NEL

NS GD E067
30 Jun. 1999
PRELIMINARY

NLG4130
1 : 2 CLOCK DISTRIBUTOR (AC Coupling)

The NLG4130 is an ultra-fast 1:2 Clock Distributor operating at up to 10 GHz (MIN.). Designed with LSCFL (Low-power Source Coupled FET Logic), DC coupling is used for the signal input. Either AC coupling or DC coupling can be used for the outputs. Owing to built-in 50-ohm termination resistor between signal input pin and ground (GND), external termination resistor is unnecessary for impedance matching.
The NLG4130 is fabricated using the 0.15-μm gate length A-SAINT (**A**dvanced **S**elf-**A**ligned **I**mplantation for **N**$^+$ layer **T**echnology) process.

FEATURE

Ultra high speed :	maximum clock frequency	f_{MAX} = 10.0 GHz	[Tc = 25 ℃, MIN.]
	output rise time	tr = 25 ps (20-80%)	[Tc = 25 ℃, TYP.]
	output fall time	tf = 25 ps (20-80%)	[Tc = 25 ℃, TYP.]

High Reliability : hermetically - sealed package

APPLICATIONS

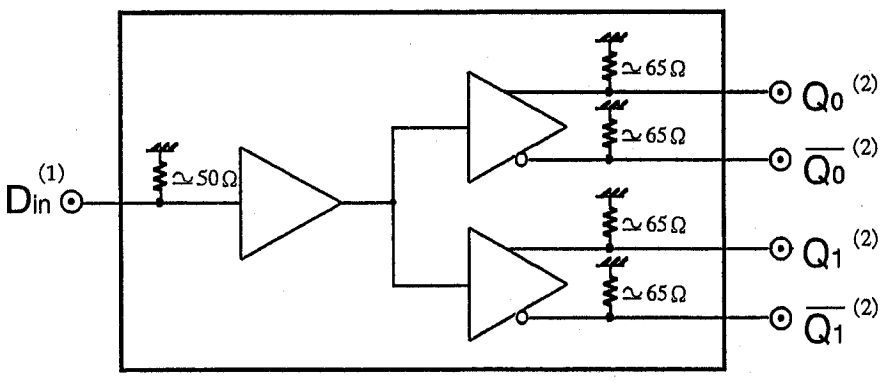
- Clock distributor
- Data distributor
- Reforming of waveform
- Line receiver
- Line driver

TRUTH TABLE

D_{in}	Q_n	$\overline{Q_n}$
H	H	L
L	L	H

Note Q_n,$\overline{Q_n}$: n=0,1

FUNCTION DIAGRAM



Notes (1) DC coupling (see page 10)
(2) AC coupling or DC coupling (see page 10)

PIN CONNECTION TABLE

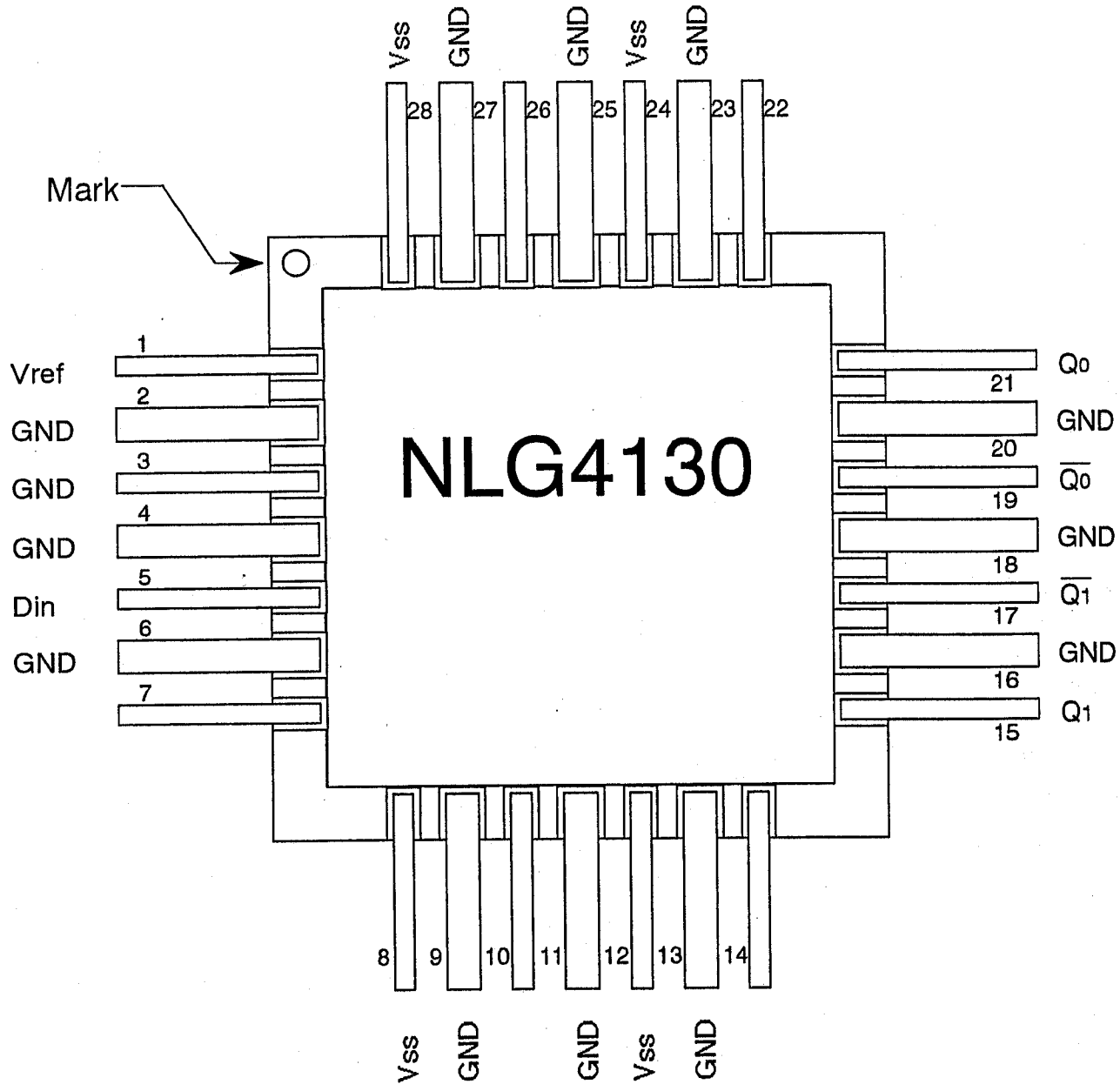
PIN No.	NAME	FUNCTION	PIN No.	NAME	FUNCTION
1	Vref	Signal Input Ref. (1)	15	Q_1	Signal Output 1 (True)
2	GND	Ground (0.0 V)	16	GND	Ground (0.0 V)
3	GND	Ground (0.0 V)	17	$\overline{Q_1}$	Signal Output 1 (Comp.)
4	GND	Ground (0.0 V)	18	GND	Ground (0.0 V)
5	Din	Signal Input	19	$\overline{Q_0}$	Signal Output 0 (Comp.)
6	GND	Ground (0.0 V)	20	GND	Ground (0.0 V)
7	NC	No Internal Connection	21	Q_0	Signal Output 0 (True)
8	Vss	Power Supply (-3.5 V)	22	NC	No Internal Connection
9	GND	Ground (0.0 V)	23	GND	Ground (0.0 V)
10	NC	No Internal Connection	24	Vss	Power Supply (-3.5 V)
11	GND	Ground (0.0 V)	25	GND	Ground (0.0 V)
12	Vss	Power Supply (-3.5 V)	26	NC	No Internal Connection
13	GND	Ground (0.0 V)	27	GND	Ground (0.0 V)
14	NC	No Internal Connection	28	Vss	Power Supply (-3.5 V)

