SMA6TY

Automotive 600 W Transil™ in SMA package

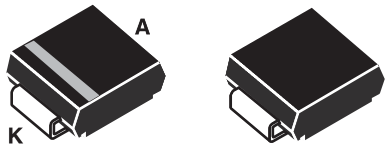
Datasheet — production data

Features

- Peak pulse power:
  - 600 W (10/1000 µs)
  - 4 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 UL 94, V0
- AEC-Q101 qualified

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[a]
  - Pulse 1: V_S = -100 V
  - Pulse 2a: V_S = +50 V
  - Pulse 3a: V_S = -150 V
  - Pulse 3b: V_S = +100 V



Unidirectional Bidirectional
SMA
(JEDEC DO-214AC)

Description

The SMA6TY Transil series has been 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 this device compatible with high-end circuits where low leakage current and high junction temperature are required to provide reliability and stability over time. SMA6TY are packaged in SMA (SMA footprint in accordance with IPC 7531 standard).

a. Not applicable to parts with stand-off voltage lower than the average battery voltage (13.5 V)

TM: Transil is a trademark of STMicroelectronics

1 Characteristics

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

Symbol	Parameter		Value	Unit
V_{PP}	Peak pulse voltage	ISO 10605 (C = 330 pF, R = 330 Ω): Contact discharge Air discharge ISO 10605 (C = 150 pF, R = 330 Ω): Contact discharge Air discharge	 30 30 30 30	kV
P_{PP}	Peak pulse power dissipation[(1)]	T_j initial = T_{amb}	600	W
T_j	Operating junction temperature range		-40 to 150	°C
T_{stg}	Storage temperature range		-65 to 150	°C
T_L	Maximum lead temperature for soldering during 10 s.		260	°C

1. For a surge greater than the maximum values, the diode will fail in short-circuit.

Figure 1. Electrical characteristics - definitions

Symbol	Parameter
V_{RM}	Stand-off voltage
V_{BR}	Breakdown voltage
V_{CL}	Clamping voltage
I_{RM}	Leakage current @ V_{RM}
I_{PP}	Peak pulse current
αT	Voltage temperature coefficient
V_F	Forward voltage drop
R_D	Dynamic resistance

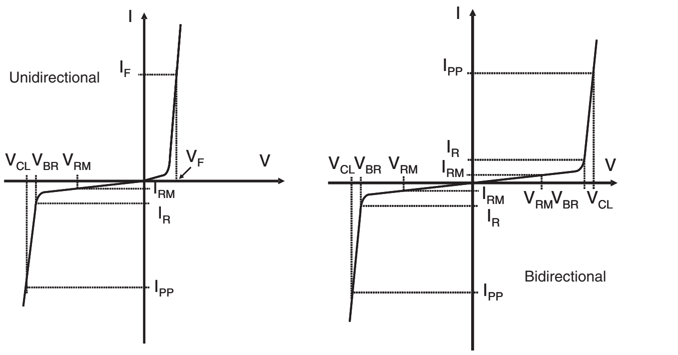


Figure 2. Pulse definition for electrical characteristics

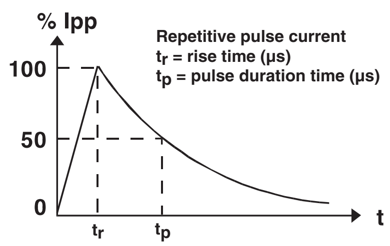


Table 2. Electrical characteristics, parameter values (T_{amb} = 25 °C)

