ROHM GROUP
LAPIS
SEMICONDUCTOR

FEBL620Q150ARB-02

ML620Q150A Series Reference Board
ML620Q150A Series EVA Board
User's Manual

Issue Date: Jan 14, 2016

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LAPIS Semiconductor Co.,Ltd.

2-4-8 Shinyokohama, Kouhoku-ku,
Yokohama 222-8575, Japan
http://www.lapis-semi.com/en/

Preface

This manual describes about the ML620Q150A Series Reference Board and ML620Q150A Series EVA Board.

There are three types of Reference Boards and an EVA Board can be used connecting to each reference board.

1. 48pinTQFP: ML620Q151A/152A/153A Reference Board
2. 52pinTQFP: ML620Q154A/155A/156A Reference Board
3. 64pinQFP: ML620Q157A/158A/159A Reference Board

Refer to following documents when necessary.

- ML620Q150A Series User's Manual
  Describes about the microcontroller ML620Q150A Series.

- uEASE User's Manual
  Describes about the On-chip debug tool uEASE.

ML620Q150A Series have nine products.

Table.1 List of the ML620Q150A Series microcontroller

Part number	ML620Q151A/152A/153A	ML620Q154A/155A/156A	ML620Q157A/158A/159A
Package	48pinTQFP	52pinTQFP	64pinQFP
Program FLASH size	ML620Q151A: 32KB ML620Q152A: 48KB ML620Q153A: 64KB	ML620Q154A:32KB ML620Q155A:48KB ML620Q156A:64KB	ML620Q157A:32KB ML620Q158A:48KB ML620Q159A:64KB

LAPIS support six types of reference boards and an evaluation board.

Table.2 List of the ML620Q150A Series Reference Board

Product name	Mounted device/socket	Note
RB-D620Q153TB48	ML620Q153A(64KB Flash) 48pinTQFP	One pcs of ML620Q153A-NNNTB is prepared into the socket, used for developing the software works on ML620Q151A/152A/153A.
RB-S620Q153TB48	48pinTQFP Socket	
RB-D620Q156TB52	ML620Q156A(64KB Flash) 52pinTQFP	One pcs of ML620Q156A-NNNTB is prepared into the socket, used for developing the software works on ML620Q154A/155A/156A.
RB-S620Q156TB52	52pinTQFP Socket	
RB-D620Q159GA64	ML620Q159A(64KB Flash) 64pinQFP	One pcs of ML620Q159A-NNNTB is prepared into the socket, used for developing the software works on ML620Q157A/158A/159A.
RB-S620Q159GA64	64pinQFP Socket	
EB-ML620Q150	-	Used as an evaluation board for the ML620Q150A Series Reference Board.

1. Overview

1.1 Features

The Reference Board is for learning how to use the ML620Q150A Series of microcontrollers, on which adding external user components if necessary. Using the Reference Board with LAPIS Semiconductor's on-hip debug emulator uEASE delivered with the software development environments, help user's software development and debugging and programming the Flash.

1.1.1 Board features

- The board delivered with ML620Q150A series microcontroller or one of 48pin TQFP/ 52pin TQFP/ 64pin TQFP socket.
- Available functions of programming the Flash ROM and on-chip debugging the software (P14/TEST0 and TEST1_N are used for the communication).
- Through-holes for connecting the pins of microcontroller to external pheripheral boards.
- The power supply is selectable, supplied from the on-chip debug emulator uEASE or an user pheripheral board.
- Pads for mounting components, useful for evaluating the microcontroller.
- EVA Board is available to be connected to the Reference Board, which has a RS232C connector and external components, useful when evaluating ISP function or A/D converter.

1.1.2 Hardware specifications

See the schematic on page 22 to 26 for more detail about connection of the mounted components.

1. Reference Board

Table.3 ML620Q150A Series Reference Board Components Overview

Mounted MCU	U1/U2 (The actual device / Socket) : ML620Q151A/2A/3A/4A/5A/6A/7A/8A/9A
Other Mounted components	PWR: Jumper for selecting the power supply input (3pin pin-header and short pin)
	VREF: VREF pin input (3pin pin-header and short pin)
	MODE: Jumper for selecting P14/TEST0 pin (3pin pin-header and short pin)
	X1, X2: Crystal resonator (32.768kHz)
	R1-R4: Resistors for lighting LEDs by P20 to P23
	P20-P23: LEDs
	CNUE: Connector for On-chip debug emulator uEASE (14pin connector)
	C1-C5: Capacitors for Crystal resonator and power lines (for mounted device) C6-C10: Capacitors for Crystal resonator and power lines (for device on the socket)
Pads (or/and) Through holes for mounting components	CN1-CN4: Connectors for EVA Board (20pin, 2.54mm pitch)
	PP0-PP11: Pads for capacitors on the AIN pins
	PP12-PP15: Pads for resistors connecting to LED
	PP16-PP19: Pads for ferrite beads on the power line
	PP20-PP21: Pads for capacitors on analog comparator input(noise filter purpose)
	XP1-XP4: Pads for crystal resonators (for mounted device and device on the socket)
	XR1-XR2: Pads for series resistance of crystal resonator
Other Through holes	VDD, VSS, VDDL1, VDDL2, AIN0-AIN11, CMP0P, CMP0M
Operating voltage	+1.8V to +5.5V
Board size	90.00 mm x 120.00 mm

2. EVA Board

Table.4 ML620Q150A Series EVA Board Components Overview

Mounted components	CN1-CN4: Connector for ML620Q150A Series Reference Board
	VDD, VSS: Check pins
	RESET_N, SW0-SW5: PUSH switches (7pcs)
	RES_ENA: Jumper for selecting the RESET pin (3pin pin header and short pin)
	VREF: Jumper for selecting the VREF pin (3pin pin header and short pin)
	SEL0-SEL11: Jumper for selecting AIN or P3 (3pin pin header and short pin)
	D1-D24: Diodes for AIN input pin.
	CN5: RS232C connector
	U1: RS232C Interface IC
	TXD, RXD: TXD/RXD connection selector for RS232C Interface IC
	R1-R12: AINn pin series resistor (12pcs) R13: RS232C transmit pin resistor (1pcs)
	C1-C5: Capacitors for power circuits(5pcs) C6-C10: Capacitors for RS232C interface IC(5pcs) C11-C17: Capacitors for PUSH switches(7pcs)
Pads (or/and) Through holes for mounting components	PP1: Pad for a capacitor placed between VREF and VSS
Other Through holes	AIN0-AIN11, P30-P35, P42-P47: Check pins
Operating voltage	+1.8V to +5.5V
Board size	140.00mm x 180.00 mm

1.2 Reference Board Outline Drawing

The Figure.1 and Figure.2 show the ML620Q150A Series Reference Board, on which as an example the 64pin QFP socket for ML620Q157A/8A/9A is mounted.

