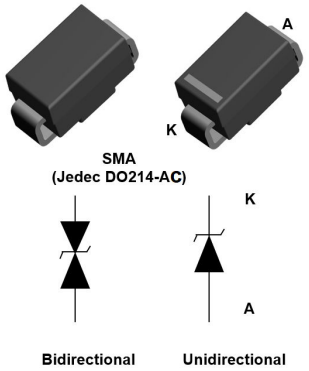
SM4TxxAY, SM4TxxCAY

Datasheet

Automotive 400 W TVS in SMA



Product status link
SM4T6V7AY, SM4T6V7CAY,
SM4T7V6AY, SM4T7V6CAY,
SM4T10AY, SM4T10CAY,
SM4T12AY, SM4T12CAY,
SM4T14AY, SM4T14CAY,
SM4T15AY, SM4T15CAY,
SM4T18AY, SM4T18CAY,
SM4T21AY, SM4T21CAY,
SM4T23AY, SM4T23CAY,
SM4T26AY, SM4T26CAY,
SM4T28AY, SM4T28CAY,
SM4T30AY, SM4T30CAY,
SM4T33AY, SM4T33CAY,
SM4T35AY, SM4T35CAY,
SM4T39AY, SM4T39CAY,
SM4T47AY, SM4T47CAY,
SM4T50AY, SM4T50CAY,
SM4T56AY, SM4T56CAY,
SM4T68AY, SM4T68CAY,
SM4T82AY, SM4T82CAY

Features

- AEC-Q101 qualified
- Peak pulse power:
  - 400 W (10/1000 µs)
  - 2.3 kW (8/20 µs)
- Stand-off voltage range from 5 V to 70 V
- Unidirectional and bidirectional types
- Low leakage current:
  - 0.2 µA at 25 °C
  - 1 µA at 85 °C
- Operating T_j max: 150 °C
- JEDEC registered package outline
- Resin meets UL94, V0

Complies with the following standards

- ISO 10605, C = 150 pF, R = 330 Ω:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)
- ISO 10605, C = 330 pF, R = 330 Ω:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)
- ISO 7637-2 (not applicable to parts with V_{RM} lower than battery voltage 13.5 V):
  - Pulse 1: V_S = -150 V
  - Pulse 2a: V_S = +112 V
  - Pulse 3a: V_S = -200 V
  - Pulse3b: V_S = +150 V

Description

The SM4TY 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. SM4TY devices are packaged in SMA (SMA footprint in accordance with IPC 7531 standard).

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
		ISO10605 (C = 330 pF, R = 330 Ω) Contact discharge Air discharge	 30 30	
P_{PP}	Peak pulse power dissipation	T_j initial = T_{amb}	400	W
T_{stg}	Storage temperature range		-65 to +150	°C
T_j	Operating junction temperature range		-55 to +150	°C
T_L	Maximum lead temperature for soldering during 10 s		260	°C

Figure 1. Electrical characteristics - parameter definitions

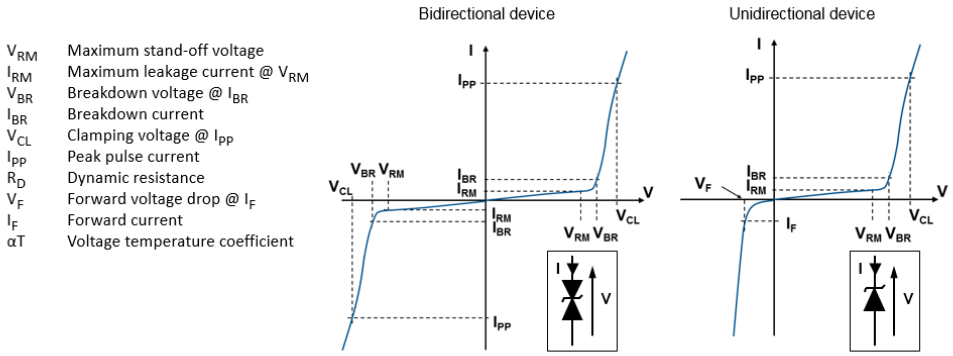


Figure 2. Pulse definition for electrical characteristics

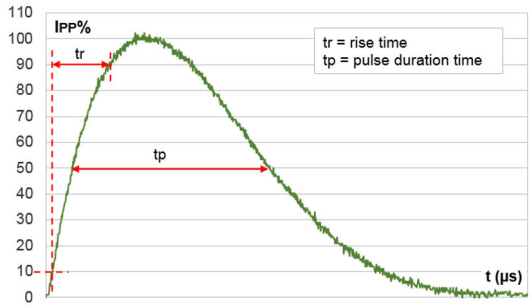


Table 2. Electrical characteristics - parameter values (T_{amb} = 25 °C, unless otherwise specified)

