



RFS P2023
2.4 GHz 802.11b/g
WLAN Power Amplifier
Data Sheet - Rev 2.3

FEATURES

- <3% EVM, 145 mA @ P_{OUT} = +19 dBm with IEEE 802.11g Modulation at 54 Mbps
- -38 dBc ACPR 1st Sidelobe at +23 dBm with IEEE 802.11b Modulation at 11 Mbps
- -54 dBc ACPR 2nd Sidelobe at +23 dBm with IEEE 802.11b Modulation at 11 Mbps
- No RF Matching Required
- 34 dB of Linear Power Gain
- Temperature-Compensated Linear Power Detector

APPLICATIONS

- IEEE 802.11 b/g WLAN
- 2.4 GHz Cordless Phones
- 2.4 GHz ISM Equipment



PRODUCT DESCRIPTION

The RFS P2023 power amplifier is a high performance InGaP HBT IC designed for transmit applications in the 2.4-2.5 GHz band. The part is matched at the input and output so no additional RF matching components are required off-chip. The

PA exhibits unparalleled linearity and efficiency for both 802.11g and 802.11b WLAN systems. The power detector is temperature compensated on chip enabling a single-ended output voltage. The part is biased by a single +3.3 V supply.

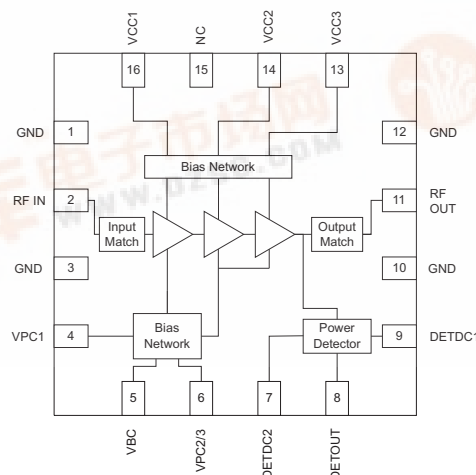


Figure 1: Block Diagram and Pinout



Table 1: Pin Description

| PIN | NAME | DESCRIPTION | PIN | NAME | DESCRIPTION |
|-----|--------------------|-----------------------|-----|--------------------|-----------------|
| 1 | GND | Ground | 9 | DET _{DC1} | Detector Bias 1 |
| 2 | RF _{IN} | RF Input | 10 | GND | Ground |
| 3 | GND | Ground | 11 | RF _{OUT} | RF Output |
| 4 | V _{PC1} | Power Control 1 | 12 | GND | Ground |
| 5 | V _{BC} | Bias Circuit Voltage | 13 | V _{CC3} | Supply Voltage |
| 6 | V _{PC2/3} | Power Control 2/3 | 14 | V _{CC2} | Supply Voltage |
| 7 | DET _{DC2} | Detector Bias 2 | 15 | NC | No Connect |
| 8 | DET _{OUT} | Power Detector Output | 16 | V _{CC1} | Supply Voltage |

ELECTRICAL CHARACTERISTICS

Table 2: Absolute Minimum and Maximum Ratings

| PARAMETER | MIN | MAX | UNIT | COMMENTS |
|---|-----|------|------|--|
| DC Power Supply (V_{CC1} , V_{CC2} , V_{CC3}) | | 4.0 | V | |
| Power Control Level (V_{PC1} , $V_{PC2/3}$) | | 4.0 | V | Applied to series resistors external to V_{PC} pins. No RF signal applied. |
| DC Current Consumption | | 400 | mA | |
| RF Input Level (RF_{IN}) | | -5 | dBm | |
| Operating Ambient Temperature | 0 | +85 | °C | |
| Storage Temperature | -55 | +150 | °C | |

Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability.

Table 3: Operating Ranges

| PARAMETER | MIN | TYP | MAX | UNIT | COMMENTS |
|--|------|-----|------|------|--|
| Operating Frequency | 2400 | - | 2500 | MHz | |
| Supply Voltage (V_{CC1} , V_{CC2} , V_{CC3}) | 3.0 | 3.3 | 3.6 | V | |
| Power Control Voltage (V_{PC1} , $V_{PC2/3}$) | - | 3.3 | - | V | PA_{ON} . Applied to series resistors external to V_{PC} pins. |
| | 0 | - | 0.5 | V | $PA_{SHUTDOWN}$. Applied to series resistors external to V_{PC} pins. |

The device may be operated safely over these conditions; however, parametric performance is guaranteed only over the conditions defined in the electrical specifications.

