

APRIL. 1998

# DATA SHEET

KA2143B



## R/G/B VIDEO AMPLIFIER

The KA2143B is a very high frequency video amplifier system with OSD interface intended to be used in Monitor with high resolution up to  $1024 \times 768$ . It contains 3 matched R/G/B video Amplifiers with Blank signal and provides a flexible interfacing to DC controlled adjustment system.

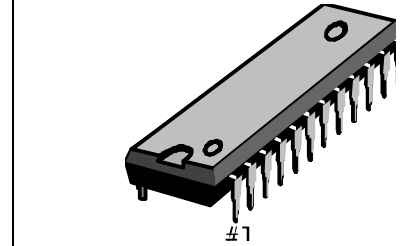
## FUNCTIONS

- R/G/B Video Amplifier
- OSD Interface
- Contrast/OSD Contrast/SUB Contrast Control
- Blank/Clamp Gate
- Video Clamp

## FEATURES

- 3-Channel R/G/B Video Amplifier, 110MHz Bandwidth
- TTL OSD Input, 50MHz Bandwidth
- DC Contrast Control range: -38dB
- DC SUB Contrast Control range: -11dB
- Capable of  $7.5V_{pp}$  Output Swing Range
- Video/OSD high speed Switch

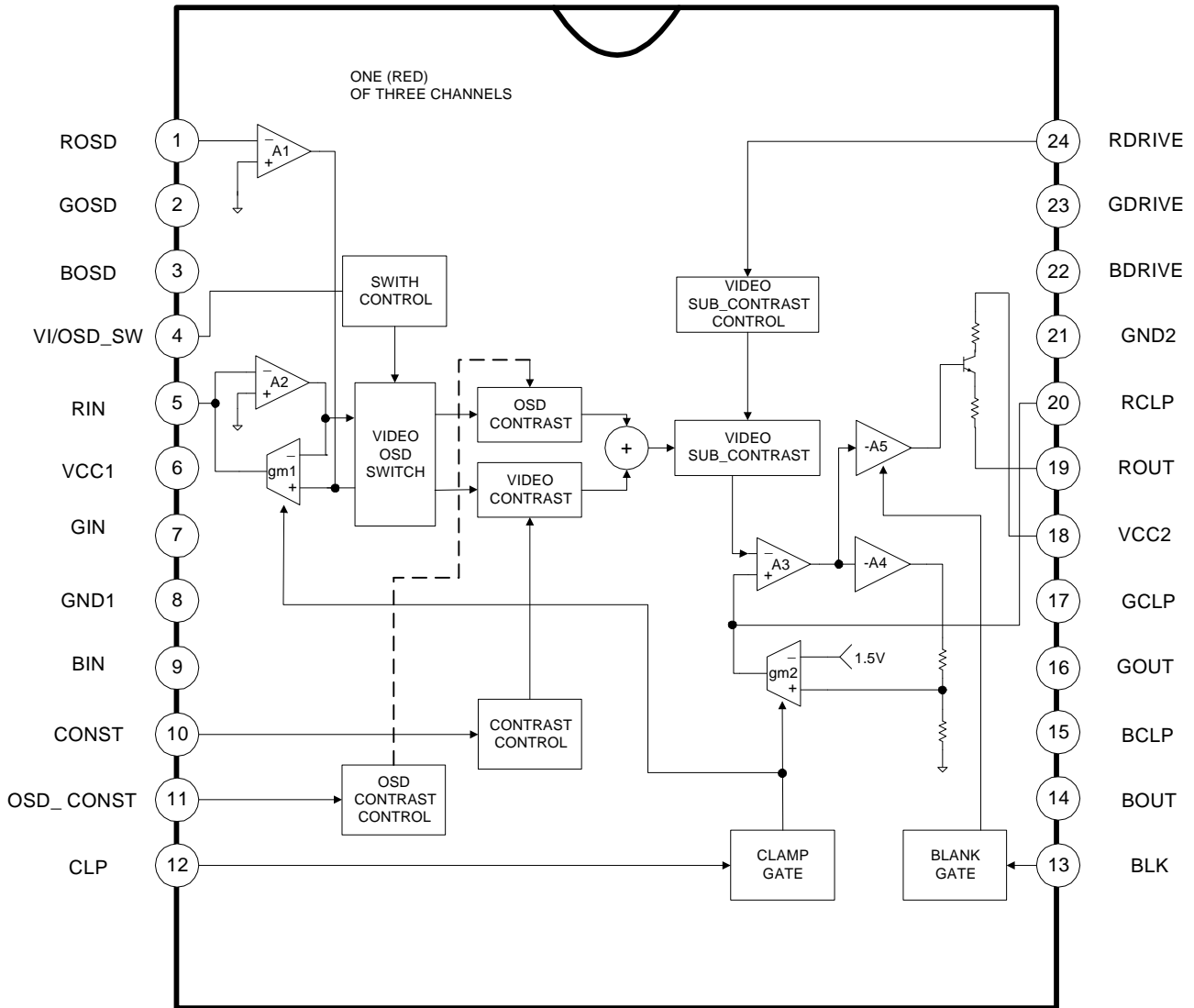
24-DIP-300



## ORDERING INFORMATION

| Device  | Package    | Operating Temperature |
|---------|------------|-----------------------|
| KA2143B | 24-DIP-300 | -20 °C ~ +70 °C       |

BLOCK DIAGRAM



## PIN CONFIGURATIONS

Table 1. Pin Configurations

| Pin No | Symbol           | I/O | Configurations                |
|--------|------------------|-----|-------------------------------|
| 1      | ROSD             | I   | Red OSD Input                 |
| 2      | GOSD             | I   | Green OSD Input               |
| 3      | BOSD             | I   | Blue OSD Input                |
| 4      | VI/OSD_SW        | I   | Video or OSD Switch           |
| 5      | RIN              | I   | Red Video Input               |
| 6      | V <sub>CC1</sub> | -   | V <sub>CC</sub> (normal)      |
| 7      | GIN              | I   | Green Video Input             |
| 8      | GND              | -   | Ground                        |
| 9      | BIN              | I   | Blue Video Input              |
