Horizontal and vertical deflection controller for autosync monitors

TDA4852

FEATURES

- Low jitter
- All adjustments DC-controllable
- Alignment-free oscillators
- Sync separators for video or horizontal and vertical TTL sync levels regardless of polarity
- Horizontal oscillator with PLL1 for sync and PLL2 for flyback
- Constant vertical and E/W amplitude in autosync operation
- DC-coupling to vertical power amplifier
- Internal supply voltage stabilization with excellent ripple rejection to ensure stable geometrical adjustments

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_P	positive supply voltage (pin 1)	9.2	12	16	V
I_P	supply current	–	40	–	mA
$V_{i\ sync}$	AC-coupled composite video signal with negative-going sync (peak-to-peak value, pin 9)	–	1	–	V
	sync slicing level	–	120	–	mV
	DC-coupled TTL-compatible horizontal sync signal (peak-to-peak value, pin 9)	1.7	–	–	V
	slicing level	1.2	1.4	1.6	V
	DC-coupled TTL-compatible vertical sync signal (peak-to-peak value, pin 10)	1.7	–	–	V
	slicing level	1.2	1.4	1.6	V
$I_{o\ V}$	vertical differential output current (peak-to-peak value, pins 5 and 6)	–	1	–	mA
$I_{o\ H}$	horizontal sink output current on pin 3	–	–	60	mA
T_{amb}	operating ambient temperature range	0	–	+70	°C

GENERAL DESCRIPTION

The TDA4852 is a monolithic integrated circuit for economical solutions in autosync monitors. The IC incorporates the complete horizontal and vertical small signal processing. In conjunction with TDA4860/61/65, or TDA8351 (vertical output circuits) the ICs offer an extremely advanced system solution.

ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
TDA4852	20	DIL	plastic	SOT146

Horizontal and vertical deflection controller
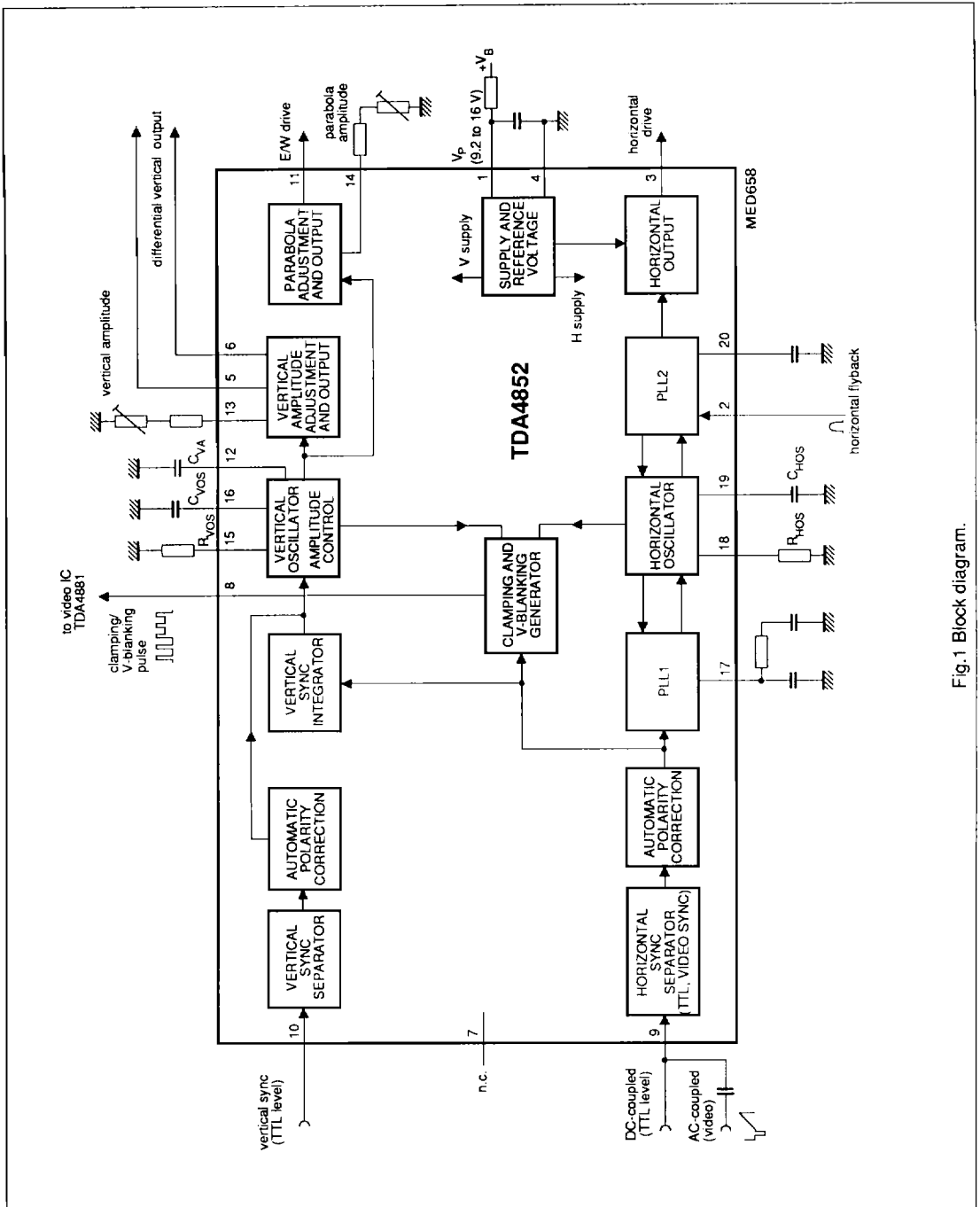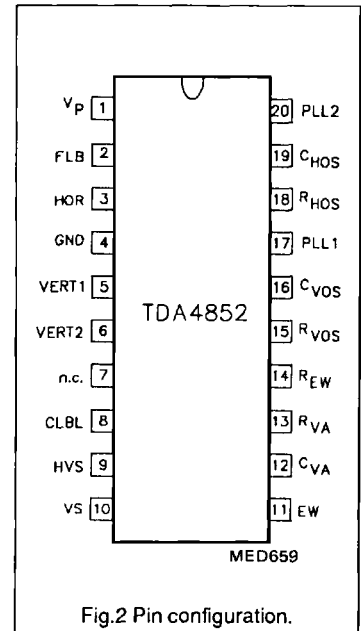# for autosync monitors

