NEL

NS GD E071B
23 Feb. 2000
PRELIMINARY

NLG4305
1 : 16 DEMUX

The NLG4305 is an ultra-fast 1:16 demultiplexer. It divides serial input signal operating at up to 12.5 Gb/s into 16 parallel output signal as fast as 781.25 Mb/s (MIN.) .
It is designed with LSCFL (Low-power Source Coupled FET Logic) .
Owing to built-in 50-ohm termination resistors, external termination resistors are unnecessary for impedance matching.
The NLG4305 is fabricated using the 0.15-μm gate length A-SAINT (Advanced Self-Aligned Implantation for N^+ layer Technology) process.

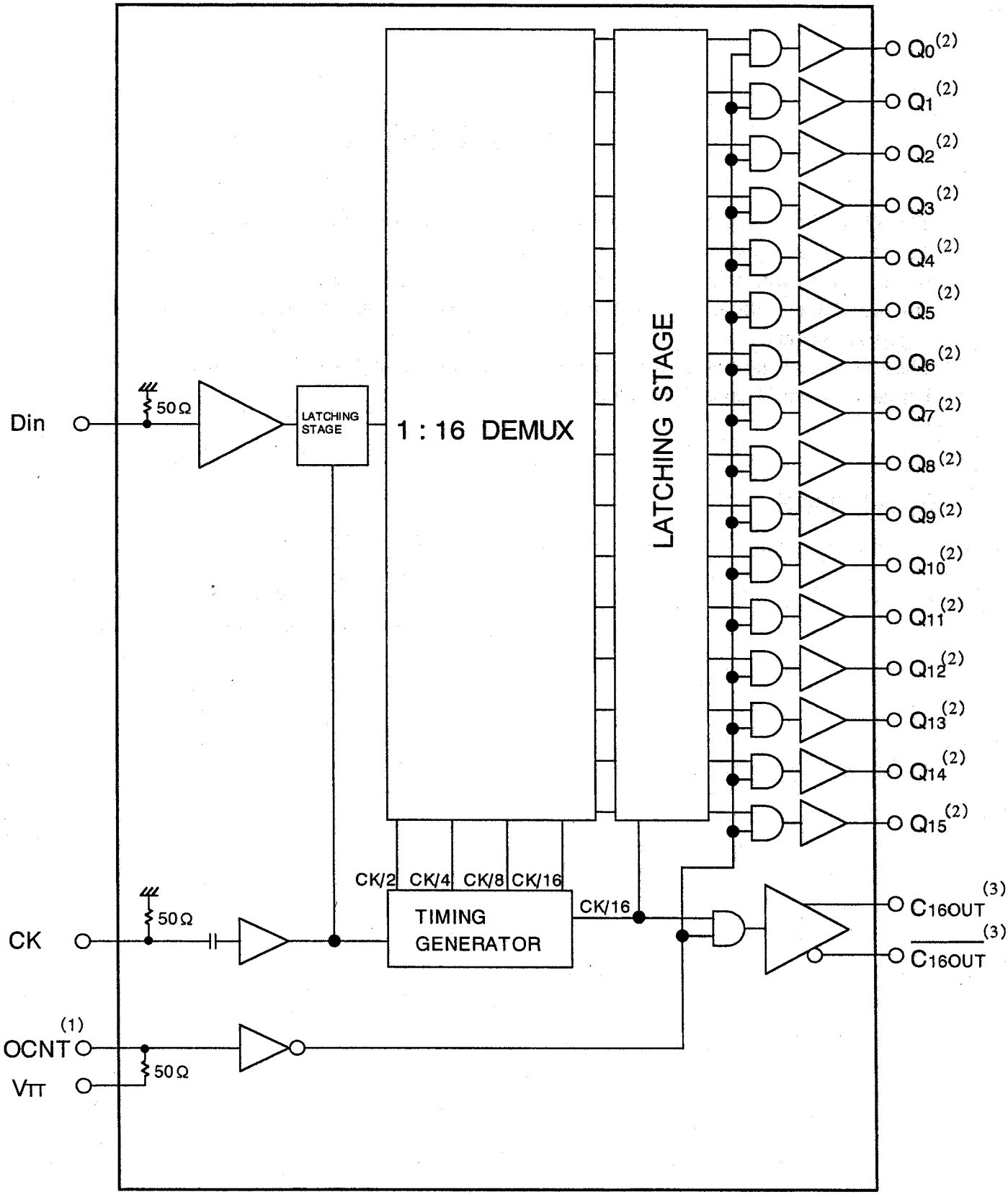
FEATURES

Ultra-high speed :	maximum clock frequency	f_{MAX} : 12.5 GHz	[Tc = 25℃, MIN.]
	minimum clock frequency	f_{MIN} : 2.0 GHz	[Tc = 25℃, MAX.]
	output rise time	tr = 190 ps (20-80%)	[Tc = 25℃, TYP.]
	output fall time	tf = 190 ps (20-80%)	[Tc = 25℃, TYP.]
High reliability :	Hermetically-sealed package		

APPLICATIONS

- Serial-to-parallel converters
- High speed testers
- Digital transmission system receivers
- Computer links
- Board links

FUNCTIONAL DIAGRAM



Notes

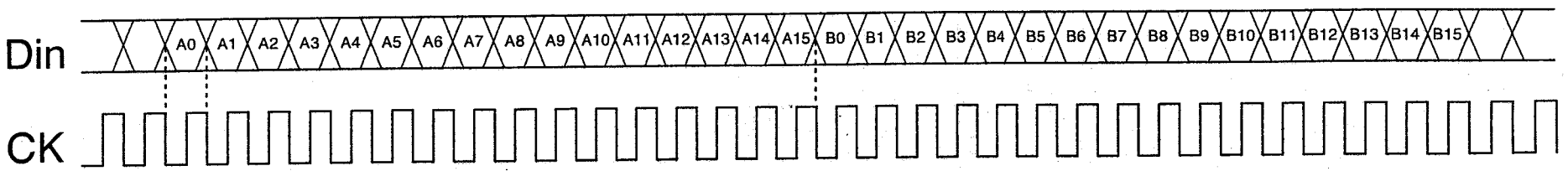
(1) OCNT : When input is high level, Q0～Q15 and C_{16OUT} are low level, and C_{16OUT} is high level.

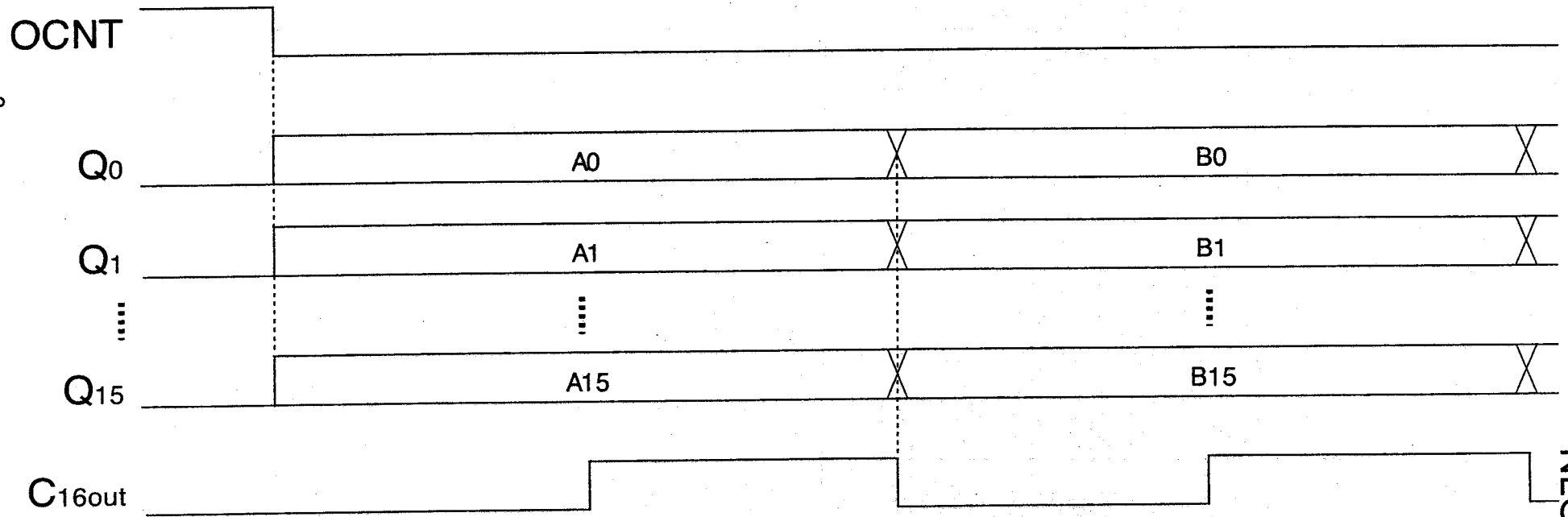
(2) Data output terminals. (ECL output)

