SP9T GSM/UMTS Dual Mode Antenna Switch

CXG1230EQ

Description

The CXG1230EQ is one of a range of low insertion loss, high linearity, low IMD and high power MMIC antenna switch modules for GSM/UMTS dual-mode handsets. This switch contains on-chip logic circuits and a dual-LPF on GSM transmit paths for suppression of transmitter harmonics. It enables the reduction of component count and simple PCB layout.
This switch also provides excellent ESD performance.
(Applications: GSM (Quad band)/UMTS (Triple band, class I-VI) dual-mode handset)

Features

- ◆ Low height (1.3mm Max.)
- ◆ Low insertion loss
  - 0.90dB (Typ.) on Tx1 (915MHz)
  - 1.15dB (Typ.) on Tx2 (1910MHz)
  - 1.35dB (Typ.) on Rx4 (1990MHz)
  - 0.85dB (Typ.) on TRx (1980MHz)
- ◆ Built-in dual-LPF
  - Att –30dB (Typ.) @2fo (Tx1)
  - Att –30dB (Typ.) @2fo (Tx2)
- ◆ 4 CMOS compatible control lines

Package

Small package size: 28-pin LQFN (4.5mm × 3.2mm × 1.3mm)

Structure

GaAs Junction-gate PHEMT built-in logic circuits and dual-LPF
Sony PHEMT GaAs process is utilized for low insertion loss.

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

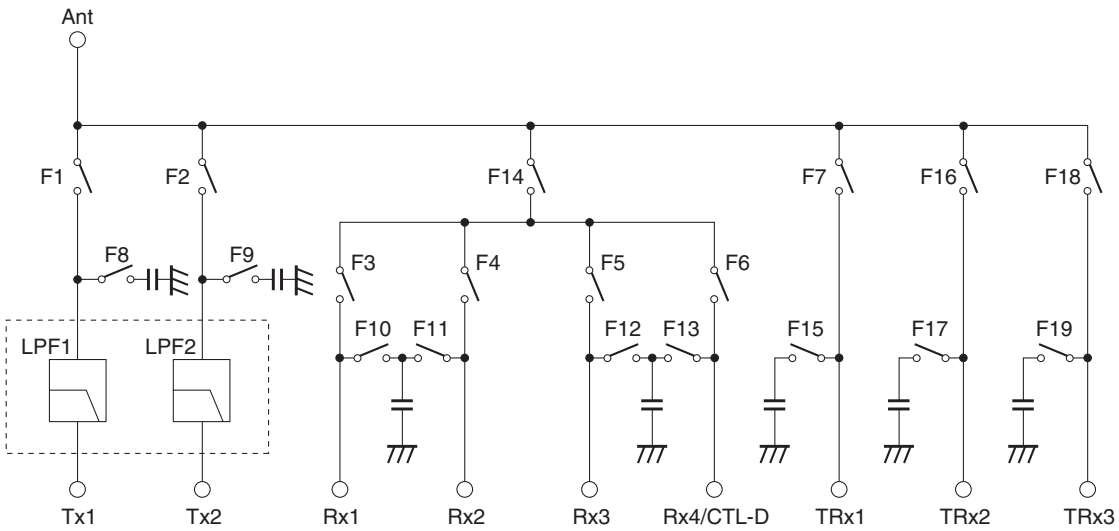
E06143A65

Absolute Maximum Ratings

(Ta = 25℃)

◆ Bias voltage	V_{DD}	7	V
◆ Control voltage (CTL-A/B/C)	Vctl	5	V
◆ Operating temperature	Topr	–20 to +90	℃
◆ Storage temperature	Tstg	–65 to +150	℃

