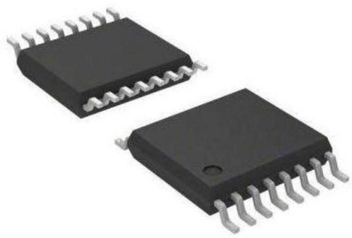
Four Channel LVDS Differential Cable Driver

PRODUCT DESCRIPTION

The MS21147T is a four channel LVDS differential cable driver, meeting the amplitude characteristic of multi-point low voltage differential signaling (MLVDS). Each current-mode driver provides 600mV differential output voltage for 100Ω external differential load.

The MS21147T is applied for point-to-point and multi-point base-band data transmission through 100Ω controlled impedance media. The transmission media could be PCB traces, backplane or cables. The ultimate data rate and distance depend on the media attenuation characteristic, the noise coupled with environment and other system characteristics.



TSSOP16

FEATURES

- 200Mbps (100MHz) Data Rate
- Propagation Delay Time 3ns (Typ.)
- Output High Impedance on Power-down Mode
- 3.3V Power Supply
- ±600mV Differential Signal
- Operating Temperature Range：-40°C to 125°C

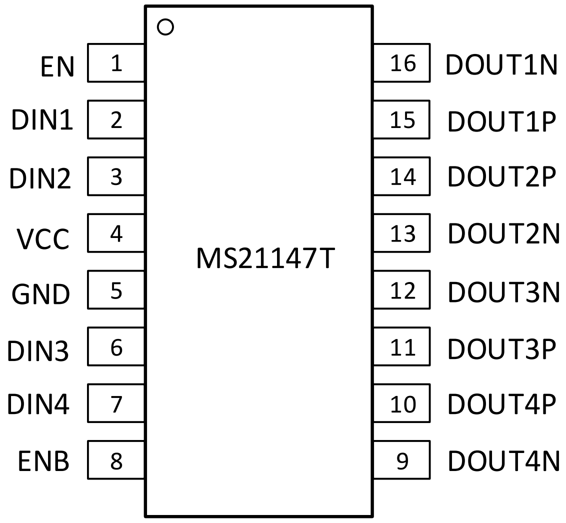
APPLICATIONS

- Multi-function Printer
- Flat Panel Display Interface
- Monitoring Camera

PRODUCT SPECIFICATION

Part Number	Package	Marking
MS21147T	TSSOP16	MS21147T

PIN CONFIGURATION

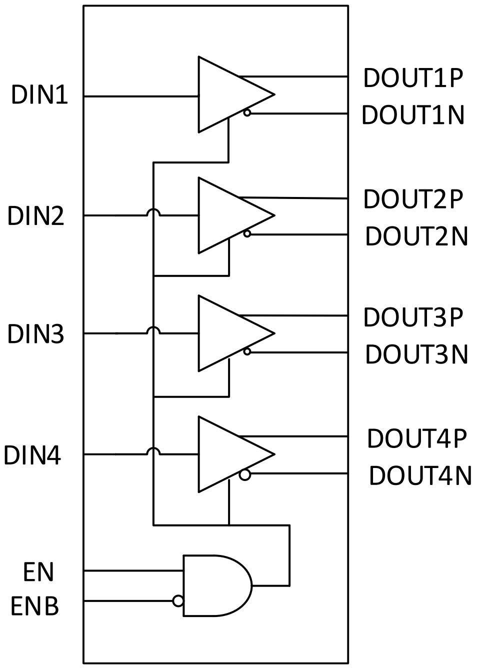


PIN DESCRIPTION

Pin	Name	Type	Description
1	EN	I	Enable Input
2	DIN1	I	Data Input (Channel 1), TTL or CMOS Logical Level
3	DIN2	I	Data Input (Channel 2), TTL or CMOS Logical Level
4	VCC	-	Power Supply
5	GND	-	Ground
6	DIN3	I	Data Input (Channel 3), TTL or CMOS Logical Level
7	DIN4	I	Data Input (Channel 4), TTL or CMOS Logical Level
8	ENB	I	Enable Input
9	DOUT4N	O	Negative Output (Channel 4), MLVDS Level
10	DOUT4P	O	Positive Output (Channel 4), MLVDS Level
11	DOUT3P	O	Positive Output (Channel 3), MLVDS Level
12	DOUT3N	O	Negative Output (Channel 3), MLVDS Level
13	DOUT2N	O	Negative Output (Channel 2), MLVDS Level
14	DOUT2P	O	Positive Output (Channel 2), MLVDS Level
15	DOUT1P	O	Positive Output (Channel 1), MLVDS Level
16	DOUT1N	O	Negative Output (Channel 1), MLVDS Level

Note: Not used data input pins are left floating.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Any exceeding absolute maximum rating application causes permanent damage to device. Because long-time absolute operation state affects device reliability. Absolute ratings just conclude from a series of extreme tests. It doesn't represent chip can operate normally in these extreme conditions.

