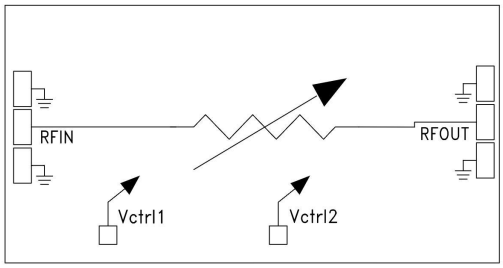
TFVCA2050
20~50 GHz GaAs MMIC Voltage-Controlled Attenuator

★1.Product Features

- Broad operating frequency: 20~50 GHz
- Excellent linearity:
  input third-order intercept point (IP3) typ. +32 dBm
- Large attenuation dynamic range: 35 dB
- Die size: 2.78 × 1.37 × 0.1 mm

Functional Block Diagram



★2.Product Introduction

TFVCA2050 is a 20~50 GHz GaAs MMIC voltage-controlled attenuator (VVA) designed to control the RF signal level with a 35 dB dynamic range using analog DC control voltages. The chip integrates two parallel attenuation units controlled by two analog control voltages, Vctrl1 and Vctrl2.

To achieve the optimal linearity performance: 1. Fix Vctrl2 at -3 V and vary the first-stage attenuation voltage Vctrl1 from -3 V to 0 V; 2. Then fix Vctrl1 at 0 V and vary the second-stage attenuation voltage Vctrl2 from -3 V to 0 V. Alternatively, the Vctrl1 and Vctrl2 pins can be shorted to use a single control voltage for the full analog attenuation range, at the cost of a slight degradation in input IP3.

Typical applications: automatic gain control (AGC) circuits, and temperature compensation for multi-gain-stage point-to-point microwave radio / VSAT transceivers.

- Point-to-point wireless communication
- VSAT (Very Small Aperture Terminal) satellite transceivers
- Test and measurement instruments
- Microwave sensors
- Electronic countermeasures and radar systems

★3.Electrical Characteristics(TA=+25℃)

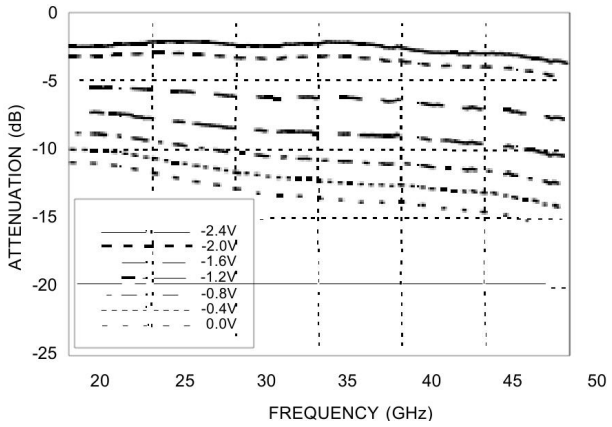
Parameter	Condition	Min	Typ	Max	Unit
Insertion Loss	20-27 GHz	—	3	3.5	dB
	27-35 GHz	—	3	4	dB
	35-50 GHz	—	3.5	4.5	dB
Attenuation Dynamic Range	20-27 GHz	25	30	—	dB
	27-35 GHz	30	35	—	dB
	35-50 GHz	35	40	—	dB
Input Return Loss	—	—	13	—	dB
Output Return Loss	—	—	13	—	dB

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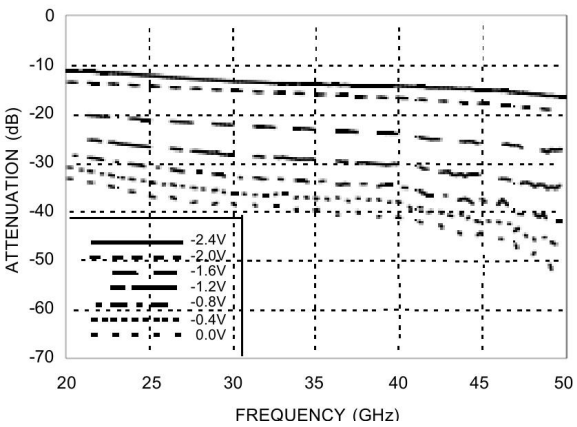
Parameter	Condition	Min	Typ	Max	Unit
Input Third-Order Intercept Point (IP3)	—	—	33	—	dBm

