Curso ARM Cortex M3

Temario Día 2

- Bus USB
  - Topologia del bus USB
  - Protocolos y clases de dispositivos
- Ejemplos
  - Como Device: Bootoader emulando un pendriver
  - Como Host: Interfaz HID (leer un mouse USB)

El bus USB

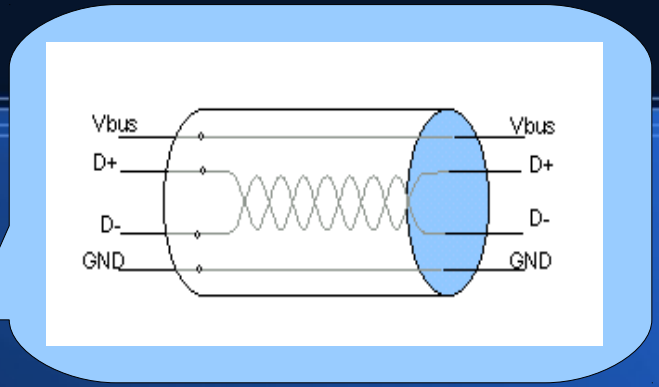
Creado para eliminar la diversidad de conectores y buses externos

El bus USB

Características:

- Transmisión Serie
- Half Duplex (en un solo sentido al mismo tiempo)
- Arquitectura Maestro/Esclavo
- Provee alimentación a los dispositivos
- Soporta Hot-Plug
- Configuración automatica
- Define tipos estandar de interfeces

El bus USB



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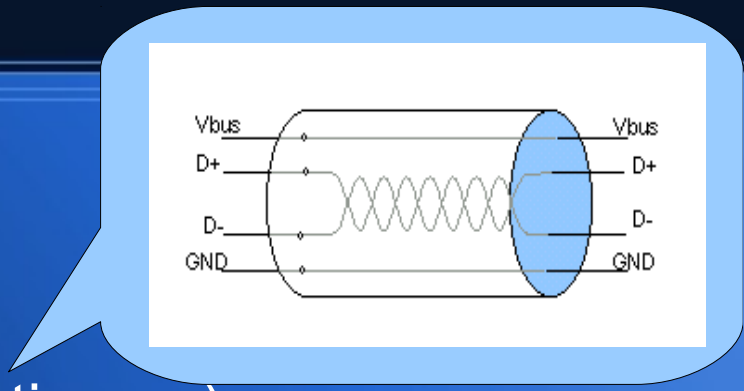

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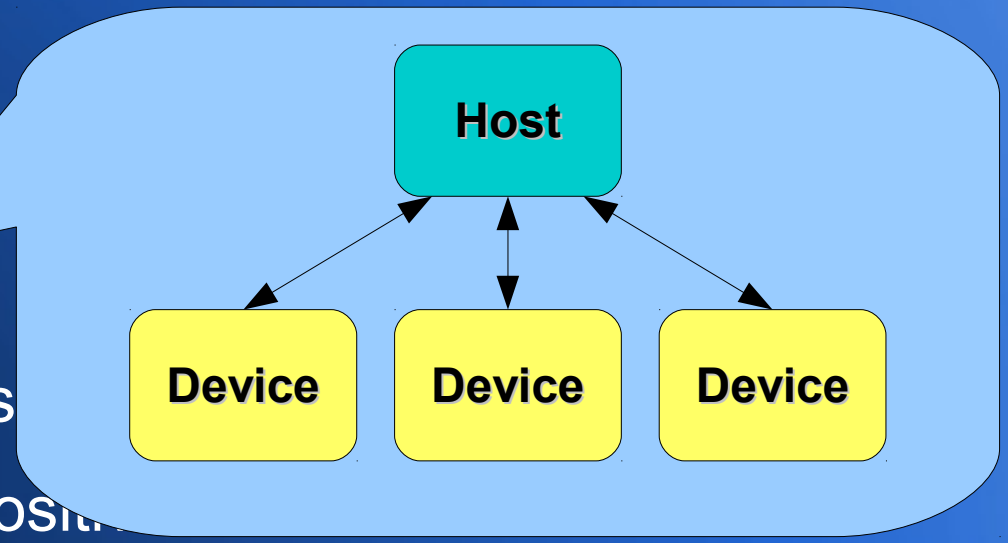

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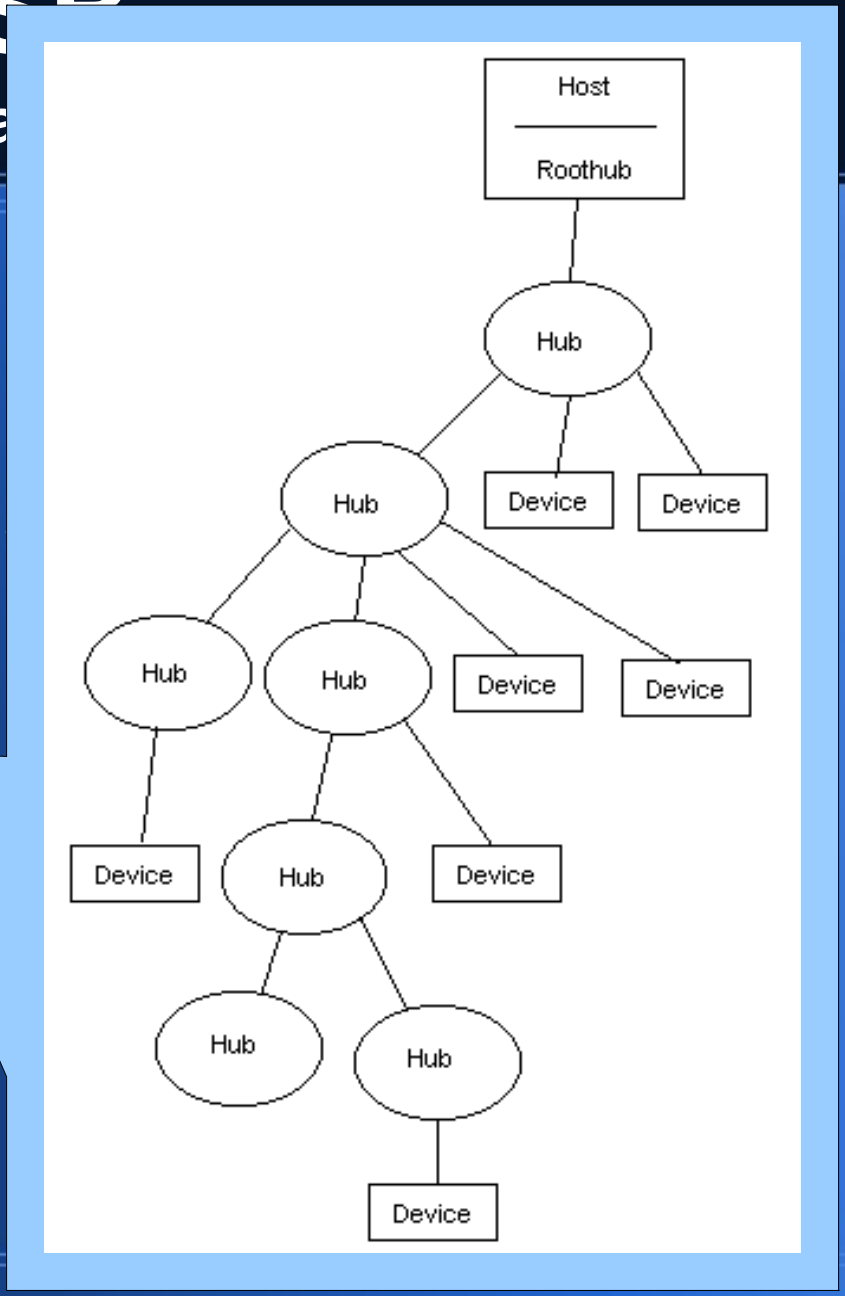

