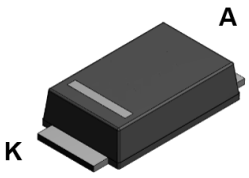
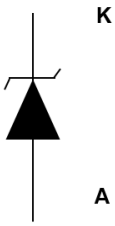
SM6FxxAY

Datasheet

Automotive 600 W TVS in SOD128 Flat



SOD128 Flat



Unidirectional

Product status link	
SM6FY	SM6F5.0AY, SM6F6.0AY, SM6F6.5AY, SM6F8.5AY, SM6F10AY, SM6F11AY, SM6F13AY, SM6F12AY, SM6F14AY, SM6F15AY, SM6F16AY, SM6F18AY, SM6F20AY, SM6F22AY, SM6F23AY, SM6F24AY, SM6F26AY, SM6F28AY, SM6F30AY, SM6F31AY, SM6F33AY, SM6F36AY

Features

- AEC-Q101 qualified
- Peak pulse power: 600 W (10/1000 µs) and 4 kW (8/20 µs)
- Stand-off voltage range from 5 V to 36 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 175 °C (T_j max.) up to 240 W (10/1000 µs)
- Lead finishing: matte tin platting

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 SM6FY 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}	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_{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

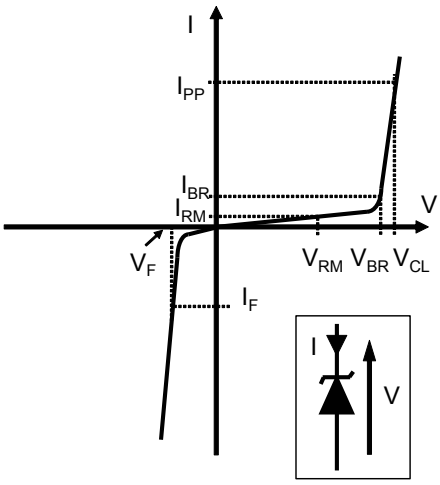


Figure 2. Pulse definition for electrical characteristics

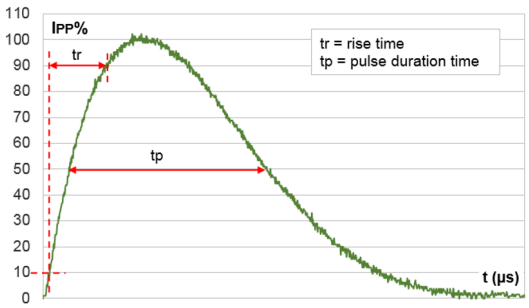


Table 2. Electrical characteristics - parameter values (T_{amb} = 25 °C, unless otherwise specified)