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Fig.1 Block diagram.

Horizontal and vertical deflection controller for autosync monitors

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PINNING

SYMBOL	PIN	DESCRIPTION
V_P	1	positive supply voltage
FLB	2	horizontal flyback input
HOR	3	horizontal output
GND	4	ground (0 V)
VERT1	5	vertical output 1; negative-going sawtooth
VERT2	6	vertical output 2; positive-going sawtooth
n.c.	7	not connected
CLBL	8	clamping/blanking pulse output
HVS	9	horizontal sync/video input
VS	10	vertical sync input
EW	11	E/W output (parabola to driver stage)
C_{VA}	12	capacitor for amplitude control
R_{VA}	13	vertical amplitude adjustment input
R_{EW}	14	E/W amplitude adjustment input (parabola)
R_{VOS}	15	vertical oscillator resistor
C_{VOS}	16	vertical oscillator capacitor
PLL1	17	PLL1 phase
R_{HOS}	18	horizontal oscillator resistor
C_{HOS}	19	horizontal oscillator capacitor
PLL2	20	PLL2 phase

V_P [1]	[20] PLL2
FLB [2]	[19] C_{HOS}
HOR [3]	[18] R_{HOS}
GND [4]	[17] PLL1
VERT1 [5]	[16] C_{VOS}
VERT2 [6]	[15] R_{VOS}
n.c. [7]	[14] R_{EW}
CLBL [8]	[13] R_{VA}
HVS [9]	[12] C_{VA}
VS [10]	[11] EW

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Fig.2 Pin configuration.

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TDA4852

FUNCTIONAL DESCRIPTION

Horizontal sync separator and polarity correction

An AC-coupled video signal or a DC-coupled TTL sync signal (H only or composite sync) is input on pin 9. Video signals are clamped with top sync on 1.28 V, and are sliced at 1.4 V. This results in a fixed absolute slicing level of 120 mV related to top sync.

DC-coupled TTL sync signals are also sliced at 1.4 V, however with the clamping circuit in current limitation. The polarity of the separated sync is detected by internal integration of the signal, then the polarity is corrected. The corrected sync is input signal for the vertical sync integrator and the PLL1 stage.

Vertical sync separator, polarity correction and vertical sync integrator

DC-coupled vertical TTL sync signals may be applied to pin 10. They are sliced at 1.4 V. The polarity of the separated sync is detected by internal integration, then the polarity is corrected. If pin 10 is not used, it must be connected to ground.

The separated $V_{i\,sync}$ signal from pin 10, or the integrated composite sync signal from pin 9 (TTL or video) triggers directly the vertical oscillator.

Clamping and V-blanking generator

A combined clamping and V-blanking pulse is available on pin 8 (suitable for the video pre-amplifier TDA4881). The lower level of 1.9 V is the blanking signal derived from the vertical blanking pulse from the internal vertical oscillator.

Vertical blanking starts with vertical sync and stops at the begin of vertical scan. By this, an optimum blanking is achieved.

The upper level of 5.4 V is the horizontal clamping pulse with an internally fixed pulse width of 0.8 µs. A monoflop, which is triggered by the trailing edge of the horizontal sync pulse, generates this pulse. If composite sync is applied, one clamping pulse per H-period is generated during V-sync. The phase of the clamping pulse may change during V-sync (see Fig.8).

PLL1 phase detector

The phase detector is a standard type using switched current sources. The middle of the sync is compared with a fixed point of the oscillator sawtooth voltage. The PLL filter is connected to pin 17. If composite sync is applied, the disturbed control voltage is corrected during V-sync (see Fig.8).

Horizontal oscillator

This oscillator is of the relaxation type and requires a fixed capacitor of 10 nF at pin 19. By changing the current into pin 18 the whole frequency range from 13 to 100 kHz can be covered.

The current can be generated either by a frequency to voltage converter or by a resistor. A frequency adjustment may also be added if necessary.

The PLL1 control voltage at pin 17 modulates via a buffer stage the oscillator thresholds. A high DC-loop gain ensures a stable phase relationship between horizontal sync and line flyback pulses.

PLL2 phase detector

This phase detector is similar to the PLL1 phase detector. Line flyback signals (pin 2) are compared with a fixed point of the oscillator sawtooth voltage. Delays in the horizontal deflection circuit are compensated by adjusting the phase relationship between horizontal sync and horizontal output pulses.

