ESDA14V2-4BF1

QUAD BIDIRECTIONAL TRANSIL™ ARRAY FOR ESD PROTECTION

ASD™

APPLICATION

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

- Computers
- Printers
- Communication systems and cellular phones
- Video equipment

This device is particularly adapted to the protection of symmetrical signals.

DESCRIPTION

The ESDA14V2-4BF1 is a monolithic array designed to protect up to 4 lines in a bidirectional way against ESD transients.

The device is ideal for situations where board space saving is requested.

FEATURES

- 4 Bidirectional Transil™ functions
- ESD Protection: IEC61000-4-2 level 4
- Stand off voltage: 12 V MIN.
- Low leakage current < 1 µA
- 50W Peak pulse power (8/20µs)

BENEFITS

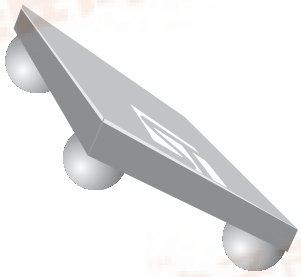
- High ESD protection level
- High integration
- Suitable for high density boards

COMPLIES WITH THE FOLLOWING STANDARDS:

- IEC61000-4-2: 15kV (air discharge)
  8kV (contact discharge)
- MIL STD 883E- Method 3015-7: class3
  25kV (human body model)

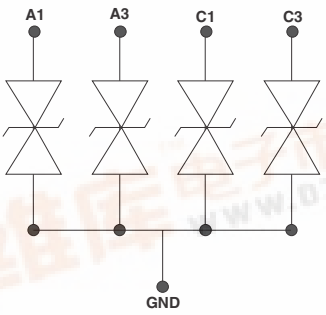
Order Codes

Part Number	Marking
ESDA14V2-4BF1	EA

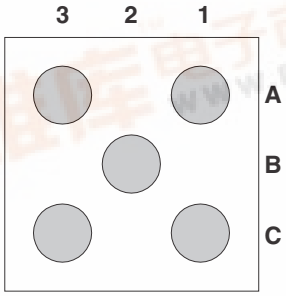


Flip-Chip
(5 bumps)

FUNCTIONAL DIAGRAM



PIN CONFIGURATION (Ball Side)

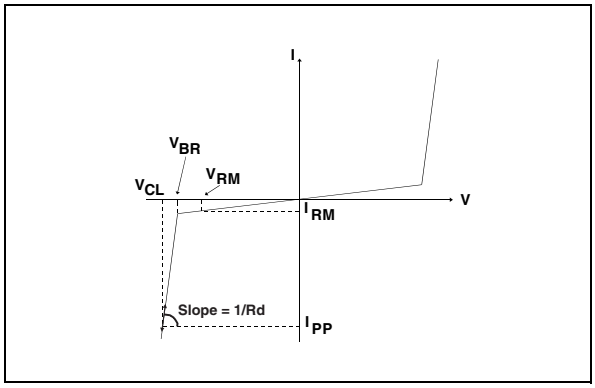


ABSOLUTE MAXIMUM RATING (T_{amb} = 25°C)

Symbol	Parameter		Value	Unit
V_{PP}	ESD discharge	MIL STD 883E - Method 3015-7 IEC61000-4-2 air discharge IEC61000-4-2 contact discharge	± 25 ± 15 ± 8	kV
P_{PP}	Peak pulse power (8/20µs)		50	W
T_j	Junction temperature		125	°C
T_{stg}	Storage temperature range		-55 to +150	°C
T_L	Lead solder temperature (10 seconds duration)		260	°C
T_{op}	Operating temperature range		-40 to +125	°C

ELECTRICAL CHARACTERISTICS (T_{amb} = 25°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
C	Capacitance
Rd	Dynamic resistance



Part Number	V_{BR} @ I_R			I_{RM} @ V_{RM}		R_d	αT	C
	min.	max.		max.		typ. note 1	max. note 2	max. 0V bias
	V	V	mA	µA	V	Ω	10^{-4}/°C	pF
ESDA14V2-4BF1	14.2	18	1	1	12	3.2	10	15
				0.1	3			

Note 1: Square pulse, I_{PP} = 3A, tp = 2.5µs.

Note 2: $\Delta V_{BR} = \alpha T$ (Tamb -25°C) x V_{BR} (25°C)

Fig. 1: Clamping voltage versus peak pulse current (Tj initial = 25°C) (Rectangular waveform).