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
SM6F5.0AY	20	50	5.0	6.4	6.74	7.1	10	9.2	68	0.031	13.4	298	0.021	5.7
SM6F6.0AY	20	50	6.0	6.7	7.05	7.4	10	10.3	61	0.048	13.7	290	0.022	5.9
SM6F6.5AY	20	50	6.5	7.2	7.58	8	10	11.2	56	0.057	14.5	276	0.024	6.1
SM6F8.5AY	20	50	8.5	9.4	9.9	10.4	1	14.4	41.7	0.096	19.5	205	0.044	7.3
SM6F10AY	0.2	1	10	11.1	11.7	12.3	1	17	37	0.127	21.7	184	0.051	7.8
SM6F11AY	0.2	1	11	12.3	13	13.7	1	18	33.8	0.127	24.2	1665	0.064	8.1
SM6F12AY	0.2	1	12	13.3	14	14.7	1	19.9	31	0.168	25.3	157	0.068	8.3
SM6F13AY	0.2	1	13	14.4	15.2	16	1	21.5	29	0.190	27.2	147	0.076	8.4
SM6F14AY	0.2	1	14	15.7	16.5	17.3	1	23.1	26	0.223	29	136	0.086	8.6
SM6F15AY	0.2	1	15	16.7	17.6	18.5	1	24.4	25.1	0.235	32.5	123	0.114	8.8
SM6F16AY	0.2	1	16	17.9	18.8	19.8	1	26	23.1	0.268	34.7	115	0.130	9.0
SM6F18AY	0.2	1	18	20	21.1	22.2	1	29.2	21.5	0.326	39.3	102	0.168	9.2
SM6F20AY	0.2	1	20	22.2	23.4	24.6	1	32.4	19.4	0.402	42.8	93	0.196	9.4
SM6F22AY	0.2	1	22	24.4	25.7	27	1	35.5	17.7	0.480	48.3	83	0.257	9.6
SM6F23AY	0.2	1	23	25.7	27	28.4	1	37.8	16.4	0.573	49.2	81	0.257	9.6
SM6F24AY	0.2	1	24	26.7	28.1	29.5	1	38.9	16	0.588	50	80	0.256	9.6
SM6F26AY	0.2	1	26	28.9	30.4	31.9	1	42.1	14.9	0.685	53.5	75	0.288	9.7
SM6F28AY	0.2	1	28	31.1	32.7	34.3	1	45.4	13.8	0.804	59	68	0.363	9.8
SM6F30AY	0.2	1	30	33.2	35	36.8	1	48.4	13	0.885	64.3	62	0.442	9.9
SM6F31AY	0.2	1	31	34.2	36	37.8	1	50.2	12.3	1.01	65	61	0.45	9.9
SM6F33AY	0.2	1	33	36.7	38.6	40.5	1	53.3	11.8	1.08	69.7	57	0.512	10
SM6F36AY	0.2	1	36	40	42.1	44.2	1	58.1	10.3	1.35	76	52	0.612	10

