

# ML620Q130 Series Reference Board User's Manual

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## Preface

This manual describes about the ML620Q130 Series Reference Board.

There are two types of Reference Boards can be used connecting to each reference board.

1. 16pinWQFN, SSOP : ML620Q131/132/133 Reference Board
2. 20pinTSSOP : ML620Q134/135/136 Reference Board

Refer to following documents when necessary.

- ML620Q130 Series User's Manual  
Describes about the microcontroller ML620Q130 Series.
- uEASE User's Manual  
Describes about the On-chip debug tool uEASE.

ML620Q130 Series have nine products.

Table.1 List of the ML620Q130 Series microcontroller

Part number	ML620Q131/132/133		ML620Q134/135/136
Package	16pinWQFN	16pinSSOP	20pinTSSOP
Program FLASH size	ML620Q131: 8KB ML620Q132: 16KB ML620Q133: 24KB		ML620Q134:8KB ML620Q135:16KB ML620Q136:24KB

LAPIS support six types of reference boards.

Table.2 List of the ML620Q130 Series Reference Board

Product name	Mounted device/socket	Note
RB-D620Q133GD16	ML620Q133(24KB Flash) 16pinWQFN	One pcs of ML620Q133-NNNGD is prepared into the socket, used for developing the software works on ML620Q131/132/133.
RB-S620Q133GD16	16pinWQFN Socket	
RB-D620Q133MB16	ML620Q133(24KB Flash) 16pinSSOP	One pcs of ML620Q133-NNNMB is prepared into the socket, used for developing the software works on ML620Q131/132/133.
RB-S620Q133MB16	16pinSSOP Socket	
RB-D620Q136TD20	ML620Q136(24KB Flash) 20pinTSSOP	One pcs of ML620Q136-NNNTD is prepared into the socket, used for developing the software works on ML620Q134/135/136.
RB-S620Q136TD20	20pinTSSOP Socket	

## 1. Overview

### 1.1 Features

The Reference Board is for learning how to use the ML620Q130 Series of microcontrollers, on which adding external user components if necessary. Using the Reference Board with LAPIS Semiconductor's on-chip 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 ML620Q130 series microcontroller or one of 16pin WQFN/ 16pin SSOP/ 20pin TSSOP socket.
- Available functions of programming the Flash ROM and on-chip debugging the software (PA2/TEST0 and TEST1\_N are used for the communication).
- Through-holes for connecting the pins of microcontroller to external peripheral boards.
- The power supply is selectable, supplied from the on-chip debug emulator uEASE or an user peripheral 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 UART function or A/D converter.

#### 1.1.2 Hardware specifications

See the schematic on page 23 to 24 for more detail about connection of the mounted components.

#### 1. ML620Q131/132/133 Reference Board

Mounted MCU	U1/U2 (The actual device / Socket) : ML620Q131/2/3 (16pin SSOP) U3/U4 (The actual device / Socket) : ML620Q131/2/3 (16pin WQFN)
Other Mounted components	PWR: Jumper for selecting the power supply input (3pin pin-header and short pin)
	MODE: Jumper for selecting PA2/TEST0 pin (3pin pin-header and short pin)
	X1-X4: Crystal resonator (4MHz)
	XT1-XT4: Ceramic resonator (4MHz)
	R1-R2: Resistors for lighting LEDs by PA0 and PB7
	R3: Resistor for pull-up of RESET_N
	PA0, PB7: LEDs
	CNUE: Connector for On-chip debug emulator uEASE (14pin connector)
Pads (or/and) Through holes for mounting components	C1-C4, C9-C12: Capacitors for Crystal resonator and power lines (for mounted device) C5-C8, C13-C16: Capacitors for Crystal resonator and power lines (for device on the socket)
	CN1-CN4: Connectors for EVA Board (20pin, 2.54mm pitch)
	PP1-PP2: Pads for resistors connecting to LED
	PP3-PP6: Pads for ferrite beads on the power line
	PP7-PP12: Pads for capacitors on the AIN pins
	PP13-PP15: Pads for capacitors on analog comparator input(noise filter purpose)
	XP1-XP8: Pads for crystal resonators (for mounted device and device on the socket) XR1-XR4: Pads for series resistance of crystal resonator
Other Through holes	VDD, VSS, VDDL1, VDDL2, VDDL3, VDDL4, AIN0-AIN5, CMP0P, CMP0M, CMP1P
Operating voltage	+1.6V to +5.5V
Board size	90.00 mm x 120.00 mm

2. ML620Q134/135/136 Reference Board

Mounted MCU	U1/U2 (The actual device / Socket) : ML620Q134/5/6 (20pin TSSOP)
Other Mounted components	PWR: Jumper for selecting the power supply input (3pin pin-header and short pin)
	MODE: Jumper for selecting PA2/TEST0 pin (3pin pin-header and short pin)
	X1, X2: Crystal resonator (4MHz)
	XT1-XT2: Ceramic resonator (4MHz)
	R1-R2: Resistors for lighting LEDs by PA0 and PB7
	R3: Resistor for pull-up of RESET_N
	PA0, PB7: LEDs
	CNUE: Connector for On-chip debug emulator uEASE (14pin connector)
	C1-C4: Capacitors for Crystal resonator and power lines (for mounted device) C5-C8: Capacitors for Crystal resonator and power lines (for device on the socket)
	Pads (or/and) Through holes for mounting components
PP1-PP2: Pads for resistors connecting to LED	
PP3-PP4: Pads for ferrite beads on the power line	
PP5-PP12: Pads for capacitors on the AIN pins	
PP13-PP15: Pads for capacitors on analog comparator input(noise filter purpose)	
XP1-XP4: Pads for crystal resonators (for mounted device and device on the socket)	
Other Through holes	XR1-XR2: Pads for series resistance of crystal resonator
	VDD, VSS, VDDL1, VDDL2, VDDL3, VDDL4, AIN0-AIN7, CMP0P, CMP0M, CMP1P
Operating voltage	+1.6V to +5.5V
Board size	90.00 mm x 120.00 mm

### 1.2 Reference Board Outline Drawing

The Figure.1 and Figure.2 show the ML620Q131/132/133 Reference Board outline drawing.

