Ordering number : EN5899

CMOS IC

LC573010A, 573015A

4-bit Single Chip Microcontroller

Overview

LC573010A and LC573015A are CMOS 4-bit microcontroller featuring low-voltage operation and low power dissipation.

Both LC573010A and LC573015A incorporate a 4-bit parallel processing ALU, 1 K bytes/1.5 K bytes ROM, a 32 × 4-bit RAM, a 16-bit timer, and an infrared remote control transmission carrier output circuit.

Applications

- Remote controller
- Control of small measuring instruments

Features

- ROM : 1024 × 8 bits (LC573010A)
  1536 × 8 bits (LC573015A)
- RAM : 32 × 4 bits
- Cycle time

Cycle time	System clock generator	Oscillation frequency	Supply voltage
17.6 µsec	Ceramic oscillation circuit	455 kHz	2.3 to 6.0 V

- Current dvain

At normal operation

Current drain	System clock generator	Oscillation frequency	Supply voltage
150 µA typ	CR oscillation	455 kHz	3.0 V
400 µA typ	CR oscillation	455 kHz	5.0 V

HALT mode

Current drain	System clock generator	Oscillation frequency	Supply voltage
80 µA typ	CR oscillation	455 kHz	3.0 V
300 µA typ	CR oscillation	455 kHz	5.0 V

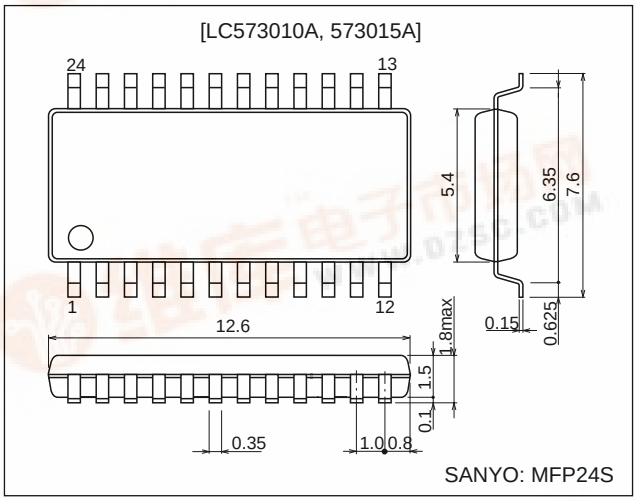
HOLD mode

Leakage current	Condition	Oscillation frequency	Supply voltage
0.1 µA typ	When CR oscillation is at STOP mode	455 kHz	5.0 V

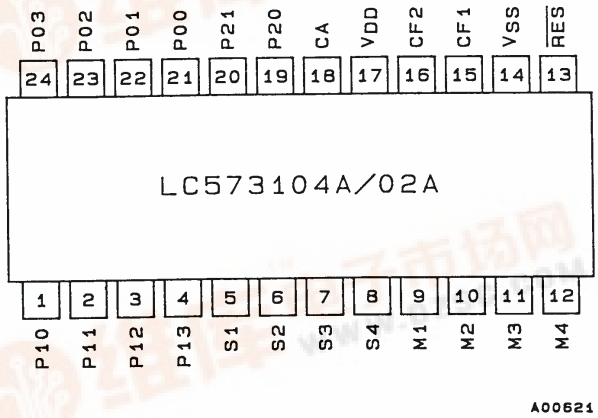
Package Dimensions

unit: mm

3112-MFD24S



Pin Assignment



SANYO Electric Co.,Ltd. Semiconductor Bussiness Headquarters
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

