

WDJ7222

High Speed USB2.0(480Mbps) DPDT Analog Switch

Description

The WDJ7222 is a high bandwidth, fast double-pole double-throw (DPDT) analog switch. Its wide bandwidth and low bit-to-bit skew allow it to pass high-speed differential signals with good signal integrity. Each switch is bidirectional and offers little or no attenuation of the high-speed signals at the outputs. Its high channel-to-channel crosstalk rejection results in minimal noise interference.

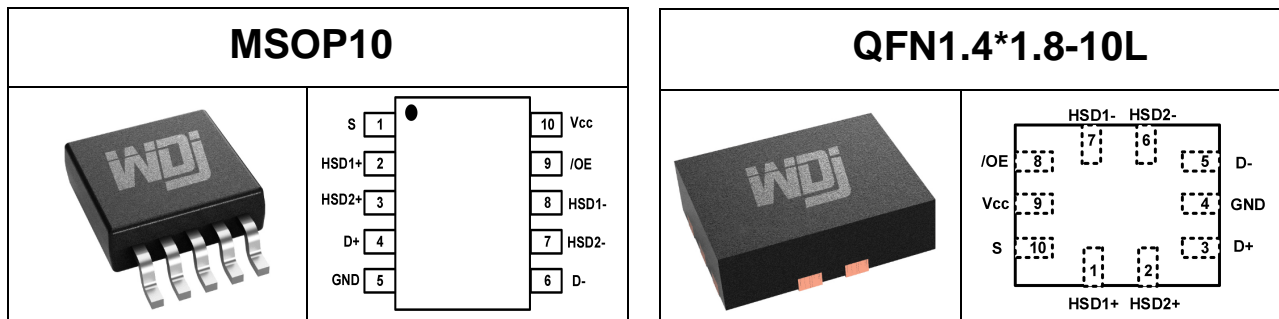
Features

- Supply Range: 1.8 V to 5.5 V
- Rail-to-Rail Signal Range
- On-Resistance Matching: 0.05 Ω (TYP)
- ON-Resistance: 4.5 Ω (TYP) at 4.5V
- ON-Resistance Flatness: 0.9 Ω (TYP) at 4.5V
- High Off Isolation: -32 dB at 250 MHz
- -41 dB (250 MHz) Crosstalk Rejection Reduces
- Break-Before-Make Switching
- -3 dB Bandwidth: 720 MHz
- Operation Temperature Range: -40° C to +125° C

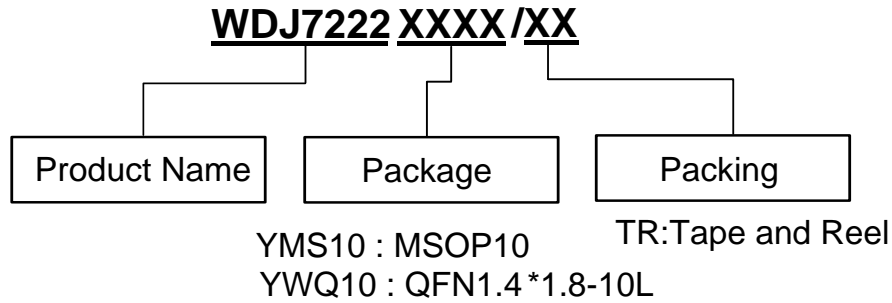
Typical Applications

- Cell Phones
- PDAs
- Portable Instrumentation
- Differential Signal Data Routings
- USB 2.0 Signal Routing

Pin Configuration



Ordering Information



Pin Description

Name	Pin Number		Description
	YQ10	YM10	
V+	9	10	Positive Power Supply
S	10	1	Select Input
D+,D-	3,5	4,6	Data Ports
HSD1+,HSD1-	1,7	2,7	Data Ports 1
HSD2+,HSD2-	2,6	3,8	Data Ports 2
/OE	8	9	Output Enable
GND	4	5	Ground

