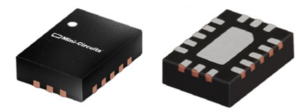
MMIC SURFACE MOUNT

Voltage Variable Attenuator PVA-453-34+

50Ω 10 to 45 GHz

THE BIG DEAL

- Ultra-broad band, 10 to 45 GHz
- Wide attenuation range, up to 51 dB typ. at 30 GHz
- Excellent return loss for all attenuation states
- Low insertion loss, 2 dB typ.
- High IIP3 in all attenuation states



Generic photo used for illustration purposes only

CASE STYLE: JV2579

+RoHS Compliant
The +Suffix identifies RoHS Compliance.
See our website for methodologies and qualifications

APPLICATIONS

- 5G MIMO and Back Haul Radio Systems
- Satellite Communications
- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems

PRODUCT OVERVIEW

The PVA-453-34+ is an absorptive voltage variable attenuator MMIC die fabricated using GaAs pHEMT technology packaged in a small 3.5x2.5 mm SMT package. This VVA covers the frequency range of 10 to 45 GHz offering high dynamic range, low distortion, and low insertion loss. It features two independently controlled attenuators using analog control voltages from -4V to 0V. This product is ideal for applications where a DC voltage is utilized to control RF signal levels such as temperature compensation and AGC circuits.

KEY FEATURES

Feature	Advantages
High IIP3, +26 to +43 dBm typ. over attenuation range	Low distortion enabling improved system performance.
Wide attenuation range, • 45 dB typ. at 20 GHz • 51 dB typ. at 30 GHz • 38 dB typ. at 40 GHz	Low insertion loss and high dynamic range simplify the use of analog signal control.

Mini-Circuits
www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

ELECTRICAL SPECIFICATIONS AT 25°C, 50Ω, UNLESS NOTED OTHERWISE

Frequency (GHz)	Condition[1]	Min Attenuation (dB)[2]		Max Attenuation (dB)		Attenuation Range (dB)		Return Loss (dB)		IIP3 (dBm)
		Typ.	Max.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Worst Case, Typ
10-20	VCTL1 = -4 V to 0 V, VCTL2 = - 4 V	2.1	3.5	18.8	23.8	15.3	21.7	7	17	30
20-30		2.2	3.7	22.9	27.6	19.2	25.4	7.5	14	
30-40		3.0	5.9	26.4	31.1	20.5	28.1	6.5	16	
40-45		4.1	6.3	28.8	34.0	22.5	29.9	10	19	
10-20	VCTL1 = 0 V, VCTL2 = - 4 V to 0 V	23.8	28.3	32.1	41.6	3.8	17.7	7	14	30
20-30		27.6	31.8	41.8	51.9	10.0	24.3	7.5	13	
30-40		31.2	36.2	38.3	48.0	-	16.8	6.5	15	
40-45		34.0	36.5	34.7	38.0	-	4.0	10	18	
10-20	VCTL1 = -4 V to 0 V, VCTL2 = -4 V to 0 V VCTL1 = VCTL2	2.1	3.5	32.1	41.5	28.6	39.5	8	17	26
20-30		2.2	3.7	41.4	51.9	37.7	49.7	7.5	14	
30-40		3.0	5.9	37.9	48.0	32.0	45.0	6.5	16	
40-45		4.1	6.3	34.6	38.0	28.3	33.9	10	19	

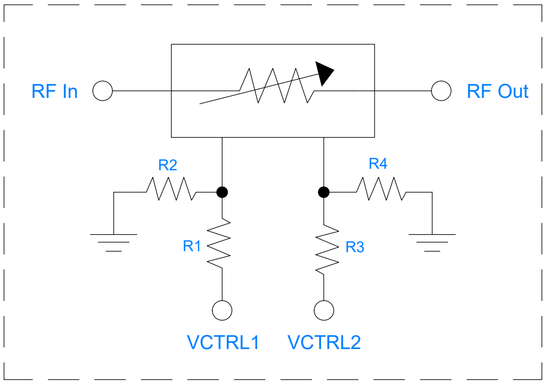
1. VCTL1 and VCTL2: -4V (min. attenuation) to 0V (max. attenuation). Maximum current for VCTL1 or VCTL2: 5 mA (max at VCTL= -4V)
2. Min attenuation state is the insertion loss.

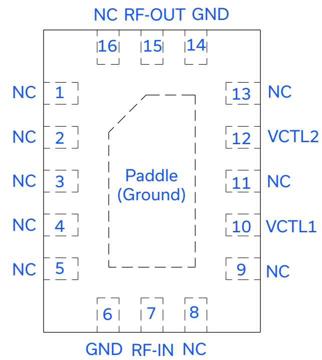
MAXIMUM RATINGS[3]

Parameter	Ratings
Operating Case Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Control Voltage (Vctl1/Vctl2)	-5 to +1V
Absolute Max. RF Input Level	+23 dBm
Thermal Resistance at max. attenuation	44.8°C/W

