

# ML70Q5111LA

## Bluetooth Baseband Controller IC

### GENERAL DESCRIPTION

The ML70Q5111LA is a CMOS digital IC for use in 2.4 GHz band Bluetooth™ systems. This IC incorporates the ARM7TDMI® as the CPU core, features a highly expandable architecture, and supports the interfaces for a variety of applications. Used in conjunction with the ML7050LA (Bluetooth RF Transceiver IC) and the OKI Bluetooth Protocol Stack Software, data/voice communications are possible while maintaining interconnectivity with other Bluetooth systems. Also this IC is equipped with 4 Mbit Flash ROM to reduce the external parts.

### FEATURES

- Compliant to Bluetooth Specification (Ver. 1.1)
- The ARM7TDMI® is installed as the CPU (operation at a maximum of 32 MHz in this LSI)
- 1-Ch, 16-bit auto-reload timer
- 3-Ch, 18-bit auto-reload timer
- Interrupt controller (17 causes)
- Built-in 8 kbyte, 4-Way Unified Cache
- Built-in 32 kbyte
- Up to a total of 2 Mbyte of SRAM, ROM, and Flash ROM can be connected to the external memory bus.
- Built-in 4Mbit Flash ROM
  - Endurance 10<sup>4</sup> cycles
- Selectable master clock (12/13/16 MHz).
- PCM-CVSD transcoder is installed.
- Installed interfaces:
  - UART<sup>(\*)</sup> interface (Up to 921.6 Kbps)
  - USB<sup>(\*)</sup> interface (conforms to USB1.1)
  - UART/synchronous serial port interface
  - General-purpose I/O interface (programmable interrupts)
  - PCM interface (PCMLinear/A-law/μ-law can be selected)
  - JTAG interface
- (\*) This mark indicates interfaces that support the HCI command.
- Built-in Regulator and Power-on-Reset
- Single power supply voltage: 3.0 to 3.6 V
- Package: 144-pin BGA (P-LFBGA144-1111-0.80-MC)  
(Dimensions: 11 mm × 11 mm × 1.5 mm; pin pitch: 0.8 mm)



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Thumb is trademark of ARM Ltd., UK.

BLUETOOTH is a trademark owned by Bluetooth SIG, Inc. and licensed to Oki Electric Industry.

The information contained herein can change without notice owing to the product being under development.

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Conditions	Rating	Unit
Power supply voltage	$V_{DD}$	—	-0.3 to +4.5	V
Input voltage	$V_I$	—	-0.3 to +4.5	V
Allowable power dissipation	$P_d$	—	1.35	W
Storage temperature	$T_{stg}$	—	-55 to 150	°C

**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply voltage	$V_{DD}$	—	3.0	3.3	3.6	V
“H” level input voltage	$V_{ih}$	—	2.2	—	3.6	V
“L” level input voltage	$V_{il}$	—	0	—	0.8	V
Operating temperature	$T_a$	—	-40	—	85	°C

**INTERNAL FLASH ROM PROGRAMMING CONDITIONS**

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage	$V_{DD}$	—	3.0	3.3	3.6	V
Operating temperature	$T_a$	During Read	-40	—	85	°C
		During Programming	0	—	85	°C

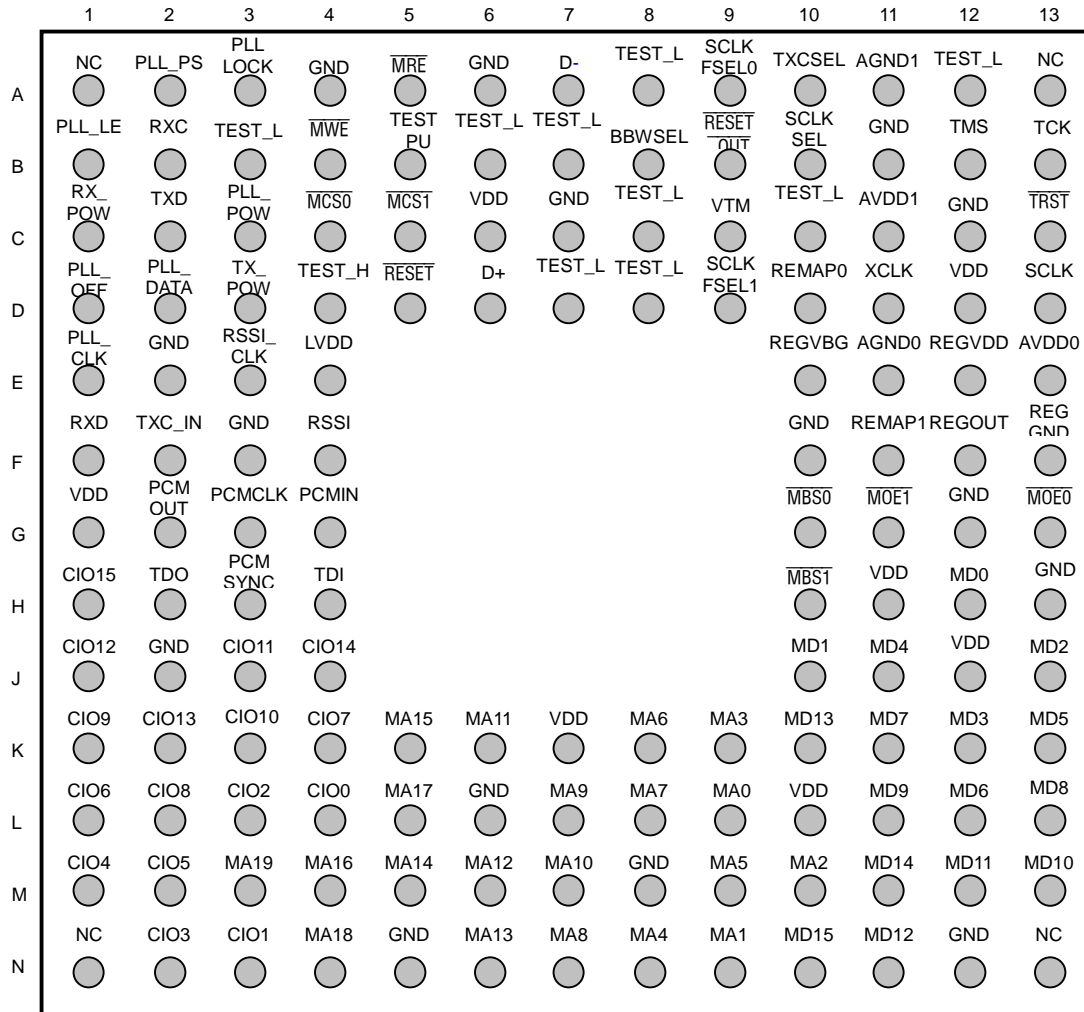
**ELECTRICAL CHARACTERISTICS****DC Characteristics(1) (Except USB port)** $(V_{DD} = 3.3 \text{ V} \pm 0.3 \text{ V}, T_a = -40 \text{ to } 85^\circ\text{C})$ 