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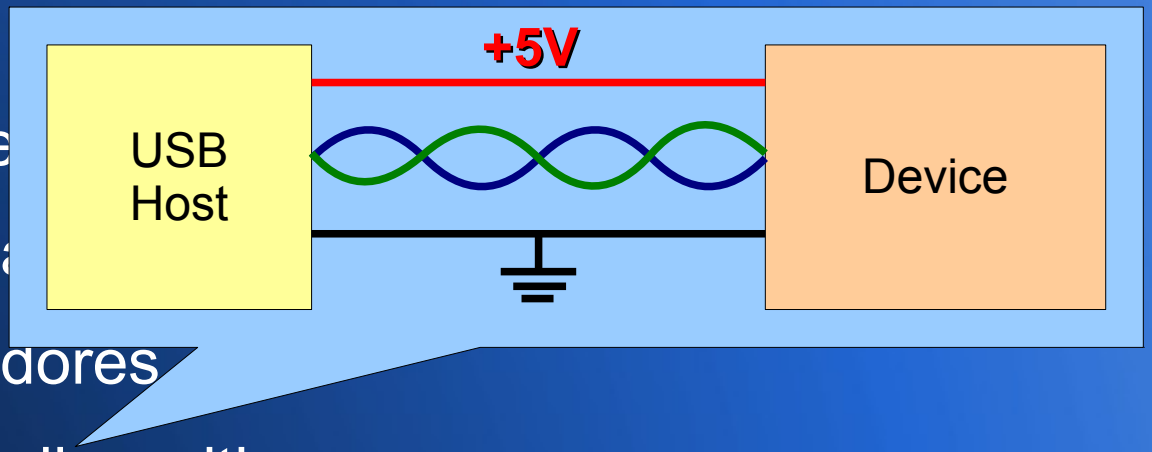

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- Half Duplex (e iempo)
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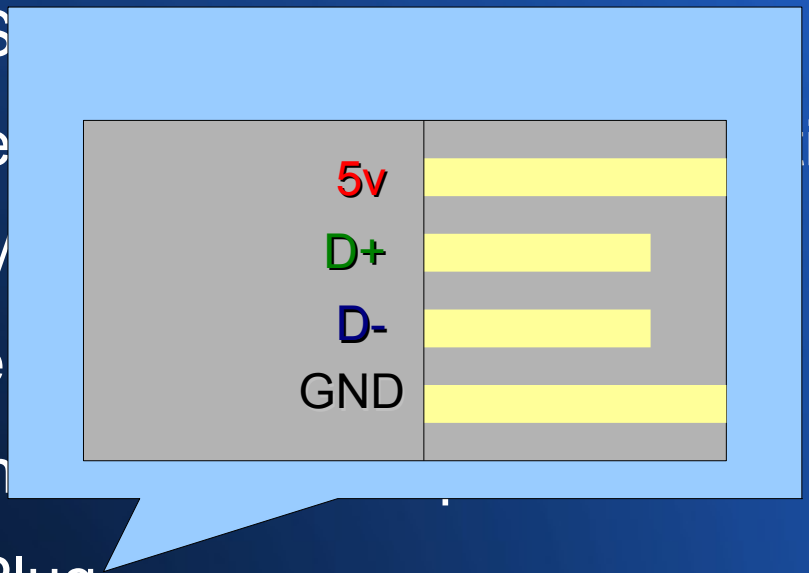

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- Half Duplex (en un
- Arquitectura Maestr
- Red basada en con
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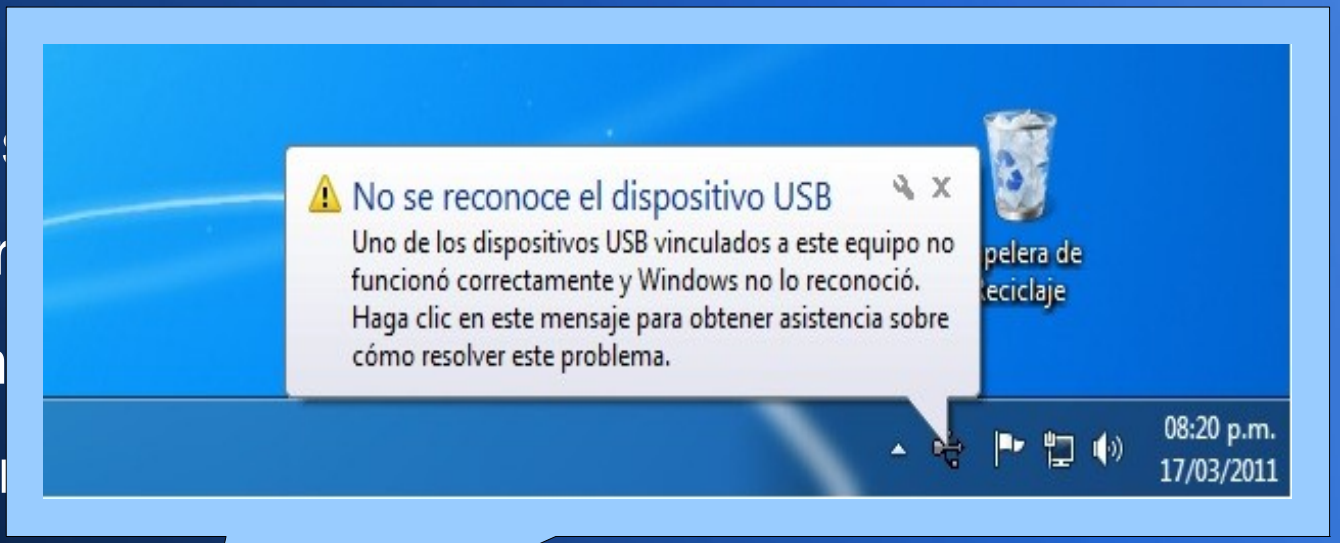

