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April 1st, 2010
Renesas Electronics Corporation

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User's Manual



78K0/KF2 Demo Board

Campaign Board

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

Global Document No. U18121EE1V0UM00 (1st edition)

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:

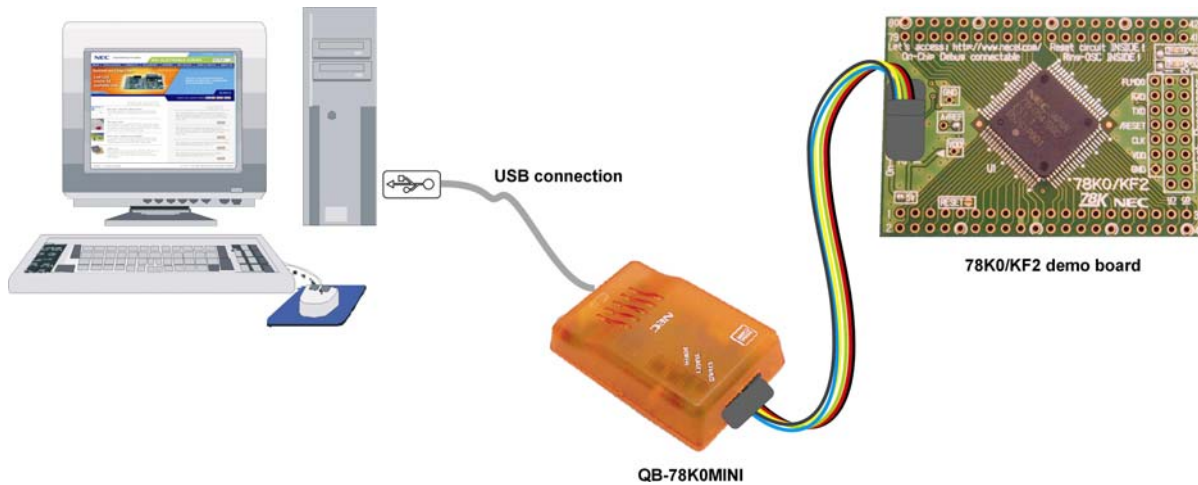


Figure 1: 78K0/KF2 demo board system configuration

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.

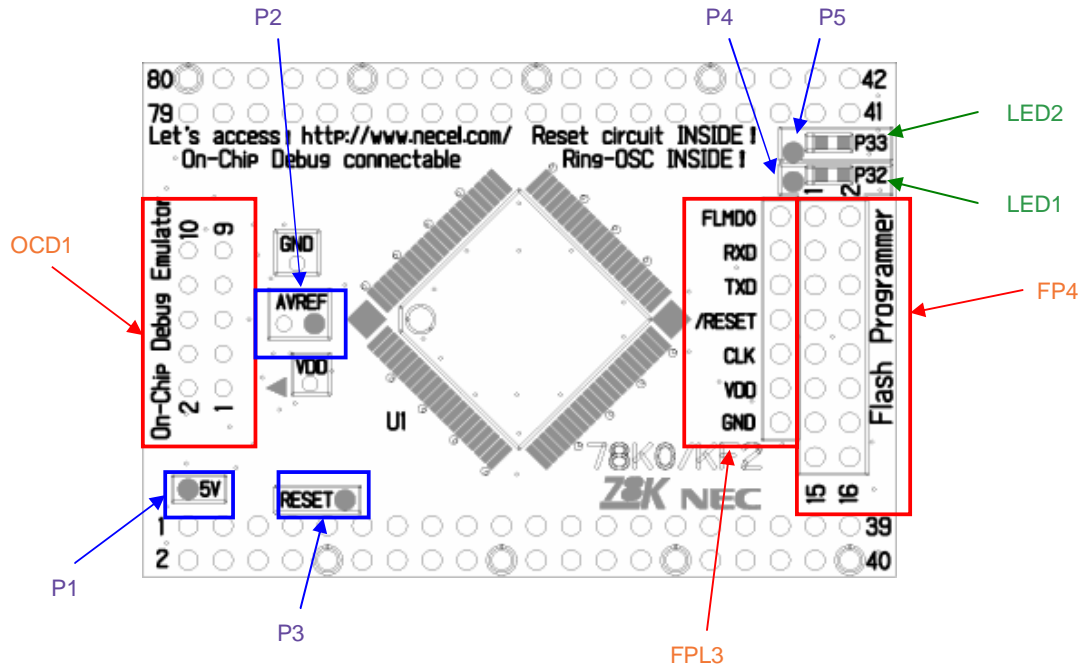


Figure 2: 78K0/KF2 demo board connectors, soldering bridges and LED's

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-FP4 or alternative the PG-FP4 FLASH programmer. The configuration for on-board FLASH programming is shown in figure below.

