

## AAT2075B2 Data Sheet

75Ω Digital Attenuator 2-Bit 15dB DC~2700 MHz

### 1. Product Overview

#### 1.1 General Description

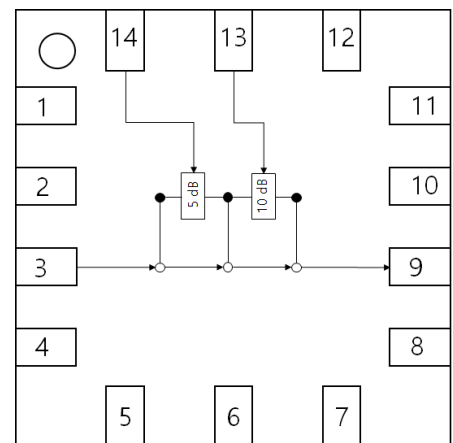
The AAT2075B2 is a GaAs MMIC two bit positive control digital attenuator. The device operates from DC to 2700 MHz with a control and supply voltage of +3 V or +5 V. The AAT2075B2 has LSB of 5 dB and a total attenuation of 15dB. The AAT2075B2 is composed of two cascade fixed attenuators. The states of attenuator are controlled by the logic level voltage. The attenuator bit values are 5 dB (LSB), 10dB for a total attenuation of 15dB. Attenuation accuracy is  $\pm(0.15 \text{ dB} + 3 \% \text{ of attenuation setting})$  @ DC~1200 MHz.

#### 1.2 Features

- 75 Ω Impedance
- Attenuation: 15 dB with 5 dB LSB
- Attenuation Accuracy:  
 $\pm (0.15 \text{ dB} + 3 \%)$  @DC~1200 MHz

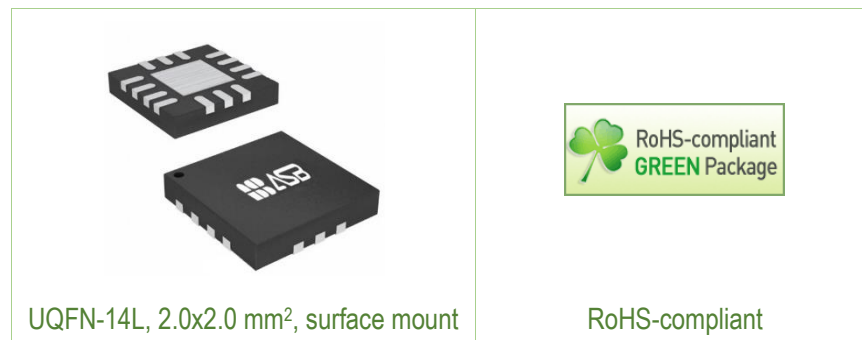
#### 1.3 Applications

- Telecommunication System
- CATV and FTTH



AAT2075B2 Block Diagram (X-ray view)

#### 1.4 Package Profile & RoHS Compliance



## 2. Summary on Product Performances

### 2.1 Electrical Specifications

Supply voltage = +5 V, T<sub>A</sub> = +25 °C, Z<sub>O</sub> = 75 Ω.

Parameter	Test Condition	Min	Typ	Max	Unit
Reference Insertion Loss (IL)	5 MHz		0.3		dB
	50 MHz		0.3		
	500 MHz		0.4		
	1200 MHz	-	0.5	-	
	2000 MHz		0.3		
	2700 MHz		0.9		
Attenuation Accuracy <sup>1)</sup>	DC – 1200 MHz	±(0.15 dB + 3% of attenuation setting)			
	DC – 2700 MHz	±(0.5 dB + 10% of attenuation setting)			
Return Loss	DC – 1200 MHz	15	18	-	dB
	DC – 2700 MHz	14	15		
Switching Characteristics:					
Rise/fall Time	(10% to 90% RF)		300		ns
On/off Time	(50% V <sub>ctrl</sub> to RF)		320		
Input P1dB	50 MHz		27		dBm
	1200 MHz		22		
	2000 MHz	-	20	-	
	2700 MHz		15		
IIP3 <sup>2)</sup>	50 MHz		39		dBm
	1200 MHz		40		
	2000 MHz	-	37	-	
	2700 MHz		34		
IIP2 <sup>2)</sup>	50 MHz		60		dBm
	860 MHz	-	70		
Supply Voltage (Vs)		+3	+5	-	V
Control Voltage	High	Vs-0.5	Vs		V
	Low	0	-	+0.5	
Current			600		uA

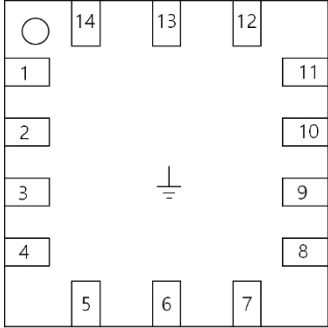
1) Attenuation accuracy are calculated at any bit or combination

2) IIP3 and IIP2 are measured with two tones at an input power of +0 dBm/tone separated by 6 MHz.

### 2.2 Truth Table

State	V1	V2
Insertion loss	Low	Low
5 dB	High	Low
10 dB	Low	High
15 dB	High	High

## 2.3 Pin Configuration

Pin	Description	Simplified Outline
1, 2, 4, 6, 8, 10, 11	No connection	
3	RF1, RF port	
9	RF2, RF port	
5, 7	RF GND	
12	Vs, DC power supply voltage.	
13	V2, DC control voltage. Controls 10 dB attenuation state.	
14	V1, DC control voltage. Controls 5 dB attenuation state.	

Note: Backside metal paddle is DC ground.

## 2.4 Absolute Maximum Ratings

Parameters	Max. Ratings
Operation Case Temperature	-40 to +85 °C
Storage Temperature	-65 to +150 °C
Device Voltage	+7 V
Input RF Power	+27 dBm @ 50 MHz +22 dBm @ 1200 MHz +15 dBm @ 2700 MHz

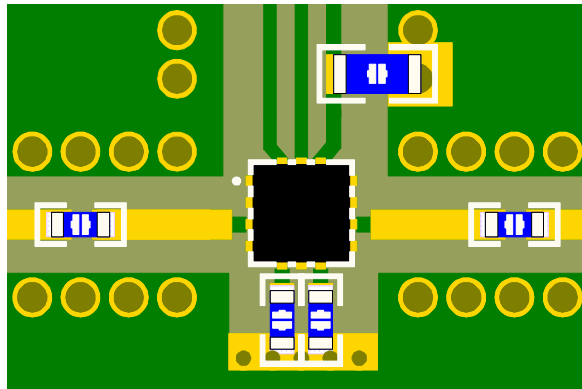
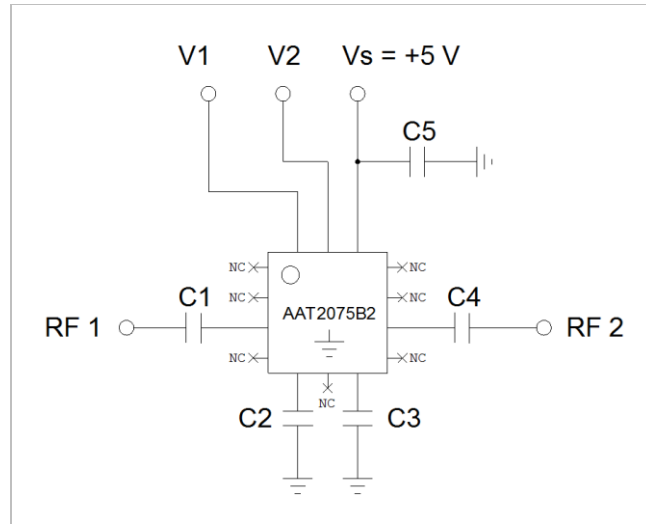
## 2.5 Moisture Sensitivity Level

