
HA19216/MP

6-Bit Flash Type Analog-to Digital Converter

HITACHI

Description

The HA19216/MP bipolar LSI performs high speed 6-bit A/D conversion. Digital data output and clock input terminals are compatible with TTL and CMOS. The HA19216/MP are designed for video signal processing application.

Features

- 6-bit resolution (including overflow)
- 6-bit latched three-state outputs
- Maximum conversion Rate: 20 Msps (Min)
- Single Power Supply: +5 V
- Digital data output, high impedance state control and clock input terminals compatible with TTL and CMOS
- Needs no sample and hold circuit
- 18-pin DIP package and 28-pin surface mount package.
- Output current:
 - $I_{OL} = 1.4$ mA (guaranteed)
 - $I_{OH} = -5$ mA (guaranteed)

Application

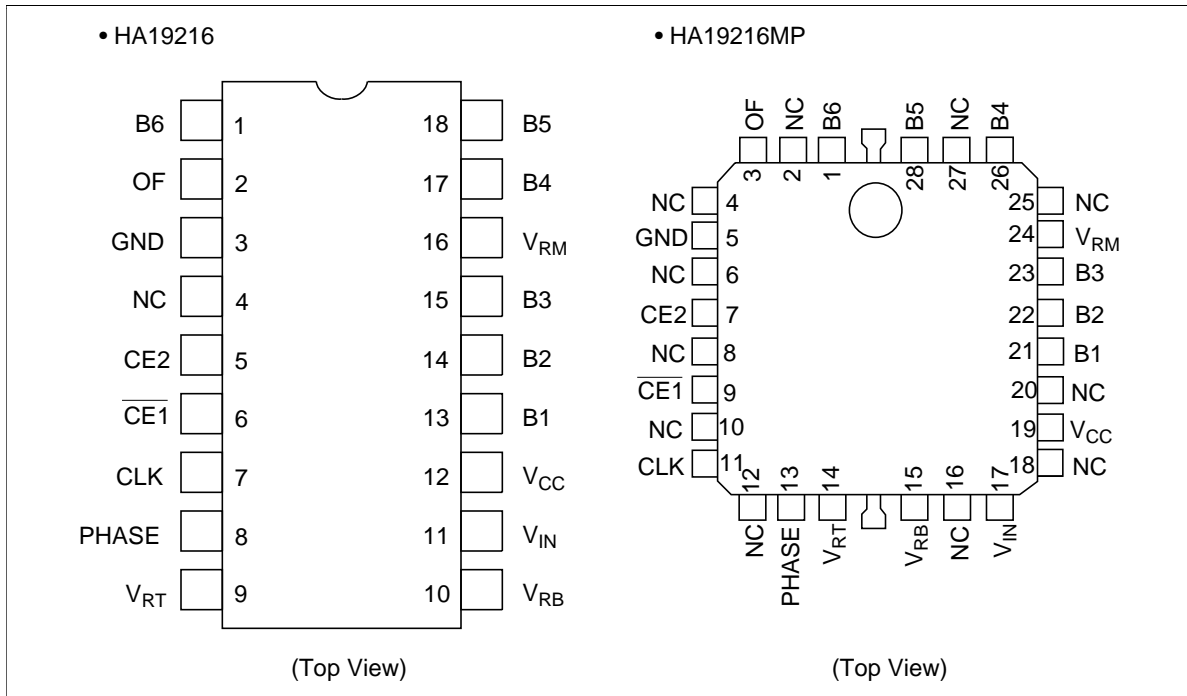
- Pattern recognition using a computer
- High-speed measuring instruments

Ordering Information

Type No.	Package
HA19216	300mil 18 pin plastic DIP (DP-18A)
HA19216MP	28 pin plastic QFI (MP-28)

HA19216/MP

Pin Arrangement



Pin Function

Pin No.		Symbol	Function	Remarks
HA19216	HA19216MP			
1	1	B6	Bit 6 digital output (MSB)	
2	3	OF	Digital output (Overflow)	
3	5	GND	Ground	
4	—	NC	Not connected	
5	7	CE2	Digital output high	Impedance control input
6	9	$\overline{\text{CE1}}$	Digital output high	Impedance control input
7	11	CLK	Clock input	
8	13	PHASE	Clock phase control input	
9	14	V_{RT}	High level reference voltage input	
10	15	V_{BR}	Low level reference voltage input	
11	17	V_{IN}	Analog input	
12	19	V_{CC}	Power supply	
13	21	B1	Bit 1 digital output (LSB)	

Pin Function (Cont)

Pin No.		Symbol	Function	Remarks
HA19216	HA19216MP			
14	22	B2	Bit 2 digital output	
15	23	B3	Bit 3 digital output	
16	24	V _{RM}	Reference voltage center tap	
17	26	B4	Bit 4 digital output	
18	28	B5	Bit 5 digital output	

Note:

