Electronic Components

October 1, 2008
ODHKGA4163-02

KGA4163

10 Gbps Transimpedance Amplifier IC

GENERAL DESCRIPTION

Oki's 10Gbps transimpedance amplifier is fabricated 0.1 µm gate length P-HEMTs for high-speed optical communication. The IC has high sensitivity and overload performance.

FEATURES

- Transimpedance : 1.4kOhm (Differential)
- Sensitvity : -20.5dBm
- Overload : +2dBm
- Chip Size : 0.80×1.09mm^2
- +3.3V Single Power Supply

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Parameters	Symbol	Units	Rating
Supply Voltage	V_d	V	0 to +4
Input Current	$I_{(IN)}$	mA	+4
Storage Temperature Range	T_{ST}	°C	–40 to +125

RECOMMENDED OPERATING CONDITIONS

Parameters	Symbol	Units	Min.	Typ.	Max.
Supply Voltage	V_d	V	+3.05	+3.30	+3.55
Operating Temperature Range *1)	Ts	°C	-10	—	+90

*1) At backside of die.

ELECTRICAL CHARACTERISTICS

(Ta= 25°C, V_d= +3.30V, $C_{(diode)} \approx$ 0.15pF, unless otherwise noted)

Parameters	Units	Min.	Typ.	Max.
Transimpedance (Differential Output, $I_{(IN)}$<50 µA)	Ω	750	1400	1900
Transimpedance (Single Ended Output, $I_{(IN)}$<50 µA)	Ω	375	700	950
Maximum Single Ended Output Swing	mVpp	300	450	570
Small Signal Bandwidth (–3 dB)	GHz	9.0	11.0	—
Optical Sensitivity *1)	dBm	—	-20.5	-19.8
Optical Overload *1)	dBm	+1.0	+2.0	—
Output Return Loss (f < 10 GHz)	dB	—	—	-10
Input Bias Voltage ($I_{(IN)}$ = 0 mA) *2), *3)	V	+0.58	+0.75	+0.92
Supply Current *2)	mA	—	64	79
Power Consumption *2)	W	—	0.20	0.28

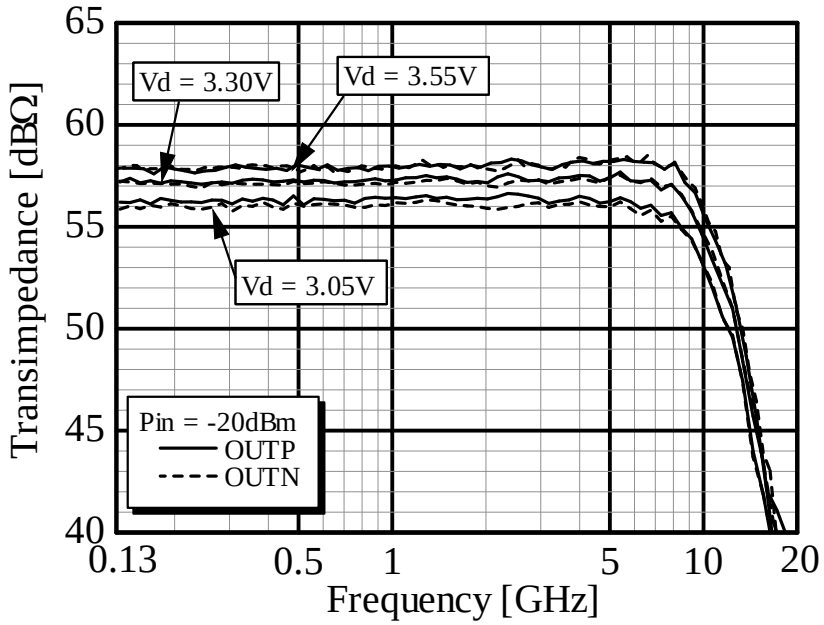
*1) Measured at 10^{-12} BER with a 2^{31}-1 PRBS at 10Gbps, assuming responsivity of photo diode of 1.0 A/W and extinction ratio of transmitter of 13dB.

