

OVERVIEW

The SM5312A is a 3-channel video buffer with built-in 5th-order lowpass filters. The SM5312A outputs Y, C, and composite signals at the same time. Composite signal is outputted mixing Y and C signals. Any channels drive maximum 2 loads.

FEATURES

- Supply voltage: $5V \pm 10\%$
- Output gain: $6 \pm 0.5\text{dB}$, $0 \pm 0.5\text{dB}$
- Filter passband ($\pm 1.5\text{dB}$): 6MHz
- Output drive capability: maximum 2 loads at 75Ω terminated
- Sag compensation circuit built-in (Y, YCMIX)
- Mixer built-in for output composite signal (YCMIX)
- Disable function implemented
- Group delay (100kHz to 5MHz): 10ns (typ)
- Package: 24-pin VSOP

APPLICATIONS

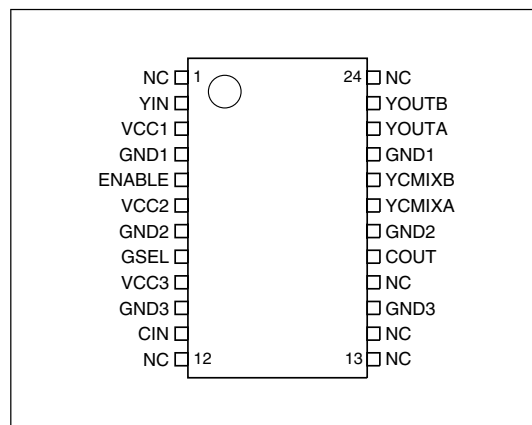
- Set top boxes
- LCD TVs
- PDPs
- Camcorders
- DVD players/recorders

ORDERING INFORMATION

Device	Package
SM5312AV	24-pin VSOP

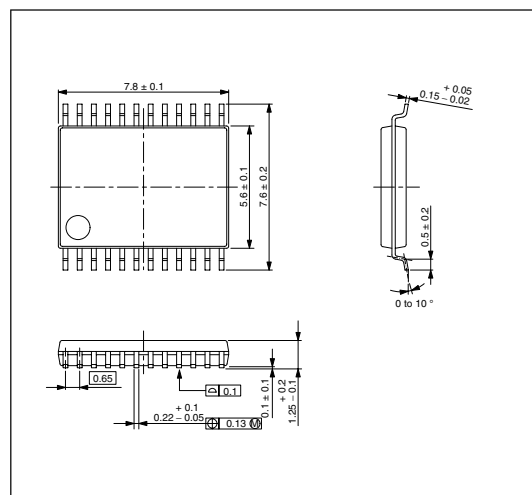
PINOUT

(Top view)

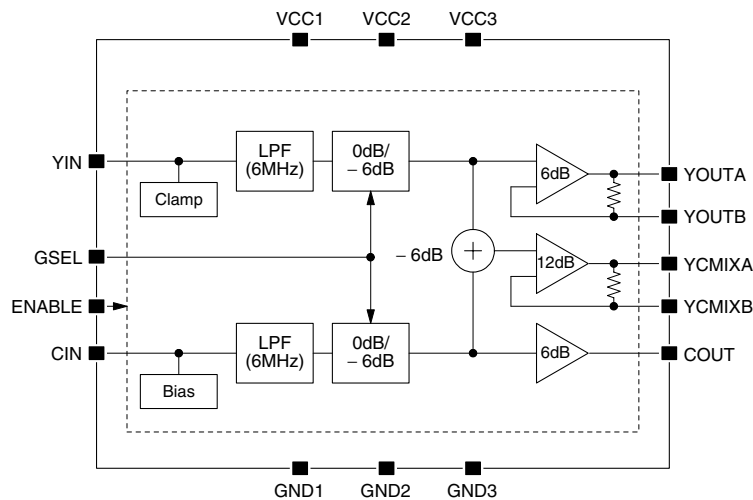


PACKAGE DIMENSIONS

(Unit: mm)