3. Permanent damage may occur if any of these limits are exceeded.

APPLICATION CIRCUIT & PAD DESCRIPTION





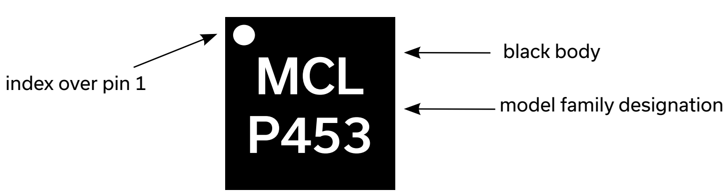
PAD CONNECTIONS

NO CONNECTION	1, 2, 3, 4, 5, 8, 9, 11, 13, 16
RF IN	7
VCTL1	10
VCTL2	12
RF OUT	15
GROUND	6, 14

Components	Size	Value	Qty	Part Number
R1, R3	0201	6.2 kΩ	2	RK73414TTC6201F
R2, R4	0201	2.1 kΩ	2	RK73H1HT2010F

Note: The voltage divider network is required to increase the tuning voltage range of the VVA

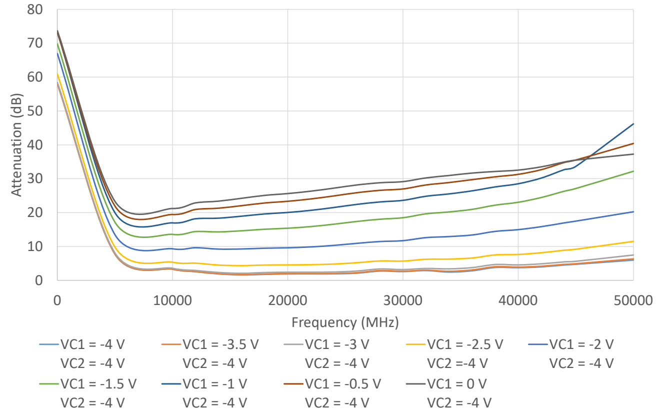
PRODUCT MARKING



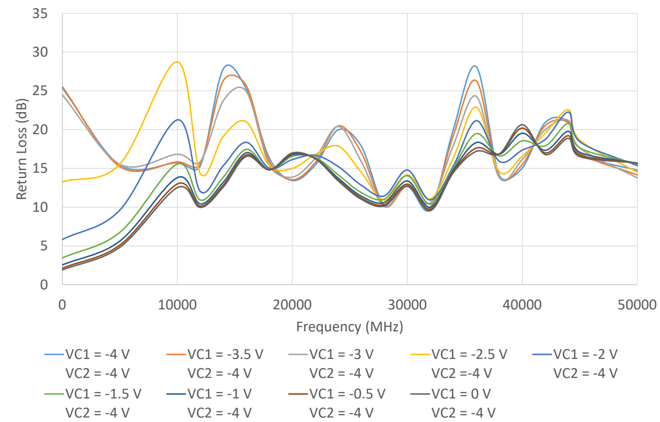
Marking may contain other features or characters for internal lot control

TYPICAL PERFORMANCE CURVES

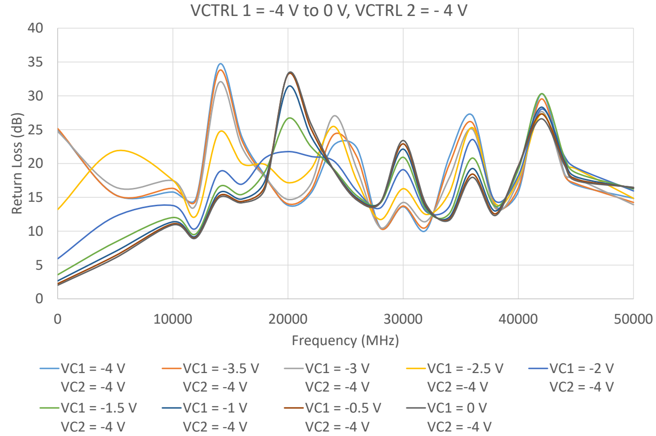
Attenuation vs. Frequency at Various Control Voltages
VCTRL 1 = -4 V to 0 V, VCTRL 2 = - 4 V



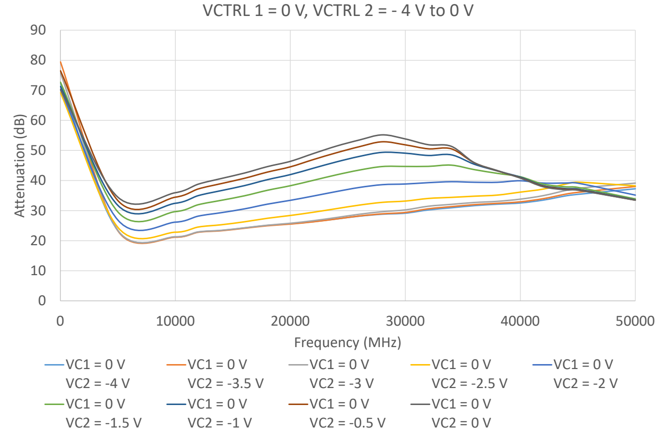
Input Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = -4 V to 0 V, VCTRL 2 = - 4 V



