

## Surface Mount TRANSZORB® Transient Voltage Suppressors



DO-215AA (SMBG)

PRIMARY CHARACTERISTICS	
$V_{WM}$	5.0 V to 188 V
$P_{PPM}$	600 W
$I_{FSM}$ (uni-directional only)	100 A
$T_J$ max.	150 °C

### DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-directional devices use C or CA suffix (e.g. SMBG10CA).

Electrical characteristics apply in both directions.

### FEATURES

- Low profile package
- Ideal for automated placement
- Glass passivated chip junction
- Available in uni-directional and bi-directional
- 600 W peak pulse power capability with a 10/1000  $\mu$ s waveform, repetitive rate (duty cycle): 0.01 %
- Excellent clamping capability
- Very fast response time
- Low incremental surge resistance
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Solder dip 260 °C, 40 s
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



### TYPICAL APPLICATIONS

Use in sensitive electronics protection against voltage transients induced by inductive load switching and lighting on ICs, MOSFET, signal lines of sensor units for consumer, computer, industrial, automotive and telecommunication.

### MECHANICAL DATA

**Case:** DO-215AA (SMBG)

Molding compound meets UL 94 V-0 flammability rating

Base P/N-E3 - RoHS compliant, commercial grade

Base P/NHE3 - RoHS compliant, high reliability/automotive grade (AEC Q101 qualified)

**Terminals:** Matte tin plated leads, solderable per J-STD-002 and JESD22-B102

E3 suffix meets JESD 201 class 1A whisker test, HE3 suffix meets JESD 201 class 2 whisker test

**Polarity:** For uni-directional types the band denotes cathode end, no marking on bi-directional types

MAXIMUM RATINGS ( $T_A = 25$ °C unless otherwise noted)			
PARAMETER	SYMBOL	VALUE	UNIT
Peak pulse power dissipation with a 10/1000 $\mu$ s waveform <sup>(1)(2)</sup> (Fig. 1)	$P_{PPM}$	600	W
Peak pulse current with a 10/1000 $\mu$ s waveform <sup>(1)</sup>	$I_{PPM}$	See next table	A
Peak forward surge current 8.3 ms single half sine-wave uni-directional only <sup>(2)</sup>	$I_{FSM}$	100	A
Operating junction and storage temperature range	$T_J, T_{STG}$	- 55 to + 150	°C

#### Notes:

(1) Non-repetitive current pulse, per Fig. 3 and derated above  $T_A = 25$  °C per Fig. 2

