2N3810HR

Hi-Rel PNP dual matched bipolar transistor 60 V, 0.05 A

Datasheet - production data

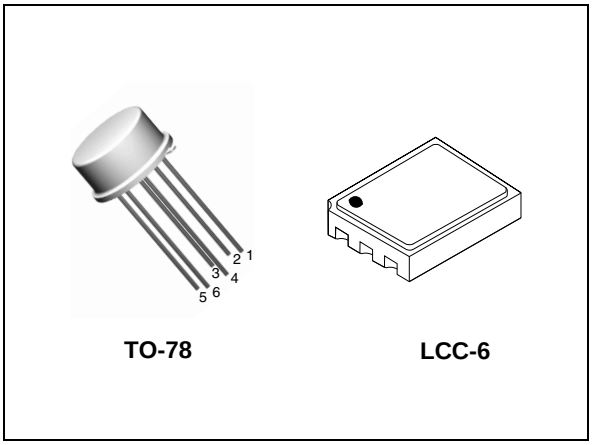
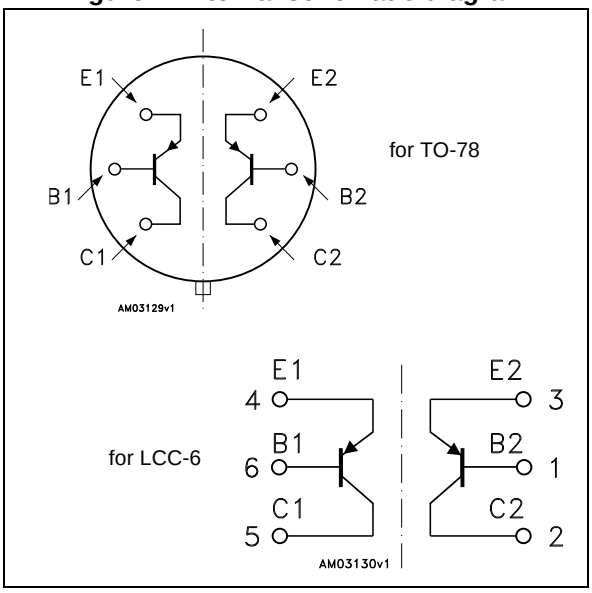


Figure 1. Internal schematic diagram



Features

BV_{CEO}	60 V
I_C (max)	0.05 A
H_{FE} at 10 V - 150 mA	> 150
Operating temperature range	-65°C to +200°C

- Hi-Rel PNP dual matched bipolar transistor
- Linear gain characteristics
- ESCC qualified
- European preferred part list - EPPL
- Radiation level: lot specific total dose contact marketing for specified level

Description

The 2N3810HR is a silicon planar epitaxial PNP transistor in TO-78 and LCC-6 packages. It is specifically designed for aerospace Hi-Rel applications and ESCC qualified according to the 5207-005 specification. In case of conflict between this datasheet and ESCC detailed specification, the latter prevails.

Table 1. Device summary

Device	Qualification system	Agency specification	Package	Radiation level	EPPL
SOC3810HRx	ESCC Flight	5207/005	LCC-6	-	Yes
2N3810HRx	ESCC Flight	5207/005	TO-78	-	-

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CBO}	Collector-base voltage (I_E = 0)	-60	V
V_{CEO}	Collector-emitter voltage (I_B = 0)	-60	V
V_{EBO}	Emitter-base voltage (I_C = 0)	-5	V
I_C	Collector current	-50	mA
P_{TOT}	Total dissipation at $T_{amb} \leq 25$ °C for TO-78 (1) for TO-78 (2) for LCC-6 (1) (3) for LCC-6 (2) (3) Total dissipation at $T_c \leq 25$ °C for TO-78 (1) for TO-78 (2)	 0.5 0.6 0.6 1.2 0.5 0.6	 W W W W W W
TSTG	Storage temperature	-65 to 200	°C
TJ	Max. operating junction temperature	200	°C

