YCM210

High IIP3 GaAs Mixer

Description

YCM210 is high IIP3 GaAs pHEMT MMIC mixer with integrated LO amplifier.

It combines low conversion loss and a low noise figure with a low demand of LO power and DC power covering 100 to 3500MHz.

It is well suited for demanding cellular base station mixer that require high sensitivity and effective blocker immunity.

Applications

- Base Station, Repeater
- Automotive, IoT, Point-to-point radio links
- Wireless Data, Satellite Terminals
- High Dynamic Range Infrastructure system
- Wideband Instrumentation

Features

- + 26 dBm input IP3 @ 850MHz
- Conversion Loss : 6.5 dB @ 850MHz
- Single Positive Supply : 10mA @ 3.3V
- LO drive level: -8 to +8dBm
- Available 3.0 to 5.0 V single voltage
- Lead-free, RoHS2 compliant

Electrical Specification

Parameters	Min	Typ	Max	Unit	Test Conditions
RF Frequency Range	100	850	3500	MHz	
LO Frequency Range	70	780	3430	MHz	Low-Side LO
IF Frequency Range	30	70	700	MHz	
Conversion Loss		6.1		dB	f_{RF}=850MHz, f_{LO}=780MHz, f_{IF}=70MHz
Noise Figure (SSB)		6.1		dB	f_{RF}=850MHz, f_{LO}=780MHz, f_{IF}=70MHz
LO to RF Isolation		17.3		dB	LO Power=0 dBm, f_{LO}=780MHz
LO to IF Isolation		20.7		dB	LO Power=0 dBm, f_{LO}=780MHz
RF to IF Isolation		16.8		dB	RF power=0dBm, f_{RF} = 850MHz, f_{LO}=780MHz
IIP3		25.5		dBm	f_{RF1}=849MHz, f_{RF2}=850MHz, f_{LO}=780MHz, f_{IF}= 70MHz, each input RF power 0dBm/tone
IIP1		18.0		dBm	f_{RF}=850MHz, f_{LO}=780MHz, f_{IF}=70MHz
Supply Voltage	2.7	3.3	5.0	V	
Supply Current		11		mA	LO Power = 0 dBm

Notes:
VDD = 3.3V, TA = 25℃, LO = 0dBm, ZS = ZL =50, unless otherwise noted.

Typical RF Performance (f_{IF} = 70 MHz)

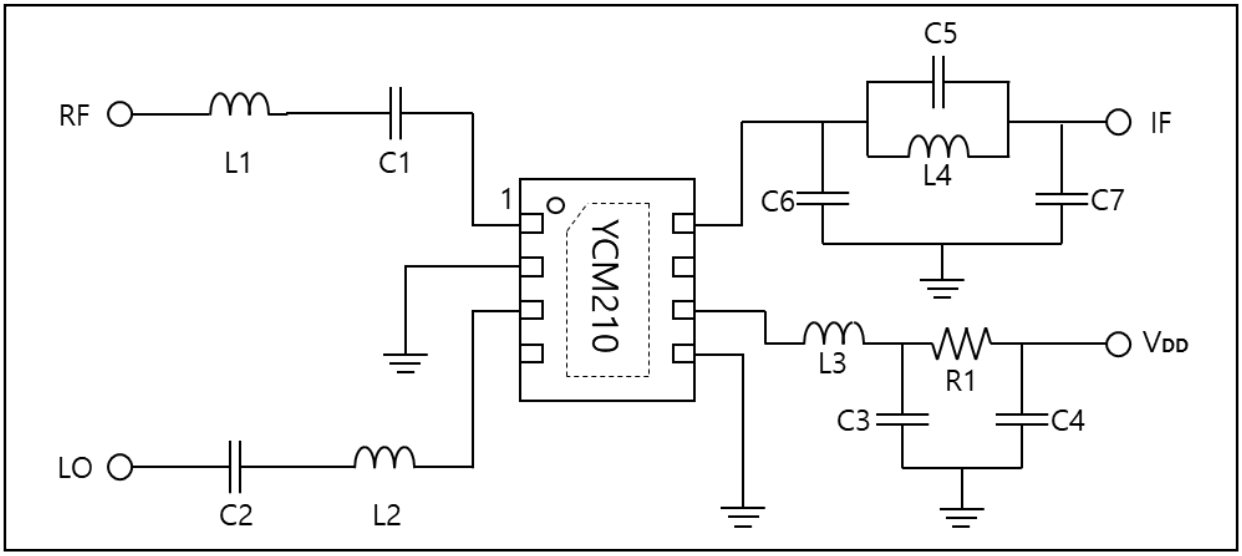
Parameter	Specification Conditions					Unit
RF Frequency	850	1800	2100	2600	3500	MHz
LO Frequency	780	1730	2030	2530	3430	MHz
IF Frequency	70					MHz
Conversion Loss	6.1	5.5	7.2	6.9	5.6	dB
Noise Figure (SSB)	6.1	5.5	7.2	6.9	5.6	dB
LO to RF Isolation	17.3	11.4	8.15	10.7	5.5	dB
LO to IF Isolation	24.7	19.5	16.6	20.6	33.5	dB
RF to IF Isolation	16.7	16	10.5	14.3	29.3	dB
IIP3	25.5	20.4	22.6	19.3	19.7	dBm
IIP1	18.0	15.5	14.5	17.0	16.0	dBm
Ids (I_{DD})	3.3					V
	11	10	14	16	17	mA
LO input Drive Level	0					dBm

Typical RF Performance (f_{IF} = 140 MHz)

Parameter	Specification Conditions					Unit
RF Frequency	850	1800	2100	2600	3500	MHz
LO Frequency	710	1660	1960	2460	3360	MHz
IF Frequency	140					MHz
Conversion Loss	6.7	5.9	7.5	7.5	6	dB
Noise Figure (SSB)	6.7	5.9	7.5	7.5	6	dB
LO to RF Isolation	20.1	19.8	14.6	21.5	4.8	dB
LO to IF Isolation	20.8	19.9	15.1	22.4	36.6	dB
RF to IF Isolation	16.4	16.2	9.8	12.8	29.3	dB
IIP3	26.3	18.5	25.2	20.4	20.3	dBm
IIP1	19	16.5	15.0	17.6	15	dBm
Ids (I_{DD})	3.3					V
	10	10	12	16	17	mA
LO input Drive Level	0					dBm

Notes:
Frequency space is 1 MHz for IIP3 measurement.
Temperature of test ambient (TA) = 25℃, ZS = ZL =50, unless otherwise noted. .

Application Circuit

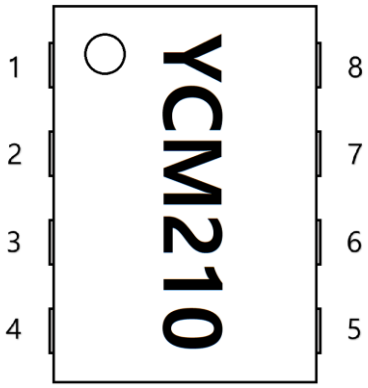


Notes:
Refer to the performance plots by frequency for detailed component values.

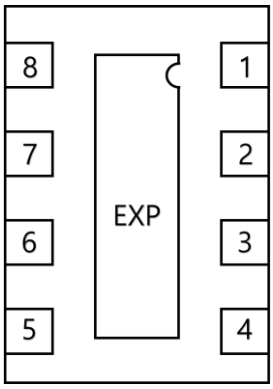
Absolute Maximum Ratings

Parameter	Ratings	Units
Max RF / IF Input Power	17	dBm
Max LO Drive Input Power	10	dBm
Max Device Voltage (VDD)	6.0	V
Junction Temperature	160	℃
Operating Temperature (TL)	-40 ~ -105	℃
Storage Temperature	-55 ~ 150	℃
ESD Sensitivity Ratings	Class 1A	-
Moisture Sensitivity Level	Level 3	-

Pin Configuration



Top View



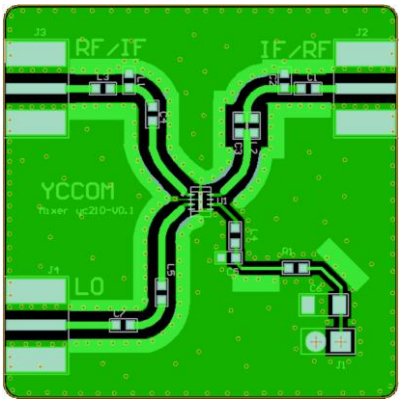
Bottom View

Pin	
1	RF/IF
2	GND
3	LO
4	N/C
5	GND
6	Vdd
7	NC
8	IF/RF
EXP	GND

Pin Description

Evaluation Board PCB Information

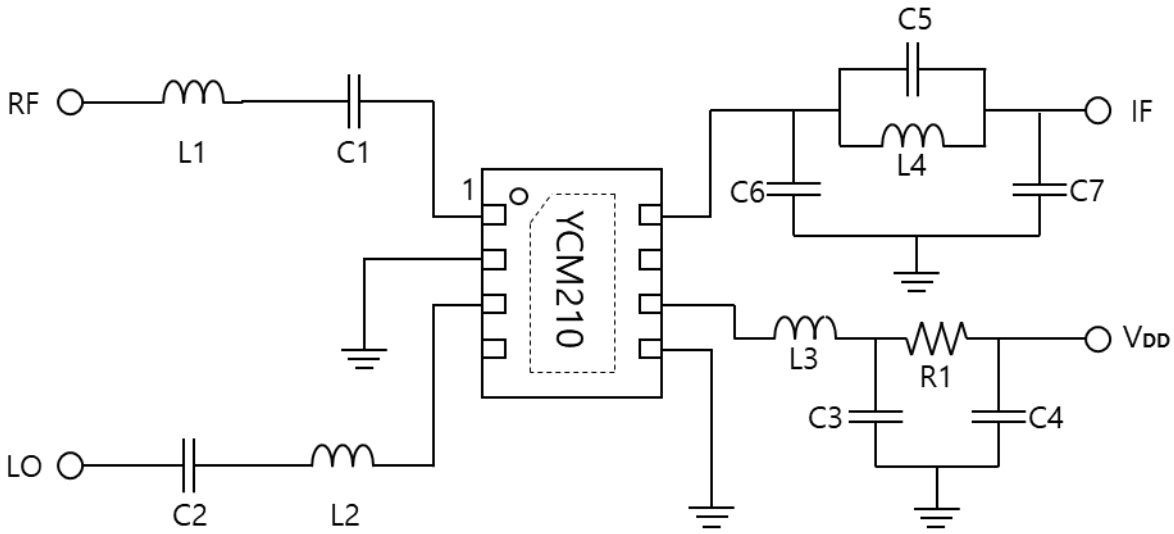
Layer	Id	Type	Material	Thickness
	F.Silkscreen	Top Silk Screen	Not specified	
	F.Paste	Top Solder Paste		
	F.Mask	Top Solder Mask	Not specified	0.01 mm
	F.Cu	Copper		0.017 mm
	Dielectric 1	Core	FR4	0.4 mm
	In1.Cu	Copper		0.017 mm
	Dielectric 2	PrePreg	FR4	0.7 mm
	In2.Cu	Copper		0.017 mm
	Dielectric 3	Core	FR4	0.4 mm
	B.Cu	Copper		0.017 mm
	B.Mask	Bottom Solder Mask	Not specified	0.01 mm
	B.Paste	Bottom Solder Paste		
	B.Silkscreen	Bottom Silk Screen	Not specified	



