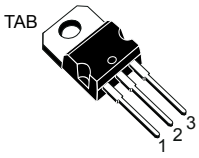
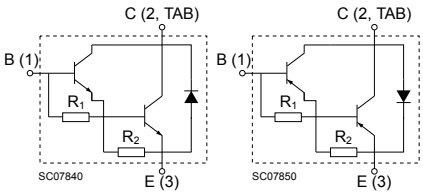
TIP120, TIP121, TIP122
TIP125, TIP127

Datasheet

Low voltage complementary power Darlington transistors



TO-220



NPN: R_1 = 7 kΩ, R_2 = 70 Ω PNP: R_1 = 16 kΩ, R_2 = 60 Ω

STPOWER

Product status links
TIP120
TIP121
TIP122
TIP125
TIP127

Features

- Low collector-emitter saturation voltage
- Complementary NPN - PNP transistors

Application

- General purpose linear and switching

Description

The devices are manufactured in planar technology with “base island” layout and monolithic Darlington configuration. The resulting transistors show exceptional high gain performance coupled with very low saturation voltage.

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter		Value			Unit
		NPN	TIP120	TIP121	TIP122	
		PNP	TIP125		TIP127	
V_{CBO}	Collector-base voltage (I_E = 0 A)		60	80	100	V
V_{CEO}	Collector-emitter voltage (I_B = 0 A)		60	80	100	V
V_{EBO}	Collector-base voltage (I_C = 0 A)		5			V
I_C	Collector current		5			A
I_{CM}	Collector peak current		8			A
I_B	Base current		0.12			A
P_{TOT}	Total power dissipation at $T_C \leq 25°C$		65			W
	Total power dissipation at $T_A \leq 25°C$		2			
T_{stg}	Storage temperature range		-65 to 150			°C
T_J	Maximum operating junction temperature		150			°C

Note: For PNP types voltage and current values are negative.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	1.92	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	62.5	°C/W

2 Electrical characteristics

T_C = 25°C unless otherwise specified.

Table 3. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cut-off current	I_B = 0 A, V_{CE} = 30 V for TIP120/125		-	0.5	mA
		I_B = 0 A, V_{CE} = 40 V for TIP121		-	0.5	
		I_B = 0 A, V_{CE} = 50 V for TIP122/127		-	0.5	
I_{CBO}	Collector cut-off current	I_B = 0 A, V_{CE} = 60 V for TIP120/125		-	0.2	mA
		I_B = 0 A, V_{CE} = 80 V for TIP121		-	0.2	
		I_B = 0 A, V_{CE} = 100 V for TIP122/127		-	0.2	
I_{EBO}	Emitter cut-off current	I_C = 0 A, V_{EB} = 5 V		-	2	mA
$V_{CEO(sus)}$(1)	Collector-emitter sustaining voltage	I_B = 0 A, I_C = 30 mA for TIP120/125	60	-		V
		I_B = 0 A, I_C = 30 mA for TIP121	80	-		
		I_B = 0 A, I_C = 30 mA for TIP122/127	100	-		
$V_{CE(sat)}$(1)	Collector-emitter saturation voltage	I_C = 3 A, I_B = 12 mA		-	2	V
		I_C = 5 A I_B = 20 mA		-	4	
$V_{BE(on)}$(1)	Base-emitter on voltage	I_C = 3 A, V_{CE} = 3 V		-	2.5	V
h_{FE}(1)	DC current gain	I_C = 0.5 A, V_{CE} = 3 V	1000	-		
		I_C = 3 A, V_{CE} = 3 V	1000	-		

1. *Pulsed: Pulse duration ≤ 300 µs, duty cycle ≤ 2%.*

Note: For PNP types voltage and current values are negative.