Parameter	Symbol	Ratings	Unit
Power Supply Voltage	V_{CC}	-0.5 ~ 4	V
Inputs and Outputs Voltage	V_{CCIO}	-0.5 ~ (V_{CC}+0.3)	V
Operating Temperature Range	T_A	-40 ~ 125	°C
Storage Temperature Range	T_{STG}	-65 ~ 150	°C
Soldering Temperature(10s)	T_{SOLDER}	260	°C
ESD (HBM)	V_{HBM}	>±8000	V

ELECTRICAL CHARACTERISTICS

Unless otherwise noted, V_{CC} = 3.3V, external differential R_L = 100Ω, C_L=15pF, T_A=25°C.

Electrical Characteristics

Parameter	Symbol	Pin	Condition	Min	Typ	Max	Unit
Differential Output Voltage	V_{OD}	DOUTP, DOUTN	R_L=100Ω (Figure 1)	500	600	700	mV
Differential Output Voltage Difference(Complementary)	ΔV_{OD}	DOUTP, DOUTN	R_L=100Ω (Figure 1)		1	50	mV
Common-mode Output Voltage	V_{OS}	DOUTP, DOUTN	R_L=100Ω (Figure 1)	0.95	1.15	1.35	V
Common-mode Output Voltage Difference(Complementary)	ΔV_{OS}	DOUTP, DOUTN	R_L=100Ω (Figure 1)		10	50	mV
High-level Output Voltage	V_{OH}	DOUTP, DOUTN	R_L=100Ω	1.2	1.45	1.7	V
Low-level Output Voltage	V_{OL}	DOUTP, DOUTN	R_L=100Ω	0.7	0.85	1.0	V
High-level Input Voltage	V_{IH}	DIN, EN, ENB		2.4		V_{CC}	V
Low-level Input Voltage	V_{IL}	DIN, EN, ENB		GND		0.8	V
Input Current	I_I	DIN, EN, ENB	Input=V_{CC}, GND, 2.5V or 0.4V	-10	±1	+10	μA
Input Clamping Voltage	V_{CL}	DIN, EN, ENB	I_{CL}=-18mA	-1.1	-0.77		V
Output Short-circuit Current	I_{OS}	DOUTP, DOUTN	DOUTP or DOUTN=0V	-10	-6.6	-5.0	mA
Output Three-state Current	I_{OZ}	DOUTP, DOUTN	V_{CC}=3.3V, EN=0.8V, ENB=2.0V |DOUTP-DOUTN|=3.6V	-300	±80	+300	μA
Power-down Current	I_{OFF}	DOUTP, DOUTN	VCC Power down，|DOUTP-DOUTN|=3.6V	-3	1	3	mA
No-load Power Supply Current, Driver Enabled	I_{CC}	VCC	DIN=V_{CC} or GND		8.0	11.0	mA
With-load Power Supply Current, Driver Enabled	I_{CCL}	VCC	R_L=100Ω DIN=V_{CC} or GND		31	40	mA
No-load Power Supply Current, Driver Disabled	I_{CCZ}	VCC	DIN=V_{CC} or GND EN=GND, ENB=V_{CC}		3.1	5.0	mA

Switching Characteristics

V_{CC} = 3.3V, T_A = 25°C [1].

