#### AMGP-6551

## 40.5 – 43.5 GHz SMT Packaged Up-Converter

# AVAGO

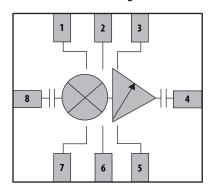
### **Data Sheet**



#### **Description**

The AMGP-6551 is a surface mount packaged broadband Up-converter that combines a sub-harmonic, SSB mixer with a variable gain amplifier. It is designed for use at frequencies between 37.5 GHz and 43.5 GHz and provides 10 dB of conversion gain with >20 dB gain control dynamic range. This Up-converter required +20 dBm LO drive level, and it supports IF from DC to 3 GHz. OIP3 of +20 and +16 dBm are achieved at 40.5 and 43.5 GHz respectively.

#### **Functional Block Diagram**



Pin	Function			
1	IF1			
2	Vd1			
3	IF2			
4	RF_OUT			
5	Vd3			
6	Vc			
7	Vd2			
8	RF_IN			



Attention: Observe Precautions for handling electrostatic sensitive devices. ESD Machine Model: 30 V

ESD Human Body Model: 150 V Refer to Avago Application Note A004R: Electrostatic Discharge Damage and Control.

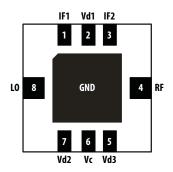
#### **Features**

- 5 x 5 mm surface mount package
- RF frequency range from 40.5 to 43.5 GHz
- LO frequency range from 18.5 to 23.5 GHz
- IF frequency range from DC to 3 GHz
- +20 dBm LO driver power
- 10 dB Conversion Gain
- 20 dB Dynamic Range
- +20 dBm Output IP3 @ 40.5 GHz, and +16 dBm @ 43.5 GHz
- Vdd = 3.5 V and Idd = 300 mA
- 1 to 0 V Control voltage (Vc)

#### **Application**

• Microwave Radio Systems

#### **Package Diagram**



#### **ELECTRICAL SPECIFICATIONS**

**Table 1. Absolute Minimum and Maximum Ratings** 

·		Specificati	ons			
		Min.	Max.	Unit	Comments	
Supply Voltage	Vd		5	V		
Control Voltage	Vc	-3	+1.5	V		
LO Input Power	LO		24	dBm		
MSL			MSL2A			
Channel Temperature			150	°C		
Storage Temperature		-45	150	°C		

**Table 2. Recommended Operating Range** 

Parameter			Specifica	tions			
Description Pin		Min.	Typical	Max.	Unit	Comments	
Supply	y Voltage	Vd	3.0	3.5	4.0	V	
Contro	ol Voltage	Vc	-1		0	V	Vc = -1 V for Max. Gain Vc = 0 V for Min. Gain
Frequency Range		RF	40.5		43.5	GHz	
		LO	18.5		23.5		
		IF	DC		3		
LO Pov	wer		+18	+20	+22	dBm	
Bias Cı	urrent			300		mA	
Therm	al Resistance, θ <sub>ch-b</sub>			18.8		°C/W	
Case T	emperature		-40		+85	°C	
ESD	Human Body Model			150		V	HBM Class 0 is ESD < 250 V
	Machine Model			< 30		V	MM Class A is ESD < 200 V This product is highly sensitive to esd damage

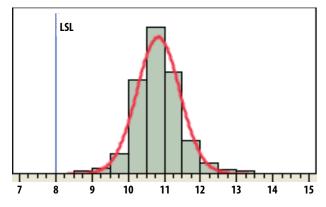
#### **Table 3. RF Electrical Characteristics**

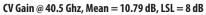
All data measured on Connectorized Taconic RF-35A2 demo board at Vd = 5 V,  $T_A$  = 25° C, IF = 1.8 GHz @ -10 dBm, LO = +20 dBm, Upper Side Band (RF = IF + 2\*LO) and 50  $\Omega$  at all ports, unless otherwise specified.

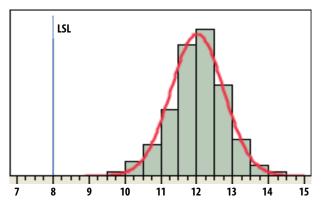
Return Loss measurement includes effect of connector + PCB.

