

## STEREO DEMODULATOR FOR CAR- AND MAINS OPERATED RADIOS

Technology: Bipolar

Features:

- Supply voltage range  $V_S = 8 \dots 18 \text{ V}$
- FM mpx. switch or matrix operation possible
- Excellent rejection of ARI\* subcarrier and pilot tone harmonics

Case:  
18 pin dual inline plastic

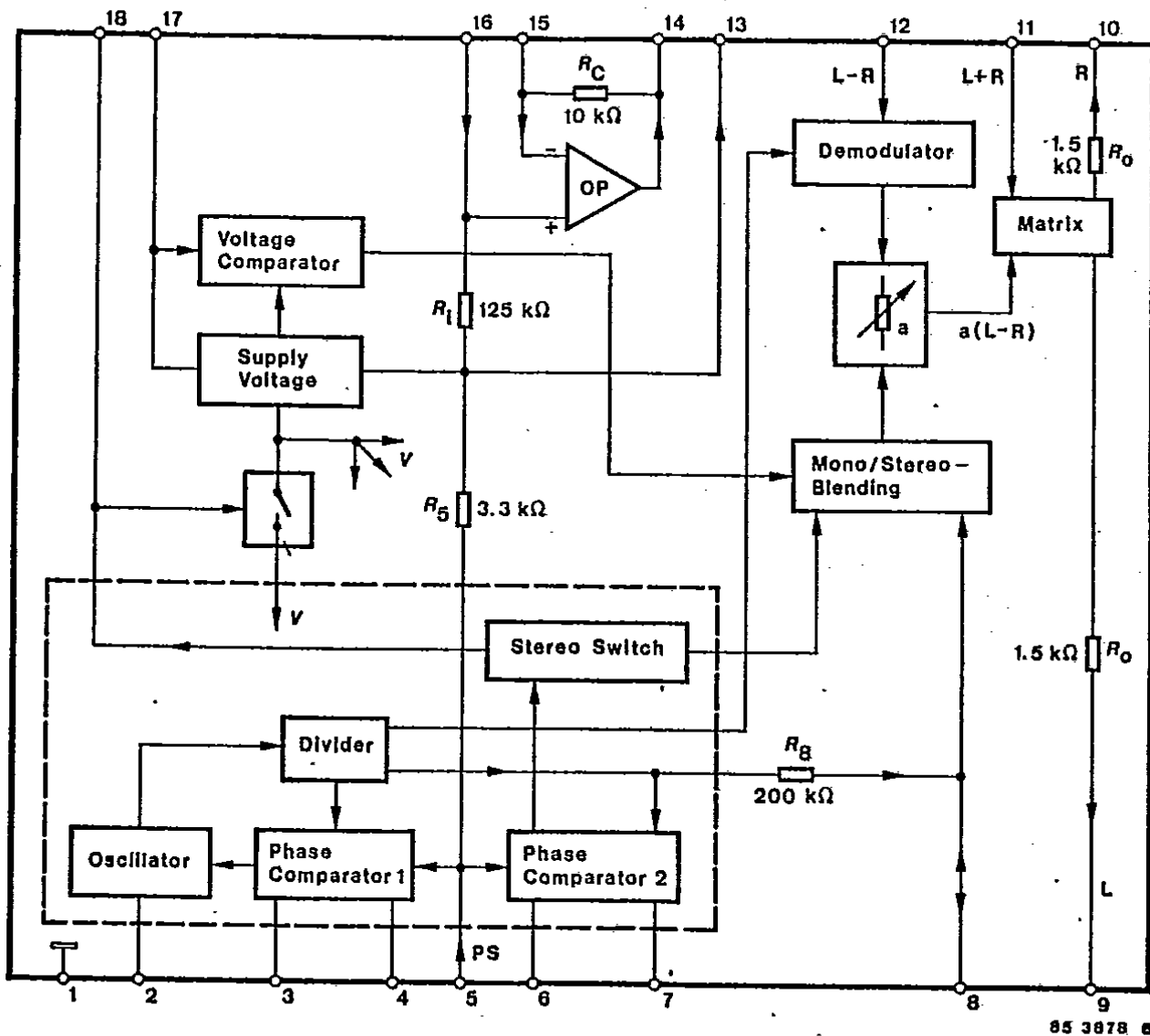


Fig. 1 Block diagram and pin connections

## Pin configuration

Pin	Function	Pin	Function
1	Ground	10	Output R
2	Oscillator RC	11	(L+R) input
3	TP phase comparison 1	12	(L-R) input
4	TP phase comparison 1	13	Reference voltage
5	Pilot tone (PT) input	14	Output op amp
6	TP phase comparison 2	15	-input op amp
7	TP phase comparison 2	16	+input op amp
8	$f_{osc}$ output/St-Mo blending $V_H$	17	Supply voltage
9	Output L	18	Lamp connection/oscillator switch

## Description

The TCA 4511 decodes the transmitter side stereo information in both L and R channels. Stereo transmission is shown by means of an indicator lamp. A continual blending of mono and stereo signals is possible. The switching frequencies are controlled by a phase-locked loop. The stereo decoder can be used in time multiplex (switching) or in frequency multiplex (matrix) mode of operation.

## Switching operation

The MPX input signal is corrected in amplitude and phase by an operational amplifier. For this purpose an RC circuit is connected at Pin 15.

Subsequently, the (L+R) and (L-R) signals are processed in separate stages. The (L-R) signal is demodulated and can be reduced by the factor  $a$  through mono/stereo blending. In the final matrix circuit the aggregate signal (L+R) is added to the demodulated signal  $a$  (L-R) according to the following formula:

