To our customers,

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April 1st, 2010
Renesas Electronics Corporation

RENESAS

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DESCRIPTION

M61005FP is a semiconductor integrated circuit containing distance detection signal processing circuit for 3V supply voltage.
This device transforms each optical inflow current I1 and I2 from PSD SENSOR into the voltage, and integrates that output after doing calculation corresponds to I1/(I1+I2), and outputs it as the voltage data.

FEATURES

- Wide supply voltage range Vcc = 2.2 to 5.5V
- Includes clamp level switching circuit
  (Switch is 15 kinds by outside control)
- Includes infinity judge function
- Includes POWER ON RESET function
- Includes Simple temperature detection function
 (This output voltage is inputted to the microcomputer,
  and temperature compensation is possible.)

APPLICATION

Auto focus control for the CAMERA
Sensor for short distance   etc

RECOMMENDED OPERATING CONDITION

Supply voltage ••••••••••••••	2.2 to 5.5V
Rated supply voltage ••••••••••••••	3.0V

PIN CONFIGURATION (TOP VIEW)

M61005FP

Pin	Name		Pin	Name
1	AFOUT		16	NC (TESTN)
2	GND1		15	CHN
3	GND2		14	PSDN
4	NC		13	NC
5	VCC2		12	VCC1
6	CONT		11	PSDF
7	CMOUT		10	CHF
8	CLALV		9	NC (TESTF)
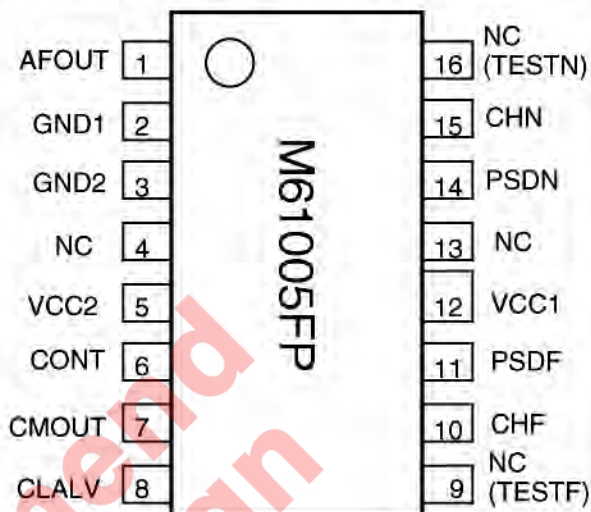
Outline 16P2E

Note: pin9,16 is connected only engineering sample
Vcc1,GND1:Use small signal
Vcc2,GND2:Use non small signal

