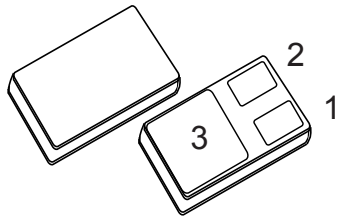
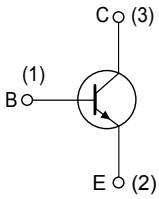
2ST15300

Datasheet

Rad-Hard 300 V, 5 A NPN bipolar transistor



SMD.5



DS10450

Features

V_{CBO}	I_C(max.)	H_{FE} at 0.6 V, 250 mA	T_j(max.)
300 V	5 A	> 55	200 °C

- 100 krad
- Linear gain characteristics
- Inductive load ruggedness

Description

The 2ST15300 is a power bipolar transistor able to operate under severe environment conditions and radiation exposure. It offers high reliability performance and immunity to the total ionizing dose (TID) up to 100 krad.

Qualified as per 5201/020 ESCC specification and available in SMD.5 hermetic package, it is specifically recommended for space and harsh environment applications and suitable for satellite electrical propulsion, inductive load switches and linear amplifiers.

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

Product status link
2ST15300

1 Electrical ratings

Table 1. Absolute maximum ratings (pre-irradiation)

Symbol	Parameter	Value	Unit
V_{CBO}	Collector-base cut-off current (I_E = 0)	300	V
V_{CEO}	Collector-emitter voltage (I_B = 0)	100	V
V_{EBO}	Emitter-base current (I_C = 0)	6	V
I_C	Drain current (pulsed)	5	A
P_{TOT}	Total power dissipation at $T_{case} \leq 25$ °C	40	W
	Total power dissipation at $T_{ambient} \leq 25$ °C	2.2	
T_{op}	Operating temperature range	-65 to 200	°C
T_j	Max. operating junction temperature	200	°C

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case max.	4.38	°C/W
$R_{thJ\text{-}a}$	Thermal resistance junction-ambient max.	80	°C/W

2 Electrical characteristics

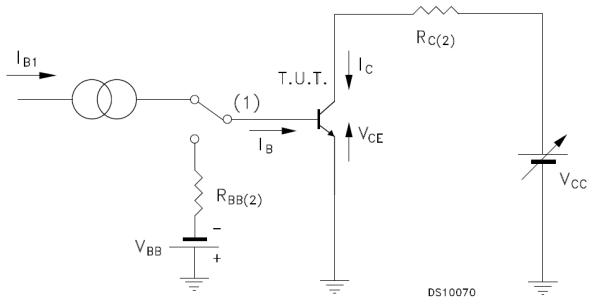
T_C = 25 °C unless otherwise specified

Table 3. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Max.	Unit
I_{CBO}	Collector-base cut-off current (I_E = 0)	V_{CB} = 300 V		10	µA
		V_{CB} = 300 V, T_C = 150 °C		100	
I_{EBO}	Emitter-base cut-off current (I_C = 0)	V_{EB} = 6 V		50	µA
$V_{(BR)CBO}$	Collector-base breakdown voltage (I_E = 0)	I_C = 10 mA	300		V
$V_{(BR)CEO}$	Collector-emitter breakdown voltage (I_B = 0)	I_C = 10 mA	100		V
$V_{(BR)EBO}$	Emitter-base breakdown voltage (I_C = 0)	I_E = 10 µA	6		V
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_C = 5 A, I_B = 1 A		0.7	V
$V_{BE(sat)}$	Base-emitter saturation voltage	I_C = 5 A, I_B = 1 A		1.4	V
h_{FE}	DC current gain	I_C = 50 mA, V_{CE} = 0.6 V	50		
		I_C = 250 mA, V_{CE} =0.6 V	55		
		I_C = 1 A, V_{CE} = 5 V	55		
		I_C = 5 A, V_{CE} = 5 V	35		
t_{ON}	Turn-on time	V_{CC} = 30 V, I_C = 3 A, I_{B1} = 0.3 A, I_{B2} = 0.3 A, resistive load		0.4	µs
t_{OFF}	Turn-off time			3.5	µs
C_{OB}	Output-base	V_{CB} = 10 V, f = 1 MHz		120	pF

2.1 Test circuits

Figure 1. ESCC resistive load switching test circuit



Note: (1) Fast electronic switch

Note: (2) Non-inductive resistor

3 Radiation hardness assurance

This products is guaranteed in radiation as per ESCC 22900 and in compliance with ESCC 5201/020 specification. Each lot is tested in radiation according to the following procedure:

- Standard dose rate window (typical at 0.1 rad / sec.)
- Test of 11 samples (5 biased at 80% of BV_{CBO}, 5 unbiased and 1 for reference)
- Acceptance criteria in compliance with the post radiation electrical characteristics as per Table 4.

Table 4. Post radiation electrical characteristics at 100 krad (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} = 240 V		10	µA
I_{EBO}	Emitter-base cut-off current (I_C = 0)	V_{EB} = 6 V		50	µA
$V_{(BR)CBO}$	Collector-base breakdown voltage (I_E = 0)	I_C = 10 mA	240		V
$V_{(BR)CEO}$ (1)	Collector-emitter breakdown voltage (I_B = 0)	I_C = 10 mA	100		V
$V_{(BR)EBO}$	Emitter-base breakdown voltage (I_C = 0)	I_E = 10 µA	6		V
$V_{CE(sat)}$ (1)	Collector-emitter saturation voltage	I_C = 5 A, I_B = 1 A		0.7	V
$V_{BE(sat)}$ (1)	Base-emitter saturation voltage	I_C = 5 A, I_B = 1 A		1.4	V
[h_{FE}]	Post irradiation gain calculation(2)	I_C = 50 mA, V_{CE} = 0.6 V	[25]		
		I_C = 250 mA, V_{CE} = 0.6 V	[27.5]		
		I_C = 1 A, V_{CE} = 5 V	[27.5]		
		I_C = 5 A, V_{CE} = 5 V	[17.5]		

