

## MOS INTEGRATED CIRCUIT

### 30-CHANNEL REMOTE CONTROL RECEIVER

- PROGRAM MEMORY OUTPUTS
- INTEGRATED CLOCK OSCILLATOR
- SEQUENTIAL PROGRAM CHANGE COMMAND
- 5 BINARY CODED INPUT/OUTPUT LINES

The M 1130 is a monolithic integrated circuit intended for a remote-controlled system in which 30 different ultrasonic frequencies are used to transmit 30 control commands. Both the M 1024 and the M 1124 can be used as transmitter. The M 1130 measures the frequency of the incoming signal by counting the cycles during a fixed measuring time determined by a 4.4336 MHz quartz crystal. The accepted ultrasonic commands are converted into a coded signal and issued on 5 input/output lines (A to E). The 30 commands can be given not only ultrasonically, but also by applying a 5-bit word to the above mentioned lines. An additional "sequential program change" command is available only on the receiver. Signals to control three analog values, e.g. volume, brightness and colour saturation are internally stored by the M 1130 and continuously delivered in the shape of square wave voltages. The duty cycle of these signals determines the level of the analog value. An output is provided to drive a relay which switches the TV set ON or OFF. The program output lines are provided to drive all the circuits which need a 4-bit binary code such as the H 770/1/2/3 quad analog switches, or the M 193 electronic program memory. The M 1130 is constructed in a low threshold P-channel silicon gate technology and is supplied in an 18-lead dual-in-line plastic package.

### ABSOLUTE MAXIMUM RATINGS\*

$V_{DD}^{**}$	Supply voltage	-20 to 0.3	V
$V_i$	Input voltage	-20 to 0.3	V
$I_o$	Output current (pins 2 to 14 and 16)	5	mA
$P_{tot}$	Total power dissipation (per package)	800	mW
$T_{stg}$	Storage temperature	-65 to 150	°C
$T_{op}$	Operating temperature	0 to 70	°C

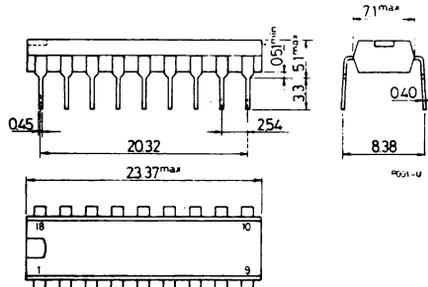
\* Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other condition above those indicated in the operational sections of this specification is not implied. Exposure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

\*\* All voltages values are referred to  $V_{SS}$  pin voltage.

**ORDERING NUMBER:** M 1130 B1

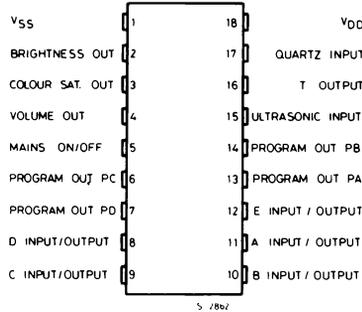
### MECHANICAL DATA

Dimensions in mm



# M 1130

## PIN CONNECTIONS



## TRUTH TABLES

Table 1 (Clock frequency = 4.4336 MHz)

Channel no.	Ultrasonic frequency (Hz)	Command	Code				
			E	A	B	C	D
—	—	Sequential progr. change - Mains ON	L	H	H	H	H
1	33 945	Mains OFF	H	L	H	H	H
2	34 291	Muting ON/OFF	L	L	H	H	H
3	34 638	Colour saturation +	H	H	L	H	H
4	34 984	Normalisation	L	H	L	H	H
5	35 330	Colour saturation -	H	L	L	H	H
6	35 677	S1	L	L	L	H	H
7	36 023	Brightness +	H	H	H	L	H
8	36 370	S2	L	H	H	L	H
9	36 716	Brightness -	H	L	H	L	H
10	37 062	S3	L	L	H	L	H
11	37 409	Volume + (Muting OFF)	H	H	L	L	H
12	37 755	S4 (Fine tuning -)	L	H	L	L	H
13	38 101	Volume - (Muting OFF)	H	L	L	L	H
14	38 448	S5 (Fine tuning +)	L	L	L	L	H
15	38 794	Program 1	H	H	H	H	L
16	39 141	Program 2	L	H	H	H	L
17	39 487	Program 3	H	L	H	H	L
18	39 833	Program 4	L	L	H	H	L
19	40 180	Program 5	H	H	L	H	L
20	40 526	Program 6	L	H	L	H	L
21	40 872	Program 7	H	L	L	H	L
22	41 219	Program 8	L	L	L	H	L
23	41 565	Program 9	H	H	H	L	L
24	41 912	Program 10	L	H	H	L	L
25	42 258	Program 11	H	L	H	L	L
26	42 604	Program 12	L	L	H	L	L
27	42 951	Program 13	H	H	L	L	L
28	43 298	Program 14	L	H	L	L	L
29	43 643	Program 15	H	L	L	L	L
30	43 990	Program 16	L	L	L	L	L

Note: S1 to S3 are additional commands.

