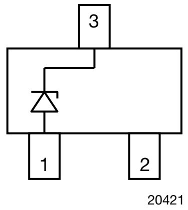
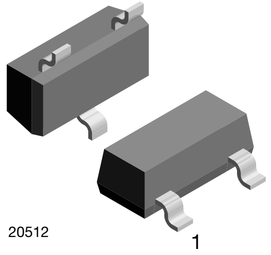
Single-Line ESD Protection in SOT-23





FEATURES

- Single-line ESD protection device
- ESD immunity acc. IEC 61000-4-2
  ± 30 kV contact discharge
  ± 30 kV air discharge
- ESD capability according to AEC-Q101: human body model: class H3B: > 8 kV
- Space saving SOT-23 package
- e3 - Sn
- AEC-Q101 qualified available
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

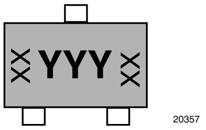
e3

RoHS
COMPLIANT

HALOGEN
FREE

GREEN
(5-2008)

MARKING (example only)



YYY = type code (see table below)
XX = date code

LINKS TO ADDITIONAL RESOURCES

3D Models

SPICE Models

ORDERING INFORMATION

PART NUMBER (EXAMPLE)	ENVIRONMENTAL AND QUALITY CODE				PACKAGING CODE		ORDERING CODE (EXAMPLE)
	AEC-Q101 QUALIFIED	RoHS-COMPLIANT + LEAD (Pb)-FREE		TIN PLATED	3K PER 7" REEL (8 mm TAPE), 15K/BOX = MOQ	10K PER 13" REEL (8 mm TAPE), 10K/BOX = MOQ	
		STANDARD	GREEN				
GSOT05-		E		3	-08		GSOT05-E3-08
GSOT05-			G	3	-08		GSOT05-G3-08
GSOT05-	H	E		3	-08		GSOT05-HE3-08
GSOT05-	H		G	3	-08		GSOT05-HG3-08
GSOT05-		E		3		-18	GSOT05-E3-18
GSOT05-			G	3		-18	GSOT05-G3-18
GSOT05-	H	E		3		-18	GSOT05-HE3-18
GSOT05-	H		G	3		-18	GSOT05-HG3-18

PACKAGE DATA

DEVICE NAME	PACKAGE NAME	TYPE CODE	ENVIRONMENTAL STATUS	WEIGHT	MOLDING COMPOUND FLAMMABILITY RATING	MOISTURE SENSITIVITY LEVEL	SOLDERING CONDITIONS
GSOT03	SOT-23	03	Standard	8.8 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	Peak temperature max. 260 °C
		03G	Green	8.1 mg			
GSOT04	SOT-23	04	Standard	8.8 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	Peak temperature max. 260 °C
		04G	Green	8.1 mg			
GSOT05	SOT-23	05	Standard	8.8 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	Peak temperature max. 260 °C
		05G	Green	8.1 mg			
GSOT08	SOT-23	08	Standard	8.8 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	Peak temperature max. 260 °C
		08G	Green	8.1 mg			
GSOT12	SOT-23	12	Standard	8.8 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	Peak temperature max. 260 °C
		12G	Green	8.1 mg			
GSOT15	SOT-23	15	Standard	8.8 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	Peak temperature max. 260 °C
		15G	Green	8.1 mg			
GSOT24	SOT-23	24	Standard	8.8 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	Peak temperature max. 260 °C
		24G	Green	8.1 mg			
GSOT36	SOT-23	36	Standard	8.8 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	Peak temperature max. 260 °C
		36G	Green	8.1 mg			

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ABSOLUTE MAXIMUM RATINGS GSOT03

PARAMETER	TEST CONDITIONS	SYMBOL	VALUE	UNIT
Peak pulse current	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	I_{PPM}	30	A
Peak pulse power	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	P_{PP}	369	W
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses	V_{ESD}	± 30	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses		± 30	kV
Operating temperature	Junction temperature	T_J	-40 to +125	°C
Storage temperature		T_{STG}	-55 to +150	°C

ABSOLUTE MAXIMUM RATINGS GSOT04

PARAMETER	TEST CONDITIONS	SYMBOL	VALUE	UNIT
Peak pulse current	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	I_{PPM}	30	A
Peak pulse power	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	P_{PP}	429	W
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses	V_{ESD}	± 30	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses		± 30	kV
Operating temperature	Junction temperature	T_J	-40 to +125	°C
Storage temperature		T_{STG}	-55 to +150	°C

