SGS-THOMSON MICROELECTRONICS

M104

PCM REMOTE CONTROL RECEIVER

- 128 CHANNEL DECODING
- 5-BIT BINARY STATIC OUTPUTS (32 programs)
- 4 ANALOGUE CONTROLS/63 STEPS
- 445 TO 510 kHz REFERENCE OSCILLATOR
- 5 V SUPPLY VOLTAGE
- LOCAL CONTROLS AVAILABLE
- INTEGRATED DIGITAL POWER ON RESET
- SERIAL "I-BUS" OUTPUT FOR TELETEXT AND VIEWDATA
- TO BE USED IN CONJUNCTION WITH M709 OR M710 R.C. TRANSMITTERS (flash transmission mode)
- TECHNICAL NOTE TN 155 AVAILABLE
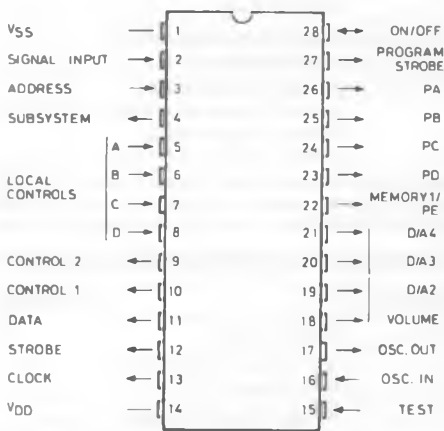
DIP28

ORDER CODE : M104B1

DESCRIPTION

The M104 has been developed for remote control of TV or radio sets in conjunction with M709/M710 R.C. transmitters. The receiver decodes the transmitted commands only if the transmitted address matches the address code selected at the receiver. 2 addresses are available for this purpose. The accepted command is afterwards released on the serial data bus.

When the M104 is operating in the subsystem mode (e.g. Teletext, Viewdata) and a command is continuously received, the Data Bus is disabled after the last signal has been released ; it is reenabled after the reception or the internal generation of the "end of transmission code". The frequency of the clock oscillator can be in the range 445 to 510 kHz and no synchronization is required with the transmitter clock.

The M104 is produced with N-channel silicon gate technology and is assembled in a 28 pin dual in-line plastic package.
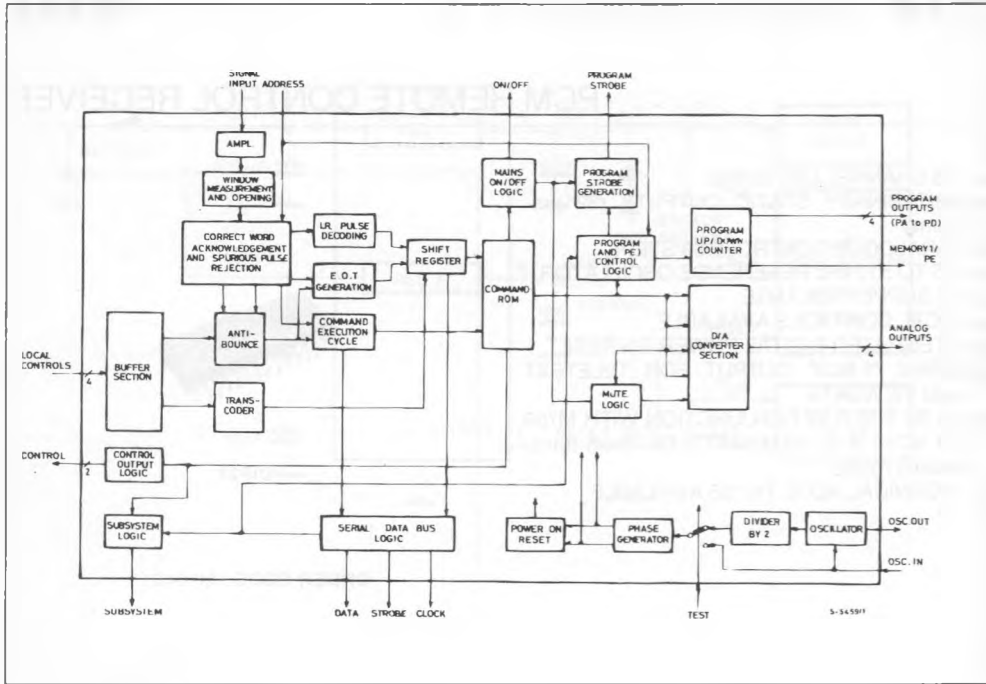
PIN CONNECTIONS

