NEC

User's Manual

78K0/KF2 Demo Board

Campaign Board

Demonstration Board for the NEC QB-78K0MINI On-Chip Debug Emulator

Document No. 78K0KF2DEMOV100
Date Published September 2005

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Revision History

Date	Revision	Chapter	Description
07-09-2005	V1.00	---	First release

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1. Introduction

The *78K0/KF2 demo board* is a demonstration kit for the evaluation of the On-Chip debugging feature by using the QB-78K0MINI On-Chip debug emulator. It supports onboard FLASH programming and real time execution of application programs up to 128 KB based on the 78K0/KF2 microcontroller. The board is prepared to be connected to user hardware parts such as digital I/O or analogue signals.

1.1 Main features of 78K0/KF2 demo board

- On-Chip debugging support by using QB-78K0MINI emulator
- Easy to use device demonstration capabilities of the 78K0/KF2 device
- FLASH programming support by using PG-FPL3 or PG-FP4 FLASH programmer
- All microcontroller signals assigned to external connectors
- Analogue to digital signal conversion is supported
- Various input / output signals available, such as
    - All I/O ports prepared to be connected to user hardware
    - Timer input / output signals
    - SIO/UART interfaces
    - 8 analogue input lines
    - 2 I/O ports connected to LED's

***78K0/KF2 demo board* is not intended for code development. NEC does not allow and does not support in any way any attempt to use *78K0/KF2 demo board* in a commercial or technical product.**

2. *78K0/KF2 demo board* system configuration

The *78K0/KF2 demo board* system configuration is given in the diagram below:

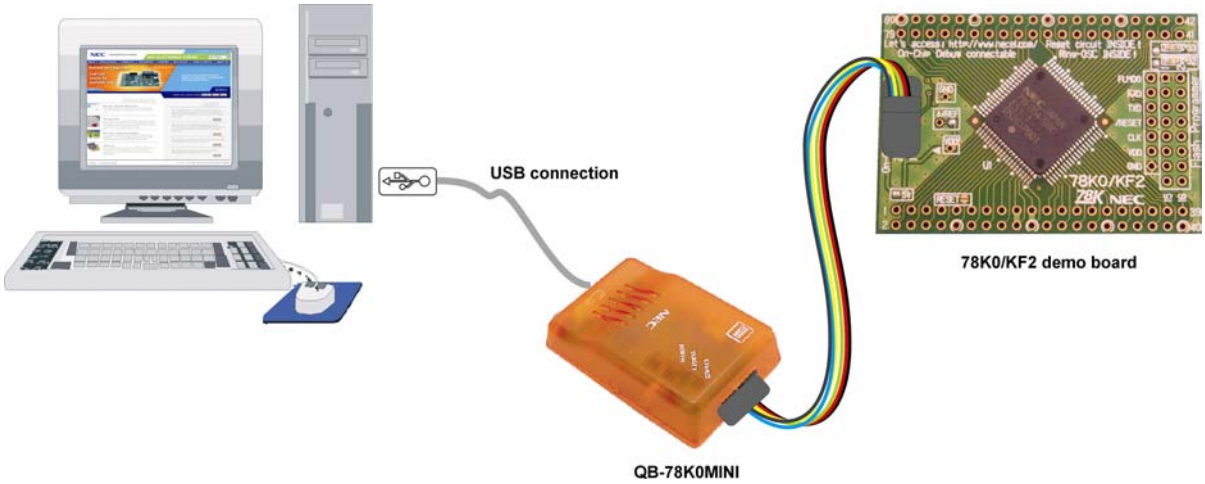


Figure 1: *78K0/KF2 demo* board system configuration

2.1 *78K0/KF2 demo board*

The *78K0/KF2 demo board* is a demonstration kit for the evaluation of the On-Chip debugging feature by using the QB-78K0MINI On-Chip debug emulator. The uPD78F0547DGC microcontroller is a typical device with On-Chip debugging support and has been used to realize the 78K0/KF2 demo board.