ABSOLUTE MAXIMUM RATINGS GSOT05

PARAMETER	TEST CONDITIONS	SYMBOL	VALUE	UNIT
Peak pulse current	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	I_{PPM}	30	A
Peak pulse power	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	P_{PP}	480	W
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses	V_{ESD}	± 30	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses		± 30	kV
Operating temperature	Junction temperature	T_J	-40 to +125	°C
Storage temperature		T_{STG}	-55 to +150	°C

ABSOLUTE MAXIMUM RATINGS GSOT08

PARAMETER	TEST CONDITIONS	SYMBOL	VALUE	UNIT
Peak pulse current	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	I_{PPM}	18	A
Peak pulse power	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	P_{PP}	345	W
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses	V_{ESD}	± 30	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses		± 30	kV
Operating temperature	Junction temperature	T_J	-40 to +125	°C
Storage temperature		T_{STG}	-55 to +150	°C

For technical questions, contact: ESDprotection@vishay.com
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ABSOLUTE MAXIMUM RATINGS GSOT12				
PARAMETER	**TEST CONDITIONS**	**SYMBOL**	**VALUE**	**UNIT**
Peak pulse current	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	I_{PPM}	12	A
Peak pulse power	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	P_{PP}	312	W
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses	V_{ESD}	± 30	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses		± 30	kV
Operating temperature	Junction temperature	T_J	-40 to +125	°C
Storage temperature		T_{STG}	-55 to +150	°C

ABSOLUTE MAXIMUM RATINGS GSOT15				
PARAMETER	**TEST CONDITIONS**	**SYMBOL**	**VALUE**	**UNIT**
Peak pulse current	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	I_{PPM}	8	A
Peak pulse power	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	P_{PP}	230	W
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses	V_{ESD}	± 30	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses		± 30	kV
Operating temperature	Junction temperature	T_J	-40 to +125	°C
Storage temperature		T_{STG}	-55 to +150	°C

ABSOLUTE MAXIMUM RATINGS GSOT24				
PARAMETER	**TEST CONDITIONS**	**SYMBOL**	**VALUE**	**UNIT**
Peak pulse current	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	I_{PPM}	5	A
Peak pulse power	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	P_{PP}	235	W
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses	V_{ESD}	± 30	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses		± 30	kV
Operating temperature	Junction temperature	T_J	-40 to +125	°C
Storage temperature		T_{STG}	-55 to +150	°C

ABSOLUTE MAXIMUM RATINGS GSOT36				
PARAMETER	**TEST CONDITIONS**	**SYMBOL**	**VALUE**	**UNIT**
Peak pulse current	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	I_{PPM}	3.5	A
Peak pulse power	Pin 3 to 1 acc. IEC 61000-4-5, t_p = 8/20 µs; single shot	P_{PP}	248	W
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses	V_{ESD}	± 30	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses		± 30	kV
Operating temperature	Junction temperature	T_J	-40 to +125	°C
Storage temperature		T_{STG}	-55 to +150	°C

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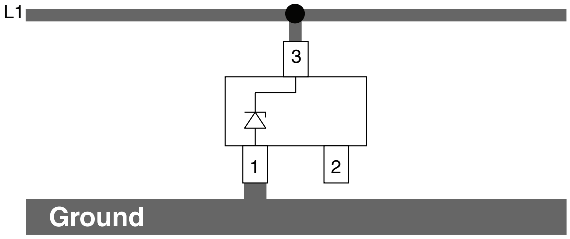
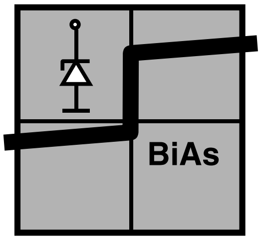
BiAs-MODE (1-line Bidirectional Asymmetrical protection mode)