$\overline{\text{CE1}}$	CE2	B1 – B6	OF
x	L	Z	Z
L	H	H/L	H/L
H	H	Z	H/L

H: High level

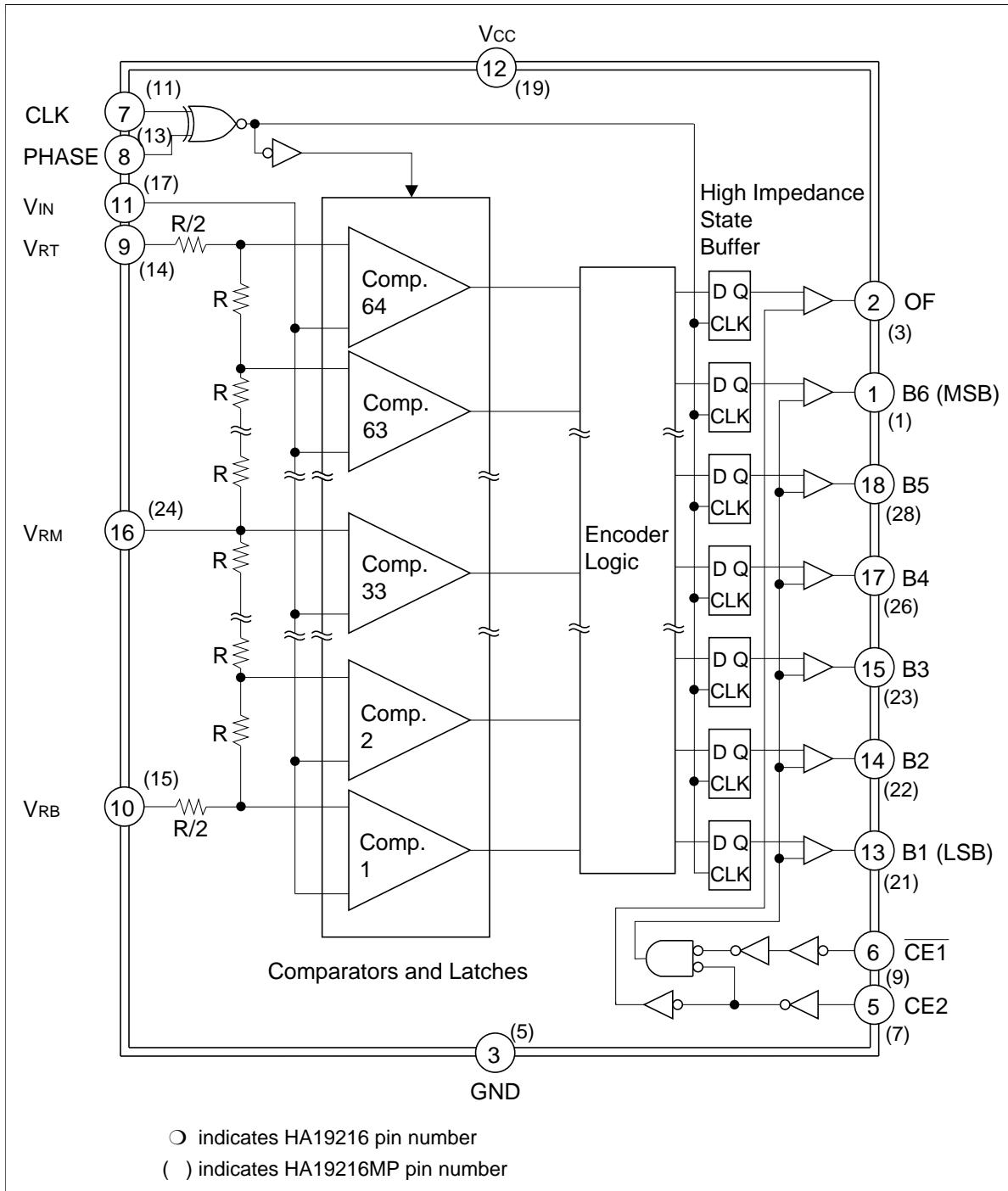
L: Low level

x: Don't care

Z: High impedance

HA19216/MP

Block Diagram



Interface

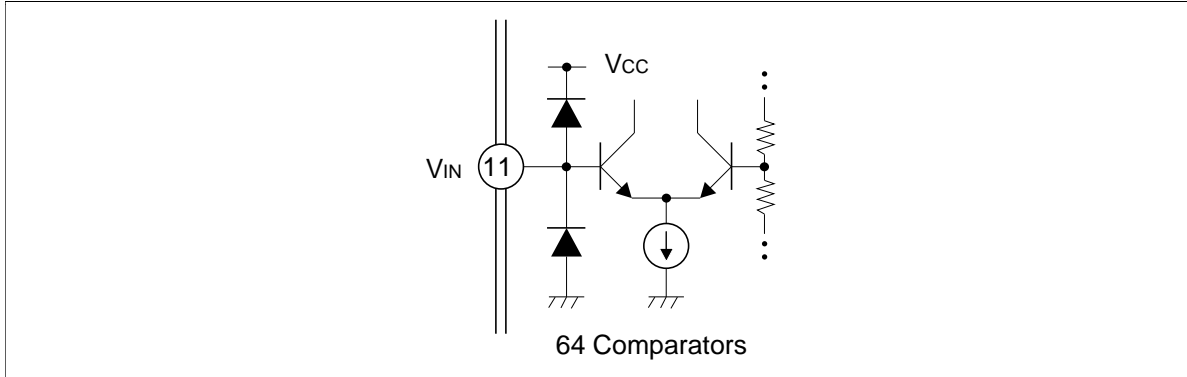


Figure 1 Analog Input

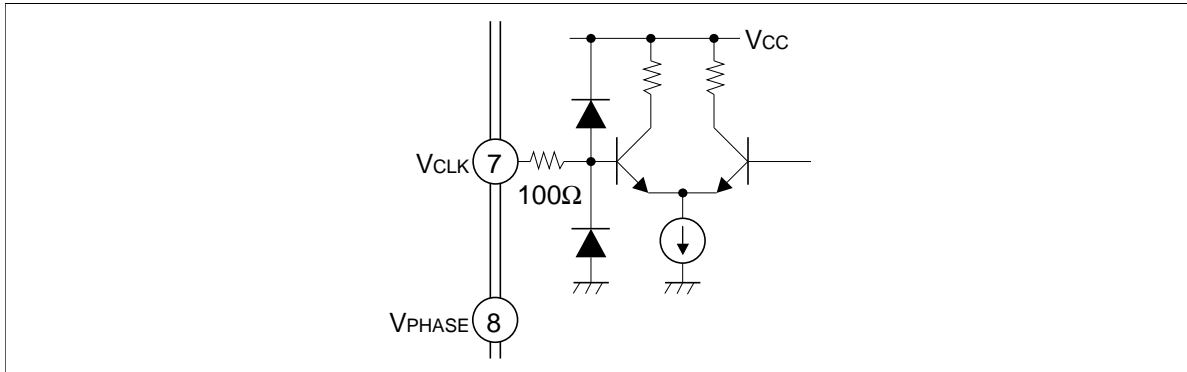


Figure 2 Clock Input

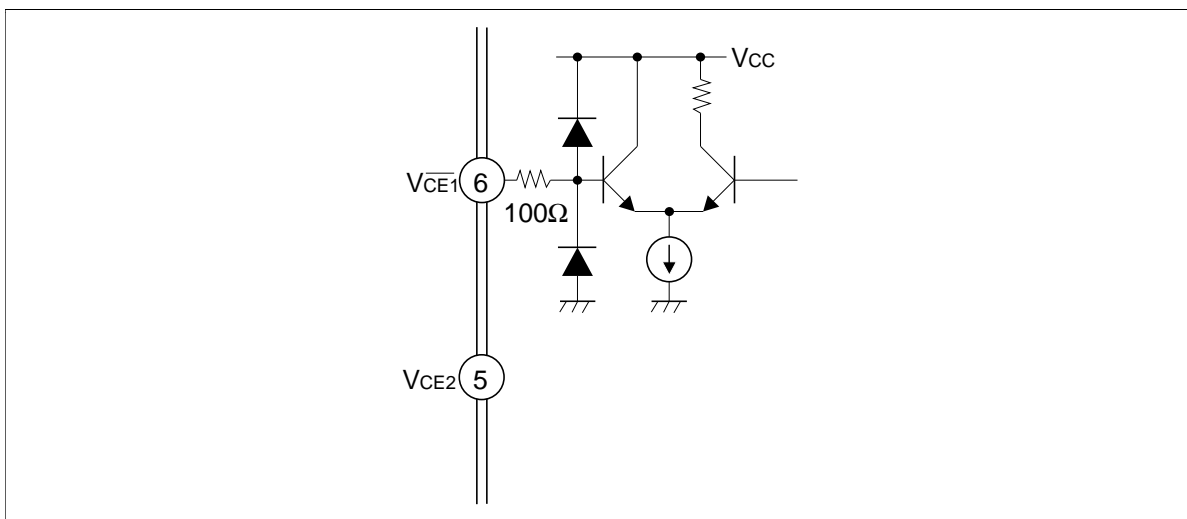


Figure 3 High Impedance State Control Input

HA19216/MP

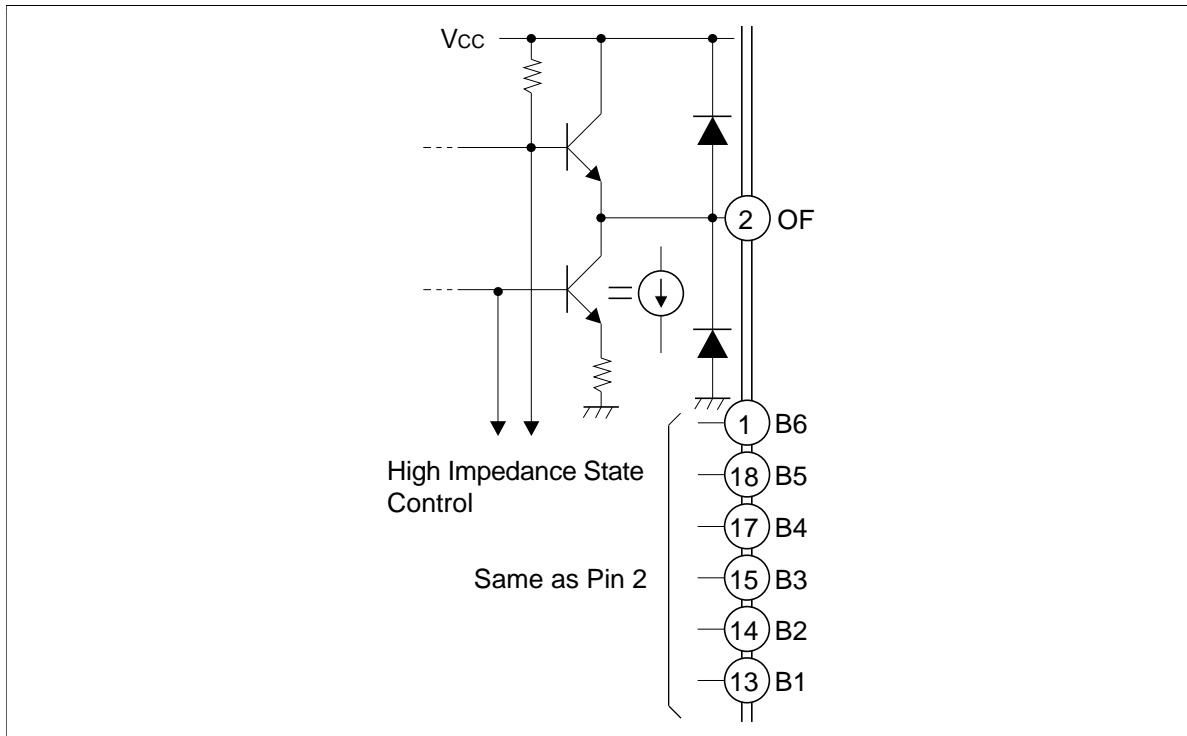


Figure 4 Digital Output

Absolute Maximum Ratings (Ta = 25°C, unless otherwise specified)

Item	Symbol	Rating	Unit
Supply voltage	V_{CC}	+7.0	V
Input signal voltage*	V_{IN}	0 to V_{CC}	V
Input reference voltage*	V_R	0 to V_{CC}	V
Digital input voltage	V_I	0 to V_{CC}	V
Voltage applied to digital output pin in high impedance	V_O	0 to V_{CC}	V
Power dissipation	P_T	550	mW
Operating temperature	T_{opr}	0 to +70	°C
Storage temperature	T_{stg}	-55 to +125	°C