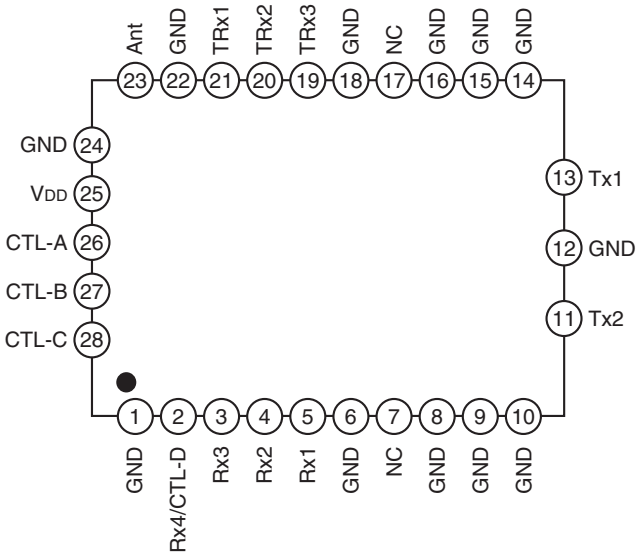
Block Diagram



Note) Built-in SW control circuit

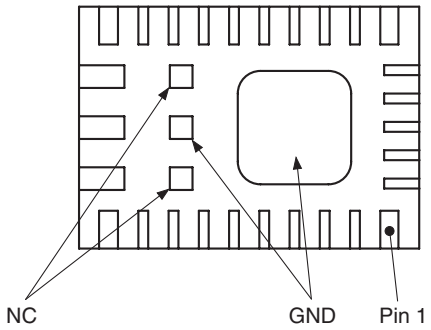
Pin Configuration

(Top View)



Note) Each Rx path can be used from 869 to 1990MHz frequency.
User can select these Rx paths suitably.

Pin Description



Pin No.	Symbol	Pin No.	Symbol
1	GND	15	GND
2	Rx4/CTL-D	16	GND
3	Rx3	17	NC
4	Rx2	18	GND
5	Rx1	19	TRx3
6	GND	20	TRx2
7	NC	21	TRx1
8	GND	22	GND
9	GND	23	Ant
10	GND	24	GND
11	Tx2	25	V_{DD}
12	GND	26	CTL-A
13	Tx1	27	CTL-B
14	GND	28	CTL-C

Truth Table

Active path	Vctl state				Switch state																		
	A	B	C	D	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19
Tx1	H	H	L	L	H	L	L	L	L	L	L	L	H	H	H	H	H	L	H	L	H	L	H
Tx2	H	L	L	L	L	H	L	L	L	L	L	H	L	H	H	H	H	L	H	L	H	L	H
Rx1	L	L	L	L	L	L	H	L	L	L	L	H	H	L	H	H	H	H	H	L	H	L	H
Rx2	L	L	H	L	L	L	L	H	L	L	L	H	H	H	L	H	H	H	H	L	H	L	H
Rx3	L	H	H	L	L	L	L	L	H	L	L	H	H	H	H	L	H	H	H	L	H	L	H
Rx4	L	H	L	L	L	L	L	L	L	H	L	H	H	H	H	H	L	H	H	L	H	L	H
TRx1	H	L	H	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	H	L	H
TRx2	H	H	H	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	H	L	L	H
TRx3	—	—	—	H	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	H	H	L

Electrical Characteristics

(V_{DD} = 2.8V, Vctl = 2.6V, Ta = 25℃)

Item	Symbol	Path	Condition	Min.	Typ.	Max.	Unit
Insertion loss	IL	Tx1 – Ant	*1	—	0.90	1.15	dB
		Tx2 – Ant	*2	—	1.15	1.40	
		Ant – TRx1 (Tx)	*3	—	0.55/0.85	0.75/1.05	
		Ant – TRx2 (Tx)	*3	—	0.55/0.85	0.75/1.05	
		Ant – TRx3 (Tx)	*3	—	0.55/0.85	0.75/1.05	
		Ant – Rx1	*4	—	0.90/1.35	1.10/1.55	
		Ant – Rx2	*4	—	0.90/1.35	1.10/1.55	
		Ant – Rx3	*4	—	0.90/1.35	1.10/1.55	
		Ant – Rx4	*4	—	0.90/1.35	1.10/1.55	
		Ant – TRx1 (Rx)	*5	—	0.55/1.05	0.75/1.25	
		Ant – TRx2 (Rx)	*5	—	0.55/1.05	0.75/1.25	
		Ant – TRx3 (Rx)	*5	—	0.55/1.05	0.75/1.25	