Level 3 at 260 °C reflow

*(Intentionally Blanked)*

## 3. Application: DC ~ 1200 MHz ( $V_s = +5\text{ V}$ , $75\ \Omega$ )

### 3.1 Application Circuit & Evaluation Board



PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	25x50
EB No.	EB-2x2-QFN14_ATT01

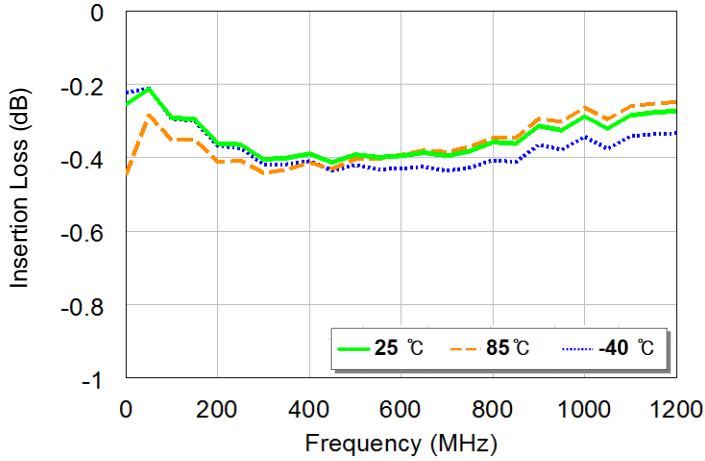
#### Bill of Material

Symbol	Value	Size	Description	Manufacturer
AAT2075B2	-	-	2-Bit digital attenuator	ASB
C1, C4	1 $\mu\text{F}$	0402	DC blocking capacitor	Murata
C2, C3	1 $\mu\text{F}$	0402	Bypass capacitor	Murata
C5	10 $\mu\text{F}$	0805	Decoupling capacitor	Murata

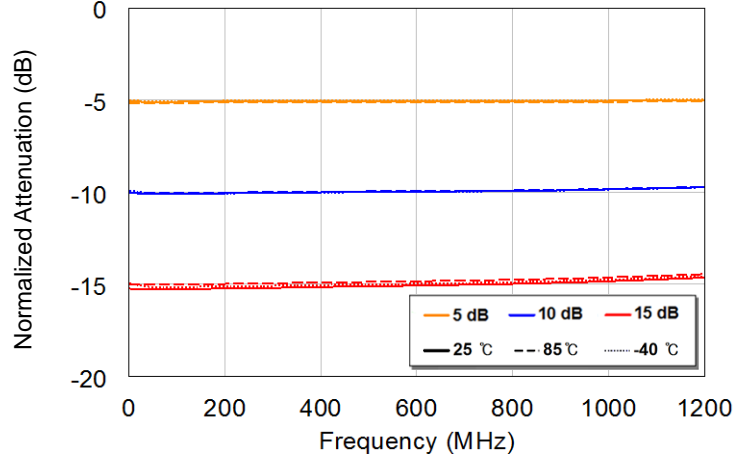
Note: Bypass capacitors (C2 and C3) should be close to the RF GND(pin 5 and pin 7).

## 3.2 Plot of Performances

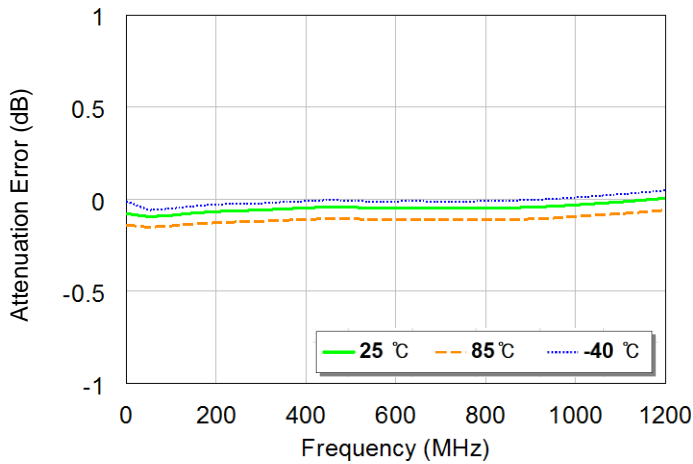
Insertion loss over temp.



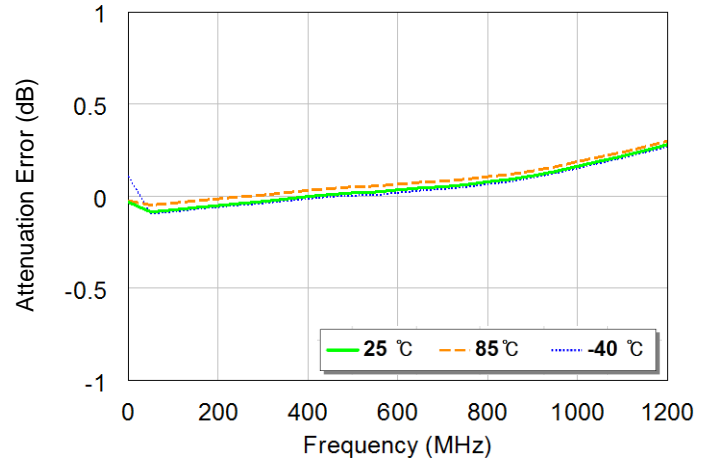
Normalized attenuation all states over temp.



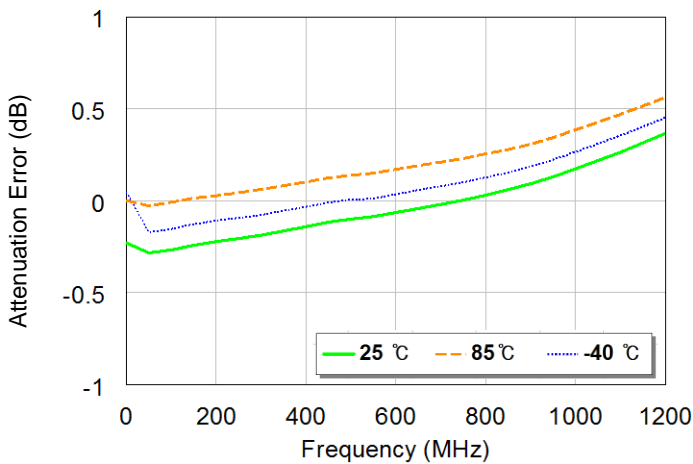
Step error (@5 dB atten.) over temp.