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

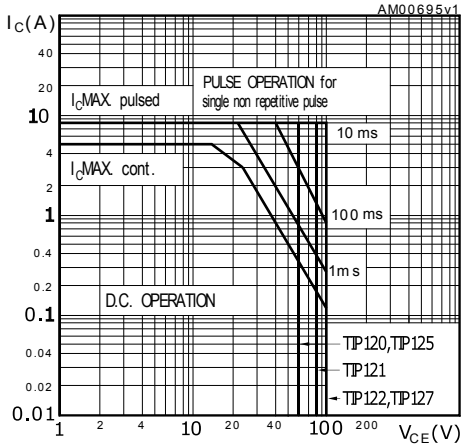


Figure 2. Derating curve

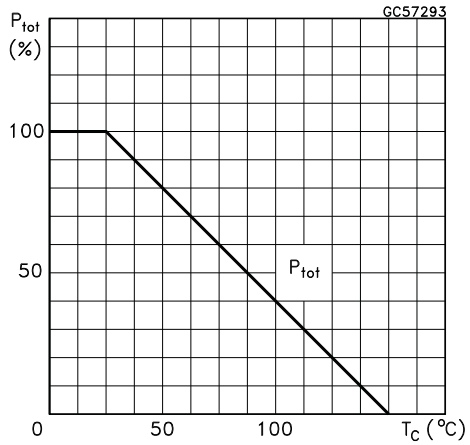


Figure 3. DC current gain (NPN)

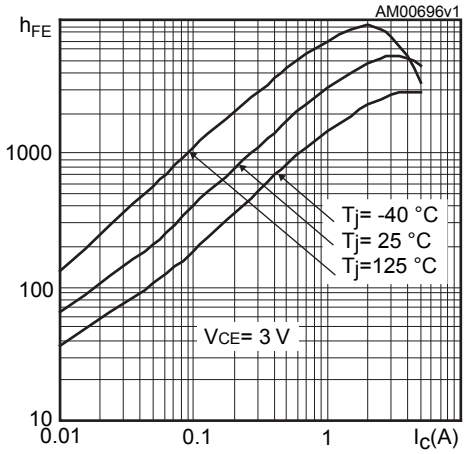


Figure 4. DC current gain (PNP)

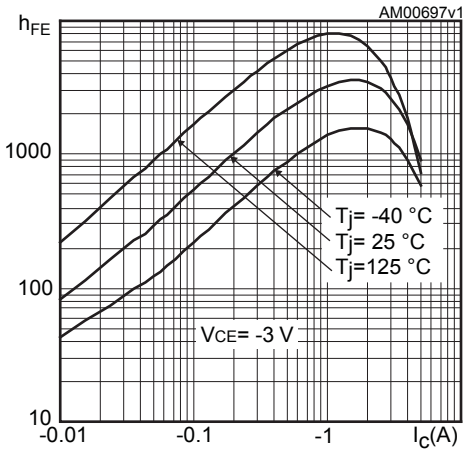


Figure 5. Collector-emitter saturation voltage (NPN)

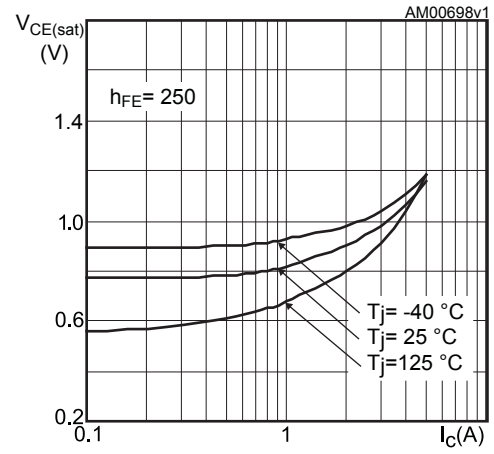


Figure 6. Collector-emitter saturation voltage (PNP)

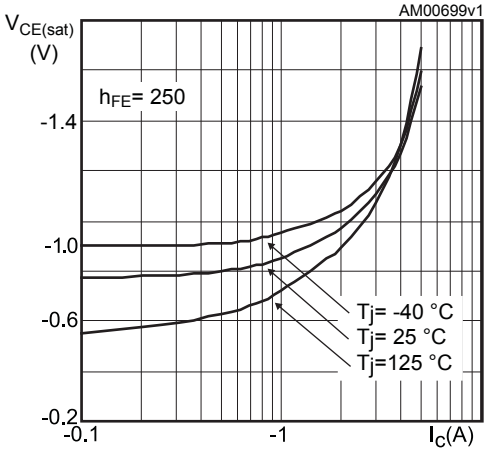


Figure 7. Base-emitter saturation voltage (NPN)

