BSW6620

Ultra High Isolation SPDT RF Switch

5MHz–9000MHz

Product Description

The BSW6620 is an absorptive SPDT 50Ω matched RF switch supporting bandwidth up to 9GHz. It's high linearity performance across the temperature range makes it ideally suitable for use in 3G/4G/5G/6G wireless infrastructure and 802.11 a/n/ac/ax applications where high isolation and excellent performance is required.
The BSW6620 is designed with robust ESD protection circuits at all pins and packaged in an industry standard, fully RoHS2-compliant, 16Lead, 4mm x 4mm x 0.9mm QFN package.
The BSW6620 does not require blocking capacitors. If DC is presented at the RF port, add a blocking capacitor.
A functional block diagram is shown in Figure 1.

Block Diagram

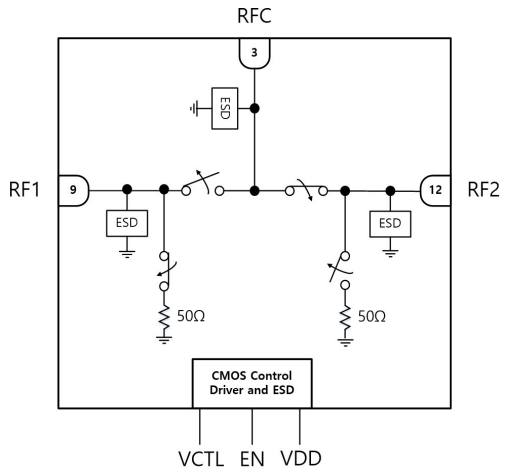


Figure 1. Functional Block Diagram

Applications

- Wireless 3G/4G/5G/6G Infrastructure
- Base station & Repeater
- WLAN 802.11 a/b/ac/ax

Package Type

4mm x 4mm x 0.9mm, 16-Lead QFN Package

Figure 2. Package type

Device Features

- Supply Voltage : 2.7V to 5.5V
- Low Insertion Loss
  : 0.70dB @ 2GHz
  : 0.80dB @ 4GHz
  : 0.76dB @ 6GHz
  : 0.72dB @ 7.2GHz
- Ultra High Isolation
  - RFC to RFx
    : 69dB @ 2GHz
    : 58dB @ 4GHz
    : 53dB @ 6GHz
    : 48dB @ 7.2GHz
  - RFx to RFx
    : 57dB @ 2GHz
    : 51dB @ 4GHz
    : 45dB @ 6GHz
    : 42dB @ 7.2GHz
- Switching time : 120 to 240ns
- ESD, HBM : ±2.0kV @All pins
- Operating temperature range : -40°C to +125°C

Electrical Specifications

Typical conditions are at VDD = 5V, T_A = +25°C, VCTL/EN Low = 0V, VCTL/EN High = 3.3V, Z_L = 50Ω, excluding SMA Connector and PCB losses(1), unless otherwise noted.

Table 1. Electrical Specifications

Parameter	Path	Condition	Min	Typ	Max	Unit
Operating Frequency			5		9000	MHz
Insertion Loss	RFC - RFx	1GHz 2GHz 3GHz 4GHz 5GHz 6GHz 7GHz 8GHz 9GHz		0.61 0.70 0.94 0.80 0.78 0.76 0.70 0.95 2.32		dB
Isolation (C to X)	RFC - RFx	1GHz 2GHz 3GHz 4GHz 5GHz 6GHz 7GHz 8GHz 9GHz		77 69 63 58 55 53 49 44 43		dB
Isolation (X to X)	RFx - RFx	1GHz 2GHz 3GHz 4GHz 5GHz 6GHz 7GHz 8GHz 9GHz		63 57 53 51 47 45 43 40 38		dB
Return Loss (Active Port)	RFC / RF1 / RF2	5MHz—2GHz 2GHz—5GHz 5GHz—8GHz 8GHz—9GHz		23 / 21 / 21 15 / 15 / 15 20 / 20 / 20 8 / 8 / 8		dB
Return Loss (Terminated Port)	RF1 / RF2	5MHz—2GHz 2GHz—5GHz 5GHz—8GHz 8GHz—9GHz		15 / 15 15 / 17 12 / 15 12 / 12		dB

(1) Excluding SMA Connector and PCB loss.
1GHz (0.11dB), 2GHz (0.23dB), 3GHz (0.24dB), 4GHz (0.37dB), 5GHz (0.37dB), 6GHz (0.53dB), 7GHz (0.79dB), 8GHz (0.63dB), 9GHz (0.70dB)

Electrical Specifications

Typical conditions are at VDD = 5V, T_A = +25°C, VCTL/EN Low = 0V, VCTL/EN High = 3.3V, Z_L = 50Ω, excluding SMA Connector and PCB losses(1), unless otherwise noted.

Parameter		Path	Condition	Min	Typ	Max	Unit
Operating Frequency				5		9000	MHz
Input P1dB		RFC - RFx	2.35GHz 3.5GHz 4.9GHz		36.5 35.7 35.8		dBm
Input IP2(2)		RFC - RFx	2.35GHz 3.5GHz 4.9GHz		112 107 102		dBm
Input IP3(2)		RFC - RFx	2.35GHz 3.5GHz 4.9GHz		66 68 65		dBm
2nd Harmonics(3)		RFC - RFx	2.35GHz 3.5GHz 4.9GHz		100 95 92		dBc
3rd Harmonics(3)		RFC - RFx	2.35GHz 3.5GHz 4.9GHz		101 105 96		dBc
Switching Characteristics	Rising Time Falling Time	RFC - RFx	10% RF to 90% RF 90% RF to 10% RF		50 50		ns
	On Time Off Time	RFC - RFx	50% CTRL to 90% RF 50% CTRL to 10% RF		240 120		ns
	Settling Time	RFC - RFx	50% CTRL to 0.05dB final value Rising Edge 50% CTRL to 0.05dB final value Falling Edge		320 150		ns
Maximum Spurious Level		RFC - RFx	5MHz—9GHz(4)		<-145		dBm/10Hz

(2) The each-tone Power is 18dBm and Tone spacing is 20kHz.

