# NLG4140
# 12.5 GHz 1 : 2 CLOCK DISTRIBUTOR (AC Coupling)

The NLG4140 is an ultra-fast 1:2 Clock Distributor operating at up to 12.5 GHz (MIN.) . Designed with LSCFL (Low-power Source Coupled FET Logic) , either AC coupling or DC coupling can be used for signal input and 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 NLG4140 is fabricated using the 0.15-$\mu$m gate length A-SAINT (Advanced Self-Aligned Implantation for $N^+$ layer Technology) process .

## FEATURES

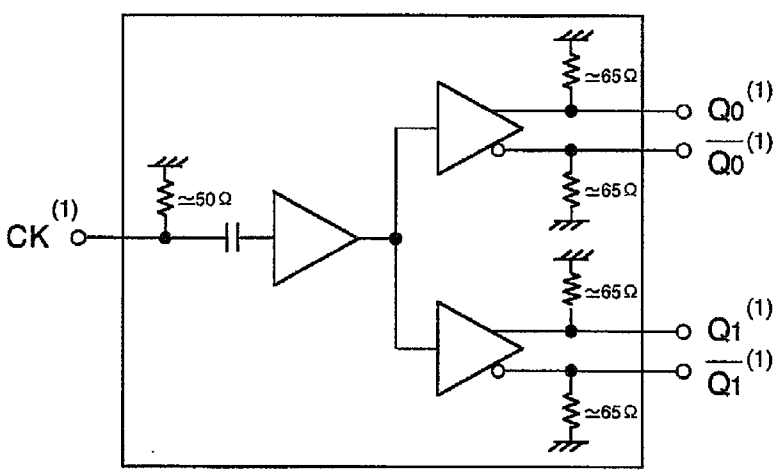
| | | | |
|---|---|---|---|
| Ultra-high speed : | maximum clock Frequency | $f_{MAX}$: 12.5 GHz | [MIN.] |
| | minimum clock Frequency | $f_{MIN}$ : 2.0 GHz | [MAX.] |
| | output rise time | tr = 15 ps (20-80 %) | [TYP.] |
| | output fall time | tf = 15 ps (20-80 %) | [TYP.] |

High Reliability : hermetically-sealed package

## APPLICATIONS

- Clock distributor
- Reforming of waveform

## FUNCTIONAL DIAGRAM




Note (1) DC coupling or AC coupling (see page 9)

## TRUTH TABLE

| CK | Qn | $\overline{Qn}$ |
|---|---|---|
| H | H | L |
| L | L | H |

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

## PIN CONNECTION TABLE

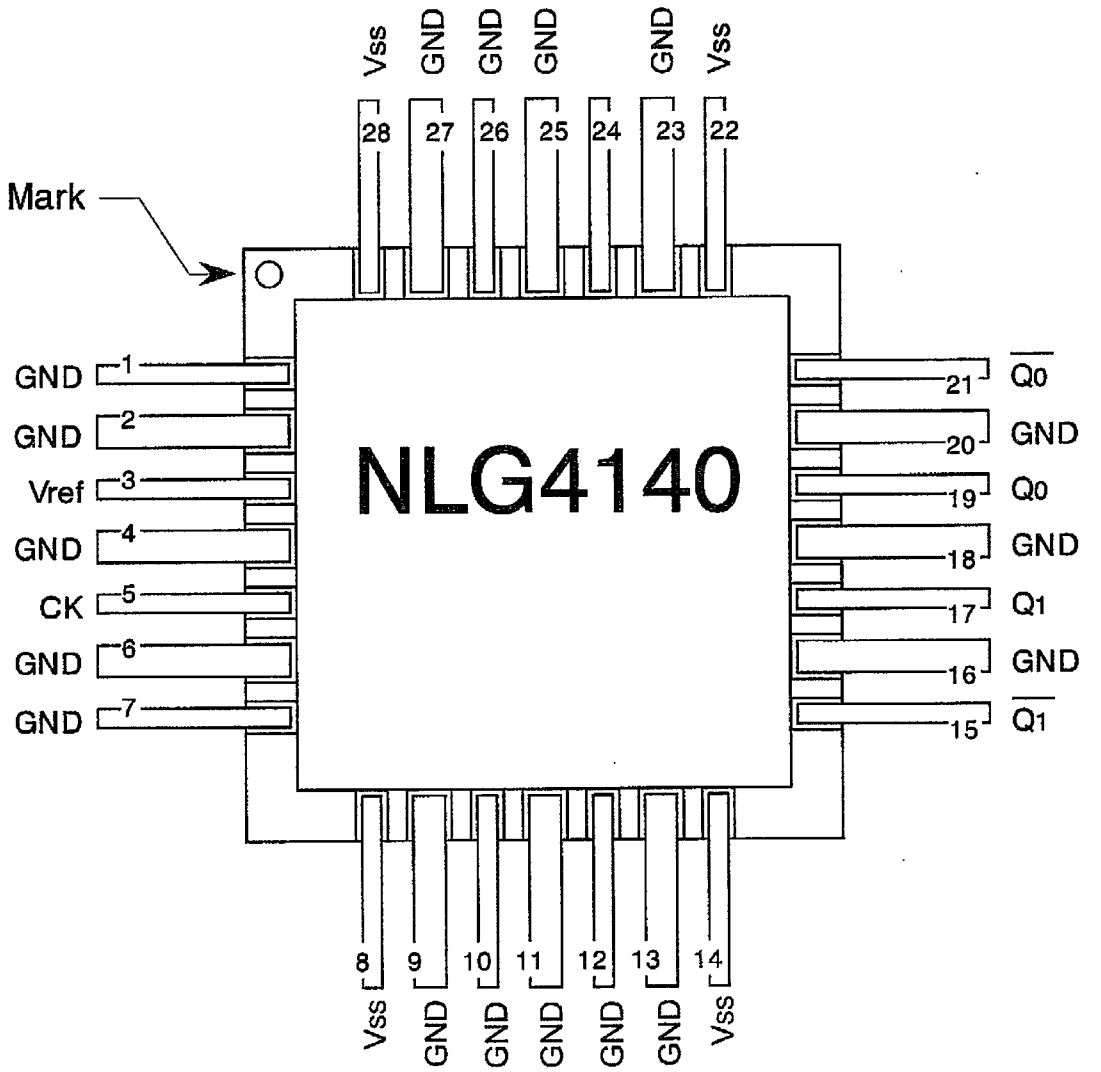
| PIN No. | NAME | FUNCTION | PIN No. | NAME | FUNCTION |
|---|---|---|---|---|---|
| 1 | GND | Ground (0.0 V) | 15 | $\overline{Q_1}$ | Signal Output 1 (Comp.) |
| 2 | GND | Ground (0.0 V) | 16 | GND | Ground (0.0 V) |
| 3 | Vref | Input Ref. (1) | 17 | $Q_1$ | Signal Output 1 (True) |
| 4 | GND | Ground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

