



No.1 Ultra Low Power "Eco-Micro" Product Matrix

December 2010

OKI SEMICONDUCTOR CO., LTD.

OKI
OKI SEMICONDUCTOR

NEW 8bit low power MCU series with Flash ROM and LCD drivers

ML610Q400

1.1V - 3.6V operation
0.15 μ A in STOP mode
0.5 μ A in HALT mode

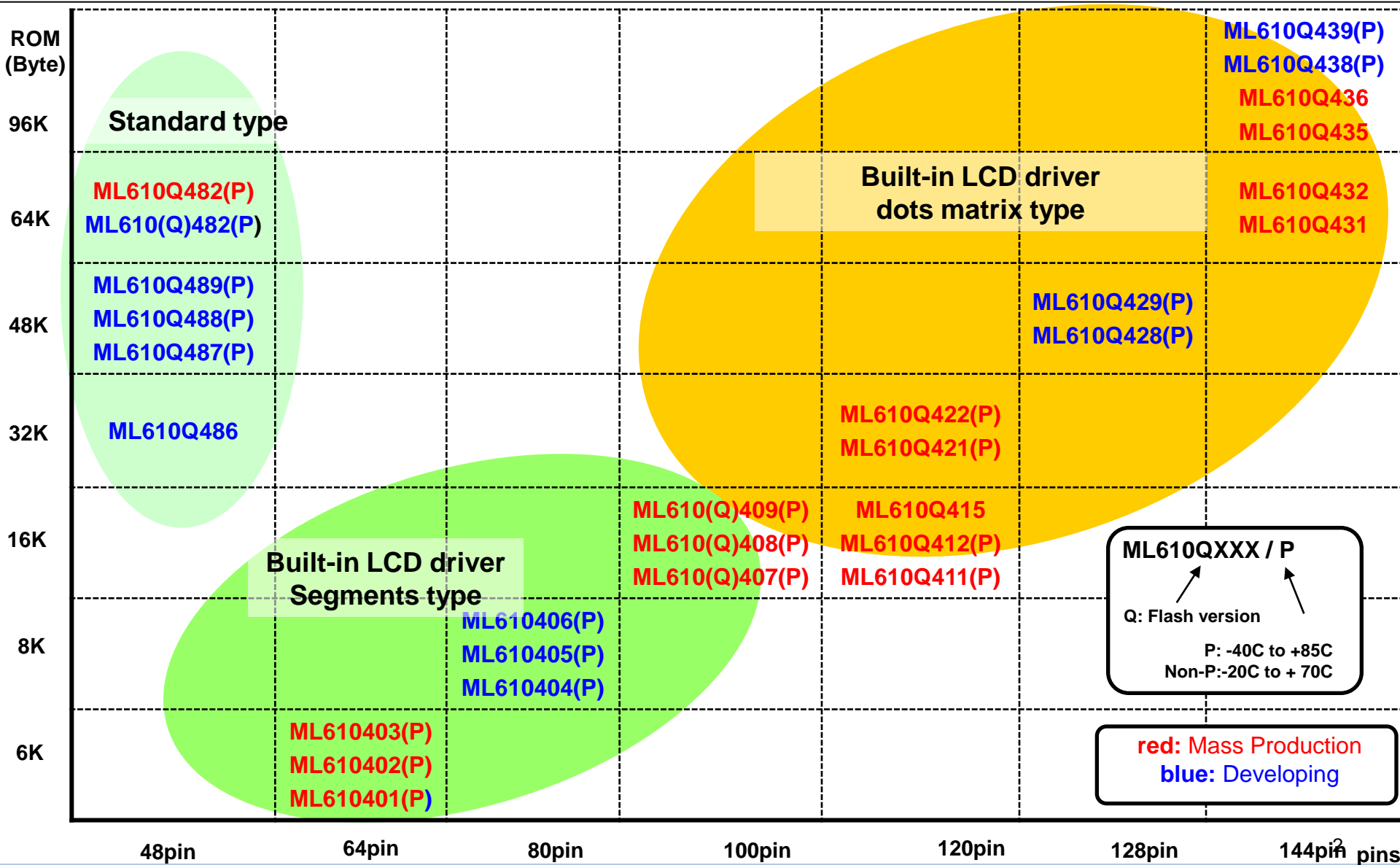
Dots

1536
1024
800
400
144

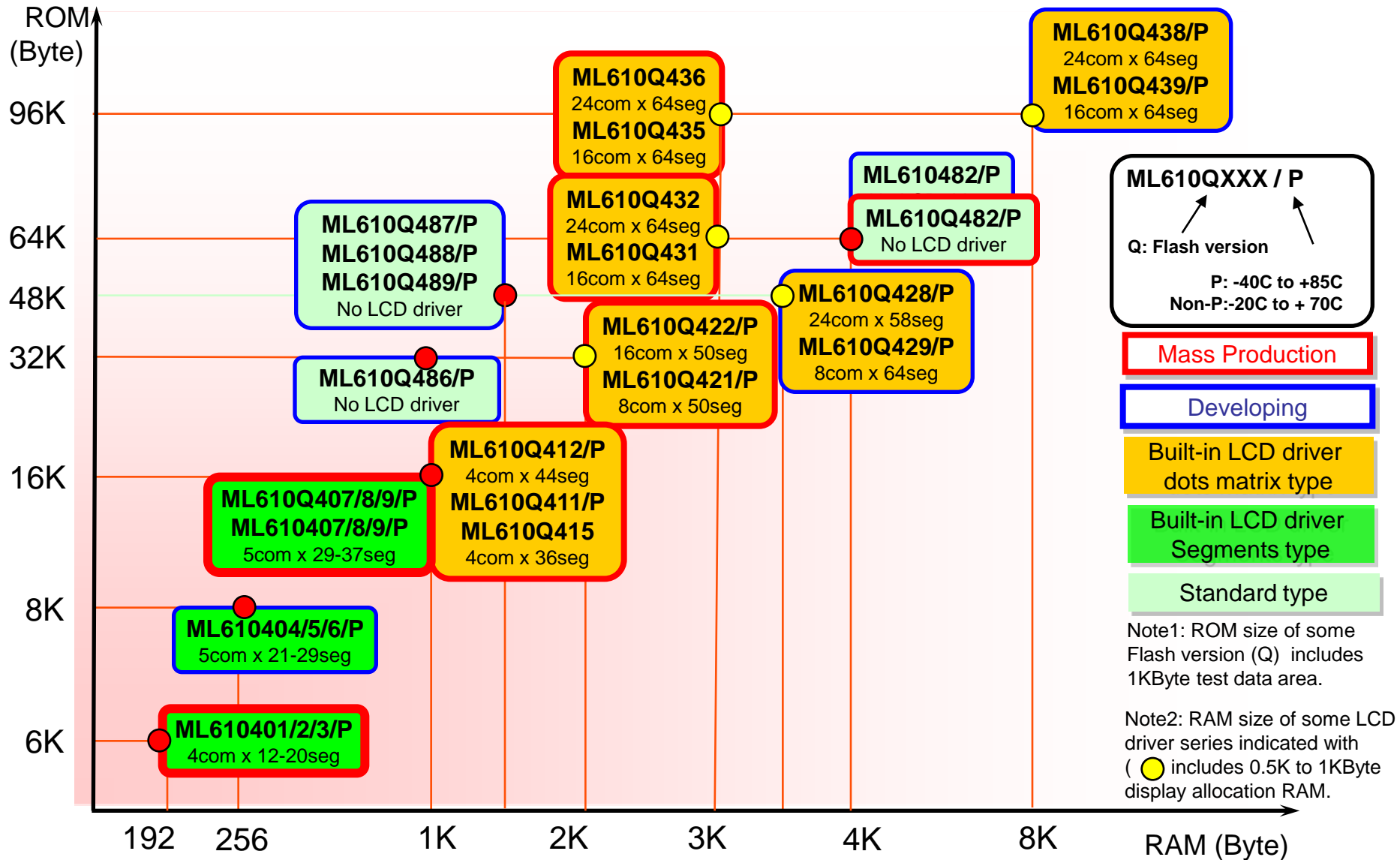
16KB 32KB 64KB
Flash ROM size

The graphic shows several OKI ML610Q400 microcontroller chips of different sizes. A vertical axis on the left is labeled 'Dots' and has values 144, 400, 800, 1024, and 1536. A horizontal axis at the bottom is labeled 'Flash ROM size' and has values 16KB, 32KB, and 64KB. The chips are arranged in a grid-like pattern, with larger chips corresponding to higher dot counts and larger flash ROM sizes.