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Table 4: IEEE 802.11g Modulation, 54 Mbps OFDM
(V_{CC} = 3.3 V, V_{PC} = 3.3 V, P_{OUT} = +19 dBm, +25 °C)

| PARAMETER | MIN | TYP | MAX | UNIT | COMMENTS |
|------------------------------|------|------------|------------|---------|--|
| Power Gain | 31.5 | 34.5 | 37.0 | dB | P _{OUT} = +19 dBm |
| Gain Ripple | | | ±0.75 | dB | |
| Current Consumption | | 145 | 165 | mA | P _{OUT} = +19 dBm |
| Error Vector Magnitude (EVM) | | 2.8 -31 | 4.0 -28 | % dB | P _{OUT} = +19 dBm P _{OUT} = +19 dBm |
| Power Detector Voltage | 0.50 | 0.60 | 0.70 | V | P _{OUT} = +19 dBm, 1KΩ Load |
| Detector Sensitivity | | 75 | | mV/dB | |
| Detector Output Impedance | 1 | | | KΩ | |

Notes:

1. EVM includes noise floor of 1% (-40 dB).

Table 5: IEEE 802.11b Modulation, 11 Mbps DSSS, CCK
(V_{CC} = 3.3 V, V_{PC} = 3.3 V, P_{OUT} = +21 dBm, +25 °C)

| PARAMETER | MIN | TYP | MAX | UNIT | COMMENTS |
|--|------|------|-------|-------|--|
| Power Gain | 31.5 | 34.5 | 37.0 | dB | P _{OUT} = +21 dBm |
| Gain Ripple | | | ±0.75 | dB | |
| Current Consumption | | 175 | 195 | mA | P _{OUT} = +21dBm |
| ACPR - 1st Sidelobe (11 MHz Offset) | | -38 | -33 | dBc | P _{OUT} = +21 dBm; 1,2,5,5,11 Mbps |
| ACPR - 2nd Sidelobe (22 MHz Offset) | | -54 | -53 | dBc | P _{OUT} = +21 dBm; 1,2,5,5,11 Mbps |
| Power Detector Voltage | 0.7 | 0.8 | 0.9 | V | P _{OUT} = +21 dBm, 1KΩ Load |
| Detector Sensitivity | | 75 | | mV/dB | |
| Detector Output Impedance | 1 | | | KΩ | |

Table 6: Continuous Wave Signal
(V_{CC} = 3.3 V, V_{PC} = 3.3 V, +25 °C)

| PARAMETER | MIN | TYP | MAX | UNIT | COMMENTS |
|-------------------------------|------|------------|------------|--------|----------------------------|
| P1 dB | 25.0 | 26.5 | 28.0 | dBm | |
| Harmonics 2fo 3fo | | -20 -25 | -16 -20 | dBc | |
| Stability | | 5:1 | | | P _{out} = +25 dBm |
| Input Return Loss | | -7 | -4 | dB | |
| Output Return Loss | | -12 | -9 | dB | |
| Output Noise Power | | | 130 | dBm/Hz | |
| Reverse Isolation | 40 | | | dB | |
| Shutdown Current | | | 1 | μA | |
| Quiescent Current | 30 | 45 | 60 | mA | |
| T _{ON} Setting Time | | | 1 | μS | Settles within ±0.5 dB |
| T _{OFF} Setting Time | | | 1 | μS | |

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PERFORMANCE DATA

Figure 2: Gain, Current, EVM vs. Output Power at 2.412 GHz, 3.3 V (IEEE 802.11g @ 54 Mbps)

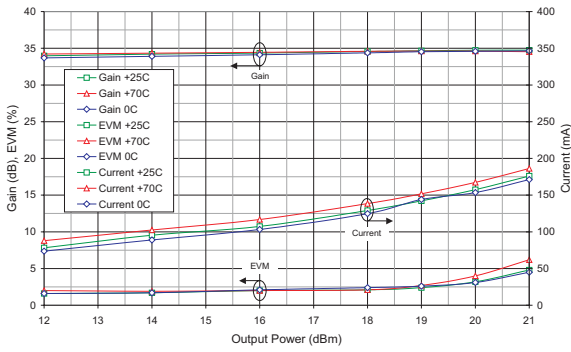


Figure 3: Gain, Current vs. Output Power at 2.412 GHz, 3.3 V (IEEE 802.11b Signal @ 11 Mbps)

