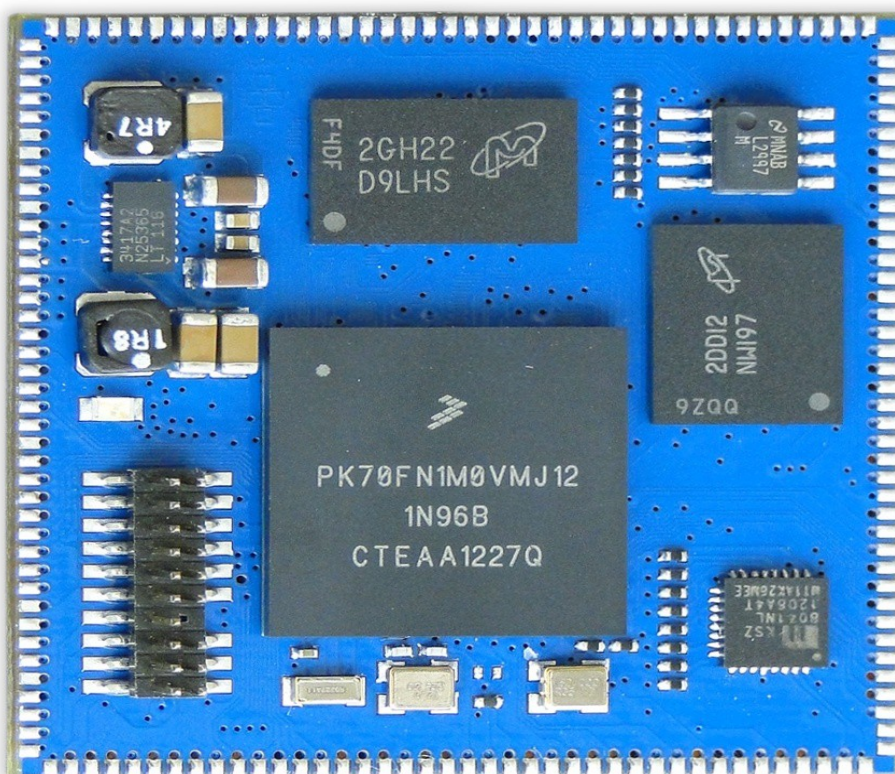


SQM4-K70 Datasheet

Rev. 1.1b



Revision history

Date	Doc.Rev	SQM4-K70 version	Changes
11. 6. 2012	Rev.1.0	V1.0	Initial Release
28. 8. 2012	Rev.1.1	V1.1	RIM Frame size changed Solder mask color set to blue
26. 2. 2013	Rev.1.1b	V1.1b	UART0 pinout corrected, suggested ALT changed

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1. Introduction

1.1 Hardware

SQM4-K70 is a solderable computer module based on the new Freescale ARM Cortex M4 microcontroller Kinetis K70 series. It runs at up to 150 Mhz and consumes as little as 500mW.

It also offers all the interfaces needed in a modern embedded device: beside the internal Flash memory, external NAND Flash, interfaces available for data storage – SD micro card, USB Memory Stick.

The module provides glueless connectivity to passive and active LCDs with resolution up to 800x600, as well as 4-wire resistive touch screens without next controller.

An integrated Ethernet PHY provides 10/100 Mbit Ethernet connection with time stamp functionality.

1.2 Software

The MQX is default supported operating software as well as bare metal routines. In other way are a lot of RTOS applicable on ARM M4/ Kinetis family microcontrollers.

