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## **DUAL 4-PORT AND DUAL 8-PORT LVDS REPEATERS**

#### **FEATURES**

- Two Line Receivers and Eight ('109) or Sixteen ('117) Line Drivers Meet or Exceed the Requirements of ANSI EIA/TIA-644 Standard
- Typical Data Signaling Rates to 400 Mbps or Clock Frequencies to 400 MHz
- Outputs Arranged in Pairs From Each Bank
- Enabling Logic Allows Individual Control of Each Driver Output Pair, Plus All Outputs
- Low-Voltage Differential Signaling With Typical Output Voltage of 350 mV and a 100-Ω Load
- Electrically Compatible With LVDS, PECL, LVPECL, LVTTL, LVCMOS, GTL, BTL, CTT, SSTL, or HSTL Outputs With External Termination Networks
- Propagation Delay Times < 4.5 ns
- Output Skew Less Than 550 ps Bank Skew Less Than150 ps Part-to-Part Skew Less Than 1.5 ns
- Total Power Dissipation Typically <500 mW</li>
  With All Ports Enabled and at 200 MHz
- Driver Outputs or Receiver Input Equals High Impedance When Disabled or With V<sub>CC</sub> < 1.5 V</li>
- Bus-Pin ESD Protection Exceeds 12 kV
- Packaged in Thin Shrink Small-Outline Package With 20-Mil Terminal Pitch

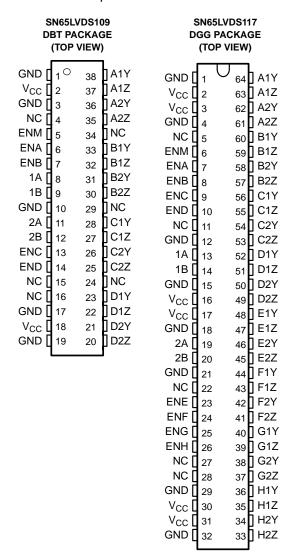
### **DESCRIPTION**

The SN65LVDS109 and SN65LVDS117 are configured as two identical banks, each bank having one differential line receiver connected to either four ('109) or eight ('117) differential line drivers. The outputs are arranged in pairs having one output from each of the two banks. Individual output enables are provided for each pair of outputs and an additional enable is provided for all outputs.

The line receivers and line drivers implement the electrical characteristics of low-voltage differential signaling (LVDS). LVDS, as specified in EIA/TIA-644, is a data signaling technique that offers low power, low noise emission, high noise immunity, and high switching speeds. (Note: The ultimate rate and distance of data transfer is dependent upon the attenuation characteristics of the media, the noise coupling to the environment, and other system characteristics.)

The intended application of these devices, and the LVDS signaling technique, is for point-to-point or point-to-multipoint (distributed simplex) baseband data transmission on controlled impedance media of approximately 100  $\Omega.$  The transmission media may be printed-circuit board traces, backplanes, or cables. The large number of drivers integrated into the same silicon substrate, along with the low pulse skew of balanced signaling, provides extremely precise timing alignment of the signals being repeated from the inputs. This is particularly advantageous for implementing system clock and data distribution trees.

The SN65LVDS109 and SN65LVDS117 are characterized for operation from -40°C to 85°C.





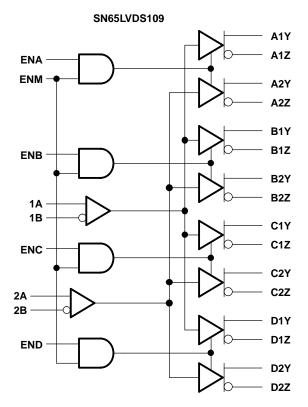
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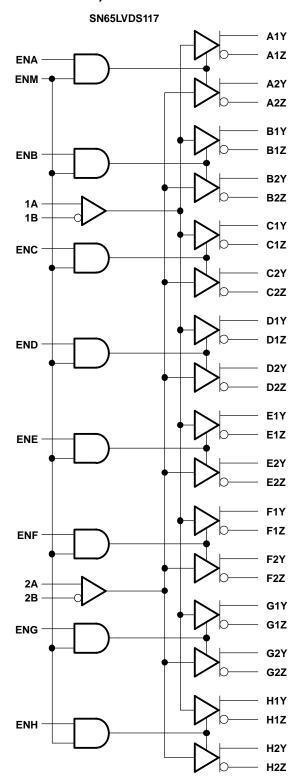




These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## **LOGIC DIAGRAM (POSITIVE LOGIC)**







### **SELECTION GUIDE TO LVDS SPLITTERS**

The SN65LVDS109 and SN75LVDS117 are both members of a family of LVDS splitters and repeaters. A brief overview of the family is provided by Table 1.

