



CeraDiode

SMD type, single, case size 0402, 0603 and 1003

Series/Type:	CDS*C**GTH
Ordering code:	B725**D****H***
Date:	2007-02-20
Version:	3

Reliable ESD protection of high-speed single lines



Description

Due to the ongoing miniaturization, today's electronic devices are more and more sensitive to electrostatic discharges (ESD). Therefore reliable protection components become absolutely necessary to safeguard your valuable electronics against the impact of ESD.

CeraDiodes are ceramic semiconductors optimized specifically for high performance in ESD applications. They have a non-linear voltage/current characteristic for effectively suppressing extremely fast voltage transients and offer superior parametric stability over the complete operating range of $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$.

CeraDiodes are bi-directional devices. A single CeraDiode connected from signal/data line to ground routes both positive and negative ESD transitions safely to the ground plane. This technique eliminates the need to route ESD charge into the power plane, possibly damaging nearby integrated circuits. CeraDiodes for high-speed lines exhibits a very low capacitance designed for maximum ESD protection combined with minimal signal distortion.

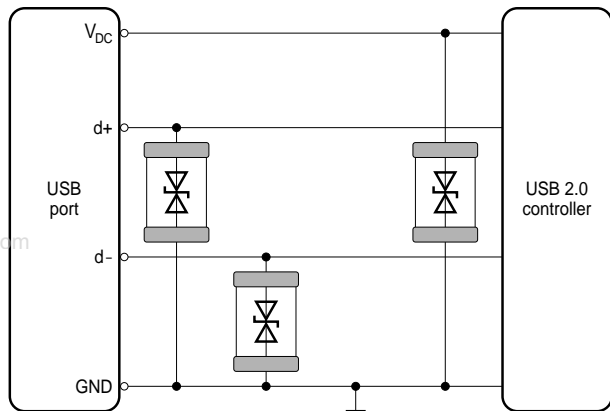
Features

- Bi-directional ESD protection to IEC 61000-4-2 (level 4)
- Suitable for uni- and bi-directional lines
- Bi-directional ESD protection in a two-pin line
- Routes all ESD events, both positive and negative, safely to ground
- Suitable for DC working voltages up to 30 V
- Very low capacitance down to 2 pF
- USB 2.0 compliant
- No derating of maximum ratings up to 85 °C
- Surface mount package in case sizes
 - 0402 (semiconductor package SOD-723)
 - 0603 (semiconductor package SOD-523)
 - 1003 (semiconductor package SOD-323)
- Extremely fast response time $< 0.5\text{ ns}$
- Lead-free nickel barrier terminations suitable for lead-free soldering
- RoHS-compatible

Applications

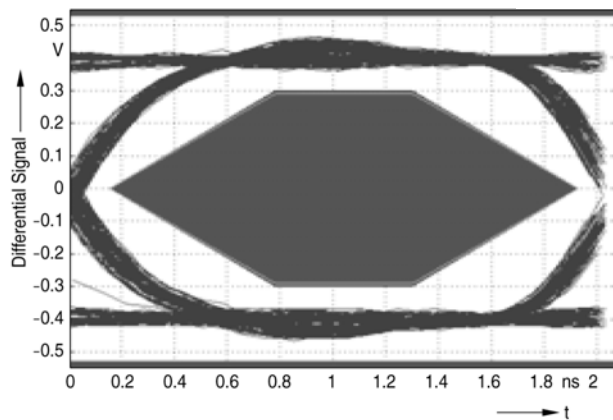
- Interfaces (e.g. audio and video, USB, IEEE 1394, Ethernet, DVI)
- EDP products (e.g. desktop and notebook computers)
- Peripherals (e.g. printers, memory cards, etc.)
- Portable handheld products (e.g. PDA)
- Mobile communication
- Consumer products (Flat TVs, set top boxes, MP3 players, digital cameras, etc.)
- Liquid crystal displays (LCD) / monitors

Application example



Note: USB 2.0 protection with high-speed single CeraDiodes.

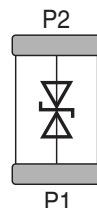
USB 2.0 compliance test



Note: USB 2.0 compliance test results of CDS2C16GTH.

Pin configuration

Pin	Description
P1	GND
P2	I/O Line



Due to the symmetrical configuration no marking information is needed. P1 and P2 can be interchanged.

