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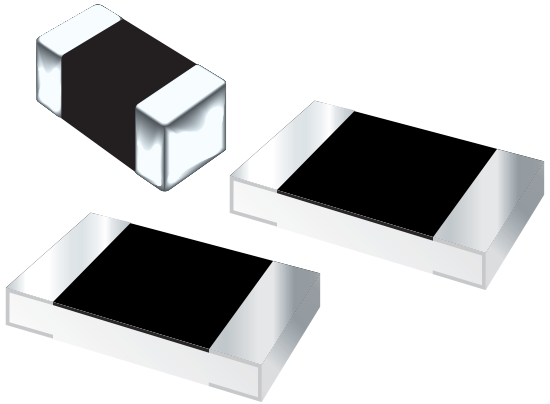
Reliable Electronic Solutions

ChipGuard®

Family of ESD Clamp Protectors



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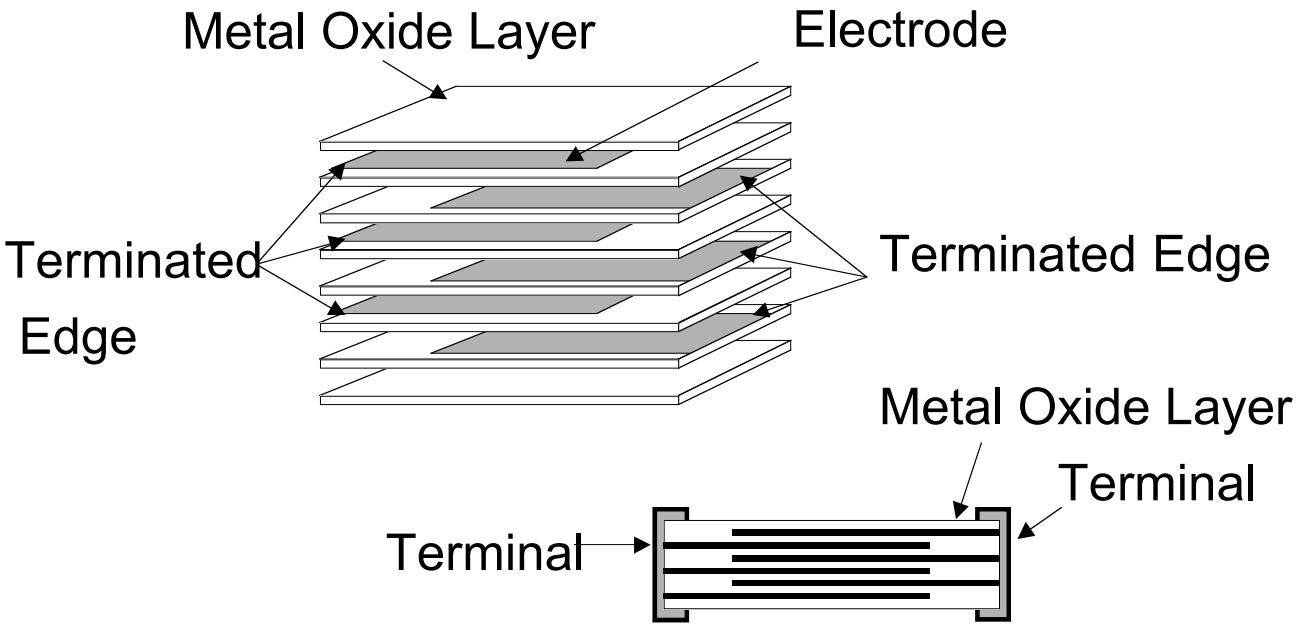
Construction of Multilayer Chip



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What is ESD?

- ESD is an abbreviation for Electrostatic Discharge.
  - ESD is the transfer of electrical charge between two surfaces of unequal potential.
  - ESD, although not harmful to humans, can be damaging to sensitive electronic components.

