RGB Video Amplifier with OSD Input

Monolithic IC MM1381, 1382, 1383

Outline

MM1381XD, MM1382XD and MM1383XD are wideband RGB video amplifiers with OSD input, developed for use in monitors. The main differences between them are video amp bandwidth and output rise time, and output fall time.

Model	MM1381	MM1382	MM1383
Video amp band	85MHz	110MHz	140MHz
Output rise time	3.5nS	3.0nS	2.3nS
Output fall time	4.5nS	4.0nS	3.3nS

MM1382XD is described here as the representative model.
MM1382 is a wideband video amp system with OSD input, developed for use in high resolution RGB monitors. MM1382 has three matched video amps with a blanking function. All DC control input is high impedance, and the operating range is set for easy interface with serial bus control systems, at 0~4V. The OSD section has three TTL inputs and DC contrast control. OSD signals have TTL input interface, and these signals are made internally so that OSD input low level and video black level are the same. OSD display color balance follows video signal color balance control adjustment. In addition, MM1382 has a built-in spot-killer circuit that protects the CRT when monitor power is turned off.

Features

1. Built-in wideband video amp 110MHz @ – 3dB (4V_{P-P} output)
2. OSD input has TTL interface bandwidth 50MHz
3. Output voltage less than 0.1V for blanking
4. High-speed switching between VIDEO/OSD
5. Each channel has an independent drive pin for color balance adjustment
6. Built-in high impedance DC contrast control, 0~4V (> 40dB range)
7. Built-in high impedance DC drive control, 0~4V (±3dB range)
8. Built-in high impedance DC OSD contrast control, 0~4V (> 40dB range)
9. 7V_{P-P} output swing (band slightly attenuated)
10Output can drive hybrid or discrete CRT drivers directly

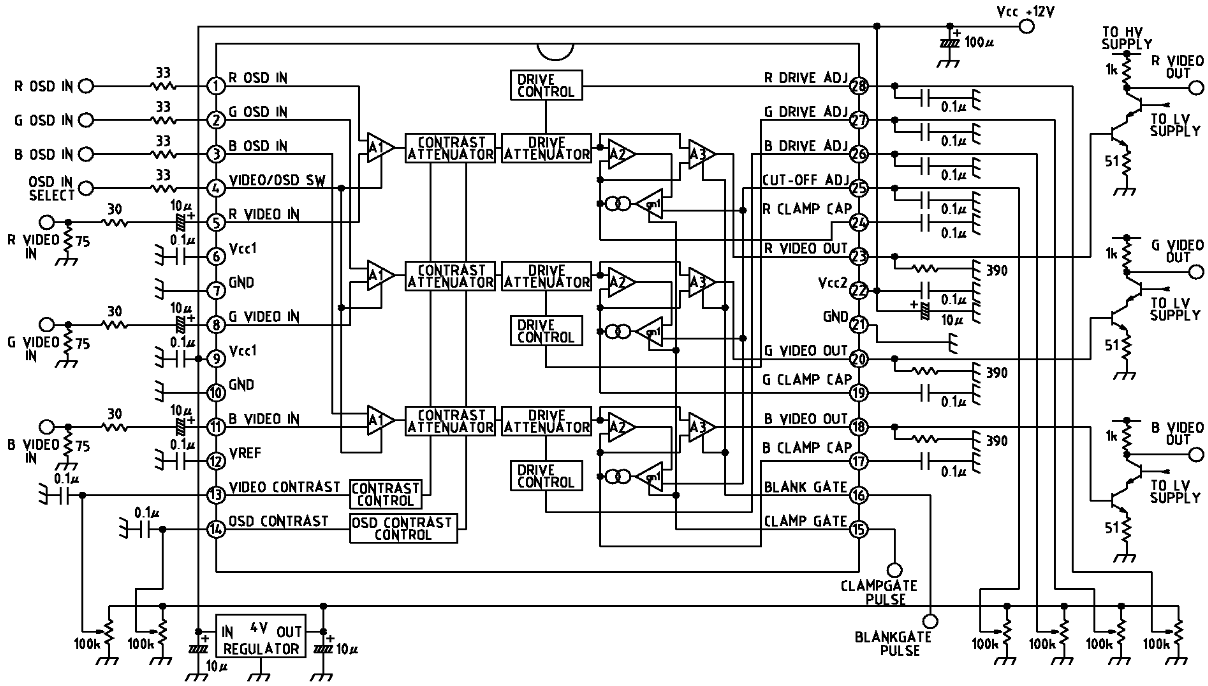
Package

DIP-28C (MM1381XD, MM1382XD, MM1383XD)

