LAPIS SEMICONDUCTOR

Electronic Components

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ODHKGA5115-03

KGA5115

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%
- 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

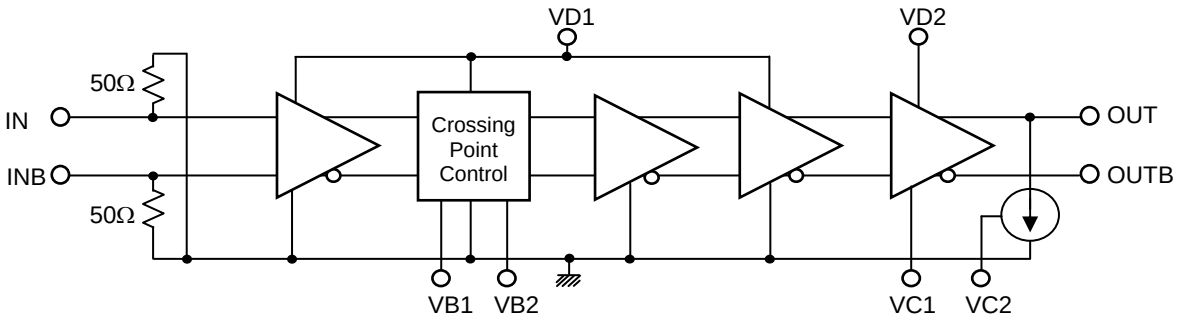
GENERAL DESCRIPTIONS

KGA5115 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.
KGA5115 data input accepts single-ended or differential AC coupled signal. KGA5115 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.

KGA5115 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. KGA5115 is sutable for small form factor application such as XFP.

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 the Back Side of the Chip	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 the Back Side of the Chip	Ts	-5	-	90	°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 5.
3) Refer to TYPICAL APPLICATION (Output AC coupled) of page 6.
4) The value is amplitude into each port (IN/INB).

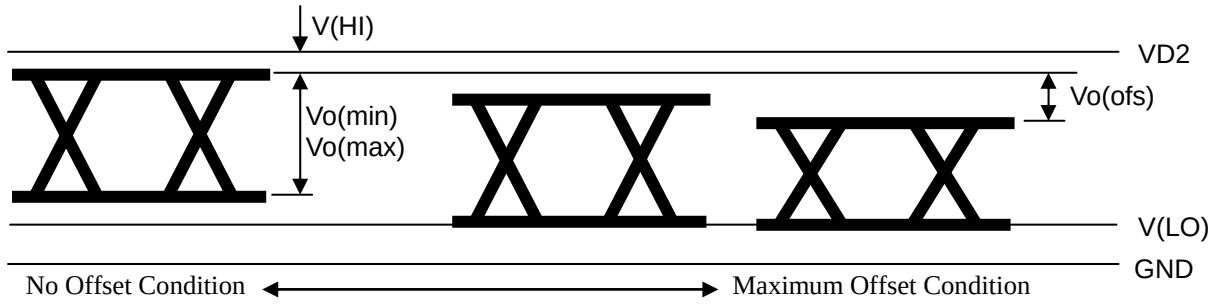
ELECTRICAL CHARACTERISTICS

This table is electrical characteristics at “OUT” port.

