

LU850425

8-bit Microcomputer for DSP Camera Systems

DESCRIPTION

The LU850425 is a CMOS 8-bit single-chip microcomputer for CCD digital camera systems which include a CDS/AGC IC (IR3Y38M), a DSP IC (LR38266), a timing generator IC (LR38578), and this microcomputer IC.

FEATURES

- Auto exposure control (electronic exposure and mechanical exposure)
- Auto carrier balance tuning
- Auto white balance control
- In combination with an external controller (personal computer), functions below can be controlled (see "**Serial Control Interface**" in FUNCTIONAL DESCRIPTION)

① Switchable :

AGC→ON/OFF

Auto white balance→AUTO/PRESET

Aperture enhancement→ON/OFF

Back light compensation→ON/OFF

GAMMA correction→ON/OFF

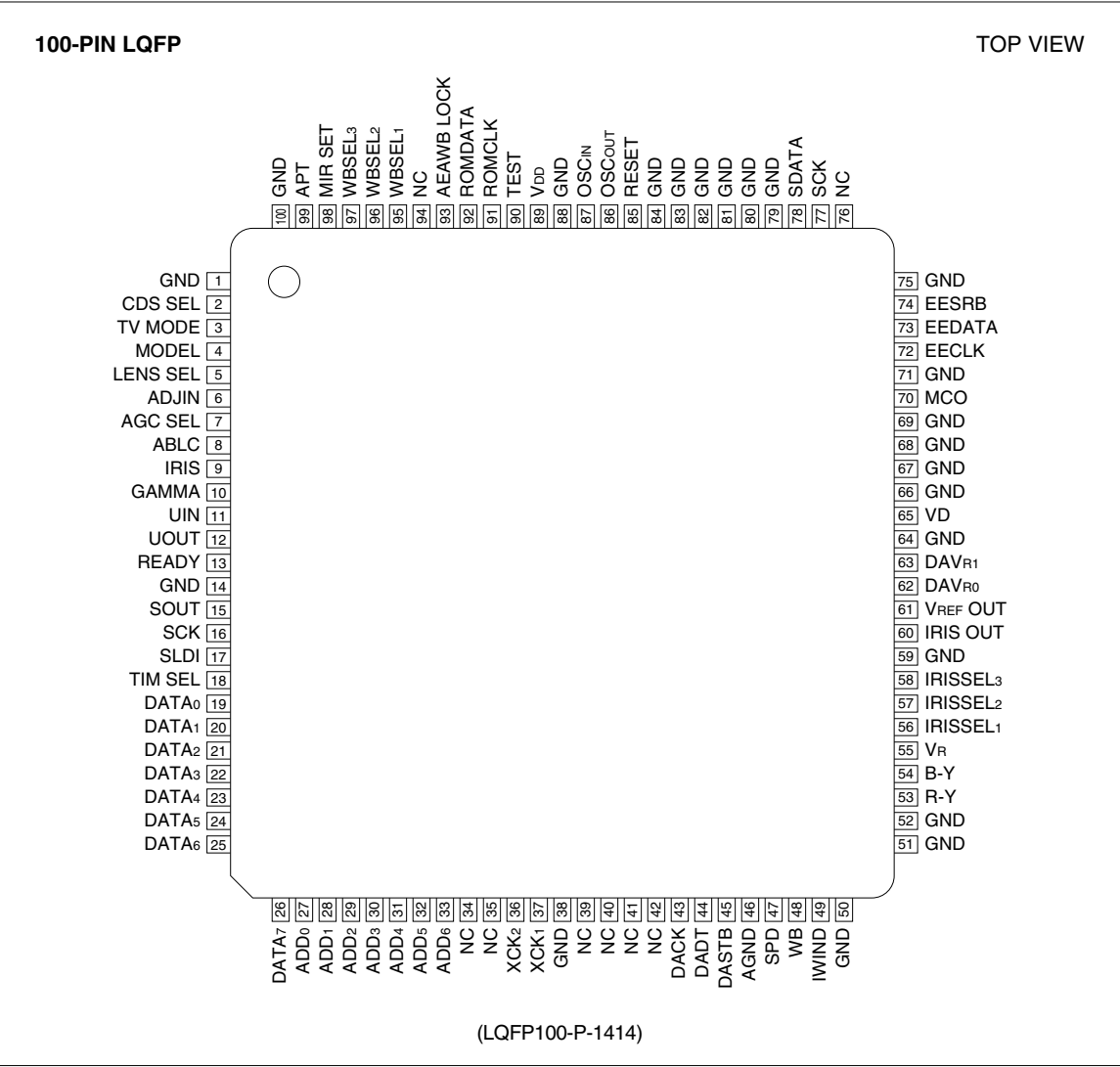
② Electronic shutter speed selection :