The uPD78F0547DGC contains 128 KB internal FLASH ROM and 7 KB internal RAM and operates at a maximum frequency of 20 MHz.

3. *78K0/KF2 demo board* components

The *78K0/KF2 demo board* is equipped with two LED's and several connectors in order to be connected to a dedicated FLASH programmer or connect any target hardware.

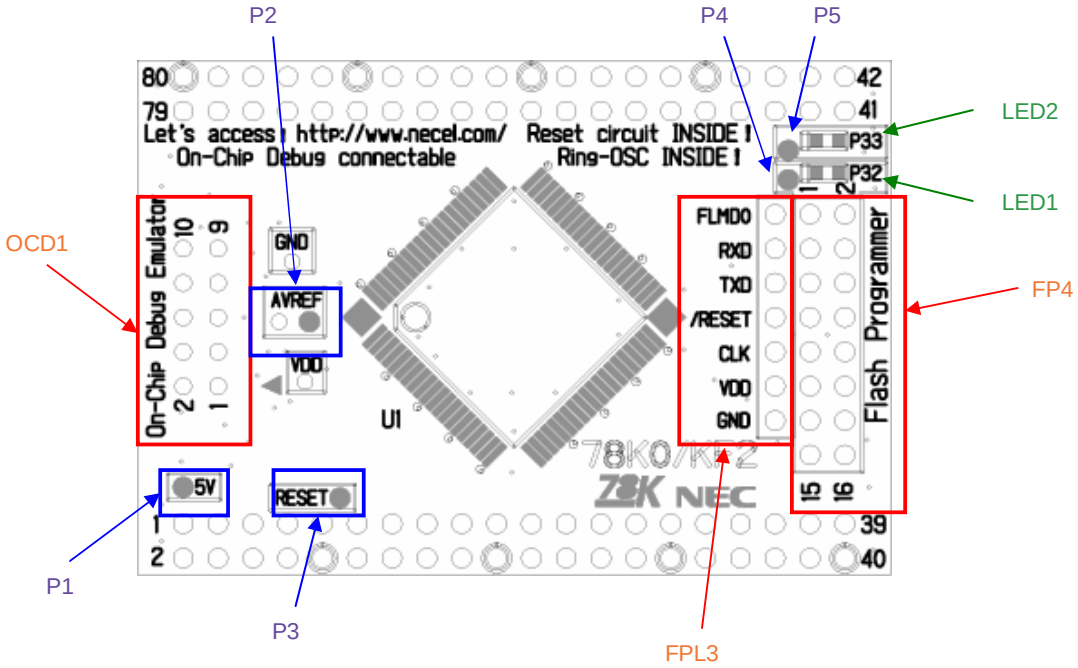


Figure 2: 78K0/KF2 demo board connectors, soldering bridges and LED's

All of the 78K0/KF2 On-Chip resources are free for user application hardware and software. Please read the user's manual of the 78K0/KF2 device carefully to get information about the electrical specification of the available I/O ports before you connect any external signal to the *78K0/KF2 demo board*!

3.1 Configuration, soldering bridges P1-P5

The different operation modes of the *78K0/KF2 demo board* can be set by the soldering bridges P1-P5. The different configuration modes are shown in the table below:

Modes	P1 (5V)	P2 (AVREF)	P3 (RESET)	P4 (P32 / LED1)	P5 (P33 / LED2)
On-Chip Debug Mode	SHORT	SHORT	OPEN	Don't Care	Don't Care
On-Chip Debug Mode (with External Power Supply)	OPEN	OPEN	OPEN	Don't Care	Don't Care
Flash Programmer Mode	Don't Care	SHORT	Don't Care	Don't Care	Don't Care
Flash Programmer Mode (with External Power Supply)	OPEN	OPEN	Don't Care	Don't Care	Don't Care
Normal Mode (with External Power Supply)	OPEN	OPEN	Don't Care	Don't Care	Don't Care

Table 1: Configuration, soldering bridges P1-P5

3.2 OCD1 connector

The OCD1 connector (not assembled) allows connecting the QB-78K0MINI On-Chip debug emulator to the *78K0/KF2 demo board* in order to use On-Chip debug function of the 78K0/KF2 device.

