SMM4F

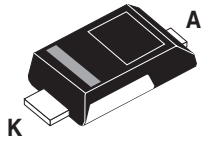
High junction temperature Transil™

Features

- Typical peak pulse power:
  - 400 W (10/1000 µs)
  - 2.4 kW (8/20 µs)
- Stand off voltage range: from 5 V to 33 V
- Unidirectional types
- Low leakage current:
  - 0.2 µA at 25 °C
  - 1 µA at 85 °C
- Operating T_j max: 175 °C
- JEDEC registered package outline
- RoHS package
- Halogen free molding compound

Complies with the following standards

- IEC 61000-4-2 level 4:
  - 15 kV (air discharge)
  - 8 kV (contact discharge)
- MIL STD 883G-Method 3015-7: class3
  - 25 kV (human body model)



STmite flat
(DO222-AA)

Description

The SMM4F Transil series has been designed to protect sensitive equipment against electro-static discharges according to IEC 61000-4-2, MIL STD 883 Method 3015, and electrical over stress such as IEC 61000-4-4 and 5. They are generally for surges below 400 W 10/1000 µs.

This planar technology makes it compatible with high-end equipment and SMPS where low leakage current and high junction temperature are required to provide reliability and stability over time. Their low clamping voltages provide a better safety margin to protect sensitive circuits with extended life time expectancy.

Packaged in STmite flat, this minimizes PCB space consumption (footprint in accordance with IPC 7531 standard).

TM: Transil is a trademark of STMicroelectronics

1 Characteristics

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

Symbol	Parameter		Value	Unit
V_{PP}	Peak pulse voltage (IEC 61000-4-2 contact discharge)		30	kV
P_{PP}	Peak pulse power dissipation (1)	T_j initial = T_{amb}	400	W
P	Power dissipation on infinite heatsink	T_{amb} = 125 °C	2.5	W
I_{FSM}	Non repetitive surge peak forward current for unidirectional types	t_p = 10 ms T_j initial = T_{amb}	30	A
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

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

Table 2. Thermal resistances

Symbol	Parameter	Value	Unit
$R_{th(j-l)}$	Junction to leads	20	°C/W
$R_{th(j-a)}$	Junction to ambient on PCB with recommended pad layout	250	

Table 3. Electrical characteristics - parameter definitions (T_{amb} = 25 °C)

Symbol	Parameter
V_{RM}	Stand-off voltage
V_{BR}	Breakdown voltage
I_R	Breakdown current
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

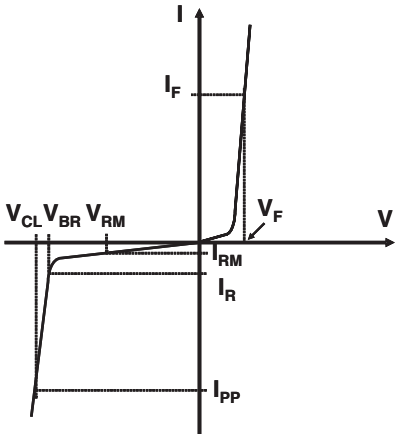


Table 4. Electrical characteristics - parameter values (T_{amb} = 25 °C)

Type	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(3)
	25 °C	85 °C		min	typ	max		max			max			max
	µA		V	V			mA	V	A	Ω	V	A	Ω	10-4/°C
SMM4F5.0A	10	50	5.0	6.46	6.80	7.14	10	9.2	43.5	0.047	13.4	174	0.04	5.7
SMM4F6.0A	10	50	6.0	6.65	7.00	7.35	10	10.3	38.8	0.076	13.7	170	0.04	5.9
SMM4F6.5A	10	50	6.5	7.13	7.50	7.88	10	11.2	37.5	0.093	14.5	160	0.04	6.1
SMM4F8.5A	10	50	8.5	9.5	10.0	10.5	1	14.4	27.7	0.141	19.5	124	0.07	7.3
SMM4F10A	0.2	1	10	11.4	12.0	12.6	1	17.0	23.5	0.187	21.7	106	0.09	7.8
SMM4F12A	0.2	1	12	13.3	14.0	14.7	1	19.9	20.1	0.259	25.3	91	0.12	8.3
SMM4F13A	0.2	1	13	14.3	15.0	15.8	1	21.5	18.6	0.309	27.2	85	0.13	8.4
SMM4F15A	0.2	1	15	17.1	18.0	18.9	1	24.4	16.4	0.335	32.5	71	0.19	8.8
SMM4F18A	0.2	1	18	20.9	22.0	23.1	1	29.2	14.0	0.436	39.3	59	0.27	9.2
SMM4F20A	0.2	1	20	22.8	24.0	25.2	1	32.4	12.0	0.600	42.8	54	0.33	9.4
SMM4F24A	0.2	1	24	26.6	28.01	29.4	1	38.9	9.5	1.00	50	46	0.47	9.6
SMM4F26A	0.2	1	26	28.5	30.0	31.5	1	42.1	9.0	1.18	53.5	43	0.51	9.7
SMM4F28A	0.2	1	28	31.4	33.0	34.7	1	45.4	8.0	1.34	59.0	39	0.62	9.8
SMM4F33A	0.2	1	33	37.1	39.0	41.0	1	53.3	7.0	1.76	69.7	33	0.87	10.0