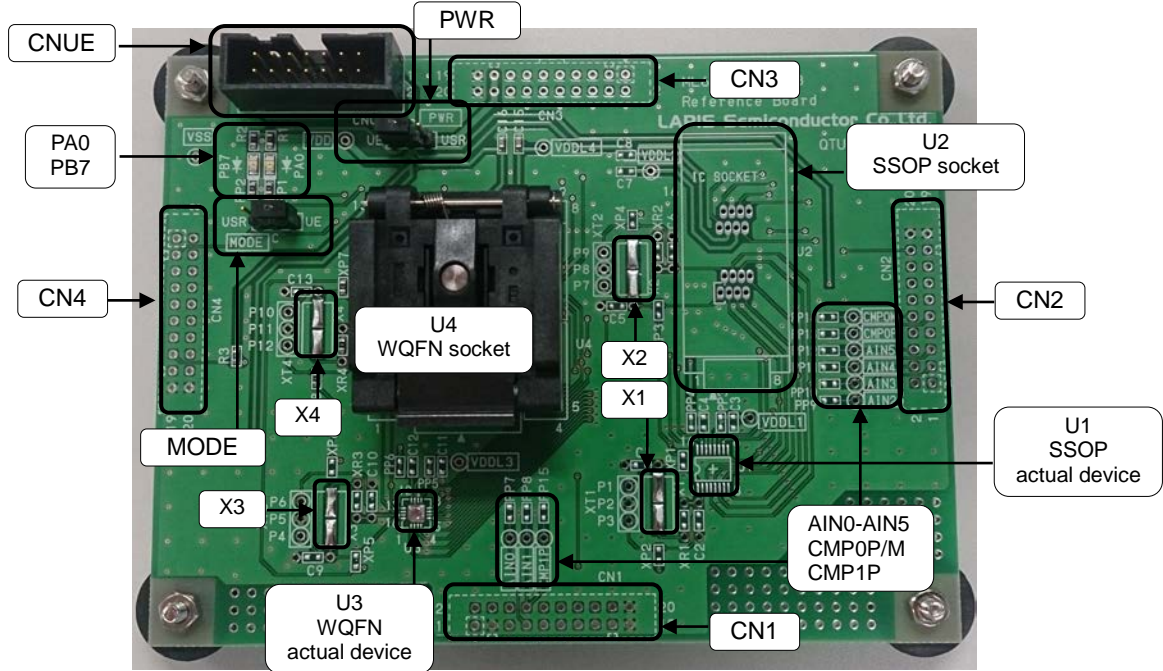


Fig.1 ML620Q131/132/133 Reference Board Outline Drawing

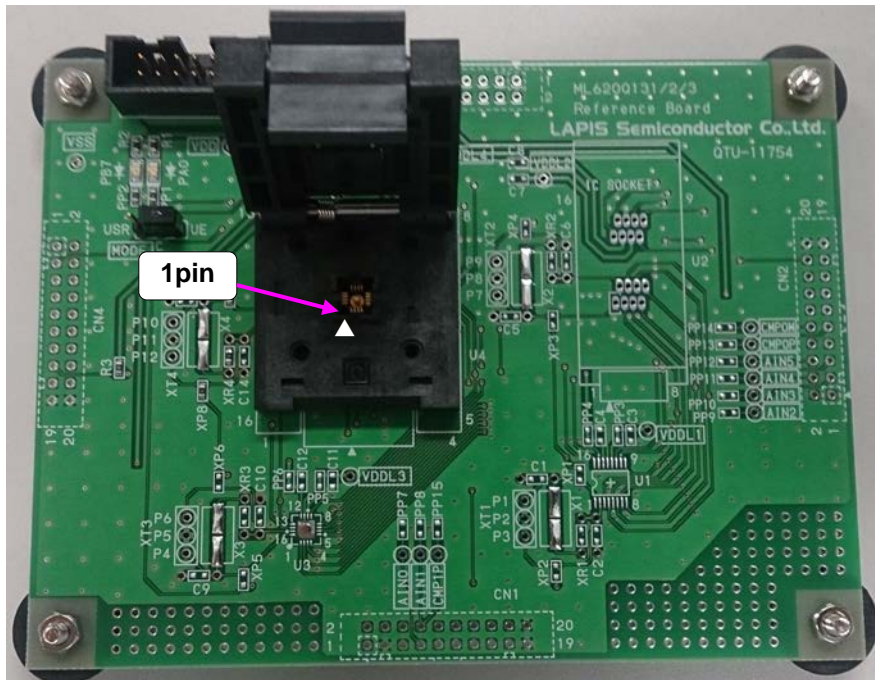


Fig.2 ML620Q131/132/133 Reference Board Socket 1pin direction

**[Note]**

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

The Figure.3 and Figure.4 show the ML620Q134/135/136 Reference Board outline drawing.

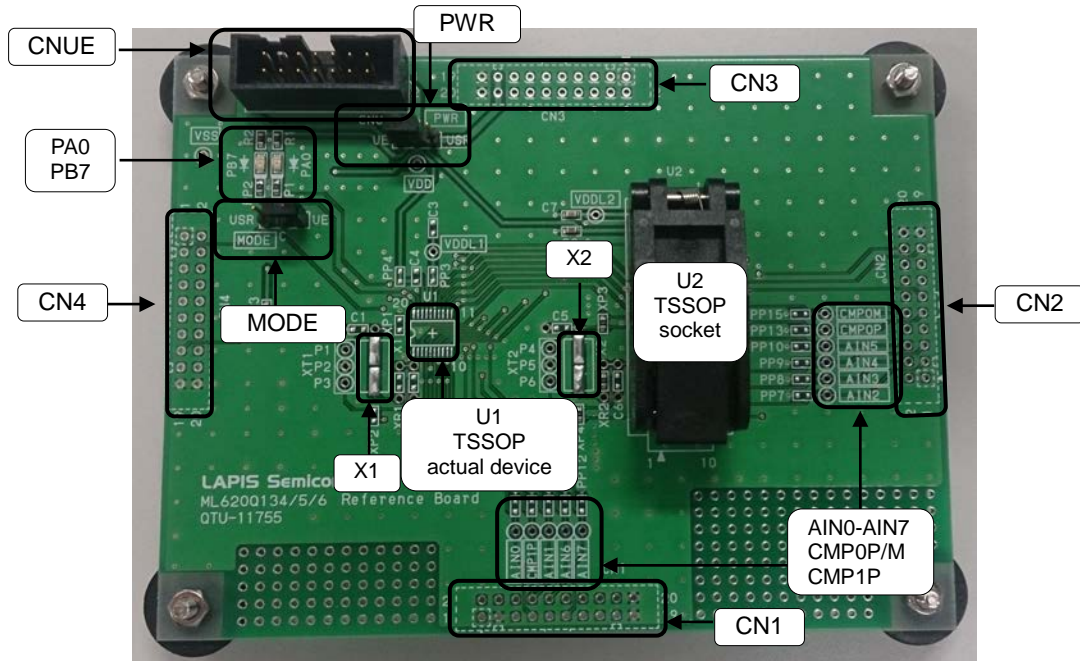


Fig.3 ML620Q134/135/136 Reference Board Outline Drawing

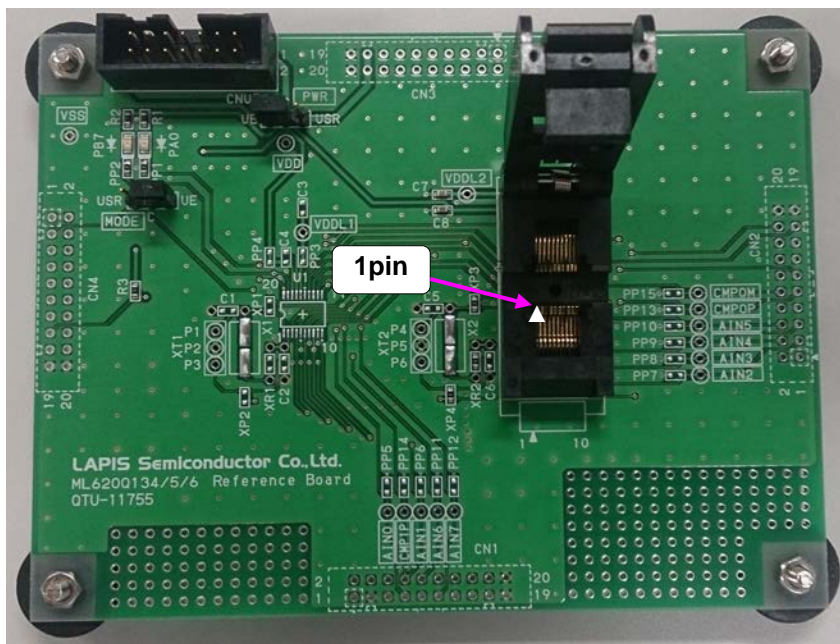


Fig.4 ML620Q134/135/136 Reference Board Socket 1pin direction

**[Note]**

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

## 2. Function of Reference Board

### 2.1 Power Circuit

The Figure.5 shows power circuit of the ML620Q131/132/133 Reference Board.  
 The Figure.6 shows power circuit of the ML620Q134/135/136 Reference Board.

