

DATA SHEET

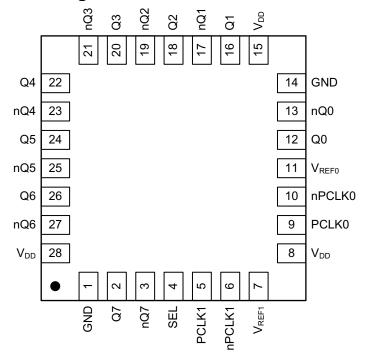
General Description

The IDT8SLVD1208I is a high-performance differential LVDS fanout buffer. The device is designed for the fanout of high-frequency, very low additive phase-noise clock and data signals. The IDT8SLVD1208I is characterized to operate from a 2.5V power supply. Guaranteed output-to-output and part-to-part skew characteristics make the IDT8SLVD1208I ideal for those clock distribution applications demanding well-defined performance and repeatability. Two selectable differential inputs and eight low skew outputs are available. The integrated bias voltage reference enables easy interfacing of single-ended signals to the device inputs. The device is optimized for low power consumption and low additive phase noise.

Features

- Eight low skew, low additive jitter LVDS output pairs
- Two selectable, differential clock input pairs
- Differential PCLK, nPCLK pairs can accept the following differential input levels: LVDS, LVPECL
- Maximum input clock frequency: 2GHz (maximum)
- LVCMOS/LVTTL interface levels for the control input (input select)
- Output skew: 8ps (typical)
- Propagation delay: 255ps (typical)
- Low additive phase jitter, RMS; $f_{REF} = 156.25MHz$, $V_{PP} = 1V$, 10kHz - 20MHz: 65fs (typical)
- Maximum device current consumption (I_{DD}): 170mA
- 2.5V supply voltage
- Lead-free (RoHS 6), 28-Lead VFQFN packaging
- -40°C to 85°C ambient operating temperature

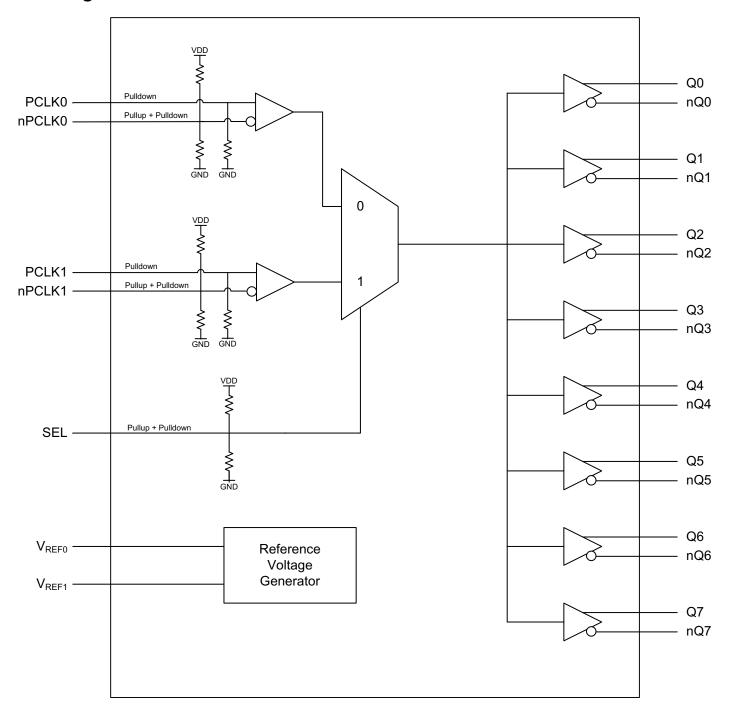
Pin Assignment



IDT8SLVD1208I

28 lead VFQFN 5.0mm x 5.0mm x 0.925mm package body Pad size 3.25mm x 3.25 mm **NB Package Top View**

