OKI SEMICONDUCTOR

Dear customers,

About the change in the name such as "Oki Electric Industry Co. Ltd." and "OKI" in documents to OKI Semiconductor Co., Ltd.

The semiconductor business of Oki Electric Industry Co., Ltd. was succeeded to OKI Semiconductor Co., Ltd. on October 1, 2008. Therefore, please accept that although the terms and marks of "Oki Electric Industry Co., Ltd.", “Oki Electric”, and "OKI" remain in the documents, they all have been changed to "OKI Semiconductor Co., Ltd.". It is a change of the company name, the company trademark, and the logo, etc. , and NOT a content change in documents.

October 1, 2008
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OKI SEMICONDUCTOR

Electronic Components

October 1, 2008
ODHKGL5115KD-06

KGL5115KD

11.3 Gbps Modulator Driver IC

FEATURES

- Maximum Input Data Rate : up to 11.3Gbps
- Output Amplitude : up to 2.3Vpp
- Maximum Output Offset : 1.0V at 50Ω Load
- Crossing Point Controllability : 35% - 80%
- Small Package : 4 x 4 mm QFN
- Low Power Consumption : 0.45W @ 2.3Vpp Output and output AC coupled using Bias-T.

APPLICATIONS

- Sonet OC-192 / STM64 Transmission System up to 11.3Gbps
- WDM System
- 10GBE System
- Optical Transponder/Transceiver/Transmitter
- 300Pin / XENPAK / Xpak / X2 /XFP
- Sonet/SDH Test Equipment

GENERAL DESCRIPTIONS

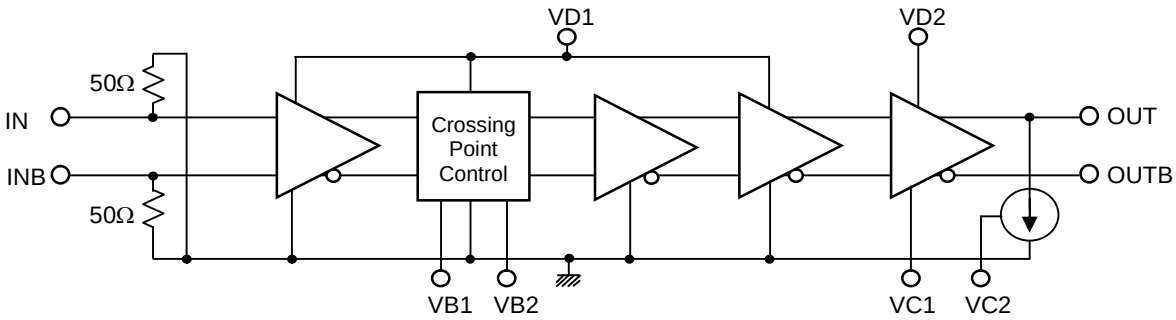
KGL5115KD is a high performance electroabsorption modulator and direct modulated LASER diode driver IC for sonet/SDH and 10GBE applications up to 11.3Gbps.

The device provids typically 2.3Vpp output , output amplitude control, output offset control and output crossing point (X-Point)control.
KGL5115KD data input accepts single-ended or differential AC coupled signal. KGL5115KD suports differential DC coupled or AC coupled (using external bias tee) output.
The output amplitude is able to be controled from 0.8Vpp up to 2.3Vpp by bias voltage of VC1. The output offset can be tuned over 1.0V by bias voltage of VC2. The output crossing point (X-Point) is capable of adjusting from 35% to 80% of the output eye diagram via the differential voltage between VB1 and VB2.

KGL5115KD is very low power device, typical power consumption is 0.58W at output DC coupled and 2.3Vpp output amplitude condition or 0.45W at output AC coupled using bias tee and 2.3Vpp output amplitude condition. KGL5115KD is sutable for small form factor application such as XFP.

The package of KGL5115KD is 4 x 4mm QFN package.