### Notes

(1) Vref: Internally generated reference voltage that determines the clock input threshold level.

(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 | +0.5 V ~ - 4.0 V |
| Vin | Applied Voltage Amplitude at Clock Input (CK) | 1.6 Vp-p |
| Vinck | Applied Voltage at Clock Input (CK) | +1.6 V ~ - 1.6 V |
| Vout | Applied Voltage at Clock Outputs ($Q_0$, $\overline{Q_0}$, $Q_1$, $\overline{Q_1}$) | +0.2 V ~ - 1.75 V |
| Vref | Applied Voltage at Vref pin under Bias | - 1.0 V ~ - 2.5 V |
| Tstor | Storage temperature | - 60 ℃ ~ +150 ℃ |
| $T_C$(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 | Clock Input Reference Voltage | Normally Open | | | V |
| CK | Clock Input Interface (CK) | DC Coupling or AC Coupling (See AC Characteristics) | | | — |
| OUT | Clock Output Interface ($Q_0$, $\overline{Q_0}$, $Q_1$, $\overline{Q_1}$) | DC Coupling or AC Coupling (See AC Characteristics) | | | — |

## DC CHARACTERISTICS

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

| SYMBOL | PARAMETER | MIN. | TYP. | MAX. | UNITS | |
|---|---|---|---|---|---|---|
| Iss | Power Supply Current | | 410 | 580 | mA | (2) |
| Pd | Power Dissipation | | 1.4 | 2.2 | 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-ohm resistors.

## AC CHARACTERISTICS

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

| SYMBOL | PARAMETER | MIN. | TYP. | MAX. | UNITS | |
|---|---|---|---|---|---|---|
| Vin | Minimum Input Voltage Amplitude | | | 0.55 | VP-P | (4) |
| Vcenter | Clock Input Center Voltage | - 0.5 | | 0.5 | V | (4) |
| $f_{MAX}$ | Maximum Clock Frequency | 12.5 | | | GHz | |
| $f_{MIN}$ | Minimum Clock Frequency | | | 2.0 | GHz | |
| Vamp | Output Voltage Amplitude (Q0, $\overline{Q0}$, Q1, $\overline{Q1}$) | 0.55 | 0.90 | | VP-P | (1), (2) (4) |
| VOH | Output Voltage, High (Q0, $\overline{Q0}$, Q1, $\overline{Q1}$) | -0.20 | - 0.05 | | V | (3), (4) |
| VOL | Output Voltage, Low (Q0, $\overline{Q0}$, Q1, $\overline{Q1}$) | | - 1.10 | -0.75 | V | (3), (4) |
| tr | Output Rise Time (Q0, $\overline{Q0}$, Q1, $\overline{Q1}$) | | 15 | 25 | ps | (1), (4) |
| tf | Output Fall Time (Q0, $\overline{Q0}$, Q1, $\overline{Q1}$) | | 15 | 25 | ps | (1), (4) |
| tdLH | Output Rise Delay (CK - Qn, $\overline{Qn}$) | 190 | 220 | 250 | ps | (4) |
| tdHL | Output Fall Delay (CK - Qn, $\overline{Qn}$) | 190 | 220 | 250 | ps | (4) |