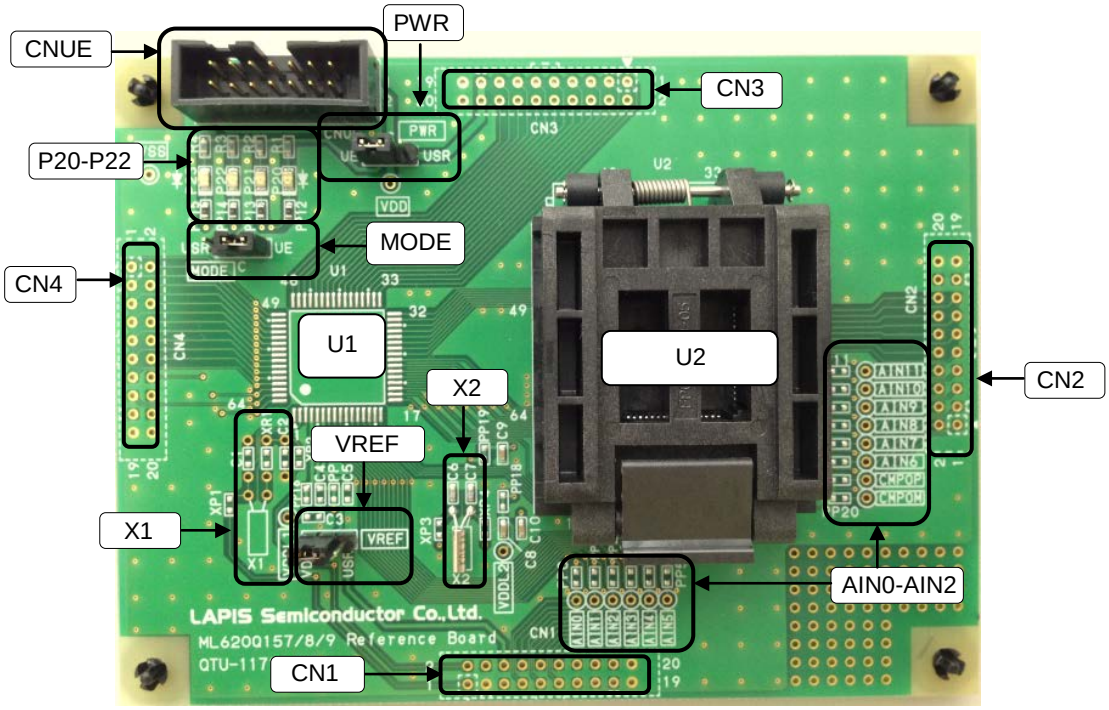


Fig.1 ML620Q150A Series Reference Board Outline Drawing

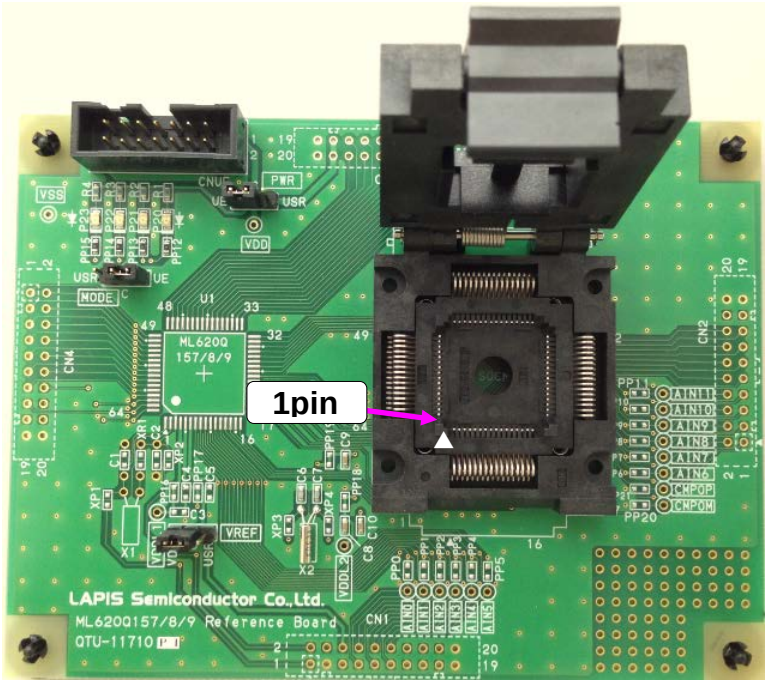


Fig.2 ML620Q150A Series Reference Board Socket 1pin direction

【Note】

Place the microcontroller Reference Board when turning off the power supply. Place the microcontroller in the right direction.

1.3 EVA Board Outline Drawing

The Figure.3 show the ML620Q150A Series EVA Board.

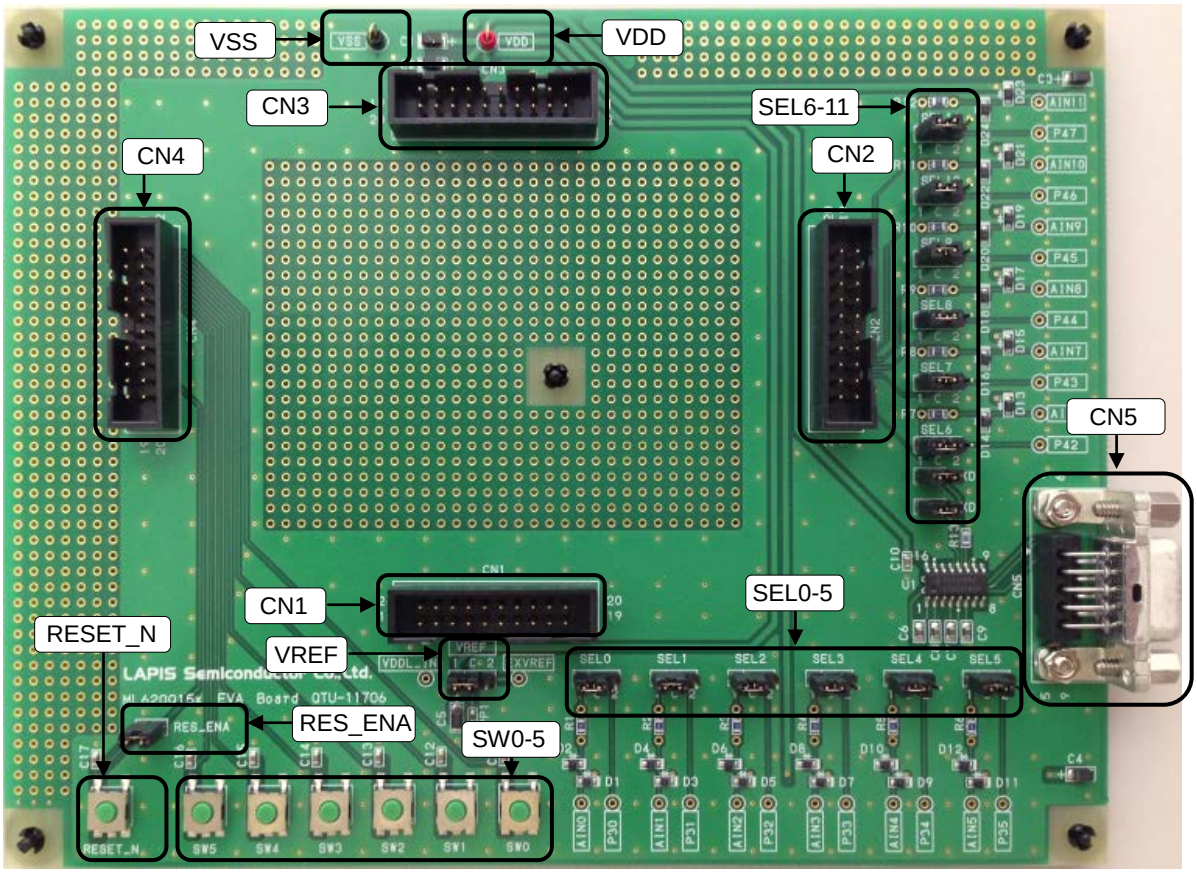


Fig.3 ML620Q150A Series EVA Board Outline Drawing

2. Function of Reference Board

2.1 Power Circuit

Power supply for VDD is selectable by PWR jumper (uEASE/USR).
Power supply for VREF is selectable by VREF jumper (VDD/USR)

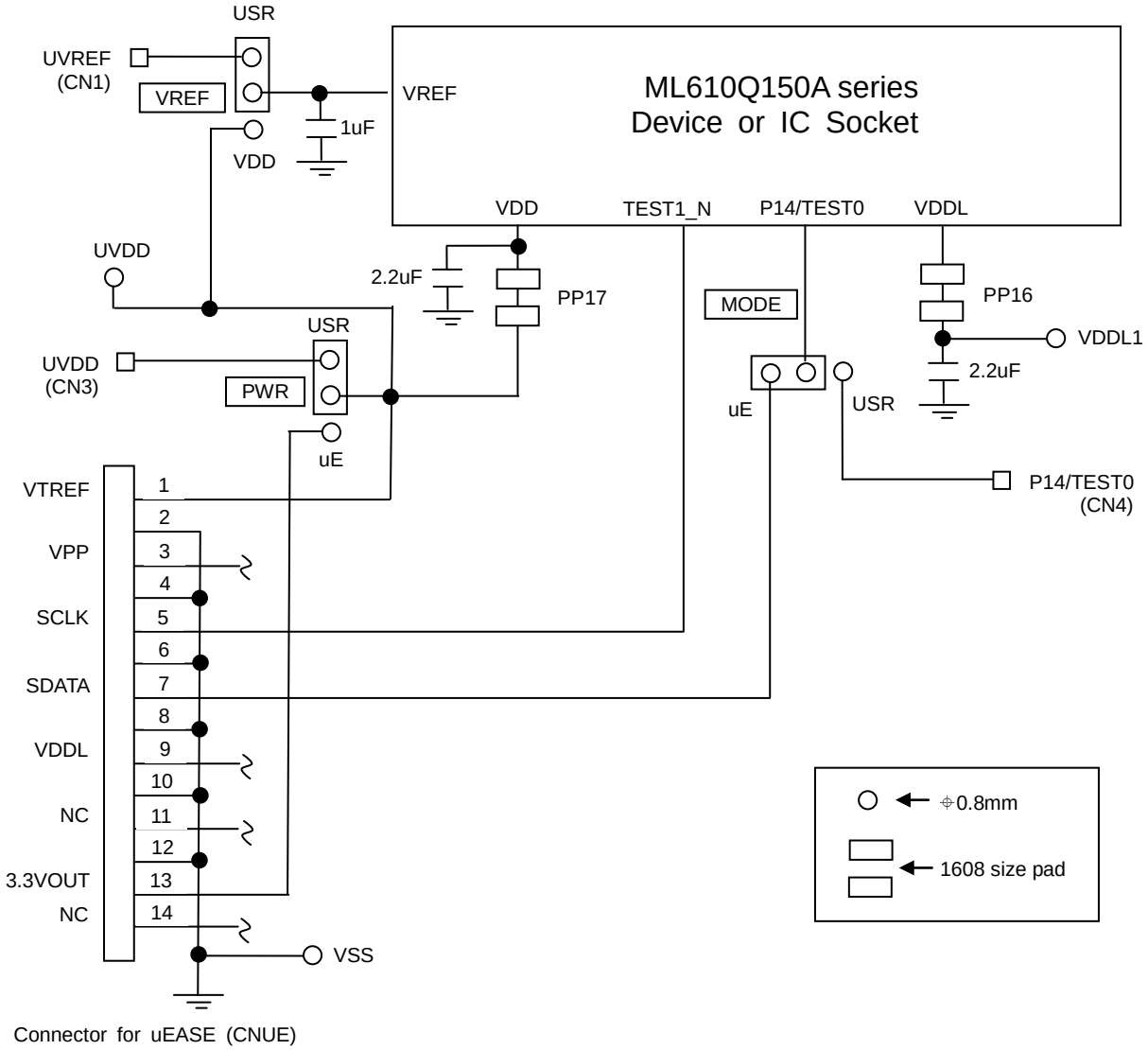


Fig.4 Power Circuit

[Note]

- When selecting "USR" on the PWR jumper and connecting uEASE, connect the uEASE at first and power up the user application system the second. As well, power off the user application system at first and power off the uEASE the second.
- When selecting "VREFF" on the VREF jumper and conencting uEASE, connect the uEASE at first and power up the user application system the second. As well, power off the user application system at first and power off the uEASE the second.
- When selecting "USR" on the MODE jumper, uEASE is not available to use and instead P14/TEST0 pin on the microcontroller is available to use.

