

# Two-input/One-output LPF switching, Wideband Two-system Video Driver Monolithic IC MM1788AVxx

April 28, 2009

## Outline

This IC is a 2-channel video driver whose bandwidth is wide enough to support the high-definition video quality. Besides, it has an integrated sixth order Butterworth LPF, one of whose 3 cutoff frequencies ( $f_c$ ) is selectable to allow outputs of various signals with the optimal condition.

## Features

1. Supports D4 ( $f_c = 50\text{MHz}$ )
2. Can select one of three kinds of LPF cut-off frequency. ( $f_{BW} [= 6.75\text{MHz}, 13.5\text{MHz}]$ ,  $f_c [= 30\text{MHz}]$ )
3. Sixth-order Butterworth LPF integrated

## Package

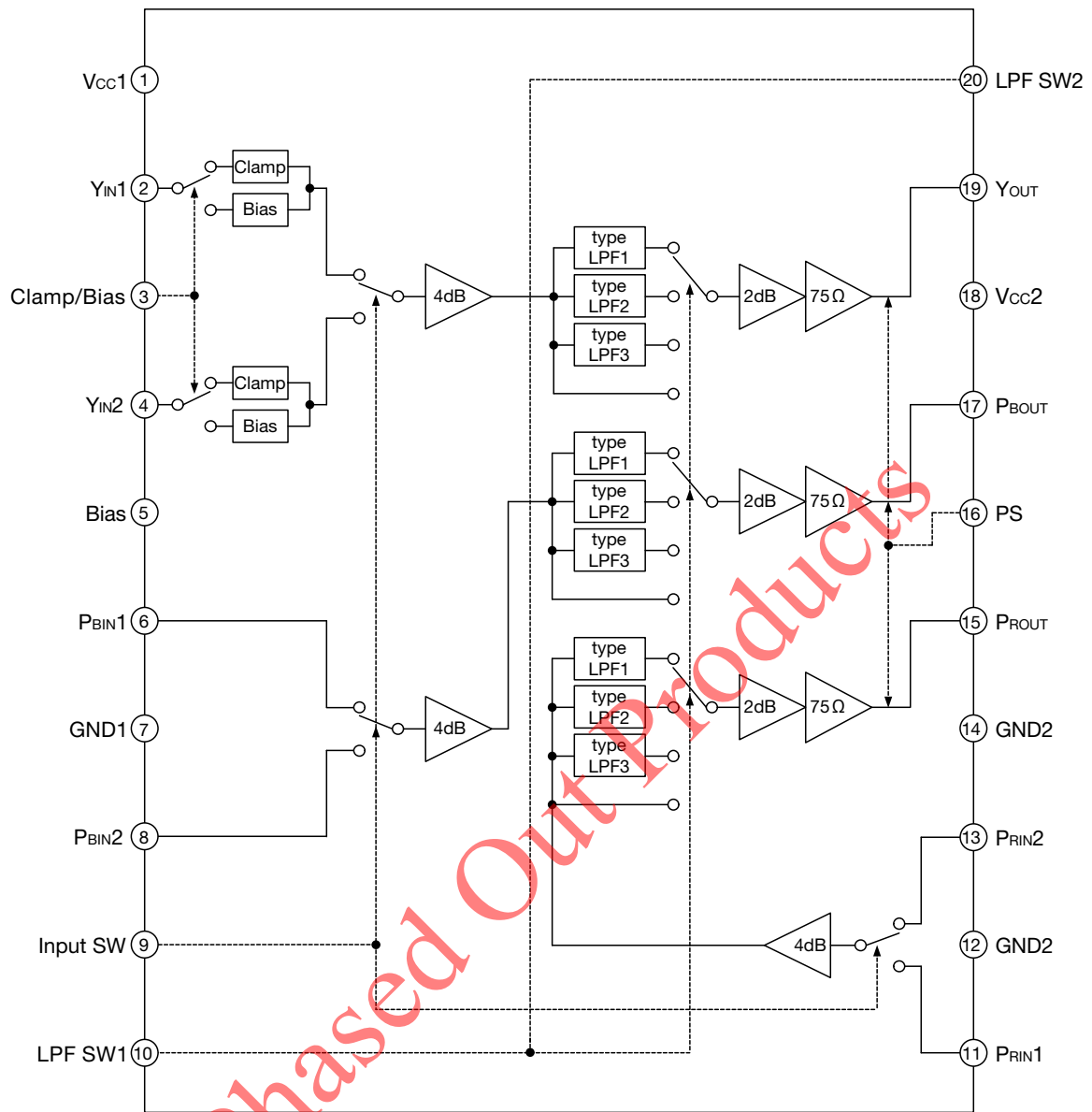
TSOP-20B (with radiate heat plate)