- Port
  - Input port (S port, M port) : 2-port (8 pins) [Key scan input port]
  - Input/Output port : 3-port (10 pins)
    - P0 port, P1 port 2-port (8 pins) [Key scan output port]
    - P2 port 1-port (2 pins) [Key scan expansion port]
      [LED direct drivable port]
- Infrared remote control carrier generation circuit
  - Software-controllable remote control carrier output ON/OFF.
  - Software-controllable carrier frequency and duty ratio.
    <38 kHz-1/3 duty, 38 kHz-1/2 duty, 57 kHz-1/2 duty>
    (When fixed carrier signal is output, it is specified by mask option)
  - 1 kHz to 200 kHz infrared remote control transmission carrier frequency.
    (When carrier output is selected by timer at mask option, and when 455 kHz CR oscillator is used)
  - Infrared carrier output-dedicated terminal built-in (CA terminal).
  - 108 ms HALT-mode cancel signal output.
- Timer
  - 16-bit software-controllable timer
    Timer input clock : Ceramic (CR) oscillation frequency (455 kHz)
  - 108 ms HALT release request signal generation timer (Free running timer)
  - Watchdog timer (changed over between USED/UNUSED by mask option)
- Sub-routine stack level
  - 2 levels
- Oscillation circuit
  - Ceramic (CR) oscillation circuit : 455 kHz (for System clock generation), feedback resistor built-in.
- Standby function
  - HALT mode
    HALT mode used to reduce current drain.
    HALT mode suspends program execution.
    Following shows how to release the HALT mode.
    (A) System reset
    (B) HALT mode release request signal
  - HOLD mode
    HOLD mode stops ceramic resonator (CR). The HOLD mode can be released in two ways.
    (A) System reset
    (B) Apply H level input to S port pin or M port pin. (However, it is necessary to set S port or M port HOLD mode release permission flag beforehand.)
- Form of shipment
  - MFP-24S (1.0 mm pitch)

Note : When dipping in solder to mount the MFP package on board, contact SANYO for instructions.

The Application Development System for the LC573100 Series.

Manual
(1) Users Manual : LC573100 Series Users Manual
(2) Development Tool Manual : LC573100 Series Development Tool Manual

Development Tools
- Tools for application development of the LC573100 Series
  (1) Personal computer (MS-DOS based)
  (2) Cross assembler (LC573100. EXE)
  (3) Mask option generator (SU573100. EXE)
- Tools to evaluate application development of the LC573100 Series.
  (1) EVA chip (LC5797)

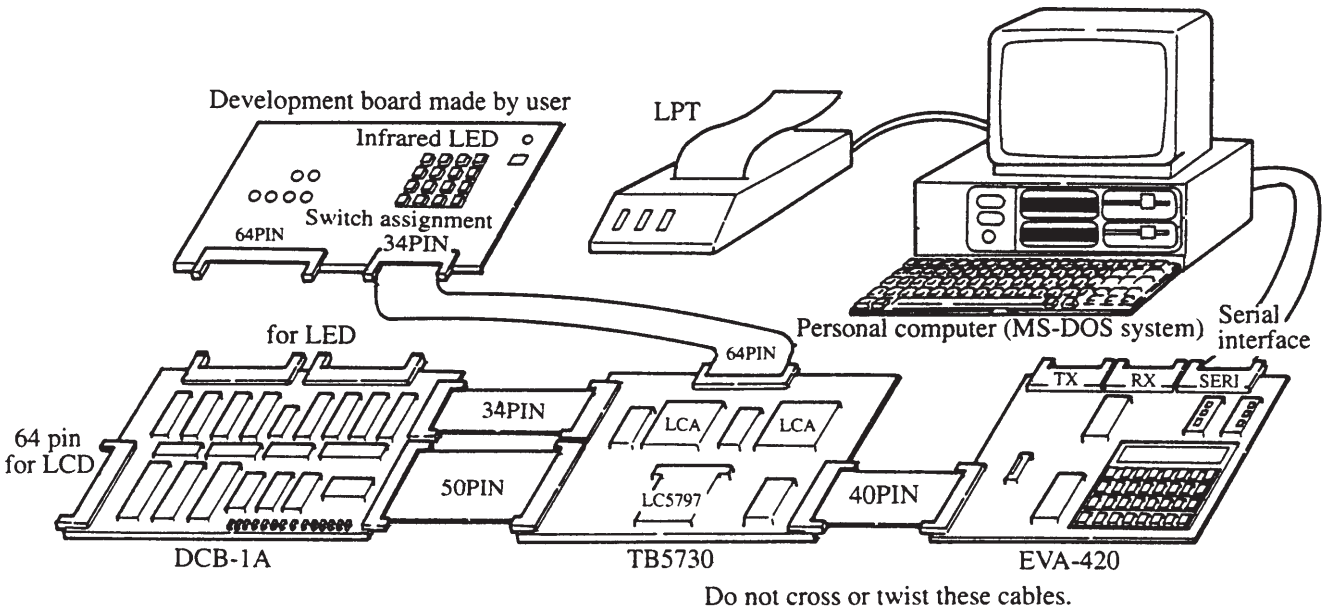
Note : 1 As RAM capacity differs between EVA chip (LC5797) and the LC573100 Series, always check before programming and debugging.
LC573010A/LC573015S : 64 × 4 bits
LC5797 : 256 × 4 bits

Note : 2 Always keep the DPH value in mind when programming. Only DPH '0' to '3' may be used as the RAM address.
If DPH other than **'0' to '3' is used as RAM address** when programming, SANYO will not be liable for any trouble caused.