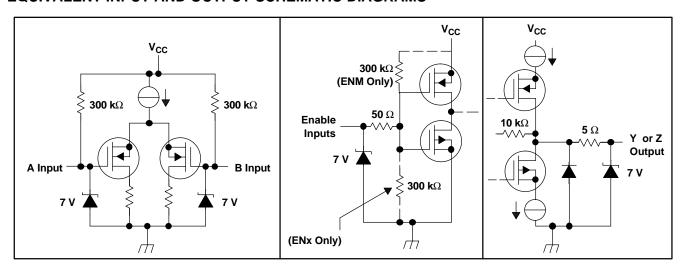
**NUMBER NUMBER DEVICE PACKAGE COMMENTS** OF OF INPUTS OUTPUTS SN65LVDS104 1 LVDS 4 LVDS 16-pin D 4-Port LVDS repeater 16-pin D SN65LVDS105 1 LVTTL 4 LVDS 4-Port TTL-to-LVDS repeater 38-pin DBT 8-Port LVDS repeater SN65LVDS108 1 LVDS 8 LVDS 2 LVDS 8 LVDS 38-pin DBT Dual 4-port LVDS repeater **SN65LVDS109** SN65LVDS116 1 LVDS 16 LVDS 16-Port LVDS repeater 64-pin DGG Dual 8-Port LVDS repeater SN65LVDS117 2 LVDS 16 LVDS 64-pin DGG

**Table 1. LVDS SPLITTER AND REPEATER FAMILY** 

#### **FUNCTION TABLE**

INPUTS	OUTPUTS					
$V_{ID} = V_A - V_B$	V <sub>ID</sub> = V <sub>A</sub> - V <sub>B</sub> ENM ENx					
X	L	Х	Z	Z		
X	Х	L	Z	Z		
$V_{ID} \ge 100 \text{ mV}$	Н	Н	Н	L		
$-100 \text{ mV} < V_{ID} < 100 \text{ mV}$	Н	Н	?	?		
$V_{ID} \le -100 \text{ mV}$	Н	Н	L	Н		

### **EQUIVALENT INPUT AND OUTPUT SCHEMATIC DIAGRAMS**





### **ABSOLUTE MAXIMUM RATINGS**

over operating free-air temperature range (unless otherwise noted)(1)

		UNIT
Supply voltage range, V	–0.5 V to 4 V	
Input voltage range	Enable inputs	–0.5 V to 6 V
Input voltage range	A, B, Y or Z	-0.5 V to 4 V
Electrostatic discharge	A, B, Y, Z, and GND <sup>(3)</sup>	Class 3, A:12 kV, B: 500 V
Continuous power dissip	pation	See Dissipation Rating Table
Storage temperature ran	–65°C to 150°C	
Lead temperature 1,6 m	260°C	

<sup>(1)</sup> Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

### **DISSIPATION RATING TABLE**

PACKAGE	T <sub>A</sub> ≤ 25°C POWER RATING	DERATING FACTOR <sup>(1)</sup> ABOVE T <sub>A</sub> = 25°C	T <sub>A</sub> = 85°C POWER RATING
DBT	1277 mW	10.2 mW/°C	644 mW
DGG	2094 mW	16.7 mW/°C	1089 mW

<sup>(1)</sup> This is the inverse of the junction-to-ambient thermal resistance when board-mounted (low-k) with no air flow.

## **RECOMMENDED OPERATING CONDITIONS**

		MIN	NOM	MAX	UNIT
$V_{CC}$	Supply voltage	3	3.3	3.6	V
$V_{IH}$	High-level input voltage	2			V
$V_{IL}$	Low-level input voltage			0.8	V
V <sub>I</sub> or V <sub>IC</sub>	Voltage at any bus terminal (separately or common-mode)	0		V <sub>CC</sub> - 0.8	V
T <sub>A</sub>	Operating free-air temperature	-40		85	°C

<sup>2)</sup> All voltage values, except differential I/O bus voltages, are with respect to network ground terminal.

<sup>(3)</sup> Tested in accordance with MIL-STD-883C Method 3015.7.