FUNCTION DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit	Note
Supply Voltage	VD1	-0.3	4.0	V	
Supply Voltage of Output Stage	VD2	-0.3	6.0	V	DC coupled [2]
		-0.3	4.0	V	AC coupled using Bias-Tee[3]
X-Point Control and Reference Voltage	VB1/VB2	-1.0	2.4	V	
Output Amplitude Control Voltage	VC1	-1.0	1.6	V	
Output Bias Control Voltage	VC2	-1.0	2.6	V	
Input Amplitude	Vin	-	1.5	Vpp	AC coupled
Operating Temperature at Package Base	Ts	-45	100	°C	
Storage Temperature	Tst	-45	125	°C	

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit	Note
Supply Voltage	VD1	3.0	3.3	3.47	V	
Supply Voltage of Output Stage	VD2	4.5	5.0	5.25	V	DC coupled [2]
		3.0	3.3	3.47	V	AC coupled using Bias-Tee[3]
X-Point Control Voltage	VB1	0.4	1.2	2.0	V	
X-Point Reference Voltage	VB2[1]	1.0	1.2	1.4	V	
Output Amplitude Control Voltage	VC1	0	-	1.2	V	
Output Bias Control Voltage	VC2	0	-	2.4	V	
Single-ended Input Amplitude	Vin	0.4	-	1.2	Vpp	AC coupled
Differential Input Amplitude[4]		0.2	-	1.2	Vpp	AC coupled
Operating Temperature at Package Base	Ts	-40	-	95	°C	
Input Interface	AC coupled (External blocking capacitor is required)					
Output Interface	DC coupled (Need 50Ω termination to VD2) [2] or AC coupled using Bias-Tee[3]					

1) VB2 can be open or biased by the external circuit. For VB2 opened, VB2 is biased at about 0.364 x VD1.
2) Refer to TYPICAL APPLICATION (Output DC coupled) of page 6.
3) Refer to TYPICAL APPLICATION (Output AC coupled) of page 7.
4) The value is amplitude into each port (IN/INB).

ELECTRICAL CHARACTERISTICS

♦ Temperature range : -5°C ~ 85°C

This table is electrical characteristics at "OUT" port.

Parameter		Symbol	Condition	Min	Typ	Max	Unit
Maximum Input Data Rate			NRZ	11.3	-	-	Gbps
Supply Current		Id1		-	50	75	mA
Supply Current		Id2	Condition2, VC1=1.2V, VC2=0V	-	80	120	mA
			Condition1, VC1=1.2V, VC2=2.4V	-	120	165	mA
Power Consumption		Pwr	Condition2, 2.3Vpp	-	0.45	-	W
			Condition1, 2.3Vpp, No Offset	-	0.58	-	
Minimum Output Amplitude		Vo(min)	50 Ω load	-	-	1.2	Vpp
Maximum Output Amplitude		Vo(max)	No Offset, 50 Ω load	2.3	-	-	Vpp
Amplitude Monitor Resistance		Rmod	Ta = R.T.	-	2.0	-	Ω
Output High Voltage		V(HI)	Condition1, No Offset	VD2-0.5	-	VD2	V
Output High Voltage Offset		Vo(ofs)	Condition1	1.0	-	-	V
Minimum Output Low Voltage		V(LO)	Condition1	-	1.7	1.9	V
Bias Monitor Resistance		Rbias	Ta = R.T.	-	2.0	-	Ω
X-Point Control Range	High	XPH	50 Ω load, NRZ	75	80	-	%
	Low	XPL		-	35	40	
X-Point Stability		Del (Xp)	50 Ω load, -5 – 85°C	-10	-	10	%
Output Rise/Fall Time		Tr/Tf	50 Ω load, 20% – 80%	-	28	40	ps
Input Return Loss		S11	100kHz–10GHz	-	12	-	dB

Note) Condition1 : VD2=5.0V, 50Ω load, output DC coupled
Condition2 : VD2=3.3V, 50Ω load, output AC coupled using Bias-T