Order code	I_{RM} max @ V_{RM}			V_{BR} @ I_R (1)				V_{CL} @ I_{PP} 10/1000 µs		R_D (2) 10/1000 µs	V_{CL} @ I_{PP} 8/20 µs		R_D (2) 8/20 µs	αT
	25 °C	85 °C		min.	typ.	max.		max			max			max
	µA		V	V			mA	V(3)	A(4)	Ω	V(3)	A(4)	Ω	10-4/ °C
SMA6T6V7AY/CAY	20	50	5.00	6.40	6.70	7.1	10	9.1	68.0	0.029	13.4	298	0.021	5.7
SMA6T7V6AY/CAY	20	50	6.50	7.20	7.60	8.0	10	10.2	56.0	0.04	14.5	276	0.024	6.1
SMA6T10AY/CAY	20	50	8.60	9.50	10.0	10.5	1	14.5	41.0	0.098	18.6	215	0.038	7.3
SMA6T12AY/CAY	0.2	1	10.2	11.4	12.0	12.6	1	16.7	36.0	0.114	21.7	184	0.049	7.8
SMA6T14AY/CAY	0.2	1	12.0	13.3	14.0	14.7	1	18.8	31.0	0.133	23.5	157	0.056	8.3
SMA6T15AY/CAY	0.2	1	12.8	14.3	15.0	15.8	1	21.2	28.0	0.193	27.2	147	0.078	8.4
SMA6T18AY/CAY	0.2	1	15.3	17.1	18.0	18.9	1	25.2	24.0	0.263	32.3	123	0.111	8.8
SMA6T22AY/CAY	0.2	1	18.8	20.9	22.0	23.1	1	30.6	20.0	0.375	39.3	102	0.159	9.2
SMA6T24AY/CAY	0.2	1	20.5	22.8	24.0	25.2	1	33.2	18.0	0.444	42.8	93.0	0.189	9.4
SMA6T28AY/CAY	0.2	1	24.0	26.7	28.1	29.5	1	37.8	16.0	0.516	44.3	80.0	0.184	9.6
SMA6T30AY/CAY	0.2	1	25.6	28.5	30.0	31.5	1	41.5	14.5	0.690	53.5	75.0	0.293	9.7
SMA6T33AY/CAY	0.2	1	28.2	31.4	33.0	34.7	1	45.7	13.1	0.84	59.0	68.0	0.357	9.8
SMA6T39AY/CAY	0.2	1	33.3	37.1	39.0	41.0	1	53.9	11.1	1.16	69.7	57.0	0.504	10
SMA6T47AY/CAY	0.2	1	40.0	44.4	46.7	49.1	1	62.8	9.70	1.42	73.6	48.0	0.511	10.1
SMA6T56AY/CAY	0.2	1	47.6	53.2	56.0	58.8	1	76.6	7.80	2.28	100	40.0	1.030	10.0
SMA6T68AY/CAY	0.2	1	58.1	64.6	68.0	71.4	1	92.0	6.50	3.17	121	33.0	1.50	10.4
SMA6T82AY/CAY	0.2	1	70.0	77.8	81.9	86.0	1	110	5.50	4.38	120	27.0	1.27	10.5

1. Pulse test: t_p < 50 ms
2. To calculate maximum clamping voltage at another surge level, use the following formula:
   $V_{CLmax} = V_{CL} - R_D \times (I_{PP} - I_{PPappli})$ where $I_{PPappli}$ is the surge current in the application.
3. To calculate V_{BR} or V_{CL} versus junction temperature, use the following formulas:
   V_{BR} @ T_J = V_{BR} @ 25°C x (1 + αT x (T_J - 25))
   V_{CL} @ T_J = V_{CL} @ 25°C x (1 + αT x (T_J - 25))
4. Surge capability given for both directions for unidirectional and bidirectional types.

Figure 3. Relative variation of peak power versus initial junction temperature

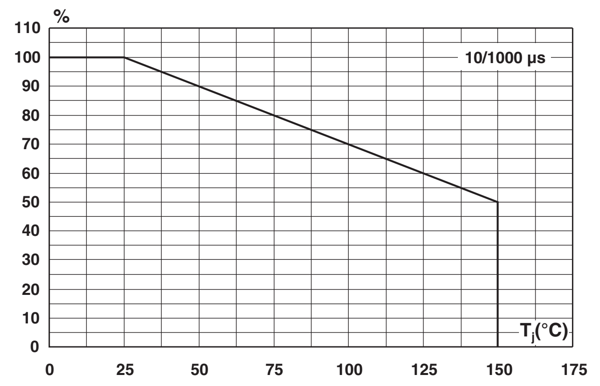


Figure 4. Peak pulse power versus exponential pulse duration

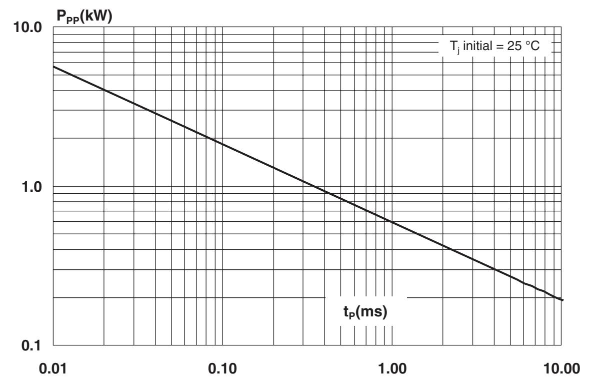


Figure 5. Clamping voltage versus peak pulse current exponential waveform (maximum values)

