

## QS Family

### QFN Style Solder-Down Computer-on-Modules

- Solder-down version
- 27mm square
- 2.3mm total height
- QFN type lead style
  - 1mm pitch
  - 100 pads
  - Thermal pad
- Visual solder joint inspection possible after soldering
- Single-sided assembly
- High speed design compliant
- 3.3V power supply



## Key Features

- Processor                    RENESAS RZ/G2L  
Dual 1.2GHz Arm® Cortex®-A55  
200-MHz Arm® Cortex®-M33
- RAM                            512MB/1GB DDR3L SDRAM
- ROM                            4GB eMMC
  
- Grade                         Industrial
- Temperature                -40°C to 85°C
- Display support
  
- Interfaces                    24-bit RGB  
MIPI® DSI (2-lanes)
  
- GPU/VPU                    500-MHz Arm® Mali™-G31  
H.264 Video Codec Processor
  
- Connectivity
  - Gb Ethernet, USB2.0, eMMC/SD
  - UART, I²C, SPI, PWM, SAI, CAN

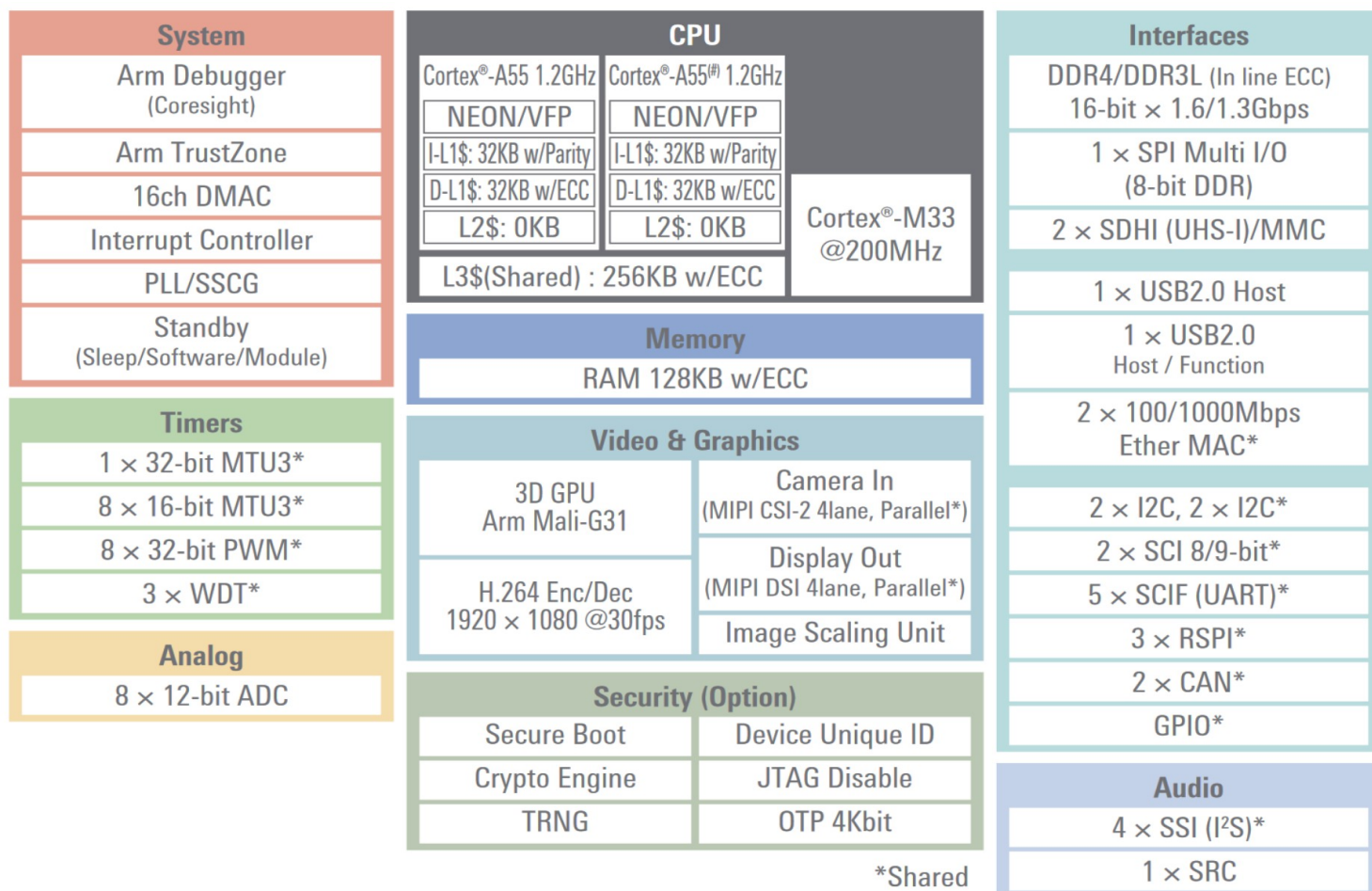
**RZ/G2L  
Dual  
Cortex®-A55**

## OS Support

- Linux



### RZ/G2L Block Diagram



### QSRZ – Main Feature Comparison and Ordering Information

	QSRZ-G2L0	QSRZ-G2L1
Primary Arm® Core	2x Cortex®-A55 up to 1.2 GHz	
Secondary Arm® Core	1x Cortex-M33 up to 500 MHz	
RAM	1 GB	512 MB
ROM	4GB eMMC	
Display Interface	24-bit RGB + 2-lane MIPI-DSI	
GPU	yes	
CAN	2x	
Security	Secure Boot, Cryptography	
Temperature	-40°C to 85°C	