(2) Mounted on 0.2 x 0.2" (5.0 x 5.0 mm) copper pads to each terminal

ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25 °C unless otherwise noted)									
DEVICE TYPE MODIFIED GULL WING	DEVICE MARKING CODE		BREAKDOWN VOLTAGE V <sub>BR</sub> AT I <sub>T</sub> (1) (V)		TEST CURRENT I <sub>T</sub> (mA)	STAND-OFF VOLTAGE V <sub>WM</sub> (V)	MAXIMUM REVERSE LEAKAGE AT V <sub>WM</sub> I <sub>D</sub> (μA) (3)	MAXIMUM PEAK PULSE SURGE CURRENT I <sub>PPM</sub> (A) (2)	MAXIMUM CLAMPING VOLTAGE AT I <sub>PPM</sub> V <sub>C</sub> (V)
	UNI	BI	MIN.	MAX.					
(+)SMBG5.0	KD	KD	6.40	7.82	10	5.0	800	62.5	9.6
(+)SMBG5.0A(5)	KE	KE	6.40	7.07	10	5.0	800	65.2	9.2
(+)SMBG6.0	KF	KF	6.67	8.15	10	6.0	800	52.6	11.4
(+)SMBG6.0A	KG	KG	6.67	7.37	10	6.0	800	58.3	10.3
(+)SMBG6.5	KH	AH	7.22	8.82	10	6.5	500	48.8	12.3
(+)SMBG6.5A	KK	AK	7.22	7.98	10	6.5	500	53.6	11.2
(+)SMBG7.0	KL	KL	7.78	9.51	10	7.0	200	45.1	13.3
(+)SMBG7.0A	KM	KM	7.78	8.60	10	7.0	200	50.0	12.0
(+)SMBG7.5	KN	AN	8.33	10.2	1.0	7.5	100	42.0	14.3
(+)SMBG7.5A	KP	AP	8.33	9.21	1.0	7.5	100	46.5	12.9
(+)SMBG8.0	KQ	AQ	8.89	10.9	1.0	8.0	50	40.0	15.0
(+)SMBG8.0A	KR	AR	8.89	9.83	1.0	8.0	50	44.1	13.6
(+)SMBG8.5	KS	AS	9.44	11.5	1.0	8.5	20	37.7	15.9
(+)SMBG8.5A	KT	AT	9.44	10.4	1.0	8.5	20	41.7	14.4
(+)SMBG9.0	KU	AU	10.0	12.2	1.0	9.0	10	35.5	16.9
(+)SMBG9.0A	KV	AV	10.0	11.1	1.0	9.0	10	39.0	15.4
(+)SMBG10	KW	AW	11.1	13.6	1.0	10	5.0	31.9	18.8
(+)SMBG10A	KX	AX	11.1	12.3	1.0	10	5.0	35.3	17.0
(+)SMBG11	KY	KY	12.2	14.9	1.0	11	5.0	29.9	20.1
(+)SMBG11A	KZ	KZ	12.2	13.5	1.0	11	5.0	33.0	18.2
(+)SMBG12	LD	BD	13.3	16.3	1.0	12	5.0	27.3	22.0
(+)SMBG12A	LE	BE	13.3	14.7	1.0	12	5.0	30.2	19.9
(+)SMBG13	LF	LF	14.4	17.6	1.0	13	1.0	25.2	23.8
(+)SMBG13A	LG	LG	14.4	15.9	1.0	13	1.0	27.9	21.5
(+)SMBG14	LH	BH	15.6	19.1	1.0	14	1.0	23.3	25.8
(+)SMBG14A	LK	BK	15.6	17.2	1.0	14	1.0	25.9	23.2
(+)SMBG15	LL	BL	16.7	20.4	1.0	15	1.0	22.3	26.9
(+)SMBG15A	LM	BM	16.7	18.5	1.0	15	1.0	24.6	24.4
(+)SMBG16	LN	LN	17.8	21.8	1.0	16	1.0	20.8	28.8
(+)SMBG16A	LP	LM	17.8	19.7	1.0	16	1.0	23.1	26.0
(+)SMBG17	LQ	LQ	18.9	23.1	1.0	17	1.0	19.7	30.5
(+)SMBG17A	LR	LR	18.9	20.9	1.0	17	1.0	21.7	27.6
(+)SMBG18	LS	BS	20.0	24.4	1.0	18	1.0	18.6	32.2
(+)SMBG18A	LT	BT	20.0	22.1	1.0	18	1.0	20.5	29.2
(+)SMBG20	LU	LU	22.2	27.1	1.0	20	1.0	16.8	35.8
(+)SMBG20A	LV	LV	22.2	24.5	1.0	20	1.0	18.5	32.4
(+)SMBG22	LW	BW	24.4	29.8	1.0	22	1.0	15.2	39.4
(+)SMBG22A	LX	BX	24.4	26.9	1.0	22	1.0	16.9	35.5
(+)SMBG24	LY	BY	26.7	32.6	1.0	24	1.0	14.0	43.0
(+)SMBG24A	LZ	BZ	26.7	29.5	1.0	24	1.0	15.4	38.9
(+)SMBG26	MD	CD	28.9	35.3	1.0	26	1.0	12.9	46.6
(+)SMBG26A	ME	CE	28.9	31.9	1.0	26	1.0	14.3	42.1
(+)SMBG28	MF	MF	31.1	38.0	1.0	28	1.0	12.0	50.0
(+)SMBG28A	MG	MG	31.1	34.4	1.0	28	1.0	13.2	45.4
(+)SMBG30	MH	CH	33.3	40.7	1.0	30	1.0	11.2	53.5
(+)SMBG30A	MK	CK	33.3	36.8	1.0	30	1.0	12.4	48.4
(+)SMBG33	ML	CL	36.7	44.9	1.0	33	1.0	10.2	59.0
(+)SMBG33A	MM	CM	36.7	40.6	1.0	33	1.0	11.3	53.3
(+)SMBG36	MN	CN	40.0	48.9	1.0	36	1.0	9.3	64.3
(+)SMBG36A	MP	CP	40.0	44.2	1.0	36	1.0	10.3	58.1
(+)SMBG40	MQ	CQ	44.4	54.3	1.0	40	1.0	8.4	71.4
(+)SMBG40A	MR	CR	44.4	49.1	1.0	40	1.0	9.3	64.5



