IP4790CZ38

DisplayPort protection

Rev. 01 — 14 July 2008 **Product data sheet**

1. General description

The IP4790CZ38 is a single chip ElectroStatic Discharge (ESD) protection solution for the DisplayPort interfaces. The low capacitance, typically 0.7 pF to ground, supports the high data rates defined by the DisplayPort interface standard.

2. Features

- Robust ESD protection does not degrade even after several discharge incidents
- Low leakage, even after several hundred ESDs
- Very high ns diode switching speed and low line capacitance (0.7 pF to ground and 0.05 pF between channels) ensures signal integrity
- Integrated rail-to-rail clamping diodes with downstream ESD protection of ±8 kV according to IEC 61000-4-2, level 4 on all Main Link (ML) signal lines
- Matched 0.5 mm trace spacing
- Optimized TSSOP 38-pin package:
  - Highly integrated
  - Small footprint
  - PCB-level
  - RF-routing
  - Lead (Pb) free
- Complies with *Directive 2002/95/EC, Restriction of Hazardous Substances (RoHS)*

3. Applications

The IP4790CZ38 can be used with a range of DisplayPort devices including:

- Personal computer
- PC monitor
- Notebook

4. Ordering information

Table 1. Ordering information

Type number	Package		
	Name	Description	Version
IP4790CZ38	TSSOP38	plastic thin shrink small outline package; 38 leads; body width 4.4 mm; lead pitch 0.5 mm	SOT510-1

5. Functional diagram

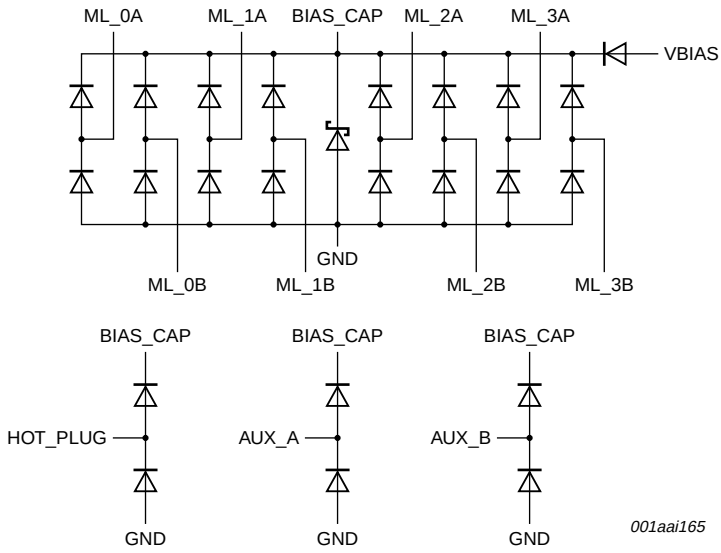


Fig 1. Functional diagram

6. Pinning information

6.1 Pinning

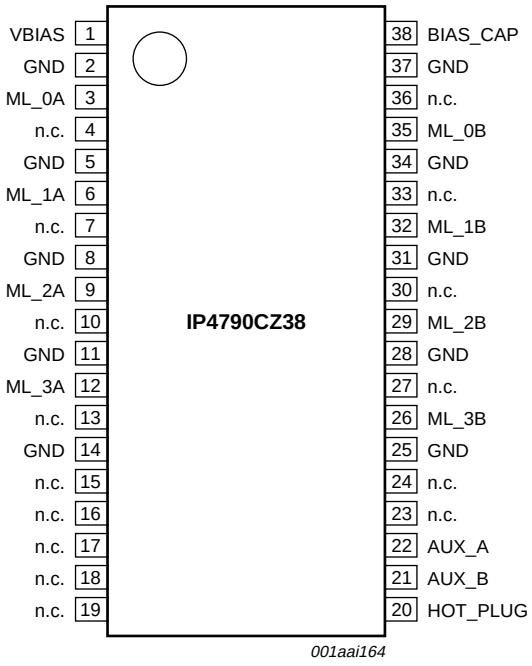


Fig 2. Pin configuration SOT510-1 (TSSOP38)

6.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
VBIAS	1	bias voltage
GND	2	ground
ML_0A	3	main link 0A lane protection
n.c.	4	not connected
GND	5	ground
ML_1A	6	main link 1A lane protection
n.c.	7	not connected
GND	8	ground
ML_2A	9	main link 2A lane protection
n.c.	10	not connected
GND	11	ground
ML_3A	12	main link 3A lane protection
n.c.	13	not connected
GND	14	ground
n.c.	15, 16, 17, 18, 19	not connected
HOT_PLUG	20	Hot Plug signal protection
AUX_B	21	auxiliary channel B protection
AUX_A	22	auxiliary channel A protection
n.c.	23, 24	not connected
GND	25	ground
ML_3B	26	main link 3B lane protection
n.c.	27	not connected
GND	28	ground
ML_2B	29	main link 2B lane protection
n.c.	30	not connected
GND	31	ground
ML_1B	32	main link 1B lane protection
n.c.	33	not connected
GND	34	ground
ML_0B	35	main link 0B lane protection
n.c.	36	not connected
GND	37	ground
BIAS_CAP	38	capacitor bias (optional)

