# TVS Products

Industry leading circuit protection solutions to
safeguard data interfaces from ESD and surge transients
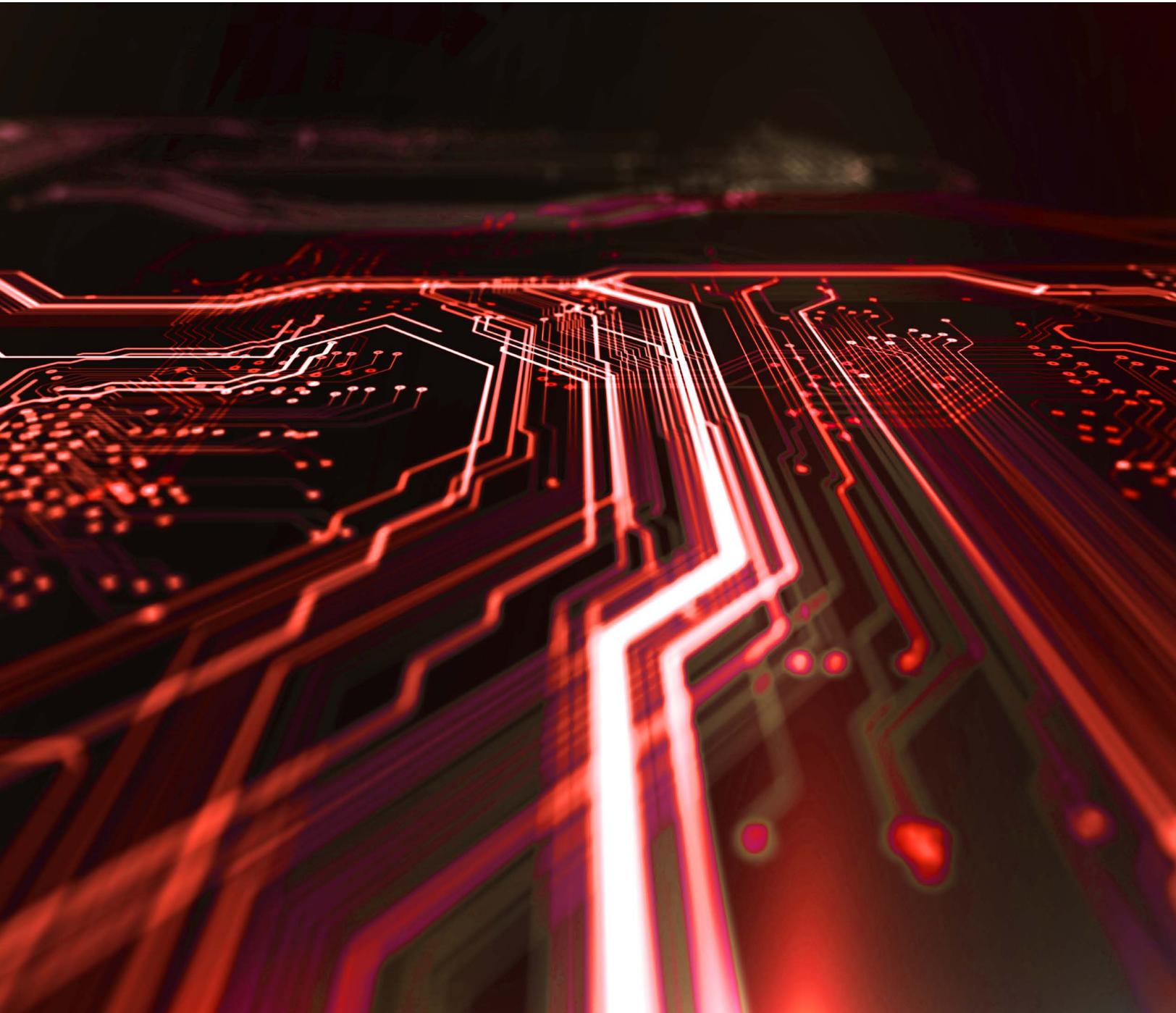
SEMTECH

semtech.com/circuit-protection

TVS SOLUTIONS

For more than 25 years, Semtech's Protection Products Group has been on the forefront of developing cutting-edge circuit protection solutions to safeguard the various circuit buses, ports, connectors, and interfaces found in consumer products and electronic systems. Semtech's proprietary Transient Voltage Suppression (TVS) technologies lead the industry in protecting high-speed data circuits against electrostatic discharge (ESD), electromagnetic interference, cable discharge, lightning, and power surges. These innovative devices help ensure electronics do not fail in the presence of highly destructive overvoltage threats.

What is ESD?

Electrostatic discharge (ESD) is a natural phenomenon that occurs all around us. ESD events occur when electrons - due to friction or induction - are redistributed on a material surface in such a way to create a charge imbalance and thus an electric field. When an electric field is sufficiently strong, the static charges seek equilibrium across the potential difference, and a violent electrical zap known as an electrostatic discharge can occur. These common electrical shocks occur with such frequency that most of the time they may not even be perceptible to humans, but they can mean disaster for microelectronic-based electronics. An ESD strike and resulting failure to the electronic product may lead to lost time to market, revenue and a loss of reputation in the market for a product supplier.

Transient Environment
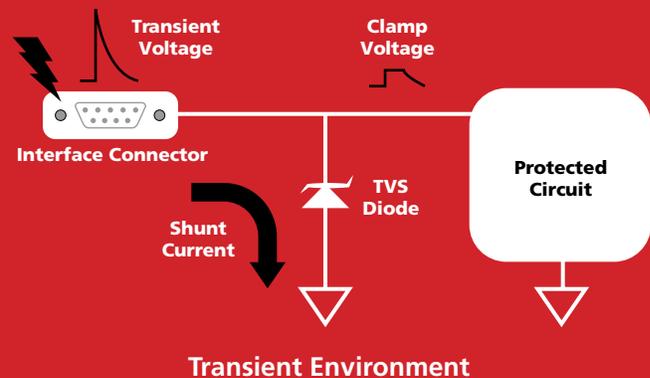
THE NEED FOR ROBUST ESD PROTECTION

The world is more connected than ever. From smartphones to tablets to smart vehicles – these devices give us constant access to real-time information and live communication. As our world becomes more connected, microelectronic chips are also becoming faster and more advanced. As this trend continues, the chips enabling these smaller, thinner and faster microelectronics must likewise scale to smaller geometries. As a result, these devices exhibit an increased sensitivity to real world ESD and transient voltage threats.

Increased device vulnerability to ESD threats, coupled with the trend in chip miniaturization, has compounded the challenge of designing adequate circuit-level ESD protection. With the increased ESD sensitivity of digital ICs, the need to protect systems with more robust off-chip/system-level TVS is more critical today than ever.

TVS APPLICATION MATRIX

Semtech's protection products meet the industry's most rigid immunity standards, including:

- IEC 61000-4-2 (ESD)
- IEC 61000-4-4 (EFT)
- IEC 61000-4-5 (lightning)
- Telcordia GR-1089
- ITU K.20, K.21

FEATURES

- Sub-5V solutions: 2.5V – 3.3V
- Ultra-low capacitance devices: <0.5pF
- Extremely low clamping voltage
- ESD protection with EMI/RFI filtering
- Single-line and multi-line protection
- Small package solutions, including Semtech's own leadless package
- High volume manufacturing
- RoHS/WEEE Compliant

