NEL

Revised on August 5 , 1994

NLG4115
2 : 1 SELECTER

The NLG4115 is an ultra-fast 2:1 SELECTER operating at up to 10 Gb/s [Tc = 25 ℃ , MIN.] .
Designed with LSCFL (Low-power Source Coupled FET Logic) , it uses SCFL I/O levels (V_H : 0.0 V, V_L : - 0.9 V) .
Owing to built-in 50-ohm termination resistors between signal input pins and ground (GND) , external termination resistors are unnecessary for impedance matching .
The NLG4115 is fabricated using the 0.15- μ m gate length A-SAINT (Advanced Self-Aligned Implantation for N^+ layer Technology) process .

FEATURES

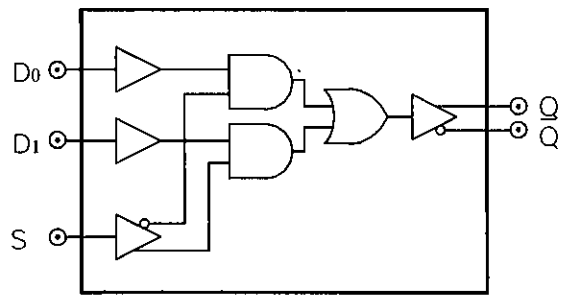
Ultra-high speed : maximum data operating speed f_{MAX} : ≧10.0 Gb/s [Tc = 25 ℃ , MIN.]
output rise time tr = 25 ps (20-80%) [Tc = 25 ℃ , TYP.]
output fall time tf = 20 ps (20-80%) [Tc = 25 ℃ , TYP.]

High Reliability : hermetically-sealed package

APPLICATIONS

- 2-1 Multiplexer
- Basic circuit for multi-bit multiplexer

FUNCTIONAL DIAGRAM



TRUTH TABLE

D_0	D_1	S	Q	$\overline{Q}$
L	X	L	L	H
H	X	L	H	L
X	L	H	L	H
X	H	H	H	L

Note
X : Arbitrary

PIN CONNECTION TABLE

PIN No.	NAME	FUNCTION	PIN No.	NAME	FUNCTION
1	D_0	Data Input 0	15	N.C.	No Internal Connection
2	GND	Ground (0.0 V)	16	GND	Ground (0.0 V)
3	Vrefs	Select Signal Input Ref. (1)	17	$\overline{Q}$	Data Output (Comp.)
4	GND	Ground (0.0 V)	18	GND	Ground (0.0 V)
5	S	Select Signal Input	19	Q	Data Output (True)
6	GND	Ground (0.0 V)	20	GND	Ground (0.0 V)
7	D_1	Data Input 1	21	N.C.	No Internal Connection
8	N.C.	No Internal Connection	22	Vref	Data Input Ref. (3)
9	GND	Ground (0.0 V)	23	GND	Ground (0.0 V)
10	V_{SS}	Power Supply (- 3.5 V)	24	V_{SS}	Power Supply (- 3.5 V)
11	GND	Ground (0.0 V)	25	GND	Ground (0.0 V)
12	V_{SS}	Power Supply (- 3.5 V)	26	V_{SS}	Power Supply (- 3.5 V)
13	GND	Ground (0.0 V)	27	GND	Ground (0.0 V)
14	Vcsout	Output Swing Adjust (2)	28	N.C.	No Internal Connection

Notes

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

(2) Vcsout : Output swing adjustment pin. Generally left unconnected.
To decrease the output swing, connect a resistor between Vcsout pin and V_{SS} pin as shown in sample implementation (see page 9).
Output swing can n

