2:1 Mux/DeMux High Bandwidth HDMI™ 2.1 Compliant Signal Switch

Descriptions

RLCS412Q series of switch circuits are targeted for high-resolution video network that are based on DVI/HDMI™ standard, and TMDS signal process. The RLCS412Q is an 8- to 4-Channel HMux/DeMux Switch. The device multiplexes differential signals to one of two corresponding outputs. The switch is bidirectional and offers little or no attenuation of the high-speed signals at the outputs. It is designed for low bit-to-bit skew and high channel-to-channel noise isolation.

The high bandwidth provides the resolution required by the next generation HDTV and PC graphics. Three differential channels are used for data (video signals for DVI or audio/video signals for HDMI), and one differential channel is used for Clock for decoding the TMDS signals at the outputs.

Because of its passive bidirectional feature, this switch can be used either at the video driver side or at the receiver side. For PC graphics applications, the device sits at the driver side to switch between multiple display units such as LCD monitor, projector, TV, etc. For consumer video applications, the device sits at the receiver end to switch between the source components such as DVD, D-VHS, STB, etc.

Features

- 4-Differential Channel 2:1 Mux/DeMux
- HDMI 2.1 compatible
- High Bandwidth: 5.7GHz @-3dB BW
- Supports both AC coupled and DC coupled signals
- Isolation: -40dB @ 2.0 Gbps
- Crosstalk: -31dB @ 2.0 Gbps
- ESD Tolerance: 2kV HBM
- Low bit-to-bit skew, Bidirectional

Applications

- Routing of HDMI 2.1 video signals with low signal attenuation between source and sink for 4K2K ultra high definition video display and broadcast video equipment.
- Routing of DisplayPort video signals with low signal attenuation between source and sink for PC and monitor.

Order information

Package		Part Number	Quantity per Reel
QFN 9×3.5-42L	Tape and Reel	RLCS412QN42/R6	3000PCS

