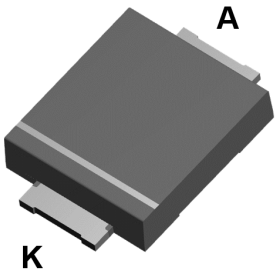
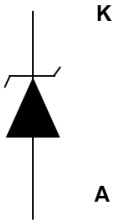
SMB15FxxAY

Datasheet

Automotive 1500 W TVS in SMB Flat



SMB Flat
(Jedec DO221-AA)



Unidirectional

Product status link
SMB15FxxAY series
SMB15F5.0AY, SMB15F6.0AY, SMB15F6.5AY, SMB15F8.5AY, SMB15F10AY, SMB15F11AY, SMB15F13AY, SMB15F12AY, SMB15F14AY, SMB15F15AY, SMB15F16AY, SMB15F18AY, SMB15F20AY, SMB15F22AY, SMB15F23AY, SMB15F24AY, SMB15F26AY, SMB15F28AY, SMB15F30AY, SMB15F31AY, SMB15F33AY, SMB15F36AY, SMB15F40AY, SMB15F48AY, SMB15F58AY, SMB15F64AY

Features

- AEC-Q101 qualified
- Peak pulse power: 1500 W (10/1000 µs) and 10 kW (8/20 µs)
- Flat and thin package: 1 mm
- Stand-off voltage range: from 5 V to 64 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.: 1100 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
- ISO10605, IEC 61000-4-2, C= 150 pF - R = 330 Ω exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)
- ISO10605 - C = 330 pF, R = 330 Ω exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)
- ISO7637-2 (Not applicable to parts with stand-off voltage lower than battery voltage)
  - Pulse1: V_S = -150 V
  - Pulse 2a: V_S = +112 V
  - Pulse 3a: V_S = -220 V
  - Pulse 3b: V_S = +150 V

Description

The SMB15FxxAY series are designed to protect sensitive automotive circuits against surges defined in ISO 7637-2 and against electrostatic discharges according to ISO 10605.

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	ISO10605 (C = 330 pF, R = 330 Ω):		kV
		Contact discharge	30	
		Air discharge	30	
		ISO10605 / IEC 61000-4-2 (C = 150 pF, R = 330 Ω)		
		Contact discharge	30	
		Air discharge	30	
P_{PP}	Peak pulse power dissipation	10/1000 µs, T_j initial = T_{amb}	1500	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