Auto E/E [1/60 (1/50) to 1/70 000 s] or fixed E/E [1/60 (1/50), 1/100 (1/60), 1/250, 1/500, 1/1 000, 1/5 000 and 1/10 000 s]


() = PAL mode

- Switchable between NTSC and PAL modes
- Single +3.3 V power supply
- Package :
100-pin LQFP (LQFP100-P-1414) 0.5 mm pin-pitch


PIN CONNECTIONS



PIN DESCRIPTION

PIN NO.	SYMBOL	I/O	POLARITY	DESCRIPTION															
1	GND	I	—	A grounding pin.															
2	CDS SEL	I	—	CDS/AGC IC selection. When using IR3Y38M, set to H level.															
3	TV MODE	I	—	TV standard/CCD selection.															
4	MODEL	I	—	<table border="1"> <tr> <td>Pin 3</td><td>L</td><td>H</td><td>L</td><td>H</td></tr> <tr> <td>Pin 4</td><td>L</td><td>L</td><td>H</td><td>H</td></tr> <tr> <td>CCD</td><td>270 k</td><td>320 k</td><td>410 k</td><td>470 k</td></tr> </table>	Pin 3	L	H	L	H	Pin 4	L	L	H	H	CCD	270 k	320 k	410 k	470 k
Pin 3	L	H	L	H															
Pin 4	L	L	H	H															
CCD	270 k	320 k	410 k	470 k															
5	LENS SEL	I	—	Selection of output of pin 60 (pin 9 is input H level). H : Auto exposure lens L : Passive exposure lens															
6	ADJIN	I	—	Adjustment selection. H : Camera L : Adjustment															
7	AGC SEL	I	—	Selection of AGC function. H : ON L : OFF															
8	ABLC	I	—	Selection of auto backlight compensation. L : ABLC OFF H : ABLC ON															
9	IRIS	I	—	Exposure mode selection. H : Mechanical exposure L : Electronic exposure															
10	GAMMA	I	—	Selection of gamma correction. H : $\gamma = 1.0$ L : $\gamma = 0.45$															
11	UIN	I	—	The serial data is fed from adjustment tool or PC. Without input data, keep at H level. For details, see " Serial Control Interface " in FUNCTIONAL DESCRIPTION.															
12	UOUT	O	—	Outputs the serial data to adjustment tool or PC. For details, see " Serial Control Interface " in FUNCTIONAL DESCRIPTION.															
13	READY	O		Outputs high level at AE/AWB lock mode.															
14	GND	I	—	A grounding pin.															
15	SOUT	O	—	Outputs the serial data to LR38266.															
16	SCK	O	—	Outputs the clock signal to LR38266.															
17	SLDI	O	—	Outputs the strobe signal to LR38266. LR38266 latches the serial data from pin 15 of LU850425 by both SCK and SLDI.															
18	TIM SEL	I	—	Timing IC selection. When using LR38578, set to H level.															

