



## ULS4X2

Advance

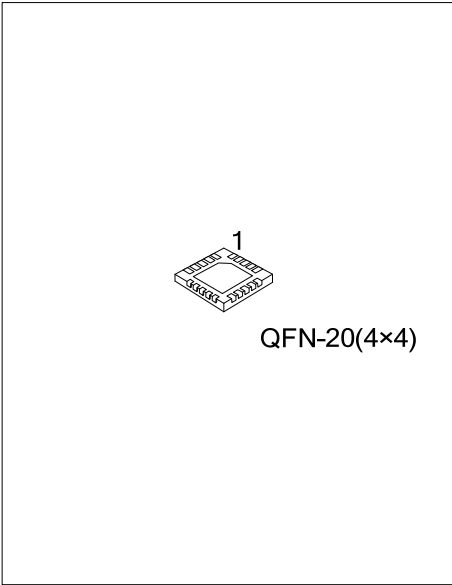
CMOS IC

### 4X2 SWITCH MATRIX WITH TONE/POLARITY CONTROLLER

#### DESCRIPTION

The UTC **ULS4X2** is a low-cost 4 x 2 switch matrix with tone detector in a 20-lead QFN package. It is used in RF multiplexing applications from 200 to 3000 MHz. There is a 4 bit decoder and tone/polarity detector integrated with RF switch which can reject DiSEqC control signals. Switch may be used in 50/75 ohm systems.

Both switch outputs (OP1 & OP2) can independently select any of the four inputs (HH, HL, VH, VL) or simultaneously select the same inputs. Note that the switch is bi-directional and input/output functionality may be interchanged.

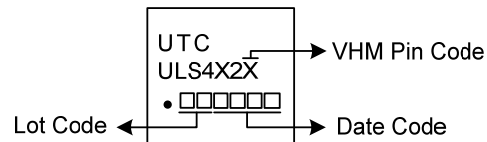


#### ORDERING INFORMATION

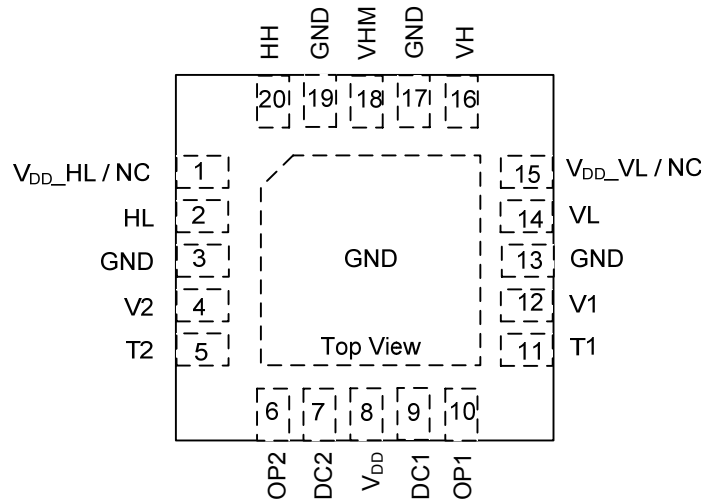
Ordering Number	Package	Packing
ULS4X2AG-Q20-4040-R	QFN-20(4x4)	Tape Reel
ULS4X2BG-Q20-4040-R	QFN-20(4x4)	Tape Reel

<p>ULS4X2XG-Q20-4040-R</p> <ul style="list-style-type: none"> <li>(1) Packing Type</li> <li>(2) Package Type</li> <li>(3) Green Package</li> <li>(4) VHM Pin Code</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel</li> <li>(2) Q20-4040: QFN-20(4x4)</li> <li>(3) G: Halogen Free and Lead Free</li> <li>(4) Refer to TRUTH TABLE</li> </ul>
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#### MARKING



