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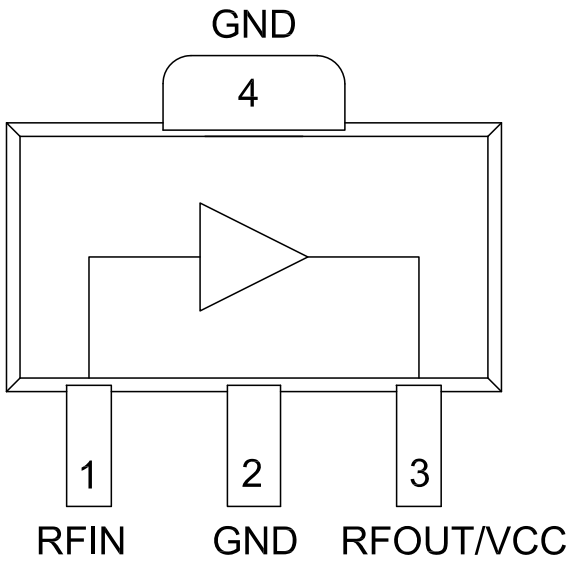
RFGA2054

InGaP HBT MMIC AMPLIFIER
50MHz TO 3000MHz

Package: SOT-89





Functional Block Diagram

Features

- Low Cost
- Broadband Gain
- Internally Matched
- Internal Active Bias
- No Dropping Resistor
- Single Supply 5V Operation
- HBM ESD Level >1000V

Applications

- PA Driver Amplifier
- LO Buffer Amplifier
- Cellular, PCS, GSM, UMTS, LTE, TD-SCDMA
- Wideband Instrumentation
- Wireless Data, Satellite Terminals

Product Description

The RFGA2054 is a high performance InGaP HBT MMIC amplifier. The RFGA2054's internal active bias circuitry allows the amplifier to operate directly from a 5V supply and provides stable current over temperature and process Beta variation. This Darlington amplifier is internally matched to 50Ω making it ideal for applications requiring small footprints and minimal external components.

Ordering Information

RFGA2054SR	7” Sample reel with 100 pieces
RFGA2054SQ	Sample bag with 25 pieces
RFGA2054TR7	7” Reel with 750 pieces
RFGA2054TR13	13” Reel with 2500 pieces
RFGA2054PCK-410	500MHz to 3000MHz PCBA with 5-piece sample bag

Optimum Technology Matching® Applied

☐ GaAs HBT	☐ SiGe BiCMOS	☐ GaAs pHEMT	☐ GaN HEMT
☐ GaAs MESFET	☐ Si BiCMOS	☐ Si CMOS	☐ BiFET HBT
☑ InGaP HBT	☐ SiGe HBT	☐ Si BJT	☐ LDMOS

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage (V_{CC})	6.0	V
Device Current (I_{CC})	130	mA
CW Input Power, 50Ω Output VSWR	15	dBm
CW Input Power, 10:1 Output VSWR	10	dBm
Operating Junction Temperature (T_J)	150	°C
Operating Temperature Range (T_L)	-40 to +85	°C
Storage Temperature	-55 to +150	°C
ESD Rating - Human Body Model	1C (1000V)	
Moisture Sensitivity Level	MSL-2	

NOTES: 1. The maximum rating must all be met simultaneously.
2. $P_{DISS} = P_{DC} + P_{RFIN} - P_{RFOUT}$.
3. $T_J = T_L + P_{DISS} * R_{TH}$.

