APRIL. 1998

DATA SHEET

KA2140B

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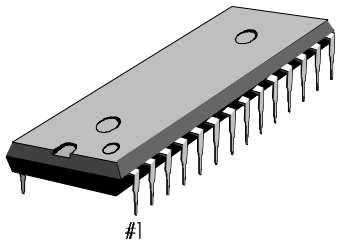
R/G/B VIDEO AMPLIFIER

The KA2140B is a very high frequency video amplifier system with an OSD interface, intended to be used in monitor with high resolution up to 1280 × 1024. It contains 3 matched R/G/B video Amplifiers with Blank signal and provides a flexible interfacing to DC controlled adjustment system.

28-DIP-600A



FUNCTIONS

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

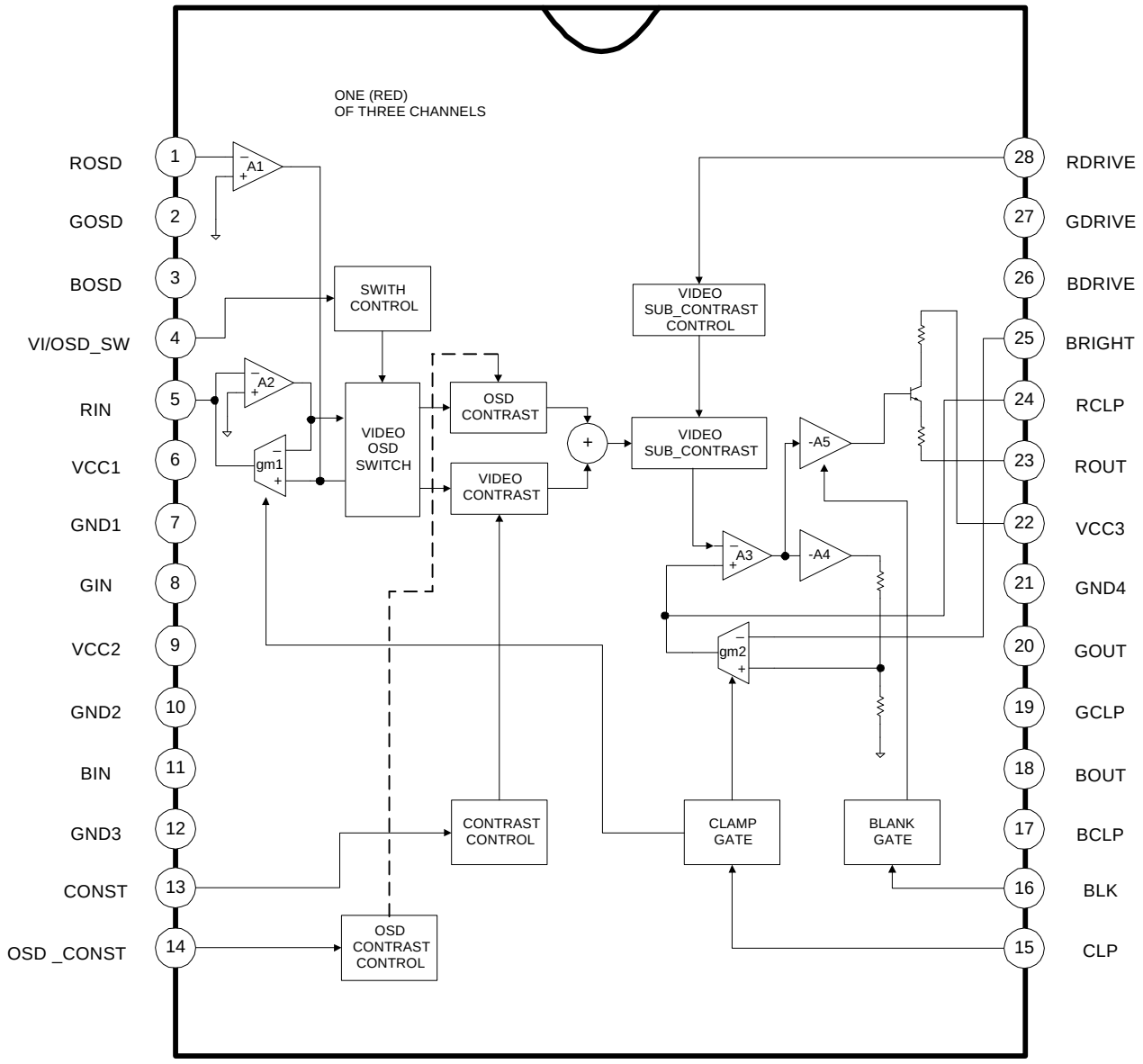
ORDERING INFORMATION

Device	Package	Operating Temperature
KA2140B	28-DIP	-25 °C ~ +80 °C

FEATURES

- 3 - Channel R/G/B Video Amplifier, 130MHz Bandwidth
- TTL OSD Input, 50MHz Bandwidth
- DC Contrast Contol range: -38dB
- DC SUB Contrast Control range: -11dB
- Capable of 7.5V_{PP} Output Swing Range
- Video/OSD high speed Switch