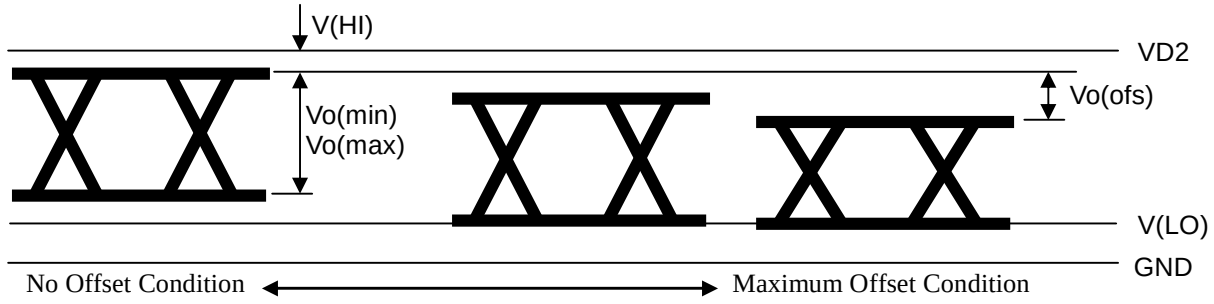
♦ Temperature range : -40°C ~ 95°C

This table is electrical characteristics at "OUT" port.

Parameter		Symbol	Condition	Min	Typ	Max	Unit
Maximum Input Data Rate			NRZ	11.3	-	-	Gbps
Supply Current		Id1		-	50	78	mA
Supply Current		Id2	Condition2, VC1=1.2V, VC2=0V	-	80	122	mA
			Condition1, VC1=1.2V, VC2=2.4V	-	120	167	mA
Power Consumption		Pwr	Condition2, 2.3Vpp	-	0.45	-	W
			Condition1, 2.3Vpp, No Offset	-	0.58	-	
Minimum Output Amplitude		Vo(min)	50 Ω load	-	-	1.2	Vpp
Maximum Output Amplitude		Vo(max)	No Offset, 50 Ω load	2.2	-	-	Vpp
Amplitude Monitor Resistance		Rmod	Ta = R.T.	-	2.0	-	Ω
Output High Voltage		V(HI)	Condition1, No Offset	VD2-0.5	-	VD2	V
Output High Voltage Offset		Vo(ofs)	Condition1	0.95	-	-	V
Minimum Output Low Voltage		V(LO)	Condition1	-	1.7	2.0	V
Bias Monitor Resistance		Rbias	Ta = R.T.	-	2.0	-	Ω
X-Point Control Range	High	XPH	50 Ω load, NRZ	73	80	-	%
	Low	XPL		-	35	40	
X-Point Stability		Del (Xp)	50 Ω load, -40 – 95°C	-12	-	12	%
Output Rise/Fall Time		Tr/Tf	50 Ω load, 20% – 80%	-	28	42	ps
Input Return Loss		S11	100kHz–10GHz	-	12	-	dB

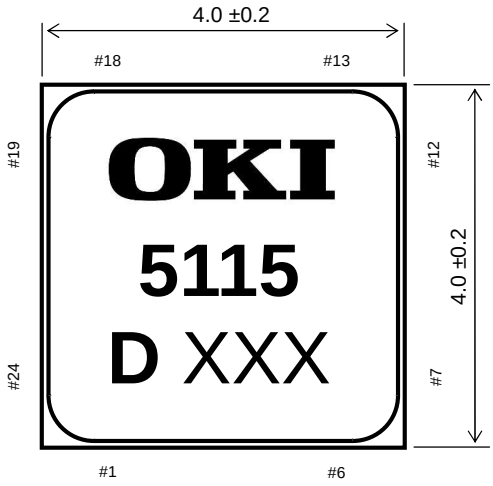
Note) Condition1 : VD2=5.0V, 50Ω load, output DC coupled
Condition2 : VD2=3.3V, 50Ω load, output AC coupled using Bias-T

1) Output high voltage with offset control is defined by "V(HI)-Vo(ofs)

