AH225

1 W High Linearity InGaP HBT Amplifier

Applications

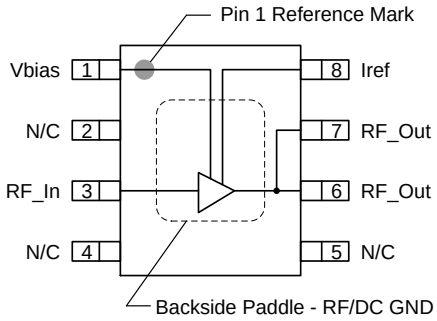
- Repeaters
- Base Station Transceivers
- High Power Amplifiers
- Mobile Infrastructure
- LTE / WCDMA / CDMA / WiMAX

8-Pin SOIC-8 Package

Product Features

- 400 – 2700 MHz
- 15.5 dB Gain at 2140 MHz
- +31 dBm P1dB
- +46 dBm Output IP3
- 300 mA Quiescent Current
- +5 V Single Supply
- MTTF > 100 Years
- Capable of handling 10:1 VSWR at 5 V_{CC}, 2.14 GHz, +31.5 dBm CW Pout or +23 dBm WCDMA Pout
- Lead-free / RoHS-compliant SOIC-8 Package

Functional Block Diagram



General Description

The AH225 is a high dynamic range driver amplifier in a low-cost surface-mount package. The InGaP / GaAs HBT is able to achieve high performance for various narrowband-tuned application circuits with up to +46 dBm OIP3 and +31.2 dBm of compressed 1 dB power. The integrated active bias circuitry in the devices enables excellent stable linearity performance over temperature. It is housed in a lead-free/RoHS-compliant SOIC-8 package. All devices are 100% RF and DC tested.

The AH225 is targeted for use as a driver amplifier in wireless infrastructure where high linearity and medium power is required. The AH225 is ideal for the final stage of small repeaters or as driver stages for high power amplifiers. In addition, the amplifier can be used for a wide variety of other applications within the 400 to 2700 MHz frequency band.

Pin Configuration

Pin No.	Label
1	V_{BIAS}
2, 4, 5	N / C
3	RF_{IN}
6, 7	RF_{OUT}
8	I_{REF}
Backside Paddle	RF/ DC GND

Ordering Information

Part No.	Description
AH225-S8G	1W High Linearity Amplifier

Standard T/R size = 1000 pieces on a 7” reel

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Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	−65 to 150 °C
RF Input Power, CW, 50 Ω, T=+25 °C	+26 dBm
Device Voltage (V_{CC}, V_{BIAS})	+8 V
Device Current	900 mA
Device Power	+5 W

Operation of this device outside the parameter ranges given above may cause permanent damage.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
V_{CC}	+4.5	+5	+5.25	V
T_{CASE}	−40		+85	°C
Tj for >10^6 hours MTTF			+200	°C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Test conditions unless otherwise noted: V_{CC}=+5 V, I_{CQ}= 300 mA, I_{REF} = 15 mA , Temp= +25°C, tuned application circuit

Parameter	Conditions	Min	Typ	Max	Units
Operational Frequency Range		400		2700	MHz
Test Frequency			2140		MHz
Gain		13.3	15.5		dB
Input Return Loss			18		dB
Output Return Loss			9.4		dB
Output P1dB		+30	+31.2		dBm
Output IP3	Pout = +19 dBm / tone, Δf=1 MHz	+43	+46		dBm
WCDMA Channel Power (1)	ACLR= −50 dBc		+21.3		dBm
Noise Figure			6		dB
Operating Current Range, Icc (2)			300	350	mA
Thermal Resistance (Junction to case) θ_{jc}	Junction to backside paddle		17.5	35	°C / W

Notes:
1. ACLR Test set-up: 3GPP WCDMA, 1±64DPCH, ±5 MHz, no clipping, PAR = 10.2 dB at 0.01% Probability.
2. This corresponds to the quiescent collector current or operating current under small-signal conditions into pins 6 and 7.

Performance Summary Table

Test conditions unless otherwise noted: V_{CC}=+5 V, I_{CQ}= 300 mA, Temp= +25°C, in an application circuit tuned for each frequency.

Parameter	Typical							Units
Frequency	750	940	1500	1840	1960	2140	2600	MHz
Gain	20.1	19.8	17	15.1	15.4	15.2	13.2	dB
Input Return Loss	14.5	10.5	17.2	11	15.4	18	19.4	dB
Output Return Loss	7	8.4	11	10.7	8.3	9.4	5.5	dB
Output P1dB	+30.4	+31	+31.3	+30.7	+31.3	+31	+30.5	dBm
Output IP3 (1)	+45	+47.3	+48	+46	+53.6	+47	+48.7	dBm
WCDMA Channel Power (ACLR= −50 dBc)	+21.2	+21.7	+22	+21.6	+21.7	+21.4	+21.3	dBm

Notes:
1. OIP3 is measured with two tones at an output power of +20 dBm / tone for 750 MHz, +22 dBm / tone for 940 MHz and +19 dBm / tone for 1490, 1840, 1960, 2140, 2600 MHz application circuits respectively.

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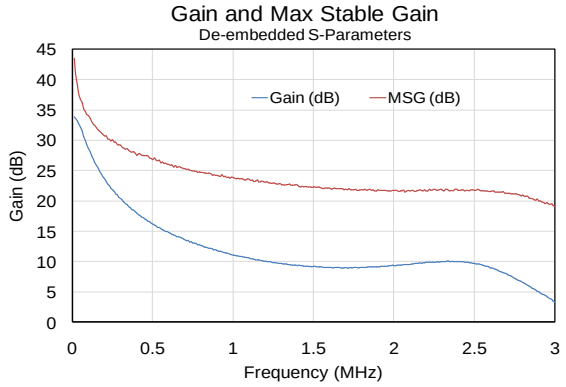
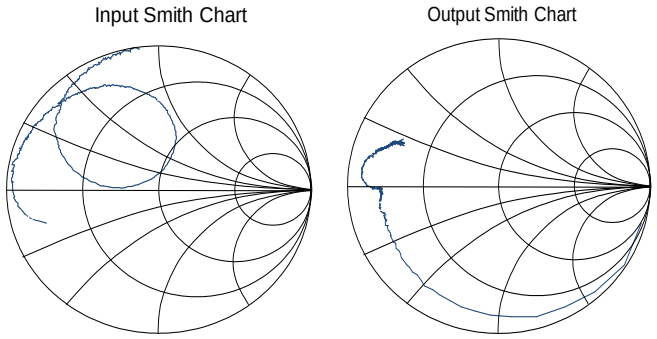
Device Characterization Data





Notes:

1. The gain for the unmatched device in 50 ohm system is shown as the trace in blue color, Gain (dB). For a tuned circuit for a particular frequency, it is expected that actual gain will be higher, up to the maximum stable gain. The maximum stable gain is shown in the red line, DB [MSG]. The impedance loss plots are shown from 0.05 – 4 GHz.

S-Parameters

Test Conditions: V_{CC} = +5 V, I_{CQ} = 300 mA, T =+25 °C, unmatched 50 ohm system, calibrated to device leads)

Freq (GHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
50	−2.90	−165.27	32.12	136.60	−40.91	46.68	−0.94	−74.85
100	−1.57	−171.34	28.59	116.71	−38.86	31.54	−1.66	−113.38
200	−0.99	179.84	23.57	100.17	−37.78	17.25	−1.95	−143.44
400	−0.81	169.25	17.96	86.66	−37.58	7.00	−2.15	−162.82
800	−0.97	152.64	12.56	69.77	−36.47	−0.03	−2.08	−173.99
1000	−1.12	145.10	11.02	62.27	−36.53	−6.84	−2.19	−175.67
1200	−1.25	136.77	10.01	54.20	−35.91	−8.53	−2.20	−177.71
1400	−1.53	128.95	9.29	46.48	−35.54	−14.78	−2.19	−178.63
1800	−2.52	110.16	8.93	27.07	−34.79	−32.76	−2.20	−179.60
2100	−4.69	91.38	9.54	5.44	−33.84	−58.32	−1.92	−179.47
2000	−3.69	98.77	9.27	13.27	−34.06	−50.56	−2.01	179.89
2200	−6.45	86.18	9.79	−4.317	−33.35	−72.56	−1.80	179.99
2400	−13.76	87.27	10.01	−28.04	−33.51	−107.65	−1.25	179.43
2600	−10.27	171.20	8.85	−57.83	−34.02	−157.07	−0.81	175.18
2800	−4.15	159.31	6.56	−84.16	−35.29	156.89	−0.78	171.95
3000	−1.93	143.93	3.19	−104.79	−34.70	116.80	−0.99	167.43

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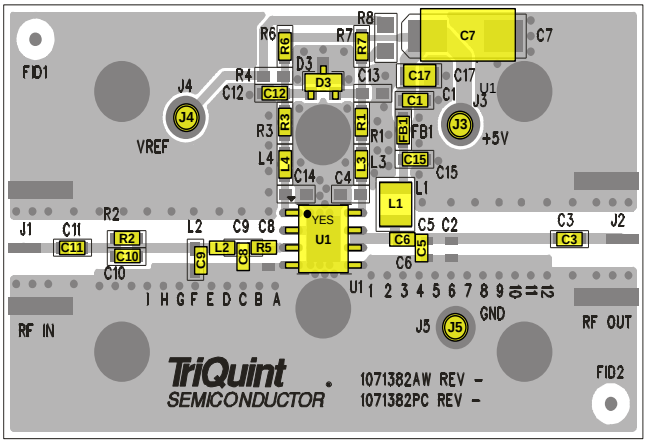
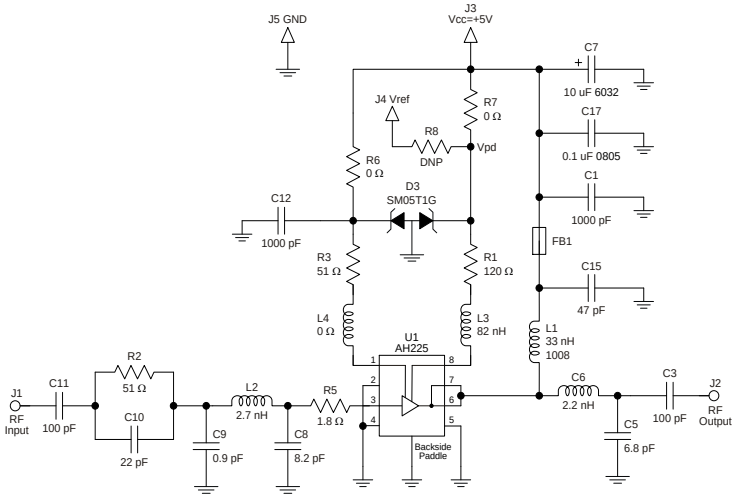
Reference Design: 700 – 850 MHz





Notes:

1. See PC Board Layout, page 20 for more information.
2. Vref J4 turret can be used as control voltage for device power down (low = RF off) by setting R8 = 0 Ω and R7 = no connect.
3. The primary RF microstrip characteristic line impedance is 50 Ω.
4. Do not exceed +5.5V on Vpd or Vcc or TVS diode D3 will be damaged.
5. Components shown on the silkscreen but not on the schematic are not used.
6. The edge of C6 is placed at 70 mils from the edge of AH225 RFout pin pad (3˚ at 750 MHz).
7. C5 is placed against the edge of C6.
8. The edge of R5 is placed at 10 mils from the edge of AH225 RFin pin pad (0.5˚ at 750 MHz).
9. C8 is placed against the edge of R5, L2 against C8 and C9 against L2.
10. Zero ohm jumpers may be replaced with copper traces in the target application layout.
11. DNP means Do Not Place.
12. Inductor L3 on Vpd line is critical for linearity performance.
13. The locations of C11, R2, C10 and C3 are non-critical. They can be placed closer to the device.
14. Ferrite Bead FB1 eliminates bypass line resonances between C15 and C1. Steward MI0603K300R-10.
15. All components are of 0603 size unless stated otherwise.

