
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.

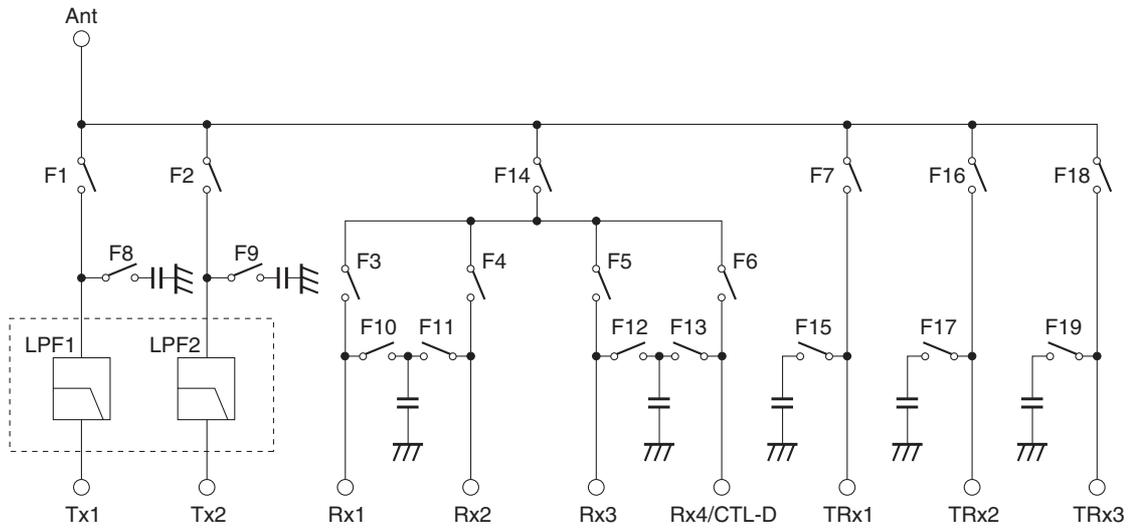
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**Absolute Maximum Ratings**

(Ta = 25°C)

| | | | |
|-------------------------------|------------------|-------------|----|
| ◆ Bias voltage | V _{DD} | 7 | V |
| ◆ Control voltage (CTL-A/B/C) | V _{ctl} | 5 | V |
| ◆ Operating temperature | T _{opr} | -20 to +90 | °C |
| ◆ Storage temperature | T _{stg} | -65 to +150 | °C |

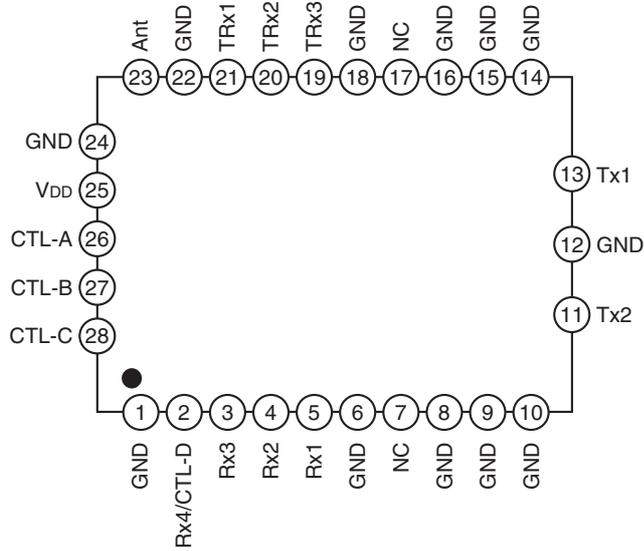
Block Diagram



Note) Built-in SW control circuit

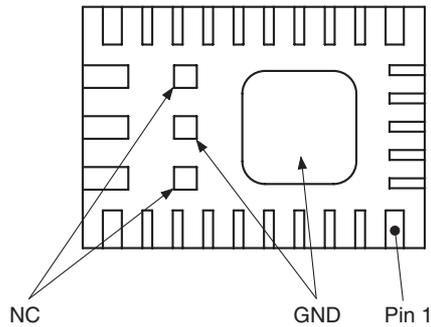
Pin Configuration

(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, V_{ctl} = 2.6V, T_a = 25°C)

| 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 | ISO. | Tx Path Activated | | | | | | dB |
| | | Active path: Tx1 – Ant | | | | | | |
| | | Tx1 – Rx1 | 824 to 915MHz | 27 | 35 | — | | |
| | | Tx1 – Rx2 | | 27 | 35 | — | | |
| | | Tx1 – Rx3 | | 30 | 40 | — | | |
| | | Tx1 – Rx4 | | 30 | 40 | — | | |
| | | Tx1 – Tx2 | | 25 | 35 | — | | |
| | | Tx1 – Tx2 | 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 | 20 | 27 | — | | |
| | | Tx2 – Rx2 | 1850 to 1910MHz | 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 | ISO. | Rx Path Activated | | | | | | dB |
| | | Active path: Ant – Rx1 | | | | | | |
| | | 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°C)

