Product Description

Teledyne TDGB010 cascadable broadband InGaP HBT MMIC amplifier is a high-performance solution for general-purpose, high-reliability RF and microwave amplification needs. This 50-ohm gain block is based upon a mature and reliable Heterojunction Bipolar Transistor (HBT), Indium Gallium Phosphide (InGaP) process and utilizes proprietary MMIC design techniques.

The TDGB010 is packaged in a 2-lead, hermetic, ceramic package. The TDGB010 requires minimal external components for simplicity of design implementation. Teledyne e2v HiRel Electronics can provide various levels of device screening for high-reliability military or space applications.

Features

- Reliable low-cost InGaP HBT design
- Extremely broadband (optimized for
- low parasitic reactances)
- Excellent gain flatness and high P1dB
- Single-power supply operation
- 50 Ω input/output matched

Applications

- Narrowband and broadband applications for both Defense & Aerospace designs
- Linear & saturated amplifier applications
- Gain stage or driver amplifiers utilized in many applications such as point-to-point radio, test equipment, VSAT, and military or space applications
- SCDs are supported

Package: Hermetic, 2-pin, 6.6 mm x 3.6 mm

Table 1. Ordering Information

TD=Teledyne	Function GB=Gain Block	Freq (GHz)	Device Gain Code	Package	# Leads
TD	**GB**	**010**	**C**	**L**	**2**
TDGB010AL2-11	FM [1/]		A = 13.6dB*	L – 2-lead Hermetic Gullwing	
TDGB010AL2-01	EM [/2]		B = 16.5dB*		
TDGB010AL2-00	EVK		C = 18.4dB		
TDGB010BL2-11	FM [1/]				
TDGB010BL2-01	EM [/2]				
TDGB010BL2-00	EVK				
TDGB010CL2-11	FM [1/]				
TDGB010CL2-01	EM [/2]				
TDGB010CL2-00	EVK			*Contact Factory for Availability.	
FM = Flight qualified unit, **EM** = 25°C tested evaluation unit, **EVK** = Engineering evaluation kit					

1/ The catalog flight device receives processing per Teledyne HiRel's DOC-0420 which is based upon MIL-STD-883 Class-S.
2/ EM units are engineering evaluation units that are tested at 25C only and processed to a non-compliant flow (e.g., no burn-in, non-hermetic, etc.). These units are non-hermetic and are not suitable for qualification, production, radiation testing or flight use.
Please contact factory for specialized screening and qualification requirements.

Table 2. Absolute Maximum Ratings 2/

Parameter	Rating (by Gain Code if noted)	Unit
RF Input Power	+20	dBm
Power Dissipation	312(A), 329(B), 308(C)	mW
Device Current	82(A), 80(B), 74(C)	mA
Channel Temperature	150	°C
Operating Temperature	-45 to +85	°C
Storage Temperature	-65 to +150	°C
ESD Level (HBM) 3/	Class 1A	
Moisture Sensitivity Level	Hermetic	

Notes:
2/ Caution! Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum ratings may degrade performance and may affect device reliability.
3/ Caution! ESD sensitive device.

Table 3. Thermal Characteristics (Typical values unless otherwise noted)

Parameter	Condition	Units	Typ. (by Gain Code if noted)
MTTF versus Temperature at Icc = 50 mA			
Case Temperature (T_{case})		°C	85
MTTF		hours	$>10^6$
Thermal Resistance – Junction-to-Case θ_{JC}	$\theta_{JC} = (J_T - T_{case})/V_D * I_{CC}$)	°C/W	290(A), 290(B), 290(C)

Table 4. Nominal Operating Parameters

Parameters (by Gain Code as noted)	Test Conditions	Min (A)	Typ. (A)	Min (B)	Typ. (B)	Min (C)	Typ. (C)	Max.	Units
General Performance	Vd = +3.8V (A)&(B), +4.2v (C), Icc=50 mA, Z_0=50 Ω, Ta=+25°C								
Small Signal Power Gain, S21	f = 0.1-to-1.0 GHz f = 1.0-to-4.0 GHz f = 4.0-to-6.0 GHz f = 6.0-to-10.0 GHz (Ta = -45°C to +85°C)		13.6 13.5 13.0 11.6	12.9 11.0 9.6 6.4	17.1 16.5 15.4 12.5	18.4 14.5 12.1 6.7	19.3 16.0 13.8 10.3		dB dB dB dB
Gain Flatness, GF	f = 0.1-to-6.0 GHz (Ta = -45°C to +85°C)		±0.7		±4.3		±5.9	±7.4	dB
Input VSWR	f = 0.1-to-4.0 GHz f = 4.0-to-6.0 GHz f = 6.0-to-10.0 GHz (Ta = -45°C to +85°C)		2.0:1 2.4:1 2.5:1		2.0:1 2.4:1 2.5:1		1.2:1 1.9:1 3.3:1	1.9:1 2.9:1 8.8:1	
Output VSWR	f = 0.1-to-4.0 GHz f = 4.0-to-6.0 GHz f = 6.0-to-10.0 GHz (Ta = -45°C to +85°C)		2.0:1 2.4:1 2.5:1		2.0:1 2.4:1 2.5:1		1.3:1 1.9:1 2.2:1	2.2:1 2.8:1 8.0:1	
Bandwidth, BW	BW3 (3dB) (Ta = -45°C to +85°C)		12.0	2.4	7.0	2.3	3.2	4.1	GHz
Output Power @ 1-dB Compression, P1dB	f = 2.0 GHz f = 6.0 GHz f = 10.0 GHz		14.3 14.5 12.7		15.2 15.4 12.9		16.3 16.4 13.7		dBm dBm dBm
Noise Figure, NF	f = 3.0 GHz		5.5		5.5		5.5		dB
3rd Order Intercept, IP3	f = 2.0 GHz		+28		+28		+28		dBm
Reverse Isolation,S12	f = 0.1 to 10.0 GHz (Ta = -45°C to +85°C)		-17		-17	-12.0	-17.3		dB
Device Voltage, V_D	Icc = 50 mA (Ta = -45°C to +85°C)	3.7	3.8	3.6	3.8	4.0	4.2	3.9 (A) 4.6 (B) 4.6 (C)	V