## Applications

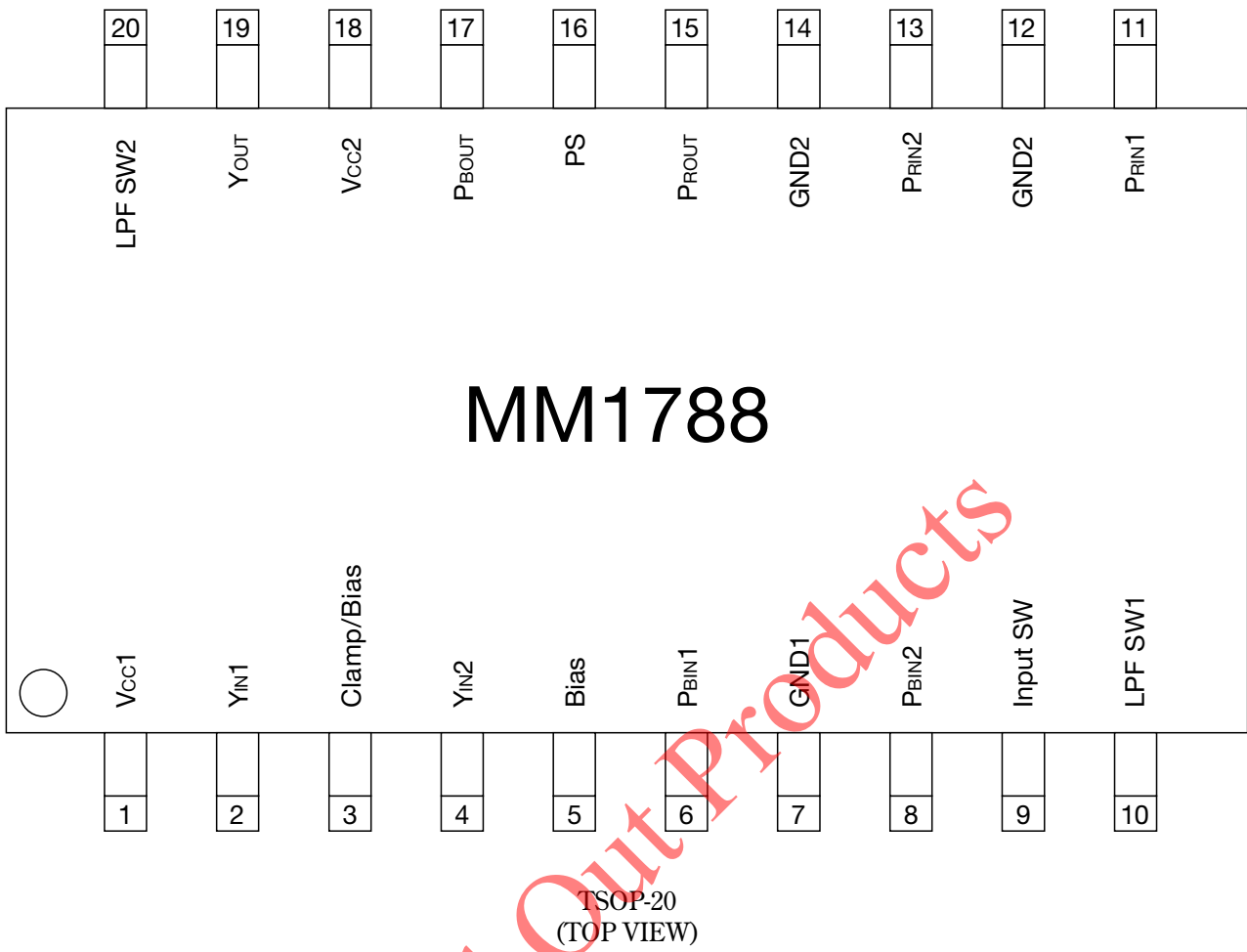
1. DVD recorder
2. Blu-ray recorder

Phased Out Products

Block Diagram

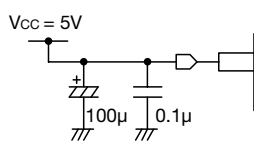


Pin Assignment



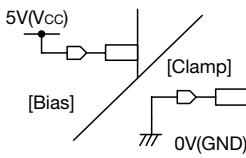
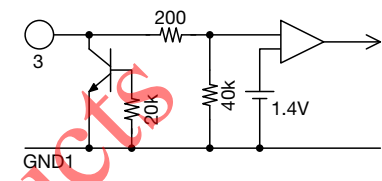
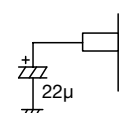
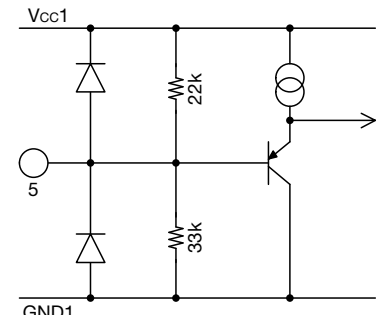
1	Vcc1	6	P <sub>BIN1</sub>	11	P <sub>RIN1</sub>	16	PS
2	Y <sub>IN1</sub>	7	GND1	12	GND2	17	P <sub>BOUT</sub>
3	Clamp/Bias	8	P <sub>BIN2</sub>	13	P <sub>RIN2</sub>	18	V <sub>CC2</sub>
4	Y <sub>IN2</sub>	9	Input SW	14	GND2	19	Y <sub>OUT</sub>
5	Bias	10	LPF SW1	15	P <sub>ROUT</sub>	20	LPF SW2

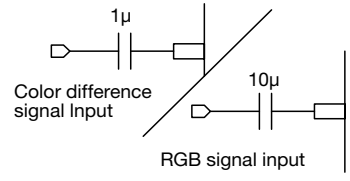
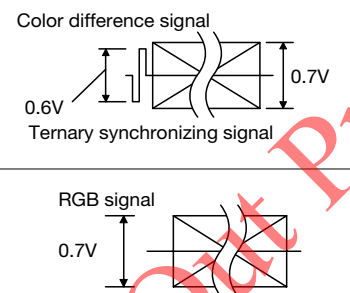
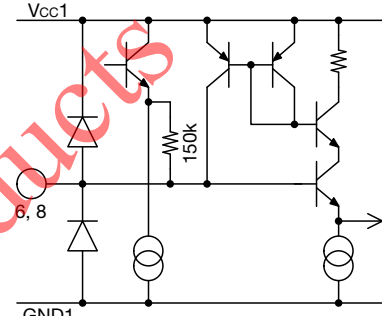
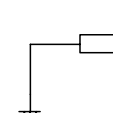
**Pin Description**

Pin No.	Pin name	Pin description	
1 18	Vcc1 Vcc2	<b>Function</b>	
		Positive Voltage Supply Pin to apply a positive supply voltage. Apply 5V. 1pin and 18pin are not shorted inside the IC. Vcc2 is connected to an output stage circuit, and Vcc1 is connected to a circuit other than an output stage circuit.  Note : Please arrange power supply bypass capacitor near the terminal.	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
			
