

HX11024-Q 0.1-5.0GHz DP4T Antenna Switch Module

Description

The HX11024-Q is a DP4T (double-pole four-throw) antenna switch module specifically designed for multimode broadband cellular applications, supporting GSM, WCDMA, LTE, and 5G NR across a frequency range of 100 MHz to 5.0 GHz. The RF performance has been optimized to achieve low insertion loss and minimal harmonics, thereby meeting the stringent requirements set forth by all LTE standards.

No external DC blocking capacitors are necessary as long as no DC voltage is applied to any RF path.

The HX11024-Q integrates both a DP4T switch and an RFFE serial controller on a single SOI chip. It features four symmetrical transmit/receive ports suitable for GSM/WCDMA/LTE/5G NR applications, providing versatile operational combinations across different modes.

Low insertion loss is consistently demonstrated in every path of the HX11024-Q—from the antenna port to any RF port—while maintaining high isolation between both opposite and adjacent paths. Furthermore, the HX11024-Q achieves excellent linearity performance.

Encapsulated in a compact 2mm x 2mm LGA package with a low profile of just 0.51 mm, this product complies with RoHS regulations and is halogen-free.

The HX11024-Q is rated at Moisture Sensitivity Level 3 (MSL3) at temperatures up to 260°C according to JEDEC J-STD-020 standards.

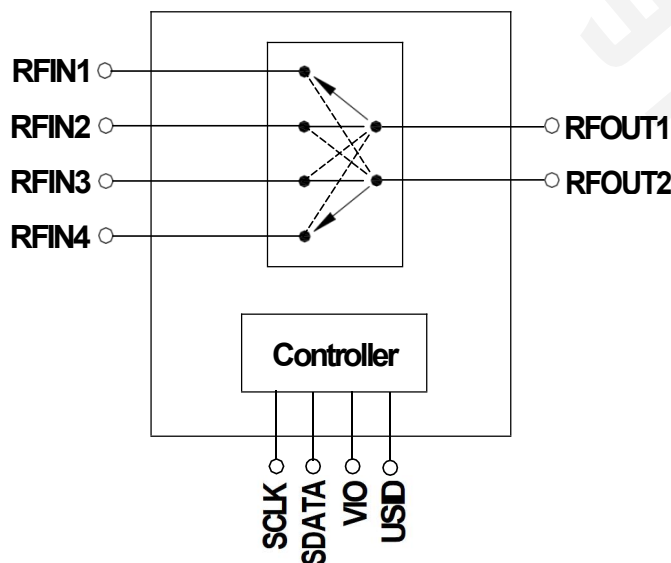
Features

- ★ Broadband support 0.1-5.0GHz
- ★ Advanced SOI process
- ★ Low insertion loss
- ★ High Isolation
- ★ Excellent linearity
- ★ 4 symmetrical RF ports
- ★ RFFE control interface
- ★ Ultra small LGA footprint, 2mm x 2mm x 0.51mm, 16-pin
- ★ Green product

Application

- ★ Transmit/Receive for GSM/WCDMA/LTE Cellular handsets and data cards
- ★ 5G NR N77-N79 Applications

Block Diagram



Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage (VIO)	2.5	V
Control Voltage (SCLK,SDATA)	2.5	V
RF Input Power	37	dBm
RF Input Power(12.5% duty cycle)	41	dBm
Operating Temperature	-40 to 90	°C
Storage Temperature	-55 to 150	°C
ESD-Human Body Mode (HBM)	-1.0 to 1.0	kV



ESD Caution

Appropriate precautions in handling, packaging and testing devices must be observed.

Recommended Operating Conditions

Parameter	Symbol	Condition	Minimum	Typical	Maximum	Unit
Supply Voltage	VIO		1.65	1.8	2	V
Supply Current	IIO			20	50	μA
SDATA, SCLK - Voltage High	VHigh		0.8 x VIO	1.8	VIO	V
SDATA, SCLK - Voltage Low	VLow		0	0	0.2 x VIO	V
Control Current	ICTRL	SDATA, SCLK, USID in Static State	0.3	0.5	2	μA
Operating Case Temperature	Tc		-40	25	85	°C

Note:

1. USID Pin should be tied to VIO Pin or GND Pin. When USID Pin is not connected, USID will be tied low internally.
2. NC Pin is not used in this product and it can be tied to any DC signal.

