

CXM3553ER

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 +1.8 V 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 : 0.50 dB (Typ.) TRx (Cellular band)
 0.60 dB (Typ.) TRx (IMT Tx band)
- ◆ High linearity: IIP3 = 68 dB
- ◆ Low voltage operation: V_{DD} = 2.5 V
- ◆ No DC blocking capacitors
- ◆ Small package (Size): VQFN-30P (3.4 mm × 4.0 mm × 0.85 mm 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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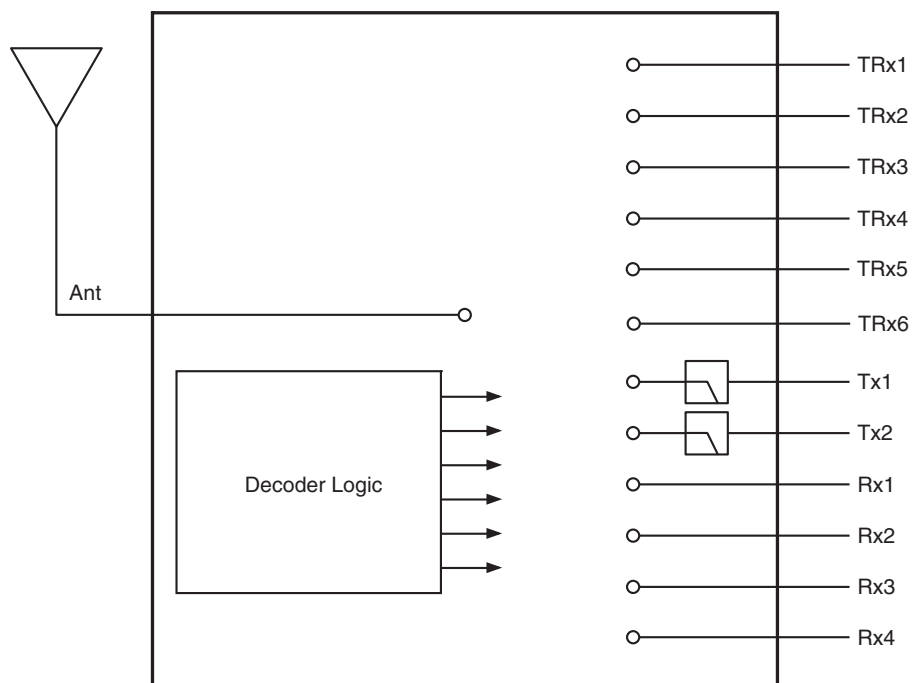
Absolute Maximum Ratings