Table 4. Nominal Operating Parameters (continued)

Parameters (by Gain Code as noted)	Test Conditions	Min (A)	Typ. (A)	Min (B)	Typ. (B)	Min (C)	Typ. (C)	Max.	Units
General Performance	Vd = +3.8V (A)&(B), +4.2v (C), Icc=50 mA, Z_0=50 Ω, Ta=+25°C								
Gain Temperature Coefficient, $\partial GT/\partial T$	f = 0.1-to-1.0 GHz, 25°C to -45°C f = 1.0-to-4.0 GHz, 25°C to -45°C f = 4.0-to-6.0 GHz, 25°C to -45°C f = 6.0-to-10.0 GHz, 25°C to -45°C f = 0.1-to-1.0 GHz, 25°C to +85°C f = 1.0-to-4.0 GHz, 25°C to +85°C f = 4.0-to-6.0 GHz, 25°C to +85°C f = 6.0-to-10.0 GHz, 25°C to +85°C		-0.02		-0.02	-0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.02 -0.05	+0.0005 +0.0021 +0.0033 +0.0068 -0.0031 -0.0049 -0.0048 -0.0112	+0.02 +0.02 +0.02 +0.02 +0.02 +0.02 +0.02 +0.05	dB/ °C

Figure 3. Test Circuit Block Diagram

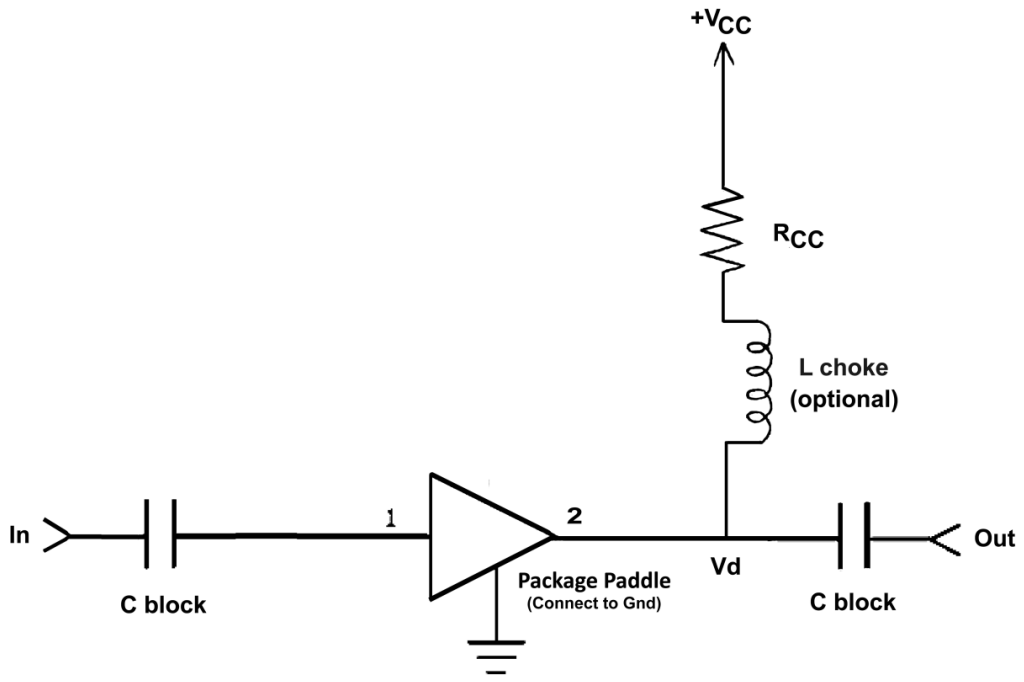


Figure 4. Package Drawing (dimensions are in millimeters)

