

# LVDS Driver and Receiver Generalized Propagation Delays

**Table 1: Cross Reference of Applicable Products**

Product Name:	Manufacturer Part Number	SMD #	Device Type	Internal PIC
3.3-Volt Quad Driver	UT54LVDS031LV/E	5962-98651	02, 03, 04, 05	WD03, WD07, WD28, WD30
3.3-Volt Quad Receiver	UT54LVDS032LV/E	5962-98652	02, 03, 04, 05	WD04, WD08, WD29, WD31
3.3-Volt Quad Receiver with Termination Resistor	UT54LVDS032LVT	5962-04201	01, 02	WD06, WD10
3.3V Bus Quad Driver	UT54LVDM031LV	5962-06201	01	WD21
3.3V Dual Driver and Receiver	UT54LVDM055LV	5962-06202	01	WD22
5.0V Quad Driver	UT54LVDS031	5962-95833	02	JR05, JR08
5.0V Quad Receiver	UT54LVDS032	5962-95834	02	JR06, JR09
5.0V Quad Driver with Cold Spare	UT54LVDS031	5962-95833	03	JR10
5.0V Quad Receiver with Cold Spare	UT54LVDS032	5962-95834	03	JR11
3.0V Quad Bus LVDS Crosspoint Switch	UT54LVDM228	5962-01537	01	WD15, WD16
3.0V Octal Bus LVDS Repeater	UT54LVDM328	5962-01536	01	WD17, WD18

## 1.0 Overview

Many system designers require propagation delay performance of LVDS devices over temperature and voltage. Propagation delay limits presented in the device datasheet and corresponding SMDs sometimes range from 3.0ns to 11.0ns and account for voltage and temperature variations. Often this wide limit ranges makes it difficult to analyze critical system timing requirements for a narrower temperature and voltage range. The following Application Note provides a summary of propagation delay values over temperature and voltage for each device in the CAES Colorado Springs LVDS Family as listed in Table 1.

**Note:** Data presented in this application note is not guaranteed and is based on device characterization data over multiple lots.

## 2.0 Generalized Propagating Delay Values

Data contained below includes AC parameters from the datasheet that do not have notes such as "Guaranteed by characterization", "Guaranteed by design", or are mathematical combinations of other AC values associated with them. AC switching characteristics of devices listed in table 1 are only guaranteed to the limits listed in the device datasheet and corresponding SMD. Data listed in tables 2 – 12 below is not guaranteed.

# LVDS Driver and Receiver

## Generalized Propagation Delays

**Table 2. Generalized Propagation Delay values for UT54LVDS031LV/E 3.3V Quad LVDS Driver**

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean	
25	TPLH	3.0	ns	1.00	1.06	1.03	
		3.6	ns	1.07	1.13	1.10	
	TPHL	3.0	ns	1.17	1.25	1.21	
		3.6	ns	1.08	1.19	1.13	
	TPLZ	3.0	ns	2.02	2.18	2.11	
		3.6	ns	2.08	2.22	2.15	
	TPHZ	3.0	ns	2.01	2.17	2.10	
		3.6	ns	2.07	2.21	2.15	
	TPZL	3.0	ns	1.63	1.86	1.78	
		3.6	ns	1.32	1.49	1.43	
	TPZH	3.0	ns	1.62	1.84	1.76	
		3.6	ns	1.29	1.48	1.41	
	125.0	TPLH	3.0	ns	1.10	1.17	1.13
			3.6	ns	1.20	1.25	1.22
TPHL		3.0	ns	1.26	1.35	1.30	
		3.6	ns	1.16	1.27	1.21	
TPLZ		3.0	ns	2.33	2.53	2.44	
		3.6	ns	2.38	2.55	2.47	
TPHZ		3.0	ns	2.32	2.52	2.44	
		3.6	ns	2.37	2.54	2.47	
TPZL		3.0	ns	1.91	2.17	2.07	
		3.6	ns	1.53	1.75	1.67	
TPZH		3.0	ns	1.88	2.14	2.05	
		3.6	ns	1.52	1.73	1.65	
-55.0		TPLH	3.0	ns	0.94	0.99	0.96
			3.6	ns	1.02	1.09	1.06
	TPHL	3.0	ns	1.11	1.18	1.15	
		3.6	ns	1.03	1.13	1.07	
	TPLZ	3.0	ns	1.82	1.95	1.89	
		3.6	ns	1.88	2.00	1.95	
	TPHZ	3.0	ns	1.81	1.94	1.89	
		3.6	ns	1.87	2.00	1.94	
	TPZL	3.0	ns	1.44	1.65	1.57	
		3.6	ns	1.16	1.32	1.26	
	TPZH	3.0	ns	1.43	1.63	1.55	
		3.6	ns	1.14	1.30	1.24	

