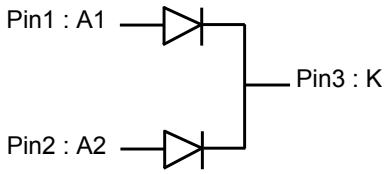
STTH60200CHR

Datasheet

Rad-Hard 60 A - 200 V fast recovery rectifier

SMD1



The upper metallic lid is not internally connected to any pin, nor to the IC die inside the package

Features

- Forward current: 2 x 30 A
- Repetitive peak reverse voltage: 200 V
- Low forward voltage drop: 0.95 V at 60 A / 125 °C
- Monolithic dual die - common cathode
- Ceramic hermetic package
- TID and SEE characterized
- Package mass: 2.3 g
- ESCC qualified: 5103/033

Description

The STTH60200CHR is a monolithic dual rectifier assembled in a SMD1 hermetic package and screened to comply with the ESCC5000 specification for Rad-Hard products. It is in addition characterized in total dose and in single event effect. it is intended to get ESCC qualified.

The ESCC Detail Specification for this device is available from the European Space Agency web site. ST guarantees full compliance of qualified parts with the ESCC Detailed Specification.

Product status link
STTH60200CHR

Product summary	
$I_{F(AV)}$	2 x 30 A
V_{RRM}	200 V
T_j(max)	175 °C
$V_{F(max)}$ at 2 x 30 A / 125 °C	0.95 V

1 Characteristics

1.1 Absolute maximum ratings

The absolute maximum ratings are limiting values at 25°C, per diodes unless otherwise notified. Values provided in Table 1. Absolute maximum ratings shall not be exceeded at any time during use or storage

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{RRM}	Repetitive peak reverse voltage	200	V
I_O	Average output rectified current per diode(1) per package	40 60	A
I_{FSM}(2)	Forward surge current	300	A
T_{op}	Operating temperature range (case temperature)	-65 to +175	°C
T_j	Maximum junction temperature	+175	°C
T_{stg}	Storage temperature range	-65 to +175	°C
T_{sol}(3)	Soldering temperature	+245	°C

1. *DC value. For T_{case} > +65 °C, derate linearly to 0 A at +175 °C.*
2. *At T_{amb}<= +25 °C*
3. *Duration 5 seconds maximum with at least 3 minutes between consecutive temperature peaks.*

1.2 Thermal parameters

Table 2. Thermal parameters

Symbol	Parameter		Typ. value	Max. value	Unit
$R_{th(j-c)}$	Thermal resistance, junction to case (1)	Per diode	-	2.4	°C/W
		Per package	-	2.0	

1. *When only 1 diode is used, the dissipation is made from a part of the die, hence to a higher thermal resistance.*

1.3 Electrical characteristics

Limiting value per diodes, unless otherwise specified.

Table 3. Static electrical characteristics

Symbol	Parameter	MIL-STD-750 test method	Test conditions[1]		Min.	Typ.	Max.	Unit
I_R	Reverse leakage current	4016	DC method, V_R = 200 V	T_j = 25 °C	-	0.02	30	µA
				T_j = 125 °C	-	105	300	
V_F [2]	Forward voltage drop	4011	I_F = 5 A	T_j = -55 °C	-	0.88	1.04	V
				T_j = 25 °C	-	0.74	0.87	
				T_j = 125 °C	-	0.57	0.66	
			I_F = 10 A	T_j = -55 °C	-	0.92	1.07	
				T_j = 25 °C	-	0.81	0.92	
				T_j = 125 °C	-	0.65	0.75	
			I_F = 20 A	T_j = -55 °C	-	0.98	1.15	
				T_j = 25 °C	-	0.88	1.02	
				T_j = 125 °C	-	0.74	0.87	
			I_F = 30 A	T_j = -55 °C	-	1.03	1.20	
				T_j = 25 °C	-	0.95	1.09	
				T_j = 125 °C	-	0.82	0.95	
			I_F = 40 A	T_j = -55 °C	-	1.08	1.25	
				T_j = 25 °C	-	1.00	1.15	
				T_j = 125 °C	-	0.88	1.02	

1. *Test performed with both anode terminals 1 and 2 tied together*
2. *Pulse width 680 µs, duty cycle ≤ 2%*