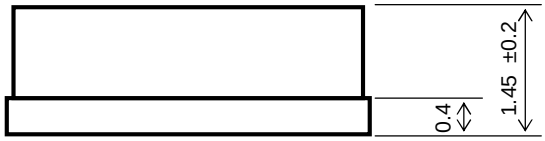


PACKAGE DIMENSIONS

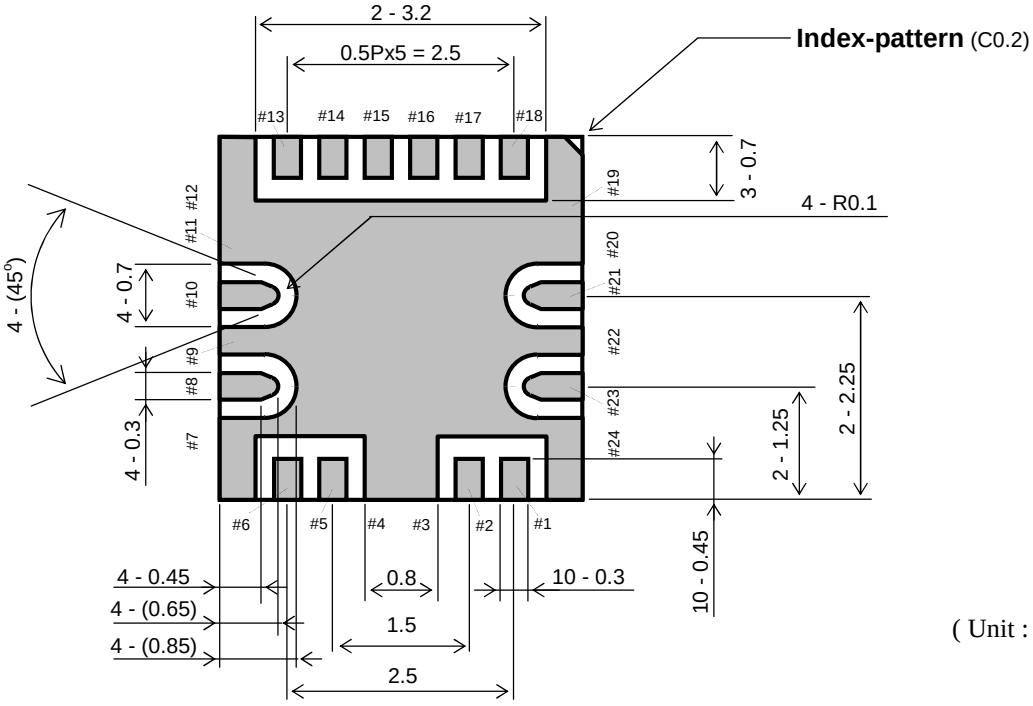
(Top View)



(Side View)



(Bottom View)



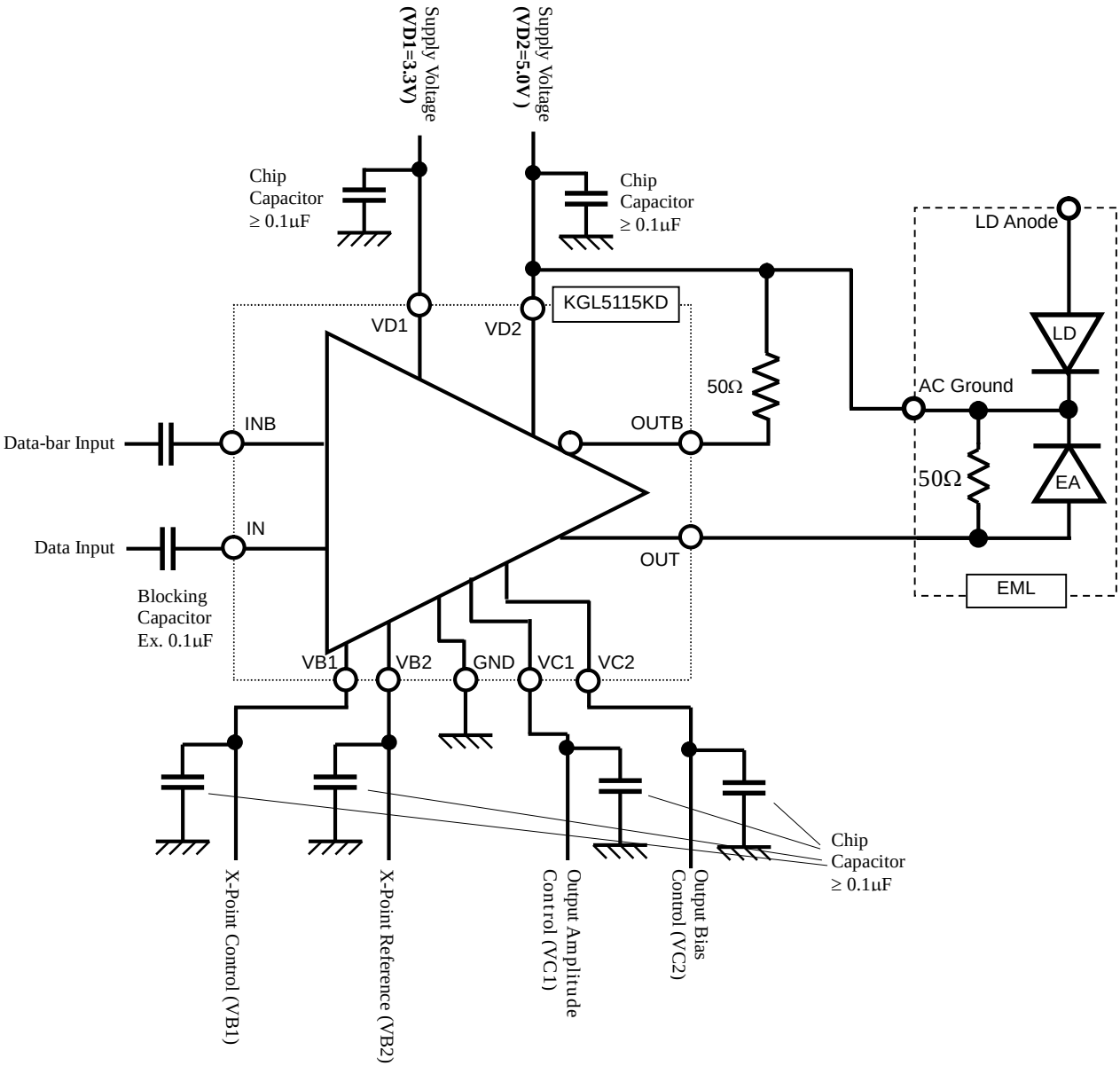
(Unit : mm)

