



DC35GN-15-Q4

15 Watts • 50 Volts • Pulsed & CW
GaN on SiC Wideband Transistor
QFN 4x4 mm

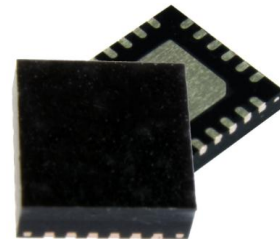
GENERAL DESCRIPTION

The DC35GN-15-Q4 is a COMMON SOURCE, class -AB, GaN on SiC HEMT transistor capable of broadband pulsed and CW RF power applications. This transistor utilizes gold metallization, air-cavity Cu-base QFN package with high-thermal conductivity to provide superior electrical and thermal performance with excellent reliability & ruggedness.

FEATURES:

- Wide-band DC-3.5 GHz general purpose driver applications
- Ideal for Pulsed Radar, Avionics, ISM, and CW Communication
- 15 W Pulsed and CW Psat and 18 dB Power Gain @ 1.4 GHz
- Low-cost QFN package with excellent RF & Thermal performance
- 50V Bias Operation with high breakdown voltage

PACKAGE OUTLINE QFN 4X4 mm



ABSOLUTE MAXIMUM RATINGS

Maximum CW Power Dissipation

Device Dissipation @ 25°C 15 W

Maximum Voltage and Current

Drain-Source Voltage (V_{DSS}) 125 V
Gate-Source Voltage (V_{GS}) -8 to +0 V
Supply Current (I_{DD}) 700 mA

Maximum Temperatures

Storage Temperature (T_{STG}) -55 to +125° C
Operating Junction Temperature +200 °C

TYPICAL PERFORMANCE SUMMARY ¹ @ 25°C

| Parameter | Units | 0.960 GHz | 1.2 GHz | 1.4 GHz | 2.7 GHz | 2.9 GHz | 3.1 GHz | 3.5 GHz |
|---------------------------|-------|-----------|---------|---------|---------|---------|---------|---------|
| Output Power Psat | W | 20 | 21 | 19 | 20 | 20 | 20 | 16 |
| Power Gain | dB | 18.5 | 18.3 | 18 | 13 | 13 | 13 | 12 |
| η_D Drain Efficiency | % | 65 | 72 | 66 | 60 | 63 | 60 | 60 |

¹ Bias Condition: Vdd=+50V, Idq= 40 mA (Vgs= -2.0 ~ -4.5V typical), PW= 1 mS, DC = 10%
RF performance measured on the recommended evaluation board.



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DC FUNCTIONAL CHARACTERISTICS @ 25°C

| | | | | | | |
|--------------|--------------------------------|------------------------------|------|------|------|----|
| $I_{D(Off)}$ | Drain leakage current | $V_{GS} = -8V, V_{DD} = 50V$ | | | 1 | mA |
| $I_{G(Off)}$ | Gate leakage current | $V_{GS} = -8V, V_{DD} = 0V$ | | | 0.2 | mA |
| BV_{DSS} | Drain-Source breakdown voltage | $V_{GS} = -8V, I_{DD} = 2mA$ | 125 | | | V |
| $V_{GS(TH)}$ | Gate Threshold Voltage | $V_{DS} = 50V, I_{DD} = 2mA$ | -4.8 | -3.4 | -2.5 | V |

ELECTRICAL CHARACTERISTICS¹ @ 25°C

| Symbol | Characteristics | Test Conditions ¹ | Min | Typ | Max | Units |
|---------------|---|---------------------------------|-----|------------|-----|--------------------|
| P_{out} | Output Power | $P_{in}=0.32W$ Freq=1400 MHz | 15 | 19 | | W |
| G_p | Power Gain | $P_{in}=0.32W$ Freq=1400 MHz | | 18 | | dB |
| η_D | Drain Efficiency | $P_{in}=0.32W$ Freq=1400 MHz | 55 | 66 | | % |
| D_r | Droop | $P_{in}=0.32W$ Freq=1400 MHz | | 0.1 | | dB |
| VSWR-T | Load Mismatch Tolerance | $P_{in}=0.32W$ Freq=1400 MHz | | | 5:1 | |
| Θ_{jc} | Thermal Resistance including PCB, $T_{base} = 85\text{ }^\circ\text{C}$ | Pulse Width=1 mS Duty=10% CW | | 3.5 8.4 | | $^\circ\text{C/W}$ |

¹ Bias Condition: $V_{dd}=+50V, I_{dq}= 40\text{ mA}$ ($V_{gs} = -2.0 \sim -4.5V$ typical), $PW=1\text{ mS}$, $DC = 10\%$
RF performance measured on the recommended evaluation board.



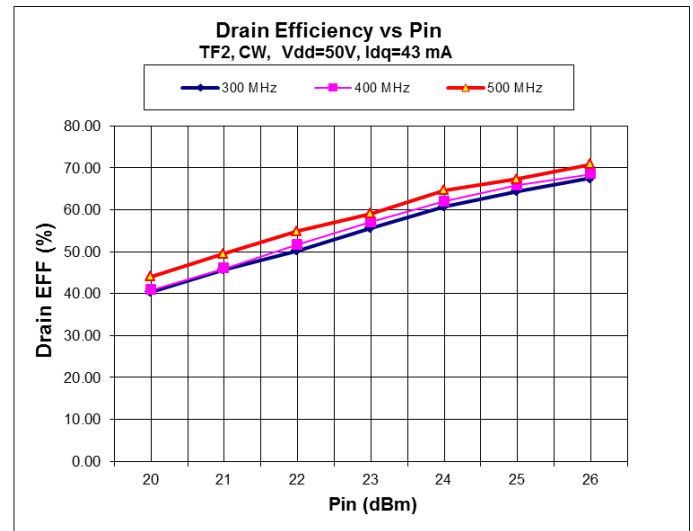
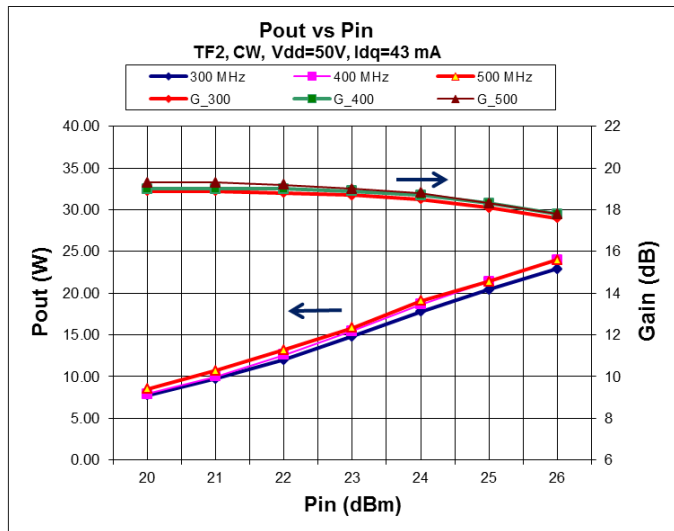
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TYPICAL CW PERFORMANCE DATA 300 – 500 MHz Band

| Frequency | Pin (W) | Pout (W) | Id (A) | RL (dB) | η_D (%) | Gain (dB) | Droop (dB) |
|-----------|---------|----------|--------|---------|--------------|-----------|------------|
| 300 MHz | 0.32 | 20.4 | .633 | -11 | 64.5 | 18.1 | N/A |
| 400 MHz | 0.32 | 21.4 | .649 | -12.5 | 66 | 18.3 | N/A |
| 500 MHz | 0.32 | 21.4 | .635 | -12.3 | 67 | 18.3 | N/A |