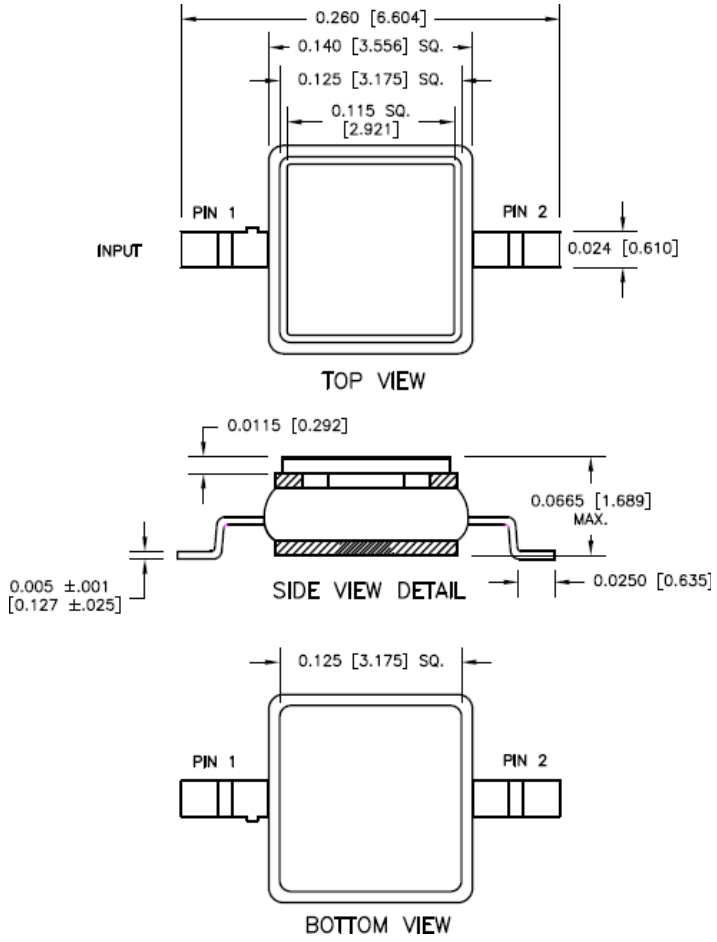


Figure 5. Solder Land Pattern (dimensions are in millimeters)

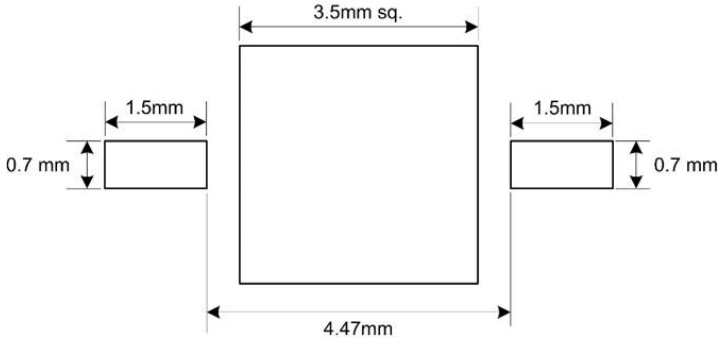


Table 5. Pin Descriptions

Pin #	Pin Name	Description
1	RFIN	RF input pin. A DC blocking capacitor specified for the frequency of operation should be used.
2	RFOUT/DCBIAS	RF output and bias pin. Biasing is accomplished with an external series resistor and a choke inductor. The resistor value is determined by the following equation: $R = \frac{(Vcc - Vd)}{Icc}$
Package Paddle	Gnd	Ground Connection

Figure 6. Package Marking

10AF DOP Serial #	10BF DOP Serial #	10CF DOP Serial #

10XZ

X – denotes gain (A,B,C)