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ESD Standards

- Human Body Model
  - **IEC61000-4-2**
  - ANSI C63.16
  - MIL-STD-883E
  - ESDA STM5.1
  - JEDEC EIA / JESD22-A114-B
  - AEC-Q100-002
- Charged Device Models
  - ESDA STM5.3
  - JEDEC EIA/ JESD22-C101-B
  - AEC-Q100-011
- Machine Models
  - ESDA STM5.2
  - JEDEC EIA/ JESD22-A115
  - AEC-Q100-003

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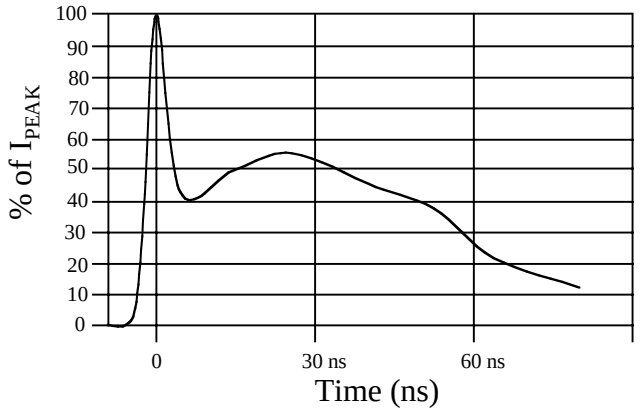
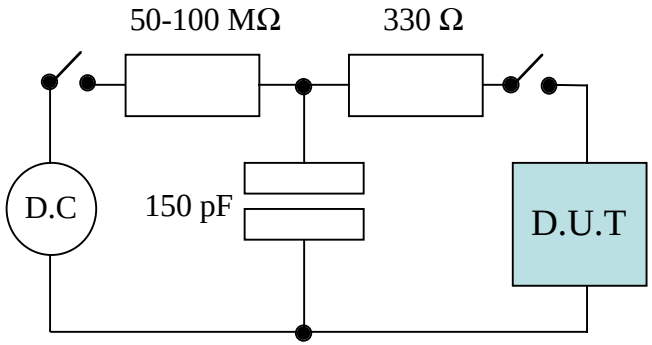
ESD Standards





IEC61000-4-2 Level	Contact Voltage (kV)	Air Discharge Voltage (kV)	Peak Contact Current (A)	Contact Current @ 30 ns (A)	Contact Current @ 60 ns (A)
Level 1	2	2	7.5	4	2
Level 2	4	4	15	8	4
Level 3	6	8	22.5	12	6
Level 4	**8**	**15**	**30**	**16**	**8**

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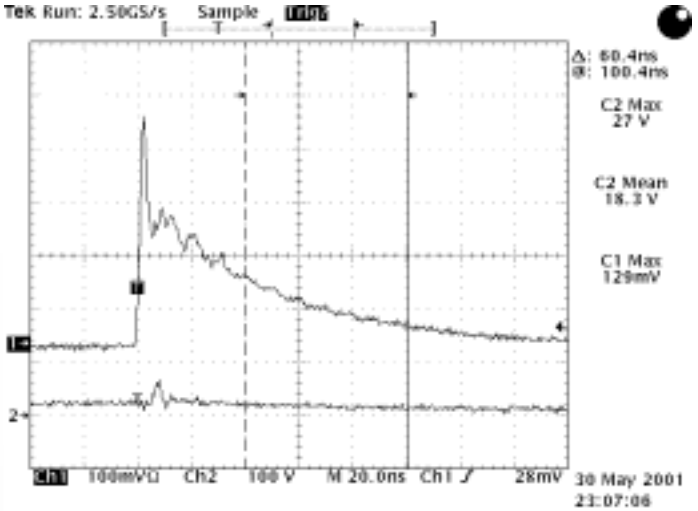
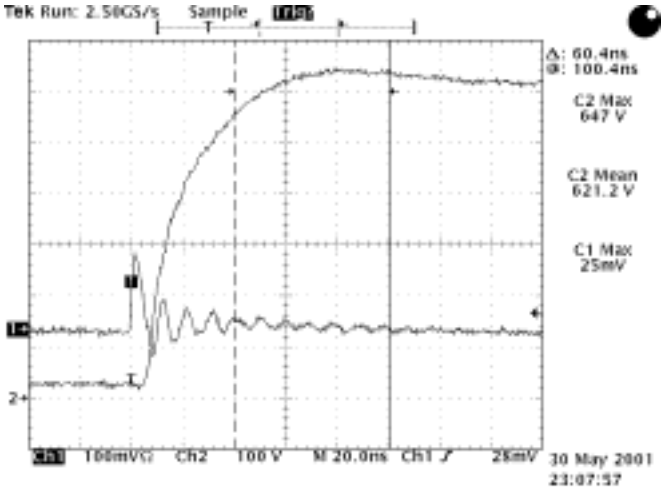
Protection Qualities