*2) Under the recommended operating conditions (-10°C < Ta < 90°C, 3.05V < Vd < 3.55V)

*3) The input bias voltage will increase in the value, according to the input current. At $I_{(IN)}$ = 2.5mA, the value is about 1.0V.

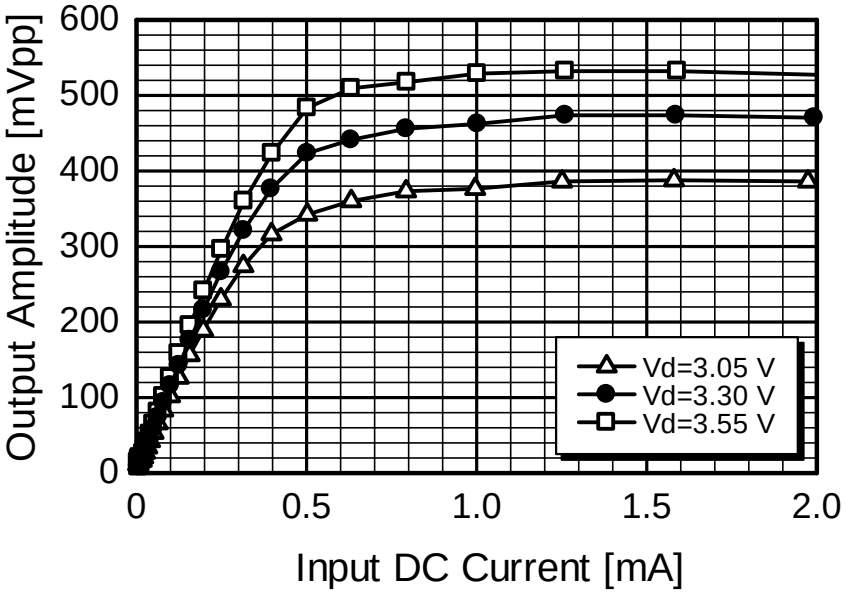
FREQUENCY RESPONSE (TYP.)

(Ta= 25°C, $C_{(diode)} \approx 0.15$ pF)



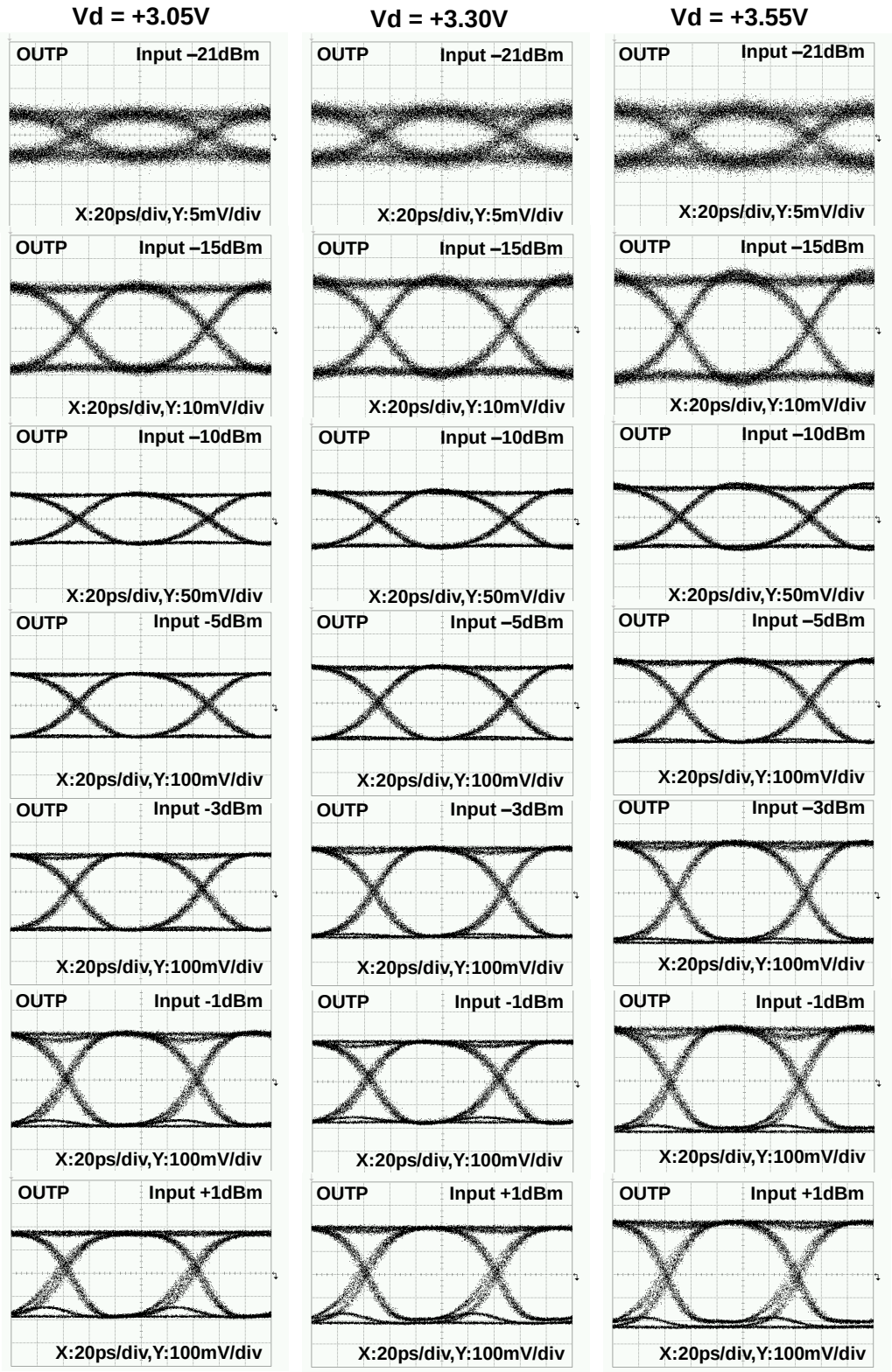
OUTPUT VOLTAGE VS. INPUT CURRENT (TYP.)