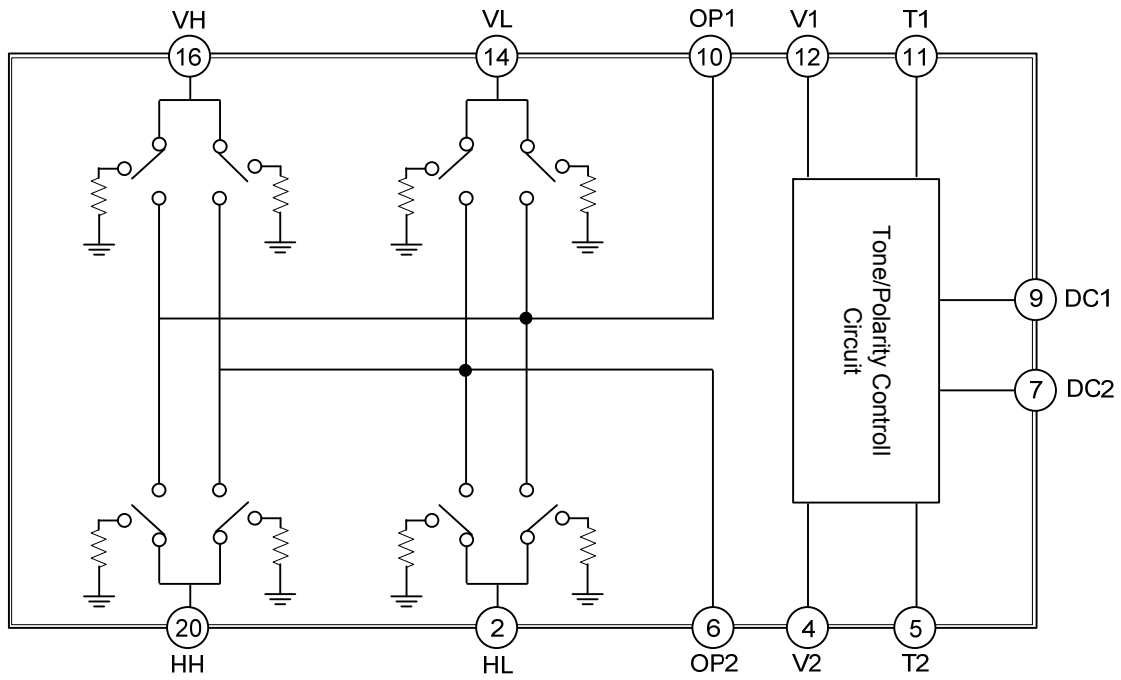
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	V <sub>DD_HL</sub> / NC	ESD V <sub>DD</sub> path can be connected to pin 8 (V <sub>DD</sub> ), or let this pin NC
15	V <sub>DD_VL</sub> / NC	ESD V <sub>DD</sub> path can be connected to pin 8 (V <sub>DD</sub> ), or let this pin NC
3, 13, 17, 19	GND	Ground pin, connect to ground
2	HL	RF input pin
14	VH	
16	VL	
20	HH	
4	T2	Tone and polarity detector input
5	V2	
6	OP2	RF output pin
10	OP1	
7	DC2	By-pass, connect to by-pass capacitor
9	DC1	
8	V <sub>DD</sub>	IC Power , connect to 3.6V power
11	T1	Tone and polarity detector input
12	V1	
18	VHM	Vertical-Horizontal mirror Connect to ground → Normal Leave open → Mirror
Back side paddle	GND	Connected to PCB GND

■ BLOCK DIAGRAM



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### ■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Bias Voltage Range	V <sub>DD</sub>	+5	V
Maximum Input Power (200 ~ 3000MHz)	I <sub>P</sub>	+17	dBm
Storage Temperature	T <sub>STG</sub>	-65 ~ +150	°C
Operating Temperature	T <sub>OPR</sub>	-40 ~ +85	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