OCD1	Function
1	RESET_IN
2	RESET_OUT
3	FLMD0
4	VDD_IN
5	X2 / PortA
6	GND
7	X1 / PortB
8	GND
9	Reserved
10	5Vout (max. 50 mA)

Table 2: OCD1 connector

To enable On-Chip debugging for the 78K0/KF2 demo board, please configure the soldering bridges P1-P5 as following:

Modes	P1 (5V)	P2 (AVREF)	P3 (RESET)	P4 (P32 / LED1)	P5 (P33 / LED2)
On-Chip Debug Mode	SHORT	SHORT	OPEN	Don't Care	Don't Care
On-Chip Debug Mode (with External Power Supply)	OPEN	OPEN	OPEN	Don't Care	Don't Care

Table 3: Configuration for OCD

Note: Do not connect the QB-78K0MINI On-Chip debug emulator and the FLASH programmer at the same time to the *78K0/KF2 demo board*.

For information on Option Byte and FLASH memory security ID setting of the 78K0/KF2 device to enable On-Chip debugging please refer to the 78K0/KF2 user's manual respectively the QB-78K0MINI user's manual.

Note: In case of wrong setting of the FLASH memory security ID, address 0x84 and 0x85-0x8e, On-Chip debugging by using QB-78K0MINI becomes inactive. In this case erase the internal FLASH ROM of the 78K0/KF2 device by using one of the dedicated FLASH programmer's, PG-FPL3 or PG-FP4.

3.3 *78K0/KF2 demo board* FLASH programming configuration

The internal FLASH ROM of the 78K0/KF2 device can be reprogrammed by using the PG-FPL3 or alternative the PG-FP4 FLASH programmer. The configuration for on-board FLASH programming is shown in figure below.

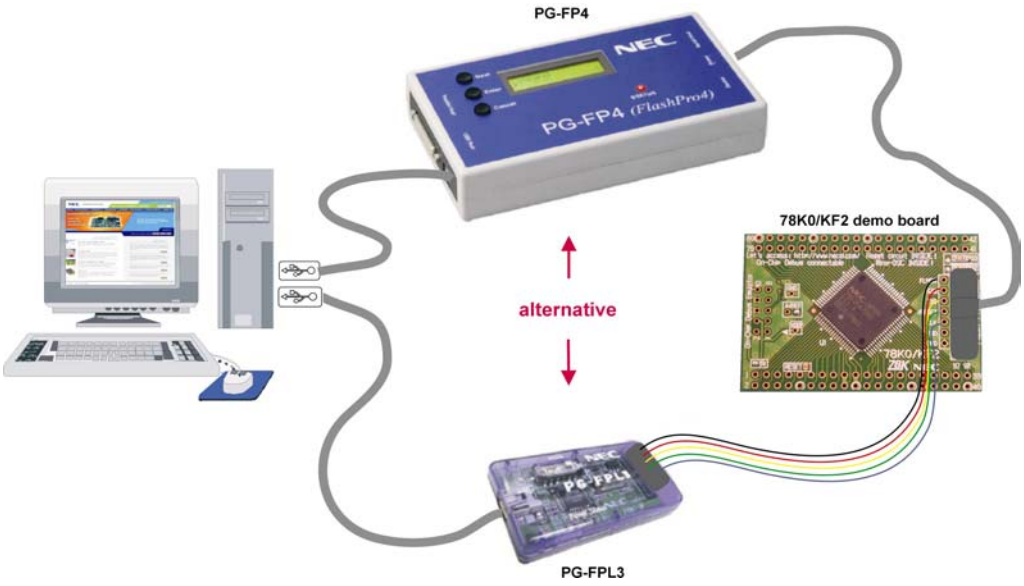


Figure 3: *78K0/KF2 demo board* FLASH programming configuration

3.3.1 FP4 connector

The FP4 connector (not assembled) allows connecting the PG-FP4 flash programmer to *78K0/KF2 demo board* in order to program application programs into the CPU internal flash memory of the uPD78F0547DGC device. Please note, PG-FP4 is a separate product from NEC and it is not included in this package.