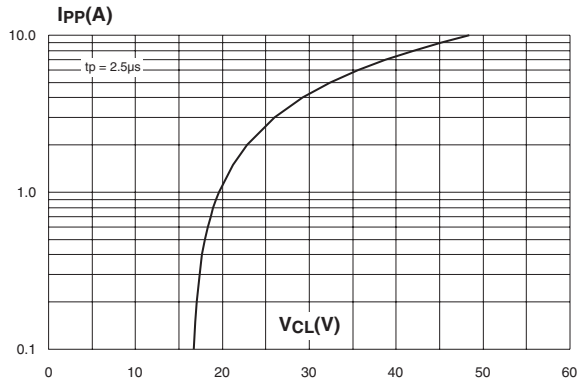


Fig. 2: Capacitance versus reverse applied voltage (typical values).

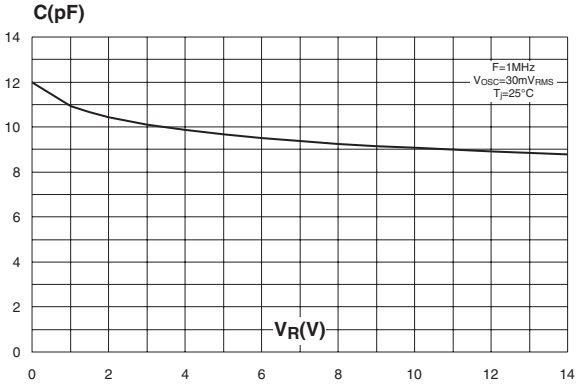
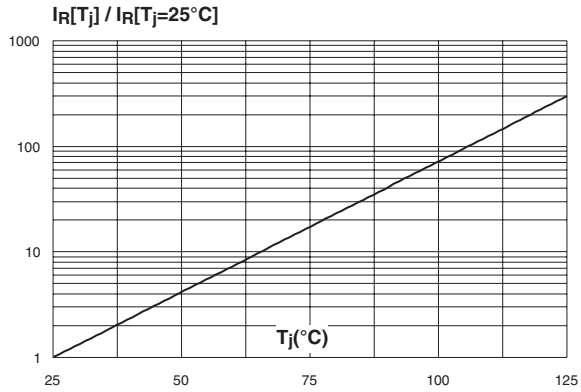
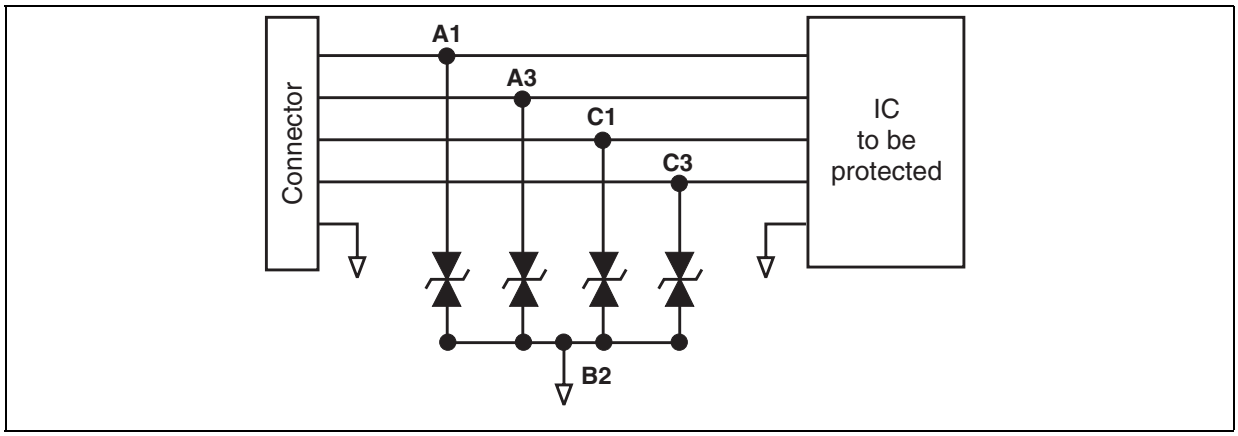


Fig. 3: Relative variation of leakage current versus junction temperature (typical values).