★4.Typical Test Curve

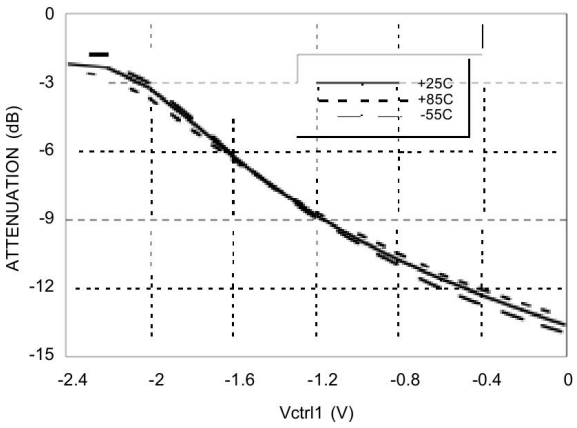
Attenuation vs. Frequency
(Vctrl1 variable, Vctrl2 = -3 V)



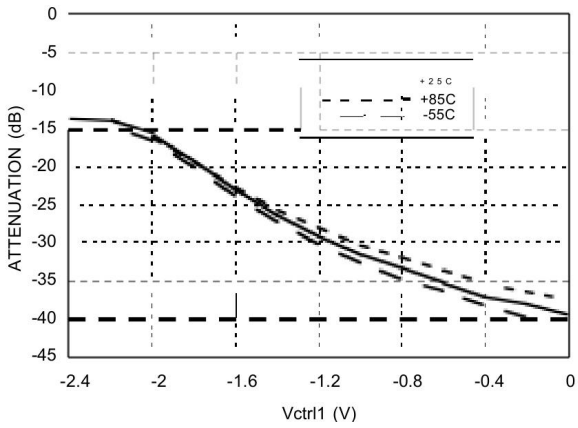
Attenuation vs. Frequency
(Vctrl1 = 0 V, Vctrl2 variable)



Attenuation vs. Vctrl1 at 30 GHz
(TA = -55℃/+25℃/+85℃, Vctrl2 = -3 V)

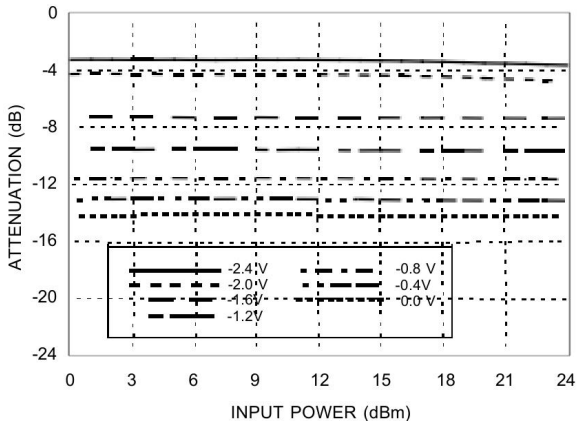


Attenuation vs. Vctrl2 at 30 GHz
(TA = -55℃/+25℃/+85℃, Vctrl1 = 0 V)

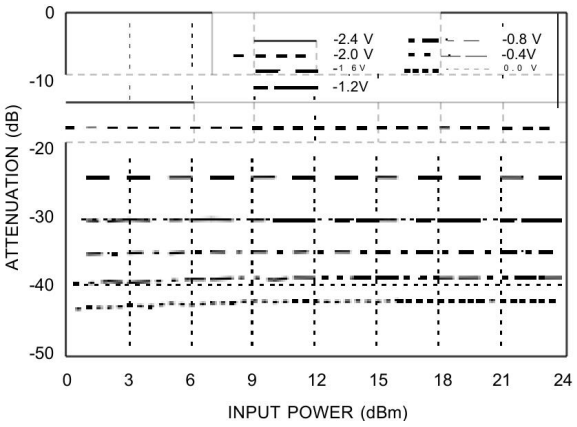


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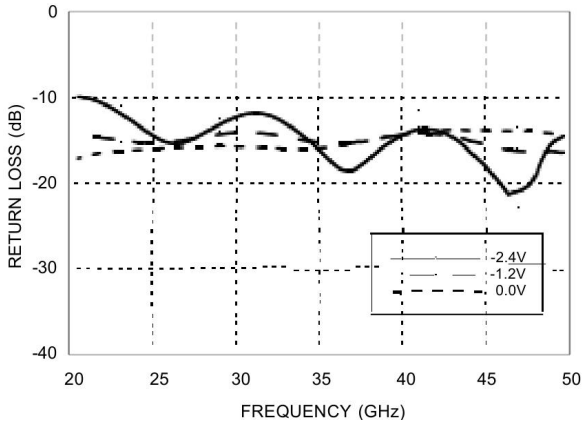
Attenuation vs. Input Power at 30 GHz
(Vctrl1 variable, Vctrl2 = -3 V)



