

Dear customer

LAPIS Semiconductor Co., Ltd. ("LAPIS Semiconductor"), on the 1<sup>st</sup> day of October, 2020, implemented the incorporation-type company split (shinsetsu-bunkatsu) in which LAPIS established a new company, LAPIS Technology Co., Ltd. ("LAPIS Technology") and LAPIS Technology succeeded LAPIS Semiconductor's LSI business.

Therefore, all references to "LAPIS Semiconductor Co., Ltd.", "LAPIS Semiconductor" and/or "LAPIS" in this document shall be replaced with "LAPIS Technology Co., Ltd."

Furthermore, there are no changes to the documents relating to our products other than the company name, the company trademark, logo, etc.

Thank you for your understanding.

LAPIS Technology Co., Ltd.  
October 1, 2020

# ML620Q504 Reference Board User's Manual

---

Issue Date: Jan 14, 2015

### Notes

- 1) The information contained herein is subject to change without notice.
- 2) Although LAPIS Semiconductor is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors. Therefore, in order to prevent personal injury or fire arising from failure, please take safety measures such as complying with the derating characteristics, implementing redundant and fire prevention designs, and utilizing backups and fail-safe procedures. LAPIS Semiconductor shall have no responsibility for any damages arising out of the use of our Products beyond the rating specified by LAPIS Semiconductor.
- 3) Examples of application circuits, circuit constants and any other information contained herein are provided only to illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.
- 4) The technical information specified herein is intended only to show the typical functions of the Products and examples of application circuits for the Products. No license, expressly or implied, is granted hereby under any intellectual property rights or other rights of LAPIS Semiconductor or any third party with respect to the information contained in this document; therefore LAPIS Semiconductor shall have no responsibility whatsoever for any dispute, concerning such rights owned by third parties, arising out of the use of such technical information.
- 5) The Products are intended for use in general electronic equipment (i.e. AV/OA devices, communication, consumer systems, gaming/entertainment sets) as well as the applications indicated in this document.
- 6) The Products specified in this document are not designed to be radiation tolerant.
- 7) For use of our Products in applications requiring a high degree of reliability (as exemplified below), please contact and consult with a LAPIS Semiconductor representative: transportation equipment (i.e. cars, ships, trains), primary communication equipment, traffic lights, fire/crime prevention, safety equipment, medical systems, servers, solar cells, and power transmission systems.
- 8) Do not use our Products in applications requiring extremely high reliability, such as aerospace equipment, nuclear power control systems, and submarine repeaters.
- 9) LAPIS Semiconductor shall have no responsibility for any damages or injury arising from non-compliance with the recommended usage conditions and specifications contained herein.
- 10) LAPIS Semiconductor has used reasonable care to ensure the accuracy of the information contained in this document. However, LAPIS Semiconductor does not warrant that such information is error-free and LAPIS Semiconductor shall have no responsibility for any damages arising from any inaccuracy or misprint of such information.
- 11) Please use the Products in accordance with any applicable environmental laws and regulations, such as the RoHS Directive. For more details, including RoHS compatibility, please contact a ROHM sales office. LAPIS Semiconductor shall have no responsibility for any damages or losses resulting non-compliance with any applicable laws or regulations.
- 12) When providing our Products and technologies contained in this document to other countries, you must abide by the procedures and provisions stipulated in all applicable export laws and regulations, including without limitation the US Export Administration Regulations and the Foreign Exchange and Foreign Trade Act.
- 13) This document, in part or in whole, may not be reprinted or reproduced without prior consent of LAPIS Semiconductor.

Copyright 2015 LAPIS Semiconductor Co., Ltd.

---

## LAPIS Semiconductor Co.,Ltd.

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

### Preface

This manual describes the operation of the ML620Q504 Reference Board, which the ML620Q504, LAPIS SEMICONDUCTOR's ultra low-power 16-bit microcontroller is mounted.

The following manuals are also available. Please read them as necessary.

- ML620Q504 User's Manual  
Description on the ML620Q504 hardware
  
- uEASE User's Manual  
Description on the on-chip debug tool uEASE

### 1. Hardware overview

The ML620Q504 Reference Board is prepared for having you study the operations of the ML620Q504. By connecting the on-chip debug emulator uEASE ( hereafter “uEASE”) , the ML620Q504 Reference Board enables software development, debug and Flash programming into the device with using the software development tool bundled with the uEASE.

This board also works in stand-alone mode without uEASE bus supplying power externally. Before starting work with this board, please read below carefully and understand notices.