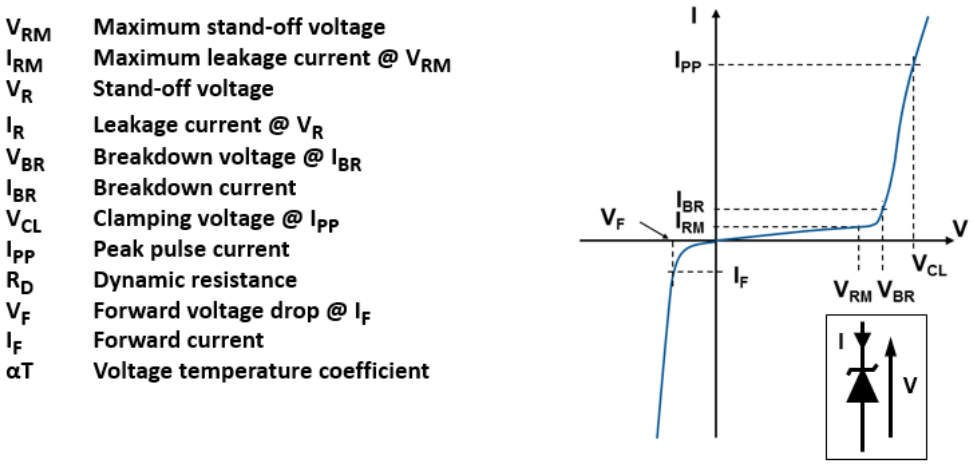


Figure 2. Pulse definition for electrical characteristics

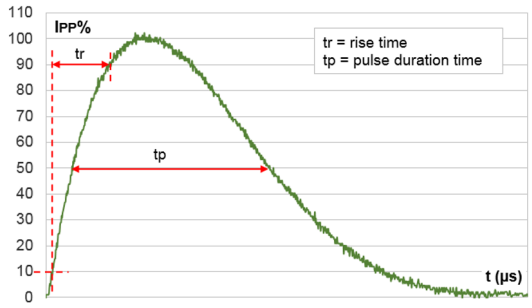


Table 2. Electrical characteristics - parameter values (T_{amb} = 25 °C, unless otherwise specified)

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
SMB15F5.0AY	20	50	5.0	6.4	6.74	7.1	10	9.2	171	0.012	13.4	746	0.008	5.7
SMB15F6.0AY	20	50	6.0	6.7	7.05	7.4	10	10.3	152	0.019	13.7	730	0.009	5.9
SMB15F6.5AY	20	50	6.5	7.2	7.58	8	10	11.2	140	0.023	14.5	690	0.009	6.1
SMB15F8.5AY	20	50	8.5	9.4	9.9	10.4	1	14.4	105	0.038	19.5	512	0.018	7.3
SMB15F10AY	0.2	1	10	11.1	11.7	12.3	1	17	92	0.051	21.7	461	0.020	7.8
SMB15F11AY	0.2	1	11	12.3	13	13.7	1	18	85	0.051	24.2	413	0.025	8.1
SMB15F12AY	0.2	1	12	13.3	14	14.7	1	19.9	79	0.066	25.3	394	0.027	8.3
SMB15F13AY	0.2	1	13	14.4	15.2	16	1	21.5	73	0.075	27.2	368	0.030	8.4
SMB15F14AY	0.2	1	14	15.7	16.5	17.3	1	23.1	67	0.087	29	338	0.035	8.6
SMB15F15AY	0.2	1	15	16.7	17.6	18.5	1	24.4	64	0.092	32.5	308	0.045	8.8
SMB15F16AY	0.2	1	16	17.9	18.8	19.8	1	26	58	0.107	34.7	293	0.049	9.0
SMB15F18AY	0.2	1	18	20	21.1	22.2	1	29.2	53	0.132	39.3	254	0.067	9.2
SMB15F20AY	0.2	1	20	22.2	23.4	24.6	1	32.4	48	0.163	42.8	234	0.078	9.4
SMB15F22AY	0.2	1	22	24.4	25.7	27	1	35.5	44	0.193	48.3	207	0.103	9.6
SMB15F23AY	0.2	1	23	25.7	27	28.4	1	37.8	41	0.229	49.2	202	0.103	9.6
SMB15F24AY	0.2	1	24	26.7	28.1	29.5	1	38.9	40	0.235	50	200	0.103	9.6
SMB15F26AY	0.2	1	26	28.9	30.4	31.9	1	42.1	37	0.276	53.5	187	0.116	9.7
SMB15F28AY	0.2	1	28	31.1	32.7	34.3	1	45.4	34	0.326	59	169	0.146	9.8
SMB15F30AY	0.2	1	30	33.2	35	36.8	1	48.4	32	0.363	64.3	156	0.176	9.9
SMB15F31AY	0.2	1	31	34.2	36	37.8	1	50.2	31	0.400	65	153	0.178	9.9
SMB15F33AY	0.2	1	33	36.7	38.6	40.5	1	53.3	29	0.441	69.7	143	0.204	10
SMB15F36AY	0.2	1	36	40	42.1	44.2	1	58.1	26	0.539	76	131	0.243	10
SMB15F40AY	0.2	1	40	44.4	46.7	49	1	64.5	24	0.646	84	119	0.294	10.1
SMB15F48AY	0.2	1	48	53.2	56	58.8	1	77.4	20	0.930	100	100	0.412	10.3
SMB15F58AY	0.2	1	58	64.6	68	71.4	1	93.6	16	1.39	121	83	0.598	10.4
SMB15F64AY	0.2	1	64	71.1	74.8	78.6	1	103	14.6	1.66	134	75	0.74	10.5

