

Application Note ANI-23

Fault Tolerance Testing

Introduction

RS-485 / RS-422 Transceivers with ±60V fault tolerance provide rugged solutions for the real world where equipment can get installed incorrectly, wiring is incorrect or accidentally gets pinched resulting in shorts from ±60V to ground.

There are no industry standard tests, procedures or conditions stated in industry's datasheets for the ±60V specification. So let's put some devices from various vendors to the test. We took 11 different parts from MaxLinear and 4 other vendors and submitted them to two types of tests summarized in Table 1 to evaluate fault tolerance performance. An overview of device specifications is given in Table 2. In addition, a long term test was conducted on the MaxLinear parts, more of a real world scenario.

Test #	Test	Description	Comments
		Transient fault voltage applied to Y/Z outputs at 5V increments	
1	Transient Fault Voltage Test	Vcc = VL = 5V; DI = H or DI = L.	Passed up to ±60V
		Record when failure occurs.	
2	Transient Fault Voltage Test	Same as Test 1, except ±61V transient fault voltage applied to Y/Z outputs and sample size increased	Passed up to ±61V
		Vcc = VL = 5V	
3	Sweep Voltage Test	Connect Y/Z outputs to power supply, slowly sweep voltage from 0V to +80 (and 0V to -80V).	Passed up to ±70V
		Record when failure occurs.	
		Vcc = VL = 0V	
4	Long Term Fault Short Test	Connect Y/Z outputs to fault voltage	Passed up to ±61V for 36 hours
4	Long term rault Short lest	Power On device with Vcc = VL = 5V	rassed up to ±017 for 36 flours
		Record when failure occurs or stop at 36 hours.	

Table 1: Summary of Fault Tolerance Testing

		MaxLinear	MaxLinear	MaxLinear	MaxLinear	Vendor A	Vendor A	Vendor B	Vendor B	Vendor C	Vendor D
Function	on	XR33156	XR33053	XR33158	XR33152	Device 1	Device 2	Device 1	Device 2	Device 1	Devices 1, 2, 3
Fault Pro	tection (V)	±60	±60	±60	±60	±60	±60	±60	±60	±70	±80 /±60*
Common	Mode (V)	±25	±25	±25	±25	±25	±25	±25	±25	-20 to +25	-7 to +12
Supply (\	V)	3.0 - 5.0	3.0 - 5.0	3.0 - 5.0	3.0 - 5.0	4.5 - 5.5	4.5 - 5.5	3.0 - 5.5	3.0 - 5.5	4.5 - 5.5	4.5 - 5.5
Speed (b	ops)	20Mbps	1Mbps	20Mbps	250kbps	1Mbps	15Mbps	20Mbps	250Kbps	115Kbps	250Kbps 10Mbps
VL pin		Yes	No	No	No	No	No	No	No	No	No
Cable Inv	vert	Yes	No	Yes	Yes	No	No	No	No	No	No
Fail Safe		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Duplex		Full	Full	Half	Half	Full	Full	Full	Full	Full	Half
Unit Load	d	1/2.5	1/10	1/2.5	1/10	1/4	1/4	1/8	1/8	1/8	1/4
Devices	on bus	80	320	80	320	128	128	256	256	256	128
ESD	Bus	±15KV	±15KV	±15KV	±15KV	±2KV	±15KV	±15KV	±15KV	±16KV	±15KV
(HBM)	Other	±4KV	±4KV	±4KV	±4KV	±2KV	±8KV	±8KV	±8KV	±4KV	?
Tempera Grades (ture °C)	-40 to 85, -40 to 105	-40 to 85	-40 to 85	0 to 70, -40 to 85, -40 to 125	0 to 70, -40 to 85, -40 to 125	-40 to 105	-40 to 105			
Package	s	SOIC-8	SOIC-14	SOIC-8	SOIC-8	SOIC-14	SOIC-14, MSOP-10	SOIC-14, DFN-10	SOIC-14, DFN-10	SOIC-14	SOIC-14, SOIC-8

Table 2: Specification Comparison



Test 1: Transient Fault Voltage test to output Y/Z

Test Setup:

Application evaluation board with Vcc = VL = 5.0V, VL with 0.1uF, Vcc with 0.1uF and 10uF on VL.

HP6236B DC-Tripple outputs supply for fault transient testing voltage.

HP E3631A DC Power supply for Vcc = VL = 5V.