Order Code	QSRZ/G2L/1GS/4GF/I	QSRZ/G2L/512S/4GF/I

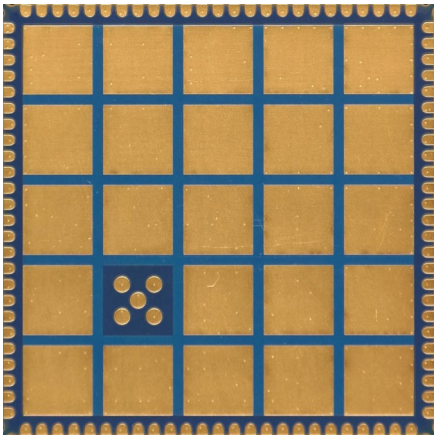
## QFN Style Computer On Module Advantages

### Defined Return Path

The reason PCB layout becomes more and more important is because of the trend to faster, higher integrated, smaller formfactors, and lower power electronic circuits. The higher the switching frequencies are, the more radiation may occur on a PCB. With good layout, many EMI problems can be minimized to meet the required specifications.

When a module or component is used in a design, the supplier specifies the basis for such a layout. It's not only the pinout which should lead to an easy wiring without the need for crossings. He has also provide a proper solution for the signal path back to the module. If this return path, mostly the ground plane, cannot be connected near the signal pin, the return current has to take another way and this may result in a loop area. The larger the area, the more radiation and EMI problems may occur.

Ka-Ro QSCOM modules uses a large ground pad on the bottom side. With this a defined ground plane connection is available for all signals. In addition to have a good return path for all signals this large ground pad can be used for cooling.



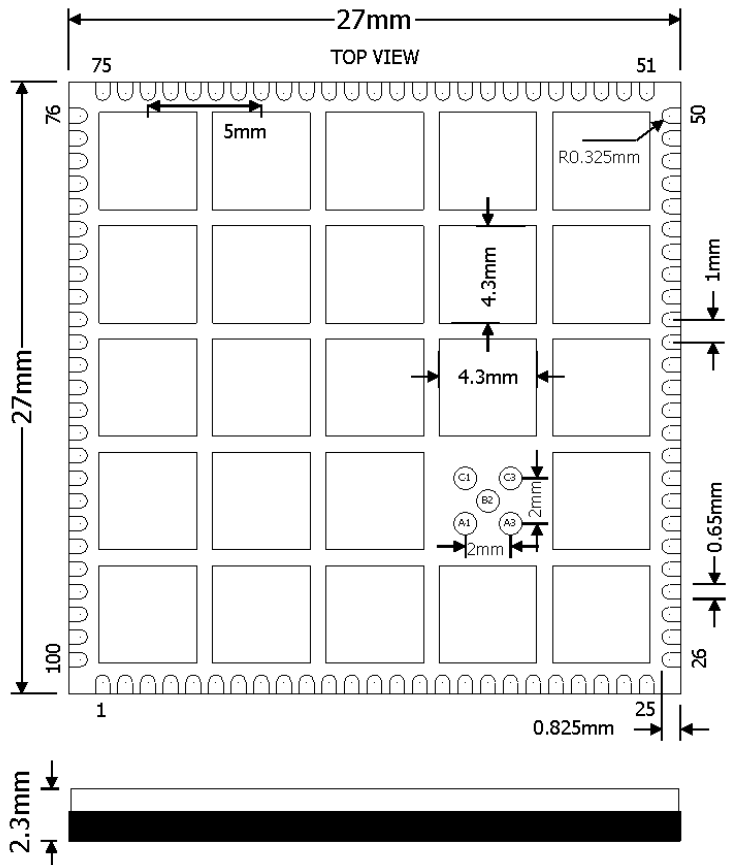
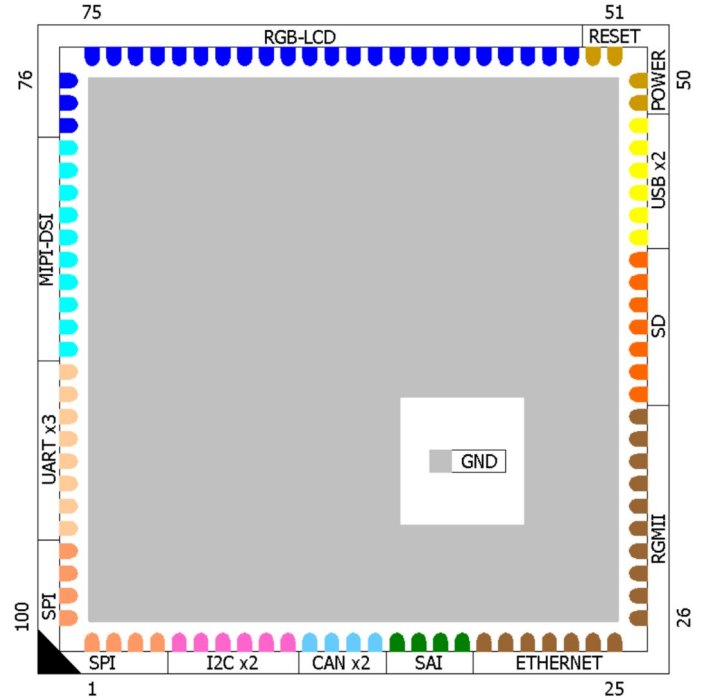
### Easy Wiring - Even 2-layer printed circuit boards can be used.