(3) 1/16 clock output terminals. (ECL output)

NEL

TIMING CHART





NLG4305

PIN CONNECTION TABLE

No.	NAME	FUNCTION	No.	NAME	FUNCTION
1	GND	Ground (0.0V)	43	GND	Ground (0.0V)
2	NC	No Internal Connection	44	VSS	Power Supply (- 3.5 V)
3	GND	Ground (0.0V)	45	GND	Ground (0.0V)
4	VTT	Input Signal Termination Power Supply (- 2.0 V)	46	Q14	1/16 Data Output 14 (4)
5	GND	Ground (0.0V)	47	GND	Ground (0.0V)
6	OCNT	Output Control Input	48	Q2	1/16 Data Output 2 (4)
7	GND	Ground (0.0V)	49	GND	Ground (0.0V)
8	Vrefr	OCNT Input Ref. (3)	50	Q10	1/16 Data Output 10 (4)
9	GND	Ground (0.0V)	51	GND	Ground (0.0V)
10	NC	No Internal Connection	52	VSS	Power Supply (- 3.5 V)
11	GND	Ground (0.0V)	53	GND	Ground (0.0V)
12	NC	No Internal Connection	54	C16OUT	1/16 Clock Output (Comp.) (4)
13	GND	Ground (0.0V)	55	GND	Ground (0.0V)
14	Din	Data Input	56	C16OUT	1/16 Clock Output (True) (4)
15	GND	Ground (0.0V)	57	GND	Ground (0.0V)
16	Vrefd	Data Input Ref. (1)	58	Q11	1/16 Data Output 11 (4)
17	GND	Ground (0.0V)	59	GND	Ground (0.0V)
18	Vrefc	Clock Input Ref. (2)	60	VSS	Power Supply (- 3.5 V)
19	GND	Ground (0.0V)	61	GND	Ground (0.0V)
20	CK	Clock Input	62	Q3	1/16 Data Output 3 (4)
21	GND	Ground (0.0V)	63	GND	Ground (0.0V)
22	GND	Ground (0.0V)	64	GND	Ground (0.0V)
23	GND	Ground (0.0V)	65	Q15	1/16 Data Output 15 (4)
24	GND	Ground (0.0V)	66	GND	Ground (0.0V)
25	VSS	Power Supply (- 3.5 V)	67	Q7	1/16 Data Output 7 (4)
26	GND	Ground (0.0V)	68	GND	Ground (0.0V)
27	VSS	Power Supply (- 3.5 V)	69	VSS	Power Supply (- 3.5 V)
28	GND	Ground (0.0V)	70	GND	Ground (0.0V)
29	Q0	1/16 Data Output 0 (4)	71	Q13	1/16 Data Output 13 (4)
30	GND	Ground (0.0V)	72	GND	Ground (0.0V)
31	Q8	1/16 Data Output 8 (4)	73	Q5	1/16 Data Output 5 (4)
32	GND	Ground (0.0V)	74	GND	Ground (0.0V)
33	Q4	1/16 Data Output 4 (4)	75	VSS	Power Supply (- 3.5 V)
34	GND	Ground (0.0V)	76	GND	Ground (0.0V)
35	Q12	1/16 Data Output 12 (4)	77	Q9	1/16 Data Output 9 (4)
36	GND	Ground (0.0V)	78	GND	Ground (0.0V)
37	Q6	1/16 Data Output 6 (4)	79	Q1	1/16 Data Output 1 (4)
38	GND	Ground (0.0V)	80	GND	Ground (0.0V)
39	VSS	Power Supply (- 3.5 V)	81	NC	No Internal Connection
40	GND	Ground (0.0V)	82	GND	Ground (0.0V)
41	TCMON	Case Temperature Monitor	83	VSS	Power Supply (- 3.5 V)
42	GND	Ground (0.0V)	84	GND	Ground (0.0V)

Notes

See Page 5.

PIN CONNECTION TABLE

Notes

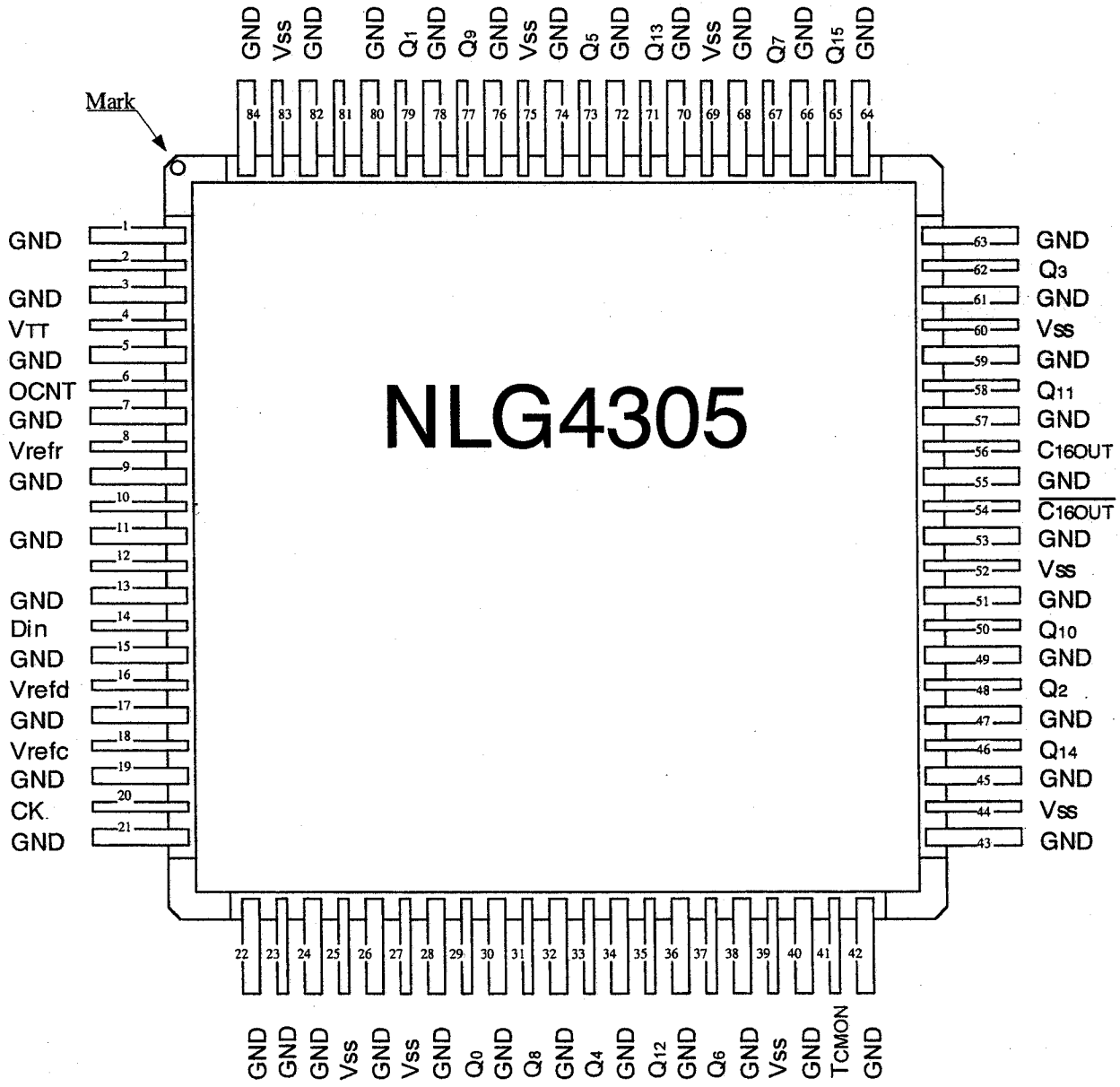
(1) V_{refd} : Internally generated reference voltage that determines the data input threshold level. By applying - 0.75 to - 0.2 V externally to this pins, an arbitrary data input threshold voltage can be established.