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

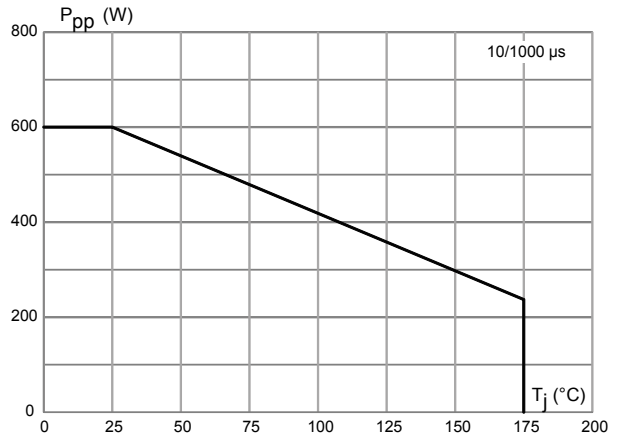


Figure 4. Maximum peak pulse power versus exponential pulse duration

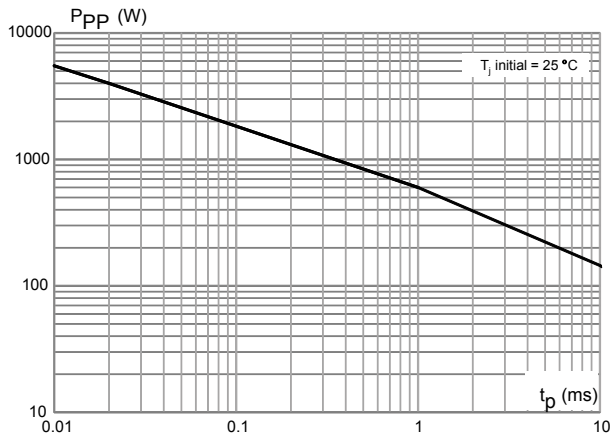


Figure 5. Maximum peak pulse current versus clamping voltage

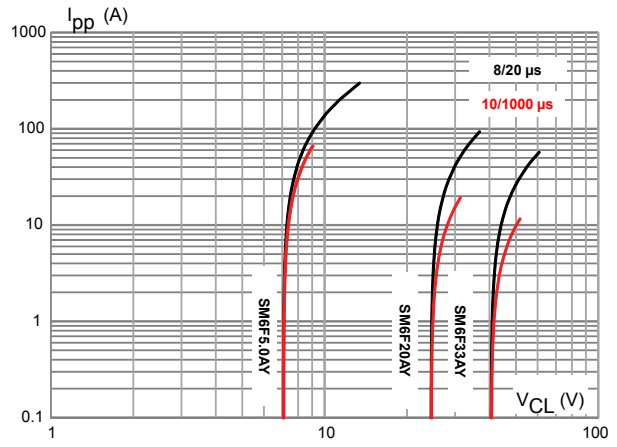


Figure 6. Dynamic resistance versus pulse duration

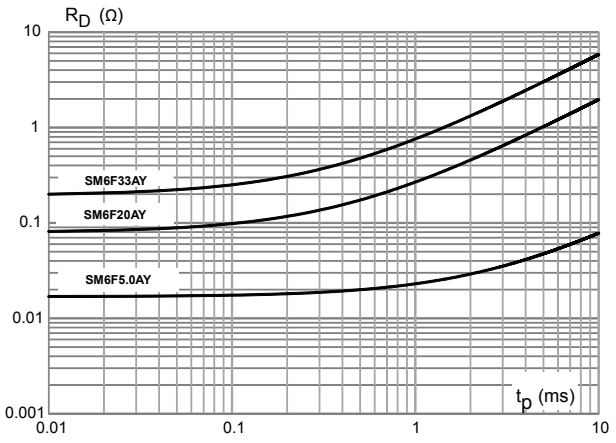


Figure 7. Junction capacitance versus reverse applied voltage (unidirectional types)