VSS	1	28	ON/OFF
SIGNAL INPUT	2	27	PROGRAM STROBE
ADDRESS	3	26	PA
SUBSYSTEM	4	25	PB
LOCAL CONTROLS A	5	24	PC
LOCAL CONTROLS B	6	23	PD
LOCAL CONTROLS C	7	22	MEMORY1/PE
LOCAL CONTROLS D	8	21	D/A4
CONTROL 2	9	20	D/A3
CONTROL 1	10	19	D/A2
DATA	11	18	VOLUME
STROBE	12	17	OSC. OUT
CLOCK	13	16	OSC. IN
VDD	14	15	TEST

NOTE : THE TEST PIN MUST BE CONNECTED TO VSS

S - 4609/1

BLOCK DIAGRAM

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	− 0.3 to + 7	V
V_I	Input Voltage (except pin 2) Input voltage pin 2	− 0.3 to + 7 − 0.3 to + 14	V
$V_{O(off)}$	Off-state Output Voltage (pins 26, 25, 24, 23, 22, 27, 21, 20, 19, 18, 28) Off-state Output Voltage (pins 17, 10, 9, 4, 12, 11, 13)	14 7	V V

Stresses above those listed under " Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	4.75 to 5.25	V
V_I	Input Voltage (except pin 2) Input Voltage pin 2	0 to 5.25 0 to 13.2	V V
$V_{O(off)}$	Off state Output Voltage (pins 26, 25, 24, 23, 22, 27, 21, 20, 19, 18, 28) Off state Output Voltage (pins 17, 10, 9, 4, 12, 11, 13)	Max 13.2 Max 5.5	V V

Note : Test pin and unused open drain outputs must be connected to V_{SS}.

STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)
Typical Values are at 5 V, T_{amb} = 25 °C

Symbol	Parameter	Pins	Test Conditions	Value			Unit
				Min.	Typ.	Max.	
V_{IL}	Input Low Voltage	3-28				0.8	V
		5-6-7-8				1.5	
V_{IH}	Input High Voltage	3-28		2.5			V
		5-6-7-8		4			
V_{iPP}	Peak to Peak Voltage	2		0.5		13.2	V
V_{OL}	Output Low Voltage	26-25-24-23-22 10-9-21-20 19-18-28-4	V_{DD} = 4.75 V I_{OL} = 0.8 mA			0.4	V
		27-12-11-13	V_{DD} = 4.75 V I_{OL} = 1.6 mA			0.4	
I_{IL}	Input Low Current	3-5-6-7-8	V_{DD} = 5.25 V V_{IL} = 0.4 V			– 0.4	mA
I_{IH}	Input High Current	28-3	V_{DD} = 5.25 V V_{IH} = 5.25 V			25	µA
$I_{O(off)}$	Output Leakage Current	26-25-24-23-22 27-21-20-19 18-28	V_{DD} = 5.25 V $V_{O(off)}$ = 13.2 V			50	µA
		10-9-4 12-11-13	V_{DD} = 5.25 V $V_{O(off)}$ = 5.25 V			25	
I_{DD}	Supply Current	14	V_{DD} = 5.25 V All Outputs Open			50	mA

DESCRIPTION

PIN 1 - V_{SS}.

The substrate of the ICs is connected to this pin. It is the reference pin for all parameters of the ICs.

PIN 2 - SIGNAL INPUT.

The minimum signal to be applied is 0.5 V peak to peak.