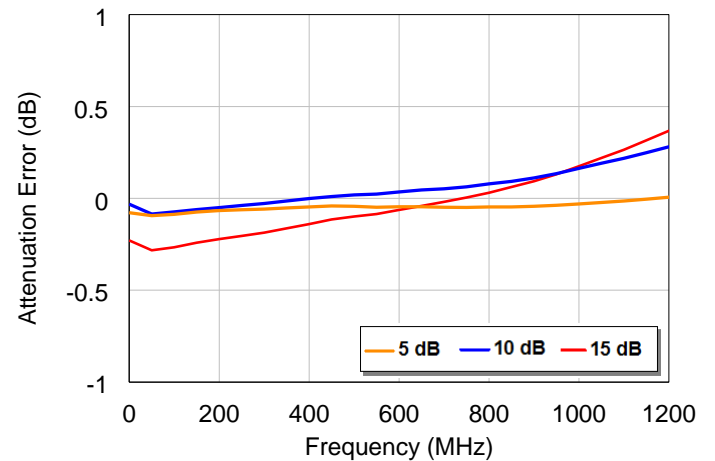
Step error (@10 dB atten.) over temp.



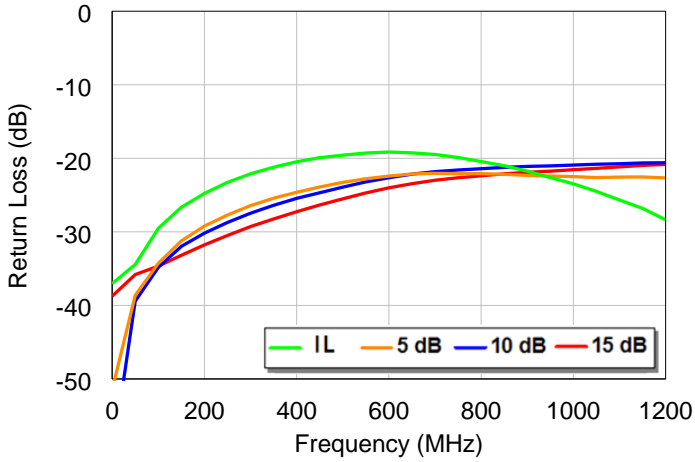
Step error (@15 dB atten.) over temp.



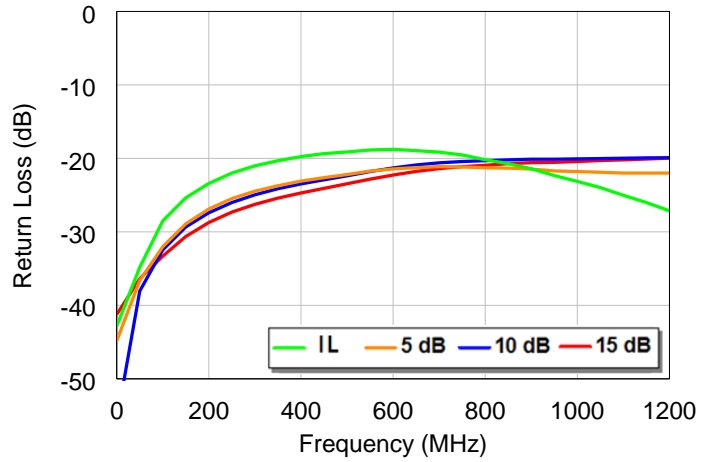
Step error vs. frequency over all states



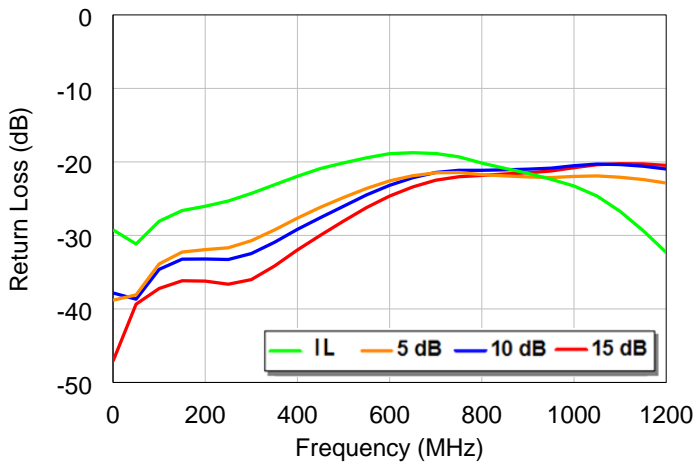
Input return loss over all states (25°C)



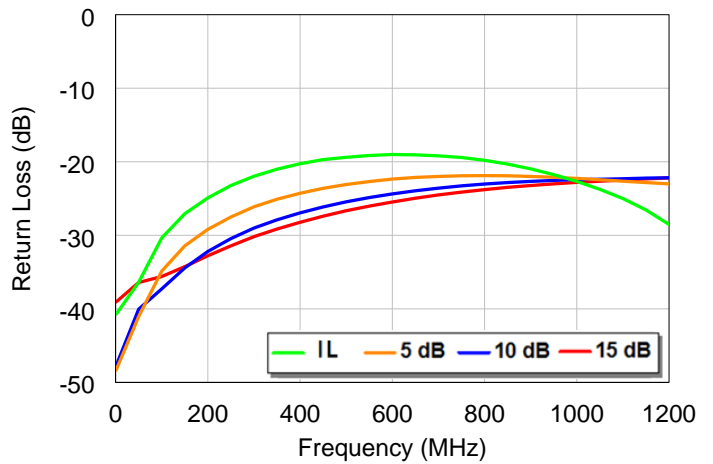
Input return loss over all states (85°C)



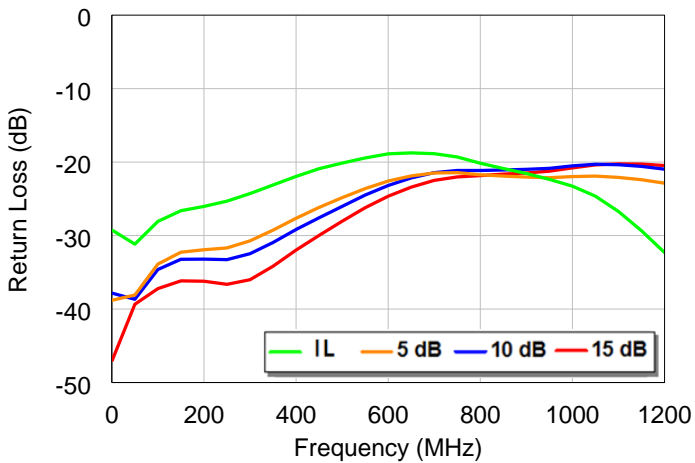
Input return loss over all states (-40°C)



