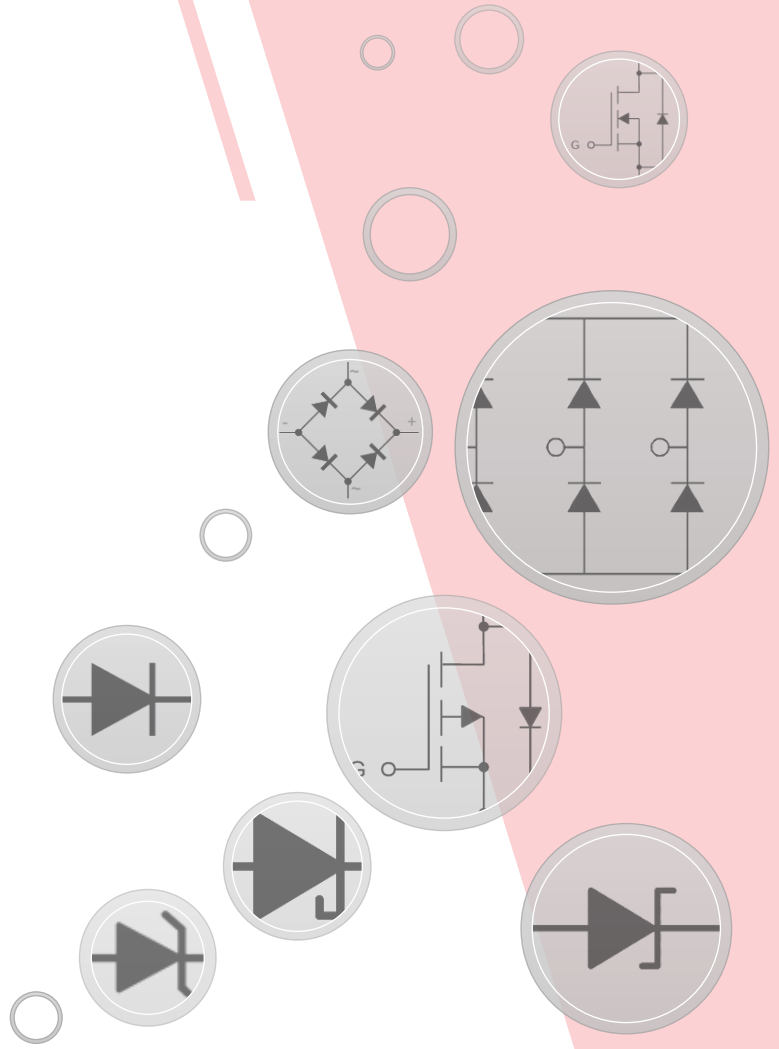
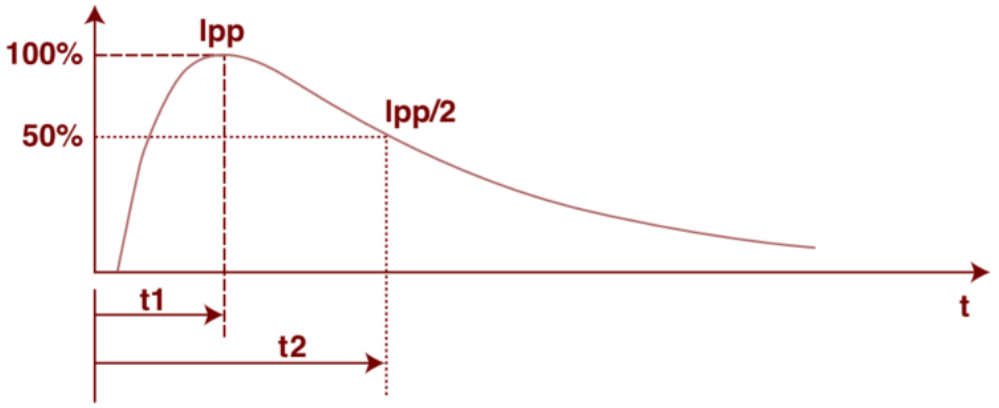
Micro Commercial Components