	Performance (40.5 – 43.5 GHz)						
Parameter		Min.	Тур.	Max.	Unit	Comments	
Max. Conversion Gain	RF = 40.5 GHz	8	10.79		dB	(@ Vc = -1 V)	
	RF = 42 GHz		12.07				
	RF = 43.5 GHz		9.87				
Gain Dynamic Range			24		dB		
Input IP3	RF = 40.5 GHz	+4.5	8.99		dBm	$\Delta$ IF = 10 MHz,	
	RF = 42 GHz		5.18			IF Input -10 dBm/Tone	
	RF = 43.5 GHz		9.59				
Sideband REjection			15		dBc	In max gain state	
LO-RF Isolation			15		dB		
2*LO Leak. @RF Port			10		dBc		
RF Return Loss			12		dB		
IF Return Loss			12		dB		
LO Return Loss			8		dB		

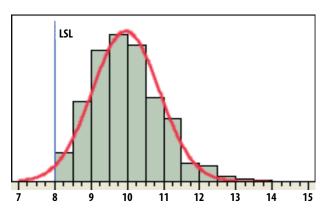
# Product Consistency Distribution Charts at 40.5 GHz, 42 GHz and 43.5 GHz, Vdd = 5 V, VC = -1 V, LO = 21 dBm, IF = -5 dBm (Sample size of 2,000 pieces)



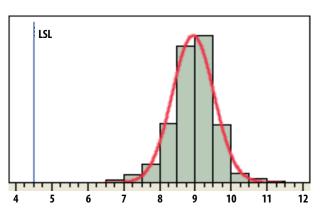




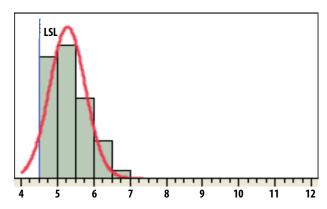
CV Gain @ 42 Ghz, Mean = 12.07 d , LSL = 8 dB



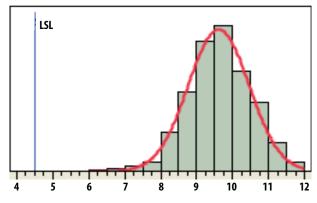
CV Gain @ 43.5 Ghz, Mean = 9.87 dB, LSL = 8 dB



IIP3 @ 40.5 Ghz, Mean = 8.99 dBm, LSL = 4.5 dBm



IIP3 @ 42 Ghz, Mean = 5.18 dBm, LSL = 4.5 dBm

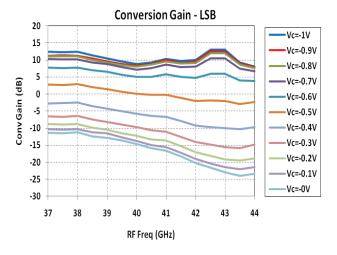


IIP3 @ 43.5 Ghz, Mean = 9.59 dBm, LSL = 4.5 dBm

#### Selected performance plots

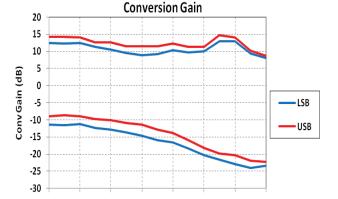
All data measured on Connectorized Taconic RF-35A2 demo board at Vd = 5 V,  $T_A = 25^{\circ}$  C, IF = 1.8 GHz @ -10 dBm, LO = +20 dBm, Upper Side Band (RF = IF + 2\*LO) and 50  $\Omega$  at all ports, unless otherwise specified.

Return Loss measurement includes effect of connector + PCB.



Conversion Gain - USB 20 Vc=-1V 15 Vc=-0.9V 10 Vc=-0.8V 5 Vc=-0.7V (dB) 0 Vc=-0.6V Conv Gain -5 Vc=-0.5V Vc=-0.4V -10 Vc=-0.3V -15 Vc=-0.2V -20 Vc=-0.1V -25 Vc=-0V -30 37 41 42 43 44 38 39 40 RF Freq (GHz)

Figure 1. LSB Conversion Gain vs Control Voltage



41

RF Freq (GHz)

42

43

44

Figure 2. USB Conversion Gain vs Control Voltage

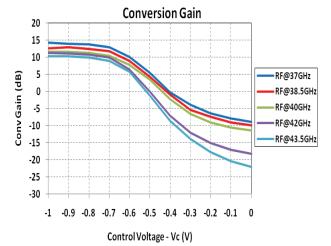


Figure 3. Conversion Gain (max and min gain)

