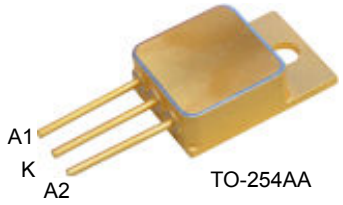
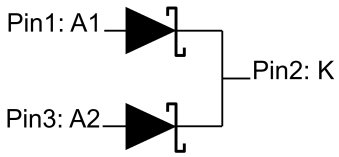
STPS40A150CHR

Datasheet

Rad-Hard 2 x 20 A - 150 V Schottky rectifier in TO-254AA package



The body is not connected to any lead terminal or to any part of the die.



Product status link
STPS40A150CHR

Product summary	
$I_{F(AV)}$	2 x 20 A
V_{RRM}	150 V
T_j(max)	175 °C
$V_{F(max)}$ at 2 x 20 A / 125 °C	0.79 V

Features

- Average forward current I_O: 2 x 20 A
- Repetitive peak reverse voltage V_{RRM}: 150 V
- Low forward voltage drop: 0.79 V max. at 40 A / 125°
- Off state immunity dV/dt up to 10 kV/µs
- Monolithic dual die - common cathode
- Hermetic package
- TID immune up to 3 Mrad(Si)
- SEB immune at 62.5 MeV.cm^2 / mg
- Package mass: 9.4 g
- ESCC qualified: 5106/023

Description

The STPS40A150CHR is package and screened to comply with the ESCC5000 specification for aerospace products. It is a dual monolithic Schottky rectifier assembled in an TO-254AA hermetic package and characterized in total dose at high dose rate and in single event effect to be used in aerospace applications.

The complete ESCC specification for this device will be available from the European Space Agency web site. ST will guarantee full compliance of qualified parts with the ESCC detailed specification.

1 Characteristics

1.1 Absolute maximum ratings

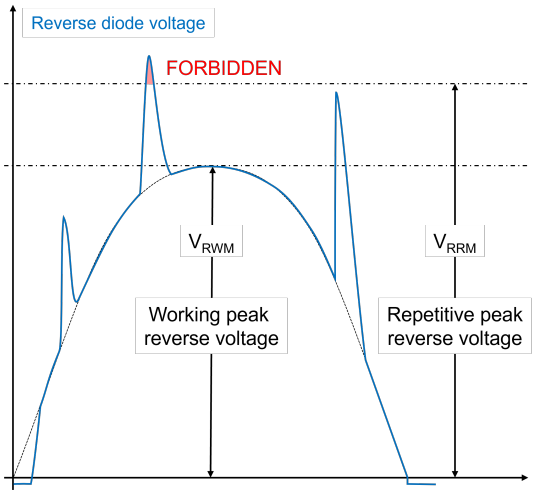
The absolute maximum ratings are limiting values at 25°C per diode unless otherwise notified. Values provided in Table 1 shall not be exceeded at any time during use or storage

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{RRM}	Repetitive peak reverse voltage	150	V
V_{RWM}(1)	Working peak reverse voltage	150	V
I_O(2)(3)	Average output rectified current per diode per package	 20 40	A
I_{FSM}(4)	Forward surge current	220	A
dV/dt(5)	Reverse voltage maximum rise rate	10	kV/µs
T_{op}	Operating temperature range (case temperature)	-65 to +175	°C
T_j(6)	Maximum junction temperature	+175	°C
T_{stg}	Storage temperature range	-65 to +175	°C
T_{sol}(7)	Soldering temperature	+245	°C
ESD	Electrostatic discharge - Human body model	8	kV

1. *See Figure 1.*
2. *Per diode: at T_{case} > +99°C, derate linearly to 0A at +175°C. Per package: at T_{case} > +126°C, derate linearly to 0A at +175°C.*
3. *Each diode of the pair can be used up to 40 A provided the total current complies with the 40 A absolute maximum rating of the TO-254AA.*
4. *Pulse duration: t_p = 10 ms sinusoidal*
5. *specified by design, characterization, and test at 25°C of 10 parts per wafer lot.*
6. *$(dP_{tot}/dT_j) < (1/R_{th(j-a)})$ condition to avoid thermal runaway for a diode on its own heatsink.*
7. *Duration 5 seconds maximum with at least 3 minutes between consecutive temperature peaks.*

Figure 1. V_{RRM} and V_{RWM} definition with their waveform



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	-	1.8	°C/W
		Per package	-	1.3	