Typical Performance 700 – 850 MHz

Test conditions unless otherwise noted: V_{CC} = +5 V, I_{CQ} = 300 mA

Parameter	Conditions	Typical Value			Units
Frequency		700	750	800	MHz
Gain		20	20.1	20.2	dB
Input Return Loss		12	14.5	16	dB
Output Return Loss		6	7	8.6	dB
Output P1dB		+30.4	+30.4	+30.7	dBm
Output IP3 at 20 dBm/tone, Δf = 1 MHz		+44.1	+45	+44.6	dBm
WCDMA Channel Power (1)	ACLR= −50 dBc	+20.6	+21.2	+21.4	dBm
OFDMA Channel Power at 2.5% EVM (2)	Pout= +17 dBm/Tone, Δf = 1 MHz	+22.8	+23.6	+23.3	dBm

Notes:

1. ACLR Test set-up: 3GPP WCDMA, TM1+64 DPCH, +5 MHz offset, PAR = 10.2 dB at 0.01% Prob.
2. EVM Test set-up: 802.16 – 2004 OFDMA, 64 QAM – ½, 1024 FFT, 20 symbols, 30 sub channels.

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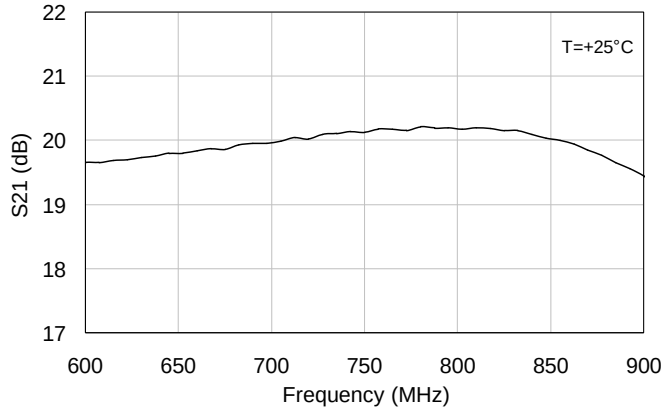
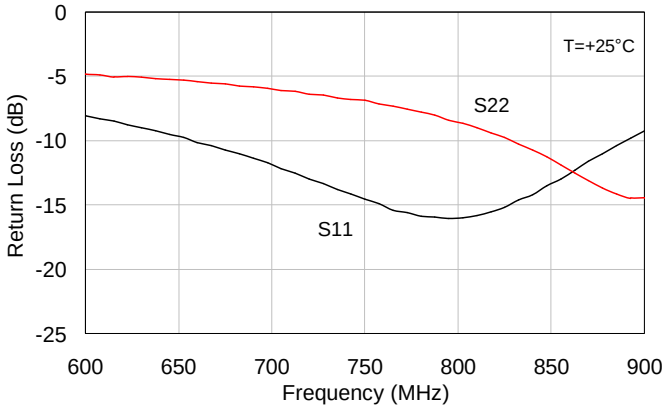
Typical Performance Plots 700 – 850 MHz

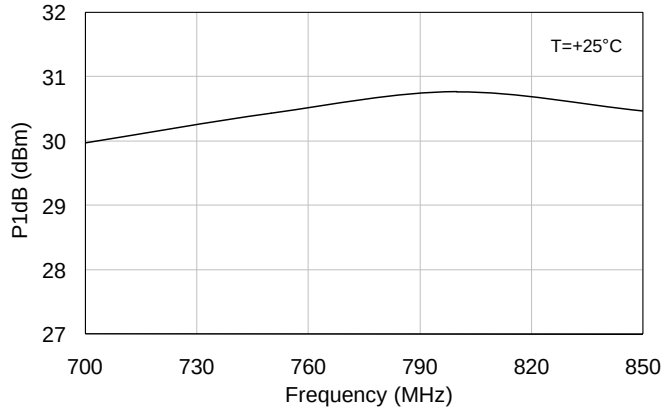
S21 vs. Frequency



Return Loss vs. Frequency

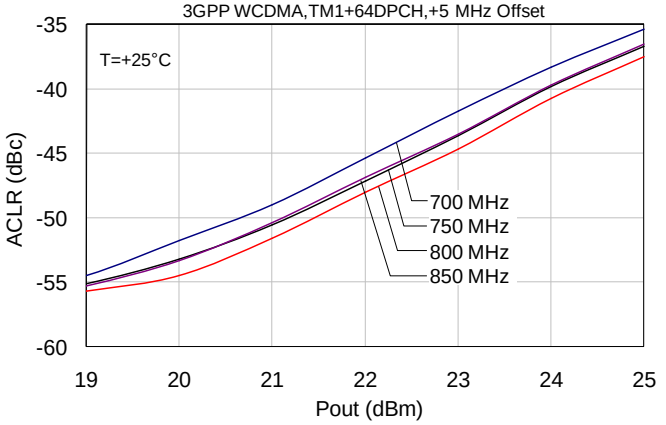


P1dB vs. Frequency



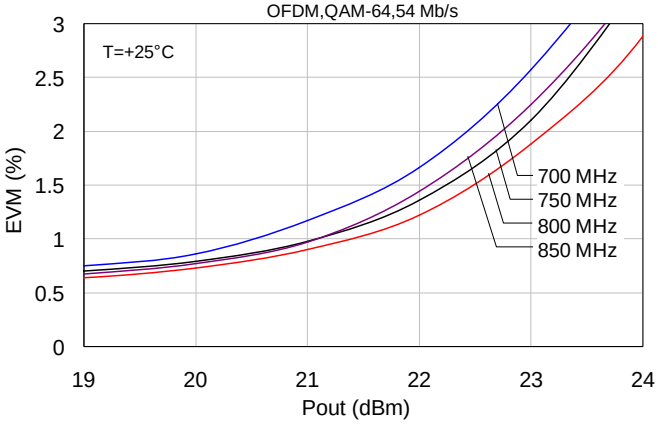
ACLR vs. Pout vs. Freq

3GPP WCDMA,TM1+64DPCH,+5 MHz Offset



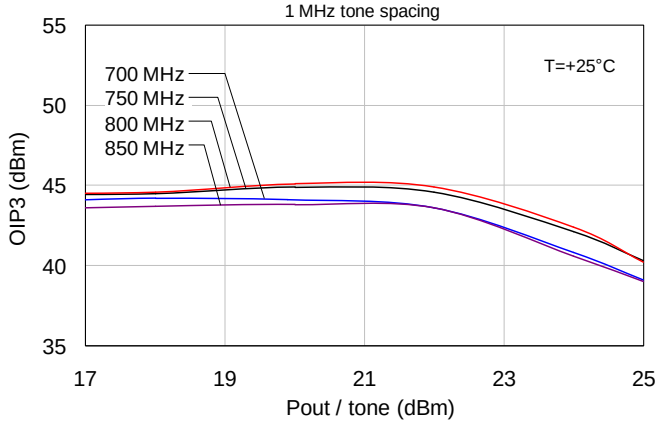
EVM vs. Pout vs. Freq

OFDM,QAM-64,54 Mb/s



OIP3 vs. Pout / tone vs. Freq

1 MHz tone spacing



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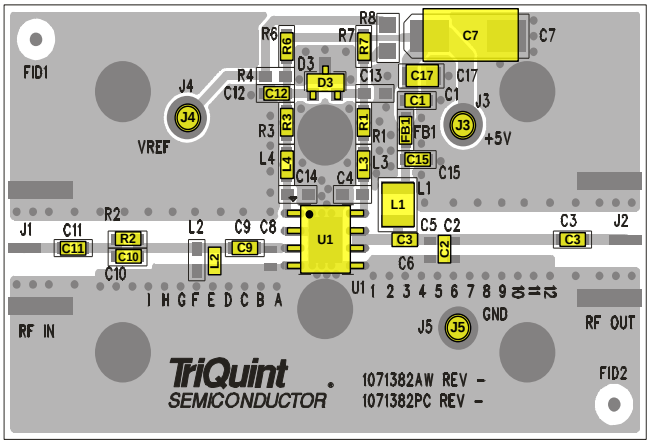
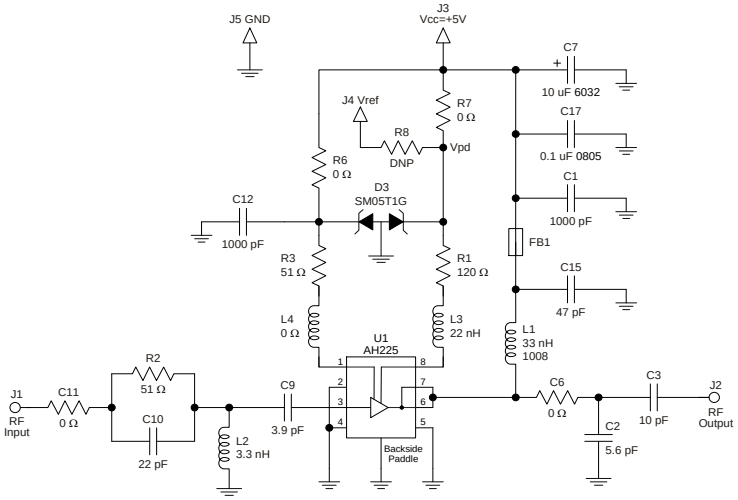
Application Circuit 920-960 MHz (AH225-S8PCB900)





Notes:

1. See PC Board Layout, page 20 for more information.
2. Vref J4 turret can be used as control voltage for device power down (low = RF off) by setting R8 = 0 Ω and R8 = no connect.
3. The primary RF microstrip characteristic line impedance is 50 Ω.
4. Do not exceed +5.5V on Vpd or Vcc or TVS diode D3 will be damaged.
5. Components shown on the silkscreen but not on the schematic are not used.
6. The edge of L2 is placed at 170 mils from the edge of AH225 RFin pin pad (8.5˚ at 940 MHz).
7. The edge of C9 is placed at 80 mils from the edge of AH225 RFin pin pad (4˚ at 940 MHz).
8. The edge of C2 is placed at 220 mils from the edge of AH225 RFout pin pad (11˚ at 940 MHz).
9. Zero ohm jumpers may be replaced with copper traces in the target application layout. C2 location will need to be re-optimized if replaced with copper trace.
10. DNP means Do Not Place.
11. Inductor L3 on Vpd line is critical for linearity performance.
12. The locations of C11, R2, C10 and C3 are non-critical. They can be placed closer to the device.
13. Ferrite Bead FB1 eliminates bypass line resonances between C15 and C1. Steward MI0603K300R-10.
14. All components are of 0603 size unless stated otherwise.