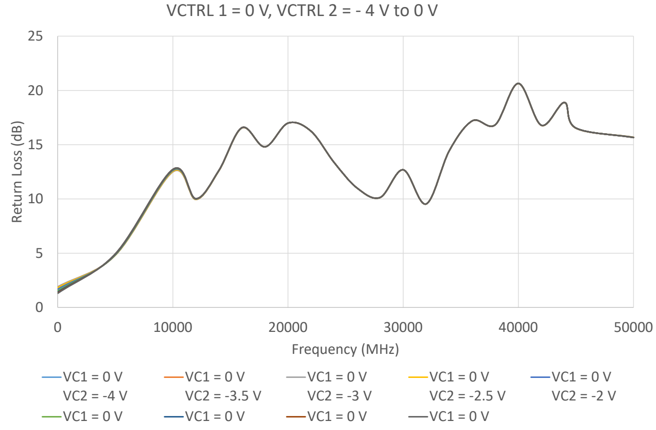
Output Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = -4 V to 0 V, VCTRL 2 = - 4 V



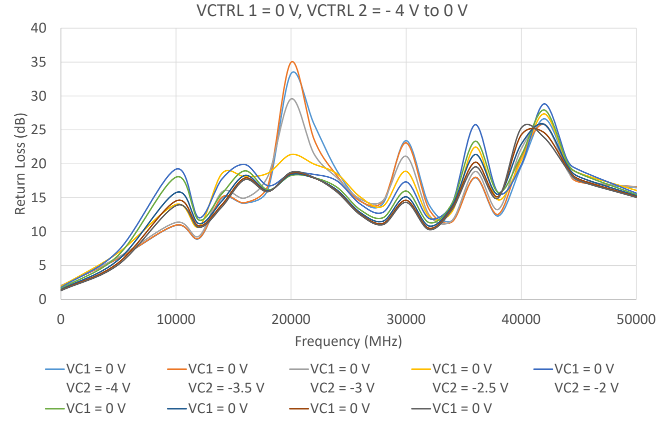
Attenuation vs. Frequency at Various Control Voltages
VCTRL 1 = 0 V, VCTRL 2 = - 4 V to 0 V



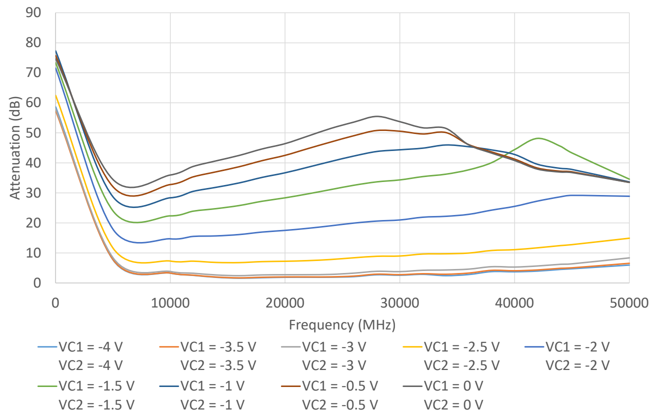
Input Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = 0 V, VCTRL 2 = - 4 V to 0 V



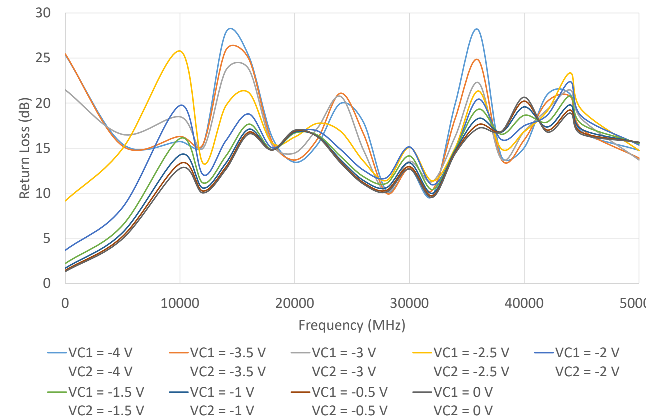
Output Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = 0 V, VCTRL 2 = - 4 V to 0 V



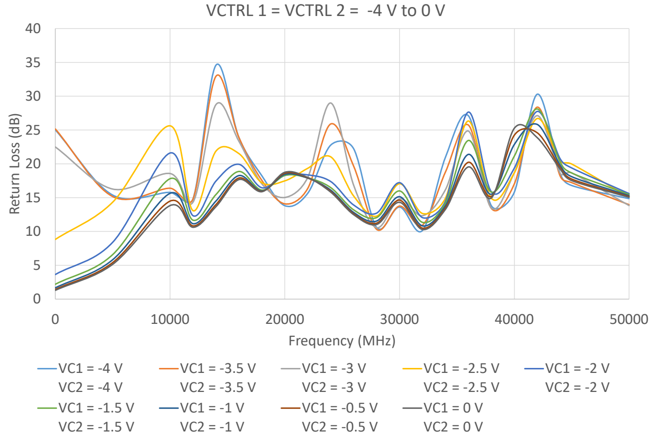
Attenuation vs. Frequency at Various Control Voltages
VCTRL 1 = VCTRL 2 = -4 V to 0 V