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Mass storage Device Class

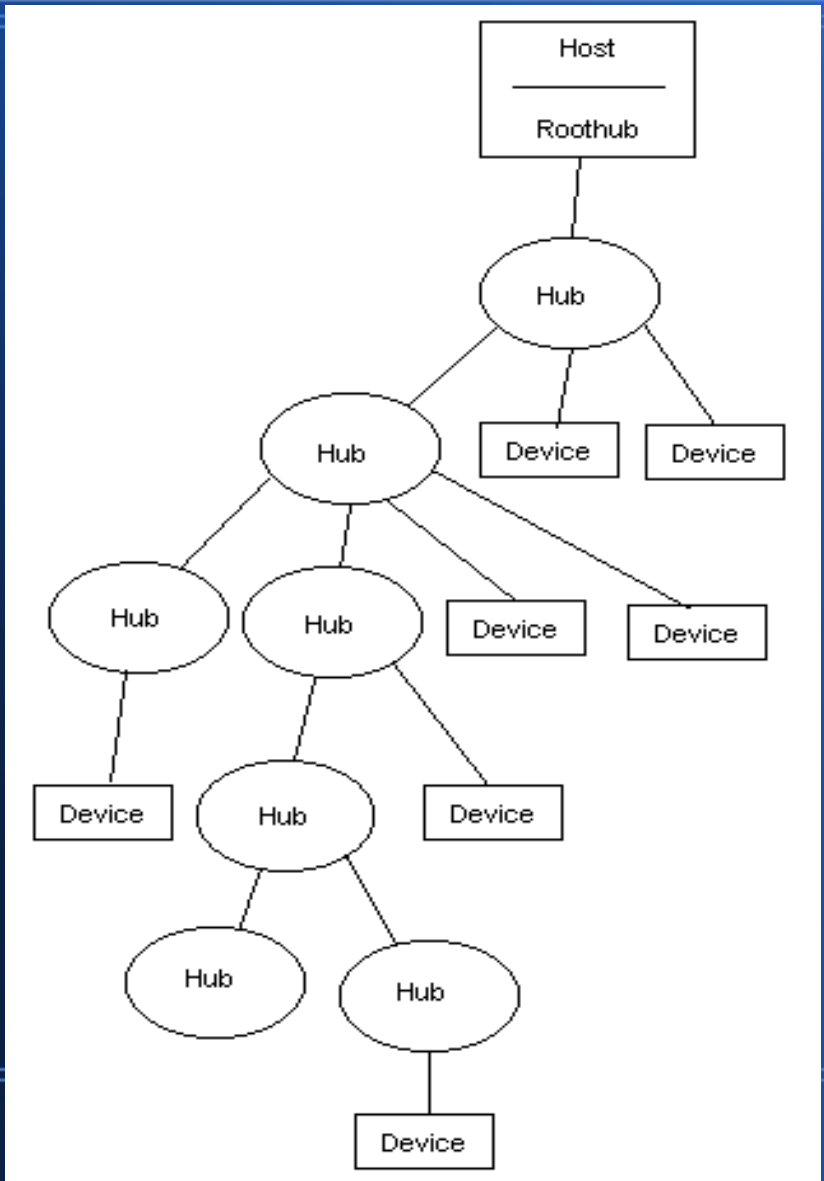
Human Interface Device Class

Comunication Device Class

Printer Device Class

El bus USB

Topologia:



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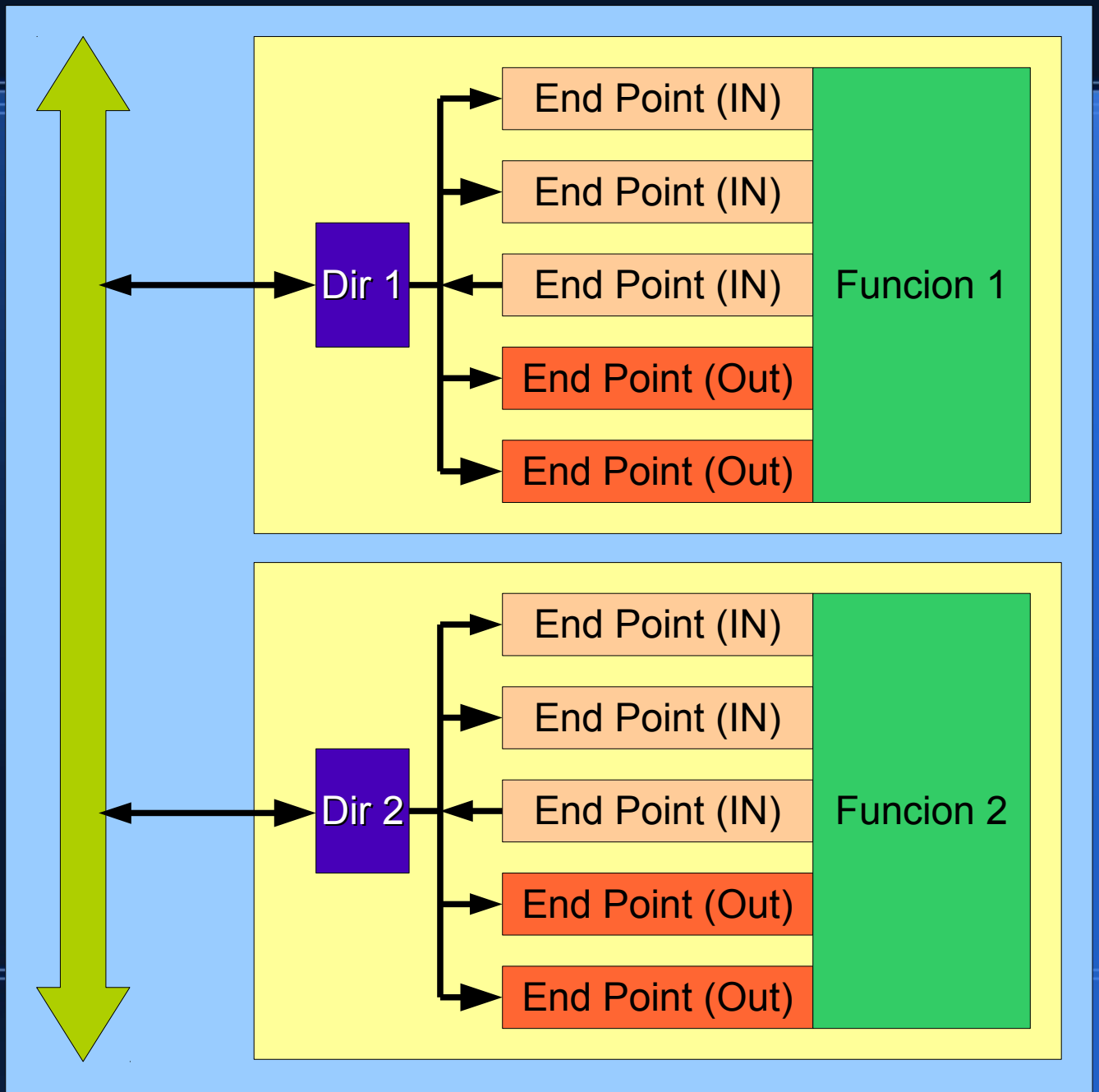
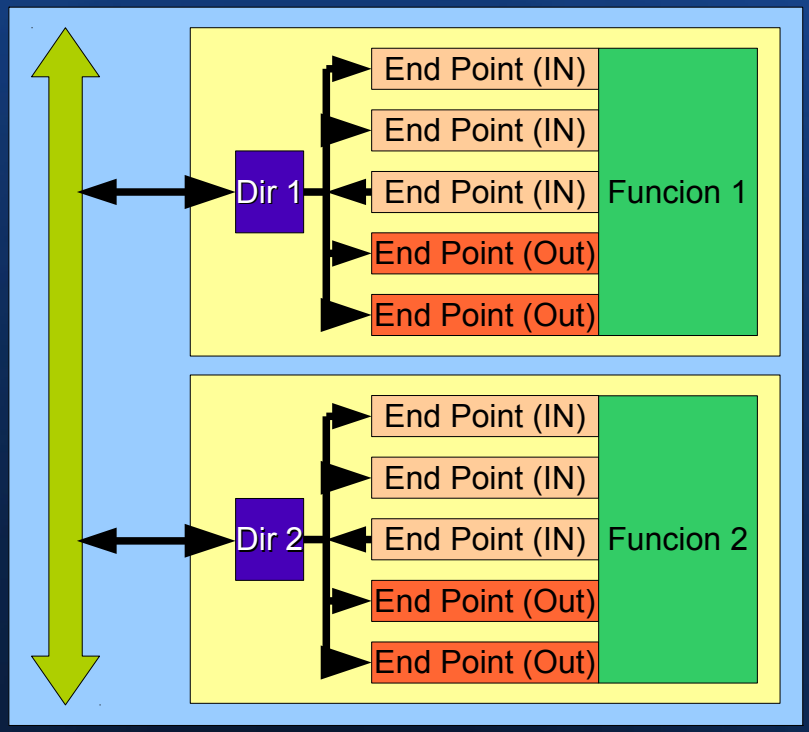
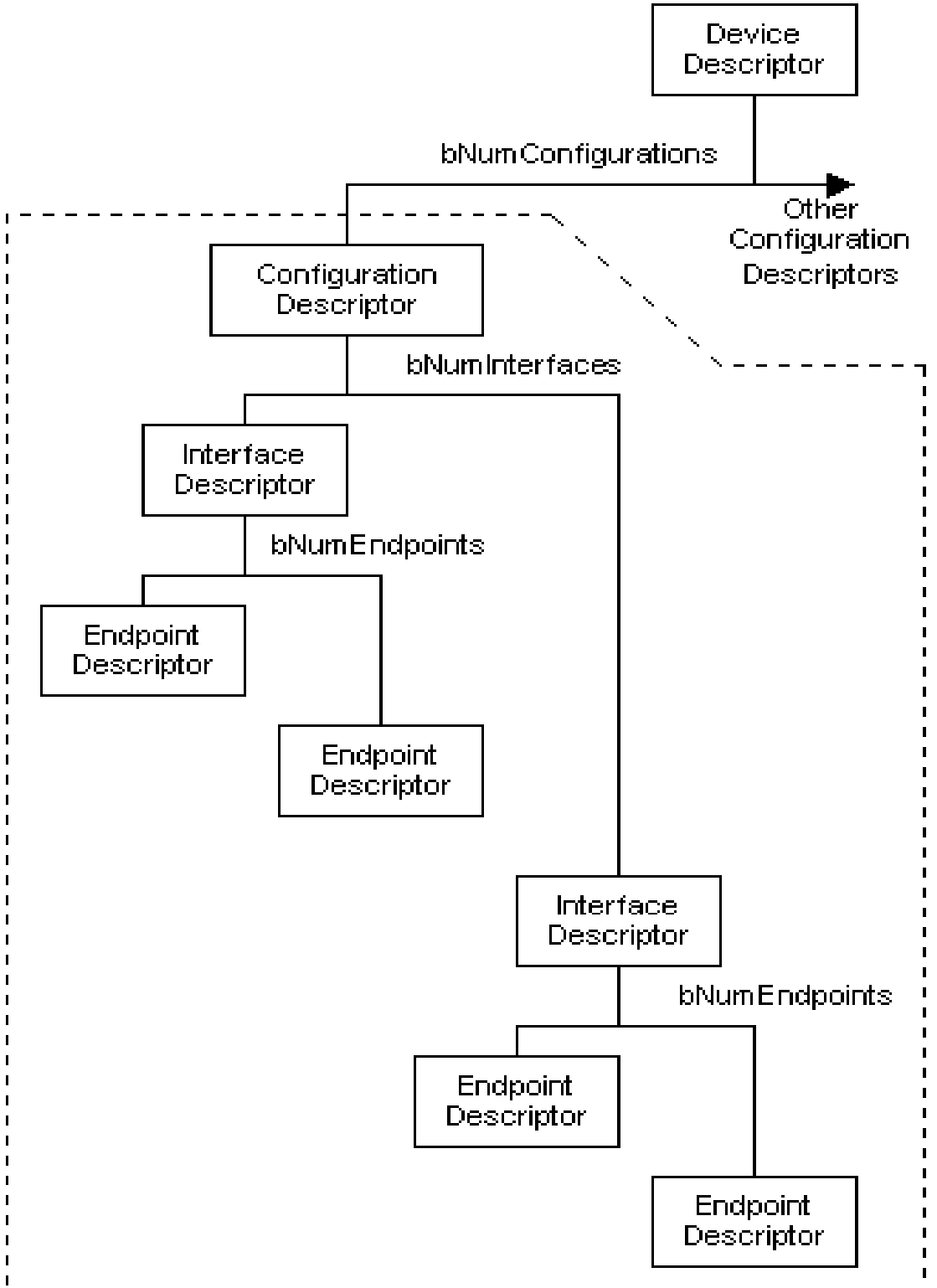
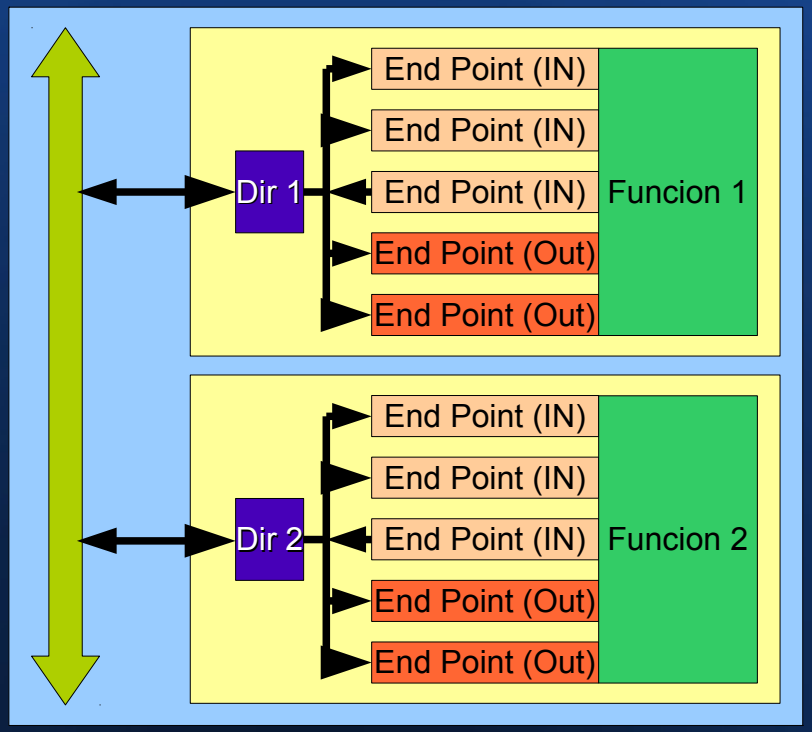