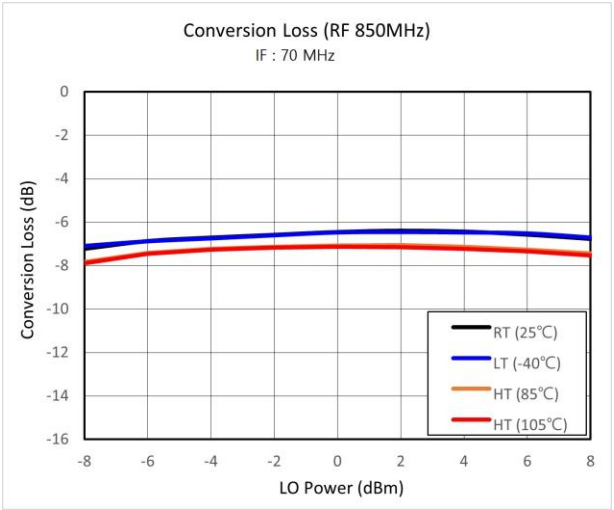
Notes:
50 ohm line dimensions. (FR4, Er=4.5)
Transmission Line Width : 0.70 mm
Spacing between T.L and GND : 0.50 mm

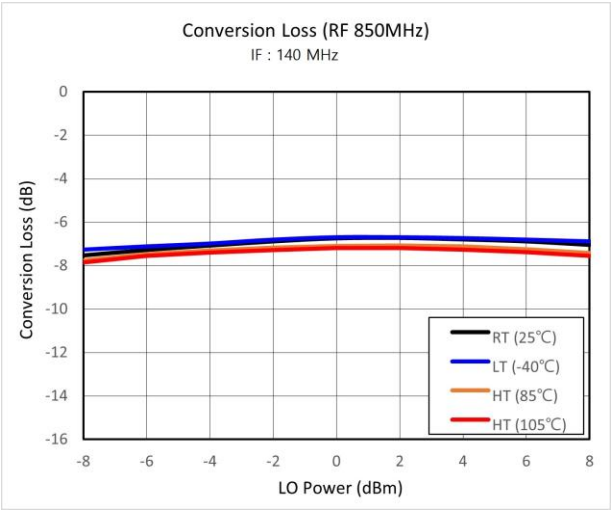
Performance Plots

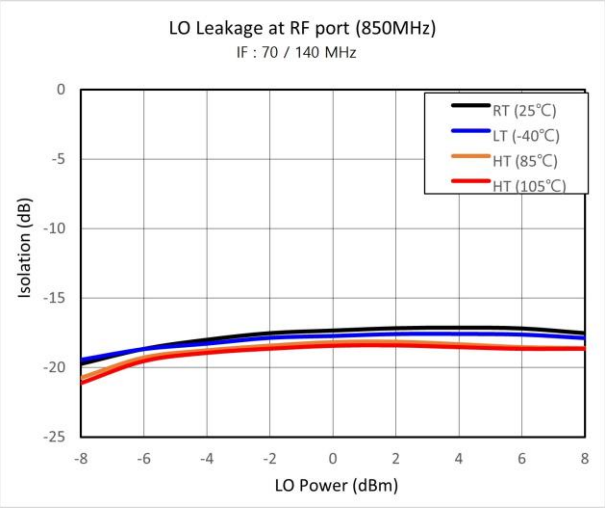
RF Frequency : 850MHz
Bais Conditions : V_{DD} = +3.3V, Z_O = 50Ω
LO : 0dBm, LSB

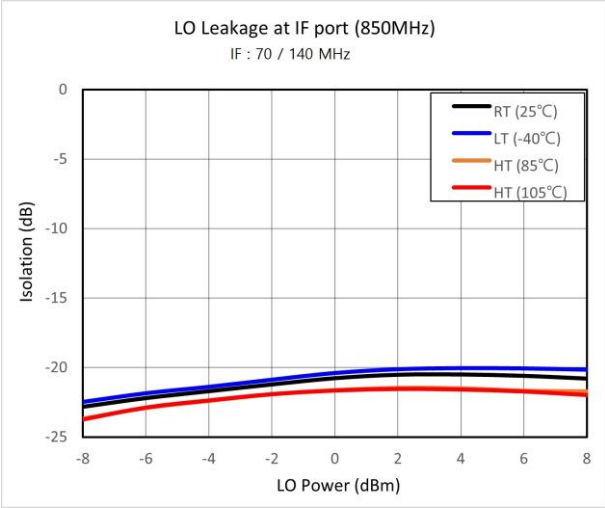


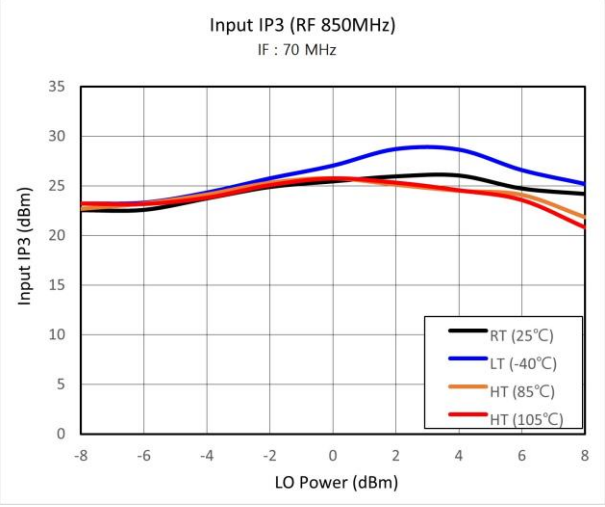
Code (Unit)	C1 (pF)	C2 (pF)	C3 (pF)	C4 (uF)	C5 (pF)	C6 (pF)	C7 (pF)	L1 (nH)	L2 (nH)	L3 (nH)	L4 (nH)	R1 (Ω)
Value	2.5	4	100	10	4.7	NC	NC	10	6.8	27	5.6	100

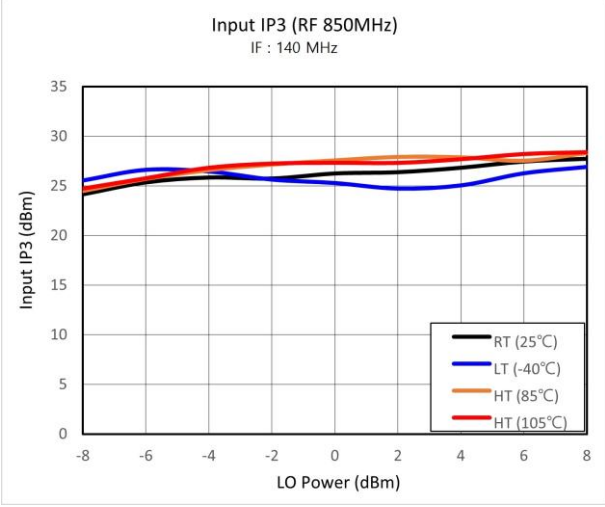





LO Leakage at RF port (850MHz)
IF : 70 / 140 MHz
Isolation (dB)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

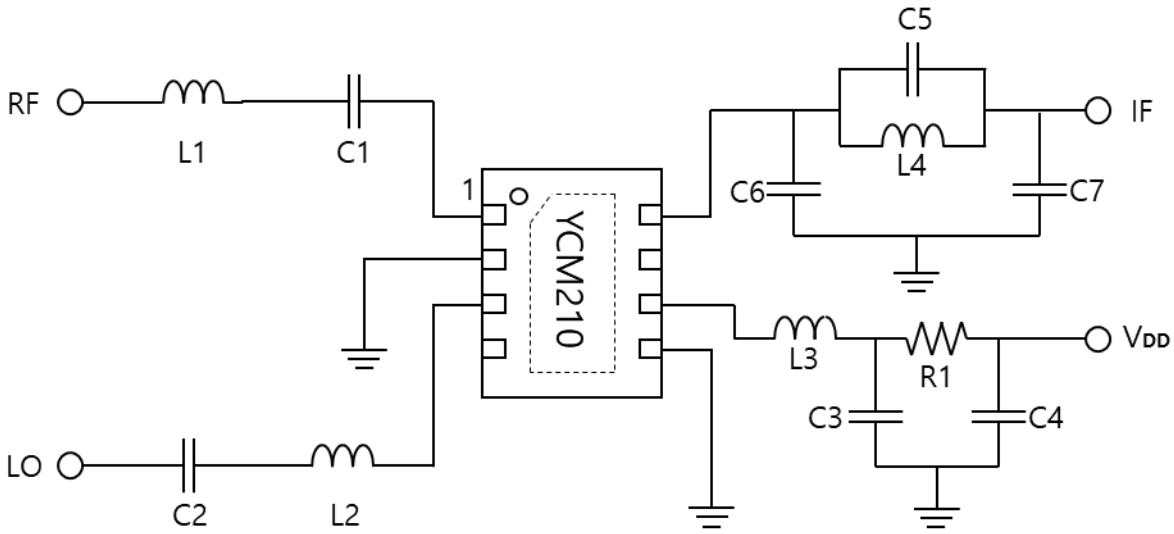

LO Leakage at IF port (850MHz)
IF : 70 / 140 MHz
Isolation (dB)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)


Input IP3 (RF 850MHz)
IF : 70 MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

