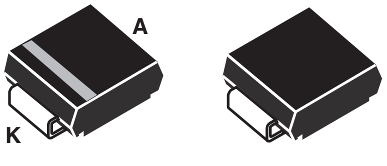
Automotive 600 W Transil™

Datasheet - production data



SMB
(JEDEC DO-214AA)

Features

- Peak pulse power:
  - 600 W (10/1000 µs)
  - 4 kW (8/20 µs)
- Stand-off voltage range: from 6 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
- High power capability at $T_{j\ max}$:
  - 515 W (10/1000 µs)
- 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 = -150 V
  - Pulse 2a: V_S = +112 V
  - Pulse 3a: V_S = -220 V
  - Pulse 3b: V_S = +150 V

Description

The SM6TY Transil series has been designed to protect sensitive automotive circuits against surges defined in ISO 7637-2 and against electrostatic discharges according 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. SM6TY are packaged in SMB (SMB 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)

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		-55 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

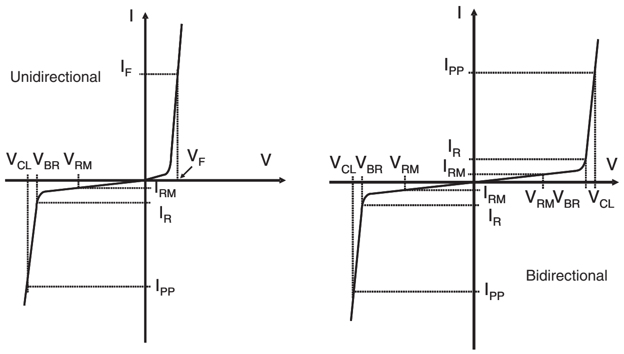


Figure 2. Pulse definition for electrical characteristics

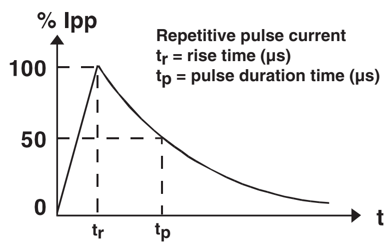


Table 2. Electrical characteristics, parameter values (T_{amb} = 25 °C)

Order code	I_{RM} max at V_{RM}			V_{BR} at I_R (1)				V_{CL} at I_{PP} 10/1000 µs		R_D (2) 10/1000 µs	V_{CL} at I_{PP} 8/20 µs		R_D (2) 8/20 µs	αT
	25 °C	85 °C		min.	typ.	max.		max.			max.			max.
	µA	µA	V	V	V	V	mA	V(3)	A(4)	Ω	V(3)	A(4)	Ω	10-4/°C
SM6T6V8AY/CAY	20	50	5.80	6.45	6.80	7.10	10	10.5	57.0	0.059	13.4	298	0.021	5.70
SM6T7V5AY/CAY	20	50	6.40	7.13	7.50	7.90	10	11.3	53.0	0.065	14.5	276	0.024	6.10
SM6T10AY/CAY	20	50	8.55	9.50	10.0	10.5	1	14.5	41.0	0.098	18.6	215	0.038	7.30
SM6T12AY/CAY	0.2	1	10.2	11.4	12.0	12.6	1	16.7	36.0	0.114	21.7	184	0.049	7.80
SM6T15AY/CAY	0.2	1	12.8	14.3	15.0	15.8	1	21.2	28	0.193	27.2	147	0.078	8.40
SM6T16V5AY/CAY	0.2	1	14.1	15.7	16.5	17.3	1	23.1	26	0.254	29	136	0.092	8.60
SM6T18AY/CAY	0.2	1	15.3	17.1	18.0	18.9	1	25.2	24.0	0.263	32.5	123	0.111	8.80
SM6T22AY/CAY	0.2	1	18.8	20.9	22.0	23.1	1	30.6	20.0	0.375	39.3	102	0.159	9.20
SM6T24AY/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	9.40
SM6T27AY/CAY	0.2	1	23.1	25.7	27.0	28.4	1	37.5	16.0	0.569	48.3	83.0	0.240	9.60
SM6T30AY/CAY	0.2	1	25.6	28.5	30.0	31.5	1	41.5	14.5	0.69	53.5	75.0	0.293	9.70
SM6T33AY/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	9.80
SM6T36AY/CAY	0.2	1	30.8	34.2	36.0	37.8	1	49.9	12.0	1.01	64.3	62.0	0.427	9.90
SM6T39AY/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	10.0
SM6T42AY/CAY	0.2	1	36.0	40.0	42.1	44.2	1	58.1	10.3	1.35	76.0	52.0	0.611	10.0
SM6T47AY/CAY	0.2	1	40.0	44.4	46.7	49.0	1	64.5	9.7	1.59	84.0	48.0	0.728	10.1
SM6T56AY/CAY	0.2	1	47.6	53.2	56.0	58.8	1	76.6	7.8	2.28	100	40.0	1.03	10.0
SM6T68AY/CAY	0.2	1	58.1	64.6	68.0	71.4	1	92	6.5	3.17	121	33.0	1.50	10.4
SM6T75AY/CAY	0.2	1	64.1	71.3	75.0	78.8	1	103	5.8	4.17	134	30.0	1.84	10.5
SM6T82AY/CAY	0.2	1	70.0	77.8	81.9	86.0	1	113	5.5	4.91	146	27.0	2.22	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. Peak power dissipation versus initial junction temperature (typical values)

