KGL4126FA

10.7 Gbps Mach-Zehnder Modulator Driver IC

FEATURES

- High Output Voltage: Maximum Amplitude > 6.0 Vpp
- X-Point Control Function
- Output Amplitude Control Function

APPLICATIONS

- SONET OC-192 and SDH STM-64 Transmission Systems up to 10.7 Gbps
- DWDM Systems
- Optical Transmitters/Transceivers/Transponders
- SONET/SDH Test Equipment

GENERAL DESCRIPTION

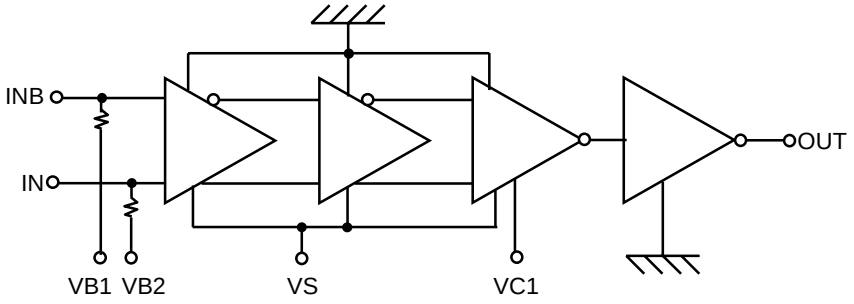
The KGL4126FA is a high performance Mach Zehnder Modulator driver for SONET/SDH and 10GbE applications up to 10.7Gb/s. The device provides a single-ended output voltage > 6Vpp, output amplitude control, and duty cycle (X-Point) control.

The KGL4126FA data input accepts single ended or differential AC-coupled signals. External Capacitors for AC Termination and Blocking Capacitors are Required. The device provides a minimum of 6 Vpp output voltage AC coupled to a 50-ohm load. The output amplitude can be tuned by varying VD, which is supplied at the output port using an external Bias-T.

The KGL4126FA is capable of adjusting the crossing point (X-point) from 45% to 55% of the output eye diagram via the differential voltage between VB1 and VB2. The device specifications are guaranteed for all crossing points from 45% to 55%.

The KGL4126FA is packaged in a high performance 20-pin 12mm QFP package.

KGL4126FA BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit	Note
Supply Voltage	VS	-6.5	0.3	V	
X-Point Control Voltage	VB1	VS-4.5 (Min. -6.5)	VS+2.0 (Max. 0.3)	V	
Current Source FET Gate Bias Voltage	VC1	-6.5	VS+1.2 (Max. 0.3)	V	
DC Bias for Output Stage Amplifier	VD	0	5.0	V	
Operating Temperature at Package Base	Ts	-10	100	°C	
Storage Temperature	Tst	-40	125	°C	

RECOMMENDED OPERATING CONDITIONS

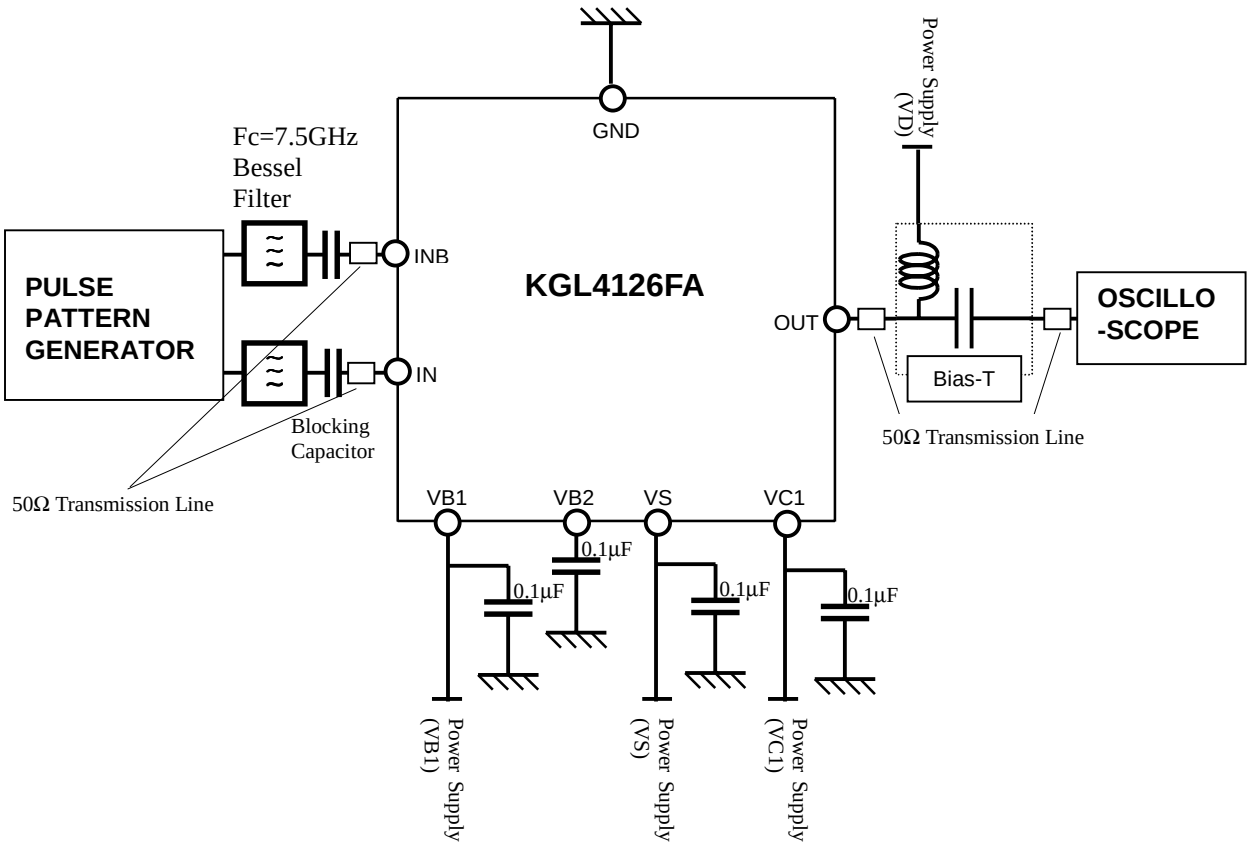
Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	VS	-5.46		-4.94	V
DC Bias for Output Stage Amplifier *1,2	VD	2.0		4.0	V
X-Point Control Voltage	VB1	VS+1.1		VS+1.5	V
Current Source FET Gate Bias Voltage *1,3	VC1	VS	VS+0.85	VS+1.0	V
Input Amplitude : Differential	Vin	0.25		1	Vpp
: Single – Ended		0.5		1	Vpp
Operating Temperature at Package Base	Ts	0		70	°C
Input Interface	AC coupled (External blocking capacitor is required)				
Output Interface	AC coupled (External Bias-T is required for VD)				

*1 Output amplitude can be tuned by control voltage VD.
*2 VD is supplied at Output Port using External Bias-T.
*3 It is recommended to set VC1 to a fixed value between VS+0.7V and VS+1.0V.

