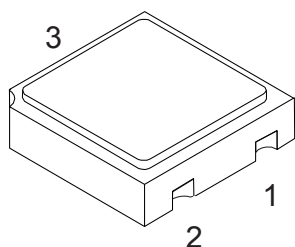
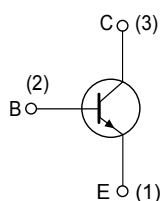


Rad-Hard 50 V, 0.8 A NPN transistor



LCC-3



DS10450

Features

V_{ce0}	$I_C(\text{max.})$	H_{FE} at 10 V, 150 mA	$T_j(\text{max.})$
50 V	0.8 A	> 100	200 °C

- Hermetic packages
- ESCC qualified
- 100 krad

Description

The SOC2222AHR 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 5201/002 specification and available in LCC-3 hermetic package, 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

SOC2222AHR

Product summary

Product summary				
Part-number	Qualification system	Agency specification	Package	Radiation level
SOC2222ARHRx	ESCC Flight	5201/002	LCC-3	100 krad
SOC2222AHRx	ESCC Flight	5201/002	LCC-3	-

Note: See [Table 6](#) for ordering information.

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CBO}	Collector-base voltage ($I_E = 0$)	75	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	50	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	0.8	A
P_{TOT}	Total dissipation at $T_{amb} \leq 25\text{ °C}$	0.5 0.73 ⁽¹⁾	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	Value	Unit
R_{thJA}	Thermal resistance junction-ambient (max)	350	°C/W
		240 ⁽¹⁾	

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

2 Electrical characteristics

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

Symbol	Parameter	Test conditions	Min.	Max.	Unit
I_{CBO}	Collector-base cut-off current ($I_E = 0$)	$V_{CB} = 60\text{ V}$		10	nA
		$V_{CB} = 60\text{ V}$, $T_{amb} = 150\text{ °C}$		10	μA
I_{EBO}	Emitter-base cut-off current ($I_C = 0$)	$V_{EB} = 3\text{ V}$		10	nA
$V_{(BR)CBO}$	Collector-base breakdown voltage ($I_E = 0$)	$I_C = 100\text{ }\mu\text{A}$	75		V
$V_{(BR)CEO}^{(1)}$	Collector-emitter breakdown voltage ($I_B = 0$)	$I_C = 10\text{ mA}$	50		V
$V_{(BR)EBO}$	Emitter-base breakdown voltage ($I_C = 0$)	$I_C = 100\text{ }\mu\text{A}$	6		V
$V_{CE(sat)}^{(1)}$	Collector-emitter saturation voltage	$I_C = 150\text{ mA}$, $I_B = 15\text{ mA}$		0.3	V
$V_{BE(sat)}^{(1)}$	Base-emitter saturation voltage	$I_C = 150\text{ mA}$, $I_B = 15\text{ mA}$		1.2	V
$h_{FE}^{(1)}$	DC current gain	$I_C = 0.1\text{ mA}$, $V_{CE} = 10\text{ V}$	35		
		$I_C = 10\text{ mA}$, $V_{CE} = 10\text{ V}$	75		
		$I_C = 150\text{ mA}$, $V_{CE} = 10\text{ V}$	100	300	
		$I_C = 500\text{ mA}$, $V_{CE} = 10\text{ V}$	40		
		$I_C = 10\text{ mA}$, $T_{amb} = -55\text{ °C}$, $V_{CE} = 10\text{ V}$	35		
h_{fe}	Small signal current gain	$I_C = 20\text{ mA}$, $f = 100\text{ MHz}$, $V_{CE} = 20\text{ V}$	2.5		
C_{OBO}	Output capacitance ($I_E = 0$)	$100\text{ kHz} \leq f \leq 1\text{ MHz}$, $V_{CB} = 10\text{ V}$		8	pF
t_{on}	Turn-on time	$I_{CC} = 150\text{ mA}$, $I_{B1} = 15\text{ mA}$, $V_{CC} = 30\text{ V}$		35	ns
t_{off}	Turn-off time	$I_{CC} = 150\text{ mA}$, $I_{B1} = I_{B2} = 15\text{ mA}$, $V_{CC} = 30\text{ V}$		285	ns