7. Limiting values

Table 3. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{ESD}	electrostatic discharge voltage	signal pins to ground: ML_xA, ML_xB, AUX_A, AUX_B and HOT_PLUG	[1][2]	-	±8	kV
V_{VBIAS}	voltage on pin VBIAS			GND – 0.5	5.5	V
T_{stg}	storage temperature			–55	+125	°C
P_{tot}	total power dissipation			-	0	mW

[1] Human Body Model (HBM) according IEC 61000-4-2, level 4.

[2] Where x = 0, 1, 2 and 3.

8. Characteristics

Table 4. Characteristics

T_{amb} = 25 °C; unless otherwise indicated.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{BRzd}	Zener diode breakdown voltage	measured with I = 1 mA		6	-	9	V
V_{Fd}	diode forward voltage			-	0.7	-	V
Pins ML_xA, ML_xB[1]							
I_{bck}	back current	from pins ML_xA and ML_xB to bias; at power-down; $V_{VBIAS} < V_{ch(ML)}$	[1]	-	0.1	5	µA
I_{RM}	reverse leakage current	per ML channel; measured with V = 3.0 V		-	-	1	µA
C_{ch}	channel capacitance	V_{VBIAS} = 5 V; f = 1 MHz; $V_{ch(ML)}$ = 2.5 V	[2]	-	0.7	-	pF
ΔC_{ch}	channel capacitance difference	V_{VBIAS} = 5 V; f = 1 MHz; $V_{ch(ML)}$ = 2.5 V	[2]	-	0.05	-	pF
$C_{ch(mutual)}$	mutual channel capacitance	between signal pin and n.c. pin; V_{VBIAS} = 0 V; f = 1 MHz; $V_{ch(ML)}$ = 2.5 V	[2]	-	0.07	-	pF
R_{dyn}	dynamic resistance	positive transient; measured with I = 1 A	[3]	-	2.4	-	Ω
		negative transient; measured with I = 1 A	[3]	-	1.3	-	Ω
$V_{CL(ch)trt(pos)}$	positive transient channel clamping voltage	V_{ESD} = ±8 kV	[4]	-	8	-	V

[1] Where x = 0, 1, 2 and 3.

[2] This parameter is guaranteed by design and verified by device characterization.

[3] According to IEC 61000-4-5/9.

[4] Human Body Model (HBM) according IEC 61000-4-2, level 4.

9. Application information

The IP4790CZ38 simplifies the protection of an DisplayPort interface.

