SECAM DECODER

GENERAL DESCRIPTION

The TDA8490 is a monolithic integrated SECAM decoder. This circuit is intended to be used in conjunction with TDA8390 or TDA8461 (PAL decoder), TDA8451 (delay) and TDA8452 (filter). In this application the TDA8490 is placed in parallel with the demodulation circuit of the PAL decoder.

Features

- Limiter input for chrominance signal
- SECAM demodulator
- Clamp circuits and de-emphasis for colour difference signals
- Sandcastle pulse detector
- Identification circuit for horizontal and vertical SECAM identification

QUICK REFERENCE DATA

parameter	conditions	symbol	min.	typ.	max.	unit
Supply voltage		$V_P = V_{9-1}$	10,8	12,0	13,2	V
Supply current		$I_P = I_9$	40	55	70	mA
Chrominance amplifier and demodulator						
Input signal (peak-to-peak value)	SECAM with correct limiting	$V_{3-1(p-p)}$	15	100	300	mV
R-Y and B-Y output						
R-Y output signal amplitude (peak-to-peak value)	pin 12	$V_{12-1(p-p)}$	1,01	1,26	1,51	V
B-Y output signal amplitude (peak-to-peak value)	pin 11	$V_{11-1(p-p)}$	1,28	1,60	1,92	V
Identification						
Input voltage for line identification	pin 4	V_{4-1}	4,1	–	13,2	V
Input voltage for frame identification	pin 4	V_{4-1}	0	–	2,9	V
Switching level for line/frame identification	pin 4	V_{4-1}	3,0	3,5	4,0	V
Sandcastle detector and clamp pulse generator						
Frame blanking detection level		V_{7-1}	1,0	1,5	2,0	V
Line blanking detection level		V_{7-1}	3,0	3,5	4,0	V
Burst gate detection level		V_{7-1}	6,5	7,0	7,5	V

PACKAGE OUTLINE

18-lead DIL; plastic, with internal heat spreader (SOT102).

