# SZA-2044 / SZA-2044Z

## 2.0-2.7 GHz 5V 1W Power Amplifier

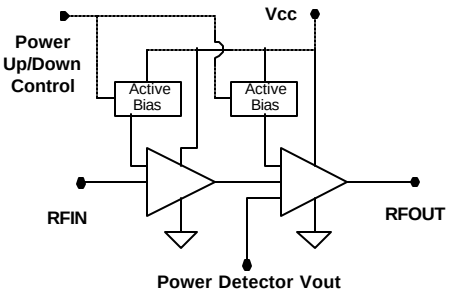
RoHS Compliant & Green Package

**4mm x 4mm QFN Package**

## Product Description

Sirenza Microdevices' SZA-2044 is a high efficiency class AB Heterojunction Bipolar Transistor (HBT) amplifier housed in a low-cost surface-mountable plastic 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 stage for 802.11b/g and 801.16 equipment in the 2.0-2.7 GHz bands. It can run from a 3V to 5V supply. Optimized on-chip impedance matching circuitry provides a 50Ω nominal RF input impedance. 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 is available in a RoHS Compliant and Green package with matte tin finish, designated by the "Z" package suffix.

### Functional Block Diagram




## Product Features

- **802.11g 54Mb/s Class AB Performance**
  **Pout = 22.5dBm @ 3% EVM, 5V, 340mA**
  **Pout = 18dBm @ 3% EVM, 3.3V, 175mA**
- **On-chip Output Power Detector**
- **P1dB = 29.5dBm @ 5V, P1dB = 25dBm @ 3.3V**
- **Robust - Survives RF Input Power = +15dBm**
- **Power up/down control < 1μs**
- **Available in RoHS Green Compliant Package**

## Applications

- **802.11b/g WLAN, 2.4GHz ISM Applications**
- **WiMax 802.16, MMDS and MDS bands**

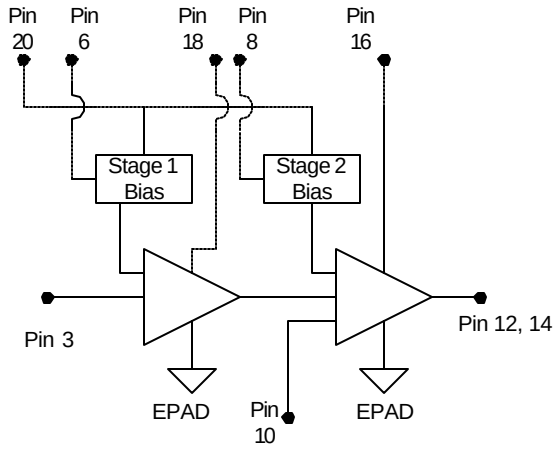
### Key Specifications

| Symbol | Parameters: Test Conditions, App circuit page 4 $Z_0 = 50\Omega$, $V_{CC} = 5.0V$, Iq = 300mA, $T_{BP} = 30°C$ | Unit | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| $f_O$ | Frequency of Operation | MHz | 2000 | | 2700 |
| $P_{1dB}$ | Output Power at 1dB Compression – 2.4 GHz | dBm | | 29.5 | |
| | Output Power at 1dB Compression – 2.5 GHz | | 28.0 | 29.5 | |
| $S_{21}$ | Small Signal Gain at 2.4 GHz | dB | 23.5 | 25.5 | 27.5 |
| | Small Signal Gain at 2.5 GHz | | 23.5 | 25.5 | 27.5 |
| Pout | Output power at 3% EVM 802.11g 54Mb/s - 2.4GHz | dBm | | 22.5 | |
| | Output Power at 3% EVM 802.11g 54Mb/s - 2.5GHz | | | 22.5 | |
| NF | Noise Figure at 2.5 GHz | dB | | 6.1 | |
| IM3 | Third Order Intermod at 18dBm per tone - 2.5GHz | dBc | | -44 | -40 |
| IRL | Worst Case Input Return Loss 2.4-2.5GHz | dB | 10 | 13 | |
| ORL | Worst Case Output Return Loss 2.4-2.5GHz | | 9 | 11 | |
| Vdet Range | Output Voltage Range for Pout=15dBm to 29dBm | V | | 0.9 to 1.7 | |
| $I_{cq}$ | Quiescent Current ($V_{cc}$ = 5V) | mA | 255 | 300 | 345 |
| $I_{VPC}$ | Power Up Control Current, Vpc=5V, ( $I_{VPC1} + I_{VPC2}$ ) | mA | | 1.9 | |
| $I_{LEAK}$ | Off Vcc Leakage Current Vpc=0V | uA | | 6 | 100 |
| $R_{th, j-l}$ | Thermal Resistance (junction - lead) | ºC/W | | 28 | |

