Data Sheet

CADEKA
Amplify the Human Experience

COMLINEAR® CLCUSB42

Low Power, High-Speed (480MSPS) USB 2.0 Analog Switch

FEATURES

- ±8kV ESD protection on all pins
- 7pF on capacitance
- 4.0Ω on resistance
- 720MHz -3dB bandwidth
- <1µA supply current in standby mode
- <6µA over a wide control voltage range
- -45dB crosstalk
- Power-off protection when V_S = 0V; D+ and D- tolerate up to 5.25V
- Power-on protection when $V_S \neq 0V$; D+ and D- tolerate up to 5.25V
- Input voltage range extends 0.3V beyond V_S
- Operates from 3V to 4.3V supplies
- Pb-free 1.4mm x 1.8mm QFN-10 package

APPLICATIONS

- Cell phones
- PDAs
- Digital cameras
- Notebooks
- LCD TVs
- Set top box
- High-speed differential signal applications
- USB 2.0 switching

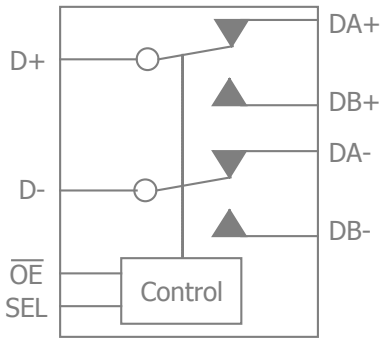
General Description

The CLCUSB42 is a dual-pole, double-throw (DPDT) analog switch designed for switching high-speed analog signals. The CLCUSB42 is optimized for switching 480Mbps (USB2.0) signals in portable devices such as cell phones, digital cameras, PDAs, and notebook computers.

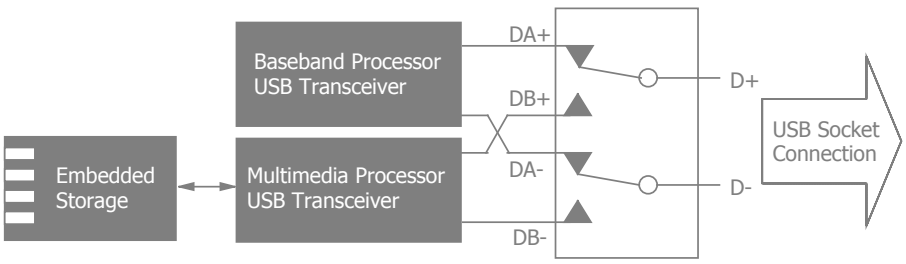
The CLCUSB42 offers superior crosstalk (-45dB) and off-isolation (-30dB) to reduce channel-to-channel interferance and provide good signal integrity. The low on-channel resistance and capacitance reduce attentuation and distortion during bi-directional HS signal routing.

The CLCUSB42 also features protection circuitry on D+ and D- pins that allows the switch to handle overvoltage conditions when powered on or off.

Functional Block Diagram



Typical Application

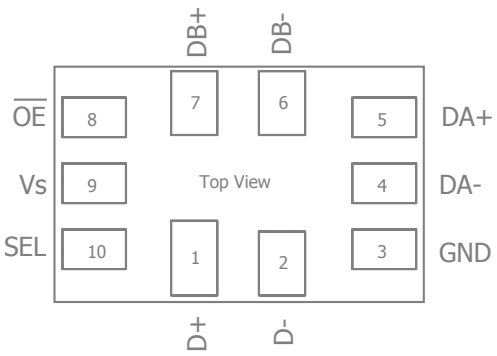


Ordering Information

Part Number	Package	Pb-Free	RoHS Compliant	Operating Temperature Range	Packaging Method
CLCUSB42ILP10X	QFN-10	Yes	Yes	-40°C to +125°C	Reel

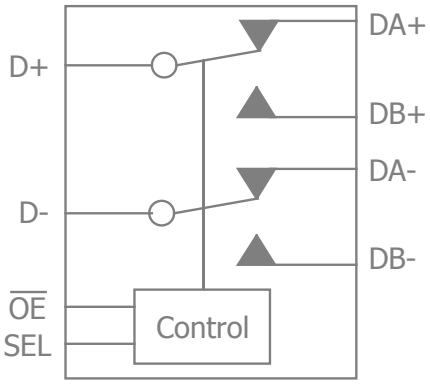
Moisture sensitivity level for all parts is MSL-1.