A certain amount of phase adjustment is possible by injecting a DC current from an external source into the PLL2 filter capacitor at pin 20.

Horizontal driver

This open-collector output stage (pin 3) can directly drive an external driver transistor. The saturation voltage is less than 300 mV at 20 mA.

To protect the line deflection transistor, the horizontal output stage does not conduct for V_P < 6.4 V (pin 1).

Vertical oscillator and amplitude control

This stage is designed for fast stabilization of the vertical amplitude after changes in sync conditions. The free-running frequency f_0 is determined by the values of R_{VOS} and C_{VOS}. The recommended values should be altered marginally only to preserve the excellent linearity and noise performance. The vertical drive currents I_5 and I_6 are in relation to the value of R_{VOS}. Therefore, the oscillator frequency must be determined only by C_{VOS} on pin 16.

$$f_0 = \frac{1}{10.8 \times R_{VOS} \times C_{VOS}}$$

To achieve a stabilized amplitude the free-running frequency f_0 (without adjustment) must be lower than the lowest occuring sync frequency. The following contributions can be assumed:

minimum frequency offset between f_0 and the lowest trigger frequency	10%
spread of IC	±3%
spread of R (22 kΩ)	±1%
spread of C (0.1 µF)	±5%
	19%

Result: $f_0 = \dfrac{50}{1.19}$ Hz = 42 Hz

(for 50 to 110 Hz application)

Horizontal and vertical deflection controller for autosync monitors

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_P	supply voltage (pin 1)	−0.5	16	V
V_3	voltage on pin 3	−0.5	16	V
V_8	voltage on pin 8	−0.5	7	V
V_n	voltage on pins 5, 6, 9, 10, 13, 14 and 18	−0.5	6.5	V
I_2	current on pin 2	−	±10	mA
I_3	current on pin 3	−	100	mA
I_8	current on pin 8	−	−10	mA
T_{stg}	storage temperature range	−55	+150	°C
T_{amb}	operating ambient temperature range	0	70	°C
T_j	maximum junction temperature	0	+150	°C
V_{ESD}	electrostatic handling for all pins (note 1)	−	±400	V

Note to the Limiting Values

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

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\,j-a}$	from junction to ambient in free air	65 K/W

Horizontal and vertical deflection controller
for autosync monitors

TDA4852

CHARACTERISTICS

V_P = 12 V; T_{amb} = +25 °C; measurements taken in Fig.3 unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	positive supply voltage (pin 1)		9.2	12	16	V
I_P	supply current	I_{18} = −1.05 mA	−	36	44	mA
		I_{18} = −3.388 mA	−	40	49	mA
Internal reference voltage						
V_{ref}	internal reference voltage		6.0	6.25	6.5	V
TC	temperature coefficient	T_{amb} = +20 to +100 °C	−	−	±90	10^{-6}/K
PSRR	power supply ripple rejection	f = 1 kHz sinewave	60	75	−	dB
		f = 1 MHz sinewave	25	35	−	dB
V_P	supply voltage (pin 1) to ensure all internal reference voltages		9.2	−	16	V
Composite sync input (AC-coupled)		V_{10} = 5 V				
$V_{i\,sync}$	sync amplitude of video input signal (pin 9)	sync on green	−	300	−	mV
	top sync clamping level		1.1	1.28	1.5	V
	slicing level above top sync level	R_S = 50 Ω	90	120	150	mV
R_S	allowed source resistance for 7% duty factor	$V_{i\,sync}$ > 200 mV	−	−	1.5	kΩ
r_9	differential input resistance	during sync	−	80	−	Ω
I_9	charging current of coupling capacitor	V_9 > 1.5 V	1.3	2	3	μA
t_{int}	vertical sync integration time to generate vertical trigger pulse	f_H = 31 kHz; I_{18} = −1.050 mA	7	10	13	μs
		f_H = 64 kHz; I_{18} = −2.169 mA	3.5	5	6.5	μs
		f_H = 100 kHz; I_{18} = −3.388 mA	2.5	3.4	4.5	μs
Horizontal sync input (DC-coupled, TTL-compatible)						
$V_{i\,sync}$	sync input signal (peak-to-peak value, pin 9)		1.7	−	−	V
	slicing level		1.2	1.4	1.6	V
t_p	minimum pulse width		700	−	−	ns
t_r, t_f	rise time and fall time		10	−	500	ns
I_9	input current	V_9 = 0.8 V	−	−	−200	μA
		V_9 = 5.5 V	−	−	10	μA
Automatic horizontal polarity switch		H-sync on pin 9				
$t_{p\,H}/t_H$	horizontal sync pulse width related to t_H (duty factor for automatic polarity correction)		−	−	30	%
t_p	delay time for changing sync polarity		0.3	−	1.8	ms