## Pin Out Description

| Pin # | Function | Description |
|---|---|---|
| 1,2,4,5, 7,9,11, 13, 15,17,19 | N/C | These are unused pins and not wired inside the package. They may be grounded or connected to adjacent pins. |
| 6 | VPC1 | VPC1 is the bias control pin for the stage 1 active bias circuit. An external series resistor is required for proper setting of bias levels. Refer to the evaluation board schematic for resistor value. To prevent potential damage, do not apply voltage to this pin that is +1V greater than voltage applied to pin 20 (Vbias) unless Vpc supply current capability is less than 10 mA. |
| 8 | VPC2 | VPC2 is the bias control pin for the stage 2 active bias circuit. An external series resistor is required for proper setting of bias levels. Refer to the evaluation board schematic for resistor value. To prevent potential damage, do not apply voltage to this pin that is +1V greater than voltage applied to pin 20 (Vbias) unless Vpc supply current capability is less than 10 mA. |
| 10 | Vdet | Output power detector voltage. Load with > 10K ohms for best performance |
| 3 | RFIN | RF input pin. This is DC grounded internal to the IC. Do not apply voltage to this pin. |
| 12,14 | RFOUT | RF output pin. This is also another connection to the 2nd stage collector. |
| 16 | VC2 | 2nd stage collector bias pin. Apply 3.0 to 5.0V to this pin. |
| 18 | VC1 | 1st stage collector bias pin. Apply 3.0 to 5.0V to this pin. |
| 20 | Vbias | Active bias network VCC. Apply 3.0 to 5.0V to this pin. |
| EPAD | Gnd | Exposed area on the bottom side of the package needs to be soldered to the ground plane of the board for optimum thermal and RF performance. Several vias should be located under the EPAD as shown in the recommended land pattern (page 5). |

## Simplified Device Schematic




**Caution: ESD Sensitive**

Appropriate precaution in handling, packaging and testing devices must be observed.

## Absolute Maximum Ratings

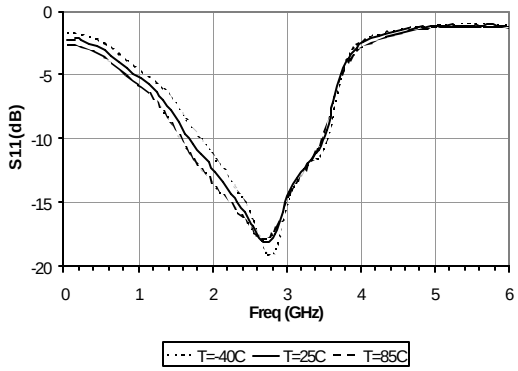
| Parameters | Value | Unit |
|---|---|---|
| VC2 Collector Bias Current ($I_{VC2}$) | 500 | mA |
| VC1 Collector Bias Current ($I_{VC1}$) | 150 | mA |
| Device Voltage ($V_D$) | 7.0 | V |
| Power Dissipation | 3 | W |
| Operating Lead Temperature ($T_L$) | -40 to +85 | ºC |
| Max RF Input Power for 50 ohm output load | 15 | dBm |
| Max RF Input Power for 10:1 VSWR RF out load | 8 | dBm |
| Storage Temperature Range | -40 to +150 | ºC |
| Operating Junction Temperature ($T_J$) | +150 | ºC |
| ESD Human Body Model (Class 1C) | 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.**

