太欣半導體股份有限公司
SYNTEK SEMICONDUCTOR CO., LTD.

USB 2.0 DSC/DV Camera controller

STK1365

Product Data Sheet

Version 1.0
November 27, 2009

Taipei Office
10F, No. 1, Alley 30, Lane 358, Rueiguang Road, Neihu District, Taipei, Taiwan R.O.C.
台北市內湖區瑞光路 **358** 巷 **30** 弄 **1** 號 **10** 樓
TEL: 886-2-26590055
FAX: 886-2-26590077

Hsinchu Office
3F, No. 24-2, Industry E. Road IV, Science-Based Industrial Park, Hsinchu, Taiwan, R.O.C.
新竹市科學工業園區工業東四路 **24-2** 號 **3** 樓
TEL: 886-3-5773181
FAX: 886-3-5778010

太欣半導體股份有限公司
SYNTEK SEMICONDUCTOR CO., LTD.

STK1365

Revision History

Rev.	Date	Author	Description
1.0	2009.11.27	Martinkao	First draft

Table of Contents

STK1365 Digital Camera Controller

1. Product Overview

The Syntek STK1365 is a high performance, high integration single chip digital-still-video and live-video camera controller. The STK1365 can act as a high performance tethered camera, a high quality digital still camera or a high bandwidth digital video recorder all in one set of hardware and software. The high-speed architecture, high quality image processor and motion JPEG compression/decompression engine create the best bandwidth utilization path for video camera systems. The STK1365 is capable of outputting excellent quality 30 frame-per-second VGA images, from CCD or CMOS sensors through its USB1.1 interface. The STK1365 is also capable of storing JPEG compressed pictures on most popular non-volatile/volatile memory or mini-storage cards. Other auxiliary features such as TFT LCD interface, TV display, audio annotation, recording and playback, programmable user interface logic and power management are all integrated into a single chip. The Direct-Memory-Access logic that moves data between the storage device and memory buffer enables the STK1365 to perform as a digital video recording device. Also integrated on chip is a high speed, 4-cycle per instruction micro-controller to perform configuration, flow control and statistical data analysis to control the auto white balance and auto exposure features.

The flexible architecture of the STK1365 enables it to support various applications such as digital still camera, video mail camera, video-conferencing camera, surveillance camera, Web camera, wireless camera, toy camera, toy camcorder and digital video recorder.

2. Product Features

Dual Mode, High Quality Digital Still Camera plus PC Camera functions

- Support up to 12MPixel image sensors at capture mode
- Support 1280x1024 (SXGA) CMOS/CCD sensors up to 5~10 fps at display or capture mode
- Support 1024x768 (XGA) CMOS/CCD sensors up to 10~15 fps at display or capture mode
- Support 800x600 (SVGA) CMOS/CCD sensors up to 24 fps at display or capture mode
- Support 640x480 (VGA) CMOS/CCD sensors up to 30 fps at display or capture mode
- Also support CIF/QVGA, QCIF resolution CMOS/CCD sensors at 30 fps
- Support D1 MJPEG AVI up to 30 fps
- Support 720p MJPEG AVI up to 15 fps

JPEG Compression/Decompression Engine

- Support for sequential DCT/IDCT based encoding and decoding
- Nonlinear color correction matrix
- Smooth gamma curve
- Programmable color space conversion
- Adjustable luminance curve for brightness and contrast

- Support for YCrCb 4:1:1 and 4:2:2 sampling in three component images
- Loadable quantization table to enhance picture quality and compression ratio
- Highly pipelined architecture to compress/decompress high resolution image data
- Integrated downscaler for decompressed images

Image Enhancement Engine

- Programmable filter to perform edge enhancement, brightness, contrast, hue and saturation adjustment
- Proprietary color interpolation filter to create missing color components
- Color Space Conversion between YC_bC_r and RGB color formats
- Programmable Gamma correction table
- Support for auto white balancing and auto exposure
- Support for sensor color correction
- Advanced edge enhancement and color noise removal processing
- Luminance noise removal
- Precise digital zooming (12bit)
- Overlay support (scaler, masked blit operation support with 2-bit alpha blending, UV keying special effect)
- AF support (8x8 windows)
- Lens roll-off and advanced optical black compensation.
- Secondary output mode (for improved shot to shot timing)

Sensor Interface

- Seamless interface with most CMOS Image Sensor chips
- Seamless interface with most CCD Image Sensor chips
- Supports SXGA, XGA, SVGA, VGA, CIF/QVGA and QCIF resolution sensor
- Supports both 10bit and 8bit data width

Graphic Accelerator Engine

- Bitmap copy including 1, 4, and 8 bit mode
- Support compressed bitmap
- Arithmatic operations including logic operation and color keying.