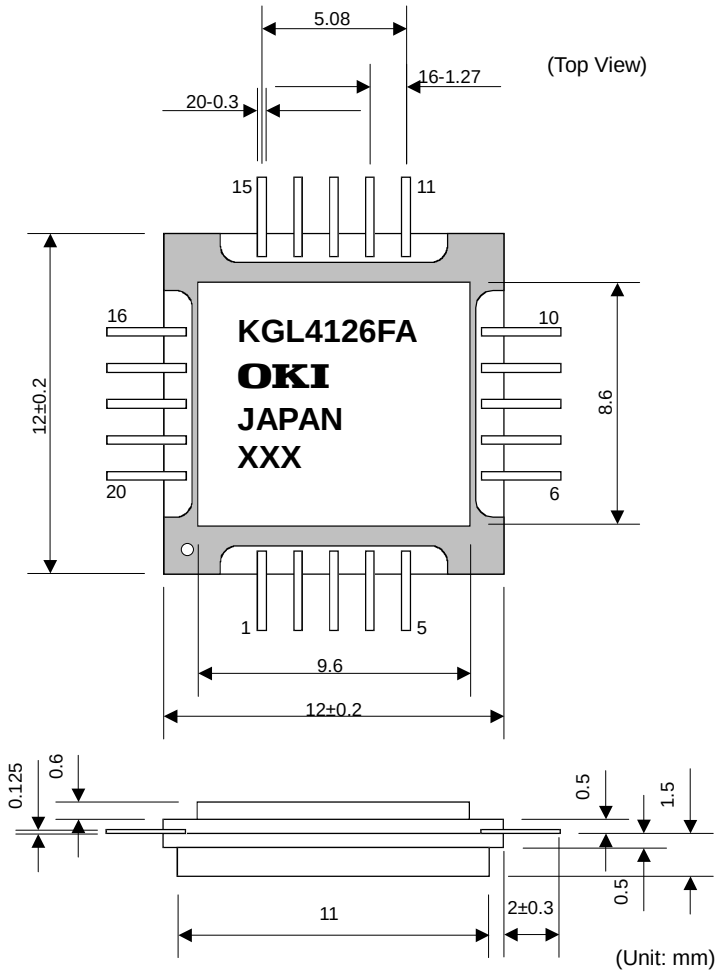
ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Data Rate		NRZ	10.7			Gbps
Supply Current of VS	Iss	X-Point : 45% - 55%		210	250	mA
Supply Current of VD	ID	Supply DC Bias by Bias-T		90	130	mA
Output Amplitude (Max)	Vo (Max)	50 Ω load,(AC Coupled)	6.0			Vpp
X-Point Control	Xp	NRZ, 50 Ω load	45		55	%
Output Rise/Fall Time	Tr/Tf	50 Ω load 20%-80%			40	ps
Input Return Loss	S11	100kHz–10 GHz		13		dB

AC CHARACTERISTICS TEST CIRCUIT



PACKAGE DIMENSIONS



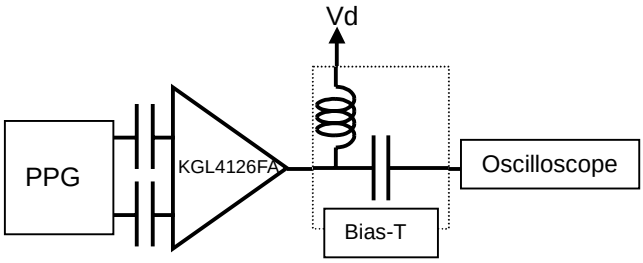
PIN CONNECTIONS

No.	Symbol	Note
1	GND	Ground
2	GND	Ground
3	GND	Ground
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	OUT.	Signal Output and DC Bias Port
10	GND	Ground
11	GND	Ground
12	VC1	Current Source FET Gate Bias Voltage
13	VS	Supply Voltage Port
14	VB2	Input Termination Port
15	VB1	X-Point Control and Inverted Input Termination Port
16	GND	Ground
17	INB	Inverted Input Port
18	GND	Ground
19	IN	Signal Input Port
20	GND	Ground

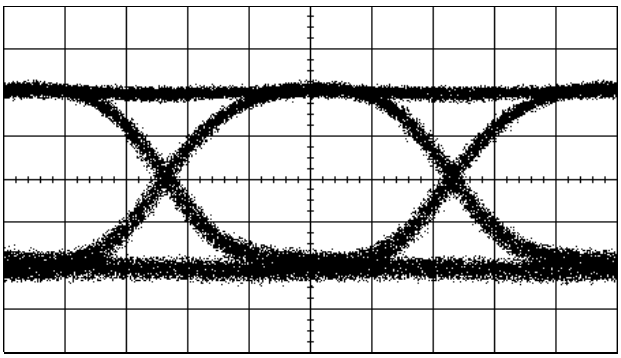
TYPICAL OPERATING CHARACTERISTICS

Measured Condition

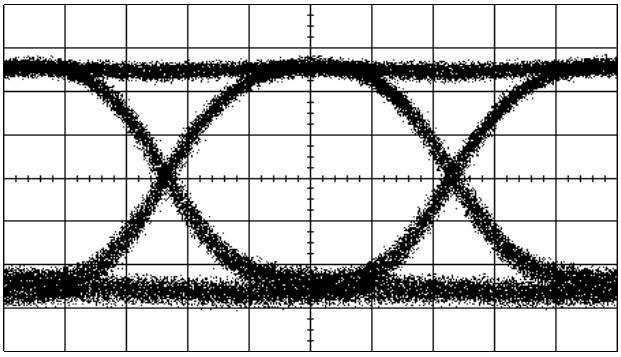
Display Factor V : 1.0V/div, H : 20 ps/div, Offset : 0V
Input Signal 10.7Gbps, NRZ, PN31, Differential 0.25Vpp, AC Coupled
Tr/Tf(20-80%)≅36ps (through 7.5GHz Bessel Filters)



