SZM-3066Z

3.3GHz to 3.8GHz 2W POWER AMPLIFIER

rfmd.com

Package: QFN, 6mmx6mm

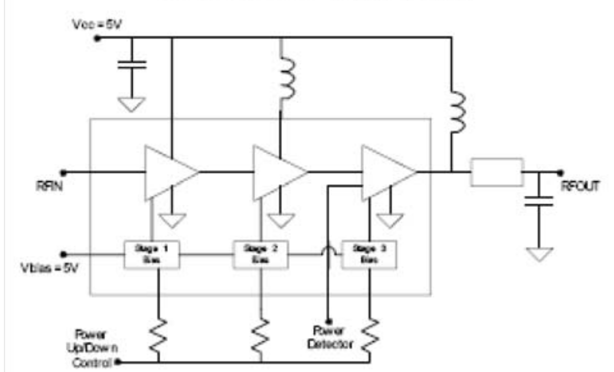
Product Description

RFMD's SZM-3066Z is a high linearity class AB Heterojunction Bipolar Transistor (HBT) amplifier housed in a low-cost surface-mountable plastic Q-FlexN multi-chip module package. This HBT amplifier is made with InGaP on GaAs device technology and fabricated with MOCVD for an ideal combination of low cost and high reliability. This product is specifically designed as a final or driver stage for 802.16 equipment in the 3.3GHz to 3.8GHz bands. It can run from a 3V to 6V supply. The external output match and bias adjustability allows load line optimization for other applications or over narrower bands. It features an output power detector, on/off power control and high RF overdrive robustness. A 20dB step attenuator feature can be utilized by switching the second stage Power up/down control. This product features a RoHS compliant and Green package with matte tin finish, designated by the 'Z' suffix.

Optimum Technology Matching® Applied

- [ ] GaAs HBT
- [ ] GaAs MESFET
- [x] InGaP HBT
- [ ] SiGe BiCMOS
- [ ] Si BiCMOS
- [ ] SiGe HBT
- [ ] GaAs pHEMT
- [ ] Si CMOS
- [ ] Si BJT
- [ ] GaN HEMT
- [ ] RF MEMS

Functional Block Diagram



Features

- P_{1dB}=33.5dBm at 5V
- Three Stages of Gain: 34dB
- 802.11g 54Mb/s Class AB Performance
- P_{OUT}=26dBm at 2.5% EVM, V_{CC} 5V, 730mA
- Active Bias with Adjustable Current
- On-Chip Output Power Detector
- Low Thermal Resistance
- Power Up/Down Control <1µs
- Attenuator Step 20dB at V_{PC2}=0V
- Class 1C ESD Rating

Applications

- 802.16 WiMAX Driver or Output Stage
- Fixed Wireless, WLL

Parameter	Specification Min.	Specification Typ.	Specification Max.	Unit	Condition
Frequency of Operation	3300		3800	MHz	
Output Power at 1dB Compression		33.5		dBm	3.5GHz
Gain	32.5	34.0		dBm	@ P_{OUT}=26dBm-3.5GHz
Output power		26.0		dBm	@ 2.5% EVM 802.11g 54Mb/s - 3.5GHz
Third Order Suppression		-38.0	-33.0	dBc	P_{OUT}=23dBm per tone - 3.5GHz
Noise Figure		5.0		dB	@ 3.6GHz
Worst Case Input Return Loss	11.0	14.0		dB	3.3GHz to 3.8GHz
Worst Case Output Return Loss	6.0	9.0		dB	3.3GHz to 3.8GHz
Supply voltage range	3.0	5.0	6.0	V	
Output Voltage Range		0.9 to 2.2		V	for P_{OUT}=10dBm to 30dBm
Quiescent Current	540	600	660	mA	V_{CC}=5V
Power Up Control Current		5.0		mA	V_{PC}=5V, $I_{VPC1}+I_{VPC2}+I_{VPC3}$
VCC Leakage Current			0.1	mA	V_{CC}=5V, V_{PC}=0V
Thermal Resistance		12.0		°C/W	junction - lead

Test Conditions: 3.3GHz to 3.8GHz App circuit, Z_0=50Ω, V_{CC}=5V, I_Q=600mA, T_{BP}=30°C

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Absolute Maximum Ratings

Parameter	Rating	Unit
VC3 Collector Bias Current (I_{VC3})	1500	mA
VC2 Collector Bias Current (I_{VC2})	600	mA
VC1 Collector Bias Current (I_{VC1})	300	mA
*Device Voltage (V_D)	9.0	V
Power Dissipation	6	W
**Max RF output Power for 50Ω continuous long term operation	30	dBm
Max RF Input Power for 10:1 VSWR output load	5	dBm
Storage Temperature Range	-40 to +150	°C
Operating Temp Range (T_L)	-40 to +85	°C
ESD Rating - Human Body Model	1000	V