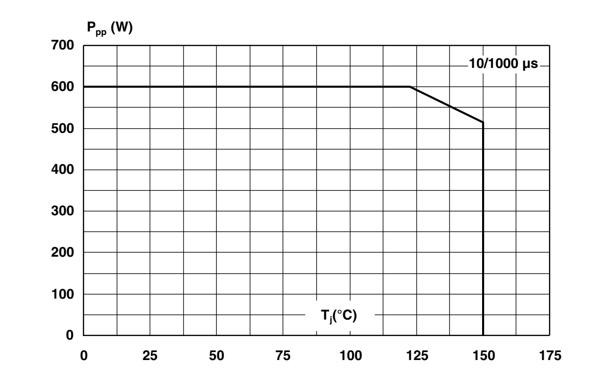


Figure 4. Peak pulse power versus exponential pulse duration

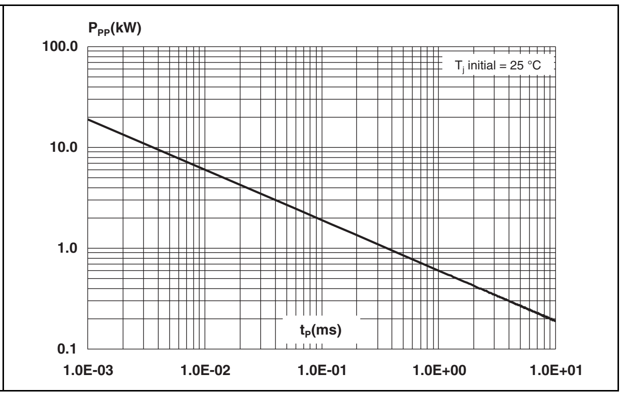


Figure 5. Clamping voltage versus peak pulse current exponential waveform (maximum values)

