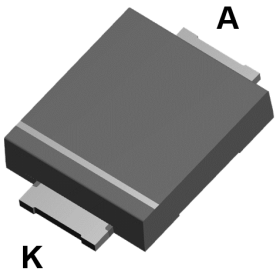
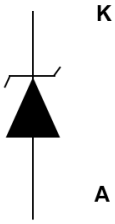
SMB6FxxA

Datasheet

600 W TVS in SMB Flat



SMB Flat
(Jedec DO221-AA)



Unidirectional

Product status link	
SMB6F	SMB6F5.0A, SMB6F6.0A, SMB6F6.5A, SMB6F8.5A, SMB6F10A, SMB6F11A, SMB6F13A, SMB6F12A, SMB6F14A, SMB6F15A, SMB6F16A, SMB6F18A, SMB6F20A, SMB6F22A, SMB6F23A, SMB6F24A, SMB6F26A, SMB6F28A, SMB6F30A, SMB6F31A, SMB6F33A, SMB6F36A, SMB6F40A, SMB6F48A, SMB6F58A, SMB6F64A, SMB6F70A, SMB6F85A, SMB6F100A, SMB6F130A, SMB6F154A, SMB6F170A, SMB6F188A

Features

- Peak pulse power: 600 W (10/1000 µs) and 4 kW (8/20 µs)
- Flat and thin package: 1 mm
- Stand-off voltage range from 5 V to 188 V
- Unidirectional type
- Low leakage current: 0.2 µA at 25 °C and 1 µA at 85 °C
- Operating T_j max: 175 °C
- High power capability at T_j max.: up to 470 W (10/1000 µs)
- Lead finishing: matte tin plating

Complies with the following standards

- UL94, V0
- J-STD-020 MSL level 1
- J-STD-002, JESD 22-B102 E3 and MIL-STD-750, method 2026 solderable matte tin plated leads
- JESD-201 class 2 whisker test
- IPC7531 footprint
- JEDEC registered package outline
- IEC 61000-4-4 level 4:
  - 4 kV
- IEC 61000-4-2, C= 150 pF - R = 330 Ω exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)

Description

The SMB6FxxA series are designed to protect sensitive circuits against surges.

The Planar technology makes it compatible with high-end circuits where low leakage current and high junction temperature are required to provide long term reliability and stability.

1 Characteristics

Table 1. Absolute maximum ratings (T_{amb} = 25 °C)

Symbol	Parameter		Value	Unit
V_{PP}	Peak pulse voltage	IEC 61000-4-2 (C = 150 pF, R = 330 Ω) Contact discharge Air discharge	 30 30	kV
P_{PP}	Peak pulse power dissipation	10/1000 µs, T_j initial = T_{amb}	600	W
T_{stg}	Storage temperature range		-65 to +175	°C
T_j	Operating junction temperature range		-55 to +175	°C
T_L	Maximum lead temperature for soldering during 10 s		260	°C

Figure 1. Electrical characteristics - parameter definitions

V_{RM} Maximum stand-off voltage
I_{RM} Maximum leakage current @ V_{RM}
V_R Stand-off voltage
I_R Leakage current @ V_R
V_{BR} Breakdown voltage @ I_{BR}
I_{BR} Breakdown current
V_{CL} Clamping voltage @ I_{PP}
I_{PP} Peak pulse current
R_D Dynamic resistance
V_F Forward voltage drop @ I_F
I_F Forward current
αT Voltage temperature coefficient