*1 Frequency = 915MHz, Input signal is CW, Pin = +34dBm

*2 Frequency = 1910MHz, Input signal is CW, Pin = +32dBm

*3 Frequency = 855/1980MHz, Input signal is CW, Pin = +29dBm

*4 Frequency = 960/1990MHz, Input signal is CW, Pin = –5dBm

*5 Frequency = 900/2170MHz, Input signal is CW, Pin = –5dBm

Item	Symbol	Path	Condition	Min.	Typ.	Max.	Unit
Isolation	**Tx Path Activated**						
	ISO.	Active path: Tx1 – Ant					dB
		Tx1 – Rx1	824 to 915MHz	27	35	—	
		Tx1 – Rx2		27	35	—	
		Tx1 – Rx3		30	40	—	
		Tx1 – Rx4		30	40	—	
		Tx1 – Tx2		25	35	—	
			1760 to 1830MHz	25	30	—	
		Tx1 – TRx1	824 to 915MHz	25	35	—	
		Tx1 – TRx2		25	34	—	
		Tx1 – TRx3		25	35	—	
		Active path: Tx2 – Ant					
		Tx2 – Rx1	1710 to 1785MHz 1850 to 1910MHz	20	27	—	
		Tx2 – Rx2		20	30	—	
		Tx2 – Rx3	1850 to 1880MHz	32	34	—	
		Tx2 – Rx4	1710 to 1785MHz 1850 to 1910MHz	25	35	—	
		Tx2 – TRx1		25	35	—	
		Tx2 – TRx2		25	30	—	
		Tx2 – TRx3		25	35	—	
		Active path: TRx1 – Ant					
		TRx1 – Rx1	824 to 849MHz 1710 to 1980MHz	25	35	—	
		TRx1 – Rx2		25	35	—	
		TRx1 – Rx3		25	35	—	
		TRx1 – Rx4		25	35	—	
		TRx1 – Tx1	824 to 915MHz 1710 to 1980MHz	25	35	—	
		TRx1 – Tx2		20	30	—	
		TRx1 – TRx2		13	18	—	
		TRx1 – TRx3		20	26	—	
		Active path: TRx2 – Ant					
		TRx2 – Rx1	824 to 849MHz 1710 to 1980MHz	25	35	—	
		TRx2 – Rx2		25	35	—	
		TRx2 – Rx3		25	37	—	
		TRx2 – Rx4		25	38	—	
		TRx2 – Tx1	824 to 915MHz 1710 to 1980MHz	25	35	—	
		TRx2 – Tx2		20	30	—	
		TRx2 – TRx1		13	18	—	
		TRx2 – TRx3		13	18	—	
		Active path: TRx3 – Ant					
		TRx3 – Rx1	824 to 849MHz 1710 to 1980MHz	25	34	—	
		TRx3 – Rx2		25	35	—	
		TRx3 – Rx3		25	36	—	
		TRx3 – Rx4		25	38	—	
		TRx3 – Tx1	824 to 915MHz 1710 to 1980MHz	25	35	—	
		TRx3 – Tx2		20	30	—	
		TRx3 – TRx1		20	25	—	
		TRx3 – TRx2		13	17	—	

Item	Symbol	Path	Condition	Min.	Typ.	Max.	Unit
Isolation	**Rx Path Activated**						
	ISO.	Active path: Ant – Rx1					dB
		Ant – Tx1	824 to 915MHz	25	35	—	
		Ant – Tx2	1710 to 1910MHz	20	28	—	
		Ant – TRx1	824 to 849MHz 1710 to 1980MHz	20	27	—	
		Ant – TRx2		25	35	—	
		Ant – TRx3		20	28	—	
		Rx1 – Tx1	824 to 915MHz	25	35	—	
		Rx1 – Tx2	1710 to 1910MHz	25	40	—	
		Rx1 – TRx1	824 to 849MHz 1710 to 1980MHz	25	34	—	
		Rx1 – TRx2		20	30	—	
		Rx1 – TRx3		25	35	—	
		Active path: Ant – Rx2					
		Ant – Tx1	824 to 915MHz	25	36	—	
		Ant – Tx2	1710 to 1910MHz	25	30	—	
		Ant – TRx1	824 to 849MHz 1710 to 1980MHz	20	28	—	
		Ant – TRx2		25	38	—	
		Ant – TRx3		20	29	—	
		Rx2 – Tx1	824 to 915MHz	25	35	—	
		Rx2 – Tx2	1710 to 1910MHz	25	35	—	
		Rx2 – TRx1	824 to 849MHz 1710 to 1980MHz	25	34	—	
		Rx2 – TRx2		20	30	—	
		Rx2 – TRx3		25	35	—	
		Active path: Ant – Rx3					
		Ant – Tx1	824 to 915MHz	25	36	—	
		Ant – Tx2	1710 to 1910MHz	20	31	—	
		Ant – TRx1	824 to 849MHz 1710 to 1980MHz	20	27	—	
		Ant – TRx2		25	38	—	
		Ant – TRx3		20	29	—	
		Rx3 – Tx1	824 to 915MHz	25	35	—	
		Rx3 – Tx2	1710 to 1910MHz	25	38	—	
		Rx3 – TRx1	824 to 849MHz 1710 to 1980MHz	25	34	—	
		Rx3 – TRx2		20	31	—	
		Rx3 – TRx3		25	36	—	
		Active path: Ant – Rx4					
		Ant – Tx1	824 to 915MHz	25	36	—	
		Ant – Tx2	1710 to 1910MHz	20	31	—	
		Ant – TRx1	824 to 849MHz 1710 to 1980MHz	20	27	—	
		Ant – TRx2		25	38	—	
		Ant – TRx3		20	29	—	
		Rx4 – Tx1	824 to 915MHz	25	35	—	
		Rx4 – Tx2	1710 to 1910MHz	25	34	—	
		Rx4 – TRx1	824 to 849MHz 1710 to 1980MHz	25	34	—	
		Rx4 – TRx2		20	31	—	
		Rx4 – TRx3		25	36	—	