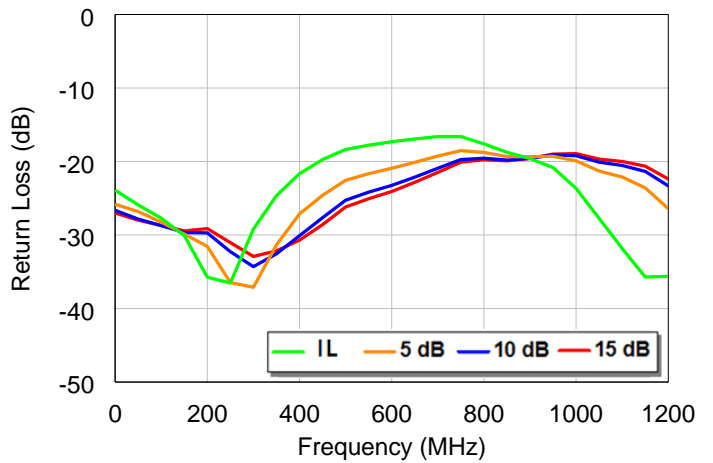
Output return loss over all states (25°C)



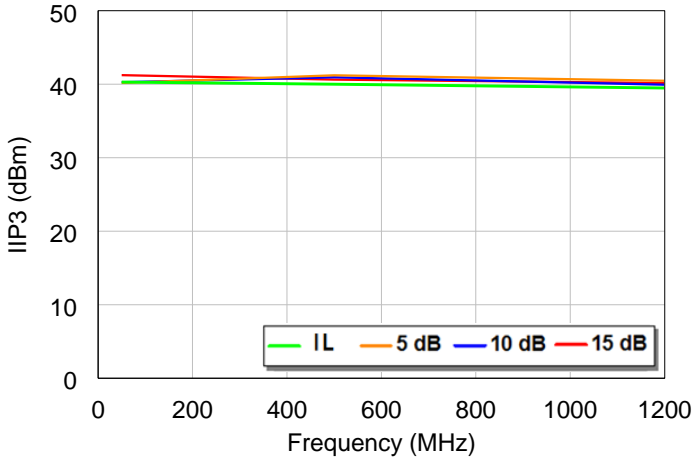
Output return loss over all states (85°C)



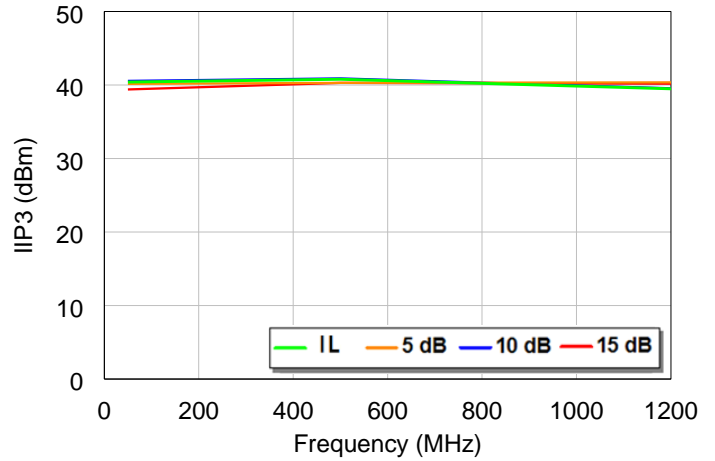
Output return loss over all states (-40°C)



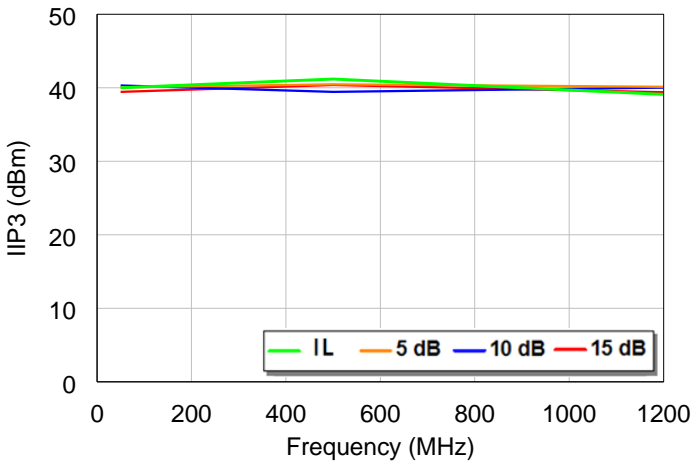
IIP3 vs. Frequency over all states (25°C)



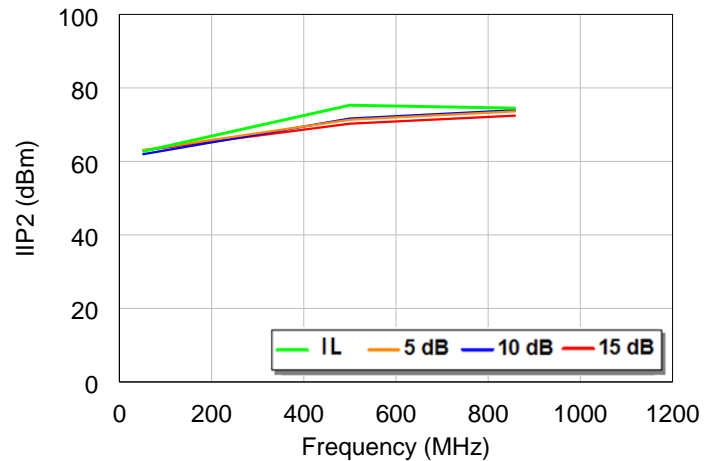
IIP3 vs. Frequency over all states (85°C)



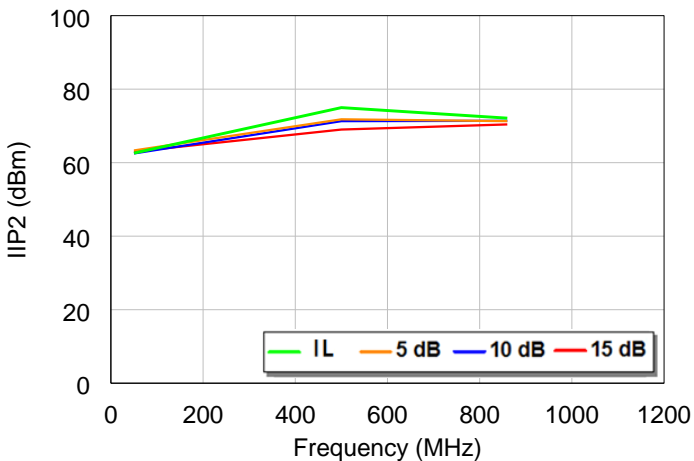
IIP3 vs. Frequency over all states (-40°C)



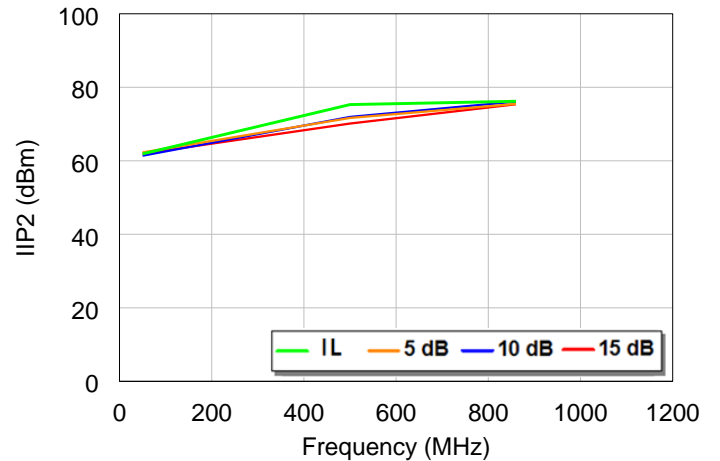
IIP2 vs. Frequency over all states (25°C)