Notes

(1) Vref : Internally generated reference voltage that determines the signal input threshold level. By applying - 0.75 V to - 0.2 V externally to this pin, an arbitrary signal input threshold voltage can be established.

(2) Terminate unused output pins to GND through 50-ohm resistors.

CONNECTION DIAGRAM (TOP VIEW)



ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING
Vss	Power Supply Voltage	0.0 V ~ - 4.0 V
Vin	Applied Voltage at Signal Input (Din)	+0.3 V ~ - 1.6 V
Vout	Applied Voltage at Signal Output (Q_0, Q_1, $\overline{Q_0}$, $\overline{Q_1}$)	+0.2 V ~ - 1.75 V
Vref	Applied Voltage at Vref pin	+0.3 V ~ - 1.6 V
Tstor	Storage temperature	- 60 ℃ ~ +150 ℃
Tc (1)	Case temperature under Bias	- 60 ℃ ~ +125 ℃

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS
Vss	Power Supply Voltage	- 3.75	- 3.5	- 3.4	V
Vref	Signal Input Reference Voltage	Adjust in the range from -0.75 V to -0.20 V			V
Din	Signal Input Interface (Din)	DC Coupling (See DC Characteristics)			—
OUT	Signal Output Interface (Q_0, Q_1, $\overline{Q_0}$, $\overline{Q_1}$)	DC coupling or AC Coupling, Terminate to GND through 50 Ω.			—

DC CHARACTERISTICS

(Vss = - 3.4 V ~ - 3.75 V, GND = 0.0 V, Tc = 0 ~ 85 ℃ (1))

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS	
V_{OH}	Output Voltage, High (Q_0, Q_1, $\overline{Q_0}$, $\overline{Q_1}$)	- 0.1	0.0		V	(2)
V_{OL}	Output Voltage, Low (Q_0, Q_1, $\overline{Q_0}$, $\overline{Q_1}$)		- 0.9	- 0.85	V	(2)
V_{IH}	Signal Input Voltage, High	- 0.2	0.0		V	
V_{IL}	Signal Input Voltage, Low		- 0.9	- 0.75	V	
Iss	Power Supply Current		560	780	mA	(3)
Pd	Power Dissipation		2.0	2.9	W	(3)

Notes

(1) Tc : temperature at package base.
(2) DC coupling, Terminate to GND through 50 Ω.
(3) Includes load current. Excludes current through input termination resistors, all of which have a value of 50 - ohm resistors.

AC CHARACTERISTICS

(Vss = - 3.5 V, GND = 0.0 V, Vref : Adjust in the range from -0.75 V to -0.2 V)

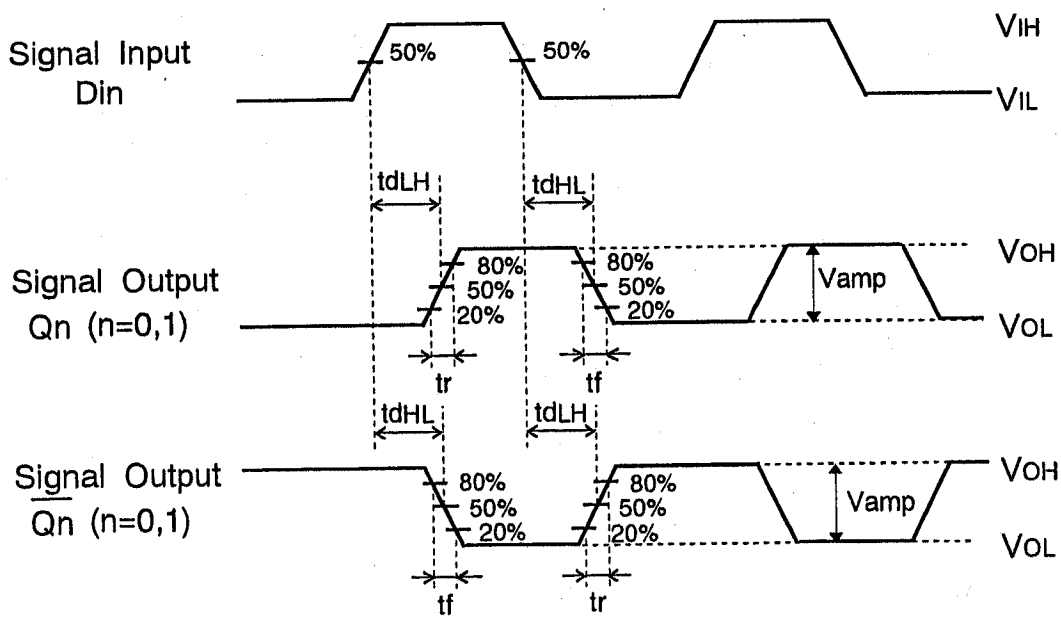
SYMBOL	PARAMETER	Tc=0℃			Tc=25℃			Tc=85℃			UNITS	
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
f_{MAX}	Maximum Clock Frequency	10.0			10.0			10.0			GHz	
Vamp	Maximum Output Voltage Amplitude	0.70	0.85		0.70	0.85		0.60	0.75		Vp-p	(1) (2)
tr	Output Rise Time (20 - 80%)		20	25		25	30		25	30	ps	(1) (3)
tf	Output Fall Time (20 - 80%)		20	25		25	30		25	30	ps	(1) (3)
tdLH	Output Rise Delay (Din - Qn, $\overline{Qn}$)	155	180	205	155	180	205	160	185	210	ps	(3)
tdHL	Output Fall Delay (Din - Qn, $\overline{Qn}$)	160	185	210	160	185	210	165	190	215	ps	(3)

