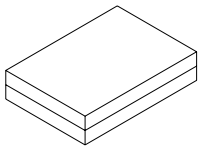
SP9T ANTENNA SWITCH GaAs MMIC

■ GENERAL DESCRIPTION

NJG1653LH4 is a GaAs SP9T antenna switch IC designed for GSM/CDMA/UMTS multimode handsets. This switch features very small package size, high IIP3, low harmonics, low insertion loss and high isolation.

This switch contains a switch die with on-chip logic circuits, ESD protection circuits and a LTCC substrate with built-in two LPFs on GSM transmit paths for suppression of transmitter harmonics.

■ PACKAGE OUTLINE



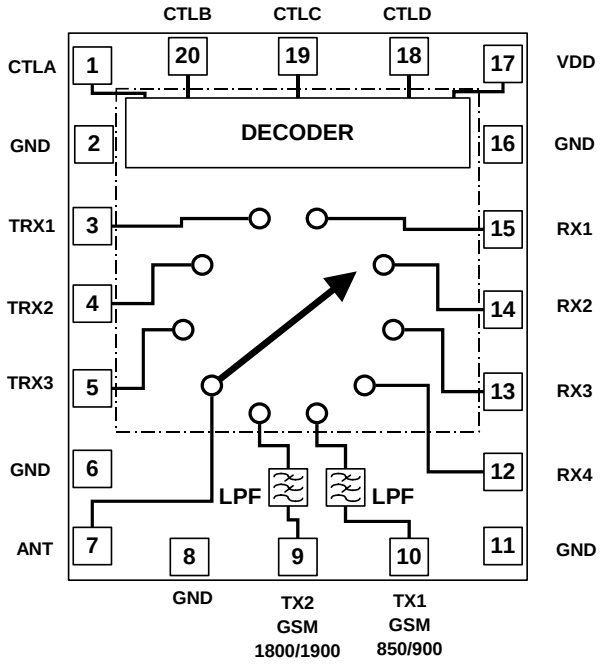
NJG1653LH4

■ FEATURES

● Small package size	LCSP20-H4 (Package size: 3.8x3.0x0.9mm)
● High IIP3	+68dBm typ. on CDMA800 @829MHz+849MHz, Pin=24dBm, V_{DD}=2.7V
	+68dBm typ. on CDMA1900 @1870MHz+1910MHz, Pin=24dBm, V_{DD}=2.7V
	+68dBm typ. on UMTS800/1800/1900/2100,
	@f_{TX}+f_J, P_{TX}=20dBm, P_J=-15dBm, V_{DD}=2.7V
● Low harmonics	-85/-75dBc typ. on GSM850/900 TX @2fo / 3fo, Pin=+35dBm, V_{DD}=2.7V
	-80/-75dBc typ. on GSM1800/1900 TX @2fo / 3fo, Pin=+32dBm, V_{DD}=2.7V
● Low insertion loss	1.0dB typ. on GSM850/900 TX @f=915MHz, Pin=35dBm, V_{DD}=2.7V
	1.0dB typ. on GSM1800/1900 TX @f=1910MHz, Pin=32dBm, V_{DD}=2.7V
	0.45dB typ. on CDMA800/UMTS800 @f=894MHz, Pin=27dBm, V_{DD}=2.7V
	0.50dB typ. on UMTS1800 @f=1880MHz, Pin=27dBm, V_{DD}=2.7V
	0.50dB typ. on CDMA1900/ UMTS1900 @f=1990MHz, Pin=27dBm, V_{DD}=2.7V
	0.55dB typ. on UMTS2100 @f=2170MHz, Pin=27dBm, V_{DD}=2.7V
● Built-in two LPFs	Attenuation 33/40dB typ. on GSM850/900 TX @2fo / 3fo
	Attenuation 27/32dB typ. on GSM1800/1900 TX @2fo / 3fo

■ PIN CONFIGURATION

(Top view)



PIN CONNECTION

1. CTLA
2. GND
3. TRX1
4. TRX2
5. TRX3
6. GND
7. ANT
8. GND
9. TX2(GSM1800/1900 TX)
10. TX1(GSM850/900 TX)
11. GND
12. RX4
13. RX3
14. RX2
15. RX1
16. GND
17. VDD
18. CTLD
19. CTLC
20. CTLB

NOTE: The information on this datasheet is subject to change without notice.

■ TRUTH TABLE

"H"=$V_{CTL(H)}$, "L"=$V_{CTL(L)}$

On Path	CTLA	CTLB	CTLC	CTLD	VDD
GSM850/900 TX – ANT	H	H	L	L	H
GSM1800/1900 TX – ANT	H	L	L	L	H
ANT – RX1	L	L	L	L	H
ANT – RX2	L	L	H	L	H
ANT – RX3	L	H	H	L	H
ANT – RX4	L	H	L	L	H
ANT – TRX1	H	L	H	L	H
ANT – TRX2	H	H	H	L	H
ANT – TRX3	X*	X*	X*	H	H
Idle	X*	X*	X*	X*	L

* X: Do not care

■ ABSOLUTE MAXIMUM RATINGS

(T_a=+25°C, Z_s=Z_l=50Ω)

PARAMETER	SYMBOL	CONDITIONS		DUTY CYCLE	RATINGS	UNITS
RF Input Power	Pin	Antenna Port	100kHz~12.75GHz	CW	28.0	dBm
		GSM850/900 TX (TX1)	824MHz~849MHz	4 : 8	36.0	dBm
			880MHz~915MHz	4 : 8	36.0	dBm
		GSM1800/1900 TX (TX2)	1710MHz~1785MHz	4 : 8	33.0	dBm
			1850MHz~1910MHz	4 : 8	33.0	dBm
		CDMA800 TX / UMTS800 TX	824MHz~849MHz	CW	34.0	dBm
		CDMA1900TX / UMTS1800/1900/ 2100 TX	1710MHz~1980MHz	CW	34.0	dBm
		All RX port	100kHz~12.75GHz	CW	28.0	dBm
Supply Voltage	V_{DD}	VDD terminal			5	V
Control Voltage	V_{CTL}	$V_{CTL(L)}$=0V, $V_{CTL(H)}$=1.8V			V_{DD}	V
Power Dissipation	P_D				1200	mW
Operating Temperature	T_{opr}				-40~+90	°C
Storage Temperature	T_{stg}				-60~+150	°C

■ ELECTRICAL CHARACTERISTICS 1 (DC)

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL(L)}$=0V, $V_{CTL(H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V_{DD}	VDD terminal	2.6	2.7	3.2	V
Operating Current 1	$I_{DD}1$	VDD terminal,fin=824~915MHz GSM850/900 TX,Pin=35dBm	-	400	800	μA
Operating Current 2	$I_{DD}2$	VDD terminal, Idle mode	-	-	0	μA
Control Current	I_{CTL}	$V_{CTL(H)}$=1.8V/1Port	-	4	10	μA
Control Voltage	$V_{CTL(H)}$		1.5	1.8	3.2	V
	$V_{CTL(L)}$		0	-	0.4	V

■ ELECTRICAL CHARACTERISTICS 2 (TX1: GSM850/900 TX ON mode)

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL(L)}$=0V, $V_{CTL(H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Frequency Range 1	$f_{GSM850\ TX}$	GSM850 TX Band	824	-	849	MHz
Frequency Range 2	$f_{GSM900\ TX}$	GSM900 TX Band	880	-	915	MHz
Insertion Loss 1	LOSS1	TX1 – ANT, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$ Pin=35dBm	-	1.0	1.3	dB
Isolation 1(1)	ISL1(1)	TX1 to RX1, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$ Pin=35dBm	40	60	-	dB
Isolation 1(2)	ISL1(2)	TX1 to RX2, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$,Pin=35dBm	40	45	-	dB
Isolation 1(3)	ISL1(3)	TX1 to RX3, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$, Pin=35dBm	32	37	-	dB
Isolation 1(4)	ISL1(4)	TX1 to RX4, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$,Pin=35dBm	25	30	-	dB
Isolation 1(5)	ISL1(5)	TX1 to TRX1 $f_{GSM850\ TX}$, $f_{GSM900\ TX}$,Pin=35dBm	32.5	37	-	dB
Isolation 1(6)	ISL1(6)	TX1 to TRX2 $f_{GSM850\ TX}$, $f_{GSM900\ TX}$,Pin=35dBm	32.5	35	-	dB
Isolation 1(7)	ISL1(7)	TX1 to TRX3 $f_{GSM850\ TX}$, $f_{GSM900\ TX}$,Pin=35dBm	32.5	37	-	dB
VSWR 1(1)	VSWR1(1)	ANT port, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$	-	1.2	1.5	
VSWR 1(2)	VSWR1(2)	TX1 port, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$	-	1.2	1.5	
2nd Harmonic Suppression 1	2HS(1)	TX1 to ANT, 2x $f_{GSM850\ TX}$, 2x $f_{GSM900\ TX}$	25	33	-	dB
3rd Harmonic Suppression 1	3HS(1)	TX1 to ANT, 3x $f_{GSM850\ TX}$, 3x $f_{GSM900\ TX}$	25	40	-	dB
2nd Harmonics 1	2fo(1)	fo= $f_{GSM850\ TX}$, $f_{GSM900\ TX}$, Pin=35dBm	-	-85	-70	dBc
3rd Harmonics 1	3fo(1)	fo= $f_{GSM850\ TX}$, $f_{GSM900\ TX}$, Pin=35dBm	-	-75	-70	dBc

■ ELECTRICAL CHARACTERISTICS 3 (TX2: GSM1800/1900 TX ON mode)

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL(L)}$=0V, $V_{CTL(H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Frequency Range 3	$f_{GSM1800\ TX}$	GSM1800 TX band	1710	-	1785	MHz
Frequency Range 4	$f_{GSM1900\ TX}$	GSM1900 TX band	1850	-	1910	MHz
Insertion Loss 2	LOSS2	TX2 – ANT, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, Pin=32dBm	-	1.0	1.4	dB
Isolation 2(1)	ISL2(1)	TX2 to RX1, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, Pin=32dBm	40	55	-	dB
Isolation 2(2)	ISL2(2)	TX2 to RX2, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, Pin=32dBm	40	55	-	dB
Isolation 2(3)	ISL2(3)	TX2 to RX3, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, Pin=32dBm	40	55	-	dB
Isolation 2(4)	ISL2(4)	TX2 to RX4, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, Pin=32dBm	40	50	-	dB
Isolation 2(5)	ISL2(5)	TX2 to TRX1, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, Pin=32dBm	34	39	-	dB
Isolation 2(6)	ISL2(6)	TX2 to TRX2, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, Pin=32dBm	33	38	-	dB
Isolation 2(7)	ISL2(7)	TX2 to TRX3, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, Pin=32dBm	27	30	-	dB
VSWR 2(1)	VSWR2(1)	ANT port, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$	-	1.3	1.5	
VSWR 2(2)	VSWR2(2)	TX2 port, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$	-	1.3	1.5	
2nd Harmonic Suppression 2	2HS(2)	TX2 to ANT, 2x $f_{GSM1800\ TX}$, 2x $f_{GSM1900\ TX}$	22	27	-	dB
3rd Harmonic Suppression 2	3HS(2)	TX2 to ANT, 3x $f_{GSM1800\ TX}$, 3x $f_{GSM1900\ TX}$	25	32	-	dB
2nd Harmonics 2	2fo(2)	TX2 to ANT fo= $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, Pin=32dBm	-	-80	-70	dBc
3rd Harmonics 2	3fo(2)	TX2 to ANT fo= $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, Pin=32dBm	-	-75	-70	dBc

■ELECTRICAL CHARACTERISTICS 4 (RX1 ON mode)