BLOCK DIAGRAM



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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_{CC1}	-	V_{CC} (Normal)
7	GND1	-	Ground 1
8	GIN	I	Green Video Input
9	V_{CC2}	-	V_{CC} (Normal)
10	GND2	-	Ground 2
11	BIN	I	Blue Video Input
12	GND3	-	Ground 3
13	CONST	I	Contrast Control
14	OSD_CONST	I	OSD Contrast Control
15	GCLP	I	Clamp Gate Signal Input
16	BLK	I	Blank Gate Signal Input
17	BCLP	-	Blue Clamp Cap
18	BOUT	O	Blue Clamp Video Output
19	GCLP	-	Green Clamp Cap
20	GOUT	O	Green Video Output
21	GND4	-	Ground 4
22	V_{CC3}	-	V_{CC} (Output Part)
23	ROUT	O	Red Video Output
24	RCLP	-	Red Clamp Cap
25	BRIGHT	I	Brightness Control
26	BDRIVE	I	Blue Gain Control
27	GDRIVE	I	Green Gain Control
28	RDRIVE	I	Red Gain Control

PIN DESCRIPTION

Table 2. Pin Description

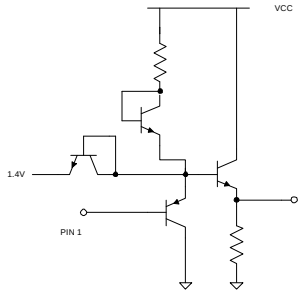
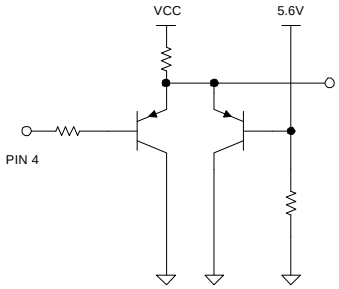
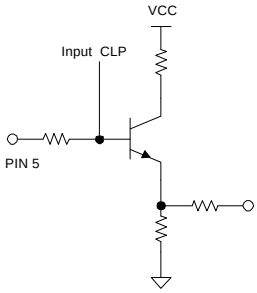
Pin No	Pin Name	Schematic	Description
1 2 3	Red OSD Input (ROSD) Green OSD Input (GOSD) Blue OSD Input (BOSD)		OSD input signals are in TTL level and will be connected to ground when switching to video input
4	Video/OSD Switch (VI/OSD_SW)		Video/OSD Switch signal is TTL Level. OSD Input = “High” Video Input = “Low”
5 8 11	Red Video Input (RIN) Green Video Input (GIN) Blue Video_in)		MAX Input Video Signal is 0.7 Vpp
6 9	$V_{CC}1$ $V_{CC}2$	-	Supply Voltage (Except Drive Stage)
7 10	GND1 GND2	-	Ground

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Table 2. Pin Description(continued)

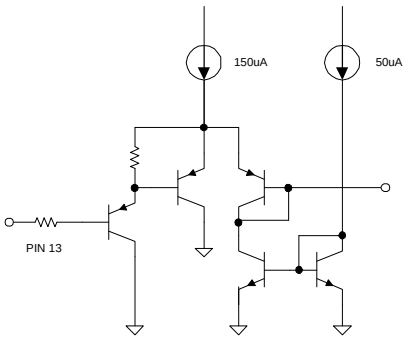
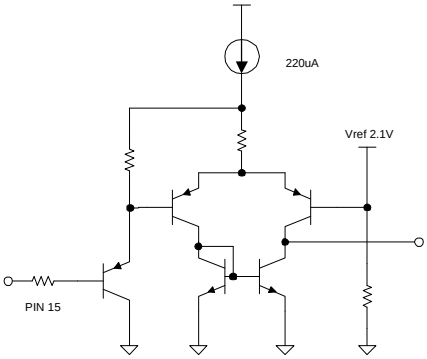
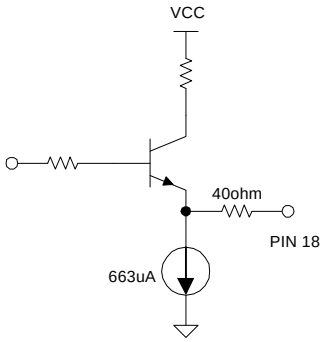
Pin No	Pin Name	Schematic	Description
13 14 26 27 28	Video Contrast (CONST) OSD Contrast (OSD_CONST) Blue Drive (BDRIVE) Green Drive (GDRIVE) Red Drive (RDRIVE)		Video and OSD maximum contrast control range (0V ~ 4V) is -38dB. Sub-contrast gain (RGB drive) control range (0V ~ 4V) is -11dB.
15 16	Clamp Gate Input (CLP) Blank Gate Input (BLP)		Video Amp activates when Clamp Gate and Blank Gate signal are in low TTL level
23 20 18	Red Video Output (ROUT) Green Video Output (GOUT) Blue Video Output (BOUT)		Video Signal Output

