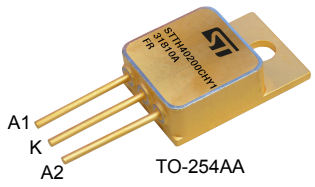
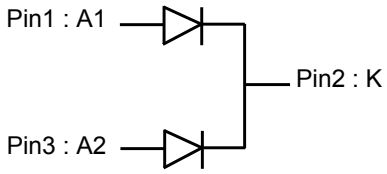
STTH40200CHR

Datasheet

Rad-Hard 40 A - 200 V fast recovery rectifier



The TO-254-AA is a metallic package.
It is not connected to any pin nor to the inside die.



Features

- Forward current: 2 x 20 A
- Repetitive peak reverse voltage: 200 V
- Low forward voltage drop: 0.87 V at 40 A / 125 °C
- Monolithic dual die - common cathode
- Ceramic hermetic package
- TID and SEE tested
- Package mass: 9.4 g
- ESCC qualified: 5103/033

Description

The STTH40200CHR is a monolithic dual rectifier assembled in a TO-254AA hermetic package and screened to comply with the ESCC5000 specification for Rad-Hard products. It is in addition tested in total dose rate and in single event effect. it is 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
STTH40200CHR

Product summary	
$I_{F(AV)}$	2 x 20 A
V_{RRM}	200 V
T_j(max)	175 °C
$V_{F(max)}$ at 125 °C	0.87 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 40	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} > +110 °C, derate linearly to 0 A at +175 °C.*
2. *Pulse width 680 µs with duty cycle <= 2%*
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	-	1.4	°C/W
		Per package	-	1.0	

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.	Max.	Unit
I_R	Reverse leakage current	4016	DC method, V_R = 200 V	T_j = 25 °C	-	30	µA
				T_j = 125 °C	-	300	
V_F [2]	Forward voltage drop	4011	I_F = 5 A	T_j = -55 °C	-	1.04	V
				T_j = 25 °C	-	0.87	
				T_j = 125 °C	-	0.66	
			I_F = 10 A	T_j = -55 °C	-	1.07	
				T_j = 25 °C	-	0.92	
				T_j = 125 °C	-	0.75	
			I_F = 20 A	T_j = -55 °C	-	1.15	
				T_j = 25 °C	-	1.02	
				T_j = 125 °C	-	0.87	
			I_F = 30 A	T_j = -55 °C	-	1.2	
				T_j = 25 °C	-	1.09	
				T_j = 125 °C	-	0.95	
			I_F = 40 A	T_j = -55 °C	-	1.25	
				T_j = 25 °C	-	1.15	
				T_j = 125 °C	-	1.02	

1. *Test performed with both anode terminals 2 and 3 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}[1][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}[2]	Reverse recovery current	T_j = 125 °C	I_F = 20 A, dIF/dt = -200 A/µs, V_R = 160 V	-	9.5		A
Q_{RR}	Reverse recovery charges			-	295		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