2.2 Low-speed Oscillation Circuit

The low-speed oscillation circuit is available for each device mounted type(U1) and soket type (U2).
The 1608 size of pads are prepared so that the PCB wiring capacitance does not affect to the oscillation.

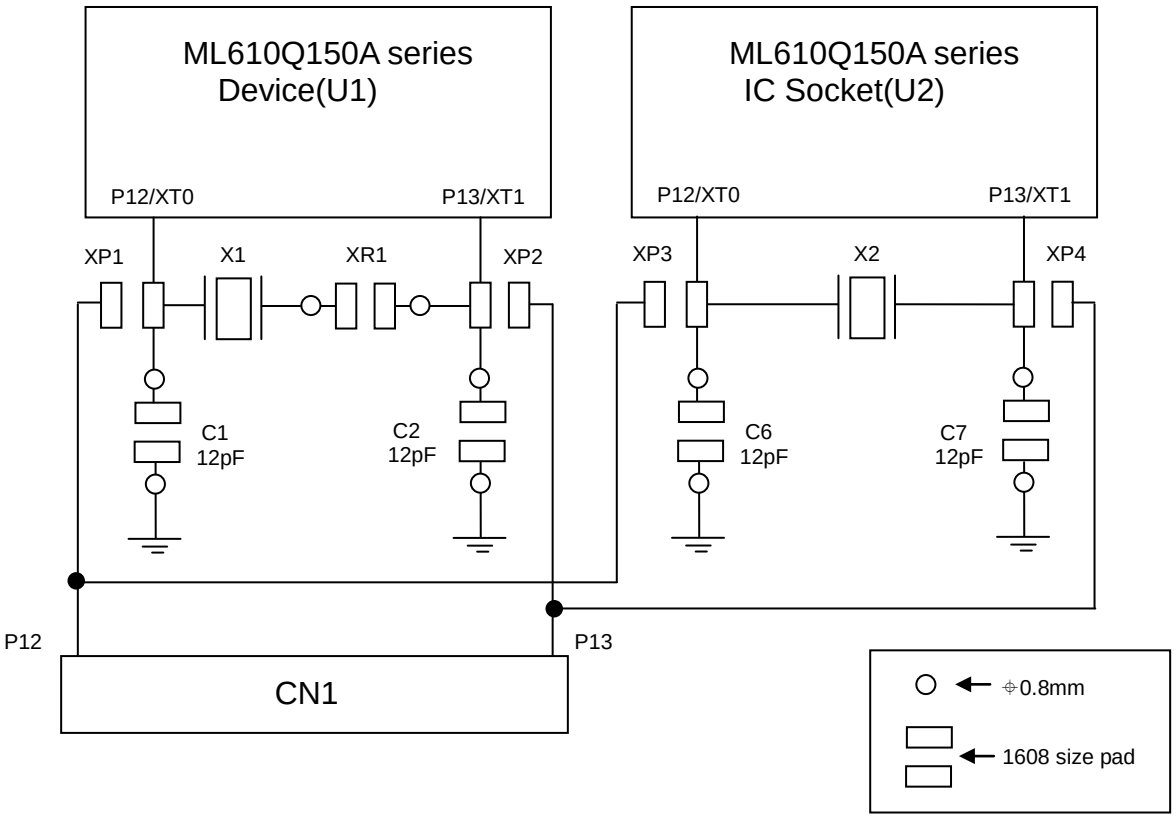


Fig.5 Low-speed Oscillation Circuit

2.3 AIN inputs for evaluating the A/D Converter

Through-holes(AIN0-AIN11) are available to input voltages direclty to the pins of microtontroller.
The 1608 size of pads can be used for external components such as denoising capactors.

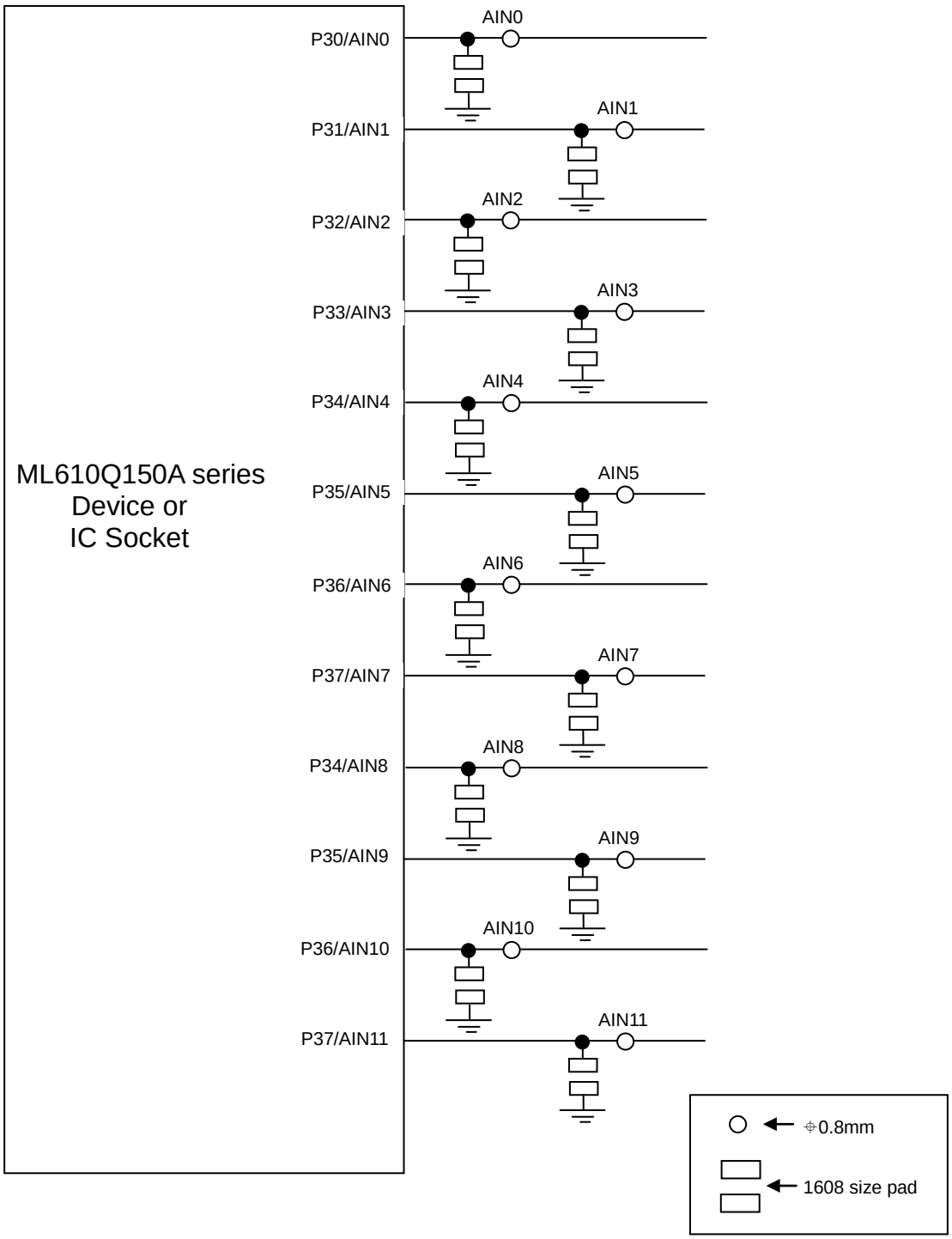


Fig.6 AIN inputs for evaluating the A/D converter

2.4 Analog Comparator Input

Through-holes(COM0M, CMP0P) are available to input voltages direclty to the pins of microtontroller.
The 1608 size pads can be used for mounting denoising capactors.

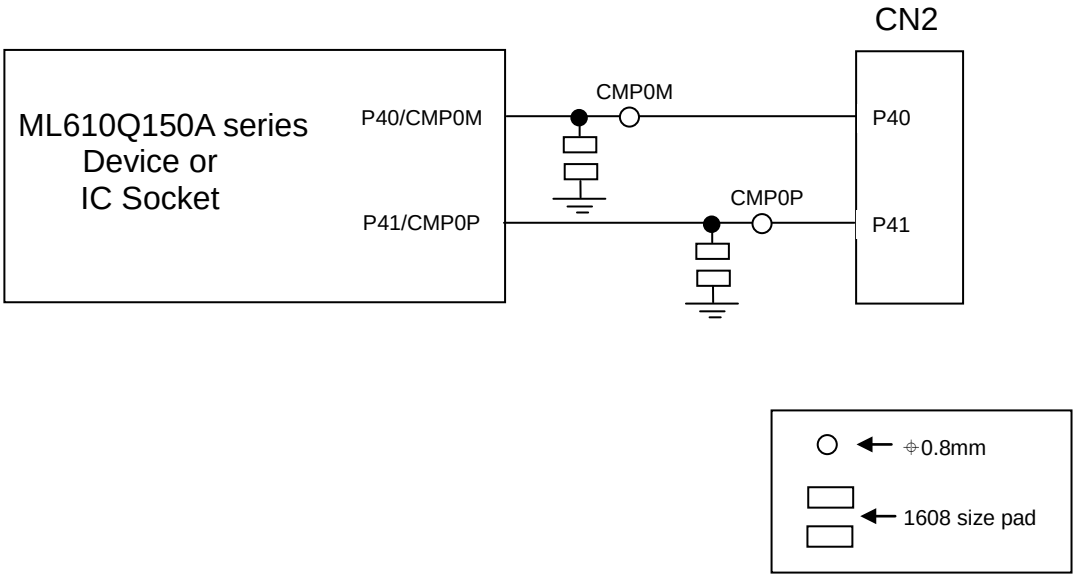


Fig.7 Analog Comparator Input

2.5 uEASE Interface

Selecting a jumper pin on the MODE jumper, one of the on-chip debug emulator uEASE or a genral port P14 is available to use.