(2) V_{refc} : Internally generated reference voltage that determines the clock input threshold level. By applying - 2.1 to - 1.55 V externally to this pins, an arbitrary clock input threshold voltage can be established.

(3) V_{refr} : Internally generated reference voltage that determines the threshold level of the output control input. By applying - 1.6 to - 1.0 V externally to this pins, an arbitrary the threshold voltage of the output control input can be established.

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

CONNECTION DIAGRAM (TOP VIEW)



ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING
Vss	Power Supply Voltage	+0.5 V ~ - 4.0 V
VTT	Termination Voltage	+ 0.5 V ~ - 2.5 V
Vindin	Applied Voltage at Data Input (Din)	+ 0.3 V ~ - 1.6 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
VOCNT	Applied Voltage at Output Control Input (OCNT)	+ 0.3 V ~ - 2.5 V
VoutE	Applied Voltage at Signal Outputs ($Q_0 \sim Q_{15}$, C_{16OUT}, $\overline{C_{16OUT}}$)	+0.2 V ~ - 2.5 V
Vrefd	Applied Voltage at Vrefd pin	+ 0.3 V ~ - 1.6 V
Vrefc	Applied Voltage at Vrefc pin under Bias	- 1.0 V ~ - 2.5 V
Vrefr	Applied Voltage at Vrefr pin	+0.3 V ~ - 2.5 V
VTCMON	Applied Voltage at Case Temperature Monitor pin	-1.0 V ~ + 1.0 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
VTT	Termination Voltage		- 2.0		V
Vrefd	Data Input Reference Voltage	Adjust in the range from -0.75 V to -0.2 V			V
Vrefc	Clock Input Reference Voltage	Normally Open			V
Vrefr	Output Control Input Reference Voltage	Normally Open			V
Din	Data Input Interface	DC Coupling (See DC Characteristics)			–
CK	Clock Input Interface	DC Coupling (See DC Characteristics) or AC Coupling (See AC Characteristics)			–
OCNT	Output Control Input Interface	Normally Open (In this condition, OCNT is set to low level)			–
OUT	Data Output, 1/16 Clock Output Interface ($Q_0 \sim Q_{15}$, C_{16OUT}, $\overline{C_{16OUT}}$)	Terminate with 50 ohm to -2.0 V			–
TCMON	Case Temperature Monitor	Connect to a DC voltmeter for estimating case temperature. Relationship between TCMON and case temperature is shown in page 19.			–

Notes

(1) Tc : temperature at package base.

DC CHARACTERISTICS

(V_{SS} = -3.75 V ~ -3.4 V, V_{TT} = -2.0 V, GND = 0.0 V, Tc = 0 ~85℃ (1))

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS	
V_{OHE}	Output Voltage, High ($Q_0 \sim Q_{15}$, C_{16OUT}, $\overline{C_{16OUT}}$)	-0.98	- 0.75		V	
V_{OLE}	Output Voltage, Low ($Q_0 \sim Q_{15}$, C_{16OUT}, $\overline{C_{16OUT}}$)	V_{TT}	- 1.80	-1.57	V	
V_{IH}	Input Voltage, High (Din, CK)	- 0.2	0.0		V	
V_{IL}	Input Voltage, Low (Din, CK)		- 0.90	- 0.75	V	
V_{IHE}	Input Voltage, High (OCNT)	-1.17	- 0.90		V	
V_{ILE}	Input Voltage, Low (OCNT)	V_{TT}	- 1.70	-1.48	V	
I_{SS}	Power Supply Current (V_{SS})		1.1	1.5	A	
I_{TT}	Power Supply Current (V_{TT})		24	30	mA	(2)
Pd	Power Dissipation		3.9	5.6	W	(3)

AC CHARACTERISTICS

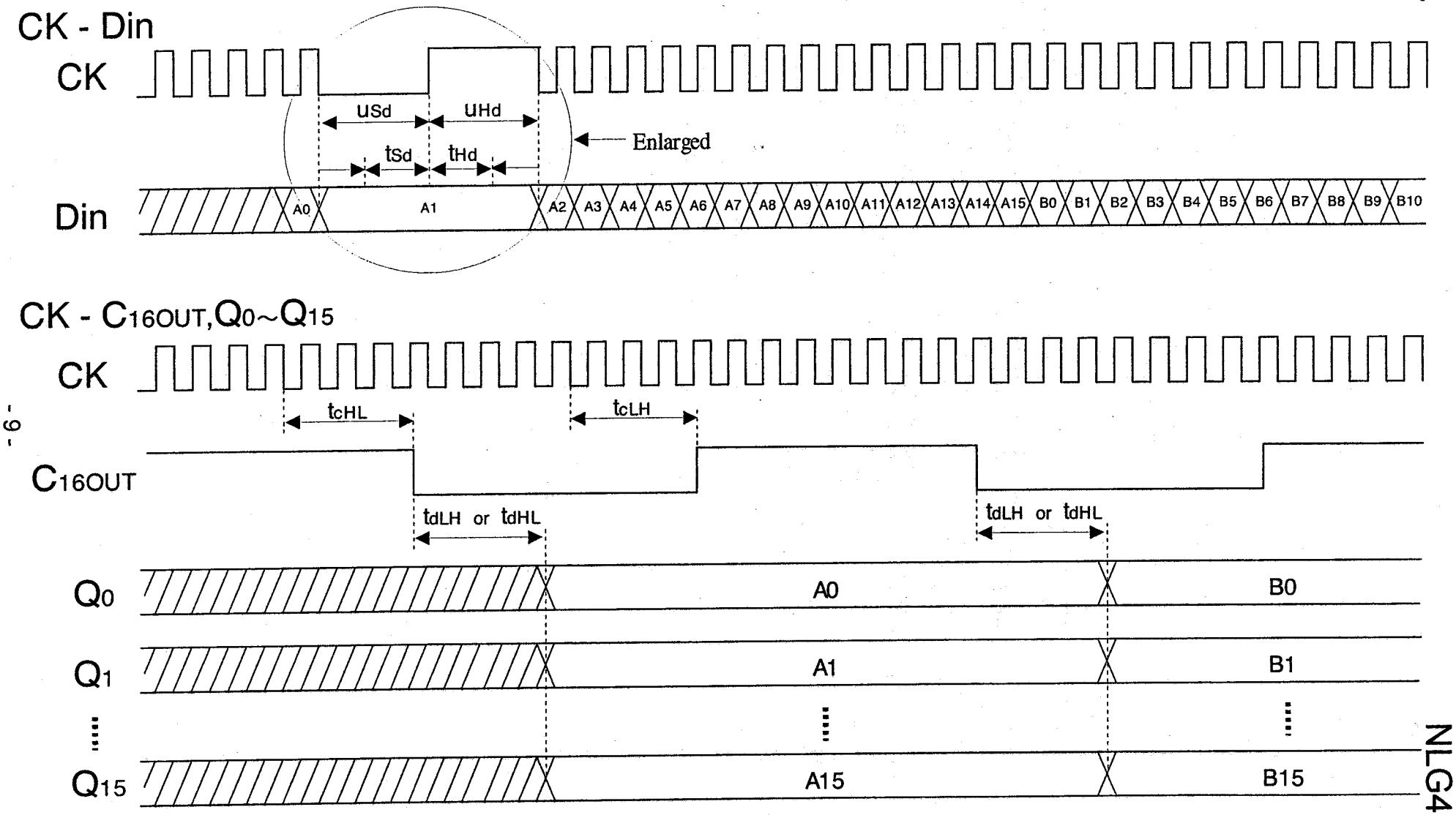
(V_{SS} = -3.5 V, V_{TT} = -2.0 V, GND = 0.0 V, OCNT : Open,
Vrefd : Adjust in the range from -0.75 V to -0.2 V, Vrefc : Open, Vrefr : Open)