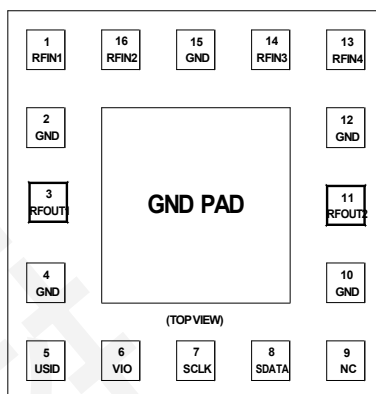
Logic Truth Table for Operation Modes (Table 1: Direct Mode)

Mode		Register 0	Register 1					
RFOUT1	RFOUT2	D0	D5	D4	D3	D2	D1	D0
Isolation	Isolation	0	0	0	0	0	0	0
RFIN1	Isolation	0	0	0	0	0	0	1
RFIN2	Isolation	0	0	0	0	0	1	0
RFIN3	Isolation	0	0	0	0	1	0	0
RFIN4	Isolation	0	0	0	1	0	0	0
RFIN1	RFIN2	0	0	1	0	0	1	1
RFIN1	RFIN3	0	0	1	0	1	0	1
RFIN2	RFIN3	0	0	1	0	1	1	0
RFIN1	RFIN4	0	0	1	1	0	0	1
RFIN2	RFIN4	0	0	1	1	0	1	0
RFIN3	RFIN4	0	0	1	1	1	0	0
RFIN2	RFIN1	0	1	0	0	0	1	1
RFIN3	RFIN1	0	1	0	0	1	0	1
RFIN3	RFIN2	0	1	0	0	1	1	0
RFIN4	RFIN1	0	1	0	1	0	0	1
RFIN4	RFIN2	0	1	0	1	0	1	0
RFIN4	RFIN3	0	1	0	1	1	0	0
Isolation	RFIN1	0	1	1	0	0	0	1
Isolation	RFIN2	0	1	1	0	0	1	0
Isolation	RFIN3	0	1	1	0	1	0	0
Isolation	RFIN4	0	1	1	1	0	0	0

Logic Truth Table for Operation Modes (Table 2: Cross Mode)

Mode		Register 0	Register 1					
RFOUT1	RFOUT2	D0	D5	D4	D3	D2	D1	D0
Isolation	Isolation	1	0	0	0	0	0	0
Isolation	RFIN1	1	0	0	0	0	0	1
Isolation	RFIN2	1	0	0	0	0	1	0
Isolation	RFIN3	1	0	0	0	1	0	0
Isolation	RFIN4	1	0	0	1	0	0	0
RFIN2	RFIN1	1	0	1	0	0	1	1
RFIN3	RFIN1	1	0	1	0	1	0	1
RFIN3	RFIN2	1	0	1	0	1	1	0
RFIN4	RFIN1	1	0	1	1	0	0	1
RFIN4	RFIN2	1	0	1	1	0	1	0
RFIN4	RFIN3	1	0	1	1	1	0	0
RFIN1	RFIN2	1	1	0	0	0	1	1
RFIN1	RFIN3	1	1	0	0	1	0	1
RFIN2	RFIN3	1	1	0	0	1	1	0
RFIN1	RFIN4	1	1	0	1	0	0	1
RFIN2	RFIN4	1	1	0	1	0	1	0
RFIN3	RFIN4	1	1	0	1	1	0	0
RFIN1	Isolation	1	1	1	0	0	0	1
RFIN2	Isolation	1	1	1	0	0	1	0
RFIN3	Isolation	1	1	1	0	1	0	0
RFIN4	Isolation	1	1	1	1	0	0	0

Pin-Out



Pin Definitions

Pin	Name	Description
1	RFIN1	RF I/O
2	GND	Ground
3	RFOUT1	RF I/O
4	GND	Ground
5	USID	USID configurable Address input
6	VIO	MIPI decoder interface voltage
7	SCLK	RF FE Clock
8	SDATA	RF FE Data
9	NC	N/C
10	GND	Ground
11	RFOUT2	RF I/O
12	GND	Ground
13	RFIN4	RF I/O
14	RFIN3	RF I/O
15	GND	Ground
16	RFIN2	RF I/O
GND PAD	GND PAD	Ground