(3) Tone Power is 18dBm.

(4) No spurious signals were detected in all Frequency range.

Product Description

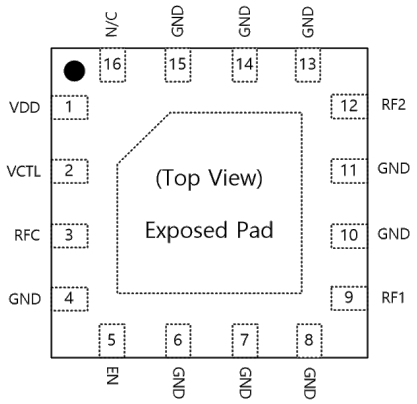


Figure 3. Pin Description (Top View)

Table 2. Pin Descriptions

Pin No.	Pin Name	Description
1	VDD	Supply Voltage.
2	VCTL	Switch Control Input. (Referring to Table 3)
3	RFC	RFC Port.
4, 6, 7, 8, 10, 11, 13, 14, 15	GND	Ground.
5	EN	Switch Control Input. (Referring to Table 3)
9	RF1	RF1 Port.
12	RF2	RF2 Port.
16	N/C	Internal connection to Ground, External connection to PCB Ground Recommended to maximize isolation.
Pad	Exposed Pad	Ground.

Table 3. Control Truth Table

VCTL	EN	RFC-RF1	RFC-RF2
1	0	ON	OFF
0	0	OFF	ON
0	1	OFF	OFF
1	1	OFF	OFF

Table 4. Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Supply Voltage	VDD	2.7		5.5	V
Supply Current	IDD	-	210	-	μA
Digital Input Control (VCTL/EN)	VL_{High}	1.0	-	3.3	V
	VL_{Low}	0	-	0.7	V
Operating Temperature Range	T_O	-40	+25	+125	°C
RF Input Power	P_{OP}	-	-	See Figure 4	dBm

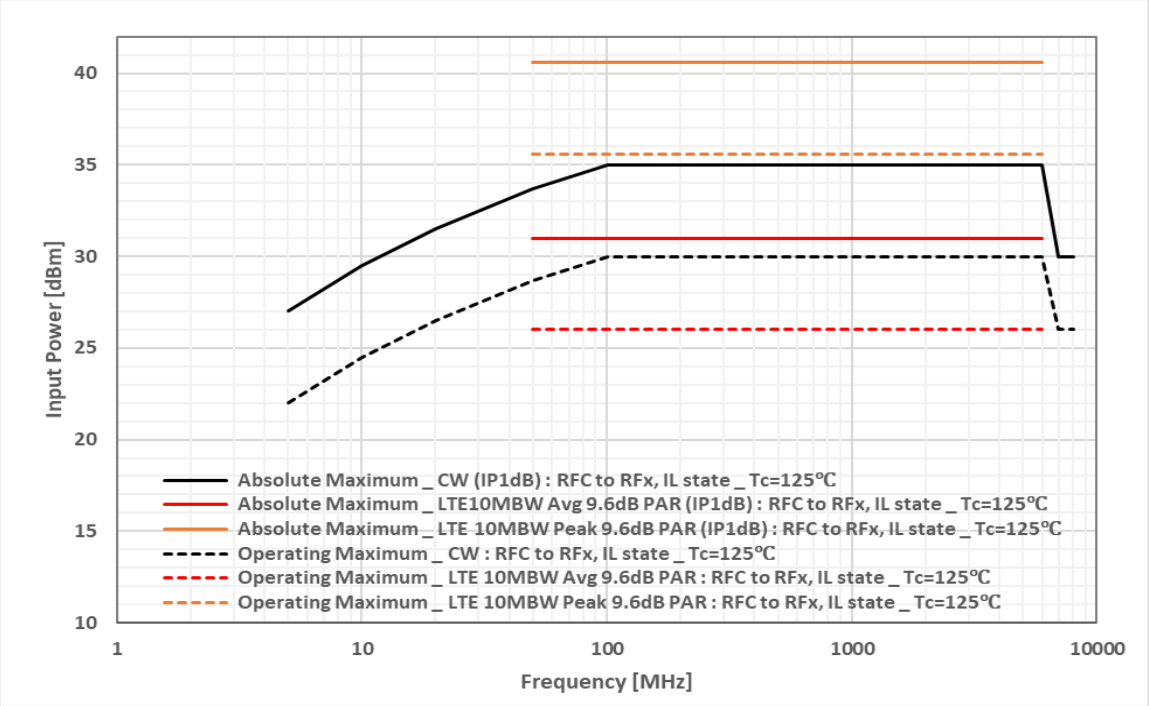
Table 5. Absolute Maximum Ratings

Parameter			Symbol	Min	Max	Unit
Supply Voltage			VDD	-0.3	5.5	V
Digital Input Voltage			VCTL / EN	-0.3	3.6	V
Maximum Input Power			RF_{MAX}	-	See Figure 4	dBm
Storage Temperature Range			T_{ST}	-65	+150	°C
ESD	HBM	ALL pins	V_{ESDHBM}	-	±2000	V
	CDM	ALL pins	V_{ESDCDM}	-	±1000	V

Table 6. Package Thermal Characteristics

Parameter	Symbol	Value	Unit
Junction to Ambient Thermal Resistance	θ_{JA}	43.2	°C/W

Figure 4. Power De-rating Curve



Typical Performances

Typical conditions are at VDD = 5V, T_A = 25°C, VCTL/EN Low = 0V, VCTL/EN High = 3.3V, Z_L = 50Ω, Excluding SMA Connector and PCB losses, unless otherwise noted.