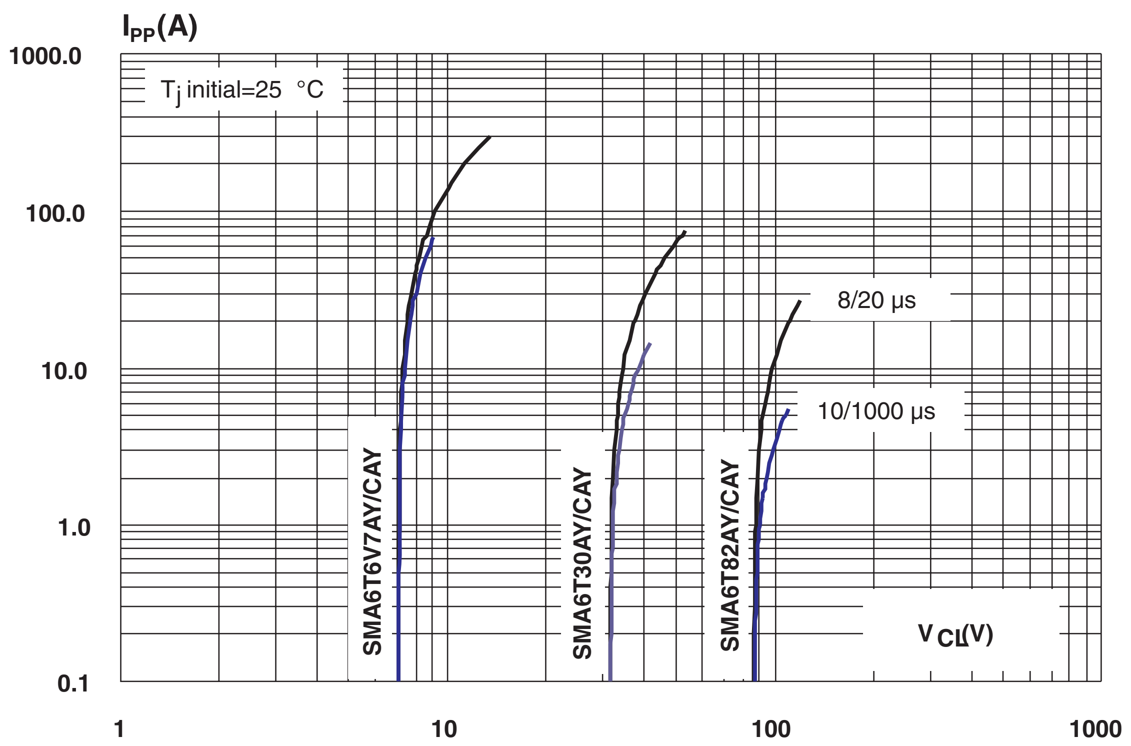


Figure 6. ISO 7637-2 pulse 1 response (V_S = -100 V)

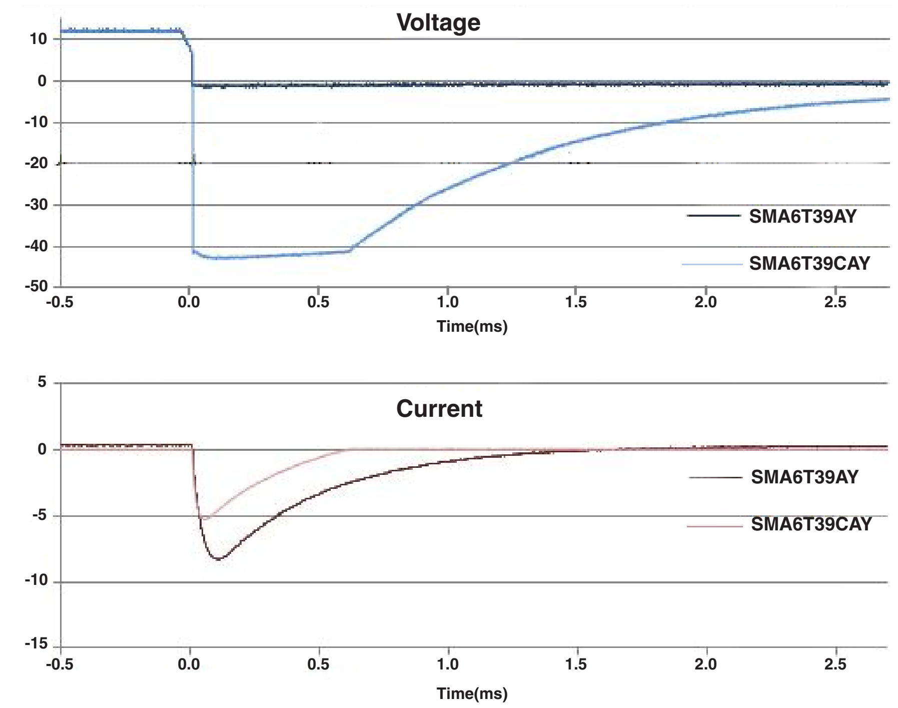


Figure 7. ISO 7637-2 pulse 2a response (V_S = 50 V)