(2) EVA chip board (TB5730)

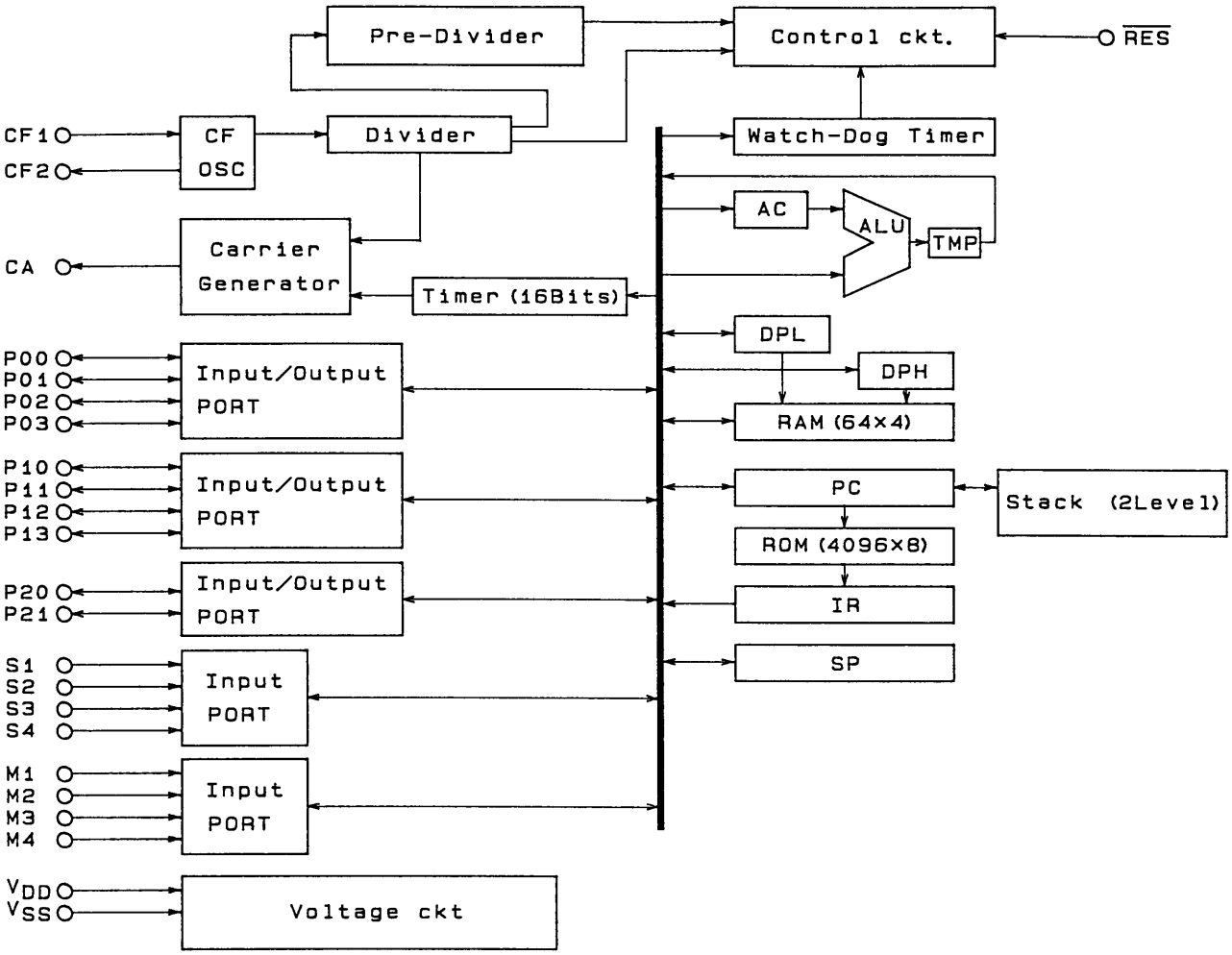
Note : The application evaluation board is the evaluation board made by the user.