Horizontal and vertical deflection controller for autosync monitors

TDA4852

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Vertical sync input (DC-coupled, TTL-compatible)		V-sync on pin 10				
$V_{i\,sync}$	sync input signal (peak-to-peak value, pin 10)		1.7	–	–	V
	slicing level		1.2	1.4	1.6	V
I_{10}	input current	$0 < V_{10} < 5.5$ V	–	–	±10	µA
$t_{p\,V}$	maximum vertical sync pulse width for automatic vertical polarity switch		–	–	300	µs
Horizontal clamping / blanking generator output		Fig.6				
V_8	output voltage LOW		–	–	0.9	V
	blanking output voltage	internal V blanking	1.6	1.9	2.2	V
	clamping output voltage	H-sync on pin 9	5.15	5.4	5.65	V
I_8	internal sink current for all output levels	H and V scanning	2.3	2.9	3.5	mA
	external load current		–	–	–3.0	mA
t_8	clamping pulse start	with end of H-sync				
t_{clp}	clamping pulse width	$V_8 = 3$ V	0.6	0.8	1.0	µs
S	steepness of rise and fall times		–	60	75	ns/V
Vertical oscillator		$V_{ref} = 6.25$ V				
f_0	vertical free-running frequency	$R_{15} = 22$ kΩ; $C_{16} = 0.1$ µF	–	42	–	Hz
f_v	nominal vertical sync range	no f_0 adjustment	50	–	110	Hz
V_{15}	voltage on pin 15	$R_{15} = 22$ kΩ	2.8	3.0	3.2	V
t_d	delay between sync pulse and start of vertical scan	measured on pin 8	240	300	360	µs
I_{12}	control current for amplitude control		–	±200	–	µA
C_{12}	capacitor for amplitude control		–	–	0.18	µF
Vertical differential output		Fig.7				
I_0	differential output current between pins 5 and 6 (peak-to-peak value)	mode 3; $I_{13} > -135$ µA; $R_{15} = 22$ kΩ	0.9	1.0	1.1	mA
	maximum offset-current error	$I_0 = 1$ mA	–	–	±2.5	%
	maximum linearity error		–	–	±1.5	%
Vertical amplitude adjustment (in percentage of output signal)						
V_{13}	input voltage		–	5.0	–	V
I_{13}	adjustment current	$I_{o\,max}$ (100%)	–110	–120	–135	µA
		$I_{o\,min}$ (typically 58%)	–	0	–	µA
Horizontal comparator PLL1						
V_{17}	upper control voltage limitation		–	5.9	–	V
	lower control voltage limitation		–	5.1	–	V
I_{17}	control current	Fig.6	–	$±0.083I_{18}$	–	mA