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

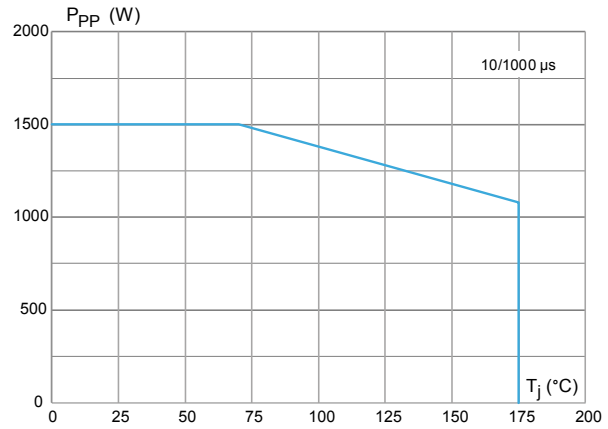


Figure 4. Maximum peak pulse power versus exponential pulse duration

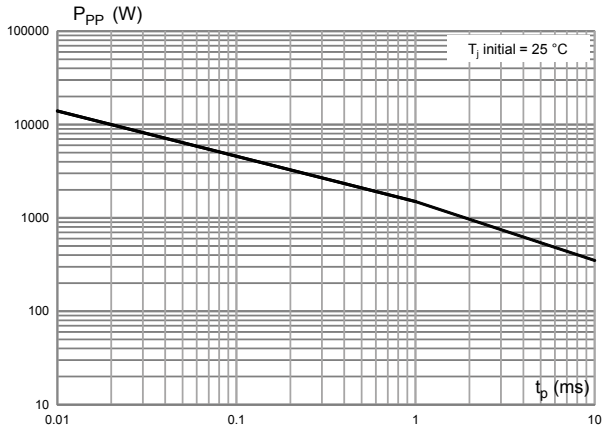


Figure 5. Maximum peak pulse current versus clamping voltage

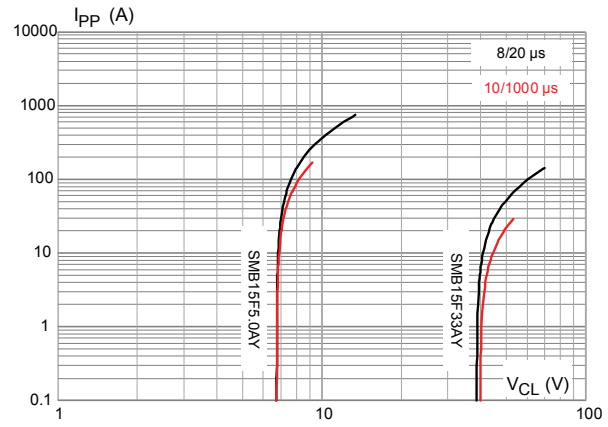


Figure 6. Dynamic resistance versus pulse duration

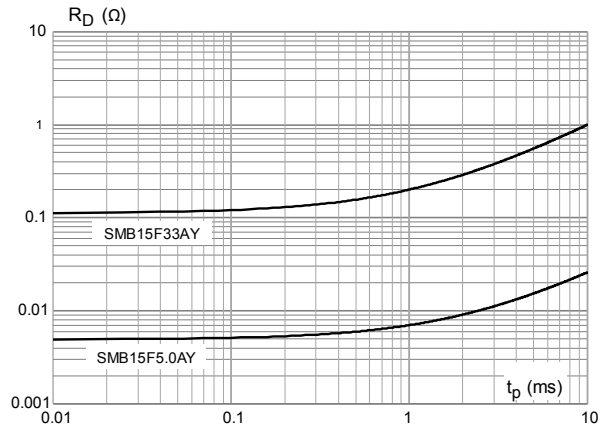


Figure 7. Junction capacitance versus reverse applied voltage (unidirectional types)