Figure 5. Insertion Loss vs Frequency

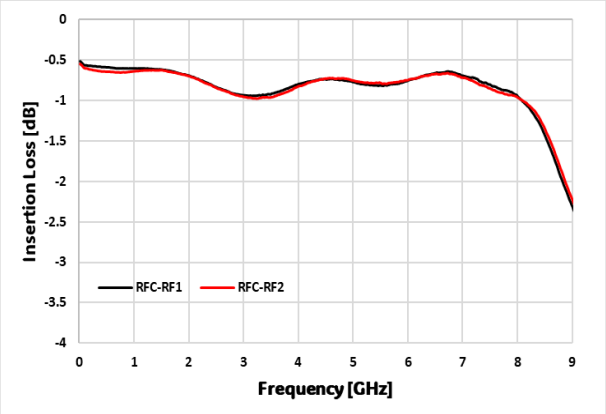


Figure 6. Insertion Loss vs VDD (RFC-RF1)

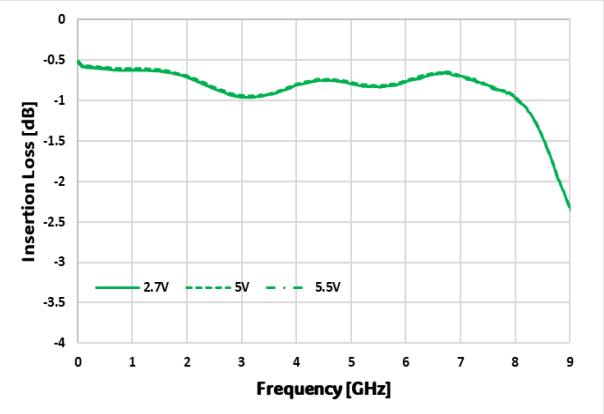


Figure 7. Insertion Loss vs Temp (RFC-RF1)

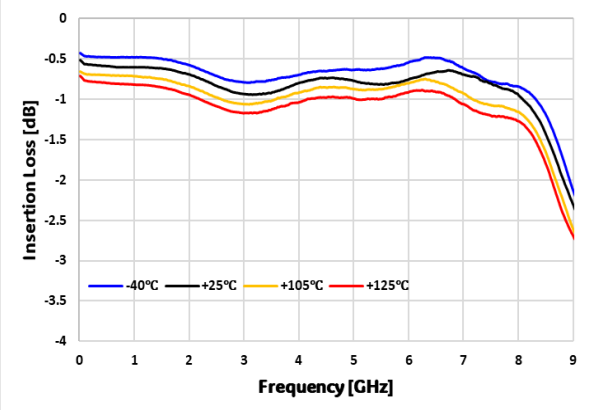


Figure 8. Return Loss vs Frequency (RFC Port)

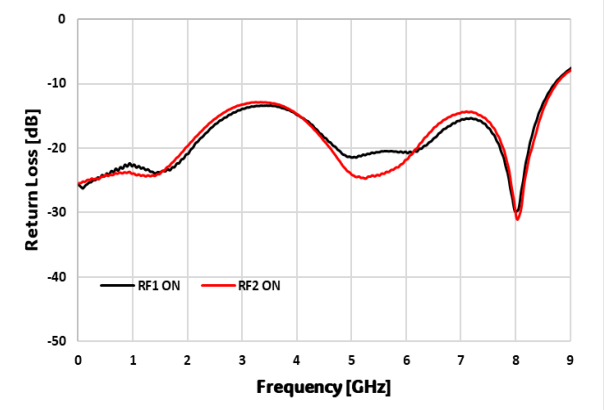


Figure 9. Return Loss vs VDD (RFC Port)

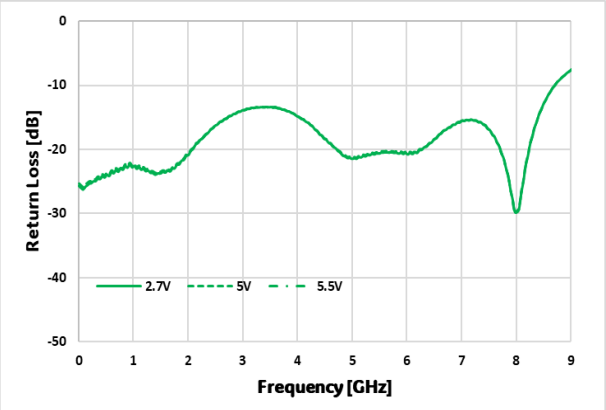
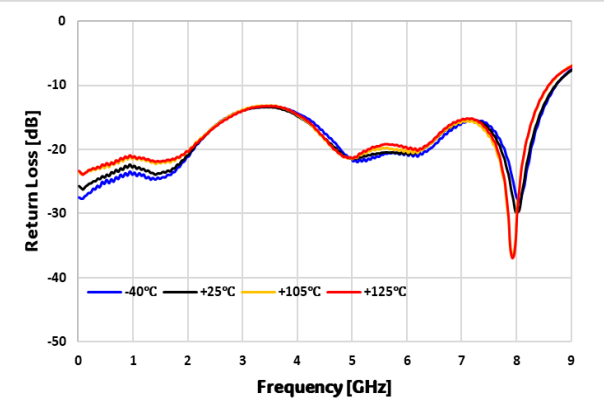


Figure 10. Return Loss vs Temp (RFC Port)



Typical Performances

Typical conditions are at VDD = 5V, T_A = 25°C, VCTL/EN Low = 0V, VCTL/EN High = 3.3V, Z_L = 50Ω, Excluding SMA Connector and PCB losses, unless otherwise noted.