SYMBOL	PARAMETER	Tc=0 ℃			Tc=25 ℃			Tc=85 ℃			UNITS	
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
Vin	Minimum Clock Input Voltage Amplitude		0.5	0.6		0.5	0.6		0.5	0.6	Vp-p	
f_{MAX}	Maximum Clock Frequency	12.5			12.5			12.5			GHz	(4)
f_{MIN}	Minimum Clock Frequency			2.0			2.0			2.0	GHz	(4)
tr	Output Rise Time ($Q_0 \sim Q_{15}$, 20-80%)		190	320		190	320		200	330	ps	
tf	Output Fall Time ($Q_0 \sim Q_{15}$, 20-80%)		190	320		190	320		200	330	ps	
trc	Output Rise Time (C_{16OUT}, $\overline{C_{16OUT}}$, 20-80%)		160	260		160	260		170	270	ps	
tfc	Output Fall Time (C_{16OUT}, $\overline{C_{16OUT}}$, 20-80%)		160	260		160	260		170	270	ps	
tdLH	Output Rise Delay (C_{16OUT} - $Q_0 \sim Q_{15}$)	95	145	195	100	150	200	115	165	215	ps	(5)
tdHL	Output Fall Delay (C_{16OUT} - $Q_0 \sim Q_{15}$)	95	145	195	100	150	200	115	165	215	ps	(5)
tcLH	Output Rise Delay (CK - C_{16OUT}, $\overline{C_{16OUT}}$)	475	525	575	480	530	580	495	545	595	ps	(5)
tcHL	Output Fall Delay (CK - C_{16OUT}, $\overline{C_{16OUT}}$)	475	525	575	480	530	580	495	545	595	ps	(5)
tSd	Minimum Setup Time (Din - CK)		-5	10		-5	10		0	15	ps	(5)
tHd	Minimum Hold Time (CK - Din)		25	40		25	40		25	40	ps	(5)

Notes

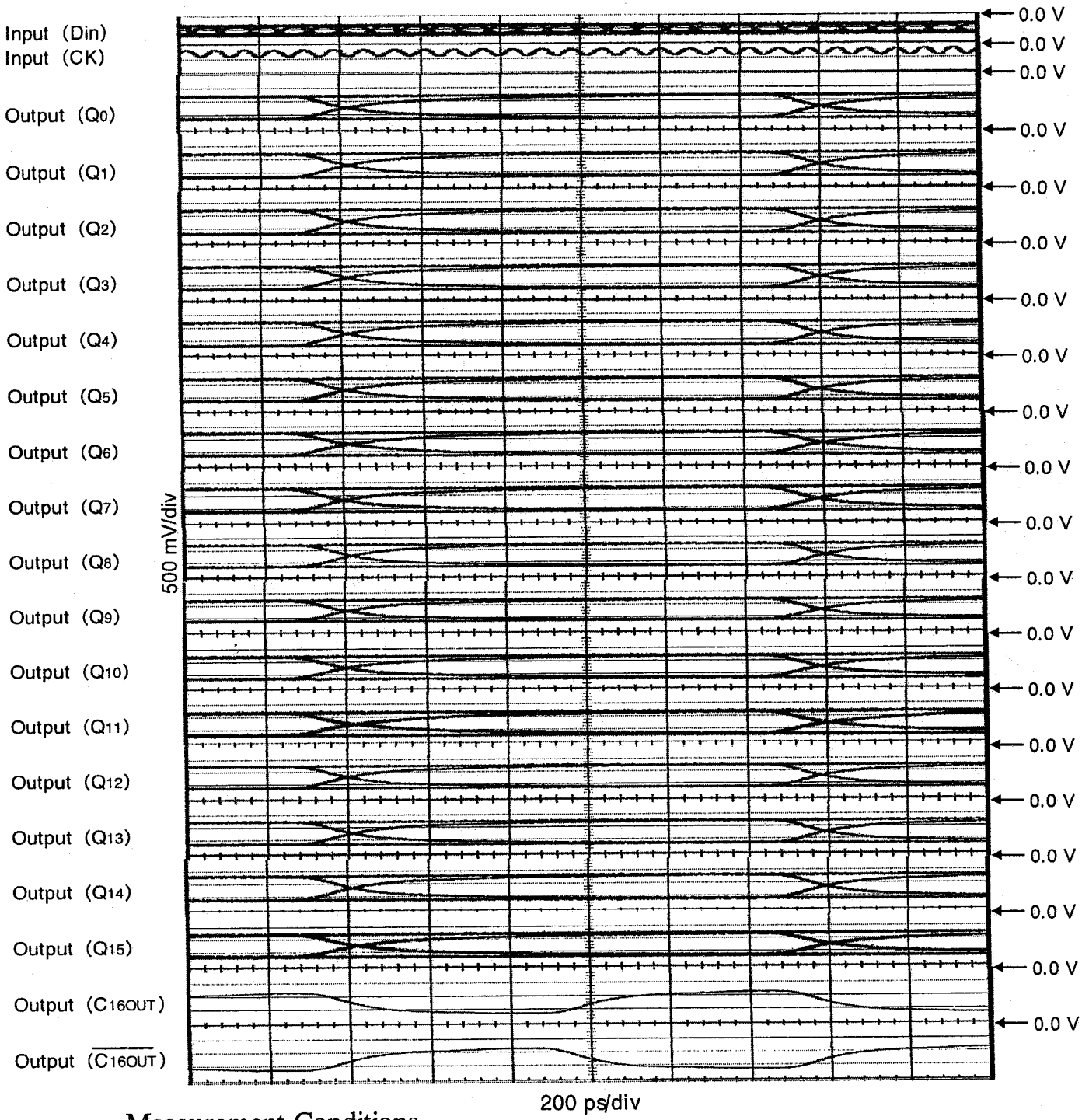
(1) Tc : temperature at package base.
(2) OCNT = - 0.8 V
(3) Pd = Vss × Iss. Excludes current through input termination resistors and ECL output FETs.
(4) Confirmed by error-free operation using a pseudo-randompattern having a word length of 2^{23}-1 bits.
(5) See page 9.

TIMING CHART (INCLUDING DELAY TIMES)



(See the timing chart on page 3 for a more complete logical description. Here, tsd and tHD are the minimum setup and hold times as defined on the previous page; usd and uHd are the corresponding user setup and hold times.)