		<b>Input signal</b>	
		DC voltage : 4.5~5.5V	

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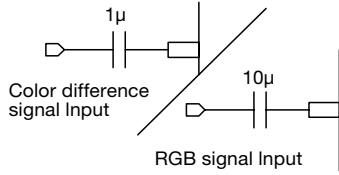
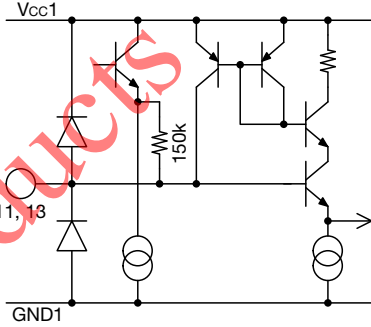
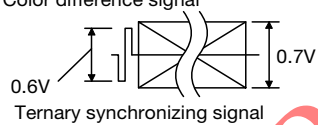
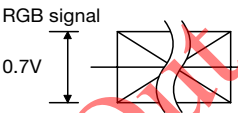
Pin No.	Pin name	Pin description						
		<b>Function</b>						
		<p>Component Y Signal Input or RGB Signal Input                      Pin to input component Y signals or RGB signals                      Select an input type (Clamp/Bias) with the Clamp/Bias pin (3pin).</p> <p>Note : As shown below, select an external input capacitance corresponding to an input type (Clamp/Bias).</p> <p>Pin Voltage : 1.3V typ. [at Clamp][at Single mode]                      or 2.4V typ. [at Bias][at Single mode]</p> <p>Input Impedance : Low [Clamp circuit ON]                      or High[Clamp circuit OFF]                      or 150kΩ[Bias]</p>						
<b>2</b> <b>4</b>	Y <sub>IN1</sub> Y <sub>IN2</sub>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">External circuit</th> <th style="width: 50%; text-align: center;">Equivalent circuit diagram</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"> <p>Component Y signal input (Clamp select) 0.1µ</p> <p>RGB signal input (Bias select) 10µ</p> <p>When not using it : Open</p> </td> <td rowspan="3" style="text-align: center; vertical-align: middle;"> <p>Vcc1</p> <p>2, 4</p> <p>GND1</p> </td> </tr> <tr> <th style="text-align: center;">Input signal</th> </tr> <tr> <td style="text-align: center;"> <p>Component Y signal</p> <p>1V</p> <p>0.6V Ternary synchronizing signal</p> <p>RGB signal</p> <p>0.7V</p> </td> </tr> </tbody> </table>	External circuit	Equivalent circuit diagram	<p>Component Y signal input (Clamp select) 0.1µ</p> <p>RGB signal input (Bias select) 10µ</p> <p>When not using it : Open</p>	<p>Vcc1</p> <p>2, 4</p> <p>GND1</p>	Input signal	<p>Component Y signal</p> <p>1V</p> <p>0.6V Ternary synchronizing signal</p> <p>RGB signal</p> <p>0.7V</p>
External circuit	Equivalent circuit diagram							
<p>Component Y signal input (Clamp select) 0.1µ</p> <p>RGB signal input (Bias select) 10µ</p> <p>When not using it : Open</p>	<p>Vcc1</p> <p>2, 4</p> <p>GND1</p>							
Input signal								
<p>Component Y signal</p> <p>1V</p> <p>0.6V Ternary synchronizing signal</p> <p>RGB signal</p> <p>0.7V</p>								

Pin No.	Pin name	Pin description	
3	Clamp/Bias	<b>Function</b>	
		<p>Clamp/Bias select                      Select an input type (Clamp/Bias) of Y<sub>IN1</sub> and Y<sub>IN2</sub> (2 and 4pin) with a voltage applied to this pin.</p> <p>Threshold : 1.4V typ.                      Input Impedance : 40kΩ typ.</p>	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
		 <p>When not using it : Open</p>	
		<b>Input signal</b>	DC voltage : 0V(GND)~5V(Vcc)
5	Bias	<b>Function</b>	
		<p>Bias                      All the reference voltages used inside the IC are produced according to the resistance divider of this pin.                      Pin to stabilize reference voltages, and reduce both power supply ripple by decreasing impedance with an external 22uF.</p> <p>Input Impedance : 13kΩ typ.</p>	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
		 <p>When not using it : Open</p>	
<b>Input signal</b>		—	

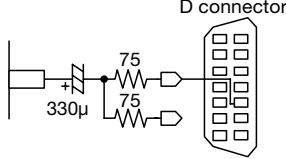
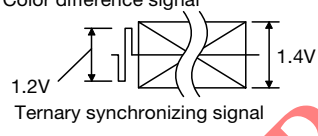
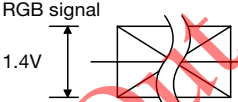
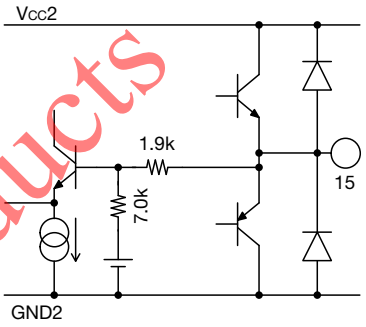
Pin No.	Pin name	Pin description	
6 8	P <sub>BIN1</sub> P <sub>BIN2</sub>	<b>Function</b>	
		Color difference P <sub>B</sub> Signal Input or RGB Signal Input Pin to input color difference signals P <sub>B</sub> or RGB signals Bias input pin  Pin Voltage : 2.4V typ. Input Impedance : 150kΩ typ.	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
		 <p style="text-align: center;">When not using it : Open</p>	
		<b>Input signal</b>	
			
			
7 12 14	GND1 GND2 GND2	<b>Function</b>	
		GND Ground pin.	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
			
<b>Input signal</b>		—	
		—	

Pin No.	Pin name	Pin description	
9	Input SW	<b>Function</b>	
		Input signal select Select 2 kind of Input signal (Y <sub>IN1</sub> /Y <sub>IN2</sub> , P <sub>BIN1</sub> /P <sub>BIN2</sub> , P <sub>RIN1</sub> /P <sub>RIN2</sub> ) with a voltage applied to this pin.  Threshold Voltage : 1.4V typ. Input Impedance : 40kΩ typ.	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
		<p style="text-align: center;">When not using it : Open</p>	
		<b>Input signal</b>	
10 20	LPF SW1 LPF SW2	<b>Function</b>	
		LPF select Select a cutoff frequency of LPF (Y/P <sub>B</sub> /P <sub>R</sub> ) with a voltage applied to this pin. (pass bandwidth : 6.75MHz, 13.5MHz, 30MHz, Through mode)  See section "Switch Control Table" how to select Cutoff frequency.  Threshold Voltage : 1.4V typ. Input Impedance : 40kΩ typ.	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
		<p style="text-align: center;">When not using it : Open</p>	
		<b>Input signal</b>	



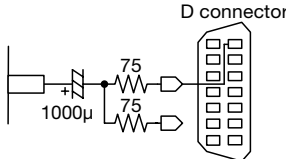
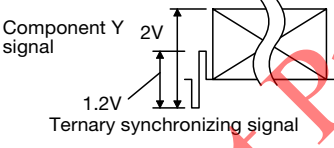
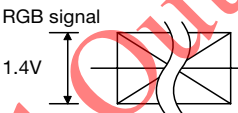
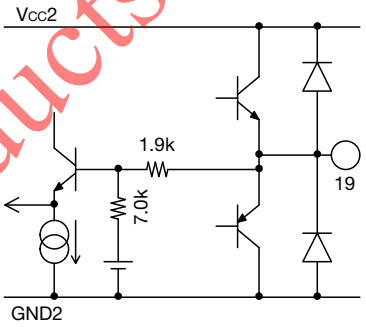
Pin No.	Pin name	Pin description	
11 13	P <sub>RIN1</sub> P <sub>RIN2</sub>	<b>Function</b>	
		Color difference P <sub>R</sub> Signal Input or RGB Signal Input Pin to input color difference signals P <sub>R</sub> or RGB signals Bias input pin  Pin Voltage : 2.4V typ. Input Impedance : 150kΩ typ.	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
		 <p>Color difference signal Input</p> <p>RGB signal Input</p> <p>When not using it : Open</p>	
		<b>Input signal</b>	
 <p>Color difference signal</p> <p>0.6V</p> <p>0.7V</p> <p>Ternary synchronizing signal</p>			
 <p>RGB signal</p> <p>0.7V</p>			