PIN CONNECTION

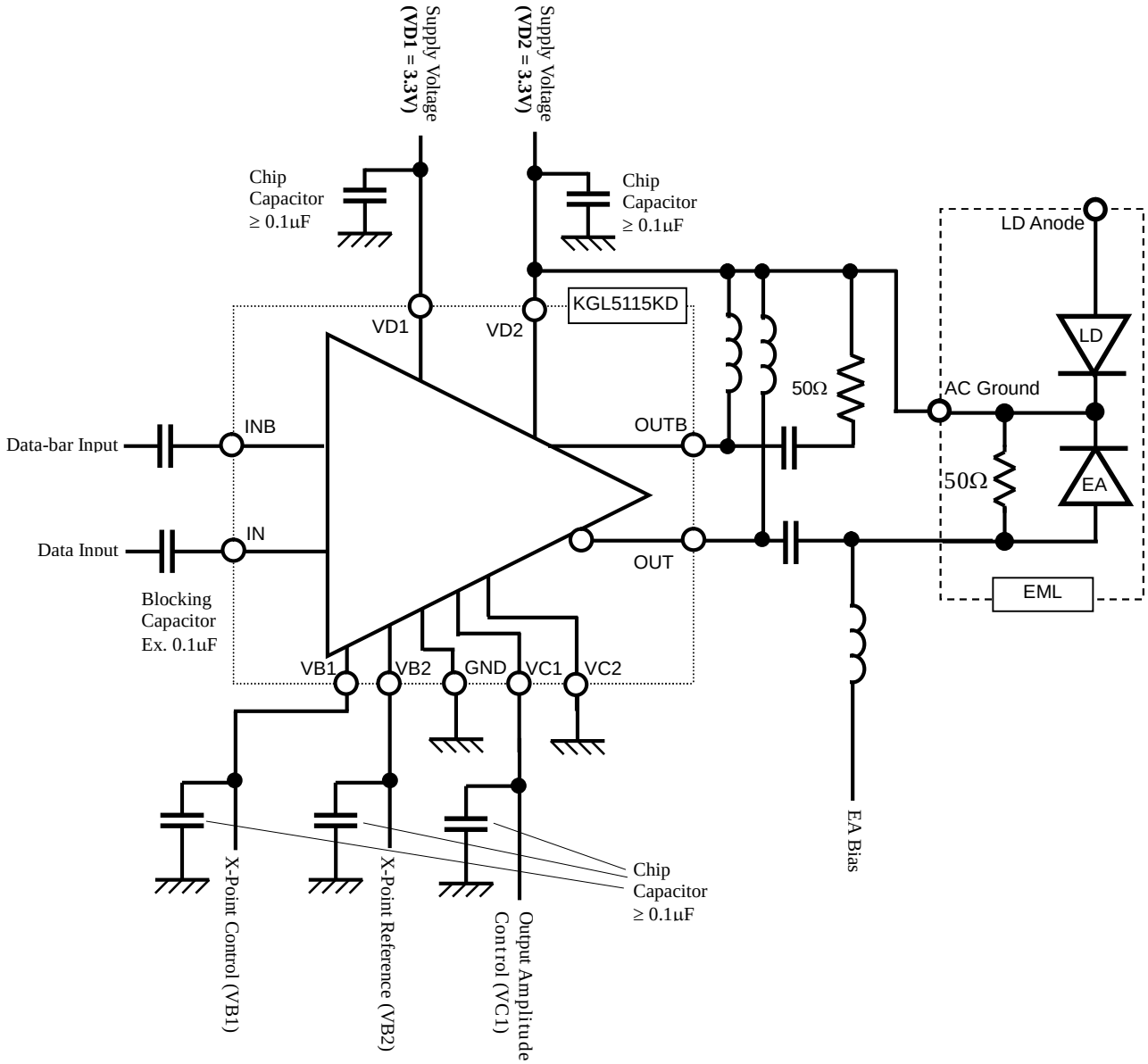
No.	Symbol	Note
1	GND	Ground
2	GND	Ground
3	GND	Ground
4	GND	Ground
5	Rmod	Amplitude Monitor Output Port
6	Rbias	Bias Monitor Output Port
7	GND	Ground
8	OUT	Output Port
9	GND	Ground
10	OUTB	Inverted Output Port
11	GND	Ground
12	GND	Ground
13	VC2	Output Bias Control Port
14	VC1	Output Amplitude Control Port
15	VD2	Supply Voltage Port
16	VD1	Supply Voltage Port
17	VB2	X-Point Reference Port
18	VB1	X-Point Control Port
19	GND	Ground
20	GND	Ground
21	INB	Inverted Input Port
22	GND	Ground
23	IN	Signal Input Port
24	GND	Ground

