

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.

AVX VG series parts (large case size, high energy) are glass encapsulated. These parts provide the same high reliability as traditional VC series parts. The glass encapsulation provides also enhanced resistance against harsh environment or process such as acids, salts, chlorite flux.

Operating Temperature: -55°C to +125°C

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



LEAD-FREE
LEAD-FREE COMPATIBLE
COMPONENT



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			
VC = Varistor Chip VG = Varistor Glass Encapsulated Chip		0402 0603 0805 1206 1210 1812 2220	05 = 5.6Vdc 09 = 9Vdc 12 = 12Vdc 14 = 14Vdc 16 = 16Vdc 18 = 18Vdc 26 = 26Vdc 30 = 30Vdc 31 = 31Vdc	34 = 34Vdc 38 = 38Vdc 42 = 42Vdc 45 = 45Vdc 48 = 48Vdc 56 = 56Vdc 60 = 60Vdc 85 = 85Vdc	A = 0.1J B = 0.2J C = 0.3J D = 0.4J E = 0.5J F = 0.7J H = 1.2J J = 1.5J K = 0.6J	L = 0.8J S = 1.9-2.0J X = 0.05J M = 1J N = 1.1J U = 4.0-5.0J P = 2.5-3.7J Y = 6.5-12J	150 = 18V 220 = 22V 250 = 27V 300 = 32V 380 = 38V 390 = 42V 400 = 42V 440 = 44V 540 = 54V	570 = 57V 580 = 60V 620 = 67V 650 = 67V 770 = 77V 800 = 80V 101 = 100V 111 = 110V 151 = 150V	D = 7" (1000)* R = 7" (4000)* T = 13" (10,000)* W = 13" (10,000)** 0402 only	P = Ni/Sn plated

*Not available for 0402
**Only available for 0402



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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
VGAS181216P390 __	16	11	24.5±10%	40	5	15	2.9	10	1000	7000	K	27.5	0.07
VGAS181216P400 __	16	11	24.5±10%	42	5	10	2.9	10	1000	5000	K	27.5	0.070
VGAS222016Y400 __	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
VGAS181218P440 __	18	14	27.5±10%	44	5	15	2.9	6	800	5000	K	27.5	0.05
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
VGAS181226P570 __	26	23	35.0±10%	57	5	15	3.0	8	600	3000	K	30	0.015
VGAS222026Y570 __	26	23	35±10%	57	10	15	6.8	20	1100	7000	K	30	0.030
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	30	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
VGAS181231P650 __	31	25	39.0±10%	65	5	15	3.7	8	800	2600	K	30	0.06
VCAS120634N770 __	34	30	47.0±10%	77	1	15	1.1	1.5	200	400	K	48	0.008
VGAS121034S770 __	34	30	47.0±10%	77	2.5	15	2	3.0	400	1000	K	48	0.040
VGAS181234U770 __	34	30	47.0±10%	77	5	15	5	6.1	800	1500	K	48	0.080
VGAS222034Y770 __	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	15	0.8	-	180	600	K	48	0.016
VCAS120642K900 __	42	32	56±10%	90	1	15	0.6	-	200	260	K	48	0.012
VGAS181242U900 __	42	35	56.0±10%	90	5	15	4.0	6	500	1800	K	48	0.015
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
VGAS121065P131 __	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_M]
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 Power Dissipation (W)



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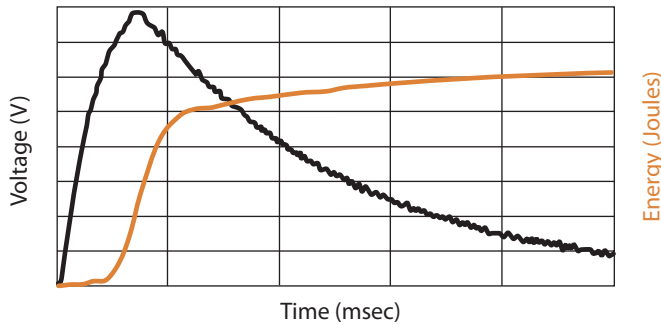
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AUTOMOTIVE SERIES – LOAD DUMP TEST