CG0603MLC-12
- ESD source : 1 kV
- 1= I curve, 2= V curve
- V_{max} = 27 V



Without ESD Protection
- ESD source : 1 kV
- 1= I curve, 2= V curve
- V_{max} = 647 V



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Key ESD Parameters

- These characteristics are important when selecting ESD protection:
  - Working Voltage
  - Capacitance
  - Leakage Current
  - Clamping Voltage
  - Response Time
  - Impulse to Standards Capability

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ESD Overvoltage Protection

- Three new MLV (Multilayer Varistor) families released:

MLA

- CG0402MLA-xx
- CG0603MLA-xx

MLE

- CG0402MLE-18
- CG0603MLE-18

MLC

- CG0603MLC-xx

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MLA Series Varistors

- Excellent Clamping Ratio.
- High transient (8/20 µs) current capability of 20 A (0402) and 30 A (0603).
- 5.5 V working voltage capability.
- Quick response time of less than 1 ns.
- Voltage clamp specification to 8/20 µs waveform.
- Compact 0402 package size available.

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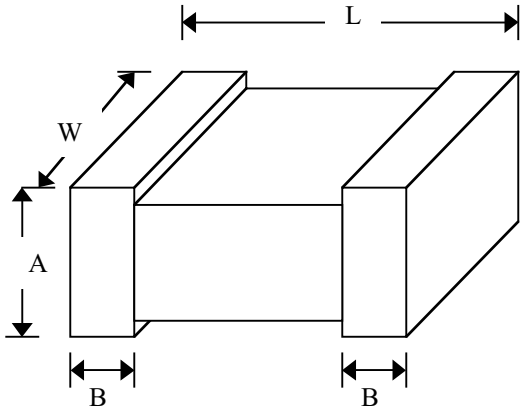
MLA Key Parameters

Model	Vrms (V)	V_{DC} (V)	V_N Min. (V)	V_N Max. (V)	V_C (V)	I_{TM} (Max.) (A)	W_{TM} (Max.) (J)	C_P (pF) Typ.
	<50 µA		1 mA DC		1 A @ 8/20 µs	@ 8/20 µs	10/1000 µs	1 Vrms @1MHz
CG0402MLA-5.5MG	4	5.5	6.4	9.6	19	20	0.05	300
CG0402MLA-14KG	11	14	16.2	19.8	38	20	0.05	100
CG0402MLA-18KG	14	18	19.8	24.2	45	20	0.05	95
CG0603MLA-5.5ME	4	5.5	6.4	9.6	19	30	0.1	300
CG0603MLA-14KE	11	14	16.2	19.8	35	30	0.1	160
CG0603MLA-18KE	14	18	19.8	24.2	40	30	0.1	140

Standard	IEC 61000-4-2 Level 4			Response time	<1 ns
T_A	Operating temperature	-55 +125	°C		
T_{stg}	Storage temperature	-55 +125	°C		



	0603	0402
L	1.60 ± 0.20 (0.064 ± 0.008)	1.00 ± 0.15 (0.04 ± 0.006)
W	0.80 ± 0.20 (0.032 ± 0.008)	0.50 ± 0.10 (0.02 ± 0.004)
A	0.80 ± 0.20 (0.032 ± 0.008)	0.50 ± 0.10 (0.02 ± 0.004)
B	0.30 ± 0.20 (0.012 ± 0.008)	0.25 ± 0.15 (0.012 ± 0.006)

