瞬態電壓抑制二極體

SM8Z 系列 - 6600W 超大功率車載浪湧防護器件

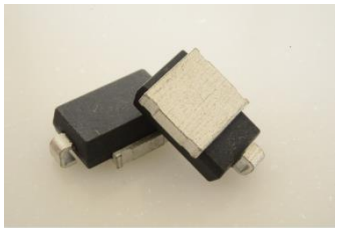
Working Voltage: 10 to 43 V Peak Pulse Power: 6600 Watt

概述

隨著車用市場蓬勃的發展，更多先進的車用電子與設備逐漸被導入汽車系統中，對於車用電子相關的法規愈趨嚴格，包含與車用安全有關的 ISO 26262[1]、可靠度有關的 AEC-Q101[2]、生產品質要求 TS-16949[3]和車用電子系統的 EMC 要求 ISO 7637[4]等法規，不斷更新其規範，以確保用車安全。

其中，針對車用保護元件在 EMC 方面的議題，拋負載浪湧的測試，多年來主要以 ISO 7637-2 5a 為主。在 2010 年，ISO 國際組織發布新的車用拋負載衝擊波測試規範 ISO 16750-2 5a 波形[5]，取代 ISO 7637-2，藉由加嚴拋負載衝擊波測試條件，希望能提供更佳的保護元件運用在車用電子系統。我司於 "Transient Voltage Suppressors (TVS) for Automotive Electronic Protection[6]" 一文中介紹 TVS 特性、車用電子應用、拋負載現象產生原因和 ISO 7637-2 5a 測試規範，並且分析我司 TVS-SM8Z 產品承受拋負載衝擊波的能力。此份報告主要根據 ISO 16750-2 5a 規範評估林朋 TVS-SM8Z 產品承受能力。

材料

產品	VB(V)@IT=5mA	IR(uA)@VR	VR(V)	樣品數	外觀
SM8Z18A	20.0~22.1	10	18	5	
SM8Z24A	26.7~29.5		24		
SM8Z28A	31.1~34.4		28		
SM8Z30A	33.3~36.8		30		
SM8Z33A	36.7~40.6		33		
SM8Z43A	47.8~52.8		43		

測試儀器

EMTEST-LD 200N[7]

圖一、LD 200N

測試條件

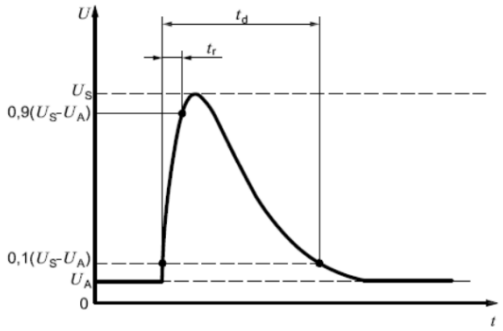
拋負載測試		
規範	**12V-system**	**24V-system**
Us (V)	87	174
Ua (V)	14	27
tr/td (ms)	10/400	10/350
Ri (Ω)	2→1	5→4
Pulse	10	
Interval (sec)	60	

規範：ISO 7637-2 5a 和 ISO 16750-2 5a 比較

以下將針對拋負載測試規範 ISO 16750-2 5a 和 ISO 7637-2 5a 差異的比較表：

拋負載測試				
	12V-system		**24V-system**	
規範	ISO 7637-2 5a	ISO 16750-2 5a	ISO 7637-2 5a	ISO 16750-2 5a
Us (V)	65≦Us≦87		123≦Us≦174	
Ua (V)	14		27	
Tr (ms)	10		10	
td (ms)	400		350	
Ri (Ω)	0.5≦Ri≦4		1≦Ri≦8	
Pulse (#)	1	10	1	10
Interval (sec)	-	60	-	60