Typical Performance 920 – 960 MHz

Test conditions unless otherwise noted: V_{CC} = +5 V, I_{CQ} = 300 mA

Parameter	Typical Value			Units
Frequency	920	940	960	MHz
Gain	19.7	19.8	19.9	dB
Input Return Loss	9.6	10.5	10.4	dB
Output Return Loss	8	8.4	9	dB
Output P1dB	+31.1	+31	+31.1	dBm
Output IP3 at 22 dBm / tone, Δf = 1 MHz	+46.2	+47.3	+48	dBm
WCDMA Channel Power (1) (ACLR= −50 dBc)	+21.6	+21.7	+21.6	dBm
Nosie Figure	9.3	9.2	9.3	dB

Notes:

1. ACLR Test set-up: 3GPP WCDMA, TM1+64 DPCH, +5 MHz offset, PAR = 10.2 dB at 0.01% Prob.

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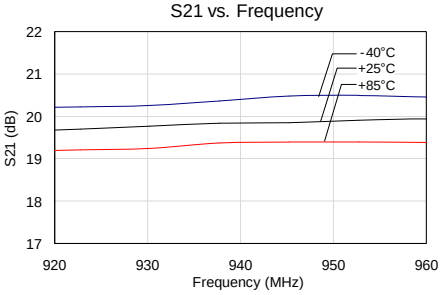
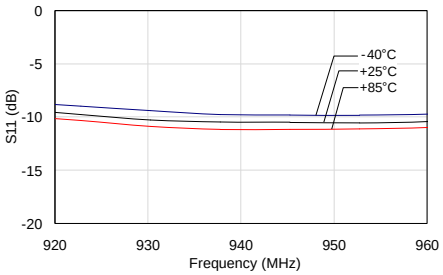
Typical Performance Plots 920 – 960 MHz

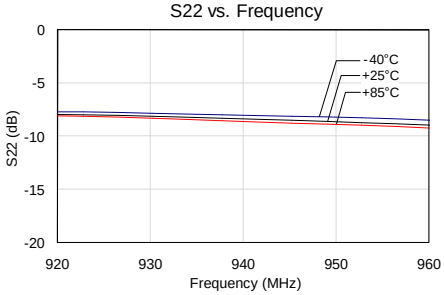
S21 vs. Frequency



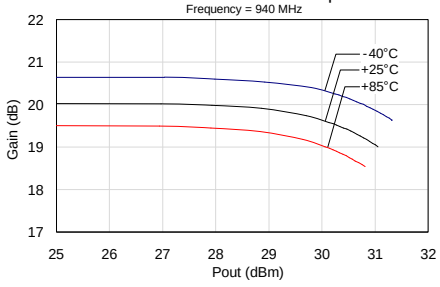
S11 vs. Frequency



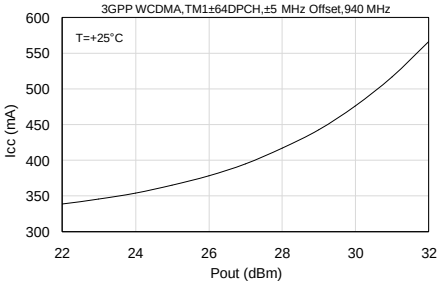
S22 vs. Frequency



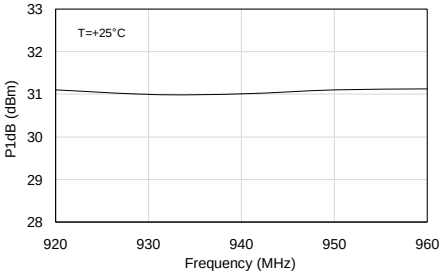
Gain vs. Pout vs. Temp
Frequency = 940 MHz



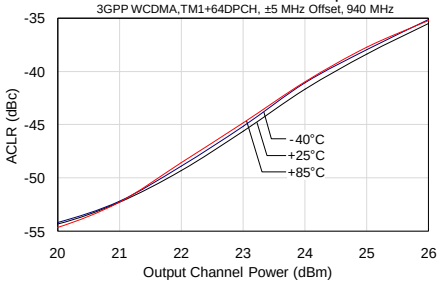
Icc vs. Pout
3GPP WCDMA,TM1±64DPCH,±5 MHz Offset,940 MHz



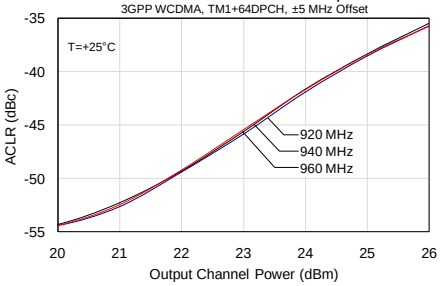
P1dB vs. Frequency



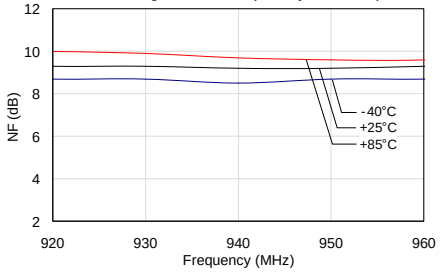
ACLR vs. Pout vs. Temp
3GPP WCDMA,TM1+64DPCH, ±5 MHz Offset, 940 MHz



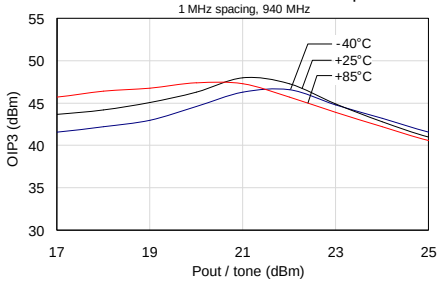
ACLR vs. Pout vs. Freq
3GPP WCDMA, TM1+64DPCH, ±5 MHz Offset



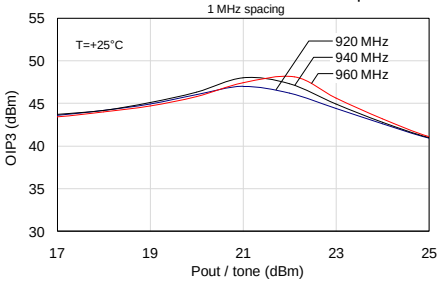
Noise Figure vs. Frequency vs. Temp



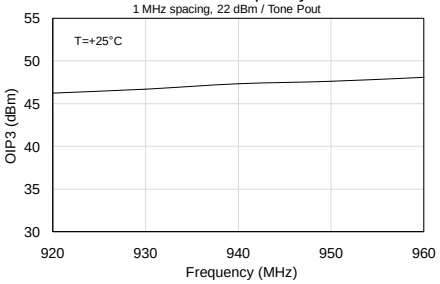
OIP3 vs. Pout/Tone vs. Temp
1 MHz spacing, 940 MHz



OIP3 vs. Pout/Tone vs. Freq
1 MHz spacing



OIP3 vs. Frequency
1 MHz spacing, 22 dBm / Tone Pout



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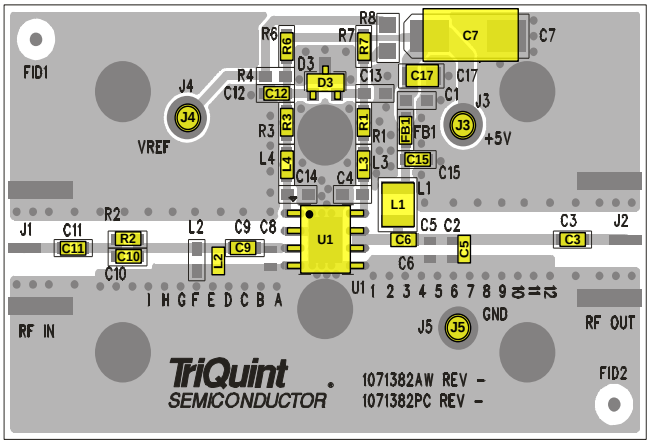
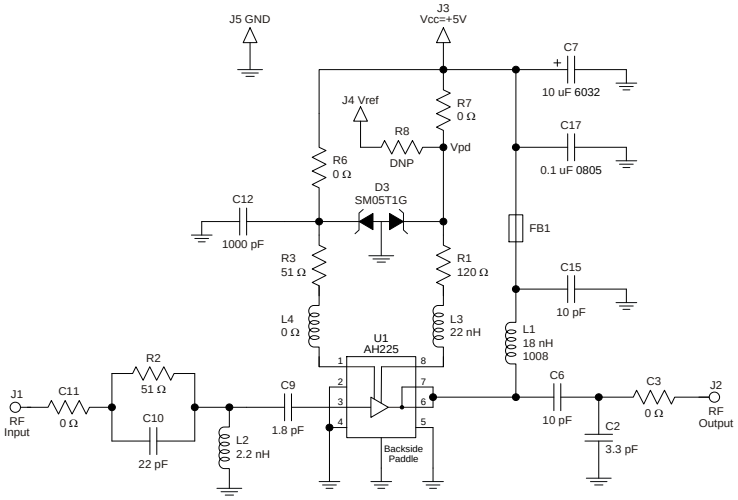
Reference Design 1475 – 1510 MHz





Notes:

1. See PC Board Layout, page 20 for more information.
2. Vref J4 turret can be used as control voltage for device power down (low = RF off) by setting R8 = 0 Ω and R8 = no connect.
3. The primary RF microstrip characteristic line impedance is 50 Ω.
4. Do not exceed +5.5V on Vpd or Vcc or TVS diode D3 will be damaged.
5. Components shown on the silkscreen but not on the schematic are not used.
6. The edge of L2 is placed against the edge of C9.
7. The edge of C9 is placed at 75 mils from the edge of AH225 RFin pin pad (6˚ at 1490 MHz).
8. The edge of C2 is placed at 300 mils from the edge of AH225 RFout pin pad (24˚ at 1490 MHz).
9. Zero ohm jumpers may be replaced with copper traces in the target application layout.
10. DNP means Do Not Place.
11. Inductor L3 on Vpd line is critical for linearity performance.
12. The locations of C11, R2, C10 and C3 are non-critical. They can be placed closer to the device.
13. Ferrite Bead FB1 eliminates bypass line resonances between C15 and C1. Steward MI0603K300R-10.
14. All components are of 0603 size unless stated otherwise.

Typical Performance 1475 – 1510 MHz

Test conditions unless otherwise noted: V_{CC} = +5 V, I_{CQ} = 300 mA

Parameter	Typical Value			Units
Frequency	1475	1490	1510	MHz
Gain	17	17	17	dB
Input Return Loss	17.5	17.2	15.2	dB
Output Return Loss	10	11	13	dB
Output P1dB	+31.4	+31.3	+31	dBm
Output IP3 at 19 dBm / tone, Δf = 1 MHz	+47.6	+48	+47	dBm
WCDMA Channel Power (ACLR= −50 dBc) (1)	+22	+22	+21.8	dBm
OFDMA Channel Power at 2.5% EVM (2)	+23.9	+23.9	+23.7	dBm

Notes:

1. ACLR Test set-up: 3GPP WCDMA, TM1+64 DPCH, +5 MHz offset, PAR = 10.2 dB at 0.01% Prob.
2. EVM Test set-up: 802.16 – 2004 OFDMA, 64 QAM – ½, 1024 FFT, 20 symbols, 30 sub channels.