With a solid ground plane on the bottom layer, high speed signals can be routed on the top layer at a defined impedance. However, this is only possible if a peripheral or plug can be connected directly without crossing the routing.

## Advanced Soldering

Using a large solder pad underneath the component has not only electrical and thermal advantages. This is also used to hold the component at a defined height during soldering, without the solder being compressed by the weight, which could result in short circuits.

## Standard Contact Assignments



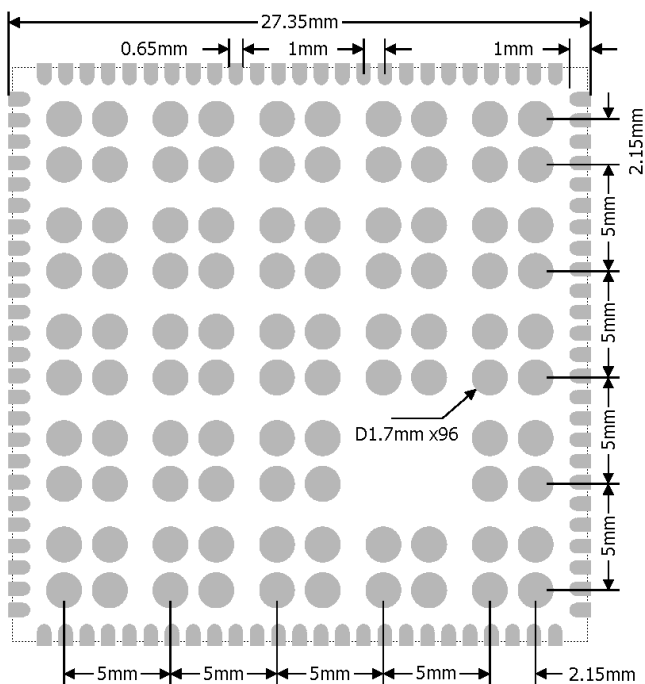


## Soldering Recommendations

Ka-Ro QSCOM modules are compatible with industrial standard reflow profile for Pb-free solders. Ka-Ro will give following recommendations for soldering the module to ensure reliable solder joint and operation of the module after soldering. Since the profile used is process and layout dependent, the optimum profile should be studied case by case. Thus following recommendations should be taken as a starting point guide.

- Refer to technical documentations of particular solder paste for reflow profile configurations
- Avoid using more than one flow.
- A 150 $\mu$ m stencil thickness is recommended.
- Aperture size of the stencil should be 1:1 with the pad size.
- A low residue, “no clean” solder paste should be used due to low mounted height of the component.