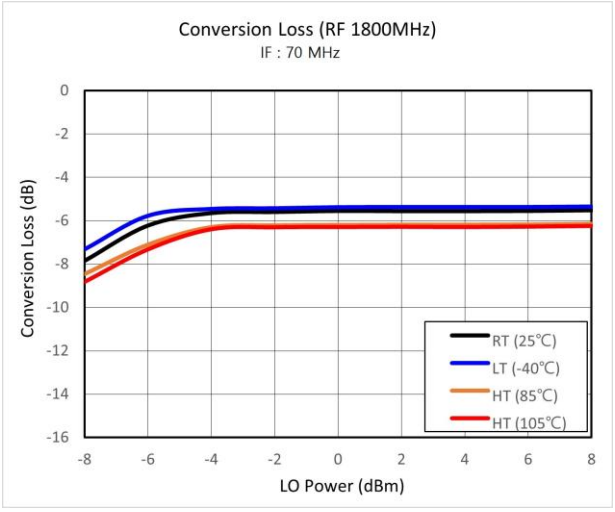

Input IP3 (RF 850MHz)
IF : 140 MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

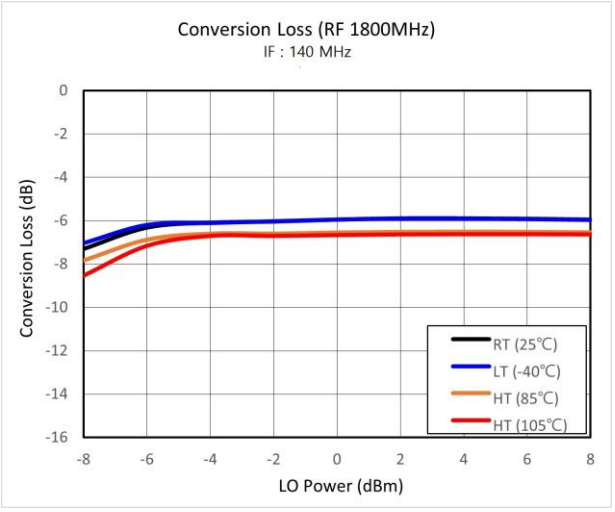
Performance Plots

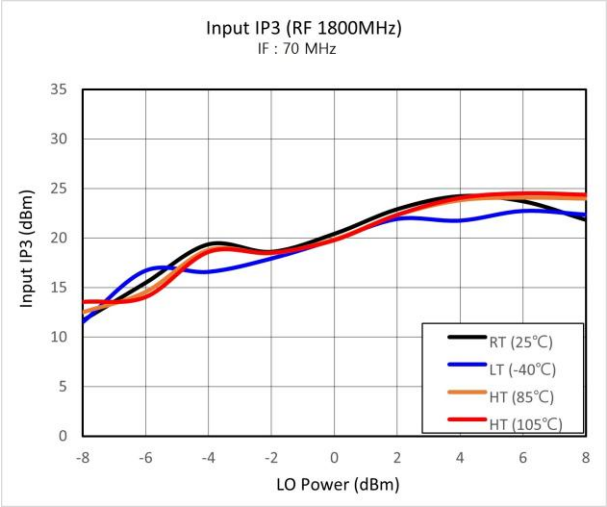
RF Frequency : 1800MHz
Bais Conditions : V_{DD} = +3.3V, Z_O = 50Ω
LO : 0dBm, LSB

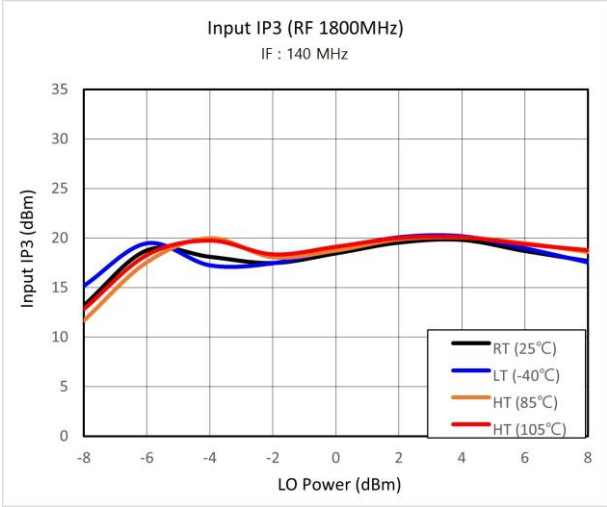


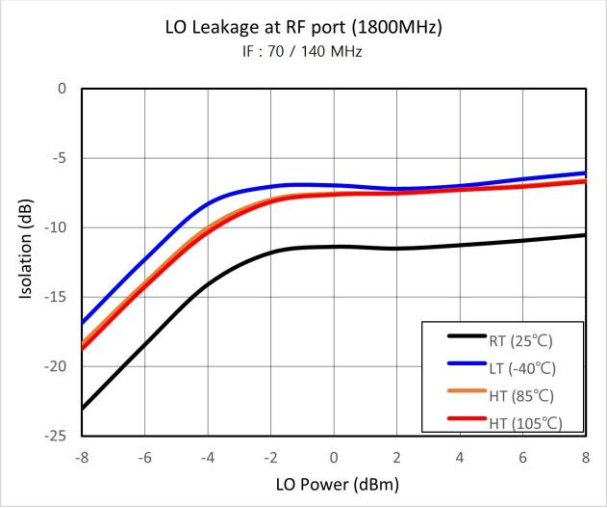
Code (Unit)	C1 (pF)	C2 (pF)	C3 (pF)	C4 (uF)	C5 (pF)	C6 (pF)	C7 (pF)	L1 (nH)	L2 (nH)	L3 (nH)	L4 (nH)	R1 (Ω)
Value	2	2	100	10	2	NC	4	5.6	4.7	3.9	2.2	100

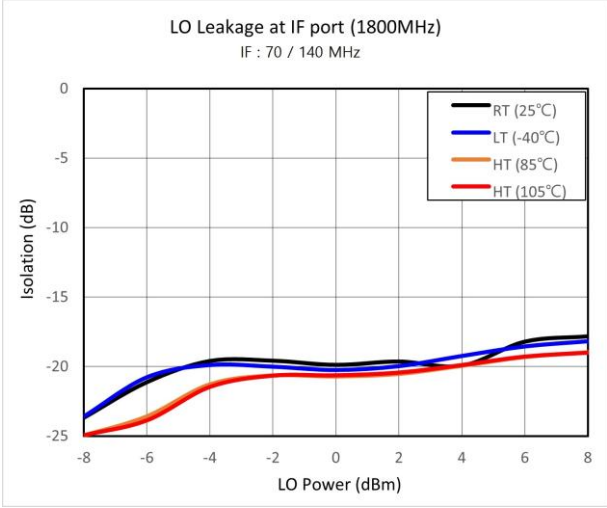





Input IP3 (RF 1800MHz)
IF : 70 MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

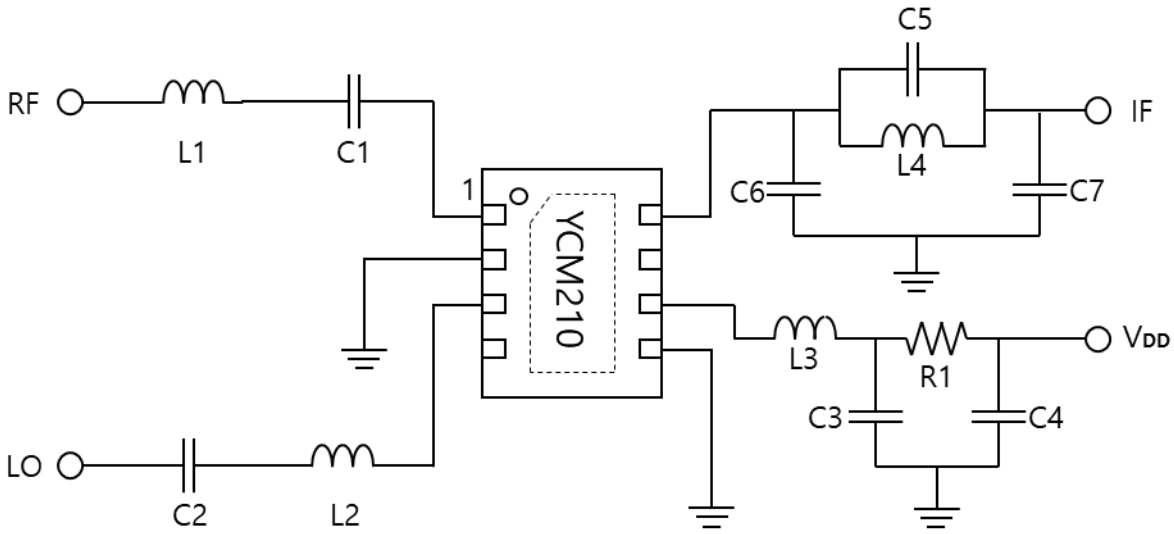

Input IP3 (RF 1800MHz)
IF : 140 MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)


LO Leakage at RF port (1800MHz)
IF : 70 / 140 MHz
Isolation (dB)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

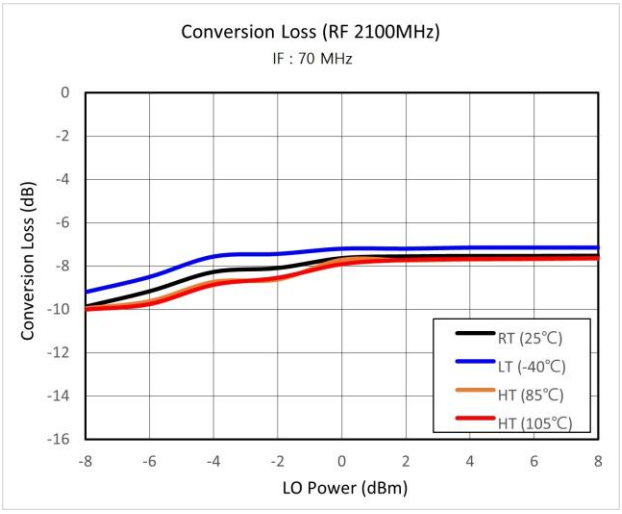

LO Leakage at IF port (1800MHz)
IF : 70 / 140 MHz
Isolation (dB)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