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	µA	V	V	V	V	mA	V	A	Ω	V	A	Ω	10^{-4}/°C
SM4T6V7AY/CAY	20	50	5	6.4	6.74	7.1	10	9.2	43.5	0.049	13.4	174	0.036	5.7
SM4T7V6AY/CAY	20	50	6.5	7.2	7.58	8	10	11.2	35.7	0.091	14.5	160	0.041	6.1
SM4T10AY/CAY	20	50	8.5	9.4	9.9	10.4	1	14.4	27.7	0.145	19.5	124	0.073	7.3
SM4T12AY/CAY	0.2	1	10	11.1	11.7	12.3	1	17	23.5	0.201	21.7	106	0.089	7.8
SM4T14AY/CAY	0.2	1	12	13.3	14	14.7	1	19.9	20.1	0.259	25.3	91	0.116	8.3
SM4T15AY/CAY	0.2	1	13	14.4	15.2	16	1	21.5	18.6	0.298	27.2	85	0.132	8.4
SM4T18AY/CAY	0.2	1	15	16.7	17.6	18.5	1	24.4	16.4	0.361	32.5	71	0.197	8.8
SM4T21AY/CAY	0.2	1	18	20.0	21.1	22.2	1	29.2	13.7	0.514	39.3	59	0.291	9.2
SM4T23AY/CAY	0.2	1	20	22.2	23.4	24.6	1	32.4	12.3	0.637	42.8	54	0.338	9.4
SM4T26AY/CAY	0.2	1	22	24.4	25.7	27	1	35.5	11.2	0.760	48.3	48	0.444	9.6
SM4T28AY/CAY	0.2	1	24	26.7	28.1	29.5	1	38.9	10.3	0.912	50	46	0.446	9.6
SM4T30AY/CAY	0.2	1	26	28.9	30.4	31.9	1	42.1	9.5	1.07	53.5	43	0.502	9.7
SM4T33AY/CAY	0.2	1	28	31.1	32.7	34.3	1	45.4	8.8	1.26	59	39	0.632	9.8
SM4T35AY/CAY	0.2	1	30	33.3	35.1	36.9	1	48.4	8.3	1.39	64.3	36	0.762	9.9
SM4T39AY/CAY	0.2	1	33	36.7	38.6	40.5	1	53.3	7.5	1.70	69.7	33	0.884	10
SM4T47AY/CAY	0.2	1	40	44.4	46.7	49	1	64.5	6.2	2.49	84	27	1.30	10.1
SM4T50AY/CAY	0.2	1	43	47.8	50.3	52.8	1	69.4	5.7	2.91	91	25	1.53	10.2
SM4T56AY/CAY	0.2	1	48	53.3	56.1	58.9	1	77.4	5.2	3.56	100	23	1.79	10.3
SM4T68AY/CAY	0.2	1	58	64.4	67.8	71.2	1	93.6	4.3	5.21	121	19	2.62	10.4
SM4T82AY/CAY	0.2	1	70	77.8	81.9	86	1	113	3.5	7.72	146	16	3.75	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_{CL}max. = V_{BR}max. + R_D x $I_{PPappli}$.*
4. *Surge capability given for both directions for unidirectional and bidirectional devices*