1.3 Features Summary

CPU:

MK70FN1M0 120 / 150 Mhz

Memory:

1 MB FLASH on chip

128 kB SRAM on chip

64MBx16 DDR2 on module

128 MBx8 NAND FLASH on module

Interfaces:

8 Bit processor bus

LCD 24bit

Touch screen

I2S audio digital

I2C interconnect

CAN

USB OTB/HOST/DEVICE

SPI

UART / IR

SDCard

Ethernet 10/100 Mbit

Tamper detect

A/D high speed 12 bit

A/D 16 bit

D/A 12 bit

Compare

Up to 134 GPIO

1.4 Reference Documents

Freescale MK70FN1M0 Microcontroller K70 Sub-Family Data Sheet for 120 MHz devices in 256 pin packages:

http://cache.freescale.com/files/microcontrollers/doc/data_sheet/K70P256M120SF3.pdf?fsp=1

Kinetis K70 Family Fact Sheet:

http://cache.freescale.com/files/32bit/doc/fact_sheet/KNTSK70FS.pdf?fsp=1

Micron DDR2 memory datasheet:

http://www.micron.com/~media/Documents/Products/Data%20Sheet/DRAM/1Gb_DDR2.pdf

Micron NAND Flash memory datasheet:

<http://www.micron.com/my/login?returnUrl=http://www.micron.com/parts/nand-flash/mass-storage/mt29f4g16abadah4-it>

Micrel Ethernet PHY:

http://www.micrel.com/_PDF/Ethernet/datasheets/ksz8041nl_rnl.pdf#page=2

2. Functional Description

2.1 Block Diagram

3. Signal Description

This chapter describes the signals grouped by their function and used in SQM4-EasyBoard. Some of SQM4-K70 pins have dedicated functionality, but most are highly multiplexed. Same pin can have up to 8 different roles and the same functionality is sometimes also usable as a General Purpose Input/Output pin (GPIO).

IO Types notation:	I:	Digital CMOS input
	O:	Digital CMOS output
	IO:	Digital CMOS input / output

AIN: Analog input
 AOUT: Analog output
 AINOUT: Analog input / output
 PWR: Power supply
 PWOUT: Power supply output

3.1 Memory Bus

Pin Name	Description	IO type	Multiplexed
FB_D0	Flex Bus data	IO	PTC15
FB_D1	Flex Bus data	IO	PTC14
FB_D2	Flex Bus data	IO	PTC13
FB_D3	Flex Bus data	IO	PTC12
FB_D4	Flex Bus data (8 bit NAND used only)	IO	NFC_D12
FB_D5	Flex Bus data (8 bit NAND used only)	IO	NFC_D13
FB_D6	Flex Bus data (8 bit NAND used only)	IO	NFC_D14
FB_D7	Flex Bus data (8 bit NAND used only)	IO	NFC_D15
FB_CS2_B	Flex Bus Chip Select	IO	PTC18
FB_CS0_B	Flex Bus Chip Select	IO	PTD1

3.2 SD card

Pin Name	Description	IO type	Multiplexed
SDHC0_D1	Bidirectional line for read/write data	IO	PTE0
SDHC0_D0	Bidirectional line for read/write data	IO	PTE1
SDHC0_DCLK	SD/SDIO Card Bus Clock	IO	PTE2
SDHC0_CMD	SD/SDIO Card Command	IO	PTE3
SDHC0_D3	Bidirectional line for read/write data	IO	PTE4
SDHC0_D2	Bidirectional line for read/write data	IO	PTE5

3.3 LCD Controller

Pin Name	Description	IO type	Multiplexed
GLCD_PCLK	LCD Pixel Clock	IO	PTF0
GLCD_DE	LCD Data Enable	IO	PTF1
GLCD_HSYNC	LCD Refresh Horizontal Sync	IO	PTF2