The receiver input section performs the following tests on the incoming signal to achieve the necessary noise immunity :

- measurement of the pulse distance (time base synchronization)

- check of the position of the received bits opening window at the time bases

- check of the parity bit

- check of the absence of pulses between the parity bit and the stop-pulse

- check of noise level ; the receiver checks parasitic transient inside and outside the time windows.

If the above test conditions are not fulfilled, the received word is rejected and not decoded. If the received signal is acknowledged as a valid word it is stored and decoded. The received coded word is also released on the serial data bus.

The end of transmission will be acknowledged by receiving the end of transmission code or by means of an internal timer if the transmission remains interrupted for more than about 550 ms.

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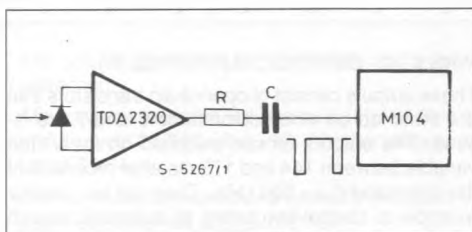
Supply Voltage of TDA 2320	R	C
5	2.2 K	4.7 nF
12	10 K	4.7 nF

The end of transmission code is also released on the Data Bus.

PIN 3 - ADDRESS INPUT.

The receiver decodes only signals transmitted with addresses 1 and 2. This input has integrated pull-up resistor of 50 K (max).

Address Pin 3	
1	Low
2	High

PIN 4 - SUBSYSTEM MODE INDICATION.

This open drain output is set high at power on reset and can be switched low with commands 56 to 62. It is repositioned high by commands 2, 12 and 63.

When the receiver is in the subsystem mode (output low) and a command is received continuously the data bus is disabled after the first signal has been released.

It is reenabled after the reception or the internal generation of the "end of transmission code".

No Program change command is executed when M104 is in subsystem mode.

PINS 5-6-7-8 - LOCAL CONTROL INPUTS LOC-A, LOC-B, LOC-C, LOC-D.

These inputs are provided for emergency operations. Therefore only a few controls are provided.

Local input commands and I.R. commands have the same priority.

If a complete I.R. command has been received, the local inputs are blocked until the command has been executed and the "end of transmission code" generated.

Viceversa an I.R. signal cannot be decoded until an issued local command has been executed and the "end of transmission" released.

All these inputs have integrated pull-up resistor of 50 KΩ (max).

Each command is accepted after it has been present continuously for about 40 ms.

Inputs				Data Bus Codes						Function
A	B	C	D	C1	C2	C3	C4	C5	C6	
H	H	H	H							
L	H	H	H	L	L	L	H	L	L	Program +
H	L	H	H	H	L	L	H	L	L	Program −
L	L	H	H	H	L	L	L	L	H	Volume −
H	H	L	H	H	H	L	L	L	L	
L	H	L	H	L	L	L	L	L	H	Volume +
H	L	L	H	L	H	L	L	L	H	A 2 +
L	L	L	H	L	H	L	H	L	L	Normalization
H	H	H	L	L	H	H	H	L	L	Memory 1 H
L	H	H	L	H	H	L	L	L	H	A 2 −
H	L	H	L	L	L	H	L	L	H	A 3 +
L	L	H	L	H	L	L	L	L	H	A 3 −
H	H	L	L	H	L	H	H	L	L	Memory 1 L
L	H	L	L	L	H	H	L	L	H	A 4 +
H	L	L	L	H	H	H	L	L	H	A 4 −
L	L	L	L	L	H	L	L	L	L	Mains off

PINS 9-10 - CONTROL OUTPUT R2, R1.

These outputs consist of open drain transistors that are switched on when commands 6 and 7 are issued. The outputs remain switched on for a time variable between 144 and 173 ms after reception of the command (f_{ref} = 500 kHz). They can be used for example to control fine tuning or automatic search commands of M293 (Electronic Program Memory).

Command N°	R1 (pin 10)	R2 (pin 9)
6	L	H
7	H	L

PINS 11-12-13 - SERIAL DATA BUS.

DATA (pin 11)

STROBE (pin 12)

CLOCK (pin 13)

Each signal, either remote or local, is released on this serial data bus to control external circuits (Teletext, Viewdata, Videorecorder, Hi-Fi, etc...).

