Rohm Semiconductor - ML610Q432A-NNNTC03A7 Datasheet

Welcome to E-XFL.COM

What is "Embedded - Microcontrollers"?

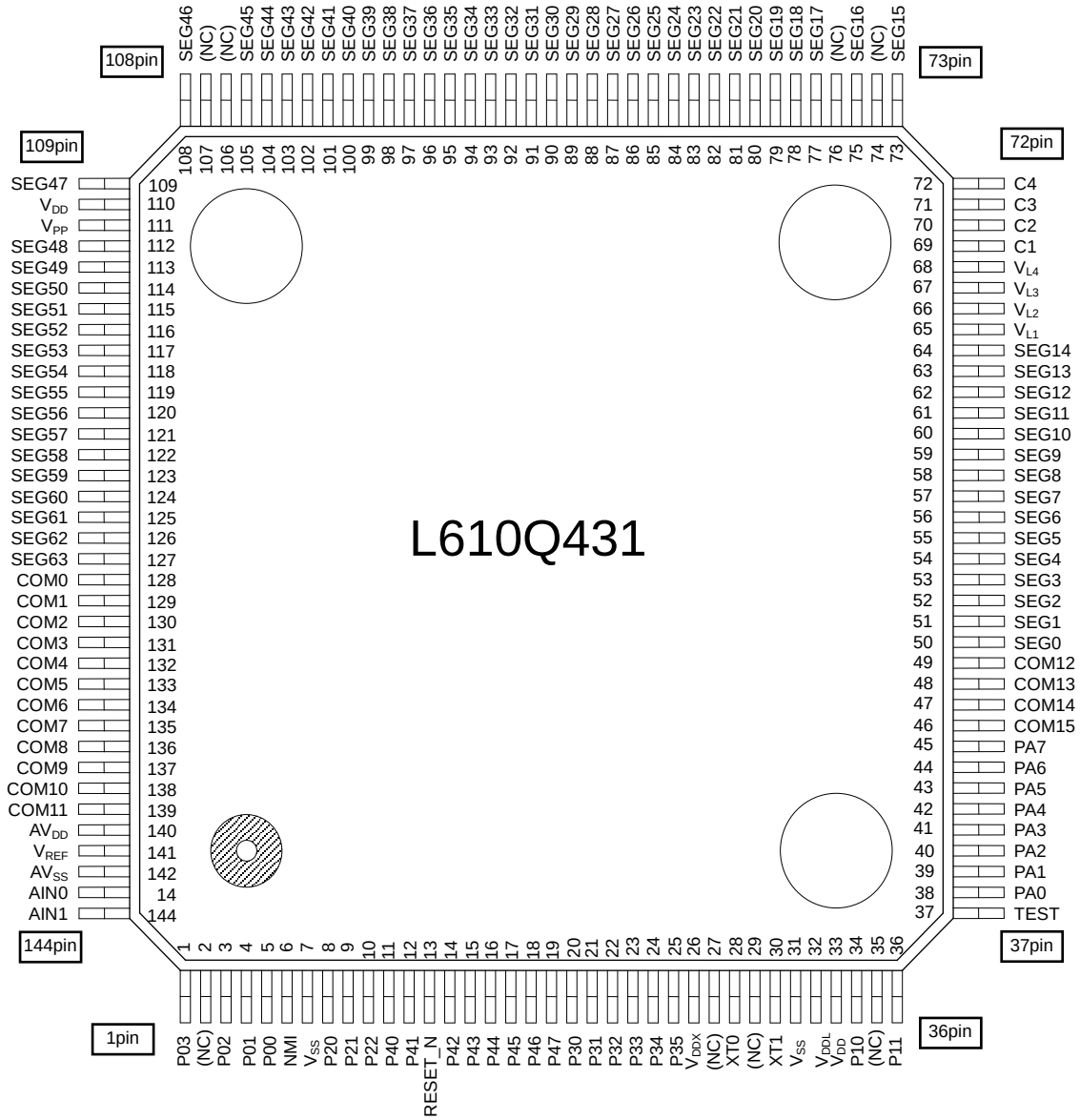
"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Obsolete
Core Processor	nX-U8/100
Core Size	8-Bit
Speed	4.2MHz
Connectivity	I²C, SSP, UART/USART
Peripherals	LCD, Melody Driver, POR, PWM, WDT
Number of I/O	14
Program Memory Size	64KB (32K x 16)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	3K x 8
Voltage - Supply (Vcc/Vdd)	1.1V ~ 3.6V
Data Converters	A/D 2x12b, 2x24b
Oscillator Type	Internal
Operating Temperature	-20°C ~ 70°C (TA)
Mounting Type	Surface Mount
Package / Case	144-LQFP
Supplier Device Package	144-LQFP (20x20)
Purchase URL	https://www.e-xfl.com/product-detail/rohm-semi/ml610q432a-nnntc03a7