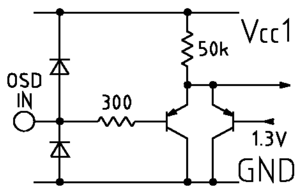
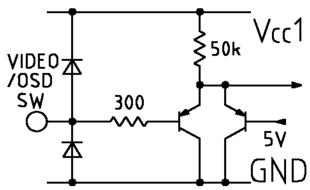
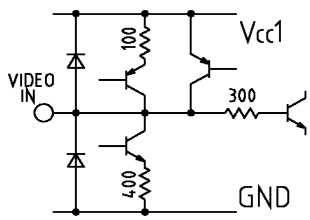
Applications

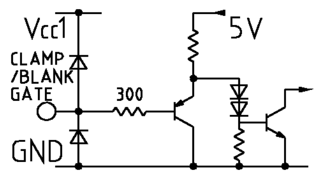
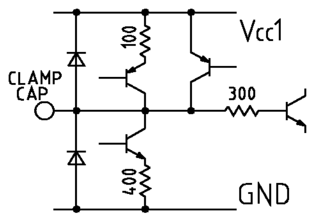
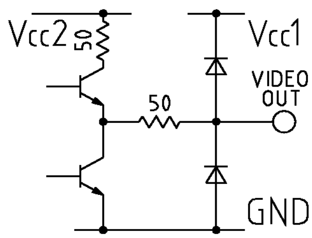
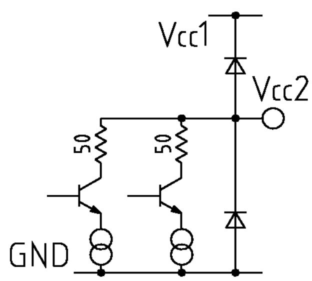
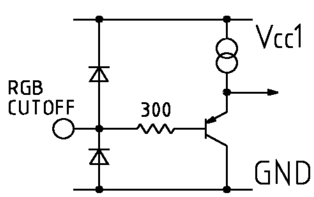
1. High resolution RGB CRT monitors with OSD function
2. AGC amps for video
3. Gain and DC offset control
4. LCD or CCD system interface amp

Block Diagram



Pin Description

Pin no.	Pin name	Internal equivalent circuit diagram	Pin Description
1 2 3	R OSD IN G OSD IN B OSD IN		These inputs accept standard TTL input. Each color is either completely ON (logic high) or completely OFF (logic low). Connect unused pins to ground with a 47kΩ resistor.
4	VIDEO/OSD SWITCH		This input accepts standard TTL input. H : OSD, L : VIDEO Connect OSD to ground with a 47kΩ resistor when not in use.
5 8 11	R VIDEO IN G VIDEO IN B VIDEO IN		Video inputs. These inputs must be AC coupled using a capacitor of at least 1μF. The ideal capacitance is 10 (F. DC playback is done with these inputs. Also, serial resistor of approximately 33Ω must be used.
6 9	Vcc1		Power supply pin (except for output stage).
7 10 21	GND		GND pins. The GND pins are all connected internally, and must be connected on the board as well.
12	VREF		Used for internal reference additional filter capacitor. Voltage of this pin is 2.0V.
13 14 26 27 28	VIDEO CONTRAST OSD CONTRAST B DRIVE G DRIVE R DRIVE		Contrast control pin : 4V no attenuation 0V attenuation over 60dB Drive control pin : 4V no attenuation 0V 12dB attenuation

Pin no.	Pin name	Internal equivalent circuit diagram	Pin Description
15 16	CLAMP GATE BLANK GATE		These two pins accept TTL input and are active low. Clamp gate supplies video signal DC playback. Blank gate makes video output less than 200mV.
17 19 24	B CLAMP CAP G CLAMP CAP R CLAMP CAP		External clamp capacitors are charged, then discharged to the correction voltage required for DC playback. Recommended value is 0.1µF.
18 20 23	B VIDEO OUT G VIDEO OUT R VIDEO OUT		Video output. Output must have 390Ω impedance to obtain the correct black level.
22	Vcc2		Output stage power supply pin. Internal connection to Vcc1 does not exist.
25	RGB CUT OFF ADJUST		Sets video output black level for all three channels. Range : 0~4V Minimum value for black level is limited to approximately 300mV.

