MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

Advance Information

100MHz Video Processor with OSD Interface

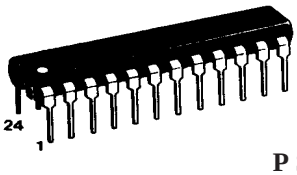
The MC13282E is a three channels wideband amplifiers designed for use as a video pre-amplifier in high resolution RGB color monitor with OSD feature. MC13281FX is a drop in replacement of MC13282E using for models without OSD feature.

Features :
- 4Vp-p Output with 100MHz Bandwidth
- 3.5nS Rise/Fall Time
- Subcontrast Control
- Contrast Control
- 50MHz OSD Interface (MC13282E only)
- OSD Contrast Control (MC13282E only)
- Package: NDIP 24

MC13282E
MC13281FX

100MHz Video Processor with OSD Interface

Silicon Monolithic Integrated Circuit



P SUFFIX
PLASTIC PACKAGE
CASE 724

DEVICE	TEMPERATURE RANGE	PACKAGE
MC13282EP	0 TO +70 °C	Plastic DIP
MC13281FXP	0 TO +70 °C	Plastic DIP

PIN ASSIGNMENT (TOP VIEW)

MC13282E

R Sub_contrast	1	24	Blank
R Input	2	23	Clamp
G Sub_contrast	3	22	R Output
G Input	4	21	R Clamp Cap
B Sub_contrast	5	20	V5
B Input	6	19	G Output
Ground	7	18	G Clamp Cap
ROSD	8	17	Video Vcc
Vcc	9	16	B Clamp Cap
GOSD	10	15	B Output
OSD Contrast	11	14	Fast Commutate
BOSD	12	13	Contrast

MC13281FX

R Sub_contrast	1	24	Blank
R Input	2	23	Clamp
G Sub_contrast	3	22	R Output
G Input	4	21	R Clamp Cap
B Sub_contrast	5	20	V5
B Input	6	19	G Output
Ground	7	18	G Clamp Cap
NC	8	17	Video Vcc
Vcc	9	16	B Clamp Cap
NC	10	15	B Output
NC	11	14	NC
NC	12	13	Contrast

This document contains information on a product under development. Motorola reserves the right to change or discontinue this product without notice.

ABSOLUTE MAXIMUM RATING

Table 1

Parameter	Pin	Value	Unit
Power Supply Voltage	9	-0.5,10	Vdc
	17	-0.5,10	Vdc
Voltage at Video Amplifier Inputs	2,4,6,8,10,12	-0.5,+5.0	Vdc
Voltage at Video Amplifier Output Collectors	17	-0.5,10	Vdc
Collector-Emitter Current (Three Channels)	17	120	mA
Storage Temperature		-65 to +150	˚C
Junction Temperature		150	˚C
Operating Temperature		0 to +70	˚C

Device should not be operated at these limits. Refer to "Recommended Operating Conditions" section for actual device operation.

RECOMMENDED OPERATING CONDITIONS

Table 2

Parameter	Pin	Min	Typ	Max	Unit
Power Supply Voltage	9,17	7.6	8	8.4	Vdc
Power Supply Current	9,17		70		mA
Contrast Control	13	0		5	Vdc
Sub-Contrast Control	1,3,5	0		5	Vdc
Blanking Input Threshold	24		1.25		V
Clamping Input Threshold	23		3.75		V
Video Signal Amplitude	2,4,6		0.7		Vpp
OSD Signal Input Low Voltage	8,10,12			2.7	V
OSD Signal Input High Voltage	8,10,12	3.3			V
Collector-Emitter Current (Three Channels)	17	0		50	mA
Operating Ambient Temperature		0	25	70	˚C

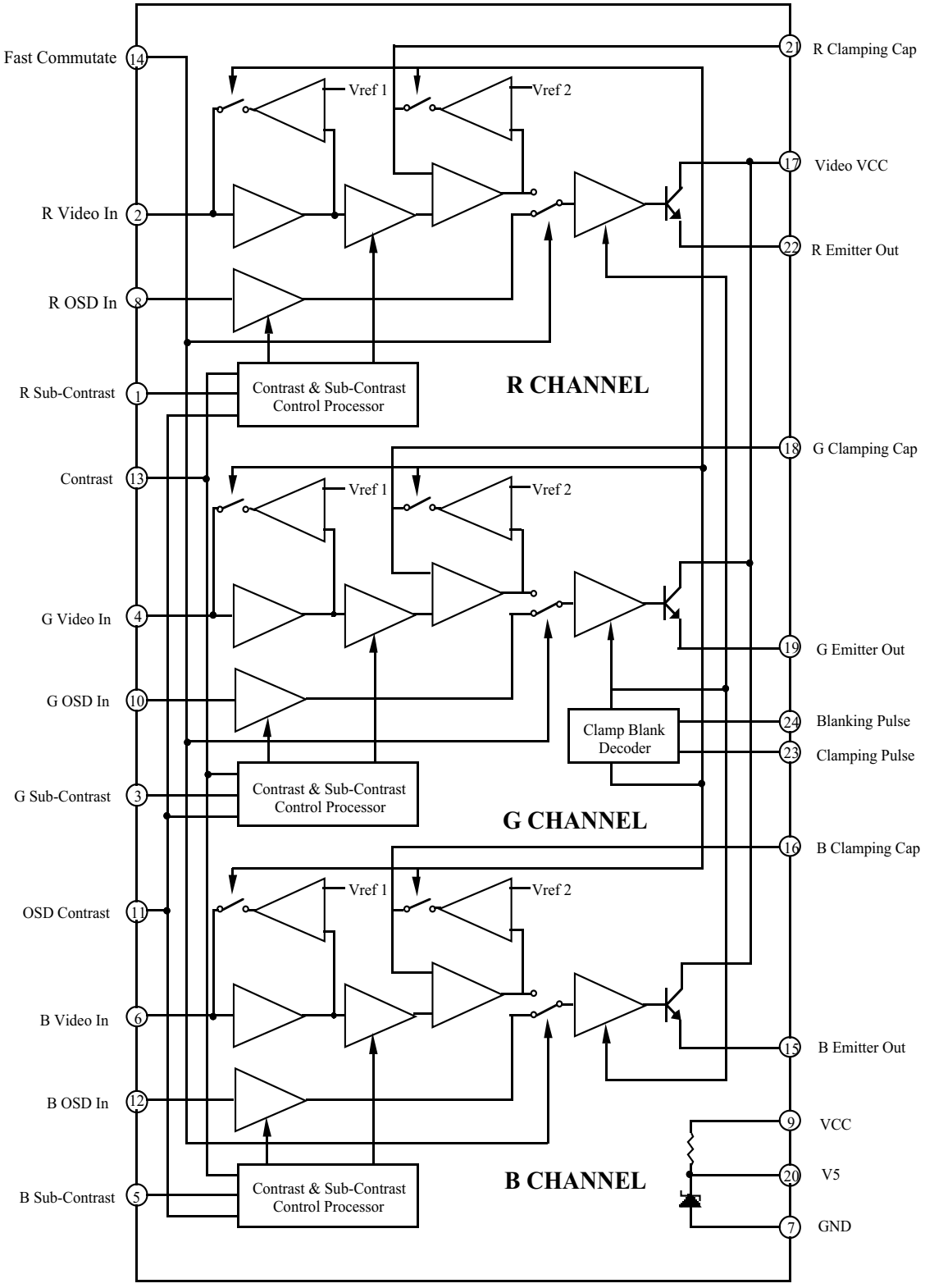
ELECTRICAL CHARACTERISTICS (Refer to test circuit figure 1, TA=25˚C, Vcc=8.0Vdc)

