



Application Specific Discretes  
A.S.D.™

## ESDA6V1-5W6 TRANSIL™ ARRAY FOR ESD PROTECTION

### APPLICATIONS

Where transient overvoltage protection in ESD sensitive equipment is required, such as :

- Computers
- Printers
- Communication systems
- Cellular phone handsets and accessories
- Other telephone sets
- Set top boxes

### DESCRIPTION

The ESDA6V1-5W6 is a 5-bit wide monolithic suppressor which is designed to protect components connected to data and transmission lines against ESD.

### FEATURES

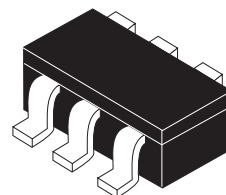
- 5 UNIDIRECTIONAL TRANSIL™ FUNCTIONS
- BREAKDOWN VOLTAGE:  $V_{BR} = 6.1V$  min
- LOW LEAKAGE CURRENT:  $I_R \max < 1 \mu A$
- VERY SMALL SIZE FOR PCB SPACE SAVING:  $4.2mm^2$  TYPICALLY

### BENEFITS

- High integration
- Suitable for high density boards

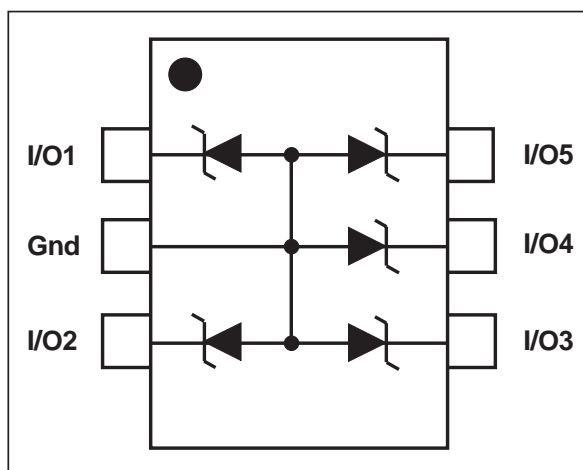
### COMPLIES WITH THE FOLLOWING STANDARDS:

- IEC 61000-4-2: level 4
  - 15 kV (air discharge)
  - 8 kV (contact discharge)
- MIL STD 883C-Method 3015-6: class3 (human body model)

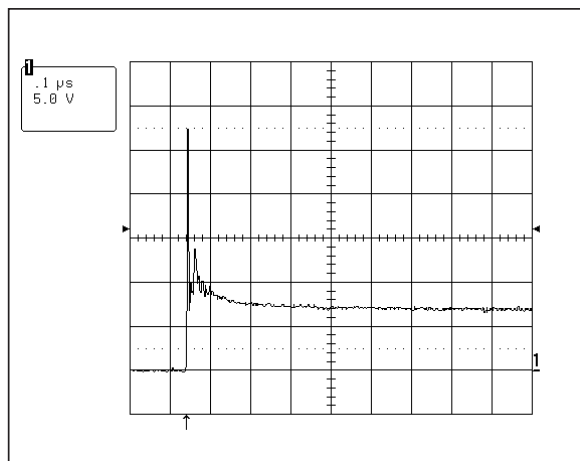


SOT323-6L

### FUNCTIONAL DIAGRAM



### ESD response to IEC61000-4-2 (air discharge 16kV, positive surge)



## ESDA6V1-5W6

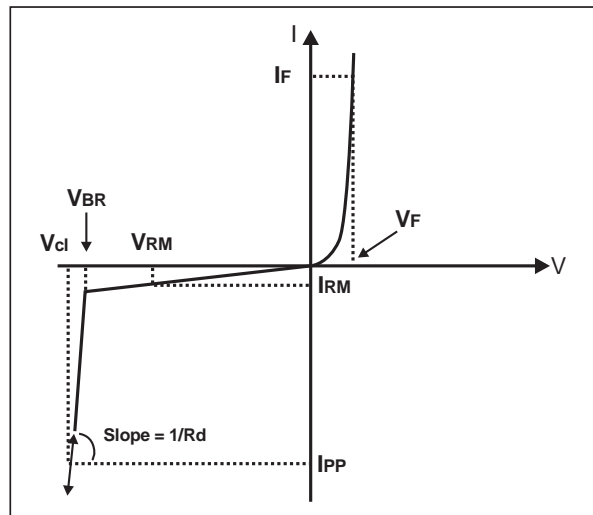
### ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25^{\circ}\text{C}$ )

