

Hi-Rel NPN dual matched bipolar transistor 60 V, 0.03 A

Datasheet - production data

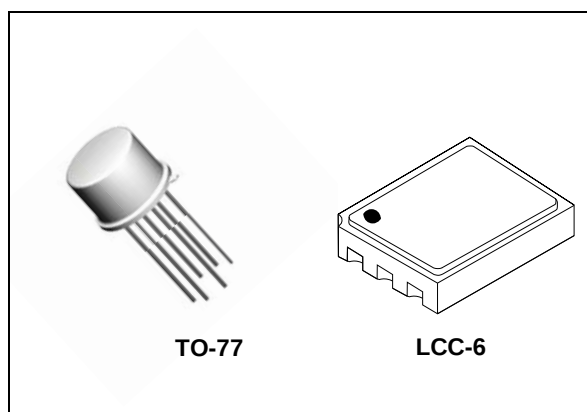
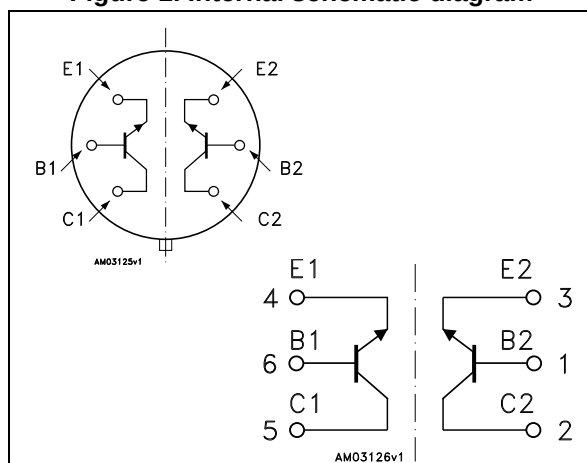


Figure 1. Internal schematic diagram



Features

Symbol	Value
BV_{CEO}	60 V
I_C (max)	0.03 A
H_{FE} at 10 V - 150 mA	> 300
Operating temperature range	-65°C to +200°C

- Hi-Rel NPN 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 2N2920AHR is a silicon planar epitaxial NPN transistor in TO-77 and LCC-6 packages. It is specifically designed for aerospace Hi-Rel applications and is ESCC qualified according to the 5207-002 specification. In case of conflict between this datasheet and the ESCC specifications, the latter prevails.

Table 1. Device summary

Device	Qualification system	Agency specification	Package	Radiation level	EPPL
SOC2920AHRx	ESCC Flight	5207/002	LCC-6	-	Yes
2N2920AHRx	ESCC Flight	5207/002	TO-77	-	-

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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 ($I_C = 0$)	6	V
I_C	Collector current	30	mA
P_{TOT}	Total dissipation at $T_{amb} \leq 25\text{ °C}$ for TO-77 ⁽¹⁾	0.3	W
	for TO-77 ⁽²⁾	0.5	W
	for LCC-6 ⁽¹⁾	0.3	W
	for LCC-6 ⁽²⁾	0.5	W
	Total dissipation at $T_c \leq 25\text{ °C}$ for TO-77 ⁽¹⁾	0.75	W
	for TO-77 ⁽²⁾	1.25	W
T_{STG}	Storage temperature	-65 to 200	°C
T_J	Max. operating junction temperature	200	°C

1. One section.
2. Both sections

Table 3. Thermal data for through-hole package

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case ⁽¹⁾	max 233	°C/W
	Thermal resistance junction-case ⁽²⁾	max 140	°C/W
R_{thJA}	Thermal resistance junction-ambient ⁽¹⁾	max 583	°C/W
	Thermal resistance junction-ambient ⁽²⁾	max 350	°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 291	°C/W
	Thermal resistance junction-ambient ⁽²⁾⁽³⁾	max 175	°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