(3) Evaluation board [EVA420 (Monitor ROM : ER-573000)]
(4) Display and mask option data control board [DCB-1A (REV3.6)]

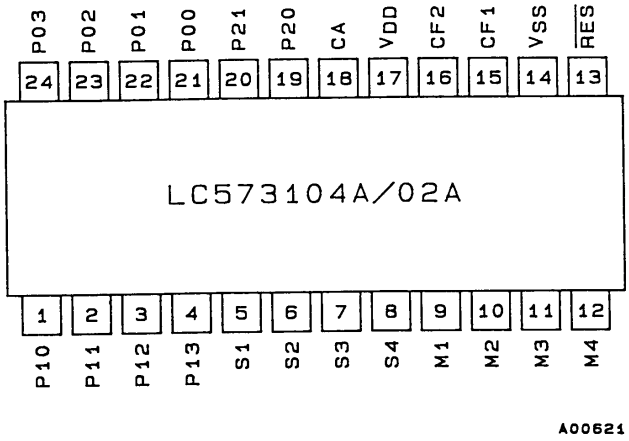


Development Support System Outline

Block Diagram



Pin Assignment



Pin Functions

MFP24S Pin no.	Pin name	Input/ output	Function description	Option	Reset status
17	V_{DD}	–	Supply voltage. See Figure 1.		
14	V_{SS}	–	Ground. See Figure 1.		
15	CF1	Input	Used for system clock oscillation • 455 kHz ceramic resonator is connected between CF1 and CF2 for oscillation. • Stops oscillation when receiving CR oscillation stop command.		
16	CF2	Output			
5 6 7 8	S1 S2 S3 S4	Input	Input port S. • LSI system is reset by charging V_{DD} to S1 to S4 simultaneously. (Mask option) • Data is loaded in accumulator.	(1) Low level HOLD Tr YES/NO (2) Reset by S1 to S4.	• Pull-down resistor ON • Reset signal ENABLE
9 10 11 12	M1 M2 M3 M4	Input	Input port M. Data loaded in accumulator	Low level HOLD Tr YES/NO	• Pull-down resistor ON
21 22 23 24	P00 P01 P02 P03	Input/ output	Input/output port • Data loaded in accumulator. • Output pin to output data from accumulator. (P-ch open drain output)		
1 2 3 4	P10 P11 P12 P13	Input/ output	Input/output port • Data loaded in accumulator. • Output pin to output data from accumulator. (P-ch open drain output)		
19 20	P20 P21	Input/ output	Input/output port • Data loaded in accumulator. • Output pin to output data from accumulator. (P-ch open drain output) • LED direct drivable pin		
18	CA	Output	Remote control carrier output.	Fixed carrier output/carrier output by timer	• At reset low level • At fixed carrier output 38 kHz-1/3 duty
13	$\overline{RES}$	Input	Reset input. Internal pull-up resistor.		