Item	Symbol	Path		Condition		Min.	Typ.	Max.	Unit
Harmonic		Tx1 – Ant	2nd Harmonic	1648 to 1698MHz 1760 to 1830MHz	CW, Pin = +34dBm	—	–43	–36	dBm
			3rd Harmonic	2472 to 2547MHz 2640 to 2745MHz		—	–41	–36	
		Tx2 – Ant	2nd Harmonic	3420 to 3570MHz 3760 to 5730MHz	CW, Pin = +32dBm	—	–40	–36	
			3rd Harmonic	5130 to 5355MHz 5550 to 5730MHz		—	–40	–36	
		<Low band> TRx1 – Ant TRx2 – Ant TRx3 – Ant	2nd Harmonic	1648 to 1698MHz	CW, Pin = +29dBm	—	–43	–36	
			3rd Harmonic	2472 to 1698MHz		—	–43	–36	
		<High band> TRx1 – Ant TRx2 – Ant TRx3 – Ant	2nd Harmonic	3420 to 3960MHz	CW, Pin = +29dBm	—	–43	–36	
			3rd Harmonic	5130 to 5940MHz		—	–43	–36	
Attenuation		Tx1 – Ant		1648 to 1830MHz	2fo	25	30	—	dB
				2472 to 2745MHz	3fo	25	30	—	
				3296 to 3660MHz	4fo	20	25	—	
				4120 to 4575MHz	5fo	17	20	—	
				4944 to 5490MHz	6fo	17	20	—	
				5768 to 6405MHz	7fo	17	20	—	
		Tx2 – Ant		3420 to 3820MHz	2fo	25	30	—	
				5130 to 5730MHz	3fo	25	30	—	
VSWR	VSWR	Ant		824 to 2170MHz		—	1.5	1.7	—
		Tx1		824 to 915MHz		—	1.3		
		Tx2		1710 to 1910MHz		—	1.3		
		TRx1		824 to 2170MHz		—	1.2		
		TRx2				—	1.2		
		TRx3				—	1.2		
		Rx1		869 to 1990MHz		—	1.2		
		Rx2				—	1.2		
		Rx3				—	1.2		
		Rx4				—	1.4		
Switching speed		Ant – Tx1 Ant – Tx2 Ant – TRx		90% OFF to 90% ON		—	3	5	μs

Supply voltage

(Ta = 25℃)