| 10     | CONST            | I   | Contrast Control              |
| 11     | OSD_CONST        | I   | OSD Contrast Control          |
| 12     | CLP              | I   | Clamp Gate Signal Input       |
| 13     | BLK              | I   | Blank Gate Signal Input       |
| 14     | BOUT             | O   | Blue Video Output             |
| 15     | BCLP             | -   | Blue Clamp Cap                |
| 16     | GOUT             | O   | Green Video Output            |
| 17     | GCLP             | -   | Green Clamp Cap               |
| 18     | V <sub>CC2</sub> | -   | V <sub>CC</sub> (output part) |
| 19     | ROUT             | O   | Red Video Output              |
| 20     | RCLP             | -   | Red Clamp Cap                 |
| 21     | GND              | -   | Ground                        |
| 22     | BDRIVE           | I   | Blue Gain Control             |
| 23     | GDRIVE           | I   | Green Gain Control            |
| 24     | RDRIVE           | I   | Red Gain Control              |

## PIN DESCRIPTION

Table 2. Pin Description

| Pin No      | Pin Name   | Schematic | Description   |
|-------------|--|-----------|---|
| 1<br>2<br>3 | Red OSD Input (ROSD)<br>Green OSD Input (GOSD)<br>Blue OSD Input (BOSD)    |           | OSD input signals are in TTL level and will be connected to ground when switching video input |
| 4           | Video/OSD Switch (VI/OSD_SW)   |           | Videl/OSD switch signal is TTL level<br>OSD Input = "High"<br>Video Input = "Low"             |
| 5<br>7<br>9 | Red Video Input (RIN)<br>Green Video Input (GIN)<br>Blue Video Input (BIN) |           | MAX Input Video Signal is 0.7Vpp  |
| 6           | V <sub>CC1</sub>   | -         | Supply Voltage (except drive stage)   |
| 8           | GND  | -         | Ground  |