1.1 Characteristics (curves)

Figure 3. Maximum peak power dissipation versus initial junction temperature

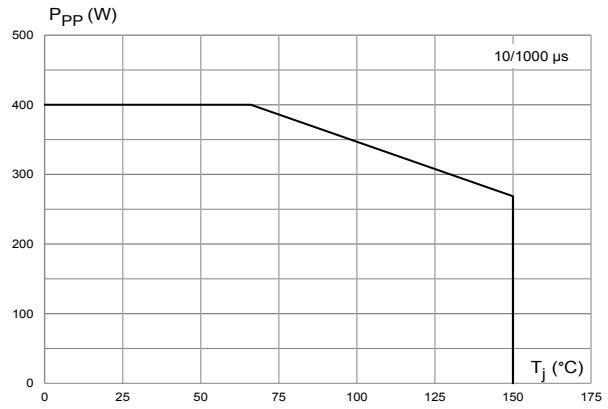


Figure 4. Maximum peak pulse power versus exponential pulse duration

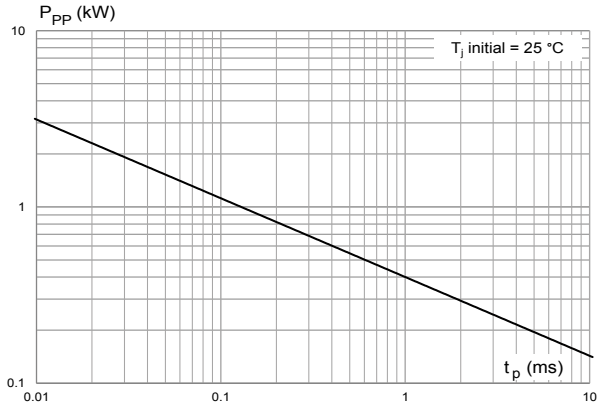


Figure 5. Maximum peak pulse current versus clamping voltage

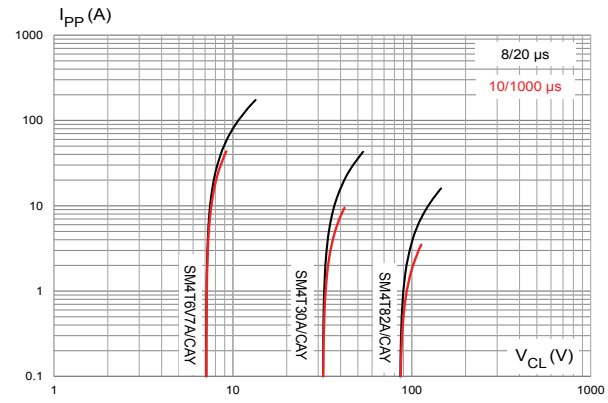


Figure 6. Dynamic resistance versus pulse duration

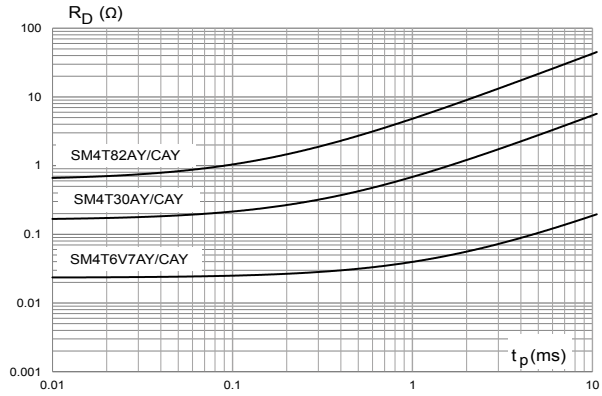


Figure 7. Junction capacitance versus reverse applied voltage (unidirectional type)

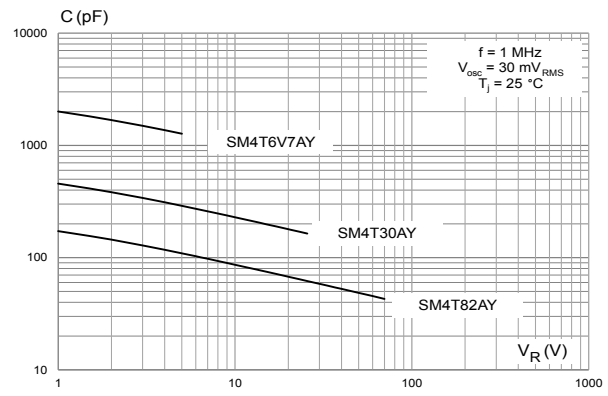


Figure 8. Junction capacitance versus applied voltage (bidirectional type)