表一、ISO 7637-2 5a 和 ISO 16750-2 5a 測試規格比較表



Key

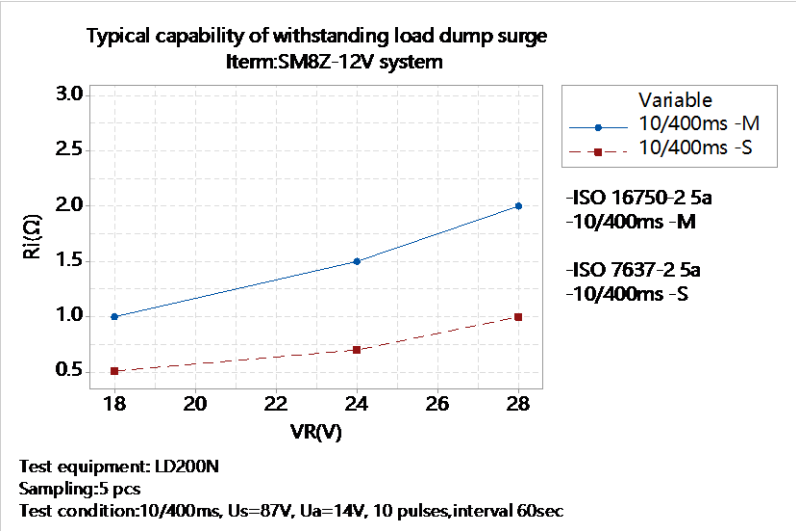
t	time
U	test voltage
t_d	duration of pulse
t_r	rising slope
U_A	supply voltage for generator in operation (see ISO 16750-1)
U_S	supply voltage

圖二、ISO 16750-2 pulse 5a[5]

結果

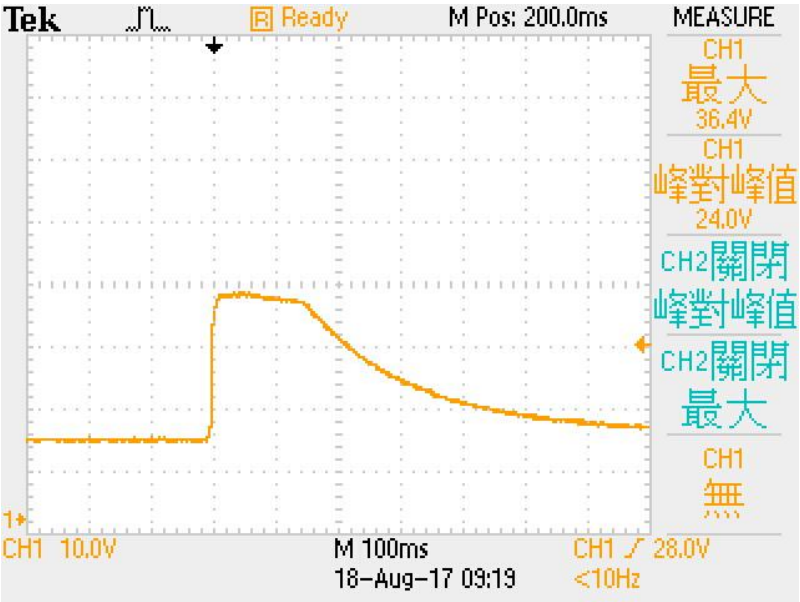
【12V-System】

測試條件：10/400ms, Us=87V, Ua=14V, 10 pulses, interval=60 sec, Sampling=5 pcs



圖三、SM8Z 12V-system 產品拋負載測試結果

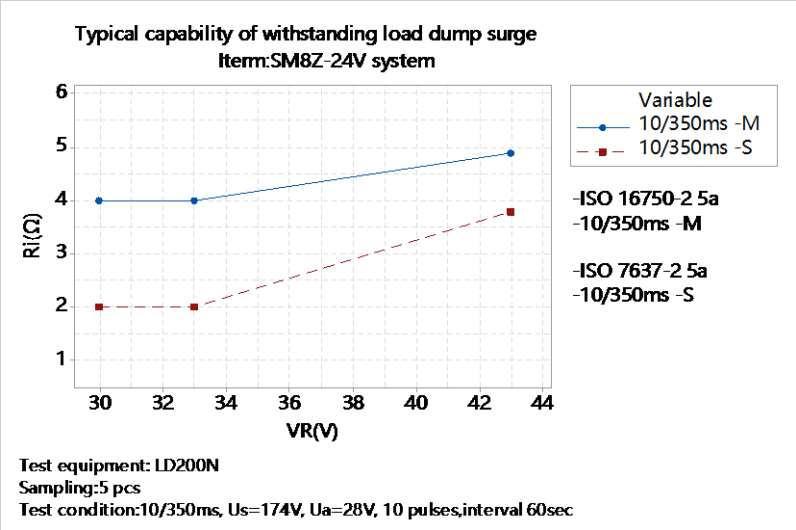
圖四為 12V-system 產品經拋負載測試後，電壓抑制在 36.4V。



圖四、SM8Z28A (scale:10V/division)