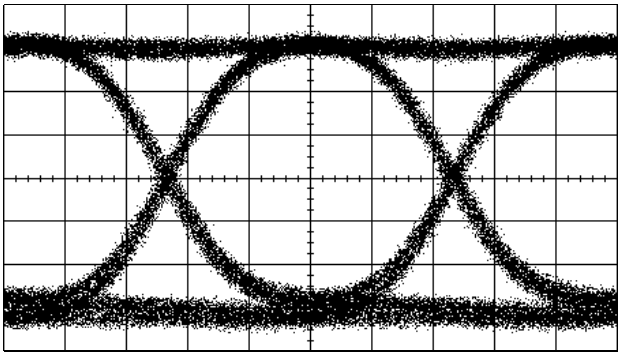
Waveform @10.7Gbps Operate



Vs : -5.0V Is : 209.4mA
Vb1 : -3.800V Crossing-Point : 50.3%
Vc1 : -4.0V
Vd : 2.39V Id : 55.5mA
Power : 1.180W
Amplitude: **4.007Vpp**
Tr : 28.4ps
Tf : 27.6ps
JitterP-P : 10.4ps



Vs : -5.0V Is : 209.4mA
Vb1 : -3.785V Crossing-Point [%] : 50.6%
Vc1 : -4.0V
Vd : 3.04V Id : 72.3mA
Power : 1.267W
Amplitude: **5.009Vpp**
Tr : 28.9ps
Tf [ps] : 28.9ps
JitterP-P : 10.2ps



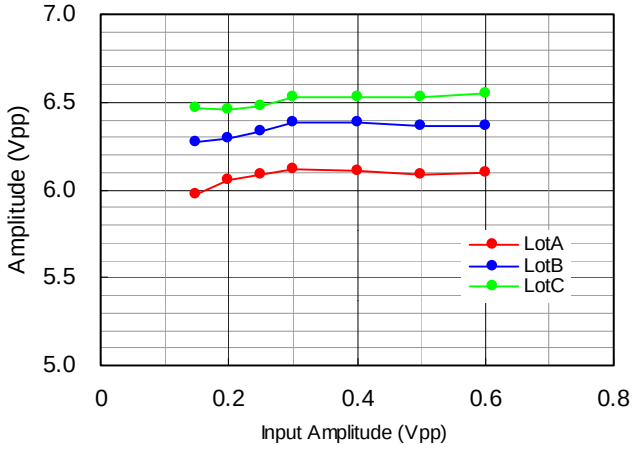
Vs : -5.0V Is : 209.3mA
Vb1 : -3.760V Crossing-Point : 49.8%
Vc1 : -4.0V
Vd : 3.78V Id : 89.1mA
Power : 1.383W
Amplitude: **6.004Vpp**
Tr : 30.2ps
Tf : 31.6ps
JitterP-P : 10.1ps

Note Jitter(p-p) means " 6 × Jitter(RMS) ".

TYPICAL OPERATING CHARACTERISTICS CONTINUED -

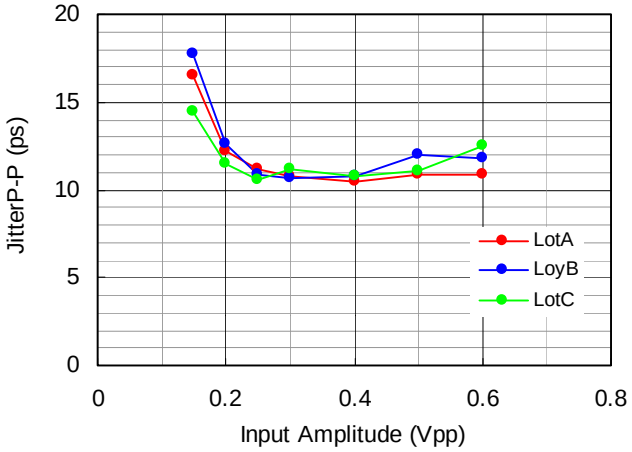
Output Amplitude Dependence on Input Amplitude

(Vs=-5.2V,VB1:Xp≦50%@VD=4.0V,Vc1=-4.2V,VD=4.0V)



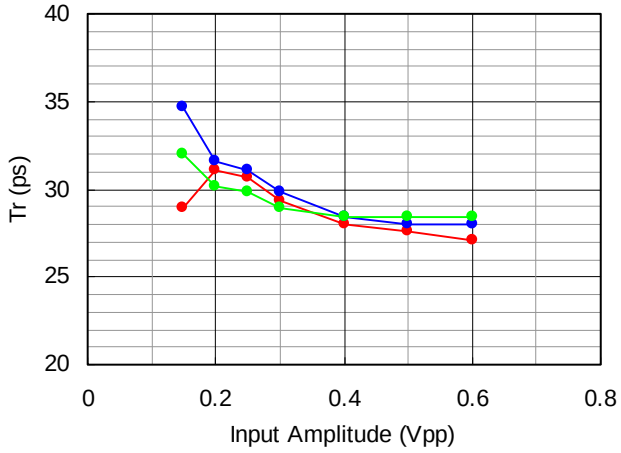
Jitter Dependence on Input Amplitude

(Vs=-5.2V,VB1:Xp≦50%@VD=4.0V,Vc1=-4.2V,VD=4.0V)



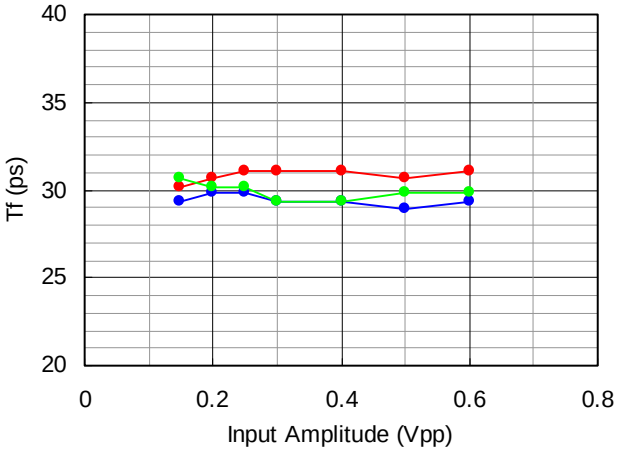
Rise Dependence on Input Amplitude

(Vs=-5.2V,VB1:Xp≦50%@VD=4.0V,Vc1=-4.2V,VD=4.0V)



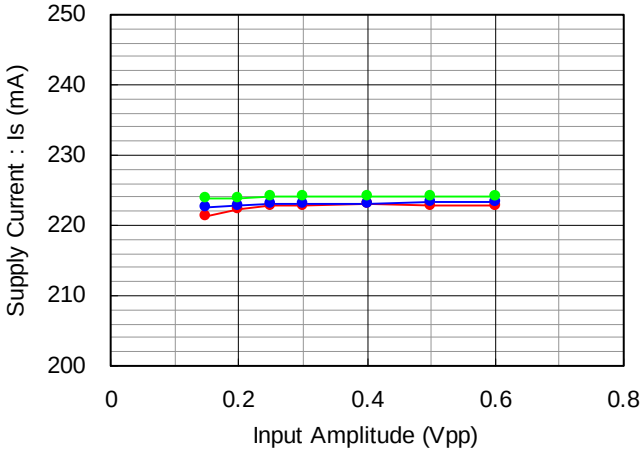
Fall Time Dependence on Input Amplitude

(Vs=-5.2V,VB1:Xp≦50%@VD=4.0V,Vc1=-4.2V,VD=4.0V)