4.ML610Q400 Series Lineup (ROM size & pin number)



ML610Q400 Series Lineup (Memory & LCD Segments MAP)



ML610Q400s Specification Table 1/5

 Built-in LCD driver
 dots matrix type

Part Number		Q432	Q431	Q422(P)	Q421(P)	Q412(P)	Q411(P)	Q415
CPU		8bit RISC CPU nX-U8/100 Core						
ROM (Flash)		64 Kbyte		32 Kbyte		16 Kbyte		
Data RAM		2 Kbyte		1 Kbyte				
Display allocation Register		1 Kbyte				-		
LCD Driver		24com x64seg	16com x64seg	16com x 50seg	8com x 50seg	4com x 44seg	4com x 36seg	
Max. Number of Dots		1536	1024	800	400	176	144	
Port (Incl. 2nd func.)		23	31	23	31	23	31	
A/D Converter	12-bit SA	2 (w / Amp)		2 (no Amp)				
	24-bit RC	2						
Serial I/F		I ² C (Master) x 1, UART x 1, SSIO(SPI) x 1						
Timer	8bit Timer	4						
	16bit PWM	1						
	Others	Capture x 2, TBC (Time Base Counter) x 1, WDT x 1, 1kHz Timer x 1						
External Interrupt		5						
Other Functions		Clock output (High/Low speed), Low speed oscillation frequency compensation, Battery level detector, Buzzer & Melody						
Operating Frequency	High Speed	Max.4.096MHz (PLL oscillation, Crystal/Ceramic oscillation, External clock),				-		
	Middle Speed	500kHz (Internal RC oscillation)				500KHz(Internal RC oscillation / External clock)		1/1 to 1/8 of RC 500kHz
	Low Speed	32.768kHz (Crystal oscillation)						
Minimum Execution Time		0.244us@4.096MHz 30.5us@32.768KHz				2us@500KHz 30.5us@32KHz	2us@500KHz 30.5us@32KHz	2us@500KHz
Supply Voltage		1.1V to 3.6V						
Operating Temperature (°C)		-20 °C to 70 °C		-20 °C to 70 °C, -40 °C to 85 °C (P version)				-20 to 70 °C
Supply Current (Typ./25 °C)	Standby mode	HALT mode : 0.5uA(Q415:5.5uA), STOP mode : 0.15uA						
	Operating mode	32.768KHz : 5uA (Run duty = 100%), 500KHz : 70uA (Internal RC), 4.096MHz : 800uA (Internal PLL)				32KHz : 5.5uA (Run duty = 100%), 500KHz : 80uA (Internal RC)		500KHz : 80uA (Internal RC)
Supply Form		Die, 144LQFP		Die, 120TQFP				
Status		Mass Production						