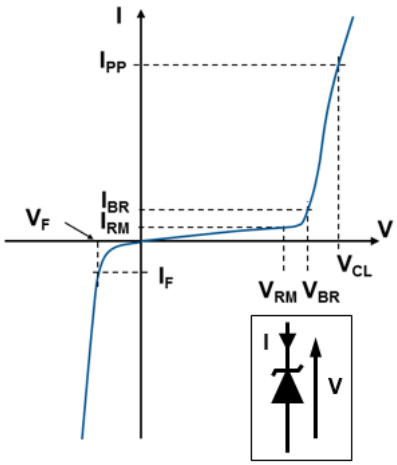


Figure 2. Pulse definition for electrical characteristics

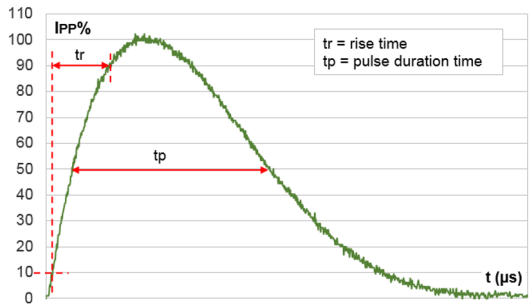


Table 2. Electrical characteristics - parameter values (T_{amb} = 25 °C, unless otherwise specified)

Type	I_{RM} max at V_{RM}			V_{BR} at I_{BR} (1)				10 / 1000 µs			8 / 20µs			αT
								V_{CL} (2)(3)	I_{PP} (4)	R_D	V_{CL} (2)(3)	I_{PP} (4)	R_D	
	25 °C	85 °C		Min.	Typ.	Max.		Max.		Max.	Max.		Max.	Max.
	µA		V	V			mA	V	A	Ω	V	A	Ω	10^{-4}/°C
SMB6F5.0A	20	50	5.0	6.4	6.74	7.1	10	9.2	68	0.031	13.4	298	0.021	5.7
SMB6F6.0A	20	50	6.0	6.7	7.05	7.4	10	10.3	61	0.048	13.7	290	0.022	5.9
SMB6F6.5A	20	50	6.5	7.2	7.58	8	10	11.2	56	0.057	14.5	276	0.024	6.1
SMB6F8.5A	20	50	8.5	9.4	9.9	10.4	1	14.4	41.7	0.096	19.5	205	0.044	7.3
SMB6F10A	0.2	1	10	11.1	11.7	12.3	1	17	37	0.127	21.7	184	0.051	7.8
SMB6F11A	0.2	1	11	12.3	13	13.7	1	18	33.8	0.127	24.2	1665	0.064	8.1
SMB6F12A	0.2	1	12	13.3	14	14.7	1	19.9	31	0.168	25.3	157	0.068	8.3
SMB6F13A	0.2	1	13	14.4	15.2	16	1	21.5	29	0.190	27.2	147	0.076	8.4
SMB6F14A	0.2	1	14	15.7	16.5	17.3	1	23.1	26	0.223	29	136	0.086	8.6
SMB6F15A	0.2	1	15	16.7	17.6	18.5	1	24.4	25.1	0.235	32.5	123	0.114	8.8
SMB6F16A	0.2	1	16	17.9	18.8	19.8	1	26	23.1	0.268	34.7	115	0.130	9.0
SMB6F18A	0.2	1	18	20	21.1	22.2	1	29.2	21.5	0.326	39.3	102	0.168	9.2
SMB6F20A	0.2	1	20	22.2	23.4	24.6	1	32.4	19.4	0.402	42.8	93	0.196	9.4
SMB6F22A	0.2	1	22	24.4	25.7	27	1	35.5	17.7	0.480	48.3	83	0.257	9.6
SMB6F23A	0.2	1	23	25.7	27	28.4	1	37.8	16.4	0.573	49.2	81	0.257	9.6
SMB6F24A	0.2	1	24	26.7	28.1	29.5	1	38.9	16	0.588	50	80	0.256	9.6
SMB6F26A	0.2	1	26	28.9	30.4	31.9	1	42.1	14.9	0.685	53.5	75	0.288	9.7
SMB6F28A	0.2	1	28	31.1	32.7	34.3	1	45.4	13.8	0.804	59	68	0.363	9.8
SMB6F30A	0.2	1	30	33.2	35	36.8	1	48.4	13	0.885	64.3	62	0.442	9.9
SMB6F31A	0.2	1	31	34.2	36	37.8	1	50.2	12.3	1.01	65	61	0.45	9.9
SMB6F33A	0.2	1	33	36.7	38.6	40.5	1	53.3	11.8	1.08	69.7	57	0.512	10
SMB6F36A	0.2	1	36	40	42.1	44.2	1	58.1	10.3	1.35	76	52	0.612	10
SMB6F40A	0.2	1	40	44.4	46.7	49	1	64.5	9.7	1.60	84	48	0.729	10.1
SMB6F48A	0.2	1	48	53.2	56	58.8	1	77.4	8.1	2.28	100	40	1.03	10.3
SMB6F58A	0.2	1	58	64.6	68	71.4	1	93.6	6.7	3.34	121	33	1.51	10.4
SMB6F64A	0.2	1	64	71.1	74.8	78.6	1	103	5.8	4.17	134	30	1.84	10.5
SMB6F70A	0.2	1	70	77.9	82	86.1	1	113	5.5	4.91	146	27	2.22	10.5
SMB6F85A	0.2	1	85	95	100	105	1	137	4.6	7.17	178	22.5	3.29	10.6
SMB6F100A	0.2	1	100	111	117	123	1	162	3.8	10.3	212	19	4.68	10.7
SMB6F130A	0.2	1	130	144	152	160	1	209	3	16.3	265	15	7	10.8
SMB6F154A	0.2	1	154	171	180	189	1	246	2.4	23.8	317	12.6	10.2	10.8
SMB6F170A	0.2	1	170	190	200	210	1	275	2.2	30	353	11.3	12.7	10.8
SMB6F188A	0.2	1	188	209	220	231	1	328	2	48.5	388	10.3	15.2	10.8