BLOCK DIAGRAM



PIN DESCRIPTION

Number	Name	I/O ^{*1}	Description
1	NC ^{*2}	-	No connection
2	YIN	I	Y signal input
3	VCC1	-	Power supply 1
4	GND1	-	Ground 1
5	ENABLE	Ip	Y, YCMIX, C-blocks enable signal input (pull-down resistor built-in) H: Enable, L: Disable
6	VCC2	-	Power supply 2
7	GND2	-	Ground 2
8	GSEL	Ip	Gain select (pull-down resistor built-in) H: 0dB (all output), L: 6dB (all output)
9	VCC3	-	Power supply 3
10	GND3	-	Ground 3
11	CIN	I	C signal input
12, 13, 14	NC ^{*2}	-	No connection
15	GND3	-	Ground 3
16	NC ^{*2}	-	No connection
17	COUT	O	C signal output
18	GND2	-	Ground 2
19	YCMIXA	O	YCMIX signal output (A)
20	YCMIXB	O	YCMIX signal output (B)
21	GND1	-	Ground 1
22	YOUTA	O	Y signal output (A)
23	YOUTB	O	Y signal output (B)
24	NC ^{*2}	-	No connection

*1. I: input, Ip: input with pull-down resistor, O: output

*2. NC: Leave open or connect to ground (we recommended to connect to ground).

PIN EQUIVALENT CIRCUITS

Number	Name	I/O ^{*1}	Equivalent circuit
2	YIN	I	
5 8	ENABLE GSEL	I _p	
11	CIN	I	
17	COUT	O	
19 20 22 23	YCMIXA YCMIXB YOUTA YOUTB	O	

*1. I: input, I_p: input with pull-down resistor, O: output

Note. Resistance values indicate design values.

SPECIFICATIONS

Absolute Maximum Ratings

$V_{CC1} = V_{CC2} = V_{CC3} = V_{CC}$, $GND1 = GND2 = GND3 = GND = 0V$

Parameter	Symbol	Condition	Rating	Unit
Supply voltage range	V_{CC}		- 0.3 to 7.0	V
Input voltage range	V_{IN}	YIN, CIN, ENABLE, GSEL pins	GND - 0.3 to $V_{CC} + 0.3$	V
Storage temperature range	T_{STG}		- 55 to 125	°C
Power dissipation ^{*1}	P_D		2.5	W

*1. $T_a = 25^\circ\text{C}$, when mounted on NPC's regulation substrate (110 × 65 × 1.6mm double layer glass- epoxy substrate with 160% wiring factor)
Reduced at the rate of 25mW/°C when $T_a > 25^\circ\text{C}$

Recommended Operating Conditions

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	V_{CC}		4.5 to 5.5	V
Operating ambient temperature	T_a		- 25 to 80	°C

Electrical Characteristics

$V_{CC} = 5.0V$, $T_a = 25^\circ\text{C}$, $f_{in} = 100\text{kHz}$, $V_{IN} = 1.0V_{p-p}$, $R_L = 75\Omega$, unless otherwise noted.
Refer to "MEASUREMENT CIRCUIT".

Parameter	Symbol	Condition	Rating			Unit	Test level
			min	typ	max		
Supply voltage 1	I_{CC1}	No input, ENABLE = HIGH, GSEL = LOW	-	50	70	mA	I
Supply voltage 2	I_{CC2}	No input, ENABLE = LOW, GSEL = LOW	-	1.5	3.0	mA	I
Output gain 1	A_{V1}	GSEL = LOW	5.5	6.0	6.5	dB	I
Output gain 2	A_{V2}	GSEL = HIGH	- 0.5	0.0	0.5	dB	I
Maximum output amplitude (Y)	V_{out1}	$R_L = 75\Omega$, THD $\leq 1.5\%$, GSEL = LOW, YOUT, YCMIX	-	2.8	-	V _{p-p}	I
Maximum output amplitude (C)	V_{out2}	$R_L = 75\Omega$, THD $\leq 1.5\%$, GSEL = LOW, COUT	-	2.0	-	V _{p-p}	I
Input amplitude (Y) ^{*1}	V_{I1}	AC-coupled inputs, THD $\leq 1.5\%$, YIN	-	-	1.4	V _{p-p}	I
Input amplitude (C) ^{*1}	V_{I2}	AC-coupled inputs, THD $\leq 1.5\%$, CIN	-	-	1.0	V _{p-p}	I
Input clamp voltage	V_{CLMP}	No input, YIN	1.1	1.3	1.5	V	I
Input bias voltage	V_{BIAS}	No input, CIN	1.95	2.15	2.35	V	I
Maximum overshoot	V_{OS}	GSEL = LOW, 2V _{p-p} output pulse, Input tr and tf = 100ns	-	5	-	%	II
Output drive capability	R_L	One load unit = 150 Ω , THD $\leq 1.5\%$	-	-	2	load	I
Logic HIGH-level input voltage	V_{IH}	ENABLE, GSEL	2.5	-	-	V	I
Logic LOW-level input voltage	V_{IL}	ENABLE, GSEL	-	-	1.0	V	I
Logic HIGH-level input current	I_{IH}	ENABLE, GSEL, $V_{IN} = V_{CC}$	-	120	200	μA	I