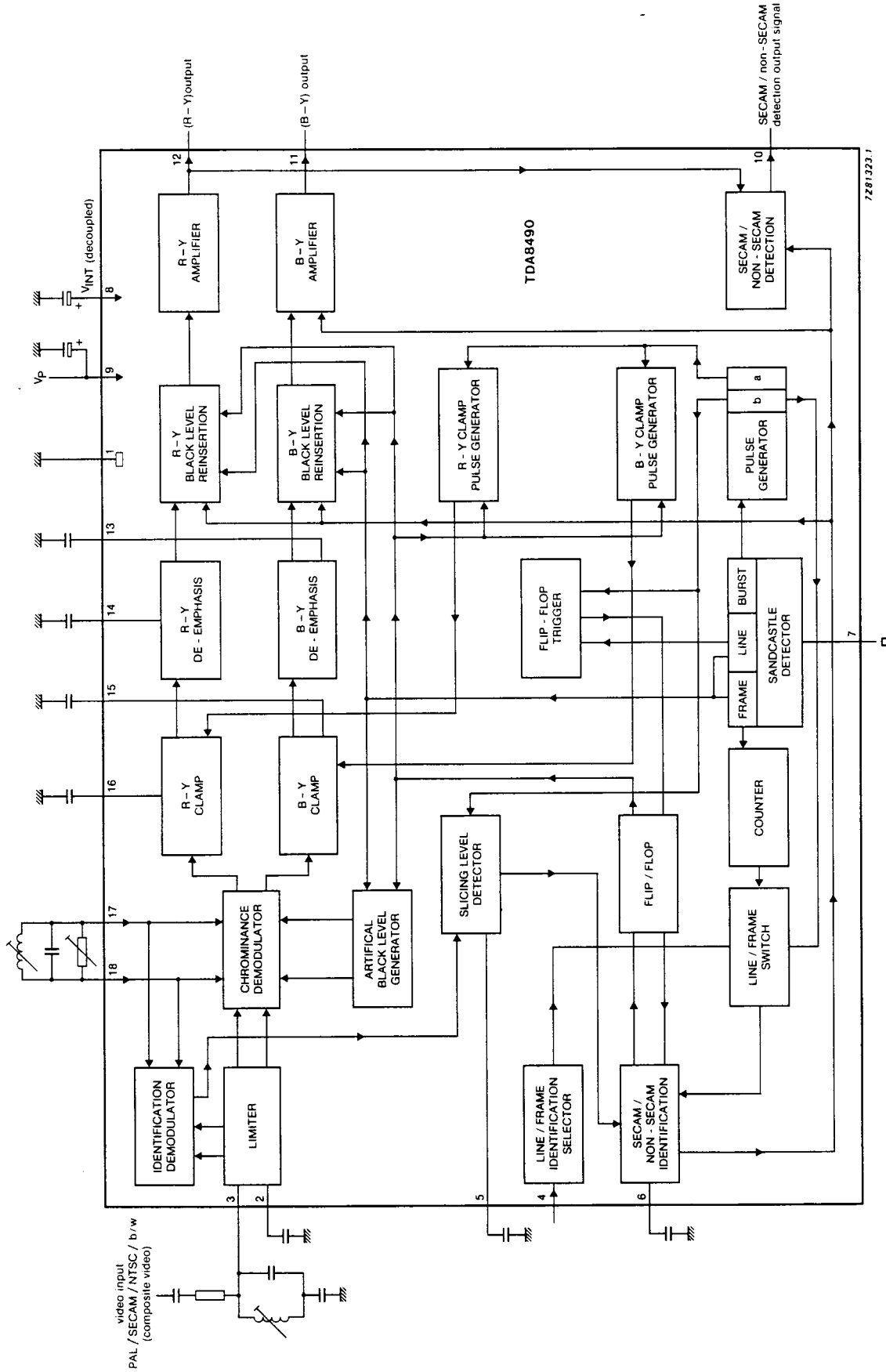

Fig. 1 Block diagram.

PINNING

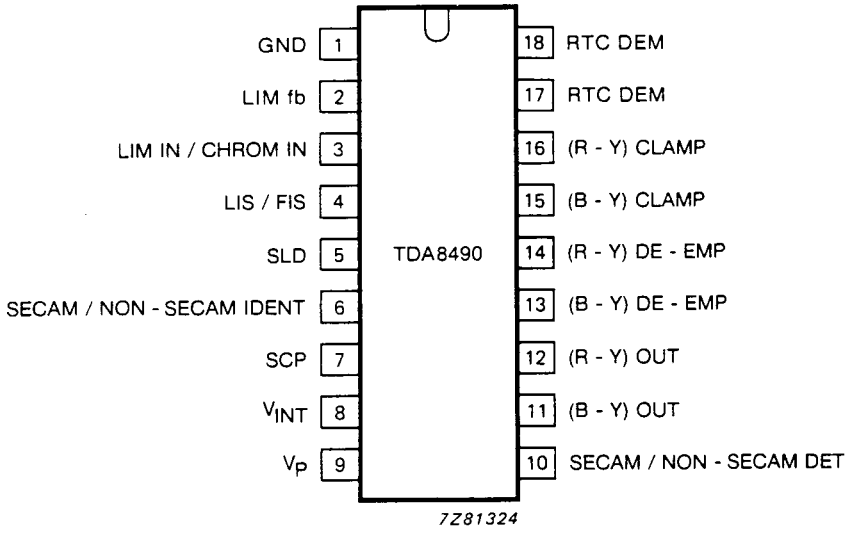

Fig. 2 Pinning diagram.

1	GND	ground
2	LIM fb	limiter feedback
3	LIM IN/ CHROM IN	limiter input/ chrominance input
4	LIS/FIS	line identification selector/ frame identification selector
5	SLD	slicing level detector
6	SECAM/NON-SECAM IDENT	SECAM/non-SECAM identification circuit
7	SCP	sandcastle pulse input
8	V_{INT}	internal supply voltage (decoupled)
9	V_P	supply voltage
10	SECAM/NON-SECAM DET	SECAM/non-SECAM detection circuit
11	(B-Y)OUT	(B-Y) signal output
12	(R-Y)OUT	(R-Y) signal output
13	(B-Y)DE-EMP	(B-Y) de-emphasis circuit
14	(R-Y)DE-EMP	(R-Y) de-emphasis circuit
15	(B-Y)CLAMP	(B-Y) clamping circuit
16	(R-Y)CLAMP	(R-Y) clamping circuit
17	RTC DEM	reference tuned circuit demodulator
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FUNCTIONAL DESCRIPTION

Demodulation

The TDA8490 comprises a chrominance and an identification demodulator, both using the same reference tuned circuit. The identification circuit automatically detects whether the incoming signal at pin 3 (applied via a bandpass filter with a bell-shaped response) is SECAM or non-SECAM (NTSC, PAL or black-and-white).