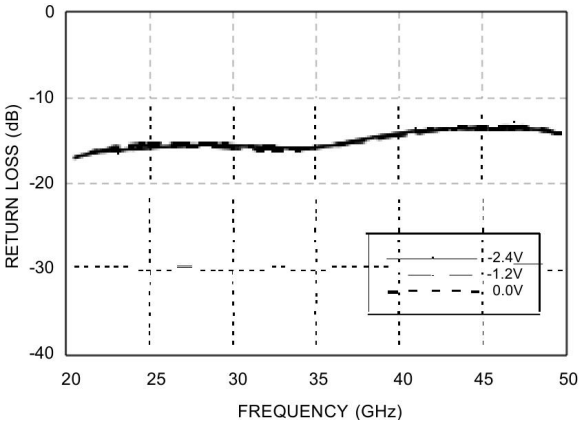
Attenuation vs. Input Power at 30 GHz
(Vctrl2 variable, Vctrl1 = 0 V)



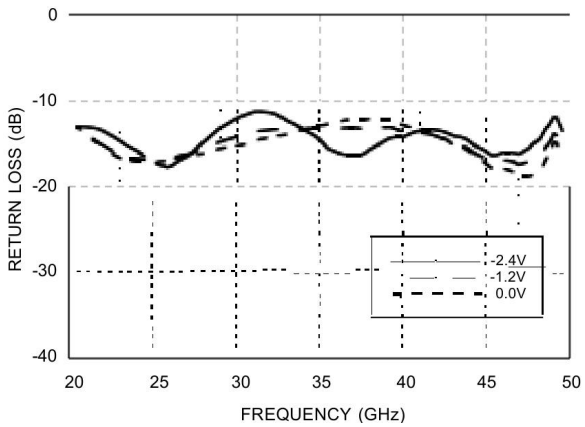
Input Return Loss vs. Frequency
(Vctrl1 variable, Vctrl2 = -3 V)



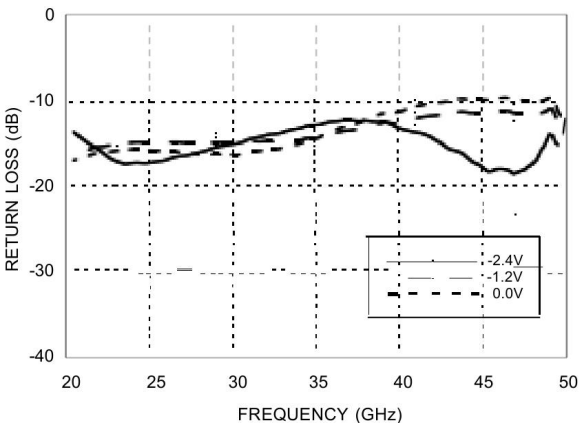
Input Return Loss vs. Frequency
(Vctrl1 = 0 V, Vctrl2 variable)



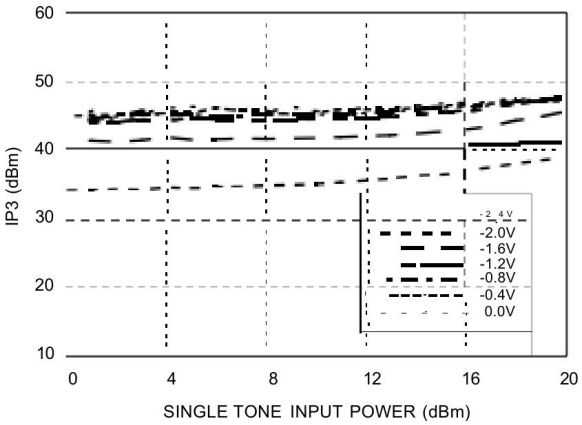
Output Return Loss vs. Frequency
(Vctrl1 variable, Vctrl2 = -3 V)