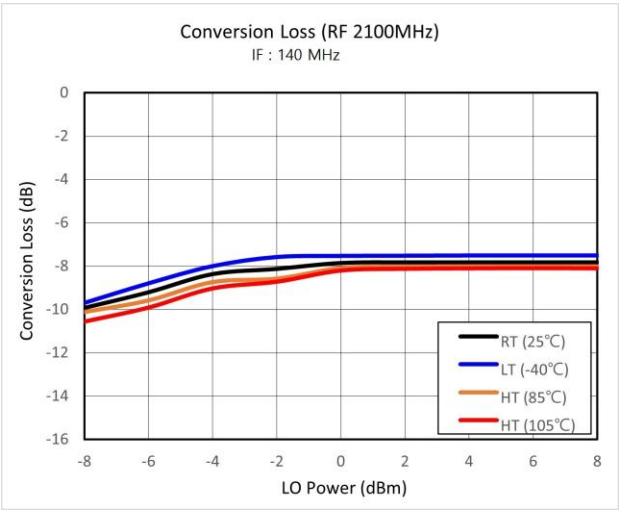
Performance Plots

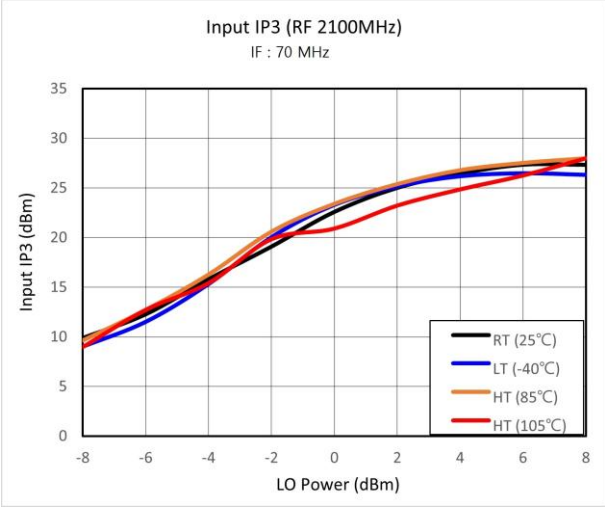
RF Frequency : 2100MHz
Bais Conditions : V_{DD} = +3.3V, Z_O = 50Ω
LO : 0dBm, LSB

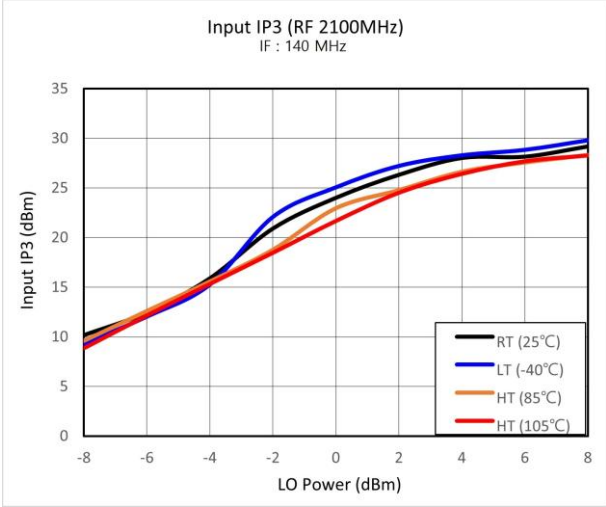


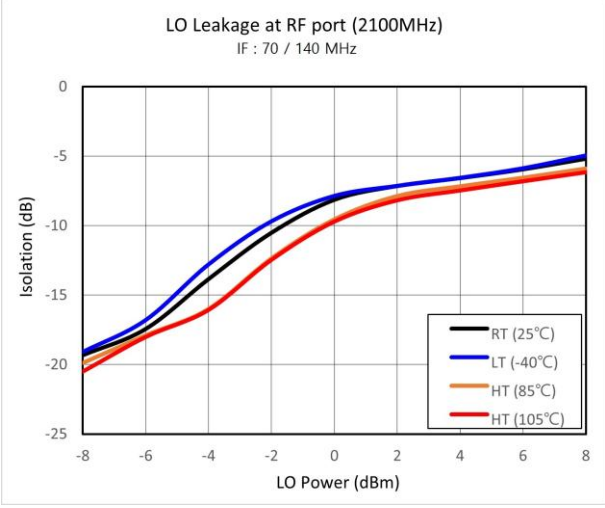
Code (Unit)	C1 (pF)	C2 (pF)	C3 (pF)	C4 (uF)	C5 (pF)	C6 (pF)	C7 (pF)	L1 (nH)	L2 (nH)	L3 (nH)	L4 (nH)	R1 (Ω)
Value	2	2	100	10	2	NC	NC	2.2	4.7	3.3	2.2	100

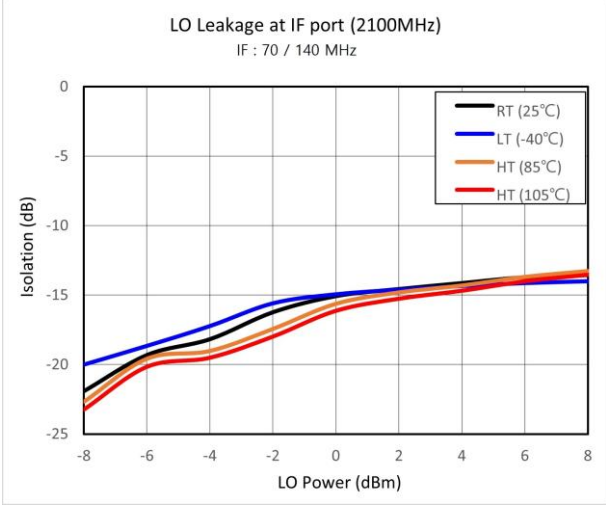





Input IP3 (RF 2100MHz)
IF : 70 MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

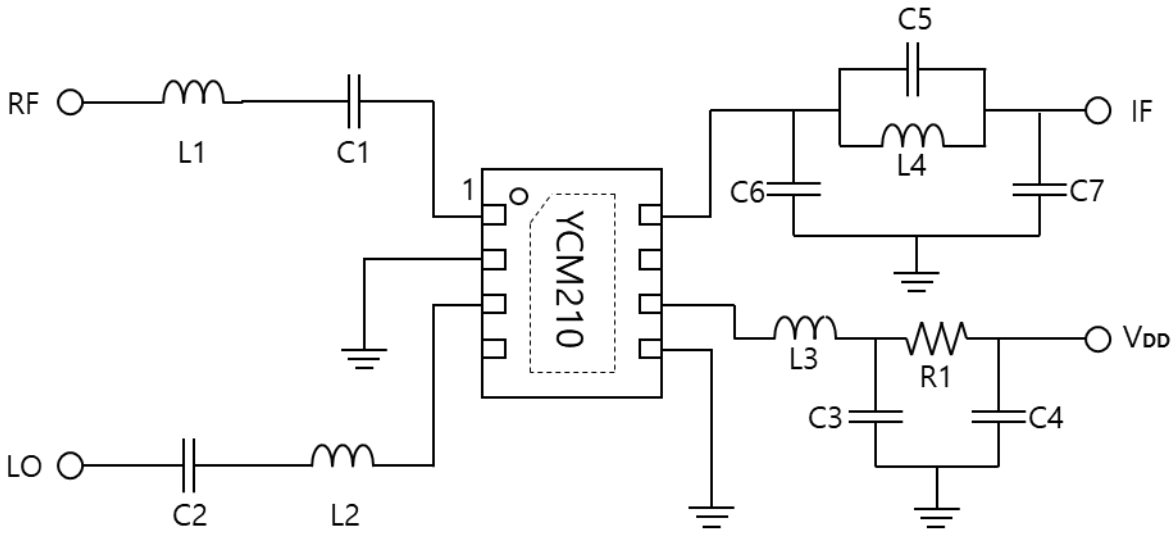

Input IP3 (RF 2100MHz)
IF : 140 MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)


LO Leakage at RF port (2100MHz)
IF : 70 / 140 MHz
Isolation (dB)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

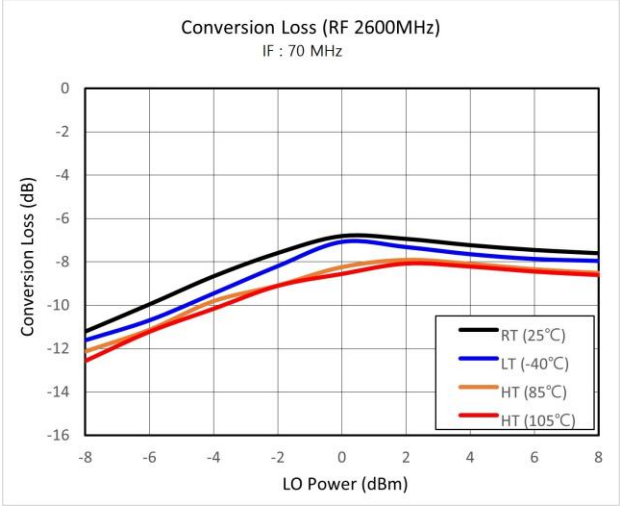

LO Leakage at IF port (2100MHz)
IF : 70 / 140 MHz
Isolation (dB)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

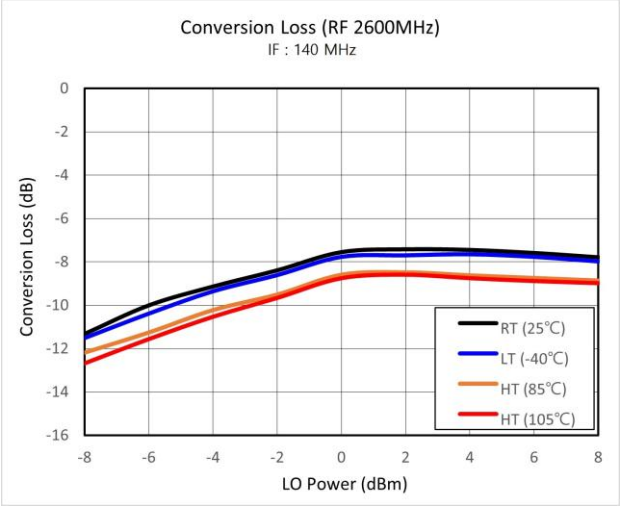
Performance Plots

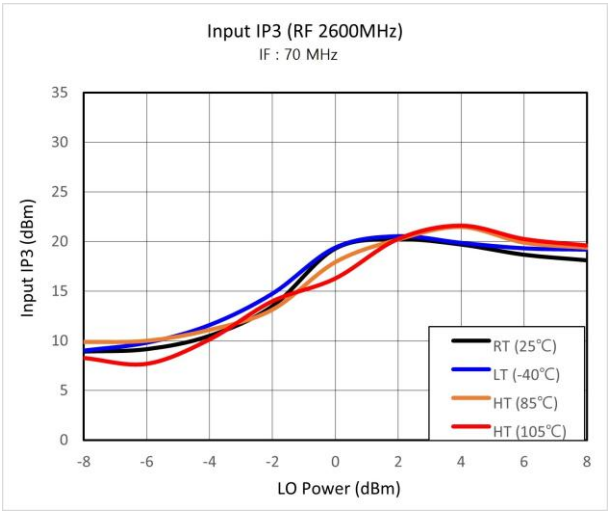
RF Frequency : 2600MHz
Bais Conditions : V_{DD} = +3.3V, Z_O = 50Ω
LO : 0dBm, LSB