When the SECAM signal is detected, it is applied to a limiter/amplifier after which it is demodulated. The (R-Y) and (B-Y) signals are applied sequentially, therefore, only one demodulator is required. After demodulation the signals are applied to the (R-Y) and (B-Y) clamp circuits, where the black levels are clamped to the same DC level.

Artificial black levels are inserted during line blanking period. The clamp circuits then react upon these levels instead of the demodulated burst signal (necessary in case there are no line burst signals available). The inserted signals may not be identical to the detected black levels, because of circuitry spread. This can be corrected by detuning the demodulator tuned circuit.

R-Y and B-Y output signals

The R-Y and B-Y signals are available every other line. A new black level is reinserted during blanking and timing b (Fig. 5). If a non-SECAM signal is present the R-Y output will generate a DC level of approximately 3,8 V (the same as the black level generated during normal SECAM condition on both outputs). The B-Y output generates a DC level of approximately 0,8 V in this condition.

SECAM or non-SECAM signals may also be identified by the information at pin 10:

- 2,6 V indicates a SECAM signal.
- 0 V indicates a non-SECAM signal.

The SECAM or non-SECAM signals can be identified by using the (B-Y) demodulator output level at pin 11. Depending on the PAL decoder used in conjunction with this device, the information can be passed to the microcomputer via the I^2C bus.

Priority identification

The two chrominance outputs of TDA8490 are connected to the chrominance outputs of the PAL decoder TDA8461 or TDA8390. The output signal of the TDA8490 and PAL decoder alternately determine the priority of the overall system. In the event of a clash on these outputs, caused by a reflected PAL signal being detected as a SECAM signal by TDA8490, the total system will default to PAL priority.

Identification

The identification circuit compares the voltage difference, which is obtained after demodulation, with the state of the flip-flop. For line identification this comparison occurs during the internally generated pulse 'B' (Fig. 3). Only SECAM signals provide voltage difference from line to line during comparison. If the phase relationship between both the signals is incorrect, the flip-flop will receive an extra input pulse.

The identification (as above) occurs when the line identification system is active. When the frame identification system is switched on (pin 4), the system only compares the demodulator output voltage during a 4-line gate pulse, which is present during frame blanking. The 4-line gate pulse starts 10 burst gate pulses after the start of the vertical blanking part of the sandcastle signal. The operation is identical to the line identification. Timing of the 4-line gate pulse is shown in Fig. 4.

Sandcastle detector

The sandcastle pulse detector requires a 3-level sandcastle pulse. It detects the various blanking and gating pulses and generates the correct drive pulses for the clamping circuits (Fig. 3).

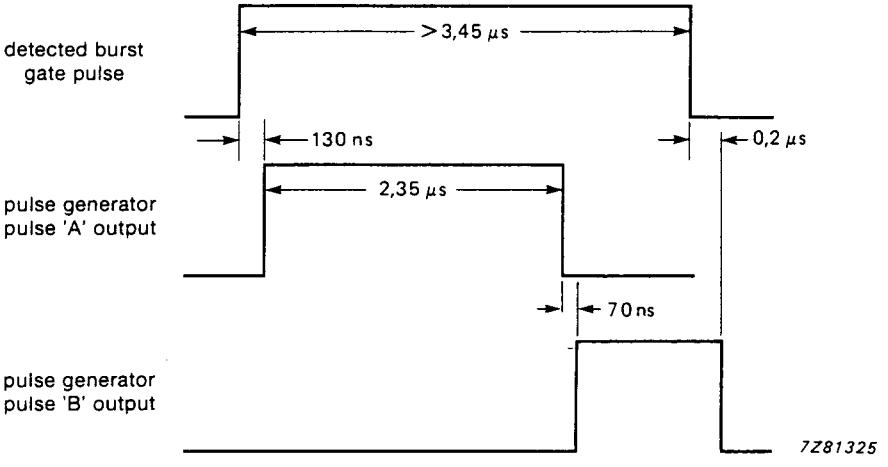


Fig. 3 Burst and derived pulses.