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
“H” level output voltage	$V_{oh}$	$I_{oh} = -2 \text{ mA}$	2.4	—	—	V
“L” level output voltage	$V_{ol}$	$I_{ol} = 2 \text{ mA}$	—	—	0.4	V
Input leak current	$I_i$	$V_i = \text{GND to } 3.6 \text{ V}$	-10	—	10	$\mu\text{A}$
Output leak current	$I_o$	$V_o = \text{GND to } V_{DD}$	-10	—	10	$\mu\text{A}$
Power supply current (during operation)	$I_{ddo}$	During 32 MHz operation	0	70	90	mA
Power supply current (during stand-by)	$I_{dds}$	CLK Stopped	—	200	800	$\mu\text{A}$

**DC Characteristics(2) USB port (D+, D-)** $(V_{DD} = 3.3\text{ V} \pm 0.3\text{ V}, T_a = -40\text{ to }85^\circ\text{C})$ 

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Differential input sensitivity	$V_{DI}$	{(D+) – (D–)}	0.2	—	—	V
Differential common mode range	$V_{CM}$	Includes VDI	0.8	—	2.5	V
Single ended receiver threshold	$V_{SE}$	—	0.8	—	2.0	V
“H” output voltage	$V_{OH}$	15 K $\Omega$ to GND	2.8	—	3.6	V
“L” output voltage	$V_{OL}$	1.5 K $\Omega$ to 3.6 V	—	—	0.3	V
Output leakage current	$I_{LO}$	$0\text{ V} < V_{IN} < V_{DD}$	–10	—	+10	$\mu\text{A}$

**PIN PLACEMENT**



**TOP VIEW**

**PIN DESCRIPTIONS****RF I/F**

Pin Name	Direction [*0]	Internal Pull Up/Down	Initial Value	Pin Placement	Description
TXD	O	—	L	C2	Transmit data output (To ML7050LA Pin# A8)
RXD	I	—	—	F1	Receive data input (To ML7050LA Pin# H5)
PLL_DATA	O	—	L	D2	PLL setting data output (To ML7050LA Pin# H3)
PLL_CLK	O	—	L	E1	PLL setting clock output (To ML7050LA Pin# G3)
PLL_LE	O	—	L	B1	PLL setting load enable output (To ML7050LA Pin# H4)
PLL_OFF	O	—	L	D1	PLL Open-loop/Closed-loop control signal output (To ML7050LA Pin# G8)
PLL_POW	O	—	H	C3	Local transmit circuit power control signal output (To ML7050LA Pin# A7)
TX_POW	O	—	H	D3	Transmit power control signal output (To ML7050LA Pin# B6)
RX_POW	O	—	H	C1	Receive power control signal output (To ML7050LA Pin# B3)
RSSI	I	Pull down	—	F4	Receive field strength data input
RSSI_CLK	O	—	H	E3	RSSI transfer clock
PLL_PS	O	—	L	A2	PLL power control signal output
PLLLOCK	I	Pull down	—	A3	PLL lock signal input
RXC	O	—	L	B2	Bluetooth receive clock output (1 MHz)
TXC_IN	I	Pull down	—	F2	Bluetooth transmit clock input (1 MHz) When the transmit clock is used by a clock (RXC) that is generated from the receive data, set TXCSEL(Pin# A10) to H and connect to RXC(Pin# B2).
TXCSEL	I	Pull down	—	A10	Bluetooth transmit clock setting pin L: Select 1 MHz divided by internal PLL. H: Select TXC_IN input signal.

[\*0] "I" = Input, "O" = Output, "I/O" = Input/Output, "Oc" = Open Collector

**CLK and Configuration**

Pin Name	Direction	Internal Pull Up/Down	Initial Value	Pin Placement	Description
SCLK	I	—	—	D13	Master clock (12, 13 or 16 MHz) input pin (Power level: CMOS level)
XCLK	I	—	—	D11	User clock input pin
SCLKSEL	I	Pull down	—	B10	System clock select pin L: Select CLK divided by internal PLL H: Select XCLK input signal
SCLKFSEL0	I	Pull down	—	A9	Master clock select pin SCLKFSEL[1:0] = "00" : 12 MHz "01" : 13 MHz "10" : 16 MHz "11" : Forbidden
SCLKFSEL1	I	Pull down	—	D9	
$\overline{\text{RESET}}$	I	—	—	D5	Hardware reset pin (Reset = L)
$\overline{\text{RESET\_OUT}}$	O	—	—	B9	Hardware reset pin (Reset = L), Output
BBWSEL	I	Pull down	—	B8	BANK0 region bit width select pin L: 8-bit H: 16-bit
REMAP0	I	—	—	D10	REMAP select pin during boot up REMAP[1:0] = "00" Forbidden "01" Stacked Flash ROM "10" External $\overline{\text{MCS1}}$ device "11" External $\overline{\text{MCS0}}$ device
REMAP1	I	—	—	F11	

**Memory I/F**

Pin Name	Direction	Internal Pull Up/Down	Initial Value	Pin Placement	Description
MA[19:0]	O	—	L	[*1]	External address bus
MD[15:0]	I/O	Pull up	—	[*2]	External data bus
$\overline{\text{MWE}}$	O	—	H	B4	External write enable signal output
$\overline{\text{MRE}}$	O	—	H	A5	External read enable signal output
$\overline{\text{MCS0}}$	O	—	H	C4	External space 0 chip select
$\overline{\text{MCS1}}$	O	—	H	C5	External space 1 chip select
$\overline{\text{MBS0}}$	O	—	H	G10	External lower byte select
$\overline{\text{MBS1}}$	O	—	H	H10	External upper byte select
$\overline{\text{MOE0}}$	O	—	H	G13	External $\overline{\text{MCS0}}$ device output enable ( $\overline{\text{MCS0}}$ and $\overline{\text{MRE}}$ OR output)
$\overline{\text{MOE1}}$	O	—	H	G11	External $\overline{\text{MCS1}}$ device output enable ( $\overline{\text{MCS1}}$ and $\overline{\text{MRE}}$ OR output)

[\*1] MA19: M3; MA18: N4; MA17: L5; MA16: M4; MA15: K5; MA14: M5  
 MA13: N6; MA12: M6; MA11: K6; MA10: M7; MA9: L7; MA8: N7; MA7: L8  
 MA6: K8; MA5: M9; MA4: N8; MA3: K9; MA2: M10; MA1: N9; MA0: L9

