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Application Note 117
DS2490 Universal Serial Bus Descriptors

It is assumed that the reader of this application note is familiar with Universal Serial Bus (USB) technology and terms. The USB specification can be obtained from the USB Implementers Forum web site at: www.usb.org.

A typical Universal Serial Bus (USB) environment consists of a USB enabled host computer and one or more USB device peripherals. In USB terminology, descriptors are used to inform the host PC system what capabilities are supported by a USB device as well as specific device characteristics. When requested by the host, these descriptors are provided by the device and are communicated in a hierarchical manner, providing top to low level information. Additionally, a typical USB device will described itself to the host with USB core specification descriptors and, depending on device complexity, descriptors from one or more USB device class specifications. The DS2490 is a USB Vendor–Specific Device and is described with descriptors from the USB core specifications.

When a USB device is attached to the bus, an initialization or enumeration process begins during which descriptor requests are made by the host computer. First a Device Descriptor request is sent to determine general device information. A Configuration Descriptor request then follows which returns configuration, interface, and lower level descriptors in the proper order.

DS2490 USB DESCRIPTOR HIERARCHY Figure 1

- DEVICE
  - CONFIGURATION
    - INTERFACE (alt–0)
      - INTERRUPT ENDPOINT (10 ms polling interval)
      - BULK OUT ENDPOINT (16–byte max packet size)
      - BULK IN ENDPOINT (16–byte max packet size)
    - INTERFACE (alt–1)
      - INTERRUPT ENDPOINT (10 ms polling interval)
      - BULK OUT ENDPOINT (64–byte max packet size)
      - BULK IN ENDPOINT (64–byte max packet size)
    - INTERFACE (alt–2)
      - INTERRUPT ENDPOINT (1 ms polling interval)
      - BULK OUT ENDPOINT (16–byte max packet size)
      - BULK IN ENDPOINT (16–byte max packet size)
    - INTERFACE (alt–3)
      - INTERRUPT ENDPOINT (1 ms polling interval)
      - BULK OUT ENDPOINT (64–byte max packet size)
      - BULK IN ENDPOINT (64–byte max packet size)

DS2490 DESCRIPTOR SUMMARY

DESCRIPTOR		INTERFACE NUMBER	ALTERNATE SETTING	SIZE (BYTES)
Device description				18
Device configuration				9
Interface		0	0	9
Endpoint – Interrupt	10 ms polling period	0	0	7
Endpoint – Bulk OUT (to 2490)	16–byte max packet size	0	0	7
Endpoint – Bulk IN (from 2490)	16–byte max packet size	0	0	7
Interface		0	1	9
Endpoint – Interrupt	10 ms polling period	0	1	7
Endpoint – Bulk OUT (to 2490)	64–byte max packet size	0	1	7
Endpoint – Bulk IN (from 2490)	64–byte max packet size	0	1	7
Interface		0	2	9
Endpoint – Interrupt	1 ms polling period	0	2	7
Endpoint – Bulk OUT (to 2490)	16–byte max packet size	0	2	7
Endpoint – Bulk IN (from 2490)	16–byte max packet size	0	2	7
Interface		0	3	9
Endpoint – Interrupt	1 ms polling period	0	3	7
Endpoint – Bulk OUT (to 2490)	64–byte max packet size	0	3	7
Endpoint – Bulk IN (from 2490)	64–byte max packet size	0	3	7
		Total Descriptor Size		147 bytes

DEVICE DESCRIPTOR

Summary:

The device descriptor provides the host with general information about the DS2490. It informs the host that it is a vendor–specific class device and there is only one configuration.

