

1. Description

The SMxx-02HTG series TVS Diode Array is designed to protect sensitive equipment from damage due to electrostatic discharge (ESD), electrical fast transients (EFT), and lightning induced surges. The SM series can absorb repetitive ESD strikes above the maximum level specified in the IEC 61000-4-2 international standard without performance degradation and safely dissipate up to 24A of 8/20 μ s induced surge current (IEC-61000-4-5, 2nd Edition) with very low clamping voltages.

3. Features

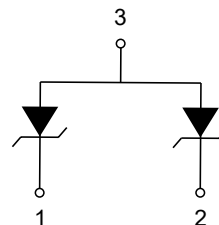
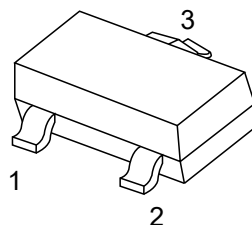
- RoHS compliant and lead-free
- ESD, IEC 61000-4-2, ± 30 kV contact, ± 30 kV air
- EFT, IEC 61000-4-4, 50A (5/50ns)
- Lightning, IEC 61000-4-5, 2nd Edition, 24A ($t_p=8/20\mu$ s, SM05)

2. Applications

- Industrial Equipment
- Test and Medical
- Equipment
- Point-of-Sale Terminals
- Motor Controls
- Legacy Ports
- (RS-232, RS-485)
- Security and Alarm
- System
- Automotive Electronics

- Working voltages: 5V, 12V, 15V, 24V and 36V
- Low clamping voltage
- Low leakage current
- AEC-Q101 qualified (SOT-23 package)
- Moisture Sensitivity Level (MSL-1)

4. Pinning information



SOT-23



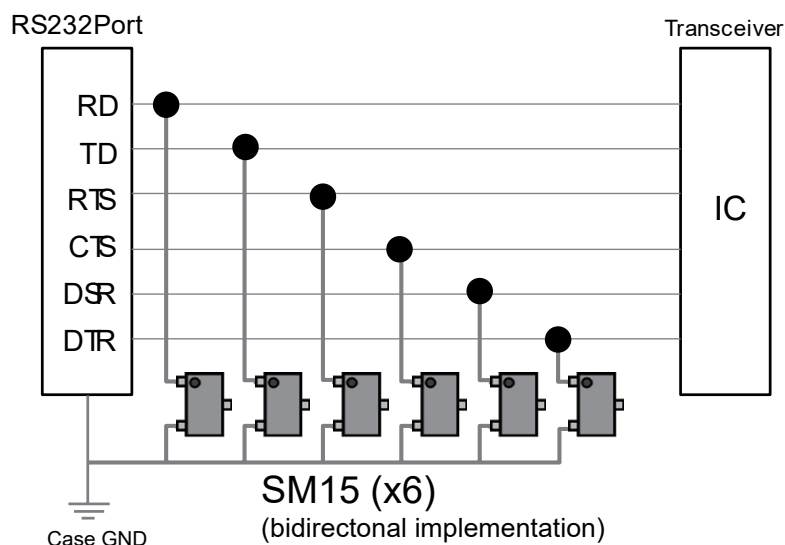
5. Absolute Maximum Ratings $T_J = 25^\circ\text{C}$

Parameter	Symbol	Value	Units
Peak Pulse Power ($t_p=8/20\mu\text{s}$)	P_{PK}	400	W
Junction Temperature	T_{OP}	-40 to 125	$^\circ\text{C}$
Storage Temperature	T_{STOR}	-55 to 150	$^\circ\text{C}$

Notes:

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the component. This is a stress only rating and operation of the component at these or any other conditions above those indicated in the operational sections of this specification is not implied.

6. RS-232 Application Example





7.1 Electrical Characteristics (SM05)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Reverse Stand off Voltage	V_{RWM}	$I_R \leq 1\mu A$			5	V
Reverse Voltage Drop	V_R	$I_R = 1mA$	6			V
Leakage Current	I_{LEAK}	$V_R = 5V$			1	μA
Clamp Voltage ¹	V_C	$I_{PP} = 1A$, $t_p = 8/20\mu s$, Pin 1 or Pin 2 to Pin 3			9.8	V
		$I_{PP} = 10A$, $t_p = 8/20\mu s$, Pin 1 or Pin 2 to Pin 3			13	V
Dynamic Resistance ²	R_{DYN}	TLP, $t_p = 100ns$, I/O to GND		0.19		Ω
Peak Pulse Current (8/20 μs) ¹	I_{PP}	$t_p = 8/20\mu s$			24	A
ESD Withstand Voltage ¹	V_{ESD}	IEC 61000-4-2 (Contact Discharge)	± 30			kV
		IEC 61000-4-2 (Air Discharge)	± 30			kV
Diode Capacitance ¹	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz			400	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz			350	pF