Supply Connections

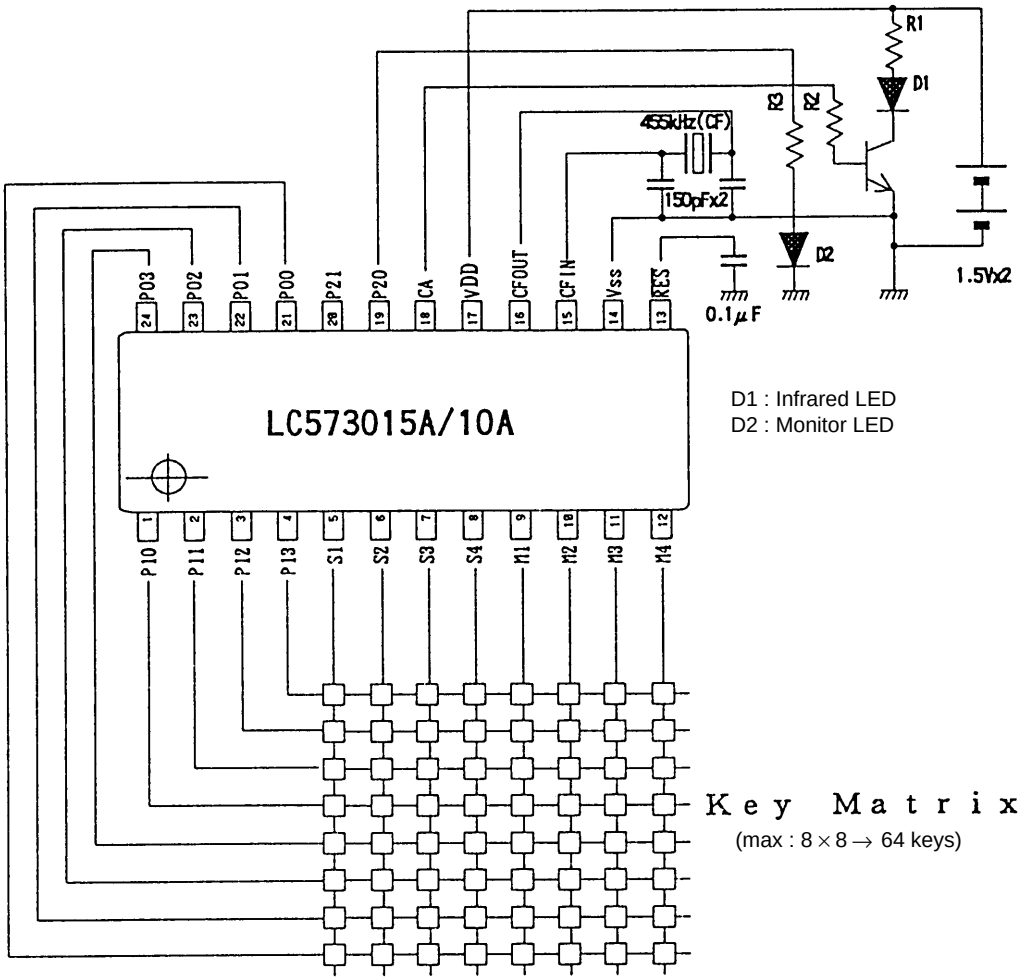
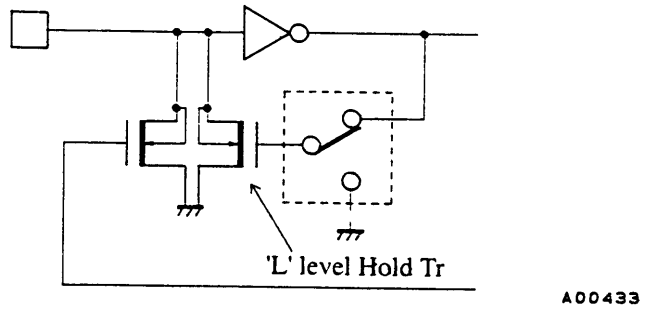