PIN CONFIGURATION

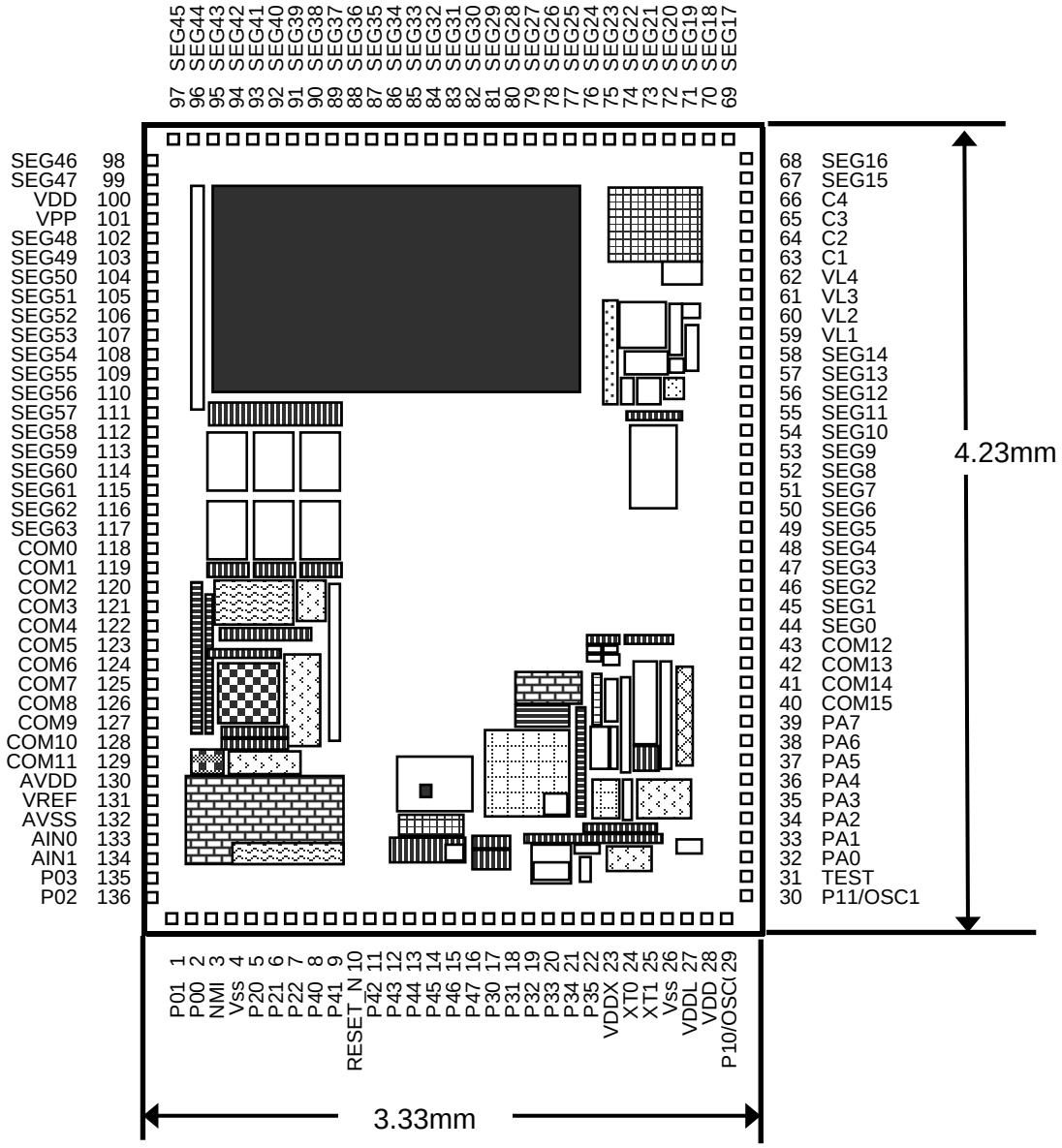
ML610Q431 LQFP144 Pin Layout



(NC): No Connection

Figure 3 ML610Q431 LQFP144 Pin Configuration

ML610Q431 Chip Pin Layout & Dimension



Chip size	3.33 mm × 4.23 mm
PAD count	136 pins
Minimum PAD pitch:	100 µm
PAD aperture:	80 µm × 80 µm
Chip thickness	350 µm
Voltage of the rear side of chip:	V_{SS} level

Figure 5 ML610Q431 Chip Layout & Dimension

ML610Q432 Pad Coordinates

Table 2 ML610Q432 Pad Coordinates

Chip Center: X=0,Y=0

PAD No.	Pad Name	X (m)	Y (m)	PAD No.	Pad Name	X (m)	Y (m)	PAD No.	Pad Name	X (m)	Y (m)
1	P01	-1400	-1978	51	SEG7	1528	200	101	V_{PP}	-1528	1600
2			-1978	52	SE	1528	300	102	SEG48	-1528	1500
3	NMI	-12	8	53	SE	1528	400	103	SEG49	-1528	1400
4	V_{SS}	-1100	8	54	SE	1528	500	104	SEG50	-1528	1300
5	P20	-10	978	55		1528	600	105	SEG51	-1528	1200
6	P21			56	SEG12	1528	700	106	SEG52	-1528	1100
7	P22	-800	-1978	57	SEG13	1528	800	107	SEG53	-1528	1000
8	P40	-700	-1978			1528	900	108	SEG54	-1528	900
9		600	8	59	V_L	1528	1000	109	SEG55	-1528	800
10	RESET_N		-1978	60	V_{L2}	1528	1100	110	SEG56	-1528	700
11	P42		-1978	61		1528	1200	111	SEG57	-1528	600
12	P43	-300	-1978	6	V_{L4}	1528	1300	112	SEG58	-1528	500
13	P44	-200	-1978	63	C1	1528	1400	113	SEG59	-1528	400
14	P45	-100	-1978	64	C2	1528	1500	114	SEG60	-1528	300
15	P46			65		1528	1600	115	SEG61	-1528	200
16	P47		-1978	66	C	1528	1700	116	SEG62	-1528	100
17	P30	0	-1978	67	SE	1528	1800	117	SEG63	-1528	0
18	P31	0	-1978	68	SE	1528	1900	118	COM0	-1528	-100
19	P32	0	-1978	69		1400	1978	119	COM1	-1528	-200
20				70	SEG18	1300	1978	120	COM2	-1528	-300
21	P34	600	-1978	71	SEG19	1200	1978	121	COM3	-1528	-400
22	P35										

