TDA3563

NTSC Decoder With RGB Inputs

Product Specification

Linear Products

DESCRIPTION

The TDA3563 is a monolithic, integrated color decoder for the NTSC standard. It combines all functions required for the identification and demodulation of NTSC signals. Furthermore, it contains a luminance amplifier, and an RGB matrix and amplifier. These amplifiers supply signals up to 5.3V peak-to-peak (picture information) enabling direct drive of the output stages. The circuit also contains inputs for data insertion, analog as well as digital, which can be used for Teletext information, channel number display, etc.

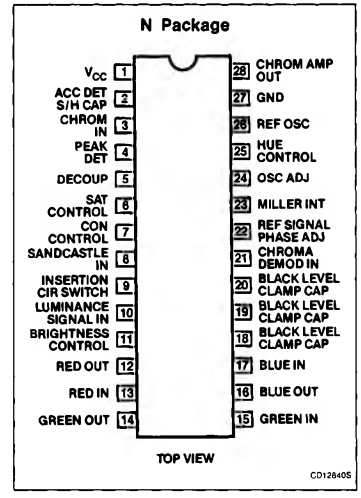
FEATURES

- **Single-chip chroma & luminance processor**
- **ACC with peak detector**
- **DC control settings**
- **External linear RGB inputs**
- **High level RGB outputs**
- **No black level disturbance when nonsync external RGB signals are available on the inputs**
- **Luminance signal with clamp**
- **Black current stabilizer**
- **On-chip hue control**

APPLICATIONS

- **Video monitors and displays**
- **Text display systems**
- **Television receivers**
- **Graphic systems**
- **Video processing**

PIN CONFIGURATION



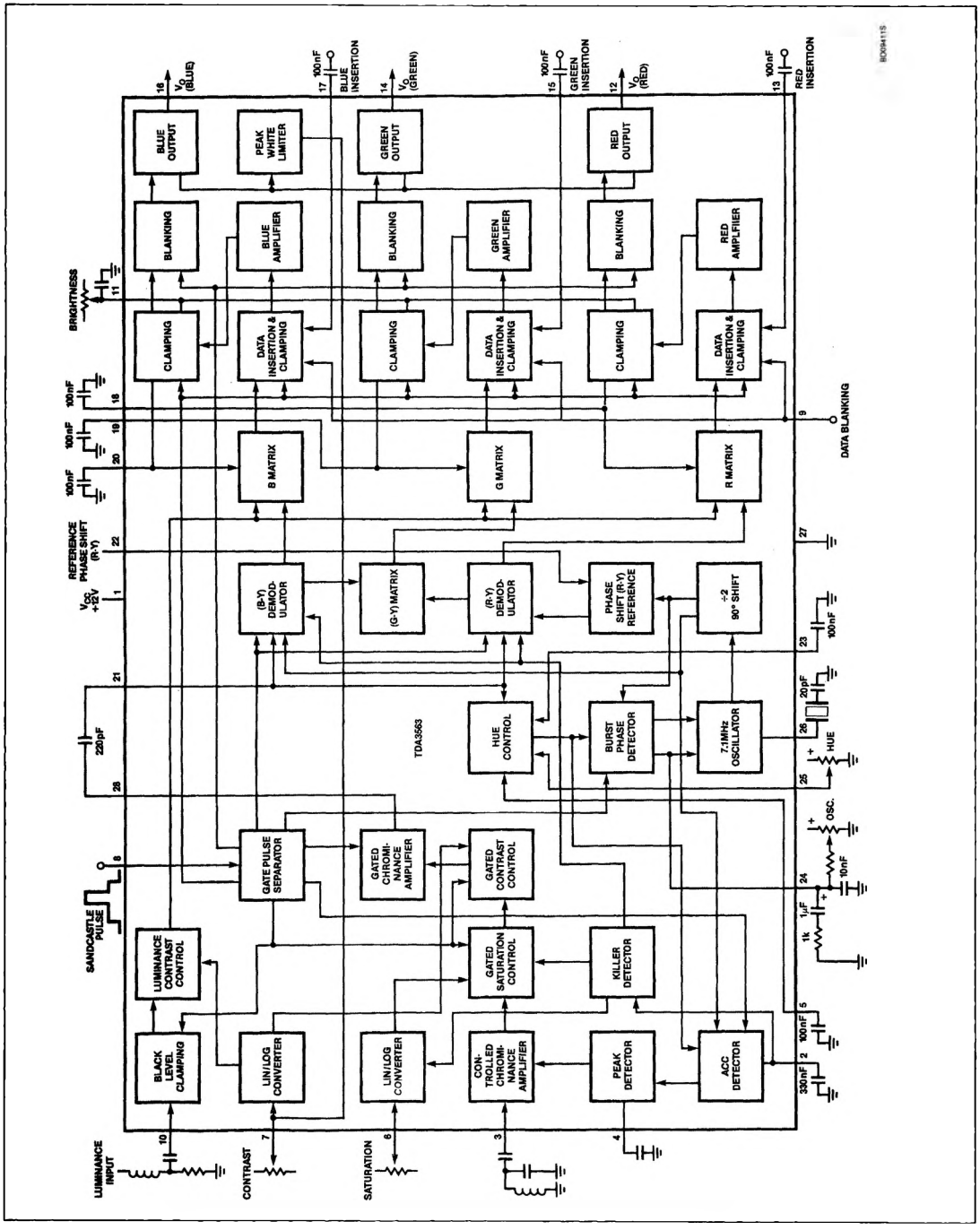
ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE
28-Pin Plastic DIP (SOT-117)	−25°C to +65°C	TDA3563N