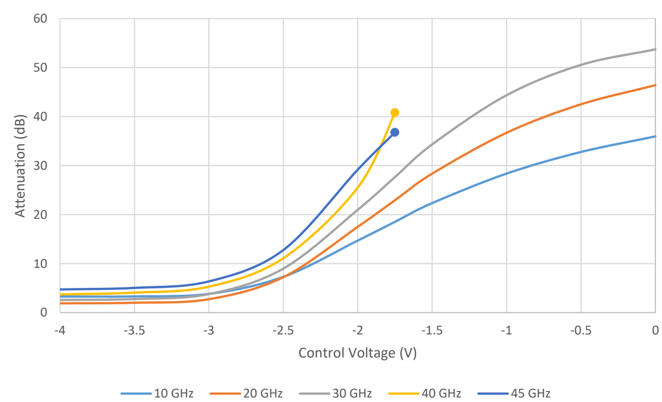
Input Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = VCTRL 2 = -4 V to 0 V



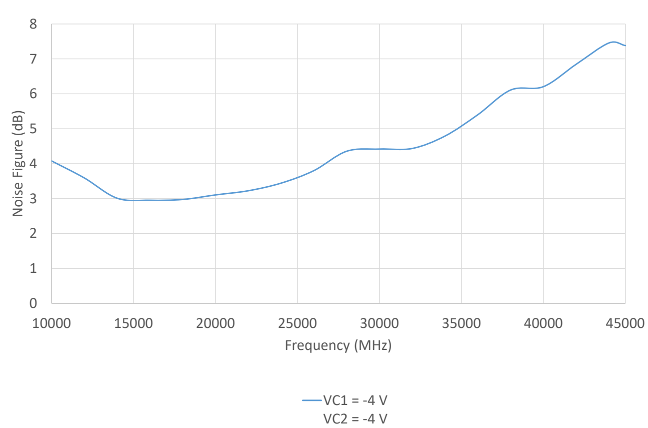
Output Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = VCTRL 2 = -4 V to 0 V



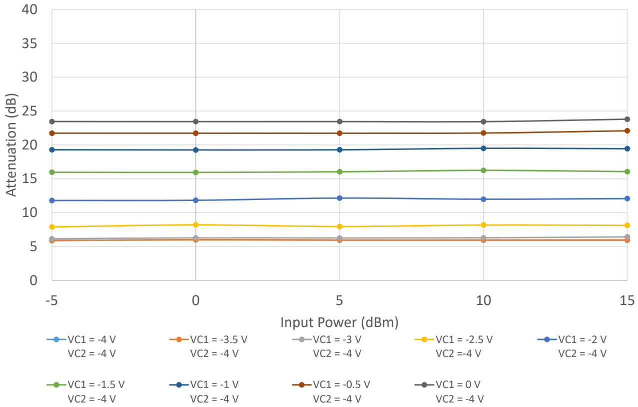
Attenuation vs. Control Voltage at Various Frequencies
(VCTRL1 = VCTRL2)



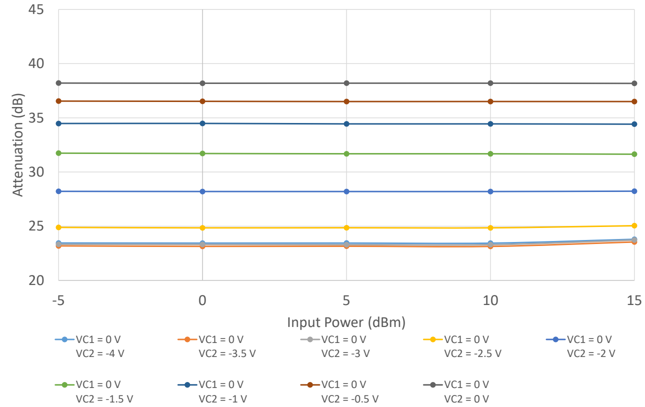
Noise Figure vs. Frequency



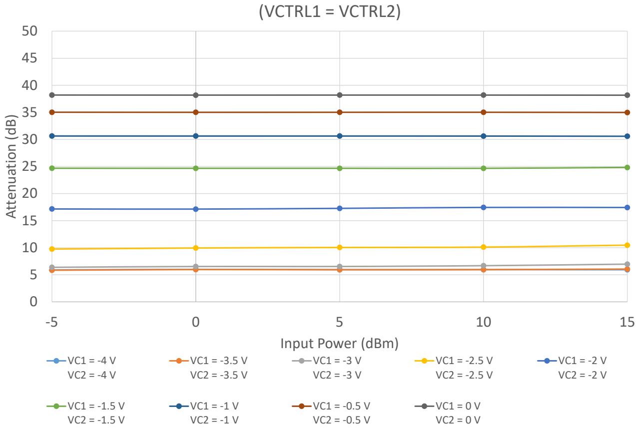
Attenuation vs. Input Power Over Control Voltages at 10 GHz
(Fixed VCTRL2)