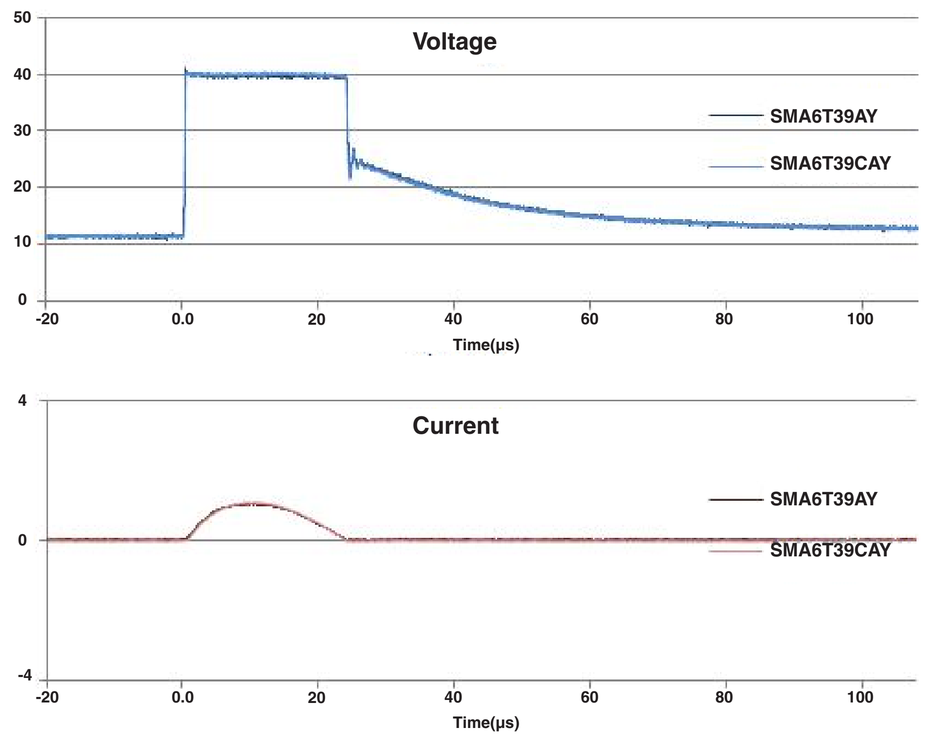


Figure 8. ISO 7637-2 pulse 3a response (V_S = -150 V)