SAMPLE INPUT AND OUTPUT WAVEFORMS (13.5 Gb/s)

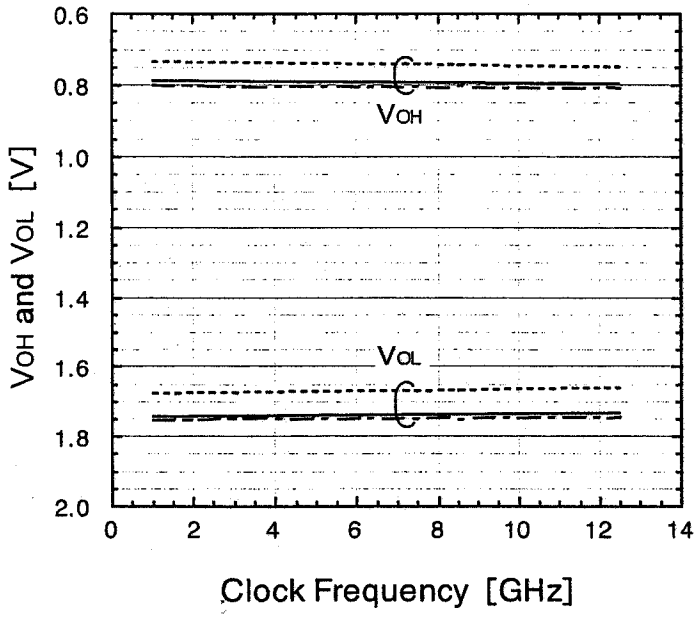


Measurement Conditions

Vss = - 3.5 V
VTT = - 2.0 V
Vrefd = - 0.50 V
Vrefc : Open
Din : 13.5 Gb/s, PN = 31, VIH = - 0.2 V, VIL = - 0.75 V
CK : 13.5 GHz, Vin = 0.3 Vp-p, DC coupling
Tc = 60 ℃
ECL outputs (Q0～ Q15, C16OUT, $\overline{C16OUT}$) connected to the 50-ohm impedance pins of a sampling oscilloscope via ECL terminators. Results given here were obtained using the NEL test fixture.

SAMPLE AC CHARACTERISTICS ($Q_0 \sim Q_{15}$)

Vss = -3.5 V, V_{TT} = -2.0 V

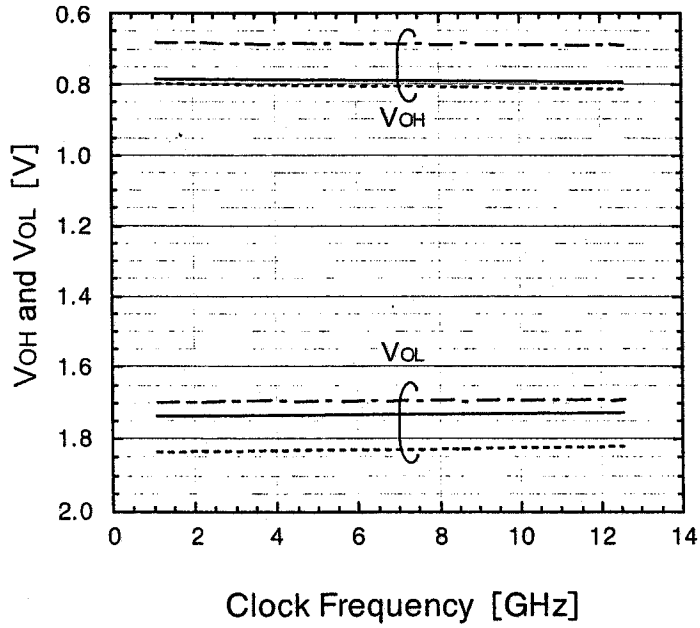


—·—·— : Tc = 0 ℃
——— : Tc = 25 ℃
- - - - - - : Tc = 85 ℃

Measurement Conditions

Din : V_{IH} = -0.2 V, V_{IL} = -0.75 V
CK : Vin = 0.5 Vp-p
Vrefd : Open
Vrefc : Open
Vrefr : Open
Results given here were obtained using the NEL test fixture.

V_{TT} = -2.0 V, Tc = 25 ℃

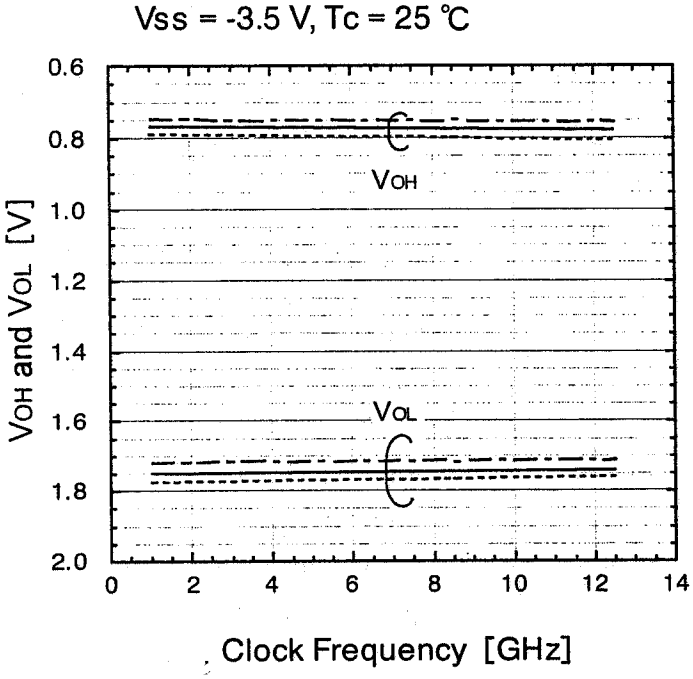


—·—·— : Vss = - 3.4 V
——— : Vss = - 3.5 V
- - - - - - : Vss = - 3.75 V

Measurement Conditions

Din : V_{IH} = -0.2 V, V_{IL} = -0.75 V
CK : Vin = 0.5 Vp-p
Vrefd : Open
Vrefc : Open
Vrefr : Open
Results given here were obtained using the NEL test fixture.

SAMPLE AC CHARACTERISTICS ($Q_0 \sim Q_{15}$)



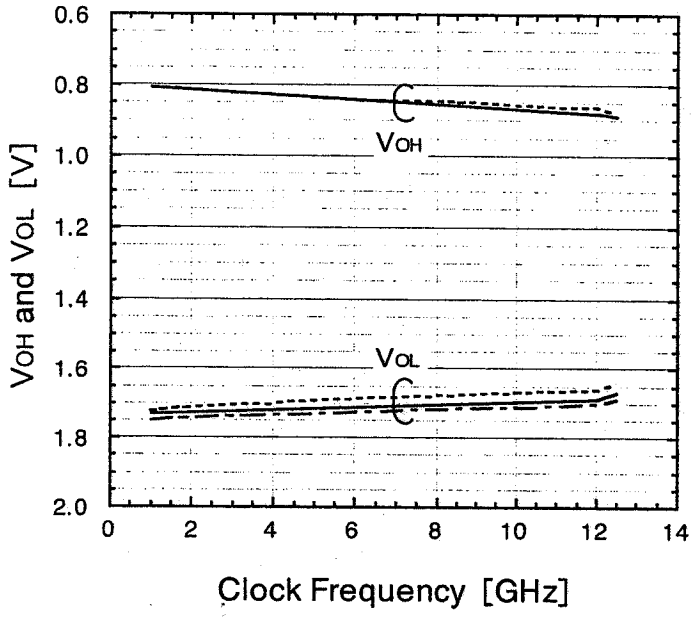
—·—·—·	:	V_{TT} = - 1.9 V
————	:	V_{TT} = - 2.0 V
- - - - - -	:	V_{TT} = - 2.1 V

Measurement Conditions

Din : V_{IH} = -0.2 V, V_{IL} = -0.75 V
CK : Vin = 0.5 Vp-p
Vrefd : Open
Vrefc : Open
Vrefr : Open
Results given here were obtained using the NEL test fixture.