Symbol	Test conditions	Value	Unit
$V_{PP}$	ESD discharge - MIL STD 883C - Method 3015-6 IEC 61000-4-2 air discharge IEC 61000-4-2 contact discharge	25 20 15	kV
$P_{PP}$	Peak pulse power (8/20 $\mu\text{s}$ )	100	W
$T_j$	Junction temperature	150	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature range	-55 to +150	$^{\circ}\text{C}$
$T_L$	Lead solder temperature (10 seconds duration)	260	$^{\circ}\text{C}$
$T_{op}$	Operating temperature range (note 1)	-40 to +125	$^{\circ}\text{C}$

**Note 1:** The evolution of the operating parameters versus temperature is given by curves and  $\alpha T$  parameter.

### ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25^{\circ}\text{C}$ )

Symbol	Parameter
$V_{RM}$	Stand-off voltage
$V_{BR}$	Breakdown voltage
$V_{CL}$	Clamping voltage
$I_{RM}$	Leakage current
$I_{PP}$	Peak pulse current
$\alpha T$	Voltage temperature coefficient
$C$	Capacitance
$R_d$	Dynamic impedance
$V_F$	Forward voltage drop

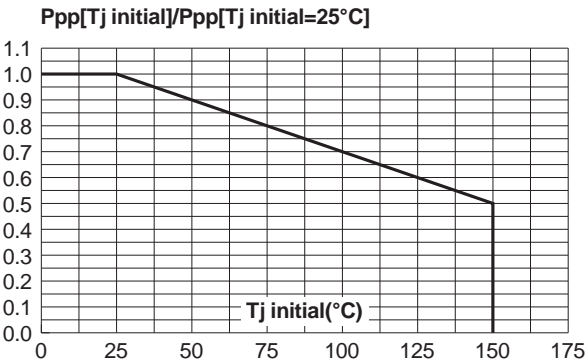


Type	$V_{BR} @ I_R$			$I_{RM} @ V_{RM}$		$R_d$	$\alpha T$	$C$	$V_F @ I_F$	
	min.	max		max.		typ.	max.	typ.	max	
	V	V	mA	$\mu\text{A}$	V	note 2	note 3	0V bias	V	mA
ESDA6V1-5W6	6.1	7.2	1	1	3	610	6	50	1.25	200

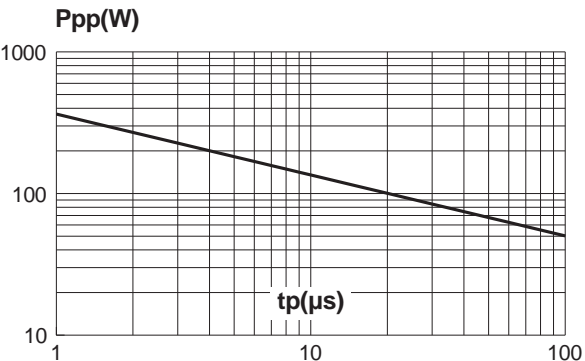
**Note 2 :** Square pulse,  $I_{pp} = 15\text{A}$ ,  $t_p = 2.5\mu\text{s}$ .

**Note 3:**  $\Delta V_{BR} = \alpha T * (T_{amb} - 25^{\circ}\text{C}) * V_{BR}(25^{\circ}\text{C})$

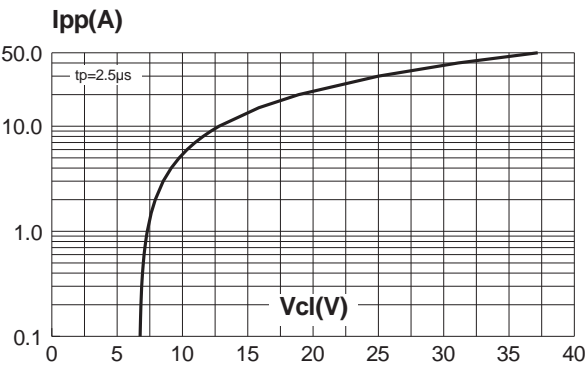
**Fig. 1:** Peak power dissipation versus initial junction temperature.