Test Procedure:

- 1. Power on device with Vcc = VL = 5V
- 2. First fault voltage with DI = H (+25V)
- 3. Retest the device with another setup. Making sure the device is still functional after the transient test.
- 4. Second fault voltage with DI = L (+25V)
- 5. Retest the device with another setup. Making sure the device is still functional after the transient test.
- 6. Third fault voltage with DI = H (-25V)
- 7. Retest the device with another setup. Making sure the device is still functional after the transient test.
- 8. Fourth fault voltage with DI = L (-25V)
- 9. Repeat the process from step 2 to step 8, at 5V interval until part failure occurs.
- 10. Record the fault voltage when failure occurs.

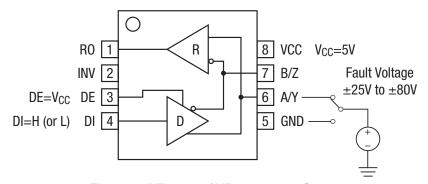


Figure 1: XR33152 / XR33158 Test Setup

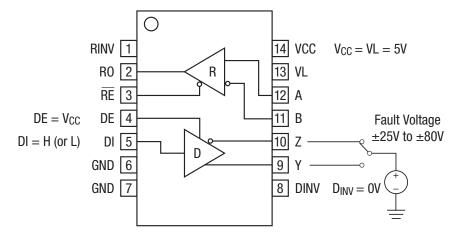


Figure 2: XR33156 / XR33053 Test Setup



Part(1)/Fault ((V)	25	-25	30	-30	35	-35	40	-40	45	-45	50	-50	55	-55	60	-60	65	-65	70	-70	75	-75	80	-80
DI=		Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н
DI		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Vendor Device 1	1	Р	Р	Р	Р	Р	P	Р	Р	Р	Р	Р	Р	Р	Р	P									
		P P	P	P P	P P	P P	F																		
Vendor Device 1	2	Р	Р	Р	Р	Р	P	Р	Р	Р	Р	Р	Р	Р	P	F									
Vendor	4	Р	P	Р	Р	Р	Р	Р	Р	Р	Р	Р	-		-										
Device 2	1	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F													
Vendor Device 2	2	P	P	Р	Р	Р	P	P	Р	Р	Р	P													\vdash
		P P	P P	P F	Р	Р	Р	Р	Р	Р	Р	F				-			-						
Vendor B Device 1	1	P	P	'																					
Vendor B	_	Р	Р	F																					
Device 1	2	Р	Р																						
Vendor B Device 2	1	Р	Р	Р	Р	Р	P	F				-							_						\vdash
		P P	P P	P P	P P	P P	P P	Р				-							-						$\overline{}$
Vendor B Device 2	2	Р	Р	Р	Р	Р	P	Р	F																
Vendor C	4	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F				
Device 1	1	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р					
Vendor C Device 1	2	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р					\vdash
		P P	P	P P	P P	P P	P	P P	P	P	F	Р	F												
Vendor D Device 1	1	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	<u> </u>			
Vendor D	2	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р				
Device 1		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р				
Vendor D Device 2	1	Р	Р	Р	Р	Р	P	Р	Р	Р	Р	Р	Р	Р	Р	P	Р	Р	Р	F					
		P P	P P	P P	P P	P	P P	P P	P P	P P	P P	P	P P	P P	P P	P	P P	P	P	Р	Р				
Vendor D Device 2	2	Р	Р	Р	Р	Р	P	P	Р	Р	Р	Р	Р	Р	P	P	Р	Р	Р	Р	F				
Vendor D	_	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р				
Device 3	1	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р				
Vendor D	2	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	P	Р	Р	Р	Р	Р				
Device 3		P P	P	P P	P P	P P	P	P P	P F	P	P 65.2	Р													
XR33152	1	Р	Р	Р	Р	Р	P	Р	Р	Р	Р	Р	Р	Р	P	Р	Р	P	I all	05.2					
VD00450		P	P	Р	Р	Р	P	P	Р	P	Р	P	Р	P	P	P	Р	F	Fail	65.6	l				
XR33152	2	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р							
XR33152	3	Р	Р	Р	Р	Р	P	Р	Р	Р	Р	P	Р	Р	Р	P	Р		Fail	-66.4	1				
		P P	P	P P	P P	P P	P	P P	F P	Fail	68.1														
XR33156	1	P	P	Р	P	Р	P	P	P	P	P	P	Р	P	P	P	P	P	I all	00.1					
VD22156	_	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F	Fail	65.5					
XR33156	2	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р							
XR33156	3	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	P	Р	_	Fail	-66.1					\square
		P P	P	P P	P P	P P	P P	P P	F	Fail	65.5	<u> </u>				$\overline{}$									
XR33158	1	Р	P	Р	Р	Р	P	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	ı all	00.0					
VD20150		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Fail	-66.2					
XR33158	2	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F							二
XR33158	3	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F	Fail	65.43	3				\vdash
		P P	P	P P	P P	P P	P	P P	P F	Fail	65.6					\square									
XR33053	1	Р	Р	Р	Р	Р	P	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	P	1 all	55.0					
XR33053	2	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F	Fail	65.7					
AN33033		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р							
XR33053	3	P P	P P	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F	Fail	65.2	1				\vdash
NOTE 1: VL no		-		Р	P	Р	P	Р	P	Р	Р	Р	Р	Р	Р	P	Р	Р		<u> </u>	<u> </u>	<u> </u>			

