NTSC→PAL Converter
Monolithic IC MM1130

Outline

This is an NTSC/PAL signal switching IC.
In PAL conversion mode, a frequency-converted (fc=4.43MHz) NTSC format chroma signal is phase converted (R-Y axis component is inverted) every 1 hour by shifting burst signal phase by 45°.
Circuit configuration includes VCO (horizontal sync), VCXO (phase conversion carrier), phase conversion circuit, switches, amps, etc.

Features

1. PAL conversion with phase conversion performed
2. Two possible phase conversion carriers : crystal oscillation and external input
3. No adjustments
4. Four possible mode selections by CTL and EXT pins

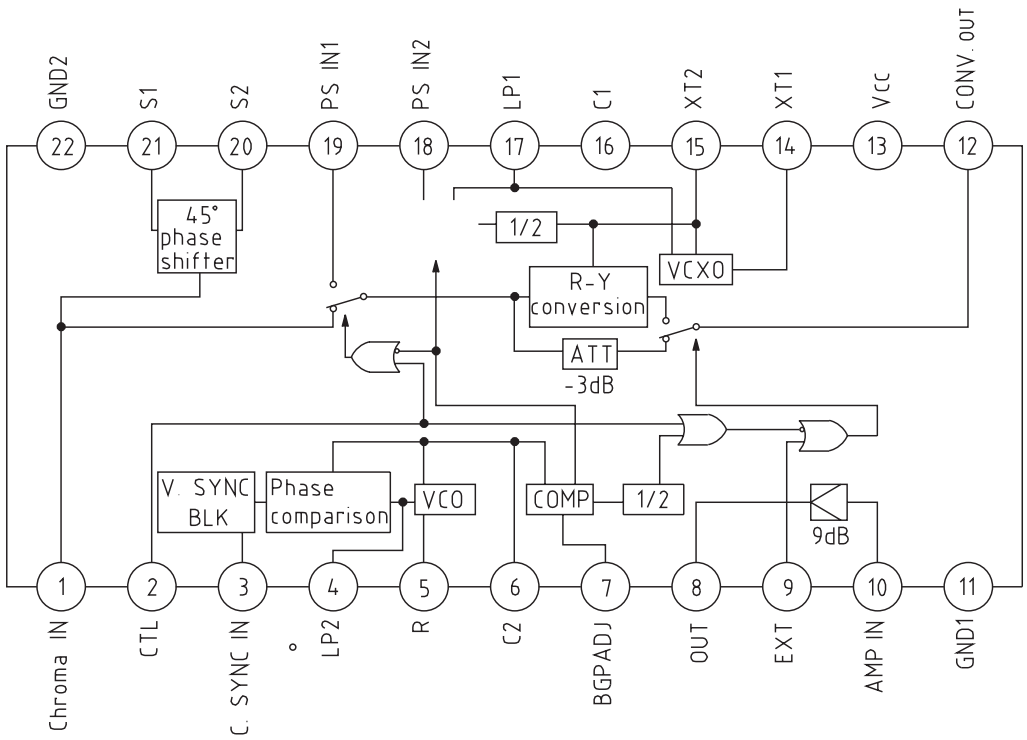
Package

SDIP-22A (MM1130XD)

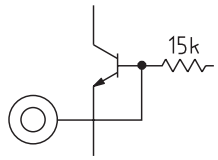
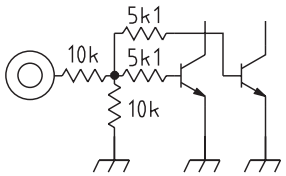
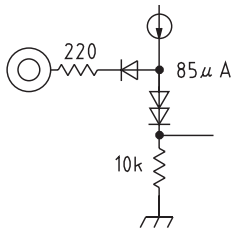
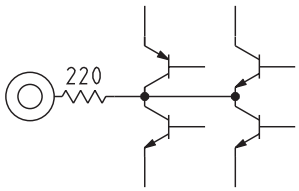
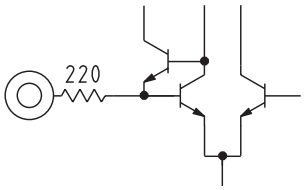
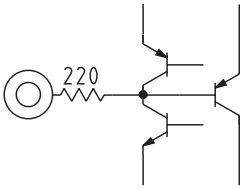
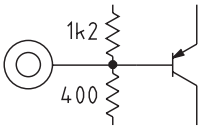
Applications