$$(L-R) + a(L-R) = L(1+a) + R(1-a)$$

$$(L+R) - a(L-R) = L(1-a) + R(1+a)$$

$$0 \leq a \leq 1$$

Mono                      Blending                      Stereo

## Absolute maximum ratings

Reference point Pin 1

Supply voltage	Pin 17	$V_S$	18	V
Lamp voltage	Pin 18	$V_{LP}$	18	V
Current for stereo indicator lamp $V_{18} \cdot I_{LP} \leq 300 \text{ mW}$	Pin 18	$I_{LP}$	50	mA
Minimum values at all terminals		$V_{ext}$	$\geq 0$	V
Junction temperature		$T_j$	+150	°C
Storage temperature range		$T_{stg}$	-40...+150	°C
Ambient temperature range		$T_{amb}$	-25...+85	°C

The generated output signals are then forwarded to two external RC low-passes for deemphasis.

The required frequency to demodulate the L-R signal is obtained by a phase-locked loop (PLL) from the divider. By means of a pilot tone applied to Pin 5, the oscillator is synchronized by phase comparison 1. An additional phase comparison 2 provides mono or stereo information. Based on this information, the indicator lamp is activated and lights up when a sufficiently strong signal is present at the input. Moreover, the (L-R) reduction is eliminated.

If switch S1 is open, the IC switches the oscillator off, whereby the stereo switch and the mono/stereo blending suppress the L-R signal. The supply current is thus reduced. Also, since the oscillator does not resonate when switch S1 is open, AM receiver signals can be forwarded without interference via the IC.

If Pin 8 is not connected, the oscillator frequency can be measured. For normal operating functions, the blending voltage  $V_H$  is applied to Pin 8 or Pin 8 must be blocked by a capacitor. Otherwise, cross-talk is affected by the oscillator frequency.