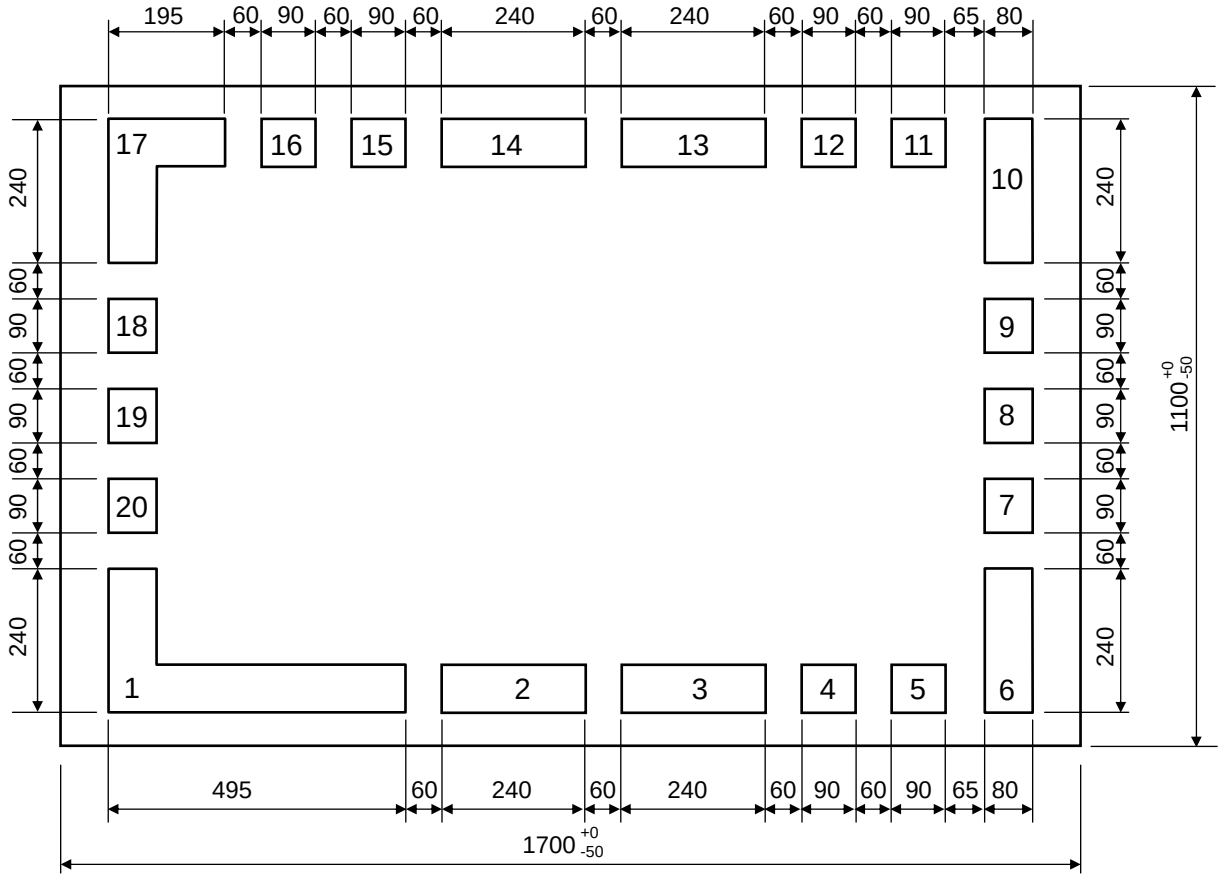
Parameter		Symbol	Condition	Min	Typ	Max	Unit
Maximum Input Data Rate			NRZ	11.3	-	-	Gbps
Supply Current		Id1		-	50	75	mA
Supply Current		Id2	Condition2, VC1=1.2V, VC2=0V	-	80	120	mA
			Condition1, VC1=1.2V, VC2=2.4V	-	120	165	mA
Power Consumption		Pwr	Condition2, 2.3Vpp	-	0.45	-	W
			Condition1, 2.3Vpp, 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, Ts=-5 – 90°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

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



CHIP DIMENSIONS



(Unit : μm)