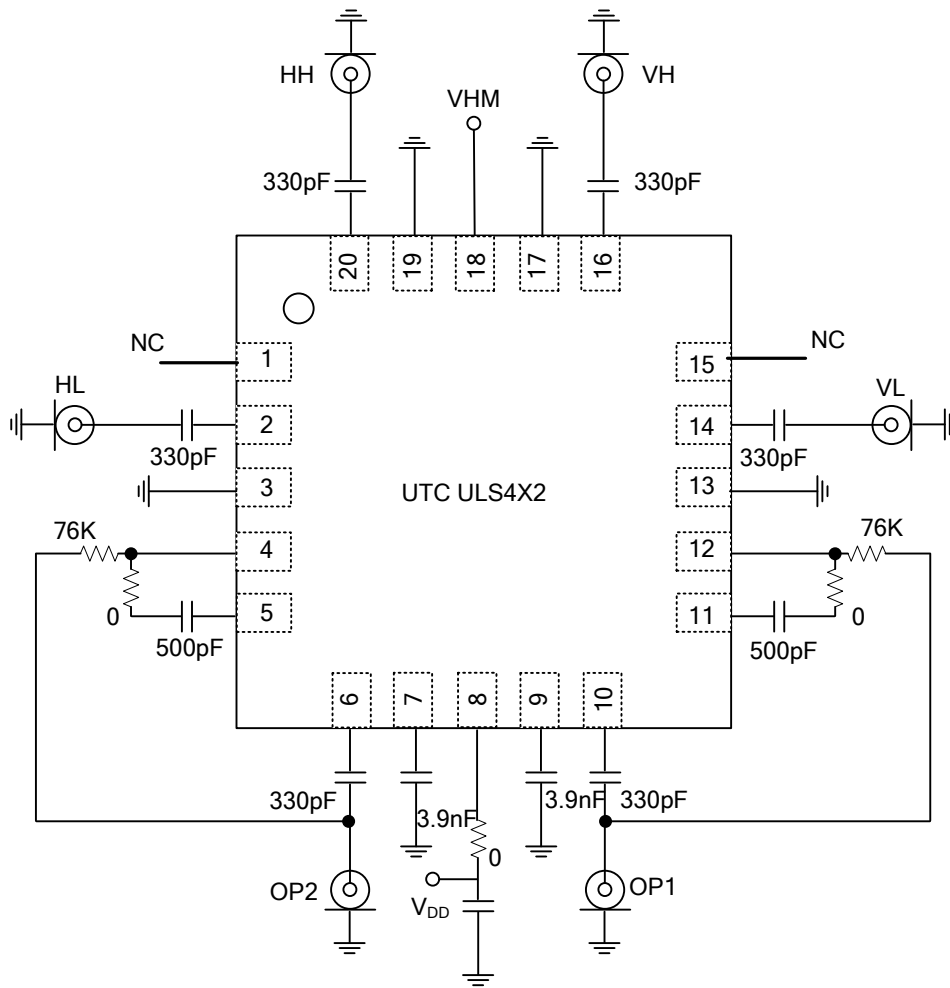
### ■ ELECTRICAL CHARACTERISTICS

(T<sub>A</sub>=+25°C, V<sub>DD</sub>=+3.3V, 50ohm System. All R<sub>F</sub> port are terminated to 50 ohm)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Switch</b>						
Insertion Loss	I <sub>L</sub>	200~950MHz		6.4		dB
		950~1450MHz		6.5		
		1450~2150MHz		6.6		
		2150~3000MHz		6.8		
Isolation	I <sub>SO</sub>	200~950MHz		73		dB
		950~1450MHz		64		
		1450~2150MHz		51		
		2150~3000MHz		40		
Return Loss (Input, VL, HI, VH, HH)	R <sub>L_IN</sub>	200~3000MHz	14	19		dB
Return Loss (Output, OP1, OP2)	R <sub>L_OUT</sub>	200~3000MHz	12	15		dB
Output IP3	O <sub>IP3</sub>	200~3000MHz	20.8			dBm
Input Power for 1 dB Compression	I <sub>P1db</sub>	200~3000MHz	14.5			dBm
Switching On/Off Speed t <sub>RISE</sub> /t <sub>FALL</sub> (10/90% RF)	T <sub>sw</sub>	200~3000MHz			10	ms
<b>Polarity and Tone Detector</b>						
Polarity Threshold	V <sub>PTH</sub>	With external 76kΩ	14.1	14.8	15.6	V
Tone Signal Frequency	F <sub>tone</sub>	-40~85°C, 650m V <sub>PP</sub>	1	22	2200	KHz
Tone Signal Duty Cycle	DU	-40~85°C	20	50	80	%
Tone Signal Amplitude Threshold	V <sub>TTH</sub>	With external 76kΩ and 500pF	0.04	0.16		V <sub>PP</sub>
<b>Power Supply</b>						
Supply Voltage	V <sub>DD</sub>	-40~85°C	3.0	3.3	4.2	V
Current Consumption	I <sub>DD</sub>	-40~85°C	1.5	2.0	2.5	mA

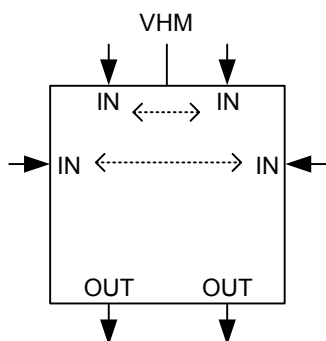
Note: Tone/Polarization threshold could be tuned by change the value of external R, C. Please Contact AMICCOM FAE for specified application.