Caution! ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

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RFMD Green: RoHS compliant per EU Directive 2002/95/EC, halogen free per IEC 61249-2-21, < 1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Linear Operation					Typical performance at 25 °C using the standard sample EVB with R2 = open. This design is for linear operation only.
Input Power (P_{IN})			3.0	dBm	Max recommended continuous input power, V_{CC} < 5.0V, Load VSWR < 2:1; R2 = open
Gain		20.3		dB	850MHz
	17.3	18.8	20.3	dB	2140MHz
		18.4		dB	2650MHz
OIP3		33.5		dBm	850MHz (0dBm/Tone, 1MHz spacing)
	28	30.5		dBm	2140MHz (0dBm/Tone, 1MHz spacing)
		29.0		dBm	2650MHz (0dBm/Tone, 1MHz spacing)
P1dB		20.3		dBm	850MHz
	18.5	20.0		dBm	2140MHz
		19.5		dBm	2650MHz
Input Return Loss		13		dB	2140MHz
Output Return Loss		13.5		dB	
Isolation		23		dB	
Noise Figure		3.6		dB	
Operating Current (Quiescent)		68	78	mA	At V_{CC} = 5.0V
Operating Voltage (V_{CC})		5.0	5.25	V	Max recommended voltage for continuous operation
Thermal Resistance (R_{TH})		135		°C/W	At quiescent current, no RF, V_{CC} = 5.0V
Saturated Operation					Typical performance at 25 °C using the input pull-down resistor (R2 = 5.1 KΩ) to lower quiescent current. See schematic following the "saturated operation plots".
Input Power (P_{IN})			10	dBm	Max. recommended continuous input power V_{CC} < 5.0V, Load VSWR < 2:1, R2 = 5.1 KΩ
Saturated Output Power		20		dBm	850MHz
		20.5		dBm	2140MHz
		20.7		dBm	2650MHz
Operating Current			90	mA	Max recommended current for continuous operation
Operating Voltage		5.0	5.25	V	Max recommended voltage for continuous operation

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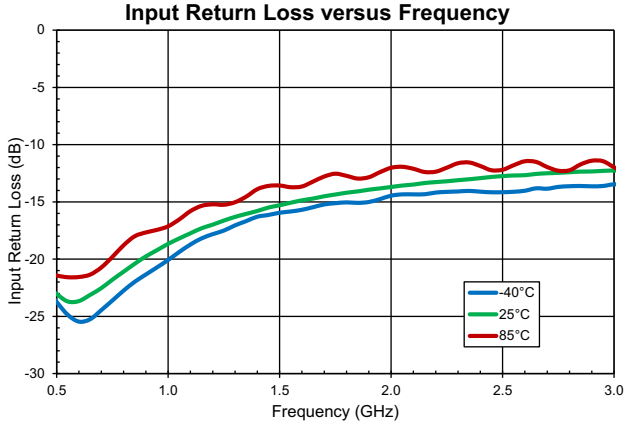
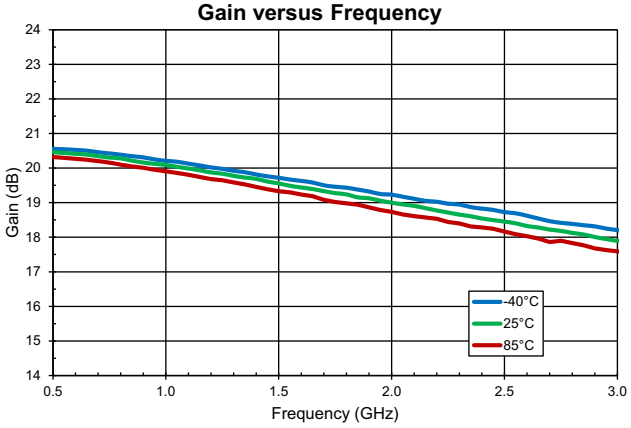
Typical Performance: 500MHz to 3000MHz Application Circuit

(Linear Operation, R2 = Open)

