DATA SHEET

TDA4691
Sync Processor with Clock (SPC)

Preliminary specification
File under Integrated Circuits, IC02

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Philips
Semiconductors

PHILIPS

Sync Processor with Clock (SPC) TDA4691

FEATURES

- Sync processor for horizontal (H) and vertical (V) sync pulses generated by internal 13.5 MHz oscillator
- Stable 'On Screen Display (OSD)', if no input signal is present with free running internal oscillator; automatic turn over to locked oscillator, if input signal is available
- External clock oscillator can be used
- Standard 50/60 Hz signals are identified automatically
- Additional outputs for 13.5 MHz, composite sync, 50//60 Hz identification, signal identification (mute), super-sandcastle 12 V
- TTL compatible outputs (H, V, composite sync and 13.5 MHz)
- 3 different time constants for the PHI1 PLL: fast, normal and slow (T_1, T_2 and T_3). Fast and normal time constant are set independent from each other
- Start of H-pulse definable by application
- Digital interference reduction for H and V signals
- Digital noise detector
- Time correction of non-standard H-pulses and equalizing pulses for optimum PLL control.

GENERAL DESCRIPTION

The TDA4691 is a bipolar integrated circuit for sync processing in 50/100 and 60/120 Hz TV sets, preferably in conjunction with the programmable deflection controller TDA9150. A line locked 13.5 MHz clock with several dividers and logic circuitry is available generating the horizontal and vertical sync outputs. The device can be assembled in a DIL20 or SO20 package.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
V_{P2}	supply voltage		4.5	5.0	5.5	V
I_{P2}	supply current		–	–	30	mA
V_{P1}	supply voltage		7.2	8.0	8.8	V
I_{P1}	supply current		–	–	30	mA
P_{tot}	total power dissipation		–	260	430	mW
Inputs						
V_{20}	input voltage	R_G = 1 kΩ	–	1	2	V
Outputs						
V_4	signal identification voltage	no signal; 1 mA	–	–	0.3	V
		signal	open collector	–	V_{P1}	V
V_7	50/60 Hz voltage	50 Hz; 1 mA	–	–	0.3	V
		60 Hz	open collector	–	V_{P1}	V
V_{10}	vertical output voltage	HIGH; –1 to 0 mA	2.7	–	V_{P2}	V
		LOW; 2 mA	–	–	0.8	V
V_{11}	horizontal output voltage	HIGH; –1 to 0 mA	2.7	–	V_{P2}	V
		LOW; 2 mA	–	–	0.8	V
V_{13}	clock output voltage	HIGH; –1 to 0 mA	2.7	–	V_{P2}	V
		LOW; 2 mA	–	–	0.8	V

ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
TDA4691	20	DIL	plastic	SOT146(1)
TDA4691T	20	SO	plastic	SOT163(2)

Note

1. SOT146-1; 1996 December 9.
2. SOT4163-1; 1996 December 9.

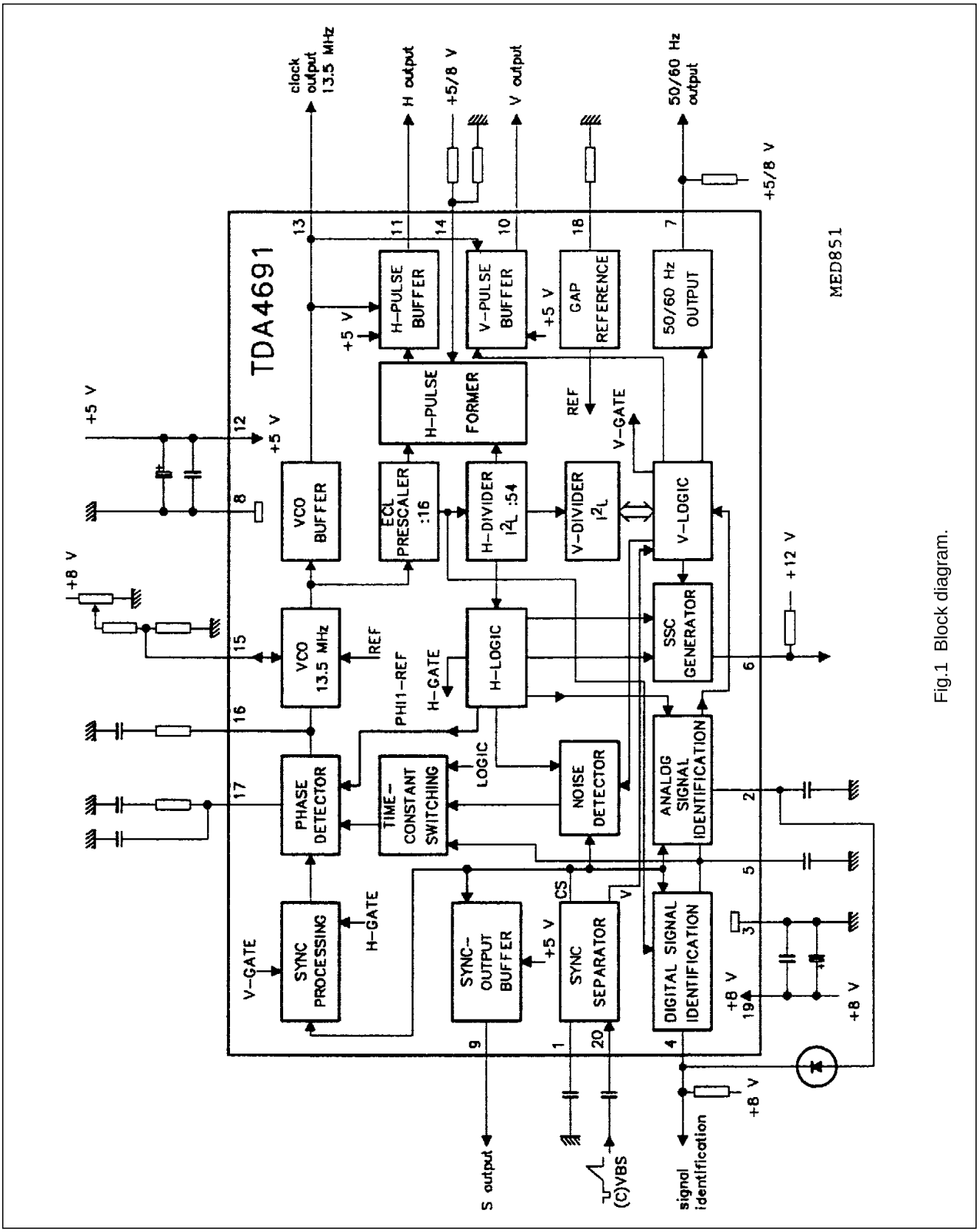


Fig.1 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
BL	1	black level storage of sync separator
INT1	2	integration for time constant switching
GND1	3	ground for 8 V supply
SI	4	signal identification output
INT2	5	integration for signal identification
SSC	6	sandcastle output
50/60 Hz	7	50/60 Hz output
GND2	8	ground for 5 V supply
CS	9	sync output
V_{out}	10	V-output buffer
H_{out}	11	H-output buffer
V_{P2}	12	supply 5 V
CL_{out}	13	clock-output buffer
SH	14	start of H-pulse
VCOF	15	current defining VCO frequency
Fi_1	16	phase detector filtering
Fi_2	17	phase detector filtering
V_{REF}	18	reference voltage
V_{P1}	19	supply 8 V
(C)VBS	20	input sync separator

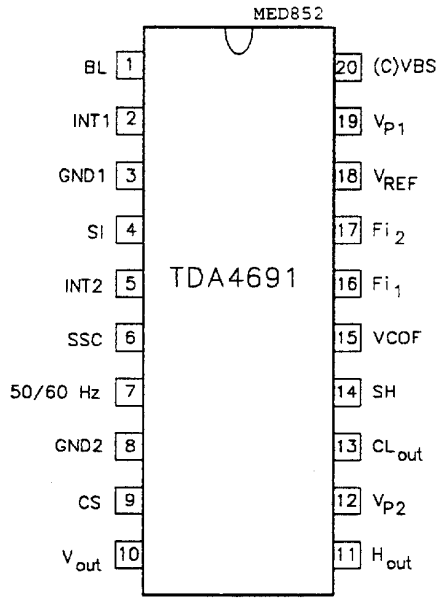


Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

(See block diagram Fig.1 and timing Figs 12 to 16)

Sync separator

Top-sync and blacklevel are stored and H and V sync pulses are sliced in the middle of both levels (50%).

Sync-output buffer

This circuit turns the current pulse from the sync separator into a TTL signal.