Z – E or F denotes EM or FM

10CF – would be the FM with 18.4 dB of gain

DOP – Internal Tracking Number

Figure 7. Typical Performance Curves for Gain Code A

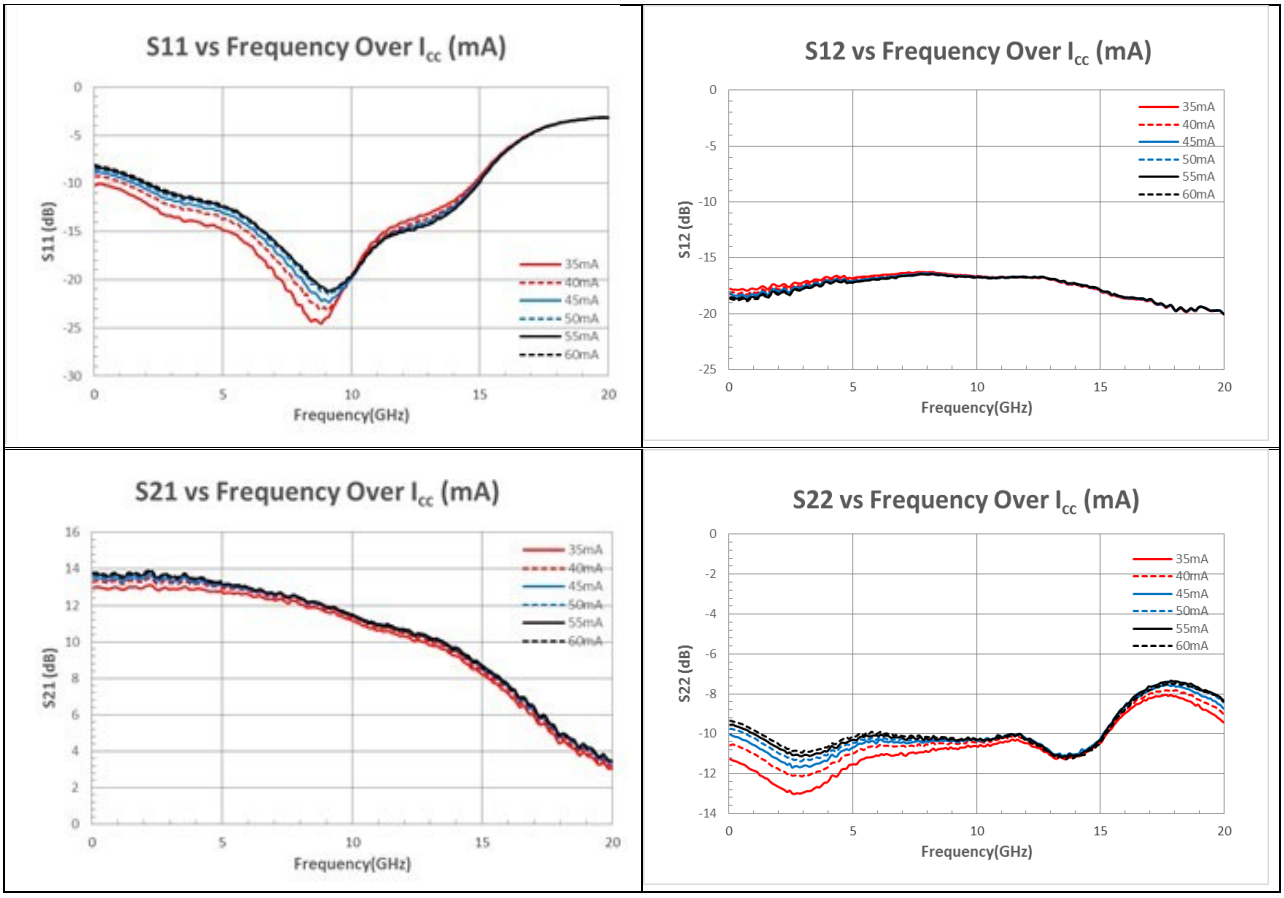


Figure 7. Typical Performance Curves for Gain Code A (continued)