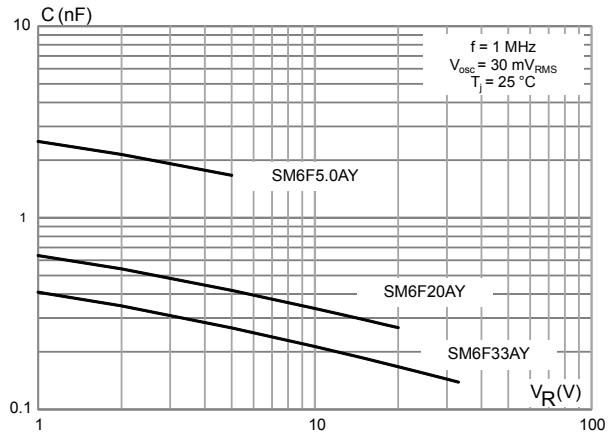


Figure 8. Leakage current versus junction temperature

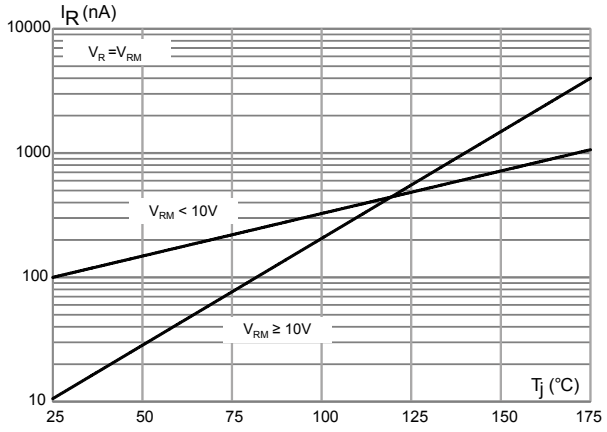


Figure 9. Peak forward voltage drop versus peak forward current

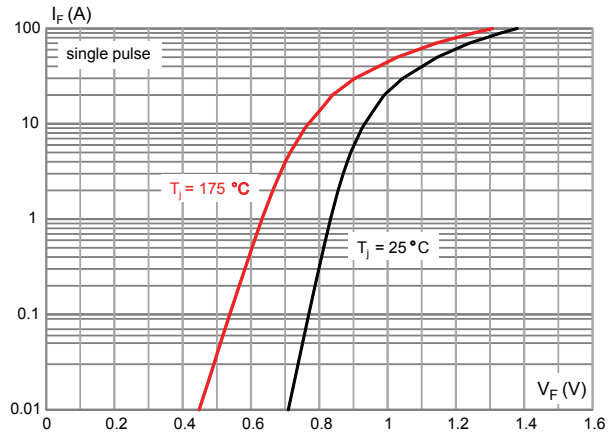


Figure 10. Thermal impedance junction to ambient versus pulse duration

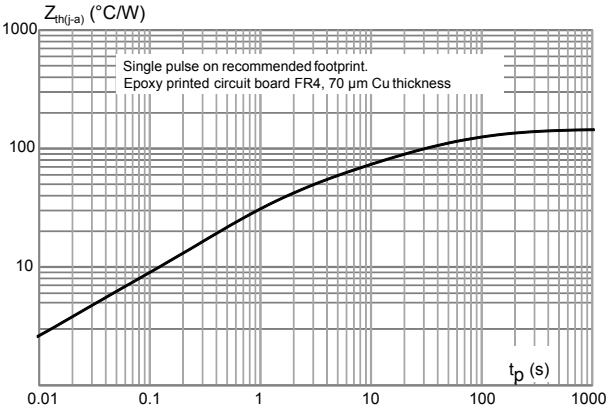


Figure 11. Thermal resistance junction to ambient versus copper area under each lead (SOD128 Flat)

