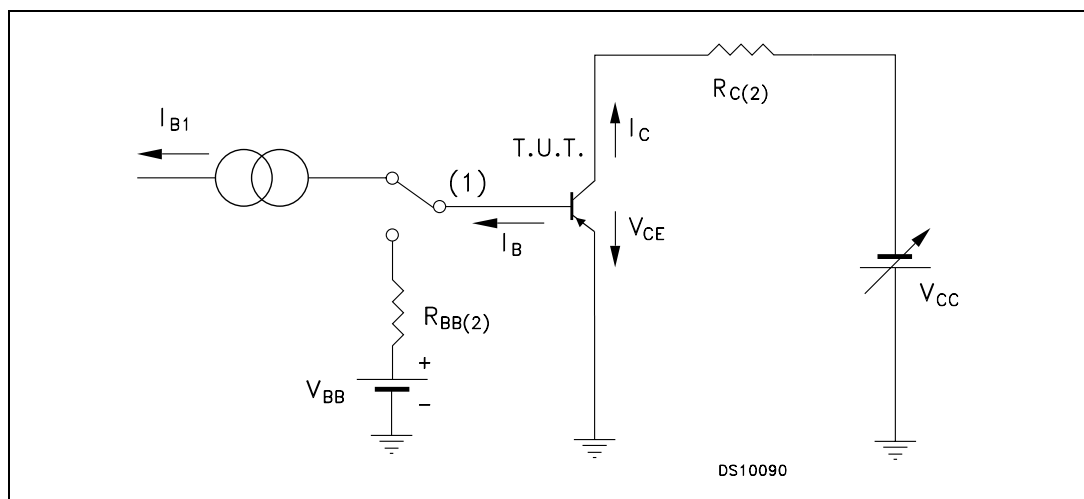


Figure 6. Switching time resistive load Figure 7. Switching time resistive load



## 2.2 Test circuit

Figure 8. Resistive load switching test circuit



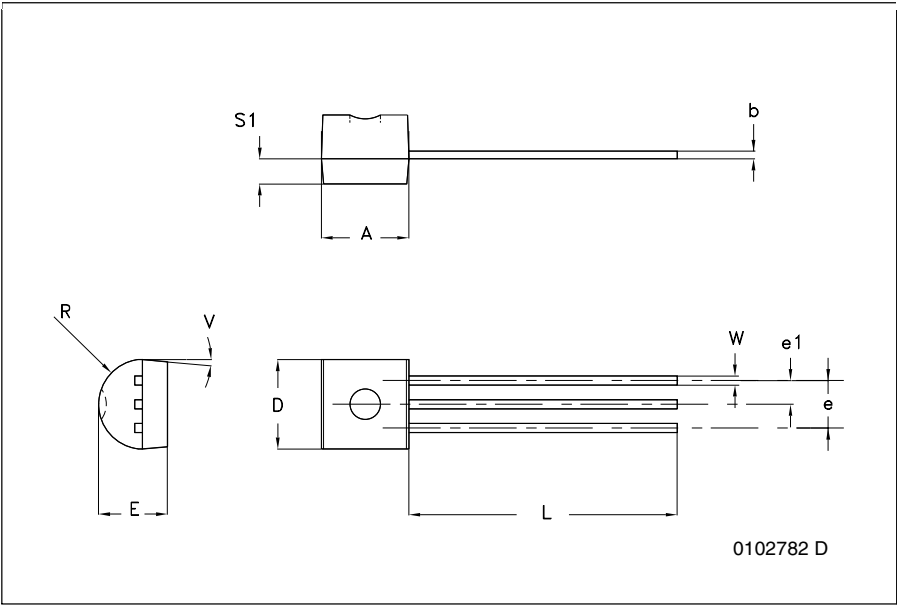
1. Fast electronic switch
2. Non-inductive resistor

### 3 Package mechanical data

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

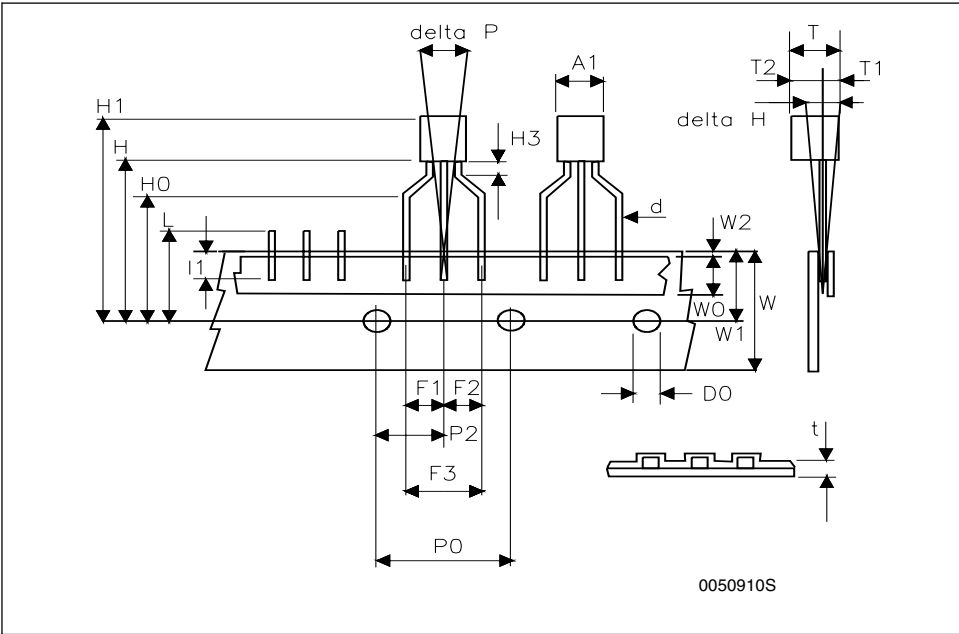
TO-92 bulk shipment mechanical data

| 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     | 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 |
| I1      | 3.00  |       |       |
| delta P | -1.00 |       | 1.00  |





## 4 Revision history

**Table 5. Document revision history**

| Date        | Revision | Changes                                                             |
|-------------|----------|---------------------------------------------------------------------|
| 24-Mar-2003 | 1        | Initial release.                                                    |
| 29-Mar-2006 | 2        | New template.                                                       |
| 25-Jun-2008 | 3        | Updated TO-92 mechanical data.                                      |
| 28-Apr-2009 | 4        | Added new order code STX790AG-AP <a href="#">Table 1 on page 1.</a> |

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