Block Diagram



Pin Descriptions and Characteristics

Table 1. Pin Descriptions

Number	Name	Ту	ре	Description	
1, 14	GND	Power		Ground supply pin.	
4	SEL	Input	Pullup/ Pulldown	Reference select control pin. See Table 3 for function. LVCMOS/LVTTL interface levels.	
5	PCLK1	Input	Pulldown	Non-inverting differential clock/data input.	
6	nPCLK1	Input	Pullup/ Pulldown	Inverting differential clock/data input. V _{DD} /2 default when left floating.	
8, 15, 28	V _{DD}	Power		Power supply pin.	
9	PCLK0	Input	Pulldown	Non-inverting differential clock/data input.	
10	nPCLK0	Input	Pullup/ Pulldown	Inverting differential clock/data input. V _{DD} /2 default when left floating.	
11	V _{REF0}	Output		Bias voltage reference for the PCLK0, nPCLK0 inputs.	
7	V _{REF1}	Output		Bias voltage reference for the PCLK1, nPCLK1 inputs.	
12, 13	Q0, nQ0	Output		Differential output pair 0. LVDS interface levels.	
16, 17	Q1, nQ1	Output		Differential output pair 1. LVDS interface levels.	
18, 19	Q2, nQ2	Output		Differential output pair 2. LVDS interface levels.	
20, 21	Q3, nQ3	Output		Differential output pair 3. LVDS interface levels.	
22, 23	Q4, nQ4	Output		Differential output pair 4. LVDS interface levels.	
24, 25	Q5, nQ5	Output		Differential output pair 5. LVDS interface levels.	
26, 27	Q6, nQ6	Output		Differential output pair 6. LVDS interface levels.	
2, 3	Q7, nQ7	Output	_	Differential output pair 7. LVDS interface levels.	

NOTE: Pulldown and Pullup refers to an internal input resistors. See Table 2, Pin Characteristics, for typical values.

Table 2. Pin Characteristics

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
C _{IN}	Input Capacitance			2		pF
R _{PULLDOWN}	Input Pulldown Resistor			51		kΩ
R _{PULLUP}	Input Pullup Resistor			51		kΩ

Function Table

Table 3. SEL Input Selection Function Table

Input	
SEL	Operation
0	PCLK0, nPCLK0 is the selected differential clock input.
1	PCLK1, nPCLK1 is the selected differential clock input.
Open	Input buffers are disabled and outputs are static.

NOTE: SEL is an asynchronous control.

Absolute Maximum Ratings

NOTE: Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These ratings are stress specifications only. Functional operation of product at these conditions or any conditions beyond those listed in the *DC Characteristics or AC Characteristics* is not implied. Exposure to absolute maximum rating conditions for extended periods may affect product reliability.

Item	Rating
Supply Voltage, V _{DD}	4.6V
Inputs, V _I	-0.5V to V _{DD} + 0.5V
Outputs, I _O Continuous Current Surge Current	10mA 15mA
Input Sink/Source, I _{REF}	±2mA
Maximum Junction Temperature, T _{J,MAX}	125°C
Storage Temperature, T _{STG}	-65°C to 150°C
ESD - Human Body Model, NOTE 1	2000V
ESD - Charged Device Model, NOTE 1	500V

NOTE 1: According to JEDEC/JS-001-2012/ 22-C101E.

DC Electrical Characteristics

Table 4A. Power Supply DC Characteristics, V_{DD} = 2.5V \pm 5%, T_A = -40°C to 85°C

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
V_{DD}	Power Supply Voltage		2.375	2.5V	2.625	V
I _{DD}	Power Supply Current	Q0 to Q7 terminated 100Ω between nQx, Qx		150	170	mA

Table 4B. LVCMOS/LVTTL DC Characteristics, $V_{DD} = 2.5V \pm 5\%$, $T_A = -40$ °C to 85°C

Symbol	Parameter		Test Conditions	Minimum	Typical	Maximum	Units
V _{MID}	Input voltage - open p	pin	Open		V _{DD} / 2		V
V _{IH}	Input High Voltage			0.7 * V _{DD}		V _{DD} + 0.3	V
V _{IL}	Input Low Voltage			-0.3		0.2 * V _{DD}	V
I _{IH}	Input High Current	SEL	$V_{DD} = V_{IN} = 2.625V$			150	μΑ
I _{IL}	Input Low Current	SEL	V _{DD} = 2.625V, V _{IN} = 0V	-150			μΑ

Table 4C. Differential Inputs Characteristics, $V_{DD} = 2.5V \pm 5\%, T_A = -40^{\circ}C$ to $85^{\circ}C$

Symbol	Parameter		Test Conditions	Minimum	Typical	Maximum	Units
I _{IH}	Input High Current	PCLK0, nPCLK0 PCLK1, nPCLK1	$V_{IN} = V_{DD} = 2.625V$			150	μΑ
		PCLK0, PCLK1	V _{IN} = 0V, V _{DD} = 2.625V	-10			μΑ
I _{IL}	Input Low Current	nPCLK0, nPCLK1	V _{IN} = 0V, V _{DD} = 2.625V	-150			μА
V _{REF0} , V _{REF1}	Reference Voltage for Input Bias		I _{REFx} = ±1mA	V _{DD} – 1.5	V _{DD} – 1.25	V _{DD} – 1.15	V
V	Peak-to-Peak Voltage; NOTE 1		f _{REF} < 1.5GHz	0.1		1.5	V
V _{PP}	reak-10-reak vollag	e, NOTE I	f _{REF} > 1.5GHz	0.2		1.5	V
V _{CMR}	Common Mode Input Voltage; NOTE 1, 2			1.0		V _{DD} – 0.6	V

NOTE 1: $V_{\rm IL}$ should not be less than -0.3V. NOTE 2: Common mode input voltage is defined at the crosspoint.