## **ELECTRICAL CHARACTERISTICS**

over recommended operating conditions (unless otherwise noted)

	PAF	RAMETER	TEST CONDITIONS	MIN	TYP <sup>(1)</sup>	MAX	UNIT	
V <sub>ITH+</sub>	Positive-going d	lifferential input voltage threshold	Con Figure 4 and Table 2			100	mV	
V <sub>ITH-</sub>	Negative-going	differential input voltage threshold	See Figure 1 and Table 2	-100			mv	
V <sub>OD</sub>	Differential outp	ut voltage magnitude	B 400 0 W 4400 mV	247	340	454		
$\Delta  V_{OD} $	Change in differ between logic s	rential output voltage magnitude tates	$R_L$ = 100 Ω, $V_{ID}$ = ±100 mV, See Figure 1 and Figure 2	-50		50	mV	
V <sub>OC(SS)</sub>	Steady-state co	mmon-mode output voltage		1.125		1.37 5	V	
$\Delta V_{OC(SS)}$	Change in stead voltage between	dy-state common-mode output n logic states	See Figure 3	-50		50	mV	
V <sub>OC(PP)</sub>	Peak-to-peak co	ommon-mode output voltage			50	150		
·		SN65LVDS109	Enabled, $R_L = 100 \Omega$		46	64		
	Supply current		Disabled		6	8	A	
I <sub>CC</sub>			Enabled, $R_L = 100 \Omega$		85	122	mA	
		SNOSLVDSTT/	Disabled		6	8		
	Immust assume at /A	an Diagrata)	V <sub>I</sub> = 0 V	-2		-20		
l <sub>l</sub>	Input current (A	or B inputs)	V <sub>I</sub> = 2.4 V	-1.2			μΑ	
I <sub>I(OFF)</sub>	Power-off input	current (A or B inputs)	$V_{CC} = 1.5 \text{ V}, \qquad V_{I} = 2.4 \text{ V}$			20	μA	
I <sub>IH</sub>	High-level input	current (enables)	V <sub>IH</sub> = 2 V			20	μΑ	
I <sub>IL</sub>	Low-level input	current (enables)	V <sub>IL</sub> = 0.8 V			10	μA	
	Object singuity and		$V_{OY}$ or $V_{OZ} = 0$ V			±24	^	
I <sub>OS</sub>	Short-circuit out	put current	V <sub>OD</sub> = 0 V			±12 mA		
I <sub>OZ</sub>	High-impedance output current		$V_O = 0 \text{ V or } V_{CC}$			±1	μA	
I <sub>O(OFF)</sub>	Power-off outpu	t current	$V_{CC} = 1.5 \text{ V}, \qquad V_{O} = 3.6 \text{ V}$			±1	μΑ	
C <sub>IN</sub>	Input capacitano	ce (A or B inputs)	$V_I = 0.4 \sin (4E6\pi t) + 0.5 V$		5		n.E	
Co	Output capacita	nce (Y or Z outputs)	V <sub>I</sub> = 0.4 sin (4E6πt) + 0.5 V, Disabled		9.4		pF	

<sup>(1)</sup> All typical values are at  $25^{\circ}$ C and with a 3.3-V supply.



## **SWITCHING CHARACTERISTICS**

over recommended operating conditions (unless otherwise noted)

	PARAMETER	TEST CONDITIONS	MIN	TYP <sup>(1)</sup>	MAX	UNIT
t <sub>PLH</sub>	Propagation delay time, low-to-high-level output		1.6	2.8	4.5	20
t <sub>PHL</sub>	Propagation delay time, high-to-low-level output		1.6	2.8	4.5	ns
t <sub>r</sub>	Differential output signal rise time		0.3	0.8	1.2	20
t <sub>f</sub>	Differential output signal fall time	$R_L = 100 \Omega, C_L = 10 pF,$	0.3	0.8	1.2	ns
t <sub>sk(p)</sub>	Pulse skew ( t <sub>PHL</sub> - t <sub>PLH</sub>  ) <sup>(2)</sup>	See Figure 4		140	500	20
t <sub>sk(o)</sub>	Output skew <sup>(3)</sup>			100	550	ps
t <sub>sk(b)</sub>	Bank skew <sup>(4)</sup>			40	150	ps
t <sub>sk(pp)</sub>	Part-to-part skew <sup>(5)</sup>				1.5	ns
t <sub>PZH</sub>	Propagation delay time, high-impedance-to-high-level output			5.7	15	
t <sub>PZL</sub>	Propagation delay time, high-impedance-to-low-level output	See Figure 5		7.7	15	ns
t <sub>PHZ</sub>	Propagation delay time, high-level-to-high-impedance output	See Figure 5		3.2	15	
$t_{PLZ}$	Propagation delay time, low-level-to-high-impedance output			3.2	15	

- (1) All typical values are at 25°C and with a 3.3-V supply.
  (2) t<sub>sk(p)</sub> is the magnitude of the time difference between the t<sub>PLH</sub> and t<sub>PHL</sub> of any output of a single device.
  (3) t<sub>sk(o)</sub> is the magnitude of the time difference between the t<sub>PLH</sub> or t<sub>PHL</sub> of any outputs with both inputs tied together.
- $t_{sk(0)}$  is the magnitude of the time difference between the  $t_{PLH}$  and  $t_{PLH}$  of the two outputs of any bank of a single device.  $t_{sk(pp)}$  is the magnitude of the time difference in propagation delay times between any specified terminals of two devices when both devices operate with the same supply voltages, at the same temperature, and have identical packages and test circuits.