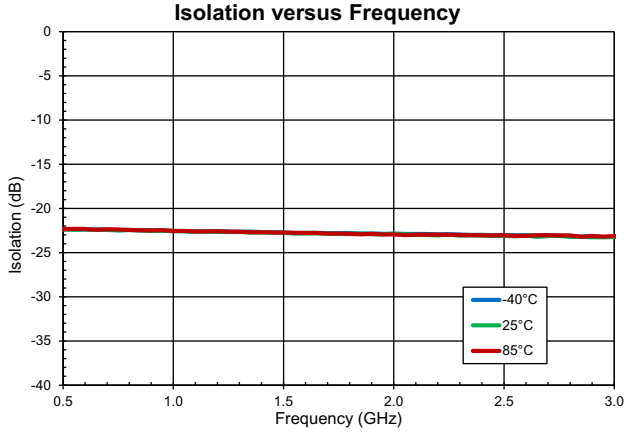
Input Return Loss versus Frequency



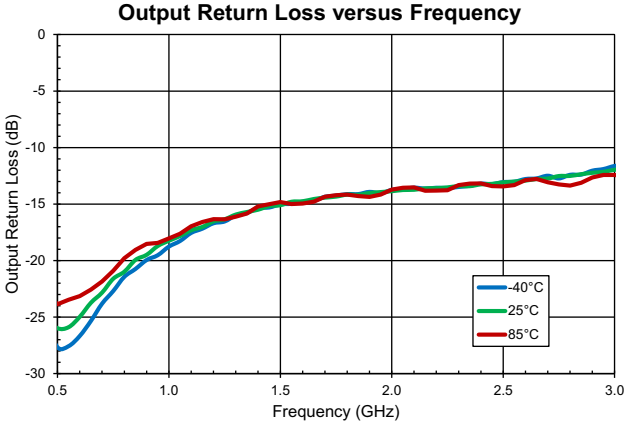
Gain versus Frequency



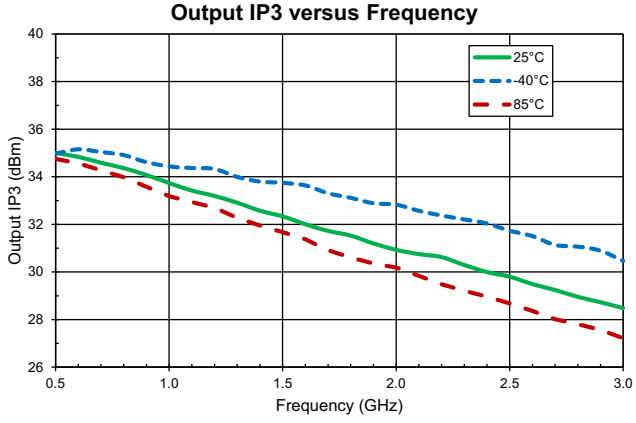
Isolation versus Frequency



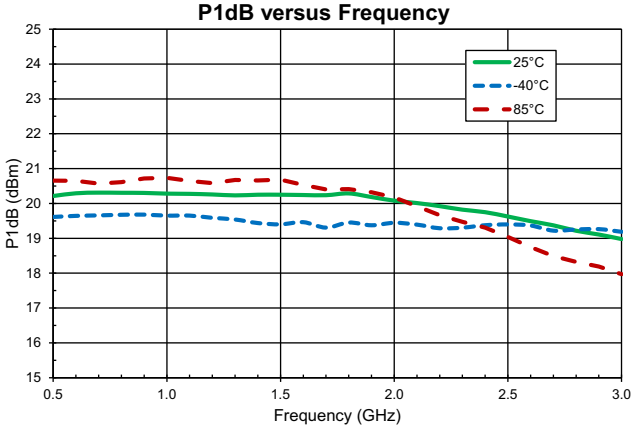
Output Return Loss versus Frequency



Output IP3 versus Frequency



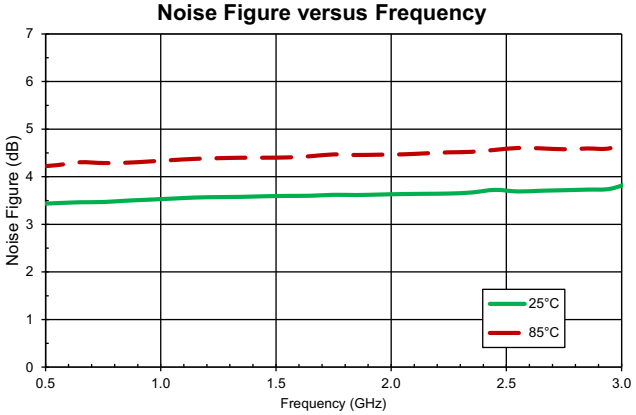