PERFORMANCE PLOTS





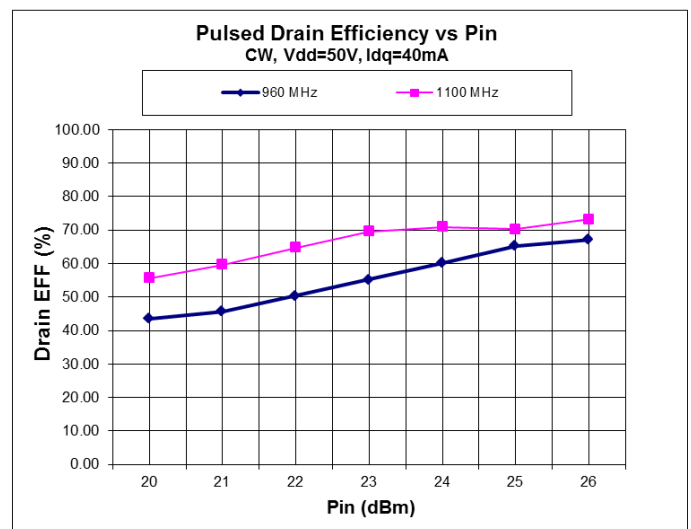
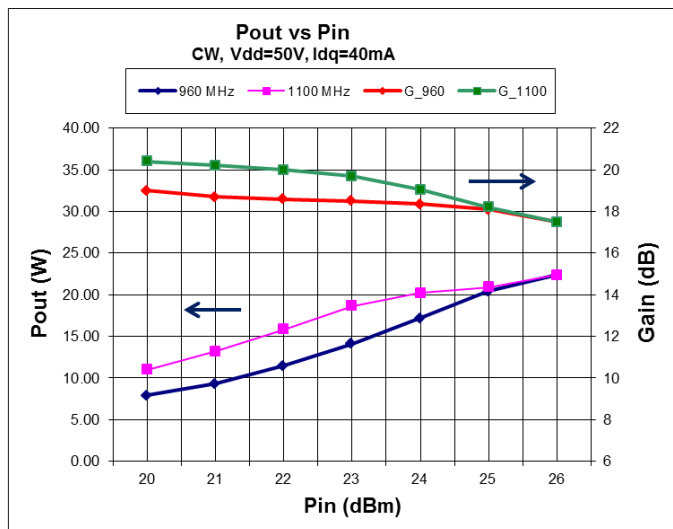
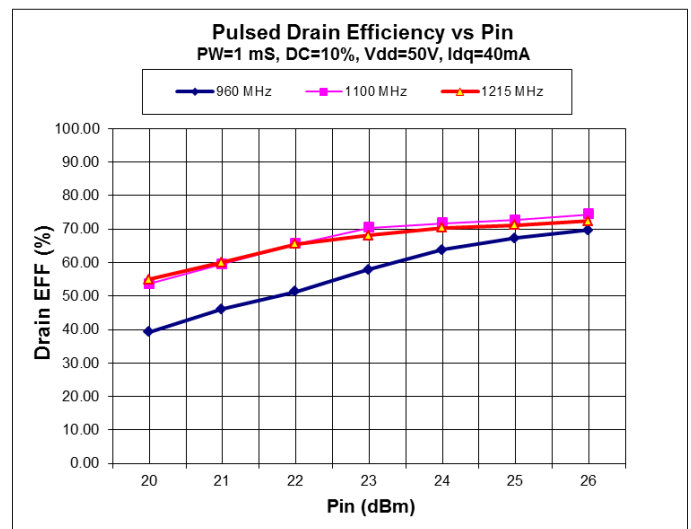
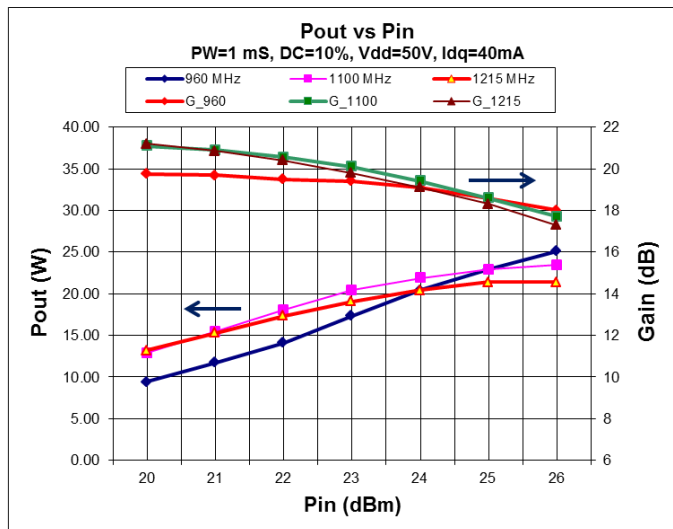
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TYPICAL BROAD BAND PULSED PERFORMANCE DATA¹ 0.96 – 1.215 GHz Band

| Frequency | Pin (W) | Pout (W) | Id (A) | RL (dB) | η_D (%) | Gain (dB) | Droop (dB) |
|-----------|---------|----------|--------|---------|--------------|-----------|------------|
| 960 MHz | 0.32 | 22 | .680 | -12 | 67 | 18.6 | 0.25 |
| 1100 MHz | 0.32 | 22 | .630 | -10.5 | 72 | 18.6 | 0.12 |
| 1215 MHz | 0.32 | 21 | .600 | -14.7 | 71 | 18.3 | 0.10 |

PERFORMANCE PLOTS



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Specifications are subject to change, consult the RFIS factory at (408) 986-8031 for the latest information