#### 1.1 Features

- On-chip debugging and Flash programming are supported by using the TEST0 pin and TEST1\_N pin,
- Power supply can be provided from the uEASE or the customer's target board.

#### 1.2 Hardware Specifications

The hardware specifications of this reference board are shown in the following table.

Embedded microcontroller	ML620Q504 Reference Board U1: ML620Q504
Embedded components	JP1: Jumper for selecting power supply ( 3pin pin-header and short pin )
	JP2: Jumper for selecting reference voltage for SA-ADC (VREF) ( 3pin pin-header and short pin )
	CNuE: Connector for on-chip debug emulator ( 14pins )
	SW1: Switch for reset input ( tact switch )
	SW2: Switch for P51 input ( tack switch )
	SW3: Switch for hardware re-mapping *
	LED1-2: LED ( LED1 and LED2 are connected with P52 and P53 respectively )
	XT1: 32.768kHz crystal
	XT3: 16MHz ceramic oscillator
Operating Voltage	+1.8V ~ +3.6V
Size	71.12 mm x 53.34 mm

\* Please refer to “Boot Area Remap Function by Hardware” of the user's manual of ML620Q504

1.3 View of the ML620Q504 reference board

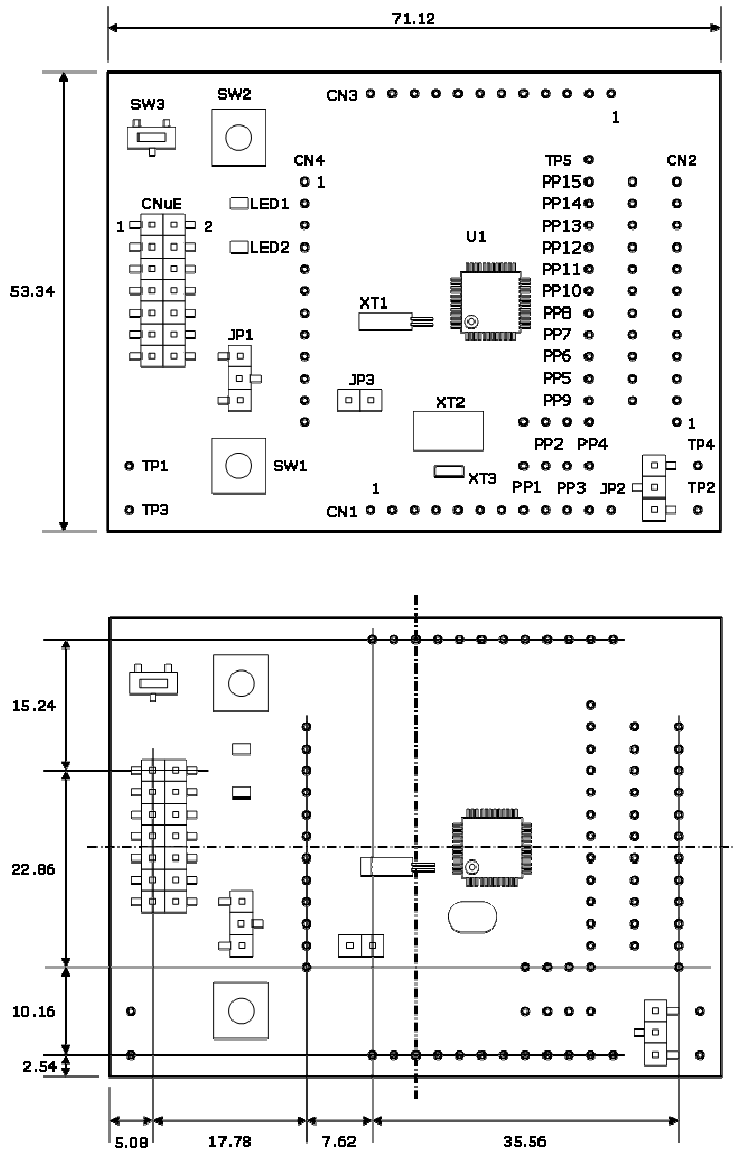
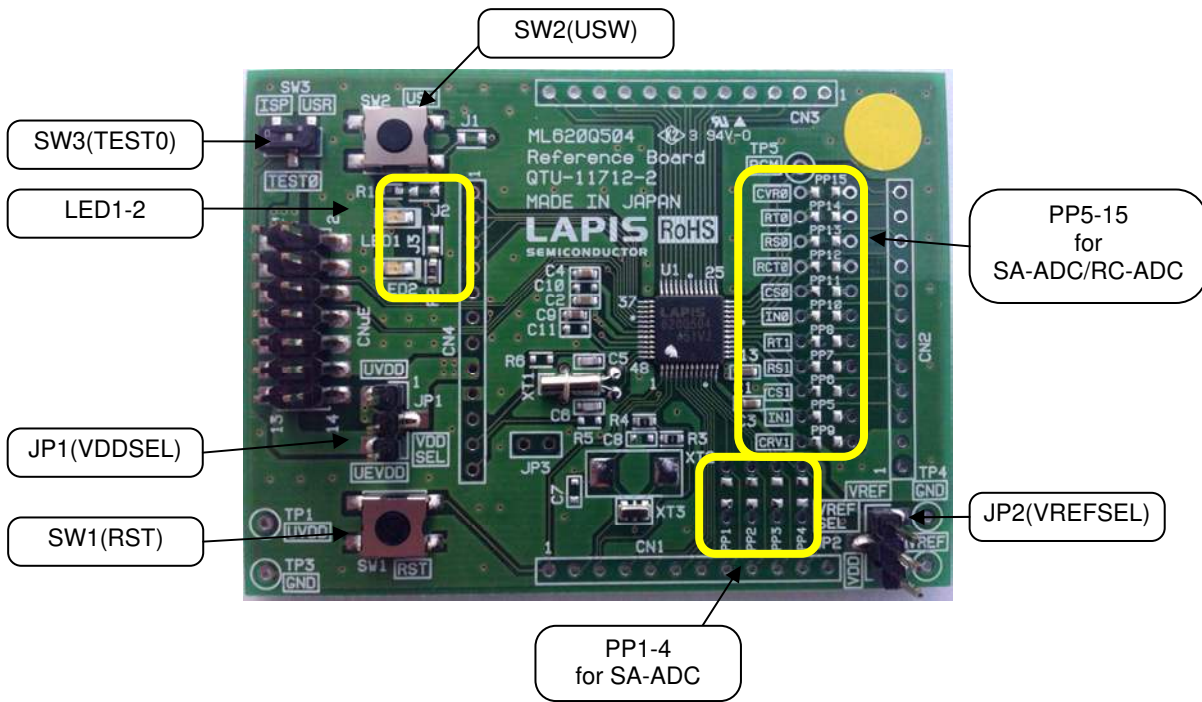