*1. This item shows the maximum value of input amplitude which meets the output distortion ratio shown in the condition column. When the signal amplitude that exceeds this specification value is input, the output distortion ratio increases. When using this device, the input signal level should be set to amplitude below specification value (max).

Filter Electrical Characteristics

$V_{CC} = 5.0V$, $T_a = 25^\circ C$, $f_{in} = 100kHz$, $V_{IN} = 1.0V_{p-p}$, $R_L = 75\Omega$, unless otherwise noted.
Refer to “MEASUREMENT CIRCUIT”.

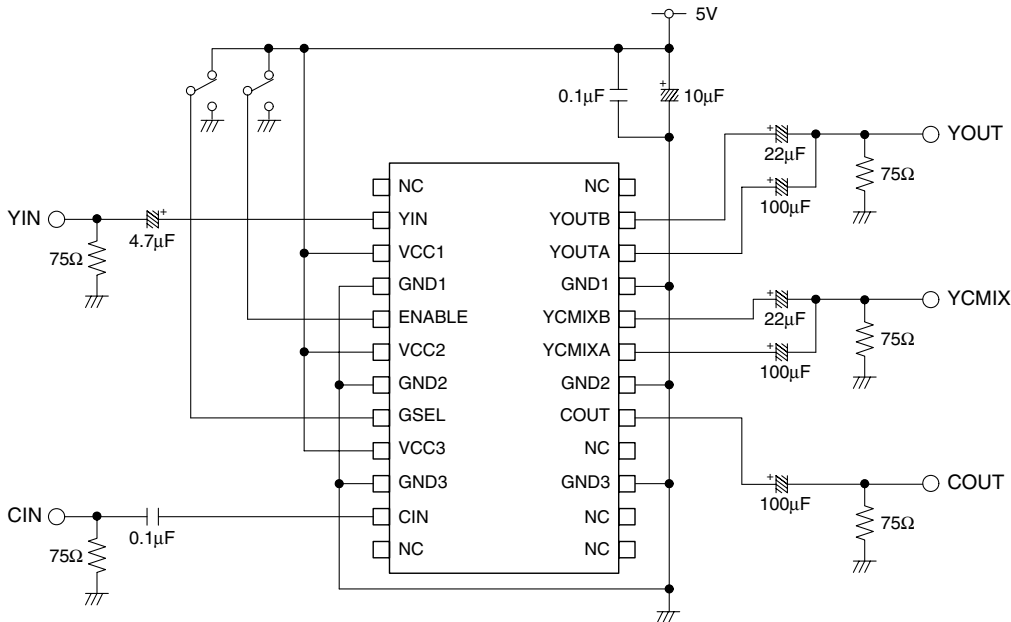
Parameter	Symbol	Condition	Rating			Unit	Test level
			Min	Typ	Max		
Passband attenuation	F_{PB}	$f_{in} = 6MHz/100kHz$	-1.5	0	1.5	dB	I
Stopband attenuation	F_{SB}	$f_{in} = 27MHz/100kHz$	30	40	-	dB	II
Crosstalk (between Y and C)	X_{TALK}	$V_{IN} = 0.5V_{p-p}$, $f_{in} = 1MHz$, between YOUT and COUT	-	-50	-	dB	II
Group delay deviation	ΔT_{GD}	100kHz to 5MHz	-	10	-	ns	II

Test level

I : 100% of products tested at $T_a = + 25^\circ C$.

II : Guaranteed as result of design and characteristics evaluation.

MEASUREMENT CIRCUIT



FUNCTIONAL DESCRIPTION

Enable Function

Pin number	Name	Setting	Function
5	ENABLE	H	Y, YCMIX, C enable
		L	Y, YCMIX, C disable (The outputs are in high-impedance state when disabled.)