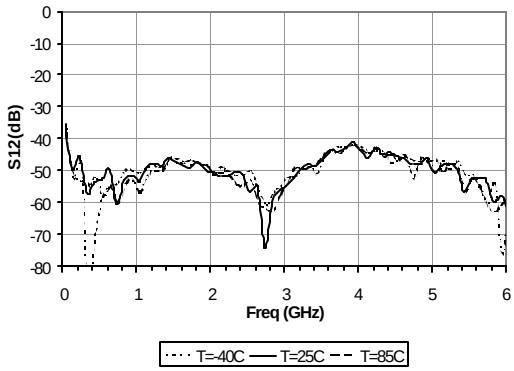
**Bias conditions should also satisfy the following expression:**
**$I_D V_D < (T_J - T_L) / R_{TH, j-l}$**

**Performance: 2.3 - 2.7 GHz Evaluation Board Data ($V_{cc}$ = $V_{pc}$ = 5.0V, $I_q$ = 300mA)**

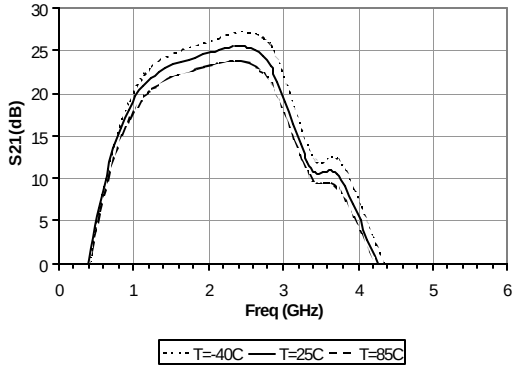
**S11 - Input Return Loss**



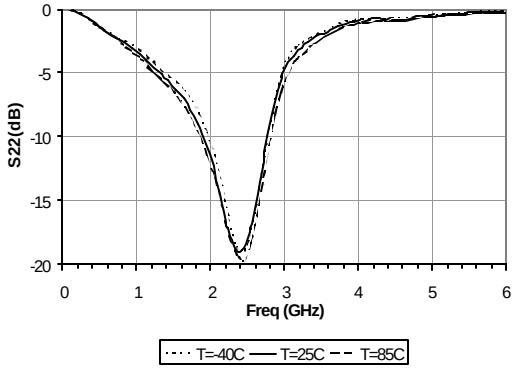

**S12 - Isolation**



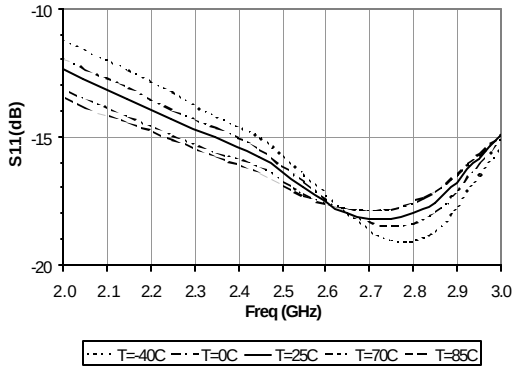

**S21 - Gain**



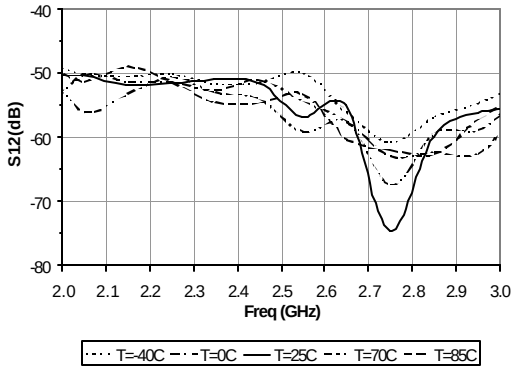