Maximum ratings ($T_A = 85\text{ °C}$)

Rating	Symbol	Value	Unit
Maximum DC working voltage	V_{DC}	CDS2C15GTH: 15 CDS2C16GTH: 16 CDS3C16GTH: 16 CDS3C30GTH: 30 CDS4C16GTH: 16	V
Air discharge ESD capability (to IEC 61000-4-2 method)	V_{ESD}	15	kV
Contact discharge ESD capability (to IEC 61000-4-2 method)	V_{ESD}	8	kV
Operating temperature (without derating)	T_{op}	-40 to +85	°C
Storage temperature	T_{stg}	-40 to +125	°C

Characteristics ($T_A = 25\text{ °C}$)

CDS2C15GTH

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	$I_{BR} = 1\text{ mA}$	23	-	-	V
Leakage current	I_{leak}	$V_{leak} = 5.6\text{ V}$	-	-	1	μA
Clamping voltage	V_{clamp}	$I_{PP} = 1\text{ A}, 8/20\ \mu\text{s}$	-	-	66	V
Capacitance	C	$V = 1\text{ V}, f = 1\text{ MHz}$	-	10	15	pF

CDS2C16GTH

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	$I_{BR} = 1\text{ mA}$	65	-	-	V
Leakage current	I_{leak}	$V_{leak} = 5.6\text{ V}$	-	-	1	μA
Clamping voltage	V_{clamp}	$I_{PP} = 1\text{ A}, 8/20\ \mu\text{s}$	-	-	290	V
Capacitance	C	$V = 1\text{ V}, f = 1\text{ MHz}$	-	2	3	pF

CDS3C16GTH

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	$I_{BR} = 1 \text{ mA}$	65	-	-	V
Leakage current	I_{leak}	$V_{leak} = 5.6 \text{ V}$	-	-	1	μA
Clamping voltage	V_{clamp}	$I_{PP} = 1 \text{ A}, 8/20 \mu\text{s}$	-	-	290	V
Capacitance	C	$V = 1 \text{ V}, f = 1 \text{ MHz}$	-	3	5	pF

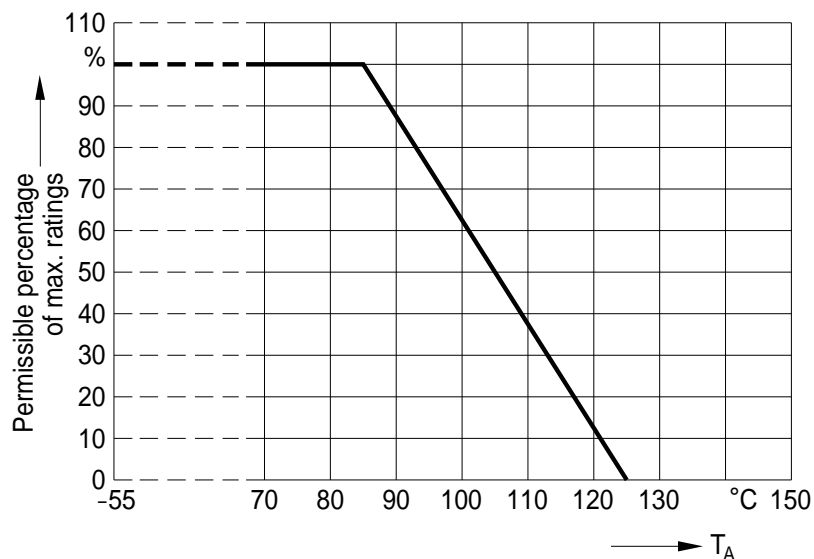
CDS3C30GTH

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	$I_{BR} = 1 \text{ mA}$	50	-	-	V
Leakage current	I_{leak}	$V_{leak} = 5.6 \text{ V}$	-	-	1	μA
Clamping voltage	V_{clamp}	$I_{PP} = 1 \text{ A}, 8/20 \mu\text{s}$	-	-	120	V
Capacitance	C	$V = 1 \text{ V}, f = 1 \text{ MHz}$	-	10	15	pF