Note

The separated burst pulse is divided into two parts (Fig. 3). Required burst gate pulse: $> 3{,}45\ \mu s$.

Pulse 'A':
- timing R-Y clamp (only present during a red line)
- timing B-Y clamp (only present during a blue line)

Pulse 'B':
- SECAM line identification timing

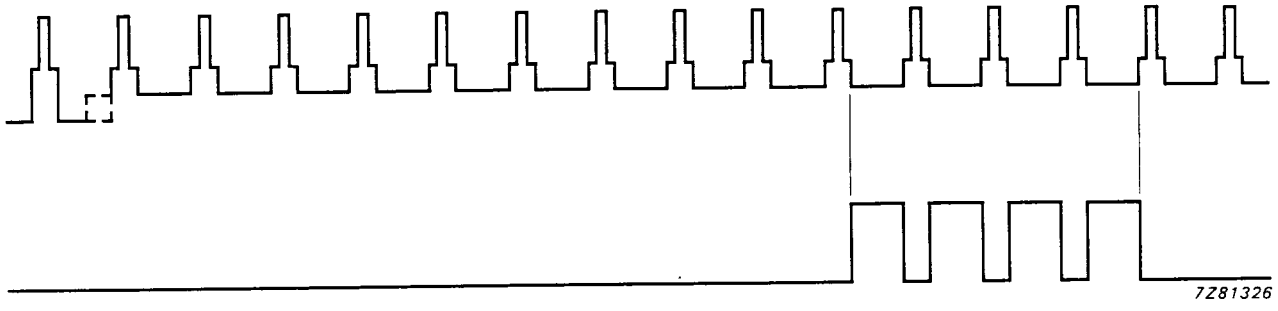


Fig. 4 above: Sandcastle signal during frame period (even and odd).

below: 4-line gate pulse.