QFN Pin Configuration



QFN Pin Assignments

Pin No.	Pin Name	Description
1	D+	Common Data Port
2	D-	Common Data Port
3	GND	Ground
4	DA-	A Data Port
5	DA+	A Data Port
6	DB-	B Data Port
7	DB+	B Data Port
8	$\overline{OE}$	Output Enable Bar
9	V_S	Positive supply
10	SEL	Select Input



Truth Table

SEL	$\overline{OE}$	Function
X	HIGH	Disconnect
LOW	LOW	Select A Port; (D+, D- = DA+, DA-)
HIGH	LOW	Select B Port; (D+, D- = DB+, DB-)

Absolute Maximum Ratings

The safety of the device is not guaranteed when it is operated above the "Absolute Maximum Ratings". The device should not be operated at these "absolute" limits. Adhere to the "Recommended Operating Conditions" for proper device function. The information contained in the Electrical Characteristics tables and Typical Performance plots reflect the operating conditions noted on the tables and plots.

Parameter	Min	Max	Unit
Supply Voltage	-0.5	4.6	V
SEL Voltage	-0.5	4.6	V
Input Voltage Range (DA/B+, DA/B-)	0.5	$+V_S$ +0.3V	V
Input Voltage Range (D+, D- when $V_S > 0$)	0.5	$+V_S$ +0.3V	V
Input Voltage Range (D+, D- when $V_S = 0$)	-0.5	5.25	V
Input / Output Current		50	mA

Reliability Information

Parameter	Min	Typ	Max	Unit
Junction Temperature			150	°C
Storage Temperature Range	-65		150	°C
Lead Temperature (Soldering, 10s)			260	°C

ESD Protection

Product	DFN-10
Human Body Model (HBM)	8kV
Charged Device Model (CDM)	1.5kV
Charged Device Model (MM)	400V

Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
Operating Temperature Range	-40		+125	°C
Supply Voltage Range	3		4.3	V
SEL Voltage Range	0		V_S	V
Input Voltage Range (D+, D-, DA/B+, DA/B-)	0		V_S	V

Electrical Characteristics

T_A = 25°C, V_S = +3V, **bold** indicates -40°C to +125°C of T_j; unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Frequency Domain Response						
BW_{-3dB}	-3dB Bandwidth	$R_L = R_S = 50\Omega$, C_L = 0pF		720		MHz
		$R_L = R_S = 50\Omega$, C_L = 5pF		550		MHz
Time Domain Response						
t_{ON}	Turn-On Time	$V_{IN/OUT}$ = 0.8V, $R_L = 50\Omega$, C_L = 5pF, $V_{SEL\_HIGH} = V_S$, V_{SEL_LOW} = 0, 3 ≤ V_S ≤ 3.6V		13	30	ns
t_{OFF}	Turn-Off Time	$V_{IN/OUT}$ = 0.8V, $R_L = 50\Omega$, C_L = 5pF, $V_{SEL\_HIGH} = V_S$, V_{SEL_LOW} = 0, 3 ≤ V_S ≤ 3.6V		12	25	ns
$t_{PD\_RISE/FALL}$	Rise/Fall Propagation Delay	$R_L = R_S = 50\Omega$, C_L = 5pF, V_S = 3.3V		0.25		ns
t_{BBM}	Break-Before-Make Delay Time	$R_L = R_S = 50\Omega$, C_L = 5pF, 3 ≤ V_S ≤ 3.6V		5		ns
t_{SK1}	Output Skew Between Switches	Skew between Switch 1 and Switch 2, $R_L = 50\Omega$, C_L = 5pF, 3 ≤ V_S ≤ 3.6V		0.05		ns
t_{SK2}	Output Skew of Same Switches	Skew between opposite transitions in same switch, $R_L = 50\Omega$, C_L = 5pF, 3 ≤ V_S ≤ 3.6V		0.02		ns
Distortion/Noise Response						
OFF_{ISO}	Off Isolation	f = 240MHz, $R_L = R_S = 50\Omega$, C_L = 0pF, V_S = 3V		-30		dB
X_{TALK}	Crosstalk	Channel-to-channel at f = 240MHz, $R_L = R_S = 50\Omega$, C_L = 0pF, V_S = 3V		-45		dB
DC Performance						
V_{SEL_HIGH}	Control Input High Voltage	3 ≤ V_S ≤ 3.6V	**1.3**			V
		V_S = 4.3V	**1.7**			V
V_{SEL_LOW}	Control Input Low Voltage	3 ≤ V_S ≤ 3.6V			**0.5**	V
		V_S = 4.3V			**0.7**	V
I_{SEL}	Control Input Leakage Current	0 ≤ V_{SEL} ≤ V_S, V_S = 4.3V	**-1**		**1**	µA
I_S	Quiescent Supply Current	V_{SEL} = 0V or V_S, $I_{IN/OUT}$ = 0A			**1**	µA
I_{ST}	Increase in I_S on V_S pin per Control Voltage	V_{SEL} = 2.6V, V_S = 4.3V			**10**	µA
		V_{SEL} = 1.8V, V_S = 4.3V			**30**	µA
I_{LEAK}	OFF-State Leakage Current on D±, DA/B±	0 < $V_{D±, DA±, DB±}$ ≤ 3.6V, V_S = 4.3V	**-2**		**2**	µA
I_{OFF}	Power OFF Leakage Current on D±	$V_{D±}$ = 4.3V, V_S = 0V	**-2**		**2**	µA
R_{ON}	ON Resistance	$V_{IN/OUT}$ = 0.4V, $I_{IN/OUT}$ = 8A, V_S = 3V		4	**6.5**	Ω
Δ R_{ON}	ON Resistance Match Between Channels(1)	$V_{IN/OUT}$ = 0.4V, $I_{IN/OUT}$ = 8A, V_S = 3V		0.35		Ω
R_{FLAT_ON}	R_{ON} Flatness(2)	0V < $V_{IN/OUT}$ ≤ 1.0V, $I_{IN/OUT}$ = 8A, V_S = 3V		1		Ω
Capacitance						
C_{IN}	Control Pin Input Capacitance	f = 240MHz, V_S = 0V		1.5		pF
C_{ON}	ON Capacitance	f = 240MHz, V_S = 3.6V		7		pF
C_{OFF}	OFF Capacitance	f = 240MHz, V_S = 3.6V		3.5		pF