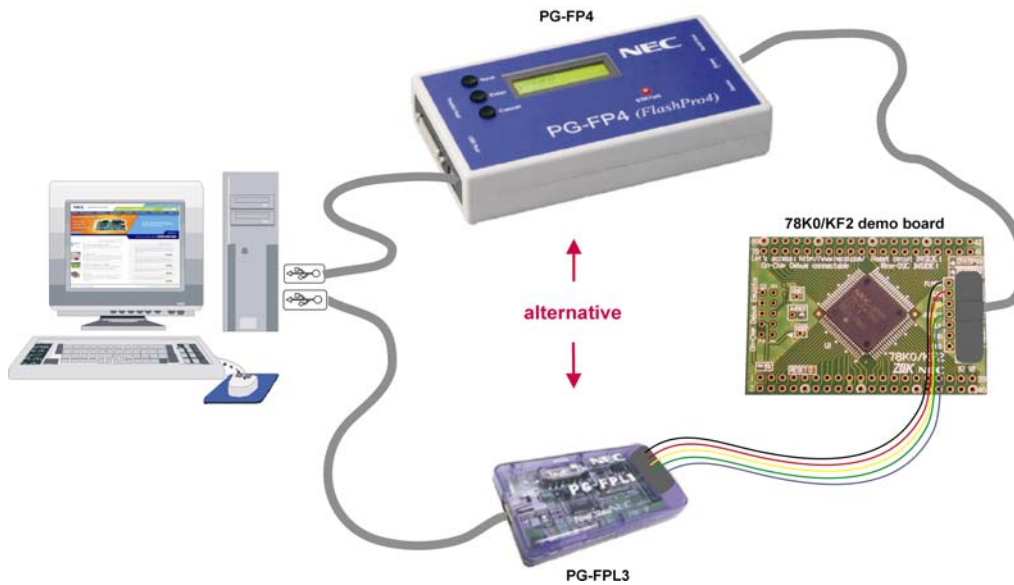


Figure 3: 78K0/KF2 demo board FLASH programming configuration

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

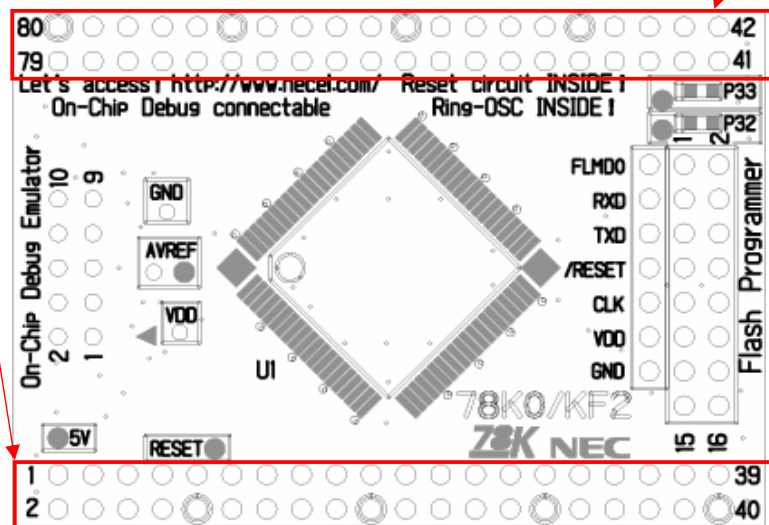
For disconnecting a LED from a port for alternative usage open the connection of the corresponding soldering bridge P4 respectively P5.