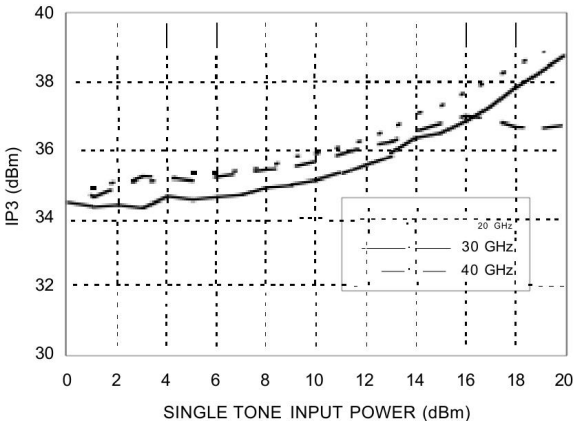
Output Return Loss vs. Frequency
(Vctrl1 = 0 V, Vctrl2 variable)



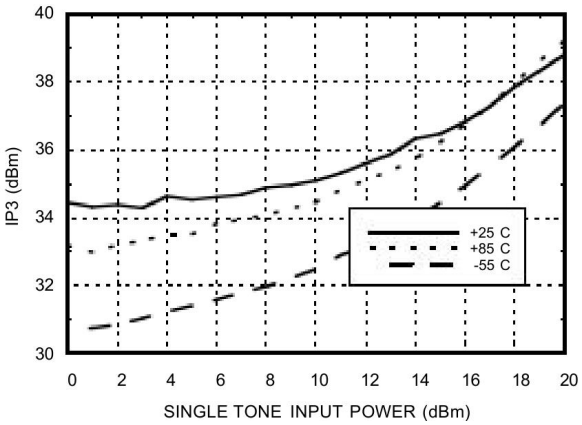
Input IP3 vs. Input Power at 30 GHz
(Vctrl1 variable, Vctrl2 = -3 V)



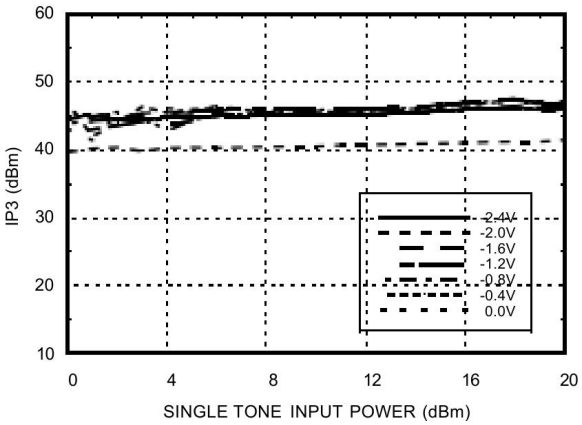
Input IP3 vs. Input Power over Frequency
(Vctrl1 = -2 V, Vctrl2 = -3 V)



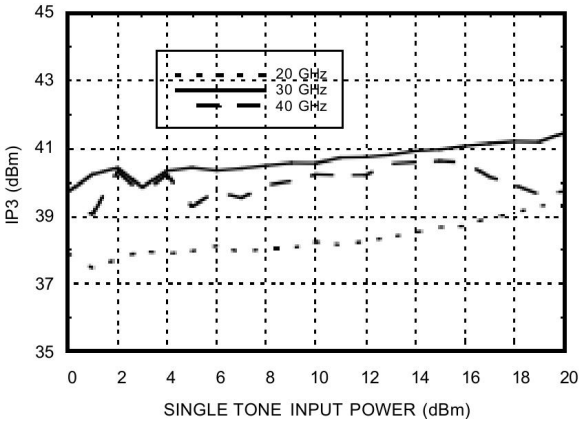
Input IP3 vs. Input Power at 30 GHz over
Temperature (TA = -55℃/+25℃/+85℃,
Vctrl1 = -2 V, Vctrl2 = -3 V)



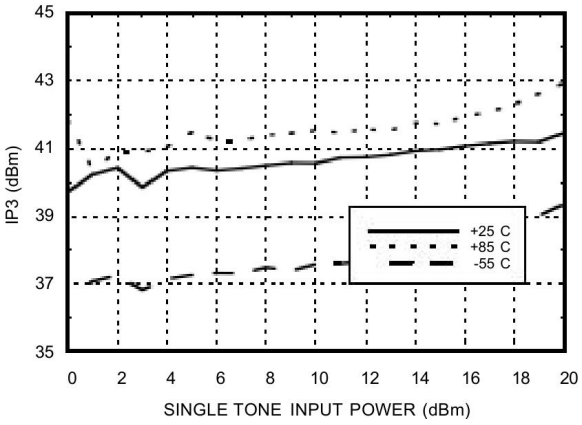
Input IP3 vs. Input Power at 30 GHz
(Vctrl1 = 0 V, Vctrl2 variable)