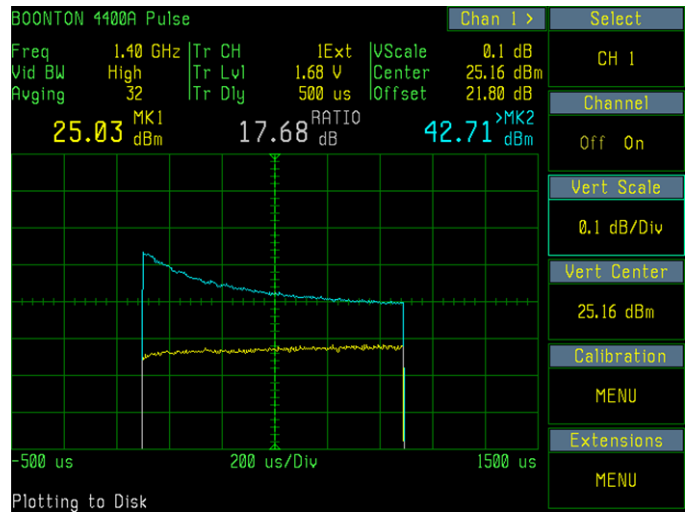
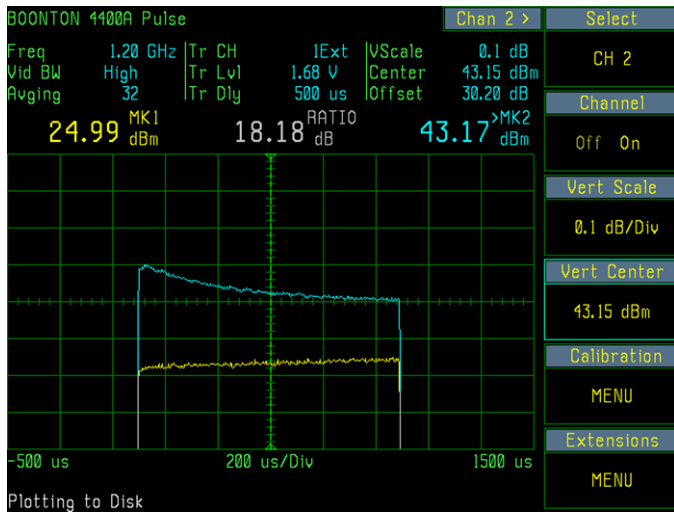
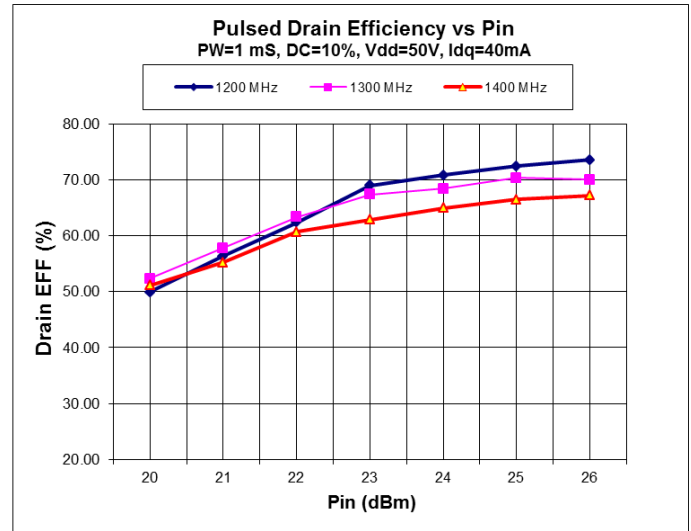
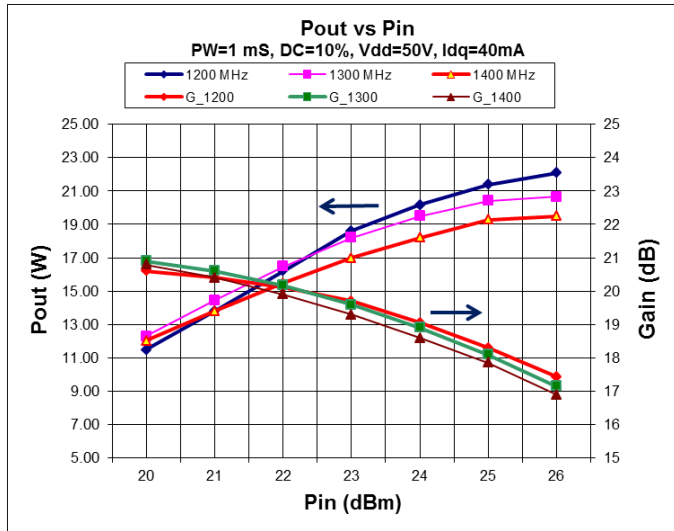
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TYPICAL BROAD BAND PULSED PERFORMANCE DATA¹ 1.2 – 1.4 GHz Band

| Frequency | Pin (W) | Pout (W) | Id (A) | RL (dB) | η_D (%) | Gain (dB) | Drop (dB) |
|-----------|---------|----------|--------|---------|--------------|-----------|-----------|
| 1200 MHz | 0.32 | 21.4 | .590 | -10 | 72.5 | 18.3 | 0.1 |
| 1300 MHz | 0.32 | 20.4 | .580 | -17 | 70.3 | 18.1 | 0.1 |
| 1400 MHz | 0.32 | 19.3 | .580 | -12 | 66.5 | 17.9 | 0.12 |