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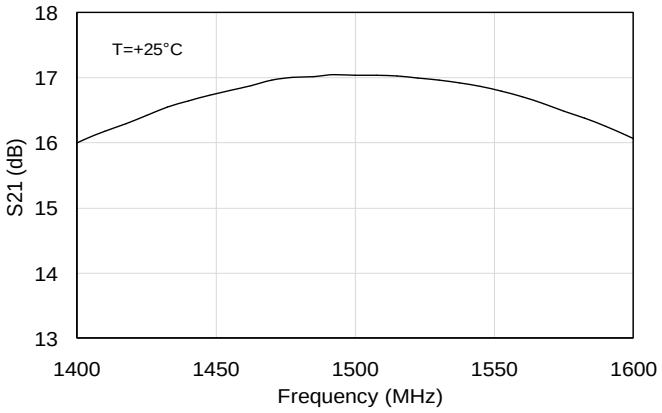
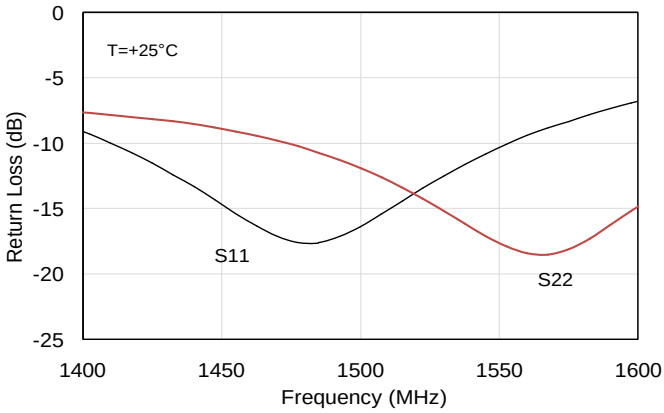
Typical Performance Plots 1475 – 1510 MHz

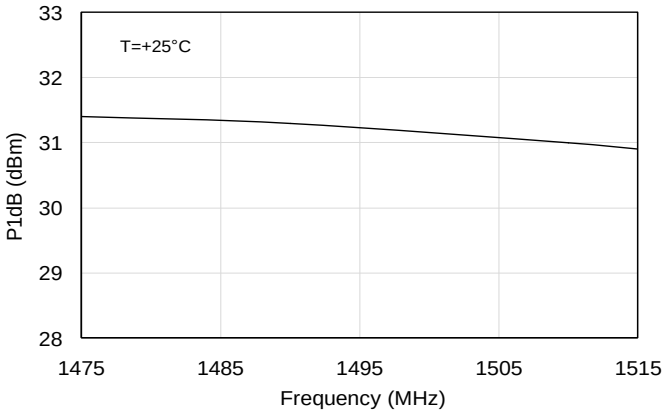
S21 vs. Frequency



Return Loss vs. Frequency

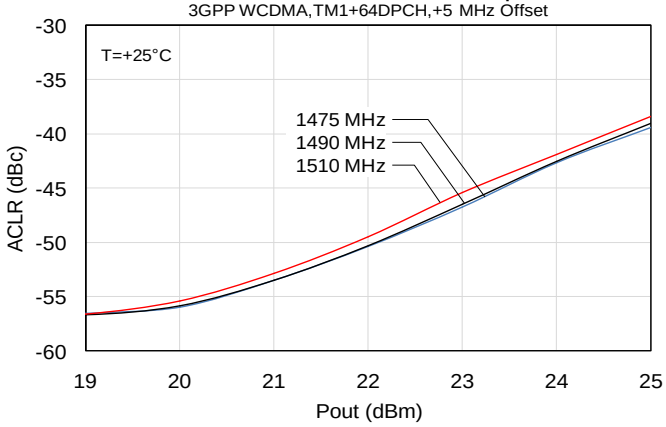


P1dB vs. Frequency



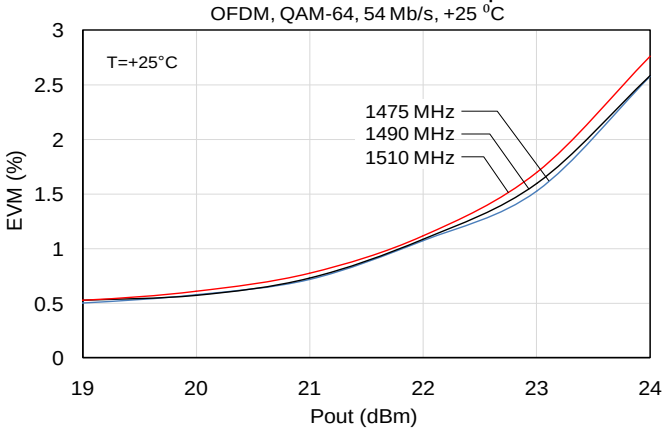
ACLR vs. Pout vs. Freq

3GPP WCDMA,TM1+64DPCH,+5 MHz Offset



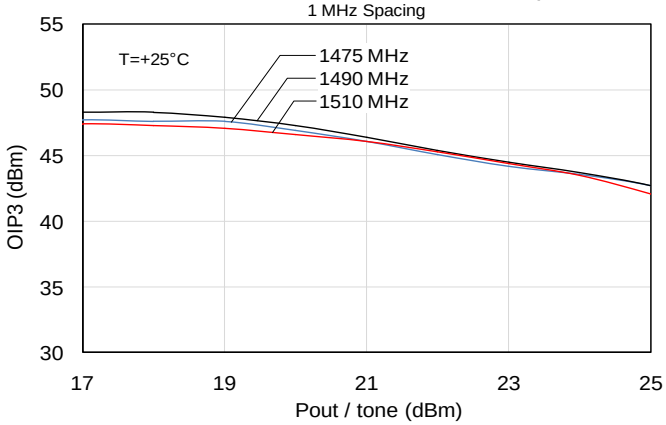
EVM vs. Pout vs. Freq

OFDM, QAM-64, 54 Mb/s, +25 ^{0}C



OIP3 vs. Pout / tone vs. Freq

1 MHz Spacing



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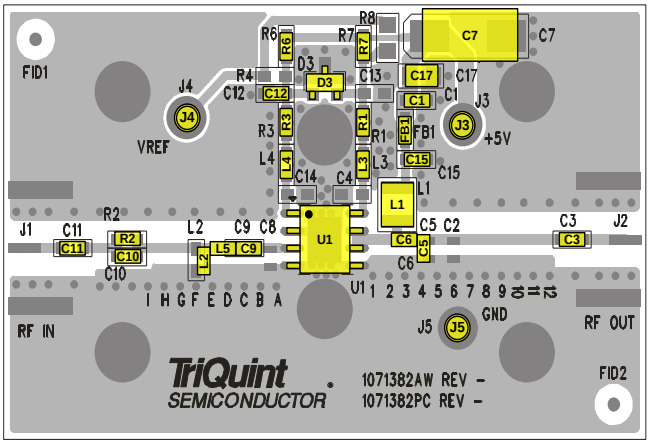
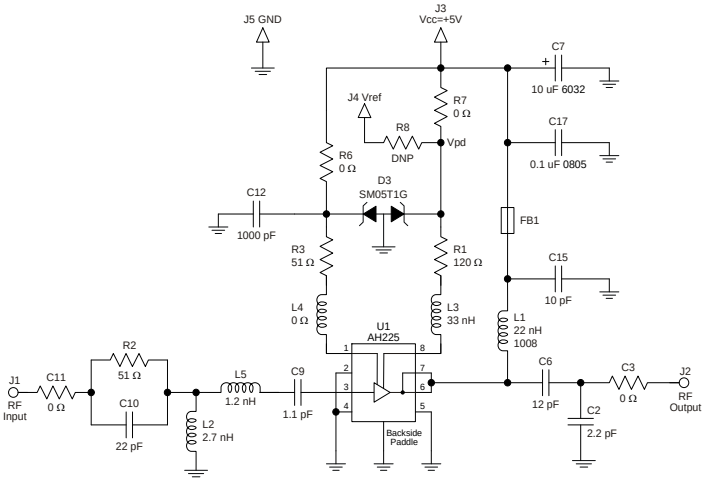
Reference Design 1805 – 1880 MHz





Notes:

1. See PC Board Layout, page 20 for more information.
2. Vref J4 turret can be used as control voltage for device power down (low = RF off) by setting R8 = 0 Ω and R8 = no connect.
3. The primary RF microstrip characteristic line impedance is 50 Ω.
4. Do not exceed +5.5V on Vpd or Vcc or TVS diode D3 will be damaged.
5. Components shown on the silkscreen but not on the schematic are not used.
6. The edge of C9 is placed at 10 mils from the edge of AH225 RFin pin pad (0.5˚ at 1840 MHz).
7. The edge of L2 is placed against the edge of L5.
8. The edge of C6 is placed at 80 mils from the edge of AH225 RFout pin pad (8˚ at 1840 MHz).
9. The edge of C5 is placed against the edge of C6.
10. Zero ohm jumpers may be replaced with copper traces in the target application layout.
11. DNP means Do Not Place.
12. Inductor L3 on Vpd line is critical for linearity performance.
13. The locations of C11, R2, C10 and C3 are non-critical. They can be placed closer to the device.
14. Ferrite Bead FB1 eliminates bypass line resonances between C15 and C1. Steward MI0603K300R-10.
15. All components are of 0603 size unless stated otherwise.

Typical Performance 1805 – 1880 MHz

Test conditions unless otherwise noted: V_{CC} = +5 V, I_{CQ} = 300 mA

Parameter	Typical Value			Units
Frequency	1805	1840	1880	MHz
Gain	15.1	15.1	15.1	dB
Input Return Loss	12	11	10	dB
Output Return Loss	9.5	10.7	12	dB
Output P1dB	+30.8	+30.7	+30.6	dBm
Output IP3 at 19 dBm / tone, Δf = 1 MHz	+46.2	+46	+45	dBm
WCDMA Channel Power (ACLR= −50 dBc) (1)	+21.7	+21.6	+21.4	dBm
OFDMA Channel Power at 2.5% EVM (2)	+23.6	+23.5	+23.3	dBm
Nosie Figure	5.7	5.7	5.8	dB

Notes:

1. ACLR Test set-up: 3GPP WCDMA, TM1+64 DPCH, +5 MHz offset, PAR = 10.2 dB at 0.01% Prob.
2. EVM Test set-up: 802.16 – 2004 OFDMA, 64 QAM – ½, 1024 FFT, 20 symbols, 30 sub channels.

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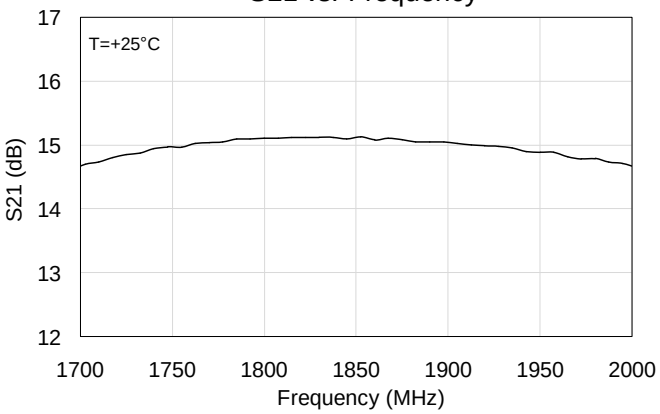
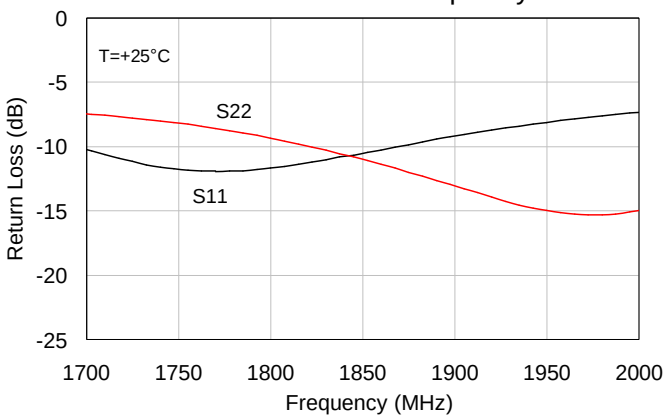
Typical Performance Plots 1805 – 1880 MHz