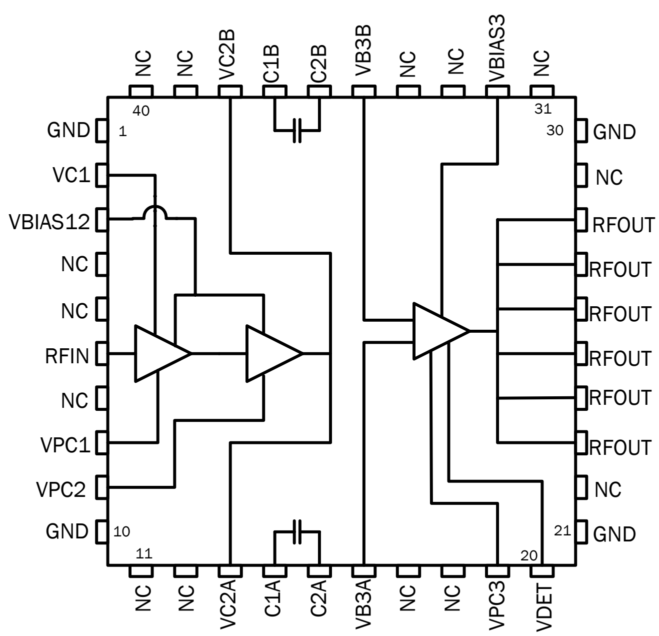
*Note: No RF Drive
**Note: With specified application circuit
Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation, the device voltage and current must not exceed the maximum operating values specified in the table on page one.
Bias Conditions should also satisfy the following expression:
$I_D V_D < (T_J - T_L) / R_{TH,\ j-l}$

Caution! ESD sensitive device.

Typical Performance 3.3Ghz to 3.8GHz App Circuit (V_{CC}=5V, I_{CQ}=600mA, 802.11g 54mb/s 64QAM)

Parameter	Units	3.3GHz	3.4Ghz	3.5GHz	3.6GHz	3.7GHz	3.8GHz
Gain @ P_{OUT}=26dBm	dB	35.2	35.2	35.2	34.5	32.8	30.0
P1dB	dBm	34.4	34.3	34.3	34.1	33.9	33.0
P_{OUT} @ 2.5% EVM	dBm	26.5	26.5	26.5	26.5	26.0	26.0
Current @P_{OUT} 2.5% EVM	mA	769	769	752	750	750	720
Input Return Loss	dB	14	17	19	21	19	16
Output Return Loss	dB	10.0	10.5	10.0	9.0	9.0	8.0
Step Attenuation (V_{PC2}=0V)	dB	23.0	22.0	22.0	21.0	18.0	15.0

Simplified Device Schematic



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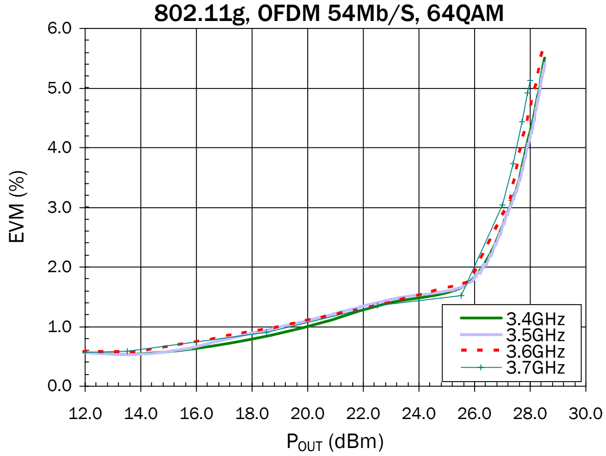
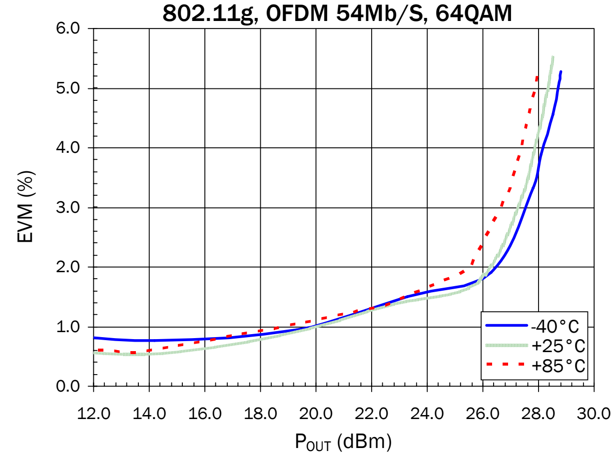
Measured 3.3GHz to 3.8GHz Application Circuit Data ($V_{CC}=V_{PC}=5.0V$ $I_Q=600mA$, $T=25°C$)

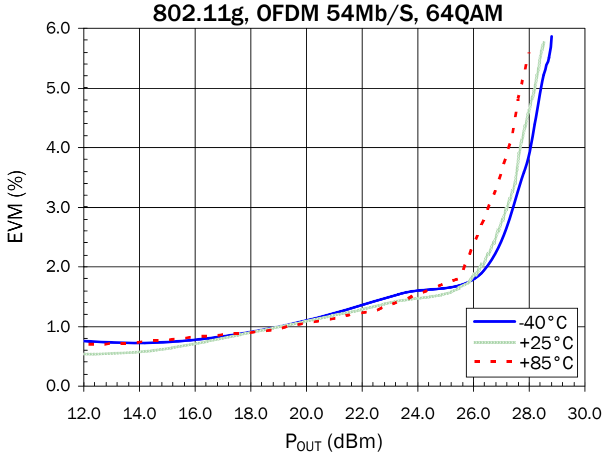
EVM versus P_{OUT} T=+25°C
802.11g, OFDM 54Mb/S, 64QAM



