
Description

The CXM3553ER is a SP12T antenna switch module for GSM/UMTS/CDMA multi-mode handset. The CXM3553ER has a built-in dual low pass filter and a +1.8V CMOS compatible decoder. The Sony GaAs Junction gate pHEMT (JPHEMT) MMIC process is used for low insertion loss and high linearity.
(Applications: GSM/UMTS/CDMA multi-mode handset)

Features

- ◆ Low insertion loss : 0.50dB (Typ.) TRx (Cellular band)
 0.60dB (Typ.) TRx (IMT Tx band)
- ◆ High linearity: IIP3 = 68dB
- ◆ Low voltage operation: V_{DD} = 2.5V
- ◆ No DC blocking capacitors
- ◆ Small package (Size): VQFN-30P (3.4mm × 4.0mm × 0.85mm Max.)
- ◆ Lead-free and RoHS compliant

Structure

GaAs Junction Gate pHEMT (JPHEMT) MMIC Switch, CMOS Decoder

This IC is ESD sensitive device. Special handling precautions are required.

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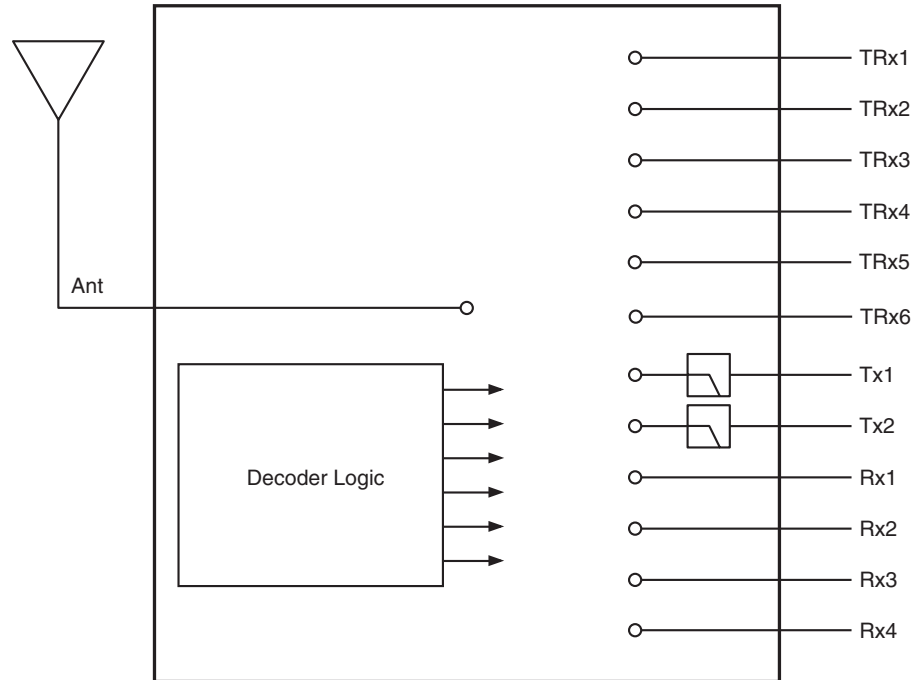


