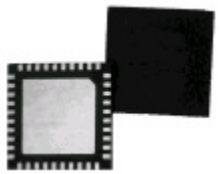
Preliminary

SZM-2066Z

2.4-2.7GHz 2W Power Amplifier



RoHS Compliant & Green Package

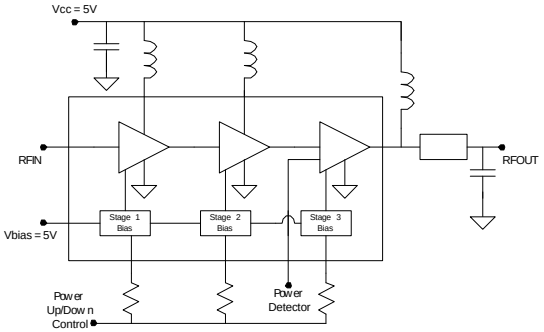
6mm x 6mm QFN Package

Product Description

Sirenza Microdevices' SZM-2066Z 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 and 802.11b/g equipment in the 2.4-2.7 GHz 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. This product features a RoHS compliant and Green package with matte tin finish, designated by the 'Z' suffix.

Functional Block Diagram



Product Features

- **P1dB = 33.5dBm @ 5V**
- **Three Stages of Gain: 37dB**
- **802.11g 54Mb/s Class AB Performance**
  Pout = 26dBm @ 2.5% EVM, Vcc 5V, 690mA
  Pout = 27dBm @ 2.5% EVM, Vcc 6V, 730mA
- **Active Bias with Adjustable Current**
- **On-chip Output Power Detector**
- **Low Thermal Resistance**
- **Power up/down control < 1μs**

Applications

- **802.16 WiMAX Driver or Output Stage**
- **802.11b/g WLAN, WiFi**

Key Specifications

Symbol	Parameters: Test Conditions, 2.5-2.7GHz App circuit, Z_0 = 50Ω, V_{CC} = 5.0V, Iq = 590mA, T_{BP} = 30ºC	Unit	Min.	Typ.	Max.
f_O	Frequency of Operation	MHz	2400		2700
P_{1dB}	Output Power at 1dB Compression – 2.7GHz	dBm	32.0	33.5	
S_{21}	Small Signal Gain – 2.7GHz	dB	31.5	34.5	
Pout	Output power at 2.5% EVM 802.11g 54Mb/s - 2.7GHz	dBm		26	
IM3	Third Order Suppression (Pout=23dBm per tone) - 2.7GHz	dBc		-45	-40
NF	Noise Figure at 2.7 GHz	dB		7.5	
IRL	Worst Case Input Return Loss 2.4-2.7GHz	dB	9	14	
ORL	Worst Case Output Return Loss 2.5-2.7GHz		8	12	
Vdet Range	Output Voltage Range for Pout=10dBm to 33dBm	V		0.9 to 1.8	
I_{cq}	Quiescent Current (V_{cc} = 5V)	mA	510	590	670
I_{VPC}	Power Up Control Current (V_{pc}=5V, (I_{VPC1} +I_{VPC2}+ I_{VPC3})	mA		4	
I_{leak}	Vcc Leakage Current (V_{cc} = 5V, V_{pc} = 0V)	μA			50
$R_{th, j-l}$	Thermal Resistance (junction - lead)	ºC/W		10	

Typical Performance (Vcc=5V, Icq=590mA, * 802.11g 54Mb/s 64QAM)

Parameter	Units	2.3GHz	2.4GHz	2.5GHz	2.6GHz	2.7GHz
Gain @ Pout=26dBm	dB	36.3	36.8	36.9	36.5	35.3
P1dB	dBm	33.5	33.5	33.5	33.5	33.5
Pout @ 2.5% EVM*	dBm	26	26	26	26	26
Current @ Pout 2.5% EVM*	mA	705	700	710	700	680
Input Return Loss	dB	-16	-16	-14	-14	-14
Output Return Loss	dB	-12	-18	-12	-16	-21

Absolute Maximum Ratings

Parameters	Value	Unit
VC3 Collector Bias Current (I_{VC3})	1500	mA
VC2 Collector Bias Current (I_{VC2})	500	mA
VC1 Collector Bias Current (I_{VC1})	150	mA
Device Voltage (V_D)	9.0	V
Power Dissipation	6	W
Operating Lead Temperature (T_L)	-40 to +85	ºC
Max RF Input Power for 50 ohm output load	26	dBm
Max RF Input Power for 10:1 VSWR RF out load	5	dBm
Storage Temperature Range	-40 to +150	ºC
Operating Junction Temperature (T_J)	+150	ºC
ESD Human Body Model	500	V

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.

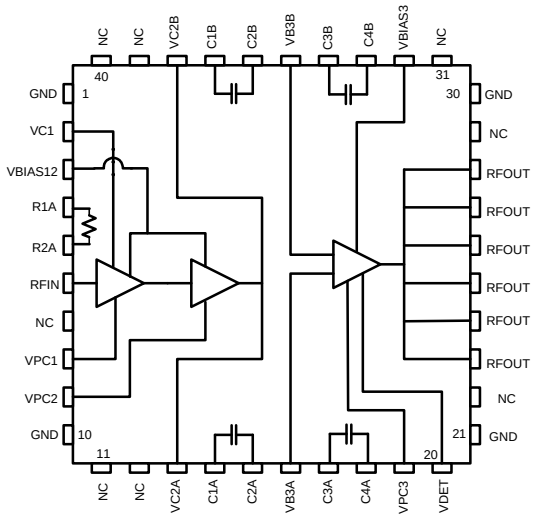
Bias conditions should also satisfy the following expression:
$I_D V_D < (T_J - T_L) / R_{TH, j-l}$

Caution: ESD Sensitive
Appropriate precaution in handling, packaging and testing devices must be observed.