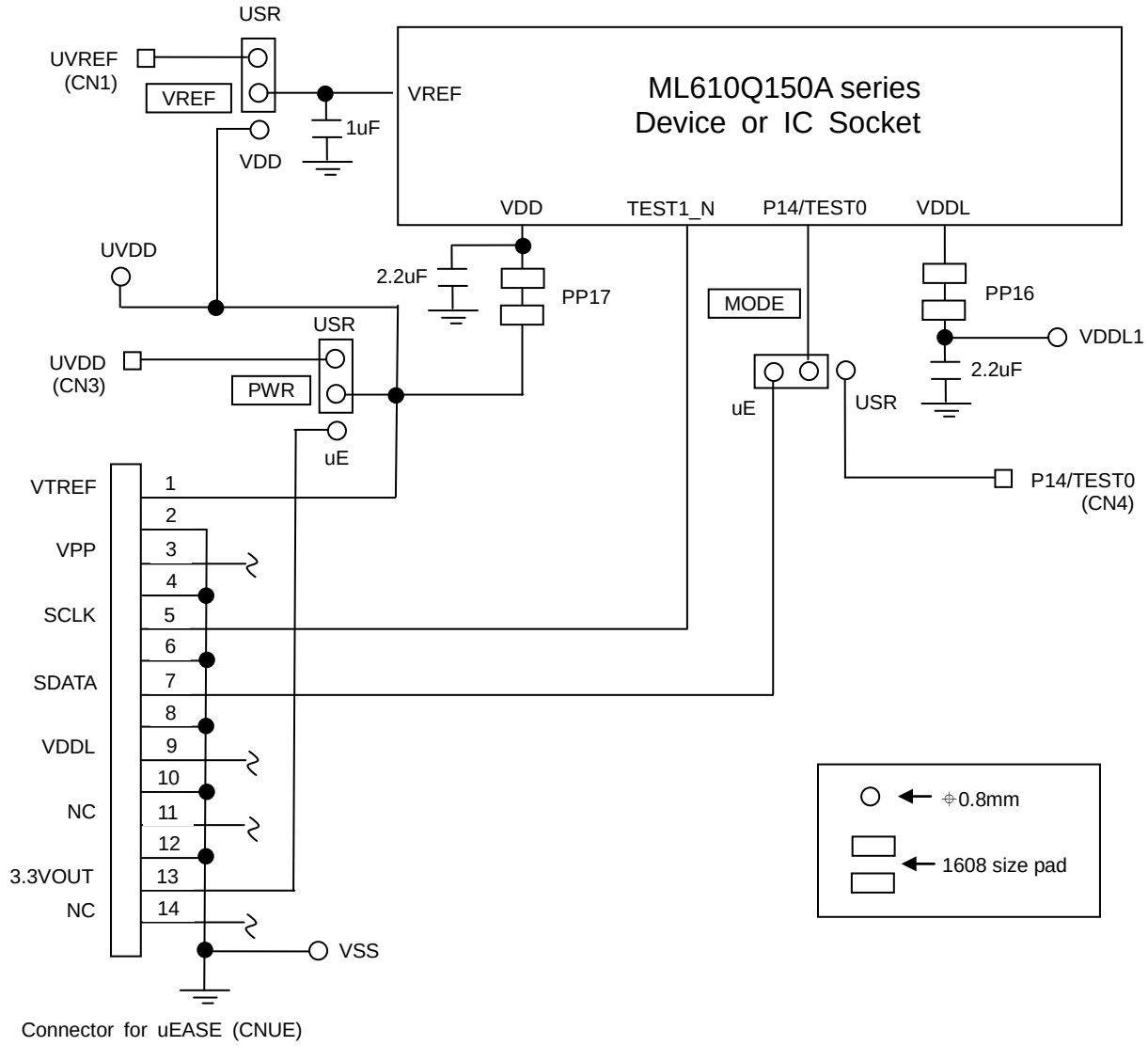


Fig.8 uEASE Interface

[Note]

- When selecting "USR" on the MODE jumper, uEASE is not available to use and instead P14/TEST0 pin on the microcontroller is available to use.

2.6 When using the A/D Converter

The through-holes AIN0 to AIN11 that are close to the device are prepared to evaluate the A/D converter. Place denoise-purpose capctiors onto the pads PP0 to PP11 if necessary.

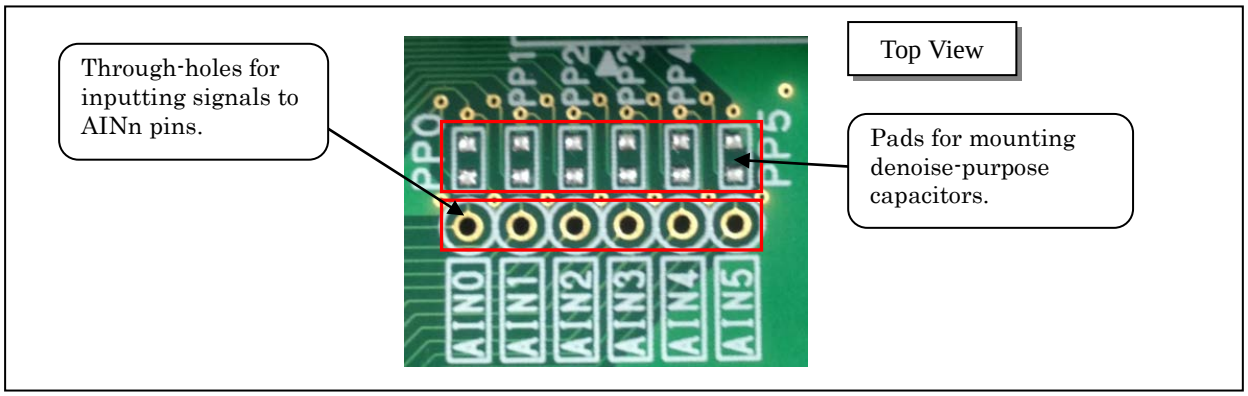


Fig.9 Through-holes and Pads used for A/D converter function

2.7 When Not using the LED

P20-P22 of the microcontroller are ports that can directly drive a LED. The Ports are connected to the LEDs through zero-ohm chip resistors. Remove the resistors when not using the LEDs.

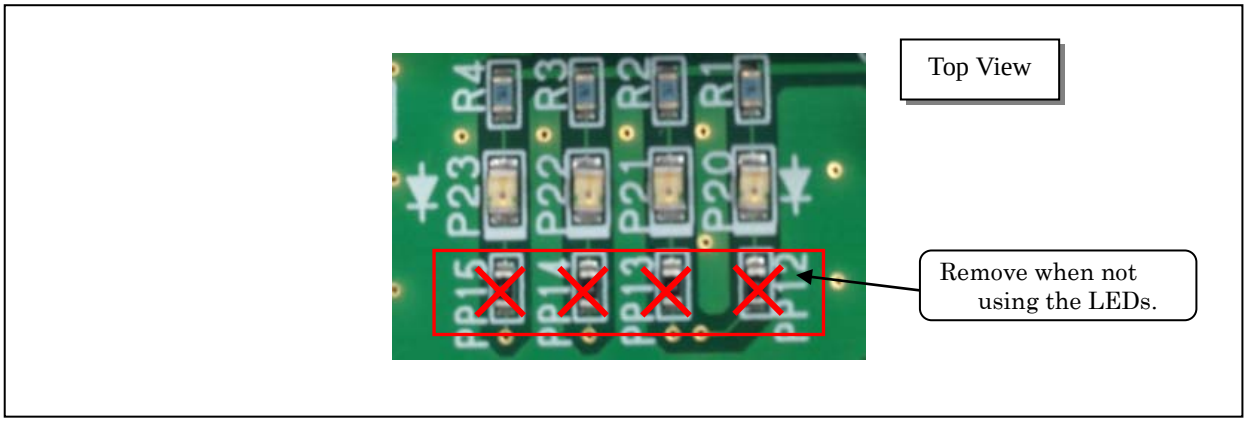


Fig.10 Zero-ohm resistors for LEDs

3. Function of EVA Board

3.1 RS232C Communication Circuit

P43/AIN7/TXD0 and P42/AIN6/RXD0 are disconnectable from the RS232C circuit by using the TXD jumper and RXD jumper.