<b>ELECTRICAL CHARACTERISTICS</b> ( $T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted)									
DEVICE TYPE MODIFIED GULL WING	DEVICE MARKING CODE		BREAKDOWN VOLTAGE $V_{BR}$ AT $I_T$ <sup>(1)</sup> (V)		TEST CURRENT $I_T$ (mA)	STAND-OFF VOLTAGE $V_{WM}$ (V)	MAXIMUM REVERSE LEAKAGE AT $V_{WM}$ $I_D$ ( $\mu\text{A}$ ) <sup>(3)</sup>	MAXIMUM PEAK PULSE SURGE CURRENT $I_{PPM}$ (A) <sup>(2)</sup>	MAXIMUM CLAMPING VOLTAGE AT $I_{PPM}$ $V_C$ (V)
	UNI	BI	MIN.	MAX.					
(+)SMBG43	MS	CS	47.8	58.4	1.0	43	1.0	7.8	76.7
(+)SMBG43A	MT	CT	47.8	52.8	1.0	43	1.0	8.6	69.4
(+)SMBG45	MU	MU	50.0	61.1	1.0	45	1.0	7.5	80.3
(+)SMBG45A	MV	MV	50.0	55.3	1.0	45	1.0	8.3	72.7
(+)SMBG48	MW	MW	53.3	65.1	1.0	48	1.0	7.0	85.5
(+)SMBG48A	MX	MX	53.3	58.9	1.0	48	1.0	7.8	77.4
(+)SMBG51	MY	MY	56.7	69.3	1.0	51	1.0	6.6	91.1
(+)SMBG51A	MZ	MZ	56.7	62.7	1.0	51	1.0	7.3	82.4
(+)SMBG54	ND	ND	60.0	73.3	1.0	54	1.0	6.2	96.3
(+)SMBG54A	NE	NE	60.0	66.3	1.0	54	1.0	6.9	87.1
(+)SMBG58	NF	NF	64.4	78.7	1.0	58	1.0	5.8	103
(+)SMBG58A	NG	NG	64.4	71.2	1.0	58	1.0	6.4	93.6
(+)SMBG60	NH	NH	66.7	81.5	1.0	60	1.0	5.6	107
(+)SMBG60A	NK	NK	66.7	73.7	1.0	60	1.0	6.2	96.8
(+)SMBG64	NL	NL	71.1	86.9	1.0	64	1.0	5.3	114
(+)SMBG64A	NM	NM	71.1	78.6	1.0	64	1.0	5.8	103
(+)SMBG70	NN	NN	77.8	95.1	1.0	70	1.0	4.8	125
(+)SMBG70A	NP	NP	77.8	86.0	1.0	70	1.0	5.3	113
(+)SMBG75	NQ	NQ	83.3	102	1.0	75	1.0	4.5	134
(+)SMBG75A	NR	NR	83.3	92.1	1.0	75	1.0	5.0	121
(+)SMBG78	NS	NS	86.7	106	1.0	78	1.0	4.3	139
(+)SMBG78A	NT	NT	86.7	95.8	1.0	78	1.0	4.8	126
(+)SMBG85	NU	NU	94.4	115	1.0	85	1.0	4.0	151
(+)SMBG85A	NV	NV	94.4	104	1.0	85	1.0	4.4	137
(+)SMBG90	NW	NW	100	122	1.0	90	1.0	3.8	160
(+)SMBG90A	NX	NX	100	111	1.0	90	1.0	4.1	146
(+)SMBG100	NY	NY	111	136	1.0	100	1.0	3.4	179
(+)SMBG100A	NZ	NZ	111	123	1.0	100	1.0	3.7	162
(+)SMBG110	PD	PD	122	149	1.0	110	1.0	3.1	196
(+)SMBG110A	PE	PE	122	135	1.0	110	1.0	3.4	177
(+)SMBG120	PF	PF	133	163	1.0	120	1.0	2.8	214
(+)SMBG120A	PG	PG	133	147	1.0	120	1.0	3.1	193
(+)SMBG130	PH	PH	144	176	1.0	130	1.0	2.6	231
(+)SMBG130A	PK	PK	144	159	1.0	130	1.0	2.9	209
(+)SMBG150	PL	PL	167	204	1.0	150	1.0	2.2	268
(+)SMBG150A	PM	PM	167	185	1.0	150	1.0	2.5	243
(+)SMBG160	PN	PN	178	218	1.0	160	1.0	2.1	287
(+)SMBG160A	PP	PP	178	197	1.0	160	1.0	2.3	259
(+)SMBG170	PQ	PQ	189	231	1.0	170	1.0	2.0	304
(+)SMBG170A	PR	PR	189	209	1.0	170	1.0	2.2	275
SMBG188	PT	PT	209	255	1.0	188	1.0	1.7	344
SMBG188A	PS	PS	209	231	1.0	188	1.0	2.0	328