Gain selection Function

Pin number	Name	Setting	Function
8	GSEL	H	All output gain: 0dB
		L	All output gain: 6dB

Sag Compensation Circuit

The Y and YCMIX output have built-in sag compensation circuits. When using a sag compensation circuit, should be connected external capacitors shown figure 1. If the sag compensation circuit is used, the sag is suppressed even when using a smaller external capacitance compared to the capacitance when not using the sag compensation circuit. (In figure 1, capacitance values of 100 μ F and 22 μ F are recommended). If the sag compensation circuit is not used, the sag compensation circuit does not function when the YOUTA and YOUTB are short-circuited (figure 2).

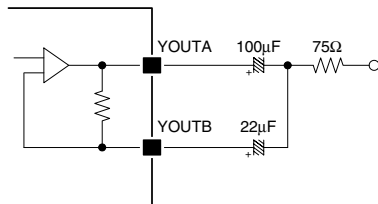


Figure 1. Sag compensation circuit capacitor connection

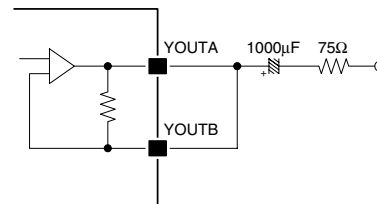
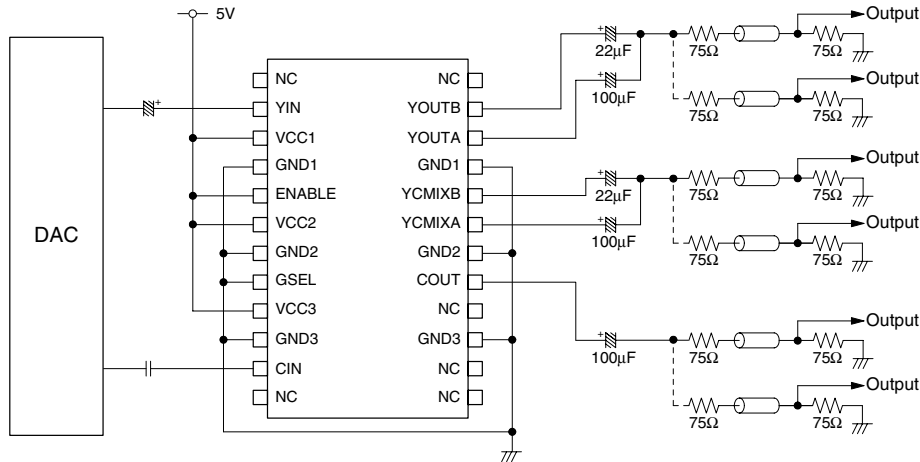


Figure 2. Capacitor connection without using the sag compensation circuit

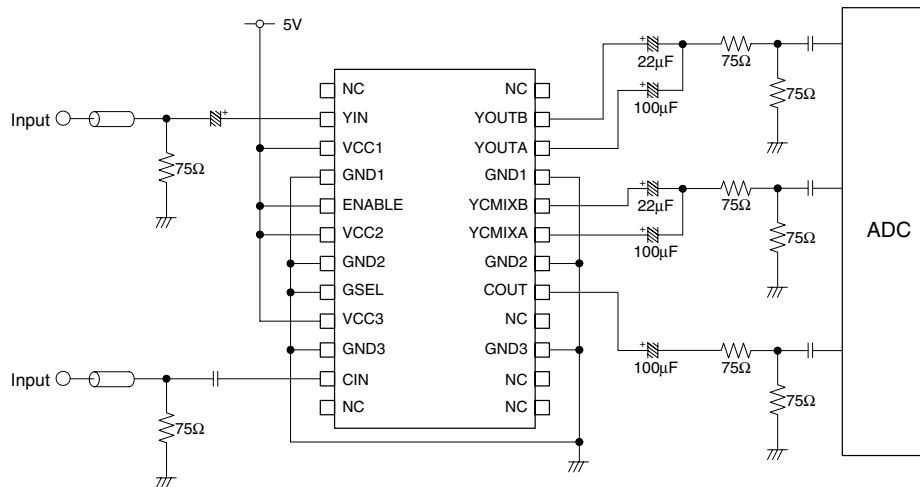
TYPICAL APPLICATION CIRCUIT

On Output Side Using



- Note. 1. Decoupling capacitors between supply pins are not shown in this diagram.
 2. For actual use, the decoupling capacitors of suitable capacitance value should be connected between supply pins.
 3. The capacitance values (100μF, 22μF) in this diagram are recommended.
 4. A capacitor (0.1μF recommended) should be connected between the unused input terminals and GND.
 5. The NC pins should be open or connect to GND (we recommended to connect to GND).