Pin Name	Description	IO type	Multiplexed
GLCD_VSYNC	LCD Refresh Vertical Sync	IO	PTF3
GLCD_D0	LCD Display Data driven from frame buffer	IO	PTF4
GLCD_D1	LCD Display Data driven from frame buffer	IO	PTF5
GLCD_D2	LCD Display Data driven from frame buffer	IO	PTF6
GLCD_D3	LCD Display Data driven from frame buffer	IO	PTF7
GLCD_D4	LCD Display Data driven from frame buffer	IO	PTF8
GLCD_D5	LCD Display Data driven from frame buffer	IO	PTF9
GLCD_D6	LCD Display Data driven from frame buffer	IO	PTF10
GLCD_D7	LCD Display Data driven from frame buffer	IO	PTF11
GLCD_D8	LCD Display Data driven from frame buffer	IO	PTF12
GLCD_D9	LCD Display Data driven from frame buffer	IO	PTF13
GLCD_D10	LCD Display Data driven from frame buffer	IO	PTF14
GLCD_D11	LCD Display Data driven from frame buffer	IO	PTF15
GLCD_D12	LCD Display Data driven from frame buffer	IO	PTF16
GLCD_D13	LCD Display Data driven from frame buffer	IO	PTF17
GLCD_D14	LCD Display Data driven from frame buffer	IO	PTF18
GLCD_D15	LCD Display Data driven from frame buffer	IO	PTE26
GLCD_D16	LCD Display Data driven from frame buffer	IO	PTE27
GLCD_D17	LCD Display Data driven from frame buffer	IO	PTE28
GLCD_D18	LCD Display Data driven from frame buffer	IO	PTF22
GLCD_D19	LCD Display Data driven from frame buffer	IO	PTF23
GLCD_D20	LCD Display Data driven from frame buffer	IO	PTF24
GLCD_D21	LCD Display Data driven from frame buffer	IO	PTF25
GLCD_D22	LCD Display Data driven from frame buffer	IO	PTF26
GLCD_D23	LCD Display Data driven from frame buffer	IO	PTF27

3.4 UARTS

Pin Name	Description	IO type	Multiplexed
UART3_RTS_B	Full Function UART Request to Send	IO	PTB8
UART3_CTS_B	Full Function UART Clear to Send	IO	PTB9
UART3_RX	Full Function UART Receive Data	IO	PTB10
UART3_TX	Full Function UART Transmit Data	IO	PTB11
UART0_RX	UART Receive Data	IO	PTB16

Pin Name	Description	IO type	Multiplexed
UART0_TX	UART Transmit Data	IO	PTB17
UART5_RX	UART Receive Data	IO	PTF19
UART5_TX	UART Transmit Data	IO	PTF20
UART5_RTS_B	UART Request to Send	IO	PTF21

3.5 Synchronous Serial Port (SSP)

Pin Name	Description	IO type	Multiplexed
SPI2_PCS0	Chip select for SSP2	IO	PTD11
SPI2_SCK	Serial bit clock	IO	PTD12
SPI2_SOUT	Serial data out	IO	PTD13
SPI2_SIN	Serial data in	IO	PTD14
SPI2_PCS1	Chip select for SSP2	IO	PTD15
SPI0_PCS0	Chip select for SSP0	IO	PTE16
SPI0_SCK	Serial bit clock	IO	PTE17
SPI0_SOUT	Serial data out	IO	PTE18
SPI0_SIN	Serial data in	IO	PTE19

3.6 USB

Pin Name	Description	IO type	Multiplexed
USB0_DN	USB OTG/HOST/DEVICE Negative Line	IO	
USB0_DP	USB OTG/HOST/DEVICE Positive Line	IO	
USB0_VBUS	USB Power Bus	PWR	
USB_OC1	USB Overcurrent HOST	IO	PTD2
USB_OC2	USB Overcurrent OTG	IO	PTD3
USB_EN1	USB Power Enable HOST	IO	PTD6
USB_EN2	USB Power Enable OTG	IO	PTD7

3.7 I2C

Pin Name	Description	IO type	Multiplexed
I2C0_SCL	Serial Clock	IO	PTB2
I2C0_SDA	Serial Data	IO	PTB3

3.8 I2S

Pin Name	Description	IO type	Multiplexed
I2S0_MCLK	Audio Master Clock	IO	PTE6
I2S0_RXD0	Receive Data	IO	PTE7
I2S0_RX_FS	Receive Frame Sync	IO	PTE8
I2S0_RX_BCLK	Transmit Bit Clock	IO	PTE9
I2S0_TXD0	Transmit Data	IO	PTE10
I2S0_TX_FS	Transmit Frame Sync	IO	PTE11
I2S0_BCLK	Transmit Bit Clock	IO	PTE12

3.9 Tamper detect

Pin Name	Description	IO type	Multiplexed
TAMPER0	External tamper input or active tamper output	IO	
TAMPER1	External tamper input or active tamper output	IO	
TAMPER2	External tamper input or active tamper output	IO	