Horizontal and vertical deflection controller for autosync monitors

TDA4852

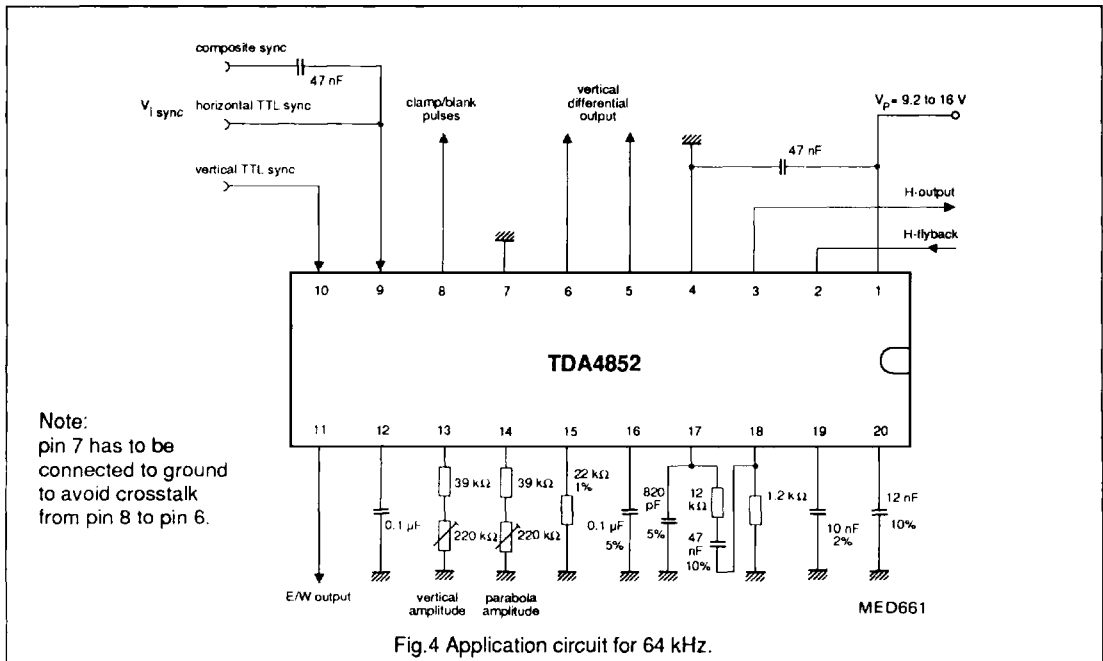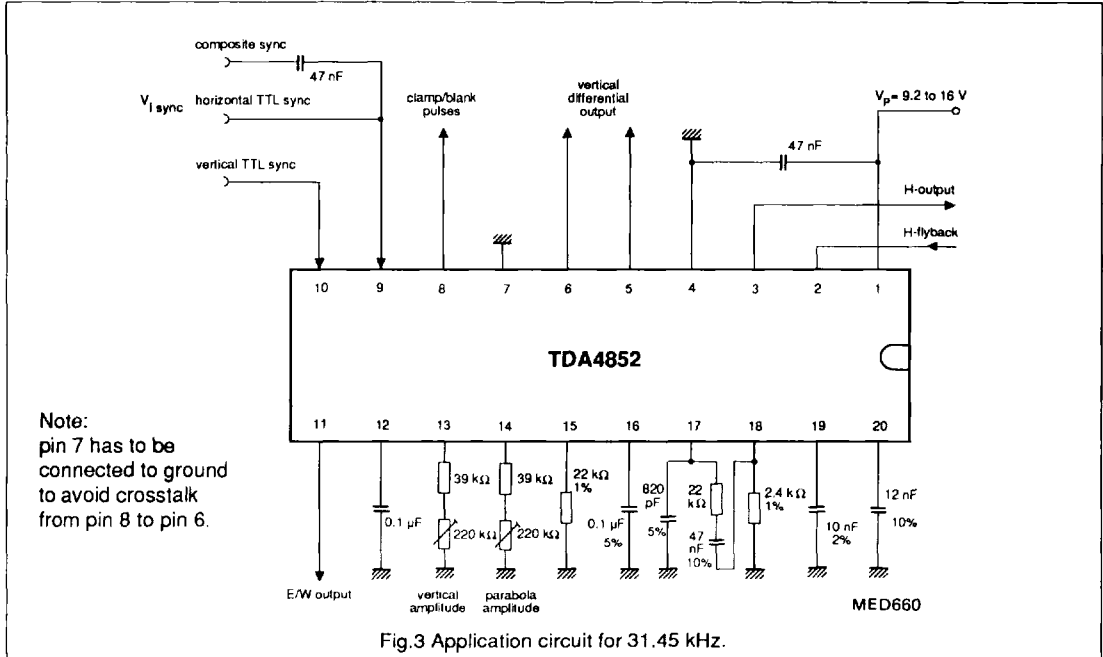| SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Horizontal oscillator						
f_{osc}	centre frequency	$R_{18} = 2.4$ kΩ (pin 18); $C_{19} = 10$ nF (pin 19)	–	31.45	–	kHz
	deviation of centre frequency		–	–	±3	%
	temperature coefficient		0	+200	+300	10^{-6}/K
φ_H/t_H	relative holding/catching range		±6	±6.5	±7.3	%
I_{18}	external oscillator current		–0.5	–	–4.3	mA
V_{18}	voltage at reference current input (pin 18)		2.35	2.5	2.65	V
Horizontal PLL2		Fig.6				
V_2	upper clamping level of flyback input	$I_2 = 6$ mA	–	5.5	–	V
	lower clamping level of flyback input	$I_2 = –1$ mA	–	–0.75	–	V
	H-flyback slicing level		–	3.0	–	V
t_d/t_H	delay between middle of sync and middle of H-flyback related to t_H		–	3.0	–	%
V_{20}	upper control voltage limitation		–	6.2	–	V
	lower control voltage limitation		–	4.8	–	V
I_{20}	control current		–	±0.083I_{18}	–	μA
$\Delta t/t_H$	PLL2 control range related to t_H		30	–	–	%
Horizontal output (open-collector)		Fig.6				
V_3	output voltage LOW	$I_3 = 20$ mA	–	–	0.3	V
		$I_3 = 60$ mA	–	–	0.8	V
t_p/t_H	t_H duty factor		42	45	48	%
V_P	threshold to activate under voltage protection	horizontal output off	–	5.6	–	V
		horizontal output on	–	5.8	–	V
Δt_H	jitter of horizontal output	f = 31 kHz	–	–	3.5	ns
		f = 64 kHz	–	–	1.9	ns
		f = 100 kHz	–	–	1.2	ns
E/W output		note 1				
V_{11}	bottom output signal during mid-scan (pin 11)	internally stabilized	1.05	1.2	1.35	V
	top output signal during flyback		4.2	4.5	4.8	V
	temperature coefficient of output signal		–	–	250	10^{-6}/K
E/W amplitude adjustment (parabola)		Fig.7				
V_{14}	input voltage (pin 14)		–	5.0	–	V
I_{14}	adjustment current	100% parabola	–110	–120	–135	μA
		typically 28% parabola	–	0	–	μA

Note to the characteristics

1. Parabola amplitude does not track with vertical amplitude adjustment. Tracking can be achieved by a resistor from vertical amplitude potentiometer to pin 14.