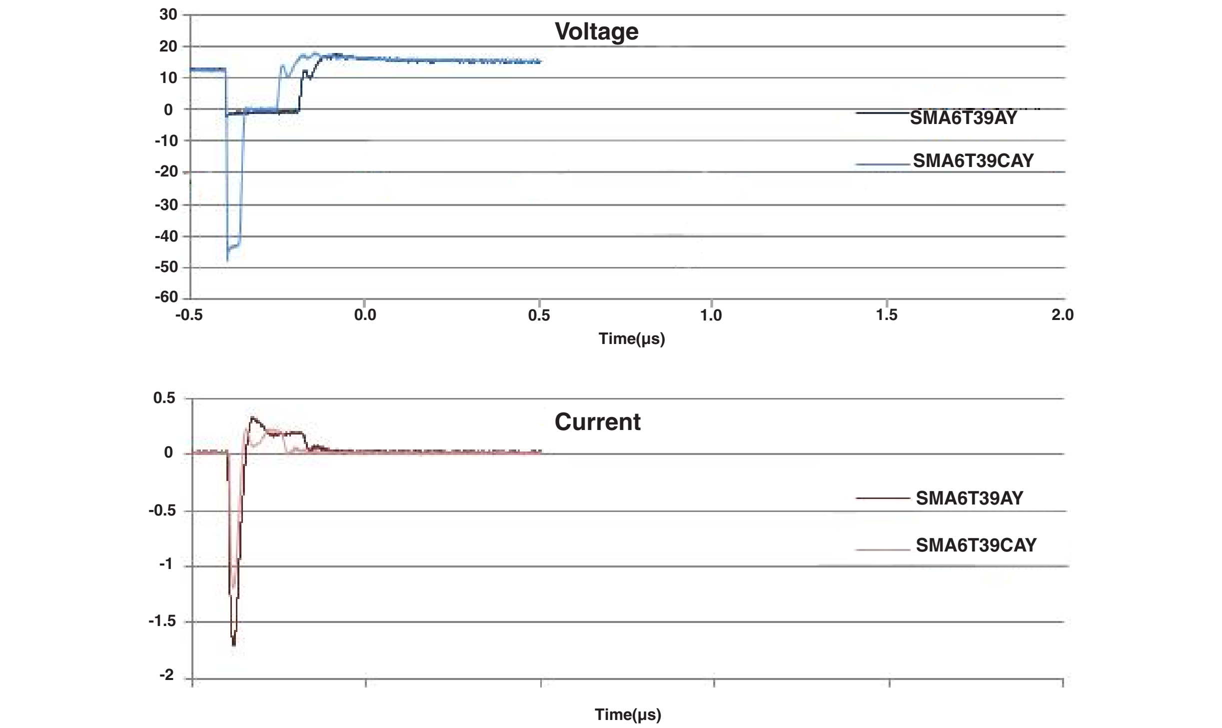
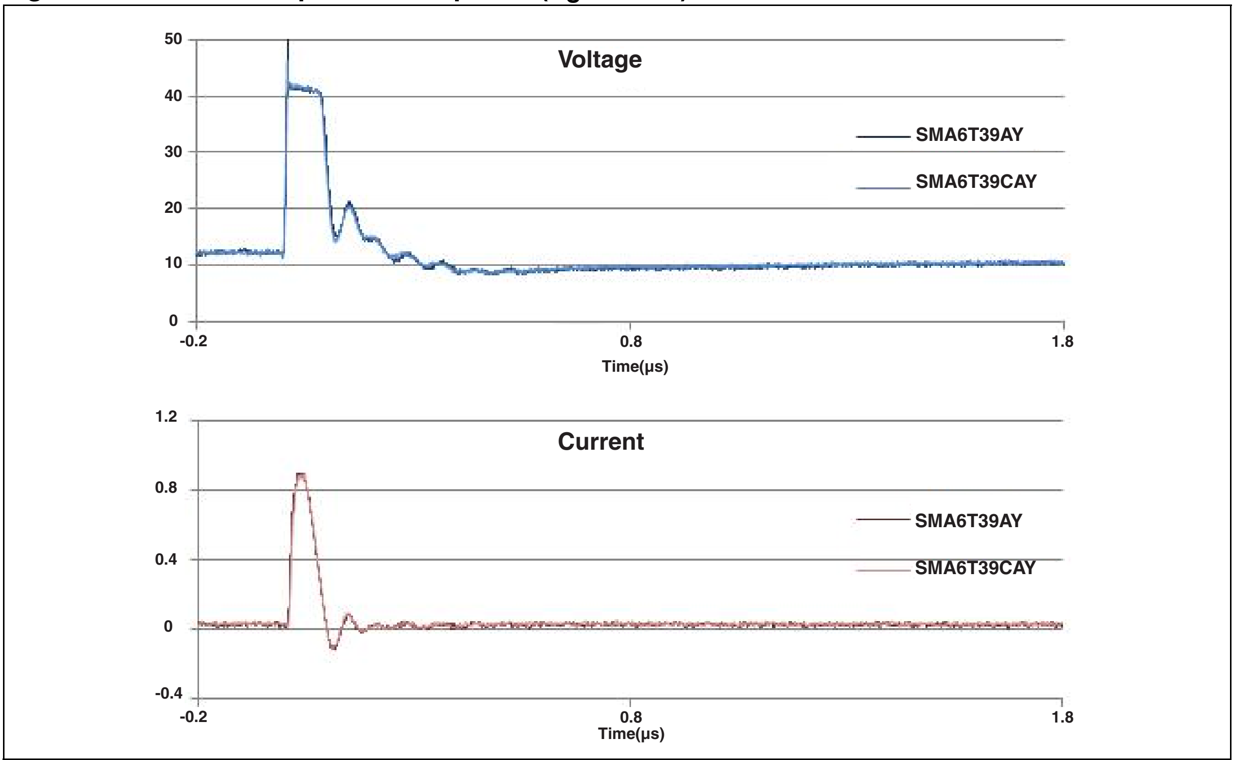


Figure 9. ISO 7637-2 pulse 3b response (V_S = 100 V)



Note: ISO7637-2 pulses responses are not applicable for products with a stand off voltage lower than the average battery voltage (13.5 V).