Item	Min.	Typ.	Max.	Unit
Bias voltage (V_{DD})	2.6	2.8	3.0	V

Control voltage

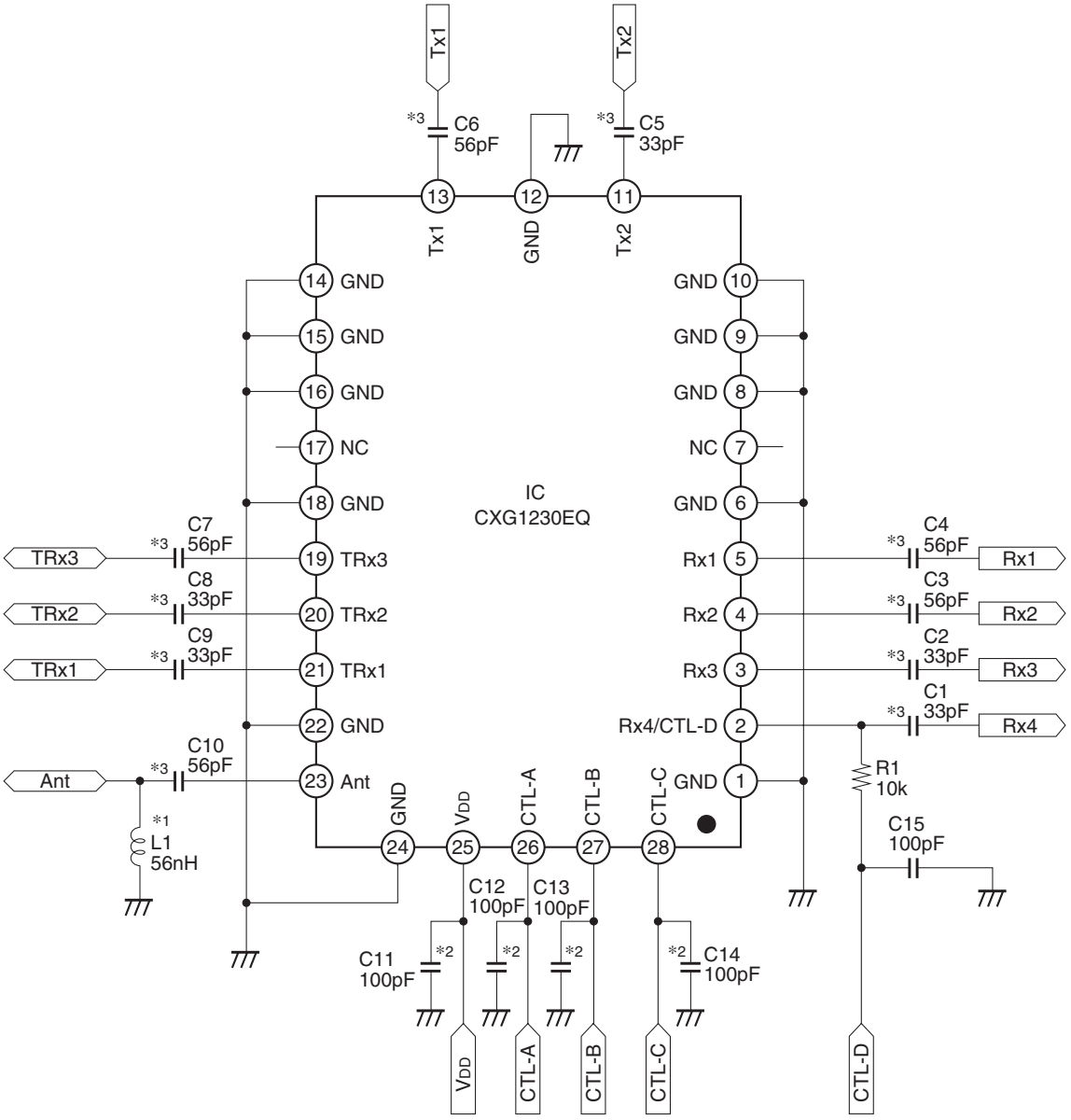
(Ta = 25℃)

Item	State	Min.	Typ.	Max.	Unit
Control voltage (CTL-A/B/C)	High	2.0	2.6	2.8	V
	Low	0	—	0.5	

Current consumption

Item	Condition	Min.	Typ.	Max.	Unit
Bias current	V_{DD} = 2.8V	—	280	360	μA
Control current	Vctl (H) = 2.6V/1-wire	—	30	38	

Recommended Circuit 1
(GSM: Quad band, UMTS: Triple band)

