

## Kingston Technology KUSBDTE/xx USB Flash Storage Devices

### 1. Introduction

This product description of the DataTraveler Elite unit is provided by Kingston Technology, and is applicable for Kingston's USB Flash Drive products based on SLC NAND flash.

#### 1.1. Product Outline

The DataTraveler Elite operates as a removable disk without driver installation via a standard USB port. It is compatible with the following Windows Operating Systems:

Windows 2000 and Windows XP

Mac OS: 9.1 and above (some versions may not be supported due to possible Mac OS issues)

### 2. Part Numbers

*Table 1: Available DataTraveler Elite Products / Part Numbers*

Part Number	Description
KUSBDTE/256	T5 USB2.0 2x128MB - 8bit
KUSBDTE/512	T5 USB2.0 2x256MB - 8bit
KUSBDTE/1GB	T5 USB2.0 2x512MB - 8bit
KUSBDTE/2GB	T5 USB2.0 2x1024MB - 8bit
KUSBDTE/4GB	T5 USB2.0 4x1024MB - 8bit

## 2.1 Product Architecture

The diagram in Figure 1 illustrates the DataTraveler Elite's main functional blocks.

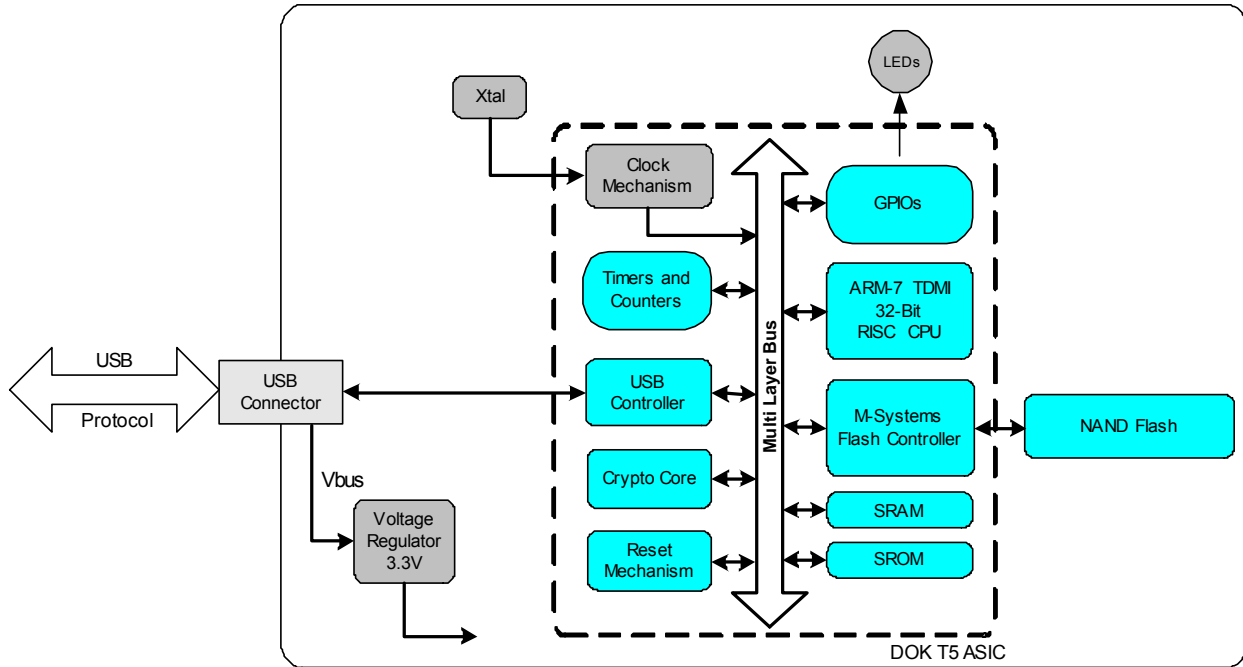
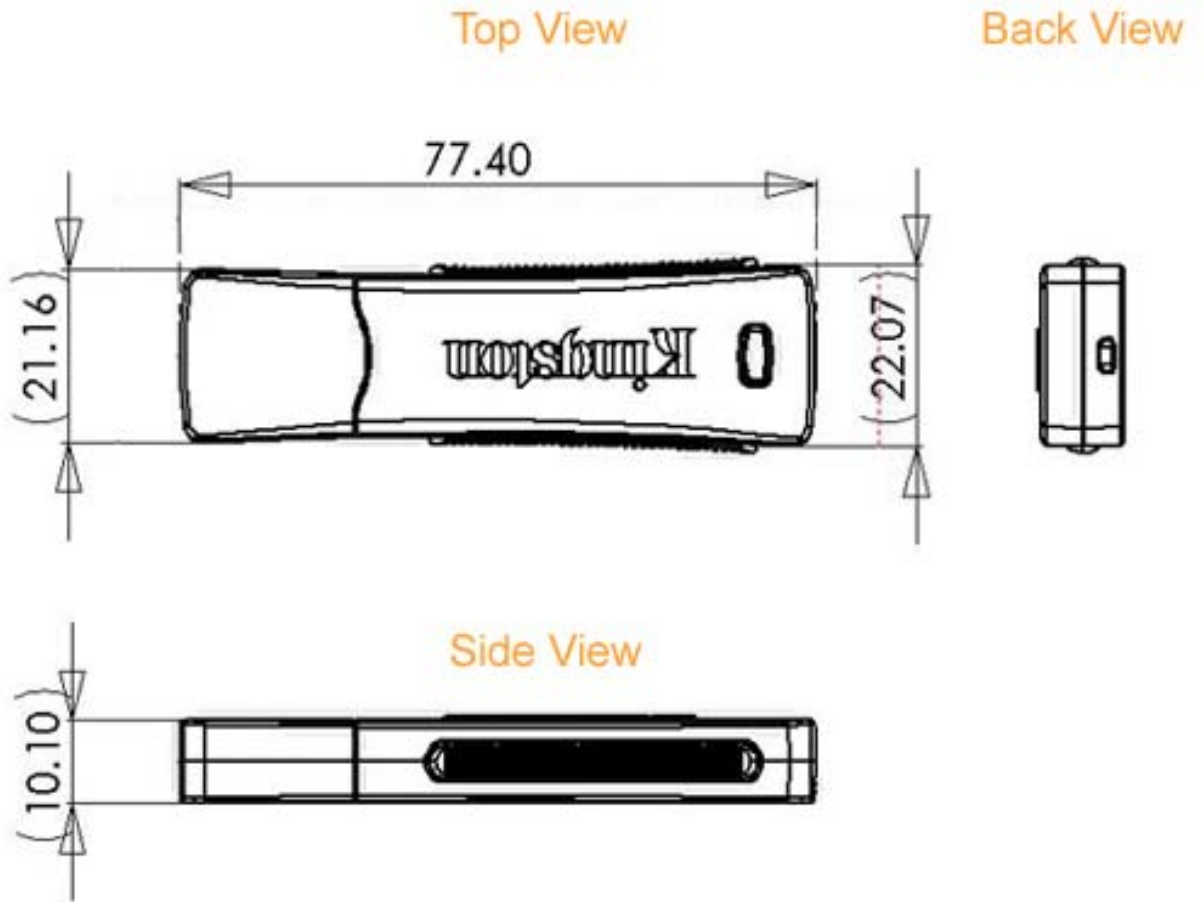