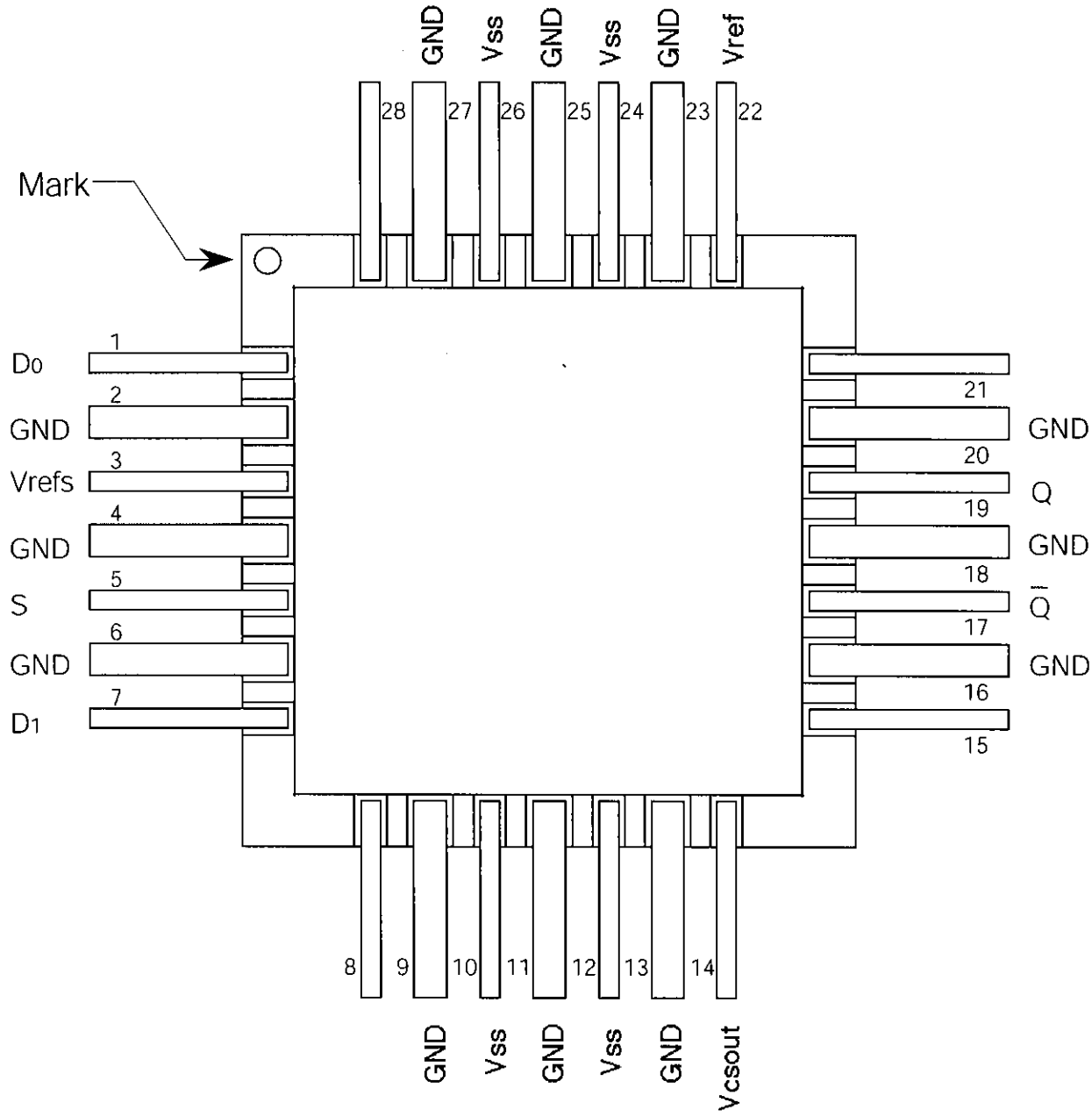
ATTENTION

Please pay attention not to touch the V_{csout} pin to the GND or the other pins while applying the Vss voltage, otherwise the IC would be damaged.

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

(4) Terminate unused output pins in 50 - ohms.

CONNECTION DIAGRAM (TOP VIEW)



ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING
V_{SS}	Power Supply Voltage	0.0 V ~ - 4.0 V
V_{IN}	Applied Voltage at Signal Inputs (D_0, D_1, S)	+ 0.3 V ~ - 1.6 V
Vout	Applied Voltage at Signal Outputs (Q, $\overline{Q}$)	+ 0.2 V ~ - 1.75 V
Vcsout	Applied Voltage at V_{csout} pin	Open Circuit Voltage ~ V_{SS}
Vrefs	Applied Voltage at Vrefs pin	+ 0.3 V ~ - 1.6 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
V_{SS}	Power Supply	- 3.4	- 3.5	- 3.75	V
Vrefs	Slect Signal Input Reference	- 0.2	- 0.5	- 0.75	V
Vref	Data Input Reference	- 0.2	- 0.5	- 0.75	V
Vcsout	Output Swing Adjust	Normally Open			V

DC CHARACTERISTICS

(V_{SS}=- 3.4 V ~ - 3.75 V. GND = 0.0 V. T_c = 0 ~ 85 ℃ (1))

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS	
V_{OH}	Output Voltage, High	- 0.1	0.0		V	
V_{OL}	Output Voltage, Low		- 0.9	- 0.85	V	
V_{IH}	Input Voltage, High	- 0.2	0.0		V	
V_{IL}	Input Voltage, Low		- 0.9	- 0.75	V	
I_{SS}	Power Supply Current		480	670	mA	(2)
Pd	Power Dissipation		1.7	2.5	W	(2)

Notes

(1) Tc : Temperature at package base.

(2) : Includes load current. Excludes current through input termination resistors, all of which have a value of 50 - ohms.

AC CHARACTERISTICS

(Vss = - 3.5 V, GND = 0.0 V , Vref = - 0.2 ～ - 0.75 V , Vrefs = - 0.2 ～ - 0.75 V)