IIP2 vs. Frequency over all states (85°C)

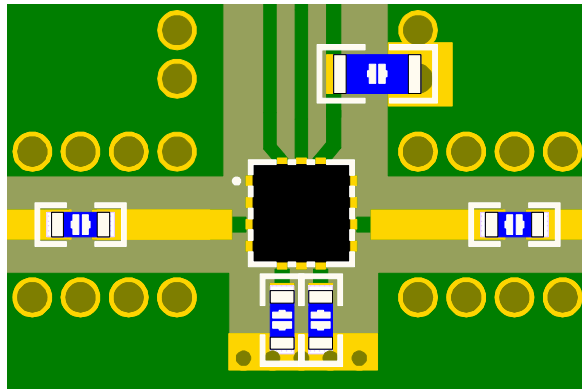
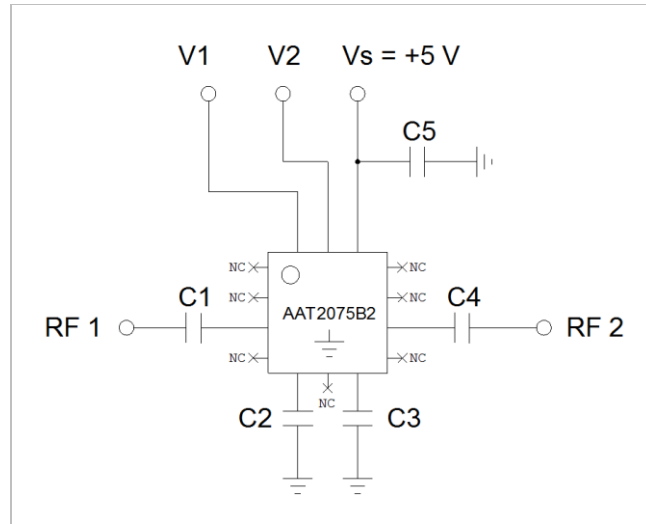


IIP2 vs. Frequency over all states (-40°C)



## 4. Application: DC ~ 2700 MHz ( $V_s = +5\text{ V}$ , $75\ \Omega$ )

### 4.1 Application Circuit & Evaluation Board



PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	25x50
EB No.	EB-2x2-QFN14_ATT01

#### Bill of Material

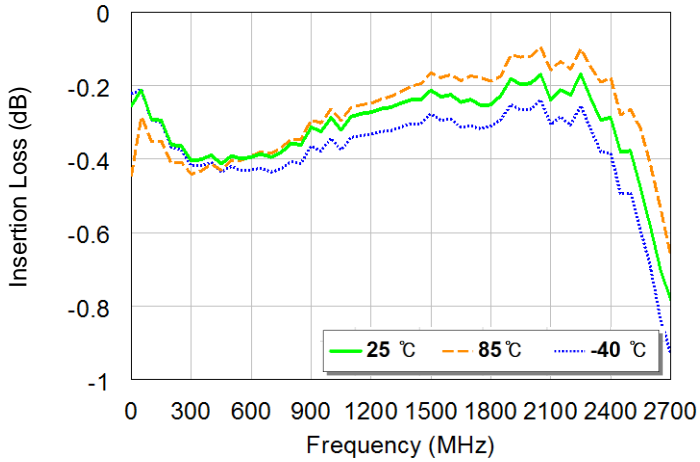
Symbol	Value	Size	Description	Manufacturer
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C5	10 $\mu\text{F}$	0805	Decoupling capacitor	Murata

Note: Bypass capacitors (C2 and C3) should be close to the RF GND(pin 5 and pin 7).

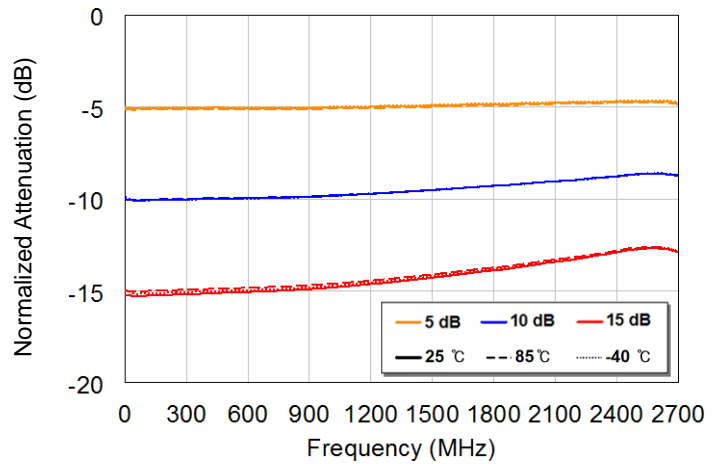


## 4.2 Plot of Performances

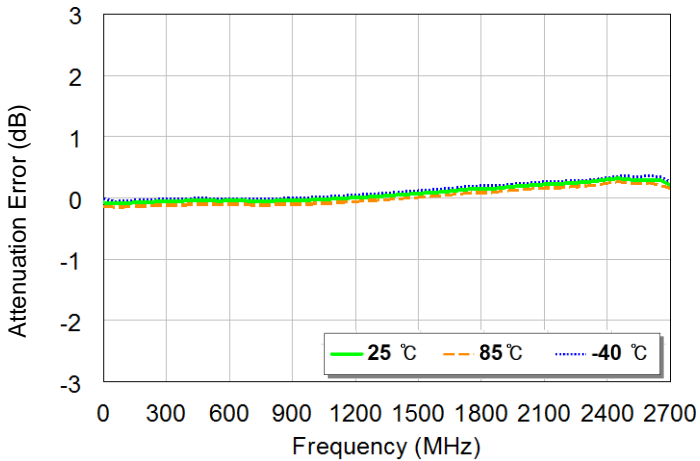
Insertion loss over temp.



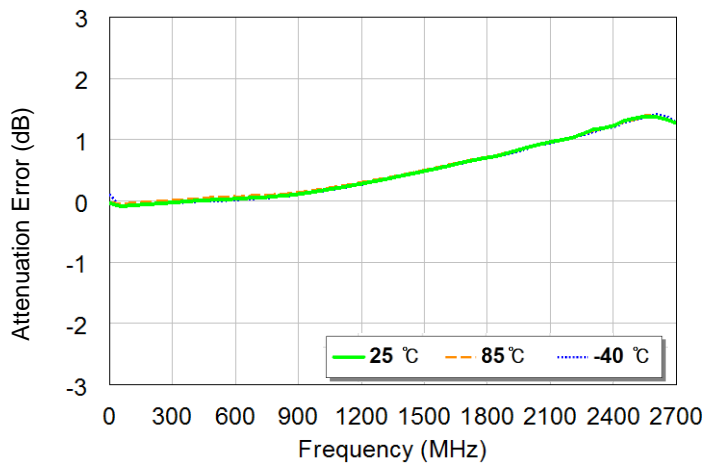
Normalized attenuation all states over temp.