Notes

(1) Measurement Condition : f = 10.0 GHz

(2) AC coupling 50Ω to GND.
DC block : Picosecond Pulse Labs., Model 5501A

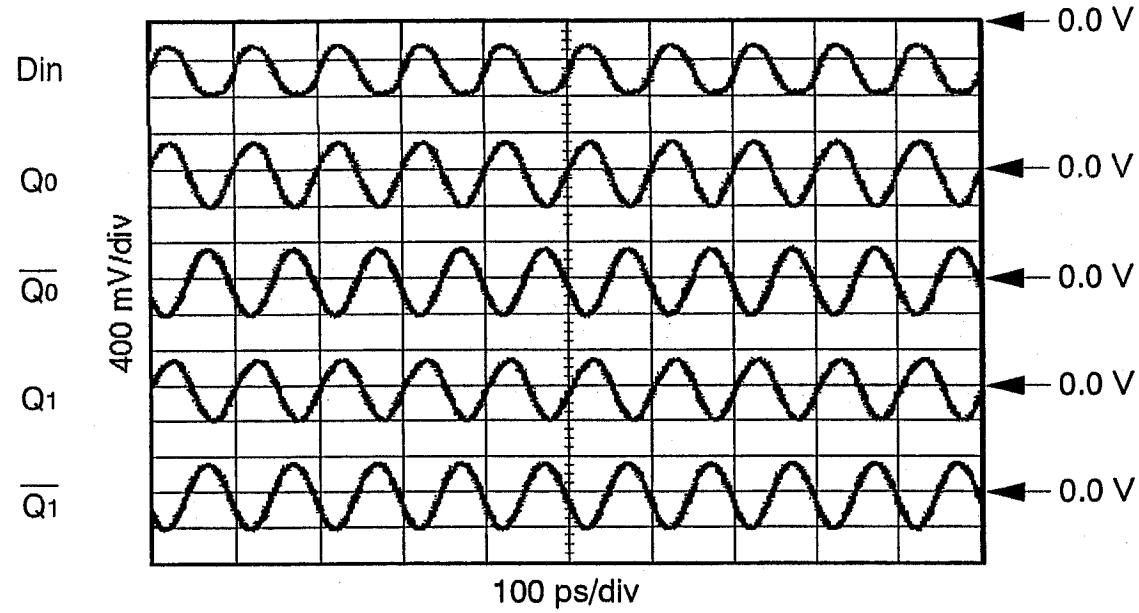
(3)



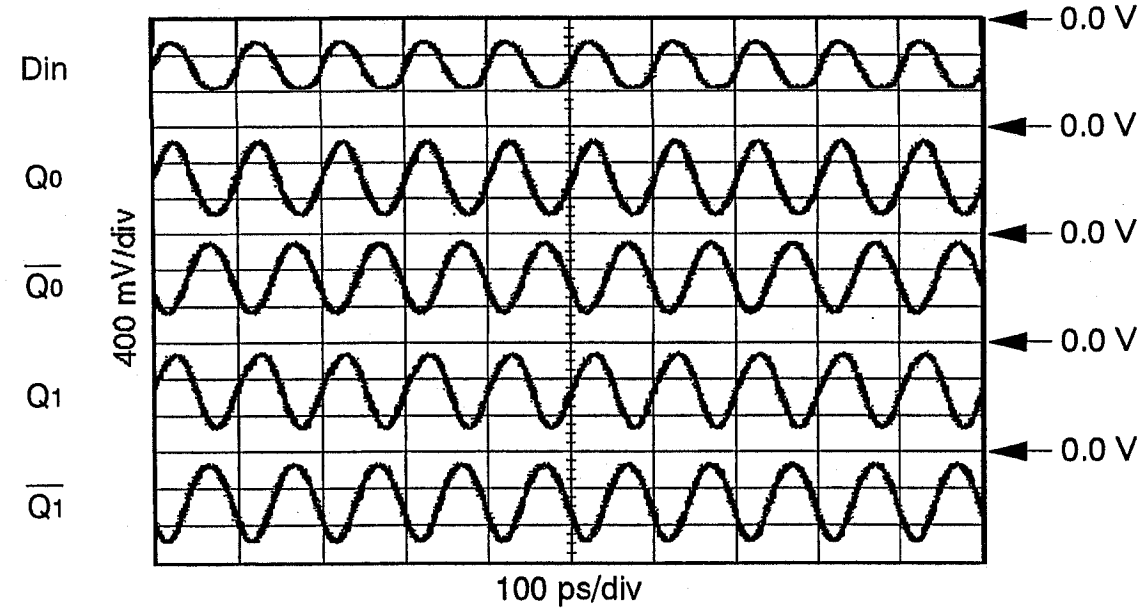
SAMPLE INPUT AND OUTPUT WAVEFORMS

(10 GHz Clock Signal Distribution)