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

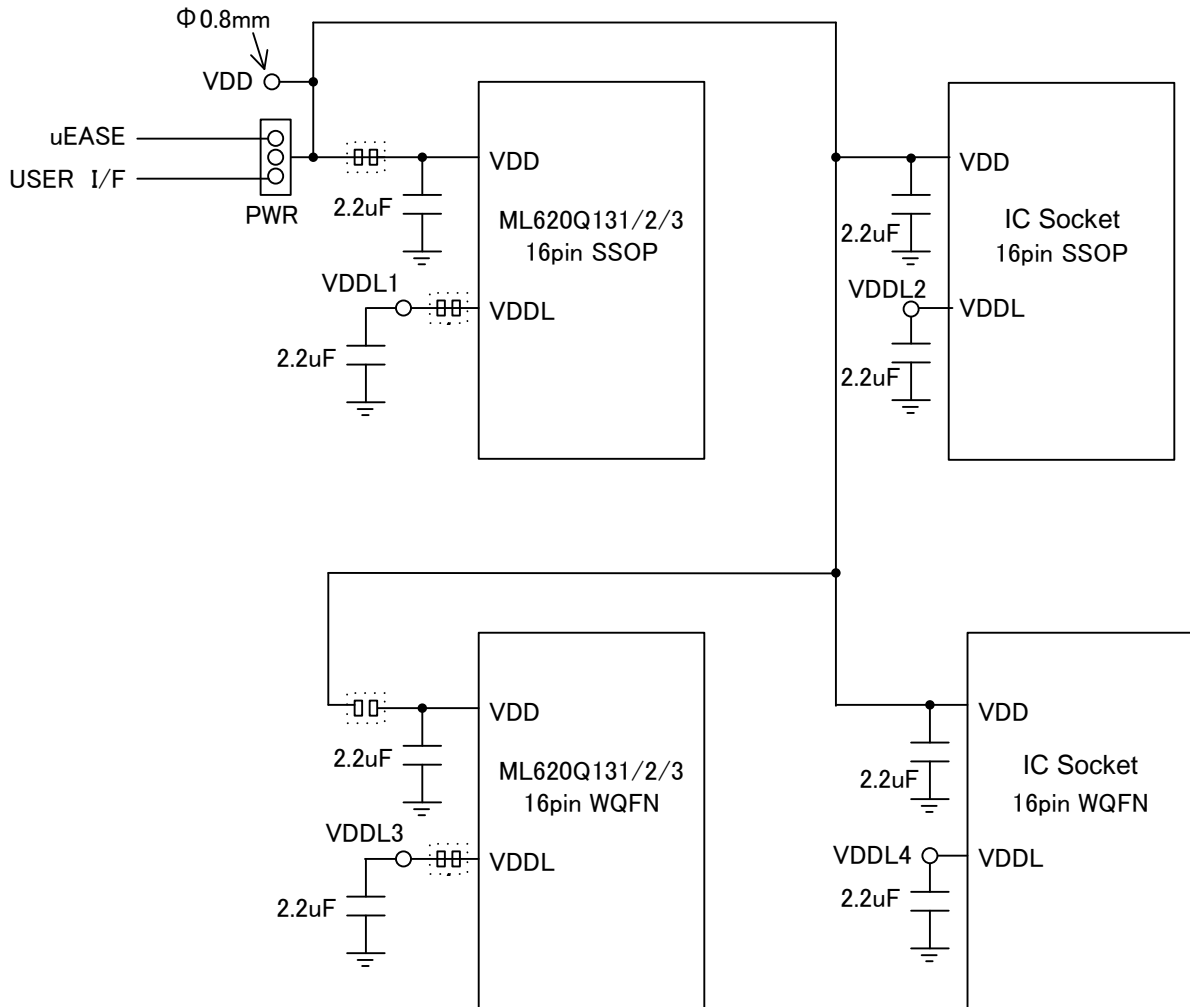


Fig.5 Power Circuit (ML620Q131/132/133 Reference Board)



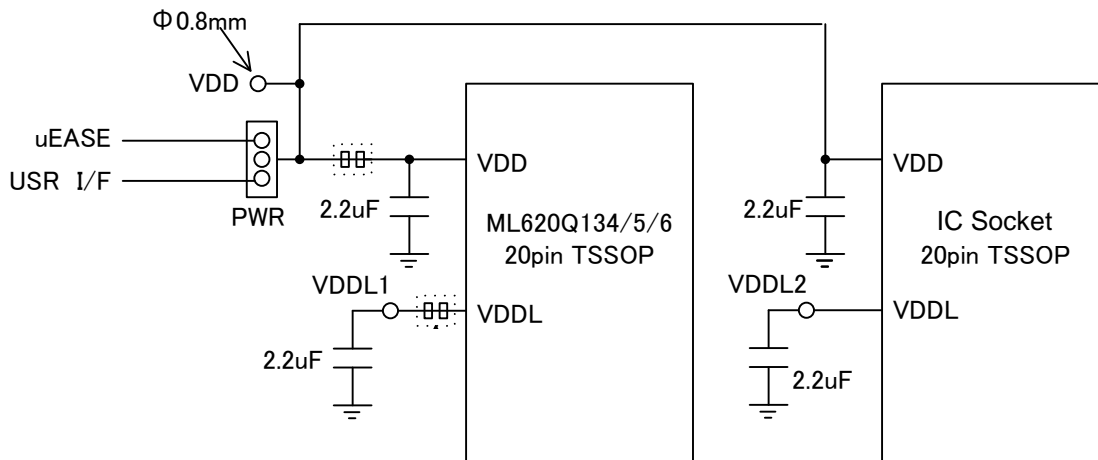


Fig.6 Power Circuit (ML620Q134/135/136 Reference Board)

[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 “USR” on the MODE jumper, uEASE is not available to use and instead PA2/TEST0 pin on the microcontroller is available to use.

## 2.2 High-speed Oscillation Circuit

The Figure.7 shows high-speed oscillation circuit of the ML620Q131/132/133 Reference Board.

The high-speed oscillation circuit is available for each device mounted type(U1 or U3) and socket type (U2 or U4). The 1608 size of pads are prepared so that the PCB wiring capacitance does not affect to the oscillation.

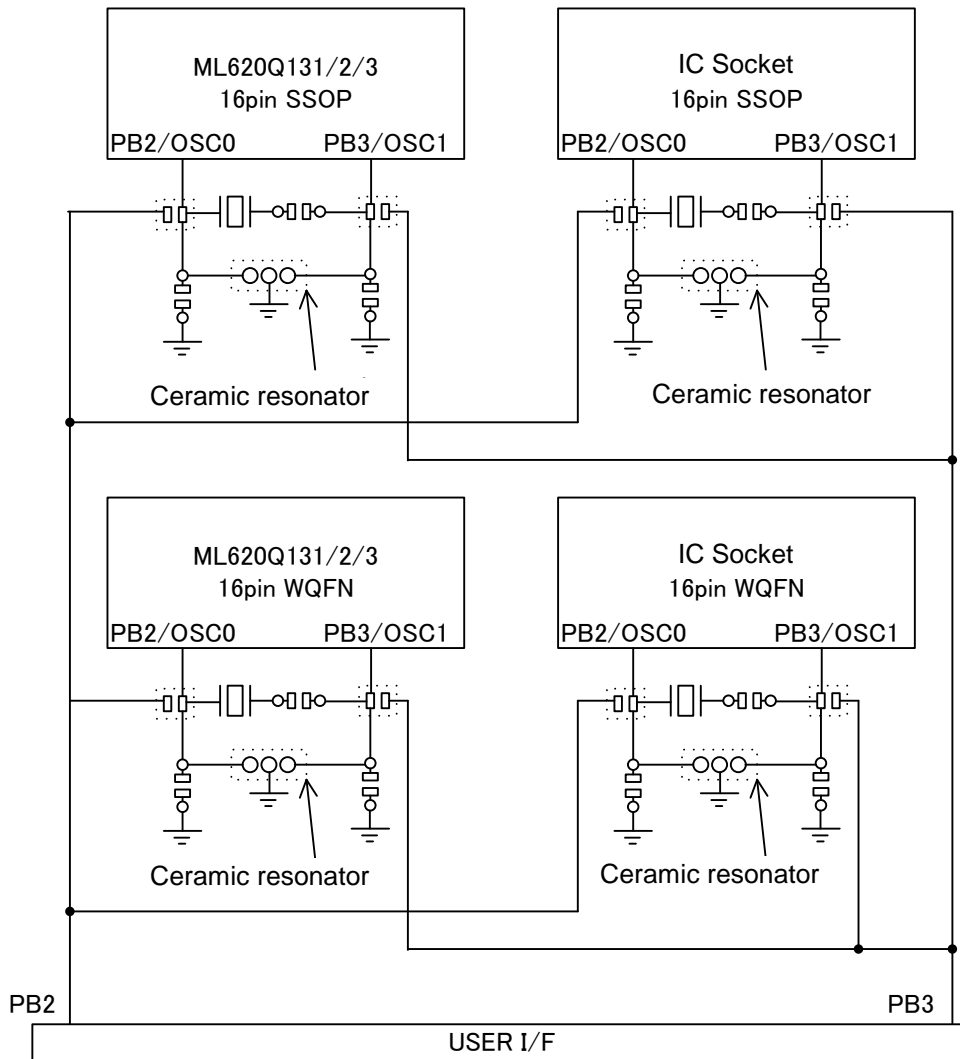


Fig.7 High-speed Oscillation Circuit (ML620Q131/132/133 Reference Board)

The Figure.8 shows high-speed oscillation circuit of the ML620Q134/135/136 Reference Board.

