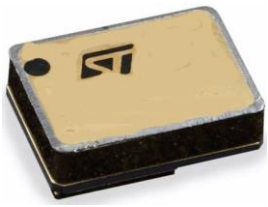
STTH60400HR

Aerospace 60 A - 400 V fast recovery rectifier

Datasheet - preliminary data



SMD1

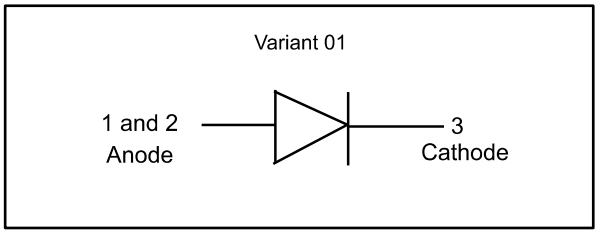
The upper metallic lid is not internally connected to any pin, nor to the IC die inside the package

Description

The STTH60400 is assembled in an SMD1 hermetic package and tested in total dose at high dose rate and in Single Event Effect to be used in aerospaces applications. it is intended to get ESCC qualified.

The complete ESCC specification for this device is available from the European space agency web site. ST guarantees full compliance of qualified parts with such ESCC detailed specifications.

Figure 1: Functional diagram



Features

- Very small conduction losses
- Negligible switching losses
- High surge current capability
- Hermetic package
- TID and SEE tested
- Package mass: 3 g
- ESCC qualification in progress

Table 1: Device summary

Order code	ESCC detailed	Quality	Lead finish	EPPL	$IF_{(AV)}$	V_{rrm}	T_j(max)	V_{Frrm}(max)
STTH60400SA1	-	Engineering model	Gold	-	60	400	175	1.35 V
STTH60400SAG(1)	TBD	Flight model	Gold	(2)				

Notes:

(1)In developpment

(2)Planned

1 Characteristics

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
I_{FSM} (1)(2)	Forward surge current	500	A
V_{RRM}	Repetitive peak reverse voltage	400	V
I_O (3)	Average output rectified current	60	A
T_j	Junction temperature range	+ 175	°C
T_{stg}	Storage temperature range	-65 to + 175	°C
T_{sol} (4)	Soldering temperature	+245	°C
$R_{th(j-c)}$	Thermal resistance, junction to case	1.8	°C/W
$R_{th(j-a)}$	Thermal resistance, junction to ambient	55	°C/W
t_{fr} (5)	Forward recovery time	250	ns
V_{fr} (6)	Forward recovery voltage	3	V
I_{RM} (7)	Reverse recovery current	26	A
S_{factor} (8)	Reverse recovery charge	1400	nC
Q_{RR} (9)	Softness factor	0.3	

Notes:

(1)Sinusoidal pulse of 10 ms duration.

(2)At Tamb ≤ +25 °C

(3)At T_{case} ≥ +29.2 °C, derate linearly to 0 A at +175 °C.

(4)Duration 5 seconds maximum. The same package must not be resoldered until 3 minutes have elapsed.

(5)At T_{amb} = +22 ±3 °C and I_F = 60 A, V_{FR} = 1.2 V, dI_F/dt = -400 A/µs

(6)At T_{amb} = +22 ±3 °C and I_F = 60 A, V_{FR} = 1.2 V, dI_F/dt = -400 A/µs

(7)At T_{amb} = +125 °C and I_F = 60 A, V_R = 320 V, dI_F/dt = -200 A/µs

(8)At T_{amb} = +125 °C and I_F = 60 A, V_R = 320 V, dI_F/dt = -200 A/µs

(9)At T_{amb} = +125 °C and I_F = 60 A, V_R = 320 V, dI_F/dt = -200 A/µs

Table 3: Thermal parameter

Symbol	Parameter	Value	Unit
$R_{th(j-c)}$	Junction to case (1)	1.8	°C/W

Notes:

(1)Package mounted on infinite heatsink.

Table 4: Electrical measurements at ambient temperature, T_{amb} = 22 ±3 °C

Symbol	Parameter	MIL-STD-750 test method	Test conditions(1)	Limits		Unit
				Min.	Max.	
I_R	Reverse leakage current	4016	DC method, V_R = 400 V		20	µA
V_{F1}(2)	Forward voltage	4011	Pulse method, I_F = 60 A		1.35	V
C	Capacitance	4001	V_R = 10 V, F = 1 MHz		250	pF
t_{rr}	Reverse recovery time	4031	I_F = 1 A, V_R = 30 V, dI_F/dt = -50 A/µs		75	ns

Notes:

(1)Testing performed with both anode terminals 2 and 3 tied together

(2)Pulse width ≤ 680 µs, duty cycle ≤ 2%

Table 5: Electrical measurements at high and low temperatures

Symbol	Parameter	MIL-STD-750 test method	Test conditions(1)	Limits		Unit
				Min.	Max.	
I_R	Reverse current	4016	T_{case} = +125 (+0, -5) °C DC method, V_R = 400 V	-	200	mA
V_{F1}(2)	Forward voltage	4011	T_{case} = +125 (+0, -5) °C pulse method, I_F = 60 A	-	1.15	V
			T_{case} = -55 (+0, -5) °C pulse method, I_F = 60 A	-	1.35	V

Notes:

(1)Read and record measurements shall be performed on a sample of 5 components with 0 failures allowed. Alternatively a 100% inspection may be performed.