APPLICATIONS

- Portable electronics
- Ethernet
- Set top box
- HDTV/monitor interfaces
- Telecom/datacom interfaces
- Servers/desktop
- Notebooks/tablets
- Automotive interfaces (AEC-Q100 qualified)
- Wearables
- IoT nodes
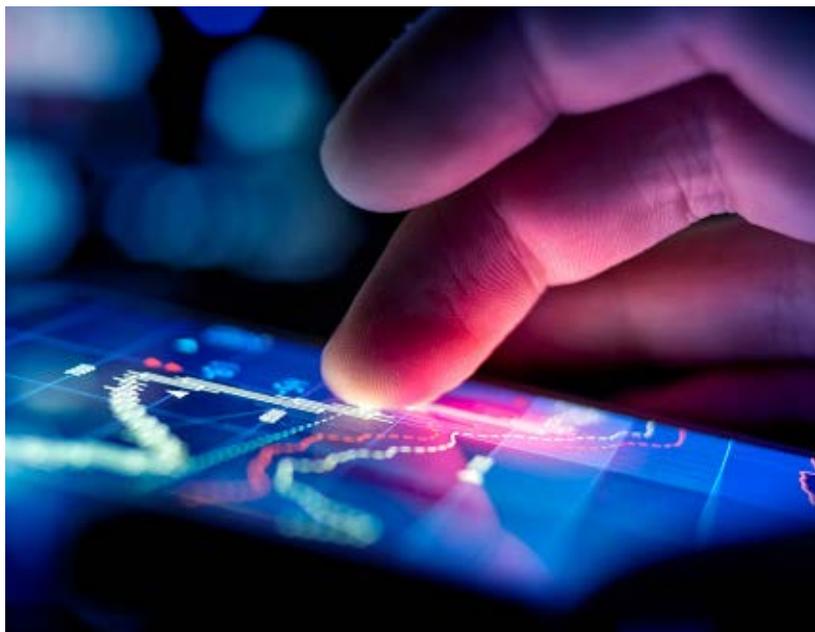
TVS SOLUTIONS

Semtech has a rich and diverse portfolio of TVS protection devices. It is helpful to think of these devices as categorized into five basic subgroups:

µClamp® Family (MicroClamp)
- General purpose ESD protection
- Single-line and multi-line devices
- Used in broad markets, but more commonly in portable and handheld applications

RClamp® Family (RailClamp)
- Low capacitance ESD and transient voltage protection
- Protection for high-speed lines
- Surge and ESD level protection
- Multi-market adoption: used in high-speed data lines (differential pairs) and some RF applications

PClamp® Family (PowerClamp)
- Higher surge immunity for Vbus and DC lines
- High-surge protection (>100A 8x20µs surge events)
- Generally intended for Vbus and DC line applications

TClamp® Family (TransClamp)
- High-surge, low capacitance protection
- Single-line and multi-line devices
- Targeted at telecom and some industrial applications

EClamp® Family (EMI Clamp)
- ESD protection in combination with filter devices
- TVS with integrated passive components, used for EMI filtering applications
- EClamp family also features TVS and termination passives for data interfaces
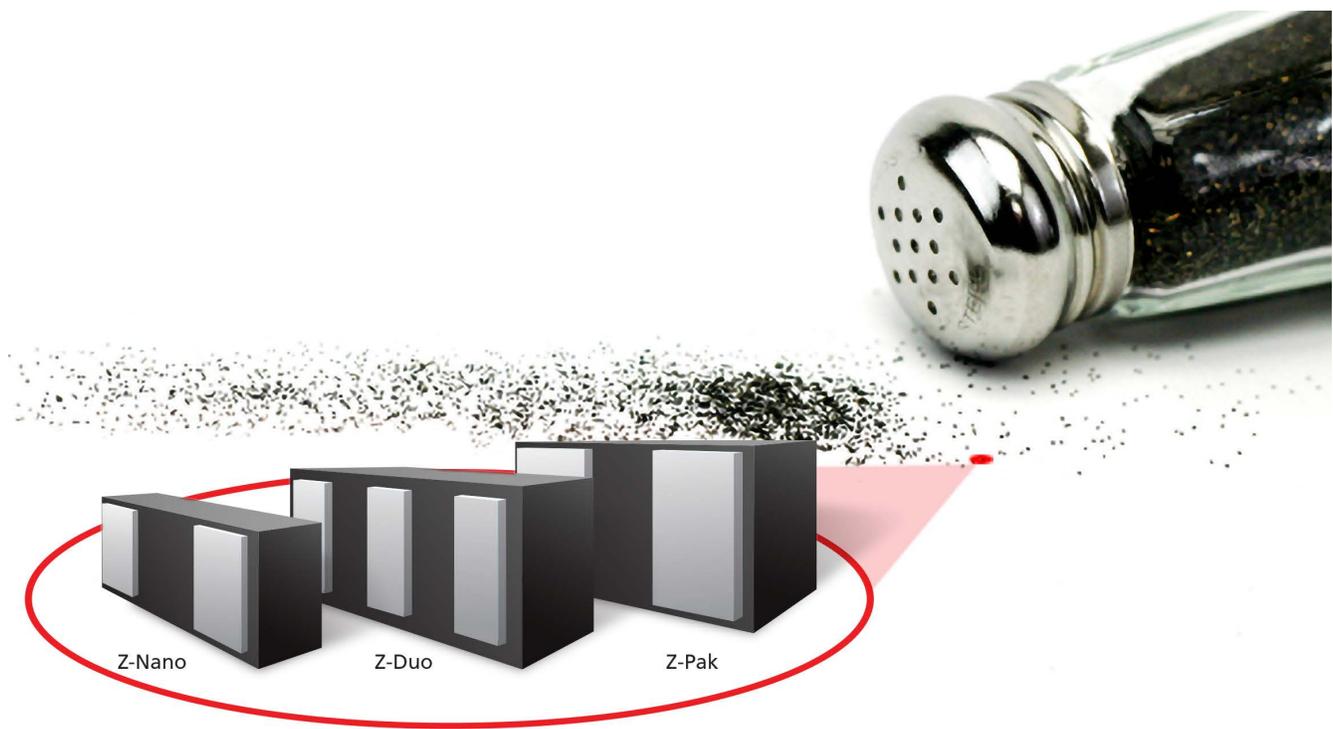
Z-Nano   Z-Duo   Z-Pak

| Part Number	T-Carrier	xDSL	Antenna	Automotive (AEC-Q100)	10/100/1000 Ethernet	Industrial Sensing	Serial/Parallel Ports	LVDS	USB1.1/2.0/3.0/OTG	Multimedia Memory Port	Audio	Color LCD Display	VBus/DC line	Keypad	HDMI/DisplayPort	Analog Video
EMI Clamp® – ESD + EMI Protection Devices																
EClamp2374KQ 🚗				■								■				
EClamp2374K / EClamp2376K / EClamp2378K												■				
EClamp2384K / EClamp2386K / EClamp2388K												■				
EClamp2394P / EClamp2396P / EClamp2398P												■				
EClamp2410P											■					
EClamp2422N										■						
EClamp2454P / EClamp2456P / EClamp2458P												■				
EClamp2455K											■					
EClamp2455P											■					
EClamp2465T											■					
EClamp2515K											■					
EClamp2522P									■							
STF203-15 / STF203-22 / STF203-33											■					
TransClamp® – High-Power Surge TVS																
TClamp0602N	■	■			■											
TClamp1202P							■									
TClamp1272S		■														
TClamp2472S		■														
TClamp2482S		■														
TClamp2502N					■											■
TClamp2512N					■											
TClamp3302N		■			■											■
TClamp3312N					■											
LC01-6	■															
LC03-3.3	■				■											
LC03-6	■	■			■											
LC04-6	■	■														
LC05-6	■															
LC04-12	■	■														
RailClamp® – Low capacitance TVS																
RClamp0502A				■				■	■							■
RClamp0582BQ 🚗			■						■						■	
RClamp0582N			■			■			■	■						■
RClamp0504FA				■				■	■	■						■
RClamp0504N	■	■		■			■	■	■	■						■
RClamp0504PA				■				■	■	■					■	■
RClamp0506T								■							■	
RClamp0592PWQ 🚗		■	■	■				■	■						■	■
RClamp0521PA								■	■	■						
RClamp0521Z		■						■	■						■	
RClamp0524PA								■				■			■	
RClamp0524PQ 🚗				■				■				■			■	
RClamp0531TQ 🚗		■	■	■												
RClamp0532T				■					■						■	
RClamp0534N				■					■							
RClamp0542T								■							■	
RClamp0544T								■							■	
RClamp0551P								■	■						■	
RClamp0552T								■	■							
RClamp0554S	■			■			■	■	■	■						■
RClamp3324T				■					■						■	
RClamp3354S				■				■								
RClamp0564P				■		■		■				■			■	■
RClamp7534P				■		■	■	■				■			■	■
RClamp0584J								■							■	
RClamp0821P								■	■	■						■
RClamp0854P								■								
RClamp1255P								■								
RClamp1502B								■	■							
RClamp1521P								■	■	■						■
RClamp1654P								■								
RClamp1851ZA		■														
RClamp2402B								■	■							
RClamp2451ZA		■														
RClamp2502L	■			■												
RClamp2504N				■				■								■
RClamp2504P				■				■								■
RClamp2574N				■				■								
RClamp2574NQ 🚗			■	■				■								
RClamp3374N			■	■												
RClamp3304NA	■			■				■	■							■
RClamp3304P				■				■		■						■
RClamp3321P								■								
RClamp3324P			■	■				■								
RClamp3328P				■				■		■					■	
RClamp3331ZA								■	■							
RClamp3346P			■					■	■	■						