## Recommended stencil design

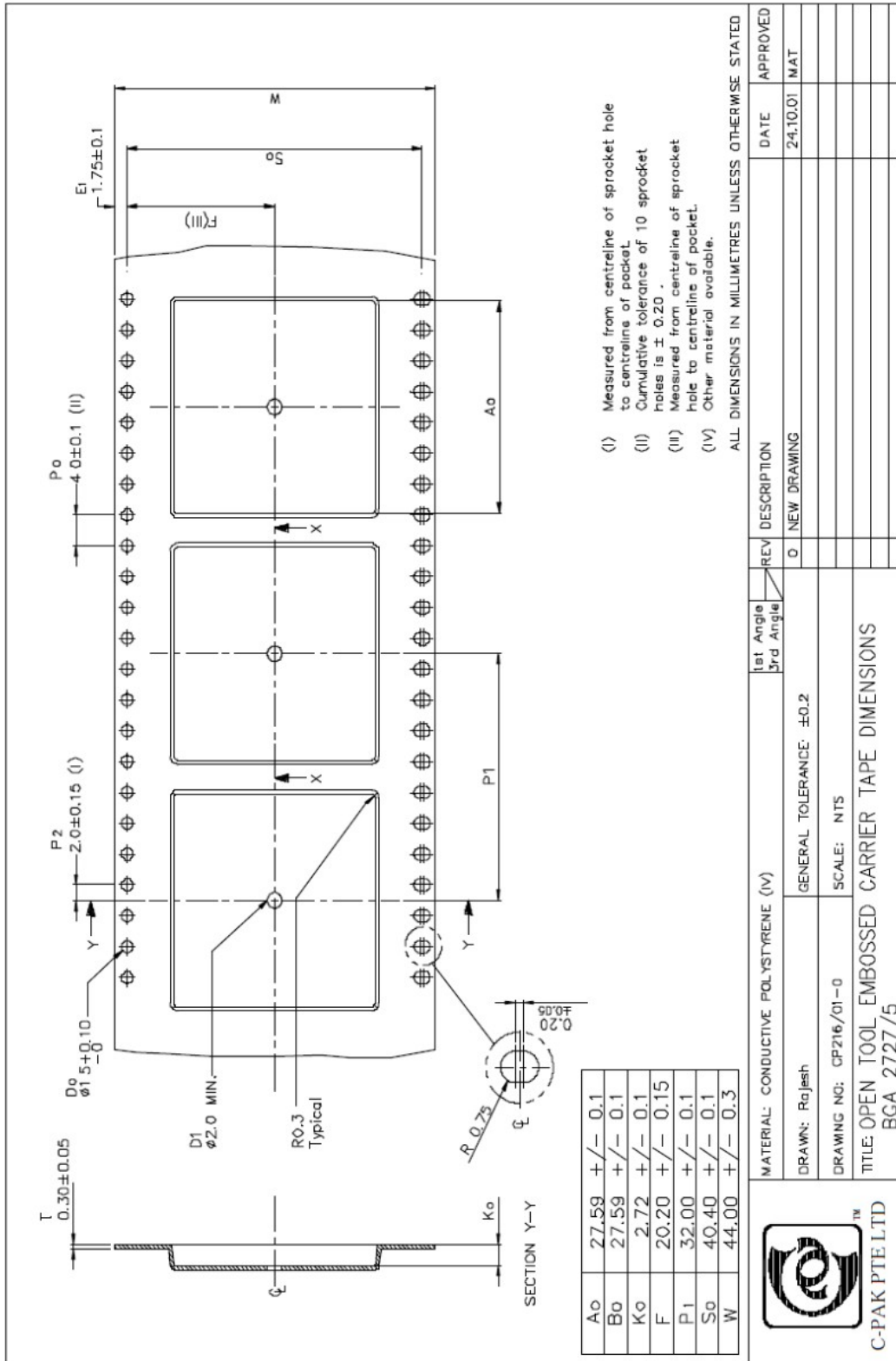


Aperture size of the stencil is 1:1 with the pad size. Four 1.7mm diameter bumps are used for each of the 4.3mm square GND pads sections giving a 50% solder paste padding. The lower component settling with this ensures that the pads at the edge are always soldered even at vertical misalignment by distortion or warping.

## Thermal Considerations

The QSCOM module consume more than 1 W of DC power. In any application where high ambient temperatures for more than a few seconds can occur, it is important that a sufficient cooling surface is provided to dissipate the heat. The thermal pad at the bottom of the module must be connected to the application board ground planes by soldering. The application board should provide a number of vias under and around the pad to conduct the produced heat to the board ground planes, and preferably to a copper surface on the other side of the board in order to conduct and spread the heat. The module internal thermal resistance should in most cases be negligible compared to the thermal resistance from the module into air, and common equations for surface area required for cooling can be used to estimate the temperature rise of the module. Only copper planes on the circuit board surfaces with a solid thermal connection to the module ground pad will dissipate heat. For an application with high load the maximum allowed ambient temperature should be reduced due to inherent heating of the module, especially with small fully plastic enclosed applications where heat transfer to ambient air is low due to low thermal conductivity of plastic. The module measured on the evaluation board exhibits a temperature rise of about 20°C above ambient temperature. An insufficiently cooled module will rapidly heat beyond operating range in ambient room temperature.