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

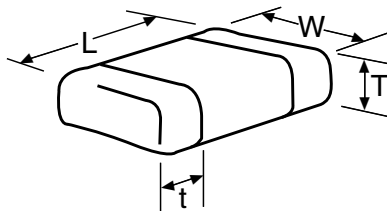
VCAS060316B400	0.5Ω	1Ω	4Ω
100ms	37	38	42
200ms	36	37	41
400ms	35	36	39
VCAS120616K380	0.5Ω	1Ω	4Ω
100ms	42	45	55
200ms	40	43	50
400ms	39	40	45
VCAS121016J390	0.5Ω	1Ω	4Ω
100ms	48	53	74
200ms	46	50	64
400ms	43	46	56
VGAS181216P400	0.5Ω	1Ω	4Ω
100ms	46	52	72
200ms	37	41	59
400ms	32	35	51
VGAS222016Y400	0.5Ω	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	1Ω	4Ω	8Ω
100ms	51	56	58
200ms	50	54	56
400ms	49	51	53
VCAS080526A580	1Ω	4Ω	8Ω
100ms	51	53	59
200ms	49	51	57
400ms	48	50	51
VCAS080526C580	1Ω	4Ω	8Ω
100ms	51	54	62
200ms	49	51	56
400ms	48	49	51
VCAS120626D580	1Ω	4Ω	8Ω
100ms	52	60	68
200ms	50	57	65
400ms	47	54	61
VCAS121026H560	1Ω	4Ω	8Ω
100ms	61	74	91
200ms	59	69	82
400ms	55	64	70
VCAS060330A650	1Ω	4Ω	8Ω
100ms	57	59	63
200ms	56	58	61
400ms	54	57	58
VCAS080530A650	1Ω	4Ω	8Ω
100ms	58	62	66
200ms	56	61	64
400ms	53	57	61
VCAS080530C650	1Ω	4Ω	8Ω
100ms	58	61	63
200ms	57	58	62
400ms	55	56	59
VCAS120630D650	1Ω	4Ω	8Ω
100ms	61	70	75
200ms	57	66	69
400ms	56	62	64
VCAS121030H620	1Ω	4Ω	8Ω
100ms	70	77	98
200ms	64	70	89
400ms	56	65	70
VGAS181234U770	1Ω	4Ω	8Ω
100ms	87	110	125
200ms	82	97	114
400ms	75	85	95
VGAS222034Y770	1Ω	4Ω	8Ω
100ms	100	125	165
200ms	91	115	155
400ms	84	104	120

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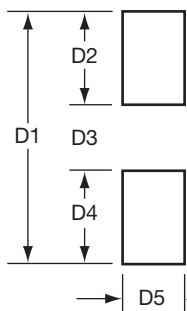


DIMENSIONS: mm (inches)

AVX Style		0402	0603	0805	1206	1210	1812	2220
(L) Length	mm (in.)	1.00±0.10 (0.040±0.004)	1.60±0.15 (0.063±0.006)	2.01±0.20 (0.079±0.008)	3.20±0.20 (0.126±0.008)	3.20±0.20 (0.126±0.008)	4.50±0.30 (0.177±0.012)	5.70±0.40 (0.224±0.016)
(W) Width	mm (in.)	0.50±0.10 (0.020±0.004)	0.80±0.15 (0.031±0.006)	1.25±0.20 (0.049±0.008)	1.60±0.20 (0.063±0.008)	2.49±0.20 (0.098±0.008)	3.20±0.30 (0.126±0.012)	5.00±0.40 (0.197±0.016)
(T) Max Thickness	mm (in.)	0.6 (0.024)	0.9 (0.035)	1.02 (0.040)	1.02 (0.040) 1.70 (0.067) ¹⁾ 1.80 (0.071) ²⁾	1.70 (0.067)	2.00 (0.080)	2.50 (0.098)
(t) Land Length	mm (in.)	0.25±0.15 (0.010±0.006)	0.35±0.15 (0.014±0.006)	0.71 max. (0.028 max.)	0.94 max. (0.037 max.)	1.14 max. (0.045 max.)	1.00 max. (0.039 max.)	1.00 max. (0.039 max.)