1. *Pulse test: pulse duration ≤ 300 µs, duty cycle ≤ 2%.*
2. *The post-irradiation gain calculation [h_{FE}] is made according to MILSTD-750 test method 1019.*

Table 5. Post radiation electrical characteristics at 30 krad (T_{amb} = 25 °C unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Max	Unit
$V_{(BR)CBO}$	Collector-base breakdown voltage (I_E = 0)	I_C = 10 mA	270		V
I_{CBO}	Collector-base cut-off current (I_E = 0)	V_{CB} = 270 V		10	µA

4 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.

4.1 SMD.5 package information

Figure 2. Surface mount SMD.5 package outline (3-terminal)

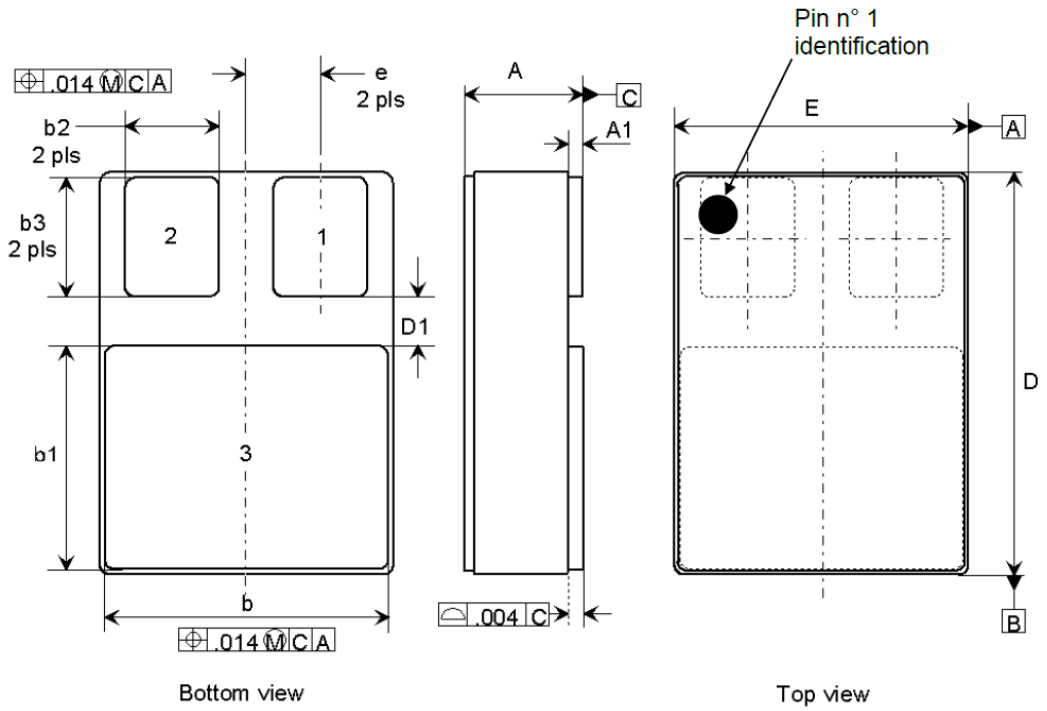


Table 6. SMD.5 package mechanical data

Symbols	Dimensions (mm)			Dimensions (inches)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.84		3.30	0.112		0.130
A1	0.25	0.38	0.51	0.010	0.015	0.020
b	7.13	7.26	7.39	0.281	0.286	0.291
b1	5.58	5.72	5.84	0.220	0.225	0.230
b2	2.28	2.41	2.54	0.090	0.095	0.100
b3	2.92	3.05	3.18	0.115	0.120	0.125
D	10.03	10.16	10.28	0.395	0.400	0.405
D1	0.76			0.030		
E	7.39	7.52	7.64	0.291	0.296	0.301
e		1.91			0.075	

5 Order codes

Table 7. **Ordering information**

Part number	Agency specification	Quality level	Radiation level	Package	Mass	Lead finish	Marking	Packing
2ST15300SR1	-	Engineer model	-	SMD.5	1 g	Gold	2ST15300SR1	Strip pack
2ST15300RSRHRG	5201/020	Flight model	100 krad				520102001R	
2ST15300RSRHRGW								Tape and reel
2ST15300RSRHRT						Solder dip	520102002R	Strip pack
2ST15300RSRHRTW								Tape and reel

Contact ST sales office for information about the specific conditions for products in die form.

6 Other information

Table 8. Traceability and documentation

Screening type	Date code[1]	Radiation level	Documentation
Engineering model	3yywwN	-	Certificate of conformance
Flight model	yywwN	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.

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

Revision history

Table 9. **Document revision history**

Date	Version	Changes
07-Aug-2019	1	First release.
12-Oct-2020	2	Updated *Section Description*, *Table 3. Electrical characteristics*. Added *Section 2.1 Test circuits*. Minor text changed
19-Jan-2021	3	Updated *Table 1*, *Figure 2* and *Table 5*.
11-Mar-2021	4	Updated *Table 6* and *Table 1*.
27-Jul-2022	5	Updated *Table 7*.
28-Oct-2022	6	Updated *Features*, *Description*, *Section 3 Radiation hardness assurance* and *Section 5 Order codes*.
27-Apr-2023	7	Updated Table 4. Inserted Table 5.
17-May-2023	8	Updated Table 5.

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