♦ 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	

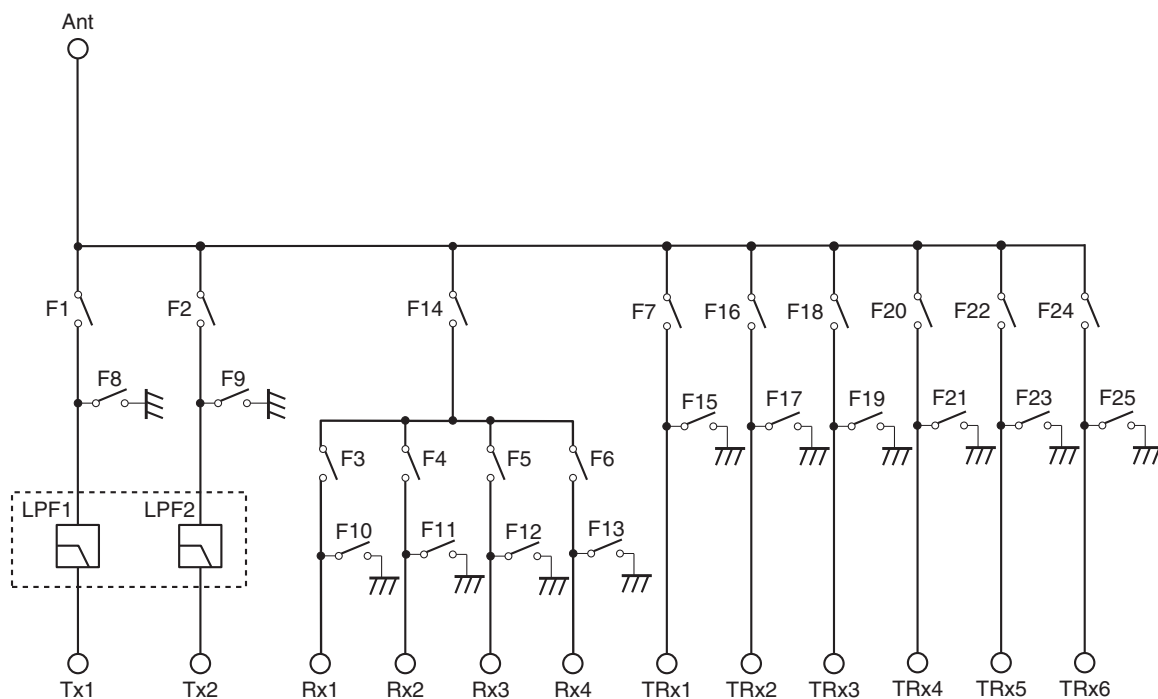


Block Diagram

SP12T Antenna Switch Module



SP12T 6TRx/2Tx/4Rx



Truth Table

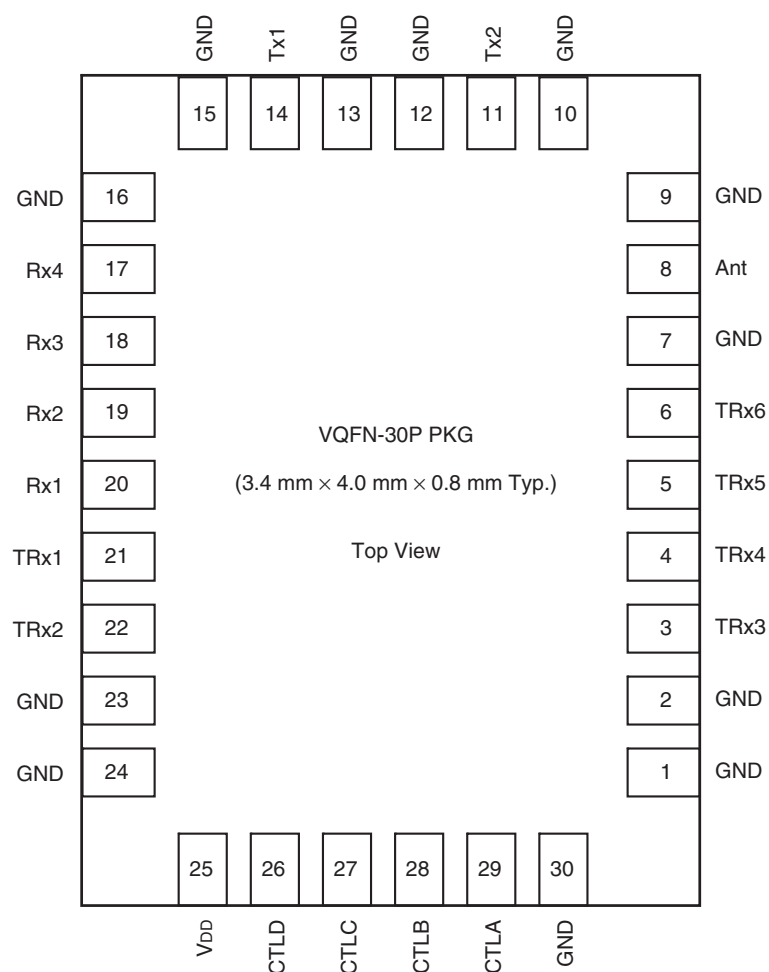
State	Active path	Vctl state				Switch state* ¹																								
		A	B	C	D	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21	F22	F23	F24	F25
1	Tx1	H	H	L	L	H	L	L	L	L	L	L	L	H	H	H	H	H	L	H	L	H	L	H	L	H	L	H	L	H
2	Tx2	H	L	L	L	L	H	L	L	L	L	L	H	L	H	H	H	H	L	H	L	H	L	H	L	H	L	H	L	H
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	L	H	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	H	L	H	H	L	H	L	H	L	H	L	H	L	H
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 869 MHz to 1990 MHz.

*³ Each TRx path can be used over a wide frequency range from 452 MHz to 2690 MHz.