The serial data bus has the following configuration :

All outputs have open drain configuration. See also description of pin 4 for subsystem mode operation.
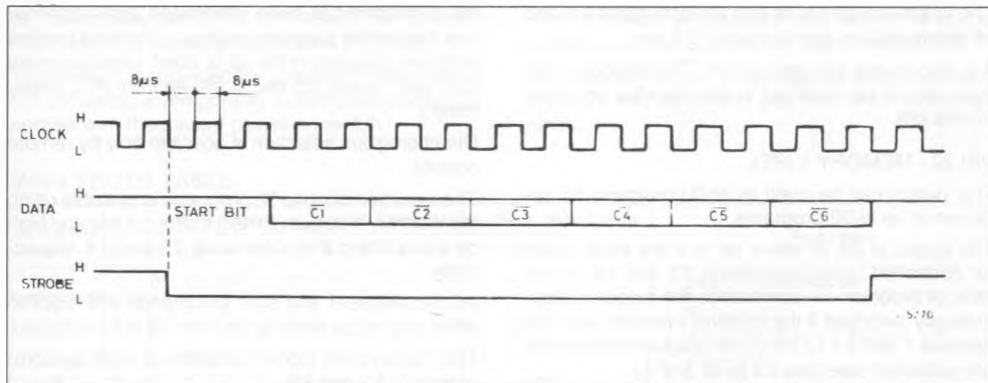
PIN 14 - V_{DD}.

The supply voltage has to be 5 V ± 5 %. An internal power-on reset (lasting 125 ms) is generated when the 5 V is applied.

PIN 15 - TEST.

This pin is used for testing and has to be connected to V_{SS}.

PIN 16-17 - CLOCK OSCILLATOR.

The frequency of the clock oscillator should be be-tween 445 and 510 kHz using a cheap ceramic resonator. In these conditions the value of the reference frequency of the transmitter can be in the same range. In other words the transmitter and the receiver can operate with different reference frequencies. The clock signal can be used to drive the clock of other ICs through a capacitor connected at pin 16. The 3.3 MΩ resistor must be connected in any case to provide correct reset generation at power-on. If pin16 is temporarily connected to GND, a power-on reset is generated at release of this condition.
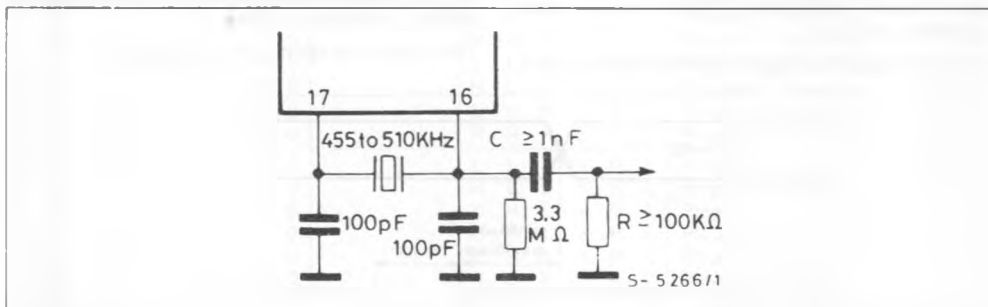
PIN 18 TO 21 - ANALOGUE CONTROL OUTPUTS.

These outputs are provided to control four analogue values (for example volume, brightness, colour saturation and contrast in TV sets).

The outputs deliver square wave signals of 7.8 kHz with a duty cycle variable in 63 steps.

In the case of a continuous command for varying the analogue information, the duty cycle is changed at the rate of the transmitted signal (approximately every 102 ms with f_{ref} = 500 kHz).

Local controls are varied every 115 ms (f_{ref} = 500 kHz).

The circuits is provided with underflow and overflow protection.

At supply on reset the volume output (pin 18) is set at duty cycle 21/64 (pulse = H). All other outputs are set at 31/64.

The normalization command sets all the outputs except volume to mid position (31/64).

