Stereo Decoder for Low-Voltage Operation — TCA 4510

Bipolar circuit

The TCA 4510 decodes the transmitter-side stereo information in both L and R channels. Stereo transmission is shown by means of an indicator lamp. Continuous blending of mono and stereo signals is possible. The switching frequencies are controlled by a phase-locked loop.

- Good channel separation
- No need for coils
- Controllable channel separation
- Good rejection of ARI subcarrier and pilottone harmonics

Type	Ordering code	Package outline
TCA 4510	Q 67000-A 1533	DIP 18

Maximum ratings

Supply voltage	V_S	18	V
Lamp voltage	V_{LP}	18	V
Current for stereo indication lamp	I_{LP}	60	mA
Thermal resistance (system-air)	$R_{th\ SA}$	70	K/W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−40 to 125	°C

Range of operation

Supply voltage range	V_S	4.5 to 18	V
Ambient temperature range	T_{amb}	−25 to 85	°C

Characteristics (V_S = 8 V; T_{amb} = 25 °C)

		min	typ	max	
Total current without I_{LP} (S_1 closed)	I_S		10	15	mA
Total current without I_{LP} (S_1 open)	I_S		6	8	mA
MPX op amp output voltage	V_{14}	700	900		mV_{pp}
Output voltage 1 kHz (stereo) (for modul. output, V_i = 700 mV_{pp})	V_q	700	900	1100	mV_{pp}
Output voltage 1 kHz (mono) (L or R modul., V_i = 700 mV_{pp})	V_q	350	450	550	mV_{pp}
Input resistance	R_i	90	100		kΩ
Output resistance	R_q		1.5	2	kΩ
Cross-talk attenuation (f_{AF} = 1 kHz; V_H > 0.8 V)	a_{cr}		40		dB
19 kHz reduction V_i = 700 mV_{pp} (test circuit 1)	a_{19}		32		dB
19 kHz reduction V_i = 700 mV_{pp} (test circuit 2)	a_{19}		30		dB
38 kHz reduction V_i = 700 mV_{pp} (test circuit 1)	a_{38}		40		dB
38 kHz reduction V_i = 700 mV_{pp} (test circuit 2)	a_{38}		30		dB
57 kHz reduction V_i = 700 mV_{pp} (test circuit 1)	a_{57}		45		dB
57 kHz reduction V_i = 700 mV_{pp} (test circuit 2)	a_{57}		37		dB
76 kHz reduction V_i = 700 mV_{pp} (test circuit 1)	a_{76}		40		dB
76 kHz reduction V_i = 700 mV_{pp} (test circuit 2)	a_{76}		20		dB
Oscillator switch-off (S_1 open)	V_{LP}			0.4	V
Oscillator functions (S_1 closed)	V_{LP}	0.9			V
Oscillator function (I_{LP} = 10 mA)	V_{LP}	0.9			V
Mono a_{cr} = 6 dB (f_{AF} = 1 kHz)	V_H			0.5	V
Stereo a_{cr} = 40 dB (f_{AF} = 1 kHz)	V_H		0.8	0.9	V
Threshold stereo on (S_1 closed)	$V_{i\,PT}$		30		mV_{pp}
Threshold stereo off (S_1 closed)	$V_{i\,PT}$		15		mV_{pp}
Switch-over to mono	V_S		4.8	5	V
Lamp current	I_{LP}	10	35	50	mA
Oscillator basic frequency	f_{osc}		19		kHz
Catching range	f_C		±1		kHz
Channel balance (S_1 open; V_H = 0 V)	B			0.5	dB
Signal-to-noise ratio (RMS 20 Hz—15 Hz)	S/N	60			dB
Total harmonic distortion					
V_q = 700 mV_{pp}; f_{AF} = 1 kHz (test circuit 1)	THD			0.5	%
V_q = 900 mV_{pp}; f_{AF} = 1 kHz (test circuit 2)	THD			0.5	%