3.10 JTAG

Pin Name	Description	IO type	Multiplexed
TCK	Test Clock	IO	PTA0
TDI	Test Data In	IO	PTA1
TDO	Test Data Out	IO	PTA2
TMS	Test Mode Select	IO	PTA3
TRACE_CLKOUT	Trace Clock Output	IO	PTA6
TRACE_D3	Trace Data	IO	PTA7
TRACE_D2	Trace Data	IO	PTA8
TRACE_D1	Trace Data	IO	PTA9
TRACE_DO	Trace Data	IO	PTA10

3.11 Digital to Analog Converter

Pin Name	Description	IO type	Multiplexed
DAC0_OUT	Output D/A converter 12 bit	AOUT	
DAC1_OUT	Output D/A converter 12 bit	AOUT	
VSSA	Analog ground	AOUT	

3.12 CAN

Pin Name	Description	IO type	Multiplexed
CAN1_RX	CAN Receive Pin	IO	GLCD_D20
CAN1_TX	CAN Transmit Pin	IO	GLCD_D21
CAN0_TX	CAN Transmit Pin	IO	PTB18
CAN0_RX	CAN Receive Pin	IO	PTB19

3.13 Touch

Pin Name	Description	IO type	Multiplexed
ADC1_SE10	4wire Resistive Touch Panel (X Plus Term)	AINOUT	PTB4
ADC1_SE11	4wire Resistive Touch Panel (X Minus Term)	AINOUT	PTB5
ADC1_SE12	4wire Resistive Touch Panel (Y Plus Term)	AINOUT	PTB6
ADC1_SE13	4wire Resistive Touch Panel (Y Minus Term)	AINOUT	PTB7

3.14 Ethernet

Pin Name	Description	IO type	Multiplexed
LLEDK	Activity Indicator	O	RMII0_TXEN
RLEDK	Speed Indicator	O	RMII0_CRS_DV
RX-	TX Differential Output (minus)	O	RMII0_RXD1
RX+	TX Differential Output (plus)	O	RMII0_RXD0
TX-	RX Differential Input (minus)	I	RMII0_TXD1
TX+	RX Differential Input (plus)	I	RMII0_TXD0

3.15 Analog to Digital Converter

Pin Name	Description	IO type	Multiplexed
ADC0_SE16	Single ended analog channel input	AIN	
ADC1_SE16	Single ended analog channel input	AIN	
PGA0DP	Differential analog channel input	AIN	
PGA0DM	Differential analog channel input	AIN	
PGA1DP	Differential analog channel input	AIN	
PGA1DM	Differential analog channel input	AIN	
PGA2DP	Differential analog channel input	AIN	
PGA2DM	Differential analog channel input	AIN	
CMP3_IN4	Analog voltage inputs	IO	PTA24
CMP3_IN5	Analog voltage inputs	IO	PTA25
ADC2_SE15	Single ended analog channel input	IO	PTA26
ADC2_SE14	Single ended analog channel input	IO	PTA27
ADC2_SE13	Single ended analog channel input	IO	PTA28
ADC2_SE12	Single ended analog channel input	IO	PTA29

3.16 Miscalanes

Pin Name	Description	IO type	Multiplexed
NMI	Non maskable interrupt pending	IO	PTA4
FTM0_CH2	FlexTimer	IO	PTA5
RESET_B	System Reset	IO	
UART4_TX	Alternate to EXTAL1 12MHz	IO	PTE24
UART4_RX	Alternate to EXTAL2 12MHz	IO	PTE25
FTM2_CH1	FlexTimer	IO	PTA11
FTM1_FLT0	FlexTimer Fault	IO	PTA19

3.17 Power

Pin Name	Description	IO type	Multiplexed
P5V	Main power supply	PWR	
GND	System ground	PWR	
VBATIN	Batery backup and RTC power supply	PWR	
P3V3	Output supply power	PWOUT	

Pin Name	Description	IO type	Multiplexed
VDDA	Analog power supply filtered from P3V3	PWOUT	
VSSA	Analog ground filtered from GND	PWOUT	
VREFH	Analog reference positive	PWOUT	
VREFL	Analog reference negative	PWOUT	

4. SQM4 connectors

4.1 Physical location

The main 160 pin **RIM** connection is placed along the module perimeter, on the bottom or top side respectively. JTAG/JTRACE 19pin header 1.27 pitch connector is placed on the top side.