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING	UNIT
$V_{CC} = V_{1-27}$	Supply voltage (Pin 1)	13.2	V
P_{TOT}	Total power dissipation	1.7	W
T_{STG}	Storage temperature range	−65 to +150	°C
T_A	Operating ambient temperature range	−25 to +65	°C
θ_{JA}	Thermal resistance from junction to ambient (in free-air)	50	°C/W

BLOCK DIAGRAM



DC AND AC ELECTRICAL CHARACTERISTICS $V_{CC} = V_{1-27} = 12V$; $T_A = 25°C$, unless otherwise specified.

SYMBOL	PARAMETER	LIMITS			UNIT
		Min	Typ	Max	
Supply (Pin 1)					
$V_{CC} = V_{1-27}$	Supply voltage	10	12	13.2	V
$I_{CC} = I_1$	Supply current		85	115	mA
P_{TOT}	Total power dissipation		1	1.4	W
Luminance amplifier					
$V_{10-27(P-P)}$	Input voltage[1] (peak-to-peak value)		0.45		V
	Contrast control range (see Figure 1)	−17		+3	dB
	Control voltage for an attenuation of 40dB		1.2		V
I_7	Contrast control input current			15	μA
Chrominance amplifier					
$V_{3-27(P-P)}$	Input voltage[2] (peak-to-peak value)	55	550	1100	mV
	ACC control range	30			dB
	Change of the burst signal at the output over the whole control range			1	dB
V_{28-27}	Output voltage[3] (peak-to-peak value) at a burst signal of 0.3V peak-to-peak		0.15		V
V_{28-27}	Maximum output voltage range (peak-to-peak value); $R_L = 2k\Omega$		4		V
α_{28-3}	Frequency response between 0 and 5MHz			−2	dB
	Saturation control range (see Figure 2)	50			dB
I_6	Saturation control input current			20	μA
$\lvert Z_{28-27} \rvert$	Output impedance of chrominance amplifier		25		Ω
I_{28}	Output current			10	mA
Reference part					
	Phase-locked loop				
Δf	catching range[4]	500	700		Hz
$\Delta\varphi$	phase shift[4, 5]			5	deg
	Oscillator				
TC_{OSC}	temperature coefficient of oscillator frequency[4]		−1.5		Hz/°C
Δf_{OSC}	frequency variation when supply voltage increases from 10V to 13.2V[4]		40		Hz
R_{26-27}	input resistance (Pin 26)		400		Ω
C_{26-27}	input capacitance (Pin 26)			10	pF
	ACC generation (Pin 2)				
V_{2-27}	control voltage at nominal input signal		5.0		V
V_{2-27}	control voltage without chrominance input		2.7		V
V_{2-27}	color-off voltage		3.0		V
V_{2-27}	color-on voltage		3.3		V
	HUE control				
	control range	±50			deg

