

## Applicability

NET2890 Rev 2B

### NET2890 PROGRAMMING FLOWCHART

This flowchart presents a simple, yet complete NET2890 programming example. It is a good case study for programmers that are new to the NET2890.

The flowchart applies to a simple bus-powered USB device that supports:

- Enumeration
- Control transfers (read and write)
- Data transfers (IN and OUT)

The flowchart is based on an interrupt-driven CPU. After initialization, all USB events are handled under interrupt control.

For brevity, several limitations apply to the flowchart:

- Only two NET2890 data endpoints are used
- Minimal number of USB requests are supported
- Simple buffer management
- No DMA

With hardware and software support, these limitations can be removed.

#### NET2890: The Programmer's Perspective:

The NET2890 is a USB interface controller designed to abstract firmware from low-level complexities of USB. For example, to return a packet of data to the host, firmware simply writes data to a FIFO, and (optionally) sets a bit indicating that the NET2890 can send the contents of the FIFO to the host.

When the host successfully reads the packet, an interrupt (if enabled) is generated. The NET2890 automatically handles timing, PID generation, CRC, bit stuffing, retries, etc. Firmware is responsible for all data content however. For example, when a Setup Request successfully arrives, firmware must examine the request, and generate an appropriate response. Descriptor content is completely controlled by firmware. When the host requests a descriptor, firmware loads the descriptor content into a FIFO for the host to read. Note that an endpoint's descriptor content must correspond to the endpoint's programming in the NET2890.

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At a minimum, programmers should be familiar with USB specification sections 8.5 and 9.3 - 9.6.

**ENUMERATION:**

For many USB devices, the most difficult task is enumeration. A device must examine the contents of the Setup Request and respond accordingly. This flowchart supports the minimum set of Setup Requests that are required for enumeration:

- Get Device Descriptor
- Get Configuration Descriptor
- Set Address
- Set Configuration

If the program does not recognize a Setup Request it will instruct the NET2890 to stall endpoint 0.

**CONTROL TRANSFERS:**

In this flowchart, Control Read data transfers return standard descriptors to the host during enumeration. The model can easily be extended for any Control Read data transfer, including Class or Vendor Specific requests.

Control Write data transfers are not required for enumeration, however the flowchart includes Control Write data transfer programming for completeness. The model can easily be extended for any Control Write data transfer, including Class or Vendor Specific requests.

**DATA TRANSFERS:**

For brevity, this example uses only two NET2890 data endpoints. Endpoint A is arbitrarily programmed as a 64-byte BULK OUT endpoint, and endpoint B is programmed as a 64-byte BULK IN endpoint. Note that a NET2890 data endpoint can be configured as any type (BULK, ISO, or INT); size (1023 bytes max); or direction (IN or OUT).

Data transfers are somewhat artificial in this program. A real USB device typically has a mechanism for transferring data from a USB endpoint to an electronic unit (such as a MODEM) and vice-versa. This example, however, simply transfers data to or from the device's memory buffers. Once a receive buffer becomes full or a transmit buffer becomes empty, the endpoint will NAK.