4.2 RIM 160 connection

Pin #	Description
1	PTB2/I2C0_SCL
2	PTB3/I2C0_SDA
3	PTB4/ADC1_SE10
4	PTB5/ADC1_SE11
5	PTB6/ADC1_SE12
6	PTB7/ADC1_SE13
7	PTB8/UART3_RTS_B
8	PTB9/UART3_CTS_B
9	PTB10/UART3_RX
10	PTB11/UART3_TX
11	PTB16/UART0_RX
12	PTB17/UART0_TX
13	PTB18/FB_AD15
14	PTB19/FB_OE_B
15	PTB20/FB_D7/NFC_D15
16	PTB21/FB_D6/NFC_D14
17	PTB22/FB_D5/NFC_D13
18	PTB23/FB_D4/NFC_D12
19	GND
20	PTC0/FB_AD14/NFC_D11
21	PTC1/FB_AD13/NFC_D10

Pin #	Description
81	PTA3/TMS
82	RESET_B
83	DAC0_OUT
84	DAC1_OUT
85	VDDA
86	VREFH
87	VREFL
88	VSSA
89	ADC0_SE16
90	ADC1_SE16
91	PGA0DP
92	PGA0DM
93	PGA1DP
94	PGA1DM
95	PGA2PD
96	PGA2DM
97	PGA3DP
98	PGA3DM
99	PTE24/EXTAL1xUART4_TX
100	PTE25/XTALxUART4_RX
101	PTA4/NMI

22	PTC2/FB_AD12/NFC_D9
23	PTC3/CMP1_IN1
24	PTC4/FB_AD11/NFC_D8
25	PTC5/FB_AD10/NFC_D7
26	PTC6/FB_AD9/NFC_D6
27	PTC7/FB_AD8/NFC_D5
28	PTC8/FB_AD7/NFC_D4
29	PTC9/FB_AD6/NFC_D3
30	PTC10/FB_AD5/NFC_D2
31	PTC11/FB_R/W_B/NFC_WE
32	PTC12/FB_D3
33	PTC13/FB_D2
34	PTC14/FB_D1
35	PTC15/FB_D0
36	PTC18/FB_CS2_B
37	PTC19/FB_CS3_B
38	PTD0/FB_ALE
39	PTD1/FB_CSO_B
40	PTD2/FB_AD4
41	PTD3/FB_AD3
42	PTD4/FB_AD2/NFC_D1
43	PTD5/FB_AD1/NFC_D0
44	PTD6/FB_AD0
45	PTD7/FB_CLKOUT
46	PTD11/LCD CONTRAST
47	PTD12/SPI2_SCK
48	PTD13/SPI2_SOUT
49	PTD14/SPI2_SIN
50	PTD15/SPI2_PCS1
51	P5V
52	P5V
53	P5V
54	GND
55	GND

102	PTA5/FTM0_CH2
103	PTA6/TRACE_CLKOUT
104	PTA7/TRACE_D3
105	PTA8/TRACE_D2
106	PTA9/TRACE_D1
107	PTA10/TRACE_D0
108	PTA11/FTM2_CH1
109	PTA19/FTM1_FLT0
110	PTA24/CMP3_IN4
111	PTA25/CMP3_IN5
112	PTA26/ADC2_SE15
113	PTA27/ADC2_SE14
114	PTA28/ADC2_SE13
115	PTA29/ADC2_SE12
116	TAMPER0
117	TAMPER1
118	TAMPER2
119	LLEDKxRMII0_TXEN
120	RLEDKxRMII0_CRS_DV
121	xRMII0_MDIO
122	xRMII0_MDC
123	RX-xRMII0_RXD1
124	RX+xRMII0_RXD0
125	TX-xRMII0_TXD1
126	TX+xRMII0_TXD0
127	PTF0/GLCD_PCLK
128	PTF1/GLCD_DE
129	PTF2/GLCD_HSYNC
130	PTF3/GLCD_VSYNC
131	PTF4/GLCD_D0
132	PTF5/GLCD_D1
133	PTF6/GLCD_D2
134	PTF7/GLCD_D3
135	PTF8/GLCD_D4