ML610Q400s Specification Table 2/5

 Built-in LCD driver
 dots matrix type

Part Number		Q435/Q436	Q438(P)/Q439(P)	Q428(P)/ Q429(P)
CPU		8bit RISC CPU nX-U8/100 Core		
ROM(MTP)		96 KB		48 KB
RAM		2KB	6KB	3KB
Display allocation Register		1KB		1KB
LCD Driver		Q435: 16com x 64seg (1024 max.) Q436: 24com x 64seg (1536 max.)	Q438(P): 24com x 56seg (1344 max.) Q439(P): 16com x 64seg (1024 max.)	Q428(P): 24com x 58seg (1392 max.) Q429(P): 8com x 64seg (512 max.)
I/O Port (incl. 2nd function)		Q435: 31 max. Q436: 23 max.	33(53) (IN: 10, OUT: 3(+20 by Option), I/O: 20)	Q428(P): 23(43) (IN: 6, OUT: 3(+20 by Option), I/O: 14) Q429(P): 33(53) (IN: 10, OUT: 3(+20 by Option), I/O: 20)
A/D Converter		24bit RC-type x 2 12bit SA-type x 2		24bit RC-type x 2
Serial I/F		UART x1, SSIO(SPI) x1, I ² C x1		
Timer	8bit Timer	4		2
	16bit PWM	1	3	3
	Others	TBC(Time Base Counter)x1, WDTx1, 1kHz Timer x1, Capture x2		TBC(Time Base Counter)x1, WDTx1, 1kHz Timer x1,
External Interrupt		5	9	9
Other Functions		Melody/Buzzer, Clock Out, BLD and etc.		Melody, Clock Out, BLD and etc.
Operating Frequency	High Speed	4.096MHz max. (Internal PLL or Ext. Xtal) 500KHz.(Internal RC Oscillation)	4.096MHz max. (Internal PLL or Ext. Xtal) 2MHz/1MHz/500KHz RC OSC built-in (frequency is selected by mask option)	4.096MHz max. (Internal PLL or Ext. Xtal) 2MHz/500KHz RC OSC built-in (frequency is selected by software)
	Low Speed	32.768kHz (Xtal)		
Supply Voltage		1.1V to 3.6V		
Operating Temperature		-20 °C to 70 °C	-20 °C to 70 °C, -40 °C to 85 °C(P version)	-20 °C to 70 °C, -40 °C to 85 °C(P version)
Supply Current (Typ.)	Standby mode	HALT mode: 0.5uA, STOP mode: 0.15uA		
	Operating mode	32.768kHz: 5uA (100% duty) 500KHz: 70uA(Internal RC Oscillation) 4MHz: 800uA (PLL)		
Supply Form		Die, 144LQFP	Die(138pin, Pad pitch: 80um), PKG: 144LQFP	Die(125pin, Pad pitch: 80um), PKG: 128TQFP
Status		Mass Production	Developing	ES Now

ML610Q400s Specification Table 3/5

Built-in LCD driver
Segments type

Part Number		401P	402P	403P	404P	405P	406P	407P/ Q407(P)	408P/ Q408(P)	409P/ Q409(P)
CPU		8bit RISC CPU nX-U8/100 Core								
ROM		6KB(Mask)			8KB(Mask)			16KB(Mask)/16KB(MTP)		
RAM		192B			256B			1KB		
Display allocation Register		-			-			-		
LCD Driver	Segments (max.dot)	2c-14s	2c-18s	2c-22s	2c-24s	2c-28s	2c-32s	2c-32s	2c-36s	2c-40s
		3c-13s	3c-17s	3c-21s	3c-23s	3c-27s	3c-31s	3c-31s	3c-35s	3c-39s
		4c-12s	4c-16s	4c-20s	4c-22s	4c-26s	4c-30s	4c-30s	4c-34s	4c-38s
		5c-11s	5c-15s	5c-19s	5c-21s	5c-25s	5c-29s	5c-29s	5c-33s	5c-37s
		(55)	(75)	(95)	(105)	(125)	(145)	(145)	(165)	(185)
1/2,1/3bias, Programmable display allocation function										
Ports (incl. 2 nd func.)	Input	4	4	4	5	5	5	5	5	5
	Output	12	8	4	12	8	4	12	8	4
	I/O	18	18	18	22	22	22	22	22	22
A/D Converter		16bit RC type x2								
Serial I/F		-			SSIO(SPI) x2, UART x1					
Timers	Timer	8bit-Timer x2			8bit-Timer x4					
	PWM	-			16bit-PWM x1					
	Others	TBC(Time Base Counter) x1, WDT x1, Capture x2								
Ext. Interrupt		8 (incl. 4bit-OR)			13 (incl. 8bit-OR)					
Buzzer/Melody		Buzzer			Buzzer/Melody					
Other Function		Low-speed clock frequency adjustment (Accuracy 0.48ppm), Clock out								
Operating Frequency	High	500kHz(Internal RC)			500kHz/2MHz(Internal RC)					
	Low	32.768kHz (Xtal)								
Operating Voltage		1.25V to 3.6V			500kHz: 1.25V to 3.6V, 2MHz: 1.8V to 3.6V					
Operating Temperature		401P to 409P, Q407P to Q409P: -40 °C to 85 °C Q407 to Q409: -20 °C to 70 °C								
Supply Current (Typ.)	Standby mode	STOP mode: 0.3uA(TBD), HALT mode: 0.9uA(TBD)								
	Operating mode				32KHz: 6uA(TBD), 500kHz: 80uA(TBD)			2MHz: 400uA(TBD)		
Supply Form		Die or 64TQFP			Die or 80TQFP			Die or 100TQFP		
Status		Mass Production			Developing			MP Now : Q407(P), Q408(P), Q409(P) Developing:407(P), 408(P),409(P)		