Dir 1
End Point (IN)
End Point (IN)
End Point (IN)
End Point (Out)
End Point (Out)
Funcion 1
Dir 2
End Point (IN)
End Point (IN)
End Point (IN)
End Point (Out)
End Point (Out)
Funcion 2

El b


End Point (IN)
End Point (IN)
End Point (IN)
End Point (Out)
End Point (Out)
Dir 1
Funcion 1
End Point (IN)
End Point (IN)
End Point (IN)
End Point (Out)
End Point (Out)
Dir 2
Funcion 2


Device Descriptor
bNumConfigurations
Other Configuration Descriptors
Configuration Descriptor
bNumInterfaces
Interface Descriptor
bNumEndpoints
Endpoint Descriptor
Endpoint Descriptor
Interface Descriptor
bNumEndpoints
Endpoint Descriptor
Endpoint Descriptor

El b


End Point (IN)
End Point (IN)
End Point (IN)
End Point (Out)
End Point (Out)
Dir 1
Funcion 1
End Point (IN)
End Point (IN)
End Point (IN)
End Point (Out)
End Point (Out)
Dir 2
Funcion 2


Device Descriptor
bNumConfigurations
Other Configuration Descriptors
Configuration Descriptor
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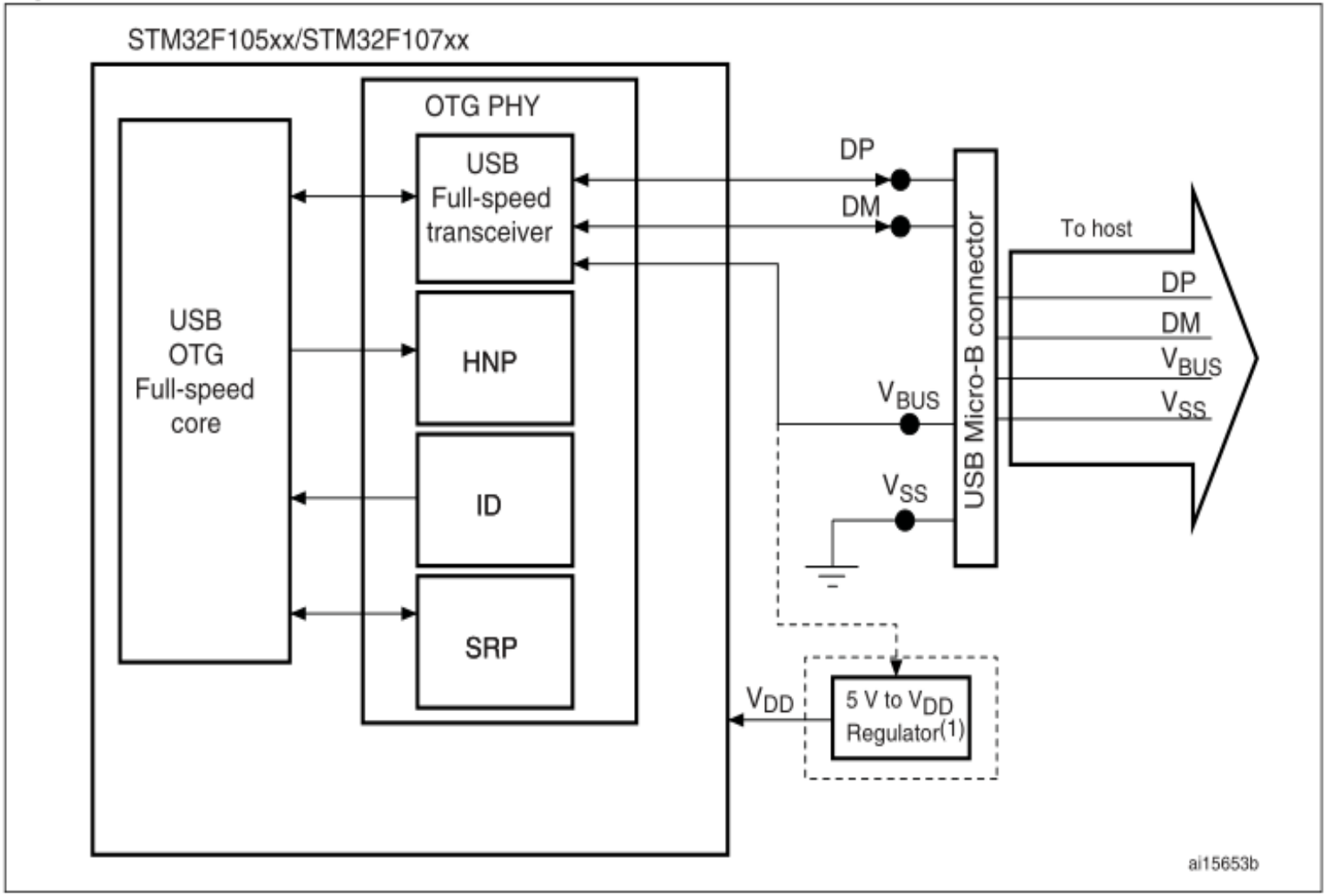
Interface Descriptor
bNumEndpoints
Mas tarde volveremos sobre esto
Interface Descriptor
bNumEndpoints
Endpoint Descriptor
Endpoint Descriptor

