



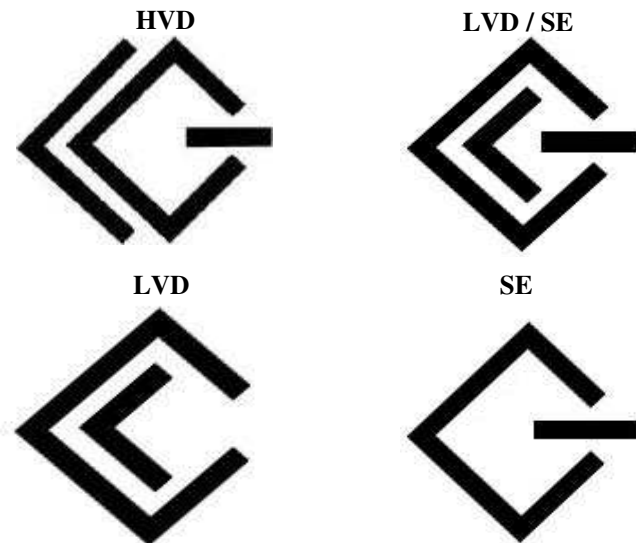
**SCSI Expander Solution  
For Now and the Future...**



10783 Bell Court  
Rancho Cucamonga, CA 91730  
909-987-3966 • Fax 909-989-2365  
[www.rancho.com](http://www.rancho.com)

### **Rack Mounted SCSI Expanders**

RTLVD-HVDR1/E    RTLVD-HVDR2/E  
RTLVD-HVDR3/E    RTLVD-HVDR4/E  
                          RTLVD-LVDR4/E



**警告使用者：**

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

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## OVERVIEW

The Rancho SCSI Rack Mounted Expanders are available in two configurations. Both configurations contain four independent expanders. The RTLVD-LVDR4/E extends the Ultra320 SCSI bus to double its specified maximum length. The RTLVD-HVDR2/E/RTLVD-HVDR4/E converts LVD or Single-Ended to HVD SCSI. The RTLVD-HVDR2/E/RTLVD-HVDR4/E's throughput is limited to Ultra SCSI speeds of 40 Mbytes/second/per channel. When the RTLVD-LVDR4/E is used in conjunction with an Ultra4 SCSI host adapter, this expander maintains backward compatibility with previous generation devices on single-ended segments while retaining optimal performance and maximum cable length of LVD. This expander can also be used with Ultra, Ultra2, Ultra3 host adapters to add Ultra4 devices and increase cable lengths. These expanders are operationally transparent, performing only signal level translation. There are no limits on the quantity or location of SCSI devices other than the limits of the SCSI specification. The expanders are multimode and therefore, can operate in either Single-Ended or LVD mode in any combination. This selection is controlled by a sensing signal (DIFFSENSE) provided by the SCSI devices on the bus.

The RTLVD-LVDR4/E expander supports all current Single ended and LVD SCSI operations and handle data rates up to 20/40/80/160/320 megatransfers per second. It is a transparent Low Voltage Differential (LVD) expander based on the Small Computer System Interface (SCSI) Parallel Interface-4 (SPI-4) standard.

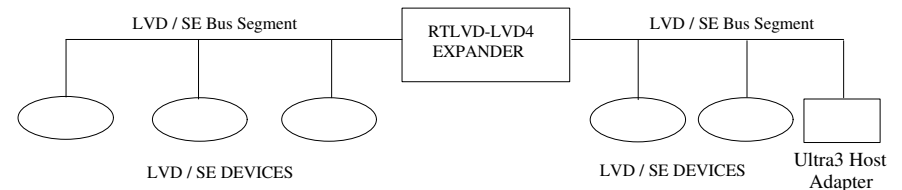
The RTLVD-HVDR4E has enhanced dual blower cooling and low RPM/Failed Blower warning system. This enables it to operate in racks up to 50° C and altitudes up to 3,000 meters.

