

BDE6A5.0D

Low Capacitance ESD Protection for High Speed Data

The BDE6A5.0D Series is designed to protect high speed data lines from ESD. Its common anode design protects up to four separate I/O lines and one power line using only one package. Ultra-low capacitance and high level of ESD protection makes this device well suited for use in USB 2.0 applications.

Specification Features:

- Protects up to four separate I/O lines & one power line
- Low capacitance (0.7 pF) for high-speed interfaces
- Low Body Height: 0.03" (0.75 mm)
- Low Leakage Current: < 1 uA
- Stand-off Voltage: 5V
- IEC61000-4-2 Level 4 ESD Protection
- This is a Pb-Free Device

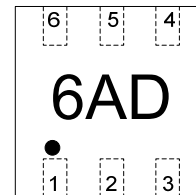
Mechanical Characteristics:

- CASE: Void-free, transfer-molded, thermosetting plastic Epoxy Meets UL 94 V-0
- LEAD FINISH: NiPdAu
- MOUNTING POSITION: Any
- QUALIFIED MAX REFLOW TEMPERATURE: 260°C
- Device Meets MSL 1 Requirements
- RoHS/WEEE Compliant
- Marking: Marking code, microdot at PIN-1

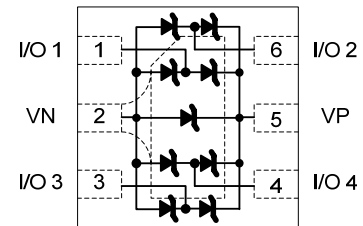
Applications

- High Speed Communication Line Protection
- Multi Media Card (MMC) Interfaces
- SD Card Interfaces
- USB 2.0 High Speed Data Line and Power Line Protection
- Monitors and Flat Panel Displays
- MP3
- Notebooks
- Digital Video Interface (DVI), MDDI and HDMI
- Gigabit Ethernet

Package Type
DFN1616-6L



Pin Assignment and Schematic



Ordering Information

Device	Package	Shipping
BDE6A5.0D	DFN1616-6L	3000/Tape & Reel

**Maximum Ratings**

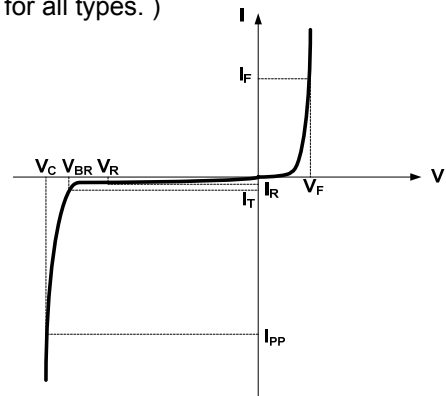
Rating	Symbol	Value	Unit
IEC 61000-4-2 (ESD) Contact Air		± 8 ± 15	kV
Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^{\circ}\text{C}$
Lead Solder Temperature – Maximum (10 Second Duration)	T_L	260	$^{\circ}\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Electrical Characteristics

($T_A = 25^{\circ}\text{C}$ unless otherwise noted, Max. $V_F = 1.0\text{ V}$ @ $I_F = 10\text{ mA}$ for all types.)

Symbol	Parameter
I_{PP}	Maximum Reverse Peak Pulse Current
V_C	Clamping Voltage @ I_{PP}
V_{RWM}	Working Peak Reverse Voltage
I_R	Maximum Reverse Leakage Current @ V_{RWM}
I_T	Test Current
V_{BR}	Breakdown Voltage @ I_T
I_F	Forward Current
V_F	Forward Voltage @ I_F
P_{PK}	Peak Power Dissipation
C	Max. Capacitance @ $V_R = 0$ and freq.=1 MHz



Uni-Directional TVS I-V Curve

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Reverse Stand-off Voltage	V_{RWM}	Pin 5 to GND	--	--	5	V
Reverse Breakdown Voltage	V_{BR}	$I_T = 1\text{ mA}$, Pin 5 to GND	6	6.6	7	V
		$I_T = 1\text{ mA}$, any I/O pin to GND	7	7.4	8	V
Reverse Leakage Current	I_R	$V_{RWM} = 5\text{ V}$, $T = 25^{\circ}\text{C}$ Pin 5 to GND	--	--	1	μA
Clamping Voltage	V_C	$I_{PP}^{(1)} = 1\text{ A}$, any I/O ⁽²⁾ pin to GND	--	--	9.8	V
		$I_{PP} = 6\text{ A}$, Pin 5 to GND	--	--	12.5	V
Junction Capacitance	C_j	$V_R = 0\text{ V}$, $f = 1\text{ MHz}$, any I/O pin to GND	--	--	1	pF
		$V_R = 0\text{ V}$, $f = 1\text{ MHz}$, between I/O pins	--	0.35	0.45	pF

Note1: Surge current wave form per figure 3.