PIN DESCRIPTION

Pin name	I/O	Description	Primary/ Secondary/ Tertiary	Logic
System				
RESET_N	I	Reset input pin. When this pin is set to a “L” level, system reset mode is set and the internal section is initialized. When this pin is set to a “H” level subsequently, program execution starts. A pull-up resistor is internally connected.	—	Negative
XT0	I	Crystal connection pin for low-speed clock.	—	—
XT1	O	A 32.768 kHz crystal oscillator (see measuring circuit 1) is connected to this pin. Capacitors CDL and CGL are connected across this pin and V_{SS} as required.	—	—
OSC0	I	Crystal/ceramic connection pin for high-speed clock.	Secondary	—
OSC1	O	A crystal or ceramic is connected to this pin (4.1 MHz max.). Capacitors CDH and CGH (see measuring circuit 1) are connected across this pin and V_{SS}. This pin is used as the secondary function of the P10 pin(OSC0) and P11 pin(OSC1).	Secondary	—
LSCLK	O	Low-speed clock output pin. This pin is used as the secondary function of the P20 pin.	Secondary	—
OUTCLK	O	High-speed clock output pin. This pin is used as the secondary function of the P21 pin.	Secondary	—
General-purpose input port				
P00-P03	I	General-purpose input port. Since these pins have secondary functions, the pins cannot be used as a port when the secondary functions are used.	Primary	Positive
P10-P11	I	General-purpose input port. Since these pins have secondary functions, the pins cannot be used as a port when the secondary functions are used.	Primary	Positive
General-purpose output port				
P20-P22	O	General-purpose output port. Since these pins have secondary functions, the pins cannot be used as a port when the secondary functions are used.	Primary	Positive
General-purpose input/output port				
P30-P35	I/O	General-purpose input/output port. Since these pins have secondary functions, the pins cannot be used as a port when the secondary functions are used.	Primary	Positive
P40-P47	I/O	General-purpose input/output port. Since these pins have secondary functions, the pins cannot be used as a port when the secondary functions are used.	Primary	Positive
PA0-PA7	I/O	General-purpose input/output port. These pins are for the ML610Q431, but are not provided in the ML610Q432.	Primary	Positive

Pin name	I/O	Description	Primary/ Secondary/ Tertiary	Logic
RC oscillation type A/D converter				
IN0	I	Channel 0 oscillation input pin. This pin is used as the secondary function of the P30 pin.	Secondary	—
CS0	O	Channel 0 reference capacitor connection pin. This pin is used as the secondary function of the P31 pin.	Secondary	—
RS0	O	This pin is used as the secondary function of the P32 pin which is the reference resistor connection pin of Channel 0.	Secondary	—
RT0	O	Resistor sensor connection pin of Channel 0 for measurement. This pin is used as the secondary function of the P33 pin.	Secondary	—
R T0	O	Resistor/capacitor sensor connection pin of Channel 0 for measurement. This pin is used as the secondary function of the P34 pin.	Secondary	—
RCM	O	RC oscillation monitor pin. This pin is used as the secondary function of the P35 pin.	Secondary	—
IN1	I	Oscillation input pin of Channel 1. This pin is used as the secondary function of the P44 pin.	Secondary	—
CS1	O	Reference capacitor connection pin of Channel 1. This pin is used as the secondary function of the P45 pin.	Secondary	—
RS1	O	Reference resistor connection pin of Channel 1. This pin is used as the secondary function of the P46 pin.	Secondary	—
RT1	O	Resistor sensor connection pin for measurement of Channel 1. This pin is used as the secondary function of the P47 pin.	Secondary	—
Successive approximation type A/D converter				
AV_{SS}	—	Negative power supply pin for successive approximation type A/D converter.	—	—
AV_{DD}	—	Positive power supply pin for successive approximation type A/D converter.	—	—
V_{REF}	—	Reference power supply pin for successive approximation type A/D converter.	—	—
AIN0	I	Channel 0 analog input for successive approximation type A/D converter.	—	—
AIN1	I	Channel 1 analog input for successive approximation type A/D converter.	—	—
LCD drive signal				
COM0-15	O	Common output pins.	—	—
COM16-23	O	Common output pins. These pins are for the ML610Q432, but are not provided in the ML610Q431.	—	—
SEG0-63	O	Segment output pin.	—	—
LCD driver power supply				
V_{L1}	—	Power supply pins for LCD bias (internally generated). Capacitors Ca, Cb, Cc, and Cd (see measuring circuit 1) are connected between V_{SS} and V_{L1}, V_{L2}, V_{L3}, and V_{L4}, respectively.	—	—
V_{L2}	—		—	—
V_{L3}	—		—	—
V_{L4}	—		—	—
C1	—	Power supply pins for LCD bias (internally generated). Capacitors C12 and C34 (see measuring circuit 1) are connected between C1 and C2 and between C3 and C4, respectively.	—	—
C2	—		—	—
C3	—		—	—
C4	—		—	—
For testing				
TEST	I/O	Input/output pin for testing. A pull-down resistor is internally connected.	—	—
Power supply				
V_{SS}	—	Negative power supply pin.	—	—
V_{DD}	—	Positive power supply pin.	—	—
V_{DDL}	—	Positive power supply pin (internally generated) for internal logic. Capacitors CL0 and CL1 (see measuring circuit 1) are connected between this pin and V_{SS}.	—	—
V_{DDX}	—	Plus-side power supply pin (internally generated) for low-speed oscillation. Capacitor Cx (see measuring circuit 1) is connected between this pin and V_{SS}.	—	—
V_{PP}	—	Power supply pin for programming Flash ROM. A pull-up resistor is internally connected.	—	—