### Notes

(1) Measurement Condition : f = 12.5 GHz

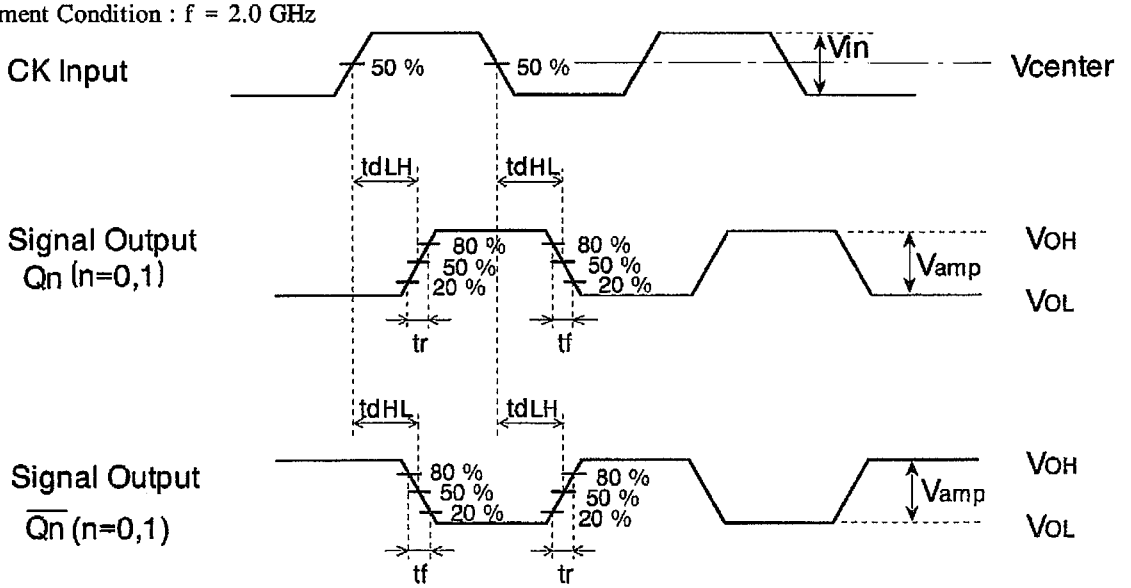
(2) AC coupling 50Ω to GND

DC Block : Picosecond Pulse Labs. , Model 5501A

(3) DC coupling 50Ω to GND

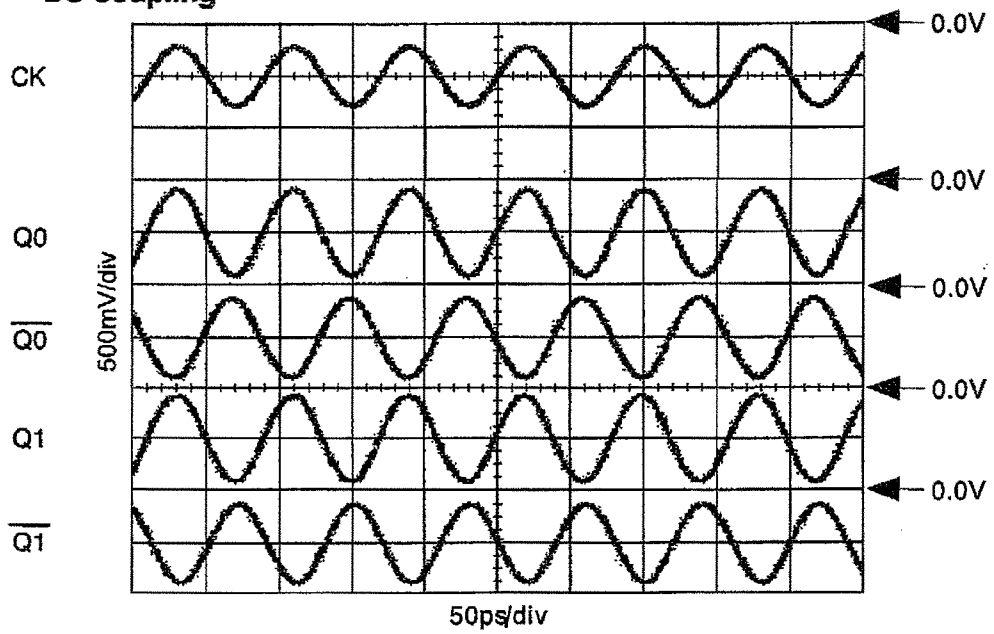
Measurement Condition : f = 2.0 GHz

(4)