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Pin No.	Pin name	Pin description	
15	P <sub>ROUT</sub>	<b>Function</b>	
		Color difference P <sub>R</sub> Signal Output or RGB Signal Output Pin to output color difference signals P <sub>R</sub> or RGB signals Bias output pin  Pin Voltage : 2.4V typ. Output Dynamic Range : 3.0V <sub>p-p</sub> typ.	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
		 <p>When not using it : Open</p>	
		<b>Output signal</b>	
 <p>Color difference signal</p> <p>1.2V</p> <p>1.4V</p> <p>Ternary synchronizing signal</p>			
 <p>RGB signal</p> <p>1.4V</p>			
			

Phased Out Products

Pin No.	Pin name	Pin description	
16	PS	<b>Function</b>	
		Power Save select Select Power Save ON/OFF with a voltage applied to this pin.  Threshold Voltage : 1.4V typ. Input Impedance : 40kΩ typ.	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
		<p>When not using it : Open</p>	
		<b>Input signal</b>	
		DC voltage : 0V(GND)~5V(Vcc)	
17	PBOUT	<b>Function</b>	
		Color difference P <sub>B</sub> signal output or RGB signal output Pin to output color difference signals P <sub>B</sub> or RGB signals Bias output pin  Pin Voltage : 2.4V typ. Output Dynamic Range : 3.0Vp-p typ.	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
		<p>When not using it : Open</p>	
		<b>Output signal</b>	
		Color difference signal <p>Ternary synchronizing signal</p>	
		RGB signal 	

Pin No.	Pin name	Pin description	
19	Y <sub>OUT</sub>	<b>Function</b>	
		Component Y signal output or RGB signal output Pin to output component Y signals or RGB signals Select an output type (Clamp/Bias) with the Clamp/Bias pin (3pin).  Pin Voltage : 1.3V typ. [Clamp] or 2.4V typ. [Bias]  Output Dynamic Range : 2.7V <sub>p-p</sub> typ. [Clamp] or 3.0V <sub>p-p</sub> typ. [Bias]	
		<b>External circuit</b>	<b>Equivalent circuit diagram</b>
		 <p style="text-align: center;">When not Using it : Open</p>	
		<b>Output signal</b>	
 <p style="text-align: center;">Component Y signal</p> <p style="text-align: center;">Ternary synchronizing signal</p>			
 <p style="text-align: center;">RGB signal</p>			
			

Phased Output Products

**Absolute Maximum Ratings** (Except where noted otherwise, Ta=25°C)

Item	Symbol	Ratings	Units
Storage temperature	T <sub>STG_S</sub>	-55~+150	°C
Operating temperature	T <sub>OPR_S</sub>	-40~+85	°C
Supply voltage	V <sub>CC max._S</sub>	6	V
Allowable loss (Note1)	P <sub>D_S</sub>	3.1	W

Note1 : Board mounting power dissipation. Board size 50×50×1.0mm  
 Layer : Both side Material : Glass epoxy Wire rate : 60%

**Recommended Operating Conditions**

Item	Symbol	Ratings	Units
Operating temperature	T <sub>OPR_S</sub>	-40~+85	°C
Operating voltage	V <sub>CCOP_S</sub>	4.5~5.5	V

**Electrical Characteristics (DC Character)** (Except where noted otherwise, Ta=25°C, V<sub>CC</sub>=5V)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units	
Supply current	I <sub>CC</sub>	No signal	80	110	140	mA	
Supply current on Power Save	I <sub>CC_PS</sub>	No signal		1	1.5	mA	
Terminal voltage	Luminance input	V <sub>YIN1,2</sub>	2, 4pin	1.1	1.3	1.5	V
	Component input	V <sub>PBIN1,2, PRIN1,2</sub>	6, 8, 11, 13pin	1.9	2.4	2.9	V
	Luminance output	V <sub>YOUT</sub>	19pin		1.3		V
	Component output	V <sub>PBOUT, PROUT</sub>	15, 17pin		2.4		V
Output dynamic range	DR <sub>YOUT_clamp</sub>	SIN wave : 100kHz THD=1.0%	2.6	2.7		V	
	DR <sub>n_bias</sub> (Note3)	SIN wave : 100kHz THD=1.0%	2.8	3.0		V	
Control terminal input voltage	High	V <sub>thHm</sub> (Note2)	2.1			V	
	Low	V <sub>thLm</sub> (Note2)			0.7	V	
Control terminal input current	High	I <sub>IHm</sub> (Note2)			160	μA	
	Low	I <sub>ILm</sub> (Note2)			15	μA	

**Electrical Characteristics (AC Character)** (Except where noted otherwise, Ta=25°C, Vcc=5V)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Input impedance at Bias select	Z <sub>YIN1&amp;2</sub> , P <sub>BIN1&amp;2</sub> , P <sub>RIN1&amp;2</sub>	2, 4, 6, 8, 11, 13pin	100	150	200	kΩ
Voltage gain	G <sub>1n</sub> (Note3)	SIN wave : 0.7V f=100kHz	5.7	6.0	6.3	dB
Frequency characteristic 1 (Y1, Y2, P <sub>B1</sub> , P <sub>B2</sub> , P <sub>R1</sub> , P <sub>R2</sub> ) at Standard Definition select	f <sub>1n</sub> (Note3)	SIN wave : 0.7V 6.75MHz/100kHz	-1.0	0.0	1.0	dB
	f <sub>2n</sub> (Note3)	SIN wave : 0.7V 27MHz/100kHz		-33	-27	dB
Frequency characteristic 2 (Y1, Y2, P <sub>B1</sub> , P <sub>B2</sub> , P <sub>R1</sub> , P <sub>R2</sub> ) at Progressive Scan select	f <sub>3n</sub> (Note3)	SIN wave : 0.7V 13.5MHz/100kHz	-1.0	0.0	1.0	dB
	f <sub>4n</sub> (Note3)	SIN wave : 0.7V 54MHz/100kHz		-33	-27	dB
Frequency characteristic 3 (Y1, Y2, P <sub>B1</sub> , P <sub>B2</sub> , P <sub>R1</sub> , P <sub>R2</sub> ) at High Definition select	f <sub>5n</sub> (Note3)	SIN wave : 0.7V 30MHz/100kHz	-1.0	0.0	1.0	dB
	f <sub>6n</sub> (Note3)	SIN wave : 0.7V 74MHz/100kHz		-30	-24	dB
Frequency characteristic 4 (Y1, Y2, P <sub>B1</sub> , P <sub>B2</sub> , P <sub>R1</sub> , P <sub>R2</sub> ) at Through Mode select	f <sub>7n</sub> (Note3)	SIN wave : 0.7V 50MHz/100kHz	-6.0	-3.0		dB
Group delay 1	t <sub>1GDn</sub> (Note3)	Standard Definition select at 100kHz		80	150	ns
Group delay 2	t <sub>2GDn</sub> (Note3)	Progressive Scan select at 100kHz		45	80	ns
Group delay 3	t <sub>3GDn</sub> (Note3)	High Definition select at 100kHz		22	45	ns
Group delay deviation 1 at Standard Definition select	Δt <sub>1GDn</sub> (Note3)	to 3.58MHz		4	10	ns
		to 4.43MHz		6	10	ns
		to 6MHz		12	20	ns
Group delay deviation 2 at Progressive Scan select	Δt <sub>2GDn</sub> (Note3)	to 2MHz		1	10	ns
		to 12MHz		6	20	ns
Group delay deviation 3 at High Definition select	Δt <sub>3GDn</sub> (Note3)	to 4MHz		1	10	ns
		to 24MHz		5	10	ns
Between channel Group delay deviation 4	Δt <sub>4chGD</sub>	Between Y and Pb (P <sub>R</sub> ) at 4MHz (Standard Definition)		1	10	ns
Between channel Group delay deviation 5	Δt <sub>5chGD</sub>	Between Y and Pb (P <sub>R</sub> ) at 24MHz (High Definition)		5	10	ns