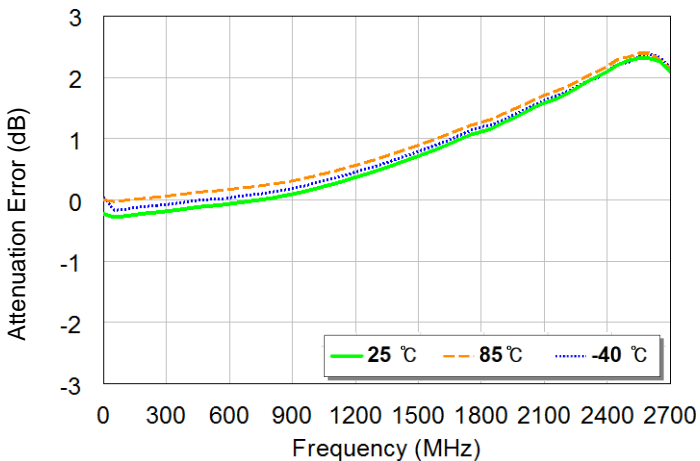
Step error (@5 dB atten.) over temp.



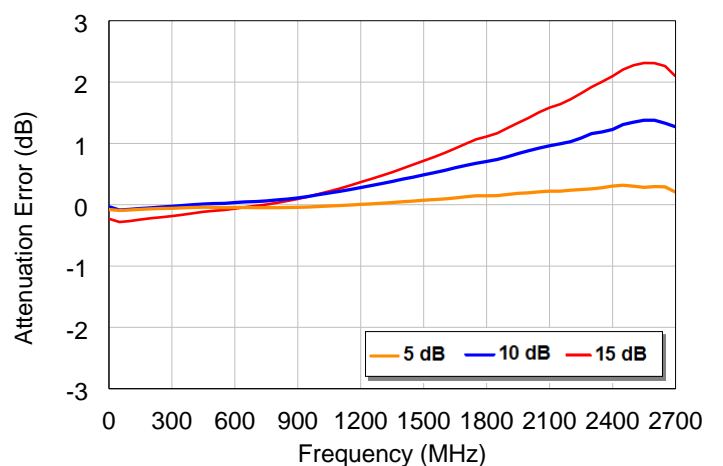
Step error (@10 dB atten.) over temp.



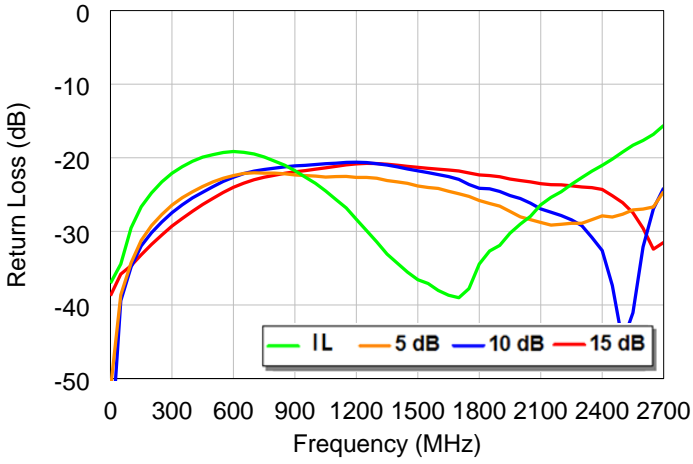
Step error (@15 dB atten.) over temp.



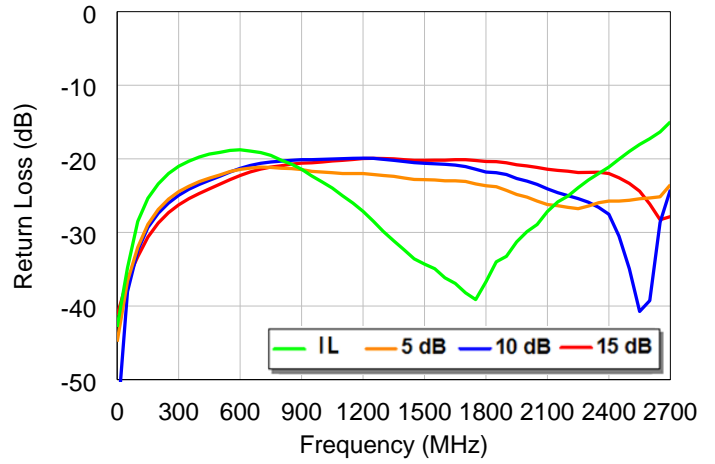
Step error vs. frequency over all states



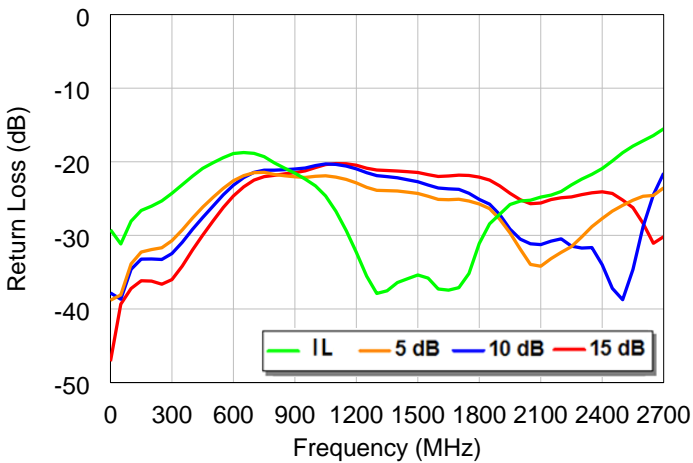
Input return loss over all states (25°C)



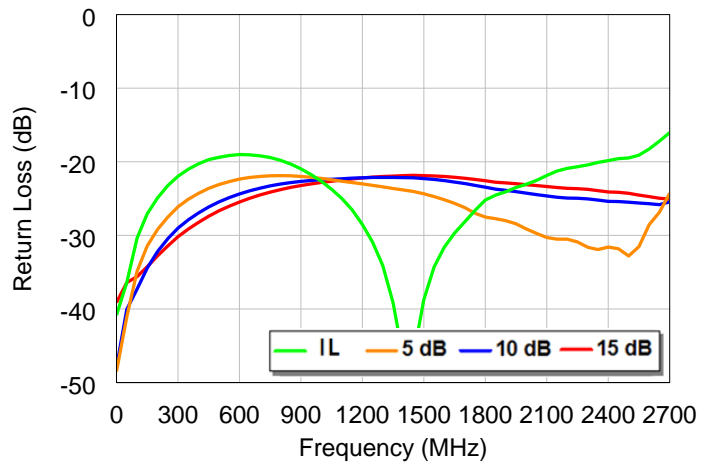
Input return loss over all states (85°C)