PERFORMANCE PLOTS



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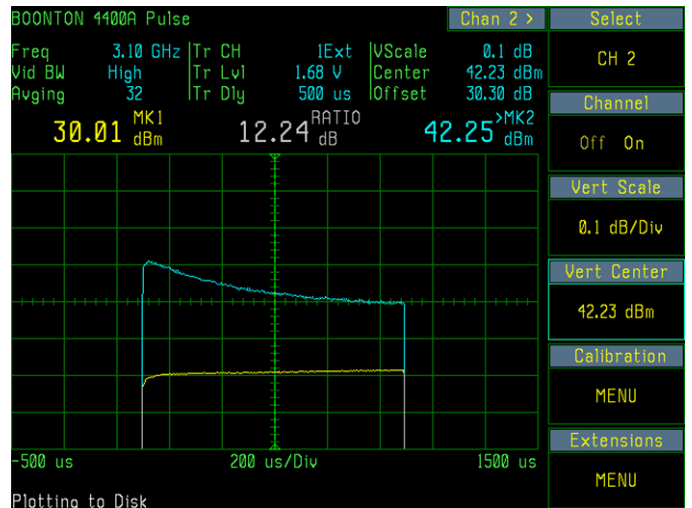
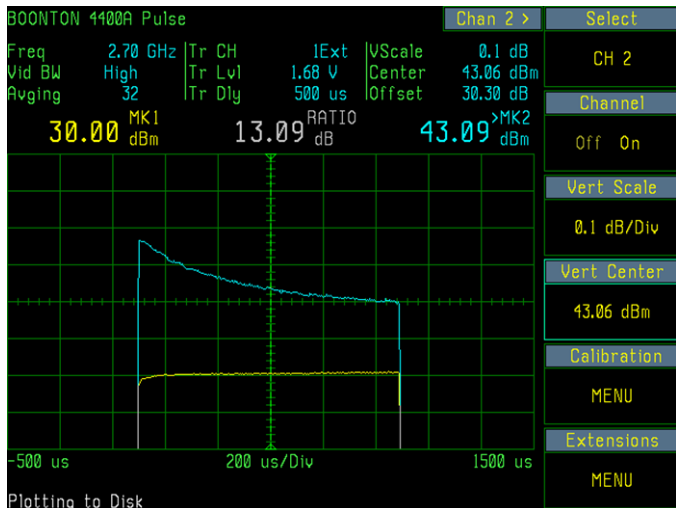
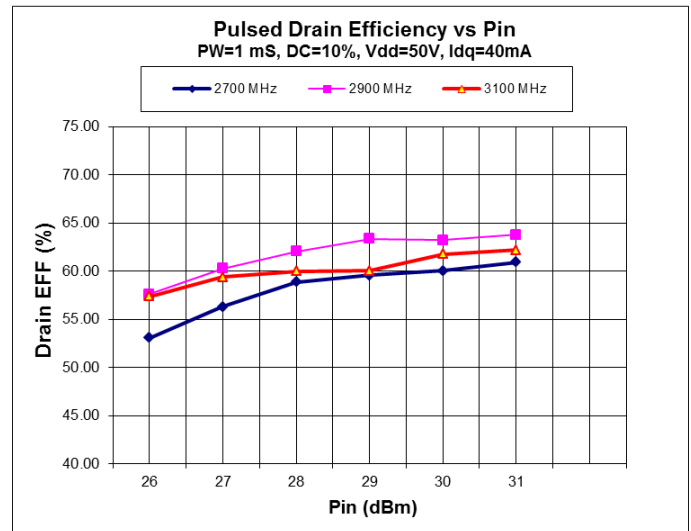
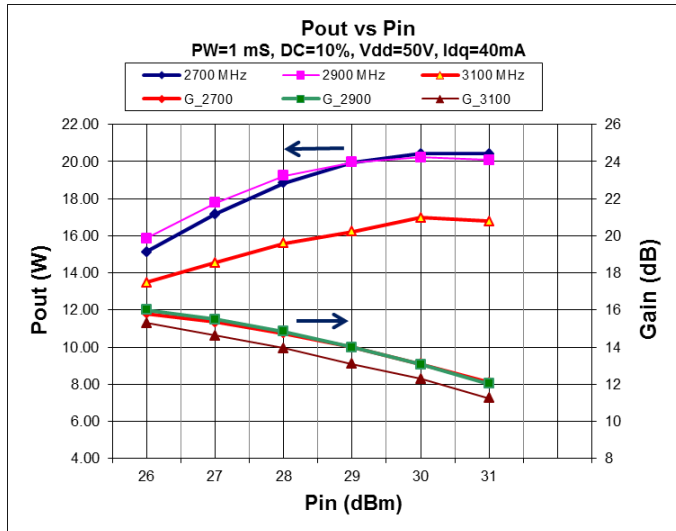
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TYPICAL BROAD BAND PULSED PERFORMANCE DATA¹ 2.7 – 3.1 GHz Band

| Frequency | Pin (W) | Pout (W) | Id (A) | RL (dB) | η_D (%) | Gain (dB) | Droop (dB) |
|-----------|---------|----------|--------|---------|--------------|-----------|------------|
| 2700 MHz | 1.0 | 20.4 | .680 | -6.0 | 60.0 | 13.1 | 0.12 |
| 2900 MHz | 1.0 | 20.2 | .640 | -10.2 | 63 | 13.1 | 0.10 |
| 3100 MHz | 1.0 | 17 | .550 | -9.5 | 62 | 12.3 | 0.09 |

PERFORMANCE PLOTS



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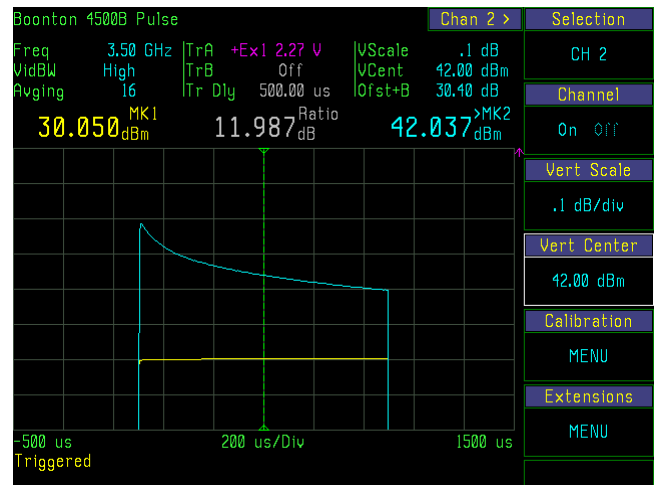
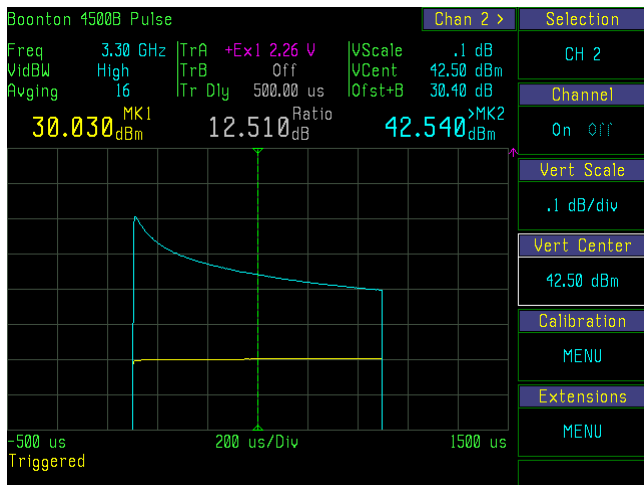
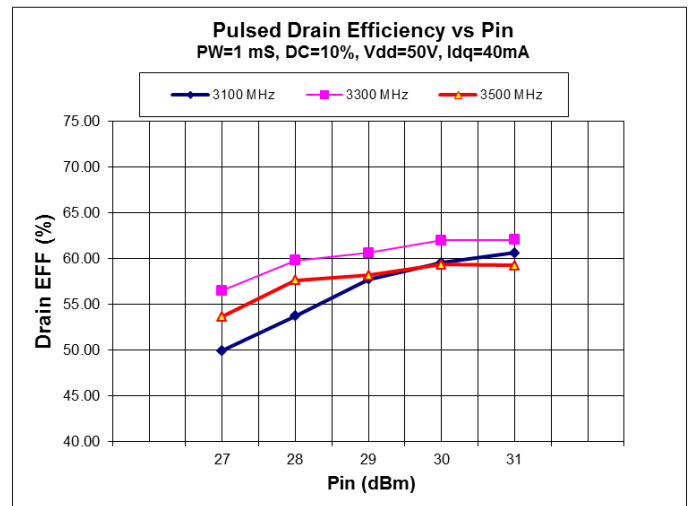
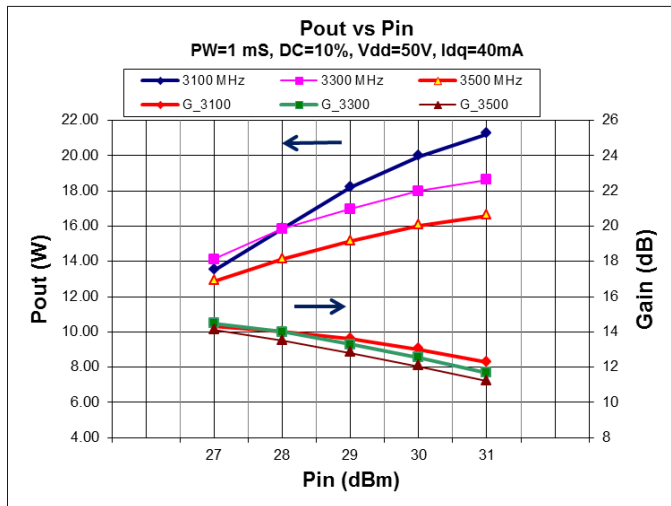
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TYPICAL BROAD BAND PULSED PERFORMANCE DATA¹ 3.1 – 3.5 GHz Band