Part Number	T-Carrier	xDSL	Antenna	Automotive (AEC-Q100)	10/100/1000 Ethernet	Industrial Sensing	Serial/Parallel Ports	LVDS	USB1.1/2.0/3.0/OTG	Multimedia Memory Port	Audio	Color LCD Display	VBus/DC line	Keypad	HDMI/DisplayPort	Analog Video
RClamp3552T				■				■	■							
RClamp3624T									■							
RClamp3654PA									■							
RClamp7522T									■						■	
RClamp7524T									■						■	
RClamp7528T								■	■	■		■			■	
RClamp7538P								■	■	■		■			■	
RClamp0821ZA		■													■	
RClamp5031ZA		■							■	■						
RClamp3521ZA								■	■							
🚗 RClamp0551PQ			■	■					■						■	
🚗 RClamp0561PQ			■	■					■						■	
🚗 RClamp1561PQ			■													
RClamp3351ZA								■	■	■						
RClamp3371ZC					■				■						■	
RClamp3391ZC																
🚗 RClamp3331PQ			■	■				■	■							
🚗 RClamp0582NQ				■											■	■
RClamp0521ZA		■							■						■	
SR05		■					■		■							■
SR12		■														
SR2.8																■
SR3.3									■							■
SR70	■	■														
SRDA05-4	■								■							■
SRDA12-4		■														
SRDA3.3-4	■								■							■
SRV05-4	■					■	■	■	■							■

MicroClamp® – TVS Arrays

Part Number	T-Carrier	xDSL	Antenna	Automotive (AEC-Q100)	10/100/1000 Ethernet	Industrial Sensing	Serial/Parallel Ports	LVDS	USB1.1/2.0/3.0/OTG	Multimedia Memory Port	Audio	Color LCD Display	VBus/DC line	Keypad	HDMI/DisplayPort	Analog Video
🚗 µClamp0301PQ				■										■		
µClamp0501H / µClamp0501P							■							■	■	
µClamp0501T							■							■	■	
µClamp0502P											■			■	■	
µClamp0502T							■							■	■	
µClamp0561P / µClamp1061P / µClamp1261P / µClamp1561P / µClamp2461P / µClamp3061P / µClamp3661P / µClamp4061P / µClamp6061P														■		
µClamp0504T / µClamp0505T / µClamp0506T														■	■	

Part Number	T-Carrier	xDSL	Antenna	Automotive (AEC-Q100)	10/100/1000 Ethernet	Industrial Sensing	Serial/Parallel Ports	LVDS	USB1.1/2.0/3.0/OTG	Multimedia Memory Port	Audio	Color LCD Display	VBus/DC line	Keypad	HDMI/DisplayPort	Analog Video
µClamp0508T							■				■			■		
µClamp0504A							■							■		
µClamp0505A							■				■			■		
µClamp0511P													■	■		
µClamp0511T								■				■	■	■		
µClamp0524P							■							■		
µClamp0541Z											■		■	■		
µClamp1201H / µClamp1201P							■						■	■		
µClamp1211P													■	■		
µClamp1211T											■		■	■		
µClamp1211Z													■	■		
µClamp2401T							■							■		
µClamp2501T / µClamp2511T											■			■		
µClamp2501ZA														■		
µClamp2804L				■												
µClamp3301P							■							■		
µClamp3304A							■									
µClamp3305P / µClamp3306P							■						■	■		
µClamp3311P													■	■		
🚗 µClamp3311PQ			■	■										■		
µClamp3311T							■							■		
µClamp3321ZA											■		■	■		
µClamp3324P							■							■		
µClamp3381P												■				
µClamp3603T				■										■		
µClamp5011ZA											■			■	■	
SM712							■									

LCDA/SLVU Families – TVS Arrays

Part Number	T-Carrier	xDSL	Antenna	Automotive (AEC-Q100)	10/100/1000 Ethernet	Industrial Sensing	Serial/Parallel Ports	LVDS	USB1.1/2.0/3.0/OTG	Multimedia Memory Port	Audio	Color LCD Display	VBus/DC line	Keypad	HDMI/DisplayPort	Analog Video
LCDA12C-1 / LCDA15C-1 / LCDA24C-1		■					■									
🚗 SLVU2.8Q				■												■
SLVU2.8-4					■											
SLVU2.8-8					■											

PowerClamp® High-surge TVS Diode

Part Number	T-Carrier	xDSL	Antenna	Automotive (AEC-Q100)	10/100/1000 Ethernet	Industrial Sensing	Serial/Parallel Ports	LVDS	USB1.1/2.0/3.0/OTG	Multimedia Memory Port	Audio	Color LCD Display	VBus/DC line	Keypad	HDMI/DisplayPort	Analog Video
PClamp0501P									■					■		
PClamp0801P									■					■		■
PClamp1011P									■					■		
PClamp1021P									■					■		
PClamp1211P									■							
PClamp1221P									■					■		
PClamp2011P									■					■		

EMIClamp® – ESD + EMI Protection Devices

Part Number	Description	Device Schematic	V_{RWM} Max (V)	V_{BR} Min (V)	C (pF) @ V_R = 0V	C (pF) @ V_R = 2.5V	R (ohm)	L (nH)	C Max (pF) L-G @ V_R = 0V	I_R Max (µA) @ V_{RWM}	Package	Size (mm)
EClamp2374K EClamp2376K EClamp2378K	4, 6, 8-line ESD/EMI protection for color LCD interfaces		5	6	10	–	100	–	24	–	SLP1713P8 SLP2513P12 SLP3313P16	1.7 x 1.3 x 0.5 2.5 x 1.3 x 0.5 3.3 x 1.3 x 0.5
EClamp2384K EClamp2386K EClamp2388K	4, 6, 8-line ESD/EMI protection for color LCD interfaces, 400µm lead pitch		5	6	–	12	200	–	–	–	SLP1713P8 SLP2513P12 SLP3313P16	1.7 x 1.3 x 0.5 2.5 x 1.3 x 0.5 3.3 x 1.3 x 0.5
EClamp2394P EClamp2396P EClamp2398P	4, 6, 8-line ESD/EMI protection for color LCD interfaces		5	6	–	12	–	19	–	–	SLP2116P8 SLP3016P12 SLP4016P16	2.1 x 1.6 x 0.58 3.0 x 1.6 x 0.58 4.0 x 1.6 x 0.58
EClamp2374KQ	4-line ESD/EMI TVS for color LCD display		5	6	20	–	100	n/a	24	0.50	SLP1713P	1.7 x 1.3 x 0.5
EClamp2422N	2 line ESD/EMI protection for audio interfaces		5	6	100	–	–	2	–	–	SLP1510N6	1.45 x 1.0 x 0.58
EClamp2454P EClamp2456P EClamp2458P	4, 6, 8-line ESD/EMI protection for color LCD interfaces		5	6	–	12	–	28	–	–	SLP2116P8 SLP3016P12 SLP4016P16	2.1 x 1.6 x 0.58 3.0 x 1.6 x 0.58 4.0 x 1.6 x 0.58
EClamp2455K EClamp2455P	4-line ESD/EMI protection for SIM cards, ('K'=400µm lead pitch) ('P'=500µm lead pitch)		5	6	20	–	100 47	–	24	0.5	SLP1713P8 SLP2116P8	1.7 x 1.3 x 0.5 2.1 x 1.6 x 0.58
EClamp2465T	4-line ESD/EMI protection for SIM card		5	6	10	–	100	–	12	0.5	SLP1713P8T	1.7 x 1.3 x 0.4
EClamp2515K	ESD protection for T-Flash/MicroSD interfaces		5	6	22	–	45	–	–	–	SLP3313P16	3.3 x 1.3 x 0.5
EClamp2522P	USB upstream port filter & TVS for EMI filtering and ESD protection		5.5	6	20	–	22	–	45	1	SLP1616P6	1.6 x 1.6 x 0.58
STF203-15 STF203-22 STF203-33	USB upstream port filter & TVS for EMI filtering and ESD protection		5.25	6	47	–	15 22 33	–	–	5	SC-70 6L	2.1 x 2.1 x 1.1 2.1 x 2.1 x 1.1 2.1 x 2.1 x 1.1

