

TransGuard® Automotive Series

Multilayer Varistors for Automotive Applications



GENERAL DESCRIPTION

The TransGuard Automotive Series are zinc oxide (ZnO) based ceramic semiconductor devices with non-linear, bi-directional voltage-current characteristics.

They have the advantage of offering bi-directional overvoltage protection as well as EMI/RFI attenuation in a single SMT package. The Automotive Series high current and high energy handling capability make them well suited for protection against automotive related transients.

FEATURES

- High Reliability
- High Energy Absorption (Load Dump)
- High Current Handling
- AEC Q200 Qualified
- Bi-Directional protection
- EMI/RFI attenuation
- Multi-strike capability
- Sub 1nS response to ESD strike

APPLICATIONS

- Internal Combustion Engine (ICE) Vehicles
- Hybrid Electric Vehicles (HEV)
- Plug-in Hybrid Electric Vehicles (PHEV)
- Commercial Vehicles
 - CAN, LIN, FLEXRAY based modules
 - Sensors
 - Module load dump protection
 - Motor/inductive load transient suppression



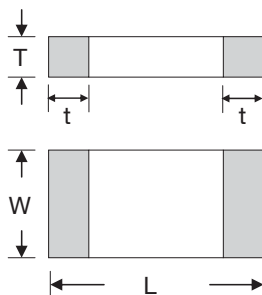
HOW TO ORDER

VC	AS	1206	18	D	400	R	P
Varistor Chip	Automotive Series	Case Size	Working Voltage	Energy Rating	Clamping Voltage	Package	Termination
		0402	05 = 5.6Vdc	A = 0.1J	150 = 18V	D = 7" (1000)*	P = Ni/Sn plated
		0603	09 = 9Vdc	B = 0.2J	220 = 22V	R = 7" (4000)*	
		0805	12 = 12Vdc	C = 0.3J	250 = 27V	T = 13" (10,000)*	
		1206	14 = 14Vdc	D = 0.4J	300 = 32V	W = 13" (10,000)**	
		1210	16 = 16Vdc	E = 0.5J	380 = 38V	0402 only	
		1812	18 = 18Vdc	F = 0.7J	390 = 42V		
		2220	26 = 26Vdc	H = 1.2J	400 = 42V		
			30 = 30Vdc	J = 1.5J	540 = 54V		
			31 = 31Vdc	K = 0.6J	151 = 150V		
			34 = 34Vdc	L = 0.8J			
			38 = 38Vdc	S = 1.9-2.0J			
			42 = 42Vdc	X = 0.05J			
			45 = 45Vdc	M = 1J			
			48 = 48Vdc	N = 1.1J			
			56 = 56Vdc	U = 4.0-5.0J			
			60 = 60Vdc	P = 2.7-3.0J			
			85 = 85Vdc	Y = 7.2-12J			

*Not available for 0402

**Only available for 0402

PHYSICAL DIMENSIONS: mm (inches)



Size (EIA)	Length (L)	Width (W)	Max Thickness (T)	Land Length (t)
0402	1.00±0.10 (0.040±0.004)	0.50±0.10 (0.020±0.004)	0.60 (0.024)	0.25±0.15 (0.010±0.006)
0603	1.60±0.15 (0.063±0.006)	0.80±0.15 (0.031±0.006)	0.90 (0.035)	0.35±0.15 (0.014±0.006)
0805	2.01±0.20 (0.079±0.008)	1.25±0.20 (0.049±0.008)	1.02 (0.040)	0.71 max. (0.028 max.)
1206	3.20±0.20 (0.126±0.008)	1.60±0.20 (0.063±0.008)	1.02 (0.040)	0.94 max. (0.037 max.)
1210	3.20±0.20 (0.126±0.008)	2.49±0.20 (0.098±0.008)	1.70 (0.067)	0.14 max. (0.045 max.)
1812	4.50±0.30 (0.177±0.012)	3.20±0.30 (0.126±0.012)	2.00 (0.079)	1.00 max. (0.040 max.)
2220	5.70±0.40 (0.224±0.016)	5.00±0.40 (0.197±0.016)	2.00 (0.079)	1.00 max. (0.040 max.)