Sync processing

This circuit assures that phase comparison can operate correctly during V-pulses. Phase jumps initiated by alternating headpulses of VCR recorders are quickly recovered. The sync processing contains the functions H/2 suppression, sync extension and sync interruption. These three functions are only active if successive pulses have a minimum distance of 1.6 µs.
The H/2 suppression operates with a gate −15 µs up to +14 µs around the PHI1-reference and is necessary for suppression of the equalizing pulses. For sync interruption this gate is closed earlier if the detected sync is longer than 4.8 µs.
Only during V-pulses will the duration of the applied pulses be tested. If they are longer than 1.6 µs they will be recognized as sync pulses and enlarged up to 4.6 µs.

Phase detector (PHI1)

The phase detector has separate filters for the fast time constant T_1 (pin 17) and normal time constant T_2 (pins 17 and 16). The slow time constant T_3 uses the normal time constant T_2 with reduced control current. For reduction of H-pulse modulation the filter at pin 16 is switched off during sync time if normal time constant T_2 is on. Thus no frequency shifting of the oscillator is possible during sync.

Time-constant switching

This block contains a switch and an impedance converter (buffer). The switch connects the filters at pin 16 and 17 in parallel (normal time constant T_2 or slow time constant T_3). The buffer transfers the control voltage at pin 17 to pin 16 (fast time constant T_1). Which of the 2 functions is active is determined by the blocks noise detector, V-logic or signal identification.

VCO 13.5 MHz

The adjustment of the nominal frequency (13.5 MHz) is achieved at pin 15. The VCO control voltage is applied (from the phase detector) at pin 16.
The control range can be adjusted by the current at pin 18.
Pin 15 can be used to feed in an external frequency. Under these circumstances the internal VCO is switched off by application.
The control voltage at pin 16 can be used to control the external VCO.

VCO-buffer

The VCO-buffer delivers a TTL compatible signal of 13.5 MHz to pin 13.

ECL-prescaler

This block consists of a :16 asynchronous prescaler.

H-divider

This is a divider by 54. It is split into a prescaler :2 and a divider by 27. Out of this block several signals are taken for generation of H-frequently pulses in the H-logic block. These signals must have good timing. This is achieved by special synchronization.

H-logic

This block creates all pulses necessary for the SSC generator, the signal identification, the phase detector, the sync preparation and the V-divider.

V-divider

The V-divider consists of an asynchronous 10-bit divider and a decoder logic. The divider is clocked with twice the line frequency. The decoder circuit delivers the pulses necessary for the V-logic.

V-logic

In the V-logic the V-syncs from the sync separator are evaluated and noise reduced. Also certain operation states are switched ON and OFF. Additionally the reset pulse for the V-divider and the 50/60 Hz information is generated.

H-pulse former

The H-pulse starting point can be shifted in this stage, also the gate pulse of ~2.4 µs is generated for use in the digital noise identification block.

H-pulse buffer

In this circuit the line signal will be pre-synchronized by output signal of the :16 divider and synchronized by the 13.5 MHz clock. The buffer delivers TTL output signals.

V-pulse buffer

The signal out of the V-divider is synchronized with 13.5 MHz clock and converted to a TTL output level.

Gap reference

This circuit operates with the gap-principle and is stable with regard to temperature and supply voltage changes.

50/60 Hz output

This is an open-collector output, which is LOW if more than 287 lines/field are detected.

SSC generator

The SSC generator generates a 3 stage super-sandcastle pulse on an open-collector output, which is able to operate up to 12 volts. The blanking thresholds 2.5 V and 4.5 V are derived from the gap reference (point 16).

Signal identification with Digital PLL (DPLL)

The analog signal identification with output signal at pin 4 is completed with a DPLL. This PLL is able to lock on the separated sync although the 13.5 MHz VCO is not locked on the input signal. The ratio of the lock condition to the unlock condition influences the voltage at pin 5. The detector circuit of the analog signal identification block evaluates the voltages at pins 2 and 5. If the voltage at pin 5 reaches 4 V (most of the time the PLL is locked) pin 4 will be HIGH. The voltages at pins 2 and 5 together with the state of the V-logic set the operation state of the TDA4691. The TDA4691 is able to accommodate to different input conditions automatically.

Some operation conditions can be set externally by influencing the voltages at pins 2 and 5:

1. Time constant T_1 (fast) on: voltage at pin 2 is limited to 5 V (0 to 5 V).
2. Time constant T_3 (slow) on: voltage at pin 5 is limited to 6.2 V (0 to 6.2 V).
3. Time constant T_3 (slow) inoperative: voltage at pin 2 is limited between 4 V and 6.5 V.
4. Time constant T_3 (slow) inoperative with input signal: voltage at pin 2 is limited to 6.5 V (0 to 6.5 V).
5. VCO frequency fixed to f_0: pin 2 is set to ground ($V_2 < 1$ V).

Noise detector

This block switches the time constant to ‘slow’ if on standard signal a certain noise level is reached. This noise level is measured in a small window inside the sync pulse.

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{P1}	supply voltage	0	9.0	V
I_{P1}	supply current	–	40	mA
V_{P2}	supply voltage	0	5.7	V
I_{P2}	supply current	–	50	mA
P_{tot}	total power dissipation	–	650	mW
T_{stg}	storage temperature	–25	+150	°C
T_{amb}	operating ambient temperature	0	+70	°C
V_{ESD}	ESD-protection on all pins; note 1	300	–	V
$I_{I/O}$	currents on all pins except supply pins 3, 8, 12 and 19	–10	+10	mA
V_I	voltage applied to pins 1, 2, 4, 5, 7, 14 and 20	0	V_{P1}	V
V_I	voltage applied to pins 9, 10, 11 and 13	0	V_{P2}	V
V_6	voltage applied to pin 6	0	13.2	V
V_{15}	voltage applied to pin 15	0	5	V
V_{16}	voltage applied to pin 16	0	5	V
V_{17}	voltage applied to pin 17	0	5	V
V_{18}	voltage applied to pin 18	0	5	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
$R_{th\ j\text{-}a}$	from junction to ambient in free air	
	SOT146 (without heat spreader)	65 K/W
	SOT163	85 K/W