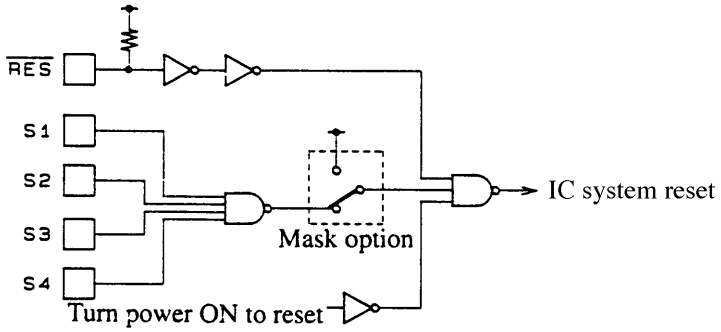
Figure 1 Supply Connections

Mask Option

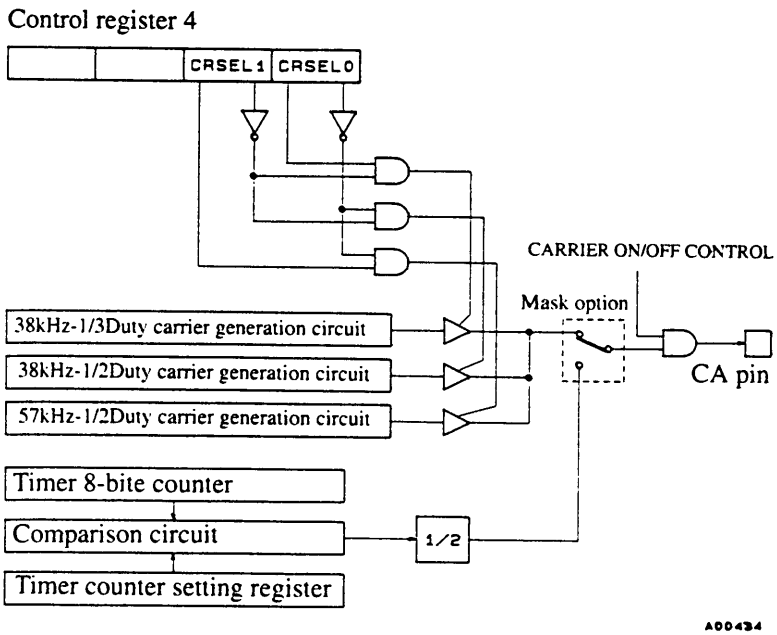
Input port option

Option	Circuit	Remarks
Low level hold Tr selection		Next port switches over in sequence. • S1 to S4, M1 to M4 Input signal level Hold Tr selection • Low level hold Tr used. • Low level hold Tr not used.

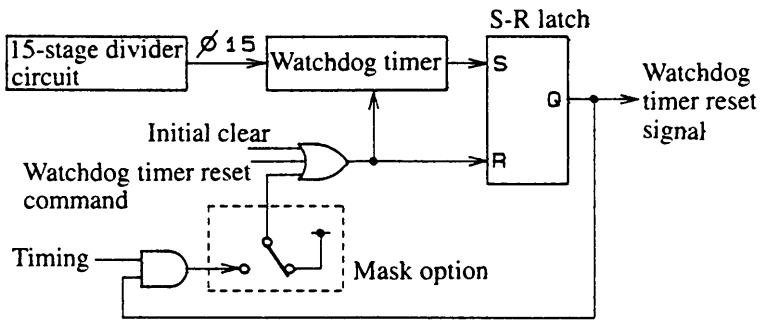
Reset signal option by S port

Option	Circuit	Remarks
Resetting IC by S port		Selects signal for resetting IC system by simultaneously charging High level to S1 to S4. • Allow • Prohibit

Carrier standard clock generation circuit option for remote control

Option	Circuit	Remarks
38/57 kHz		Software-controllable carrier frequency and duty. • Following carrier frequency and duty may be selected by setting control register 4. (1) 38 kHz-1/3 duty (2) 38 kHz-1/2 duty (3) 57 kHz-1/2 duty
Timer 8-bit overflow		Timer 8-bit overflow signal generates carrier signal for infrared remote control. Fixed 1/2 duty

Watchdog timer circuit option

Option	Circuit	Remarks
Watchdog timer selection		Watchdog timer used/unused selection

Specifications

Absolute Maximum Ratings at Ta = ±25 +2°C, V_{SS} = 0 V

Parameter	Symbol	Conditions	Rating	Unit
Supply voltage range	V_{DD}		–0.3 to +7.0	V
Input voltage range	V_{IN}	S1 to S4, M1 to M4, $\overline{RES}$, P00 to P03, P10 to P13, P20, P21, CF1 (P00 to P03, P10 to P13, P20, P21 are input mode)	–0.3 to V_{DD} +0.3	V
Output voltage range	V_{OUT}	CA, P00 to P03, P10 to P13, P20, P21, CF2 (P00 to P03, P10 to P13, P20, P21 are output mode)	–0.3 to V_{DD} +0.3	V
Output current (Per 1 pin)	I_{OUT1}	CA (per 1 pin)	25	mA
	I_{OUT2}	P00 to P03, P10 to P13 (per 1 pin)	500	µA
	I_{OUT3}	P20, P21 (per 1 pin)	10	mA
	I_{OUT4}	Output pins other than listed above (per 1 pin)	500	µA
Total output current of all pins except CA	I_{ALL}	All pins totalled (except for CA pin)	25	mA
Operating temperature range	T_{opr}		–30 to +70	˚C
Storage temperature range	T_{stg}		–40 to +125	˚C

Recommended Operating Range at Ta = –30 to +70°C, V_{SS} = 0 V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply voltage	V_{DD}		2.3		6.0	V
Input high level voltage	V_{IH1}	S1 to S4, M1 to M4, P00 to P03, P10 to P13, P20, P21 (P0, P1, P2 ports are input mode)	0.7V_{DD}		V_{DD}	V
Input low level voltage	V_{IL1}		V_{SS}		0.3V_{DD}	V
Input high level voltage	V_{IH2}	$\overline{RES}$	0.75V_{DD}		V_{DD}	V
Input low level voltage	V_{IL2}		0		0.25V_{DD}	V
Operation frequency	f_{OPG}	At CR oscillation, Figure.2	380	455	500	kHz