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

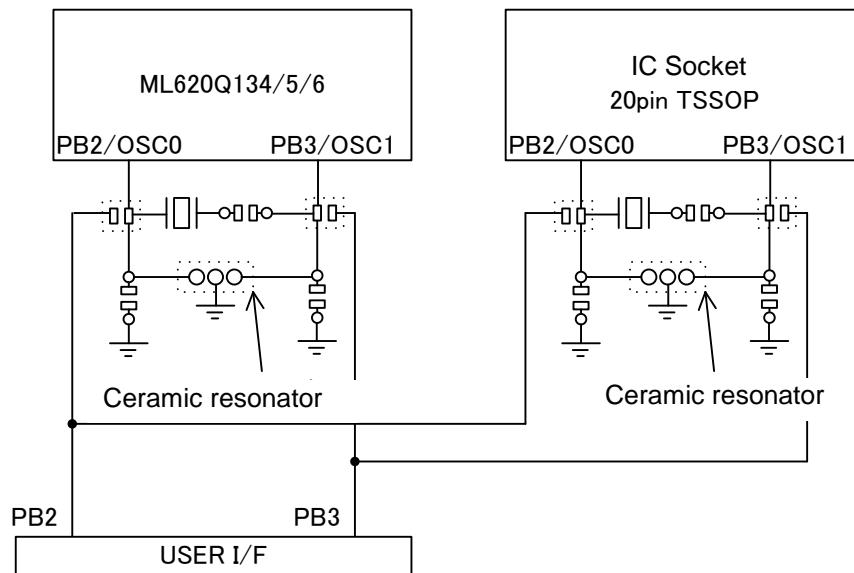


Fig.8 High-speed Oscillation Circuit (ML620Q134/135/136 Reference Board)

### 2.3 AIN Inputs and Analog Comparator Inputs Circuit

The Figure.9 shows AIN inputs and analog comparator inputs of the ML620Q131/132/133 Reference Board. Through-holes(AIN0-AIN5, CMP0P, CMP0N, CMP1P) are available to input voltages directly to the pins of microcontroller.

The 1608 size of pads can be used for external components such as denoising capacitors.

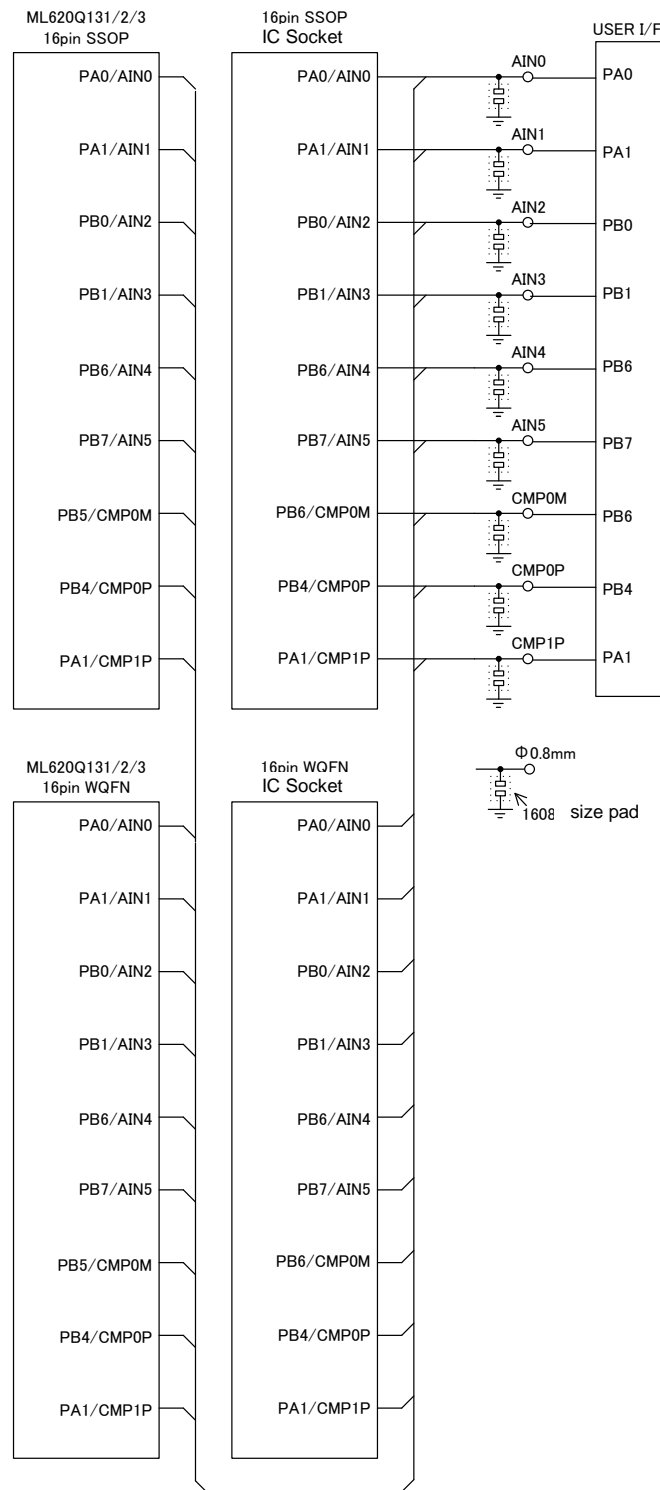


Fig.9 AIN inputs and analog comparator inputs circuit (ML620Q131/132/133 Reference Board)

The Figure.10 shows AIN inputs and analog comparator inputs of the ML620Q134/135/136 Reference Board. Through-holes(AIN0-AIN7, CMP0P, CMP0N, CMP1P) are available to input voltages directly to the pins of microcontroller.

The 1608 size of pads can be used for external components such as denoising capacitors.

