RF SWITCH

CG2176X3

50Ω TERMINATION TYPE HIGH POWER SPDT SWITCH

DESCRIPTION

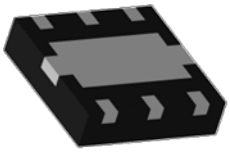
- The CG2176X3 is a pHEMT GaAs MMIC 50Ω termination type high power SPDT (Single Pole Double Throw) switch which was developed for WiMAX and WiFi.

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 :
  $L_{ins}1$ = 0.45 dB TYP. @ f = 2.3 to 2.7 GHz
  $L_{ins}2$ = 0.50 dB TYP. @ f = 3.3 to 3.8 GHz
  $L_{ins}3$ = 0.55 dB TYP. @ f = 4.9 to 5.85 GHz
- High isolation :
  ISL1 = 30 dB TYP. @ f = 2.3 to 2.7 GHz
  ISL2 = 25 dB TYP. @ f = 3.3 to 3.8 GHz
  ISL3 = 22 dB TYP. @ f = 4.9 to 5.85 GHz
- Power handling :
  $P_{in(0.5dB)}$ = +37.5 dBm TYP.
  @ VC(H) = 3.0 V, VC(L) = 0 V

PACKAGE

- 6-pin Thin SON (X3) Package
  (1.5mm x 1.5mm x 0.37mm)



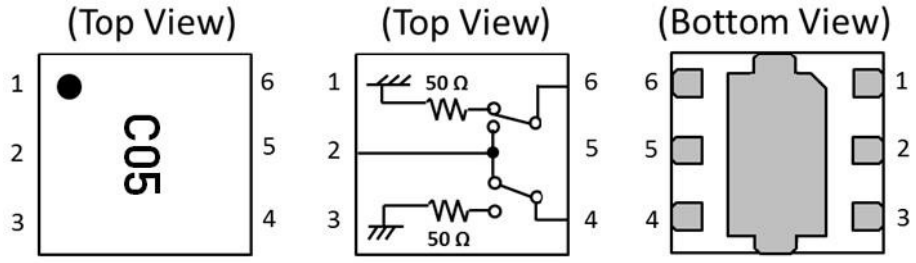
APPLICATIONS

- WiMAX and wireless LAN (IEEE802.11a/b/g/n/ac)

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Description
CG2176X3	CG2176X3-C2	6-pin plastic TSON (XS03) (Pb-Free)	C05	• Embossed tape 8 mm wide • Pin 1, 6 face the perforation side of the tape • MOQ 10 kpcs/reel
CG2176X3-EVAL	CG2176X3-EVAL			• Evaluation Board with DC block capacitors, power supply bypass capacitors, and RF and DC connectors • MOQ 1

PIN CONFIGURATION AND INTERNAL BLOCK DIAGRAM



Pin No.	Pin Name
1	VC1
2	RFC
3	VC2
4	RF2
5	GND
6	RF1

Remark Exposed pad : GND

TRUTH TABLE

VC1	VC2	RFC-RF1	RFC-RF2
High	Low	ON	OFF
Low	High	OFF	ON

ABSOLUTE MAXIMUM RATINGS

(T_A = +25˚C, unless otherwise specified)

Parameter	Symbol	Rating	Unit
Control Voltage	VC	6.0 Note 1	V
Input Power (ON Port)	P_{in}	+38 Note 2	dBm
Input Power (OFF Port)	$P_{in(off)}$	+20	dBm
Operating Ambient Temperature	T_A	-45 ~ +85	˚C
Storage Temperature	T_{stg}	-55 ~ +150	˚C

Note 1. |VC1 - VC2|≦6.0V
2. 3.0V≦|VC1 - VC2|≦5.0V

RECOMMENDED OPERATING RANGE

(T_A = +25˚C, unless otherwise specified)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Operating Frequency	f1	2.3	-	2.7	GHz
	f2	3.3	-	3.8	GHz
	f3	4.9	-	5.85	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