TransClamp® – High-Power Surge TVS

Part Number	Description	Device Schematic	V_{RWM} Max (V)	V_{BR} Min (V)	C_J Max (pF) L-L@ V_R = 0V	Peak Power (W) (8/20μs)	Peak Power (W) (10/1000μs)	I_{PP} (A) @ (10/1000μs)	I_{PP} (A) @ (8/20μs)	I_R Max (μA) @ V_{RWM}	Package	Size (mm)
TClamp0602N TClamp2502N TClamp3302N	2-line, low cap TVS for Ethernet and telecom interfaces		6 2.5 3.3	6.8 – –	12	2,500 – –		–	95	5 0.5 1	SLP2626P10	2.6 x 2.6 x 0.6 2.6 x 2.6 x 0.6 2.6 x 2.6 x 0.6
TClamp1202P	Low cap TVS for RS-485 interfaces		12	13.3	12	–	300	12	100	0.1	SLP2020P5	2.0 x 2.0 x 0.6
TClamp1272S	Low cap TVS for xDSL interfaces		12	13.5	5	600	–	–	20	0.1	SOT-23 6L	3.1 x 2.8 x 1.45
TClamp2512N TClamp3312N	2-line, low cap TVS for Ethernet and telecom interfaces		2.5V 3.3V	2.7V 3.5V	8	–	–	–	120	0.1	SLP2626P10	2.6 x 2.6 x 0.6 2.6 x 2.6 x 0.6
TClamp2472S	Low cap TVS for xDSL interfaces		24	27	2	–	–	–	–	0.1	SOT-23 6L	3.1 x 2.8 x 1.45
TClamp2482S	Low cap TVS for xDSL interfaces		24	27	2	150	–	–	20	0.1	SOT-23 6L	3.1 x 2.8 x 1.45
LC01-6	Low cap TVS for high-speed telecommunication systems		6	8	–	–	1,500	100	–	25	SO-16W	10.3 x 10.3 x 2.65
LC03-3.3	2-line, low cap 3.3V TVS for high-speed interfaces		3.3	–	12	1,800	–	–	100	1	SO-8	5.0 x 6.0 x 1.75
LC03-6	2-line, low cap TVS for high-speed data interfaces		6	6.8	12	2,000	–	–	100	25	SO-8	5.0 x 6.0 x 1.75
LC04-6 LC05-6	Dual, low cap TVS array for telecom linecard applications, protects 2 tip and ring line pairs		6	6.8	15	– 2,000	1,000 –	70 –	200 100	15	SO-16	10.0 x 6.0 x 1.75 10.0 x 6.0 x 1.75
LC04-12	Dual, low cap TVS array for telecom linecard applications, protects 2 tip and ring line pairs		12	13.3	15	600	600	25	100	2	SO-16	10.0 x 6.0 x 1.75
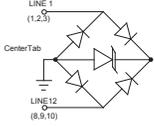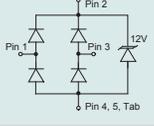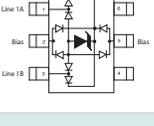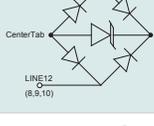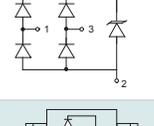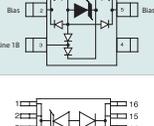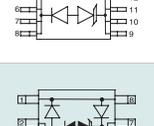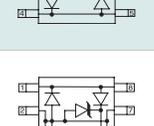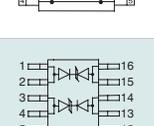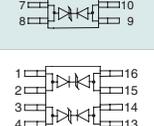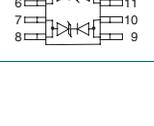
RailClamp® – Low Capacitance TVS

Part Number	Description	Device Schematic	V_{RWM} Max (V)	V_{BR} Min (V)	C_j Max (pF) L-L @ V_R = 0V	Peak Power (W) (8/20µs)	I_{PP} (A) @ (8/20µs)	I_R Max (µA) @ V_{RWM}	Package	Size (mm)
RClamp0502A	2-line, ultra-low cap TVS array		5	6	0.7	50	3	1	SC-89	1.7 x 1.7 x 0.6
RClamp0502BA RClamp1502B RClamp2402B	2-line protection, ultra-low cap TVS for ESD/CDE protection		5 15 24	6 16.7 26.7	0.9	125 200 200	5 5 4	1	SC-75	1.7 x 1.75 x 0.9 1.7 x 1.75 x 0.9 1.7 x 1.75 x 0.9
RClamp2451ZA	24V, 1-line ESD protection		24	25.5	0.45	60	3	0.05	SLP0603P2X3	0.6 x 0.3 x 0.25
RClamp0504FA RClamp0504S RClamp0504N	4-line protection, low cap TVS array		5	6	1.5 1.5 5*	150 150 300	6 6 12	3 3 5	SC-70 6L SOT-23 6L SLP2020P6	2.1 x 2.1 x 1.1 3.1 x 2.8 x 1.45 2.0 x 2.0 x 0.6
RClamp0504PA	4-line protection, low cap TVS array		5	6	1	150	6	3	SLP1616P6	1.6 x 1.6 x 0.58
RClamp0506T	6-line protection, ultra-low cap TVS for high-speed applications		5	6.5	0.4	75	5	0.1	SLP3313P6T	3.3 x 1.3 x 0.4
🚗 RClamp0592PWQ	5V, 2-line surge and ESD protection for high-speed applications		5	6.5	1.2	60	10	0.1	DFN1006N3T	1.0 x 0.6 x 0.55
RClamp0521PA RClamp0821P RClamp1521P	Ultra-low cap, 1-line ESD protection		5 8 15	6 10 16.7	0.5	100 100 120	4	1	SLP1006P2	1.0 x 0.6 x 0.5 1.0 x 0.6 x 0.5 1.0 x 0.6 x 0.5
RClamp0521Z	Ultra small, 1-line ESD protection		5	6	0.5	100	4	0.1	SLP0603P2X3A	0.6 x 0.3 x 0.25
RClamp3552T	2-line, low voltage, ESD protection		3.5	–	0.4	60	4	0.3	SLP0603P2X3	0.6 x 0.3 x 0.25
RClamp0522P	Protect 2 lines for high-speed applications		5	6	0.4	150	5	1	SLP1610P4	1.6 x 1.0 x 0.58
🚗 RClamp0524PQ RClamp0524PA	Protect 4 lines for high-speed applications		5	6 6.5	0.4	150 75	5	1 0.1	SLP2510P8	2.5 x 1.0 x 0.58 2.5 x 1.0 x 0.58
🚗 RClamp0531TQ	1-line protection, ultra-low cap TVS for automotive applications		5	6	0.8	80	4	0.1	SLP1006P2T	1.0 x 0.6 x 0.4