Absolute Maximum Ratings

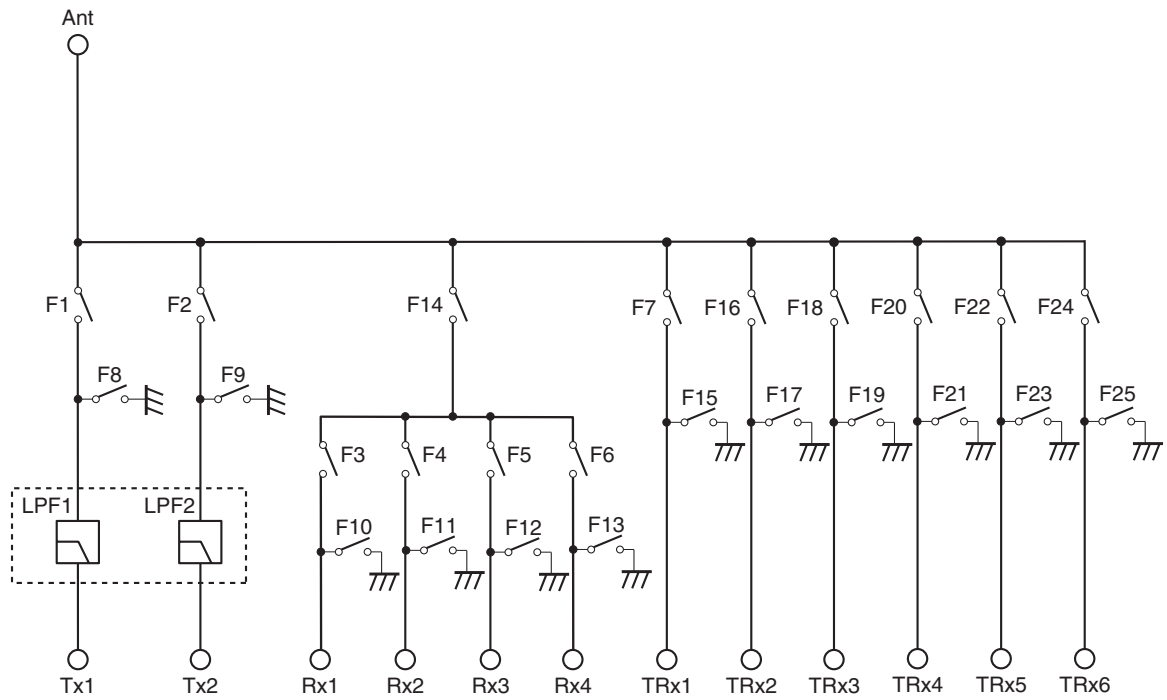
◆ Supply voltage	V _{DD}	4	V	(Ta = 25°C)
◆ Control voltage	V _{ctl}	4	V	(Ta = 25°C)
◆ Maximum input	[Tx1]	36	dBm	(Duty cycle = 12.5% to 50%) (Ta = 25°C)
	[Tx2]	34	dBm	(Duty cycle = 12.5% to 50%) (Ta = 25°C)
	[TRx]	32	dBm	(Ta = 25°C)
	[Rx]	13	dBm	(Ta = 25°C)
◆ Operating temperature	T _{opr}	-35 to +90	°C	
◆ Storage temperature	T _{stg}	-65 to +150	°C	