1. One section.
2. Both sections.
3. When mounted on a 15 x 15 x 0.6 mm ceramic substrate.

Table 3. Thermal data for through-hole package

Symbol	Parameter		Value	Unit
R_{thJC}	Thermal resistance junction-case (1)	max	350	°C/W
	Thermal resistance junction-case (2)	max	292	°C/W
R_{thJA}	Thermal resistance junction-ambient (1)	max	350	°C/W
	Thermal resistance junction-ambient (2)	max	292	°C/W

1. One section.
2. Both sections.

Table 4. Thermal data for SMD package

Symbol	Parameter		Value	Unit
R_{thJA}	Thermal resistance junction-ambient (1)(3)	max	292	°C/W
	Thermal resistance junction-ambient (2)(3)	max	146	°C/W

1. One section.
2. Both sections.
3. When mounted on a 15 x 15 x 0.6 mm ceramic substrate.

2 Electrical characteristics

T_{case} = 25 °C unless otherwise specified.

Table 5. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector-base cut-off current (I_E = 0)	V_{CB} = -50 V V_{CB} = -50 V T_C = 150 °C		-	-10 -10	νA ∝A
I_{EBO}	Emitter-base cut-off current (I_C = 0)	V_{EB} = -4 V		-	-20	νA
$V_{(BR)CBO}$	Collector-base breakdown voltage (I_E = 0)	I_C = -10 ∝A	-60	-		V
$V_{(BR)CEO}$ (1)	Collector-emitter breakdown voltage (I_B = 0)	I_C = -10 mA	-60	-		V
$V_{(BR)EBO}$	Emitter-base breakdown voltage (I_C = 0)	I_E = -10 ∝A	-5	-		V
$V_{CE(sat)}$ (1)	Collector-emitter saturation voltage	I_C = -100 µA I_B = -10 µA I_C = -1 mA I_B = -100 µA		-	-0.2 -0.25	V V
$V_{BE(sat)}$ (1)	Base-emitter saturation voltage	I_C = -100 µA I_B = -10 µA I_C = -1 mA I_B = -100 µA		-	-0.7 -0.8	V V
h_{FE} (1)	DC current gain	I_C = -10 µA V_{CE} = -5 V I_C = -100 µA V_{CE} = -5 V I_C = -500 µA V_{CE} = -5 V I_C = -1 mA V_{CE} = -5 V I_C = -10 mA V_{CE} = -5 V I_C = -100 µA V_{CE} = -5 V T_{amb} = -55 °C	100 150 150 150 125 60	-	 450 450 450	
h_{FE2-1} / h_{FE2-2}	DC current ratio comparison	I_C = -100 µA V_{CE} = -5 V	0.91	-	1.1	
h_{FE2-1} / h_{FE2-2}	DC current ratio comparison	I_C = -100 µA V_{CE} = -5 V T_{amb} = -55 °C to +125 °C	0.85	-	1.18	
$\Delta \lvert V_{BE1} - V_{BE2} \rvert$	Base-emitter voltage differential	V_{CE} = -5 V I_C = -10 µA V_{CE} = -5 V I_C = -100 µA V_{CE} = -5 V I_C = -10 mA		-	5 3 5	mV mV mV
$\Delta \lvert V_{BE1} - V_{BE2} \rvert$	Base-emitter voltage differential	V_{CE} = -5 V I_C = -100 µA T_{amb} = -55 °C to +25 °C T_{amb} = +25 °C to +125 °C		-	0.8 1	mV mV
I_{Lk}	Leakage current between active devices	V = -50 V to E_2, B_2, C_2 V = 0 V to E_1, B_1, C_1		-	-5	µA