Block Diagram and Pin Configuration

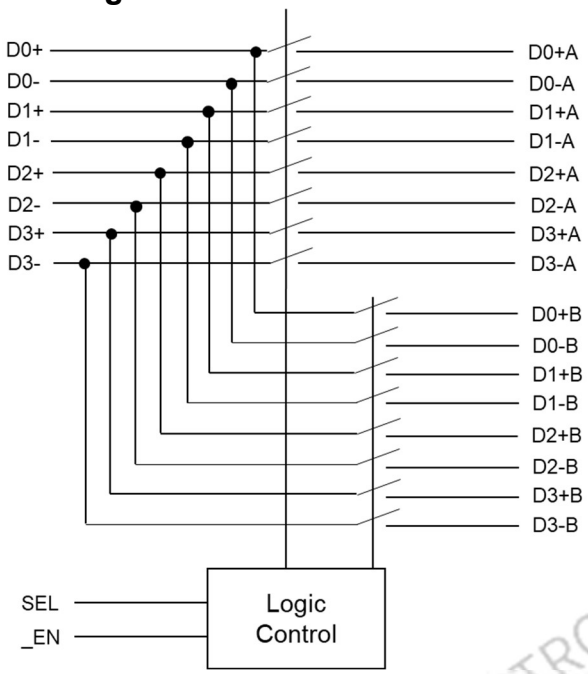


Fig.1 Block Diagram

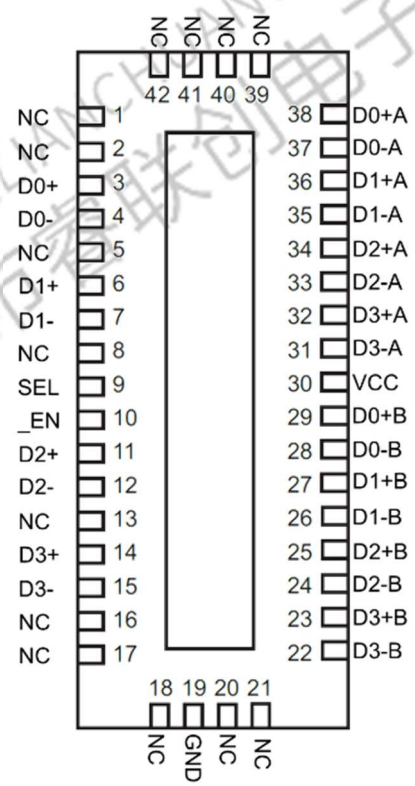


Fig.2 Top-Through View

Pin Description

Pin#	Pin Name	Signal Type	Description
3	D0+	I/O	Positive differential signal 0 for COM port
4	D0-	I/O	Negative differential signal 0 for COM port
6	D1+	I/O	Positive differential signal 1 for COM port
7	D1-	I/O	Negative differential signal 1 for COM port
9	SEL	I	Select Pin, See Truth Table
10	_EN	I	Enable Pin, Active Low
11	D2+	I/O	Positive differential signal 2 for COM port
12	D2-	I/O	Negative differential signal 2 for COM port
14	D3+	I/O	Positive differential signal 3 for COM port
15	D3-	I/O	Negative differential signal 3 for COM port
19	GND	Ground	Power Ground
22	D3-B	I/O	Negative differential signal 3 for port B
23	D3+B	I/O	Positive differential signal 3 for port B
24	D2-B	I/O	Negative differential signal 2 for port B
25	D2+B	I/O	Positive differential signal 2 for port B
26	D1-B	I/O	Negative differential signal 1 for port B
27	D1+B	I/O	Positive differential signal 1 for port B
28	D0-B	I/O	Negative differential signal 0 for port B
29	D0+B	I/O	Positive differential signal 0 for port B
30	VCC	Power	Positive Supply Voltage
31	D3-A	I/O	Negative differential signal 3 for port A
32	D3+A	I/O	Positive differential signal 3 for port A
33	D2-A	I/O	Negative differential signal 2 for port A
34	D2+A	I/O	Positive differential signal 2 for port A
35	D1-A	I/O	Negative differential signal 1 for port A
36	D1+A	I/O	Positive differential signal 1 for port A
37	D0-A	I/O	Negative differential signal 0 for port A
38	D0+A	I/O	Positive differential signal 0 for port A
Others	NC	/	Not Connected

Truth Table

_EN	SEL	Dx+/-
High	X	Hi-Z
Low	Low	Dx+/-A
Low	High	Dx+/-B

Note:

1. x=0,1,2,3

Maximum Ratings

(Above which useful life may be impaired. For user guidelines, not tested.)

Storage Temperature	-65℃ to +150℃
Junction Temperature	125°C
Supply Voltage to Ground Potential	-0.5V to +5.5V
High Speed Data Channel D0~D3	-0.5V to 3.8V
CEC, SCL, SDA, HPD	-0.5V to 5.5V
DC Input Voltage	-0.5V to VCC
DC Output Current	120mA
Power Dissipation	0.5W

Notes:

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Electrical Characteristics

Parameter			Test conditions(1)	Min	Typ.(2)	Max	Unit
PORT A							
R_{ON}	ON-state resistance	D0 to D3	V_{CC}=3V, 1.5V≤$V_{I/O}$≤V_{CC}, $I_{I/O}$=-40mA		6.5	9.5	Ω
		SCL,SDA, HPD,CEC			6	9.5	Ω
$R_{ON(flat)}$	ON-state resistance flatness	All I/O	V_{CC}=3V, $V_{I/O}$ =1.5V and V_{CC},$I_{I/O}$=-40mA		1.5		Ω
ΔR_{ON}	On-state resistance match between high-speed channels	D0 to D3	V_{CC}=3V,1.5V≤$V_{I/O}$≤V_{CC}, $I_{I/O}$=-40mA		0.4	1	Ω
I_{OFF}	Leakage under power off	All outputs	V_{CC}=0V, $V_{I/O}$ =0V to 3.6V , V_{IN}=V to 5.5V		±10		uA
PORTB							
R_{ON}	ON-state resistance	D0 to D3	V_{CC}=3V, 1.5V≤$V_{I/O}$≤V_{CC}, $I_{I/O}$=-40mA		8.2	10.5	Ω
		SCL,SDA, HPD,CEC			6	9.5	Ω
$R_{ON(flat)}$	ON-state resistance flatness	All I/O	V_{CC}=3V, $V_{I/O}$ =1.5V and V_{CC},$I_{I/O}$=-40mA		1.5		Ω
ΔR_{ON}	On-state resistance match between high-speed channels	D0 to D3	V_{CC}=3V,1.5V≤$V_{I/O}$≤V_{CC}, $I_{I/O}$=-40mA		0.4	1	Ω
I_{OFF}	Leakage under power off	All outputs	V_{CC}=0V, $V_{I/O}$ =0V to 3.6V , V_{IN}=V to 5.5V			±10	uA
DIGITAL INPUTS(SEL1,SEL2,EN1,EN2)							
VIH	High-level control input voltage	SEL1, SEL2, EN1, EN2		1.4			V
VIL	LOW-level control input voltage					0.5	V
VIH	Digital input high leakage current		V_{CC}=3.6V, V_{IN}=VCC			±10	uA
VIL	Digital input low leakage current		V_{CC}=3.6V, V_{IN}=GND			±10	uA
SUPPLY							
I_{CC}	VCC supply current		V_{CC}=3.6V, $I_{I/O}$ =0,Normal operation mode, _ENx=L		100		uA
I_{CC}, PD	VCC supply current in power-down mode		V_{CC}=3.6V, $I_{I/O}$ =0, _ENx=H		2		uA