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

Table 5. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector-base cut-off current ($I_{\text{E}} = 0$)	$V_{\text{CB}} = 45\text{ V}$ $V_{\text{CB}} = 45\text{ V}$ $T_{\text{C}} = 150\text{ °C}$			2 10	nA μA
I_{CEO}	Collector cut-off current ($I_{\text{B}} = 0$)	$V_{\text{CE}} = 5\text{ V}$			2	nA
I_{EBO}	Emitter-base cut-off current ($I_{\text{C}} = 0$)	$V_{\text{EB}} = 5\text{ V}$			2	nA
$V_{(\text{BR})\text{CBO}}$	Collector-base breakdown voltage ($I_{\text{E}} = 0$)	$I_{\text{C}} = 10\text{ }\mu\text{A}$	60			V
$V_{(\text{BR})\text{CEO}}^{(1)}$	Collector-emitter breakdown voltage ($I_{\text{B}} = 0$)	$I_{\text{C}} = 10\text{ mA}$	60			V
$V_{(\text{BR})\text{EBO}}$	Emitter-base breakdown voltage ($I_{\text{C}} = 0$)	$I_{\text{E}} = 10\text{ }\mu\text{A}$	6			V
$V_{\text{CE(sat)}}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 1\text{ mA}$ $I_{\text{B}} = 0.1\text{ mA}$			0.35	V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 1\text{ mA}$ $I_{\text{B}} = 0.1\text{ mA}$	0.5		1	V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 10\text{ }\mu\text{A}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 100\text{ }\mu\text{A}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 1\text{ mA}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 10\text{ }\mu\text{A}$ $V_{\text{CE}} = 5\text{ V}$ $T_{\text{amb}} = -55\text{ °C}$	150 225 300 50		600	
$h_{\text{FE2-1}} / h_{\text{FE2-2}}$	DC current transfer ratio comparison	$I_{\text{C}} = 100\text{ }\mu\text{A}$ $V_{\text{CE}} = 5\text{ V}$ $T_{\text{amb}} = -55\text{ °C to }+25\text{ °C}$	0.91		1.1	
$h_{\text{FE2-1}} / h_{\text{FE2-2}}$	DC current transfer ratio comparison	$I_{\text{C}} = 100\text{ }\mu\text{A}$ $V_{\text{CE}} = 5\text{ V}$ $T_{\text{amb}} = -55\text{ °C to }+125\text{ °C}$	0.85		1.18	
$\Delta V_{\text{BE1}} - V_{\text{BE2}} $	Base-emitter voltage differential	$V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 10\text{ }\mu\text{A}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 100\text{ }\mu\text{A}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 1\text{ mA}$			2 1.5 2	mV mV mV
$\Delta V_{\text{BE1}} - V_{\text{BE2}} $	Base-emitter voltage differential	$V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 100\text{ }\mu\text{A}$ $T_{\text{amb}} = -55\text{ °C to }+25\text{ °C}$ $T_{\text{amb}} = +25\text{ °C to }+125\text{ °C}$			0.4 0.5	mV mV
I_{Lk}	Leakage current between active devices	$V = 50\text{ V to }E_2, B_2, C_2$ $V = 0\text{ V to }E_1, B_1, C_1$			5	μA

Table 5. Electrical characteristics (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
f_T	Transition frequency	$I_C = 0.5 \text{ mA}$ $V_{CE} = 5 \text{ V}$	60			MHz
h_{ob}	Output admittance	$V_{CE} = 5 \text{ V}$ $I_C = 1 \text{ mA}$ $f = 1 \text{ kHz}$			1	μmho
h_{ib}	Input impedance	$V_{CB} = 5 \text{ V}$ $I_C = 1 \text{ mA}$ $f = 1 \text{ kHz}$	25		32	Ω
C_{obo}	Output capacitance ($I_E = 0$)	$V_{CB} = 5 \text{ V}$ $100 \text{ kHz} > f > 1 \text{ MHz}$			6	pF
NF	Noise figure	$V_{CE} = 5 \text{ V}$ $I_C = 10 \mu\text{A}$ $R_S = 10 \text{ k}\Omega$ $f = 1 \text{ kHz}$ Bandwidth = 200 Hz			3	dB
NF	Noise figure	$V_{CE} = 5 \text{ V}$ $I_C = 10 \mu\text{A}$ $R_S = 10 \text{ k}\Omega$ $10 \text{ Hz} \leq f \leq 15.7 \text{ kHz}$ Bandwidth = 200 Hz			3	dB