Pin Out Description

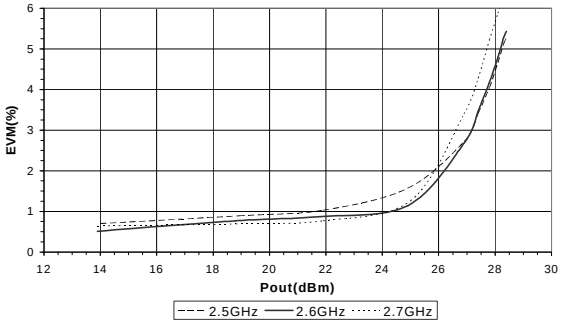
Pin #	Function	Description
7, 11,12, 22, 29, 31, 39, 40	NC	These are no connect (NC) pins and are not wired inside the package. It is recommended to connect them as shown in the application circuit to achieve the stated performance.
1,10, 21, 30	GND	These pins are internally grounded inside the package 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, 5	R1A, R2A	A resistor is tied across these pins internal to the package.
6	RFIN	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. 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 and connect to the 2nd stage collector. To achieve specified performance, the layout of these pins should match the Recommended Land Pattern, pg. 13.
14,15, 17, 18, 33, 34 36, 37	C1A, C2A C1B, C2B, C3A, C4A, C4A, C4B	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, pg. 13.
19	VPC3	Power up/down control pin for the 2st 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.

Simplified Device Schematic

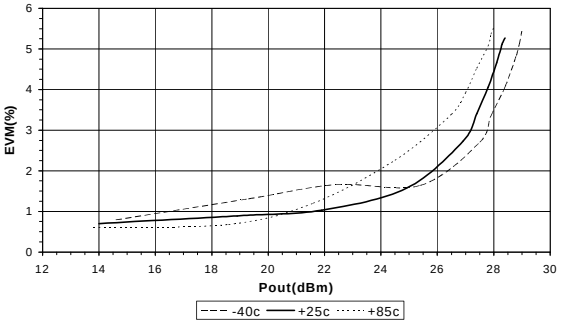


Measured 2.5-2.7 GHz Application Circuit Data (V_{cc} = V_{pc} = 5.0V, I_q = 590mA, T=25C)

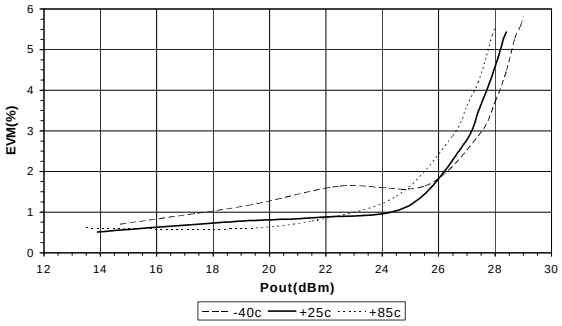
EVM vs Pout, T=+25C
802.11g, OFDM, 54Mb/s, 64QAM



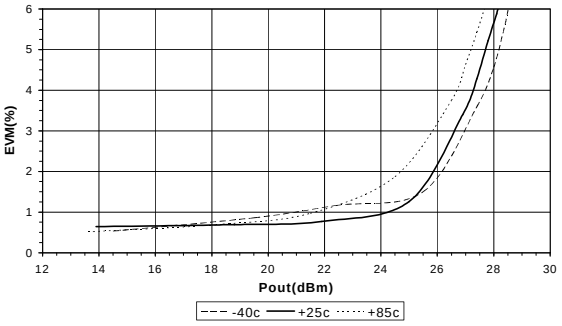
EVM vs Pout, F=2.5GHz
802.11g, OFDM, 54Mb/s, 64QAM



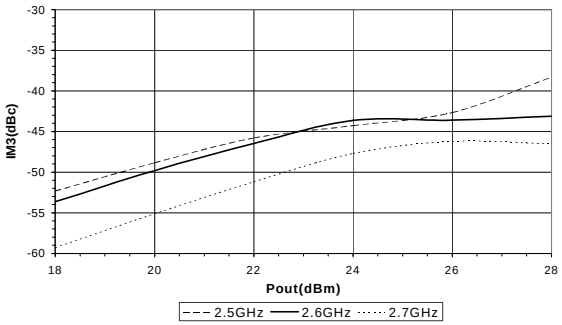
EVM vs Pout, F=2.6GHz
802.11g, OFDM, 54Mb/s, 64QAM



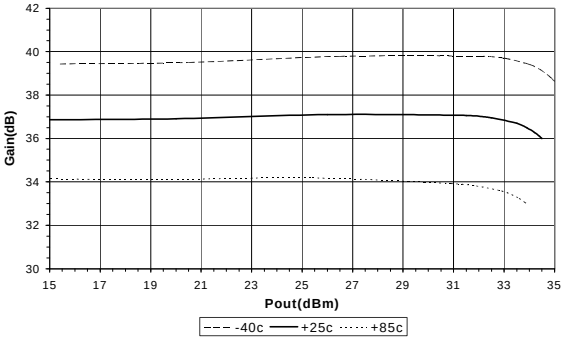
EVM vs Pout, F=2.7GHz
802.11g, OFDM, 54Mb/s, 64QAM