Figure 10. Junction capacitance versus reverse applied voltage for unidirectional types (typical values)

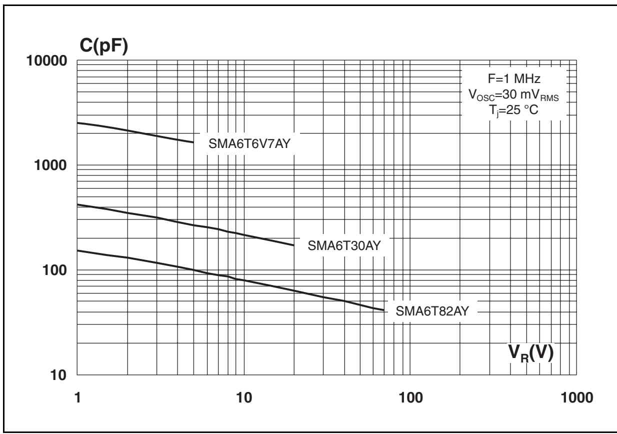


Figure 11. Junction capacitance versus reverse applied voltage for bidirectional types (typical values)

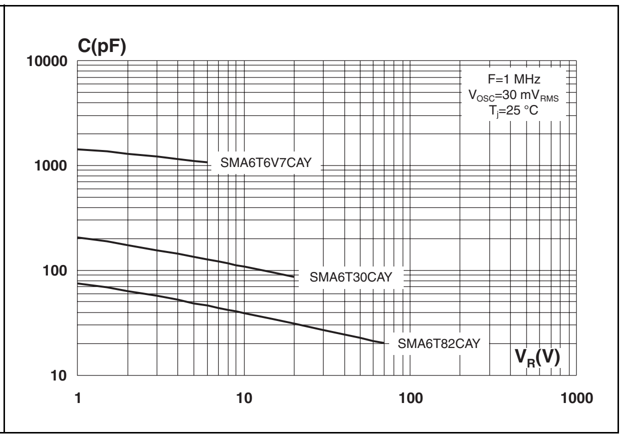


Figure 12. Relative variation of thermal impedance, junction to ambient, versus pulse duration

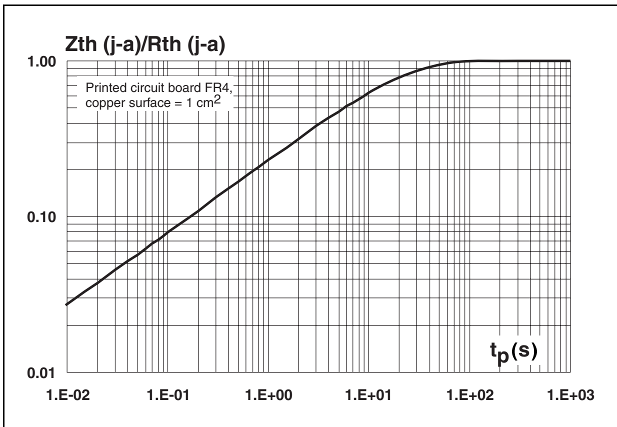


Figure 13. Thermal resistance junction to ambient versus copper surface under each lead

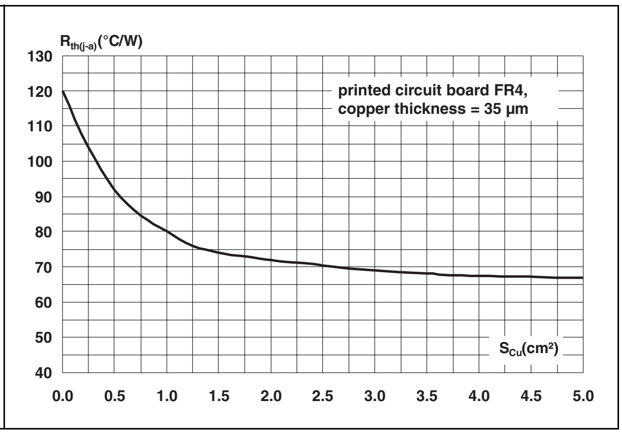


Figure 14. Leakage current versus junction temperature (typical values)