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

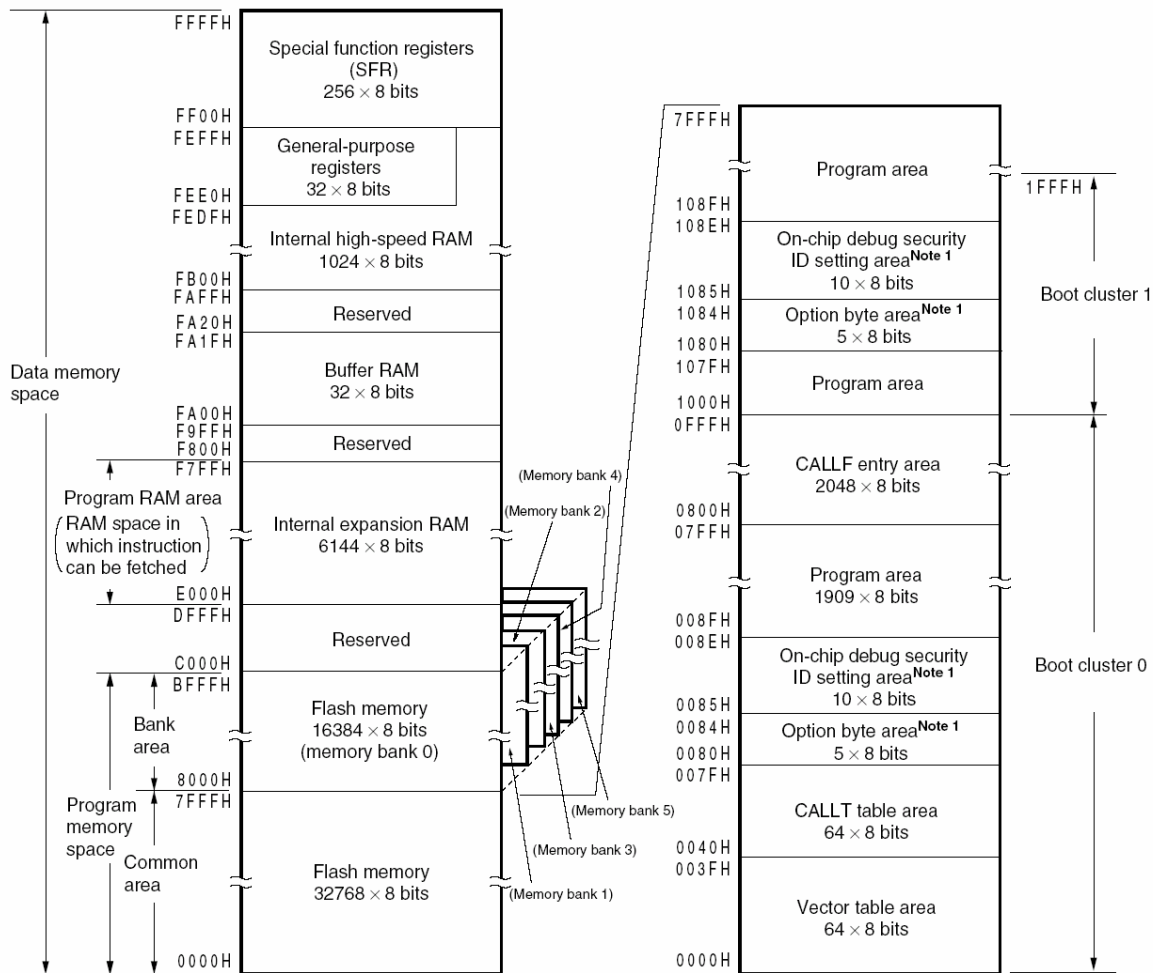
| J1 | Function | J2 | Function | J3 | Function | J4 | Function |
|----|------------------|----|---------------------|----|-------------------|----|----------------------|
| 1 | P120/INTP0/EXLVI | 21 | P60/SCL0 | 41 | P31/INTP2 (PortA) | 61 | P27/ANI7 |
| 2 | P47 | 22 | P61/SDA0 | 42 | P50 | 62 | P26/ANI6 |
| 3 | P46 | 23 | P62/EXSCL0 | 43 | P51 | 63 | P25/ANI5 |
| 4 | P45 | 24 | P63 | 44 | P52 | 64 | P24/ANI4 |
| 5 | P44 | 25 | P33/TI51/TO51/INTP4 | 45 | P53 | 65 | P23/ANI3 |
| 6 | P43 | 26 | P64 | 46 | P30/INTP1 | 66 | P22/ANI2 |
| 7 | P42 | 27 | P65 | 47 | P17/TI50/TO50 | 67 | P21/ANI1 |
| 8 | P41 | 28 | P66 | 48 | P16/TOH1/INTP5 | 68 | P20/ANI0 |
| 9 | P40 | 29 | P67 | 49 | P15/TOH0 | 69 | P130 |
| 10 | RESET | 30 | P77/KR7 | 50 | P14/RXD6 | 70 | P04/SCK11 |
| 11 | P124/XT2/EXCLKS | 31 | P76/KR6 | 51 | P13/TXD6 | 71 | P03/SI11 |
| 12 | P123/XT1 | 32 | P75/KR5 | 52 | P12/SO10 | 72 | P02/SO11 |
| 13 | IC/FLMD0 | 33 | P74/KR4 | 53 | P11/SI10/RXD0 | 73 | P01/TI010/TO00 |
| 14 | P122/X2/EXCLK | 34 | P73/KR3 | 54 | P10/SCK10/TXD0 | 74 | P00/TI000 |
| 15 | P121/X1 | 35 | P72/KR2 | 55 | P54 | 75 | P145/STB0 |
| 16 | REGC | 36 | P71/KR1 | 56 | P55 | 76 | P144/SOA0 |
| 17 | VSS | 37 | P70/KR0 | 57 | P56 | 77 | P143/SIA0 |
| 18 | EVSS | 38 | P06/TI011/TO01 | 58 | P57 | 78 | P142/SCKA0 |
| 19 | VDD | 39 | P05/TI001/SSI11 | 59 | AVREF | 79 | P141/BUZ/BUSY0/INTP7 |
| 20 | EVDD | 40 | P32/INTP3 (PortB) | 60 | AVSS | 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 μ PD78F0547DGC 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 security 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

