M50602P

ELECTRONIC VOLUME CONTROL CMOS 5-BIT D/A CONVERTER

DESCRIPTION

The M50602P is a controller IC that controls digitally the control voltage of an electronic volume control. Fabricated using aluminum gate CMOS technology, this IC has a built-in 5-bit D/A converter circuit based on the PWM system and it can control analogue quantities in 32 steps.

FEATURES

- Low power dissipation
- Built-in ceramic oscillator circuit with a high frequency stability
- Control of analogue quantities in 32 steps
- Self-contained offset function
- Self-contained preset function

APPLICATION

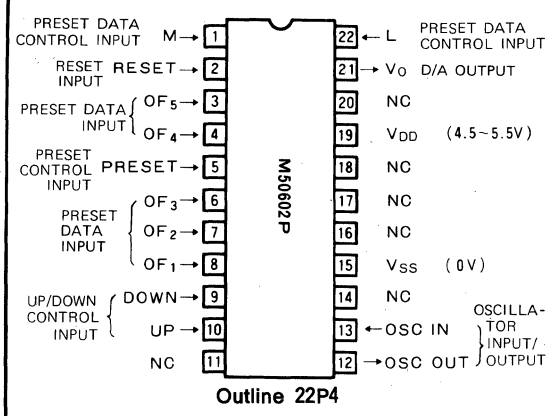
Electronic volume control systems

FUNCTION

The M50602P is CMOS IC containing a 5-bit up/down counter, an oscillator circuit, a frequency divider and a D/A converter, and it is designed to control digitally the control voltage of an electronic volume control.

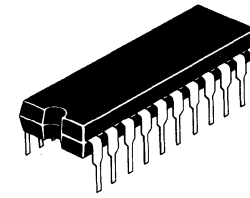
Functions include manual up/down and auto up/down functions of the 5-bit up/down counter and a preset function for presetting the contents of the counter to "0," "16" or to any value using the 5-bit offset inputs.

PIN CONFIGURATION (TOP VIEW)



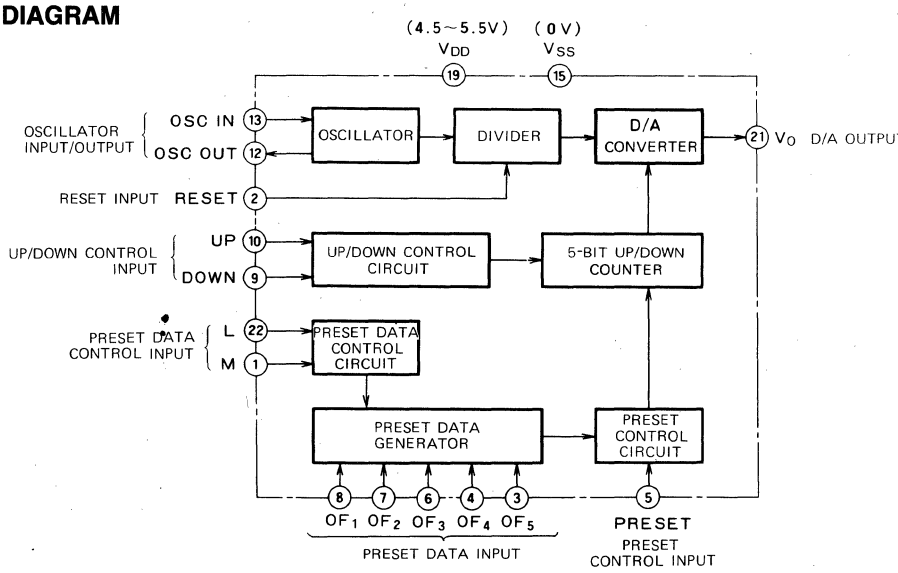
Outline 22P4

NC: NO CONNECTION



22-pin molded plastic DIL

BLOCK DIAGRAM



MITSUBISHI ELECTRIC

FUNCTIONAL DESCRIPTION

Oscillator Circuit

This IC contains an oscillator circuit. The reference signal is obtained by mounting a ceramic vibrator and two capacitors at the OSC IN and OSC OUT pins. A typical circuit is shown in Fig. 1.

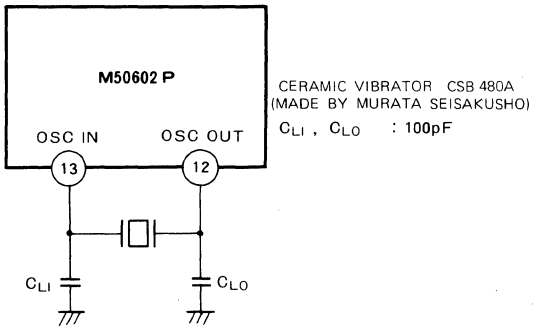


Fig. 1 Typical oscillator circuit (using ceramic vibrator)

Up/Down Function

Every time a high-level signal is applied to the UP pin, the contents of the 5-bit up/down counter increase by one step. When "31" has been reached, no further increase is possible. The high-level must be 100μs at the minimum.

When a high-level signal is kept applied to the UP pin for more than 0.41 ~ 0.52 sec, the contents of the 5-bit up/down counter increase at a rate of approximately 9.77 steps/sec. Until "31" has been reached.