Table 5. Electrical characteristics (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
h_{fe}	Small signal current gain	V_{CE} = -5 V I_C = -10 mA f = 1 kHz	125	-		
h_{fe}	Small signal current gain	V_{CE} = -10 V I_C = -10 mA f = 1 kHz	150	-	600	
f_T	Transition frequency	I_C = -1 mA V_{CE} = -5 V	80	-	500	MHz
Cobo	Output capacitance (I_E = 0)	V_{CB} = -5 V 100 kHz ≤ f ≤ 1 MHz		-	6	πΦ
Cibo	Input capacitance (I_C = 0)	V_{EB} = -0.5 V 100 kHz ≤ f ≤ 1 MHz		-	15	πΦ
hie	Input impedance	I_C = -1 mA V_{CE} = -10 V f = 1 kHz	3	-	30	κW
NF	Noise figure	V_{CE} = -5 V I_C = -200 µA R_S = 2 kΩ f = 100 Hz		-	7	δB
NF	Noise figure	V_{CE} = -5 V I_C = -200 µA R_S = 2 kΩ f = 1 kHz		-	3	δB
NF	Noise figure	V_{CE} = -5 V I_C = -200 µA R_S = 2 kΩ Bandwidth = 10 Hz to 15.7 kHz		-	3.5	δB

1. Pulsed duration = 300 µs, duty cycle ≤ 1.5%

2.1 Electrical characteristics (curves)

Figure 2. h_{FE} @ V_{CE} = 5 V

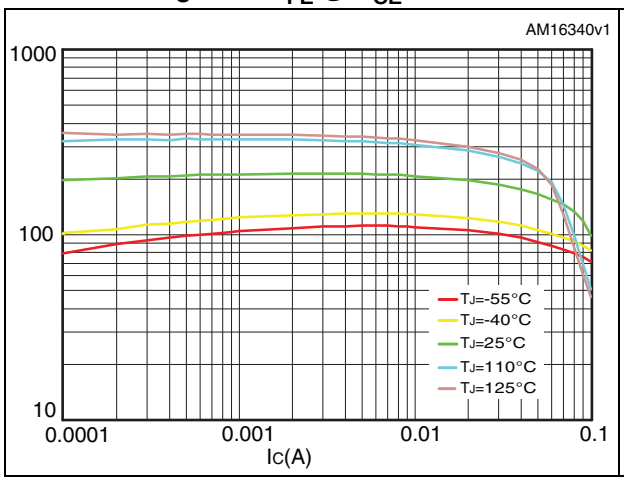


Figure 3. $V_{CE(sat)}$ @ h_{FE} =10

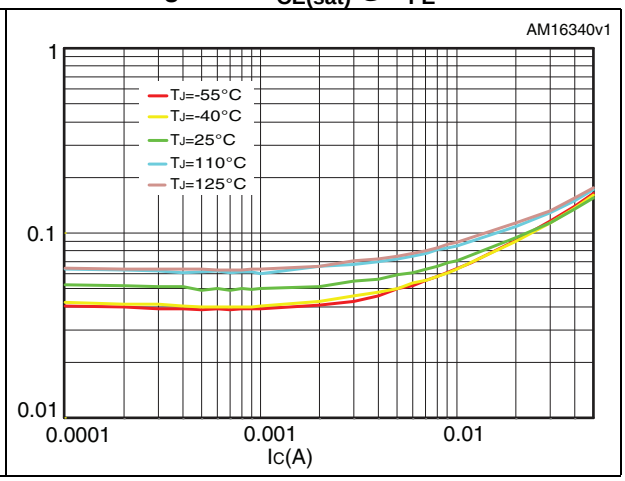
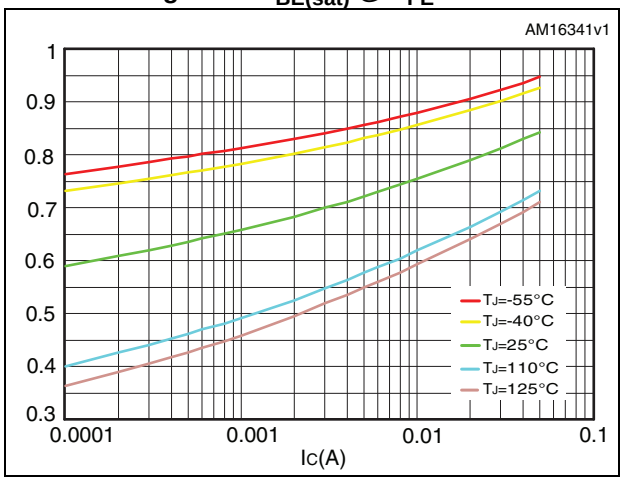