AC Coupling



DC Coupling



Measurement Conditions

Vss = - 3.5 V

Vref = - 0.48 V

Din : 10 GHz, V_{IH} = - 0.2 V, V_{IL} = - 0.75 V

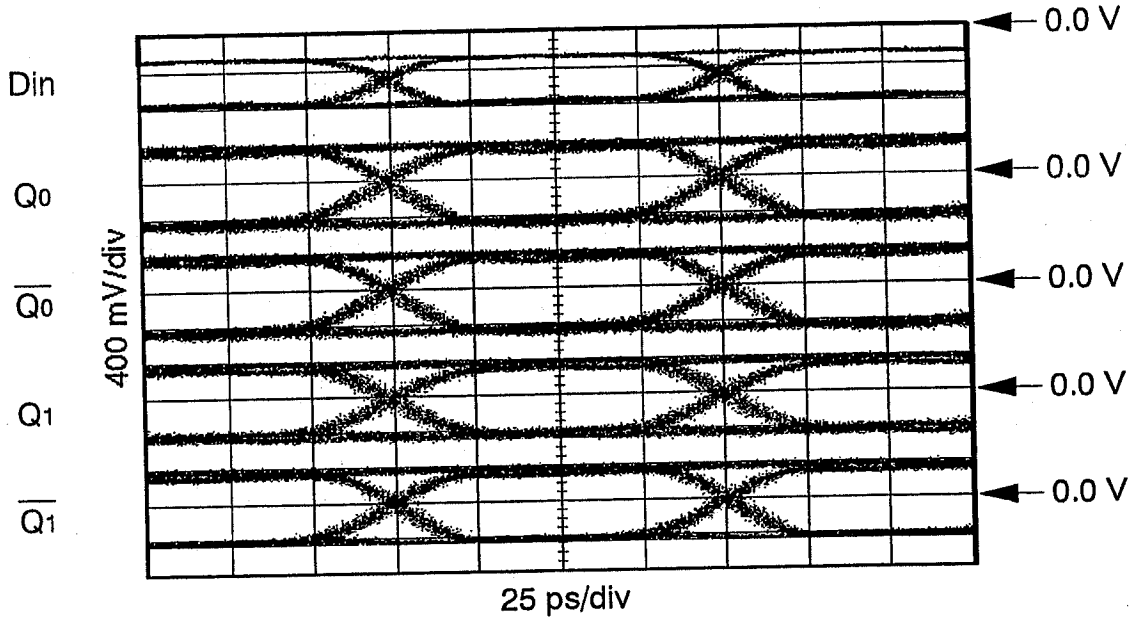
Signal outputs connected to the 50 - ohm impedance pins of a sampling oscilloscope.

Results given here were obtained using the NEL test fixture.

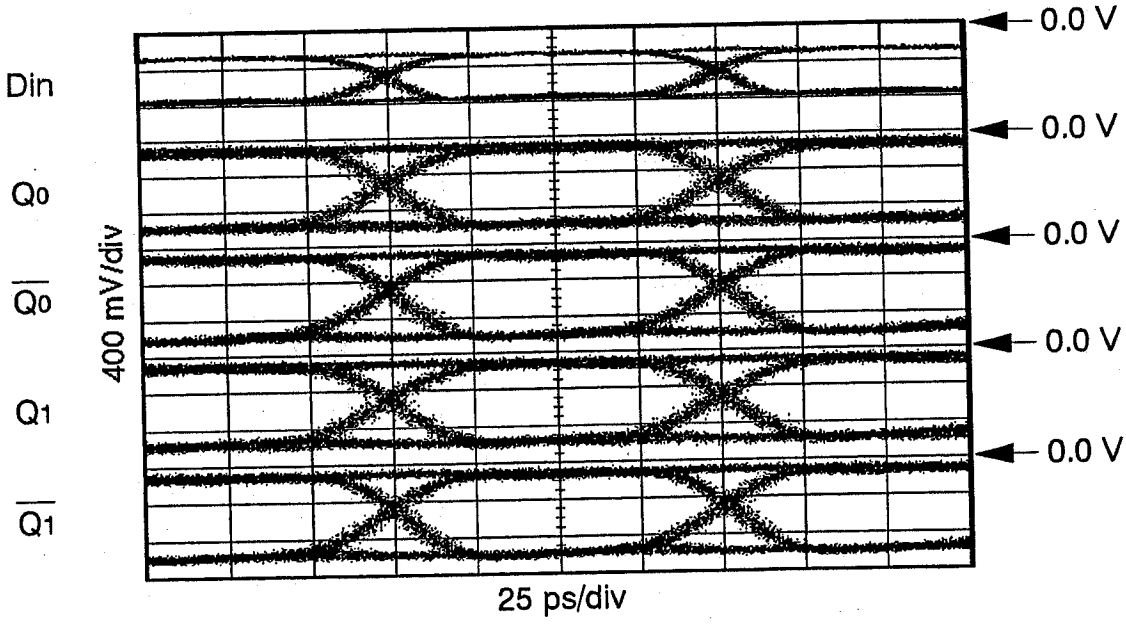
SAMPLE INPUT AND OUTPUT WAVEFORMS

(10 Gb/s NRZ Data Signal Distribution)

AC Coupling



DC Coupling

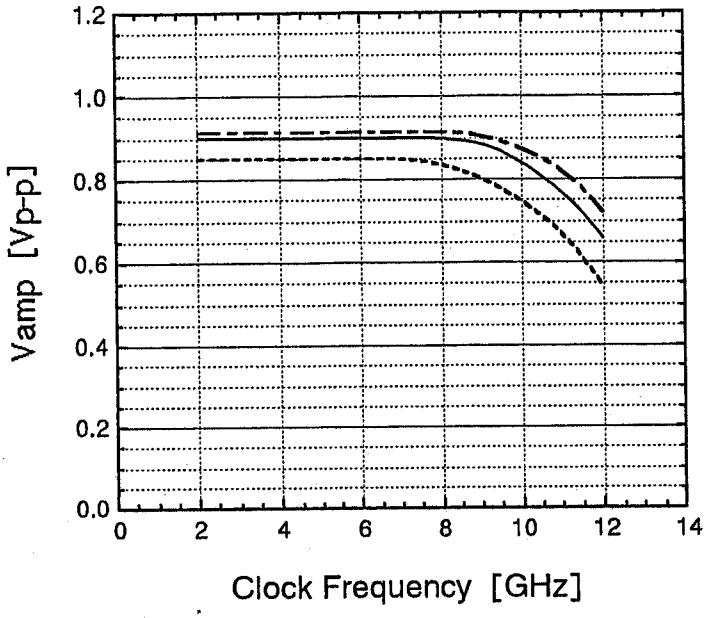


Measurement Conditions

Vss = - 3.5 V
Vref = - 0.48 V
Din : 10 Gb/s, PN=23, V_{IH} = - 0.2 V, V_{IL} = - 0.75 V
Signal outputs connected to the 50 - ohm impedance pins of a sampling oscilloscope.
Results given here were obtained using the NEL test fixture.

