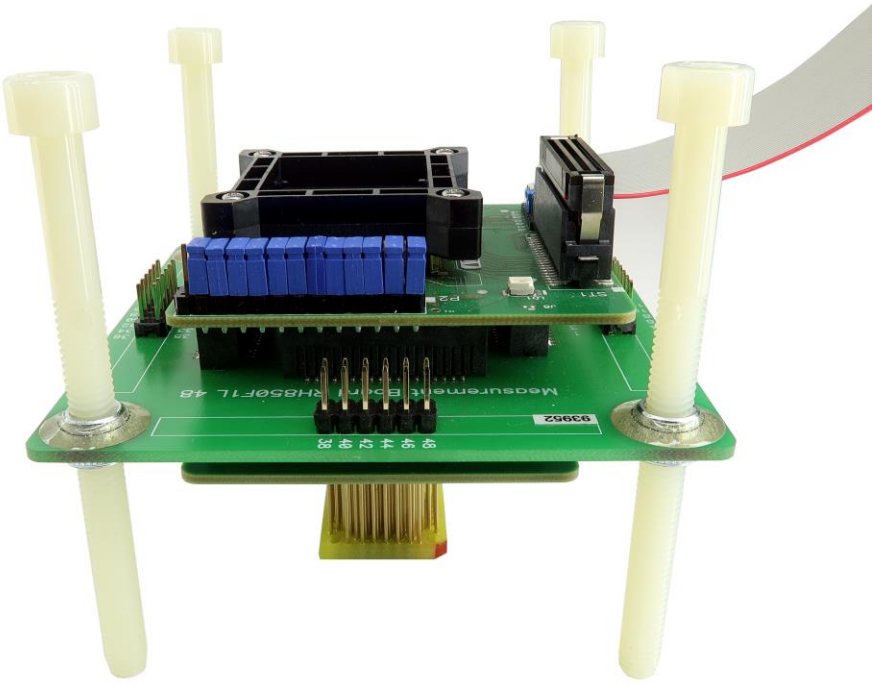
Renesas RH850/F1L Emulation Adapter



RH850 Emulation Adapter System

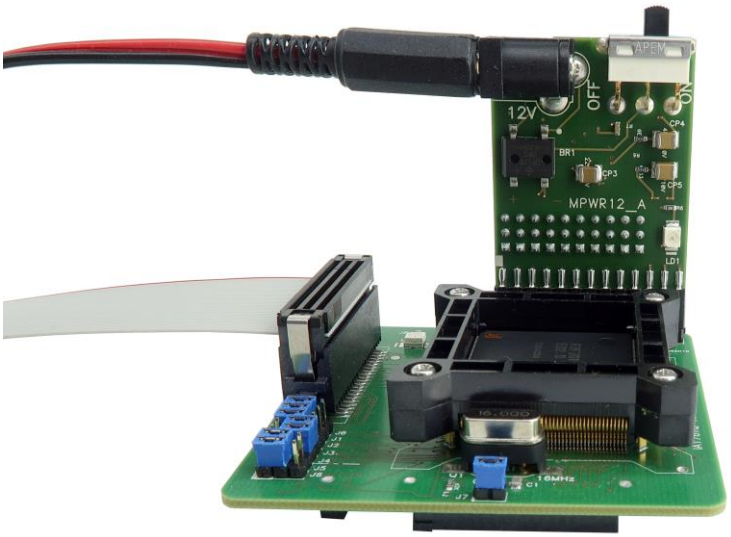
The RH850/F1L emulation adapter primary use case is providing the trace functionality (On-Chip Trace Buffer, Software Trace, User Trace Port) for the smaller RH850/F1L series packages, where typically on-chip trace logic is not built-in and available. The emulation adapter is based on the 176-pin superset device and provides the adaptation to 48-pin, 64-pin, 80-pin, 100-pin and 144-pin QFP package.
Alternative use case is a standalone operation. In this case the application development and testing can be started while the target may not be available yet.
Renesas RH850/F1L emulation adapter is based on Renesas RH850/F1L R7F7010073 device in the QFP176 package. This is a superset device with 2MB program flash and can emulate all RH850/F1L devices.
Complete emulation system is split into individual parts which makes the system flexible. A typical setup in conjunction with the target contains:

- IEA-RH850F1L (MCU part)

  The emulation adapter comes without the microcontroller! It's up to the user to obtain it from Renesas and mount it in the emulation adapter socket. It's recommended that the mask of the inserted 176-pin superset device matches with the mask of the original target microcontroller.

- Pin count conversion board either for TET or Renesas adaptation
- TET or Renesas solder part

Optional measurement boards are available for each pin count and expose all microcontroller pins for measurement and inspection. Also optional is a power supply part, which can be used for emulation adapter standalone operation (without the target) or when there are problems with the target supplying the power.
For a standalone operation without the target the IEA-RH850F1L (MCU) and IEA-PS (Power Supply) are required only.

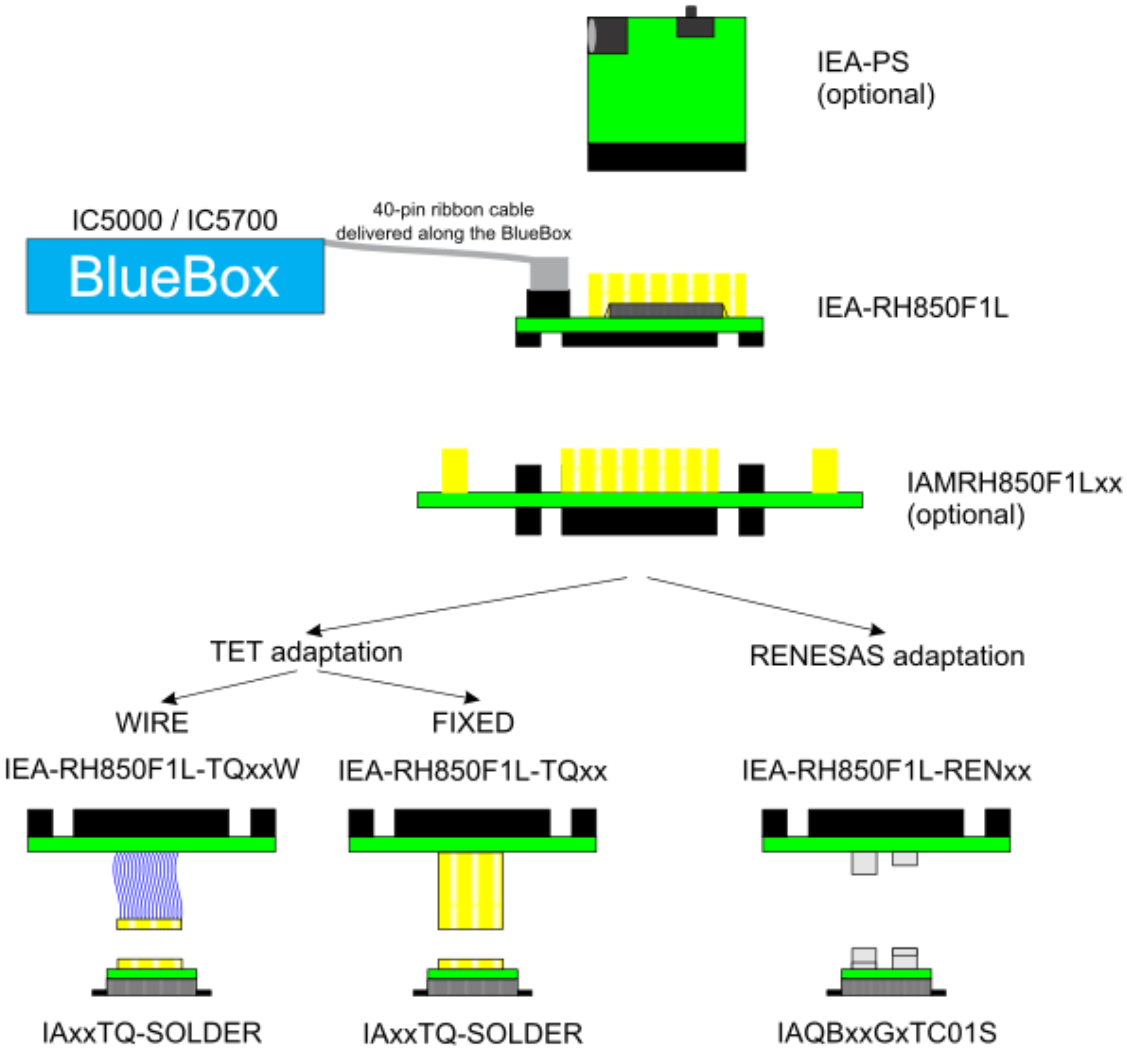


Standalone operation – minimum setup

Ordering Code:	**Description:**
IEA-RH850F1L	Emulation Adapter
IEA-PS	Emulation Adapter Power Supply
QFP144	
IEA-RH850F1L-TQ144	TQ144 Pin Count Conversion Board
IA144TQ-SOLDER	Solder Part TQ144QFP (20 mm x20 mm)
IAMRH850F1L144	144-pin Measurement Board
QFP100	
IEA-RH850F1L-TQ100	TQ100 Pin Count Conversion Board
IA100TQ-SOLDER	Solder Part TQ100QFP (14 mm x14 mm)
IEA-RH850F1L-REN100	Renesas 100-Pin Count Conversion Board
IAQB100GCTC01S	Renesas QFP100 Solder Part
IAMRH850F1L100	100-pin Measurement Board