MIPI RFFE Register Map

Register 0	Description	Default	Notes	Trigger Support
[7:1]	Reserved	0000000	Reserved	0 Trigger
[0]	Output Cross	0	0=RF port in direct mode 1=RF port in cross mode See Logic Truth Table for Operational Modes	
Register 1	Description	Default	Notes	Trigger Support
[7:6]	Reserved	00	Reserved	0 Trigger
[5:4]	RFOUT Connect Mode	00	00 = RFOUT1 enable, RFOUT2 isolation 01 = RFOUT1 to Low bit port in Reg01[3:0] 10 = RFOUT2 to Low bit port in Reg01[3:0] 11 = RFOUT2 enable, RFOUT1 isolation	
[3:0]	RFIN Select	0000	See Logic Truth Table for Operational Modes	
Register 28	Description	Default	Notes	Trigger Support
[7:6]	PWR_MODE	10	00 = Normal Operation (ACTIVE) 01 = Default Settings (STARTUP) 10 = Low Power (LOW POWER) 11 = Reserved	NA
[5]	Trigger Mask 2	0	0 = Trigger Enable 1 = Trigger Disable	
[4]	Trigger Mask 1	0	0 = Trigger Enable 1 = Trigger Disable	
[3]	Trigger Mask 0	0	0 = Trigger Enable 1 = Trigger Disable	
[2]	Trigger Register 2	0	1 = Load Trigger 2 Registers	
[1]	Trigger Register 1	0	1 = Load Trigger 1 Registers	
[0]	Trigger Register 0	0	1 = Load Trigger 0 Registers	
Register 29	Description	Default	Notes	Trigger Support
[7:0]	Product ID	0x24	Product ID = 0x24	NA
Register 30	Description	Default	Notes	Trigger Support
[7:0]	Manufacturer ID	0x4E	Manufacturer ID[7:0] = 0x4E	NA
Register 31	Description	Default	Notes	Trigger Support
[7:4]	Manufacturer ID	0011	Manufacturer ID[11:8] = 0011	NA
[3:0]	Unique Slave ID	0110	Unique Slave ID = 0110 if USID=0 Unique Slave ID = 0111 if USID=1	
Register 32	Description	Default	Notes	Trigger Support
[7:0]	EXT_PRODUCT_ID	0x00	This is a read-only register. However, during the programming of the USID a write command sequence is performed on this register, even though the write does not change its value	NA

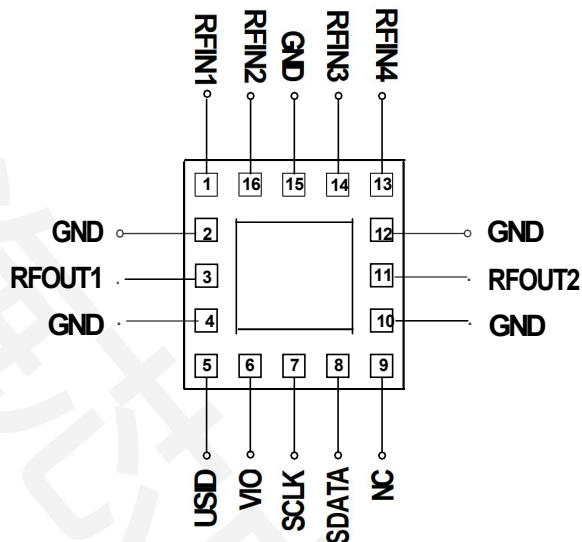
Register	Description	Default	Notes	Trigger Support
33				
[7:0]	REVISION_ID	0x02	This is an RFFE2 register to contain information about the revision of this module. The intent here is to use this as a type of scratch register -- to contain various information or serialization.	NA
34				
[7:4]	GSID0	0000	Group slave ID 0	NA
[3:0]	GSID1	0000	Group slave ID 1	
43				
[7:4]	Reserved	0000	Reserved	NA
[3:0]	BUS_LOAD	0010	SDATA Driver strength in Readback Mode 0x0: 10pF 0x1: 30pF 0x2: 50pF 0x3: 150pF 0x4-0xF: reserved	

GSM/WCDMA/LTE/5G NR RF Electrical Specifications

(Test Condition $V_{IO} = 1.8V$, $P_N = 0dBm$, $T_c = 25^\circ C$, 50Ω , unless otherwise specified)