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 = 150 V	T_j = 25 °C	-	1.3	14	µA
				T_j = 125 °C	-	1.8	8	mA
V_F [2][3]	Forward voltage drop	4011	I_F = 5 A	T_j = -55 °C	-	0.775	0.840	V
				T_j = 25 °C	-	0.706	0.780	
				T_j = 125 °C	-	0.560	0.620	
			I_F = 10 A	T_j = -55 °C	-	0.940	1.040	
				T_j = 25 °C	-	0.775	0.850	
				T_j = 125 °C	-	0.625	0.700	
			I_F = 20 A	T_j = -55 °C	-	1.300	1.455	
				T_j = 25 °C	-	0.855	0.940	
				T_j = 125 °C	-	0.710	0.790	
			I_F = 30 A	T_j = -55 °C	-	1.675	1.890	
				T_j = 25 °C	-	0.910	1.000	
				T_j = 125 °C	-	0.775	0.850	
			I_F = 40 A	T_j = -55 °C	-	2.090	2.370	
				T_j = 25 °C	-	0.965	1.050	
				T_j = 125 °C	-	0.830	0.910	

1. *Measurement per diode.*
2. *Pulse width 680 µs, duty cycle ≤ 2%*
3. *Each diode of the pair can be used up to 40 A provided the total current complies with the 40 A absolute maximum rating of the TO-254AA.*

Table 4. Dynamic electrical characteristics

Symbol	Parameter	MIL-STD-750 test method	Test conditions		Min.	Typ.	Max.	Unit
C[1]	Junction capacitance	4001	T_j = 25 °C	V_R = 10 V, F = 1 MHz	-	-	310	pF

1. *Guaranteed by sampling. In case the sampling acceptance criteria is not met, guaranteed by a 100% test.*

1.4 Characteristics (curves)

Figure 2. Average forward current versus case temperature (DC, per diode)

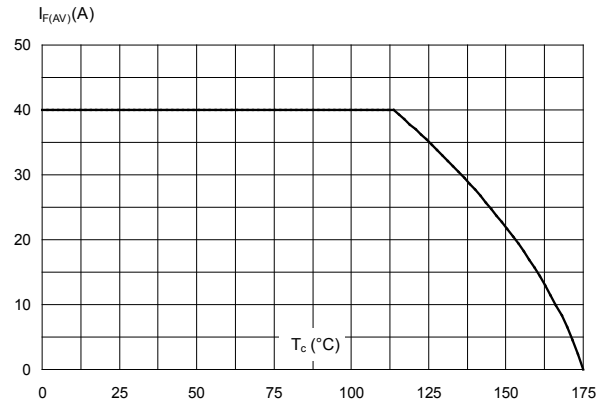


Figure 3. Forward voltage drop versus forward current (typical values, per diode)

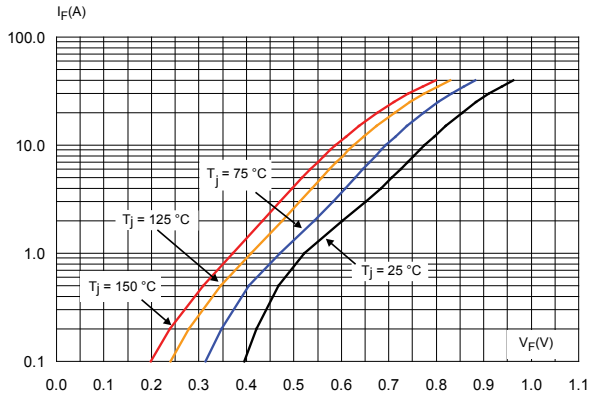


Figure 4. Reverse leakage current versus reverse voltage (typical values, per diode)