CHARACTERISTICS

V_{P1} = 8 V; V_{P2} = 5 V; measured at T_{amb} = +25 °C; unless otherwise specified; application see Figs 10 and 11; video input signal referenced to CCIR standard.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply (pins 19 and 12; all voltages are measured with regard to ground (pins 3 and 8))						
V_{19}	supply voltage		7.2	8.0	8.8	V
I_{P1}	supply current		–	20	30	mA
V_{12}	supply voltage	same rise time as V_{19}	4.5	5.0	5.5	V
I_{P2}	supply current		–	15	30	mA
P_{tot}	total power dissipation		–	260	430	mW
Sync separator (pin 20)						
$V_{20(p-p)}$	input voltage (peak-to-peak value)	AC coupled	–	1	2	V
$V_{20(p-p)}$	sync amplitude (peak-to-peak value)		0.1	–	0.6	V
R_G	source resistor of generator		–	–	1	kΩ
I_{20}	current during sync		–	–30	–	μA
I_{20}	current during remaining time		–	1	–	μA
Black level (pin 1)						
SLH	slicing level H		–	50	–	%
SLV	slicing level V		–	50	–	%
Sync output (pin 9)						
V_9	no sync	I_9 = +1 mA	–	0.3	–	V
V_9	positive sync	I_9 = –1 mA	2.7	–	V_{12}	V
C_L	load capacitance		–	–	40	pF
t_1	time delay between pin 20 and pin 9	see Fig.3	100	200	500	ns
t_2	time delay between pin 20 and pin 9	see Fig.3	100	300	500	ns
Phase detector (pins 16 and 17)						
f_0	nominal sync frequency		–	15.625	–	kHz
f_0'	f_{osc} : 864 = phiref		–	15.625	–	kHz
I_{17}	current at sync time (fast and normal time constant)		–	±240	–	μA
I_{17}	current at sync time (slow time constant)		–	±80	–	μA
I_{16}	current at sync time	time constant T_1	–	±2	–	mA
V_{17}	filter 2 voltage		1.5	3	4.5	V
V_{16}	filter 1 voltage		1.5	3	4.5	V
$\Delta f_0/\Delta V_{16}$	VCO sensitivity	see VCO	–	360	–	kHz/V
13.5 MHz VCO (pin 15)						
R_{15}	f_0 defining resistor	see Fig.4(a)	–	3.75	–	kΩ
V_{15}	pin voltage (V_{19} dependent)	see Fig.4(a)	2.9	3	3.1	V
I_{15}	current for 13.5 MHz		–720	–800	–880	μA
g_{VCO}	transconductance at f_0		15.2	–	18.6	kHz/μA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\Delta f_0/\Delta V_{16}$	VCO sensitivity	4% control range; depending on current at pin 18	–	360	–	kHz/V
Input of external oscillator (pin 15)						
V_{15}	pin voltage AC	see Fig.4(b)	1	–	3	V
V_{15}	pin voltage DC	dependent on V_{19}	–	5	–	V
R_{int}	internal resistance	see Fig.4(b)	–	7	–	kΩ
C_{int}	internal capacitance	see Fig.4(b)	–	4	–	pF
13.5 MHz buffer (pin 13)						
V_{13}	clock HIGH level output voltage	I_{13} = –1 mA; V_{12} = 4.5 V	2.7	–	V_{12}	V
V_{13}	clock HIGH level output voltage	I_{13} = 0 mA	2.7	–	V_{12}	V
V_{13}	clock LOW level output voltage	I_{13} = 2 mA; V_{12} = 5.5 V	0	–	0.8	V
t_r	rise time	see Fig.5	–	20	–	ns
t_f	fall time	see Fig.5	–	20	–	ns
D_{13}	mark-to-space ratio	V_{13} = 1.5 V	45/55	–	55/45	%
C_L	load capacitance		–	–	40	pF
ΔT_{13}	jitter on clock output (peak-to-peak value)	normal time constant T_2; measured between lines 25 and 305	–	–	2	ns
H-output buffer (pin 11)						
V_{11}	H HIGH level output voltage	I_{11} = –1 mA; V_{12} = 4.5 V	2.7	–	V_{12}	V
V_{11}	H HIGH level output voltage	I_{11} = 0 mA	2.7	–	V_{12}	V
V_{11}	H LOW level output voltage	I_{11} = 2 mA; V_{12} = 5.5 V	0	–	0.8	V
t_r	rise time	see Fig.6	–	25	–	ns
t_f	fall time	see Fig.6	–	25	–	ns
t_3	time relation pin 13 to 11	see Fig.6	–	25	55	ns
t_4	time relation pin 13 to 11	see Fig.6	3	–	–	ns
t_5	H-pulse width	see Fig.6	3.0	3.6	4.2	µs
C_L	load capacitance	see Fig.6	–	–	40	pF
Start of H-pulse (pin 14)						
I_{14}	current pin 14		–	–	±100	µA
t_{61}	time delay pulse between pin 20 and 11	see Fig.6	–1.1	–1.3	–1.5	µs
t_{62}	time delay pulse between pin 20 and 11	see Fig.6	–0.6	–0.8	–1.0	µs
t_{63}	time delay pulse between pin 20 and 11	see Fig.6	3.8	4.0	4.2	µs
t_{64}	time delay pulse between pin 20 and 11	see Fig.6	5.0	5.2	5.4	µs
V_{14} (t_{61})	voltage pin 14 (proportional to V_{19})		0	–	1	V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{14} (t_{62})	voltage pin 14 (proportional to V_{19})		2	2.4	2.8	V
V_{14} (t_{63})	voltage pin 14 (proportional to V_{19})		3.5	4	4.5	V
V_{14} (t_{64})	voltage pin 14 (proportional to V_{19})		5	5.5	6	V
V-output buffer (pin 10)						
V_{10}	V HIGH level output voltage	I_{10} = –1 mA; V_{12} = 4.5 V	2.7	–	V_{12}	V
V_{10}	V HIGH level output voltage	I_{10} = 0 mA	2.7	–	V_{12}	V
V_{10}	V LOW level output voltage	I_{10} = 2 mA; V_{12} = 5.5 V	0	–	0.8	V
t_r	rise time	see Fig.6	–	25	–	ns
t_f	fall time	see Fig.6	–	25	–	ns
t_3	time relation pin 13 to 10	see Fig.6	–	25	55	ns
t_4	time relation pin 13 to 10	see Fig.6	3	–	–	ns
t_5	V-pulse width	see Fig.7	280	320	350	µs
t_6	time delay between pin 20 and pin 10	see Fig.7	12	16	20	µs
C_L	load capacitance	see Fig.7	–	–	40	pF
Reference (pin 18)						
V_{REF}	reference voltage		1.1	1.2	1.3	V
R_{18}	control current defining resistor		8	–	30	kΩ
Δf	control range VCO		–	±4	–	%
$I_{18/1}$	current pin 18 (±4%)		–	105	–	µA
Δf_a	adjustable control range		±3	–	±5	%
$I_{18/3}$	current pin 18 (±3%)		–	80	–	µA
$I_{18/3}$	current pin 18 (±5%)		–	120	–	µA
50/60 Hz output (pin 7; open collector; see Fig.8)						
V_7	output voltage pin 7; 50 Hz ≥ 287.5 lines/field = LOW	I_7 = 1 mA	0	–	0.3	V
		I_7 = 2 mA	0	0.3	0.8	V
V_7	output voltage pin 7; 60 Hz ≤ 287 lines/field = HIGH		2.7	–	V_{19}	V
I_7	output leakage current		–	–	50	µA
Sandcastle output (pin 6)						
V_6	burstkey pulse	see Fig.9	9.5	10	12	V
V_6	H-blanking pulse independent from V_{supply}		4.3	4.5	4.7	V
V_6	V-blanking pulse independent from V_{supply}		2.3	2.5	2.7	V
V_6	voltage pin 6 LOW		0	0.2	0.8	V
t_w	pulse width burstkey; 50 Hz	at 6.5 V; see Fig.9	4.0	4.3	4.7	µs
t_w	pulse width burstkey; 60 Hz	at 6.5 V; see Fig.9	3.3	3.8	4.1	µs
t_2	time relation between pin 20 and burstkey	see Fig.9	2.2	2.5	2.8	µs

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
t_3	time relation between pin 20 and blanking	see Fig.9	3.5	4.0	4.5	µs
t_4	H-blanking time	see Fig.9	–	11.8	–	µs
t_5	start time H-pulse pin 20 to stop time burstkey pin 6; 50 Hz	H-sync = 4.7 µs; see Fig.9	8.0	9.0	9.7	µs
t_5	start time H-pulse pin 20 to stop time burstkey pin 6; 60 Hz	see Fig.9	7.5	8.6	9.2	µs
t_6	V-blanking pulse; 50 Hz		–	–2.5 to +22.5	–	lines
t_6	V-blanking pulse; 60 Hz		–	–3.0 to +17	–	lines
Integration (pin 5)						
V_5	no TV signal	see Fig.16	0	–	2	V
	TV signal	see Fig.16	4	–	–	V
V_5	slow time constant on		5	–	6.2	V
Signal identification (pin 4; open collector via R_4 to V_{19} or V_{12})						
V_4	voltage pin 4, if no signal is identified	I_4 = 1 mA	0	–	0.3	V
		I_4 = 5 mA	0	0.2	0.8	V
V_4	voltage pin 4, if signal is identified		–	–	V_{19}	V
I_4	leakage current		–	–	50	µA
Integration (pin 2; see Fig.15)						
V_2	no signal at pin 20		–	1.5	–	V
V_2	noise at input pin 20		–	3	–	V
V_2	switching T_3 to T_1 (delay 7 fields)		–	2.5	–	V
V_2	switching T_3 to T_1 (noise and signal at input pin 20)		–	2.5	–	V
V_2	release V-divider		–	4	–	V
	hysteresis		–	–0.2	–	V
V_2	release time constant normal (T_2) signal identification at pin 4		–	5	–	V
	hysteresis		–	–0.2	–	V
V_2	release noise detector		–	6.5	–	V

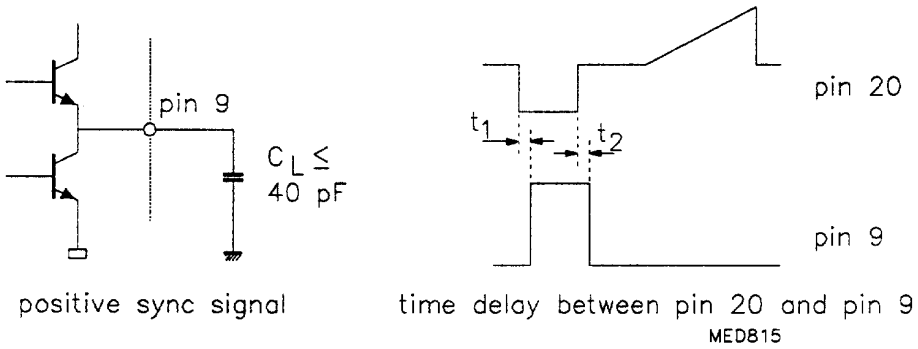


Fig.3 Sync output.

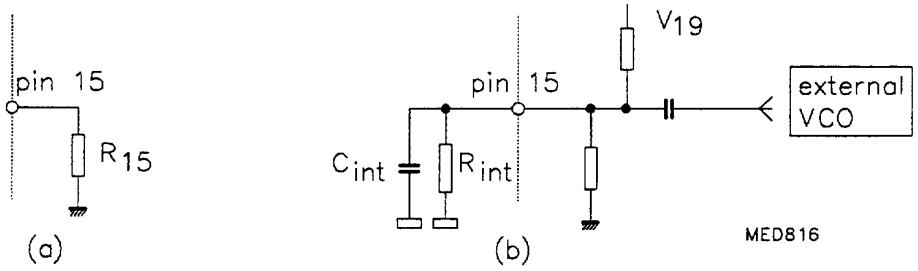


Fig.4 Pin 15 circuit for (a) internal VCO; (b) external VCO.

