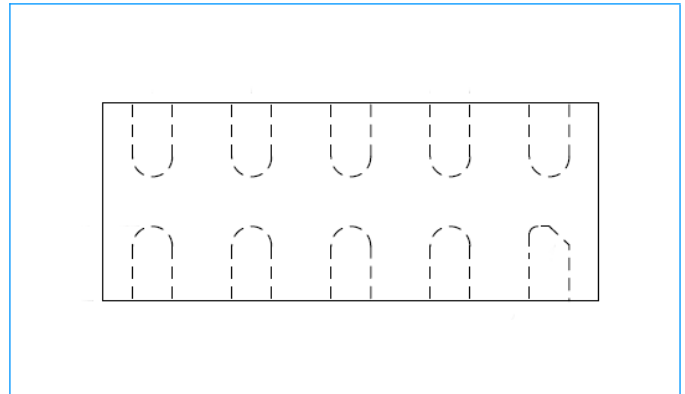


## Ultra-Low Capacitance TVS Protection

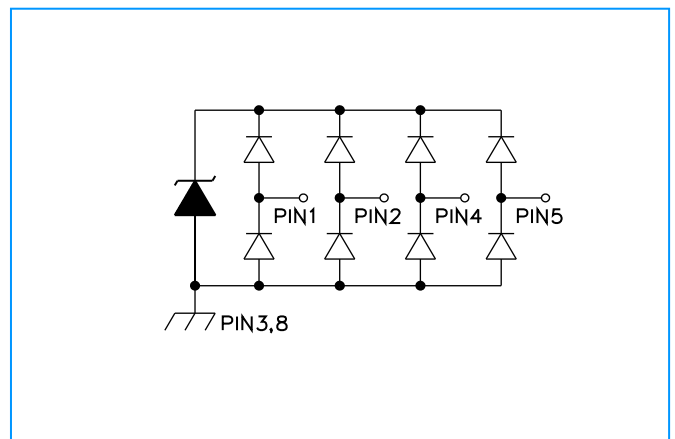
### SE05NRE14GA

#### Feature

- ⌞ Transient protection for high-speed data lines
  - IEC 61000-4-2 (ESD)  $\pm 25\text{kV}$  (Air)
  - $\pm 17\text{kV}$  (Contact)
  - IEC 61000-4-4 (EFT) 40A (5/50 ns)
  - Cable Discharge Event (CDE)
- ⌞ Package optimized for high-speed lines
- ⌞ Ultra-small package (2.5mm x 1.0mm x 0.55mm)
- ⌞ Protects four data lines
- ⌞ Low capacitance: 0.6pF for each channel
- ⌞ Low leakage current: 0.1 $\mu\text{A}$  @  $V_{\text{RWM}}$ (Typical)
- ⌞ Low clamping voltage
- ⌞ Each I/O pin can withstand over 1000 ESD strikes for  $\pm 8\text{kV}$  contact discharge



#### Pin Configuration



#### Applications

- ⌞ Serial ATA
- ⌞ PCI Express
- ⌞ Desktops, Servers and Notebooks
- ⌞ MDDI Ports
- ⌞ USB 2.0/3.0 Power and Data Line Protection
- ⌞ Display Ports
- ⌞ High Definition Multi-Media Interface (HDMI)
- ⌞ Digital Visual Interfaces (DVI)

#### Mechanical Characteristics

- ⌞ DFN-10L package
- ⌞ Flammability Rating: UL 94V-0
- ⌞ Marking: Part number
- ⌞ Packaging: Tape and Reel