Block Diagram

SP12T Antenna Switch Module



SP12T 6TRx/2Tx/4Rx

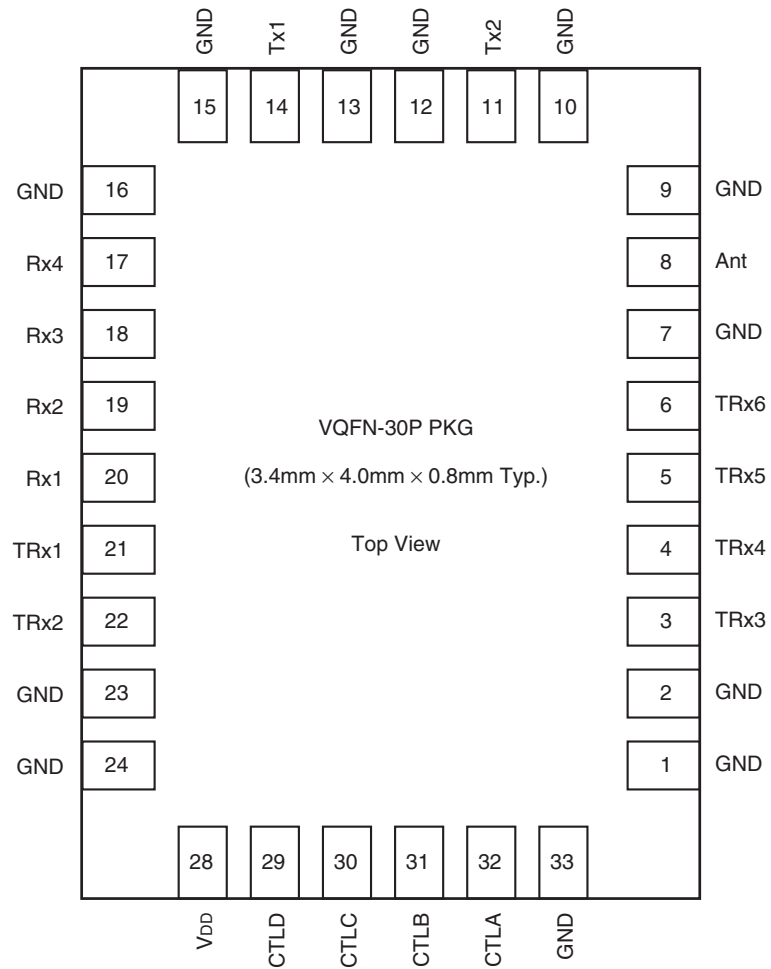


Truth Table

State	Active path	Vctl state				Switch state*1																								
		A	B	C	D	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21	F22	F23	F24	F25
1	Tx1	H	H	L	L	H	L	L	L	L	L	L	L	H	H	H	H	H	L	H	L	H	L	H	L	H	L	H	L	H
2	Tx2	H	L	L	L	L	H	L	L	L	L	L	H	L	H	H	H	H	L	H	L	H	L	H	L	H	L	H	L	H
3	Rx1*2	L	L	L	L	L	L	H	L	L	L	L	H	H	L	H	H	H	H	H	L	H	L	H	L	H	L	H	L	H
4	Rx2*2	L	L	H	L	L	L	L	H	L	L	L	H	H	H	L	H	H	H	H	L	H	L	H	L	H	L	H	L	H
5	Rx3*2	L	H	H	L	L	L	L	L	H	L	L	H	H	H	H	L	H	H	H	L	H	L	H	L	H	L	H	L	H
6	Rx4*2	L	H	L	L	L	L	L	L	L	H	L	H	H	H	H	L	H	H	L	H	L	H	L	H	L	H	L	H	L
7	TRx1*3	H	L	H	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	H	L	H	L	H	L	H	L	H
8	TRx2*3	H	H	H	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	H	L	L	H	L	H	L	H	L	H
9	TRx3*3	H	L	H	H	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	H	H	H	L	H	L	H	L	L
10	TRx4*3	H	H	H	H	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	H	L	L	L	L	L	H	L	H
11	TRx5*3	H	L	L	H	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	H	L	H	H	H	H	L	L	H
12	TRx6*3	H	H	L	H	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	H	L	H	L	H	L	H	H	L

*1 State "L" means a switch "OFF", state "H" means a switch "ON".
 *2 Each Rx path can be used over a wide frequency range from 869MHz to 1990MHz.
 *3 Each TRx path can be used over a wide frequency range from 452MHz to 2690MHz.

Pin Configuration



DC Bias Conditions

(Ta = 25°C)

Item	Min.	Typ.	Max.	Unit
V _{DD}	2.5	2.8	3.3	V
V _{ctl} (H)	1.35	1.8	3.1	V
V _{ctl} (L)	0	—	0.45	V

Electrical Characteristics

(V_{DD} = 2.5V, T_a = 25°C)

Item	Symbol	Path	Conditions	Min.	Typ.	Max.	Unit
Insertion loss	I.L	Ant-TRx1	*1, *2, *3	—	0.48	0.58	dB
			*4	—	0.59	0.74	
			*5	—	0.64	0.79	
			*6	—	0.73	0.93	
			*7	—	0.87	1.07	
		Ant-TRx2	*1, *2, *3	—	0.48	0.58	
			*4	—	0.55	0.70	
			*5	—	0.60	0.75	
			*6	—	0.67	0.87	
			*7	—	0.81	1.01	
		Ant-TRx3	*1, *2, *3	—	0.44	0.54	
			*4	—	0.56	0.71	
			*5	—	0.63	0.78	
			*6	—	0.75	0.95	
			*7	—	0.97	1.17	
		Ant-TRx4	*1, *2, *3	—	0.44	0.54	
			*4	—	0.59	0.74	
			*5	—	0.66	0.81	
			*6	—	0.77	0.97	
			*7	—	0.94	1.14	
		Ant-TRx5	*1, *2, *3	—	0.44	0.54	
			*4	—	0.62	0.77	
			*5	—	0.70	0.85	
			*6	—	0.81	1.01	
			*7	—	0.99	1.19	
		Ant-TRx6	*1, *2, *3	—	0.45	0.55	
			*4	—	0.62	0.77	
			*5	—	0.70	0.85	
			*6	—	0.81	1.01	
			*7	—	0.99	1.19	
		Ant-Tx1	*8	—	1.01	1.16	
		Ant-Tx2	*9	—	0.98	1.18	
		Ant-Rx1	*10	—	0.71	0.81	
			*11	—	1.09	1.24	
		Ant-Rx2	*10	—	0.71	0.81	
			*11	—	1.09	1.24	
		Ant-Rx3	*10	—	0.72	0.82	
			*11	—	1.06	1.21	
		Ant-Rx4	*10	—	0.73	0.83	
			*11	—	1.03	1.18	