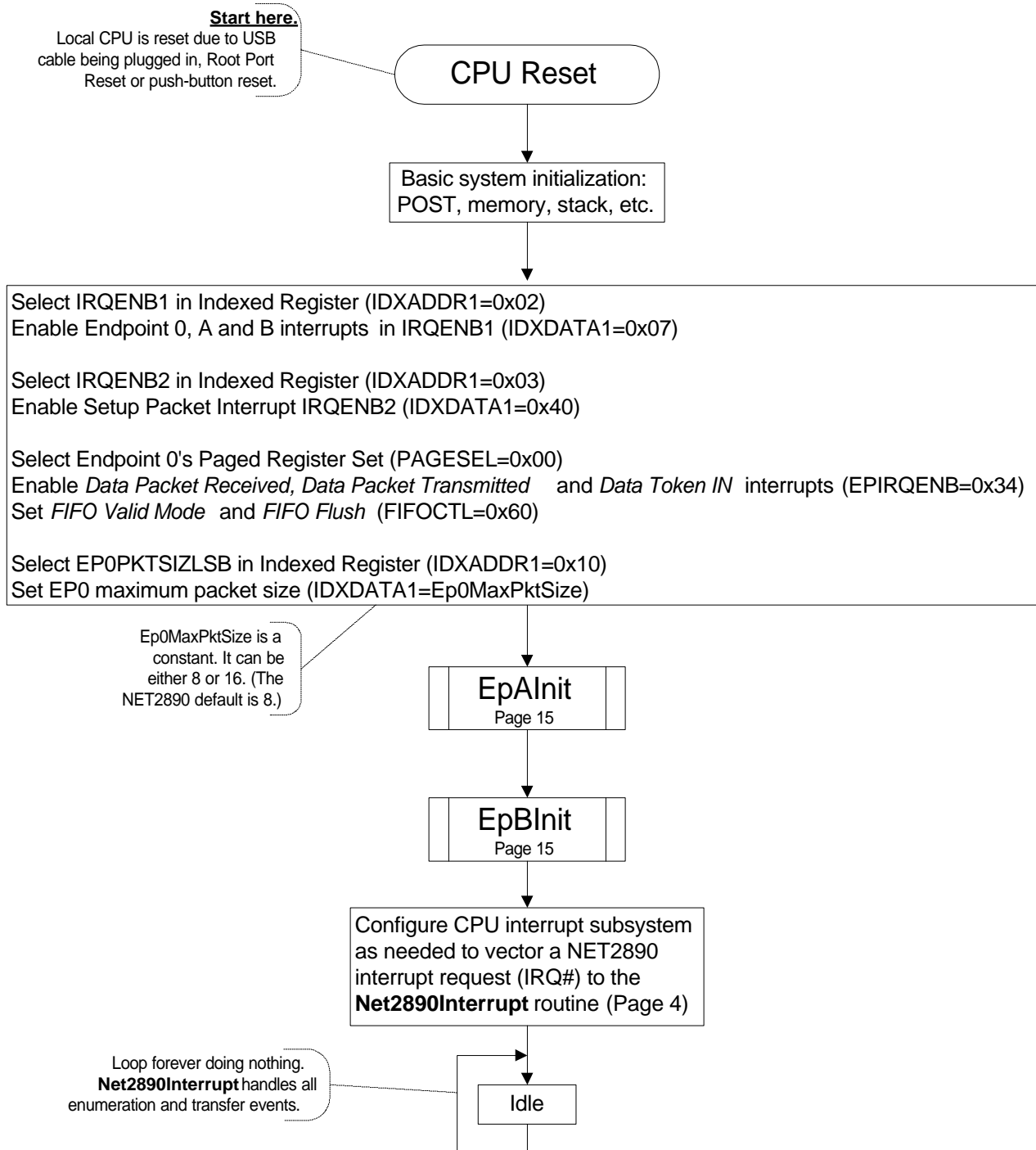
**CHIP ERRATA**

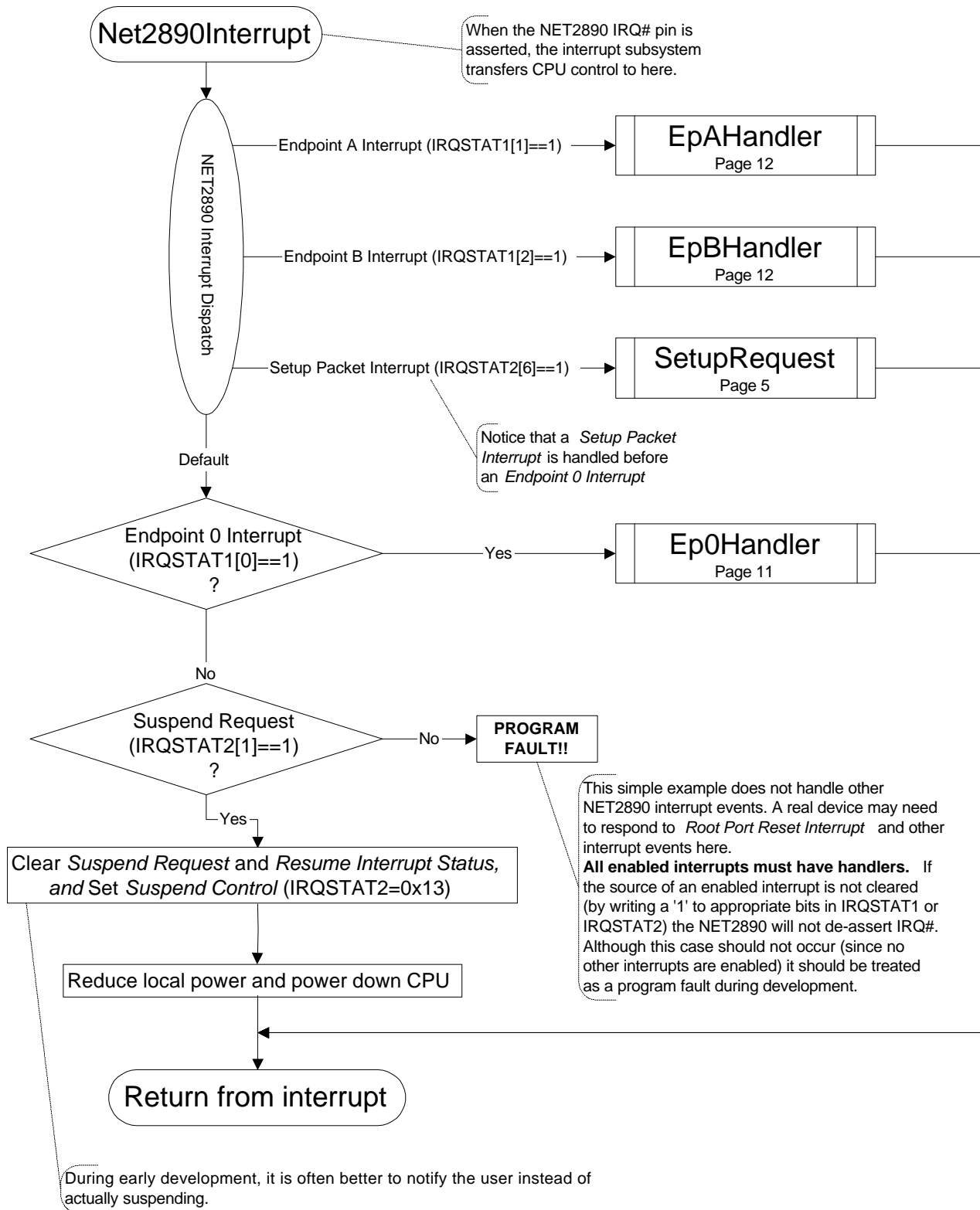
This flowchart includes a workaround for NET2890 errata 630-0057-0401.

