

When receiving an FM broadcast signal, the state of tuning is indicated by the flashing LED. Precise tuning is indicated when the center of three LEDs lights. The outer two LEDs indicate the direction the dial should be moved to obtain precise tuning.

When receiving an AM broadcast signal, precise tuning to a particular station is displayed when all three LEDs are lit.

Features

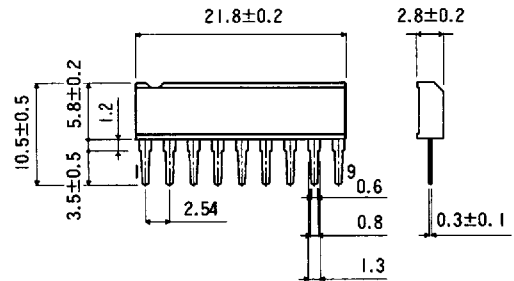
- available in a SIP9 package
- wide supply voltage range (4.5 ~ 15 V)
- detuning direction and AM tuning are implemented in a single IC
- can also be used to indicate tape feed direction in car stereos and other tape recorders

Applications

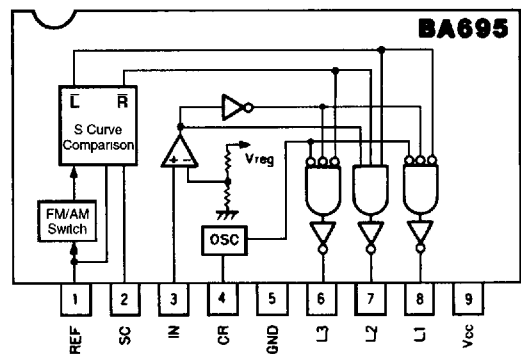
- radio cassette tape recorder
- car stereo radio cassette tape player
- microcassette tape recorder
- error detector

Dimensions (Units : mm)

BA695 (SIP9)



Block diagram



BA695 LED tuning indicator driver

Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Limits	Unit	
Power supply voltage	V	16	V	
Power dissipation	P_d	500	mW	Reduce power by 5 mW for each degree above 25°C
Operating temperature	T_{opr}	$-10 \sim +60$	$^\circ\text{C}$	
Storage temperature	T_{stg}	$-55 \sim +125$	$^\circ\text{C}$	

Recommended operating conditions ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Min	Typ	Max	Unit
Power supply voltage	V_{CC}	4.5		14	V

Electrical characteristics (unless otherwise noted, $T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{ V}$)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Quiescent current	I_Q		7	12	mA	
Output saturation voltage	V_{OL}		0.3		V	$I_{LED} = 10\ \mu\text{A}$
FM tuning display voltage	V_{FT}		70		mV	Displayed using $ V_{SC} - V_{REF} $
LED flash period	T_O		0.3		s	$R = 27\ \text{k}\Omega$, $C = 10\ \mu\text{F}$
AM tuning display voltage	V_{AT}	0.4	0.6	0.7	V	$V_{REF} = 0\ \text{V}$
FM reference voltage	V_{REF}	2	6	$V_{CC} - 2$	V	
FM - LED on voltage	V_{FO}	0.4	0.6	0.7	V	

Figure 1 Test circuit

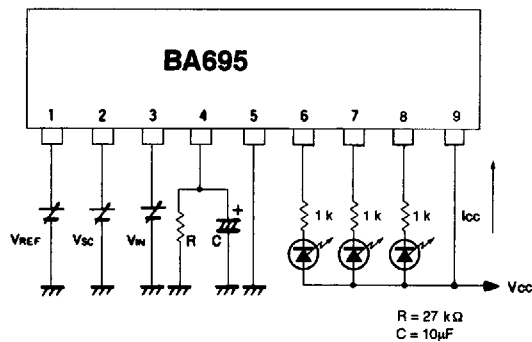
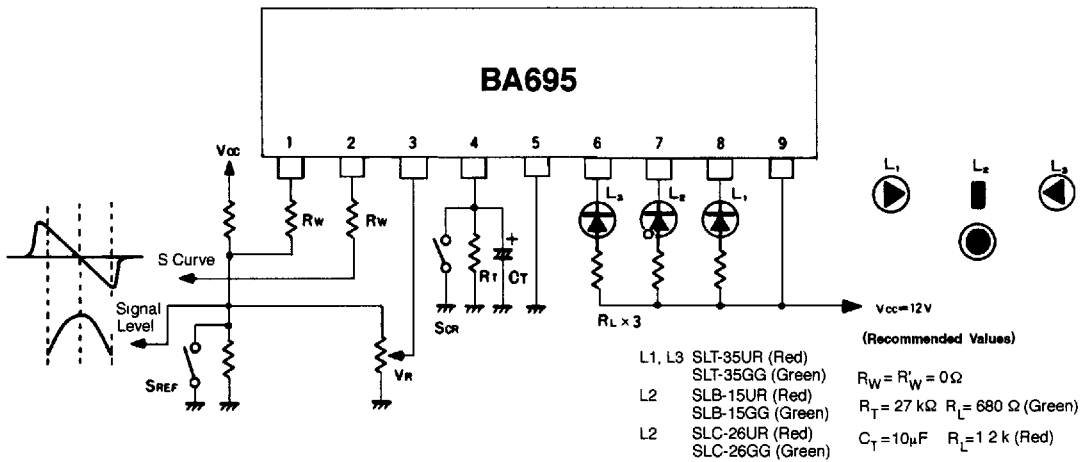