1. Pulsed duration = 300 μs , duty cycle $\leq 1.5\%$

2.1 Radiation assurance

Radiation test are guaranteed in compliance with ESCC 22900 and ESCC 5201/002 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 5201/002 post radiation electrical characteristics ($T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Max	Unit
I_{CBO}	Collector cut-off current ($I_E = 0$)	$V_{CB} = 60\text{ V}$		10	nA
I_{EBO}	Emitter cut-off current ($I_C = 0$)	$V_{EB} = 3\text{ V}$		10	nA
$V_{(BR)CBO}$	Collector-base breakdown voltage ($I_E = 0$)	$I_C = 100\text{ }\mu\text{A}$	75		V
$V_{(BR)CEO}^{(1)}$	Collector-emitter breakdown voltage ($I_B = 0$)	$I_C = 10\text{ mA}$	50		V
$V_{(BR)EBO}$	Emitter-base breakdown voltage ($I_C = 0$)	$I_E = 100\text{ }\mu\text{A}$	6		V
$V_{CE(sat)}^{(1)}$	Collector-emitter saturation voltage	$I_C = 150\text{ mA}$, $I_B = 15\text{ mA}$		0.3	V
$V_{BE(sat)}^{(1)}$	Base-emitter saturation voltage	$I_C = 150\text{ mA}$, $I_B = 15\text{ mA}$		1.2	V
$[h_{FE}]^{(1)}$	Post irradiation gain calculation ⁽²⁾	$I_C = 0.1\text{ mA}$, $V_{CE} = 10\text{ V}$	[17.5]		
		$I_C = 10\text{ mA}$, $V_{CE} = 10\text{ V}$	[37.5]		
		$I_C = 150\text{ mA}$, $V_{CE} = 10\text{ V}$	[50]	300	
		$I_C = 500\text{ mA}$, $V_{CE} = 10\text{ V}$	[20]		

1. Pulsed duration = 300 μs , duty cycle $\geq 2\%$

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.

2.2 Electrical characteristics (curves)

Figure 1. DC current gain

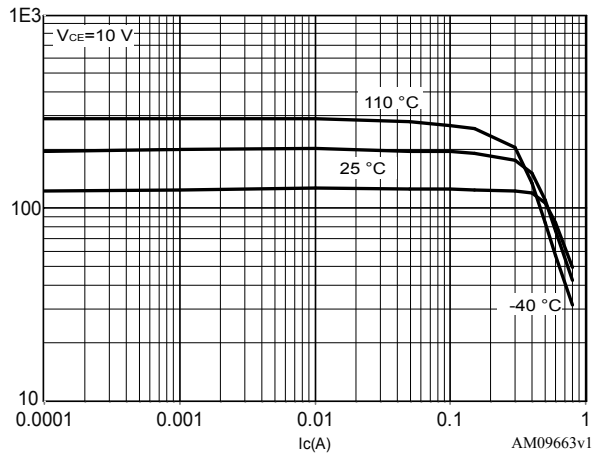


Figure 2. Collector emitter saturation voltage

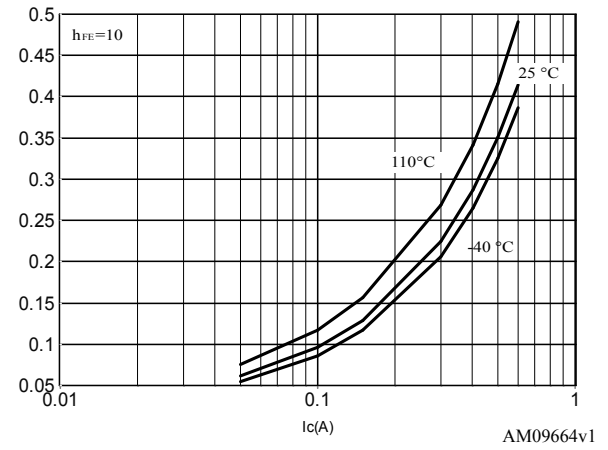
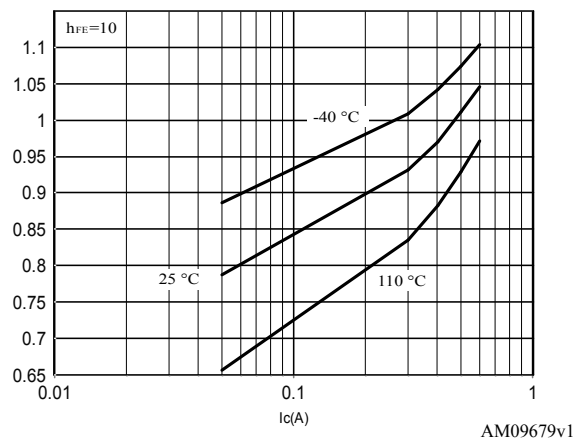
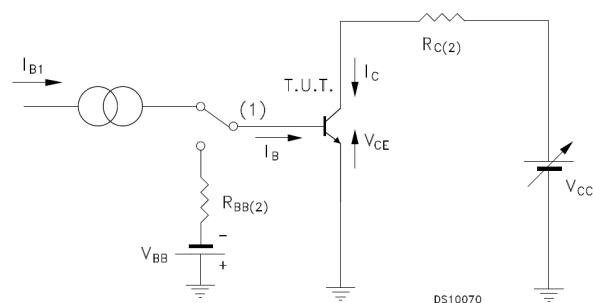