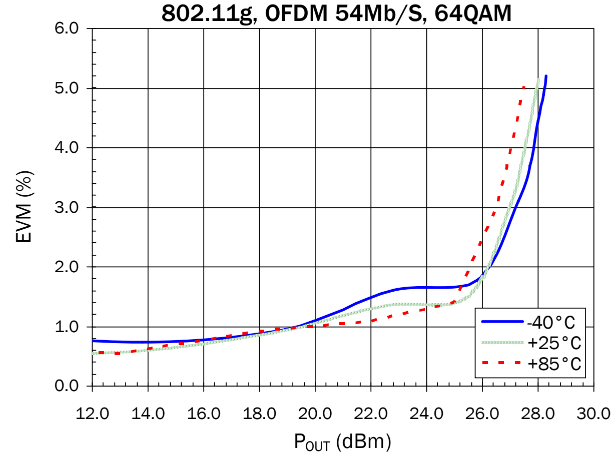
EVM versus P_{OUT} F=3.4GHz
802.11g, OFDM 54Mb/S, 64QAM



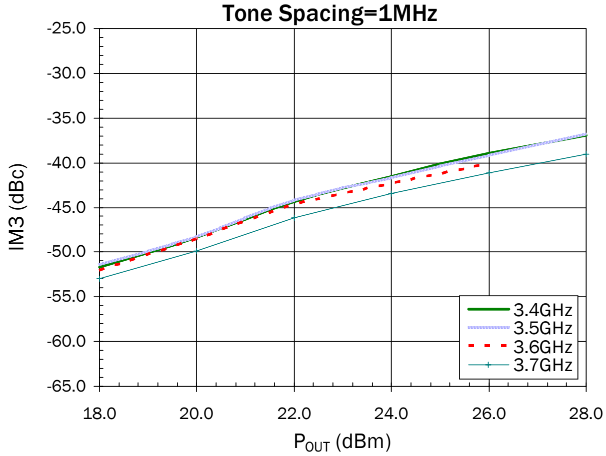
EVM versus P_{OUT} F=3.6GHz
802.11g, OFDM 54Mb/S, 64QAM



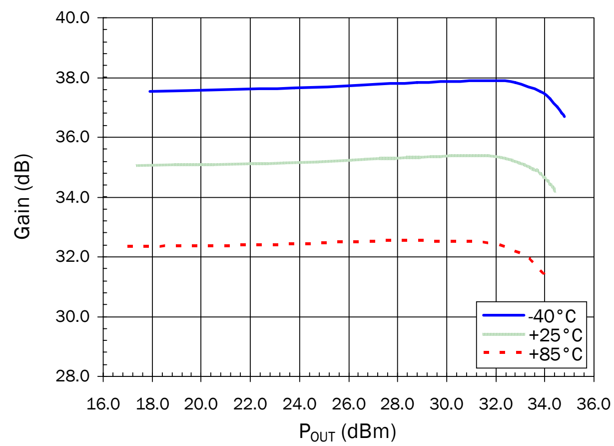
EVM versus P_{OUT} F=3.7GHz
802.11g, OFDM 54Mb/S, 64QAM



IM3 versus P_{OUT} (2 Tone Avg.), T=+25°C
Tone Spacing=1MHz



Typical Gain versus P_{OUT}, F=3.4GHz



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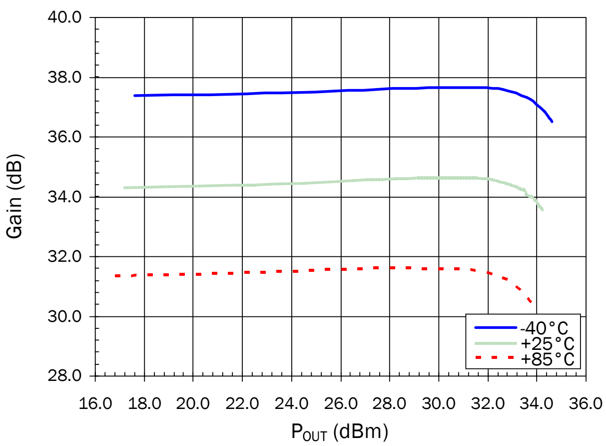
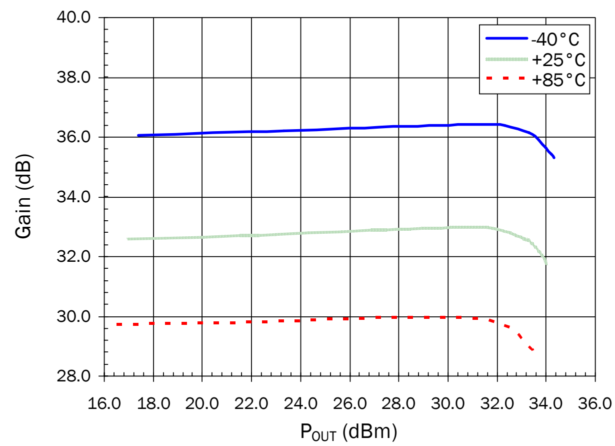
Measured 3.3GHz to 3.8GHz Application Circuit Data (V_{CC}=V_{PC}=5.0V I_Q=600mA, T=25°C)