Figure 1: Kingston DataTraveler Elite Block Diagram

### 3. PRODUCT SPECIFICATIONS

#### 3.1 Device Dimensions (in mm.)



## 3.2 Performance

Table 2 describes the read/write performance of the DataTraveler Elite Extended. Performance was measured using industry-standard benchmark software (SI Software Sandra Plus).

*Table 2: Kingston DataTraveler Elite Read/Write Performance (MB/Sec)*

Capacity	Full-Speed	High-Speed	
		Enhanced Configuration (High Power)	
		Single Flash	Multiple Flash
256MB	1/1	N/A	23/13 <sup>2</sup>
512MB	1/1	N/A	23/13 <sup>2</sup>
1GB	1/1	N/A	23/13 <sup>2</sup>
2GB	1/1	N/A	23/12 <sup>2</sup>
4GB	1/1	N/A	23/11 <sup>2</sup>

1. Default flash configuration for the indicated capacity and power configuration.
2. Performance was measured on a high-end platform with the following configuration: P4-2.7 GHz, 512MB RAM.

## 3.3 LED Functionality

- **LED flashing slowly:** Kingston DataTraveler Elite is connected and inactive.
  - **LED flashing rapidly:** Kingston DataTraveler Elite is transmitting/receiving data or is engaged in the identification process.
  - **Default LED colors:**
    - o Blue: USB high-speed mode
    - o Red: USB full-speed mode
- \* This mode is dependent on the USB port interface.

