

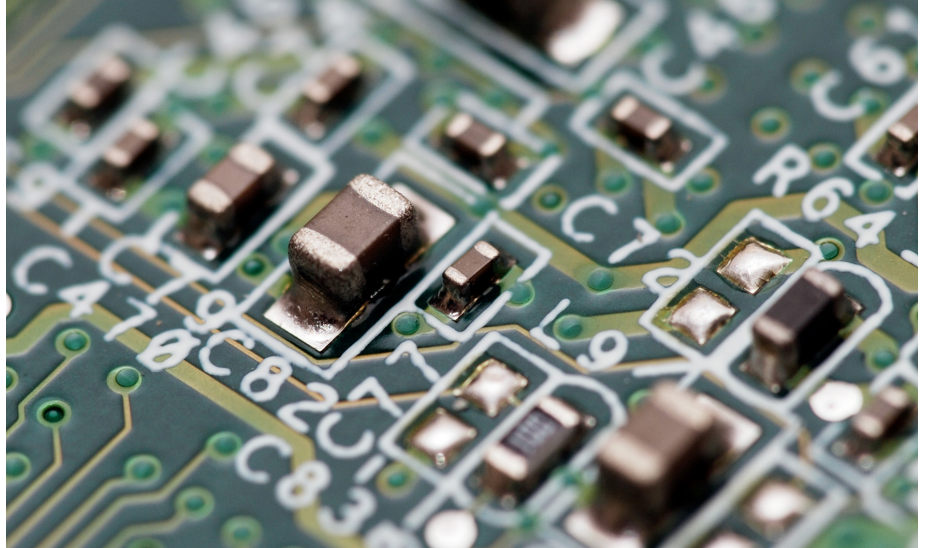


ESD Solutions for Protecting SPI Ports

RClamp®0582BQ

KEY FEATURES

- 5V working voltage
- Protects two high-speed data lines
- ±25kV contact/±30kV air
- Dynamic resistance: 0.52Ω
- Low capacitance: 1.2pF (typ)
- Industry standard SC-75 package



Alternative Solutions

RClamp®0502A

KEY FEATURES

- 5V working voltage
- Protects two high-speed data lines
- ±15kV contact/±20kV air
- Low capacitance: 0.7pF I/O to I/O
- Flow-through package (1.6x1.6x0.6mm)

RClamp®0531TQ

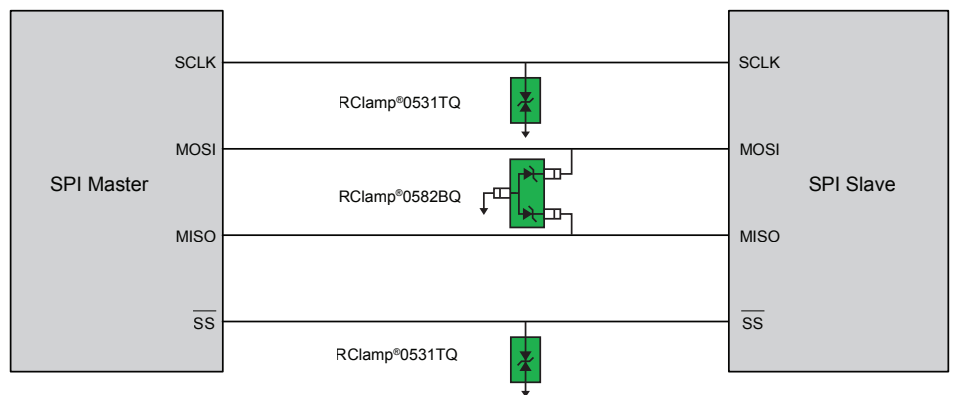
KEY FEATURES

- 5V working voltage
- Protects one high-speed data line
- ±12kV contact/±20kV air
- Low capacitance: 0.8pF I/O to GND
- Flow-through package (1.0x0.6x0.4mm)

ESD Protection to Safeguard SPI Ports

The Serial Peripheral Interface (SPI) is a serial communication interface used for short distance communication in embedded systems. SPI uses a full-duplex mode communication standard and employs a master/slave architecture.

The SPI bus is often vulnerable to damage from ESD transient voltage spikes. To adequately protect SPI ports from ESD damage, circuit designers use transient voltage suppressors to safeguard from these transient threats. Semtech's 5V transient voltage protection diodes (TVS) are ideally suited for safeguarding SPI ports that reside in harsh electrical environments. The schematic below shows a typical example of protecting a SPI port from ESD damage.