BLOCK DIAGRAM

Note: pin9,16 is connected only engineering sample
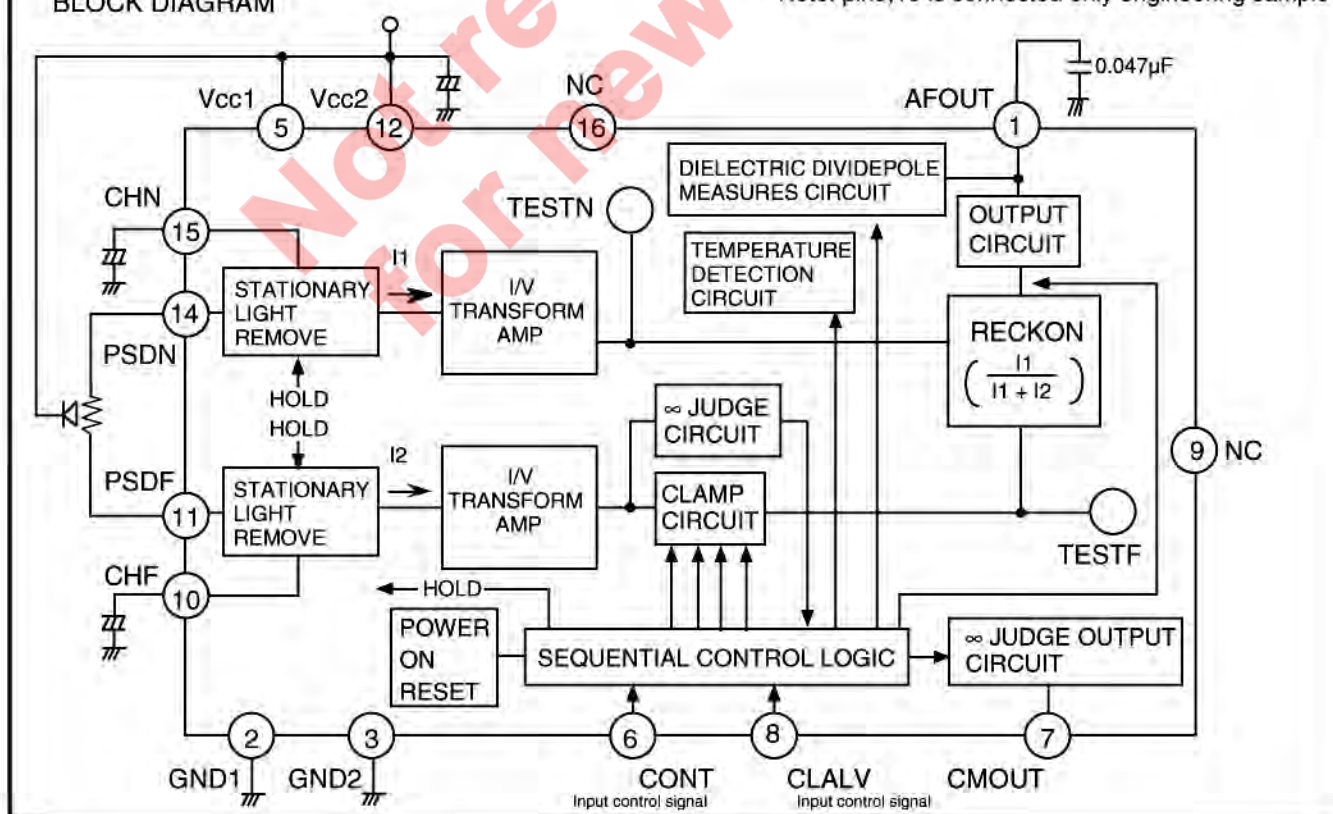
ABSOLUTE MAXIMUM RATINGS   (Ta = 25°C ,unless noted)

Parameter	Symbol	Ratings	Unit	Remark
Supply voltage	Vcc	7.0	V	note 1
Power dissipation	Pd	320	mW	Ta = 25°C
Thermal derating	Kθ	− 3.2	mW/°C	Ta ≥ 25°C
Pin supply voltage	VIF	7.0	V	Pin6,7,8
Another pin supply voltage	VI/O	0 to Vcc + 0.3	V	note 2
Output pin inflow current	Icmout	0.5	mA	NPN open collector
Operating temperature	Topr	− 10 to 50	°C	
Storage temperature	Tstg	− 40 to 125	°C	

note 1:As a principle,do not provide a supply voltage reversely.
note 2:As a principle,do not provide the terminals with the voltage over supply voltage or under
        ground voltage.

ELECTRICAL CHARACTERISTICS (Ta=25°C, Vcc=3.0V, unless otherwise noted)