## PARAMETER MEASUREMENT INFORMATION

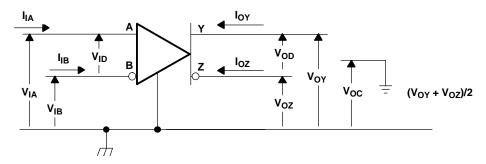


Figure 1. Voltage and Current Definitions

Table 2. Receiver Minimum and Maximum Input Threshold Test Voltages

APPLIED \	OLTAGES	RESULTING DIFFERENTIAL INPUT VOLTAGE	RESULTING COMMON- MODE INPUT VOLTAGE
VIA	V <sub>IB</sub>	V <sub>ID</sub>	V <sub>IC</sub>
1.25 V	1.15 V	100 mV	1.2 V
1.15 V	1.25 V	-100 mV	1.2 V
2.4 V	2.3 V	100 mV	2.35 V
2.3 V	2.4 V	-100 mV	2.35 V
0.1 V	0 V	100 mV	0.05 V
0 V	0.1 V	-100 mV	0.05 V
1.5 V	0.9 V	600 mV	1.2 V
0.9 V	1.5 V	−600 mV	1.2 V
2.4 V	1.8 V	600 mV	2.1 V
1.8 V	2.4 V	−600 mV	2.1 V
0.6 V	0 V	600 mV	0.3 V
0 V	0.6 V	−600 mV	0.3 V

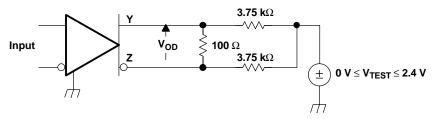
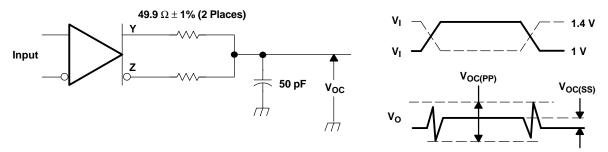


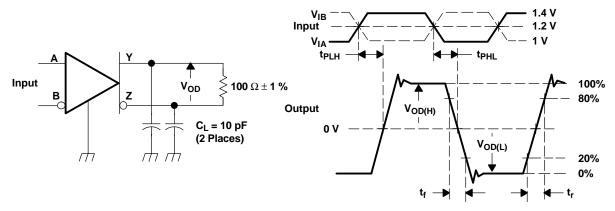
Figure 2. V<sub>OD</sub> Test Circuit





A. All input pulses are supplied by a generator having the following characteristics:  $t_r$  or  $t_f \le 1$  ns, pulse repetition rate (PRR) = 0.5 Mpps, pulsewidth = 500  $\pm 10$  ns.  $C_L$  includes instrumentation and fixture capacitance within 0,06 mm of the D.U.T. The measurement of  $V_{OC(PP)}$  is made on test equipment with a -3 dB bandwidth of at least 300 MHz.

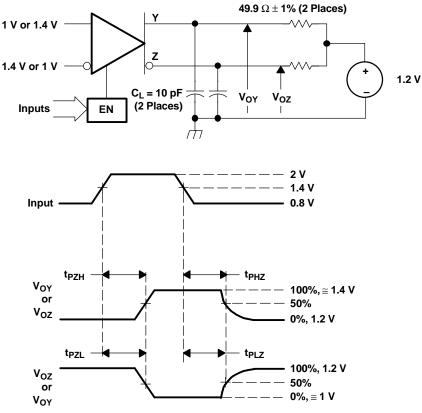
Figure 3. Test Circuit and Definitions for the Driver Common-Mode Output Voltage



A. All input pulses are supplied by a generator having the following characteristics:  $t_r$  or  $t_f \le 1$  ns, pulse repetition rate (PRR) = 50 Mpps, pulsewidth = 10  $\pm$ 0.2 ns .  $C_L$  includes instrumentation and fixture capacitance within 0,06 mm of the D.U.T.

Figure 4. Test Circuit, Timing, and Voltage Definitions for the Differential Output Signal



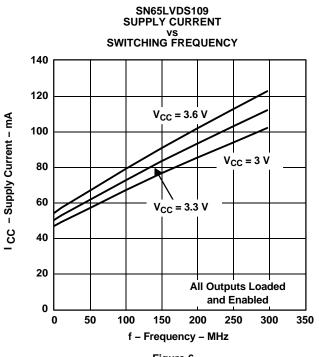


A. All input pulses are supplied by a generator having the following characteristics:  $t_r$  or  $t_f \le 1$  ns, pulse repetition rate (PRR) = 0.5 Mpps, pulsewidth = 500  $\pm 10$  ns .  $C_L$  includes instrumentation and fixture capacitance within 0,06 mm of the D.U.T.