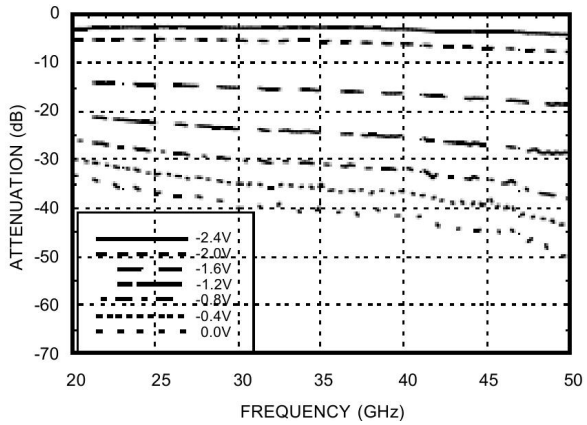
Input IP3 vs. Input Power over Frequency
(Vctrl1 = 0 V, Vctrl2 = -2 V)



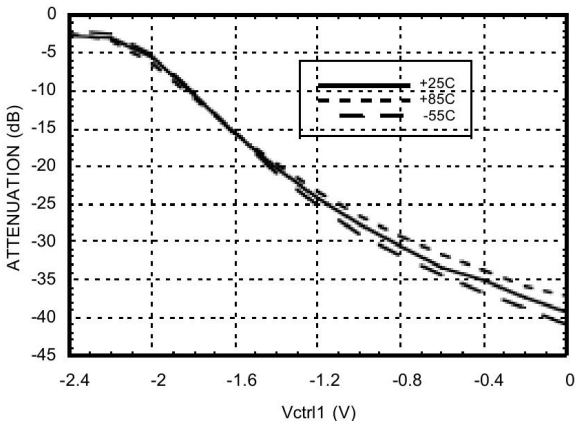
Input IP3 vs. Input Power at 30 GHz over
Temperature (TA = -55℃/+25℃/+85℃,
Vctrl1 = 0 V, Vctrl2 = -2 V)



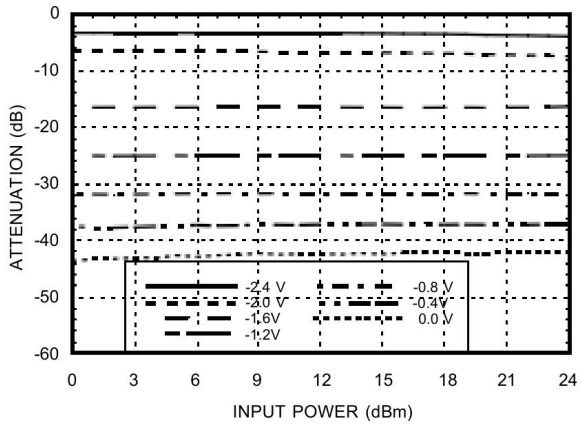
Attenuation vs. Frequency (Vctrl1 = Vctrl2 shorted)



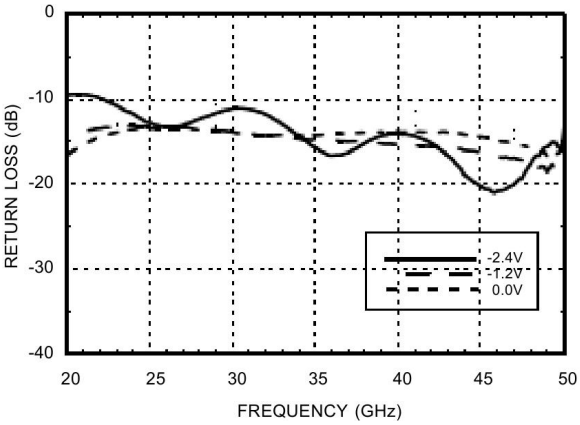
Attenuation vs. Control Voltage at 35 GHz over Temperature (TA = -55℃/+25℃/+85℃, Vctrl1 = Vctrl2)