[\*2] MD15: N10; MD14: M11; MD13: K10; MD12: N11; MD11: M12; MD10: M13  
 MD9: L11; MD8: L13; MD7: K11; MD6: L12; MD5: K13; MD4: J11; MD3: K12;  
 MD2: J13; MD1: J10; MD0: H12

**USB I/F**

Pin Name	Direction	Internal Pull Up/Down	Initial Value	Pin Placement	Description
D+	I/O	—	Z	D6	USB data
D-	I/O	—	Z	A7	USB data
VBUS (GPIO0)	I	—	—	L4	USB detection pin

**UART I/F**

Pin Name	Direction	Internal Pull Up/Down	Initial Value	Pin Placement	Description
SOUT	O	—	H	H1	ACE transmit serial data (Pin shared with GPIO15)
SIN	I	—	—	J4	ACE receive serial data (Pin shared with GPIO14)
DCD	I	—	—	K2	Data carrier detection (Pin shared with GPIO13)
RTS	O	—	H	J1	ACE transmit data ready (Pin shared with GPIO12)
CTS	I	—	—	J3	ACE transmit ready (Pin shared with GPIO11)
DSR	I	—	—	K3	Receive data ready (Pin shared with GPIO10)
DTR	O	—	H	K1	Receive ready (Pin shared with GPIO9)
RI	I	—	—	L2	Ring indicator (Pin shared with GPIO8)

**SIO I/F**

Pin Name	Direction	Internal Pull Up/Down	Initial Value	Pin Placement	Description
STXD	O	—	H	K4	Serial data output (Pin shared with GPIO7)
SRXD	I	—	—	L1	Serial data input (Pin shared with GPIO6)
STDCLK	I/O	—	—	M2	Clock for serial data output (Pin shared with GPIO5) During initialization: input
SRDCLK	I/O	—	—	M1	Clock for serial data input (Pin shared with GPIO4) During initialization: input

**μPLAT\_SIO I/F**

Pin Name	Direction	Internal Pull Up/Down	Initial Value	Pin Placement	Description
UTXD	O	—	H	N2	Serial data output (Pin shared with GPIO3)
URXD	I	—	—	L3	Serial data input (Pin shared with GPIO2)

**GPIO I/F**

Pin Name	Direction	Internal Pull Up/Down	Initial Value	Pin Placement	Description
GPIO[15:0]	I/O	—	—	[*3]	Parallel I/O data During initialization: input

**JTAG I/F**

Pin Name	Direction	Internal Pull Up/Down	Initial Value	Pin Placement	Description
TDI	I	Pull down	—	H4	Serial data input
TDO	O	—	L	H2	Serial data output
TRST	I	Pull down	—	C13	Reset pin
TMS	I	Pull down	—	B12	Mode setting pin
TCK	I	Pull down	—	B13	Serial data clock

**PCM I/F**

Pin Name	Direction	Internal Pull Up/Down	Initial Value	Pin Placement	Description
PCMOUT	O	—	L	G2	PCM data output
PCMIN	I	Pull down	—	G4	PCM data input
PCMSYNC	I/O	Pull down	—	H3	PCM sync signal (8 kHz) During initialization: input (can be switched by an internal register)
PCMCLK	I/O	Pull down	—	G3	PCM clock (64 kHz/128 kHz) During initialization: input (can be switched by an internal register)

[\*3] CIO15: H1 GPIO15/SOUT (UART I/F)  
 CIO14: J4 GPIO14/SIN (UART I/F)  
 CIO13: K2 GPIO13/DCD (UART I/F)  
 CIO12: J1 GPIO12/RTS (UART I/F)  
 CIO11: J3 GPIO11/CTS (UART I/F)  
 CIO10: K3 GPIO10/DSR (UART I/F)  
 CIO9: K1 GPIO9/DTR (UART I/F)  
 CIO8: L2 GPIO8/RI (UART I/F)  
 CIO7: K4 GPIO7/STXD (SIO I/F)  
 CIO6: L1 GPIO6/SRXD (SIO I/F)  
 CIO5: M2 GPIO5/STXDCLK (SIO I/F)  
 CIO4: M1 GPIO4/SRXDCLK (SIO I/F)  
 CIO3: N2 GPIO3/UTXD (μPLAT\_SIO I/F)  
 CIO2: L3 GPIO2/URXD (μPLAT\_SIO I/F)  
 CIO1: N3 GPIO1  
 CIO0: L4 GPIO0/VBUS (USB I/F)



**TEST I/F**

Pin Name	Direction	Internal Pull Up/Down	Initial Value	Pin Placement	Description
TEST_L	I	—	—	[*4]	Test pin (input)
TEST_H	I	—	—	D4	Test pin (input)
TEST_PU	Oc	—	L	B5	Test monitor pin
VTM	I	—	—	C9	Test pin
NC	—	—	—	A1, A13, N1, N13	No Connection

**Power, GND**

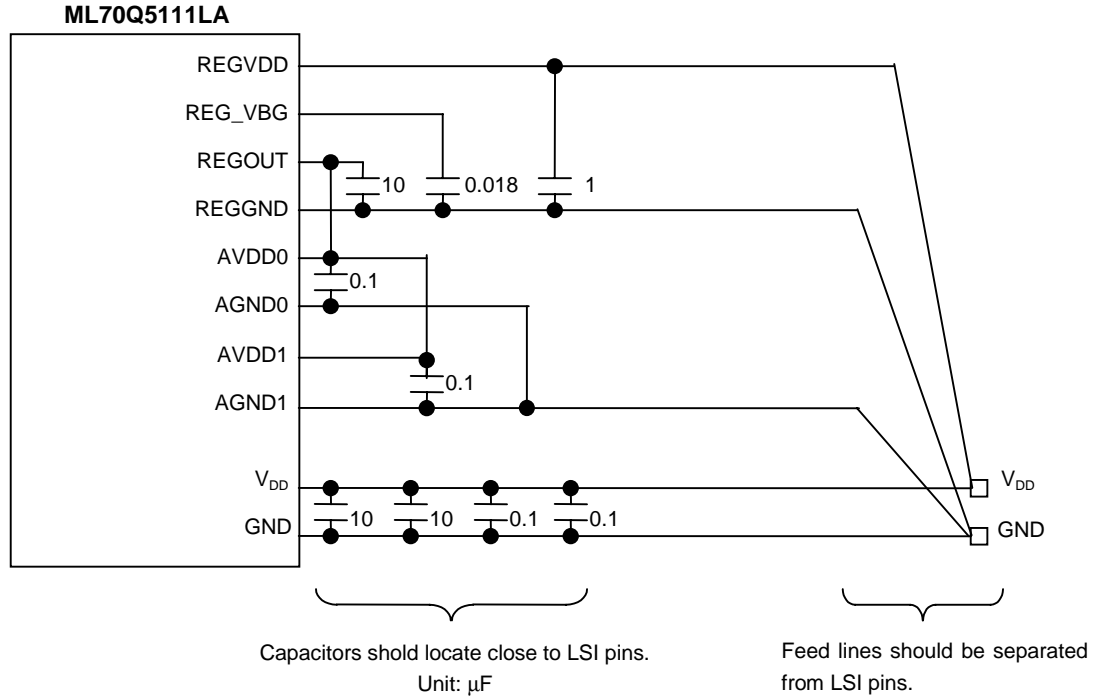
Pin Name	Direction	Internal Pull Up/Down	Initial Value	Pin Placement	Description
V <sub>DD</sub>	—	—	—	[*5]	I/O power pin 3.3 V ±0.3 V
LVDD	—	—	—	E4	I/O power pin 3.3 V ±0.3 V (Same voltage to the V <sub>DD</sub> for ML7050LA)
GND	—	—	—	[*6]	Digital block ground pin
AVDD0	—	—	—	E13	Analog block power pin 2.5 V ±0.25 V (Connect to REGOUT pin: F12)
AVDD1	—	—	—	C11	
AGND0	—	—	—	E11	Analog block ground pin (Connect to REGGND pin: F13)
AGND1	—	—	—	A11	
REGVDD	—	—	—	E12	Regulator power pin (3.0 to 3.6 V)
REGGND	—	—	—	F13	Regulator ground pin
REGOUT	—	—	—	F12	Regulator output
REGVBG	—	—	—	E10	Regulator reference voltage tuning