Figure 5. Enable and Disable Time Circuit and Definitions



## **TYPICAL CHARACTERISTICS**





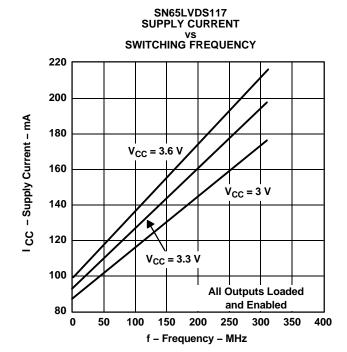
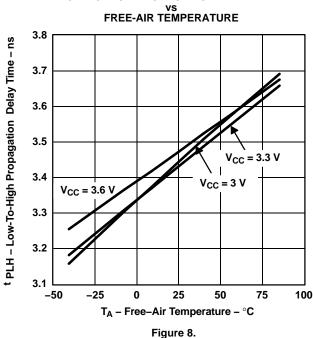


Figure 7.

# LOW-TO-HIGH PROPAGATION DELAY TIME vs



## HIGH-TO-LOW PROPAGATION DELAY TIME

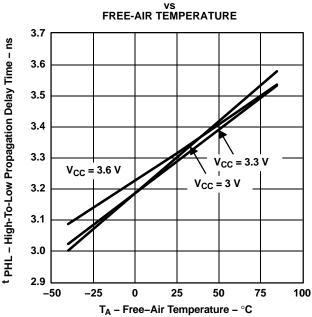


Figure 9.



## **TYPICAL CHARACTERISTICS (continued)**

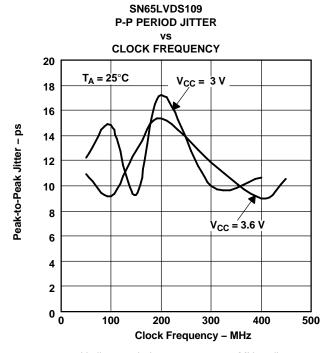
## P-P EYE-PATTERN JITTER vs PRBS SIGNALING RATE 900 T<sub>A</sub> = 25°C 800 $V_{CC} = 3.6 \text{ V}$ 700 Peak-to-Peak Jitter - ps 600 500 $V_{CC} = 3 \dot{V}$ 400 300 200 100 o o 200 400 600 800

**SN65LVDS109** 

NOTES: Input: 2<sup>15</sup> PRBS with peak-to-peak jitter < 100 ps at 100 Mbps, all outputs enabled and loaded with differential 100-Ω loads, worst-case output, supply decoupled with 0.1-μF and 0.001-μF ceramic 0603-style capacitors placed 1 cm from the device.

Figure 10.

Signaling Rate - Mbps



NOTES: Input: 50% duty cycle square wave with jitter period < 10 ps at 100 MHz, all outputs enabled and loaded with differential 100-Ω loads, worst-case output, supply decoupled with 0.1-μF and 0.001-μF ceramic 0603-style capacitors 1 cm from the device.

Figure 11.



## **TYPICAL CHARACTERISTICS (continued)**

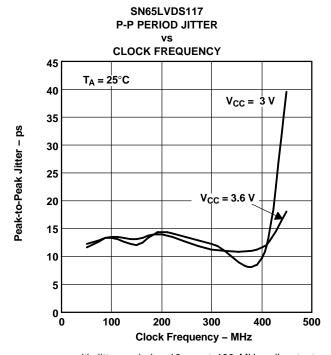
## P-P EYE-PATTERN JITTER vs PRBS SIGNALING RATE 900 T<sub>A</sub> = 25°C 800 700 Peak-to-Peak Jitter - ps $V_{CC} = 3.6 V$ 600 500 V<sub>CC</sub> = 3 V 400 300 200 100 0 0 r 100 200 300 400

**SN65LVDS117** 

NOTES: Input:  $2^{15}$  PRBS with peak-to-peak jitter < 115 ps at 100 Mbps, all outputs enabled and loaded with differential  $100-\Omega$  loads, worst-case output, supply decoupled with  $0.1-\mu F$  and  $0.001-\mu F$  ceramic 0805-style capacitors 1 cm from the device.

Figure 12.

Signaling Rate - Mbps



NOTES: Input: 50% duty cycle square wave with jitter period < 10 ps at 100 MHz, all outputs enabled and loaded with differential 100-Ω loads, worst-case output, supply decoupled with 0.1-μF and 0.001-μF ceramic 0805-style capacitors 1 cm from the device.