1. *To calculate V_{BR} versus T_j : V_{BR} at T_j = V_{BR} at 25 °C x (1 + αT x (T_j - 25))*
2. *To calculate V_{CL} versus T_j : V_{CL} at T_j = V_{CL} at 25 °C x (1 + αT x (T_j - 25))*
3. *To calculate V_{CL} max versus $I_{PPappli}$: V_{CLmax} = V_{BR} max + RD x $I_{PPappli}$*

4. *Surge capability given for both directions*

1.1 Characteristics (curves)

Figure 3. Maximum peak power dissipation versus initial junction temperature

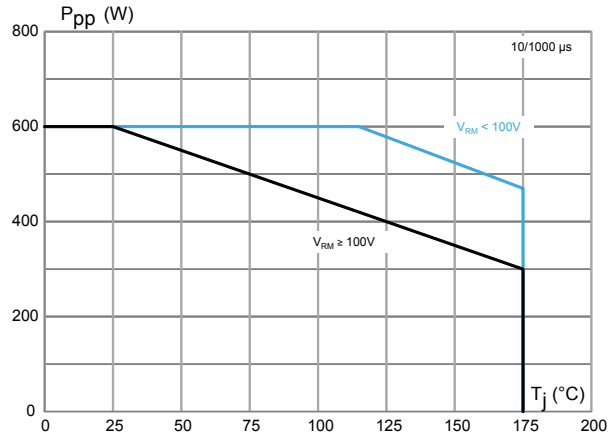


Figure 4. Maximum peak pulse power versus exponential pulse duration

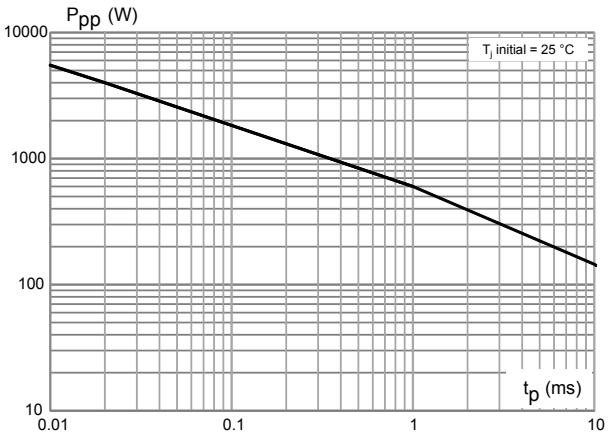


Figure 5. Maximum peak pulse current versus clamping voltage

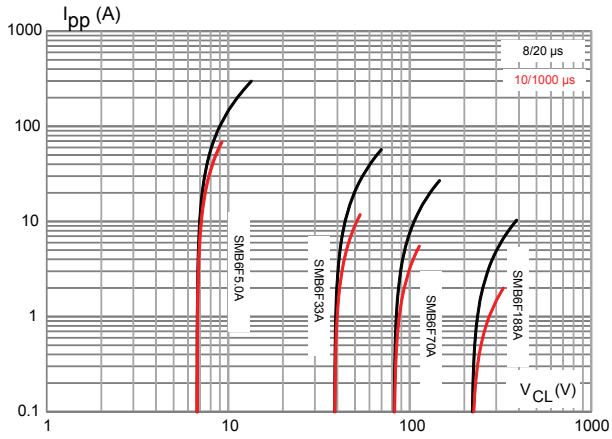


Figure 6. Dynamic resistance versus pulse duration

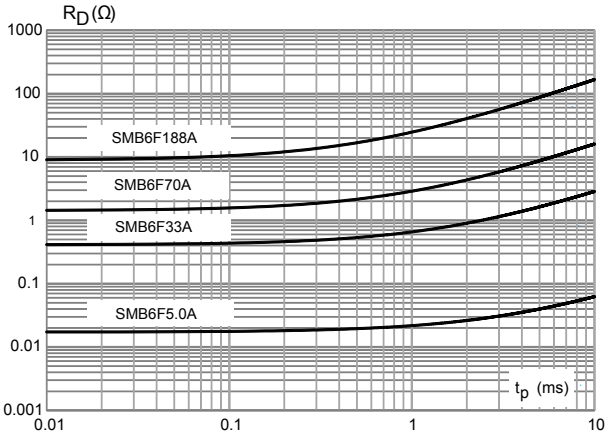


Figure 7. Junction capacitance versus reverse applied voltage (unidirectional types)