7.2 Electrical Characteristics (SM12)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Reverse Stand off Voltage	V_{RWM}	$I_R \leq 1\mu A$			12	V
Reverse Voltage Drop	V_R	$I_R = 1mA$	13.3			V
Leakage Current	I_{LEAK}	$V_R = 12V$			1	μA
Clamp Voltage ¹	V_C	$I_{PP} = 1A$, $t_p = 8/20\mu s$, Pin 1 or Pin 2 to Pin 3			18.5	V
		$I_{PP} = 10A$, $t_p = 8/20\mu s$, Pin 1 or Pin 2 to Pin 3			22.5	V
Dynamic Resistance ²	R_{DYN}	TLP, $t_p = 100ns$, I/O to GND		0.25		Ω
Peak Pulse Current (8/20 μs) ¹	I_{PP}	$t_p = 8/20\mu s$			17	A
ESD Withstand Voltage ¹	V_{ESD}	IEC 61000-4-2 (Contact Discharge)	± 30			kV
		IEC 61000-4-2 (Air Discharge)	± 30			kV
Diode Capacitance ¹	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz			150	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz			120	pF



7.3 Electrical Characteristics (SM15)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Reverse Stand off Voltage	V_{RWM}	$I_R \leq 1\mu A$			15	V
Reverse Voltage Drop	V_R	$I_R = 1mA$	16.7			V
Leakage Current	I_{LEAK}	$V_R = 15V$			1	μA
Clamp Voltage ¹	V_C	$I_{PP} = 1A$, $t_p = 8/20\mu s$, Pin 1 or Pin 2 to Pin 3			24	V
		$I_{PP} = 10A$, $t_p = 8/20\mu s$, Pin 1 or Pin 2 to Pin 3			30	V
Dynamic Resistance ²	R_{DYN}	TLP, $t_p = 100ns$, I/O to GND		0.3		Ω
Peak Pulse Current (8/20 μs) ¹	I_{PP}	$t_p = 8/20\mu s$			12	A
ESD Withstand Voltage ¹	V_{ESD}	IEC 61000-4-2 (Contact Discharge)	± 30			kV
		IEC 61000-4-2 (Air Discharge)	± 30			kV
Diode Capacitance ¹	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz			100	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz			75	pF

7.4 Electrical Characteristics (SM24)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Reverse Stand off Voltage	V_{RWM}	$I_R \leq 1\mu A$			24	V
Reverse Voltage Drop	V_R	$I_R = 1mA$	26.7			V
Leakage Current	I_{LEAK}	$V_R = 24V$			1	μA
Clamp Voltage ¹	V_C	$I_{PP} = 1A$, $t_p = 8/20\mu s$, Pin 1 or Pin 2 to Pin 3			36	V
		$I_{PP} = 5A$, $t_p = 8/20\mu s$, Pin 1 or Pin 2 to Pin 3			42	V
Dynamic Resistance ²	R_{DYN}	TLP, $t_p = 100ns$, I/O to GND		0.5		Ω
Peak Pulse Current (8/20 μs) ¹	I_{PP}	$t_p = 8/20\mu s$			7	A
ESD Withstand Voltage ¹	V_{ESD}	IEC 61000-4-2 (Contact Discharge)	± 30			kV
		IEC 61000-4-2 (Air Discharge)	± 30			kV
Diode Capacitance ¹	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz			65	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz			50	pF