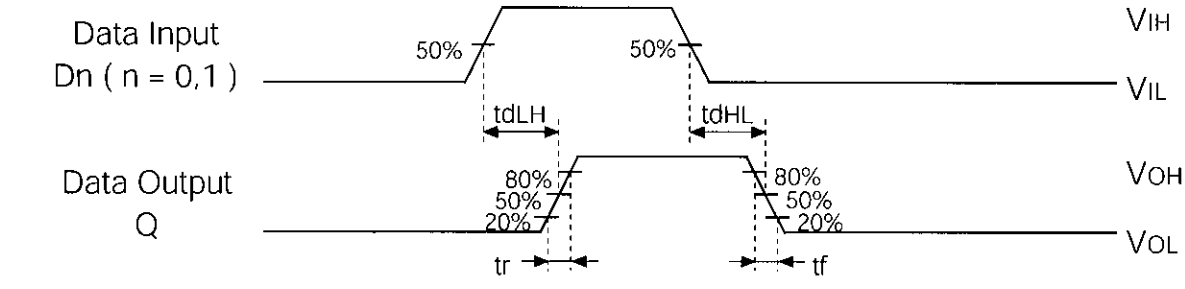
SYMBOL	PARAMETER	Tc=0℃			Tc=25℃			Tc=85℃			UNITS	
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
fMAX	Maximum data operating speed	≧10.0			≧10.0			≧10.0			Gb/s	(1)
tr	Output Rise Time (20-80%)		25	35		25	35		30	40	ps	(2)
tf	Output Fall Time (20-80%)		20	30		20	30		25	35	ps	(2)
tdLH	Output Rise Delay (Dn-Q,$\overline{Q}$)	195	215	235	195	215	235	200	220	240	ps	(2)
tdHL	Output Fall Delay (Dn-Q,$\overline{Q}$)	195	220	245	195	220	245	200	225	250	ps	(2)
tsLH	Output Fall Delay ($\overline{S}$-Q,$\overline{Q}$)	190	220	250	190	220	250	190	225	255	ps	(3)
tsHL	Output Fall Delay ($\overline{S}$-Q,$\overline{Q}$)	195	225	255	195	225	260	200	230	260	ps	(3)

Notes

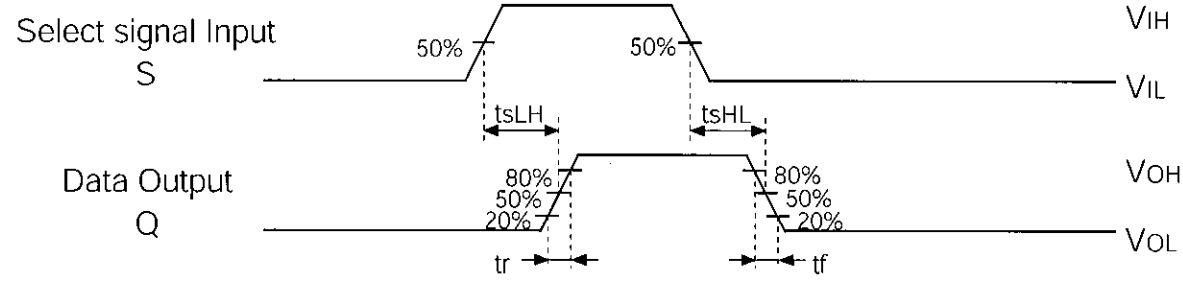
(1) : Confirmed by error-free operation (an error rate of less than 1×10^{-13}) using a pseudo-random pattern having a word length of 2^{23} -1 bits .

The minimum value for the maximum data operating speed given above was limited by the maximum speed (10.0Gb/s) of the apparatus used in the measurement.

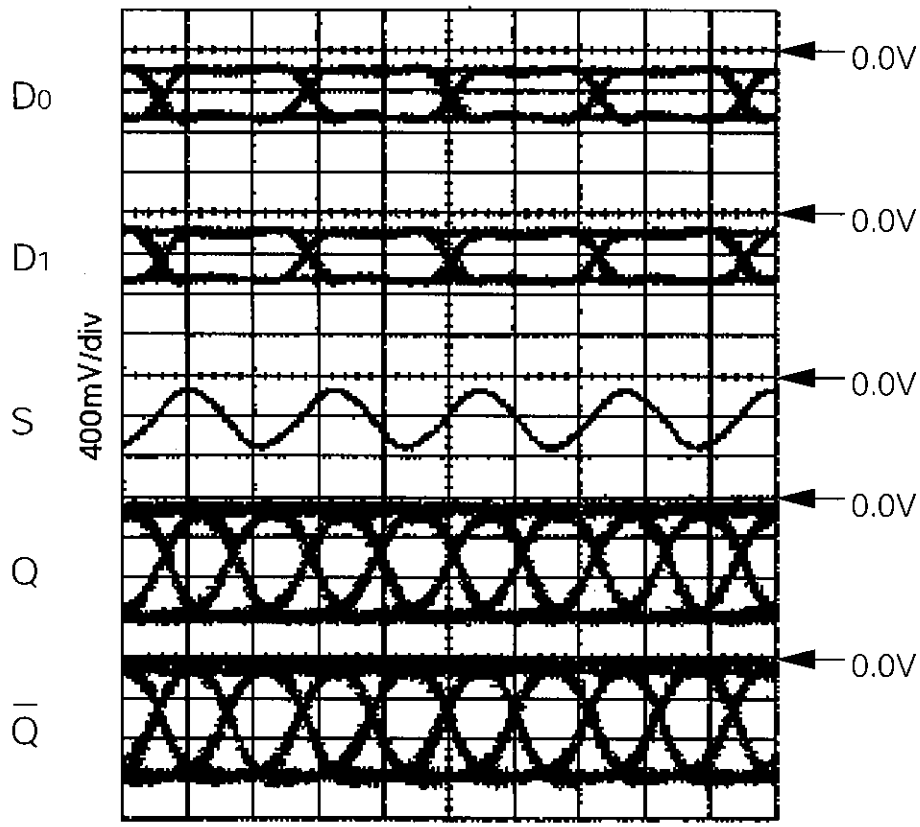
(2)