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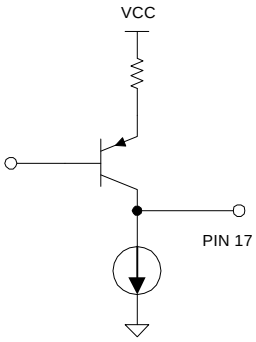
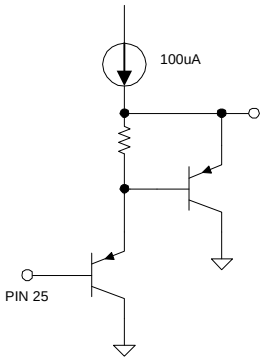
Table 2. Pin Description(continued)

Pin No	Pin Name	Schematic	Description
17 19 24	Blue Clamp Cap (BCLP) Gclamp_Cap (GCLP) Red Clamp Cap (RCLP)		Brightness Controlling activates by charging and discharging of the external cap. (0.1μF)
12 21	GND4 GND3	-	Ground
22	V_{CC3}	-	Supply Voltage for drive part
25	Bright Control (BRIGHT)		During the clamp Gate period, Video signal's DC level (clamp level) is fixed according to the Bightness control voltage.

ABSOLUTE MAXIMUM RATINGS (TA = 25 °C) (1)

Table 3. Absolute Maximum Ratings

No	Item	Symbol	Value			Unit
			Min	Typ	Max	
1	Maximum Supply Voltage	Vccmax	-	-	13.5	V
2	Operating Temperature (2)	Topr	-25	-	80	°C
3	Storage Temperature	Tstg	-65	-	150	°C
4	Operating Supply Voltage	Vccopr	11.4	12.0	12.6	V (3)
5	Maximum Supply Current	I_{CC}max	85	110	135	mA
6	Power Dissipation	P_D	-	-	2.5	W
7	Thermal Resistance (Junction-ambient)	θja	-	46	-	°C/W
8	Junction Temperature	Tj	-	150	-	°C

ELECTRICAL CHARACTERISTICS

DC Electrical Characteristics

T_A = 25 °C, V_{CC1} = V_{CC2} = V_{CC3} = 12V: V_{13} = 4V:V_{14} = 4V ; V_{16} = 4V; Vdrive = 4V; V_4 = OV; V_{15} = OV; V_{25} = 1V unless otherwise specified

Table 4. DC Electrical Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Current	Icc	(4)	75	100	125	mA
Video Input Resistance	R_{IN}	Any Amplifier	-	100	-	kΩ
Clamp Gate Low Input Voltage	V_{15l}	Clamp Comparators On	0.8	1.5	-	V
Clamp Gate High Input Voltage	V_{15h}	Clamp Comparators Off	-	1.5	2.0	V
Clamp Gate Low Input Current	I_{15l}	V_{15} = 0V	-5.0	-2.0	-	μA
Clamp Gate High Input Current	I_{15h}	V_{15} = 12V	-	0.01	1.0	μA
Blank Gate Low Input Voltage	V_{16l}	Blank Gate On	0.8	1.5	-	V
Blank Gate High Input Voltage	V_{16h}	Blank Gate Off	-	1.5	2.0	V
Blank Gate Low Input Current	I_{16l}	V_{16} = 0V	-5.0	-2.0	-	μA
Blank Gate High Input Current	I_{16h}	V_{16} = 12V	-	0.01	1.0	μA
Video Input bias Voltage	V_{bias}		1.6	1.9	2.2	V