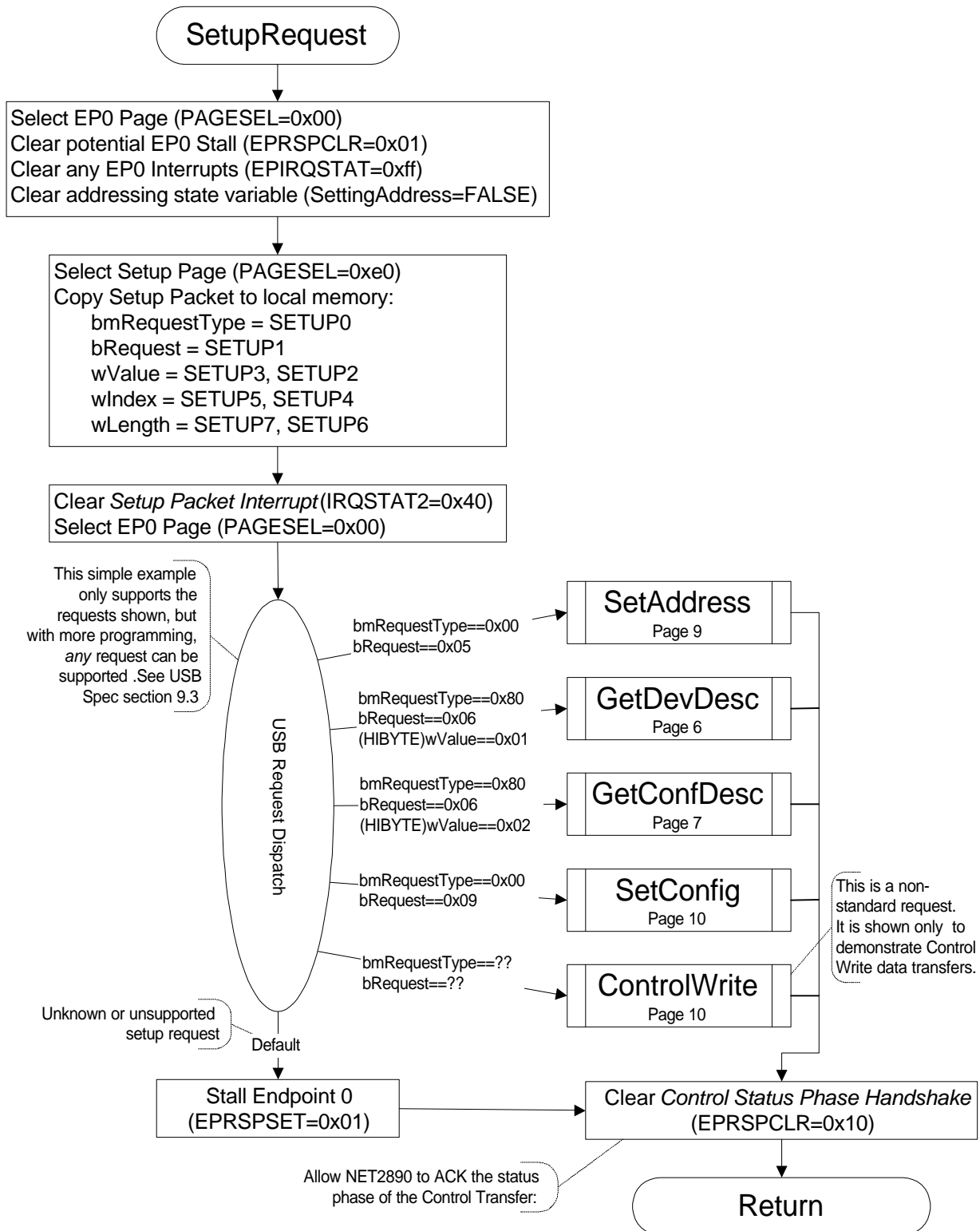
**DISCLAIMER**

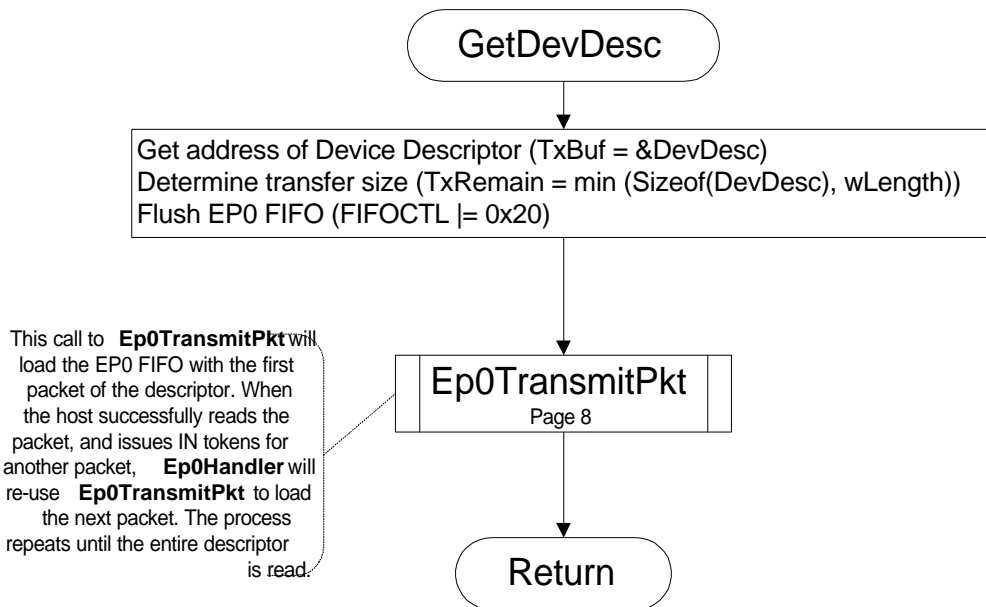
NetChip's NET2890 design team has made every effort to make this document useful, accurate and complete. You should recognize, however, that errors and omissions may exist. If you have problems with this document, please contact NetChip Technology, Inc.