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL(L)}$=0V, $V_{CTL(H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Frequency Range 3	$f_{GSM850\ RX}$	GSM850 RX band	869	-	894	MHz
Frequency Range 4	$f_{GSM900\ RX}$	GSM900 RX band	925	-	960	MHz
Frequency Range 7	$f_{GSM1800\ RX}$	GSM1800 RX band	1805	-	1880	MHz
Frequency Range 8	$f_{GSM1900\ RX}$	GSM1900 RX band	1930	-	1990	MHz
Insertion Loss 3(1)	LOSS3(1)	RX1 - ANT, $f_{GSM850\ RX}$, $f_{GSM900\ RX}$, Pin=10dBm	-	0.8	1.0	dB
Insertion Loss 3(2)	LOSS3(2)	RX1 – ANT, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$, Pin=10dBm	-	1.0	1.3	dB
Isolation 3(1)	ISL3(1)	TX1 to ANT, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$ Pin=10dBm	28	33	-	dB
Isolation 3(2)	ISL3(2)	TX2 to ANT, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$ Pin=10dBm	30	35	-	dB
VSWR 3(1)	VSWR3(1)	ANT port, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$	-	1.3	1.5	
VSWR 3(2)	VSWR3(2)	RX1 port, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$	-	1.3	1.5	
VSWR 3(3)	VSWR3(3)	ANT port, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$	-	1.5	1.8	
VSWR 3(4)	VSWR3(4)	RX1 port, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$	-	1.5	1.8	

■ ELECTRICAL CHARACTERISTICS 5 (RX2 ON mode)

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL(L)}$=0V, $V_{CTL(H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Frequency Range 3	$f_{GSM850\ RX}$	GSM850 RX band	869	-	894	MHz
Frequency Range 4	$f_{GSM900\ RX}$	GSM900 RX band	925	-	960	MHz
Frequency Range 7	$f_{GSM1800\ RX}$	GSM1800 RX band	1805	-	1880	MHz
Frequency Range 8	$f_{GSM1900\ RX}$	GSM1900 RX band	1930	-	1990	MHz
Insertion Loss 4(1)	LOSS4(1)	RX2 - ANT, $f_{GSM850\ RX}$, $f_{GSM900\ RX}$, Pin=10dBm	-	0.8	1.0	dB
Insertion Loss 4(2)	LOSS4(2)	RX2 – ANT, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$, Pin=10dBm	-	1.0	1.3	dB
Isolation 4(1)	ISL4(1)	TX1 to ANT, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$ Pin=10dBm	30	35	-	dB
Isolation 4(2)	ISL4(2)	TX2 to ANT, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$ Pin=10dBm	30	35	-	dB
VSWR 4(1)	VSWR4(1)	ANT port, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$	-	1.3	1.5	
VSWR 4(2)	VSWR4(2)	RX2 port, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$	-	1.3	1.5	
VSWR 4(3)	VSWR4(3)	ANT port, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$	-	1.5	1.8	
VSWR 4(4)	VSWR4(4)	RX2 port, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$	-	1.5	1.8	

■ELECTRICAL CHARACTERISTICS 6 (RX3 ON mode)

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL(L)}$=0V, $V_{CTL(H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Frequency Range 3	$f_{GSM850\ RX}$	GSM850 RX band	869	-	894	MHz
Frequency Range 4	$f_{GSM900\ RX}$	GSM900 RX band	925	-	960	MHz
Frequency Range 7	$f_{GSM1800\ RX}$	GSM1800 RX band	1805	-	1880	MHz
Frequency Range 8	$f_{GSM1900\ RX}$	GSM1900 RX band	1930	-	1990	MHz
Insertion Loss 5(1)	LOSS5(1)	RX3 - ANT, $f_{GSM850\ RX}$, $f_{GSM900\ RX}$, Pin=10dBm	-	0.8	1.0	dB
Insertion Loss 5(2)	LOSS5(2)	RX3 – ANT, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$, Pin=10dBm	-	1.0	1.3	dB
Isolation 5(1)	ISL5(1)	TX1 to ANT, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$ Pin=10dBm	30	35	-	dB
Isolation 5(2)	ISL5(2)	TX2 to ANT, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$ Pin=10dBm	30	40	-	dB
VSWR 5(1)	VSWR5(1)	ANT port, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$	-	1.3	1.5	
VSWR 5(2)	VSWR5(2)	RX3 port, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$	-	1.3	1.5	
VSWR 5(3)	VSWR5(3)	ANT port, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$	-	1.5	1.8	
VSWR 5(4)	VSWR5(4)	RX3 port, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$	-	1.5	1.8	

■ ELECTRICAL CHARACTERISTICS 7 (RX4 ON mode)

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL(L)}$=0V, $V_{CTL(H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Frequency Range 3	$f_{GSM850\ RX}$	GSM850 RX band	869	-	894	MHz
Frequency Range 4	$f_{GSM900\ RX}$	GSM900 RX band	925	-	960	MHz
Frequency Range 7	$f_{GSM1800\ RX}$	GSM1800 RX band	1805	-	1880	MHz
Frequency Range 8	$f_{GSM1900\ RX}$	GSM1900 RX band	1930	-	1990	MHz
Insertion Loss 6(1)	LOSS6(1)	RX4 - ANT, $f_{GSM850\ RX}$, $f_{GSM900\ RX}$, Pin=10dBm	-	0.8	1.0	dB
Insertion Loss 6(2)	LOSS6(2)	RX4 – ANT, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$, Pin=10dBm	-	1.0	1.3	dB
Isolation 6(1)	ISL6(1)	TX1 to ANT, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$ Pin=10dBm	30	35	-	dB
Isolation 6(2)	ISL6(1)	TX2 to ANT, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$ Pin=10dBm	30	45	-	dB
VSWR 6(1)	VSWR6(1)	ANT port, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$	-	1.3	1.5	
VSWR 6(2)	VSWR6(2)	RX4 port, $f_{GSM850\ TX}$, $f_{GSM900\ TX}$	-	1.3	1.5	
VSWR 6(3)	VSWR6(3)	ANT port, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$	-	1.5	1.8	
VSWR 6(4)	VSWR6(4)	RX4 port, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$	-	1.5	1.8	

■ ELECTRICAL CHARACTERISTICS 8 (TRX1 ON mode)

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL\ (L)}$=0V, $V_{CTL(H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Frequency Range 5	$f_{GSM1800\ TX}$	Band III TX band	1710	-	1785	MHz
Frequency Range 7	$f_{GSM1800\ RX}$	Band III RX band	1805	-	1880	MHz
Frequency Range 6	$f_{GSM1900\ TX}$	Band II TX band	1850	-	1910	MHz
Frequency Range 8	$f_{GSM1900\ RX}$	Band II RX band	1930	-	1990	MHz
Frequency Range 9	$f_{UMTS2100\ TX}$	Band I TX band	1920	-	1980	MHz
Frequency Range 10	$f_{UMTS2100\ RX}$	Band I RX band	2110	-	2170	MHz
Insertion Loss 7(1)	LOSS7(1)	ANT- TRX1, $f_{GSM1800\ TX}$, $f_{GSM1800\ RX}$, Pin=27dBm	-	0.50	0.75	dB
Insertion Loss 7(2)	LOSS7(2)	ANT- TRX1, $f_{GSM1900\ TX}$, $f_{GSM1900\ RX}$, Pin=27dBm	-	0.50	0.75	dB
Insertion Loss 7(3)	LOSS7(3)	ANT- TRX1, $f_{UMTS2100\ TX}$, $f_{UMTS2100\ RX}$, Pin=27dBm	-	0.50	0.75	dB
Isolation 7(1)	ISL7(1)	TRX1 to RX1, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, Pin=27dBm	40	55	-	dB
Isolation 7(2)	ISL7(2)	TRX1 to RX2, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, Pin=27dBm	40	50	-	dB
Isolation 7(3)	ISL7(3)	TRX1 to RX3, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, Pin=27dBm	40	50	-	dB
Isolation 7(4)	ISL7(4)	TRX1 to RX4, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, Pin=27dBm	40	45	-	dB
0.1dB Compression Input Power 1	$P_{-0.1dB}$(1)	TRX1 to ANT, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$	32	34	-	dBm
UMTS Input 2nd Order Intercept Point 1	IIP2(1)U	TRX1 to ANT, Tone1: f_{TX}=1745MHz, P_{TX}=20dBm, Tone2: f_J =95MHz, P_J=-15dBm *1	102	115	-	dBm
UMTS Input 2nd Order Intercept Point 2	IIP2(2)U	TRX1 to ANT, Tone1: f_{TX}=1880MHz, P_{TX}=20dBm, Tone2: f_J =80MHz, P_J=-15dBm *1	102	115	-	dBm
UMTS Input 2nd Order Intercept Point 3	IIP2(3)U	TRX1 to ANT, Tone1: f_{TX}=1950MHz, P_{TX}=20dBm, Tone2: f_J =190MHz, P_J=-15dBm *1	102	125	-	dBm
UMTS Input 3rd Order Intercept Point 1	IIP3(1)U	TRX1 to ANT, Tone1: f_{TX}=1745MHz, P_{TX}=20dBm, Tone2: f_J =1650MHz, P_J=-15dBm *2	61	68	-	dBm
UMTS Input 3rd Order Intercept Point 2	IIP3(2)U	TRX1 to ANT, Tone1: f_{TX}=1880MHz, P_{TX}=20dBm, Tone2: f_J =1800MHz, P_J=-15dBm *2	61	68	-	dBm
UMTS Input 3rd Order Intercept Point 3	IIP3(3)U	TRX1 to ANT, Tone1: f_{TX}=1950MHz, P_{TX}=20dBm, Tone2: f_J =1760MHz, P_J=-15dBm *2	61	67	-	dBm

*1: The UMTS input IP2 is defined as following equation, IIP2 = (P_{TX} +P_J– IMD2)
*2: The UMTS input IP3 is defined as following equation, IIP3 = (2 x P_{TX} +P_J– IMD3) / 2

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL\ (L)}$=0V, $V_{CTL\ (H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
VSWR 7(1)	VSWR7(1)	ANT port, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$, $f_{UMTS2100\ RX}$	-	1.3	1.5	
VSWR 7(2)	VSWR7(2)	TRX2 port, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$, $f_{UMTS2100\ RX}$	-	1.3	1.5	

■ ELECTRICAL CHARACTERISTICS 9 (TRX2 ON mode)