| Frequency | Pin (W) | Pout (W) | Id (A) | RL (dB) | η_D (%) | Gain (dB) | Drop (dB) |
|-----------|---------|----------|--------|---------|--------------|-----------|-----------|
| 3100 MHz | 1.0 | 20.0 | .670 | -6 | 60 | 13 | 0.2 |
| 3300 MHz | 1.0 | 18.0 | .580 | -7.6 | 62 | 12.6 | 0.12 |
| 3500 MHz | 1.0 | 16.0 | .540 | -8.4 | 60 | 12 | 0.11 |

PERFORMANCE PLOTS



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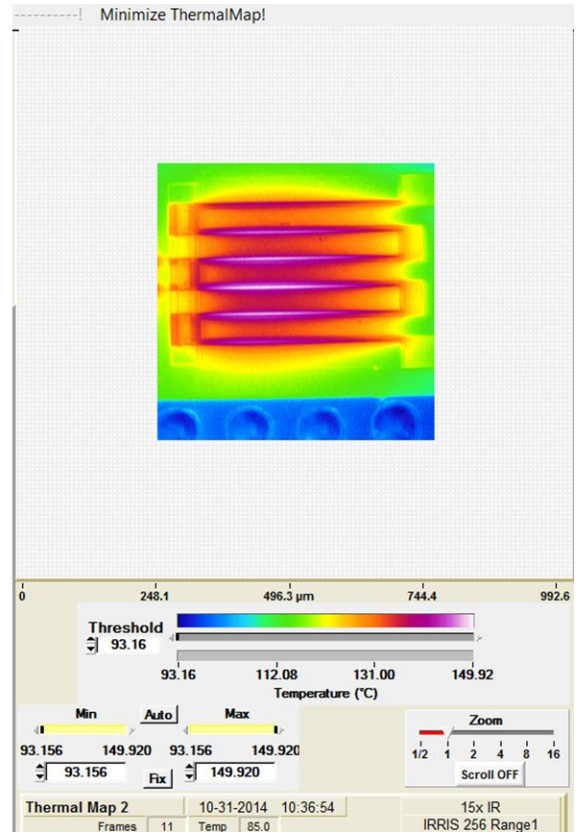
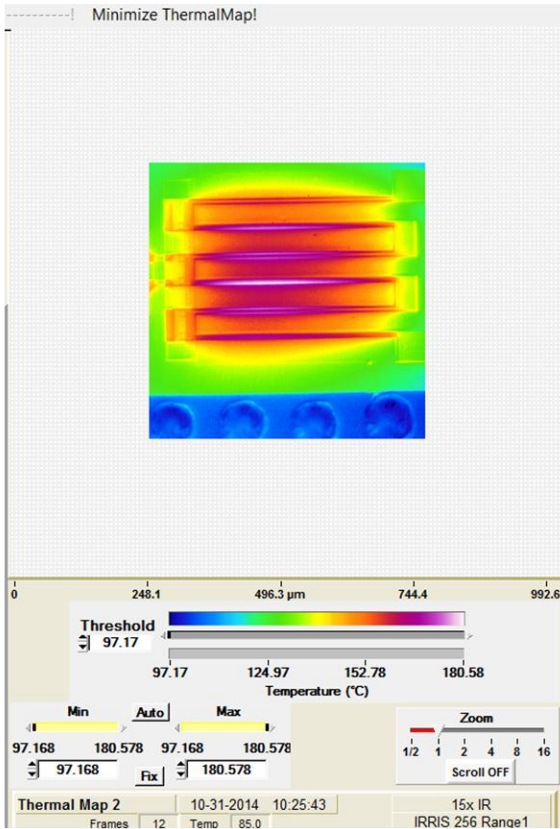
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THERMAL IR SCAN DATA (Freq = 1.2 GHz)