APPLICATION EXAMPLE



TECHNICAL INFORMATION

1. ESD protection by ESDA14V2-4BF1

With the focus of lowering the operation levels, the problem of malfunction caused by the environment is critical. Electrostatic discharge (ESD) is a major cause of failure in electronic systems.

As a transient voltage suppressor, ESDA14V2-4BF1 is an ideal choice for ESD protection by suppressing ESD events. It is capable of clamping the incoming transient to a low enough level such that any damage is prevented on the device protected by ESDA14V2-4BF1.

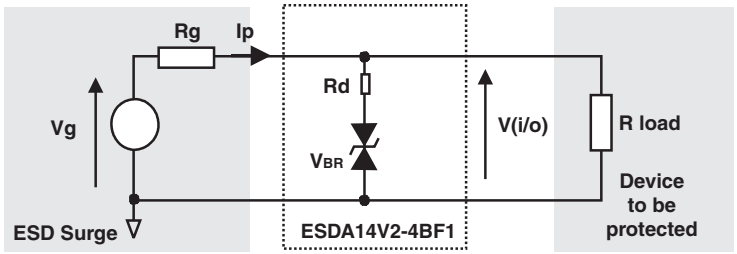
ESDA14V2-4BF1 serves as a parallel protection elements, connected between the signal line and ground. As the transient rises above the operating voltage of the device, the ESDA14V2-4BF1 becomes a low impedance path diverting the transient current to ground.

The clamping voltage is given by the following formula:

$$V_{CL} = V_{BR} + R_d.I_{PP}$$

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:

$$V(i/o) = V_{BR} + R_d \times \frac{V_G}{R_G}$$

The results of the calculation done V_G = 8kV, R_G = 330Ω (IEC61000-4-2 standard), V_{BR} = 14.2V (typ.) and R_d = 3.2Ω (typ.) give:

$$V(i/o) = 91.8 \text{ Volts}$$

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: ESD test board.

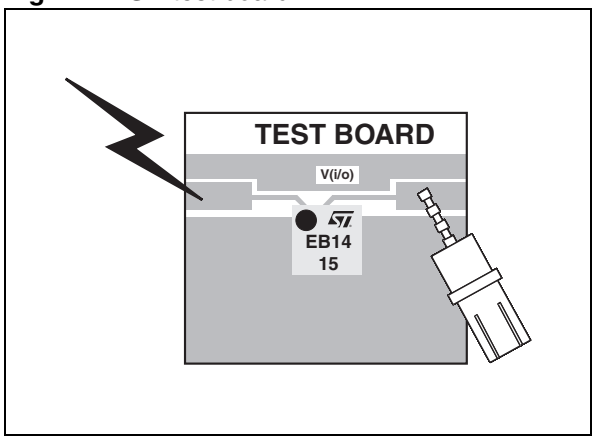
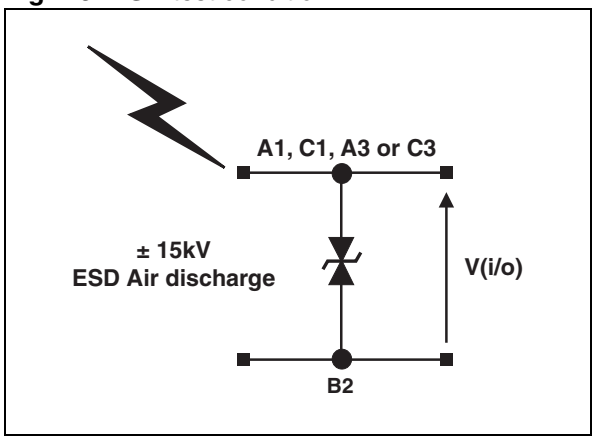
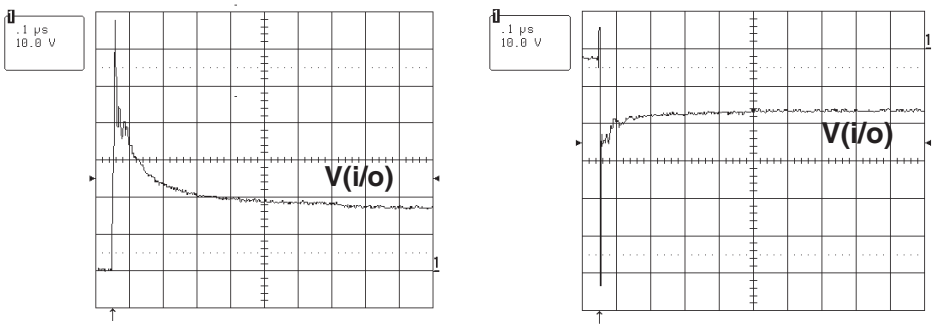


Fig. A3: ESD test condition.