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL\ (L)}$=0V, $V_{CTL(H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Frequency Range 5	$f_{GSM1800\ TX}$	Band III TX band	1710	-	1785	MHz
Frequency Range 7	$f_{GSM1800\ RX}$	Band III RX band	1805	-	1880	MHz
Frequency Range 6	$f_{GSM1900\ TX}$	Band II TX band	1850	-	1910	MHz
Frequency Range 8	$f_{GSM1900\ RX}$	Band II RX band	1930	-	1990	MHz
Frequency Range 9	$f_{UMTS2100\ TX}$	Band I TX band	1920	-	1980	MHz
Frequency Range 10	$f_{UMTS2100\ RX}$	Band I RX band	2110	-	2170	MHz
Insertion Loss 8(1)	LOSS8(1)	ANT- TRX2, $f_{GSM1800\ TX}$, $f_{GSM1800\ RX}$, Pin=27dBm	-	0.50	0.75	dB
Insertion Loss 8(2)	LOSS8(2)	ANT- TRX2, $f_{GSM1900\ TX}$, $f_{GSM1900\ RX}$, Pin=27dBm	-	0.50	0.75	dB
Insertion Loss 8(3)	LOSS8(3)	ANT- TRX2, $f_{UMTS2100\ TX}$, $f_{UMTS2100\ RX}$, Pin=27dBm	-	0.55	0.80	dB
Isolation 8(1)	ISL8(1)	TRX2 to RX1, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, Pin=27dBm	40	55	-	dB
Isolation 8(2)	ISL8(2)	TRX2 to RX2, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, Pin=27dBm	40	50	-	dB
Isolation 8(3)	ISL8(3)	TRX2 to RX3, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, Pin=27dBm	40	50	-	dB
Isolation 8(4)	ISL8(4)	TRX2 to RX4, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, Pin=27dBm	40	45	-	dB
0.1dB Compression Input Power 2	$P_{-0.1dB}$(2)	TRX2 to ANT, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$	32	34	-	dBm
UMTS Input 2nd Order Intercept Point 4	IIP2(4)U	TRX2 to ANT, Tone1: f_{TX}=1745MHz, P_{TX}=20dBm, Tone2: f_J =95MHz, P_J=-15dBm *1	102	115	-	dBm
UMTS Input 2nd Order Intercept Point 5	IIP2(5)U	TRX2 to ANT, Tone1: f_{TX}=1880MHz, P_{TX}=20dBm, Tone2: f_J =80MHz, P_J=-15dBm *1	102	120	-	dBm
UMTS Input 2nd Order Intercept Point 6	IIP2(6)U	TRX2 to ANT, Tone1: f_{TX}=1950MHz, P_{TX}=20dBm, Tone2: f_J =190MHz, P_J=-15dBm *1	102	125	-	dBm
UMTS Input 3rd Order Intercept Point 4	IIP3(4)U	TRX2 to ANT, Tone1: f_{TX}=1745MHz, P_{TX}=20dBm, Tone2: f_J =1650MHz, P_J=-15dBm *2	61	68	-	dBm
UMTS Input 3rd Order Intercept Point 5	IIP3(5)U	TRX2 to ANT, Tone1: f_{TX}=1880MHz, P_{TX}=20dBm, Tone2: f_J =1800MHz, P_J=-15dBm *2	61	68	-	dBm
UMTS Input 3rd Order Intercept Point 6	IIP3(6)U	TRX2 to ANT, Tone1: f_{TX}=1950MHz, P_{TX}=20dBm, Tone2: f_J =1760MHz, P_J=-15dBm *2	61	68	-	dBm

*1: The UMTS input IP2 is defined as following equation, IIP2 = (P_{TX} +P_J– IMD2)
*2: The UMTS input IP3 is defined as following equation, IIP3 = (2 x P_{TX} +P_J– IMD3) / 2

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL\ (L)}$=0V, $V_{CTL(H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
CDMA Input 3rd Order Intercept Point 1	IIP3(1)C	TRX2 to ANT, f=1870+1910MHz,each tone 24dBm*3	65	68	-	dBm
VSWR 8(1)	VSWR8(1)	ANT port, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$, $f_{UMTS2100\ RX}$	-	1.3	1.5	
VSWR 8(2)	VSWR8(2)	TRX2 port, $f_{GSM1800\ TX}$, $f_{GSM1900\ TX}$, $f_{UMTS2100\ TX}$, $f_{GSM1800\ RX}$, $f_{GSM1900\ RX}$, $f_{UMTS2100\ RX}$	-	1.3	1.5	

*3: The CDMA input IP3 is defined as following equation, IIP3=(3 x Pout - IM3) / 2 + LOSS

■ ELECTRICAL CHARACTERISTICS 10 (TRX3 ON mode)

(General conditions: T_a=+25°C, Z_s=Z_l=50Ω, V_{DD}=2.7V, $V_{CTL\ (L)}$=0V, $V_{CTL(H)}$=1.8V, with application circuit)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Frequency Range 1	$f_{GSM850\ TX}$	Band V TX band	824	-	849	MHz
Frequency Range 3	$f_{GSM850\ RX}$	Band V RX band	869	-	894	MHz
Insertion Loss 9	LOSS9	ANT- TRX3, $f_{GSM850\ TX}$, $f_{GSM850\ RX}$, Pin=27dBm	-	0.45	0.70	dB
Isolation 9(1)	ISL9(1)	TRX3 to RX1,$f_{GSM850\ TX}$, Pin=27dBm	40	55	-	dB
Isolation 9(2)	ISL9(2)	TRX3 to RX2, $f_{GSM850\ TX}$, Pin=27dBm	40	55	-	dB
Isolation 9(3)	ISL9(3)	TRX3 to RX3, $f_{GSM850\ TX}$, Pin=27dBm	40	55	-	dB
Isolation 9(4)	ISL9(4)	TRX3 to RX4, $f_{GSM850\ TX}$, Pin=27dBm	40	55	-	dB
0.1dB Compression Input Power 3	$P_{-0.1dB}$(3)	TRX3 to ANT, $f_{GSM850\ TX}$	32	34	-	dBm
UMTS Input 2nd Order Intercept Point 7	IIP2(7)U	TRX3 to ANT, Tone1: f_{TX}=835MHz, P_{TX}=20dBm, Tone2: f_J =45MHz, P_J=-15dBm *1	102	120	-	dBm
UMTS Input 3rd Order Intercept Point 7	IIP3(7)U	TRX3 to ANT, Tone1: f_{TX}=835MHz, P_{TX}=20dBm, Tone2: f_J =790MHz, P_J=-15dBm *2	61	69	-	dBm
CDMA Input 3rd Order Intercept Point 2	IIP3(2)C	TRX3 to ANT, f=829+849MHz,each tone 24dBm*3	65	68	-	dBm
VSWR 9	VSWR9(1)	ANT port, $f_{GSM850\ TX}$, $f_{GSM850\ RX}$	-	1.2	1.4	
VSWR 9	VSWR9(2)	TRX3 port, $f_{GSM850\ TX}$, $f_{GSM850\ RX}$	-	1.2	1.4	

*1: The UMTS input IIP2 is defined as following equation, IIP2 = (P_{TX} +P_J– IMD2)
*2: The UMTS input IIP3 is defined as following equation, IIP3 = (2 x P_{TX} +P_J– IMD3) / 2
*3: The CDMA input IP3 is defined as following equation, IIP3=(3 x Pout - IM3) / 2 + LOSS

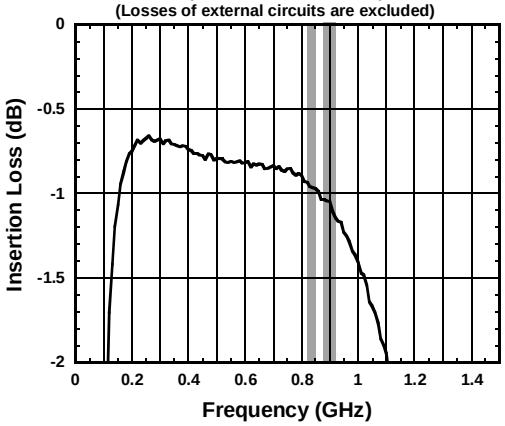
■ TERMINAL INFORMATION

No.	SYMBOL	DESCRIPTION
1	CTL_A	Control signal input terminal. This terminal is set to High-Level (+1.5~+3.2V) or Low-Level (0~+0.4V).
2	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
3	TRX1	RF transmitting/receiving port. An external capacitor is required to block DC voltage.
4	TRX2	RF transmitting/receiving port. An external capacitor is required to block DC voltage.
5	TRX3	RF transmitting/receiving port. An external capacitor is required to block DC voltage.
6	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
7	ANT	RF transmitting/receiving port. An external capacitor is required to block DC voltage.
8	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
9	TX2	RF transmitting port. An external capacitor is required to block DC voltage. This port is connected the LPF for GSM1800/1900 TX band into LTCC substrate.
10	TX1	RF transmitting port. An external capacitor is required to block DC voltage. This port is connected the LPF for GSM850/900 TX band into LTCC substrate.
11	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
12	RX4	RF receiving port. An external capacitor is required to block DC voltage.
13	RX3	RF receiving port. An external capacitor is required to block DC voltage.
14	RX2	RF receiving port. An external capacitor is required to block DC voltage.
15	RX1	RF receiving port. An external capacitor is required to block DC voltage.
16	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
17	VDD	Positive voltage supply terminal. The positive voltage (+2.6~+3.2V) has to be supplied. Please connect a bypass capacitor with GND terminal for excellent RF performance.
18	CTL_D	Control signal input terminal. This terminal is set to High-Level (+1.5~+3.2V) or Low-Level (0~+0.4V).
19	CTL_C	Control signal input terminal. This terminal is set to High-Level (+1.5~+3.2V) or Low-Level (0~+0.4V).
20	CTL_B	Control signal input terminal. This terminal is set to High-Level (+1.5~+3.2V) or Low-Level (0~+0.4V).

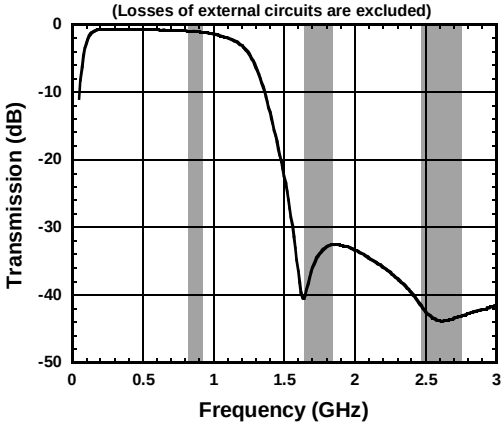
■ ELECTRICAL CHARACTERISTICS (GSM850/900 TX ON mode)

(With Application circuit, Loss of external circuit are excluded)

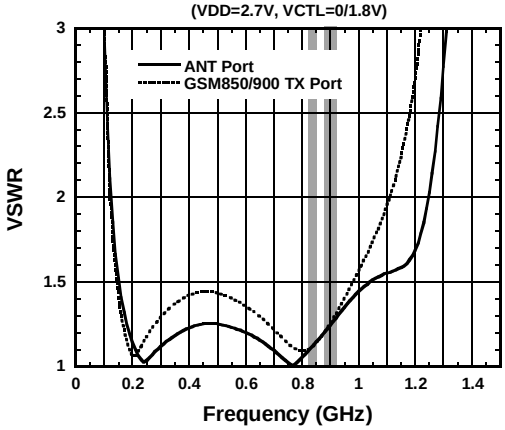
GSM850/900 TX Port to ANT Port
Insertion Loss vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



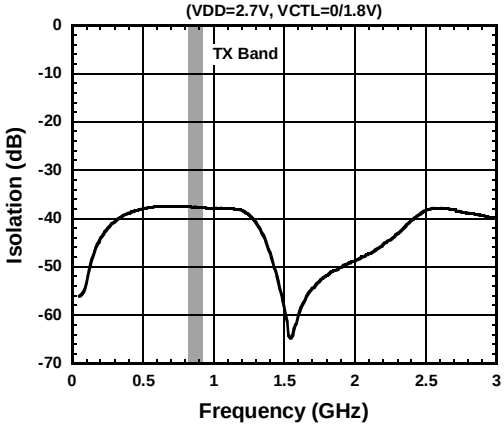
GSM850/900 TX Port to ANT Port
Transmission Characteristics
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



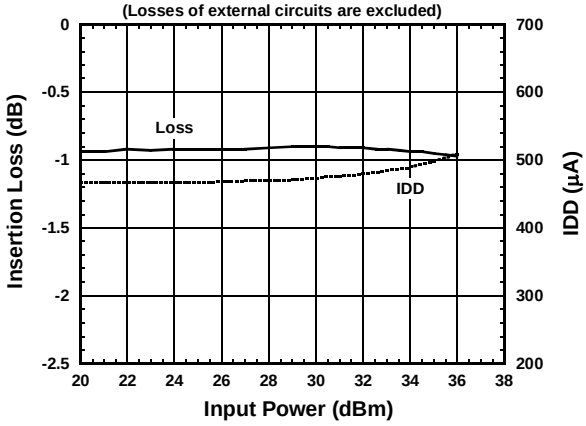
VSWR vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