**S22 - Output Return Loss**




**Narrowband S11 - Input Return Loss**

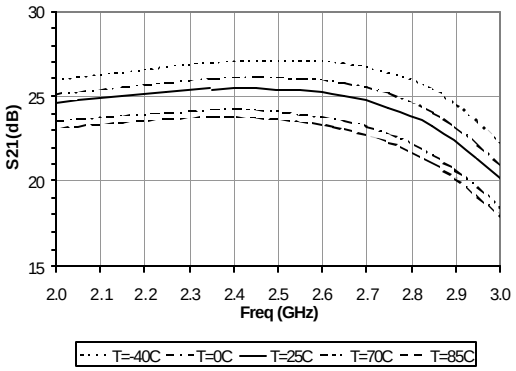



**Narrowband S12 - Isolation**

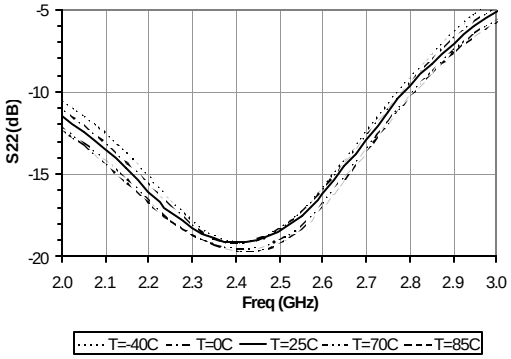


**Performance: 2.3 - 2.7 GHz Evaluation Board Data ($V_{cc}$ = $V_{pc}$ = 5.0V, $I_q$ = 300mA)**

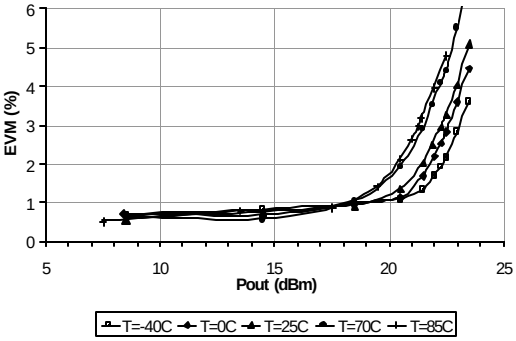
**Narrowband S21 - Gain**



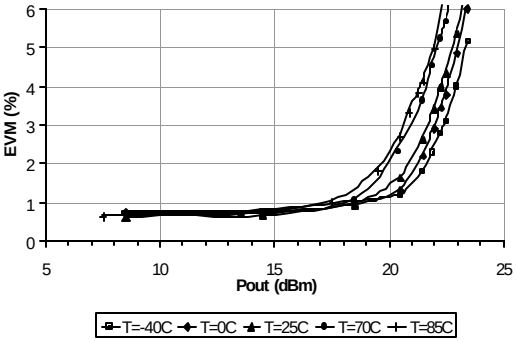

**Narrowband S22 - Output Return Loss**



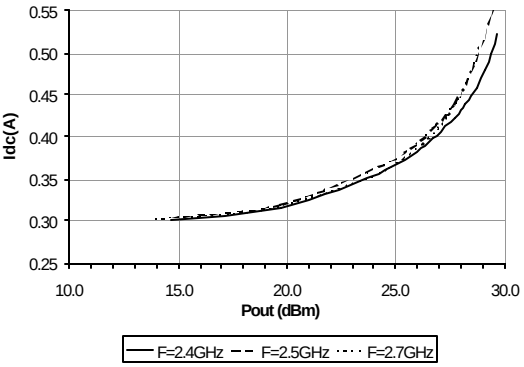