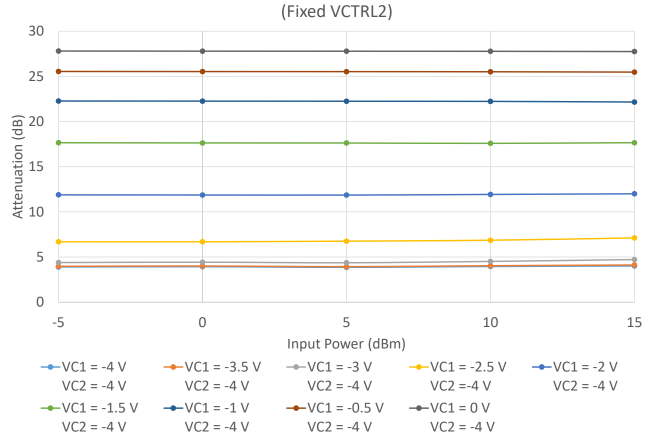
Attenuation vs. Input Power Over Control Voltages at 10 GHz
(Fixed VCTRL1)



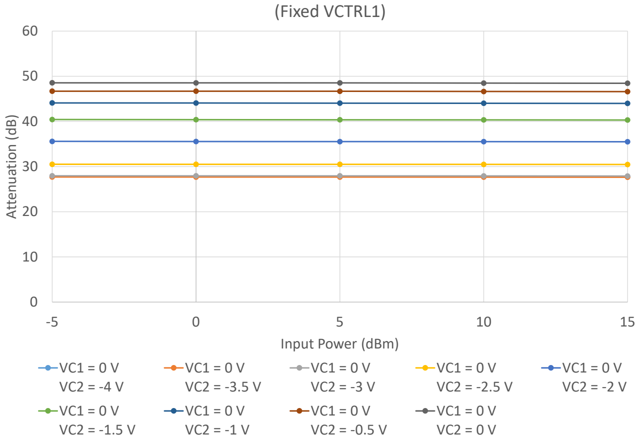
Attenuation vs. Input Power Over Control Voltages at 10 GHz
(VCTRL1 = VCTRL2)



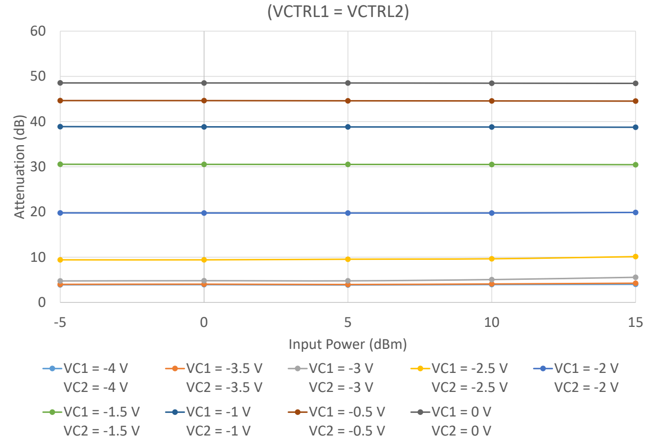
Attenuation vs. Input Power Over Control Voltages at 20 GHz
(Fixed VCTRL2)



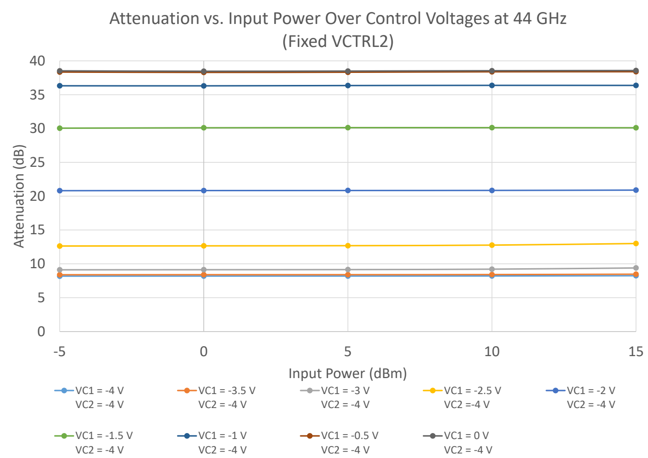
Attenuation vs. Input Power Over Control Voltages at 20 GHz
(Fixed VCTRL1)