(Ta= 25°C, Extinction ratio of optical input signal: 13dB)



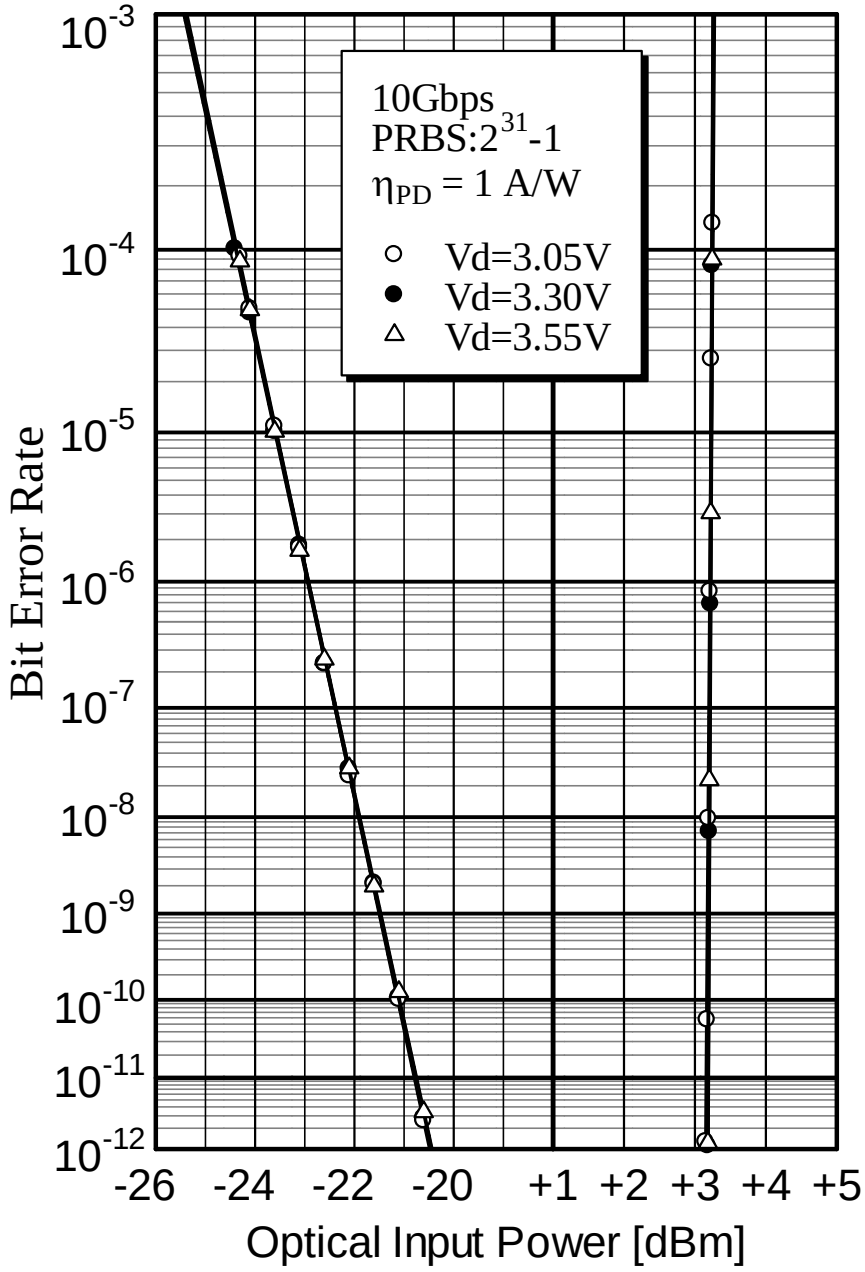
EYE DIAGRAMS (TYP.)

