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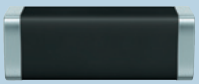

Multilayer Varistors (MLVs)

for ESD and High Energy Transient Protection in Automotive Applications

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What are multilayer varistors (MLVs)?

- MLVs are multilayer semiconductor ceramic components for ESD protection of safety-relevant data lines and bus systems and for high-energy transient protection (e.g. load dump and jump start) in automotive electronic devices.
- MLVs can replace semiconductor diodes.

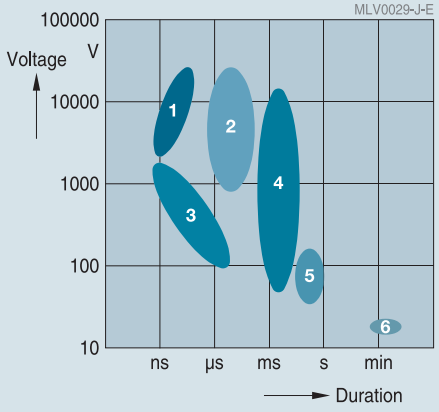
Benefits for customer applications

- Bidirectional protection for ESD and high energy transients
- Low capacitance types for bus systems
- Use of parasitic capacitance for RFI suppression and RF filtering (replacement of additional MLCC)
- High signal integrity due to low non-linearity → no signal distortion
- Use at temperatures up to 150 °C
- No temperature derating up to 125 °C/150 °C (depending on type)
- High energy handling capability
- Low parasitic inductance
- Low leakage current
- Fast response time < 0.5 ns

Qualification

- Reliability based on AEC-Q200, Rev. C
- ESD protection according to IEC61000-4-2 and ISO10605
- Jump start and load dump protection to ISO7637

Overview of transient overvoltages



1. Electrostatic discharge (ESD)
2. Surge (high energy transients µs)
3. Burst (fast transient single pulse ns)
4. Switched inductive loads
5. Load dump
6. Jump start

Selection Guide

Typical requirements for automotive applications

ESD protection.
Typical applications: Bus systems, car infotainment. Typical case sizes: 0603, 0805

- ESD specification (e.g. IEC, ISO, AEC, JEDEC, HBM, customer specification)
- Type of bus system (e.g. LIN, CAN, FlexRay) defines capacitance requirement on protection device
  - Special capacitance range (controlled capacitance, low capacitance, high-speed)
  - Enhanced temperature requirement (150 °C)
    - High temperature (HT) range

Load dump/jump start protection.
Typical application: battery line. Typical case sizes: 1210, 2220

- Load dump / jump start requirements (e.g. ISO 7637)
- Additional requirements (e.g. centralized or module protection)
  - AUTO range
  - Enhanced temperature requirement (150 °C)
    - AUTO high temperature range

Transient voltage/RFI suppression.
Typical application: DC motors. Typical case sizes: SR1 (1812), SR2 (2220), SR6 (1206)

- RFI suppression requirements:
  Noise suppression level (e.g. VDE 0879, part 3), capacitance value, frequency range
- Additional requirements (e.g. load dump, jump start, ISO 7637, JASO)
- Leaded transient voltage / RFI suppressors (SHCV) [1)]

Surge current protection.
Typical application: motors. Typical case sizes: 3225, 4032

- Additional requirements (e.g. load dump, jump start)
- SMD disk varistors AUTO range (CU AUTO) [1)]

[1)] For samples or further information please contact your EPCOS sales office.

Product Range

Electrical parameters of parts in the sample kit

Case size	EPCOS type	V_{DC} [V]	$I_{surge,\,max}$ @ 8/20 µs [A]	W_{max} @ 2 ms [mJ]	W_{LD} @ 10 pulses [J]	$P_{diss,\,max}$ [mW]	V_V @ 1 mA*) [V]	V_{jump} @ 5 min. [V]	$V_{clamp,\,max}$ [V]	I_{clamp} @ 8/20 µs [A]	C_{typ} [pF]	C_{max} [pF]
AUTO range												
0805	CT0805S14BAUTOG	16	120	300	1	8	22	24.5	42	1.0	400	–
1206	CT1206K20AUTOG	26	200	700	1.5	8	33	27.0	54	1.0	600	–
1210	CT1210S14BAUTOG	16	400	1600	3	10	22	24.5	40	2.5	1700	–
1210	CT1210K17AUTOG	22	400	1700	3	10	27	26.5	44	2.5	1800	–
1210	CT1210K20AUTOG	26	400	1900	3	10	33	27.0	54	2.5	1500	–
1210	CT1210K25AUTOG	31	300	1700	3	10	39	29.0	65	2.5	1200	–
2220	CN2220S14BAUTOGK2	16	1200	5800	12	30	22	24.5	40	10.0	9500	–
2220	CN2220S14BAUTOE2G2K2	16	1200	5800	25	30	22	24.5	40	10.0	15000	–
2220	CN2220K30AUTOE2G2K2	34	1200	12000	25	30	47	45.0	77	10.0	10000	–
Standard and special capacitance range												
0603	CT0603K25G	31	30	300	–	3	39	–	67	1	90	–
0805	CT0805K25G	31	80	300	–	5	39	–	67	1	250	–
0603	CT0603K17LCG	22	10	100	–	1	27	–	50	1	–	50.0
0603	CT0603S17BCCG	22	30	75	–	3	25	–	50	1	–	74.2
0603	CT0603S17ALCG	22	30	75	–	3	25	–	50	1	–	75.0
0603	CT0603K14G	18	30	200	–	3	22	–	40	1	100	–
0603	CT0603S14AHSG	16	5	30	–	3	23	–	66	1	15	30.0
0603	CT0603L25HSG	32	5	–	–		51.9	–	120	1	10	15.0
AUTO high temperature range												
0603	CN0603S14BHTG2	18	30	200	–	3	22	–	42	1	120	–