Note : This package is non-hermetic.

TYPICAL APPLICATION (DC coupled)



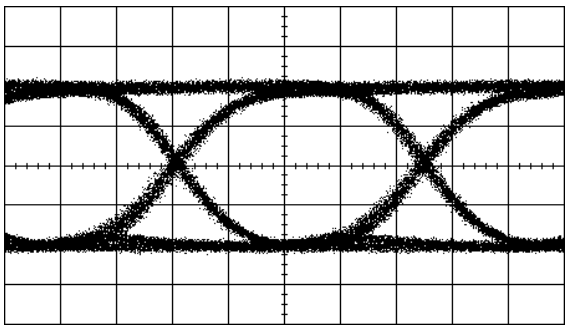
TYPICAL APPLICATION (AC coupled)



TYPICAL CHARACTERISTICS (OUTPUT AC COUPLED CONDITION)

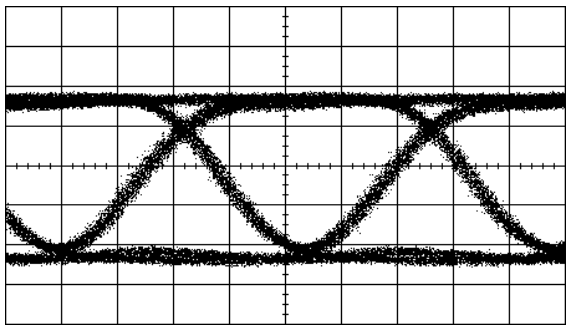
Input Signal : 11.3Gbps, NRZ PN31, Differential 0.2Vp-p (each port)
VD1=3.3V, VD2=3.3V
Display Factor V:600mV/div, H:20ps/div
Test circuit diagram of these measurements is shown in page 9.

