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NTE7137
Integrated Circuit
Advanced Monitor Video Controller

Description:

The NTE7137 is a monolithic integrated RGB amplifier in a 20–Lead DIP type package designed for color monitor systems with super VGA performance. It is intended for DC or AC coupling of the color signals to the cathodes of a CRT.

Features:

- Fully DC Controllable
- 3 Separate Video Channels
- Input Black Level Clamping
- White Level Adjustment for 2 Channels Only
- Brightness Control with Correct Grey Scale Tracking
- Contrast Control for All 3 Channels Simultaneously
- Cathode Feedback to Internal Reference for Cut–Off Control, Which Allows Unstabilized Video Supply Voltage
- Current Outputs for RGB Signal Currents
- RGB Voltage Outputs to External Peaking Circuits
- Blanking and Switch–Off Input for Screen Protection
- Sync On Green Operation Possible

Absolute Maximum Ratings:

Supply Voltage (Pin7), V_P . . . . . 0 to +8.8V
Input Voltage Range (Pin2, Pin5, Pin8), V_i . . . . . –0.1 to V_P
External DC Voltage Ranges, V_{ext}
  Pin14, Pin17, Pin14 . . . . . –0.1 to V_P
  Pin13, Pin16, Pin19 . . . . . No External Voltages
  Pin1, Pin3, Pin6, Pin11 . . . . . –0.1 to V_P
  Pin9 . . . . . –0.1 to V_P+0.7V
  Pin10 . . . . . –0.1 to V_P+0.7V0
Average Output Current (Pin14, Pin17, Pin20), I_o . . . . . 0 to 50mA
Peak Output Current (Pin14, Pin17, Pin20), I_M . . . . . 0 to 100mA
Total Power Dissipation, P_{tot} 1200mW
Electrostatic Handling for All Pins (Note 1), V_{esd} . . . . . ±500V
Operating Junction Temperature Range, T_J . . . . . –25° to +150°C
Operating Ambient Temperatrure Range, T_A . . . . . 0° to +70°C
Storage Temperature Range, T_{stg} . . . . . –25° to +150°C
Thermal Resistance, Junction–to–Ambient (In Free Air), R_{thJA} 65K/W

Note 1. Equivalent to discharging a 200pF capacitor through a 0Ω series resistor.

Electrical Characteristics: (V_P = 8V, T_A = +25°C, Note 2 unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply						
Supply Voltage Range (Pin7)	V_P		7.2	8.0	8.8	V
Supply Current (Pin7)	I_P		–	46	56	mA
Video Signal Inputs						
Input Voltage (Black–to–White, Pin2, Pin5, Pin8)	$V_{I(b-w)}$		–	0.7	1.0	V
DC Current	$I_{2, 5, 8}$	No Clamping	–0.1	–	+0.1	µA
		During Clamping	±50	–	–	µA
Brightness Control						
Input Voltage Range	V_1	Note 3	1.0	–	6.0	V
Input Resistance to V_{N1}	R_1		–	50	–	kΩ
Black Level Voltage Change at Nominal Gain (Pin19, Pin16, Pin13)	ΔV_{bl1}	V_1 = 1V, $V_{3, 11}$ Open–Circuit	–	–80	–	mV
		V_1 = 6V, $V_{3, 11}$ Open–Circuit	–	240	–	mV
Input Voltage for Nominal Brightness	V_{N1}	Pin1 Open–Circuit	–	2.25	–	V
Contrast Control (Note 4)						
Input Voltage Range	V_6	Note 3	1.0	–	6.0	V
Current	I_6		–5	–1	–	µA
Contrast Relative to Nominal Contrast	C_v	V_1 = 6V, $V_{3, 11}$ Open–Circuit	–	3	–	dB
		V_1 = 4.5V, $V_{3, 11}$ Open–Circuit	–	0	–	dB
		V_1 = 1V, $V_{3, 11}$ Open–Circuit	–	–20	–	dB
Tracking of RGB Signals	T_r	2.5V < V_6 < 6V, $V_{3, 11}$ Open Circuit	–	0	0.5	dB
Gain Control						
Input Voltage Range	$V_{3, 11}$	Note 3	1.0	–	6.0	V
Input Resistance Against $V_{N3, N11}$	$R_{3, 11}$		–	43	–	kΩ
Gain Relative to Nominal Gain	G_v	V_6 = 4.5V, $V_{3, 11}$ = 6V	–	2	–	dB
		V_6 = 4.5V, $V_{3, 11}$ = 1V	–	–4	–	dB
Input Voltage for Nominal Gain	$V_{N3, N11}$	Pin3, Pin11 Open Circuit	–	4.6	–	V
Feedback Input						
Input Voltage Range	$V_{3, 11}$	Note 5	tbn	5.8	tbn	V
Output Current	$I_{18, 15, 12}$	During Output Clamping	–1.5	–1.0	–0.1	µA
Voltage Outputs (Pin19, Pin16, Pin13)						
Signal Output Voltage (Black–to–White Value)	$V_{O(b-w)}$	$V_{3, 11}$ Open, V_6 = 4.5V, $V_{I(b-w)}$ = 0.7V	–	0.8	–	V
Black Level Voltage	V_{bl}	During Output Clamping, Depending on Black Level Adjustment, Note 6	0.3	–	1.0	V
		During Switch–Off	–	0.1	0.3	V
Signal–to–Noise Ratio	S/N		–	–	44	dB

Note 2. All voltages measured to GND (Pin4).

Note 3. Typical range is 1 to 6V, the range can be increased (e.g. 0 to 7V) to slightly increase the control range.

Note 4. Open contrast control pin leads to undefined contrast setting.