Reference voltage difference	$V_{RT} - V_{RB}$	1.3	V
Reference center tap voltage	V_{RM}	Open state voltage ± 0.1	V

Note: V_{IN} and V_R should not be lower than 1.5 V at the same time.

Electrical Characteristics ($T_a = 25^\circ\text{C}$, $V_{CC} = 5.0\text{ V}$, $V_{RT} = 3.0\text{ V}$, $V_{RB} = 2.0\text{ V}$, unless otherwise specified)

Item		Symbol	Min	Typ	Max	Unit	Test Condition
Resolution			6	6	6	bits	
Operating supply voltage		V_{CC}	4.75	5.0	5.25	V	
Quiescent current		I_{CC}	—	50	84	mA	$f_{CLK} = 20\text{ Msps}$
Digital input voltage	High	V_{IH}	2.0	—	V_{CC}	V	
	Low	V_{IL}	0	—	0.8	V	
Digital input current	High	I_{IH}	—	—	100	μA	$V_I = 2.7\text{ V}$
	Low	I_{IL}	-100	—	—	μA	$V_I = 0.4\text{ V}$
Digital output voltage	High	V_{OH}	3.4	3.8	—	V	$I_{OH} = -5\text{ mA}$
	Low	V_{OL}	—	0.61	0.76	V	$I_{OL} = 1.4\text{ mA}$
Digital output current (High impedance)	High	I_{OZH}	—	—	100	μA	$V_O = 5.0\text{ V}$