1) Applicable for: VCAS120618E380, VCAS120626F540, VCAS120631M650, VCAS120634N770, VCAS120642L800, VCAS120645K900, VCAS120656F111

2) Applicable for: VCAS120642L800, VCAS120660M131



SOLDERING PAD: mm (inches)

Pad Layout	0402	0603	0805	1206	1210	1812	2220
D1	1.70 (0.067)	2.54 (0.100)	3.05 (0.120)	4.06 (0.160)	4.06 (0.160)	5.60 (0.220)	6.60 (0.26)
D2	1.61 (0.024)	0.89 (0.035)	1.02 (0.040)	1.02 (0.040)	1.02 (0.040)	1.00 (0.039)	1.00 (0.039)
D3	1.51 (0.020)	0.76 (0.030)	1.02 (0.040)	2.03 (0.080)	2.03 (0.080)	3.60 (0.142)	4.60 (0.18)
D4	1.61 (0.024)	0.89 (0.035)	1.02 (0.040)	1.02 (0.040)	1.02 (0.040)	1.00 (0.039)	1.00 (0.039)
D5	1.51 (0.020)	0.76 (0.030)	1.27 (0.050)	1.65 (0.065)	2.54 (0.100)	3.00 (0.118)	5.00 (0.20)

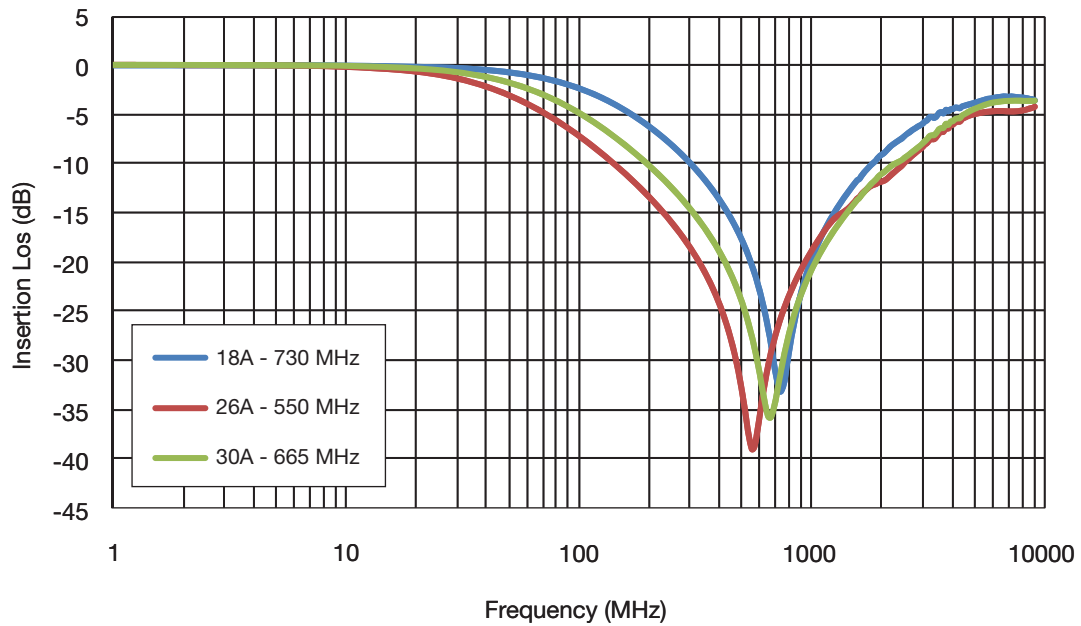
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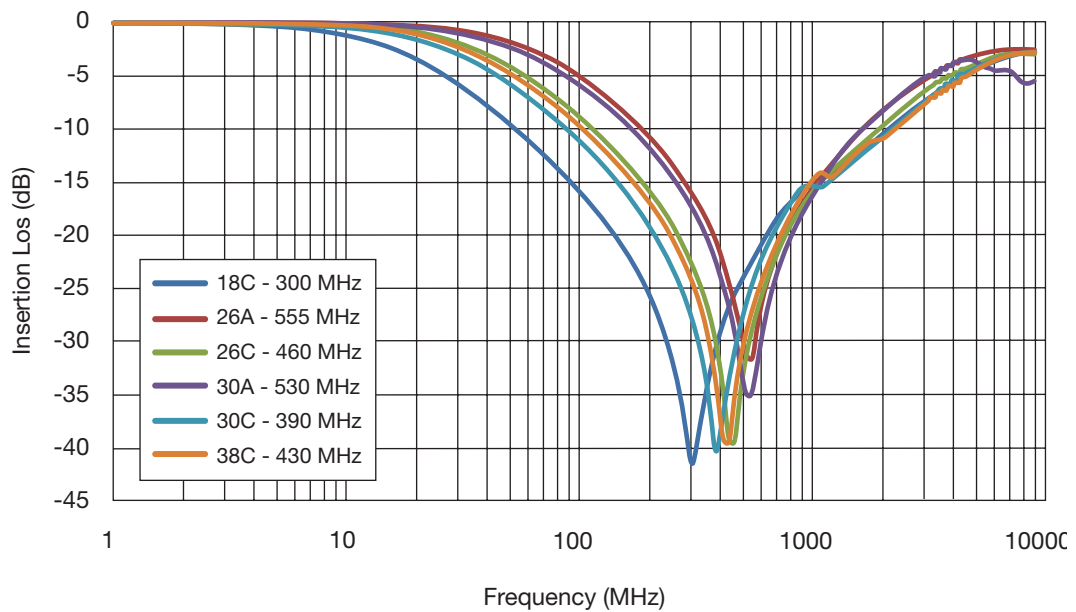