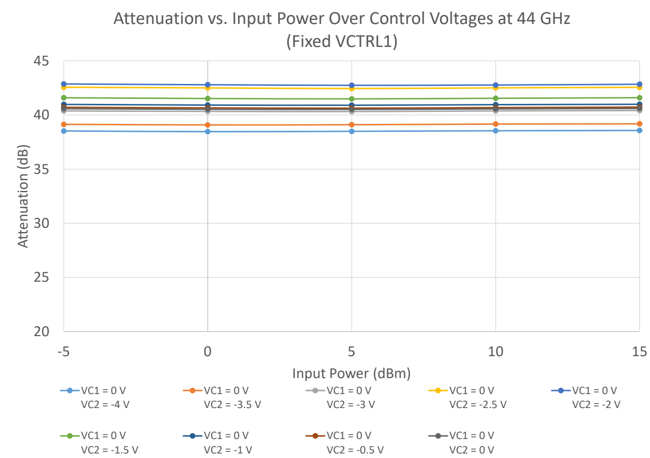


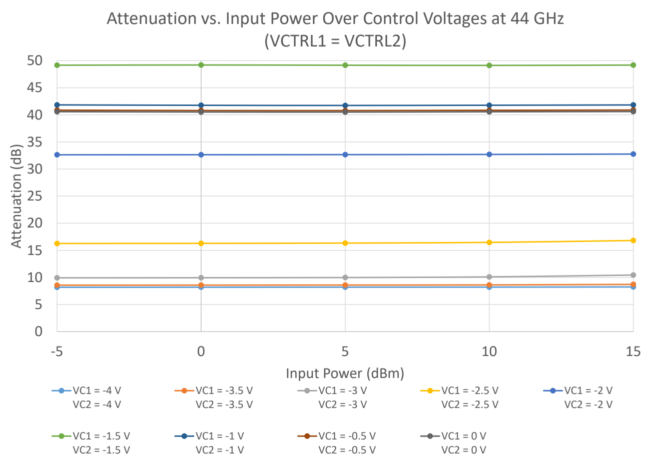
Attenuation vs. Input Power Over Control Voltages at 20 GHz
(VCTRL1 = VCTRL2)

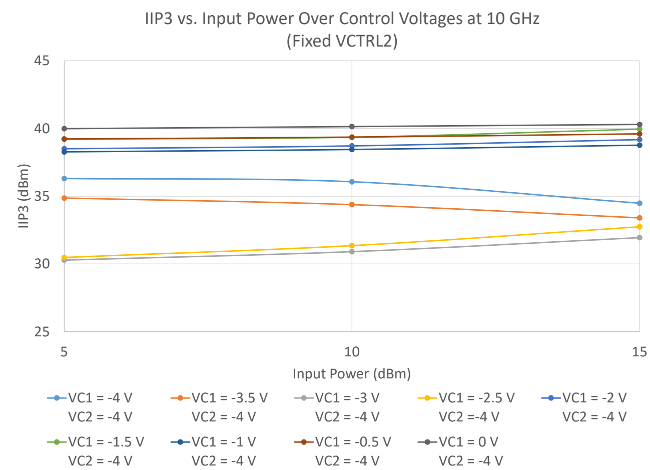


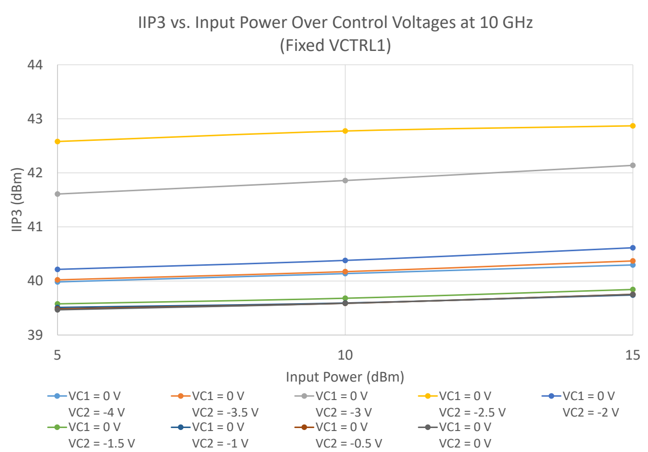
1. Package parasitics limit maximum attenuation range above 30 GHz and may cause attenuator to be non-monotonic with control voltages greater than -1.5V

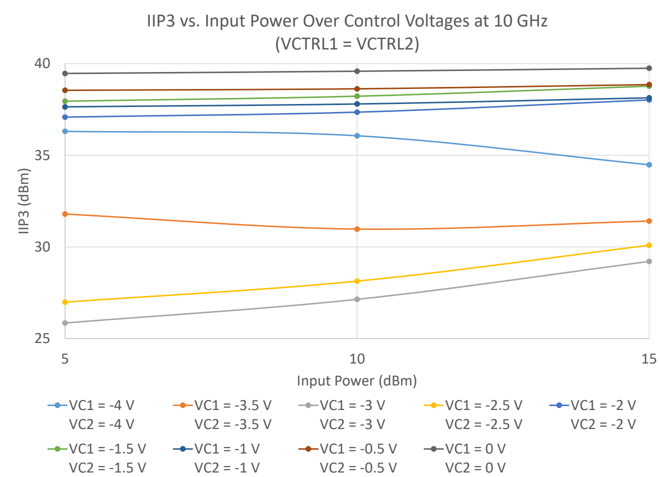

Attenuation vs. Input Power Over Control Voltages at 44 GHz
(Fixed VCTRL2)
Attenuation (dB)
Input Power (dBm)
VC1 = -4 V VC2 = -4 V
VC1 = -3.5 V VC2 = -4 V
VC1 = -3 V VC2 = -4 V
VC1 = -2.5 V VC2 = -4 V
VC1 = -2 V VC2 = -4 V
VC1 = -1.5 V VC2 = -4 V
VC1 = -1 V VC2 = -4 V
VC1 = -0.5 V VC2 = -4 V
VC1 = 0 V VC2 = -4 V