IM3 vs Pout (2 tone avg.), T=+25C
Tone Spacing=1MHz

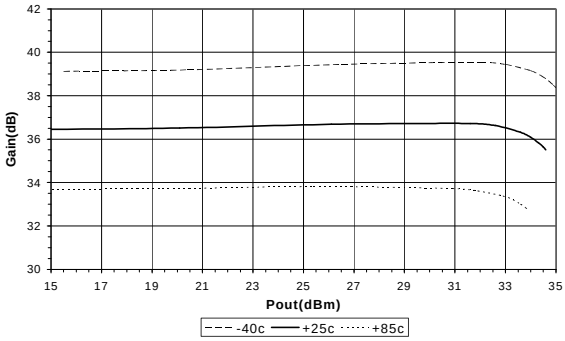


Typical Gain vs Pout, F=2.5GHz

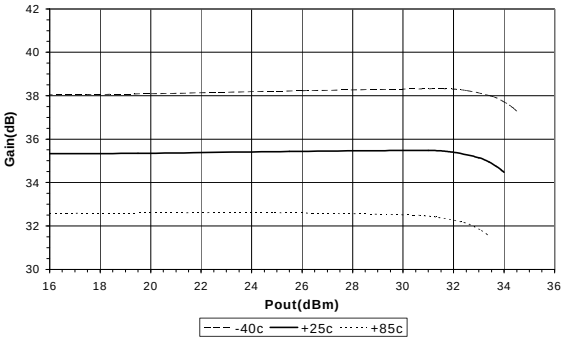


Measured 2.5-2.7 GHz Application Circuit Data (V_{cc} = V_{pc} = 5.0V, I_q = 590mA, T=25C)

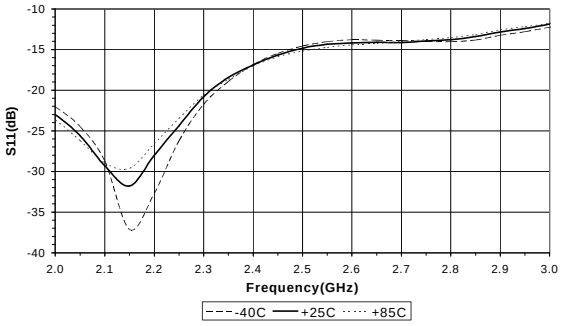
Typical Gain vs Pout, F=2.6GHz



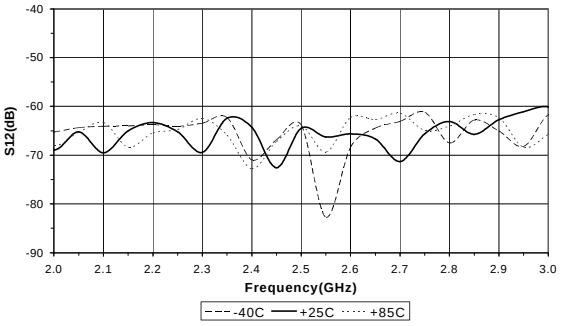
Typical Gain vs Pout, F=2.7GHz



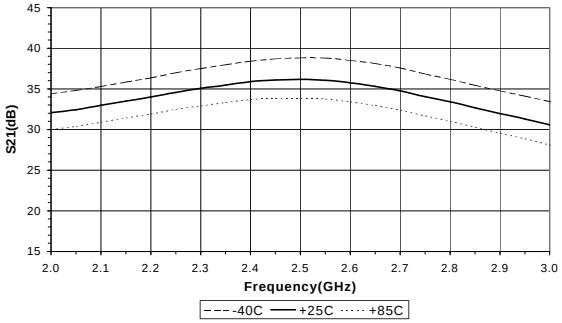
Narrowband S11 - Input Return Loss



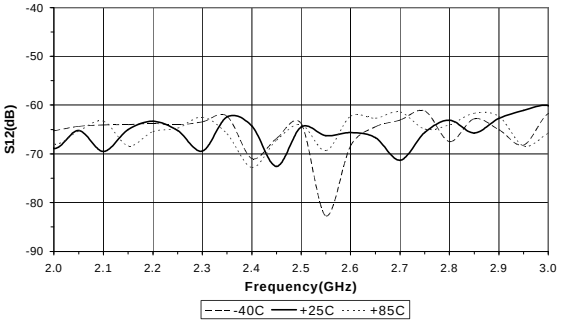
Narrowband S12 - Reverse Isolation



Narrowband S21 - Forward Gain

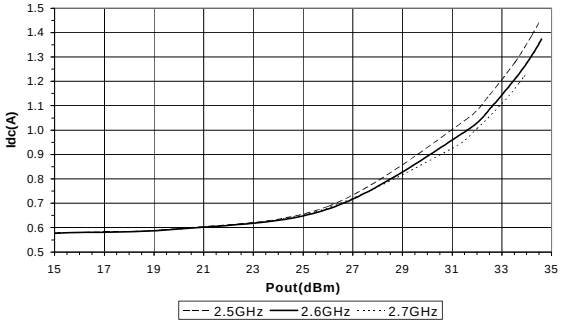


Narrowband S12 - Reverse Isolation

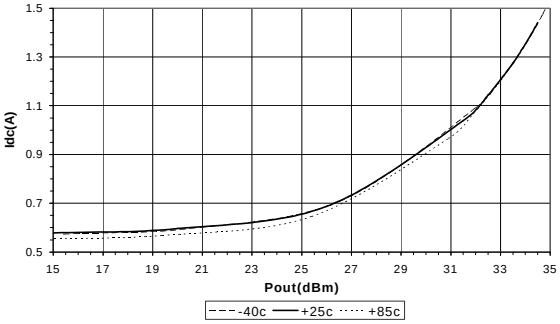


Measured 2.5-2.7 GHz Application Circuit Data (V_{cc} = V_{pc} = 5.0V, I_q = 590mA, T=25C)