FORWARD TRANSMISSION CHARACTERISTICS (S21)

0603 Case Size



0805 Case Size



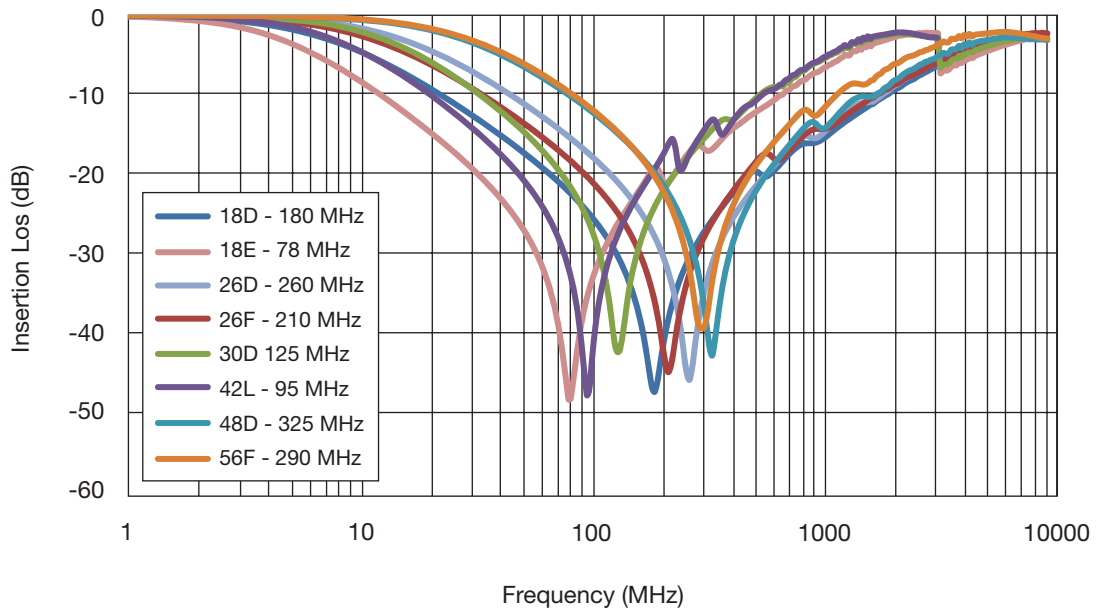
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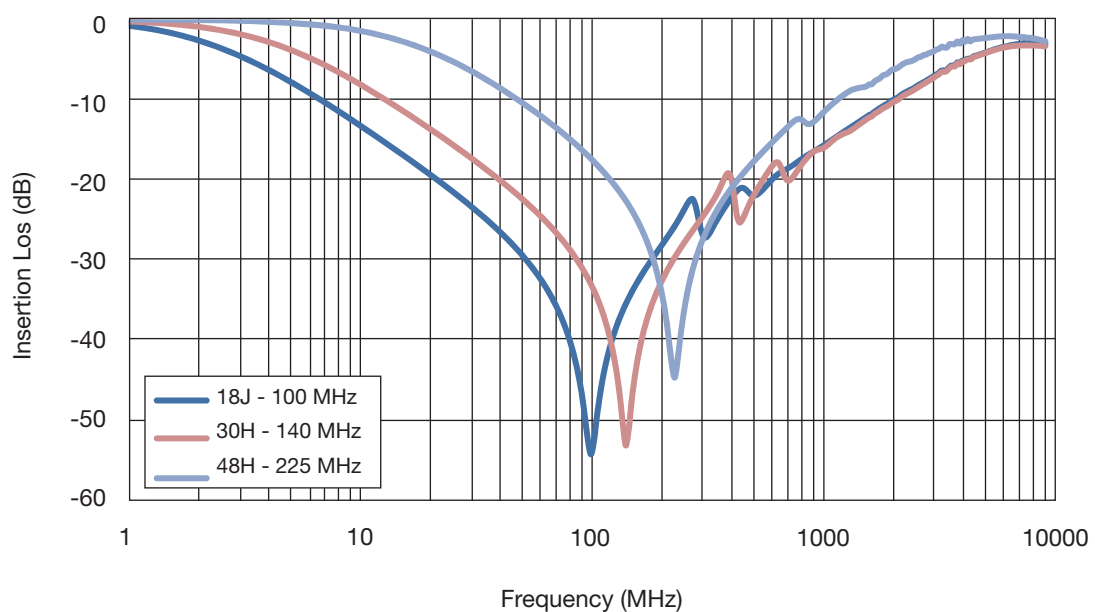