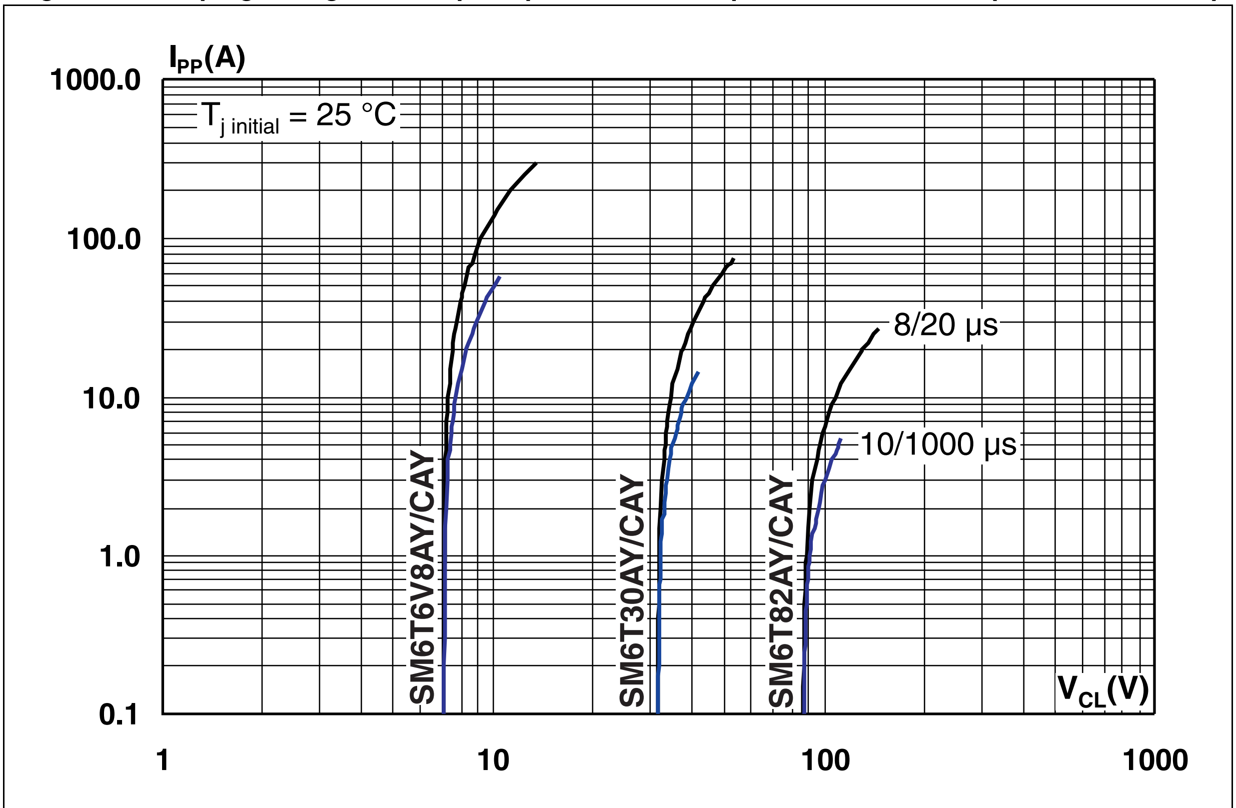


Figure 6. ISO 7637-2 pulse 1 response (V_S = -150 V)

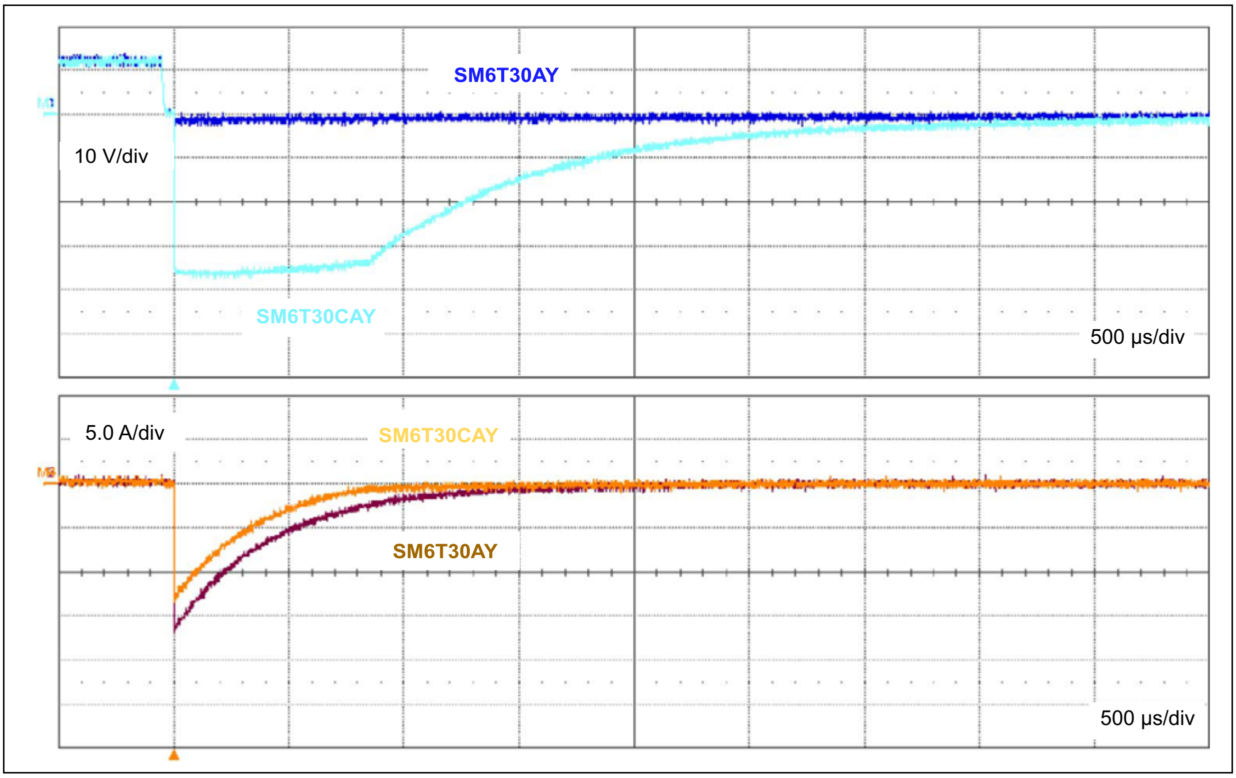


Figure 7. ISO 7637-2 pulse 2a response (V_S = 112 V)