# LVDS Driver and Receiver Generalized Propagation Delays

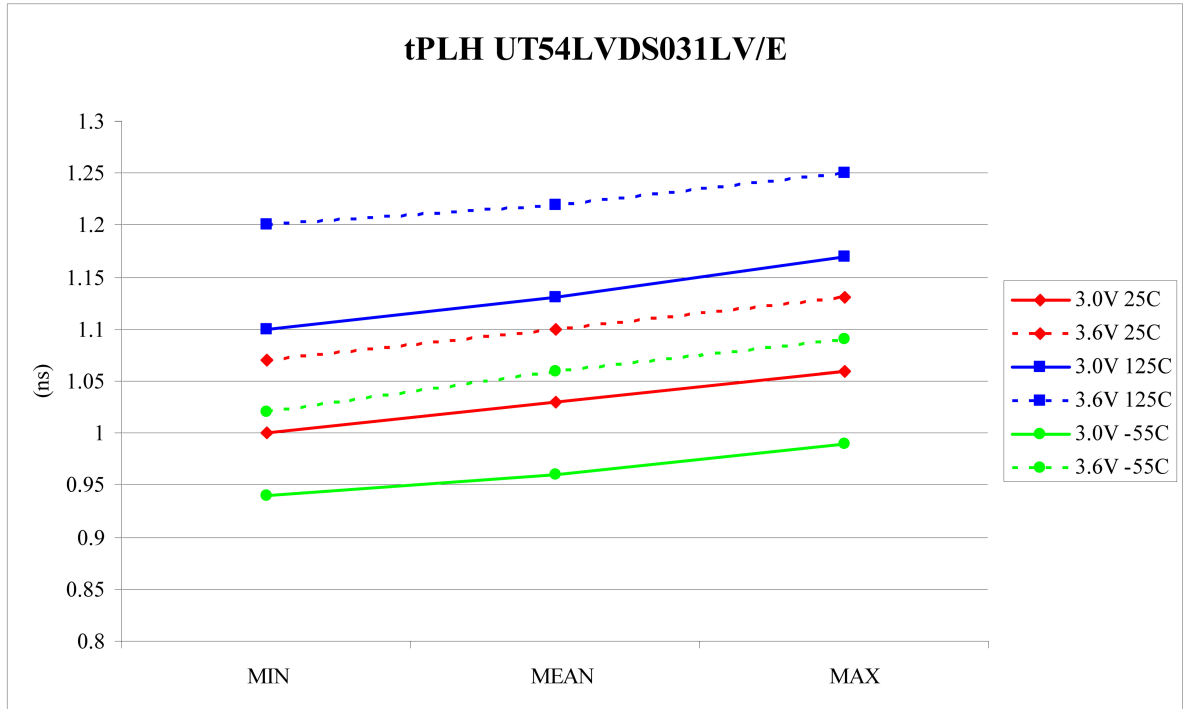


Figure 1. Example plot of generalized prop delay  $t_{PLH}$  for the UT54LVDS031LV/E