P1dB versus Frequency



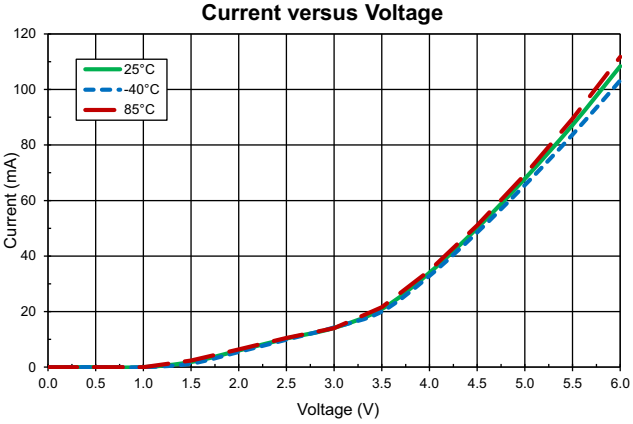
Typical Performance: 500MHz to 3000MHz Application Circuit

(Linear Operation, R2 = Open)

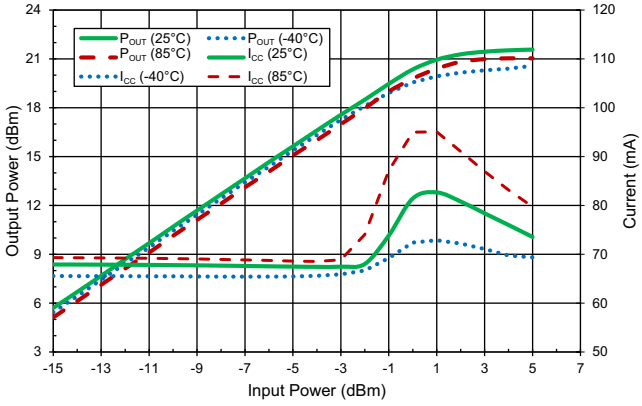
Noise Figure versus Frequency



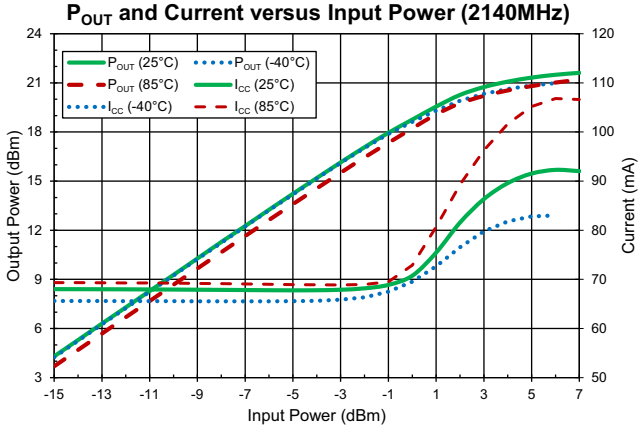
Current versus Voltage



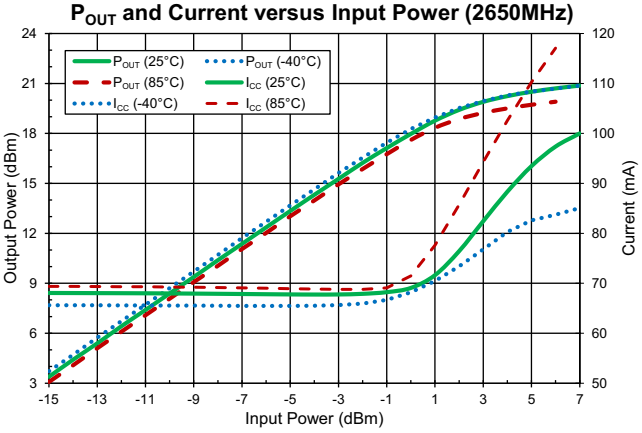
P_{OUT} and Current versus Input Power (850MHz)