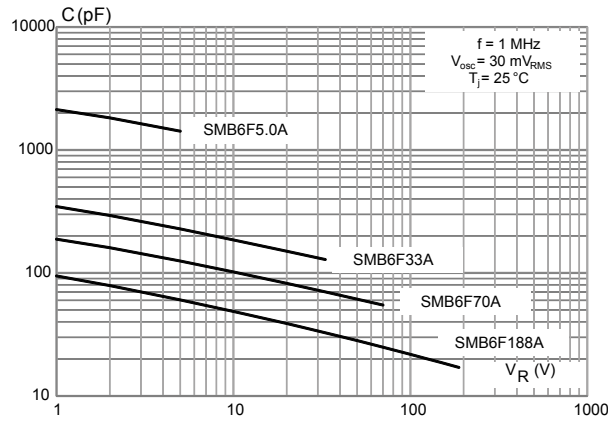


Figure 8. Leakage current versus junction temperature

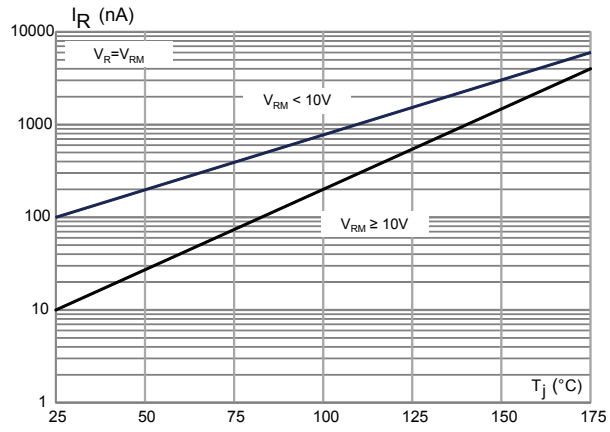


Figure 9. Peak forward voltage drop versus peak forward current

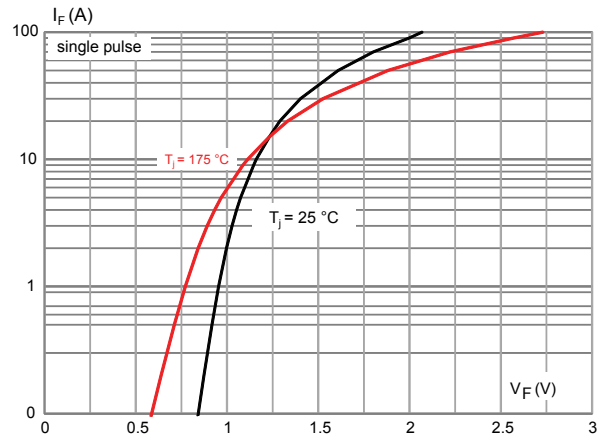


Figure 10. Thermal impedance junction to ambient versus pulse duration

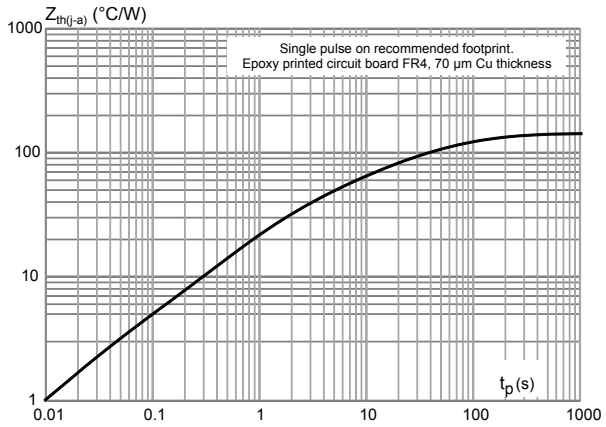
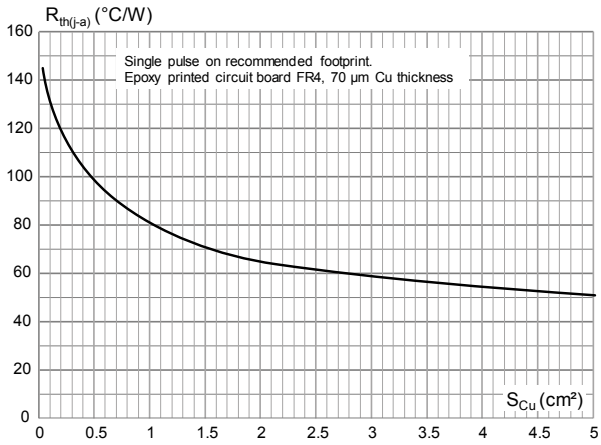


Figure 11. Thermal resistance junction to ambient versus copper area under each lead (SMB Flat)



2 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.