Attenuation vs. Input Power Over Control Voltages at 44 GHz
(Fixed VCTRL1)
Attenuation (dB)
Input Power (dBm)
VC1 = 0 V VC2 = -4 V
VC1 = 0 V VC2 = -3.5 V
VC1 = 0 V VC2 = -3 V
VC1 = 0 V VC2 = -2.5 V
VC1 = 0 V VC2 = -2 V
VC1 = 0 V VC2 = -1.5 V
VC1 = 0 V VC2 = -1 V
VC1 = 0 V VC2 = -0.5 V
VC1 = 0 V VC2 = 0 V

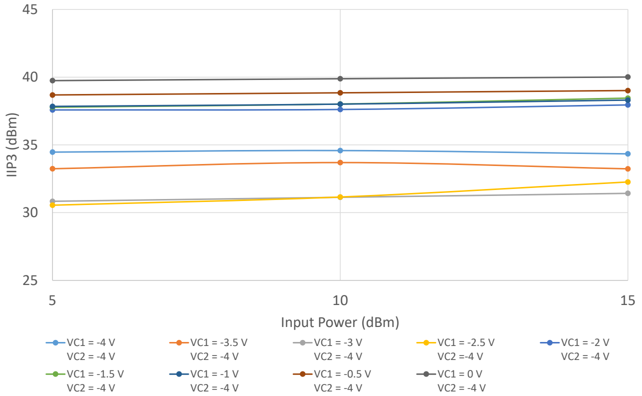

Attenuation vs. Input Power Over Control Voltages at 44 GHz
(VCTRL1 = VCTRL2)
Attenuation (dB)
Input Power (dBm)
VC1 = -4 V VC2 = -4 V
VC1 = -3.5 V VC2 = -3.5 V
VC1 = -3 V VC2 = -3 V
VC1 = -2.5 V VC2 = -2.5 V
VC1 = -2 V VC2 = -2 V
VC1 = -1.5 V VC2 = -1.5 V
VC1 = -1 V VC2 = -1 V
VC1 = -0.5 V VC2 = -0.5 V
VC1 = 0 V VC2 = 0 V


IIP3 vs. Input Power Over Control Voltages at 10 GHz
(Fixed VCTRL2)
IIP3 (dBm)
Input Power (dBm)
VC1 = -4 V VC2 = -4 V
VC1 = -3.5 V VC2 = -4 V
VC1 = -3 V VC2 = -4 V
VC1 = -2.5 V VC2 =-4 V
VC1 = -2 V VC2 = -4 V
VC1 = -1.5 V VC2 = -4 V
VC1 = -1 V VC2 = -4 V
VC1 = -0.5 V VC2 = -4 V
VC1 = 0 V VC2 = -4 V

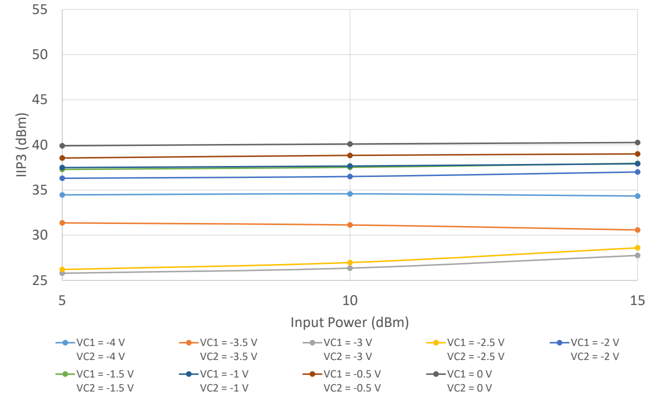

IIP3 vs. Input Power Over Control Voltages at 10 GHz
(Fixed VCTRL1)
IIP3 (dBm)
Input Power (dBm)
VC1 = 0 V VC2 = -4 V
VC1 = 0 V VC2 = -3.5 V
VC1 = 0 V VC2 = -3 V
VC1 = 0 V VC2 = -2.5 V
VC1 = 0 V VC2 = -2 V
VC1 = 0 V VC2 = -1.5 V
VC1 = 0 V VC2 = -1 V
VC1 = 0 V VC2 = -0.5 V
VC1 = 0 V VC2 = 0 V


IIP3 vs. Input Power Over Control Voltages at 10 GHz
(VCTRL1 = VCTRL2)
IIP3 (dBm)
Input Power (dBm)
VC1 = -4 V VC2 = -4 V
VC1 = -3.5 V VC2 = -3.5 V
VC1 = -3 V VC2 = -3 V
VC1 = -2.5 V VC2 = -2.5 V
VC1 = -2 V VC2 = -2 V
VC1 = -1.5 V VC2 = -1.5 V
VC1 = -1 V VC2 = -1 V
VC1 = -0.5 V VC2 = -0.5 V
VC1 = 0 V VC2 = 0 V