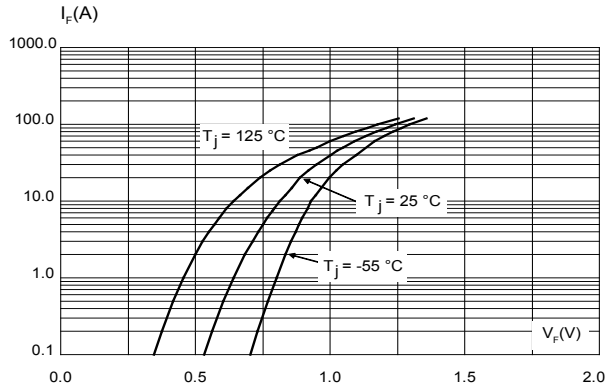


Figure 2. Maximum forward voltage drop versus forward current

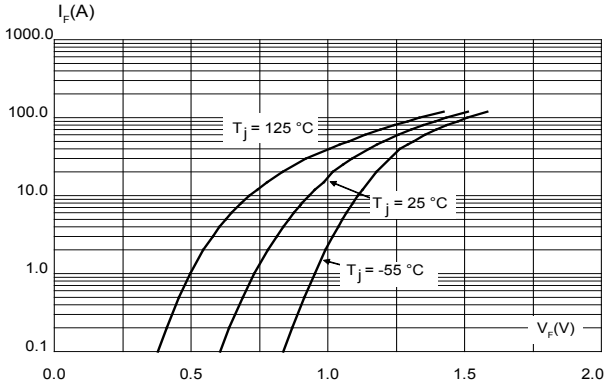


Figure 3. Relative variation of Rthjc versus pulse duration

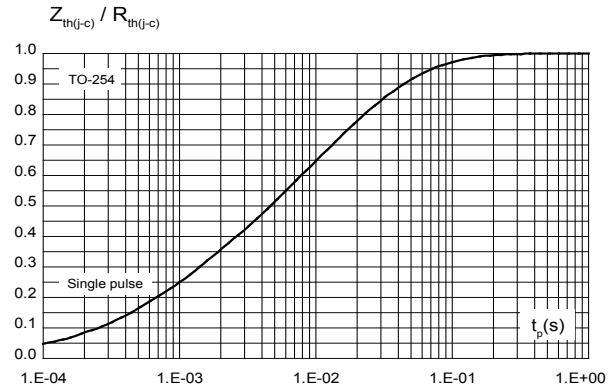


Figure 4. Typical peak reverse recovery current versus dI_F/dt

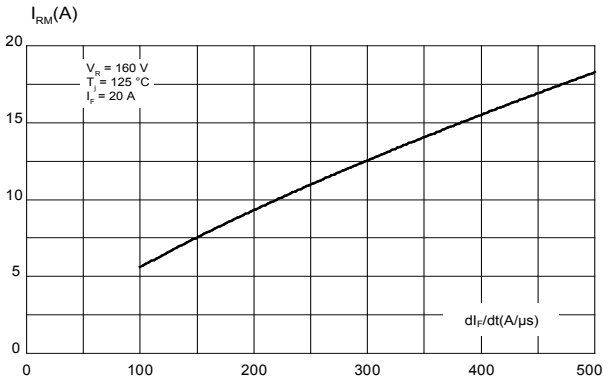


Figure 5. Reverse recovery time versus dI_F/dt (typical values)