Note2: I/O pins are pin 1, 3, 4 and 6.

APPLICATION INFORMATION

Device Connection Options for Protection of Four High-Speed Data Lines

The BDE6A5.0D is designed to protect data lines by clamping them a fixed reference. When the voltage on the protected line exceeds the reference voltage the steering diodes are forward biased, conducting the transient current away from the sensitive circuitry. Data lines are connected at pins 1, 3, 4 and 6. The center pin should be connected directly to a ground plane. The path length is kept as short as possible to minimize parasitic inductance. Pin 2 is not connected. The positive reference is connected at pin 5. The options for connecting the positive reference are as follows :

1. To protect data lines and the power line, connect pin 5 directly to the positive supply rail (VCC). In this configuration the data lines are referenced to the supply voltage. The internal TVS diode prevents over-voltage on the supply rail.

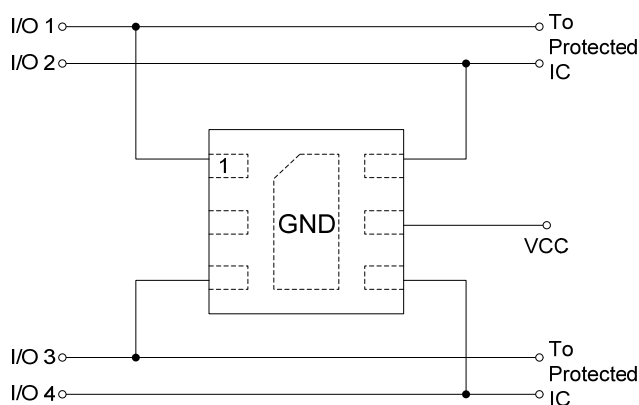


Fig. 1 Protection of Four Data Lines and Power Supply Line

2. In applications where the supply rail does not exit, the internal TVS may be used as the reference. In this case, pin 5 is not connected. The steering diodes will begin to conduct when the voltage on the protected line exceeds the working voltage of the TVS (plus one diode drop).