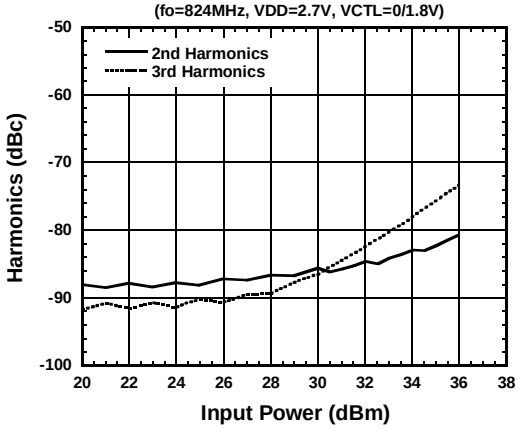
GSM850/900 TX Port to TRX3 Port
Isolation vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



Insertion Loss, IDD vs. Input Power
(f=824MHz, VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



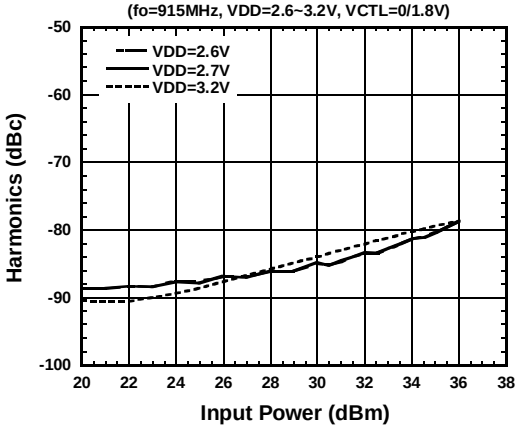
Harmonics vs. Input Power
(fo=824MHz, VDD=2.7V, VCTL=0/1.8V)



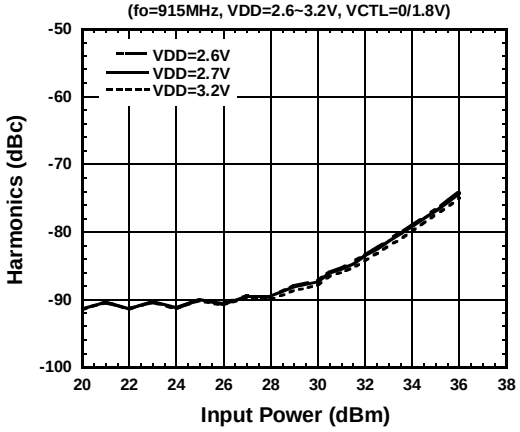
■ ELECTRICAL CHARACTERISTICS (GSM850/900 TX ON mode)

(With Application circuit, Loss of external circuit are excluded)

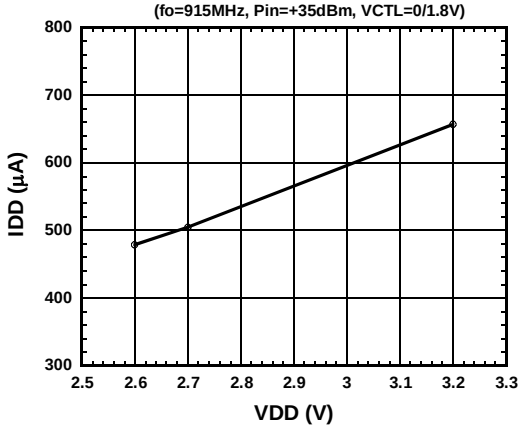
2nd Harmonics vs. Input Power
(fo=915MHz, VDD=2.6~3.2V, VCTL=0/1.8V)



3rd Harmonics vs. Input Power
(fo=915MHz, VDD=2.6~3.2V, VCTL=0/1.8V)



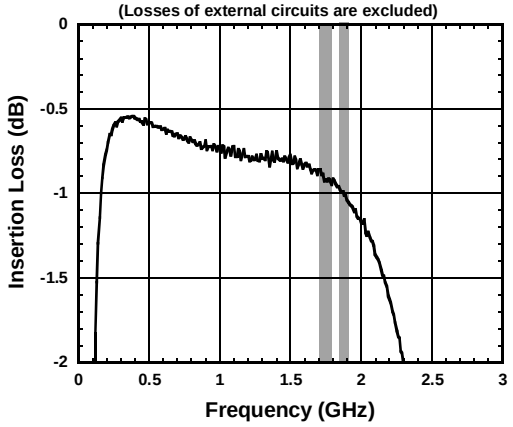
IDD vs. VDD
(TX1 ON mode)
(fo=915MHz, Pin=+35dBm, VCTL=0/1.8V)



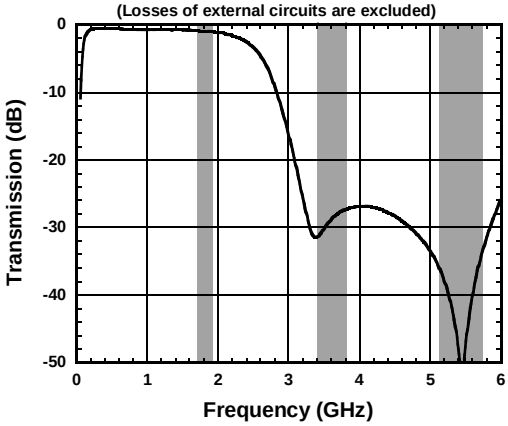
■ ELECTRICAL CHARACTERISTICS (GSM1800/1900 TX ON mode)

(With Application circuit, Loss of external circuit are excluded)

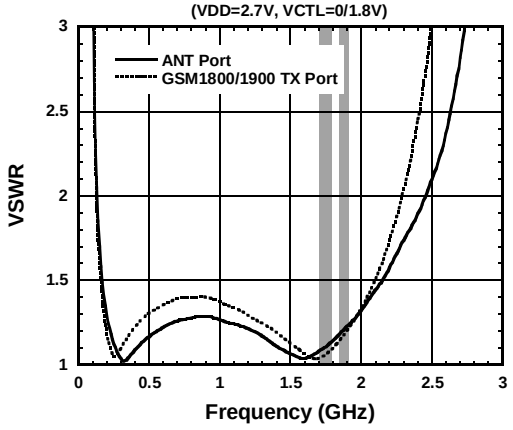
GSM1800/1900 TX Port to ANT Port
Insertion Loss vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



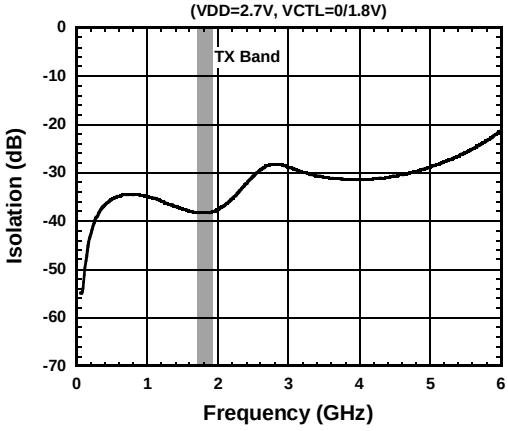
GSM1800/1900 TX Port to ANT Port
Transmission Characteristics
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



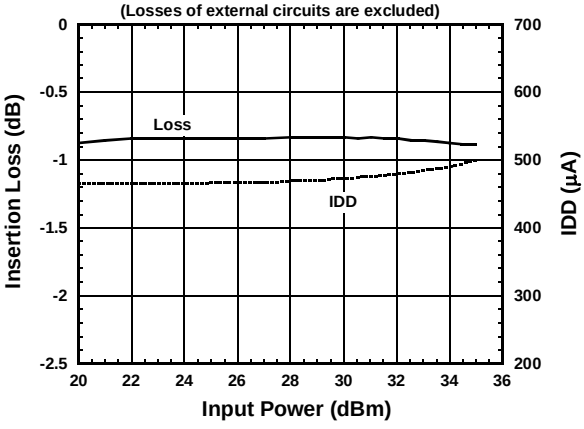
VSWR vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



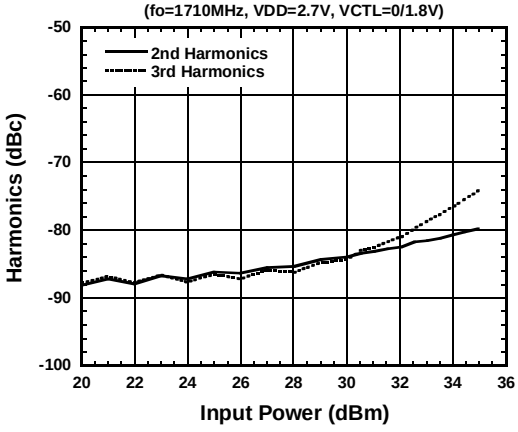
GSM1800/1900 TX Port to TRX2 Port
Isolation vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



Insertion Loss, IDD vs. Input Power
(f=1710MHz, VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)

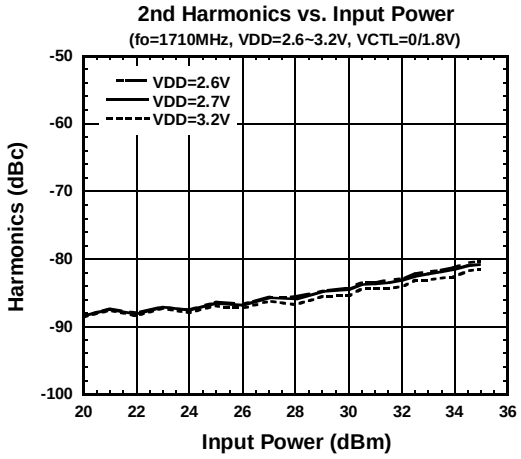


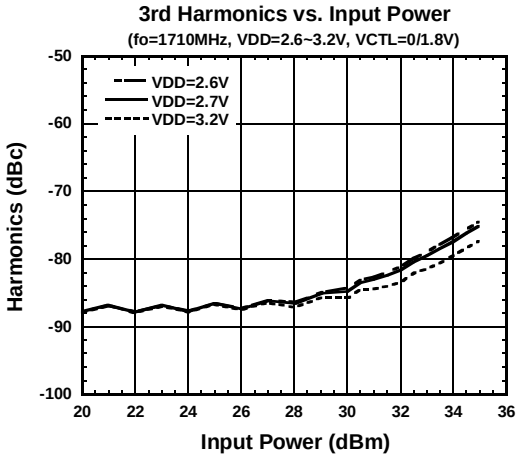
Harmonics vs. Input Power
(fo=1710MHz, VDD=2.7V, VCTL=0/1.8V)



■ ELECTRICAL CHARACTERISTICS (GSM1800/1900 TX ON mode)

(With Application circuit, Loss of external circuit are excluded)

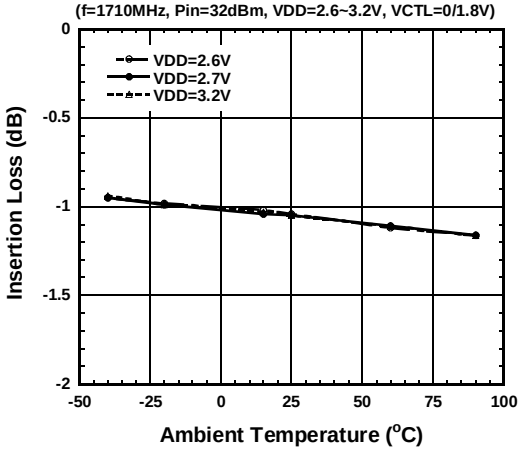




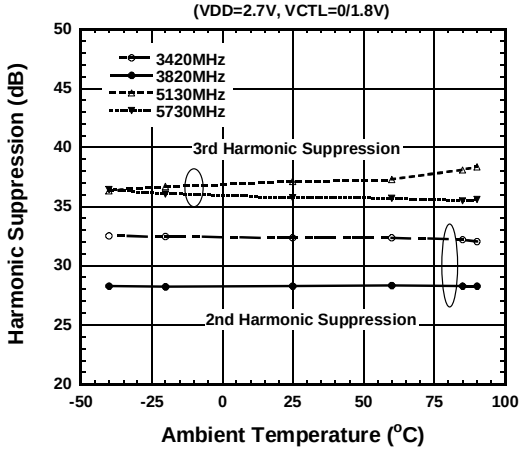
■ ELECTRICAL CHARACTERISTICS (GSM1800/1900 TX ON mode)