(3)



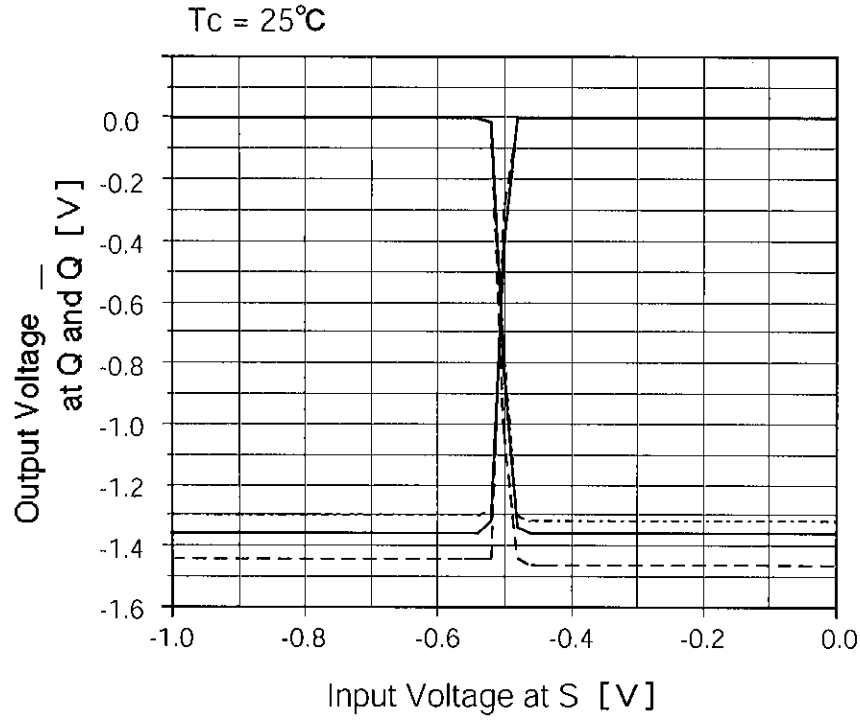
INPUT AND OUTPUT WAVEFORMS (18 Gb/s)



Measurement Conditions

Vss = - 3.5 V, Vref = - 0.50 V, Vrefs = - 0.47 V, Vcsout : open .
D0 a 9.0 Gb/s pseudo-random pattern having a word length of 2^{23} -1 bits .
D1 a 9.0 Gb/s pseudo-random pattern having a word length of 2^{23} -1 bits .
S a 9.0 GHz signal .
Data outputs connected to the 50-ohm impedance pin of a sampling oscilloscope .
Results given here were obtained using the NEL test fixture.

SAMPLE DC TRANSFER CHARACTERISTICS

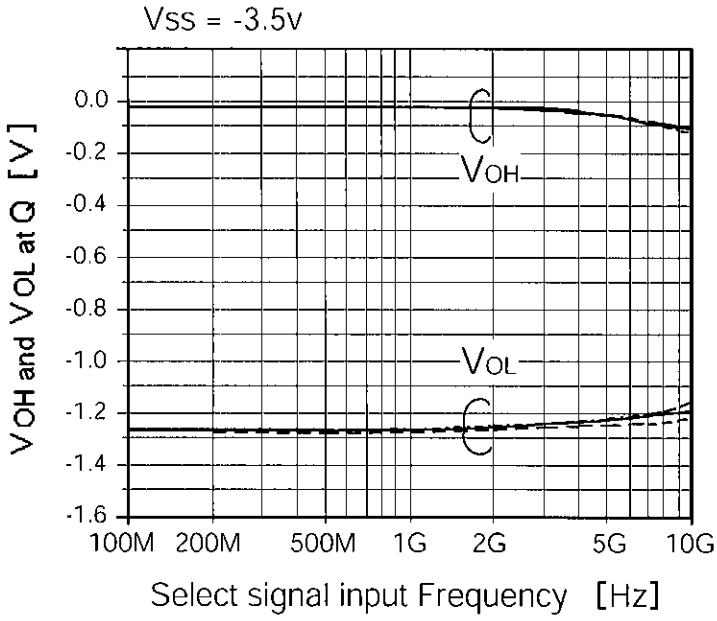


- - - - - - - - -	:	Vss = - 3.4 V
———	:	Vss = - 3.5 V
- - - - - - -	:	Vss = - 3.75 V