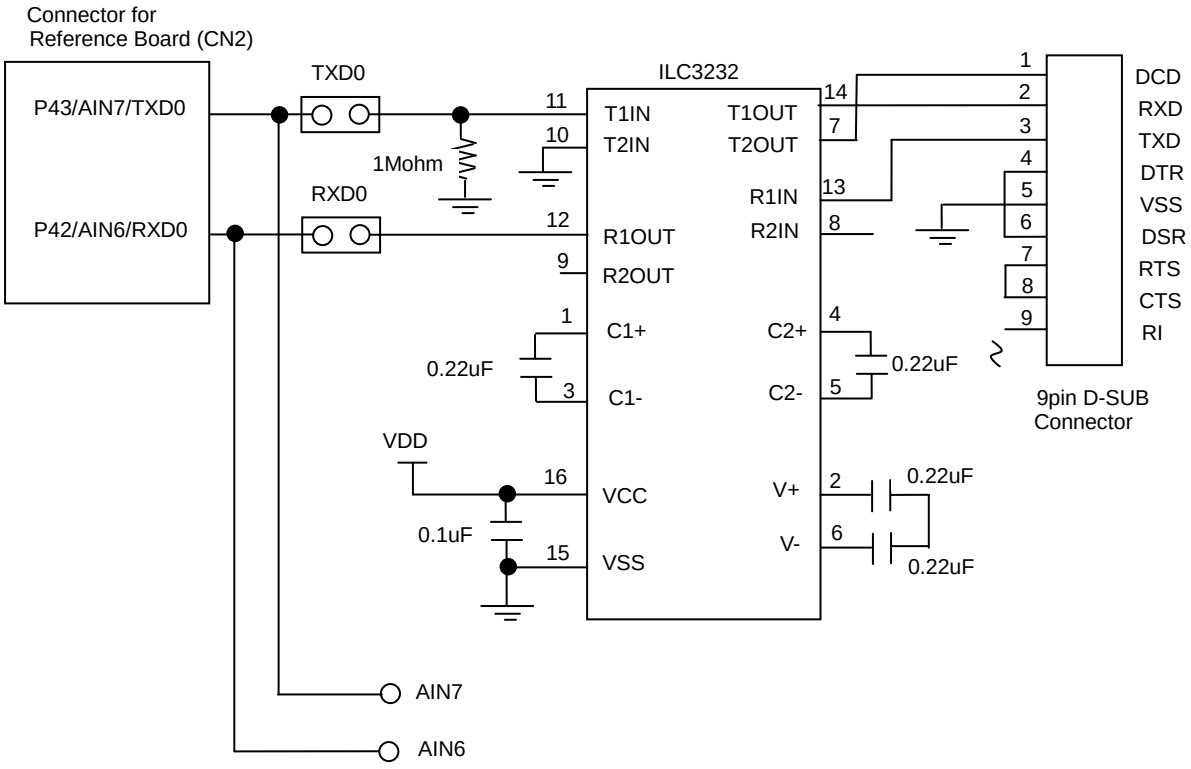


Fig.11 RS232C Communication Circuit

3.2 Input Switch

Five push swiches are available connected to Port 0(P05-P00) and RESET_N pin.
The swich for the RESET_N is disconnectable by using the RESET_N jumper.

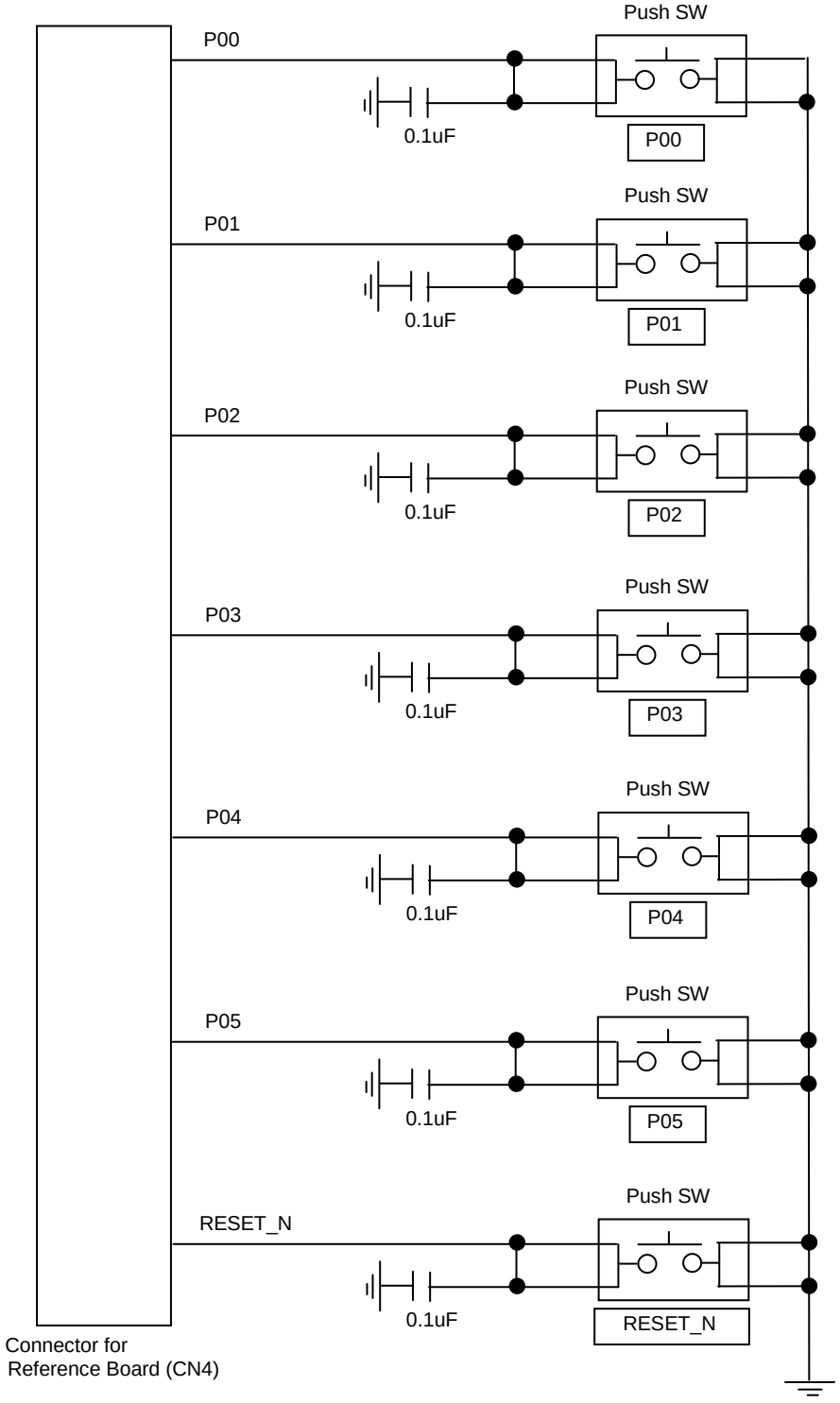


Fig.12 Input Switches

3.3 AIN Input for A/D Converter

The input circuits are selectable by using the SELn jumpers. One input line has diodes and a resistor for the evaluation.
VDD or an external voltage supplied to the VREF pin is selectable by the VREF jumper.