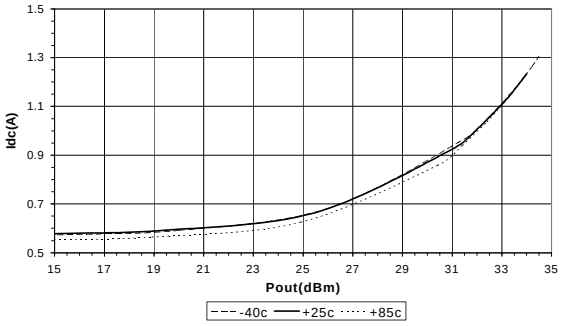
DC Supply Current (Idc) vs Pout, T=+25C



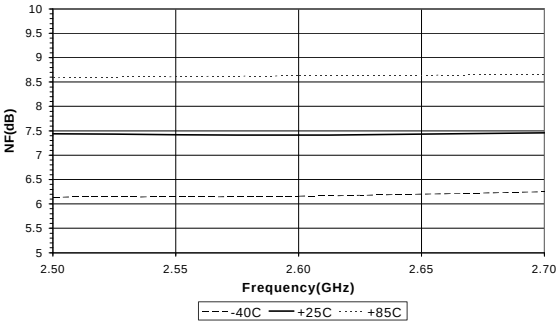
DC Supply Current (Idc) vs Pout, F=2.5GHz



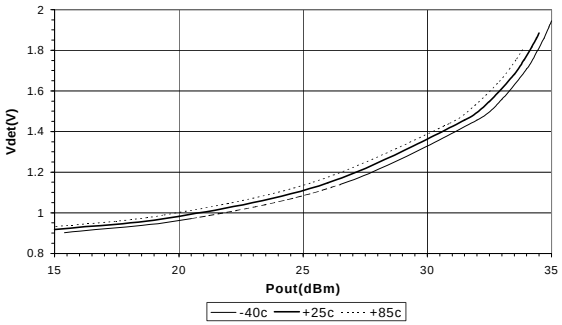
DC Supply Current (Idc) vs Pout, F=2.7GHz



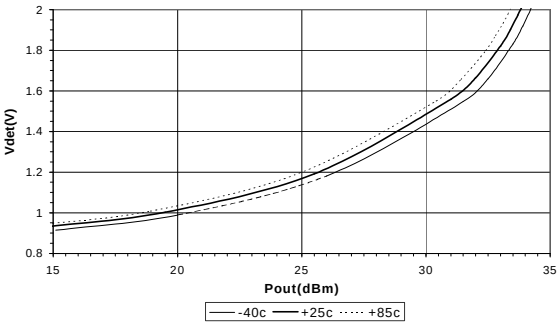
Noise Figure vs Frequency



RF Power Detector (Vdet) vs Pout, F=2.5GHz

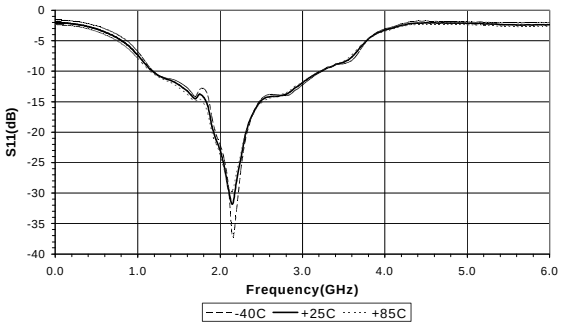


RF Power Detector (Vdet) vs Pout, F=2.7GHz

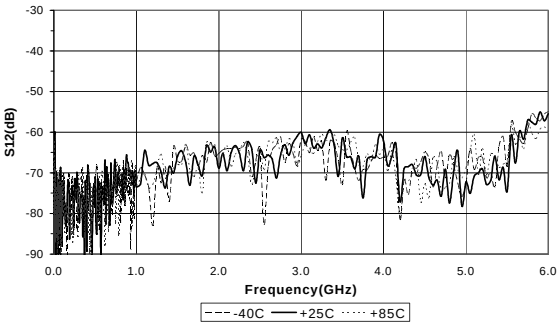


Measured 2.5-2.7 GHz Application Circuit Data (V_{cc} = V_{pc} = 5.0V, I_q = 590mA, T=25C)