(Ta= 25°C, Optical Input Signal: PRBS 2^{31}-1 at 10Gbps, Extinction ratio of optical input signal: 13dB)



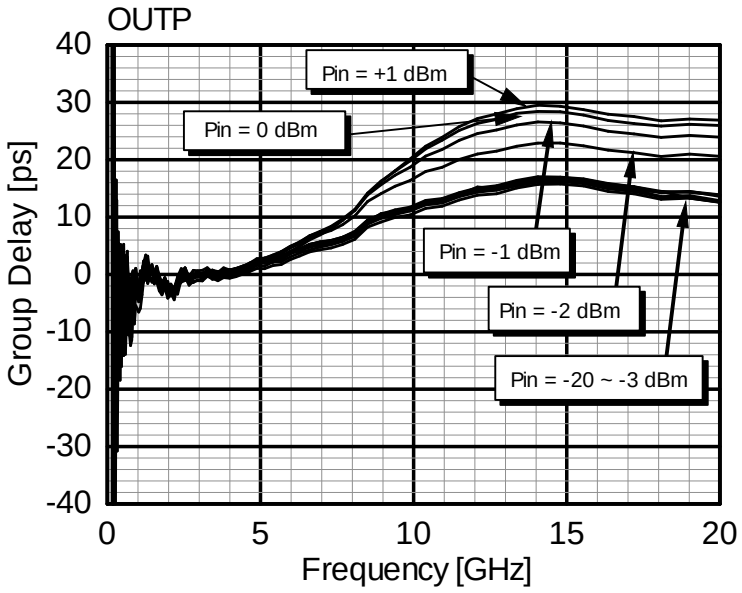
BIT ERROR RATE CHARACTERISTICS (TYP.)

(Ta= 25°C, $C_{(diode)} \approx$ 0.15pF, Extinction ratio of optical input signal: 13dB)