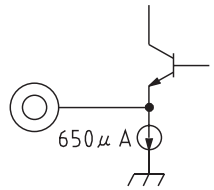
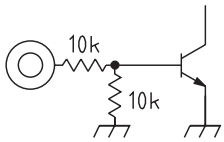
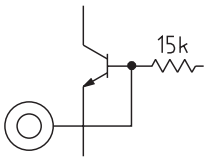
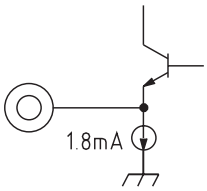
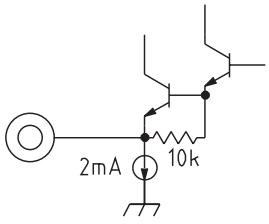
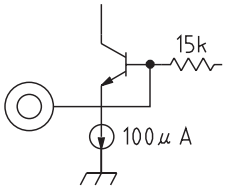
1. VCR

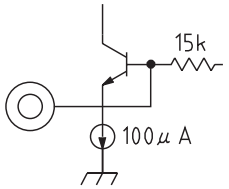
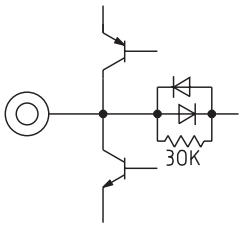
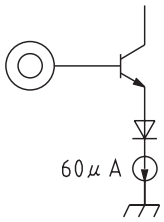
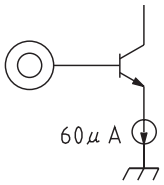
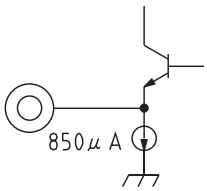
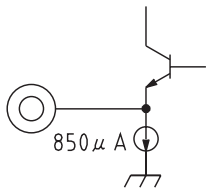
Block Diagram



Pin Description

Pin no.	Pin name	Function	Internal equivalent circuit diagram
1	chroma IN	Inputs chroma signal	
2	CTL	Mode setting pin	
3	C.SYNC IN	Inputs composite sync signal	
4	LP2	Time constant connection pin for H. SYNC APC loop LPF	
5	R	H. SYNC APC feedback pin	
6	C2	Pin for connecting H. SYNC APC free run frequency setting capacitor	
7	BGP ADJ	Fine tuning of position for sampling burst signal. Use open.	

Pin no.	Pin name	Function	Internal equivalent circuit diagram
8	OUT	Amp output pin	
9	EXT	Mode setting pin	
10	AMP IN	Amp input pin	
11	GND1	GND pin	
12	CONV.OUT	Multiplication circuit output pin	
13	Vcc	Vcc pin. Inputs 5V.	
14	XT1	Carrier (2fsc) oscillation circuit output pin	
15	XT2	Carrier (2fsc) input pin	

Pin no.	Pin name	Function	Internal equivalent circuit diagram
16	C1	Carrier APC phase shift pin	
17	LP1	Time constant connection pin for carrier APC loop LPF	
18	PS IN2	Carrier APC input pin. Pin 18 input signal burst signal and carrier signal are phase locked.a	
19	PS IN1	Burst signal phase input pin during PAL conversion.	
20	S2	Phase shift circuit output pin. Signal is Pin 21 output inverted.	
21	S1	Phase shift circuit output pin. Signal is Pin 20 output inverted.	
22	GND2	GND pin	

Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Ratings	Units
Storage temperature	T_{STG}	–40~+125	°C
Operating temperature	T_{OPR}	–20~+75	°C
Power supply voltage	V_{CC} max.	7	V
Allowable loss	Pd	600	mW

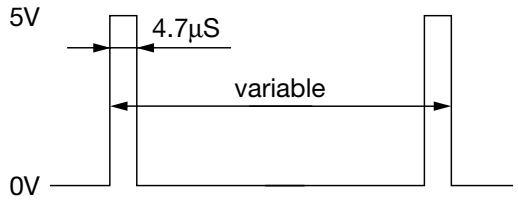
Electrical Characteristics (Except where noted otherwise, Ta=25°C, V_{CC}=5.0V, SW13 : b)

Item	Symbol	Measurement circuit	Measurement conditions	Min.	Typ.	Max.	Units
Operating power supply voltage	V_{CC}			4.7	5.0	5.3	V
Consumption current	I_{CC}	13	SW2, 9, 13 : a, no input		29.0	40.0	mA
Dynamic range	D			0.8			V_{P-P}
Slew mode (SW2 : b, SW9 : a, V_{IN}1=SG1, V_{IN}3=SG2)							
Gain	Gt	8	✶1	–1.0	0	1.0	dB
Phase difference	⊿θt	8	✶2	–5	0	5	deg
PAL conversion mode Hn (SW2 : a, SW9 : a, V_{IN}1=SG1, V_{IN}3=SG2) ✶3							
Burst gain	G1bt	8	✶1	–1.0	0	1.0	dB
Red gain	G1r	8	✶1	–1.0	0	1.0	dB
Green gain	G1g	8	✶1	–1.0	0	1.0	dB
Blue gain	G1b	8	✶1	–1.0	0	1.0	dB
Burst phase	θ1bt	8		130.0	135.0	140.0	deg
Red phase	θ1r	8		98.5	103.5	108.5	deg
Green phase	θ1g	8		235.6	240.6	245.6	deg
Blue phase	θ1b	8		342.6	347.6	352.6	deg
PAL conversion mode Hn+1 (SW2 : a, SW9 : a, V_{IN}1=SG1, V_{IN}3=SG2) ✶3							
Burst gain	G2bt	8	✶1	–1.0	0	1.0	dB
Red gain	G2r	8	✶1	–1.0	0	1.0	dB
Green gain	G2g	8	✶1	–1.0	0	1.0	dB
Blue gain	G2b	8	✶1	–1.0	0	1.0	dB
Burst phase	θ2bt	8		–145.0	–135.0	–125.0	deg
Red phase	θ2r	8		–113.5	–103.5	–93.5	deg
Green phase	θ2g	8		–250.6	–240.6	–230.6	deg
Blue phase	θ2b	8		–357.6	–347.6	–337.6	deg
(SW2 : a, SW9 : a, V_{IN}1=SG1, V_{IN}3=SG2)							
DC step	⊿V	8	✶4			40	mV
BGP timing	t1	8	✶5	3.5	4.3	5.1	µS
BGP width	t2	8	✶5	3.7	4.5	5.3	µS
Hn/Hn+1 switching timing	t3	8	✶5	–0.6	0.2	1.0	µS
VCO (SW2 : a, SW9 : a, V_{IN}1 : N0)							
Free-running frequency	fo1	6	V_{IN}3 : GND	14.2	15.7	17.2	kHz
Acquisition range	fc1	6	V_{IN}3 : SG3 ✶6	1.5			kHz
VCXO (SW2 : b, SW9 : b)							
Free-running frequency	fo2	14	V_{IN}1 : No, V_{IN}3 : 5.0V	8.86 6438	8.86 7238	8.86 8038	MHz
Acquisition range	fc2	14	V_{IN}1 : SG4, V_{IN}3 : SG2 ✶7	400			Hz
(SW2 : b, SW9 : b, V_{IN}1=SG5, V_{IN}3=SG3)							
Carrier leak	Vc1	12	✶8			–20	dB
Control pin input resistance (V_{IN}1=SG1, V_{IN}3=SG2)							
CTL pin switching voltage	Vt1	3	Lower pin 3 from 5V. Voltage when pin 8 switches.	0.7	1.4	2.1	V
EXT pin switching voltage	Vt2	9	Lower pin 9 from 5V. Voltage when pin 8 switches.	0.7	1.4	2.1	V