39

40

38

37

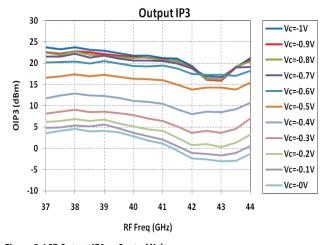


Figure 4. Conversion Gain vs. Control Voltage

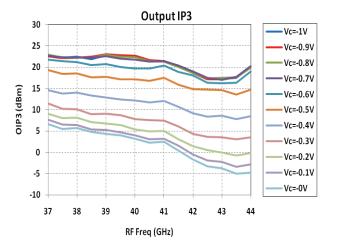


Figure 5. LSB Output IP3 vs Control Voltage

Figure 6. USB Output IP3 vs Control Voltage

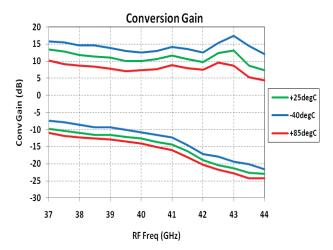


Figure 7. USB Conversion Gain vs Temperature (min and max gain)

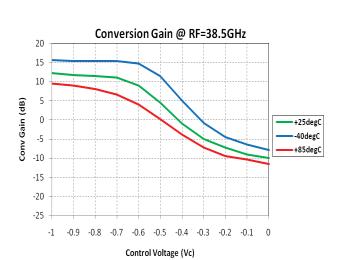


Figure 9. USB Conversion Gain vs. Temperature at 38.5 GHz

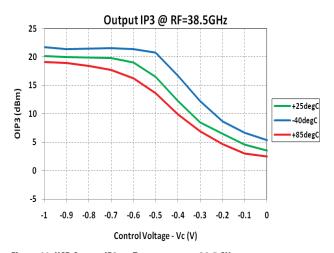


Figure 11. USB Output IP3 vs. Temperature at 38.5 GHz

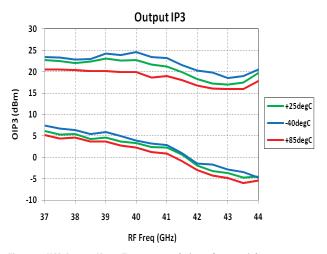


Figure 8. USB Output IP3 vs Temperature (min and max gain)