* Line-to-ground capacitance (max) value

RailClamp® – Low Capacitance TVS (Continued)

Part Number	Description	Device Schematic	V$_{RWM}$ Max (V)	V$_{BR}$ Min (V)	C$_J$ Max (pF) L-L @ V$_R$ = 0V	Peak Power (W) (8/20μs)	I$_{PP}$ (A) @ (8/20μs)	I$_R$ Max (μA) @ V$_{RWM}$	Package	Size (mm)
RClamp0534N	4-line protection, low cap TVS for high-speed applications		5	6	3	500	25	0.5	SLP3020N10	3.0 x 2.0 x 0.6
RClamp0542T	Protect 2 lines for high-speed applications		5	6.5	0.4	75	5	0.05	SLP1610P4T	1.6 x 1.0 x 0.4
RClamp0544T	Protect 4 lines for high-speed applications		5	6.5	0.4	75	5	0.1	SLP2010P8T	2.0 x 1.0 x 0.4
RClamp0551P	Ultra-low cap, 1-line ESD protection		5	6	0.5	60	3	0.1	SLP1006P2	1.0 x 0.6 x 0.5
RClamp0552T	Ultra-low cap, 2-line ESD protection		5	6.5	0.4	60	3	0.02	SLP1006N3T	1.0 x 0.6 x 0.4
RClamp0564P	4-line, low-capacitance protection for high-speed interfaces		5	6.5	0.20	–	3	50	SGP2010N5	2.0 x 1.0 x 0.5
RClamp7534P	4-line, low-capacitance protection for high-speed interfaces		5	6.5	0.22	–	4	100	SGP2010N5	2.0 x 1.0 x 0.5
RClamp0554S	4 line protection, low cap TVS for high-surge applications		5	6	5*	375	25	0.5	SOT-23 6L	3.1 x 2.8 x 1.45
RClamp0582B	2-line protection, ultra-low cap TVS for high-speed applications		5	6	0.8	300	15	0.1	SC-75	1.7 x 1.75 x 0.9
🚗 RClamp0582BQ	2 line protection, ultra-low cap TVS for automotive applications		5	6	0.8	300	15	0.1	SC-75	1.7 x 1.75 x 0.9
RClamp0582N	2 data, 1 power line protection, ultra-low cap TVS for automotive applications		6.5	7	0.5	125	5	0.1	SLP1210N6	1.2 x 1.0 x 0.58
RClamp0584J	4-line protection, ultra-low cap for high-speed applications		5	6.5	0.4	75	5	0.1	SLP2710P8	2.7 x 1.0 x 0.5

* Line-to-ground capacitance (max) value

RailClamp® – Low Capacitance TVS (Continued)

| Part Number	Description	Device Schematic	V_{RWM} Max (V)	V_{BR} Min (V)	C_J Max (pF) L-L @ V_R = 0V	Peak Power (W) (8/20μs)	I_{PP} (A) @ (8/20μs)	I_R Max (μA) @ V_{RWM}	Package	Size (mm)
RClamp0854P	3 data line protection and 1 power line for USB charger and USB OTG		5.5	6.5	0.5	100	3	1	SLP1616P6	1.6 x 1.6 x 0.58
RClamp1654P	3 data line protection and 1 power line for USB charger and USB OTG		5.5	6.5	0.5	100	3	1	SLP1616P6	1.6 x 1.6 x 0.58
RClamp2502L	2.5V, flow-through TVS for gigabit and fast Ethernet protection		2.5	–	5	800	40	1	SO-8	5.0 x 6.0 x 1.75
RClamp2504N RClamp3304NA	4-line protection, low cap TVS array for Ethernet and telecom interfaces		2.5 3.3	–	5*	450	25	5	SLP2626P10	2.6 x 2.6 x 0.6 2.6 x 2.6 x 0.6
RClamp2504P RClamp3304P	4-line ultra-low cap TVS array		2.5 3.3	–	0.8*	80	5	0.5	SLP1616P6	1.6 x 1.6 x 0.58 1.6 x 1.6 x 0.58
🚗 RClamp2574NQ RClamp3374N	4-line protection, high power TVS for Ethernet interfaces		2.5 3.3	–	5*	1,000	40	0.5	SLP3020N10	3.0 x 2.0 x 0.6 3.0 x 2.0 x 0.6
RClamp3321P	3.3V, 1-line ESD protection		3.3	5.5	0.35	25	3	0.05	SLP1006P2	1.0 x 0.6 x 0.5
RClamp3324P	3.3V, 4-line surge and ESD protection		3.3	–	0.4	–	4.5	0.05	SGP2510P8	2.5 x 1.0 x 0.6
RClamp3328P	3.3V, 8-line surge and ESD protection		3.3	–	0.4	75	5	0.1	SGP3810N9	3.8 x 1.0 x 0.5
RClamp3331ZA	3.3V, 1-line ESD protection		3.3	5.5	0.45	30	4	0.05	SLP0603P2X3	0.6 x 0.3 x 0.25
RClamp3346P	3.3V, 6-line ESD protection for high-speed applications		3.3	–	0.4	–	4.5	0.05	SGP2708N7	2.7 x 0.8 x 0.5

* Line-to-ground capacitance (max) value

RailClamp® – Low Capacitance TVS (Continued)

| Part Number	Description	Device Schematic	V$_{RWM}$ Max (V)	V$_{BR}$ Min (V)	C$_J$ Max (pF) L-L @ V$_R$ = 0V	Peak Power (W) (8/20µs)	I$_{PP}$ (A) @ (8/20µs)	I$_R$ Max (µA) @ V$_{RWM}$	Package	Size (mm)
RClamp3324T	3.3V, flow-through TVS for USB 3.0 interfaces		3.3	–	0.4	75	5	0.1	SLP1710P4T	1.7 x 1.0 x 0.4
RClamp3354S	4-line, 3.3V TVS for GbE interfaces		3.3	–	5*	400	25	0.5	SOT-23	3.1 x 2.8 x 1.45
RClamp3654PA	3 data line protection and 1 power line for USB charger and USB OTG		5.5	6.5	0.5	100	3	1	SLP1616P6	1.6 x 1.6 x 0.58
RClamp7522T	2-line protection, ultra-low cap TVS for high-speed applications		5	6.5	0.4	100	4	0.1	SLP1007N5T	1.0 x 0.7 x 0.4
RClamp7524T	4-line protection, ultra-low cap TVS for high-speed applications		5	6.5	0.4	75	5	0.1	SLP1308N5T	1.3 x 0.8 x 0.4
RClamp7528T RClamp7538P	8-line protection, ultra-low cap TVS for high-speed applications		5	6.5	0.4	75	5	0.1	SLP2611N9T SLP3810N9	2.6 x 1.1 x 0.4 3.8 x 1.0 x 0.5
SR05 SR12	2-line, low cap TVS diode array		5 12	6 13.3	10*	500 550	25 16	5 1	SOT-143	3.04 x 2.64 x 1.22 3.04 x 2.64 x 1.22
SR2.8 SR3.3	2-line, low cap TVS diode array		2.8 3.3	–	10*	200 150	14 10	1 1	SOT-143	3.04 x 2.64 x 1.22 3.04 x 2.64 x 1.22
SR70	2-line, low cap TVS diode array		70	85	10*	–	24	5	SOT-143	3.04 x 2.64 x 1.22
SRDA3.3-4	4-line, low capacitance TVS diode array		3.3	–	15*	500	25	1	SO-8	5.0 x 6.0 x 1.75