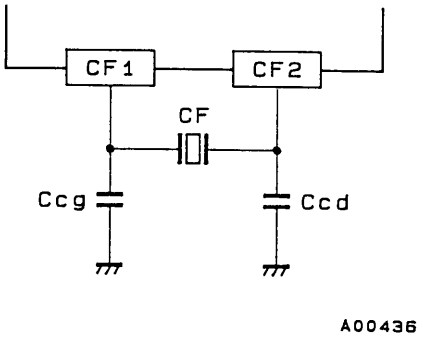


Figure.2 : CR Oscillation Circuit

Electrical Characteristics at Ta = –30 to +70°C, V_{SS} = 0 V

Parameter	Symbol	Conditions		Ratings min	Ratings typ	Ratings max	Unit
Input impedance	R_{IN}1A	V_{DD} = 2.9 V, V_{IL} = 0.4 V, S1 to S4, M1 to M4: Low level hold Tr, Figure 3		150	300	1000	kΩ
	R_{IN}1B	V_{DD} = 2.9 V, V_{IL} = 0.4 V, S1 to S4, M1 to M4: Low level pull-down Tr, Figure 3		30	50	100	kΩ
	R_{IN}2	V_{DD} = 2.9 V, V_{IH} = V_{DD}, $\overline{RES}$		10		300	kΩ
Output high level voltage	V_{OH}1	V_{DD} = 2.9 V, I_{OH} = –450 µA, P00 to P03, P10 to P13		V_{DD}–0.45			V
Output off-leak current	$\|I_{OFF}\|$	V_{DD} = 2.9 V, P00 to P03, P10 to P13	V_{IN} = V_{SS}			1.0	µA
	$\|I_{OFF}\|$		V_{IN} = V_{DD}			1.0	µA
Output high level voltage	V_{OH}2	V_{DD} = 2.9 V, I_{OH} = –10 mA, P20, P21		V_{DD}–1.5			V
Output off-leak current	$\|I_{OFF}\|$	V_{DD} = 2.9 V, P20, P21	V_{IN} = V_{SS}			1.0	µA
	$\|I_{OFF}\|$		V_{IN} = V_{DD}			1.0	µA
Output current (H)	I_{OH}1	V_{DD} = 3.0 V, V_{OH} = V_{DD}–1.5 V, CA			–12	–6	mA
Output current (L)	I_{OL}1	V_{DD} = 3.0 V, V_{OH} = 0.9 V, CA		2	5		mA
HALT-mode supply current	IDD1	V_{DD} = 3.0 V, 455 kHZ CR oscillation, Ccd = Ccg = 150 pF, Ta≤ 50˚C, Figure 5			80	300	µA
Operating Current	I_{DD}2	V_{DD} = 3.0 V, 455 kHz CR oscillation, Ccd = Ccg = 150 pF, Ta ≤ 50˚C, Figure 5			150	500	µA
Supply leak current 1	I_{LEAK}1	V_{DD} = 3.0 V	Ta = 25˚C		0.2	1	µA
Supply leak current 2	I_{LEAK}2		Ta = 50˚C		1	5	µA
Oscillator start-up voltage	V_{ST}	Ccd = Ccg = 150 pF, 455 kHz CR oscillation, Figure 4				2.3	V
Oscillator sustaining voltage	V_{SUS}			2.0			V
Oscillator start-up time	t_{ST}	V_{DD} = 2.3 V, Ccd = Ccg = 150 pF, 455 kHz CR oscillation, Figure 4				30	ms

Recommended Oscillators

Oscillator	Manufacturer	Part number	Ccg	Ccd
455 kHz ceramic oscillator	Kyocera	KRB-455BK/Y	150 pF	150 pF
	Murata	CSB455E	150 pF	150 pF
	Fuji Ceramics	POE-455	150 pF	150 pF