QFP80	
IEA-RH850F1L-TQ80	TQ80 Pin Count Conversion Board
IEA-RH850F1L-ATQ80W	TQ80 Pin Count Conversion Flexible Board
IA80ATQ-SOLDER	Solder Part TQ80QFP (12 mm x 12 mm)
IEA-RH850F1L-REN80	Renesas 80-Pin Count Conversion Board
IAQB80GKTC01S	Renesas QFP80 Solder Part
IAMRH850F1L80	80-pin Measurement Board
QFP64	
IEA-RH850F1L-TQ64	TQ64 Pin Count Conversion Board
IA64ATQ-SOLDER	Solder Part TQ64QFP (10 mm x 10 mm)
IEA-RH850F1L-REN64	Renesas 64-Pin Count Conversion Board
IAQB64GBTC01S	Renesas QFP64 Solder Part
IAMRH850F1L64	64-pin Measurement Board
QFP48	
IEA-RH850F1L-TQ48	TQ48 Pin Count Conversion Board
IEA-RH850F1L-TQ48W	TQ48 Pin Count Flexible Conversion Board
IA48TQ-SOLDER	Solder Part TQ48QFP (7 mm x 7 mm)
IEA-RH850F1L-REN48	Renesas 48-Pin Count Conversion Board
IAQB48GATC01S	Renesas QFP48 Solder Part
IAMRH850F1L48	48-pin Measurement Board

The RH850/F1L emulation adapter is used in conjunction with the iC5000 and the iC5700 BlueBox. The BlueBox connects to the ST1 connector on the emulation adapter through the 40-pin ribbon cable, which comes along the BlueBox.



RH850/F1L emulation adapter "ecosystem"

Inserting the microcontroller

The emulation adapter comes without the microcontroller! It's up to the user to obtain it from Renesas and mount it in the emulation adapter socket. It's recommended that the mask of the inserted 176-pin superset device matches with the mask of the original target microcontroller.

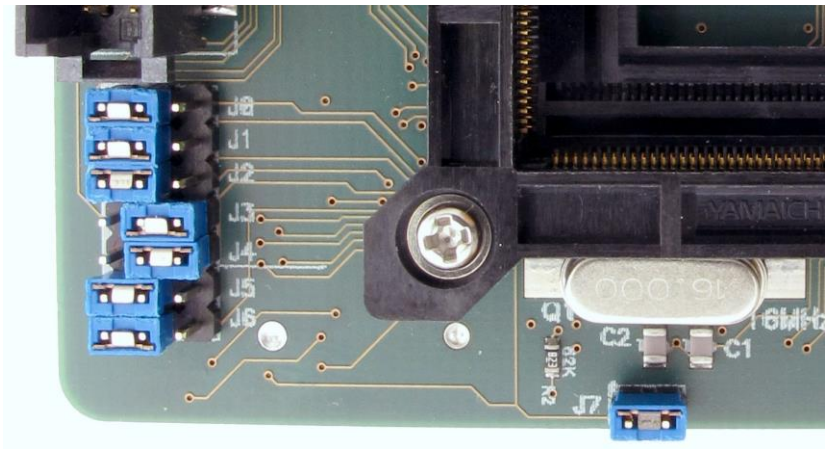
Remove the four screws on the CPU socket and remove the socket cover to insert the microcontroller. Pay attention to the pin 1 position when inserting the microcontroller. The pin 1 location is in the corner next to the LED. Re-attach the socket cover and carefully tighten the four screws. Excessive force can damage the socket.

Jumper configuration

Note: On the PCB, pin 1 is marked with a white square around the pin.

J0-J5: CPU port JP0 connection configuration

Port JP0 signals JP0.0 to JP0.5 can operate in alternate modes. They can be configured either for one of the available debug interfaces or for standard I/O operation. When comparing to the JTAG debug interface (6 signals), LPD1 debug interface requires only one JP0 line and leaving remaining lines for the user respectively target usage. Similarly, LPD4 debug interface requires four JP0 line and leaving remaining line for the user (target) usage.
Jumpers J0-J5 defines where JP0.0-JP0.5 signals connect, either to the debug connection on the emulation adapter or to the target. The JP0 port configuration is set through Option bytes (refer to the microcontroller reference manual for more details) and can be configured in 4 different ways.
Position 1-2: JP0.x connected to the debug connector
Position 2-3: JP0.x connected to the target



The following table reflects possible variations:

Port	Signal	Jumper	JTAG	LPD4*	LPD1	I/O (no debug)
JP0.0	TDI	J0	1-2	1-2	1-2	2-3
JP0.1	TDO	J1	1-2	1-2	2-3	2-3
JP0.2	TCK	J2	1-2	1-2	2-3	2-3
JP0.3	TMS	J3	1-2	2-3	2-3	2-3
JP0.4	TRST	J4	1-2	2-3	2-3	2-3
JP0.5	RDY	J5	1-2	1-2	2-3	2-3

* Default setting

J6: User Trace configuration

Jumper J6 is per default set in position 1-2 (manufacturing position) and must not be changed by the user. Position 2-3 is reserved for future debug extensions.

Jumper	User Trace Port	Reserved
J6	1-2	2-3

J7: target reset configuration

Jumper J7 connects the reset line between the emulation device and the target. By default J7 is populated.
In case when the debugger has problems connecting to the microcontroller or when the debugging is unpredictable, it is recommended removing the jumper for troubleshooting purpose since the target reset can be one of possible reasons preventing the debugger gaining full control over the microcontroller.

P2: power selection

The P2 header row is used for power supply selection. Power supplies are organized in groups and the same voltage must be supplied for each group:

- POWER_1 = REG0VDD, REG1VDD, I0VDD, OSCVDD, E0VDD, E1VDD
- POWER_3 = REG2VDD
- POWER_5 = A0VDD
- GND = all VSS

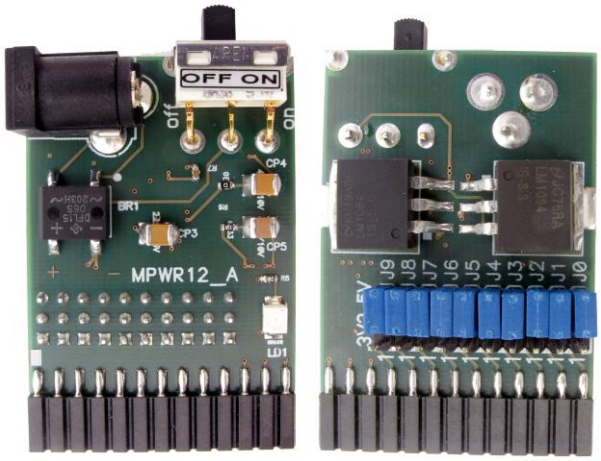
Refer to the microcontroller user manual for more details which power supply designation belongs to which power supply.

Signal direction	Signal	Pin	Pin	Signal	Signal direction
target	TPOWER_1	1	2	POWER_1	CPU
target	TPOWER_1	3	4	POWER_1	CPU
target	TPOWER_3	5	6	POWER_3	CPU
target	TPOWER_3	7	8	POWER_3	CPU
target	TPOWER_5	9	10	POWER_5	CPU
target	TPOWER_5	11	12	POWER_5	CPU
	NC	13	14	NC	
	NC	15	16	NC	
	NC	17	18	NC	
	NC	19	20	NC	
	GND	21	22	GND	
	GND	23	24	GND	
	GND	25	26	GND	

P4 signal description

By default jumpers are set and connect target power supply coming from the target to the microcontroller residing on the emulation adapter. If a different power source is to be used

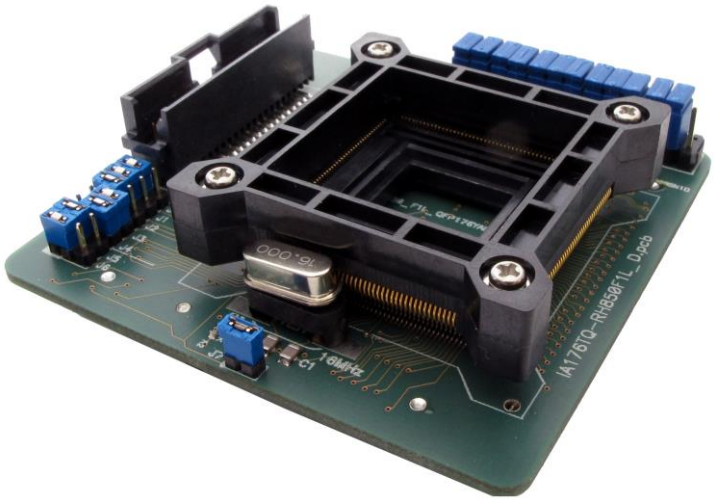
(e.g. in case of standalone operation), jumpers must be removed, and power source must be applied to POWER_1 (pins 2,4), POWER_3 (pins 6,8), POWER_5 (pins 10,12), and GND (pins 22,24,26) signals.
iSYSTEM power supply adapter can be ordered separately under the IEA-PS ordering code. It connects on top of the emulation adapter directly to the U3 header row and allows standalone usage of the emulation adapter. 3.3V or 5V voltage can be selected for each group with appropriate jumpers J0-J9. This is convenient when the target is not available or it's not adjusted for the emulation adapter connection yet.