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} = 2.5 V, 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-TRx1, 2, 3, 4, 5, Rx1, 2, 3, 4	*8	35	—	—	dB
		Tx2-TRx1, 2, 3, 4, 5, Rx1, 2, 3, 4	*9	32	—	—	
		TRx1, 2-TRx, 3, 4, 5	452 to 1990 MHz	30	—	—	
		TRx3-TRx5, 6, TRx4-TRx6, TRx1, 2-Trx6	452 to 1990 MHz	20	—	—	
		TRx1-TRx4-TRx5-Trx6	452 to 1990 MHz	15	—	—	
VSWR	VSWR	All ports active paths	452 to 2170 MHz	—	—	1.50	—
Harmonics	2fo	Ant-TRx1, 2, 3, 4, 5, 6	*3	—	-72	-36	dBm
	3fo			—	-67	-36	
	2fo	Ant-TRx1, 2, 3, 4, 5, 6	*4	—	-63	-36	
	3fo			—	-66	-36	
	2fo	Ant-Tx1	*8	—	-41	-36	
	3fo			—	-50	-36	
	2fo	Ant-Tx2	*9	—	-48	-36	
	3fo			—	-48	-36	
Attenuation	ATT	Tx1-Ant	1648 to 1830 MHz	25	—	—	dB
			2472 to 2745 MHz	25	—	—	
			3296 to 12750 MHz	20	—	—	
		Tx2-Ant	3420 to 3820 MHz	25	—	—	
			5130 to 5730 MHz	25	—	—	
			6840 to 12750 MHz	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 = 1.80 V	—	—	10	μA
Supply current	IDD		VDD = 2.80 V	—	0.27	0.40	mA

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

Corresponding band of TRx (UMTS/CDMA)

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

Corresponding band of GSM Tx/Rx(GSM)

- *8 Pin = 35 dBm, 824 to 915 MHz (GSM850/900 Tx)
- *9 Pin = 32 dBm, 1710 to 1910 MHz (GSM1800/1900 Tx)
- *10 Pin = 10 dBm, 869 to 960 MHz (GSM850/900 Rx)
- *11 Pin = 10 dBm, 1805 to 1990 MHz (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 +20 dBm on TRx	fBlocker –15 dBm on Ant		IMD Condition
Band I	2140 MHz	1950 MHz	IMD2 (fRx-fTx)	190 MHz	*13
			IMD2 (fRx-fTx)	4090 MHz	*14
			IMD3 (2fTx-fRx)	1760 MHz	*15
			IMD3 (2fTx-fRx)	6040 MHz	*16
Band II	1960 MHz	1880 MHz	IMD2 (fRx-fTx)	80 MHz	*17
			IMD2 (fRx-fTx)	3840 MHz	*18
			IMD3 (2fTx-fRx)	1800 MHz	*19
			IMD3 (2fTx-fRx)	5720 MHz	*20
Band V	880 MHz	835 MHz	IMD2 (fRx-fTx)	45 MHz	*21
			IMD2 (fRx-fTx)	1715 MHz	*22
			IMD3 (2fTx-fRx)	790 MHz	*23
			IMD3 (2fTx-fRx)	2550 MHz	*24

IIP3 Condition

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

Triple Beat Ratio(V_{DD} = 2.5 V, T_a = 25 °C)

Item	Symbol	Path	Condition				Min.	Typ.	Max.	Unit
Triple Beat Ratio	TBR		Pin 1 at TRx* ¹ 21.5 dBm [MHz]	Pin 2 at TRx* ¹ 21.5 dBm [MHz]	Jammer at Ant -30 dBm [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 50 Ω.
Measured with the recommended circuit

IIP2(V_{DD} = 2.5 V, T_a = 25 °C)