P_{OUT} and Current versus Input Power (2140MHz)

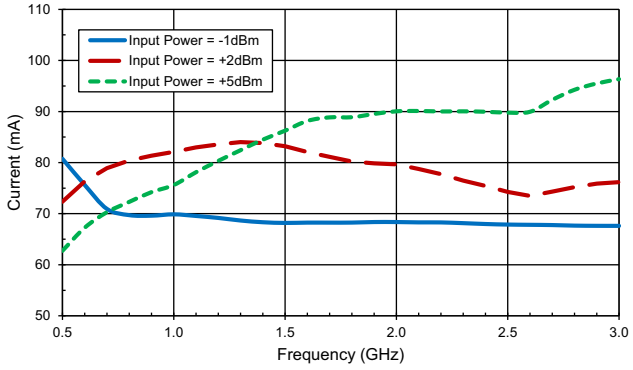


P_{OUT} and Current versus Input Power (2650MHz)



Large Signal Current versus Frequency

(25°C, 50Ω)



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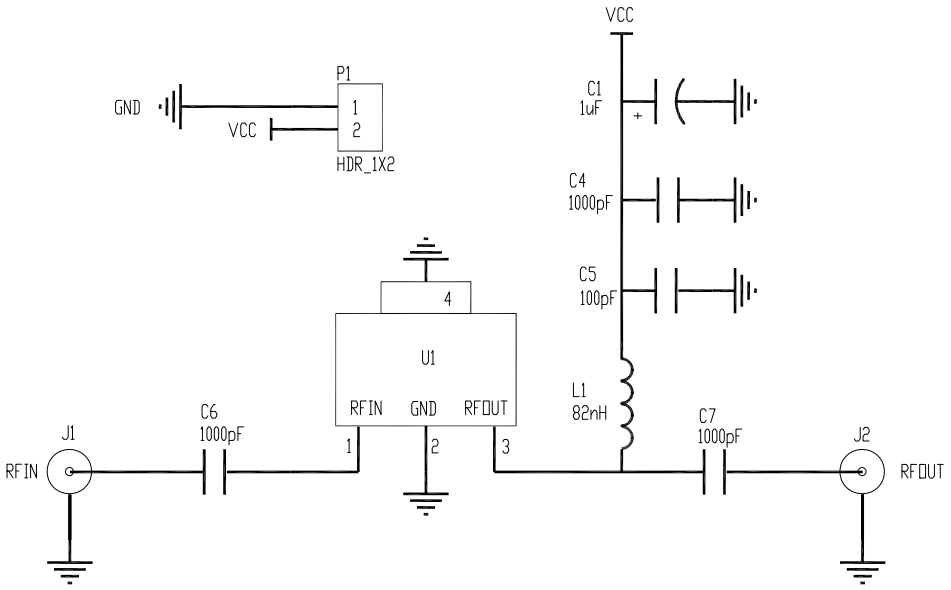
Evaluation Board Schematic