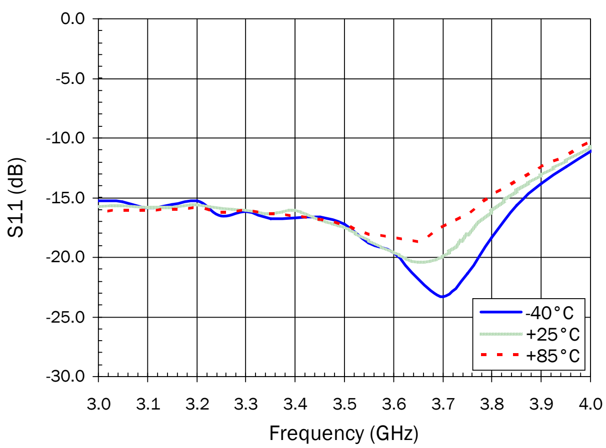
Typical Gain versus P_{OUT}, F=3.6GHz



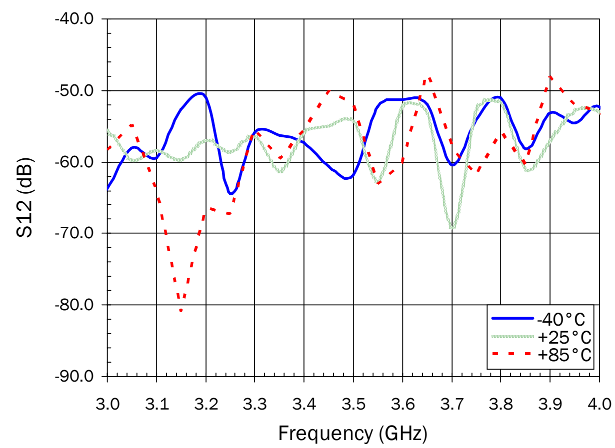
Typical Gain versus P_{OUT}, F=3.7GHz



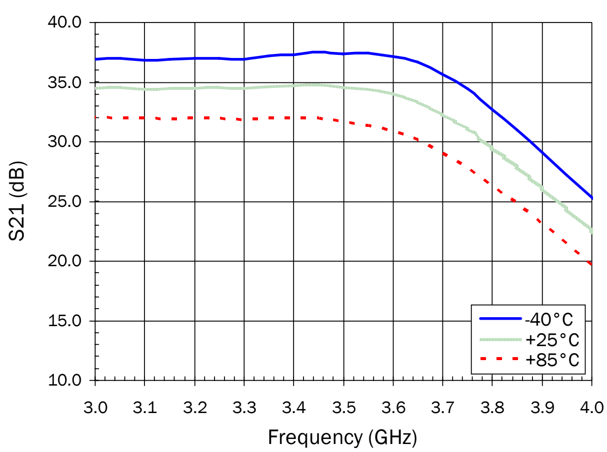
Narrowband S11 - Input Return Loss



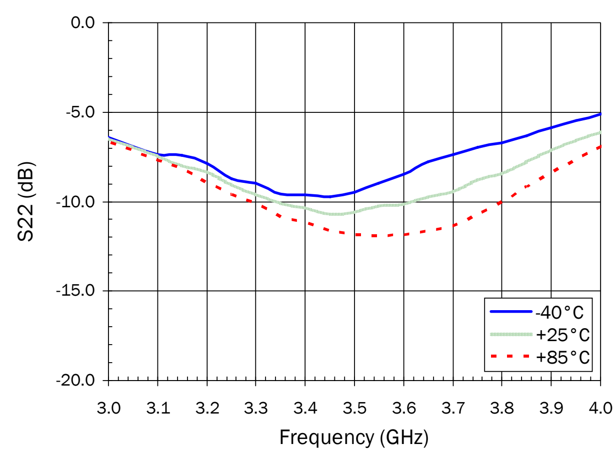
Narrowband S12 - Reverse Isolation



Narrowband S21 - Forward Gain



Narrowband S22 - Output Return Loss



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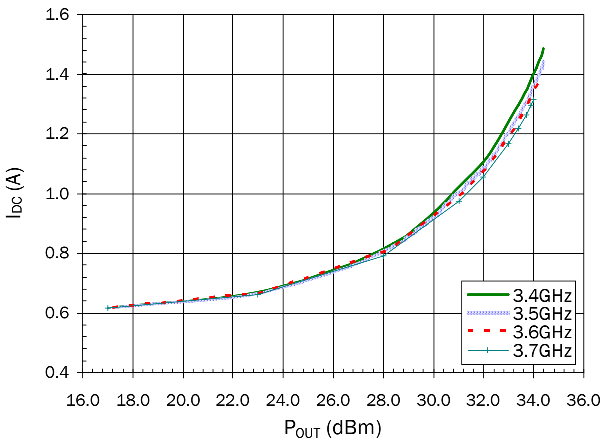
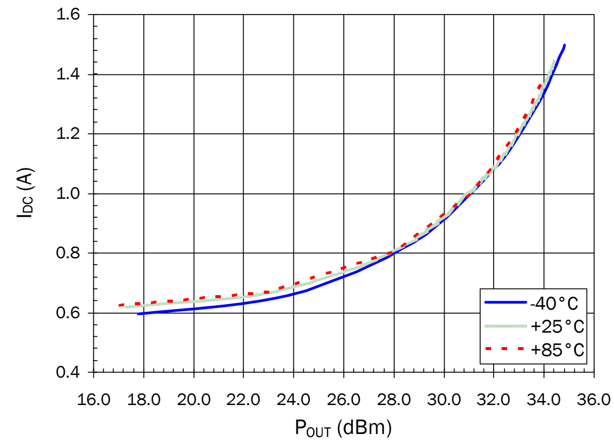
Measured 3.3GHz to 3.8GHz Application Circuit Data ($V_{CC}=V_{PC}=5.0V$ $I_Q=600mA$, $T=25°C$)