Notes:

1. V_I, Vo. I_I, and I_O refer to I/0 pins, V_{IN} refers to the control inputs.
2. All typical values are at Vcc = 3.3 V (unless otherwise noted), TA = 25°C.
3. $R_{(ON/FLAT)}$ is the difference of R_{ON} in a given channel at specified voltages.
4. ΔR_{ON} is the difference of R_{ON} from center port to any other ports.

Switching Characteristics (TA= -40℃ to +105°C, VCC=3.3V±10%)

Parameter	Description	Min.	Typ.	Max	Unit
T_{pd}	Propagation delay (input pin to output pin) on all channels		80		ps
t_{b-b}	Bit-to-bit skew within the same differential pair of Dx± channels		5	7	ps
t_{ch-ch}	Channel-to-channel skew of Dx+ channels			35	ps
Tsw a-b	Time it takes to switch from port A to port B			0.1	us
Tsw b-a	Time it takes to switch from port B to port A			0.1	us
Tstartup	VCC valid to channel enable			10	us
Twakeup	Enabling output by changing OE from low to High			10	us

Dynamic Electrical Characteristics Over Operating Range (TA= -40° to +105°C, VCC=3.3V±10%)

Parameter	Description	Test conditions		Min.	Typ.	Max	Unit
X_{TALK}	Crosstalk on High Speed Channels	See Fig.3 for Measurement setup	f = 3.0GHz		-25	-22	dB
			f = 2.7GHz		-28	-25	
			f = 1.7GHz		-31	-28	
			f = 1.35GHz		-32	-28	
O_{IRR}	OFF Isolation on High Speed Channels	See Fig.4 for Measurement setup	f = 3.0GHz		-22	-20	
			f = 2.7GHz		-22	-20	
			f = 1.7GHz		-29	-26	
			f = 1.35GHz		-30	-27	
I_{LOSS}	Different Insertion Loss on High Speed Channels	@3.0GHz(see Fig.5)		-2.0	-1.7		dB
		@5.4GHz(see Fig.5)		-2.0	-1.7		
R_{LOSS}	Different Return Loss on High Speed Channels	@3.0GHz(6.0Gbps)			-16.0	-14	dB
		@2.7GHz(5.4Gbps)			-14.0	-12.5	
BW	Bandwidth -3dB	see Fig.5			5.7		GHz

Note:

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteris-tics for the applicable device type.
2. Typical values are at VCC=3.3V,TA=25℃ ambient and maximum loading.