(T_A=+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	$L_{ins}1$	f = 2.3 to 2.7 GHz	-	0.45	0.60	dB
	$L_{ins}2$	f = 3.3 to 3.8 GHz	-	0.50	0.65	dB
	$L_{ins}3$	f = 4.9 to 5.85 GHz	-	0.55	0.75	dB
Isolation (RFC – OFF Port)	ISL1	f = 2.3 to 2.7 GHz	27	30	-	dB
	ISL2	f = 3.3 to 3.8 GHz	22	25	-	dB
	ISL3	f = 4.9 to 5.85 GHz	19	22	-	dB
Isolation (RF2 – RF1)	ISL4	f = 2.3 to 2.7 GHz	23	26	-	dB
	ISL5	f = 3.3 to 3.8 GHz	20	23	-	dB
	ISL6	f = 4.9 to 5.85 GHz	17	20	-	dB
Return Loss	RL1	f = 2.3 to 2.7 GHz	12	17	-	dB
	RL2	f = 3.3 to 3.8 GHz	12	17	-	dB
	RL3	f = 4.9 to 5.85 GHz	12	17	-	dB
Unused Port Return Loss	URL1	f = 2.3 to 2.7 GHz	12	17	-	dB
	URL2	f = 3.3 to 3.8 GHz	12	17	-	dB
	URL3	f = 4.9 to 5.85 GHz	12	17	-	dB
0.5 dB Loss Compression Input Power **Note**	$P_{in(0.5\ dB)}$	f = 2.3 to 2.7 GHz	+35.5	+37.5	-	dBm
		f = 3.3 to 3.8 GHz	+35.5	+37.5	-	dBm
		f = 4.9 to 5.85 GHz	+35.5	+37.5	-	dBm
Error Vector Magnitude	EVM	802.11a, 64QAM, 54Mbps, Pin≦+25dBm	-	0.5	-	%
		802.11g, 64QAM, 54Mbps, Pin≦+25dBm	-	0.5	-	%
		802.11ac, 256QAM, MCS9, 80MHz, Pin≦+25dBm	-	0.5	-	%
Switch Control Current	I_{cont}	RF None	-	16	30	μA
Switch Control Speed	t_{sw}	50% CTL to 90/10% RF	-	100	250	ns

Note $P_{in(0.5dB)}$ is the measured input power level when the insertion loss increases 0.5dB more than that of the linear range.

ELECTRICAL CHARACTERISTICS 2

(T_A=+25˚C, VC(H)=1.8V, VC(L)=0V, Zo=50Ω, DC Block Capacitance=8pF, unless otherwise specified)

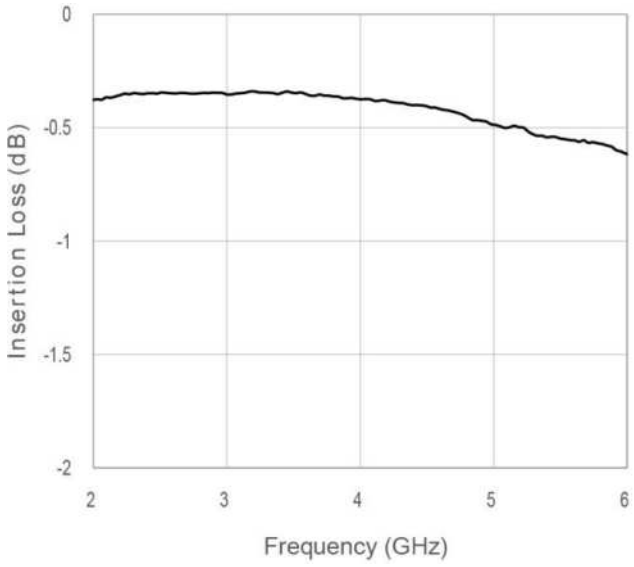
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss	$L_{ins}1$	f = 2.3 to 2.7 GHz	-	0.45	0.60	dB
	$L_{ins}2$	f = 3.3 to 3.8 GHz	-	0.50	0.65	dB
	$L_{ins}3$	f = 4.9 to 5.85 GHz	-	0.55	0.75	dB
Isolation (RFC – OFF Port)	ISL1	f = 2.3 to 2.7 GHz	27	30	-	dB
	ISL2	f = 3.3 to 3.8 GHz	22	25	-	dB
	ISL3	f = 4.9 to 5.85 GHz	19	22	-	dB
Isolation (RF2 – RF1)	ISL4	f = 2.3 to 2.7 GHz	23	26	-	dB
	ISL5	f = 3.3 to 3.8 GHz	20	23	-	dB
	ISL6	f = 4.9 to 5.85 GHz	17	20	-	dB
Return Loss	RL1	f = 2.3 to 2.7 GHz	12	17	-	dB
	RL2	f = 3.3 to 3.8 GHz	12	17	-	dB
	RL3	f = 4.9 to 5.85 GHz	12	17	-	dB
Unused Port Return Loss	URL1	f = 2.3 to 2.7 GHz	12	17	-	dB
	URL2	f = 3.3 to 3.8 GHz	12	17	-	dB
	URL3	f = 4.9 to 5.85 GHz	12	17	-	dB
0.5 dB Loss Compression Input Power **Note**	$P_{in(0.5\ dB)}$	f = 2.3 to 2.7 GHz	+35.5	+37.5	-	dBm
		f = 3.3 to 3.8 GHz	+34.0	+36.0	-	dBm
		f = 4.9 to 5.85 GHz	+34.0	+36.0	-	dBm
Switch Control Current	I_{cont}	RF None	-	12	24	μA
Switch Control Speed	t_{sw}	50% CTL to 90/10% RF	-	250	500	ns