PIN NO.	SYMBOL	I/O	POLARITY	DESCRIPTION
19	DATA ₀	I	–	Inputs image data from LR38266. DATA ₀ : LSB DATA ₇ : MSB
20	DATA ₁	I	–	
21	DATA ₂	I	–	
22	DATA ₃	I	–	
23	DATA ₄	I	–	
24	DATA ₅	I	–	
25	DATA ₆	I	–	
26	DATA ₇	I	–	
27	ADD ₀	O	–	Outputs address data to LR38266. ADD ₀ : LSB ADD ₆ : MSB
28	ADD ₁	O	–	
29	ADD ₂	O	–	
30	ADD ₃	O	–	
31	ADD ₄	O	–	
32	ADD ₅	O	–	
33	ADD ₆	O	–	
34	NC	O	–	No connection.
35	NC	O	–	No connection.
36	XCK ₂	O	–	Master clock output.
37	XCK ₁	I	–	Master clock input (5.5 MHz, TYP.).
38	GND	–	–	A grounding pin.
39	NC	O	–	No connection.
40	NC	O	–	No connection.
41	NC	O	–	No connection.
42	NC	O	–	No connection.
43	DACK	O	–	Outputs the clock signal to MB88346BV. For details, see " TIMING CHART (D) ".
44	DADT	O	–	Outputs the serial data to MB88346BV. For details, see " TIMING CHART (D) ".
45	DASTB	O	–	Outputs the strobe signal to MB88346BV. For details, see " TIMING CHART (D) ".
46	AGND	–	–	A grounding pin for D/A output circuit.
47	SPD	I	–	Inputs DC level to select shutter speed. For details, see " ELECTRONIC SHUTTER SPEED CONTROL " in Preset Function Control.
48	WB	I	–	Inputs DC level to select white balance mode. For details, see " WHITE BALANCE " in Preset Function Control.
49	IWIND	I	–	Inputs DC level to select exposure window. For details, see " (3) Window Selection of Emphasis Range at Auto Exposure " in ELECTRONIC SHUTTER SPEED CONTROL.
50	GND	I	–	Not used. A grounding pin.
51	GND	I	–	Not used. A grounding pin.
52	GND	I	–	Not used. A grounding pin.
53	R – Y	I	–	Inputs DC level to vary R – Y gain by manual. The detail is shown at " WHITE BALANCE " in Preset Function Control.

PIN NO.	SYMBOL	I/O	POLARITY	DESCRIPTION
54	B – Y	I	–	Inputs DC level to vary B – Y gain by manual. The detail is shown at " WHITE BALANCE " in Preset Function Control.
55	V _R	I	–	Inputs the reference DC voltage for built-in A/D.
56	IRISSEL ₁	I	–	Inputs the preset shutter speed mode 1. (See " ELECTRONIC SHUTTER SPEED CONTROL " in Preset Function Control.)
57	IRISSEL ₂	I	–	Inputs the preset shutter speed mode 2. (See " ELECTRONIC SHUTTER SPEED CONTROL " in Preset Function Control.)
58	IRISSEL ₃	I	–	Inputs the preset shutter speed mode 3. (See " ELECTRONIC SHUTTER SPEED CONTROL " in Preset Function Control.)
59	GND	I	–	A grounding pin.
60	IRIS OUT	O	–	Outputs the analog signal to control auto mechanical exposure lens.
61	V _{REF} OUT	O	–	Outputs the V _{REF} DC to IR3Y38M.
62	DAVR ₀	I	–	Inputs DC reference voltage for built-in D/A output of pin 60.
63	DAVR ₁	I	–	Inputs DC reference voltage for built-in D/A output of pin 61.
64	GND	I	–	Not used. A grounding pin.
65	VD	I	–	Inputs VD signal from LR38266.
66	GND	I	–	A grounding pin.
67	GND	I	–	A grounding pin.
68	GND	I	–	A grounding pin.
69	GND	I	–	A grounding pin.
70	MCO	I		Inputs MCO signal from LR38266.
71	GND	I	–	A grounding pin.
72	EECLK	O	–	Outputs the clock signal to LR38578.
73	EEDATA	O	–	Outputs the data signal to LR38578.
74	EESRB	O	–	Outputs the strobe signal to LR38578. This signal makes LR38578 latch the data of EEDATA (pin 73) by EECLK (pin 72).
75	GND	–	–	A grounding pin.
76	NC	O	–	No connection.
77	SCK	O	–	Outputs the clock signal to CDS/AGC (IR3Y38M).
78	SDATA	O	–	Outputs the serial data to CDS/AGC (IR3Y38M).
79	GND	–	–	A grounding pin.
80	GND	I	–	A grounding pin.
81	GND	I	–	A grounding pin.
82	GND	I	–	A grounding pin.
83	GND	I	–	A grounding pin.
84	GND	I	–	A grounding pin.
85	RESET	I	–	Inputs the reset signal of LU850425.
86	OSCOUT	O	–	No connection.
87	OSCIN	I	–	A grounding pin.
88	GND	–	–	A grounding pin.