ML610Q400s Specification Table 4/5

Standard type

Part Number		Q482/Q482P	482/482P	Q486	Q486P
CPU		8bit RISC CPU nX-U8/100 Core			
ROM		64Kbyte (Flash)	64 Kbyte (Mask)	32 Kbyte (Flash)	
Data RAM		4 Kbyte		1 Kbyte	
LCD Driver		-			
Max. Number of Dots		-			
Port (Incl. 2nd function)		35		32 (5 LED driving port)	
A/D Converter	12-bit SA-type	-		4 (no Amp)	
	24-bit RC-type	2		-	
Serial I/F		I ² C (Master) x 1, UART x 1, SSIO(SPI) x 1			
Timer	8bit Timer	4			
	16bit PWM	1			
	Others	Capture x 2, TBC (Time Base Counter) x 1, WDT x 1, 1kHz Timer x 1		TBC (Time Base Counter) x 1, WDT x 1,	
External Interrupt		5		4	
Other Functions		Clock output (High/Low speed), Low speed oscillation frequency compensation, Buttery level detector, Buzzer, Analog comparator		Buttery level detector, -	
Operating Frequency	High Speed	Max.4.096MHz (PLL oscillation, Crystal/Ceramic oscillation, External clock),		-	
	Middle Speed	500kHz (Internal RC oscillation)			
	Low Speed	32.768kHz (Crystal oscillation)		1/16 of RC 500kHz	
Minimum Execution Time		0.244us@4.096MHz 30.5us@32.768KHz		2us@500KHz 32.0us@31.25kHz	
Supply Voltage		1.1V to 3.6V		1.6V to 3.6V	
Operating Temperature (°C)		-20 °C to 70 °C, -40 °C to 85 °C(P version)		-20 to 70	-40 to 85
Supply Current (Typ./25 °C)	Standby mode	HALT mode : 0.5uA, STOP mode : 0.15uA		HALT mode : 15uA, STOP mode : 0.2uA	
	Operating mode	32.768kHz : 6uA (Run duty = 100%), 500KHz : 82uA (Internal RC), 4.096MHz : 830uA (Internal PLL)		31.25kHz : 20uA (Run duty = 100%), 500KHz : 90uA (Internal RC),	
Supply Form		Die, 48TQFP		Die, 48TQFP	
Status		Mass Production		Developing	

ML610Q400s Specification Table 5/5

Standard type

Part Number		Q487	Q487P	Q488	Q488P	Q489	Q489P
CPU		8bit RISC CPU nX-U8/100 Core					
ROM (Flash)		48 Kbyte					
Data RAM		1.5 Kbyte					
LCD Driver		-					
Max. Number of Dots		-					
Port (Incl. 2nd function)		36					
A/D Converter	12-bit SA-type	-					
	24-bit RC-type	-					
Serial I/F		I ² C (Master/Slave) x 1, UART x 2, SSIO(SPI) x 1					
Timer	8bit Timer	8					
	16bit PWM	2					
	Others	TBC (Time Base Counter) x 1, WDT x 1, WDTOUT(Q487 only)					
External Interrupt		6					
Other Functions		Clock output (High/Low speed), Low speed oscillation frequency compensation					
Operating Frequency	High Speed	1MHz Internal RC oscillation		Max.4.096MHz (Crystal/Ceramic oscillation)			
	Middle Speed	-		-			
	Low Speed	32.768kHz (Crystal oscillation)				1/16 of 4MHz	
Minimum Execution Time		1us@1MHz 30.5us@32.768KHz		0.244us@4.096MHz 30.5us@32.768KHz		0.244us@4.096MHz 32.0us@31.25kHz	
Supply Voltage		1.8V to 3.8V					
Operating Temperature (°C)		-20 to 70	-40 to 85	-20 to 70	-40 to 85	-20 to 70	-40 to 85
Supply Current (Typ./25 °C)	Standby mode	HALT mode : 1.7uA, STOP mode : 0.2uA				HALT mode : TBD, STOP mode : 0.2uA	
	Operating mode	32.768kHz : 7.5uA (Run duty = 100%), 1MHz : 195uA		31.25kHz : TBD, 4MHz : TBD			
Supply Form		Die, 48TQFP					
Status		Developing					

Thank You