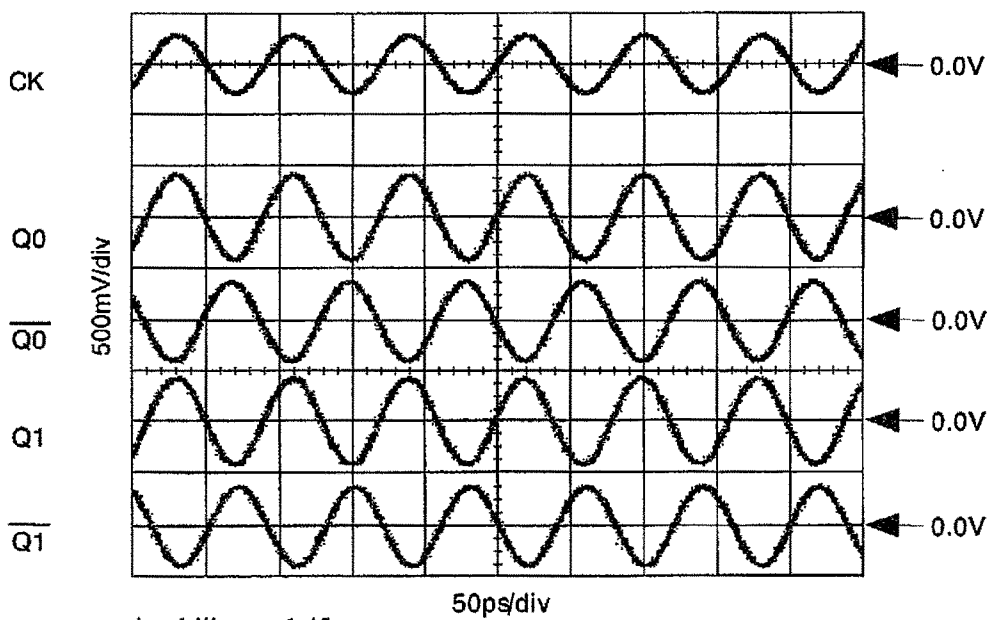


## SAMPLE INPUT AND OUTPUT WAVEFORMS (12.5GHz)

**DC Coupling**




**AC Coupling**



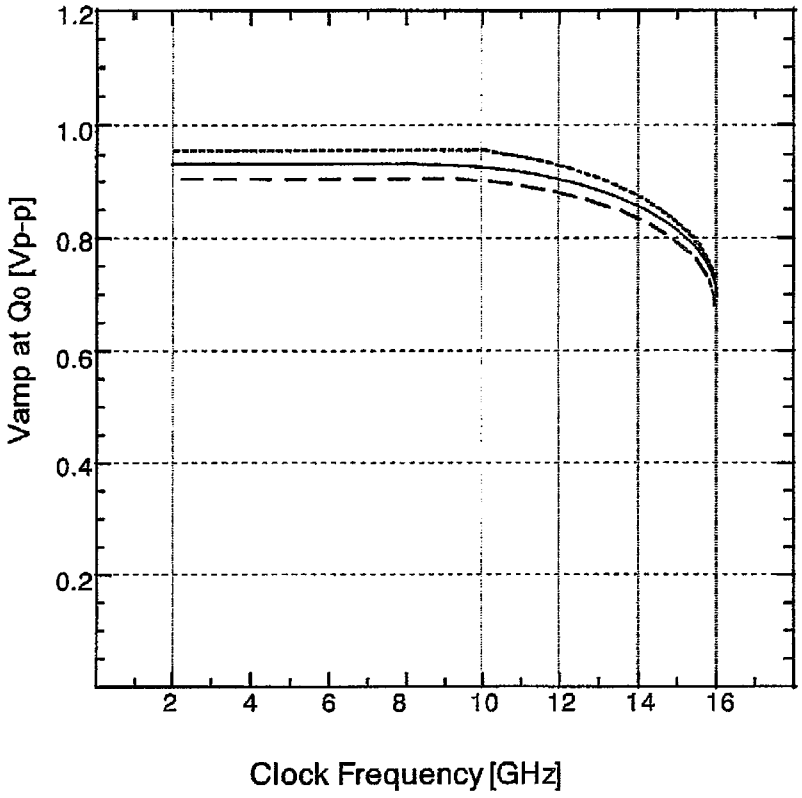

output signal jiiters = 1.45 psrms

Measurement Conditions

Tc=35℃
Vss=-3.5V
Vref: OPEN
Clock input signal jitter = 1.23 psrms
Clock 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=-3.5V