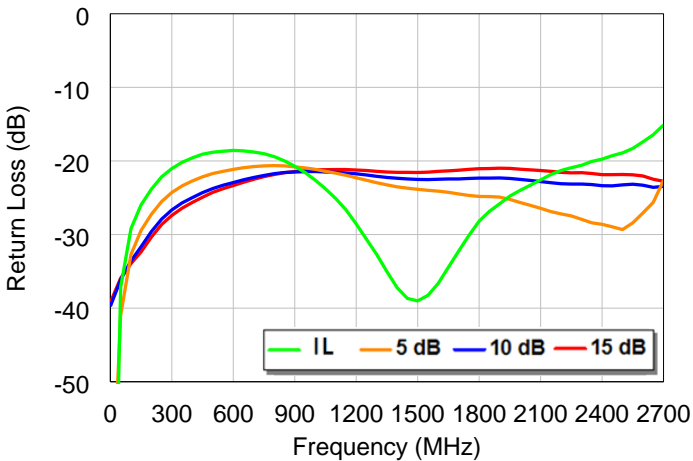
Input return loss over all states (-40°C)



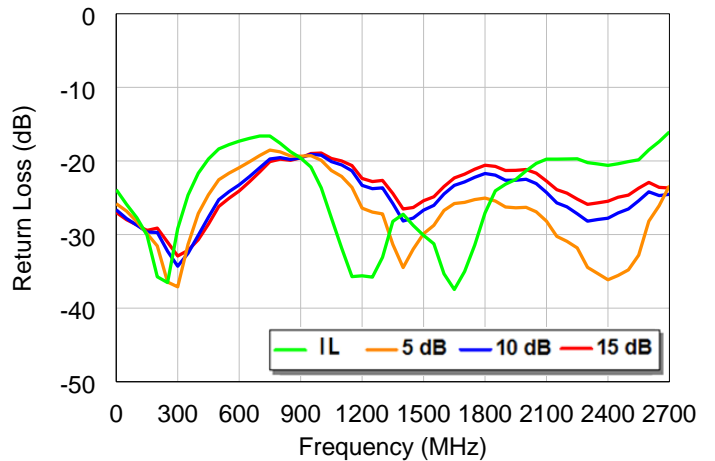
Output return loss over all states (25°C)



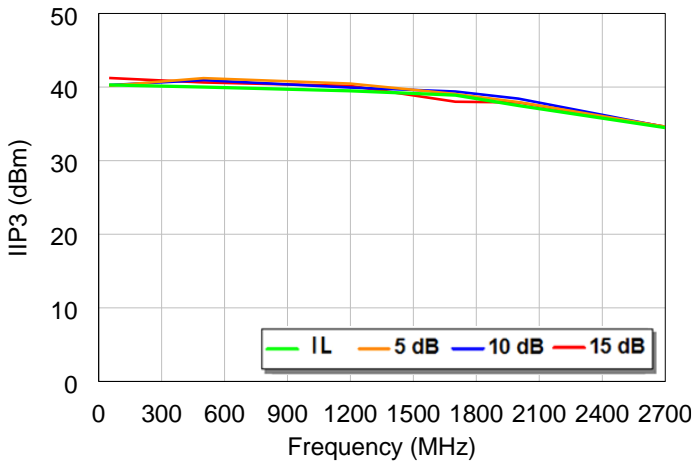
Output return loss over all states (85°C)



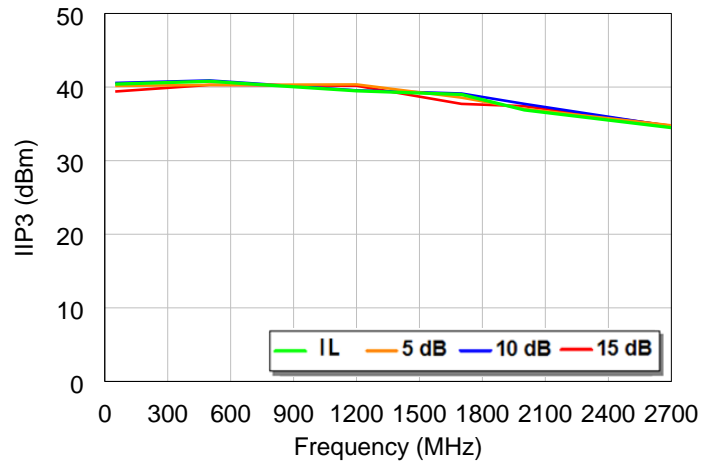
Output return loss over all states (-40°C)



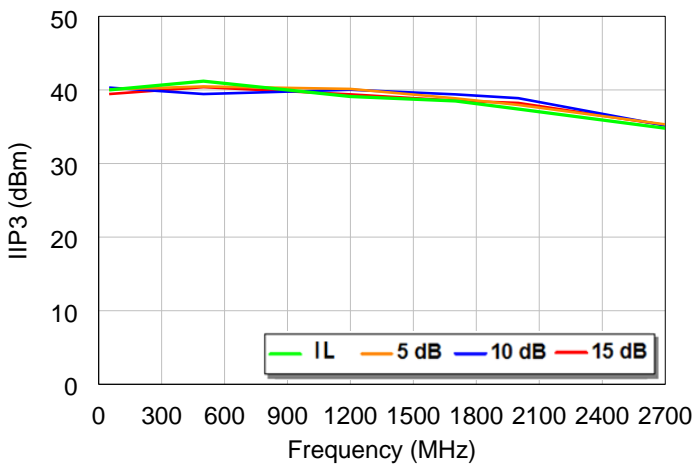
IIP3 vs. Frequency over all states (25°C)



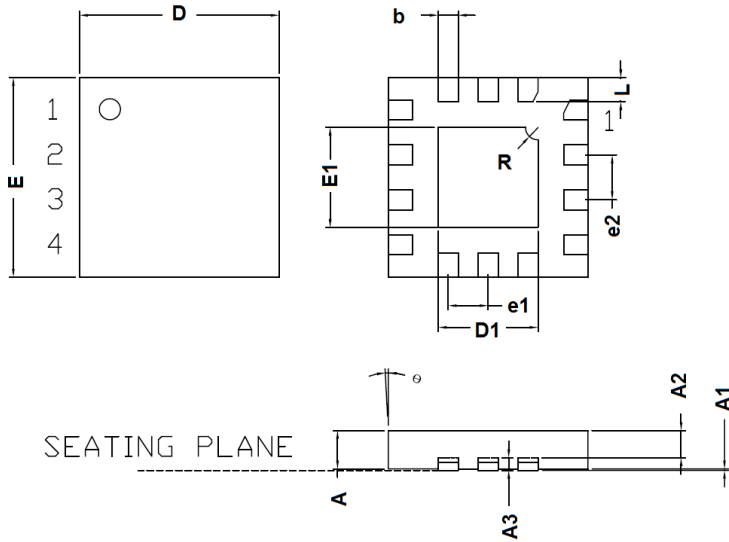
IIP3 vs. Frequency over all states (85°C)



IIP3 vs. Frequency over all states (-40°C)