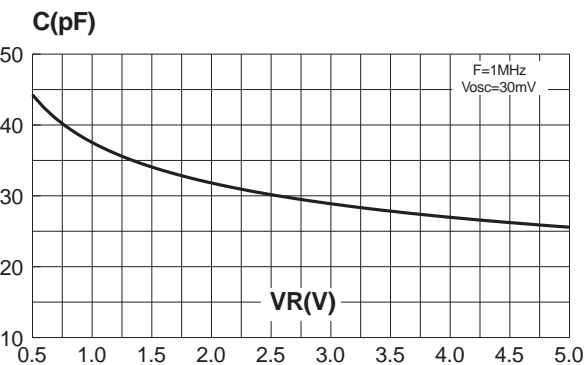
**Fig. 2:** Peak pulse power versus exponential pulse duration ( $T_j \text{ initial} = 25^\circ\text{C}$ ).



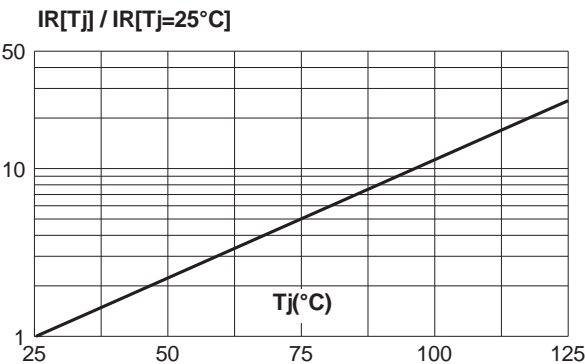
**Fig. 3:** Clamping voltage versus peak pulse current ( $T_j \text{ initial} = 25^\circ\text{C}$ ) Rectangular waveform  $t_p = 2.5\mu\text{s}$ .



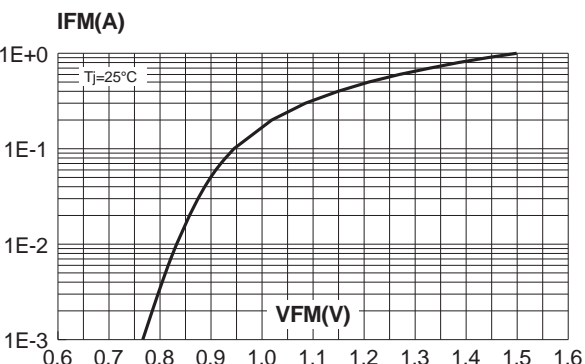
**Fig. 4:** Capacitance versus reverse applied voltage (typical values).