2.3Vpp Output, Xp=50%

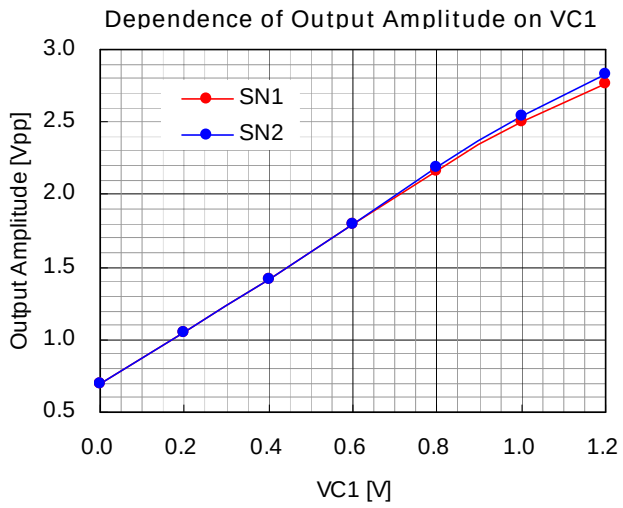


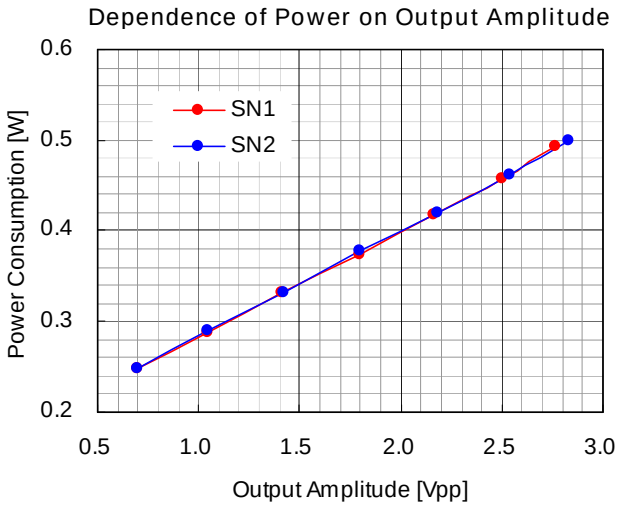
ID1 : 51.7mA
ID2 : 81.0mA
Power : 0.438W
Amplitude : 2.34Vpp
Tr : 29.8
Tf : 26.2ps
Xp : 53.0%