Figure 3. Base emitter saturation voltage



2.3 Test circuits

Figure 4. ESCC resistive load switching test circuit



Note: (1) Fast electronic switch

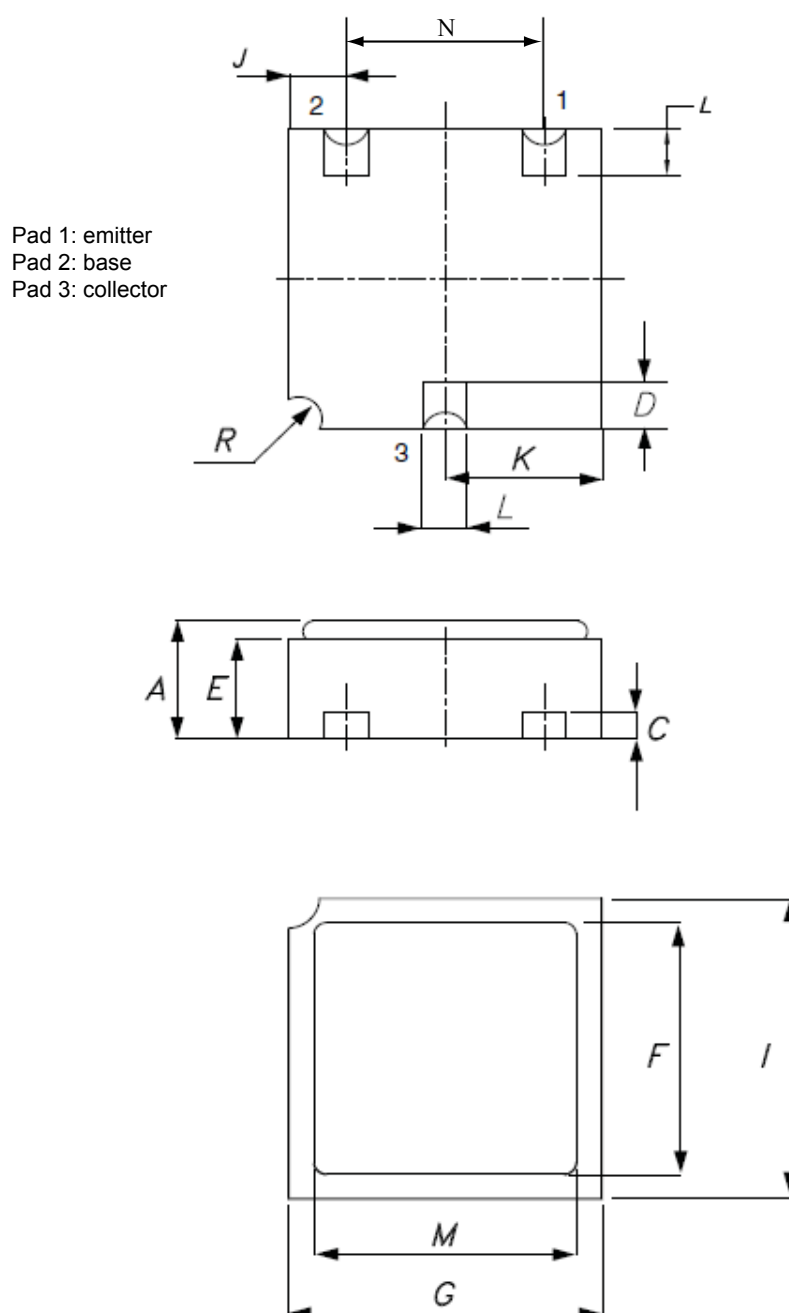
Note: (2) Non-inductive resistor

3 Package information

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 LCC-3 package information

Figure 5. LCC-3 package outline



0041211 rev.14

Table 5. 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 6. Ordering information

Part number	ESCC specification	Screening option	Radiation level	Package	Mass	Lead finish	Marking ⁽¹⁾	Packing
SOC2222A1	-	Engineering model	-	LCC-3	0.6 g	Gold	SOC2222A1	WafflePack
SOC2222ARHRG	5201/002/04R	Flight model	100 krad			Gold	520100204R	WafflePack
SOC2222ARHRT	5201/002/05R					Solder Dip	520100205R	
SOC2222ARHRTW	5201/002/05R					Solder Dip	520100205R	Tape and reel
SOC2222AHRG	5201/002/04		-			Gold	520100204	WafflePack
SOC2222AHRT	5201/002/05		-			Solder Dip	520100205	
SOC2222AHRTW	5201/002/05		-			Solder Dip	520100205	Tape and reel

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 specific conditions for products in die form.



5 Other information

5.1 Traceability information

Table 7. 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 8. 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 9. Document revision history

Date	Revision	Changes
11-Sep-2024	1	Initial release.

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