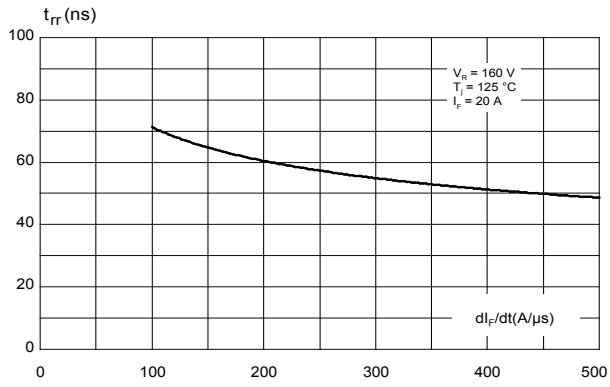


Figure 6. Typical reverse recovery charges versus dI_F/dt

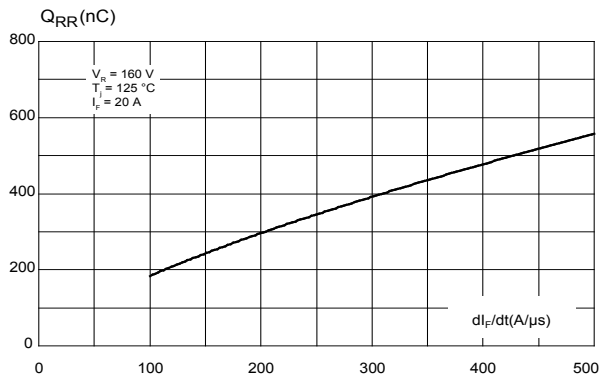


Figure 7. Typical reverse recovery softness factor versus dI_F/dt

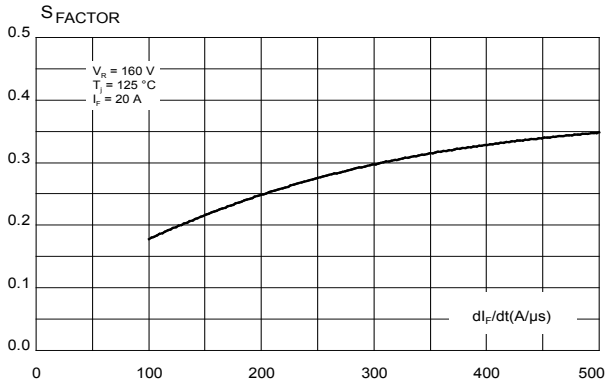


Figure 8. Relative variations of dynamic parameters versus junction temperature

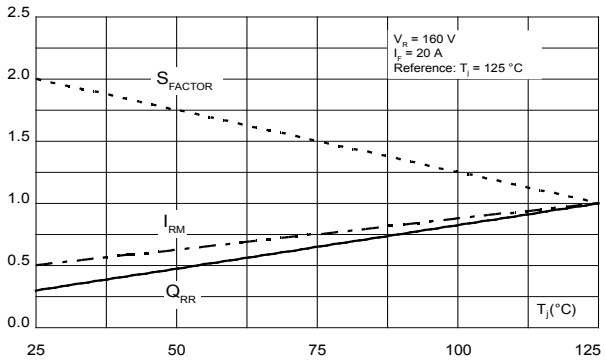
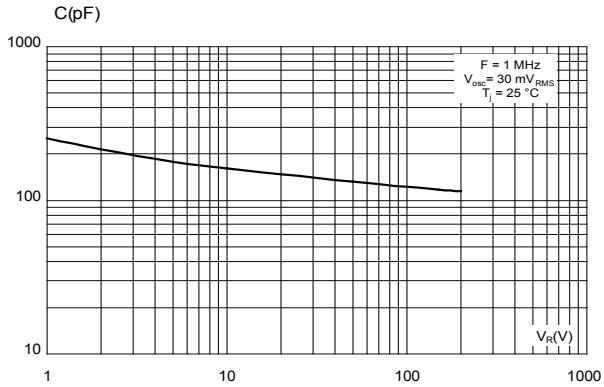


Figure 9. Junction capacitance versus reverse voltage applied (typical values)



2 Radiation

The technology of 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

Diodes are considered as intrinsically immune to Total Ionization Dose (TID) up to at least 300 krad(Si) as per ESCC-Q-ST-60-15C.

ST has characterized the STTH40200CHR in TID up to 3 Mrad(Si) on 21 parts issued from two different diffusion lots, packaged in SMD1, 7 parts unbiased, 7 parts reverse biased and 7 parts forward biased.

The irradiation has been done according to the ESCC 22900 specification standard window i.e. high dose rate (0.36 to 180 krad(Si)/hour).

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 key parameters were measured four times:

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

All parameters stay within specification after each steps, supporting the claim that the product sustains 3 Mrad(Si). However, in absence of TID test on each wafer lot, the product is not ESCC qualified at this radiation level.

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.
- PIST (post-irradiation stress) test:

  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

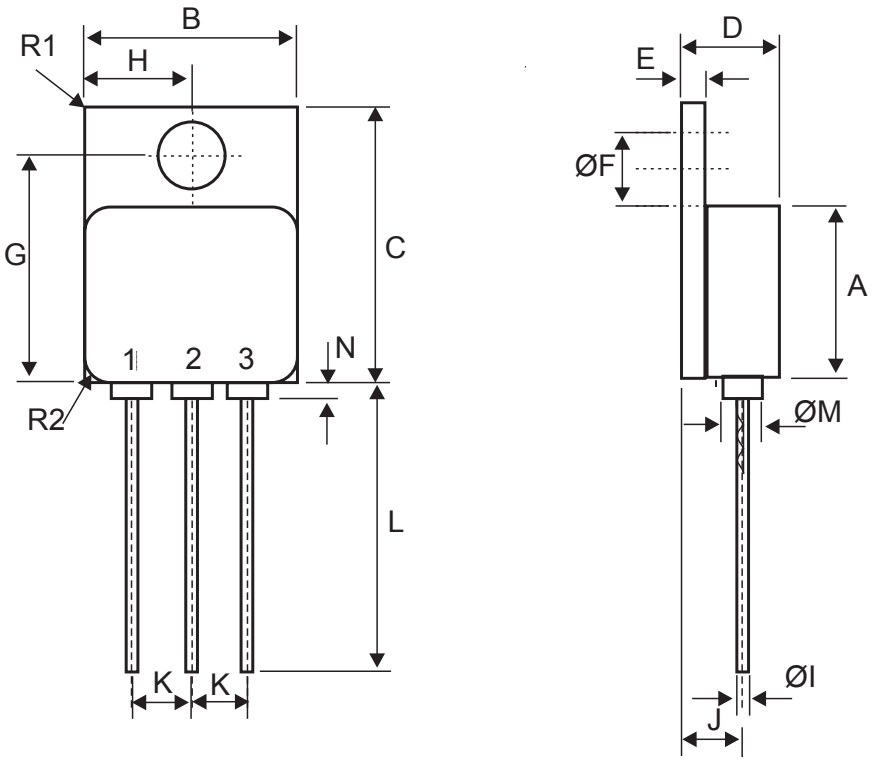
Type	Conditions	Result
Total ionisation dose	Charaterization of 2 wafer lots at 22 +/- 3°C High dose rate 7 reverse biased + 7 forward biased + 7 unbiased	Immune up to 3 Mrad(Si)
Single effect burnout	LET : 62.5 MeV.cm/mg V_{cc} : 400 V - Ambient temperature : 25°C	No burnout

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 TO-254AA package information

Figure 10. TO-254AA package outline



The TO-254-AA is a metallic package. It is not connected to any pin nor to the inside die.

Table 6. TO-254AA package mechanical data

Symbols	Dimansions (mm)			Dimansions (inches)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	13.59		13.84	0.535		0.545
B	13.59		13.84	0.535		0.545
C	20.07		20.32	0.790		0.800
D	6.3		6.7	0.248		0.264
E	1		3.9	0.039		0.154
ØF	3.5		3.9	0.138		0.154
G	16.89		17.4	0.665		0.685
H		6.86 BSC			0.270 BSC	
ØI	0.89		1.14	0.035		0.045
J		3.81 BSC			0.150 BSC	
K		3.81 BSC			0.150 BSC	
L	12.95		14.5	0.510		0.571
ØM		3.05			0.120	
N			0.71			0.028
R1			1			0.039
R2		1.65			0.065	

1. *3 locations*
2. *Radius of heatsink flange corner - 4 locations*
3. *Radius of body corner - 4 locations*

4 Ordering information

Table 7. Ordering information

All order codes on a single line	ESCC detail specification	Quality	Package	Lead finishing	Marking[1]	Weight	Packing
STTH40200CHY1	-	Engineering model	TO-254AA	Gold	STTH40200CHY1	9.4 g	Strip pack
STTH40200CHYG	5103/033/01	Flight model			510303301		
STTH40200CHYT	5103/033/02			Solder dip	510303302		

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

Date code information is 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

Documentation is provided for each product as per below table.

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 TN1181 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 • Diffusion line (plant + wafer size) • Diffusion run (wafer lot number) and wafer ID • Reference of the applicable ESCC Qualification maintenance lot • Reference to the ESCC detail specification • ST Rennes assembly lot ID

Revision history

Table 10. **Document revision history**

Date	Revision	Changes
14-May-2018	1	First issue.
04-May-2020	2	Updated ESCC qualification on Section Features and Table 7. Ordering information.
09-Jun-2020	3	Updated Section Features and Table 7.
27-Jul-2020	4	Updated Table 7.
16-Dec-2020	5	Added Section 1.4 Characteristics (curves).