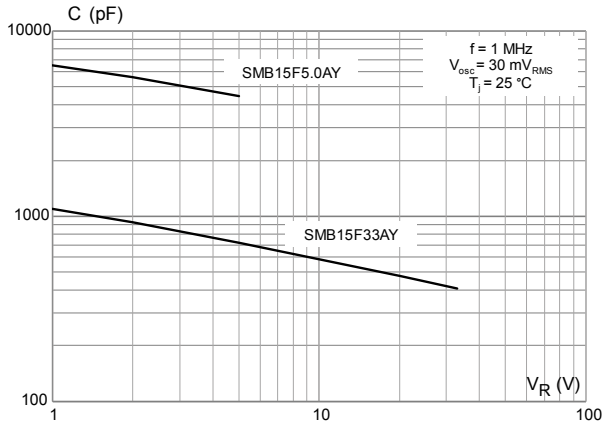


Figure 8. Leakage current versus junction temperature

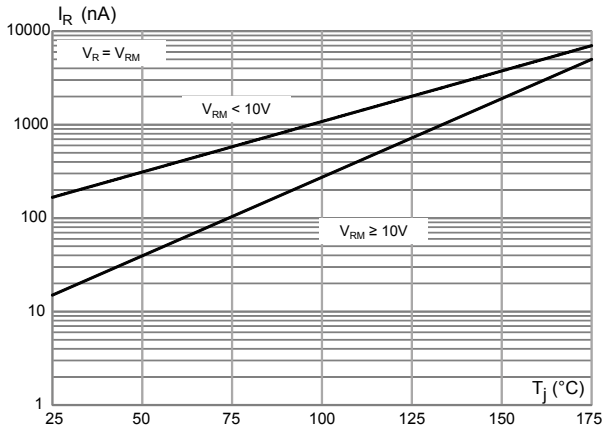


Figure 9. Peak forward voltage drop versus peak forward current

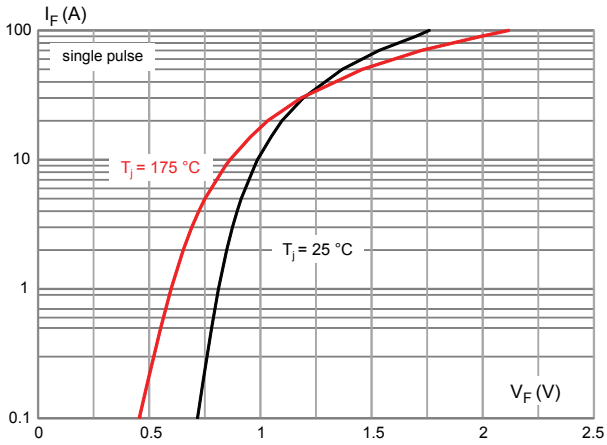


Figure 10. Thermal impedance junction to ambient versus pulse duration

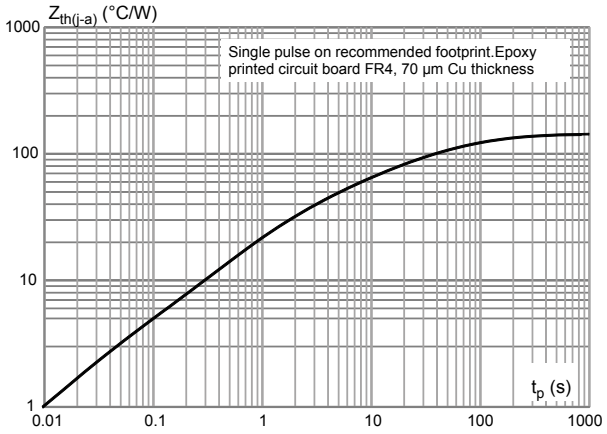


Figure 11. Thermal resistance junction to ambient versus copper area under each lead (SMB Flat)