Figure 4. $V_{BE(sat)}$ @ h_{FE} =10



3 Package mechanical data

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3.1 TO-78

Figure 5. TO-78 drawing

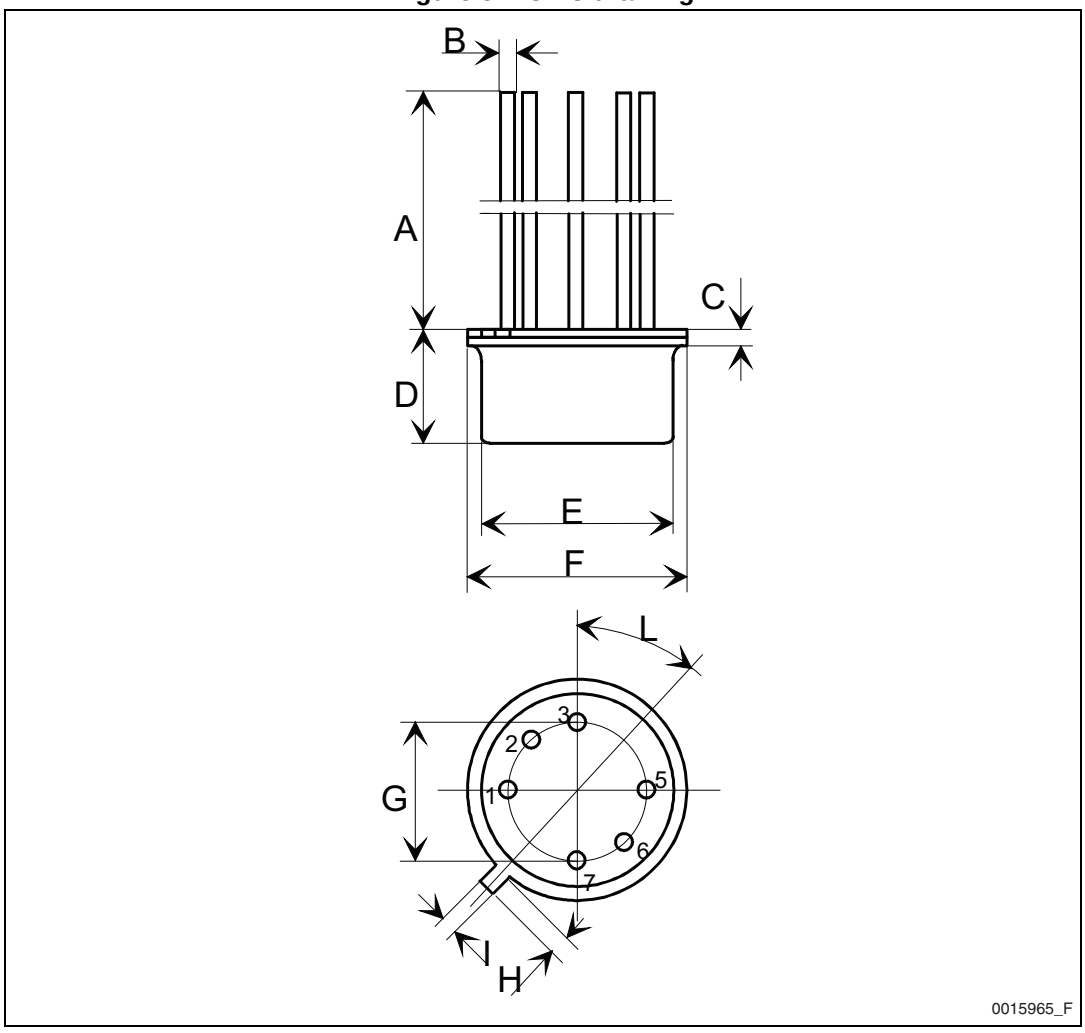

Table 6. TO-78 mechanical data

Dim.	mm			inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	12.70		13.70	0.500		0.539
B	0.40		0.47	0.016		0.019
C	0.55		0.76	0.022		0.030
D	4.26		4.57	0.168		0.180
E	8.15		8.25	0.321		0.325
F	9.05		9.25	0.356		0.364
G	4.85	5.08	5.31	0.191	0.200	0.209
H	0.71		0.85	0.028		0.034
I	0.90		1.00	0.035		0.040
L	42°		48°			