SAMPLE AC CHARACTERISTICS (C16OUT, $\overline{C16OUT}$)

Vss = -3.5 V, V_{TT} = -2.0 V

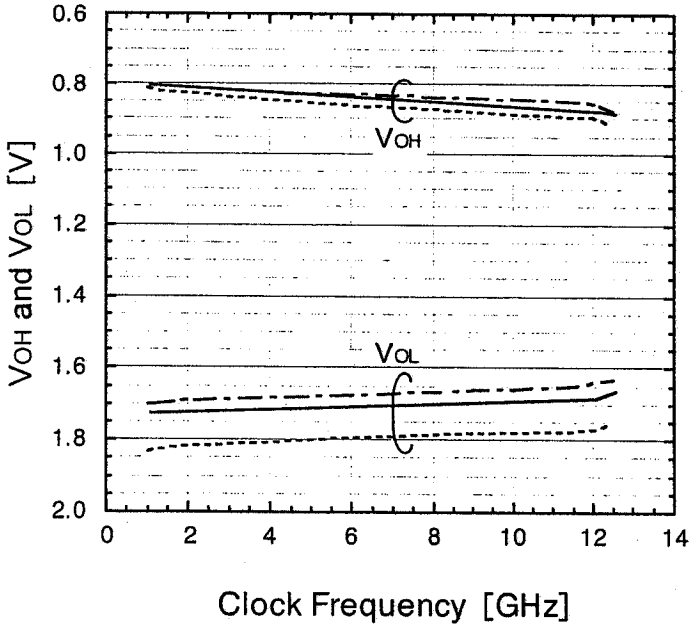


—·—·—· : Tc = 0 ℃
———— : Tc = 25 ℃
- - - - - - : Tc = 85 ℃

Measurement Conditions

Din : V_{IH} = -0.2 V, V_{IL} = -0.75 V
CK : Vin = 0.5 Vp-p
Vrefd : Open
Vrefc : Open
Vrefr : Open
Results given here were obtained using the NEL test fixture.

V_{TT} = -2.0 V, Tc = 25 ℃

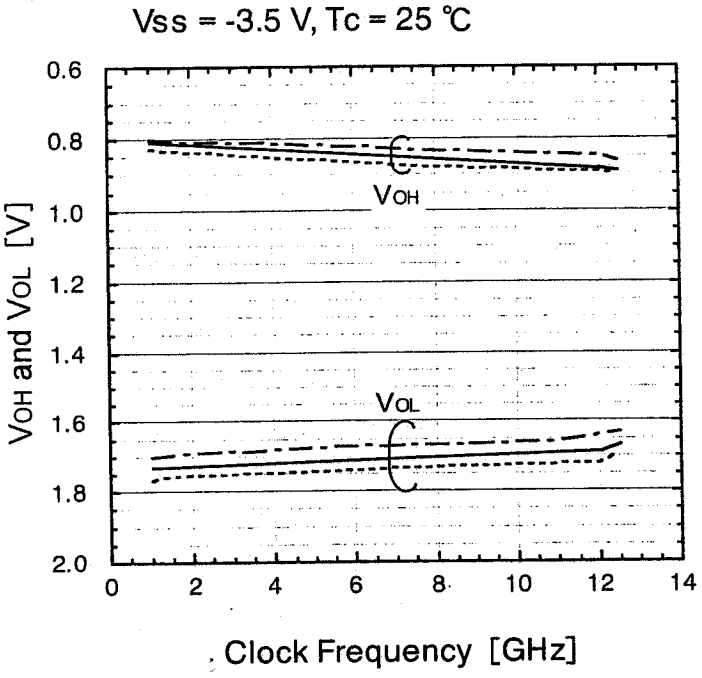


—·—·—· : Vss = - 3.4 V
———— : Vss = - 3.5 V
- - - - - - : Vss = - 3.75 V

Measurement Conditions

Din : V_{IH} = -0.2 V, V_{IL} = -0.75 V
CK : Vin = 0.5 Vp-p
Vrefd : Open
Vrefc : Open
Vrefr : Open
Results given here were obtained using the NEL test fixture.

SAMPLE AC CHARACTERISTICS (C16OUT, $\overline{C16OUT}$)