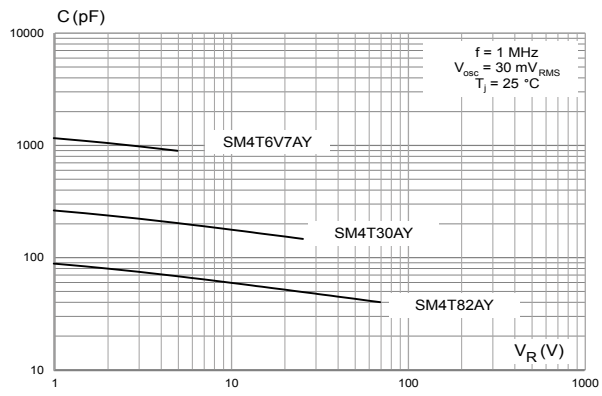


Figure 9. Leakage current versus junction temperature

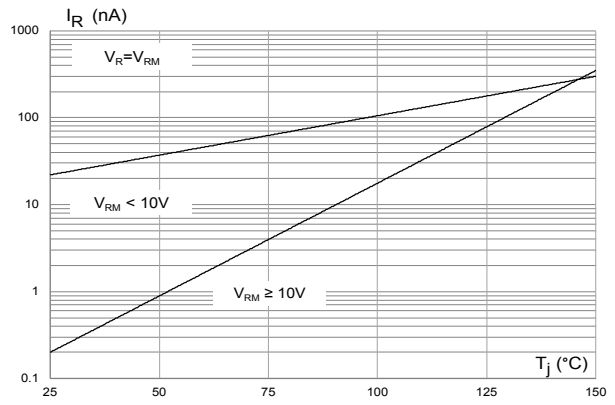


Figure 10. Peak forward voltage drop versus peak forward current

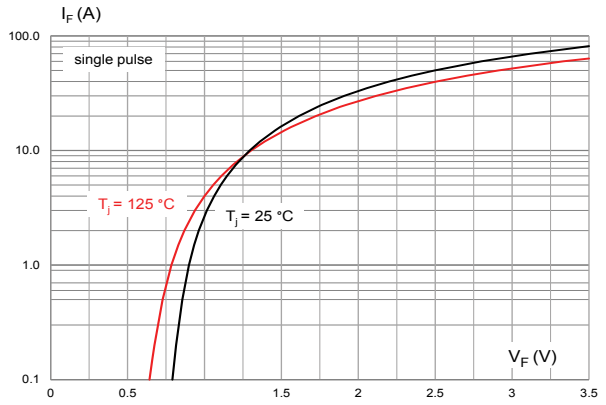


Figure 11. Thermal impedance junction to ambient versus pulse duration

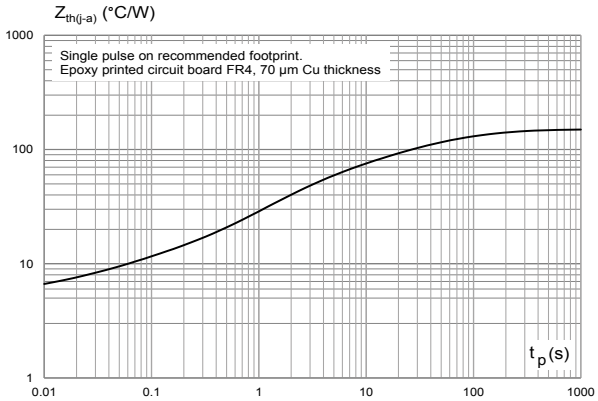


Figure 12. Thermal resistance junction to ambient versus copper area under each lead