	Low	I_{OZL}	-100	—	—	μA	$V_O = 0.5\text{ V}$
Reference current	RT	I_{RT}	—	8	12	mA	$V_{IN} = 1.9\text{ V}$
	RB	I_{RB}	-12	-8	—	mA	$V_{IN} = 3.1\text{ V}$
Input current		I_{IN}	—	20	50	μA	$V_{IN} = 3.1\text{ V}$
Input capacitance		C_{IN}	—	15	—	pF	$V_{RB} < V_{IN} < V_{RT}$, $f(V_{IN}) = 1\text{ MHz}$
Static linearity error	Differential	D.N.L.	-0.25	—	+0.25	LSB	
	Integral	I.N.L.	—	—	1.0	LSB _{p,p}	
Maximum conversion rate		f_{CLK} max.	20	—	—	Msps	
Digital output propagation delay		t_{PD}	—	34	50	ns	$C_L = 15\text{ pF}$
Digital output rise time		t_{TLH}	—	10	15	ns	$C_L = 15\text{ pF}$
Digital output fall time		t_{THL}	—	17	25	ns	$C_L = 15\text{ pF}$
Digital output enable time (High impedance)		t_{ZH}	—	12	20	ns	
		t_{ZL}	—	48	70	ns	
Digital output disable time (High impedance)		t_{HZ}	—	32	43	ns	
		t_{LZ}	—	23	33	ns	
Clock pulse width	Vphase = 0.8 V	t_{WH}	28	32	—	ns	
		t_{WL}	15	18	—	ns	
	Vphase = 2.0V	t_{WH}	10	13	—	ns	
		t_{WL}	33	37	—	ns	