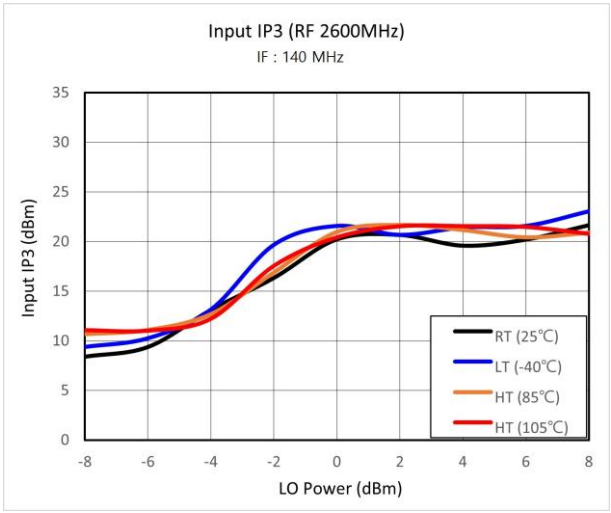


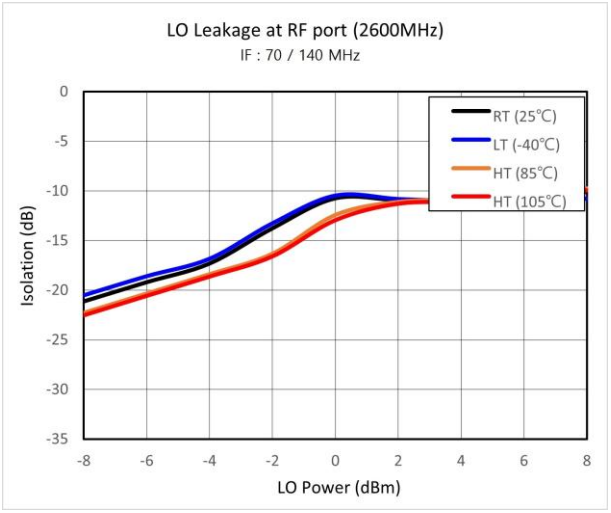
Code (Unit)	C1 (pF)	C2 (pF)	C3 (pF)	C4 (uF)	C5 (pF)	C6 (pF)	C7 (pF)	L1 (nH)	L2 (nH)	L3 (nH)	L4 (nH)	R1 (Ω)
Value	1	1	100	10	1.8	1	NC	3.3	2.2	1	2	30

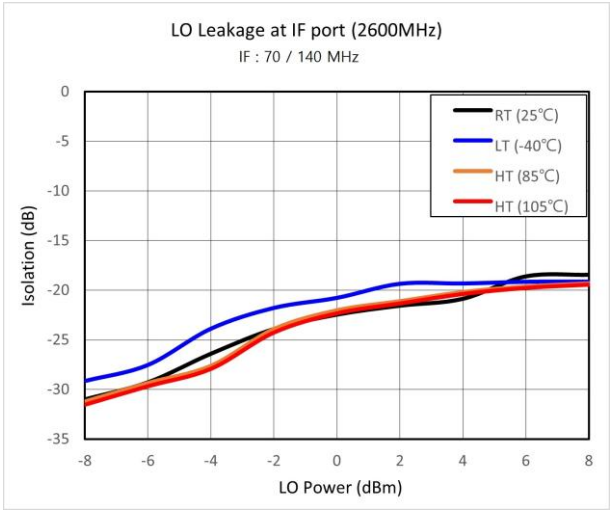





Input IP3 (RF 2600MHz)
IF : 70 MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

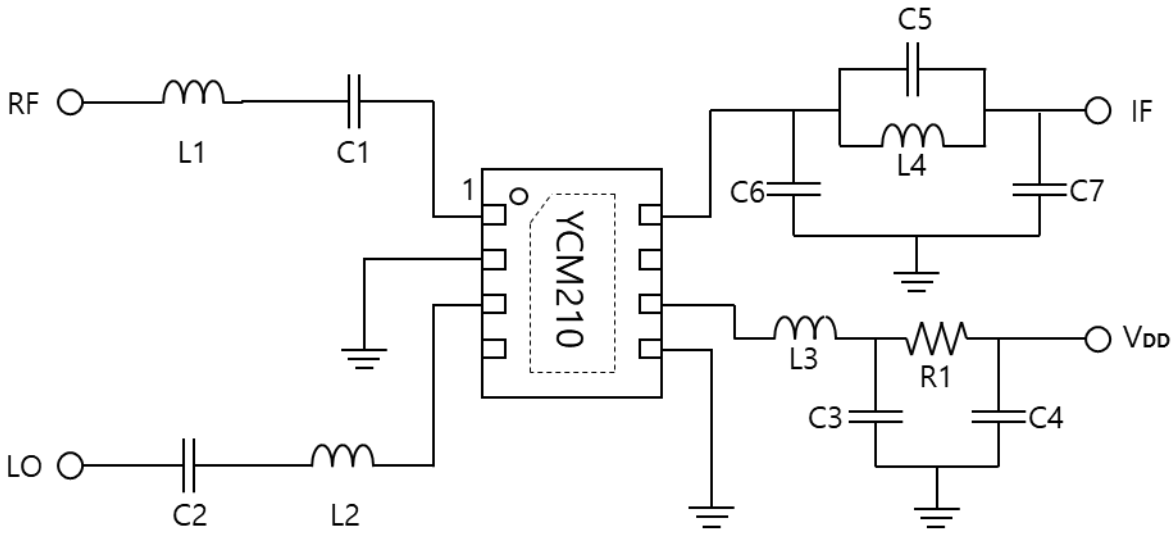

Input IP3 (RF 2600MHz)
IF : 140 MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)


LO Leakage at RF port (2600MHz)
IF : 70 / 140 MHz
Isolation (dB)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

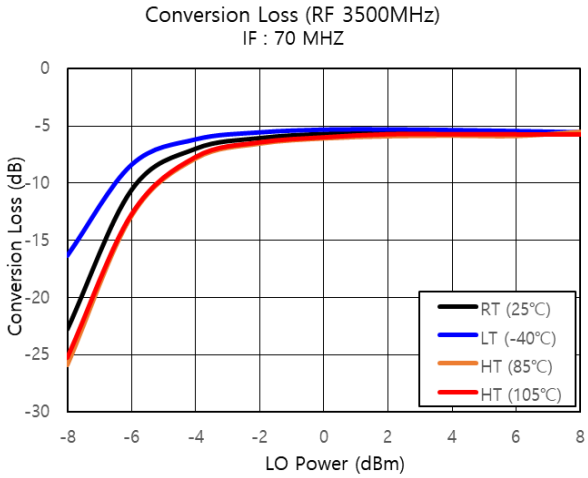

LO Leakage at IF port (2600MHz)
IF : 70 / 140 MHz
Isolation (dB)
LO Power (dBm)
RT (25℃)
LT (-40℃)
HT (85℃)
HT (105℃)

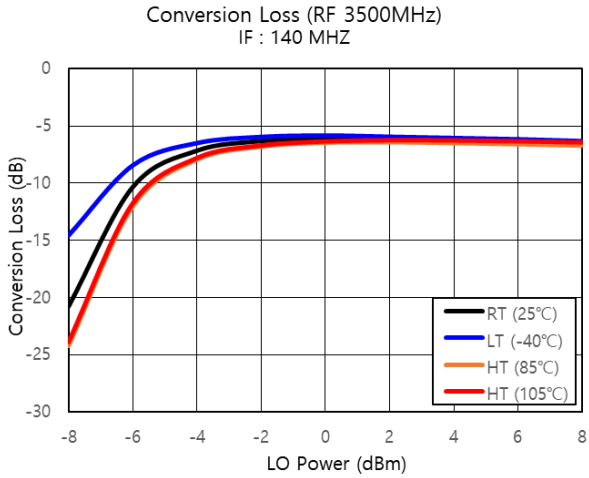
Performance Plots

RF Frequency : 3500MHz
Bais Conditions : V_{DD} = +3.3V, Z_O = 50Ω
LO : 0dBm, LSB

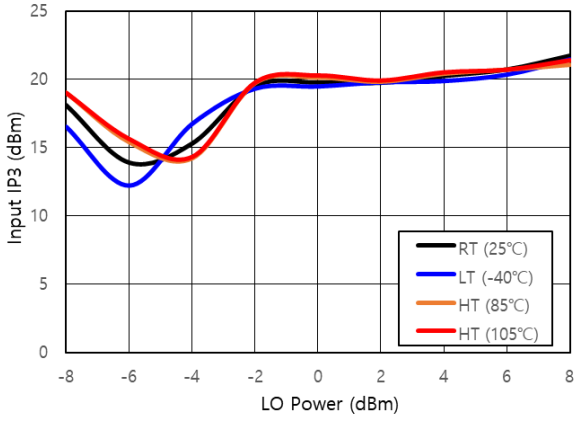


Code (Unit)	C1 (pF)	C2 (pF)	C3 (pF)	C4 (uF)	C5 (pF)	C6 (pF)	C7 (pF)	C8 (pF)	L1 (nH)	L2 (nH)	L4 (nH)	R1 (Ω)
Value	1.5	5.6	100	10	1.5	3.3	NC	7	1.5	1	1	0

