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

Descriptions

The RLCS422 is an 8-to-4-channel Mux/DeMux switch designed for DVI/HDMI™ standards and TMDS signal processing. It multiplexes differential signals bidirectionally with minimal signal attenuation, ensuring low skew and high noise isolation. Its high bandwidth supports next-gen HDTV and PC graphics. Three channels handle data (DVI video or HDMI audio/video), while one manages clock signals for TMDS decoding. The switch works passively at both driver (e.g., LCD, projector, TV) and receiver (e.g., DVD, STB) ends. Its wide voltage range enables DC-coupled multi-standard operation, saving space by eliminating AC capacitors. It also supports 0V-3.3V CMOS signals up to 1MHz and switches DDC/HPD signals.

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
- Supports DDC with HPD channel mux/demux @ HDMI
- Supports 720 Mbps high-speed DP AUX @ DP

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	Top-Side Marking
QFN 5×5-40L	Tape and Reel	RLCS422QN40/R6	RLCS422

SHENZHEN RUILIANCHUANG ELECTRONIC CO.,LTD 深圳市睿联创电子有限公司

Block Diagram and Pin Configuration

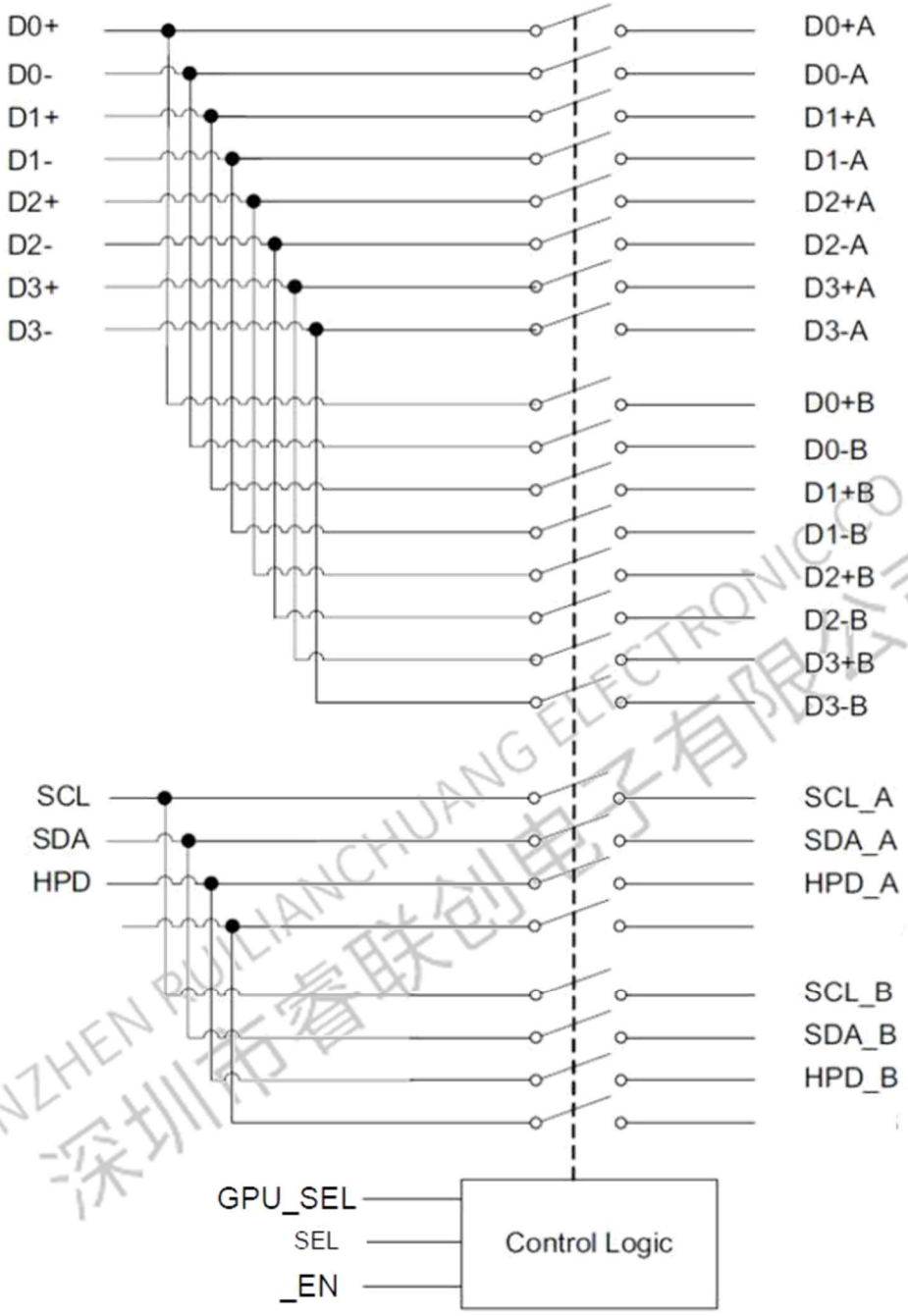


Fig.1 Block Diagram

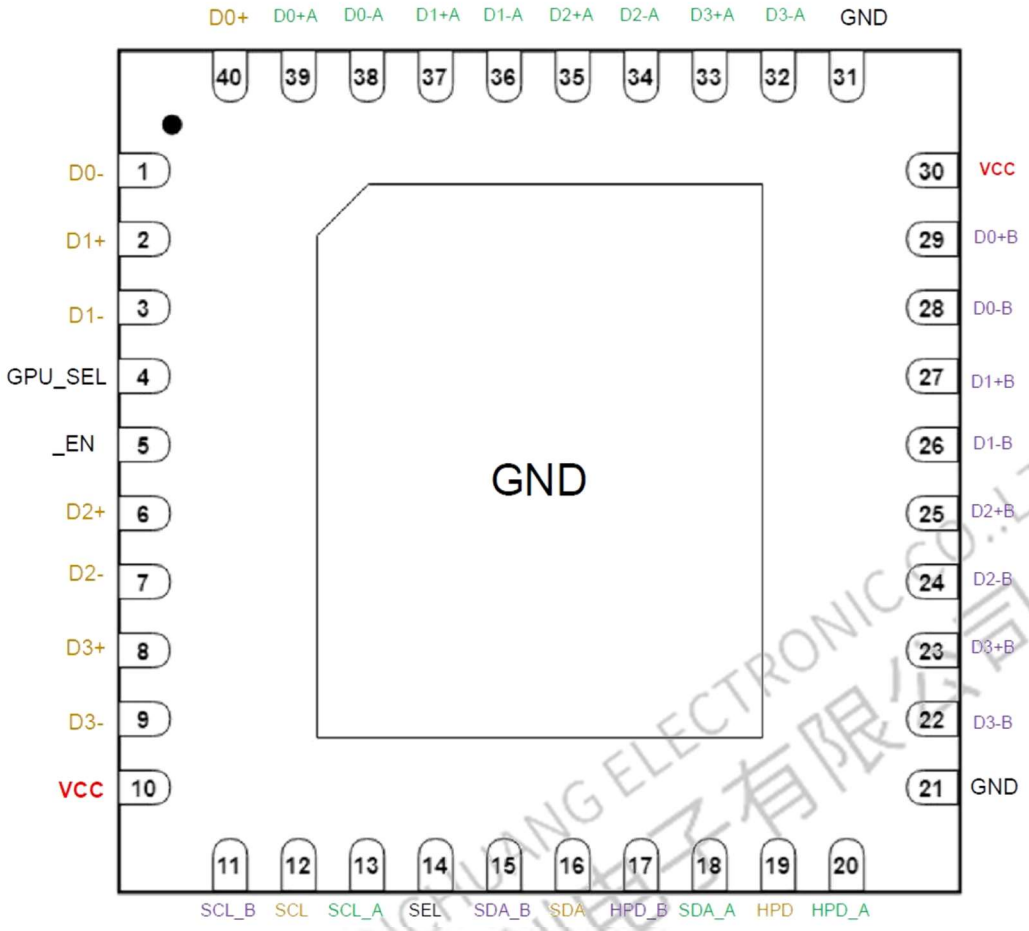


Fig.2 Top-Through View

Truth Table

_EN	GPU_SEL	D0-D3
High	X	Hi-Z
Low	Low	A
Low	High	B

SEL	SCL	SDA	HPD
X	Hi-Z	Hi-Z	Hi-Z
Low	A	A	A
High	B	B	B

Pin Description

Pin#	Pin Name	Signal Type	Description
40	D0+	I/O	Positive differential signal 0 for COM port
1	D0-	I/O	Negative differential signal 0 for COM port
2	D1+	I/O	Positive differential signal 1 for COM port
3	D1-	I/O	Negative differential signal 1 for COM port
4	GPU_SEL	I	GPU Switch logic control
5	_EN	I	Chip Enable, Active low
6	D2+	I/O	Positive differential signal 2 for COM port
7	D2-	I/O	Negative differential signal 2 for COM port
8	D3+	I/O	Positive differential signal 3 for COM port
9	D3-	I/O	Negative differential signal 3 for COM port
10,30	VCC	Power	Supply Voltage
11	SCL_B	I/O	DDC clock for port B
12	SCL	I/O	DDC clock for COM port
13	SCL_A	I/O	DDC clock for port A
14	SEL	I	Switch logic control for DDC/AUX and HPD
15	SDA_B	I/O	DDC data for port B
16	SDA	I/O	DDC data for COM port
17	HPD_B	I/O	Hot plug detect for B port
18	SDA_A	I/O	DDC data for port A
19	HPD	I/O	Hot plug detect for COM port
20	HPD_A	I/O	Hot plug detect for port A
21,31	GND	Ground	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
32	D3-A	I/O	Negative differential signal 3 for port A
33	D3+A	I/O	Positive differential signal 3 for port A
34	D2-A	I/O	Negative differential signal 2 for port A
35	D2+A	I/O	Positive differential signal 2 for port A
36	D1-A	I/O	Negative differential signal 1 for port A
37	D1+A	I/O	Positive differential signal 1 for port A
38	D0-A	I/O	Negative differential signal 0 for port A
39	D0+A	I/O	Positive differential signal 0 for port A

SHENZHEN RUILIANCHUANG ELECTRONIC CO.,LTD 深圳市睿联创电子有限公司

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.

SHENZHEN RUILIANCHUANG ELECTRONIC CO.,LTD
深圳市睿联创电子有限公司

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
PORT B							
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
Tstart up	VCC valid to channel enable			10	us
Twake up	Enabling output by changing OE from low to High			10	us

SHENZHEN RUILIANCHUANG ELECTRONIC CO.,LTD
深圳市睿联创电子有限公司

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.