(2)Pulse width ≤ 680 µs, duty cycle ≤ 2%

2 Radiation

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

The product radiation hardness assurance is supported by a Total Ionisation Dose (TID) test at high dose rate on each diffusion lot and a Single Effect Event (SEE) characterization.

2.1 Total dose radiation (TID) testing

Each diffusion lot is tested in total ionizing dose at high dose rate on 10 parts housed in SMD1, 5 biased and 5 unbiased.

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

Both pre-irradiation and post-irradiation performances are 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 are measured :

- Before irradiation
- After irradiation (target 1 Mrad (Si))
- After 24 hrs at room temperature
- after 168 hrs at 100 °C anneal

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 influence 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 6: Radiation hardness assurance summary

Type	Conditions	Result
Total ionisation dose	High dose rate 5 biased + 5 unbiased Each wafer lot	Immune up to 1 Mrad(Si)
Single effect burnout	LET= Tbd V_{cc}: Tbd	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 2: Surface mount SMD1 package outline (3-terminal)

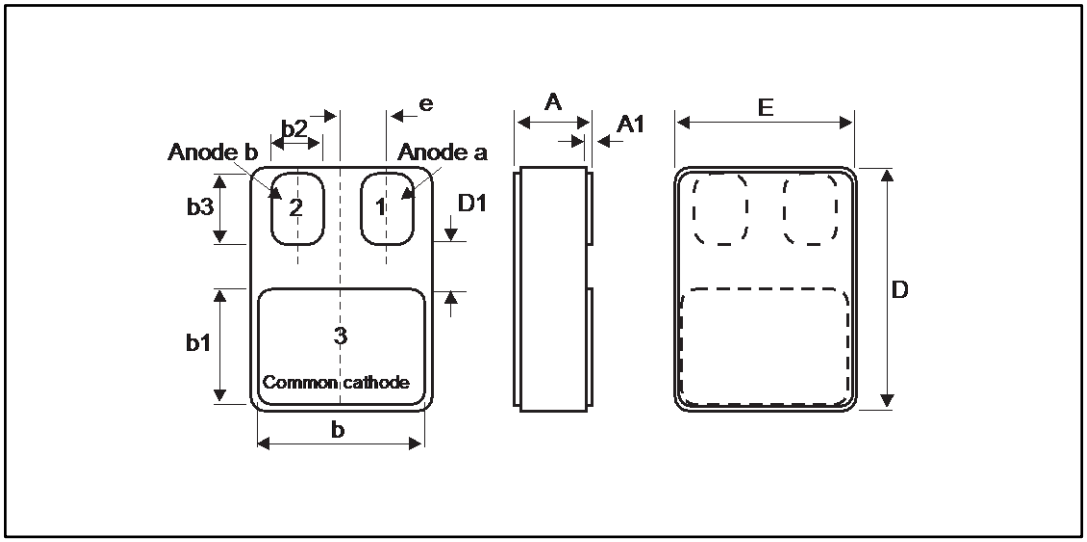


Table 7: SMD1 package mechanical data

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 8: Ordering information

Order code	ESCC detailed specification	Package	Lead finishing	Comment	Marking	Weight	EPP	Packing
STTH60400SA1	-	SMD1	Gold	Single die	STTH60400SA1	3 g	-	Strip pack
STTH60400SAG(1)	TBD				Tbd		(2)	

Notes:

(1)Under development

(2)Planned

5 Other information

5.1 Traceability information

Date code in formation is structured as described in *Table 7: "SMD1 package mechanical data"*

Table 9: Date codes

Model	Datacode
EM	3yywwN(1)
ESCC	yywwN

Notes:

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

5.2 Documentation

The table below provides the default documentation packed together with the parts depending on their quality level.

Table 10: Default documentation provided with the parts

Quality level	Documentation
Engineering Model	Certificate of Conformance
ESCC Flight	Certificate of Conformance includes the reference of the ESCC qualification maintenance test lot.

6 Revision history

Table 11: Document revision history

Date	Revision	Changes
07-Mar-2017	1	First issue.

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