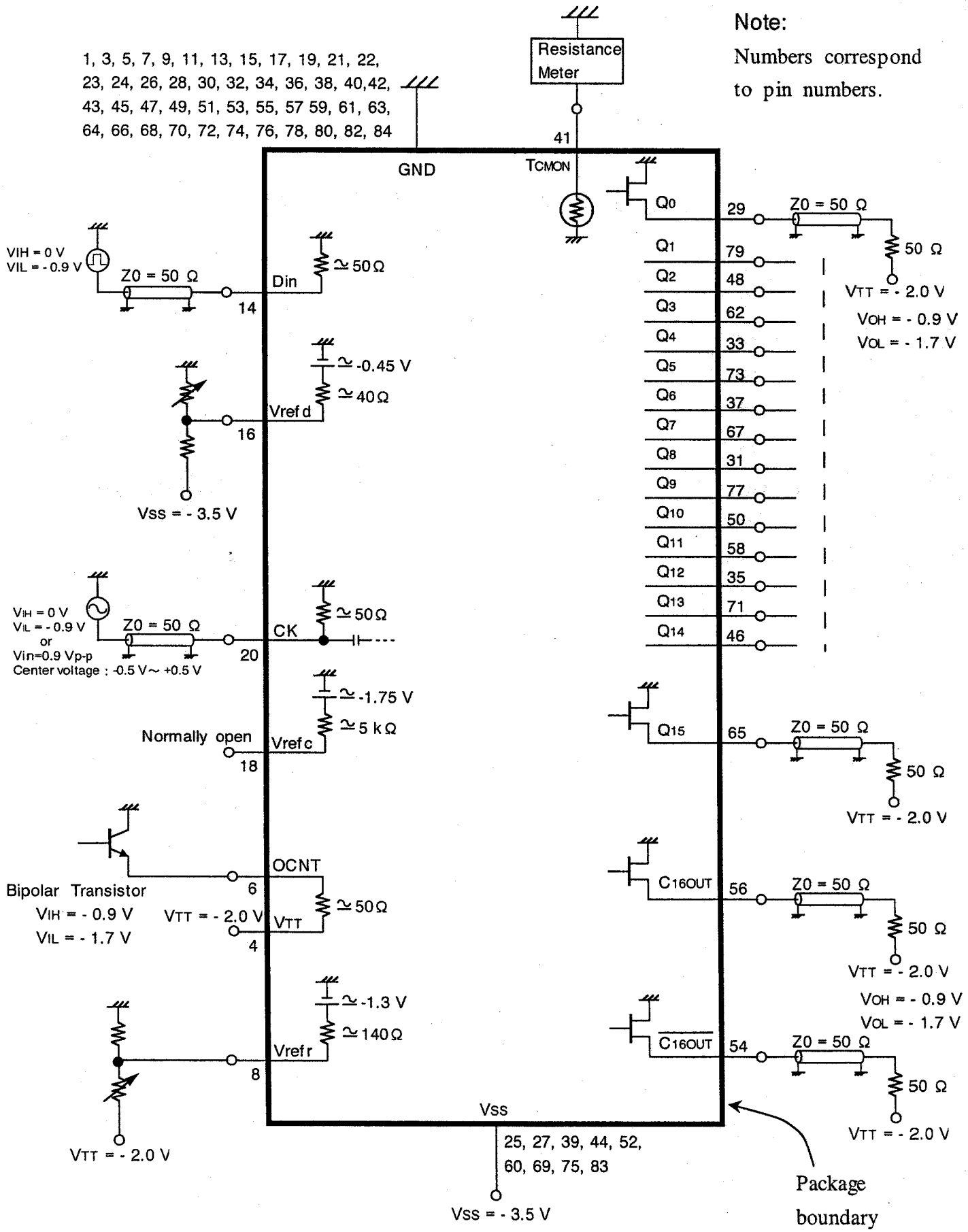


—·—·—· : V_{TT} = - 1.9 V
———— : V_{TT} = - 2.0 V
- - - - - - : V_{TT} = - 2.1 V

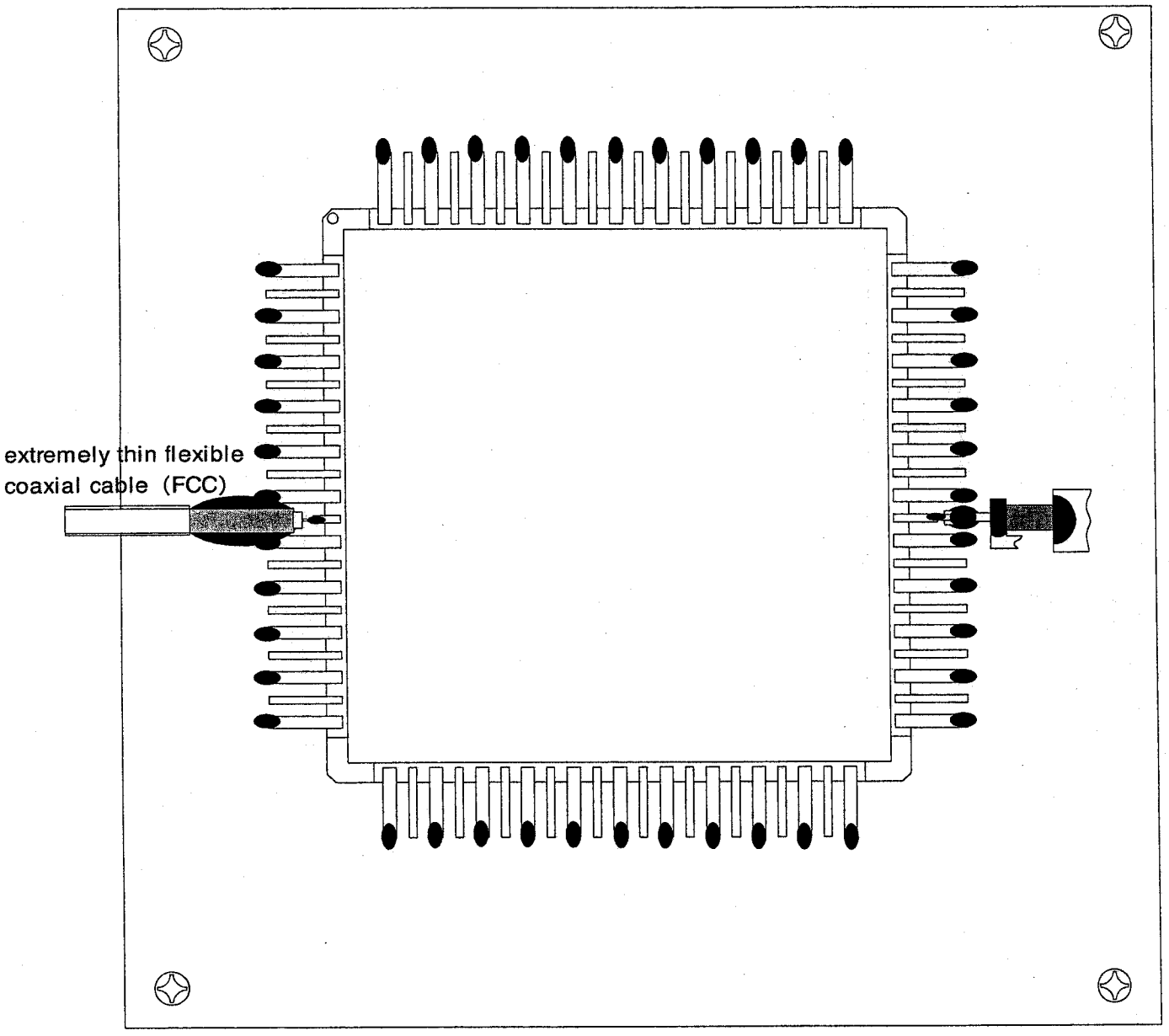
Measurement Conditions

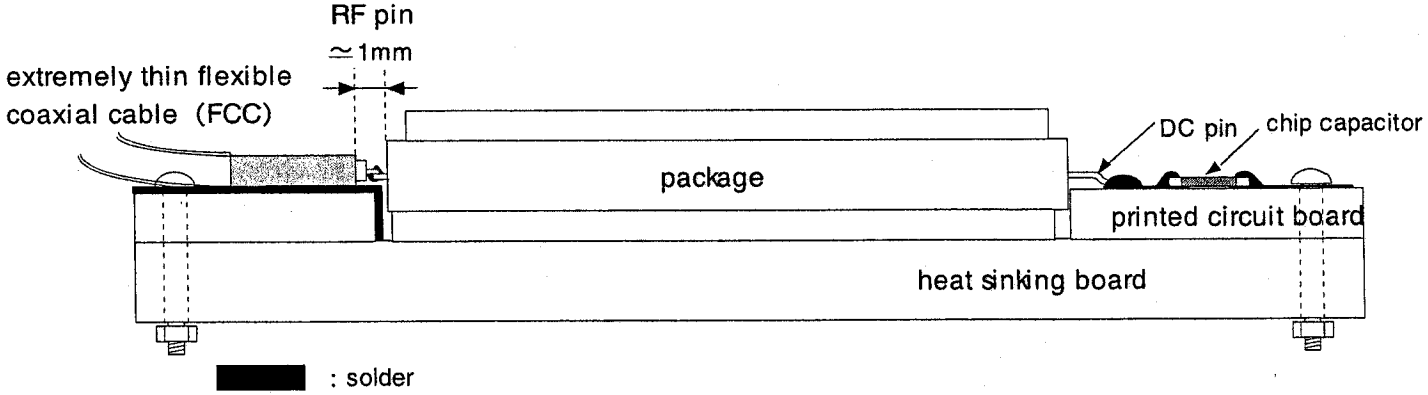
Din : V_{IH} = -0.2 V, V_{IL} = -0.75 V
CK : Vin = 0.5 Vp-p
Vrefd : Open
Vrefc : Open
Vrefr : Open
Results given here were obtained using the NEL test fixture.