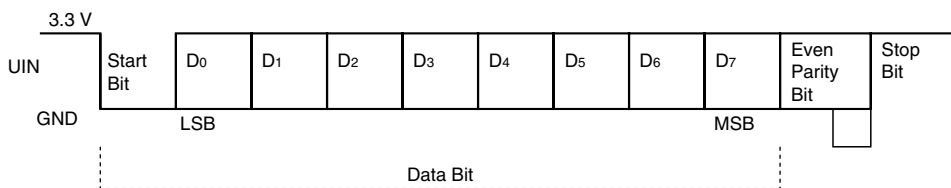
PIN NO.	SYMBOL	I/O	POLARITY	DESCRIPTION
89	VDD	I	—	Supply of +3.3 V power.
90	TEST	—	—	Connected to GND.
91	ROMCLK	O	—	Outputs the clock to EEPROM. For details, see " TIMING CHART (A) ".
92	ROMDATA	I/O	—	Inputs the data from EEPROM/output the data to EEPROM. For details, see " TIMING CHART (A) ".
93	AEAWB LOCK	I	—	AE and AWB lock selection. H : Auto exposure, auto white balance lock ON L : Auto exposure, auto white balance lock OFF
94	NC	O	—	No connection.
95	WBSEL ₁	I	—	White balance mode selection. For details, see " WHITE BALANCE " in Preset Function Control.
96	WBSEL ₂	I	—	White balance mode selection. For details, see " WHITE BALANCE " in Preset Function Control.
97	WBSEL ₃	I	—	White balance mode selection. For details, see " WHITE BALANCE " in Preset Function Control.
98	MIR SEL	I	—	Mirror mode selection. L : Normal mode H : Mirror mode
99	APT	I	—	Selection of aperture enhancement. H : ON L : OFF
100	GND	I	—	A grounding pin.

FUNCTIONAL DESCRIPTION

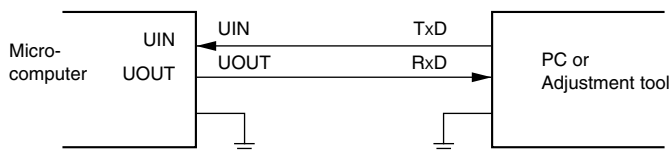
Serial Control Interface (For adjustment tool)

FORMAT OF DATA TRANSFERS

- Format of transfers : Asynchronous (Based on RS-232C standard)
- Bit rate : 9 600 bps
- Data length : 8 bits
- Parity check : 1 even parity bit
- Start bit : 1 bit
- Stop bit : 1 bit
- Signal voltage level (CMOS)



- Connection



ADJUSTMENT MODE

When the signal level of pin 6 (ADJIN) is low, the video quality adjustment by a PC or an adjustment tool is possible.

When the signal level of pin 6 (ADJIN) is high, the microcomputer control is by a PC.

Preset Function Control

(by high/low condition at inputs and by DC level of A/D inputs)

Below functions are available to be selected under the condition of a low level of pin 6 (ADJIN).

WHITE BALANCE

(1) White Balance Mode Selection by Pins 95, 96 and 97 (Digital Input)

White balance mode is selected by the combination of high/low level at three pins below.

WBSEL ₁ 95 PIN	WBSEL ₂ 96 PIN	WBSEL ₃ 97 PIN	WHITE BALANCE MODE	NOTE
L	L	L	A/D input (pin 48) control is available. See "(2) White Balance Mode Selection by Pin 48 (Analog Input)".	
H	L	L	A/D input (pin 53 and 54) control is available.	
L	H	L	Set the condition just before selecting this mode.	
H	H	L	Auto white balance mode.	
L	L	H	Preset mode 1	1
H	L	H	Preset mode 2	1
L	H	H	Preset mode 3	1
H	H	H	Preset mode 4	1

(2) White Balance Mode Selection by Pin 48 (Analog Input)

White balance mode can be selected by DC input level at pin 48 if all the above 95, 96, and 97 pins are connected to low.