2.1 SMB Flat package information

Figure 12. SMB Flat package outline

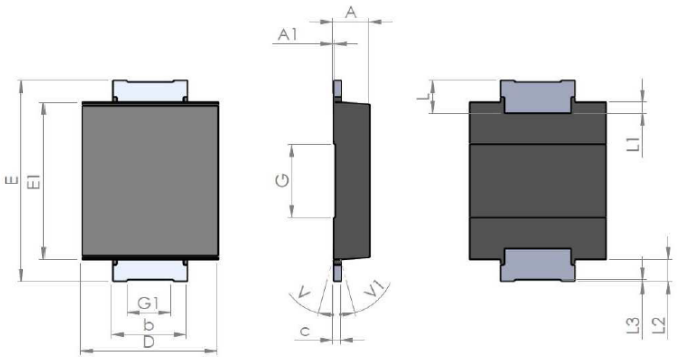


Table 3. SMB Flat mechanical data

Ref.	Dimensions					
	Millimeters			Inches[1]		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.90		1.10	0.035		0.044
A1		0.05			0.002	
b	1.95		2.20	0.076		0.087
c	0.15		0.40	0.005		0.016
D	3.30		3.95	0.129		0.156
E	5.20		5.60	0.204		0.221
E1	4.05		4.60	0.159		0.182
G		2.00			0.079	
G1		1.20			0.047	
L	0.75		1.20	0.029		0.048
L1		0.30			0.012	
L2		0.60			0.024	
L3	0.02			0.000		
V			8°			8°
V1			8°			8°