Table 4D. LVDS DC Characteristics, V_{DD} = 2.5V \pm 5%, T_A = -40°C to 85°C

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
V _{OD}	Differential Output Voltage	outputs loaded with 100 Ω	247		454	mV
ΔV_{OD}	V _{OD} Magnitude Change				50	mV
V _{OS}	Offset Voltage		1.125		1.55	V
ΔV _{OS}	V _{OS} Magnitude Change				50	mV

AC Electrical Characteristics

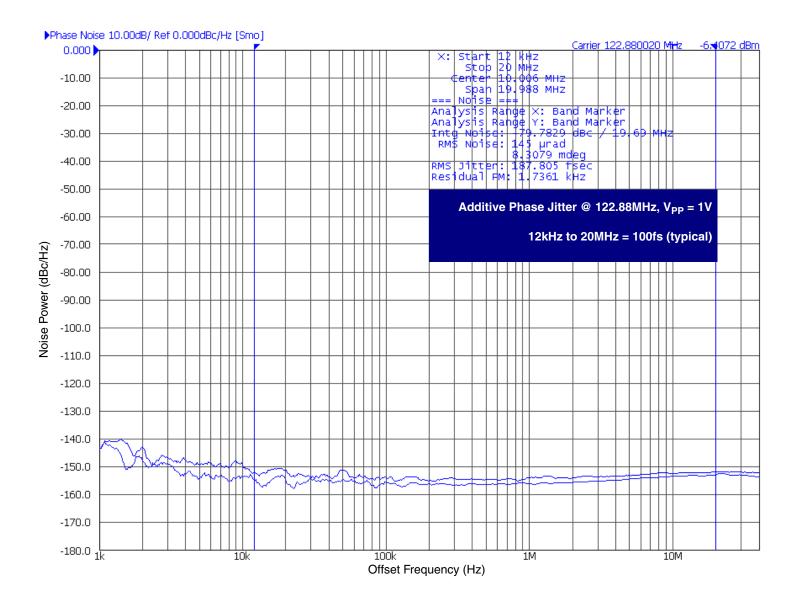
Table 5. AC Electrical Characteristics, $V_{DD} = 2.5V \pm 5\%$, $T_A = -40$ °C to 85°C

Symbol	Parameter		Test Conditions	Minimum	Typical	Maximum	Units
f _{REF}	Input Frequency	PCLK[0:1], nPCLK[0:1]				2	GHz
ΔV/Δt	Input Edge Rate	PCLK[0:1], nPCLK[0:1]		1.5			V/ns
t _{PD}	Propagation NOTE 1	Delay;	PCKx, nPCLKx to any Qx, nQx for V _{PP} = 0.1V or 0.3V	150	255	380	ps
tsk(o)	Output Skev	w; NOTE 2, 3				40	ps
tsk(i)	Input Skew;	NOTE 3				60	ps
tsk(p)	Pulse Skew		f _{REF} = 100MHz			25	ps
tsk(pp)	Part-to-Part NOTE 3, 4	Skew;				230	ps
	Buffer Additive Phase Jitter, RMS; refer to Additive Phase Jitter Section		f _{REF} = 122.88MHz Square Wave, V _{PP} = 1V, Integration Range: 1kHz – 40MHz		140	180	fs
			f _{REF} = 122.88MHz Square Wave, V _{PP} = 1V, Integration Range: 10kHz – 20MHz		100	130	fs
			f _{REF} = 122.88MHz Square Wave, V _{PP} = 1V, Integration Range: 12kHz – 20MHz		100	130	fs
			f _{REF} = 156.25MHz Square Wave, V _{PP} = 1V, Integration Range: 1kHz – 40MHz		95	140	fs
			f _{REF} = 156.25MHz Square Wave, V _{PP} = 1V, Integration Range: 10kHz – 20MHz		65	95	fs
t_{JIT}			f _{REF} = 156.25MHz Square Wave, V _{PP} = 1V, Integration Range: 12kHz – 20MHz		65	95	fs
			f_{REF} = 156.25MHz Square Wave, V_{PP} = 0.5V, Integration Range: 1kHz – 40MHz		85	125	fs
			f _{REF} = 156.25MHz Square Wave, V _{PP} = 0.5V, Integration Range: 10kHz – 20MHz		61	100	fs
			f _{REF} = 156.25MHz Square Wave, V _{PP} = 0.5V, Integration Range: 12kHz – 20MHz		61	100	fs
t _R / t _F	Output Rise	/ Fall Time	20% to 80% outputs loaded with 100 Ω	30	100	300	ps
MUX _{ISOLATION}	Mux Isolatio	n; NOTE 5	f _{REF} = 100MHz		-82		dB