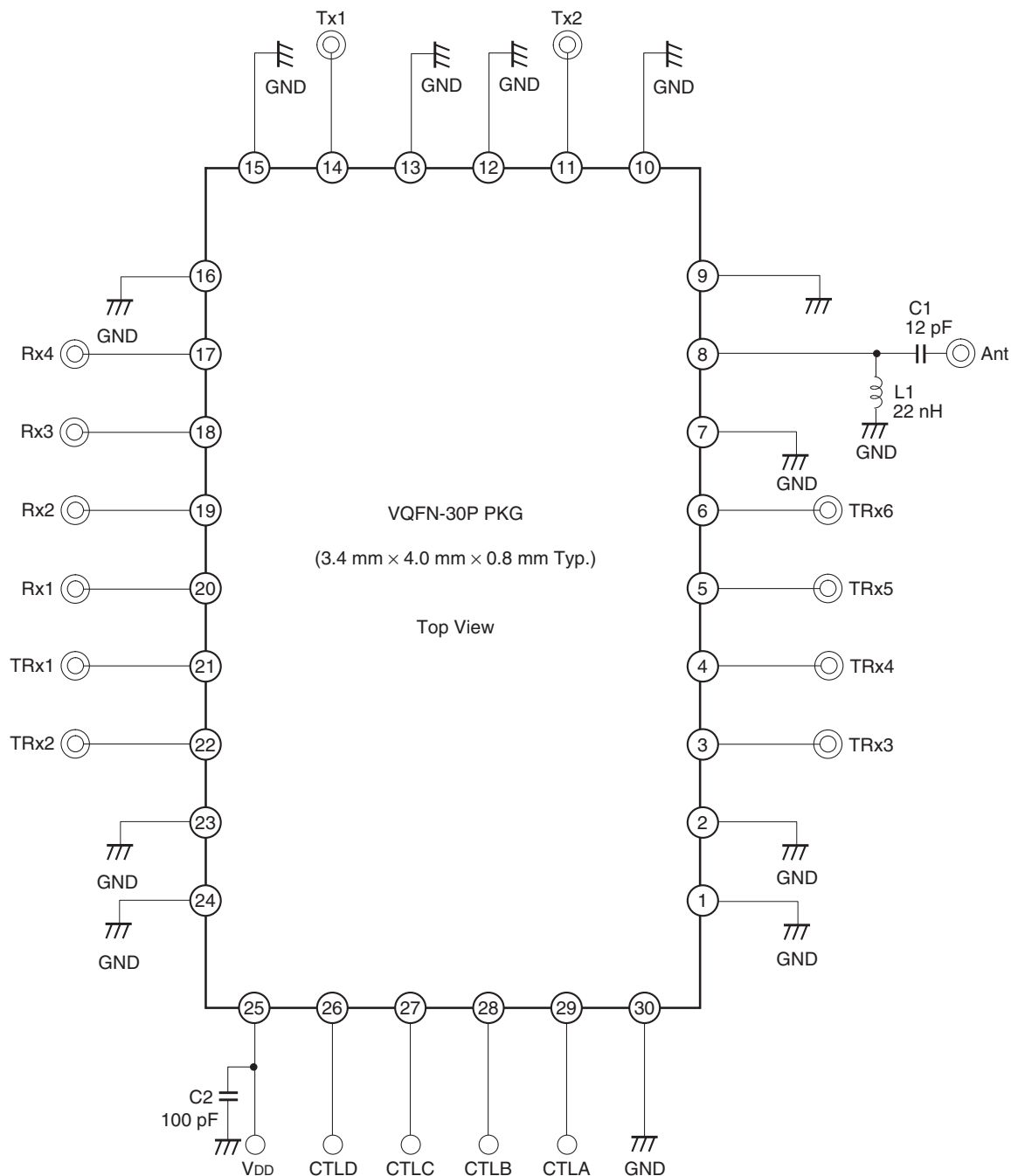
Item	Symbol	Path	Condition			Min.	Typ.	Max.	Unit
Input IP2	IIP2		Pin 1 at TRx* ¹ 24 dBm [MHz]	Jammer at Ant -20 dBm [MHz]	IM2 Product at TRx* ¹ [MHz]				dBm
		Ant-Trx1, Trx2, Trx3, Trx4, Trx5, Trx6	836.61	1718.61	881.61	113.5	—	—	
			836.61	45	881.61	95.5	—	—	
			1885	3850	1965	95.5	—	—	
			1885	80	1965	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 50 Ω.
Measured with the recommended circuit