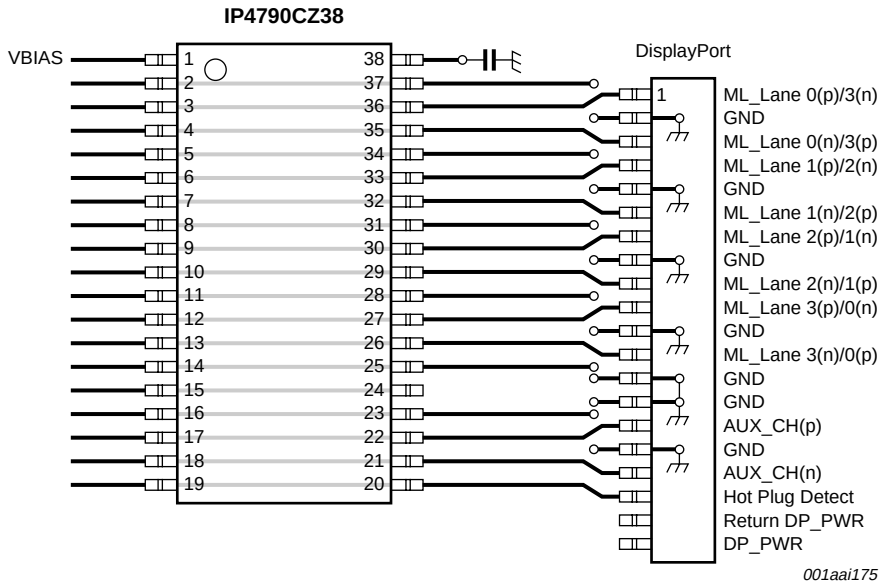
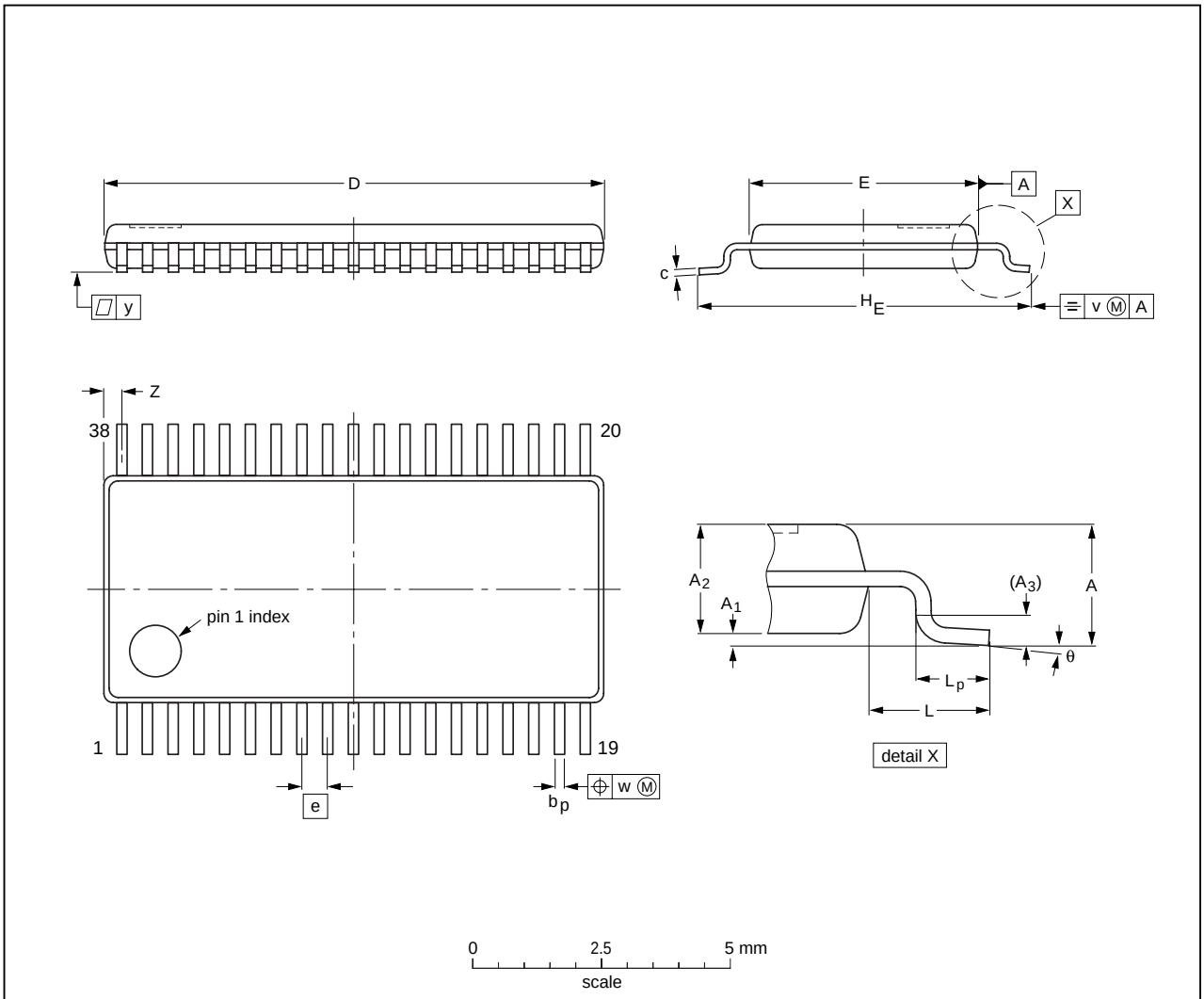


Fig 3. Typical application

Connecting an optional 100 nF capacitor to the BIAS_CAP pin (lead 38) enhances the ESD protection clamping performance. The VBIAS pin reduces the capacitive load of the ESD protection and V_{VBIAS} can be in the range 2.5 V to 5.5 V.

10. Package outline

TSSOP38: plastic thin shrink small outline package; 38 leads; body width 4.4 mm; lead pitch 0.5 mm **SOT510-1**



DIMENSIONS (mm are the original dimensions).

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	v	w	y	$Z^{(1)}$	θ
mm	1.1	0.15 0.05	0.95 0.85	0.25	0.27 0.17	0.20 0.09	9.8 9.6	4.5 4.3	0.5	6.4	1	0.7 0.5	0.2	0.08	0.08	0.49 0.21	8^o 0^o

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT510-1		MO-153				~~03-02-18~~ 05-11-02

Fig 4. Package outline SOT510-1 (TSSOP38)

11. Soldering of SMD packages

This text provides a very brief insight into a complex technology. A more in-depth account of soldering ICs can be found in Application Note *AN10365 "Surface mount reflow soldering description"*.