**Table 2: Output code at pins 6, 7, 13, 14**

Program no.	PA	PB	PC	PD
1	L	L	L	L
2	H	L	L	L
3	L	H	L	L
4	H	H	L	L
5	L	L	H	L
6	H	L	H	L
7	L	H	H	L
8	H	H	H	L
9	L	L	L	H
10	H	L	L	H
11	L	H	L	H
12	H	H	L	H
13	L	L	H	H
14	H	L	H	H
15	L	H	H	H
16	H	H	H	H

## RECOMMENDED OPERATING CONDITIONS

<b>I<sub>DD</sub></b>	Supply voltage	-18 ±1	V
<b>V<sub>IH</sub></b>	Input voltage	0 to V <sub>DD</sub>	V
<b>I<sub>OB</sub></b>	Output current (pins 2 to 14 and 16)	max [2.5]	mA
<b>f<sub>clk</sub></b>	Input clock frequency	4.4336	MHz
<b>T<sub>op</sub></b>	Operating temperature	0 to 70	°C

## STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

Typical values are at T<sub>amb</sub> = 25°C

Parameter	Test conditions	Values			Unit
		Min.	Typ.	Max.	
<b>I<sub>DD</sub></b>	Supply current	V <sub>DD</sub> =-19V		-25	mA
<b>V<sub>IH</sub></b>	High level input voltage	-1		V <sub>SS</sub>	V
<b>V<sub>IL</sub></b>	Low level input voltage	pins 8-9-10-11-12		V <sub>DD</sub>	V
<b>V<sub>Ipp</sub></b>	Ultrasonic input peak to peak voltage (pin 15)	The signal must be applied without D.C. voltage		500	mV
<b>V<sub>OH</sub></b>	High level output voltage	I <sub>OH</sub> =-1 mA	pins 2 to 7-13-14	V <sub>SS</sub> -0.6	V

# M 1130

## DYNAMIC ELECTRICAL CHARACTERISTICS (Clock frequency = 4.4336 MHz)

Parameter		Min.	Typ.	Max.	Unit
f	Analog output frequency		17.6		kHz
D	Analog output duty cycle	1/63		62/63	
t <sub>1</sub>	Mains ON/OFF command delay time		669.8		ms
t <sub>2</sub>	Program stepping delay time with continuous command		692.9		ms
t <sub>3</sub>	Analog output delay time with continuous command		138.6		ms
t <sub>w1</sub>	Pulse width at pin 16 with command 12 (FT-)		21.6		μs
t <sub>w2</sub>	Pulse width at pin 16 with command 14 (FT +)		23.1		ms

## DESCRIPTION

The function of the M 1130 is explained with reference to the various pins as follows:

### Pin 1 - V<sub>SS</sub>

The substrate of the integrated circuit is connected to this pin. It is the reference point for all the voltage parameters of the device and has to be connected to the highest potential of the supply voltage.

Examples: V<sub>SS</sub> = 0V    V<sub>DD</sub> = -18V

or  
V<sub>SS</sub> = +18V    V<sub>DD</sub> = 0V

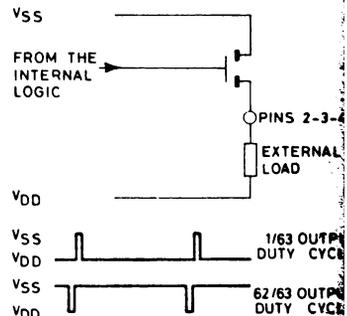
### Pin 18 - V<sub>DD</sub>

Negative pole of the supply voltage.

### Pins 2, 3, 4 - D/A Outputs

These outputs are designed to control brightness, colour saturation and volume respectively. A square wave is produced when resistors are inserted between the outputs and V<sub>DD</sub> (see fig. 1). The frequency of the square wave is about 17.5 kHz, the duty cycle is variable between 1/63 to 62/63. The information contained in the pulse duty cycle and D.C. voltages are obtained by integrating the output signals with RC networks. Approximately 115 ms after the switch-on of an ultrasonic command, the pulse duty cycle is advanced by one step. In the case of a continuous signal, further steps follow at intervals of 138.5 ms until the final value is reached. The time needed to traverse the entire range of variation is 8.5 seconds. During the pulse duration, the open drain output transistor is turned on and has a voltage drop of max 0.6V at 1 mA output current. When the supply is switched on the analog outputs are normalized to the pulse duty cycle of 32/63. A Mute command switches the open drain output transistor at pin 4 OFF and ON after a delay of 0,7 sec. The sound is also restored after a normal delay when one of the commands "Volume +" or "Volume -" is given. The sound is unmuted when the TV set is switched ON.