MCC TVS Diodes

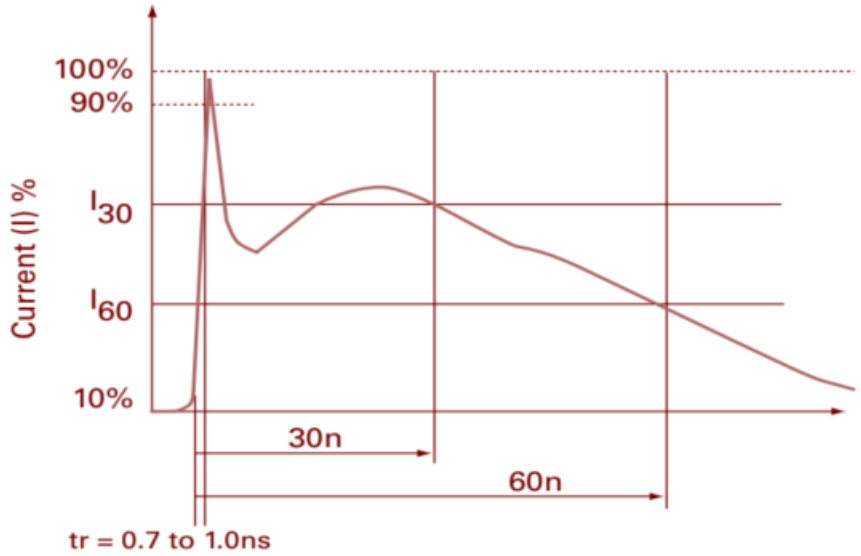


Voltage Transients

- Miniaturization of electronics component has resulted in vulnerable to electrical stress such as overcurrent and overvoltage.
- Overvoltage could be due to power fault or voltage transients caused by Electrostatic discharge (ESD), Lightning induced transients or inductive load switching.
- Component which is not able to handle the sudden increase in energy could result in abnormal working behaviour, system damage or potential safety hazard.
- Therefore, voltage transients must be controlled or suppressed to prevent system damage or catastrophic failures.
- Various studies are being carried out to characterize different type of voltage transients. The 2 most common transient models are lightning transient waveform and ESD waveform.



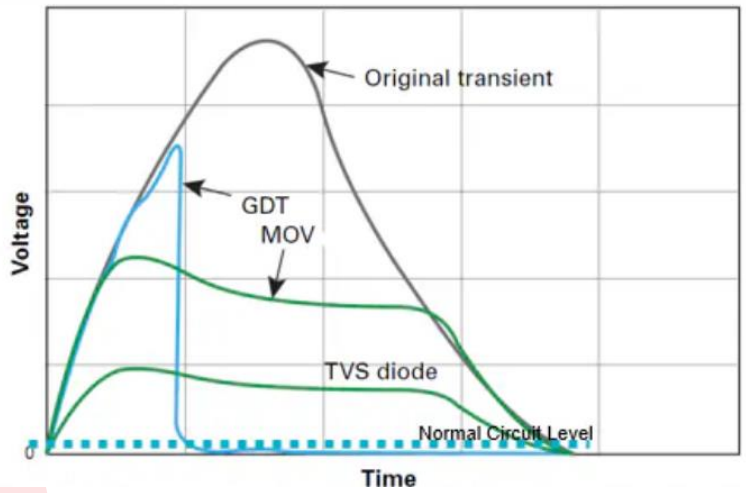
Lightning Transient Waveform



ESD Waveform

Overvoltage Protection Devices

- Basically, there are 2 types of overvoltage protection mechanism:
  - Clamping: clamp the voltage to certain level but device suffer high heat generation.
  - Crowbar: short circuits the output to allow high current dissipation.