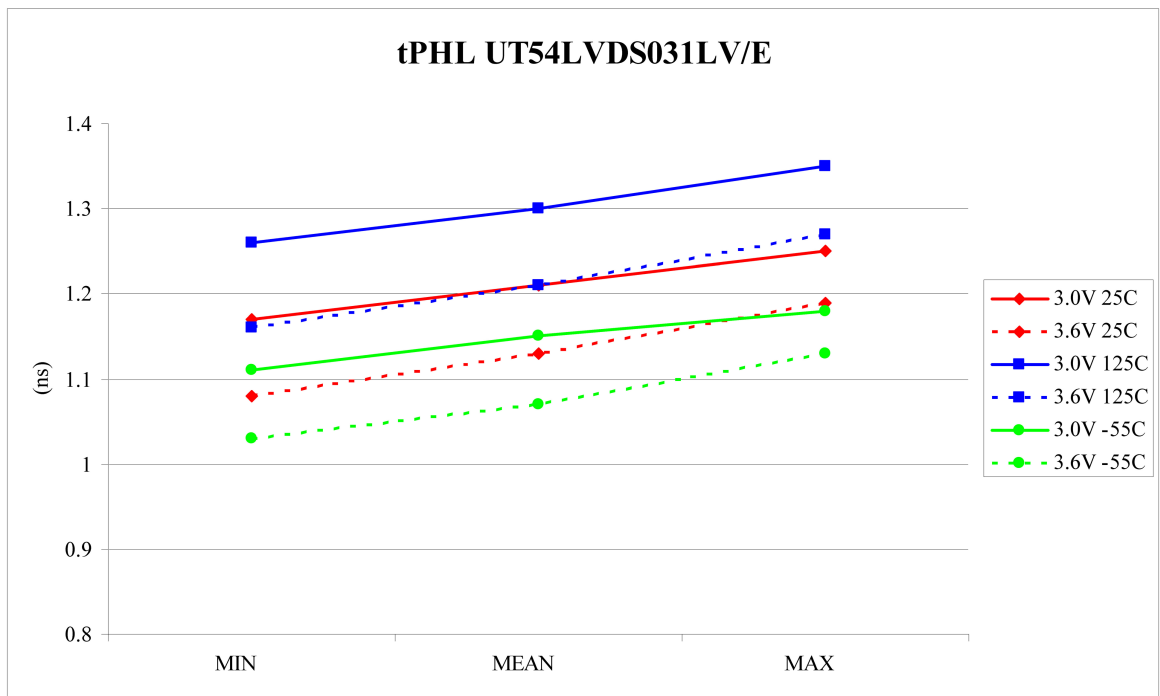


Figure 2. Example plot of generalized prop delay  $t_{PHL}$  for the UT54LVDS031LV/E

# LVDS Driver and Receiver Generalized Propagation Delays

**Table 3. Generalized Propagation Delay values for UT54LVDS032LV/E 3.3V Quad LVDS Receiver**

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean	
25.0	TPLH	3.0	ns	2.58	2.72	2.67	
		3.6	ns	2.49	2.62	2.56	
	TPHL	3.0	ns	2.48	2.63	2.56	
		3.6	ns	2.40	2.54	2.47	
	TPLZ	3.0	ns	2.72	2.90	2.82	
		3.6	ns	2.72	2.85	2.79	
	TPHZ	3.0	ns	2.95	3.14	3.06	
		3.6	ns	2.90	3.06	2.99	
	TPZL	3.0	ns	1.56	1.77	1.68	
		3.6	ns	1.44	1.58	1.52	
	TPZH	3.0	ns	1.91	2.17	2.05	
		3.6	ns	1.75	1.96	1.87	
	125.0	TPLH	3.0	ns	2.77	2.93	2.86
			3.6	ns	2.66	2.80	2.75
TPHL		3.0	ns	2.65	2.80	2.74	
		3.6	ns	2.56	2.70	2.64	
TPLZ		3.0	ns	3.06	3.30	3.19	
		3.6	ns	3.03	3.23	3.13	
TPHZ		3.0	ns	3.33	3.61	3.49	
		3.6	ns	3.25	3.49	3.37	
TPZL		3.0	ns	1.89	2.17	2.04	
		3.6	ns	1.73	1.93	1.83	
TPZH		3.0	ns	2.26	2.61	2.45	
		3.6	ns	2.04	2.32	2.20	
-55.0		TPLH	3.0	ns	2.47	2.62	2.55
			3.6	ns	2.40	2.52	2.47
	TPHL	3.0	ns	2.38	2.54	2.46	
		3.6	ns	2.31	2.46	2.39	
	TPLZ	3.0	ns	2.54	2.68	2.61	
		3.6	ns	2.54	2.67	2.61	
	TPHZ	3.0	ns	2.72	2.88	2.8	
		3.6	ns	2.69	2.83	2.76	
	TPZL	3.0	ns	1.40	1.55	1.47	
		3.6	ns	1.29	1.41	1.35	
	TPZH	3.0	ns	1.72	1.91	1.81	
		3.6	ns	1.60	1.76	1.67	