## GENERAL FEATURES

- 1.75"x17"x16" fits 19" 1U rack
- Weight: 12 lbs (E Version 12.5 lbs)
- Supports legacy and Ultra4 devices on the same bus\*
- Power: 50 Watts, 100-240 VAC @ 50/60 Hz \*\* (E Version 65 Watts)
- Extends Ultra through Ultra4 SCSI bus length via LVD
- Data Transfer is completely bi directional
- Plug and Play transparent operation. No software support required
- Supports SCSI-1, 2,3, 4, Ultra, Ultra2, Ultra3, Ultra4
- Supports data rates up to 320Mbytes/sec \*
- Does not require a SCSI ID
- Active negation for SE mode for higher data integrity
- Double Transition Clocking
- Cyclic Redundancy Check (CRC) for data reliability
- Domain Validation for optimal transfer speed
- Compliance with SCSI Parallel Interface-4 (SPI-4) \*
- Compliant with SCSI Enhance Parallel Interface (EPI) specifications
- State matching retiming logic with precision delay control calibration
- Diffsense receiver for precise mode selection
- E Version low RPM/Failed Blower Warning LEDs
- E Version Dual Blower cooling

\* RTLVD-LVDR4/E \*\*RTLVD-HVDR2/E/RTLVD-HVDR4/E

The Rancho RTLVD-LVDR4/E contains four RTLVD-LVD4 Expanders, each with two SCSI ports and LVD/Single-Ended. Figure 1 illustrates a typical LVD Expander application.



**Figure 1: One SCSI Bus with Two Physical Segments (X4)**

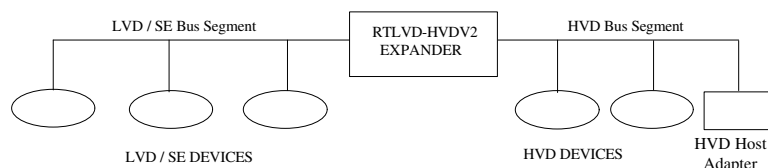
Rancho Technology, Inc.  
 909-987-3966 • fax 909-989-2365  
<http://www.rancho.com>  
 General information: [scsi@rancho.com](mailto:scsi@rancho.com)  
 Technical Support: [support@rancho.com](mailto:support@rancho.com)  
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## SCSI TERMINOLOGY

The Expanders contains the logic to control the signal flow between the two SCSI ports. It also contains filtering and delay circuits to remove false edges from the REQ and ACK signals. This logic enables the bus segments to be in the same SCSI bus state after a short delay.

The RTLVD-HVDR2/E/RTLVD-HVDR4/E contains four RTLVD-HVDV2 Expanders each with two SCSI ports, HVD and LVD/SE. Figure 2 illustrates a typical LVD/HVD Application.



**Figure 2: LVD/HVD Application**

The Expanders contains the logic to control the signal flow between the two SCSI ports. It also contains filtering and delay circuits to remove false edges from the REQ and ACK signals. This logic enables the bus segments to be in the same SCSI bus state after a short delay.

**Single Ended (SE) Interface** - An electrical signal interface that uses a single line for each SCSI signal. Its advantage is its design use less chips and cost less. Its disadvantage is more susceptible to noise and limited cable distance of up to 20 feet.

**High Voltage differential (HVD) Interface** - An electrical signal interface that uses a wire pair for each SCSI signal. The true or false state of a signal is determined by the difference between these two signals. Advantage of HVD is that it has higher noise immunity than SE, and has a maximum cable length of up to 82 feet. Maximum data transfer is 40 MB/s.

**Low Voltage Differential (LVD) Interface** - An interface that uses the same concept as HVD. It also uses a pair of wires for each SCSI signal but uses a lower voltage level to differentiate their true or false states. Advantage of LVD it has lower power requirement. It maximum cable length is 40 feet. LVD interface is required for speeds greater than 40 MB/s.