TERMINATION OF UNUSED PINS

Table 3 Termination of Unused Pins

Pin	Recommended pin termination
V_{PP}	Open
AV_{DD}	V_{SS}
AV_{SS}	V_{SS}
V_{REF}	V_{SS}
AIN0, AIN1	Open
V_{L1}, V_{L2}, V_{L3}, V_{L4}	Open
C1, C2, C3, C4	Open
RESET_N	Open
TEST	Open
NMI	Open
P00 to P03	V_{DD} or V_{SS}
P10 to P11	V_{DD}
P20 to P22	Open
P30 to P35	Open
P40 to P47	Open
PA0 to PA7	Open
COM0 to 23	Open
SEG0 to 63	Open

CLOCK GENERATION CIRCUIT OPERATING CONDITIONS

(V_{SS} = 0V)

Parameter	Symbol	Condition	Rating			Unit
			Min.	Typ.	Max.	
Low-speed crystal oscillation frequency	f_{XTL}	—	—	32.768k	—	Hz
Recommended equivalent series resistance value of low-speed crystal oscillation	R_L	—	—	—	40k	Ω
Low-speed crystal oscillation external capacitor *1	C_{DL}/C_{GL}	C_L=6pF of crystal oscillation *2	—	0	—	pF
		C_L=9pF of crystal oscillation	—	6	—	
		C_L=12pF of crystal oscillation	—	12	—	
High-speed crystal/ceramic oscillation frequency	f_{XTH}	—	—	4.0M / 4.096M	—	Hz
High-speed crystal oscillation external capacitor	C_{DH}	—	—	24	—	pF
	C_{GH}	—	—	24	—	

*1: The external C_{DL} and C_{GL} need to be adjusted in consideration of variation of internal loading capacitance C_D and C_G, and other additional capacitance such as PCB layout.

*2: When using a crystal oscillator C_L = 6pF, there is a possibility that can not be adjusted by external C_{DL} and C_{GL}.

OPERATING CONDITIONS OF FLASH ROM

(V_{SS} = AV_{SS} = 0V)

Parameter	Symbol	Condition	Range	Unit
Operating temperature	T_{OP}	At write/erase	0 to +40	°C
Operating voltage	V_{DD}	At write/erase*1	2.75 to 3.6	V
	V_{DDL}	At write/erase*1	2.5 to 2.75	
	V_{PP}	At write/erase*1	7.7 to 8.3	
Write cycles	C_{EP}	—	80	cycles
Data retention	Y_{DR}	—	10	years

*1:When writing to and erasing on the flash Memory, the voltage in the specified range needs to be supplied to the V_{DDL} pin.

DC CHARACTERISTICS (2/5)

(V_{DD} = 1.1 to 3.6V, AV_{DD} = 2.2 to 3.6V, V_{SS} = AV_{SS} = 0V, Ta = –20 to +70°C, unless otherwise specified) (2/5)

Parameter	Symbol	Condition		Rating Min.	Rating Typ.	Rating Max.	Unit	Measuring circuit
V_{L1} voltage	V_{L1}	V_{DD} = 3.0V, Tj = 25°C	CN4–0 = 00H	0.89	0.94	0.99	V	1
			CN4–0 = 01H	0.91	0.96	1.01		
			CN4–0 = 02H	0.93	0.98	1.03		
			CN4–0 = 03H	0.95	1.00	1.05		
			CN4–0 = 04H	0.97	1.02	1.07		
			CN4–0 = 05H	0.99	1.04	1.09		
			CN4–0 = 06H	1.01	1.06	1.11		
			CN4–0 = 07H	1.03	1.08	1.13		
			CN4–0 = 08H	1.05	1.10	1.15		
			CN4–0 = 09H	1.07	1.12	1.17		
			CN4–0 = 0AH	1.09	1.14	1.19		
			CN4–0 = 0BH	1.11	1.16	1.21		
			CN4–0 = 0CH	1.13	1.18	1.23		
			CN4–0 = 0DH	1.15	1.20	1.25		
			CN4–0 = 0EH	1.17	1.22	1.27		
			CN4–0 = 0FH	1.19	1.24	1.29		
			CN4–0 = 10H	1.21	1.26	1.31		
			CN4–0 = 11H	1.23	1.28	1.33		
			CN4–0 = 12H	1.25	1.30	1.35		
			CN4–0 = 13H	1.27	1.32	1.37		
			CN4–0 = 14H *1	1.29	1.34	1.39		
			CN4–0 = 15H *1	1.31	1.36	1.41		
			CN4–0 = 16H *1	1.33	1.38	1.43		
			CN4–0 = 17H *1	1.35	1.40	1.45		
			CN4–0 = 18H *1	1.37	1.42	1.47		
			CN4–0 = 19H *1	1.39	1.44	1.49		
			CN4–0 = 1AH *1	1.41	1.46	1.51		
			CN4–0 = 1BH *1	1.43	1.48	1.53		
			CN4–0 = 1CH *1	1.45	1.50	1.55		
			CN4–0 = 1DH *1	1.47	1.52	1.57		
			CN4–0 = 1EH *1	1.49	1.54	1.59		
			CN4–0 = 1FH *1	1.51	1.56	1.61		
V_{L1} temperature deviation	ΔV_{L1}	V_{DD} = 3.0V		—	–1.5	—	mV/°C	
V_{L1} voltage dependency	ΔV_{L1}	V_{DD} = 1.3 to 3.6V		—	5	20	mV/V	
V_{L2} voltage	V_{L2}	V_{DD} = 3.0V, Tj = 25°C 300kΩ load (V_{L4}–V_{SS})		Typ. –10%	V_{L1}×2	Typ. +4%	V	
V_{L3} voltage	V_{L3}	V_{DD} = 3.0V, Tj = 25°C 300kΩ load (V_{L4}–V_{SS})	1/3 bias	Typ. –10%	V_{L1}×2	Typ. +4%		
			1/4 bias		V_{L1}×3			
V_{L4} voltage	V_{L4}		1/3 bias	Typ. –10%	V_{L1}×3	Typ. +5%		
			1/4 bias		V_{L1}×4			
LCD bias voltage generation time	T_{BIAS}	—		—	—	600	ms	