SAMPLE AC CHARACTERISTICS (AC coupling)

Vss = -3.5 V

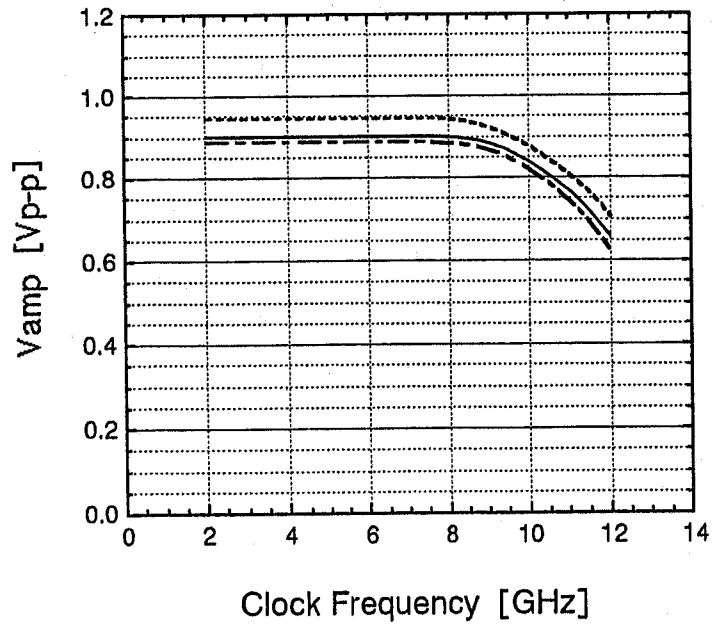


—·—·—· : Tc = 0 ℃
——— : Tc = 25 ℃
- - - - - - : Tc = 85 ℃

Measurement Conditions

Din : V_{IH} = -0.2 V, V_{IL} = -0.75 V
Vref = - 0.48 V
DC block : Picosecond Pulse Labs., Model 5501A
Qn : AC coupling, 50 - ohms to GND
Results given here were obtained using the NEL test fixture.

Tc = 25 ℃



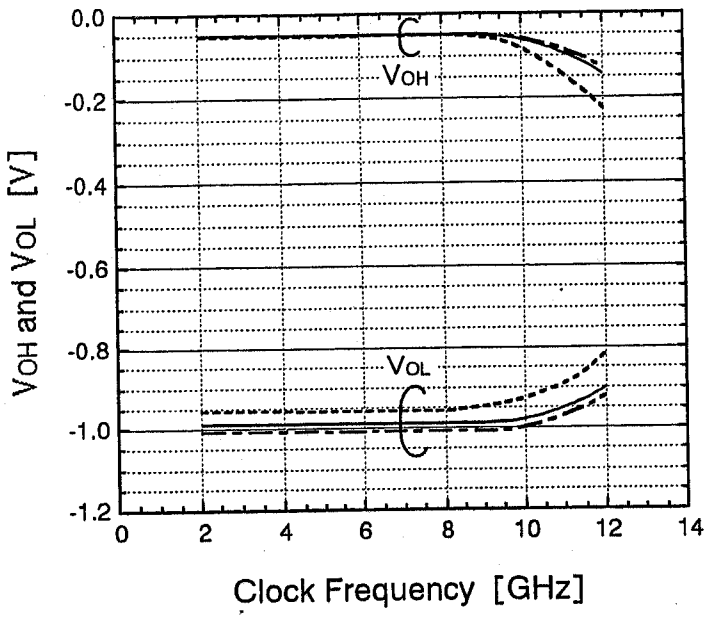
—·—·—· : Vss = - 3.4 V
——— : Vss = - 3.5 V
- - - - - - : Vss = - 3.75 V

Measurement Conditions

Din : V_{IH} = -0.2 V, V_{IL} = -0.75 V
Vref = - 0.48 V
DC block : Picosecond Pulse Labs., Model 5501A
Qn : AC coupling, 50 - ohms to GND
Results given here were obtained using the NEL test fixture.

SAMPLE AC CHARACTERISTICS (DC coupling)

Vss = -3.5 V

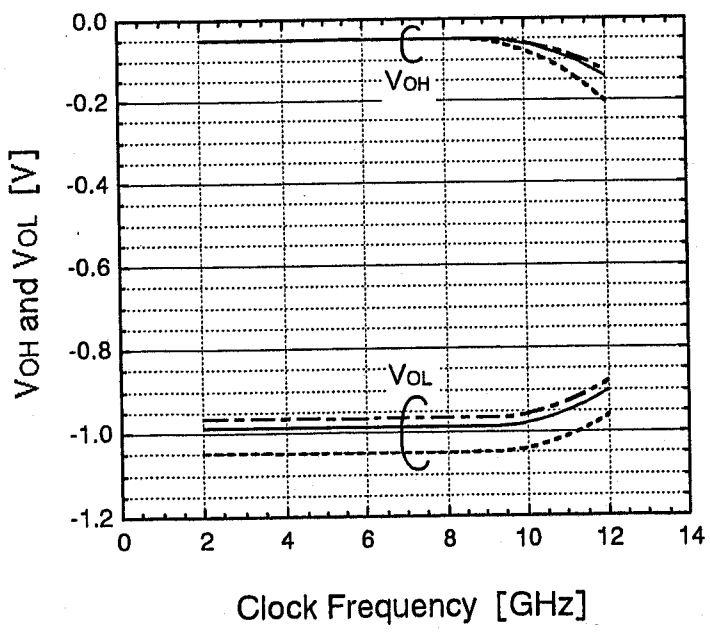


—·—·—· : Tc = 0 ℃
——— : Tc = 25 ℃
- - - - - - : Tc = 85 ℃

Measurement Conditions

Din : V_{IH} = -0.2 V, V_{IL} = -0.75 V
Vref = - 0.48 V
Qn : DC coupling, 50 - ohms to GND
Results given here were obtained using the NEL test fixture.