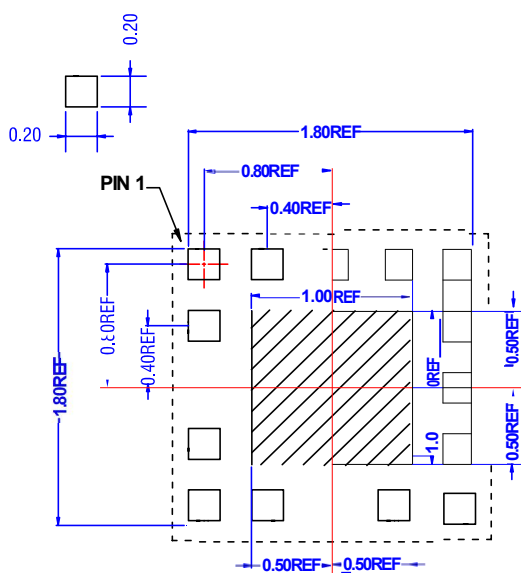
Parameter	Condition	Minimum	Typical	Maximum	Unit
Frequency		698		5000	MHz
Insertion Loss, RFOUT1/ RFOUT2 to RFIN1/RFIN2/ RFIN3/RFIN4	703 MHz to 960 MHz		0.5	0.6	dB
	1700 MHz to 2200 MHz		0.55	0.7	
	2300 MHz to 2700 MHz		0.65	0.85	
	3300 MHz to 4200 MHz		0.75	1.1	
	4400 MHz to 5000 MHz		0.8	1.2	
Isolation, RFOUT1/RFOUT2 to RFIN1/RFIN2/RFIN3/ RFIN4	703 MHz to 960 MHz	28	43		dB
	1700 MHz to 2200 MHz	23	37		
	2300 MHz to 2700 MHz	21	33		
	3300 MHz to 4200 MHz	18	30		
	4400 MHz to 5000 MHz	16	28		
VSWR, RFOUT1/RFOUT2 to RFIN1/RFIN2/RFIN3/RFI N4	703 MHz to 960 MHz		1.07 :1	1.13 :1	
	1700 MHz to 2200 MHz		1.27 :1	1.33 :1	
	2300 MHz to 2700 MHz		1.57 :1	1.65 :1	
	3300 MHz to 4200 MHz		1.80 :1	1.95 :1	
	4400 MHz to 5000 MHz		2.07 :1	2.16 :1	
Harmonics VSWR = 1:1	$f_o = 617 - 915MHz$; PIN = 26dBm; CW	$2f_o$	-76	-68	dBm
		$3f_o$	-79	-67	
	$f_o = 1710 - 1910MHz$; PIN = 35dBm; CW	$2f_o$	-70	-58	
		$3f_o$	-77	-63	
	$f_o = 2300 - 2690MHz$; PIN = 32dBm; CW	$2f_o$	-66	-56	
		$3f_o$	-74	-65	
Harmonics VSWR = 6:1	$f_o = 617 - 915MHz$; PIN = 35dBm; CW	$2f_o$	-55	-40	dBm
		$3f_o$	-49	-40	
	$f_o = 1710 - 1910MHz$; PIN = 33dBm; CW	$2f_o$	-60	-45	
		$3f_o$	-57	-45	
	$f_o = 2300 - 2690MHz$; PIN = 33dBm; CW	$2f_o$	-57	-43	
		$3f_o$	-51	-40	
IMD2			TBD		
IMD3			TBD		
Switching On/Off Time	From end of RFFE Sequence to 90/10% of final RF amplitude		1.8	2	μs
Switching Rise/Fall Time	10/90% RF to 90/10% RF		0.3	0.5	μs

Application Schematic

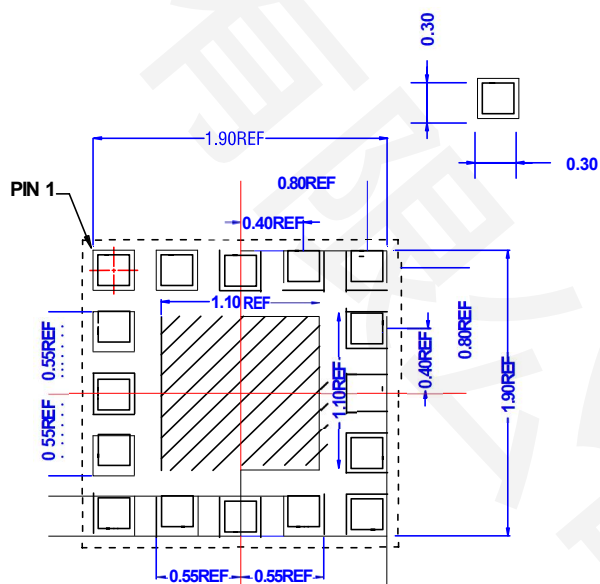


1. RF input and output are 50-Ohm microstrip.
2. Decoupling capacitors may be added for VIO according to different applications.