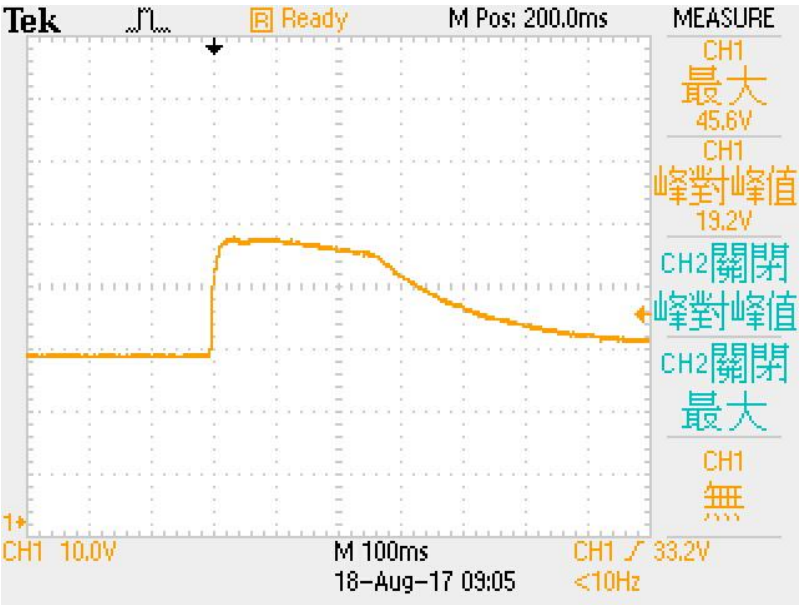
【24V-system】

測試條件：10/350ms, Us=174V, Ua=28V, 10 pulses, interval=60 sec, Sampling=5 pcs



圖五、SM8Z 24V-system 產品拋負載測試結果

圖六為 24V-system 材料經拋負載測試後，電壓抑制在 45.6V。



圖六、SM8Z33A(scale:10V/division)

結論

由於車用市場需求的快速成長，對於車用電子零件需求逐漸提高，加上車用電子零件精密度的提高，對雜訊流的容忍度更小，所以對於保護性產品的要求將會提高。拋負載防護的規範從過去的 ISO 7637-2 5a 衝擊波變更至 ISO 16750-2 5a 衝擊波，訂定更嚴苛的條件測試產品，以期能提高車用系統的保護性。

擁有高可靠性的 TVS-SM8Z 系列已經通過 AEC-Q101，不僅可通過 ISO 7637-2 5a 規範，在 ISO 16750-2 5a 規範的測試下，依然展現其良好的保護性能，確保車用系統的運作！

參考文獻

1. ISO 26262, Functional Safety Draft International Standard for Road Vehicles: Background, Status, and Overview.
2. AEC-Q101-Rev-D1: Failure mechanism based stress test qualification for discrete semiconductors in automotive applications, *Automotive Electronics Council, Component Technical Committee*.
3. TS-16949, Automotive Quality Management.
4. ISO 7637-2: Road vehicles -- Environmental conditions and testing for electrical and electronic equipment -- Part 2: Electrical loads.
5. ISO 16750-2: Road vehicles -- Environmental conditions and testing for electrical and electronic equipment -- Part 2: Electrical loads.
6. Transient Voltage Suppressors (TVS) for Automotive Electronic Protection, William Yang.
7. EMTEST LD200N: http://www.emtest.com/zh/home.php.
8. ANOVA-KA series: http://www.anova-semi.com/_i/assets/file/product/79df8f5258aa415fc6baecc739095239.pdf