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Differential Propagation Delay (High to Low)	t_{PHLD}	R_L=100Ω, C_L=15pF [2] Figure 2 and Figure 3		3.0		ns
Differential Propagation Delay (Low to High)	t_{PLHD}			3.0		ns
Differential Propagation Delay Skew |tPHLD- tPLHD|	t_{SDK}			100		ps
Channel Propagation Delay Skew [3]	t_{SK1}			100		ps
Rise Time	t_R			2		ns
Fall Time	t_F			1.8		ns
Output High Level to High Impedance Delay	t_{PHZ}	R_L=100Ω, C_L=15pF [3] Figure 4 and Figure 5		4		ns
Output Low Level to High Impedance Delay	t_{PLZ}			4		ns
Output High Impedance to High Level Delay	t_{PZH}			8.4		ns
Output High Impedance to Low Level Delay	t_{PZL}			5.7		ns
Maximum Operating Frequency	f_{MAX}			100		MHz

Note:

1. Normal test for input signal: f=1MHz, Z_O=50Ω.
2. Load capacitance includes probe and soldering capacitance.
3. Channel Propagation Delay Skew is the maximum propagation delay difference between four channels.

Test Circuit

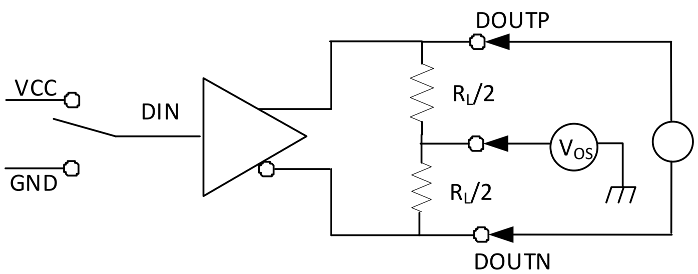


Figure 1. V_{OD}, V_{OS} Test Circuit

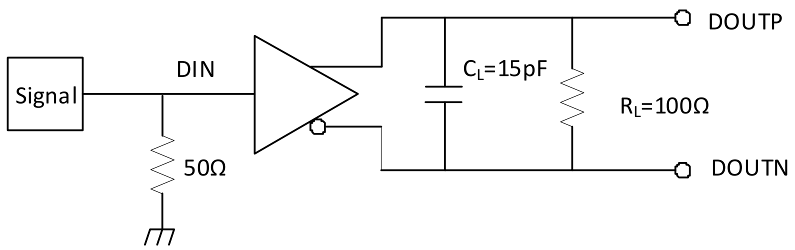


Figure 2. Propagation Delay and Edge Transition Time Test Circuit

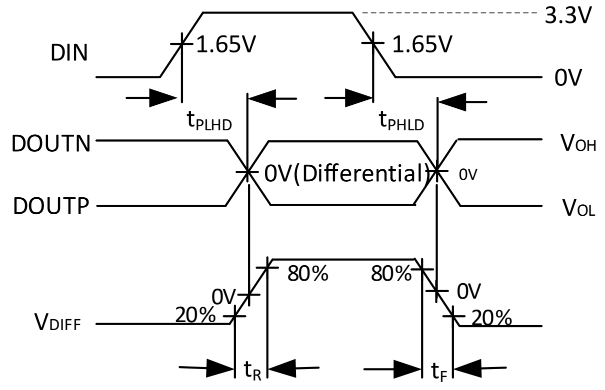


Figure 3. Propagation Delay and Edge Transition Time Waveform

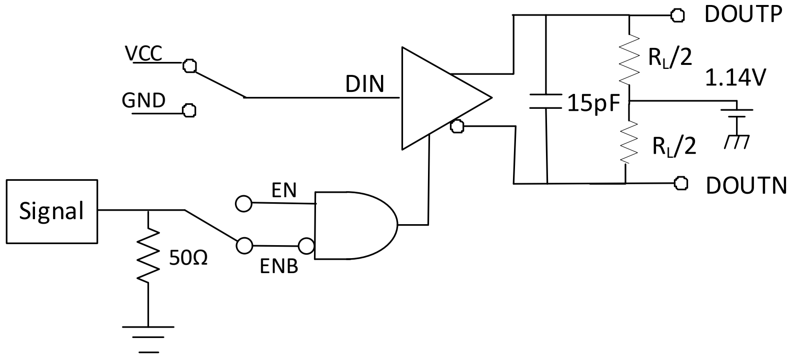


Figure 4. Three-state Delay Test Circuit

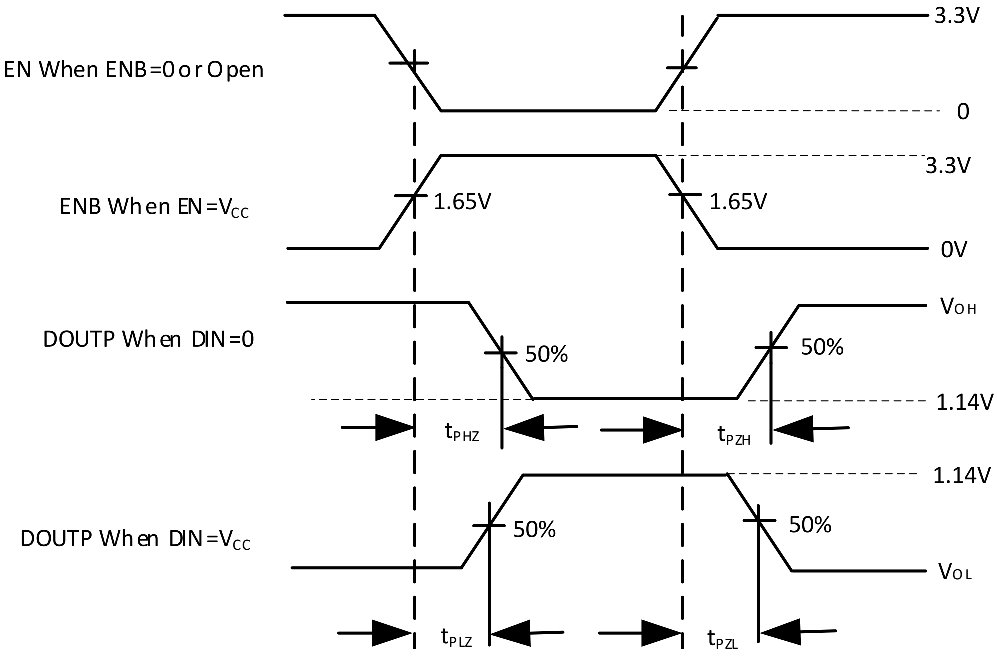
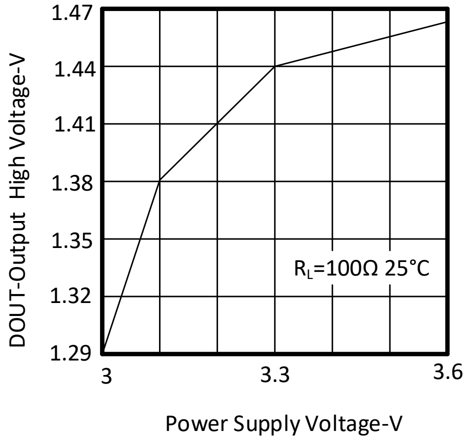


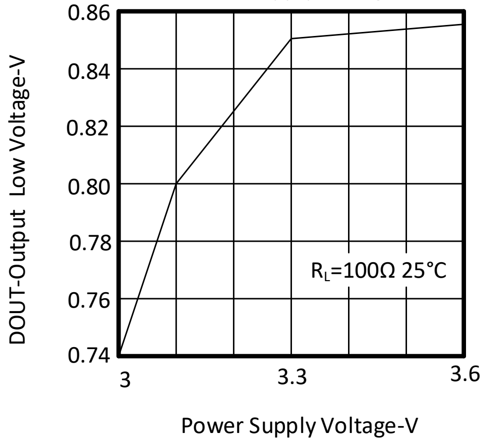
Figure 5. Three-state Delay Waveform

TYPICAL CHARACTERISTICS CURVE

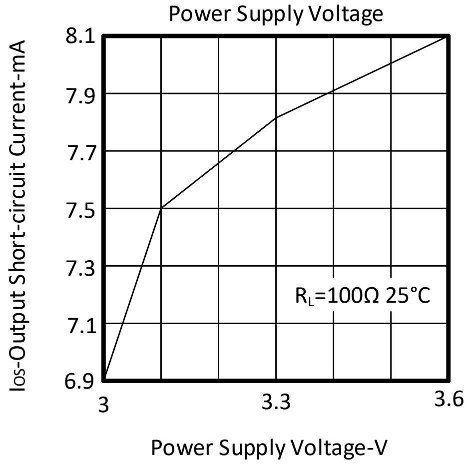
Output High Voltage VS.
Power Supply Voltage