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

Control voltage

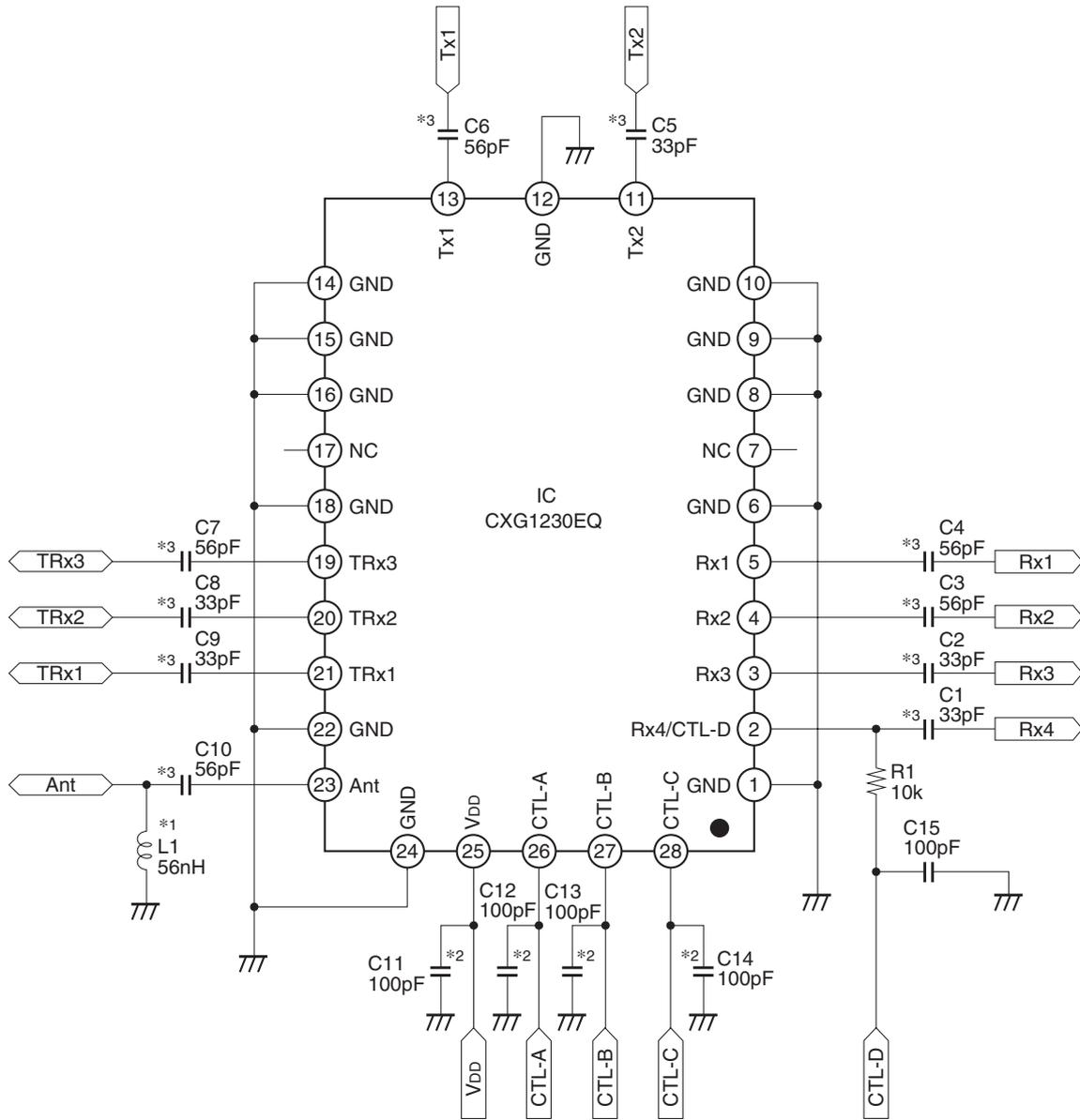
(Ta = 25°C)