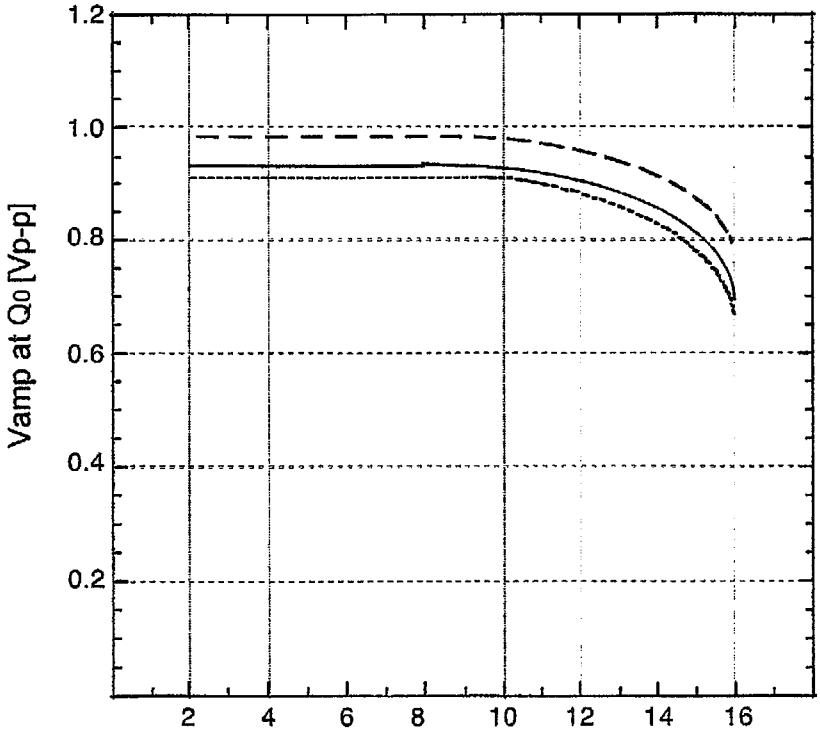



---------- : Tc=0℃
——— : Tc=35℃
— — — — : Tc=85℃

**Measurement Conditions**

Din : 0.55Vp-p
$V_{ref}$ : OPEN
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=35℃



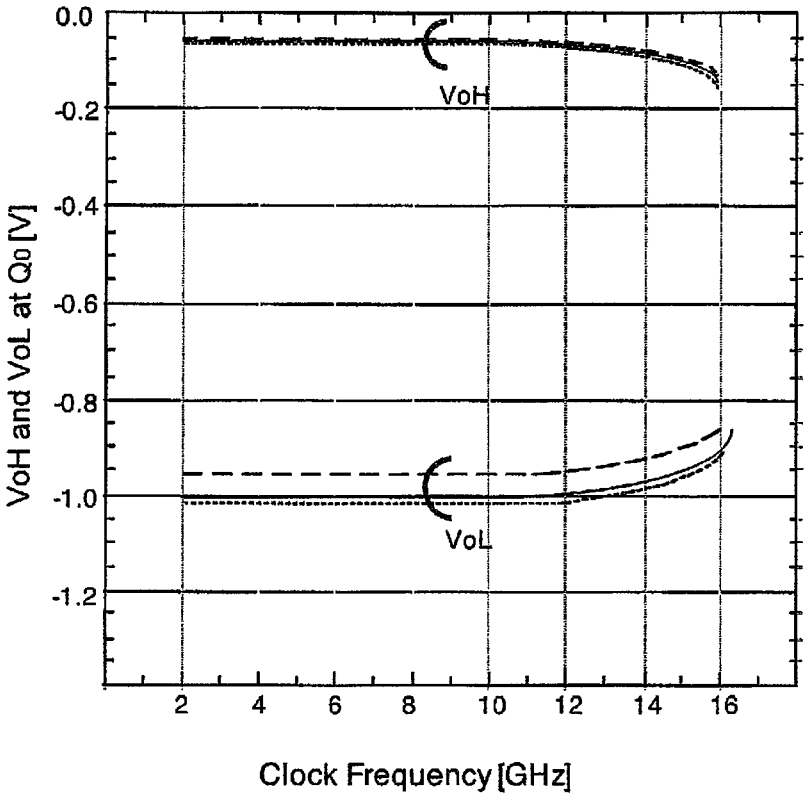

---------- : Vss=-3.4V
——— : Vss=-3.5V
— — — — : Vss=-3.75V

**Measurement Conditions**

Din : 0.55Vp-p
$V_{ref}$ : OPEN
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=-3.5V