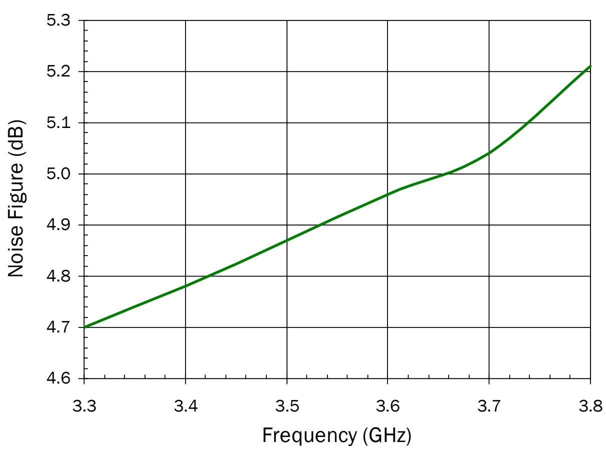
DC Supply Current versus P_{OUT}, T=25°C



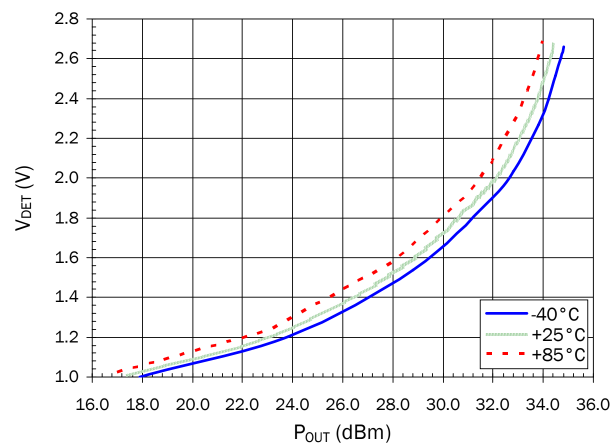
DC Supply Current versus P_{OUT}, F=3.5GHz



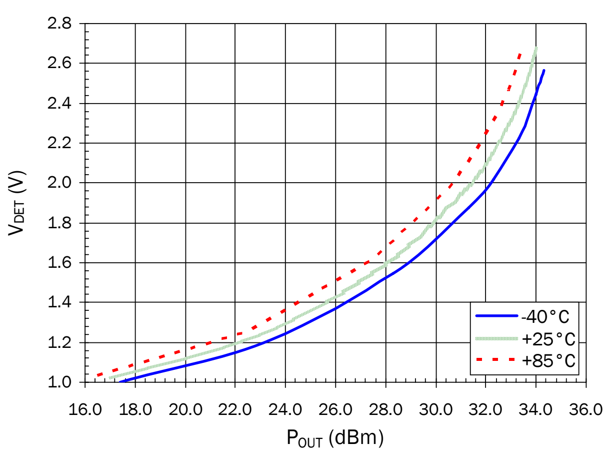
Noise Figure versus Frequency, T=+25°C



RF Power Detector (V_{DET}) versus P_{OUT}, F=3.4GHz

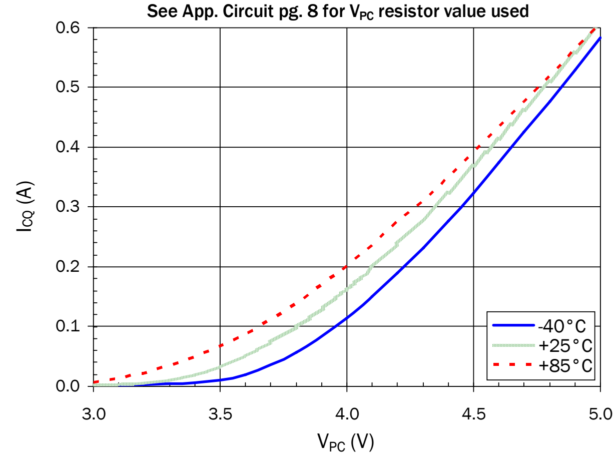


RF Power Detector (V_{DET}) versus P_{OUT}, F=3.7GHz



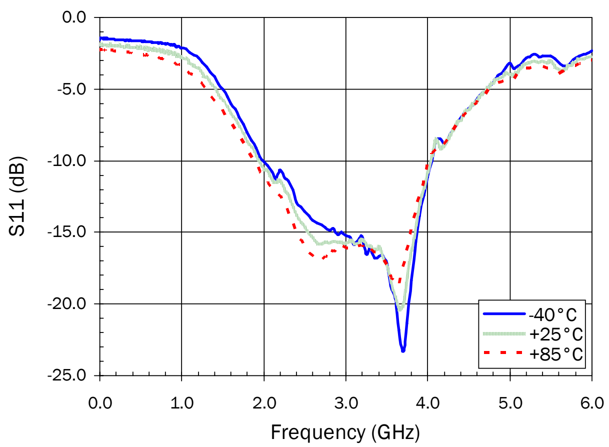
I_{CQ} versus V_{PC}, V_{CC}=5V, Swept V_{PC}

See App. Circuit pg. 8 for V_{PC} resistor value used

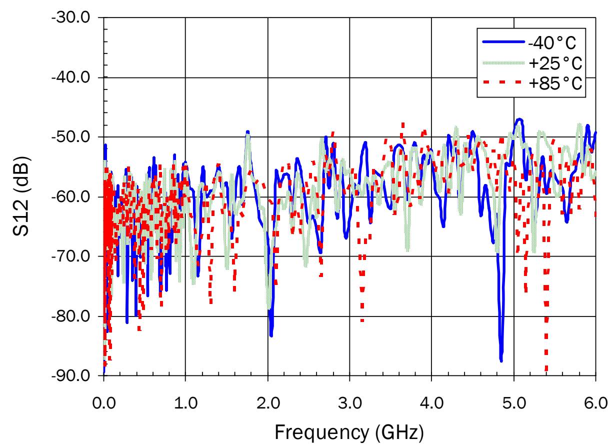


Measured 3.3GHz to 3.8GHz Application Circuit Data (V_{CC}=V_{PC}=5.0V I_Q=600mA, T=25°C)