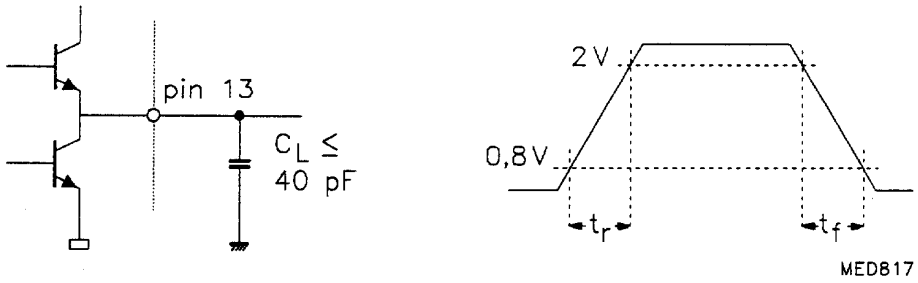
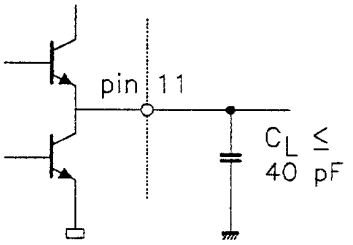
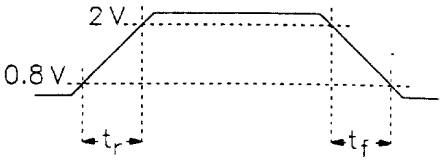


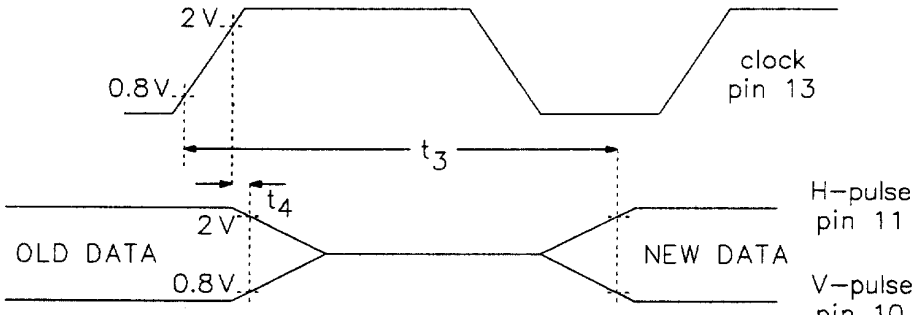
Fig.5 Clock output.



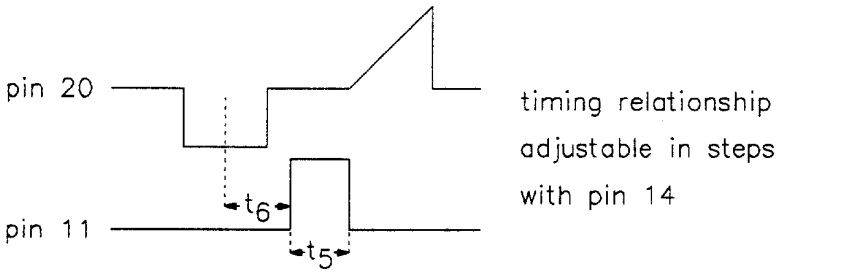
horizontal output pin 11



rise and fall time pin 10, 11



time relationship pin 13 to 11/10



time delay between pin 20 and pin 11

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Fig.6 Time relationship of pin 10/11 to pin 13/20.

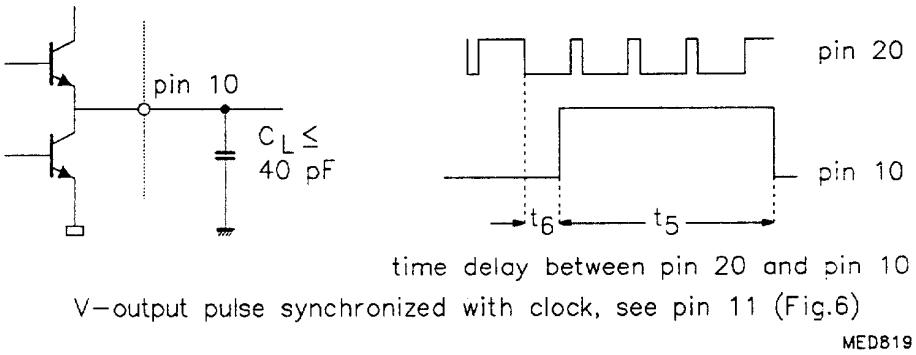


Fig.7 Time relationship pin 10 to pin 20.

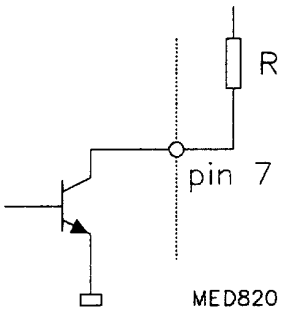


Fig.8 50/60 Hz output.

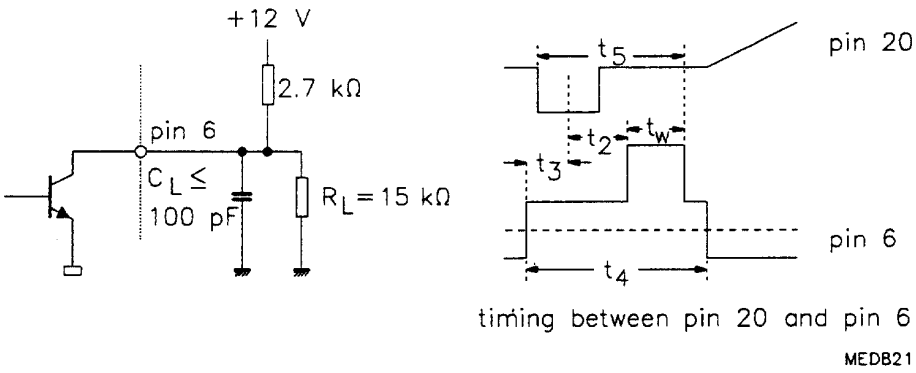
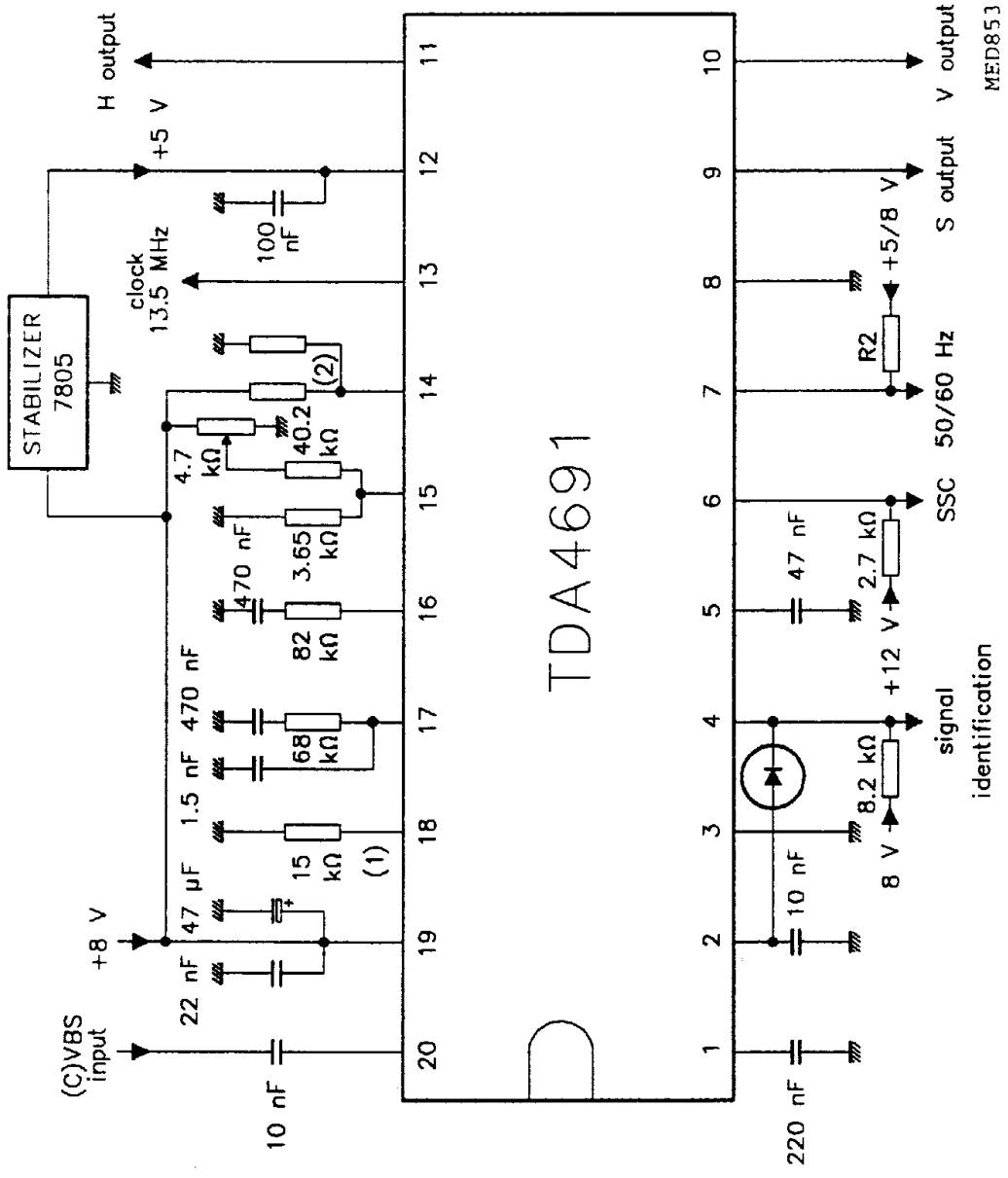


Fig.9 Sandcastle output.