Logic Function Table

/OE	S	HSD1+,HSD1-	HSD2+,HSD2-
0	0	ON	OFF
0	1	OFF	ON
1	X	OFF	OFF

Absolute Maximum Ratings

Parameters		Min.	Max.	Unit
V+	Supply Voltage Range	-0.3	6	V
V _{IS}	Analog, Digital Voltage Range	-0.3	(V+)+0.3	V
I _{IN}	Continuous Current HSDn or Dn	-100	+100	mA
I _{peak}	Peak Current HSDn or Dn	-150	+150	mA
T _J	Junction Temperature		150	°C
T _{stg}	Storage Temperature	-65	150	°C

(1) Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

ESD Ratings

ESD		Value	Unit
V(ESD)	Electrostatic Discharge	Human-Body Model (HBM)	5K
		Charged-Device Model (CDM)	2K

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

Symbol	Parameter	Min	Max	Unit
V _{CC}	Supply Voltage	1.8	5.5	V
T _A	Operating Temperature	-40	125	°C

(1) All unused digital inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
MSOP10	180.7	66.2	°C/W
QFN1.4*1.8-10L	120	46	°C/W

Electrical Characteristics

$T_A = +25^{\circ}\text{C}$, $V_+ = 1.8\text{V}$ to 5.5V , $\text{GND} = 0\text{V}$ (unless otherwise noted)

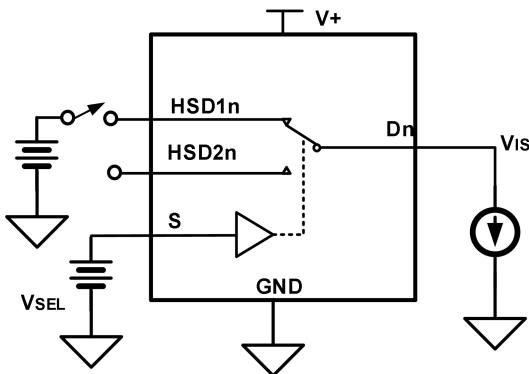
Parameter	Symbol	Conditions	V+	Temp	Min	Typ	Max	Units
Analog Switch								
On-Resistance	R_{ON}	$V_{IS} = 0\text{V}$ to 0.4V , $I_D = 10\text{mA}$.	4.5V	+25°C		4.5	5	Ω
				Full			7	
			3V	+25°C		6.5	7	Ω
				Full			10	
On-Resistance Flatness	R_{FLAT}	$V_{IS} = 0\text{V}$ to 1.0V , $I_D = 10\text{mA}$.	4.5V	+25°C		0.9	1.2	Ω
				Full			1.5	
			3V	+25°C		3.2	3.5	Ω
				Full			4.5	
On-Resistance Matching	ΔR_{ON}	$V_{IS} = 0\text{V}$ to 0.4V , $I_D = 10\text{mA}$.	4.5V	+25°C		0.05	0.1	Ω
				Full			0.15	
			3V	+25°C		0.05	0.1	Ω
				Full			0.15	
Increase In I_{CC} per Control Voltage	I_{CCT}	V_S or $V_{IOE} = 2.6\text{V}$	4.3V	Full			20	μA
Source Off Leakage Current	$I_{HSD2(OFF)}$ $I_{HSD1(OFF)}$	$V_{IS} = 5\text{V} / 0.5\text{V}$, $V_D = 0.5\text{V} / 5\text{V}$	5.5V	Full			1	μA
Channel On Leakage Current	$I_{HSD2(ON)}$ $I_{HSD1(ON)}$	$V_{IS} = 5\text{V} / 0.5\text{V}$, $V_D = \text{floating}$	5.5V	Full			1	μA
Digital Control Inputs								
Input High Voltage	V_{IH}		3.3V	Full	1.7			V
Input Low Voltage	V_{IL}		3.3V	Full			0.5	V
Input Leakage current	I_{IN}	V_S , $V_{IOE} = 0\text{V}$ or V_+	5.5V	Full			1	μA
Power Requirements								
Power Supply Range	V_+			Full	1.8		5.5	V
Quiescent Supply Current	I_{CC}	V_S , $V_{IOE} = 0\text{V}$ or V_+	5.5V	Full			1	μA

Electrical Characteristics (Continued)

$T_A = +25^\circ\text{C}, V_+ = 1.8\text{V to } 5.5\text{V}, \text{GND} = 0\text{V}$ (unless otherwise noted)