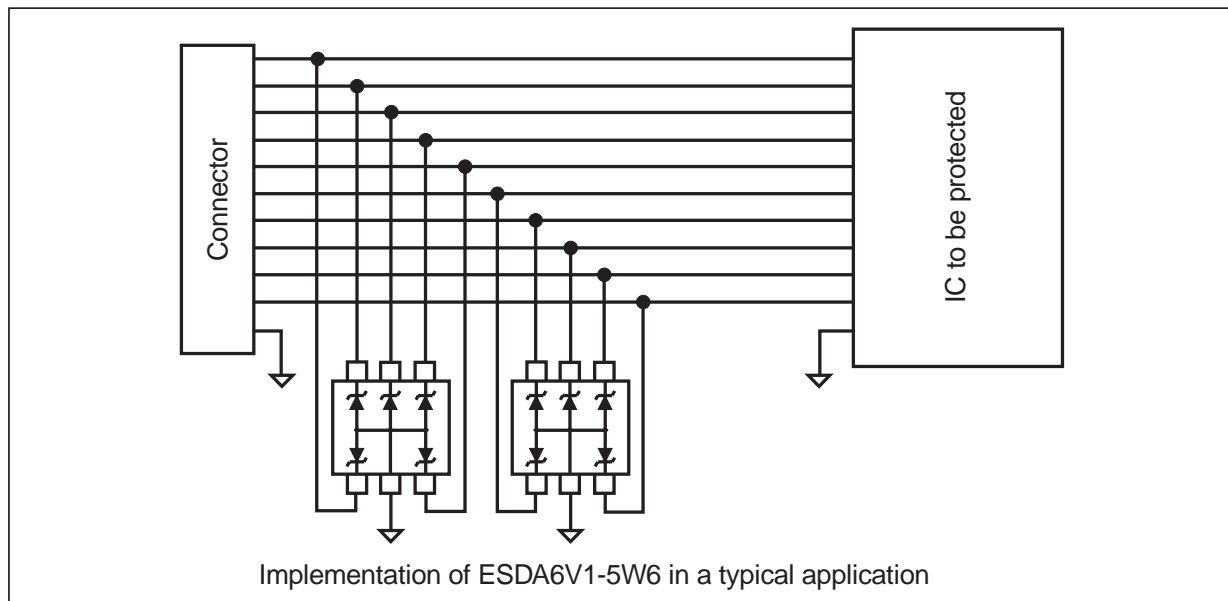
**Fig. 5:** Relative variation of leakage current versus junction temperature (typical values).



**Fig. 6:** Peak forward voltage drop versus peak forward current (typical values).



## APPLICATION EXAMPLE



## TECHNICAL INFORMATION

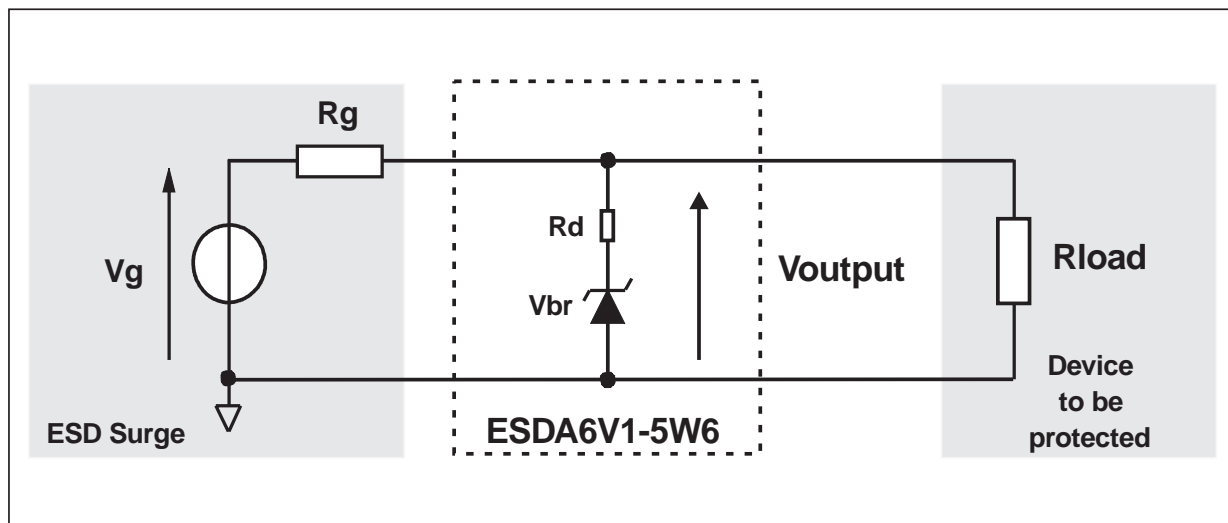
## ESD PROTECTION

The **ESDA6V1-5W6** is particularly optimized to perform ESD protection. ESD protection is achieved by clamping the unwanted overvoltage. The clamping voltage is given by the following formula :

$$V_{cl} = V_{br} + R_d \cdot I_{pp}$$

As shown in figure A1, the ESD strikes are clamped by the transient voltage suppressor.