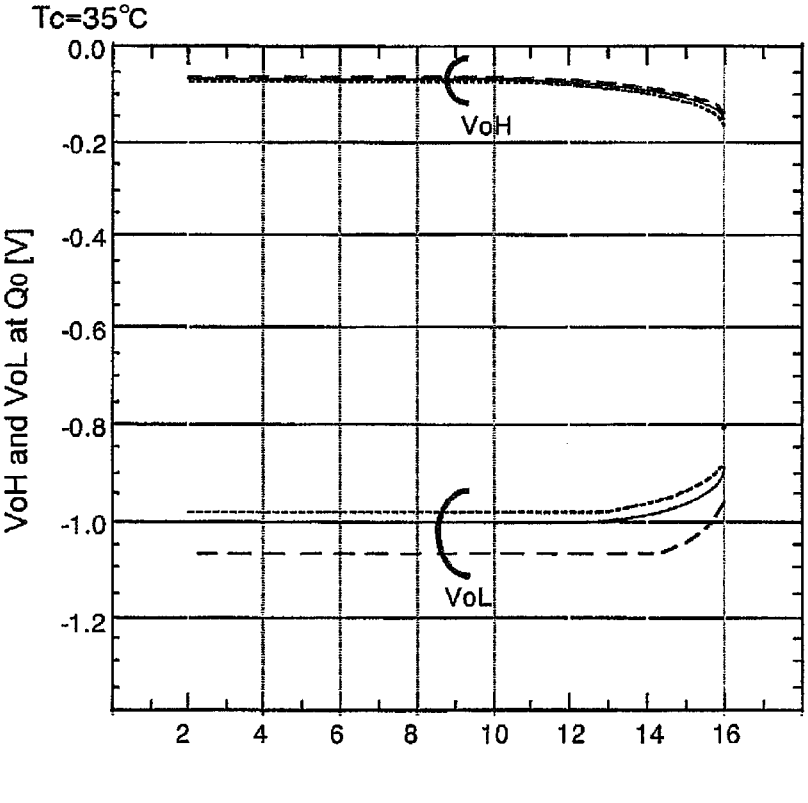



: Tc=0℃
: Tc=35℃
: Tc=85℃

**Measurement Conditions**

Din : 0.55Vp-p
$V_{ref}$ : OPEN
DC block : Picosecond Pulse Labs
Model 5501A
Qn : DC coupling,50 - ohms to GND
Results given here were obtained
using the NEL test fixture.

