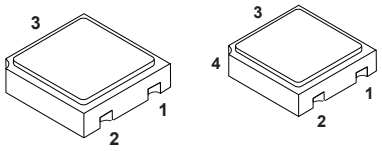
2N2907AHR

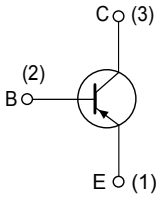
Datasheet

Rad-hard 60 V, 0.6 A PNP transistor



LCC-3 **UB**

Pin 4 in UB is connected to the metallic lid.



DS10460

Features

V_{CBO}	I_C(max.)		H_{FE} at 10 V, 150 mA	T_j(max.)
60 V	ESCC	0.5 A	> 100	200 °C

- Hermetic packages
- ESCC qualified
- 100 krad

Description

The 2N2907AHR is a bipolar transistor able to operate under severe environment conditions and radiation exposure providing high immunity to total ionizing dose (TID).

Qualified as per ESCC 5202/001 specification and available in LCC-3 and UB hermetic packages, it is specifically recommended for space and harsh environment applications and suitable for low current and high precision circuits such preamplifiers, oscillators, current mirror configuration.

In case of discrepancies between this datasheet and the relevant agency specification, the latter takes precedence.

Product status link
2N2907AHR

Product summary

Product summary				
Part-number	**Qualification system**	**Agency specification**	**Package**	**Radiation level**
2N2907ARUBx	ESCC Flight	5202/001	UB	100 krad
2N2907AUBx	ESCC Flight	5202/001	UB	-
SOC2907ARHRx	ESCC Flight	5202/001	LCC-3	100 krad
SOC2907AHRx	ESCC Flight	5202/001	LCC-3	-

Note: See Table 7 for ordering information.

1 Electrical ratings

Note: For PNP transistor voltage and current polarity is reversed.

Table 1. 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		0.5	A
P_{TOT}	Total dissipation at $T_{amb} \leq 25$ °C	LCC-3 and UB LCC-3 and UB(1)	0.4 0.73	W
T_{OP}	Operating temperature range		-65 to 200	°C
T_J	Max. operating junction temperature		200	°C

1. *When mounted on a 15 x 15 x 0.6 mm ceramic substrate.*

Table 2. Thermal data

Symbol	Parameter	LCC-3 and UB Value	Unit
RthJA	Thermal resistance junction-ambient (max.)	437.5 240(1)	°C/W

1. *When mounted on a 15 x 15 x 0.6 mm ceramic substrate.*

2 Electrical characteristics

2.1 Electrical characteristics

Table 3. Electrical characteristics (T_{amb} = 25 °C unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Max.	Unit
I_{CBO}	Collector-base cut-off current (I_E = 0)	V_{CB} = 50 V		10	nA
		V_{CB} = 50 V, T_{amb} = 150 °C		10	µA
I_{CEX}	Collector-emitter cut-off current	V_{CE} = 30 V, V_{BE} = -0.5 V		50	nA
$V_{(BR)CBO}$	Collector-base breakdown voltage (I_E = 0)	I_C = 10 µA	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_C = 10 µA	5		V
$V_{CE(sat)}$ (1)	Collector-emitter saturation voltage	I_C = 150 mA, I_B = 15 mA		0.4	V
$V_{BE(sat)}$ (1)	Base-emitter saturation voltage	I_C = 150 mA, I_B = 15 mA		1.3	V
h_{FE} (1)	DC current gain	I_C = 0.1 mA, V_{CE} = 10 V	75		
		I_C = 10 mA, V_{CE} = 10 V	100		
		I_C = 150 mA, V_{CE} = 10 V	100	300	
		I_C = 500 mA, V_{CE} = 10 V	50		
h_{fe}	Small signal current gain	I_C = 20 mA, f = 100 MHz, V_{CE} = 20 V	2		
C_{OBO}	Output capacitance (I_E = 0)	100 kHz ≤ f ≤ 1 MHz, V_{CB} = 10 V		8	pF
t_{on}	Turn-on time	I_{CC} = 150 mA, I_{B1} = 15 mA, V_{CC} = 30 V		45	ns
t_{off}	Turn-off time	I_{CC} = 150 mA, I_{B1} = -I_{B2} = 15 mA, V_{CC} = 30 V		300	ns

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

2.2 Radiation assurance

Radiation test are guaranteed in compliance with ESCC 22900 and ESCC 5202/001 specifications.
Each lot is tested in radiation according to the following procedure:

- Radiation condition of 0.1 rad (Si)/s.
- Test of 11 samples by wafer, 5 biased at 80% of V(BR)CEO, 5 unbiased and for reference.
- Acceptance criteria in compliance with the post radiation electrical characteristics as per Table 4.