Table 3

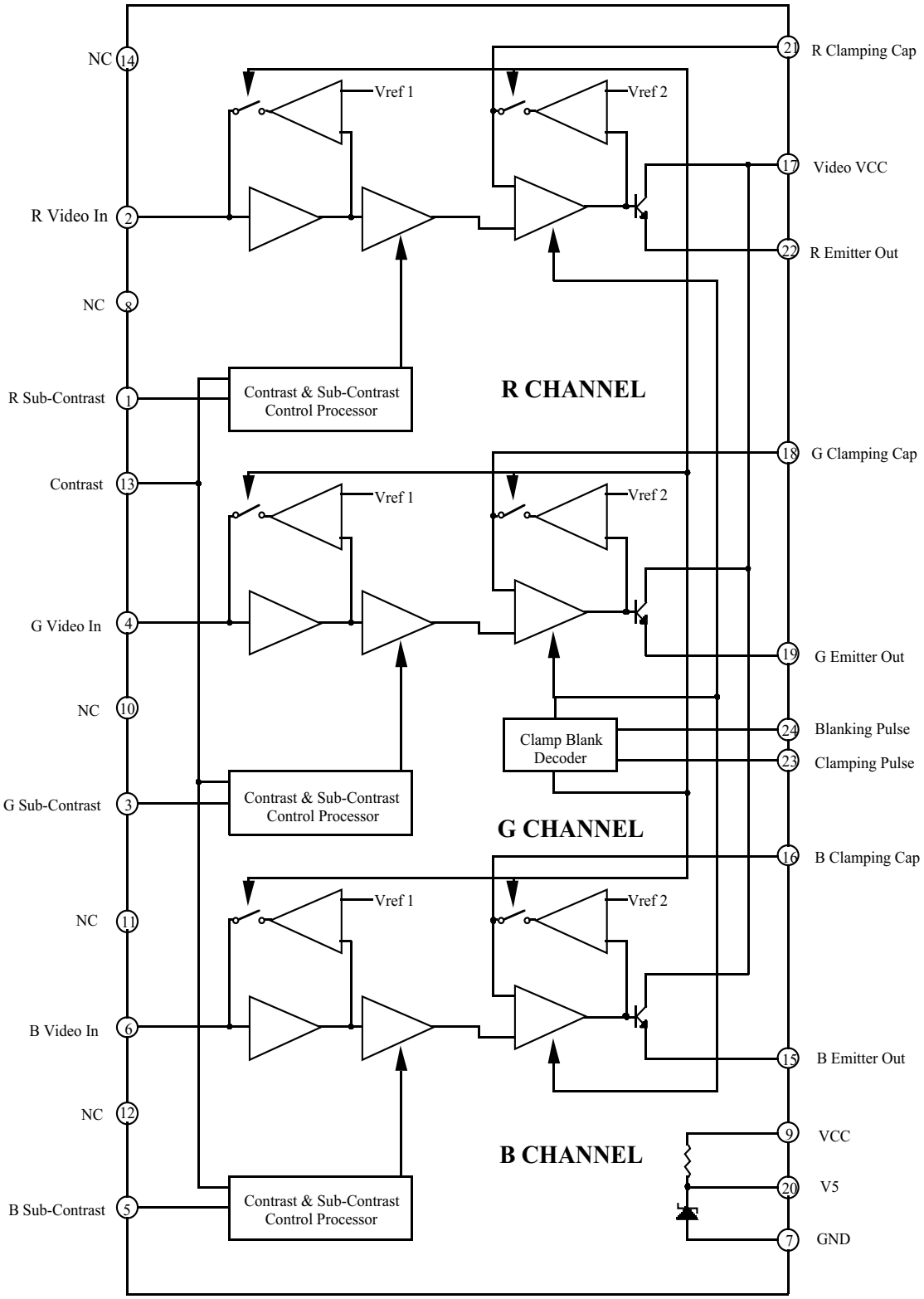
Parameter	Condition	Pin	Min	Typ	Max	Unit
Input Impedance		2,4,6	100			KΩ
Internal DC Bias Voltage				2.7		Vdc
Input Signal Amplitude	with 75 Ω resistor termination at input	2,4,6		0.7	1.0	Vpp
Output Signal Amplitude	V2,V4,V6 = 0.7Vpp V1,V3,V5,V13 = 5V	15,19,22	3.6	4		Vpp
Voltage Gain	V14 = 0V			5.6		V/V
Contrast Control	V13 = 5 to 0V V1,V3,V5 = 5V	13		-26		dB
Sub-contrast Control	V1,V3,V5 = 5 to 0V V13=5V	1,3,5		-26		dB
Emitter DC Level		15,19,22	1.0	1.2	1.4	Vdc
Clamping Pulse Width			500			nS
Blanking Input Threshold		24		1.25		V
Clamping Input Threshold		23		3.75		V
Video Rise Time	V2,V4,V6 = 0.7Vpp	15,19,22		3.5		nS
Video Fall Time	Vout = 4Vpp RL > 300Ω, CL < 5pF			3.5		nS
Video Bandwidth	V2,V4,V6 = 0.7Vpp V1,V3,V5,V13 = 5V V14 = 0V RL > 300Ω, CL < 5pF	15,19,22		100		MHz
OSD Signal Input Low Voltage		8,10,12			2.7	V
OSD Signal Input High Voltage		8,10,12	3.3			V
Fast Commutate Input Signal		14		TTL		V
OSD Rise Time	V8,V10,V12 = 5V	15,19,22		7		nS
OSD Fall Time	V11=5V, V14=5V			7		nS
OSD Bandwidth	V8,V10,V12 = 5V V11=5V, V14=5V	15,19,22		50		MHz
OSD Propagation Delay				17		nS