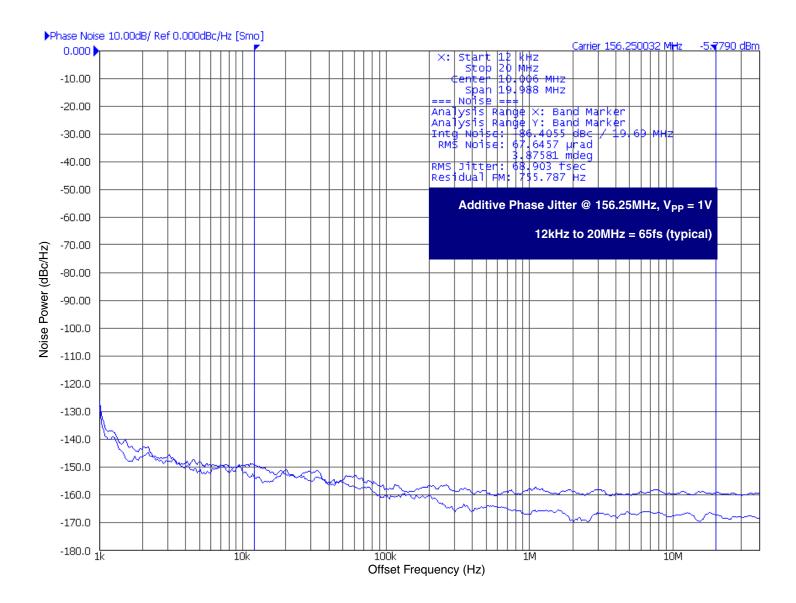
NOTE: Electrical parameters are guaranteed over the specified ambient operating temperature range, which is established when the device is mounted in a test socket with maintained transverse airflow greater than 500 lfpm. The device will meet specifications after thermal equilibrium has been reached under these conditions.

- NOTE 1: Measured from the differential input crosspoint to the differential output crosspoint.
- NOTE 2: Defined as skew between outputs at the same supply voltage and with equal load conditions. Measured at the differential crosspoints.
- NOTE 3: This parameter is defined in accordance with JEDEC Standard 65.
- NOTE 4: Defined as skew between outputs on different devices operating at the same supply voltage, same frequency, same temperature and with equal load conditions. Using the same type of inputs on each device, the outputs are measured at the differential crosspoints.
- NOTE 5: Qx, nQx outputs measured differentially. See MUX Isolation diagram in the Parameter Measurement Information section.