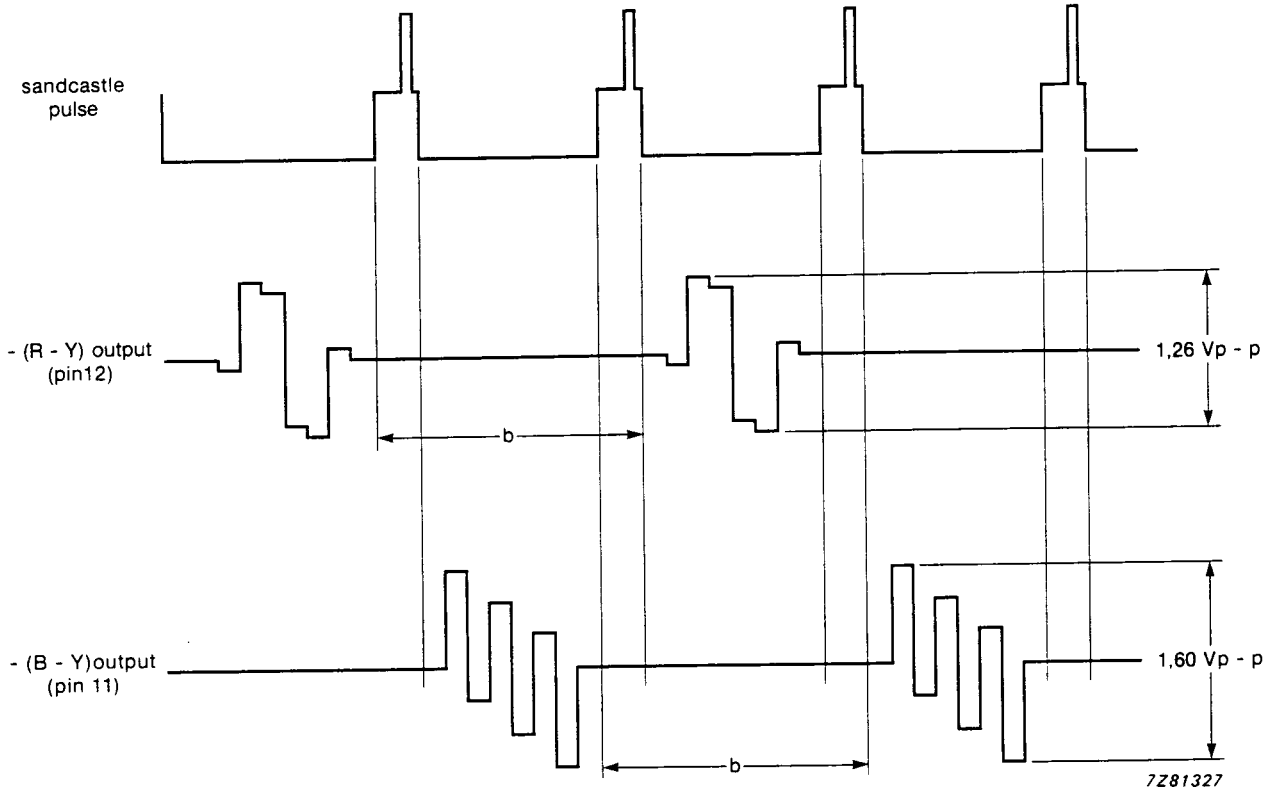


Fig. 5 $-(R\text{-}Y)$ and $-(B\text{-}Y)$ output signals compared to the sandcastle input signal.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

parameter	conditions	symbol	min.	max.	unit
Supply voltage	pin 9	V_P	–	13,2	V
Total power dissipation		P_{tot}	–	1,7	W
Storage temperature range		T_{stg}	–25	+ 150	°C
Operating ambient temperature range		T_{amb}	–25	+ 65	°C

CHARACTERISTICS

V_P = 12 V; T_{amb} = 25 °C; unless otherwise specified

parameter	conditions	symbol	min.	typ.	max.	unit
Supply						
Supply voltage		$V_P = V_{9-1}$	10,8	12,0	13,2	V
Supply voltage	decoupled, pin 8	$V_{INT} = V_{8-1}$	10,6	11,8	13,0	V
Supply current		$I_P = I_9$	40	55	70	mA
Total power dissipation		P_{tot}	–	660	840	mW
Thermal resistance from junction to ambient		$R_{th\ j\text{-}a}$	–	50	–	K/W
External capacitance	pin 8	$C_o = C_{8-1}$	–	–	4,7	μF
Chrominance amplifier and demodulator	note 1					
Input signal (peak-to-peak value)	non-SECAM signal	$V_{3-1(p\text{-}p)}$	–	–	1,1	V
Input signal (peak-to-peak value)	SECAM signal with correct limiting	$V_{3-1(p\text{-}p)}$	15	100	300	mV
Input resistance	pin 3	R_{3-1}	9,5	11,8	14,1	kΩ
Input capacitance	pin 3	C_{3-1}	–	–	5	pF
Input resistance	between pins 17 and 18	R_{17-18}	2,9	3,6	4,3	kΩ
Input capacitance	between pins 17 and 18	C_{17-18}	–	12	–	pF
De-emphasis output resistance	pins 13 and 14	R_{13-1} R_{14-1}	1,45	1,75	2,05	kΩ
Zero point stability of chrominance demodulator	note 2 pins 11 and 12	$f_{11, 12}$	–	5	–	kHz
(B-Y)/(R-Y) gain ratio	note 7		1,38	1,55	1,73	