Figure 13.



## **TYPICAL CHARACTERISTICS (continued)**

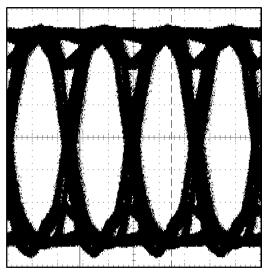


Figure 14. Typical Differential Eye Pattern at 400 Mbps

#### **APPLICATION INFORMATION**

#### **FAIL SAFE**

A common problem with differential signaling applications is how the system responds when no differential voltage is present on the signal pair. The LVDS receiver is like most differential line receivers, in that its output logic state can be indeterminate when the differential input voltage is between –100 mV and 100 mV and within its recommended input common-mode voltage range. Hovever, TI LVDS receivers handles the open-input circuit situation differently.

Open-circuit means that there is little or no input current to the receiver from the data line itself. This could be when the driver is in a high-impedance state or the cable is disconnected. When this occurs, the LVDS receiver pulls each line of the signal pair to near  $V_{CC}$  through 300-k $\Omega$  resistors as shown in Figure 15. The fail-safe feature uses an AND gate with input voltage thresholds at about 2.3 V to detect this condition and force the output to a high-level regardless of the differential input voltage.

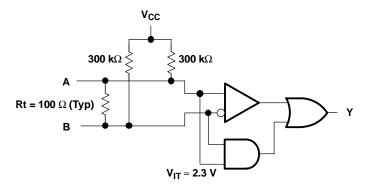


Figure 15. Open-Circuit Fail Safe of the LVDS Receiver

It is only under these conditions that the output of the receiver will be valid with less than a 100 mV differential input voltage magnitude. The presence of the termination resistor, Rt, does not affect the fail-safe function as long as it is connected as shown in Figure 15. Other termination circuits may allow a dc current to ground that could defeat the pullup currents from the receiver and the fail-safe feature.

### **CLOCK DISTRIBUTION**

The SN65LVDS109 and SN65LVDS117 devices solve several problems common to the distribution of timing critical clock and data signals. These problems include:

- Excessive skew between the signals
- Noise pickup over long signaling paths
- High power consumption
- Control of which signal paths are enabled or disabled
- Elimination of radiation from unterminated lines

Buffering and splitting the two related signals on the same silicon die minimizes corruption of the timing relation between the two signals. Buffering and splitting the two signals in separate devices will introduce considerably higher levels of uncontrolled timing skew between the two signals. Higher speed operation and more timing tolerance for other components of the system is enabled by the tighter system timing budgets provided by the single die implementations of the SN65LVDS109 and SN65LVDS117.

The use of LVDS signaling technology for both the inputs and the outputs provides superior common-mode and noise tolerance compared to single-ended I/O technologies. This is particularly important because the signals that are being distributed must be transmitted over longer distances, and at higher rates, than can be accommodated with single-ended I/Os. In addition, LVDS consumes considerably less power than other high-performance differential signaling schemes.



The enable inputs provided for each output pair may be used to turn on or off any of the paths. This function is required to prevent radiation of signals from the unterminated signal lines on open connectors, such as when boards or devices are being swapped in the end equipment. The individual bank enables are also required if redundant paths are being utilized for reliability reasons.

The diagram below shows how a pair of clock (C) and data (D) input signals is being identically repeated out two of the available output pairs. A third output pair is shown in the disabled state.

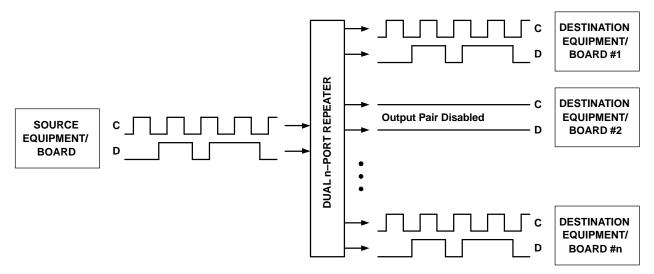


Figure 16. LVDS Repeating Splitter Application Example Showing Individual Path Control

### INPUT LEVEL TRANSLATION

An LVDS receiver can be used to receive various other types of logic signals. Figure 17 through Figure 25 show the termination circuits for SSTL, HSTL, GTL, BTL, LVPECL, PECL, CMOS, and TTL.