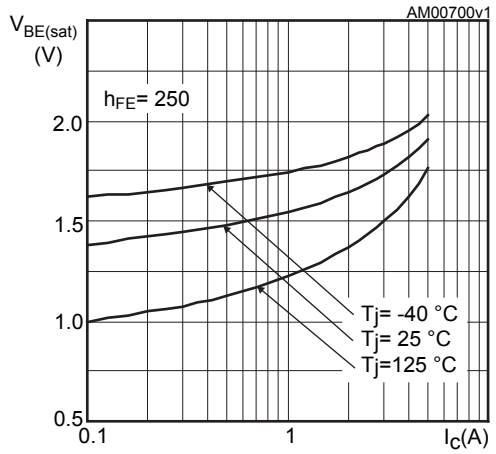


Figure 8. Base-emitter saturation voltage (PNP)

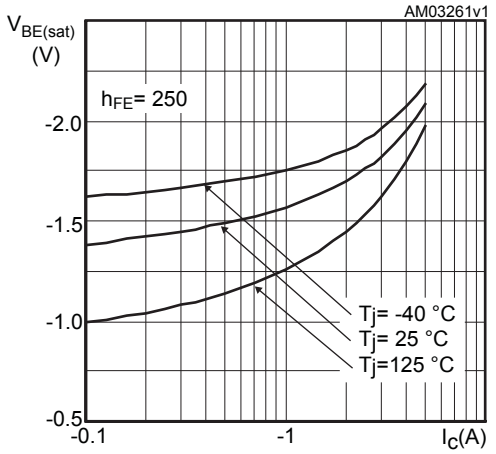


Figure 9. Base-emitter on voltage (NPN)

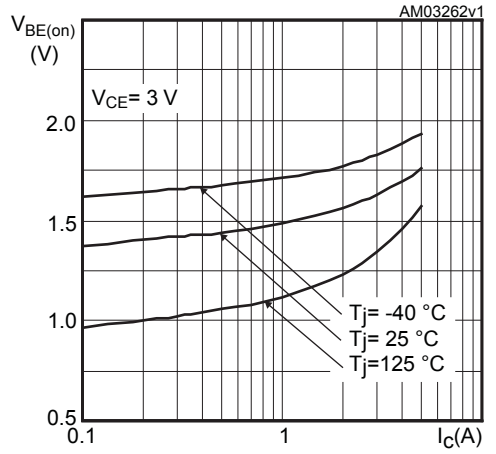


Figure 10. Base-emitter on voltage (PNP)

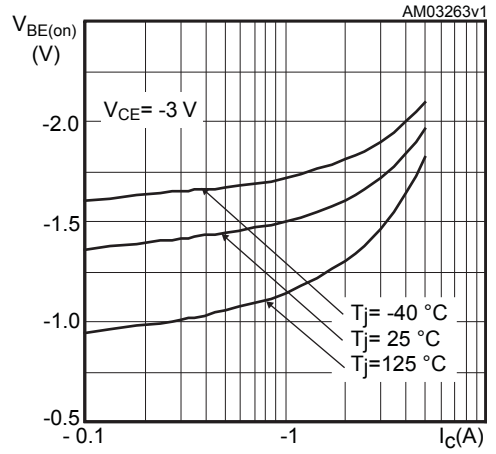


Figure 11. Resistive load switching time (NPN, on)

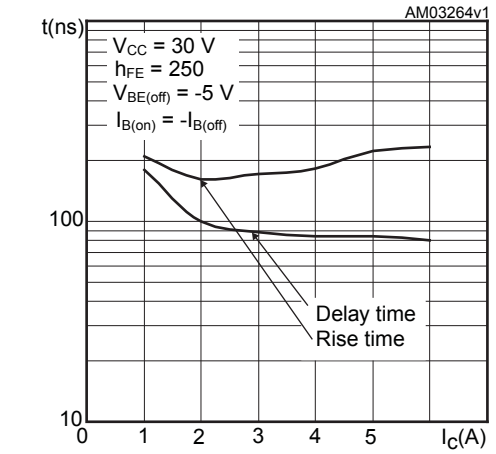


Figure 12. Resistive load switching time (PNP, on)