# Packaging



- (I) Measured from centreline of sprocket hole to centreline of pocket.
- (II) Cumulative tolerance of 10 sprocket holes is  $\pm 0.20$ .
- (III) Measured from centreline of sprocket hole to centreline of pocket.
- (IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED

MATERIAL: CONDUCTIVE POLYSTYRENE (IV)		1st Angle	REV	DESCRIPTION	DATE	APPROVED
DRAWN: Rajesh		3rd Angle	0	NEW DRAWING	24.10.01	MAT
GENERAL TOLERANCE: $\pm 0.2$						
DRAWING NO: CP216/01-0						
SCALE: NTS						
TITLE: OPEN TOOL EMBOSSED CARRIER TAPE DIMENSIONS						
BCA 2727/5						
C-PAK PTE LTD						

THIS DRAWING CONTAINS INFORMATION THAT IS PROPRIETARY TO C-PAK PTE.LTD.

PINOUT						
PIN	Type	QS Standard	RZ/G2L Pad Name	Alternate functions	GPIO	Description (refer to RZ/G2L manuals for details)
<b>POWER SUPPLY &amp; RESET</b>						
<b>1<sup>st</sup> SPI</b>						
1	3V3	SPIA_NSS	P43_3	<b>RSPI0_SSL_B</b> GTIOC5B_B IRQ7_D / MTIOC8D_B	P43_3	Slave Select signal
2	3V3	SPIA_MISO	P43_2	<b>RSPI0_MISO_B</b> GTIOC5A_B IRQ6_C / MTIOC8C_B	P43_2	Master In/Slave Out signal
3	3V3	SPIA_MOSI	P43_1	<b>RSPI0_MOSI_B</b> GTIOC4B_B GTIOC6B_C IRQ5_C / MTIOC8B_B	P43_1	Master Out/Slave In signal
4	3V3	SPIA_SCK	P43_0	<b>RSPI0_CK_B</b> GTIOC4A_B GTIOC6A_C IRQ4_C / MTIOC8A_B	P43_0	Serial Clock signal
<b>I2C</b>						
5	3V3	I2CA_SCL	RIIC1_SDA	<b>RIIC1_SDA</b>	N/A	I2C Data
6	3V3	I2CA_SDA	RIIC1_SCL	<b>RIIC1_SCL</b>	N/A	I2C Clock
7	3V3	INTA	P46_3	SSI1_RXD_D GTETRGD_D CAN1_RX_DATARATE_EN_E RIIC3_SCL_C	<b>P46_3</b>	
8	3V3	I2CB_SCL	P42_4	<b>RIIC2_SCL_C</b> CAM_FIELD_B CAN0_RX_DATARATE_EN_D SCIF2_RTS#_D	P42_4	
9	3V3	I2CB_SDA	P42_3	<b>RIIC2_SDA_C</b> RSPI2_SSL_B CAN0_TX_DATARATE_EN_D SCIF2_CTS#_D MTIOC7D_B	P42_3	
10	3V3	INTB	P46_2	SSI1_TXD_D GTETRGC_D CAN1_TX_DATARATE_EN_E RIIC3_SDA_C	<b>P46_2</b>	
<b>CAN</b>						
11	3V3	CANA_RX	P42_2	ADC_TRG_D RSPI2_MISO_B <b>CAN0_RX_D</b> SCIF2_SCK_D MTIOC7C_B	P42_2	
12	3V3	CANA_TX	P42_1	USB1_OVRCUR_D RSPI2_MOSI_B <b>CAN0_TX_D</b> SCIF2_RXD_D MTIOC7B_B	P42_1	
13	3V3	CANB_RX	P46_1	SSI1_RCK_D GTETRGB_D <b>CAN1_RX_E</b> RIIC2_SCL_D	P46_1	
14	3V3	CANB_TX	P46_0	SSI1_BCK_D GTETRGA_D <b>CAN1_TX_E</b> RIIC2_SDA_D	P46_0	
<b>SAI</b>						
15	3V3	SAI_TX	P45_2	<b>SSI0_TXD_D</b> POE8#_C SCI1_SCK_B	P45_2	Serial Audio Interface serial data line 0
16	3V3	SAI_RX	P45_3	<b>SSI0_RXD_D</b> POE10#_C SCI1_CTS# RTS#_B	P45_3	Serial Audio Interface serial data line 1
17	3V3	SAI_SCK	P45_0	<b>SSI0_BCK_D</b> POE0#_C SCI1_RXD_B	P45_0	
18	3V3	SAI_FS	P45_1	<b>SSI0_RCK_D</b> POE4#_C SCI1_TXD_B	P45_1	