**Ultra SCSI** – A standard for data transfer. Maximum transfer of 40 MB/s. Another term used for this FAST 20 SCSI.

**Ultra2 SCSI** – A standard for data transfer. Maximum transfer of 80 MB/s. Another term used for this FAST 40 SCSI.

**Ultra3 SCSI** – A standard for data transfer. Maximum transfer of 160 MB/s. Another term used for this FAST 80 SCSI.

**Ultra4 SCSI** – A standard for data transfer. Maximum transfer of 320 MB/s. Another term used for this FAST 160 SCSI.

## CONNECTOR DEFINITION (WIDE – HVD)

Table 7. WIDE - HVD Connector pin configuration

Signal name	Connector contact number	Cable conductor number		Connector contact number	Signal name
+DB(12)	1	1	2	35	-DB(12)
+DB(13)	2	3	4	36	-DB(13)
+DB(14)	3	5	6	37	-DB(14)
+DB(15)	4	7	8	38	-DB(15)
+DB(P1)	5	9	10	39	-DB(P1)
GROUND	6	11	12	40	GROUND
+DB(0)	7	13	14	41	-DB(0)
+DB(1)	8	15	16	42	-DB(1)
+DB(2)	9	17	18	43	-DB(2)
+DB(3)	10	19	20	44	-DB(3)
+DB(4)	11	21	22	45	-DB(4)
+DB(5)	12	23	24	46	-DB(5)
+DB(6)	13	25	26	47	-DB(6)
+DB(7)	14	27	28	48	-DB(7)
+DB(P)	15	29	30	49	-DB(P)
DIFFSENS	16	31	32	50	GROUND
TERMPWR	17	33	34	51	TERMPWR
TERMPWR	18	35	36	52	TERMPWR
RESERVED	19	37	38	53	RESERVED
+ATN	20	39	40	54	-ATN
GROUND	21	41	42	55	GROUND
+BSY	22	43	44	56	-BSY
+ACK	23	45	46	57	-ACK
+RST	24	47	48	58	-RST
+MSG	25	49	50	59	-MSG
+SEL	26	51	52	60	-SEL
+C/D	27	53	54	61	-C/D
+REQ	28	55	56	62	-REQ
+I/O	29	57	58	63	-I/O
GROUND	30	59	60	64	GROUND
+DB(8)	31	61	62	65	-DB(8)
+DB(9)	32	63	64	66	-DB(9)
+DB(10)	33	65	66	67	-DB(10)
+DB(11)	34	67	68	68	-DB(11)

Notes:

The minus sign next to a signal indicates active low.

The conductor number refers to the conductor position when using flat-ribbon cable.

Pin assignments for RTLVD-HVD.

## RTLVD-LVDR4/E DESCRIPTION

The RTLVD-LVDR4/E Quad Rack Mounted Expanders provides a high-performance interconnection between Single-Ended devices and LVD SCSI devices. All of the LVD ports operate in multimode. It can therefore operate in LVD or Single-Ended mode. This feature is totally automatic upon being connected to the SCSI bus. Because the expander operates in multimode, it can also be used as a Single-Ended or LVD extender. This enables the Single-Ended and LVD SCSI bus length to be effectively doubled in length.

Figure 3, below, is a basic block diagram of a SCSI expander. The receiver transmitter pairs move the data from one bus to the other through the internal logic of the expander, which takes care of cleaning up the signals as well as translating any differences between the buses.

