MO9122
220-625 MHz High Performance Differential Oscillator

KDS DAISHINKU CORP.

Features

- Any frequency between 220 MHz and 625 MHz accurate to 6 decimal places
- LVPECL and LVDS output signaling types
- 0.6ps RMS phase jitter (random) over 12 kHz to 20 MHz bandwidth
- Frequency stability as low as ±10 ppm
- Industrial and extended commercial temperature ranges
- Industry-standard packages: 3.2x2.5, 5.0x3.2 and 7.0x5.0 mmxmm
- For frequencies lower than 220 MHz, refer to MO9121 datasheet

Applications

- 10GB Ethernet, SONET, SATA, SAS, Fibre Channel, PCI-Express
- Telecom, networking, instrumentation, storage, servers

Pb-Free   RoHS Compliant
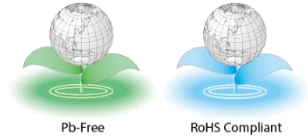
Electrical Characteristics

Parameter and Conditions	Symbol	Min.	Typ.	Max.	Unit	Condition
LVPECL and LVDS, Common Electrical Characteristics						
Supply Voltage	Vdd	+2.97	+3.3	+3.63	V	
		+2.25	+2.5	+2.75	V	
		+2.25	–	+3.63	V	Termination schemes in Figures 1 and 2 - XX ordering code
Output Frequency Range	f	220	–	625	MHz	
Frequency Stability	F_stab	-10	–	+10	ppm	Inclusive of initial tolerance, operating temperature, rated power supply voltage, and load variations
		-20	–	+20	ppm	
		-25	–	+25	ppm	
		-50	–	+50	ppm	
First Year Aging	F_aging1	-2.0	–	+2.0	ppm	+25°C
10-year Aging	F_aging10	-5.0	–	+5.0	ppm	+25°C
Operating Temperature Range	T_use	-40	–	+85	°C	Industrial
		-20	–	+70	°C	Extended $\overline{ST}$
Input Voltage High	VIH	70%	–	–	Vdd	Pin 1, OE or $\overline{ST}$
Input Voltage Low	VIL	–	–	30%	Vdd	Pin 1, OE or $\overline{ST}$
Input Pull-up Impedance	Z_in	–	100	250	kΩ	Pin 1, OE logic high or logic low, or $\overline{ST}$ logic high
		2.0	–	–	MΩ	Pin 1, $\overline{ST}$ logic low
Start-up Time	T_start	–	6.0	10	ms	Measured from the time Vdd reaches its rated minimum value.
Resume Time	T_resume	–	6.0	10	ms	In Standby mode, measured from the time $\overline{ST}$ pin crosses 50% threshold.
Duty Cycle	DC	45	–	55	%	Contact KDS for tighter duty cycle
LVPECL, DC and AC Characteristics						
Current Consumption	Idd	–	+61	+69	mA	Excluding Load Termination Current, Vdd = 3.3V or 2.5V
OE Disable Supply Current	I_OE	–	–	+35	mA	OE = Low
Output Disable Leakage Current	I_leak	–	–	+1.0	µA	OE = Low
Standby Current	I_std	–	–	+100	µA	$\overline{ST}$ = Low, for all Vdds
Maximum Output Current	I_driver	–	–	+30	mA	Maximum average current drawn from OUT+ or OUT-
Output High Voltage	VOH	Vdd-1.1	–	Vdd-0.7	V	See Figure 1(a)
Output Low Voltage	VOL	Vdd-1.9	–	Vdd-1.5	V	See Figure 1(a)
Output Differential Voltage Swing	V_Swing	+1.2	+1.6	+2.0	V	See Figure 1(b)
Rise/Fall Time	Tr, Tf	–	300	500	Ps	20% to 80%, see Figure 1(a)
OE Enable/Disable Time	T_oe	–	–	115	Ns	f = 220 MHz - For other frequencies, T_oe = 100ns + 3 period
RMS Period Jitter	T_jitt	–	1.2	1.7	Ps	f = 266 MHz, Vdd = +3.3V or +2.5V
		–	1.2	1.7	Ps	f = 312.5 MHz, Vdd = +3.3V or +2.5V
		–	1.2	1.7	Ps	f = 622.08 MHz, Vdd = +3.3V or +2.5V
RMS Phase Jitter (random)	T_phj	–	0.6	0.85	Ps	f = 312.5 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds
LVDS, DC and AC Characteristics						
Current Consumption	Idd	–	+47	+55	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I_OE	–	–	+35	mA	OE = Low
Differential Output Voltage	VOD	+250	+350	+450	mV	See Figure 2