**EVM vs Pout, F=2.4GHz**
**802.11g, OFDM, 54 Mb/s, 64QAM**



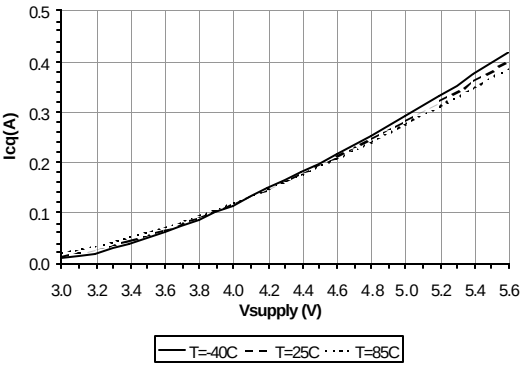

**EVM vs Pout, F=2.5GHz**
**802.11g, OFDM, 54 Mb/s, 64QAM**




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

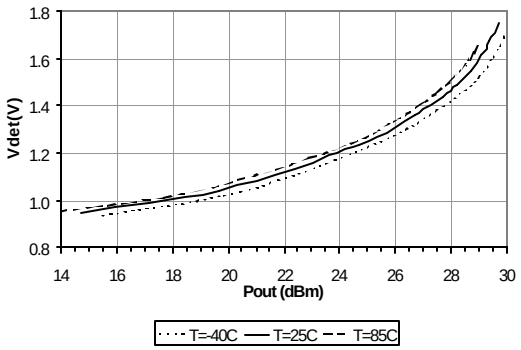



**Icq (DC Bias Point) vs Vsupply (V+ and Vpc)**

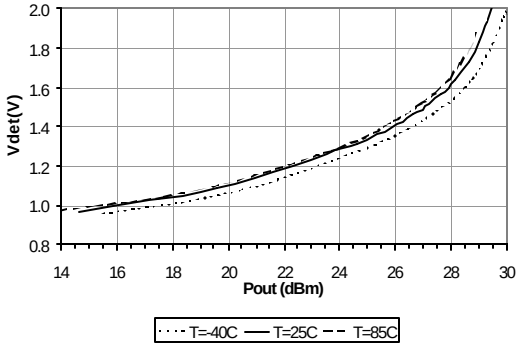


**Performance: 2.3 - 2.7 GHz Evaluation Board Data ($V_{cc}$ = $V_{pc}$ = 5.0V, $I_q$ = 300mA)**

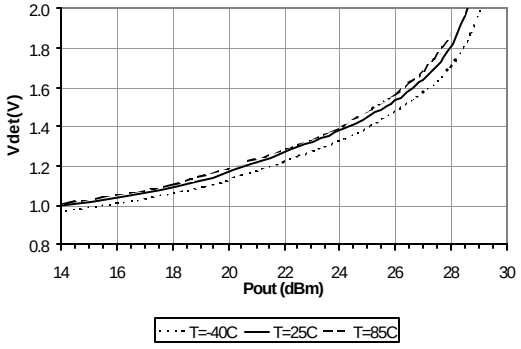
RF Power Detector (Vdet) vs Pout
F=2.4GHz