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MLA Series Varistors

- Applications:
  - General ESD protection applications
    - Transient Power Supply Protection for ICs and Transistors
    - Digital and Signal Control Lines in Cellular Phones, PCs, HDDs, PDAs, etc.
  - Automotive Electronics protection

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Reliable Electronic Solutions

MLA Competition Analysis

Littelfuse

Multilayer Transient Voltage Surge Suppressors

Bourns P/N	Littlefuse P/N	VDC	VDC	ITM		WTM		VC		VNDC (min)		VNDC (max)		Cp	
CG0402MLA-5.5	V5.5MLA0402	5.5	5.5	20	20	0.05	0.05	19	16	6.4	7.1	9.6	9.3	300	220
CG0402MLA-14	V14MLA0402	14	14	20	20	0.05	0.05	38	30	16.2	15.9	19.8	20.3	100	70
CG0402MLA-18	V18MLA0402	18	18	20	20	0.05	0.05	45	40	19.8	22	24.2	28	95	40
CG0603MLA-5.5	V5.5MLA0603	5.5	5.5	30	30	0.1	0.1	19	16	6.4	7.1	9.6	9.3	300	660

AVX

Bourns P/N	AVX P/N	VDC	VDC	ITM		WTM		VC		VNDC (min)		VNDC (max)		Cp	
CG0402MLA-5.5	VC040205X150	5.5	5.6	20	20	0.05	0.05	19	16	6.4	7.6	9.6	9.3	300	360
CG0402MLA-14	VC040214X300	14	14	20	20	0.05	0.05	38	30	16.2	16.5	19.8	20.3	100	120
CG0402MLA-18	VC040218X400	18	18	20	20	0.05	0.05	45	40	19.8	22.9	24.2	28	95	90
CG0603MLA-5.5	VC060305A150	5.5	5.6	30	30	0.1	0.1	19	16	6.4	7.6	9.6	9.3	300	825
CG0603MLA-14	VC060314A300	14	14	30	30	0.1	0.1	35	30	16.2	16.5	19.8	20.3	160	424
CG0603MLA-18	VC060318A400	18	18	30	30	0.1	0.1	40	40	19.8	22.9	24.2	28	140	225

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MLE Series

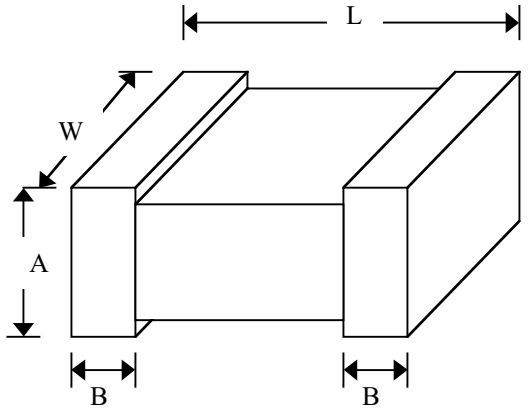
- Low capacitance of 40 pF ±10 pF.
- High 8/20 μs transient current capability.
- Clamping ratio specified at 8 kV contact & 15 kV air discharge tests.
- 18 V max working voltage capability.
- Quick response time of less than 1 ns.
- Compact 0402 package size available.

BOURNS®
Reliable Electronic Solutions

MLE Key Parameters

Continuous Operating Voltage			Clamping Voltage			Off-state Current					Capacitance
Vrms (V)	V_{DC} (V)		V_{CLAMP} (V)			I_L (µA)					C_P (pF)
Max	Typ	Max	Typical			Maximum					Maximum
			8 kV Contact	15 kV Air	1 A @ 8/20 µs	3.5 V	5.5 V	9 V	12 V	18 V	1 Vrms @1MHz
8.5	12	18	100	120	50	0.3	0.4	0.5	1	10	9
8.5	12	18	40	60	60	0.3	0.4	0.5	1	10	50

IEC 61000-4-2 Level 4			Response Time	<1 ns
Operating temperature	-55 +125	°C		
Storage temperature	-55 +125	°C		



	0603	0402
L	1.60 ± 0.20 (0.064 ± 0.008)	1.00 ± 0.15 (0.04 ± 0.006)
W	0.80 ± 0.20 (0.032 ± 0.008)	0.50 ± 0.10 (0.02 ± 0.004)
A	0.80 ± 0.20 (0.032 ± 0.008)	0.50 ± 0.10 (0.02 ± 0.004)
B	0.30 ± 0.20 (0.012 ± 0.008)	0.25 ± 0.15 (0.012 ± 0.006)

ChipGuard®

BOURNS®
Reliable Electronic Solutions

MLE Series

- Applications:
  - High speed protection applications
    - Set-top boxes
    - Data transmission lines
      - LANs (Local Area Networks)
      - Ethernet
      - RS232 & RS485, etc.