Video Input/Output Interface

- Supports NTSC/PAL composite TV encoder output
- Support digital video output stream.
- Support CCIR 656 video format output.

.

Audio Processor

- Internal A/D and D/A audio codec for audio recording, and play back
- Support IMA 4/3/2-bit ADPCM audio compression

Embedded Micro controller

- Turbo8032 compatible micro-controller
- Fast fully associative code cache
- Arithmetic engine for 32-bit operations

Memory Sub-System

- SDRAM – up to 64MB, x16 external bus
- DMA memory data movement
- Supports up to 4 SDRAM banks to reduce page break latency
- Secure Digital (SD) interface
- Multimedia Memory Card (MMC) 4.0 interface
- Serial Flash (SPI interface)

Host Interface

- Fully compatible with full speed USB 1.1 Spec
- Supports USB Control, Interrupt, Bulk and Isochronous pipes:
  2x Bulk IN, 2x Bulk Out, 1x ISO, 2x Interrupt endpoints
- Automatic adjustable alternate setting to fit bandwidth budget
- 22-bit power-on strapping register for USB vender/product ID and enumeration
- High speed UART (16550 compatible)
- Serial synchronous interface
- Support general 8-bit host interface for external controllers.

LCD Interface

- 6 or 8-bit per component TFT support
- 256 colors overlay with 4-bit alpha blending channel
- Supports AU TFT LCD with digital interface
- Supports Toppoly TFT LCD with digital interface
- Supports CASIO TFT LCD with digital interface
- Supports CSTN panel models from Truly, Power chip, Tianma, Wintek ond others using Sitronix ST7628, Sitronix ST7636R and Ultrachip UC1681S controllers.
- Supports OLED panels from Lightronik and other using Solomon SSD1332 controller.

General Purpose Input/Output Interface

- 22 general purpose input/output ports for user interface and inter-component communication
- One 8bit ADC input
- One 8bit DAC output
- Interface with status LCD panel controller
- Supports Iris control
- Supports IGBT flash bulb control
- Keyboard controller – two wire remote keyboard support

Miscellaneous Circuit

- Automatic TV detection comparator
- Battery-low voltage detector (8 levels)
- Real-Time Clock
- System bootable from SPI and USB.

Power management

- 1.8V Core Supply Voltage
- 3.3V Input/Output tolerance
- Active power management (sequentially powers on required module)
- Dynamic power management, independent module frequency setting
- Low power consumption

Software and Development System

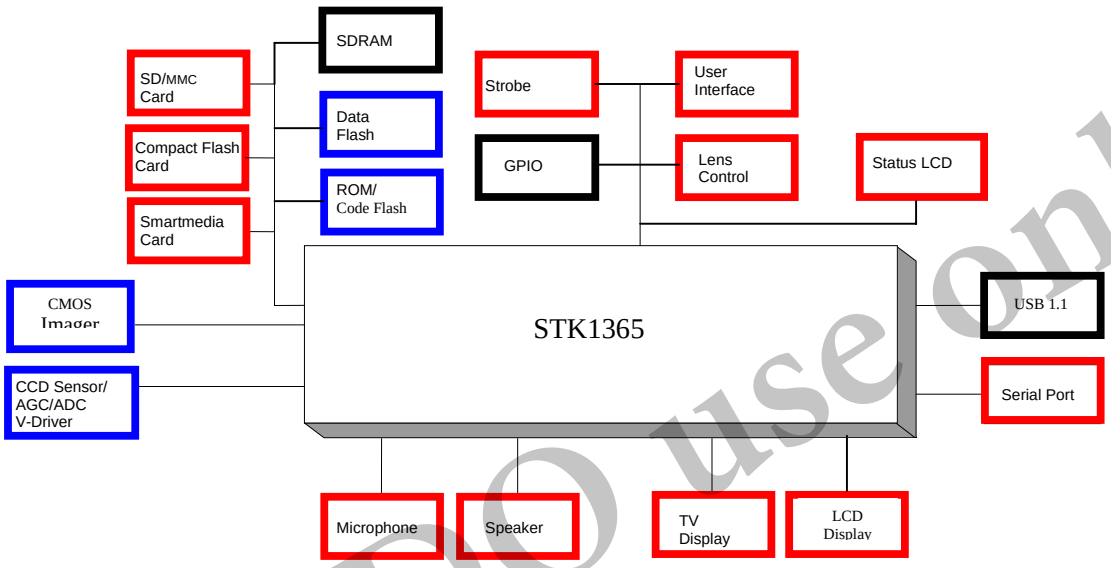
- Supports MS-Windows driver for Win98, Win2000, WinME, WinXP
- TWAIN driver
- WIA driver
- Turbo-8032 firmware
- Reference development AP
- Reference development hardware platform