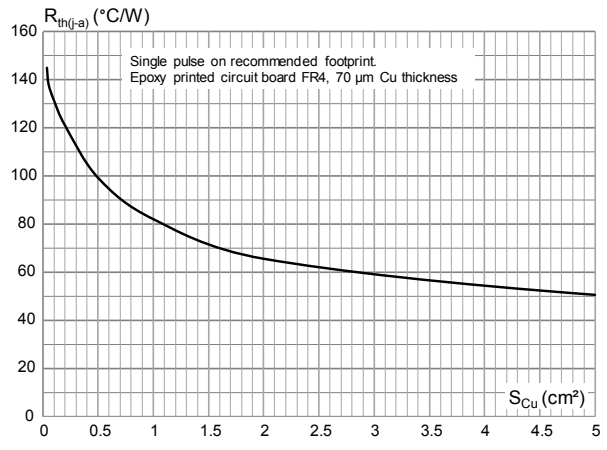


Figure 12. ISO7637-2 pulse 1: Vs = -150 V with 12 V battery

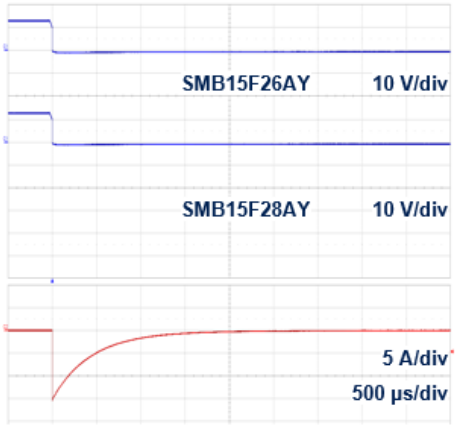


Figure 13. ISO7637-2 pulse 2a: Vs = +112 V with 12 V battery

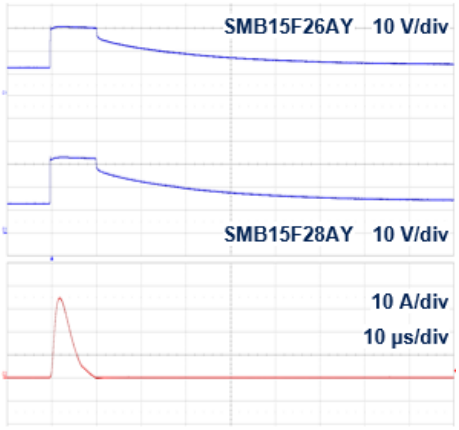


Figure 14. ISO7637-2 pulse 3a: Vs = -220 V with 12 V battery

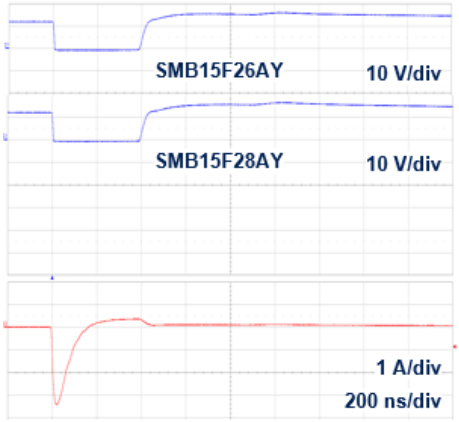
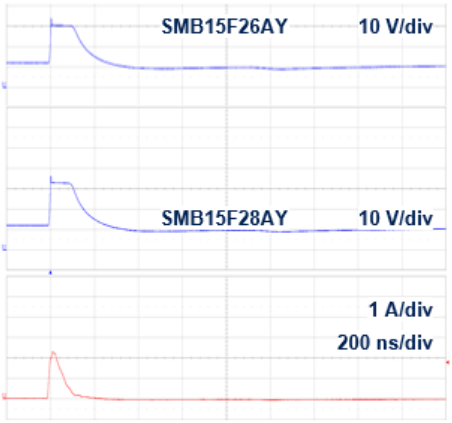