# LVDS Driver and Receiver

## Generalized Propagation Delays

**Table 4. Generalized Propagation Delay values for UT54LVDS033LVT 3.3V Quad LVDS Receiver with Integrated Termination Resistor**  
**UT54LVDS032LVT**

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean	
25.0	TPLH	3.0	ns	2.58	2.72	2.67	
		3.6	ns	2.49	2.62	2.56	
	TPHL	3.0	ns	2.48	2.63	2.56	
		3.6	ns	2.40	2.54	2.47	
	TPLZ	3.0	ns	2.72	2.90	2.82	
		3.6	ns	2.72	2.85	2.79	
	TPHZ	3.0	ns	2.95	3.14	3.06	
		3.6	ns	2.90	3.06	2.99	
	TPZL	3.0	ns	1.56	1.77	1.68	
		3.6	ns	1.44	1.58	1.52	
	TPZH	3.0	ns	1.91	2.17	2.05	
		3.6	ns	1.75	1.96	1.87	
	125.0	TPLH	3.0	ns	2.77	2.93	2.86
			3.6	ns	2.66	2.80	2.75
TPHL		3.0	ns	2.65	2.80	2.74	
		3.6	ns	2.56	2.70	2.64	
TPLZ		3.0	ns	3.06	3.30	3.19	
		3.6	ns	3.03	3.23	3.13	
TPHZ		3.0	ns	3.33	3.61	3.49	
		3.6	ns	3.25	3.49	3.37	
TPZL		3.0	ns	1.89	2.17	2.04	
		3.6	ns	1.73	1.93	1.83	
TPZH		3.0	ns	2.26	2.61	2.45	
		3.6	ns	2.04	2.32	2.20	
-55.0		TPLH	3.0	ns	2.47	2.62	2.55
			3.6	ns	2.40	2.52	2.47
	TPHL	3.0	ns	2.38	2.54	2.46	
		3.6	ns	2.31	2.46	2.39	
	TPLZ	3.0	ns	2.54	2.68	2.61	
		3.6	ns	2.54	2.67	2.61	
	TPHZ	3.0	ns	2.72	2.88	2.80	
		3.6	ns	2.69	2.83	2.76	
	TPZL	3.0	ns	1.40	1.55	1.47	
		3.6	ns	1.29	1.41	1.35	
	TPZH	3.0	ns	1.72	1.91	1.81	
		3.6	ns	1.60	1.76	1.67	

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## Generalized Propagation Delays