*1: When using 1/4 bias, the V_{L1} voltage is set to typ. 1.32 V (same voltage as in CN4–0 = 13H).

DC CHARACTERISTICS (3/5)

(V_{DD} = 1.1 to 3.6V, AV_{DD} = 2.2 to 3.6V, V_{SS} = AV_{SS} = 0V, Ta = –20 to +70°C, unless otherwise specified) (3/5)

Parameter	Symbol	Condition		Rating Min.	Rating Typ.	Rating Max.	Unit	Measuring circuit
BLD threshold voltage	V_{BLD}	V_{DD} = 1.35 to 3.6V	LD2–0 = 0H	Typ. –2%	1.35	Typ. +2%	V	
			LD2–0 = 1H		1.4			
			LD2–0 = 2H		1.45			
			LD2–0 = 3H		1.5			
			LD2–0 = 4H		1.6			
			LD2–0 = 5H		1.7			
			LD2–0 = 6H		1.8			
			LD2–0 = 7H		1.9			
			LD2–0 = 8H		2.0			
			LD2–0 = 9H		2.1			
			LD2–0 = 0AH		2.2			
			LD2–0 = 0BH		2.3			
			LD2–0 = 0CH		2.4			
			LD2–0 = 0DH		2.5			
			LD2–0 = 0EH		2.7			
			LD2–0 = 0FH		2.9			
BLD threshold voltage temperature deviation	ΔV_{BLD}	V_{DD} = 1.35 to 3.6V		—	0.1	—	%/°C	
Supply current 1	IDD1	CPU: In STOP state. Low-speed/high-speed oscillation: stopped.	Ta = 25°C	—	0.15	0.50	µA	1
			Ta = -20 to +70°C	—	—	2.50		
Supply current 2	IDD2	CPU: In HALT state (LTBC, RTC: Operating*3*5). High-speed oscillation: Stopped. LCD/BIAS circuits: Stopped.	Ta = 25°C	—	0.5	1.3	µA	
			Ta = -20 to +70°C	—	—	3.5		
Supply current 3	IDD3	CPU: In 32.768kHz operating state.*1*3 High-speed oscillation: Stopped. LCD/BIAS circuits: Operating.*2	Ta = 25°C	—	5	7	µA	
			Ta = -20 to +70°C	—	—	12		
Supply current 4	IDD4	CPU: In 500kHz CR operating state. LCD/BIAS circuits: Operating.*2	Ta = 25°C	—	70	85	µA	
			Ta = -20 to +70°C	—	—	100		
Supply current 5	IDD5	CPU: In 4.096MHz operating state.*2*3 PLL: In oscillating state. LCD/BIAS circuits: Operating. *2 V_{DD} = 1.8 to 3.6V	Ta = 25°C	—	0.8	1.0	mA	
			Ta = -20 to +70°C	—	—	1.2		
Supply current 6	IDD6	CPU: In 4.096MHz operating state.*2 PLL: In oscillating state. *3*4 A/D: In operating state. LCD/BIAS circuits: Operating. *2 V_{DD} = AV_{DD} = 3.0V	Ta = 25°C	—	1.5	1.6	mA	
			Ta = -20 to +70°C	—	—	2.5		

*1: CPU operating rate is 100% (No HALT state).

*2: All SEGs: off waveform, No LCD panel load, 1/3 bias, 1/3 duty, Frame frequency: Approx. 64 Hz, Bias voltage multiplying clock: 1/128 LSCLK (256Hz)

*3 : Use 32.768KHz Crystal Oscillator C-001R (Epson Toyocom) with capacitance C_{GL}/C_{DL}=0pF.

*4 : Use 4.096MHz Crystal Oscillator HC49SFWB (Kyocera).

*5 : Significant bits of BLKCON0~BLKCON4 registers are all “1”.