DC AND AC ELECTRICAL CHARACTERISTICS (Continued) $V_{CC} = V_{1-27} = 12V$; $T_A = 25°C$, unless otherwise specified.

SYMBOL	PARAMETER	LIMITS			UNIT
		Min	Typ	Max	
Demodulator part					
$V_{21-27(P-P)}$	Input burst signal amplitude (peak-to-peak value)		300		mV
	Ratio for demodulated signals for equal input signal amplitudes				
$\frac{V_{16-27}}{V_{12-27}}$	(B-Y)/(R-Y)		1.06± 10%		
$\frac{V_{14-27}}{V_{12-27}}$	(G-Y)/(R-Y); no (B-Y) signal		−0.27± 20%		
$\frac{V_{14-27}}{V_{16-27}}$	(G-Y)/(B-Y); no (R-Y) signal		−0.2± 20%		
	Frequency response between 0 and 1MHz			−3	dB
RGB matrix and amplifiers					
$V_{12, 14, 16-27}$	Output voltage[3] (peak-to-peak value) at nominal luminance/contrast (black-to-white)	4.5	5.3	6.3	V
$V_{12, 14, 16-27}$	Maximum peak-white level[6]	9.0	9.3	9.6	V
$I_{12, 14, 16}$	Maximum output current			10	mA
	Output black level voltage for brightness control of 2V		2.7		V
	Brightness control voltage range		see Figure 3		
I_{11}	Brightness control input current			50	μA
	Relative spread between the R, G, and B output signals			10	%
	Blanking level at the RGB outputs	1.9	2.1	2.3	V
$\frac{\Delta V_{BL}}{V_{BL}} \times \frac{V_{CC}}{\Delta V_{CC}}$	Tracking of output black level with supply voltage		1.1		
$\lvert Z_{12, 14, 16-27} \rvert$	Output impedance of RGB outputs		50		Ω
	Frequency response of total luminance and RGB amplifier circuits for f = 0 to 5MHz			−3	dB
Data insertion					
$V_{13, 15, 17-27(P-P)}$	Input signals (peak-to-peak value) for an RGB output voltage of 5V (peak-to-peak)	0.9	1	1.1	V
Data blanking (Pin 9)					
V_{9-27}	Input voltage for no data insertion			0.3	V
V_{9-27}	Input voltage for data insertion	0.9			V
$V_{9-27(m)}$	Maximum input voltage			2	V
t_D	Delay of data blanking			20	ns
I_9	Input current			35	μA

DC AND AC ELECTRICAL CHARACTERISTICS (Continued) $V_{CC} = V_{1-27} = 12V$; $T_A = 25°C$, unless otherwise specified.

SYMBOL	PARAMETER	LIMITS			UNIT
		Min	Typ	Max	
Sandcastle input (Pin 8)					
V_{8-27}	Level at which the RGB blanking is activated	1	1.5	2	V
V_{8-27}	Level at which burst gating and clamping pulse are separated	6.5	7.0	7.5	V
t_D	Delay between black level clamping and burst gating pulse		0.4		µs
	Input current				
$-I_8$	at $V_{8-27} = 0$ to 1V			1	mA
I_8	at $V_{8-27} = 1$ to 8.5V		20		µA
I_8	at $V_{8-27} = 8.5$ to 12V			2	mA

NOTES:
1. Signal with negative-going sync; amplitude includes sync amplitude.
2. Indicated is a signal for a color bar with 75% saturation; chrominance to burst ratio is 2.2:1.
3. At nominal contrast and saturation. Nominal contrast is specified as the maximum contrast −3dB and nominal saturation as the maximum saturation −6dB.
4. All frequency variations are referred to 3.58MHz carrier frequency.
5. For ±400Hz deviation of the oscillator frequency.
6. If the typical voltage for this white level is exceeded, the output voltage is reduced by discharging the capacitor at Pin 7 (contrast control); discharge current is 1.5mA.