FP4	Signal
1	GND
2	RESET
3	SI / RXD
4	VDD
5	SO / TXD
6	N.C.
7	N.C.
8	N.C.
9	CLK
10	N.C.
11	N.C.
12	FLMD1
13	N.C.
14	FLMD0
15	N.C.
16	N.C.

Table 4: FP4 connector

(N.C. = Not Connected)

When using PG-FP4, the programming interface to the 78K0/KF2 device must be set to the asynchronous serial interface UART6.

To enable on-board FLASH programming for the *78K0/KF2 demo board*, please configure the soldering bridges P1-P5 as following:

Modes	P1 (5V)	P2 (AVREF)	P3 (RESET)	P4 (P32 / LED1)	P5 (P33 / LED2)
Flash Programmer Mode	Don't Care	SHORT	Don't Care	Don't Care	Don't Care
Flash Programmer Mode (with External Power Supply)	OPEN	OPEN	Don't Care	Don't Care	Don't Care

Table 5: Configuration for FLASH programming

Note: Do not connect the PG-FP4 FLASH programmer and the QB-78K0MINI On-Chip debug emulator at the same time to the *78K0/KF2 demo board*.

3.3.2 FPL3 connector

The FPL3 connector (not assembled) allows connecting the PG-FPL3 flash programmer to *78K0/KF2 demo board* in order to program application programs into the CPU internal flash memory of the uPD78F0547DGC device. Please note, PG-FPL3 is a separate product from NEC and it is not included in this package.

FPL3	Signal
1	GND
2	VDD
3	CLK
4	RESET
5	TXD
6	RXD
7	FLMD0

Table 6: FPL3 connector

When using PG-FPL3, the programming interface to the 78K0/KF2 device must be set to the asynchronous serial interface UART6.

To enable on-board FLASH programming for the *78K0/KF2 demo board*, please configure the soldering bridges P1-P5 as following:

Modes	P1 (5V)	P2 (AVREF)	P3 (RESET)	P4 (P32 / LED1)	P5 (P33 / LED2)
Flash Programmer Mode	Don't Care	SHORT	Don't Care	Don't Care	Don't Care
Flash Programmer Mode (with External Power Supply)	OPEN	OPEN	Don't Care	Don't Care	Don't Care

Table 7: Configuration for FLASH programming

Note: Do not connect the PG-FPL3 FLASH programmer and the QB-78K0MINI on-chip debug emulator at the same time to the *78K0/KF2 demo board*.

3.4 AD converter reference voltage input

The reference voltage input AVREF of the 78K0/KF2 device is connected to VDD by the soldering bridge P2.

3.5 External LED's 1–2

The LED's 1-2 are connected to the 78K0/KF2 device and are free for user application purposes. The LED's are connected via a 620 Ω resistor to VDD and therefore active low.

Port	LED
P32	LED1
P33	LED2

Table 8: LED1-2 connection

For disconnecting a LED from a port for alternative usage open the connection of the corresponding soldering bridge P4 respectively P5.

3.6 External connectors J1, J2, J3, and J4

J1, J2, J3 and J4 are connectors for external user hardware. All CPU signals of the 78K0/KF2 device are connected to these connectors. The corresponding assignment of the processor pins is shown below.