Tc=35°C

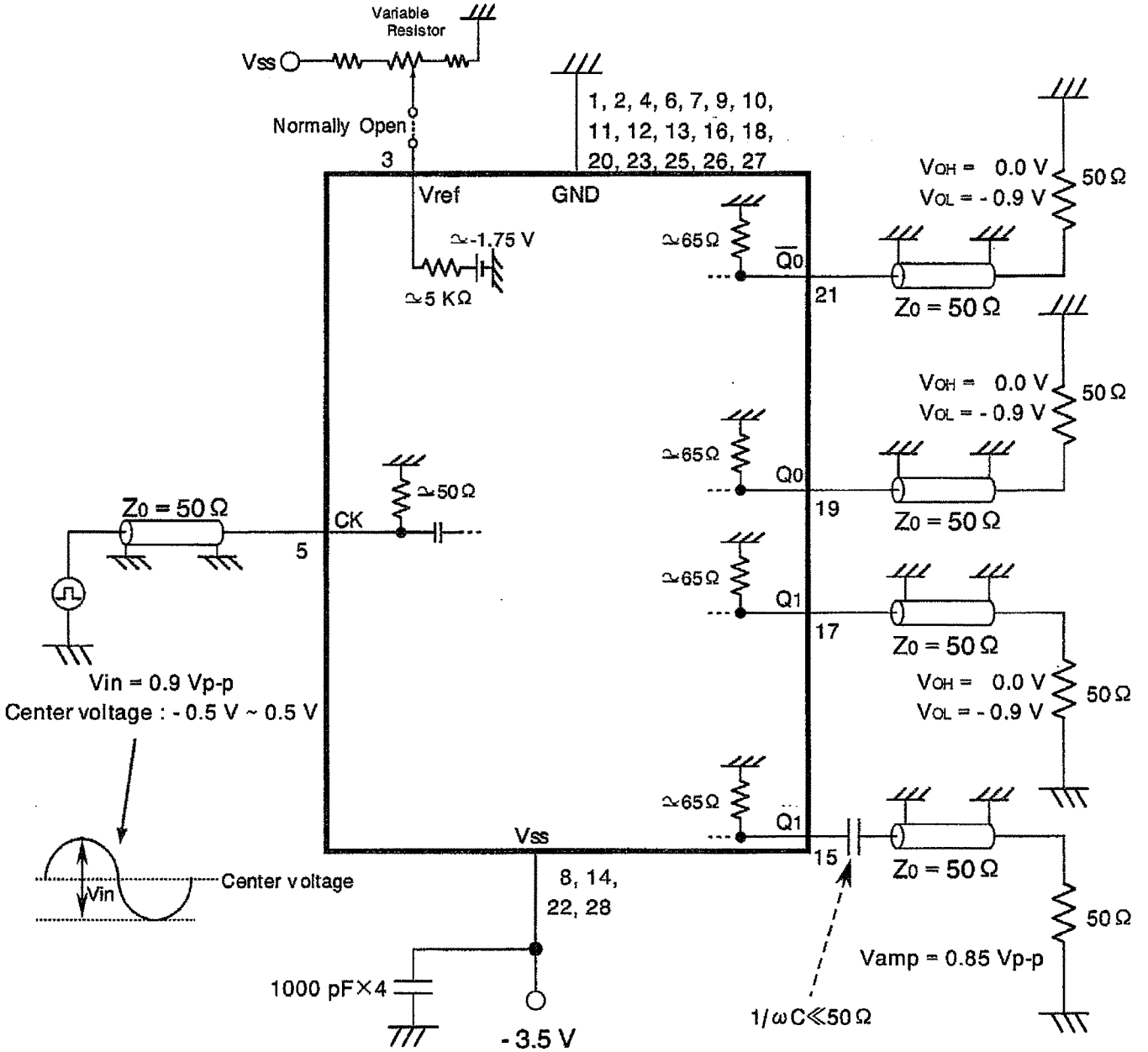



: Vss=-3.4V
: Vss=-3.5V
: Vss=-3.75V

**Measurement Conditions**

Din : 0.55Vp-p
$V_{ref}$ : OPEN
DC block : Picosecond Pulse Labs
Model 5501A
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

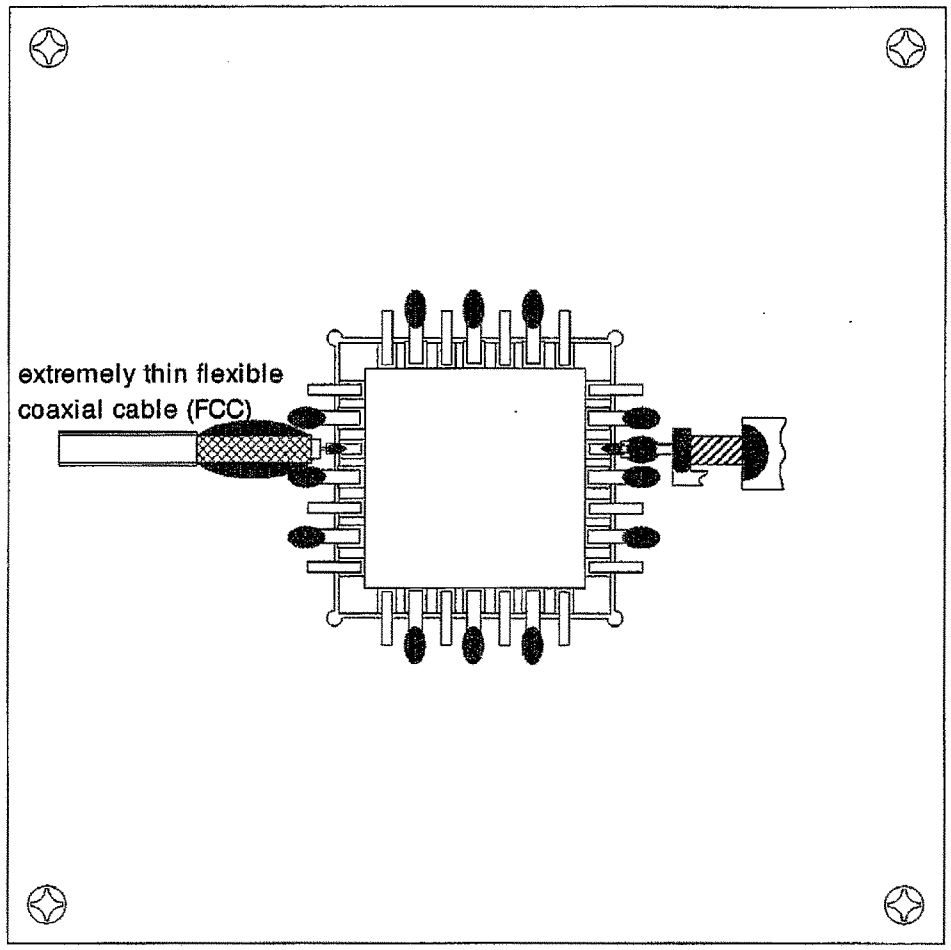
(2) Either AC coupling or DC coupling can be used for all outputs ($Q_0$, $\overline{Q_0}$, $Q_1$, $\overline{Q_1}$).