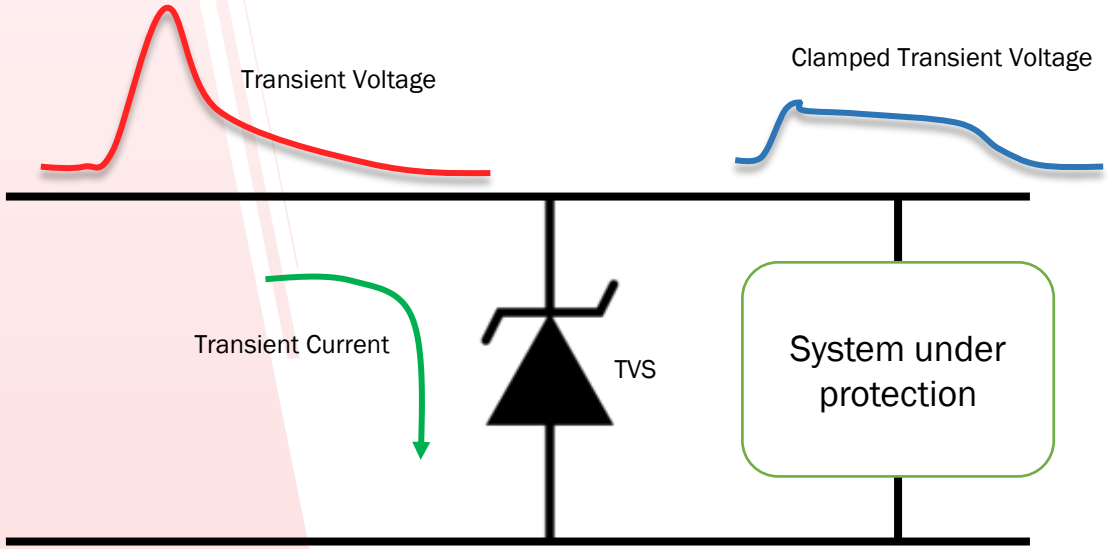
- Table below shows common overvoltage protection devices and technologies used to suppress transients.

	Clamping		Crowbar	
Device	Transient Voltage Suppressor (TVS)	Metal Oxide Varistor (MOV)	Thyristor	Gas Discharge Tube (GDT)
Technology	Semiconductor	Ceramic	Semiconductor	Spark gap
Polarity	Uni/Bi-directional	Bi-directional	Uni/Bi-directional	Bi-directional
Residue Voltage Level	Low	High	Low	Low
Surge Withstanding Capability	Low	High	Medium	High
Pulse Cycle Capability	Excellent	Good	Excellent	Good
Response time	Very Fast	Fast	Very Fast	Slow
Capacitance	High	High	Low	Low

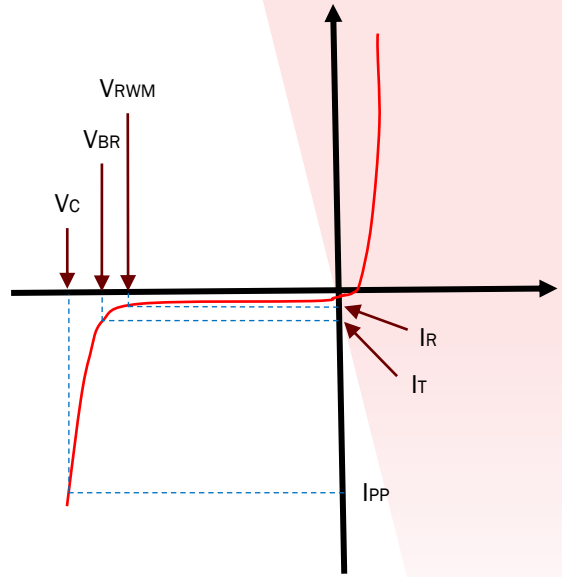
- Semiconductor devices are generally outperformed MOV and GDT in multiple aspects.
- Comparing to Thyristor, TVS are more commonly used due to clamping mechanism and system level compatibility.

What is TVS?

- Transient Voltage Suppressor also known as TVS in short is a semiconductor device which should ideally limit the transient voltage to a defined level; therefore, to protect the system behind it from overvoltage stress and conduct the excess transient current back to the source.