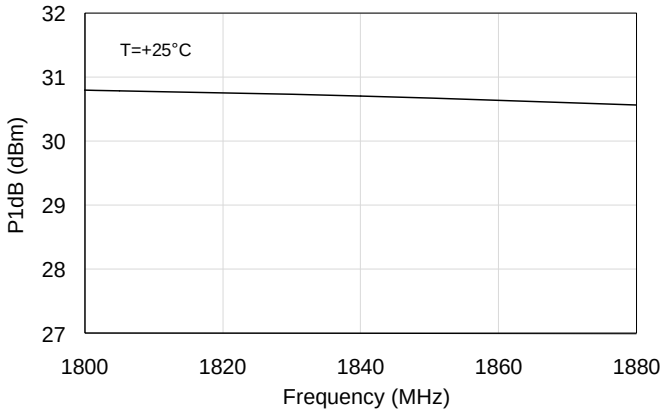
S21 vs. Frequency



Return Loss vs. Frequency

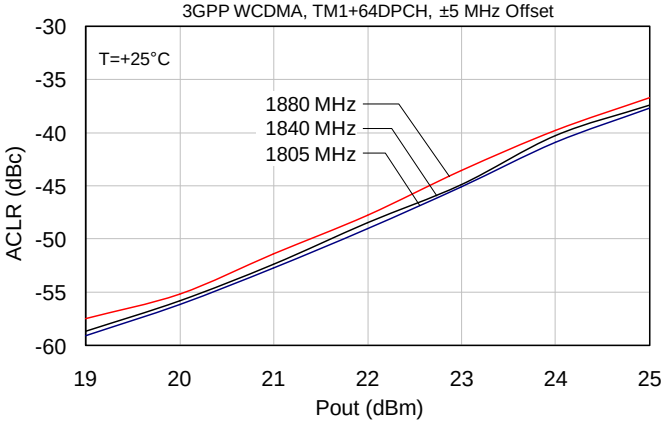


P1dB vs. Frequency



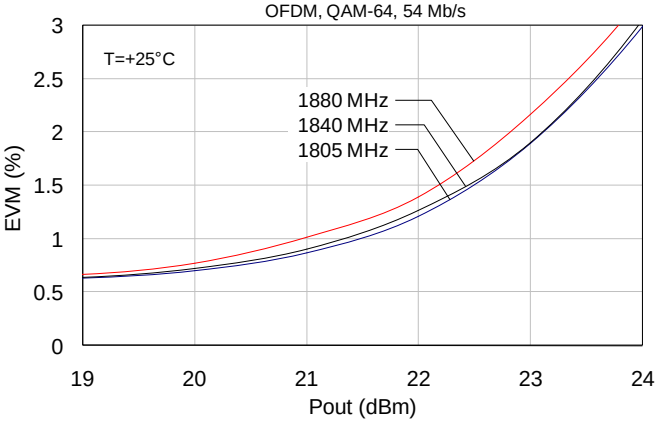
ACLR vs. Pout vs. Freq

3GPP WCDMA, TM1+64DPCH, ±5 MHz Offset



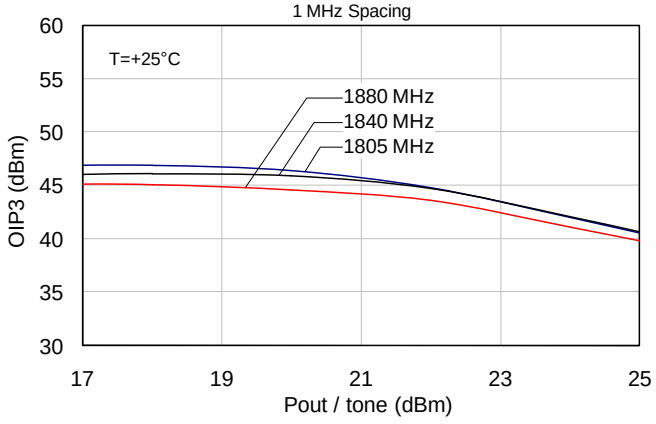
EVM vs. Pout vs. Freq

OFDM, QAM-64, 54 Mb/s



OIP3 vs. Pout / tone vs. Freq

1 MHz Spacing



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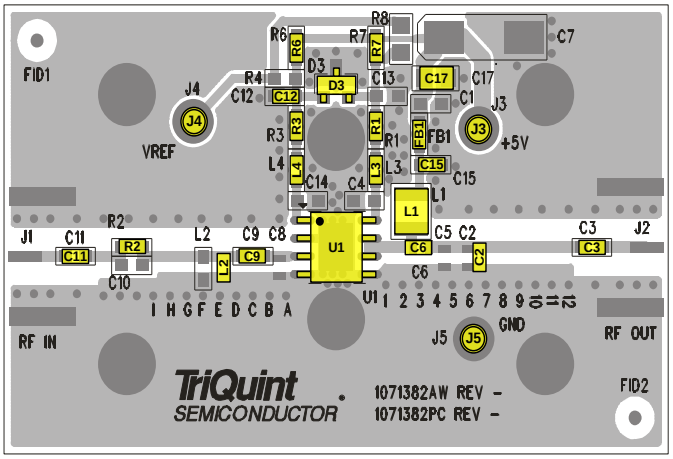
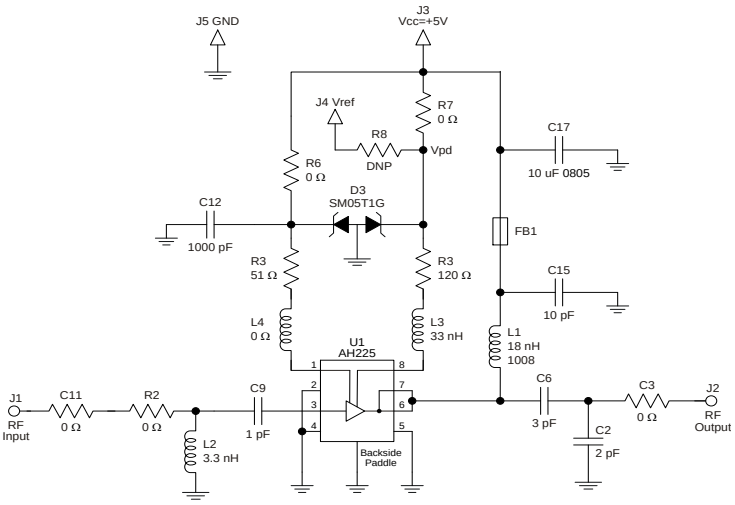
Application Circuit 1930 – 1990 MHz (AH225-S8PCB1960)





Notes:

1. See PC Board Layout, page 20 for more information.
2. Vref J4 turret can be used as control voltage for device power down (low = RF off) by setting R8 = 0 Ω and R8 = no connect.
3. The primary RF microstrip characteristic line impedance is 50 Ω.
4. Do not exceed +5.5V on Vpd or Vcc or TVS diode D3 will be damaged.
5. Components shown on the silkscreen but not on the schematic are not used.
6. The edge of L2 is placed at 135 mils from the edge of AH225 RFin pin pad (14.7˚ 1960 MHz).
7. The edge of C9 is placed at 75 mils from the edge of AH225 RFin pin pad (8.4˚ 1960 MHz).
8. The edge of C2 is placed at 320 mils from the edge of AH225 RFout pin pad (33˚ at 1960 MHz).
9. The edge of C6 is placed at 85 mils from the edge of AH225 RFout pin pad (8.4˚ at 1960 MHz).
10. Zero ohm jumpers may be replaced with copper traces in the target application layout.
11. DNP means Do Not Place.
12. The locations of C11, R2, C10 and C3 are non-critical. They can be placed closer to the device.
13. Ferrite Bead FB1 eliminates bypass line resonances between C15 and C1. Steward MI0603K300R-10.
14. All components are of 0603 size unless stated otherwise.

Typical Performance 1930 – 1990 MHz

Test conditions unless otherwise noted: V_{CC} = +5 V, I_{CQ} = 300 mA

Parameter	Typical Value			Units
Frequency	1930	1960	1990	MHz
Gain	15.2	15.4	15.6	dB
Input Return Loss	16	15.4	14.5	dB
Output Return Loss	7	8.3	9.6	dB
Output P1dB	+31.2	+31.3	+31.1	dBm
Output IP3 at 19 dBm / tone, Δf = 1 MHz	+51.3	+53.6	+47.5	dBm
WCDMA Channel Power (ACLR= −50 dBc) (1)	+21.8	+21.7	+21.7	dBm
Nosie Figure	5.9	5.9	6	dB

Notes:

1. ACLR Test set-up: 3GPP WCDMA, TM1+64 DPCH, +5 MHz offset, PAR = 10.2 dB at 0.01% Prob.
2. EVM Test set-up: 802.16 – 2004 OFDMA, 64 QAM – ½, 1024 FFT, 20 symbols, 30 sub channels.

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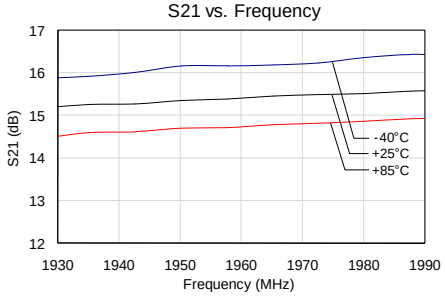
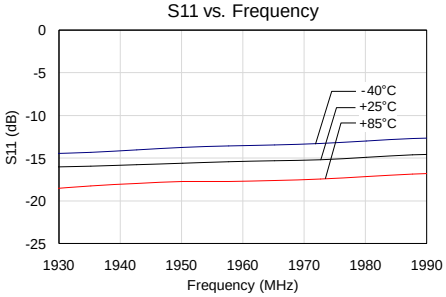
Typical Performance Plots 1805 – 1880 MHz

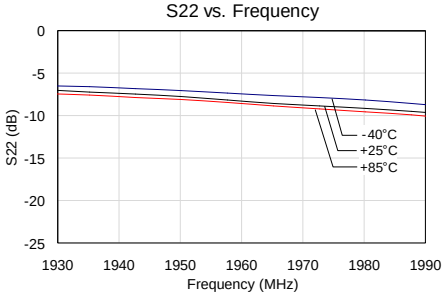
S21 vs. Frequency



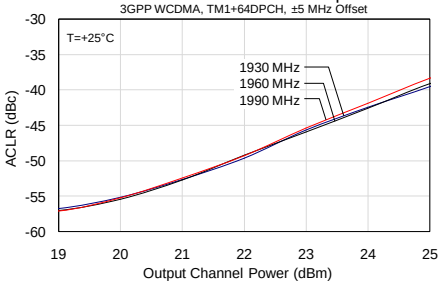
S11 vs. Frequency



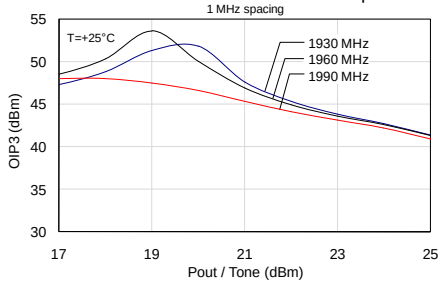
S22 vs. Frequency



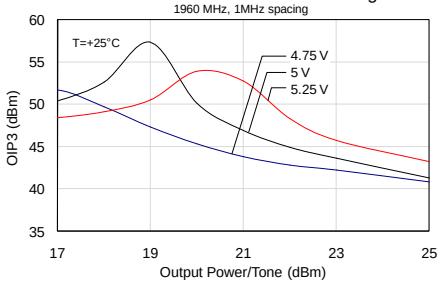
ACLR vs. Pout vs. Freq
3GPP WCDMA, TM1+64DPCH, ±5 MHz Offset



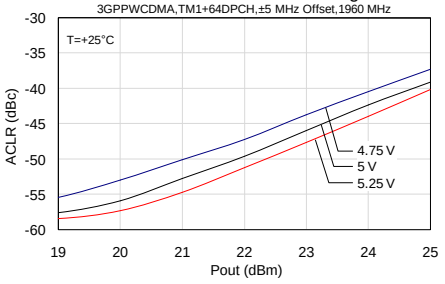
OIP3 vs. Pout / Tone vs. Freq
1 MHz spacing