Table 4. ESCC 5202/001 post radiation electrical characteristics (T_{amb} = 25 °C unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{CBO}	Collector cut-off current (I_E = 0)	V_{CB} = 50 V		-	10	nA
I_{CEX}	Collector-emitter cut-off current	V_{CE} = 30 V, V_{BE} = -0.5 V		-	50	nA
$V_{(BR)CBO}$	Collector-base breakdown voltage (I_E= 0)	I_C =10 µA	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 µA	5	-		V
$V_{CE(sat)}$(1)	Collector-emitter saturation voltage	I_C =150 mA, I_B = 15 mA		-	0.4	V
$V_{BE(sat)}$(1)	Base-emitter saturation voltage	I_C = 150 mA, I_B = 15 mA		-	1.3	V
[h_{FE}](1)	Post irradiation gain calculation (2)	I_C = 0.1 mA, V_{CE} = 10 V	[30]	-		
		I_C = 10 mA, V_{CE} = 10 V	[50]	-		
		I_C = 150 mA, V_{CE} = 10 V	[50]	-	300	
		I_C= 500 mA, V_{CE}= 10 V	[25]	-		

1. *Pulsed duration = 300 µs, duty cycle ≥ 2 %*
2. *The post-irradiation gain calculation of [h_{FE}], made using h_{FE} measurements from prior to and on completion of irradiation testing and after each annealing step if any, shall be as specified in MILSTD-750 method 1019.*

2.3 Electrical characteristics (curves)

Figure 1. DC current gain (V_{CE} = 1 V)

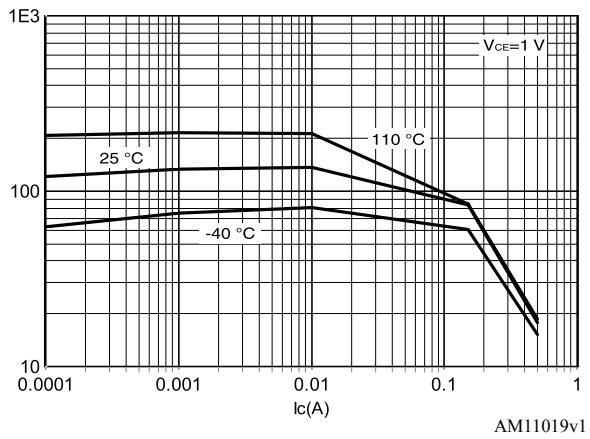


Figure 2. DC current gain (V_{CE} = 10 V)