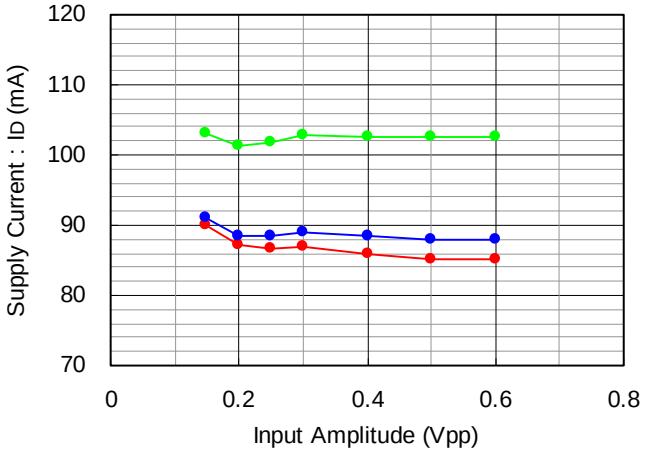
Is Dependence on Input Amplitude

(Vs=-5.2V,VB1:Xp≦50%@VD=4.0V,Vc1=-4.2V,VD=4.0V)



ID Dependence on Input Amplitude

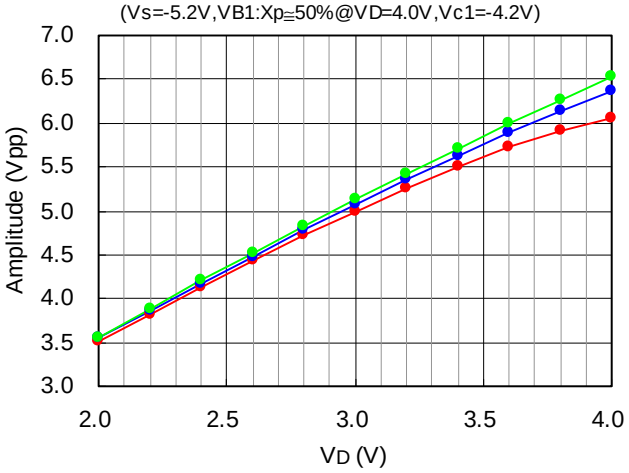
(Vs=-5.2V,VB1:Xp≦50%@VD=4.0V,Vc1=-4.2V,VD=4.0V)



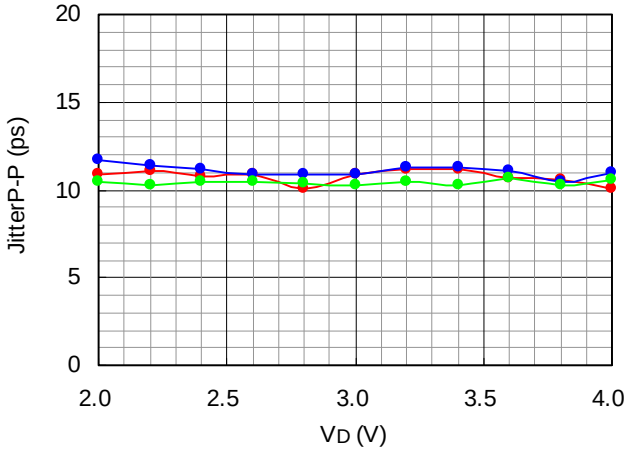
Input Signal - 10.7Gbps, NRZ, PN31, Differential 0.25Vpp, AC Coupled, Tr/Tf (20-80%)≦36ps

TYPICAL OPERATING CHARACTERISTICS CONTINUED -

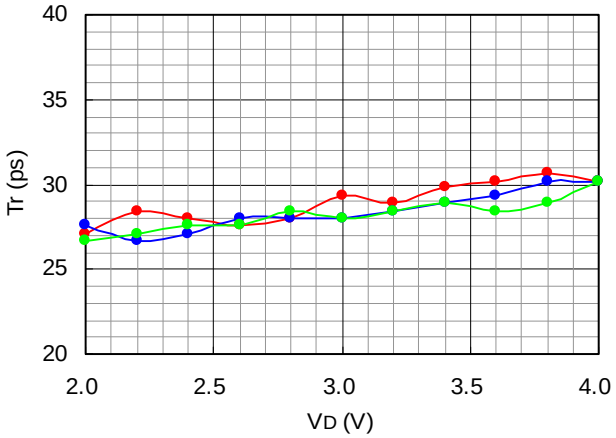
Output Amplitude Dependence on VD
(Vs=-5.2V,VB1:Xp≒50%@VD=4.0V,Vc1=-4.2V)



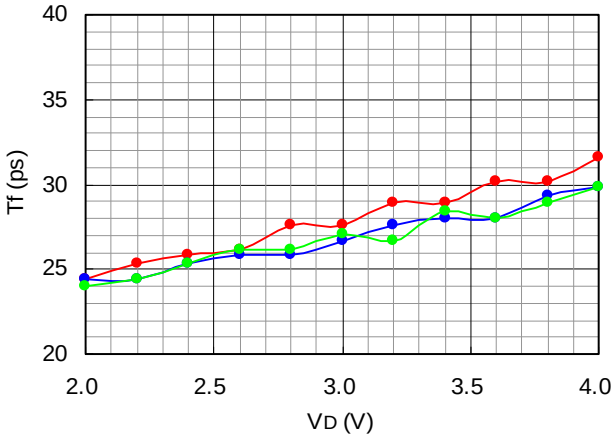
Jitter Dependence on VD
(Vs=-5.2V,VB1:Xp≒50%@VD=4.0V,Vc1=-4.2V)



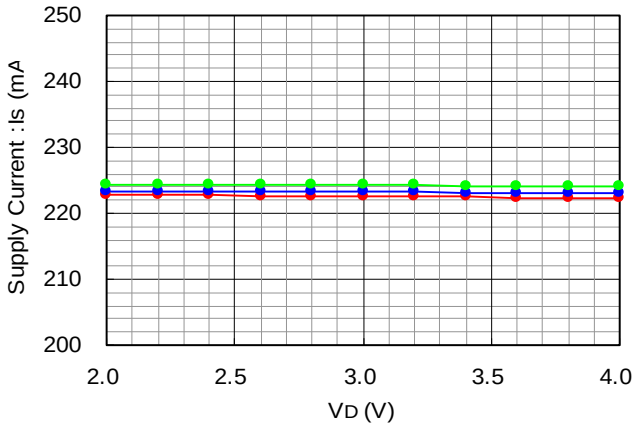
Rise Time Dependence on VD
(Vs=-5.2V,VB1:Xp≒50%@VD=4.0V,Vc1=-4.2V)