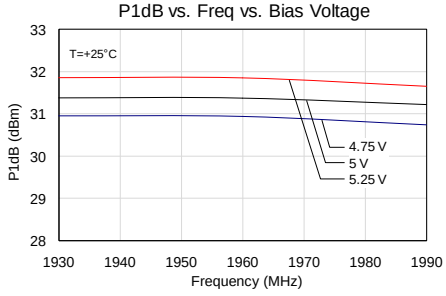
OIP3 vs. Pout/Tone vs. Bias Voltage
1960 MHz, 1MHz spacing



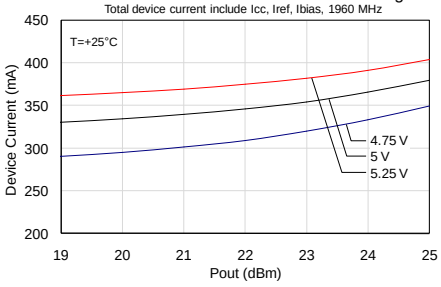
ACLR vs. Pout vs Bias Voltage
3GPPWCDMA,TM1+64DPCH,±5 MHz Offset,1960 MHz



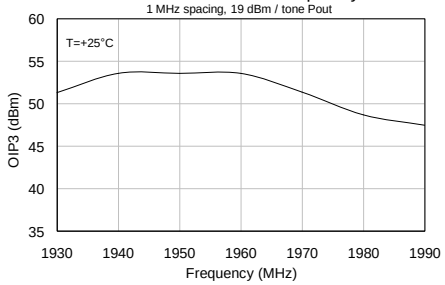
P1dB vs. Freq vs. Bias Voltage



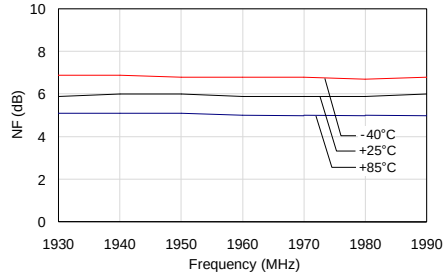
Total device current vs. Pout vs. Bias Voltage
Total device current include Icc, Iref, Ibias, 1960 MHz



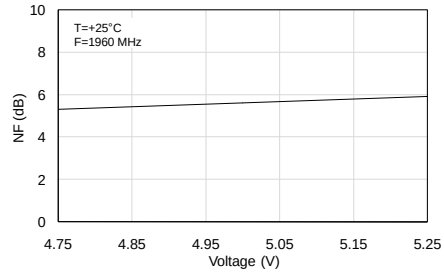
OIP3 vs. P1dB vs. Frequency
1 MHz spacing, 19 dBm / tone Pout



Noise Figure vs. Frequency



Noise Figure vs. Bias Voltage



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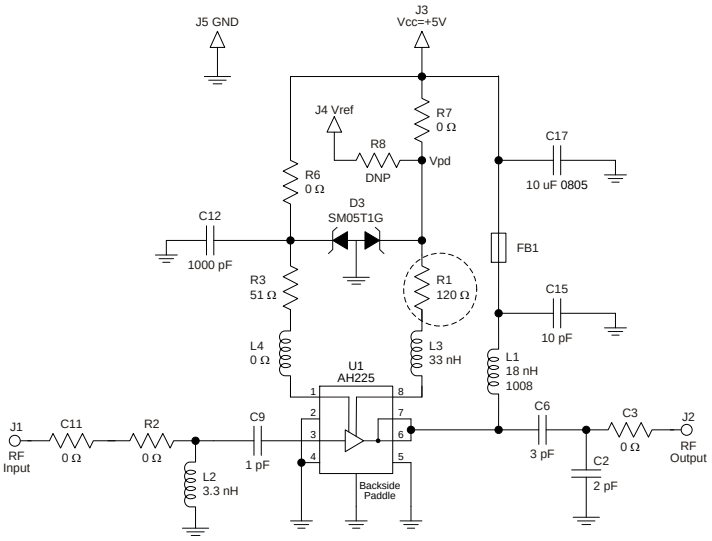
Reduced Bias Configuration Application Note

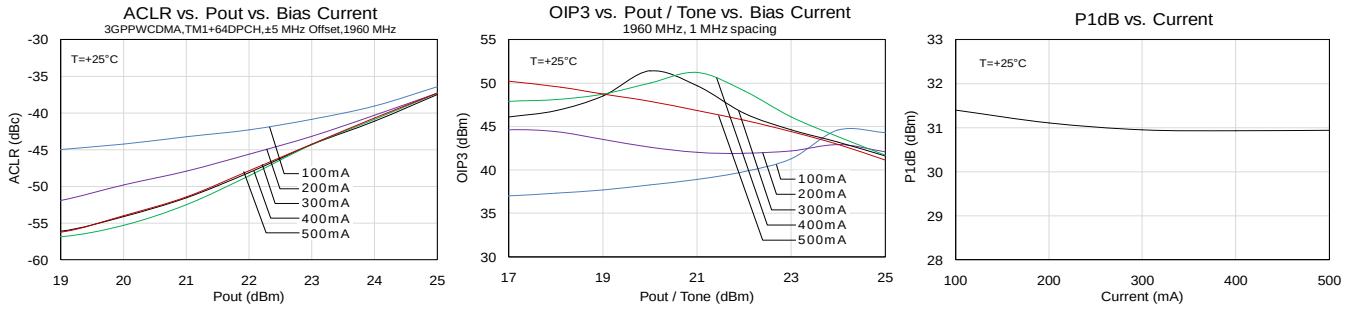
The AH225 can be configured to be operated with lower bias current by varying the Vpd resistor-R1 as highlighted on the schematic below. Lowering the current has little effect on the gain, OIP3, and P1dB performance of the device, but will slightly lower the ACLR performance of the device as shown below. It is expected that variation of the bias current for other frequency applications will produce similar performance results. The data below represents data taken from the AH225-S8PCB1960 with data taken at 1960 MHz.

R1 (Ω)	I_{CQ} (mA)	Gain (dB)	P_{DISS} (W)	P1dB (dBm)	OIP3 (dBm)[1]	Pout (dBm)[2]
56.2	500	15.6	2.5	+30.9	+48.7	+21.4
82	400	15.4	2	+30.9	+48.7	+21.6
120	300	15.2	1.5	+30.9	+48.5	+21.4
200	200	14.8	1	+31.1	+43.5	+19.9
403	100	14	0.5	+31.4	+37.7	+15

Notes:
1. OIP3 is measured with two tones at output power of 19 dBm / tone separated by 1 MHz spacing.
2. ACLR Test set-up: 3GPP WCDMA, TM1+64 DPCH, +5 MHz offset, PAR = 10.2 dB at 0.01% Prob. Pout (Channel power) at −50 dBc ACLR is shown in the table above.

Reduced Bias Configuration Application Circuit





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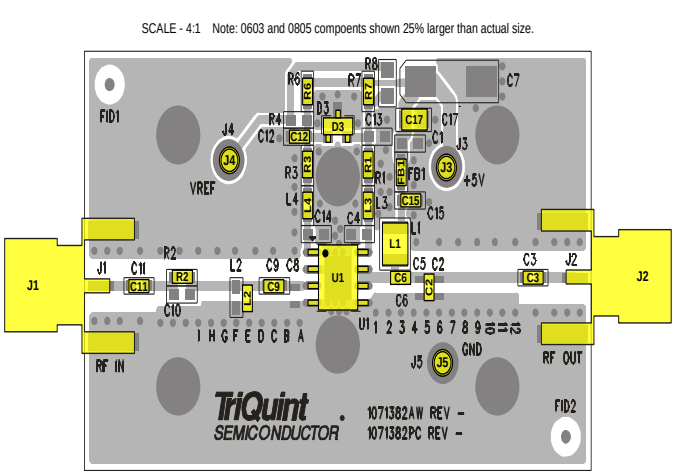
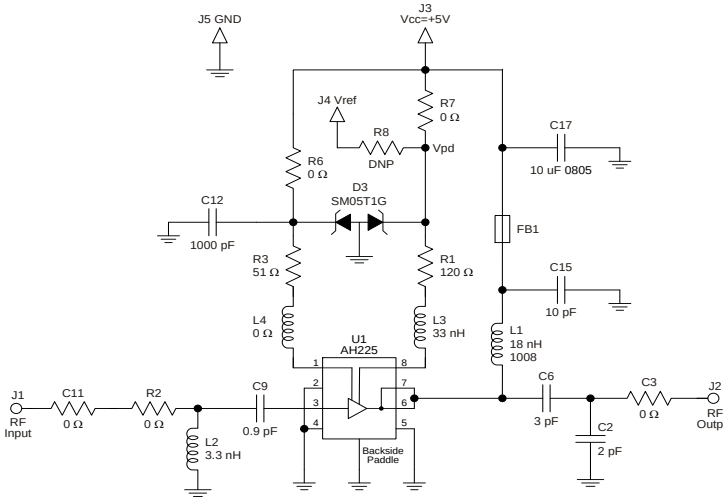
Application Circuit 2110 – 2170 MHz (AH225-S8PCB2140)





Notes:

1. See PC Board Layout, page 20 for more information.
2. Vref J4 turret can be used as control voltage for device power down (low = RF off) by setting R8 = 0 Ω and R8 = no connect.
3. The primary RF microstrip characteristic line impedance is 50 Ω.
4. Do not exceed +5.5V on Vpd or Vcc or TVS diode D3 will be damaged.
5. Components shown on the silkscreen but not on the schematic are not used.
6. The edge of L2 is placed at 205 mils from the edge of Ah225 RFin pin pad (23˚ at 2140 MHz).
7. The edge of C9 is placed at 80 mils from the edge of AH225 RFin pin pad (9˚ at 2140 MHz).
8. The edge of C2 is placed at 205 mils from the edge of AH225 RFout pin pad (23˚ at 2140 MHz).
9. The edge of C6 is placed at 80 mils from the edge of AH225 RFout pin pad (9˚ at 2140 MHz).
10. Zero ohm jumpers may be replaced with copper traces in the target application layout.
11. DNP means Do Not Place.
12. Inductor L3 on Vpd line is critical for linearity performance.
13. The locations of C11, R2, C10 and C3 are non-critical. They can be placed closer to the device.
14. Ferrite Bead FB1 eliminates bypass line resonances between C15 and C1. Steward MI0603K300R-10.
15. All components are of 0603 size unless stated otherwise.