Figure 11. Return Loss vs Frequency (Active Port)

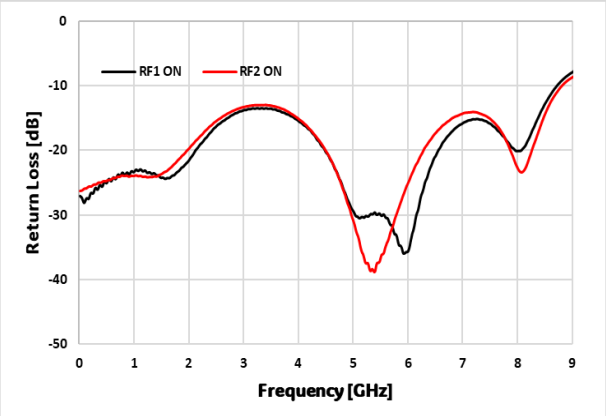


Figure 12. Return Loss vs VDD (Active Port)

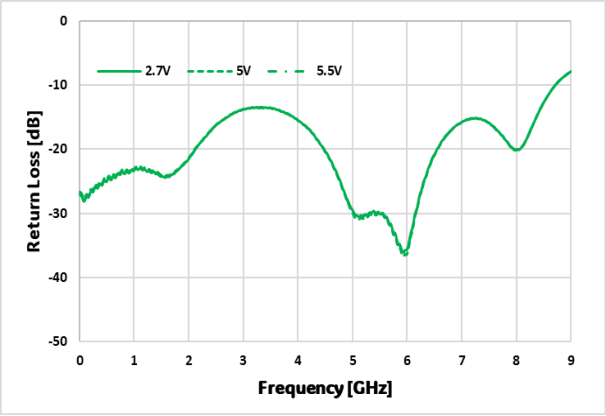


Figure 13. Return Loss vs Temp (Active Port)

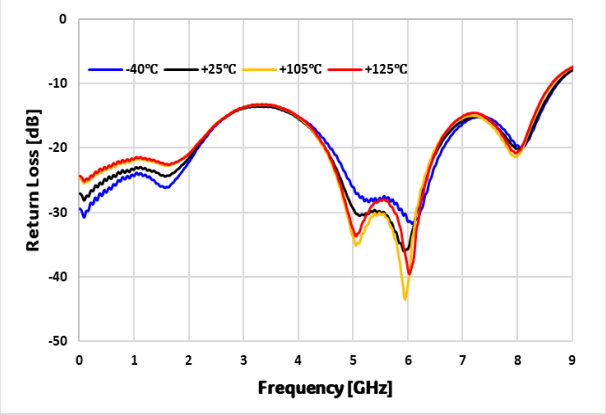


Figure 14. Return Loss vs Frequency (Terminated Port)

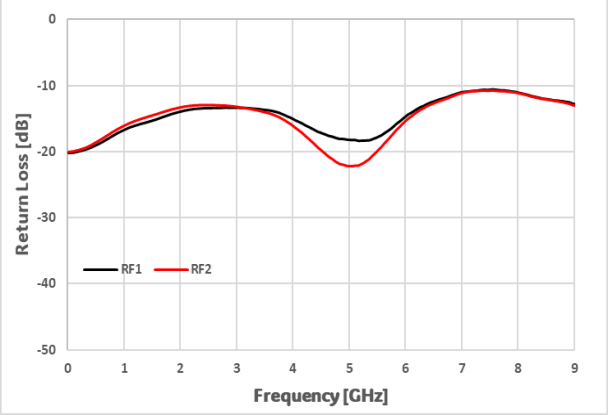


Figure 15. Return Loss vs VDD (Terminated Port)

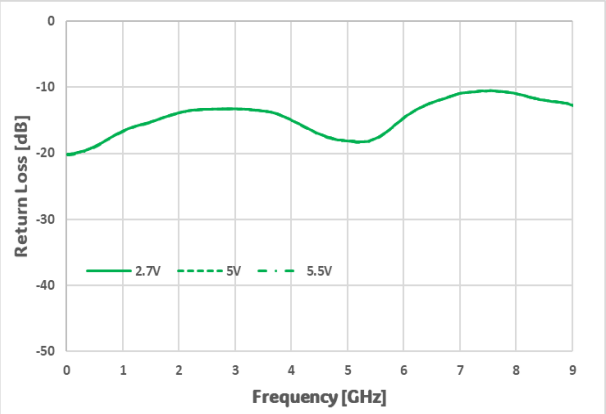
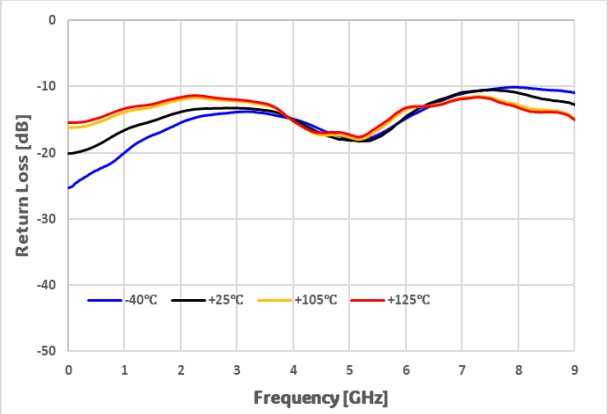


Figure 16. Return Loss vs Temp (Terminated Port)



Typical Performances

Typical conditions are at VDD = 5V, T_A = 25°C, VCTL/EN Low = 0V, VCTL/EN High = 3.3V, Z_L = 50Ω, Excluding SMA Connector and PCB losses, unless otherwise noted.