## Ultra-Low Capacitance TVS Protection

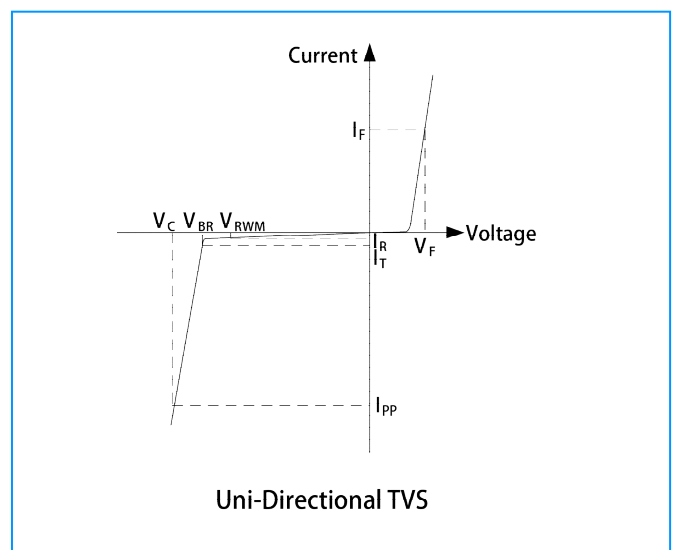
### SE05NRE14GA

#### Absolute Maximum Rating

Symbol	Parameter	Value	Units
$V_{ESD}$	ESD per IEC 61000-4-2 (Air)	$\pm 25$	KV
	ESD per IEC 61000-4-2 (Contact)	$\pm 17$	
$T_{OPT}$	Operating Temperature	-55/+125	$^{\circ}C$
$T_{STG}$	Storage Temperature	-55/+150	$^{\circ}C$

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

Symbol	Parameter
$V_{RWM}$	Nominal Reverse Working Voltage
$I_R$	Reverse Leakage Current @ $V_{RWM}$
$V_{BR}$	Reverse Breakdown Voltage @ $I_T$
$I_T$	Test Current for Reverse Breakdown
$V_C$	Clamping Voltage @ $I_{PP}$
$I_{PP}$	Maximum Peak Pulse Current
$C_J$	Parasitic Capacitance
$V_R$	Reverse Voltage
f	Small Signal Frequency
$I_F$	Forward Current
$V_F$	Forward Voltage @ $I_F$



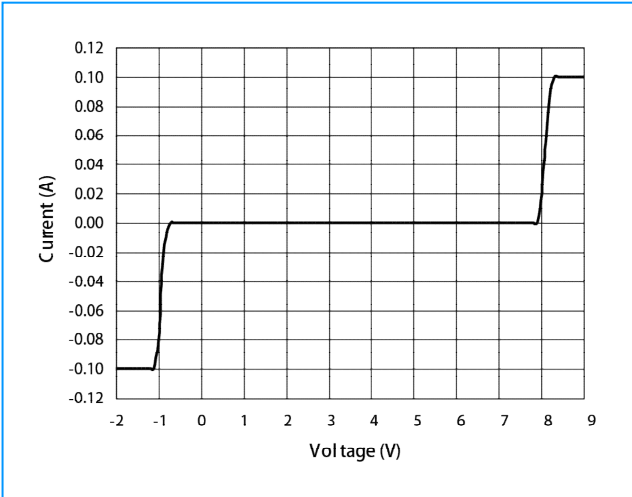
Symbol	Test Condition	Minimum	Typical	Maximum	Units
$V_{RWM}$	---	---	---	5.0	V
$I_R$	$V_{RWM} = 5V, T = 25^{\circ}C$ Between I/O and GND	---	0.1	1.0	$\mu A$
$V_{BR}$	$I_T = 1mA$ Between I/O and GND	6.0	8.0	10.0	V
$V_C$	$I_{PP} = 4A, tp = 8/20\mu s$ Between I/O and GND	---	12	15	V
$C_J$	$V_R = 0V, f = 1MHz$ Between I/O and GND	---	0.6	0.8	pF
$C_J$	$V_R = 0V, f = 1MHz$ Between I/O and I/O	---	0.3	0.4	pF