With the GSOTxx one signal- or data-lines (L1) can be protected against voltage transients. With pin 1 connected to ground and pin 3 connected to a signal- or data-line which has to be protected. As long as the voltage level on the data- or signal-line is between 0 V (ground level) and the specified maximum reverse working voltage (V_{RWM}) the protection diode between pin 1 and pin 3 offers a high isolation to the ground line. The protection device behaves like an open switch.
As soon as any positive transient voltage signal exceeds the breakdown voltage level of the protection diode, the diode becomes conductive and shorts the transient current to ground. Now the protection device behaves like a closed switch. The clamping voltage (V_C) is defined by the breakdown voltage (V_{BR}) level plus the voltage drop at the series impedance (resistance and inductance) of the protection diode.
Any negative transient signal will be clamped accordingly. The negative transient current is flowing in the forward direction through the protection diode. The low forward voltage (V_F) clamps the negative transient close to the ground level.
Due to the different clamping levels in forward and reverse direction the GSOTxx clamping behavior is Bidirectional and Asymmetrical (BiAs).





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ELECTRICAL CHARACTERISTICS GSOT03 (T_{amb} = 25 °C unless otherwise specified) between pin 3 and pin 1						
PARAMETER	**TEST CONDITIONS/REMARKS**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	1	lines
Reverse stand-off voltage	Max. reverse working voltage	V_{RWM}	-	-	3.3	V
Reverse voltage	at I_R = 100 µA	V_R	3.3	-	-	V
Reverse current	at V_R = 3.3 V	I_R	-	-	100	µA
Reverse breakdown voltage	at I_R = 1 mA	V_{BR}	4	4.6	5.5	V
Reverse clamping voltage	at I_{PP} = 1 A	V_C	-	5.7	7.5	V
	at I_{PP} = I_{PPM} = 30 A		-	10	12.3	V
Forward clamping voltage	at I_{PP} = 1 A	V_F	-	1	1.2	V
	at I_{PP} = I_{PPM} = 30 A		-	4.5	-	V
Capacitance	at V_R = 0 V; f = 1 MHz	C_D	-	420	600	pF
	at V_R = 1.6 V; f = 1 MHz		-	260	-	pF

ELECTRICAL CHARACTERISTICS GSOT04 (T_{amb} = 25 °C unless otherwise specified) between pin 3 and pin 1						
PARAMETER	**TEST CONDITIONS/REMARKS**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	1	lines
Reverse stand-off voltage	Max. reverse working voltage	V_{RWM}	-	-	4	V
Reverse voltage	at I_R = 20 µA	V_R	4	-	-	V
Reverse current	at V_R = 4 V	I_R	-	-	20	µA
Reverse breakdown voltage	at I_R = 1 mA	V_{BR}	5	6.1	7	V
Reverse clamping voltage	at I_{PP} = 1 A	V_C	-	7.5	9	V
	at I_{PP} = I_{PPM} = 30 A		-	11.2	14.3	V
Forward clamping voltage	at I_{PP} = 1 A	V_F	-	1	1.2	V
	at I_{PP} = I_{PPM} = 30 A		-	4.5	-	V
Capacitance	at V_R = 0 V; f = 1 MHz	C_D	-	310	450	pF
	at V_R = 2 V; f = 1 MHz		-	200	-	pF

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ELECTRICAL CHARACTERISTICS GSOT05 (T_{amb} = 25 °C unless otherwise specified)
between pin 3 and pin 1

PARAMETER	TEST CONDITIONS/REMARKS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	1	lines
Reverse stand-off voltage	Max. reverse working voltage	V_{RWM}	-	-	5	V
Reverse voltage	at I_R = 10 μA	V_R	5	-	-	V
Reverse current	at V_R = 5 V	I_R	-	-	10	μA
Reverse breakdown voltage	at I_R = 1 mA	V_{BR}	6	6.8	8	V
Reverse clamping voltage	at I_{PP} = 1 A	V_C	-	7	8.7	V
	at I_{PP} = I_{PPM} = 30 A		-	12	16	V
Forward clamping voltage	at I_{PP} = 1 A	V_F	-	1	1.2	V
	at I_{PP} = I_{PPM} = 30 A		-	4.5	-	V
Capacitance	at V_R = 0 V; f = 1 MHz	C_D	-	260	350	pF
	at V_R = 2.5 V; f = 1 MHz		-	150	-	pF

ELECTRICAL CHARACTERISTICS GSOT08 (T_{amb} = 25 °C unless otherwise specified)
between pin 3 and pin 1