1. *Values in inches are converted from mm and rounded to 3 decimal digits.*

Figure 13. Footprint recommendations, dimensions in mm (inches)

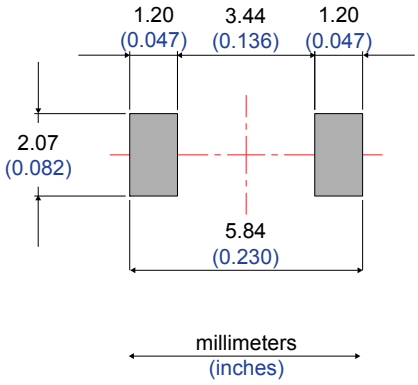
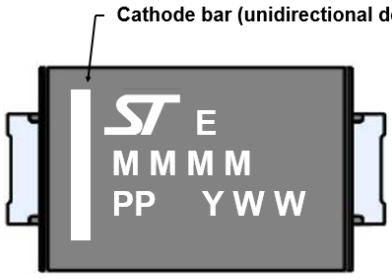
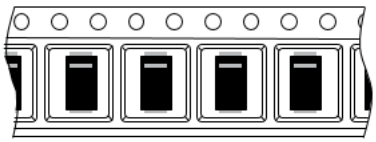


Figure 14. Marking layout (refer to ordering information table for marking)



E : ECOPACK grade
MMMM : Marking
PP : Assembly location
Y : Year
WW : week

Figure 15. Package orientation in reel



Taped according to EIA-481
Note: Pocket dimensions are not on scale
Pocket shape may vary depending on package
On bidirectional devices, marking and logo may be not always in the same direction

Figure 16. Tape and reel orientation

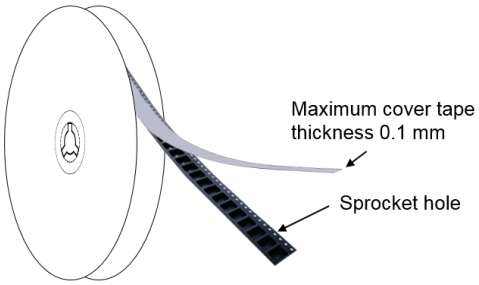


Figure 17. Reel dimensions (mm)

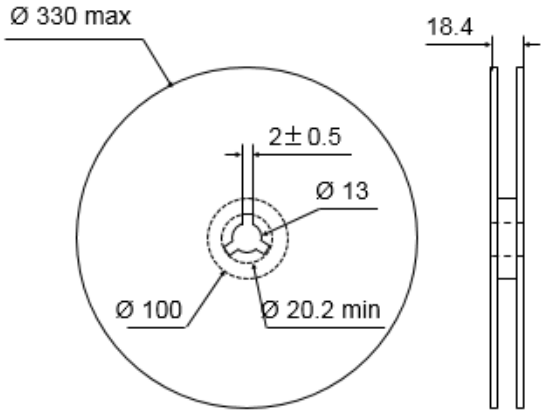


Figure 18. Inner box dimensions (mm)