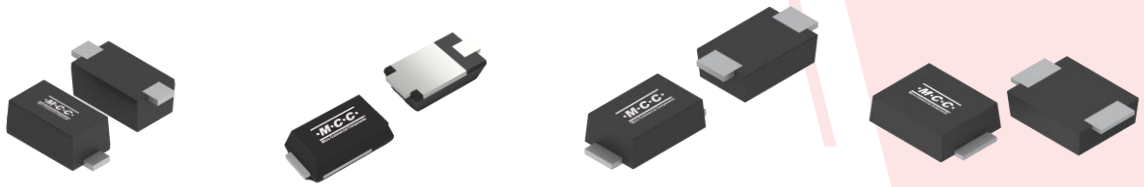
- TVS is connected in parallel to the protected line and in reversed direction. The nominal voltage of the line should not exceed the reverse working voltage (V_{RWM}) of the TVS. When the reversed bias voltage exceeds the breakdown voltage (V_{BR}), TVS starts to conduct. If the voltage continue to raise further, TVS will go into avalanche breakdown and huge current will be conducted through the TVS.
- Excessive transient current flows through the TVS back to the source, causing voltage to remain constant, thus protecting the system behind it. However, every semiconductor device is limited by the power it could dissipate. Similarly, TVS works the same. The clamping voltage (V_C) at the peak pulse current (I_{PP}) should not exceed the peak pulse power (P_{PP}) of the TVS. Otherwise, TVS will suffer electrical overstress and may resulted in damage or failure.



MCC TVS Diodes

- MCC offers more than 4,000 TVS diodes for selection and about 40% of them are AEC-Q101 qualified.
- As an integrated device manufacturer, MCC manages every single details from materials, chip design to assembly and test to ensure consistent and persistent quality TVS diodes shipped to our customers.
- Innovation and development has never been stopped in MCC. Throughout years of innovations, MCC TVS diodes is approaching the 5th Generation of technology platform.
- Other than SMA, SMB & SMC packages, MCC offers low profile packages such as SOD-123FL, SOD-123HL, SMA-FL & SMBF with height as low as 1.15mm. Table below shows the matrix of non-automotive grade TVS diodes in peak pulse power, packages including axial leaded & reverse working voltage range.

Low Profile SMD Packages



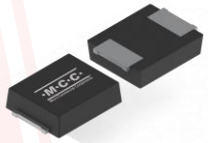
SOD-123FL | SOD-123HL | DO-221AC (SMA-FL) | SMBF

Surface Mount Packages

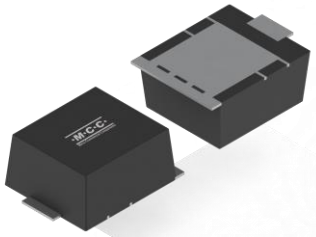
SMA | SMB | SMC | DO-218AB

MCC TVS Diodes Packages

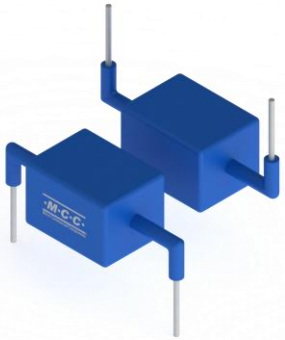
High Power Packages



SMG



SME



AK

Axial Leaded Packages

DO-41

DO-15

DO-201AE

R-6

MCC Non-Automotive TVS

Non-Automotive Grade TVS (surface mount type)				
P_{PP} (W)	Configuration	Package	Family Series	VRWM (V)
200	Bi-dir	SOD-123FL	SMF	5 ~ 170
	Uni-dir	SOD-123FL	SMF	5 ~ 170
		SOD-123HL	SMH	5 ~ 100
400	Bi-dir	SOD-123FL	SM4F	5 ~ 45
		DO-221AC	SMAF	5 ~ 300
		SMA	SMAJ	5 ~ 440
			SMAJP4KE	5.8 ~ 495
			SMAJS	24
	Uni-dir	SOD-123HL	SM4H	5 ~ 100
		SOD-123FL	SM4F	5 ~ 100
		DO-221AC	SMAF	5 ~ 300
		SMA	SMAJ	5 ~ 440
			SMAJP4KE	5.8 ~ 495

Non-Automotive Grade TVS (surface mount type)				
P_{PP} (W)	Configuration	Package	Family Series	VRWM (V)
500	Uni-dir	SMB	SMBSAC	5 ~ 50
600	Bi-dir	DO-221AC	SMA6J..FL	11 ~ 85
		SMBF	SMBF	5 ~ 220
		SMA	SMA6J	5 ~ 58
		SMB	SMBJ	5 ~ 440
			SMBJ..L	220 ~ 440
			SMBJP6KE	5.8 ~ 468
	Uni-dir	DO-221AC	SMA6J..FL	5 ~ 130
		SMBF	SMBF	5 ~ 220
		SMA	SMA6J	5 ~ 58
		SMB	SMBJ	5 ~ 440
			SMBJ..L	220 ~ 440
			SMBJP6KE	5.8 ~ 468
			SMBJP6KE..L	214 ~ 342