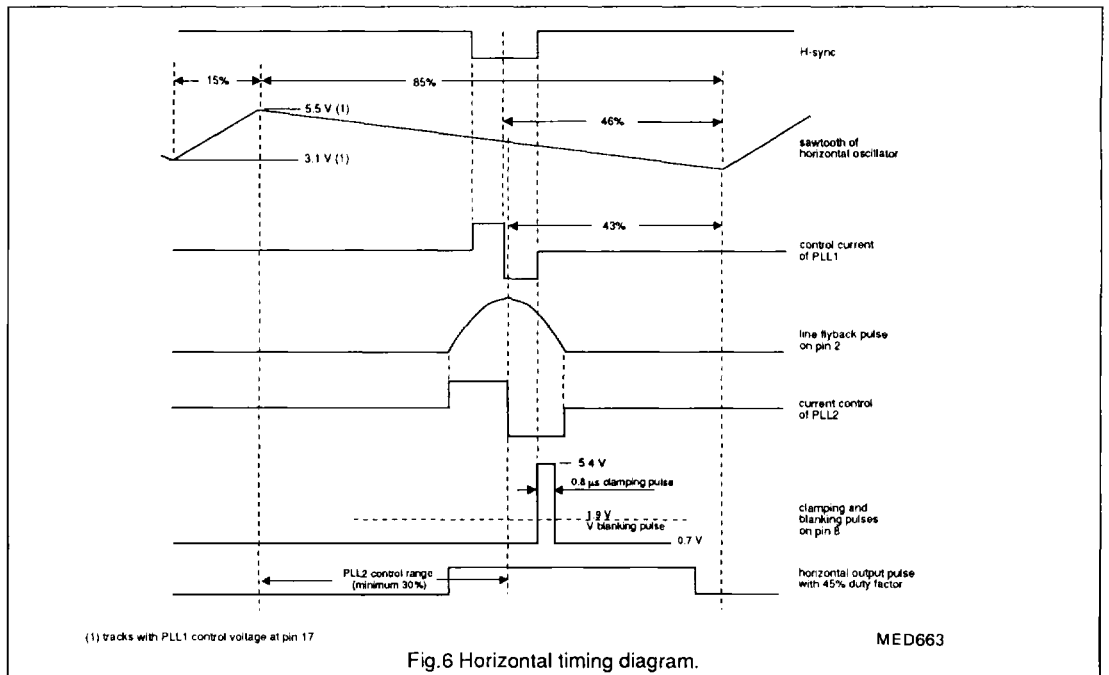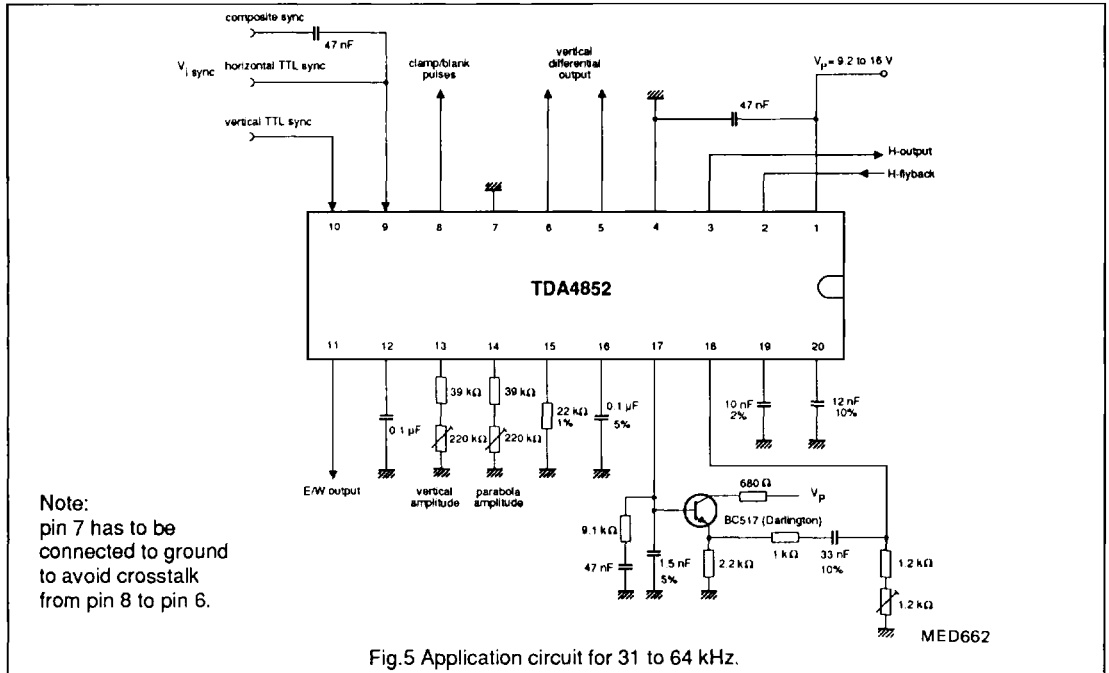## Horizontal and vertical deflection controller for autosync monitors

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APPLICATION INFORMATION

Fig.3 Application circuit for 31.45 kHz.

Fig.4 Application circuit for 64 kHz.

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TDA4852

Note:
pin 7 has to be
connected to ground
to avoid crosstalk
from pin 8 to pin 6.

Fig.5 Application circuit for 31 to 64 kHz.