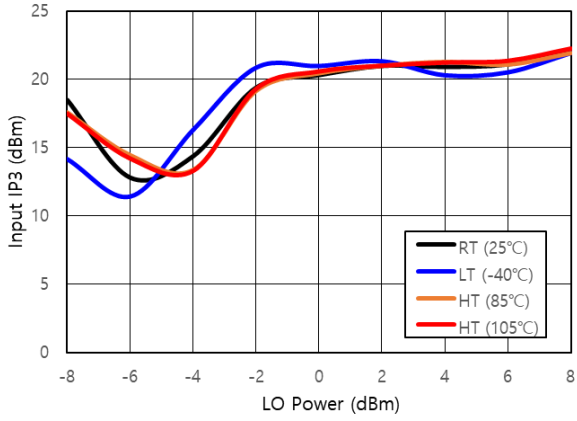




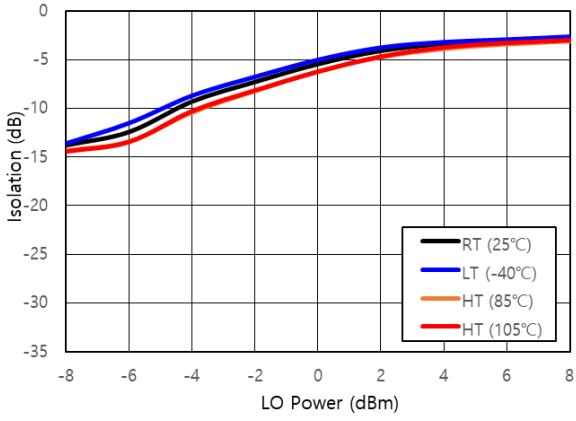
Input IP3 (RF 3500MHz)
IF : 70 MHZ



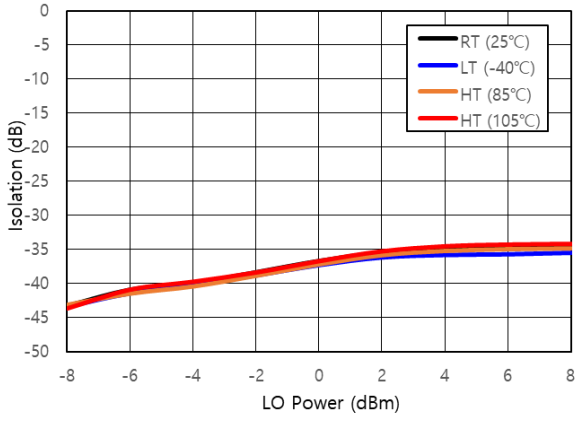
Input IP3 (RF 3500MHz)
IF : 140 MHZ



LO Leakage at RF port (3500MHz)
IF : 70/140 MHZ

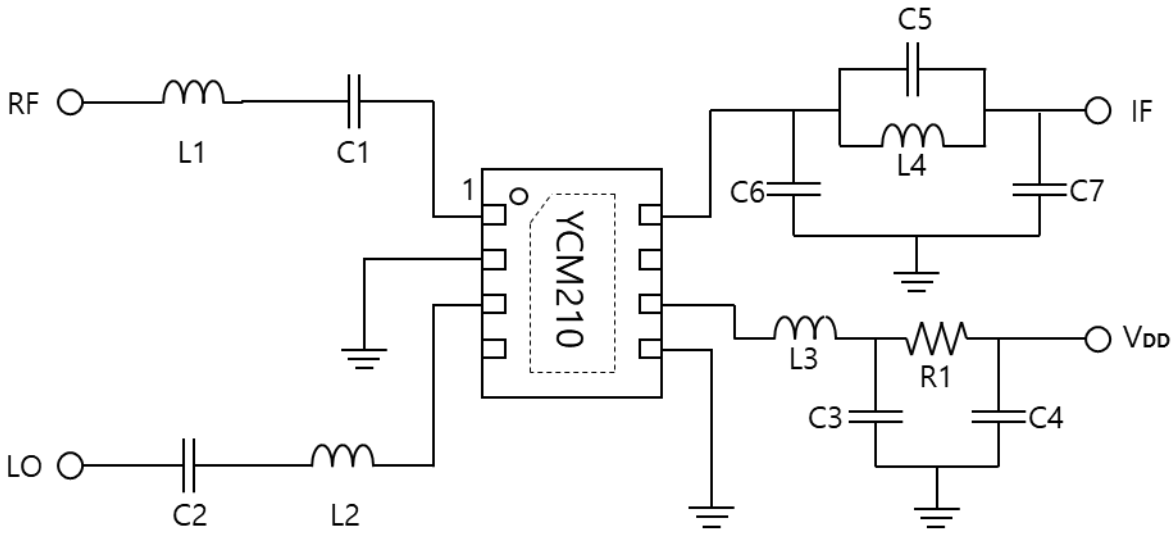


LO Leakage at IF port (3500MHz)
IF : 70/140 MHZ

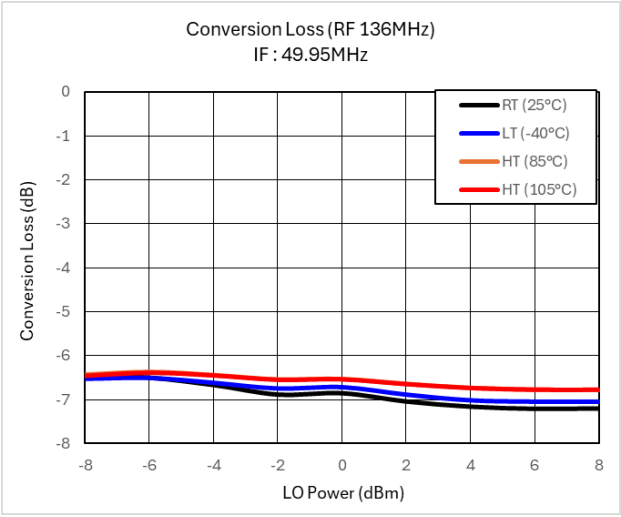


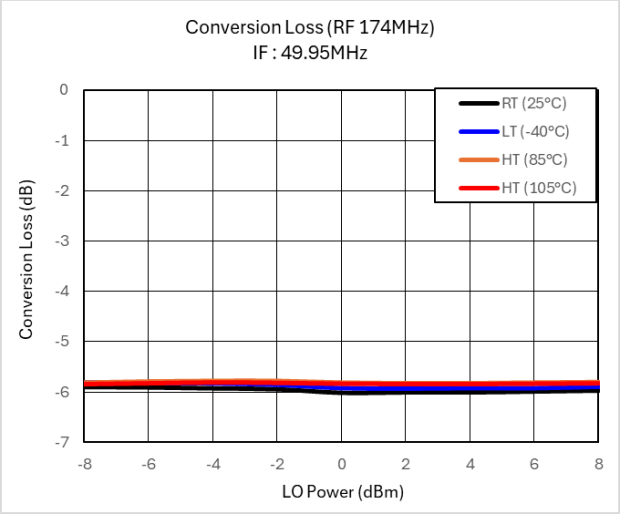
Performance Plots

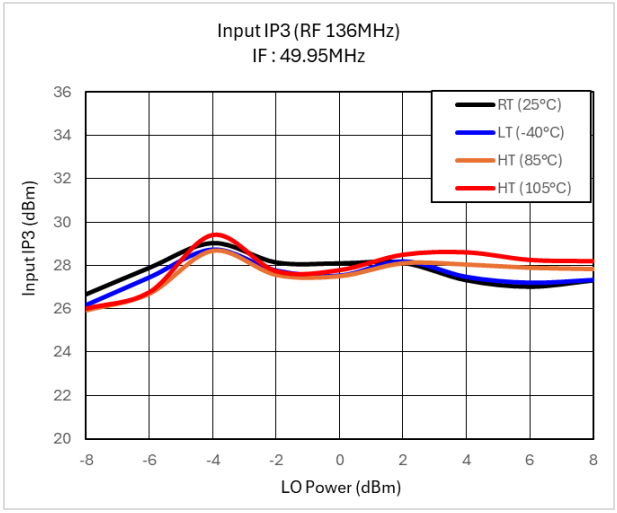
RF Frequency : 136MHz, 174MHz
Bais Conditions : V_{DD} = +3.3V, Z_O = 50Ω
RF : 0dBm, USB

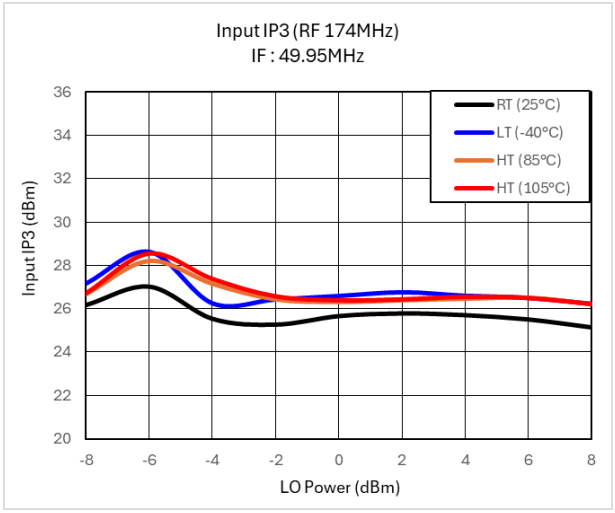


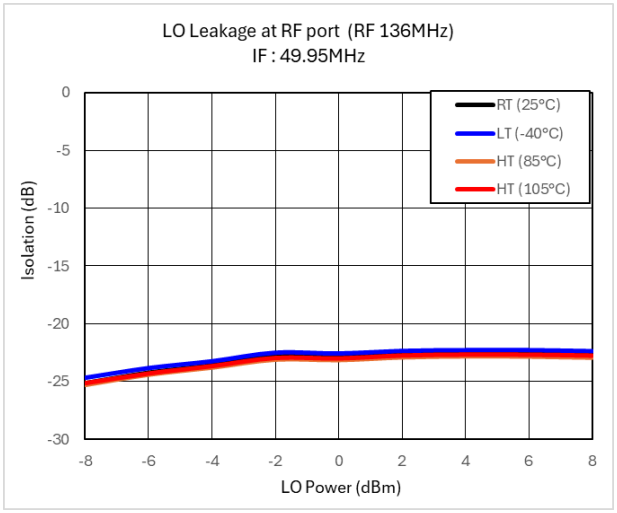
Code (Unit)	C1 (pF)	C2 (pF)	C3 (pF)	C4 (uF)	C5 (pF)	C6 (pF)	C7 (pF)	L1 (nH)	L2 (nH)	L3 (nH)	L4 (nH)	R1 (Ω)
Value	15	39	100	10	18	NC	NC	27	47	150	47	100