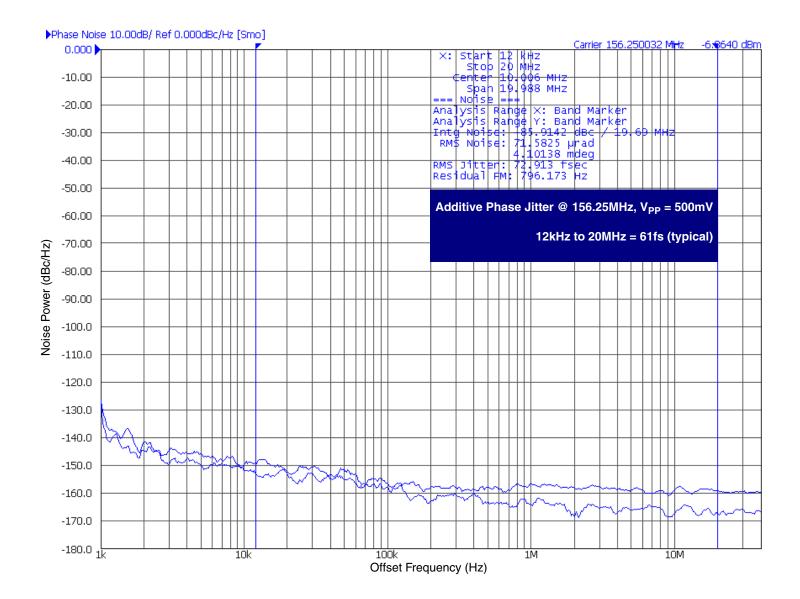
Typical Phase Noise at 122.88MHz



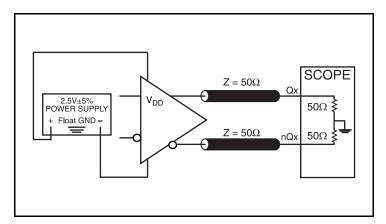
Typical Phase Noise at 156.25MHz



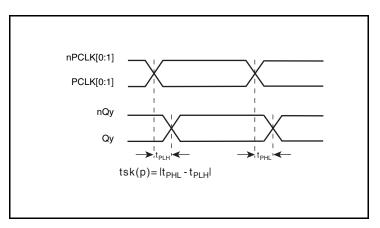
Typical Phase Noise at 156.25MHz



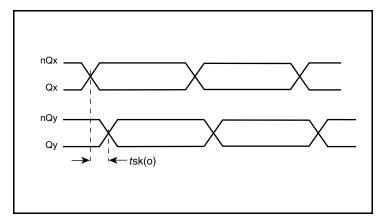
Parameter Measurement Information



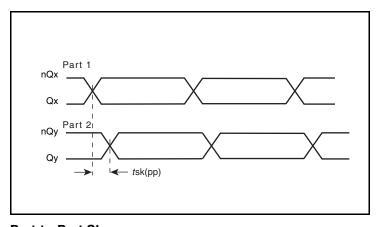
2.5V LVDS Output Load AC Test Circuit



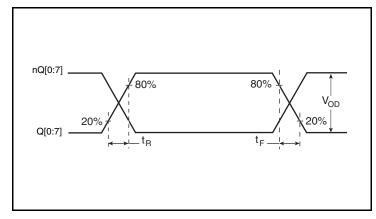
Differential Input Level



Pulse Skew



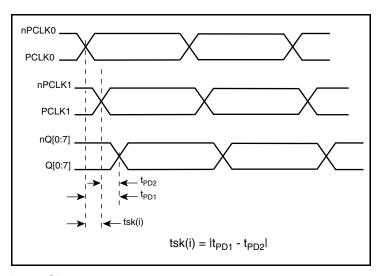
Output Skew

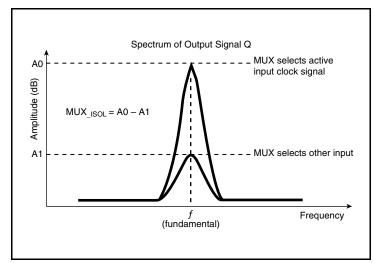


Part-to-Part Skew

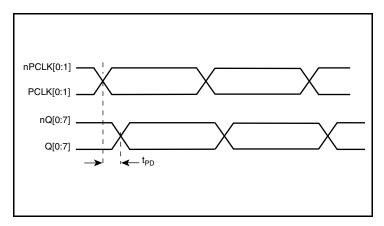
Output Rise/Fall Time

Parameter Measurement Information, continued

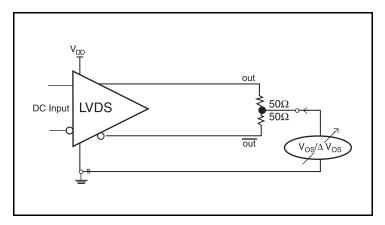




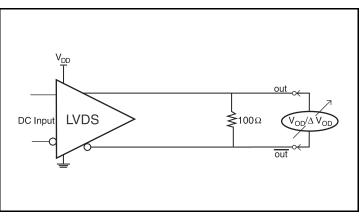
Input Skew



MUX Isolation



Propagation Delay



Differential Output Voltage Setup

Offset Voltage Setup

Applications Information

Recommendations for Unused Input and Output Pins

Inputs:

PCLK/nPCLK Inputs

For applications not requiring the use of a differential input, both the PCLK and nPCLK pins can be left floating. Though not required, but for additional protection, a $1k\Omega$ resistor can be tied from PCLK to ground.

Outputs:

LVDS Outputs

All unused LVDS output pairs can be either left floating or terminated with 100Ω across. If they are left floating, there should be no trace attached.