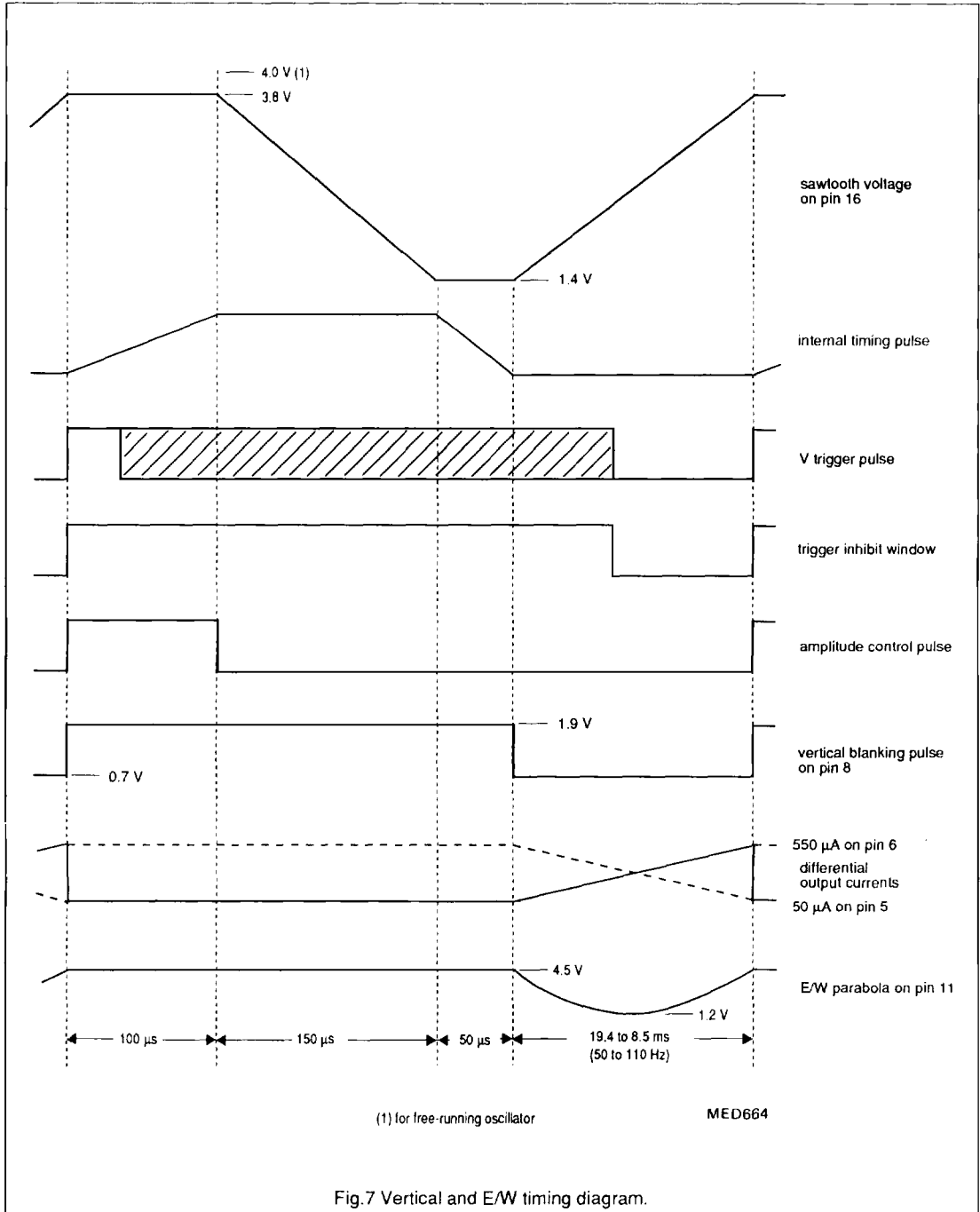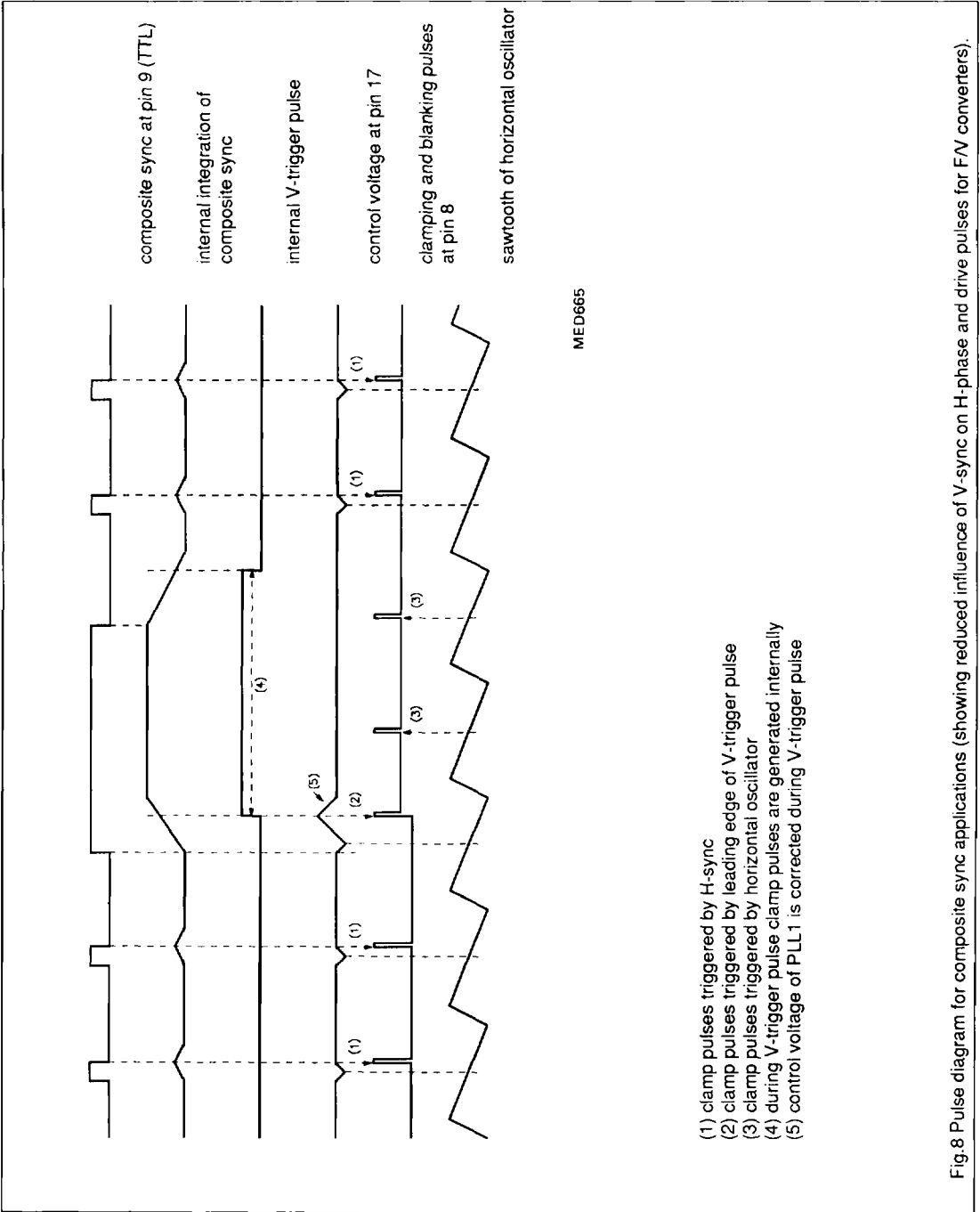(1) tracks with PLL1 control voltage at pin 17

