

## Dual-Band Wireless DPDT RF Switch

### DESCRIPTION

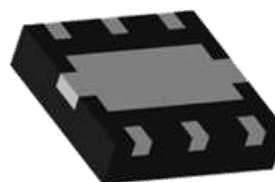
- The CG2164X3 is a GaAs MMIC DPDT (Double Pole Double Throw) switch for 2.5 GHz and 6 GHz dual-band wireless LAN applications

### FEATURES

- Control Voltage:  
VC(H) = 1.8 to 5.0 V (3.0V TYP.)  
VC(L) = -0.2 to 0.2 V (0V TYP.)
- Low Insertion Loss:  
 $L_{ins} = 0.50$  dB TYP. @  $f = 2.5$  GHz  
 $L_{ins} = 0.60$  dB TYP. @  $f = 6.0$  GHz
- High Isolation:  
ISL = 23 dB TYP. @  $f = 2.5$  GHz  
ISL = 15 dB TYP. @  $f = 6.0$  GHz
- Power Handling:  
 $P_{in}(0.5dB) = +32$  dBm TYP. @  $f = 2.5$  GHz,  
VC(H) = 3.0 V, VC(L) = 0 V  
 $P_{in}(0.5dB) = +30$  dBm TYP. @  $f = 6.0$  GHz,  
VC(H) = 3.0 V, VC(L) = 0 V

### PACKAGE

- 6-pin TSON Package  
(1.5mm x 1.5mm x 0.37mm)



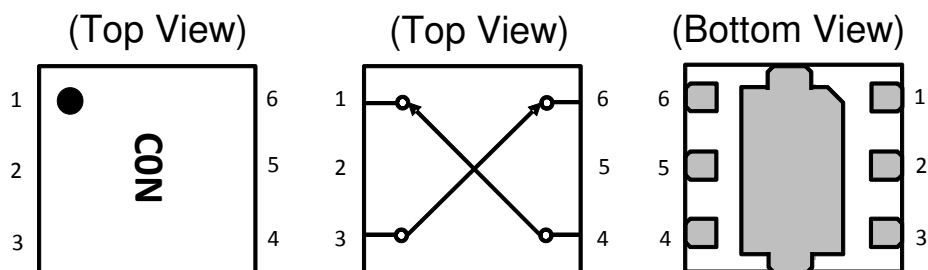
### APPLICATIONS

- Dual-band wireless LAN  
(IEEE802.11a/b/g/n/ac)

### ORDERING INFORMATION

| Part Number   | Order Number  | Package                      | Marking | Description                                                                                                                                                          |
|---------------|---------------|------------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CG2164X3      | CG2164X3-C2   | 6-pin plastic TSON (Pb-Free) | C0N     | <ul style="list-style-type: none"> <li>Embossed tape 8 mm wide</li> <li>Pin 1, 6 face the perforation side of the tape</li> <li>MOQ 10 kpcs/reel</li> </ul>          |
| CG2164X3-EVAL | CG2164X3-EVAL |                              |         | <ul style="list-style-type: none"> <li>Evaluation Board with DC block capacitors, power supply bypass capacitors, and RF and DC connectors</li> <li>MOQ 1</li> </ul> |

## PIN CONFIGURATION AND INTERNAL BLOCK DIAGRAM



| Pin No. | Pin Name |
|---------|----------|
| 1       | ANT2     |
| 2       | VC2      |
| 3       | RX       |
| 4       | TX       |
| 5       | VC1      |
| 6       | ANT1     |

**Remark** Exposed pad : GND

## TRUTH TABLE

| VC1  | VC2  | ANT1-TX | ANT1-RX | ANT2-TX | ANT2-RX |
|------|------|---------|---------|---------|---------|
| High | Low  | OFF     | ON      | ON      | OFF     |
| Low  | High | ON      | OFF     | OFF     | ON      |