Figure 17. Isolation vs Frequency (RFC-RFx)

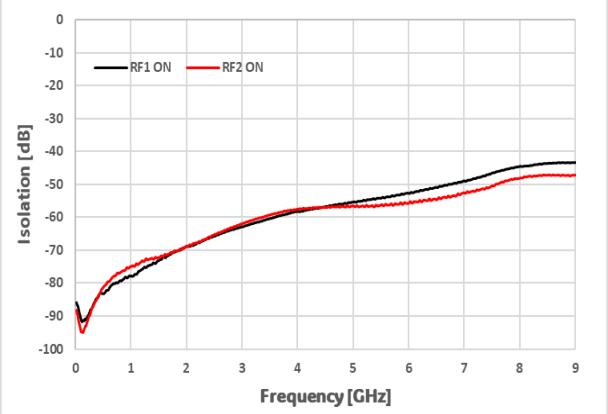


Figure 18. Isolation vs VDD (RFC-RF1, RF2 ON)

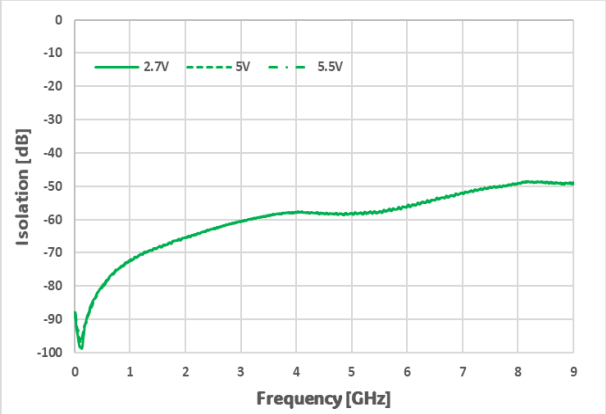


Figure 19. Isolation vs Temp (RFC-RF1, RF2 ON)

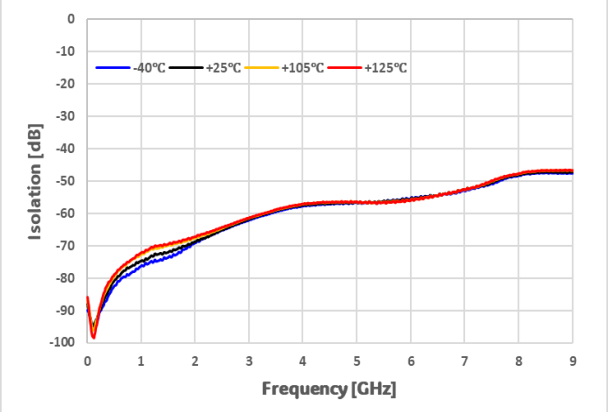


Figure 20. Isolation vs Frequency (RFx-RFx)

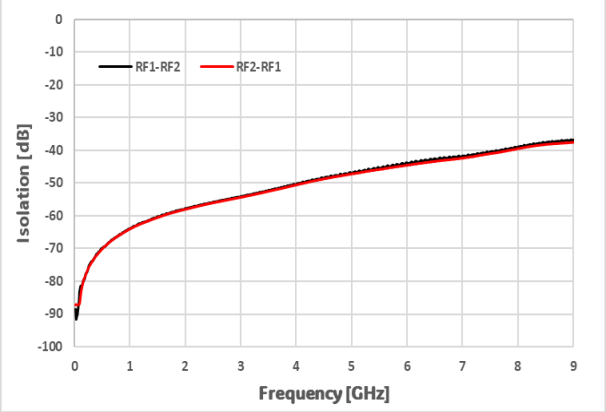


Figure 21. Isolation vs VDD (RF1-RF2)

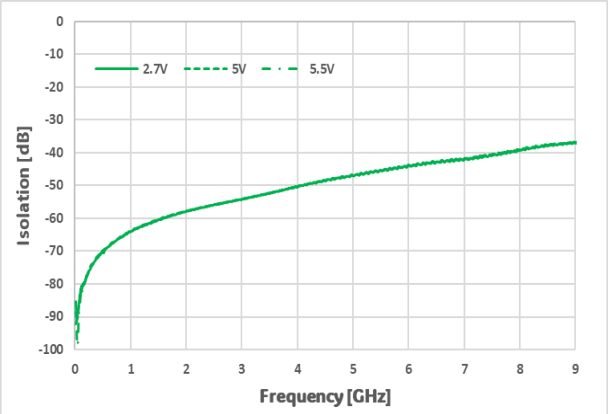
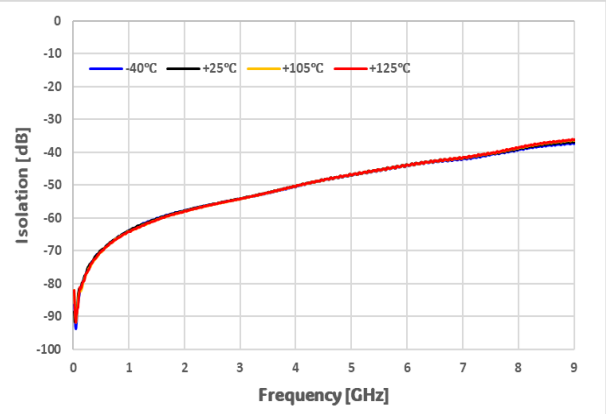


Figure 22. Isolation vs Temp (RF1-RF2)



Typical Performances

Typical conditions are at VDD = 5V, T_A = 25°C, VCTL/EN Low = 0V, VCTL/EN High = 3.3V, Z_L = 50Ω, Excluding SMA Connector and PCB losses, unless otherwise noted.