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ELECTRICAL CHARACTERISTICS

AVX PN	V _W (DC)	V _W (AC)	V _B	V _C	I _{VC}	I _L	E _T	E _{LD}	I _P	Cap	Freq	V _{Jump}	P _{Diss. Max}
VCAS040205X150 __	5.6	4.0	8.5±20%	18	1	35	0.05	-	20	175	M	-	0.001
VCAS060305A150 __	5.6	4.0	8.5±20%	18	1	35	0.1	-	30	750	K	-	0.001
VCAS080505A150 __	5.6	4.0	8.5±20%	18	1	35	0.1	-	40	1100	K	-	0.001
VCAS080505C150 __	5.6	4.0	8.5±20%	18	1	35	0.3	-	120	3000	K	-	0.005
VCAS120605A150 __	5.6	4.0	8.5±20%	18	1	35	0.1	-	40	1200	K	-	0.002
VCAS120605D150 __	5.6	4.0	8.5±20%	18	1	35	0.4	-	150	3000	K	-	0.008
VCAS040209X200 __	9	6.4	12.7±15%	22	1	25	0.05	-	20	175	M	-	0.001
VCAS060309A200 __	9	6.4	12.7±15%	22	1	25	0.1	-	30	550	K	-	0.002
VCAS080509A200 __	9	6.4	12.7±15%	22	1	25	0.1	-	40	750	K	-	0.002
VCAS080512A250 __	12	8.5	16±15%	27	1	25	0.1	-	40	525	K	-	0.002
VCAS040214X300 __	14	10	18.5±12%	32	1	15	0.05	-	20	85	K	16	0.001
VCAS060314A300 __	14	10	18.5±12%	32	1	15	0.1	-	30	350	K	16	0.002
VCAS080514A300 __	14	10	18.5±12%	32	1	15	0.1	-	40	325	K	16	0.002
VCAS080514C300 __	14	10	18.5±12%	32	1	15	0.3	-	120	900	K	20	0.006
VCAS120614A300 __	14	10	18.5±12%	32	1	15	0.1	-	40	600	K	20	0.002
VCAS120614D300 __	14	10	18.5±12%	32	1	15	0.4	-	150	1050	K	20	0.008
VCAS060316B400 __	16	11	25.5±10%	42	1	10	0.2	0.25	30	150	K	27.5	0.003
VCAS120616K380 __	16	11	25.5±10%	38	1	10	0.6	1.5	200	930	K	27.5	0.010
VCAS121016J390 __	16	11	25.5±10%	42	5	10	1.6	3	500	3100	K	27.5	0.030
VCAS181216P400 __	16	11	24.5±10%	42	5	10	2.9	10	1000	5000	K	27.5	0.070
VCAS222016Y400 __	16	11	24.5±10%	42	10	10	7.2	25	1500	13000	K	25.5	0.100
VCAS040218X400 __	18	13	25.5±10%	42	1	10	0.05	0.05	20	65	M	27.5	0.001
VCAS060318A400 __	18	13	25.5±10%	42	1	10	0.1	0.25	30	150	K	27.5	0.003
VCAS080518A400 __	18	13	25.5±10%	42	1	10	0.1	0.1	30	225	K	27.5	0.002
VCAS080518C400 __	18	13	25.5±10%	42	1	10	0.3	1	120	550	K	27.5	0.007
VCAS120618A400 __	18	13	25.5±10%	42	1	10	0.1	0.5	30	350	K	27.5	0.002
VCAS120618D400 __	18	13	25.5±10%	42	1	10	0.4	1.5	150	900	K	27.5	0.008
VCAS120618E380 __	18	13	25.5±10%	38	1	10	0.5	1.5	200	930	K	27.5	0.010
VCAS121018J390 __	18	13	25.5±10%	42	5	10	1.6	3	500	3100	K	27.5	0.030
VCAS060326A580 __	26	18	34.5±10%	60	1	10	0.1	0.1	30	155	K	27.5	0.002
VCAS080526A580 __	26	18	34.5±10%	60	1	10	0.1	0.15	30	120	K	27.5	0.002
VCAS080526C580 __	26	18	34.5±10%	60	1	10	0.3	0.5	100	250	K	27.5	0.006
VCAS120626D580 __	26	18	34.5±10%	60	1	10	0.4	1	120	500	K	27.5	0.008
VCAS120626F540 __	26	18	33.0±10%	54	1	15	0.7	1.5	200	600	K	27.5	0.008
VCAS121026H560 __	26	18	34.5±10%	60	5	10	1.2	3	300	2150	K	27.5	0.018
VCAS060330A650 __	30	21	41.0±10%	67	1	10	0.1	0.15	30	125	K	29	0.002
VCAS080530A650 __	30	21	41.0±10%	67	1	10	0.1	0.15	30	90	M	29	0.002
VCAS080530C650 __	30	21	41.0±10%	67	1	10	0.3	0.5	80	250	K	29	0.005
VCAS120630D650 __	30	21	41.0±10%	67	1	10	0.4	1	120	400	K	29	0.008
VCAS121030H620 __	30	21	41.0±10%	67	5	10	1.2	3	280	1850	K	29	0.018
VCAS121030S620 __	30	21	41.0±10%	67	5	10	1.9	3	300	1500	K	29	0.038
VCAS080531C650 __	31	25	39.0±10%	65	1	10	0.3	0.5	80	250	K	29	0.005
VCAS120631M650 __	31	25	39.0±10%	65	1	15	1	1.5	200	500	K	29	0.008
VCAS120634N770 __	34	30	47.0±10%	77	1	15	1.1	1.5	200	400	K	48	0.008
VCAS121034S770 __	34	30	47.0±10%	77	2.5	15	2	3.0	400	1000	K	48	0.040
VCAS181234U770 __	34	30	47.0±10%	77	5	15	5	6.1	800	1500	K	48	0.080
VCAS222034Y770 __	34	30	47.0±10%	77	10	15	12	25	2000	6300	K	48	0.240
VCAS080538C770 __	38	30	47.0±10%	77	1	10	0.3	-	80	200	K	48	0.006
VCAS120642L800 __	42	32	51.0±10%	80	1	35	0.8	-	180	600	K	48	0.016
VCAS120642K900 __	42	32	56±10%	90	1	15	0.6	-	200	260	K	48	0.012
VCAS120645K900 __	45	35	56±10%	90	1	25	0.6	-	200	260	K	48	0.012
VCAS120648D101 __	48	34	62.0±10%	100	1	10	0.4	-	100	225	K	48	0.008
VCAS121048H101 __	48	34	62.0±10%	100	1	10	1.2	-	250	500	K	48	0.022
VCAS120656F111 __	56	40	68.0±10%	110	1	15	0.7	-	100	180	K	48	0.014
VCAS120660M131 __	60	50	82.0±10%	135	1	15	1	-	150	250	K	48	0.008
VCAS121060J121 __	60	42	76±10%	120	5	10	1.5	-	250	400	K	48	0.03
VCAS121065P131 __	65	50	82±10%	135	2.5	15	2.7	-	350	600	K	48	0.05
VCAS121085S151 __	85	60	100.0±10%	150	1	35	2	-	250	275	K	48	0.040