For more information contact:
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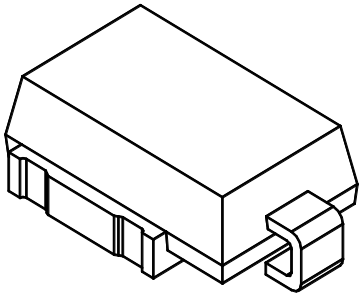
E-mail: annalee@anova-semi.com

Working Voltage: 10 to 43 V
Peak Pulse Power: 6600 W

Surface Mount Transient Voltage Suppressors

Features

- Optimized glass passivated chip
- T_J = 175 °C capability suitable for high reliability and automotive requirement
- 6600 W peak pulse power capability with a 10/1000 µs waveform, repetitive rate (duty cycle):0.01 %
- Meet ISO 7637-2 5a/5b and ISO 16750 load dump test (varied by test condition)
- AEC-Q101 qualified
- Low leakage current
- Low forward voltage drop
- Uni-directional polarity
- Excellent clamping capability
- Very fast response time
- RoHS compliant



DO-218AB

Mechanical Data

- Case: DO-218AB
- Molding compound: UL94V-0 flammability
- Polarity: Heatsink is anode

Maximum Ratings(T_A=25℃ unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak power dissipation with a 10/1000µs waveform(1)	P_{PP}	6600	W
Peak power dissipation with a 10/10,000µs waveform	P_{PP}	5200	W
Peak pulse current with a 10/1000µs waveform(1)	I_{PP}	See Next Table	A
Power dissipation on infinite heatsink at T_L = 25 °C	P_D	8.0	W
Peak forward surge current 8.3 ms single half sine-wave	I_{FSM}	700	A
Operating junction and storage temperature range	T_J, T_{STG}	- 55 to +175	°C

Note:

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

Ratings and Characteristics Curves (T_A=25℃ unless otherwise noted)