PARAMETER	TEST CONDITIONS/REMARKS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	1	lines
Reverse stand-off voltage	Max. reverse working voltage	V_{RWM}	-	-	8	V
Reverse voltage	at I_R = 5 μA	V_R	8	-	-	V
Reverse current	at V_R = 8 V	I_R	-	-	5	μA
Reverse breakdown voltage	at I_R = 1 mA	V_{BR}	9	10	11	V
Reverse clamping voltage	at I_{PP} = 1 A	V_C	-	10.7	13	V
	at I_{PP} = I_{PPM} = 18 A		-	15.2	19.2	V
Forward clamping voltage	at I_{PP} = 1 A	V_F	-	1	1.2	V
	at I_{PP} = I_{PPM} = 18 A		-	3	-	V
Capacitance	at V_R = 0 V; f = 1 MHz	C_D	-	160	250	pF
	at V_R = 4 V; f = 1 MHz		-	80	-	pF

ELECTRICAL CHARACTERISTICS GSOT12 (T_{amb} = 25 °C unless otherwise specified)
between pin 3 and pin 1

PARAMETER	TEST CONDITIONS/REMARKS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	1	lines
Reverse stand-off voltage	Max. reverse working voltage	V_{RWM}	-	-	12	V
Reverse voltage	at I_R = 1 μA	V_R	12	-	-	V
Reverse current	at V_R = 12 V	I_R	-	-	1	μA
Reverse breakdown voltage	at I_R = 1 mA	V_{BR}	13.5	15	16.5	V
Reverse clamping voltage	at I_{PP} = 1 A	V_C	-	15.4	18.7	V
	at I_{PP} = I_{PPM} = 12 A		-	21.2	26	V
Forward clamping voltage	at I_{PP} = 1 A	V_F	-	1	1.2	V
	at I_{PP} = I_{PPM} = 12 A		-	2.2	-	V
Capacitance	at V_R = 0 V; f = 1 MHz	C_D	-	115	150	pF
	at V_R = 6 V; f = 1 MHz		-	50	-	pF

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ELECTRICAL CHARACTERISTICS GSOT15 (T_{amb} = 25 °C unless otherwise specified) between pin 3 and pin 1

PARAMETER	TEST CONDITIONS/REMARKS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	1	lines
Reverse stand-off voltage	Max. reverse working voltage	V_{RWM}	-	-	15	V
Reverse voltage	at I_R = 1 µA	V_R	15	-	-	V
Reverse current	at V_R = 15 V	I_R	-	-	1	µA
Reverse breakdown voltage	at I_R = 1 mA	V_{BR}	16.5	18	20	V
Reverse clamping voltage	at I_{PP} = 1 A	V_C	-	19.4	23.5	V
	at $I_{PP} = I_{PPM}$ = 8 A		-	24.8	28.8	V
Forward clamping voltage	at I_{PP} = 1 A	V_F	-	1	1.2	V
	at $I_{PP} = I_{PPM}$ = 8 A		-	1.8	-	V
Capacitance	at V_R = 0 V; f = 1 MHz	C_D	-	90	120	pF
	at V_R = 7.5 V; f = 1 MHz		-	35	-	pF

ELECTRICAL CHARACTERISTICS GSOT24 (T_{amb} = 25 °C unless otherwise specified) between pin 3 and pin 1

PARAMETER	TEST CONDITIONS/REMARKS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	1	lines
Reverse stand-off voltage	Max. reverse working voltage	V_{RWM}	-	-	24	V
Reverse voltage	at I_R = 1 µA	V_R	24	-	-	V
Reverse current	at V_R = 24 V	I_R	-	-	1	µA
Reverse breakdown voltage	at I_R = 1 mA	V_{BR}	27	30	33	V
Reverse clamping voltage	at I_{PP} = 1 A	V_C	-	34	41	V
	at $I_{PP} = I_{PPM}$ = 5 A		-	41	47	V
Forward clamping voltage	at I_{PP} = 1 A	V_F	-	1	1.2	V
	at $I_{PP} = I_{PPM}$ = 5 A		-	1.4	-	V
Capacitance	at V_R = 0 V; f = 1 MHz	C_D	-	65	80	pF
	at V_R = 12 V; f = 1 MHz		-	20	-	pF