Measurement Conditions

D_0	:	-0.75 V
D_1	:	-0.2 V
Vref	:	Open
Vrefs	:	- 0.49 V
Vcsout	:	Open

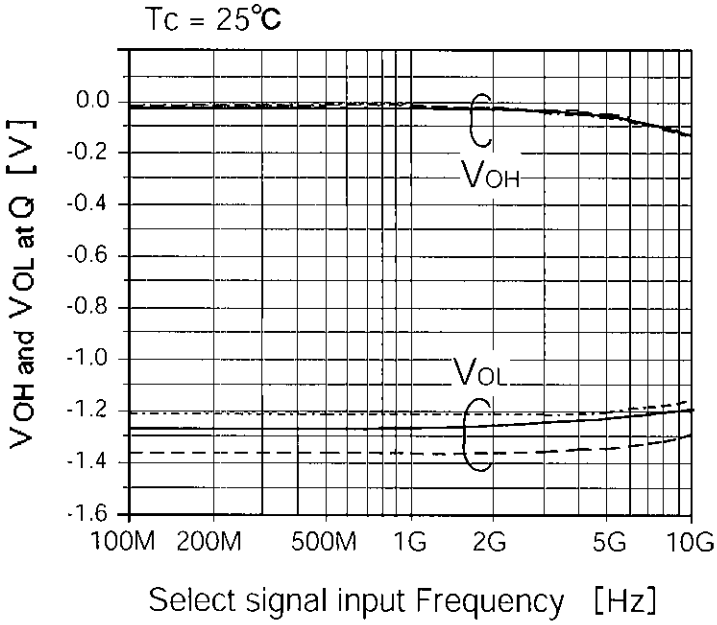
SAMPLE AC CHARACTERISTICS



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

Measurement Conditions

D0 = - 0.75 V
D1 = - 0.2 V
S : VIH = - 0.2 V
and VIL = - 0.75 V
Vref : Open
Vrefs = - 0.49 V
Vcsout : Open
Results given here were obtained using the NEL test fixture.



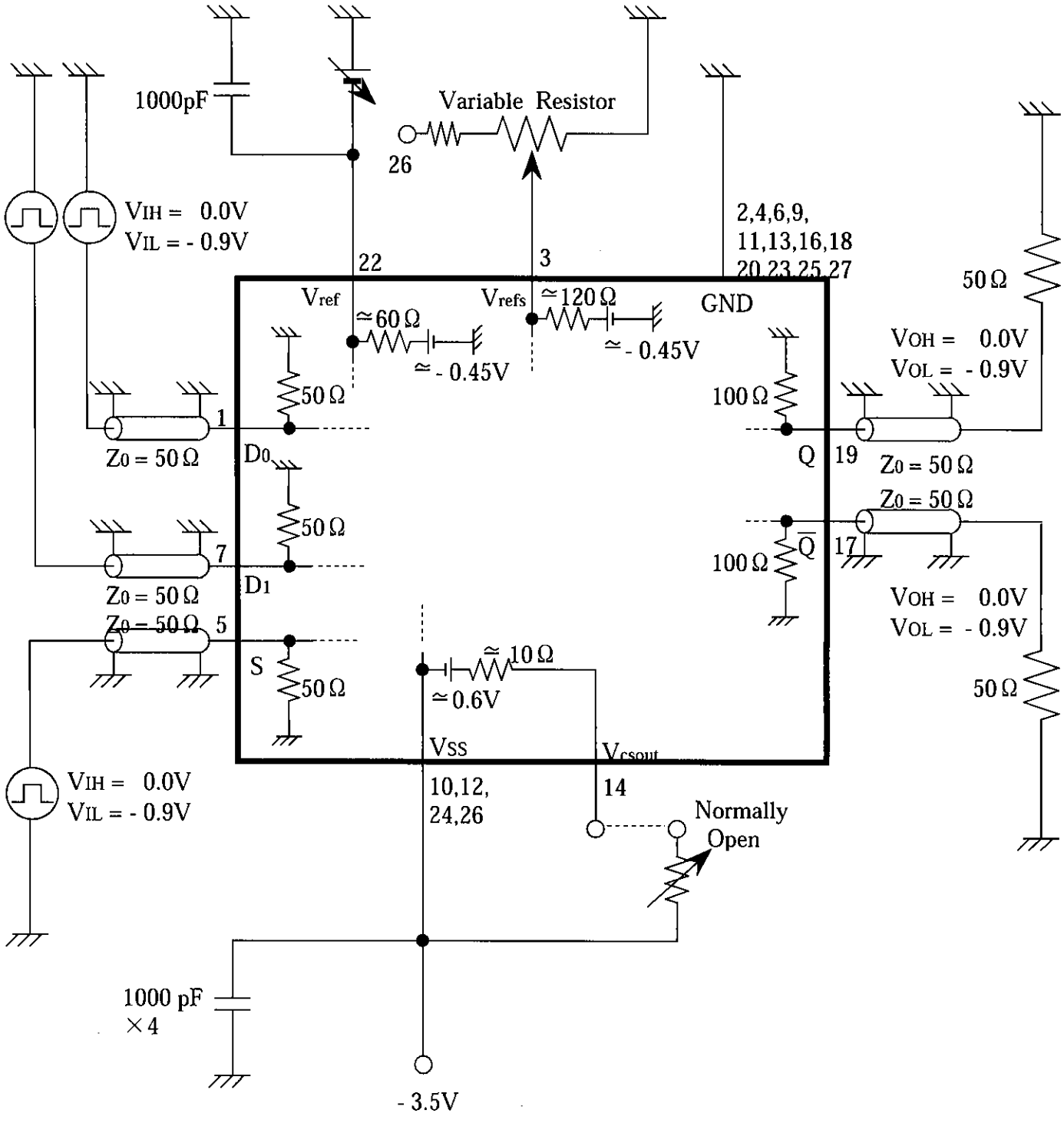
- - - - - -	:	Vss = - 3.4 V
———	:	Vss = - 3.5 V
- - - - - -	:	Vss = - 3.75 V

Measurement Conditions

D0 = - 0.75 V
D1 = - 0.2 V
S : VIH = - 0.2 V
and VIL = - 0.75 V
Vref : Open
Vrefs = - 0.49 V
Vcsout : Open
Results given here were obtained using the NEL test fixture.