Item	Symbol	Path	Conditions	Min.	Typ.	Max.	Unit			
Isolation	ISO	Tx1-Rx1, 2, 3, 4, 5, Rx1, 2, 3, 4	*8	30	—	—	dB			
		Tx2-Rx1, 2, 3, 4, 5, Rx1, 2, 3, 4	*9	32	—	—				
		TRx1, 2-TRx, 3, 4, 5	452 to 1990MHz	30	—	—				
		TRx3-TRx5, 6, TRx4-TRx6, TRx1, 2-Trx6	452 to 1990MHz	20	—	—				
		TRx1-TRx4-TRx5-Trx6	452 to 1990MHz	15	—	—				
VSWR	VSWR	All ports active paths	452 to 2170MHz	—	—	1.50	—			
Harmonics	2fo	Ant-TRx1, 2, 3, 4, 5, 6	*3	—	-72	-36	dBm			
				—	-67	-36				
	3fo	Ant-TRx1, 2, 3, 4, 5, 6	*4	—	-63	-36				
				—	-66	-36				
	2fo	Ant-Tx1	*8	—	-41	-36				
				—	-50	-36				
	3fo	Ant-Tx1	*8	—	-48	-36				
				—	-48	-36				
Attenuation	ATT	Tx1-Ant	1648 to 1830MHz	25	—	—	dB			
			2472 to 2745MHz	25	—	—				
			3296 to 12750MHz	20	—	—				
		Tx2-Ant	3420 to 3820MHz	25	—	—				
			5130 to 5730MHz	25	—	—				
			6840 to 12750MHz	20	—	—				
		Intermodulation power in Rx band	IMD2	Ant-TRx1, 2, 3, 4, 5, 6	*12,*13,*14,*17,*18,*21,*22	—		—	-105	dBm
			IMD3		*12,*15,*16,*19,*20,*23,*24	—		—	-105	
Input IP3	IIP3	Ant-TRx1, 2, 3, 4, 5, 6	*12,*25	—	68	—	dBm			
			*12,*26	—	68	—				
SWitching time	Ts		50% ctl to 90% RF	—	3	5	μs			
Control current	Ictl		Vctl = 1.80V	—	—	10	μA			
Supply current	IDD		VDD = 2.80V	—	0.27	0.40	μA			

Electrical characteristics are measured with all RF ports terminated in 50Ω.

Corresponding band of TRx (UMTS/CDMA)

- *1 Pin = 26dBm, 452 to 468MHz (Band class 5)
- *2 Pin = 26dBm, 704 to 787MHz (Band 13, Band 17)
- *3 Pin = 26dBm, 824 to 960MHz (Band 5, Band 8)
- *4 Pin = 26dBm, 1710 to 1990MHz (Band 1 Tx, Band 2 Tx, Band 3 Tx, Band 4 Tx)
- *5 Pin = 10dBm, 2110 to 2170MHz (Band 1 Tx, Band 4 Tx)
- *6 Pin = 26dBm, 2300 to 2400MHz (Band 40)
- *7 Pin = 26dBm, 2500 to 2690MHz (Band 7)

Corresponding band of GSM Tx/Rx(GSM)

- *8 Pin = 35dBm, 824 to 915MHz (GSM850/900 Tx)
- *9 Pin = 32dBm, 1710 to 1910MHz (GSM1800/1900 Tx)
- *10 Pin = 10dBm, 869 to 960MHz (GSM850/900 Rx)
- *11 Pin = 10dBm, 1805 to 1990MHz (GSM1800/1900 Rx)
- *12 Measured with the recommended circuit

Note) *13 to *26 are shown in the next page.

IMD Condition

Band	fRx on TRx	fRx +20dBm on TRx	fBlocker -15dBm on Ant		IMD Condition
Band I	2140MHz	1950MHz	IMD2 (fRx-fTx)	190MHz	*13
			IMD2 (fRx-fTx)	4090MHz	*14
			IMD3 (2fTx-fRx)	1760MHz	*15
			IMD3 (2fTx-fRx)	6040MHz	*16
Band II	1960MHz	1880MHz	IMD2 (fRx-fTx)	80MHz	*17
			IMD2 (fRx-fTx)	3840MHz	*18
			IMD3 (2fTx-fRx)	1800MHz	*19
			IMD3 (2fTx-fRx)	5720MHz	*20
Band V	880MHz	835MHz	IMD2 (fRx-fTx)	45MHz	*21
			IMD2 (fRx-fTx)	1715MHz	*22
			IMD3 (2fTx-fRx)	790MHz	*23
			IMD3 (2fTx-fRx)	2550MHz	*24

IIP3 Condition

Band	f1 +27dBm on TRx	f2 +27dBm on TRx	IIP3 Condition $IIP3 = (3 \times P_{out} - IM3)/2$
Band I	1950MHz	1951MHz	*25
Band V	835MHz	836MHz	*26

Triple Beat Ratio

(V_{DD} = 2.5V, T_a = 25°C)