Package

- 128-pin LQFP

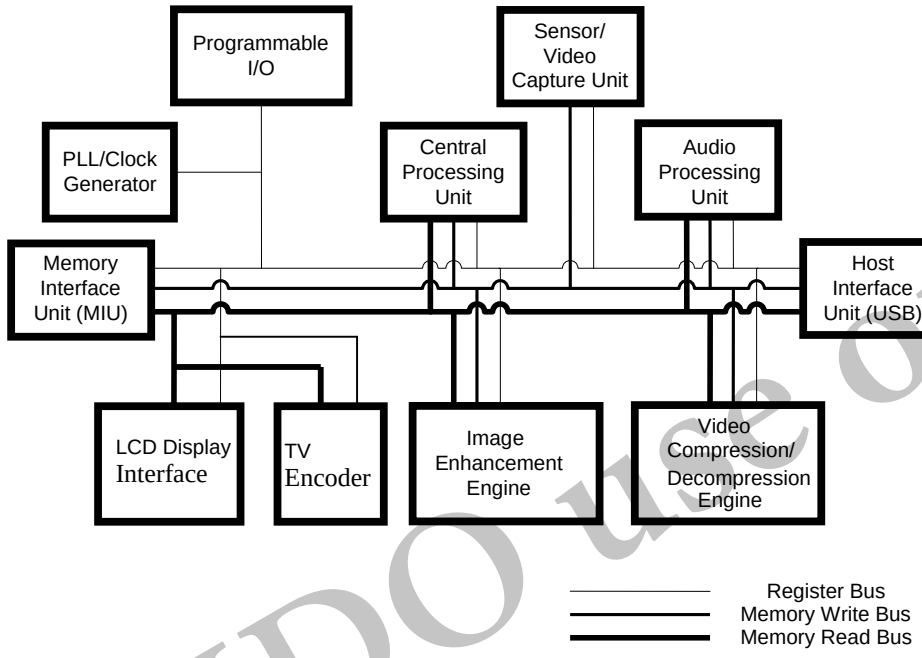
3. Block Diagrams

System Block Diagram



STK1365 System Block Diagram

Internal Block Diagram



STK1365 Internal Block Diagram

4. Pin Assignment

128-pin LQFP

5. Pin List

Pin	Pand Name	PU/PD	I/O	Commennt
1	SDDATA<2>	PU	O	Also serves as WEb for CFC/SMC/NOR
2	SDDATA<3>	PU	O	Also serves as OEb/REb for CFC/SMC/NOR
3	MDQMH/MBE_1		O	RA13 for NOR flash.
4	VDD_IO		Power	3.3V
5	MA<7>		O	
6	MA<8>		O	
7	MA<9>		O	
8	MA<10>		O	
9	MA<11>		O	
10	VSS_IO		Power	Ground
11	MBA<0>		O	
12	MBA<1>		O	
13	VSS_CORE		Power	Ground
14	MD<8>	PU	I/O	PS<8> - USB PID 0
15	MD<9>	PU	I/O	PS<9> - USB PID 1
16	MD<10>	PU	I/O	PS<10> - USB PID 2
17	VDD_IO		Power	3.3V
18	MD<11>	PU	I/O	PS<11> - USB PID 3
19	MD<12>	PU	I/O	PS<12> - USB PID 4
20	MD<13>	PU	I/O	PS<13> - USB PID 5
21	MD<14>	PU	I/O	PS<14> - USB Self Power
22	MD<15>	PU	I/O	PS<15> - USB High Power
23	USB_AVSS		Power	Ground
24	DPLUS		I/O	
25	DMINUS		I/O	
26	USB AVDD		Power	3.3V
27	LCD_DATA<7>		O	
28	LCD_DATA<6>		O	
29	LCD_DATA<5>		O	