Tc = 25 ℃

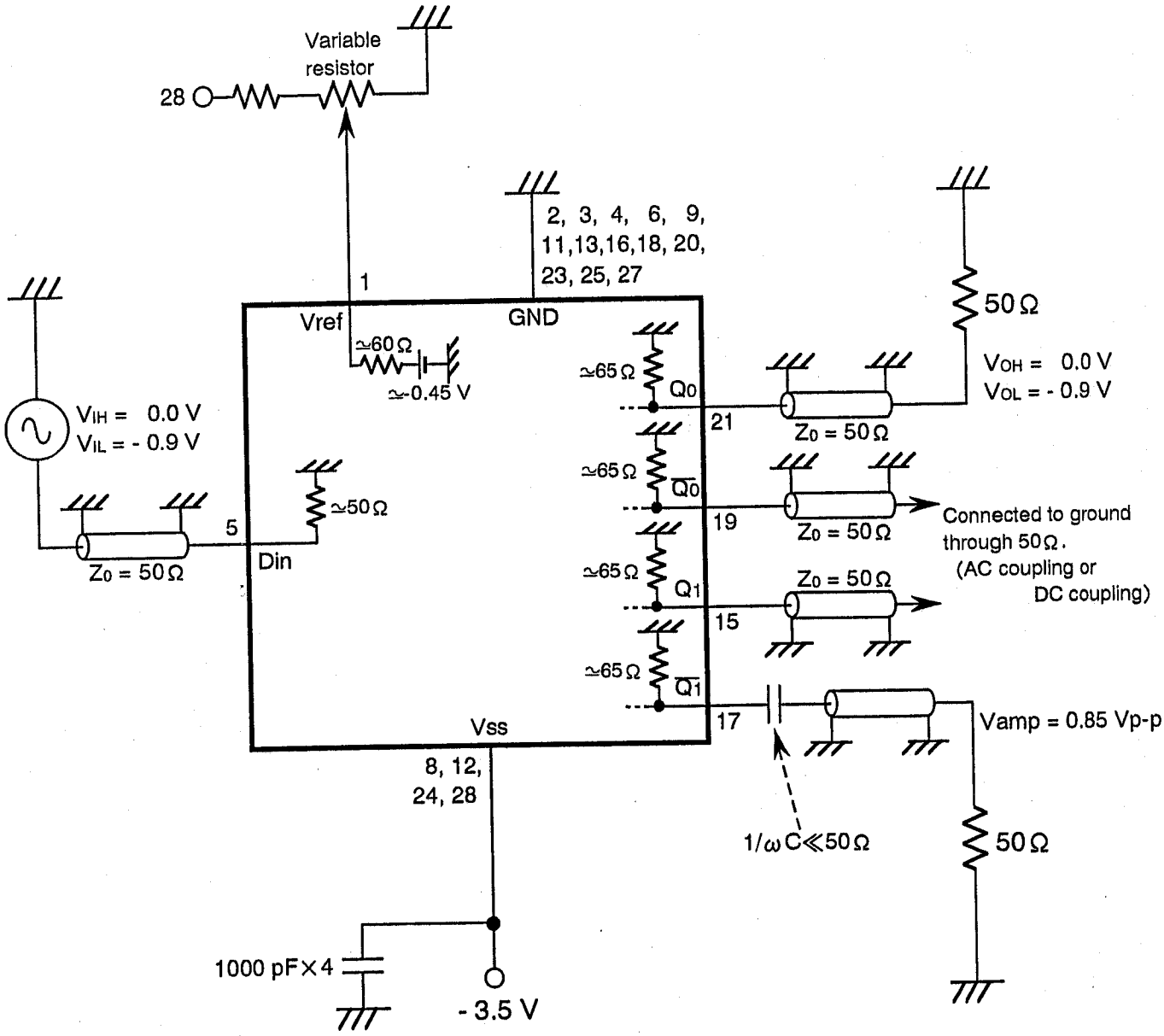


—·—·—· : Vss = - 3.4 V
——— : Vss = - 3.5 V
- - - - - - : Vss = - 3.75 V

Measurement Conditions

Din : V_{IH} = -0.2 V, V_{IL} = -0.75 V
Vref = - 0.48 V
Qn : DC coupling, 50 - ohms to GND
Results given here were obtained using the NEL test fixture.