Recommended Circuit

Operation frequency range: 0.8-2.7 GHz

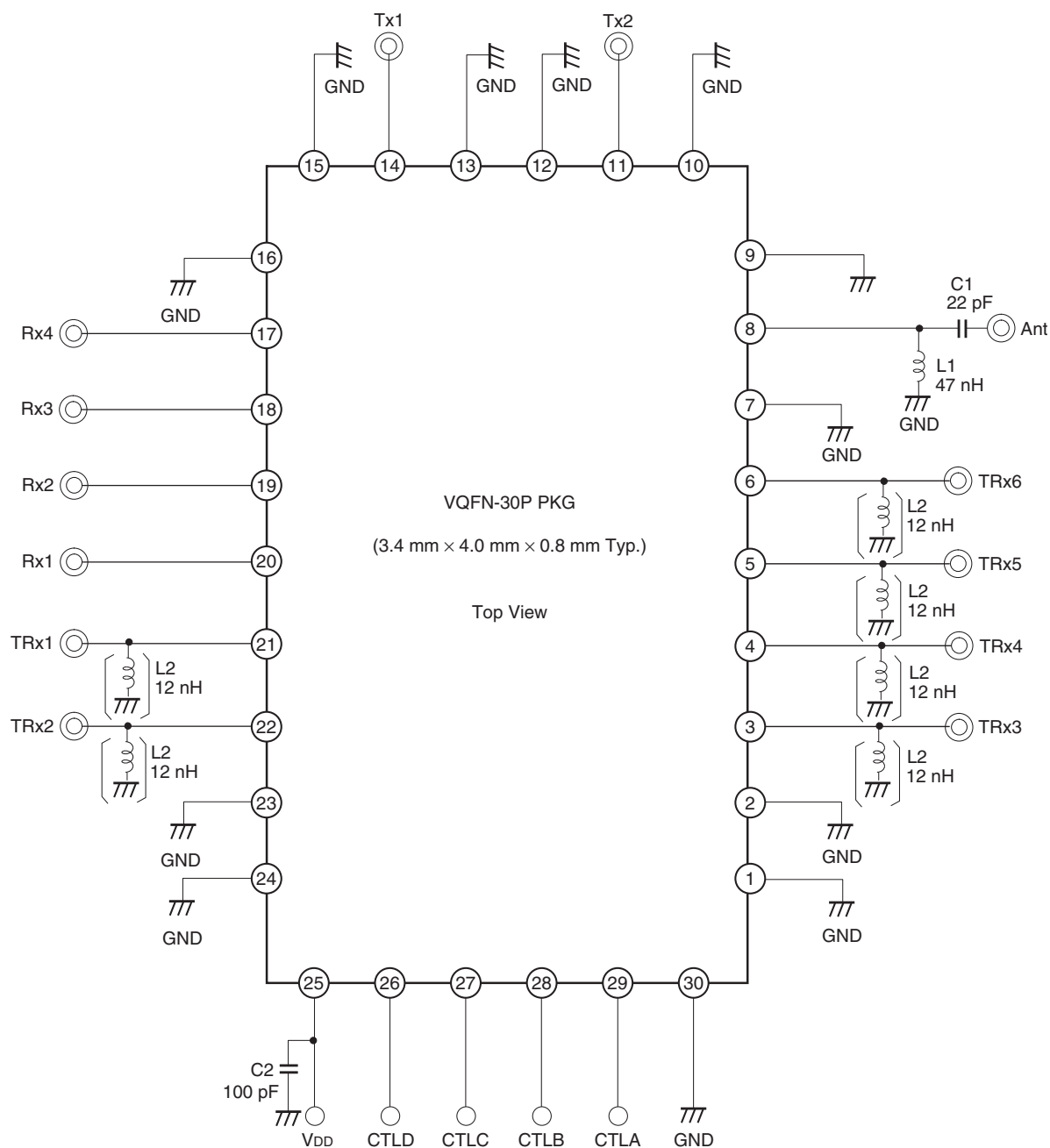


*1 No DC blocking capacitors are required on all RF ports.

*2 The DC levels of all RF ports are GND.

*3 L1 (22 nH) and C1 (12 pF) are recommended on Ant port for ESD protection.