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Differential gain	DG (Y <sub>OUT</sub> )	Staircase signal 1V		1.0	1.5	%
Differential phase	DP (Y <sub>OUT</sub> )	Staircase signal 1V (without 13.5MHz-LPF)		1.0	1.5	°
		Staircase signal 1V (13.5MHz-LPF)		2.0	2.5	°
Crosstalk	CT <sub>n</sub> (Note3)	f=4.43MHz, 0.7V		-60	-55	dB
Crosstalk	CT <sub>n</sub> (Note3)	f=20MHz, 0.7V		-45	-40	dB
S/N 1	SN1 <sub>n</sub> (Note3)	BW : 100k~6MHz		-77		dB
S/N 2	SN2 <sub>n</sub> (Note3)	BW : 100k~30MHz		-63		dB

Note2 : The subscript number "m" is the terminal of under table.

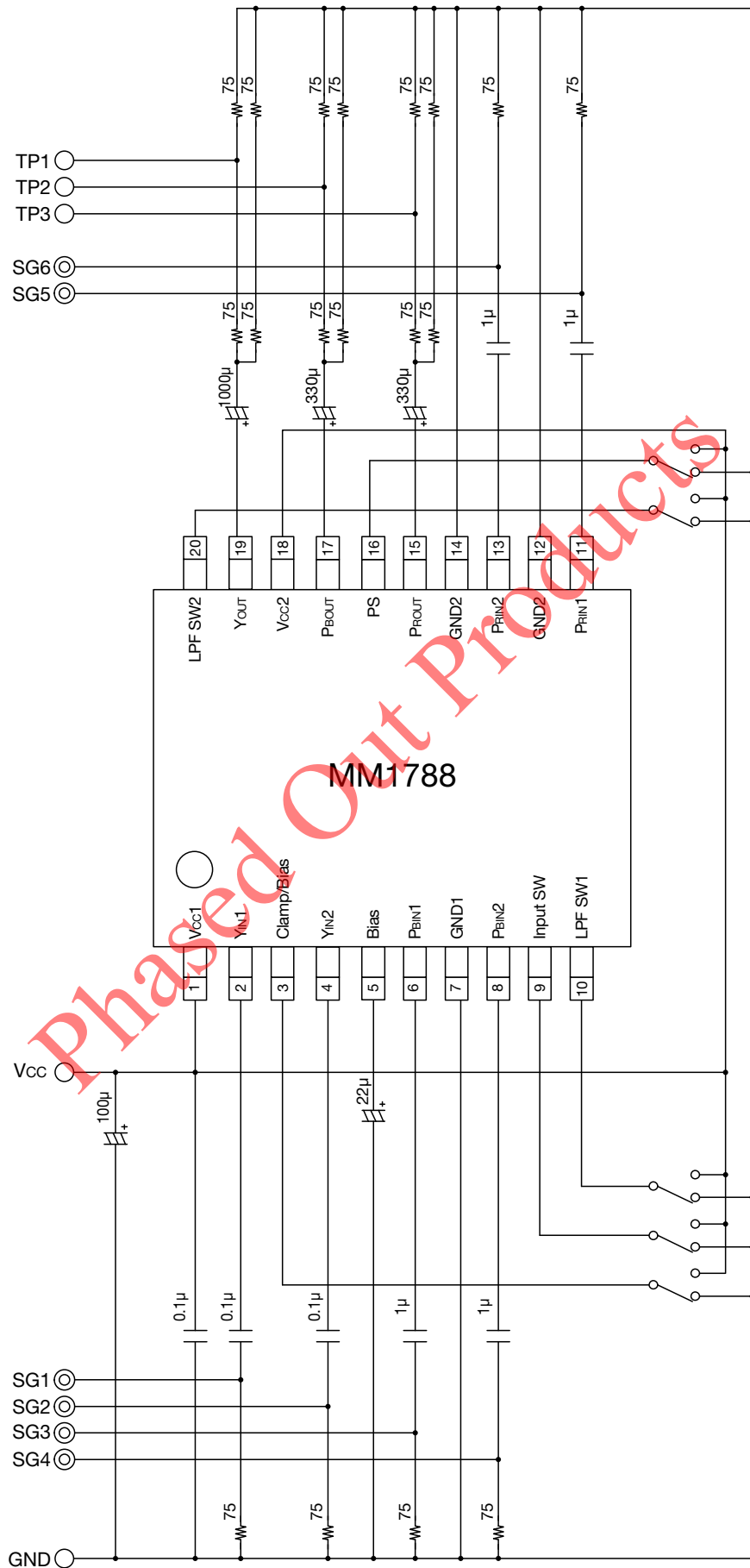
m	terminal
1	Clamp/Bias
2	Input SW
3	LPF SW1
4	LPF SW2
5	PS

Note3 : The subscript number "n" is the combination of under table.

n	input	output
1	Y <sub>IN1</sub>	Y <sub>OUT</sub>
2	Y <sub>IN2</sub>	
3	P <sub>BIN1</sub>	P <sub>BOUT</sub>
4	P <sub>BIN2</sub>	
5	P <sub>RIN1</sub>	P <sub>ROUT</sub>
6	P <sub>RIN2</sub>	