HA19216/MP

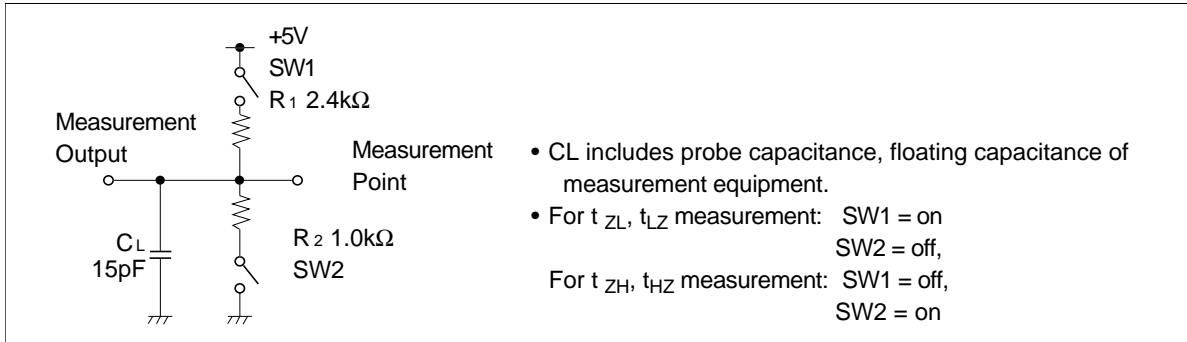


Figure 5 Measurement Load for Digital Output, Enable Time, Disable Time

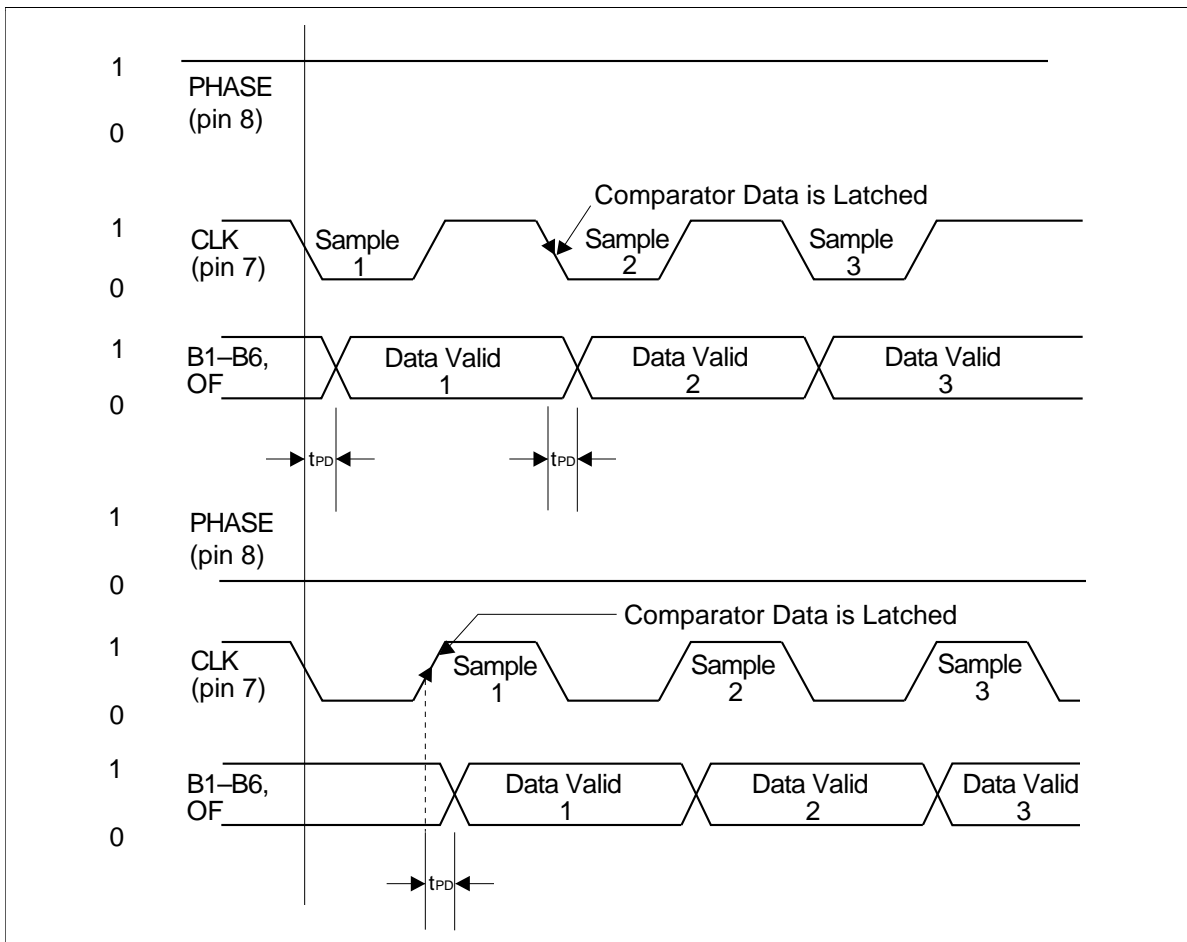


Figure 6 Timing Diagram

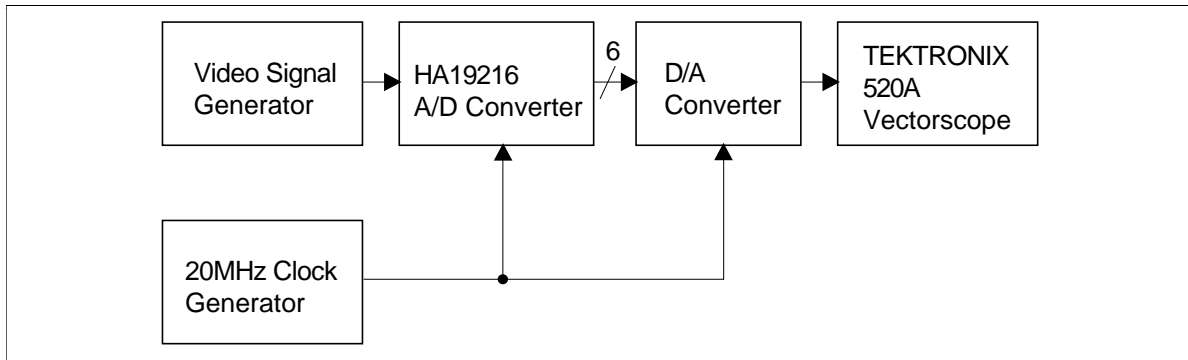


Figure 7 Measuring Circuit for DG and DP

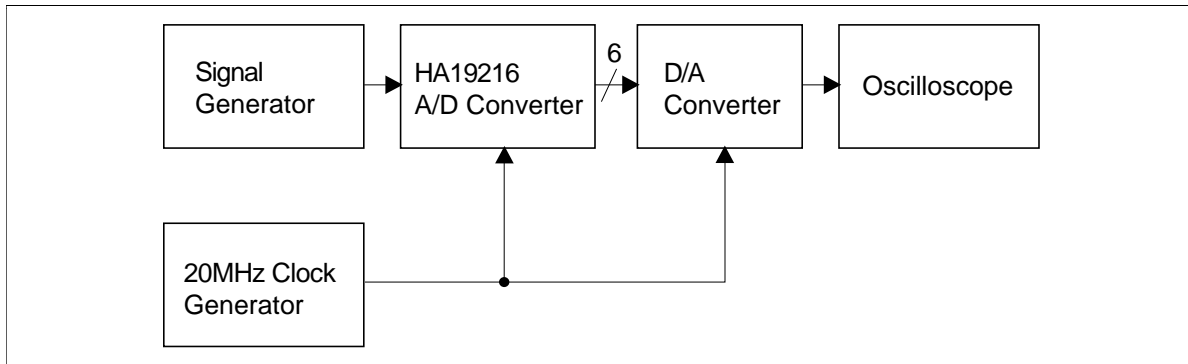


Figure 8 Measuring Circuit for Analog Input Frequency Response

High Frequency Input Response

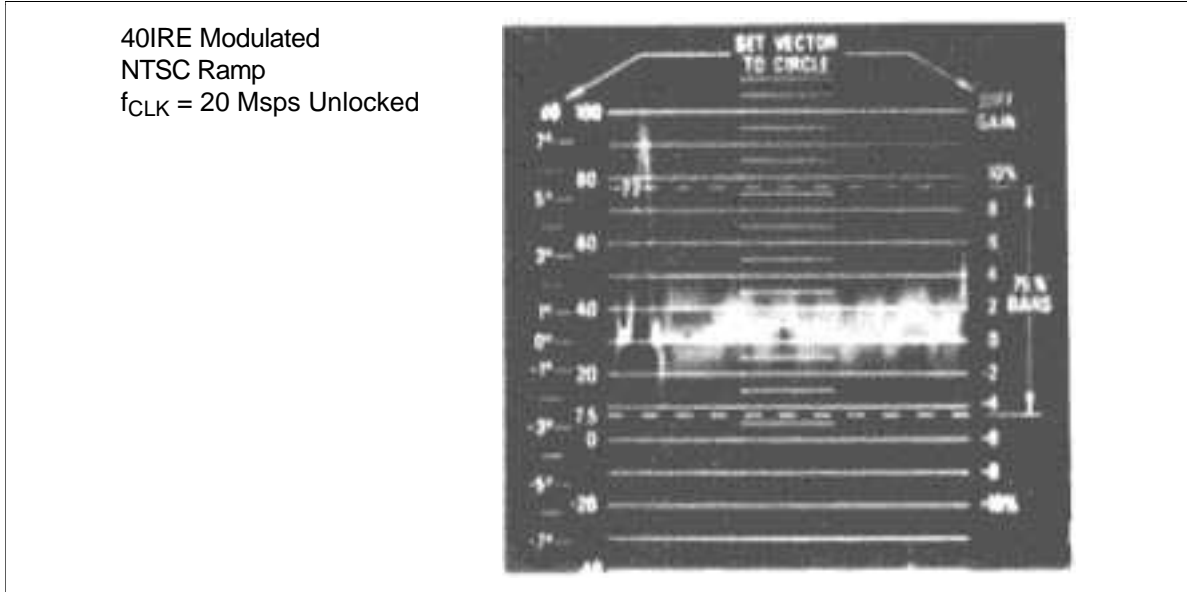


Figure 9 High Frequency Analog Input Response Differential Phase

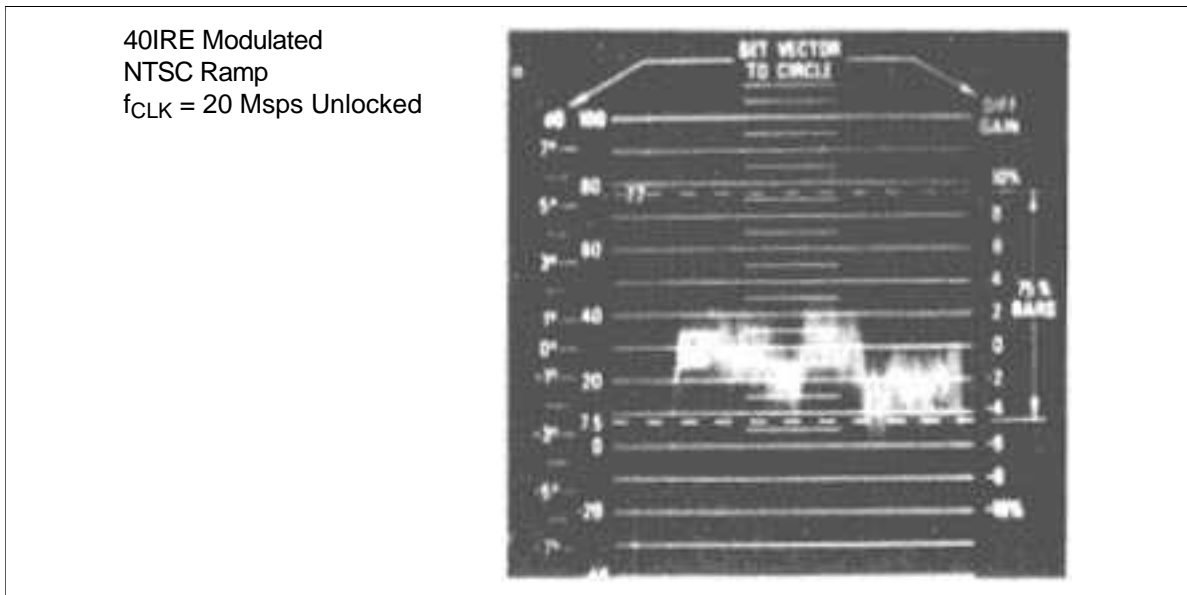


Figure 10 High Frequency Analog Input Response Differential Gain

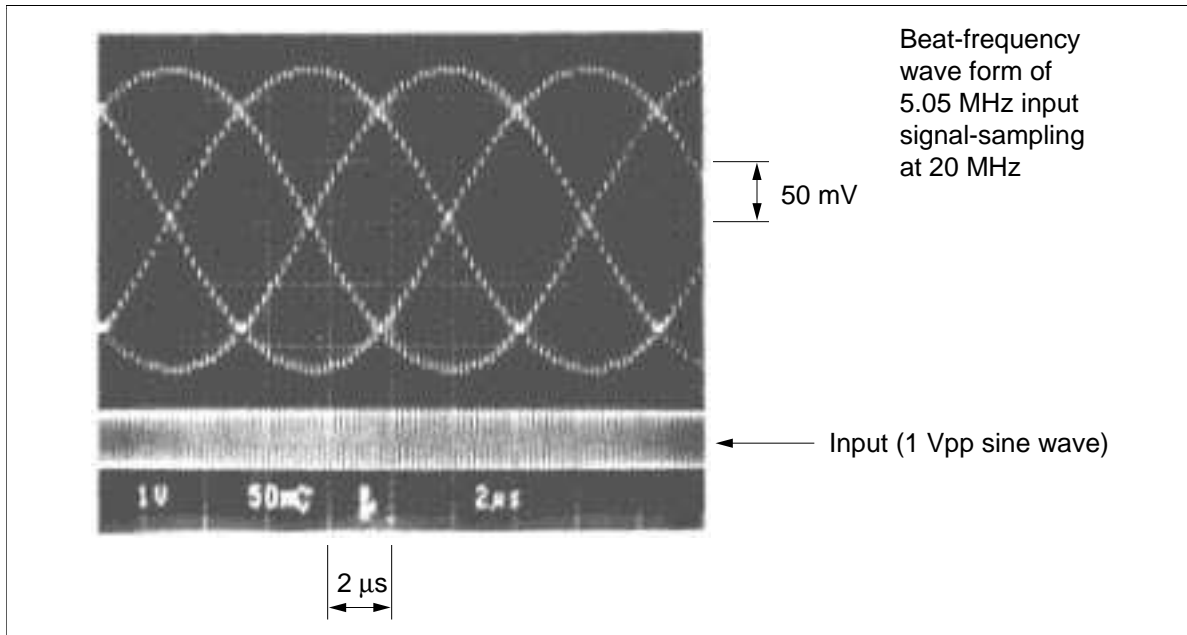


Figure 11 Beat-Frequency Waveform of 5.05 MHz Input Signal-Sampled at 20 MHz