Electrical Characteristics (continued)

Parameter and Conditions	Symbol	Min.	Typ.	Max.	Unit	Condition
LVDS, DC and AC Characteristics (continued)						
Output Disable Leakage Current	I_leak	–	–	+1.0	µA	OE = Low
Standby Current	I_std	–	–	+100	µA	$\overline{ST}$ = Low, for all Vdds
VOD Magnitude Change	ΔVOD	–	–	+50	mV	See Figure 2
Offset Voltage	VOS	+1.125	+1.2	+1.375	V	See Figure 2
VOS Magnitude Change	ΔVOS	–	–	+50	mV	See Figure 2
Rise/Fall Time	Tr, Tf	–	495	600	ps	20% to 80%, see Figure 2
OE Enable/Disable Time	T_oe	–	–	115	ns	f = 220 MHz - For other frequencies, T_oe = 100ns + 3 period
RMS Period Jitter	T_jitt	–	1.4	1.7	ps	f = 266 MHz, Vdd = +3.3V or +2.5V
		–	1.4	1.7	ps	f = 312.5 MHz, Vdd = +3.3V or +2.5V
		–	1.2	1.7	ps	f = 622.08 MHz, Vdd = +3.3V or +2.5V
RMS Phase Jitter (random)	T_phj	–	0.6	0.85	ps	f = 312.5 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds

Pin Description

Pin	Map		Functionality
1	OE	Input	H or Open: specified frequency output L: output is high impedance
	$\overline{ST}$	Input	H or Open: specified frequency output L: Device goes to sleep mode. Supply current reduces to I_std.
2	NC	NA	No Connect; Leave it floating or connect to GND for better heat dissipation
3	GND	Power	VDD Power Supply Ground
4	OUT+	Output	Oscillator output
5	OUT-	Output	Complementary oscillator output
6	VDD	Power	Power supply voltage

Top View

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OE/ST  1        6  VDD
NC     2        5  OUT-
GND    3        4  OUT+
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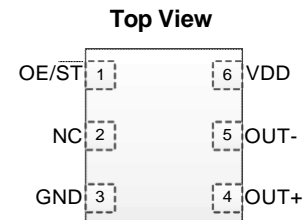
Absolute Maximum

Attempted operation outside the absolute maximum ratings of the part may cause permanent damage to the part. Actual perfor- mance of the IC is only guaranteed within the operational specifications, not at absolute maximum ratings.

Parameter	Min.	Max.	Unit
Storage Temperature	-65	+150	°C
VDD	-0.5	+4.0	V
Electrostatic Discharge (HBM)	–	+2000	V
Soldering Temperature (follow standard Pb free soldering guidelines)	–	+260	°C

Thermal Consideration

Package	θJA, 4 Layer Board (°C/W)	θJC, Bottom (°C/W)
7050, 6-pin	142	27
5032, 6-pin	97	20
3225, 6-pin	109	20