Maximum thermal resistance						
Junction ambient		$R_{thJA}$		78		K/W
Electrical characteristics for switching operation			Min.	Typ.	Max.	
$V_S = 8\text{ V}$ , reference point Pin 1, $T_{amb} = 25\text{ °C}$ , unless otherwise specified						
Supply voltage range	Pin 17	$V_S$	8		18	V
Total supply current (FM-operation) S1 closed	Pin 17	$I_S$		14	20	mA
Total supply current (AM-operation) S1 open	Pin 17	$I_S$		10	15	mA
Lamp current control range $V_{18} \cdot I_{LP} \leq 300\text{ mW}$	Pin 18	$I_{LP}$	10		25	mA
Lamp current short circuited $V_{18} \cdot I_{LP} \leq 300\text{ mW}$	Pin 18	$I_{LP}$			50	mA
<b>Input amplifier</b>						
Input signal	Pin 16	$V_i$			1.6	$V_{pp}$
Output signal	Pin 14	$V_o^{1)}$		$V_{18}$		V
Input resistance	Pin 16	$R_i$	90	125		k $\Omega$
Feedback resistance	Pin 15/14	$R_f$		10		k $\Omega$
Reference voltage	Pin 13	$V_{Ref}$		1.75		V
<b>Stereo matrix</b>						
Output voltage (Stereo) modulated	Pin 9, 10	$V_{oAF}^{1) 6)}$	0.9	1.2	1.6	$V_{pp}$
Output voltage (Mono) L or R modulated	Pin 9, 10	$V_{oAF}^{2) 6)}$	0.45	0.6	0.8	$V_{pp}$
Output resistance	Pin 9, 10	$R_o$		1.5	2	k $\Omega$
Separation Fig. 2 $f_{AF} = 1\text{ kHz}$	Pin 9, 10	$\alpha_v^{1)}$	34	40		dB
Rejection ratio 19 kHz		$\alpha_{19}$	30	32		dB
38 kHz		$\alpha_{38}$	30	40		dB
57 kHz		$\alpha_{57}$	30	45		dB
76 kHz		$\alpha_{76}$	30	40		dB
Supply voltage rejection ratio	Pin 9, 10	$V_{ripple}^{3)}$	40	45		dB
Noise voltage	Pin 9, 10	$V_{on}^{4)}$		30	80	$\mu\text{V}$
Total harmonic distortion $f_{AF} = 1\text{ kHz}$	Pin 9, 10	THD <sup>1) 6)</sup>			0.5	%
Channel balance	Pin 9, 10	$B_{al}^{2)}$			0.5	dB
Switching noise mono/stereo S1 closed-open	Pin 9, 10	$\Delta V_o$			60	mV

Oscillator			Min.	Typ.	Max.	
Output resistance for $f_{osc}$ -measuring	Pin 8	$R_o$		200		k $\Omega$
Oscillator basic frequency		$f_{osc}$		19		kHz
Capture and hold range	Pin 2	$f_{C/H}^{1)}$	$\pm 0.4$	$\pm 1$	$\pm 2.0$	kHz
Balancing resistor $f_{osc} = 19$ kHz	Pin 2/1	$R_{osc}$	13		18	k $\Omega$
Oscillator-"ON"						
S1 closed	Pin 18	$V_L$	1.0			V
$I_o = 10$ mA	Pin 18	$V_L$	0.9			V
Oscillator-"OFF"						
S1 open or $V_{18} \leq 0.4$ V	Pin 18	$V_L$			0.4	V
Phase comparison						
Input voltage	Pin 5	$V_i^{1)}$	0.5	0.7	0.9	$V_{pp}$
Input resistance	Pin 5	$R_i$		3.3		k $\Omega$
Input voltage	Pin 5	$V_i$			1.6	$V_{pp}$
Stereo switch						
$f = 19$ kHz, S1 closed						
Switch threshold "ON"	Pin 5	$V_{IPT}$		30	55	mV $_{pp}$
"OFF"	Pin 5	$V_{IPT}$	12	15		mV $_{pp}$
Hysteresis	Pin 5	H	3	6	9	dB
Mono/stereo blending						
Mono						
$V_H = V_8 = 0.5$ V		$\alpha_{blend}^{7)}$	3	6	9	dB
Stereo						
$V_H = V_8 = 0.9$ V		$\alpha_{blend}^{7)}$	34			dB