500MHz to 3000MHz Application Circuit for Linear Operation

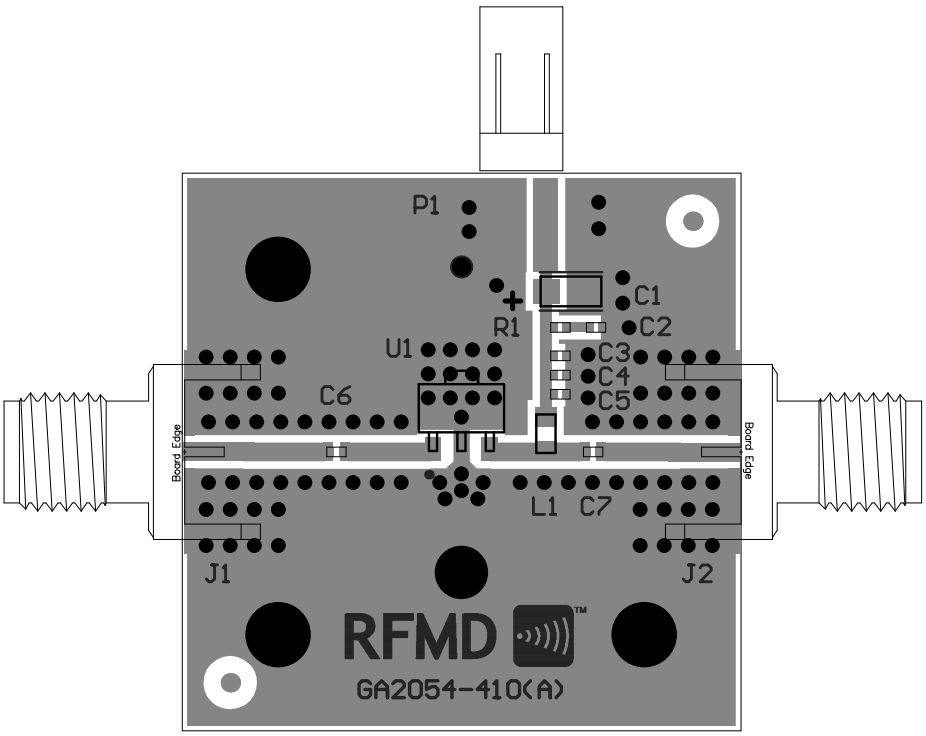


Evaluation Board Bill of Materials (BOM)

500MHz to 3000MHz Application Circuit

Description	Reference Designator	Manufacturer	Manufacturer's P/N
GA2054 Evaluation Board			GA2054-410(A)
CAP, 1μF, 20%, 25V, TANT-A	C1	AVX Corporation	TAJA105M025
CAP, 1000pF, 10%, 50V, X7R, 0402	C4, C6, C7	Taiyo Yuden (USA), Inc.	RM UMK105BJ102KV-F
CAP, 100pF, 5%, 50V, C0G, 0402	C5	Taiyo Yuden (USA), Inc.	RM UMK105CG101JV-F
IND, 82nH, 10%, W/W, 0805	L1	Coilcraft, Inc.	0805CS-820XKBC
CONN, SMA, END LNCH, FLT, 0.062"	J1-J2	Johnson Components, Inc.	142-0701-821
CONN, HDR, ST, PLRZD, 2-PIN, 0.100"	P1	ITW Pancon	MPSS100-2-C
InGaP Darlington HBT Gain Block	U1	RFMD	GA2054
Do Not Place	C2-C3, R1-R2		

Evaluation Board Assembly Drawing



NOTE: R2 not shown. For saturated operation mount R2 shunt to GND between C6 and Pin 1.

Pin Names and Descriptions

Pin	Name	Description
1	RF IN	RF Input. External DC block is required.
2	GND	DC and RF Ground
3	RF OUT/VCC	RF Output, Device Collector
4	GND	DC and RF Ground. Must be soldered to EVB ground plane over a bed of vias for thermal and RF performance.

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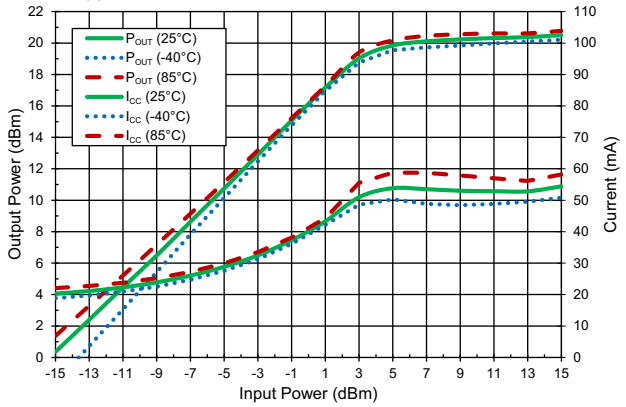
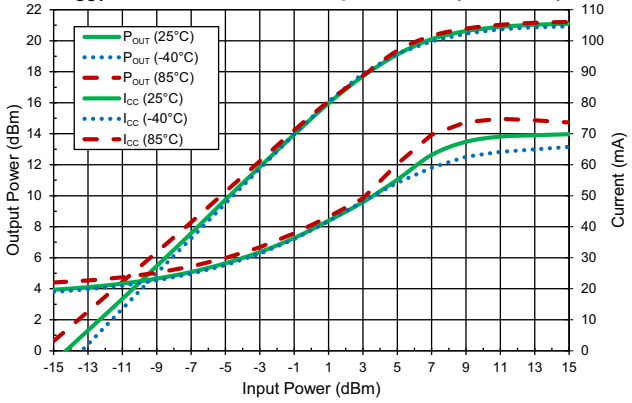
Typical Performance under Saturated Operation, R2 = 5.1 KΩ