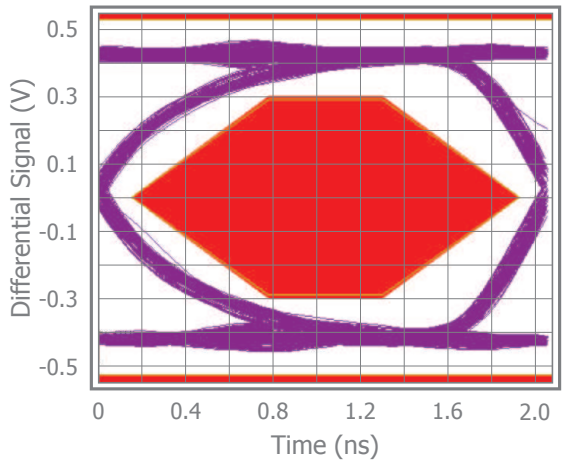
Notes:

1. Δ $R_{ON(MAX)}$ = | R_{ON} (Channel1) - R_{ON} (Channel2) |
2. R_{FLAT_ON} is defined as the difference between the maximun and minimum value of R_{ON} measured over specified $V_{IN/OUT}$ range.

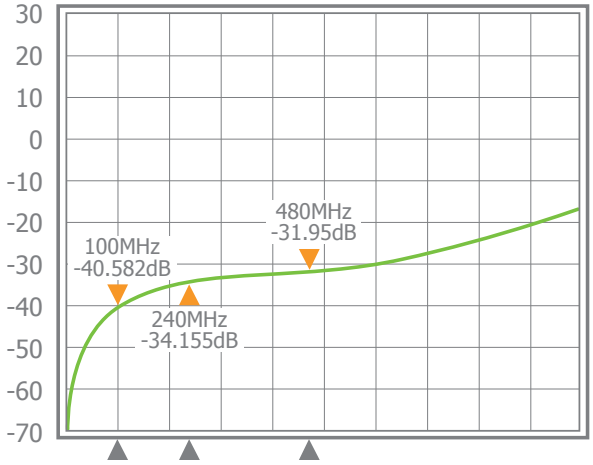
Typical Performance Characteristics

T_A = 25°C, V_S = +3V; unless otherwise noted.