FORWARD TRANSMISSION CHARACTERISTICS (S21)

1206 Case Size



1210 Case Size



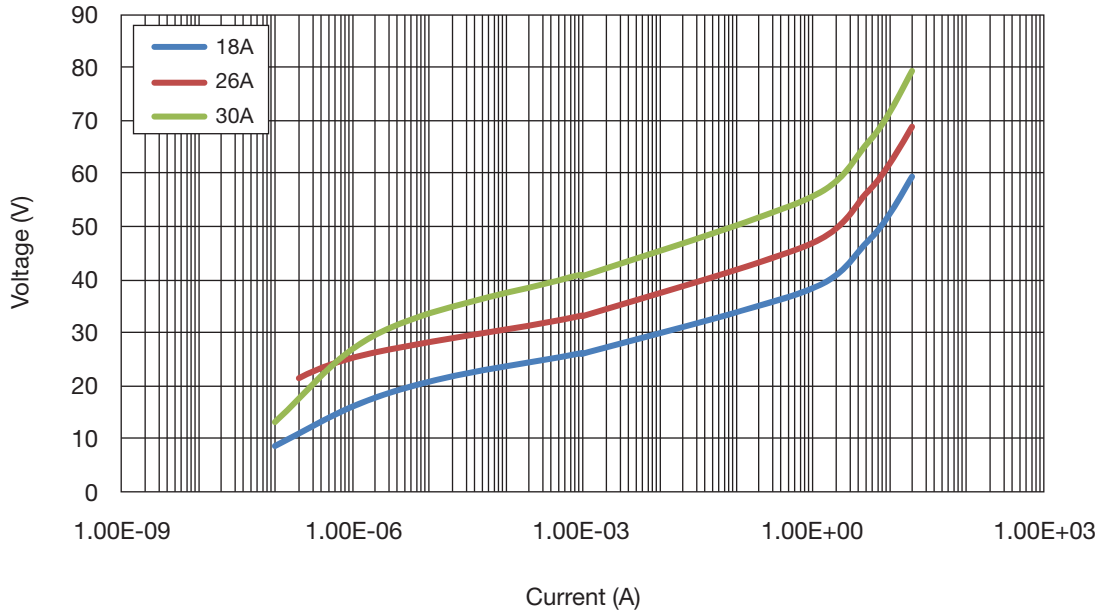
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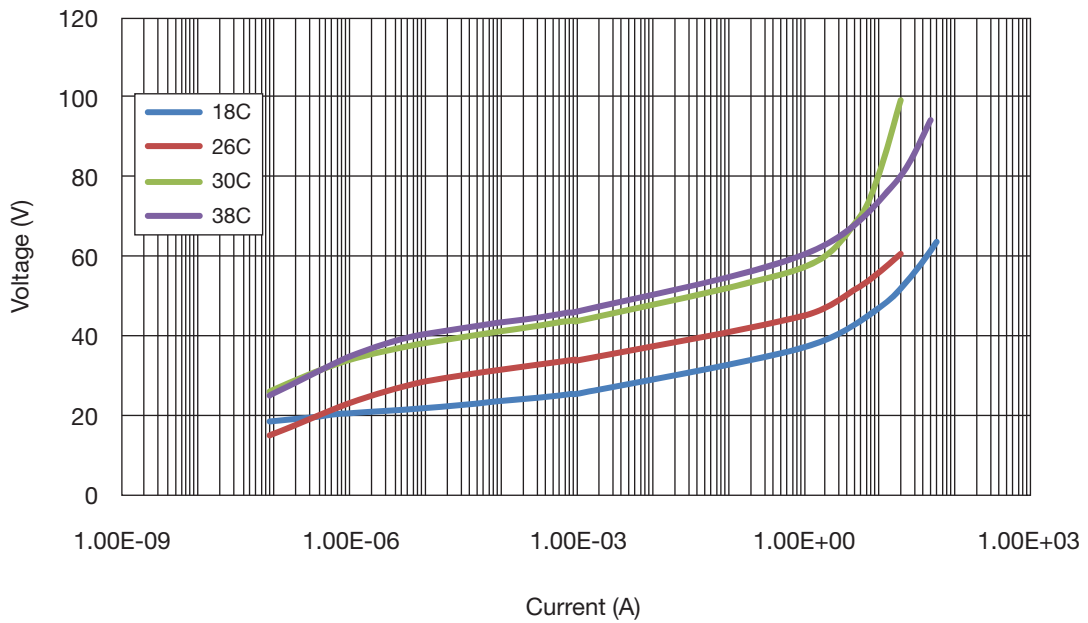