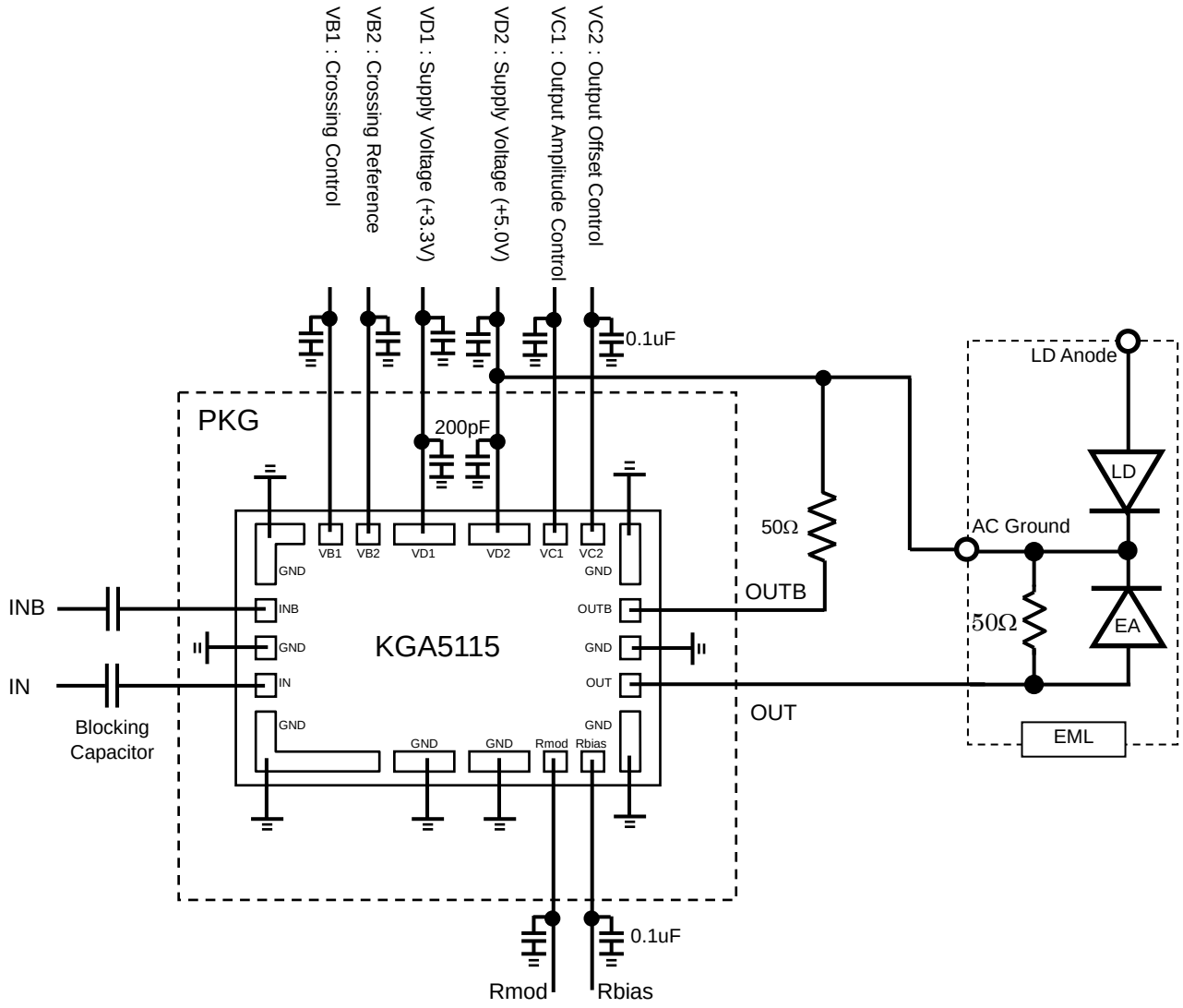
The thickness is 220 μm ± 30 μm
Back side metalization : Ti 1000Å / Au 3000Å