SAMPLE IMPLEMENTATION



SAMPLE MOUNTING

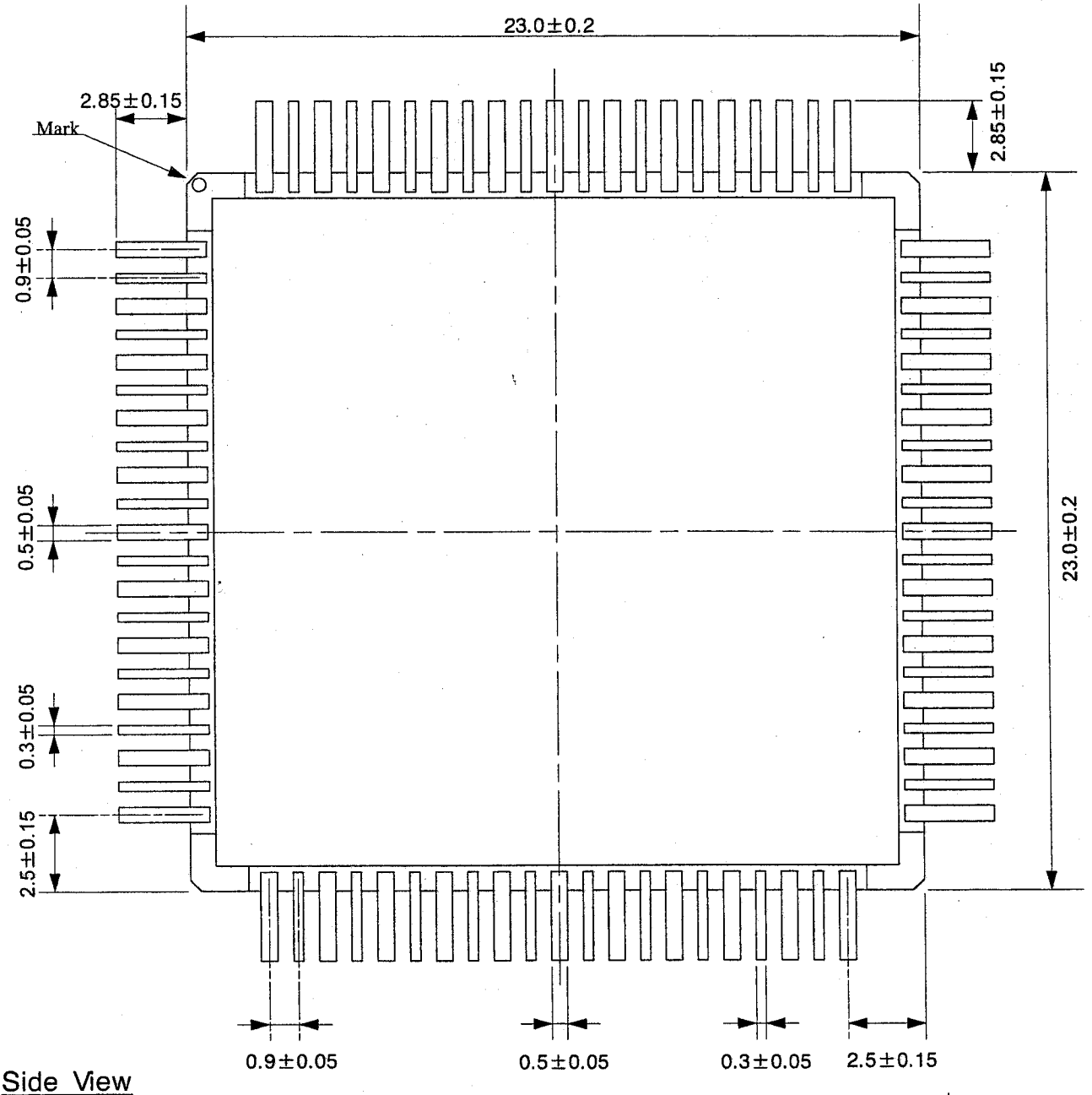




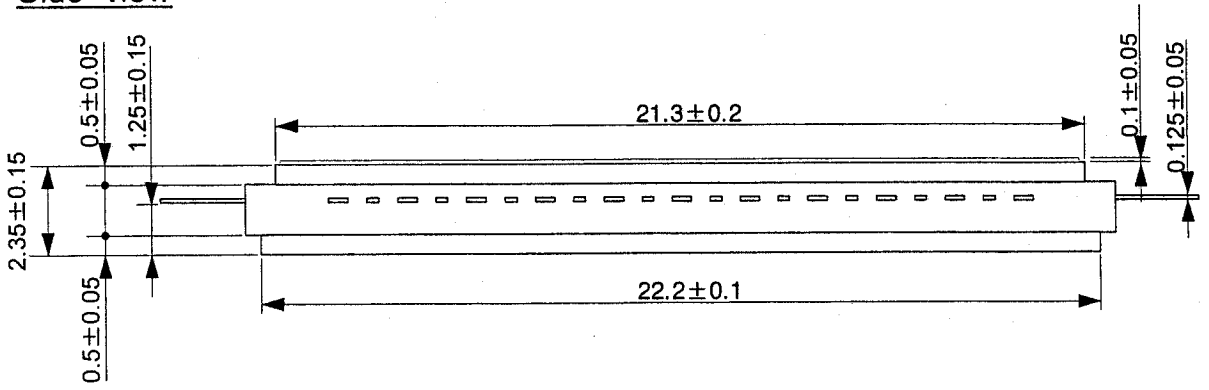
Caution : The package base should be connected to the ground.

TB 84 - PIN PACKAGE DIMENSION (mm)

Top View



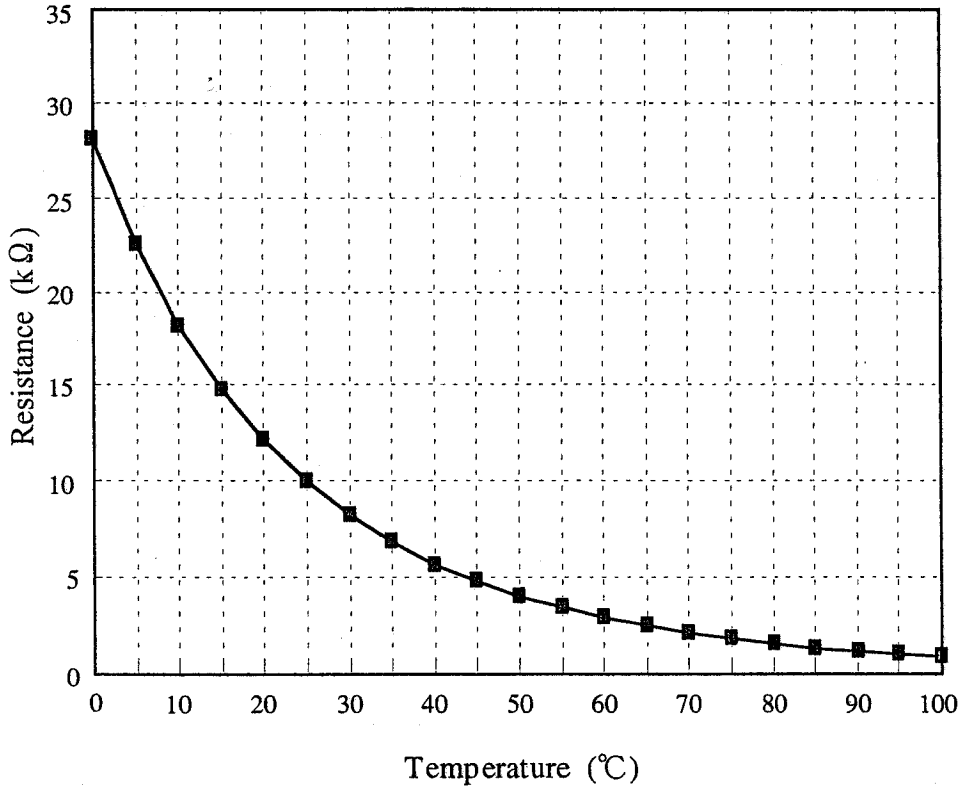
Side View



SAMPLE TEMPERATURE MONITOR

TCMON Resistance Value Versus Case Temperature

TEMPERATURE (℃)	RESISTANCE (kΩ) TYP.	TEMPERATURE (℃)	RESISTANCE (kΩ) TYP.
0	28.08	55	3.464
5	22.56	60	2.950
10	18.24	65	2.523
15	14.84	70	2.166
20	12.15	75	1.867
25	10.00	80	1.615
30	8.277	85	1.402
35	6.887	90	1.221
40	5.759	95	1.068
45	4.839	100	0.9362
50	4.085		



HANDLING INSTRUCTIONS

Since the NLG4305 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) Power Supply Sequence

The following power supply sequence is recommended.

1) Set supply voltage Vss, V_{TT}, Vrefd, Vrefc, Vrefr and GND to 0 V.
2) Apply Vss, V_{TT}, Vrefd, Vrefc and Vrefr.

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

(2) Handling Precautions

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.

MEMO

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.

5. Though NTT Electronics Corp. makes every effort to improve quality and reliability, there is a risk that failure or malfunction may occur in semiconductors. It is therefore necessary that the purchasers should take responsibility for making a design that allows the products to operate safely on equipment and systems without any direct threat to the human body and/or property, should such failures or malfunction occur.

6. NTT Electronics Corp.'s semiconductor device products are designed to be used with multimedia networks communication equipment and related measuring equipment. They have not been developed for such equipment that may affect people's lives. Those who intend to use the products for special purposes that may affect human life as a result of failure or malfunction in the equipment using the products or that require extremely high reliability (e.g. life support, aircraft and space rockets, control in nuclear power facilities, submarine relays, control of operations, etc.) shall contact NTT Electronics Corp. before using the products. NTT Electronics Corp. shall not assume any liability for damage that may occur during operation of the products without prior consultation.

7. Some of the products are classified as strategic materials and the 'Foreign Exchange and Foreign Trade Control Act' applies. Export of the applicable products necessitates obtaining approval from the Japanese Government as required by law.

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.

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