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Reliable Electronic Solutions

MLE Competition Analysis

- Littelfuse

Multilayer Transient Voltage Surge Suppressors

Part No	VDC	VC			Cp	IL		
		8kV	15kV	8/20us 1A	(pF)	3.5 V	5.5 V	18 V
CG0404MLE-18G	18	100	120	50	7 typ	0.3	0.4	10
V0402MHS12	18	125	160	55	12 typ	0.1	0.15	
V18MLE0402	18	125	160	50	40 typ	0.1	0.3	10
CG0603MLE-18E	18	40	60	60	50 max	0.3	0.4	10
V18MLE0603	18	75	85	50	100 max	0.1	0.3	25
V18MLE0603L	18	100	140	50	60 max	0.1	0.3	25

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MLC Series

- Ultra-low capacitance of 0.50 pF maximum.
- IEC61000-4-2 level 4 ESD specifications.
- Guaranteed ESD repetitions at 8 kV contact &15 kV air discharge tests.
- Excellent clamp voltages under 8 kV tests.
- Quick response time of less than 1 ns.

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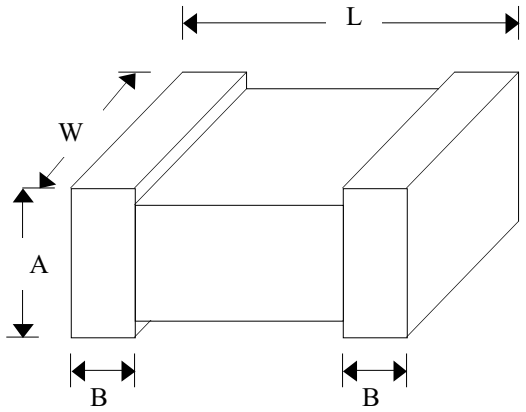
MLC Key Parameters

Part No	Continuous Operating Voltage		Clamping Voltage		Off-state Current	Trigger Voltage	Response Time	Capacitance
	V_{DC} (V)		V_{CLAMP} (V)		I_L (nA)	V_T (V)	T_d (ns)	C_{OFF} (pF)
	Typ	Max	Typ	Max	Max	Typ	Max	Max
CG0603MLC-05	5	6	20	35	50	150	1	0.5
CG0603MLC-12	12		30	50	50	150	1	0.5

Standard	IEC 61000-4-2 Level 4		
T_A	Operating temperature	-55 to +85	°C
T_{stg}	Storage temperature	-55 to +85	°C



	0603
L	1.60 ± 0.20 (0.064 ± 0.008)
W	0.80 ± 0.20 (0.032 ± 0.008)
A	0.80 ± 0.20 (0.032 ± 0.008)
B	0.30 ± 0.20 (0.012 ± 0.008)

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MLC Series

- Applications:
  - High speed data / communication ports
    - USB 2.0
    - IEEE1394
  - Mobile phone antenna protection

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MLC Competition Analysis

- Cooper
  - Replacement to SurgX® series.
- Littelfuse
  - Similar to PulseGuard™ PGB series.