PAD ASSIGNMENT

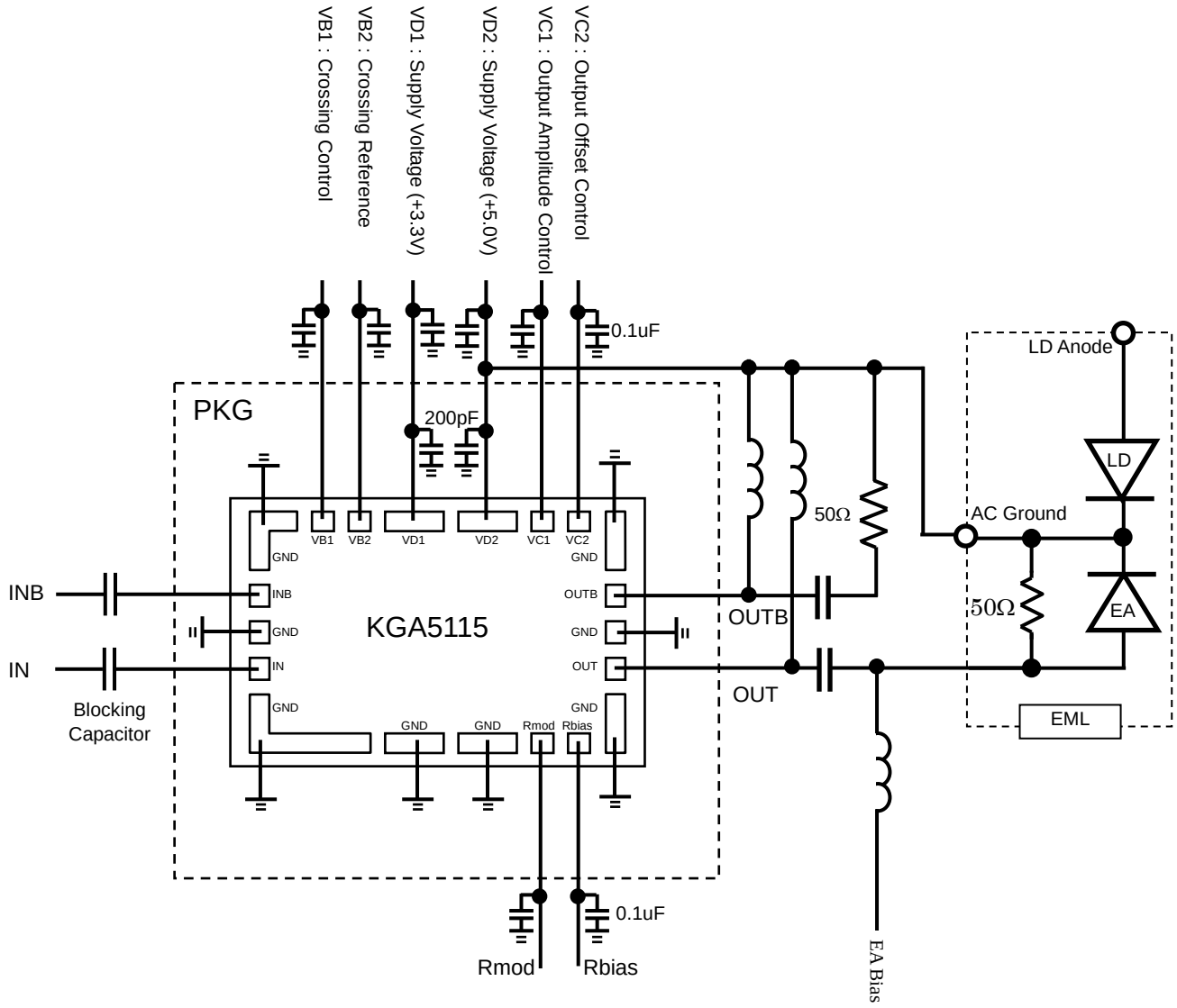
No.	Symbol	Note
1	GND	Ground
2	GND	Ground
3	GND	Ground
4	Rmod	Amplitude Monitor Output Port
5	Rbias	Bias Monitor Output Port
6	GND	Ground
7	OUT	Output Port
8	GND	Ground
9	OUTB	Inverted Output Port
10	GND	Ground

No.	Symbol	Note
11	VC2	Output Bias Control Port
12	VC1	Output Amplitude Control Port
13	VD2	Supply Voltage Port
14	VD1	Supply Voltage Port
15	VB2	X-Point Reference Port
16	VB1	X-Point Control Port
17	GND	Ground
18	INB	Inverted Input Port
19	GND	Ground
20	IN	Signal Input Port

TYPICAL APPLICATION (DC coupled)



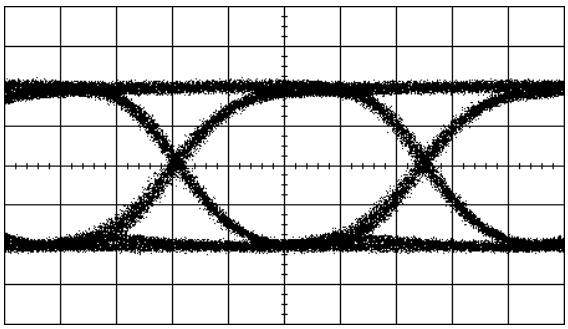
TYPICAL APPLICATION (AC coupled)