| 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

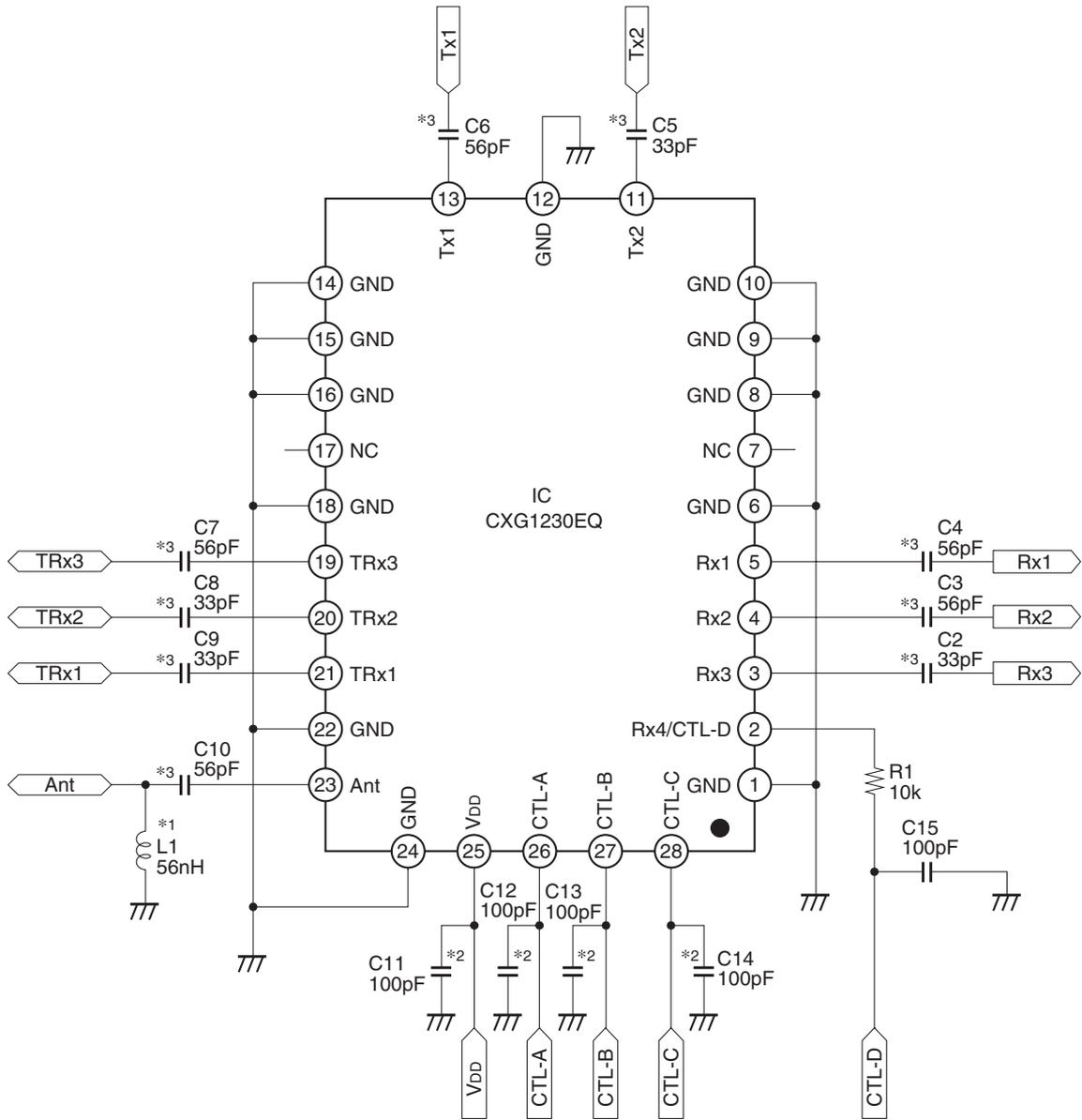
| Item | Condition | Min. | Typ. | Max. | Unit |
|-----------------|------------------------------------|------|------|------|------|
| Bias current | V _{DD} = 2.8V | — | 280 | 360 | μA |
| Control current | V _{ctl} (H) = 2.6V/1-wire | — | 30 | 38 | |