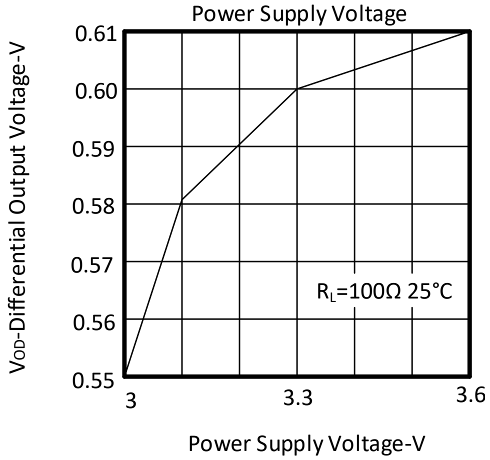
Output Low Voltage VS.
Power Supply Voltage



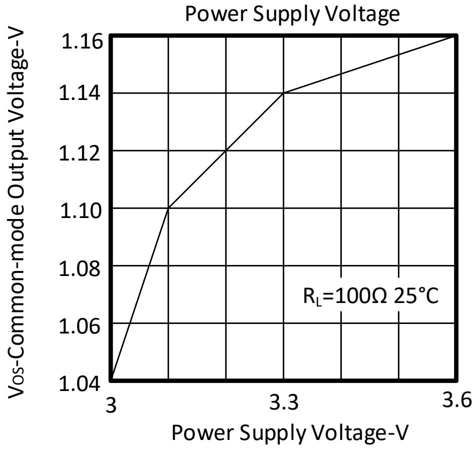
Output Short-circuit Current VS.
Power Supply Voltage