Figure 1 The ML620Q504 reference board size and external components

2. Function



2.1 Jumper for Power Supply

	Connect between ① and ②	Connect between ② and ③
JP1(VDDSEL)	Supply power from TP1(UVDD)	Supply power from the uEASE. The current supply capability of the uEASE is 100mA @3.3V.
JP2(VREFSEL)	VREF is provided from TP1(UVDD) .	VREF is provided from TP2(VREF).

2.2 SW1(RST)

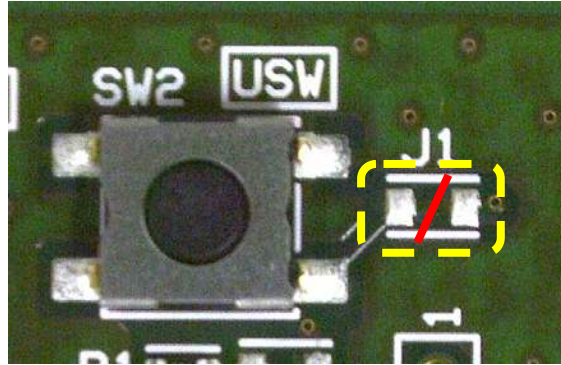
SW1 is a tack switch connected to the RESET\_N pin. By pressing this SW1, the ML620Q504 causes reset.

### 2.3 SW2(USW)

SW2 is a tack switch connected to the P51 pin.

When use the P51 pin, please connect the pull-up resistor by setting SFR of the ML620Q504.

When remove this SW2, please cut the PCB pattern at J1 as shown in the below picture.



Cut the PCB pattern at J1

### 2.4 SW3(TEST0)

SW3 is used for selecting hardware re-mapping.

When use hardware re-mapping, please set this SW3 to “ISP”.

When do not use hardware re-mapping, please set this SW3 to “USR”.