V_W(DC) DC Working Voltage [V]
V_W(AC) AC Working Voltage [V]
V_B Typical Breakdown Voltage [V @ 1mA_{DC}]
V_C Clamping Voltage [V @ I_W]
I_{VC} Test Current for V_C
I_L Maximum leakage current at the working voltage [μA]

E_T Transient Energy Rating [J, 10x1000μs]
I_P Peak Current Rating [A, 8x20μs]
Cap Typical capacitance [pF] @ frequency specified and 0.5V_{RMS}
V_{Jump} Jump Start (V)
P_D Power Dissipation (W)

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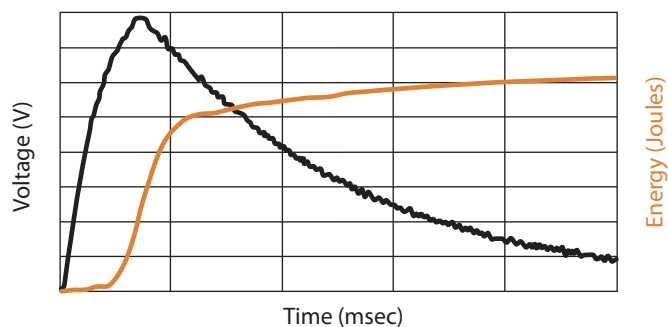
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AUTOMOTIVE SERIES – LOAD DUMP TEST

According to ISO DP7637 rev 2 Pulse 5

**Automotive Load Dump Pulse
(According to ISO 7637 Pulse 5)**



When using the test method indicated below, the amount of Energy dissipated by the varistor must not exceed the Load Dump Energy value specified in the product table.