Operation frequency range: 0.45-2.7 GHz



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

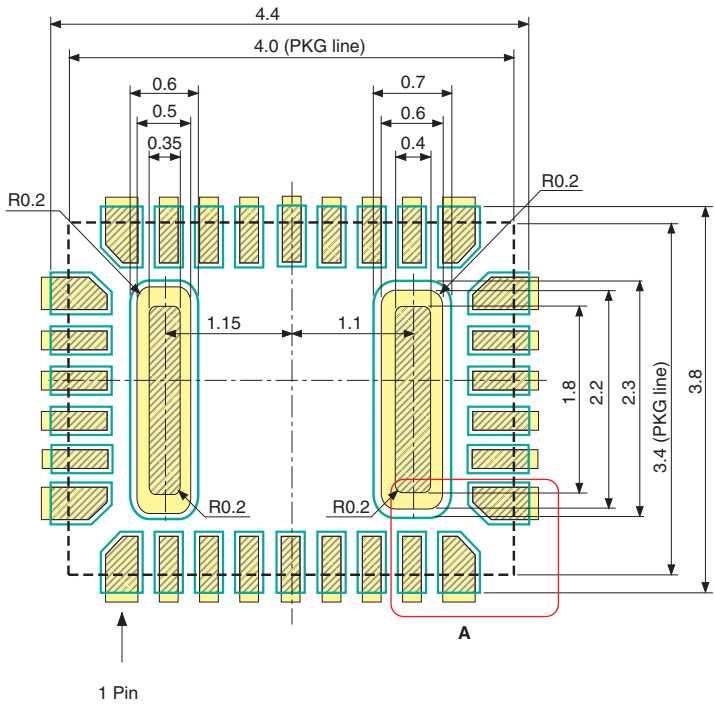
PCB Layout Template

Foot Pattern

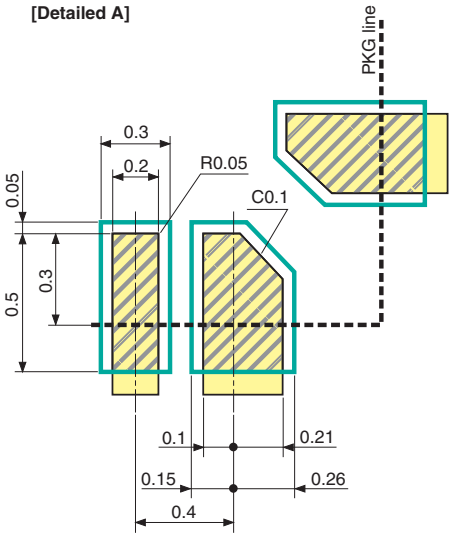
- PKG size : 4.0 mm × 3.4 mm
- Pin pitch : 0.4 mm pitch

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

* Metal mask thickness: 110 μm

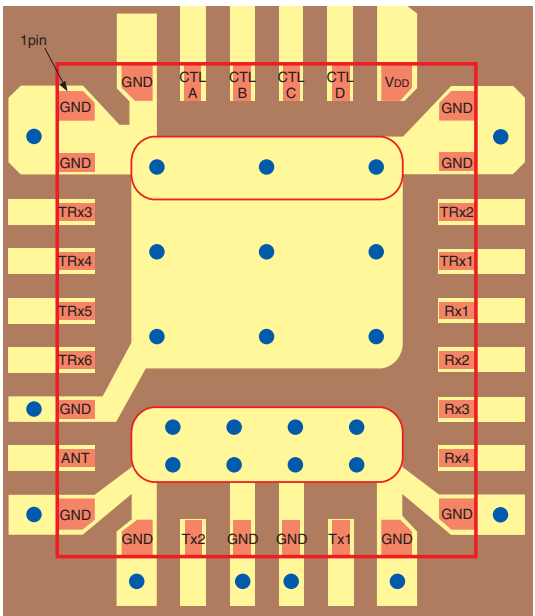


[Detailed A]