MCC Non-Automotive TVS

Non-Automotive Grade TVS (surface mount type)

P_{PP} (W)	Configuration	Package	Family Series	VRWM (V)
1000	Bi-dir	SMB	SMB10J	5 ~ 120
			SMBJ1.0KE	5.8 ~ 77.8
	Uni-dir	SMB	SMB10J	5 ~ 120
			SMBJ1.0KE	5.8 ~ 77.8
1500	Bi-dir	SMB	SMB15J	15 ~ 58
		SMC	SMCJ1.5KE	5.8 ~ 495
			SMCJ	5 ~ 440
	Uni-dir	SMB	SMB15J	15 ~ 58
		SMC	SMCJ1.5KE	5.8 ~ 495
			SMCJ	5 ~ 440
2000	Bi-dir	SMB	SMB20J	20 ~ 58
	Uni-dir	SMB	SMB20J	20 ~ 58
3000	Bi-dir	SMC	SMLJ	5 ~ 440
	Uni-dir	SMC	SMLJ	5 ~ 440
5000	Bi-dir	SMC	5.0SMLJ	11 ~ 400
	Uni-dir	SMC	5.0SMLJ	11 ~ 400

Non-Automotive Grade TVS (Axial leaded type)

P_{PP} (W)	Configuration	Package	Family Series	VRWM (V)
400	Bi-dir	DO-41	P4KE(5.8~495)	5.8 ~ 495
	Uni-dir	DO-41	P4KE(5.8~495)	5.8 ~ 495
500	Bi-dir	DO-15	P5KE(5~200)	5 ~ 200
			SA(5~170)	5 ~ 170
	Uni-dir	DO-15	P5KE(5~200)	5 ~ 200
			SA(5~170)	5 ~ 170
600	Bi-dir	DO-15	P6KE(5.8~512)	5.8 ~ 512
	Uni-dir	DO-15	P6KE(5.8~512)	5.8 ~ 512
1500	Bi-dir	DO-201AE	1.5KE(5.8~467)	5.8 ~ 467
	Uni-dir	DO-201AE	1.5KE(5.8~467)	5.8 ~ 467
			LCE(6.5~28)	6.5 ~ 28
3000	Bi-dir	R-6	3KP(5~220)	5 ~ 220
	Uni-dir	R-6	3KP(5~220)	5 ~ 220
5000	Bi-dir	R-6	5KP(5~440)	5 ~ 440
			5KP..L(22~188)	22 ~ 188
	Uni-dir	R-6	5KP(5~440)	5 ~ 440
			5KP..L(22~188)	22 ~ 188
6000	Bi-dir	R-6	SLD(10~60)	10 ~ 60
	Uni-dir	R-6	SLD(10~60)	10 ~ 60

MCC High Power TVS

- Applications exposed to harsh environment are susceptible to strong transients and interferences. Typical 5kW TVS may suffer to keep the system protected. In such cases, high power TVS such as 15kW or 30kW TVS could come handy.
  - 15KP series
  - 30KP series
- Further up, higher power TVS such as MCC AK series are characterized using peak pulse current waveform of 8/20us which is the testing requirement by safety standard such as UL or IEC for lightning surge protection. Below table shows MCC AK series product range from 1kA to 15kA peak pulse current.
  - AK series

High Power TVS (Axial leaded type)

P_{PP} (W)	Configuration	Package	Family Series	VRWM (V)
15000	Bi-dir	R-6	15KP(17~280)	17 ~ 280
			15KP..L(17~280)	17 ~ 280
	Uni-dir	R-6	15KP(17~280)	17 ~ 280
			15KP..L(17~280)	17 ~ 280
30000	Bi-dir	R-6	30KP(28~288)	28 ~ 288
	Uni-dir	R-6	30KP(28~288)	28 ~ 288