Table 4. Dynamic electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
C[1]	Junction capacitance	T_j = 25 °C	V_R = 10 V, F = 1 MHz	-	-	225	pF
t_{rr}[2]	Reverse recovery time	T_j = 25 °C	I_F = 1 A, dIF/dt = -50 A/µs, V_R = 30 V	-	-	60	ns
I_{RM}	Reverse recovery current	T_j = 125 °C	I_F = 30 A, dI_F/dt = -200 A/µs, V_R = 160 V	-	10.5		A
Q_{RR}	Reverse recovery charges			-	335		nC
S_{factor}	Softness factor			-	0.25		

1. *By default, guaranteed by sampling. Guaranteed by a 100% test in case the sampling acceptance criteria is not met.*
2. *Guaranteed by design and characterization. Not tested in production*

1.4 Characteristics (curves)

Figure 1. Typical forward voltage drop versus forward current

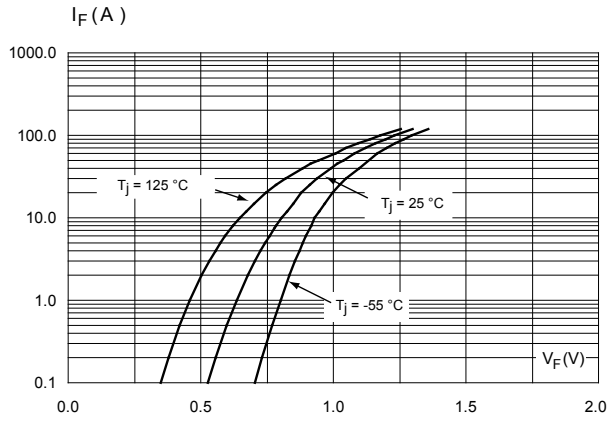


Figure 2. Maximum forward voltage drop versus forward current

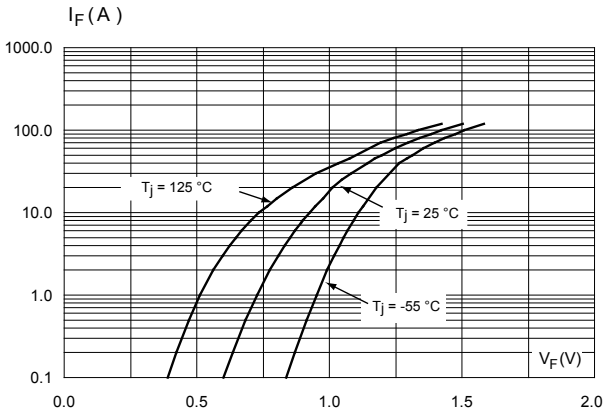


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

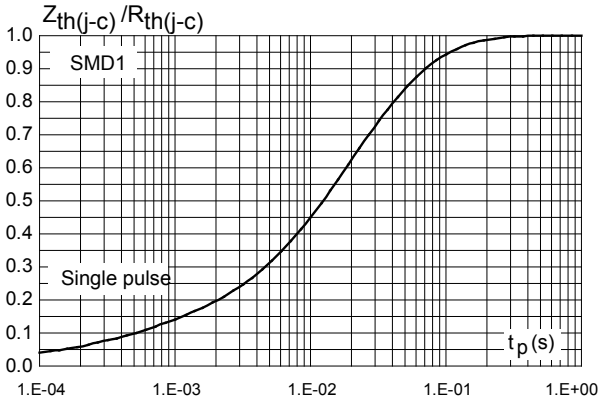


Figure 4. Typical peak reverse recovery current versus dI_F/dt

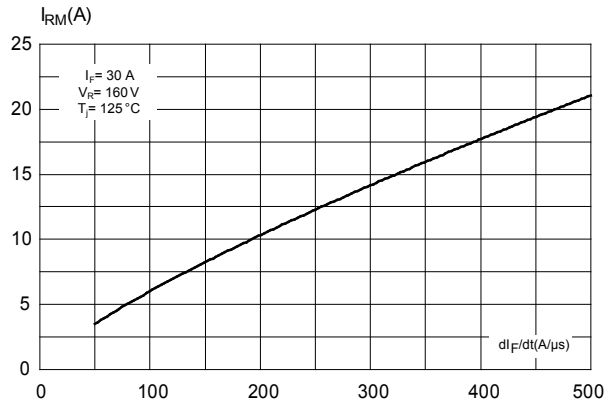


Figure 5. Typical reverse recovery time versus dI_F/dt

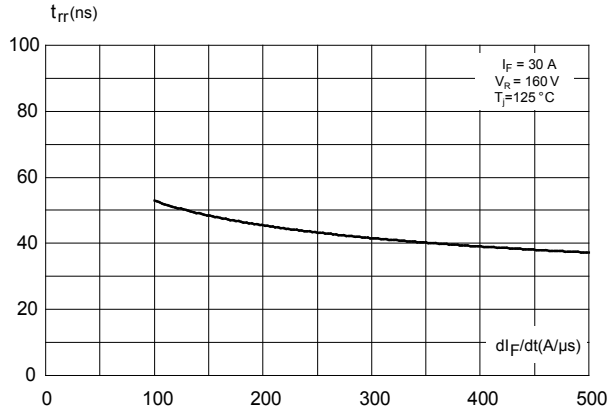


Figure 6. Typical reverse recovery charges versus dI_F/dt

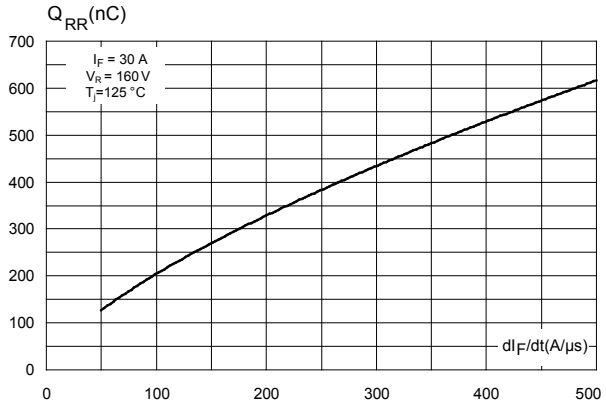
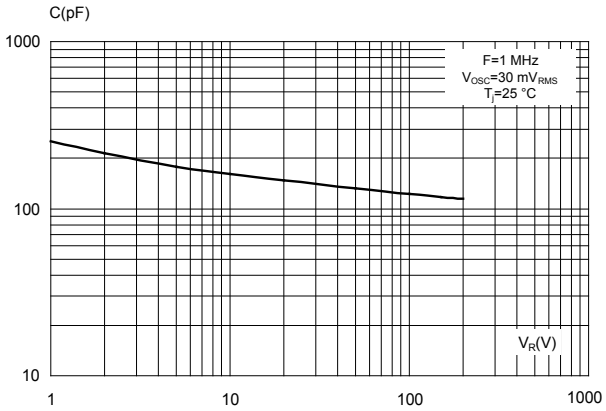


Figure 7. Typical junction capacitance versus reverse voltage applied



2 Radiation

The technology of the STMicroelectronics Rad-Hard rectifier's diodes is intrinsically highly resistant to radiative environments.

The product radiation hardness assurance is supported by a total ionisation dose (TID) test at high dose rate and a single effect event (SEE) characterization.