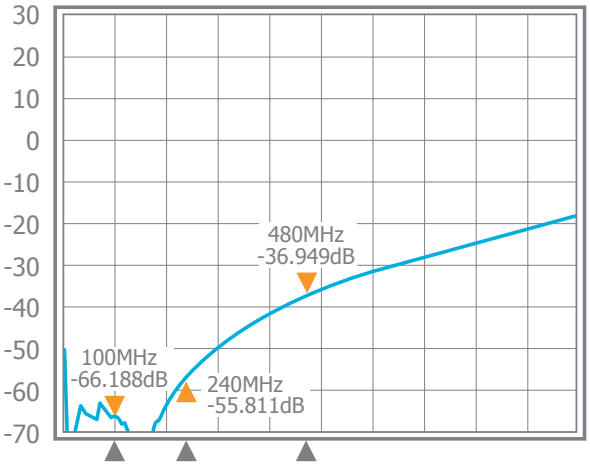
Eye Diagram



Off Isolation vs. Frequency



Crosstalk vs. Frequency



Timing Diagrams

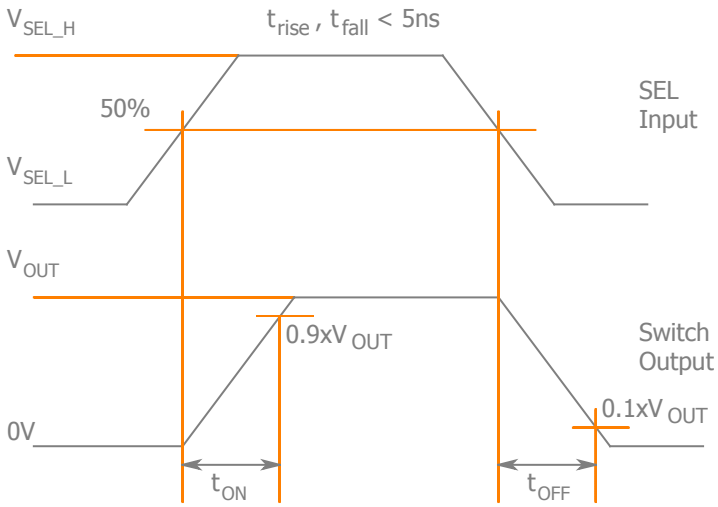


Figure 1. t_{ON}, t_{OFF}

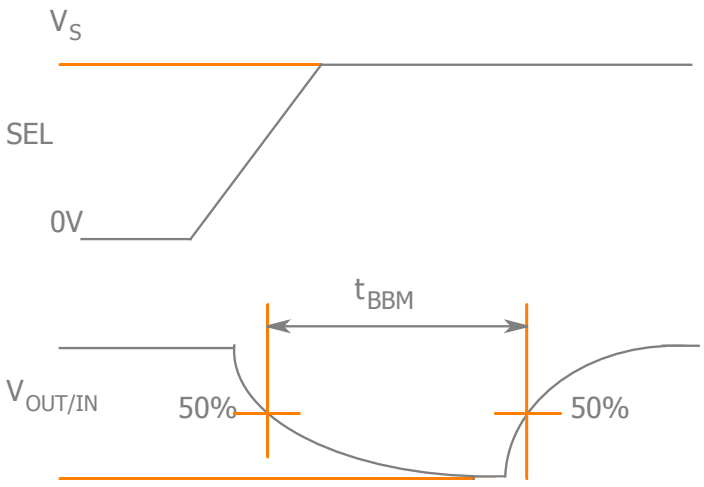
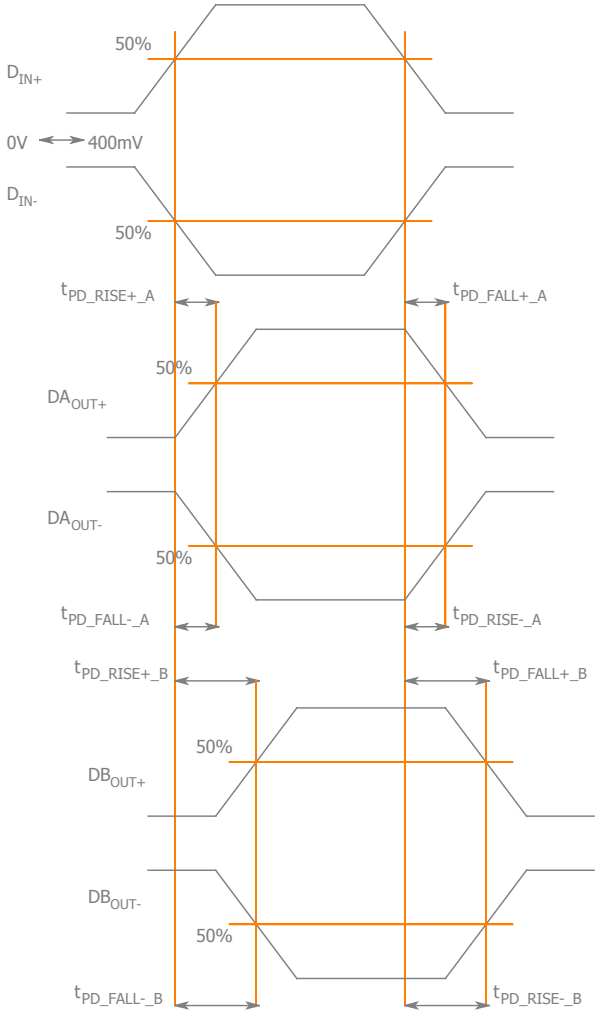