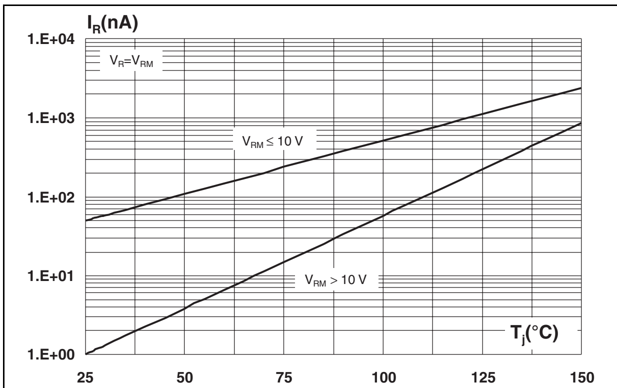
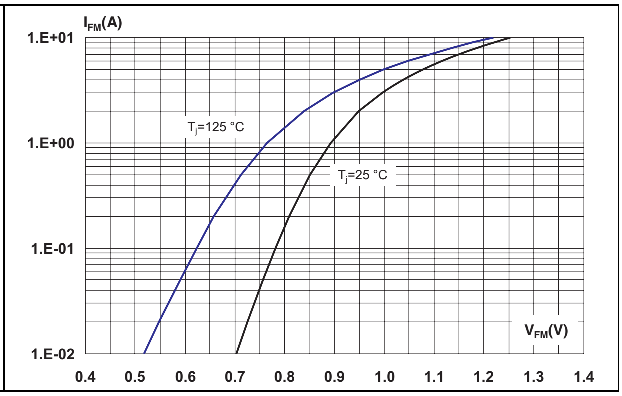


Figure 15. Peak forward voltage drop versus peak forward current (typical values)

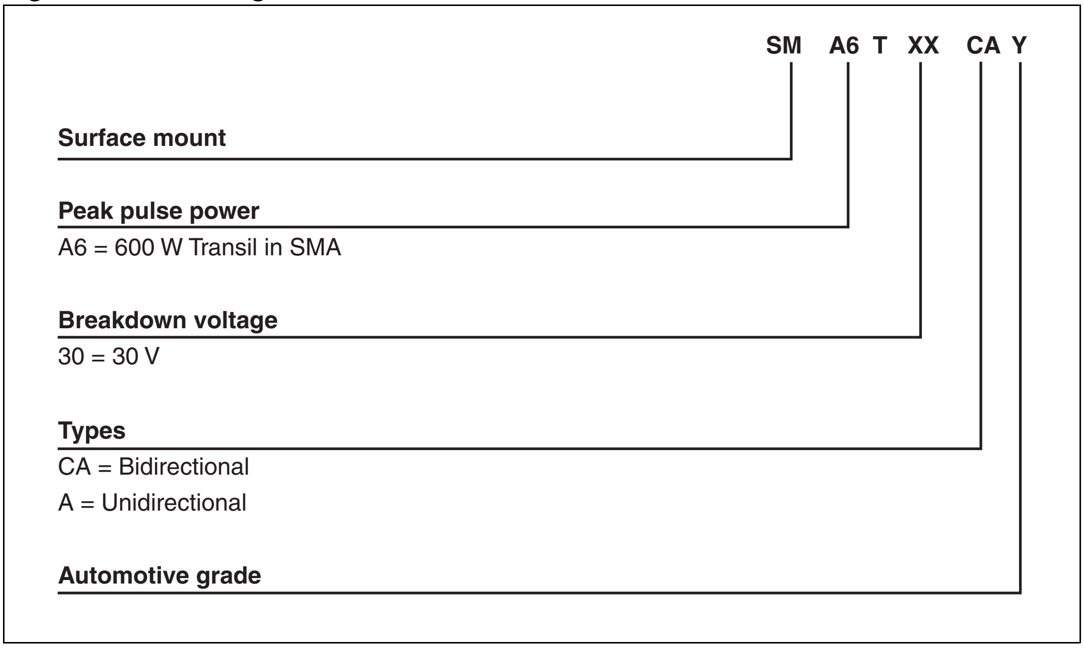


2 Application and design guidelines

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

3 Ordering information scheme

Figure 16. Ordering information scheme

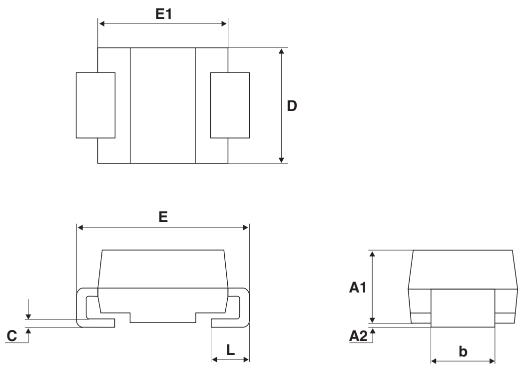


4 Packaging information

- Case: JEDEC DO-214AA molded plastic over planar junction
- Terminals: solder plated, solderable as per MIL-STD-750, Method 2026
- Polarity: for unidirectional types the band indicates cathode
- Flammability: epoxy meets UL 94, V0
- RoHS package

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.