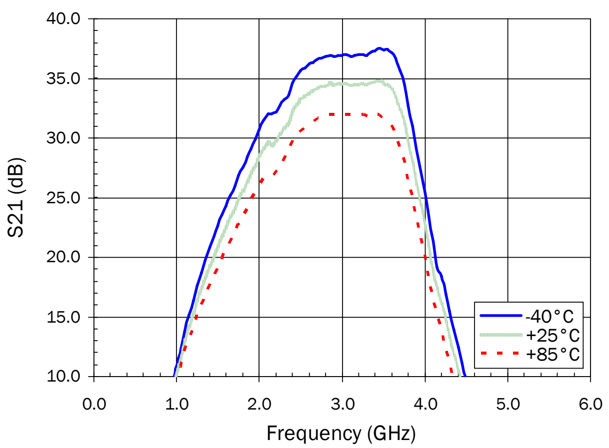
Broadband S11 - Input Return Loss



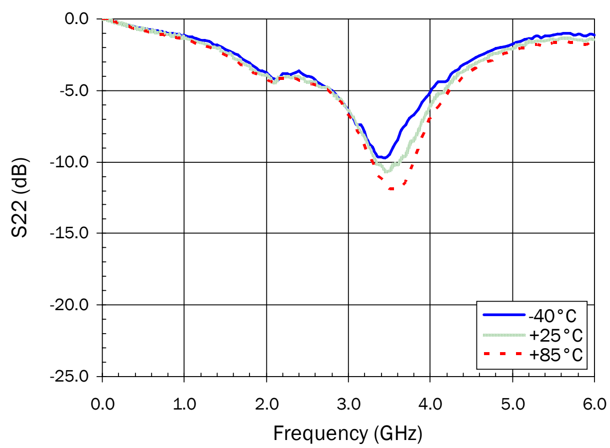
Broadband S12 - Reverse Isolation



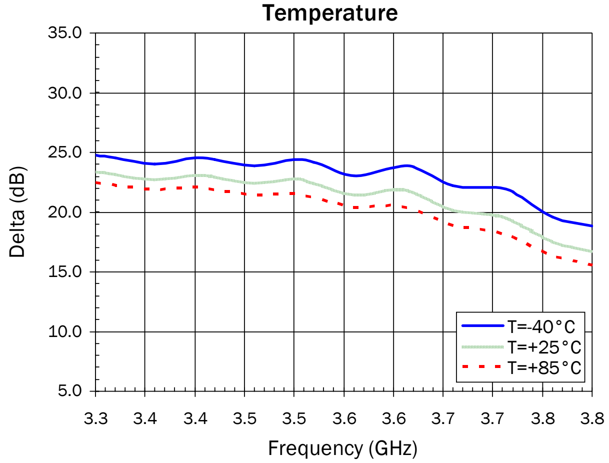
Broadband S21 - Forward Gain



Broadband S22 - Output Return Loss



20dB Step Attenuator Function Gain Delta versus Temperature



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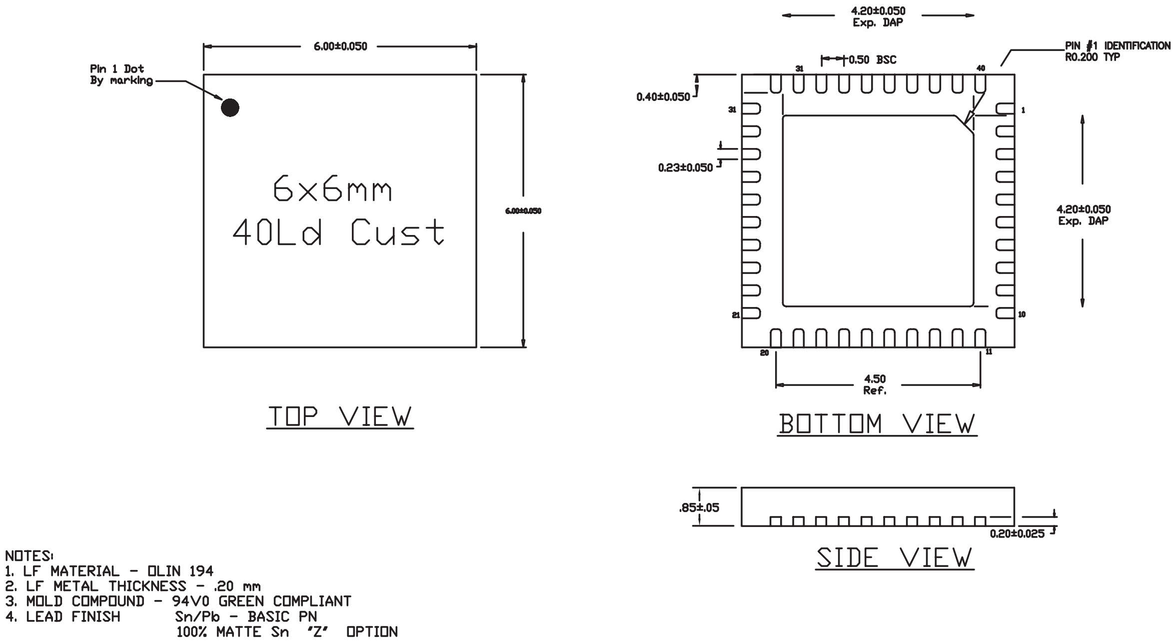
Pin	Function	Description
5, 7, 11, 12, 17, 18, 22, 29, 31, 33, 34, 39, 40	NC	These are no connect (NC) pins and are not wired inside the package. It is recommended to connect them as shown in the application circuit to achieve the stated performance.
1, 10, 21, 30	GND	These pins are internally grounded inside the package to the backside ground paddle. It is recommended to also ground them external to the package to achieve the specified performance.
2	VC1	This is the collector of the first stage.
3	VBIAS12	This is the supply voltage for the active bias circuit of the 1st and 2nd stages.
4	NC	This pin is not connected inside the package, but it is recommended to connect it to GND to achieve the specified performance.
6	RF IN	This is the RF input pin. It is DC grounded inside the package. Do not apply DC voltage to this pin.
8	VPC1	Power up/down control pin for the 1st stage. An external series resistor is required for proper setting of bias levels depending on control voltage. The voltage on this pin should never exceed the voltage on pin 3 by more than 0.5V unless the supply current from pin 3 is limited <10mA.
9	VPC2	Power up/down control pin for the 2nd stage. Power down VPC2<1V for step attenuator function enable. An external series resistor is required for proper setting of bias levels depending on control voltage. The voltage on this pin should never exceed the voltage on pin 3 by more than 0.5V unless the supply current from pin 3 is limited <10mA.
13, 38	VC2A, VC2B	These two pins are connected internal to the package to the 2nd stage collector. To achieve specified performance, the layout of these pins should match the Recommended Land Pattern.
14, 15, 36, 37	C1A,C2A C1B,C2B	These pins have capacitors across them internal to the package as shown in the below schematic. They are used as tuning and RF coupling elements between the 2nd and 3rd stage.
16, 35	VB3A, VB3B	These are the connections to the base of the 3rd stage output device. To achieve specified performance, the layout of these pins should match the Recommended Land Pattern.
19	VPC3	Power up/down control pin for the 3rd stage. An external series resistor is required for proper setting of bias levels depending on control voltage. The voltage on this pin should never exceed the voltage on pin 32 by more than 0.5V unless the supply current from pin 33 is limited <10mA.
20	VDET	This is the output port for the power detector. It samples the power at the input of the 3rd stage.
23-28	RFOUT	These are the RF output pins and DC connections to the 3rd stage collector.
32	VBIAS3	This is the supply voltage for the active bias circuit of the 3rd stage.