Figure 2. Break - Before - Make Time



Rise-Time Propagation Delay

t_{PD_RISE+}, t_{PD_RISE-}

Fall-Time Propagation Delay

t_{PD_FALL+}, t_{PD_FALL-}

Output Skew Between Switches

$t_{SK(O)} = | (t_{PD\_RISE+/-\_A}) - (t_{PD\_RISE+/-\_B}) |$
OR $t_{SK(O)} = | (t_{PD\_FALL+/-\_A}) - (t_{PD\_FALL+/-\_B}) |$

Output Skew Same Switch

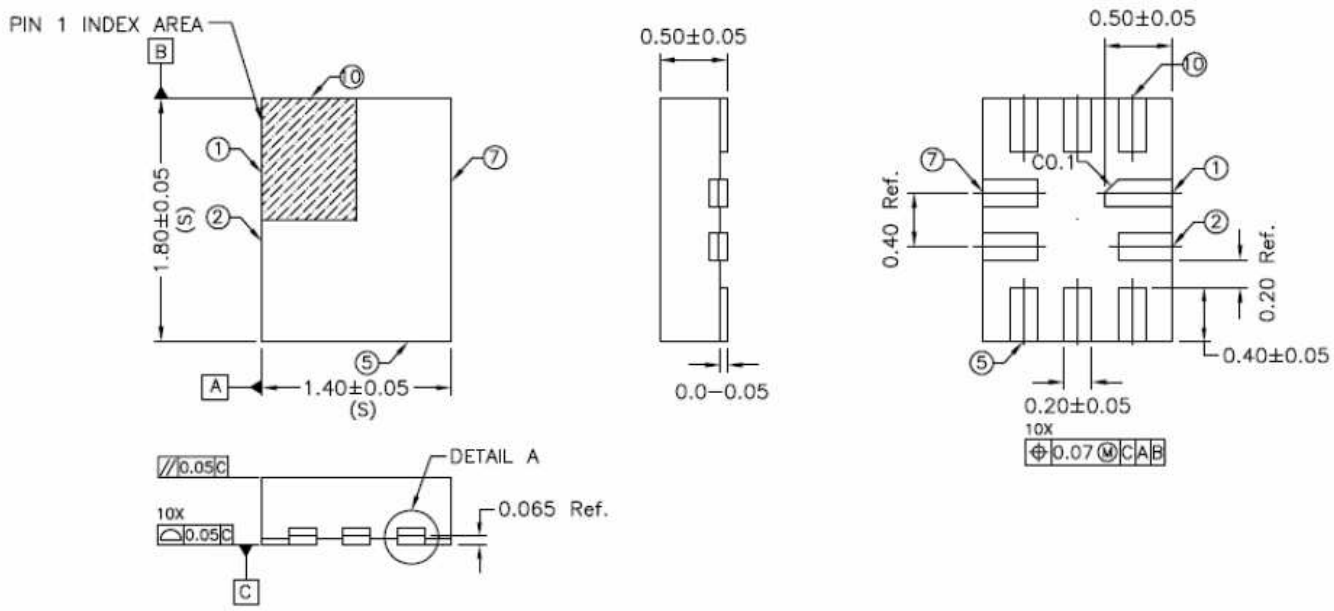
$t_{SK(P)} = | (t_{PD\_RISE+\_A/B}) - (t_{PD\_FALL+\_A/B}) |$
OR $t_{SK(P)} = | (t_{PD\_RISE-\_A/B}) - (t_{PD\_FALL-\_A/B}) |$

Figure 3. Rise / Fall Propagation Delay & Skew

Mechanical Dimensions

QFN-10 Package

Dimensions are in millimeters, unless otherwise noted.



NOTE :

1. ALL DIMENSION ARE IN mm. ANGLES IN DEGREES.
2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS. COPLANARITY SHALL NOT EXCEED 0.05 mm.
3. WARPAGE SHALL NOT EXCEED 0.05 mm.
4. PACKAGE LENGTH / PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC.(S)
5. REFER JEDEC MO-236/MO-248

For additional information regarding our products, please visit CADEKA at: cadeka.com

CADEKA Headquarters Loveland, Colorado
T: 970.663.5452
T: 877.663.5452 (toll free)

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