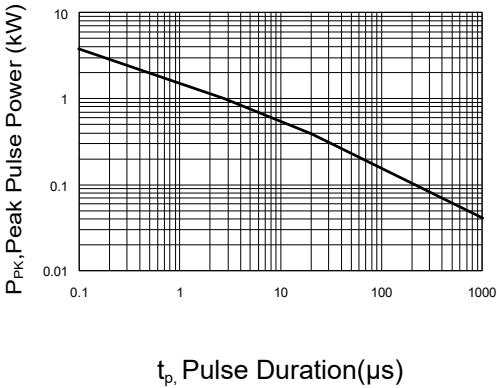
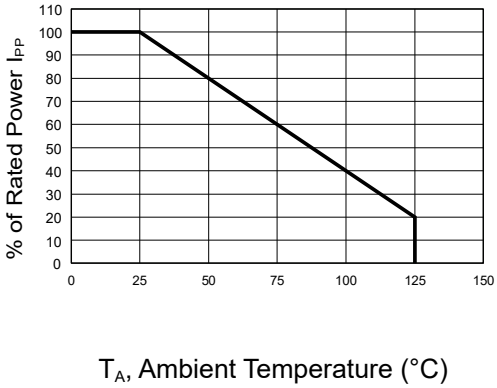
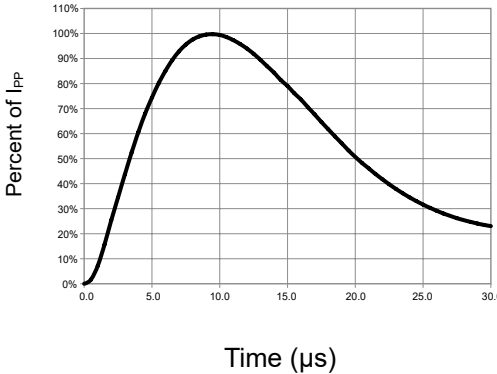
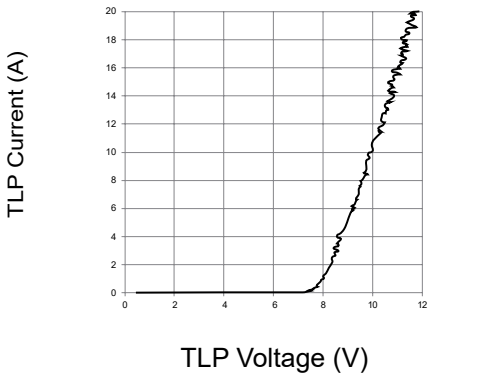
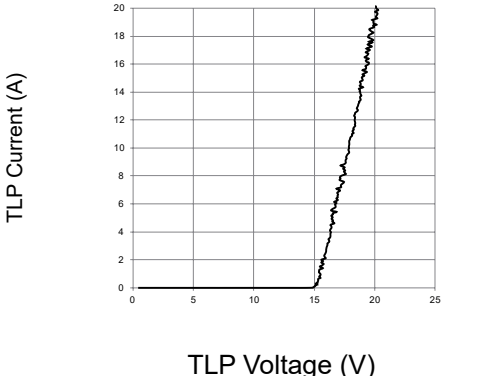
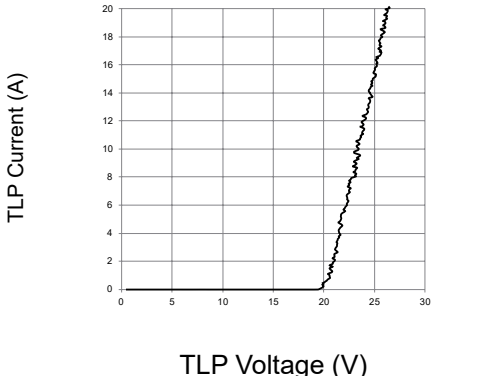


7.5 Electrical Characteristics (SM36)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Reverse Stand off Voltage	V_{RWM}	$I_R \leq 1\mu A$			36	V
Reverse Voltage Drop	V_R	$I_R = 1mA$	40			V
Leakage Current	I_{LEAK}	$V_R = 36V$			1	μA
Clamp Voltage ¹	V_C	$I_{PP} = 1A$, $t_p = 8/20\mu s$, Pin 1 or Pin 2 to Pin 3			52	V
		$I_{PP} = 4A$, $t_p = 8/20\mu s$, Pin 1 or Pin 2 to Pin 3			62	V
Dynamic Resistance ²	R_{DYN}	TLP, $t_p = 100ns$, I/O to GND		0.65		Ω
Peak Pulse Current (8/20 μs) ¹	I_{PP}	$t_p = 8/20\mu s$			5	A
ESD Withstand Voltage ¹	V_{ESD}	IEC 61000-4-2 (Contact Discharge)	± 30			kV
		IEC 61000-4-2 (Air Discharge)	± 30			kV
Diode Capacitance ¹	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz			50	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz			40	pF