The measurements done here after show very clearly (*figure A4*) the high efficiency of the ESD protection: the clamping voltage V(i/o) becomes very close to V_{BR} (positive way, *figure A4a*) and $-V_{BR}$ (negative way, *figure A4b*).

Fig. A4: Remaining voltage during ESD surge.

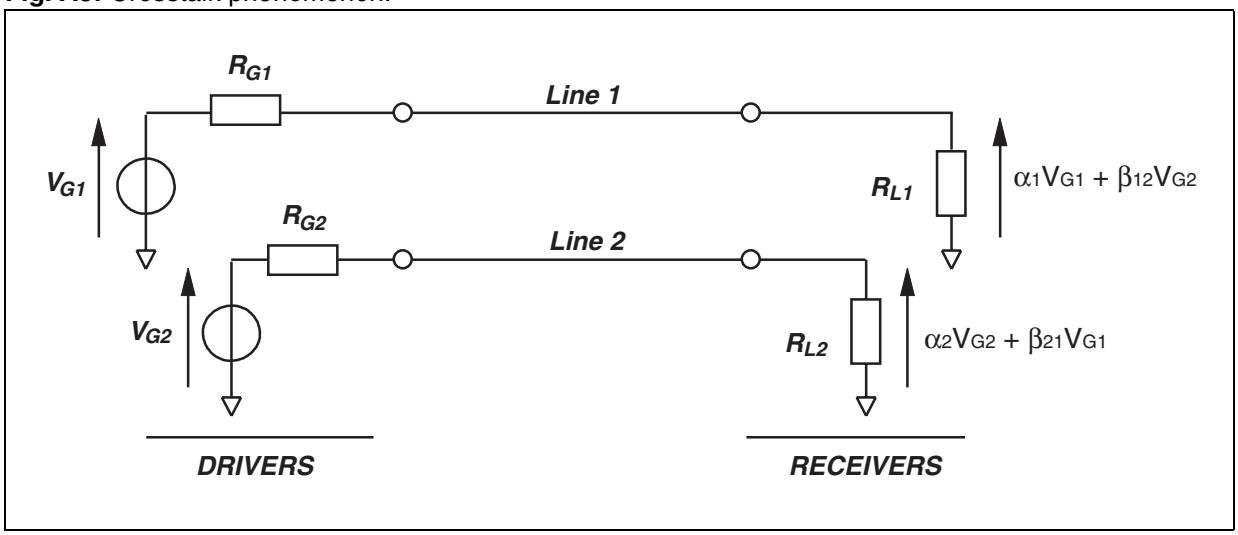


a: Response in the positive way

b: Response in the negative way

2. Crosstalk behavior

Fig. A5: Crosstalk phenomenon.



The crosstalk phenomena are due to the coupling between 2 lines. Coupling factors ($\beta 12$ or $\beta 21$) increase when the gap across lines decreases, particularly in silicon dice. In the example above, the expected signal on load R_{L2} is $\alpha_2 V_{G2}$, in fact the real voltage at this point has got an extra value $\beta_{21} V_{G2}$. 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. The perturbed line will be more affected if it works with low voltage signal or high load impedance (few kΩ).

Fig. A6: Analog crosstalk test configuration.

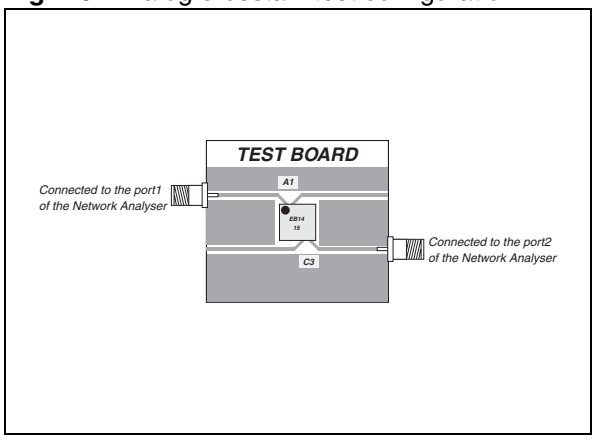


Fig. A7: Typical analog crosstalk response.