**Table 5. Generalized Propagation Delay values for UT54LVDM031LV 3.3V Quad LVDM Driver UT54LVDM031LV**

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean	
25.0	TPLH	3.0	ns	1.20	1.24	1.22	
		3.6	ns	1.27	1.33	1.30	
	TPHL	3.0	ns	1.26	1.31	1.29	
		3.6	ns	1.35	1.39	1.38	
	TPLZ	3.0	ns	2.48	2.59	2.53	
		3.6	ns	2.46	2.91	2.52	
	TPHZ	3.0	ns	2.43	2.51	2.47	
		3.6	ns	2.43	2.70	2.47	
	TPZL	3.0	ns	1.91	1.99	1.95	
		3.6	ns	1.74	1.81	1.78	
	TPZH	3.0	ns	2.04	2.14	2.09	
		3.6	ns	1.88	1.97	1.92	
	125.0	TPLH	3.0	ns	1.35	1.40	1.38
			3.6	ns	1.39	1.45	1.42
TPHL		3.0	ns	1.38	1.43	1.41	
		3.6	ns	1.45	1.50	1.47	
TPLZ		3.0	ns	2.90	3.07	2.98	
		3.6	ns	3.06	3.35	3.18	
TPHZ		3.0	ns	2.85	3.00	2.92	
		3.6	ns	2.80	3.32	2.94	
TPZL		3.0	ns	2.24	2.33	2.28	
		3.6	ns	2.03	2.10	2.06	
TPZH		3.0	ns	2.37	2.48	2.41	
		3.6	ns	2.16	2.24	2.19	
-55.0		TPLH	3.0	ns	1.09	1.16	1.12
			3.6	ns	1.20	1.26	1.22
	TPHL	3.0	ns	1.18	1.25	1.2	
		3.6	ns	1.28	1.34	1.30	
	TPLZ	3.0	ns	2.23	2.33	2.27	
		3.6	ns	2.25	2.74	2.30	
	TPHZ	3.0	ns	2.20	2.28	2.24	
		3.6	ns	2.23	2.70	2.27	
	TPZL	3.0	ns	1.68	1.76	1.71	
		3.6	ns	1.54	1.61	1.56	
	TPZH	3.0	ns	1.83	1.92	1.87	
		3.6	ns	1.72	1.78	1.75	

# LVDS Driver and Receiver

## Generalized Propagation Delays

**Table 6A. Generalized Propagation Delay values for UT54LVDM055LV 3.3V Dual LVDM Driver/Receiver Driver**

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean	
25.0	TPLH	3.0	ns	1.37	1.42	1.39	
		3.6	ns	1.43	1.50	1.46	
	TPHL	3.0	ns	1.36	1.41	1.38	
		3.6	ns	1.43	1.49	1.46	
	TPLZ	3.0	ns	1.58	1.63	1.60	
		3.6	ns	1.62	1.68	1.65	
	TPHZ	3.0	ns	1.45	1.51	1.48	
		3.6	ns	1.55	1.62	1.58	
	TPZL	3.0	ns	1.48	1.53	1.50	
		3.6	ns	1.43	1.46	1.44	
	TPZH	3.0	ns	2.48	2.62	2.56	
		3.6	ns	1.70	1.77	1.73	
	125.0	TPLH	3.0	ns	1.48	1.53	1.51
			3.6	ns	1.54	1.59	1.56
TPHL		3.0	ns	1.48	1.54	1.52	
		3.6	ns	1.54	1.58	1.56	
TPLZ		3.0	ns	1.70	1.76	1.73	
		3.6	ns	1.75	1.81	1.78	
TPHZ		3.0	ns	1.62	1.70	1.66	
		3.6	ns	1.66	1.72	1.69	
TPZL		3.0	ns	1.71	1.76	1.73	
		3.6	ns	1.60	1.63	1.61	
TPZH		3.0	ns	2.22	2.49	2.30	
		3.6	ns	2.07	2.47	2.20	
-55.0		TPLH	3.0	ns	1.27	1.31	1.29
			3.6	ns	1.37	1.45	1.40
	TPHL	3.0	ns	1.28	1.32	1.30	
		3.6	ns	1.38	1.46	1.42	
	TPLZ	3.0	ns	1.48	1.53	1.51	
		3.6	ns	1.53	1.58	1.55	
	TPHZ	3.0	ns	1.38	1.44	1.41	
		3.6	ns	1.48	1.53	1.50	
	TPZL	3.0	ns	1.35	1.38	1.37	
		3.6	ns	1.33	1.36	1.34	
	TPZH	3.0	ns	1.73	2.03	1.93	
		3.6	ns	1.50	1.54	1.52	