Figure 15. ISO7637-2 pulse 3b: Vs = +150 V with 12 V battery



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 16. SMB Flat package outline

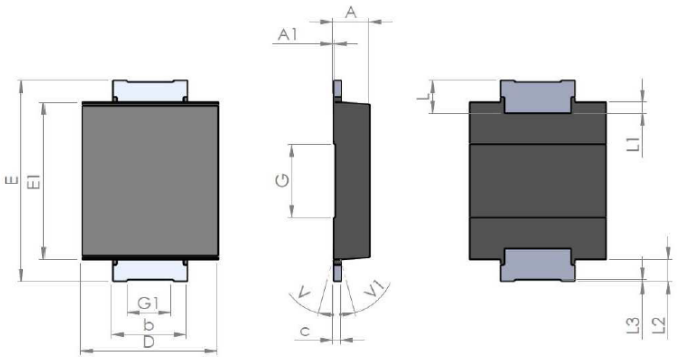


Table 3. SMB Flat mechanical data

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 17. Footprint recommendations, dimensions in mm (inches)

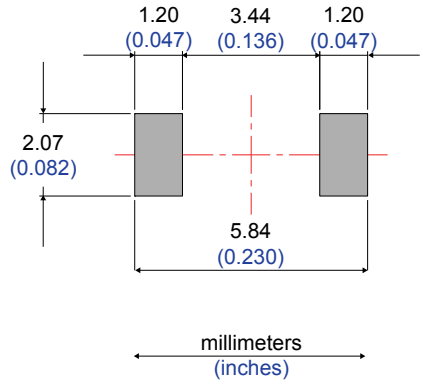
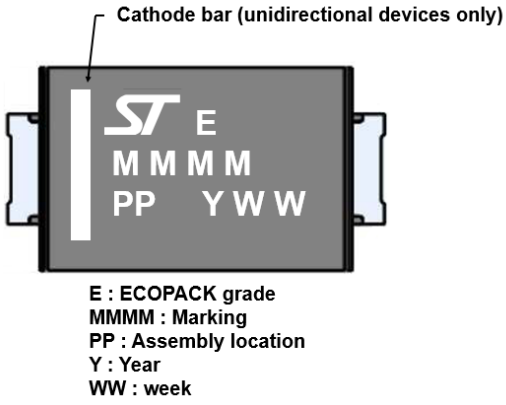
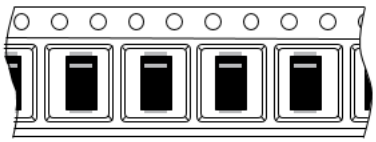


Figure 18. Marking layout (refer to ordering information table for marking)



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

Figure 19. 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 20. Tape and reel orientation

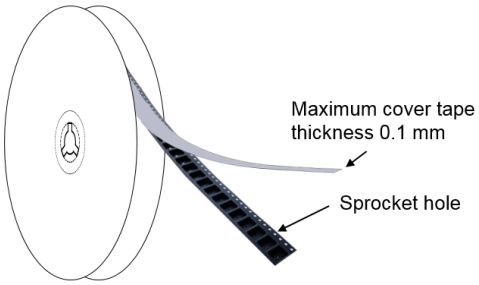


Figure 21. Reel dimensions (mm)

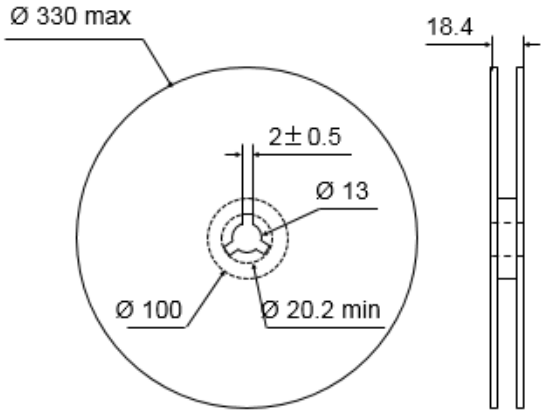


Figure 22. Inner box dimensions (mm)

