Dual 2:1 USB2.0 Mux/De-Mux with DC 30V Over-Voltage Protection

Descriptions

The RLCS4000M is a bidirectional low-power dual port, high-speed, USB 2.0 analog switch with integrated protection for USB Type-C™ systems. The device is configured as a dual 2:1 or 1:2 switch. It is optimized for use with the USB 2.0 DP/DM lines in a USB Type-C™ system.The RLCS4000M integrated over-voltage protection on the C0+/- pins can withstand up to DC 30V with automatic shutoff circuitry in order to protect system components behind the switch. GPIO controls of SEL and _EN are 1.8V logic compatible. The RLCS4000M is available in MSOP-10L with Pb-free and Halogen-free making it a perfect candidate for mobile and space constrained applications.

Features

- Supply Range 2.5 V to 5.5 V
- Differential 2:1 or 1:2 Switch/Multiplexer
- Up to DC 30V Overvoltage Protection (OVP) on C0+/- Ports
- IEC 64000-4-5 Surge Protection w/o External TVS onto C0+/- Ports: ±30V
- System Side Clamp Voltage Pulse Less than 9V, Duration Less than 200nS
- Powered Off Protection When VDD = 0 V
- Low RON of 10 Ω Typical
- Insertion loss: -1dB@200MHz, -2dB@650MHz, -3dB@1GHz
- C_{ON} of 4.8 pF , 1.8-V Compatible Logic Inputs,
- Standard Temperature Range of 0°C to 85°C

Applications

- Anywhere a USB Type-C™ o
- Micro-B Connector is Used
- Mobile Phones,
- Tablets and Notebooks

Functions and Pin Configuration

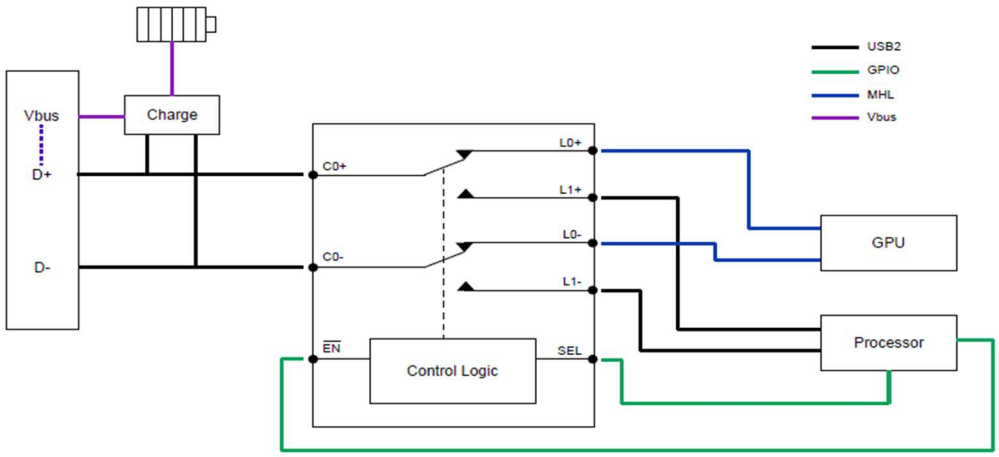


Fig.1 Functional Diagram

Pin Configuration

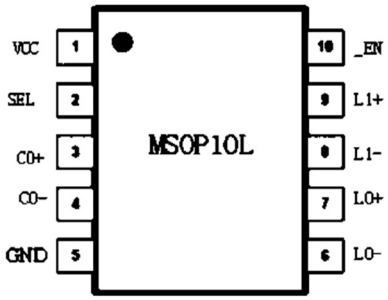


Fig.2 MSOP-10L

Pin Descriptions

MSOP-10L	Pin Name	Signal Type	Description
3	C0+	I/O	Signal I/O, Common Port
4	C0-	I/O	Signal I/O, Common Port
9	L1+	I/O	Signal I/O, Channle 1
8	L1-	I/O	Signal I/O, Channle 1
7	L0+	I/O	Signal I/O, Channle 0
6	L0-	I/O	Signal I/O, Channle 0
2	SEL	I	Operation Model Select (when SEL=0: C0→L0, when SEL=1: C0→L1)
10	_EN	I	_EN=1, Power Down is Enabled.
1	VDD	PWR	Positive Supply Voltage
5	GND	GND	Power Ground

Table-1 Pin Descriptions

Order Information

Package		Part Number	Quantity Per Reel
MSOP-10L	Tape and Reel	RLCS4000MS10/R6	3,000PCS