parameter	conditions	symbol	min.	typ.	max.	unit
R-Y and B-Y output						
R-Y output signal amplitude (peak-to-peak value)	pin 12	$V_{12-1(p-p)}$	1,01	1,26	1,51	V
B-Y output signal amplitude (peak-to-peak value)	pin 11	$V_{11-1(p-p)}$	1,28	1,60	1,92	V
B-Y output signal level	SECAM		3,5	3,8	4,1	V
B-Y output signal level	non-SECAM		–	0,8	1,1	V
R-Y output signal level			3,5	3,8	4,1	V
R-Y signal linearity	note 3		88	95	102	%
B-Y signal linearity	note 4		85	92	99	%
Inserted black levels (demodulated)	function of temperature, note 6		–	0,22	–	kHz/K
Output impedance	pin 12	$\|Z_{12-1}\|$	–	30	–	Ω
Output impedance	pin 11	$\|Z_{11-1}\|$	–	30	–	Ω
Identification	SECAM, non-SECAM					
Input voltage for line identification	pin 4	V_{4-1}	4,1	–	13,2	V
Input voltage for frame identification	pin 4	V_{4-1}	0	–	2,9	V
Switching level for line/frame identification	pin 4	V_{4-1}	3,0	3,5	4,0	V
Input current	pin 4	I_4	–	–5	–25	μA
Voltage at pin 6	during non-SECAM	V_{6-1}	–	10,2	–	V
Voltage at pin 6	during SECAM	V_{6-1}	–	7,7	–	V
Identification level at pin 6		V_{6-1}	10,5	10,8	11,0	V
Internal colour 'OFF' (pin 6)	SECAM to non-SECAM	V_{6-1}	9,7	10,0	10,3	V
Internal colour 'ON' (pin 6)	non-SECAM to SECAM	V_{6-1}	8,9	9,2	9,5	V
Colour 'ON' to colour 'OFF' hysteresis	non-SECAM to SECAM	V_{6-1}	0,5	0,8	1,0	V
Voltage at pin 10	during non-SECAM	V_{10-1}	–	1,6	0,5	V
Voltage at pin 10	during SECAM	V_{10-1}	2,1	2,6	3,1	V
Output impedance at pin 10	during SECAM	$\|Z_{10-1}\|$	1,35	1,60	1,85	kΩ

CHARACTERISTICS (continued)

parameter	conditions	symbol	min.	typ.	max.	unit
Sandcastle detector and clamp pulse generator	pin 7					
Frame blanking detection level		V_{7-1}	1,0	1,5	2,0	V
Line blanking detection level		V_{7-1}	3,0	3,5	4,0	V
Burst gate detection level		V_{7-1}	6,5	7,0	7,5	V
Input current	V_{7-1} = 0,7 V	I_7	–	−30	−100	μA
Pulse width	see Fig. 3 pulse A		1,85	2,35	2,85	μs
Required pulse width	note 5, see Fig. 3 pulse B		0,6	–	–	μs