Phased Out Products

Measuring Circuit





**Switch Control Table**

■ Clamp/Bias select

Control terminal	Input terminal
Clamp/Bias	Y <sub>IN1</sub> (Y <sub>IN2</sub> )
Low	Clamp
High	Bias

■ Input pin select

Control terminal	Y, P <sub>B</sub> , P <sub>R</sub> select
Input SW	
0	Y <sub>IN1</sub> , P <sub>BIN1</sub> , P <sub>RIN1</sub>
1	Y <sub>IN2</sub> , P <sub>BIN2</sub> , P <sub>RIN2</sub>

■ LPF select

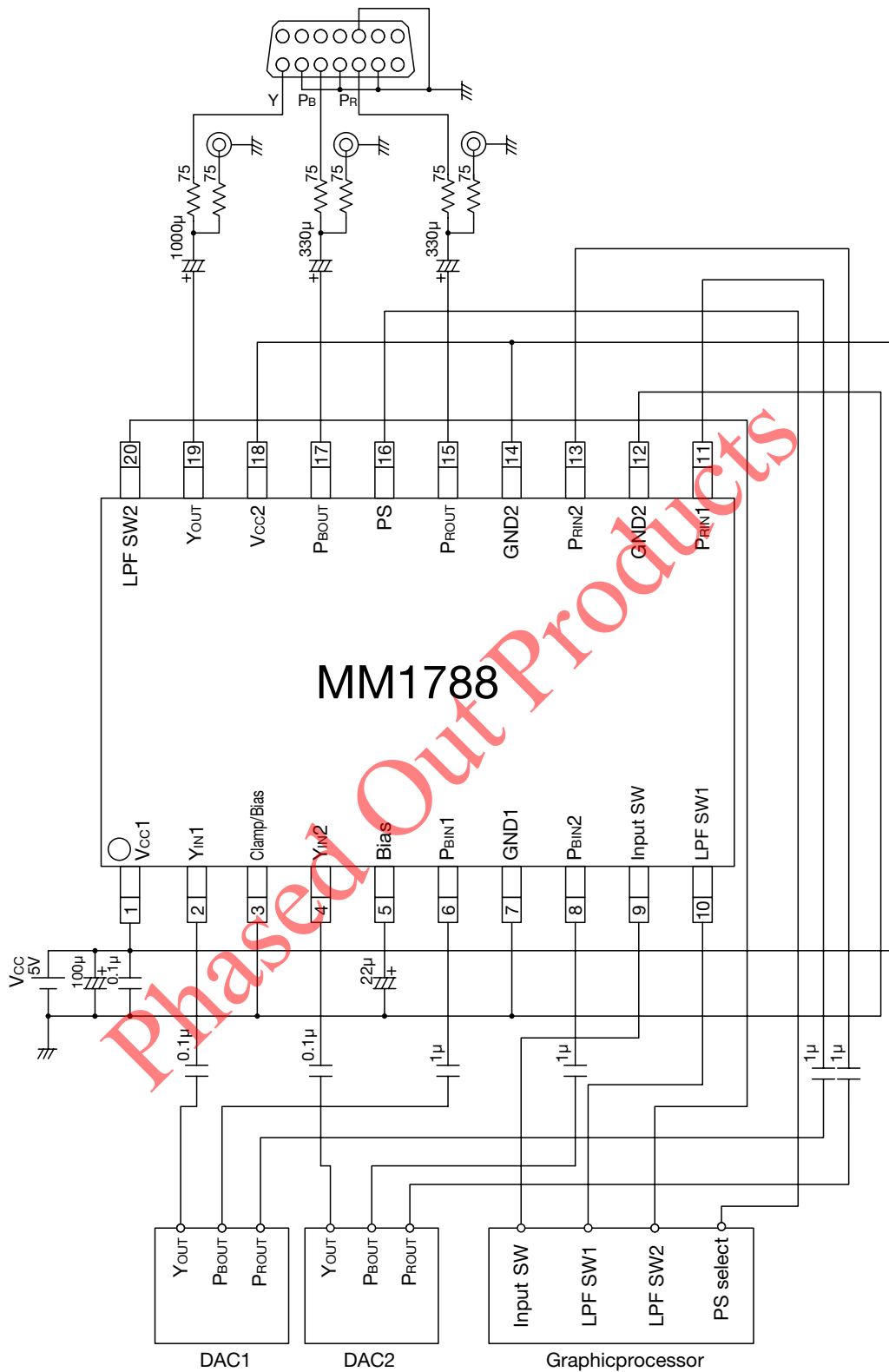
Control terminal	Y, P <sub>B</sub> , P <sub>R</sub> LPF Bandwidth
LPF SW2/1	
00	6.75MHz (Standard Definition)
01	13.5MHz (Progressive Scan)
10	30MHz (High Definition)
11	50MHz (No LPF)