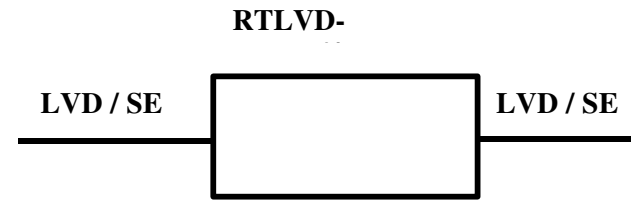
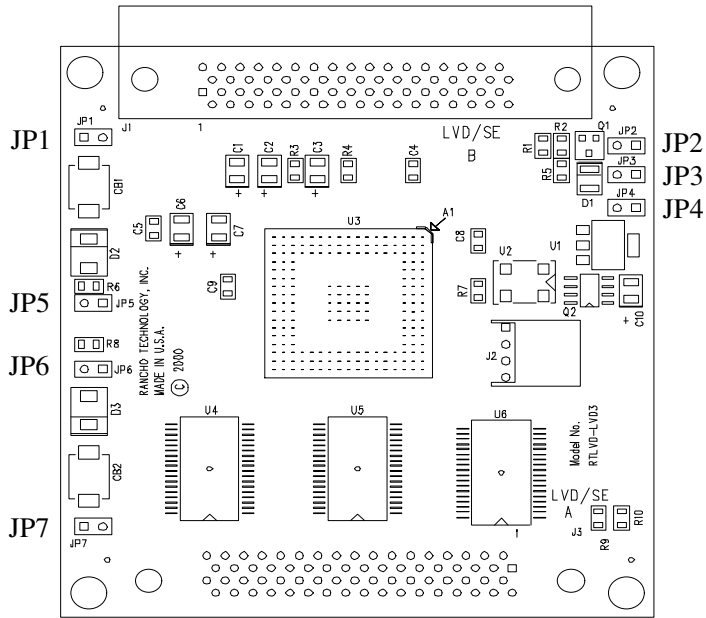


Figure 3: Block Diagram

### Design Functions:

- Extends LVD ( Ultra4 / Ultra3 / Ultra 2 ) to LVD ( Ultra4 / Ultra3 / Ultra2 )
- Converts LVD ( Ultra4 / Ultra3 / Ultra 2 ) to SE ( Ultra )
- Converts SE ( Ultra ) to LVD ( Ultra4 / Ultra3 / Ultra2 )

## CONNECTOR DEFINITION (WIDE – SE)



**Figure 4: RTLVD-LVD4**

The RTLVD-LVD4 is a Wide Ultra4 SCSI (Fast160) multimode Expander. This Expander measures 3.20 x 3.45 inches. The RTLVD-LVD4 is designed to extend WIDE Low Voltage Differential (LVD) interfaces. This allows LVD peripherals to be used on cables exceeding 12 meters in length. Two RTLVD-LVD4 expanders can be connected point-to-point up to 24 meters. As long as there is no other devices connected between the expanders. With the RTLVD-LVD4 it is possible to isolate two sections of the bus.

Because the RTLVD-LVD4 is Multimode it can also convert LVD to SE, or extend SE to SE. This expander allows the LVD bus to operate at Ultra4 SCSI speeds (up to 320 Mbytes / second).

**Table 6. WIDE – SE Connector pin configuration**

Signal name	Connector contact number	Cable conductor number		Connector contact number	Signal name
SIGNAL RETURN	1	1	2	35	-DB(12)
SIGNAL RETURN	2	3	4	36	-DB(13)
SIGNAL RETURN	3	5	6	37	-DB(14)
SIGNAL RETURN	4	7	8	38	-DB(15)
SIGNAL RETURN	5	9	10	39	-DB(P1)
SIGNAL RETURN	6	11	12	40	-DB(0)
SIGNAL RETURN	7	13	14	41	-DB(1)
SIGNAL RETURN	8	15	16	42	-DB(2)
SIGNAL RETURN	9	17	18	43	-DB(3)
SIGNAL RETURN	10	19	20	44	-DB(4)
SIGNAL RETURN	11	21	22	45	-DB(5)
SIGNAL RETURN	12	23	24	46	-DB(6)
SIGNAL RETURN	13	25	26	47	-DB(7)
SIGNAL RETURN	14	27	28	48	-DB(P)
GROUND	15	29	30	49	GROUND
GROUND	16	31	32	50	GROUND
TERMPWR	17	33	34	51	TERMPWR
TERMPWR	18	35	36	52	TERMPWR
RESERVED	19	37	38	53	RESERVED
GROUND	20	39	40	54	GROUND
SIGNAL RETURN	21	41	42	55	-ATN
GROUND	22	43	44	56	GROUND
SIGNAL RETURN	23	45	46	57	-BSY
SIGNAL RETURN	24	47	48	58	-ACK
SIGNAL RETURN	25	49	50	59	-RST
SIGNAL RETURN	26	51	52	60	-MSG
SIGNAL RETURN	27	53	54	61	-SEL
SIGNAL RETURN	28	55	56	62	-C/D
SIGNAL RETURN	29	57	58	63	-REQ
SIGNAL RETURN	30	59	60	64	-I/O
SIGNAL RETURN	31	61	62	65	-DB(8)
SIGNAL RETURN	32	63	64	66	-DB(9)
SIGNAL RETURN	33	65	66	67	-DB(10)
SIGNAL RETURN	34	67	68	68	-DB(11)