Notes to the characteristics

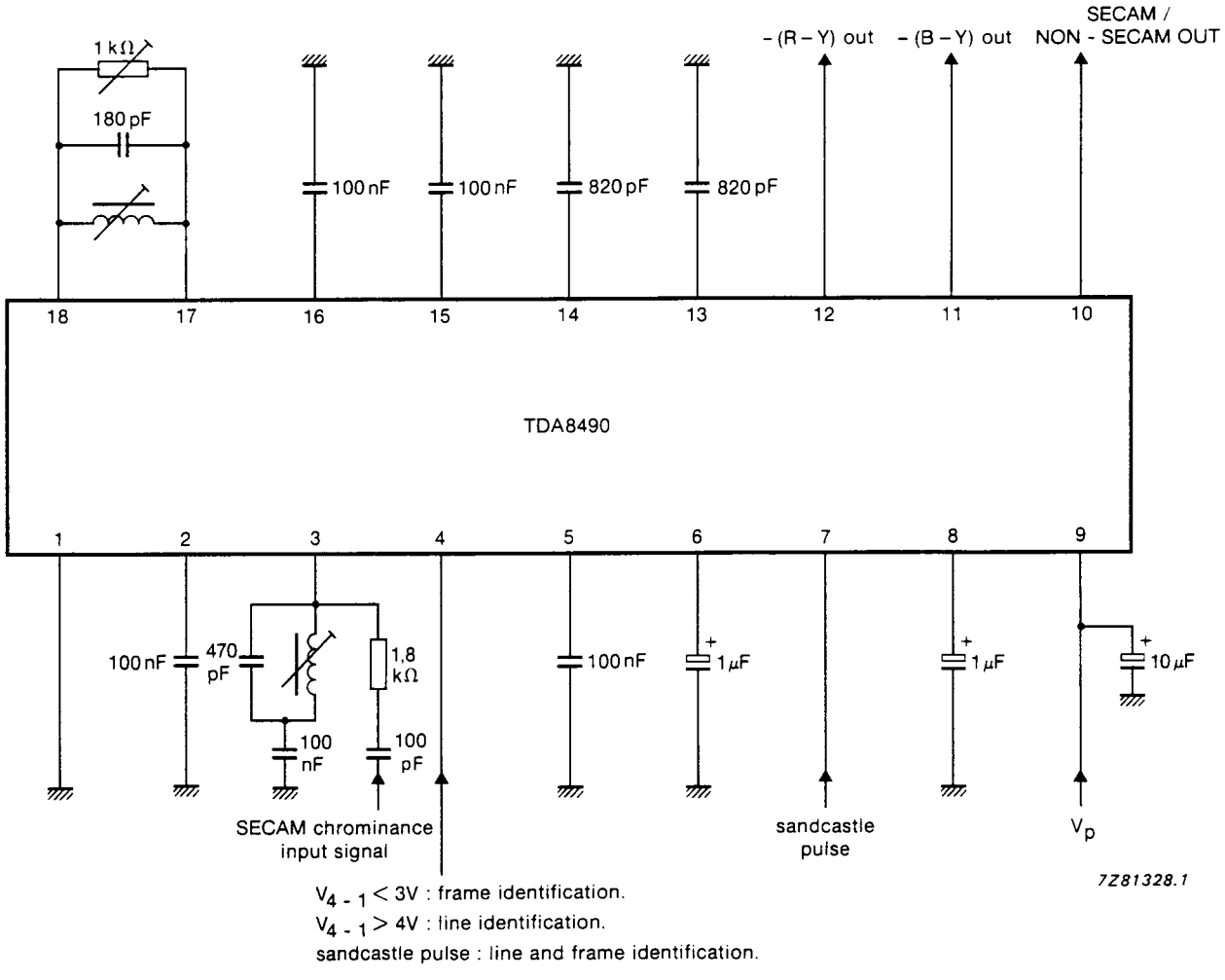
1. For alignment of the reference tuned circuit the input signal on pin 3 must be a SECAM signal at 100 mV(p-p) without deviation during a red and a blue line (black colour information, SECAM). The reference tuned circuit must be aligned to generate a colour output which corresponds to the new reinserted black level information.
2. If the input signal of the limiter is changed from 300 mV(p-p) to 15 mV(p-p), the zero point of the chrominance FM demodulator (f_o is typically 4,33 MHz) will typically shift by 5 kHz.
3. Definition of R-Y linearity = $V_{out\ cyan}/V_{out\ red}$:
   - $f_{nom\ cyan}$ = 4,68 MHz
   - $f_{nom\ red}$ = 4,12 MHz
4. Definition of B-Y linearity = $V_{out\ yellow}/V_{out\ blue}$:
   - $f_{nom\ yellow}$ = 4,02 MHz
   - $f_{nom\ blue}$ = 4,48 MHz
5. The burst gate pulse width must be larger than (2,85 + 0,6)=3,45 μs.
6. Demodulated black level at temperature X = A and at temperature Y = B.
   Artifical black level at temperature X = C and at temperature Y = D.
   Demodulated output signal ($f_o - \Delta f$) at temperature X = E1 and at temperature Y = F1.
   Demodulated output signal ($f_o + \Delta f$) at temperature X = E2 and at temperature Y = F2.

   $$E = \frac{E1 - E2}{2} \text{ and } F = \frac{F1 - F2}{2}$$

   $$\text{specification result} = \frac{(B\text{-}D)/F - (A\text{-}C)/E}{Y\text{-}X} \times \Delta f\ (kHz)/^{o}C)$$

   for B-Y $f_o = f_{ob}$ = 4,25 MHz and Δf = 230 kHz.
   for R-Y $f_o = f_{or}$ = 4,40625 MHz and Δf = 280 kHz.
7. Due to different deviations (230 or 280 kHz) and correction figures (1,9 or 1,5 x) the total B-Y signal path needs a gain, which is 1,55 x higher than the R-Y path.

APPLICATION INFORMATION



$V_{4-1} < 3V$: frame identification.
$V_{4-1} > 4V$: line identification.
sandcastle pulse : line and frame identification.

Fig. 6 Application diagram.