Wiring the Differential Input to Accept Single-Ended Levels

Figure 1 shows how a differential input can be wired to accept single ended levels. The reference voltage V1 = $V_{DD}/2$ is generated by the bias resistors R1 and R2. The bypass capacitor (C1) is used to help filter noise on the DC bias. This bias circuit should be located as close to the input pin as possible. The ratio of R1 and R2 might need to be adjusted to position the V1 in the center of the input voltage swing. For example, if the input clock swing is 2.5V and V_{DD} = 2.5V, R1 and R2 value should be adjusted to set V1 at 1.25V. The values below are for when both the single ended swing and V_{DD} are at the same voltage. This configuration requires that the sum of the output impedance of the driver (Ro) and the series resistance (Rs) equals the transmission line impedance. In addition, matched termination at the input will attenuate the signal in half. This can be done in one of two ways. First, R3 and R4 in parallel should equal the transmission

line impedance. For most 50Ω applications, R3 and R4 can be 100Ω . The values of the resistors can be increased to reduce the loading for slower and weaker LVCMOS driver. When using single-ended signaling, the noise rejection benefits of differential signaling are reduced. Even though the differential input can handle full rail LVCMOS signaling, it is recommended that the amplitude be reduced. The datasheet specifies a lower differential amplitude, however this only applies to differential signals. For single-ended applications, the swing can be larger, however $V_{\rm IL}$ cannot be less than -0.3V and $V_{\rm IH}$ cannot be more than $V_{\rm DD}$ + 0.3V. Though some of the recommended components might not be used, the pads should be placed in the layout. They can be utilized for debugging purposes. The datasheet specifications are characterized and guaranteed by using a differential signal.

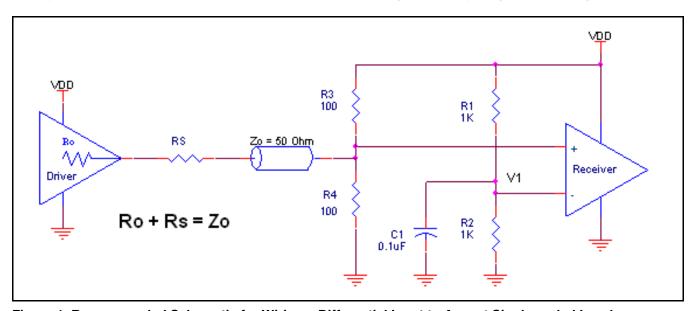


Figure 1. Recommended Schematic for Wiring a Differential Input to Accept Single-ended Levels

2.5V LVPECL Clock Input Interface

The PCLK /nPCLK accepts LVPECL, LVDS and other differential signals. Both signals must meet the V_{PP} and V_{CMR} input requirements. *Figures 2A to 2C* show interface examples for the PCLK/ nPCLK input driven by the most common driver types. The

input interfaces suggested here are examples only. If the driver is from another vendor, use their termination recommendation. Please consult with the vendor of the driver component to confirm the driver termination requirements.

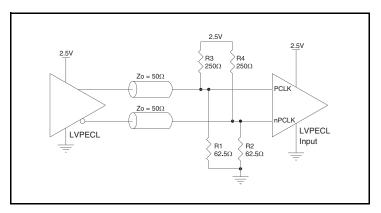


Figure 2A. PCLK/nPCLK Input Driven by a 2.5V LVPECL Driver

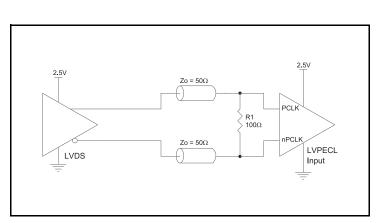


Figure 2C. PCLK/nPCLK Input Driven by a 2.5V LVDS Driver

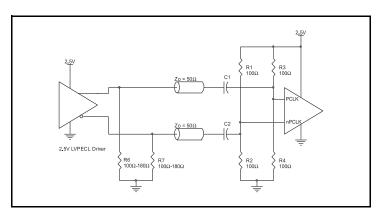
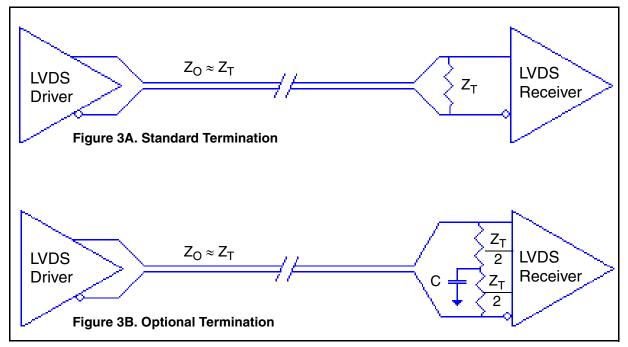