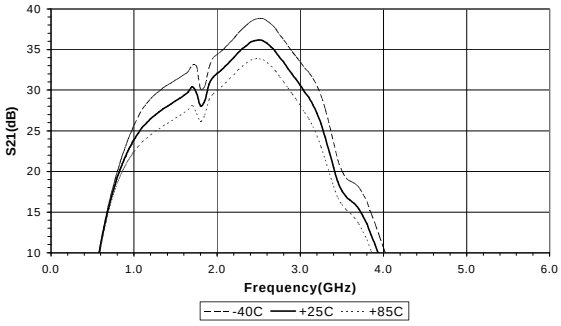
Broadband S11 - Input Return Loss



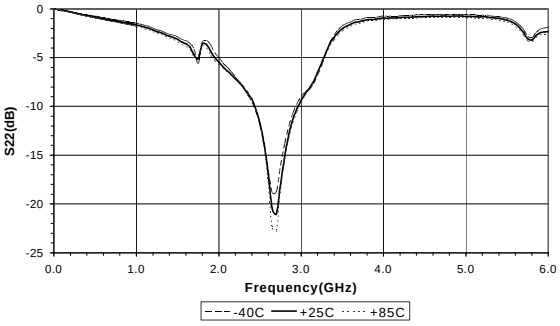
Broadband S12 - Reverse Isolation



Broadband S21 - Forward Gain

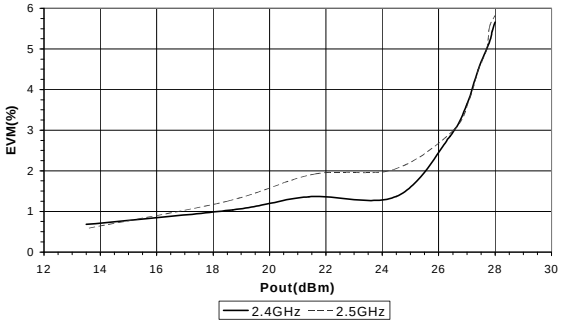


Broadband S22 - Output Return Loss

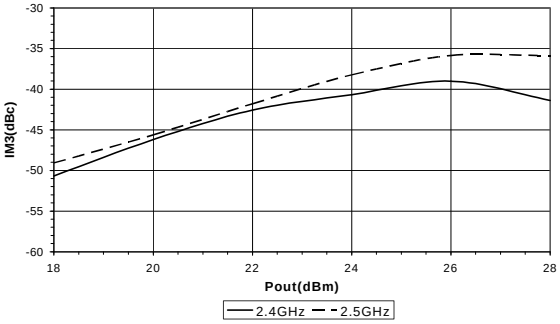


Measured 2.4-2.5 GHz Application Circuit Data (V_{cc} = V_{pc} = 5.0V, I_q = 590mA, T=25C)

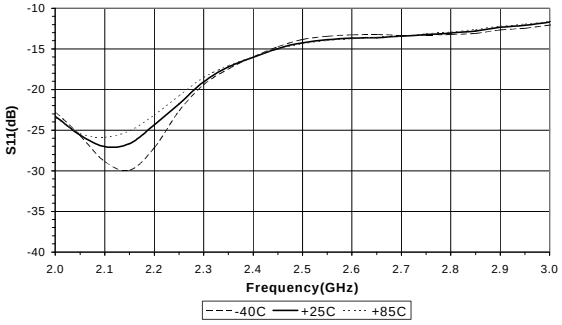
EVM vs Pout, T=+25C
802.11g, OFDM, 54Mb/s, 64QAM



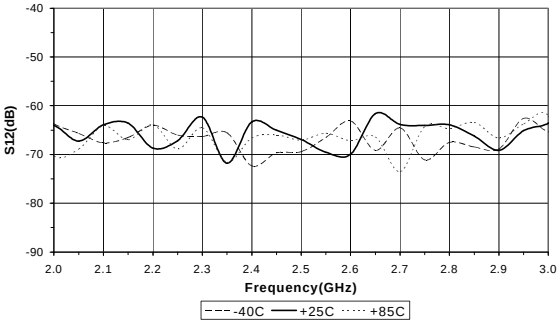
IM3 vs Pout (2 tone avg.), T=+25C
Tone Spacing=1MHz