CDS4C16GTH

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	$I_{BR} = 1 \text{ mA}$	38	-	-	V
Leakage current	I_{leak}	$V_{leak} = 5.6 \text{ V}$	-	-	1	μA
Clamping voltage	V_{clamp}	$I_{PP} = 1 \text{ A}, 8/20 \mu\text{s}$	-	-	146	V
Capacitance	C	$V = 1 \text{ V}, f = 1 \text{ MHz}$	-	3	5	pF

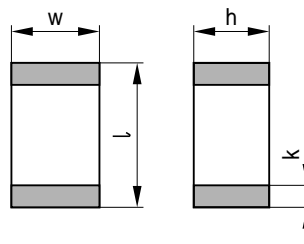
Note: Any operating voltage lower than V_{leak} results in lower leakage current.

Typical characteristics


Dimensional drawing

Dimensions in mm

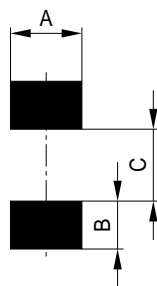
Symbol	0402		0603		1003	
	Min.	Max.	Min.	Max.	Min.	Max.
l	0.85	1.15	1.45	1.75	2.34	2.74
w	0.4	0.6	0.7	0.9	0.7	0.9
h	0.4	0.6	0.7	0.9	0.7	0.9
k	0.1	0.3	0.1	0.4	0.13	0.75



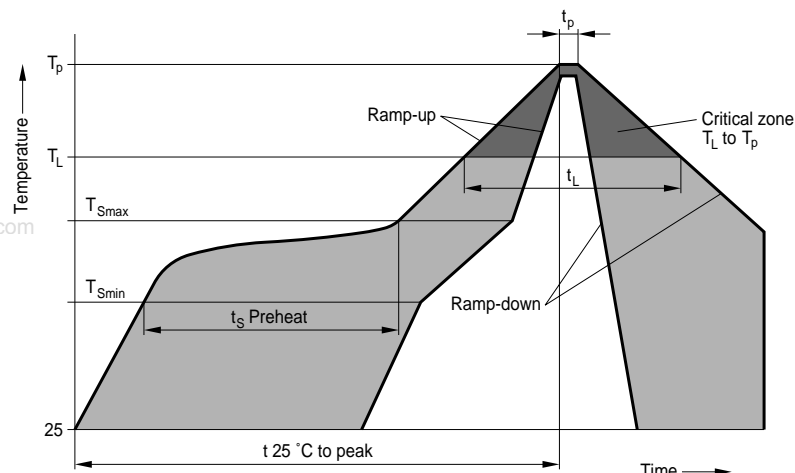
Recommended solder pad

Dimensions in mm

Symbol	0402	0603	1003
	Dim.	Dim.	Dim.
A	0.6	1.0	0.8
B	0.6	1.0	0.8
C	0.5	1.0	1.45



Recommended infrared reflow soldering temperature profile



Profile feature	Sn-Pb eutectic assembly	Pb-free assembly
Average ramp-up rate (T _{Smax} to T _p)	3 °C/ second max.	3 °C/ second max.
Preheat		
- Temperature min (T _{Smin})	100 °C	150 °C
- Temperature max (T _{Smax})	150 °C	200 °C
- Time (t _{Smin} to t _{Smax})	60 ... 120 seconds	60 ... 180 seconds
Time maintained above		
- Temperature min (T _L)	183 °C	217 °C
- Time (t _L)	60 ... 150 seconds	60 ... 150 seconds
Peak classification temperature (T _p)	220 °C ... 240 °C	240 °C ... 260 °C
Time within 5 °C of actual peak temperature (t _p)	10 ... 30 seconds	20 ... 40 seconds
Ramp-down rate	6 °C/ second max.	6 °C/ second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note: All temperatures refer to topside of the package, measured on the package body surface.

Soldering guidelines

The usage of mild, non-activated fluxes for soldering is recommended, as well as proper cleaning of the PCB.

The components are suitable for reflow soldering to JEDEC J-STD-020C.

Storage conditions

As far as possible, the components shall be employed within 12 months. They should be left in their original packing to avoid soldering problems due to oxidized contacts.