Absolute Maximum Ratings *1

Item	Symbol	Ratings	Units
Storage temperature	T_{STG}	–55~+150	°C
Power supply voltage	V_{CC} max.	15.0	V
Input voltage range	V_{IN} max.	GND ≦ V_{IN} ≦ V_{CC}	V
Video output current	I_O	28	mA
Allowable loss	Pd	2.5	W
Electrostatic breakdown		2	kV
Pin temperature		265 *16	°C

Recommended Operating Conditions *2

Item	Symbol	Ratings	Units
Operating temperature	T_{OPR}	–20~+70	°C
Operating voltage	V_{OPR}	11.4~12.6	V

DC Electrical Characteristics

(Except where noted otherwise, Ta=25°C, $V_{CC}1=V_{CC}2=12V$, V13=4V, V14=4V, V_{DRV}=4V, V_{CG}= 0V, V_{BG}=4V, V4=0V, V_{C-O}=1V) *3

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Consumption current *7	V_{CC}	$V_{CC}1+V_{CC}2$, $R_L=\infty$		95	120	mA
Video input resistance	R_{IN}			100		Ω
Clamp gate input voltage L	V_{CGL}		0.8	1.2		V
Clamp gate input voltage H	V_{CGH}			1.6	2.0	V
Clamp gate input current L	I_{CGL}	V_{CG}=0V		–1.5	–5.0	uA
Clamp gate input current H	I_{CGH}	V_{CG}=12V		0.01	1.0	uA
Blanking gate input voltage L	V_{BGL}		0.8	1.2		V
Blanking gate input voltage H	V_{BGH}			1.6	2.0	V
Blanking gate input current L	I_{BGL}	V_{BG}=0V		–8	–11	uA
Blanking gate input current H	I_{BGH}	V_{BG}=12V		0.01	1.0	uA
Reference voltage	V_{REF}			2.0		V
Input capacitor charging current	I_{ICL+}	V_{CG}=0V	450	750		uA
Input capacitor discharge current	I_{ICL-}	V_{CG}=0V	–450	750		uA
Input capacitor bias discharge current	I_{ICLB}	V_{CG}=4V		±750		nA
Clamp cap charging current	I_{OCL+}	V_{CG}=0V	450	750		uA
Clamp cap discharge current	I_{OCL-}	V_{CG}=0V	–450	–750		uA
Clamp cap bias discharge current	I_{OCLB}	V_{CG}=4V		750		nA
Output voltage L	V_{OL}	V_{C-O}=0V		50	100	mV
Output voltage H	V_{OH}	V_{C-O}=10V	7.0	7.5		V
Black level output voltage	V_O	V_{C-O}=1V *7		1.2		V
⊿Black level output voltage	⊿V_O	V_{C-O}=1V		±20	±250	mV
Output blanking voltage	V_{OBLK}	V_{BG}=0V		100	500	mV
Contrast/drive input current	I13, 14 I26~28	V13=V14=V_{DRV}=0V~4V		–125	–500	nA
Cutoff input current	I_{C-O}	$V_{□-O}$=0V~4V		–1.0	–1.5	uA
Spot killer voltage	V_{SPOT}			10.6	11.2	V