(1) control range VCO 4%; see CHARACTERISTICS.
(2) depending on H output shift; see CHARACTERISTICS.

V_P (V)	R2 (kΩ)
5	5.1
8	8.2

Fig.10 Application diagram.

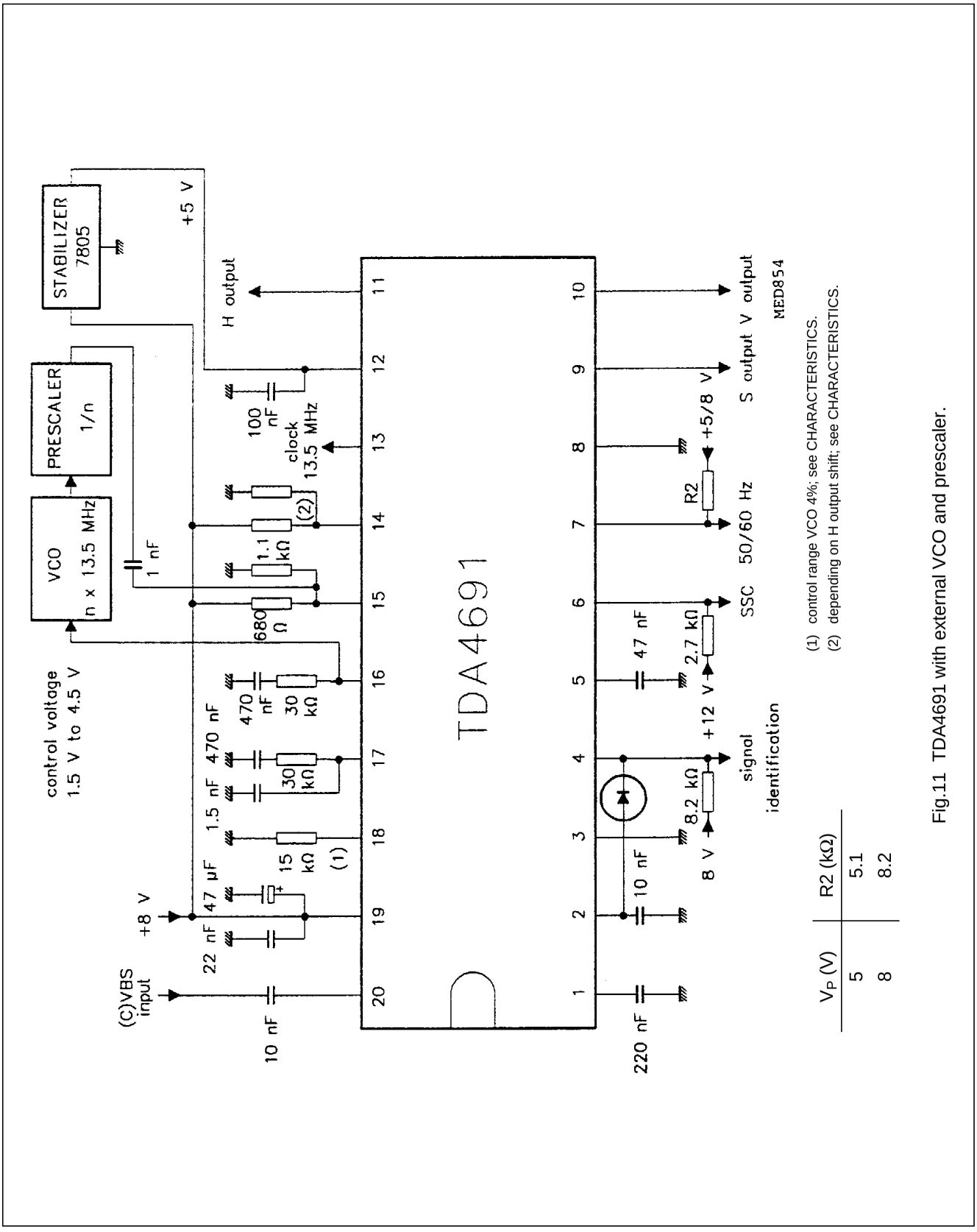


Fig.11 TDA4691 with external VCO and prescaler.

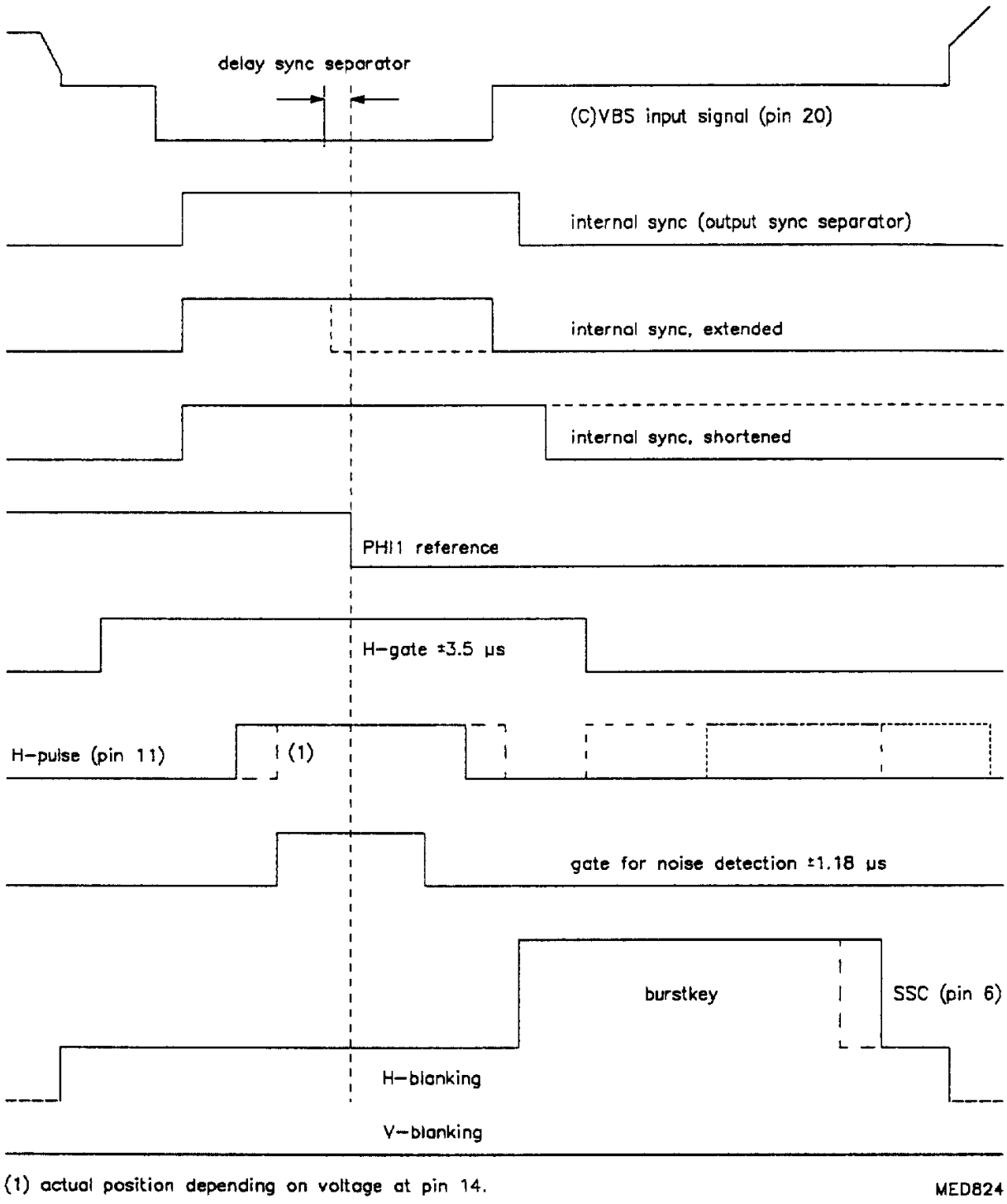


Fig.12 H-timing overview.