LOAD DUMP LIBRARY

Typical max Vz versus Pulse duration and Ri

12V SYSTEMS

VCAS060316B400	0.5Ω	1Ω	4Ω
100ms	37	38	42
200ms	36	37	41
400ms	35	36	39
VCAS120616K380	0.5Ω	1Ω	4Ω
100ms	42	45	55
200ms	40	43	50
400ms	39	40	45
VCAS121016J390	0.5Ω	1Ω	4Ω
100ms	48	53	74
200ms	46	50	64
400ms	43	46	56
VCAS181216P400	0.5Ω	1Ω	4Ω
100ms	46	52	72
200ms	37	41	59
400ms	32	35	51
VCAS222016Y400	0.5Ω	1Ω	4Ω
100ms	53	60	77
200ms	50	55	73
400ms	47	50	66
VCAS040218X400	0.5Ω	1Ω	4Ω
100ms	38	39	40
200ms	37	37	38
400ms	34	35	36
VCAS060318A400	0.5Ω	1Ω	4Ω
100ms	37	38	42
200ms	36	37	41
400ms	35	36	39
VCAS080518A400	0.5Ω	1Ω	4Ω
100ms	37	39	40
200ms	35	38	39
400ms	33	37	38
VCAS080518C400	0.5Ω	1Ω	4Ω
100ms	40	41	48
200ms	39	40	45
400ms	38	39	42
VCAS120618A400	0.5Ω	1Ω	4Ω
100ms	43	45	55
200ms	41	43	48
400ms	40	41	45
VCAS120618D400	0.5Ω	1Ω	4Ω
100ms	42	45	55
200ms	40	42	50
400ms	39	40	45
VCAS120618E380	0.5Ω	1Ω	4Ω
100ms	42	45	55
200ms	40	43	50
400ms	39	40	45
VCAS121018J390	0.5Ω	1Ω	4Ω
100ms	48	53	74
200ms	46	50	64
400ms	43	46	56

24V SYSTEMS

VCAS060326A580	0.5Ω	1Ω	4Ω
100ms	51	56	58
200ms	50	54	56
400ms	49	51	53
VCAS080526A580	0.5Ω	1Ω	4Ω
100ms	51	53	59
200ms	49	51	57
400ms	48	50	51
VCAS080526C580	0.5Ω	1Ω	4Ω
100ms	51	54	62
200ms	49	51	56
400ms	48	49	51
VCAS120626D580	0.5Ω	1Ω	4Ω
100ms	52	60	68
200ms	50	57	65
400ms	47	54	61
VCAS121026H560	0.5Ω	1Ω	4Ω
100ms	61	74	91
200ms	59	69	82
400ms	55	64	70
VCAS060330A650	0.5Ω	1Ω	4Ω
100ms	57	59	63
200ms	56	58	61
400ms	54	57	58
VCAS080530A650	0.5Ω	1Ω	4Ω
100ms	58	62	66
200ms	56	61	64
400ms	53	57	61
VCAS080530C650	0.5Ω	1Ω	4Ω
100ms	58	61	63
200ms	57	58	62
400ms	55	56	59
VCAS120630D650	0.5Ω	1Ω	4Ω
100ms	61	70	75
200ms	57	66	69
400ms	56	62	64
VCAS121030H620	0.5Ω	1Ω	4Ω
100ms	70	77	98
200ms	64	70	89
400ms	56	65	70