DC P_{diss}=10.5 W, T_{base} =87°C, T_{max}=181°C , R_{th}= 9°C/W

CW P_{diss}=8.4 W, T_{base} =86°C, T_{max}=150°C , R_{th}= 7.6°C/W



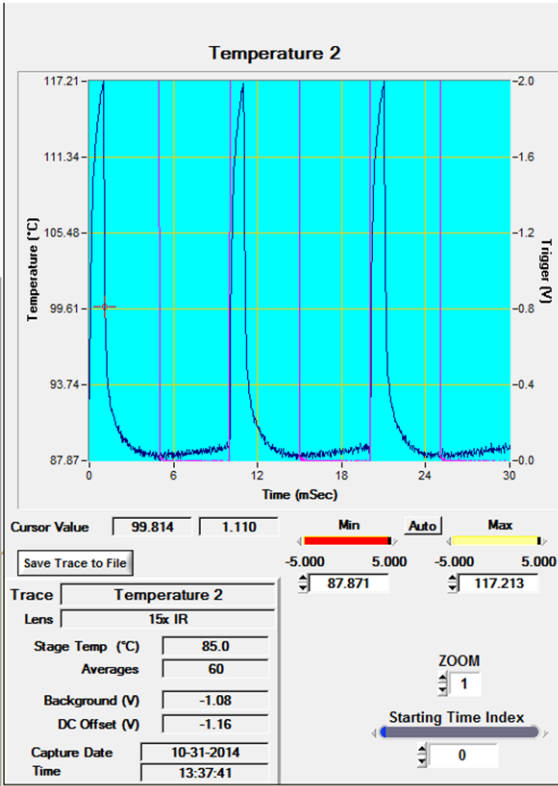


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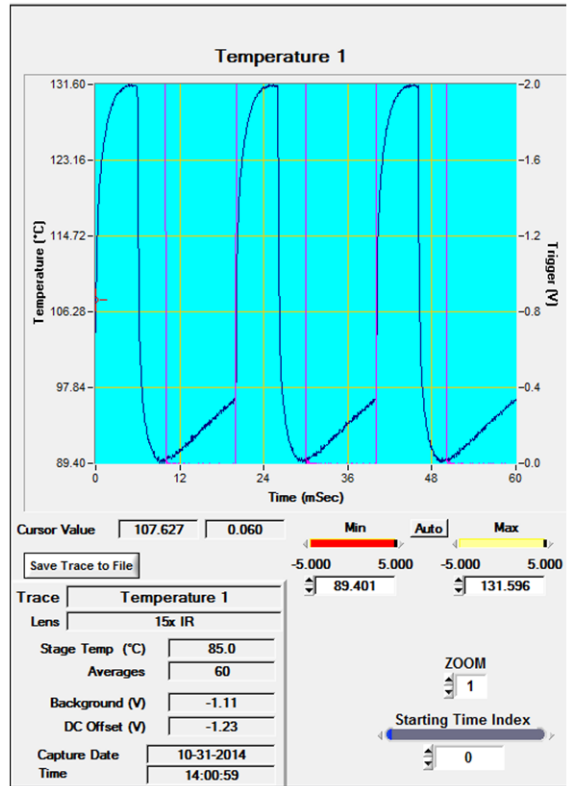
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THERMAL IR SCAN DATA (Freq = 1.2 GHz)

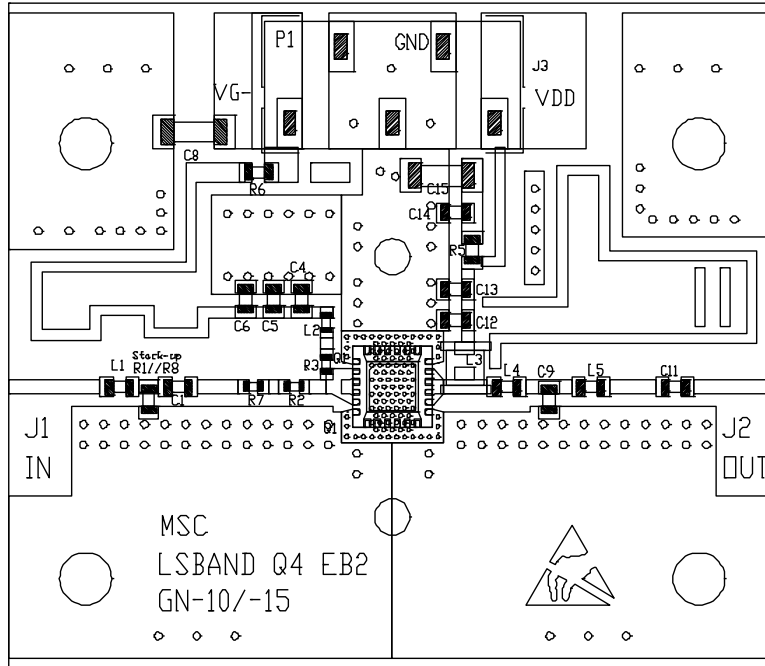
1mS,10% P_{diss}=9.7W,T_{base} =85°C, T_{max}=117°C,
R_{th}= 3.3°C/W



6mS,30% P_{diss}=9W,T_{base} =85°C, T_{max}=131°C,
R_{th}= 5.1°C/W



**EVALUATION BOARD LAYOUT Q4 EB2
 ASSEMBLY DIAGRAM AND BOM FOR 300-500 MHz**



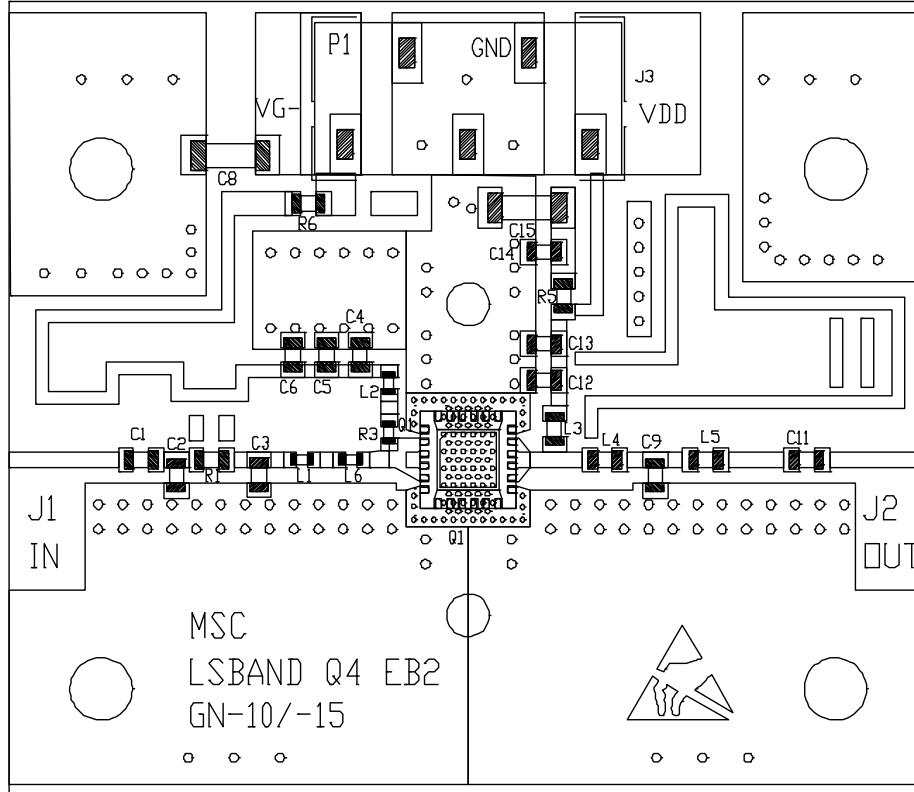
**Board Material: Rogers RO4003C, 12 Mil Thickness, Er = 3.38, 1 OZ Cu
 8 Mil Dia Vias below package, Qty: 39, Solid Cu Filled. Board Size: 1.5 x 1.3 inches**