ELECTRICAL CHARACTERISTICS GSOT36 (T_{amb} = 25 °C unless otherwise specified) between pin 3 and pin 1

PARAMETER	TEST CONDITIONS/REMARKS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	1	lines
Reverse stand-off voltage	Max. reverse working voltage	V_{RWM}	-	-	36	V
Reverse voltage	at I_R = 1 µA	V_R	36	-	-	V
Reverse current	at V_R = 36 V	I_R	-	-	1	µA
Reverse breakdown voltage	at I_R = 1 mA	V_{BR}	39	43	47	V
Reverse clamping voltage	at I_{PP} = 1 A	V_C	-	49	60	V
	at $I_{PP} = I_{PPM}$ = 3.5 A		-	59	71	V
Forward clamping voltage	at I_{PP} = 1 A	V_F	-	1	1.2	V
	at $I_{PP} = I_{PPM}$ = 3.5 A		-	1.3	-	V
Capacitance	at V_R = 0 V; f = 1 MHz	C_D	-	52	65	pF
	at V_R = 18 V; f = 1 MHz		-	12	-	pF

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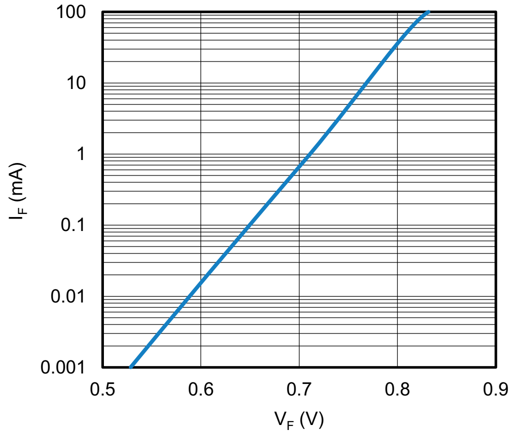

Fig. 1 - Typical Forward Current I_F vs. Forward Voltage V_F

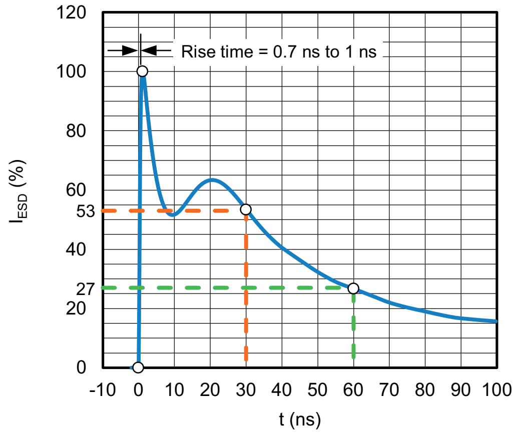

Fig. 4 - ESD Discharge Current Waveform According to IEC 61000-4-2 (330 Ω / 150 pF)