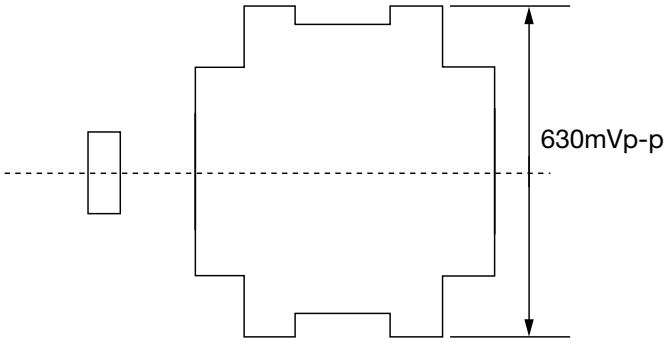
Input Signals

SG1	Color bar chroma signal f=4.433619MHz V=630mV$_{P-P}$
SG2	C. SYNC signal 0V–5V
SG3	15.74kHz pulse wave f : frequency variation 0V–5V
SG4	Color bar chroma signal f : frequency variation V=630mV$_{P-P}$
SG5	Continuous sine wave f : 4.433619MHz V=630mV$_{P-P}$

SG3



SG4



Carrier frequency variable

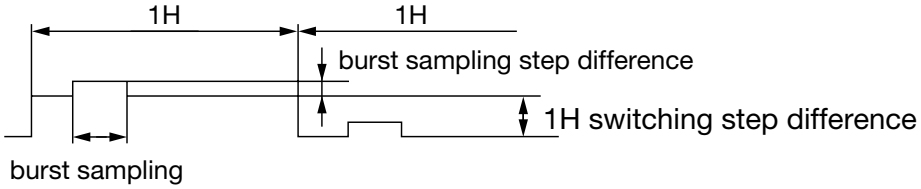
Notes:

*1 Gain is calculated by 20log (Pin 8 level/Pin 1 level).

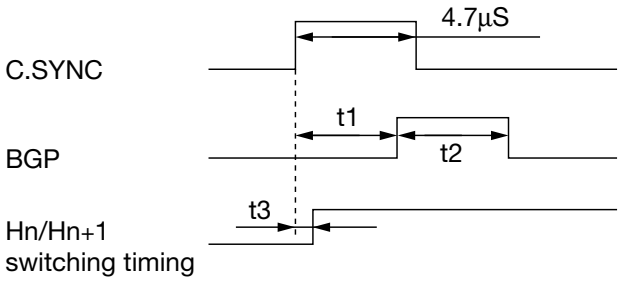
*2 Phase difference is difference between input and output phases (given B-Y axis as 0°.)

*3 Hn output is 1 horizontal output after input signal burst is shifted +45°. Hn^{+1} output is 1 horizontal output after input signal burst is shifted +45°, and that signal is R-Y converted.

*4 DC step difference is the total of burst sampling step different during PAL conversion and 1H switching step difference.



*5 BGP, Hn/Hn + 1 Switching Timing



*6 This is the smaller of frequency f and horizontal sync signal frequency (fH=15.73khz) difference when the frequencies are separated sufficiently high and low, then brought closer, and the waveform locks.

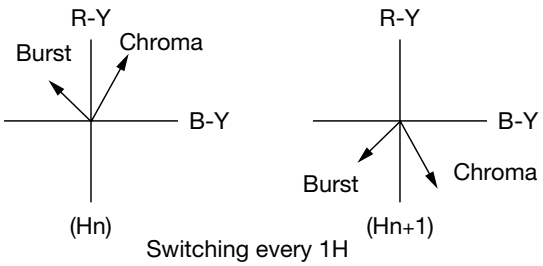
*7 This is the smaller of frequency f and carrier frequency (fC=4.433619MHz) difference when the frequencies are separated sufficiently high and low, then brought closer, and the waveform locks.