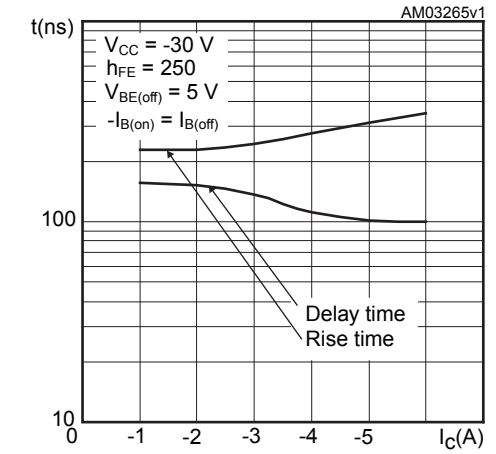


Figure 13. Resistive load switching time (NPN, off)

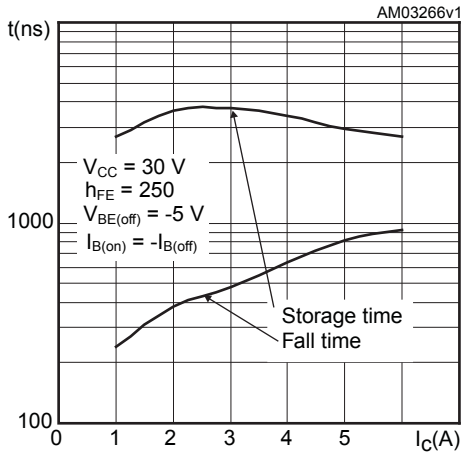


Figure 14. Resistive load switching time (PNP, off)

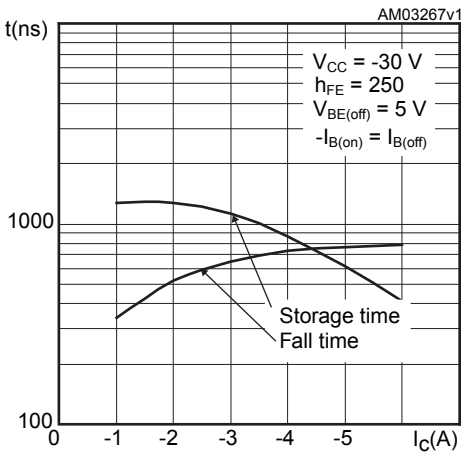


Figure 15. Capacitance characteristics (NPN)

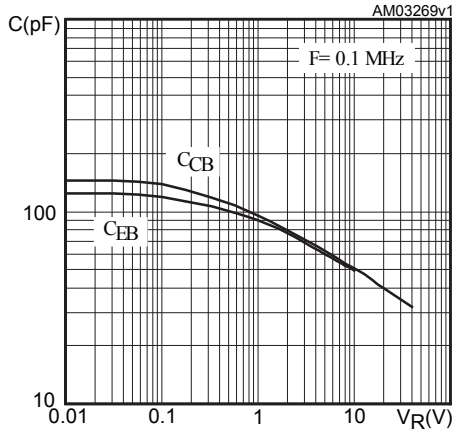
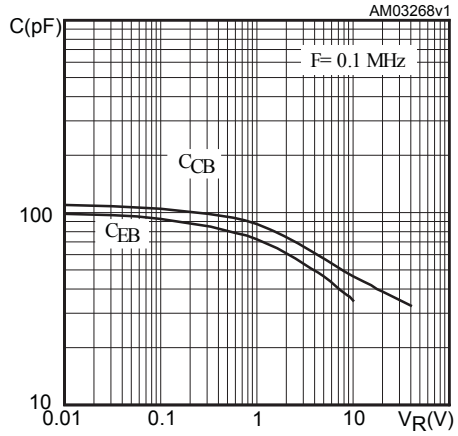
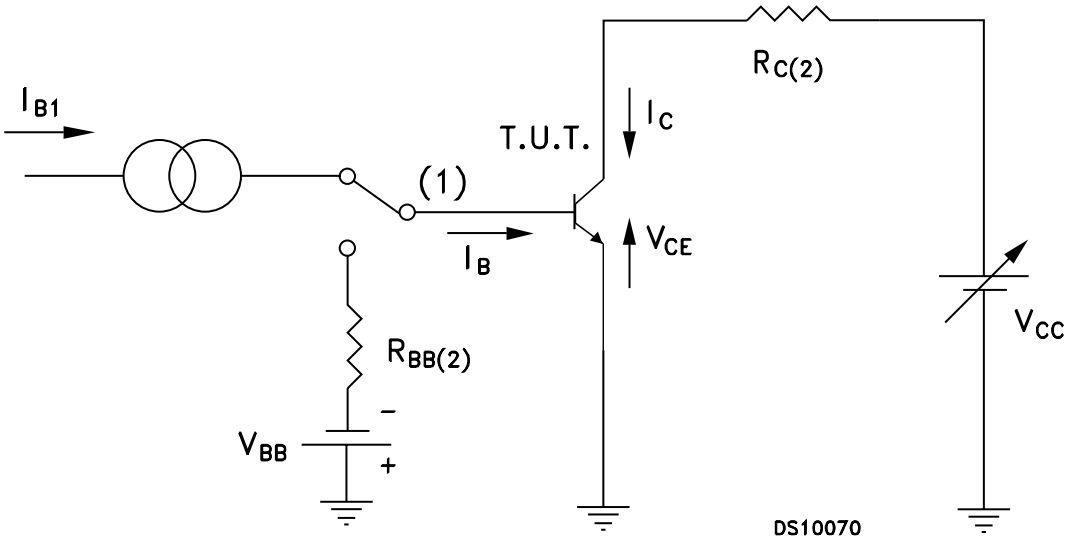