SAMPLE IMPLEMENTATION

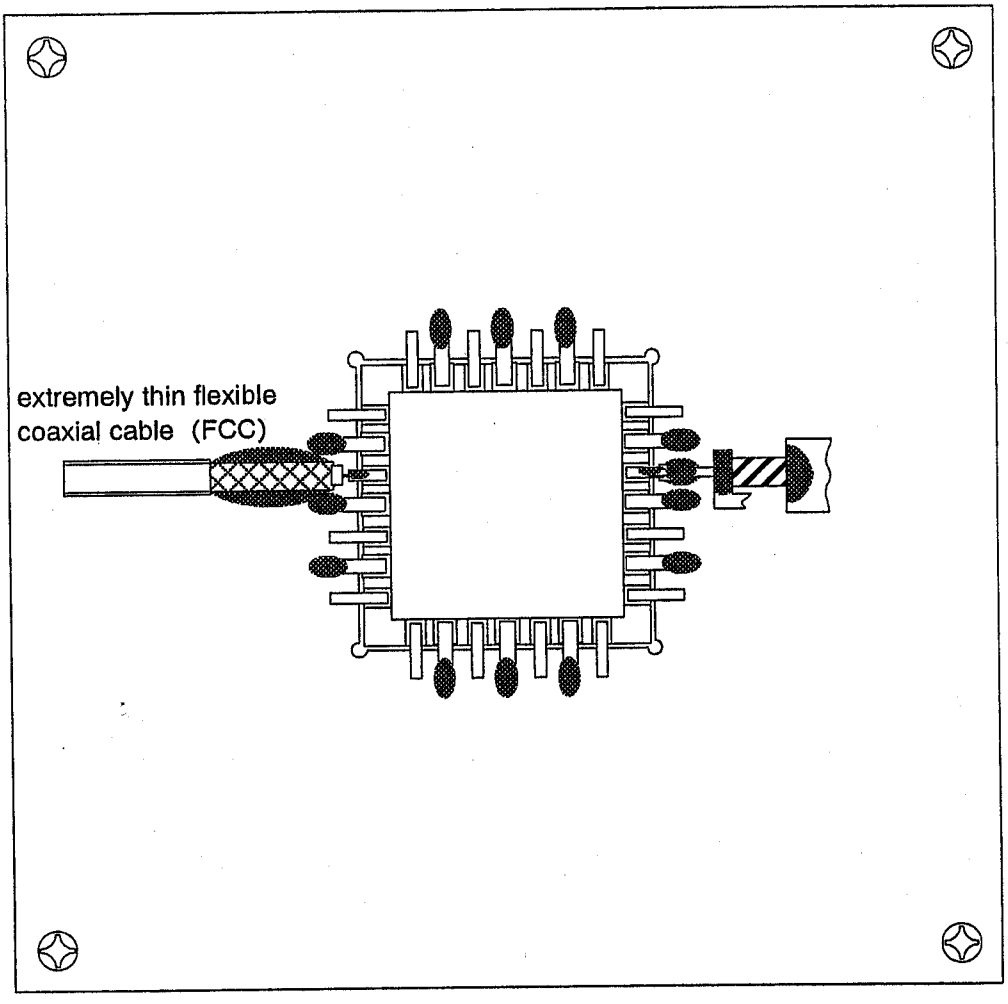


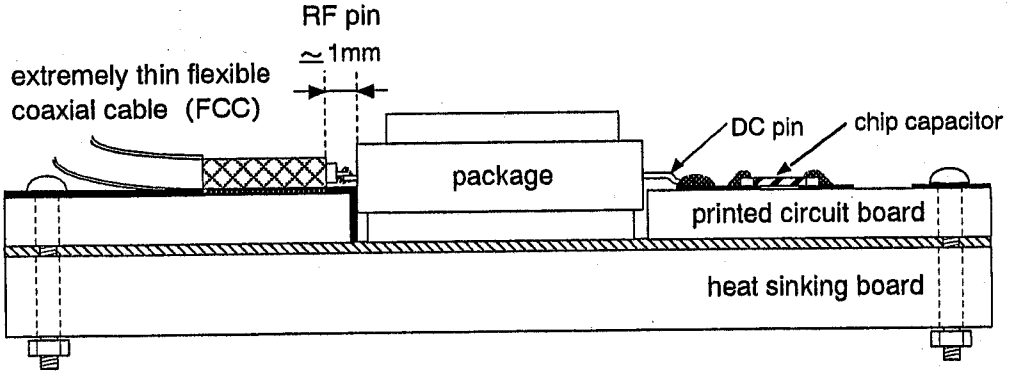
Notes

(1) Numbers represent pin numbers
(2) Either AC coupling or DC coupling can be used for all outputs (Q_0, $\overline{Q_0}$, Q_1, $\overline{Q_1}$) .
(3) AC coupling capacitor is necessary outside the NLG4130.

Although not shown here, in place of the above variable resistor, the Vref pin can be connected directly to an external power supply. in this case, apply approximately -0.5 V.

SAMPLE MOUNTING





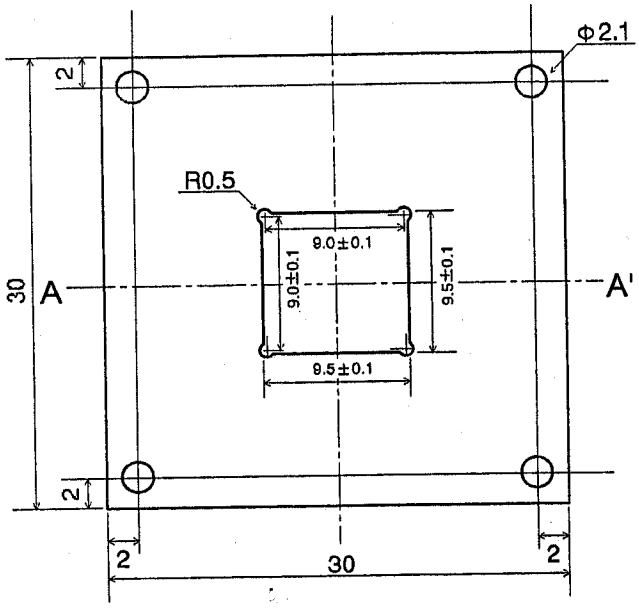
: conducting epoxy adhesive

: solder

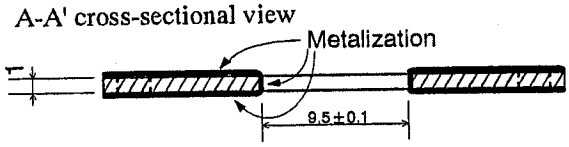
MOUNTING PARTS (unit : mm)

Printed Circuited Board

top view



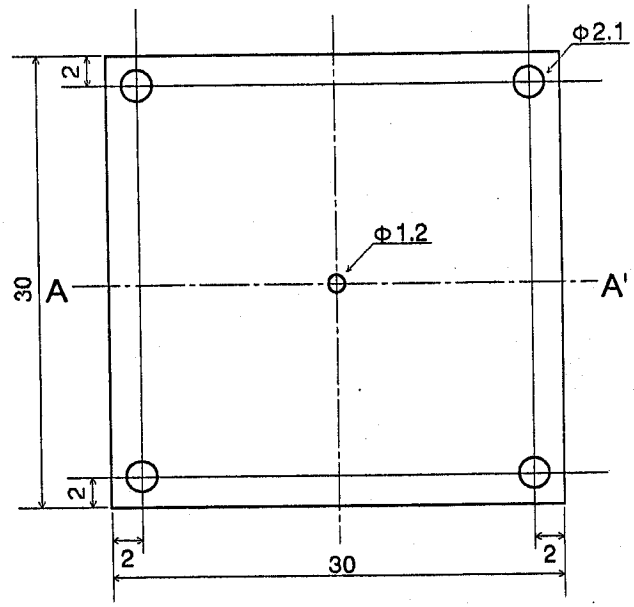
A-A' cross-sectional view



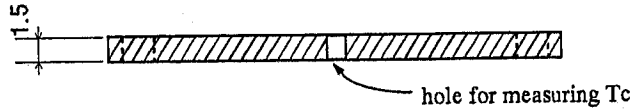
material : glass epoxy base coated
on both sides with a layer of metal and solder
(copper foil thickness : 18 μm
solder thickness : 40～70 μm)

Heat Sinking Board

top view



A-A' cross-sectional view



material : aluminum board

Solder

Sn : 60%, Φ0.6mm
(melting point : 190℃)

Conducting epoxy adhesive

Sumitomo bakelite CRM-1061

Screws for attaching the printed circuit board to the heat sinking board

4 M2×8, cross-type small screws

Nuts

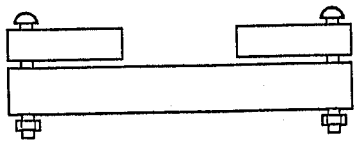
4 M2 hex nuts

Spring washers

4 M2 spring washers

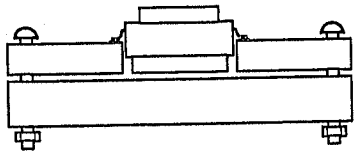
MOUNTING PROCEDURE

①



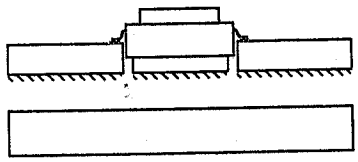
Temporarily fasten the printed circuit board to the heat sinking board with the screws.

②



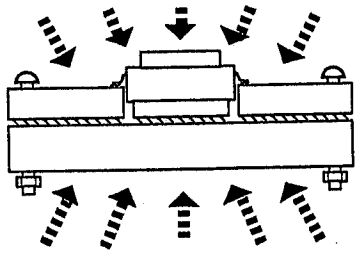
Insert the IC package into the center part of the printed circuit board. Solder the GND pins to the printed circuit board.