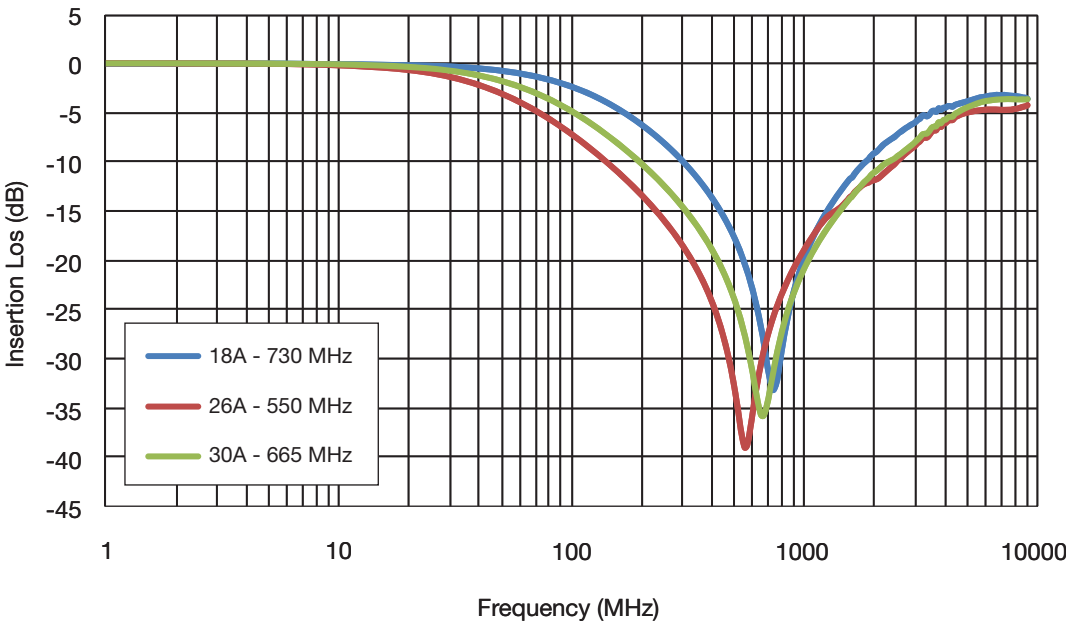
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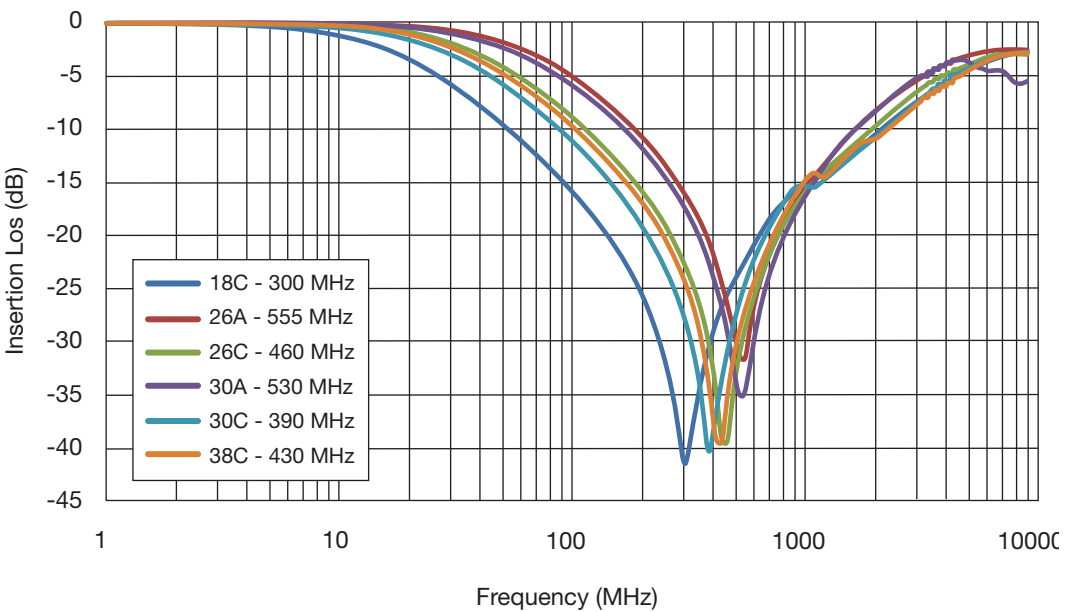
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FORWARD TRANSMISSION CHARACTERISTICS (S21)