56	GND
57	VBATIN
58	PTE0/SDHC0_D1
59	PTE1/SDHC0_D0
60	PTE2/SDHC0_DCLK
61	PTE3/SDHC0_CMD
62	PTE4/SDHC0_D3
63	PTE5/SDHC0_D2
64	PTE6/I2S0_MCLK
65	PTE7/I2S0_RXD0
66	PTE8/I2S0_RX_FS
67	PTE9/I2S0_RX_BCLK
68	PTE10/I2S0_TXD0
69	PTE11/I2S0_TX_FS
70	PTE12/I2S0_TX_BCLK
71	PTE16/SPI0_PCS0
72	PTE17/SPI0_SCK
73	PTE18/SPI0_SOUT
74	PTE19/SPI0_SIN
75	USB0_DN
76	USB0_DP
77	USB0_VBUS
78	PTA0/TCK
79	PTA1/TDI
80	PTA2/TDO

136	PTF9/GLCD_D5
137	PTF10/GLCD_D6
138	PTF11/GLCD_D7
139	PTF12/GLCD_D8
140	PTF13/GLCD_D9
141	PTF14/GLCD_D10
142	PTF15/GLCD_D11
143	PTF16/GLCD_D12
144	PTF17/GLCD_D13
145	PTF18/GLCD_D14
146	PTE26/GLCD_D15
147	PTE27/GLCD_D16
148	PTE28/GLCD_D17
149	P3V3
150	P3V3
151	GND
152	PTF19/UART5_RX
153	PTF20/UART5_TX
154	PTF21/UART5_RTS_B
155	PTF22/FTM1_CH0
156	PTF23/FTM1_CH1
157	PTF24/CAN1_RX
158	PTF25/CAN1_TX
159	PTF26/FTM2_QD_PHA
160	PTF27/FTM2_QD_PHB