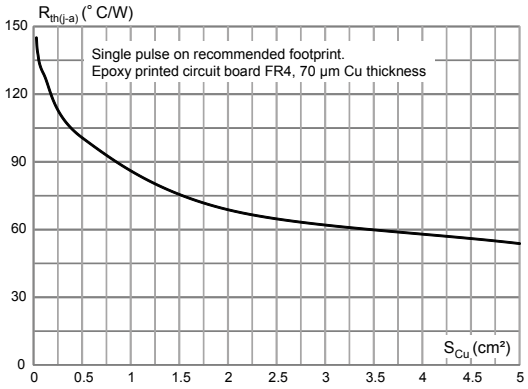


Figure 12. ISO7637-2 pulse 1: Vs = -150 V with 12 V battery

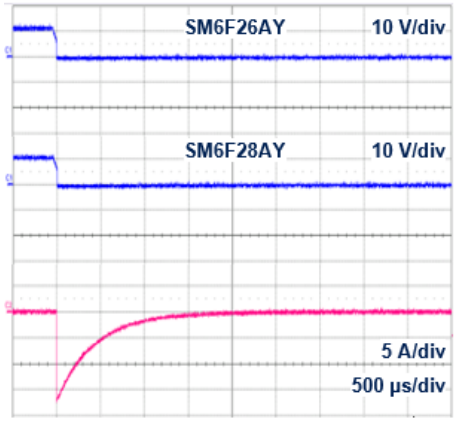


Figure 13. ISO7637-2 pulse 2a: Vs = +112 V with 12 V battery

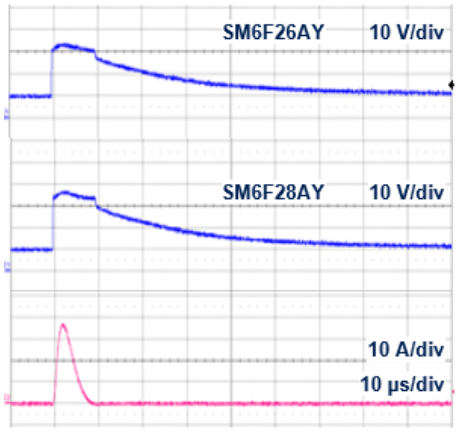


Figure 14. ISO7637-2 pulse 3a: Vs = -220 V with 12 V battery

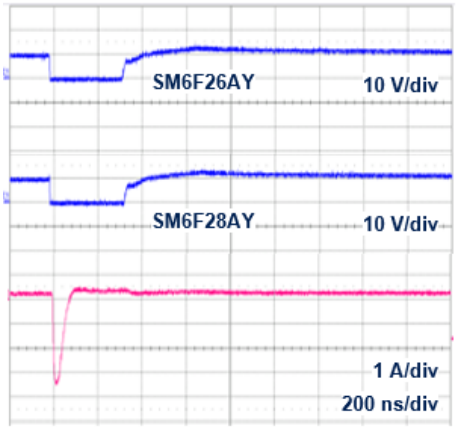
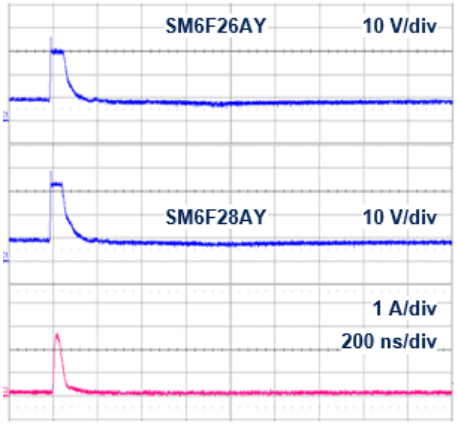


Figure 15. ISO7637-2 pulse 3b: Vs = +150 V with 12 V battery



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 SOD128 Flat package information

Figure 16. SOD128 Flat package outline

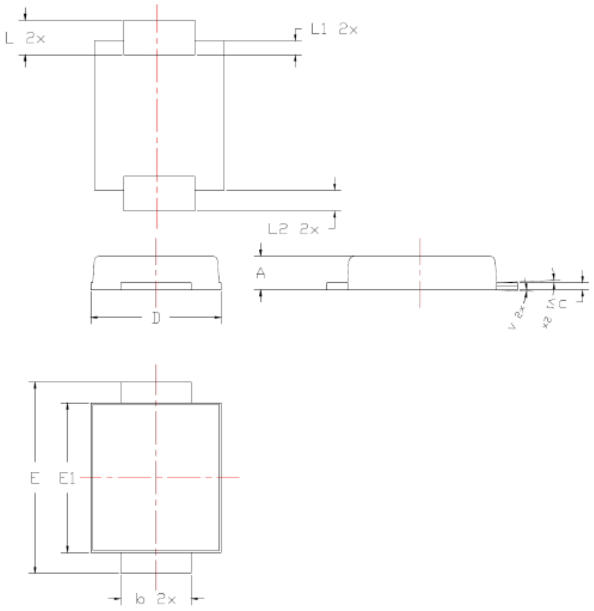


Table 3. SOD128 Flat package mechanical data

Ref.	Dimensions			
	Millimeters		Inches[1]	
	Min.	Max.	Min.	Max.
A	0.93	1.03	0.037	0.041
b	1.69	1.81	0.067	0.071
c	0.10	0.22	0.004	0.009
D	2.30	2.50	0.091	0.098
E	4.60	4.80	0.181	0.189
E1	3.70	3.90	0.146	0.154
L	0.55	0.85	0.026	0.033
L1	0.30 typ.		0.012 typ.	
L2	0.45 typ.		0.018 typ.	

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

2.2 SOD128 Flat packing info

Figure 17. Footprint recommendations, dimensions in mm (inches)

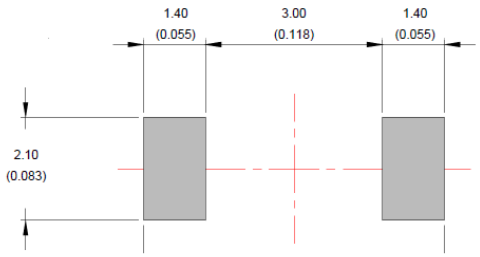
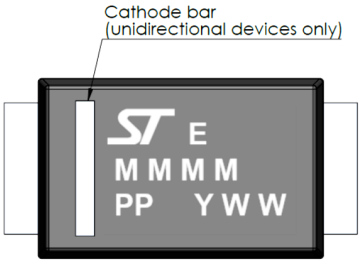
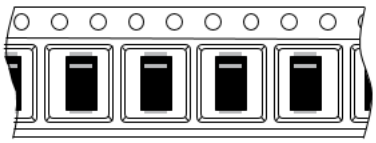