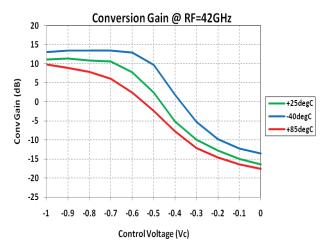


Figure 10. USB Conversion Gain vs. Temperature at 42 GHz

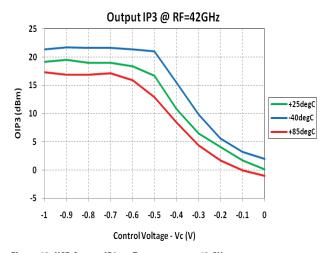


Figure 12. USB Output IP3 vs. Temperature at 42 GHz

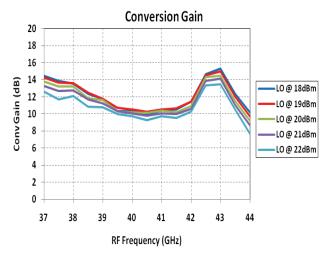


Figure 13. USB Conversion Gain @ L0 = 18-22 dBm with Vc = -1 V

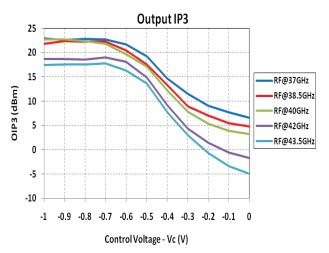


Figure 15. USB OIP3 vs. Control Voltage (Vc) with RF = 37-43.5 GHz

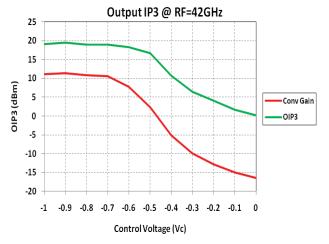


Figure 17. USB Output IP3 & Conversion gain vs. Control Voltage

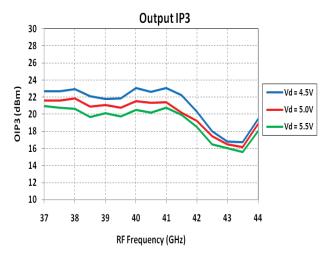


Figure 14. USB Output IP3 vs RF Freq. @ Vd = 4.5-5.5 V step 0,5 V

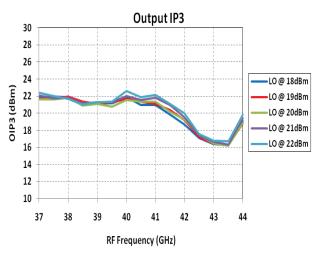


Figure 16. USB Output IP3 vs. RF Freq. @ L0 = 18-22 dBm with Vc = -1 V

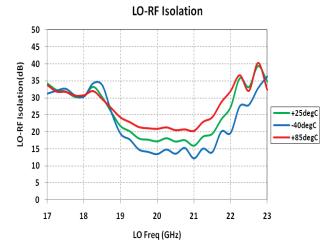


Figure 18. Over Temp. LO Rejection @ RF-port

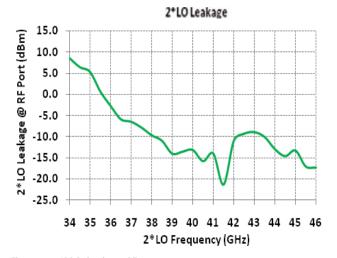


Figure 19. 2\*LO Rejection @ RF-port

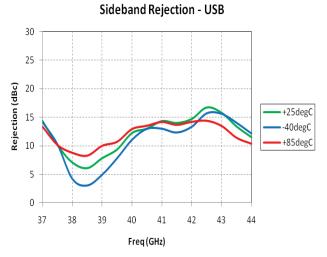


Figure 21. LSB Sideband Rejection at 25° C

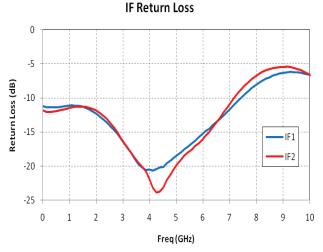


Figure 23. IF Input Return Loss vs. Frequency

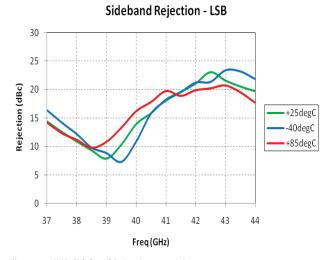


Figure 20. USB Sideband Rejection at 25° C

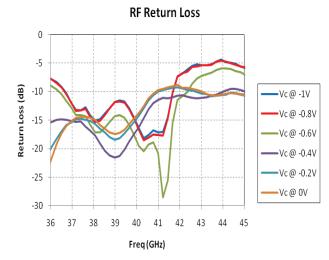


Figure 22. RF Output Return Loss vs. Control Voltage @ 25° C

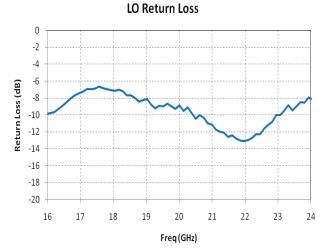
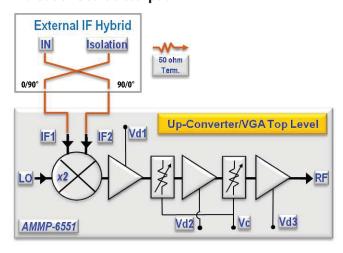


Figure 24. LO Input Return Loss with LO = +20 dBm

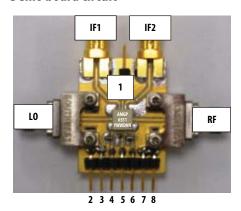
#### **Evaluation Board Description**



**Table 4. Pin Description** 

Pin#	Function	Typical	Comment
1	Vd1	3.5	100 mA
2	GND		
3	GND		
4	Vd2	3.5	100 mA
5	Vc	-1 to 0 V	< 1 mA
5	Vd3	3.5	100 mA
7	GND		
3	GND		

#### **Demo board circuit**



- 1. IF can be applied to either IN or Isolation port of a passive Hybrid.
- 2. If IF is applied to IN port, terminate Isolation port with 50 ohm
- 3. If IF is applied to Isolation port, terminate IN port with 50 ohm
- 4. Switching the IF input from In port to Isolation port or vice versa RF can be switched to LSB or USB

### Package Dimension, PCB Layout and Tape and Reel information

Please refer to Avago Technologies Application Note 5521, AMxP-xxxx production Assembly Process (Land Pattern B).

#### **Part Number Ordering Information**

	Devices per		
Part Number	Container	Container	
AMGP-6551-BLKG	10	antistatic bag	
AMGP-6551-TR1G	100	7" Reel	
AMGP-6551-TR2G	500	7″ Reel	

For product information and a complete list of distributors, please go to our web site: www.avagotech.com