Package Drawing

Dimensions in millimeters

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



Part Symbolization

The part will be symbolized with “SZM-3066Z” to designate it as RoHs green compliant product. Marking designator will be on the top surface of the package.

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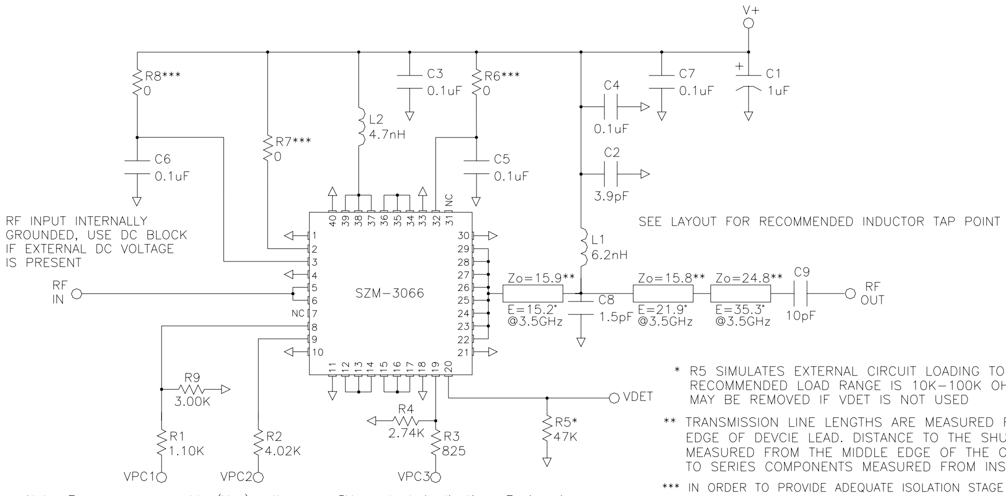
3.3 GHz to 3.8 GHz Evaluation Board Schematic

For V_{CC} = V+ = V_{PC} = 5.0 V



Note: For power up enable (Vpc) voltages < 5V, contact Applications Engineering for the appropriate R1, R9, R2, R3, and R4 values.

* R5 SIMULATES EXTERNAL CIRCUIT LOADING TO GROUND. RECOMMENDED LOAD RANGE IS 10K−100K OHMS. MAY BE REMOVED IF VDET IS NOT USED

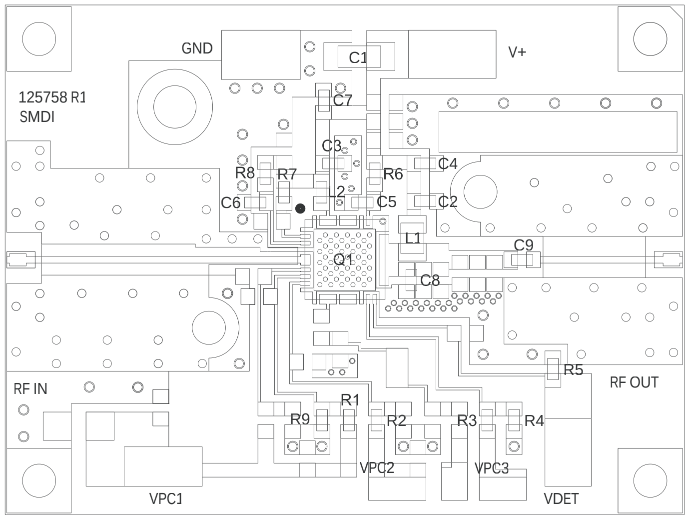
** TRANSMISSION LINE LENGTHS ARE MEASURED FROM OUTSIDE EDGE OF DEVCIE LEAD. DISTANCE TO THE SHUNT COMPONENTS ARE MEASURED FROM THE MIDDLE EDGE OF THE COMPONENT; DISTANCE TO SERIES COMPONENTS MEASURED FROM INSIDE EDGE OF LAND PAD.