Table 4. DC Electrical Characteristics (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Clamp Cap Charge Current	I_{clamp+}	Clamp Comparators On	0.45	0.75	1.05	mA
Output Clamp Cap Discharge Current	I_{clamp-}	Clamp Comparators Off	-1.05	-0.75	-0.45	mA
Video Output Low Voltage	V_{OL}	V_{25} = 0V	-	100	200	mV
Video Output High Voltage	V_{OH}	V_{25} = 10V	6.7	7.5	8.3	V
Video Black Level Output Voltage	V_{OBL}	V_{25} = 1V (5)	0.9	1.2	1.5	V
Video ΔBlack Level Output Voltage	ΔVo_{BL}	Between Any Two Amplifiers	-0.3	0	0.3	V
Video Output Blanked Voltage	V_{OB}	Blank Gate On	-	50	500	mV
Contrast/Drive Control Input Current	Iosd, Idrive Icon	Vcontrast = Vdrive: 0V to 4V	-	0.25	1	uA
Brightness Control Input Current	I_{25}	V_{25} = 0V to 4V	-	0.25	1	uA
Spot Killer Voltage	V_{spot}	V_{CC} Adjusted to Activate	8.0	10.4	11.2	V

AC Electrical Characteristics

T_A = 25 °C, $V_{CC1} = V_{CC2} = V_{CC3}$ = 12V; V_4 = 0; Vin = 0.56Vpp Manually adjust Video Output pins 18, 20 and 23 to 4V DC for the AC test (12) unless otherwise specified (14)

Table 5. AC Electrical Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Video Amplifier Gain	AV max	V13 = Vdrive = 4V,	15.5	17.5	19.5	dB
Contrast Attenuation 1	ΔAvc1	V13 = 2V	-8	-6	-4	dB
Contrast Attenuation 2	ΔAvc2	V13 = 0.25V	-	-38	-30	dB
Drive Attenuation1	ΔAvd1	Vdrive = 2V	-6	-4	-2	dB
Drive Attenuation 2	ΔAvd2	Vdrive = 0.25V	-13	-10	-7	dB
Absolute Gain Match	ΔA_V match	V13 = Vdrive = 4V (6)	-1	-	1	dB
Gain Change between Amplifiers	ΔA_V track	V13 = 4V to 2V (6,7)	-1	-	1	dB
Video Amplifier Distortion	THD	V0 = 1 V_{PP}, f = 19kHz	-	1	5	%
Video Amp Bandwidth (8,9)	f (-3dB)	V13 = 4V, Vdrive = 4V,	100	130	-	MHz
Video Output Rise Time (8)	tr (Video)	V0 = 4V_{PP}	-	2.2	3.5	ns
Video Output Fall Time (8)	tf (Video)	V0 = 4V_{PP}	-	3.0	5	ns
Video Amplifier 10kHz Isolation	Viso_10K	V13 = 4V (10)	-	-70	-45	dB

Table 5. AC Electrical Characteristics (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Video Amplifier 10MHz Isolation	Viso_10M	V13 = 4V (8,10)	-	-50	-35	dB
Blank Output Rise Time (8)	tr (Blank)	Blank Output = $1V_{PP}$	-	6	15	ns
Blank Output Fall Time (8)	tf (Blank)	Blank Output = $1V_{PP}$	-	7	20	ns
End of Blanking Propagation Delay	tr-prop (Blank)	Blank Output = $1V_{PP}$	-	16	40	ns
Start of Blanking Propagation Delay	tf-prop (Blank)	Blank Output = $1V_{PP}$	-	20	45	ns
Clamp Pulse Input Width	Wclamp		200	-	-	ns

OSD Electrical Characteristics

T_A = 25 °C; $V_{CC1} = V_{CC2} = V_{CC3}$ = 12V; V_{25} = 1V; $V_{13} = V1 = V2 = V3 = V_{14} = V_{16}$ = Vdrive = 4V; V_4 = 4V; V_{15} = 0V; unless otherwise specified

Table 6. OSD Electrical Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
OSD Input Low Input Voltage	V_{OSDI}		0.8	1.3	-	V
OSD Input High Input Voltage	V_{OSDh}		-	1.3	2.0	V
OSD Select Low Input Voltage	V_{4l}		0.8	1.6	-	V
OSD Select High Input Voltage	V_{4h}		-	1.6	2.0	V
OSD Select Low Input Current	I_{4l}	V4 = 0V	-10	-5	-	µA
OSD Select High Input Current	I_{4h}	V4 = 12V	-	0.01	0.2	µA
OSD Output Black Level	$\Delta V_{BLV - OSD}$	V25 = 1V	-	0.1	0.2	v
OSD Output Voltage	V_{OSD}	V14 = 4V, Vdrive = 2V	2.8	3.6	4.4	V_{PP}
OSD Output V_{PP} Attenuation	ΔV_{OSD_ATT}	V14 = 2V, Vdrive = 2V	30	50	70	%
Output Match between Channels	ΔV_{OSD}	V14 = 4V, Vdrive = 2V	-7	-	7	%
Video to OSD Switch Time (8)	t_r (OSD S)	V1 = V2 = V3 = V4 (13)	-	4	10	ns
OSD to Video SwitchTime (8)	t_f (OSD S)	V1 = V2 = V3 = V4 (13)	-	11	20	ns
Video to OSD Propagation Delay	t_r - pr (OSD S)	V13 = V14 = 4V	-	11	15	ns
OSD to Video Propagation Delay	t_f - pr (OSD S)	V13 = V14 = 4V	-	12	25	ns
OSD Rising Time	tr (OSD)	V15 = 4V	-	4	8	ns
OSD Falling Time	tf(OSD)	V15 = 4V	-	5	10	ns
OSD Rising Propogation Delay	tr_pr (OSD)	V15 = 4V	-	7	15	ns
OSD Falling Propogation Delay	tf_pr (OSD)	V15 = 4V	-	9	20	ns