The volume output can be switched to V_{SS} and reset to the previous level by means of command 2 (mute). It is also reset by means of the normalization command, volume + and mains off command.

The volume output is muted at each mains on and off command for approximately 0.5 sec.

It is also muted at supply on/off. The analogue outputs cannot be modified in the standby condition (mains off).

PIN 22 - MEMORY 1 (PE).

This output can be used as shift command for selection of up to 32 programs.

The output is set at power on to a low level. It can be controlled using commands 13 and 14. In the case of program +/− commands the output is automatically switched if the receiver operates with the address 1 (pin 3 = L) and if the program commands are accepted (see pins 23 to 26 and 4).

Otherwise this output is not affected by the program +/ − commands and can be used for general applications. It has open drain configuration.

PINS 23-24-25-26 - PD, PC, PB, PA PROGRAM OUTPUTS.

Open drain, binary coded, static outputs. At power on reset the outputs are set to program 1 (PA to PD = L L L L).

The program selection can be sequential or direct. If the TV set is in the standby condition the program step-by-step ± commands (8, 9) or the direct program selection commands (16 to 31) can be used to switch on the set.

In the first case the program can be stepped only if the command has been interrupted and a continuous sequential program change command causes program stepping in the up or down direction every 0.57 sec. (every 0.5 sec. if issued from R.C. transmitter).

Direct program selection is possible only by remote control.

The selection of up to 32 programs is possible using the memory 1 output (pin 22) that is put low and high by transmitting the commands 13 and 14 respectively.

All the program and shift commands are blocked when one of the commands from 56 to 62 is issued.

This "subsystem mode" condition is reset by commands 2, 12 and 63.

PIN 27 - PROGRAM STROBE OUTPUT.

The program strobe signal is generated each time the content of the memory has to be read and each time the mains output is switched off or on. It is therefore generated at direct program selection (16 to 31) program ± stepping (8, 9) and shift commands (13, 14) with address 1.

The strobe signal is not available when the M104 is in the subsystem mode ; the output has open drain configuration.

At direct program selection and shift commands, the strobe is available only one.

This output has open drain configuration.

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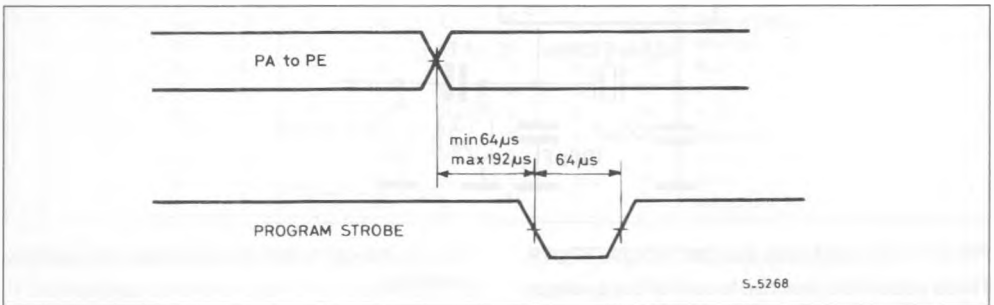
PIN 28 - MAINS ON/OFF.

This active low output, is provided to control the on/off switching of the TV set via a transistor and a relay.

When the supply voltage is applied to the device, the output transistor is automatically biased off.

In this "standby" condition, only the mains on commands are accepted.

A mains on command can be given in one of the following ways :
- a) - by commands 8 , 9 (program +/−)
- - by command 12
- - by commands 16 to 31.

All these commands are accepted only when received 5 times (about 0.4 sec).

The "end of transmission" code resets the associated counter.

b) - connecting pin 28 to V_{SS} (GND) for at least 10µ s after the power-on reset time (125 ms).

This feature is provided for automatic switch on of the set using a temporarily active slide contact in parallel with the master power on switch.

The command is accepted only when the supply voltage V_{DD} has risen above approximately 4 V.

The set can be put in standby by means of command 2. This command also has to be received 5 times.