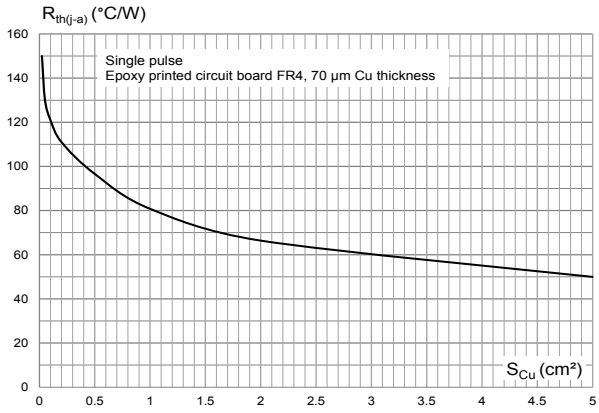


Figure 13. ISO7637-2 pulse 1: Vs = -150 V with 12 V battery

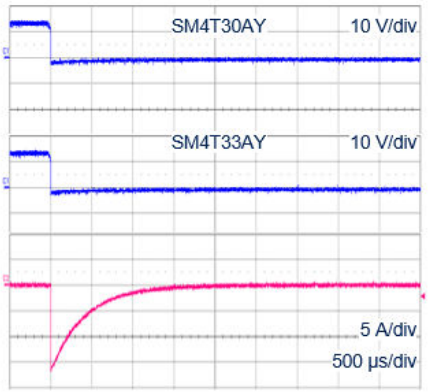


Figure 14. ISO7637-2 pulse 2a: Vs = +112 V with 12 V battery

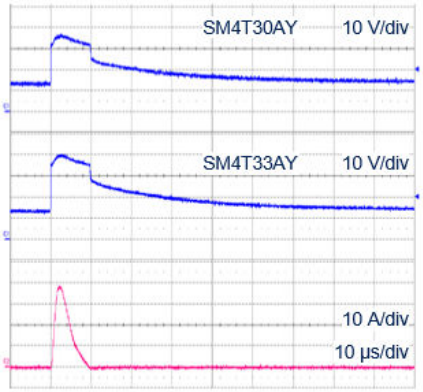


Figure 15. ISO7637-2 pulse 3a: Vs = -220 V with 12 V battery

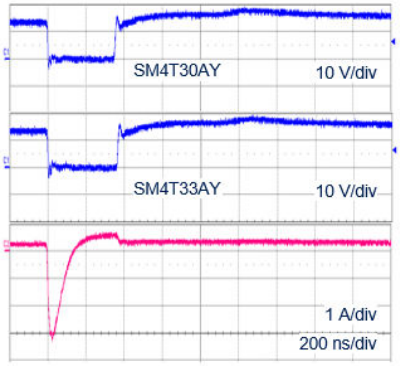
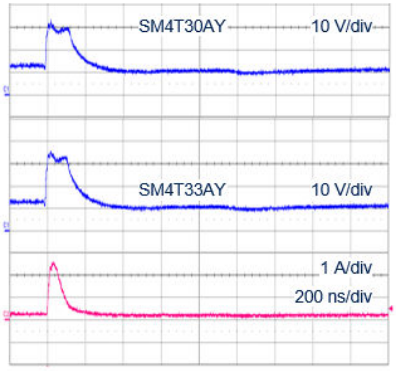