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## Generalized Propagation Delays

Table 6B. Generalized Propagation Delay values for UT54LVDM055LV 3.3V Dual LVDM Driver/Receiver Receiver

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean	
25.0	TPLH	3.0	ns	1.34	1.41	1.37	
		3.6	ns	1.23	1.30	1.26	
	TPHL	3.0	ns	1.27	1.34	1.29	
		3.6	ns	1.21	1.27	1.23	
	TPLZ	3.0	ns	1.76	1.83	1.79	
		3.6	ns	1.79	1.85	1.82	
	TPHZ	3.0	ns	2.39	2.47	2.42	
		3.6	ns	2.64	2.70	2.67	
	TPZL	3.0	ns	1.59	1.71	1.96	
		3.6	ns	1.51	1.37	2.15	
	TPZH	3.0	ns	1.97	2.06	2.00	
		3.6	ns	1.96	2.06	2.01	
	125.0	TPLH	3.0	ns	1.56	1.68	1.62
			3.6	ns	1.43	1.50	1.47
TPHL		3.0	ns	1.45	1.49	1.47	
		3.6	ns	1.40	1.44	1.42	
TPLZ		3.0	ns	1.96	2.03	2.00	
		3.6	ns	1.97	2.04	2.01	
TPHZ		3.0	ns	2.56	2.65	2.61	
		3.6	ns	2.77	2.84	2.81	
TPZL		3.0	ns	1.82	1.88	1.85	
		3.6	ns	1.73	1.79	1.76	
TPZH		3.0	ns	2.36	2.47	2.41	
		3.6	ns	2.40	2.53	2.46	
-55.0		TPLH	3.0	ns	1.21	1.28	1.24
			3.6	ns	1.12	1.18	1.15
	TPHL	3.0	ns	1.16	1.20	1.18	
		3.6	ns	1.11	1.15	1.12	
	TPLZ	3.0	ns	1.65	1.69	1.67	
		3.6	ns	1.69	1.73	1.70	
	TPHZ	3.0	ns	2.27	2.33	2.29	
		3.6	ns	2.54	2.60	2.57	
	TPZL	3.0	ns	1.44	1.68	2.88	
		3.6	ns	1.40	1.40	3.40	
	TPZH	3.0	ns	1.76	1.84	1.79	
		3.6	ns	1.75	1.85	1.79	



# LVDS Driver and Receiver

## Generalized Propagation Delays

**Table 7. Generalized Propagation Delay values for UT54LVDS031 5.0V Quad LVDS Driver**

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean
25.0	TPLH	4.5	ns	1.93	1.97	1.95
		5.5	ns	2.06	2.09	2.07
	TPHL	4.5	ns	1.90	1.92	1.91
		5.5	ns	2.04	2.08	2.05
125.0	TPLH	4.5	ns	2.46	2.60	2.53
		5.5	ns	2.14	2.24	2.19
	TPHL	4.5	ns	2.50	2.63	2.56
		5.5	ns	2.13	2.49	2.35
-55.0	TPLH	4.5	ns	1.88	1.89	1.88
		5.5	ns	1.97	2.00	1.99
	TPHL	4.5	ns	1.84	1.86	1.85
		5.5	ns	1.94	1.98	1.96

**Table 8. Generalized Propagation Delay values for UT54LVDS032 5.0V Quad LVDS Receiver**

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean
25.0	TPLH	4.5	ns	1.95	2.36	2.16
		5.5	ns	2.09	2.49	2.29
	TPHL	4.5	ns	3.01	3.67	3.38
		5.5	ns	3.15	3.83	3.53
125.0	TPLH	4.5	ns	1.99	2.81	2.40
		5.5	ns	1.68	2.45	2.05
	TPHL	4.5	ns	3.07	3.73	3.45
		5.5	ns	2.70	3.60	3.25
-55.0	TPLH	4.5	ns	1.74	2.17	1.93
		5.5	ns	1.83	2.27	2.03
	TPHL	4.5	ns	3.20	3.96	3.43
		5.5	ns	3.31	4.09	3.54