Table-2 Order Information

Truth Table

Function	SEL	_EN
C0+/- to L0+/-	L	L
C0+/- to L1+/-	H	L
All Switches Hi-Z	X	H

Table-3 Truth Table

Electrical Characteristics (Ta=25°C, VDD=3.3V, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
POWER SUPPLY						
Supply Voltage Range	VDD		2.5	3.3	5.5	V
Supply Current	I_{CC}	_EN =1 disconnection		0.6	2	uA
		_EN =0 connection		33		uA
SEL/_EN DIGITAL INPUT CONTOL						
control input logic high	V_{IH}		1.6		5.5	V
control input logic low	V_{IL}		-0.1		0.5	V
Internal pull-down resistor	R_{PD}			2		MΩ
SWITCH ON RESISTANCE AND OFF LEAKAGE						
On-Resistance	R_{ON}	V_{IS}= 0V~0.4V I_{OUT}=8mA		10	11	Ω
R_{ON} Flatness(1)	R_{FLAT}	V_{IS}= 0V~0.4V I_{OUT}=8mA		0.3	0.5	Ω
R_{ON} Matching Between Channels(2)	ΔR_{ON}	V_{IS}= 0V~0.4V I_{OUT}=8mA		0.1	0.2	Ω
OFF Leakage Current	I_{LEAK}	$V_{C0+/-}$=10V $V_{L1+/-}$= $V_{D2+/-}$ =0V		31	50	uA
SWITCH DYNAMICS						
On Capacitance	C_{ON}	$V_{C0+/-}$ = 0.2V, f = 1MHz		4		pF
Off Capacitance	C_{OFF}	$V_{C0+/-}$ = 0.2V, f = 1MHz		3		pF
Off Isolation	Off	f=250MHz, R_T=50Ω, C_L= 0pF		-38		dB
Crosstalk(3) (Channel-to-Channel)	X_{TALK}	f=250MHz, R_T=50Ω, C_L= 0pF		-41		dB
-3dB Bandwidth	BW	R_T=50Ω,C_L=0pF Signal Power 0dBm	0.9	1		GHz
Break-Before-Make	BBM	$V_{L1+/-}$=$V_{D2+/-}$ = 0.4V, R_L=50Ω		1.5		uS
Turn-on Time	t_{OFF}	$V_{C0+/-}$ = 0.4V, R_L=50Ω _EN switches from High to Low		20		uS
Turn-off Time	t_{OFF}	$V_{C0+/-}$ = 0.4V, R_L=50Ω _EN switches from Low to High		1.2		uS
Propagation Delay	t_{PD}	$V_{C0+/-}$ = 0.4V, R_L=50Ω		200		pS
OVER VOLTAGE PROTECTION						
OVP Lockout Threshold	V_{OVP}	$V_{C0+/-}$ Rising Edge	4.6	4.9	5.2	V
OVP Hysteresis	V_{HYS}	$V_{C0+/-}$ Falling Edge		200		mV
Clamp Voltage on L1+/- and $D_{2+/-}$	V_{CLAMP}	10V shorts to C0+/- with R_L=1KΩ @ L1+/- and $D_{2+/-}$		6.5	8	V
OVP Response Time	t_{FP}	10V shorts to C0+/- with R_L=1KΩ @ L1+/- and $D_{2+/-}$		200	300	nS
OVP Recovery Time	t_{FPR}	$V_{C0+/-}$ jumps from 6V to 1V step	30	45	60	uS

Table-4 Electrical Characteristics

Note:

(1) Flatness is defined as the difference between maximum and minimum value of ON-resistance at the specified analog signal voltage points.

(2) R_{ON} matching between channels is calculated by subtracting the channel with the lowest max Ron value from the channel with the highest max Ron value.

(3) Crosstalk is inversely proportional to source impedance

Typical Performance Curves (Ta=25°C, VDD=3.0V, CAP=0.1uF, unless otherwise noted)