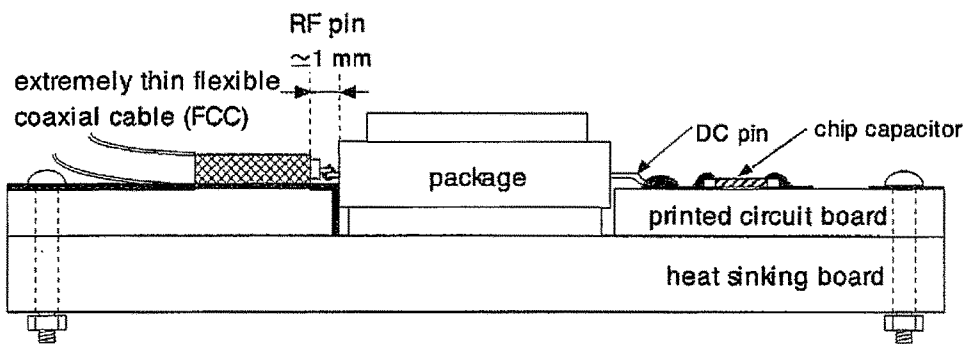
(3) AC coupling capacitor is necessary outside the NLG4140 ($Q_0$, $\overline{Q_0}$, $Q_1$, $\overline{Q_1}$).

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 - 1.75 V to the Vref pin .

## SAMPLE MOUNTING

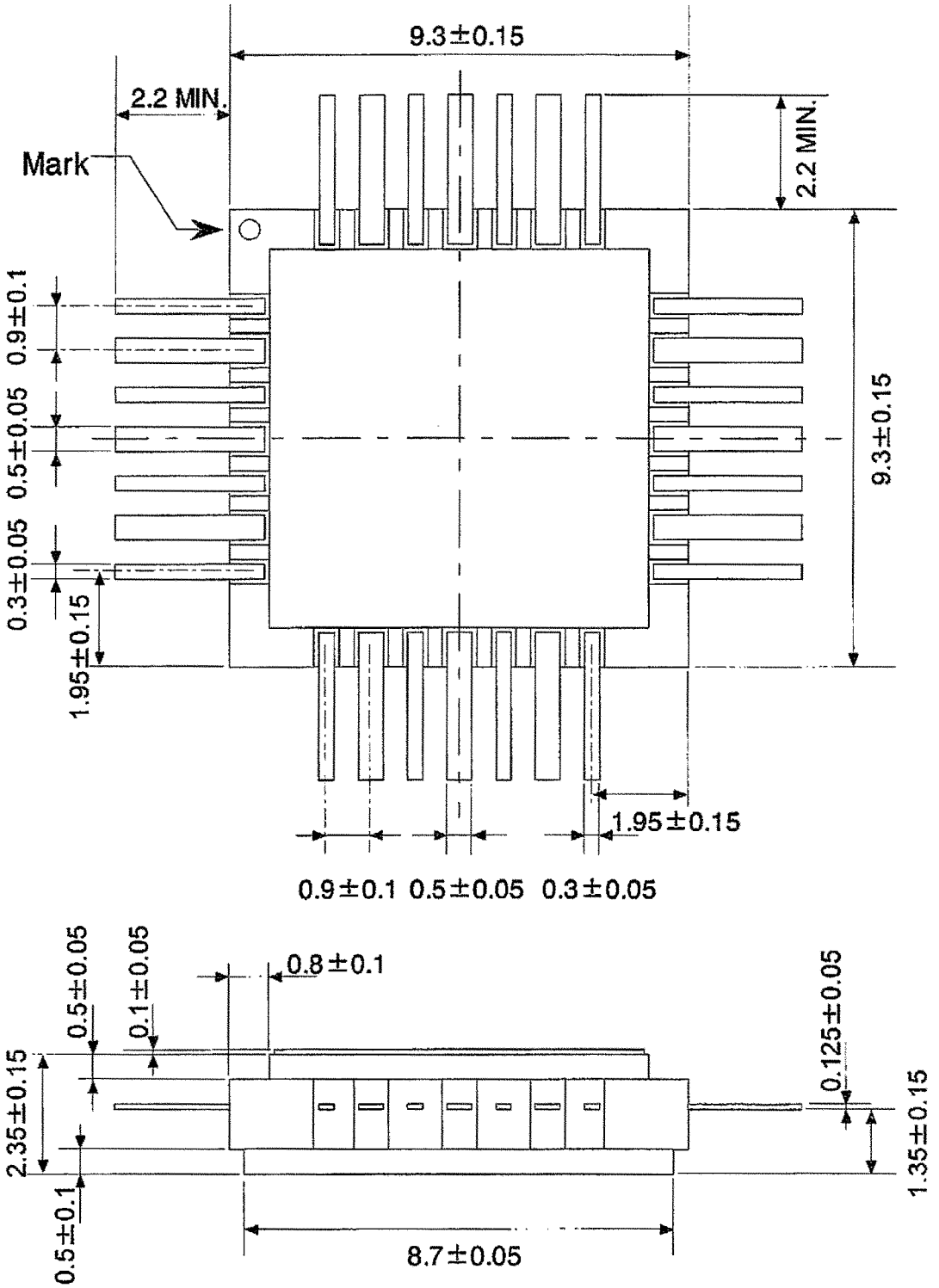



: solder

Caution : The package base should be connected to the ground.

## TB 28 - PIN PACKAGE DIMENSION (mm)



## HANDLING INSTRUCTIONS

Since the NLG4140 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.

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