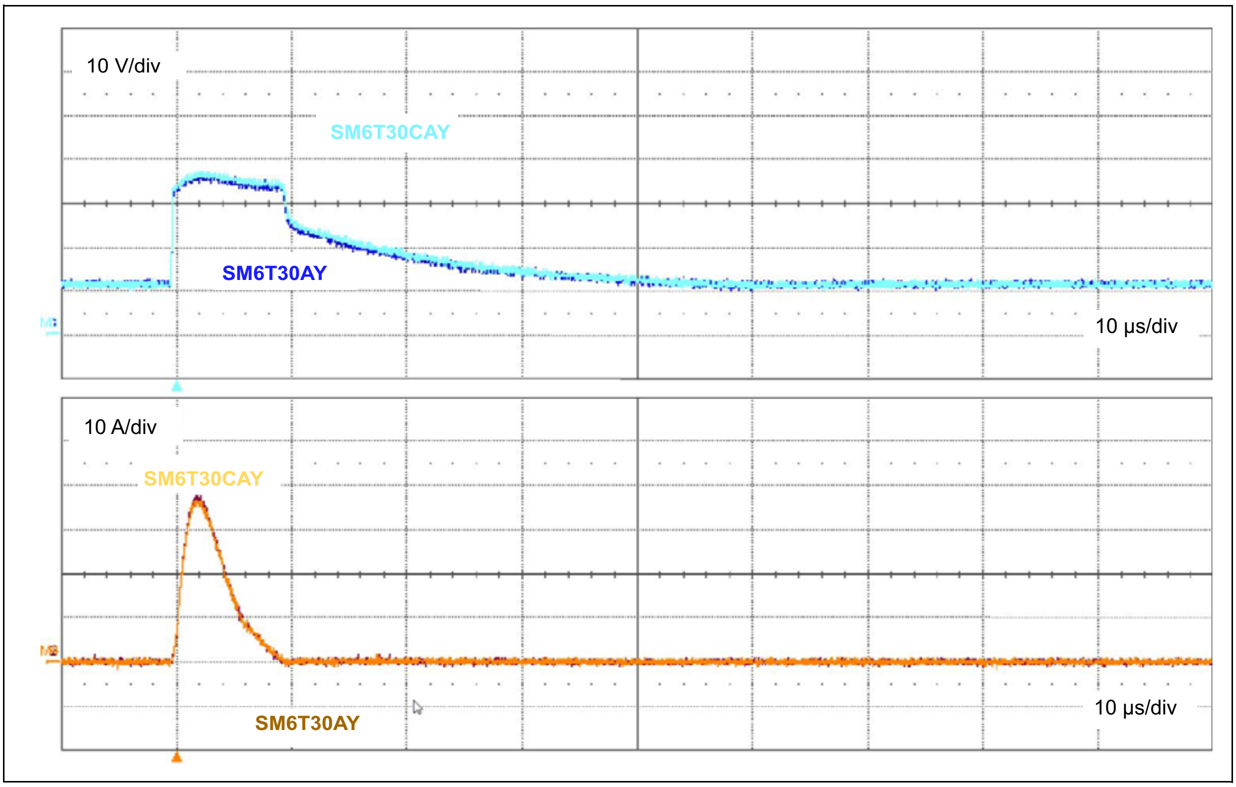


Figure 8. ISO 7637-2 pulse 3a response (V_S = -220 V)