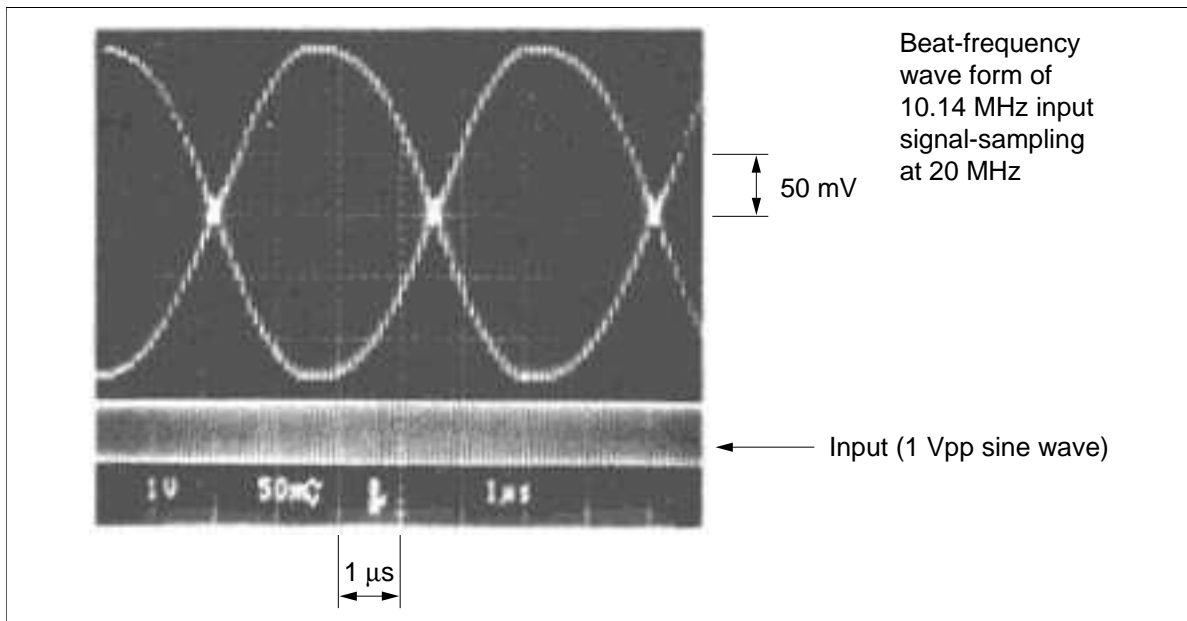


Figure 12 Beat-Frequency Waveform of 10.14 MHz Input Signal-Sampled at 20 MHz

When using this document, keep the following in mind:

1. This document may, wholly or partially, be subject to change without notice.
2. All rights are reserved: No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without Hitachi's permission.
3. Hitachi will not be held responsible for any damage to the user that may result from accidents or any other reasons during operation of the user's unit according to this document.
4. Circuitry and other examples described herein are meant merely to indicate the characteristics and performance of Hitachi's semiconductor products. Hitachi assumes no responsibility for any intellectual property claims or other problems that may result from applications based on the examples described herein.