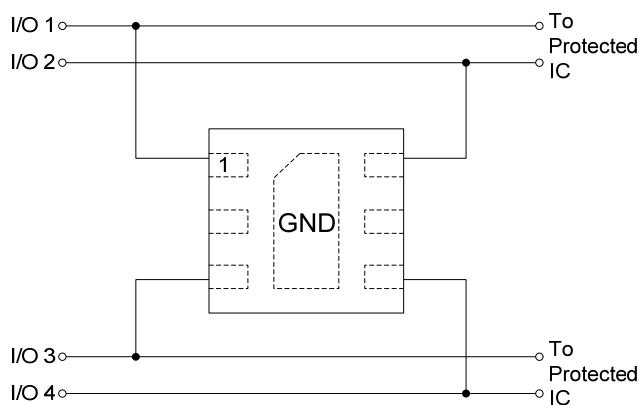


Fig. 2 Protection of Four Data Lines Using Internal TVS Diode as Reference

TYPICAL APPLICATIONS

1. Universal Serial Bus 1.1 and 2.0 Protection

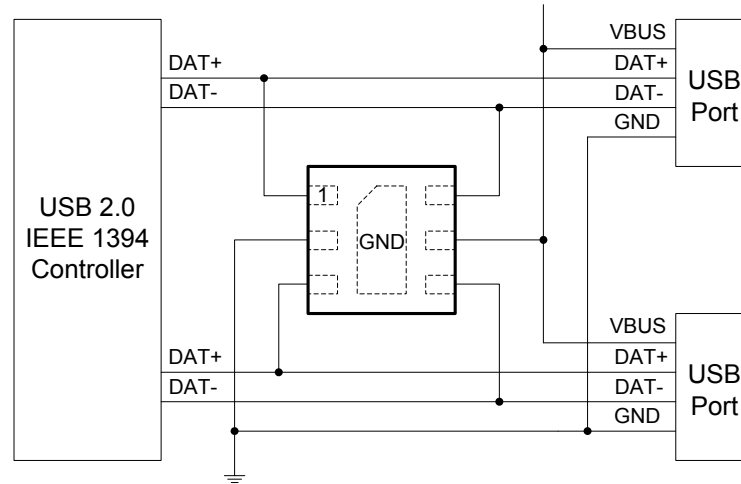


Fig. 3 Typical Application for USB ESD Protection

2. Universal Serial Bus OTG Protection

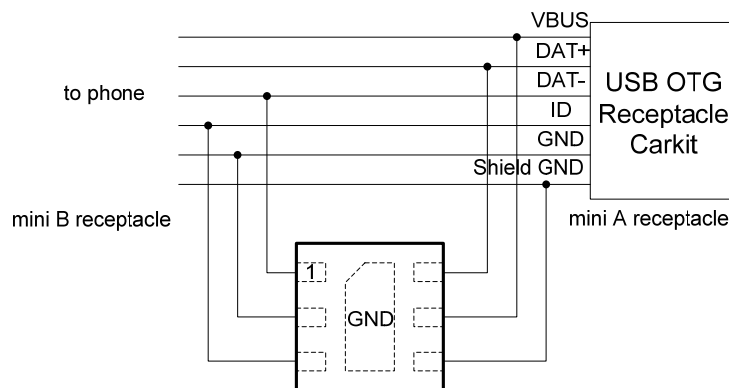


Fig. 4 Typical Application for USB OTG ESD Protection

3. Universal SIM-card Protection

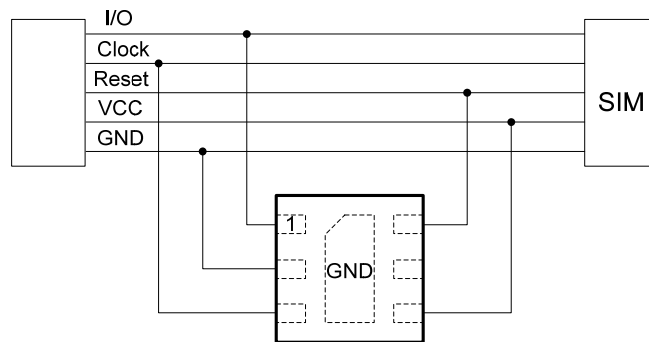


Fig. 5 Typical Application for Universal SIM-card ESD Protection

4. Universal MicroSD/TransFlash and SD-memory Card Protection

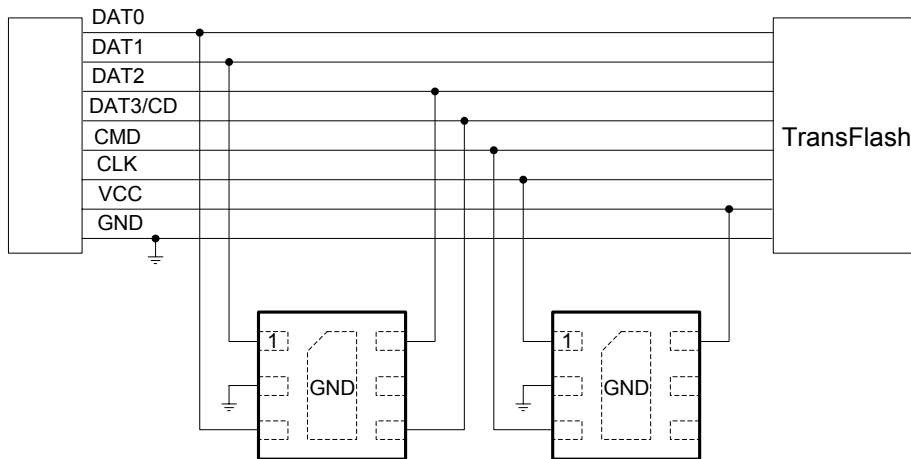
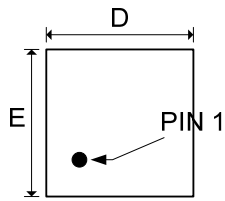


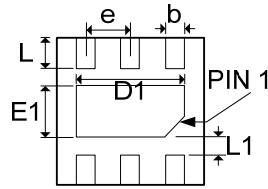
Fig. 6 Typical Application for Universal Micro-SD/TransFlash and SD-memory ESD Protection

PACKAGE OUTLINE DIMENSIONS

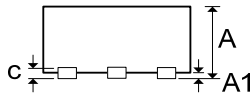
DFN1616-6L



Top View

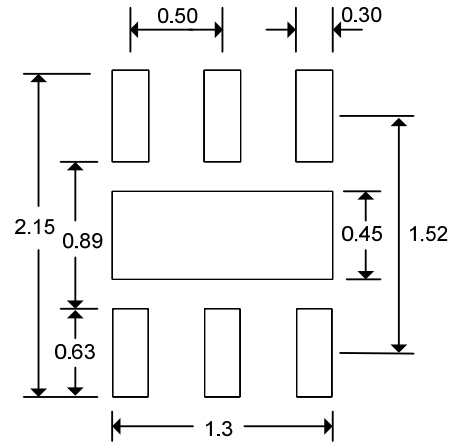


Bottom View



Side View

Soldering Footprint



Symbol	Dimensions in mm		
	MIN.	NOM.	MAX.
A	0.700	0.750	0.800
A1	0.000	---	0.050
b	0.200	0.250	0.300
c	0.195	0.203	0.211
D	1.600 BSC		
E	1.600 BSC		
L1	0.145	0.195	0.245
L	0.280	0.330	0.380
e	0.500 BSC		
D1	1.200 BSC		
E1	0.550 BSC		



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