*8 Carrier leak is the 8.86MHz component level at Pin 12.
Vc1=20log (8.86MHz component/4.43MHz component) dB

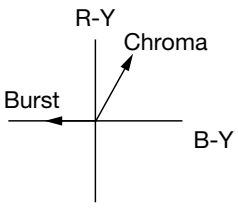
Mode Settings

CTL	EXT	
L	L	PAL conversion mode
H	L	Through mode
H	H	R-Y conversion mode
L	H	Hn + 1 (PAL) output mode

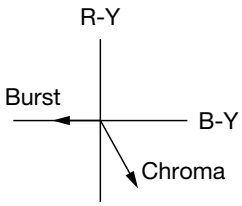
PAL conversion mode



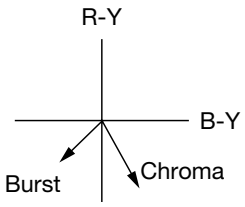
Through mode



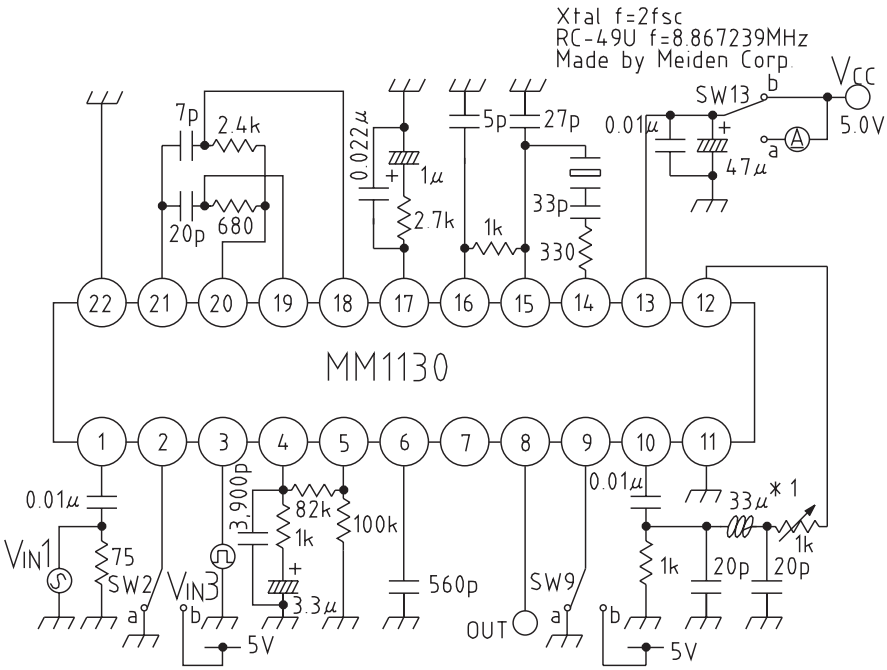
R-Y conversion output mode



Hn + 1 (PAL) output mode