Table 2. Pin Description(Continued)

| Pin No                     | Pin Name  | Schematic | Description  |
|----------------------------|---|-----------|--|
| 10<br>11<br>22<br>23<br>24 | Video Contrast (CONST)<br>OSD Contrast (OSD_CONST)<br>Blue Drive (BDRIVE)<br>Green Drive (GDRIVE)<br>Red Drive (RDRIVE) |           | Video and OSD maximum contrast control range (0V ~ 4V) is -38dB.<br>Sub contrast gain (RGB Drive) control range (0V ~ 4V) is -11dB |
| 12<br>13                   | Clamp Gate Input (CLP)<br>Blank Gate Input (BLK)  |           | Video Amp actives when clamp gate and blank gate signal is in low TTL level  |
| 19<br>16<br>14             | Red Video Output (ROUT)<br>Green Video Output (GOUT)<br>Blue Video Output (BOUT)  |           | Video signal output  |
| 15<br>17<br>20             | Blue Clamp Cap (BCLP)<br>Green Clamp Cap (GCLP)<br>Red Clamp Cap (RCLP)   |           | Brightness controlling actives by changing and discharging of the external cap. (0.1μF)  |

Table 2. Pin Description(Continued)

| Pin No | Pin Name | Schematic | Description                   |
|--------|----------|-----------|-------------------------------|
| 18     | VCC2     | -         | Supply voltage for drive part |
| 21     | GND      | -         | Ground                        |

## THERMAL & ESD CHARACTERISTICS

Table 3. Thermal &amp; ESD Parameter

| No | Item                                     | Symbol        | Value |     |     | Unit |
|----|--|---------------|-------|-----|-----|------|
|    |  |               | Min   | Typ | Max |      |
| 1  | Thermal Resistance<br>(Junction-ambient) | $\theta_{ja}$ | -     | 61  | -   | °C/W |
| 2  | Junction Temperature                     | $T_j$         | -     | 150 | -   | °C   |
| 3  | Human Body Mode<br>(C = 100p, R = 1.5k)  | HBM           | 2     | -   | -   | KV   |
| 4  | Machine Model<br>(C = 200p, R = 0)       | MM            | 300   | -   | -   | V    |
| 5  | Charge Device Model                      | CDM           | 800   | -   | -   | V    |

**ABSOLUTE MAXIMUM RATINGS (TA = 25 °C) <sup>(1)</sup>****Table 4. Absolute Maximum Ratings**

| No | Item                                 | Symbol             | Value |      |      | Unit             |
|----|--------------------------------------|--------------------|-------|------|------|------------------|
|    |                                      |                    | Min   | Typ  | Max  |                  |
| 1  | Maximum Supply Voltage               | V <sub>ccmax</sub> | -     | -    | 13.5 | V                |
| 2  | Operating Temperature <sup>(2)</sup> | T <sub>opr</sub>   | -20   | -    | 70   | °C               |
| 3  | Storage Temperature                  | T <sub>stg</sub>   | -65   | -    | 150  | °C               |
| 4  | Operating Supply Voltage             | V <sub>ccop</sub>  | 11.4  | 12.0 | 12.6 | V <sup>(3)</sup> |
| 5  | Maximum Supply Current               | I <sub>CCmax</sub> |       |      | 120  | mA               |
| 6  | Power Dissipation                    | P <sub>D</sub>     | -     | -    | 2.0  | W                |

**ELECTRICAL CHARACTERISTICS****DC Electrical Characteristics**

T<sub>A</sub> = 25 °C, V<sub>CC1</sub> = V<sub>CC2</sub> = 12V; V<sub>10</sub> = 4V; V<sub>11</sub> = 4V; V<sub>13</sub> = 4V; V<sub>drive</sub> = 4V; V<sub>4</sub> = 0V; V<sub>12</sub> = 0V  
 unless otherwise stated