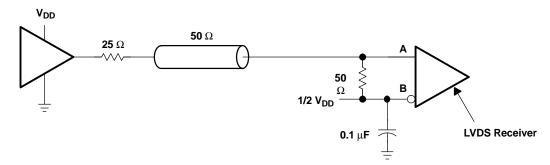


Figure 17. Stub-Series Terminated (SSTL) or High-Speed Transceiver Logic (HSTL)



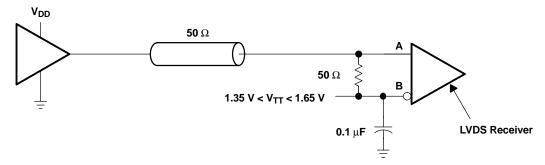


Figure 18. Center-Tap Termination (CTT)

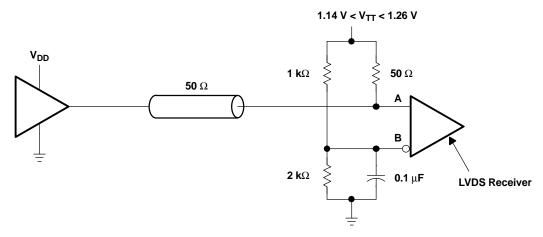


Figure 19. Gunning Transceiver Logic (GTL)

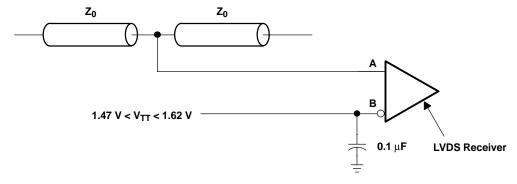


Figure 20. Backplane Transceiver Logic (BTL)



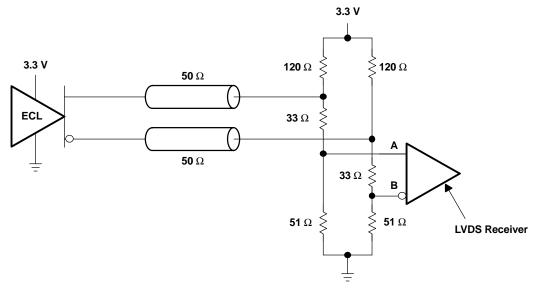


Figure 21. Low-Voltage Positive Emitter-Coupled Logic (LVPECL)

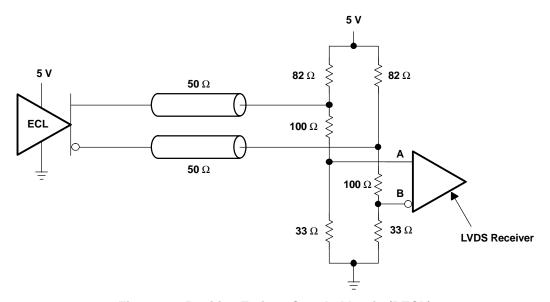


Figure 22. Positive Emitter-Coupled Logic (PECL)



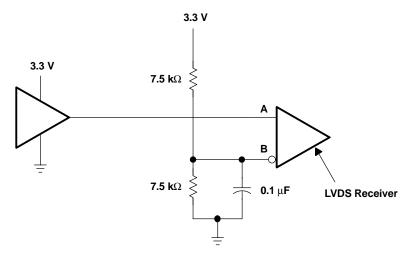


Figure 23. 3.3-V CMOS

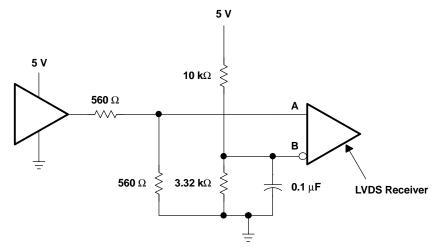


Figure 24. 5-V CMOS

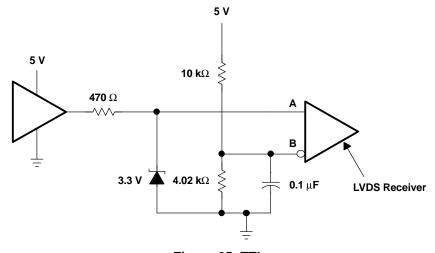


Figure 25. TTL





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#### PACKAGING INFORMATION

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	e Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN65LVDS109DBT	ACTIVE	TSSOP	DBT	38	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
SN65LVDS109DBTG4	ACTIVE	TSSOP	DBT	38	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
SN65LVDS109DBTR	ACTIVE	TSSOP	DBT	38	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
SN65LVDS109DBTRG4	ACTIVE	TSSOP	DBT	38	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
SN65LVDS117DGG	ACTIVE	TSSOP	DGG	64	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
SN65LVDS117DGGG4	ACTIVE	TSSOP	DGG	64	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
SN65LVDS117DGGR	ACTIVE	TSSOP	DGG	64	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
SN65LVDS117DGGRG4	ACTIVE	TSSOP	DGG	64	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR

<sup>&</sup>lt;sup>(1)</sup> The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