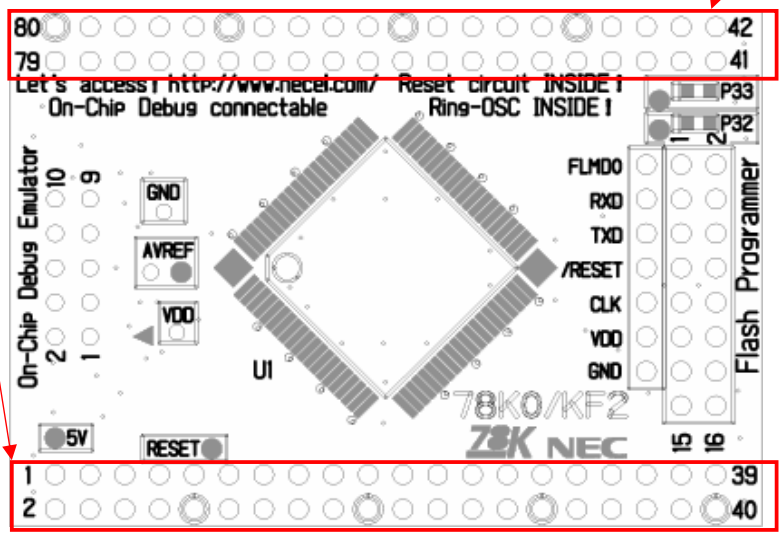
Table 9: External connectors J1, J2, J3 and J4

J1	Function
1	P120/INTP0/EXLVI
2	P47
3	P46
4	P45
5	P44
6	P43
7	P42
8	P41
9	P40
10	RESET
11	P124/XT2/EXCLKS
12	P123/XT1
13	IC/FLMD0
14	P122/X2/EXCLK
15	P121/X1
16	REGC
17	VSS
18	EVSS
19	VDD
20	EVDD

J2	Function
21	P60/SCL0
22	P61/SDA0
23	P62/EXSCL0
24	P63
25	P33/TI51/TO51/INTP4
26	P64
27	P65
28	P66
29	P67
30	P77/KR7
31	P76/KR6
32	P75/KR5
33	P74/KR4
34	P73/KR3
35	P72/KR2
36	P71/KR1
37	P70/KR0
38	P06/TI011/TO01
39	P05/TI001/SSI11
40	P32/INTP3 (PortB)

J3	Function
41	P31/INTP2 (PortA)
42	P50
43	P51
44	P52
45	P53
46	P30/INTP1
47	P17/TI50/TO50
48	P16/TOH1/INTP5
49	P15/TOH0
50	P14/RXD6
51	P13/TXD6
52	P12/SO10
53	P11/SI10/RXD0
54	P10/SCK10/TXD0
55	P54
56	P55
57	P56
58	P57
59	AVREF
60	AVSS