Item	Symbol	Path	Condition				Min.	Typ.	Max.	Unit
Triple Beat Ratio	TBR		Pin 1 at TRx* ¹ 21.5dBm [MHz]	Pin 2 at TRx* ¹ 21.5dBm [MHz]	Jammer at Ant -30dBm [MHz]	Triple Beat Product at TRx* ¹ [MHz]				dBc
		Ant-Trx1, Trx2, Trx3, Trx4, Trx5, Trx6	835.5	836.5	881.5	881.5±1	81	—	—	
			1880	1881	1960	1960±1	81	—	—	

*¹ Electrical characteristics are measured with all RF ports terminated in 50Ω.
Measured with the recommended circuit

IIP2

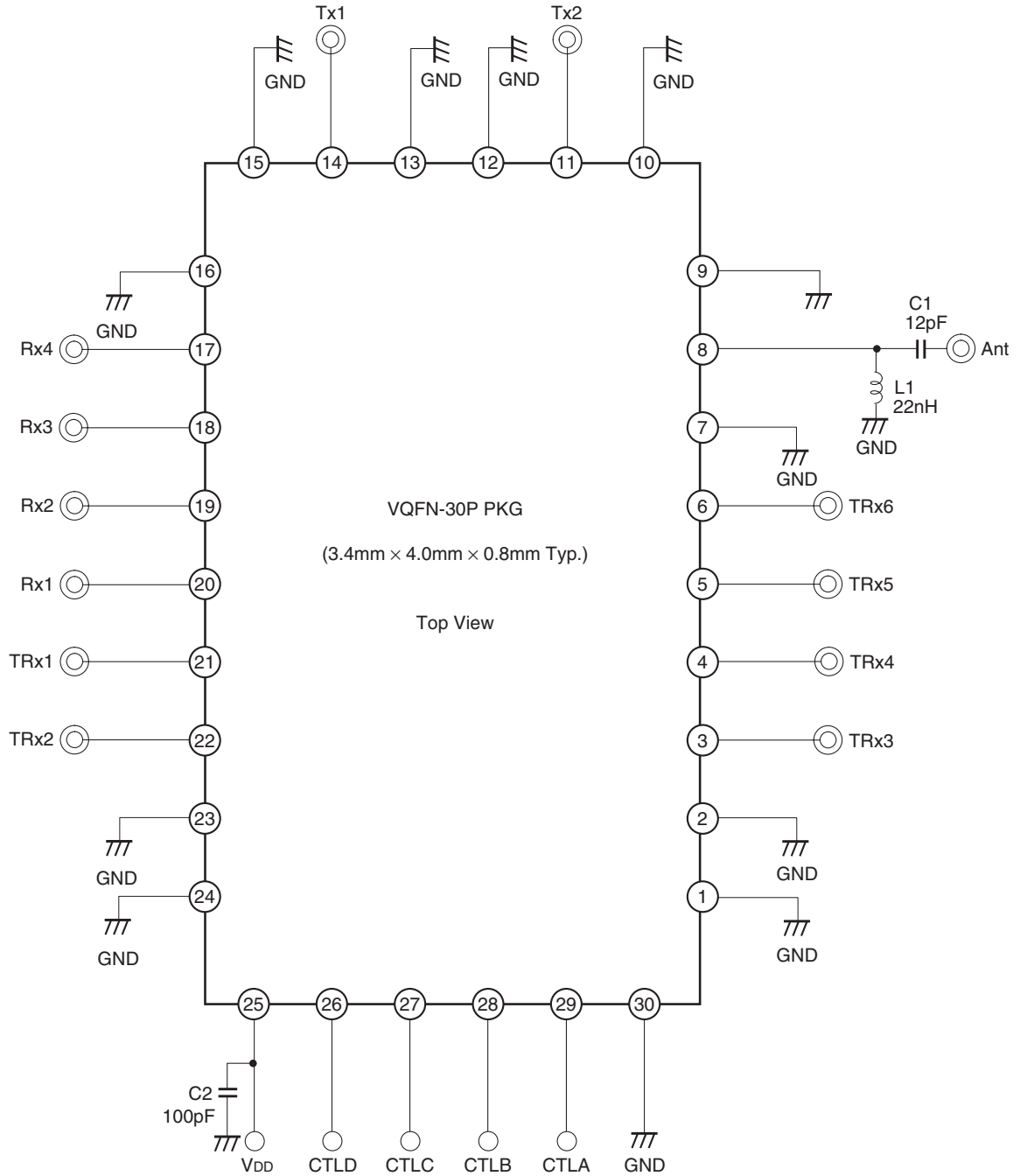
(V_{DD} = 2.5V, T_a = 25°C)