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

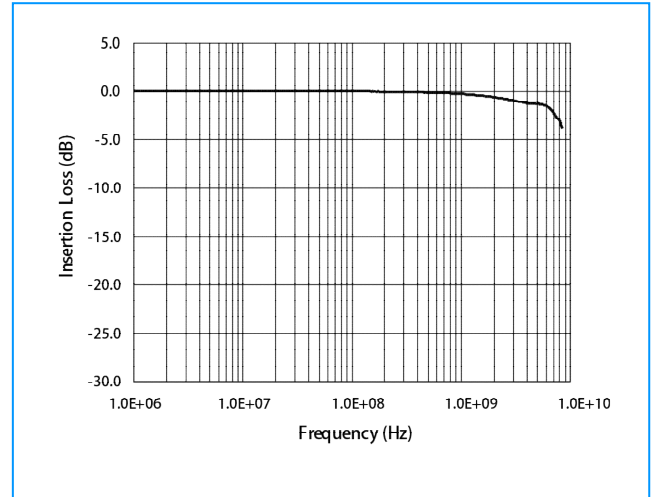
# Ultra-Low Capacitance TVS Protection

## SE05NRE14GA

### Voltage Sweeping of I/O to GND

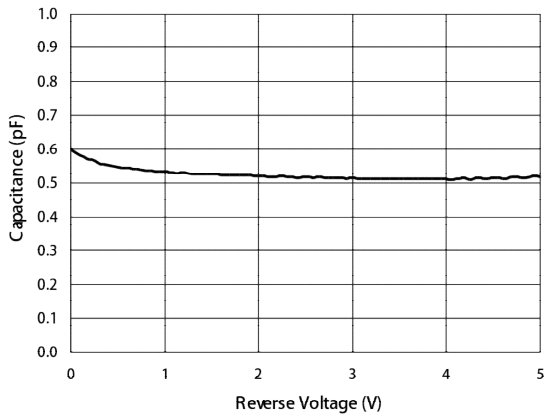


### Insertion Loss S21 of I/O to GND

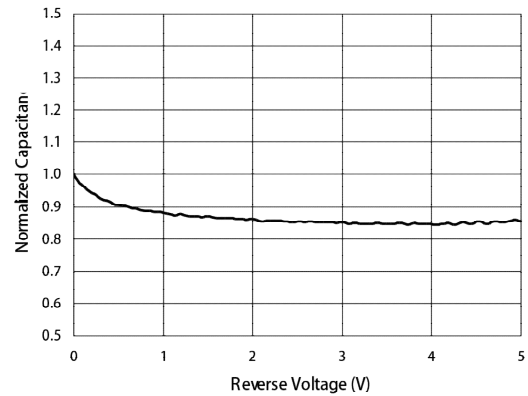


### Capacitance vs. Voltage of I/O to GND (f=1MHz)

#### Capacitance vs. Reverse Voltage



#### Normalized Capacitance vs. Reverse Voltage



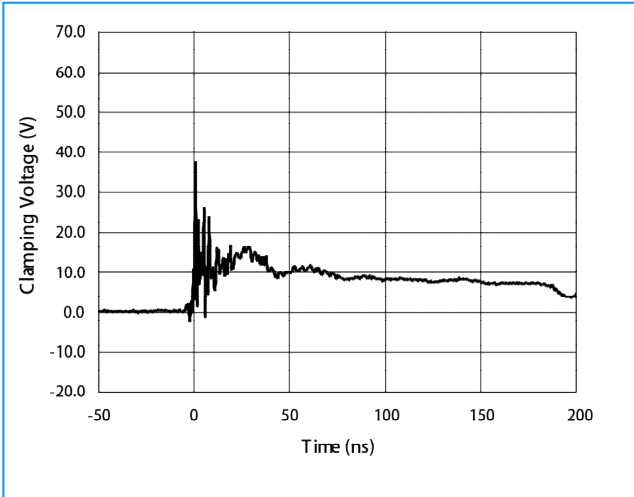
### ESD Clamping of I/O to GND

### ESD Clamping of I/O to GND

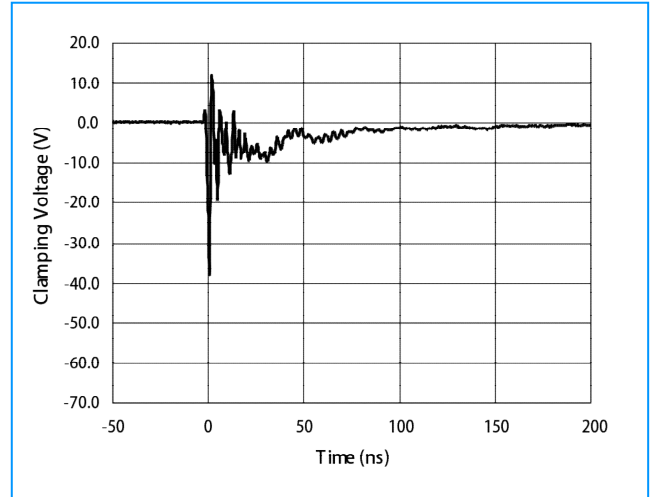
# Ultra-Low Capacitance TVS Protection

## SE05NRE14GA

(+8KV Contact per IEC 61000- 4-2)



(- 8KV Contact per IEC 61000- 4-2)



### Application Information

#### Pin Connection in PCB

SE05NE14GA provides ESD protection for four data lines simultaneously. The pin connection is shown in the figure below.