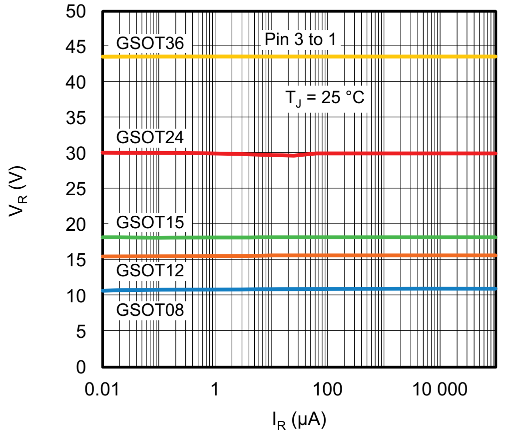

Fig. 2 - Typical Reverse Voltage V_R vs. Reverse Current I_R

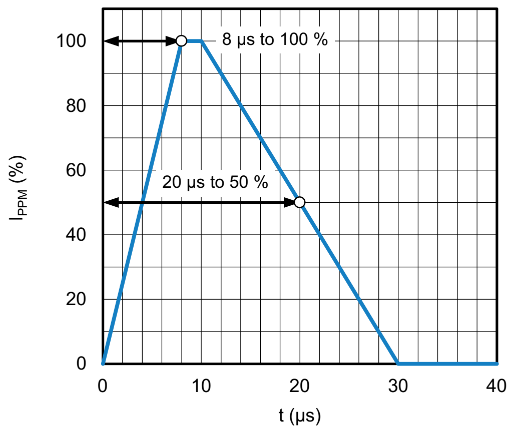

Fig. 5 - 8/20 µs Peak Pulse Current Waveform According to IEC 61000-4-5

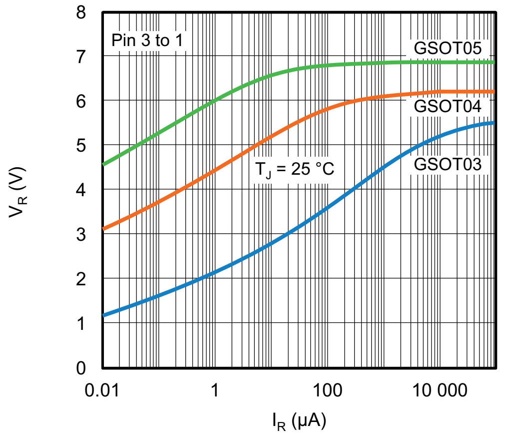

Fig. 3 - Typical Reverse Voltage V_R vs. Reverse Current I_R

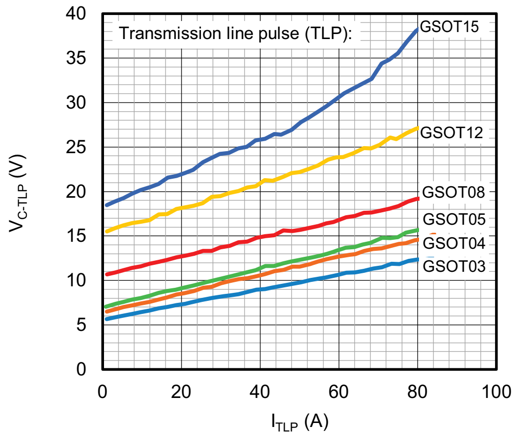

Fig. 6 - Typical Clamping Voltage vs. Peak Pulse Current

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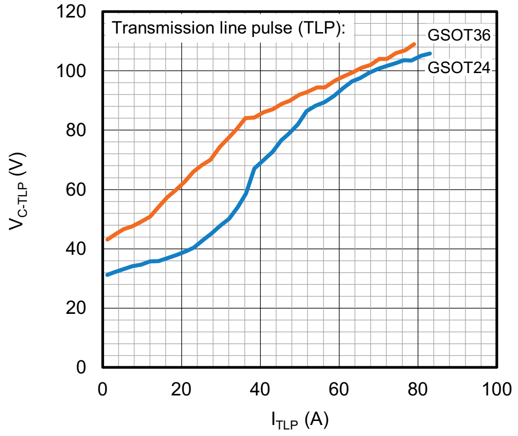