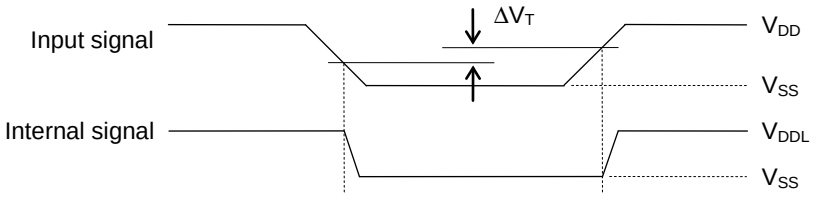
DC CHARACTERIST ICS (5/5)

(V_{DD} = 1.1 to 3.6V, AV_{DD} = 2.2 to 3.6V, V_{SS} = AV_{SS} = 0V, Ta = –20 to +70°C, unless otherwise specified) (5/5)

Parameter	Symbol	Condition	Rating			Unit	Measuring circuit
			Min.	Typ.	Max.		
Input voltage 1 (RESET_N) (TEST) (NMI) (P00–P03) (P10–P11) (P31–P35) (P40–P43) (P45–P47) (PA0–PA7)*1	VIH1	V_{DD} = 1.3 to 3.6V	0.7 ×V_{DD}	—	V_{DD}	V	5
		V_{DD} = 1.1 to 3.6V	0.7 ×V_{DD}	—	V_{DD}		
	VIL1	V_{DD} = 1.3 to 3.6V	0	—	0.3 ×V_{DD}		
		V_{DD} = 1.1 to 3.6V	0	—	0.2 ×V_{DD}		
Hysteresis width (RESET_N) (TEST_N) (NMI) (P00–P03) (P10–P11) (P31–P35) (P40–P43) (P45–P47) (PA0–PA7)*1	ΔVT	V_{DD} = 2.0 to 3.6V	0.05 ×V_{DD}	0.18 ×V_{DD}	0.4 ×V_{DD}		
		V_{DD} = 1.1 to 3.6V	0.02 ×V_{DD}	0.18 ×V_{DD}	0.4 ×V_{DD}		
Input voltage 2 (P30, P44)	VIH2	—	0.7 ×V_{DD}	—	V_{DD}		
	VIL2	—	0	—	0.3 ×V_{DD}		
Input pin capacitance (NMI) (P00–P03) (P10–P11) (P30–P35) (P40–P47) (PA0–PA7)*1	CIN	f = 10kHz V_{rms} = 50mV Ta = 25°C	—	—	5	pF	—

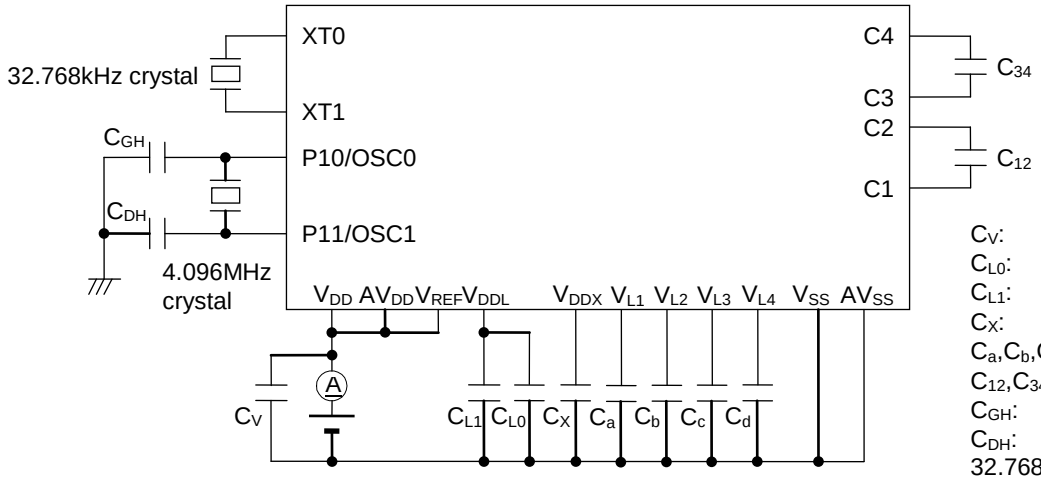
*1: ML610Q431 only

HYSTERESIS WIDTH



MEASURING CIRCUITS

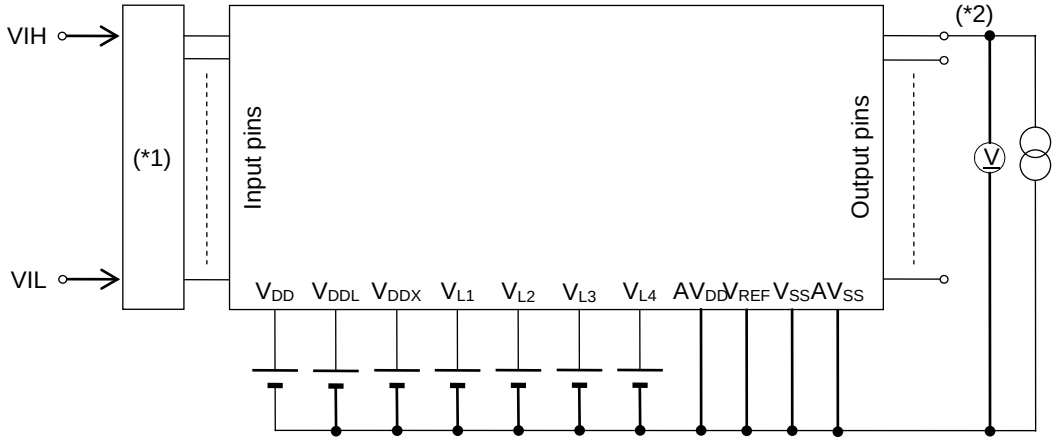
MEASURING CIRCUIT 1



C_V:	1µF
C_{L0}:	1µF
C_{L1}:	0.1µF
C_X:	0.1µF
C_a,C_b,C_c,C_d:	1µF
C_{12},C_{34}:	1µF
C_{GH}:	24pF
C_{DH}:	24pF