2.1 Total dose radiation (TID) testing

The part has been characterized in total ionizing dose at high dose rate on 12 parts packaged in SMD1, 4 parts unbiased, 4 parts reverse biased and 4 parts forward biased. All parts were from the same wafer lot.

The irradiation has been done according to the ESCC 22900 specification, standard window.

Both pre-irradiation and post-irradiation performances have been tested using the same circuitry and test conditions for a direct comparison can be done (T_{amb} = 22 ±3 °C unless otherwise specified).

The following parameters were measured :

- Before irradiation
- After irradiation at final dose 3 Mrad(Si)
- After 168 hrs at room temperature
- after 168 hrs at 100 °C anneal

Based on this characterization, the device is deemed able to sustain 3 Mrad(Si) while maintaining all its parameters within its specifications.

2.2 Single event effect

The Single Event Effect (SEE) relevant to power rectifiers are characterized, i.e. the Single Event Burnout (SEB).

The tests are performed as per ESCC 25100, each one on 3 pieces from 1 wafer at room temperature.

The accept/reject criteria are :

- SEB (Destructive mode):

  The diode is reverse biased during irradiation. The test is stopped as soon as a SEB occurs or when the reverse leakage current is above the specification or when the overall fluency on the component reaches 1E7 cm².
- Post irradiation stress test (PIST):

  After the irradiation, a stress is applied to the diode in order to reveal any latent damage on the irradiated devices.