NOTE 1: VL nd V_{CC} with 0.1uF, V_{CC} = VL, Output Y nd 10 uF on VL

Table 3: Test 1 Fault Tolerance Test Results



Vendor	Device	Fault Tolerance Clain (±V)	Test 1 Summary	% of Claim
	XR33152	60	60	100.0
Exar	XR33156	60	60	100.0
Exai	XR33158	60	60	100.0
	XR33053	60	60	100.0
Vendor A	1	60	45	75.0
veridor A	2	60	55	91.7
Vendor B	1	60	25	41.7
veridor B	2	60	35	58.3
Vendor C	1	70	65	92.9
	1	80	70	87.5
Vendor D	2	80	65	81.3
	3	80	70	87.5

Table 4: Summary of Test 1 Fault Tolerance Test Results

Test 2: Transient Fault Voltage Test to output Y and Z, ±61V on Exar Devices

Test Procedure:

Additional testing was performed to solidify the 4 MaxLinear parts. Test 1 was performed with fault voltage set at an increased ±61V with an increased sample size of 10 each of the XR33156, XR33053, XR33158 and XR33152.

Part ⁽¹⁾	Fault (V)	25	-25	30	-30	35	-35	40	-40	45	-45	50	-50	55	-55	61	-61	65	-65	70	-70
D		Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н
	!= 	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
XR33152	1															Р	Р				
711.001.02																Р	Р				
XR33152	2															Р	Р				\vdash
																Р	Р				\vdash
XR33152	3															P P	P P				\vdash
																P	Р				\vdash
XR33152	4															P	P				\vdash
	_															P	P				
XR33152	5															Р	Р				
VD22152	6															Р	Р				
XR33152	0															Р	Р				
XR33152	7															Р	Р				
71.100.102	•															Р	Р				
XR33152	8															Р	Р				
																P P	P P				\vdash
XR33152	9															P	P				
																P	Р				
XR33152	10															Р	P				

NOTE 1: VL and VCC with 0.1uF, VCC = VL, Output Y and 10 uF on VL

Table 5: Half Duplex XR33152 Transient Test, DI = H/L, $\pm 61V$ Fault Tolerance to Both Z or Y



Part ⁽¹⁾	Fault (V)	25	-25	30	-30	35	-35	40	-40	45	-45	50	-50	55	-55	61	-61	65	-65	70	-70
D		Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н
	=	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
XR33156	1															Р	Р				
7(100100	'															Р	Р				
XR33156	2															Р	Р				
	_															P	P				
XR33156	3															Р	Р				
																Р	Р				
XR33156	4															Р	P P				
																P P	P				
XR33156	5															Р	P				
																Р	Р				
XR33156	6															Р	P				
																P	P				
XR33156	7															P	P				
	_															Р	Р				
XR33156	8															Р	Р				
VD00450	0															Р	Р				
XR33156	9															Р	Р				
XR33156	10															Р	Р				
VU99120	10															Р	Р				

NOTE 1: VL and V_{CC} with 0.1uF, V_{CC} = VL, Output Y and 10 uF on VL

Table 6: Full Duplex XR33156 Transient Test, DI = H / L, ±61V Fault Tolerance to Both Z or Y

Part ⁽¹⁾	Fault (V)	25	-25	30	-30	35	-35	40	-40	45	-45	50	-50	55	-55	61	-61	65	-65	70	-70
D	l=	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н
	·-	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
XR33158	1															P P	P P				\vdash
																P	P				\vdash
XR33158	2															Р	Р				
XR33158	3															Р	Р				
X1100130	0															Р	Р				
XR33158	4															Р	Р				
																P P	P P				
XR33158	5															Р	Р				
XR33158	6															Р	Р				
XH33136	6															Р	Р				
XR33158	7															Р	Р				
																Р	Р				
XR33158	8															P P	P P				
																Р	Р				\vdash
XR33158	9															P	P				
VD22150	10															Р	Р				
XR33158	10															Р	Р				