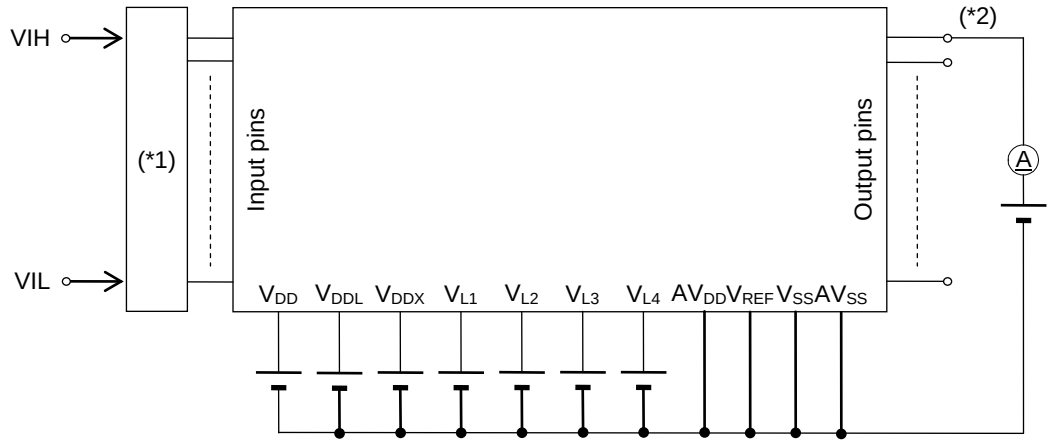
32.768kHz crystal:
C-001R (Epson Toyocom)
4.096MHz crystal:
HC49SFWB (Kyocera)

MEASURING CIRCUIT 2



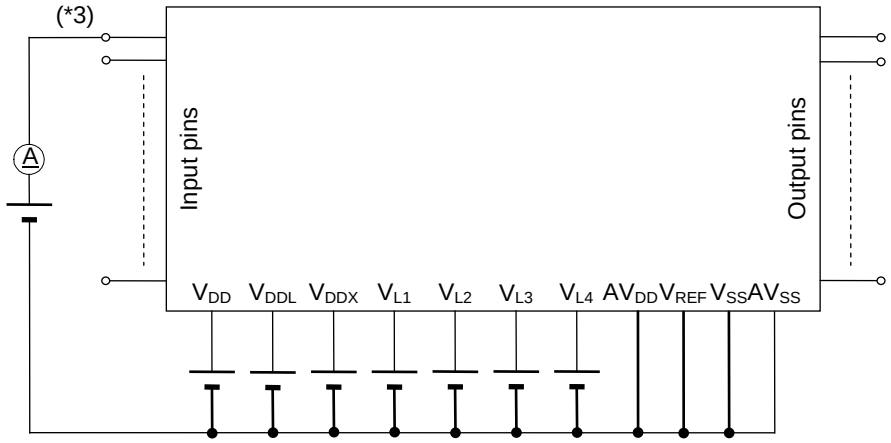
(*1) Input logic circuit to determine the specified measuring conditions.
(*2) Measured at the specified output pins.

MEASURING CIRCUIT 3



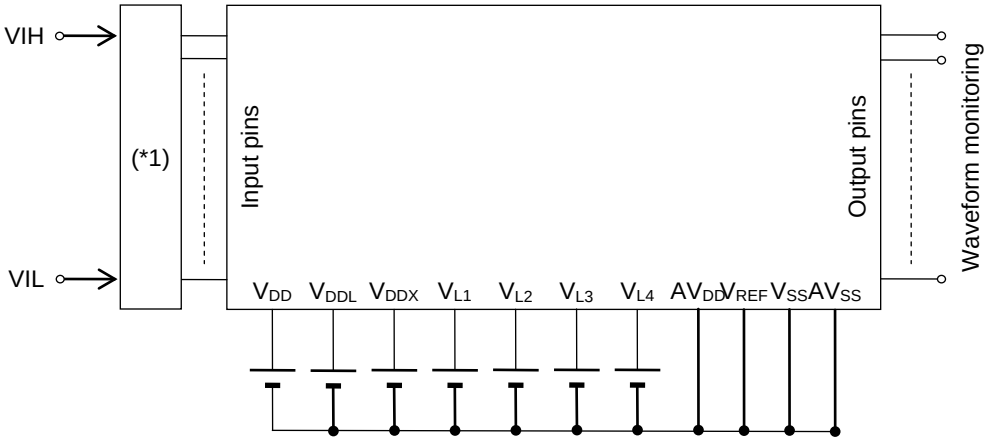
*1: Input logic circuit to determine the specified measuring conditions.
*2: Measured at the specified output pins.

MEASURING CIRCUIT 4



*3: Measured at the specified output pins.

MEASURING CIRCUIT 5

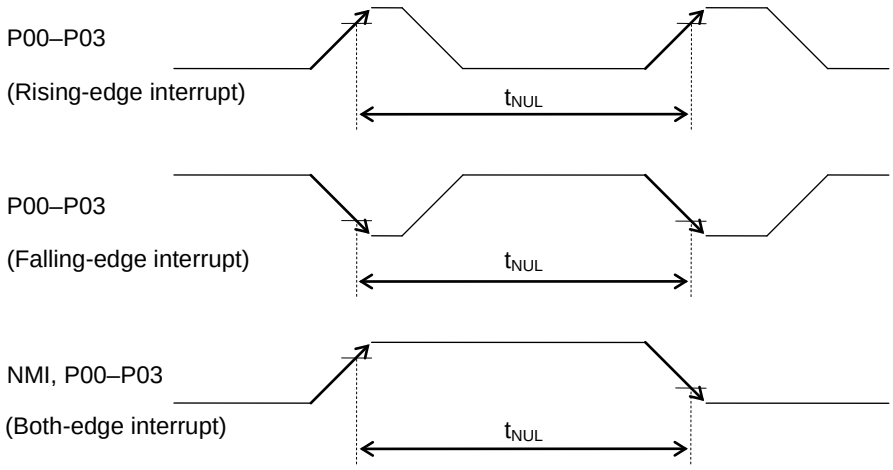


*1: Input logic circuit to determine the specified measuring conditions.