Parameter	Symbol	Conditions	V ₊	Temp	Min	Typ	Max	Units
Turn-On Time	t_{ON}	$V_{\text{IS}}=0.8\text{V}, R_{\text{L}}=50\Omega, C_{\text{L}}=10\text{pF}.$	5V	+25°C		12		ns
			3.3V	+25°C		14		ns
Turn-Off Time	t_{OFF}	$V_{\text{IS}}=0.8\text{V}, R_{\text{L}}=50\Omega, C_{\text{L}}=10\text{pF}.$	5V	+25°C		6		ns
			3.3V	+25°C		8		ns
Break-Before-Make Delay	t_{BBM}	$V_{\text{IS}}=0.8\text{V}, R_{\text{L}}=50\Omega, C_{\text{L}}=10\text{pF}.$	5V	+25°C		5		ns
			3.3V	+25°C		4		ns
-3 dB Bandwidth	BW	Signal=0dBm, $R_{\text{L}}=50\Omega, C_{\text{L}}=5\text{pF}.$	5V	+25°C		720		MHz
			3.3V	+25°C		700		MHz
Off-Isolation	OIRR	Signal=0dBm, $R_{\text{L}}=50\Omega, f=250\text{MHz}.$	5V	+25°C		-32		dB
			3.3V	+25°C		-32		dB
Non-Adjacent Channel Crosstalk	XTALK	Signal=0dBm, $R_{\text{L}}=50\Omega, f=250\text{MHz}.$	5V	+25°C		-41		dB
			3.3V	+25°C		-41		dB
Channel-to-Channel Skew	t_{SKEW}	$R_{\text{L}}=50\Omega, C_{\text{L}}=10\text{pF}.$	5V	+25°C		0.1		ns
		$R_{\text{L}}=50\Omega, C_{\text{L}}=10\text{pF}.$	3.3V	+25°C		0.1		ns
Charge Injection	Q	$R_{\text{G}}=0\Omega, C_{\text{L}}=1\text{nF}.$	5V	+25°C		6		pC
		$R_{\text{G}}=0\Omega, C_{\text{L}}=1\text{nF}.$	3.3V	+25°C		4		pC
On Capacitance	C_{ON}		5V	+25°C		6		pF
			3.3V	+25°C		6		pF

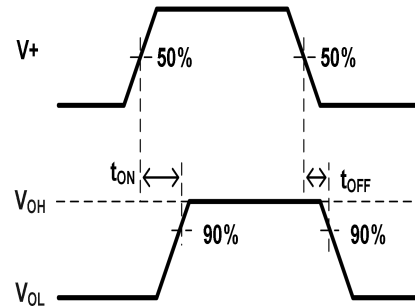
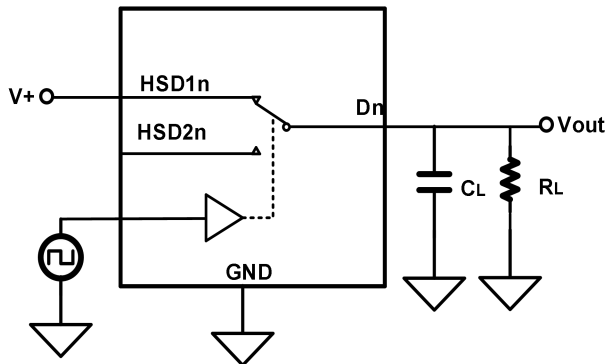
Measurement Information