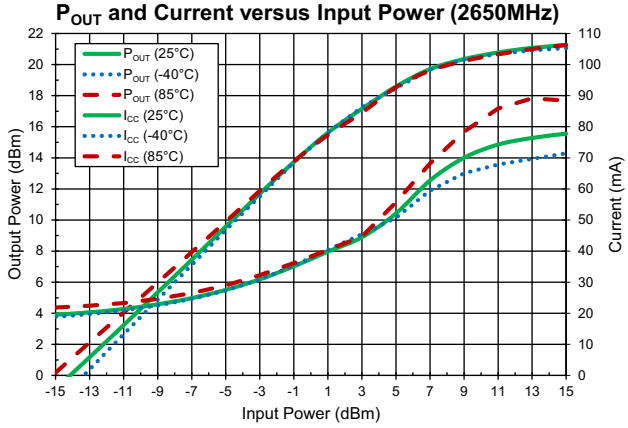
P_{OUT} and Current versus Input Power (850MHz)



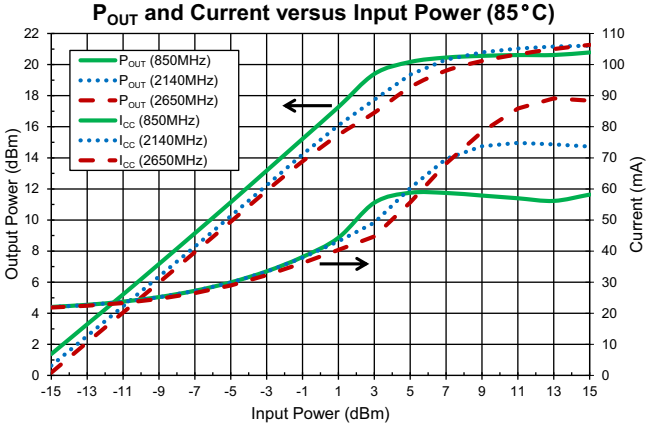
P_{OUT} and Current versus Input Power (2140MHz)



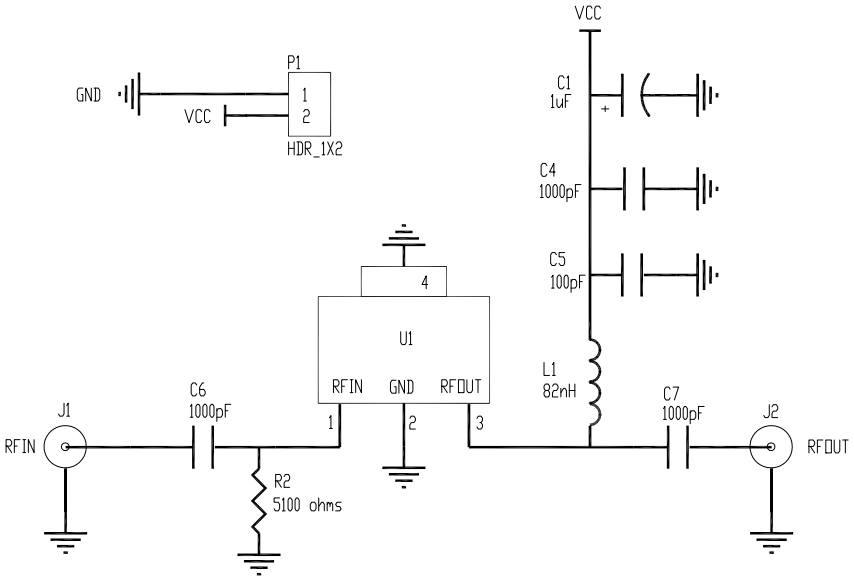
P_{OUT} and Current versus Input Power (2650MHz)