Device Descriptor

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength1	1	0x12	Size of this descriptor in bytes: 18
1	bDescriptorType	1	0x01	DEVICE Descriptor Type
2	bcdUSB	2	0x0100	USB Specification Release Number in Binary–Coded Decimal
4	bDeviceClass	1	0xFF	Vendor–Specific Class code.
5	bDeviceSubClass	1	0xFF	Subclass code: none
6	bDeviceProtocol	1	0xFF	Protocol code: none
7	bMaxPacketSize0	1	0x08	Maximum packet size for endpoint zero: 16 or 32 bytes?
8	idVendor	2	0x04FA	Dallas Semiconductor Vendor ID (assigned by USB)
10	idProduct	2	0x2490	Product ID (assigned by Dallas Semiconductor)
12	bcdDevice	2	Note 1	Device release number in binary–coded decimal
14	iManufacturer	1	0x00	Index of string descriptor describing manufacturer: none
15	iProduct	1	0x00	Index of string descriptor describing product: none16
16	iSerialNumber	1	0x00	Index of string descriptor describing the devices serial number: none
17	bNumConfigurations	1	0x01	Number of possible configurations

NOTE:

1. For silicon revision A1 this value will be 0x0001. For any silicon revisions this value will be incremented.

CONFIGURATION DESCRIPTOR

Summary:

The configuration descriptor informs the host of the amount of descriptor data to be returned to describe the configuration, the number of interfaces that are included in the configuration, and device power characteristics.

Configuration Descriptor

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x09	Size of this descriptor in bytes: 9
1	bDescriptorType	1	0x02	CONFIGURATION
2	wTotalLength	2	0x0081	Total length of data returned for this configuration. Includes the combined length of all descriptors (configuration, interface, endpoint, and class or vendor specific) returned for this configuration. (129 bytes)
4	bNumInterfaces	1	0x01	Number of interfaces supported by this configuration
5	bConfigurationValue	1	0x01	Value to use as an argument to Set Configuration to select this configuration
6	iConfiguration	1	0x00	Index of string descriptor describing this configuration: none
7	bmAttributes	1	0xE0	Configuration characteristics D7 Reserved (set to one) D6 Self Powered D5 Remote Wakeup D4..0 Reserved (reset to 0)
8	MaxPower	1	0x32	Maximum power consumption of USB device from the bus in this specific configuration when the device is fully operational. Expressed in 2 mA units (i.e., 50 = 100 mA).

INTERFACE DESCRIPTORS

Summary:

The Interface descriptor provides additional USB class and endpoint information. The single DS2490 Interface is reported as a vendor–specific class with 3 endpoints and 4 alternate interface settings. The 4 alternate interface settings are used to select a different interrupt pipe polling interval or maximum packet size on the bulk pipes as follows:

ALT SETTING	EP1 POLL INTERVAL	EP2/EP3 MAX PACKET SIZE	ALTERNATE SETTING DESCRIPTION
0	10 mS	16 bytes	Long interrupt polling interval, small packet size for bulk pipes
1	10 mS	64 bytes	Long interrupt polling interval, large packet size for bulk pipes
2	1 mS	16 bytes	Short interrupt polling interval, small packet size for bulk pipes
3	1 mS	64 bytes	Short interrupt polling interval, large packet size for bulk pipes

Interface Descriptor (infc–0, alt–0)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x09	Size of this descriptor in bytes: 9
1	bDescriptorType	1	0x04	INTERFACE descriptor type
2	bInterfaceNumber	1	0x00	Number of interface within configuration.
3	bAlternateSetting	1	0x00	Value used to select an alternate setting for the interface identified in the prior field.
4	bNumEndpoints	1	0x00	Number of endpoints used by this interface (excluding endpoint 0).
5	bInterfaceClass	1	0xFF	Vendor–Specific Interface Class code.
6	bInterfaceSubClass	1	0xFF	Subclass code: none
7	bInterfaceProtocol	1	0xFF	Protocol code: none
8	iInterface	1	0x00	Index of a string descriptor that describes this interface: none

Interface Descriptor (infc–0, alt–0)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type
2	bEndpointAddress	1	0x81	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint

3	bmAttributes	1	0x03	This field describes the endpoints attributes when it is configured using the *bConfigurationValue*. Bit 1..0, Transfer Type: 11b = Interrupt All other bits are reserved
4	wMaxPacketSize	2	0x0020	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 32 bytes.
6	bInterval	1	0x0A	Interval for polling endpoint for data transfers, expressed in milliseconds: 10 mS