**Pb-Free** (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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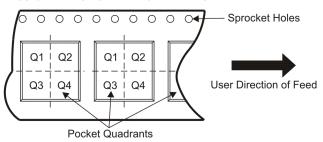
## TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
В0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

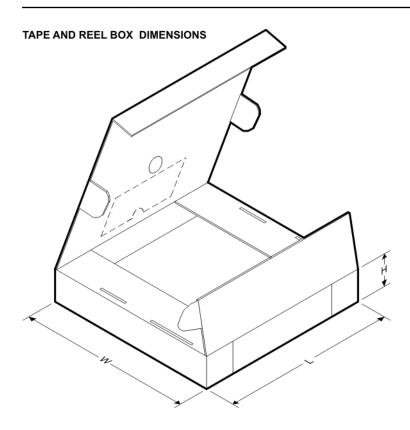
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



### \*All dimensions are nominal

Device		Package Drawing			Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN65LVDS109DBTR	TSSOP	DBT	38	2000	330.0	16.4	6.9	10.2	1.8	12.0	16.0	Q1
SN65LVDS117DGGR	TSSOP	DGG	64	2000	330.0	24.4	8.4	17.3	1.7	12.0	24.0	Q1



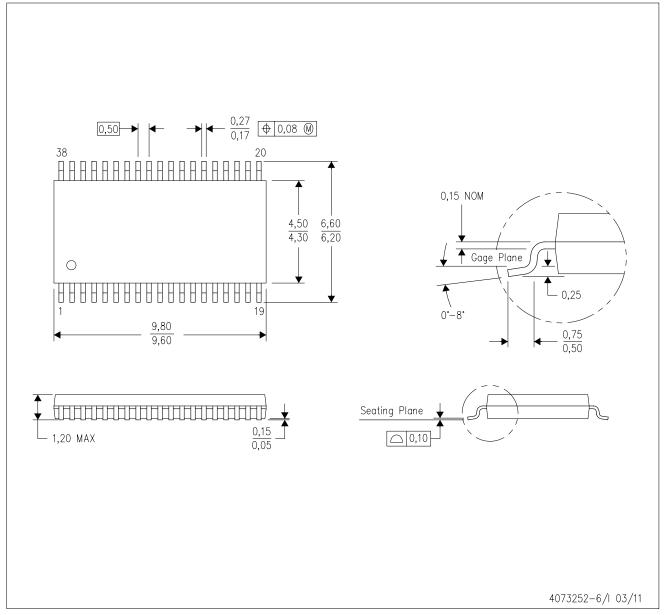


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65LVDS109DBTR	TSSOP	DBT	38	2000	346.0	346.0	33.0
SN65LVDS117DGGR	TSSOP	DGG	64	2000	346.0	346.0	41.0

DBT (R-PDSO-G38)

## PLASTIC SMALL OUTLINE



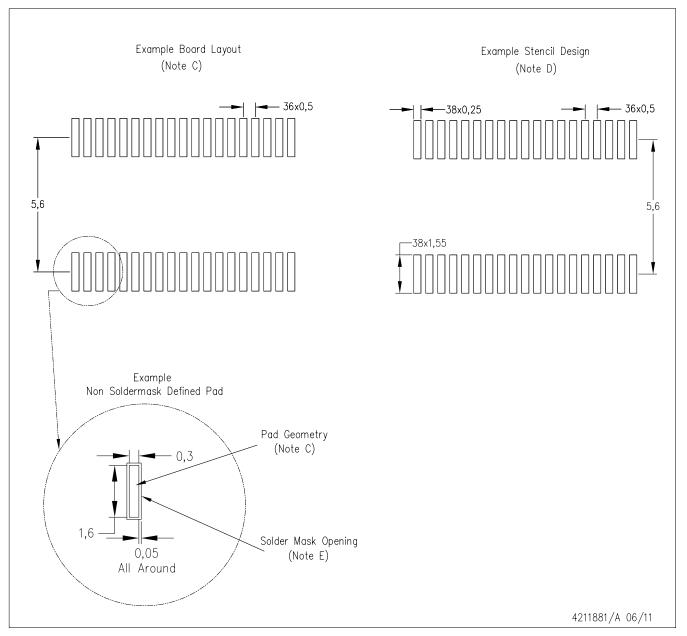
NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.

- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion.
- D. Falls within JEDEC MO-153.



# DBT (R-PDSO-G38)

## PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



## DGG (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE PACKAGE

#### **48 PINS SHOWN**



NOTES: A. All linear dimensions are in millimeters.

B. This drawing is subject to change without notice.

C. Body dimensions do not include mold protrusion not to exceed 0,15.

D. Falls within JEDEC MO-153

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