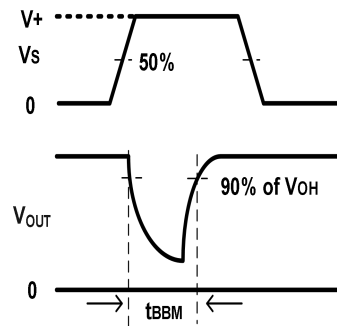
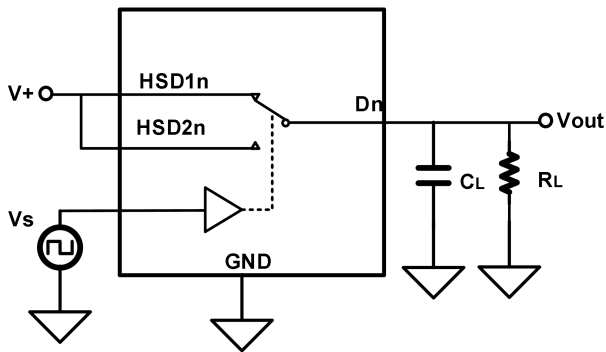
Channel On
 $R_{\text{ON}} = (V_{\text{HSD1n or HSD2n}} - V_{\text{IS}}) / I_{\text{D}}$
 $V_{\text{SEL}} = V_{\text{IH or VIL}}$

ON-State Resistance (R_{ON})

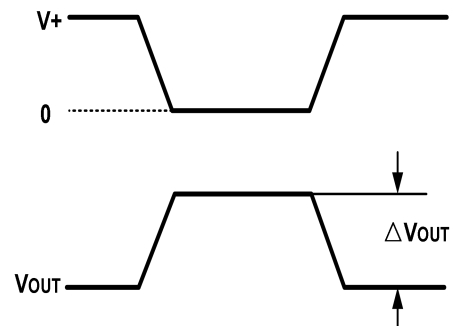
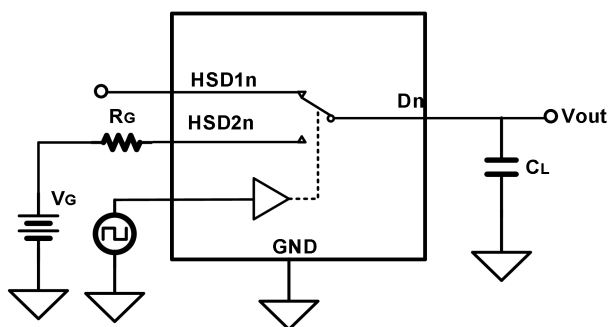
Measurement Information(Continued)



Measurement Information(Continued)
Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})



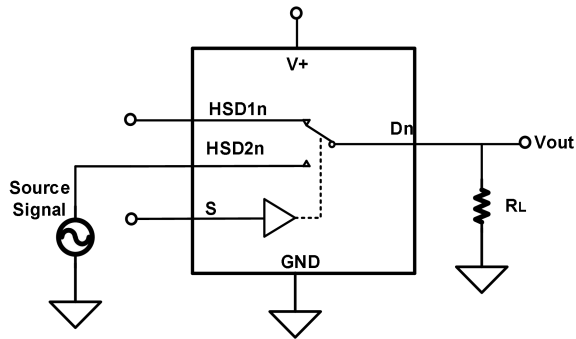
Break-Before-Make Time Delay (t_{BBM})



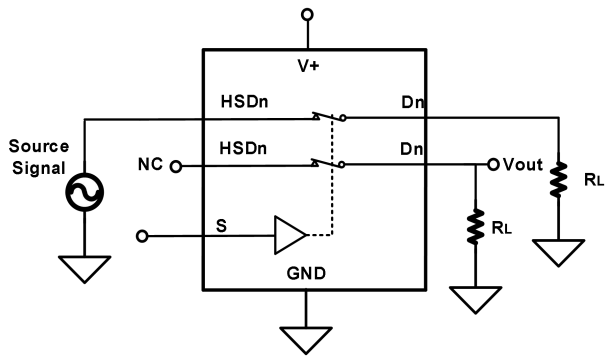
$$Q = \Delta V_{OUT} \times C_L$$

Charge Injection (Q)

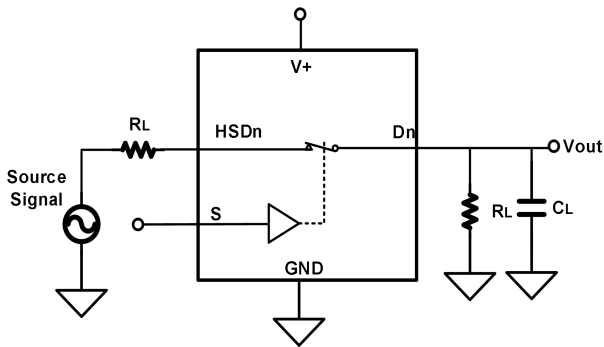
Measurement Information(Continued)