IEA-PS (optional emulation adapter power supply

Emulation adapter component parts

- ***IEA-RH850F1L***



This is the part hosting the 176-pin superset device through which the QFP48, the QFP64, the QFP80, the QFP100 and the QFP144 target devices are supported.

The emulation adapter comes without the microcontroller! It's up to the user to obtain it from Renesas and mount it in the emulation adapter socket. It's recommended that the mask of the inserted 176-pin superset device matches with the mask of the original target microcontroller.

Next picture shows a pinout of the four connectors on the bottom side of the IEA-RH850F1L.

NC	142	144	146	148	150	152	154	156	158	160	162	164	166	168	170	172	174	176	NC
NC	141	143	145	147	149	151	153	155	157	159	161	163	165	167	169	171	173	175	NC

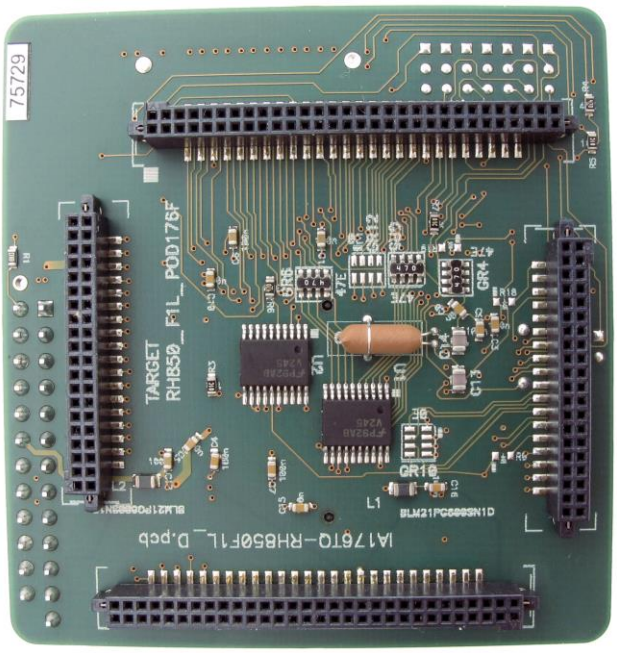
NC	NC
NC	NC
140	139
138	137
136	135
134	133
132	131
130	129
128	127
126	125
124	123
122	121
120	119
118	117
116	115
114	113
112	111
110	109
108	107
106	105
104	103
102	101
100	99
98	97
96	95
94	93
92	91
90	89
NC	NC
NC	NC

NC	NC
NC	NC
1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
37	38
39	40
41	42
43	44
45	46
47	48
49	50
51	52
NC	NC
NC	NC

NC	87	85	83	81	79	77	75	73	71	69	67	65	63	61	59	57	55	53	NC
NC	88	86	84	82	80	78	76	74	72	70	68	66	64	62	60	58	56	54	NC

NC – Not Connected

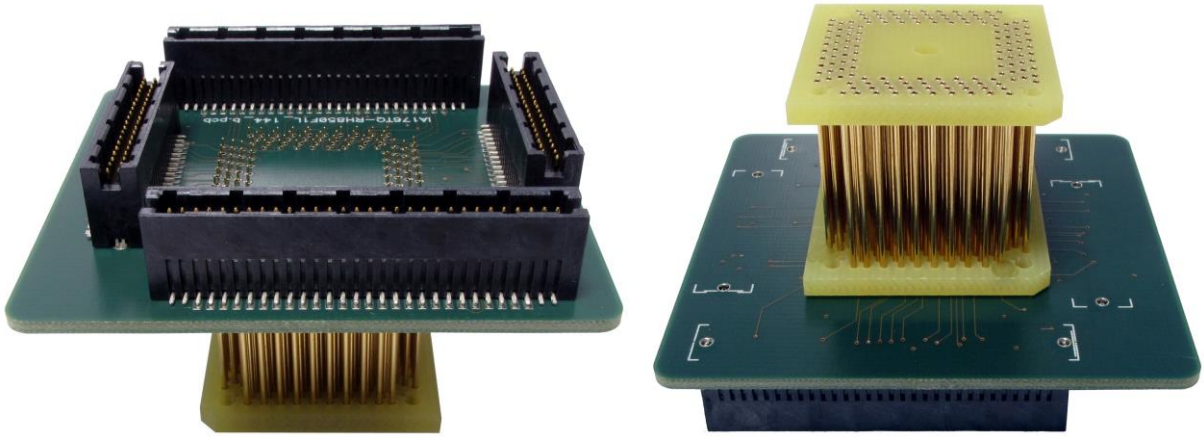
A user target could also be designed for connecting the *IEA-RH850F1L* directly to the target board. Connectors being used on the *IEA-RH850F1L* are female Tyco Electronics connectors, part number 0-0104652-4 (40 pin) and 0-0104652-6 (60 pin).



Bottom side of the IEA-RH850F1L

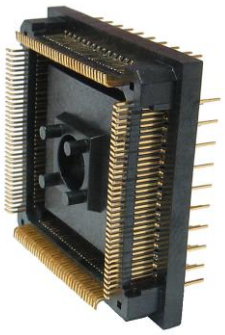
- ***QFP144 Adaptation***

IEA-RH850F1L-TQ144



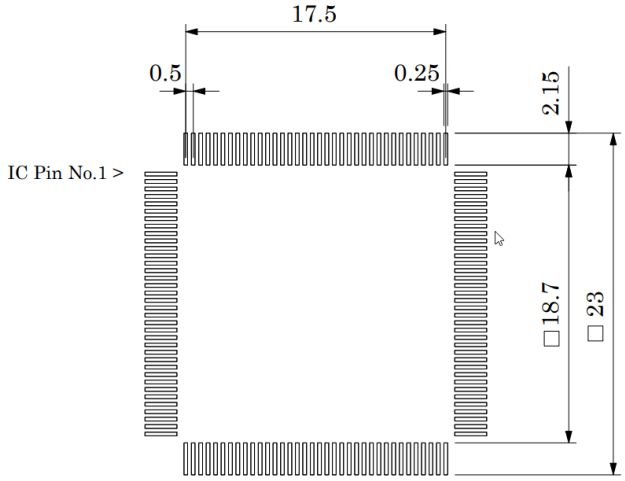
This part connects between the IEA-RH850F1L and the solder part IA144TQ-SOLDER.

IA144TQ-SOLDER (TET solder part)



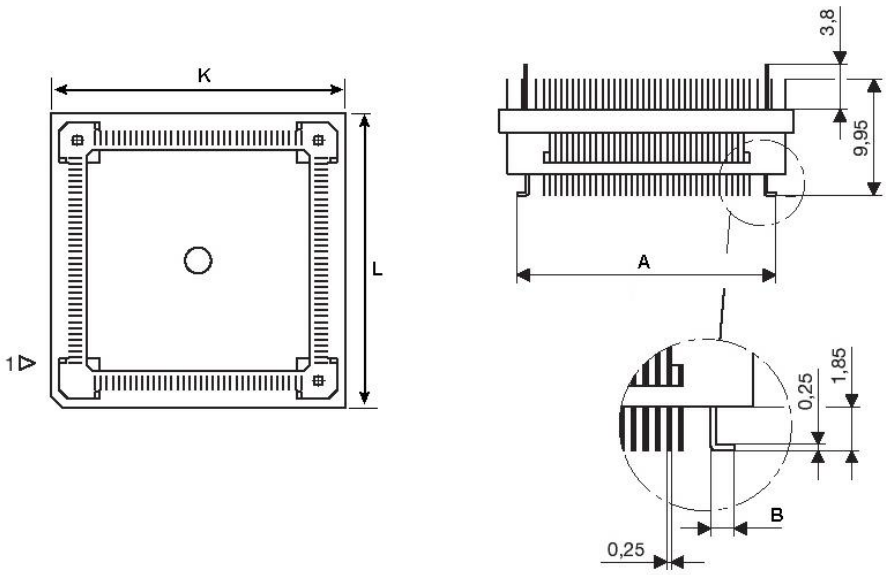
Solder part, which is soldered to the board instead of the original microcontroller.