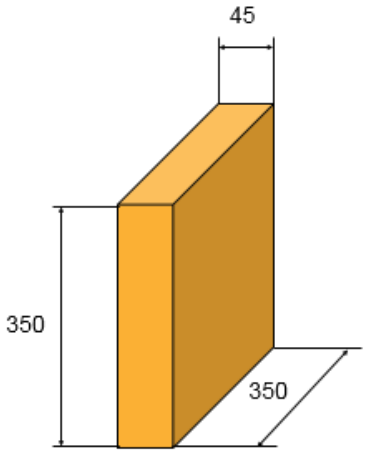
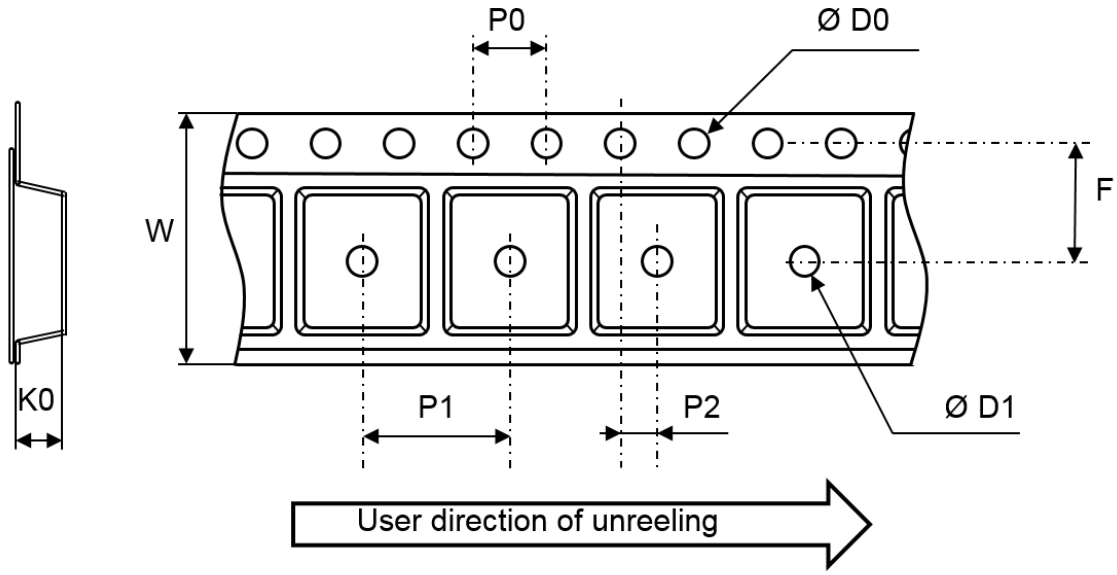


Figure 23. **Tape and reel outline**



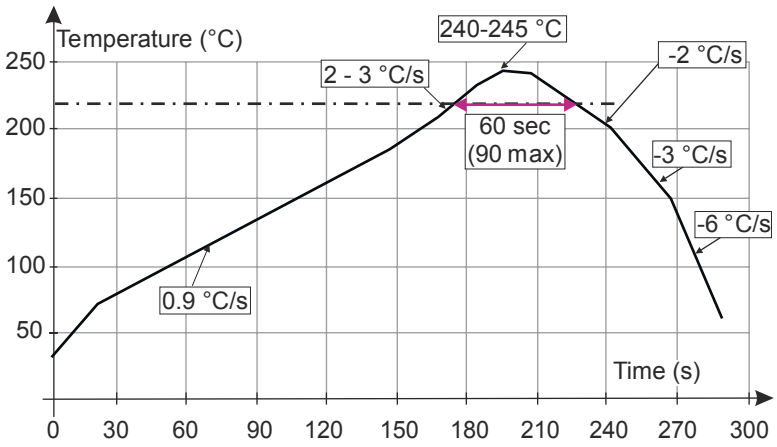
Note: Pocket dimensions are not on scale
Pocket shape may vary depending on package

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 24. **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 Application and design guidelines

More information is available in the application note AN2689 “Protection of automotive electronics from electrical hazards, guidelines for design and component selection”.