* Line-to-ground capacitance (max) value

## RailClamp® – Low Capacitance TVS (Continued)

Part Number	Description	Device|Schematic	V_RWM Max (V)	V_BR Min (V)	C_J Max (pF) L-L @ V_R = 0V	Peak Power (W) (8/20µs)	I_PP (A) @ (8/20µs)	I_R Max (µA) @ V_RWM	Package	Size (mm)
SRDA5-4 SRDA12-4	4-line, low capacitance TVS diode array		5 12	6 13.3	15*	500	25 20	10 1	SO-8	5.0 x 6.0 x 1.75 5.0 x 6.0 x 1.75
SRV05-4	4-line, low capacitance TVS diode array		5	6	5*	300	12	5	SOT-23 6L	3.1 x 2.8 x 1.45
RClamp0821ZA RClamp5031ZA	Ultra small low capacitance 1 line ESD protection		8 5	10 6.5	0.5 0.45	–	4	0.1 0.05	SLP0603P2X3F	0.6 x 0.3 x 0.25 0.6 x 0.3 x 0.25
RClamp3521ZA	1-line, low cap 3.5V TVS for high-speed interfaces		3.5	5.5	0.55	30	6	0.05	SLP0603P2X3F	0.6 x 0.3 x 0.25
RClamp3351ZA RClamp3371ZC RClamp3391ZC	Ultra low cap TVS for high-speed interfaces		3.3	5.5	0.6 0.25 0.2	65 65 45	10 9 7	0.05	SLP0603P2X3F SLP0603P2X3J SLP0603P2X3J	0.6 x 0.3 x 0.25 0.6 x 0.3 x 0.25 0.6 x 0.3 x 0.25
🚗 RClamp0551PQ	Low capacitance 1 line protection of automotive interfaces		5	6	0.5	45	3	0.1	SLP1006P2	1.0 x 0.6 x 0.5
🚗 RClamp0561PQ RClamp1561PQ	Low capacitance 1 line protection of automotive interfaces		5.5 15	6.5 16.5	0.18 0.3	40 70	2	0.05	SLP1006P2	1.0 x 0.6 x 0.5 1.0 x 0.6 x 0.5
🚗 RClamp3331PQ	Low capacitance ESD and EOS protection		3.3	6	0.38	30	10	0.05	SLP1006P2	1.0 x 0.6 x 0.5
🚗 RClamp0582NQ	Low capacitance 2 line ESD and EOS protection		6.5	7	0.5	125	5	0.1	SLP1210N6	1.2 x 1.0 x 0.58
RClamp0521ZA	Ultra small, 1-line ESD protection		5	6.5	–	–	2	0.1	SLP0603P2X3	0.6 x 0.3 x 0.25
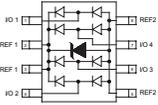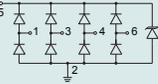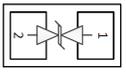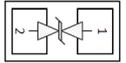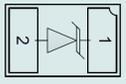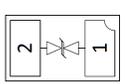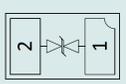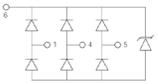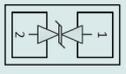
* Line-to-ground capacitance (max) value

MicroClamp® - TVS Arrays

Part Number	Description	Device Schematic	V$_{RWM}$ Max (V)	V$_{BR}$ Min (V)	C$_J$ Max (pF) L-G @ V$_R$ = 0V	Peak Power (W) (8/20µs)	I$_{PP}$ (A) @ (8/20µs)	I$_R$ Max (µA) @ V$_{RWM}$	Package	Size (mm)
µClampxx61P	High power, 1-line ESD and surge protection		5-40	–	220 to 125	1,200 to 1,500	80-5	0.2	SLP1608P2	1.6 x 0.8 x 0.5
µClamp0501H µClamp1201H	1-line ESD protection		5 12	6 13.3	160 60	240 200	16 8	5 1	SOD-523	1.7 x 0.9 x 0.7 1.7 x 0.9 x 0.7
🚗 µClamp0301PQ µClamp0501P µClamp1201P	1-line ESD protection		3 5 12	– 6 13.3	30 160 60	40 200 200	5 16 8	0.5 5 1	SLP1006P2	1.0 x 0.6 x 0.5 1.0 x 0.6 x 0.5 1.0 x 0.6 x 0.5
µClamp0501T µClamp2401T	1-line ESD protection		5 24	6 27	10 50	25 150	2 3	0.25	SLP1006P2T	1.0 x 0.6 x 0.4 1.0 x 0.6 x 0.4
µClamp0502P µClamp0502T	2-line ESD protection		5	6	10	25	2	0.25	SLP1006P3 SLP1006P3T	1.0 x 0.6 x 0.5 1.0 x 0.6 x 0.5
µClamp0504A µClamp3304A	4-line ESD protection array		5 3.3	6 –	75 30	100 40	7 5	1 0.5	SC-89	1.7 x 1.7 x 0.6 1.7 x 1.7 x 0.6
µClamp0504T µClamp0505T µClamp0506T	4, 5, 6-line ESD protection		5	6	10	25	2	0.25	SLP1313P6T	1.3 x 1.3 x 0.4 1.3 x 1.3 x 0.4 1.3 x 1.3 x 0.4
µClamp0505A	5-line ESD protection array		5	6	75	100	7	1	SC-89	1.7 x 1.7 x 0.6
µClamp0506A	5-line ESD protection array		5	6	40	100	7	1	SC-89	1.7 x 1.7 x 0.6
µClamp0506P	6-line ESD protection array		5	6	75	100	7	1	SLP1616P6	1.6 x 1.6 x 0.58
µClamp0508T	8-line ESD protection		5	6	10	25	2	0.25	SLP1713P8T	1.7 x 1.3 x 0.4
SM712	300W asymmetrical 2-line 7V/12V protection in SOT23-3		7,12	7.5 13.3	75	550-700	21	0.2	JEDEC SOT-23	3.04 x 2.64 x 1.2
µClamp2501ZA	1 line 2.5V TVS diode		2.5	3	4.5	65	8	0.05	SLP0603P2X3F	0.6 x 0.3 x 0.25
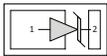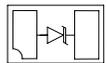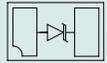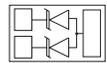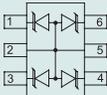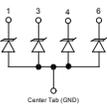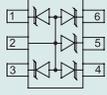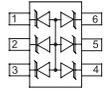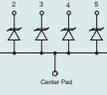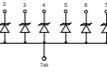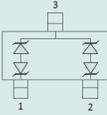
MicroClamp® - TVS Arrays (Continued)

Part Number	Description	Device Schematic	V$_{RWM}$ Max (V)	V$_{BR}$ Min (V)	C$_J$ Max (pF) L-G @ V$_R$ = 0V	Peak Power (W) (8/20µs)	I$_{PP}$ (A) @ (8/20µs)	I$_R$ Max (µA) @ V$_{RWM}$	Package	Size (mm)
µClamp0511P µClamp1211P µClamp3311P	1-line ESD protection		5 12 3.3	6 13.3 –	75 25 15	170 200 90	12 7 5	1 1 0.5	SLP1006P2	1.0 x 0.6 x 0.5 1.0 x 0.6 x 0.5 1.0 x 0.6 x 0.5
µClamp0511T	1-line ESD protection		5	6	7	–	2	0.05 (V$_R$=3.3V)	SLP1006P2T	1.0 x 0.6 x 0.4
µClamp0541Z µClamp1211Z	Ultra small, 1 line ESD protection		5 12	6 14.2	9 25	25 175	2 7	0.05	SLP0603P2X3	0.6 x 0.3 x 0.25 0.6 x 0.3 x 0.25
µClamp0524P µClamp3324P	4-line, low voltage TVS for ESD protection		5 3.3	6 –	160 30	240 40	16 5	5 0.5	SLP2116P8	2.1 x 1.6 x 0.58 2.1 x 1.6 x 0.58
µClamp2501T	1-line, 2.5V TVS for ESD protection		2.5	–	30	40	5	0.05	SLP1006P2T	1.0 x 0.6 x 0.4
µClamp2511T µClamp3311T µClamp1211T	1-line ESD protection		2.5 3.3 12	– – 13.3	10 7 7	40 40 –	5 5 –	0.05	SLP1006P2T	1.0 x 0.6 x 0.4 1.0 x 0.6 x 0.4 1.0 x 0.6 x 0.4
µClamp3321ZA	1-Line ESD protection		3.3 5	5.5 6.5	0.45 5	30	4 2.5	0.05 0.02	SLP0603P2X3	0.6 x 0.3 x 0.25
µClamp2804L	4-line, 2.8V TVS array for Ethernet applications		2.8	–	–	100	10	0.05	SO-8	5.0 x 6.0 x 1.75
µClamp3301P	1-line, low voltage ESD/CDE protection		3.3	–	30	40	5	0.5	SLP1006P2	1.0 x 0.6 x 0.5
µClamp3305P	5-line, 3.3V TVS		3.3	–	25	40	5	0.5	SLP1616P6	1.6 x 1.6 x 0.58
µClamp3306P	6-line, 3.3V TVS		3.3	–	25	40	5	0.5	SLP1616P6	1.6 x 1.6 x 0.58
µClamp3311PQ	1-line, low voltage TVS for automotive applications		3.3	–	15	90	5	0.5	SLP1006P2	1.0 x 0.6 x 0.5
µClamp3381P	3.3V, 1-line ESD and surge protection		3.3	4.5	35	275	25	0.1	SGP1006N2	1.0 x 0.6 x 0.5
µClamp5011ZA	1-line ESD protection		5	6.5	5	30	2.5	0.02	SLP0603P2X3	0.6 x 0.3 x 0.25
µClamp3612P	1-line, 33V TVS for proximity switch input protection		33	36	25	170	–	1	SLP1006P2	1.0 x 0.6 x 0.5
µClamp3603T	3-line, 36V TVS for proximity switch protection		36	–	50	–	–	1	SLP1710N6T	1.7 x 1.0 x 0.4