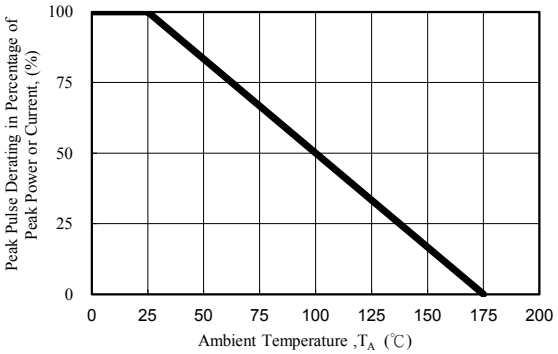


Fig. 1 - Pulse Derating Curve

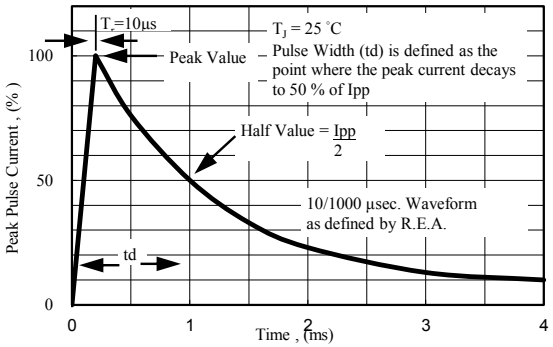


Fig. 2 - Pulse Waveform

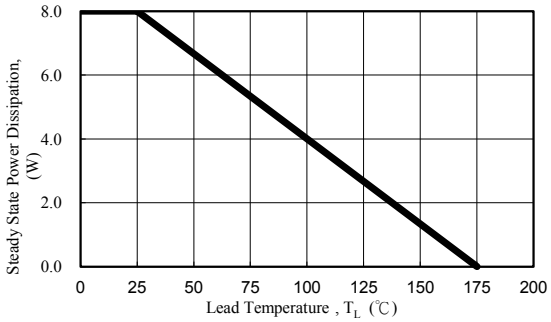


Fig. 3 - Steady State Power Derating Curve

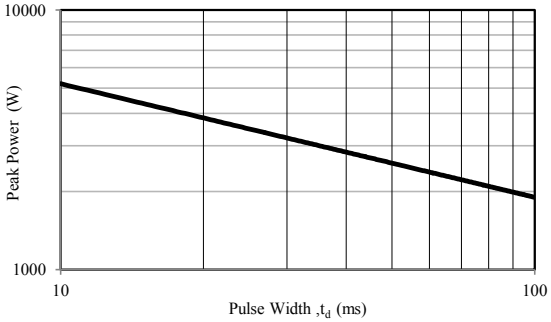
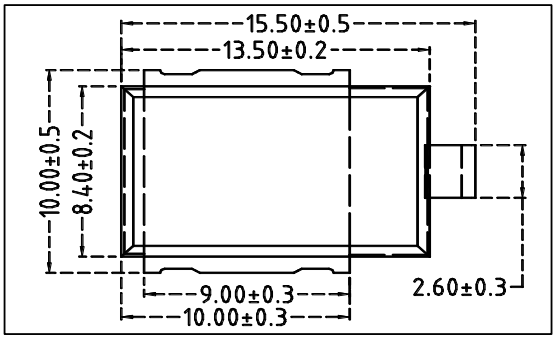
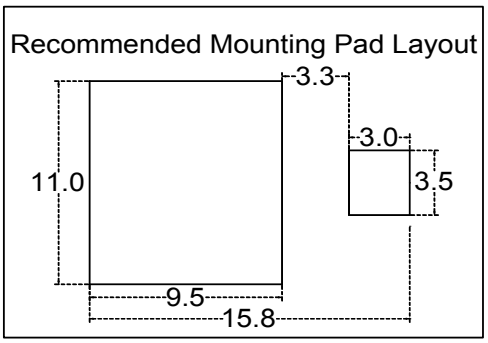
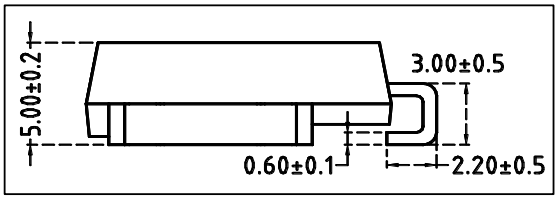


Fig. 4 - Peak Pulse Power Rating Curve

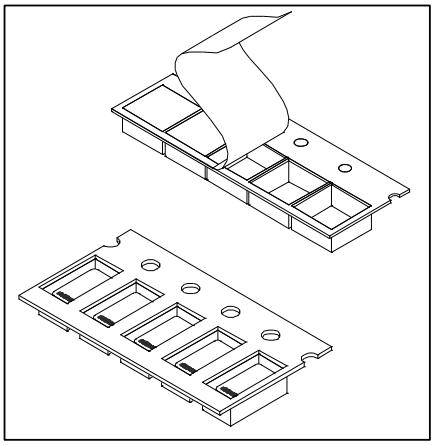
Package Outline Dimensions (millimeters)

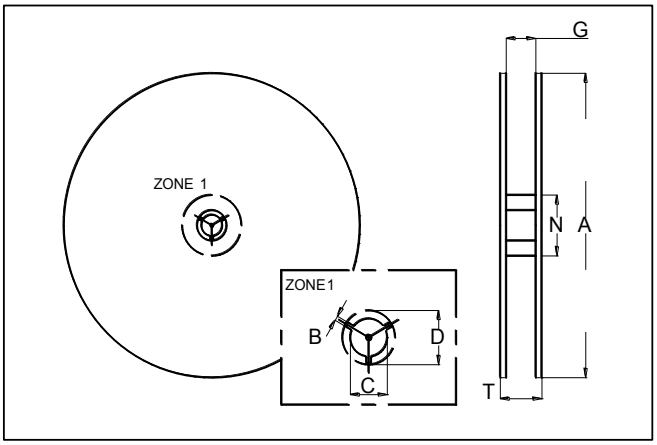






Surface Mount Tape and Reel Packaging





Dimensions in Millimeters (inches)