## ABSOLUTE MAXIMUM RATINGS

(TA = +25°C, unless otherwise specified)

| Parameter                     | Symbol           | Rating                | Unit |
|-------------------------------|------------------|-----------------------|------|
| Control Voltage               | VC               | 6.0 <sup>Note 1</sup> | V    |
| Input Power                   | P <sub>in1</sub> | +33 <sup>Note 2</sup> | dBm  |
|                               | P <sub>in2</sub> | +26 <sup>Note 3</sup> | dBm  |
| Operating Ambient Temperature | T <sub>A</sub>   | -45~+85               | °C   |
| Storage Temperature           | T <sub>stg</sub> | -55~+150              | °C   |

**Note**

1. |VC1 - VC2| ≤ 6.0V
2. 3.0V ≤ |VC1 - VC2| ≤ 5.0V f ≥ 0.5GHz
3. 3.0V ≤ |VC1 - VC2| ≤ 5.0V f ≥ 0.05GHz

## RECOMMENDED OPERATING RANGE

(TA = +25°C, unless otherwise specified)

| Parameter                  | Symbol | MIN. | TYP. | MAX. | Unit |
|----------------------------|--------|------|------|------|------|
| Operating Frequency        | f      | 0.05 | -    | 6.0  | GHz  |
| Switch Control Voltage (H) | VC(H)  | +1.8 | +3.0 | +5.0 | V    |
| Switch Control Voltage (L) | VC(L)  | -0.2 | 0    | +0.2 | V    |

## ELECTRICAL CHARACTERISTICS 1

(TA=+25°C, VC(H)=3.0V, VC(L)=0V, Zo=50Ω, DC Block Capacitance=8pF, unless otherwise specified)

| Parameter                                               | Symbol                 | Test Conditions                      | MIN. | TYP.  | MAX. | Unit |
|---------------------------------------------------------|------------------------|--------------------------------------|------|-------|------|------|
| Insertion Loss                                          | Lins1                  | f = 0.05 to 0.5 GHz <sup>Note1</sup> | -    | 0.40  | 0.65 | dB   |
|                                                         | Lins2                  | f = 0.5 to 1.0 GHz <sup>Note1</sup>  | -    | 0.45  | 0.70 | dB   |
|                                                         | Lins3                  | f = 1.0 to 2.0 GHz <sup>Note1</sup>  | -    | 0.50  | 0.75 | dB   |
|                                                         | Lins4                  | f = 2.0 to 2.5 GHz                   | -    | 0.50  | 0.75 | dB   |
|                                                         | Lins5                  | f = 2.5 to 4.9 GHz                   | -    | 0.55  | 0.90 | dB   |
|                                                         | Lins6                  | f = 4.9 to 6.0 GHz                   | -    | 0.60  | 1.00 | dB   |
| Isolation<br>(ANT to TX, RX)                            | ISL1                   | f = 0.05 to 0.5 GHz <sup>Note1</sup> | 32   | 35    | -    | dB   |
|                                                         | ISL2                   | f = 0.5 to 1.0 GHz <sup>Note1</sup>  | 26   | 29    | -    | dB   |
|                                                         | ISL3                   | f = 1.0 to 2.0 GHz <sup>Note1</sup>  | 21   | 24    | -    | dB   |
|                                                         | ISL4                   | f = 2.0 to 2.5 GHz                   | 20   | 23    | -    | dB   |
|                                                         | ISL5                   | f = 2.5 to 4.9 GHz                   | 13   | 16    | -    | dB   |
|                                                         | ISL6                   | f = 4.9 to 6.0 GHz                   | 12   | 15    | -    | dB   |
| Isolation<br>(ANT1 to ANT2, TX to RX)                   | ISL7                   | f = 0.05 to 0.5 GHz <sup>Note1</sup> | 34   | 37    | -    | dB   |
|                                                         | ISL8                   | f = 0.5 to 1.0 GHz <sup>Note1</sup>  | 27   | 30    | -    | dB   |
|                                                         | ISL9                   | f = 1.0 to 2.0 GHz <sup>Note1</sup>  | 22   | 25    | -    | dB   |
|                                                         | ISL10                  | f = 2.0 to 2.5 GHz                   | 22   | 25    | -    | dB   |
|                                                         | ISL11                  | f = 2.5 to 4.9 GHz                   | 15   | 18    | -    | dB   |
|                                                         | ISL12                  | f = 4.9 to 6.0 GHz                   | 15   | 18    | -    | dB   |
| Return Loss                                             | RL1                    | f = 0.05 to 2.0 GHz <sup>Note1</sup> | -    | 20    | -    | dB   |
|                                                         | RL2                    | f = 2.0 to 6.0 GHz                   | -    | 15    | -    | dB   |
| 0.5 dB Loss Compression<br>Input Power <sup>Note2</sup> | P <sub>in(0.5dB)</sub> | f = 0.05 GHz                         | -    | +24.5 | -    | dBm  |
|                                                         |                        | f = 0.5 to 1.0 GHz                   | -    | +31   | -    | dBm  |
|                                                         |                        | f = 2.4 to 2.5 GHz                   | -    | +32   | -    | dBm  |
|                                                         |                        | f = 4.9 to 6.0 GHz                   | -    | +30   | -    | dBm  |