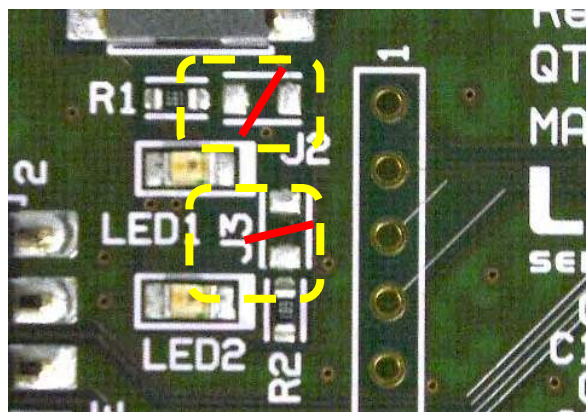


### 2.5 LED1-2

LED1 and LED2 are connected with P52 and P53 respectively.

When use LED, please set the P52 and P53 into N-ch open-drain output by setting SFR of the ML620Q504. By output “0” at P52 and P53, LED1 and LED2 turns on respectively.

When do not use LED1 and LED2, please cut the PCB pattern at J2 and J3 as shown in the below picture.

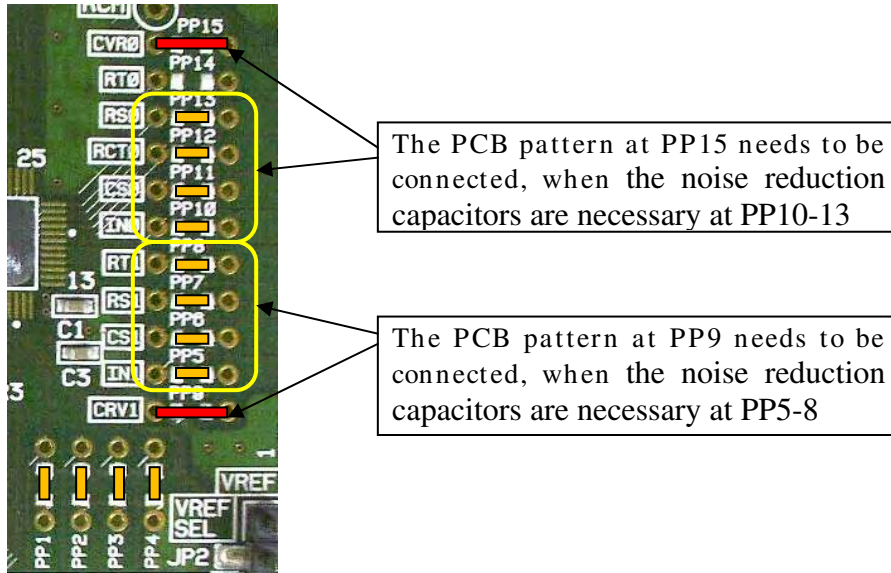


Cut the PCB pattern at J2 and J3



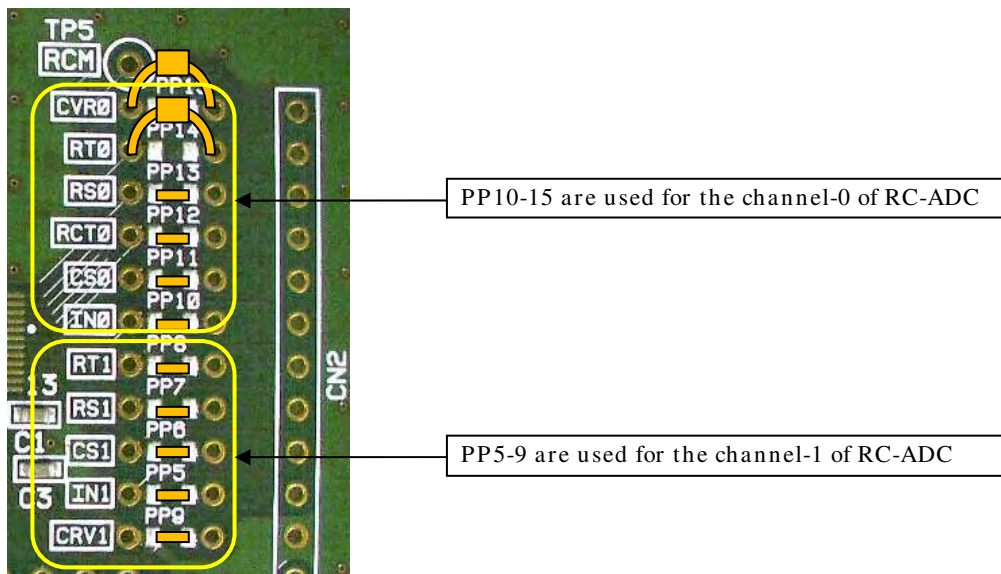
## 2.6 SA-ADC

When use the SA-ADC, please connect the input to be measured at the P34-37(AIN0-3), P20-23(AIN4-7) or P00-03(AIN8-11). When use the noise reduction capacitor for AIN0-11, please connect at PP1-4, PP5-8 or PP10-13. And please note that the PCB pattern at PP9 needs to be connected, when the noise reduction capacitors are necessary at PP5-8, and also the PCB pattern at PP15 needs to be connected, when the noise reduction capacitors are necessary at PP10-13.



## 2.7 RC-ADC

When use the channel-0 of RC-ADC, please connect capacitors and resisters at PP10-15. When use the channel-1 of RC-ADC, please connect capacitors and resisters at PP5-9. RC oscillation can be monitored at TP5(RCM).