Figure 16. Capacitance characteristics (PNP)



3 Test circuits

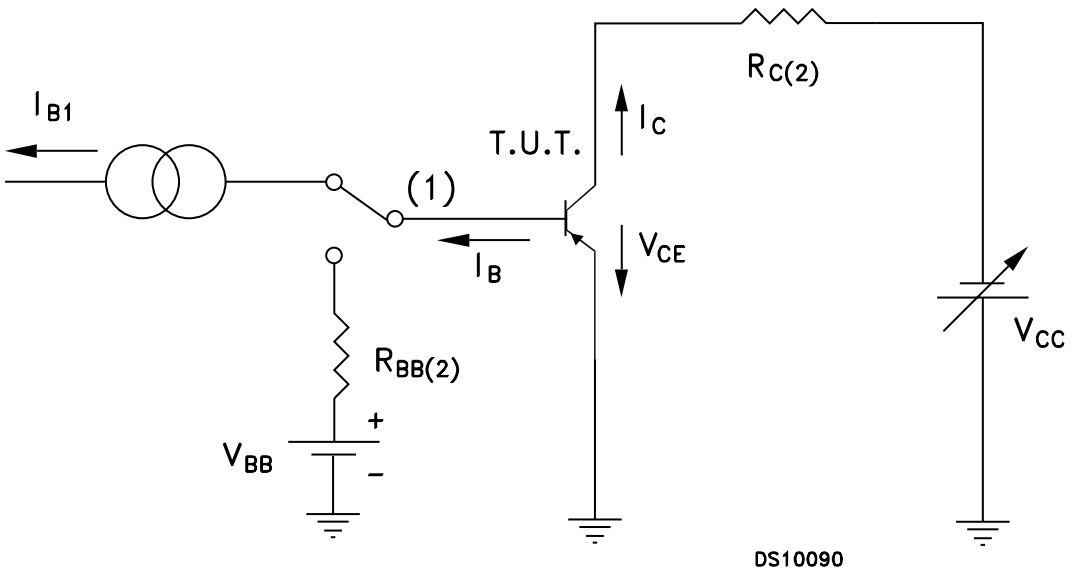
Figure 17. **Resistive load switching for NPN type**



Note: (1) Fast electronic switch.

Note: (2) Non-inductive resistor.

Figure 18. **Resistive load switching for PNP type**



Note: (1) Fast electronic switch.