(With Application circuit, Loss of external circuit are excluded)

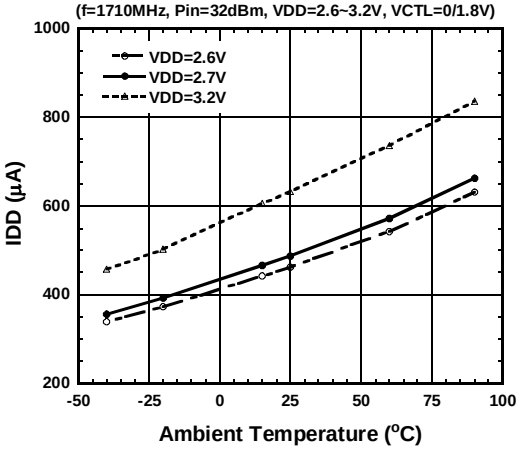
Insertion Loss vs Ambient Temperature
(f=1710MHz, Pin=32dBm, VDD=2.6~3.2V, VCTL=0/1.8V)



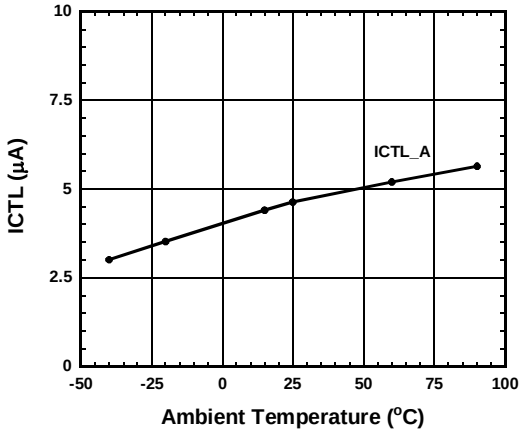
Harmonic Suppression vs Ambient Temperature
(VDD=2.7V, VCTL=0/1.8V)



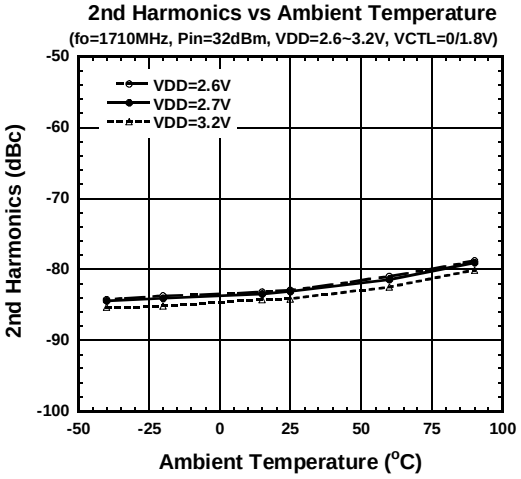
IDD vs Ambient Temperature
(f=1710MHz, Pin=32dBm, VDD=2.6~3.2V, VCTL=0/1.8V)



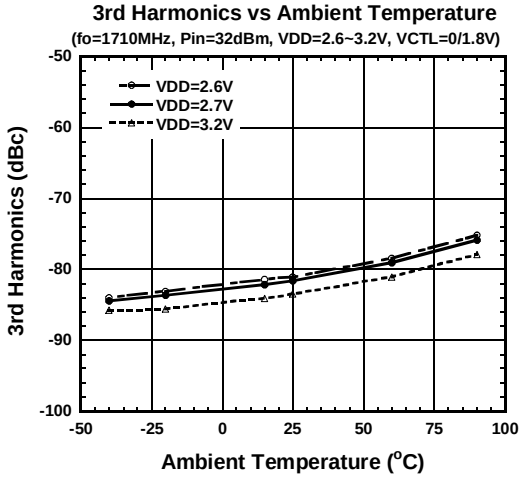
ICTL vs Ambient Temperature
(f=915MHz, Pin=35dBm, VDD=2.7V, VCTL=0/1.8V)



2nd Harmonics vs Ambient Temperature
(fo=1710MHz, Pin=32dBm, VDD=2.6~3.2V, VCTL=0/1.8V)



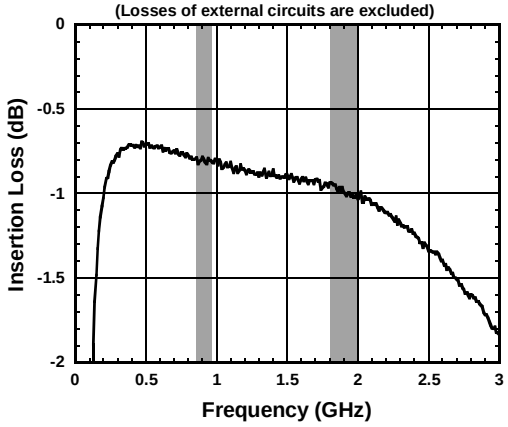
3rd Harmonics vs Ambient Temperature
(fo=1710MHz, Pin=32dBm, VDD=2.6~3.2V, VCTL=0/1.8V)



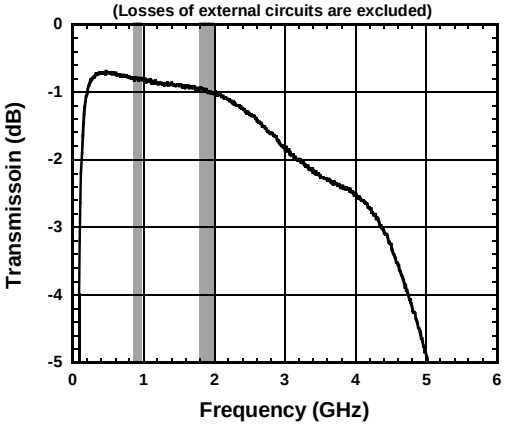
■ ELECTRICAL CHARACTERISTICS (RX1 ON mode)

(With Application circuit, Loss of external circuit are excluded)

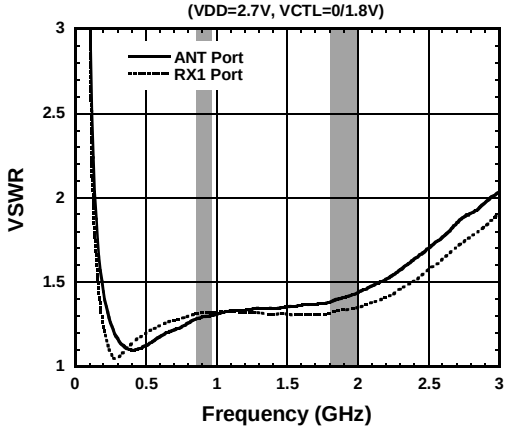
ANT Port to RX1 Port
Insertion Loss vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



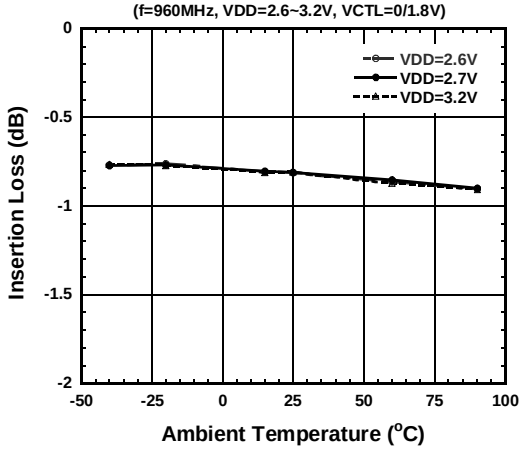
ANT Port to RX1 Port
Transmission Characteristics
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



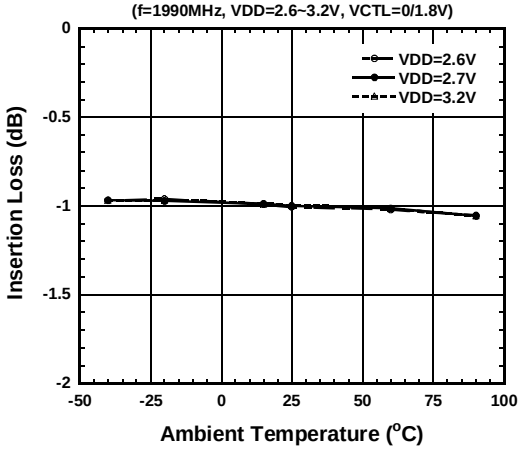
VSWR vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



Insertion Loss vs Ambient Temperature
(f=960MHz, VDD=2.6~3.2V, VCTL=0/1.8V)



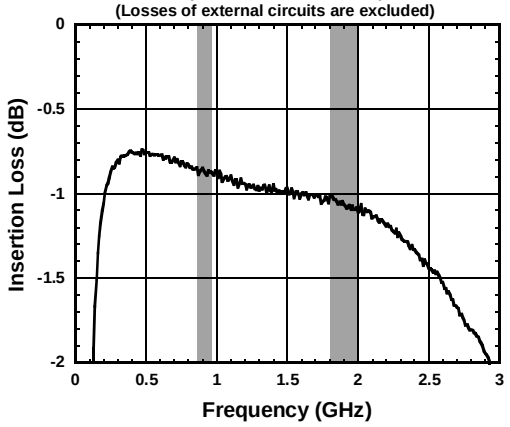
Insertion Loss vs Ambient Temperature
(f=1990MHz, VDD=2.6~3.2V, VCTL=0/1.8V)



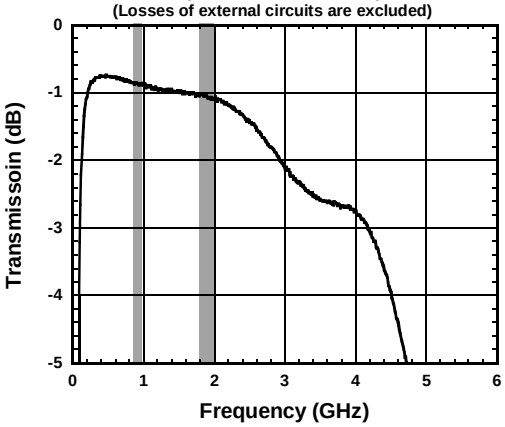
■ ELECTRICAL CHARACTERISTICS (RX2 ON mode)

(With Application circuit, Loss of external circuit are excluded)

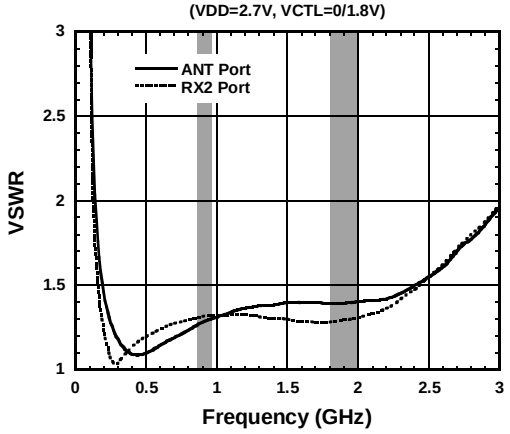
ANT Port to RX2 Port
Insertion Loss vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