AC Electrical Characteristics *14

(Except where noted otherwise, Ta=25°C, $V_{CC}1=V_{CC}2=12V$, V13=4V, V14=4V, $V_{DRV}=4V$, $V_{CG}=0V$, $V_{BG}=4V$, V4=0V. For AC tests, adjust output pins 16, 20 and 23 to 4V by hand.)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Video amp gain	Av max.	V13=4V, V_{DRV}=4V	7.5	10.0		V/V
		V_{IN}=400mV_{P-P}	16.9	20.0		dB
Contrast attenuation 1	⊿Av1	V13=2V		–6		dB
Contrast attenuation 2	⊿Av2	V13=0.25V		–40		dB
Drive attenuation 1	⊿$A_{VD}1$	V_{DRV}=2V		–4.5		dB
Drive attenuation 2	⊿$A_{VD}2$	V_{DRV}=0.25V		–11		dB
Gain matching	A_{VMAT}	V13=V_{DRV}=4V *8		±0.3		dB
Gain change between amps	⊿A_{VMAT}	V13=4V~2V *9		±0.2		dB
Video amp distortion	THD	V_O=1V_{P-P}, f=10kHz		1		%
Video amp frequency bandwidth	f_{BW}	V13=4V, V_{DRV}=3V V_O=4V_{P-P} *10, 11		110		MHz
Video output rise time	tr	V_O=4V_{P-P} *10		3.0		nS
Video output fall time	tf	V_O=4V_{P-P} *10		4.0		nS
Video amp isolation 1	$V_{SEP}1$	V13=4V *12		–70		dB
Video amp isolation 2	$V_{SEP}2$	V13=4V *10, 12		–50		dB
Blanking output rise time	tr_{-BLK}	V_O=1V_{P-P} *10		8		nS
Blanking output fall time	tf_{-BLK}	V_O=1V_{P-P} *10		14		nS
End of blanking transfer delay	trD_{-BLK}	V_O=1V_{P-P}		23		nS
Start of blanking transfer delay	tfD_{-BLK}	V_O=1V_{P-P}		20		nS
Back-porch clamping pulse width	tpw	*13	200			nS

OSD Electrical Characteristics

(Except where noted otherwise, Ta = 25°C, $V_{CC}1=V_{CC}2=12V$, V13=4V, V14=4V, $V_{DRV}=4V$, $V_{CG}=4V$, $V_{BG}=4V$, V4=4V, $V_{C-O}=1V$)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Input voltage OSD L	V_{OSDL}		0.4	1.2		V
Input voltage OSD H	V_{OSDH}			1.6	2.0	V
OSD selection input voltage L	$V4_L$		0.8	1.2		V
OSD selection input voltage H	$V4_H$			1.6	2.0	V
OSD selection input current L	$I4_L$	V4=0V		–3.0	–5.0	uA
OSD selection input current H	$I4_H$	V4=12V		0.01	2.0	uA
OSD ⊿ black level output voltage	⊿$V_{OUT-OSD}$	V_{C-O}=1V		±85	±175	mV
OSD output voltage V_{P-P}	V_{OSD-O}	V14=4V, V_{DRV}=2V		4.5		V_{P-P}
OSD output V_{P-P} attenuation	⊿V_{OSD-O}	V14=2V, V_{DRV}=2V		50	30	%
Output adjustment between channels	$V_{OSD-OMAT}$	V14=4V, V_{DRV}=2V		±2.0		%
Output fluctuation between channels	⊿$V_{OSD-OMAT}$	V14=4V~2V, V_{DRV}=2V		±3.5		%
Video to OSD switching time	tr_{-OSDSW}	V1=V2=V3=4V *15		4		nS
OSD-to-video switching time	tr_{-OSDSW}	V1=V2=V3=4V *15		11		nS
Video to OSD transfer delay	trD_{-OSDSW}	V1=V2=V3=V13=V14=4V		11		nS
OSD-to-video transport delay	tfD_{-OSDSW}	V1=V2=V3=V13=V14=4V		12		nS
OSD rise time	tr_{-OSD}	V14=4V		4		nS
OSD fall time	tf_{-OSD}	V14=4V		10		nS
OSD transfer delay start	trD_{-OSD}	V14=4V		6.5		nS
OSD transfer delay end	tfD_{-OSD}	V14=4V		9		nS
Video field slew rate to OSD1	$V_{feed}1$	V14=4V, V1=V2=V3=0V		–70		dB
Video field slew rate to OSD2	$V_{feed}2$	V14=4V, V1=V2=V3=0V		–60		dB

Notes :

*1 Absolute maximum ratings are the limits over which the device may be damaged.

*2 Operating ratings are the conditions for device functioning, but they do not guarantee s specific performance limit. Refer to the electrical characteristics section for guaranteed specifications and measuring conditions. Guaranteed specifications apply only to the listed conditions. If the device does not operate within the listed measuring conditions, there may be deterioration depending on the performance characteristics.

*3 V_{CC} supply pins 6, 9 and 22 must be connected as one externally in order to prevent internal damage during the V_{CC} power supply on/switching cycle.

*4 Human model. Discharge via 1.5kΩ from 100pF capacitor.