Recommended PCB footprint size for the IA144TQ-SOLDER by TET:



(Unit: mm)			
A	B	K	L
22	1.125	25.05	25.05

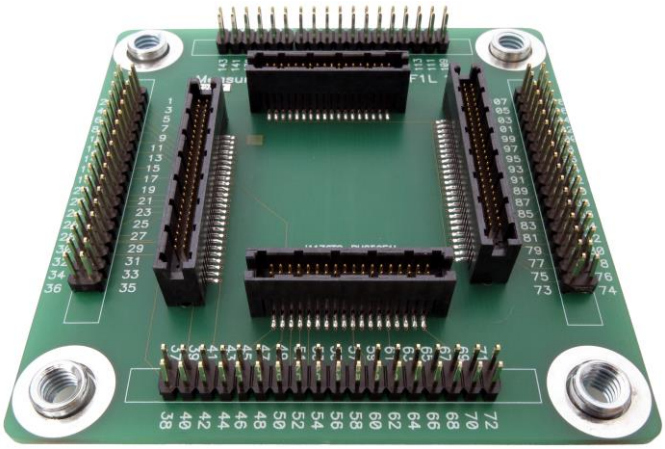
When it's meant soldering the solder part manually, it's highly recommended prolonging the pin pads on the outer side (e.g. for 1.5-2 mm) during the board layout design. Without this adjustment it's very difficult to solder the solder part manually.



IA144TQ-SOLDER dimensions

The user must be familiar with the SMT (Surface Mount Technology) soldering in order to solder the IA144TQ-SOLDER to the PCB instead of the original microcontroller. On request, iSYSTEM can provide this service too.

IAMRH850F1L144

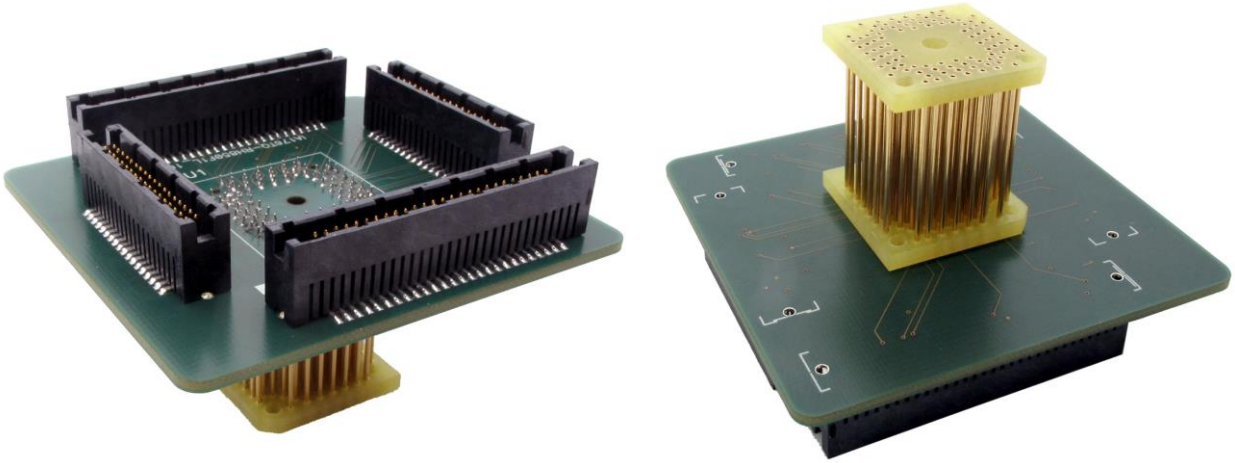


The IAMRH850F1L144 measurement board is optional and connects between the IEA-RH850F1L and the IEA-RH850F1L-TQ144.

- ***QFP100 Adaptation***

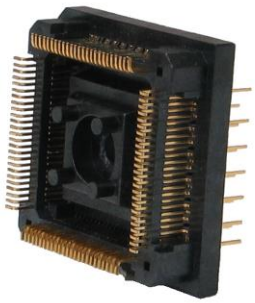
Two adaptations are available, one is based on TET parts and the alternative is based on Renesas parts.

IEA-RH850F1L-TQ100



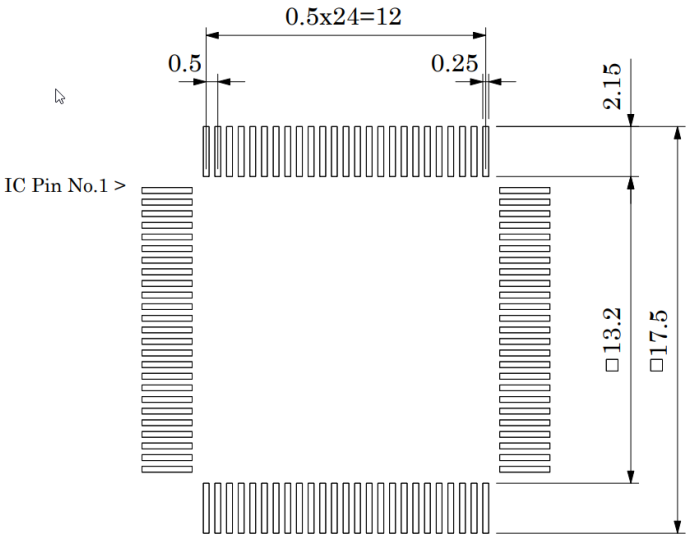
This part connects between the IEA-RH850F1L and the solder part IA100TQ-SOLDER.

IA100TQ-SOLDER (TET solder part)



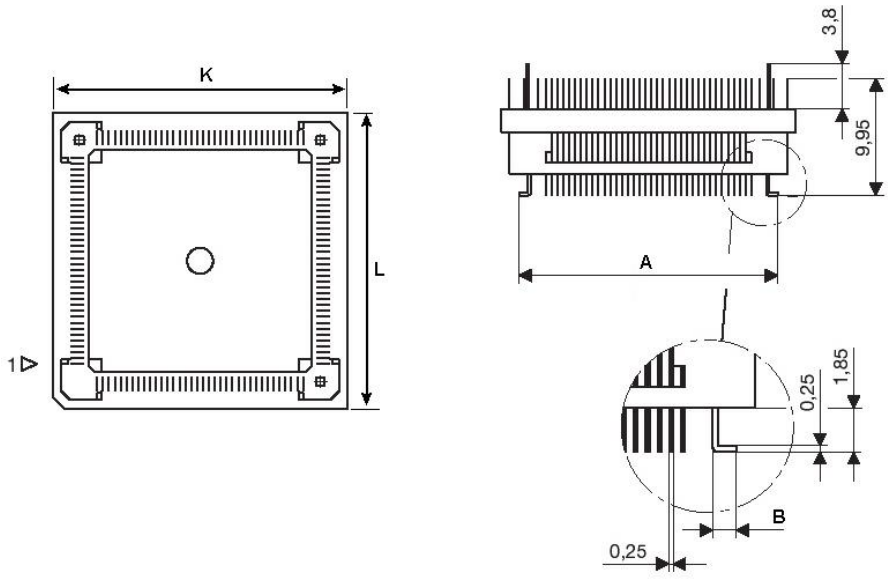
Solder part, which is being soldered to the target.

Recommended PCB footprint size for the IA100TQ-SOLDER by TET:



(Unit: mm)			
A	B	K	L
16.5	1.125	19.55	19.55

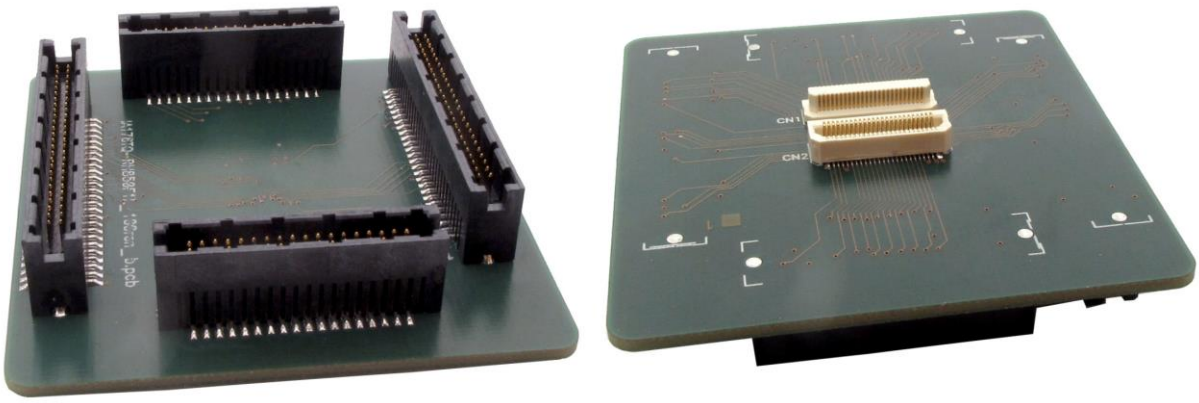
When it's meant soldering the solder part manually, it's highly recommended prolonging the dimension E on the outer side (e.g. for 1.5-2 mm) during the PCB design. Note that without this modification it's very difficult to solder the solder part manually.