**Notes:**

The minus sign next to a signal indicates active low.

The conductor number refers to the conductor position when using flat-ribbon cable.

## CONNECTOR DEFINITION (LVD)

**Table 5. LVD Connector Pin Configuration**

Signal name	Connector contact number		Cable conductor number	Connector contact number	Signal name
+DB(12)	1	1	2	35	-DB(12)
+DB(13)	2	3	4	36	-DB(13)
+DB(14)	3	5	6	37	-DB(14)
+DB(15)	4	7	8	38	-DB(15)
+DB(P1)	5	9	10	39	-DB(P1)
+DB(0)	6	11	12	40	-DB(0)
+DB(1)	7	13	14	41	-DB(1)
+DB(2)	8	15	16	42	-DB(2)
+DB(3)	9	17	18	43	-DB(3)
+DB(4)	10	19	20	44	-DB(4)
+DB(5)	11	21	22	45	-DB(5)
+DB(6)	12	23	24	46	-DB(6)
+DB(7)	13	25	26	47	-DB(7)
+DB(P)	14	27	28	48	-DB(P)
GROUND	15	29	30	49	GROUND
DIFFSENS	16	31	32	50	DIFFSENS
TERMPWR	17	33	34	51	TERMPWR
TERMPWR	18	35	36	52	TERMPWR
RESERVED	19	37	38	53	RESERVED
GROUND	20	39	40	54	GROUND
+ATN	21	41	42	55	-ATN
GROUND	22	43	44	56	GROUND
+BSY	23	45	46	57	-BSY
+ACK	24	47	48	58	-ACK
+RST	25	49	50	59	-RST
+MSG	26	51	52	60	-MSG
+SEL	27	53	54	61	-SEL
+C/D	28	55	56	62	-C/D
+REQ	29	57	58	63	-REQ
+I/O	30	59	60	64	-I/O
+DB(8)	31	61	62	65	-DB(8)
+DB(9)	32	63	64	66	-DB(9)
+DB(10)	33	65	66	67	-DB(10)
+DB(11)	34	67	68	68	-DB(11)

**Notes:**

The conductor number refers to the conductor position when using flat-ribbon cable.

## RTLVD-LVDR4/E PERFORMANCE FEATURES

- WIDE (16-bit SCSI Bus)
- Data transfers up to 320 Mbytes/second
- Supports up to 16 SCSI devices
- Supports Arbitration, Parity and Disconnect/Reconnect
- Switchable LVD/SE Termination
- Allows for bus isolation by disabling SCSI transfers
- Busy LED
- Synchronous or Asynchronous Data Transfers
- Target or initiator on either side
- LVD to LVD or SE to LVD conversion
- TERMPWR via resetting circuit protector and backflow preventing diodes
- Up to 4 expanders can be Daisy-Chained
- Packetized Transfers
- Double Clock Transition
- Cycle Redundancy Check (CRC)
- Maximum LVD cable length = 12 meter or 24 meter ( Point-to-Point )

## RTLVD-LVD4 JUMPER CONFIGURATIONS

Table 1: Jumper definition

JUMPERS			
LOCATION	JUMPER DESCRIPTION	FUNCTION	FACTORY SETTING
JP2	LVD B Terminator Power	ON = Send Term Power to LVD B Side	ON
JP1	LVD B Terminator Enable	ON = Terminator enabled	ON
JP6	LVD A Terminator Enable	ON = Terminator enabled	ON
JP7	LVD A terminator Power	ON = Send Term power to LVD A Side	ON