Figure 2 Application example



Circuit operation

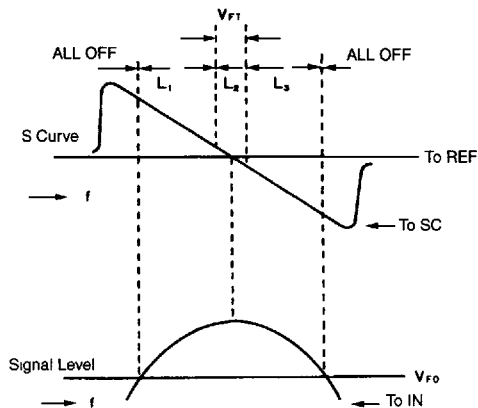
Receiving FM broadcasts (see Figure 3)

When receiving an FM broadcast signal and using the LEDs L_1 , L_2 and L_3 as shown in Figure 2:

- if the receiving frequency is detuned from the broadcasted frequency
- or the signal level is low
- or the pin 3 voltage is below the FM LED lighting voltage, typically $V_{FO} = 0.5\text{ V}$

none of the LEDs will light up.

Figure 3 Signal level and S curve relationship



If the pin 2 voltage (V_{SC}) is just above the pin 1 voltage (V_{REF}), the L_1 LED flashes to indicate the direction of tuning.

When the pin 3 voltage exceeds V_{FO} , any of the LEDs can be lit depending on the other conditions.

If the $|V_{SC} - V_{REF}|$ voltage goes below the FM tuning display voltage V_{FT} (typically 70 mV), L_2 lights up to indicate precise tuning.

If V_{SC} drops to less than V_{FT} , L_3 flashes and indicates detuning.

Receiving AM broadcasts

When receiving AM broadcasts, S_{REF} is ON and IN is switched to the tuning level for AM. When S_{REF} is set to ON, only L_2 lights up. L_1 and L_3 go out.

If a voltage above the AM tuning display voltage V_{AT} (typically 0.5 V) is present at IN, L_2 lights up to indicate tuning.

External components explanation

R_w, R'_w

When $R_w = R'_w = 0 \Omega$, V_{FT} ($|V_{SC} - V_{REF}|$) is typically 70 mV. The value of V_{FT} can be expanded by changing the value of R, as shown in Figure 4. However, R_w and R'_w must always be the same value.

The equivalent circuit for the REF and S_C pins is shown in Figure 5. The impedance between REF and S_C is typically about 60 k Ω . By setting the REF pin to GND, the S_C pin reaches almost GND when there is no load.

Figure 4 Tuning width

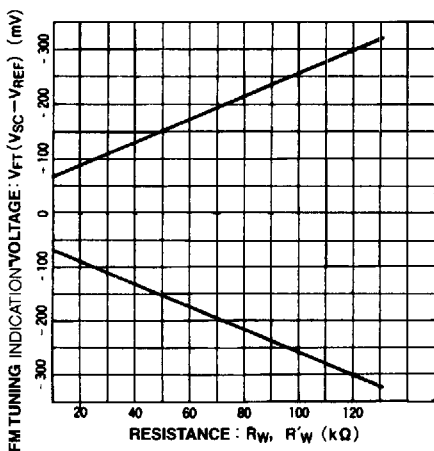
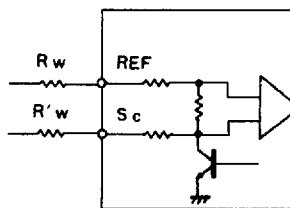


Figure 5 REF and S_C equivalent circuit diagram

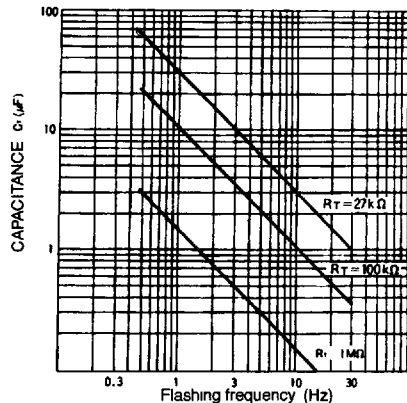


R_T , C_T

These components are used to set the flash period of the L_1 and L_3 LEDs. Any period between 0.1 ~ 1 s can be set using R_T and C_T . Fig. 6 indicates the values of the components required to achieve the desired time period.