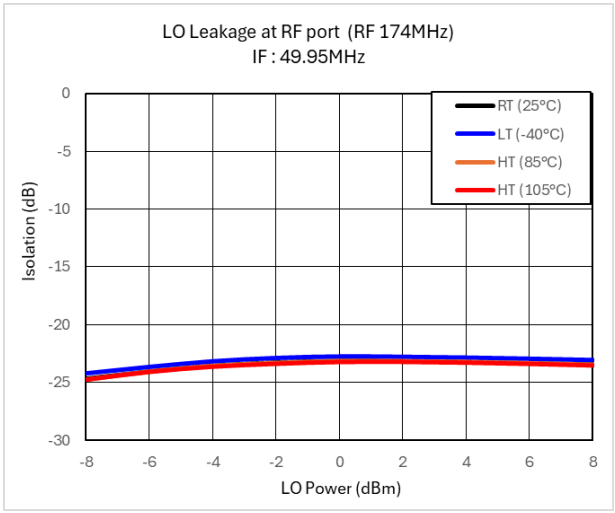


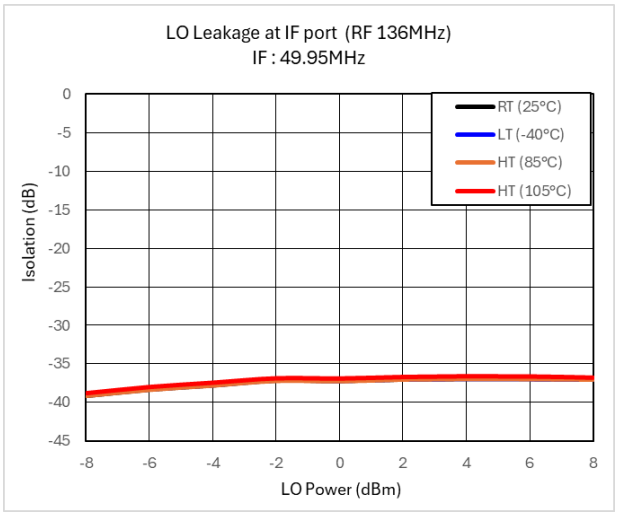


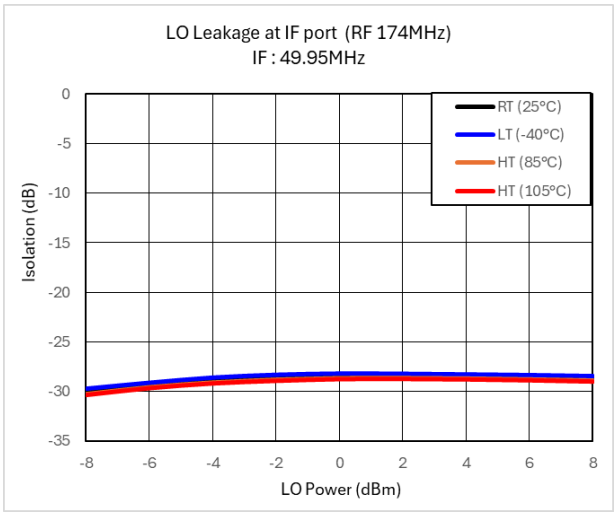

Input IP3 (RF 136MHz)
IF : 49.95MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)


Input IP3 (RF 174MHz)
IF : 49.95MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)


LO Leakage at RF port (RF 136MHz)
IF : 49.95MHz
Isolation (dB)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)

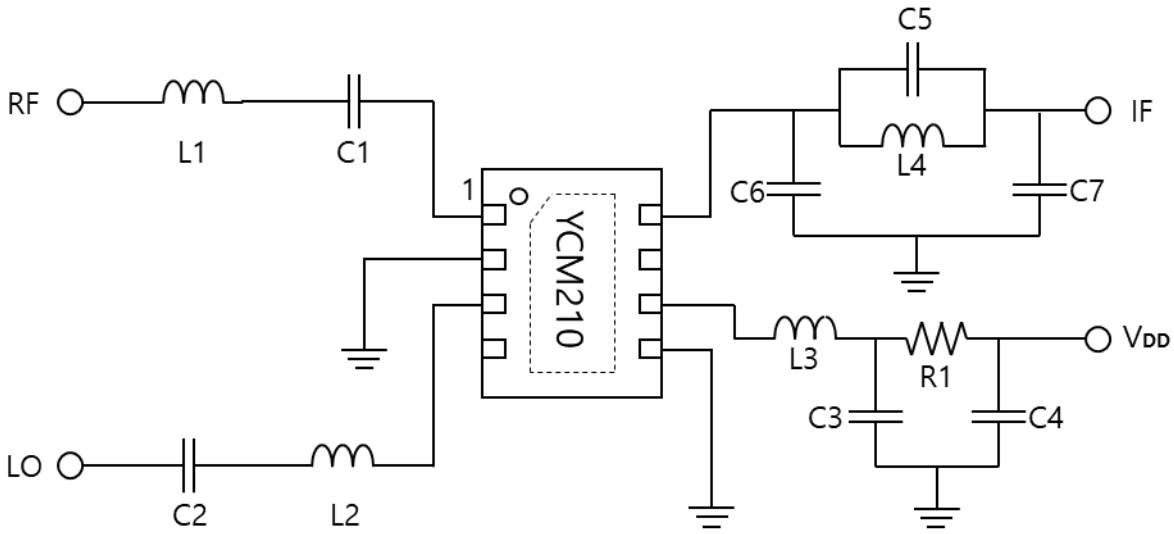

LO Leakage at RF port (RF 174MHz)
IF : 49.95MHz
Isolation (dB)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)


LO Leakage at IF port (RF 136MHz)
IF : 49.95MHz
Isolation (dB)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)

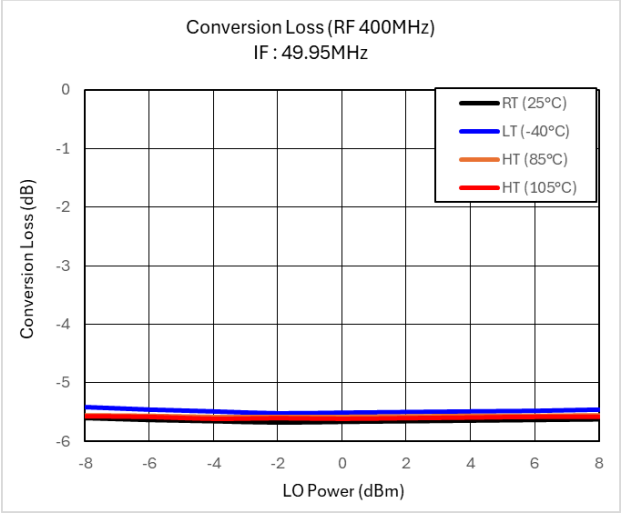

LO Leakage at IF port (RF 174MHz)
IF : 49.95MHz
Isolation (dB)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)

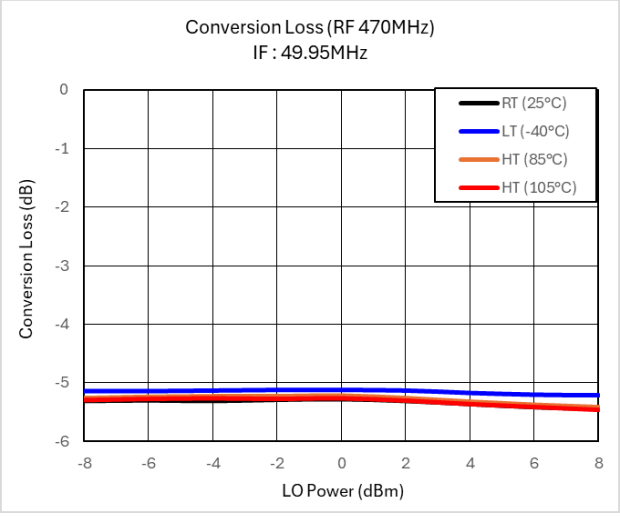
Performance Plots

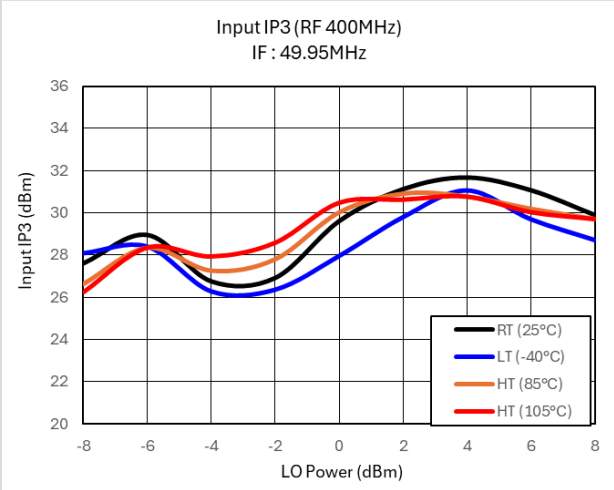
RF Frequency : 400MHz, 470MHz
Bais Conditions : V_{DD} = +3.3V, Z_O = 50Ω
RF : 0dBm, LSB