* Mask corner R = 0.05 mm

Recommended PCB design



● GND via hole

□ VQFN-30P package

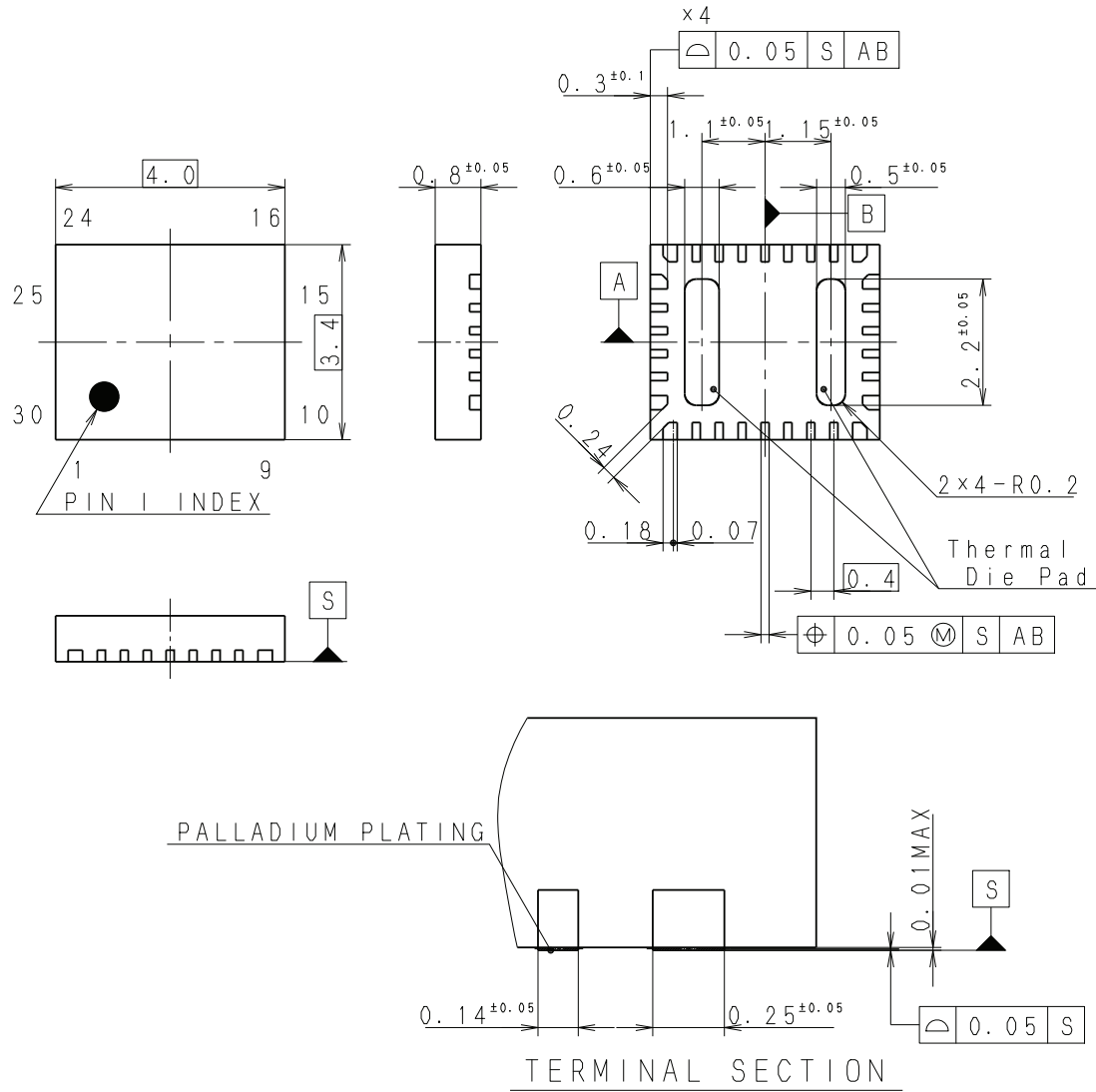


Package Outline

(Unit: mm)

Product Code: 75340935(Katoh)

30PIN VQFN (PLASTIC)



Note:Cutting burr of lead are 0.05mm MAX.

PACKAGE STRUCTURE

SONY CODE	VQFN-30P-541
JEITA CODE	_____
JEDEC CODE	_____

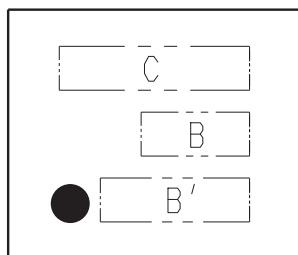
PACKAGE MATERIAL	EPOXY RESIN
TERMINAL TREATMENT	PALLADIUM PLATING
TERMINAL MATERIAL	COPPER ALLOY
PACKAGE MASS	0.04g

PART No.	AP-2000-30QNB1	Rev. 0
ISSUED	11.11.24	REVISED
PRODUCTION LINE	COMPILING DIV.	SONY SEMICONDUCTOR.
REMARKS	PKG CODE:ER-30-NBE	



Marking

Product Code: 75340935(Katoh)/75332858(SDT)/75341355(Kagoshima)



MARKING C: M3553

注1) C部は製品名(Max 5文字)を配置する。

(5文字を超える場合は製品名省略標示規定に従う。)

2) B部, B'部はロット番号(Max 7文字)を配置する。

(但し B部は年、週コードMax 3文字、B'部は組立ロット番号Max 4文字とする。)

3) 文字位置は、右詰めとする。

< INSTRUCTIONS >

1) TYPE NO. (MAX 5 CHARACTERS) IN SECTION C.

(FOR MORE THAN 5 CHARACTERS FOLLOW RULES FOR ABBREVIATIONS.)