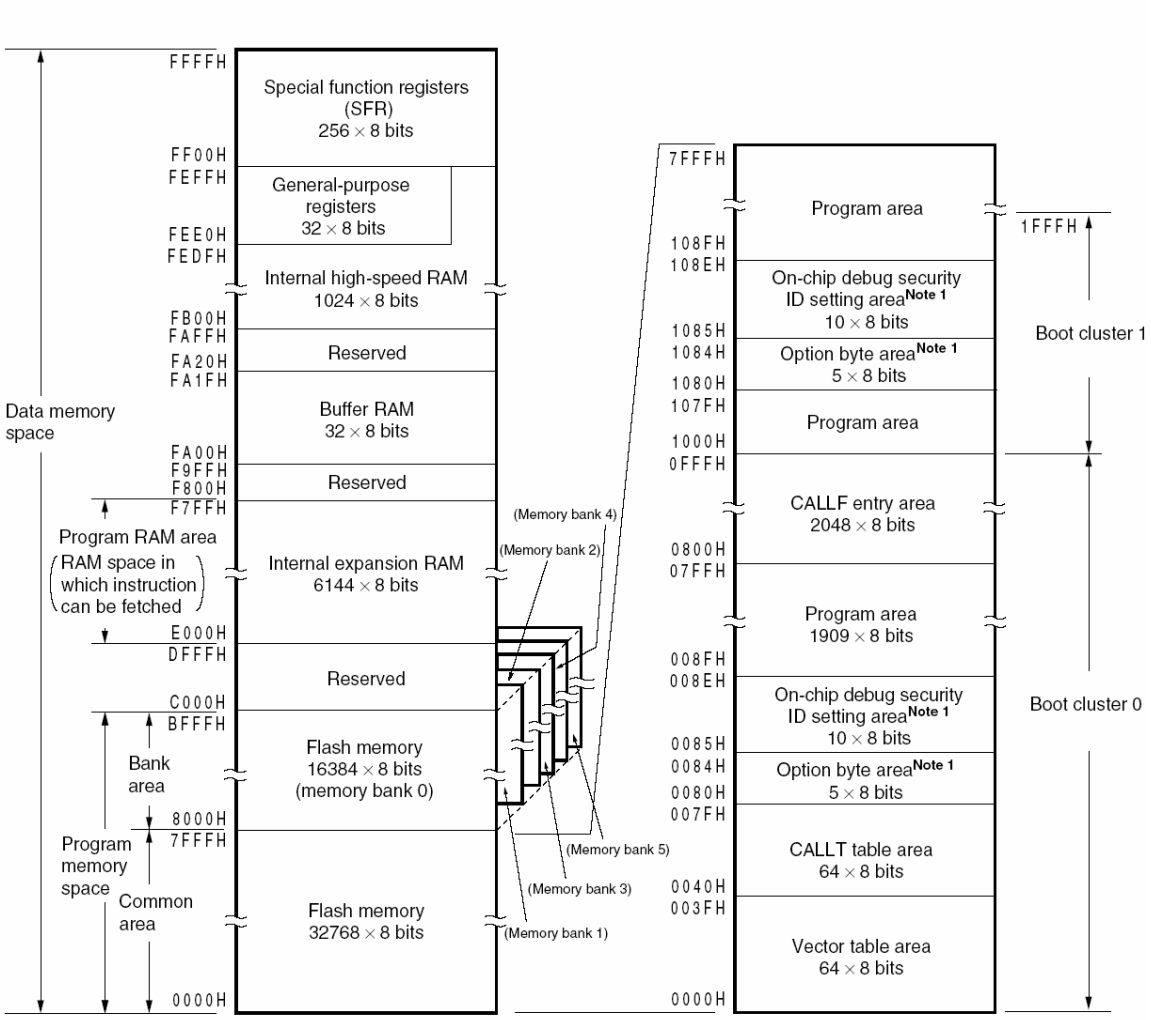
J4	Function
61	P27/ANI7
62	P26/ANI6
63	P25/ANI5
64	P24/ANI4
65	P23/ANI3
66	P22/ANI2
67	P21/ANI1
68	P20/ANI0
69	P130
70	P04/SCK11
71	P03/SI11
72	P02/SO11
73	P01/TI010/TO00
74	P00/TI000
75	P145/STB0
76	P144/SOA0
77	P143/SIA0
78	P142/SCKA0
79	P141/BUZ/BUSY0/INTP7
80	P140/PCL/INTP6



Note: Please read the user's manual of the 78K0/KF2 device carefully to get information about the electrical specification of the available I/O ports before you connect any external signal to the *78K0/KF2 demo board*!

4. 78K0/KF2 memory map

The memory layout of the µPD78F0547DGC 128KB FLASH ROM device is shown in the figure below. For more details please refer to the user's manual of the 78K0/KF2 device.



Note 1. When boot swap is not used: Set the option bytes to 0080H to 0084H, and the on-chip debug secu IDs to 0085H to 008EH.

When boot swap is used: Set the option bytes to 0080H to 0084H and 1080H to 1084H, and on-chip debug security IDs to 0085H to 008EH and 1085H to 108EH.