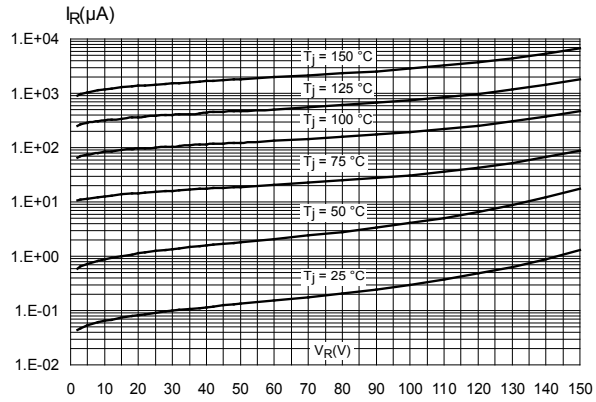


Figure 5. Relative variation of $Z_{th(j-c)}$ versus pulse duration

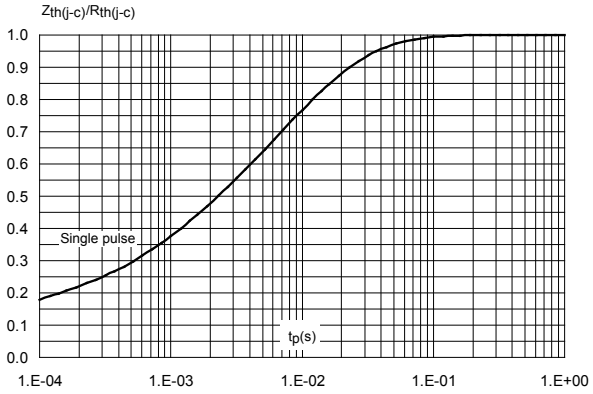
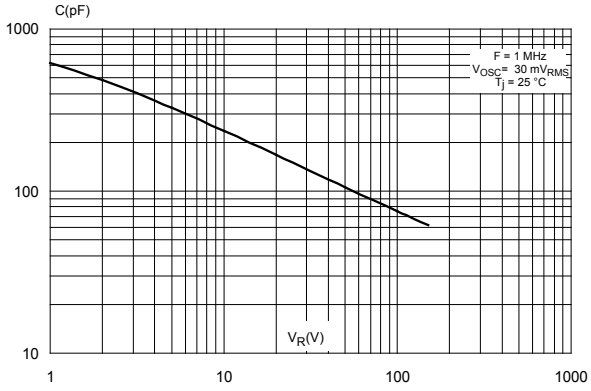


Figure 6. Junction capacitance versus reverse voltage (typical values, per diode)



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

A characterization in Total Ionizing Dose has been done at high dose rate on 12 parts housed in SMD1, 4 parts unbiased, 4 parts reverse biased and 4 parts forward biased.

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 voltage 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_{RRM}, and then decreased from 100% of the V_{RRM} 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	High dose rate 4 reverse biased + 4 forward biased + 4 unbiased	Immune up to 3 Mrad(Si)
Single effect burnout	LET : 62.5 MeV.cm²/mg: $V_r \leq 100\%\ V_{RRM}$	No burnout
PIST	LET : 62.5 MeV.cm²/mg: • $V_r \leq 85\%\ V_{RRM}$ • $V_r \leq 55\%\ V_{RRM}$ LET : 32.4 MeV.cm²/mg: $V_r \leq 100\%\ V_{RRM}$	Part functional(1) Part fully compliant to specification Part fully compliant to specification

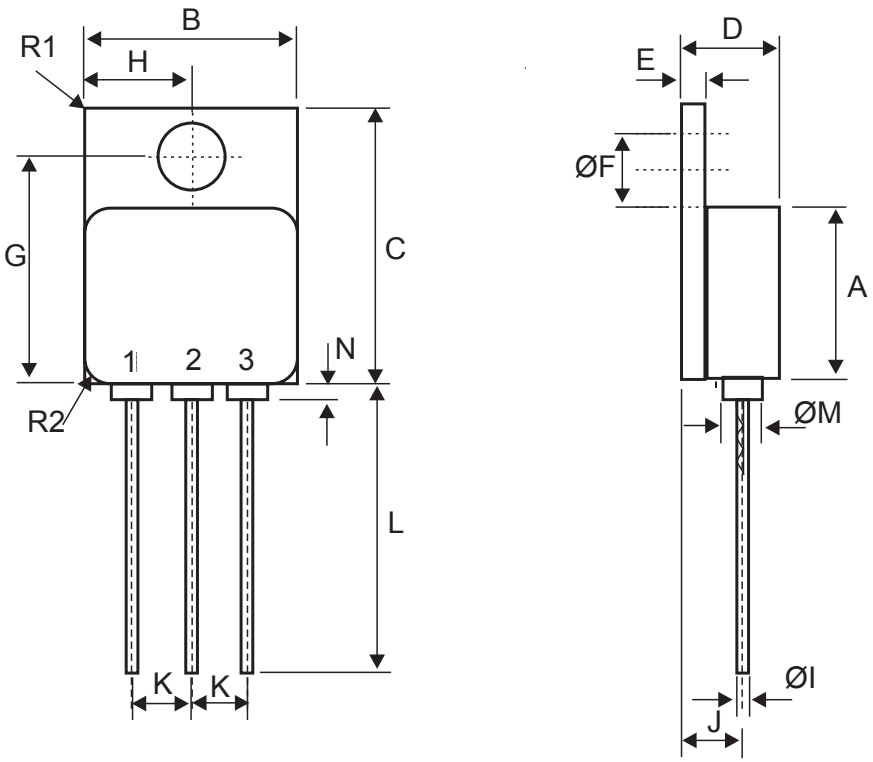
1. *I_r gets above its max specification during the test without recovery.*

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 TO-254AA package information

Figure 7. 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(1)	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(2)			1			0.039
R2(3)		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

Order codes	ESCC detail specification	Quality level	Package	Lead finishing	Marking(1)	Weight	Packing
STPS40A150CHY1	-	engineering model	TO-254AA	Gold	STPS40A150CHY1	9.4 g	Strip pack
STPS40A150CHYG	5106/023/03	Flight model			510602303		
STPS40A150CHYT	5106/023/04			Soder dip	510602304		

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

Revision history

Table 10. **Document revision history**

Date	Revision	Changes
24-Apr-2020	1	First issue.
07-Aug-2025	2	Updated description title, Section Cover image, Section Functional diagram, Section Features, Section Description, Table 1, Table 5, and Table 7.

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