*5 The typical specified value is +25°C, indicating the standard value of the most general parameter.

*6 The specified supply current is $V_{CC}1$ and $V_{CC}2$ 0 input current for RL=[symbol]. Please refer to the measuring circuit. $V_{CC}2$ supply current also depends on output load. $V_{CC}2$ load current is 8mA in the measuring circuit for video output of 1V DC.

*7 Output voltage depends on the load resistor. The measuring circuit uses RL=390Ω.

*8 Measure the gain difference between two amps. Vin=400mV_{P-P}.

*9 Measure Av max. attenuation, and measure the quantitative difference between any two amps.

*10 Special test device on GND sealed PCB not requiring a socket.

*11 Adjust input frequency from 10MHz (A_V max. reference value) to −3dB corner frequency.

*12 Measure the output level of two non-operational amps relative to the operating amp to check channel separation.

*13 200nS minimum pulse width is guaranteed to 15kHz horizontal line. This limit is guaranteed at the design stage. When using a slower line speed, a clamp pulse with longer pulse width is required.

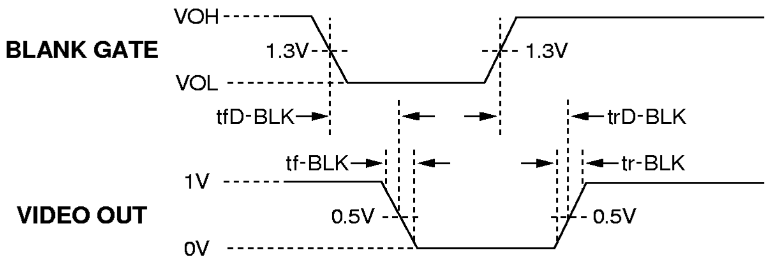
*14 4V DC level is the AC output signal center voltage for AC testing. For example, when output is 4V_{P-P}, the signal fluctuates between 2V DC and 6V DC.

*15 trosd=11nS and tfosd=4ns for V1=V2=V4−0V and video input of 0.7V. The video output waveform is the waveform shown in the timing diagram, inverted. Therefore, Trosd is actually rise time, and Tfosd is actually fall time in this situation.

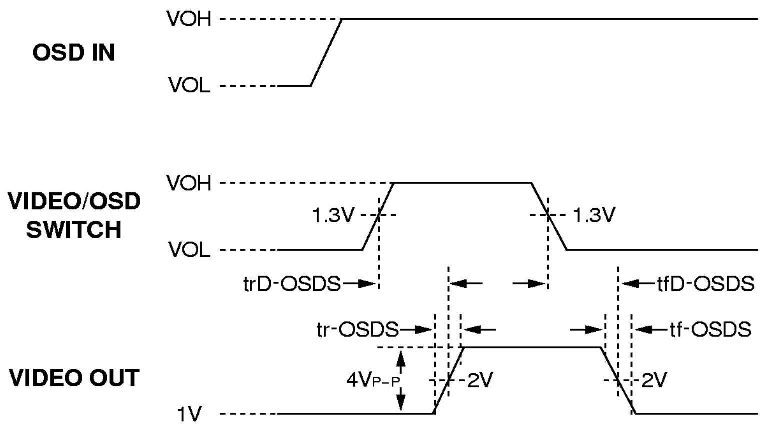
*16 Solder for 10S.

Timing Diagram

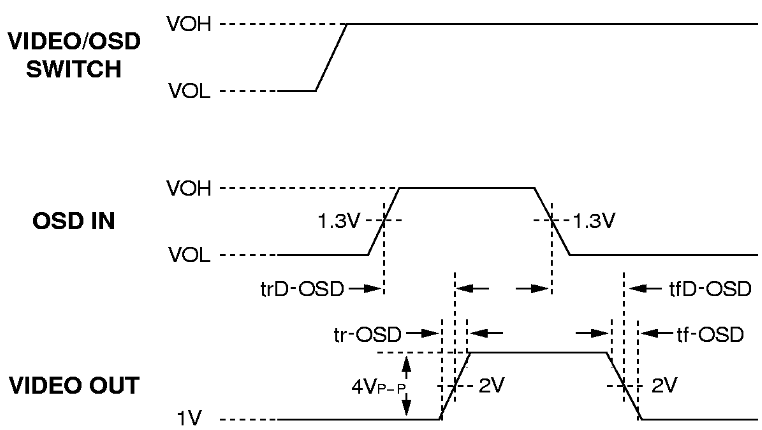
Blanking transmission delay and Rise/fall time