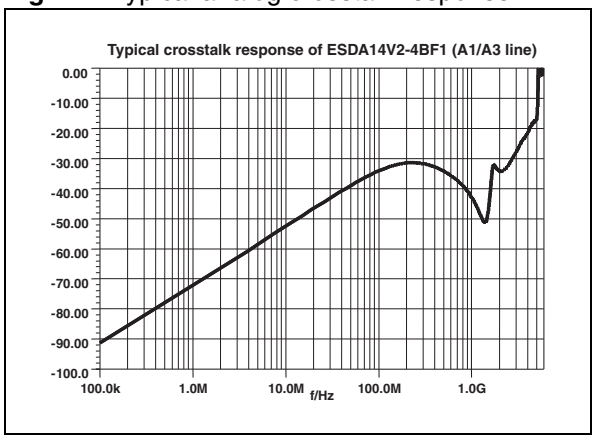


Figure A6 gives the measurement circuit for the analog crosstalk application. In *figure A7*, the curve shows the effect of the line A1on the line A3. In usual frequency range of analog signals (up to 100 MHz) the effect on disturbed line is less than -30dB.

Fig. A8: Digital crosstalk test configuration.

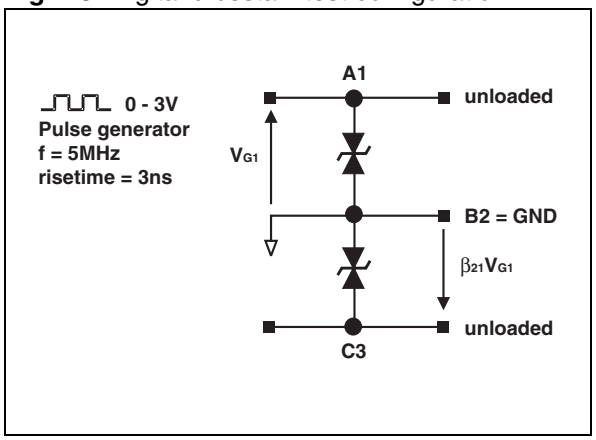


Fig. A9: Typical digital crosstalk response.

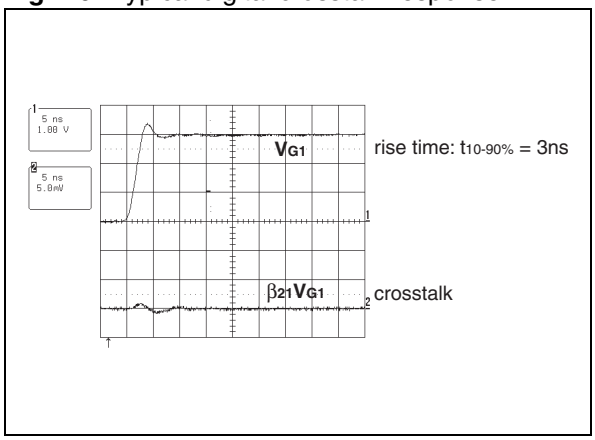
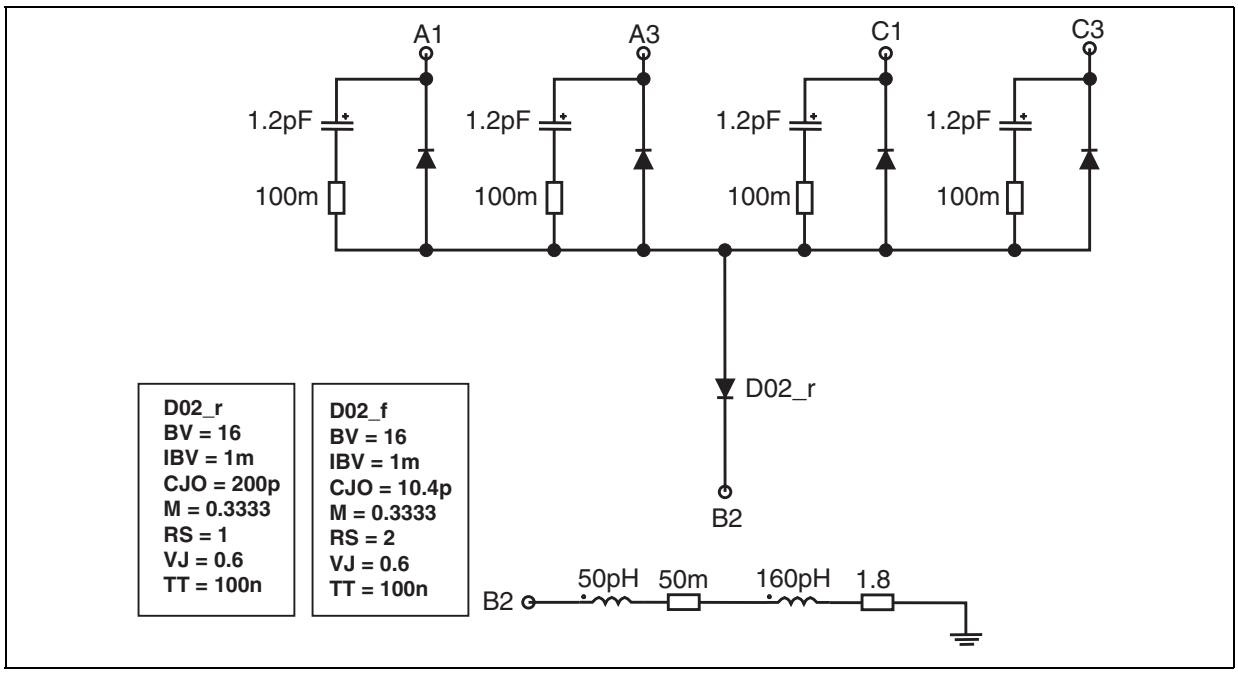