Fig. A1: ESD clamping behavior



To have a good approximation of the remaining voltages at both Vi/o side, we provide the typical dynamical resistance value  $R_d$ . By taking into account the following hypothesis :

$$R_g > R_d \text{ and } R_{load} > R_d$$

we have:

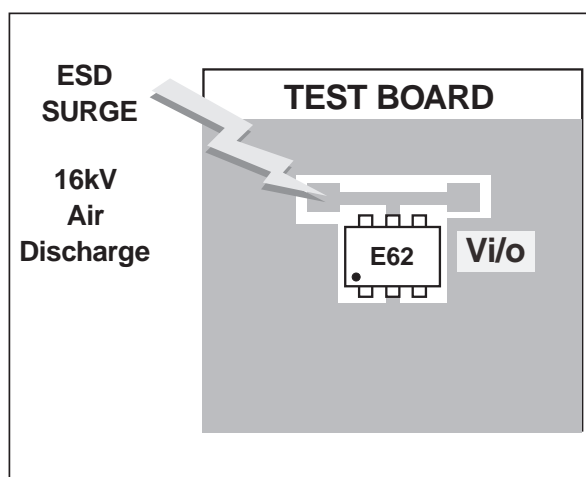
$$V_{in} = V_{br} + R_d \times \frac{V_g}{R_g}$$

The results of the calculation done for  $V_g = 8 \text{ kV}$ ,  $R_g = 330 \Omega$  (IEC 61000-4-2 standard),  $V_{br} = 6.4 \text{ V}$  (typ.) and  $R_d = 0.61 \Omega$  (typ.) give:

$$V_{output} = 21.2 \text{ V}$$

This confirms the very low remaining voltage across the device to be protected. It is also important to note that in this approximation the parasitic inductance effect was not taken into account. This could be a few tenths of volts during a few ns at the Vi/o side.

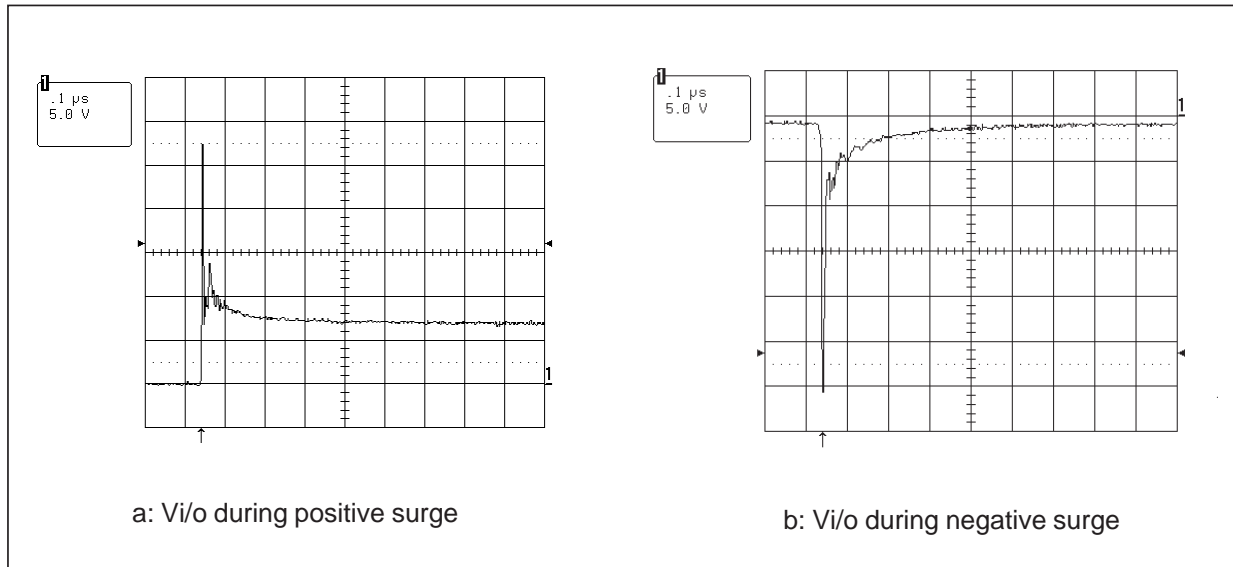
**Fig. A2:** Measurement conditions:



## ESDA6V1-5W6

The measurements done here after show very clearly (Fig. A3) the high efficiency of the ESD protection: the clamping voltage  $V_{out}$  becomes very close to  $V_{br}$  (positive way, Fig. A3a) and  $-V_f$  (negative way, Fig. A3b).