Classification	Parameter	Symbol	Test conditions	Min.	Typ.	Max.	Unit	Note
	Operating supply voltage range	VCC		2.2	3.0	5.5	V	
Consuming current	Usual consuming current	ICC1		–	3.5		mA	
	While Rapid charge consuming current 1	ICC2	While AFOUT rapid charge consuming current VAFOUT = 0V	–	8.5		mA	*1
	While Rapid charge consuming current 2	ICC3	While CH rapid charge consuming current	–	9.5		mA	*1
CONT pin	CONT "H" input voltage	VCOH		0	–	0.3	V	
	CONT "L" input voltage	VCLL		–	–	0.3	V	
	CONT "H" input current	ICLH	VIH=5.5V	–	–	1.0	µA	
	CONT "L" input current	ICLL	VIL=0V	-100	-75	-50	µA	
CLALV pin	CLALV "H" input voltage	VCLH		1.1	–	7.0	V	
	CLALV "L" input voltage	VCLL		0	–	0.3	V	
	CLALV "H" input current	ICLH	VIH=5.5V	–	–	1.0	µA	
	CLALV "L" input current	ICLL	VIL=0V	-78	-60	-42	µA	
HOLD C	CH rapid charge current	ICHQC	IPSD=5µA , VCH=0V	-2000	-1000	-500	µA	*1
	CH stationary charge current	ICHC	VCH=0V	-30	-20	-10	µA	*1
	CH stationary discharge current	ICHD	VCH=1.5V	10	20	30	µA	*1
Integration circuit	AFOUT reset current	IROUT	VAFOUT=0.5V	500	1000	2000	µA	*1
	AFOUT integrating off current	I AFOUT1	VAFOUT=0.5V	–	–	1.0	µA	*1
	AFOUT integration current	I AFOUT2	VAFOUT=0.5V VCHF=2.0V, VCHN=0V	7.0	10.0	13.0	µA	*1
	AFOUT correction for temperature integration current	I AFOUT3	VAFOUT=0.5V	3.5	5.0	6.5	µA	*1
	CMOUT leak current	ICMOUTH	VCMOUT=5.5V	–	–	1.0	µA	*1
	CMOUT saturation voltage	VCMOUTL	ICMOUT=500µA	–	–	0.3	V	*2
Sensor	Signal light saturation current	ΔINF		3.0	–	–	µA	*2
	Stationary light remove current	IPSD		–	–	30	µA	
Clamp level	Clamp level	ICLAM	Change quantitiy for TYP current	-50	–	50	%	

*1 Set up the logic control terminal, correspond to the parameter.

*2 The input current of one side channel when stationary light remove circuit and I/V transform AMP is not saturated.

ELECTRICAL CHARACTERISTICS (cont.)(Ta=25°C,Vcc=3.0V, unless otherwise noted)

Classification	Parameter	Symbol	Test conditions	Min.	Typ.	Max.	Unit	Note
AF input condition 1	AF output time(9:1) - 1	D(9:1) - 1	Near side 9 : Far side 1	typ X 0.7		typ X 1.3	V	*3
	AF output time(6:4) - 1	D(6:4) - 1	Near side 6 : Far side 4	typ X 0.7		typ X 1.3	V	*3
	AF output time(3:7) - 1	D(3:7) - 1	Near side 3 : Far side 7	typ X 0.7		typ X 1.3	V	*3
	AF slope - 1	ΔAF - 1		typ X 0.7		typ X 1.3	V	*3
	AF linearity - 1	LAF - 1		0.9	1.0	1.1		*3
AF input condition 2	AF output time(9:1) - 2	D(9:1) - 2	Near side 9 : Far side 1	typ X 0.7		typ X 1.3	V	*3
	AF output time(6:4) - 2	D(6:4) - 2	Near side 6 : Far side 4	typ X 0.7		typ X 1.3	V	*3
	AF output time(3:7) - 2	D(3:7) - 2	Near side 3 : Far side 7	typ X 0.7		typ X 1.3	V	*3
	AF slope - 2	ΔAF - 2		typ X 0.7		typ X 1.3	V	*3
	AF linearity - 2	LAF - 2		0.9	1.0	1.1		*3
AF input condition 3	AF output time(9:1) - 3	D(9:1) - 3	Near side 9 : Far side 1	typ X 0.7		typ X 1.3	V	*3
	AF output time(6:4) - 3	D(6:4) - 3	Near side 6 : Far side 4	typ X 0.7		typ X 1.3	V	*3
	AF output time(3:7) - 3	D(3:7) - 3	Near side 3 : Far side 7	typ X 0.7		typ X 1.3	V	*3
	AF slope - 3	ΔAF - 3		typ X 0.7		typ X 1.3	V	*3
	AF linearity - 3	LAF - 3		0.9	1.0	1.1		*3
AF input condition 1 minus 2	ΔAF output time(9:1)	ΔD(9:1)	Near side 9 : Far side 1(Condition 1-2)	—	—		V	
	ΔAF output time(6:4)	ΔD(6:4)	Near side 6 : Far side 4(Condition 1-2)	—	—		V	
	ΔAF output time(3:7)	ΔD(3:7)	Near side 3 : Far side 7(Condition 1-2)	—	—		V	

*3 Connect the resistance of 120KΩ instead of PSD and establish current output from PHOTO COUPLER correspond to the parameter. And input the varied resistance ratio. And measure the pulse width of SOUT output at that time,obtain AF slope and AF linearity from the equations below.