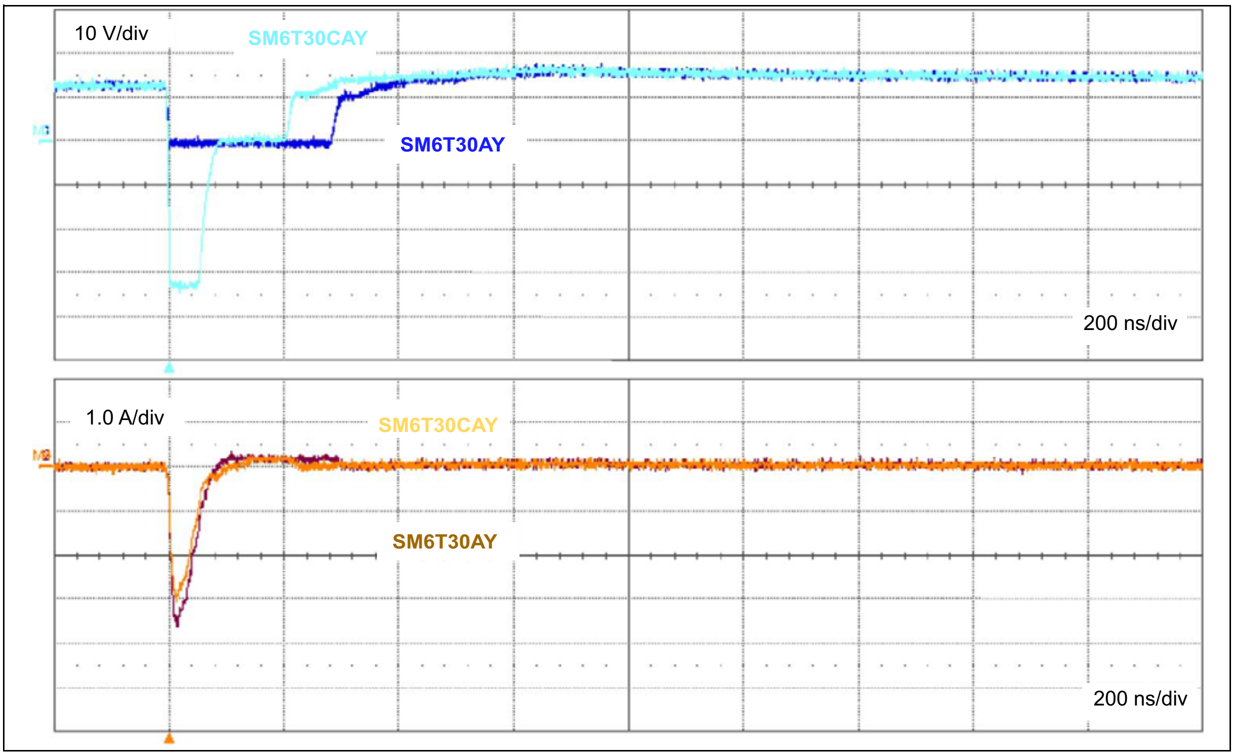
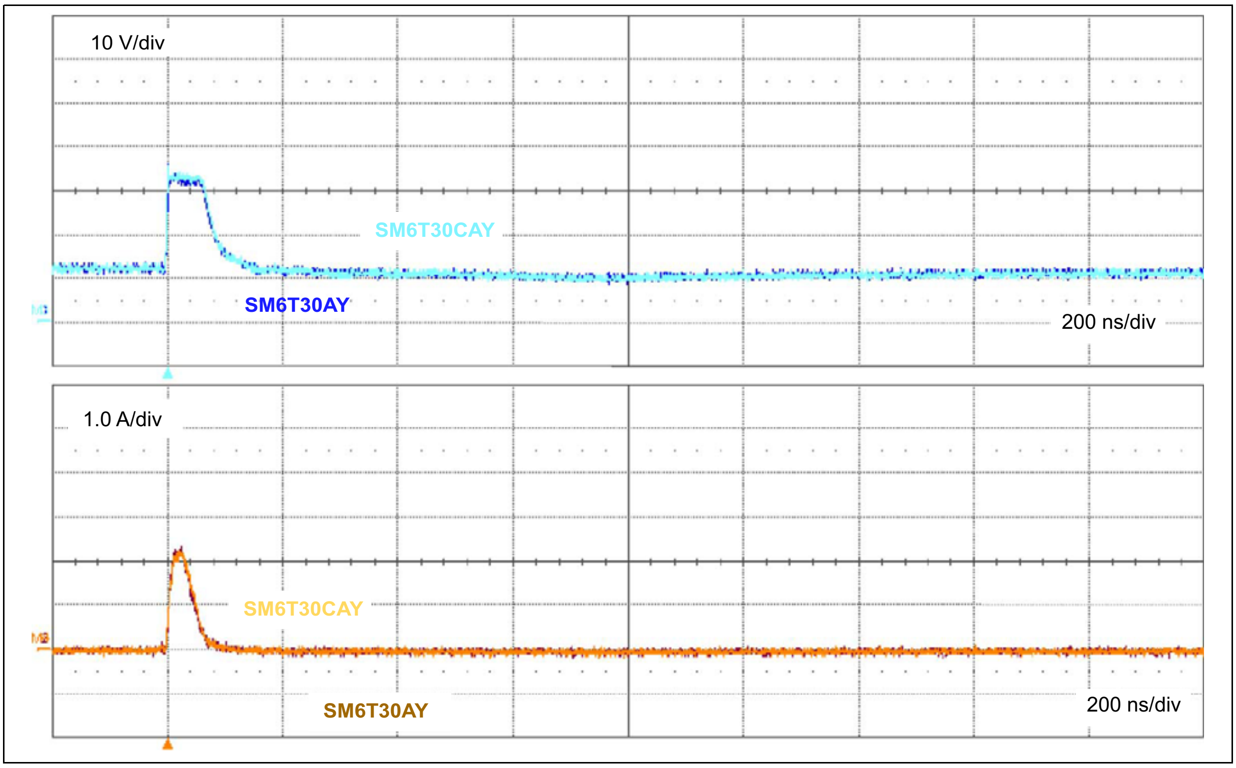


Figure 9. ISO 7637-2 pulse 3b response (V_S = 150 V)



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)