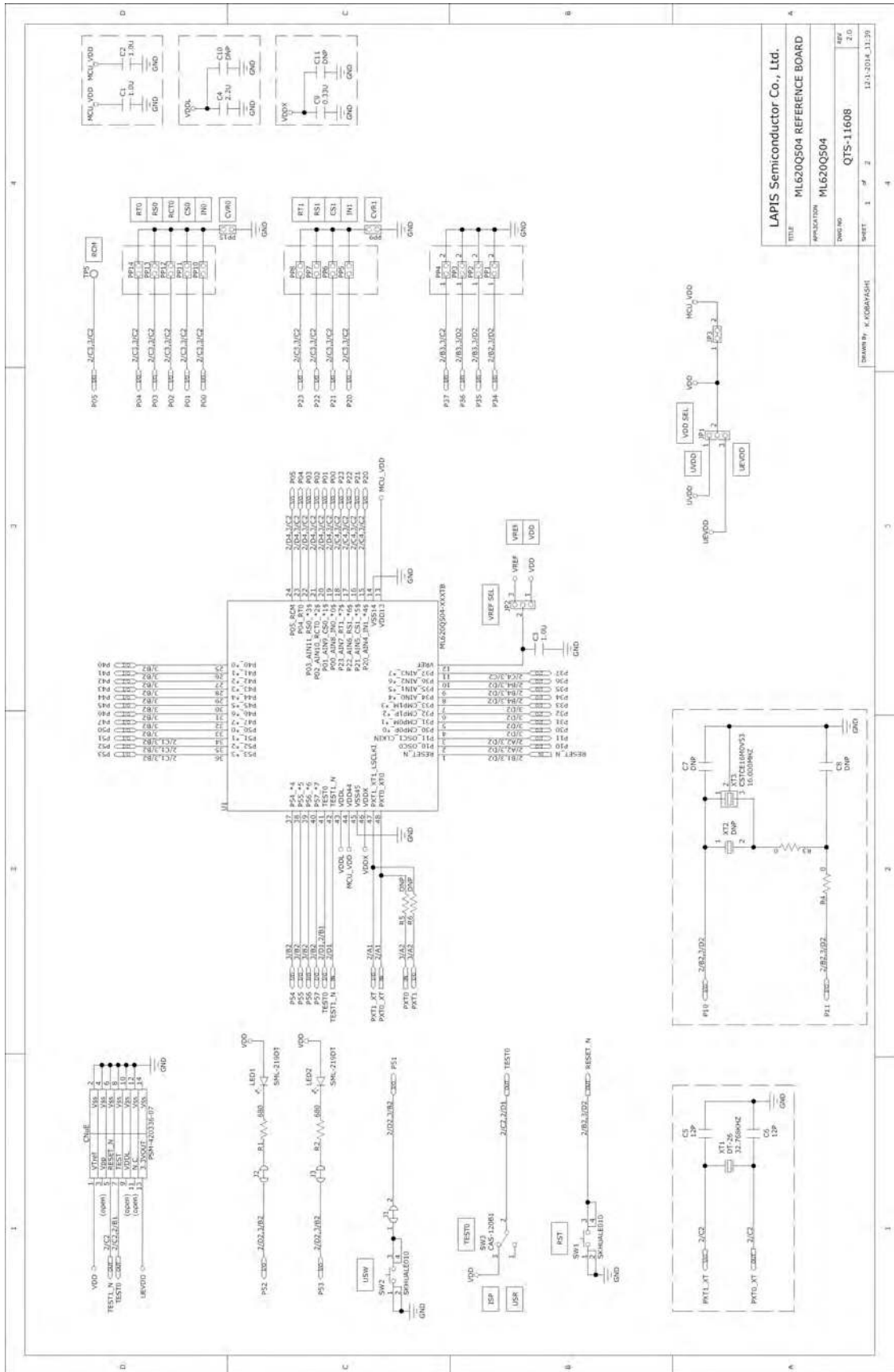


### 3. Important notice

- (1) Please read and understand the ML620Q504 user's manual and uEASE user's manual, before using the ML620Q504 reference board.
- (2) The reference board may sometime use the engineering sample of the ML620Q504. Therefore please use the mass production part of the ML620Q504 for final evaluation of the customer's system.
- (3) When set the JP1 jumper to use UVDD and connect the uEASE to the ML620Q504 reference board, please power on the customer's target board first before activate the uEASE. And also power-off the uEASE first before power off the customer's target board.
- (4) When set the JP1 jumper to use UVDD, the current supply capability of the uEASE is 100mA @3.3V.
- (5) The ML620Q504 has PCB layout in back surface. Therefore when put this board on a conductive material, it may cause malfunction due to causing a short circuit. Please use an insulation sheet or attach legs to prevent a short circuit.
- (6) LAPIS Semiconductor will not provide any support for this board, but the board can be exchanged with a new product only when it has an initial failure.

4. Circuit diagram

(1/2)



LAPIS Semiconductor Co., Ltd.			
TITLE	ML620Q504 REFERENCE BOARD		
APPLICATION	ML620Q504		
DATE/NO	QTS-11608		
REV.	2.0		
SHEET	1 of 2	12-1-2014-11:39	



## 5. Parts list

	Parts Number	Silk	Contents	Package Type	Qty.	Maker