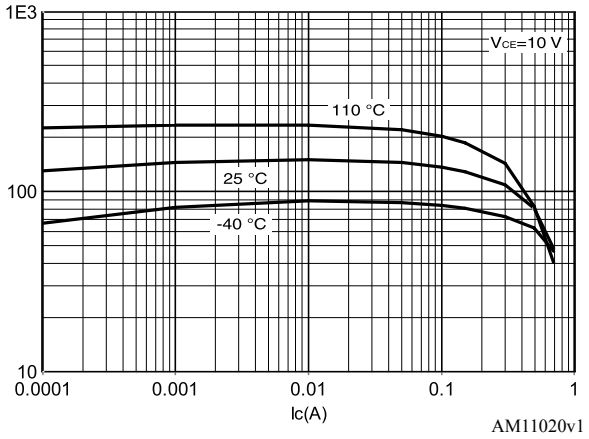


Figure 3. Collector emitter saturation voltage

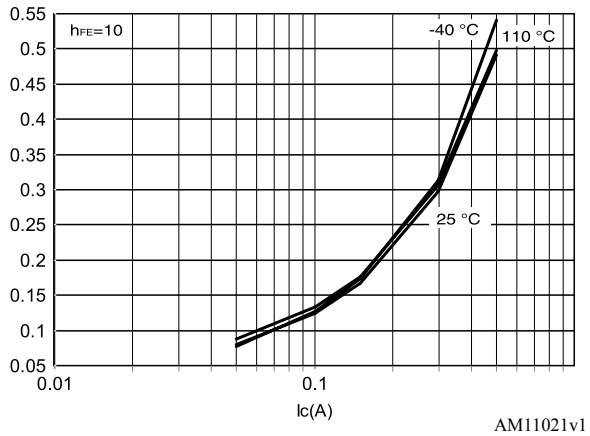
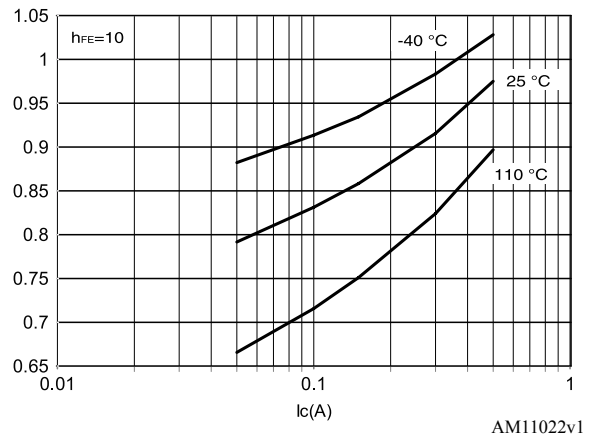


Figure 4. Base emitter saturation voltage (h_{FE} = 10)

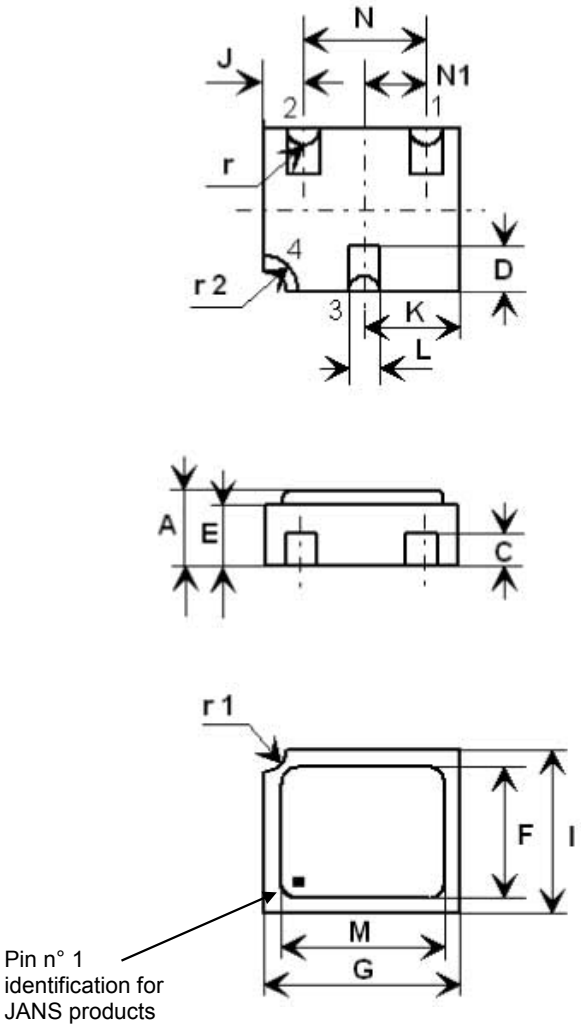


3 Package information

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 UB package information

Figure 5. UB package outline



Pad 1: Emitter

Pad 2: Base

Pad 3: Collector

Pad 4: Shielding connected to the lid

8206487 rev.6

Table 5. **UB package mechanical data**

Symbols	Dimensions in mm			Dimensions in inches (for reference only)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.16		1.42	0.045		0.056
C	0.46	0.51	0.56	0.018	0.020	0.022
D	0.56	0.76	0.96	0.024	0.030	0.036
E	0.92	1.02	1.12	0.036	0.040	0.044
F	1.95	2.03	2.11	0.077	0.080	0.083
G	2.92	3.05	3.18	0.115	0.120	0.125
I	2.41	2.54	2.67	0.095	0.100	0.105
J	0.42	0.57	0.72	0.0165	0.0225	0.0285
K	1.37	1.52	1.67	0.054	0.060	0.066
L	0.41	0.51	0.61	0.016	0.020	0.024
M	2.46	2.54	2.62	0.097	0.100	0.103
N	1.81	1.91	2.01	0.071	0.075	0.079
N1	0.91	0.96	1.02	0.036	0.038	0.040
r		0.20			0.008	
r1		0.30			0.012	
r2		0.56			0.022	