Fig. 1



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## DESCRIPTION (continued)

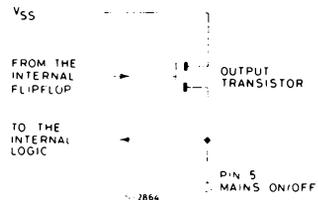
### Pin 5 - Mains switch output

This 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 M 1130 the output transistor is automatically biased off. In this "stand-by" condition, the analog outputs cannot be changed; this lasts until a mains ON command is given in one of the following modes:

- by any of the 16 program commands for 0.7 sec.
- by the command "sequential program change" (available only on direct inputs) for 0.7 sec.
- by connecting the pin 5 to  $V_{SS}$  for at least 10  $\mu$ s.

The TV set can only be switched off by a "Mains OFF" command.

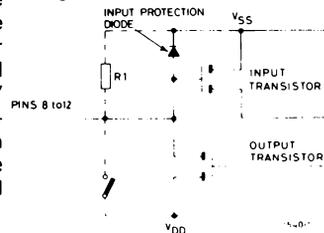
Fig. 2



### Pins 8, 9, 10, 11, 12 - Direct inputs/outputs

These pins are provided as inputs for commands on the TV set and also as outputs for ultrasonic transmitted commands. The command may be introduced directly in the form of a 5 bit word applied to the input/output lines A-B-C-D-E, according to the code indicated in the truth table. An input signal is recognized as valid after an acceptance time of 69.3 ms (for Mains ON/OFF and Muting ON 0.6 sec.), after which a further processing period of 46.2 ms occurs before the 23.1 ms output signal appears. During the 23.1 ms pulse the output transistor shown in fig. 3 is conducting. The same pulse will appear when the circuit is receiving coded commands from the ultrasonic input according to the truth table. Although the output signals are felt on the output again this does not cause interference because the inputs are latched while an output signal is available. If commands are issued either ultrasonically or normally to the television set, the manual command will always override the ultrasonic command. Concerning the "touch" command, this type of operation is possible due to the very high impedance of the MOS input. The only major point of consideration is in the choice of diode matrix; this must have such a high reverse leakage current in even the worst conditions that an incorrect command situation is avoided.

Fig. 3



### Pins 6, 7, 13, 14 - Program outputs PA-PB-PC-PD

The information of the selected program is statically available in a binary coded form. The code is shown in table 2. TV programs are chosen either selectively (by the commands "Program 1 . . . Program 16") or sequentially upwards on the command "Sequential program change". If the "Sequential program change" command is given continuously, the first change of program takes place after 115 ms and every further change at 0.7 sec intervals. After program 16 has been reached it is followed again by program 1. When the supply voltage is applied to the M 1130, the program outputs are automatically set to program 1. If the TV set is switched on by the command "Sequential program change" this command is made ineffective until it is released.

The output configurations is similar to that shown in fig. 2.

An external load of min 47 K $\Omega$  is to be connected to these outputs even if they are not used.

## DESCRIPTION (continued)

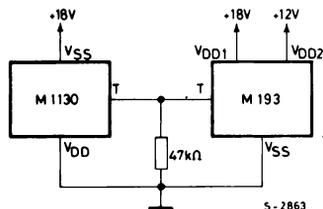
### Pin 15 - Ultrasonic input

Ultrasonic signals of at least 500 mV peak to peak have to be applied to this input via a capacitor. The integrated input amplifier is automatically biased and has an input resistance exceeding 1 Mohm. The first ultrasonic pulses arriving at pin 15 are followed by a preparation period of 23.1 ms. After a measuring time and a delay time of 46.2 ms a pulse of 23.1 ms will appear on the input/output lines according to truth table 1. If a continuous signal is present at the ultrasonic input, the interval between the output pulses amounts to 138.5 ms.

### Pin 16 - T output

When commands S4 or S5 are given, in addition to the binary coded output signals at the I/O lines, a further signal in the shape of a pulse is available at this pin. The pulse which has a duration of 21.6  $\mu$ s in the case of command S4 and of 23.1 ms in the case of command S5, is used for remote control of the fine tuning via the SGS-ATES M 193 Electronic Program Memory as shown in fig. 4.

Fig. 4



### Pin 17 - Quartz terminal

A 4.4336 MHz quartz crystal has to be connected between this pin and VSS. A resistor of 5.6 Mohm has to be connected between the input and VDD to bias the integrated oscillator. The accuracy of the frequency determines the evaluation accuracy of the ultrasonic receiver.