VOLTAGE LEVEL (PIN 48)	WHITE BALANCE MODE	NOTE
0 to 0.47 V	Auto white balance.	
0.48 to 0.94 V	Set the condition just before feed this DC level.	
0.95 to 1.41 V	Analog input (pins 53 and 54) control is available.	
1.42 to 1.88 V	Preset mode 1	1
1.89 to 2.35 V	Preset mode 2	1
2.36 to 2.82 V	Preset mode 3	1
2.83 to 3.3 V	Preset mode 4	1

NOTE :

1. All of above preset modes are optional and each mode should be adjusted by a PC or an adjustment tool.

ELECTRONIC SHUTTER SPEED CONTROL

(1) Electronic Shutter Speed Selection by Pins 56, 57 and 58 (Digital Input)

An electronic shutter speed can be selected by the combination of high/low level at three pins below under the condition of a high level of pin 9 (IRIS).

IRISSEL ₁ (PIN 56)	IRISSEL ₂ (PIN 57)	IRISSEL ₃ (PIN 58)	SHUTTER SPEED	NOTE
L	L	L	A/D input (pin 47) control is available. See "(2) Electronic Shutter Speed Selection by Pin 47 (A/D Input)".	
H	L	L	1/60 s (NTSC), 1/50 s (PAL)	
L	H	L	1/100 s (NTSC), 1/60 s (PAL) (flicker-less mode)	
H	H	L	Preset mode 1	1
L	L	H	Preset mode 2	1
H	L	H	Preset mode 3	1
L	H	H	Preset mode 4	1
H	H	H	Preset mode 5	1

(2) Electronic Shutter Speed Selection by Pin 47 (A/D Input)

An electronic shutter speed can be selected by DC input level of pin 47 if all the above 56, 57 and 58 pins are connected to low.

VOLTAGE LEVEL (PIN 47)	SHUTTER SPEED	NOTE
0 to 0.41 V	1/60 s (NTSC), 1/50 s (PAL)	
0.42 to 0.82 V	1/100 s (NTSC), 1/60 s (PAL)	
0.83 to 1.23 V	Preset mode 1	1
1.24 to 1.64 V	Preset mode 2	1
1.65 to 2.05 V	Preset mode 3	1
2.06 to 2.45 V	Preset mode 4	1
2.46 to 2.87 V	Preset mode 5	1
2.88 to 3.3 V	Preset mode 6	1

NOTE :

1. All of above preset modes are optional and each mode should be adjusted by a PC or an adjustment tool.

(3) Window Selection of Emphasis Range at Auto Exposure

INPUT VOLTAGE (PIN 49)	RANGE SELECTION	
0 to 0.8 V	Preset 1	See "Fig. 1".
0.81 to 1.6 V	Preset 2	See "Fig. 1".
1.61 to 2.4 V	Preset 3	See "Fig. 1".
2.41 to 3.3 V	Whole range	