It is recommended to use double sided PCB layout for high frequency measurement. (eg. rise/fall time, bandwidth.)

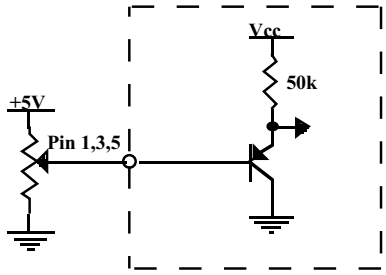
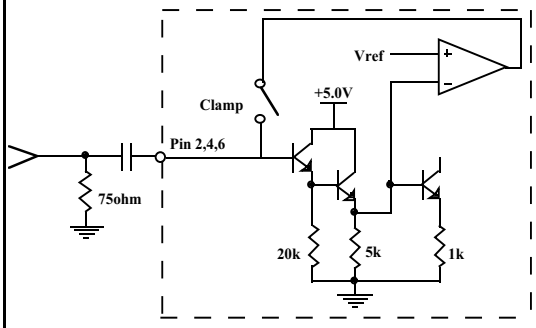
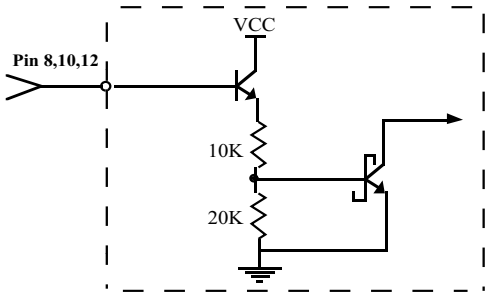
Internal Block Diagram for MC13282E



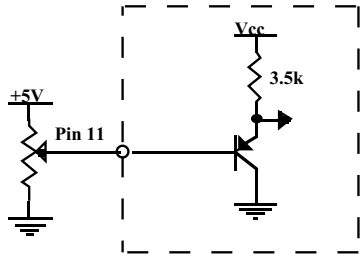
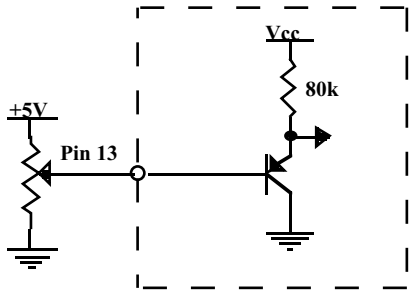
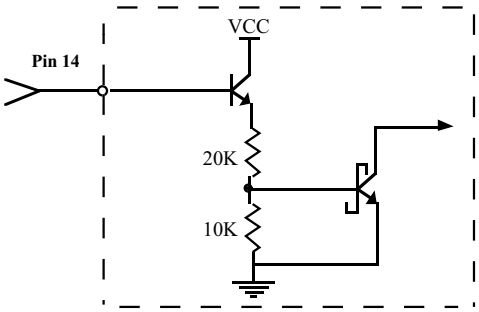
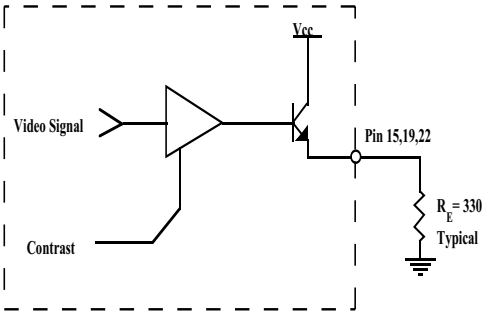
Internal Block Diagram for MC13281FX



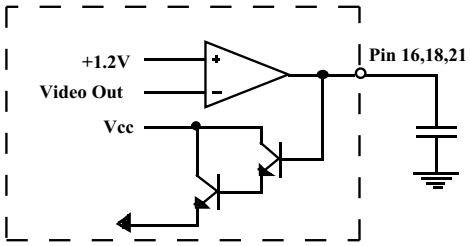
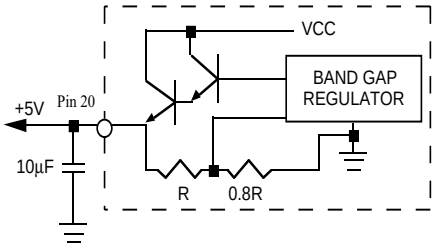
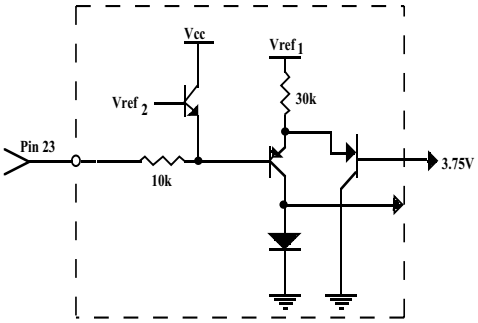
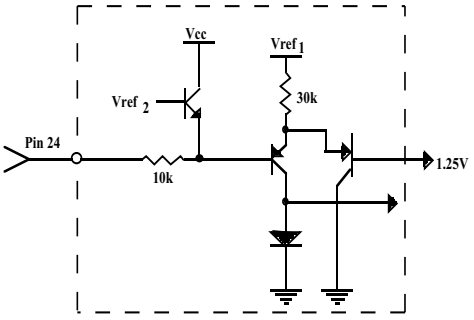
PIN OUT DESCRIPTION