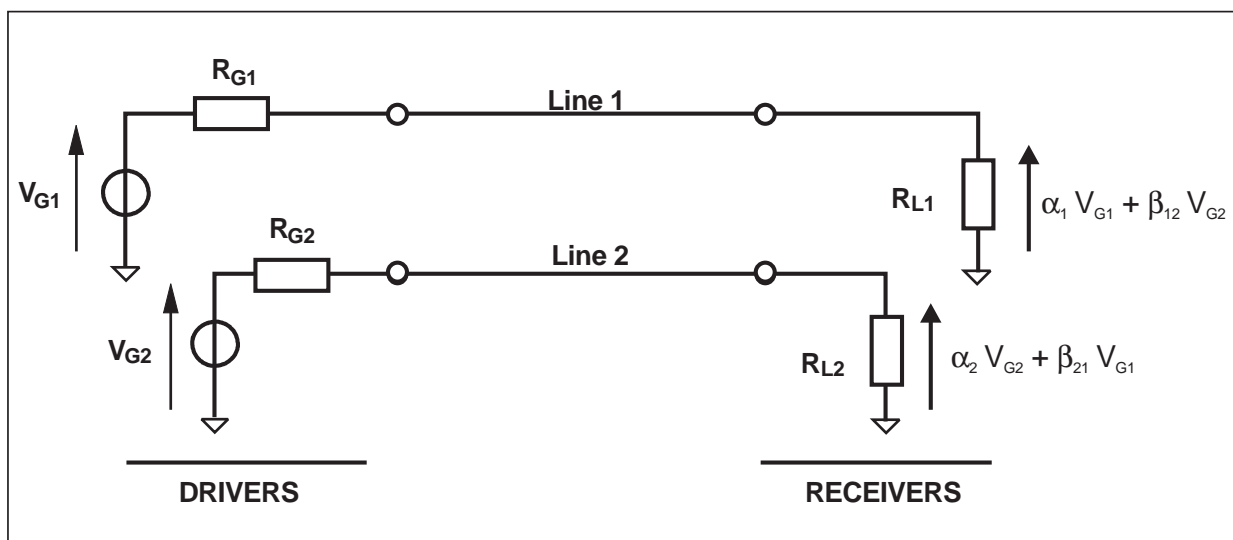
**Fig. A3:** Remaining voltage during ESD surge



One can note that the **ESDA6V1-5W6** is not only acting for positive ESD surges but also for negative ones. For these kind of disturbances it clamps close to ground voltage as shown in Fig. A3b.