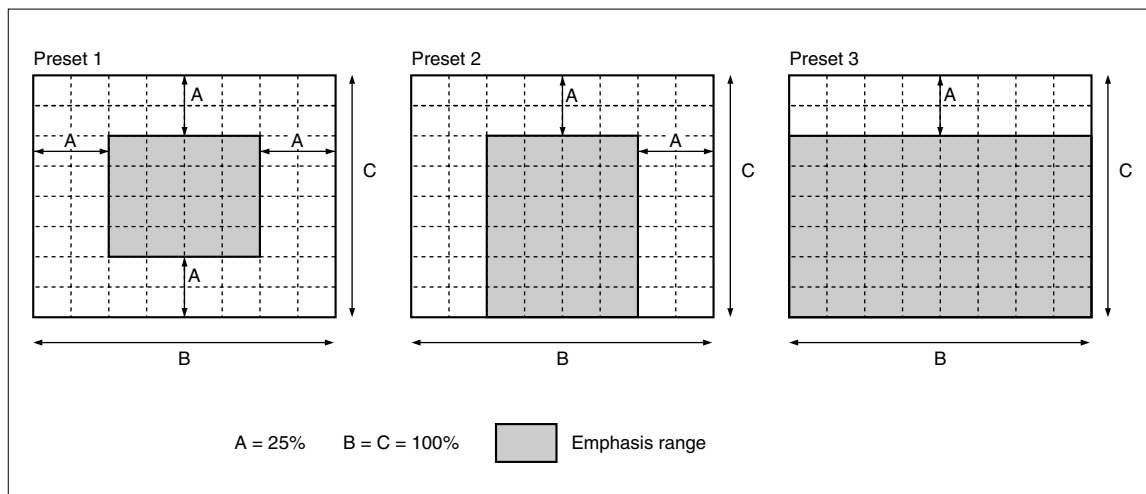


Fig. 1 Emphasis Range

Auto Exposure Control

- Auto exposure control has the following three functions :

- ① E/E (Electronic Exposure) function
- ② Mechanical exposure function
- ③ AGC (Automatic Gain Control) function

Carrier Balance Control

- Carrier balance control has the following two functions.

- ① At power on, carrier balance is automatically tuned.
- ② Carrier balance is automatically tuned against AGC operation.

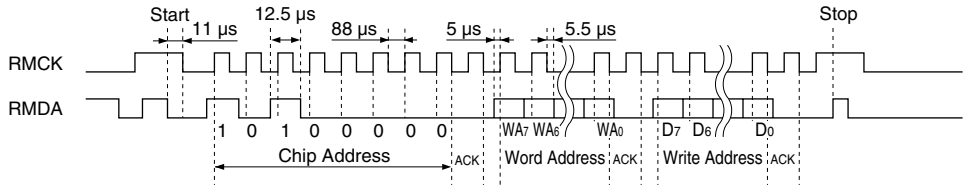
Auto White Balance Control

- Control method : A white color temperature control is sampled by an I/Q conversion signal.
- By the reasoning of the video condition from I/Q, brightness, and other signal levels, white balance is controlled to keep the best condition.

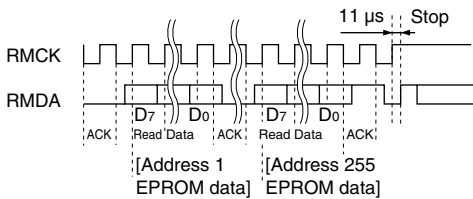
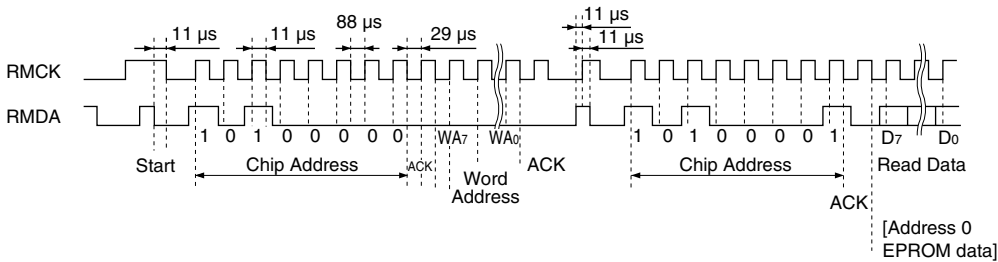
TIMING CHART

(A) LU850425 (μCOM) ↔ BF24C04F (EEPROM)