Pin	Name	Equivalent Internal Circuit	Description
1 3 5	R Subcontrast Control G Subcontrast Control B Subcontrast Control		These pins provides a max. of 26dB attentuation to vary the gain of each video amplifier separately. Input voltage from 0 to 5V. Increase the voltage will increase contrast level.
2 4 6	R Input G Input B Input		The input coupling capacitor is used for input clamping storage. The maximum source impedance is 100 Ω. Input polarity of the video signal is positive. Norminal 0.7Vpp input signal is recommended. (max. 1Vpp)
7	Video Ground		Ground for the video section (video amplifiers, RGB channels and RGB OSD, overall contrast/subcontrast controls and video reference voltage)
8 10 12	ROSD Input GOSD Input BOSD Input		OSD input for MC13282E and NC pins for MC13281FX.
9	Vcc		Connect to +8V dc supply. Decoupling is required at this pin.

PIN OUT DESCRIPTION

Pin	Name	Equivalent Internal Circuit	Description
11	OSD Contrast		On Screen Display contrast control for MC13282E and NC pin for MC13281FX. Input voltage from 0 to 5V. Increase the voltage will increase the contrast of the OSD signal
13	Contrast		Overall Contrast Control The input range is from 0V to 5V. An increase of voltage increases contrast.
14	Fast Commutate		For MC13282E, This pin is in conjunction with RGB OSD inputs. It is a very fast switch used on the R,G,B inputs for over-laying text on picture. NC pin for MC13281FX and it should be connected to ground.
15 19 22	B Emitter Output G Emitter Output R Emitter Output		The video outputs are configured as emitter-followers with driving capability of about 15mA. The DC voltage at these three emitters is set to 1.2V (Black level). The DC current through the output stage is determined by the emitter resistors (typically 330Ω).

PIN OUT DESCRIPTION

Pin	Name	Equivalent Internal Circuit	Description
16 18 21	B Clamp Capacitor G Clamp Capacitor R Clamp Capacitor		Normally a 100nF capacitor is connected to these pins. The capacitor is used for video outputs DC restoration.
17	Video VCC		Connect to +8V dc supply. This VCC is for video output stage. It is internally connected to collectors of the ouput transistors.
20	5Vref		+5 volt regulator. Minimum 10µF capacitor is required for noise filtering and compensation. It can source up to 20mA but not sink current. Output impedance is ≈ 10Ω. Recommend for voltage reference only.
23	Clamp		This pin is used for video clamping. The threshold clamping level is 3.75V
24	Blank		This pin is used for video blanking. The threshold blanking level is 1.25V

FUNCTIONAL DESCRIPTION

The MC13282E/MC13281FX composes of three video amplifiers, clamping & blanking circuitries with contrast & sub-contrast controls and OSD interface (MC13282E only). Each video amplifier is designed to have a -3dB bandwidth of 100MHz with a gain of up to about 5.6V/V or 15dB.

Video Input

Video input stages are high impedance and designed to accept a maximum signal of 1Vp-p with 75Ω termination (typically) provided externally. During the clamping period, a current is provided to the input capacitor by the clamping circuit which brings the input to a proper DC level (nominal 2.7 volts). The blanking and clamping signals are to be provided externally with threshold sitting at 1.25V and 3.75V respectively.

Video Output

Video output stages are configured as emitter-follower with driving capability of about 15mA for each channel. The DC voltage at these three emitters are set to 1.2 volts (black level). The DC current through each output stage is determined by the emitter resistor (typically 330Ω).

Contrast Control

The contrast control varies the gain of three video amplifiers from a minimum of 0.3 V/V to a maximum of 5.6V/V when all sub-contrast levels set to 5 volts.

Sub-Contrast Control

Each sub-contrast control provides a maximum of 26dB attenuation on each video amplifier separately.

FUNCTIONAL DESCRIPTION

OSD Interface

Three OSD inputs typical bandwidth are 50MHz. A fast commutate pin is provided to select either the video or the OSD inputs as a source for the amplification. OSD contrast control is also provided for the amount of amplification required when OSD inputs are selected.

Clamp Pulse Input

The clamping pulse should be provided externally and the pulse width should be no less than 500ns.