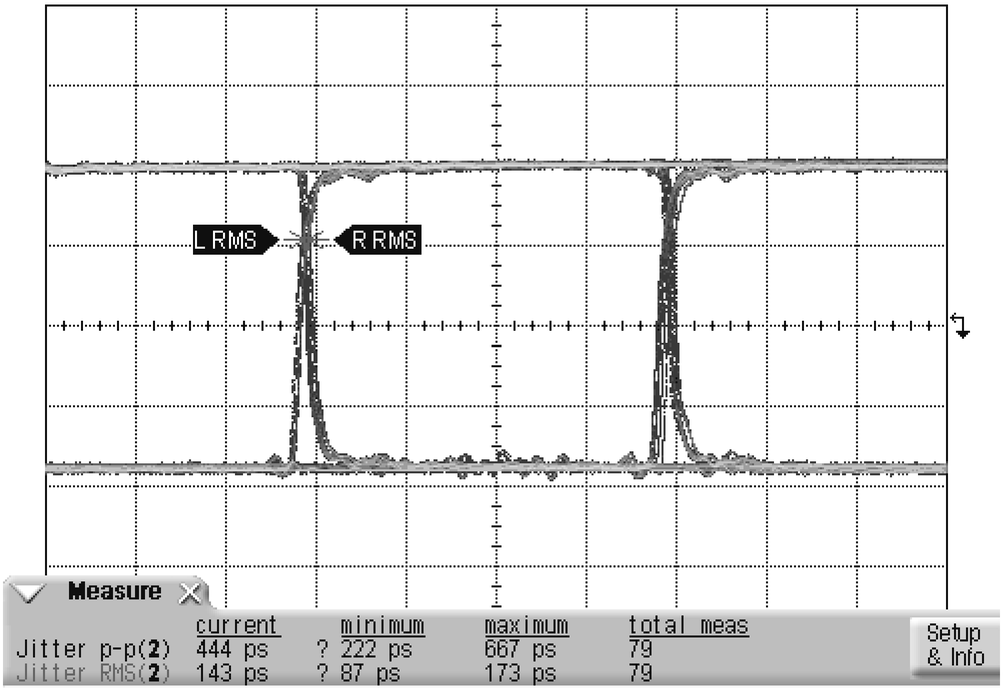


Differential Output Voltage VS.
Power Supply Voltage

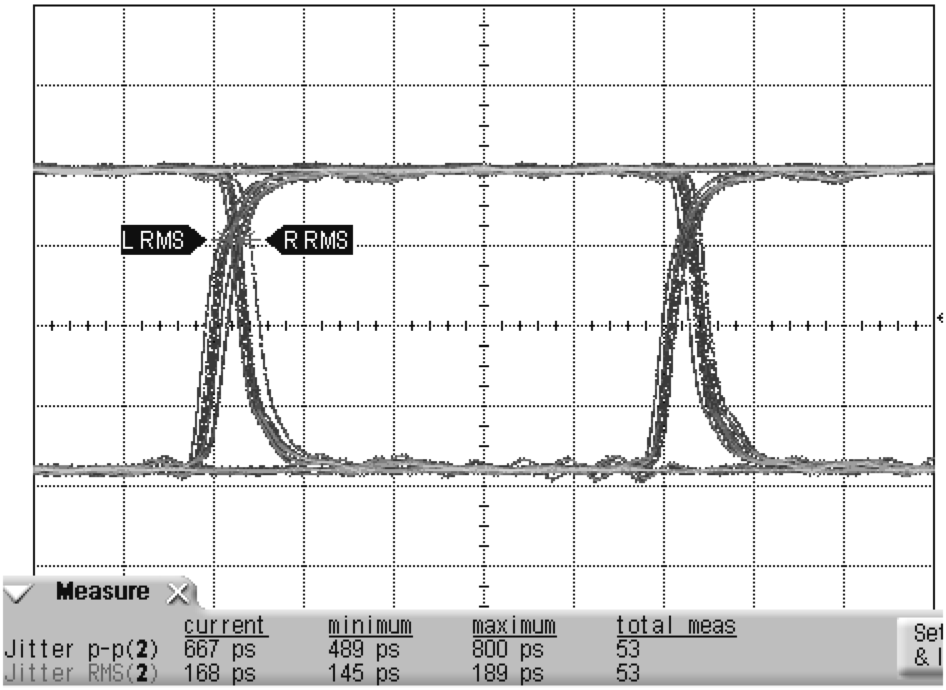


Common-mode Output Voltage VS.
Power Supply Voltage

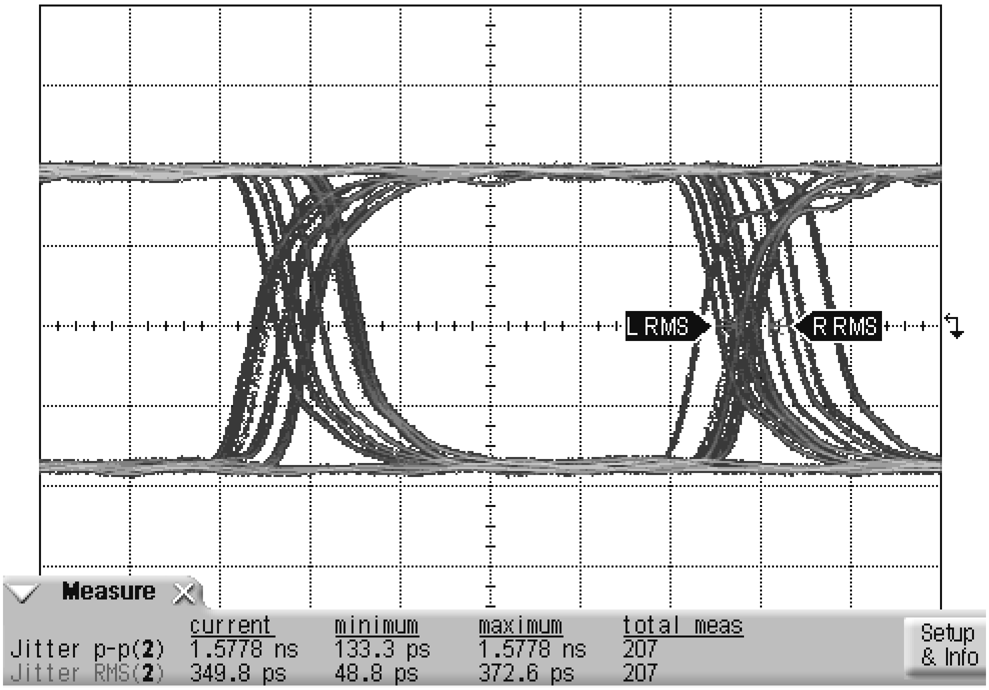




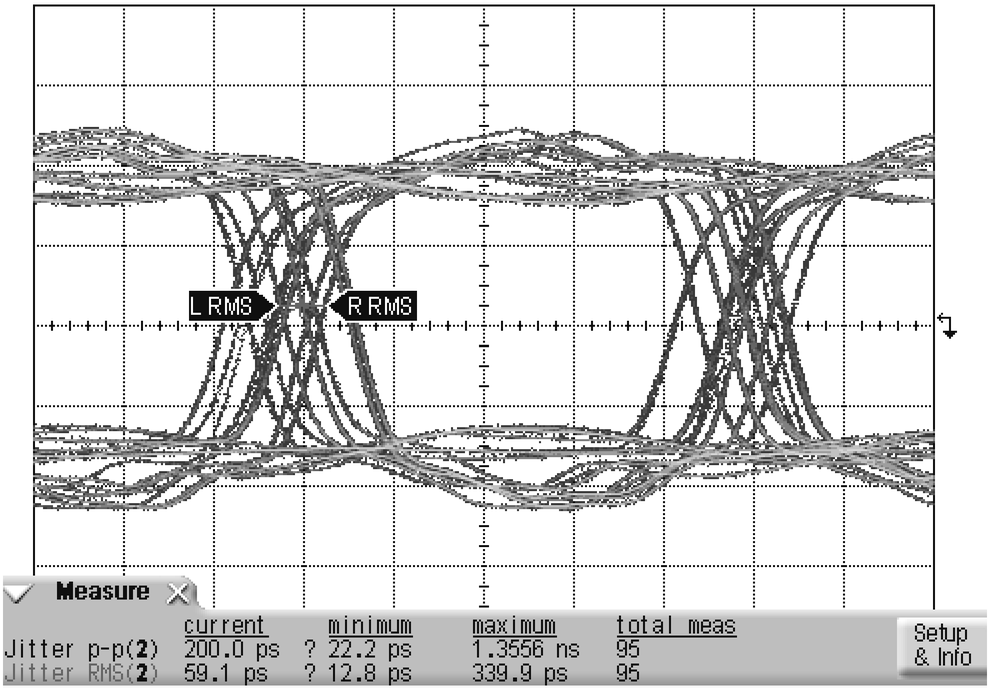
The Eye Diagram of the MS21147T as Driver and the MS21148T as Receiver: V_{CC}=3.3V, PRBS7 50Mbps CAT5E 10m



The Eye Diagram of the MS21147T as Driver and the MS21148T as Receiver: V_{CC}=3.3V, PRBS7 100Mbps CAT5E 10m



The Eye Diagram of the MS21147T as Driver and the MS21148T as Receiver: V_{CC}=3.3V, PRBS7 200Mbps CAT5E 4.5m



The Eye Diagram of the MS21147T as Driver and the MS21148T as Receiver: V_{CC}=3.3V, PRBS7 200Mbps CAT6E 10m