[\*4] TEST\_L (TEST5): A8  
 TEST\_L (TEST4): D8  
 TEST\_L (TEST3): C8  
 TEST\_L (TEST2): B7  
 TEST\_L (TEST1): D7  
 TEST\_L (TEST0): B6  
 TEST\_L (PLLSEL): C10  
 TSET\_L (PLLEN): A12  
 TSET\_L (SVCO1): B3

[\*5] C6, G1, K7, J12, H11, D12, L10

[\*6] B11, C7, A6, A4, E2, F3, J2, N5, L6, M8, N12, H13, G12, F10, C12

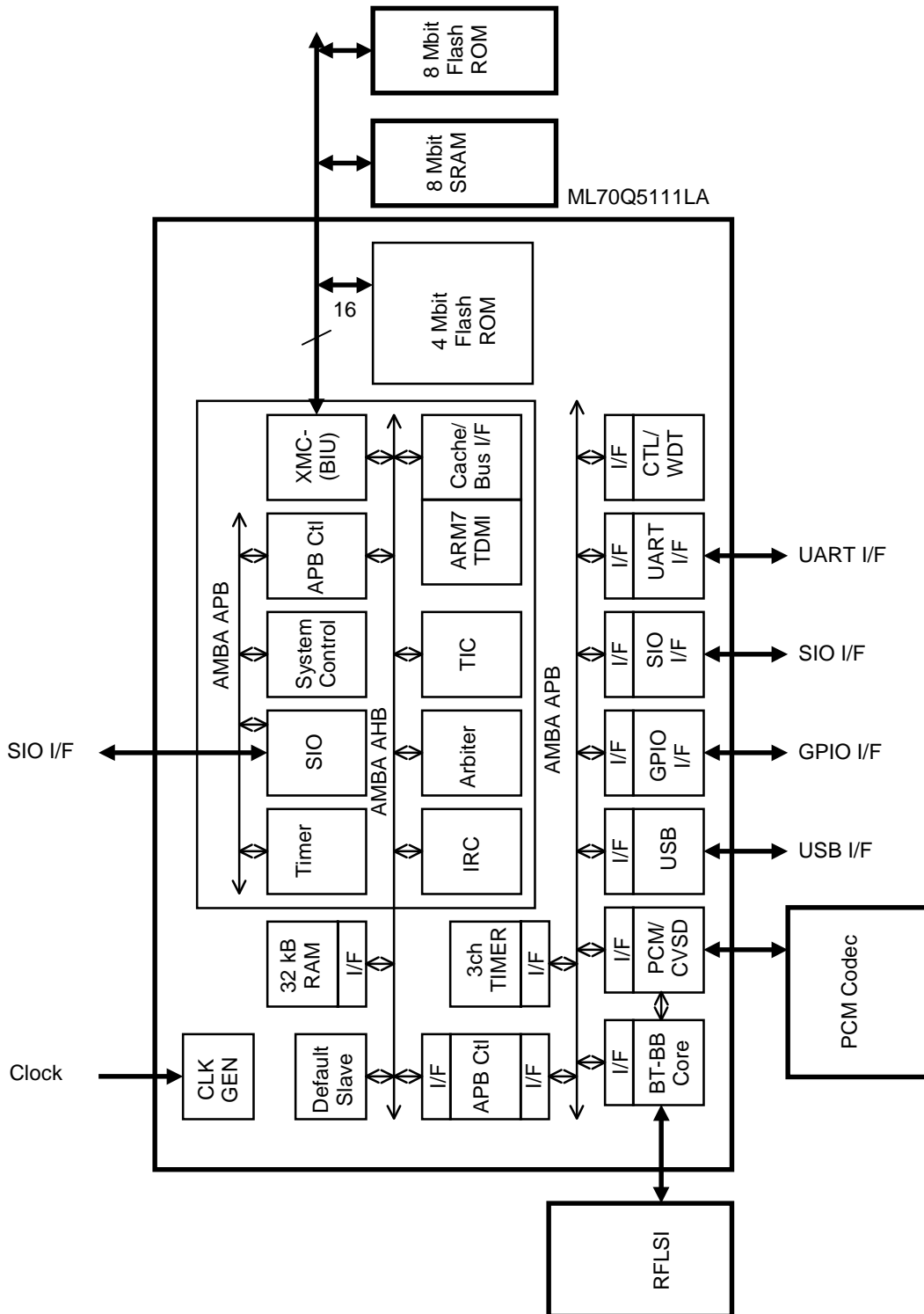
**REFERENCE FOR VOLTAGE SUPPLY CIRCUIT**



**Example for ML70Q5111LA voltage supply circuit**

The circuit is subject to change according to the specific LSI board design. Please contact Oki Electric Industry Co., Ltd. for detailed information.