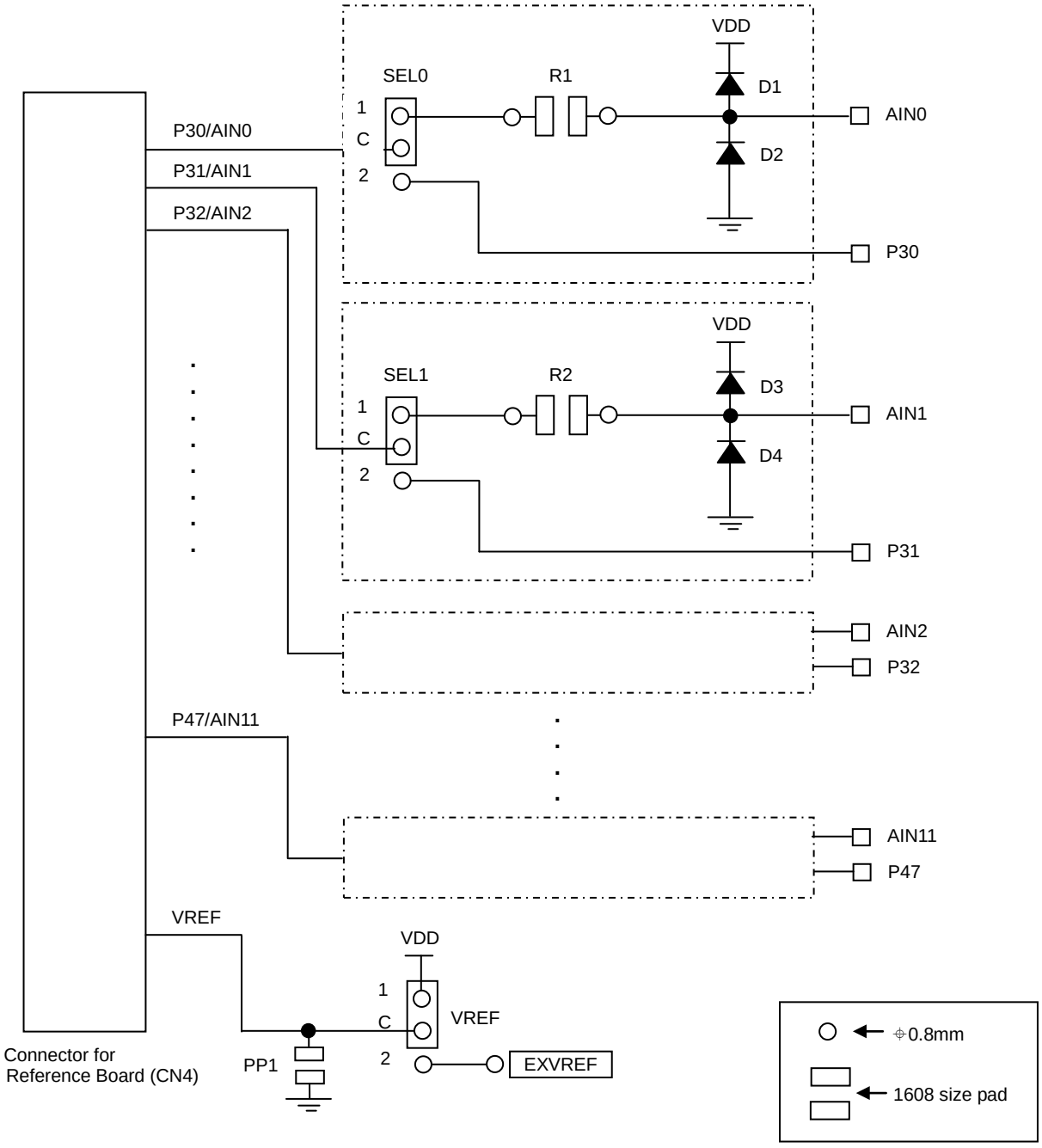


Fig.13 AIN inputs for A/D Converter

4. User Interface

4.1 ML620Q150A Series Reference Board User Interface

Table 5. and Table 6. show the pin list of the ML620Q150A series reference board user interface connector CN1, CN2, CN3 and CN4.

Table 5. ML620Q150A Series Reference Board User Interface Connecter CN1/CN2 Pin List

CN1	Q157A/8A/9A 64pin device	Q154A/5A/6A 52pin device	Q151A/2A/3A 48pin device	CN2	Q157A/8A/9A 64pin device	Q154A/5A/6A 52pin device	Q151A/2A/3A 48pin device
1	P12	P12	P12	1	P40	P40	P40
2	P13	P13	P13	2	P41	P41	P41
3	VSS	VSS	VSS	3	P42	P42	P42
4	–	–	–	4	P43	P43	P43
5	–	–	–	5	P44	P44	P44
6	VREF	VREF	VREF	6	P45	P45	P45
7	P30	P30	P30	7	P46	P46	P46
8	P31	P31	P31	8	P47	P47	P47
9	P32	P32	P32	9	P50	–	–
10	P33	P33	P33	10	P51	–	–
11	P34	P34	P34	11	P52	–	–
12	P35	P35	P35	12	P53	P53	–
13	P36	P36	–	13	P54	P54	P54
14	P37	–	–	14	P55	P55	P55
15	P70	–	–	15	P56	P56	P56
16	P71	–	–	16	P57	P57	P57
17	–	–	–	17	–	–	–
18	–	–	–	18	–	–	–
19	VSS	VSS	VSS	19	VSS	VSS	VSS
20	VSS	VSS	VSS	20	VSS	VSS	VSS

Table 6. ML620Q150A Series Reference Board User Interface Connecter CN3/CN4 Pin List

CN3	Q157A/8A/9A 64pin device	Q154A/5A/6A 52pin device	Q151A/2A/3A 48pin device	CN4	Q157A/8A/9A 64pin device	Q154A/5A/6A 52pin device	Q151A/2A/3A 48pin device
1	P60	P60	P60	1	P00	P00	P00
2	P61	P61	P61	2	P01	P01	P01
3	P62	P62	P62	3	P02	P02	P02
4	P63	P63	P63	4	P03	P03	P03
5	P64	P64	–	5	P04	P04	P04
6	P65	–	–	6	P05	P05	–
7	P66	–	–	7	P20	P20	P20
8	P67	–	–	8	P21	P21	P21
9	P80	P80	P80	9	P22	P22	P22
10	P81	P81	P81	10	P23	P23	P23
11	P82	P82	P82	11	P72	–	–
12	P83	P83	P83	12	P73	–	–
13	P84	P84	P84	13	P74	–	–
14	P85	P85	P85	14	P14/TEST0	P14/TEST0	P14/TEST0
15	P86	P86	P86	15	RESET_N	RESET_N	RESET_N
16	P87	P87	P87	16	–	–	–
17	VDD	VDD	VDD	17	–	–	–
18	VDD	VDD	VDD	18	–	–	–
19	VSS	VSS	VSS	19	VSS	VSS	VSS
20	VSS	VSS	VSS	20	VSS	VSS	VSS

4.2 ML620Q150A Series EVA Board User Interface

Table 7. and Table 8. show the pin list of the ML620Q150A series eva board user interface connector CN1, CN2, CN3 and CN4 (Listed all pins of the 64pin devices).

Table 7. ML620Q150A Series EVA Board User Interface Connecter CN1/CN2 Pin List

CN1	EVA Board	64pin device Reference Board	CN2	EVA Board	64pin device Reference Board
1	–	P12	1	–	P40
2	–	P13	2	–	P41
3	VSS	VSS	3	P42/AIN6 Input circuit or RXD0	P42/AIN6/RXD0
4	VDDL(TH)	–	4	P43/AIN7 Input circuit or TXD0	P43/AIN7/TXD0
5	–	–	5	P44/AIN8 Input circuit	P44/AIN8
6	VREF	VREF	6	P45/AIN9 Input circuit	P45/AIN9
7	P30/AIN0 Input circuit	P30/AIN0	7	P46/AIN10 Input circuit	P46/AIN10
8	P31/AIN1 Input circuit	P31/AIN1	8	P47/AIN11 Input circuit	P47/AIN11
9	P32/AIN2 Input circuit	P32/AIN2	9	–	P50
10	P33/AIN3 Input circuit	P33/AIN3	10	–	P51
11	P34/AIN4 Input circuit	P34/AIN4	11	–	P52
12	P35/AIN5 Input circuit	P35/AIN5	12	–	P53
13	–	P36	13	–	P54
14	–	P37	14	–	P55
15	–	P70	15	–	P56
16	–	P71	16	–	P57
17	–	–	17	–	–
18	–	–	18	–	–
19	VSS	VSS	19	VSS	VSS
20	VSS	VSS	20	VSS	VSS

Table 8. ML620Q150A Series EVA Board User Interface Connecter CN3/CN4 Pin List

CN3	EVA Board	64pin device Reference Board	CN4	EVA Board	64pin device Reference Board
1	-	P60	1	Push SW	P00
2	-	P61	2	Push SW	P01
3	-	P62	3	Push SW	P02
4	-	P63	4	Push SW	P03
5	-	P64	5	Push SW	P04
6	-	P65	6	Push SW	P05
7	-	P66	7	-	P20
8	-	P67	8	-	P21
9	-	P80	9	-	P22
10	-	P81	10	-	P23
11	-	P82	11	-	P72
12	-	P83	12	-	P73
13	-	P84	13	-	P74
14	-	P85	14	-	P14/TEST0
15	-	P86	15	Push SW	RESET_N
16	-	P87	16	-	-
17	VDD	VDD	17	-	-
18	VDD	VDD	18	-	-
19	VSS	VSS	19	VSS	VSS
20	VSS	VSS	20	VSS	VSS

5. Precaution for use

(1) Since the content specified herein is subject to change for improvement without notice, confirm the content is the latest when using the board.
(2) See another documents ML620Q150A series user's manual and uEASE user's manual when using the board.
(3) The Reference Board may have an engineering sample of the ML620Q150A series. Confirm the final electrical characteristics by using the mass production parts on your mass production boards.
(4) LAPIS support replacing the board for an initial failure soon after the shipment, can not support reparing the board.
(5) The boards have signal patterns on the underside, it might work in abnormal if using on conductive materials. Use it on insulating materials or having any preventable parts.

6. PCB specification and schematic

6.1 Reference Board PCB specification

Figure 14. shows the ML620Q150A Series Reference Board PCB dimensional outline drawing and layout of components.