Table 2: Connector definition

CONNECTORS					
J1	J2	J3	JP5	JP3	JP4
B - LVD/SE	DC Power	A - LVD/SE	WS_ENABLE	SCSI Activity LED Connector	XFER_ACTIVE

- XFER\_ACTIVE is an output that is set high to indicate the RTLVD-LVD4 is active, and SCSI transfers are enabled. (A Low Input ignores SCSI activity).
- WS\_ENABLE is an active low input that, when asserted, stops all transfers through the RTLVD-LVD4 as soon as the next SCSI bus free signal is detected. (Low disables operation, high enables operation).

## TERMINATION

Terminators must be installed at both ends of each segment of the SCSI bus. This applies to all three types of SCSI buses: LVD, HVD, and Single Ended.

Terminators on both ends of the SCSI expanders are factory set enabled. This assumes that the expander is the end of one bus and the start of another as in figure 7. If the expander is used to tap into the middle of an existing bus as in figure 8, the terminator on the tap side must be disabled, as it is not the end of that bus.

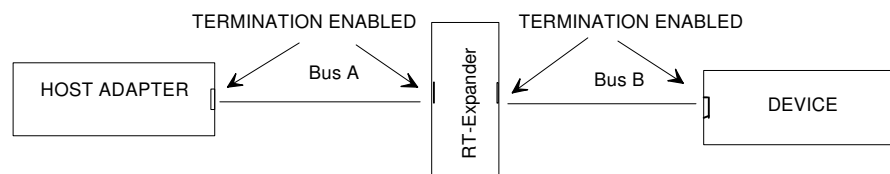


Figure 7: Termination Setting for Typical Applications (1)

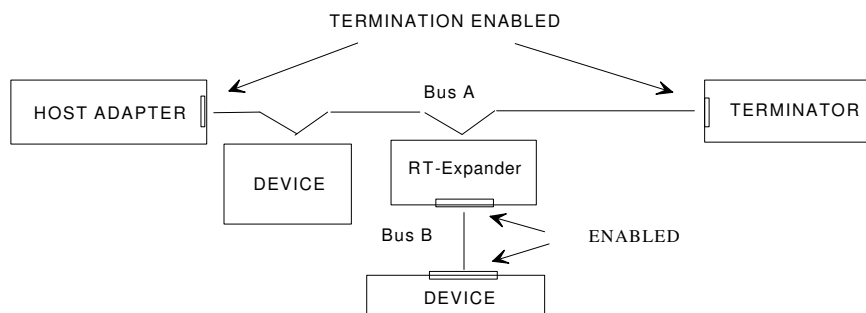


Figure 8: Termination Setting for Typical Applications (2)

## RTLVD-HVDV2 JUMPER CONFIGURATIONS

**Table 3: Jumper definition**

JUMPERS			
LOCATION	JUMPER DESCRIPTION	FUNCTION	FACTORY SETTING
JP1	HVD Terminator Power	ON = Send Term Power to HVD Bus	ON
JP2	LVD Terminator Enable	ON = Enabled	ON
JP3	HVD Terminator Disable	ON = Disabled	OFF
JP4	LVD Terminator Power	ON = Send Term Power to LVD Bus	ON

**Table 4: Connector definition**

CONNECTORS	
J1	HVD
J2	DC Power
J3	DC Power
J4	LVD/SE
J5	Reset
J6	Pin 1 XFER_ACTIVE Output (Chip active) Pin 2 Removed (key pin) Pin 3 Ground Pin 4 WS_ENABLE
J7	SCSI Activity LED Connector

- XFER\_ACTIVE is an output that is set high to indicate the RTLVD-HVDs is active, and SCSI transfers are enabled. (A Low Input ignores SCSI activity).
- WS\_ENABLE is an active low input that, when asserted, stops all transfers through the RTLVD-HVDs as soon as the next SCSI bus free signal is detected. (Low disables operation, high enables operation).