**Notes:**

- (1) Pulse test:  $t_p \leq 50\text{ ms}$
- (2) Surge current waveform per Fig. 3 and derate per Fig. 2
- (3) For bi-directional types having  $V_{WM}$  of 10 V and less, the  $I_D$  limit is doubled
- (4) All terms and symbols are consistent with ANSI/IEEE C62.35
- (5) For the bi-directional SMBG/SMBJ5.0CA, the maximum  $V_{BR}$  is 7.25 V
- (6)  $V_F = 3.5\text{ V}$  at  $I_F = 50\text{ A}$  (uni-directional only)
- (+) Underwriters laboratory recognition for the classification of protectors (QVGQ2) under the UL standard for safety 497B and file number E136766 for both uni-directional and bi-directional devices

THERMAL CHARACTERISTICS ( $T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted)			
PARAMETER	SYMBOL	VALUE	UNIT
Typical thermal resistance, junction to ambient <sup>(1)</sup>	$R_{\theta JA}$	100	$^\circ\text{C/W}$
Typical thermal resistance, junction to lead	$R_{\theta JL}$	20	$^\circ\text{C/W}$

**Note:**

(1) Mounted on minimum recommended pad layout

ORDERING INFORMATION (Example)				
PREFERRED P/N	UNIT WEIGHT (g)	PREFERRED PACKAGE CODE	BASE QUANTITY	DELIVERY MODE
SMBG5.0A-E3/52	0.096	52	750	7" diameter plastic tape and reel
SMBG5.0A-E3/5B	0.096	5B	3200	13" diameter plastic tape and reel
SMBG5.0AHE3/52 <sup>(1)</sup>	0.096	52	750	7" diameter plastic tape and reel
SMBG5.0AHE3/5B <sup>(1)</sup>	0.096	5B	3200	13" diameter plastic tape and reel

**Note:**

(1) Automotive grade AEC Q101 qualified

## RATINGS AND CHARACTERISTICS CURVES

( $T_A = 25\text{ }^\circ\text{C}$  unless otherwise noted)