PCB part number:

ML620Q151A/2A/3A Reference Board (QTU-11708)
ML620Q154A/5A/6A Reference Board (QTU-11709)
ML620Q157A/8A/9A Reference Board (QTU-11710)

Dimension:

90mm x 120mm

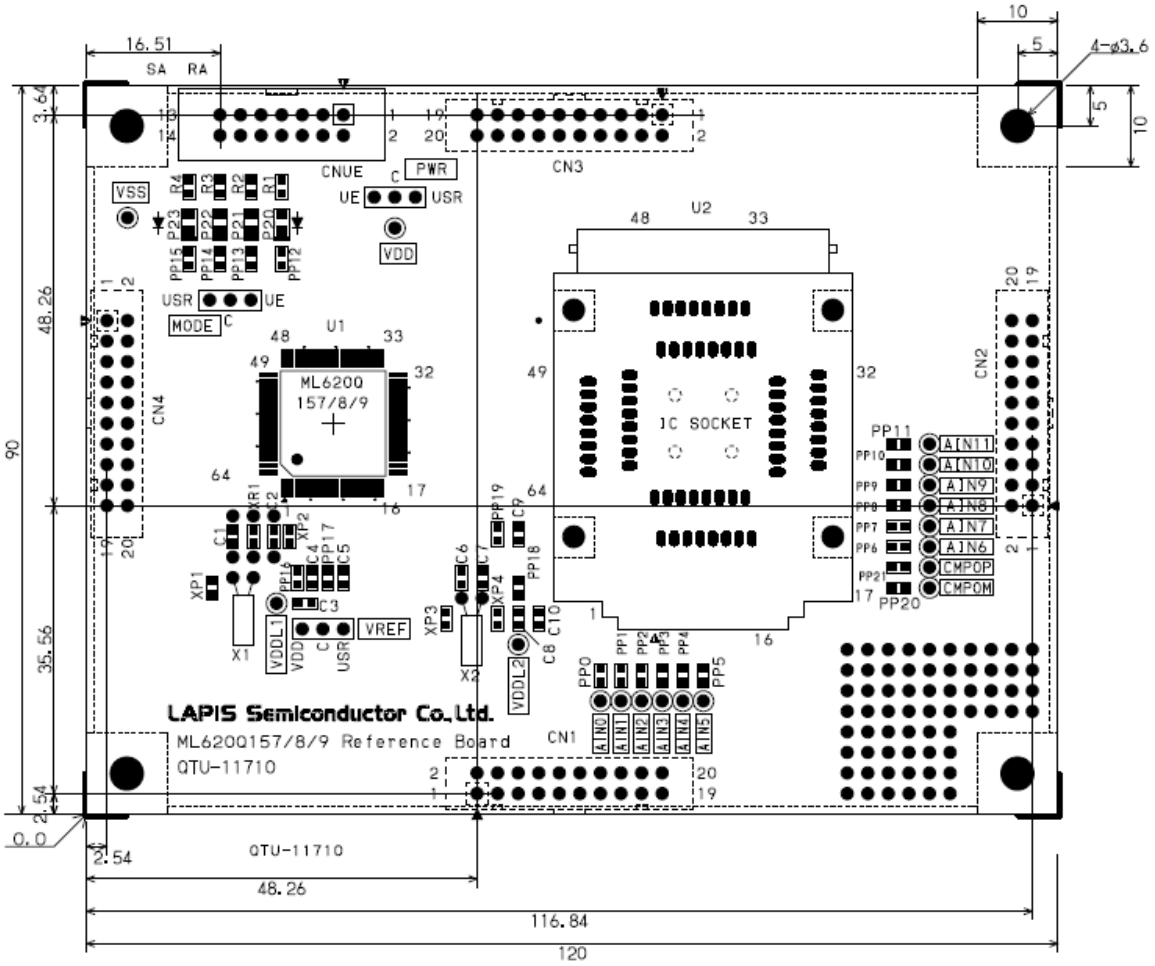


Fig.14 Reference Board PCB dimensional outline drawing and layout of components (Top view)

6.2 EVA Board PCB Specification

Figure 14. shows the ML620Q150A Series EVA Board PCB dimensional outline drawing and layout of components.

PCB part number:
ML620Q15xA EVA Board （QTU-11705）

Dimension:
140mm x 180mm

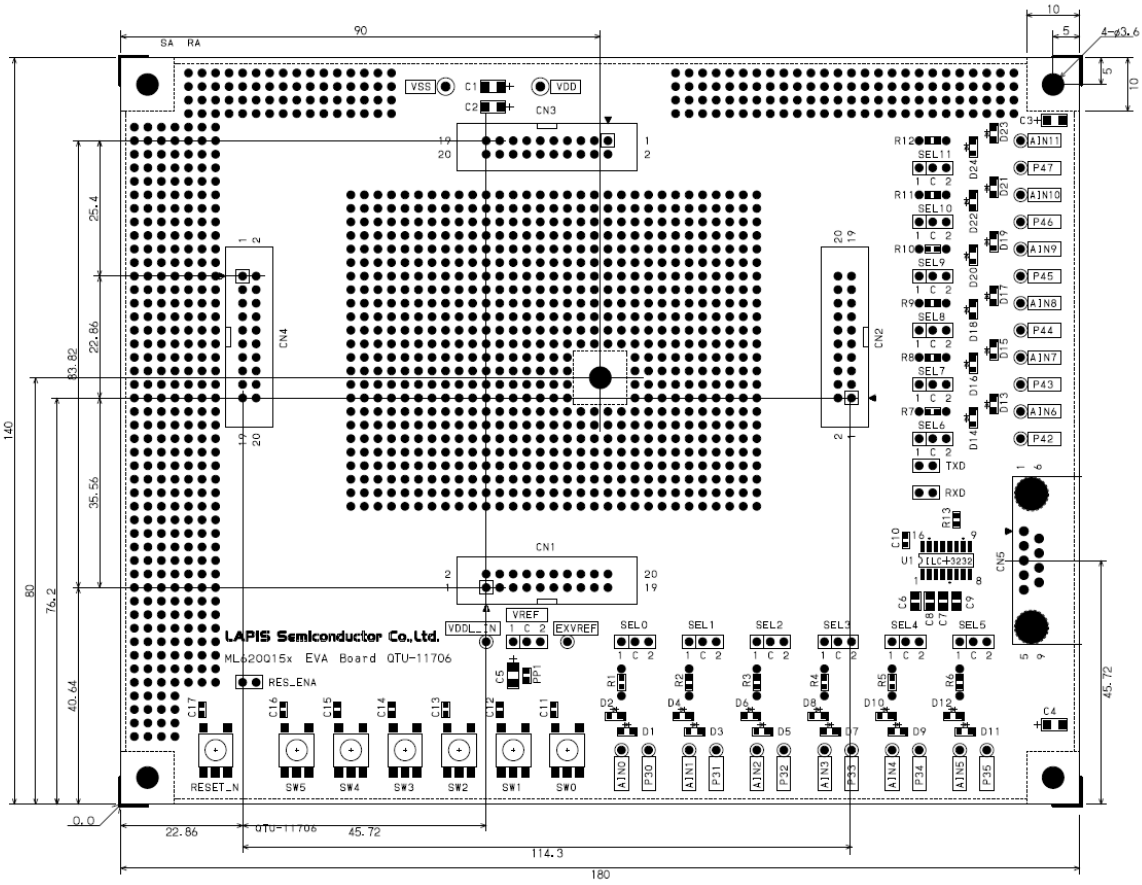
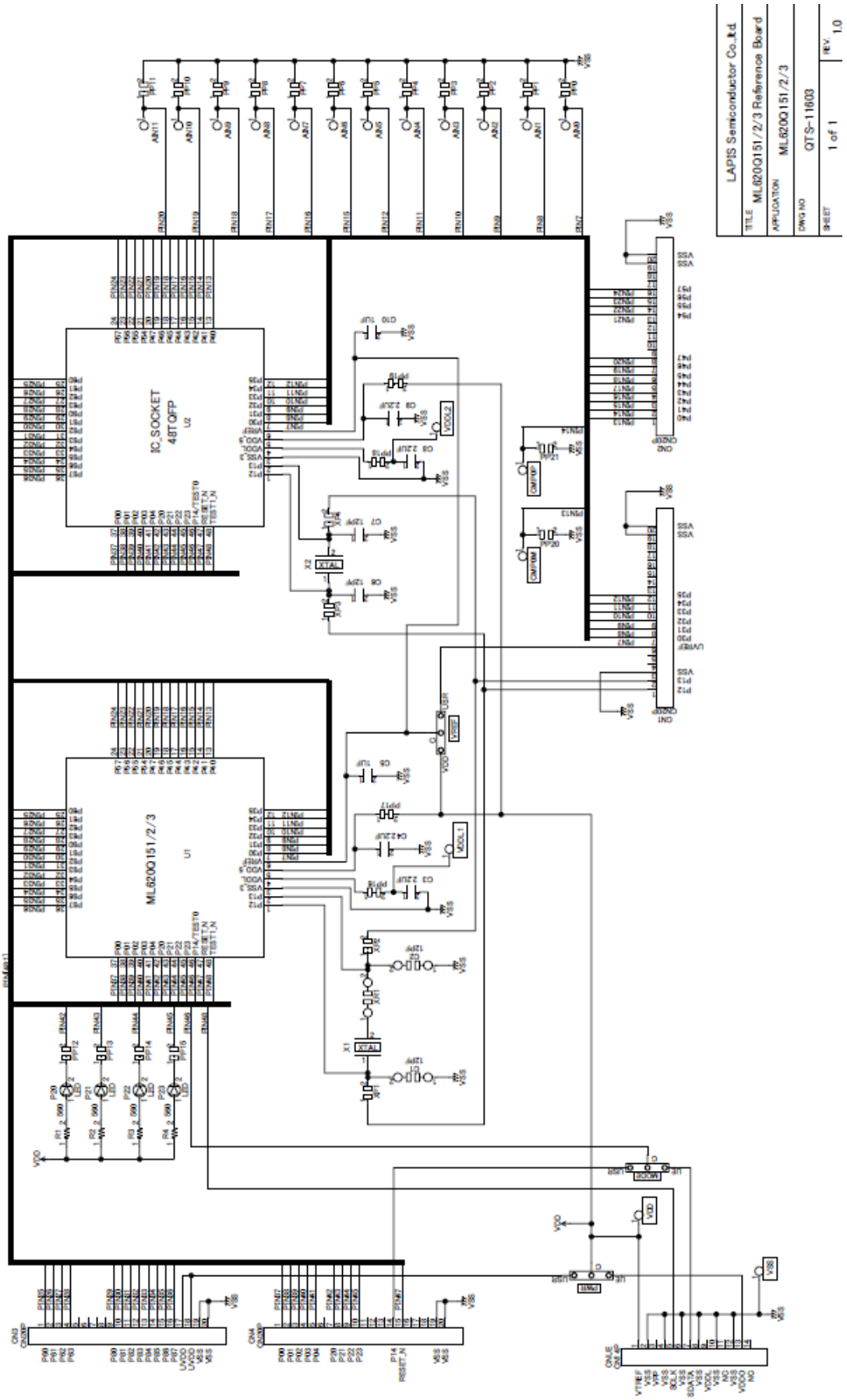