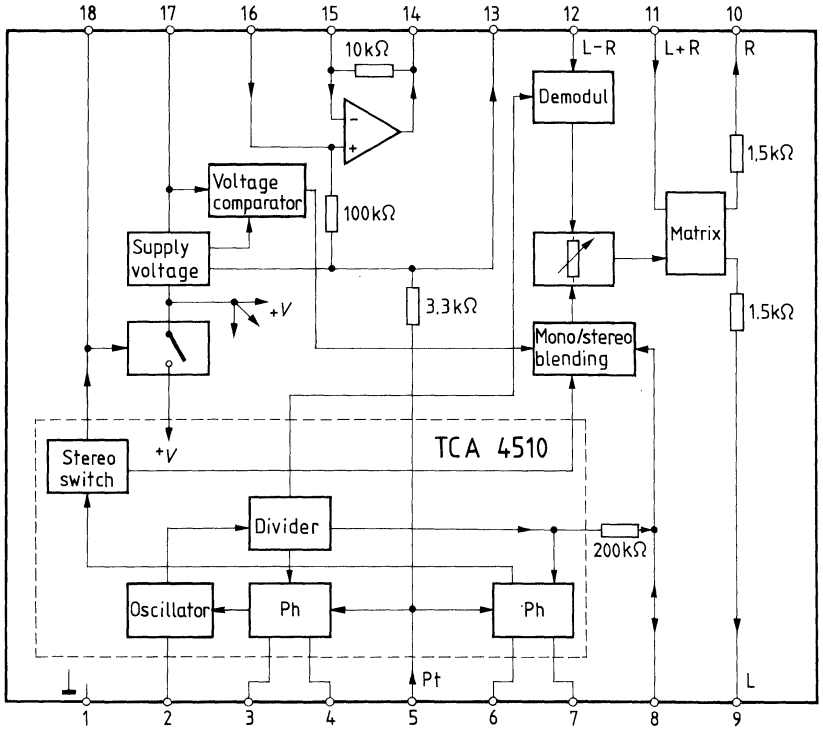
Circuit description

The TCA 4510 is especially intended for battery operation. The IC can be used in time multiplex (switching) or in frequency multiplex (matrix) mode of operation. The necessary signal separation can be achieved by means of de-emphasis, the (L—R) signals are de-emphasized prior to their demodulation.

Amplitude and phase of the MPX input signal can be corrected by an operational amplifier. For this purpose an RC circuit is connected at pin 15. In matrix mode of operation, separation of (L+R) and (L−R) signals is achieved through an attenuated tuning circuit. In case of switching mode of operation, this separation is not required.

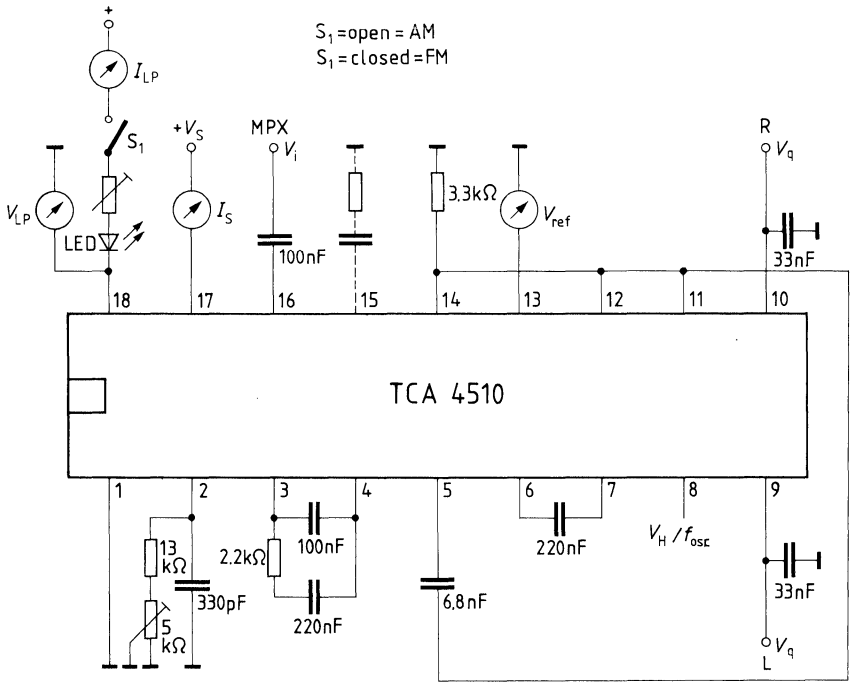
The (L−R) signal is demodulated and can be attenuated by means of an auxiliary voltage V_H or by a lower supply voltage (V_S <5 V).
The matrix generates the output signal by adding the (L+R) signal according to the formula (L+R) ± (L−R) = 2 L or 2 R, respectively. Only in case of switching mode of operation, the necessary de-emphasis is provided by output capacitors. The frequency required for demodulating the (L−R) signal is obtained by a phase-locked loop (PLL) from the divider. The oscillator is synchronized to the pilottone applied to pin 5 by means of phase comparison. A further phase comparison issues the information mono or stereo. Thus, the indicator lamp is switched and indicates as soon as a signal of adequate strength is available at the input. Moreover, the (L—R) attenuation has also been eliminated. If the switch S_1 is open, the IC switches the oscillator off, thus suppressing the (L—R) signal via the stereo switch and the mono/stereo blending. The supply current is thus reduced. If pin 8 is disconnected, the oscillator frequency can be measured