3.2 LCC-6

Figure 6. LCC-6 drawing

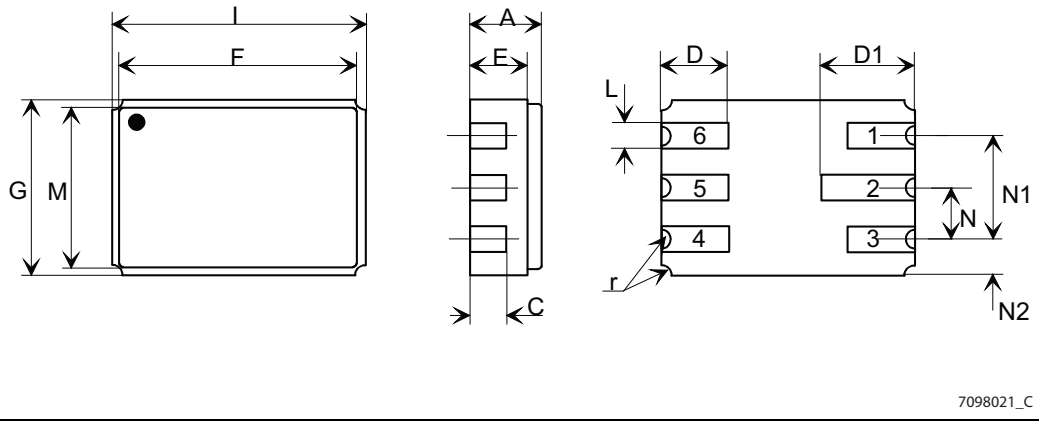

Table 7. LCC-6 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	1.53		1.96
C	0.78	0.89	0.99
D	1.52	1.65	1.78
E	12.4	1.40	1.55
F	5.77	5.84	5.92
G	4.19	4.31	4.45
I	6.10	6.22	6.35
L	0.56	0.63	0.71
M	3.86	3.94	4.01
N	1.14	1.27	1.40
N1	2.41	2.54	2.67
N2	0.64	0.89	1.14
r		0.23	
D1	2.08	2.28	2.49

4 Ordering information

Table 8. Oder codes

CPN	Agency specification	EPPL	Quality level	Radiation level	Package	Lead finish	Marking[1]	Packing
SOC38101	-	-	Engineering model ESCC	-	LCC-6	Gold	SOC38101	WafflePack
SOC3810HRG	5207/005/07	Yes	ESCC Flight	-	LCC-6	Gold	520700507	WafflePack
SOC3810HRT	5207/005/09	Yes	ESCC Flight	-	LCC-6	Solder Dip	520700509	WafflePack
2N3810HRG	5207/005/01	-	ESCC Flight	-	TO-78	Gold	520700501	Strip Pack
2N3810HRT	5207/005/02	-	ESCC Flight	-	TO-78	Solder Dip	520700502	Strip Pack

1. Specific marking only. The full marking includes in addition: For the Engineering Models: ST logo, date code; country of origin (FR). For ESCC flight parts: ST logo, date code, country of origin (FR), ESA logo, serial number of the part within the assembly lot.

Contact ST sales office for information about the specific conditions for:

- Products in die form
- Tape and reel packing

5 Revision history

Table 9. Document revision history

Date	Revision	Changes
10-Dec-2008	1	Initial release
08-Jan-2010	2	Modified *Table 1 on page 1*
14-Nov-2012	3	Added:*Section 2.1: Electrical characteristics (curves)* Updated: *Section 3: Package mechanical data*
13-May-2014	4	Updated *Table 1: Device summary*. Added *Section 4: Ordering information*.

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