PCB Layout Footprint

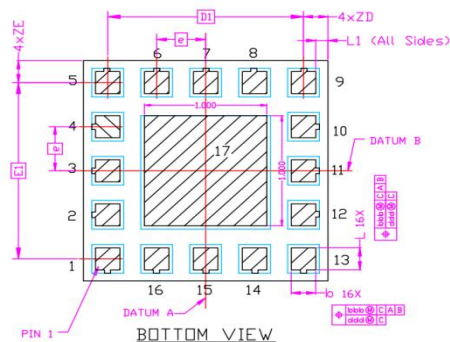
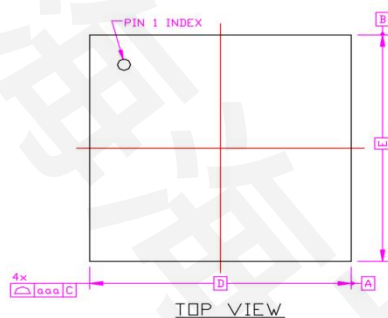


PCB Metal Top View



PCB Soldermask Top View

Package Dimensions



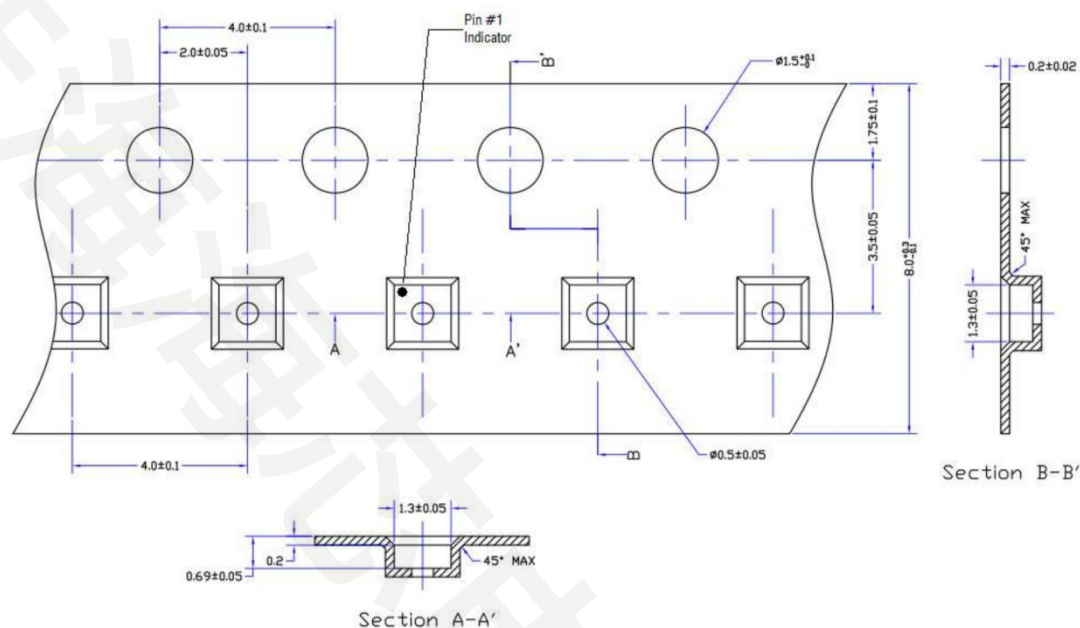
DIMENSIONAL REFERENCES unit: mm

REF.	Min.	Nom.	Max.
A	0.435	0.51	0.585
A1	-	-	0.03
A2	-	-	0.555
b	0.15	0.20	0.25
L	0.15	0.20	0.25
D	1.95	2.00	2.05
E	1.95	2.00	2.05
D1	1.60 BSC		
E1	1.60 BSC		
ZD	0.20 BSC		
ZE	0.20 BSC		
e	0.40 BSC		
L1	0.05	0.10	0.15

DIMENSIONAL REFERENCES unit: mm

REF.	TOLERANCE OF FORM AND POSITION
aaa	0.10
bbb	0.10
ccc	0.10
ddd	0.08
eee	0.08

Packaging Information



Package Type	Unit Size	Max Reel Diameter	Type Width	Pocket Pitch	Reel Capacity
Tape and Reel	2mm x 2mm x 0.51mm	7"	8mm	4mm	3000

Order Information

ORDER NUMBER	TEMPERATURE	PACKAGE DESCRIPTION	TYPE
HX11024-Q	-40°C ~ 90°C	16-Pin, 2mm x 2mm x 0.51mm LGA Module Halogen Free	Tape & Reel, 3000 pcs per Reel