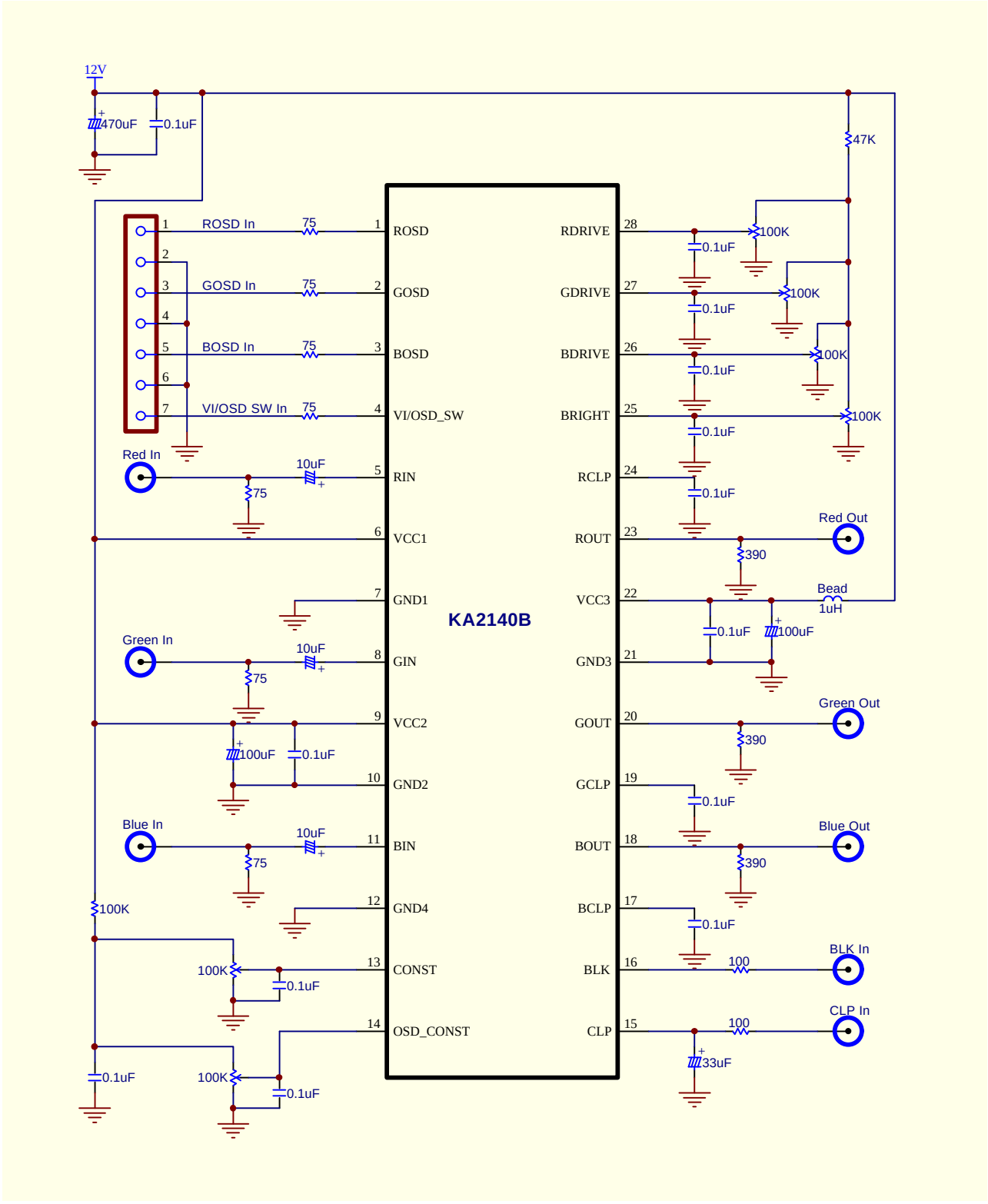
Table 6. OSD Electrical Characteristics (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Video/OSD 10kHz Isolation	Iiso10k (OSD)	V15 = 4V	-	-60	-35	dB
Video/OSD 10MHz Isolation	Iiso10M (OSD)	V15 = 4V	-	-60	-35	dB