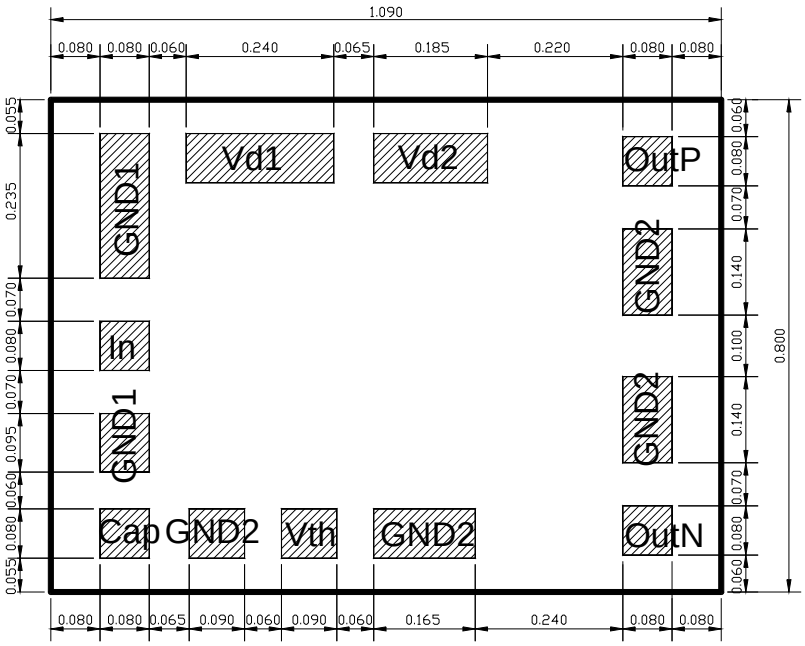


GROUP DELAY (TYP.)

(Ta= 25°C, V_d= +3.3V, $C_{(diode)} \approx 0.15$ pF)

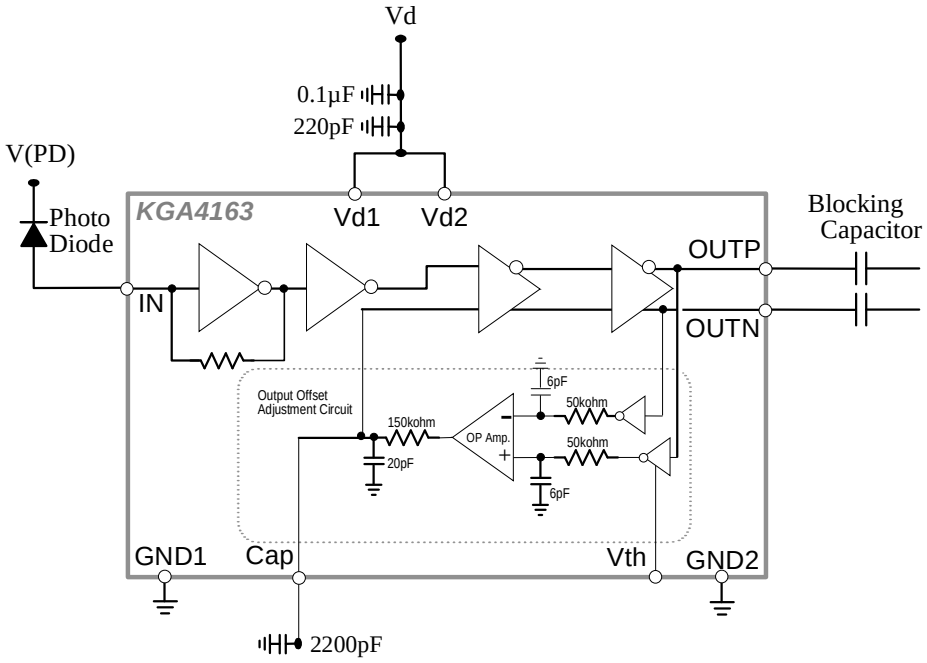


PAD LAYOUT



All dimensions are in mm. Die thickness is 0.22mm(typ.)

BLOCK DIAGRAM AND APPLICATION OUTLINES



GND1, GND2: Ground.
Vd1, Vd2: Power supply.
IN: Input; Connect to photo detector anode.
OUTP: Positive output.
OUTN: Negative output.
Cap: Pad for external capacitor to ground; The low frequency cutoff is reduced by adding external capacitors. KGA4163 has on-chip 150kΩ resistors with shunt 20pF capacitors to ground. With 2200pF external capacitors, the low frequency cutoff will be about 30kHz.
Vth: Pad for output offset adjustment. This pad can be left floating;
[If use this function] Before using this pad, please refer the additional information.

ASSEMBLY AND ESD CONSIDERATION

The product has air-bridge structures on the die surface. Do not use a vacuum tool to pick-up the product and do not touch the product surface, in order not to damage to the air-bridges.
The product 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.
The product 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 product.

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.

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 SEMICONDUCTOR 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.

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