Item	Symbol	Path	Condition			Min.	Typ.	Max.	Unit
Input IP2	IIP2		Pin 1 at TRx* ¹ 24dBm [MHz]	Jammer at Ant -20dBm [MHz]	IM2 Product at TRx* ¹ [MHz]				dBm
		Ant-Trx1, Trx2, Trx3, Trx4, Trx5, Trx6	836.61	1718.61	881.61	113.5	—	—	
			836.61	45	881.61	95.5	—	—	
			1885	3850	1965	95.5	—	—	
			1885	80	1965	95.5	—	—	
			1732.5	3865	2132.5	95.5	—	—	
1732.5	400	2132.5	95.5	—	—				

*¹ Electrical characteristics are measured with all RF ports terminated in 50Ω.
Measured with the recommended circuit

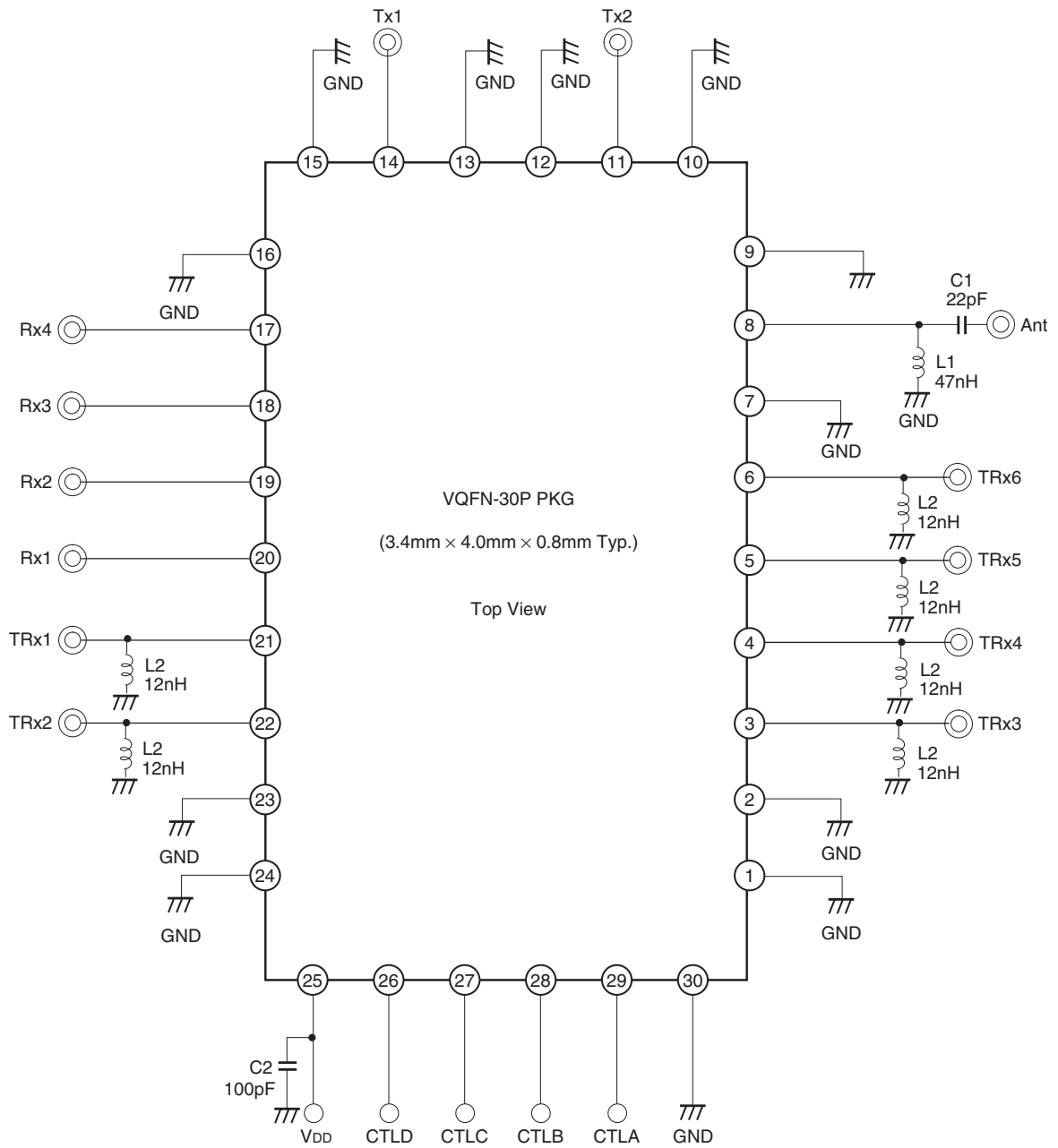
Recommended Circuit

Operatio frequency range: 0.8-2.2GHz



- *1 No DC blocking capacitors are required on all RF ports.
- *2 The DC levels of all RF ports are GND.
- *3 L1 (22nH) and C1 (12pF) are recommended on Ant port for ESD protection.

