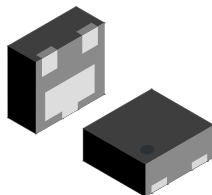
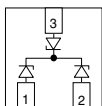


## 2-Line Low Capacitance, Bidirectional and Symmetrical (BiSy) ESD Protection Diode



DFN1110-3A

### MARKING (example only)



Dot = pin marking

X = date code

Y = type code (see table below)

### FEATURES

- Small DFN1110-3A
- 2-line ESD protection
- Working range  $\pm 5.5$  V
- Low leakage current  $I_R < 0.05$   $\mu$ A
- Low load capacitance  $C_D < 0.45$  pF
- ESD immunity acc. IEC 61000-4-2  
 $\pm 20$  kV contact discharge  
 $\pm 20$  kV air discharge
- ESD capability according to AEC-Q101:  
human body model: class H3B:  $> 8$  kV
- e3 - pins side wall plated with tin (Sn)
- AOI capable
- AEC-Q101 qualified available
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### LINKS TO ADDITIONAL RESOURCES



3D Models



Models



Application Notes

### ORDERING INFORMATION

PART NUMBER (EXAMPLE)	ENVIRONMENTAL AND QUALITY CODE			PACKAGING CODE	ORDERING CODE (EXAMPLE)
	AEC-Q101 QUALIFIED	RoHS-COMPLIANT + LEAD (Pb)-FREE TERMINATIONS	TIN PLATED	10K PER 7" REEL (8 mm TAPE) 10K/BOX = MOQ	
		GREEN			
VBUS05M2-HT5	-	G	3	-08	VBUS05M2-HT5-G3-08
VBUS05M2-HT5	H	G	3	-08	VBUS05M2-HT5HG3-08

### PACKAGE DATA

DEVICE NAME	PACKAGE NAME	TYPE CODE	WEIGHT	MOLDING COMPOUND FLAMMABILITY RATING	MOISTURE SENSITIVITY LEVEL	SOLDERING CONDITIONS
VBUS05M2-HT5	DFN1110-3A	M	1.43 mg	UL 94 V-0	MSL level 1 (according J-STD-020)	Peak temperature max. 260 °C

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	TEST CONDITIONS	SYMBOL	VALUE	UNIT
Peak pulse current	Acc. IEC 61000-4-5; $t_p = 8/20$ $\mu$ s; single shot	$I_{PPM}$	3.4	A
Peak pulse power	Acc. IEC 61000-4-5; $t_p = 8/20$ $\mu$ s; single shot	$P_{PP}$	60	W
ESD immunity	Contact discharge acc. IEC 61000-4-2; 10 pulses	$V_{ESD}$	$\pm 20$	kV
	Air discharge acc. IEC 61000-4-2; 10 pulses		$\pm 20$	
Operating temperature	Junction temperature	$T_J$	-55 to +150	°C
Storage temperature		$T_{STG}$	-55 to +150	°C

**ELECTRICAL CHARACTERISTICS** (pin 1 or pin 2 to pin 3; in both directions)  
( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

PARAMETER	TEST CONDITIONS/REMARKS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Protection paths	Number of lines which can be protected	$N_{channel}$	-	-	2	lines
Reverse stand-off voltage	Max. reverse working voltage	$V_{RWM}$	-	-	5.5	V
Reverse voltage	At $I_R = 0.1\text{ }\mu\text{A}$	$V_R$	5.5	-	-	V
Reverse current	At $V_{RWM} = 5.5\text{ V}$	$I_R$	-	< 0.001	0.1	$\mu\text{A}$
Reverse breakdown voltage	At $I_R = 1\text{ mA}$	$V_{BR}$	7.5	8.5	9.5	V
Reverse clamping voltage	At $I_{PP} = 1\text{ A}$	$V_C$	-	11	13	V
	At $I_{PP} = I_{PPM} = 3.4\text{ A}$	$V_C$	-	15	18	V
Clamping voltage	Transmission line pulse (TLP), $t_p = 100\text{ ns}$ $I_{TLP} = 8\text{ A}$	$V_{C-TLP}$	-	20	-	V
	Transmission line pulse (TLP), $t_p = 100\text{ ns}$ $I_{TLP} = 16\text{ A}$	$V_{C-TLP}$	-	27	-	V
Dynamic resistance	Transmission line pulse (TLP), $t_p = 100\text{ ns}$	$R_{DYN}$	-	1	-	$\Omega$
Capacitance	At $V_R = 0\text{ V}$ ; $f = 1\text{ MHz}$	$C_D$	-	0.37	0.45	pF
	At $V_R = 3.3\text{ V}$ ; $f = 1\text{ MHz}$		-	0.37	0.45	pF