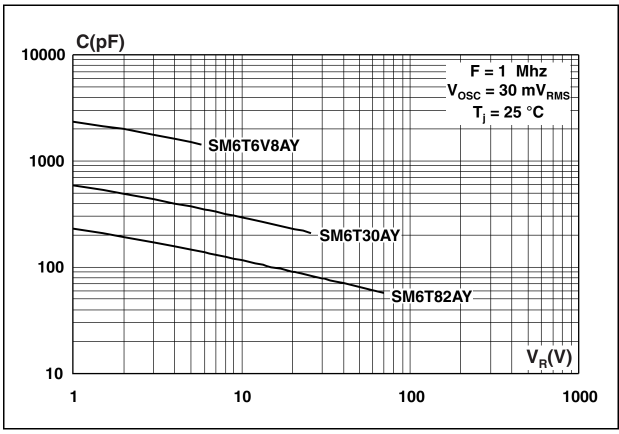


Figure 11. Junction capacitance versus reverse applied voltage for bidirectional types (typical values)

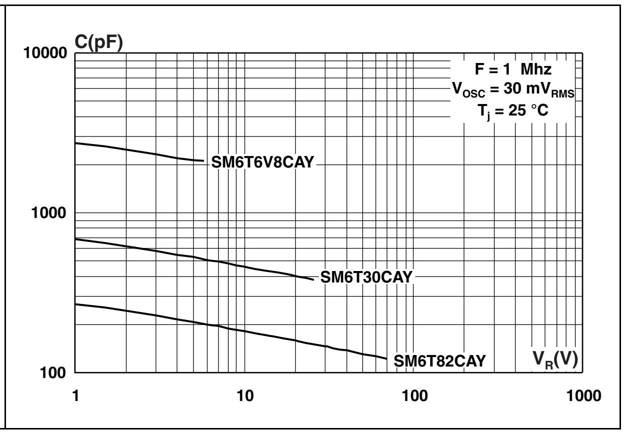


Figure 12. Relative variation of thermal impedance junction to ambient versus pulse duration

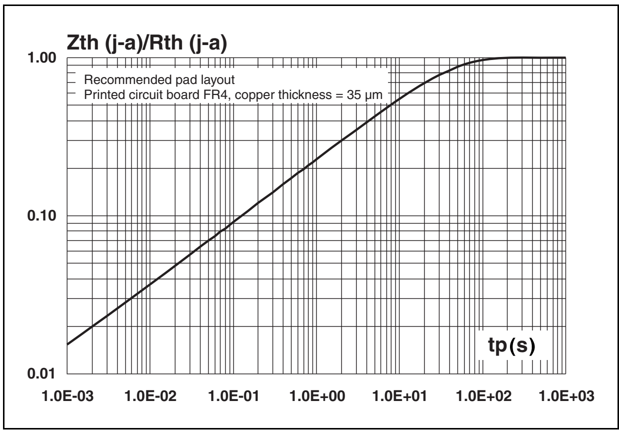


Figure 13. Thermal resistance junction to ambient versus copper surface under each lead

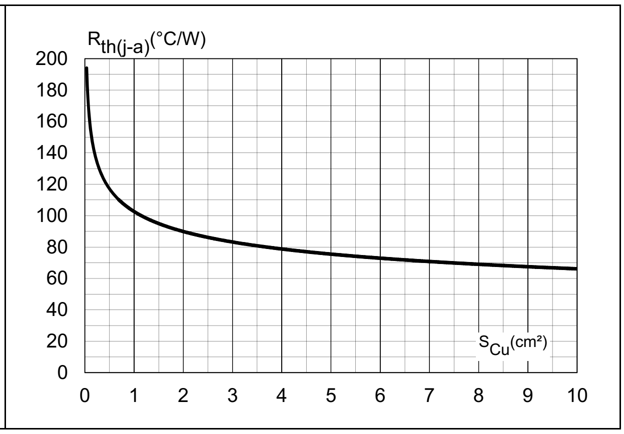


Figure 14. Leakage current versus junction temperature (typical values)

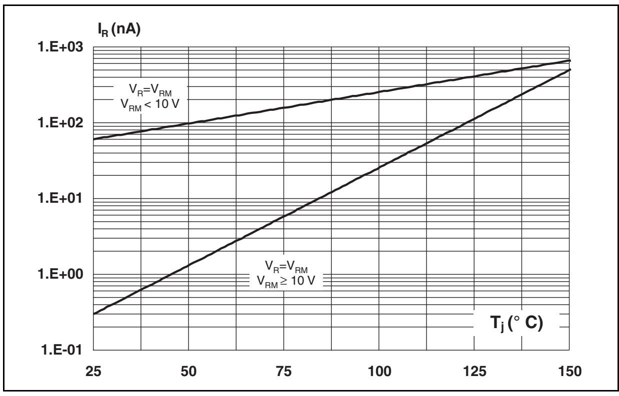
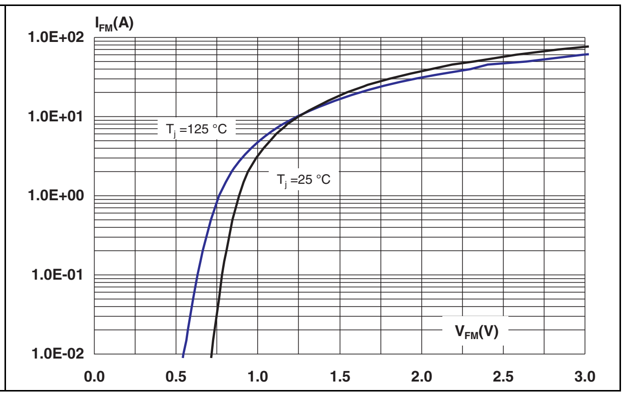