PIN	Type	QS Standard	RZ/G2L Pad Name	Alternate functions	GPIO	Description (refer to RZ/G2L manuals for details)
<b>ETHERNET</b>						
19	3V3	ENET_RST	P28_1	ET0_LINKSTA	P28_1	
20	3V3	ENET_CK125	AUDIO_CLK1	AUDIO_CLK1	N/A	
21	3V3	ENET_INT	P22_1	ET0_TX_ERR SSIO_RCK_B CAN1_RX_B MTCLKB_B	P22_1	
22	3V3	ENET_MDIO	P28_0	ET0_MDIO	P28_0	
23	3V3	ENET_MDC	P27_1	ET0_MDC RSPI1_SSL_A MTIOC8D_A	P27_1	
24	3V3	ENET_RXC	P24_0	ET0_RXC RX_CLK SSI1_BCK_B POE0#_B	P24_0	
25	3V3	ENET_RX_CTL	P24_1	ET0_RX_CTL RX_DV SSI1_RCK_B POE4#_B	P24_1	
26	3V3	ENET_RXD0	P25_0	ET0_RXD0 SSI1_TXD_B POE8#_B	P25_0	
27	3V3	ENET_RXD1	P25_1	ET0_RXD1 SSI1_RXD_B POE10#_B	P25_1	
28	3V3	ENET_RXD2	P26_0	ET0_RXD2 RSPI1_CK_A MTIOC8A_A	P26_0	
29	3V3	ENET_RXD3	P26_1	ET0_RXD3 RSPI1_MOSI_A MTIOC8B_A	P26_1	
30	3V3	ENET_TX_CTL	P20_1	ET0_TX_CTL TX_EN RSPI0_MOSI_A CAN0_TX_B	P20_1	
31	3V3	ENET_TXC	P20_0	ET0_TXC TX_CLK RSPI0_CK_A CAN_CLK_B	P20_0	
32	3V3	ENET_TXD3	P22_0	ET0_TXD3 SSIO_BCK_B CAN1_TX_B MTCLKA_B	P22_0	
33	3V3	ENET_TXD2	P21_1	ET0_TXD2 CAN0_RX_DATARATE_EN_B	P21_1	
34	3V3	ENET_TXD1	P21_0	ET0_TXD1 RSPI0_SSL_A CAN0_TX_DATARATE_EN_B	P21_0	
35	3V3	ENET_TXD0	P20_2	ET0_TXD0 RSPI0_MISO_A CAN0_RX_B	P20_2	
<b>SD</b>						
36	3V3	SD_CD	P19_0	SD1_CD_B GTIOC3A_B MTIOC1A_C RIIC2_SDA_B	P19_0	SD Card Detect
37	3V3	SD_D1	SD1_DATA1	SD1_DATA1	N/A	SD Data bidirectional signals, external pull up resistors must be added.
38	3V3	SD_D0	SD1_DATA0	SD1_DATA0	N/A	
39	3V3	SD_CLK	SD1_CLK	SD1_CLK	N/A	SD Output Clock.
40	3V3	SD_CMD	SD1_CMD	SD1_CMD	N/A	SD Command bidirectional signal, external pull up resistor must be added.
41	3V3	SD_D3	SD1_DATA3	SD1_DATA3	N/A	SD Data bidirectional signals, external pull up resistors must be added.
42	3V3	SD_D2	SD1_DATA2	SD1_DATA2	N/A	
<b>USB</b>						
43	analog	USBA_VBUS	Not connected			
44	analog	USBA_DN	USB1_DM			D- pin of the USB cable
45	analog	USBA_DP	USB1_DP			D+ pin of the USB cable



PIN	Type	QS Standard	RZ/G2L Pad Name	Alternate functions	GPIO	Description (refer to RZ/G2L manuals for details)
46	analog	USBB_VBUS	USB0_VBUSIN		30K-PD	10K/20K voltage divider
47	analog	USBB_DN	USB0_DM			D- pin of the USB cable
48	analog	USBB_DP	USB0_DP			D+ pin of the USB cable

## POWER SUPPLY & RESET

49	VIN					3.3V power supply input
50						
51	POR					PMIC reset input pin. Pulled to LDO1 (1.8V) power rail by an onboard 10K resistor. Asserted low, PMIC performs reset. Leave unconnected, if not used.
52	BOOT_MODE					L: Boot from FLASH H: Boot from UART