# LVDS Driver and Receiver

## Generalized Propagation Delays

**Table 9. Generalized Propagation Delay values for UT54LVDS031 5.0V Quad LVDS Driver with Cold Spare**

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean
25.0	TPLH	4.5	ns	1.84	2.31	2.01
		5.5	ns	1.99	2.26	2.06
	TPHL	4.5	ns	2.19	2.39	2.25
		5.5	ns	2.35	2.61	2.53
125.0	TPLH	4.5	ns	2.50	2.78	2.64
		5.5	ns	2.14	2.64	2.52
	TPHL	4.5	ns	2.19	2.58	2.28
		5.5	ns	3.05	3.30	3.16
-55.0	TPLH	4.5	ns	1.80	1.91	1.84
		5.5	ns	1.89	2.08	1.99
	TPHL	4.5	ns	2.23	2.36	2.27
		5.5	ns	2.36	2.53	2.43

**Table 10. Generalized Propagation Delay values for UT54LVDS032 5.0V Quad LVDS Receiver with Cold Spare**

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean
25.0	TPLH	4.5	ns	3.67	3.75	3.71
		5.5	ns	3.43	3.54	3.48
	TPHL	4.5	ns	3.05	3.20	3.16
		5.5	ns	3.00	3.27	3.12
125.0	TPLH	4.5	ns	4.02	4.36	4.21
		5.5	ns	3.79	4.14	3.99
	TPHL	4.5	ns	3.38	3.66	3.52
		5.5	ns	3.41	3.71	3.56
-55.0	TPLH	4.5	ns	3.13	3.38	3.24
		5.5	ns	2.96	3.20	3.09
	TPHL	4.5	ns	2.62	2.99	2.84
		5.5	ns	2.66	3.05	2.88

# LVDS Driver and Receiver Generalized Propagation Delays

**Table 11. Generalized Propagation Delay values for UT54LVDM228 3.3V LVDM Crosspoint Switch**

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean
25.0	TPLH	3.0	ns	1.30	1.90	1.65
		3.6	ns	1.40	1.53	1.46
	TPHL	3.0	ns	1.53	1.67	1.60
		3.6	ns	1.53	1.67	1.60
125.0	TPLH	3.0	ns	1.81	2.46	2.13
		3.6	ns	1.82	1.75	1.78
	TPHL	3.0	ns	1.94	1.85	1.90
		3.6	ns	1.91	1.84	1.87
-55.0	TPLH	3.0	ns	1.12	1.63	1.45
		3.6	ns	1.29	1.41	1.35
	TPHL	3.0	ns	1.42	1.57	1.49
		3.6	ns	1.44	1.58	1.51

**Table 12. Generalized Propagation Delay values for UT54LVDM328 3.3V LVDM Repeater**

Temp	Test	Vdd (V)	Units	MinData	MaxData	Mean
25.0	TPLH	3.0	ns	1.30	1.40	1.36
		3.6	ns	1.40	1.03	1.17
	TPHL	3.0	ns	1.53	1.67	1.60
		3.6	ns	1.53	1.67	1.60
125.0	TPLH	3.0	ns	1.67	1.81	1.74
		3.6	ns	1.68	1.10	1.39
	TPHL	3.0	ns	1.77	1.94	1.85
		3.6	ns	1.74	1.92	1.83
-55.0	TPLH	3.0	ns	1.12	1.24	1.18
		3.6	ns	1.29	1.02	1.09
	TPHL	3.0	ns	1.42	1.57	1.49
		3.6	ns	1.44	1.58	1.51

### 3.0 Conclusion

As a device manufacturer, CAES Colorado Springs, acknowledges that system temperature and voltage ranges are much tighter than the limits provided in the SMD and corresponding datasheet. This application note is intended to aid the user in the design critical system timings as it related to LVDS drivers and receivers.

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