**APPLICATION NOTE**

The VBUS05M2-HT5 is a two-line ESD protection device with a bidirectional and symmetrical (BiSy) breakdown and clamping performance made for application with a voltage working range up to  $\pm 5.5\text{ V}$ . The high ESD immunity and a very low capacitance makes it usable for high frequency applications like USB2.0, USB3.0, or HDMI.

With the VBUS05M2-HT5 two high speed data lines can be protected against transient voltage signals like ESD (electro static discharge). Connected to the data line (pin 1 and pin 2) and to ground (pin 3) negative transients will be clamped close above the 5.5 V working range.

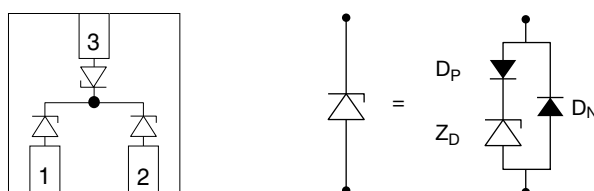
**SCHEMATIC DIAGRAM**


Fig. A

The simplified schematic diagram in Fig. A shows three identical Z-diodes with the cathode on pin 1, 2, or 3 and common anodes. In reality each Z-diode consist of one Z-diode for the adjustment of the breakdown voltage, and two low capacitance switching diodes which provide the low capacitance. Positive transients will be clamped through the switching diode  $D_P$  and the Z-diode  $Z_D$  while negative transients will be clamped through the switching diode  $D_N$ .

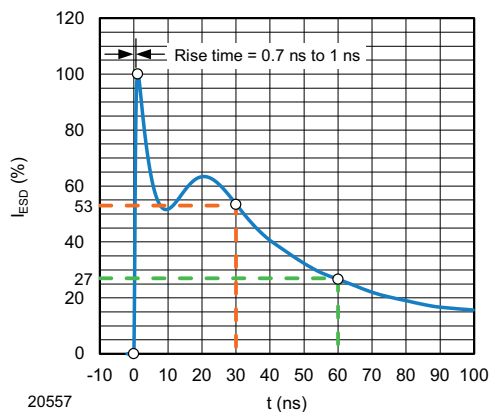
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 1 - ESD Discharge Current Wave Form acc. IEC 61000-4-2 (330  $\Omega$ /150 pF)