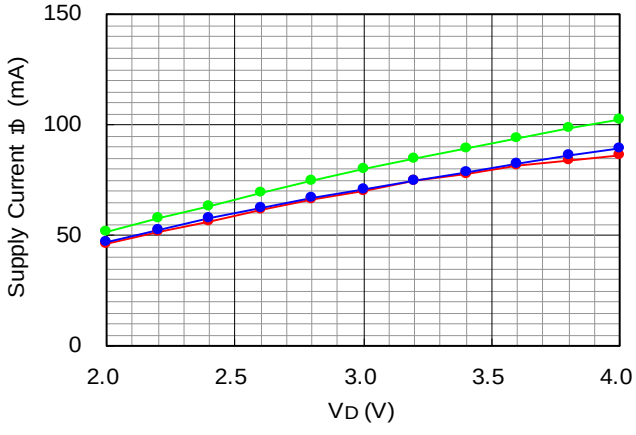
Fall Time Dependence on VD
(Vs=-5.2V,VB1:Xp≒50%@VD=4.0V,Vc1=-4.2V)



Is Dependence on VD
(Vs=-5.2V,VB1:Xp≒50%@VD=4.0V,Vc1=-4.2V)



ID Dependence on VD
(Vs=-5.2V,VB1:Xp≒50%@VD=4.0V,Vc1=-4.2V)

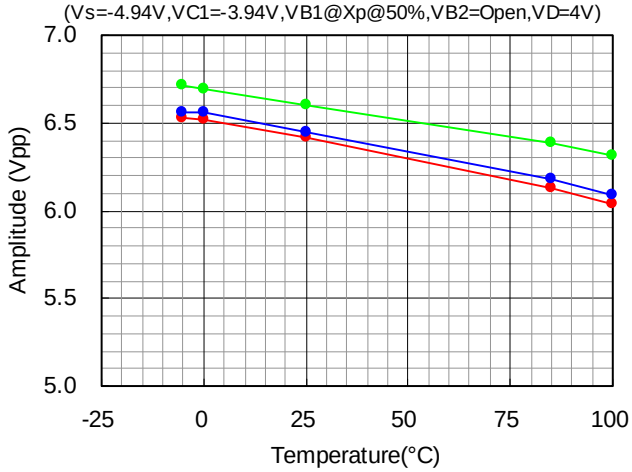


Input Signal - 10.7Gbps, NRZ, PN31, Differential 0.25Vpp, AC Coupled, Tr/Tf(20-80%)≒36ps

TYPICAL OPERATING CHARACTERISTICS CONTINUED -

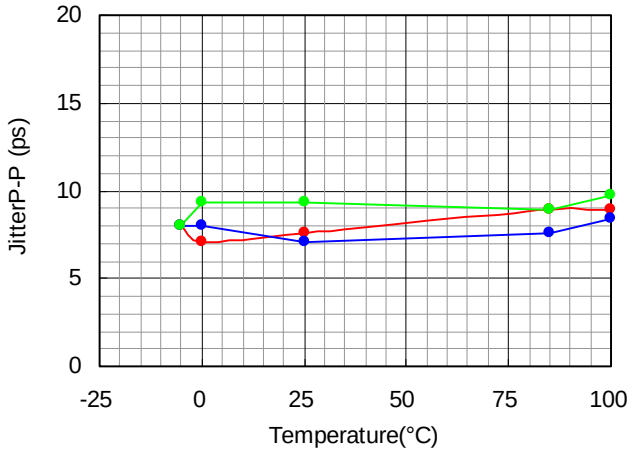
Temperature Dependence of Output Amplitude

(Vs=-4.94V,VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)



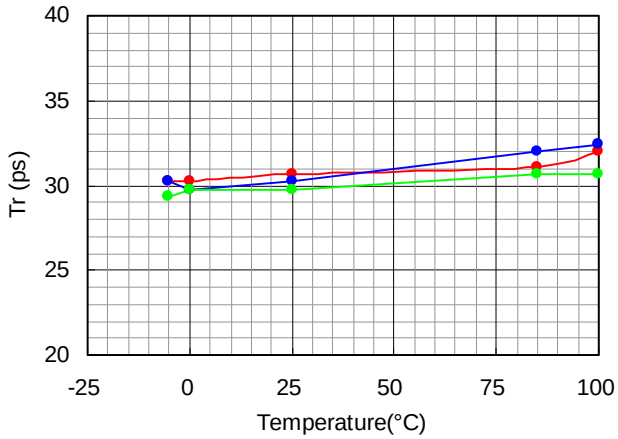
Temperature Dependence of Jitter

(Vs=-4.94V,VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)



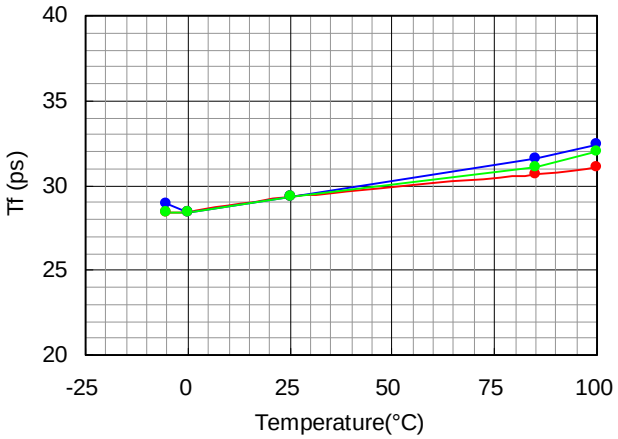
Temperature Dependence of Rise Time

(Vs=-4.94V,VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)



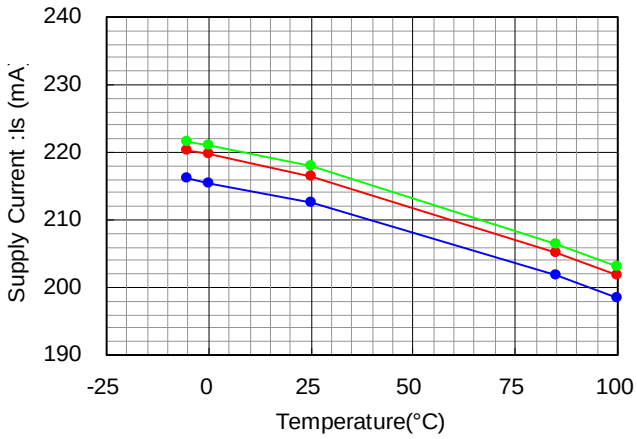
Temperature Dependence of Fall Time

(Vs=-4.94V,VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)