Storage temperature: $-25\text{ }^{\circ}\text{C}$ up to $45\text{ }^{\circ}\text{C}$

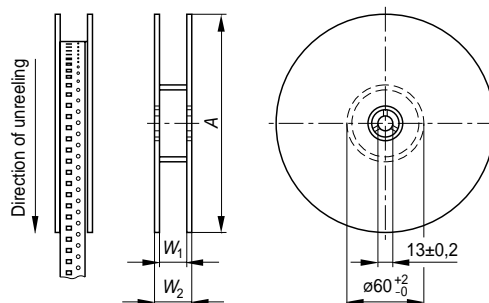
Relative humidity: $< 75\%$ annual average, $< 95\%$ on max. 30 days in a year.

Reel dimensions in mm

Definition	Symbol	Dim.	Tolerance
Reel diameter	A	180	$+0/-3$
Reel width (inside)	W_1	8.4	$+1.5/-0$
Reel width (outside)	W_2	14.4	max.

Package: 8-mm tape

Reel material: Plastic

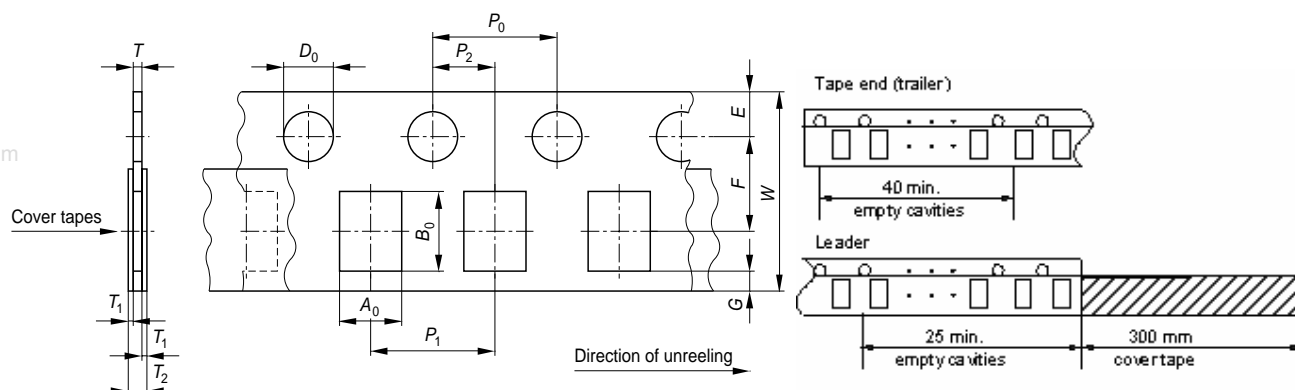


Selection guide

Part number	Ordering code	Case size	Qty. per reel	Reel size
CDS2C15GTH	B72590D0150H060	0402	10000	180 mm
CDS2C16GTH	B72590D0160H060	0402	10000	180 mm
CDS3C16GTH	B72500D0160H060	0603	4000	180 mm
CDS3C30GTH	B72500D0300H060	0603	4000	180 mm
CDS4C16GTH	B72570D0160H060	1003	4000	180 mm

Taping to IEC 60286-3

Tape material: Cardboard



Dimensions and tolerances in mm:

Definition	Symbol	0402 Dim.	0603 Dim.	1003 Dim.	Tolerance
Compartment width	A ₀	0.6	0.95	1.0	± 0.2
Compartment length	B ₀	1.15	1.8	2.85	± 0.2
Sprocket hole diameter	D ₀	1.5	1.5	1.5	+0.1/ -0
Sprocket hole pitch	P ₀	4.0	4.0	4.0	± 0.1 ¹⁾
Distance centre hole to centre compartment	P ₂	2.0	2.0	2.0	± 0.05
Pitch of the component compartments	P ₁	2.0	4.0	4.0	± 0.1
Tape width	W	8.0	8.0	8.0	± 0.3
Distance edge to centre of hole	E	1.75	1.75	1.75	± 0.1
Distance centre hole to centre compartment	F	3.5	3.5	3.5	± 0.05
Distance compartment to edge	G	0.75	0.75	0.75	min.
Thickness tape	T	0.6	0.9	1.0	max.
Overall thickness	T ₂	0.7	1.1	1.1	max.

1) $\leq \pm 0.2$ mm over any 10 pitches

Note

CeraDiodes are not suitable for switching applications or for voltage stabilization, where static power dissipation is required.

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