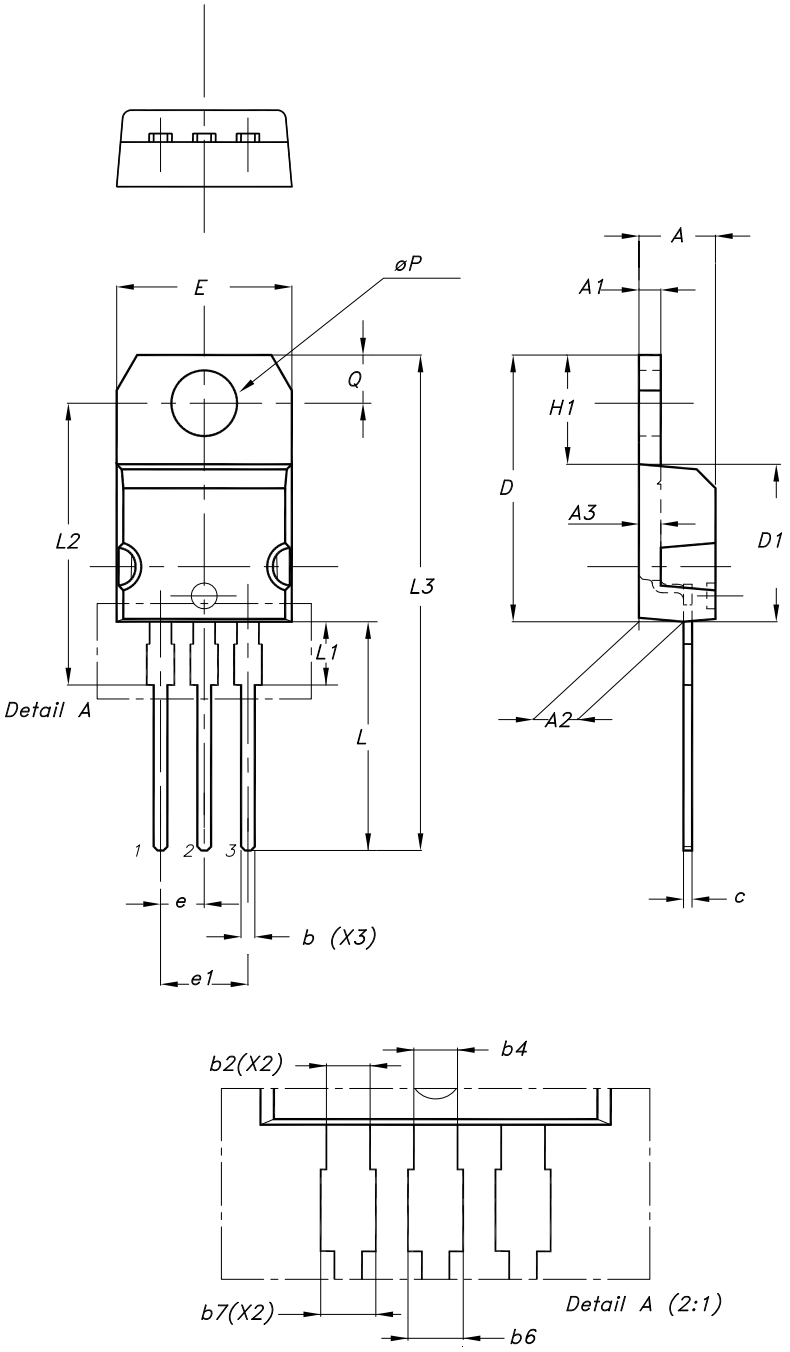
Note: (2) Non-inductive resistor.

4 Package information

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. ECOPACK is an ST trademark.

4.1 TO-220 type H package information

Figure 19. TO-220 type H package outline



0015988_H_23

Table 4. **TO-220 type H package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40	4.45	4.50
A1	1.22		1.32
A2	2.49	2.59	2.69
A3	1.17	1.27	1.37
b	0.78		0.87
b2	1.25		1.34
b4	1.20		1.29
b6			1.50
b7			1.45
c	0.49		0.56
D	15.40	15.50	15.60
D1	9.05	9.15	9.25
E	10.08	10.18	10.28
e	2.44	2.54	2.64
e1	4.98	5.08	5.18
H1	6.25	6.35	6.45
L	13.20	13.40	13.60
L1	3.50	3.70	3.90
L2	16.30	16.40	16.50
L3	28.70	28.90	29.10
∅P	3.75	3.80	3.85
Q	2.70	2.80	2.90
Slug flatness		0.03	0.10

5 Ordering information

Table 5. **Order codes**

Order codes	Marking	Polarity	Package	Packing
TIP120	TIP120	NPN	TO-220	Tube
TIP121	TIP121			
TIP122	TIP122			
TIP125	TIP125	PNP		
TIP127	TIP127			

Revision history

Table 6. Document revision history

Date	Version	Changes
21-Jun-2004	3	Document migration, no content change.
25-Nov-2008	4	Inserted new *Section 2.1: Electrical characteristics (curves)*.
11-May-2021	5	The part number TIP126 have been removed and the document has been updated accordingly. Updated title and added STPOWER LOGO in cover page. Updated Section 4 Package information. Minor text changes.

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