El bus USB

OTG – On The Go

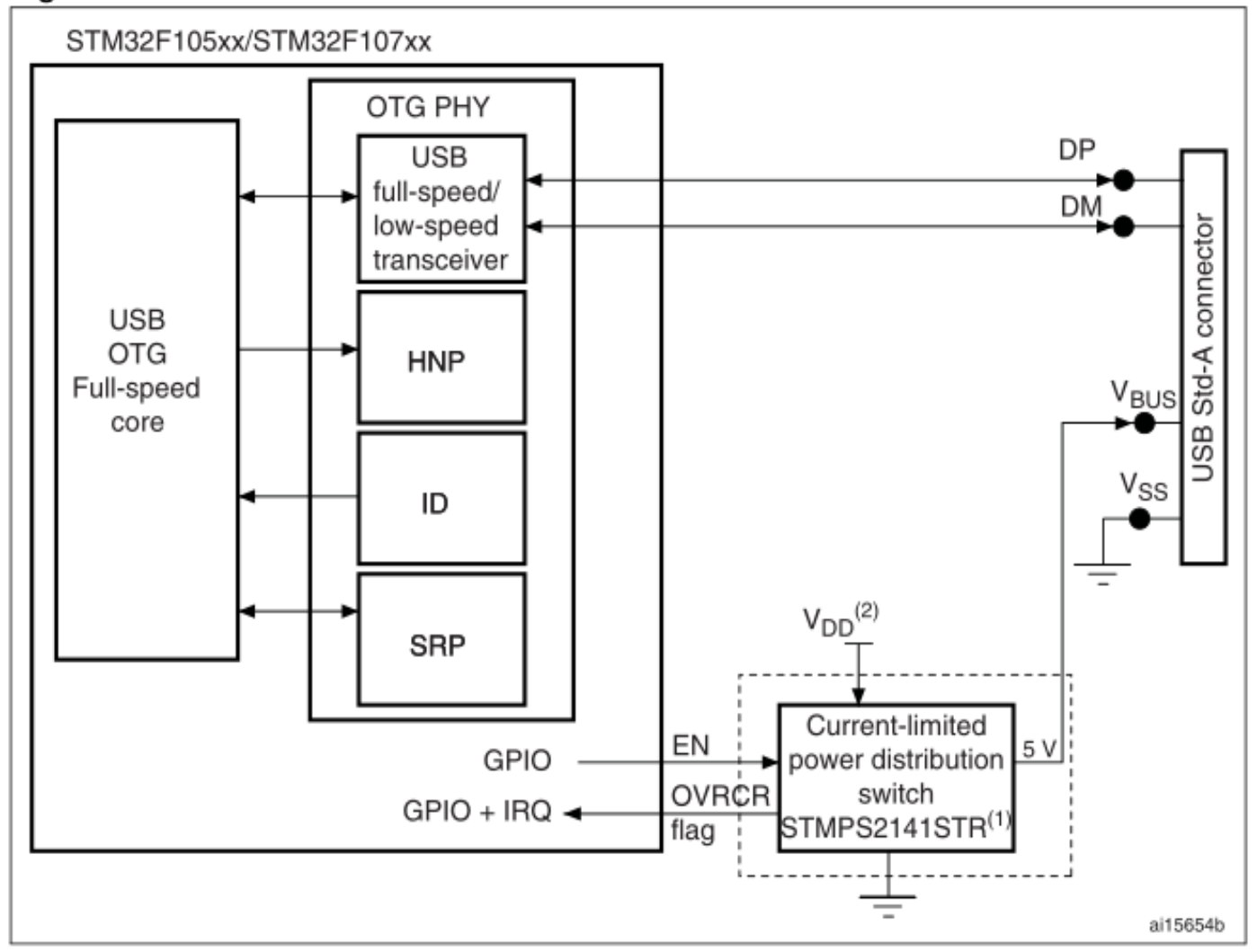
Figure 46. USB OTG FS device mode



El bus USB

OTG – On The Go

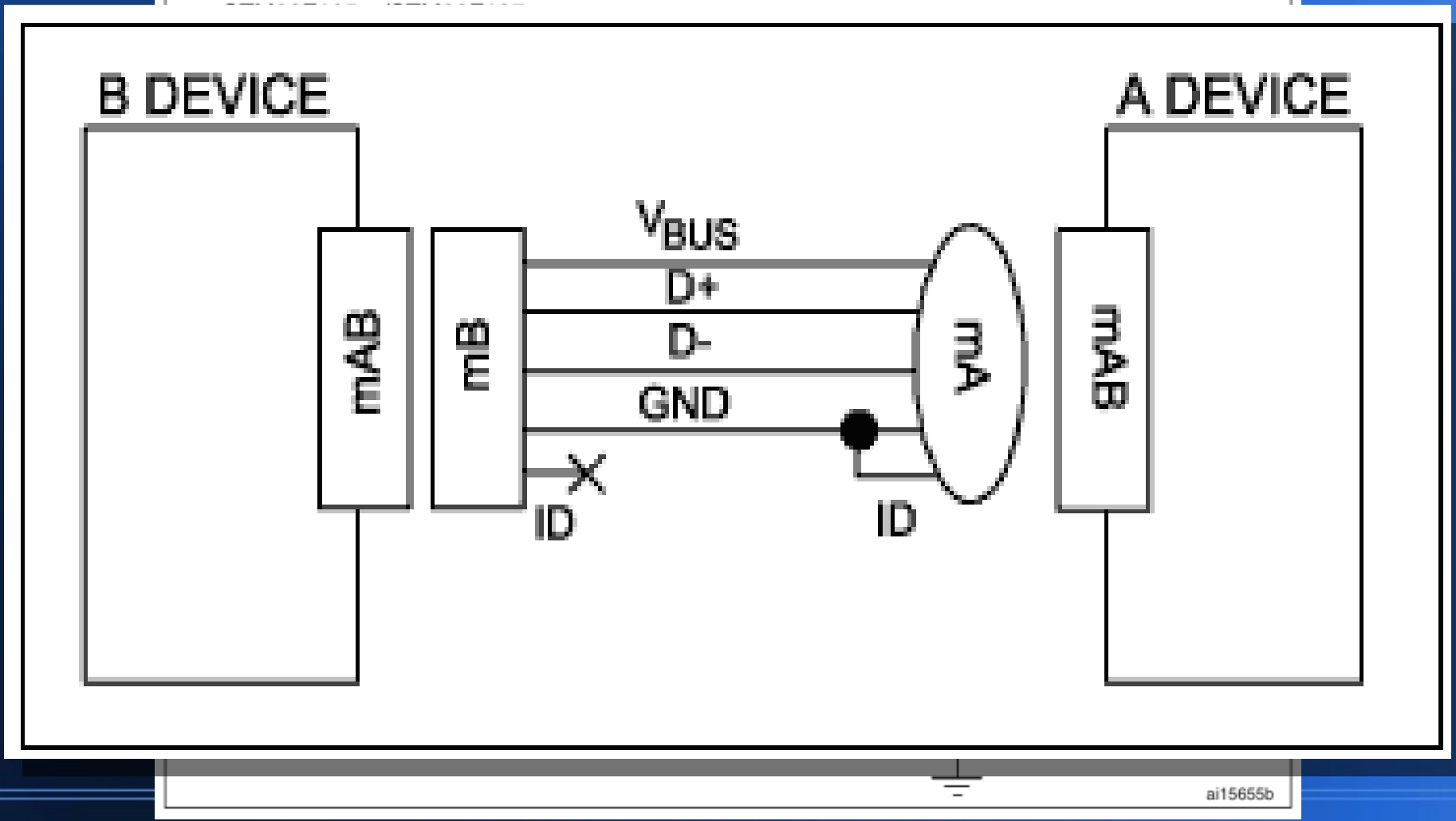
Figure 47. Host connection



El bus USB

OTG – On The Go

Figure 48. OTG connection (any protocol)

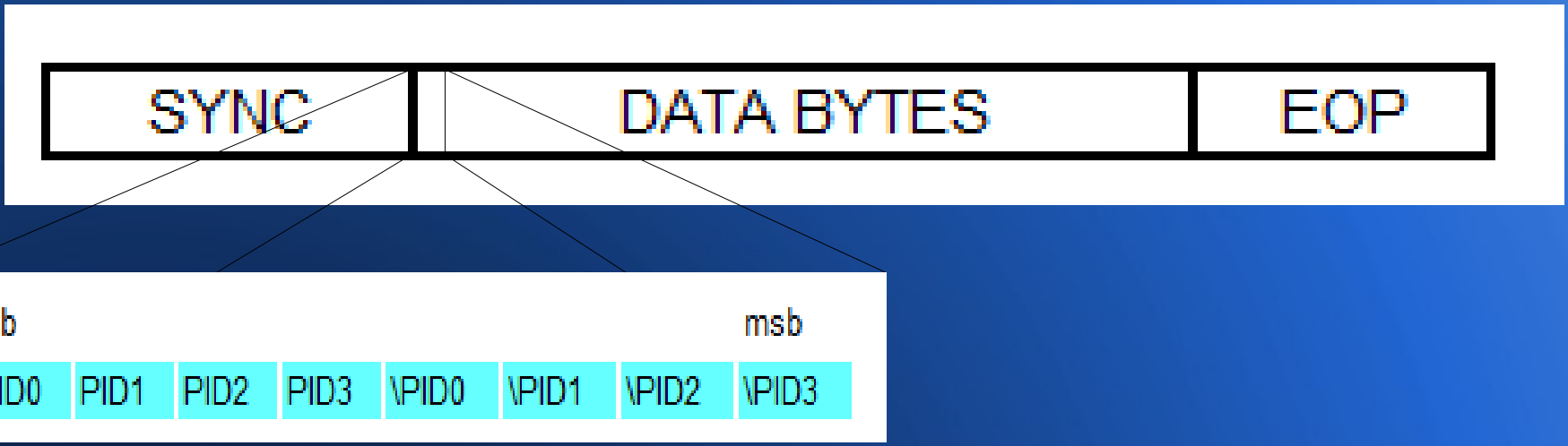


El bus USB

Formato de transmisión

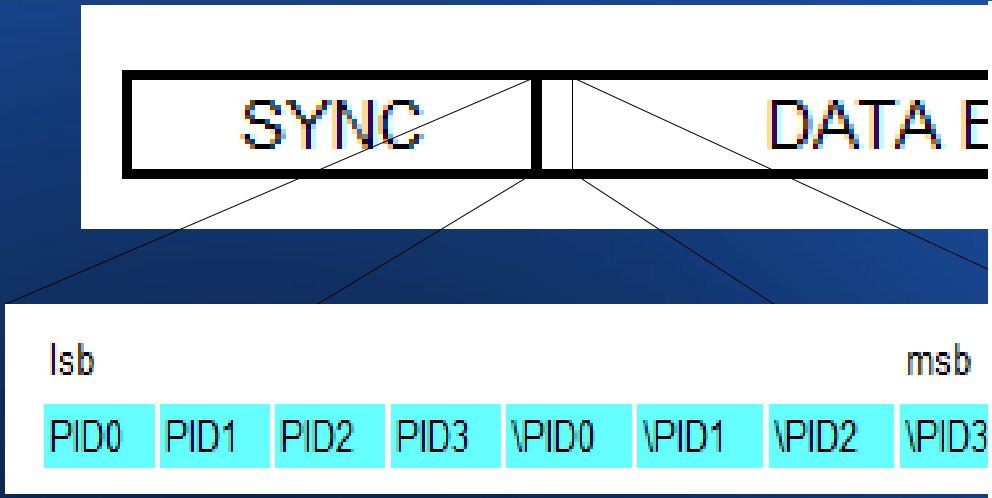
El bus USB

Formato de transmisión



El bus USB

Formato de transmisión



PID Type	PID Name	PID<3:0>*
Token	OUT	0001b
	IN	1001b
	SOF	0101b
	SETUP	1101b
Data	DATA0	0011b
	DATA1	1011b
	DATA2	0111b
	MDATA	1111b
Handshake	ACK	0010b
	NAK	1010b
	STALL	1110b
	NYET	0110b
Special	PRE	1100b
	ERR	1100b
	SPLIT	1000b
	PING	0100b
	Reserved	0000b