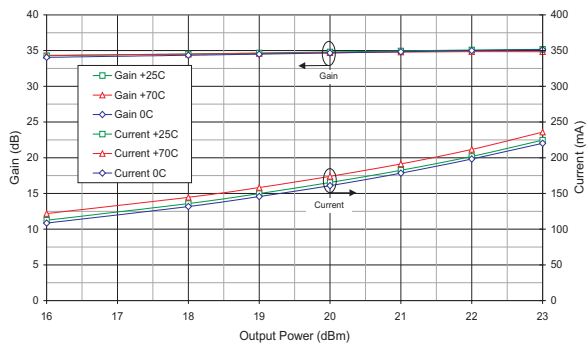


Figure 4: Gain, Current, EVM vs. Output Power at 2.437 GHz, 3.3 V (IEEE 802.11g @ 54 Mbps)

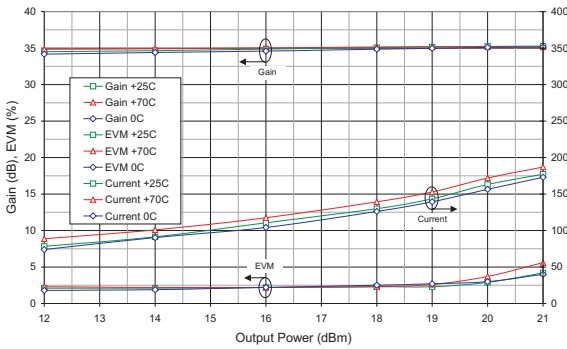


Figure 5: Gain, Current vs. Output Power at 2.437 GHz, 3.3 V (IEEE 802.11b Signal @ 11 Mbps)

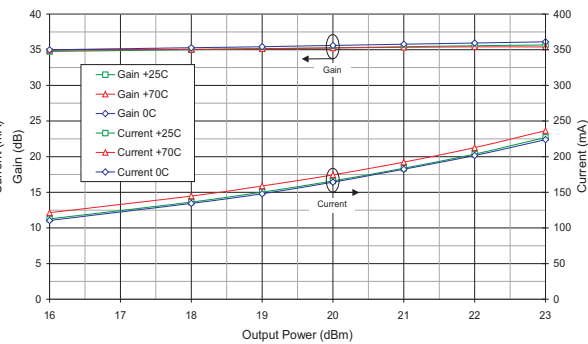


Figure 6: Gain, Current, EVM vs. Output Power at 2.462 GHz, 3.3 V (IEEE 802.11g @ 54 Mbps)

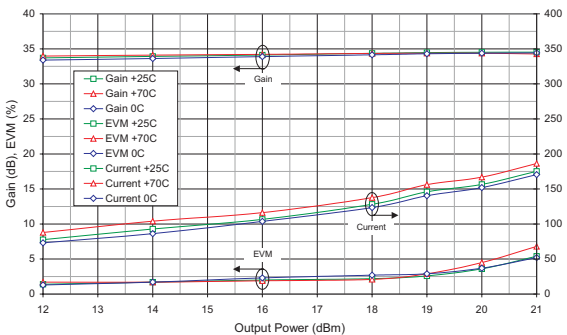


Figure 7: Gain, Current vs. Output Power at 2.462 GHz, 3.3 V (IEEE 802.11b Signal @ 11 Mbps)

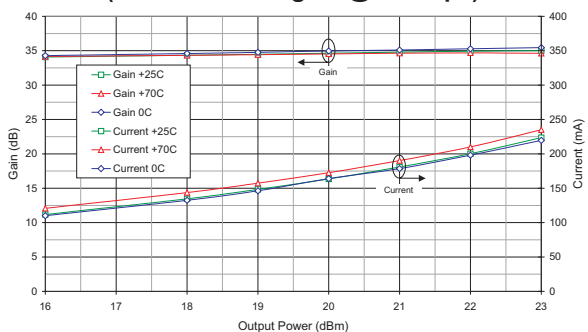


Figure 8: Power Detector Voltage vs. Output Power at 2.412 GHz, 3.3 V (IEEE 802.11g @ 54 Mbps)