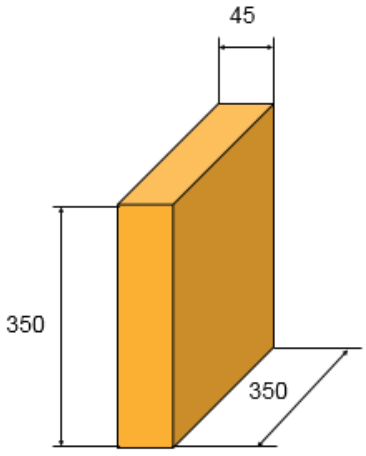
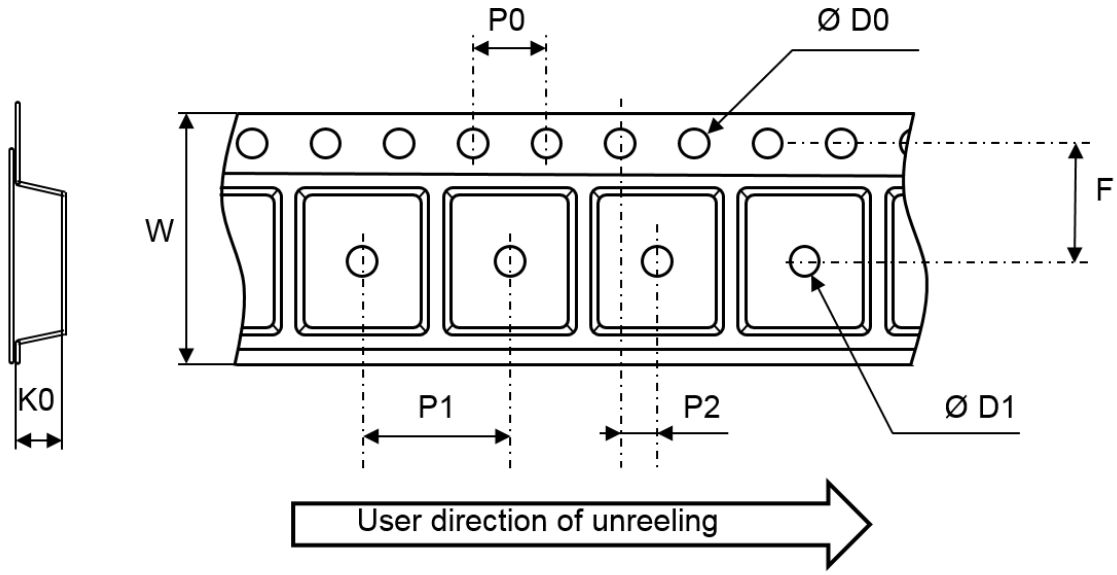


Figure 19. **Tape and reel outline**



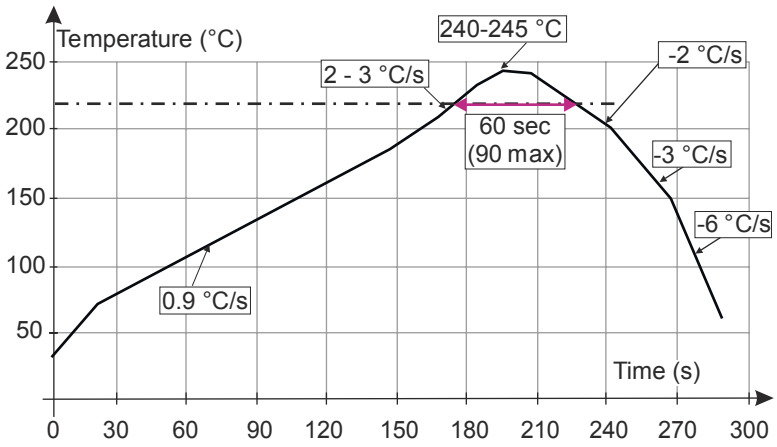
Note: Pocket dimensions are not on scale
Pocket shape may vary depending on package

Table 4. **Tape and reel mechanical data**

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
ØD0	1.45	1.50	1.55
ØD1	1.5		
F	5.4	5.5	5.6
K0	1.2	1.3	1.4
P0	3.9	4.0	4.1
P1	7.9	8.0	8.1
P2	1.9	2.0	2.1
W	11.7	12.0	12.3

2.2 Reflow profile

Figure 20. **ST ECOPACK recommended soldering reflow profile for PCB mounting**



Note: Minimize air convection currents in the reflow oven to avoid component movement. Maximum soldering profile corresponds to the latest IPC/JEDEC J-STD-020.