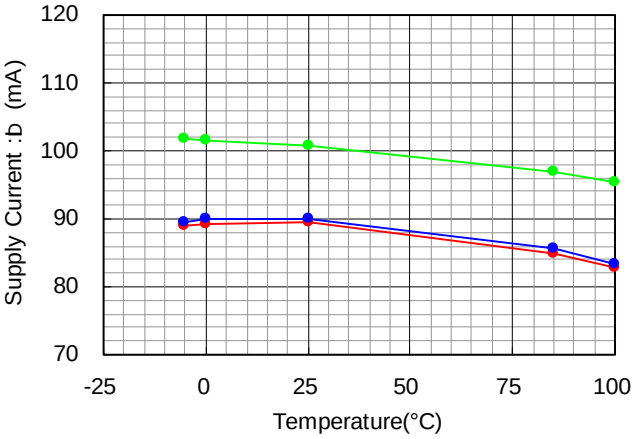
Temperature Dependence of IS

(Vs=-4.94V,VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)



Temperature Dependence of ID

(Vs=-4.94V,VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)

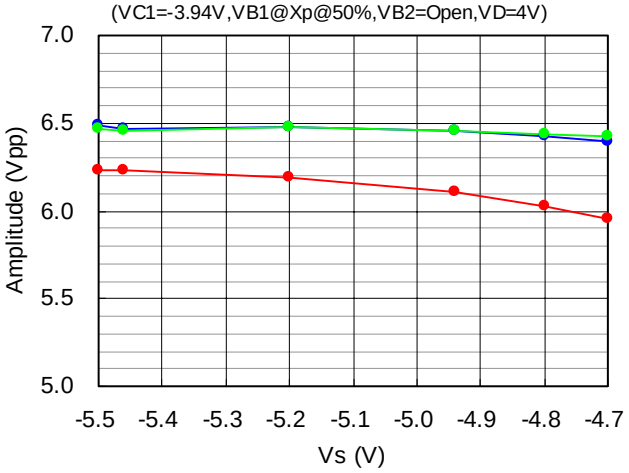


Input Signal - 10.7Gbps, NRZ, PN31, Differential 0.25Vpp, AC Coupled, Tr/Tf (20-80%)≅36ps

TYPICAL OPERATING CHARACTERISTICS CONTINUED -

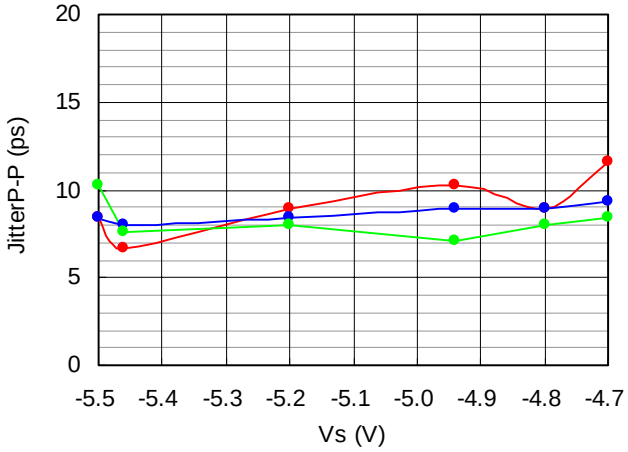
Output Amplitude Dependence on Vs

(VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)



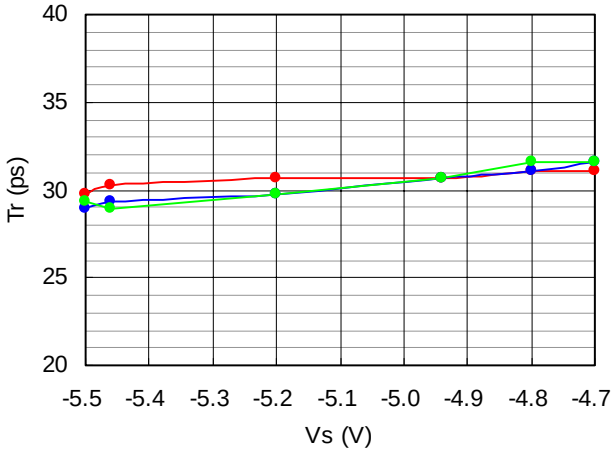
Jitter Dependence on Vs

(VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)



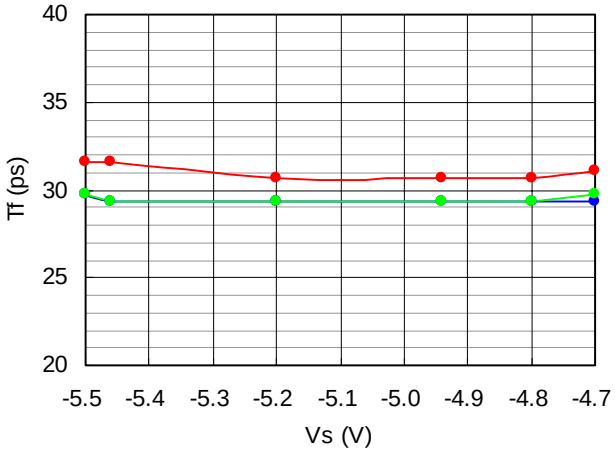
Rise Time Dependence on Vs

(VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)



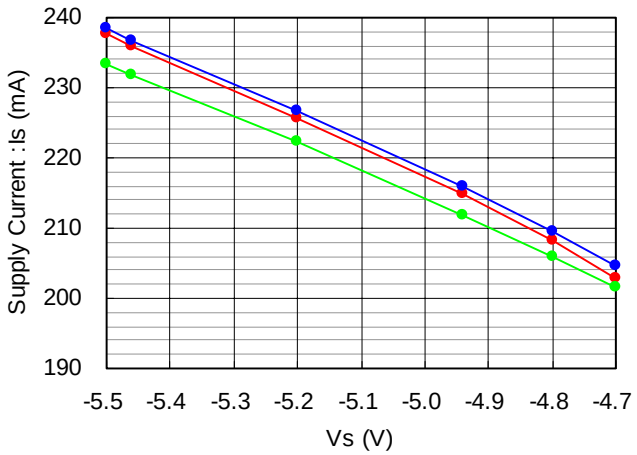
Fall Time Dependence on Vs

(VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)