Figure 18. Marking layout (refer to ordering information table for marking)



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

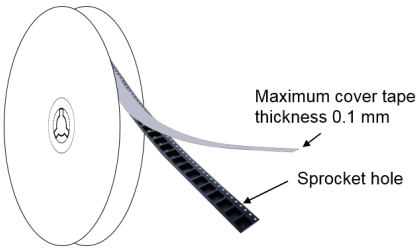


Figure 21. Reel dimensions (mm)

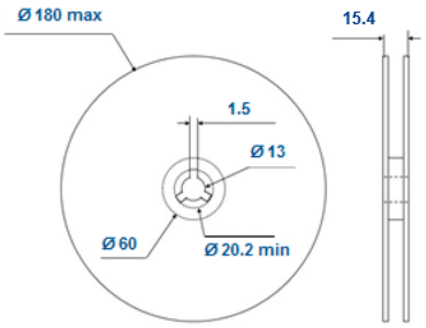


Figure 22. Inner box dimensions (mm)

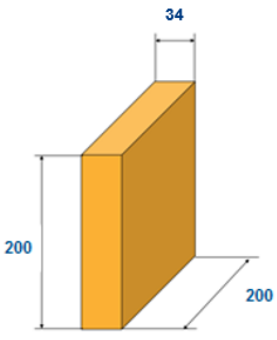
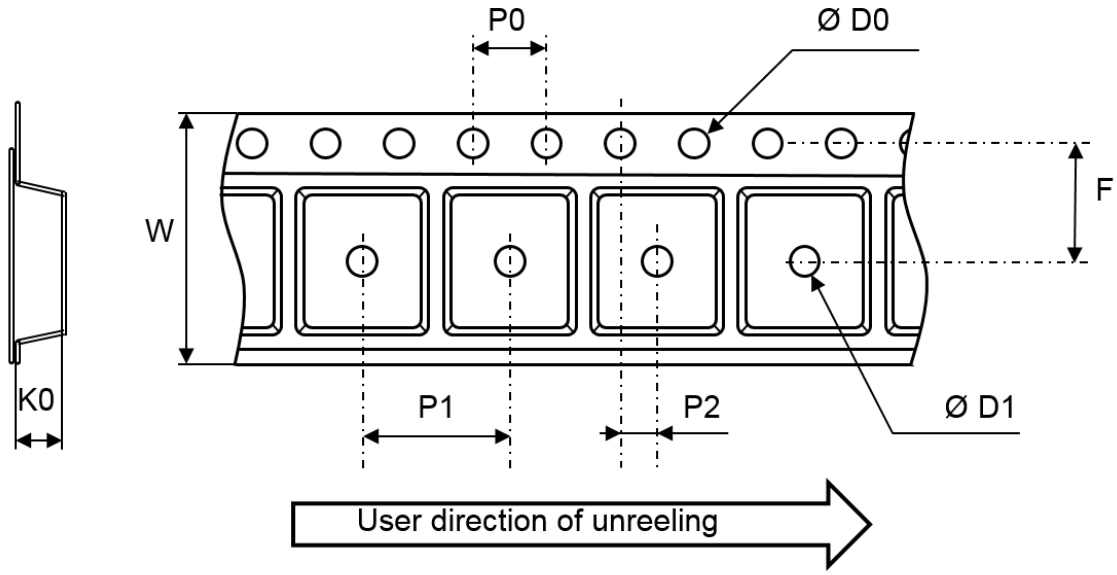