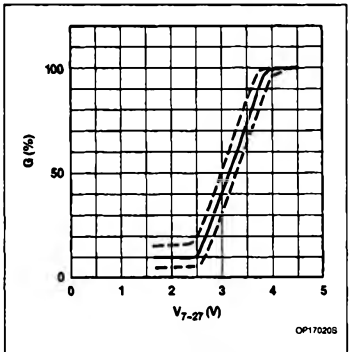


Figure 1. Contrast Control Voltage Range

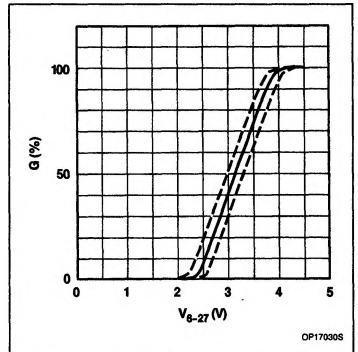


Figure 2. Saturation Control Voltage Range

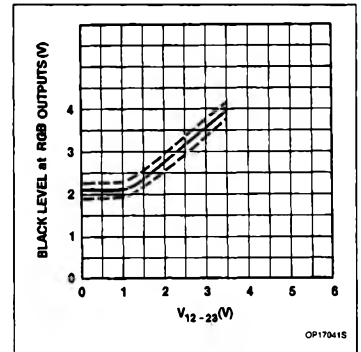


Figure 3. Brightness Control Voltage Range

APPLICATION INFORMATION

The function is described beside the corresponding pin number.

1 +12V power supply — The circuit gives good operation in a supply voltage range between 8 and 13.2V provided that the supply voltage for the controls is equal to the supply voltage of the TDA3563. All signal and control levels have a linear dependency on the supply voltage. The current consumed by the IC at +12V is typically 85mA. It is linearly dependent on the supply voltage.

2 Control voltage for identification — The output pulses of the ACC detector are detected with a sample-and-hold circuit to obtain information for the color-killer. The output is available at Pin 2.

3 Chrominance input — The chrominance signal must be AC-coupled to the input. Its amplitude must be between 55 and 1100mV$_{P-P}$ (25 to 500mV$_{P-P}$ burst signal). All figures for the chrominance signals are based on a color bar signal with 75% saturation, if the burst-to-chrominance ratio of the input is 1:2.2.

4 Control voltage ACC detector — The shifted burst signal is synchronously demodulated in a separate ACC detector to generate the ACC voltage. The output pulses of this detector are peak detected to control the gain of the chrominance amplifier, thus preventing blooming-up of the color during weak signal reception.

5 Decoupling of the 90° phase shift circuit — A control circuit is required in the 90° phase shift circuit to make the chrominance voltage independent of the hue setting. The control circuit is decoupled by a capacitor at this pin.

6 Saturation control — The saturation control range is in in excess of 50dB. The control voltage range is 2 to 4V. Saturation control is a linear function of the control voltage.

When the color-killer is active, the saturation control voltage is reduced to a low level if the resistance of the external control network is sufficiently high. Then the chrominance amplifier supplies no signal to the demodulator. Color switch-on can be delayed by proper choice of the time constant for the saturation control setting circuit.

When the saturation control pin is connected to the power supply, the color-killer circuit is overruled so that the color signal is visible on the screen. In this way it is possible to adjust the oscillator frequency without using a frequency counter (see also Pins 24 and 26).