Figure 15. Peak forward voltage drop versus peak forward current (typical values)



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 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
- Epoxy meets UL94, V0
- Lead-free 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.

Figure 16. SMB dimensions (definitions)

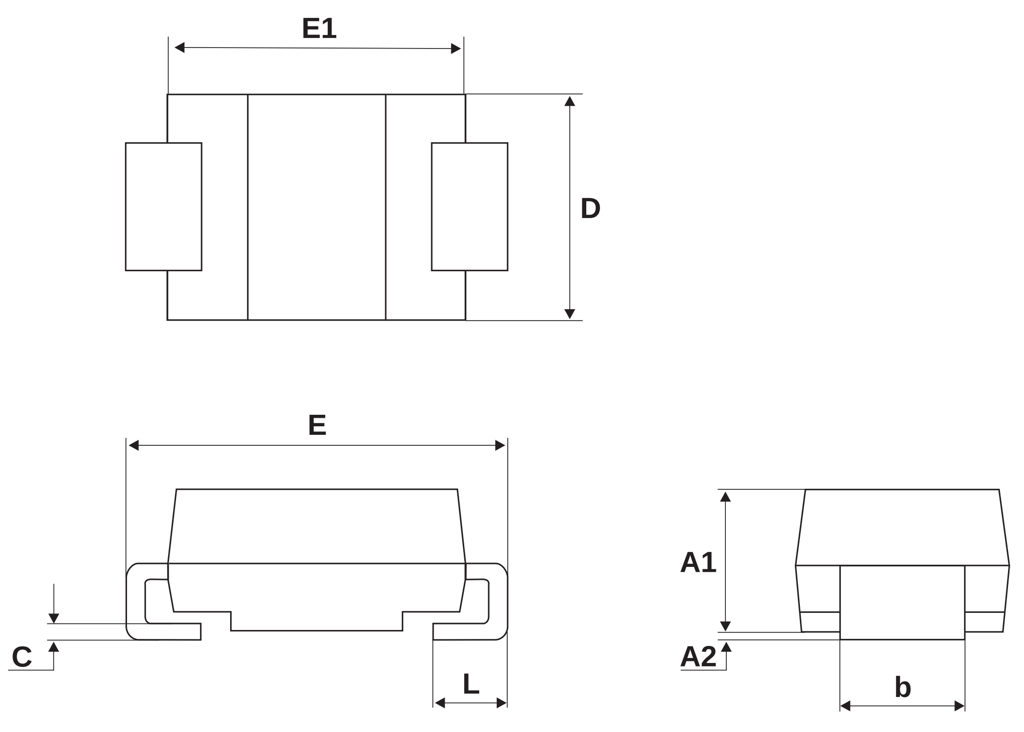


Table 3. SMB dimensions (values)

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A1	1.90	2.45	0.075	0.096
A2	0.05	0.20	0.002	0.008
b	1.95	2.20	0.077	0.087
c	0.15	0.40	0.006	0.016
D	3.30	3.95	0.130	0.156
E	5.10	5.60	0.201	0.220
E1	4.05	4.60	0.159	0.181
L	0.75	1.50	0.030	0.059

Figure 17. SMB footprint dimensions in mm (inches)

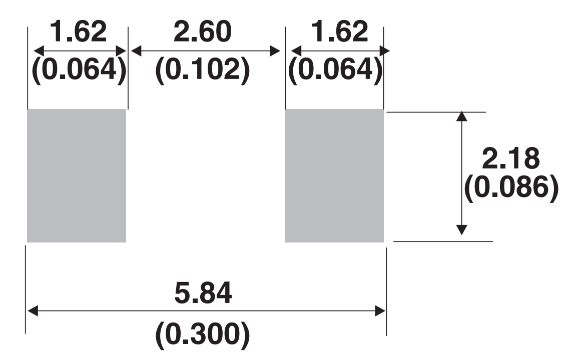
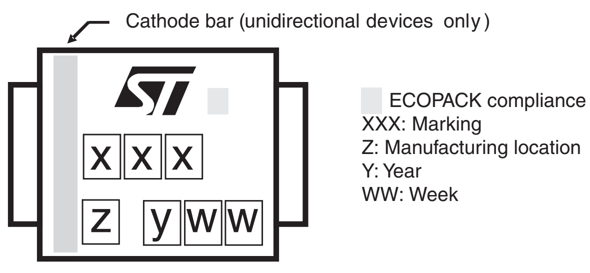