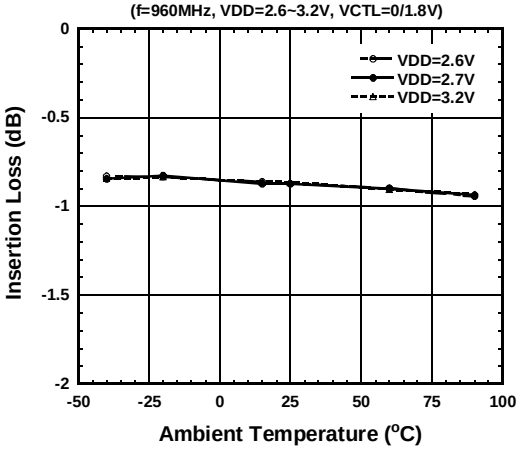
ANT Port to RX2 Port
Transmission Characteristics
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



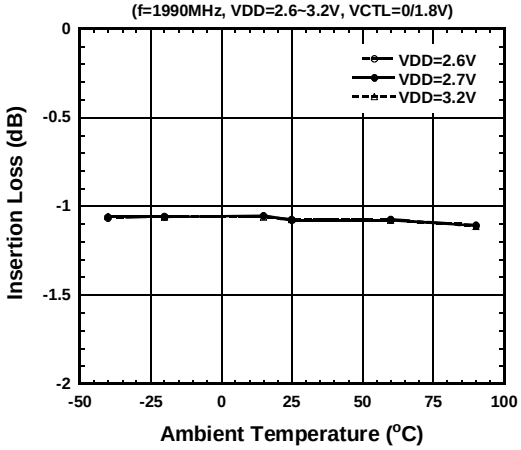
VSWR vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



Insertion Loss vs Ambient Temperature
(f=960MHz, VDD=2.6~3.2V, VCTL=0/1.8V)



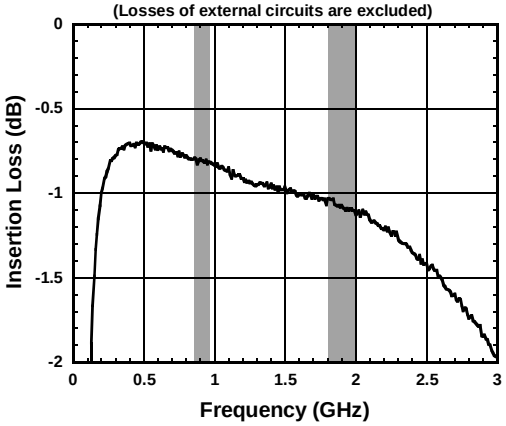
Insertion Loss vs Ambient Temperature
(f=1990MHz, VDD=2.6~3.2V, VCTL=0/1.8V)



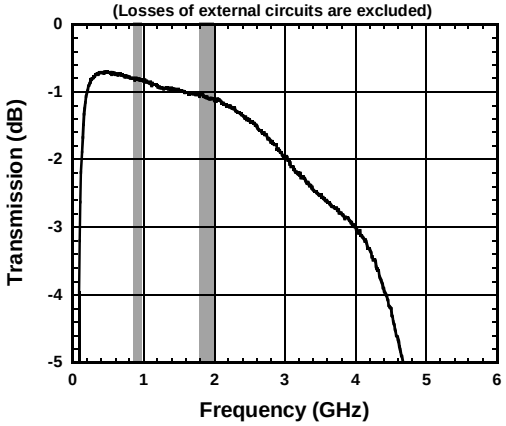
■ ELECTRICAL CHARACTERISTICS (RX3 ON mode)

(With Application circuit, Loss of external circuit are excluded)

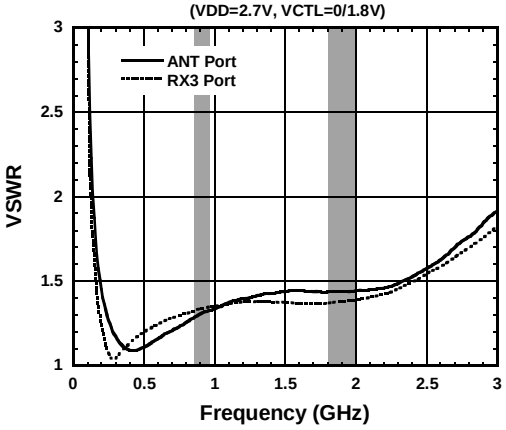
ANT Port to RX3 Port
Insertion Loss vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



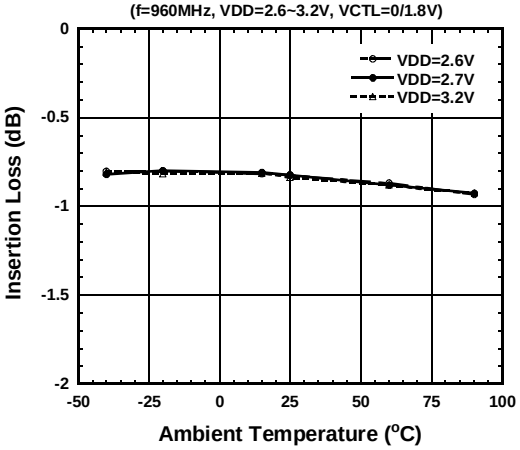
ANT Port to RX3 Port
Transmission Characteristics
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



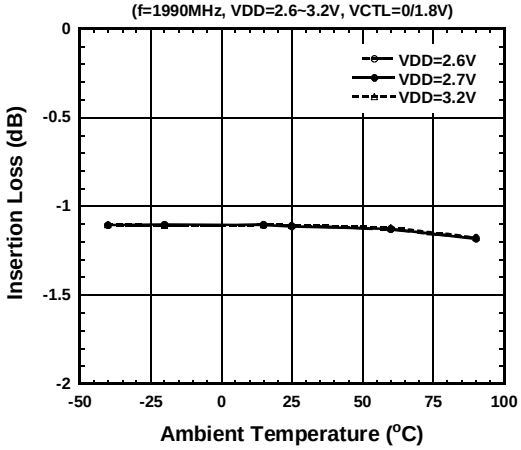
VSWR vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



Insertion Loss vs Ambient Temperature
(f=960MHz, VDD=2.6~3.2V, VCTL=0/1.8V)



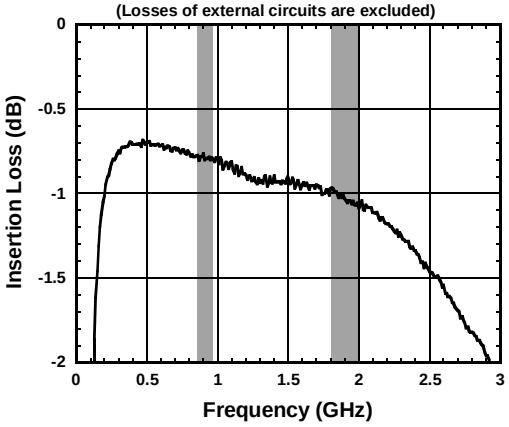
Insertion Loss vs Ambient Temperature
(f=1990MHz, VDD=2.6~3.2V, VCTL=0/1.8V)



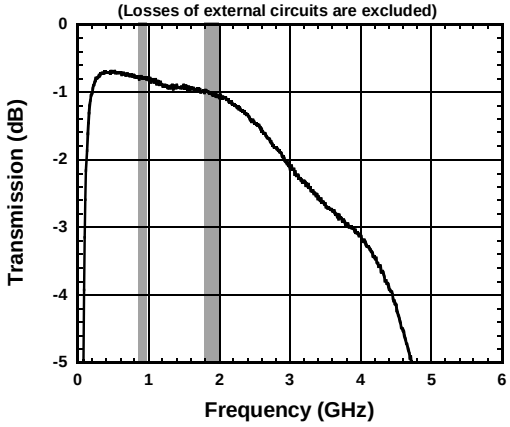
■ ELECTRICAL CHARACTERISTICS (RX4 ON mode)

(With Application circuit, Loss of external circuit are excluded)

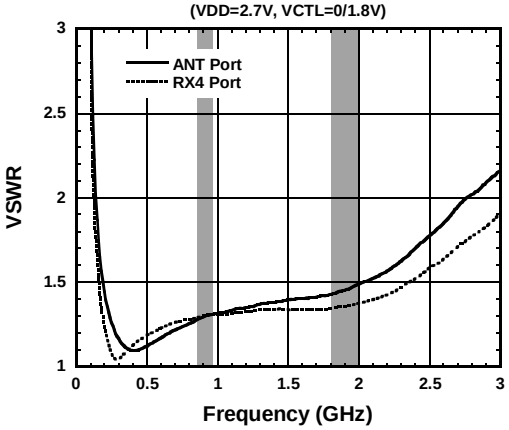
ANT Port to RX4 Port
Insertion Loss vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



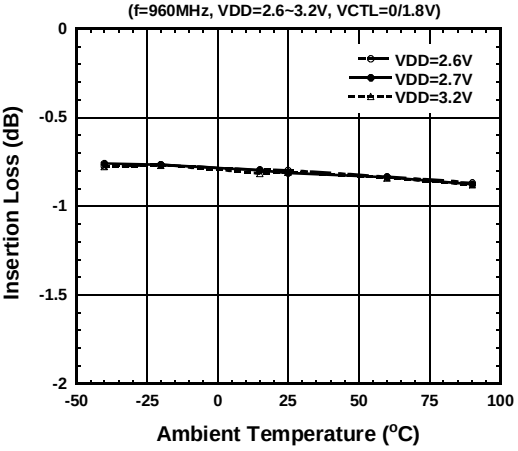
ANT Port to RX4 Port
Transmission Characteristics
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



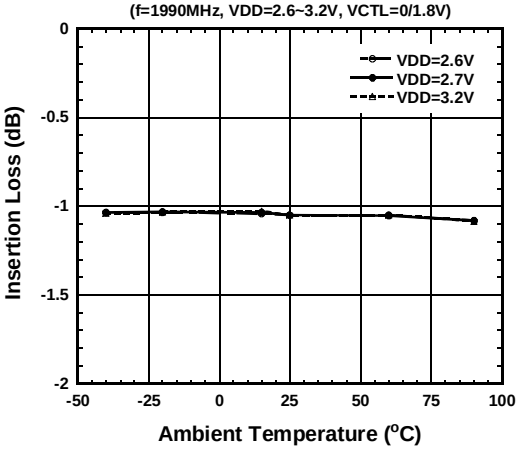
VSWR vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



Insertion Loss vs Ambient Temperature
(f=960MHz, VDD=2.6~3.2V, VCTL=0/1.8V)



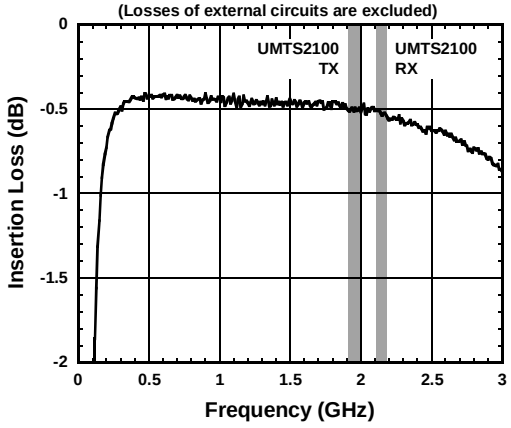
Insertion Loss vs Ambient Temperature
(f=1990MHz, VDD=2.6~3.2V, VCTL=0/1.8V)