Operatio frequency range: 0.45-2.2GHz



- *1 No DC blocking capacitors are required on all RF ports.
- *2 The DC levels of all RF ports are GND.
- *3 L1 (47nH) and C1 (22pF) are recommended on Ant port for ESD protection.
- *4 L2 (12nH) is recommended on a TRx port assigned for Band I to improve IMD2 performance. (Rx-Tx(190MHz))

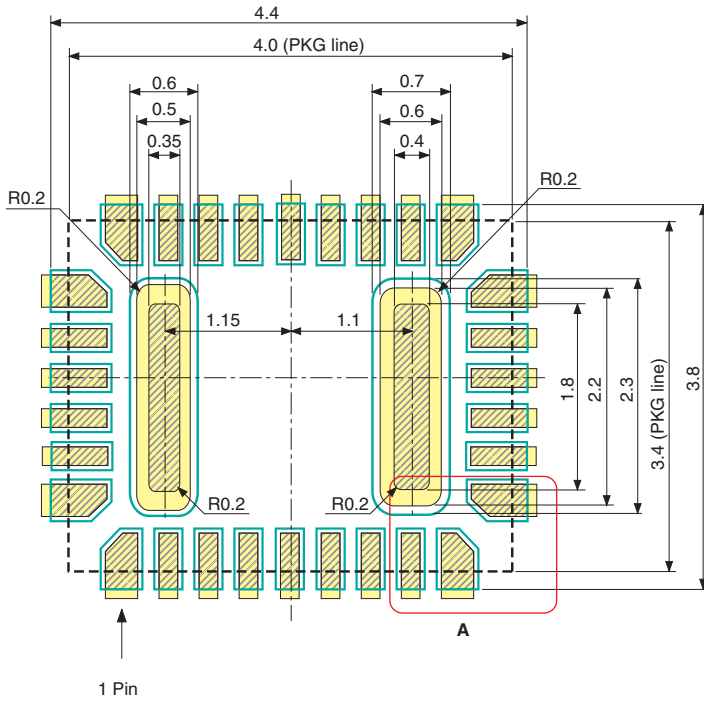
PCB Layout Template

Foot Pattern

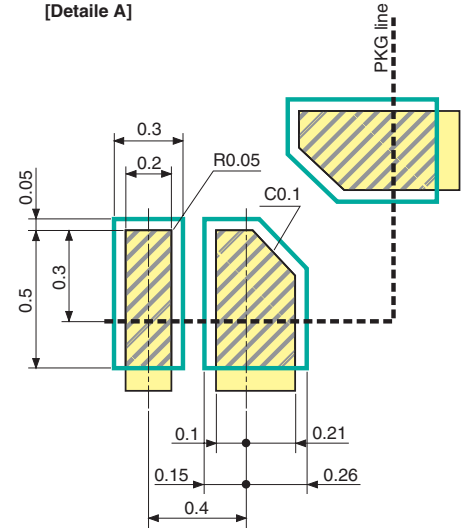
- PKG size : 4.0mm × 3.4mm
- Pin pitch : 0.4mm pitch

- Land
- Mask (Open area)
- Resist (Open area)

* Metal mask thickness: 110µm

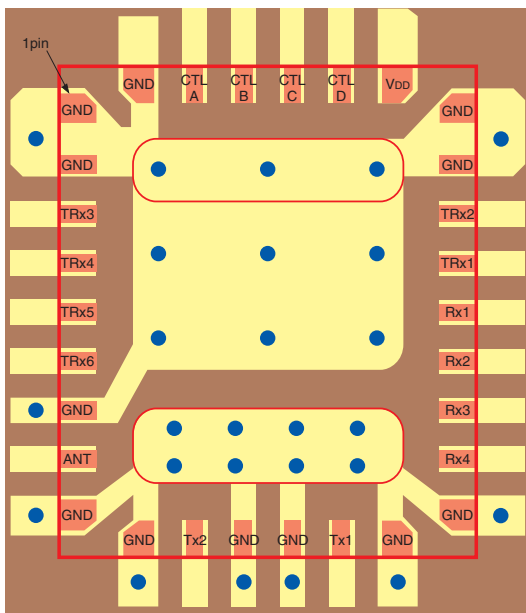


[Detail A]