Off Isolation(OIRR)



Channel To Channel Crosstalk= $-20 \times \log (V_{HSDn}/V_{OUT})$
Channel-to-Channel Crosstalk

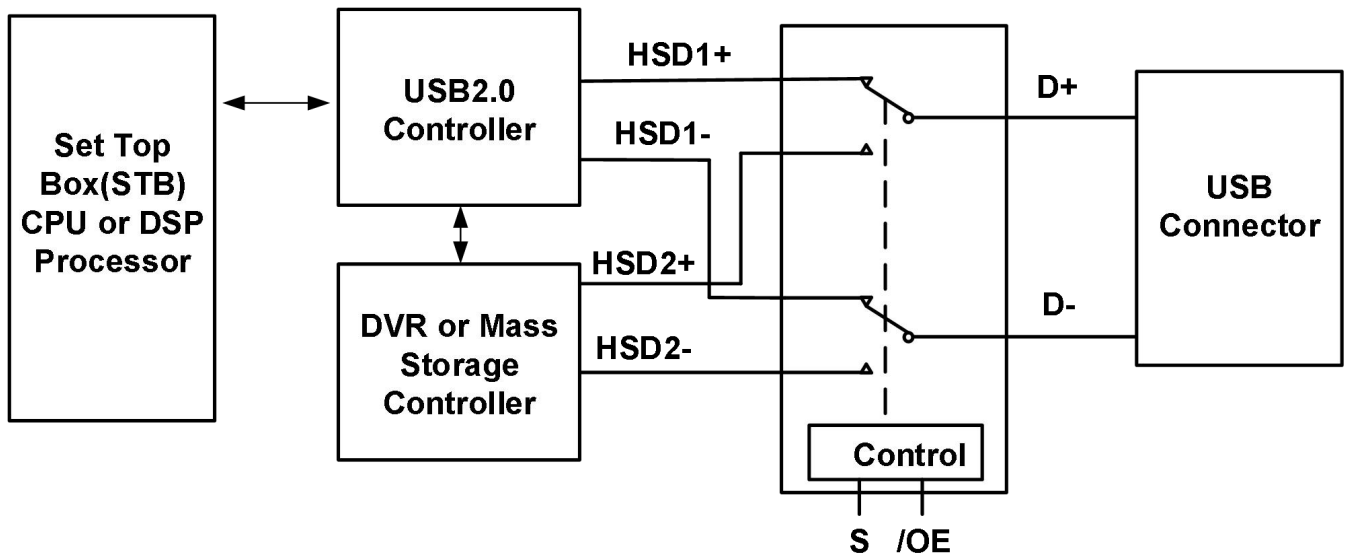


-3dB Bandwidth

Applications Note

There are many USB applications in which the USB hubs or controllers have a limited number of USB I/Os. The WDJ7222 solution can effectively expand the limited USB I/Os by switching between multiple USB buses in order to interface them to a single USB hub or controller. WDJ7222 can also be used to connect a single controller to two USB connectors or controllers.