The flashing can be stopped by setting the CR pin (pin 4) to GND. This will maintain the on state.

Figure 6 Setting for R_T and C_T

**LED Output**

The LED drive pins (pins 6, 7, and 8) are all open collectors. The output current can be set up to 20 mA by changing the current restriction resistor R_L .

Application notes**FM/AM receiver**

The example Figure 7 shows a quadrature IC being used to detect FM broadcasts. VR_1 is used to set the lighting range when receiving an FM broadcast. VR_1 must be adjusted so that the center LED in the S curve does not light up at the edge of the S curve for the maximum allowed input signal.

Voltage servo

The example in Figure 7 shows a voltage servo to detect motor speed or other such errors. When a voltage is applied to the REF and S_C inputs, one of the LEDs turns on because of the difference between these two voltages. This function can be used to determine whether the potential difference of the signal has exceeded a set level or which of the two has the higher potential. This IC can be used as a controller or an error detector.

Figure 7 Quadrature IC for detecting FM

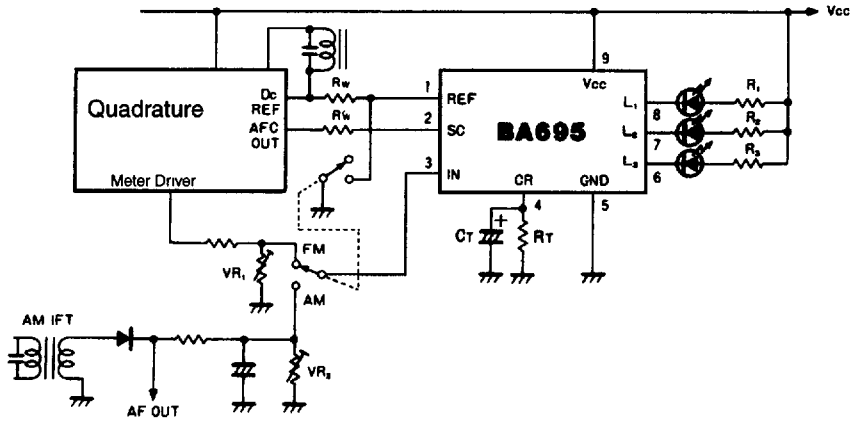


Figure 8 Voltage servo application

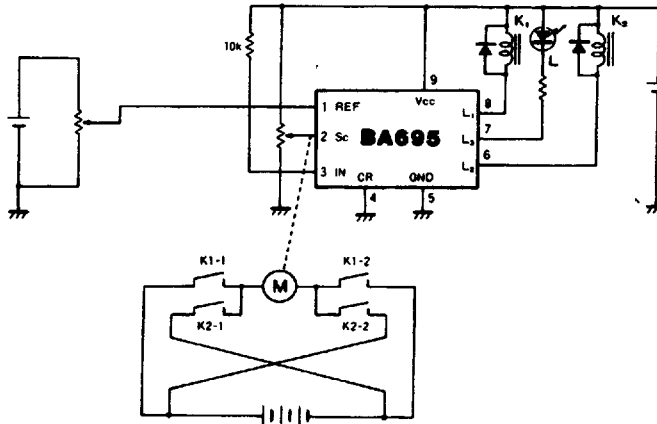


Figure 9 Example of tape direction display

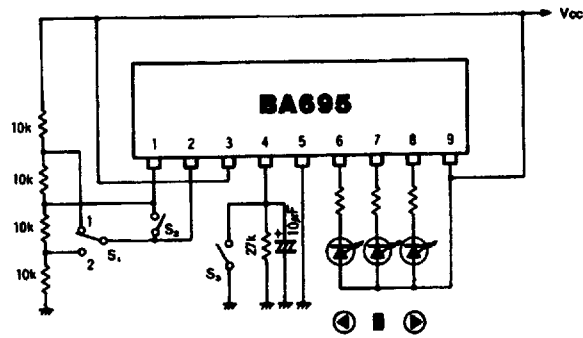


Figure 10 Example of car direction indicator display