■ Power Save select

Control terminal	Power Save
PS	
0	OFF
1	ON

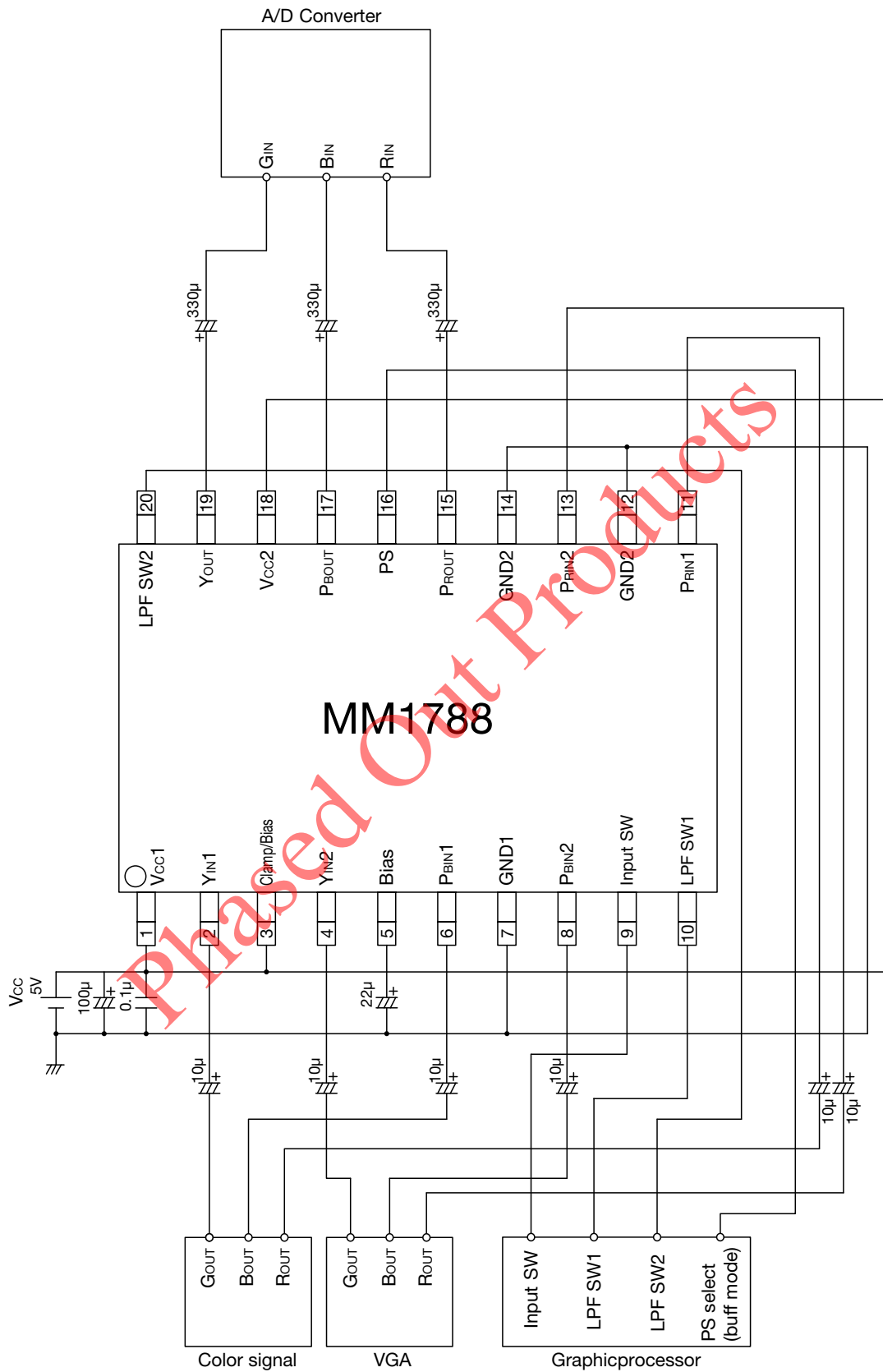
Phased Out Products

Application Circuit 1



Note : Please arrange power supply bypass capacitor near the Vcc terminal (pin).  
 Note : Please arrange the stray capacity component added to a signal output terminal to 20pF or less.

Application Circuit 2

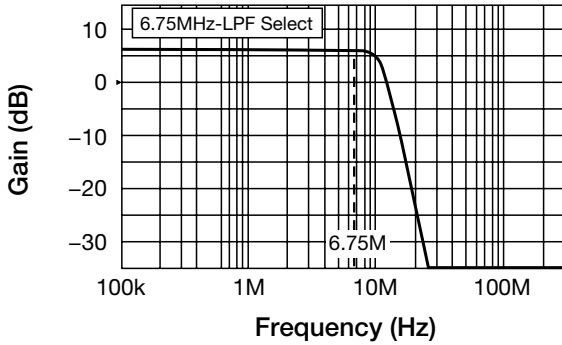


Note : Please arrange power supply bypass capacitor near the Vcc, GND terminal (pin).

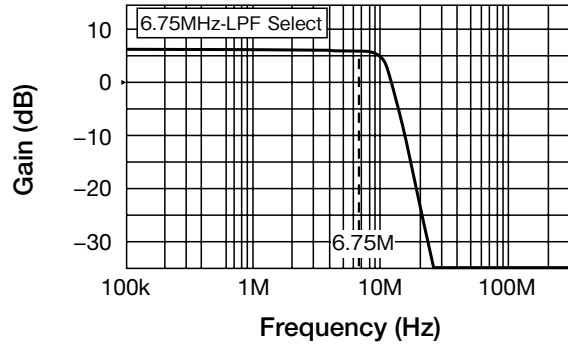
Note : Please arrange the stray capacity component added to a signal output terminal to 20pF or less.

### Characteristics 1

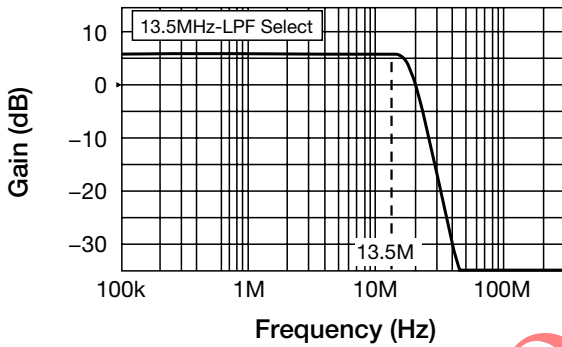
■ Frequency Characteristic 1 (Y<sub>OUT</sub>)



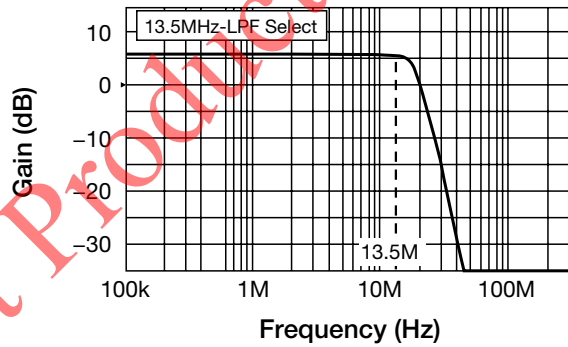
■ Frequency Characteristic 1 (P<sub>BOUT</sub>, P<sub>ROUT</sub>)



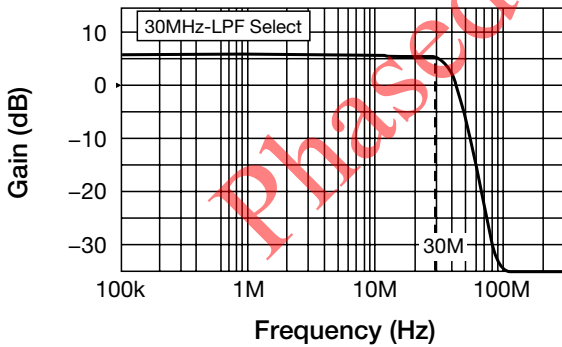
■ Frequency Characteristic 2 (Y<sub>OUT</sub>)