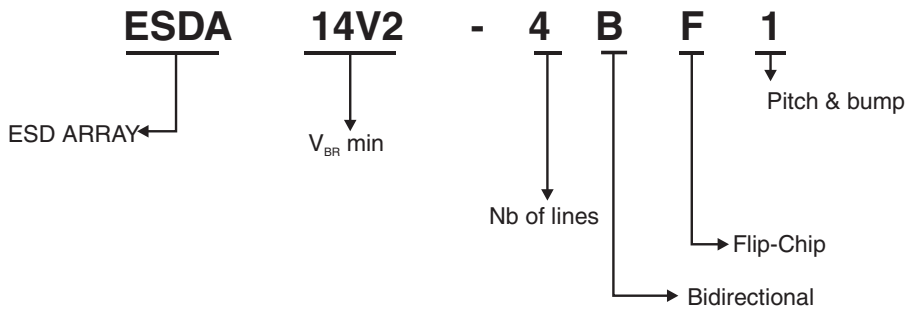
Figure A8 shows the measurement circuit used to quantify the crosstalk effect in a classical digital application.

Figure A9 shows that in such a condition, the impact on the disturbed line is less than 5 mV peak to peak. No data disturbance was noted on the concerned line. The measurements performed with falling edges give an impact within the same range.

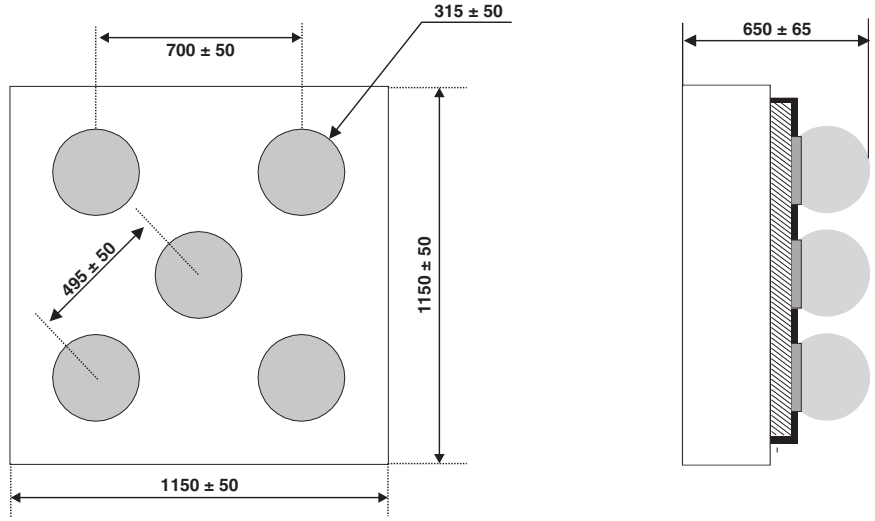
Fig. A10: Aplac model.