## 3.4 Certifications and Standard Compliance

### 1.1.1. Certifications

Kingston DataTraveler Elite has the following certifications:

- USB high-speed certification
  - o Standard configuration: USB high-speed, certified low-power device
  - o Enhanced configuration: USB high-speed certified high-power device
- WHQL for Windows 2000 and Windows XP
- FCC
- CE

### **1.1.2. Standard Compliance**

Kingston DataTraveler Elite also meets the following universal standards:

- AS/NZS 3548 (Australia and New Zealand standard)
- BSMI CNS 13438 (Taiwan Inspection standard)

### **1.1.3. Cryptography Provisions**

Kingston DataTraveler Elite meets the provisions of the Cryptography Note (Note 3) in Category 5, Part 2, of the Commerce Control List (United States Department of Commerce – Bureau of Industry and Security – Encryption regulatory).

### 3.5 Media Usage and Capacity Specifications

Table 3: Kingston DataTraveler Elite Capacities – Unformatted

Parameter	256MB		512MB		1GB	2GB	4GB
Number of flash arrays	1	2	1	2	2	2	2
Flash configuration	LB	LB	LB	LB	LB	LB	LB
Flash blocks	2048	2048	4096	4096	8192	16384	32768
Flash block size (KB)	128	128	128	128	128	128	128
Storage (virtual blocks)	976	1953	1992	4010	4010	8056	16066
Hidden configuration (virtual blocks)	1	1	1	1	1	1	1
Service sectors	2	2	2	2	2	2	2
Storage (sectors)	499,710	499,966	1,019,902	1,026,558	2,053,118	4,124,670	8,225,792
Device capacity (sectors)	499,198	499,710	1,019,390	1,026,302	2,052,606	4,124,158	8,225,278
Hidden sectors (FAT)	4	4	19	11	19	36	63
MBR (sectors)	1	1	1	1	1	1	1
FAT (sectors)	488	488	252	250	502	1008	2008
Root (sectors)	32	32	32	32	32	32	32
Actual Capacity (KB) <sup>1</sup>	249,336	249,336	512,992	509,536	1,026,016	2,061,536	4,104,572
Sectors per cluster	8	8	32	32	32	32	32

<sup>1</sup> Formatted with the FAT file system.

### 3.6 Drive Characteristics

#### *Device Information*

Device Information	DEVICE 00 Vid (0x08ec) Pid (0x0015)
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#### *Get Device Descriptor*

Command	Get Device Descriptor
Returned Device Descriptor	0x12 0x01 0x00 0x02 0x00 0x00 0x00 0x40 0xEC 0x08 0x15 0x00 0x00 0x02 0x01 0x02 0x03 0x01
Field	Value
bLength	0x12
bDescriptorType	0x01 (dev. descriptor)
bcdSB	0x0200 (USB spec. 2.0)
bDeviceClass	0x00 (IFCs specify own)
bDeviceSubClass	0x00
bDeviceProtocol	0x00
bMaxPacketSize0	0x40
idVendor	0x08EC
idProduct	0x0015
bcdDevice	0x0200
iManufacturer	0x01
iProduct	0x02
iSerialNumber	0x03
bNumConfigurations	0x01

#### *Get String Descriptor Index 1*

Command	Get String Descriptor Index 1, Language ID 0x0409
Field	Value
iManufacturer	Kingston Technolgy

#### *Get String Descriptor Index 2*

Command	Get String Descriptor Index 2, Language ID 0x0409
Field	Value
iProduct	DataTraveler Elite

### Get String Descriptor Index 3

Command	Get String Descriptor Index 3, Language ID 0x0409
Field	Value
iSerialNumber	Defined during the manufacturing process: Digit 1: CM ID Digits 2-3: PC ID Digits 4-5: Day Digit 6: Month Digit 7: Year Digits 8-9: Hours Digits 10-11: Minutes Digits 12-13: Hours Digits 14-16: Index

### Get String Descriptor Index 4

Command	Get String Descriptor Index 4, Language ID 0x0409
Field	Value
bNumConfigurations	0x01

### Get Configuration Descriptor for USB 2.0 Full Speed

Command	Get Configuration Descriptor
Field	Value
Returned Values	0x09 0x02 0x20 0x00 0x01 0x01 0x00 0x80 0x30 0x09 0x04 0x00 0x00 0x02 0x08 0x06 0x50 0x00 0x07 0x05 0x81 0x02 0x00 0x02 0x00 0x07 0x05 0x02 0x02 0x00 0x02 0x00
bLength	0x09
bDescriptorType	0x02
wTotalLength	0x0020
bNumInterfaces	0x01 (1)
bConfigurationValue	0x01
iConfiguration	0x00
bmAttributes	0x80 (bus powered)
MaxPower	0x30