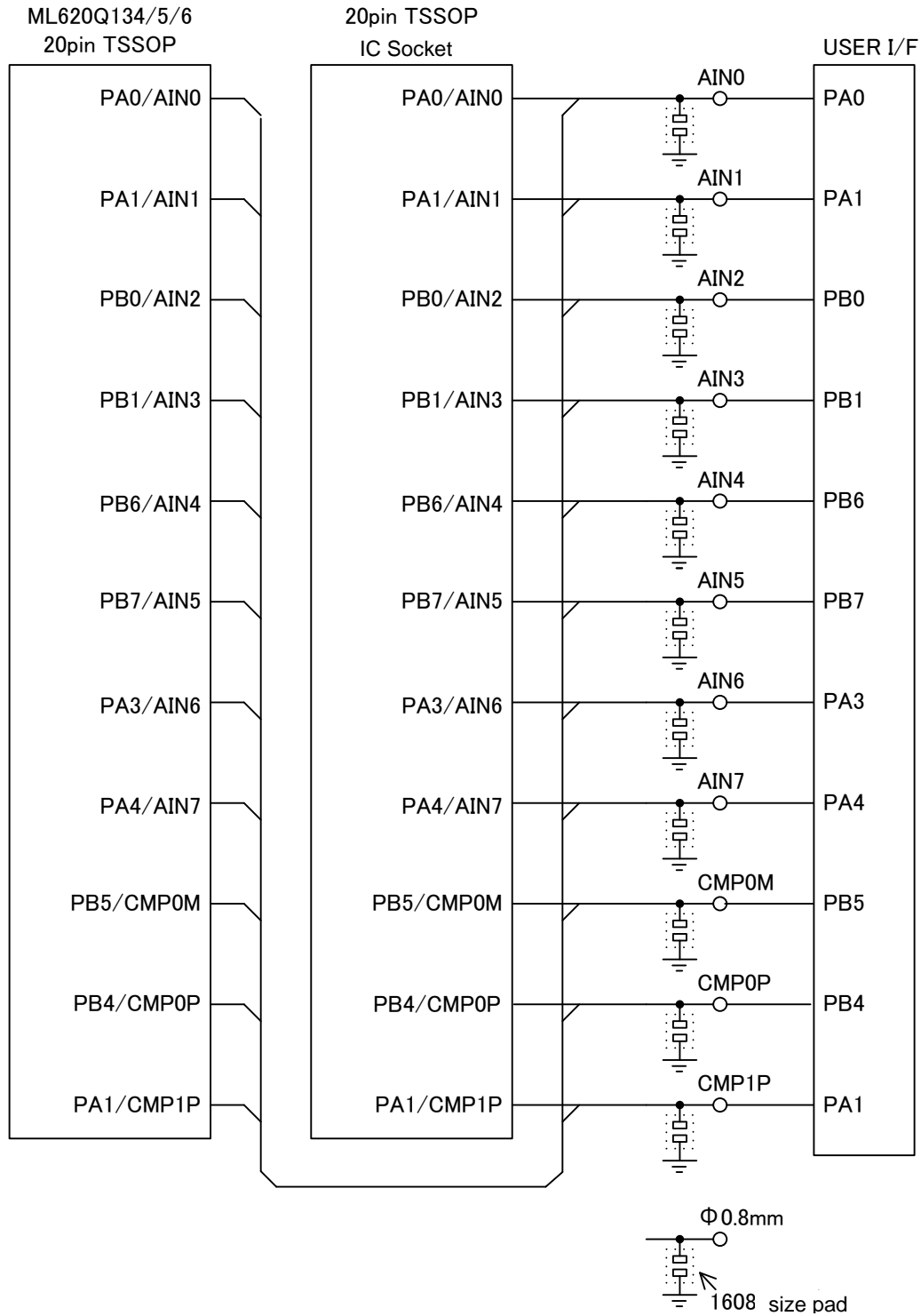


Fig.10 AIN inputs and analog comparator inputs circuit (ML620Q134/135/136 Reference Board)

### 2.4 uEASE Interface

The Figure.11 shows uEASE interface circuit of the ML620Q131/132/133 Reference Board.

The Figure.12 shows uEASE interface circuit of the ML620Q134/135/136 Reference Board.

Selecting a jumper pin on the MODE jumper, one of the on-chip debug emulator uEASE or a general port PA2 is available to use.

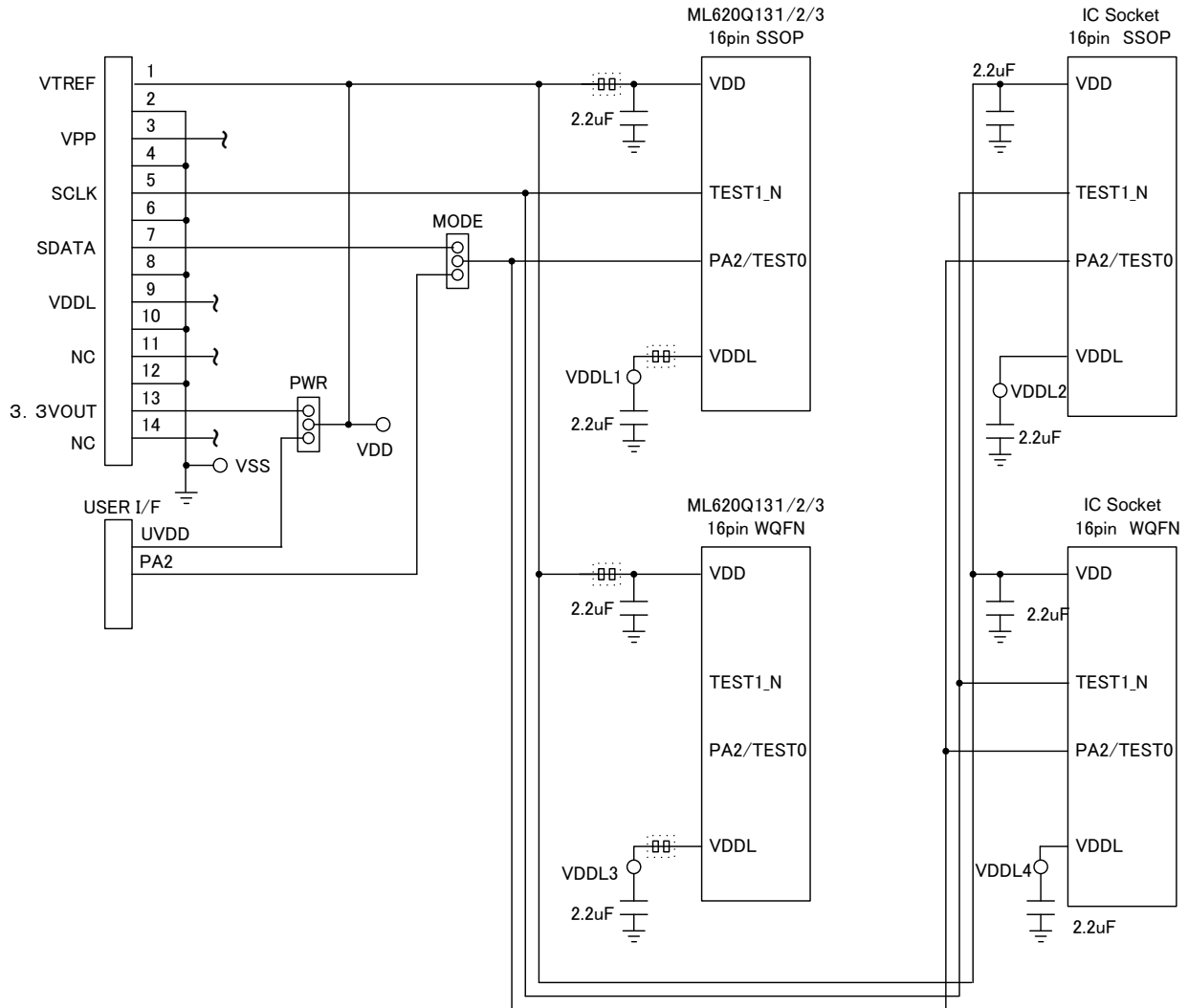


Fig.11 uEASE Interface circuit (ML620Q131/132/133 Reference Board)

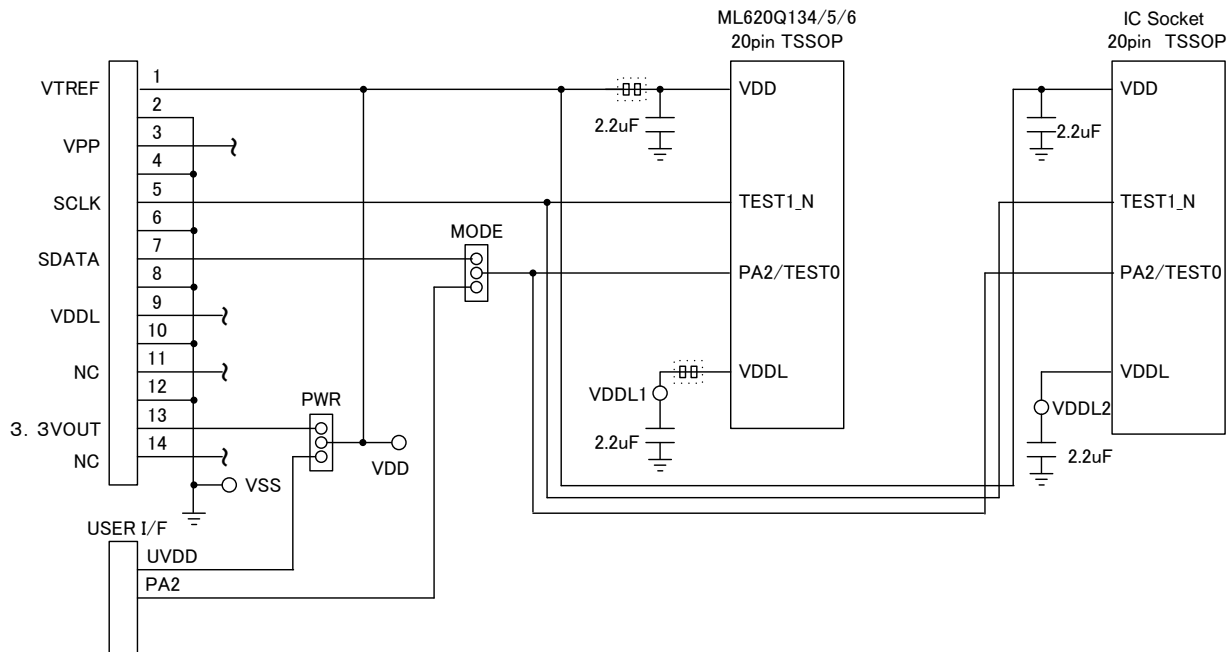


Fig.12 uEASE Interface circuit (ML620Q131/132/133 Reference Board)

[Note]

- When selecting “USR” on the MODE jumper, uEASE is not available to use and instead PA2/TEST0 pin on the microcontroller is available to use.