**Note1** DC block capacitance = 1,000pF at f=0.05 to 2.0GHz

**Note2** P<sub>in(0.5dB)</sub> is the measured input power level when the insertion loss increases 0.5dB more than that of the linear range.

## ELECTRICAL CHARACTERISTICS 2

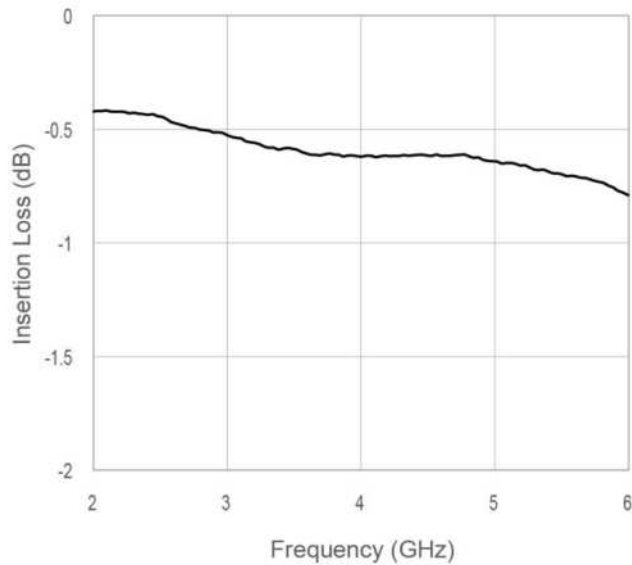
(TA=+25°C, VC(H)=3.0V, VC(L)=0V, Zo=50Ω, DC Block Capacitance=8pF, unless otherwise specified)

| Parameter                       | Symbol | Test Conditions                         | MIN. | TYP. | MAX. | Unit |
|---------------------------------|--------|-----------------------------------------|------|------|------|------|
| 2nd Harmonics                   | 2f0    | f = 2.5 GHz, Pin=+20dBm                 | -    | 85   | -    | dBc  |
|                                 |        | f = 6.0 GHz, Pin=+20dBm                 | -    | 80   | -    | dBc  |
| 3rd Harmonics                   | 3f0    | f = 2.5 GHz, Pin=+20dBm                 | -    | 85   | -    | dBc  |
|                                 |        | f = 6.0 GHz, Pin=+20dBm                 | -    | 85   | -    | dBc  |
| 3rd Order Input Intercept Point | IIP3   | f = 2.5GHz<br>2-tone 1MHz Spacing       | -    | +55  | -    | dBm  |
| Error Vector Magnitude          | EVM    | 802.11a, 64QAM, 54Mbps,<br>Pin≤+24.5dBm | -    | 2.5  | -    | %    |
|                                 |        | 802.11g, 64QAM, 54Mbps,<br>Pin≤+25dBm   | -    | 2.5  | -    | %    |
| Switch Control Speed            | tsw    | 50% CTL to 90/10%                       | -    | 30   | -    | ns   |
| Switch Control Current          | Icont  | Non RF                                  | -    | 2    | -    | μA   |