Figure 4: 78K0/KF2 memory map

5. Schematics

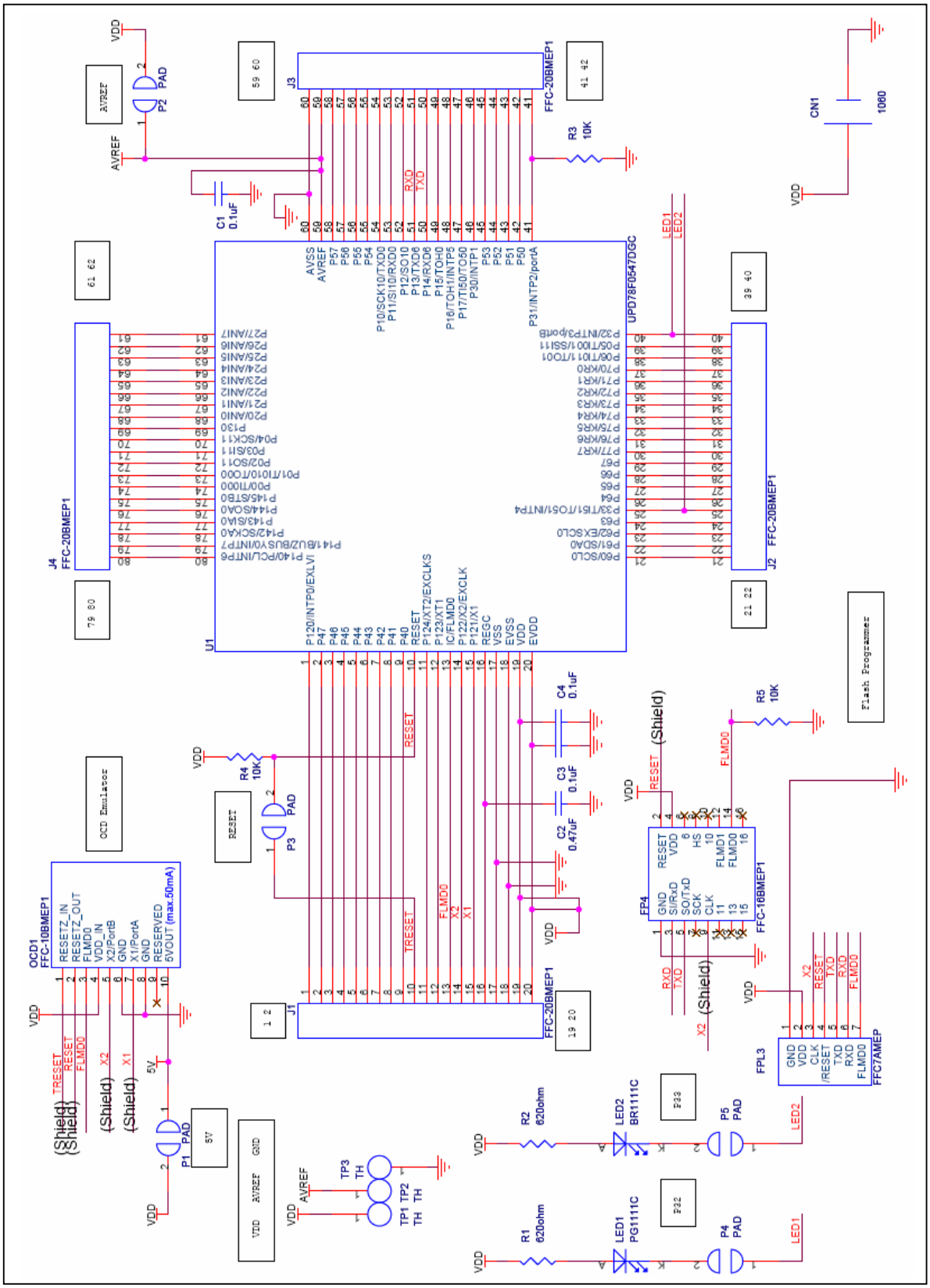


Figure 5: *78K0/KF2 demo* board schematics