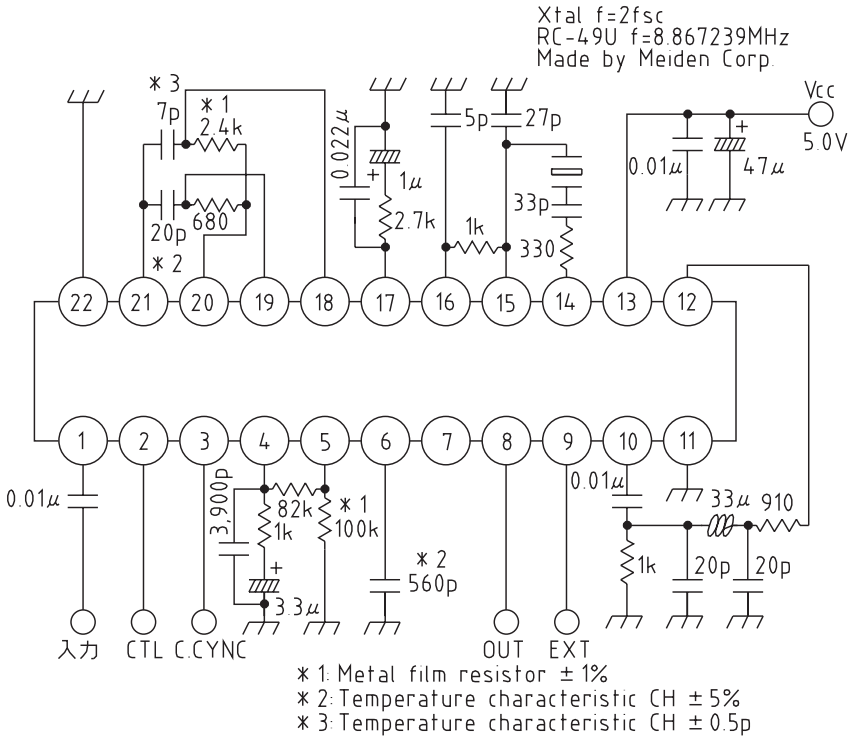
Measuring Circuit



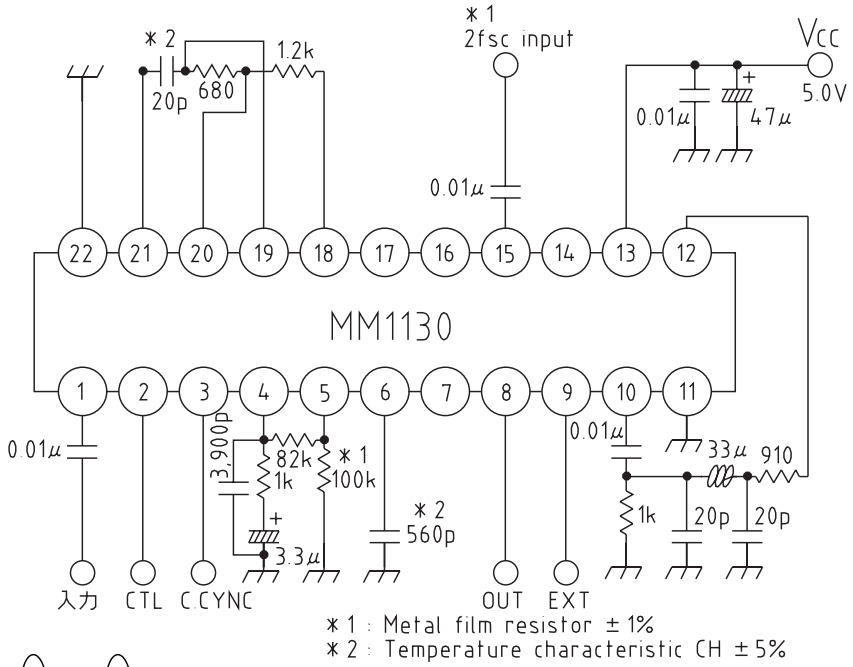
Note: *1 Adjust filter level characteristics so that f=4.43MHz, level=-5.5dB with 1kΩ semifixed resistor.

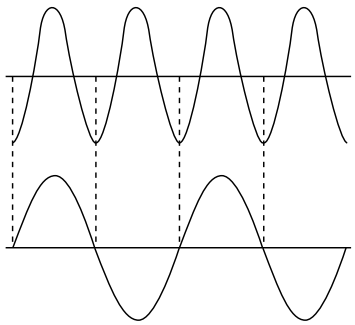
Application Circuits

1. For crystal oscillation of 2fsc



2. For external input of 2fsc





*1 Regarding 2fsc input
Input 2fsc with input level of more than 500mV$_{P-P}$ and phase as shown in the figure at left.