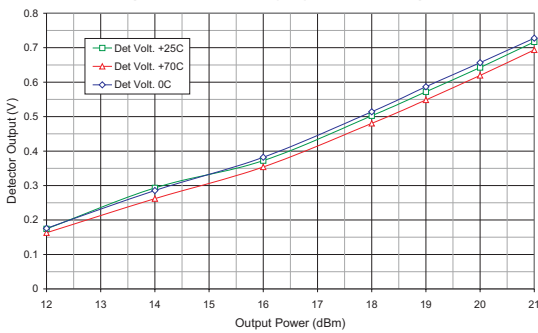


Figure 9: Power Detector Voltage vs. Output Power at 2.412 GHz, 3.3 V (IEEE 802.11b @ 11 Mbps)

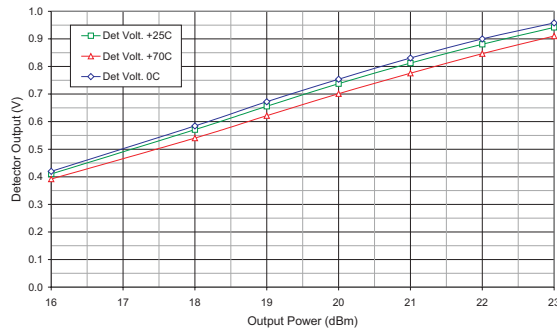


Figure 10: Power Detector Voltage vs. Output Power at 2.437 GHz, 3.3 V (IEEE 802.11g @ 54 Mbps)

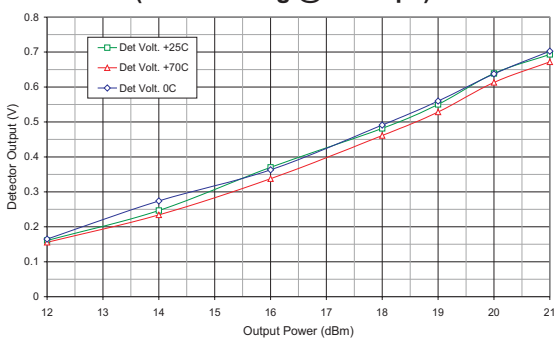


Figure 11: Power Detector Voltage vs. Output Power at 2.437 GHz, 3.3 V (IEEE 802.11b @ 11 Mbps)

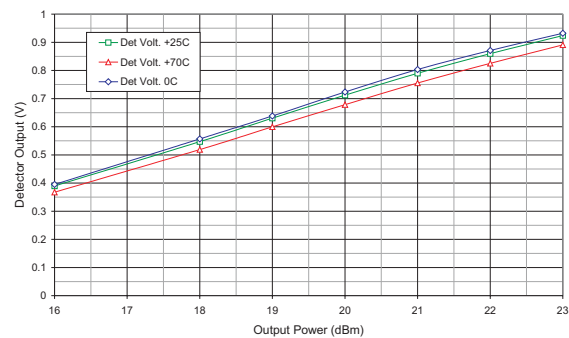


Figure 12: Power Detector Voltage vs. Output Power at 2.462 GHz, 3.3 V (IEEE 802.11g @ 54 Mbps)

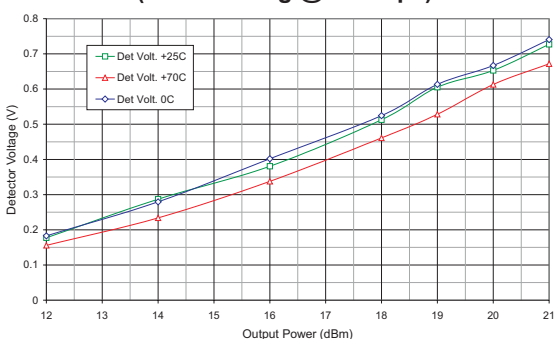


Figure 13: Power Detector Voltage vs. Output Power at 2.462 GHz, 3.3 V (IEEE 802.11b @ 11 Mbps)