M104 TRUTH TABLE

Command N°	I.R. Code						Local Controls				Data Bus Code						Function
	C1	C2	C3	C4	C5	C6	A	B	C	D	C1	C2	C3	C4	C5	C6	
0	0	0	0	0	0	0					L	L	L	L	L	L	End of Transmission
1	1	0	0	0	0	0					H	L	L	L	L	L	Mute on off
2	0	1	0	0	0	0	L	L	L	L	L	H	L	L	L	L	Mains off Mute off Subsyst. off
3	1	1	0	0	0	0					H	H	L	L	L	L	(pin 4 H)
4	0	0	1	0	0	0					L	L	H	L	L	L	
5	1	0	1	0	0	0					H	L	H	L	L	L	
6	0	1	1	0	0	0					L	H	H	L	L	L	Control 1 L
7	1	1	1	0	0	0					H	H	H	L	L	L	Control 2 L
8	0	0	0	1	0	0	L	H	H	H	L	L	L	H	L	L	Program + / Mains on
9	1	0	0	1	0	0	H	L	H	H	H	L	L	H	L	L	Program − / Mains on
10	0	1	0	1	0	0	L	L	L	H	L	H	L	H	L	L	Normalization/Mute off
11	1	1	0	1	0	0					H	H	L	H	L	L	
12	0	0	1	1	0	0					L	L	H	H	L	L	Mains on/Subsystem off (pin 4 H)
13	1	0	1	1	0	0	H	H	L	L	H	L	H	H	L	L	Memory 1 L
14	0	1	1	1	0	0	H	H	H	L	L	H	H	H	L	L	Memory 1 H
15	1	1	1	1	0	0					H	H	H	H	L	L	
16	0	0	0	0	1	0					L	L	L	L	H	L	Program 16 / Mains on
17	1	0	0	0	1	0					H	L	L	L	H	L	program 1 / Mains on
18	0	1	0	0	1	0					L	H	L	L	H	L	Program 2 / Mains on
19	1	1	0	0	1	0					H	H	L	L	H	L	Program 3 / Mains on
20	0	0	1	0	1	0					L	L	H	L	H	L	Program 4 / Mains on
21	1	0	1	0	1	0					H	L	H	L	H	L	Program 5 / Mains on
22	0	1	1	0	1	0					L	H	H	L	H	L	Program 6 / Mains on
23	1	1	1	0	1	0					H	H	H	L	H	L	Program 7 / Mains on
24	0	0	0	1	1	0					L	L	L	H	H	L	Program 8 / Mains on
25	1	0	0	1	1	0					H	L	L	H	H	L	program 9 / Mains on
26	0	1	0	1	1	0					L	H	L	H	H	L	Program 10 / Mains on
27	1	1	0	1	1	0					H	H	L	H	H	L	Program 11 / Mains on
28	0	0	1	1	1	0					L	L	H	H	H	L	Program 12 / Mains on
29	1	0	1	1	1	0					H	L	H	H	H	L	Program 13 / Mains on
30	0	1	1	1	1	0					L	H	H	H	H	L	Program 14 / Mains on
31	1	1	1	1	1	0					H	H	H	H	H	L	Program 15 / Mains on
32	0	0	0	0	0	1	L	H	L	H	L	L	L	L	L	H	Volume + / Mute off
33	1	0	0	0	0	1	L	L	H	H	H	L	L	L	L	H	Volume −
34	0	1	0	0	0	1	H	L	L	H	L	H	L	L	L	H	Analog 2 +
35	1	1	0	0	0	1	L	H	H	L	H	H	L	L	L	H	Analog 2 −
36	0	0	1	0	0	1	H	L	H	L	L	L	H	L	L	H	Analog 3 +
37	1	0	1	0	0	1	L	L	H	L	H	L	H	L	L	H	Analog 3 −
38	0	1	1	0	0	1	L	H	L	L	L	H	H	L	L	H	Analog 4 +
39	1	1	1	0	0	1	H	L	L	L	H	H	H	L	L	H	Analog 4 −

M104 TRUTH TABLE (continued)