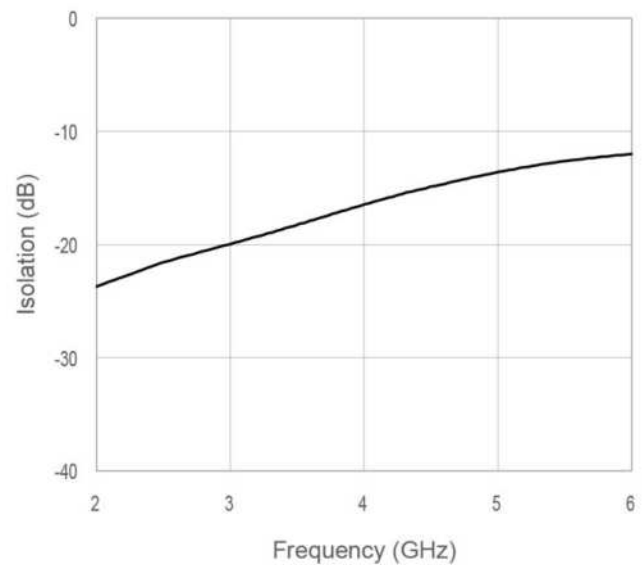
## TYPICAL CHARACTERISTICS

(VC(H)=3V, VC(L)=0V,  $T_A = +25^{\circ}\text{C}$ , DC Block Capacitance=8pF, through board loss is subtracted in insertion loss data)

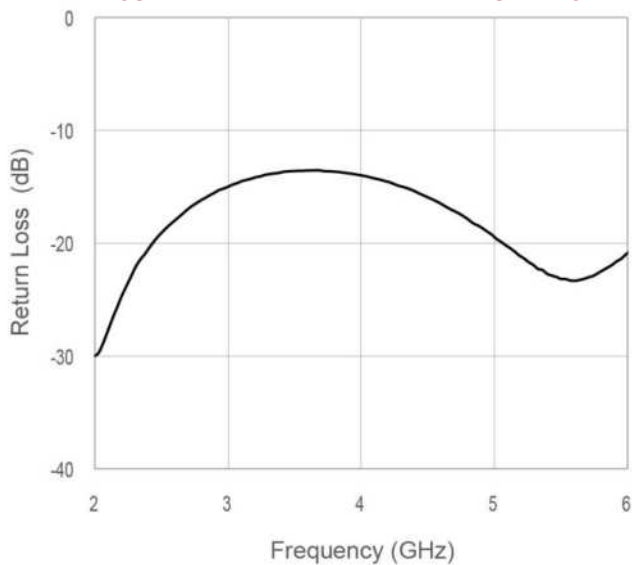
**Typical Insertion Loss vs. Frequency**