3.2 LCC-3 package information

Figure 6. LCC-3 package outline

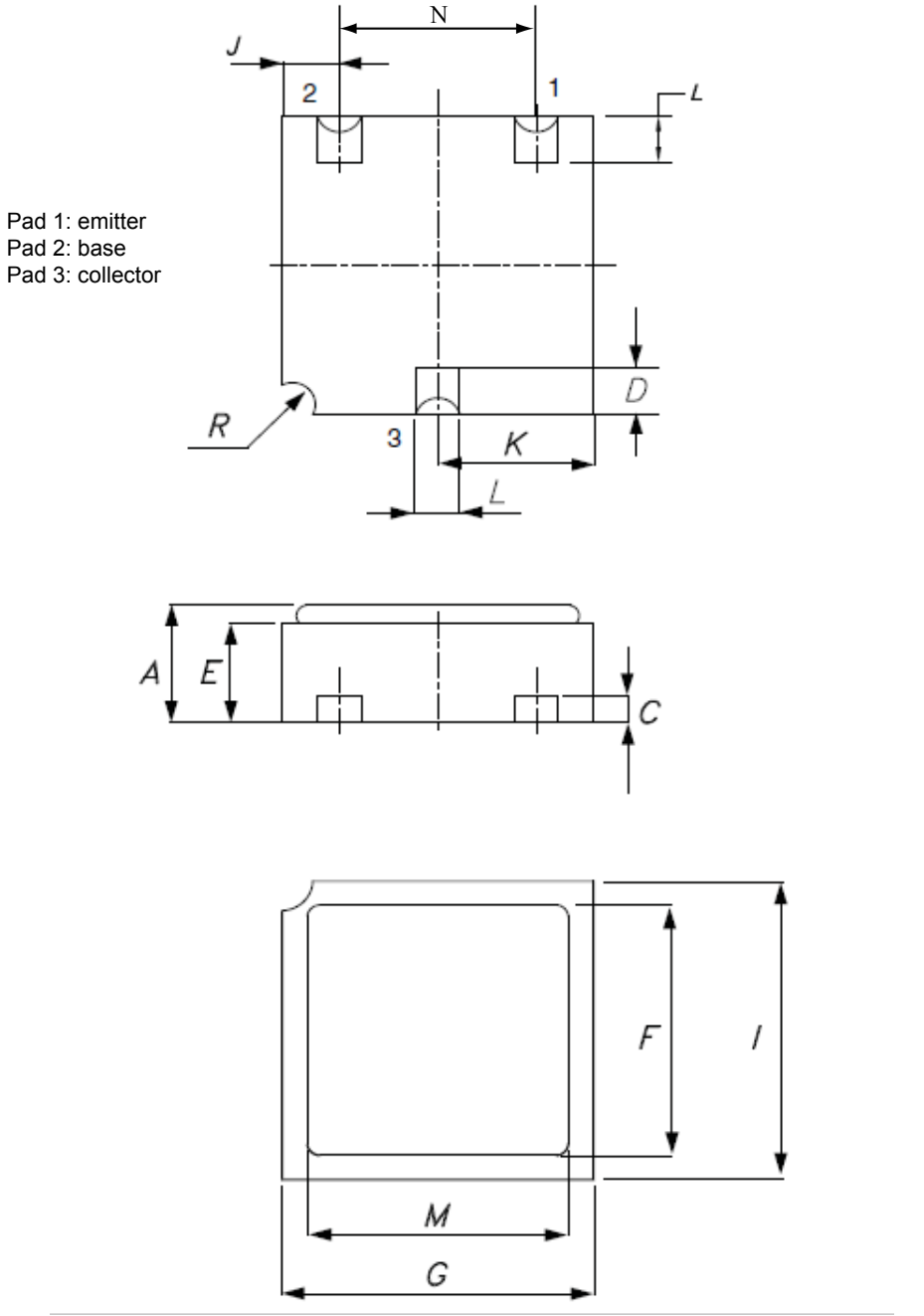


Table 6. **LCC-3 package mechanical data**

Symbols	Dimensions in mm			Dimensions in inches (for reference only)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.16		1.42	0.046		0.056
C	0.45	0.50	0.56	0.018	0.020	0.022
D	0.60	0.56	0.96	0.024	0.022	0.038
E	0.91	1.01	1.12	0.036	0.040	0.044
F	1.95	2.03	2.11	0.077	0.080	0.083
G	2.92	3.05	3.17	0.115	0.120	0.125
I	2.41	2.54	2.66	0.095	0.100	0.105
J	0.42	0.57	0.72	0.0165	0.0225	0.0285
K	1.37	1.52	1.67	0.054	0.060	0.066
L	0.40	0.50	0.60	0.016	0.020	0.024
M	2.46	2.54	2.62	0.097	0.100	0.103
N	1.80	1.90	2.00	0.071	0.075	0.079
R		0.30			0.012	

4 Ordering information

Table 7. Ordering information

Part number	ESCC specification	Screening option	Radiation level	Package	Mass	Lead finish	Mar
2N2907AUB1	-	Engineering model	-	UB	0.6 g	Gold	2N29
SOC2907A1	-		-	LCC-3			SOC
2N2907ARUBG	5202/001/06R	Flight model	100 krad	UB		Gold	5202
2N2907ARUBT	5202/001/07R					Solder Dip	5202
2N2907ARUBTW	5202/001/07R					Solder Dip	5202
2N2907AUBG	5202/001/06		-			Gold	5202
2N2907AUBT	5202/001/07		-			Solder Dip	5202
SOC2907ARHRG	5202/001/04R		100 krad	LCC-3		Gold	5202
SOC2907ARHRT	5202/001/05R					Solder Dip	5202
SOC2907ARHRTW	5202/001/05R					Solder Dip	5202
SOC2907AHRG	5202/001/04		-			Gold	5202
SOC2907AHRT	5202/001/05		-			Solder Dip	5202
SOC2907AHRTW	5202/001/05		-			Solder Dip	5202

1. *Specific marking only. The full marking includes in addition: For the Engineering Models: ST logo, date code; country of origin (FR). 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 specific conditions for products in die form.

5 Other information

5.1 Traceability information

Table 8. Date codes

Model	Date code
EM	3yywwN
ESCC	yywwN

1. *yy = year, ww = week number, N = lot index in the week.*

5.2 Documentation

Table 9. Documentation provided for each type of product

Quality level	Radiation level	Documentation
Engineering model	-	Certificate of conformance