5. No license is granted by implication or otherwise under any patents or other rights of any third party or Hitachi, Ltd.
6. **MEDICAL APPLICATIONS:** Hitachi's products are not authorized for use in **MEDICAL APPLICATIONS** without the written consent of the appropriate officer of Hitachi's sales company. Such use includes, but is not limited to, use in life support systems. Buyers of Hitachi's products are requested to notify the relevant Hitachi sales offices when planning to use the products in **MEDICAL APPLICATIONS**.

HITACHI

Hitachi, Ltd.

Semiconductor & IC Div.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100, Japan
Tel: Tokyo (03) 3270-2111
Fax: (03) 3270-5109

For further information write to:

Hitachi America, Ltd.
Semiconductor & IC Div.
2000 Sierra Point Parkway
Brisbane, CA. 94005-1835
USA
Tel: 415-589-8300
Fax: 415-583-4207

Hitachi Europe GmbH
Electronic Components Group
Continental Europe
Dornacher Straße 3
D-85622 Feldkirchen
München
Tel: 089-9 91 80-0
Fax: 089-9 29 30 00

Hitachi Europe Ltd.
Electronic Components Div.
Northern Europe Headquarters
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA
United Kingdom
Tel: 0628-585000
Fax: 0628-778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 0104
Tel: 535-2100
Fax: 535-1533

Hitachi Asia (Hong Kong) Ltd.
Unit 706, North Tower,
World Finance Centre,
Harbour City, Canton Road
Tsim Sha Tsui, Kowloon
Hong Kong
Tel: 27359218
Fax: 27306071