### Set Interface 0

Command	Set Interface 0
Field	Value
bLength	0x09
bDescriptorType	0x04
bInterfaceNumber	0x00
bAlternateSetting	0x00
bNumEndpoints	0x02



Command	Set Interface 0
Field	Value
bInterfaceClass	0x08 (Mass Storage Class)
bInterfaceSubClass	0x06 (SCSI transparent command set)
bInterfaceProtocol	0x50 (Bulk only transparent)
iInterface	0x00

*Get Descriptor (Endpoint 0x00)*

Command	Get Descriptor (Endpoint 0x00)
Field	Value
bLength	0x07
bDescriptorType	0x05
bEndpointAddress	0x81 (ep #1, IN)
bmAttributes	0x02 (Transfer Type Bulk)
wMaxPacketSize	0x0200
bInterval	0x00

*Get Descriptor (Endpoint 0x01)*

Command	Get Descriptor (Endpoint 0x01)
Field	Value
bLength	0x07
bDescriptorType	0x05
bEndpointAddress	0x02 (ep #2, OUT)
bmAttributes	0x02 (Transfer Type Bulk)
wMaxPacketSize	0x0200
bInterval	0x00

*Get Configuration Descriptor for USB 2.0 High-Speed*

Command	Get Configuration Descriptor
Field	Value
Returned Values	0x09 0x02 0x20 0x00 0x01 0x01 0x00 0x80 0x30 0x09 0x04 0x00 0x00 0x02 0x08 0x06 0x50 0x00 0x07 0x05 0x81 0x02 0x40 0x00 0x00 0x07 0x05 0x02 0x02 0x40 0x00 0x00
bLength	0x09
bDescriptorType	0x02
wTotalLength	0x0020
bNumInterfaces	0x01 (1)
bConfigurationValue	0x01
iConfiguration	0x00
bmAttributes	0x80 (bus powered)
MaxPower	0x30 (standard configuration) or 0x46 (enhanced configuration)

*Set Interface 0*

<b>Command</b>	<b>Set Interface 0</b>
<b>Field</b>	<b>Value</b>
bLength	0x09
bDescriptorType	0x04
bInterfaceNumber	0x00
bAlternateSetting	0x00
bNumEndpoints	0x02
bInterfaceClass	0x08 (Mass Storage Class)
bInterfaceSubClass	0x06 (SCSI transparent command set)
bInterfaceProtocol	0x50 (bulk only transparent)
iInterface	0x00

*Get Descriptor (Endpoint 0x00)*

<b>Command</b>	<b>Get Descriptor (Endpoint 0x00)</b>
<b>Field</b>	<b>Value</b>
bLength	0x07
bDescriptorType	0x05
bEndpointAddress	0x81 (ep #1, IN)
bmAttributes	0x02 (transfer type bulk)
wMaxPacketSize	0x0200
bInterval	0x00

*Get Descriptor (Endpoint 0x01)*

<b>Command</b>	<b>Get Descriptor (Endpoint 0x01)</b>
<b>Field</b>	<b>Value</b>
bLength	0x07
bDescriptorType	0x05
bEndpointAddress	0x02 (ep #2, OUT)
bmAttributes	0x02 (transfer type bulk)
wMaxPacketSize	0x0200
bInterval	0x00

## 4 ELECTRICAL CHARACTERISTICS

### 4.1 Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of this data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

*Table 4: Absolute Maximum Ratings*

Parameter	Symbol	Min	Max	Unit
Ambient Operating Temperature Range	$T_A$	0	60	°C
Power Supply Voltage Relative to Ground	$V_{bus}$	4	6	V
Voltage level on D+ / D- Relative to Ground 3	$V_{data}$	-1	4.6	V

\* Pulse width should not exceed 166 ns.