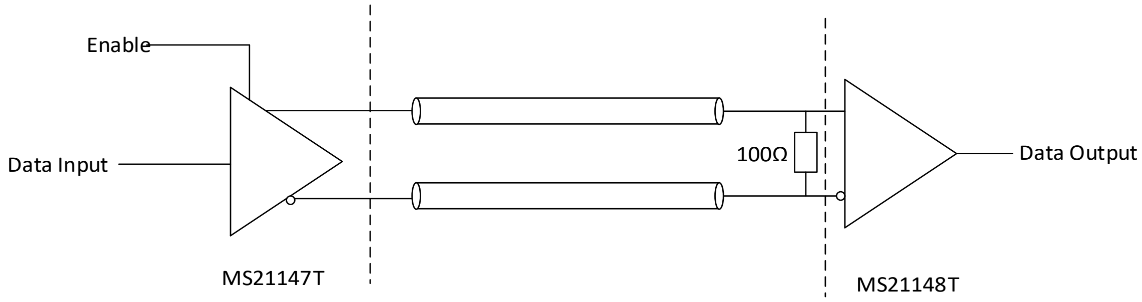
FUNCTION DESCRIPTION

The MS21147T is a four channel LVDS differential cable driver, meeting MLVDS amplitude characteristic. The technology reduces the amplitude of output voltage, improves switch speed and allows 3.3V power supply operation. Four current-mode driver all could provide 600mV peak-to-peak output voltage for 100Ω differential load. The MS21147T is applied for point-to-point and multi-point base-band data transmission through 100Ω controlled impedance media. The transmission media could be PCB traces, backplane or cables. The ultimate data rate and distance depend on the media attenuation characteristic, the noise coupled with environment and other system characteristics.