High Power TVS (I_{PP} rating)

I_{PP} (A)	Configuration	Package	Family Series	VRWM (V)
1000	Bi-dir	AK	AK1(76)	76
2500	Bi-dir	SMG	SMGJ(80)	80
3000	Bi-dir	AK	AK3(30~430)	30 ~ 430
6000	Bi-dir	AK	AK6(58~430)	58 ~ 430
10000	Bi-dir	SME	SMEJ(58~86)	58 ~ 86
		AK	AK10(58~430)	58 ~ 430
15000	Bi-dir	AK	AK15(58~76)	58 ~ 76

MCC Automotive TVS

- MCC Automotive TVS went through stringent reliability test to ensure it meets the highest standard of AEC-Q101 standard.
- Automated facilities are implemented to minimize human errors, contaminations, improve efficiency and ensure consistent quality of every single piece of TVS produced.
- MCC offers AEC-Q101 qualified TVS range from 200W to 6600W peak pulse power. They are available in various SMD packages and capable to operate up to 175°C junction temperature. The table shows the automotive TVS product range offered by MCC.

Automotive Grade TVS				
P_{PP} (W)	Configuration	Package	Family Series	VRWM (V)
200	Bi-dir	SOD-123FL	SMF..Q	5 ~ 100
	Uni-dir	SOD-123FL	SMF..HE3	5 ~ 100
			SMF..Q	5 ~ 100
400	Bi-dir	SOD-123FL	SM4F..HE3	6 ~ 45
		SMA	SMAJ..HE3	5 ~ 190
			SMAJ..Q	5 ~ 190
			SMAJP4KE..HE3	10.2 ~ 185
			SMAJP4KE..Q	5.8 ~ 185
	Uni-dir	SOD-123FL	SM4F..HE3	6 ~ 100
		SMA	SMAJ..HE3	5 ~ 190
			SMAJ..Q	5 ~ 190
			SMAJP4KE..HE3	10.2 ~ 185
			SMAJP4KE..Q	5.8 ~ 185

MCC Automotive TVS

Automotive Grade TVS				
P_{PP} (W)	Configuration	Package	Family Series	VRWM (V)
600	Bi-dir	DO-221AC	SMA6J..FLQ	5 ~ 85
		SMA	SMA6J..HE3	10 ~ 100
			SMA6J..Q	10 ~ 20
		SMB	SMBJ..HE3	5 ~ 190
			SMBJ..Q	5 ~ 190
			SMBJP6KE..HE3	10.2 ~ 185
			SMBJP6KE..Q	5.8 ~ 185
	Uni-dir	DO-221AC	SMA6J..FLQ	5 ~ 85
		SMA	SMA6J..HE3	10 ~ 100
			SMA6J..Q	10 ~ 100
		SMB	SMBJ..HE3	5 ~ 190
			SMBJ..Q	5 ~ 190
			SMBJP6KE..HE3	10.2 ~ 185
			SMBJP6KE..Q	5.8 ~ 185

Automotive Grade TVS				
P_{PP} (W)	Configuration	Package	Family Series	VRWM (V)
1500	Bi-dir	SMC	SMCJ1.5KE..HE3	10.2 ~ 185
			SMCJ1.5KE..Q	5.8 ~ 185
			SMCJ..HE3	10 ~ 190
			SMCJ..Q	5 ~ 190
	Uni-dir	SMC	SMCJ1.5KE..HE3	10.2 ~ 185
			SMCJ1.5KE..Q	5.8 ~ 185
			SMCJ..HE3	10 ~ 190
			SMCJ..Q	5 ~ 190
3000	Bi-dir	SMC	SMLJ48..HE3A	10 ~ 48
			SMLJ..Q	5 ~ 48
	Uni-dir	SMC	SMLJ48..HE3A	10 ~ 48
			SMLJ..Q	5 ~ 48
5000	Bi-dir	SMC	5.0SMLJ..HE3	5 ~ 85
	Uni-dir	SMC	5.0SMLJ..HE3	5 ~ 85
6600	Bi-dir	DO-218AB	SM8S..HE3	14 ~ 43
	Uni-dir	DO-218AB	SM8S..HE3	10 ~ 43

Micro Commercial Components

Thank you!

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