Command N°	I.R. Code						Local Controls				Data Bus Code						Function
	C1	C2	C3	C4	C5	C6	A	B	C	D	C1	C2	C3	C4	C5	C6	
40	0	0	0	1	0	1					L	L	L	H	L	H	
41	1	0	0	1	0	1					H	L	L	H	L	H	
42	0	1	0	1	0	1					L	H	L	H	L	H	
43	1	1	0	1	0	1					H	H	L	H	L	H	
44	0	0	1	1	0	1					L	L	H	H	L	H	
45	1	0	1	1	0	1					H	L	H	H	L	H	
46	0	1	1	1	0	1					L	H	H	H	L	H	
47	1	1	1	1	0	1					H	H	H	H	L	H	
48	0	0	0	0	1	1					L	L	L	L	H	H	
49	1	0	0	0	1	1					H	L	L	L	H	H	
50	0	1	0	0	1	1					L	H	L	L	H	H	
51	1	1	0	0	1	1					H	H	L	L	H	H	
52	0	0	1	0	1	1					L	L	H	L	H	H	
53	1	0	1	0	1	1					H	L	H	L	H	H	
54	0	1	1	0	1	1					L	H	H	L	H	H	
55	1	1	1	0	1	1					H	H	H	L	H	H	
56	0	0	0	1	1	1					L	L	L	H	H	H	Subsystem Mode on
57	1	0	0	1	1	1					H	L	L	H	H	H	Subsystem Mode on
58	0	1	0	1	1	1					L	H	L	H	H	H	Subsystem Mode on
59	1	1	0	1	1	1					H	H	L	H	H	H	Subsystem Mode on (pin 4 L)
60	0	0	1	1	1	1					L	L	H	H	H	H	Subsystem Mode on
61	1	0	1	1	1	1					H	L	H	H	H	H	Subsystem Mode on
62	0	1	1	1	1	1					L	H	H	H	H	H	Subsystem Mode on
63	1	1	1	1	1	1					H	H	H	H	H	H	Subsystem Mode off (pin 4 H)

Note : All the program and shift commands (13, 14) are blocked when one of the commands from 56 to 62 is issued. This condition is reset by commands 2, 12 and 63.

TYPICAL APPLICATION

Remote controlled voltage synthesizer (up to 32 stations) for TV and radio.
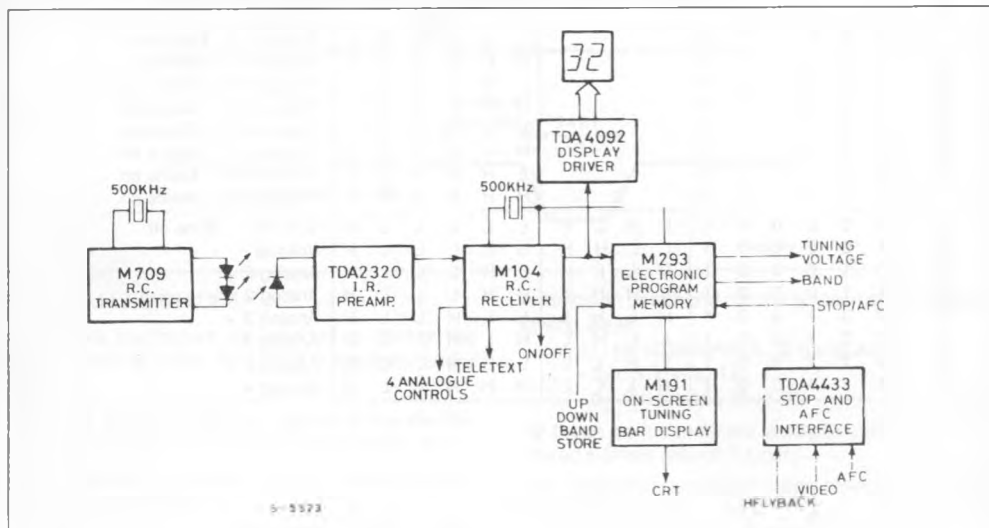
Note : For 16 program display, M192 can be used in place of TDA4092.

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