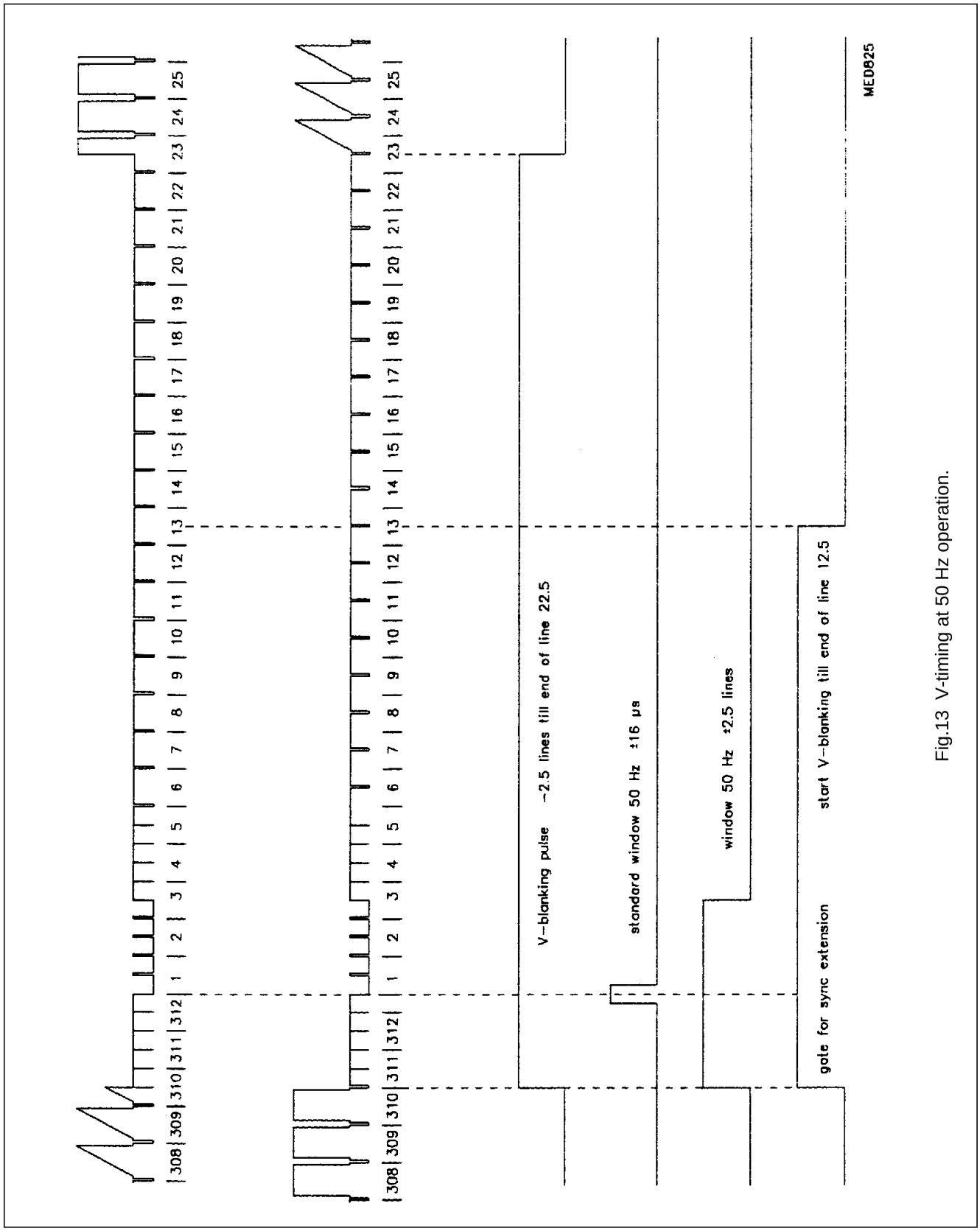


Fig.13 V-timing at 50 Hz operation.

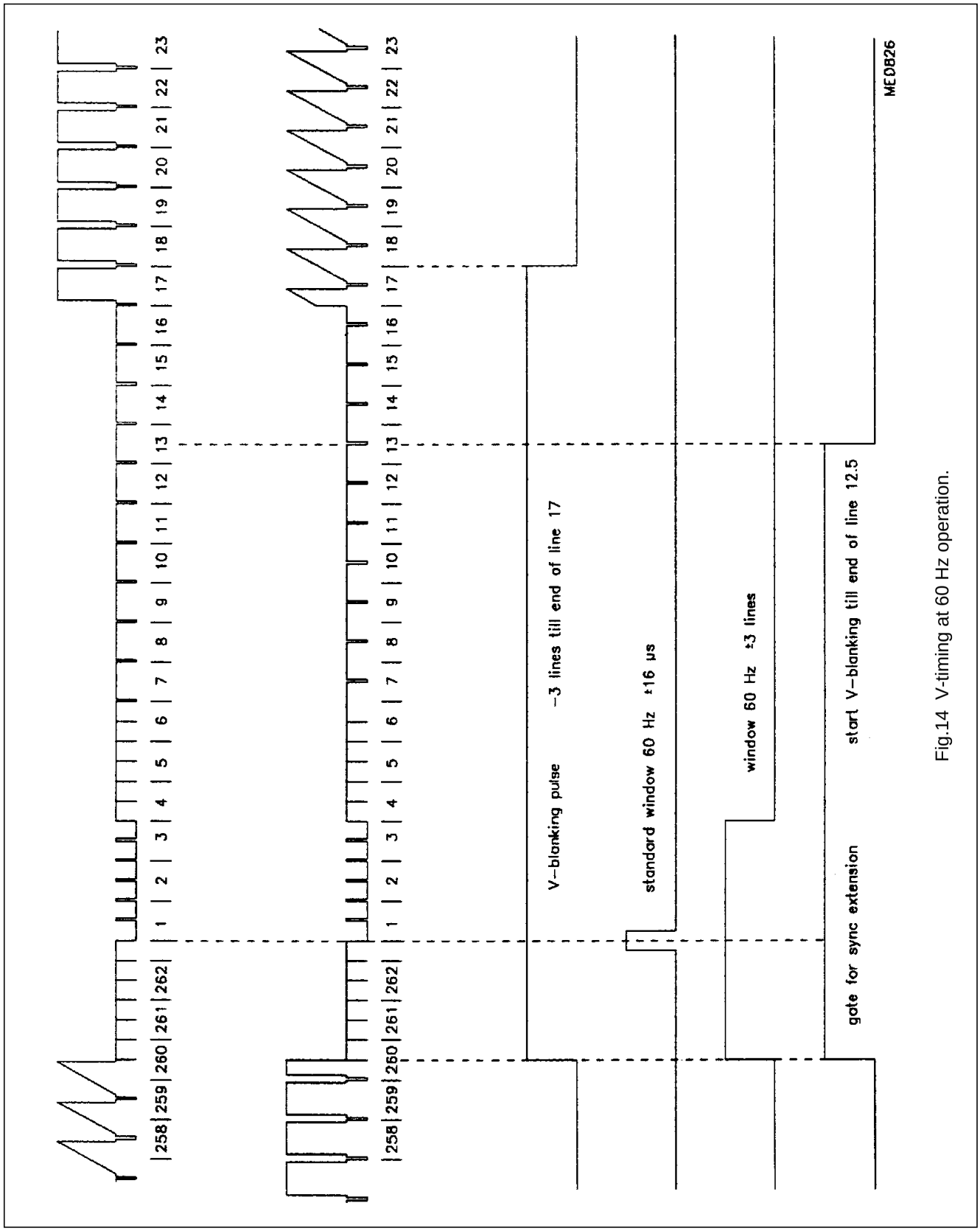


Fig.14 V-timing at 60 Hz operation.