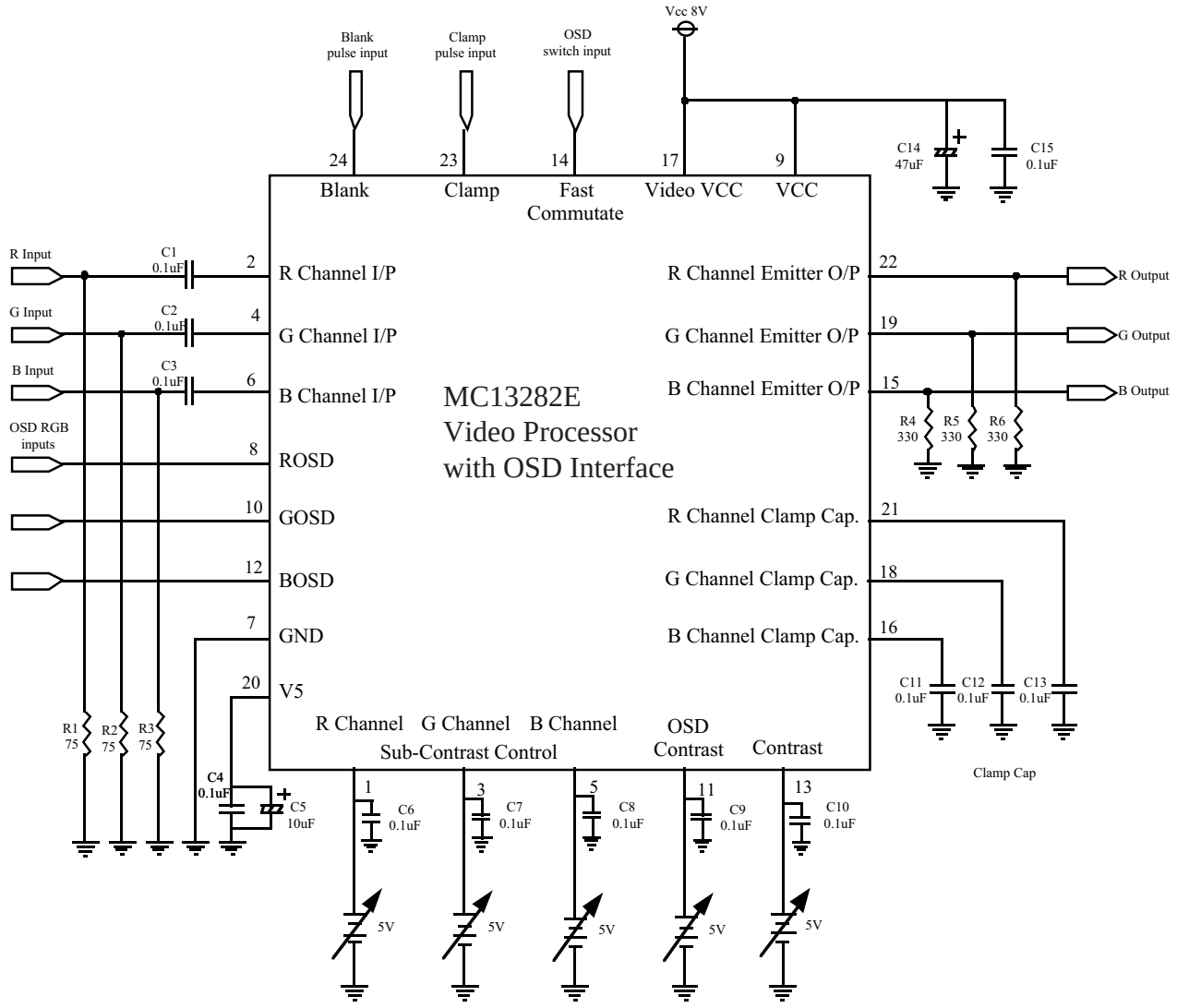
Blank Pulse Input

The blanking pulse is used to blank the video signal during the horizontal sync period or used as a control pin for video mute function.

Power Supplies

Vcc and Video Vcc supplies are to be 8 volts +/-5%

Figure 1: Test Circuit of MC13282E



For MC13281FX, the pin 14 NC should be connected to ground and OSD input pins 8, 10, 12 are no connection.

APPLICATION INFORMATION

PCB Layout

Care should be taken in the PCB layout to minimize the noise effect. The most sensitive pins are Vcc(9), Video Vcc (17), V5(20), Clamp Cap (16,18,21). It is prefer to make a ground plane and connect Vcc/Video Vcc & ground trace to power supply directly. Separate decoupling capacitors should be used for Vcc and video Vcc and connected as close as possible to the device. Multi-layer ceramic & tantalum capacitors are recommended for optimum performance. Pin 20 V5 is designed as a +5V voltage reference for contrast, RGB subcontrast and OSD contrast controls, so same precaution for Vcc should be also applied at this pin. It is necessary to put the ground connection of three clamp capacitors close to IC ground pin.

The copper trace of video signal input and output should be as short as possible and separated by ground trace to avoid any RGB cross-interference. A single side PCB layout is shown in Figure 11 for reference. A double sided PCB should be used to optimize device's performance.

RGB Input & Output

The RGB output stages are designed as emitter-followers to drive the CRT driver circuitry directly. The emitter resistor used is 330Ω typically and the driving current is 15mA for each channel. The loading impedance connected to output stages should be greater than 330Ω & less than 5pF for optimum performance. (rise/fall time, bandwidth) Typical value for the loading capacitance is 3-5pF. Figure 2 show a typical CRT driver interface.

Each RGB input video signal with is normally terminated by a 75Ω resistor for impedance matching and is ac coupled to the video input. For high resolution color monitor application, it is recommended to use coaxial cable or shielded cable for input signal connection.

APPLICATION INFORMATION

Clamp & Blank Input

The clamping input is normally (except Sync on Green) direct connected to a positive horizontal sync pulse with threshold level of 3.75V. It is used as a timing reference for the DC restoration process, so it should not be open circuit. If Sync on Green timing mode is used, the clamping pulse should be located at horizontal back porch period instead of horizontal sync tip period. Otherwise, the black level will be clamped at a wrong DC level.