2.3Vpp Output, Xp=80%

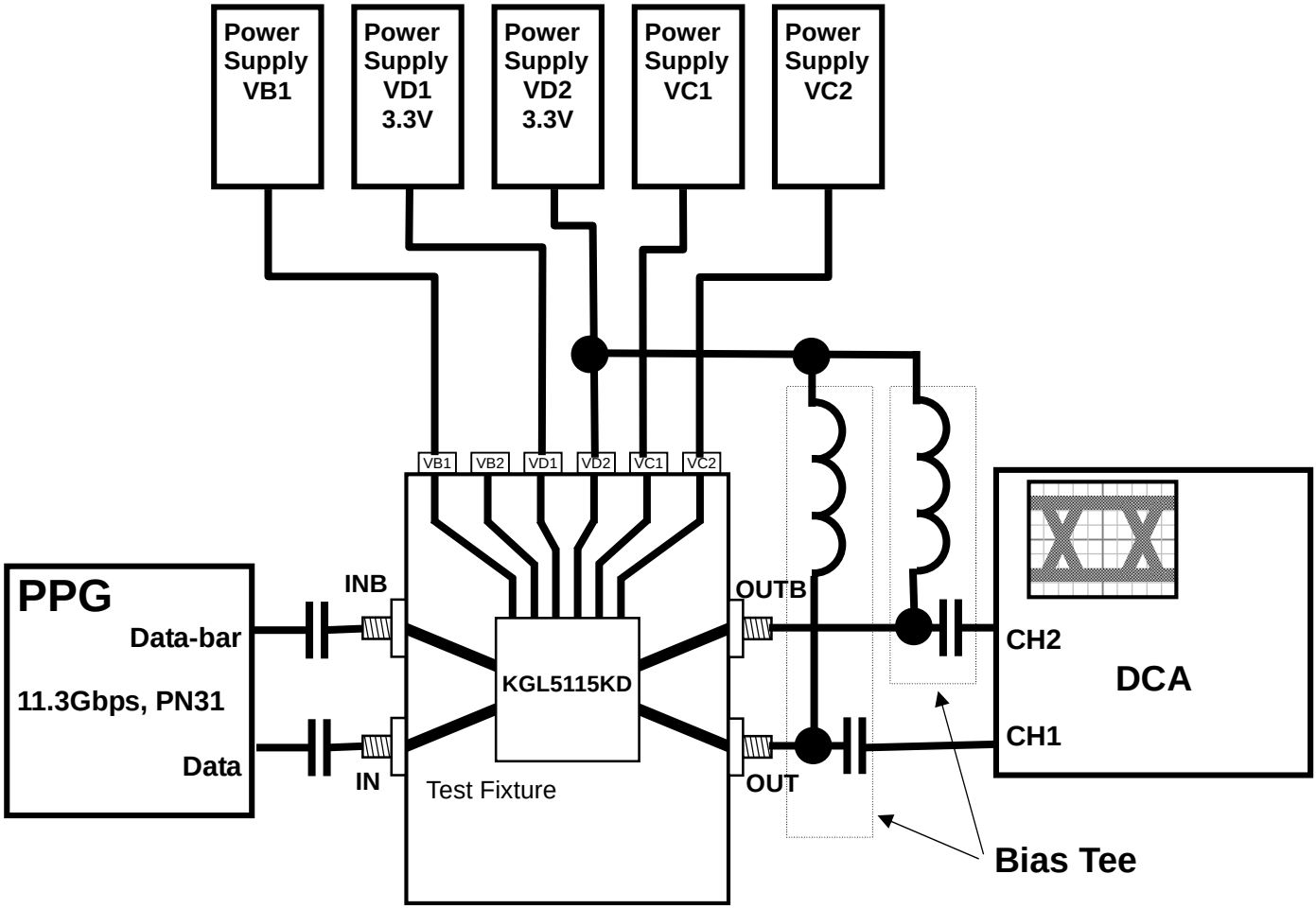


ID1 : 51.7mA
ID2 : 81.0mA
Power : 0.438W
Amplitude : 2.33Vpp
Tr : 29.3
Tf : 27.1ps
Xp : 81.3%





TEST CIRCUIT EXAMPLE AT OUTPUT AC COUPLED CONDITION



APPLICATION NOTE

1. For stable operation;
   To prevent a dependence of "X-Point" on the supply voltage VD1,
   Case 1 : VB2 is open
   VB2 is biased at about 0.364 x VD1 (1.2V@VD1=3.3V) by the internal circuit.
   Control VB1, so that the voltage difference "VB1−VB2" is constant.
   Case 2 : VB2 is biased
   Bias VB2 at about 1.2V by using the external voltage source independent of VD1.
   Control VB1 by using the external voltage source independent of VD1.

2. Power-up/shut-down sequence;
   For power-up, supply voltage (VD2) at first, next supply voltage (VD1), then control voltages (VB1, (VB2), VC1, VC2).
   For shut-down, control voltages(VB1, (VB2), VC1, VC2). at first, next VD1, then VD2.
   Customer does not need to care about the sequence for the control voltages (VB1,(VB2),VC1,VC2).

TYPICAL PCB LAYOUT AND ASSEMBLING INFORMATION

Please request us the application note named GTD18791 and GTD18806.

ESD CONSIDERATIONS

This device can be damaged by ESD; therefore appropriate precautions must be taken to avoid exposure to ESD and EOS during handling, assembly, and testing of these devices. Failure to adhere to proper ESD/EOS precautions during handling and assembly of these devices can damage or adversely affect device reliability.

SAFETY AND HANDLING INFORMATION ON GaAs DEVICES

Arsenic Compound (GaAs Devices)
The product contains arsenic (As) as a compound.
This material is stable for normal use, however, its dust or vapor may be potentially hazardous to the human body.
Avoid ingestion, fracture, burning or chemical treatment to the product.

- Do not put the product in your mouth.
- Do not burn or destroy the product.
- Do not perform chemical treatment for the product.

Keep laws and ordinances related to the disposal of the products.

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1. The information contained herein can change without notice owing to product and/or technical improvements. Before using the product, please make sure that the information being referred to is up-to-date.

2. The outline of action and examples for application circuits described herein have been chosen as an explanation for the standard action and performance of the product. When planning to use the product, please ensure that the external conditions are reflected in the actual circuit, assembly, and program designs.

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