  The reverse voltage value is increased from 0 V to 100% of $V_R$max. and then decreased from 100% of the $V_R$max. to 0 V. At each step, the reverse leakage current value is measured.

Table 5. Radiation hardness assurance summary

Type	Conditions	Result
Total ionisation dose	Characterization of 1 wafer up to 3 Mrad(Si) Test of 4 reverse biased + 4 forward biased + 4 unbiased samples Test at High Dose Rate	Immune up to 3 Mrad(Si)
Single effect burnout	LET : 61.2 MeV.cm/mg V_{cc} : 200 V	No burnout

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 SMD1 package information

Figure 8. SMD1 package outline

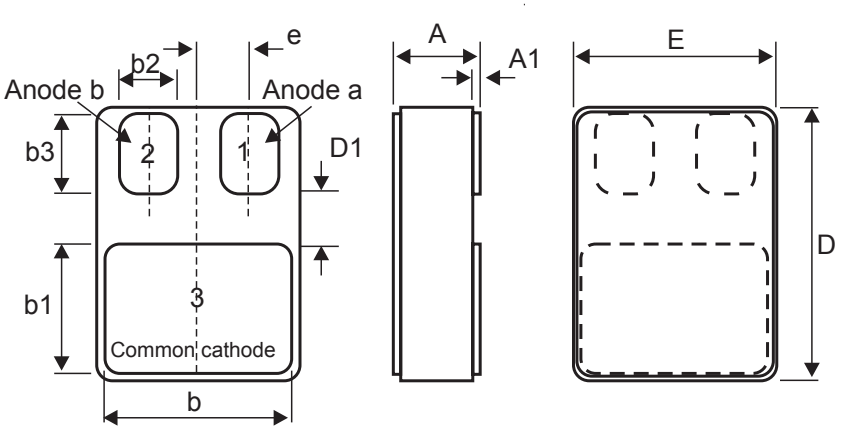


Table 6. **SMD1 package mechanical data**

Symbols	Dimansions (mm)		
	Min.	Typ.	Max.
A	3.3		3.61
A1	0.25		0.51
b	9.4		9.65
b1	10.41		10.67
b2	3.43		3.68
b3	3.86		4.11
D	15.75		16
D1	0.76		
E	11.3		11.56
e		2.67 BSC	

4 Ordering information

Table 7. Ordering information

Order codes	ESCC detail specification	Quality level	Package	Lead finishing	Marking[1]	Weight	Packing
STTH60200CSA1	-	engineering model	SMD1	Gold	STTH60200CSA1	2.3 g	Strip pack
STTH60200CSAG	5103/033/03	Flight model			510303303		

1. *Specific marking only. The full marking includes in addition:*
   - *For the Engineering Models: ST logo, date code, country of origin (FR)*
   - *For flight parts: ST logo, date code, country of origin (FR), ESA logo, serial number of the part within the assembly lot*

5 Other information

5.1 Traceability information

The date code in formation is structured as described in the table below.

Table 8. Date codes

Model	Date code[1]
EM	3yywwN
ESCC	yywwN

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

5.2 Documentation

Each product shipment includes a set of associated documentation within the shipment box. This documentation depends on the quality level of the products, as detailed in the table below.

The documentation is provided on printed paper in a dedicated envelop.

Table 9. Default documentation provided with the parts

Quality level	Documentation
Engineering Model	Certificate of Conformance including : • Customer name • Customer purchase order number • ST sales order number and item • ST part number • Quantity delivered • Date code • Reference data sheet • Reference to TN1180 on engineering models • ST Rennes assembly lot ID
ESCC Flight	Certificate of Conformance including: • Customer name • Customer purchase order number • ST sales order number and item • ST part number • Quantity delivered • Date code • Serial numbers • Reference of the applicable ESCC Qualification maintenance lot • Reference to the ESCC detail specification • ST Rennes assembly lot ID Radiation verification test report[1]

1. *Report of the ESCC22900 test supporting the delivered parts*

Revision history

Table 10. **Document revision history**

Date	Revision	Changes
12-Jul-2018	1	First issue.
12-May-2020	2	Updated ESCC qualification on Features and Table 1.

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