# NET2890 Initialization Sequence

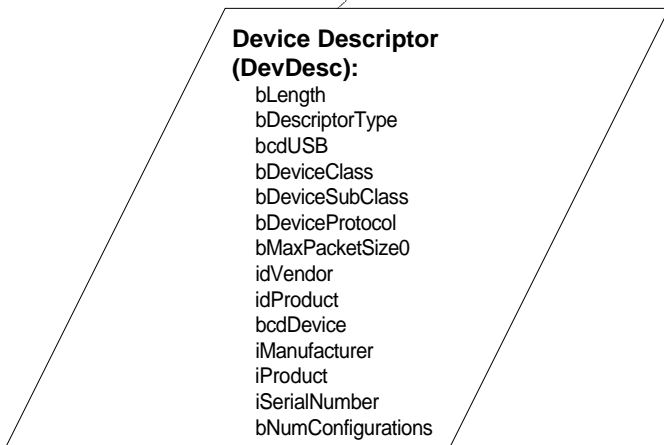


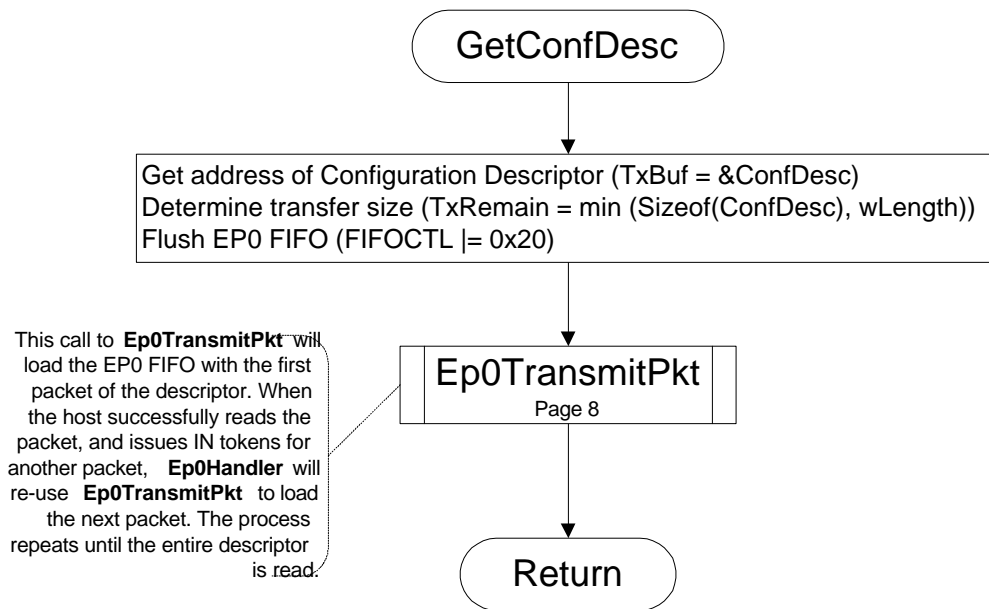




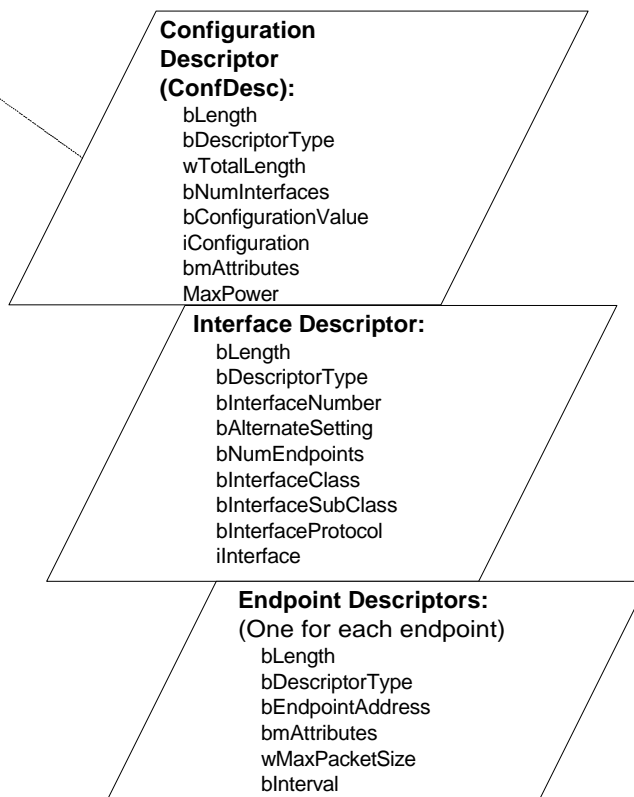


This Device Descriptor is preloaded in local memory. (See USB spec 9.6.1 for content information.) Note that NET2890 endpoint configuration must match descriptors