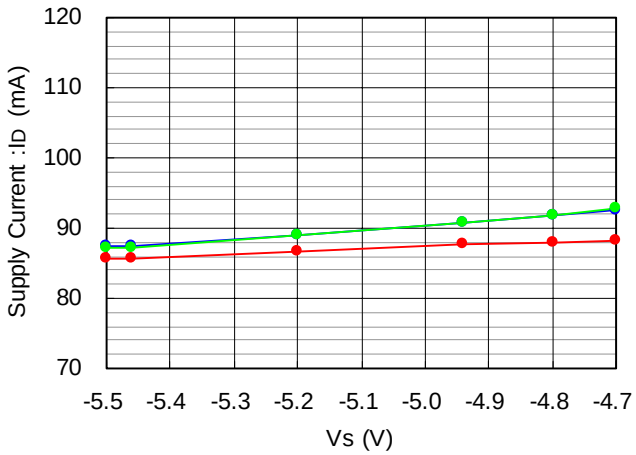
Is Dependence on Vs

(VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)



ID Dependence on Vs

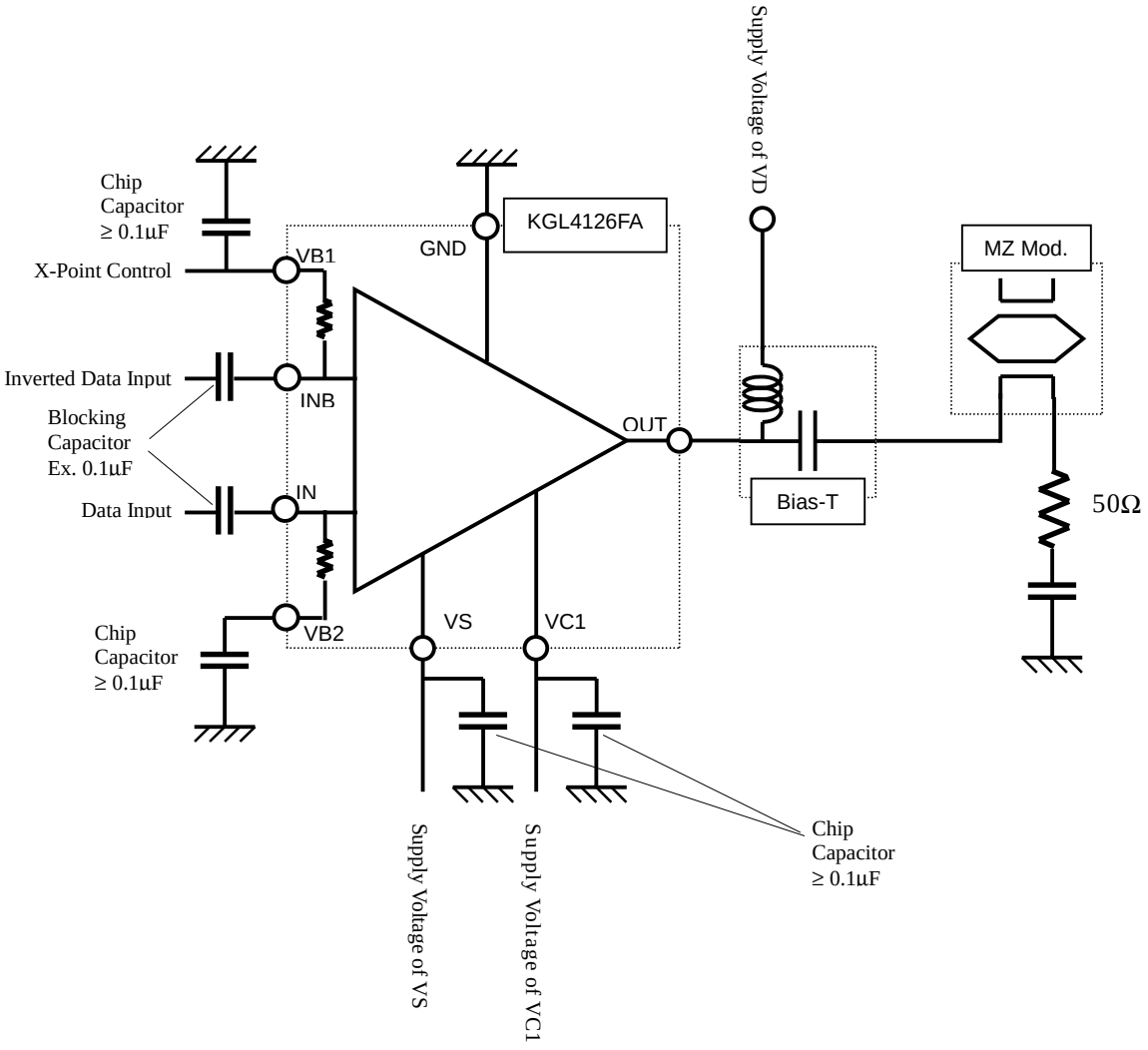
(VC1=-3.94V,VB1@Xp@50%,VB2=Open,VD=4V)



Input Signal - 10.7Gbps, NRZ, PN31, Differential 0.25Vpp, AC Coupled, Tr/Tf (20-80%)≅36ps

TYPICAL APPLICATION CIRCUIT

NOTE: EXTERNAL BLOCKING CAPACITORS ARE REQUIRED FOR THE DATA INPUTS (IN/INB). TERMINATION CAPACITORS ARE REQUIRED BETWEEN THE CONTROL VOLTAGES (VB1/VB2) AND GROUND.



APPLICATION NOTES

1. EXTERNAL BLOCKING CAPACITORS ARE REQUIRED FOR THE DATA INPUTS (IN/INB). TERMINATION CAPACITORS ARE REQUIRED BETWEEN THE CONTROL VOLTAGES (VB1/VB2) AND GROUND.