Typical Performance 2110 – 2170 MHz

Test conditions unless otherwise noted: V_{CC} = +5 V, I_{CQ} = 300 mA

Parameter	Typical Value			Units
Frequency	2110	2140	2170	MHz
Gain	15.2	15.5	15.6	dB
Input Return Loss	20	18	17	dB
Output Return Loss	7.7	9.4	12	dB
Output P1dB	+31.5	+31.2	+31.1	dBm
Output IP3 at 19 dBm / tone, Δf = 1 MHz	+45.6	+46	+46.1	dBm
WCDMA Channel Power (ACLR= −50 dBc) (1)	+20.9	+21.3	+21	dBm
Nosie Figure	6	6	5.9	dB

Notes:

1. ACLR Test set-up: 3GPP WCDMA, TM1+64 DPCH, +5 MHz offset, PAR = 10.2 dB at 0.01% Prob.

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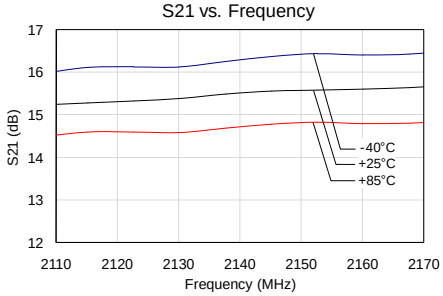
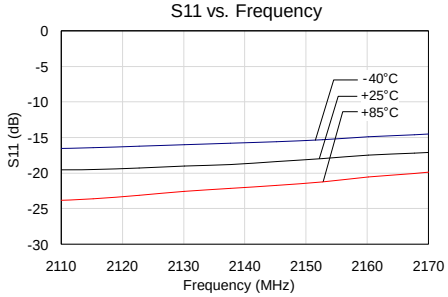
Typical Performance Plots 2110 – 2170 MHz

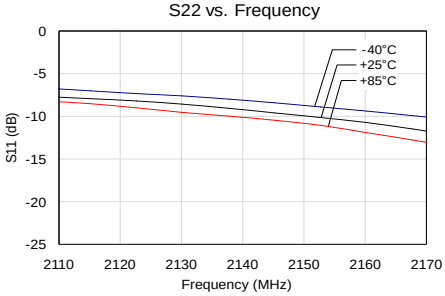
S21 vs. Frequency



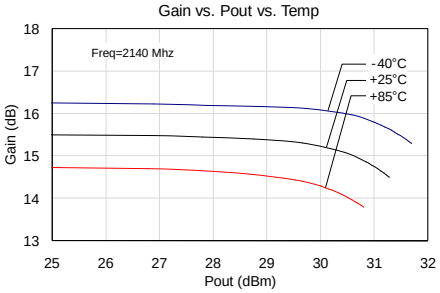
S11 vs. Frequency



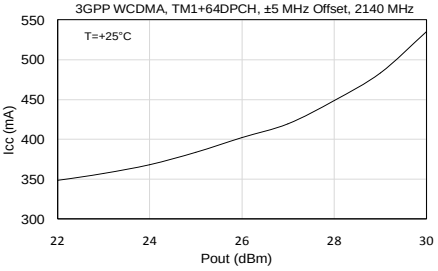
S22 vs. Frequency



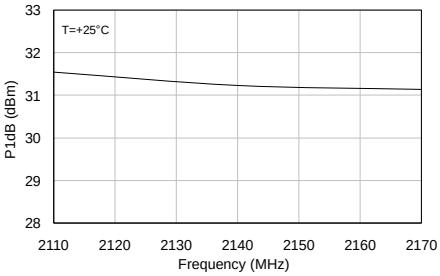
Gain vs. Pout vs. Temp



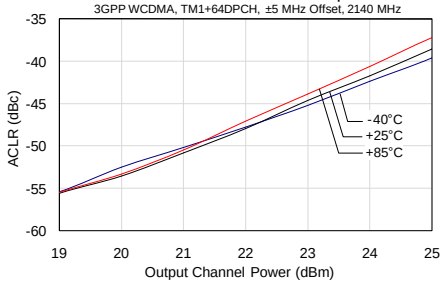
Icc vs. Pout
3GPP WCDMA, TM1+64DPCH, ±5 MHz Offset, 2140 MHz



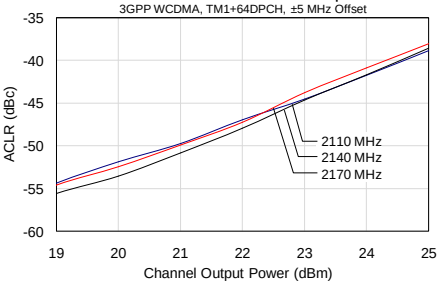
P1dB vs. Frequency



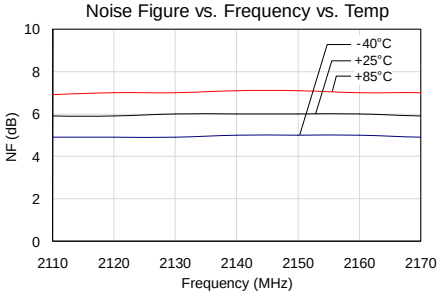
ACLR vs. Pout vs. Temp
3GPP WCDMA, TM1+64DPCH, ±5 MHz Offset, 2140 MHz



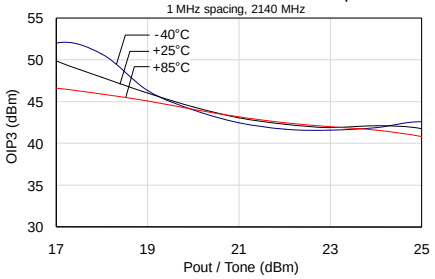
ACLR vs. Pout vs. Freq
3GPP WCDMA, TM1+64DPCH, ±5 MHz Offset



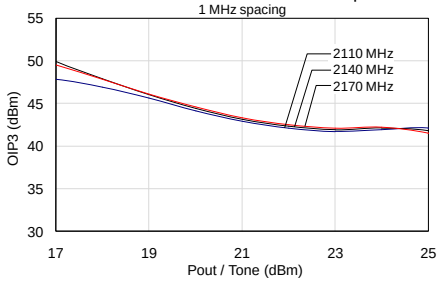
Noise Figure vs. Frequency vs. Temp



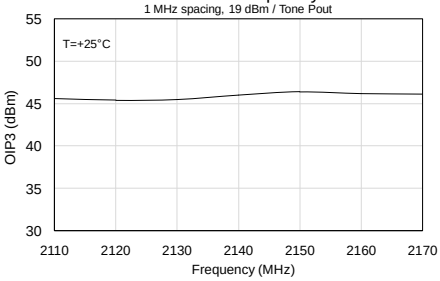
OIP3 vs. Pout/Tone vs. Temp
1 MHz spacing, 2140 MHz



OIP3 vs. Pout/Tone vs. Freq
1 MHz spacing



OIP3 vs. Frequency
1 MHz spacing, 19 dBm / Tone Pout



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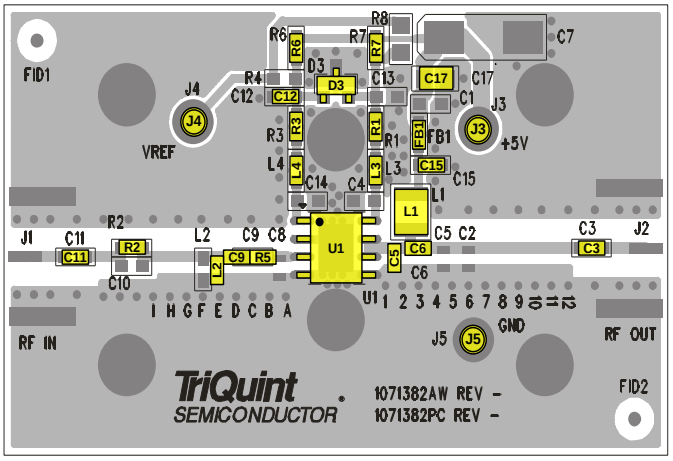
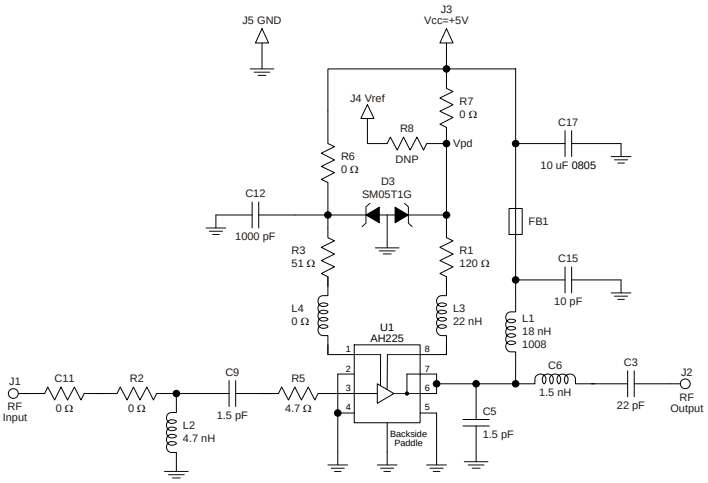
Reference Design 2500 – 2700 MHz





Notes:

1. See PC Board Layout, page 20 for more information.
2. Vref J4 turret can be used as control voltage for device power down (low = RF off) by setting R8 = 0 Ω and R8 = no connect.
3. The primary RF microstrip characteristic line impedance is 50 Ω.
4. Do not exceed +5.5V on Vpd or Vcc or TVS diode D3 will be damaged.
5. Components shown on the silkscreen but not on the schematic are not used.
6. The edge of C6 is placed at 80 mils from the edge of AH225 RFout pin pad (10.5˚ at 2600 MHz).
7. The edge of C5 is placed at 10 mils from the edge of AH225 RFout pin pad (1.5˚ at 2600 MHz).
8. The edge of R5 is placed at 5 mils from the edge of AH225 RFin pin pad (1˚ at 2600 MHz).
9. The edge of C9 is placed at 10 mils from the edge of R5 (1.5˚ at 2600 MHz).
10. L2 is placed against the edge of C9.
11. Zero ohm jumpers may be replaced with copper traces in the target application layout.
12. DNP means Do Not Place.
13. The multilayer inductor L3 on Vpd line is critical for linearity performance.
14. The locations of C11, R2, C10 and C3 are non-critical. They can be placed closer to the device.
15. Ferrite Bead FB1 eliminates bypass line resonances between C15 and C1. Steward MI0603K300R-10.
16. All components are of 0603 size unless stated otherwise.

Typical Performance 2500 – 2700 MHz

Test conditions unless otherwise noted: V_{CC} = +5 V, I_{CQ} = 300 mA

Parameter	Typical Value			Units
Frequency	2500	2600	2700	MHz
Gain	12.9	13.2	12.8	dB
Input Return Loss	13.3	19.4	15.8	dB
Output Return Loss	5.2	5.5	6.4	dB
Output P1dB	+30.4	+30.5	+30.2	dBm
Output IP3 at 19 dBm / tone, Δf = 1 MHz	+50	+48.7	+44.8	dBm
WCDMA Channel Power (ACLR= −50 dBc) (1)	+21.3	+21.3	+20.9	dBm
OFDMA Channel Power at 2.5% EVM (2)	+23	+23	+22.7	dBm

Notes:

1. ACLR Test set-up: 3GPP WCDMA, TM1+64 DPCH, +5 MHz offset, PAR = 10.2 dB at 0.01% Prob.
2. EVM Test set-up: 802.16 – 2004 OFDMA, 64 QAM – ½, 1024 FFT, 20 symbols, 30 sub channels.