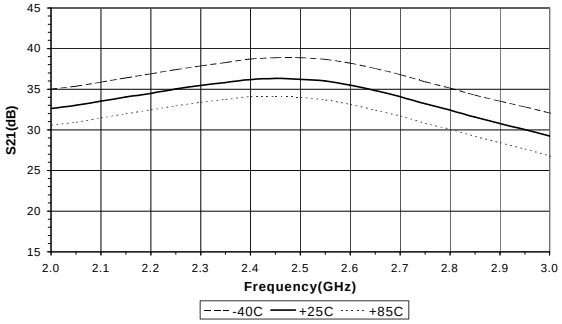
Narrowband S11 - Input Return Loss



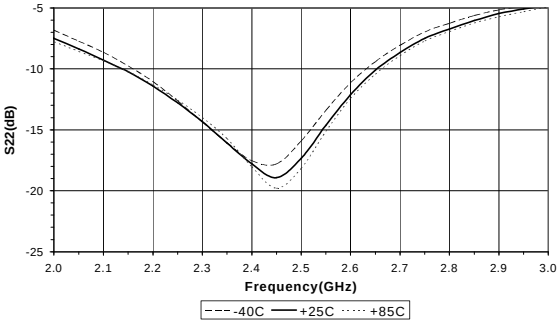
Narrowband S12 - Reverse Isolation



Narrowband S21 - Forward Gain

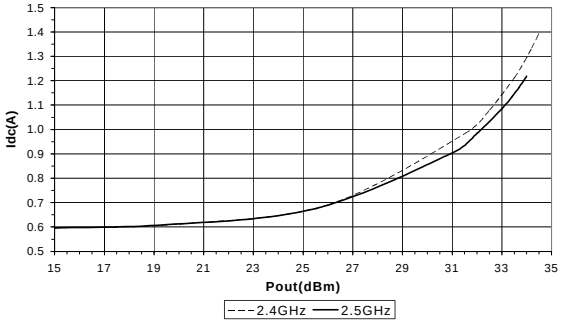


Narrowband S22 - Output Return Loss

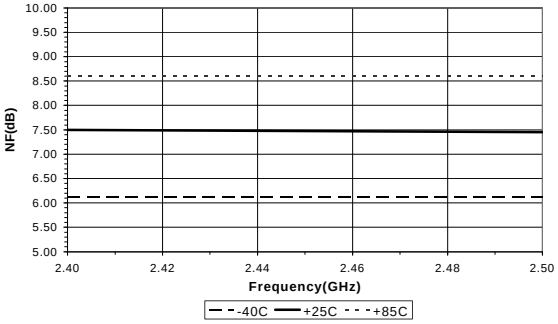


Measured 2.4-2.5 GHz Application Circuit Data (V_{cc} = V_{pc} = 5.0V, I_q = 590mA, T=25C)

DC Supply Current (Idc) vs Pout, T=+25C

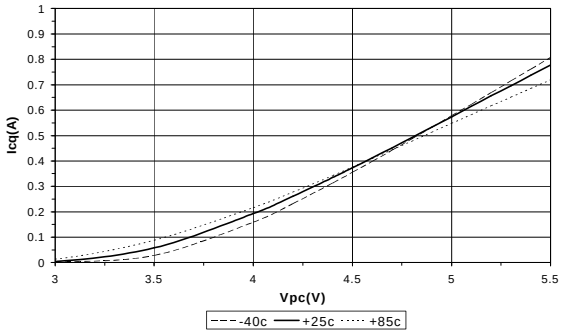


Noise Figure vs Frequency



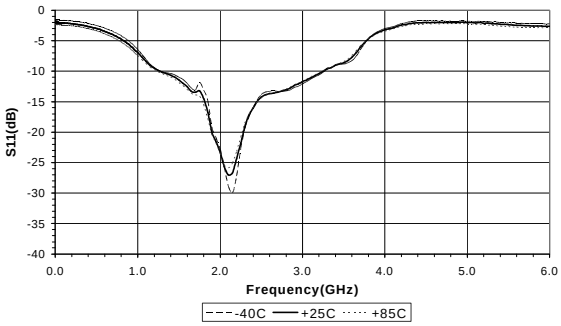
Icq vs Vpc, Vcc=5v, Swept Vpc

See App. Circuits pg. 11-12 for Vpc resistor values used

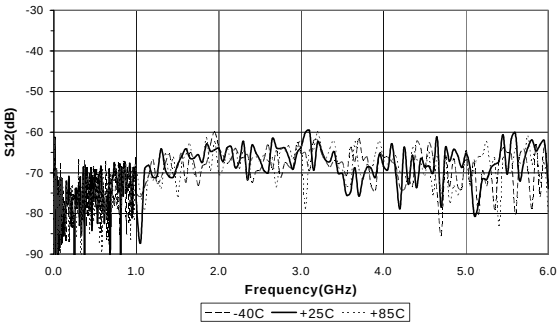


Measured 2.4-2.5 GHz Application Circuit Data (V_{cc} = V_{pc} = 5.0V, I_q = 590mA, T=25C)