NOTE 1: VL and V_{CC} with 0.1uF, V_{CC} = VL, Output Y and 10 uF on VL

Table 7: Half Duplex XR33158 Transient Test, DI = H / L, ±61V Fault Tolerance to Both Z or Y



Part ⁽¹⁾	Fault (V)	25	-25	30	-30	35	-35	40	-40	45	-45	50	-50	55	-55	61	-61	65	-65	70	-70
D	I_	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н
	i=	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
XR33053	1															Р	P				
																Р	Р				
XR33053	2															P P	P P				
																Р	P				
XR33053	3															Р	P				
																Р	Р				$\overline{}$
XR33053	4															Р	P				
																P	P				
XR33053	5															P	P				
																P	P				
XR33053	6															Р	Р				
\/Danasa	_															Р	Р				
XR33053	7															Р	Р				
VDOOOEO	0															Р	Р				
XR33053	8															Р	Р				
XR33053	9															Р	Р				
VH22022	9															Р	Р				
XR33053	10															Р	Р				
X1100000	10															Р	Р				

NOTE 1: VL and V_{CC} with 0.1uF, V_{CC} = VL, Output Y and 10 uF on VL

Table 8: Full Duplex XR33053 Transient Test, DI = H/L, $\pm 61V$ Fault Tolerance to Both Z or Y

Vendor	Device	Fault Tolerance Clain (±V)	Test 1,2 Summary	% of Claim
	XR33152	60	61	101.7
Ever	XR33156	60	61	101.7
Exar	XR33158	60	61	101.7
	XR33053	60	61	101.7
Vendor A	1	60	45	75.0
vendor A	2	60	55	91.7
Vendor B	1	60	25	41.7
Veridor B	2	60	35	58.3
Vendor C	1	70	65	92.9
	1	80	70	87.5
Vendor D	2	80	65	81.3
	3	80	70	87.5

Table 9: Updated Summary of Test 1 and Test 2 Fault Tolerance Test Results



Test 3: Sweep Voltage Test

Test Procedure:

- 1. Vcc = VL = 0V
- 2. Connect output Y (or Z) to DC power supply at 0V.
- 3. Power on device with Vcc = VL = 5V.
- 4. Set driver input DI = L (or H), slowly ramping-up voltage from (0 to ± 80 V).
- 5. Record when failure occurs.

Part ⁽¹⁾	Fault (±V)	0	5	10	15	20	25	30	35	40	45	50	55	55	60	65	70	75	80	85
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
D	l=	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н
Vendor A		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F				
Device 1	1	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р					
Vendor A	1	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р				
Device 2	-	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F				
Vendor B Device 1	1	P P	P P	Р	P P	P P	P P	P P	Р	Р	P P	P P	P	Р	P P	P F				
		P	P	P P	P	P	P	P	P P	P P	P	P	P	P P	P	P				
Vendor B Device 2	1	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F				
Vendor C		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Р	F		
Device 1	1	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р			
Vendor C	2	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р		
Device 1		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F		
Vendor D	1	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р		
Device 1	'	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F		
Vendor D Device 2	1	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	P	F		
		P P	P	P P	P P	P	P P	P	P P	P P	P	P	P	P P	P P	P	P	Р	Р	F
Vendor D Device 3	1	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F
		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	- 1	
XR33152	1	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	· ·	Fail	73.4
XR33152	2	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F	Fail	70.0
AR33132		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р		Fall	72.8
XR33152	3	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р		Fail	-72.7
X1100102	0	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F	ı alı	
XR33156	1	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Fail	-70.5
		Р	Р	Р	Р	Р	Р	Р	Р	P	Р	Р	P	Р	Р	Р	Р	F		
XR33156	2	P P	P	P P	P P	P P	P P	P	P P	P P	P P	P P	P	P P	P P	P	P	F	Fail	71.1
		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P			
XR33158	1	Р	Р	Р	Р	Р	P	Р	P	Р	Р	P	Р	Р	Р	Р	Р	F	Fail	-72.8
		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F		
XR33158	2	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	'	Fail	73.2
XR33053	4	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F	Fair	70 F
AH33033	1	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р		Fall	70.5
XR33053	2	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	F	Fail	71.5
X1100030		Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	P	Р	Р	Р	Р		I all	, 1.5