4.3 JTAG

Pin #	Description
1	P3V3
3	GND
5	GND
7	NC

Pin #	Description
2	PTA3/TMS
4	PTA0/TCK
6	PTA2/TDO
8	PTA1/TDI

9	PTA4/NMI
11	P5V
13	P5V
15	GND
17	GND
19	GND

10	RESET_B
12	PTA6/CLKOUT
14	PTA10/TRACE D0
16	PTA9/TRACE D1
18	PTA8/TRACE D2
20	PTA7/TRACE D3

5. Technical Specifications

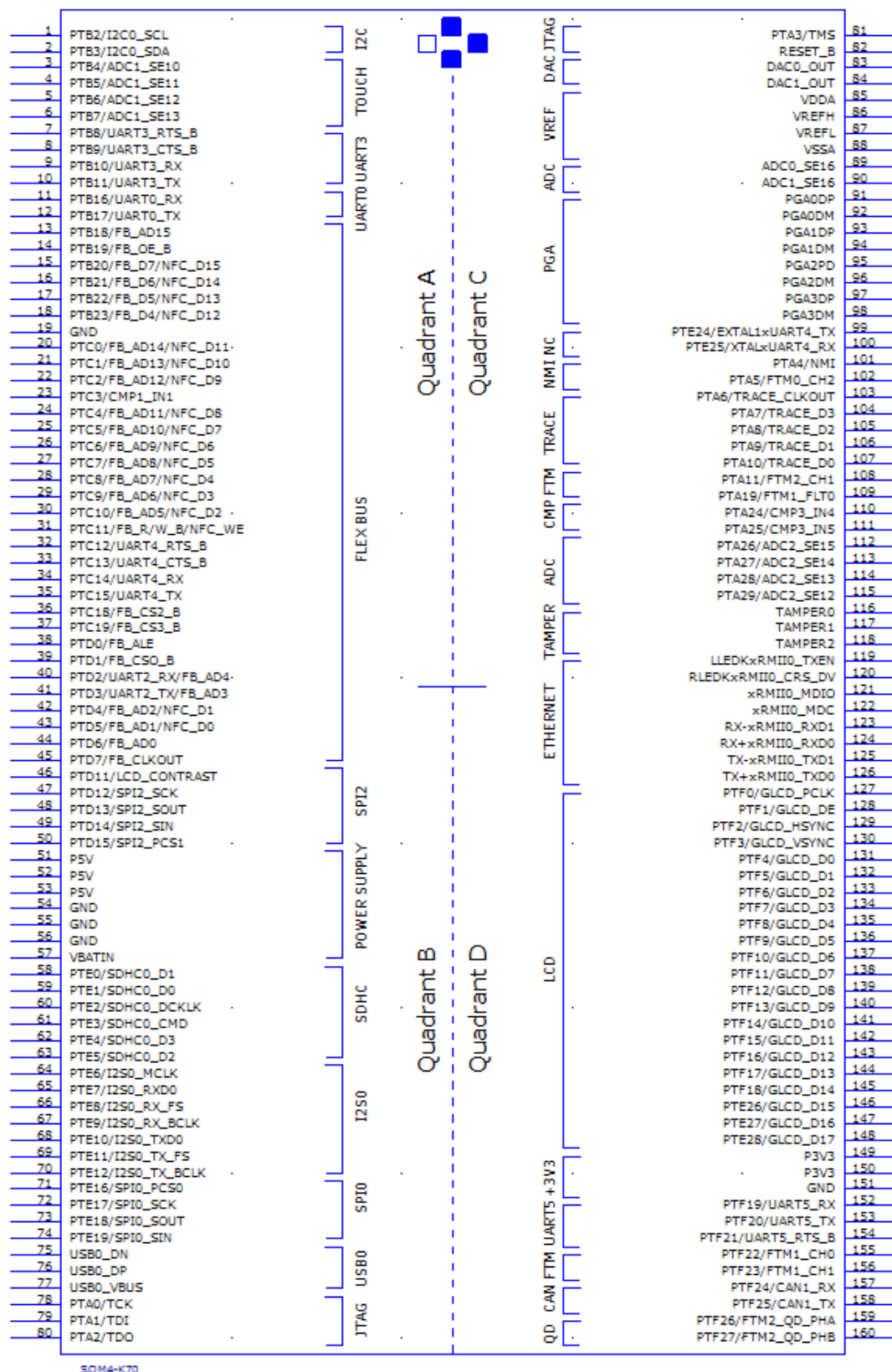
5.1 Electrical – DC characteristic

Symbol	Description	Min	Typ	Max	Unit
Vcc	Power supply voltage	2.3	3.3	5.5	V
Icc	Operating current		120	160	mA
VIH	Digital input high voltage	2.3		VCC	V
VIL	Digital input low voltage	-0.1		0.66	V
VIHUSB	Digital input high voltage USB			5.5	V
VOUT	Output supply voltage	3.2	3.3	3.4	V
IOUT	Output supply current			900	mA