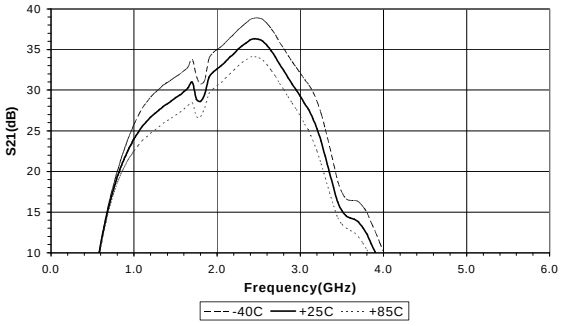
Broadband S11 - Input Return Loss



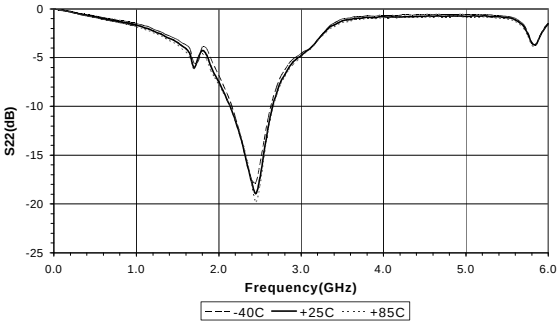
Broadband S12 - Reverse Isolation



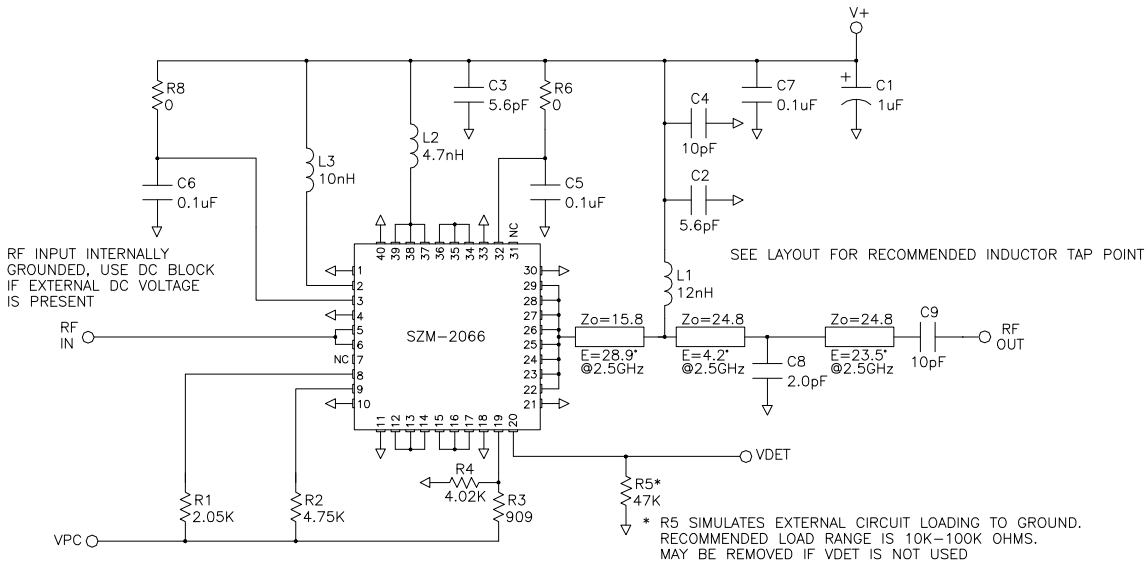
Broadband S21 - Forward Gain



Broadband S22 - Output Return Loss



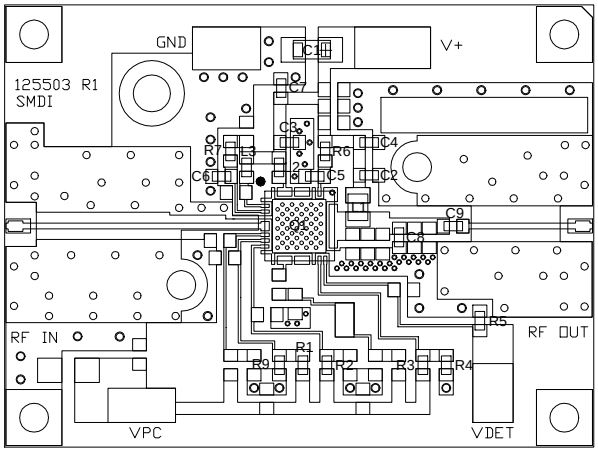
2.5-2.7 GHz Evaluation Board Schematic For Vcc = V+ = Vpc = 5.0V



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

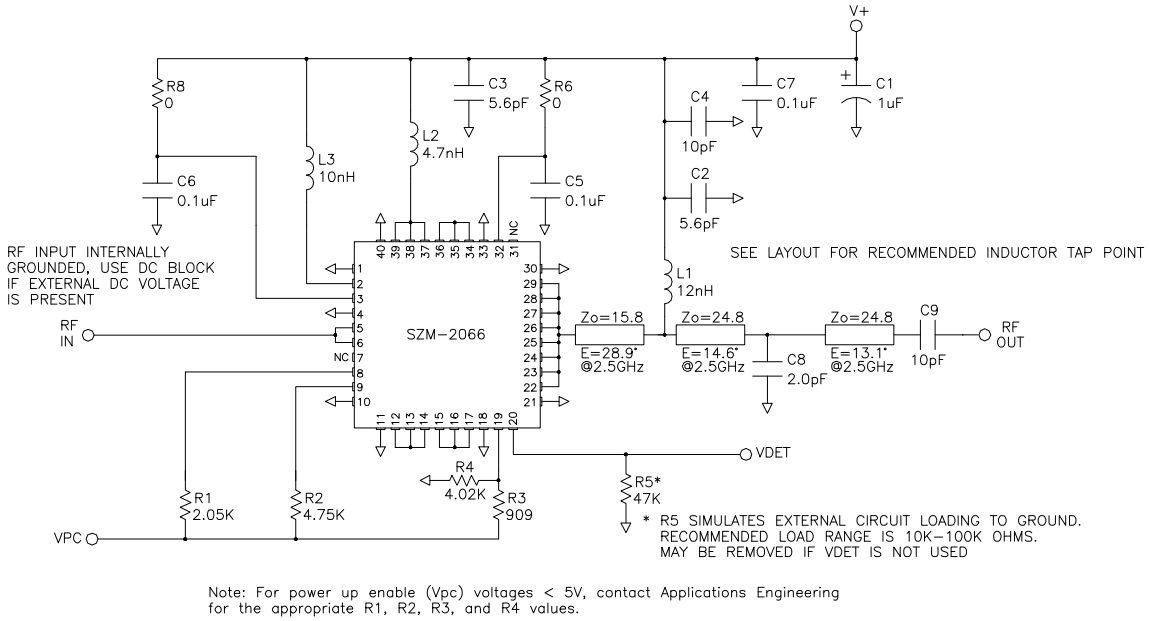
2.5-2.7 GHz Evaluation Board Layout For Vcc = V+ = Vpc = 5.0V

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



DESG	DESCRIPTION	NOTES
Q1	SZM–2066	6x6mm QFN
R1	2.05K OHM, 0603 1%	0402 may be used
R2	4.75K OHM, 0603 1%	"
R3	909 OHM, 0603 1%	"
R4	4.02K OHM, 0603 1%	"
R5	47K OHM, 0603	"
R6,7	0 OHM, 0603	"
C1	1uF 16V MLCC CAP	Tantalum ok for EVM performance Use MLCC type for best IM3 levels
C2,3	5.6pF CAP, 0603	NPO ROHM MCH185A5R6DK or equiv.
C4,5,6,7	0.1uF CAP, 0603	NPO 0402 ok ROHM MCH184CN105K or equiv.
C8	2.0pF CAP, 0603	NPO, low ESR ATC 600S2R0CW250 or equiv.
C9	10pF CAP, 0603	NPO, low ESR ATC 600S100JW250 or equiv.
L1	12nH IND 0805	Coilcraft 0805HQ – 12NXJBB
L2	4.7nH IND, 0603	TOKO 0603 – LL1608FH4N7J
L3	10nH IND, 0603	TOKO 0603 – LL1608FH10NJ