Four parallel data lines, from inner IC to I/O port connector, could connect to SE05NE14GA four I/O pins directly. Pin 3 & 8 of SE05NE14GA is the GND pin, which should connect to the GND of PCB. The wire should be as short as possible in order to minimize the parasitic inductance.

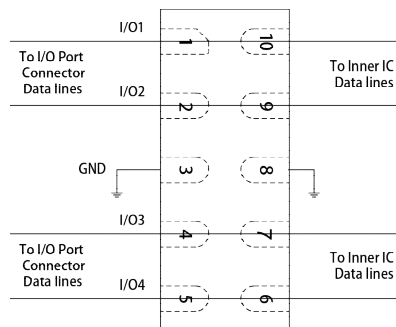


Figure 1 SE05NRE14 pin connection in PCB

#### PCB Layout Guidelines

For optimum ESD protection and the whole circuit performance, the following PCB layout guidelines are recommended:

- ❏ SE05NE14GA GND pin to the PCB GND rail path should be as short as possible. It could reduce the ESD transient return path to GND.
- ❏ The vias connecting SE05NE14GA GND pins to the PCB GND should be wide
- ❏ Place SE05NE14GA as close to the connector port as possible. It could reduce the parasitic inductance and restrict ESD coupling into adjacent traces.
- ❏ Avoid running critical signals near board edges