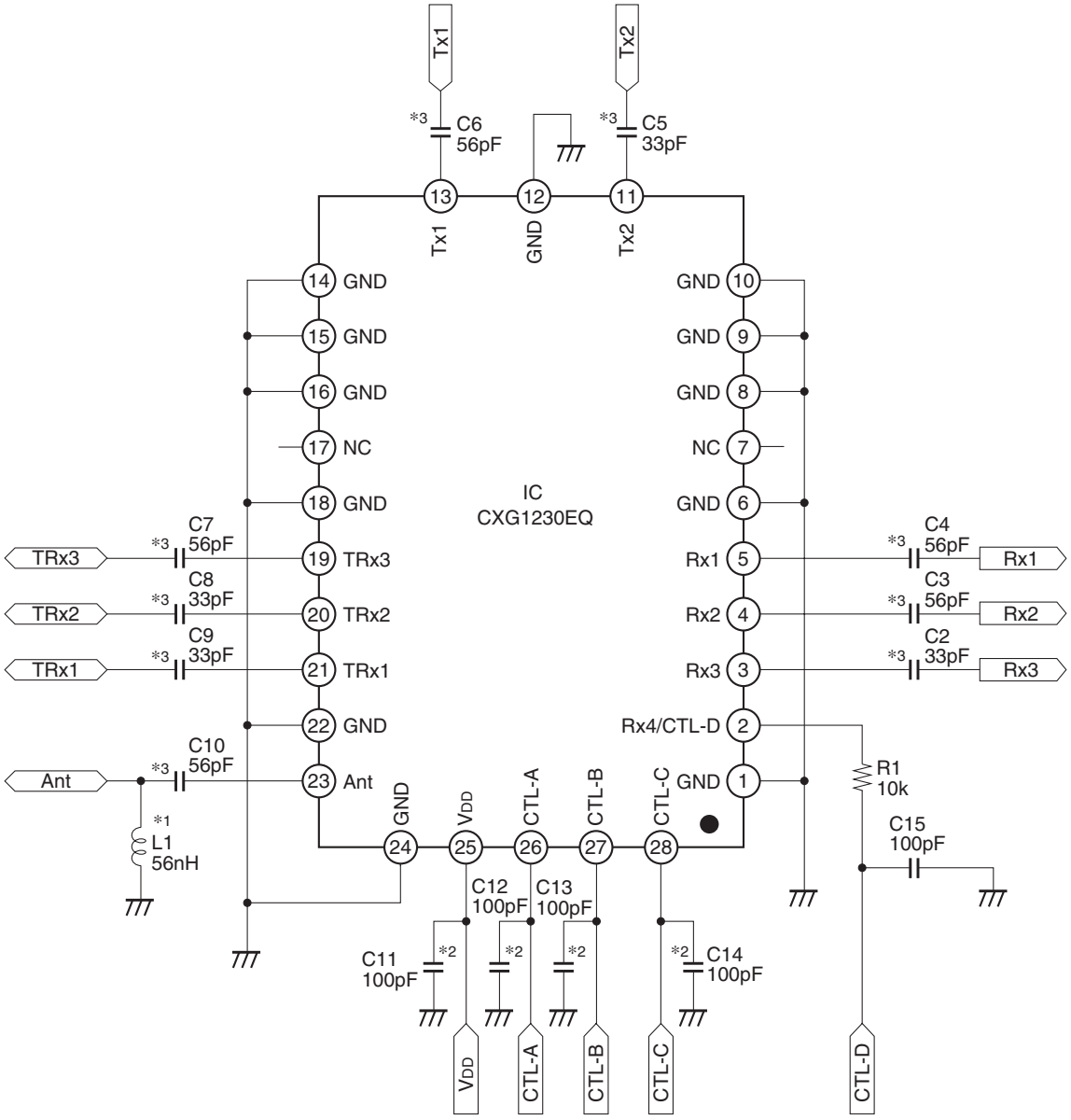


*1 Inductor (56nH) is recommended on Ant port for ESD protection.
Capacitors are required on all RF ports for DC blocking.

*2 These capacitors are not mandatory.

*3 Recommended capacitance is as follows.
For low band (869 to 960MHz): 56pF
For high band (1805 to1990MHz): 33pF

Recommended Circuit 2
(GSM: Triple band, UMTS: Triple band)



*1 Inductor (56nH) is recommended on Ant port for ESD protection.
Capacitors are required on all RF ports for DC blocking.