Note $P_{in(0.5dB)}$ is the measured input power level when the insertion loss increases 0.5dB more than that of the linear range.

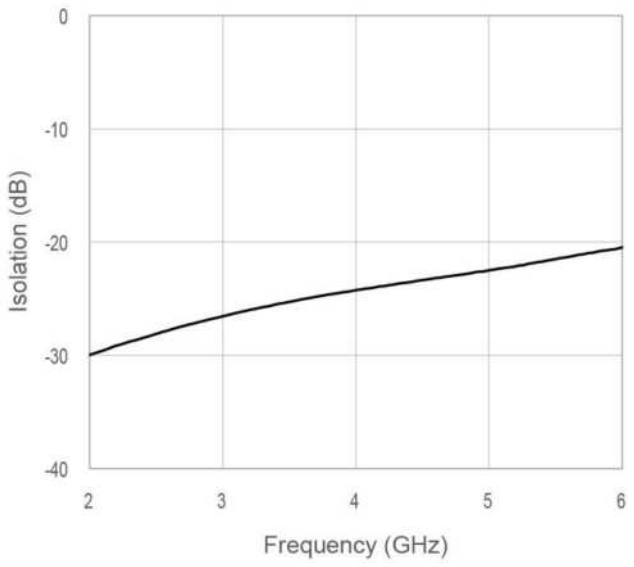
TYPICAL CHARACTERISTICS

(VC(H)=3V, VC(L)=0V, T_A = +25˚C, DC Block Capacitance=8pF, through board loss is subtracted in insertion loss data)