**BLOCK DIAGRAM**



## DESCRIPTION OF INTERNAL BLOCKS

### CLKGEN Block

- Generates from the SCLK (12/13/16 MHz) clock that is supplied to each block
- STOP/HALT function
- External clock selection function

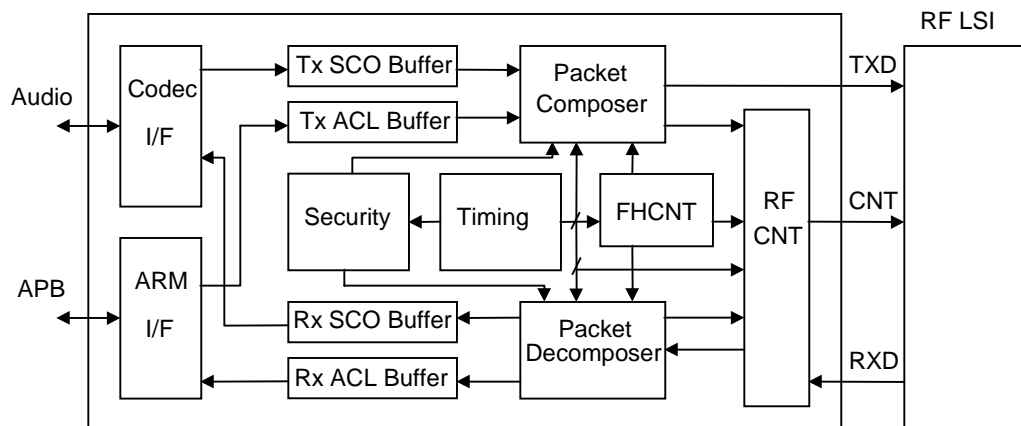
### CTL/WDT Block

- Control of the frequency division function of the internal main clock
- Control of clock supplied to each peripheral
- Control of reset of each peripheral
- STOP/HALT control
- External clock selection control
- CIO switching function
- Watchdog timer function (interrupt/reset)
- 3 types of count stop functions

### Timer Block

- 3 channels
- 18 bit timer counter for each channel
- Interrupt at counter overflow
- Independent mode for each channel (one shot/interval/free run)

### Baseband Core Block



- RF Controller
  - RF power supply control (PLL, TX, RX)
  - Local PLL frequency division ratio setting
  - Receive clock regeneration function
  - Synchronization detection (synchronizing within the permissible error limit of SyncWord)
  - Receive clock re-timing function
- FH Controller hopping
  - Sequence control
  - Frequency hopping selection function
  - CRC computation's initial value selection function
- Timing Generator
  - Bluetooth clock generation
  - Operation interrupts depend on mode (slot, scan, sniff, hold, park)
  - Sync detection timing generation (sync window  $\pm 10 \mu\text{s}$ )
  - PLL setting timing generation
  - Transmit/Receive timing generation
  - Multi-master timing management function
- Packet Composer
  - Access code generation (SyncWord generation, appending PR\*TRAILER)
  - Packet header generation (HEC generation, scrambling, FEC encoding)
  - Payload generation (CRC generation, encryption, scrambling, FEC encoding)
  - Packet synthesis
- Packet Decomposer
  - Packet decomposition (separating the packet header and the payload)
  - Packet header processing (FEC decoding, descrambling, HEC error detection, header information separation)
  - Payload processing (FEC decoding, descrambling, encryption decoding, CRC judgement, payload separation)
- Security
  - Various key generation functions (initialization, link key, encryption key)
  - Certification function
  - Encryption function

**USB Block**

- Conforms to USB standard Ver. 1.1.
- Supports 12 Mbps transfer
- Supports 4 data transfer types (control transfer, bulk transfer, interrupt transfer, and isochronous transfer)
- Built-in USB transceiver circuit
- 5 or 6 built-in end points, and built-in FIFO for data storage
- 8-, 16-, 32-bit read/write is possible for the FIFOs of EP0 to EP5 (with byte control)

**UART Block**

- Full-duplex buffering method
- All status reporting function
- Built-in 64-byte transmit/receive FIFO
- Modem control based on CTS, DCD, and DSR
- Programmable serial interface
- 5-, 6-, 7-, 8-bit characters
- Generation and verification of odd parity, even parity, or no parity
- 1, 1.5, or 2 stop bits
- Programmable Baud Rate Generator (1200 bps to 921.6 kbps)
- Error servicing for parity, overrun, and framing errors

**SIO Block**

- UART/Synchronous type serial port interface
- UART Mode:
  - Data length: can be selected as 7 or 8 bits
  - Supports odd parity, even parity, or no parity
  - Error servicing for parity, overrun, and framing errors
  - Supports 1 or 2 stop bits
  - Full-duplex communication is possible
- Clock synchronization mode:
  - Data length: can be selected as 7 or 8 bits
  - Error servicing for overrun errors
  - Full-duplex communication is possible

**μPLAT-SIO Block**

- Start-stop synchronization type serial port interface
- Built-in dedicated baud rate generator
- Data length of 7 or 8 bits can be selected
- 1 or 2 stop bits can be selected.
- Supports odd or even parity
- Error servicing for parity, overrun, and framing errors
- Full-duplex communication is possible

**PCM-CVSD Transcoder Block**

- Application side I/O:
  - PCM Codec
  - APB-Bus (USB)
- Application-side format:
  - PCM linear (8, 16 bits/sample, 64 kHz sampling frequency)/A-law/μ-law
- Bluetooth-side format:
  - CVSD/A-law/μ-law
- All combinations of the above conversions are supported
- PCMSYMC/PCMCLK I/O can be switched (in the input state after initialization)

**GPIO Block**

- All 16 bits
- Input/Output selection possible for each bit
- Interrupts can be used for all bits
- Interrupt masks and interrupt modes can be set for all bits
- In the input state immediately after a reset

## APPLICATION NOTES

### Operation During Boot Up

- Remapping during boot up is performed according to external pins REMAP[1:0].

REMAP1	REMAP0	
L	L	: Forbidden
L	H	: Stack Flash ROM
H	L	: Devices connected to external $\overline{MCS1}$
H	H	: Devices connected to external $\overline{MCS0}$

- Bit width that corresponds to BANK0 during boot up is set according to external pin BBWSEL.

BBWSEL = L : 8-bit  
 BBWSEL = H : 16-bit

### Clock Selection

- The CPU clock supply source is selected according to external pin SCLKSEL.

SCLKSEL = L : Use 32/16/8/4 MHz clock that was divided down from the internal PLL output of 192 MHz that was generated from external pin SCLK. (Initial value is 32 MHz.)

SCLKSEL = H : Use external pin XCLK.

Note: The clock supply source can also be set by the CLKCNT register in the CTL/WDT block.

- Bluetooth transmission clock is selected according to external pin TXCSEL.

TXCSEL = L : Use 1 MHz clock that was divided down from the internal PLL output (192 MHz).

TXCSEL = H : Use external pin TXC\_IN.

Note: This clock can also be set by the CLKCNT register in the CTL/WDT block.

- SCLK selection (12/13/16 MHz).

SCLKFSEL[1:0] = "00" : 12 MHz

"01" : 13 MHz

"10" : 16 MHz

"11" : Forbidden

### HCI Transport Selection

- HCI is selected (USB/UART) according to the logical value of GPIO0 at initial powerup of ML70Q5111LA.

GPIO0 = L : UART is used as HCI.