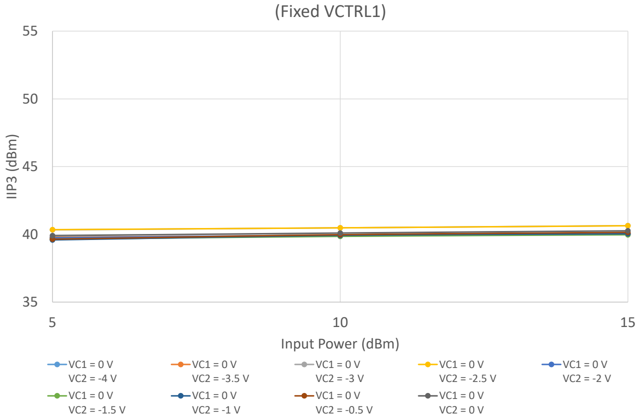
IIP3 vs. Input Power Over Control Voltages at 20 GHz
(Fixed VCTRL2)



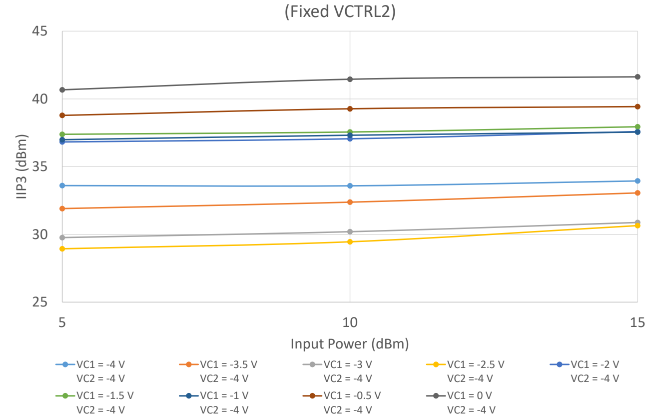
IIP3 vs. Input Power Over Control Voltages at 20 GHz
(VCTRL1 = VCTRL2)



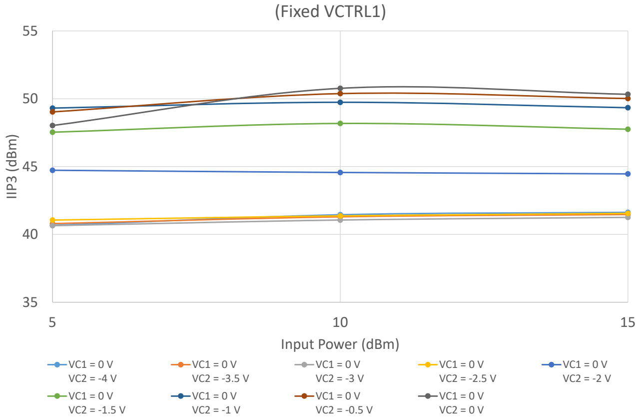
IIP3 vs. Input Power Over Control Voltages at 20 GHz
(Fixed VCTRL1)



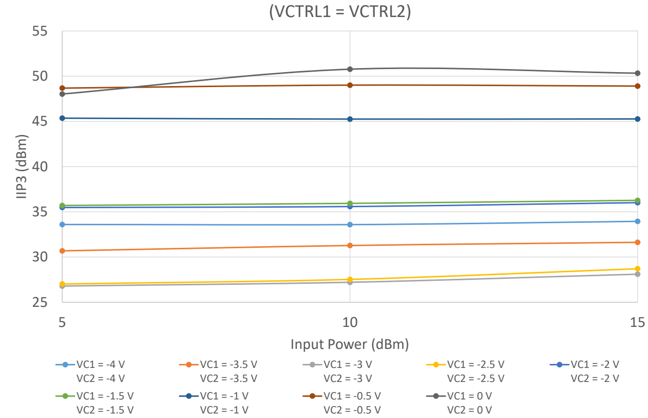
IIP3 vs. Input Power Over Control Voltages at 44 GHz
(Fixed VCTRL2)



IIP3 vs. Input Power Over Control Voltages at 44 GHz
(Fixed VCTRL1)



IIP3 vs. Input Power Over Control Voltages at 44 GHz
(VCTRL1 = VCTRL2)



ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS CLICK HERE

Performance Data	Data Table Swept Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	JV2579 Plastic package, exposed paddle, lead finish: Matte Tin
Tape & Reel **Standard quantities available on reel**	F104 7" reels with 20, 50, 100, 200, 500, 1K or 2K devices
Suggested Layout for PCB Design	PL-726
Evaluation Board	TB-PVA-453-34+ (without connectors), TB-PVA-453-34C+ (with connectors)
Environmental Ratings	ENV08T1

ESD RATING

Human Body Model (HBM): Class 1A (250 V to < 500 V) in accordance with ANSI/ESD STM 5.1 - 2001

MSL TEST FLOW CHART