Environmental Compliance

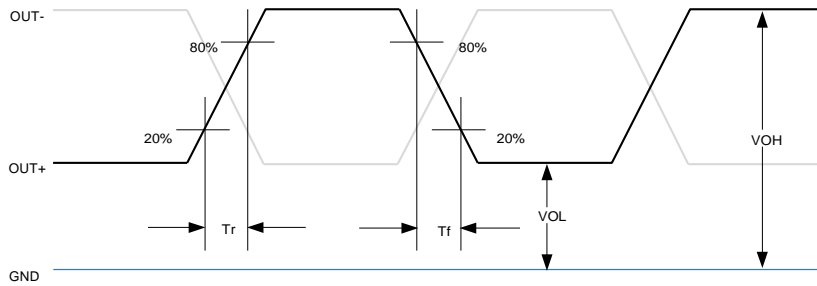| Parameter	Condition/Test Method
Mechanical Shock	MIL-STD-883F, Method 2002
Mechanical Vibration	MIL-STD-883F, Method 2007
Temperature Cycle	JESD22, Method A104
Solderability	MIL-STD-883F, Method 2003
Moisture Sensitivity Level	MSL1 @ 260°C

Waveform Diagrams

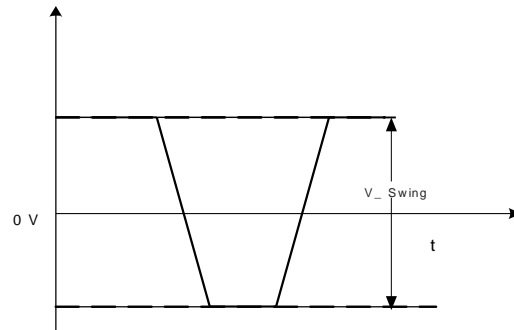**Figure 1(a). LVPECL Voltage Levels per Differential Pin (OUT+/OUT-)**

Figure 1(b). LVPECL Voltage Levels Across Differential Pair

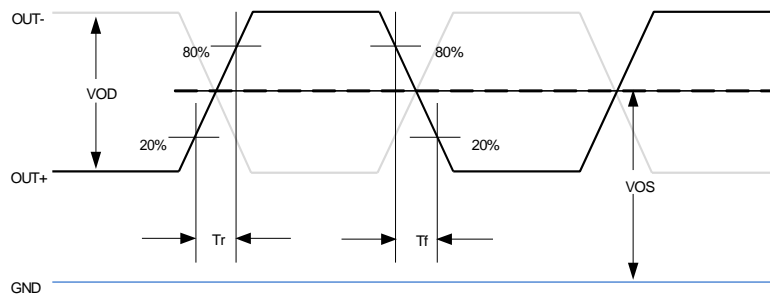**Figure 2. LVDS Voltage Levels per Differential Pin (OUT+/OUT-)**

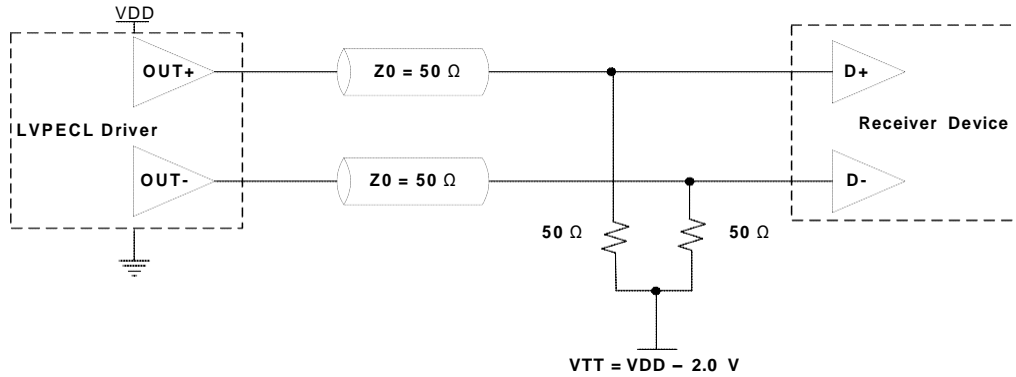## Termination Diagrams

LVPECL:

Figure 3. LVPECL Typical Termination
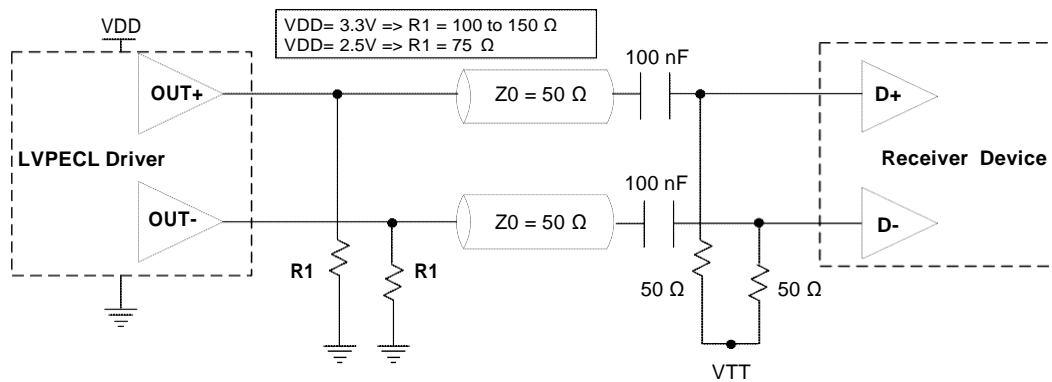
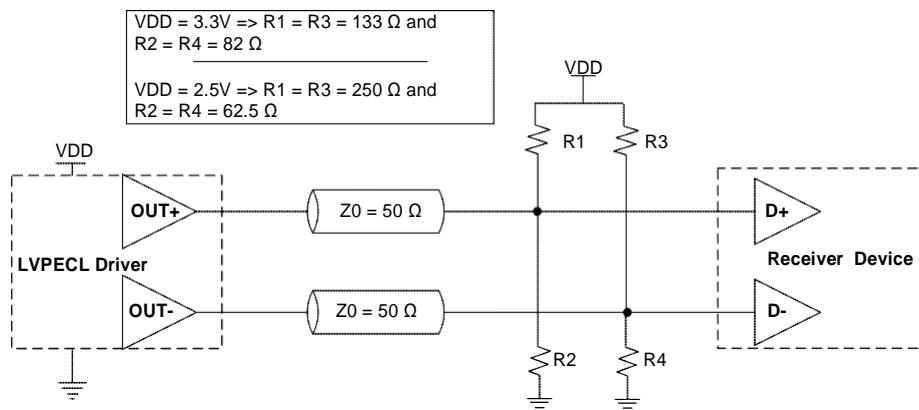**Figure 4. LVPECL AC Coupled Termination**

Figure 5. LVPECL with Thevenin Typical Termination

LVDS:

VDD

OUT+

Z0 = 50 Ω

D+

LVDS Driver

100 Ω

Receiver Device

OUT-

Z0 = 50 Ω

D-
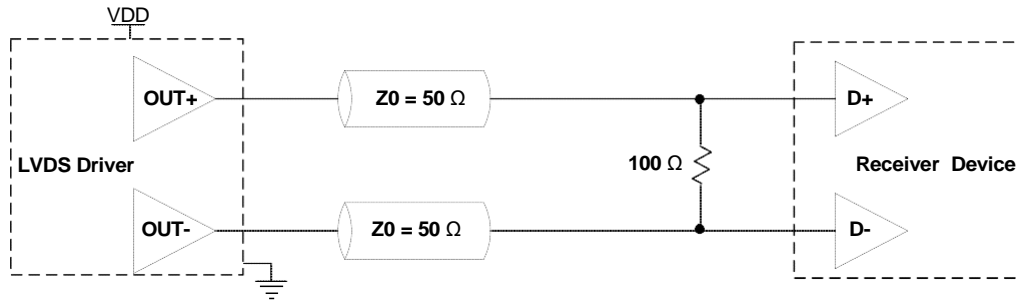
Figure 6. LVDS Single Termination (Load Terminated)