Every time a high-level signal is applied to the DOWN pin, the contents of the 5-bit up/down counter decrease by one step. When "0" has been reached, no further decrease is possible. The high-level must be 100μs at the minimum. When a high-level signal is kept applied to the DOWN pin for more than 0.41 ~ 0.52 sec, the contents of the 5-bit up/down counter decrease at a rate of approximately 9.77 steps/sec. Until "0" has been reached.

When high-level signals are applied to both the UP and DOWN pins, the contents of the 5-bit up/down counter do not change.

Preset Function

When a pulse signal such as that shown in Fig. 2 is applied to the L pin with the PRESET pin and M pin both low, the contents of the 5-bit up/down counter are preset to "0". When a pulse signal such as that shown in Fig. 2 is applied to the M pin with the PRESET pin and L pin both low, the contents of the 5-bit up/down counter are preset to "16". When a pulse signal such as that shown in Fig. 2 is applied to the PRESET pin with the M and L pins both low, the contents of the 5-bit up/down counter are preset by the contents of the offset input pins (OF_1, OF_2, OF_3, OF_4, OF_5). Consequently, the contents of the counter can be preset to any value by combining the five offset input pins. Table 1 shows the relationship between the contents of the offset input pins and the contents of the 5-bit up/down counter.

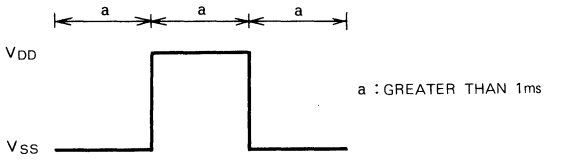


Fig. 2 L pin/M pin/PRESET pin input waveform

Table 1 Relationship between Offset Input and 5-bit UP/down Counter Contents

Offset input					5-bit up/down counter contents	Remarks
OF_1	OF_2	OF_3	OF_4	OF_5		
0	0	0	0	0	0	Lowest level
1	0	0	0	0	1	
0	1	0	0	0	2	
1	1	0	0	0	3	
0	0	1	0	0	4	
1	0	1	0	0	5	
0	1	1	0	0	6	
1	1	1	0	0	7	
0	0	0	1	0	8	
1	0	0	1	0	9	
0	1	0	1	0	10	
1	1	0	1	0	11	
0	0	1	1	0	12	
1	0	1	1	0	13	
0	1	1	1	0	14	
1	1	1	1	0	15	
0	0	0	0	1	16	Intermediate level
1	0	0	0	1	17	
0	1	0	0	1	18	
1	1	0	0	1	19	
0	0	1	0	1	20	
1	0	1	0	1	21	
0	1	1	0	1	22	
1	1	1	0	1	23	
0	0	0	1	1	24	
1	0	0	1	1	25	
0	1	0	1	1	26	
1	1	0	1	1	27	
0	0	1	1	1	28	
1	0	1	1	1	29	
0	1	1	1	1	30	
1	1	1	1	1	31	Highest level

Reset Function

This is a function used for testing. When a high-level signal is applied to the RESET pin, the frequency divider (480kHz ~ 4.88Hz) is reset.

D/A Output

This IC contains a 5-bit D/A converter which can control analogue quantities in 32 steps.

A pulse width modulated signal having a minimum pulse width of 12.5μs is output with a repeat frequency of 2.5kHz.

When the mode is set to auto up or auto down through the UP pin or DOWN pin operation, the analogue quantity can be increased or decreased at a rate of approximately 9.77 steps/sec. Consequently, the time required to set the analogue quantity from the minimum to maximum value, or vice versa, is approximately 3.18 sec.

Note: It is necessary to do the initial reset to the UP/DOWN counter and the memory after power on.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Conditions	Limits	Unit
V_{DD}	Supply voltage	with respect to V_{SS}	−0.3~7	V
V_I	Input voltage		$V_{SS} \leqq V_I \leqq V_{DD}$	—
V_O	Output voltage		$V_{SS} \leqq V_I \leqq V_{DD}$	—
P_d	Maximum power dissipation	Ta=25°C	300	mV
Topr	Operating free-air temperature range		−30~70	°C
Tstg	Storage temperature range		−40~125	°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
V_{DD}	Supply voltage	4.5	5	5.5	V
f_{OSC}	Oscillation frequency		480		kHz
V_{IH}	High-level input voltage (Note 1)	$0.7 \times V_{DD}$	V_{DD}	V_{DD}	—
V_{IL}	Low-level input voltage (Note 1)	0	0	$0.3 \times V_{DD}$	—

Note 1. These conditions apply to M, RESET, OF_5, OF_4, PRESET, OF_3, OF_2, OF_1, DOWN, UP and L pins.

ELECTRICAL CHARACTERISTICS (Ta=25°C, V_{DD}=5V, V_{SS}=0V, $C_{LI} = C_{LO}$ = 100pF, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{DD}	Operational supply voltage	Ta=−30~70°C, f_{OSC}=480kHz	4.5	5	5.5	V
I_{DD}	Supply current	f_{OSC}=480kHz		0.3	2	mA
R_I	Pull-down resistances (Note 1)	V_I=5V		100		kΩ
I_{OH}	High-level output current	V_O=0V	2			mA
I_{OL}	Low-level output current	V_O=5V	2			mA

APPLICATION EXAMPLE