NEC

Application Note

78K0R/Kx3

16-Bit Single-Chip Microcontroller

Programming Examples

78K0R/KE3
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Notes for CMOS Devices

1. **VOLTAGE APPLICATION WAVEFORM AT INPUT PIN**
   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between VIL (MAX) and VIH (MIN) due to noise, etc., the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between VIL (MAX) and VIH (MIN).

2. **HANDLING OF UNUSED INPUT PINS**
   Unconnected CMOS device inputs can result in malfunction. If an input pin is unconnected, it is possible that an internal input level may be generated due to noise, etc., causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using pull-up or pull-down circuitry. Each unused pin should be connected to VDD or GND via a resistor if there is a possibility that it will be an output pin. All handling related to unused pins must be judged separately for each device and according to related specifications governing the device.

3. **PRECAUTION AGAINST ESD**
   A strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and to quickly dissipate it should it occur. Environmental control must be adequate. When it is dry, a humidifier should be used. It is recommended to avoid using insulators that easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors should be grounded. The operator should be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with mounted semiconductor devices.

4. **STATUS BEFORE INITIALIZATION**
   Power-on does not necessarily define the initial status of a MOS device. Immediately after the power source is turned ON, devices with reset functions have not yet been initialized. Hence, power-on does not guarantee output pin levels, I/O settings or contents of registers. A device is not initialized until the reset signal is received. A reset operation must be executed immediately after power-on for devices with reset functions.

5. **POWER ON/OFF SEQUENCE**
   In the case of a device that uses different power supplies for the internal operation and external interface, as a rule, switch on the external power supply after switching on the internal power supply. When switching the power supply off, as a rule, switch off the external power supply and then the internal power supply. Use of the reverse power on/off sequences may result in the application of an overvoltage to the internal elements of the device, causing malfunction and degradation of internal elements due to the passage of an abnormal current. The correct power on/off sequence must be

judged separately for each device and according to related specifications governing the device.

6. **INPUT OF SIGNAL DURING POWER OFF STATE**
Do not input signals or an I/O pull-up power supply while the device is not powered. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Input of signals during the power off state must be judged separately for each device and according to related specifications governing the device.

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Preface

78K0R/KE3	μPD78F1142A, μPD78F1143A, μPD78F1144A, μPD78F1145A, μPD78F1146A
78K0R/KF3	μPD78F1152A, μPD78F1153A, μPD78F1154A, μPD78F1155A, μPD78F1156A
78K0R/KG3	μPD78F1162A, μPD78F1163A, μPD78F1164A, μPD78F1165A, μPD78F1166A, μPD78F1167A, μPD78F1168A
78K0R/KH3	μPD78F1174A, μPD78F1175A, μPD78F1176A, μPD78F1177A, μPD78F1178A
78K0R/KJ3	μPD78F1184A, μPD78F1185A, μPD78F1186A, μPD78F1187A, μPD78F1188A

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This programming example is a demonstration program for the usage of the A/D Converter.

1.2 Clock Generator

This programming example is a demonstration program for the usage of the Clock Generator.

1.3 DMA-Controller

This programming example is a demonstration program for the usage of the DMA Controller.

1.4 Low-Voltage Indicator

This programming example contains one demonstration program for the usage of the Low-Voltage Indicator in EXLVI interrupt mode and one demonstration program for the usage of the Low-Voltage Indicator in Reset mode.

1.5 Real-Time Counter

This programming example is a demonstration program for the usage of the Real-Time Counter.

1.6 Serial Array Unit

This programming example is a demonstration program for the usage of the Serial Array Unit in clock-synchronous interface mode and in UART mode.

The Serial Array Unit performs bidirectional communication in clock-synchronous interface mode.

Examples for the baud rate correction, bidirectional communication and transmit-only mode are available in UART mode.

1.7 Timer Array Unit

This programming example is a demonstration program for the usage of the Timer Array Unit. There are two programming examples available, one for the independent interval timer mode and one for the combined PWM mode.