SPI Port Protection with Semtech RClamp®0582BQ TVS Array Solution

RClamp[®]0582BQ - Absolute Maximum Rating

Maximum Rating	Symbol	Value	Unit
Peak Pulse Power (tp = 8/20μs)	P _{pk}	300	W
Peak Pulse Current (tp = 8/20μs)	I _{pp}	15	A
ESD per IEC 61000-4-2 (Air) ⁽¹⁾ ESD per IEC 61000-4-2 (Contact) ⁽¹⁾	V _{ESD}	±30 ±25	kV
Operating Temperature	T _j	-40 to +105	°C
Storage Temperature	T _{STG}	-55 to +150	°C

Electrical Characteristics (T = 25°C)

Parameter	Symbol	Condition	Min	Typ	Max	Units
Reverse Stand-Off Voltage	V _{RWM}	Pin 1 or Pin 2 to Pin 3			5	V
Reverse Breakdown Voltage	V _{BR}	I _{BR} = 1mA, Pin 1 to Pin 2 to Pin 3	6		11	V
Reverse Leakage Current	I _R	V _{RWM} = 5V T = 25°C, Pin 1 or Pin 2 to Pin 3 and between Pin 1 and 2			0.1	μA
					0.23	μA
Clamping Voltage	V _C	t _p = 8/20μs Pin 1 or Pin 2 to Pin 3	I _{pp} = 5A		15	V
			I _{pp} = 15A		20	
ESD Clamping Voltage ⁽²⁾	V _C	t _p = 0.2/100ns Pin 1 or Pin 2 to Pin 3	I _{pp} = 4A	13.8		
			I _{pp} = 16A	20.1		
Dynamic Resistance ^{(2) (3)}	R _{DYN}	t _p = 0.2/100ns, Pin 1 or Pin 2 to Pin 3		0.52		ohm
Junction Capacitance	C _j	Any I/O to Gnd V _R = 0, f = 1MHz, Pin 1 to pin 2		0.5	0.8	pF
		I/O to I/O V _R = 0, f = 1MHz, Pin 1 or Pin 2 to Pin 3			1.2	pF

Notes

1) Measured with a 40dB attenuator, 500ohm scope input impedance, 2GHz bandwidth. ESD gun return path connected to ESD ground plane.

2) Transmission Line Pulse Test (TLP) Settings: t_p = 100ns, t_r = 0.2ns, I_{TLP} and V_{TLP} averaging window: t₁ = 70ns to t₂ = 90ns.

3) Dynamic resistance calculated from I_{TLP} = 4A to I_{TLP} = 16A.

ORDERING INFORMATION

Part Number	Qty Per Reel	Reel Size
RClamp0582BQTCT	3,000	7 inches

RClamp[®]0502A - Absolute Maximum Rating

Maximum Rating	Symbol	Value	Unit
Peak Pulse Power ($t_p = 8/20\mu s$)	P_{pk}	50	W
Peak Pulse Current ($t_p = 8/20\mu s$)	I_{pp}	3	A
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD}	± 20 ± 15	kV
Operating Temperature	T_j	-55 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C

Electrical Characteristics (T = 25°C)

Parameter	Symbol	Condition	Min	Typ	Max	Units
Reverse Stand-Off Voltage	V_{RWM}	Between I/O lines to Gnd or I/O to I/O			5	V
Reverse Breakdown Voltage	V_{BR}	$I_t = 1mA$, Between I/O lines to Gnd	6			V
Reverse Leakage Current	I_R	$V_{RWM} = 5V$, $T = 25^\circ C$ Between I/O lines to Gnd or I/O to I/O			1	μA
Clamping Voltage	V_C	$I_{pp} = 1A$, $t_p = 8/20\mu s$ Between I/O lines to Gnd			14	V
		$I_{pp} = 3A$, $t_p = 8/20\mu s$ Between I/O to Gnd			16	V
		$I_{pp} = 3A$, $t_p = 8/20\mu s$ Between I/O to I/O			16	V
Junction Capacitance	C_j	$V_R = 0V$, $f = 1MHz$ Between I/O to Gnd			0.9	pF
		$V_R = 0V$, $f = 1MHz$ Between I/O to I/O		0.3	0.7	pF

ORDERING INFORMATION

Part Number	Qty Per Reel	Reel Size	Lead Finish
RClamp0502A.TCT	3,000	7 inches	Pb Free

RClamp[®]0531TQ - Absolute Maximum Rating

Maximum Rating	Symbol	Value	Unit
Peak Pulse Power ($t_p = 8/20\mu s$)	P_{pk}	80	W
Peak Pulse Current ($t_p = 8/20\mu s$)	I_{pp}	4	A
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD}	± 20 ± 12	kV
Operating Temperature	T_j	-55 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C

Electrical Characteristics (T = 25°C)

Parameter	Symbol	Condition	Min	Typ	Max	Units
Reverse Stand-Off Voltage	V_{RWM}				5	V
Reverse Breakdown Voltage	V_{BR}	$I_t = 1mA$	6	9.3	11	V
Reverse Leakage Current	I_R	$V_{RWM} = 5V, T = 25^\circ C$		0.010	0.100	μA
		$V_{RWM} = 5V, T = 125^\circ C$		0.020	0.200	μA
Clamping Voltage	V_C	$I_{pp} = 1A, t_p = 8/20\mu s$			12	V
		$I_{pp} = 4A, t_p = 8/20\mu s$			20	V
Junction Capacitance	C_j	$V_R = 0V, f = 1MHz, T = 25^\circ C$		0.5	0.8	pF
		$V_R = 0V, f = 1MHz, T = 125^\circ C$		0.85	1.5	pF

ORDERING INFORMATION

Part Number	Qty Per Reel	Reel Size	Lead Finish
RClamp0531TQTCT	3,000	7 inches	Lead-free NiPdAu



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