Figure 18. Marking layout[(1)]



1. Marking layout can vary according to assembly location.

Table 4. Marking

Order code	Marking	Order code	Marking
SM6T6V8AY	DEY	SM6T6V8CAY	LEY
SM6T7V5AY	DGY	SM6T7V5CAY	LGY
SM6T10AY	DPY	SM6T10CAY	LPY
SM6T12AY	DTY	SM6T12CAY	LTY
SM6T15AY	DXY	SM6T15CAY	LXY
SM6T16V5AY	DZY	SM6T16V5CAY	LZY
SM6T18AY	EEY	SM6T18CAY	MEY
SM6T22AY	EKY	SM6T22CAY	MKY
SM6T24AY	EMY	SM6T24CAY	MMY
SM6T27AY	EPY	SM6T27CAY	MPY
SM6T30AY	ERY	SM6T30CAY	MRY
SM6T33AY	ETY	SM6T33CAY	MTY
SM6T36AY	EVY	SM6T36CAY	MVY
SM6T39AY	EXY	SM6T39CAY	MXY
SM6T42AY	FBY	SM6T42CAY	NAY
SM6T47AY	FAY	SM6T47CAY	NBY
SM6T56AY	FLY	SM6T56CAY	NLY
SM6T68AY	FQY	SM6T68CAY	NQY
SM6T75AY	FSY	SM6T75CAY	NSY
SM6T82AY	FWY	SM6T82CAY	NWY

4 Ordering information

Figure 19. Ordering information scheme

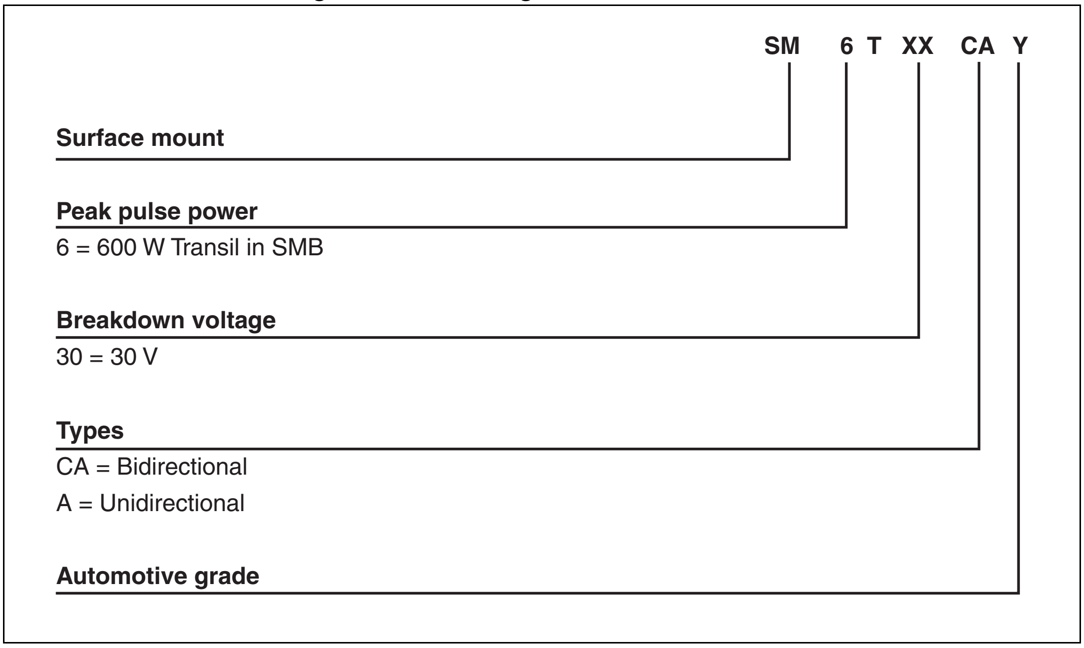


Table 5. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
SM6TxxxAy/CAy(1)	See *Table 4 on page 10*	SMB	0.11 g	2500	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

5 Revision history

Table 6. Document revision history

Date	Revision	Changes
15-Sep-2010	1	Initial release.
18-Oct-2011	2	Deleted old Table 2. Thermal parameter. Updated *Table 2* and added order codes in*Table 4*. Updated *Figure 5*, *Figure 10* and *Figure 11*. Updated *Complies with the following standards on page 1*.
27-Mar-2012	3	Added footnote on page 1.
26-Sep-2014	4	Updated *Table 2* and *Table 4*. Reformatted to current standard.
19-Nov-2014	5	Updated *Figure 7* and *Figure 8*.