4 Ordering information

Figure 25. **Ordering information scheme**

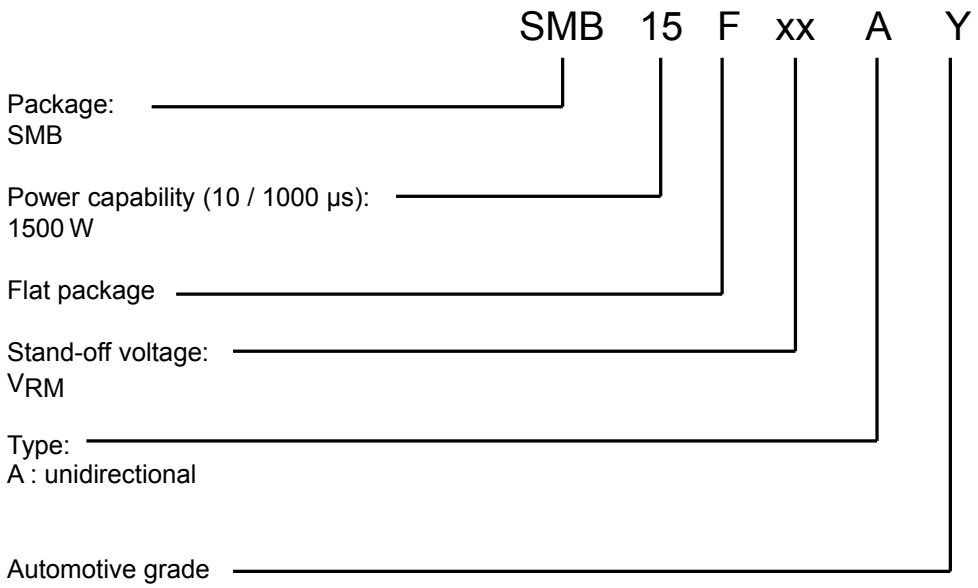


Table 5. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
SMB15FxxAY	See Section 4 .	SMB Flat	60 mg	5000	Tape and reel

4.1 Marking

Table 6. **Marking**

Order code	Marking
SMB15F5.0AY	FAIY
SMB15F6.0AY	FAKY
SMB15F6.5AY	FALY
SMB15F8.5AY	FAPY
SMB15F10AY	FASY
SMB15F11AY	FAUY
SMB15F12AY	FAWY
SMB15F13AY	FAYY
SMB15F14AY	FBAY
SMB15F15AY	FBCY
SMB15F16AY	FBEY
SMB15F18AY	FBIY
SMB15F20AY	FBMY
SMB15F22AY	FBOY
SMB15F23AY	FBPY
SMB15F24AY	FBQY
SMB15F26AY	FBSY
SMB15F28AY	FBUY
SMB15F30AY	FBWY
SMB15F31AY	FBXY
SMB15F33AY	FBZY
SMB15F36AY	FCCY
SMB15F40AY	FCGY
SMB15F48AY	FCOY
SMB15F58AY	FCYY
SMB15F64AY	FDEY

Revision history

Table 7. **Document revision history**

Date	Revision	Changes
28-Aug-2020	1	Initial release.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

STMicroelectronics:

SMB15F12AY SMB15F18AY SMB15F24AY SMB15F10AY SMB15F20AY SMB15F13AY SMB15F15AY SMB15F16AY SMB15F23AY SMB15F26AY SMB15F28AY SMB15F30AY SMB15F48AY SMB15F5.0AY SMB15F14AY SMB15F33AY SMB15F8.5AY SMB15F22AY SMB15F58AY SMB15F6.0AY SMB15F64AY SMB15F6.5AY SMB15F11AY SMB15F36AY SMB15F31AY SMB15F40AY