P_{OUT} and Current versus Input Power (85°C)

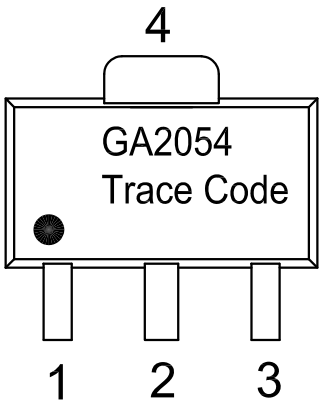


Evaluation Board Schematic for Saturated Operation



Branding Diagram

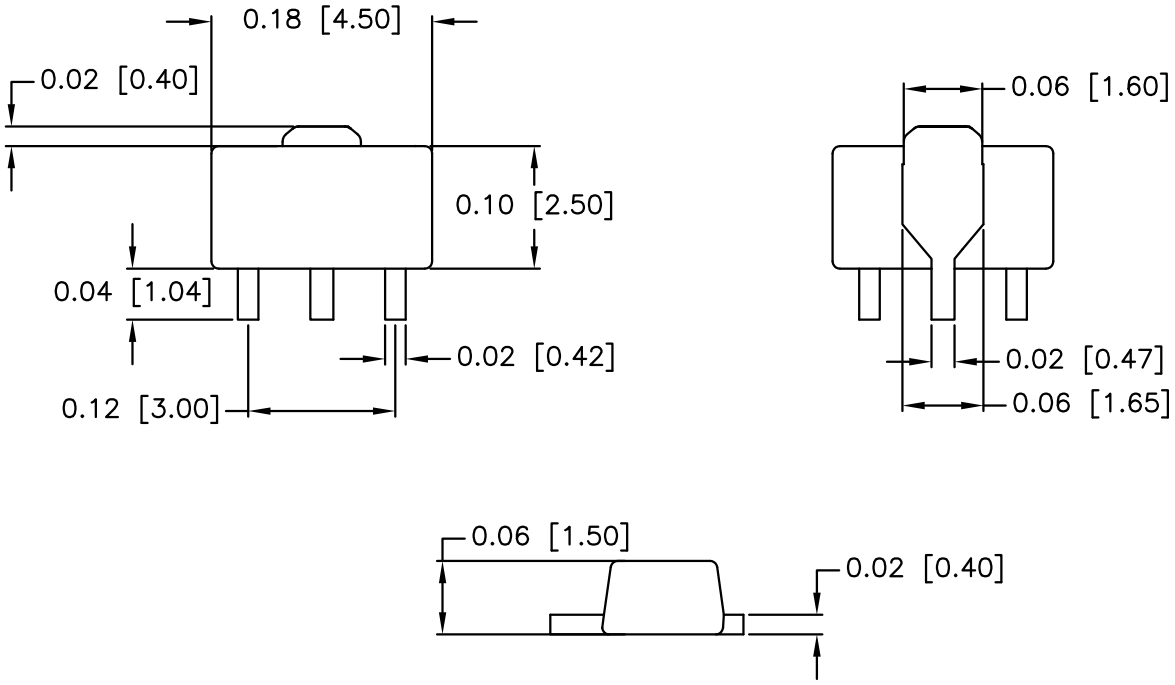
Trace Code to be assigned by the assembly SubCon.



Package Drawing

Dimensions in millimeters [inches]

Refer to drawing posted at www.rfmd.com for tolerances.



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