GPIO0 = H : USB is used as HCI.



**USB Peripheral Circuit**

- Please contact Oki Electric Industry Co., Ltd. when using USB.

**Setting the UART Baud Rate**

- Use the HCI\_VS\_Set\_LC\_Parameters command of the Vendor Specific Commands to set the UART baud rate.

Available baud rate settings:

1200/2400/4800/7200/9600/19.2K/38.4K/56K/57.6K/115.2K/230.4K/345.6K/460.8K/921.6K  
(Initial value is 115.2 kbps.)

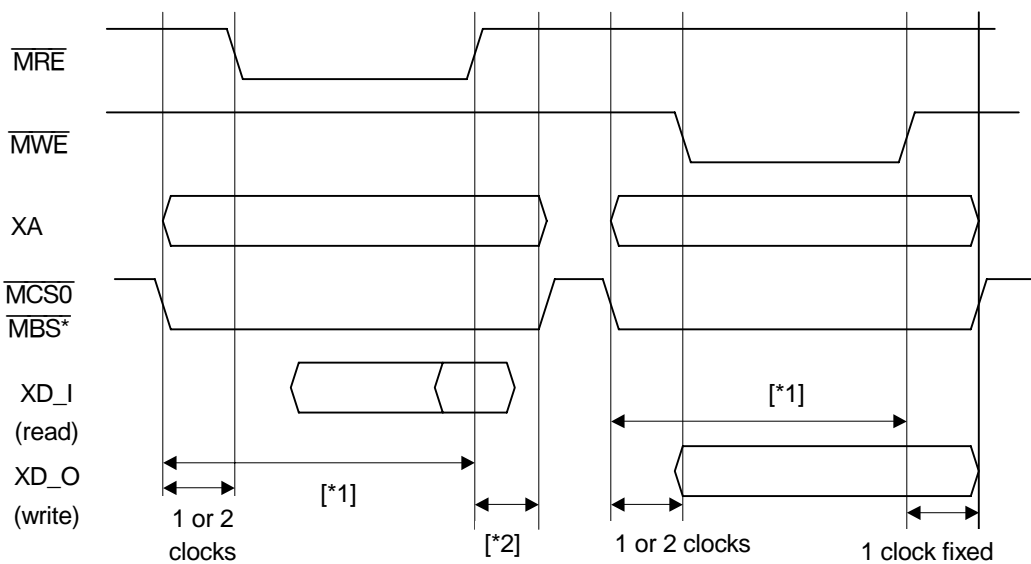
**Setting the PCM-CVSD Transcoder**

- Please use the HCI\_VS\_Set\_LC\_Parameters command of the Vendor Specific Commands in HCI to set the PCM-CVSD transcoder parameters.
- It is possible to set the following parameters using the VCCTL command:
  - PCMSYNC/PCMCLK mode (in the input state after initialization)
  - Mute reception (initial setting: OFF)
  - Mute transmission (initial setting: OFF)
  - Air coding  
CVSD (initial setting)/ $\mu$ -law/A-law
  - Interface coding  
Linear (initial setting)/ $\mu$ -law/A-law
  - PCM format (data width of one PCM Linear sample)  
8-bit (initial setting)/14-bit/16-bit
  - Serial interface format  
Short frame (initial setting)/long frame
  - Application interface mode  
PCM Codec I/F (initial setting)/APB I/F

## External Memory

- ML70Q5111LA specifications for the devices that are connected to  $\overline{MCS0}$  and  $\overline{MCS1}$  are explained below.
- When the device is connected to  $\overline{MCS0}$ :
  - 1 memory bank
  - Bus width: 8 or 16 bits
  - Byte access control:  $\overline{MBS^*}/\overline{MWE}$
  - Supported devices:  
Normal SRAM, Flash Memory, Page mode Flash memory

**Bus timing to the device connected to  $\overline{MCS0}$**



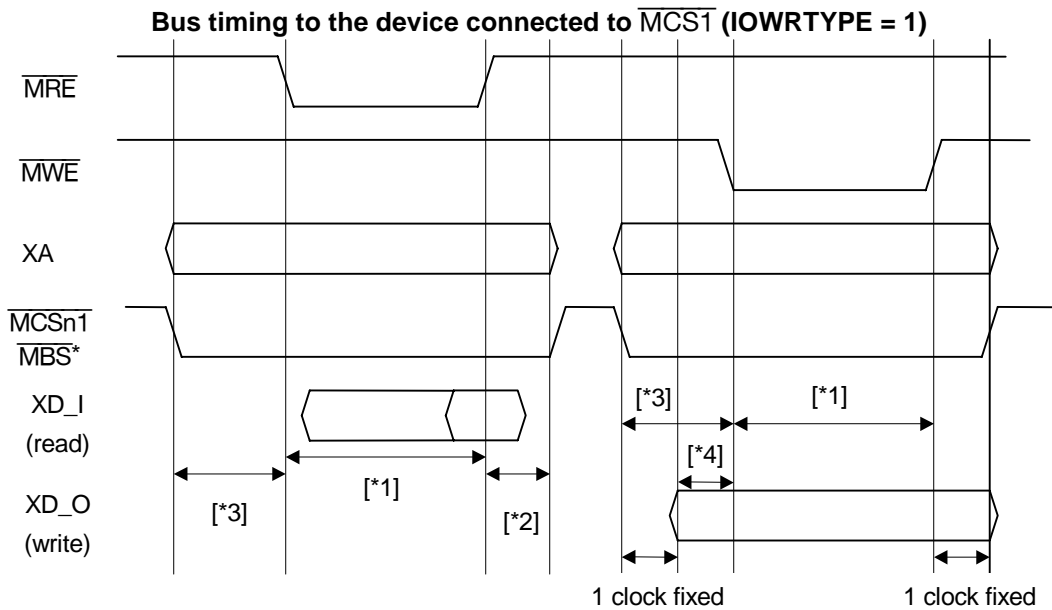
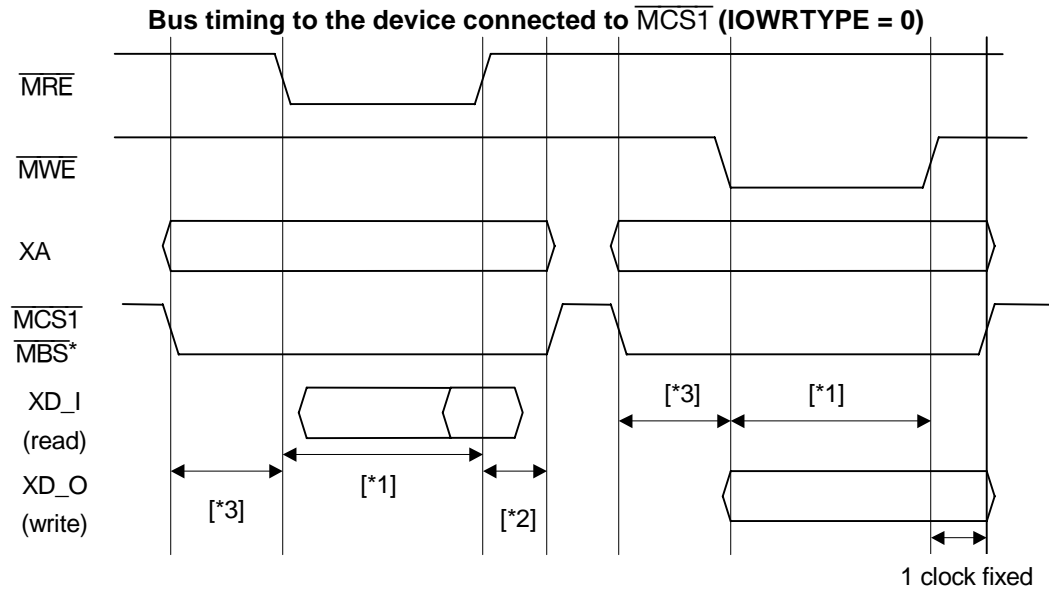
- [\*1] Access time:  
3, 4, 5, 6, 7, 8 clock cycles (including 1 clock cycle for set-up)  
6, 8, 10, 12, 14, 16 clock cycles (including 2 clock cycles for set-up)
- [\*2] Data OFF time:  
1, 2, 3, 4 clock cycles