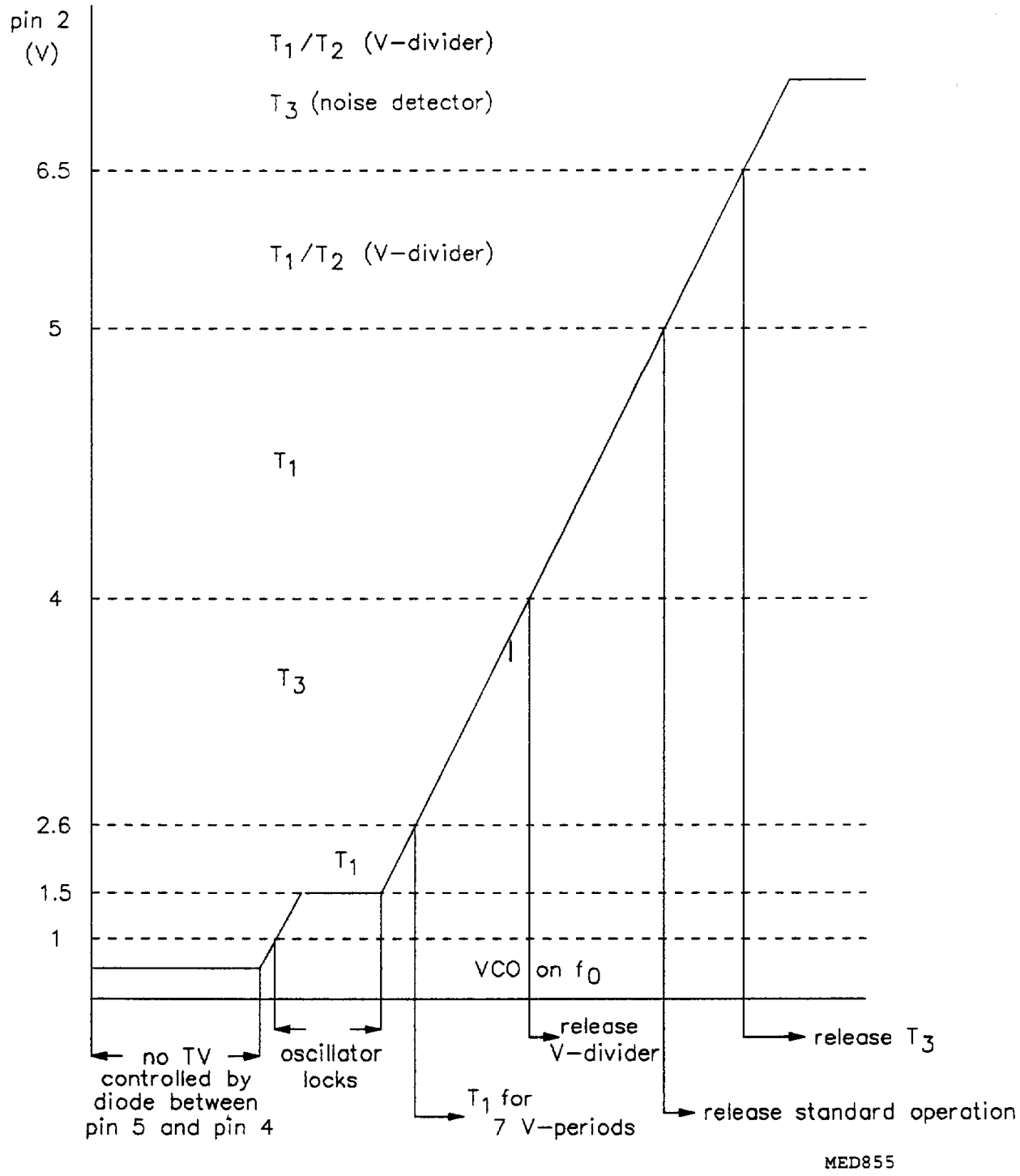


Fig.15 Control of operation states by voltage at pin 2.

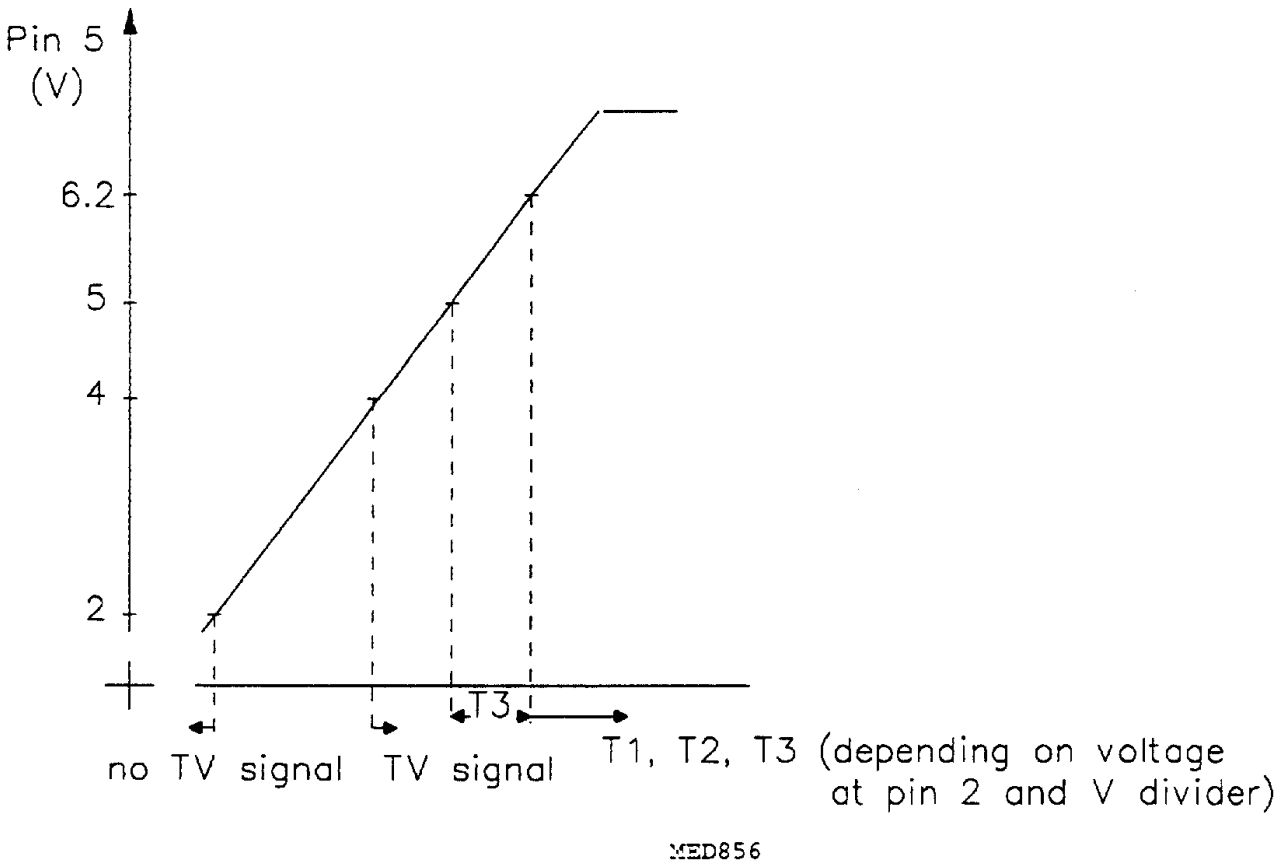


Fig.16 Control of signal identification (pin 4) and time constants by voltage at pin 5.