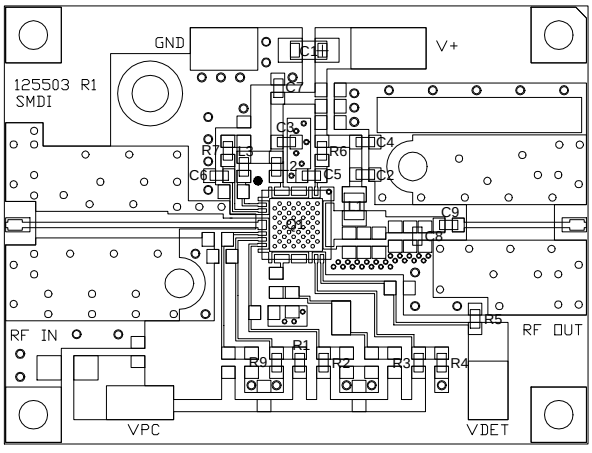
2.4-2.5 GHz Evaluation Board Schematic For Vcc = V+ = Vpc = 5.0V



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

2.4-2.5 GHz Evaluation Board Layout For Vcc = V+ = Vpc = 5.0V

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



DESG	DESCRIPTION	NOTES
Q1	SZM–2066	6x6mm QFN
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C8	2.0pF CAP, 0603	NPO, low ESR ATC 600S2R0CW250 or equiv.
C9	10pF CAP, 0603	NPO, low ESR ATC 600S100JW250 or equiv.
L1	12nH IND 0805	Coilcraft 0805HQ – 12NXJBB
L2	4.7nH IND, 0603	TOKO 0603 – LL1608FH4N7J
L3	10nH IND, 0603	TOKO 0603 – LL1608FH10NJ

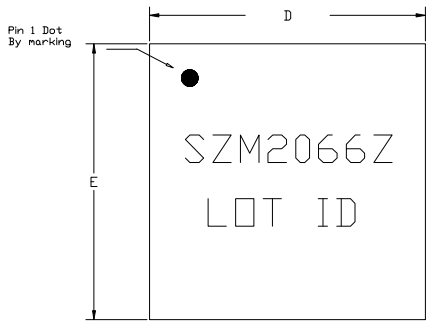
Part Symbolization

The part will be symbolized with "SZM-2066Z" to designate it as a RoHs green compliant product. Marking designator will be on the top surface of the package.

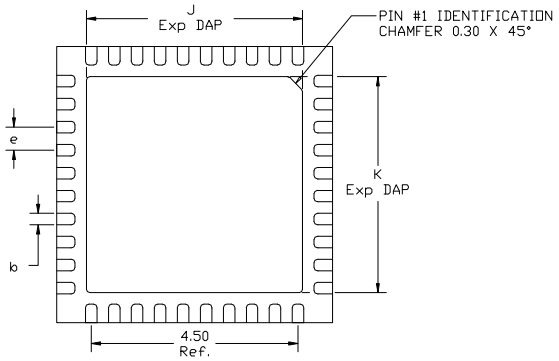
Part Number Ordering Information

Part Number	Reel Size	Devices/Reel
SZM-2066Z	13"	3000

Package Outline Drawing (dimensions in mm):

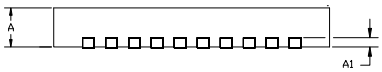


TOP VIEW



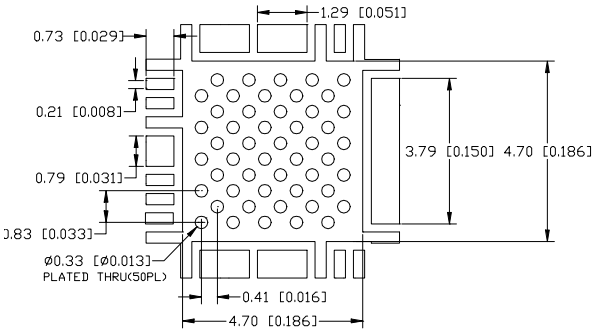
BOTTOM VIEW

DIM	Min	Nom	Max
A	.80	.85	.90
A1		.20	
b	.20	.25	.30
D	5.95	6.0	6.05
e		0.5 BSC	
E	5.95	6.0	6.05
J	4.65	4.70	4.75
K	4.65	4.70	4.75

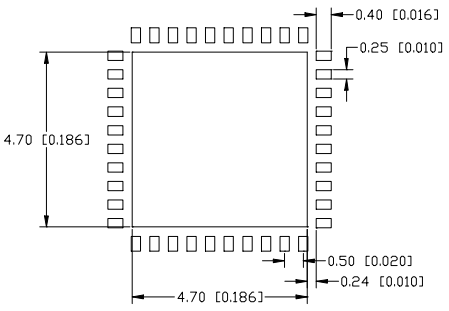


SIDE VIEW

Recommended Metal Land Pattern (dimensions in mm[in]):



Recommended PCB Soldermask for Land Pattern (dimensions in mm[in]):



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