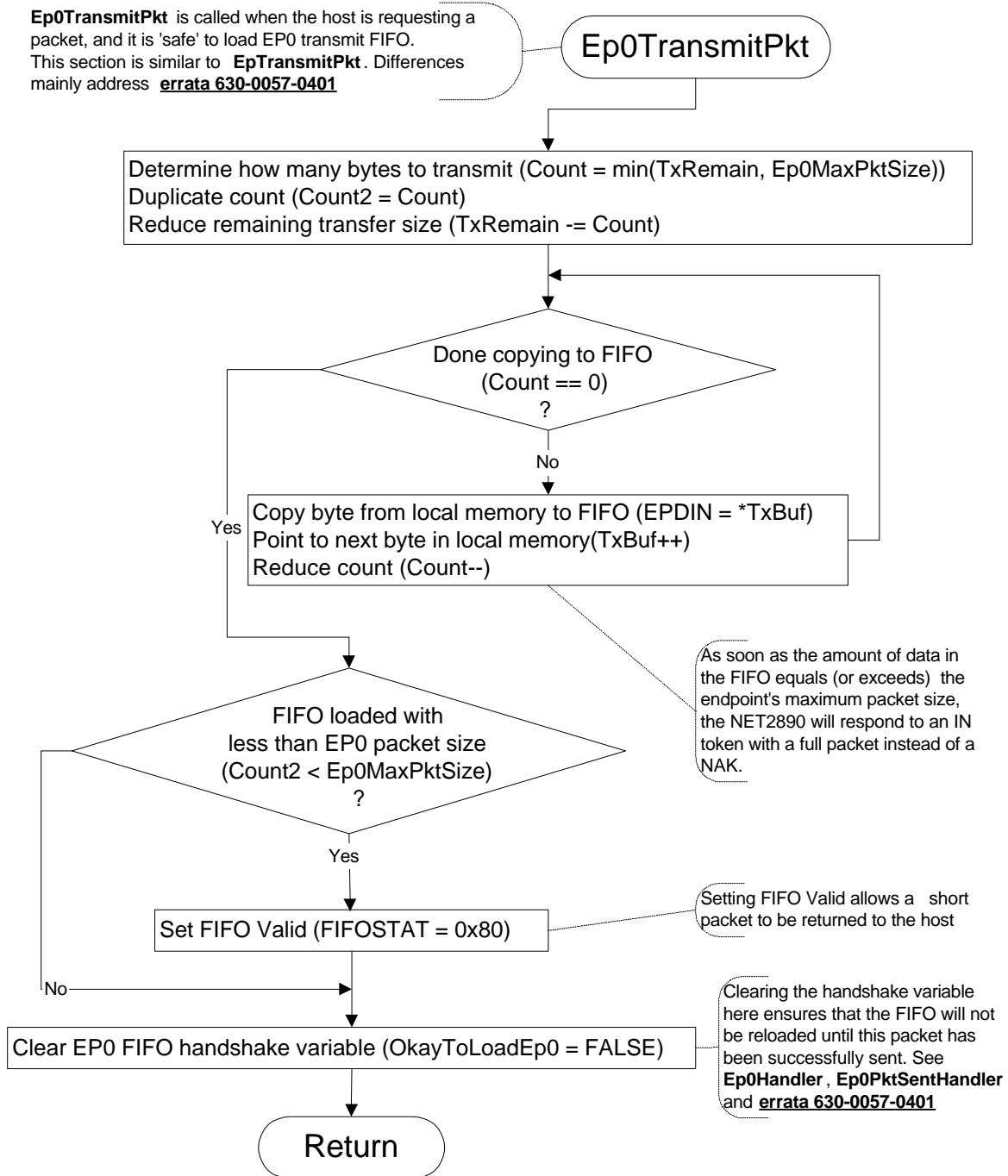




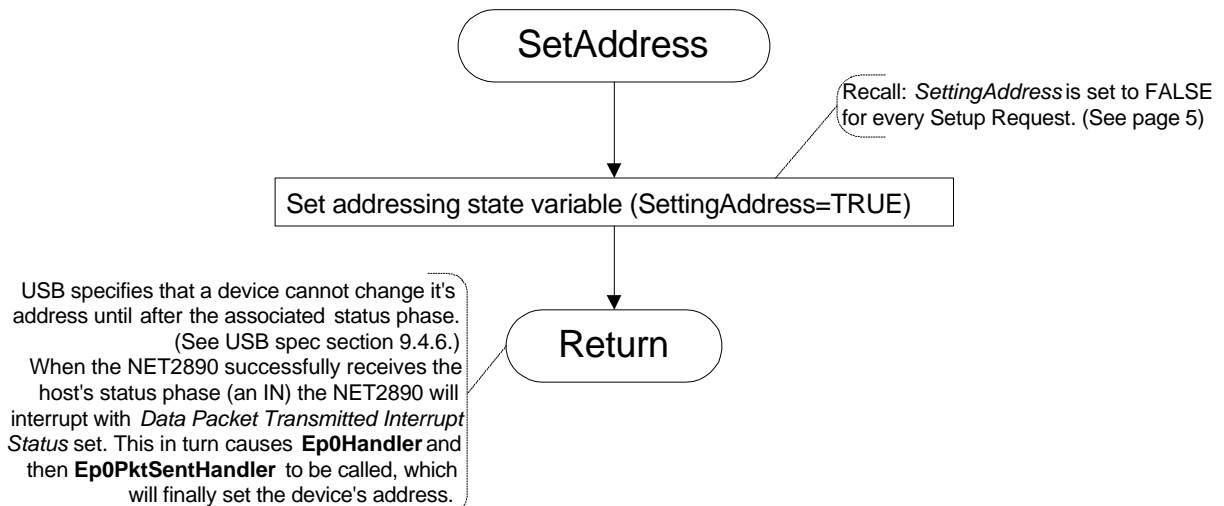
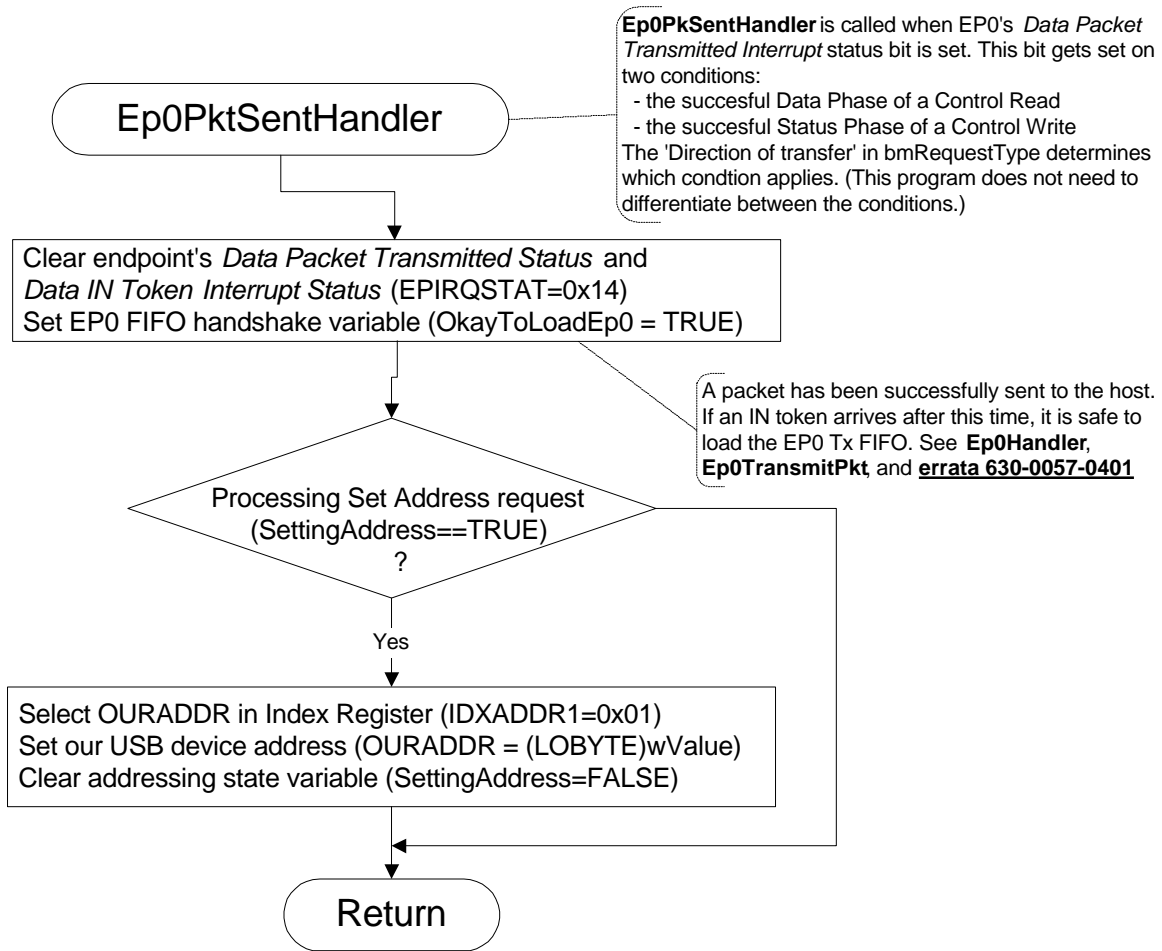
These descriptors are preloaded contiguously in local memory. (See USB spec 9.6.2 - 9.6.4 for content information.) Note that NET2890 endpoint configuration must match descriptors

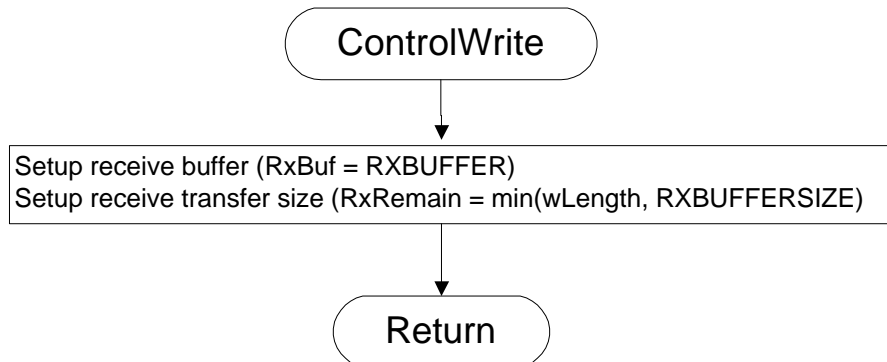
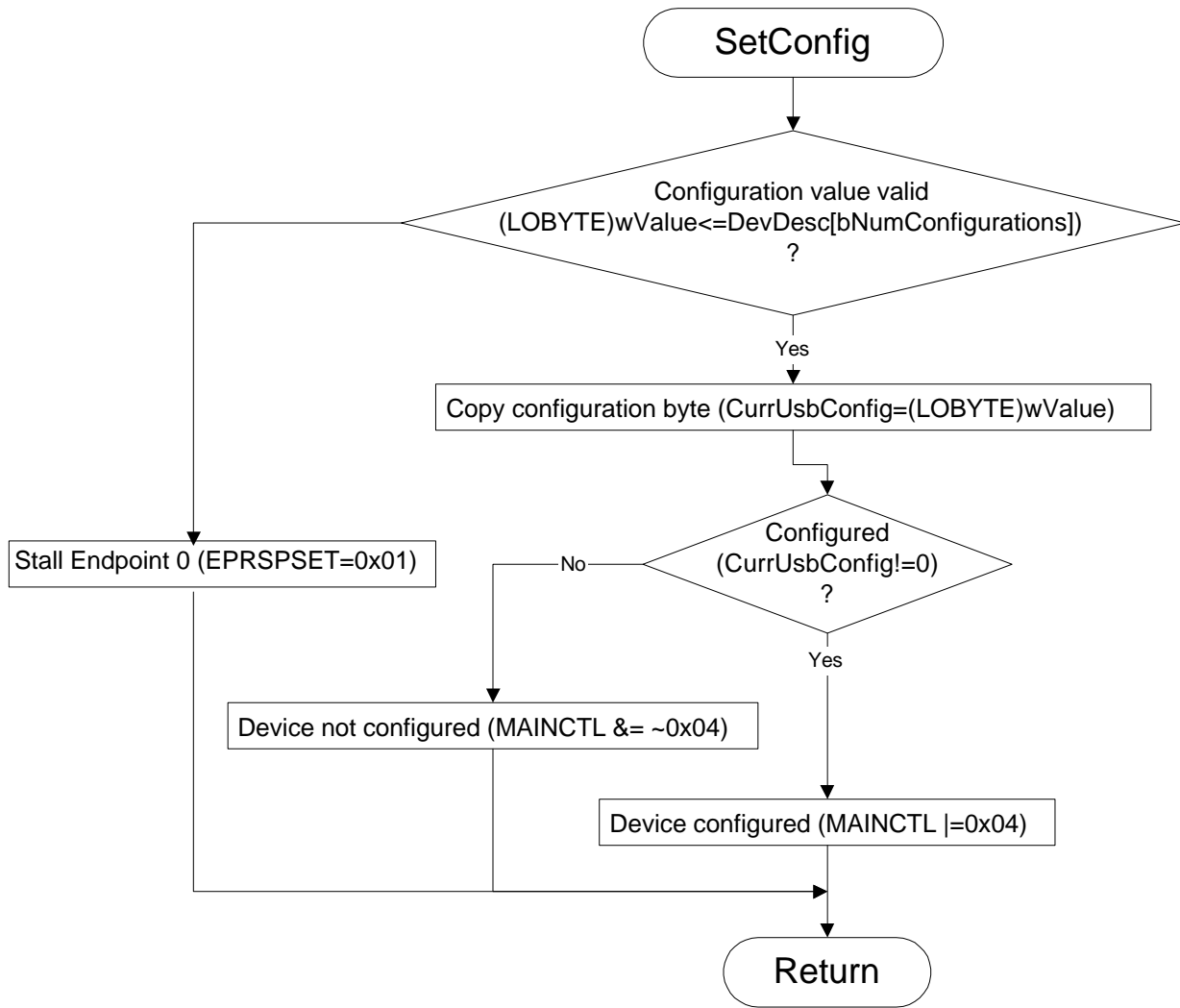