Block diagram



Test circuit 1

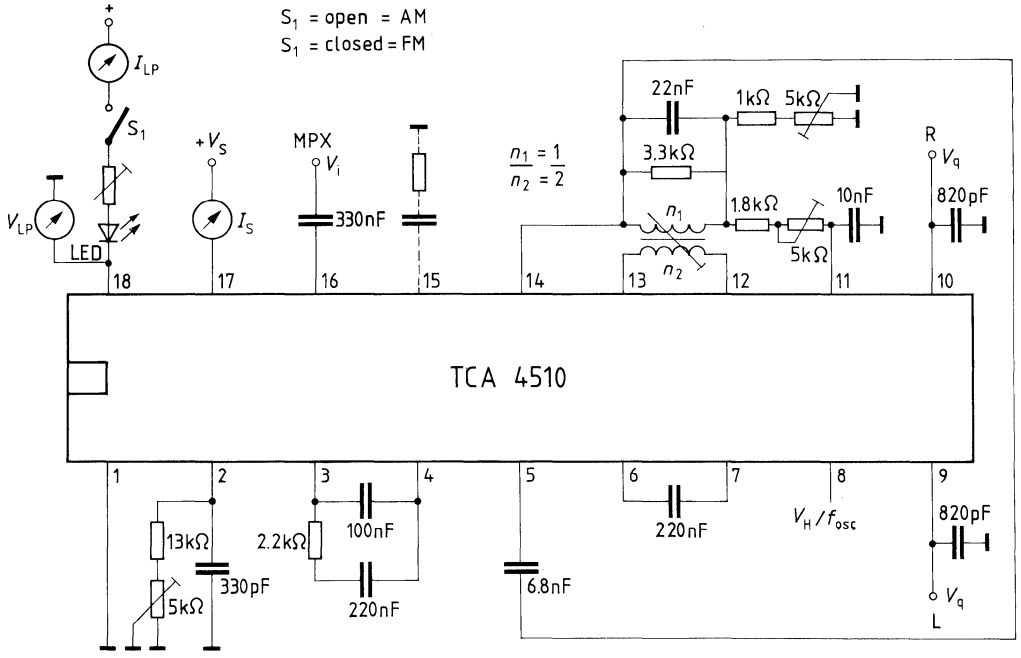
Switching mode of operation



V_i = (L+R) + (L−R)$_{HT}$ + PT
L = 100%; R = 0% or
R = 100%; L = 0%

Test circuit 2

Matrix mode of operation



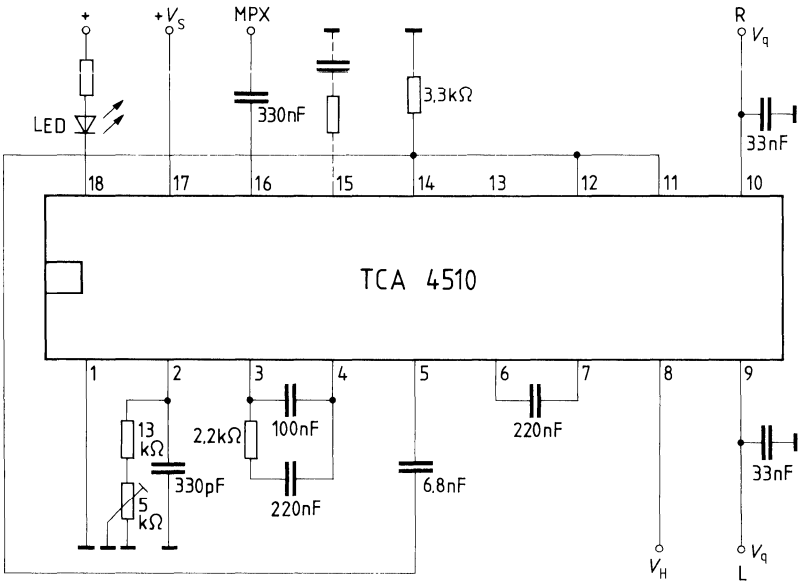
$V_i = (L + R) + (L - R)_{HT} + PT$

L = 100%; R = 0% or

R = 100%; L = 0%

Application circuit 1

Switching mode of operation



Application circuit 2

Matrix mode of operation