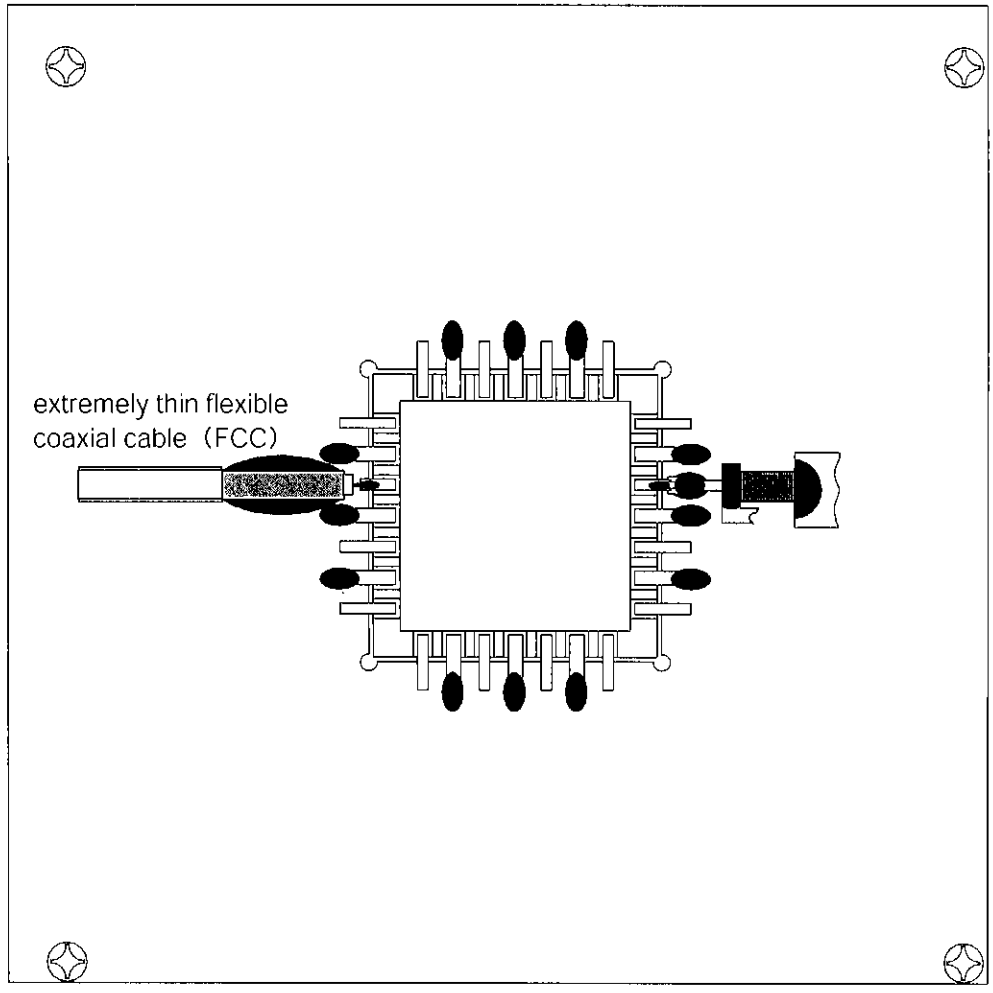
SAMPLE IMPLEMENTATION

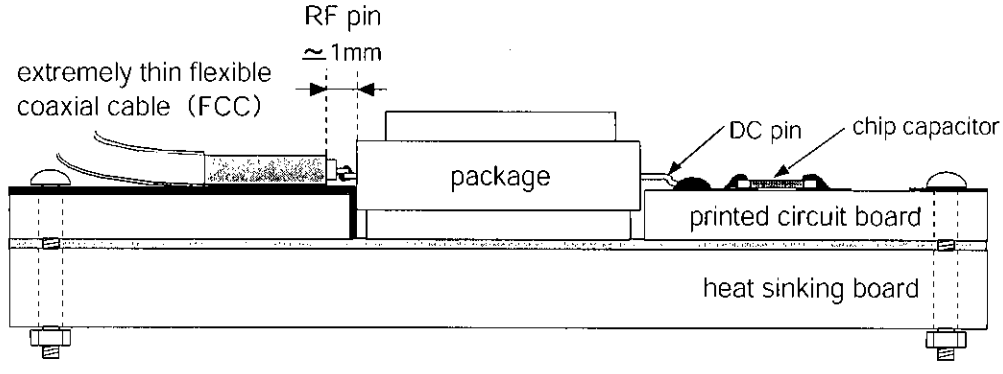
Note : Numbers represent pin numbers



As shown above, two methods exist for applying a DC voltage to the V_{ref} and V_{refs} pins. One involves a voltage divider using a variable resistor, while in the other, an external power supply is connected directly. Apply approximately - 0.5V to each pin in the latter case.