Table 10: Sweep Voltage Test Results



Vendor	Device	Fault Tolerance Clain (±V)	Test 1 Summary	% of Claim	Test 3 Summary	% of Claim
	XR33152	60	61	101.7	70	116.7
Exar	XR33156	60	61	101.7	70	116.7
⊏xar	XR33158	60	61	101.7	70	116.7
	XR33053	60	61	101.7	70	116.7
Vendor A	1	60	45	75.0	60	100.0
vendor A	2	60	55	91.7	60	100.0
Vandar D	1	60	25	41.7	60	100.0
Vendor B	2	60	35	58.3	60	100.0
Vendor C	1	70	65	92.9	70	100.0
	1	80	70	87.5	70	87.5
Vendor D	2	80	65	81.3	70	87.5
	3	80	70	87.5	80	100.0

Table 11: Summary of Test 3 Results Added to Tests 1 and 2

Test 4: Long Term Fault Short Test

Test Procedure:

Performed on XR33156 Full Duplex and XR33152 Half Duplex devices.

- 1. Device is powered off (Vcc = 0V), DI = 1Mbps input.
- 2. Connect Y and Z outputs to +61V
- 3. Power on device (Vcc = 5V). Record elapse time.
- 4. Power off device. Remove fault voltage.
- 5. Test Y/Z outputs (making sure that it is still functional after long term test).
- 6. Repeat Step 1 to Step 5 for -61V.

XR33156	Volt	age	Time	Note
Number	Start	End	Elapsed	
38	61V	61V	36 hours	Both Y and Z are functional after 36 hrs
38	-61V	-61V	36 hours	Both Y and Z are functional after 36 hrs
39	61V	61V	36 hours	Both Y and Z are functional after 36 hrs
39	-61V	-61V	36 hours	Both Y and Z are functional after 36 hrs

Table 12: XR33156 Long Term Fault Short Test Results

XR33152	Voltage		Time	Note
Number	Start	End	Elapsed	
40	61V	61V	36 hours	Both Y and Z are functional after 36 hrs
40	-61V	-61V	36 hours	Both Y and Z are functional after 36 hrs
41	61V	61V	36 hours	Both Y and Z are functional after 36 hrs
41	-61V	-61V	36 hours	Both Y and Z are functional after 36 hrs

Table 13: XR33152 Long Term Fault Short Test Results



Conclusion

The other vendors must be using the Sweep Voltage Testing to claim the fault tolerance capabilities of their devices. The MaxLinear parts pass the Sweep Voltage Test at +/- 70V, 116.7% of the +/-60V specification. However the results of the testing suggest that other vendors either just meet their spec and some do not meet it. The MaxLinear parts had similar results to Vendor D in the Sweep Voltage Tests, even though their device is rated higher.

The Sweep Voltage Test is easier, as can be seen by the voltages achieved in all of the test results. However, the Fault Voltage of Tests 1 and 2 is more realistic of conditions that will occur in the real usage of the devices. The MaxLinear devices were the only ones that met and exceeded the claimed fault voltage specification under all test conditions. The MaxLinear devices passed the Long Term Short Tests as well.



Corporate Headquarters: 5966 La Place Court Suite 100 Carlsbad, CA 92008 Tel.:+1 (760) 692-0711 Fax: +1 (760) 444-8598 www.maxlinear.com

High Performance Analog: 48760 Kato Road Fremont, CA 94538 Tel.: +1 (510) 668-7000 Fax: +1 (510) 668-7001 Email: uarttechsupport@exar.com

The content of this document is furnished for informational use only, is subject to change without notice, and should not be construed as a commitment by MaxLinear, Inc.. MaxLinear, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in the informational content contained in this guide. Complying with all applicable copyright laws is the responsibility of the user. Without limiting the rights under copyright, no part of this document may be reproduced into, stored in, or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), or for any purpose, without the express written permission of MaxLinear, Inc.

Maxlinear, Inc. does not recommend the use of any of its products in life support applications where the failure or malfunction of the product can reasonably be expected to cause failure of the life support system or to significantly affect its safety or effectiveness. Products are not authorized for use in such applications unless MaxLinear, Inc. receives, in writing, assurances to its satisfaction that: (a) the risk of injury or damage has been minimized; (b) the user assumes all such risks; (c) potential liability of

MaxLinear, Inc. is adequately protected under the circumstances.

MaxLinear, Inc. may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from MaxLinear, Inc., the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

Company and product names may be registered trademarks or trademarks of the respective owners with which they are associated.

© 2017 MaxLinear, Inc. All rights reserved

ANI-23_062117 10/10