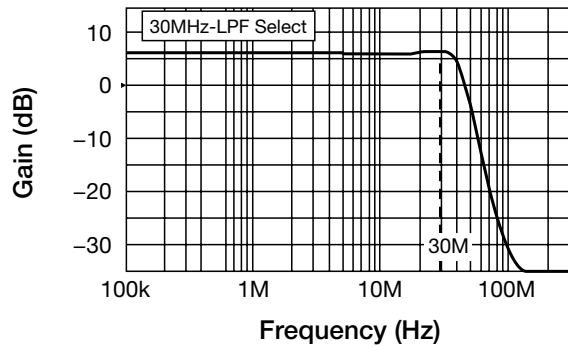
■ Frequency Characteristic 2 (P<sub>BOUT</sub>, P<sub>ROUT</sub>)



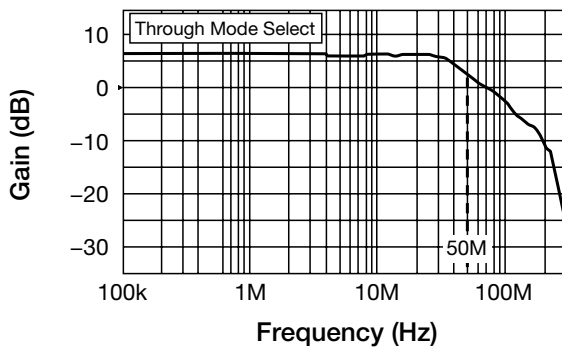
■ Frequency Characteristic 3 (Y<sub>OUT</sub>)



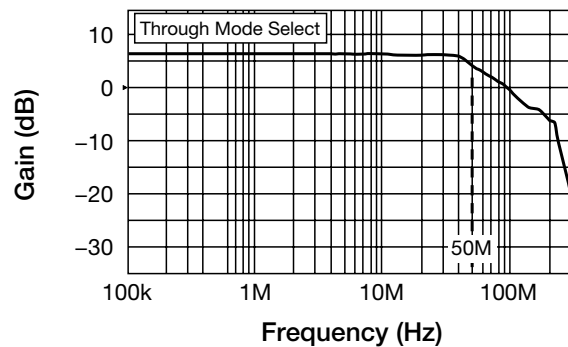
■ Frequency Characteristic 3 (P<sub>BOUT</sub>, P<sub>ROUT</sub>)



■ Frequency Characteristic 4 (Y<sub>OUT</sub>)

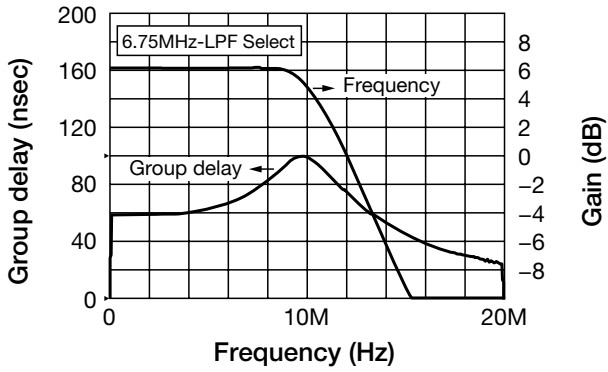


■ Frequency Characteristic 4 (P<sub>BOUT</sub>, P<sub>ROUT</sub>)

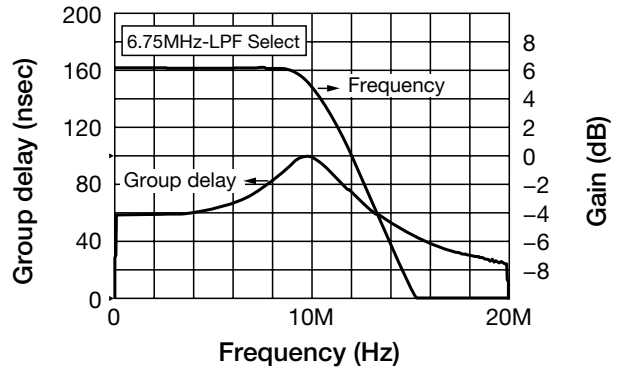


## Characteristics 2

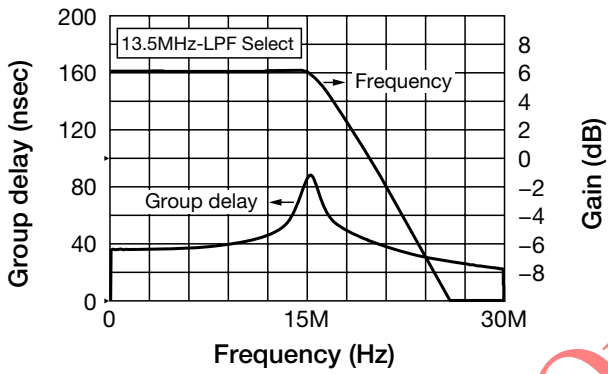
■ Group delay 1 (Y<sub>OUT</sub>)



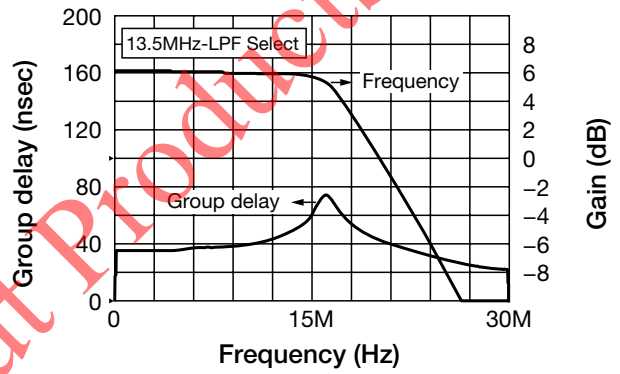
■ Group delay 1 (P<sub>BOUT</sub>, P<sub>ROUT</sub>)



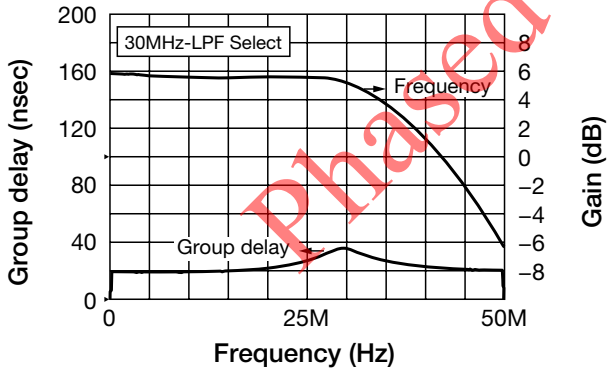
■ Group delay 2 (Y<sub>OUT</sub>)



■ Group delay 2 (P<sub>BOUT</sub>, P<sub>ROUT</sub>)



■ Group delay 3 (Y<sub>OUT</sub>)



■ Group delay 3 (P<sub>BOUT</sub>, P<sub>ROUT</sub>)