Note: Oki software settings:

- Insert the maximum wait immediately after reset.
- Page mode: OFF
- During operation (32 MHz operation),  
Access time: 3 clock cycles  
Data OFF time: 1 clock cycle

Note: A device with an access time of 120 nsec or less is recommended.

- When the device is connected to  $\overline{\text{MCS1}}$ :
  - 1 memory bank
  - Bus width: 8-bit or 16-bit
  - Byte access control:  $\overline{\text{MBS}}^*/\overline{\text{MWE}}$



- [\*1] Access time:  
2, 4, 8, 16, 32 clock cycles (including 1 clock cycle for set-up)
- [\*2] Data OFF time:  
1, 2, 3, 4 clock cycles
- [\*3] Address set-up time:  
1, 2, 3, 4 clock cycles
- [\*4] Write data set-up time:  
0 clock cycles (IOWRTYPE = 0)  
0, 1, 2, 3 clock cycles (IOWRTYPE = 1)

Relationship between address set-up time and write data set-up time (when IOWRTYPE = 1)

- Address set-up time:
  - 1 clock cycle (write data set-up: 0 clock cycles)
  - 2 clock cycles (write data set-up: 1 clock cycle)
  - 3 clock cycles (write data set-up: 2 clock cycles)
  - 4 clock cycles (write data set-up: 3 clock cycles)

Note: Oki software settings:

- Insert the maximum wait immediately after reset.
- IOWRTYPE = 0
- During operation (32 MHz operation),
  - Access time: 2 clock cycles
  - Data OFF time: 1 clock cycle
  - Address set-up time: 1 clock cycle

Note: A device with an access time of 120 nsec or less is recommended.

- Miscellaneous

- MA0 is not used with devices that have a 16-bit data bus.  
Connect MA1 to device A0. (MA0 is Open.)
- Connect MA0 to device A0 for devices that have an 8-bit data bus.
- $\overline{\text{MOE0}}$  is the AND signal for  $\overline{\text{MCS0}}$  and  $\overline{\text{MRE}}$ .  
Perform an open process when this is not in use.
- $\overline{\text{MOE1}}$  is the AND signal for  $\overline{\text{MCS1}}$  and  $\overline{\text{MRE}}$ .  
Perform an open process when this is not in use.

**Process when interface pins are unused**

- The following tables show the processes that are performed when interface pins are not used.

**RF I/F**

Pin Name	Process When Pin Not Used	Comments
PLL_DATA	Open	
PLL_CLK	Open	
PLL_LE	Open	
PLL_OFF	Open	
PLL_POW	Open	
TX_POW	Open	
RX_POW	Open	
RSSI	Pull down or GND	
RSSI_CLK	Open	
PLL_PS	Open	
PLLLOCK	Pull down or GND	
RXC	Open	
TXC_IN	Pull down or GND	
TXCSEL	Pull down or GND	

**GPIO**

Pin Name	Process When Pin Not Used	Comments
GPIO0	Pull up or $V_{DD}$	This process is not applicable when used as VBUS (USB I/F).
GPIO1	Pull down or GND	
GPIO2	Pull down or GND	
GPIO3	Pull up or $V_{DD}$	This process is not applicable when used as UTXD ( $\mu$ PLAT SIO I/F).
GPIO4	Pull down or GND	
GPIO5	Pull down or GND	
GPIO6	Pull up or $V_{DD}$	
GPIO7	Pull up or $V_{DD}$	This process is not applicable when used as STXD (SIO I/F).
GPIO8	Pull up or $V_{DD}$	
GPIO9	Pull up or $V_{DD}$	This process is not applicable when used as DTR (UART I/F).
GPIO10	Pull down or GND	
GPIO11	Pull up or $V_{DD}$	
GPIO12	Pull up or $V_{DD}$	This process is not applicable when used as RTS (UART I/F).
GPIO13	Pull down or GND	
GPIO14	Pull up or $V_{DD}$	
GPIO15	Pull up or $V_{DD}$	This process is not applicable when used as SOUT (UART I/F).

**Memory I/F**

Pin Name	Process When Pin Not Used	Comments
MA[19:0]	Open	<u>When connected</u> For 16-bit devices: <ul style="list-style-type: none"> <li>• Open MA0.</li> <li>• Connect from MA1 in order from A0 of the connected device.</li> </ul> For 8-bit devices: <ul style="list-style-type: none"> <li>• Connect to each corresponding address.</li> </ul>
MD[15:0]	Open	
$\overline{\text{MWE}}$	Open	
$\overline{\text{MRE}}$	Open	
$\overline{\text{MCS0}}$	Open	
$\overline{\text{MCS1}}$	Open	
$\overline{\text{MBS0}}$	Open	
$\overline{\text{MBS1}}$	Open	
$\overline{\text{MOE0}}$	Open	Only use when connecting to a device that has only one, but not both of $\overline{\text{MCS}}^*$ or $\overline{\text{MRE}}$ .
$\overline{\text{MOE1}}$	Open	

**USB I/F**

Pin Name	Process When Pin Not Used	Comments
D+	Open	
D-	Open	
VBUS (GPIO0)	When using UART: Pull down or GND When using USB: Pull up or Vdd	This process is not applicable when used as GPIO.