Table 3. SMA dimensions



Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A1	1.90	2.45	0.075	0.094
A2	0.05	0.20	0.002	0.008
b	1.25	1.65	0.049	0.065
c	0.15	0.40	0.006	0.016
D	2.25	2.90	0.089	0.114
E	4.80	5.35	0.189	0.211
E1	3.95	4.60	0.156	0.181
L	0.75	1.50	0.030	0.059

Figure 17. SMA footprint dimensions in mm (inches)

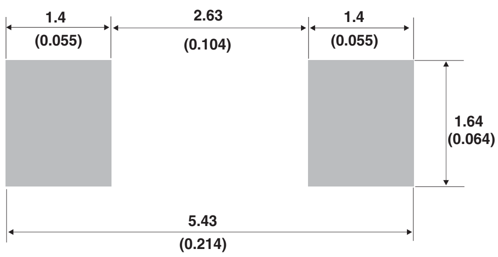
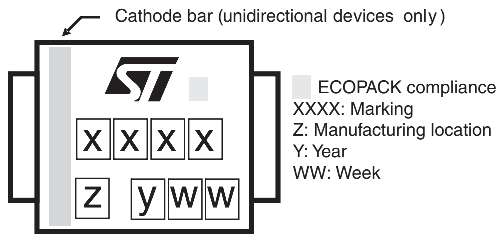


Figure 18. Marking layout(1)



1. Marking layout can vary according to assembly location.

Table 4. Marking

Order code	Marking	Order code	Marking
SMA6T6V7AY	6UAY	SMA6T6V7CAY	6BAY
SMA6T7V6AY	6UCY	SMA6T7V6CAY	6BCY
SMA6T10AY	6UDY	SMA6T10CAY	6BDY
SMA6T12AY	6UEY	SMA6T12CAY	6BEY
SMA6T14AY	6UFY	SMA6T14CAY	6BFY
SMA6T15AY	6UGY	SMA6T15CAY	6BGY
SMA6T18AY	6UHY	SMA6T18CAY	6BHY
SMA6T22AY	6UJY	SMA6T22CAY	6BJY
SMA6T24AY	6UKY	SMA6T24CAY	6BKY
SMA6T28AY	6UMY	SMA6T28CAY	6BMY
SMA6T30AY	6UNY	SMA6T30CAY	6BNY
SMA6T33AY	6UOY	SMA6T33CAY	6BOY
SMA6T39AY	6UQY	SMA6T39CAY	6BQY
SMA6T47AY	6URY	SMA6T47CAY	6BRY
SMA6T56AY	6USY	SMA6T56CAY	6BSY
SMA6T68AY	6UTY	SMA6T68CAY	6BTY
SMA6T82AY	6UUY	SMA6T82CAY	6BUY

5 Ordering information

Table 5. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
SMA6TxxxAY/CAY(1)	See *Table 4*	SMA	0.072 g	5000	Tape and reel

1. Where xxx is nominal value of V_{BR} and A or CA indicates unidirectional or bidirectional version. See *Table 2* for list of available devices and their order codes

6 Revision history

Table 6. Document revision history

Date	Revision	Changes
30-Aug-2010	1	Initial release.
17-Oct-2011	2	Deleted old Table 2. Thermal parameter. Updated *Table 2* and order codes in *Table 2* and *Table 4*. Updated *Figure 5*, *10* and *11*.
27-Mar-2012	3	Added footnote on page 1.

Mouser Electronics

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STMicroelectronics:

SMA6T22AY SMA6T22CAY SMA6T24AY SMA6T24CAY SMA6T28AY SMA6T28CAY SMA6T30AY SMA6T30CAY SMA6T33AY SMA6T39AY SMA6T39CAY SMA6T56AY SMA6T56CAY SMA6T10AY SMA6T10CAY SMA6T12AY SMA6T12CAY SMA6T14AY SMA6T14CAY SMA6T15AY SMA6T15CAY SMA6T18AY SMA6T18CAY SMA6T47AY SMA6T47CAY SMA6T68AY SMA6T68CAY SMA6T6V7AY SMA6T6V7CAY SMA6T7V6AY SMA6T7V6CAY SMA6T82AY SMA6T82CAY SMA6T33CAY