11.1 Introduction to soldering

Soldering is one of the most common methods through which packages are attached to Printed Circuit Boards (PCBs), to form electrical circuits. The soldered joint provides both the mechanical and the electrical connection. There is no single soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and Surface Mount Devices (SMDs) are mixed on one printed wiring board; however, it is not suitable for fine pitch SMDs. Reflow soldering is ideal for the small pitches and high densities that come with increased miniaturization.

11.2 Wave and reflow soldering

Wave soldering is a joining technology in which the joints are made by solder coming from a standing wave of liquid solder. The wave soldering process is suitable for the following:

- Through-hole components
- Leaded or leadless SMDs, which are glued to the surface of the printed circuit board

Not all SMDs can be wave soldered. Packages with solder balls, and some leadless packages which have solder lands underneath the body, cannot be wave soldered. Also, leaded SMDs with leads having a pitch smaller than ~0.6 mm cannot be wave soldered, due to an increased probability of bridging.

The reflow soldering process involves applying solder paste to a board, followed by component placement and exposure to a temperature profile. Leaded packages, packages with solder balls, and leadless packages are all reflow solderable.

Key characteristics in both wave and reflow soldering are:

- Board specifications, including the board finish, solder masks and vias
- Package footprints, including solder thieves and orientation
- The moisture sensitivity level of the packages
- Package placement
- Inspection and repair
- Lead-free soldering versus SnPb soldering

11.3 Wave soldering

Key characteristics in wave soldering are:

- Process issues, such as application of adhesive and flux, clinching of leads, board transport, the solder wave parameters, and the time during which components are exposed to the wave
- Solder bath specifications, including temperature and impurities

11.4 Reflow soldering

Key characteristics in reflow soldering are:

- Lead-free versus SnPb soldering; note that a lead-free reflow process usually leads to higher minimum peak temperatures (see Figure 5) than a SnPb process, thus reducing the process window
- Solder paste printing issues including smearing, release, and adjusting the process window for a mix of large and small components on one board
- Reflow temperature profile; this profile includes preheat, reflow (in which the board is heated to the peak temperature) and cooling down. It is imperative that the peak temperature is high enough for the solder to make reliable solder joints (a solder paste characteristic). In addition, the peak temperature must be low enough that the packages and/or boards are not damaged. The peak temperature of the package depends on package thickness and volume and is classified in accordance with Table 5 and 6

Table 5. SnPb eutectic process (from J-STD-020C)

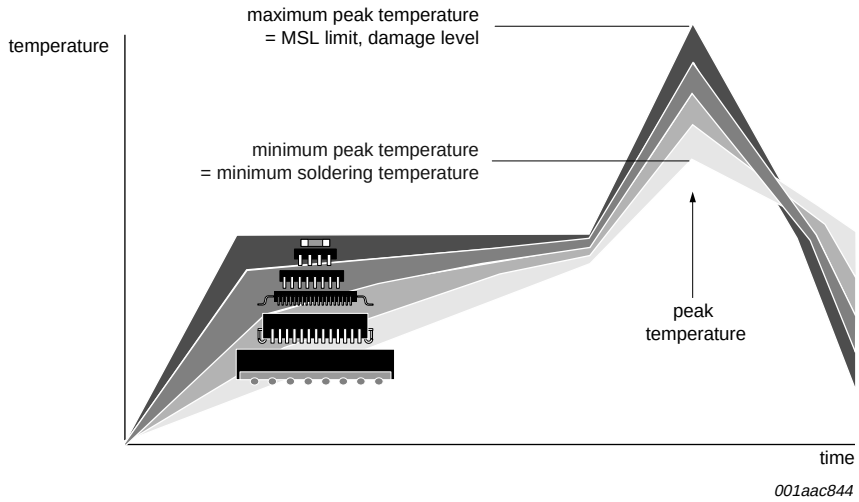
Package thickness (mm)	Package reflow temperature (°C)	
	Volume (mm^3)	
	< 350	≥ 350
< 2.5	235	220
≥ 2.5	220	220

Table 6. Lead-free process (from J-STD-020C)

Package thickness (mm)	Package reflow temperature (°C)		
	Volume (mm^3)		
	< 350	350 to 2000	> 2000
< 1.6	260	260	260
1.6 to 2.5	260	250	245
> 2.5	250	245	245

Moisture sensitivity precautions, as indicated on the packing, must be respected at all times.

Studies have shown that small packages reach higher temperatures during reflow soldering, see Figure 5.



MSL: Moisture Sensitivity Level

Fig 5. Temperature profiles for large and small components

For further information on temperature profiles, refer to Application Note *AN10365 "Surface mount reflow soldering description"*.

12. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
IP4790CZ38_1	20080714	Product data sheet	-	-

13. Legal information

13.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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Date of release: 14 July 2008

Document identifier: IP4790CZ38_1