1. Pulse test: t_p <50ms.
2. To calculate maximum clamping voltage at other surge currents, use the following formula $V_{CLmax} = R_D \times I_{PP} + V_{BRmax}$
3. To calculate V_{BR} versus junction temperature, use the following formula: V_{BR} @ $T_j = V_{BR}$ @ 25 °C x (1 + αT x (T_j - 25))

Figure 1. Definition of I_{PP} pulse

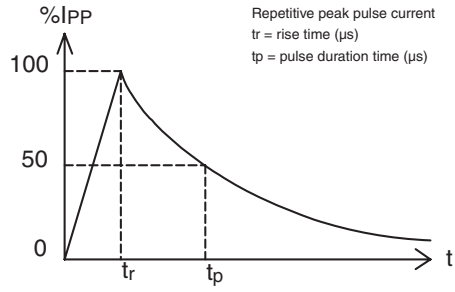


Figure 2. Peak power dissipation versus initial junction temperature

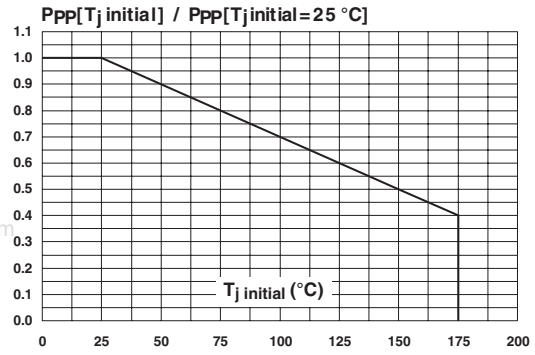


Figure 3. Peak pulse power versus exponential pulse duration (T_j initial = 25 °C)

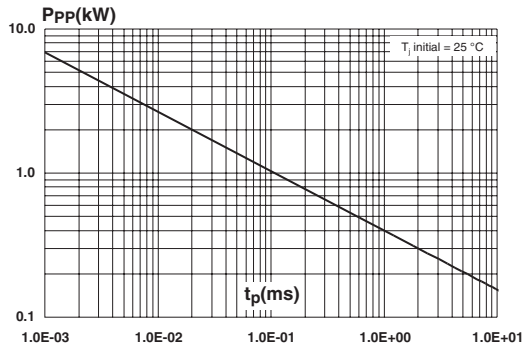


Figure 4. Clamping voltage versus peak pulse current (exponential waveform, maximum values)