Bulk (Out) Endpoint Descriptor (infc–0, alt–0, EP–2)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type
2	bEndpointAddress	1	0x02	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint
3	bmAttributes	1	0x02	This field describes the endpoints attributes when it is configured using the *bConfigurationValue*. Bit 1..0, Transfer Type: 11b = Bulk All other bits are reserved
4	wMaxPacketSize	2	0x0010	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 16 bytes.
6	bInterval	1	0x00	Interval for polling endpoint for data transfers, expressed in milliseconds: ignored for Bulk

Bulk (In) Endpoint Descriptor (infc–0, alt–0, EP–3)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type
2	bEndpointAddress	1	0x83	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint

3	bmAttributes	1	0x02	This field describes the endpoints attributes when it is configured using the *bConfigurationValue*. Bit 1..0, Transfer Type: 11b = Bulk All other bits are reserved
4	wMaxPacketSize	2	0x0010	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 16 bytes.
6	bInterval	1	0x00	Interval for polling endpoint for data transfers, expressed in milliseconds: ignored for Bulk

Interface Descriptor (infc–0, alt–1)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x09	Size of this descriptor in bytes: 9
1	bDescriptorType	1	0x04	INTERFACE descriptor type
2	bInterfaceNumber	1	0x00	Number of interface within configuration.
3	bAlternateSetting	1	0x01	Value used to select an alternate setting for the interface identified in the prior field.
4	bNumEndpoints	1	0x03	Number of endpoints used by this interface (excluding endpoint 0).
5	bInterfaceClass	1	0xFF	Vendor–Specific Interface Class code.
6	bInterfaceSubClass	1	0xFF	Subclass code: none
7	bInterfaceProtocol	1	0xFF	Protocol code: none
8	iInterface	1	0x00	Index of a string descriptor that describes this interface: none

Interrupt Endpoint Descriptor (infc–0, alt–1, EP–1)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type
2	bEndpointAddress	1	0x81	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint
3	bmAttributes	1	0x03	This field describes the endpoints attributes when it is configured using the *bConfigurationValue*. Bit 1..0, Transfer Type: 11b = Bulk All other bits are reserved

4	wMaxPacketSize	2	0x0020	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 32 bytes.
6	bInterval	1	0x0A	Interval for polling endpoint for data transfers, expressed in milliseconds: 10 mS

Bulk (Out) Endpoint Descriptor (infc–0, alt–1, EP–2)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type
2	bEndpointAddress	1	0x02	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint
3	bmAttributes	1	0x02	This field describes the endpoints attributes when it is configured using the *bConfigurationValue*. Bit 1..0, Transfer Type: 10b = Bulk All other bits are reserved
4	wMaxPacketSize	2	0x0040	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 64 bytes.
6	bInterval	1	0x00	Interval for polling endpoint for data transfers, expressed in milliseconds: ignored for Bulk

Bulk (In) Endpoint Descriptor (infc–0, alt–1, EP–3)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type
2	bEndpointAddress	1	0x83	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint
3	bmAttributes	1	0x02	This field describes the endpoints attributes when it is configured using the *bConfigurationValue.* Bit 1..0, Transfer Type: 10b = Bulk All other bits are reserved

4	wMaxPacketSize	2	0x0040	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 64 bytes.
6	bInterval	1	0x00	Interval for polling endpoint for data transfers, expressed in milliseconds: ignored for Bulk

Interface Descriptor (infc–0, alt–2)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x09	Size of this descriptor in bytes: 9
1	bDescriptorType	1	0x04	INTERFACE descriptor type
2	bInterfaceNumber	1	0x00	Number of interface within configuration.
3	bAlternateSetting	1	0x02	Value used to select an alternate setting for the interface identified in the prior field.
4	bNumEndpoints	1	0x03	Number of endpoints used by this interface (excluding endpoint 0).
5	bInterfaceClass	1	0xFF	Vendor–Specific Interface Class code.
6	bInterfaceSubClass	1	0xFF	Subclass code: none
7	bInterfaceProtocol	1	0xFF	Protocol code: none
8	iInterface	1	0x00	Index of a string descriptor that describes this interface: none