SAMPLE MOUNTING





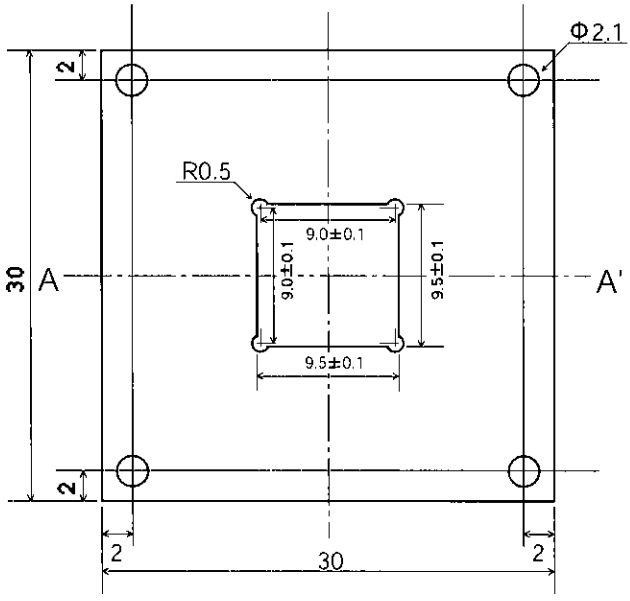
: conducting epoxy adhesive

: solder

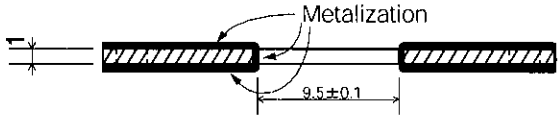
MOUNTING PARTS (unit : mm)

Printed Circuited Board

top view



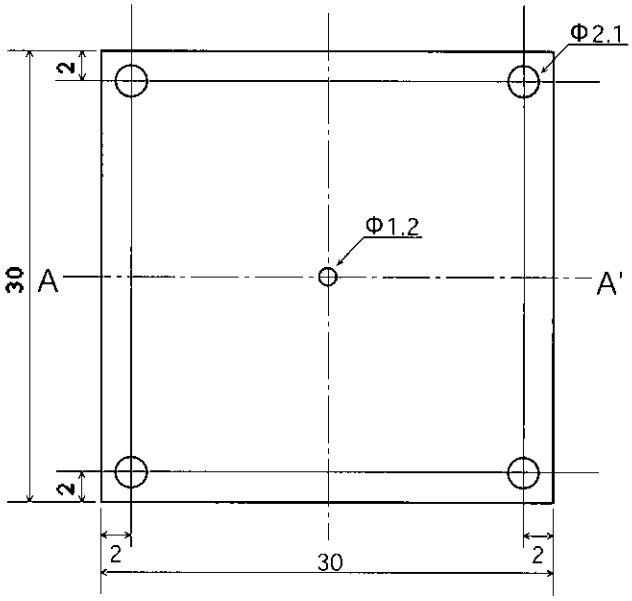
A-A' cross-sectional view



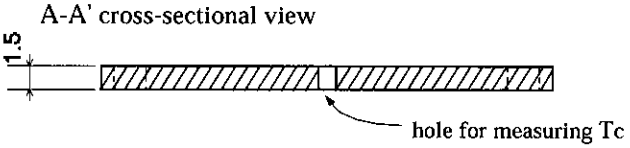
material : glass epoxy base coated
on both sides with a layer of metal and solder
(copper foil thickness : 18 μ m
solder thickness : 40~70 μ m)

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

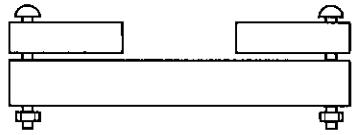
4 M2 hex nuts

Spring washers

4 M2 spring washers

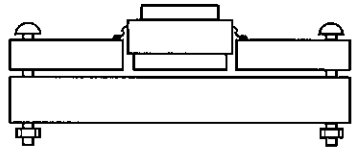
MOUNTING PROCEDURE

①



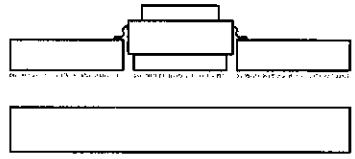
Temporarily fasten the printed circuit board to the heat sinking board with the screws.

②



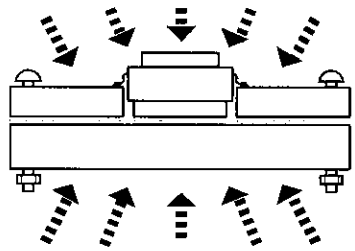
Insert the IC package into the center part of the printed circuit board. Solder the GND pins to the printed circuit board.

③



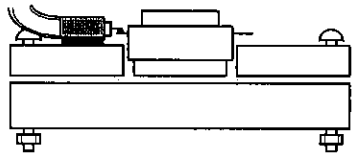
Unfasten the printed circuit board from the heat sinking board. Thinly paint the entire bottom surfaces of the printed circuit board and the IC with the conducting epoxy adhesive. Make sure that silver paste is not applied to the region between the printed circuited board and the IC.