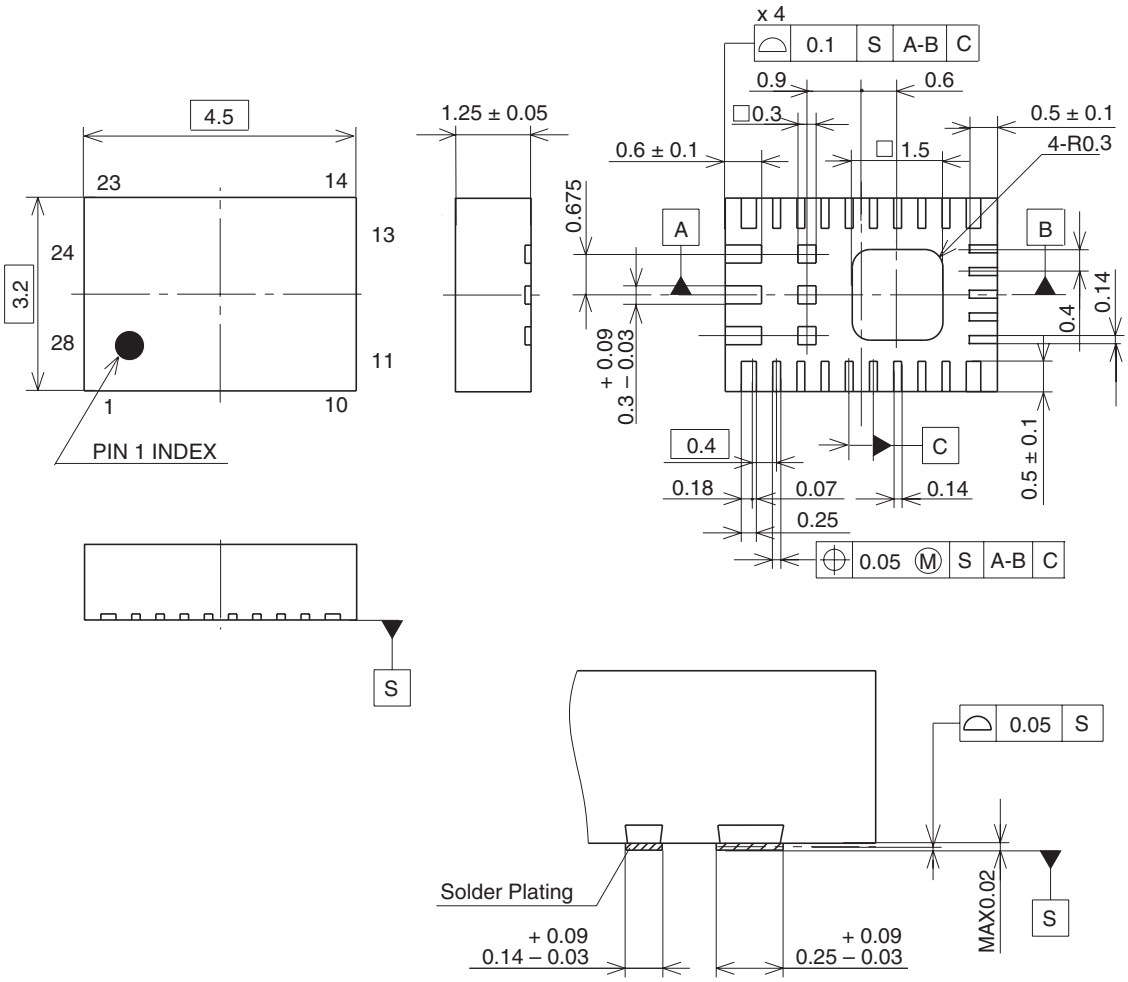
*2 These capacitors are not mandatory.

*3 Recommended capacitance is as follows.
For low band (869 to 960MHz): 56pF
For high band (1805 to1990MHz): 33pF

Package Outline

(Unit: mm)

28PIN LQFN (PLASTIC)



TERMINAL SECTION

Note:Cutting burr of lead are 0.05mm MAX.