Figure 16. ISO7637-2 pulse 3b: Vs = +150 V with 12 V battery



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 SMA package information

Figure 17. SMA package outline

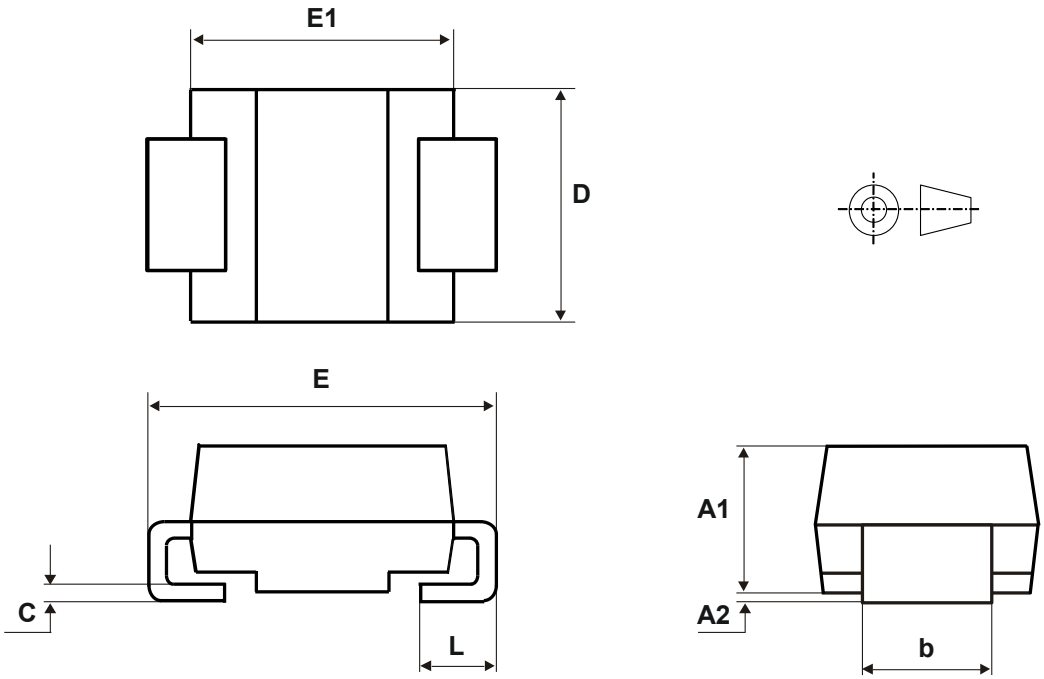


Table 3. SMA package mechanical data

Ref.	Dimensions			
	Millimeters		Inches[1]	
	Min.	Max.	Min.	Max.
A1	1.90	2.45	0.074	0.097
A2	0.05	0.20	0.001	0.008
b	1.25	1.65	0.049	0.065
c	0.15	0.40	0.005	0.016
D	2.25	2.90	0.088	0.115
E	4.80	5.35	0.188	0.211
E1	3.95	4.60	0.155	0.182
L	0.75	1.50	0.029	0.060

1. *Values in inches are converted from mm.*

Figure 18. SMA recommended footprint in mm (inches)

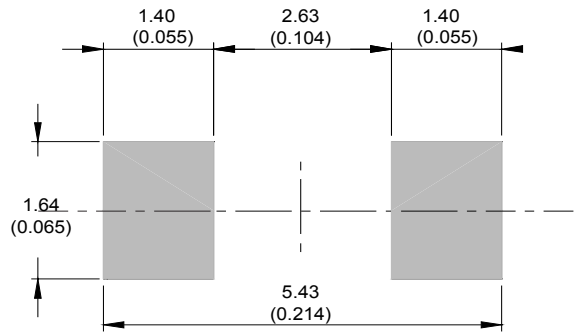
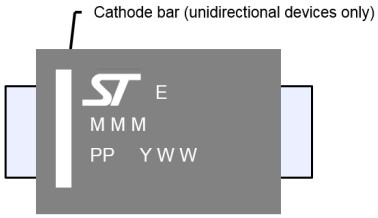
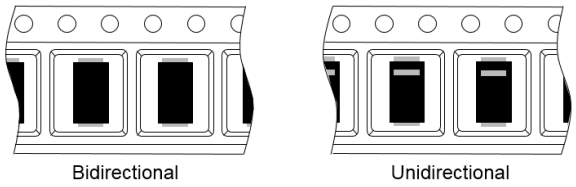


Figure 19. SMA marking



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

Figure 20. Package orientation in reel



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

Figure 21. Tape and reel orientation

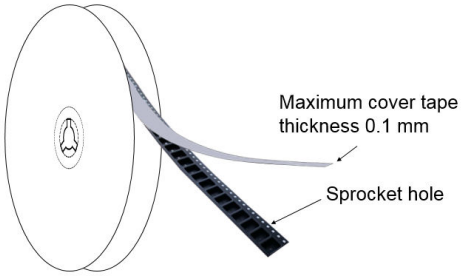


Figure 22. 13" reel dimension values (mm)

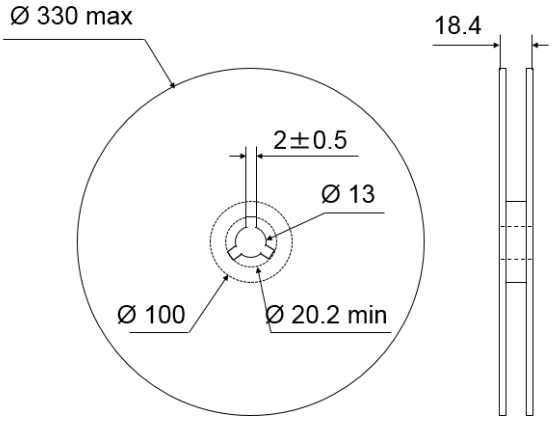


Figure 23. Inner box dimension values (mm)

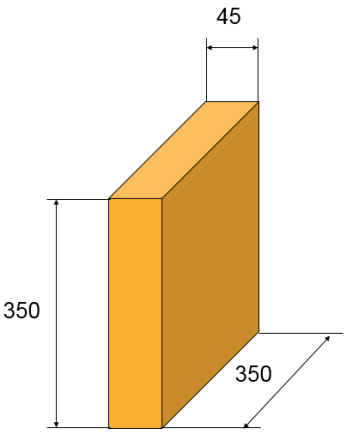
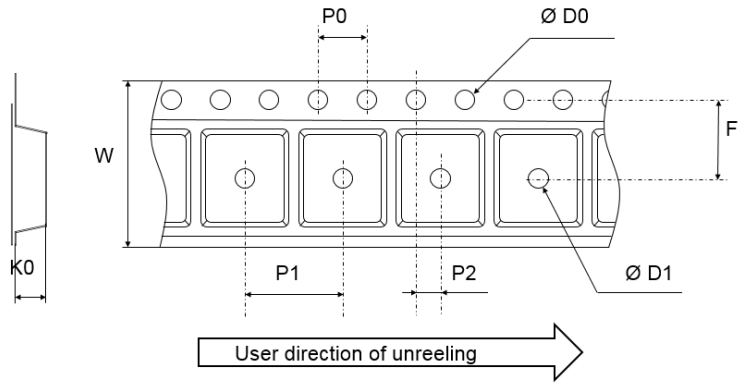