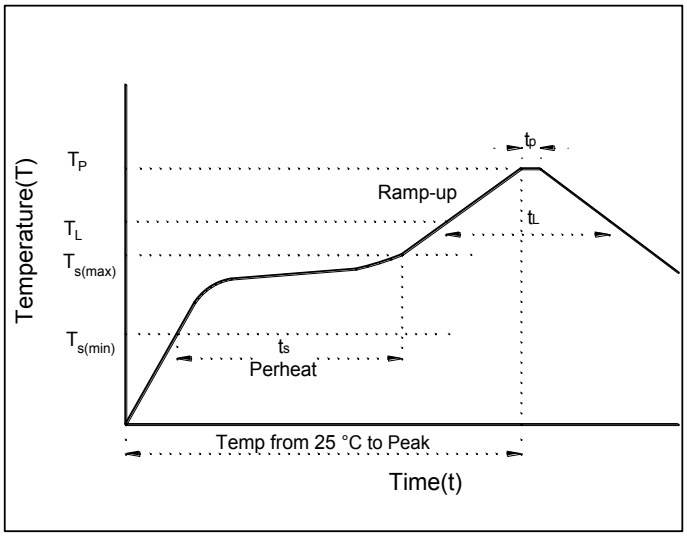
TAPE SIZE	A MAX.	B MIN.	C	D MIN.	N MIN.	G MAX.	T MAX.
24 mm (0.945)	330 ± 2.0 (13.0 ± 0.079) 178 ± 2.0 (7.0 ± 0.079)	1.5 (0.059)	13.5 ± 0.50 (0.53 ± 0.02)	20.2 (0.795)	50 (1.97)	26.4 (1.039)	30.4 (1.197)

Recommended Soldering Parameters

IR-Reflow Condition			
Pre Heat	Temp. min	150	℃
	Temp. max	200	℃
	Time(min to max)	60-180	sec
Ramp up rate (150-200℃)		<3	℃/sec

Reflow	Liquidus Temp.	>220	℃
	Peak Temp.	245	℃
	Time(Liq. to Peak)	60-150	sec
Ramp up rate (220-200℃)		<3	℃/sec
Time within actual peak temp.		10-30	sec

Ramp down Rate	<5	℃/sec
Time(25℃ to Peak temp.)	<6	min
Do not exceed	280	℃



Electrical Characteristics(T_A=25℃ unless otherwise noted)

Part Number (Uni)	Breakdown Voltage V_{BR} @I_T			Maximum Reverse Leakage I_R @V_{RWM} (uA)	Maximum I_R @V_{RWM} T_J=175 (uA)	Working Peak Reverse Voltage V_{RWM} (V)	Maximum Reverse Surge Current I_{PP} (A) (1)	Maximum Clamping Voltage V_C@I_{PP} (V)
	Min (V)	Max (V)	I_T (mA)					
SM8Z10A	11.10	12.30	5.0	15	250	10	388.00	17.0
SM8Z11A	12.20	13.50	5.0	10	150	11	363.00	18.2
SM8Z12A	13.30	14.70	5.0	10	150	12	332.00	19.9
SM8Z13A	14.40	15.90	5.0	10	150	13	307.00	21.5
SM8Z14A	15.60	17.20	5.0	10	150	14	284.00	23.2
SM8Z15A	16.70	18.50	5.0	10	150	15	270.00	24.4
SM8Z16A	17.80	19.70	5.0	10	150	16	254.00	26.0
SM8Z17A	18.90	20.90	5.0	10	150	17	239.00	27.6
SM8Z18A	20.00	22.10	5.0	10	150	18	226.00	29.2
SM8Z20A	22.20	24.50	5.0	10	150	20	204.00	32.4
SM8Z22A	24.40	26.90	5.0	10	150	22	186.00	35.5
SM8Z24A	26.70	29.50	5.0	10	150	24	170.00	38.9
SM8Z26A	28.90	31.90	5.0	10	150	26	157.00	42.1
SM8Z28A	31.10	34.40	5.0	10	150	28	145.00	45.4
SM8Z30A	33.30	36.80	5.0	10	150	30	136.00	48.4
SM8Z33A	36.70	40.60	5.0	10	150	33	124.00	53.3
SM8Z36A	40.00	44.20	5.0	10	150	36	114.00	58.1
SM8Z40A	44.40	49.10	5.0	10	150	40	102.00	64.5
SM8Z43A	47.80	52.80	5.0	10	150	43	95.10	69.4

NOTE:

1.Surge current waveform is defined at 10/1000uS waveform

2.For all types maximum VF = 1.8 V at IF = 100 A measured on 8.3 ms single half sine-wave or equivalent square wave, duty cycle = 4 pulses per minute maximum