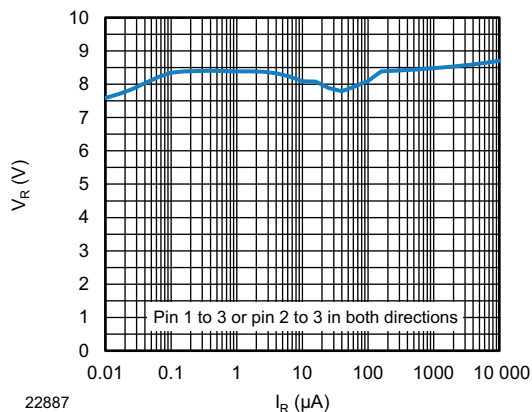


Fig. 4 - Typical Reverse Voltage vs. Reverse Current

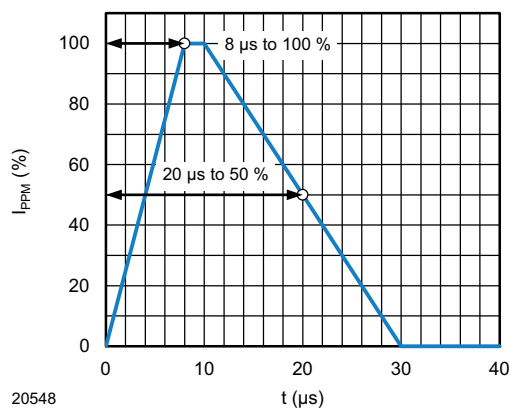


Fig. 2 - 8/20  $\mu\text{s}$  Peak Pulse Current Wave Form acc. IEC 61000-4-5

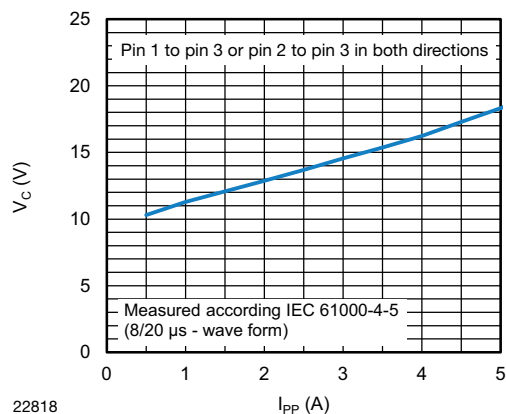


Fig. 5 - Typical Peak Clamping Voltage vs. Peak Pulse Current

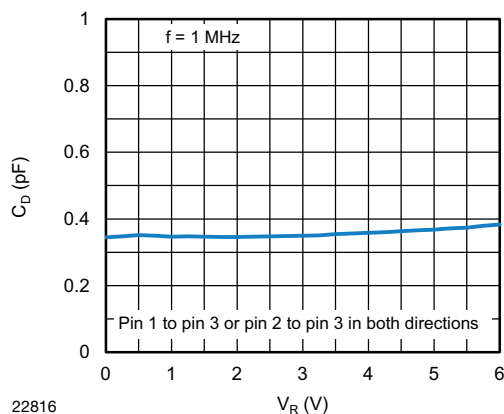


Fig. 3 - Typical Capacitance vs. Reverse Voltage

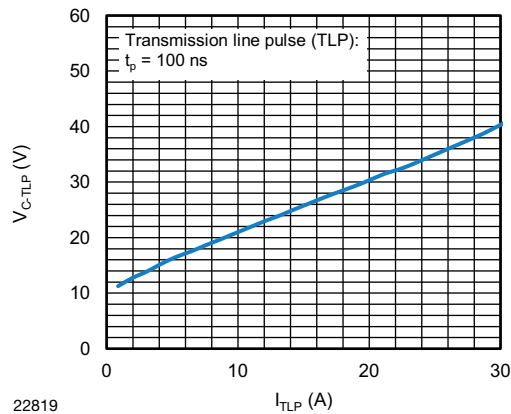
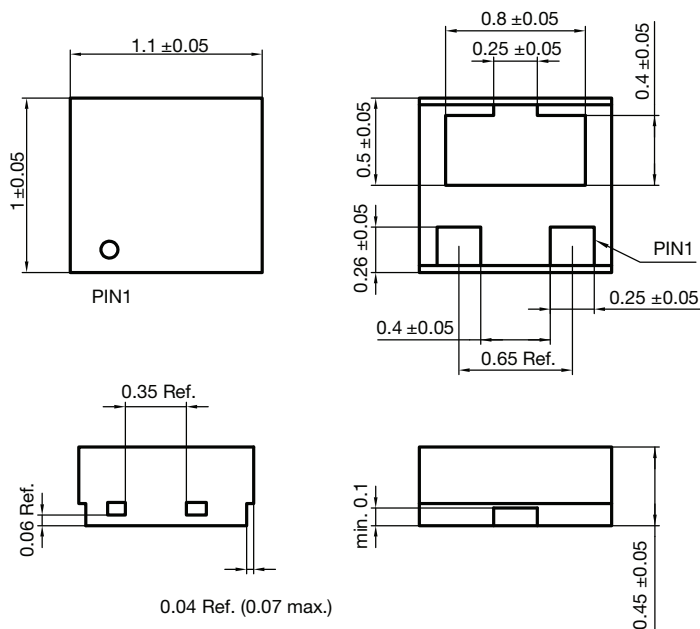
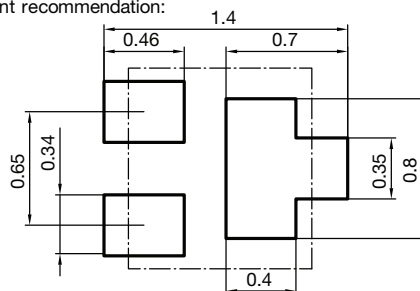


Fig. 6 - Typical Peak Forward Voltage vs. Forward Current

**PACKAGE DIMENSIONS** in millimeters (inches)


foot print recommendation:



Document no.: S8-V-3906.04-062 (4)

Package name: DFN1110-3A

Created - Date: 04-Apr-2019



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