*** IN ORDER TO PROVIDE ADEQUATE ISOLATION STAGE TO STAGE, EACH BIAS LINE SHOULD BE SUPPLIED BY A SEPARATE BUS RUNNING FROM THE MAIN POWER BUS AS THE LAYOUT. THE INDUCTORS (INCLUDING THE 0 OHM RESISTORS) AND CAPACITORS SHOULD BE RETAINED TO HELP PROVIDE ADEQUATE STAGE TO STAGE ISOLATION. ALTERNATE CONFIGURATIONS MAY IMPACT PERFORMANCE.

3.3GHz to 3.8GHz Evaluation Board Layout and Bill of Materials

For V_{CC}=V+=V_{PC}=5.0V

Board Material GETEK, 10mil thick, Dk=3.9, 2oz. copper



Bill of Materials

Desg	Description	Notes
Q1	SZM-3066Z	6mmx6mm QFN
R1	1.0KΩ, 0603 1%	0402 may be used
R2	4.02KΩ, 0603 1%	0402 may be used
R3	825Ω, 0603 1%	0402 may be used
R4	2.74KΩ, 0603 1%	0402 may be used
R5	47KΩ, 0603	0402 may be used
R6, 7, 8	0Ω, 0603	0402 may be used
R9	3kW, 0603 1%	0402 may be used
C1	1uF 16V MLCC CAP	Tantalum ok for EVM performance. Use MLCC type for best IM3 levels.
C2	3.9pF CAP, 0603	NPO, ROHM MCH185A3R9DK or equivalent
C3, 4, 5, 6, 7	0.1uF CAP, 0603	X7R 0402 ok, ROHM MCH182CN104K or equivalent
C8	1.5pF CAP, 0603	NPO, low ESR, ATC 600S1RCW250 or equivalent
C9	10pF CAP, 0603	NPO, low EST, ATC 6005100JW250 or equivalent
L1	6.2nH IND 0805	Coilcraft 0805HQ - 6N2XJBB
L2	4.7nH IND, 0603	TOKO 0603 - LL1608FH4N7J

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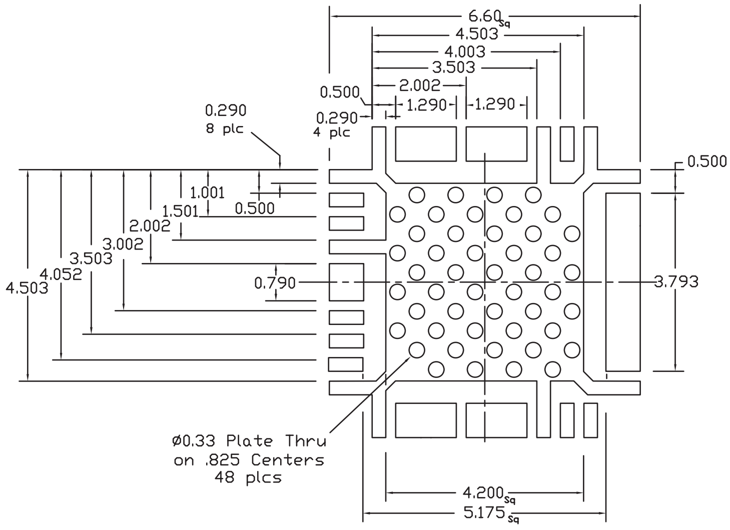
Recommended Metal Land Pattern

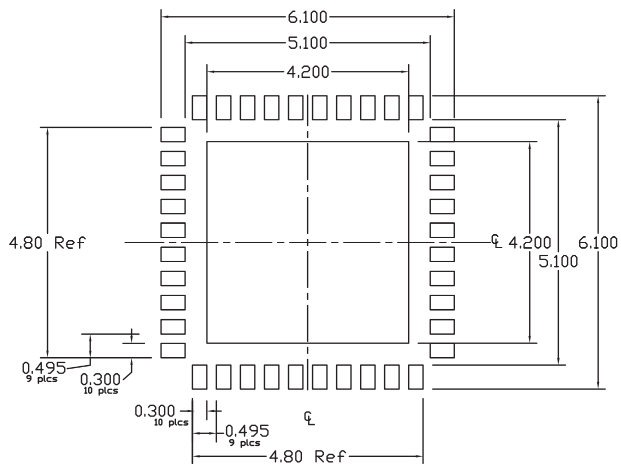
Dimensions in millimeters



Land Pattern

Recommended PCB Soldermask for Land Pattern

Dimensions in millimeters



Solder Mask Openings

Ordering Information

Part Number	Description	Reel Size	Devices/Reel
SZM-3066Z	Lead Free RoHS Compliant	7"	1000
SZM-3066Z EVB 1	3.3GHz to 3.8GHz Evaluation Board	N/A	N/A