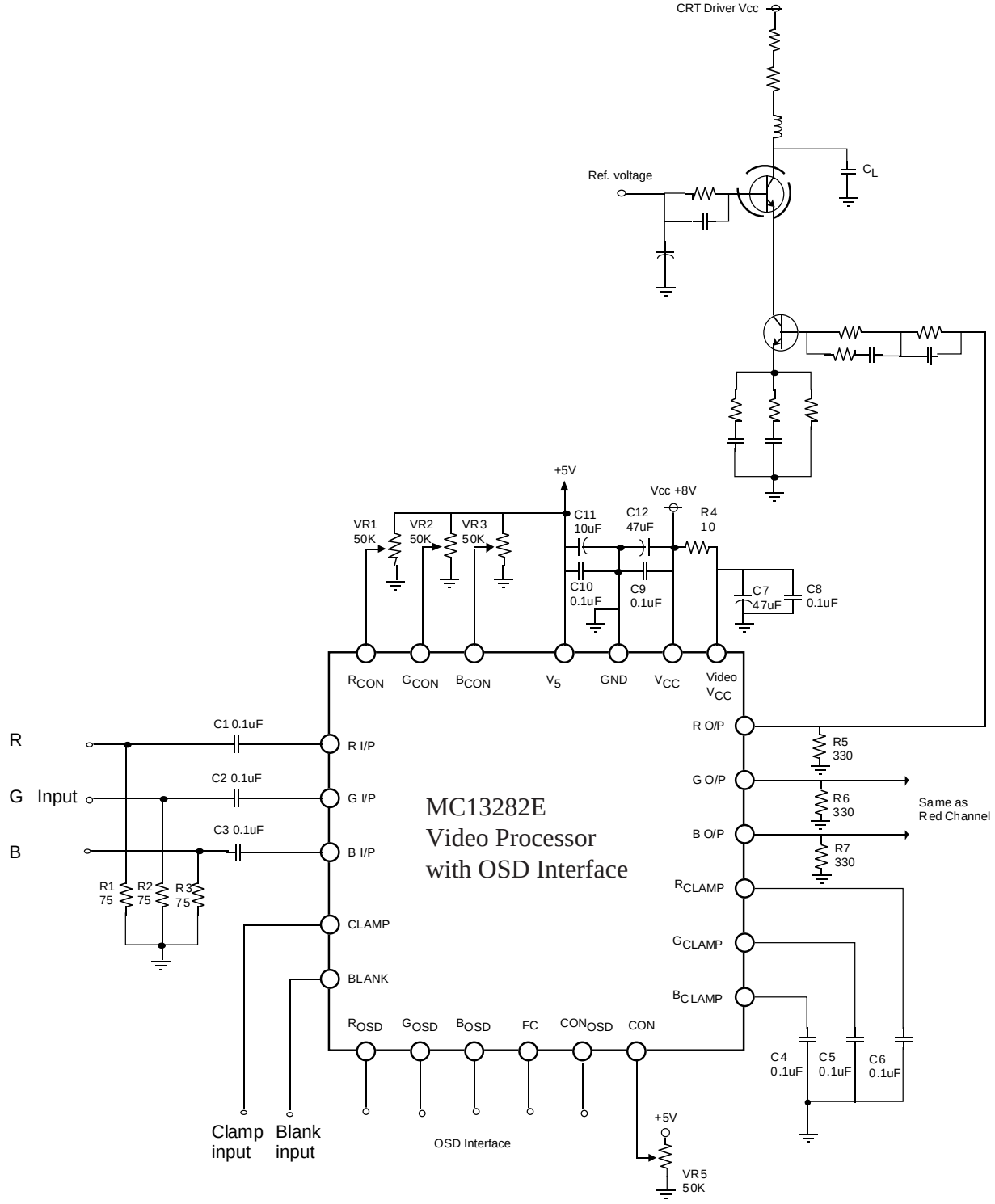
The blanking input is used as a video mute or horizontal blanking control pin and is connected to a blanking pulse generated from flyback or MCU with threshold level of 1.25V. The blanking pulse width should be equal to the flyback retrace period to make sure that the video signal is blanked properly during retrace period. It is necessary to limit the amplitude and avoid any negative value occur if flyback pulse is used. The blanking input pin cannot accept a negative voltage input. This pin should be grounded if it is not using the blanking function.

OSD interface

Figure 3 show a typical OSD application, the OSD devices like MC141540 series can directly interface with MC13282E and do not require any level shift circuitry. Separate power supply & ground is recommended for MC13282E and MC141540. Care should be taken in the PCB layout to prevent the digital noise (clock pulse) from entering the analog portion of MC13282E.

Normally the OSD switching only be occured at the video content period, it is not recommended to apply fast commutate signal to the device at horizontal sync tip period.

Figure 2: Interfacing with Video Output Driver



For MC13281FX, the pin 14 NC should be connected to ground and OSD input pins 8, 10, 12 are no connection.