| Item | Description 300 - 500 MHz |
|-----------|---------------------------------------|
| C11,C12 | 0603, 39 pF, ±5%, 250V, ATC 600S |
| C1 | 0603, 10 pF, ±5%, 250V, ATC 600S |
| C9 | 0603, 1.8 pF, ±0.25pF, 250V, ATC 600S |
| C4,C5,C13 | 0603, 470 pF, ±5%, 100V, AVX, X7R |
| C6,C14 | 0603, 10000 pF, ±10%, 100V, AVX, X7R |
| C8,C15 | 1206, 4.7 uF, ±10%, 100V, AVX, X7S |
| R1 | 0603 300 Ω |
| R8 | 0603 360 Ω |
| R5 | 0603 5.1 Ω |
| R2 | 0402 5.1 Ω |
| R3 | 0402 68 Ω |
| R6 | 0603 20 Ω |
| R7 | 0402 0 Ω JUMPER |
| L1 | 0603HP, 15 nH , 5% Coilcraft |
| L2 | 0603HP, 56 nH , 5% Coilcraft |
| L3 | 1008AF, 0.9 uH , 5% Coilcraft |
| L4 | 0603HP, 7.5 nH , 5% Coilcraft |
| L5 | 0603HP, 4.7 nH , 5% Coilcraft |
| J3 | TSM-105-01-S-SV-A, SAMTEC |
| Q1 | DC35GN-15-Q4 QFN 4X4, 24L |

Note: RF Input is DC short but Gate Input is DC Blocked

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EVALUATION BOARD LAYOUT Q4 EB2
ASSEMBLY DIAGRAM AND BOM FOR 960-1215 MHz and 1200-1400 MHz



Board Material: Rogers RO4003C, 12 Mil Thickness, Er = 3.38, 1 OZ Cu
8 Mil Dia Vias below package, Qty: 39, Solid Cu Filled. Board Size: 1.5 x 1.3 inches

| Item | Description 0.96 - 1.215 GHz | Description 1.2 - 1.4 GHz |
|------------|---------------------------------------|---------------------------------------|
| C1,C11,C12 | 0603, 39 pF, ±5%, 250V, ATC 600S | 0603, 39 pF, ±5%, 250V, ATC 600S |
| C2 | 0603, 2.4 pF, 250V, ATC 600S | N/A |
| C3 | N/A | 0603, 3.9 pF, 250V, ATC 600S |
| C9 | 0603, 1.8 pF, ±0.25pF, 250V, ATC 600S | 0603, 1.8 pF, ±0.25pF, 250V, ATC 600S |
| C4,C5,C13 | 0603, 470 pF, ±5%, 100V, AVX, X7R | 0603, 470 pF, ±5%, 100V, AVX, X7R |
| C6,C14 | 0603, 10000 pF, ±10%, 100V, AVX, X7R | 0603, 10000 pF, ±10%, 100V, AVX, X7R |
| C8,C15 | 1206, 4.7 uF, ±10%, 100V, AVX, X7S | 1206, 4.7 uF, ±10%, 100V, AVX, X7S |
| R1 | 0603 0 Ω JUMPER | 0603 6.2 Ω |
| R5 | 0603 5.1 Ω | 0603 5.1 Ω |
| R3 | 0402 12 Ω | 0402 12 Ω |
| R6 | 0603 20 Ω | 0603 20 Ω |
| L1 | 0402HP, 2.2 nH, 5% Coilcraft | 0402HP, 2.2 nH, 5% Coilcraft |
| L2 | 0402PA, 1.9 nH, 5% Coilcraft | 0402PA, 1.9 nH, 5% Coilcraft |
| L3 | 0603HP, 39 nH, 5% Coilcraft | 0603HP, 27 nH, 5% Coilcraft |
| L4 | 0603HP, 7.5 nH, 5% Coilcraft | 0603HP, 7.5 nH, 5% Coilcraft |
| L5 | 0603HP, 4.7 nH, 5% Coilcraft | 0603HP, 4.7 nH, 5% Coilcraft |
| L6 | 0402HP 1nH, 5% Coilcraft | 0402 0 Ω JUMPER |
| J3 | TSM-105-01-S-SV-A, SAMTEC | TSM-105-01-S-SV-A, SAMTEC |
| Q1 | DC35GN-15-Q4 QFN 4X4, 24L | DC35GN-15-Q4 QFN 4X4, 24L |

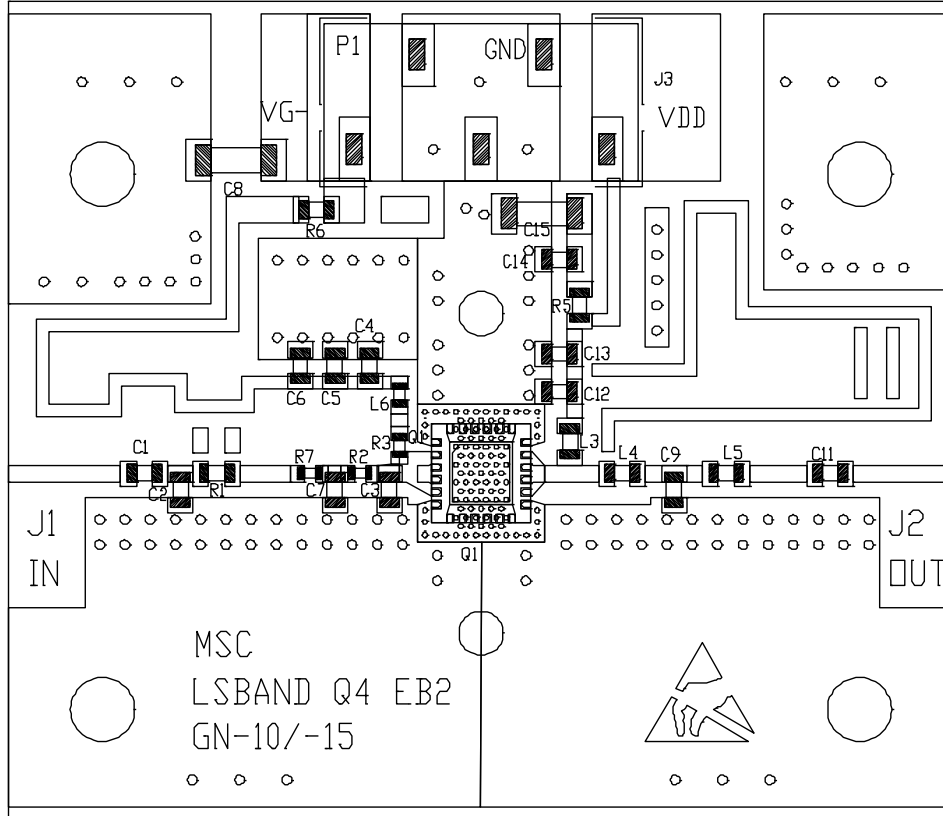
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EVALUATION BOARD LAYOUT Q4 EB2 ASSEMBLY DIAGRAM AND BOM FOR 2700-3100 MHz & 3100-3500 MHz



