

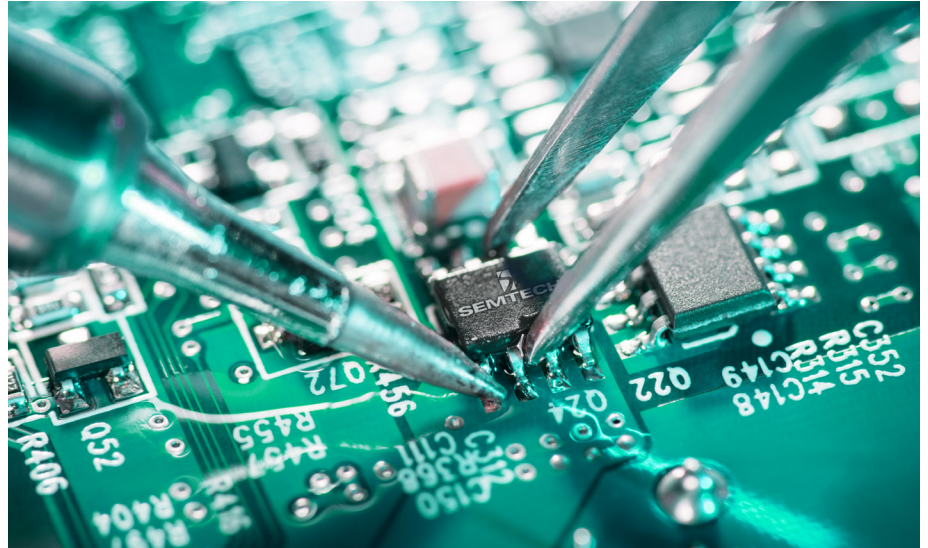


ESD Solutions for I²C Bus Protection

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

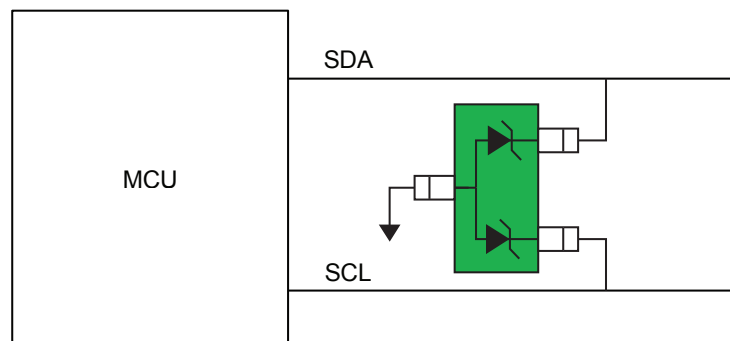
KEY FEATURES

- 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 I²C Bus

The I²C bus was developed to enable intermodule communication between circuit boards within a system. Today, the bus is mainly used to connect peripherals to microcontroller on a PCB system. The I²C bus, primarily employed for short distance communication, ranges from 100kbps to 5Mbps.

The I²C bus is often vulnerable to ESD transient voltage spikes and it is important to safeguard I²C bus interfaces from these dangerous overvoltage events. The circuit below shows an example of using a low-clamping voltage TVS array for protecting the two line I²C bus (SDA and SCL lines) from transient voltage threats.



I²C Bus Protection with Semtech's RClamp[®]0582BQ TVS Array

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
			T = 105°C, Pin 1 or Pin 2 to Pin 3 and between Pin 1 and 2		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	$^{\circ}C$
Storage Temperature	T_{STG}	-55 to +150	$^{\circ}C$

Electrical Characteristics (T = 25 $^{\circ}C$)

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	$^{\circ}C$
Storage Temperature	T_{STG}	-55 to +150	$^{\circ}C$

Electrical Characteristics (T = 25 $^{\circ}C$)

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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