LCDA/SLVU Families - TVS Arrays

Part Number	Description	Device Schematic	V$_{RWM}$ Max (V)	V$_{BR}$ Min (V)	C$_J$ Max (pF) L-G @ V$_R$ = 0V	Peak Power (W) (8/20µs)	I$_{PP}$ (A) @ (8/20µs)	I$_R$ Max (µA) @ V$_{RWM}$	Package	Size (mm)
LCDA12C-1 LCDA15C-1 LCDA24C-1	1-line, low cap TVS diode array		12 15 24	13.3 16.7 26.7	15 15 10	500	–	5 5 1	SOT-143	3.04 x 2.64 x 1.22 3.04 x 2.64 x 1.22 3.04 x 2.64 x 1.22
SLVU2.8Q	1-line, 2.8V TVS for automotive applications		2.8	–	100	400	24	0.25	SOT-23	3.1 x 2.8 x 1.45
SLVU2.8-4	4-line, EPD TVS diode array for ESD and latch-up protection		2.8	–	–	400	24	1	SO-8	5.0 x 6.0 x 1.75
SLVU2.8-8	8-line EPD TVS diode array for ESD and latch-up protection		2.8	–	–	600	30	1	SO-8	5.0 x 6.0 x 1.75
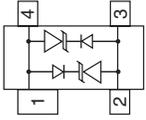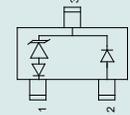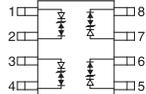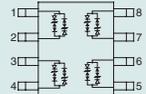
PowerClamp® High-surge TVS Diode

| Part Number	Description	Device Schematic	V$_{RWM}$ Max (V)	V$_{BR}$ Min (V)	C$_J$ Max (pF) L-G @ V$_R$ = 0V	Peak Power (W) (8/20µs)	I$_{PP}$ (A) @ (8/20µs)	I$_R$ Max (µA) @ V$_{RWM}$	Package	Size (mm)
PClamp1211P	Power MicroClamp 1-line high-surge TVS diode		13.5	14.5	2,500	5,000	180	0.35	SLP2018P6	2.0 x 1.8 x 0.57
PClamp1011P PClamp2011P	Power MicroClamp 1-line high-surge TVS diode		10 23	12.5 27	2,500 800	4,700 5,700	180 120	0.15	SLP2018P6	2.0 x 1.8 x 0.57 2.0 x 1.8 x 0.57
PClamp0501P PClamp1021P PClamp1221P	1-line surge protection		5 10 12	5 11 13	1,150 600 430	1,800 1,680 2,000	80	0.1	SGP1610N2-D	1.6 x 1.0 x 0.53 1.6 x 1.0 x 0.53 1.6 x 1.0 x 0.53
PClamp0801P	Power MicroClamp 1 line high-surge TVS diode		7.6	7.96	1,150	500	50	5	SGP1610N2-D	1.6 x 1.0 x 0.53
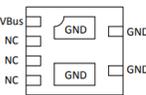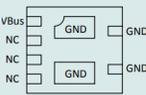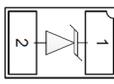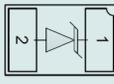
KEY APPLICATIONS
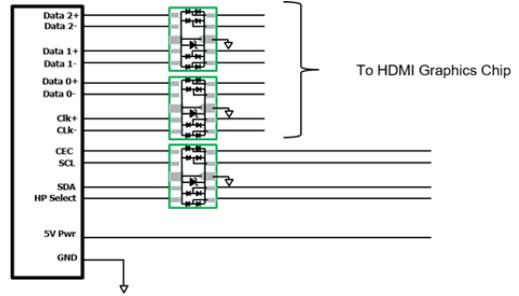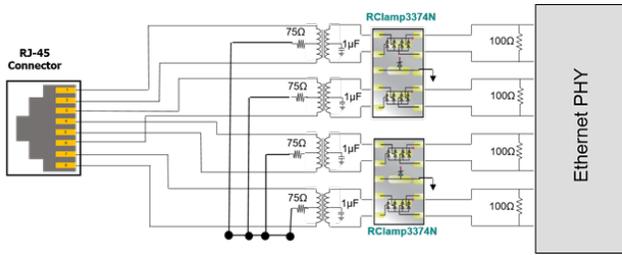
Ethernet

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
RClamp3374N	3.3	4	±30kV/±30kV	40	5	3.0 x 2.0 x 0.6
RClamp3354S	3.3	4	±30kV/±30kV	25	5	3.1 x 2.8 x 1.45
🚗 RClamp0592PWQ	5.0	2	±30kV/±30kV	10	1	1.0 x 0.6 x 0.55
🚗 RClamp0582BQ	5.0	2	±30kV/±25kV	15	1.2	1.6 x 1.6 x 0.75

HDMI

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
RClamp0574P	5.5	4	±15kV/±10kV	5	0.3	2.0 x 1.0 x 0.5
🚗 RClamp0524PQ	5.0	4	±25kV/±15kV	5	1.5	2.5 x 1.0 x 0.58
RClamp0564P	5.0	4	±15kV/±10kV	3	0.2	2.0 x 1.0 x 0.5
RClamp0524PA	5.0	4	±17kV/±12kV	5	0.8	2.5 x 1.0 x 0.58
RClamp7524T	5.0	4	±30kV/±25kV	5	0.6	1.3 x 0.8 x 0.4
RClamp7534P	5.0	4	±25kV/±20kV	4	0.22	2.0 x 1.0 x 0.5

USB 2.0 application
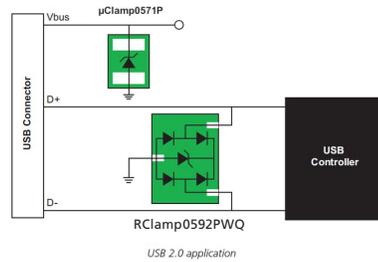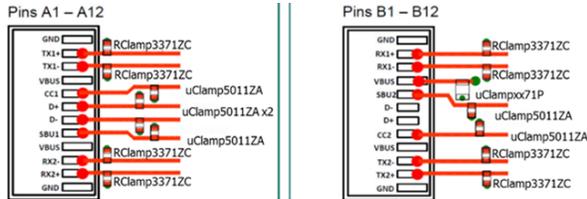
USB Type-C

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
🚗 RClamp0592PWQ	5.0	2	±30kV/±30kV	10	1	1.0 x 0.6 x 0.55
RClamp3371ZC	3.3	1	±17kV/±10kV	9	0.25	0.6 x 0.3 x 0.25
µClamp5011ZA	5.0	1	±18kV/±15kV	2.5	5	0.6 x 0.3 x 0.25
µClamp2271P	22	1	±30kV/±30kV	25	165	1.6 x 1.0 x 0.57

