MICROCHIP

LX7710

Octal 125V, 700mA Redundant Diode Pairs for Space

Description

The LX7710 is a diode array that features high breakdown voltage diodes with ESD protection and built-in redundancy that is radiation-hardened by design. It is typically used as a companion device to the AAHS298B source driver to build redundant power switches.

The array contains 8 series connected diode pairs, and is intended for power ORing applications and for redundant diode clamps for inductive loads. The series connected diodes are redundant should one of the diodes fail in a short circuit.

Individual diodes within the array have a 125V maximum reverse voltage rating, and can each handle 700mA continuous current, which is 5.6A per package. ESD protection is also included; the two series ESD zener diodes have a working voltage of 100V each for a total of 200V.

The LX7710 is packaged in a 20 pin ceramic hermetic CSOIC package and is QML-V and QML-Q certified. It operates over a -55°C to 125°C temperature range, and is radiation tolerant to a minimum of 100krad(Si) TID, as well as single event effects.

Features

- 125V minimum breakdown voltage, even if one diode in any string fails for redundancy
- 700mA current capability per diode
- Low leakage current
- ESD protected
- Radiation tolerant: 100krad(Si) TID, inherent latchup immunity due to no power pin

Applications

- Power ORing
- Redundant Power Sourcing
- Redundant Inductive Load Clamps
- Aerospace Satellite Manufacturers
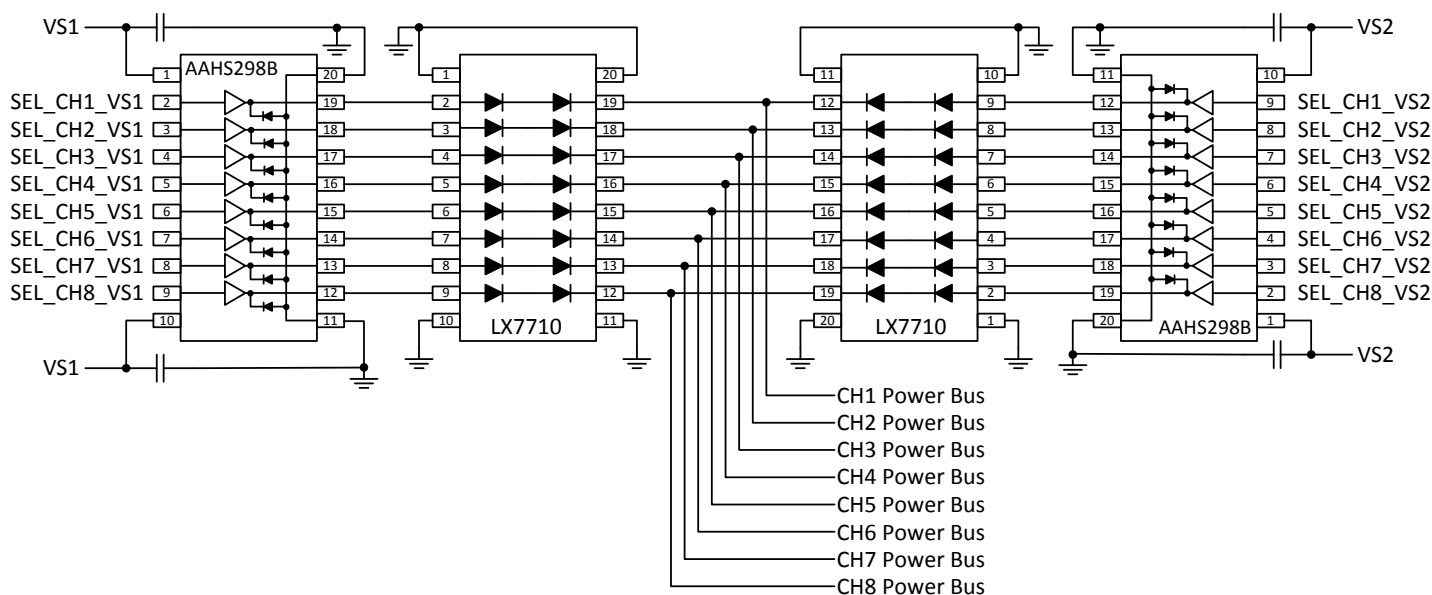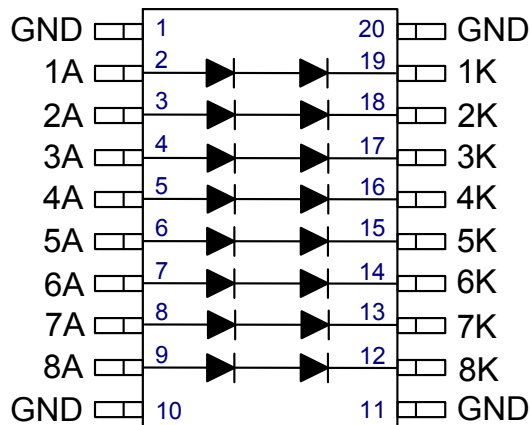- Military Power Electronics Control