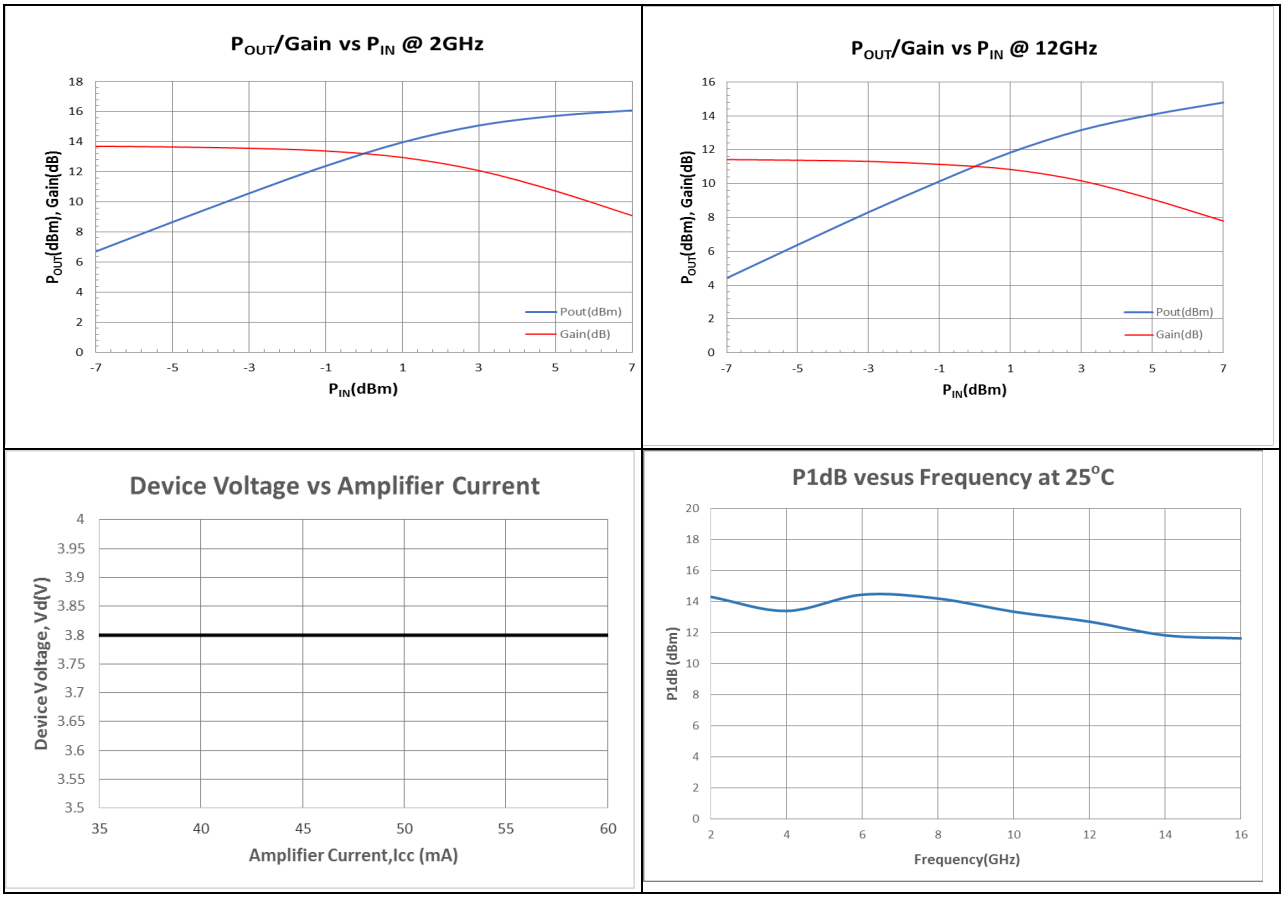


Figure 7. Typical Performance Curves for Gain Code B

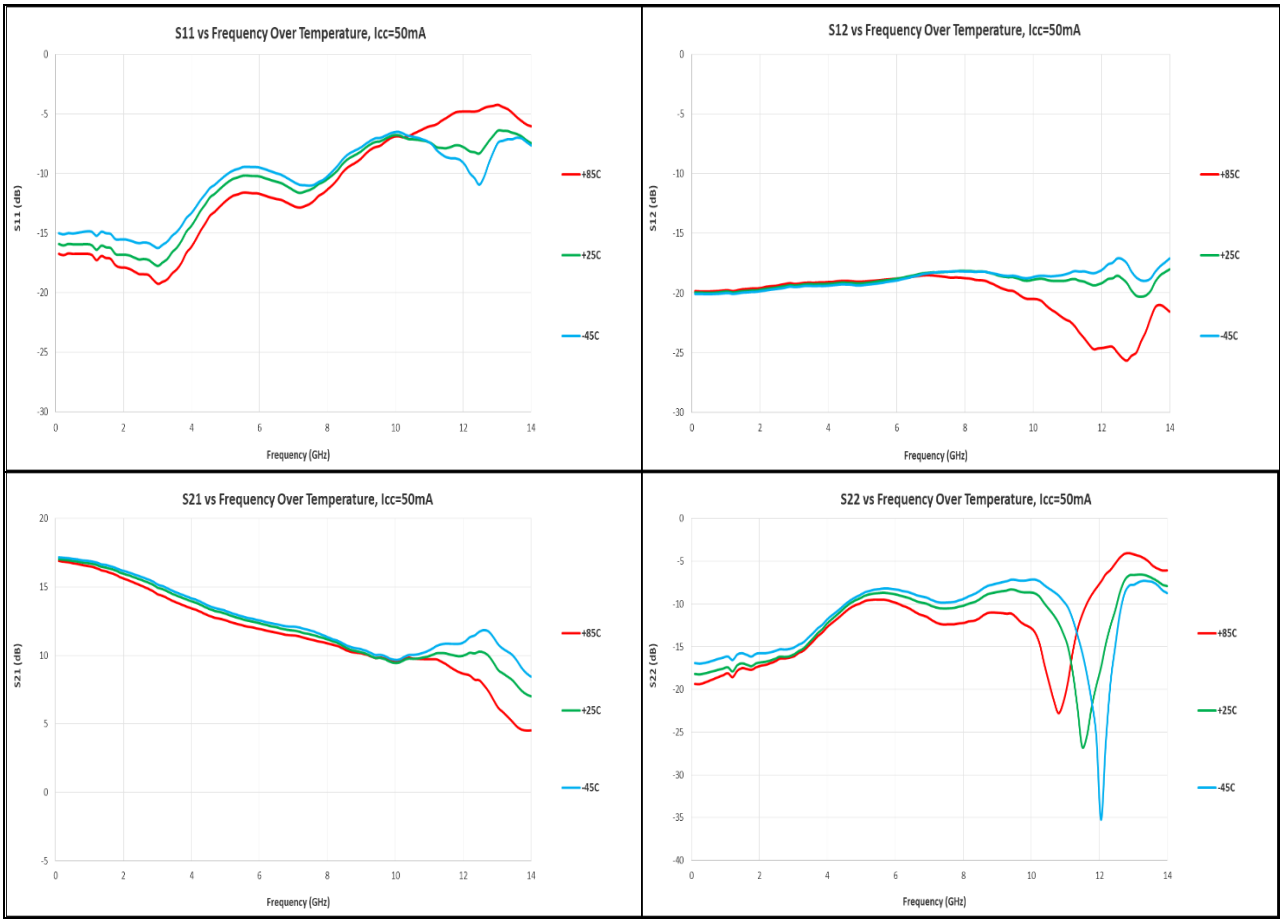


Figure 7. Typical Performance Curves for Gain Code B (continued)