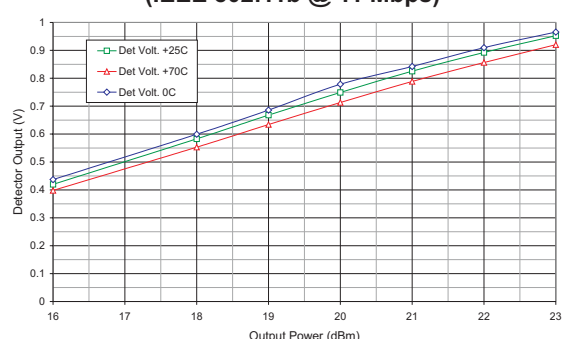


Figure 14: ACPR Sidelobes vs. Output Power at 2.412 GHz, 3.3 V (IEEE 802.11b @ 11 Mbps)

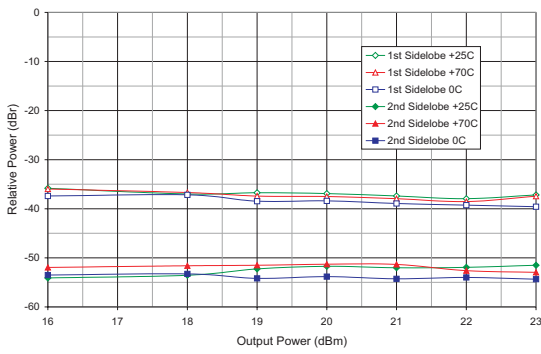


Figure 15: ACPR Sidelobes vs. Output Power at 2.462 GHz, 3.3 V (IEEE 802.11b @ 11 Mbps)

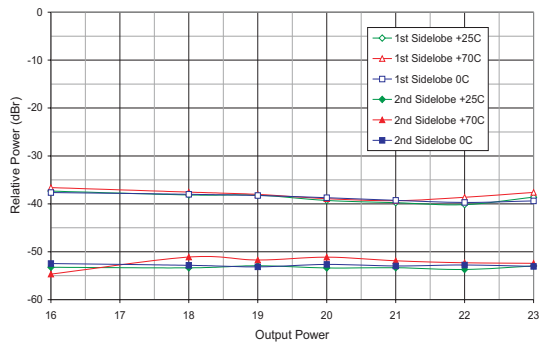


Figure 16: +23 dBm Output Power at 2.412 GHz, 3.3 V (IEEE 802.11b @ 11 Mbps)

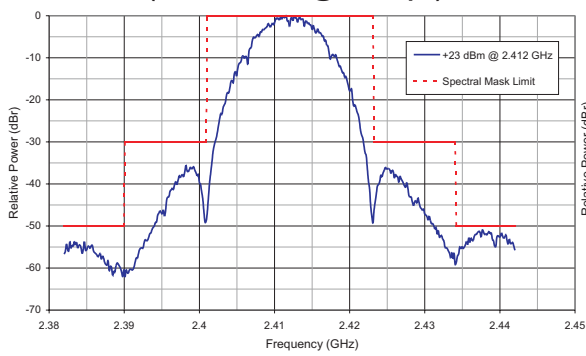


Figure 17: +23 dBm Output Power at 2.462 GHz, 3.3 V (IEEE 802.11b @ 11 Mbps)

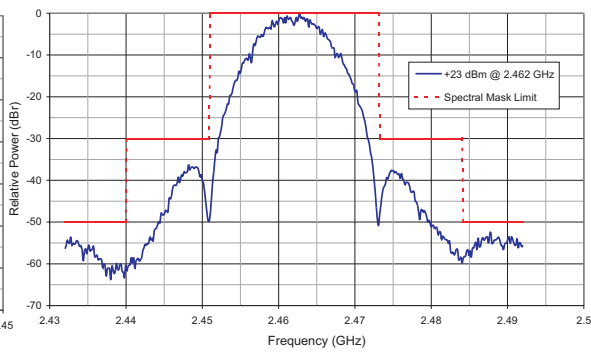
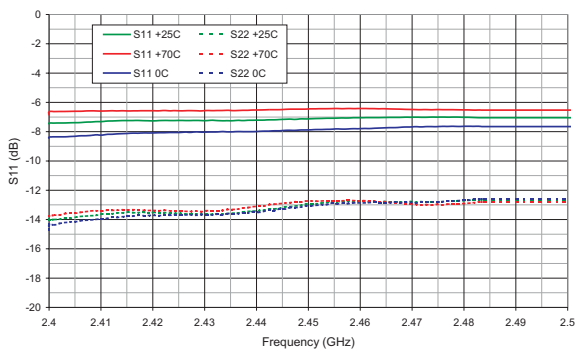