Input condition1 : I_{PSD} (Stationary light current) = 0 $\quad$ $I1 + I2 = 100nA$

Input condition2 : I_{PSD} (Stationary light current) = 0 $\quad$ $I1 + I2 = 50nA$

Input condition3 : I_{PSD} (Stationary light current) = 10μA $\quad$ $I1 + I2 = 100nA$

$D_{(9:1)}$ • • • The pulse width of SOUT output at input with I1:I2=9:1

$D_{(6:4)}$ • • • The pulse width of SOUT output at input with I1:I2=6:4
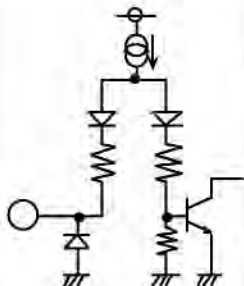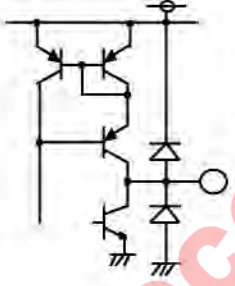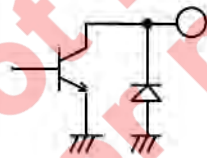
$D_{(3:7)}$ • • • The pulse width of SOUT output at input with I1:I2=3:7

AF slope : $\Delta AF = D_{(9:1)} - D_{(3:7)}$

AF linearity : $L_{(AF)} = (D_{(9:1)} - D_{(6:4)}) / (D_{(6:4)} - D_{(3:7)})$

PSD quite resistance : 120KΩ

DESCRIPTION OF PIN

Pin name	Circuit diagram	Parameter	Limits			Unit	Test conditions and note
			Min.	Typ.	Max.		
CONT CLALV		"H"input voltage	1.1	—	7.0	V	
		"L"input voltage	0	—	0.3		
		"H"input current	—	—	1.0	µA	VIH=5.5V
		"L"input current	-78	-60	-42		VIL=0V
AFOUT		"H"input voltage	—	—	VCC -1.2	V	
		"L"input voltage	0	—	0.3		
		Integration OFF current	—	—	1.0	µA	VF=0.5V
		Integration ON current (Ratio10:0)	-13	-10	-7		VF=0.5V
CMOUT		"L"output voltage	—	—	0.3	V	IOL=500µA
		"H"leak current	—	—	1.0	µA	VIN=5.5V

CONTROLS

(1) CONT •••• This terminal implements the following controls by inputted clock.

a. AFOUT rapid charge •••• After reset is started , the capacity of AFOUT is charged rapidly until first clock rises.

b. CH rapid charge •••• The capacity of CH is charged rapidly from first clock falls to second clock falls.

c. AFOUT reset 1 •••• This control implements resetting AFOUT terminal from first clock falls to second clock falls.

d . Temperature detection current ON •••• This control outputs temperature detection current from AFOUT terminal from third clock falls to forth clock falls.

e . Temperature detection current A/D converter •••• AFOUT terminal voltage is implemented A/D converter by microcomputer from forth clock falls to fifth clock falls.
This value is used correction for temperature of distance detection calculation result.
Temperature is corrected by microcomputer.

f . AFOUT reset 2 •••• This control implements resetting AFOUT terminal from fifth clock falls to sixth clock falls.

g . Stationary light hold •••• This control holds stationary light from seventh clock rises to eighth clock rises.
After seventh clock, this control holds stationary light from odd-numbered clock rises to next even-numbered clock rises.

h . AF integration •••• This control outputs current from AFOUT terminal equivalent to distance detection result from seventh clock falls to eighth clock falls.
After seventh clock, this control outputs current from AFOUT terminal from odd-numbered clock falls to next even-numbered clock falls.
AFOUT voltage that more than one time repeated this condition is implemented A/D converter by microcomputer.

(notice) As the signal from microcomputer,the signal that controls IRED ON/OFF is required.