Figure 23. IIP3 vs Frequency

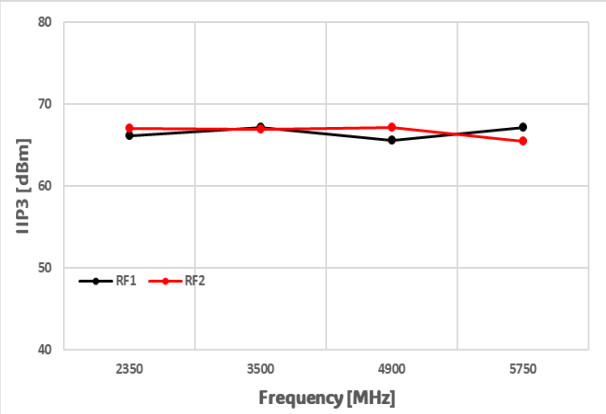
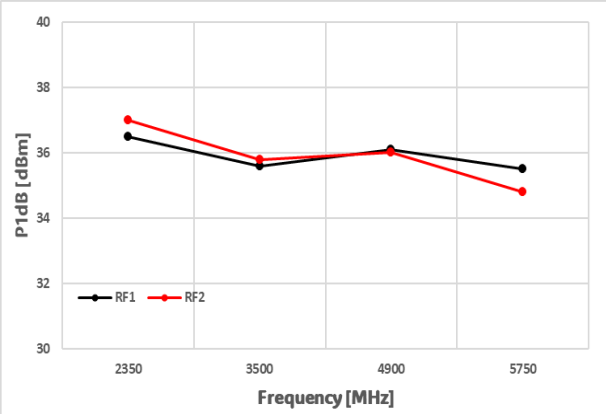
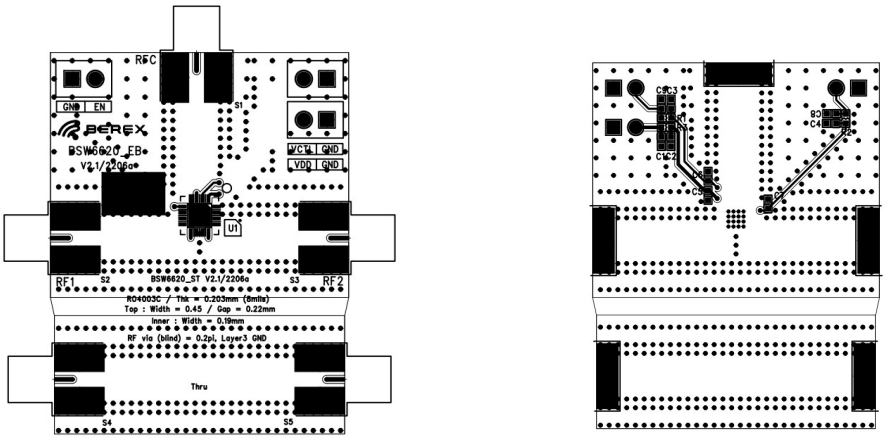


Figure 24. P1dB vs Frequency

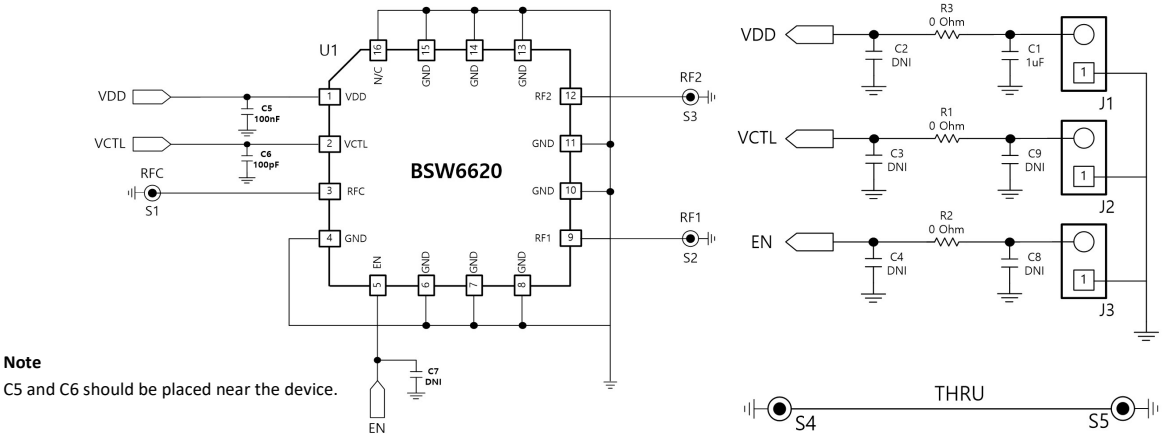


Evaluation Board



[Top View] [Bottom View]

Figure 25. Evaluation Board Layout



Note
C5 and C6 should be placed near the device.

Figure 26. Evaluation Board Schematic

Table 7. Bill of Material - Evaluation Board

No.	Ref Des	Part Qty	Value	Description	Remark
1	C1	1	100nF	CAP 1005 J 50V	
2	C5	1	1uF	CAP 1005 J 50V	
3	C6	1	100pF	CAP 1005 J 50V	
4	C2,C3,C4,C7,C8,C9	6	DNI	CAP 1005	
5	R1,R2,R3	3	0 ohm	RES 1005	
6	J1,J2,J3	3	2.54mm	2 Pin Header	
7	S1,S2,S3,S4,S5	5	CON	SMA_END_LAUNCH	Female
8	U1	1	Chip	BSW6622	