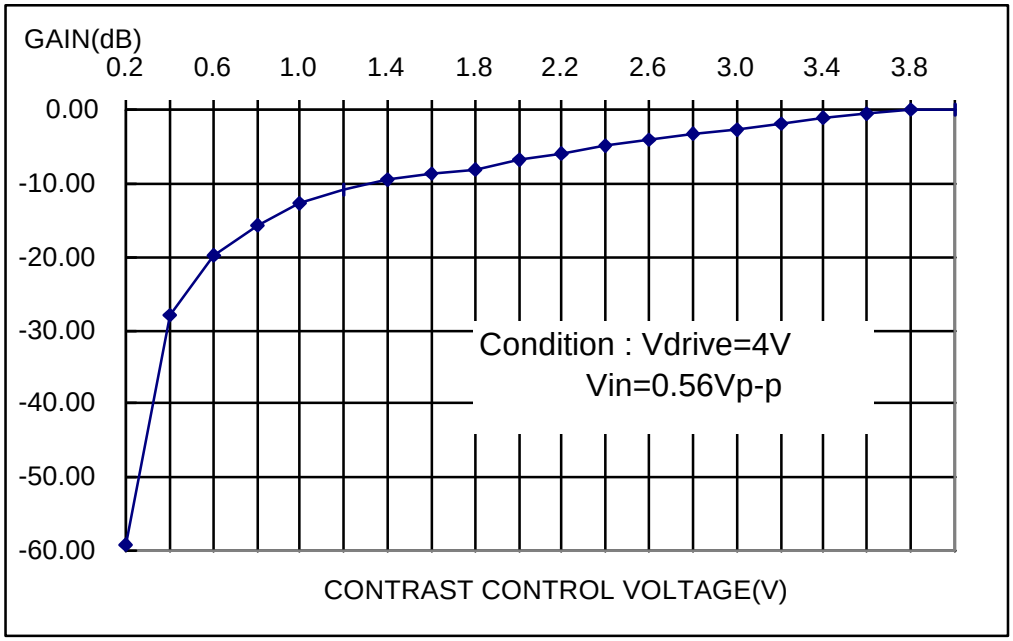
NOTES;

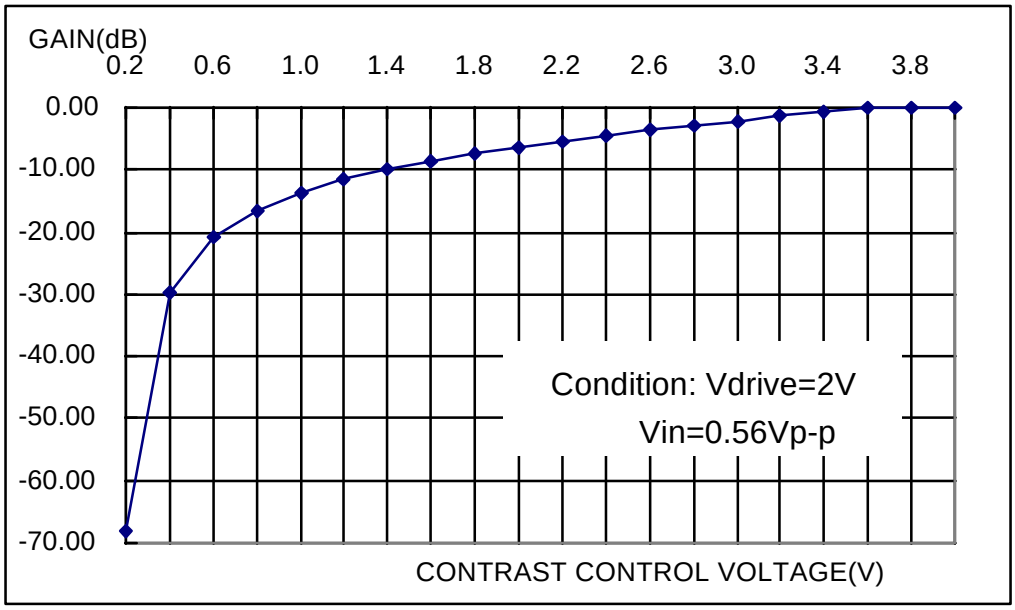
1. Absolute Maximum Ratings Indicate the limit beyond which damage to the device may occur.
2. Operating Ratings indicate conditions for which the device is functional but do not guarantee specific performance limits. For guaranteed specifications and test conditions, See the Electrical Characteristics. 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. V_{CC} supply pins 6, 9, and 22 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 RL = ∞ The supply current for V_{CC2} (pin 22) also depends on the output load.
5. Output voltage is dependent on the load resistor. Test circuit uses R_L = 390Ω
6. Measure gain difference between any two amplifiers V_{IN} = 560mV_{PP}.
7. ΔAv 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_{13}) at either 4V or 2V measured relative to an Avmax condition V_{13} = 4V. For example, at AV max 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_{13} = 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 PCBs.
9. Adjust input frequency from 10MHz (AV max 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 fin = 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 4V_{PP} the signal will swing between 2V DC and 6V DC.
13. When V1 = V2 = V3 = 0V and the video input is 0.7V, then tr (OSD) = 11ns and tf (OSD) = 4ns, The video Output wave form will be inverted from the one shown in the AC Test Circuit. Thus tr (OSD) is actually a fall time and t_f(OSD) 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

