

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	o V _P
External DC Voltage Ranges, V _{ext}	
Pin14, Pin17, Pin14 –0.1 t	
Pin13, Pin16, Pin19	
Pin1, Pin3, Pin6, Pin11	
Pin9	
Pin10	
Average Output Current (Pin14, Pin17, Pin20), I _o	
Peak Output Current (Pin14, Pin17, Pin20), I _M 0 to 10	
Total Power Dissipation, P _{tot})mW
Electrostatic Handling for All Pins (Note 1), V _{esd} ±5	500V
Operating Junction Temperature Range, T _J	50°C
Operating Ambient Temperatrure Range, T _A	70°C
Storage Temperature Range, T _{stq} –25° to +15	50°C
Thermal Resistance, Junction–to–Ambient (In Free Air), R _{thJA}	

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

<u>Electrical Characteristics:</u> $(V_P = 8V, T_A = +25^{\circ}C, Note 2 unless otherwise specified)$

Parameter	Symbol	Test Conditions	Min	Тур	Max	Unit
Supply	1					
Supply Voltage Range (Pin7)	V_{P}		7.2	8.0	8.8	V
Supply Current (Pin7)	Ι _Ρ		_	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	μΑ
		During Clamping	±50	_	-	μΑ
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)	1					
Input Voltage Range	V ₆	Note 3	1.0	_	6.0	V
Current	I ₆		- 5	– 1	-	μΑ
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		0, 11	<u> </u>			
Input Voltage Range	V _{3, 11}	Note 3	1.0	I –	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	$V_6 = 4.5V, V_{3, 11} = 1V$	_	-4	_	dB
Input Voltage for Nominal Gain	V _{N3, N11}	Pin3, Pin11 Open Circuit	_	4.6	_	V
Feedback Input	140, 1411	<u>'</u>	<u> </u>			
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)	10, 10, 12					•
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.

<u>Electrical Characteristics (Cont'd)</u>: $(V_P = 8V, T_A = +25^{\circ}C, Note 2 unless otherwise specified)$

Parameter	Symbol	Test Conditions	Min	Тур	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	Rg		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	-	μΑ
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 approximately 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 Brightness Control 1 20 Current Output Ch1 Signal Input Ch1 2 19 Voltage Output Ch1 Gain Control Ch1 3 18 Feedback Ch1 GND 4 17 Current Output Ch2 Signal Input Ch2 5 16 Voltage Output Ch2 Contrast Control 6 15 Feedback Ch2 V_P 7 14 Current Output Ch3 13 Voltage Output Ch3 Signal Input Ch3 8 Horizontal Blanking, Swith Off 9 12 Feedback Ch3 Input Clamping, Vertical Blanking 10 11 Gain Control Ch3