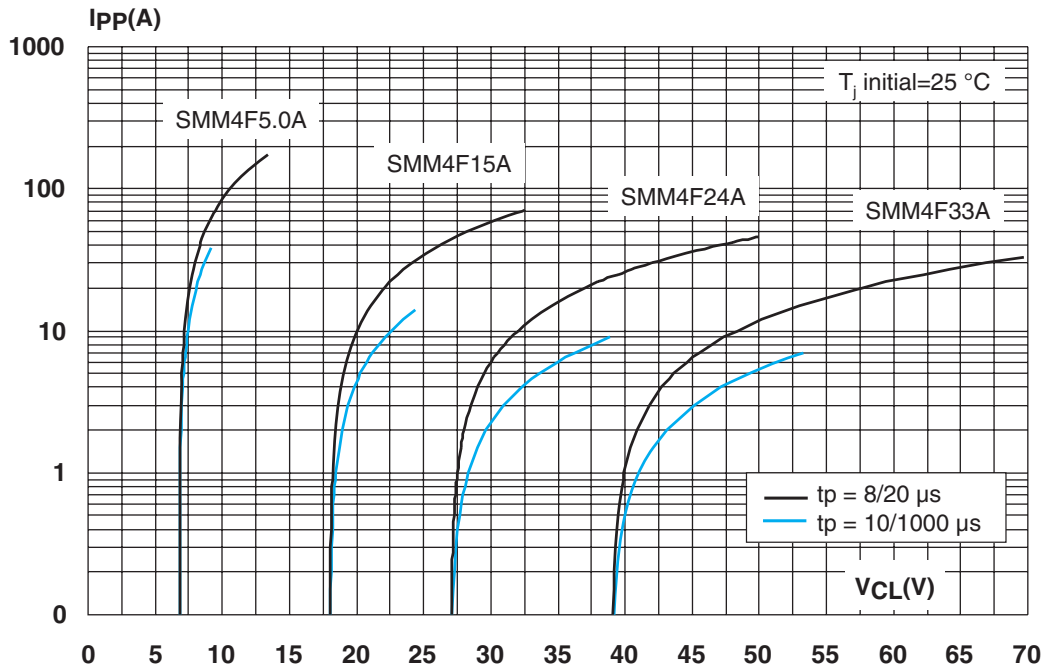


Figure 5. Junction capacitance versus reverse applied voltage (typical values)

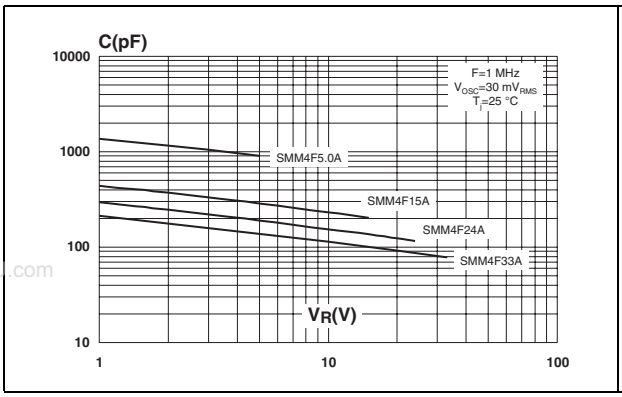


Figure 6. Peak forward voltage drop versus peak forward current (typical values)

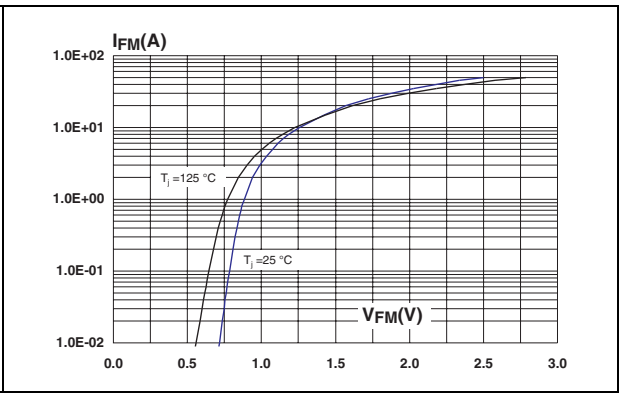


Figure 7. Relative variation of thermal impedance junction to ambient versus pulse duration (printed ciruit board FR4, S_{Cu} = 1 cm^2)

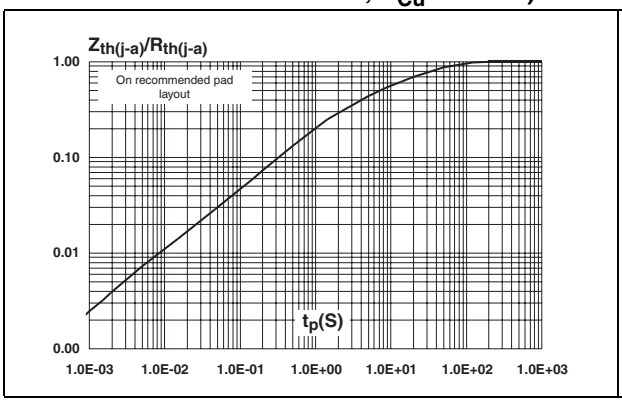


Figure 8. Thermal resistance junction to ambient versus copper surface under each lead (printed circuit board FR4, e_{Cu} = 35 µm)