0603 Case Size



0805 Case Size

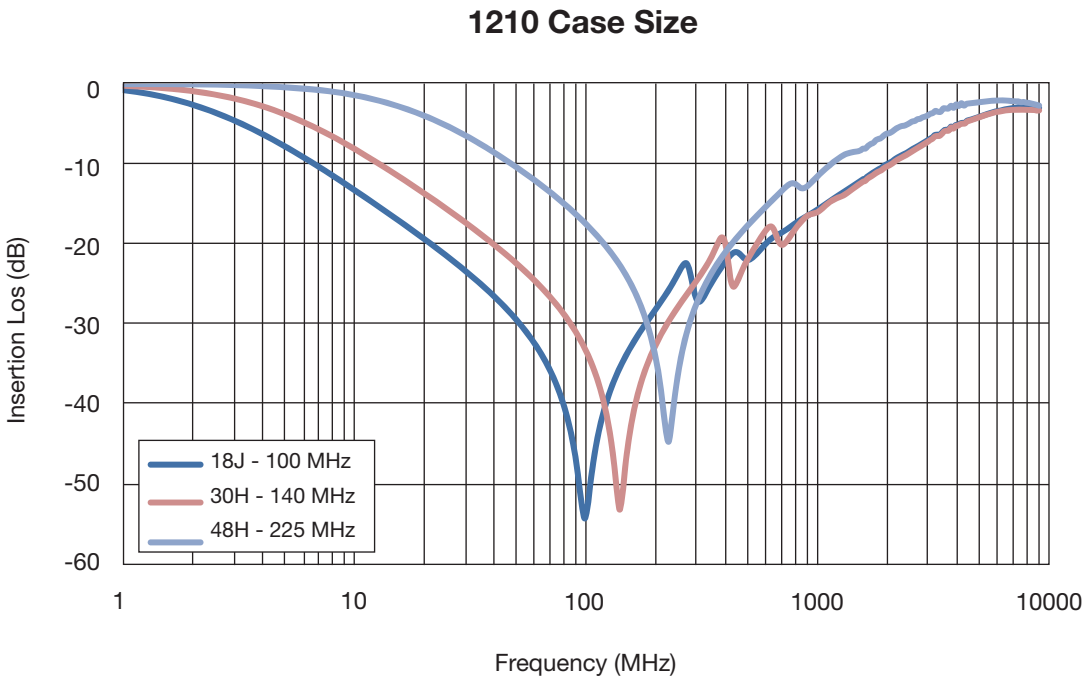
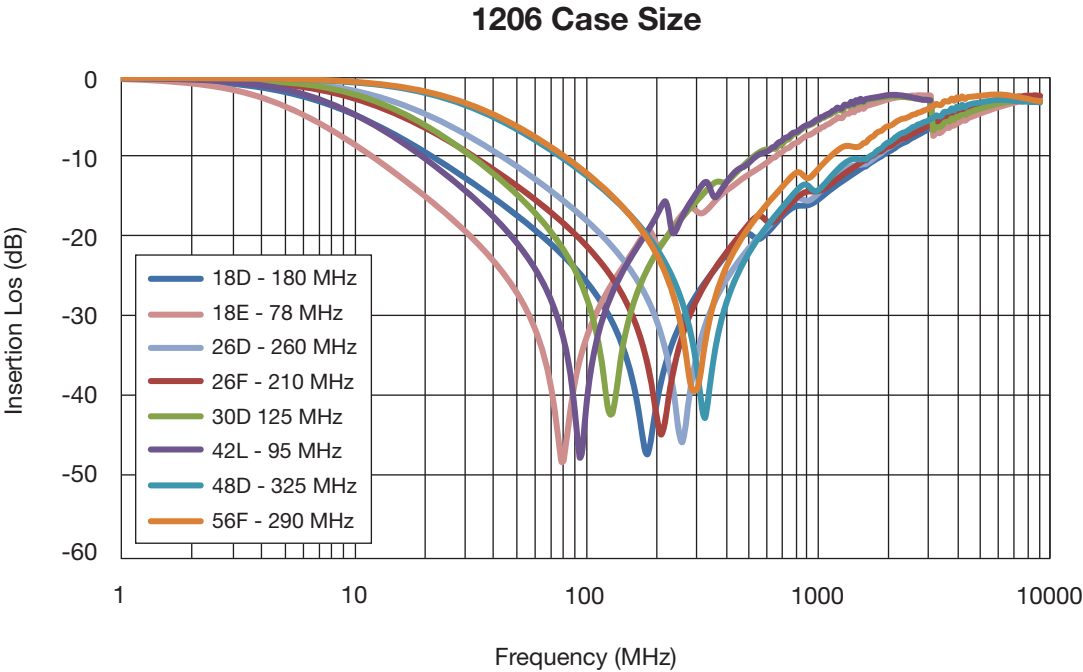


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FORWARD TRANSMISSION CHARACTERISTICS (S21)



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Multilayer Varistors for Automotive Applications