Dimensions and Patterns

Package Size – Dimensions (Unit: mm)[1]	Recommended Land Pattern (Unit: mm)[2]
3.2 x 2.5x 0.75 mm	

3.2±0.05
#6 #5 #4
YXXXX
2.5±0.05
#1 #2 #3
0.75±0.05

2.20
#4 #5 #6
0.9
#3 #2 #1
0.7
0.6

2.25
1.6
1.00
0.65 1.05

| **5.0 x 3.2 x 0.75 mm** | |

5.0±0.10
#6 #5 #4
YXXXX
3.2±0.10
#1 #2 #3
0.75±0.05

2.54
#4 #5 #6
1.20
#3 #2 #1
0.90
0.64

2.54
2.20
1.20
0.90

| **7.0 x 5.0x 0.90 mm** | |

7.0±0.10
#6 #5 #4
YXXXX
5.0±0.10
#1 #2 #3
0.90 ±0.10

5.08
#4 #5 #6
2.60
#3 #2 #1
1.10
1.40

5.08
3.80
1.60
1.60

Notes:
1. Top Marking: Y denotes manufacturing origin and XXXX denotes manufacturing lot number. The value of "Y" will depend on the assembly location of the device.
2. A capacitor of value 0.1 µF between Vdd and GND is recommended.

Ordering Information

M O 9 1 2 2 D B 6 - B 0 H - 3 3 E 0 - 0 2 2 0 1 2 3 4 5 6 T

Part Family
"MO9122"

Temmpeature Range
"D" Extended Commercial -20ºC to +70ºC
"I" Industrial   -40ºC to +85ºC

Package Size
"D6" 3.2 x 2.5 mm
"B6" 5.0 x 3.2 mm
"A6" 7.0 x 5.0 mm

Signaling Type
"B" LVPECL
"D" LVDS

Signaling Function
"0" Default

Frequency Stability
"F" ±10ppm
"G" ±20ppm
"H" ±25ppm
"K" ±50ppm

Packing
"Y" 12/16mm Tape & Reel, 1ku reel
"X" 12/16mm Tape & Reel, 250u reel
"D" 8mm Tape & Reel, 3ku reel
"E" 8mm Tape & Reel, 1ku reel
"G" 8mm Tape & Reel, 250u reel

Frequency
220.000000 MHz to 625.000000 MHz
 cf.) 220.000000 MHz -> "0220000000"
    625.000000 MHz -> "0625000000"

Function
"0" No Function

Feature Pin (#1 pin)
"E" Output Enable
"S" Standby

Supply Voltage
"25" +2.5V ±10%
"33" +3.3V ±10%
"XX" +2.25V to +3.63V

Frequencies Not Supported

Range 1: From 251.000001 MHz to 263.999999 MHz
Range 2: From 314.000001 MHz to 422.999999 MHz
Range 3: From 502.000001 MHz to 527.999999 MHz

Ordering Codes for Supported Tape & Reel Packing Method

Device Size	8 mm T&R (3ku)	8 mm T&R (1ku)	8 mm T&R (250u)	12 mm T&R (1ku)	12 mm T&R (250u)	16 mm T&R (1ku)	16 mm T&R (250u)
7.0 x 5.0 mm	–	–	–	–	–	Y	X
5.0 x 3.2 mm	–	–	–	Y	X	–	–
3.2 x 2.5 mm	D	E	G	–	–	–	–

Revision History

Version	Release Date	Change Summary
1.01	2/20/13	Original
1.02	12/3/13	Added input specifications, LVPECL/LVDS waveforms, packaging T&R options
1.03	2/6/14	Added 8mm T&R option and ±10 ppm
1.04	7/23/14	Include Thermal Consideration Table
1.05	10/6/14	Modified Thermal Consideration values