AC CHARACTERISTICS (External Interrupt)

(V_{DD} = 1.1 to 3.6V, AV_{DD} = 2.2 to 3.6V, V_{SS} = AV_{SS} = 0V, Ta = –20 to +70°C, unless otherwise specified)

Parameter	Symbol	Condition	Rating			Unit
			Min.	Typ.	Max.	
External interrupt disable period	T_{NUL}	Interrupt: Enabled (MIE = 1), CPU: NOP operation System clock: 32.768kHz	76.8	—	106.8	µs

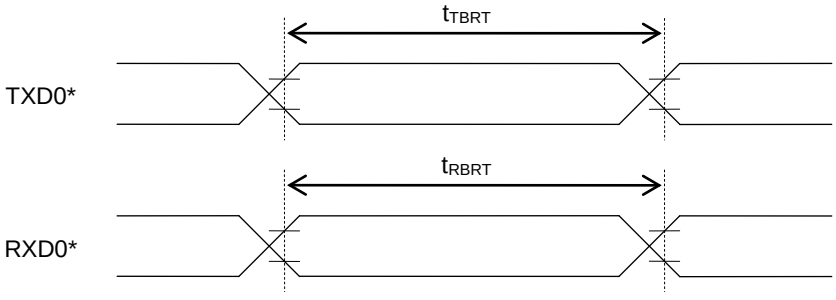


AC CHARACTERISTICS (UART)

(V_{DD} = 1.3 to 3.6V, AV_{DD} = 2.2 to 3.6V, V_{SS} = AV_{SS} = 0V, Ta = –20 to +70°C, unless otherwise specified)

Parameter	Symbol	Condition	Rating			Unit
			Min.	Typ.	Max.	
Transmit baud rate	t_{TBRT}	—	—	BRT*1	—	s
Receive baud rate	t_{RBRT}	—	BRT*1 –3%	BRT*1	BRT*1 +3%	s

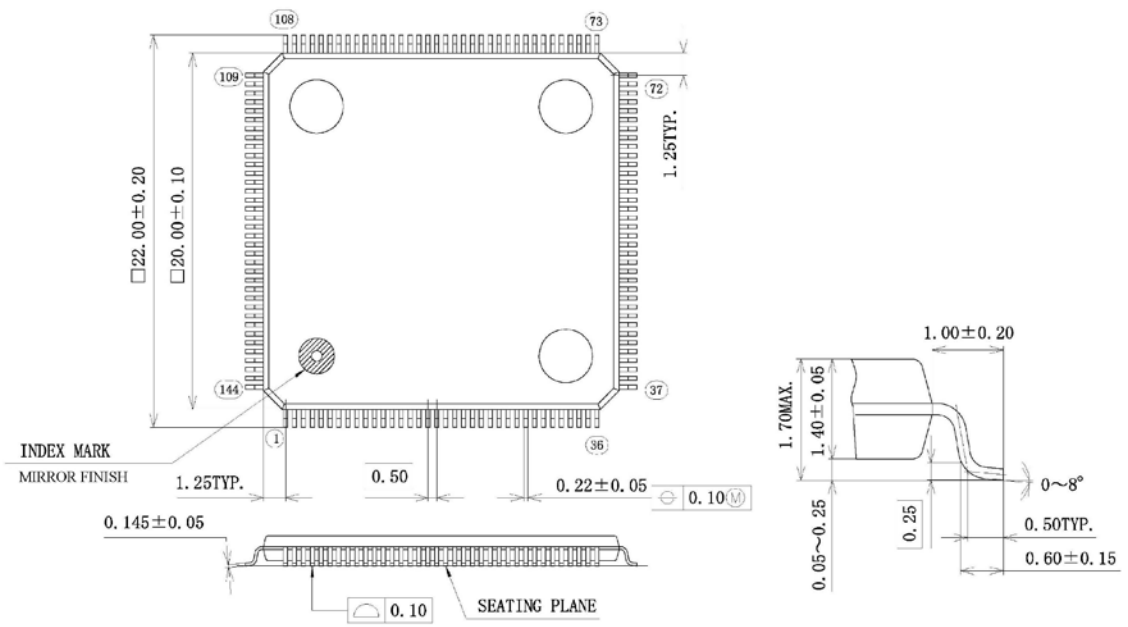
*1: Baud rate period (including the error of the clock frequency selected) set with the UART0 baud rate register (UA0BRTL,H) and the UART0 mode register 0 (UA0MOD0).



*: Indicates the secondary function of the port.

Package Dimensions

LQFP144-P-2020-0.50-ZK



Package material	Epoxy resin
Lead frame material	Cu alloy
Lead finish	Sn-2Bi (Bi 2% typ.)
Pin treatment	Solder plating (≥5μm)
Package weight (g)	1.29 TYP.
Rev. No./Last Revised	1/Oct. 3, 2008

LAPIS Semiconductor Co.,Ltd.