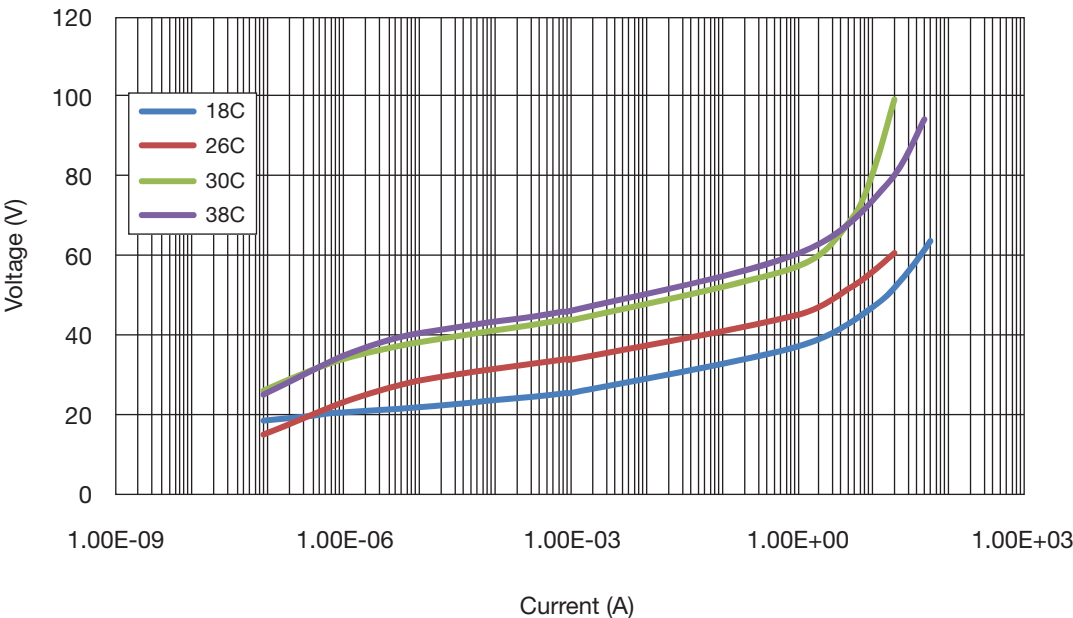


V-I CHARACTERISTICS

0603 Case Size



0805 Case Size



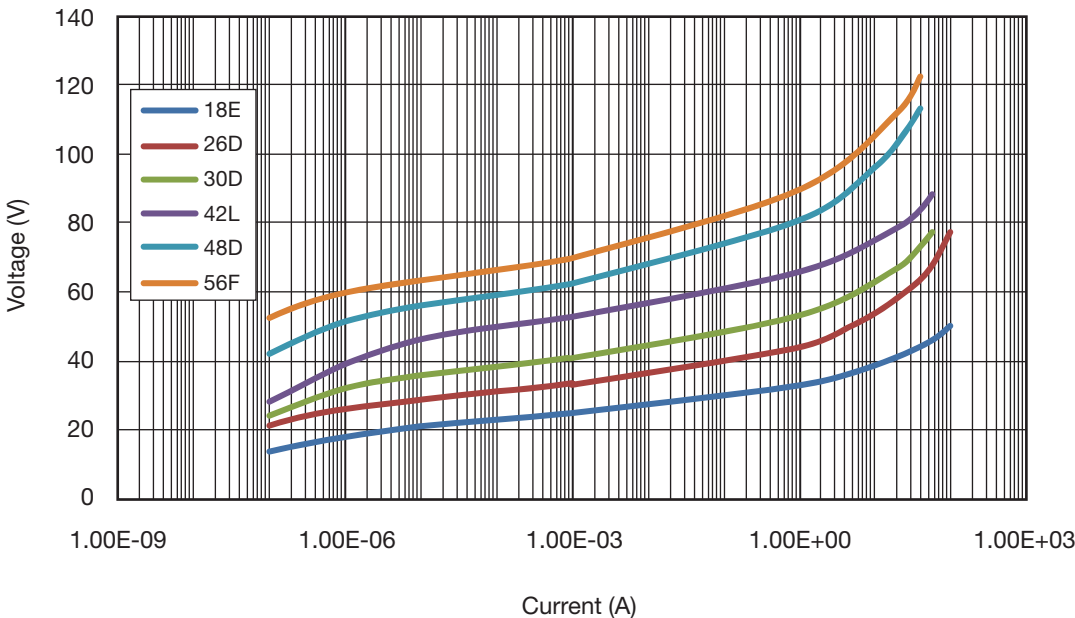
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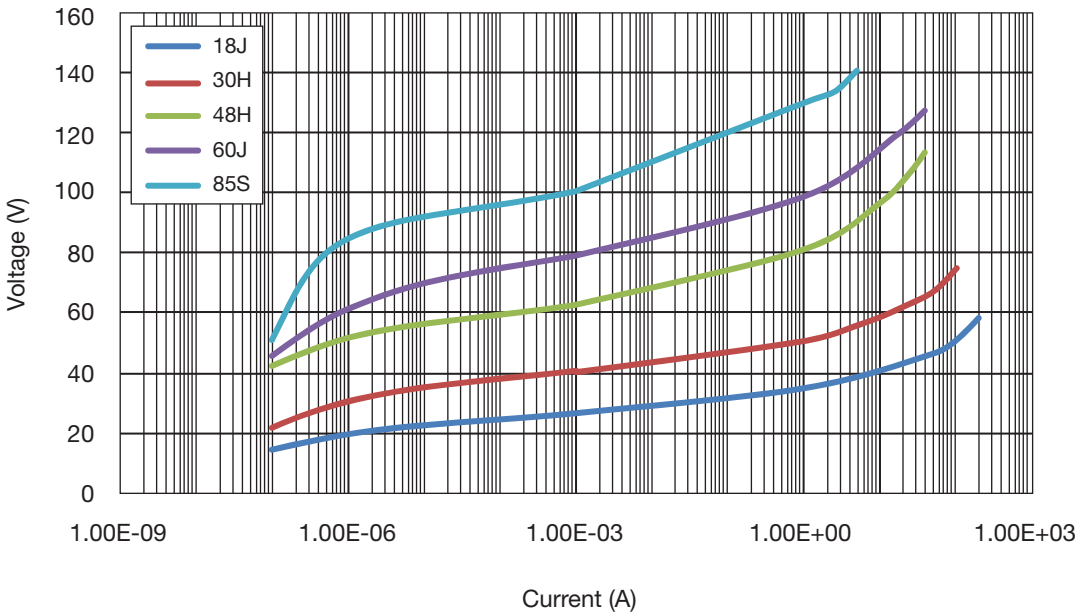
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V-I CHARACTERISTICS