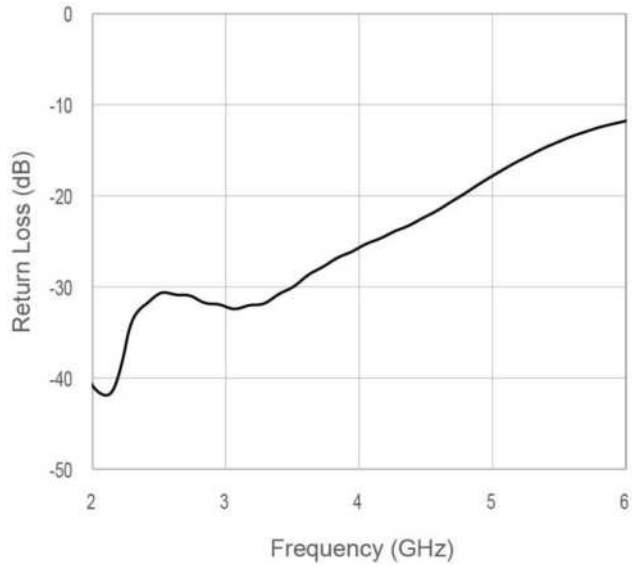
Typical Insertion Loss vs. Frequency



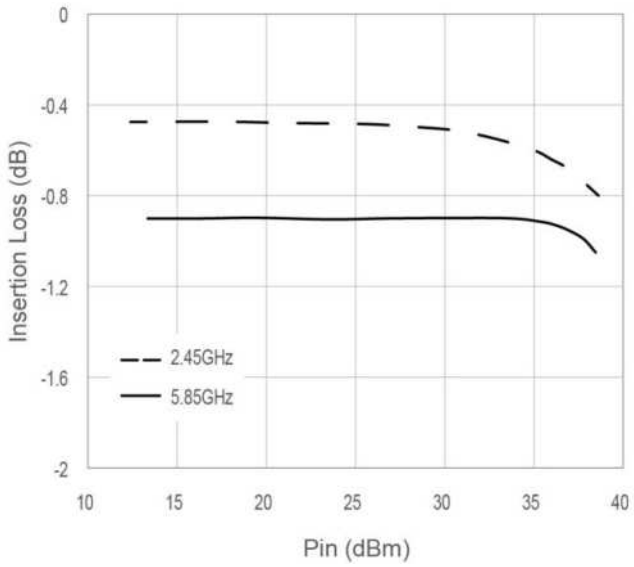
Typical Isolation vs. Frequency



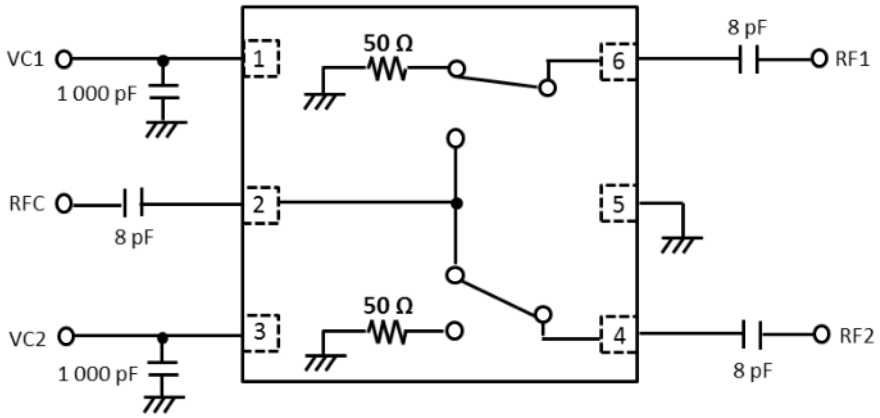
Typical Return Loss vs. Frequency



Typical Insertion Loss vs. Input Power



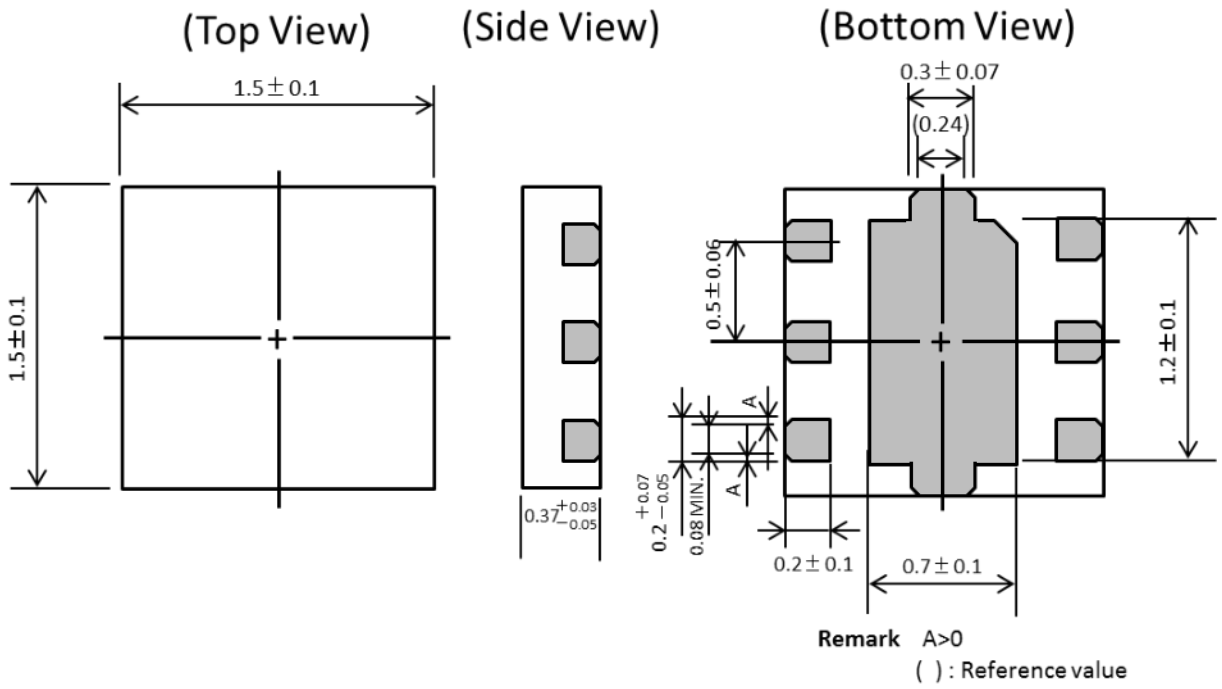
EVALUATION CIRCUIT



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.

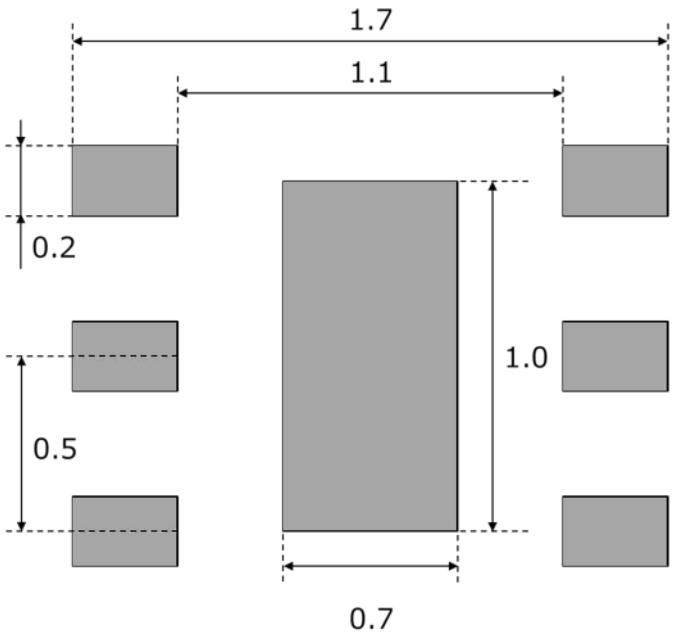
PACKAGE DIMENSIONS

6-pin Plastic TSON (XS03) (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-0014-09 (Issue A) February 17, 2016	Initial datasheet	N/A
CDS-0014-09 (Issue B) March 24, 2016	Added Eval Board ordering information Updated Marking information	1, 2
CDS-0014-10 (Issue C) March 31, 2016	Updated Max Insertion Loss f = 4.9 to 5.85 GHz, from 0.70dB to 0.75dB	3
CDS-0014-10 (Issue D) August 11, 2016	Removed “preliminary”	All
CDS-0014-10 (Issue E) January 11, 2017	Revised Electrical Characteristics table Added “Recommended Soldering Conditions” section	3, 5
CDS-0014-11 (Issue F) June 20, 2017	Revised Absolute Maximum Ratings table	2
CDS-0014-12 (Issue G) August 29, 2017	Added Error Vector Magnitude parameter to Electrical Characteristics table Added Package Dimensional Tolerance Added Typical Characteristics graphs section	3, 4, 5
CDS-0014-13 (Issue H) Nov 20, 2018	Added Electrical Characteristics table 2 Added PCB Layout Footprint	4,6

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