Figure 18: S-Parameter Data S11 and S22, 3.3 V



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APPLICATION INFORMATION

****NOTES****

RF traces should be 18 mils wide
with 20 mils of clearance
DC traces should be 8 mils wide with
8 mils of clearance
DNP = Do Not Place

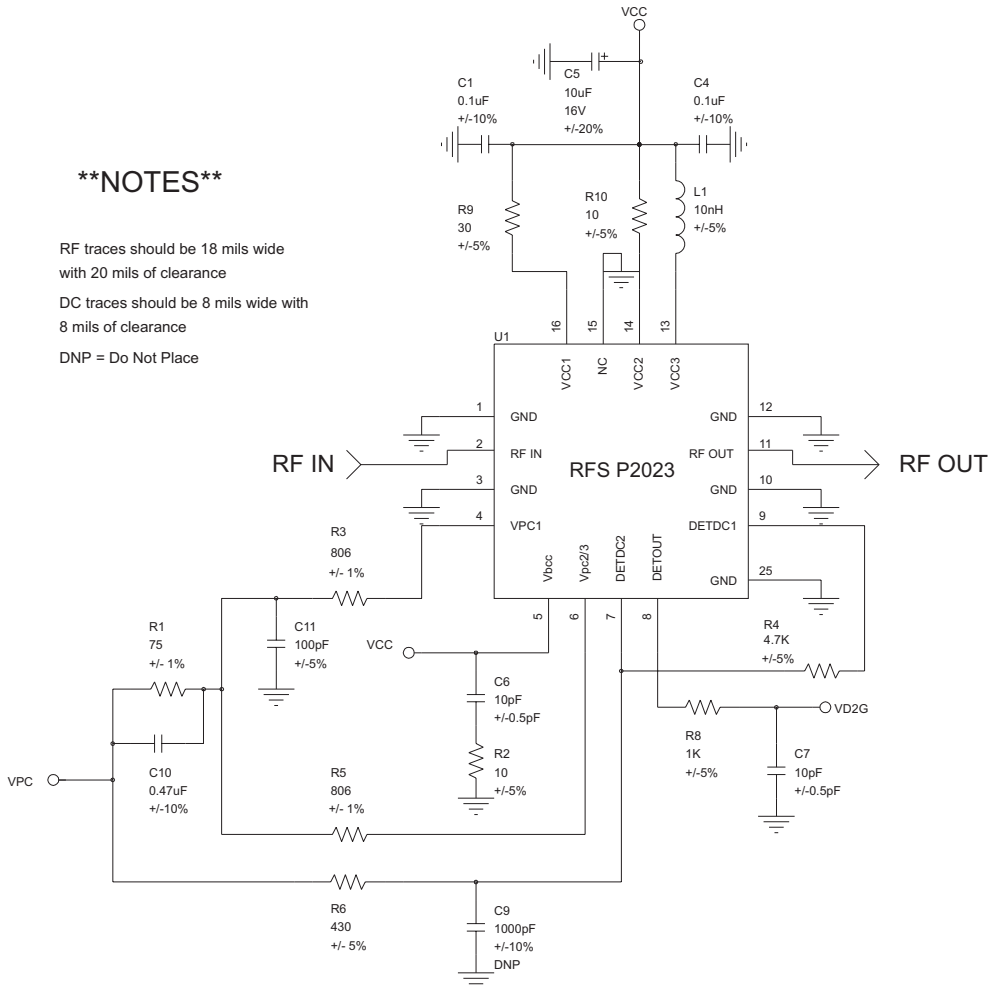
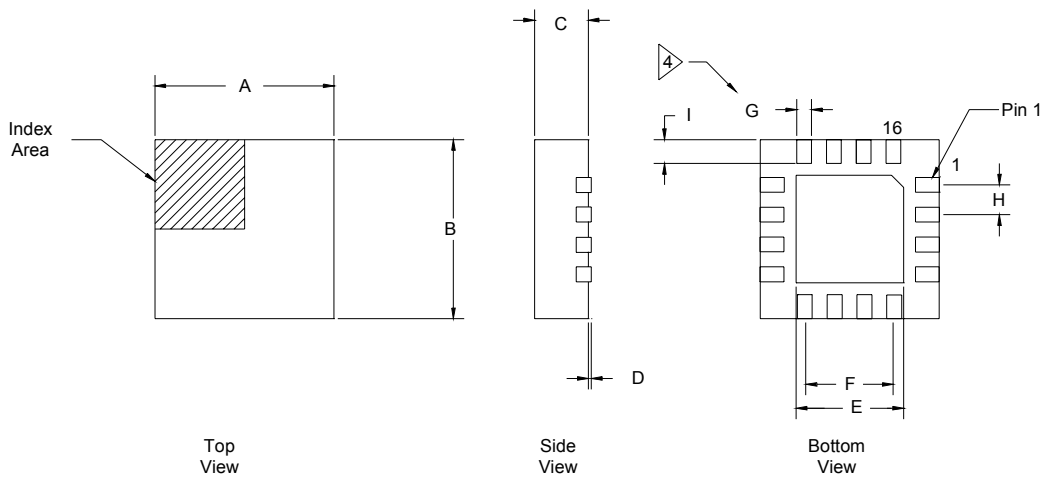