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Fig.6 Horizontal timing diagram.

Fig.7 Vertical and E/W timing diagram.

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composite sync at pin 9 (TTL)

internal integration of
composite sync

internal V-trigger pulse

control voltage at pin 17

clamping and blanking pulses
at pin 8

sawtooth of horizontal oscillator

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(1) clamp pulses triggered by H-sync
(2) clamp pulses triggered by leading edge of V-trigger pulse
(3) clamp pulses triggered by horizontal oscillator
(4) during V-trigger pulse clamp pulses are generated internally
(5) control voltage of PLL1 is corrected during V-trigger pulse

Fig.8 Pulse diagram for composite sync applications (showing reduced influence of V-sync on H-phase and drive pulses for F/V converters).
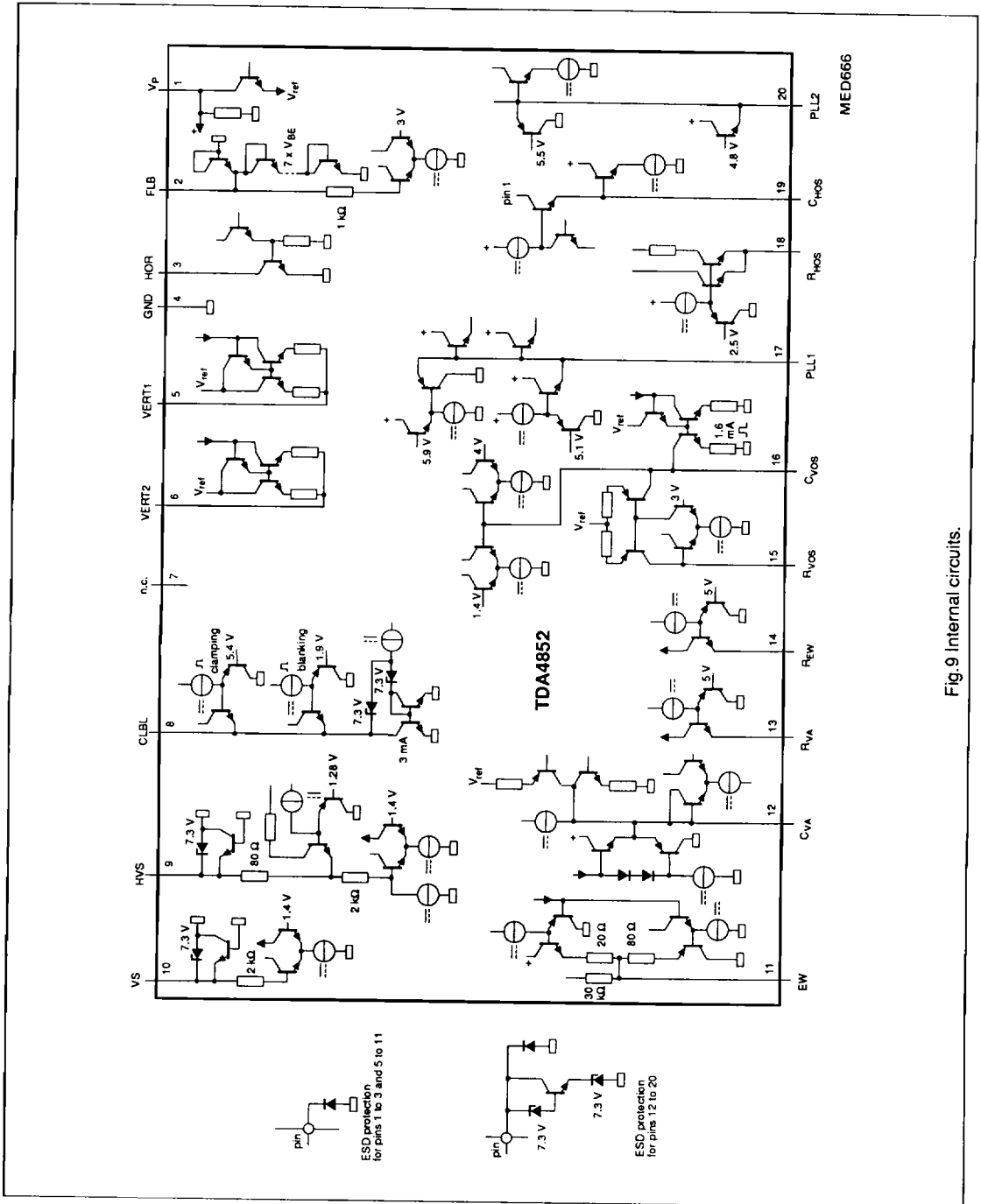
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Fig.9 Internal circuits.