The MS21147T could receive TTL or CMOS logical level, and transform it to LVDS. The MS21147T also has three-state output function, controlled by EN and ENB pins. In addition, the power dissipation would decrease when the MS21147T is disabled. The enable function table is shown as follows.

Enable		Input	Output	
EN	ENB	DIN	DOUTP	DOUTN
H	L or Open	L	L	H
H	L or Open	H	H	L
Others		X	Z	Z

TYPICAL APPLICATION DIAGRAM



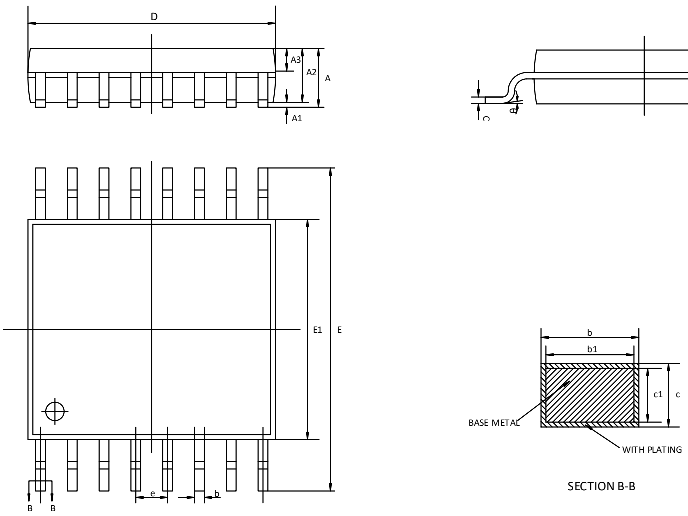
The typical application is shown as above. The MS21147T could act as driver for other LVDS receiver.The MS21147T has TSSOP package and the pin configuration makes it easy to perform PCB layout. The LVDS signal can easily match differential pair traces between driver and receiver. And the traces are allowed to be near with each other, in order to couple with noise as common-mode. The noise isolation is accomplished by the LVDS signal on one side of the device and the TTL signal on the other side.

Transmission Distance

Normally, the MS21147T is used to cooperate with the MS21148T together. For CAT5E network line, at least 10 meters could be reached for data rate less than 100Mbps. While the rate increases to 200Mbps, the transmission distance would reduce to about 5 meters. When the transmission distance is less than 0.5 meter and the data rate is below 200Mbps, most cables could be used.

PACKAGE OUTLINE DIMENSIONS

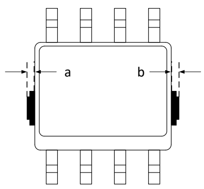
TSSOP16



Symbol	Dimensions in Millimeters		
	Min	Typ	Max
A	-	-	1.20
A1	0.05	-	0.15
A2	0.90	1.00	1.05
A3	0.39	0.44	0.49
b	0.20	-	0.28
b1	0.19	0.22	0.25
c	0.13	-	0.17
c1	0.12	0.13	0.14
D	4.90	5.00	5.10
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65BSC		
L	0.45	0.60	0.75
L1	1.00BSC		
θ	0	-	8°

Note: In addition to the package size, a, b are allowed to have the maximum size of 0.15mm for waste glue simultaneously.

The diagram is as follows: taking SOP8 package as an example.



MARKING and PACKAGING SPECIFICATION

1. Marking Drawing Description

Product Name : MS21147T

Product Code : XXXXXXX

2. Marking Drawing Demand

Laser printing, contents in the middle, font type Arial.

3. Packaging Specification

Device	Package	Piece/Reel	Reel/Box	Piece /Box	Box/Carton	Piece/Carton
MS21147T	TSSOP16	3000	1	3000	8	24000

STATEMENT

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- The process of improving product is endless. And our company would sincerely provide more excellent product for customer.

MOS CIRCUIT OPERATION PRECAUTIONS

Static electricity can be generated in many places. The following precautions can be taken to effectively prevent the damage of MOS circuit caused by electrostatic discharge:

1. The operator shall ground through the anti-static wristband.
2. The equipment shell must be grounded.
3. The tools used in the assembly process must be grounded.
4. Must use conductor packaging or anti-static materials packaging or transportation.

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