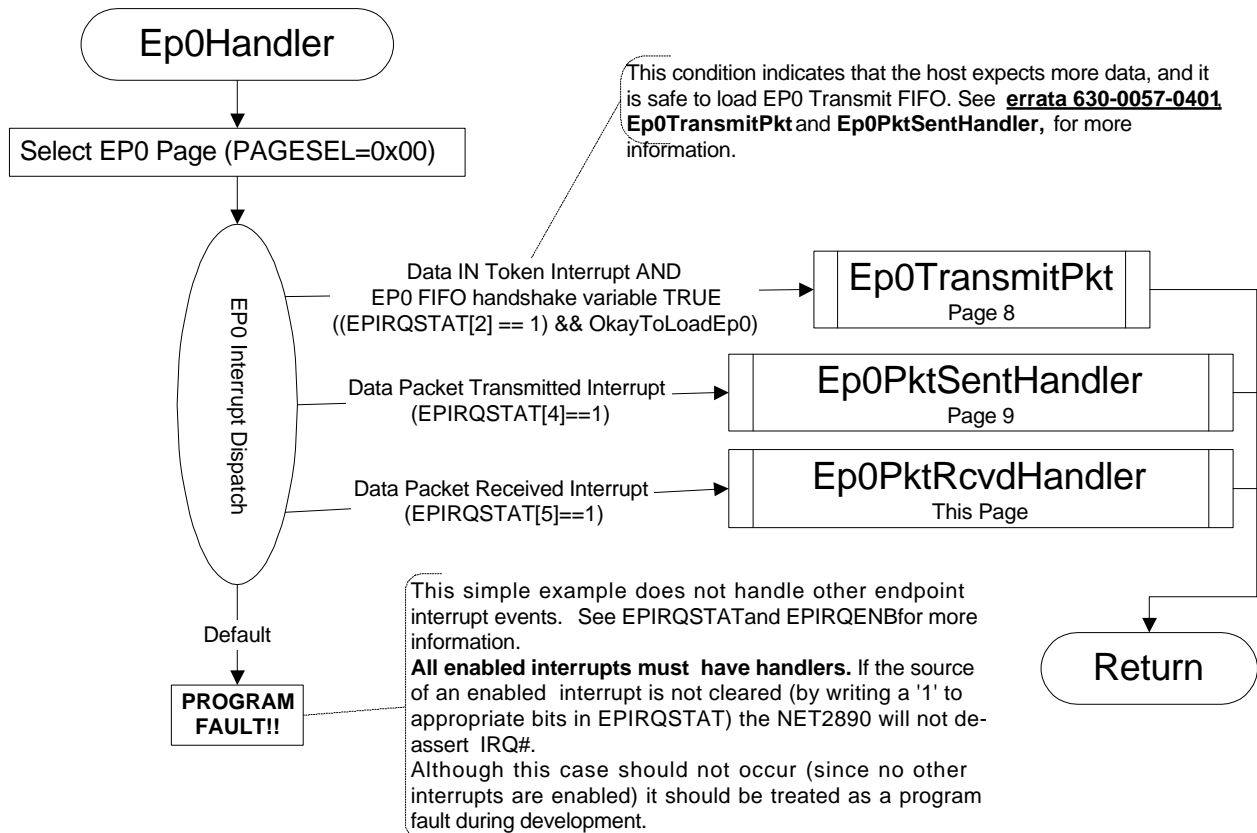
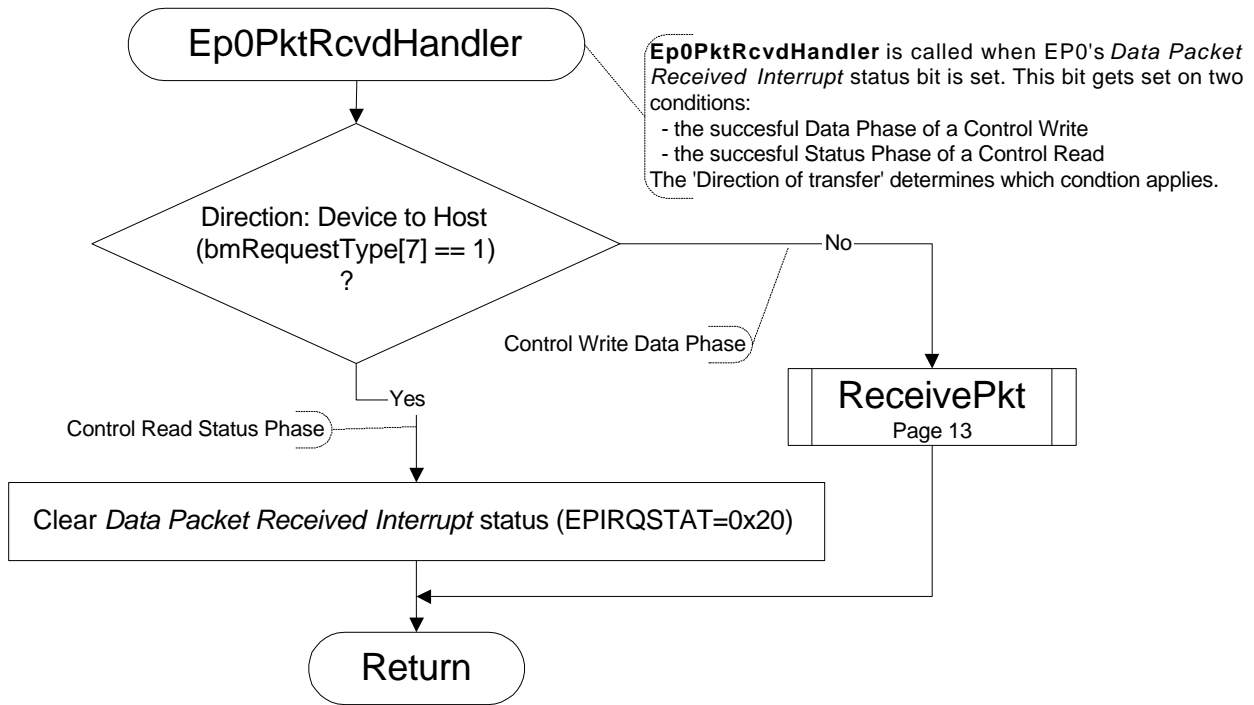
**Ep0TransmitPkt** is called when the host is requesting a packet, and it is 'safe' to load EPO transmit FIFO. This section is similar to **EpTransmitPkt**. Differences mainly address [errata 630-0057-0401](#)