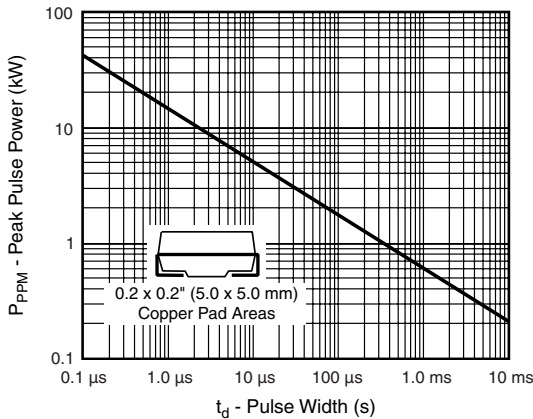


Figure 1. Peak Pulse Power Rating Curve

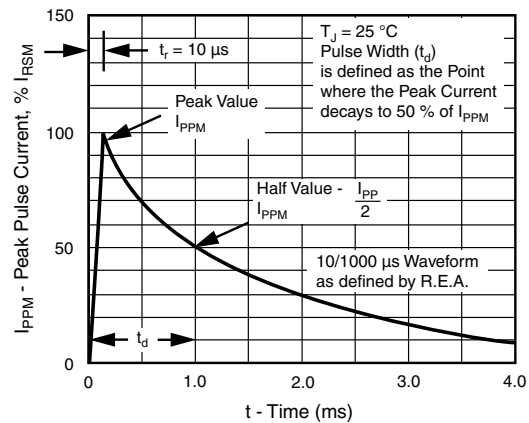


Figure 3. Pulse Waveform

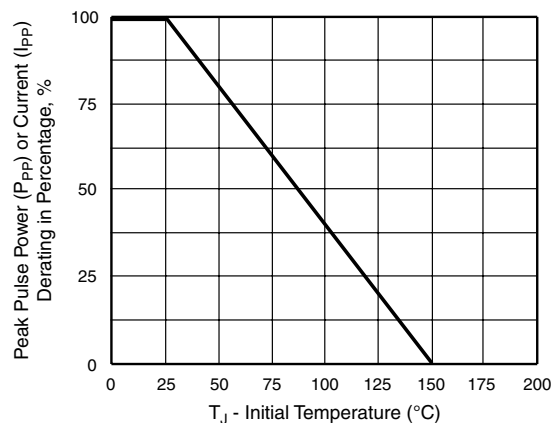


Figure 2. Pulse Power or Current vs. Initial Junction Temperature

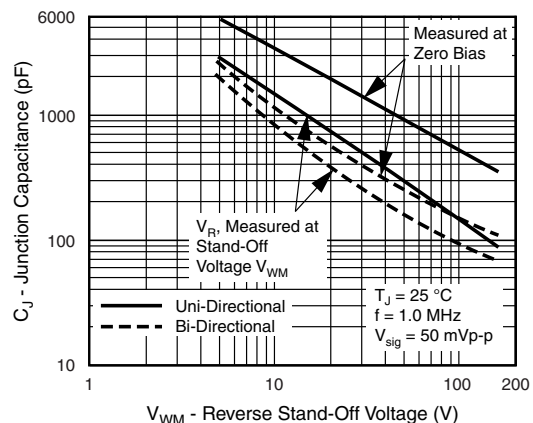


Figure 4. Typical Junction Capacitance

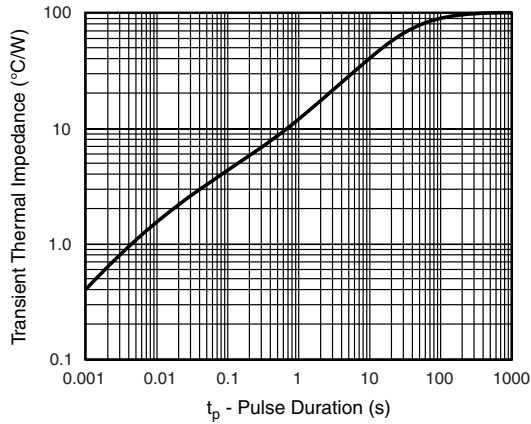


Figure 5. Typical Transient Thermal Impedance

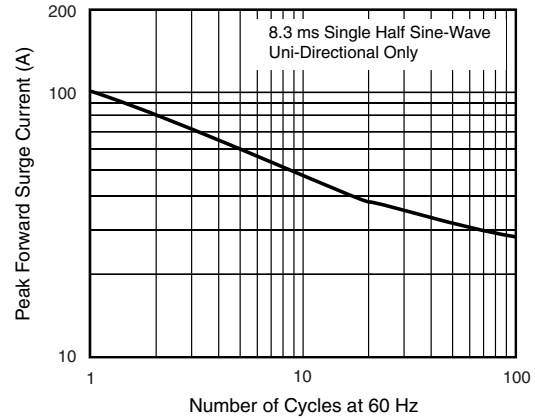
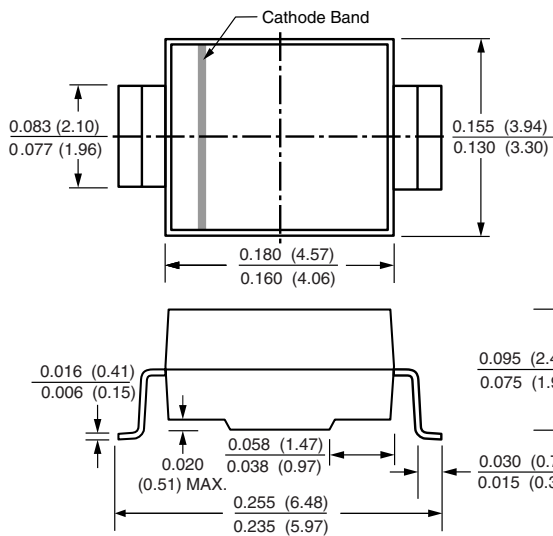


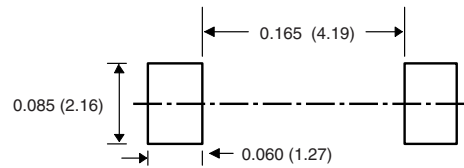
Figure 6. Maximum Non-Repetitive Peak Forward Surge Current

## PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

### DO-215AA (SMBG)



### Mounting Pad Layout





## Disclaimer

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