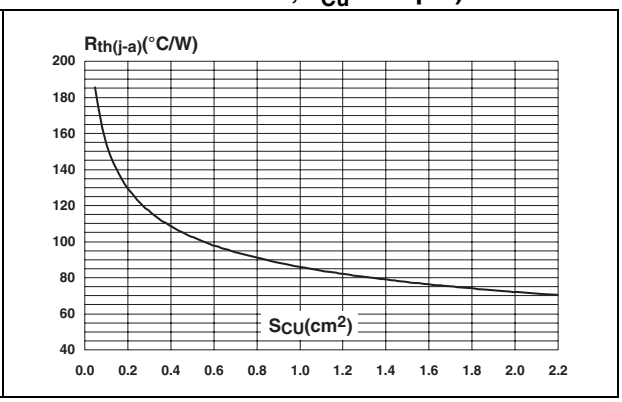
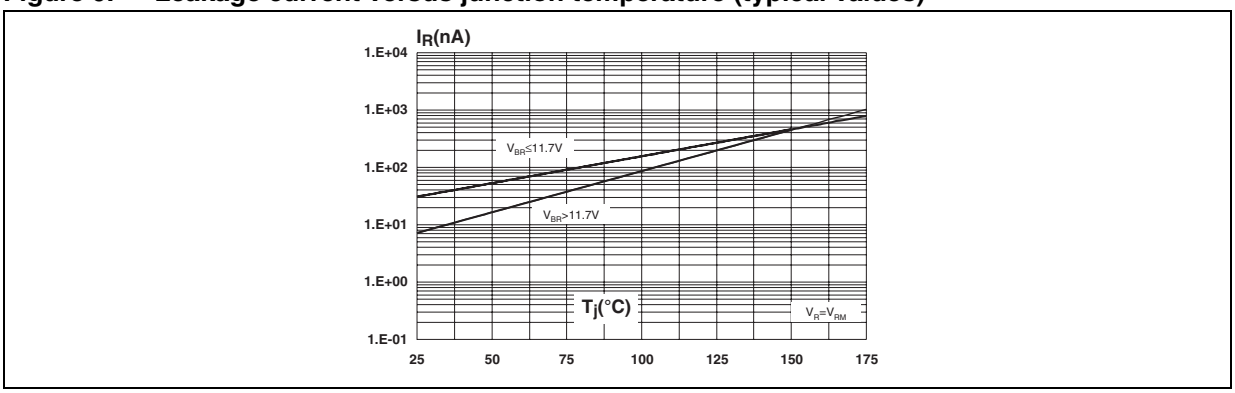
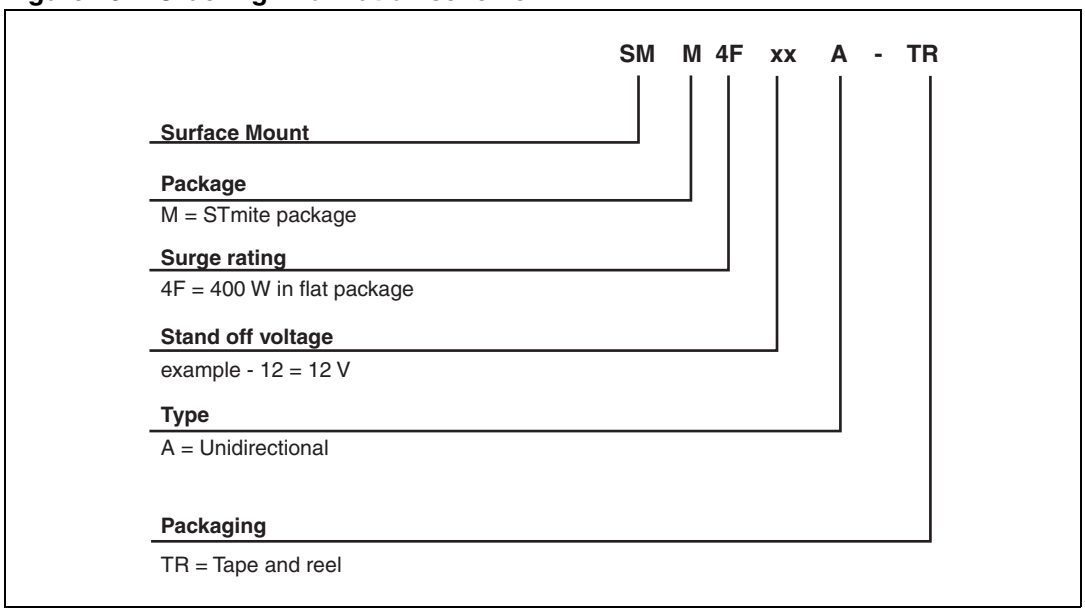


Figure 9. Leakage current versus junction temperature (typical values)