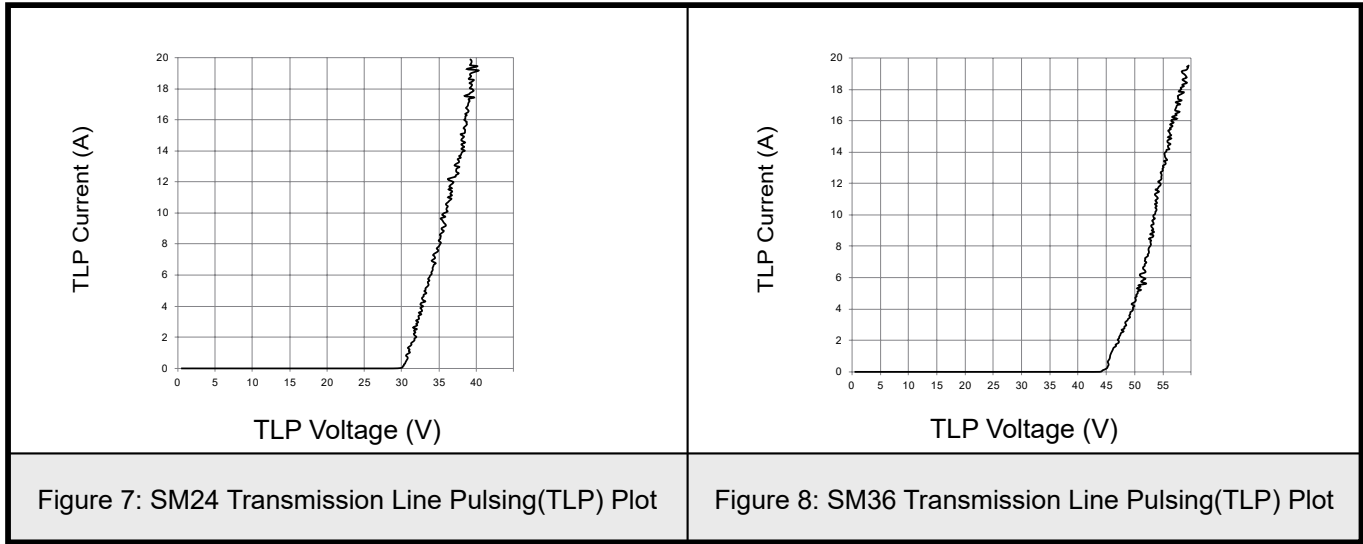


8.1Typical characteristic

 P_{PK}, Peak Pulse Power (kW) t_p, Pulse Duration(μs)	 % of Rated Power I_{PP} T_A, Ambient Temperature ($^{\circ}C$)	Figure 1: Non-Repetitive Peak Pulse Power vs. Pulse Time	Figure 2: Power Derating Curve
 Percent of I_{PP} Time (μs)	 TLP Current (A) TLP Voltage (V)	Figure 3: Pulse Waveform	Figure 4: SM05 Transmission Line Pulsing(TLP) Plot
 TLP Current (A) TLP Voltage (V)	 TLP Current (A) TLP Voltage (V)	Figure 5: SM12 Transmission Line Pulsing(TLP) Plot	Figure 6: SM15 Transmission Line Pulsing(TLP) Plot