SHENZHEN RUILIANCHUANG ELECTRONIC CO.,LTD 深圳市睿联创电子有限公司

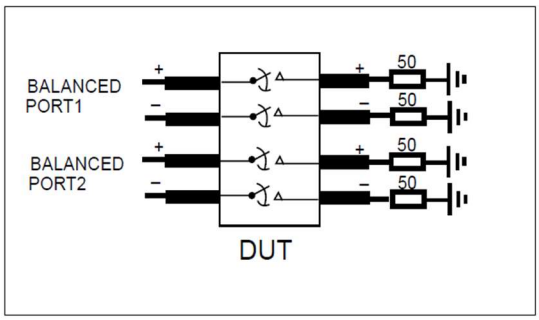


Fig.3 Crosstalk Setup

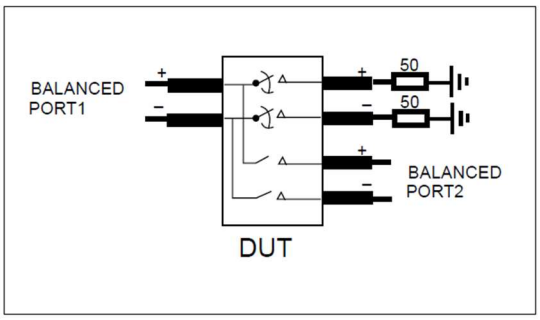


Fig.4 OFF-isolation

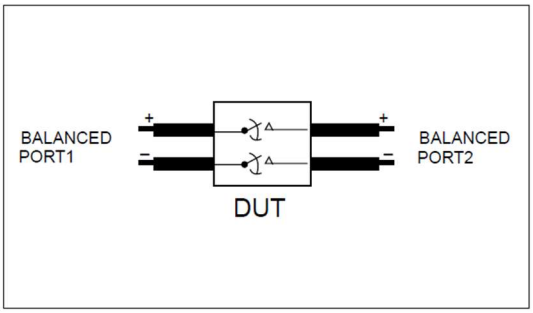
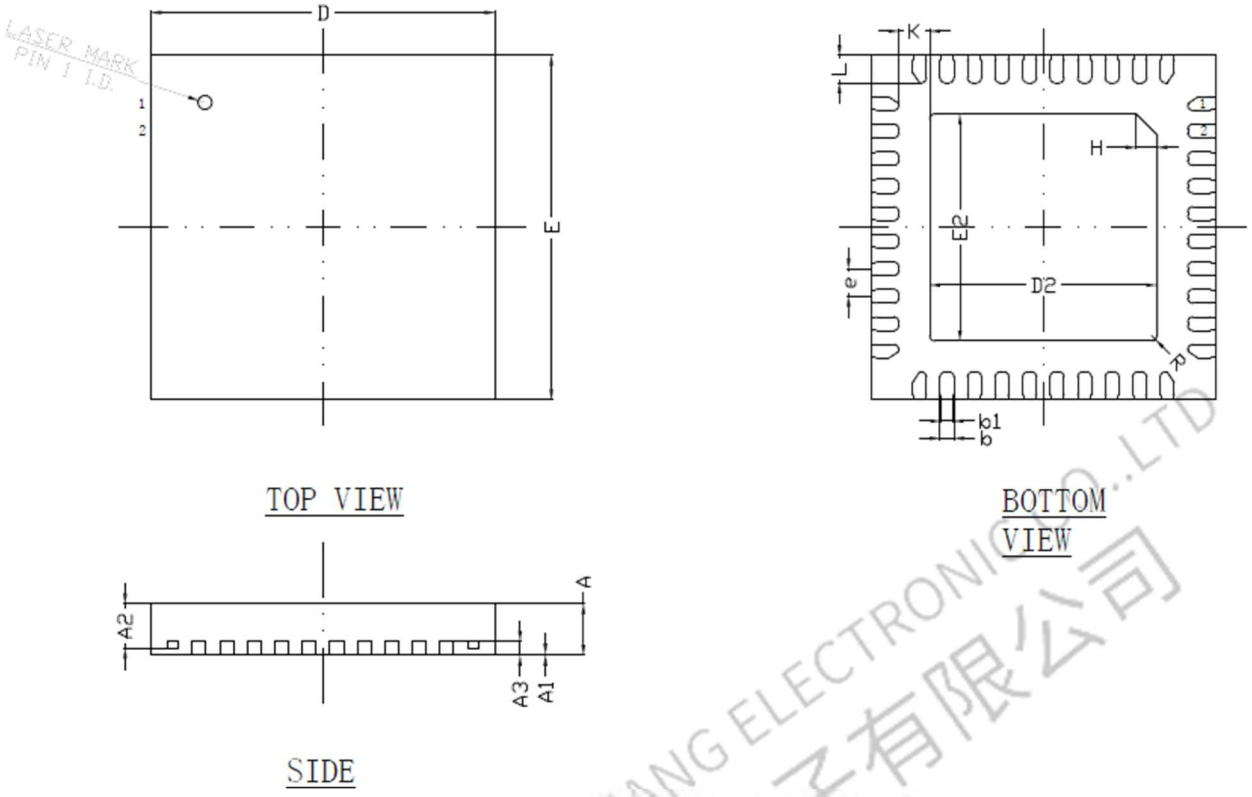