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

2.1 Electrical characteristics (curves)

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

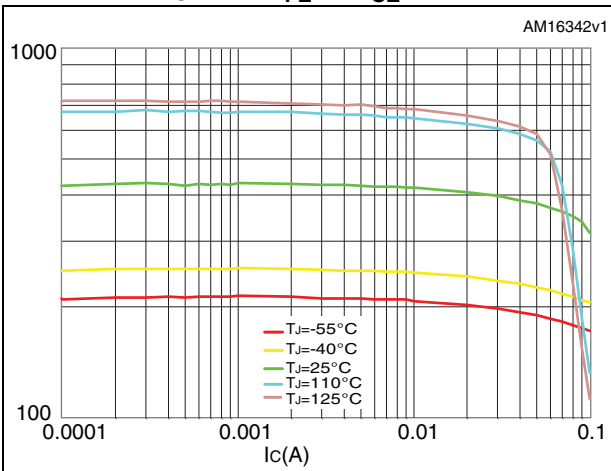


Figure 3. $V_{CE(sat)}$ @ $h_{FE} = 10$

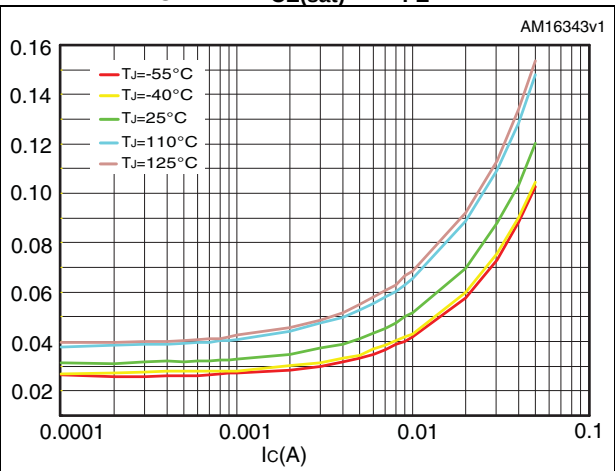
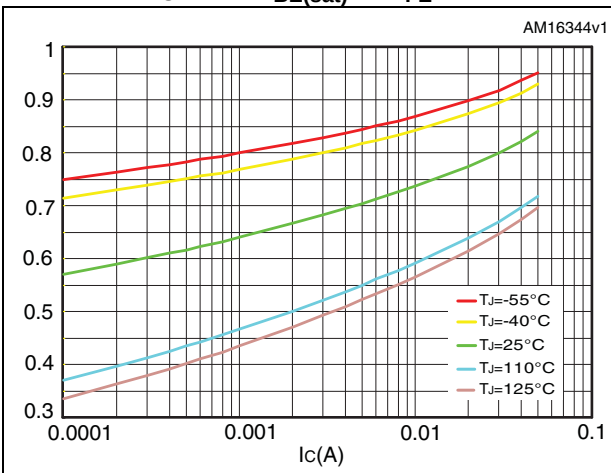


Figure 4. $V_{BE(sat)}$ @ $h_{FE} = 10$



3 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.