### 2.5 When using the A/D Converter or Analog Comparator

The through-holes AIN0 to AIN7, CMP0P, CMP0N, CMP1P that are close to the device are prepared to evaluate the A/D converter or analog comparator. Place denoise-purpose capctiors onto the pads PP0 to PP15 if necessary.

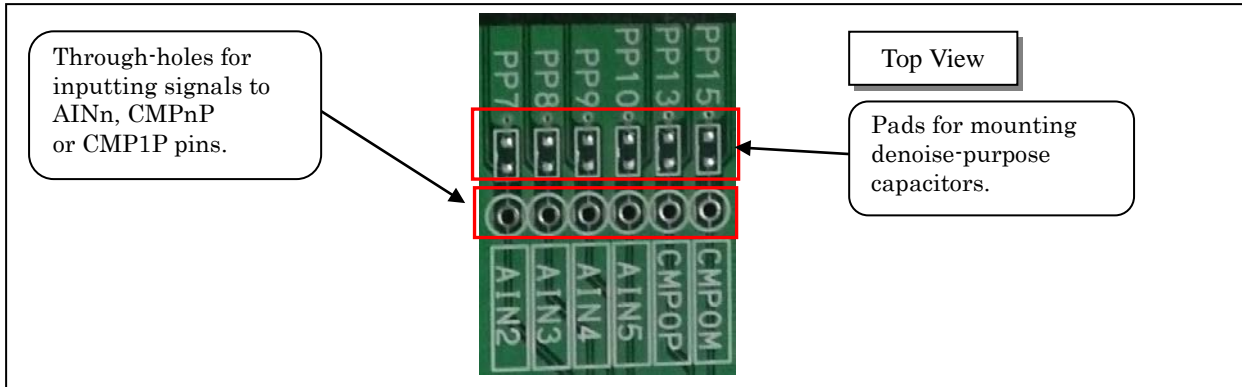


Fig.13 Through-holes and Pads used for A/D converter function

### 2.6 When Not using the LED

PA0, PB7 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.

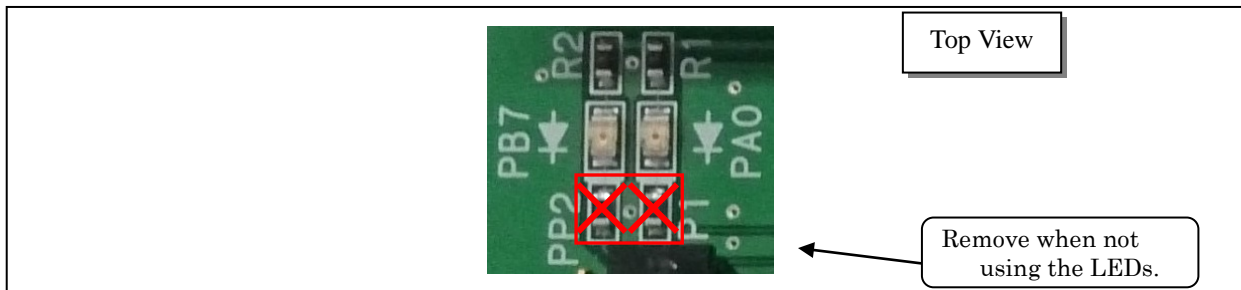


Fig.14 Zero-ohm resistors for LEDs



### 3. User Interface

#### 3.1 ML620Q130 Series Reference Board and ML620Q150A Series EVA Board User Interface

Table 3-1, Table 3-2, Table 3-3 and Table 3-4 show the pin list of the ML620Q130 series reference board and the ML620Q150A series eva board user interface connector CN1, CN2, CN3 and CN4.

Table 3-1. ML620Q130 Series Reference Board and ML620Q150A Series EVA Board User Interface Connector  
CN1 Pin List

CN1	ML620Q150A Series EVA Board	Q131/132/133 RB	Q134/135/136 RB
1	—	—	—
2	—	—	—
3	VSS	VSS	VSS
4	VDDL(TH)	—	—
5	—	—	—
6	VREF	—	—
7	P30/AIN0 Input circuit	PA0/AIN0/RXD1	PA0/AIN0/RXD1
8	P31/AIN1 Input circuit	PA1/AIN1	PA1/AIN1
9	P32/AIN2 Input circuit	—	—
10	P33/AIN3 Input circuit	—	PA3/AIN5
11	P34/AIN4 Input circuit	—	PA4/AIN7
12	P35/AIN5 Input circuit	—	PA5
13	—	—	—
14	—	—	—
15	—	—	—
16	—	—	—
17	—	—	—
18	—	—	—
19	VSS	VSS	VSS
20	VSS	VSS	VSS

Table 3-2. ML620Q130 Series Reference Board and ML620Q150A Series EVA Board User Interface Connector  
CN2 Pin List

CN2	ML620Q150A Series EVA Board	Q131/132/133 RB	Q134/135/136 RB
1	—	—	—
2	—	—	—
3	P42/AIN6 Input circuit or RXD0	PB0/AIN2/RXD0	PB0/AIN2/RXD0
4	P43/AIN7 Input circuit or TXD0	PB1/AIN3	PB1/AIN3
5	P44/AIN8 Input circuit	PB6/AIN4	PB6/AIN4
6	P45/AIN9 Input circuit	PB7/AIN5	PB7/AIN5
7	P46/AIN10 Input circuit	—	—
8	P47/AIN11 Input circuit	—	—
9	—	PB4	PB4
10	—	PB5	PB5
11	—	—	PA6
12	—	—	—
13	—	—	—
14	—	—	—
15	—	—	—
16	—	—	—
17	—	PB2	PB2
18	—	PB3	PB3
19	VSS	VSS	VSS
20	VSS	VSS	VSS

Table 3-3. ML620Q130 Series Reference Board and ML620Q150A Series EVA Board User Interface Connector  
CN3 Pin List

CN3	ML620Q150A Series EVA Board	Q131/132/133 RB	Q134/135/136 RB
1	—	—	—
2	—	—	—
3	—	—	—
4	—	—	—
5	—	—	—
6	—	—	—
7	—	—	—
8	—	—	—
9	—	—	—
10	—	—	—
11	—	—	—
12	—	—	—
13	—	—	—
14	—	—	—
15	—	—	—
16	—	—	—
17	VDD	VDD	VDD
18	VDD	VDD	VDD
19	VSS	VSS	VSS
20	VSS	VSS	VSS

Table 3-4. ML620Q130 Series Reference Board and ML620Q150A Series EVA Board User Interface Connector  
CN4 Pin List

CN4	ML620Q150A Series EVA Board	Q131/132/133 RB	Q134/135/136 RB
1	Push SW	—	—
2	Push SW	—	—
3	Push SW	PA2/EXI2	PA2/EXI2
4	Push SW	—	—
5	Push SW	—	—
6	Push SW	—	—
7	—	—	—
8	—	—	—
9	—	—	—
10	—	—	—
11	—	—	—
12	—	—	—
13	—	—	—
14	—	—	—
15	Push SW	RESET_N	RESET_N
16	—	—	—
17	—	—	—
18	—	—	—
19	VSS	VSS	VSS
20	VSS	VSS	VSS

## 4. 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 ML620Q130 series user's manual and uEASE user's manual when using the board.
- (3) The Reference Board may have an engineering sample of the ML620Q130 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 repairing 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.