1206 Case Size



1210 Case Size

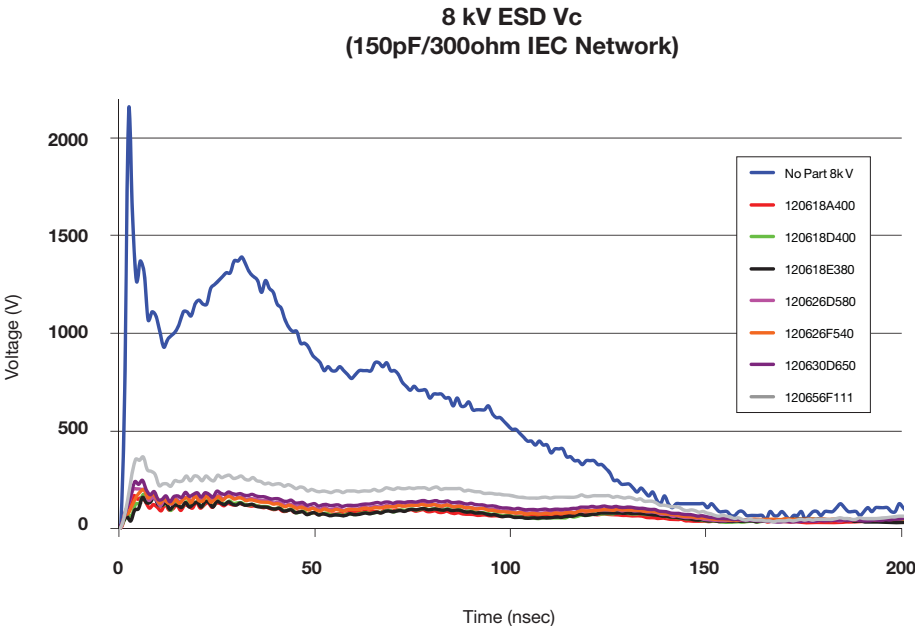


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ESD V-I CHARACTERISTICS



TYPICAL VOLTAGE AT 8 KV PULSE

8kV Pulse	Peak Voltage (V)	30ns Voltage (V)	100ns Voltage (V)
No Part (No Suppression)	2130	1370	517
120618A400	171	123	65
120618D400	177	133	66
120618E380	161	121	63
120626D580	203	155	88
120626F540	201	159	84
120630D650	249	177	106
120656F111	366	262	169

ESD 8 kV IEC 61000-4-2 150pF / 330Ω Resistor
VC060318A400