Figure 3: Interfacing with OSD Device

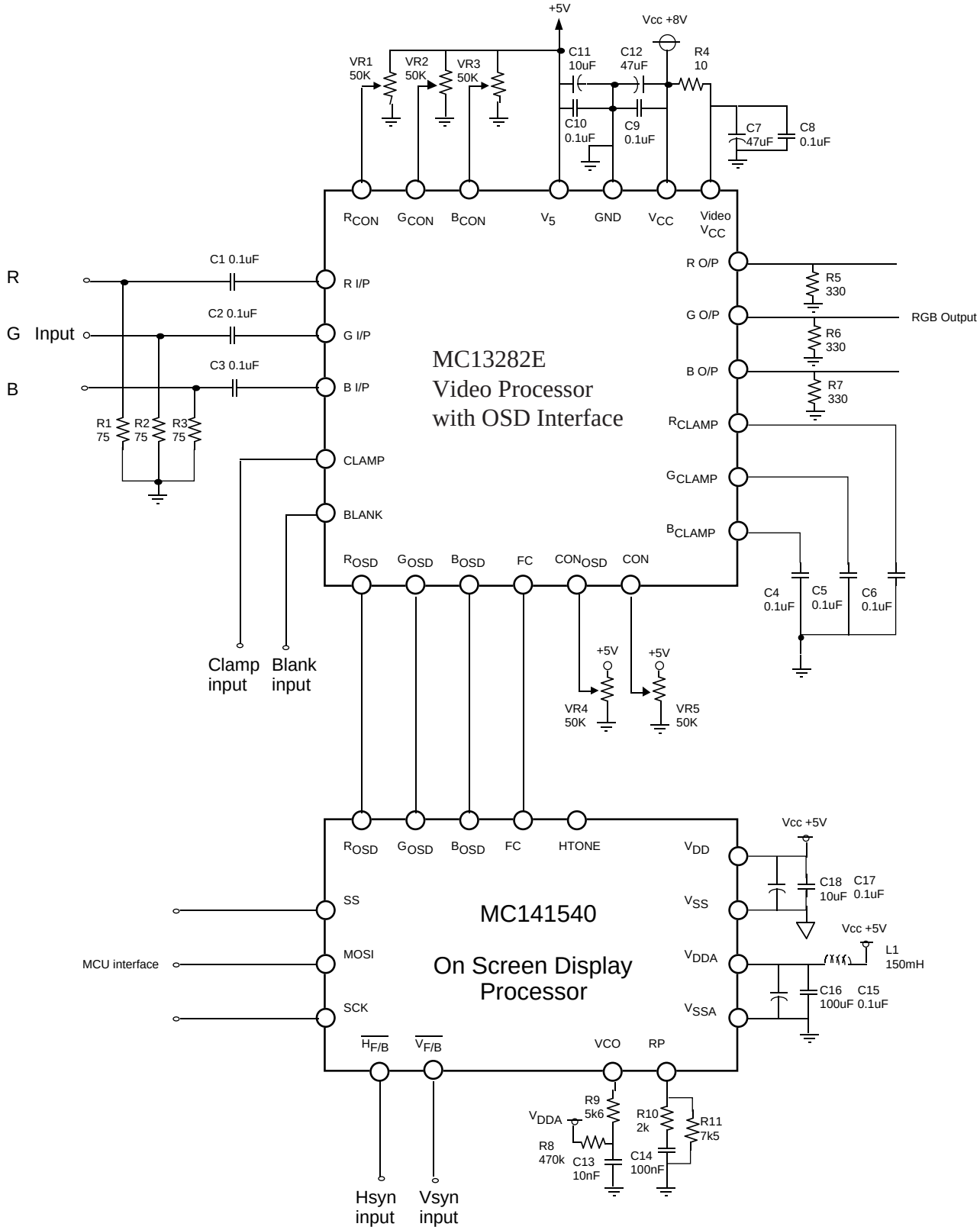


Figure 4: RGB In/Out Linearity

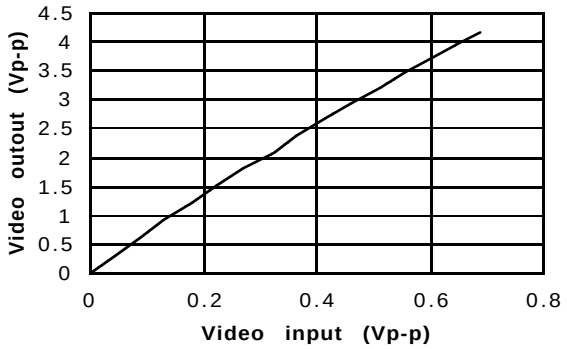


Figure 5: Contrast Control

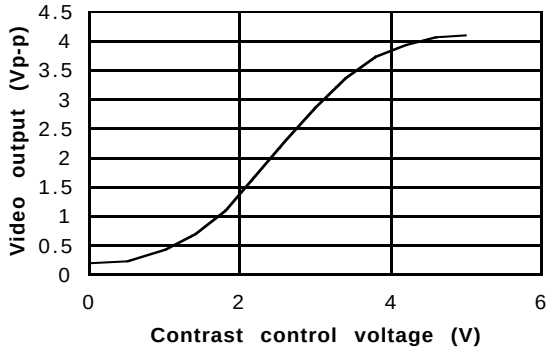


Figure 6: Sub-Contrast Control

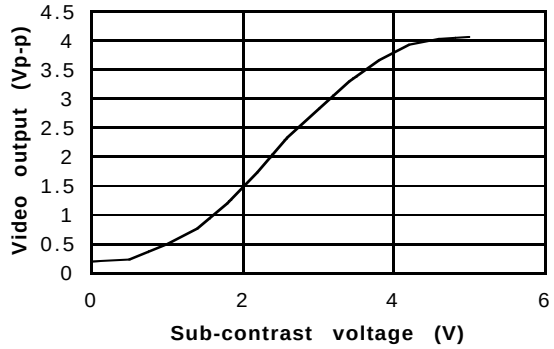


Figure 7: OSD Contrast Control

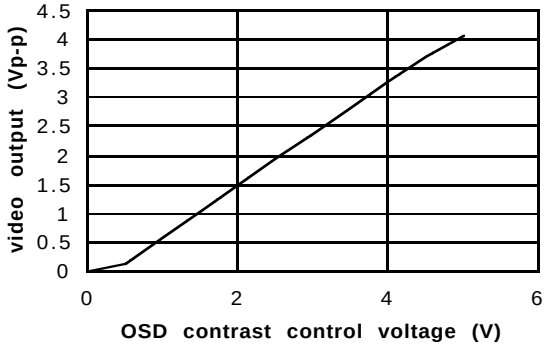


Figure 8: Crosstalk from Green to Red & Blue Channels

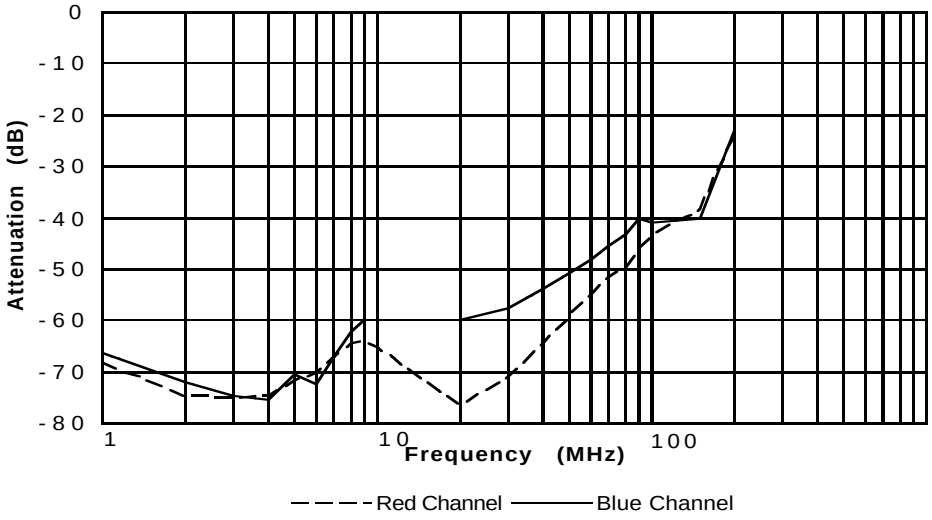
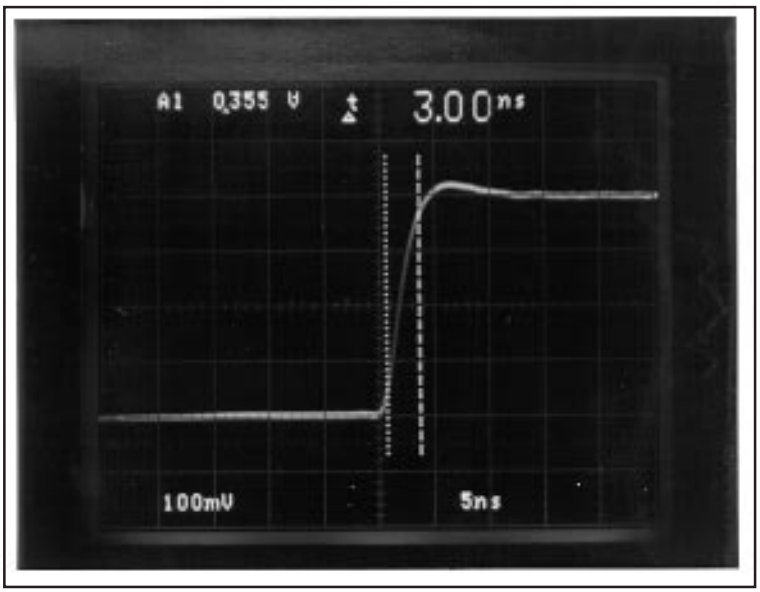