On Input Side Using



- Note. 1. Decoupling capacitors between supply pins are not shown in this diagram.
 2. For actual use, the decoupling capacitors of suitable capacitance value should be connected between supply pins.
 3. The capacitance values (100μF, 22μF) in this diagram are recommended.
 4. A capacitor (0.1μF recommended) should be connected between the unused input terminals and GND.
 5. The NC pins should be open or connect to GND (we recommended to connect to GND).

TYPICAL CHARACTERISTICS

$V_{CC} = 5.0V$, $T_a = 25^\circ C$, $f_{in} = 100kHz$, $V_{IN} = 1.0V_{p-p}$, $R_L = 75\Omega$, unless otherwise noted.

Refer to "MEASUREMENT CIRCUIT". MIX (Y, C) shows YCMIX output characteristics. Characters in parentheses () are input channel. When measuring MIX (C), YIN pin is applied 1.8V DC voltage.

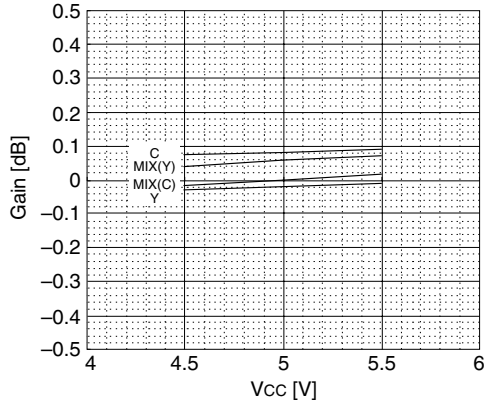


Figure 3. Gain vs. V_{CC} (0dB mode)

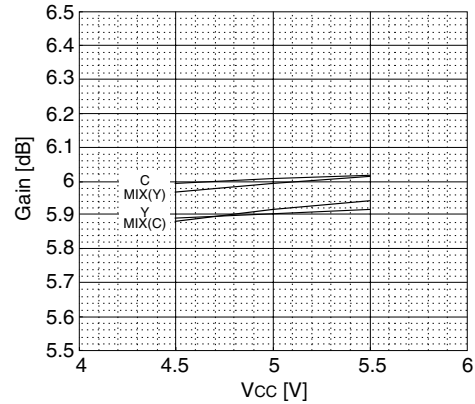


Figure 4. Gain vs. V_{CC} (6dB mode)

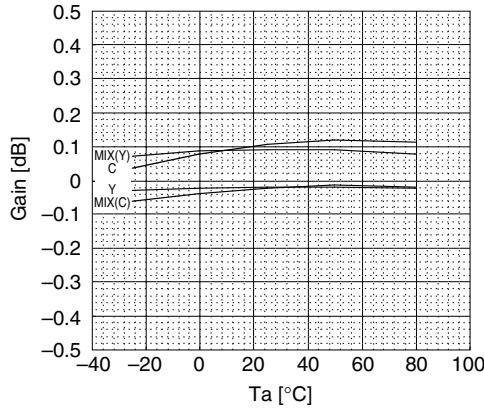


Figure 5. Gain vs. T_a (0dB mode)

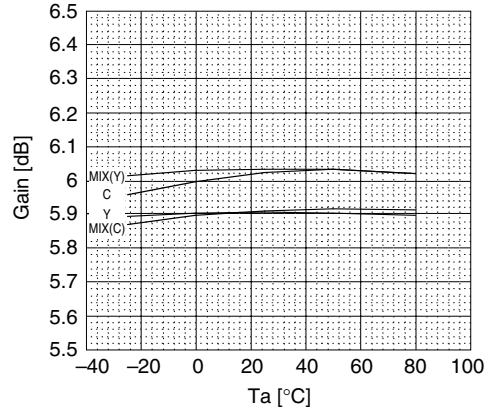


Figure 6. Gain vs. T_a (6dB mode)