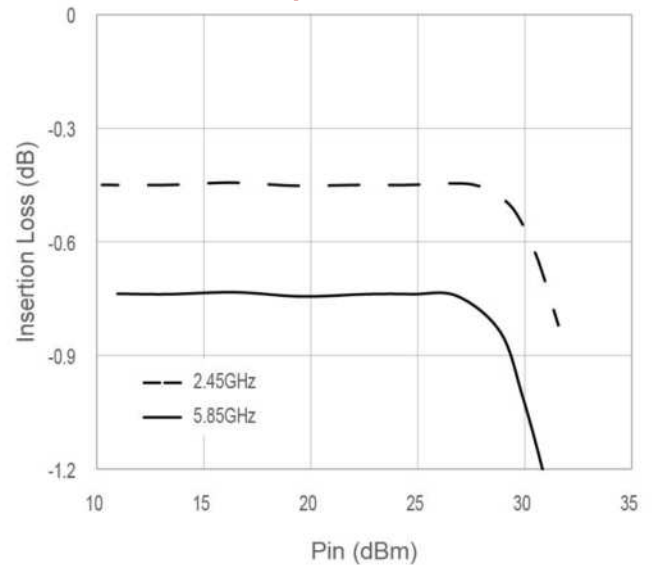
**Typical Isolation vs. Frequency**



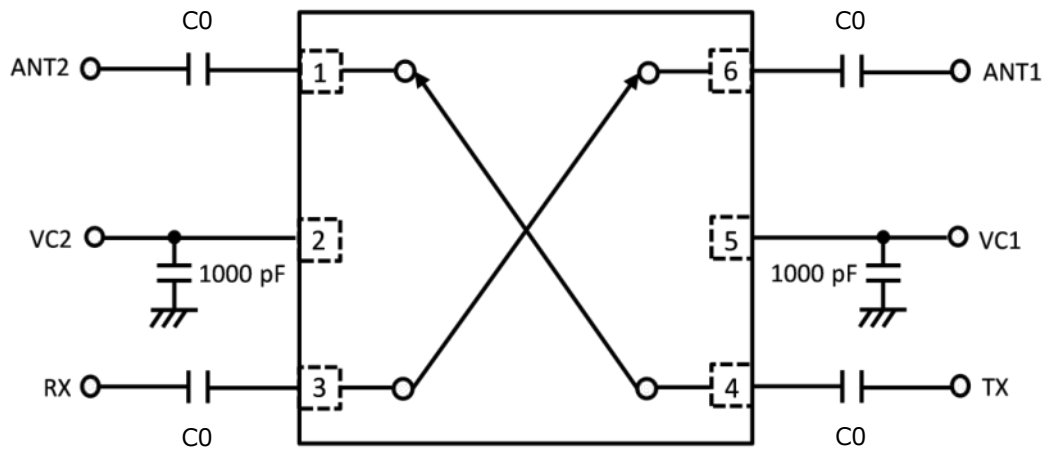
**Typical Return Loss vs. Frequency**



**Typical Insertion Loss vs. Input Power**



## EVALUATION CIRCUIT

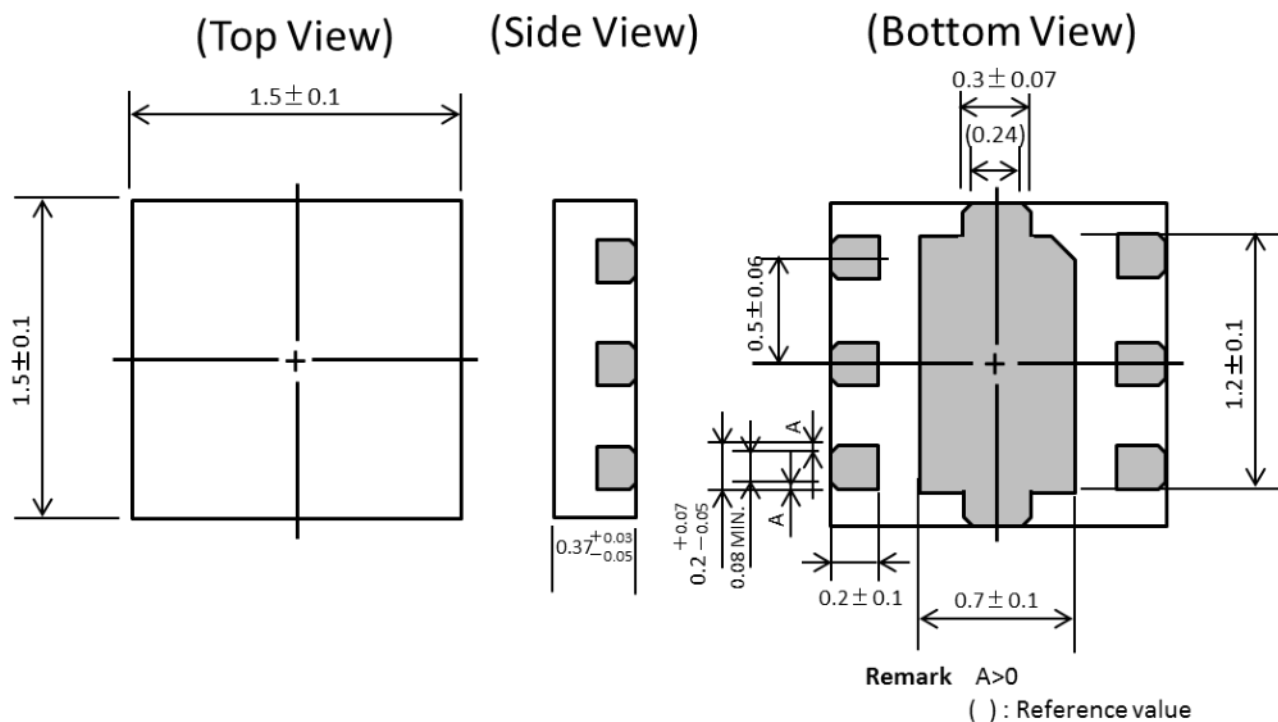


**Note** C0 : 0.05 to 2.0 GHz 1,000pF  
2.0 to 6.0 GHz 8pF

The application circuits and their parameters are for reference only and are not intended for use in actual designs. DC Blocking Capacitors are required at all RF ports.

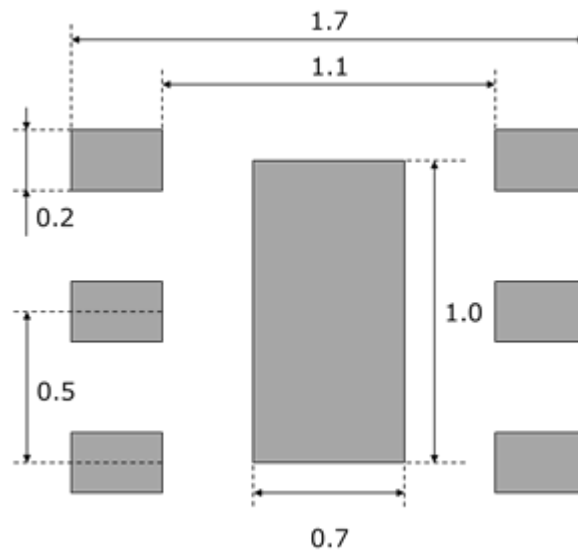
## PACKAGE DIMENSIONS

6-pin Plastic TSON (Unit: mm)



## PCB Layout Footprint

6-pin TSON (Unit: mm)



The PCB Layout Footprint In this document Is for reference only.

## RECOMMENDED SOLDERING CONDITIONS

Recommended Soldering Conditions are available on CEL's [Part Summary page](#) under Associated Documents

## REVISION HISTORY

| Version                                     | Change to current version                                                                                                                               | Page(s)    |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| CDS-0033-01 (Issue A)<br>September 14, 2016 | Preliminary datasheet                                                                                                                                   | N/A        |
| CDS-0033-02 (Issue B)<br>December 27, 2016  | Revised Electrical Characteristics table<br>Added "Recommended Soldering Conditions" section                                                            | 3, 5       |
| CDS-0033-03 (Issue C)<br>March 20, 2017     | Initial Datasheet. Revised Electrical Characteristics table                                                                                             | 3          |
| CDS-0033-05 (Issue D)<br>August 28, 2017    | Updated Characteristics tables and added Error Vector Magnitude<br>Added "Typical Characteristics" graphs section<br>Updated Evaluation Circuit diagram | 3, 4, 5, 6 |
| CDS-0033-06 (Issue E)<br>October 25, 2017   | Added PCB Layout Footprint                                                                                                                              | 7          |

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