(3) CLALV •••••••• This terminal sets up clamp level and resets a logic.

a. Clamp level •••••••• As including D/A of 4bit,15way clamp level setting is possible by inputting clock after reset is canceled(include none clamp).

b. Logic reset •••••••• This terminal resets a logic in IC at fifteenth clock
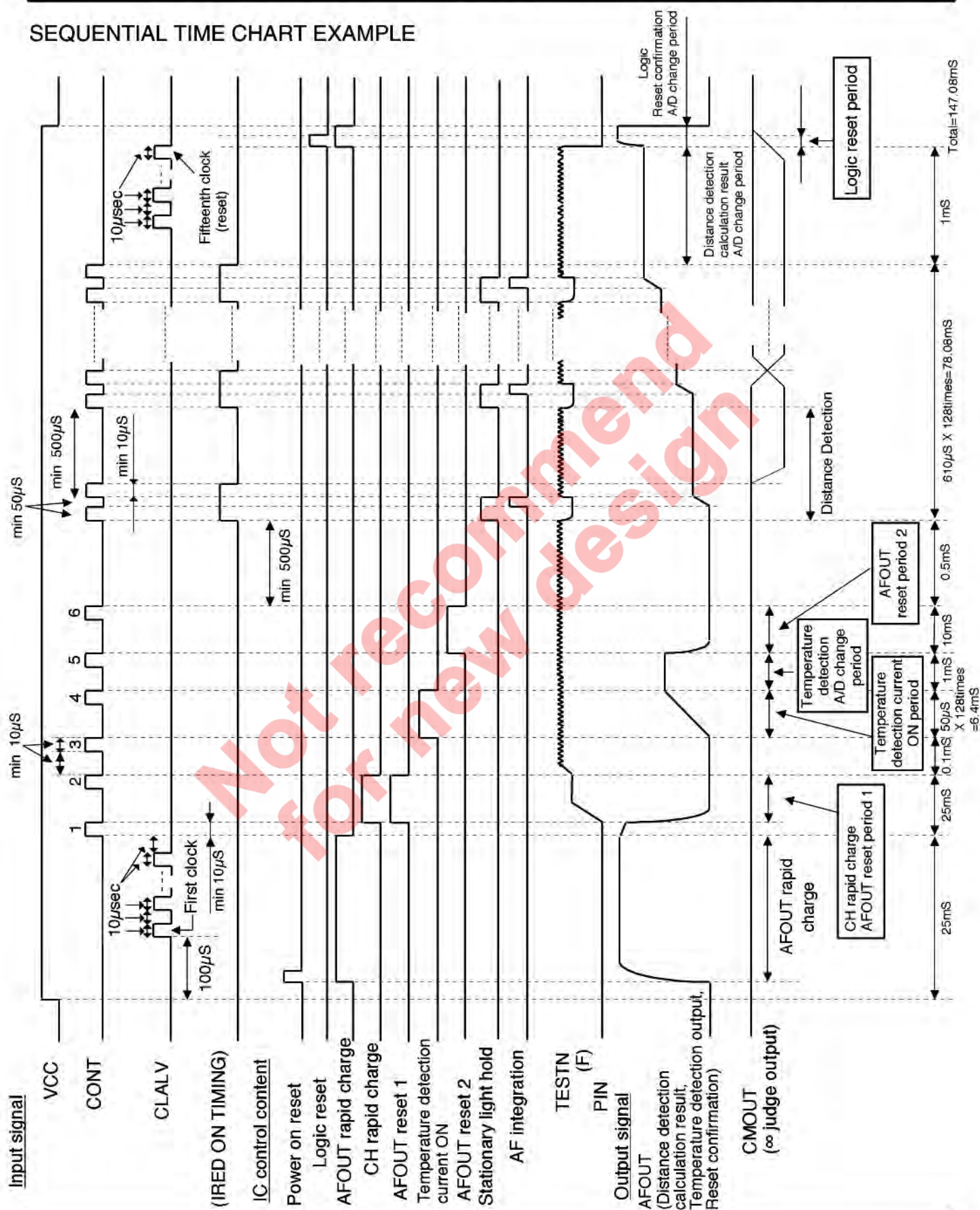In case of consecutive distance detection with VCC ON condition , it needs resetting logic.