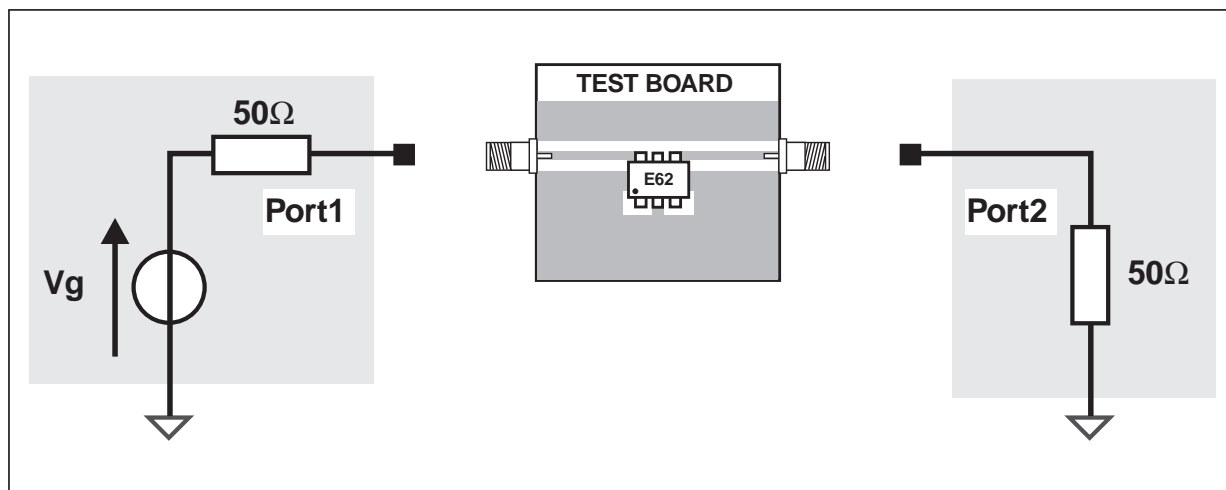
## CROSSTALK BEHAVIOR

**Fig. A4:** Crosstalk phenomenon



The crosstalk phenomena are due to the coupling between 2 lines. The coupling factor ( $\beta_{12}$  or  $\beta_{21}$ ) increases when the gap across lines decreases, particularly in silicon dice. In the example above the expected signal on load  $R_{L2}$  is  $\alpha_2 V_{G1}$ . In fact the real voltage at this point has got an extra value  $\beta_{21} V_{G1}$ . This part of the  $V_{G1}$  signal represents the effect of the crosstalk phenomenon of the line 1 on the line 2. This phenomenon has to be taken into account when the drivers impose fast digital data or high frequency analog signals in the disturbing line. The perturbed line will be more affected if it works with low voltage signal or high load impedance (few  $k\Omega$ ).

**Fig. A5:** Analog crosstalk measurements



**Fig. A6:** Typical analog crosstalk measurements

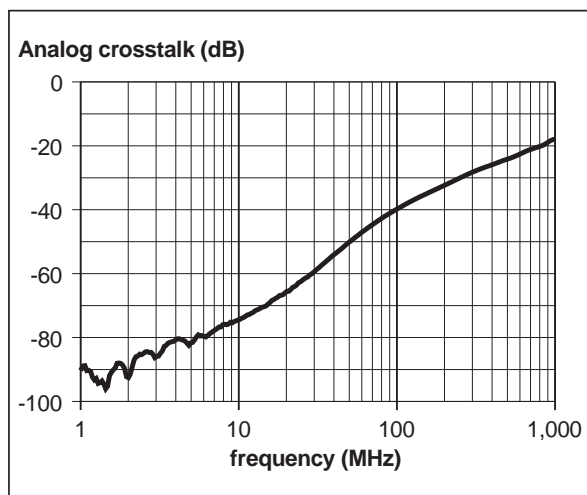


Figure A5 gives the measurement circuit for the analog crosstalk application. In figure A6, the curve shows the effect of the cell I/O5 on the cell I/O3. In usual frequency range of analog signals (up to 100MHz) the effect on disturbed line is less than -40dB.

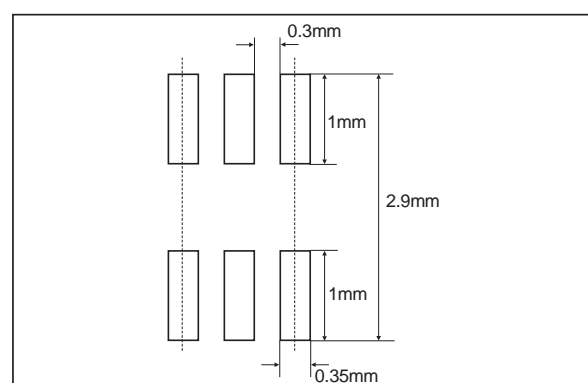


# PACKAGE MECHANICAL DATA

## SOT323-6L

REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.8	1.1	0.031	0.043
A1	0	0.1	0	0.004
A2	0.8	1	0.031	0.039
b	0.15	0.3	0.006	0.012
c	0.1	0.18	0.004	0.007
D	1.8	2.2	0.071	0.086
E	1.15	1.35	0.045	0.053
e	0.65 Typ.		0.025 Typ.	
H	1.8	2.4	0.071	0.094
Q	0.1	0.4	0.004	0.016

## FOOT PRINT



## MARKING

Type	Marking	Package	Weight	Base Qty	Delivery mode
ESDA6V1-5W6	E62	SOT323-6L	5.4 mg	3000	Tape & Reel

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