TYPICAL CHARACTERISTICS (OUTPUT AC COUPLED CONDITION)

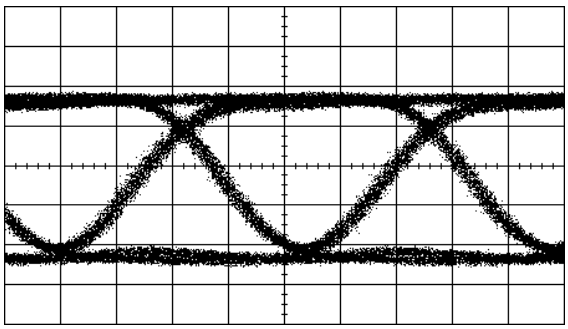
Input Signal : 11.3Gbps, NRZ PN31, Differential 0.2Vp-p (each port)
VD1=3.3V, VD2=3.3V
Display Factor V:600mV/div, H:20ps/div
Test circuit diagram of these measurements is shown in page 8.

2.3Vpp Output, Xp=50%

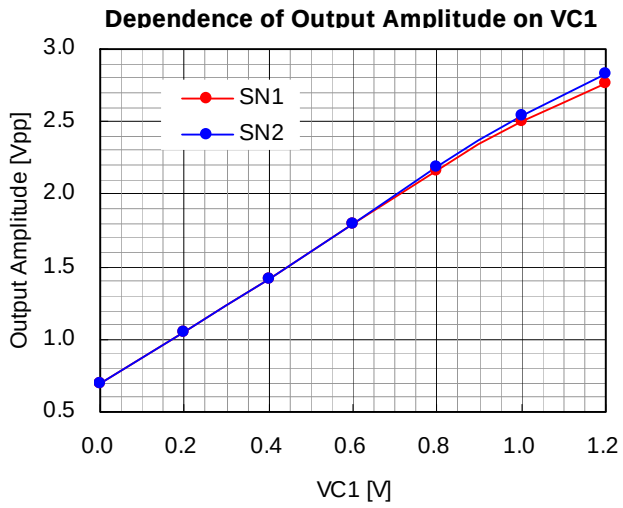


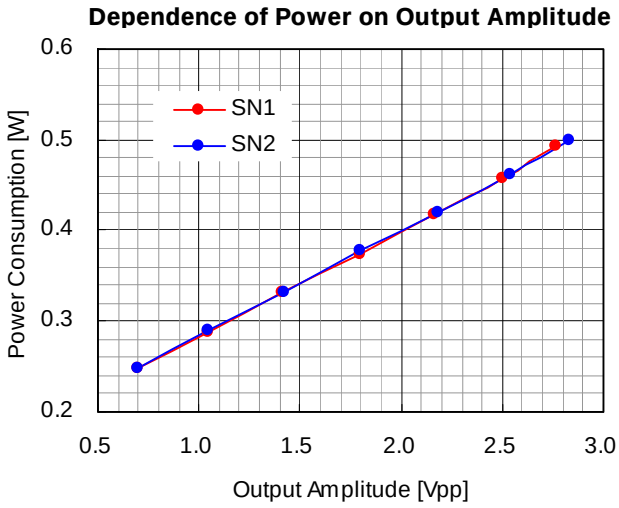
ID1 : 51.7mA
ID2 : 81.0mA
Power : 0.438W
Amplitude : 2.34Vpp
Tr : 29.8
Tf : 26.2ps
Xp : 53.0%