# Ultra-Low Capacitance TVS Protection

## SE05NRE14GA

### Application Information

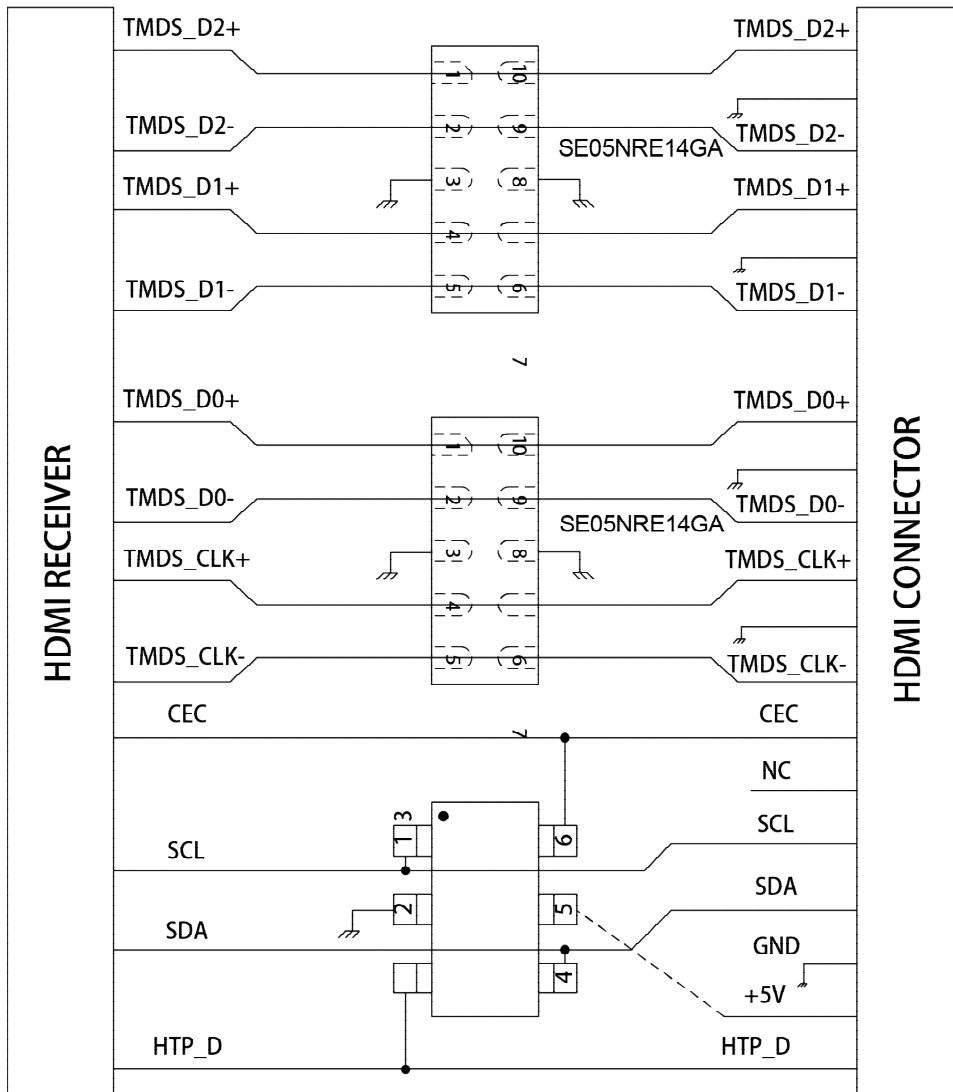


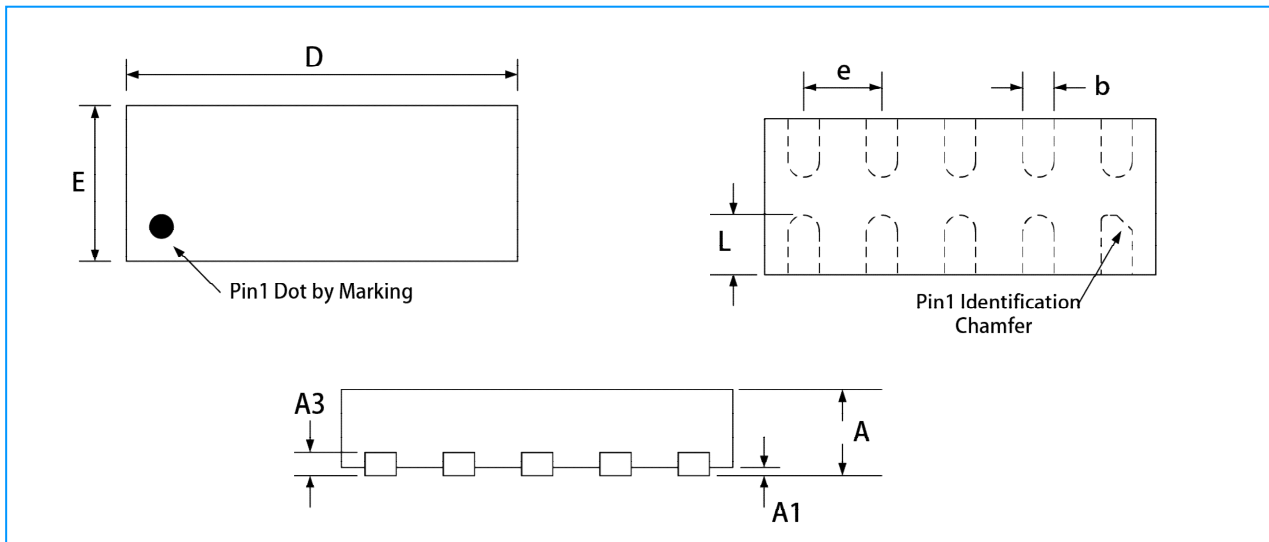
Figure 2 Layout Top View for HDMI Interface with SE05NRE14GA

# Ultra-Low Capacitance TVS Protection

## SE05NRE14GA

### Package Outline

- U DFN-10L package
- U Thermally-Enhanced
- U MSL-1 Level



### Package Dimensions (Controlling dimensions are in millimeters)

Symbol	Dimensions (mm)		Dimensions (Inches)	
	Minimum	Maximum	Minimum	Maximum
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A3	0.15REF.		0.006REF.	
b	0.150	0.250	0.006	0.010
D	2.450	2.550	0.096	0.100
E	0.950	1.050	0.037	0.041
e	0.500REF.		0.020REF.	
L	0.300	0.400	0.012	0.016