## 5. PCB specification and schematic

### 5.1 Reference Board PCB specification

Figure 15. shows the ML620Q131/132/133 Reference Board PCB dimensional outline drawing and layout of components.

PCB part number:

ML620Q131/132/133 Reference Board (QTU-11754)

Dimension:

90mm x 120mm

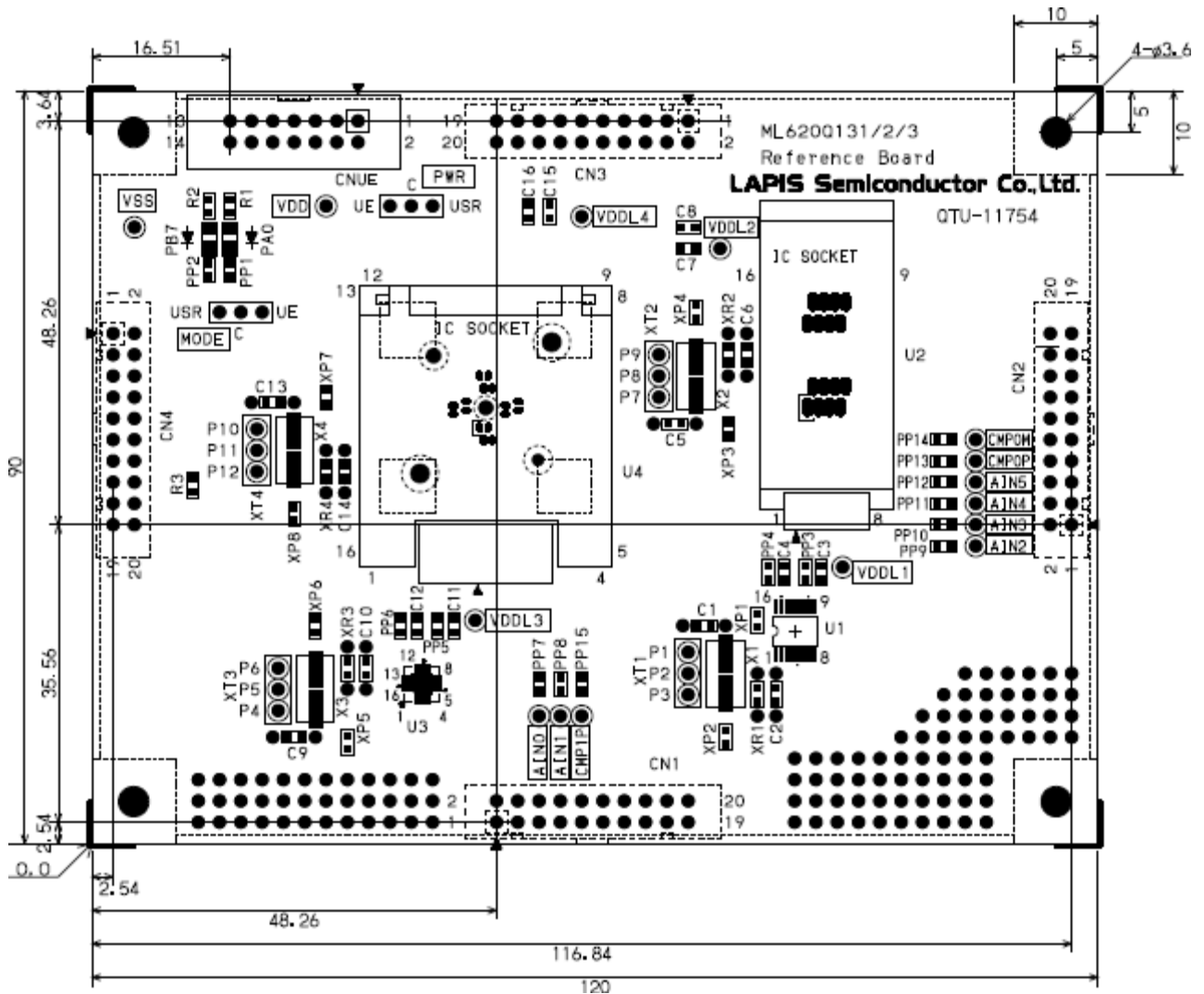


Fig.15 Reference Board PCB dimensional outline drawing and layout of components (ML620Q131/132/133 Reference Board) (Top view)

Figure 16. shows the ML620Q134/135/136 Reference Board PCB dimensional outline drawing and layout of components.

PCB part number:

ML620Q134/135/136 Reference Board (QTU-11755)

Dimension:

90mm x 120mm

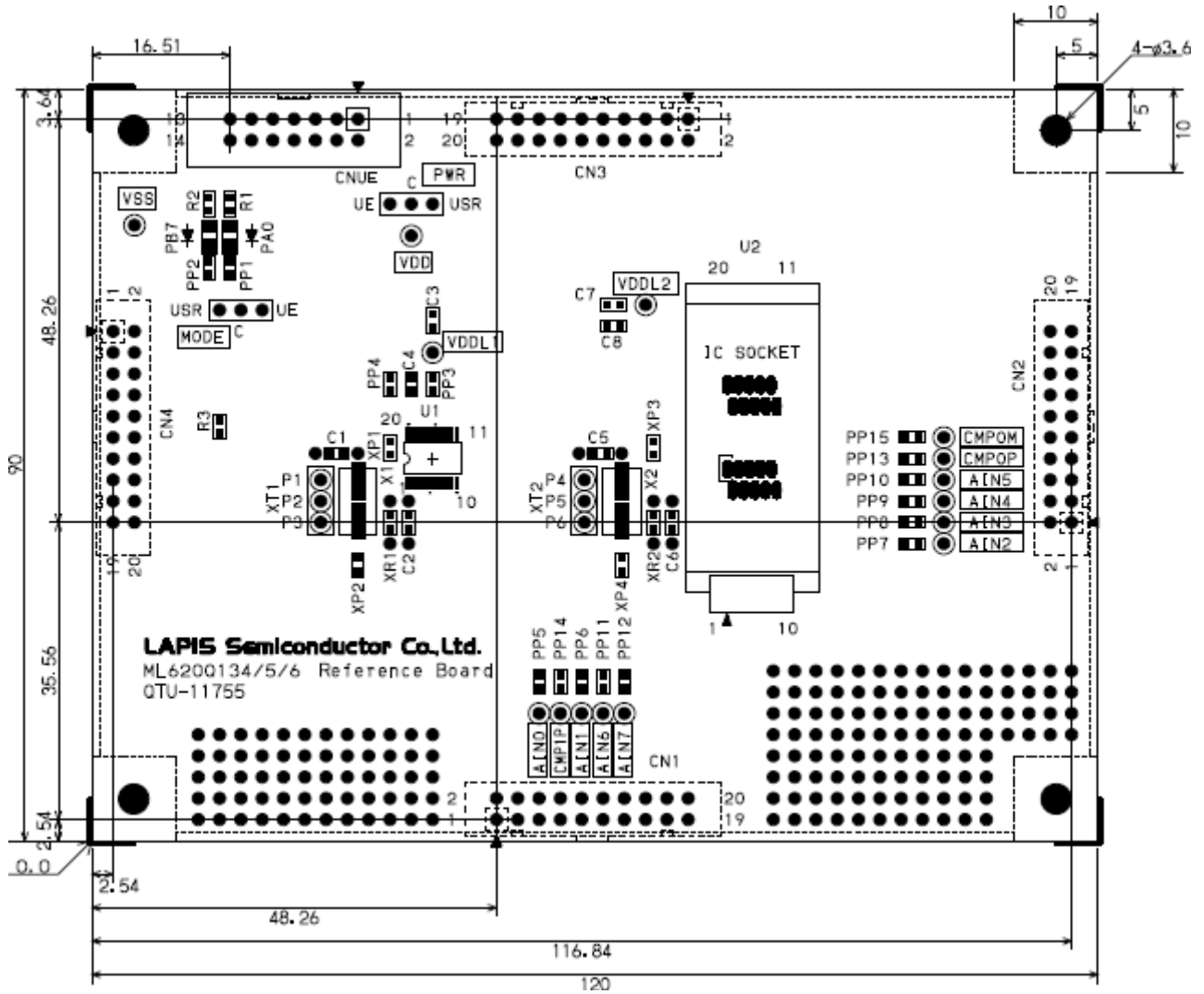


Fig.16 Reference Board PCB dimensional outline drawing and layout of components (ML620Q134/135/136 Reference Board) (Top view)

5.2 Reference Board Schematic

Figure 17. shows the schematic of ML620Q131/132/133 Reference Board.