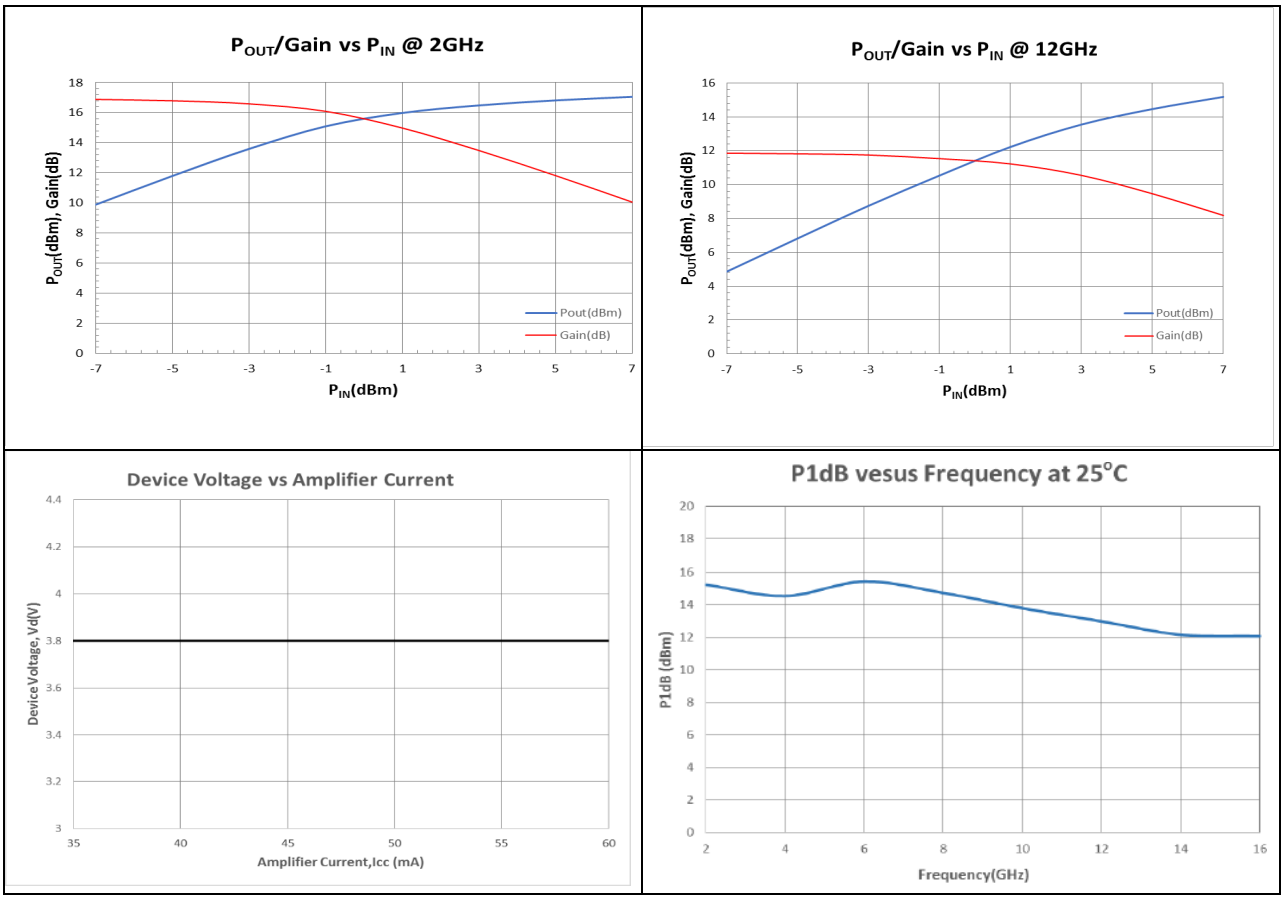


Figure 7. Typical Performance Curves for Gain Code C