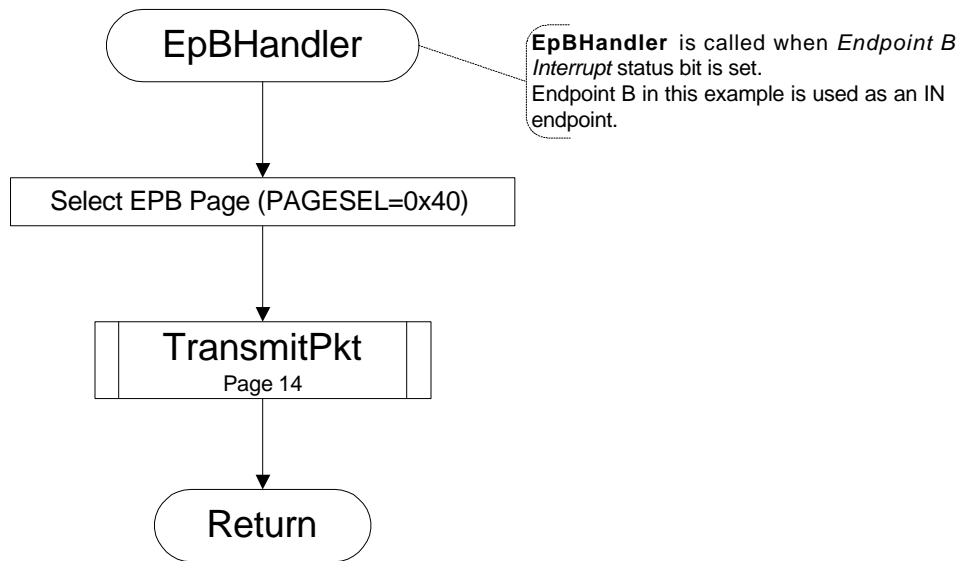
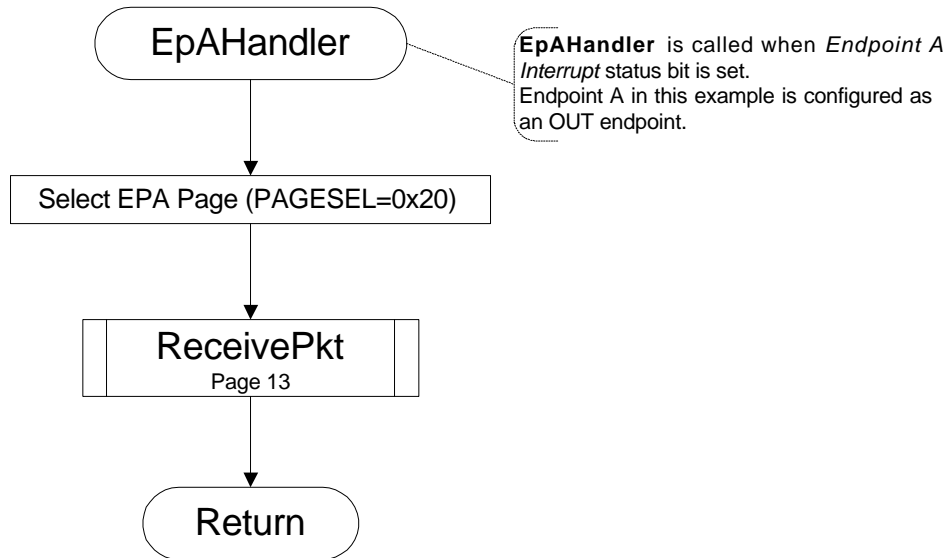












Note that in this 'artificial' device, there is no mechanism (such as a MODEM) to remove data from receive buffers. Once a buffer and its associated endpoint FIFOs are full, OUTs to that endpoint are NAKd.

ReceivePkt

ReceivePkt is called in response to a *Data Packet Received Interrupt Status* bit being set. Note that the endpoint will NAK OUT tokens as long as this bit is set.

Determine how many bytes to copy to memory (Count=min(RxRemain, FIFOCNT))  
Reduce size of remaining transfer (RxRemain -= Count)

If there is room in the endpoint's FIFO, the NET2890 can now accept another OUT data packet.

Clear endpoint's *Data Packet Received Interrupt Status* (EPIRQSTAT=0x20)

Done copying to memory  
(Count == 0)  
?