30	LCD_DATA<4>		O	
31	LCD_DATA<3>		O	
32	LCD_DATA<2>		O	
33	LCD_VSYNC		O	
34	TV_ASSIO		Power	
35	TV_AVDDIO		Power	3.3V
36	VIDEO_OUT		Ana O	Composite video output.
37	VREST		Ana I	
38	VCOMM		Ana O	
39	TV_AVSS		Power	
40	LCD_DATA_EN		O	
41	LCD_HSYNC		O	
42	LCD_CLK		O	
43	BATT_LOW		Ana I	
44	GPIO1<7>		I/O	
45	GPIO1<5>		I/O	
46	GPIO1<4>		I/O	
47	GPIO1<3>	PU	I/O	
48	GPIO1<2>		I/O	
49	VDD_CORE		Power	1.8V
50	GPIO1<1>	PU	I/O	Also serves as output port for low frequency clock output.
51	GPIO1<0>	PU	I/O	Also serves as output port for VCLK for driving sensors.
52	VSS_IO		Power	Ground
53	GPIO0<7>		I/O	Also serves as the input for 8051 int1_n.
54	RSTB		I	Hardware reset.
55	VDD_IO		Power	3.3V
56	GPIO0<3>	PU	I/O	Also serves as the input for 8051 T1.
57	GPIO0<2>	PU	I/O	Also serves as the input for 8051 T0.
58	GPIO0<1>	PU	I/O	Also serves as internal timer2 output.
59	GPIO3<1>	PU	I/O	
60	GPIO3<2>	PU	I/O	

61	GPIO3<6>		I/O	High speed UART2 RX
62	GPIO3<7>		I/O	High speed UART2 TX
63	RTC VDD		Power	Real time clock power. Separate from the chip power. 1.8V
64	OSCI_RTC		Osc	RTC OSC 32768Hz.
65	OSCO_RTC		Osc	RTC OSC 32768Hz.
66	RTC VSS		Power	Real time clock ground. Separate from the chip power. Ground
67	AUDIO_IN		Ana I	Audio Input
68	AUDIO_OUT		Ana O	Audio Ioutput
69	VDD_CORE		Power	1.8V
70	CD<1>		I	
71	CCLK		I	
72	VSS_IO		Power	Ground
73	CVREF		I/O	Also serves as the output port for generated VSYNC.
74	CHREF		I/O	Also serves as the output port for generated HSYNC.
75	CD<2>		I	
76	CD<3>		I	
77	CD<4>		I	
78	CD<5>		I	
79	Audio VDD		Power	3.3V
80	CD<6>		I	
81	CD<7>		I	
82	CD<8>		I	
83	CD<9>		I	
84	XIN		Osc	PLL OSC
85	XOUT		Osc	PLL OSC
86	PLL_AVDD		Power	1.8V
87	PLL_AVSS		Power	Ground
88	GPIO2<1>	PU	I/O	
89	GPIO2<2>	PU	I/O	
90	GPIO2<3>	PU	I/O	

91	GPIO2<4>		I/O	8051 UART0 RX in
92	GPIO2<5>		I/O	8051 UART0 TX out
93	GPIO2<6>		I/O	
94	GPIO2<7>		I/O	
95	GPIO4<7>		I/O	
96	GPIO4<6>		I/O	8051 UART1 RX in
97	GPIO4<5>		I/O	8051 UART1 TX out
98	CFCS2_B	PU	O	Also serves as SMCCS2_B and SDCMD.
99	CFCS1_B	PU	O	Also serves as SDCLK.
100	MD<0>	PU	I/O	PS<0> - Test Mode 0
101	VSS_CORE		Power	Ground
102	MD<1>	PU	I/O	PS<1> - Test Mode 1
103	MD<2>	PU	I/O	PS<2> - Test Mode 2
104	MD<3>	PU	I/O	PS<3> - Clock Source
105	MD<4>	PU	I/O	PS<4> - External ROM
106	MD<5>	PU	I/O	PS<5> - CPU Boot
107	VDD_IO		Power	3.3V
108	MD<6>	PU	I/O	PS<6> - USB Clock Div. 0
109	MD<7>	PU	I/O	PS<7> - USB Clock Div. 1
110	MA<0>		O	
111	MA<1>		O	
112	MA<2>		O	
113	VSS_CORE		Power	Ground
114	MA<3>		O	
115	MA<4>		O	
116	MA<5>		O	
117	MA<6>		O	
118	VDD_CORE		Power	1.8V
119	MRAS_B		O	
120	MWE_B		O	
121	VDD_IO		Power	3.3V