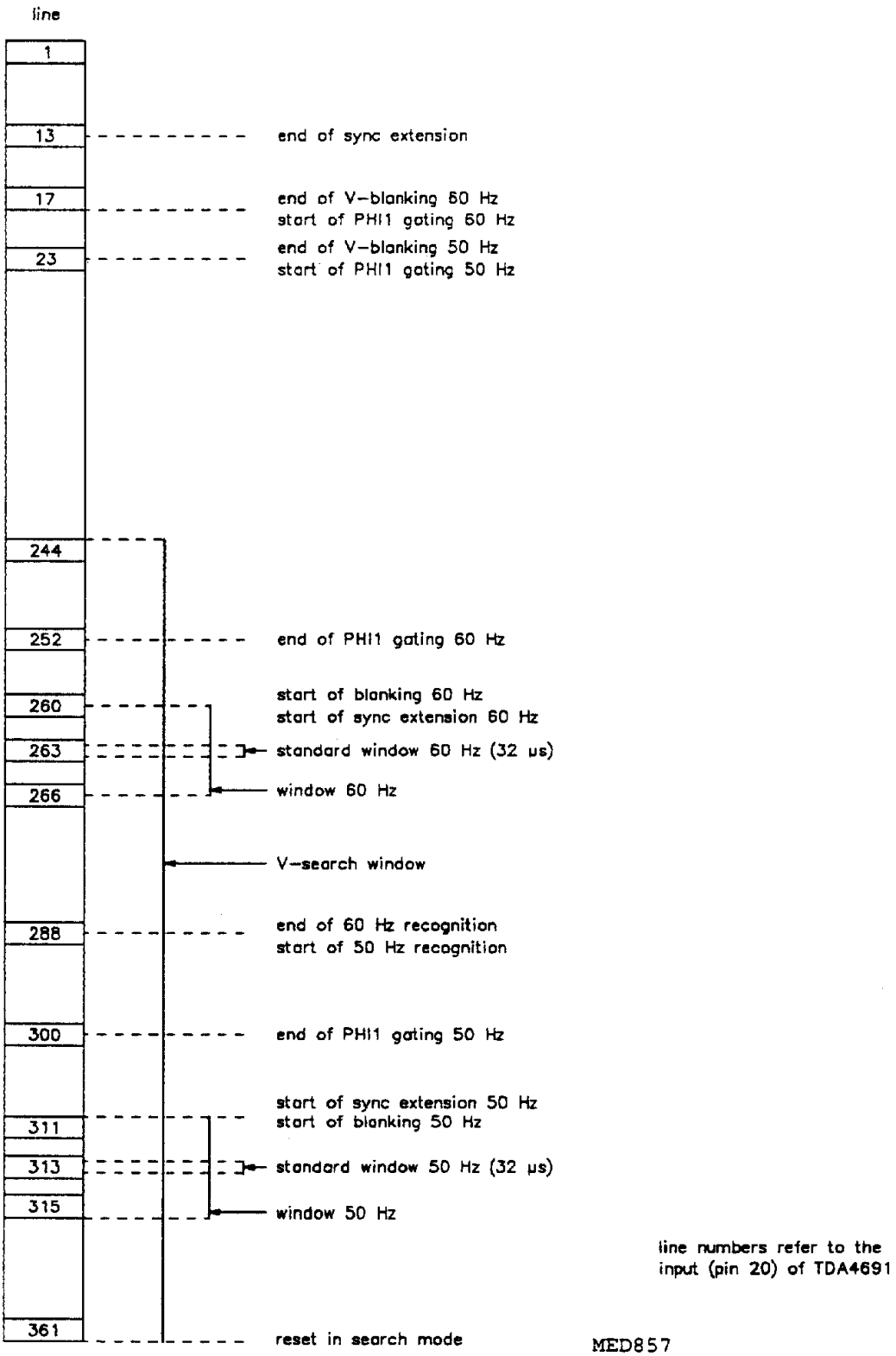
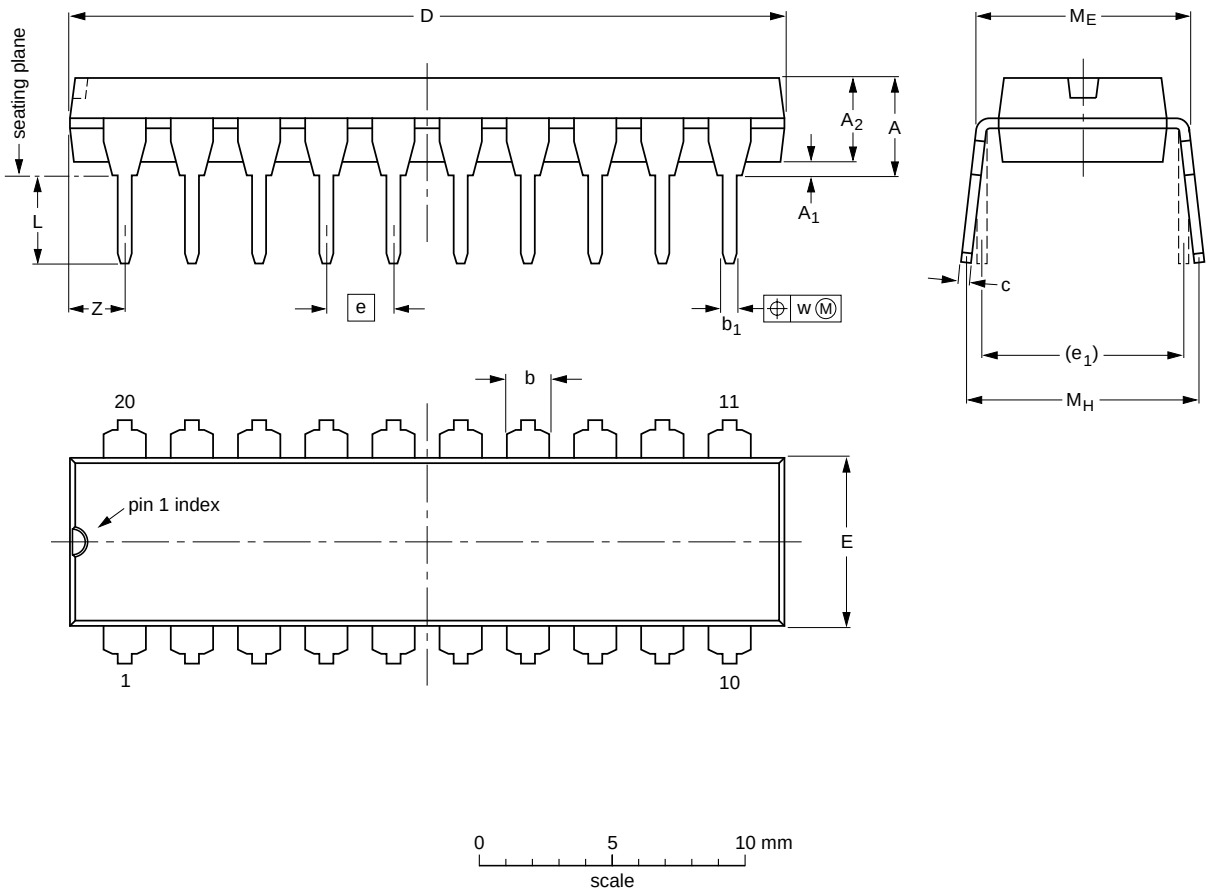


Fig.17 V-timing.

PACKAGE OUTLINES

DIP20: plastic dual in-line package; 20 leads (300 mil) SOT146-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

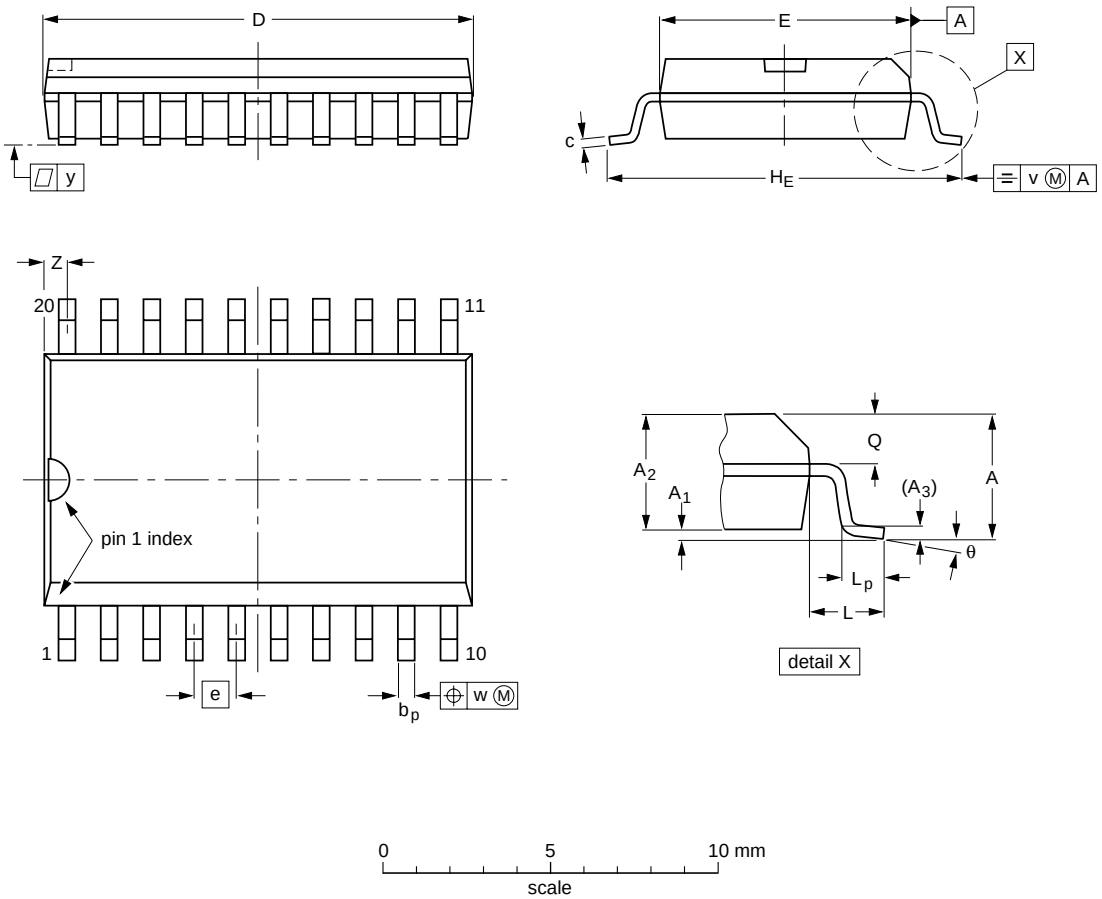
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	0.36 0.23	26.92 26.54	6.40 6.22	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.0
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.078

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT146-1			SC603			~~92-11-17~~ 95-05-24

SO20: plastic small outline package; 20 leads; body width 7.5 mm **SOT163-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8^o 0^o
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.050	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT163-1	075E04	MS-013AC				~~95-01-24~~ 97-05-22

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

DIP

Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

SO

Reflow soldering

Reflow soldering techniques are suitable for all SO packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

Wave soldering

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

Repairing soldered joints

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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