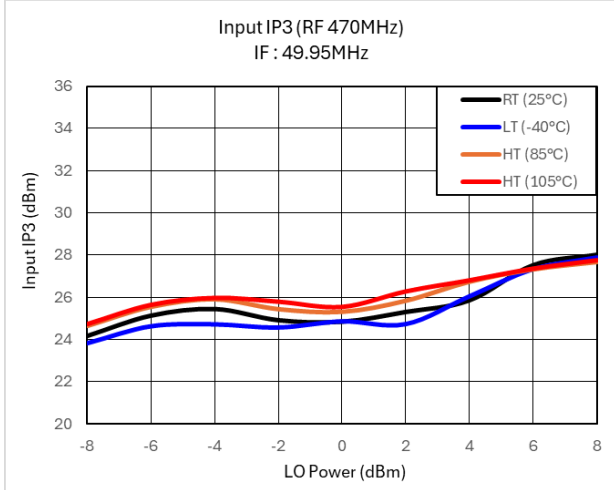


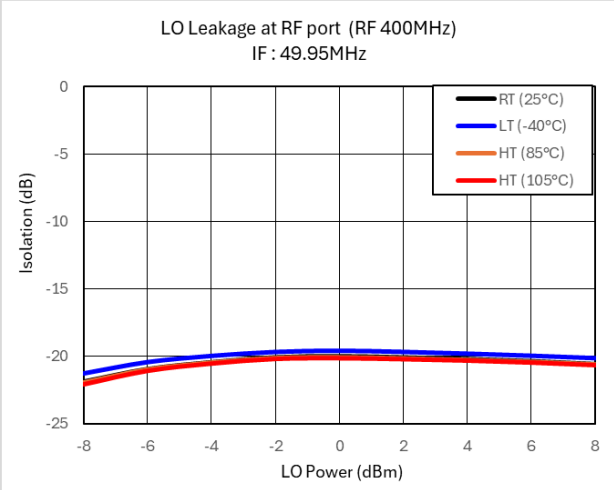
Code (Unit)	C1 (pF)	C2 (pF)	C3 (pF)	C4 (uF)	C5 (pF)	C6 (pF)	C7 (pF)	L1 (nH)	L2 (nH)	L3 (nH)	L4 (nH)	R1 (Ω)
Value	7	15	100	10	7	NC	NC	18	15	82	18	100

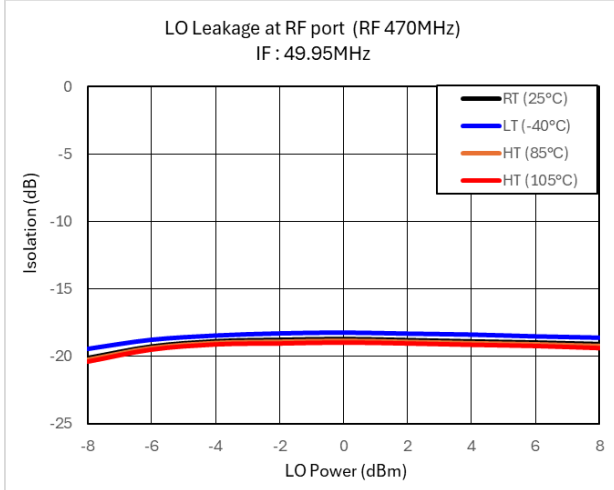


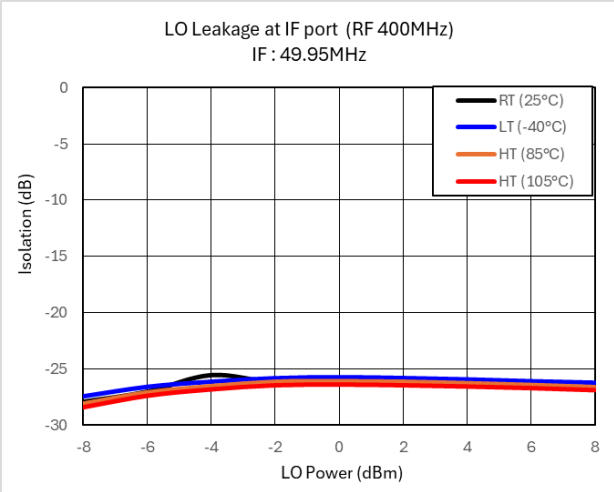


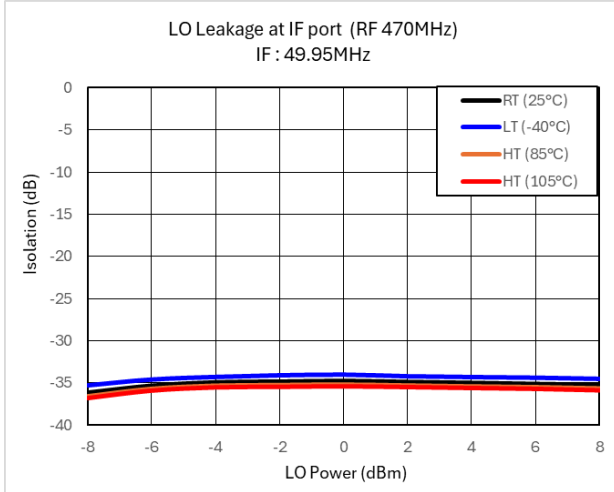

Input IP3 (RF 400MHz)
IF : 49.95MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)


Input IP3 (RF 470MHz)
IF : 49.95MHz
Input IP3 (dBm)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)


LO Leakage at RF port (RF 400MHz)
IF : 49.95MHz
Isolation (dB)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)


LO Leakage at RF port (RF 470MHz)
IF : 49.95MHz
Isolation (dB)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)


LO Leakage at IF port (RF 400MHz)
IF : 49.95MHz
Isolation (dB)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)


LO Leakage at IF port (RF 470MHz)
IF : 49.95MHz
Isolation (dB)
LO Power (dBm)
RT (25°C)
LT (-40°C)
HT (85°C)
HT (105°C)

Application Information : Review of additional bands.

The YCM210 can be used for broadband. The following shows how an EVB tuned in a specific frequency band behaves in a different band.

Tested under 850MHz application Circuit applied EVB (See the Page 5.)

RF (MHz)	680	680	680	850	850	1020	1020	1020
IF (MHz)	30	140	400	70	140	30	140	400
CL (dB)	8.1	8.4	15.3	6.1	6.7	7.0	7.1	7.8
LO-to-IF (dB)	17.8	17.2	31.7	24.7	20.8	26.9	29.1	18.3
RF-to-IF (dB)	7.5	6.4	7.4	16.7	16.4	11.7	11.3	10.9
LO-to-RF (dB)	19.3	22.8	43.9	17.3	20.1	15.7	15.3	19.9
IIP3 (dBm)	27.1	27.4	13.5	25.5	26.3	24.6	24.2	21.0

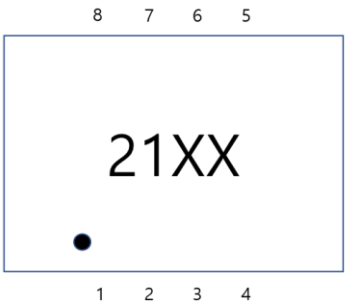
Tested under 2100MHz application Circuit applied EVB (See the Page 9.)

RF (MHz)	1680	1680	1680	2100	2100	2520	2520	2520
IF (MHz)	30	140	400	70	140	30	140	400
CL (dB)	6.7	6.5	7.3	7.2	7.5	18.0	16.3	12.8
LO-to-IF (dB)	15.7	17.1	16.1	16.6	15.1	13.2	12.1	14.0
RF-to-IF (dB)	8.9	7.6	7.3	10.5	9.8	9.2	7.3	5.7
LO-to-RF (dB)	10.1	11.5	12.8	8.2	14.6	17.6	17.0	12.0
IIP3 (dBm)	19.0	21.5	20.7	22.6	25.2	6.4	10.4	20.2

Tested under 3500MHz application Circuit applied EVB (See the Page 13.)

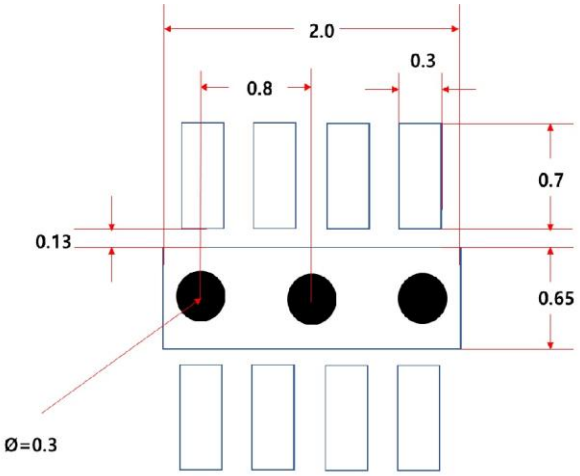
RF (MHz)	2800	2800	2800	3500	3500	4200	4200	4200
IF (MHz)	30	140	400	70	140	30	140	400
CL (dB)	7.9	9.2	22.0	5.6	6.0	7.8	6.5	6.9
LO-to-IF (dB)	19.4	17.0	13.8	33.5	36.6	21.5	21.7	27.1
RF-to-IF (dB)	20.9	21.0	28.1	29.3	29.3	21.6	20.8	21.3
LO-to-RF (dB)	13.5	15.5	15.8	5.5	4.8	5.0	4.8	4.8
IIP3 (dBm)	10.2	10.8	2.1	19.7	20.3	16.5	21.0	22.3

Package Marking

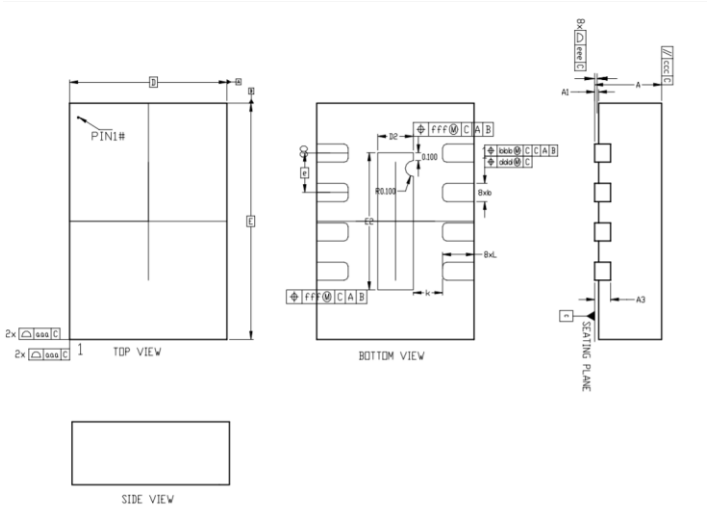


21 : Part Number (YCM210)
XX : Wafer No.

Package Marking



Package Outline Drawing



DFN 3X2 mm 8L			
Symbol	Min.	Typ.	Max.
A	0.7	0.75	0.8
A1	0	0.02	0.05
A3		0.20 REF	
b	0.18	0.23	0.28
D		2.00 BSC	
E		3.00 BSC	
D2	0.35	0.45	0.55
E2	1.64	1.74	1.84
e		0.50 BSC	
L	0.35	0.4	0.45
K	0.2		
aaa		0.15	
bbb		0.1	
ccc		0.1	
ddd		0.05	
eee		0.08	
fff		0.1	
Dimensions are in millimeters			