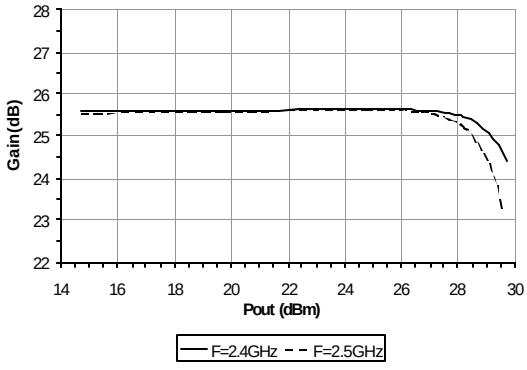

RF Power Detector (Vdet) vs Pout
F=2.5GHz



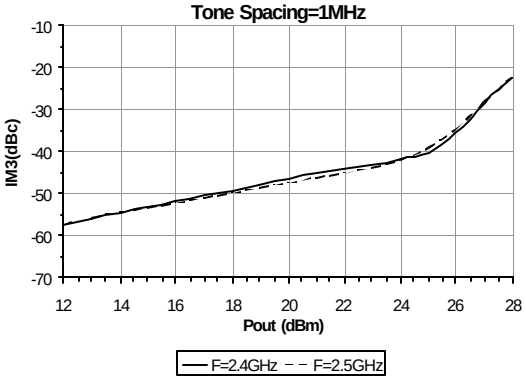

RF Power Detector (Vdet) vs Pout
F=2.7GHz




Gain vs Pout, T=25C

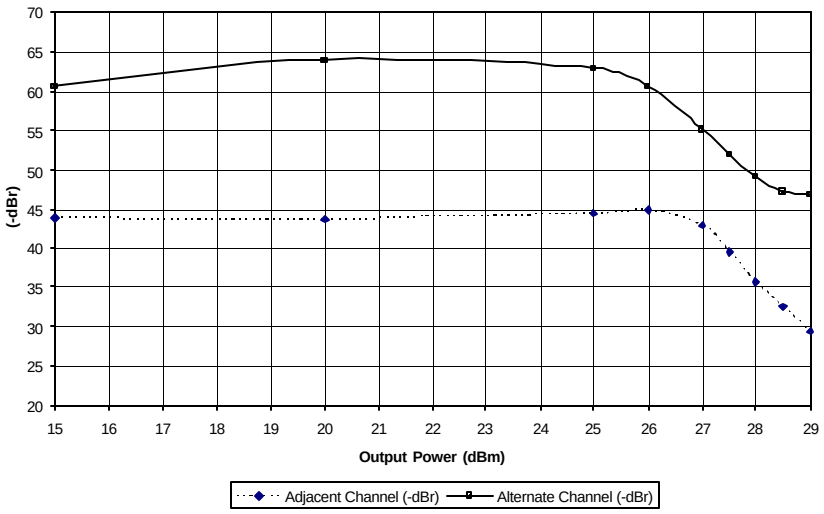



IM3 vs Pout (2 tone avg.), T=25C
Tone Spacing=1MHz

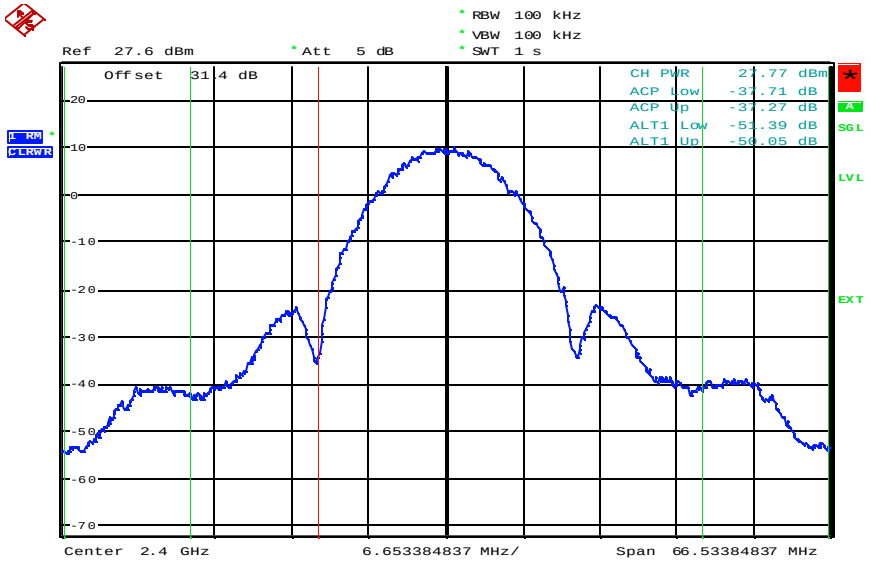


**Performance: 2.3 - 2.7 GHz Evaluation Board Data ($V_{cc}$ = $V_{pc}$ = 5.0V, $I_q$ = 300mA)**

**802.11b Spectral Regrowth vs. Output Power at 2.4 GHz**

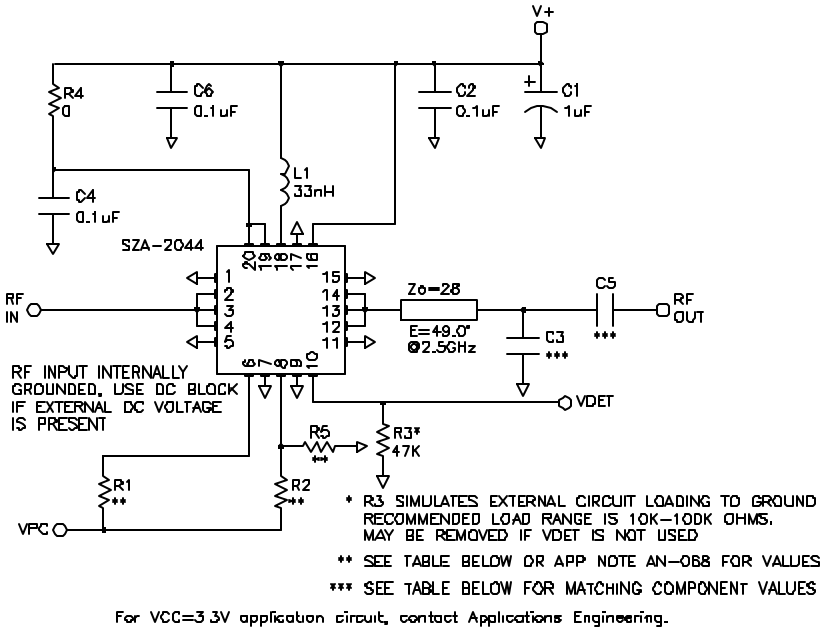



**Output Power Spectrum 802.11b 11mbps cck, Pout = 27.8dBm at 2.4GHz**




Date: 3.AUG.2004 15:48:28