Set up current value of each bit is on the right table.
The number of input clock and set up clamp level is as follows.

bit	Set up current (Typ.)
1	0.125nA
2	0.25nA
3	0.5nA
4	1.0 nA

Clock value	Clamp level(Typ.)	Clock value	Clamp level(Typ.)
0	None clamp	12	1.500 nA
1	0.125 nA	13	1.625 nA
2	0.250 nA	14	1.750 nA
3	0.375 nA	15	None clamp,Logic reset
4	0.500 nA	16	0.125 nA
5	0.625 nA	17	0.250 nA
6	0.750 nA	18	0.375 nA
7	0.875 nA	19	0.500 nA
8	1.000 nA	20	0.625 nA
9	1.125 nA	⋮	⋮
10	1.250 nA	⋮	⋮
11	1.375 nA	⋮	⋮

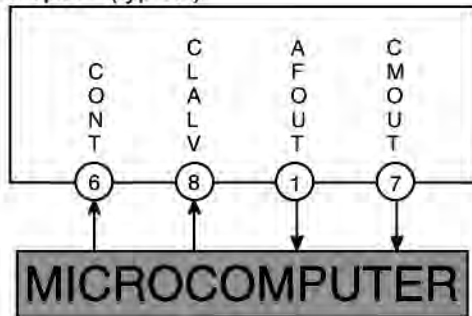Clamp level is established with fall edge of input clock. It repeats the same value after 15 clock.

SEQUENTIAL TIME CHART EXAMPLE

10μsec
Fifteenth clock (reset)

Logic Reset confirmation A/D change period

Logic reset period

Distance detection calculation result A/D change period

Total=147.08mS

1mS

min 500μS

min 10μS

min 50μS

min 500μS

Distance Detection

610μS X 128times=78.08mS

AFOUT reset period 2

0.5mS

Temperature detection A/D change period

1mS ¦ 10mS

Temperature detection current ON period

1mS 50μS X 128times =6.4mS

0.1mS

min 10μS

First clock

10μsec

min 10μS

100μS

AFOUT reset period 1

25mS

CH rapid charge AFOUT reset period 1

AFOUT rapid charge

25mS

Input signal

VCC

CONT

CLALV

(IRED ON TIMING)

IC control content
Power on reset
Logic reset
AFOUT rapid charge
CH rapid charge
AFOUT reset 1
Temperature detection current ON
AFOUT reset 2
Stationary light hold
AF integration

TESTN
(F)

PIN

Output signal

AFOUT
(Distance detection calculation result, Temperature detection output, Reset confirmation)
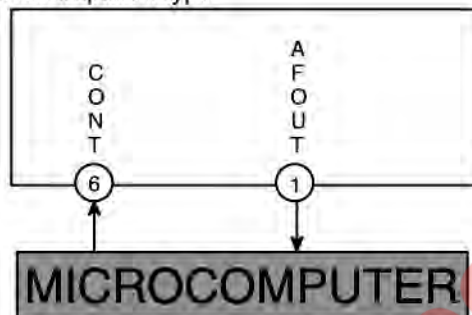
CMOUT
(∞ judge output)

MASK OPTION

(1) Control terminal variation

① Full spec (typical)

This type uses CONT,CLALV,AFOUT ,CMOUT terminal as I/F terminal to the microcomputer.
This is the typical type at M61005FP.

② Most simplified type

This type does not connect CLALV,CMOUT terminals to the microcomputer.
When above mentioned terminals are not connected to the microcomputer without changing mask,connect each terminal to the ground. In this case,clamp level becomes 0 .
And Power on reset in IC is used as reset.

③ Explanation of the terminal that can be simplified.

    (a) CLALV •••••••• In the typical type,15way clamp levels can be set by the external control,but also the terminal can be simplified by mask option as follows.

      (I) Clamp level fixation •••••••• Selects 1 point from 15 steps of clamp level and fixes it.

      (II) Clamp level 2 step changeover •••••••• Selects 2 points from clamp level and switches it by changing CLALV terminal HIGH/LOW. However,as selecting 2 points, there is a following constraint.
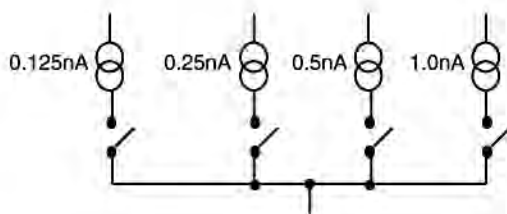
Fixes 3 parts of 4 switches correspond to each bit in figure to ON or OFF.controls another part by CLALV terminal .

    (b) CMOUT •••••••• When an infinity decision function shouldn't be necessary, it is possible that a CMOUT terminal is removed.

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