Figure 1. LX7710 Example Redundant Power Bus Switch System with AAHS298B

1   Pin Configuration and Pinout

2   Ordering Information (subject to export restrictions under EAR9A515.e)

Operating Temperature	Package Type	Package	Part Number	SMD Number	Flow	Shipping Type
-55°C to 125°C	Hermetic Ceramic	CSOIC 20L Formed leads	LX7710MDWC-V	SMD 5962-1621001VXC	QML-V	Tray
			LX7710MDWC-Q	SMD 5962-1621001QXC	QML- Q	
	Ceramic		LX7710MDWC-ES[1]	-	Engineering Samples	
			MECH-SAMPLE-CSOIC20	-	Empty Package Sample	

[1] Engineering samples are tested at room temperature only, and do not undergo thermal, environmental, or hermeticity testing

3   CSOIC-20 Pin Numbering and Pin Descriptions

Pin	Name	Pin Type	Description
1	GND	Zener GNDs	All GND pins 1, 10, 11, and 20 must be used, connected together to GND
2	1A	Diode Anode	Anode of the channel 1 series power diode pair
3	2A	Diode Anode	Anode of the channel 2 series power diode pair
4	3A	Diode Anode	Anode of the channel 3 series power diode pair
5	4A	Diode Anode	Anode of the channel 4 series power diode pair
6	5A	Diode Anode	Anode of the channel 5 series power diode pair
7	6A	Diode Anode	Anode of the channel 6 series power diode pair
8	7A	Diode Anode	Anode of the channel 7 series power diode pair
9	8A	Diode Anode	Anode of the channel 8 series power diode pair
10	GND	Zener GNDs	All GND pins 1, 10, 11, and 20 must be used, connected together to GND
11	GND	Zener GNDs	All GND pins 1, 10, 11, and 20 must be used, connected together to GND
12	8K	Diode Cathode	Cathode of the channel 8 series power diode pair
13	7K	Diode Cathode	Cathode of the channel 7 series power diode pair
14	6K	Diode Cathode	Cathode of the channel 6 series power diode pair
15	5K	Diode Cathode	Cathode of the channel 5 series power diode pair
16	4K	Diode Cathode	Cathode of the channel 4 series power diode pair
17	3K	Diode Cathode	Cathode of the channel 3 series power diode pair
18	2K	Diode Cathode	Cathode of the channel 2 series power diode pair
19	1K	Diode Cathode	Cathode of the channel 1 series power diode pair
20	GND	Zener GNDs	All GND pins 1, 10, 11, and 20 must be used, connected together to GND

4 Absolute Maximum Ratings

Stresses above those listed in ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exceeding these ratings, even momentarily, can cause immediate damage, or negatively impact long-term operating reliability.

Parameter	Min	Max	Units
Reverse Voltage per Diode		140	V
Reverse Current (into K pin or out of GND pin)		100	μA
Continuous Forward Current per Diode		1	A
Operating Junction Temperature	-55	150	°C
Storage Junction Temperature	-65	150	°C
Peak Lead Solder Temperature (10 seconds)		260 (+0, -5)	°C

5 Electrical Characteristics

The following specifications apply over the operating ambient temperature of -55°C ≤ T_A ≤ 125°C. Low duty cycle pulse testing is used which keeps junction and case temperatures equal to the ambient temperature.