7 Contrast control — The contrast control range is 20dB for a control voltage change from +2V to +4V. Contrast control is a linear function of the control voltage. The output signal is suppressed when the control voltage is 1V or less. If one or more output signals surpasses the level of 9V, the peak white limiter circuit becomes active and reduces the output signals via the contrast control by discharging a 10μF capacitor via an internal current sink.

8 Sandcastle and vertical blanking input — The output signals are blanked if the amplitude of the pulse is between 2V and 6.5V. The burst gate and clamping circuits are activated if the input pulse exceeds a level of 7.5V. The higher part of the sandcastle pulse should start just after the sync pulse to prevent clamping of the video signal on the sync pulse. The duration should be about 4μs for proper ACC operation.

9 Video-data switching — The insertion circuit is activated by means of this input by an input pulse between 1 and 2V. In that condition, the internal RGB signals are switched off and the inserted signals are supplied to the output amplifiers. If only normal operation is wanted, this pin should be connected to ground (Pin 27).

The switching times are very short (< 20ns) to avoid colored edges of the inserted signals on the screen.

10 Luminance signal input — The input signal should have a peak-to-peak amplitude of 0.45V (peak white to sync) to obtain a black-white output signal of 5.3V at nominal contrast. It must be AC-coupled to the input by a capacitor of about 22nF. The signal is clamped at the input to an internal reference voltage. The 1kΩ luminance delay line can be applied because the luminance impedance is very high. Consequently, the charging and discharging currents of the coupling capacitor are very small and do not influence the signal level at the input noticeably. Additionally, the coupling capacitor value may be small.

11 Brightness control — The black level of the RGB outputs can be set by the voltage on this pin (see Figure 3). The minimum black level is identical to the blanking level. The black level can be set higher than 4V; however, the available output signal amplitude is reduced (see also Pin 7). Brightness control also operates on the black level of the inserted signals.

12, 14, 16 RGB outputs — The output circuits for red, green, and blue are identical. Output signals are 5.3V (black-white) for nominal input signals and control settings. The black levels of the three outputs have the same value. The blanking level at the outputs is 2.1V. The peak white level is limited to 9V. When this level is exceeded, the output signal amplitude is reduced via the contrast control (see also Pin 7).

13, 15, 17 Inputs for external RGB signals — The external signals must be AC-coupled to the inputs via a coupling capacitor of about 100nF. Source impedance should not exceed 150Ω. The input signal required for a 5V$_{P-P}$ output signal is 1V$_{P-P}$. At the RGB outputs the black level of the inserted signal is identical to that of normal RGB signals. When these inputs are not used, the coupling capacitors have to be connected to ground (Pin 27).

18, 19, 20 Black level clamp capacitors — The black level clamp capacitors for the three channels are connected to these pins. The value of each capacitor should be about 100nF.