*) Tolerances see data sheet on CD-ROM

Components

CT0805 S14BAUTOG	CT1206 K20AUTOG	CT1210 S14BAUTOG	CT1210 K17AUTOG	CT1210 K20AUTOG	CT1210 K25AUTOG	CN2220S14 BAUTOGK2	CN2220S14 BAUTOE2G2K2	CN2220K30 AUTOE2G2K2

CT0603 K25G	CT0805 K25G	CT0603 K17LCG	CT0603 S17BCCG	CT0603 S17ALCG	CT0603 K14G	CT0603 S14AHSG	CT0603 L25HSG	CN0603 S14BHTG2

Application Matrix for High-Runner Types

Application examples	Power windows	Mirror controls	Central door looking	Sun roofs	Rain sensors	Windshield wipers	Seat adjustment	Airbag	Car radio	Power train	Electronic acceleration	ABS	ESP	Gearbox	Drive and chassis control	Brake by wire	Steer by wire	Shift by wire	Entertainment	Navigation	Video
AUTO range: Load dump/jump start suppression (centralized or on module)																					
CT0805S14BAUTOG							x	x		x	x	x	x	x	x	x	x				
CT0805K25AUTOG							x	x		x	x	x	x	x	x	x	x				
CT1206S14BAUTOG							x	x		x	x	x	x	x	x	x	x				
CT1206K25AUTOG							x	x		x	x	x	x	x	x	x	x				
CT1210S14BAUTOG							x	x		x	x	x	x	x	x	x	x				
CT1210K25AUTOG							x	x		x	x	x	x	x	x	x	x				
CN1812S14BAUTOG							x	x		x	x	x	x	x	x	x	x				
CN1812S14BAUTOE2G2							x	x		x	x	x	x	x	x	x	x				
CN2220S14BAUTOGK2							x	x		x	x	x	x	x	x	x	x				
CN2220S14BAUTOE2G2K2							x	x		x	x	x	x	x	x	x	x				
CN2220K30AUTOGK2							x	x		x	x	x	x	x	x	x	x				
CN2220K30AUTOE2G2K2							x	x		x	x	x	x	x	x	x	x				
Standard and special capacitance range: ESD protection and filtering in bus systems and datalines																					
Bus system	LIN						CAN class A/B			CAN class C						Flex Ray			MOST		
Data rate	20 kbit/s						10 to 100 kbit/s			100 kbit/s to 1 Mbit/s						10 Mbit/s			25 Mbit/s		
CT0603K25G	x	x	x	x	x	x	x	x	x												
CT0805K25G	x	x	x	x	x	x	x	x	x												
CT0603K17LCG	x	x	x	x	x	x	x	x	x												
CT0603S17BCCG	x	x	x	x	x	x	x	x	x												
CT0603S20ACCG	x	x	x	x	x	x	x	x	x												
CT0603S17ALCG	x	x	x	x	x	x	x	x	x												
CT0805K17LCG	x	x	x	x	x	x	x	x	x												
CT0603K14G	x	x	x	x	x	x	x	x	x												
CT0603S14AHSG										x	x	x	x	x	x	x	x	x	x	x	x
CT0603L25HSG										x	x	x	x	x	x	x	x	x	x	x	x
AUTO high temperature range: ESD protection in bus systems and overvoltage protection in high-temperature applications (hybrid systems)																					
Bus system	LIN						CAN class A/B			CAN class C						Flex Ray			MOST		
Data rate	20 kbit/s						10 to 100 kbit/s			100 kbit/s to 1 Mbit/s						10 Mbit/s			25 Mbit/s		
CN0603S14BHTG2							x	x	x												
CN0603S17BHTG							x	x	x												

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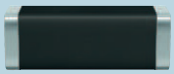

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1. Data sheet 2. General information 3. PSpice model 4. Presentation

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