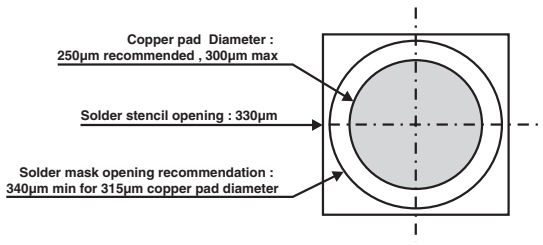
ORDER CODE



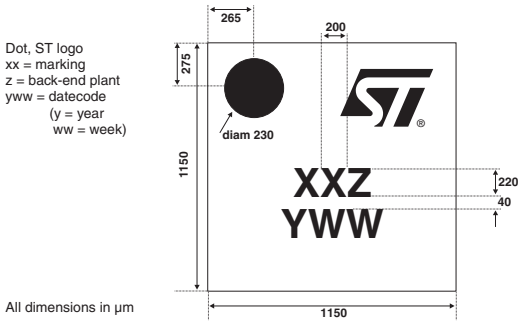
PACKAGE MECHANICAL DATA



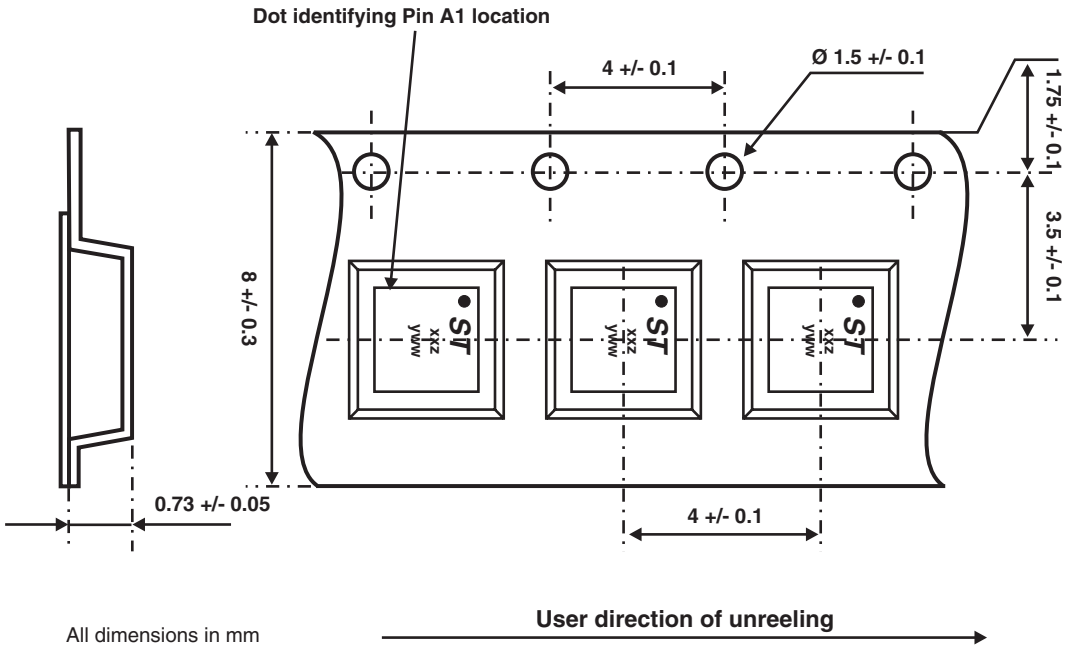
FOOT PRINT RECOMMENDATIONS



MARKING



FLIP-CHIP TAPE AND REEL SPECIFICATION



ORDERING INFORMATION

Part Number	Marking	Package	Weight	Base qty	Delivery mode
ESDA14V2-4VF1	EA	Flip Chip	2.1 mg	5000	Tape & reel

Note: More packing informations are available in the application notes
- AN1235: "Flip-Chip: Package description and recommandations for use"
- AN1751: "EMI Filters: Recommendations and measurements"

REVISION HISTORY

Table 1: Revision history

Date	Revision	Description of Changes
July-2002	1	First issue
27-May-2004	2	Die clearance optimization