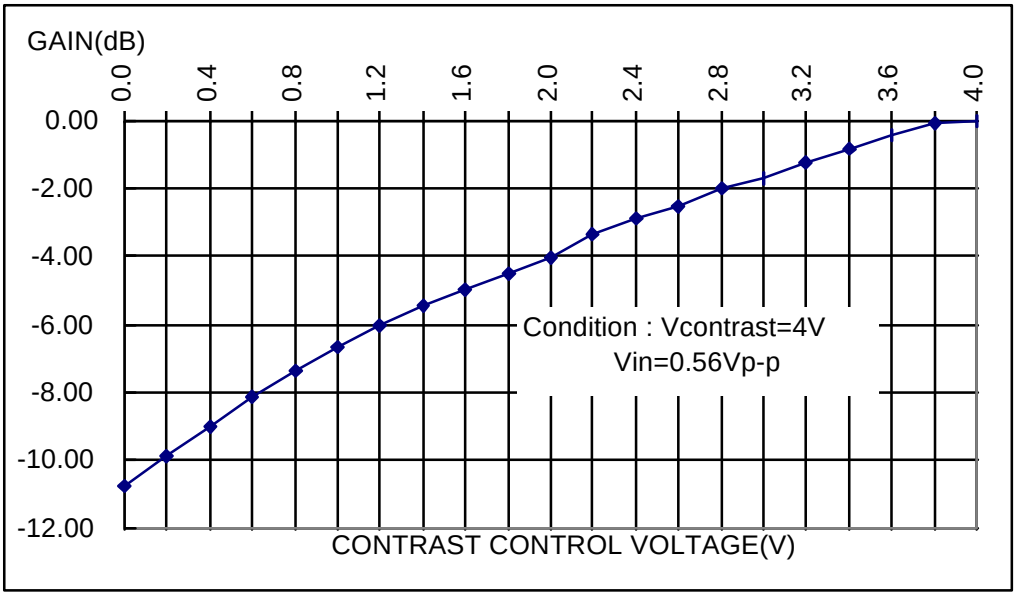


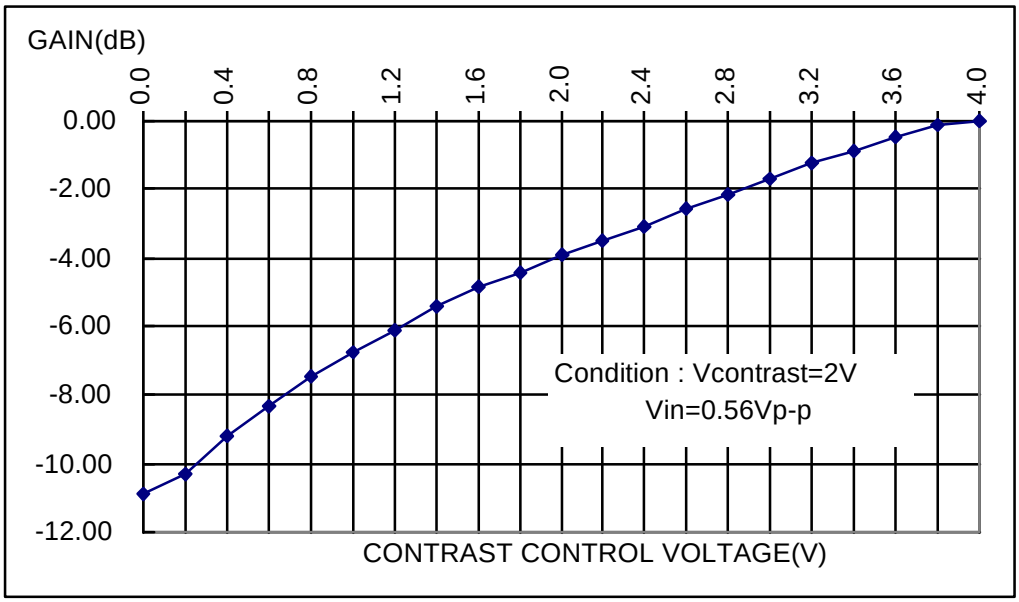
CONTRAST CONTROL CURVE



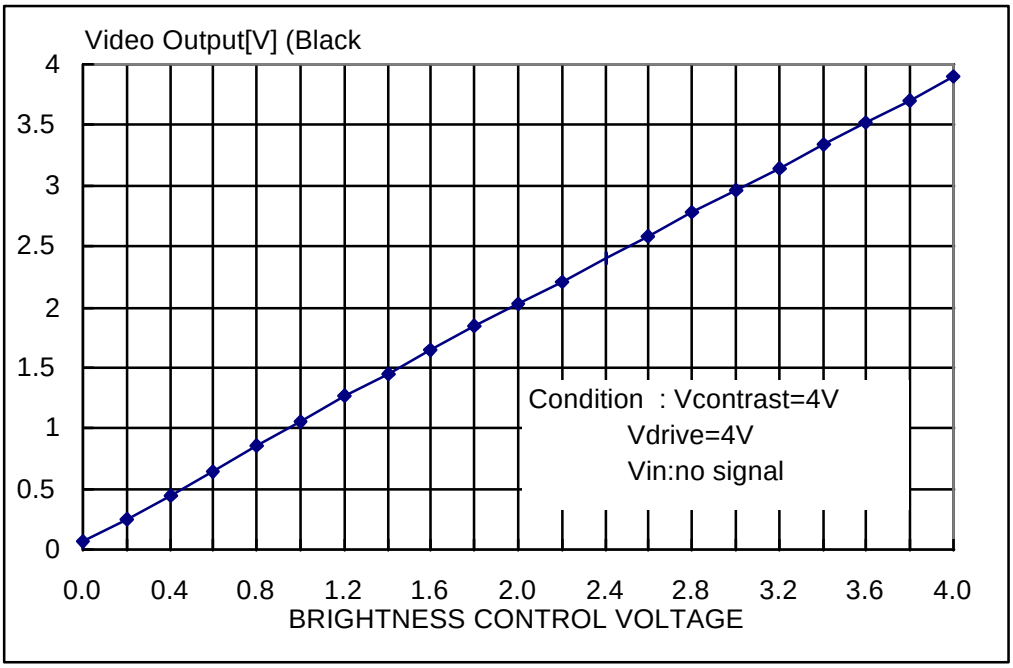