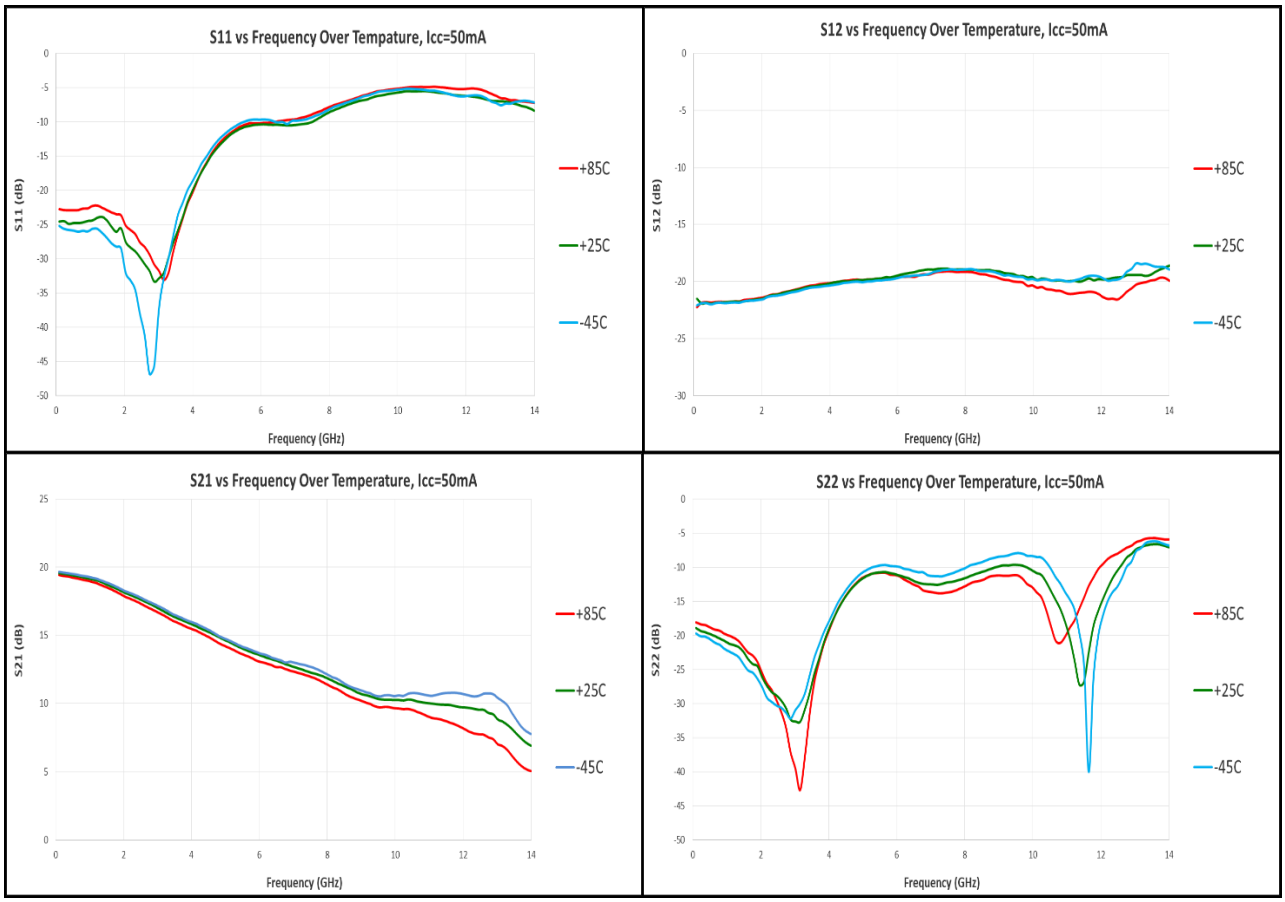


Figure 7. Typical Performance Curves for Gain Code C (continued)