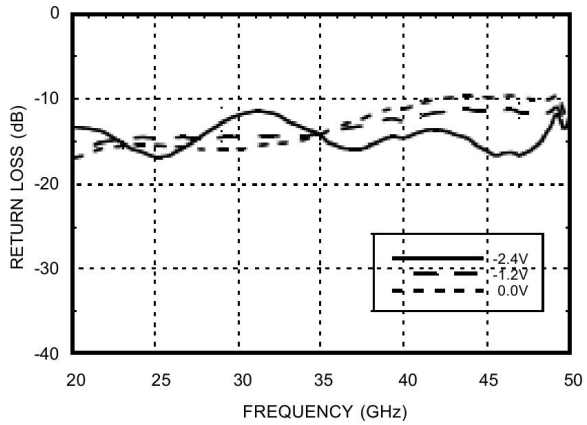
Attenuation vs. Input Power at 30 GHz (Vctrl1 = Vctrl2 shorted)



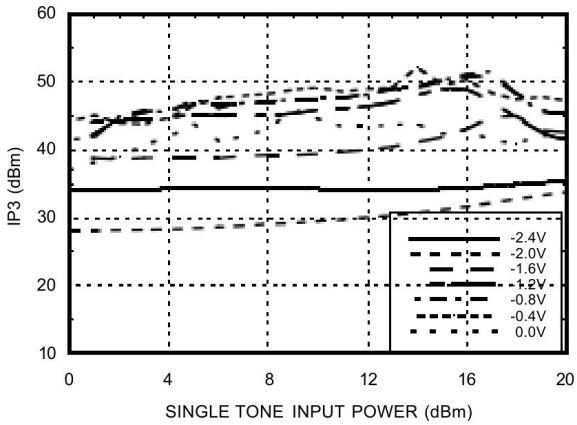
Input Return Loss vs. Frequency (Vctrl1 = Vctrl2 shorted)



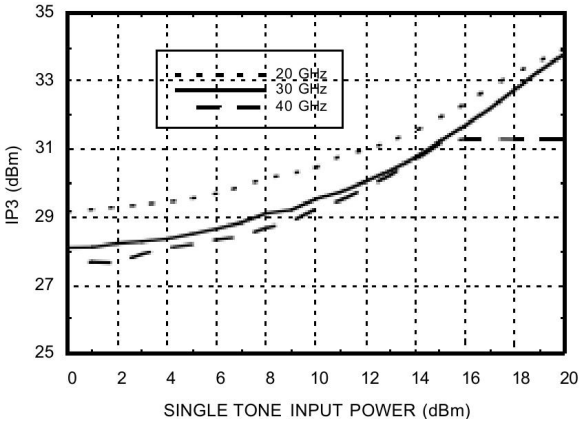
Output Return Loss vs. Frequency (Vctrl1 = Vctrl2 shorted)



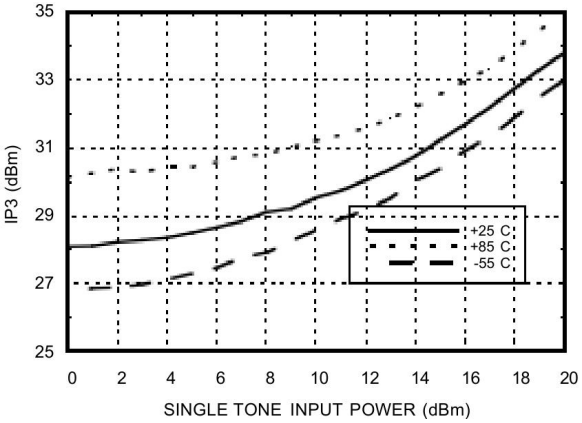
Input IP3 vs. Input Power at 30 GHz (Vctrl1 = Vctrl2 shorted)



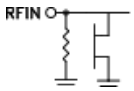
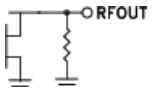
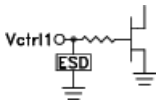
Input IP3 vs. Input Power over Frequency
(Vctrl1 = Vctrl2 shorted)



Input IP3 vs. Input Power at 30 GHz over Temperature (TA = -55℃/+25℃/+85℃, Vctrl1 = Vctrl2 shorted)



★5.Bond Pad Definition

Pad Number	Function	Description	Schematic
1	RFin	RF input, DC-coupled and matched to 50 Ω	
2	RFout	RF output, DC-coupled and matched to 50 Ω	
3	Vctrl2	Control voltage 2	
4	Vctrl1	Control voltage 1	
Die backside	GND	The chip backside must be connected to RF/DC ground	

★6.Suggested Assembly Drawing