122	MCAS_B		O	
123	MCLK		O	
124	MCKE	PD	O	
125	VSS_CORE		Power	Ground
126	GPIO4<1>	PU	I/O	Timer1 clock input
127	GPIO4<0>	PU	I/O	8051 UART0 RX out (sync mode data out)
128	MDQML/MBE_0		O	

6. DC Characteristic:

Absolute Maximum Rating

Rating	Symbol	Value	Unit
DC supply voltage (IO)	Vdd	-0.3 to +4.0	V
Voltage, any pin to ground	V	-0.3 to VDD+0.3	V
DC current drain per pin (excluding VDD , VSS)	I	±10	mA
Operating temperature range	T_A	0 to +70	°C
Storage temperature range	Tstg	-65 to +150	°C

Electrical Characteristics (Vdd=3.3v, T_A=0 to 70°C)

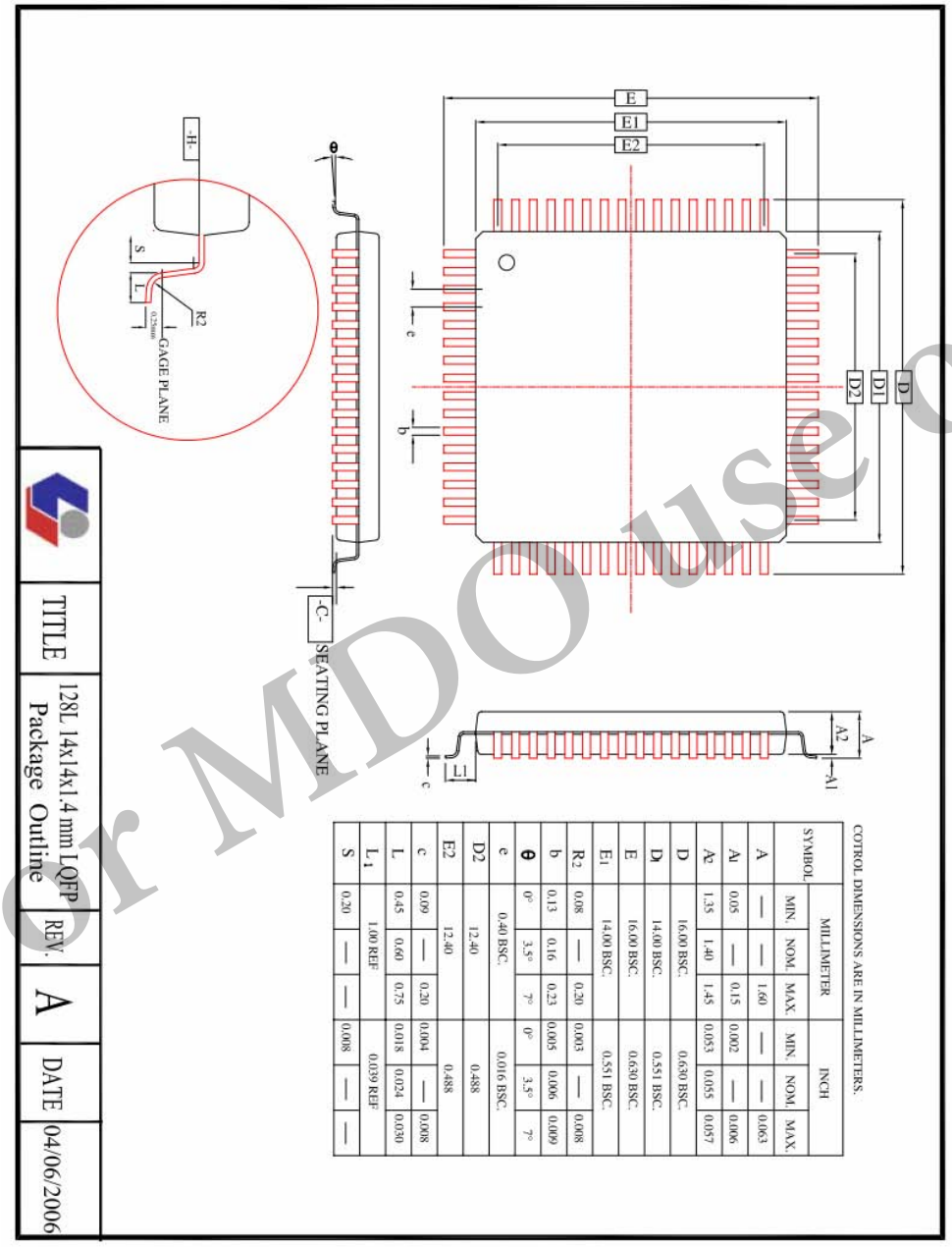
Characteristic	Symbol	Min	Typ	Max	Unit
DC supply voltage IO (Vdd to GND)	Vdd	3.00	3.3	3.6	V
DC supply current (@Vdd=3.3v)	Idd		TBD		mA
DC supply voltage core (Vdd to GND)	Vdd_core	1.62	1.8	1.98	V
DC supply current core (@Vdd_core=1.8v)	Idd_core		TBD		MA
Suspend mode current (@Vdd=3.3v)	$I_{Suspend}$		TBD		µA
High level input voltage	V_{IH}	2.0		Vdd+0.3v	V
Low level input voltage	V_{IL}	-0.3		0.8	V
Input current (V_I=Vdd +0.3v or GND)	I_{IN}	-10	1	10	µA
Input capacitance	C_{IN}			10	pF
3-state output leakage current (V_O=Vdd +0.3v or GND)	I_{OZ}	-10	1	10	µA
Output capacitance	C_{OUT}			10	PF
High level output voltage (@Iout=-2ma)	V_{OH}	2.4		Vdd	V
Low level output voltage (@Iout=2ma)	V_{OL}	0		0.4	V
Crystal frequency (at XIN and XOUT pins)	F_{XLT}	5.88	12	24.012	MHz
Crystal frequency (at XIN and XOUT pins)	F_{XLT}	5.88	12	24.012	MHz