IA100TQ-SOLDER dimensions

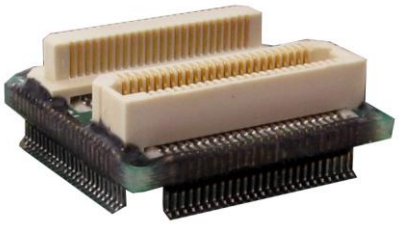
The user must be familiar with the SMT (Surface Mount Technology) soldering in order to solder the IA100TQ-SOLDER to the PCB instead of the original microcontroller. On request, iSYSTEM can provide this service too.

IEA-RH850F1L-REN100



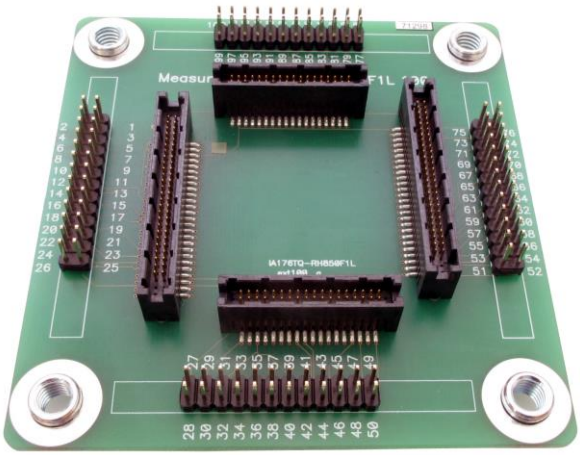
This part connects between the IEA-RH850F1L and the solder part IAQB100GCTC01S from Renesas.

IAQB100GCTC01S (Renesas solder part)



User must be familiar with the SMT (Surface Mount Technology) soldering in order to solder the IAQB100GCTC01S to the PCB instead of the original microcontroller. On request, iSYSTEM can provide this service too.

IAMRH850F1L100

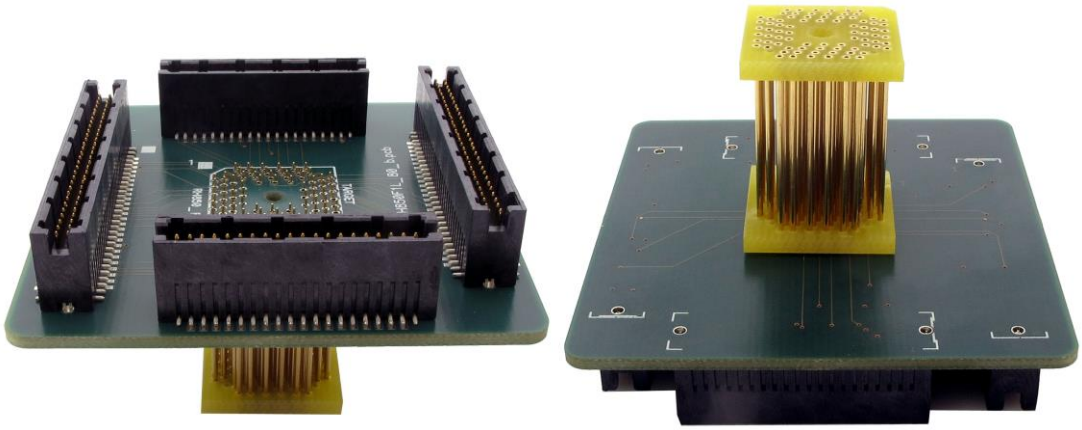


The IAMRH850F1L100 measurement board is optional and connects between the IEA-RH850F1L and the IEA-RH850F1L-REN100 for Renesas adaptation and between the IEA-RH850F1L and the IEA-RH850F1L-TQ100 for TET adaptation.

- ***QFP80 Adaptation***

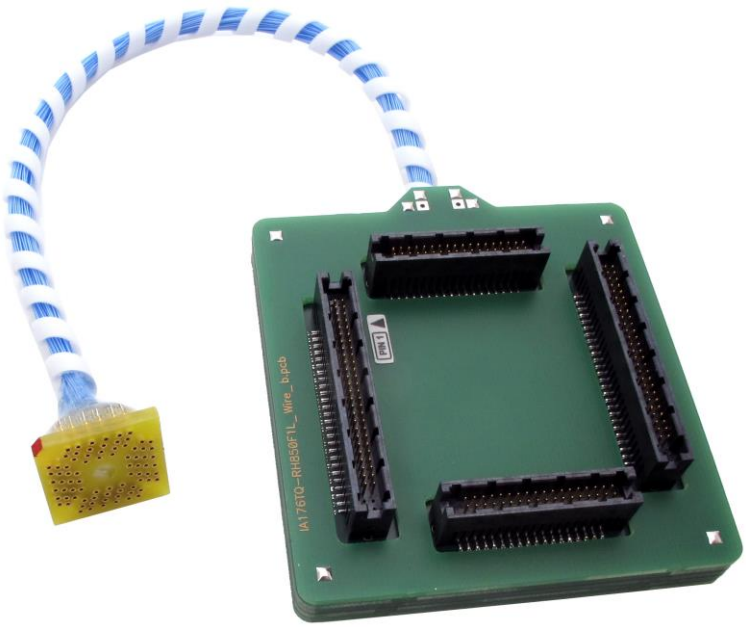
Three adaptations are available, two are based on TET parts and the alternative is based on Renesas parts.

IEA-RH850F1L-TQ80



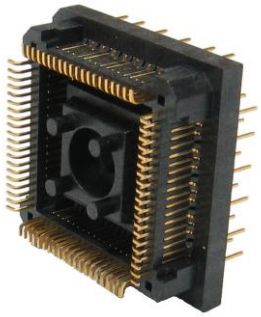
This part connects between the IEA-RH850F1L and the solder part IA80ATQ-SOLDER.

IEA-RH850F1L-ATQ80W



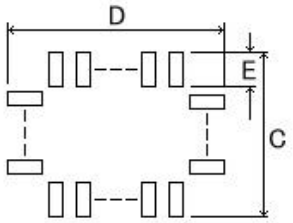
This part connects between the IEA-RH850F1L and the solder part IA80ATQ-SOLDER.

IA80ATQ-SOLDER (TET solder part)



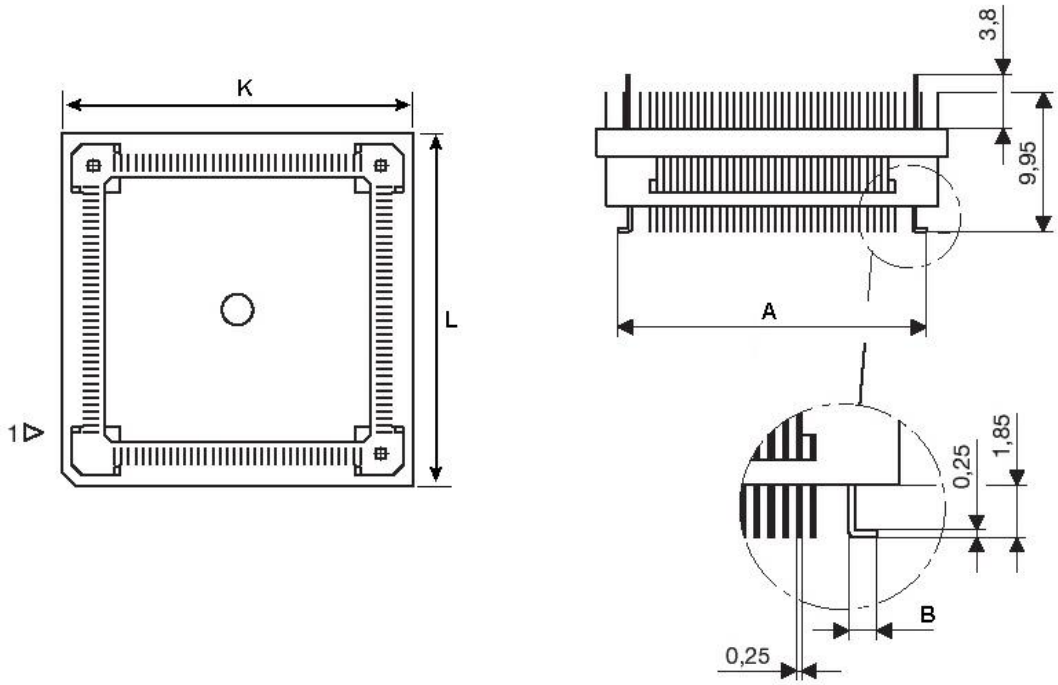
Solder part, which is being soldered to the target

Recommended PCB footprint size for the IA80ATQ-SOLDER by TET:



(Unit: mm)						
A	B	C	D	E	K	L
14.0	1.505	15.0	15.0	2.3	16.0	16.0

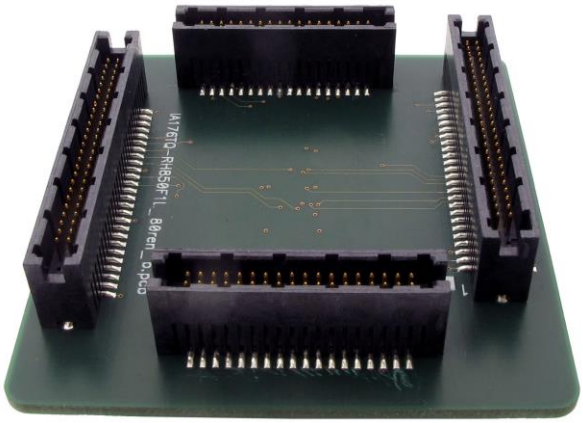
When it's meant soldering the solder part manually, it's highly recommended prolonging the dimension E on the outer side (e.g. for 1.5-2 mm) during the PCB design. Note that without this modification it's very difficult to solder the solder part manually.