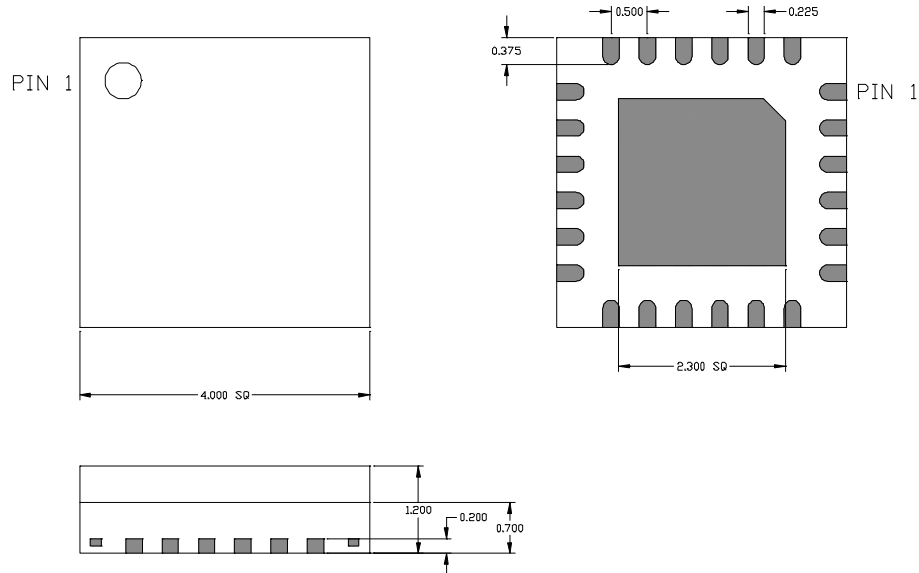
Board Material: Rogers RO4003C, 12 Mil Thickness, Er = 3.38, 1 OZ Cu
8 Mil Dia Vias below package, Qty: 39, Solid Cu Filled. Board Size: 1.5 x 1.3 inches

| Item | Description 2.7 - 3.1 GHz | Description 3.1 - 3.5 GHz |
|------------|--------------------------------------|--------------------------------------|
| C1,C11,C12 | 0603, 18 pF, ±5%, 250V, ATC 600S | 0603, 18 pF, ±5%, 250V, ATC 600S |
| C2 | N/A | N/A |
| C3 | 0603, 2.4 pF, 250V, ATC 600S | 0603, 1.5 pF, 250V, ATC 600S |
| | | ATTACH AT 1st HOLE |
| C7 | 0603, 1 pF, 250V, ATC 600S | 0603, 1 pF, 250V, ATC 600S |
| C9 | 0603, 1.2 pF, ±0.1pF, 250V, ATC 600S | 0603, 1.1 pF, ±0.1pF, 250V, ATC 600S |
| | | AS CLOSE TO L5 AS POSSIBLE |
| C4,C5,C13 | 0603, 470 pF, ±5%, 100V, AVX, X7R | 0603, 470 pF, ±5%, 100V, AVX, X7R |
| C6,C14 | 0603, 10000 pF, ±10%, 100V, AVX, X7R | 0603, 10000 pF, ±10%, 100V, AVX, X7R |
| C8,C15 | 1206, 4.7 uF, ±10%, 100V, AVX, X7S | 1206, 4.7 uF, ±10%, 100V, AVX, X7S |
| R1 | 0603 0 Ω JUMPER | 0603 0 Ω JUMPER |
| R5 | 0603 5.1 Ω | 0603 5.1 Ω |
| R2,R7 | 0402 0 Ω JUMPER | 0402 0 Ω JUMPER |
| R3 | 0402 22 Ω | 0402 22 Ω |
| R6 | 0603 20 Ω | 0603 20 Ω |
| L3 | 0402HP, 1 nH, 5% Coilcraft | 0402HP, 1 nH, 5% Coilcraft |
| L4 | 0402HP, 1 nH, 5% Coilcraft | Jumper Copper Foil |
| L5 | 0603HP, 1.8 nH, 5% Coilcraft | 0402HP, 1 nH, 5% Coilcraft |
| L6 | 0402HP, 3.9 nH, 5% Coilcraft | 0402HP, 3.9 nH, 5% Coilcraft |
| J3 | TSM-105-01-S-SV-A, SAMTEC | TSM-105-01-S-SV-A, SAMTEC |
| Q1 | DC35GN-15-Q4 QFN 4X4, 24L | DC35GN-15-Q4 QFN 4X4, 24L |

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QFN 4X4 mm PACKAGE OUTLINE & DIMENSIONS

All Dimensions are in mm (typ).



| PIN | FUNCTION |
|----------------------|-------------------------------|
| 1,6,13,18 | RF GND (Source) |
| 2,3,4,5 | RF IN (Gate) |
| 7,8,9,10,11,12 | N/C |
| 14,15,16,17 | RF OUT (Drain) |
| 19,20,21,22,23,24 | N/C |
| Backside Exposed Pad | RF GND (Source) & Thermal Pad |

Notes:

1. Backside exposed pad must be connected to Solid Cu filled vias for optimum RF & Thermal performance. See recommended evaluation board layout



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Revision History

| Revision | Date | Affected Section(s) | Description |
|----------|----------|---------------------|---|
| 2.0 | 09-16-14 | - | Initial Preliminary Release |
| 3.0 | 12-04-14 | - | Added more Preliminary Data |
| 4.0 | 2-17-15 | - | Added more Data, Updated PCB layout and BOM |
| 5.0 | 5-1-15 | - | Added 3.1-3.5 GHz Data, PCB Layout and BOM |

For the most current data, consult MICROSEMI's website: www.MICROSEMI.com
Specifications are subject to change, consult the RFIS factory at (408) 986-8031 for the latest information