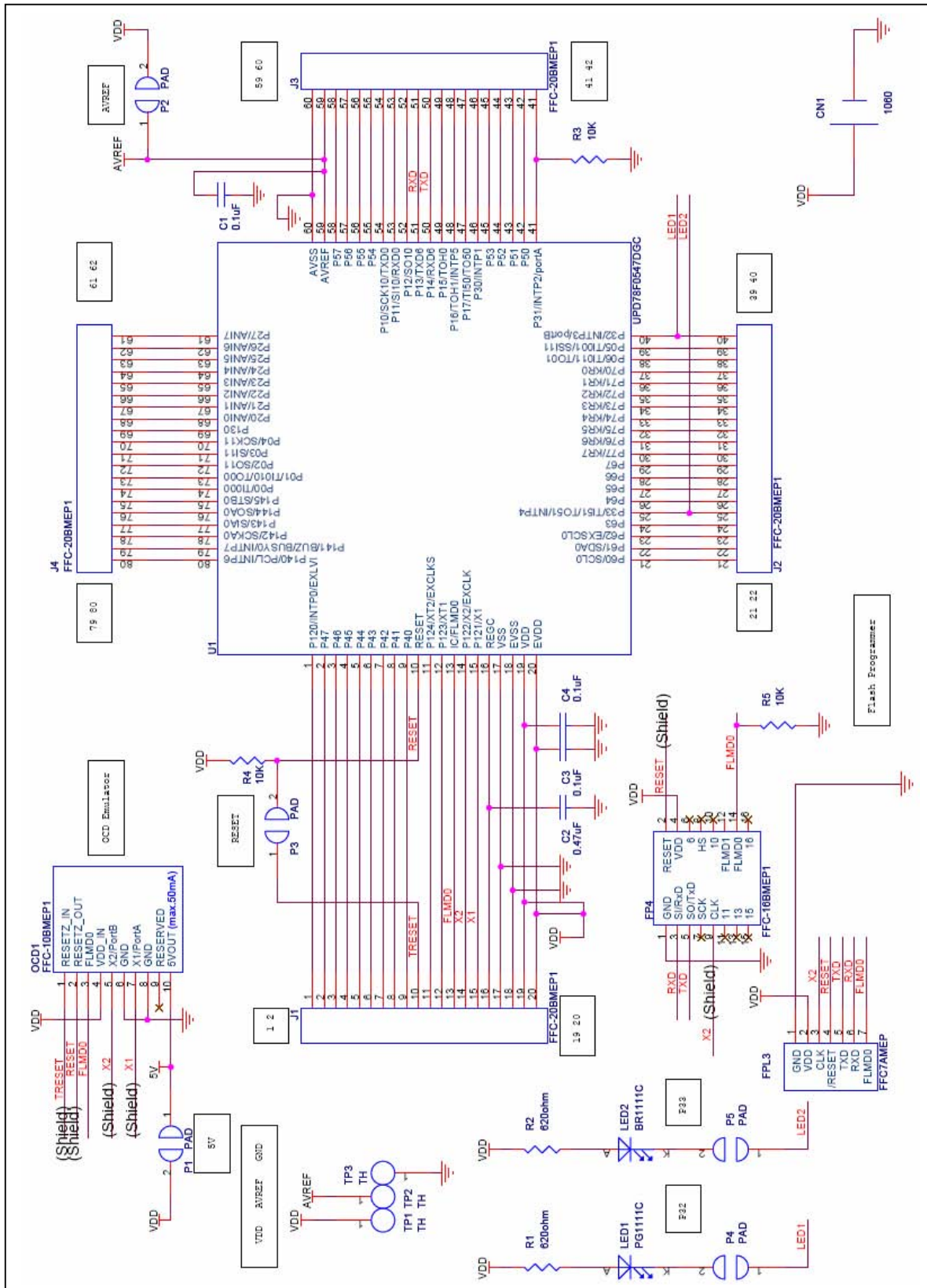


Figure 5: 78K0/KF2 demo board schematics