2 Ordering information scheme

Figure 10. Ordering information scheme



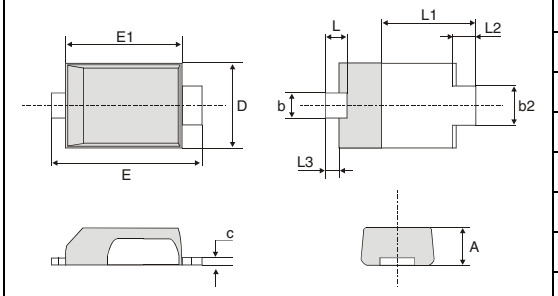
3 Package information

- Case: JEDEC DO-222AA molded plastic over Planar junction
- Terminals: Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity: For unidirectional types the band indicates cathode.
- Flammability: Epoxy is rated UL94V-0
- RoHS package

In order to meet environmental requirements, ST (also) offers these devices in ECOPACK® packages. ECOPACK® packages are Lead-free. The category of second level Interconnect is marked on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label.

ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

Table 5. STmite flat dimensions



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.80	0.85	0.95	0.031	0.033	0.037
b	0.40	0.55	0.65	0.016	0.022	0.026
b2	0.70	0.85	1.00	0.027	0.033	0.039
c	0.10	0.15	0.25	0.004	0.006	0.009
D	1.75	1.90	2.05	0.069	0.075	0.081
E	3.60	3.80	3.90	0.142	0.150	0.154
E1	2.80	2.95	3.10	0.110	0.116	0.122
L	0.50	0.55	0.80	0.020	0.022	0.031
L1	2.10	2.40	2.60	0.083	0.094	0.102
L2	0.45	0.60	0.75	0.018	0.024	0.030
L3	0.20	0.35	0.50	0.008	0.014	0.020

Figure 11. STmite flat footprint dimensions

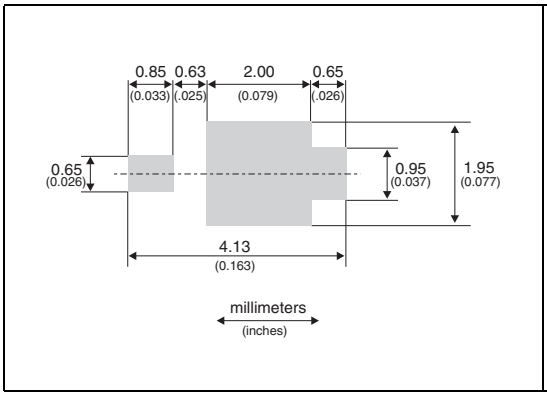


Figure 12. Marking information

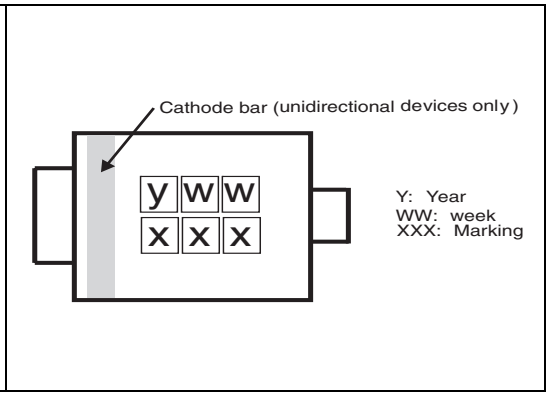


Table 6. Marking

Type	Marking
SMM4F5.0A-TR	4UA
SMM4F6.0A-TR	4UB
SMM4F6.5A-TR	4UC
SMM4F8.5A-TR	4UD
SMM4F10A-TR	4UE
SMM4F12A-TR	4UF
SMM4F13A-TR	4UG
SMM4F15A-TR	4UH
SMM4F18A-TR	4UJ
SMM4F20A-TR	4UK
SMM4F24A-TR	4UM
SMM4F26A-TR	4UN
SMM4F28A-TR	4UO
SMM4F33A-TR	4UQ

4 Ordering information

Table 7. Ordering information

Order code[1]	Marking	Package	Weight	Base qty	Delivery mode
SMM4FxxA-TR	See *Table 6.*	STmite flat	16.7 mg	12000	Tape and reel

1. xx indicates stand-off voltage

5 Revision history

Table 8. Document revision history

Date	Revision	Changes
29-Nov-2007	1	First issue.
19-Dec-2007	2	Updated I_{PP} and R_D parameters in columns 10 and 11 of *Table 4*.

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