Evaluation Board

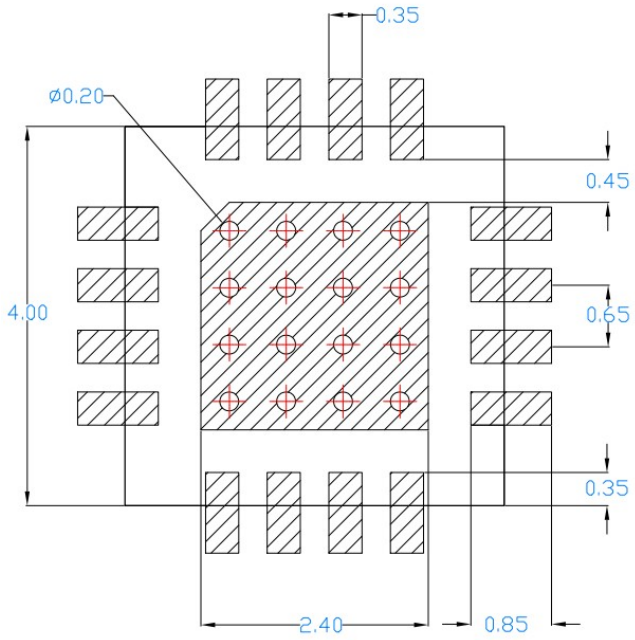


Figure 27. Suggested PCB Land Pattern

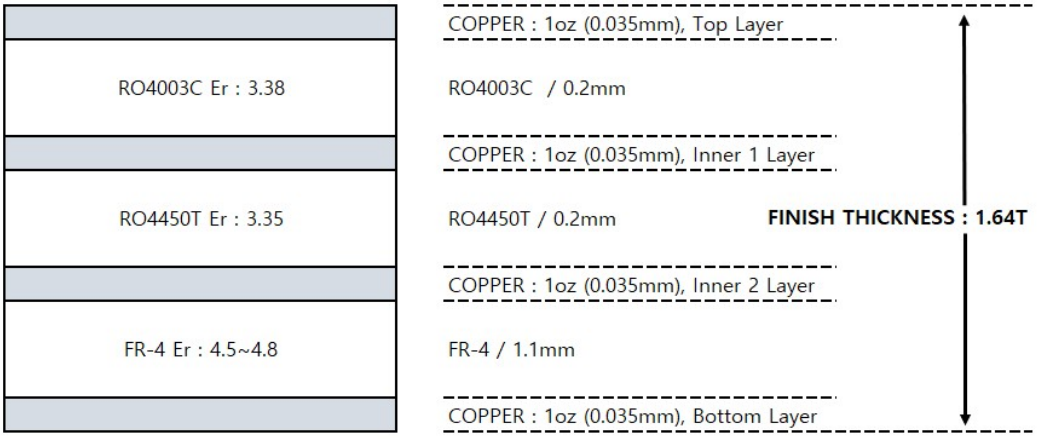
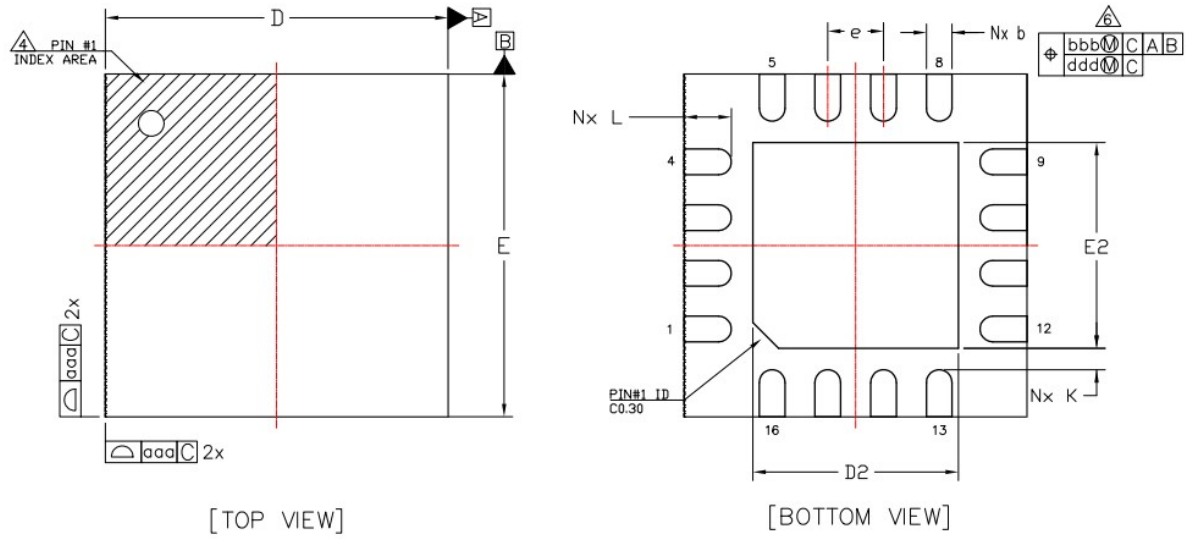
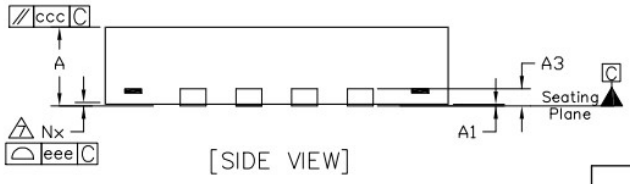