2) LOT NO. (MAX 7 CHARACTERS) IN SECTION B, B'.

(B: YEAR, WEEK CODE MAX 3 CHARACTERS, B': ASSEMBLY LOT NO. MAX 4 CHARACTERS.)

3) PUT THE POSITION OF A CHARACTER REFERENCE FROM THE RIGHT SIDE.

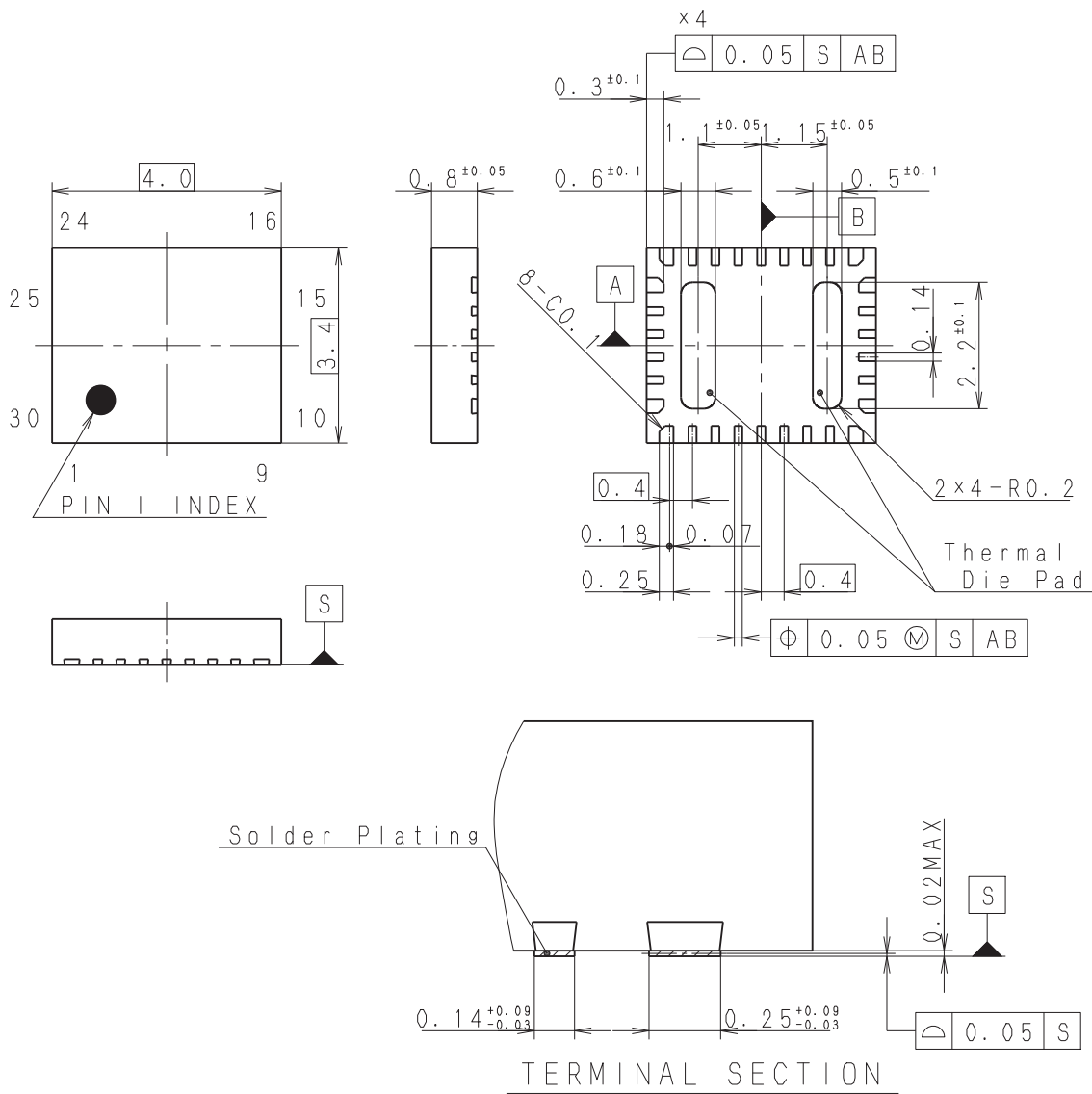


Package Outline

(Unit: mm)

Product Code: 75332858(SDT)/75341355(Kagoshima)

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