Figure 23. **Tape and reel outline**

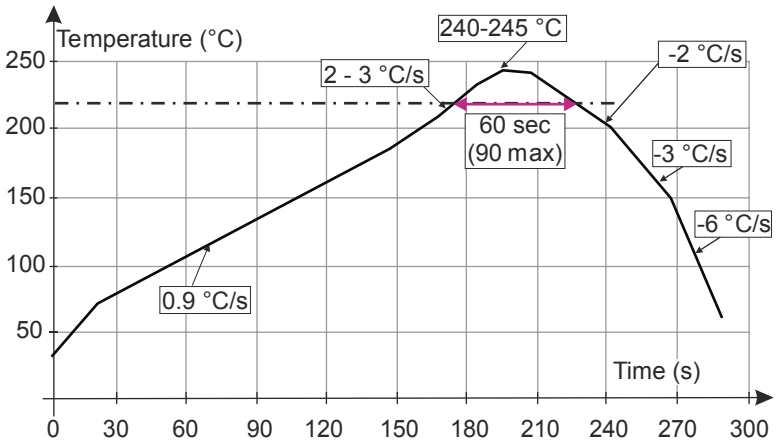


Note: Pocket dimensions are not on scale
Pocket shape may vary depending on package

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

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
ØD0	1.5	1.55	1.60
ØD1	1.5		
F	5.45	5.50	5.55
K0	1.20	1.25	1.30
P0	3.90	4.00	4.10
P1	3.90	4.00	4.10
P2	1.90	2.00	2.10
W	11.70	12.00	12.30

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**

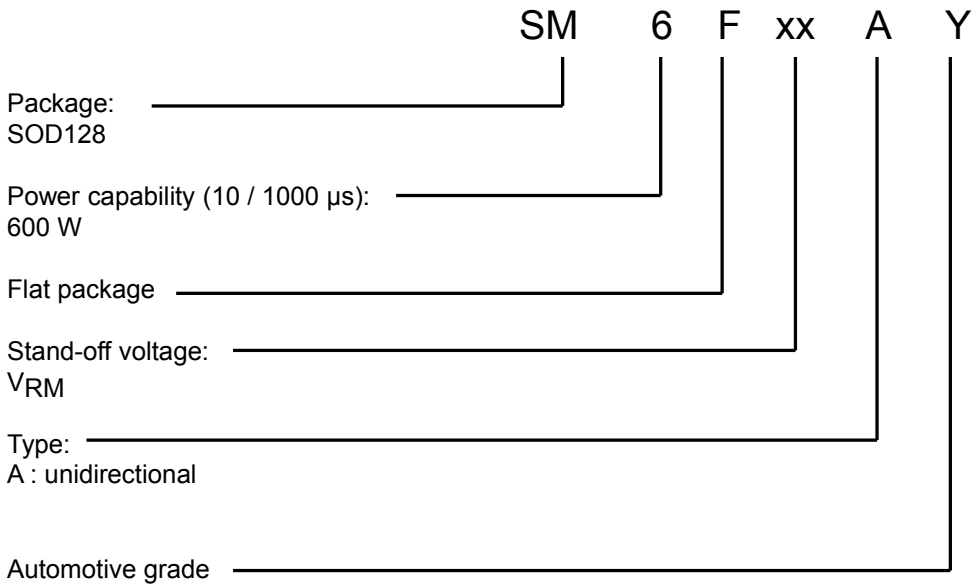


Table 5. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
SM6FxxAY	See Table 6. Marking.	SOD128 Flat	28 mg	3000	Tape and reel

Table 6. **Marking**

Order code	Marking
SM6F5.0AY	5AIY
SM6F6.0AY	5AKY
SM6F6.5AY	5ALY
SM6F8.5AY	5APY
SM6F10AY	5ASY
SM6F11AY	5AUY
SM6F12AY	5AWY
SM6F13AY	5AYY
SM6F14AY	5BAY
SM6F15AY	5BCY
SM6F16AY	5BEY
SM6F18AY	5BIY
SM6F20AY	5BMY
SM6F22AY	5BOY
SM6F23AY	5BPY
SM6F24AY	5BQY
SM6F26AY	5BSY
SM6F28AY	5BUY
SM6F30AY	5BWY
SM6F31AY	5BXY
SM6F33AY	5BZY
SM6F36AY	5CCY

Revision history

Table 7. **Document revision history**

Date	Revision	Changes
01-Jul-2019	1	Initial release.
07-Jan-2020	2	Updated links syntax.