Figure 2B. PCLK/nPCLK Input Driven by a 2.5V LVPECL Driver with AC Couple

LVDS Driver Termination

For a general LVDS interface, the recommended value for the termination impedance (Z_T) is between 90Ω and 132Ω . The actual value should be selected to match the differential impedance (Z_0) of your transmission line. A typical point-to-point LVDS design uses a 100Ω parallel resistor at the receiver and a 100Ω differential transmission-line environment. In order to avoid any transmission-line reflection issues, the components should be surface mounted and must be placed as close to the receiver as possible. IDT offers a full line of LVDS compliant devices with two types of output structures: current source and voltage source. The

standard termination schematic as shown in *Figure 3A* can be used with either type of output structure. *Figure 3B*, which can also be used with both output types, is an optional termination with center tap capacitance to help filter common mode noise. The capacitor value should be approximately 50pF. If using a non-standard termination, it is recommended to contact IDT and confirm if the output structure is current source or voltage source type. In addition, since these outputs are LVDS compatible, the input receiver's amplitude and common-mode input range should be verified for compatibility with the output.



LVDS Termination

VFQFN EPAD Thermal Release Path

In order to maximize both the removal of heat from the package and the electrical performance, a land pattern must be incorporated on the Printed Circuit Board (PCB) within the footprint of the package corresponding to the exposed metal pad or exposed heat slug on the package, as shown in *Figure 5*. The solderable area on the PCB, as defined by the solder mask, should be at least the same size/shape as the exposed pad/slug area on the package to maximize the thermal/electrical performance. Sufficient clearance should be designed on the PCB between the outer edges of the land pattern and the inner edges of pad pattern for the leads to avoid any shorts.

While the land pattern on the PCB provides a means of heat transfer and electrical grounding from the package to the board through a solder joint, thermal vias are necessary to effectively conduct from the surface of the PCB to the ground plane(s). The land pattern must be connected to ground through these vias. The vias act as "heat pipes". The number of vias (i.e. "heat pipes") are application specific

and dependent upon the package power dissipation as well as electrical conductivity requirements. Thus, thermal and electrical analysis and/or testing are recommended to determine the minimum number needed. Maximum thermal and electrical performance is achieved when an array of vias is incorporated in the land pattern. It is recommended to use as many vias connected to ground as possible. It is also recommended that the via diameter should be 12 to 13mils (0.30 to 0.33mm) with 1oz copper via barrel plating. This is desirable to avoid any solder wicking inside the via during the soldering process which may result in voids in solder between the exposed pad/slug and the thermal land. Precautions should be taken to eliminate any solder voids between the exposed heat slug and the land pattern. Note: These recommendations are to be used as a quideline only. For further information, please refer to the Application Note on the Surface Mount Assembly of Amkor's Thermally/ Electrically Enhance Leadframe Base Package, Amkor Technology.

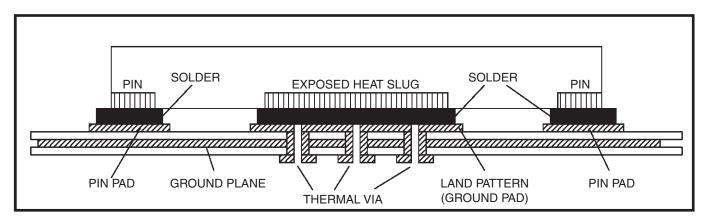


Figure 5. P.C. Assembly for Exposed Pad Thermal Release Path – Side View (drawing not to scale)

Power Considerations

This section provides information on power dissipation and junction temperature for the IDT8SLVD1208I. Equations and example calculations are also provided.

1. Power Dissipation.

The total power dissipation for the IDT8SLVD1208l is the sum of the core power plus the output power dissipation due to the load. The following is the power dissipation for $V_{DD} = 2.5V + 5\% = 2.625V$, which gives worst case results.

The maximum current at 85°C is as follows:

$$I_{DD\ MAX} = 170 \text{mA}$$

Power (core)MAX = V_{DD MAX} * I_{DD MAX} = 2.625V * 170mA = 446.25mW

Total Power MAX = 446.25mW

2. Junction Temperature.

Junction temperature, Tj, is the temperature at the junction of the bond wire and bond pad directly affects the reliability of the device. The maximum recommended junction temperature is 125°C. Limiting the internal transistor junction temperature, Tj, to 125°C ensures that the bond wire and bond pad temperature remains below 125°C.

The equation for Tj is as follows: Tj = θ_{JA} * Pd_total + TA

Tj = Junction Temperature

 θ_{JA} = Junction-to-Ambient Thermal Resistance

Pd_total = Total Device Power Dissipation (example calculation is in section 1 above)

T_A = Ambient Temperature

In order to calculate junction temperature, the appropriate junction-to-ambient thermal resistance θ_{JA} must be used. Assuming no air flow and a multi-layer board, the appropriate value is 46.2°C/W per Table 6 below.