* Mask corner R = 0.05mm

Recommended PCB desing

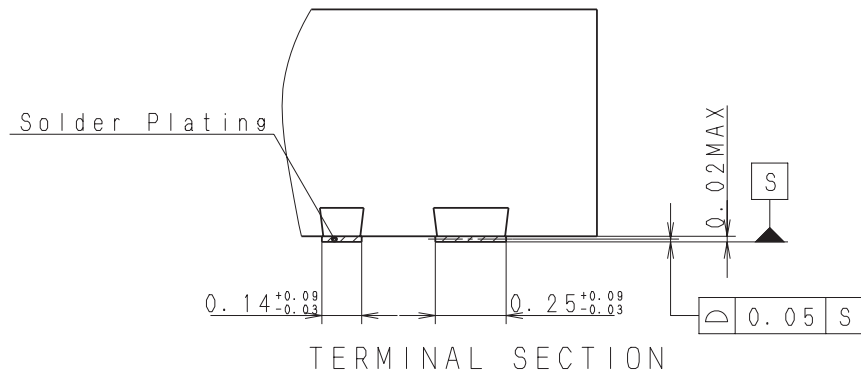
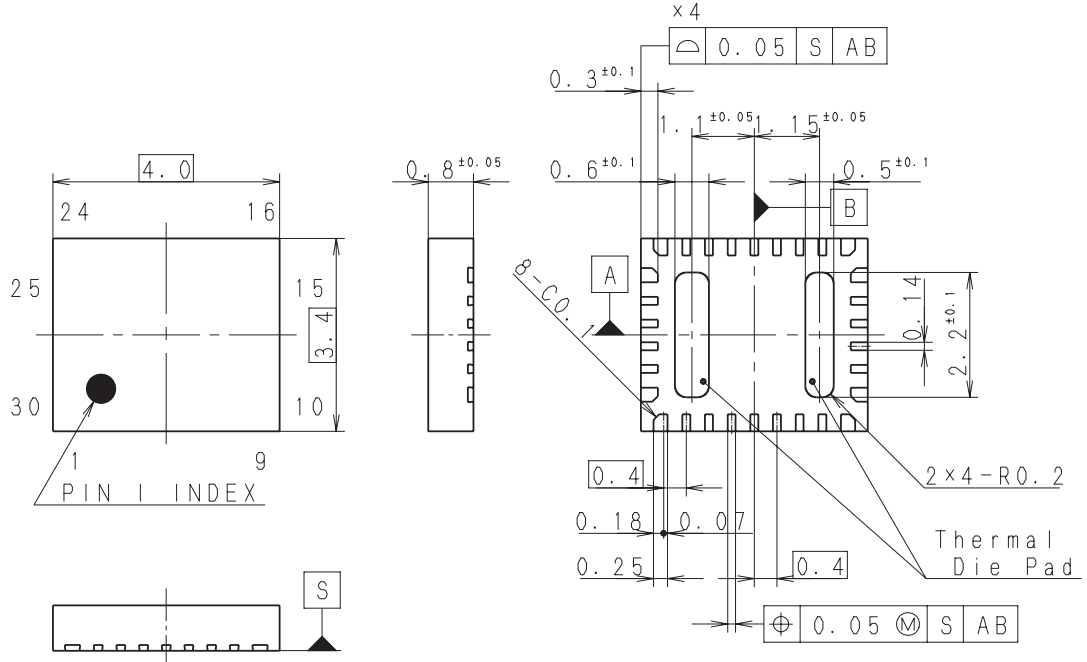


- GND via hole
- VQFN-30P package

Package Outline

(Unit: mm)

30PIN VQFN (PLASTIC)



Note:Cutting burr of lead are 0.05mm MAX.

SONY CODE	VQFN-30P-02
JEITA CODE	—
JEDEC CODE	—

AP-4000-30014S

Rev. 0

PACKAGE STRUCTURE

PACKAGE MATERIAL	EPOXY RESIN
TERMINAL TREATMENT	SOLDER PLATING
TERMINAL MATERIAL	COPPER ALLOY
PACKAGE MASS	0.04g

LEAD PLATING SPECIFICATIONS

ITEM	SPEC.
LEAD MATERIAL	COPPER ALLOY
SOLDER COMPOSITION	Sn-Bi Bi:1-4wt%
PLATING THICKNESS	5-18µm