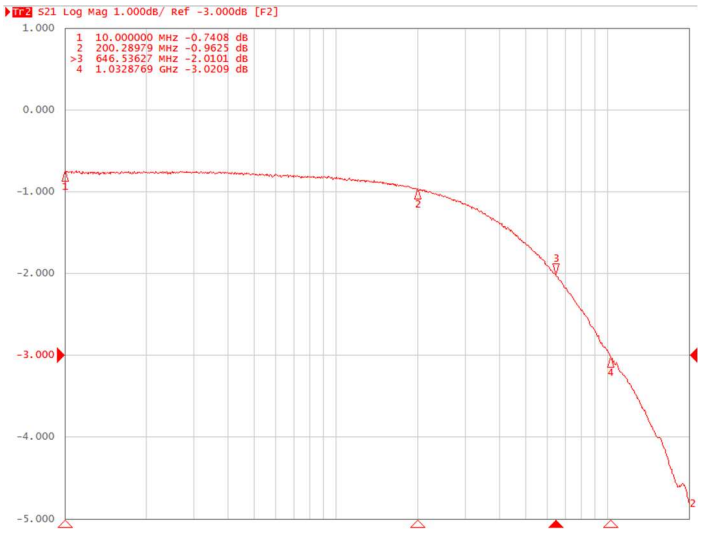


Fig.3 Switch Bandwidth or Insertion Loss

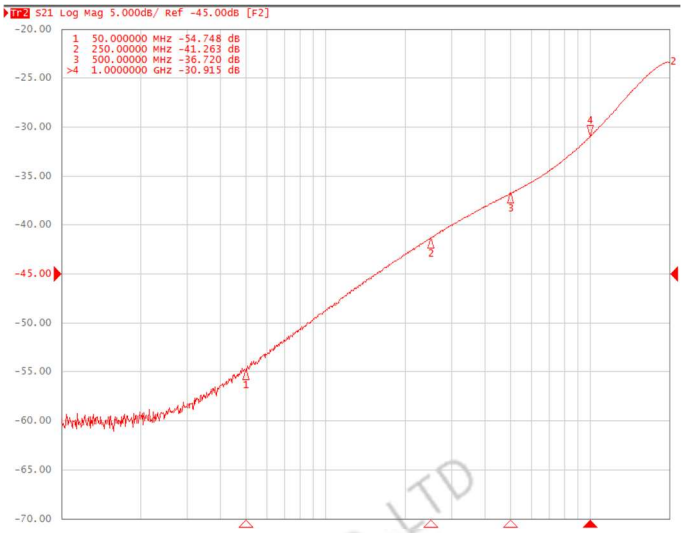


Fig.4 Switch Channel to Channel Cross-Talk

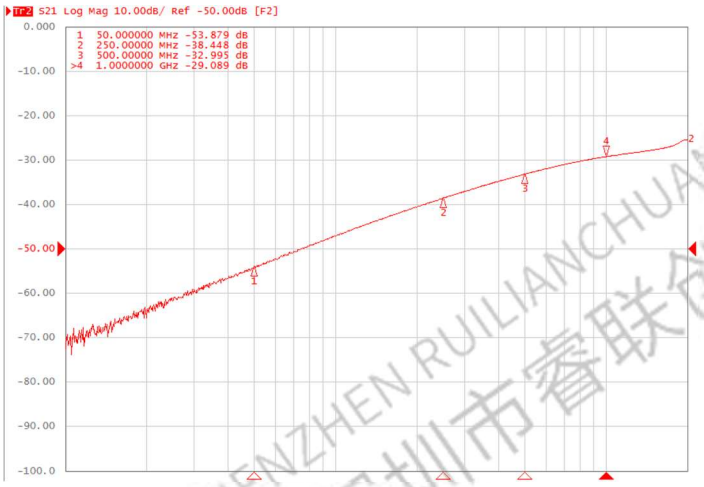
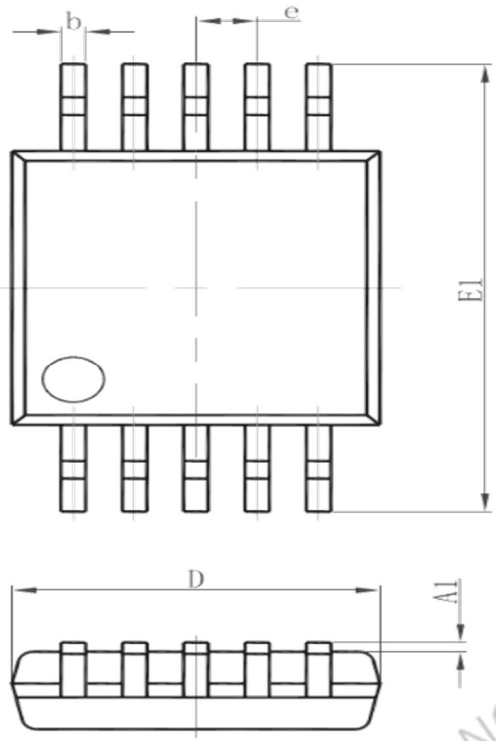


Fig.5 Switch Off Isolation

Package Outline Dimension

MSOP-10L



Symbol	Dimension in Millimeters	
	Min.	Max.
A	0.820	1.100
A1	0.020	0.150
A2	0.750	0.950
b	0.180	0.280
c	0.090	0.230
D	2.900	3.100
e	0.50(BSC)	
E	2.900	3.100
E1	4.750	5.050
L	0.400	0.800
θ	0°	6°

Table-5 Package Dimension

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