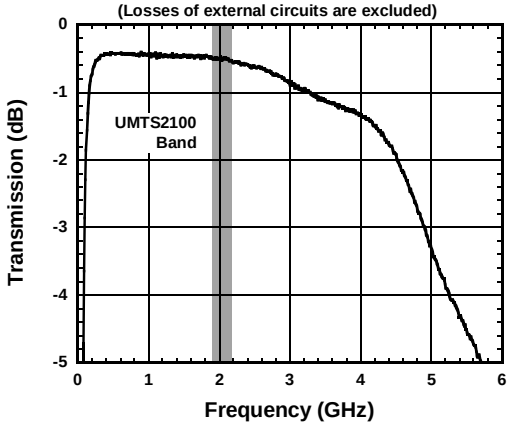
■ ELECTRICAL CHARACTERISTICS (TRX1 ON mode)

(With Application circuit, Loss of external circuit are excluded)

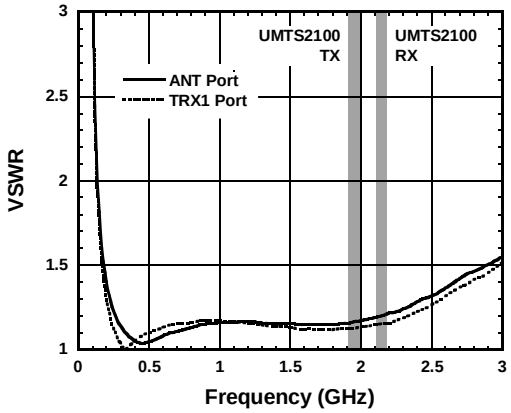
TRX1 Port to ANT Port
Insertion Loss vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



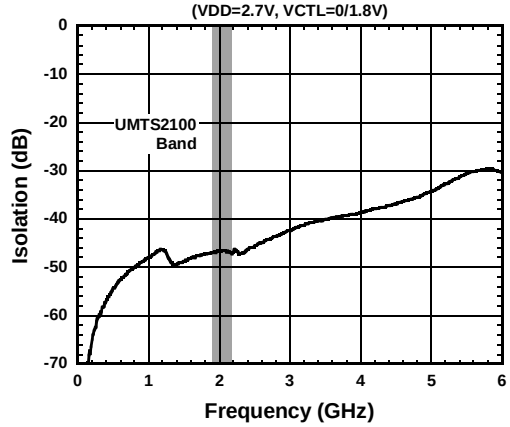
TRX1 Port to ANT Port
Transmission Characteristics
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



VSWR vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



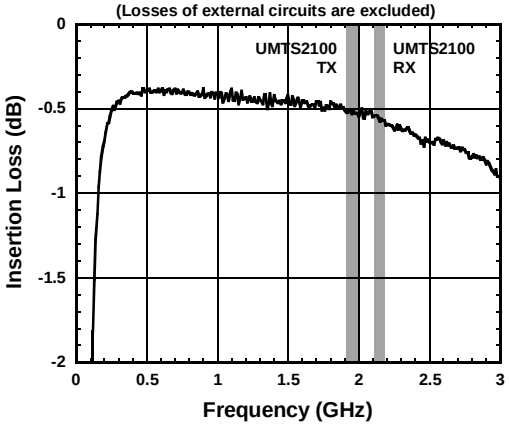
TRX1 Port to RX4 Port
Isolation vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



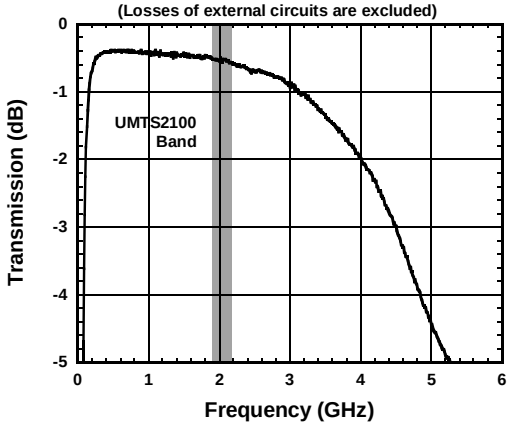
■ ELECTRICAL CHARACTERISTICS (TRX2 ON mode)

(With Application circuit, Loss of external circuit are excluded)

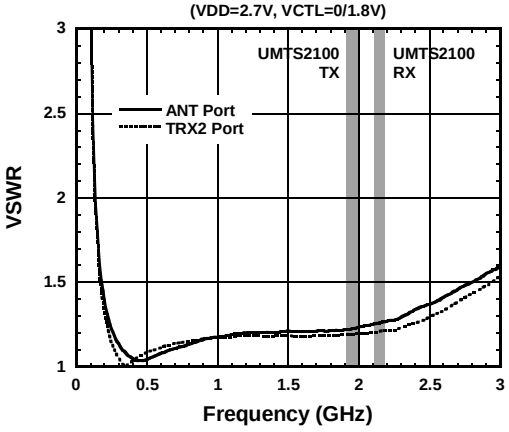
TRX2 Port to ANT Port
Insertion Loss vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



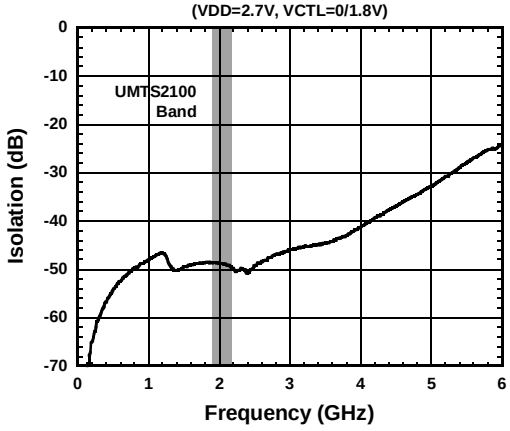
TRX2 Port to ANT Port
Transmission Characteristics
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



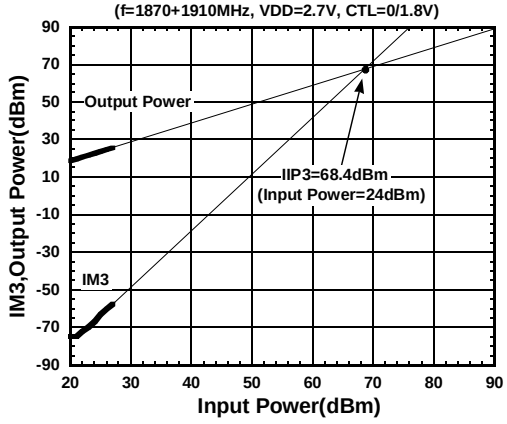
VSWR vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



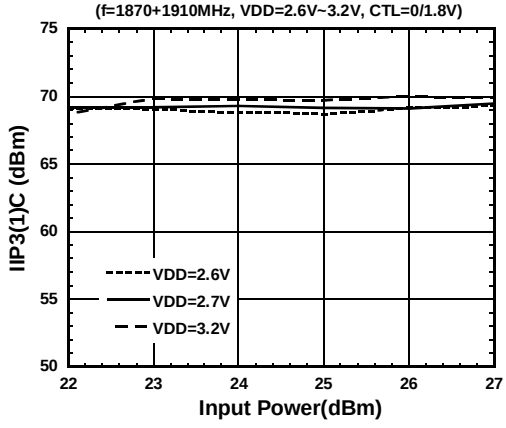
TRX2 Port to RX4 Port
Isolation vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



TRX2 Port to ANT Port
Output Power,IM3 vs. Input Power
(f=1870+1910MHz, VDD=2.7V, CTL=0/1.8V)



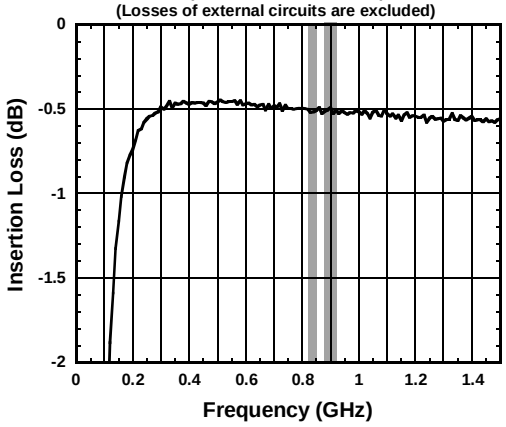
TRX2 Port to ANT Port
IIP3(1)C vs. Input Power
(f=1870+1910MHz, VDD=2.6V~3.2V, CTL=0/1.8V)



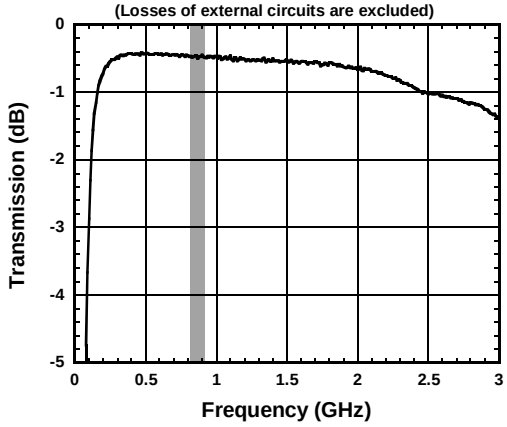
■ ELECTRICAL CHARACTERISTICS (TRX3 ON mode)

(With Application circuit, Loss of external circuit are excluded)

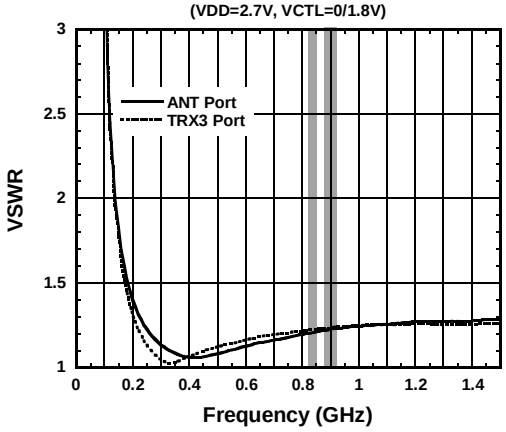
TRX3 Port to ANT Port
Insertion Loss vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



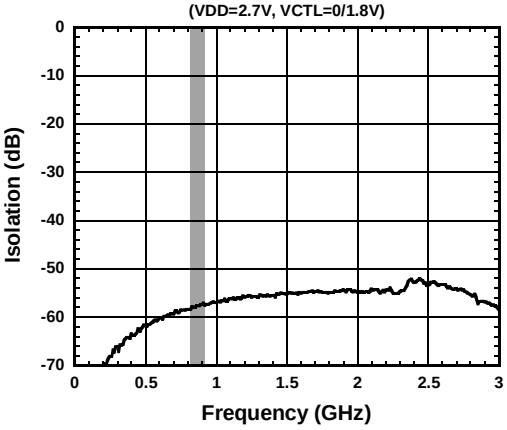
TRX3 Port to ANT Port
Transmission Characteristics
(VDD=2.7V, VCTL=0/1.8V)
(Losses of external circuits are excluded)



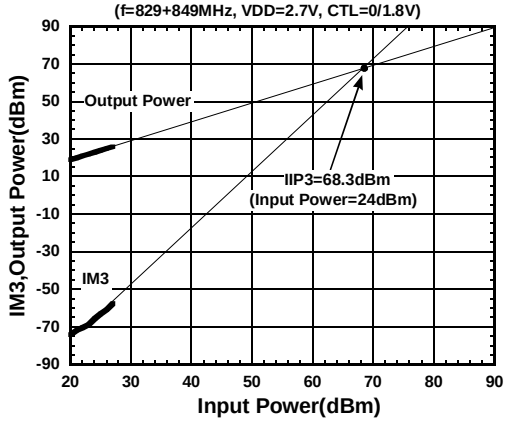
VSWR vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