Fig.5 Different Insertion Loss

SHENZHEN RUILIANCHUANG ELECTRONIC CO.,LTD
深圳市睿联创电子有限公司

Package Outline Dimensions



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.02	0.05
A2	0.60	0.65	0.70
A3		0.20REF	
b	0.15	0.20	0.25
b1		0.18REF	
D	4.90	5.00	5.10
E	4.90	5.00	5.10
D2	3.20	3.30	3.40
E2	3.20	3.30	3.40
e		0.40BSC	
H	0.25	0.30	0.35
K		0.45REF	
L	0.35	0.40	0.45
R		0.075REF	

SHENZHEN RUILIANCHUANG ELECTRONIC CO.,LTD
深圳市睿联创电子有限公司

Important Note

As the RLC product continues to improve gradually, we may experience significant changes. RLC reserves the right to correct, modify, enhance, and amend the products and services they provide, as well as the right to discontinue any product or service. Before placing an order, customers should obtain the latest information to verify that it is current and complete. All products sold must comply with RLC's terms and conditions in order to ensure proper processing of orders. RLC guarantees that the products they sell conform to the terms and conditions applicable to semiconductor sales. Only under this guarantee does RLC consider it necessary to employ testing and quality control measures for their products. Unless mandated by applicable laws requiring strict compliance, there is no obligation for testing all product parameters. RLC does not assume responsibility for customer product design or application. The materials provided contain circuit examples and usage methods solely for reference purposes; they do not guarantee suitability for volume production designs. Additionally, these materials may contain errors that could result in damages incurred by customers; therefore, RLC disclaims any liability in such cases. Customers are advised to use products within the limits specified in these materials while paying particular attention to absolute maximum ratings, operating voltages, and voltage characteristics. Any use of products outside of these specifications absolves RLC from responsibility; customers must accept full responsibility themselves. To minimize risks associated with customer-designed applications, adequate design safety measures should be implemented. When using RLC products, please ensure compliance with relevant laws and regulations pertaining to your country or region regarding application standards as well as testing requirements related to safety performance. For exports of RLC products overseas, it is essential that you adhere strictly to foreign exchange regulations and transaction laws throughout all necessary procedures involved in exportation processes. In case of disposal of any abandoned RLC product(s), please follow appropriate rules and regulations for proper disposal.

RLC products are not designed to be radiation - resistant. Based on the intended usage, customers can incorporate radiation protection measures during the product design process. Under normal circumstances, RLC products do not harm human health. However, since they contain chemicals and heavy metals, do not put them in your mouth. Additionally, the fracture surfaces of wafers and chips can be sharp. When touching them with bare hands, please be careful to avoid injury.Semiconductor products have a certain probability of failure or malfunction. To prevent disruptions and social damages resulting from personal accidents, fire accidents, etc., as well as to avoid malfunctions, customers are required to be responsible for comprehensive design, implementing fire - spread prevention measures, and safety design against misoperation. Please conduct a full assessment of the entire system, and customers can determine its applicability on their own.This material also includes content related to the company's copyright and know - how. The records in this material are not intended to promise or guarantee the implementation and use of the company's and third - party intellectual property and other rights. Without the permission of our company, it is strictly prohibited to reprint, copy any part of this work, or disclose the material information to third parties.RLC shall not be held responsible for any damage or harm that occurs which is not related to the product itself, as well as for any infringement of third - party rights such as intellectual property rights.

For more details about this material, please contact our sales office.