■ TYPICAL APPLICATION CIRCUIT

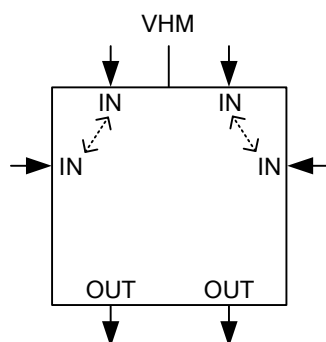


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■ TRUTH TABLE



Above Figure Show the Function of VHM. (Vertical/Horizontal Mirror)



Above Figure Show the Different Between UTC ULS4X2A and UTC ULS4X2B (High/low Band Upside Down)

V1, V2=0 means DC voltage=9.5~14V, V1, V2=1 means DC voltage=15.5~19V  
 T1, T2=0 means 22KHz tone disappeared. T1, T2=1 means 22KHz tone appeared.

UTC **ULS4X2A** When pin 18 "VHM" connected to GND

State	CONTROL INPUT				OUTPUT TO INPUT STATE	
	V1	T1	V2	T2	OP1	OP2
1	0	0	0	0	HH	HH
2	0	0	0	1	HH	HL
3	0	0	1	0	HH	VH
4	0	0	1	1	HH	VL
5	0	1	0	0	HL	HH
6	0	1	0	1	HL	HL
7	0	1	1	0	HL	VH
8	0	1	1	1	HL	VL
9	1	0	0	0	VH	HH
10	1	0	0	1	VH	HL
11	1	0	1	0	VH	VH
12	1	0	1	1	VH	VL
13	1	1	0	0	VL	HH
14	1	1	0	1	VL	HL
15	1	1	1	0	VL	VH
16	1	1	1	1	VL	VL

■ TRUTH TABLE (Cont.)

UTC **ULS4X2A** When pin 18 "VHM" open. Vertical and Horizontal will be mirror

State	CONTROL INPUT				OUTPUT TO INPUT STATE	
	V1	T 1	V2	T2	OP1	OP2
1	0	0	0	0	VH	VH
2	0	0	0	1	VH	VL
3	0	0	1	0	VH	HH
4	0	0	1	1	VH	HL
5	0	1	0	0	VL	VH
6	0	1	0	1	VL	VL
7	0	1	1	0	VL	HH
8	0	1	1	1	VL	HL
9	1	0	0	0	HH	VH
10	1	0	0	1	HH	VL
11	1	0	1	0	HH	HH
12	1	0	1	1	HH	HL
13	1	1	0	0	HL	VH
14	1	1	0	1	HL	VL
15	1	1	1	0	HL	HH
16	1	1	1	1	HL	HL

UTC **ULS4X2B** When pin 18 "VHM" connected to GND

State	CONTROL INPUT				OUTPUT TO INPUT STATE	
	V1	T 1	V2	T2	OP1	OP2
1	0	0	0	0	HL	HL
2	0	0	0	1	HL	HH
3	0	0	1	0	HL	VL
4	0	0	1	1	HL	VH
5	0	1	0	0	HH	HL
6	0	1	0	1	HH	HH
7	0	1	1	0	HH	VL
8	0	1	1	1	HH	VH
9	1	0	0	0	VL	HL
10	1	0	0	1	VL	HH
11	1	0	1	0	VL	VL
12	1	0	1	1	VL	VH
13	1	1	0	0	VH	HL
14	1	1	0	1	VH	HH
15	1	1	1	0	VH	VL
16	1	1	1	1	VH	VH

■ TRUTH TABLE (Cont.)

UTC **ULS4X2B** When pin 18 "VHM" open. Vertical and Horizontal will be mirror

State	CONTROL INPUT				OUTPUT TO INPUT STATE	
	V1	T 1	V2	T2	OP1	OP2
1	0	0	0	0	VL	VL
2	0	0	0	1	VL	VH
3	0	0	1	0	VL	HL
4	0	0	1	1	VL	HH
5	0	1	0	0	VH	VL
6	0	1	0	1	VH	VH
7	0	1	1	0	VH	HL
8	0	1	1	1	VH	HH
9	1	0	0	0	HL	VL
10	1	0	0	1	HL	VH
11	1	0	1	0	HL	HL
12	1	0	1	1	HL	HH
13	1	1	0	0	HH	VL
14	1	1	0	1	HH	VH
15	1	1	1	0	HH	HL
16	1	1	1	1	HH	HH

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