USB VP/VM Pins Electrical Characteristics (Vdd=3.3v, TA=0 to 70°C)

Characteristic	Symbol	Min	Typ	Max	Unit
Differential input sensitivity	V_{DI}	0.2			V
Differential common mode range	V_{CM}	0.8		2.5	V
Output signal crossover voltage	V_{CRS}	1.3		2.0	V
Single ended receiver threshold	V_{SE}	2.0		2.0	V
Static output low (@1.5kΩ pull up to 3.6v)	V_{OL}	0.0		0.3	V
Static output high (@15kΩ pull down to GND)	V_{OH}	2.8		3.6	V
Rise time	T_{FR}	4		20	ns
Fall time	T_{FF}	4		20	ns
Output resistance	Z_{DRV}	28		43	Ω
External D+, D- serial resistor	Rs		24		Ω

7. Package Drawing:

128-pin LQFP



COTROL DIMENSIONS ARE IN MILLIMETERS.

SYMBOL	MILLIMETER			INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	—	—	1.60	—	—	0.063
A1	0.05	—	0.15	0.002	—	0.006
A2	1.35	1.40	1.45	0.053	0.055	0.057
D	16.00 BSC.			0.630 BSC.		
D1	14.00 BSC.			0.551 BSC.		
E	16.00 BSC.			0.630 BSC.		
E1	14.00 BSC.			0.551 BSC.		
R2	0.08	—	0.20	0.003	—	0.008
b	0.13	0.16	0.23	0.005	0.006	0.009
θ	0°	3.5°	7°	0°	3.5°	7°
e	0.40 BSC.			0.016 BSC.		
D2	12.40			0.488		
E2	12.40			0.488		
c	0.09	—	0.20	0.004	—	0.008
L	0.45	0.60	0.75	0.018	0.024	0.030
L_1	1.00 REF			0.039 REF		
S	0.20	—	—	0.008	—	—