**UART I/F**

Pin Name	Process When Pin Not Used	Comments
SOUT (GPIO15)	Open	This process is not applicable when used as GPIO.
SIN (GPIO14)	Pull up or $V_{DD}$	
DCD (GPIO13)	Pull down or GND	
RTS (GPIO12)	Open	This process is not applicable when used as GPIO.
CTS (GPIO11)	Pull down or GND	
DSR (GPIO10)	Pull down or GND	
DTR (GPIO9)	Open	This process is not applicable when used as GPIO.
RI (GPIO8)	Pull up or $V_{DD}$	

**SIO I/F**

Pin Name	Process When Pin Not Used	Comments
STXD (GPIO7)	Open	This process is not applicable when used as GPIO.
SRXD (GPIO6)	Pull up or $V_{DD}$	
STDCLK (GPIO5)	Pull down or GND	
SRDCLK (GPIO4)	Pull down or GND	

 **$\mu$ PLAT\_SIO I/F**

Pin Name	Process When Pin Not Used	Comments
UTXD (GPIO3)	Open	This process is not applicable when used as GPIO.
URXD (GPIO2)	Pull down or GND	

**JTAG I/F**

Pin Name	Process When Pin Not Used	Comments
TDI	Open	
TDO	Open	
$\overline{\text{TRST}}$	Open	
TMS	Open	
TCK	Open	

**PCM I/F**

Pin Name	Process When Pin Not Used	Comments
PCMOUT	Open	
PCMIN	Open	
PCMSYNC	Open	
PCMCLK	Open	

**Processes of Other Pins****TEST I/F, etc.**

Pin Name	Process When Pin Not Used	Comments
TEST_L	GND	
TEST_H	$V_{DD}$	
TEST_PU	Open	
VTM	Open	
$\overline{\text{RESET}}$	Pull up or $V_{DD}$	
$\overline{\text{RESET\_OUT}}$	Open	
NC	Open	

- The unused pin configurations are subject to change according to the specific application. Please contact Oki Electric Industry Co., Ltd. for detailed board layout information.

## ABOUT BLUETOOTH SOFTWARE

- At Oki Electric Industry Co., Ltd., we have made available as Pack 1 the software protocol stack of the lower layer up to HCI that conforms to the Bluetooth Specification Ver. 1.1 for external Flash memory and internal Flash memory. Pack 1 contents: Baseband Controller, LMP, HCI.
- Please contact Oki Electric Industry about upper software protocol stack above HCI.
- Please contact Oki Electric Industry Co., Ltd. for more information regarding software contents, pricing, etc.

## VENDOR SPECIFIC COMMANDS

- Parameters can be set with the Pack 1 software by using the following Vendor Specific Commands.
- Please contact Oki Electric Industry Co., Ltd. for more information.

(Command example) HCI\_VS\_Set\_LC\_Parameters: Sets the link control information.

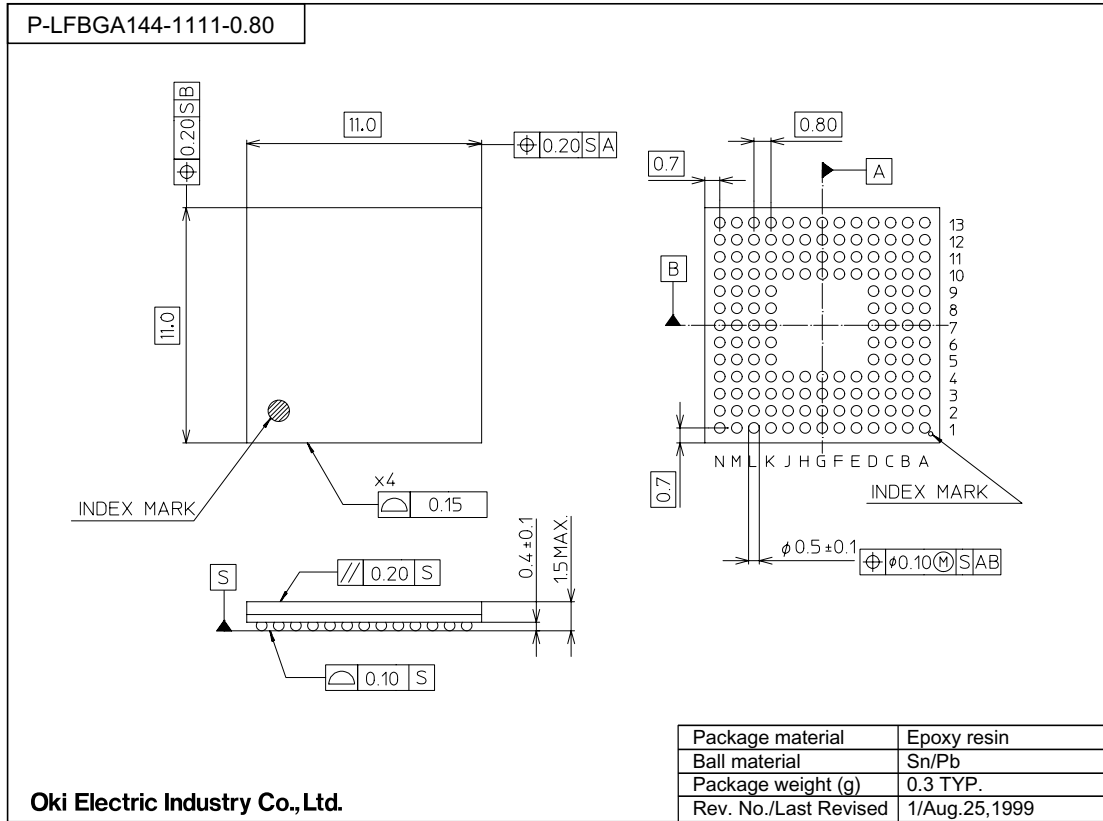
The following table shows the link control information that can be set.

Link Control Information	Comments
PCM for SCO Link	0: $\mu$ -law, 1: A-law, 2: Linear
UART baud rate	0: 9600 bps    1: 19.2 kbps 2: 38.4 kbps    3: 56 kbps 4: 115.2 kbps    5: 230.4 kbps 6: 345.6 kbps    7: 57.6 kbps 8: 460.8 kbps    9: 921.6 kbps
Poling rate	Unit: 625 $\mu$ sec
Master clock setting for ML7050LA	12: 12 MHz 13: 13 MHz 16: 16 MHz



**PACKAGE DIMENSIONS**

(Unit: mm)



**Caution regarding the installation of surface mounted type packages:**

Surface mounted type packages are very susceptible to heat during reflow mounting and package moisture content when in storage. Therefore, please contact your Oki Electric Industry Co., Ltd. sales representative when considering reflow experiments and let us know the product name, package name, pin count, package code, the desired mounting conditions (reflow method, temperature, count), storage conditions, etc.

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