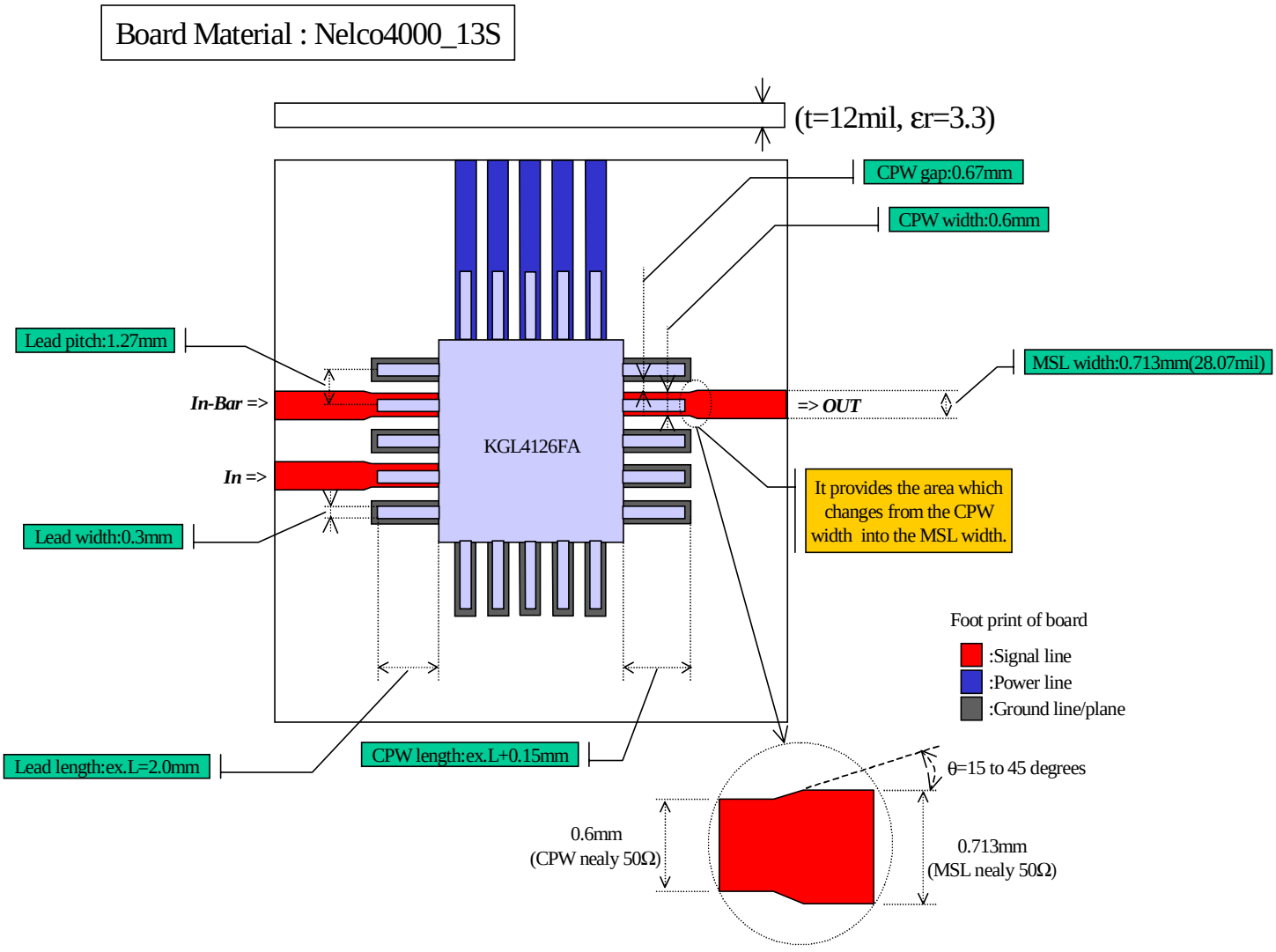
2. To minimize the dependence of the "X-Point" on the supply voltage VS
   a. Use an external voltage source of –3.8V for "VB2", or
   b. Control the voltage of "VB1", so that the voltage difference "VB1–VB2" is constant.

3. To minimize the dependence of "Output amplitude" on the supply voltage VS
   a. It is recommended to set "VC1" to a fixed value between VS+0.7V and VS+1.0V. Control the voltage of "VC1", so that the voltage difference "VC1–VS" is constant.
   b. The Output Amplitude can be tuned by adjusting VD; VD is supplied at the Output Port using an External Bias-T.

4. Power-up/shut-down sequence
   a. For manual power-up, turn on supply control voltages (VB1, VB2, VC1) at first, next VS, then VD. For shutdown, turn off VD first, then VS, then control voltages. The sequence for the control voltages (VB1, VB2, VC1) is not critical.
   b. For simultaneous start up it is recommended that the delay between the supply control voltages (VB1, VB2, VC1) and VS be minimized, or that all voltages be applied at the same time.

TYPICAL PWB LAYOUT and LAYOUT CONSIDERATIONS

To minimize crosstalk and signal losses, keep the connections between the KGL4126FA and the MZ modulator as short as possible. Circuit boards should be manufactured with low-loss dielectrics. Use good high frequency layout techniques and multi-layer boards with solid ground plane to minimize crosstalk and EMI. Controlled impedance lines are required for the data inputs and output.



Assembly and ESD Considerations

Mounting Process:

- The heat sink on the backside of IC package is recommended to have a good thermal path to the electrically grounding metal on the PC board using a conductive adhesive, such as silver paste. If conductive adhesive is not used, a thin thermal and electrically conductive film is recommended to between the IC and PC board.

Soldering Process:

- Soldering such that the heating area is spatially confined only in the vicinity of IC leads is recommended.
- The soldering condition is either shorter than 10 seconds at the lead temperature of lower than 260 degC, or shorter than 3 seconds at the temperature of lower than 310 degC.
- During soldering, pre-heating of PC board is required. The recommended temperature is in the range between 120 degC and 150 degC. If the temperature is lower than that, "solder balls" may occur.
- A soldering iron with electrical isolation higher than 10M ohm as well as a small leakage voltage is recommended.

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 FOR 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.

NOTICE

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.

3. When designing your product, please use our product below the specified maximum ratings and within the specified operating ranges including, but not limited to, operating voltage, power dissipation, and operating temperature.

4. Oki assumes no responsibility or liability whatsoever for any failure or unusual or unexpected operation resulting from misuse, neglect, improper installation, repair, alteration or accident, improper handling, or unusual physical or electrical stress including, but not limited to, exposure to parameters beyond the specified maximum ratings or operation outside the specified operating range.

5. Neither indemnity against nor license of a third party's industrial and intellectual property right, etc. is granted by us in connection with the use of the product and/or the information and drawings contained herein. No responsibility is assumed by us for any infringement of a third party's right which may result from the use thereof.

6. The products listed in this document are intended for use in general electronics equipment for commercial applications (e.g., office automation, communication equipment, measurement equipment, consumer electronics, etc.). These products are not authorized for use in any system or application that requires special or enhanced quality and reliability characteristics nor in any system or application where the failure of such system or application may result in the loss or damage of property, or death or injury to humans.
   Such applications include, but are not limited to, traffic and automotive equipment, safety devices, aerospace equipment, nuclear power control, medical equipment, and life-support systems.

7. Certain products in this document may need government approval before they can be exported to particular countries. The purchaser assumes the responsibility of determining the legality of export of these products and will take appropriate and necessary steps at their own expense for these.

8. No part of the contents contained herein may be reprinted or reproduced without our prior permission.