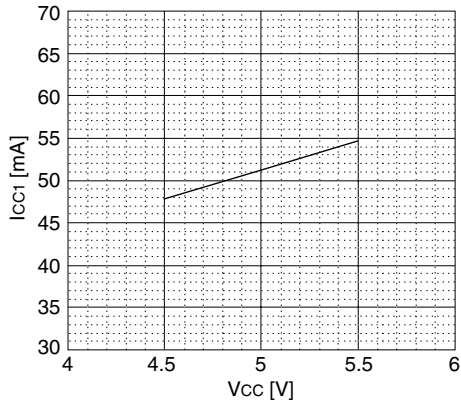


Figure 7. I_{CC1} vs. V_{CC}

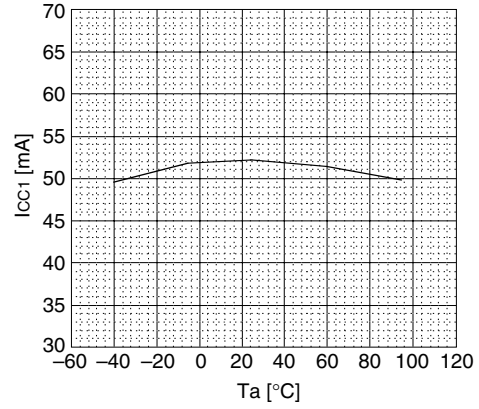


Figure 8. I_{CC1} vs. T_a

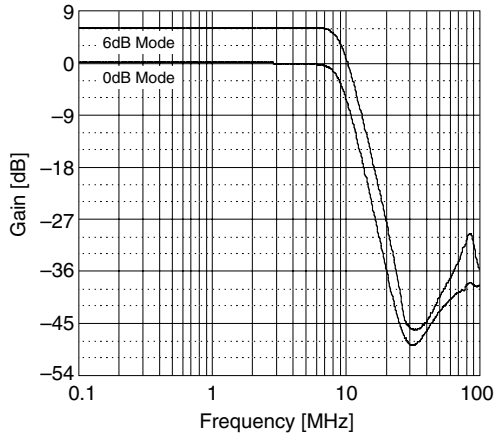


Figure 9. Frequency characteristics

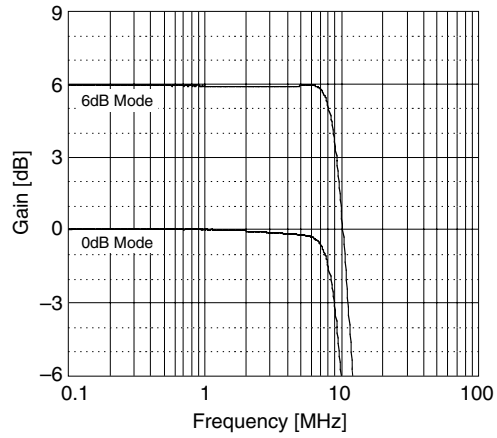


Figure 10. Frequency characteristics (-6dB to 9dB)

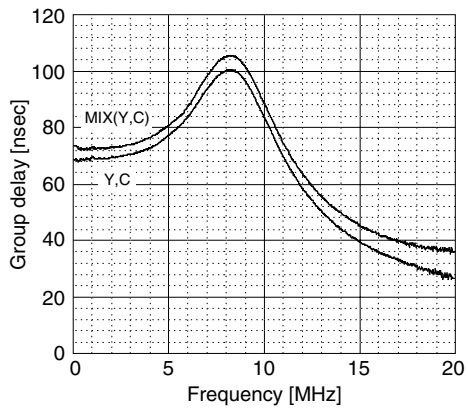


Figure 11. Group delay (0dB mode)

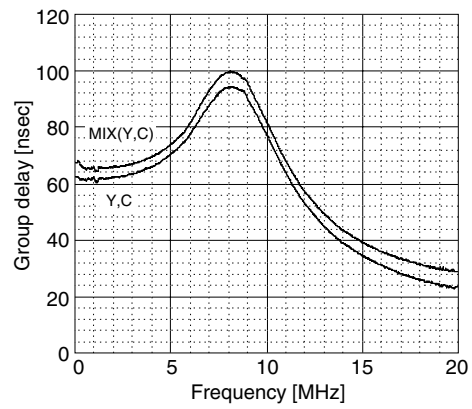


Figure 12. Group delay (6dB mode)

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The logo for NPC (Seiko NPC Corporation) consists of the letters 'NPC' in a bold, black, sans-serif font. The 'N' and 'P' are connected at the top, and the 'C' is a simple, rounded shape.

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NC0502BE 2006.04