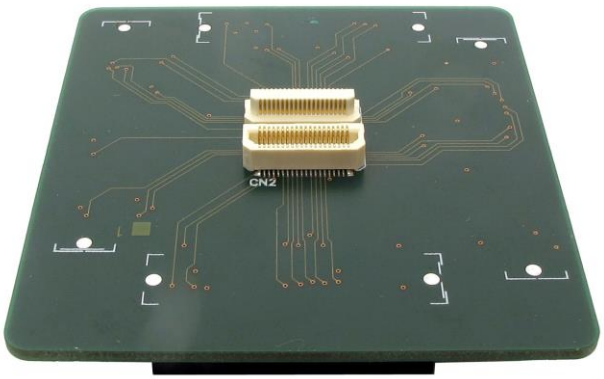


IA80ATQ-SOLDER dimensions

The user must be familiar with the SMT (Surface Mount Technology) soldering in order to solder the IA80ATQ-SOLDER to the PCB instead of the original microcontroller. On request, iSYSTEM can provide this service too.

IEA-RH850F1L-REN80



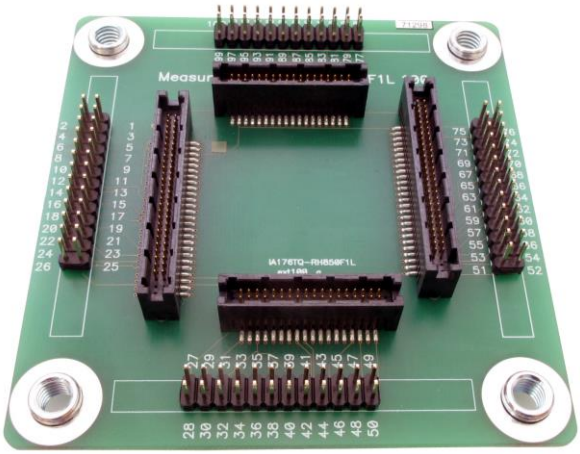


This part connects between the IEA-RH850F1L and the solder part IAQB80GKTC01S from Renesas.

IAQB80GKTC01S (Renesas solder part)

User must be familiar with the SMT (Surface Mount Technology) soldering in order to solder the IAQB80GKTC01S to the PCB instead of the original microcontroller. On request, iSYSTEM can provide this service too.

IAMRH850F1L80

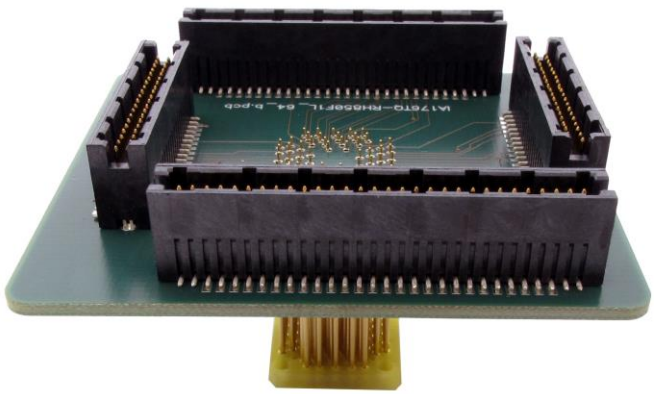


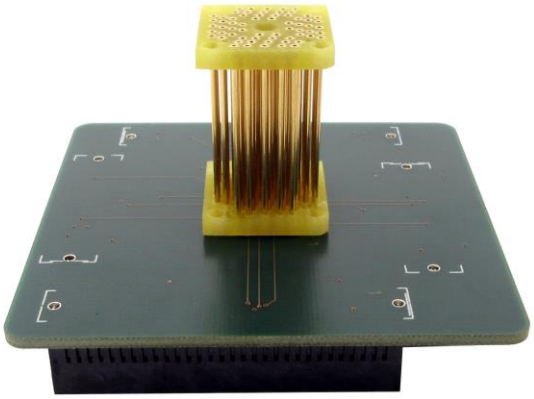
The IAMRH850F1L80 measurement board is optional and connects between the IEA-RH850F1L and the IEA-RH850F1L-REN80 for Renesas adaptation and between the IEA-RH850F1L and the IEA-RH850F1L-TQ80 for TET adaptation.

- ***QFP64 Adaptation***

Two adaptations are available, one is based on TET parts and the alternative is based on Renesas parts.

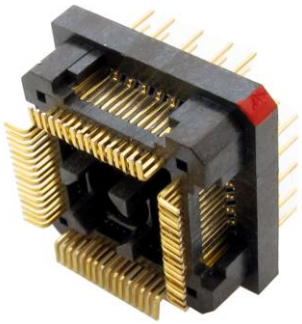
IEA-RH850F1L-TQ64





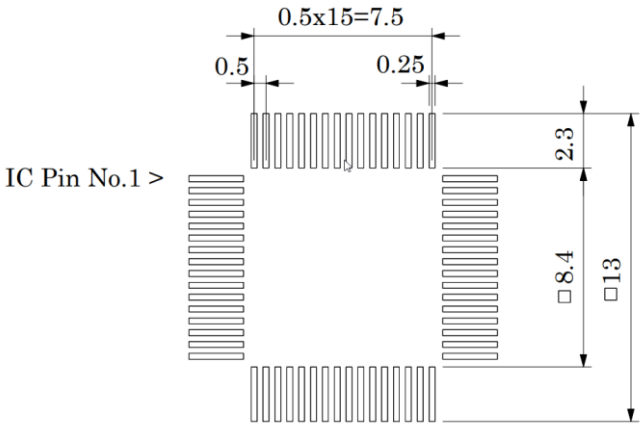
This part connects between the IEA-RH850F1L and the solder part IA64ATQ-SOLDER.

IA64ATQ-SOLDER (TET solder part)



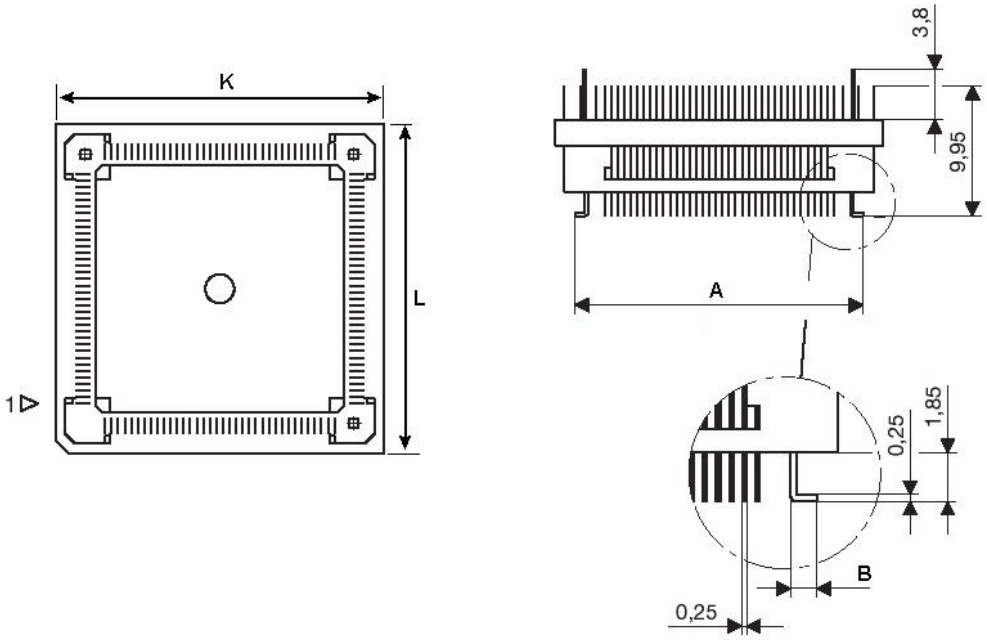
Solder part, which is being soldered to the target.