Figure 24. **Tape outline**



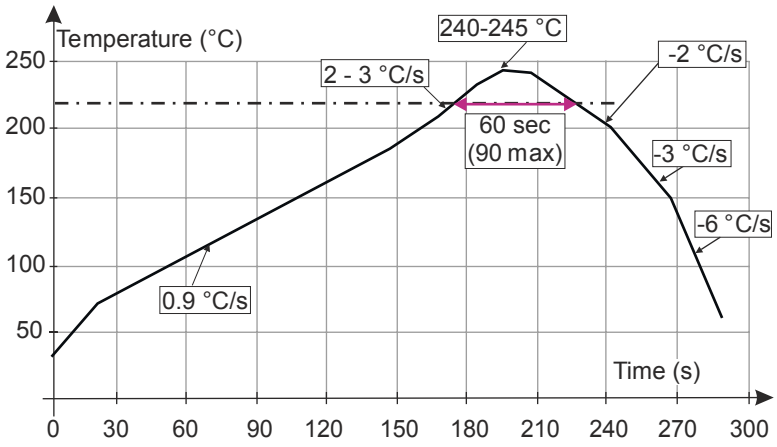
Note: Pocket dimensions are not on scale
Pocket shape may vary depending on package

Table 4. **Tape dimension values**

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
D0	1.40	1.50	1.60
D1	1.50		
F	5.40	5.50	5.60
K0	2.26	2.36	2.46
P0	3.90	4.00	4.10
P1	3.90	4.00	4.10
P2	1.95	2.00	2.05
W	11.70	12.00	12.30

2.2 Reflow profile

Figure 25. 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

Table 5. Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
SM4TxxAY/CAY(1)	See Table 6. Marking.	SMA	72 mg	5000	Tape and reel

1. *Where xx is nominal value of V_{BR} and A or CA indicates unidirectional or bidirectional version.*

Table 6. Marking

Order code	Marking	Order code	Marking
SM4T6V7AY	AEY	SM4T6V7CAY	AAY
SM4T7V6AY	DUCY	SM4T7V6CAY	DBCY
SM4T10AY	DUHY	SM4T10CAY	DBHY
SM4T12AY	AXY	SM4T12CAY	ACY
SM4T14AY	DUKY	SM4T14CAY	DBKY
SM4T15AY	BGY	SM4T15CAY	BHY
SM4T18AY	BMY	SM4T18CAY	AJY
SM4T21AY	DUQY	SM4T21CAY	DBQY
SM4T23AY	DURY	SM4T23CAY	DBRY
SM4T26AY	DUSY	SM4T26CAY	DBSY
SM4T28AY	DUTY	SM4T28CAY	DBTY
SM4T30AY	DUUY	SM4T30CAY	DBUY
SM4T33AY	CGY	SM4T33CAY	CHY
SM4T35AY	CKY	SM4T35CAY	CLY
SM4T39AY	CMY	SM4T39CAY	CNY
SM4T47AY	DUZY	SM4T47CAY	DBZY
SM4T50AY	EUAY	SM4T50CAY	EBAY
SM4T56AY	CXY	SM4T56CAY	CYY
SM4T68AY	EUFY	SM4T68CAY	EBFY
SM4T82AY	EUIY	SM4T82CAY	EBIY

Revision history

Table 7. **Document revision history**

Date	Version	Changes
08-Sep-2010	1	Initial release.
09-Nov-2011	2	Added order codes in Table 2 and Table 4. Updated Figure 5, 6 and 7.
27-Mar-2012	3	Added footnote on page 1.
05-Oct-2015	4	Updated Table 1.
26-Jan-2022	5	Minor text changes.
13-Jul-2023	6	Updated Figure 9.

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