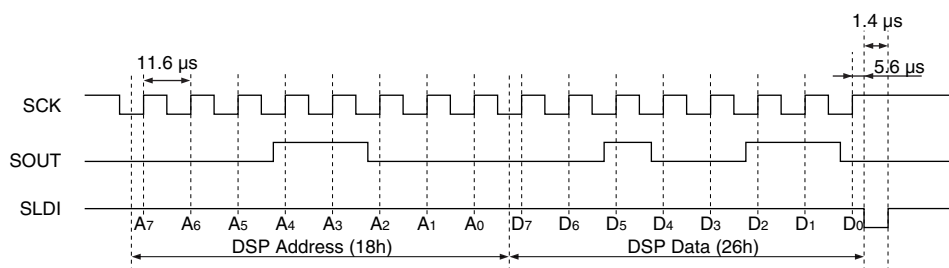
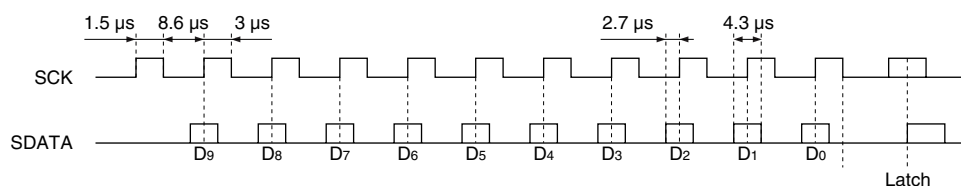
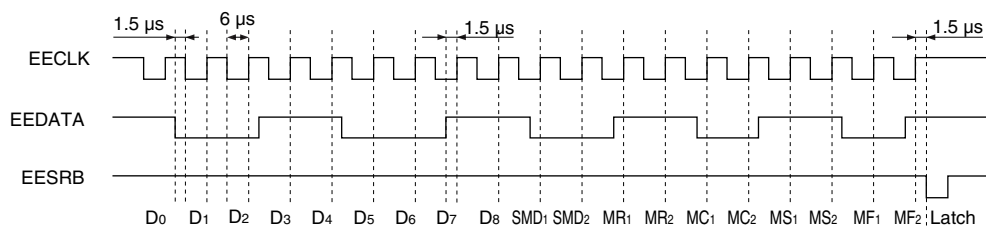
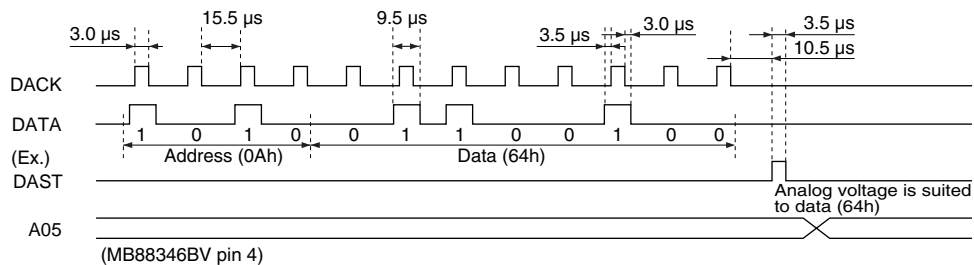
1. Write Mode (Writing data that is sent from the adjustment tool to the EEPROM.)



2. Read Mode



EEPROM MARK	MINIMUM (μs)
t _{HIGH}	11
t _{LOW}	88
t _{HD} : STA	11
t _{SU} : STA	11
t _{SU} : STO	11

(B) LU850425 (μ COM) \longleftrightarrow LR38266 (DSP)**(C) LU850425 (μ COM) \longleftrightarrow IR3Y38M (CDS/AGC)****(D) LU850425 (μ COM) \longleftrightarrow LR38578 (TIMING GENERATOR IC)****(E) LU850425 (μ COM) \longleftrightarrow MB88346BV (D/A)**

ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATING	UNIT	NOTE
Power supply voltage		V _{DD}	−0.3 to +6.5	V	
Input voltage		V _I	−0.3 to V _{DD} + 0.3	V	
Output voltage		V _O	−0.3 to V _{DD} + 0.3	V	
Output "Low" current		I _{OL1}	+30	mA	1
		I _{OL2}	+4	mA	2
Output "High" current		I _{OH}	−4	mA	3
Total output current	LOW level	ΣI _{OL1}	+100	mA	1
		ΣI _{OL2}	+20	mA	2
Total output current	HIGH level	ΣI _{OH}	−20	mA	3
Operating temperature		T _{OPR}	−10 to +50	°C	
Storage temperature		T _{STG}	−50 to +150	°C	

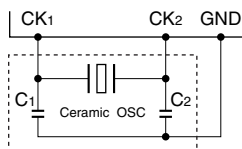
NOTES :

1. Applied to outputs. (Pins 27 to 34 and 39 to 45 without input pin.)
2. Applied to outputs. (Except pins 27 to 34 and 39 to 45 without input pin.)
3. Applied to all outputs.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Power supply voltage	V _{DD}	2.7	3.3	3.6	V
System clock frequency	f _{CK}	5.25	5.5	5.75	MHz

OSCILLATION CIRCUIT (EXAMPLE)*



Oscillation frequency resistor is contained within the IC. (Recommendation)
 Ceramic oscillator = PBRC5.50B
 (KYOTO CERAMIC CO. LTD.)
 (PBRC5.50B is contained C1, C2.)