Interrupt Endpoint Descriptor (infc–0, alt–2, EP–1)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type
2	bEndpointAddress	1	0x81	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint
3	bmAttributes	1	0x03	This field describes the endpoints attributes when it is configured using the *bConfigurationValue*. Bit 1..0, Transfer Type: 11b = Bulk All other bits are reserved
4	wMaxPacketSize	2	0x0020	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 32 bytes.
6	bInterval	1	0x01	Interval for polling endpoint for data transfers, expressed in milliseconds: 1 mS

Bulk (Out) Endpoint Descriptor (infc–0, alt–2, EP–2)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type
2	bEndpointAddress	1	0x02	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint
3	bmAttributes	1	0x02	This field describes the endpoints attributes when it is configured using the *bConfigurationValue*. Bit 1..0, Transfer Type: 10b = Bulk All other bits are reserved
4	wMaxPacketSize	2	0x0010	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 16 bytes.
6	bInterval	1	0x00	Interval for polling endpoint for data transfers, expressed in milliseconds: ignored for Bulk

Bulk (In) Endpoint Descriptor (infc–0, alt–2, EP–3)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type
2	bEndpointAddress	1	0x83	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint
3	bmAttributes	1	0x02	This field describes the endpoints attributes when it is configured using the *bConfigurationValue*. Bit 1..0, Transfer Type: 10b = Bulk All other bits are reserved
4	wMaxPacketSize	2	0x0010	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 16 bytes.
6	bInterval	1	0x00	Interval for polling endpoint for data transfers, expressed in milliseconds: ignored for Bulk

Interface Descriptor (infc–0, alt–3)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x09	Size of this descriptor in bytes: 9
1	bDescriptorType	1	0x04	INTERFACE descriptor type
2	bInterfaceNumber	1	0x00	Number of interface within configuration.
3	bAlternateSetting	1	0x03	Value used to select an alternate setting for the interface identified in the prior field.
4	bNumEndpoints	1	0x03	Number of endpoints used by this interface (excluding endpoint 0).
5	bInterfaceClass	1	0xFF	Vendor–Specific Interface Class code.
6	bInterfaceSubClass	1	0xFF	Subclass code: none
7	bInterfaceProtocol	1	0xFF	Protocol code: none
8	iInterface	1	0x00	Index of a string descriptor that describes this interface: none

Interrupt Endpoint Descriptor (infc–0, alt–3, EP–1)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type
2	bEndpointAddress	1	0x81	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint
3	bmAttributes	1	0x03	This field describes the endpoints attributes when it is configured using the *bConfigurationValue*. Bit 1..0, Transfer Type: 11b = Interrupt All other bits are reserved
4	wMaxPacketSize	2	0x0020	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 32 bytes.
6	bInterval	1	0x01	Interval for polling endpoint for data transfers, expressed in milliseconds: 1 mS

Bulk (Out) Endpoint Descriptor (infc–0, alt–3, EP–2)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type

2	bEndpointAddress	1	0x02	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint
3	bmAttributes	1	0x02	This field describes the endpoints attributes when it is configured using the *bConfigurationValue*. Bit 1..0, Transfer Type: 10b = Bulk All other bits are reserved
4	wMaxPacketSize	2	0x0040	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 64 bytes.
6	bInterval	1	0x00	Interval for polling endpoint for data transfers, expressed in milliseconds: ignored for Bulk

Bulk (In) Endpoint Descriptor (infc–0, alt–3, EP–3)

OFFSET	FIELD	SIZE	VALUE	DESCRIPTION
0	bLength	1	0x07	Size of this descriptor in bytes: 7
1	bDescriptorType	1	0x05	ENDPOINT descriptor type
2	bEndpointAddress	1	0x83	The address of the endpoint on the USB device described by this descriptor. The address is encoded as follows: Bit 3..0, The endpoint number, Bit 6..4, Reserved, reset to zero. Bit 7, Direction: 0 = OUT endpoint 1 = IN endpoint
3	bmAttributes	1	0x02	This field describes the endpoints attributes when it is configured using the *bConfigurationValue*. Bit 1..0, Transfer Type: 10b = Bulk All other bits are reserved
4	wMaxPacketSize	2	0x0040	Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected: 64 bytes.
6	bInterval	1	0x00	Interval for polling endpoint for data transfers, expressed in milliseconds: ignored for Bulk