## 2.0 - 2.7 GHz Evaluation Board Schematic For V+ = Vcc = 5.0V



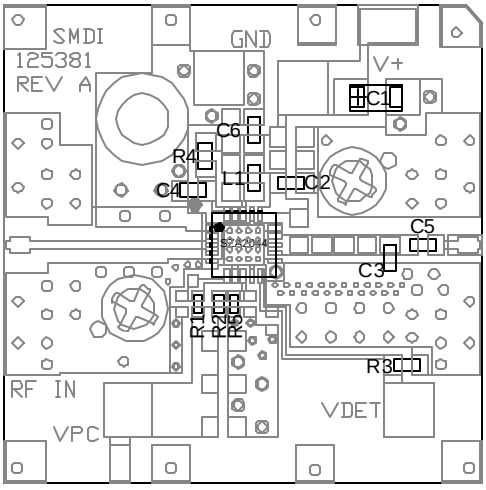

For VCC=3.3V application circuit, contact Applications Engineering.

**Important Note:**
Pins 1,2,4,5,7,9,11,13,15,17,19 are unwired (N/C) inside the package. Refer to page 2 for detailed pin descriptions. Some of these pins are wired to adjacent pins or grounded as shown in the application circuit. This is to maintain consistency with the evaluation board layout shown below. It is recommended to use this layout and wiring to achieve the specified performance.

**Note:**
Application circuits are specified below for 2.0-2.2GHz and 2.3-2.7GHz bands. Only the output matching circuit component values change.