* Don't put any signal line cross the oscillation circuit line.

ELECTRICAL CHARACTERISTICS

DC Characteristics

(V_{DD} = 2.7 to 3.3 V, T_{OPR} = -20 to +70 °C)

PARAMETER		SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	NOTE
Input voltage		V _{IL1}		0		0.2V _{DD}	V	1
		V _{IH1}		0.8V _{DD}		V _{DD}	V	
		V _{IL2}		0		0.3	V	2
		V _{IH2}		V _{DD} - 0.3		V _{DD}	V	
Input current		I _{IL1}	V _{IH} = 0 V, V _{DD} = 3 V			-10	μA	3
		I _{IH1}	V _{IN} = V _{DD} , V _{DD} = 3 V			10	μA	
		I _{IL2}	V _{IN} = 0 V, V _{DD} = 3 V	-10	-25	-50	μA	4
Output voltage		V _{OL1}	I _{OL} = 6 mA, V _{DD} = 3 V			1	V	5
		V _{OH1}	I _{OH} = -0.6 mA, V _{DD} = 3 V	V _{DD} - 0.5			V	
		V _{OL2}	I _{OL} = 0.6 mA, V _{DD} = 3 V			0.5	V	6
		V _{OH2}	I _{OH} = -0.6 mA, V _{DD} = 3 V	V _{DD} - 0.5			V	
A/D	Resolution		V _R = V _{DD} = 3 V, f _M = 5.5 MHz		10		bits	
	Differential linear tolerance		V _R = V _{DD} = 3 V, f _M = 5.5 MHz		±1	±2.5	LSB	
	Linear tolerance		V _R = V _{DD} = 3 V, f _M = 5.5 MHz		±3	±5	LSB	
	Combined tolerance		V _R = V _{DD} = 3 V, f _M = 5.5 MHz		±4	±6	LSB	
D/A	Resolution		V _R = V _{DD} = 3 V		8		bits	7
	Output resistance					6	kΩ	
	Combined tolerance				±0.03	±0.06	V	
Power consumption		I _{DD}	f _{SYST} = 2.25 MHz		4	8	mA	8
		I _{DDH}	f _{SYST} = 2.25 MHz, HALT mode		1	2	mA	
		I _{DDs1}	f _{SUB} oscillation, STOP mode		20	40	μA	9
		I _{DDs2}	f _{SUB} stop, STOP mode		1	6	μA	10

NOTES :

- Applicable pins : 95 to 100, 1, 81 to 84, 91 to 94, 64 to 66, 47 to 54, 19 to 26, 12, 13, 15, 17, 18, 72 to 75, 77 to 80 without output pin.
- Applicable pins : RESET, 3 to 10, 67 to 71, 11, 14, 16, XCK₁ without output pin.
- Applicable pins : 3 to 10, 95 to 100, 1, 81 to 84, 91 to 94, 64 to 71, 47 to 54, 19 to 26, 11 to 18, 72 to 75, 56 to 59 without output pin.
- Applicable pin : RESET
- Applicable pins : 27 to 34, 35, 39 to 45 without input pin.
- Applicable pins : 95 to 100, 1, 81 to 84, 91 to 94, 64 to 71, 19 to 26, 11 to 15, 72 to 75, 77 to 80, 56 to 59 without input pin.
- Applicable pins : 60, 61
- No load condition, V_{DD} = 3 V, main-clock frequency = 5.5 MHz
- No load condition, V_{DD} = 3 V, f_{SUB} oscillation status (32.768 kHz), V_R = GND, input signal fixed.
- No load condition, V_{DD} = 3 V, OSC_{IN} = GND, V_R = GND, input signal fixed.

PACKAGE

(Unit : mm)

100 LQFP (LQFP100-P-1414)