SUB CONTRAST CONTROL CURVE

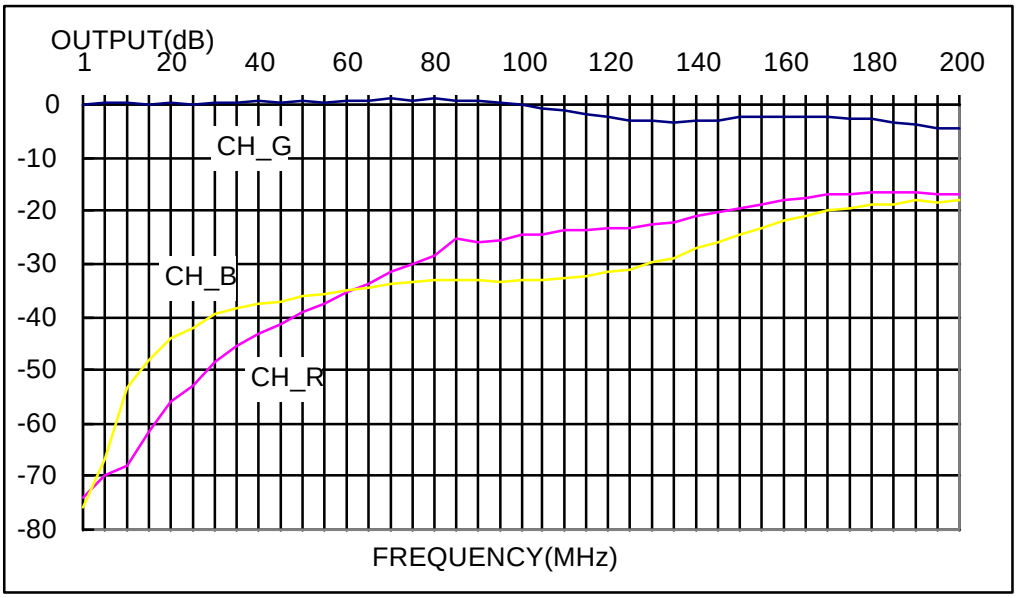




BRIGHTNESS CONTROL CURVE



CHANNEL CROSSTALK



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