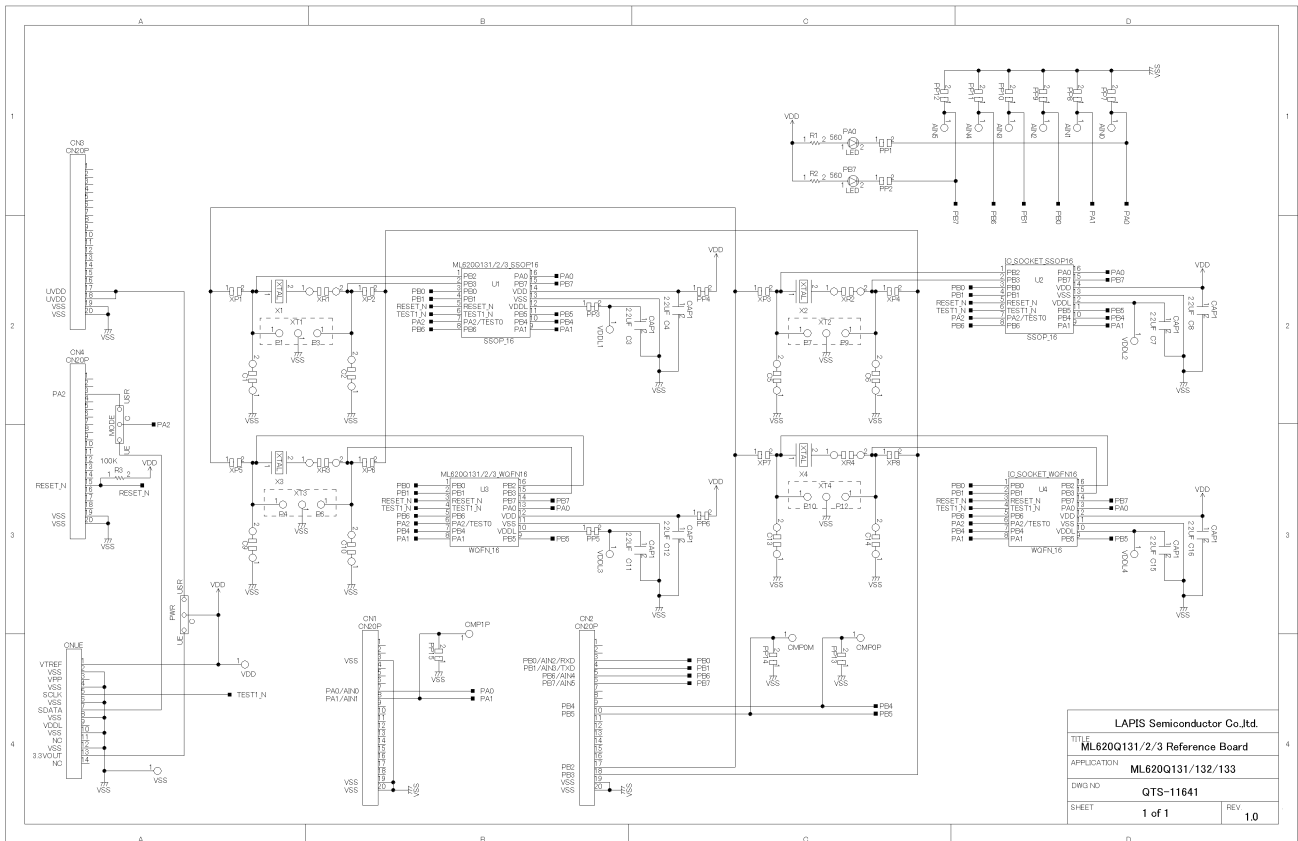


Fig.17 Reference Board Schematic (ML620Q131/132/133 Reference Board)



Figure 18. shows the schematic of ML620Q134/135/136 Reference Board.

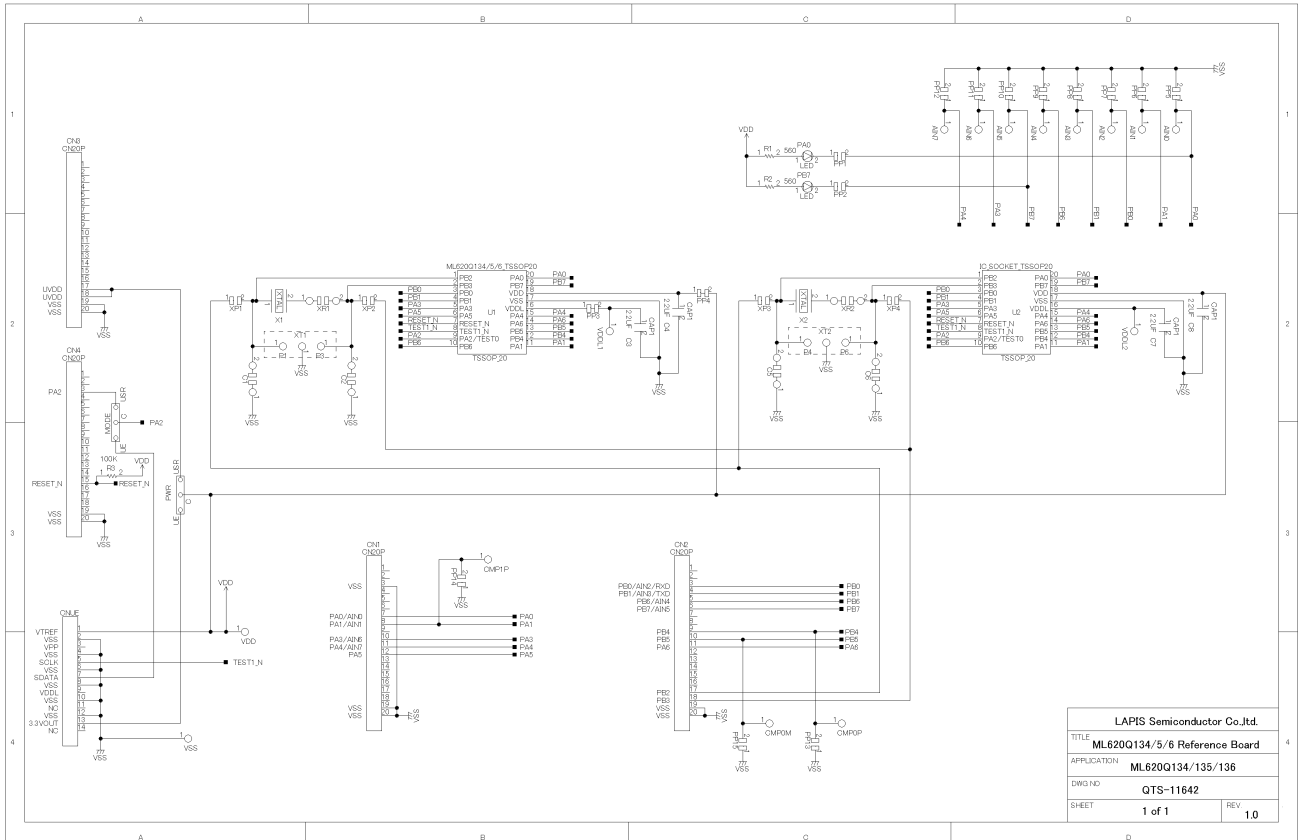


Fig.18 Reference Board Schematic (ML620Q134/135/136 Reference Board)

**REVISION HISTORY**

Document No.	Date	Page		Description
		Previous Edition	Current Edition	
FEBL620Q130RB-01	Nov 5, 2015	–	–	Formal 1 <sup>st</sup> Edition
FEBL620Q130RB-02	Jan 14, 2016	2	2	Update part number and add description

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