SONY CODE	LQFN-28P-01
EIAJ CODE	————
JEDEC CODE	————

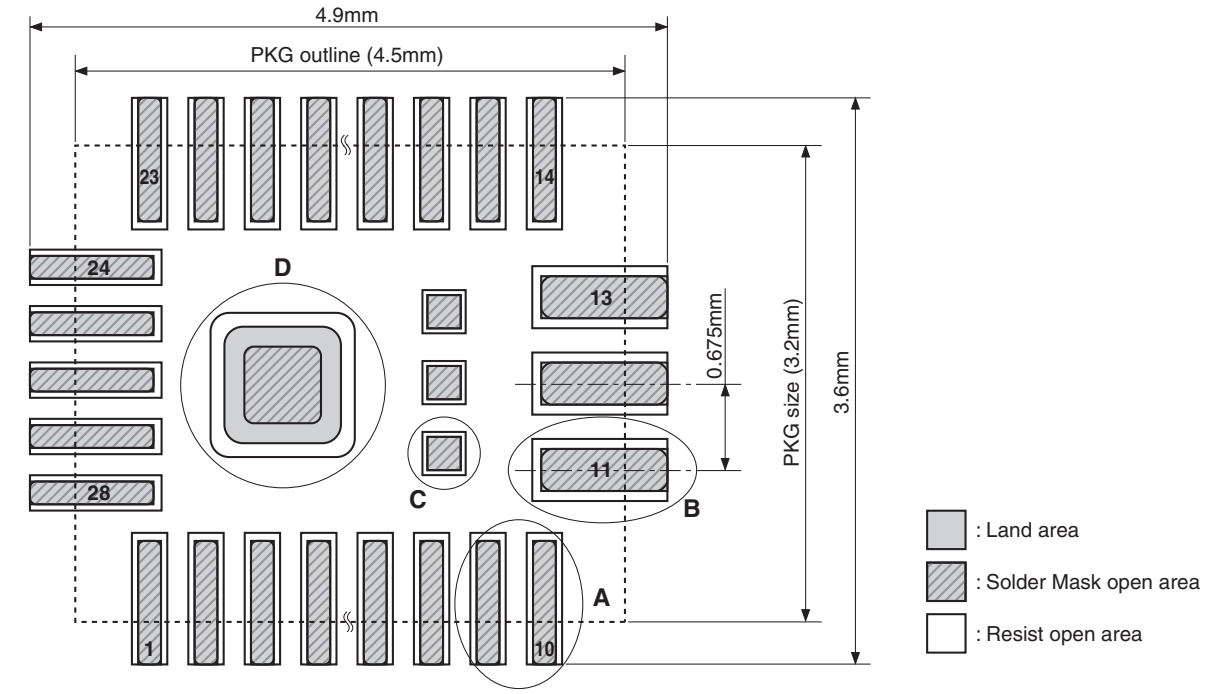
PACKAGE STRUCTURE

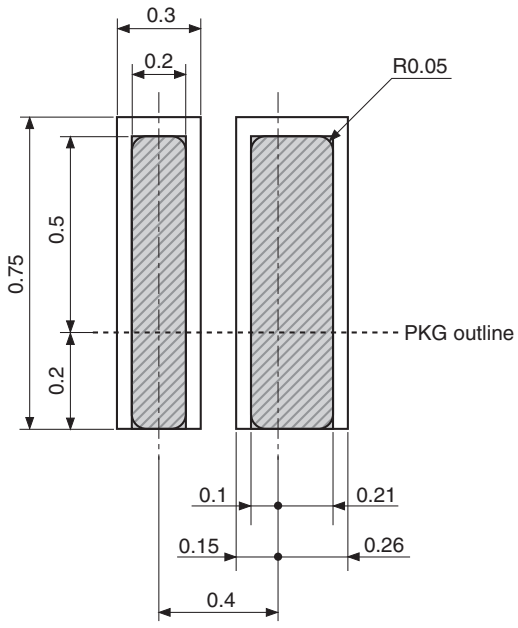
PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	COPPER ALLOY
PACKAGE MASS	0.05g

LEAD PLATING SPECIFICATIONS

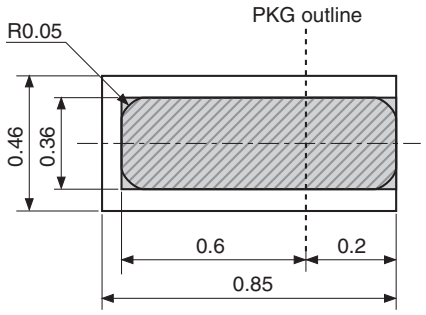
ITEM	SPEC.
LEAD MATERIAL	COPPER ALLOY
SOLDER COMPOSITION	Sn-Bi Bi:1-4wt%
PLATING THICKNESS	5-18µm

Pad Design

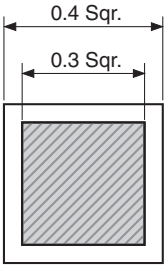




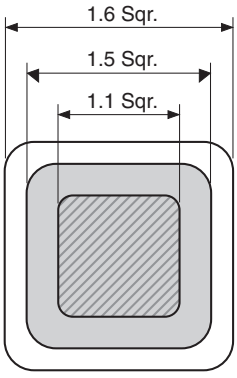
[Detail A]



[Detail B]



[Detail C]



[Detail D]

(Unit: mm)