V-I CHARACTERISTICS

0603 Case Size



0805 Case Size



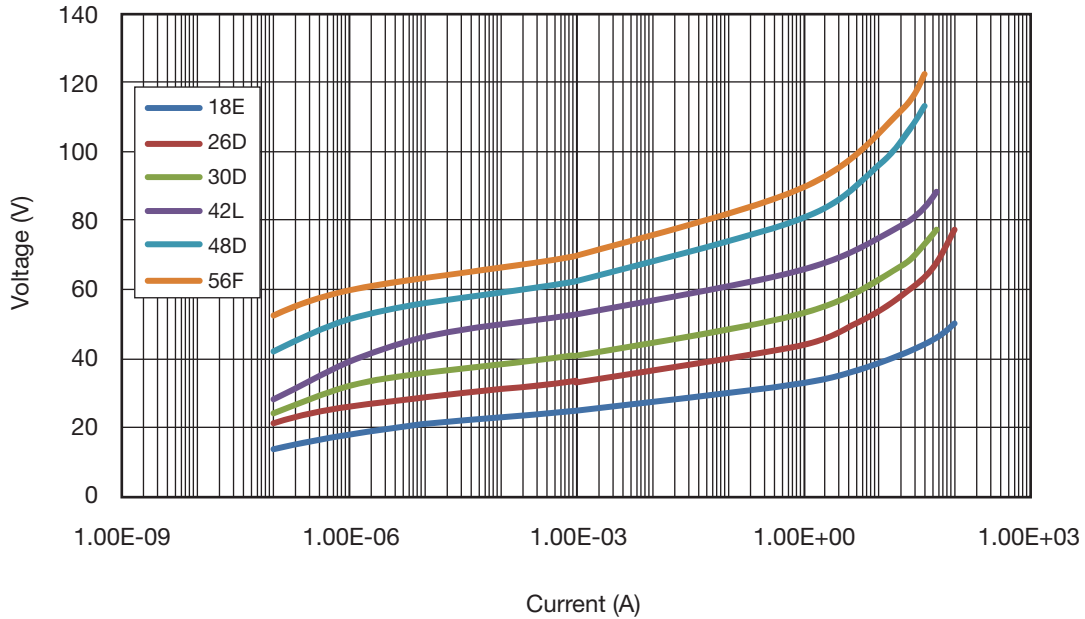
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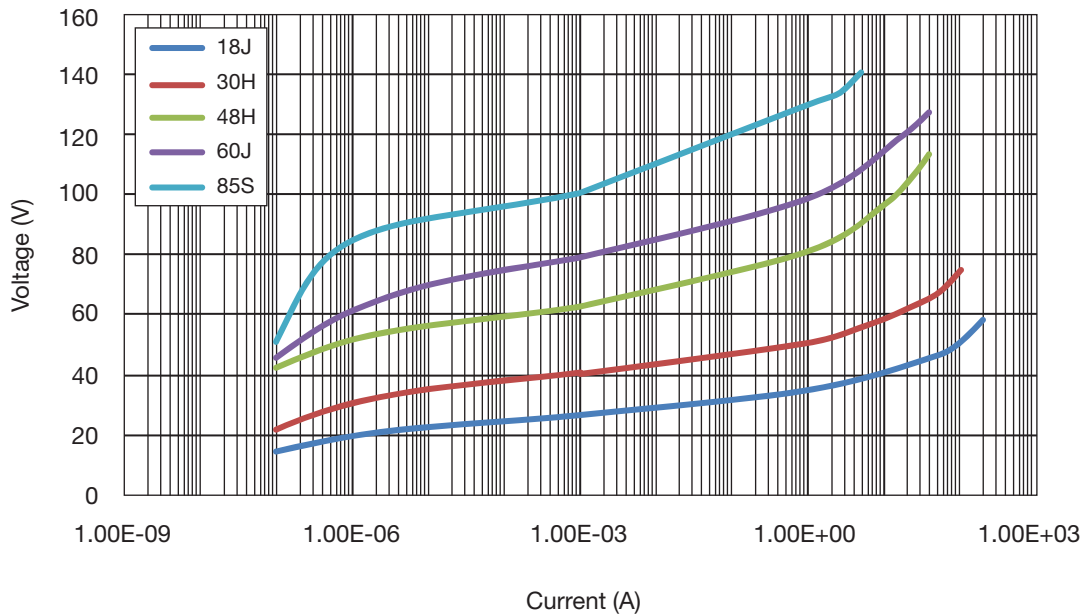


V-I CHARACTERISTICS

1206 Case Size



1210 Case Size



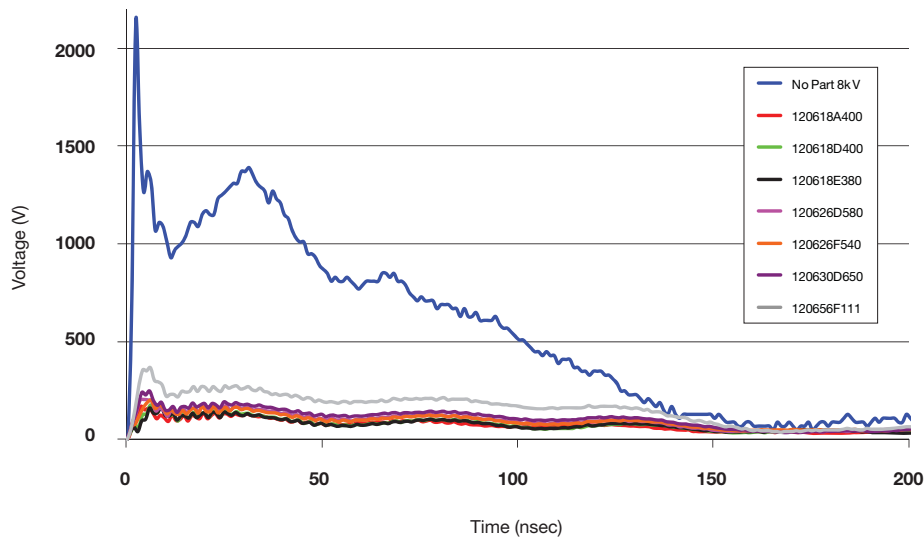
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ESD V-I CHARACTERISTICS

8 kV ESD V_c
(150pF/300ohm IEC Network)



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
102626F540	201	159	84
120630D650	249	177	106
120656F111	366	262	169

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