### 4.2 DC Characteristics

*Table 5: DC Characteristics for Full-Speed Operation ( $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 3.3\text{V}$ ,  $V_{SS} = 0\text{V}$ )*

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>USB Signals</b>						
Supply Voltage:	$V_{BUS}$		4.40	5.00	5.25	V
Supply Current (RMS)			--			
Operating:			--			
Standard Configuration	$I_{cc}$	$V_{BUS}=5.0\text{v}$		65	88	mA
Enhanced Configuration	$I_{cc}$		--	75	105	mA
Suspend	$I_{ccs}$		--	<500	<500	μA
Input Levels USB Signals (D+, D-):						
Low	$V_{IL}$	--	--	--	0.8	V
High	$V_{IH}$	--	2.0	--	--	V
Output Voltage USB Signals (D+, D-):						
Low	$V_{OL}$	$R_L$ of 1.5 kΩ to 3.6V	0	--	0.4	V
High	$V_{OH}$	$R_L$ of 15 kΩ to GND	2.6	--	3.6	V
Output Signal Crossover Voltage USB Signals (D+, D-)	$V_{CRS}$		1.3		2.0	V

Table 6: DC Characteristics for High-Speed Operation ( $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 3.3\text{V}$ ,  $V_{SS} = 0\text{V}$ )

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>USB Signals</b>						
Supply Voltage:	V <sub>BUS</sub>		4.40	5.00	5.25	V
Supply Current (RMS)			--			
Operating:			--			
Standard Configuration	I <sub>cc</sub>	V <sub>BUS</sub> =5.0v		75	100	mA
Enhanced Configuration	I <sub>cc</sub>		--	105	125	mA
Suspend	I <sub>ccs</sub>		--	<500	<500	μA
Input Levels USB Signals (D+, D-):						
Low	V <sub>IL</sub>	--	--	--	0.8	V
High	V <sub>IH</sub>	--	2.0	--	--	V
Output Voltage USB Signals (D+, D-):						
Low	V <sub>OL</sub>	R <sub>L</sub> of 1.5 kΩ to 3.6V	0	--	0.4	V
High	V <sub>OH</sub>	R <sub>L</sub> of 15 kΩ to GND	2.6	--	3.6	V
Output Signal Crossover Voltage USB Signals (D+, D-):	V <sub>CRS</sub>		1.3		2.0	V

### 4.3 Oscillator Connection

Kingston DataTraveler Elite works with an internal 48 MHz clock that it creates from an external 12 MHz clock via an internal PLL. The next figure shows the internal oscillator mode, which requires only an external 12 MHz crystal and bias capacitors. The values of the capacitors were chosen to indicate the load capacitance of the crystal, in order to cause the crystal to operate in a parallel resonant condition.

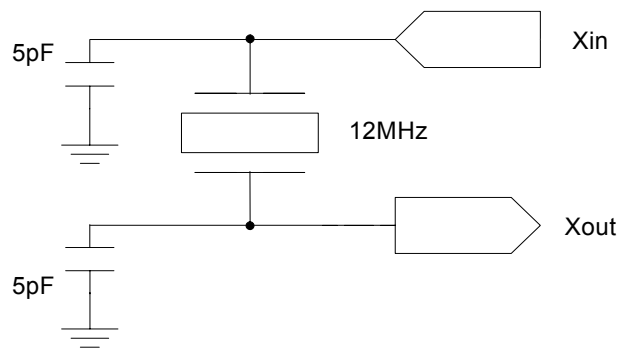


Figure 2: Internal Oscillator Mode

Table 7: Clock Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
External Clock Source Frequency $\pm 30$ ppm	f		12.000		MHz
Clock Duty Cycle	t <sub>CL</sub> , t <sub>CH</sub>	40	50	60	%
Load capacitance	C <sub>load</sub>	15	18	20	pF

## **5 ENVIRONMENTAL SPECIFICATIONS**

### **5.1 Temperature**

Operating temperature: 0° C to 60° C

Storage temperature: -40° C to 70° C

### **5.2 Humidity**

Relative humidity during operation (non-condensing): 5% to 90%

Relative humidity during storage: 5% to 95%

### **5.3 Altitude**

Operating: 6,096 m (20,000 ft)

Non-Operating: 12,192 m (40,000 ft)

### **5.4 Random Vibration**

#### **1.1.4. Operating**

5 G RMS, 10 to 2,000 Hz, 0.5 Oct/min sweep rate

#### **1.1.5. Non-Operating**

10 G RMS, 10 to 2,000 Hz, 0.5 Oct/min sweep rate

### **5.5 Shock**

Non-operating: 55 G, 11 ms, half-sine. In total, 18 shocks on 3 axes.

### **5.6 Drop Test**

Withstands drops of up to 1.5 m.

### **5.7 Dust Protection**

Level 5, according to the IEC 60529 standard.