Flight model	-	Certificate of conformance ESCC qualification maintenance lot reference
Flight model	100 krad	Certificate of conformance ESCC qualification maintenance lot reference Radiation verification test (RVT) report at 25 / 50 / 70 / 100 krad at 0.1 rad / s.

Revision history

Table 10. **Document revision history**

Date	Revision	Changes
09-Feb-2009	1	Initial release.
05-Jan-2010	2	Modified Table 1: Device summary
30-Nov-2011	3	Minor text changes in the document title and description on the coverpage
14-May-2012	4	New package inserted (UB). Updated: – Table 1: Device summary, Table 2: Absolute maximum ratings and Table 3: Thermal data. – Section 2: Electrical characteristics and Section 4: Package mechanical data. Added: – Section : and Section 6: Shipping details.
03-Jun-2013	5	Added: – New section Radiation hardness assurance – Corrected the revision number and dates of revision 3.
18-Sep-2013	6	Updated Table 1: Device summary and Table 13: Ordering information
05-May-2014	7	Updated Table 1: Device summary, Table 13: Ordering information and Section 3: Radiation hardness assurance. Added Figure 2: Safe operating area for TO-18 and Figure 3: Safe operating area for LCC-3
29-May-2014	8	Added note 1 in Table 13: Ordering information.
21-Aug-2015	9	Modified: Section 4.3: TO-18 package information Minor text changes.
02-Dec-2015	10	Updated Figure 2.: Safe operating area for TO-18 and Figure 3.: Safe operating area for LCC-3. Minor text chages.
16-Apr-2020	11	Removed TO-18 package information. Minor text changes.
02-Feb-2021	12	Updated Table 1, Table 1, Table 4, Figure 6, Table 7 and Table 9. Removed Radiation summary table. Minor text changes.
16-Nov-2021	13	Updated Features, Description and Product summary on cover page. Updated Table 1, Table 2, Table 7, Table 8 and Table 9. Updated Section 2 Electrical characteristics.
10-Feb-2022	14	Updated Description, Section 2.2 Radiation assurance, Table 7 and Table 9.

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