**Table 5. DC Electrical Characteristics**

| Parameter                          | Symbol              | Conditions            | Min   | Typ   | Max   | Unit |
|------------------------------------|---------------------|-----------------------|-------|-------|-------|------|
| Supply Current                     | I <sub>cc</sub>     | <sup>(4)</sup>        | 65    | 85    | 97    | mA   |
| Video Input Resistance             | R <sub>IN</sub>     | Any Amplifier         | 10    | 100   | -     | kΩ   |
| Clamp Gate Low Input Voltage       | V <sub>12L</sub>    | Clamp Comparators On  | 0.8   | 1.5   | 3.0   | V    |
| Clamp Gate High Input Voltage      | V <sub>12h</sub>    | Clamp Comparators Off | 0.8   | 1.5   | 2.0   | V    |
| Clamp Gate Low Input Current       | I <sub>12L</sub>    | V <sub>12</sub> = 0V  | -5.0  | -2.0  | -     | μA   |
| Clamp Gate High Input Current      | I <sub>12h</sub>    | V <sub>12</sub> = 12V | -     | 0.01  | 1.0   | μA   |
| Blank Gate Low Input Voltage       | V <sub>13L</sub>    | Blank Gate On         | 0.8   | 1.5   | -     | V    |
| Blank Gate High Input Voltage      | V <sub>13h</sub>    | Blank Gate Off        | -     | 1.5   | 2.0   | V    |
| Blank Gate Low Input Current       | I <sub>13L</sub>    | V <sub>13</sub> = 0V  | -5.0  | -2.0  | -     | μA   |
| Blank Gate High Input Current      | I <sub>13h</sub>    | V <sub>13</sub> = 12V | -     | 0.01  | 1.0   | μA   |
| Video Input bias Voltage           | V <sub>bias</sub>   |                       | 1.6   | 1.9   | 2.2   | V    |
| Output Clamp Cap Charge Current    | I <sub>clamp+</sub> | Clamp Comparators On  | 0.45  | 0.75  | 1.05  | mA   |
| Output Clamp Cap Discharge Current | I <sub>clamp-</sub> | Clamp Comparators Off | -1.05 | -0.75 | -0.45 | mA   |



Table 5. DC Electrical Characteristics(Continued)

| Parameter                                 | Symbol                        | Conditions                                    | Min  | Typ        | Max    | Unit    |
|---|-------------------------------|---|------|------------|--------|---------|
| Video Output High Voltage                 | $V_{OH}$                      | $V_{15,17,20} = 9V$                           | 6.2  | 7.5        | 9.0    | V       |
| Video Black Level Output Voltage          | $V_{OBL}$                     |   | 1.2  | 1.5        | 1.8    | V       |
| Video $\Delta$ Black Level Output Voltage | $\Delta V_{OBL}$              | Between Any Two Amplifiers                    | -0.3 | -          | 0.3    | V       |
| Video Output Blanked Voltage              | $V_{OB}$                      | Blank Gate On                                 | -    | 50         | 500    | mV      |
| Contrast/Drive Control Input Current      | $I_{osd}, I_{drive}, I_{con}$ | $V_{contrast} = V_{drive}: 0V \text{ to } 4V$ | -    | 25<br>0.25 | 2<br>1 | $\mu A$ |
| Cut-Off Control Input Current             | $I_{21}$                      |   | -    | 1.0        | 2.0    | $\mu A$ |
| Spot Killer Voltage                       | $V_{spot}$                    | $V_{CC}$ Adjusted to Activate                 | 8.0  | 10.4       | 11.2   | V       |

**AC Electrical Characteristics**

$T_A = 25^\circ C$ ,  $V_{CC1} = V_{CC2} = 12V$ ;  $V_4 = 0V$ . Manually adjust Video Output pins 14, 16 and 19 to 4V DC for the AC test <sup>(12)</sup> unless otherwise stated <sup>(14)</sup>