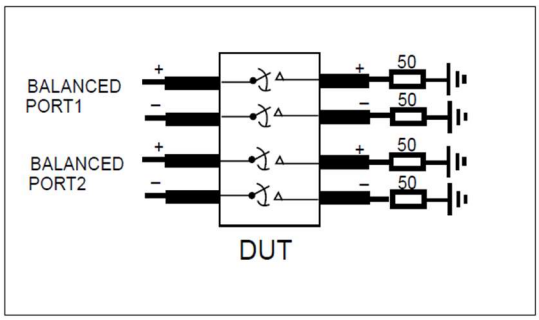


Fig.3 Crosstalk Setup

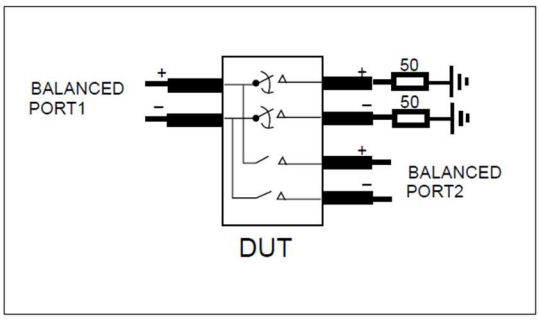


Fig.4 OFF-isolation

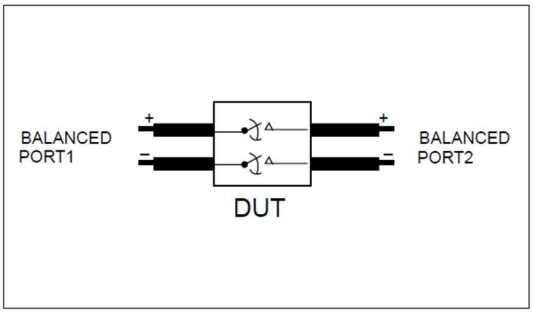
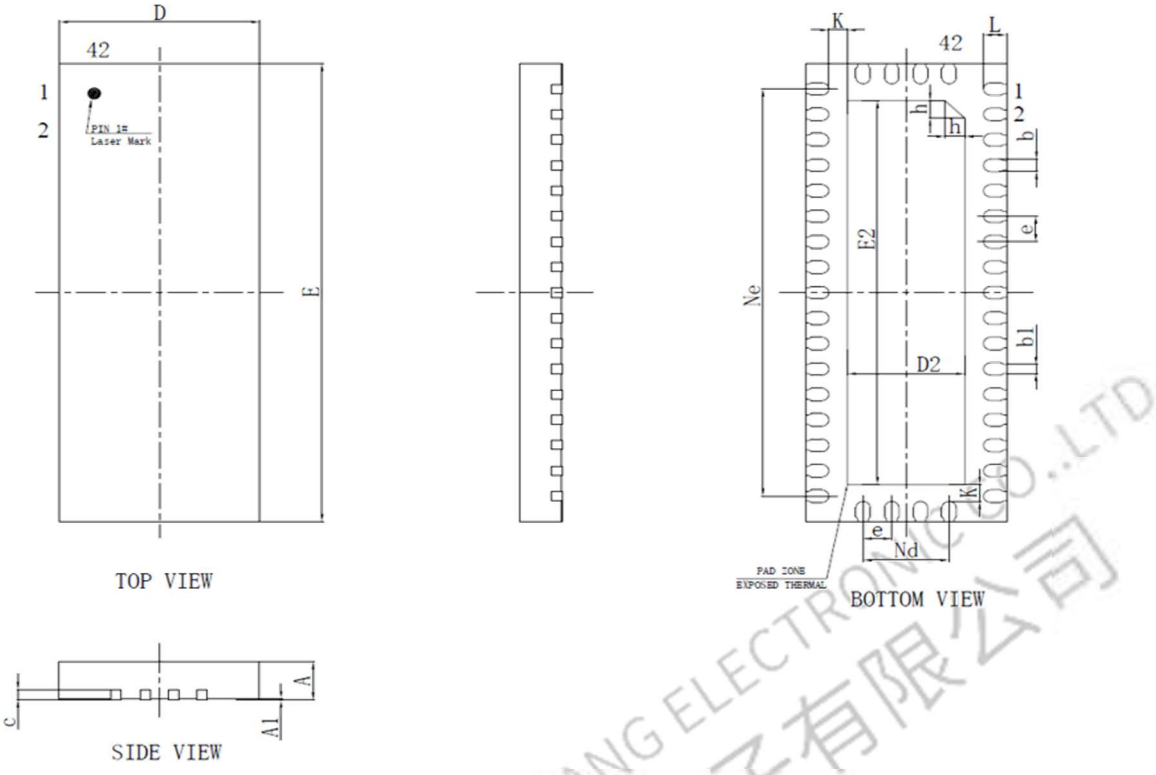


Fig.5 Different Insertion Loss

Package Outline Dimensions



Package Mechanical:42-Pin

Symbol	Millimeter		
	Min	Nom	Max
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.20	0.25	0.30
b1		0.18REF	
c		0.203REF	
D	3.40	3.50	3.60
D2	1.95	2.05	2.15
e		0.50BSC	
Nd		1.50BSC	
E	8.90	9.00	9.10
E2	7.45	7.55	7.65
Ne		8.00BSC	
L	0.35	0.40	0.45
h	0.30	0.35	0.40
K		0.325REF	

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