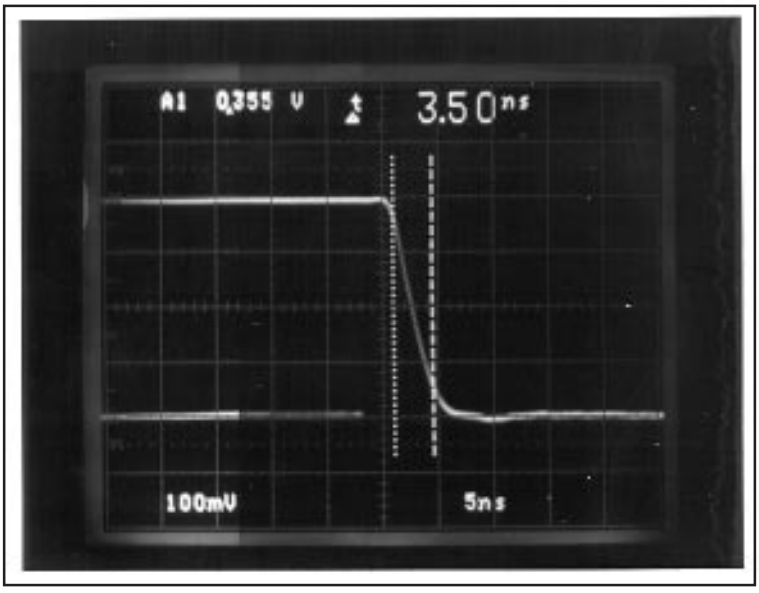


Figure 9: Rise Time



100mV/div
5ns/div
10x probe

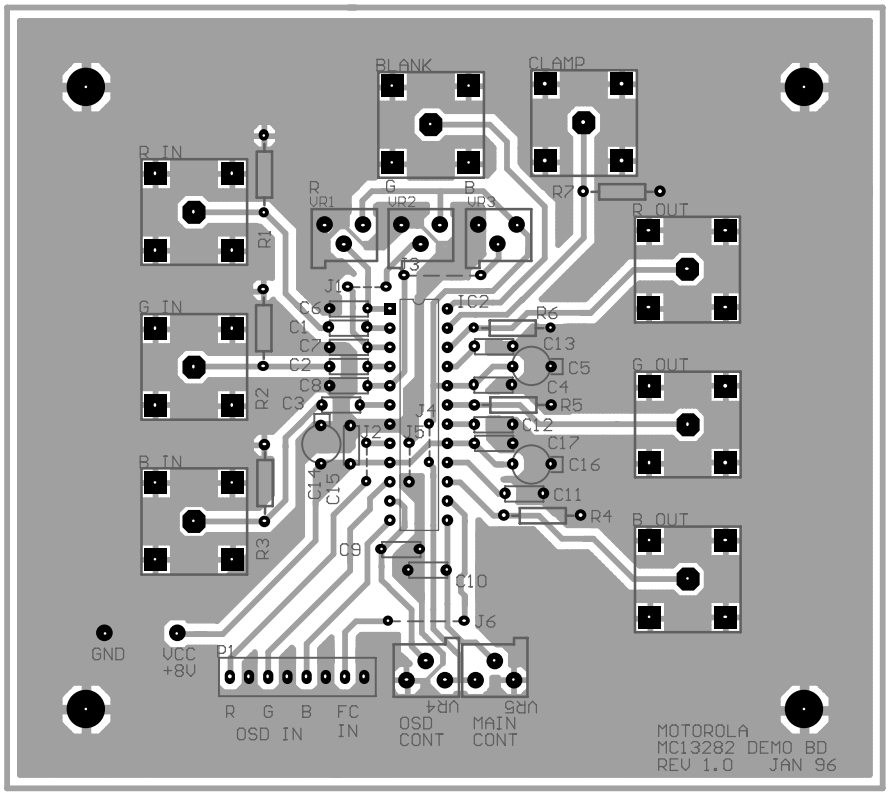
Figure 10: Fall Time



100mV/div
5ns/div
10x probe

Recommend to use double sided PCB without any socket for rise/fall time measurement. Using a input pulse with 1.5ns rise time and a active probe with 1.7pF capacitance loading.

Figure 11: Single sided PCB layout. (component side, 1:1 scale)



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