## 2.0 - 2.7 GHz Evaluation Board Layout For V+ = Vcc = 5.0V

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




| DESG | DESCRIPTION |
|---|---|
| Q1 | SZA–2044 |
| R1 | See Table 2, 0402 1% |
| R2 | See Table 2, 0402 1% |
| R3 | 47K OHM, 0603 or 0402 |
| R4 | 0 OHM, 0603 or 0402 |
| R5 | See Table 2, 0402 1% |
| C1 | 1uF 16V TANTALUM CAP |
| C2,4,6 | 0.1uF CAP, 0603 or 0402 |
| C3 | See Table 1, 0603 |
| C5 | See Table 1, 0603 |
| L1 | 33nH IND, 0603 (TOKO LL1608-FH33NJ OR EQUIV) |

| Freq. Range | C3 | C5 |
|---|---|---|
| 2.0 – 2.2 GHz | 1.0pF | 15pF |
| 2.3 – 2.7 GHz | 0.5pF | 18pF |

Table 1. Output matching capacitor values (Vcc=5V, Iq=302mA)

| VPC(V) | R1 | R2 | R5 |
|---|---|---|---|
| 2.8 | 348 | 274 | OUT |
| 3.0 | 121 | 105 | OUT |
| 3.1 | 205 | 182 | OUT |
| 3.2 | 287 | 261 | OUT |
| 3.3 | 374 | 332 | OUT |
| 5.0 | 1.82K | 1.10K | 4.75K |

Table 2. Resistor values for Vpc=2.9V to 5V (Vcc=5V, Iq=302mA)

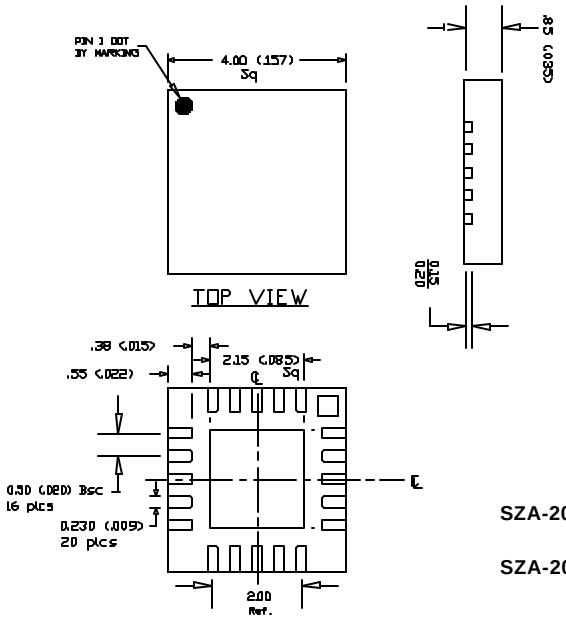
### Part Symbolization

The part will be symbolized with an "SZA-2044" for Sn/Pb plating or "SZA-2044Z" for 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 |
|---|---|---|
| SZA-2044 | 13" | 3000 |
| SZA-2044Z | 13" | 3000 |

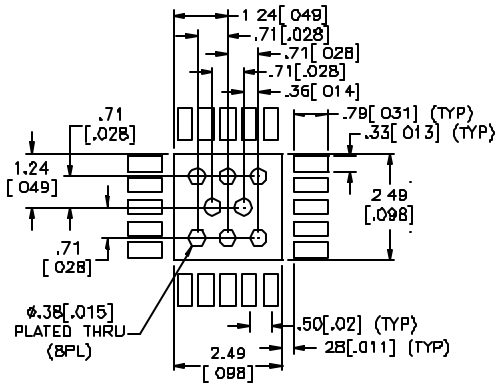
**Package Outline Drawing (dimensions in mm): Refer to package outlline drawing for more detail.**




**SZA-2044 - 85/15 Sn/Pb plating**

**SZA-2044Z - Matte Sn plating**

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




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