Supplier	Part No	VDC	VC @ 8kV		Vtrig	Cp		IL @ 12V	
			Typ.	Max.		Typ.	Max.	Min.	Typ.
Bourns	CG0603MLC-05E	12	30	50	125	0.2	1		0.01
Littelfuse	PGB0010603	24	150		1000	0.05			
Cooper	0603ESDA-TR1	14	35	60	125	0.15	1	0.01	0.1

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Other Potential ESD Competition

- Epcos (Siemens)
- Others
  - Amotech
  - Innochip
  - Ceratech
  - Walsin (Sincera)
  - EXPAN

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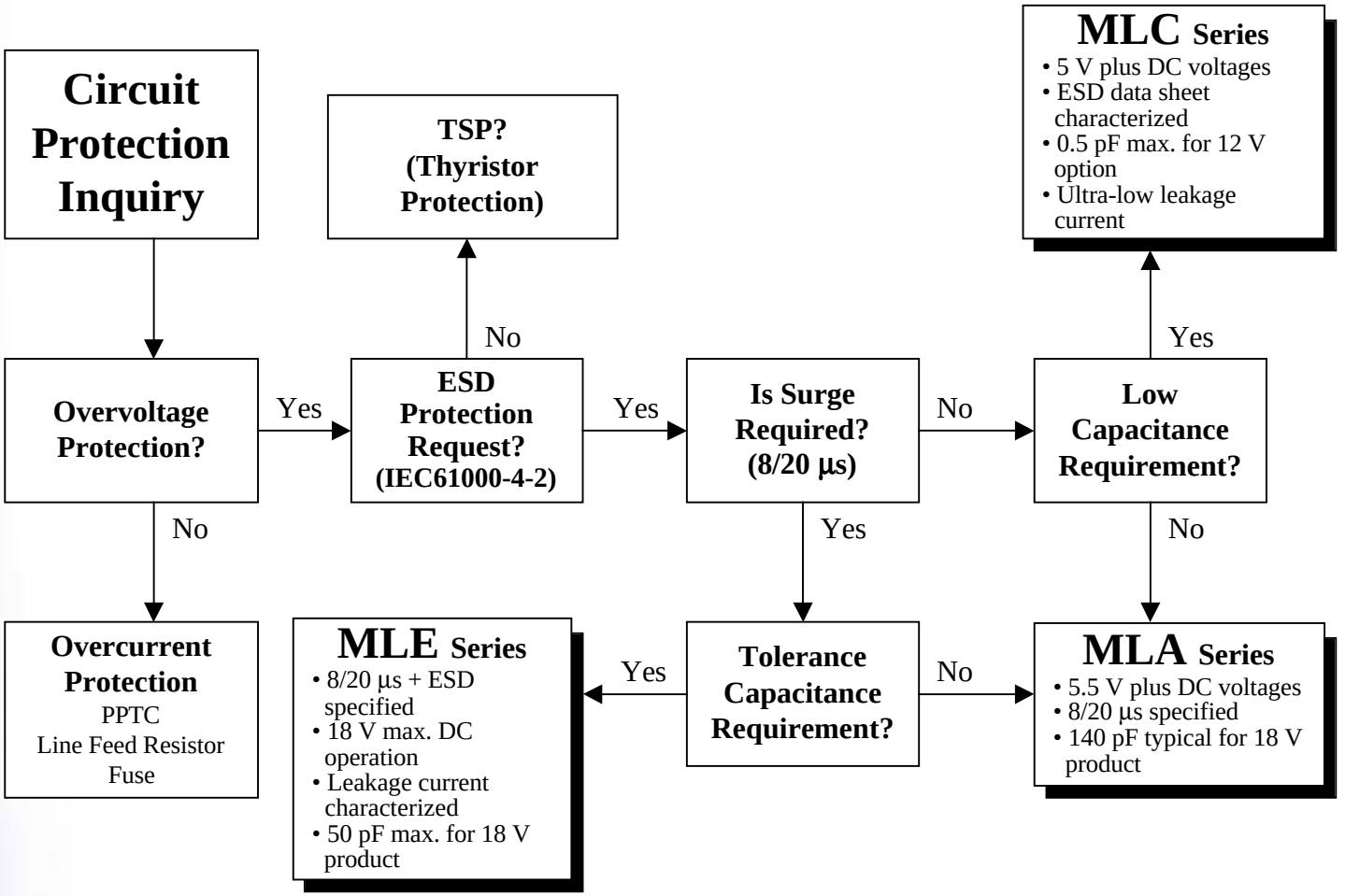
Which Family to Select?



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