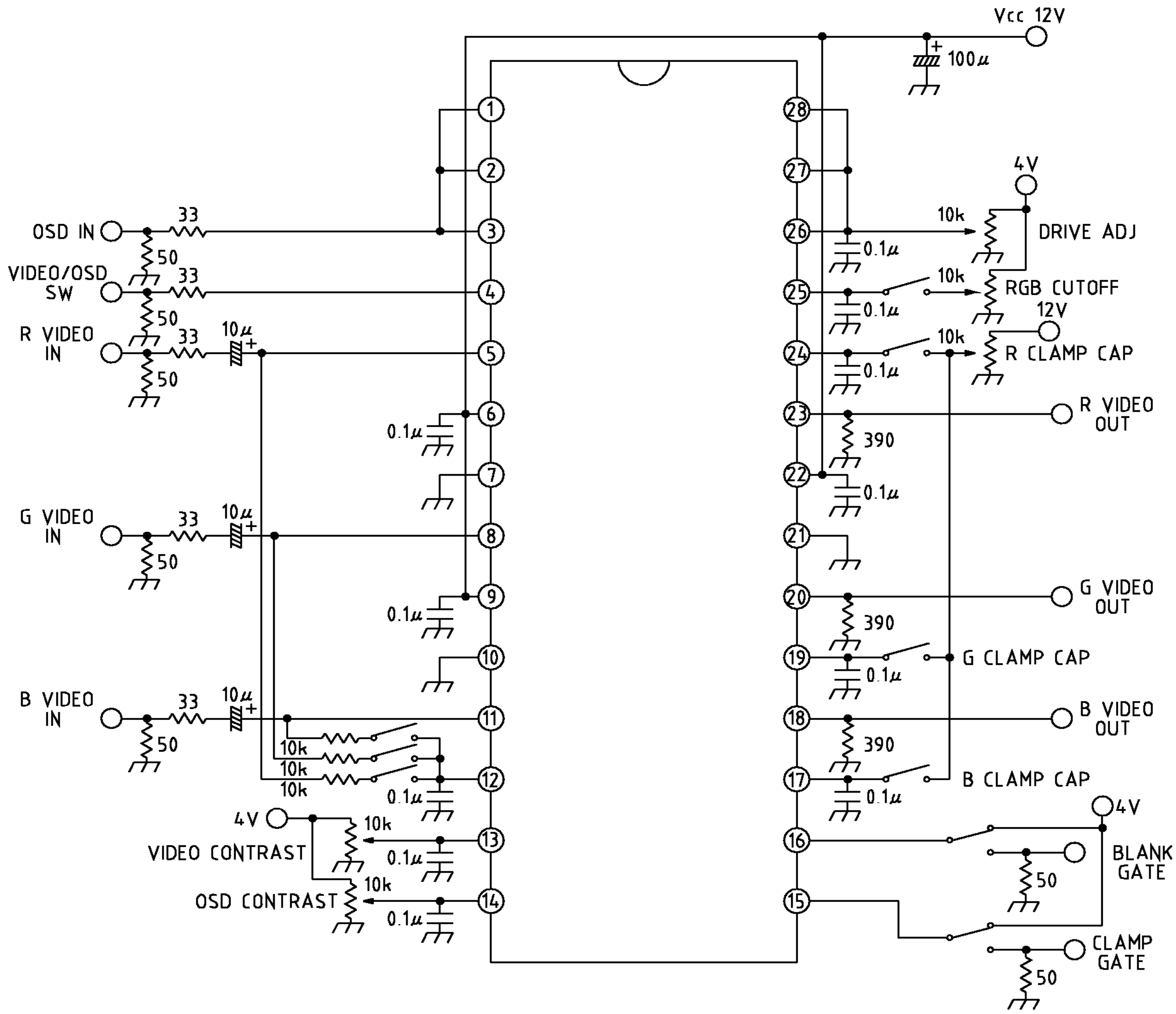
Video→OSD, OSD→Video transmission delay and Switching time



OSD transmission delay and Rise/fall time



Measuring Circuit



Application Circuits