El bus USB

Formato de transmisión

Token Packet

Sync	PID	ADDR	ENDP	CRC5	EOP
	8 bits	7 bits	4 bits	5 bits	

Data Packet

Sync	PID	DATA	CRC16	EOP
	8 bits	(0-1024) x 8 bits	16 bits	

Handshake Packet

Sync	PID	EOP
	8 bits	

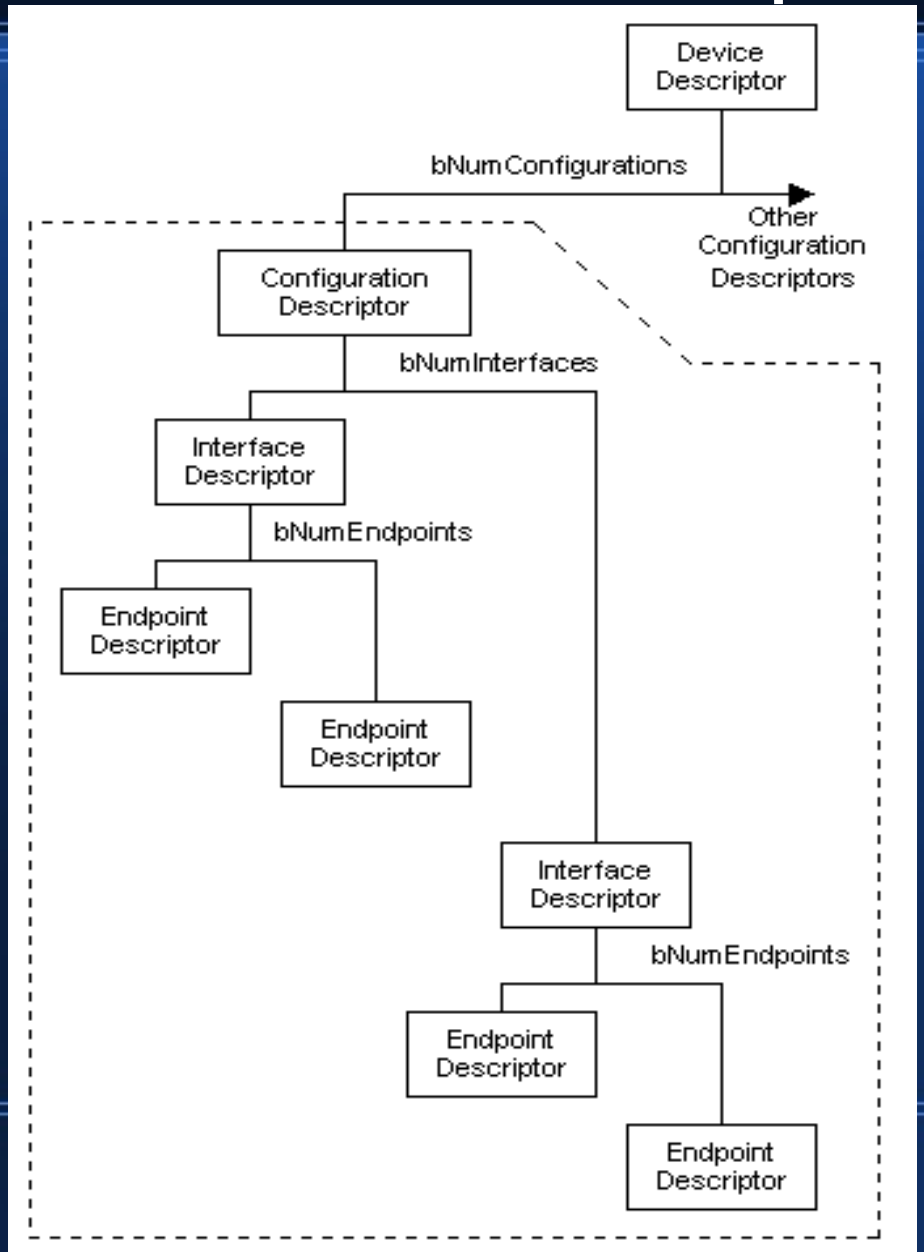
El bus USB

Tipos de transferencia

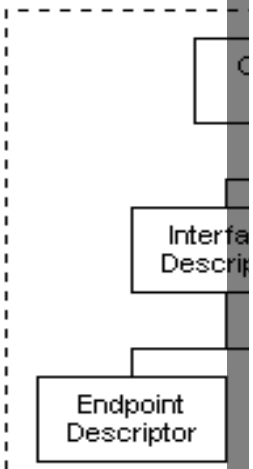
- Transferencia de control (Todos, mantiene integridad)
  - Obtiene información del dispositivo
  - Configura parámetros
- Transferencia por interrupción (mantiene integridad)
  - En cada pasaje del TOKEN manda datos si tiene
  - Mouse/Teclado/(La mayoría de los HID)
- Bulk Transfer (no mantiene integridad, pide retransmisión)
  - Dispositivos de bloques
- Transferencia Isocrónica (No mantiene integridad ni retransmite)
  - Dispositivos Real Time (Audio/Video)

El bus USB

Descripción de un dispositivo



Offset	Field	Size	Value	Description
0	bLength	1	Number	Size of this descriptor in bytes
1	bDescriptorType	1	Constant	DEVICE descriptor type (= 1)
2	bcdUSB	2	BCD	USB Spec release number
4	bDeviceClass	1	Class	Class code assigned by USB-IF 00h means each interface defines its own class FFh means vendor-defined class Any other value must be a class code
5	bDeviceSubClass	1	SubClass	SubClass Code assigned by USB-IF
6	bDeviceProtocol	1	Protocol	Protocol Code assigned by USB-IF
7	bMaxPacketSize0	1	Number	Max packet size for endpoint 0. Must be 8, 16, 32 or 64
8	idVendor	2	ID	Vendor ID - must be obtained from USB-IF
10	idProduct	2	ID	Product ID - assigned by the manufacturer
12	bcdDevice	2	BCD	Device release number in binary coded decimal
14	iManufacturer	1	Index	Index of string descriptor describing manufacturer - set to 0 if no string
15	iProduct	1	Index	Index of string descriptor describing product - set to 0 if no string
16	iSerialNumber	1	Index	Index of string descriptor describing device serial number - set to 0 if no string
17	bNumConfigurations	1	Number	Number of possible configurations