Symbol	Parameter	Test Conditions/Comments	Min	Typ	Max	Units
VBR_G-A	Reverse Breakdown	IR = 10μA; GND to A	125			V
VBR_K-A	Reverse Breakdown	IR = 10μA; K to A[1]	125			V
VBR_A-G	ESD Breakdown	IR = 10μA; A to GND[1]	125			V
VFWD_A-K	Forward Voltage	IF = 100mA at 25°C	1.49	1.54	1.61	V
		IF = 350mA at 25°C	1.65	1.74	1.86	
		IF = 700mA at 25°C	1.80	1.92	2.08	
		IF = 700mA at 125°C	1.64	1.76	1.84	
		IF = 700mA at -55°C	1.91	2.07	2.24	
IR	Reverse Current	VR = 75V at -55°C and 25°C; GND to A			100	nA
		VR = 75V at 125°C; GND to A			50	μA
C	Capacitance	VR = 0V at f = 1MHz; K to A	10	15	30	pF

[1] These are go/no-go tests

6 Thermal Properties

The θ_{JB} number is for conduction only to the ceramic base of the package. It assumes that the ceramic base has a thermal epoxy underneath the ceramic package to exhaust the heat from the package into the PCB or other surface.

Thermal Resistance	Typ	Units
θ_{JB}	3	°C/W

7 Heatsinking Recommendations

The LX7710 dissipates up to around 11W ({2V per diode series pair} x 700mA x {8 circuits}) at full load, and so thermal considerations are usually necessary. The base of the ceramic package should be used as the heat conducting surface for all but light duty applications. The metal package top is attached to the package body at the top of relatively thin cavity walls, and so has a much higher thermal resistance from the die than the base of the package. It is recommended to apply a thermal interface material between either package and its heat dissipater. The heat dissipater can be copper layers within a multilayer circuit board to spread heat laterally across the board, or a direct mounted dissipation element.

8 LX7710 Operation and Application

The LX7710 contains 8 sets of dual-diode series pairs, with dual Zener diode series pairs from each center-tap to a common GND. The diodes are rated at 700mA continuous forward current (1A continuous absolute maximum), and 125V reverse voltage. Each dual-diode series pair can therefore block 250V in normal operation, or 125V should one diode fail short in service.

The Zener diodes serve as over-voltage clamps for ESD protection, and use 4 pins for their common GND connections. Connect these 4 pins together, and to the most negative supply that the dual-diode series pairs will be connected to, typically GND. Each zener diode has a 100V working voltage, and so a 200V working voltage for the dual Zener diode series pair.

Figure 2 below shows the block diagram of the LX7710. Figure 1 on page 1 shows a typical redundant power bus switch system using the LX7710 together with the AAHS298B companion source driver.
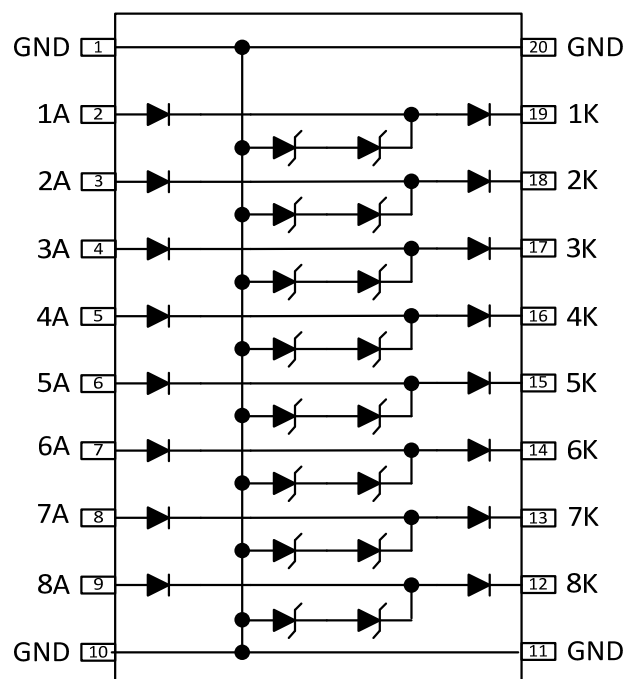