1	GRM188B31C105K	C1-3	Ceramic Capacitor 1.0 $\mu$ F/16V B	1608	3	MURATA
2	GRM188B31C225K	C4	Ceramic Capacitor 2.2 $\mu$ F/16V B	1608	1	MURATA
3	GRM1882C1H120J	C5-6	Ceramic Capacitor 12pF/50V CH	1608	2	MURATA
		C7-8	Do Not Place	1608	2	MURATA
4	GRM188B11A334K	C9	Ceramic Capacitor 3.3 $\mu$ F/10V B	1608	1	MURATA
5	GRM188B316xxxK	C10-11	Do Not Place	1608	2	-
6	A2-12PA-2.54DSA(71)	CN1-4	Do Not Place	12PIN	4	HIROSE
7	PSM-420336-07	CNuE	14pin Header	14PIN	1	HIROSUGI
8	J1608	J1-3	Do Not Place	2012	3	-
9	PSM-410336-03	JP1-2	3pin Header	3PIN	2	HIROSUGI
11	XJ8C-0211	JP3	Do Not Place	2PIN_S	1	OMRON
12	SML-219DT	LED1-2	LED Orange	2012	2	ROHM
13	TH	PP1-15	Do Not Place	2PIN	15	-
14	MCR03EZPJ681	R1-2	Resistor 680 $\Omega$	1608	2	ROHM
	MCR03EZPJ000	R3-4	Resistor 0 $\Omega$	1608	2	ROHM
		R5-6	Do Not Place	1608	2	ROHM
16	SKHUALE010	SW1-2	Tact Switch	4PIN	2	ALPS
17	CAS-120B1	SW3	Jumper Switch	3PIN	1	COPAL
18	LC-2-G(R)	TP1-2	Do Not Place	TH	2	MAC EIGHT
19	LC-2-G(B)	TP3-4	Do Not Place	TH	2	MAC EIGHT
20	LC-2-G(Y)	TP5	Do Not Place	TH	1	MAC EIGHT
21	ML620Q504-nnnTB	U1	MCU	48PQFP	1	LAPIS
22	DT-26 CL=6pF	XT1	Crystal Unit 32.768KHz	2PIN	1	DAISHINKU
23	NX8045GB-16.000M-STD-CSF-6	XT2	Do Not Place	2PIN	1	NDK
24	CSTCE16M0V53	XT3	Ceramic Resonator 16.000MHz	3PIN	1	MURATA
25	QTU-11712-2	-	PCB	-	1	LAPIS
26	JS-41060	-	Short Socket	-	3	HIROSUGI
27	B-P40	-	Anti-Vibration Feet	-	4	TAKACHI