Figure 19: Recommended Application Circuit

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PACKAGE OUTLINE



| DIMENSION | MILLIMETERS | | |
|-----------|-------------|-------|-------|
| | MIN | TYP | MAX |
| A | 2.90 | 3.00 | 3.10 |
| B | 2.90 | 3.00 | 3.10 |
| C | 0.80 | 0.90 | 1.00 |
| D | 0.00 | 0.02 | 0.05 |
| E | 1.65 | 1.80 | 1.95 |
| F | 1.50 BSC. | | |
| G | 0.225 | 0.250 | 0.275 |
| H | 0.50 BSC. | | |
| I | 0.35 | 0.40 | 0.45 |

1. All dimensions are in millimeters, angles in degrees.
2. The terminal #1 identifier and pad numbering convention shall conform to JESD 95-1 SPP-012
3. Lead coplanarity: 0.05 max.
4. Dimension applies to metalized pad and is measured between 0.25 and 0.30 MM from pad tip.

Figure 20: Package Outline

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NOTES

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ORDERING INFORMATION

| ORDER NUMBER | TEMPERATURE RANGE | PACKAGE DESCRIPTION | COMPONENT PACKAGING |
|------------------------------------|-------------------|----------------------------|---------------------------------------|
| PRFS-P2023-EVL | 0 °C to +70 °C | 16 Pin 3 x 3 x 0.9 mm LPCC | 1 piece Evaluation Board |
| PRFS-P2023-005 | 0 °C to +70 °C | 16 Pin 3 x 3 x 0.9 mm LPCC | 13" Reverse 2,500 piece Tape and Reel |
| PRFS-P2023-006 | 0 °C to +70 °C | 16 Pin 3 x 3 x 0.9 mm LPCC | 13" Forward 2,500 piece Tape and Reel |
| PRFS-P2023-007 | 0 °C to +70 °C | 16 Pin 3 x 3 x 0.9 mm LPCC | 7" Reverse 1,000 piece Tape and Reel |
| PRFS-P2023-008 | 0 °C to +70 °C | 16 Pin 3 x 3 x 0.9 mm LPCC | 7" Forward 1,000 piece Tape and Reel |
| PRFS-P2023-009 | 0 °C to +70 °C | 16 Pin 3 x 3 x 0.9 mm LPCC | 1-999 piece Tubes or Tray |
| Leadfree and RoHS Compliant | | | |
| RFS2023RS28Q1 | 0 °C to +70 °C | 16 Pin 3 x 3 x 0.9 mm LPCC | 1,000 piece Tape and Reel |
| RFS2023RS28P0 | 0 °C to +70 °C | 16 Pin 3 x 3 x 0.9 mm LPCC | 1-999 piece Tubes |
| RFS2023RS28P6 | 0 °C to +70 °C | 16 Pin 3 x 3 x 0.9 mm LPCC | 1-999 piece Tray |
| EVA2023RS28 | 0 °C to +70 °C | 16 Pin 3 x 3 x 0.9 mm LPCC | 1 piece Evaluation Board |



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