Figure 2. LX7710 Block Diagram
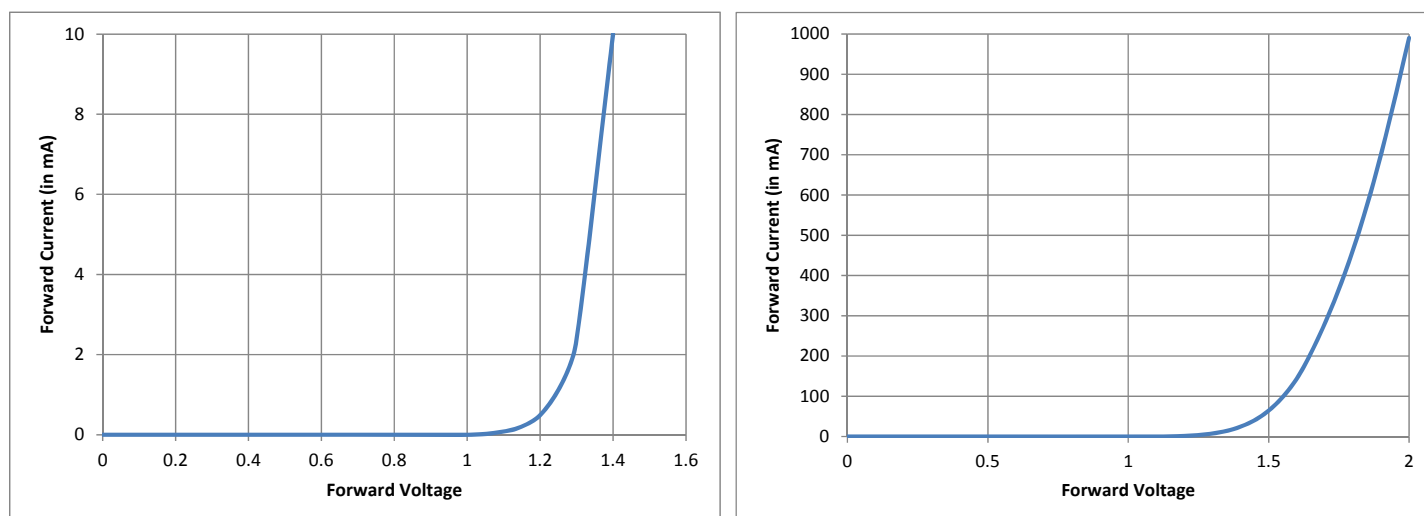
9 Characteristic Curves