Table 6. AC Electrical Characteristics

| Parameter                             | Symbol              | Conditions   | Min  | Typ  | Max  | Unit |
|---------------------------------------|---------------------|--|------|------|------|------|
| Video Amplifier Gain                  | AV max              | $V_{10} = V_{drive} = 4V$ ,<br>$V_{in} = 560mV_{pp}$ | 15.5 | 17.5 | 19.5 | dB   |
| Contrast Attenuation 1                | $\Delta Av_{c1}$    | $V_{10} = 2V$  | -8   | -6   | -4   | dB   |
| Contrast Attenuation 2                | $\Delta Av_{c2}$    | $V_{10} = 0.25V$                                     | -    | -38  | -30  | dB   |
| Drive Attenuation1                    | $\Delta Av_{d1}$    | $V_{drive} = 2V$                                     | -6   | -4   | -2   | dB   |
| Drive Attenuation 2                   | $\Delta Av_{d2}$    | $V_{drive} = 0.25V$                                  | -13  | -10  | -7   | dB   |
| Absolute Gain Match                   | $\Delta Av_{match}$ | $V_{10} = 4V, V_{drive} = 4V$ <sup>(6)</sup>         | -1   | -    | 1    | dB   |
| Gain Change between Amplifiers        | $\Delta Av_{track}$ | $V_{10} = 4V \text{ to } 2V$ <sup>(6, 7)</sup>       | -1   | -    | 1    | dB   |
| Video Amplifier Distortion            | THD                 | $V_O = 1V_{pp}, f = 19kHz$                           | -    | 1    | 5    | %    |
| Video Amp Bandwidth <sup>(8,9)</sup>  | $f(-3dB)$           | $V_{10} = 4V, V_{drive} = 4V$ ,                      | 90   | 110  | -    | MHz  |
| Video Output Rise Time <sup>(8)</sup> | $t_r(\text{Video})$ | $V_O = 4V_{pp}$                                      | -    | 3.2  | 3.8  | ns   |
| Video Output Fall Time <sup>(8)</sup> | $t_f(\text{Video})$ | $V_O = 4V_{pp}$                                      | -    | 3.5  | 5    | ns   |
| Video Amplifier 10kHz Isolation       | Viso_10K            | $V_{10} = 4V$ <sup>(10)</sup>                        | -    | -65  | -45  | dB   |
| Video Amplifier 10MHz Isolation       | Viso_10M            | $V_{10} = 4V$ <sup>(8, 10)</sup>                     | -    | -50  | -35  | dB   |
| Blank Output Rise Time <sup>(8)</sup> | $t_r(\text{Blank})$ | Blank Output = $1V_{pp}$                             | -    | 6    | 15   | ns   |

Table 6. AC Electrical Characteristics(Continued)

| Parameter                             | Symbol                           | Conditions                      | Min | Typ | Max | Unit |
|---------------------------------------|----------------------------------|---------------------------------|-----|-----|-----|------|
| Blank Output Fall Time <sup>(8)</sup> | t <sub>f</sub> (Blank)           | Blank Output = 1V <sub>PP</sub> | -   | 10  | 30  | ns   |
| End of Blanking Propagation Delay     | t <sub>r</sub> - prop<br>(Blank) | Blank Output = 1V <sub>PP</sub> | -   | 23  | 50  | ns   |
| Start of Blanking Propagation Delay   | t <sub>f</sub> - prop<br>(Blank) | Blank Output = 1V <sub>PP</sub> | -   | 20  | 45  | ns   |

**OSD Electrical Characteristics**

T<sub>A</sub> = 25 °C; V<sub>CC1</sub> = V<sub>CC2</sub> = 12V; V<sub>10</sub> = 4V; V<sub>11</sub> = 4V; V<sub>13</sub> = 4V;

V<sub>drive</sub> = 4V; V<sub>4</sub> = 4V; V<sub>12</sub> = 0V unless otherwise stated

Table 7. OSD Electrical Characteristics

| Parameter                               | Symbol                           | Conditions   | Min  | Typ  | Max  | Unit            |
|---|----------------------------------|--|------|------|------|-----------------|
| OSD Input Low Input Voltage             | V <sub>OSDL</sub>                |  | 0.4  | 1.3  | -    | V               |
| OSD Input High Input Voltage            | V <sub>OSDh</sub>                |  | -    | 1.3  | 2.0  | V               |
| OSD Select Low Input Voltage            | V <sub>4L</sub>                  | Video Inputs are Selected  | 0.8  | 1.6  | -    | V               |
| OSD Select High Input Voltage           | V <sub>4h</sub>                  | OSD Inputs are Selected  | -    | 1.6  | 2.0  | V               |
| OSD Select Low Input Current            | I <sub>4L</sub>                  | V <sub>4</sub> = 0V  | -15  | -5   | -    | μA              |
| OSD Select High Input Current           | I <sub>4h</sub>                  | V <sub>4</sub> = 12V   | -    | 0.01 | 0.2  | μA              |
| OSD ΔOutput Black Level                 | ΔV <sub>BLV</sub> - OSD          |  | -0.3 | -    | 0.3  | v               |
| OSD Output Voltage                      | V <sub>OSD</sub>                 | V <sub>11</sub> = 4V, V <sub>drive</sub> = 2V  | 2.75 | 3.95 | 5.15 | V <sub>PP</sub> |
| OSD Output V <sub>PP</sub> Attenuation  | ΔV <sub>OSD_ATT</sub>            | V <sub>11</sub> = 2V, V <sub>drive</sub> = 2V  | 30   | 50   | 70   | %               |
| Output Match between Channels           | ΔV <sub>OSD</sub>                | V <sub>11</sub> = 4V, V <sub>drive</sub> = 2V  | 0    | 5    | 10   | %               |
| Video to OSD Switch Time <sup>(8)</sup> | t <sub>r</sub> (OSD S)           | V <sub>1</sub> = V <sub>2</sub> = V <sub>3</sub> = V <sub>4</sub> <sup>(13)</sup>            | -    | 4    | 10   | ns              |
| OSD to Video Switch Time <sup>(8)</sup> | t <sub>f</sub> (OSD S)           | V <sub>1</sub> = V <sub>2</sub> = V <sub>3</sub> = V <sub>4</sub> <sup>(13)</sup>            | -    | 11   | 20   | ns              |
| Video to OSD Propagation Delay          | t <sub>r</sub> - prop<br>(OSD S) | V <sub>1</sub> = V <sub>2</sub> = V <sub>3</sub> = V <sub>10</sub> =<br>V <sub>11</sub> = 4V | -    | 11   | 15   | ns              |
| OSD to Video Propagation Delay          | t <sub>f</sub> - prop<br>(OSD S) | V <sub>1</sub> = V <sub>2</sub> = V <sub>3</sub> = V <sub>10</sub> =<br>V <sub>11</sub> = 4V | -    | 12   | 25   | ns              |