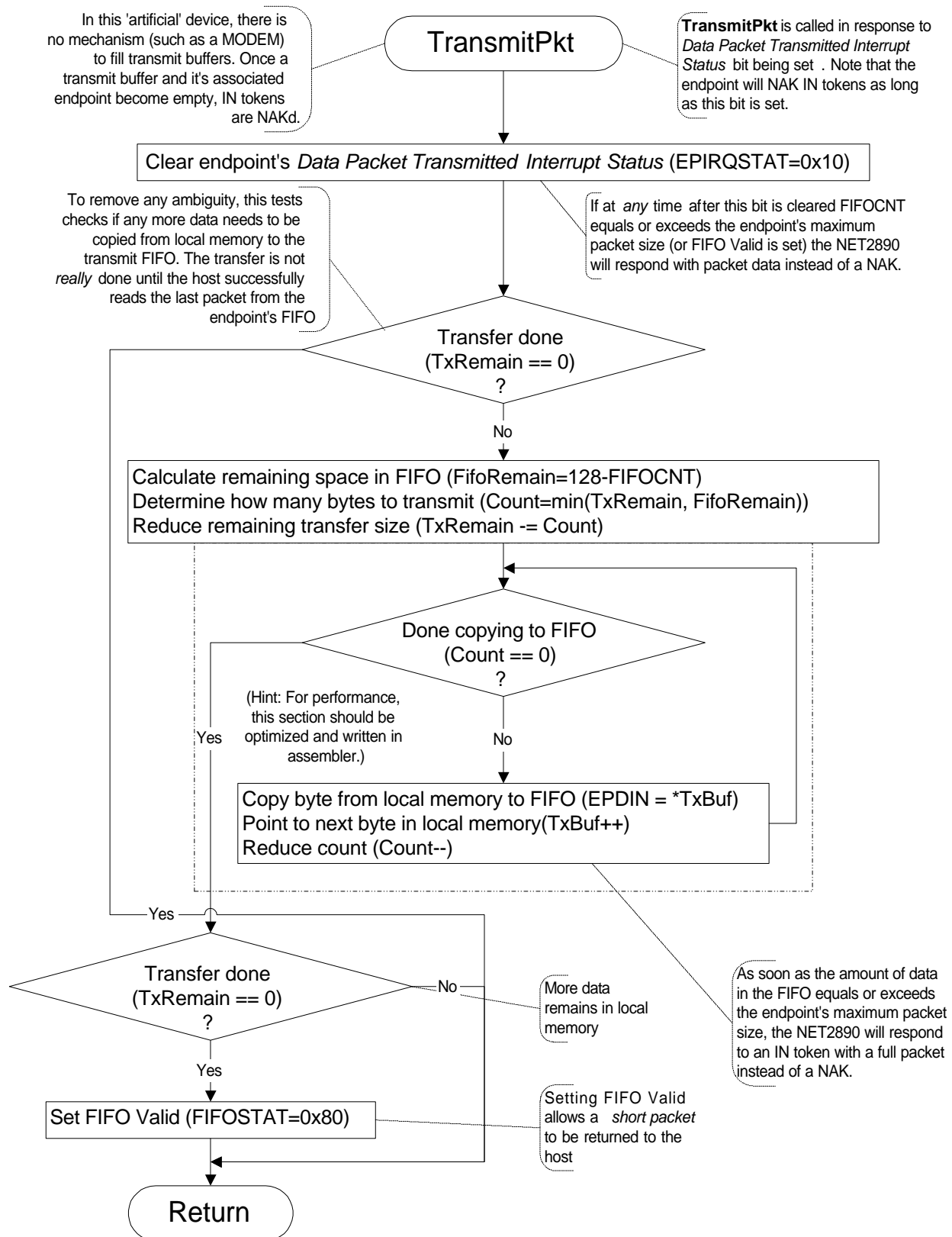
(Hint: For performance, this section should be optimized and written in assembler.)

No

Yes

Copy byte from FIFO to local memory (\*RxBuf=EPDOUT)  
Point to next byte in local memory(RxBuf++)  
Reduce count (Count--)

Return



## EpAInit

Configure Endpoint A to be a 64-byte BULK OUT endpoint at USB endpoint address 1 (0x01)

Select Endpoint A's Paged Register Set (PAGESEL=0x20)  
Clear *Timeout, Short Packet Transferred*, and all USB STALL, NAK and ACK status bits (EPUSBSTAT=0xfe)  
Clear *FIFO Overflow, Underflow, Full and Empty* (FIFOSTAT=0x3c)  
Set *FIFO Valid Mode and FIFO Flush* (FIFOCTL=0x60)  
Select EPAPKTSIZLSB in Index Register (IDXADDR1=0x12)  
Assign EPA maximum packet size (IDXDATA1=0x40)  
Assign *Endpoint Number 1 1, Direction to OUT, Type to BULK*, and *Endpoint Enable to TRUE*  
Set *Data Packet Received Interrupt enable* (EPIRQENB=0x20)  
Clear *Data Packet Received Interrupt status* (EPIRQSTAT=0x20)

Setup receive buffer (RxBuf = RXBUFFER)  
Setup receive transfer size (RxRemain = RXBUFFERSIZE)

Return

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## EpBInit

Configure Endpoint B to be a 64-byte BULK IN endpoint at USB endpoint address 2 (0x82)

Select Endpoint B's Paged Register Set (PAGESEL=0x40)  
Clear *Timeout, Short Packet Transferred*, and all USB STALL, NAK and ACK status bits (EPUSBSTAT=0xfe)  
Clear *FIFO Overflow, Underflow, Full and Empty* (FIFOSTAT=0x3c)  
Set *FIFO Valid Mode and FIFO Flush* (FIFOCTL=0x60)  
Select EPBPKTSIZLSB in Index Register (IDXADDR1=0x14)  
Assign EPB maximum packet size (IDXDATA1=0x40)  
Assign *Endpoint Number to 2, Direction to IN, Type to BULK*, and *Endpoint Enable to TRUE* (EPCFG=0x2e)  
Set *Data Packet Transmitted Interrupt Enable* (EPIRQENB=0x40)  
Clear *Data Packet Transmitted Interrupt status* (EPIRQSTAT=0x40)

Setup transmit buffer (TxBuf = TXBUFFER)  
Setup transmit transfer size (TxRemain = TXBUFFERSIZE)

Return

## Sample Enumeration Sequences

Note: The following enumeration sequences were recorded from a working NET2890-EB evaluation board with a Windows98 host. These sequences are provided as examples only.

### No Driver installed in host

Reset  
Get Device Descriptor - 64 bytes  
Reset  
Set Address  
Get Device Descriptor - 18 bytes  
  
Get Configuration Descriptor - 255 bytes  
Get String Descriptor - 255 bytes  
DialogBox installation wizard pop-up

### NcUsb.sys installed in host

Reset  
Get Device Descriptor - 64 bytes  
Reset  
Set Address  
Get Device Descriptor - 18 bytes  
  
Get Configuration Descriptor - 255 bytes  
Get Device Descriptor - 18 bytes  
Get Configuration Descriptor - 265 bytes  
Set Configuration



## USB Compatibility Ch. 9 Test

Reset  
Get Device Descriptor - 64 bytes  
Reset  
Set Address  
Get Device Descriptor - 18 bytes  
Get Configuration Descriptor - 9 bytes  
Get Configuration Descriptor - 255 bytes  
Get Device Descriptor - 18 bytes