Electrical Characteristics at Ta = –30 to +70°C, V_{SS} = 0 V

Parameter	Symbol	Condition		Ratings min	Ratings typ	Ratings max	Unit
Input impedance	R_{IN}1A	V_{DD} = 5.0 V, V_{IL} = 0.4 V, S1 to S4, M1 to M4: Low level hold Tr, Figure 3		70	200	300	kΩ
	R_{IN}1B	V_{DD} = 5.0 V, S1 to S4, M1 to M4: Low level pull-down Tr, Figure 3		30	50	100	kΩ
	R_{IN}2	V_{DD} = 5.0 V, $\overline{RES}$		10		300	kΩ
Output high level voltage	V_{OH}1	V_{DD} = 5.0 V, I_{OH} = –750 µA, P00 to P03, P10 to P13		V_{DD}–0.75			V
Output off-leak current	$\|I_{OFF}\|$	V_{DD} = 5.0 V, P00 to P03, P10 to P13	V_{IN} = V_{SS}			1.0	µA
	$\|I_{OFF}\|$		V_{IN} = V_{DD}			1.0	µA
Output high level voltage	V_{OH}2	V_{DD} = 5.0 V, I_{OH} = –10 mA, P20, P21		V_{DD}–0.5			V
Output off-leak current	$\|I_{OFF}\|$	V_{DD} = 5.0 V, P20, P21	V_{IN} = V_{SS}			1.0	µA
	$\|I_{OFF}\|$		V_{IN} = V_{DD}			1.0	µA
Output current (H)	I_{OH}1	V_{DD} = 5.0 V, V_{OH} = V_{DD} – 2.5 V, CA		10	20		mA
Output current (L)	I_{OL}1	V_{DD} = 5.0 V, V_{OL} = 0.9 V, CA		2			mA
HALT-mode supply current	I_{DD}1	V_{DD} = 5.0 V, 455 kHz CR oscillation, Ccd = Ccg = 150 pF, Ta ≤ 50°C, Figure 5			300	400	µA
Operating current	I_{DD}2	V_{DD} = 5.0 V, 455 kHz CR oscillation Ccd = Ccg = 150 pF, Ta ≤ 50°C, Figure 5			400	500	µA
Supply leak current 1	I_{LEAK}1	V_{DD} = 5.0 V	Ta = 25°C		0.2	1	µA
Supply leak current 2	I_{LEAK}2		Ta = 50°C		1	5	µA
Oscillator start-up voltage	V_{ST}	Ccd = Ccg = 150 pF, 455 kHz CR oscillation, Figure 4				2.3	V
Oscillator sustaining voltage	V_{SUS}			2.0			V
Oscillator start-up time	t_{ST}	V_{DD} = 2.3 V, Ccd = Ccg = 150 pF, 455 kHz CR oscillation, Figure 4				30	ms

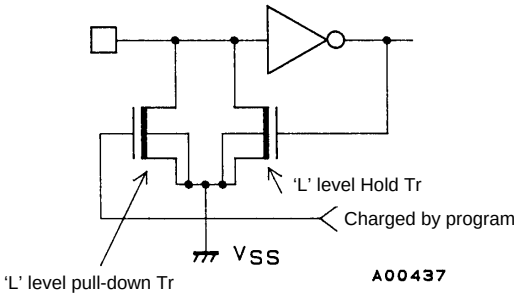
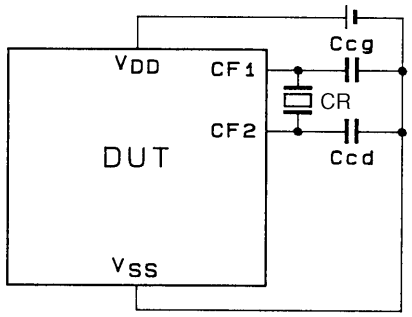


Figure 3 : S1 to S4, M1 to M4 Input Structure



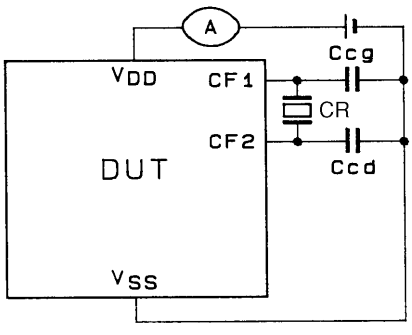


Figure4 : Oscillator Start-Up Voltage, Oscillator Sustaining Voltage, and Oscillator Start-Up Time Measuring Circuit

Note : CR is 455 kHz, S-PORT: M-PORT: Input Pull-down transistor is on. $\overline{RES}$ terminal has resistor built-in and is open. I/O-port is set at output mode and data is high.

Figure 5 : Supply Current Measuring Circuit