Recommended PCB footprint size for the IA64ATQ-SOLDER by TET:



(Unit: mm)			
A	B	K	L
12	1.505	14	14

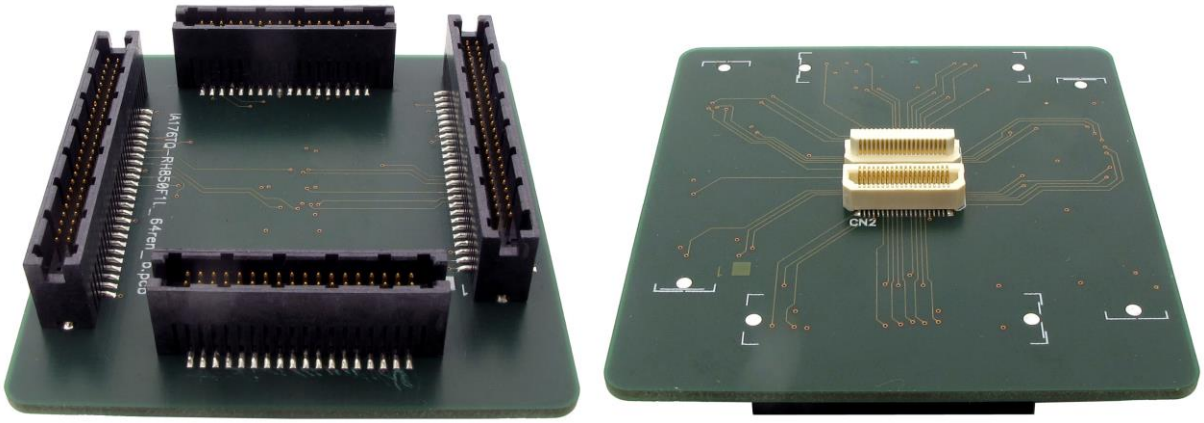
When it's meant soldering the solder part manually, it's highly recommended prolonging the dimension E on the outer side (e.g. for 1.5-2 mm) during the PCB design. Note that without this modification it's very difficult to solder the solder part manually.



IA64ATQ-SOLDER dimensions

The user must be familiar with the SMT (Surface Mount Technology) soldering in order to solder the IA64ATQ-SOLDER to the PCB instead of the original microcontroller. On request, iSYSTEM can provide this service too.

IEA-RH850F1L-REN64

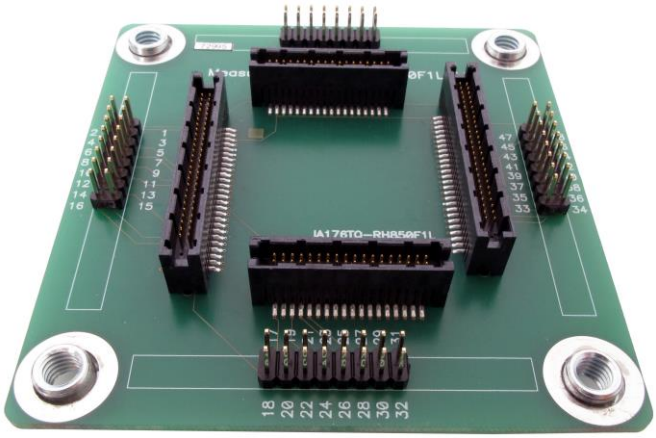


This part connects between the IEA-RH850F1L and the solder part IAQB64GBTC01S from Renesas.

IAQB64GBTC01S (Renesas solder part)

User must be familiar with the SMT (Surface Mount Technology) soldering in order to solder the IAQB64GBTC01S to the PCB instead of the original microcontroller. On request, iSYSTEM can provide this service too.

IAMRH850F1L64

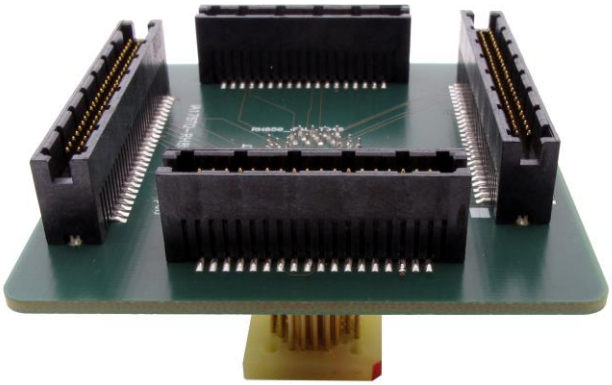


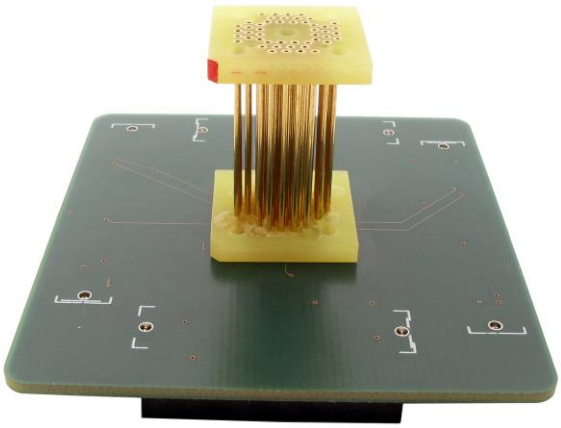
The IAMRH850F1L64 measurement board is optional and connects between the IEA-RH850F1L and the IEA-RH850F1L-REN64 for Renesas adaptation and between the IEA-RH850F1L and the IEA-RH850F1L-TQ64 for TET adaptation.

- ***QFP48 Adaptation***

Three adaptations are available, two are based on TET parts and the alternative is based on Renesas parts.

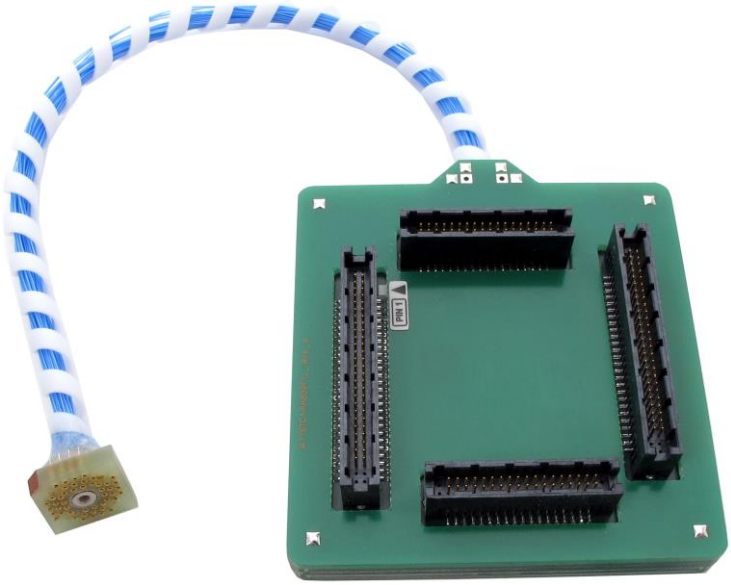
IEA-RH850F1L-TQ48





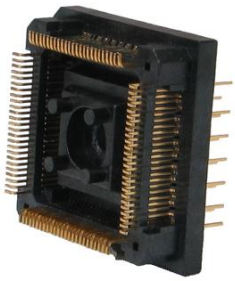
This part connects between the IEA-RH850F1L and the solder part IA48TQ-SOLDER.

IEA-RH850F1L-TQ48W



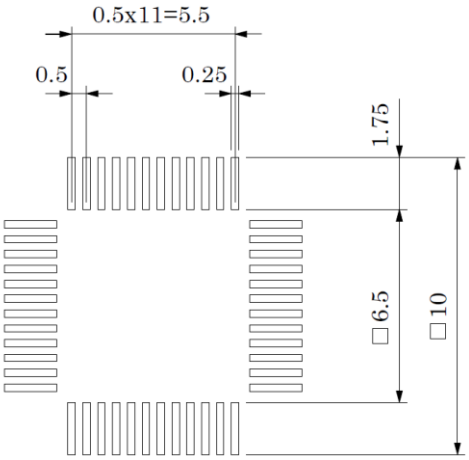
This part connects between the IEA-RH850F1L and the solder part IA48TQ-SOLDER.