2.3Vpp Output, Xp=80%



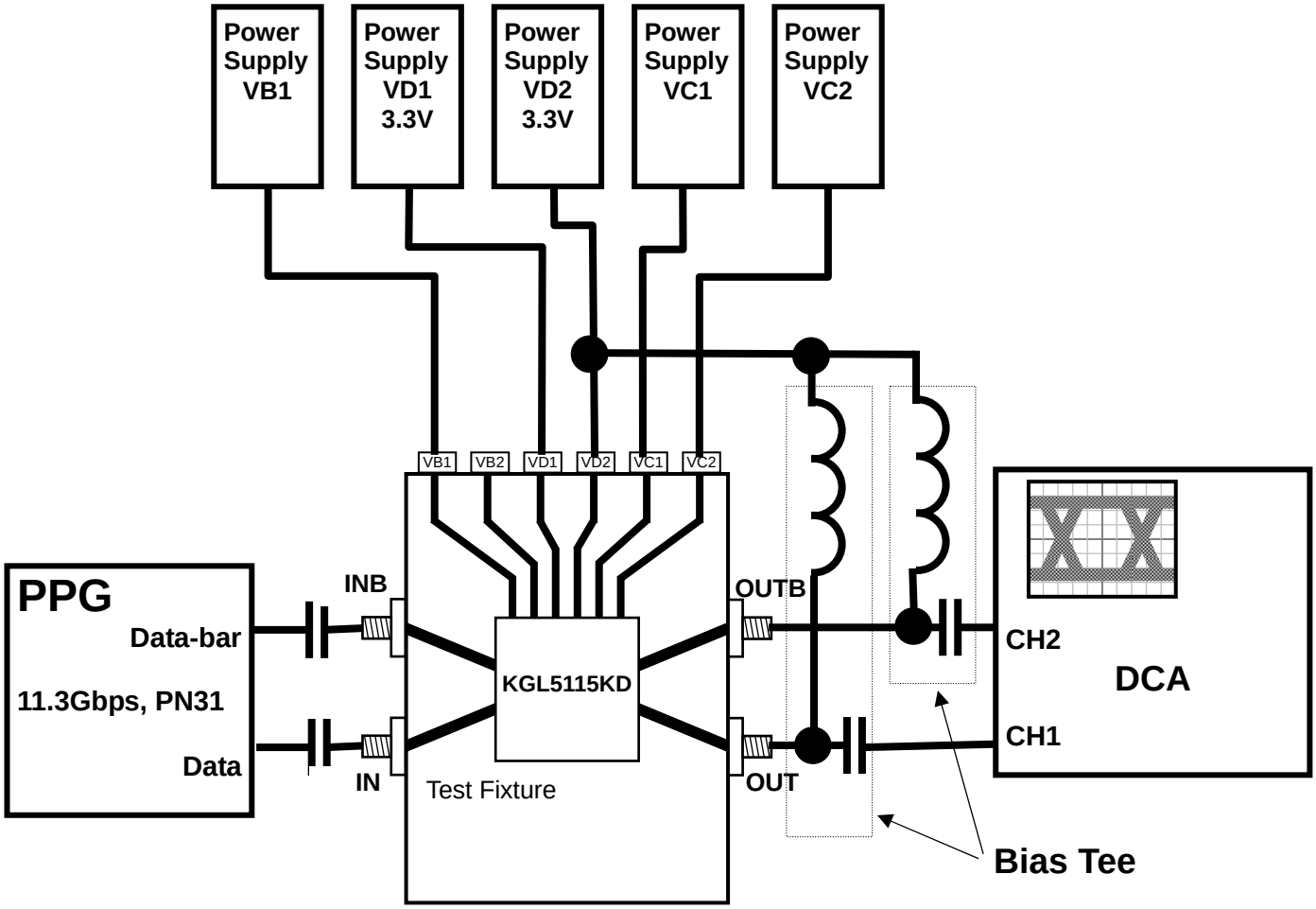
ID1 : 51.7mA
ID2 : 81.0mA
Power : 0.438W
Amplitude : 2.33Vpp
Tr : 29.3
Tf : 27.1ps
Xp : 81.3%





These measurements are performed for a packaged IC (KGL5115KD).

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).

ASSEMBLY AND ESD CONSIDERATION

This device has air-bridge structures on the die surface. Do not use a vacuum tool to pick-up the device and do not touch the surface, in order not to damage to the air-bridges.
Please keep temperature below 300degC during assembling process.
This device is recommended to be used in a hermetic environment, because the humidity stress test is not performed. In a non-hermetic environment, the long term reliability is not guaranteed.
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 the device.

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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