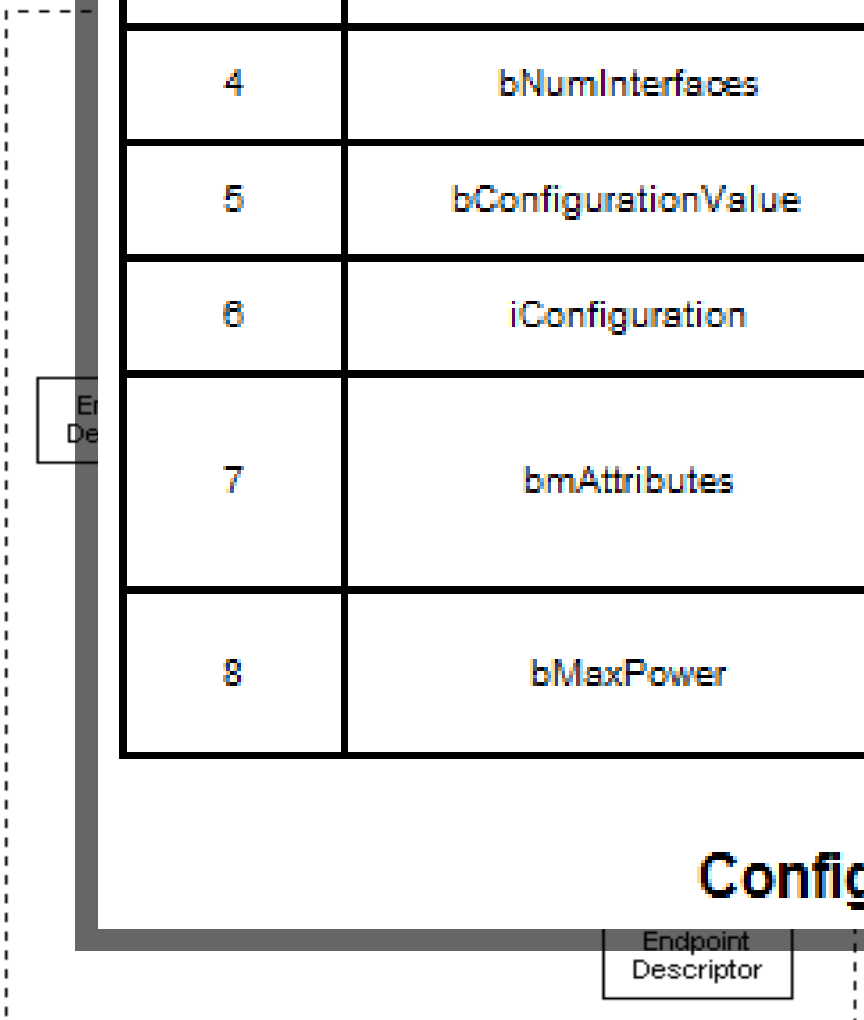


Device Descriptor

El bus USB

Offset	Field	Size	Value	Description
0	bLength	1	Number	Size of this descriptor in bytes
1	bDescriptorType	1	Constant	CONFIGURATION descriptor type (= 2)
2	wTotalLength	2	Number	Total number of bytes in this descriptor and all the following descriptors.
4	bNumInterfaces	1	Number	Number of interfaces supported by this configuration
5	bConfigurationValue	1	Number	Value used by Set Configuration to select this configuration
6	iConfiguration	1	Index	Index of string descriptor describing configuration - set to 0 if no string
7	bmAttributes	1	Bitmap	D7: Must be set to 1 D6: Self-powered D5: Remote Wakeup D4...D0: Set to 0
8	bMaxPower	1	mA	Maximum current drawn by device in this configuration. In units of 2mA. So 50 means 100 mA.

Configuration Descriptor

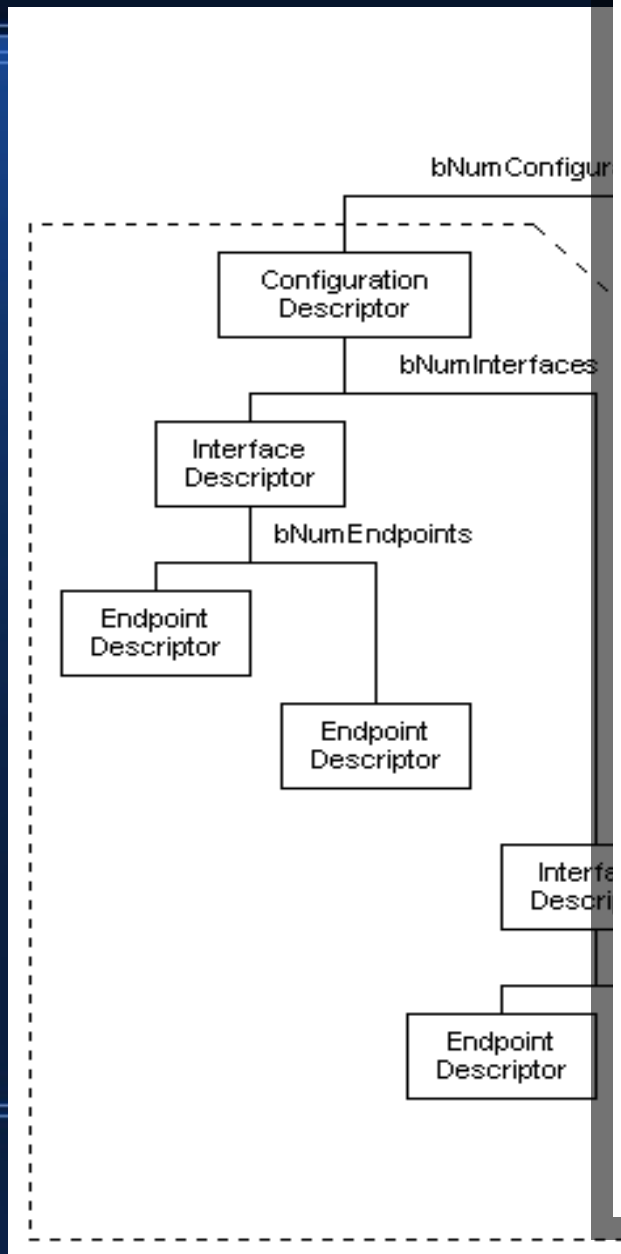


El bus USB

Offset	Field	Size	Value	Description
0	bLength	1	Number	Size of this descriptor in bytes
1	bDescriptorType	1	Constant	INTERFACE descriptor type (= 4)
2	bInterfaceNumber	1	Number	Number identifying this interface. Zero-based value.
3	bAlternateSetting	1	Number	Value used to select this alternate setting for this interface.
4	bNumEndpoints	1	Number	Number of endpoints used by this interface. Doesn't include control endpoint 0.
5	bInterfaceClass	1	Class	Class code assigned by USB-IF 00h is a reserved value FFh means vendor-defined class Any other value must be a class code
6	bInterfaceSubClass	1	SubClass	SubClass Code assigned by USB-IF
7	bInterfaceProtocol	1	Protocol	Protocol Code assigned by USB-IF
8	iInterface	1	Index	Index of string descriptor describing interface - set to 0 if no string

Interface Descriptor

Endpoint Descriptor



Offset	Field	Size	Value	Description
0	bLength	1	Number	Size of this descriptor in bytes
1	bDescriptorType	1	Constant	ENDPOINT descriptor type (= 5)
2	bEndpointAddress	1	Endpoint	The address of this endpoint within the device. D7: Direction 0 = OUT, 1 = IN D6-D4: Set to 0 D3-D0: Endpoint number
3	bmAttributes	1	Bitmap	D1:0 Transfer Type 00 = Control 01 = Isochronous 10 = Bulk 11 = Interrupt The following only apply to isochronous endpoints. Else set to 0. D3:2 Synchronisation Type 00 = No Synchronisation 01 = Asynchronous 10 = Adaptive 11 = Synchronous D5:4 Usage Type 00 = Data endpoint 01 = Feedback endpoint 10 = Implicit feedback Data endpoint 11 = Reserved D7:6 Reserved Set to 0
4	wMaxPacketSize	2	Number	Maximum packet size this endpoint can send or receive when this configuration is selected
6	bInterval	1	Number	Interval for polling endpoint for data transfers. Expressed in frames (ms) for low/full speed or microframes (125us) for high speed.

Endpoint Descriptor

Breack
Aprovechen que viene bravo después