1)  $V_i = 1.2 V_{ppMPX}$ ,  $V_H \geq 1$  V, S1 closed,  $f_{AF} = 1$  kHz

2)  $V_i = 1.2 V_{ppMPX}$ , S1 open,  $f_{AF} = 1$  kHz

3)  $V_S = 12$  V +  $V_{St}$ ,  $V_{St} = 200$  mV, 200 Hz

4) CCIR DIN 45405, unweighted, S1 open

5) S1 closed

6) after LP  $f_\alpha = 6.5$  kHz, reduction 36 dB/octave

7)  $V_{18} = 0.75 V_{ppMPX}$ , S1 closed,  $f_{AF} = 1$  kHz

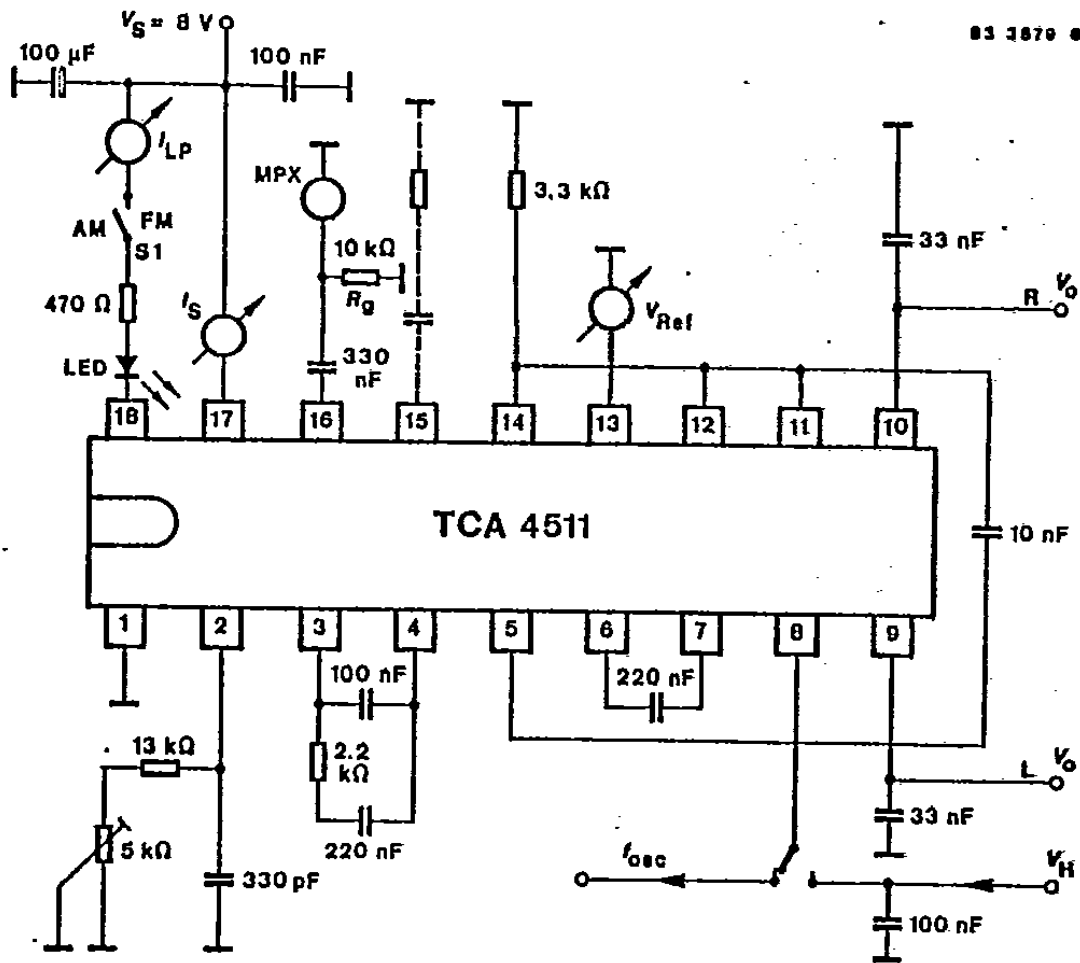


