

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

Datasheet — production data

Features

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 ESCC qualified according to the 5207-002 specification. In case of conflict between this datasheet and ESCC detailed specification, the latter prevails.

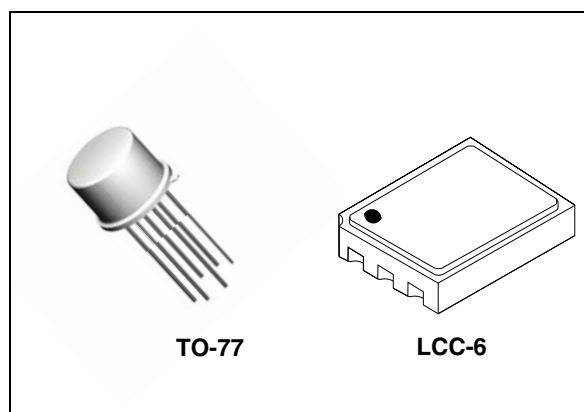


Figure 1. Internal schematic diagram

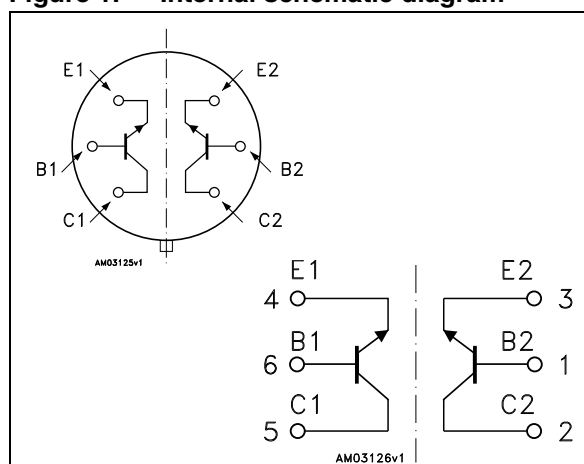


Table 1. Device summary

Order codes	Packages	Lead finish	Marking	Type	EPPL	Packaging
2N2920AHR	TO-77	Gold Solder Dip	520700203 520700206	ESCC Flight		Strip pack
2N2920AT1	TO-77	Gold	2N2920AT1	Engineering model		Strip pack
SOC2920A	LCC-6	Gold	SOC2920A	Engineering model		Waffle pack
SOC2920AHRB	LCC-6	Gold Solder Dip	520700212 520700215	ESCC Flight	Yes	Waffle pack

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 $T_{amb} \leq 25^\circ\text{C}$ for SOC2920A ⁽¹⁾	0.3	W
	for SOC2920A ⁽²⁾	0.5	W
	for 2N2920AHR ^{(1) (3)}	0.6	W
	for 2N2920AHR ^{(2) (3)}	1	W
	Total dissipation at $T_c \leq 25^\circ\text{C}$ for SOC2920A ⁽¹⁾	0.75	W
	for SOC2920A ⁽²⁾	1.25	W
T_{STG}	Storage temperature	-65 to 200	$^\circ\text{C}$
T_J	Max. operating junction temperature	200	$^\circ\text{C}$

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	233 $^\circ\text{C/W}$
	Thermal resistance junction-case ⁽²⁾	max	140 $^\circ\text{C/W}$
R_{thJA}	Thermal resistance junction-ambient ⁽¹⁾	max	583 $^\circ\text{C/W}$
	Thermal resistance junction-ambient ⁽²⁾	max	350 $^\circ\text{C/W}$

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 $^\circ\text{C/W}$
	Thermal resistance junction-ambient ⁽²⁾⁽³⁾	max	175 $^\circ\text{C/W}$

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 \left \begin{array}{c} V_{\text{BE1}} \\ V_{\text{BE2}} \end{array} \right $	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 \left \begin{array}{c} V_{\text{BE1}} \\ V_{\text{BE2}} \end{array} \right $	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 ($I_E = 0$)	$V_{CB} = 5 \text{ V}$ $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$			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 $\leq 1.5\%$