## DISPLAY

53	3V3	LCD_DE	P7_1	DISP_DE SSI0_RXD_A USB0_OTG_ID_B MTIC5V_A	P7_1	
54	3V3	LCD_VSYNC	P7_0	DISP_VSYNC SSI0_TXD_A USB0_OVRCUR_B MTIC5U_A	P7_0	
55	3V3	LCD_HSYNC	P6_1	DISP_HSYNC SSI0_RCK_A MTIOC1B_B	P6_1	
56	3V3	LCD_CLK	P6_0	DISP_CLK SSI0_BCK_A USB0_VBUSEN_B MTIOC1A_B	P6_0	
57	3V3	LCD_R1	P8_0	DISP_DATA1 USB1_VBUSEN_A RSPI2_CK_A RIIC3_SCL_A	P8_0	
58	3V3	LCD_R2	P8_1	DISP_DATA2 USB1_OVRCUR_A RSPI2_MOSI_A RIIC3_SDA_A	P8_1	
59	3V3	LCD_R3	P8_2	DISP_DATA3 RSPI2_MISO_A	P8_2	
60	3V3	LCD_R4	P9_0	DISP_DATA4 ADC_TRG_C RSPI2_SSL_A MTIOC2A_B	P9_0	
61	3V3	LCD_R5	P9_1	DISP_DATA5 MTIOC2B_B	P9_1	
62	3V3	LCD_R6	P10_0	DISP_DATA6 CAN_CLK_A MTIOC6A GTETRGA_A	P10_0	
63	3V3	LCD_R7	P10_1	DISP_DATA7 CAN0_TX_A MTIOC6B GTETRGA_A	P10_1	
64	3V3	LCD_G2	P12_0	DISP_DATA10 CAN0_RX_DATARATE_EN_A POE0#_A GTIOC7A_A	P12_0	
65	3V3	LCD_G3	P12_1	DISP_DATA11 CAN1_TX_A POE4#_A GTIOC7B_A	P12_1	
66	3V3	LCD_G4	P13_0	DISP_DATA12 CAN1_RX_A POE8#_A IRQ0_B	P13_0	
67	3V3	LCD_G5	P13_1	DISP_DATA13 CAN1_TX_DATARATE_EN_A POE10#_A IRQ1_B	P13_1	
68	3V3	LCD_G6	P13_2	DISP_DATA14 CAN1_RX_DATARATE_EN_A IRQ7_B IRQ2_B	P13_2	
69	3V3	LCD_G7	P14_0	DISP_DATA15 SSI1_BCK_A SD1_CD_A MTCLKA_A	P14_0	

PIN	Type	QS Standard	RZ/G2L Pad Name	Alternate functions	GPIO	Description (refer to RZ/G2L manuals for details)
70	3V3	LCD_B1	P15_0	DISP_DATA17 SSI1_TXD_A GTIOC4A_A MTCLKC_A	P15_0	
71	3V3	LCD_B2	P15_1	DISP_DATA18 SSI1_RXD_A GTIOC4B_A MTCLKD_A	P15_1	
72	3V3	LCD_B3	P16_0	DISP_DATA19 SCIF2_TXD_B GTIOC5A_A IRQ3_B	P16_0	
73	3V3	LCD_B4	P16_1	DISP_DATA20 SCIF2_RXD_B GTIOC5B_A IRQ4_B	P16_1	
74	3V3	LCD_B5	P17_0	DISP_DATA21 SCIF2_SCK_B GTIOC6A_A IRQ5_B	P17_0	
75	3V3	LCD_B6	P17_1	DISP_DATA22 SCIF2_CTS#_B GTIOC6B_A IRQ6_B	P17_1	
76	3V3	LCD_B7	P17_2	DISP_DATA23 SCIF2_RTS#_B IRQ7_C	P17_2	
<b>Display Control</b>						
77	3V3	LCD_EN				
78	3V3	LCD_BL	P19_1	SD1_WP_B GTIOC3B_B MTIOC1B_C RIIC2_SCL_B	P19_1	PWM Output
<b>MISC</b>						
79	3V3	LCD_R0	P7_2	DISP_DATA0 USB0_OTG_EXICEN_B MTIC5W_A	P7_2	
80	3V3	LCD_G0	P11_0	DISP_DATA8 CAN0_RX_A MTIOC6C GTETRGC_A	P11_0	
81	3V3	LCD_G1	P11_1	DISP_DATA9 CAN0_TX_Datarate_EN_A MTIOC6D GTETRGD_A	P11_1	
82	3V3	LCD_B0	P14_1	DISP_DATA16 SSI1_RCK_A SD1_WP_A MTCLKB_A	P14_1	
<b>MIPI-DSI</b>						
83	MIPI	DSI_DP1	DSI_DATA1_P	DSI_DATA1_P		
84	MIPI	DSI_DN1	DSI_DATA1_N	DSI_DATA1_N		
85	MIPI	DSI_DP0	DSI_DATA0_P	DSI_DATA0_P		
86	MIPI	DSI_DN0	DSI_DATA0_N	DSI_DATA0_N		
87	MIPI	DSI_CKP	DSI_CLKP	DSI_CLKP		
88	MIPI	DSI_CKN	DSI_CLKN	DSI_CLKN		
<b>UART</b>						
89	3V3	UARTA_RXD	P38_1	SCIF0_RXD GTETRGB_C CAN0_TX_C MTIOC4B USB1_OVRCUR_C	P38_1	1* application UART Receive Data input signal
90	3V3	UARTA_TXD	P38_0	SCIF0_TXD GTETRGA_C CAN_CLK_C MTIOC4A USB1_VBUSEN_C	P38_0	1* application UART Transmit Data output signal