3.1 TO-77 package information

Figure 5. TO-77 package outline

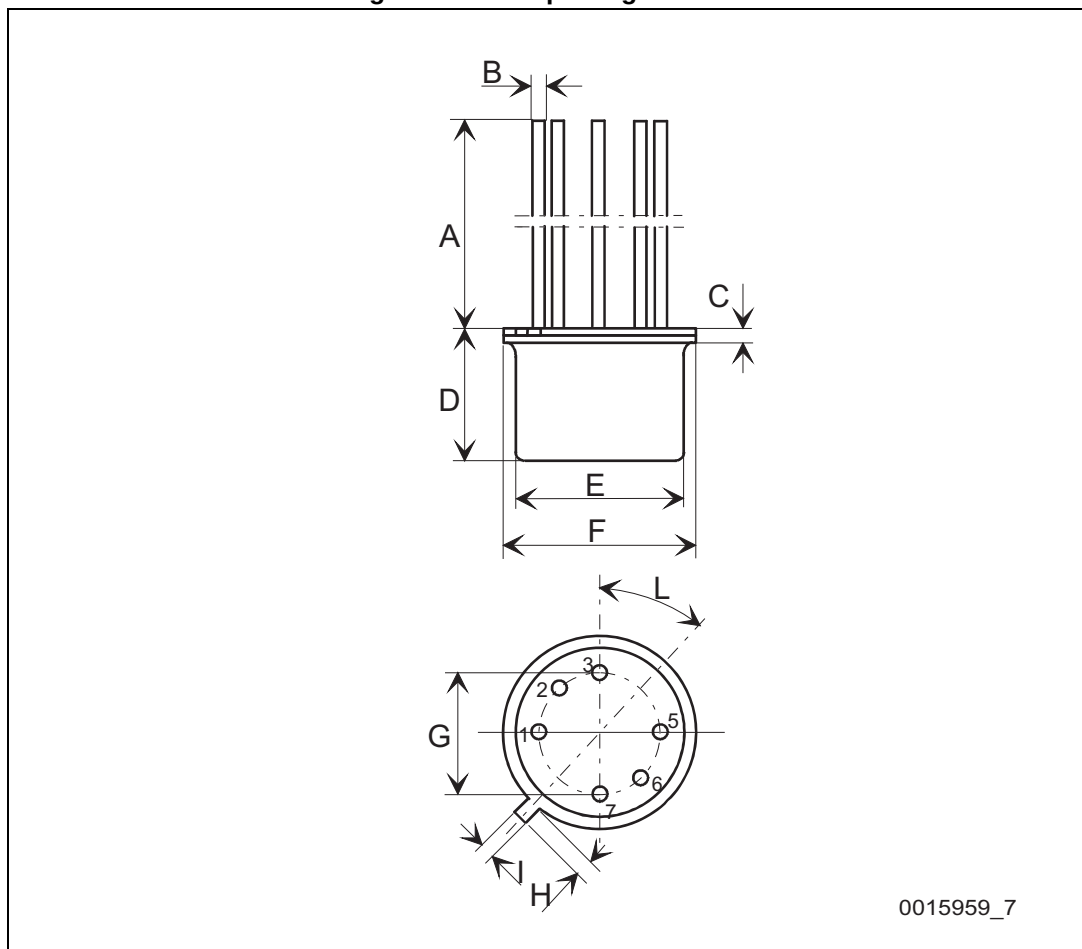


Table 6. TO-77 package mechanical data

Dim.	mm		
	Min	Typ	Max
A	12.70		13.70
B	0.40		0.47
C	0.55		0.76
D	6.11		6.47
E	8.15		8.25
F	9.05		9.25
G	4.85	5.08	5.31
H	0.71		0.85
I	0.90		1.00
L	42°		48°

3.2 LCC-6 package information

Figure 6. LCC-6 package outline

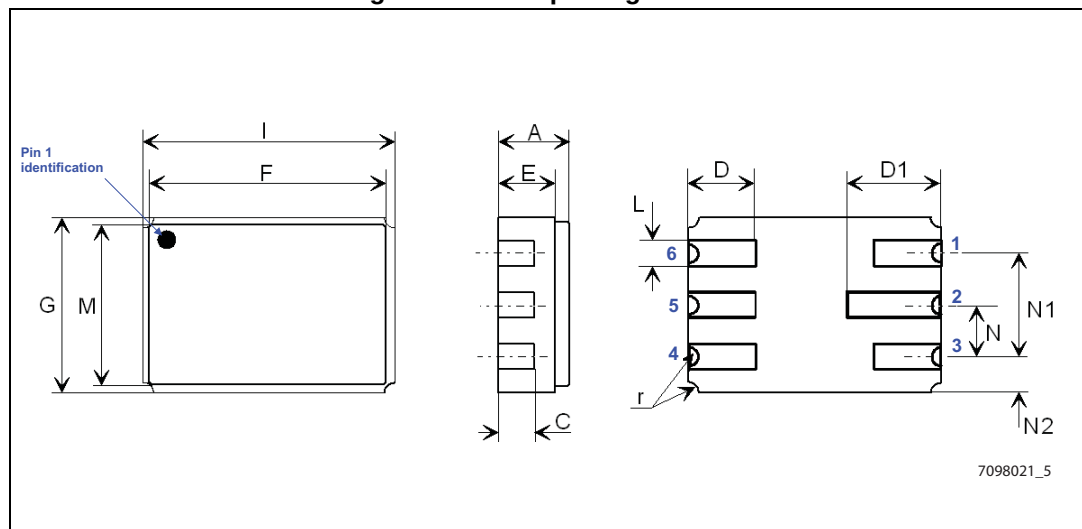


Table 7. LCC-6 package mechanical data

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	1.24	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. Ordering information

CPN	Agency specification	EPPL	Quality level	Radiation level	Package	Lead finish	Marking ⁽¹⁾	Packing
SOC2920A1	-	-	Eng. model ESCC	-	LCC-6	Gold	SOC2920A1	Waffle pack
SOC2920AHRG	5207/002/12	Yes	ESCC flight	-	LCC-6	Gold	520700212	Waffle pack
SOC2920AHRT	5207/002/15	Yes	ESCC flight	-	LCC-6	Solder dip	520700215	Waffle pack
2N2920AHRG	5207/002/03	-	ESCC flight	-	TO-77	Gold	520700203	Strip pack
2N2920AHRT	5207/002/06	-	ESCC Flight	-	TO-77	Solder dip	520700206	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:

- Product in die form
- Tape and reel packaging

5 Revision history

Table 9. Document revision history

Date	Revision	Changes
10-Dec-2008	1	Initial release
05-Jan-2010	2	Modified Table 1 on page 1
15-Nov-2012	3	Added: Section 2.1: Electrical characteristics (curves) Updated: Section 3: Package information
04-Apr-2014	4	Updated: Table 1: Device summary and Table 2: Absolute maximum ratings. Minor text changes.
14-May-2014	5	Updated Section 3.2: LCC-6, package information.
16-Mar-2016	6	Updated Section 3.1: TO-77 package information and Section 3.2: LCC-6 package information . Minor text changes.

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