USB 2.0

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
RClamp7522T	5.0	3	±25kV/±15kV	4	0.4	1.0 x 0.7 x 0.4
RClamp0582B	5.0	2	±30kV/±25kV	15	1.2	1.6 x 1.6 x 0.75
🚗 RClamp0592PWQ	5.0	2	±30kV/±30kV	10	1	1.0 x 0.6 x 0.55
µClamp0571P	5.0	1	±30kV/±30kV	80	675	1.6 x 1.0 x 0.57

Thunderbolt3

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
RClamp3391ZC	3.3	1	±15kV/±8kV	7	0.2	0.6 x 0.3 x 0.25
RClamp1011ZC	1.0	1	±15kV/±10kV	2.5	0.2	0.6 x 0.3 x 0.25

Audio Port/Side Keys Protection

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
µClamp3321ZA	3.3	1	±17kV/±15kV	4	5	0.6 x 0.3 x 0.25
µClamp0541Z	5.0	1	±17kV/±17kV	2	9	0.6 x 0.3 x 0.25
µClamp5011ZA	5.0	1	±18kV/±15kV	2.5	5	0.6 x 0.3 x 0.25
µClamp1211Z	12	1	±30kV/±30kV	7	25	0.6 x 0.3 x 0.25
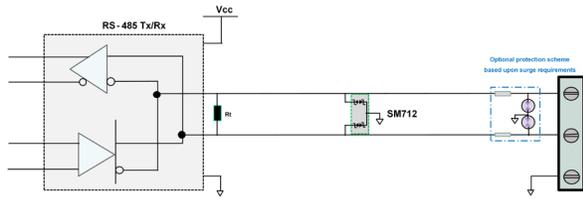
RS-485

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
SM712	12 (Pin 1 or 2 to 3) 7 (Pin 3 to 1 or 2)	2	±30kV/±30kV	21 (Pin 1 or 2 to 3) 38 (Pin 3 to 1 or 2)	75	3.04 x 2.64 x 1.2
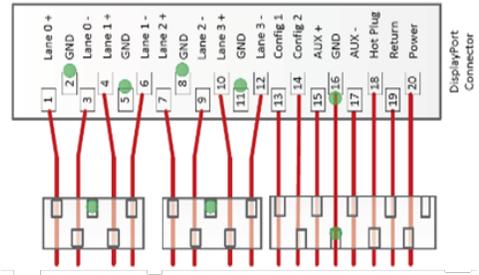
Displayport

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
RClamp0564P	5.0	4	±15kV/±10kV	3	0.2	2.0 x 1.0 x 0.5
RClamp7534P	5.0	4	±25kV/±20kV	4	0.22	2.0 x 1.0 x 0.5
RClamp7538P	5.0	8	±25kV/±20kV	5	0.6	3.8 x 1.0 x 0.5
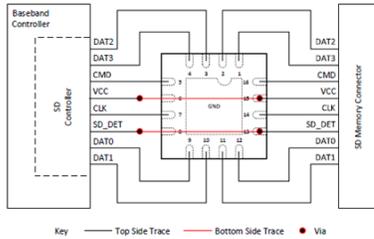
SD Card

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
RClamp3331ZA	3.3	1	±20kV/±18kV	4	0.45	0.6 x 0.3 x 0.25
RClamp3351ZA	3.3	1	±25kV/±22kV	10	0.6	0.6 x 0.3 x 0.25
PClamp0511ZV	5.0	1	±30kV/±30kV	115	275	1.0 x 0.6 x 0.25
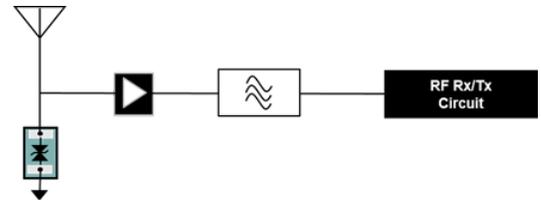
Antenna

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
RClamp3331PQ	3.3	1	±30kV/±30kV	10	0.38	1.0 x 0.6 x 0.5
RClamp0521PA	5.0	1	±15kV/±12kV	4	0.5	1.0 x 0.6 x 0.5
RClamp0531T	5.0	1	±20kV/±12kV	4	0.8	1.0 x 0.6 x 0.4
RClamp2451ZA	24	1	±18kV/±14kV	4	0.45	0.6 x 0.3 x 0.25
RClamp1521P	15	1	±15kV/±8kV	4	0.5	1.0 x 0.6 x 0.5
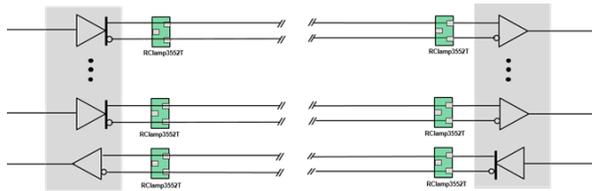
Low Voltage Differential Signaling (LVDS)

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
RClamp3552TQ	3.5	2	±20kV/±17kV	4	0.4	1.0 x 0.6 x 0.4
RClamp3331PQ	3.3	1	±30kV/±30kV	10	0.38	1.0 x 0.6 x 0.5

uClamp2424PWQ

IO-Link & Proxmity Switch Protection

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
SDC36C	33	2	±15kV/±8kV	4	120	3.04 x 2.64 x 1.2
µClamp3603T	36	3	±20kV/±15kV	16	120	1.7 x 1.0 x 0.4

VBus Protection

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
µClamp0571P	5	1	±30kV/±30kV	80	675	1.6 x 1.0 x 0.57
µClamp0871P	8	1	±30kV/±30kV	65	475	1.6 x 1.0 x 0.57
µClamp1071P	10	1	±30kV/±30kV	60	350	1.6 x 1.0 x 0.57
µClamp1271P	12	1	±30kV/±30kV	45	275	1.6 x 1.0 x 0.57
µClamp1571P	15	1	±30kV/±30kV	40	220	1.6 x 1.0 x 0.57
µClamp1871P	18	1	±30kV/±30kV	35	225	1.6 x 1.0 x 0.57
µClamp2271P	22	1	±30kV/±30kV	25	165	1.6 x 1.0 x 0.57
µClamp2671P	26	1	±30kV/±30kV	23	155	1.6 x 1.0 x 0.57
µClamp3671P	36	1	±30kV/±30kV	18	150	1.6 x 1.0 x 0.57

CAN Bus Protection

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
🚗 µClamp2424PWQ	24	2	±30kV/±30kV	5A	115pF	2.5 x 1.0 x 0.55

USB VBus

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
PClamp0501P	5	1	±30kV/±30kV	120	1150	1.6 x 1.0 x 0.53
PClamp1021P	10	1	±30kV/±30kV	80	600	1.6 x 1.0 x 0.53
PClamp1211P	13.5	1	±30kV/±30kV	180	2500	2.0 x 1.8 x 0.57
PClamp1221P	12	1	±30kV/±30kV	80	530	1.6 x 1.0 x 0.53
PClamp1011P	10	1	±30kV/±30kV	180	2500	2.0 x 1.8 x 0.57
PClamp2011P	23	1	±30kV/±30kV	120	800	2.0 x 1.8 x 0.57

Optical Modules Protection

Part Number	Vrwm	Lines	ESD Rating (Air/Contact)	Surge (8x20us) (A)	Cap (pF)	Size (mm)
µClamp0511P	5	1	±15kV/±8kV	12	75	1.0 x 0.6 x 0.5
µClamp3381P	3.3	1	±30kV/±30kV	25	35	1.0 x 0.6 x 0.5
RClamp7524T	5	4	±30kV/±25kV	5	0.6	1.3 x 0.8 x 0.4
RClamp0524T	5	4	±15kV/±8kV	5	0.8	2.5 x 1.0 x 0.4

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