IA48TQ-SOLDER (TET solder part)



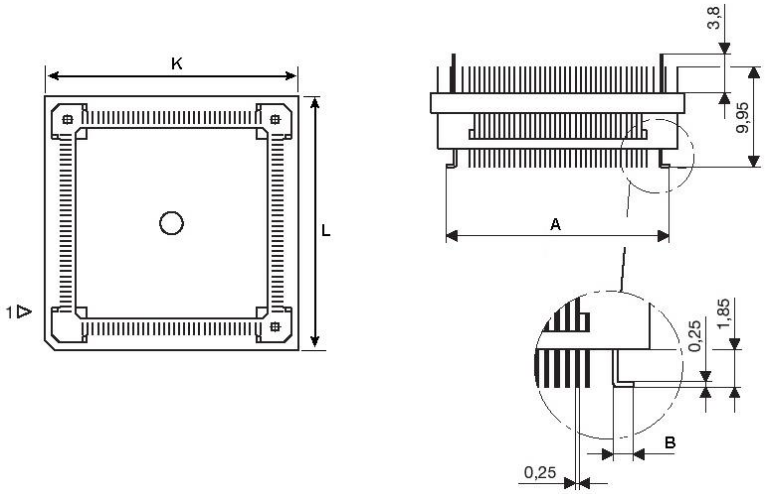
Solder part, which is being soldered to the target.

Recommended PCB footprint size for the IA48TQ-SOLDER by TET:



(Unit: mm)			
A	B	K	L
9.0	1.005	12.0	12.0

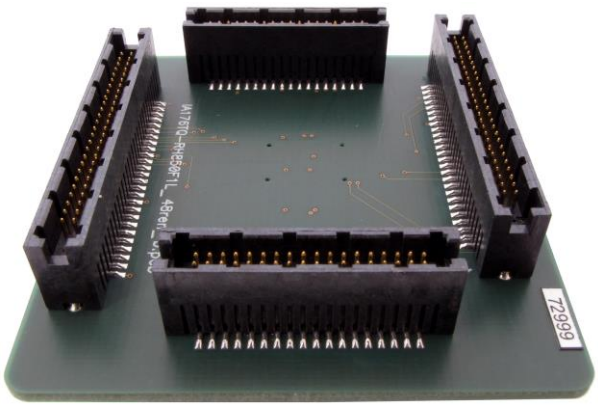
When it’s meant soldering the solder part manually, it’s highly recommended prolonging the dimension E on the outer side (e.g. for 1.5-2 mm) during the PCB design. Note that without this modification it’s very difficult to solder the solder part manually.

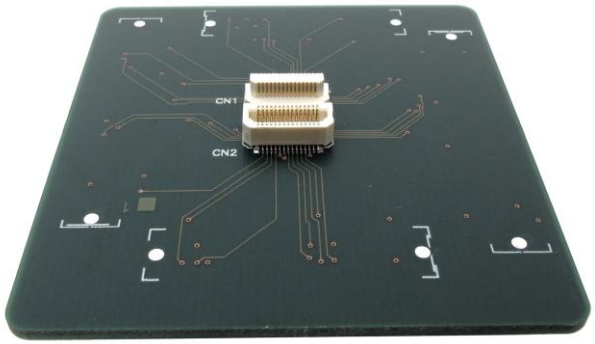


IA48TQ-SOLDER dimensions

The user must be familiar with the SMT (Surface Mount Technology) soldering in order to solder the IA48TQ-SOLDER to the PCB instead of the original microcontroller. On request, iSYSTEM can provide this service too.

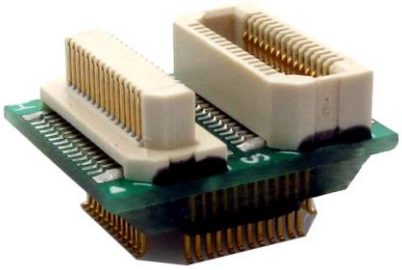
IEA-RH850F1L-REN48





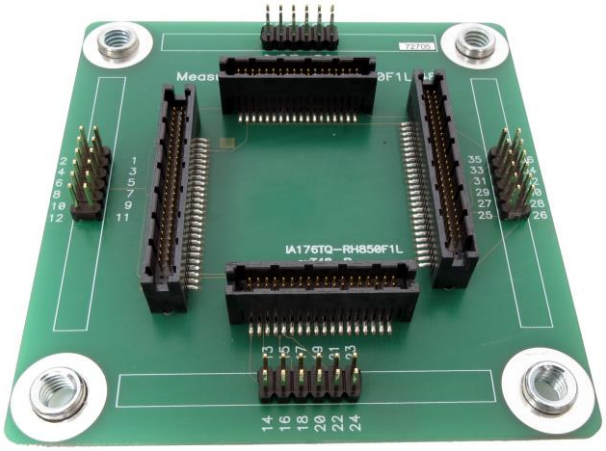
This part connects between the IEA-RH850F1L and the solder part IAQB48GATC01S from Renesas.

IAQB48GATC01S (Renesas solder part)



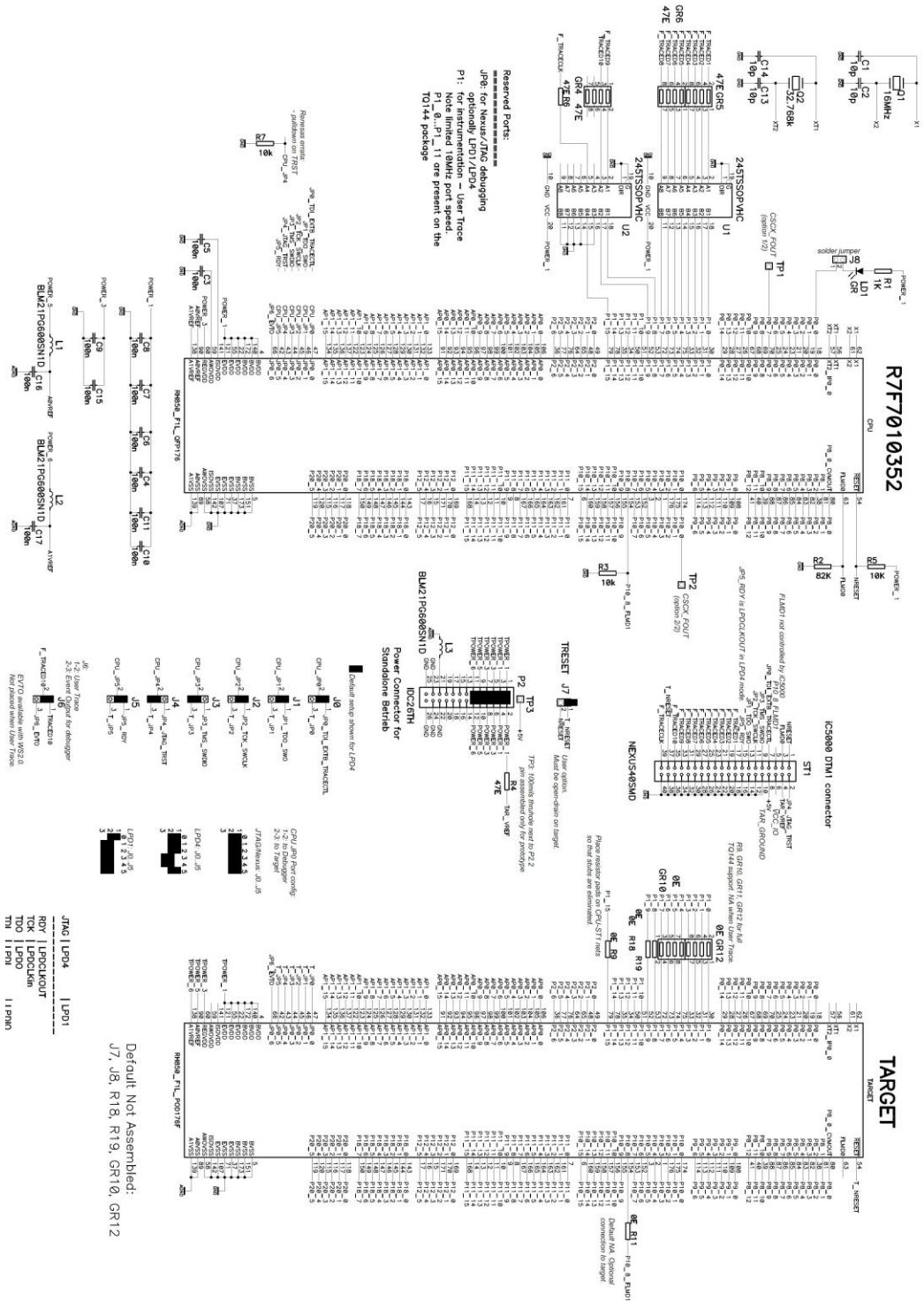
User must be familiar with the SMT (Surface Mount Technology) soldering in order to solder the IAQB48GATC01S to the PCB instead of the original microcontroller. On request, iSYSTEM can provide this service too.

IAMRH850F1L48



The IAMRH850F1L48 measurement board is optional and connects between the IEA-RH850F1L and the IEA-RH850F1L-REN48 for Renesas adaptation and between the IEA-RH850F1L and the IEA-RH850F1L-TQ48 or between the IEA-RH850F1L and the IEA-RH850F1L-TQ48W for TET adaptation.

Schematic


R7F7010352
TARGET
iC5000 DTM1 connector
NEXUS40SMD
Default Not Assembled:
J7, J8, R18, R19, GR10, GR12

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