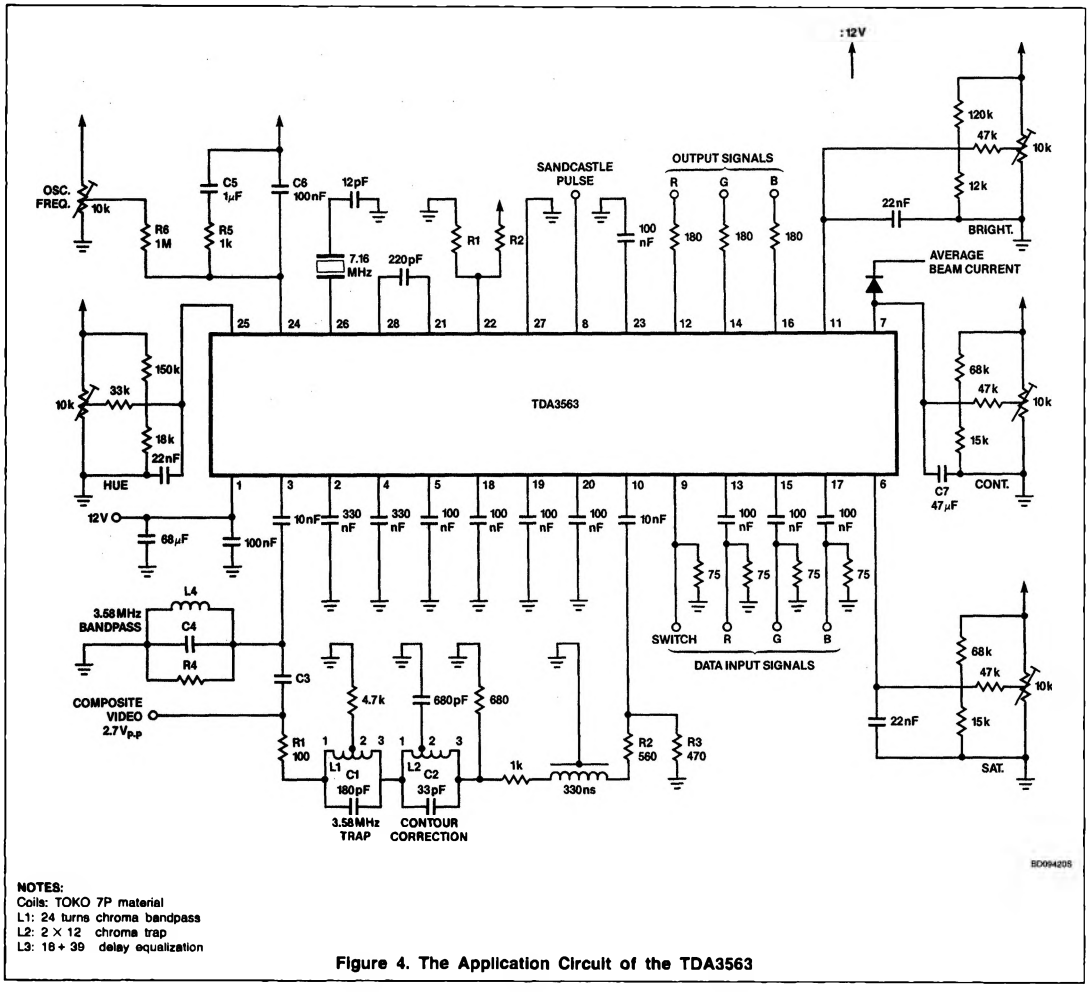
21, 22 Demodulator input and reference signal phase adjustment — The (R-Y) and (B-Y) demodulator inputs are internally connected (Pin 21). The phase angle between the two reference carriers is 115°. At the nominal hue adjustment, the (B-Y) signal is demodulated with a difference of 0°. The phase shift of 115° can be changing the voltage at Pin 22. The gain at the two demodulators is identical. The (G-Y) is composed of −0.27(R-Y) −0.22(B-Y).

23, 25 Hue control — The hue control is obtained by changing the phase of the input signal of the burst phase detector with respect to the demodulator input signal. This phase shift is obtained by generating a 90° shifted sine wave via a Miller integrator (biased via Pin 23) which is mixed with the original burst signal.

24, 26 Reference oscillator — As the burst phase detector has an asymmetrical output, the oscillator can be adjusted by changing the voltage of the output (Pin 24) via a high-ohmic resistor. The capacitor in series with the oscillator crystal must then have a fixed value. When Pin 6 (saturation control) is connected to the positive supply line, the burst phase detector is based in its nominal position and the color-killer is overruled. This position can, therefore, be used for the adjustment of the oscillator.

27 Ground

28 Output of the chrominance amplifier — The (R-Y) and (B-Y) demodulator input (Pin 21) is AC-coupled to this output.



NOTES:
Coils: TOKO 7P material
L1: 24 turns chroma bandpass
L2: 2 × 12 chroma trap
L3: 18 + 39 delay equalization

Figure 4. The Application Circuit of the TDA3563