Fig.15 EVA Board PCB dimensional outline drawing and layout of components (Top view)

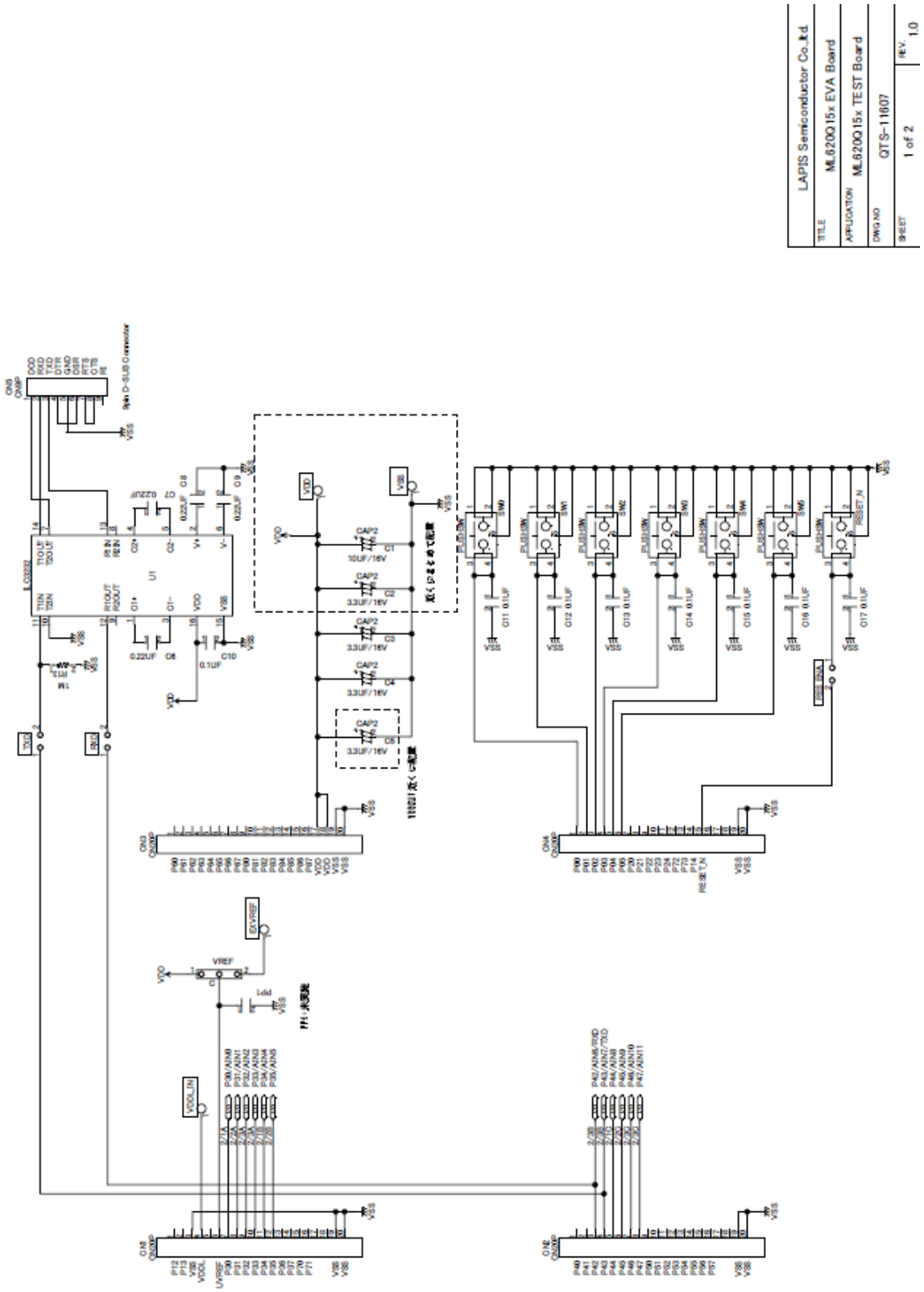
6.3 Reference Board Schematic

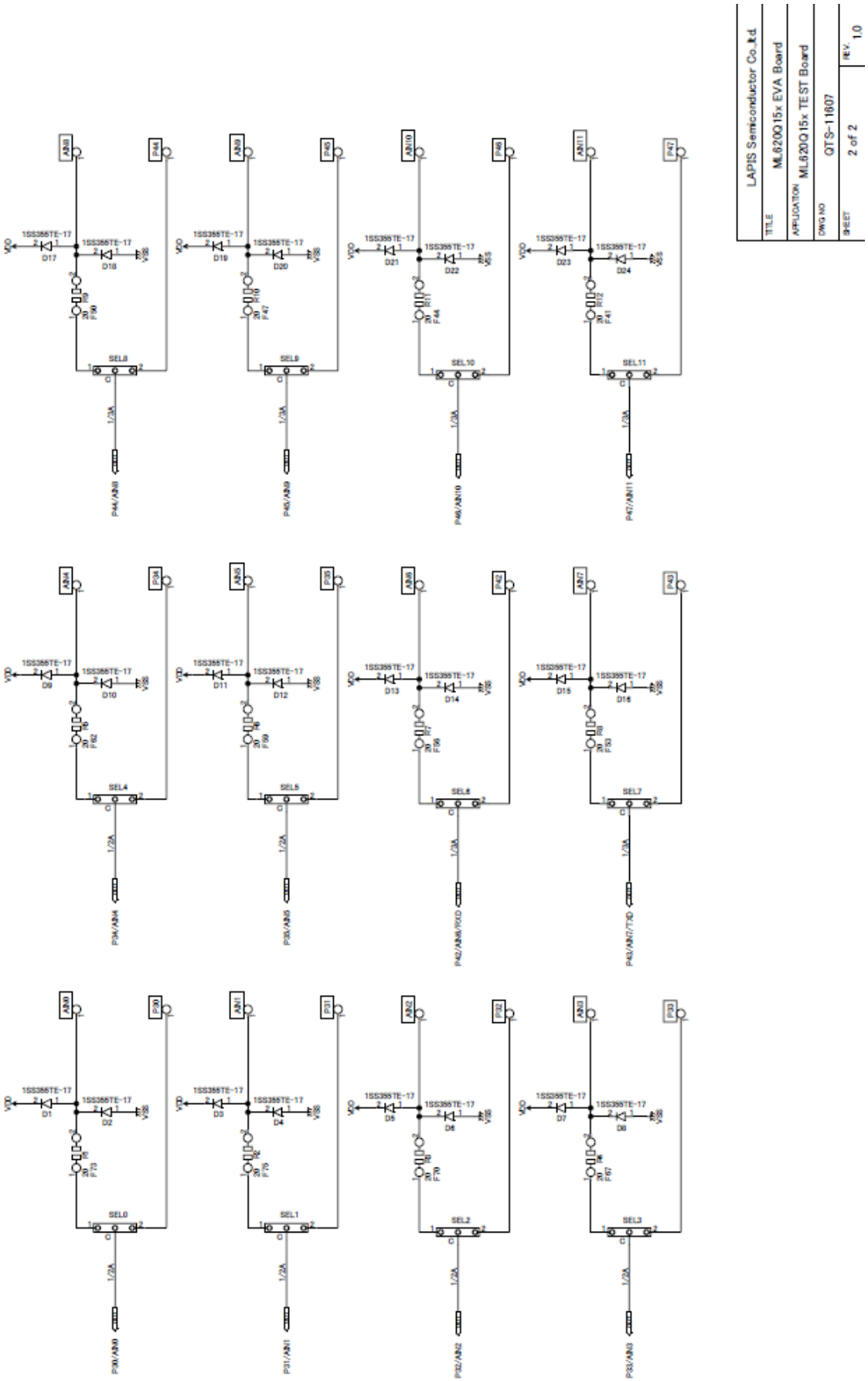
The next page shows the schematic of ML620Q150A Series Reference Board


LAPIS Semiconductor Co.,ltd.
TITLE ML620Q151/2/3 Reference Board
APPLICATION ML620Q151/2/3
DWG NO QTS-11603
SHEET 1 of 1
REV 1.0
IC_SOCKET
48TQFP
U2
ML620Q151/2/3
U1
XTAL
VDD
VSS

6.4 EVA Board Schematic

The next page shows the schematic of ML620Q150A Series EVA Board


LAPIS Semiconductor Co.,Ltd.
TITLE
ML620Q15x EVA Board
APPLICATION
ML620Q15x TEST Board
DWG NO
QTS-11607
SHEET
1 of 2
REV.
1.0


LAPIS Semiconductor Co.,ltd.
TITLE ML620Q15x EVA Board
APPLICATION ML620Q15x TEST Board
DWG NO QTS-11607
SHEET 2 of 2
REV. 1.0

REVISION HISTORY

Document No.	Date	Page		Description
		Previous Edition	Current Edition	
FEBL620Q150ARB-01	MAY 15, 2015	–	–	First Edition
FEBL620Q150ARB-02	Jan 14, 2016	2	2	Update part number and add description

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