Fig. 2 Test circuit

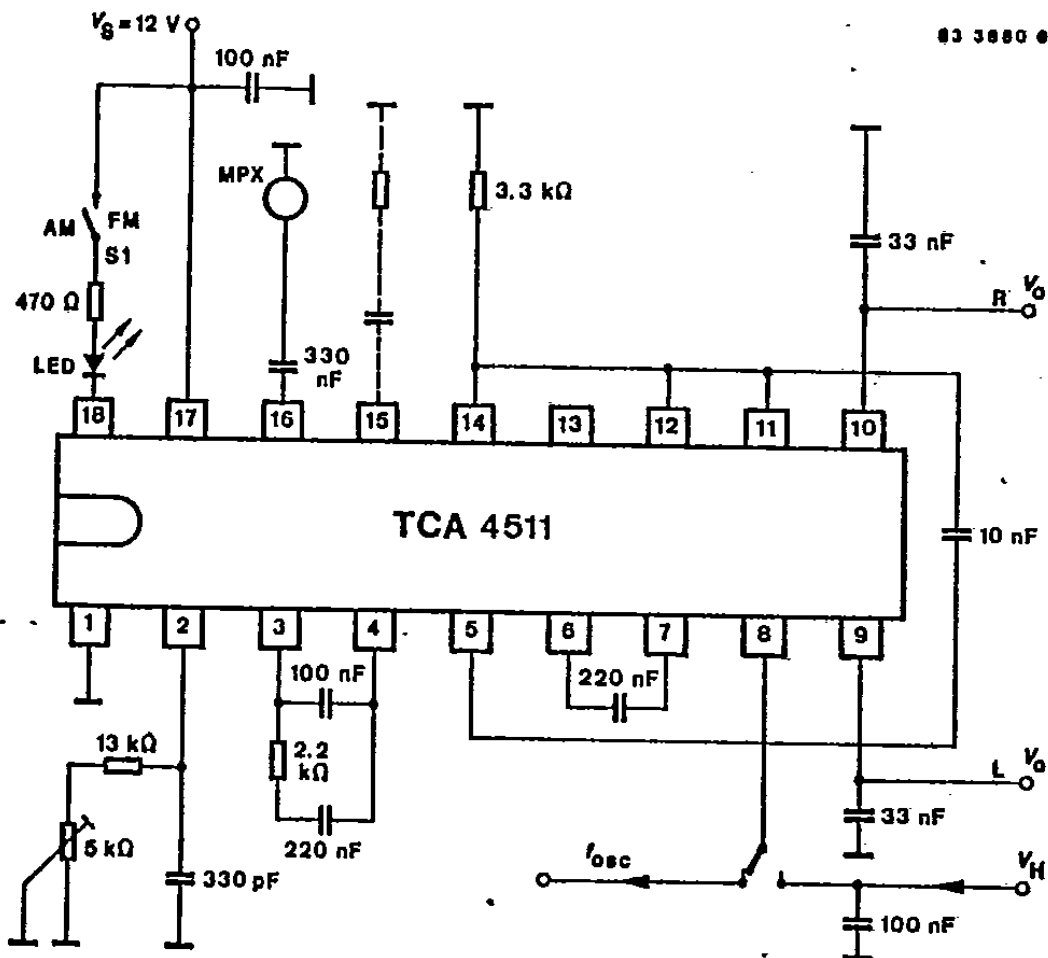
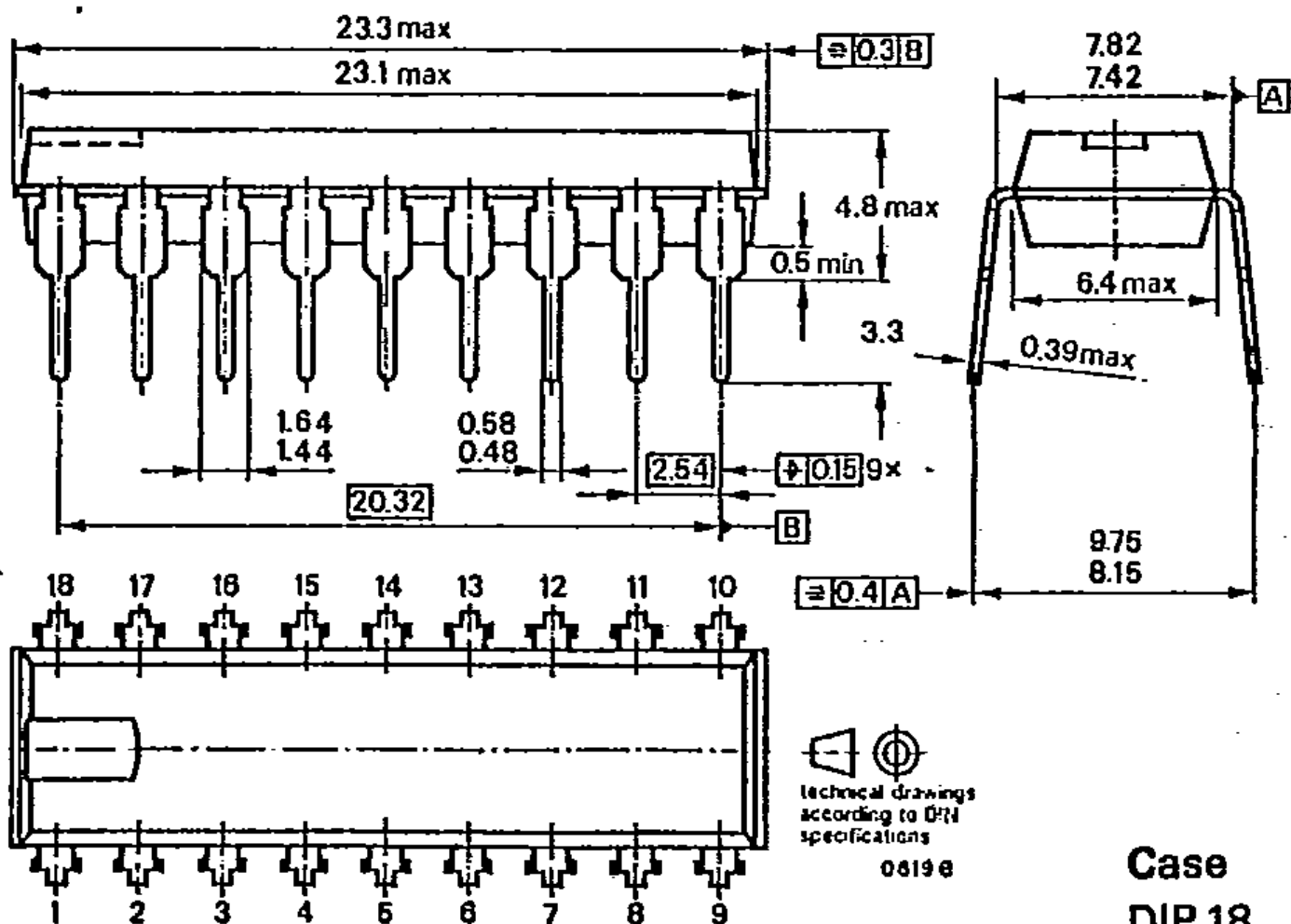


Fig. 3 Application switching operation

# Dimensions in mm



**Case  
DIP 18**