2.1 Electrical characteristics (curves)

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

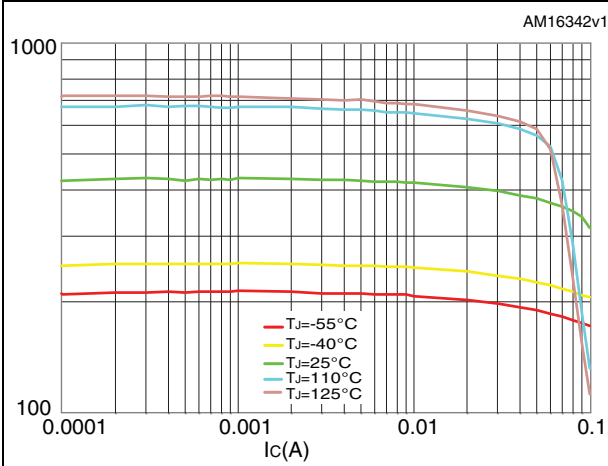


Figure 3. $V_{CE(sat)}$ @ $h_{FE} = 10$

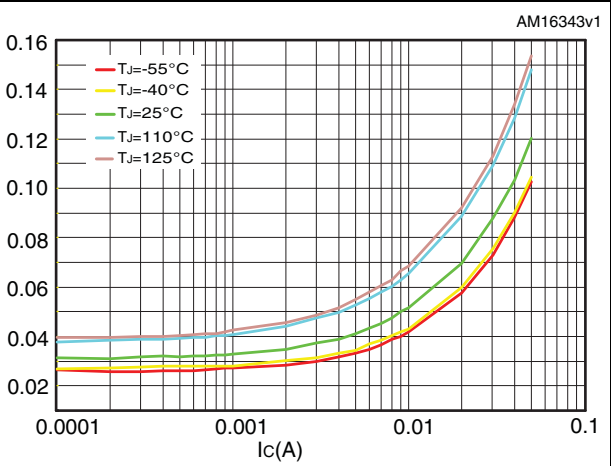
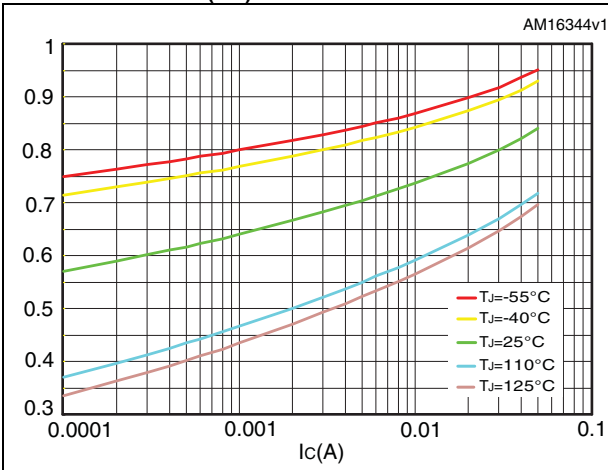


Figure 4. $V_{BE(sat)}$ @ $h_{FE} = 10$



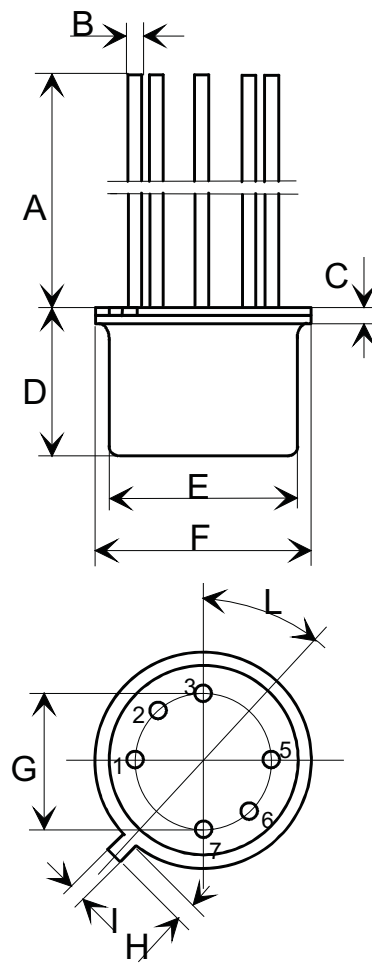
3 Package mechanical data

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. ECOPACK® is an ST trademark.

Table 6. TO-77 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°

Figure 5. TO-77 drawing

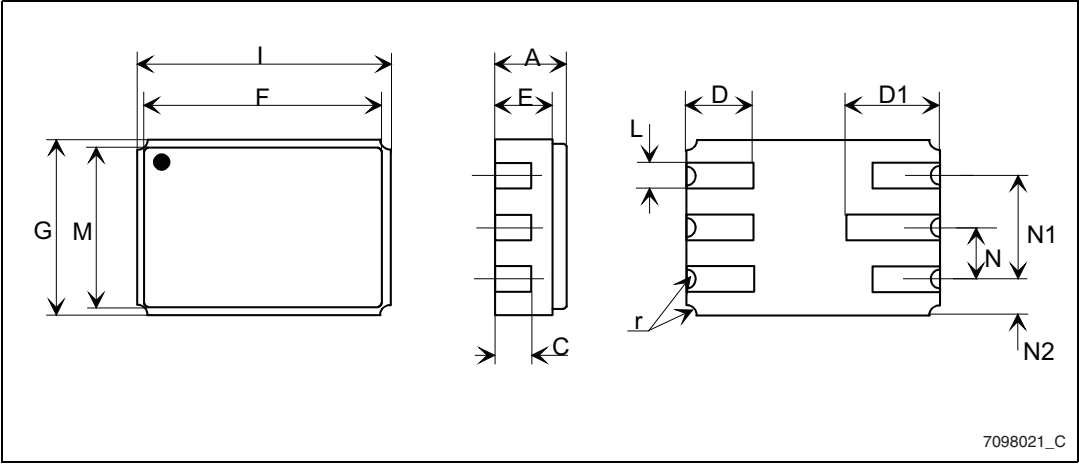


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Table 7. LCC-6 mechanical data

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

Figure 6. LCC-6 drawing



4 Revision history

Table 8. 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 mechanical data

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