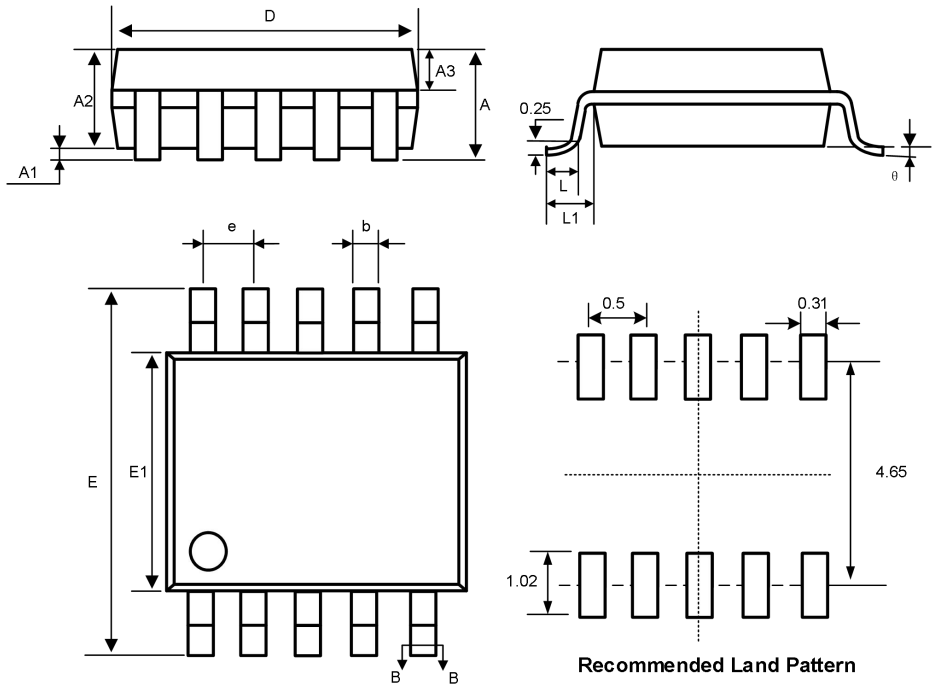
Design requirements of the USB 1.0, 1.1, and 2.0 standards should be followed. It is recommended that the digital control pins S and /OE be pulled up to V+ or down to GND to avoid undesired switch positions that could result from the floating pin.



Application Diagram

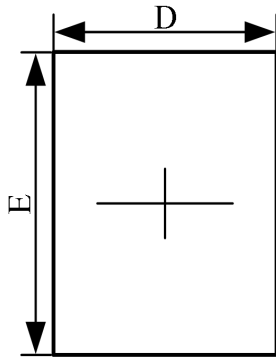
Package Outline Dimension

MSOP10

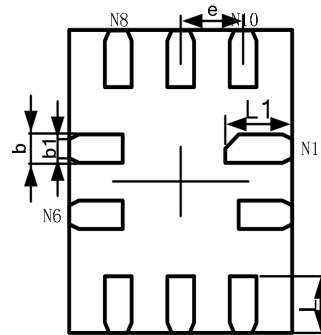


Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	1.10	—	—	0.043
A1	0.05	—	0.15	0.002	—	0.006
A2	1.30	1.40	1.50	0.051	0.055	0.059
A3	0.75	0.85	0.95	0.030	0.033	0.037
D	2.90	3.00	3.10	0.114	0.118	0.122
E	4.70	4.90	5.10	0.185	0.193	0.201
E1	2.90	3.00	3.10	0.114	0.118	0.122
e	0.50BSC			0.02BSC		
L	0.40	—	0.70	0.016	—	0.028
L1	0.95REF			0.037REF		
θ	0	—	8°	0	—	8°

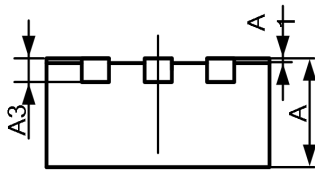
QFN1.4*1.8-10L



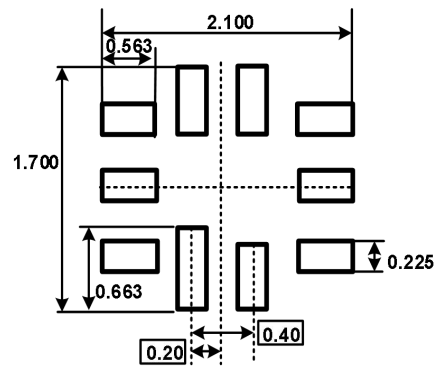
TOP VIEW



BOTTOM VIEW



SIDE VIEW



Recommended Land Pattern

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A3	0.152REF		0.006REF	
D	1.350	1.450	0.053	0.057
E	1.750	1.850	0.069	0.073
D1	—	—	—	—
E1	—	—	—	—
k	—		—	
b	0.150	0.250	0.006	0.010
b1	0.100	0.200	0.004	0.008
e	0.400TYP		0.016TYP	
L	0.350	0.450	0.014	0.018
L1	0.450	0.550	0.018	0.022

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