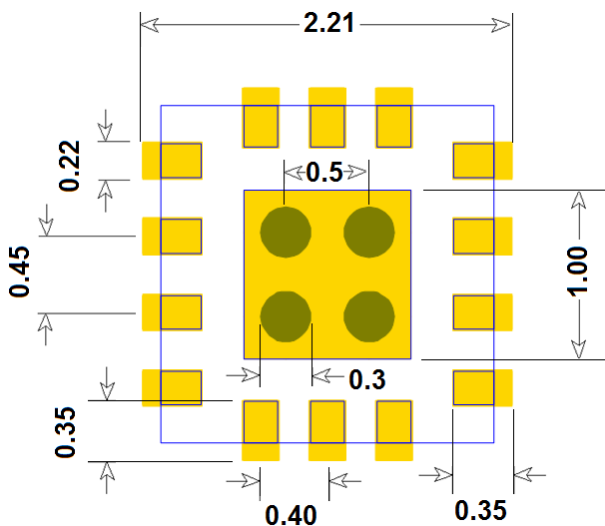


## 5. Package Outline (UQFN-14L, 2.0x2.0x0.4 mm<sup>3</sup>)



Symbols	Dimensions (In mm)		
	MIN	NOM	MAX
A	0.35	-	0.40
A1	0.00	-	0.05
A2	0.223	-	0.273
A3	-	0.127REF	-
b	0.15	0.20	0.25
D	1.95	2.00	2.03
E	1.95	2.00	2.03
D1	-	1.00BSC	-
E1	-	1.00BSC	-
e1	-	0.40BSC	-
e2	-	0.45BSC	-
L	0.195	0.245	0.295
R	-	0.125BSC	-
$\theta$	-12	-	0
Burr	0.00	0.03	0.06

## 6. Surface Mount Recommendation (In mm)

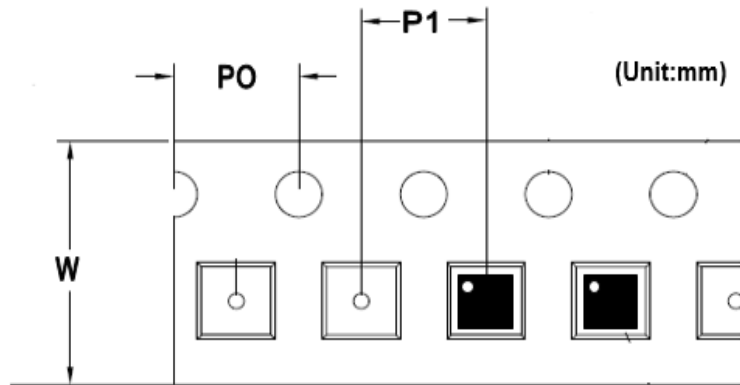


### NOTE

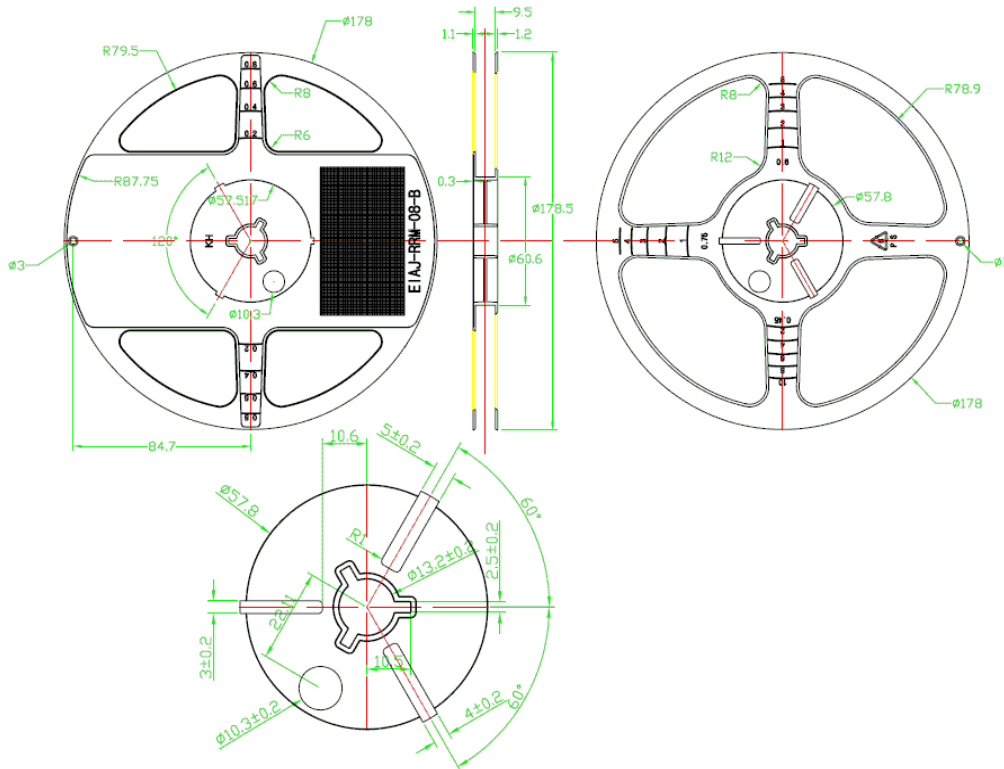
1. Recommended is that the ground via holes be placed on the bottom of the exposed pad of the device for better RF and thermal performance, as shown in the drawing at the left side

## 7. Tape and Reel Information

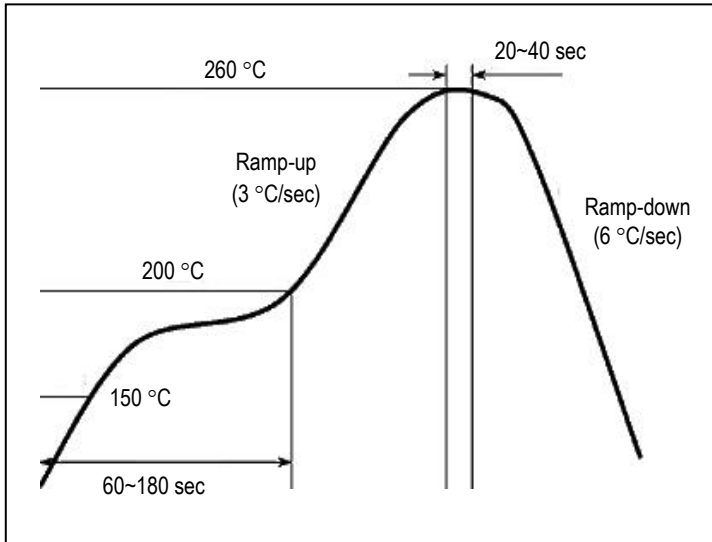
### 7.1 UQFN-14L Package



Package	Carrier Width (W)	Pitch (P0)	Pitch (P1)	Part Per Full Reel	Reel Size
UQFN-14L	8 mm	4 mm	4 mm	3,000 pcs	180 mm



## 8. Recommended Soldering Reflow Profile



*(End of Datasheet)*

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