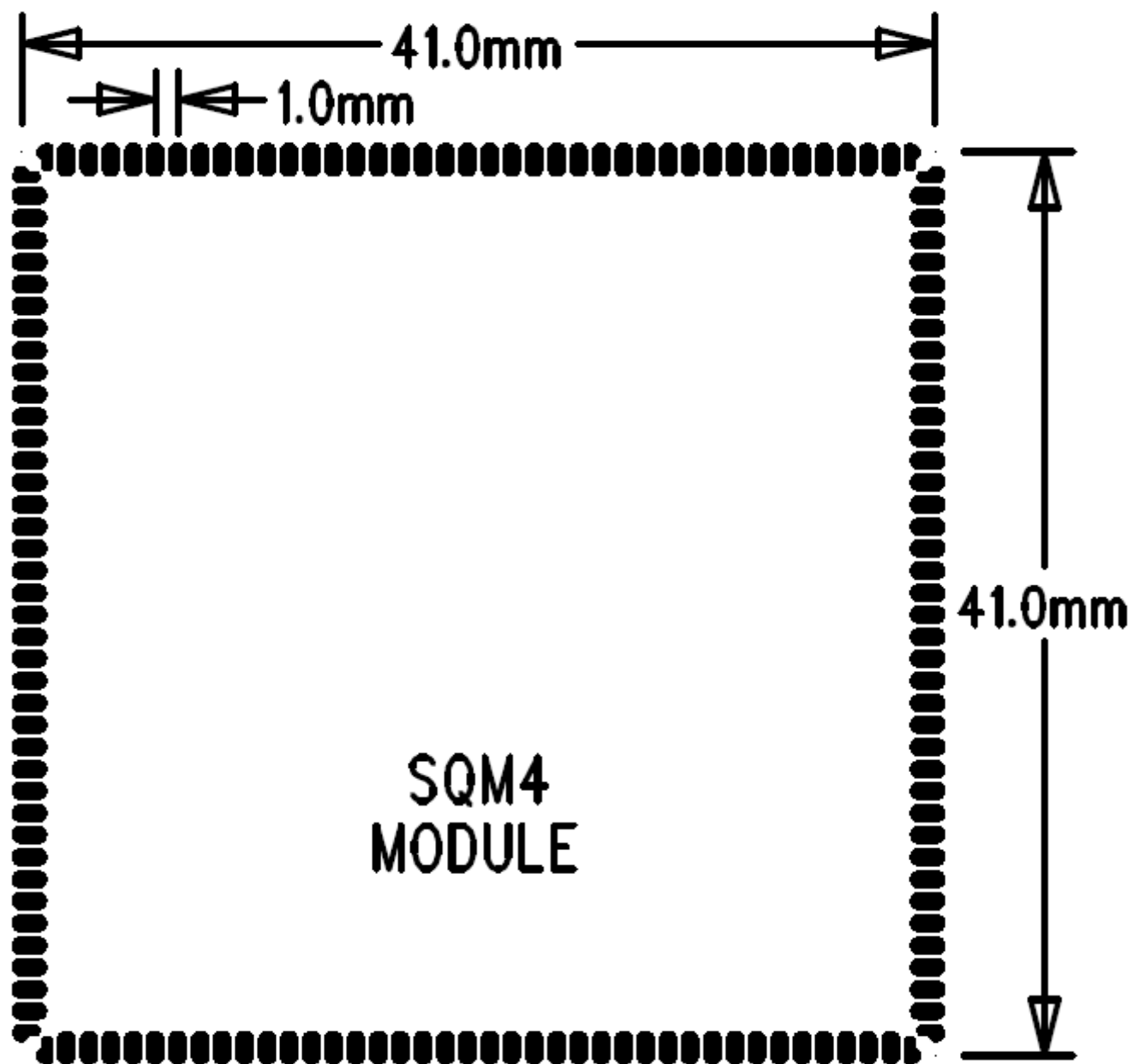
5.2 Mechanical

Symbol	Description	Min	Typ	Max	Unit
W	Width		41		mm
H	Height		41		mm
D	Depth		5.5		mm

5.3 Schematic logical symbol



5.4 PCB Footprint for SQM4 module



5.5 Temperature Range

Symbol	Description	Min	Typ	Max	Unit
T_AMB	Operating temperature range 1)	-40		85	°C
T_AMB	Operating temperature range 2)	0		70	°C
T_STOR	Storage temperature range	-40		105	°C
T_SOLD	Solderable temperature 3)		260		°C
H_AMB	Operating ambient humidity	10		90	%RH
T_STOR	Storage humidity	10		90	%RH

- 1) Industrial variant
- 2) Commercial variant
- 3) 5 seconds peak

5.5 RoHS Compliance

SQM4-K70 module comply with the European Union's Directives EN55022 Class B.

6. Final agreement

6.1 Disclaimer

ELNICO s.r.o. reserves the right to make changes, without notice, to any product, including circuits and/or software described or contained in this datasheet.

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