PIN	Type	QS Standard	RZ/G2L Pad Name	Alternate functions	GPIO	Description (refer to RZ/G2L manuals for details)
91	3V3	UARTB_RXD	P40_1	SCIF1_RXD GTIOC6B_B CAN1_RX_C MTIC5V_B SCIO_TXD_B	P40_1	2 <sup>nd</sup> application UART Receive Data input signal
92	3V3	UARTB_TXD	P40_0	SCIF1_TXD GTIOC6A_B CAN1_TX_C MTIC5U_B SCIO_RXD_B	P40_0	2 <sup>nd</sup> application UART Transmit Data output signal
93	3V3	UARTC_RXD	P48_1	SCIF2_RXD_E RSPI1_MOSI_C RIIC2_SCL_E MTCLKB_C	P48_1	3 <sup>rd</sup> application UART Receive Data input signal
94	3V3	UARTC_TXD	P48_0	SCIF2_TXD_E RSPI1_CK_C RIIC2_SDA_E MTCLKA_C	P48_0	3 <sup>rd</sup> application UART Transmit Data output signal
95	3V3	UARTC_CTS	P48_3	SCIF2_CTS#_E RSPI1_SSL_C RIIC3_SCL_D MTCLKD_C	P48_3	3 <sup>rd</sup> application UART Clear to Send <b>input</b> signal
96	3V3	UARTC_RTS	P48_4	SCIF2_RTS#_E ADC_TRG_E	P48_4	3 <sup>rd</sup> application UART Request to Send <b>output</b> signal
<b>2<sup>nd</sup> SPI</b>						
97	3V3	SPIB_NSS	P44_3	RSPI1_SSL_B SSI1_RXD_C CAN1_RX_DATARATE_EN_D MTIOC3D_B GTIOC7B_C	P44_3	
98	3V3	SPIB_MISO	P44_2	RSPI1_MISO_B SSI1_TXD_C CAN1_TX_DATARATE_EN_D MTIOC3C_B GTIOC7A_C	P44_2	
99	3V3	SPIB_MOSI	P44_1	RSPI1_MOSI_B SSI1_RCK_C CAN1_RX_D MTIOC3B_B GTIOC6B_D	P44_1	
100	3V3	SPIB_SCK	P44_0	RSPI1_CK_B SSI1_BCK_C CAN1_TX_D MTIOC3A_B GTIOC6A_D	P44_0	

## Onboard wiring

### Pins used for manufacturing – leave unconnected

PIN	(RZ/G2L PAD NAME)	PIN	(RZ/G2L PAD NAME)	PIN	(RZ/G2L PAD NAME)
C1	JTAG_TDI (TDI)			C3	JTAG_TCK (TCK/SWCLK)
		B2	JTAG_TDO (TDO)		
A1	JTAG_TRST_B (TRST#)			A3	JTAG_TMS (TMS/SWDIO)

## Onboard peripherals wiring

	RZ/G2L Pad Name	Remarks
eMMC	SD0_CLK	
	SD0_CMD	
	SD0_DATA0	
	SD0_DATA1	
	SD0_DATA2	
	SD0_DATA3	
	SD0_DATA4	
	SD0_DATA5	
	SD0_DATA6	
	SD0_DATA7	
	SD0_RST#	
LED	P48_2	Low: LED on

## Electrical characteristics

### Absolute maximum ratings

Parameter	Symbol	Min	Max	Remarks
Power supply	VIN	0V	5.5V	
Input voltage on USB VBUS pins	USBA_VBUS USBB_VBUS	0V	6V	
Input voltage on USB DN/DP pins	USBA_DN/DP USBB_DN/DP	0V	3.6V	
Input voltage on any other pins		0V	3.6V	
Storage temperature range	T <sub>STORAGE</sub>	-40°C	150°C	

### Operating ranges

Parameter	Symbol	Min	Max	Remarks
Power supply	VIN	3.1V	3.6V	
I/O input low level voltage	V <sub>IL</sub>	-	0.3 x VIN	
I/O input high level voltage	V <sub>IH</sub>	0.7 x VIN	-	
I/O output voltage	Refer to RZ/G2L datasheet.			VDD=VIN=3.3V typ.
Operating temperature range	T <sub>AMB</sub>	-40°C	85°C	
Processor junction temperature	T <sub>J</sub>	-40°C	125°C	

### Power supply currents

Parameter	Symbol	VIN	Current	Remarks
At U-Boot prompt	I <sub>UBOOT</sub>	3.3V	TBD	All pins left unconnected
At Linux prompt	I <sub>LINUX</sub>	3.3V	TBD	
Sleep	I <sub>SLEEP</sub>	3.3V	TBD	
Maximum calculated	I <sub>MAX</sub>	3.3V	TBD	Calculated on max. IDD's @ 80% onboard power supply efficiency.
Power supply rating	I <sub>SUPP</sub>	3.3V	TBD	With margin for sizing the power supply

# Mouser Electronics

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