## RTLVD-HVDR2/E - HVDR4/E DESCRIPTION

The RTLVD-HVDR2/E/RTLVD-HVDR4/E Rack Mounted Expanders provides a high-performance interconnection between LVD devices and HVD SCSI devices. All of the LVD ports operate in multimode. It can therefore operate in LVD or Single-Ended mode. This feature is totally automatic upon being connected to the SCSI bus.

Figure 5, below, is a basic block diagram of a SCSI expander. The receiver transmitter pairs move the data from one bus to the other through the internal logic of the expander, which takes care of cleaning up the signals as well as translating any differences between the busses.

**RTLVD-HVDR2/E - RTLVD-HVDR4/E**



**Figure 5: Block Diagram**

### Design Functions:

- Converts LVD ( Ultra4 / Ultra3 / Ultra 2 ) to HVD ( Ultra )
- Converts SE ( Ultra ) to HVD ( Ultra )

## RTLVD-HVDR2/E - HVDR4/E PERFORMANCE

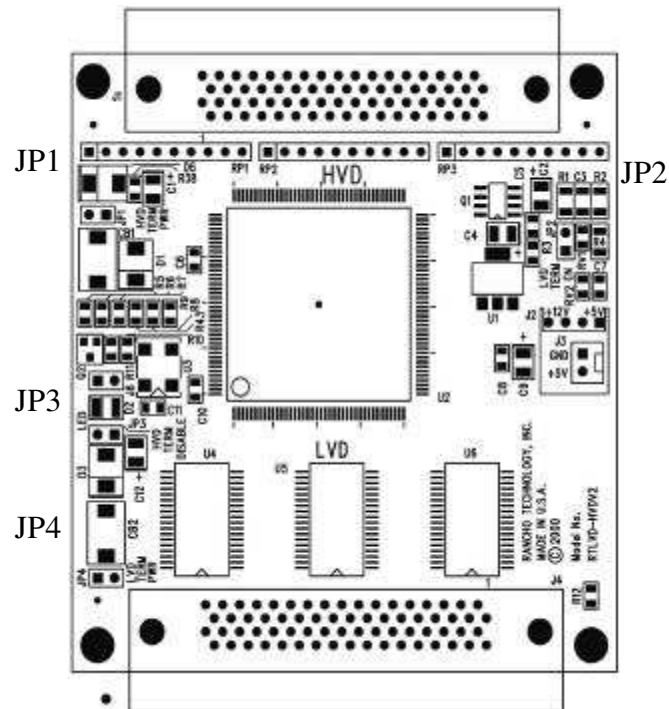


Figure 6: RTLVD-HVDV2

The RTLVD-HVDV2 is a Wide Ultra SCSI multimode Expander. This Expander measures 3.20 x 3.45 inches. The RTLVD-HVDV2 is used to convert WIDE LVD to HVD. With the RTLVD-HVDV2, it is possible to isolate two sections of the bus.

Because the RTLVD-HVDV2 is Multimode it can also convert HVD to SE. This expander allows the LVD bus to operate at speeds up to 40 Mbytes / second.

- WIDE (16-bit SCSI Bus)
- Data transfers up to 40 Mbytes/second
- Supports up to 16 SCSI devices
- Supports Arbitration, Parity and Disconnect/Reconnect
- Switchable LVD/SE Termination & HVD
- Allows for bus isolation by disabling SCSI transfers
- Busy LED
- Synchronous or Asynchronous Data Transfers
- Target or initiator on either side
- LVD to HVD or SE to HVD conversion
- TERMPWR via resetting circuit protector and backflow preventing diodes
- Up to 4 expanders can be Daisy-Chained
- Cycle Redundancy Check (CRC)
- Maximum LVD cable length = 12 meters or 24 meters ( Point-to-Point )
- Maximum HVD cable length = 25 meters
- Operating temperature 0-35° C
- E Version temperature 0-50° C
- E Version up to 3,000 meters