③



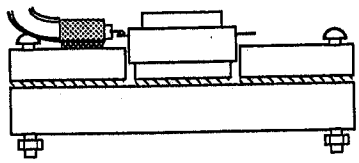
Unfasten the printed circuit board from the heat sinking board. Thinly paint the entire bottom surfaces of the printed circuit board and the IC with the conducting epoxy adhesive. Make sure that silver paste is not applied to the region between the printed circuited board and the IC.

④



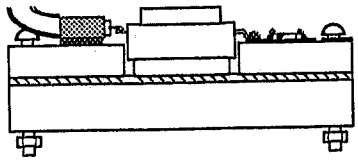
Again fasten the printed circuit board to the heat sinking board with the screws. Bake the fixture in an oven for 60 minutes at 150℃ (120℃～170℃).

⑤



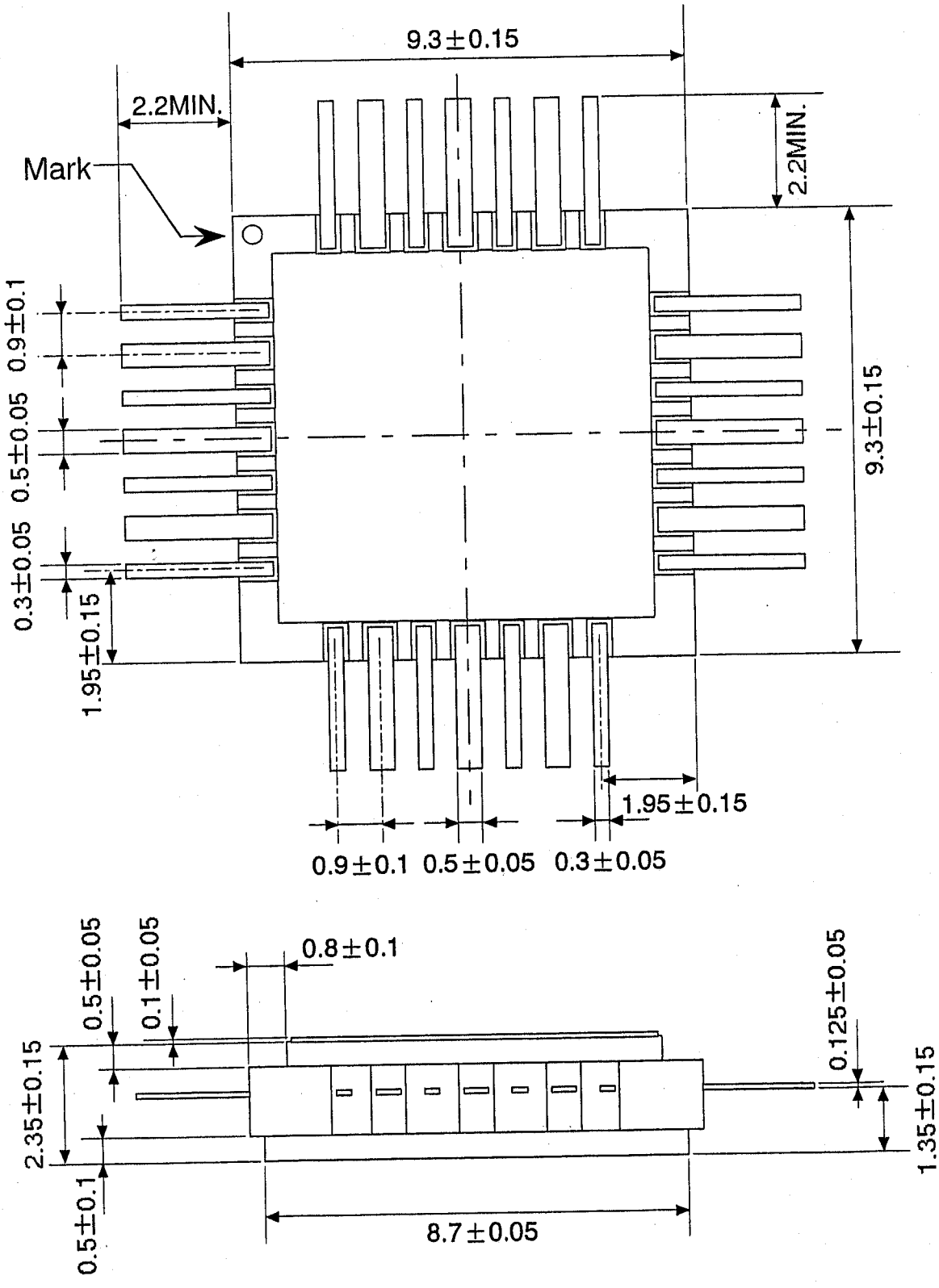
Take the fixture out of the oven. After the IC has cooled, solder the FCC to the input/output pins.

⑥



As the final step, solder the chip capacitors, chip resistors, etc., to the DC pins.

TB 28 - PIN PACKAGE DIMENSION (mm)



HANDLING INSTRUCTIONS

Since the NLG4130 is fabricated with GaAs MESFET's (Metal Semiconductor Field Effect Transistors), users are recommended to follow the instructions below to prevent damage to the chip from electro-static discharge.

1) Use a conductive working desk connected to the ground (or, a conductive table top connected to the ground).
2) Require all handling personnel to wear a conductive bracelet or wrist-strap connected to the ground through a 1 M-ohm resistors.
3) Ground all test equipment.
4) Ground all soldering iron tops.
5) Store IC's and other devices such as chip capacitors in their conductive carriers until they are soldered.

Caution

1. In order to improve products and technology, specifications are subject to change without notice.

2. When using the products, be sure the latest information and specifications are used.

3. Circuit drawings etc. shall be provided for the purpose of information only on application examples not for actual installation of equipment. NTT Electronics Corp. shall not assume any liability for damage that may result from the use of these circuit drawings etc. NTT Electronics Corp. shall not assent to or guarantee any rights of execution for patent rights of the third parties and other rights that may be raised for use of these circuit drawings.

4. To make a design, the products shall be used within the assured ranges with respect to maximum ratings, voltage, and radiation. NTT Electronics Corp. shall not take any responsibility for damage caused by neglecting the assured values or improper usage.

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8. Some of the products use GaAs (gallium arsenide). GaAs powder and vapor are dangerous for humans. Do not break, cut, crush or chemically destroy the products. To dispose of the products, follow the relevant regulations and laws; do not mix with general industrial waste and domestic garbage.

9. Any questions should be directed to the Sales Department of NTT Electronics Corp.

MEMO

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