Therefore, Tj for an ambient temperature of 85°C with all outputs switching is:

 $85^{\circ}\text{C} + 0.446\text{W} * 46.2^{\circ}\text{C/W} = 105.6^{\circ}\text{C}$. This is below the limit of 125°C .

This calculation is only an example. Tj will obviously vary depending on the number of loaded outputs, supply voltage, air flow and the type of board (multi-layer).

Table 6. Thermal Resistance θ_{JA} for 28 Lead VFQFN, Forced Convection

θ_{JA} at 0 Air Flow						
Meters per Second	0	1	2			
Multi-Layer PCB, JEDEC Standard Test Boards	46.2°C/W	39.4C/W	37.1°C/W			

Reliability Information

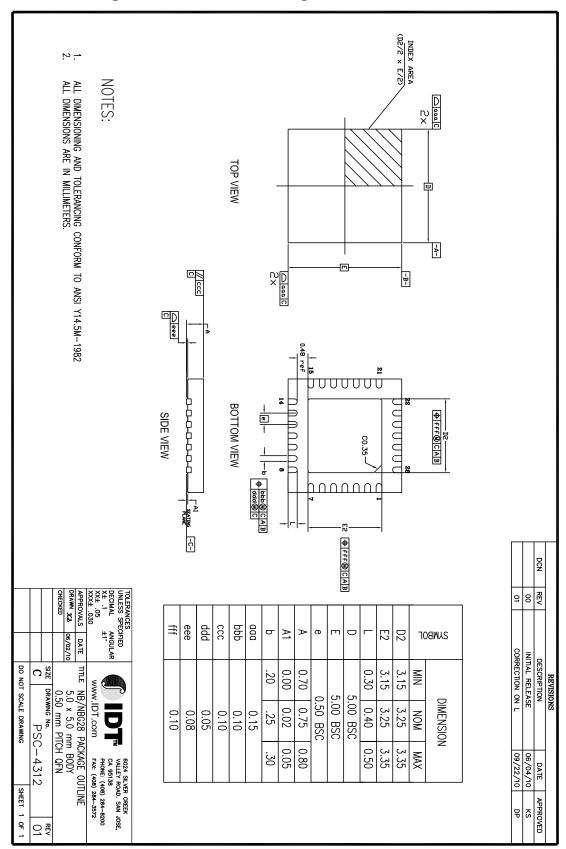
Table 7. θ_{JA} vs. Air Flow Table for a 28 Lead VFQFN

	θ_{JA} at 0 Air Flow		
Meters per Second	0	1	2
Multi-Layer PCB, JEDEC Standard Test Boards	46.2°C/W	39.4C/W	37.1°C/W

Transistor Count

The transistor count for the IDT8SLVD1208I is: 489

28 Lead VFQFN Package Outline and Package Dimensions

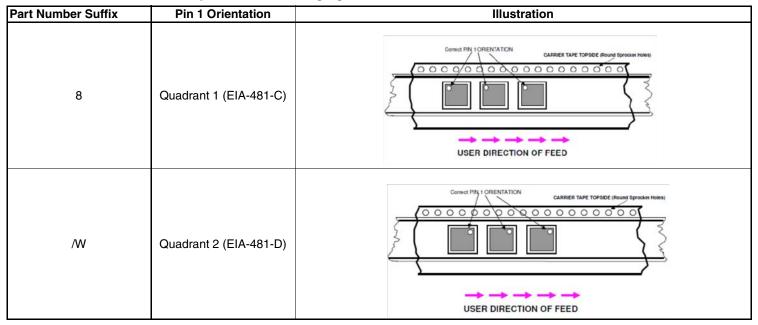


Ordering Information

Table 6. Ordering Information

Part/Order Number	Marking	Package	Shipping Packaging	Temperature
8SLVD1208NBGI	SLVD1208NBGI	"Lead-Free" 28 Lead VFQFN	Tray	-40°C to 85°C
8SLVD1208NBGI8	SLVD1208NBGI	"Lead-Free" 28 Lead VFQFN	Tape & Reel, pin 1 orientation: EIA-481-C	-40°C to 85°C
8SLVD1208NBGI/W	SLVD1208NBGI	"Lead-Free" 28 Lead VFQFN	Tape & Reel, pin 1 orientation: EIA-481-D	-40°C to 85°C

Table 9. Pin 1 Orientation in Tape and Reel Packaging



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- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001:
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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