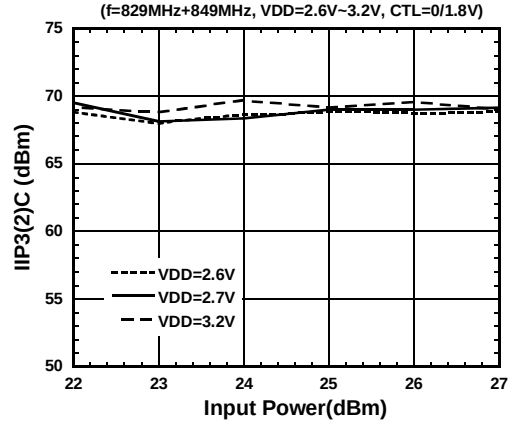
TRX3 Port to RX1 Port
Isolation vs. Frequency
(VDD=2.7V, VCTL=0/1.8V)



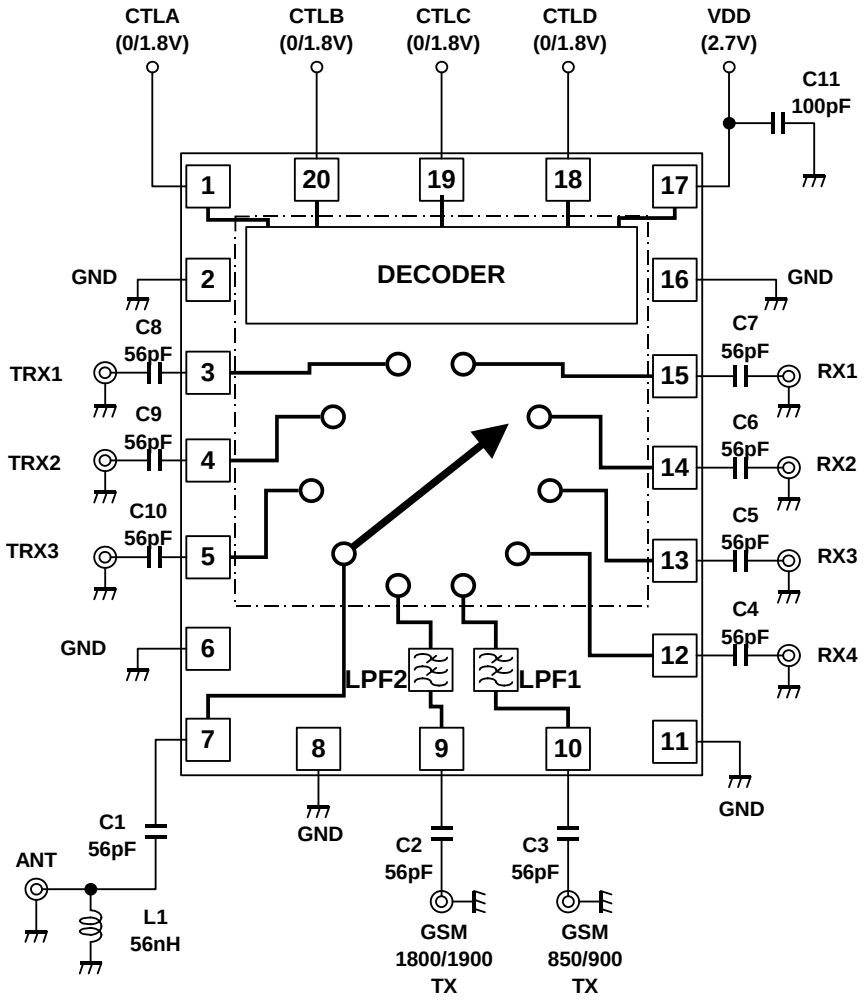
TRX3 Port to ANT Port
Output Power,IM3 vs. Input Power
(f=829+849MHz, VDD=2.7V, CTL=0/1.8V)



TRX3 Port to ANT Port
IIP3(2)C vs. Input Power
(f=829MHz+849MHz, VDD=2.6V~3.2V, CTL=0/1.8V)



■ APPLICATION CIRCUIT (Top View)



PIN CONNECTION

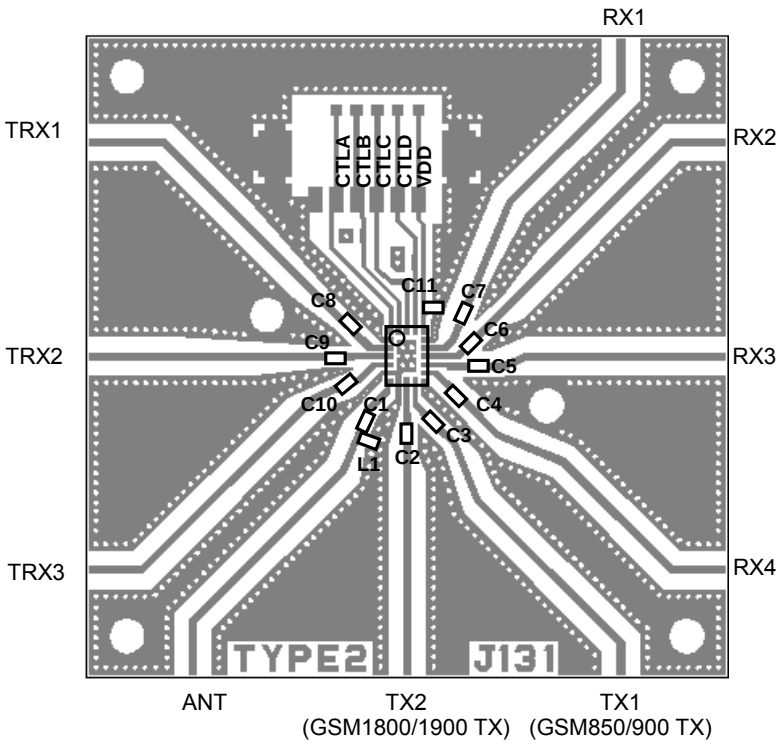
1. CTLA
2. GND
3. TRX1
4. TRX2
5. TRX3
6. GND
7. ANT
8. GND
9. TX2(GSM1800/1900 TX)
10. TX1(GSM850/900 TX)
11. GND
12. RX4
13. RX3
14. RX2
15. RX1
16. GND
17. VDD
18. CTLD
19. CTLC
20. CTLB

■ PARTS LIST

Parts number	Value	Notes
C1…C10	56pF	MURATA(GRM15)
C11	100pF	
L1*	56nH	-

* :Inductor(56nH) is recommended on ANT port for ESD protection.

■ TEST PCB LAYOUT (Top View)



PCB SIZE= 39 x 39 mm
PCB: FR-4, t=0.2mm
CAPACITOR: size 1005
MICROSTRIP LINE WIDTH=0.4mm

Board total losses (Connector and PCB)

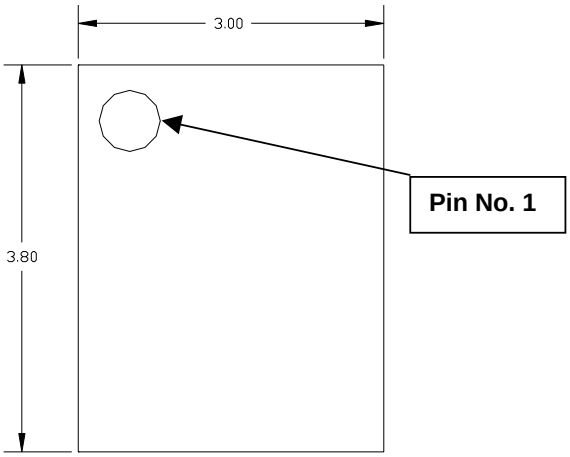
Parameter	Mode	Frequwncy (MHz)	Loss (dB)
Insertion Loss	TX1	824	0.31
		849	0.33
		880	0.33
		915	0.34
	TX2	1710	0.52
		1785	0.54
		1850	0.54
		1910	0.55
	RX1	960	0.35
		1990	0.64
	RX2	960	0.35
		1990	0.64
	RX3	960	0.32
		1990	0.58
	RX4	960	0.35
		1990	0.64
	TRX1	894	0.34
		1880	0.60
		1990	0.64
		2170	0.69
	TRX2	894	0.30
		1880	0.55
		1990	0.58
		2170	0.63
	TRX3	894	0.34
		1880	0.60
		1990	0.64
		2170	0.69
Harmonic Suppression	GSM850/900 TX1 2fo	1648	0.54
		1698	0.56
		1760	0.56
		1830	0.58
	GSM850/900 TX1 3fo	2472	0.76
		2547	0.78
		2640	0.81
		2745	0.84
	GSM1800/1900 TX2 2fo	3420	0.96
		3570	0.97
		3700	1.02
		3820	1.03
	GSM1800/1900 TX2 3fo	5130	1.42
		5355	1.51
		5550	1.50
		5730	1.51

PRECATIONS

[1] For good RF performance, the ground terminals should be directly connected to the ground patterns and the through-holes as close as possible by using relatively wide pattern.
[2] Please connect exposed GND PADs (bottom side of IC) to PCB GND using through holes.
[3] To reduce microstrip line influence on RF characteristics, please locate bypass capacitors (C11) close to VDD terminals.

■ PACKAGE OUTLINE (LCSP20-H4)

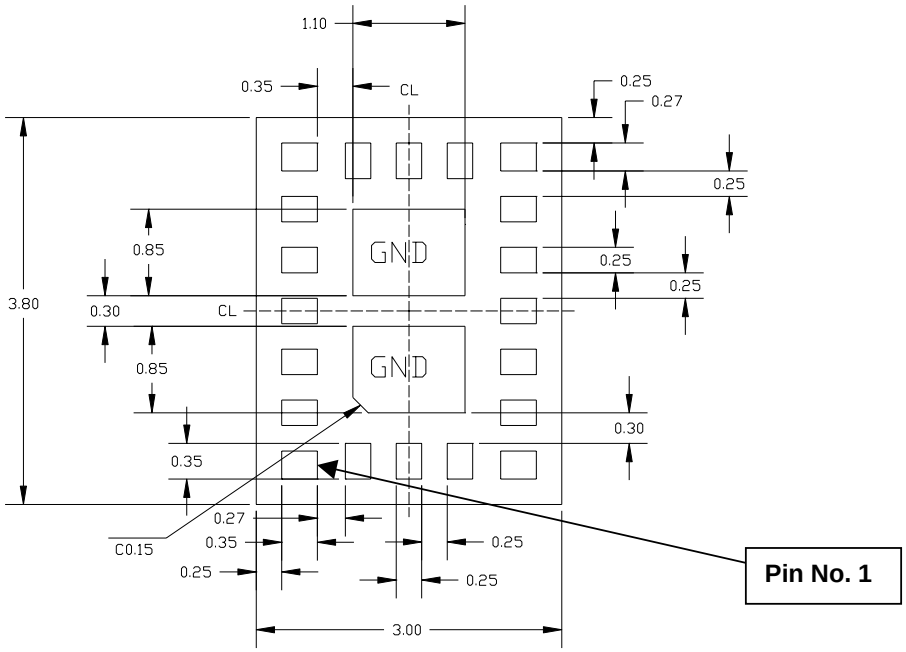
Top View



TERMINAL TREAT	Au
SUBSTRATE	LTCC
MOLDING MATERIAL	Silicone resin
UNIT	mm
WEIGHT	26.5mg

Side View

Bottom View



Cautions on using this product

This product contains Gallium-Arsenide (GaAs) which is a harmful material.

- Do NOT eat or put into mouth.
- Do NOT dispose in fire or break up this product.
- Do NOT chemically make gas or powder with this product.
- To waste this product, please obey the relating law of your country.

This product may be damaged with electric static discharge (ESD) or spike voltage. Please handle with care to avoid these damages.