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



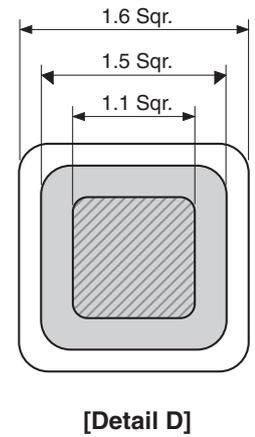
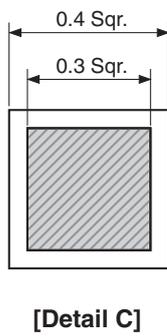
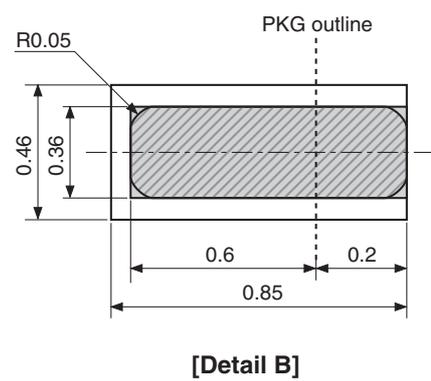
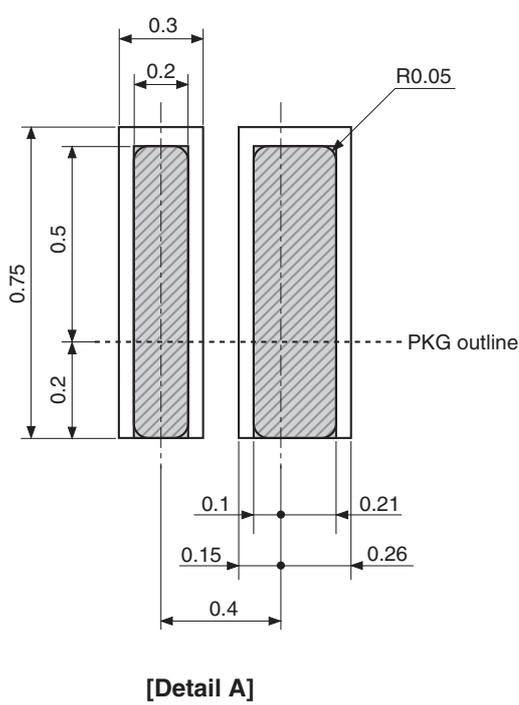
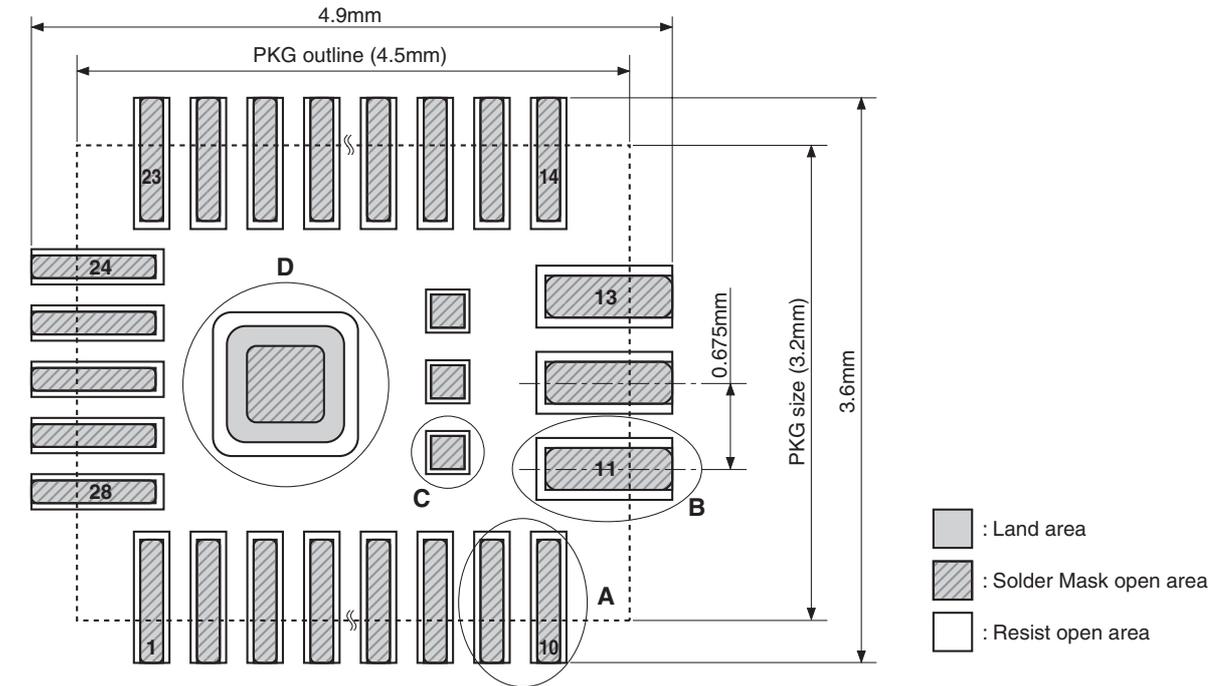
- *1 Inductor (56nH) is recommended on Ant port for ESD protection. Capacitors are required on all RF ports for DC blocking.
- *2 These capacitors are not mandatory.
- *3 Recommended capacitance is as follows.
 For low band (869 to 960MHz): 56pF
 For high band (1805 to 1990MHz): 33pF

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 to 1990MHz): 33pF

Pad Design



(Unit: mm)