Note 5. The internal reference voltage can be measured at Pin18, Pin15, and Pin12 during output clamping in closed feedback loop.

Note 6. Minimum guaranteed control range, the typical minimum black level voltage is 0.1V.

Electrical Characteristics (Cont'd): (V_P = 8V, T_A = +25°C, Note 2 unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Frequency Response at Voltage Outputs						
Gain Decreases by Frequency Response at Pin19, Pin16, Pin13	G_{vf}	70MHz	–	–	–3	dB
Rise Time at Voltage Output (Pin19, Pin16, Pin13)	t_{rO}	10% to 90% Amplitude, Input Rise Time = 1ns	–	4.5	5.0	ns
Current Outputs (Pin20, Pin17, Pin14)						
Signal Current (Black–to–White)	$I_{O(b–w)}$		–	50	–	mA
		With Peaking, Note 7	–	–	100	mA
HF Saturation of Output Transistors	$V_{20–19, 17–16, 14.13}$	I_O = 50mA	–	–	2.0	V
		I_O = 100mA	–	–	2.2	V
Threshold Voltages (Note 8)						
Threshold for Horizontal Blanking (Blanking, Output Clamping)	V_9		1.2	1.4	1.6	V
Threshold for Switch–Off (Blanking, Minimum Black Level, No Output Clamping)			5.8	6.5	6.8	V
Input Resistance Referenced to GND	R_g		50	80	110	kΩ
Delay Between Horizontal Blanking Input and Output Signal Blanking	t_{d9}		–	35	60	ns
Threshold for Vertical Blanking (Blanking, No Input Clamping)	V_{10}		1.2	3.0	3.5	V
Threshold for Clamping (Input Clamping, No Blanking)			2.6	3.0	3.5	V
Input Current	I_{10}		–3	–1	–	µA
Rise and Fall Time for Clamping Pulse	$t_{r, f10}$	Transition 1 to 3.5V	–	–	75	ns/V
Clamping Pulse Width	t_{w10}	V_{10} = 3V	0.6	–	–	µs
Delay Between Vertical Blanking Input and Output Signal Blanking	t_{d10}		–	300	–	ns

Note 2. All voltages measured to GND (Pin4).

Note 7. The external RC combination at Pin19, Pin16 and Pin13 enables peak currents during transients.

Note 8. The internal threshold voltages are derived from an internally stabilized voltage. The internal pulses are generated if the input pulses are higher than the thresholds.

Functional Description:

RGB input signals ($0.7V_{P–P}$) are capacitively coupled into the NTE7137 (Pin2, Pin5, and Pin8) from a low ohmic source and are clamped to an internal DC voltage (artificial balck level). Composite signals will not disturb normal operations because an internal clipping circuit cuts all signal parts below black level. Channes 1 and 3 have a maximum total voltage gain of 6dB (maximum contrast and maximum individual channel gain), Channel 2 of 4dB (maximum contrast and nominal channel gain). With the nominal channel gain of 1dB and nominal contrast setting the nominal black–to–white output amplitude is $0.8V_{P–P}$.

DC voltages are used for brightness, contrast and gain control. *Brightness control* yeilds a simultaneous signal black level shift of the three channels relative to a reference black level. For nominal brightness (Pin1 open–circuit) the signal black level is equal to the reference black level.

Contrast control is achieved by a voltage at Pin6 and affects the three channels simultaneously.

To provide the correct white point, an individual *gain control* (Pin3 and Pin11) adjusts the signals of Channels 1 and 3 compared to the reference Channel 2. Gain setting affects contrast and brightness to achieve correct grey scale tracking.

Each *output stage* provides a current output (Pin20, Pin17 and Pin14) and a voltage output (Pin19, Pin16 and Pin13). External cascode transistors reduce power consumption of the IC and prevent breakdown of the output transistors. Signal output currents and peaking characteristics are determined by external components at the voltage outputs and the video supply.

The three channels have separate internal feedback loops which ensure large signal linearity and marginal signal distortion in spite of output transistor thermal V_{BE} variation.

The *clamping pulse* (Pin10) is used for *input clamping* only. The input signals have to be at black level during the clamping pulse and are clamped to an internal artificial black level. The coupling capacitors are used in this way for black level storage. Because the threshold for the clamping pulse is higher than that for vertical blanking (Pin10) the rise and fall times of the clamping pulse have to be faqster than 75ns/V (1V to 3.5V).

The *vertical blanking pulse* will be detected if the input voltage (Pin10) is higher than the threshold voltage for approximately 300ns but does not exceed the threshold for the clamping pulse in the time between. During the vertical blanking pulse the input clamping is disabled to avoid misclamping in the event of composite input signals. The input signal is blanked and the artificial black level is inserted instead. Additionally the brightness is internally set to its nominal value, thus the output signal is at reference black levels. The DC value of the reference black level will be adjusted by cut–off stabilization.

During *horizontal blanking* (Pin9) the output signal is set to reference black level as previously described and *output clamping* is activated. If the voltage at Pin9 exceeds the *switch off* threshold the signal is blanked and switched to ultra black level for screen protection and spot suppression during V–flyback. Ultra black level is the lowest possible output voltage (at voltage outputs) and does not depend on cut–off stabilization.

For *cut–off stabilization* (DC coupling to the CRT) respectively *black level stabilization* (AC couplking) the video signal at the cathode or the coupling capacitor is divided by an adjustable voltage divider and fed to the feedback inputs (Pin18, Pin15 and Pin12). During horizontal blanking time this signal is compared with an internal DC voltage of approzimately 5.8V. Any difference will lead to a reference black level correction by charging or discharging the integrated capacitor which stores the reference black level information between the horizontal blanking pulses.

Pin Connection Diagram