Fig. 7 - Typical Clamping Voltage vs. Peak Pulse Current

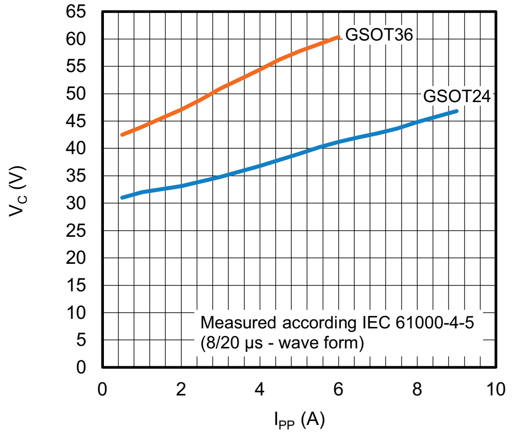

Fig. 9 - Typical Peak Clamping Voltage vs. Peak Pulse Current

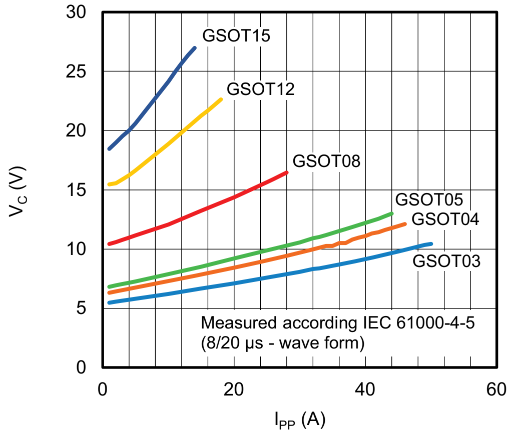

Fig. 8 - Typical Peak Clamping Voltage vs. Peak Pulse Current

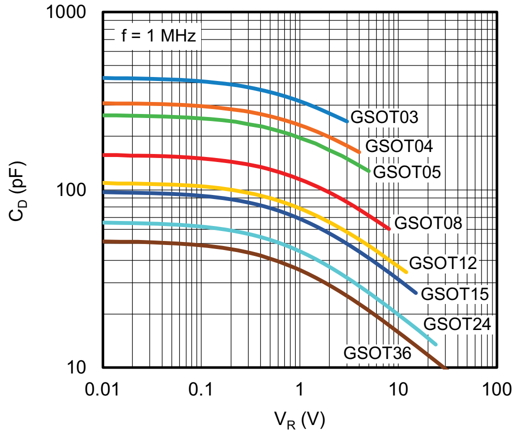

Fig. 10 - Typical Capacitance vs. Reverse Voltage

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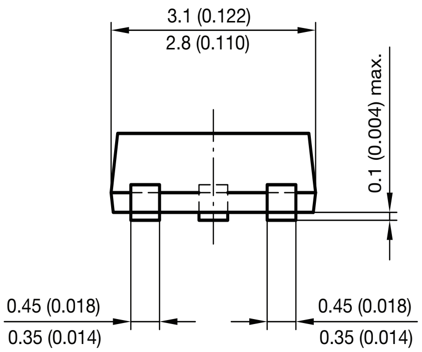
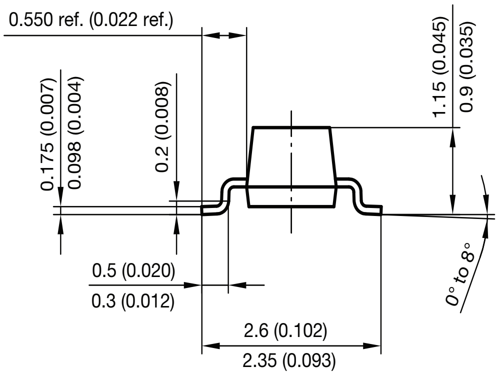
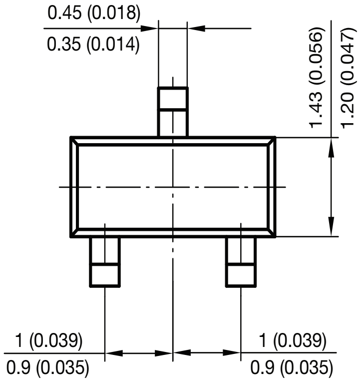
PACKAGE DIMENSIONS in millimeters (inches): **SOT-23**







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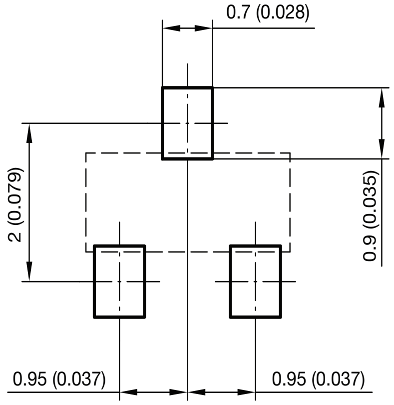

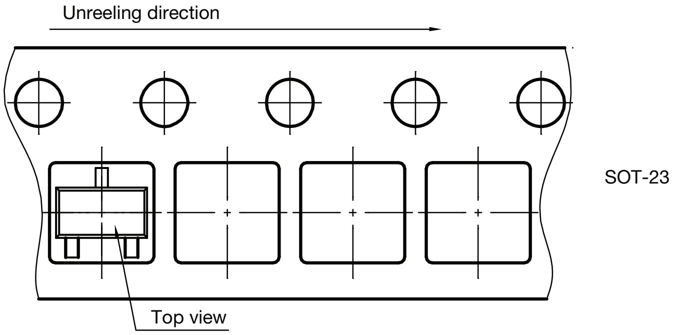

Orientation in carrier tape
SOT-23
S8-V-3929.01-006 (4)
04.02.2010
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