**NOTES;**

1. Absolute maximum rating indicates limit beyond which damage to the device may occur.
2. Operating ratings indicate conditions for which the device is functional but do not guarantee specific performance limits. For guaranteed specifications and test conditions, See the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
3. VCC supply pins 6 and 18 must be externally wired together to prevent internal damage during  $V_{CC}$  power on/off cycles.
4. The supply current specified is the quiescent current for  $V_{CC1}$  and  $V_{CC2}$  with  $R_L = \infty$ , The supply current for  $V_{CC2}$  (pin 18) also depends on the output load.
5. Output voltage is dependent on load resistor. Test circuit uses  $R_L = 39\Omega$ .
6. Measure gain difference between any two amplifiers  $V_{in} = 560mV_{pp}$ .
7.  $\Delta A_v$  track is a measure of the ability of any two amplifiers to track each other and quantifies the matching of the three attenuators. It is the difference in gain change between any two amplifiers with the contrast voltage ( $V_{10}$ ) at either 4V or 2V measured relative to an  $A_{vmax}$  condition  $V_{10} = 4V$ . For example, at  $A_{vmax}$  the three amplifier gains might be 17.1dB, 16.9dB, and 16.8dB and change to 11.2dB, 10.9dB and 10.7dB respectively for  $V_{10} = 2V$ . This yields the measured typical + 0.1dB channel tracking.
8. When measuring video amplifier bandwidth or pulse rise and fall times, a double sided full ground plane printed circuit board without socket is recommended. Video amplifier 10MHz isolation test also requires this printed circuit board. The reason for a double sided full ground plane PCB is that large measurement variations occur in single sided PCB.
9. Adjust input frequency from 10MHz ( $A_{vmax}$  reference level ) to the - 3dB frequency ( $f_{-3dB}$ ).
10. Measure output levels of the other two undriven amplifiers relative to the driven amplifier to determine channel separation. Terminate the undriven amplifier inputs to simulate generator loading. Repeat test at  $f_{in} = 10MHz$  for Iso\_10MHz.
11. A minimum pulse width of 200 ns is guaranteed for a horizontal line of 15kHz. This limit is guaranteed by design. If a lower line rate is used a longer clamp pulse may be required.
12. During the AC test the 4V DC level is the center voltage of the AC output signal . For example. if the output is 4  $V_{pp}$  the signal will swing between 2V DC and 6V DC.
13. When  $V_1 = V_2 = V_3 = 0V$  and the video input is 0.7V. then  $t_r(\text{OSD S}) = 11ns$  and  $t_f(\text{OSD S}) = 4ns$  The video Output wave form will be inverted from the one shown in AC Test Circuit. Thus  $t_r(\text{OSD S})$  is actually a fall time and  $t_f(\text{OSD S})$  is actually a rise time in this condition.
14. These parameters are not tested on each product which is controlled by an internal qualification procedure.

APPLICATION CIRCUIT