④



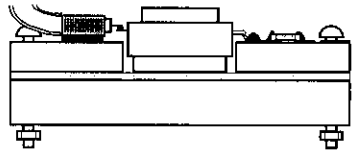
Again fasten the printed circuit board to the heat sinking board with the screws. Bake the fixture in an oven for 60 minutes at 150℃ (120℃～170℃).

⑤



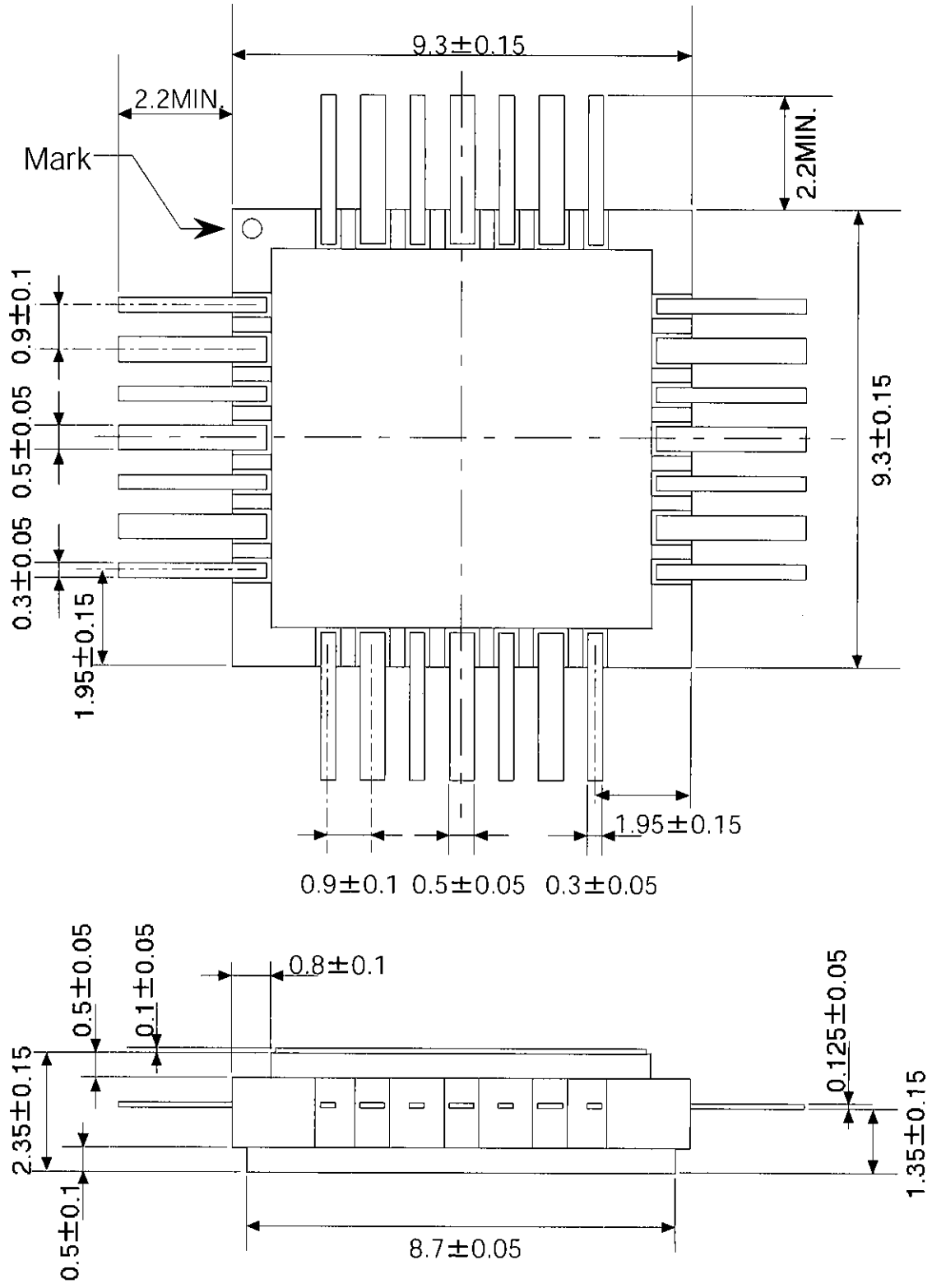
Take the fixture out of the oven. After the IC has cooled, solder the FCC to the input/output pins.

⑥



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

TB 28 - PIN PACKAGE DIMENSION (mm)



OPERATING AND HANDLING INSTRUCTIONS

Since the NEL ICs are 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 - statics discharge.

(1) Power Supply Sequence

The following power supply sequence is recommended.

1) Set supply voltage V_{SS}, V_{ref}, V_{refs} and GND to 0V.

2) Apply V_{ref}.

3) Apply V_{refs}.

4) Apply V_{SS}.

RF signals are recommended to be applied while power supplying and biasing.

(2) Handling precautions

1) Use a conductive working desk connected to ground (or, a conductive table top connected to ground).

2) Require all handling personnel to wear a conductive bracelet or wrist - strap connected to ground though a 1 M - ohm resistor.

3) Ground all test equipment.

4) Ground all soldering iron tips.

5) Store IC's and other devices such as chip capacitors in their conductive carriers until they are soldered.