Figure 28. Evaluation Board PCB Layer Information

Package Outline Drawing





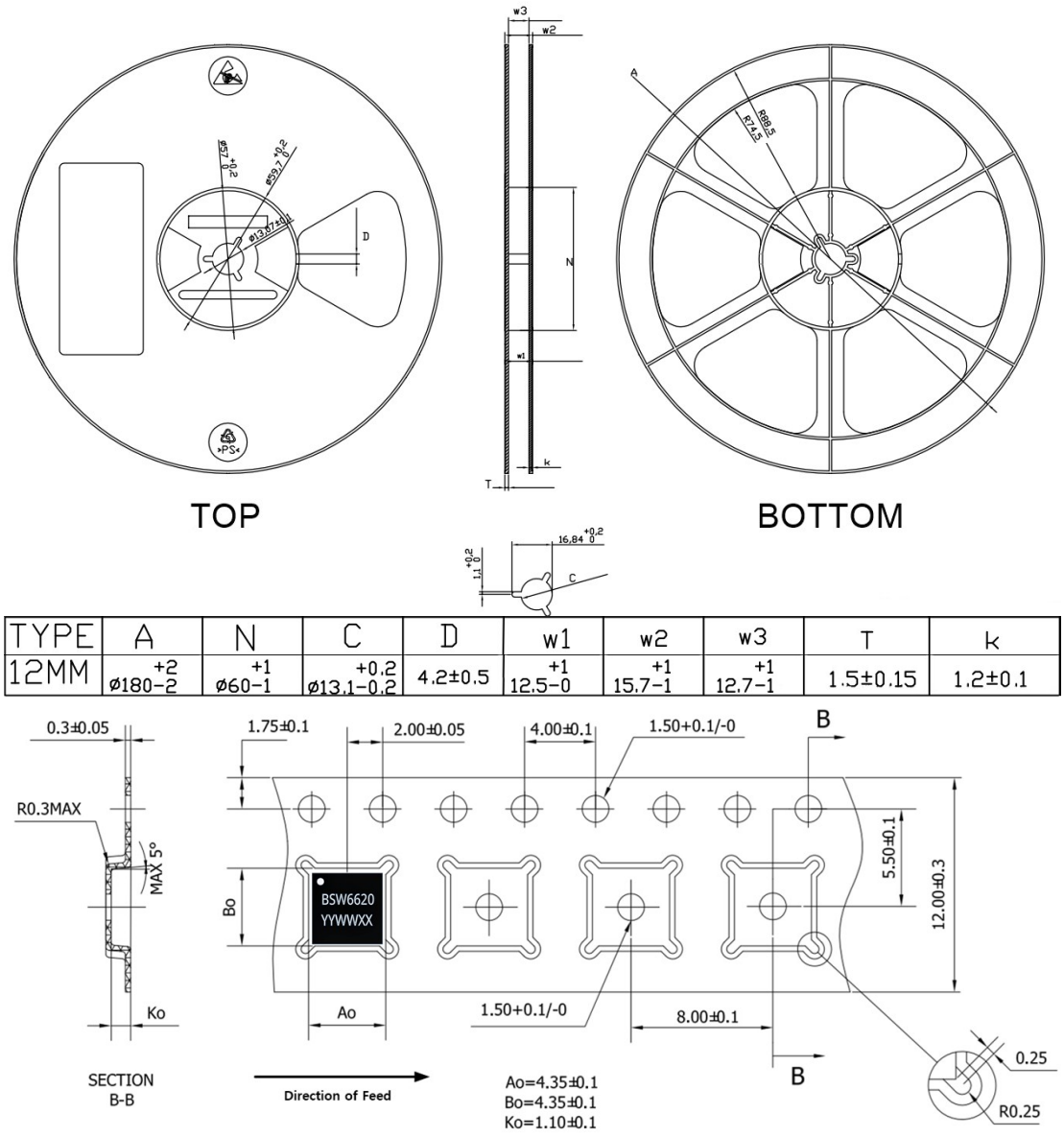
NOTES:

1. Dimensioning and tolerancing conform to ASME Y14.5–2009.
2. All dimensions are in millimeters.
3. N is the total number of terminals.
4. The location of the marked terminal #1 identifier is within the hatched area.
5. ND and NE refer to the number of terminals each D and E side respectively.
6. Dimension b applies to the metallized terminal and is measured between 0.15mm and 0.3mm from the terminal tip. If the terminal has a radius on the other end of it, dimension b should not be measured in that radius area.
7. Coplanarity applies to the terminals and all other bottom surface metallization.

Dimension Table				
Symbol Thickness	Min	Nominal	Max	Note
A	0.80	0.90	1.00	
A1	0.00	0.02	0.05	
A3	---	0.203 Ref.	---	
b	0.25	0.30	0.35	6
D		4.00 BSC		
E		4.00 BSC		
e		0.65 BSC		
D2	2.35	2.40	2.45	
E2	2.35	2.40	2.45	
K	0.20	---	---	
L	0.45	0.55	0.65	
aaa		0.05		
bbb		0.10		
ccc		0.10		
ddd		0.05		
eee		0.08		
N		16		3
ND		4		5
NE		4		5
NOTES		1,2		

Figure 29. Package Outline Dimension

Tape & Reel



TYPE	A	N	C	D	w1	w2	w3	T	k
12MM	+2 ø180−2	+1 ø60−1	+0.2 ø13.1−0.2	4.2±0.5	+1 12.5−0	+1 15.7−1	+1 12.7−1	1.5±0.15	1.2±0.1

NOTES:
1 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ±0.2
2 CAMBER IN COMPLIANCE WITH EIA 481
3 POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET,NOT POCKET HOLE

Packaging information:	
Tape Width	12mm
Reel Size	7inch
Device Cavity Pitch	8mm
Device Per Reel	1000EA

Figure 30. Tape & Reel Information

Package Marking

Marking information:	
BSW6620	Device Name
YY	Year
WW	Work Week
XX	Wafer Run Number

Figure 31. Package Marking

Lead plating finish

100% Tin Matte finish

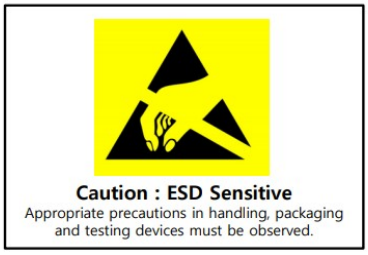
(All BeRex products undergo a 1 hour, 150 ℃, anneal bake to eliminate tin whisker growth concerns.)

ESD / MSL Rating

ESD information1 :	
Rating	Class 2 (±2000V)
Test	Human Body Model (HBM)
Standard	JEDEC Standard JS-001-2017

ESD information2 :	
Rating	Class C3 (±1000V)
Test	Charged Device Model (CDM)
Standard	JEDEC Standard JS-002-2018

MSL information:	
Rating	Level 1 at +260°C convection reflow
Standard	JEDEC Standard J-STD-020



Proper ESD procedures should be followed when handling the device.

RoHS Compliance

This part is compliant with Restrictions on the use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU as amended by Directive 2015/863/EU.

This product also is compliant with a concentration of the Substances of Very High Concern (SVHC) candidate list which are contained in a quantity of less than 0.1%(w/w) in each components of a product and/or its packaging placed on the European Community market by the BeRex and Suppliers.

NATO CAGE code:

2	N	9	6	F