3 Ordering information

Figure 21. **Ordering information scheme**

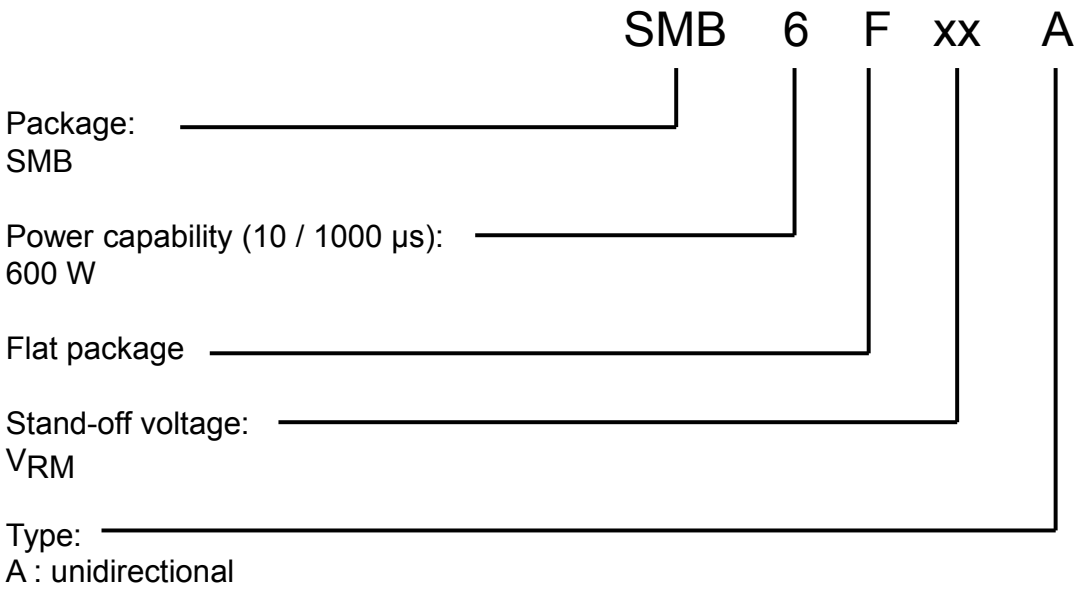


Table 5. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
SMB6FxxA	See Table 6. Marking.	SMB Flat	56 mg	5000	Tape and reel

Table 6. **Marking**

Order code	Marking
SMB6F5.0A	7AI
SMB6F6.0A	7AK
SMB6F6.5A	7AL
SMB6F8.5A	7AP
SMB6F10A	7AS
SMB6F11A	7AU
SMB6F12A	7AW
SMB6F13A	7AY
SMB6F14A	7BA
SMB6F15A	7BC
SMB6F16A	7BE
SMB6F18A	7BI
SMB6F20A	7BM
SMB6F22A	7BO
SMB6F23A	7BP
SMB6F24A	7BQ
SMB6F26A	7BS
SMB6F28A	7BU
SMB6F30A	7BW
SMB6F31A	7BX
SMB6F33A	7BZ
SMB6F36A	7CC
SMB6F40A	7CG
SMB6F48A	7CO
SMB6F58A	7CY
SMB6F64A	7DE
SMB6F70A	7DK
SMB6F85A	7DZ
SMB6F100A	7EO
SMB6F130A	7FS
SMB6F154A	7GQ
SMB6F170A	7HG
SMB6F188A	7HY

Revision history

Table 7. **Document revision history**

Date	Version	Changes
21-Jan-2019	1	Initial release.
19-Feb-2019	2	Updated link syntax.
16-May-2019	3	Updated Table 1. Absolute maximum ratings (T_{amb} = 25 °C).
14-Oct-2019	4	Added 64 V device.