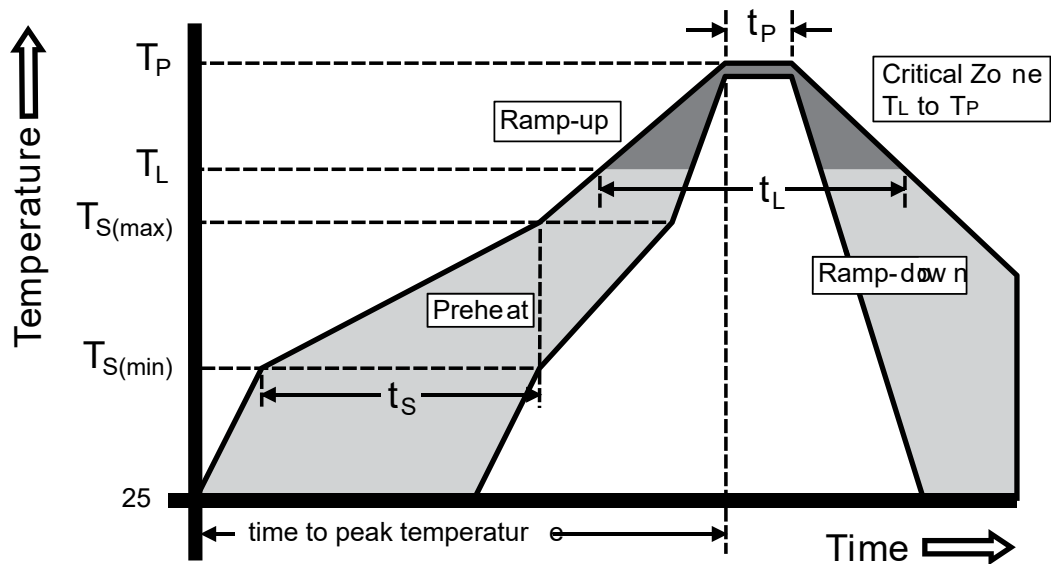
8.2Typical characteristic





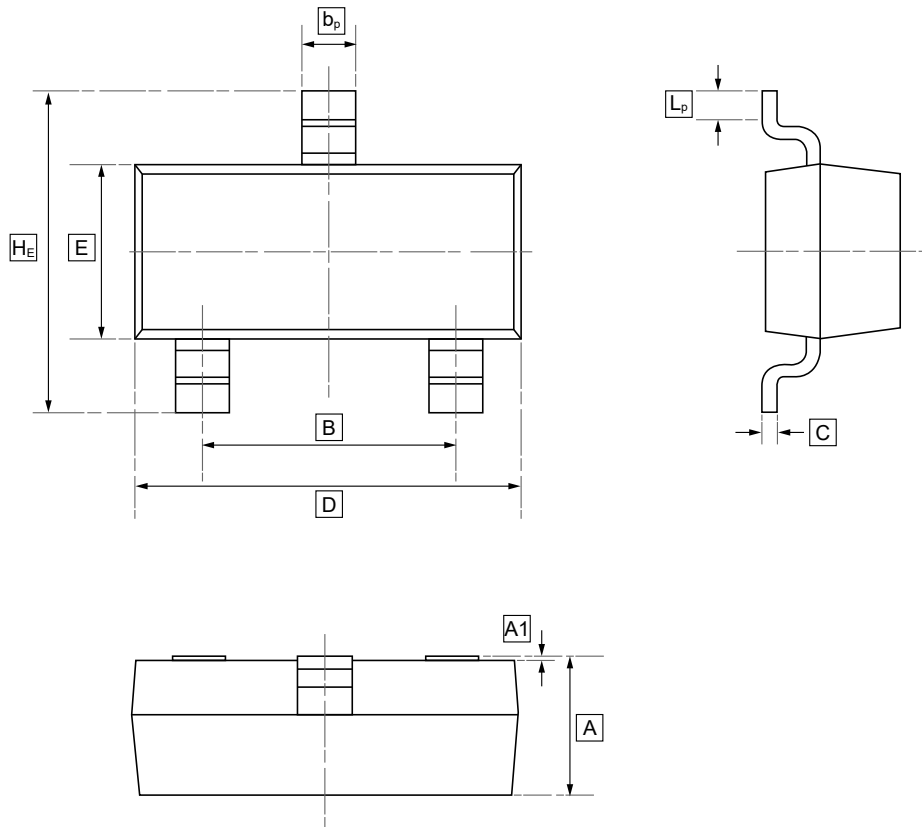
9.Recommended Soldering Conditions

Reflow Condition		Pb-Free Assembly
Pre Heat	-Temperature Min ($T_{s(min)}$)	150°C
	-Temperature Max ($T_{s(max)}$)	200°C
	-Time (Min to Max) (t_s)	60-180 secs.
Average ramp up rate (Liquidus) Temp (T_L) to peak		3°C/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3°C/sec. Max
Reflow	-Temperature (T_L) (Liquidus)	217°C
	-Temperature (T_L)	60-150 secs.
Peak Temp (T_p)		260 ^{+0/-5} °C
Time within 5°C of actual Peak Temp (T_p)		20-40 seconds
Ramp-down Rate		6°C/sec. Max
Time 25°C to Peak Temperature (T_p)		8 min. Max
Do not exceed		260°C





10.SOT-23 Package Outline Dimensions

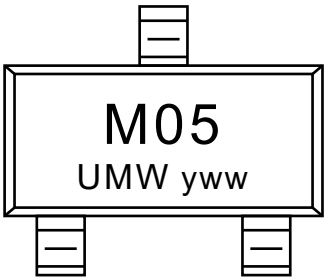


DIMENSIONS (mm are the original dimensions)

Symbol	A	B	b _p	C	D	E	H _E	A1	L _p
Min	0.95	1.78	0.35	0.08	2.70	1.20	2.20	0.013	0.20
Max	1.40	2.04	0.50	0.19	3.10	1.65	3.00	0.100	0.50



11.Ordering information



yww: Batch Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW SM05-02HTG	M05	SOT-23	3000	Tape and reel
UMW SM12-02HTG	M12	SOT-23	3000	Tape and reel
UMW SM15-02HTG	M15	SOT-23	3000	Tape and reel
UMW SM24-02HTG	M24	SOT-23	3000	Tape and reel
UMW SM36-02HTG	M36	SOT-23	3000	Tape and reel



11.Disclaimer

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