Figure 3. Forward Characteristics, 0 to 10mA and 0 to 1000mA, measured A to K (two diodes in series)
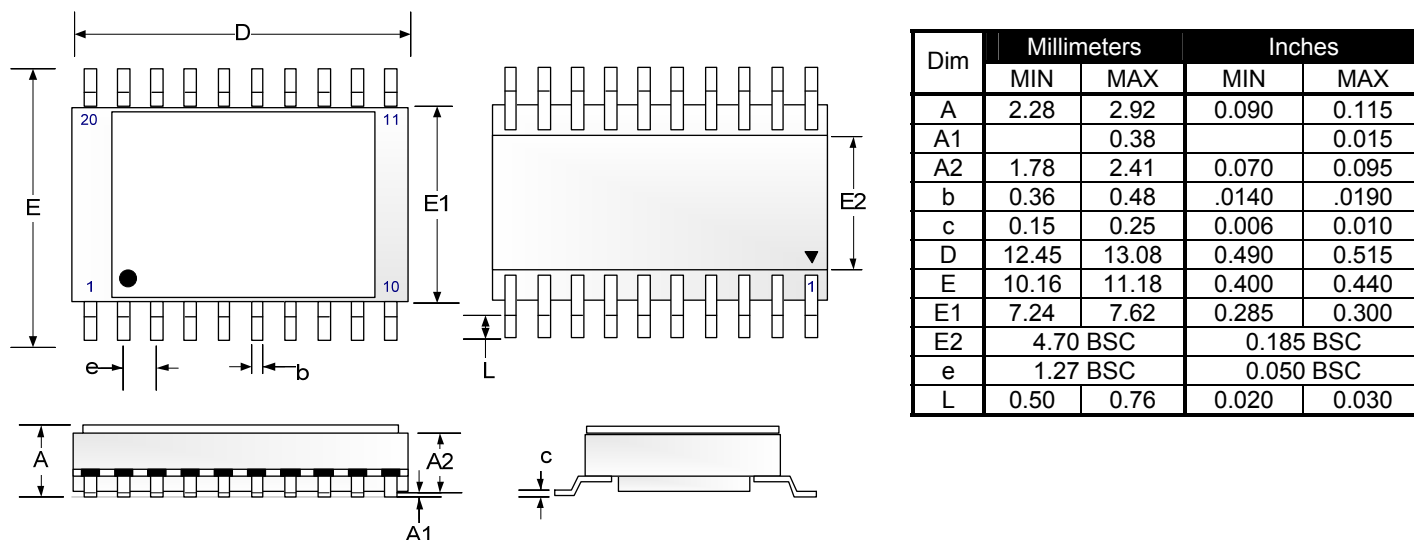
10   CSOIC 20L (Ceramic Small Outline) Dimensions

Figure 4. CSOIC-20 Package Dimensions

Dim	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	2.28	2.92	0.090	0.115
A1		0.38		0.015
A2	1.78	2.41	0.070	0.095
b	0.36	0.48	.0140	.0190
c	0.15	0.25	0.006	0.010
D	12.45	13.08	0.490	0.515
E	10.16	11.18	0.400	0.440
E1	7.24	7.62	0.285	0.300
E2	4.70 BSC		0.185 BSC	
e	1.27 BSC		0.050 BSC	
L	0.50	0.76	0.020	0.030

Note:
1. Controlling dimensions are in mm. Inch equivalents are shown for general information
2. Package mass is 0.83g typical
3. Lead material is Alloy 42 with NiAu plating (nickel under-plate followed by gold plating)
4. Lid material is Kovar with NiAu plating (nickel under-plate followed by gold plating) with AuSn solder seal
5. Lid is electrically isolated from the leads, and is bonded hermetically to the ceramic body using AuSn solder
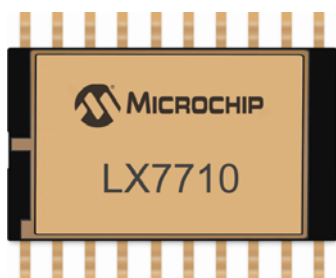6. Use the base of the package as the surface for conducting heat from the package

Figure 5. CSOIC-20 Package

11   Revision History

11.1   Revision 1.2 - December 2016

This is the release before the change log started.

11.2   Revision 1.3 - April 2021

Branding moved from Microsemi to Microchip, and some terminology changed.
Clarified latch-up immunity, added hot links to product pages and radiation test report on front page.
Engineering sample disclaimer added to Ordering Information, and operating temperature shown, not die temperature.
Clarified that Continuous Forward Current is per diode in Absolute Maximum Ratings.
Change 'anode' to 'A' in 1st and 3rd line of Electrical Characteristics table for consistency.
Added Heatsinking Recommendations section.
Added Operation and Application section.
Added package picture to package section.

11.3   Revision 1.4 - May 2023

Updated weblinks from Microsemi to Microchip.
Added empty package samples to ordering table.
Added AuSn solder seal lid attach detail to package notes.

11.4   Revision 1.5 - October 2023

Added package mass to packaging section.

11.5   Revision 1.6 - January 2024

Clarified in Electrical Characteristics table that the first three EVFWD_A-K specifications are at 25°C.

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