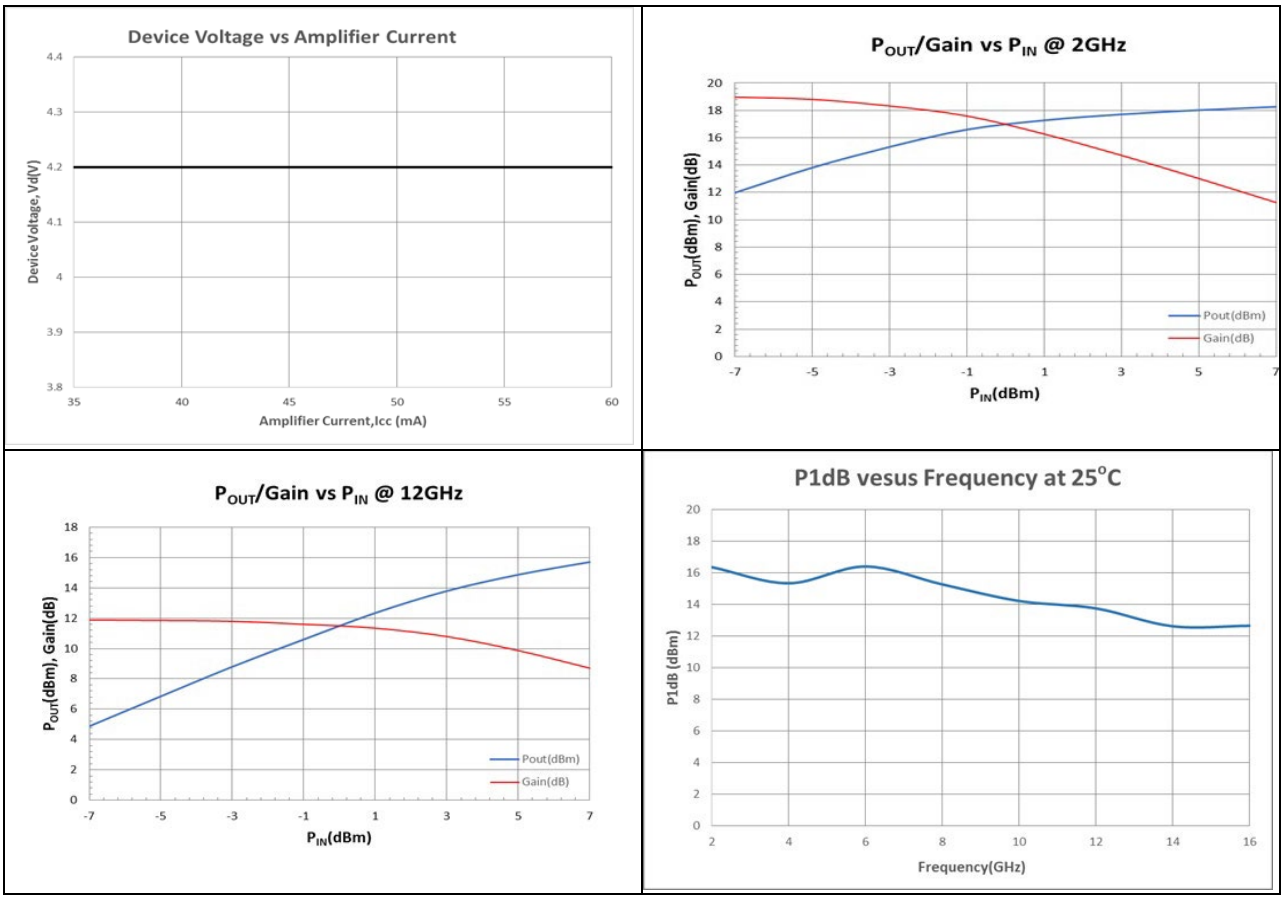
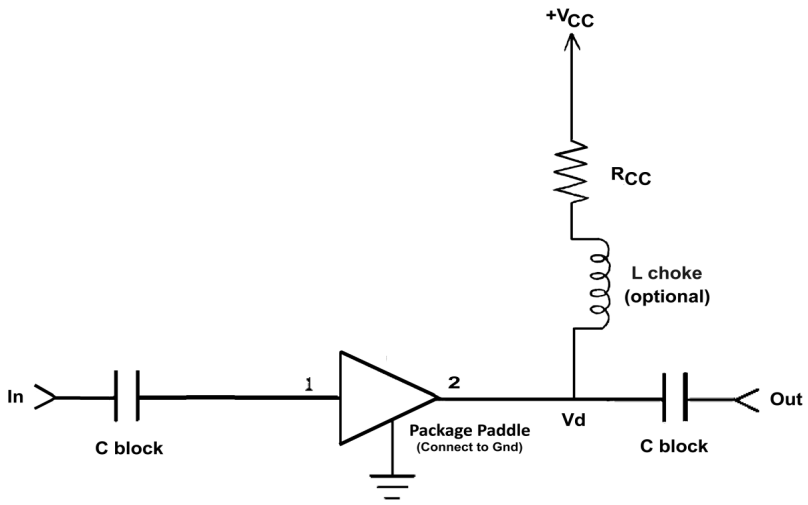


Figure 8. Typical Bias Configuration



Recommended Bias Resistor Values @ Icc = 50 mA						
Supply Voltage, V_{cc} (V)	5	8	10	12	15	20
Bias Resistor, R_{cc} (Ω), (A) & (B)	24	84	124	164	224	324
Bias Resistor, R_{cc} (Ω), (C)	16	76	116	156	216	316

Revision History

Revision	Date	Changes
2	April 30, 2020	Initial Release
2a	October 28, 2020	Corrected footer to Doc: TDGB010-DS
3	May 21, 2021	Update to Note 2/ on page #1
3a	December 9, 2021	Added /2 to Table 1 for clarification Deleted the folowing from Table 4: Sm Sig PG S21 Max limits Input VSWR Min limits Output VSWR Min limits Rev Isolation, S21 Max limit Updated Table 4 with (B) parameters Updated Figure 7 page 9 performance curves

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