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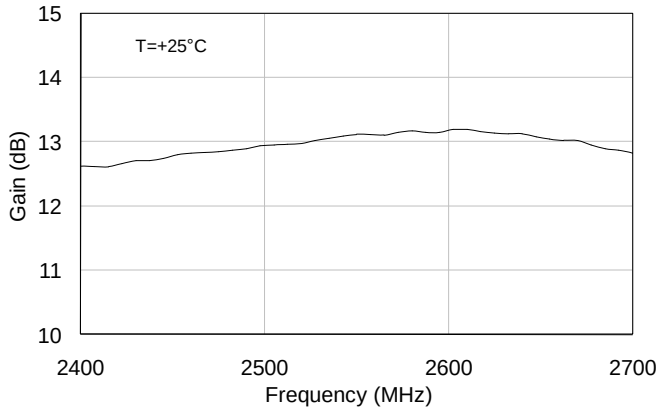
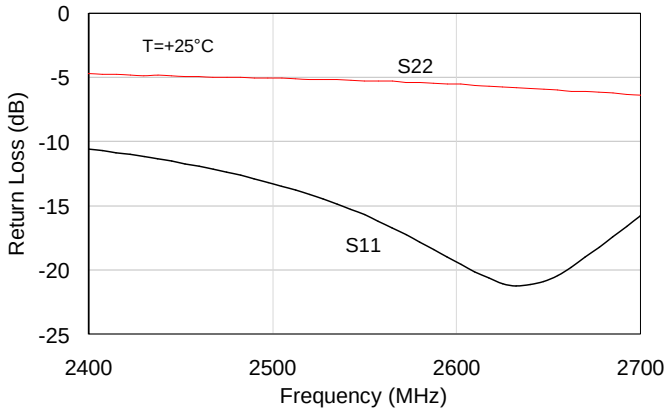
Typical Performance Plots 2500 – 2700 MHz

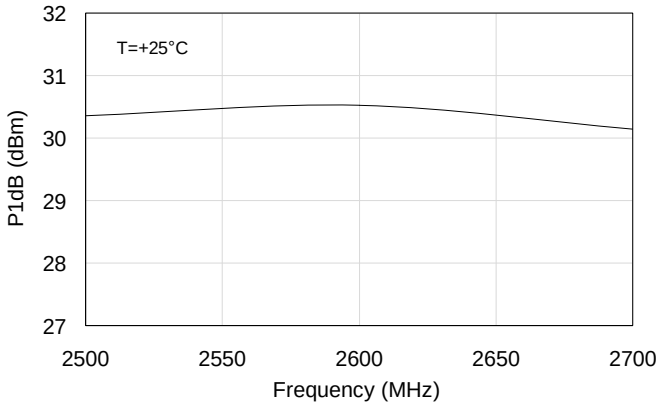
S21 vs. Frequency



Return Loss vs. Frequency

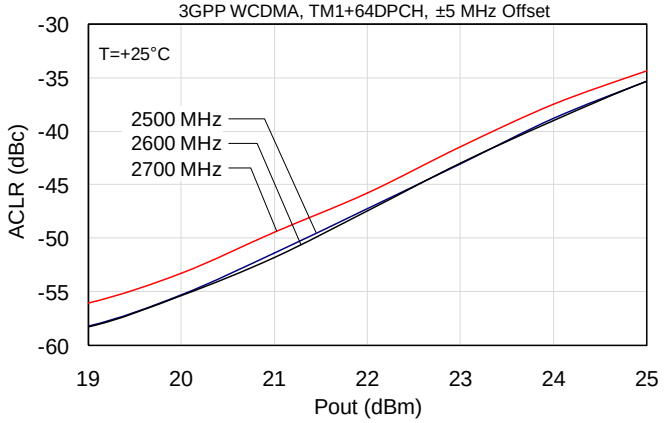


P1dB vs. Frequency



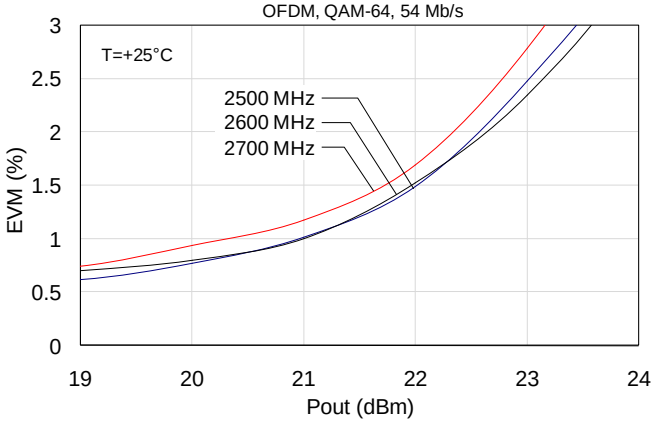
ACLR vs. Pout vs. Freq

3GPP WCDMA, TM1+64DPCH, ±5 MHz Offset



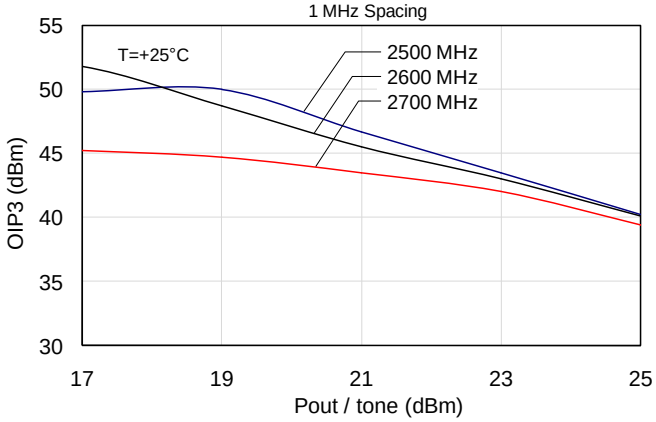
EVM vs. Pout vs. Freq

OFDM, QAM-64, 54 Mb/s



OIP3 vs. Pout / Tone vs. Freq

1 MHz Spacing



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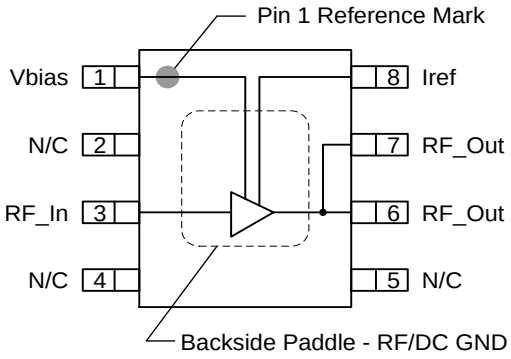
Pin Configuration and Description



Pin No.	Label	Description
1	Vbias	Voltage supply for active bias. Connect to same supply voltage as V_{CC}.
2, 4, 5	N/C	No internal connection. This pin can be grounded or N/C on PCB.
3	RF_In	RF Input. Requires matching for operation.
6	RF_Out	RF Output and DC supply voltage.
7	RF_Out	See pin 6.
8	Iref	Reference current into internal active bias current mirror. Current into Iref sets device quiescent current. Also, can be used as on/off control.
Backside Paddle	RF/DC GND	Backside Paddle. Multiple vias should be employed to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint.

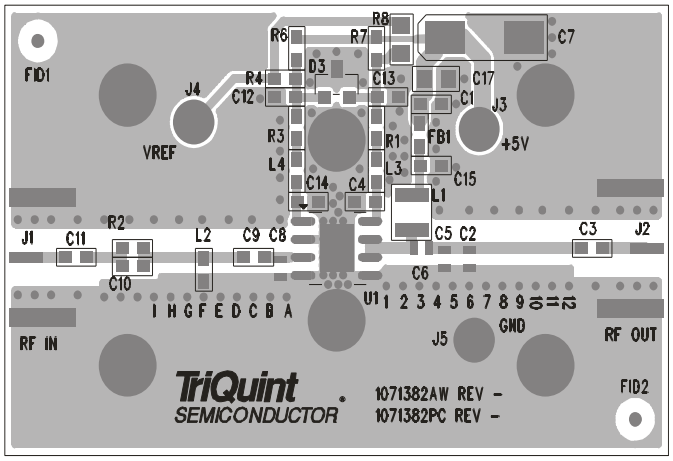
Application Board Information

PC Board Layout

Top RF layer is .014" Getek, ϵ_r = 4.0, 4 total layers (0.062" thick) for mechanical rigidity. Metal layers are 1-oz copper. Microstrip line details: width = .030", spacing = .026".

The silk screen markers 'A', 'B', 'C', etc. and '1', '2', '3', etc. are used as placemarkers for the input and output tuning shunt capacitors – C8, C5 and C2. The markers and vias are spaced in .050" increments.

The pad pattern shown has been developed and tested for optimized assembly at TriQuint Semiconductor. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended.



For further technical information, Refer to www.TriQuint.com

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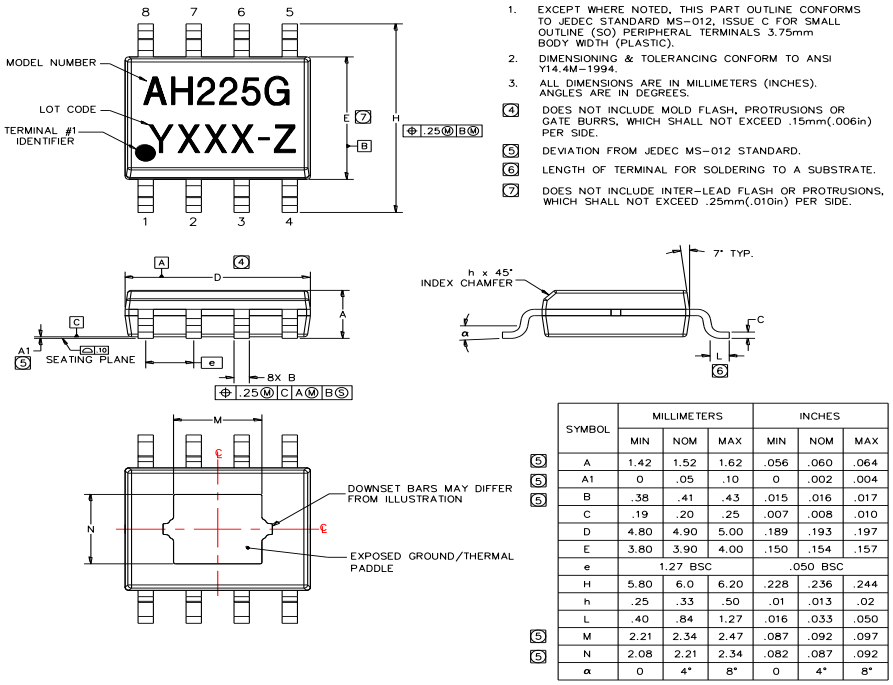
Package Marking and Dimensions

This package is lead-free/RoHS-compliant. The plating material on the leads is NiPdAu. It is compatible with both lead-free (maximum 260 ˚C reflow temperature) and lead (maximum 245 ˚C reflow temperature) soldering processes.

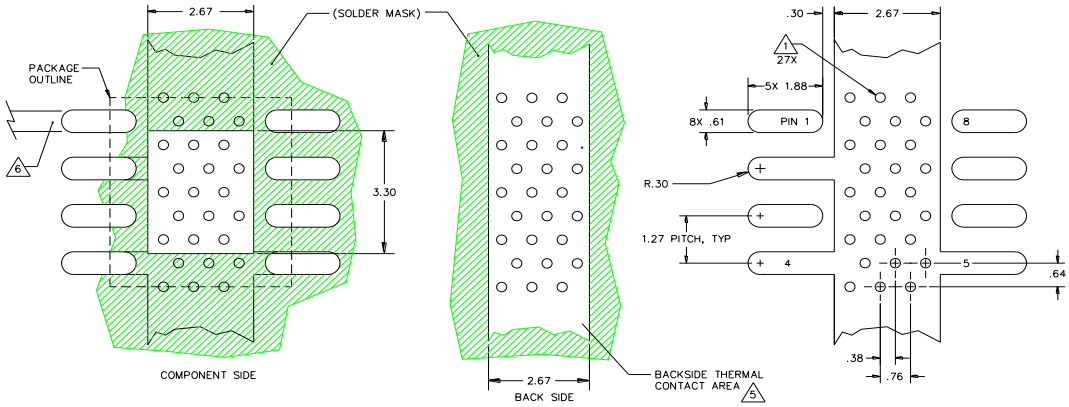
The AH225 will be marked with an "AH225G" designator with a lot code marked below the part designator. The "Y" represents the last digit of the year the part was manufactured, the "XXXX" is an auto-generated number, and "Z" refers to a wafer number in a lot batch.



NOTES:
1. EXCEPT WHERE NOTED, THIS PART OUTLINE CONFORMS TO JEDEC STANDARD MS-012, ISSUE C FOR SMALL OUTLINE (SO) PERIPHERAL TERMINALS 3.75mm BODY WIDTH (PLASTIC).
2. DIMENSIONING & TOLERANCING CONFORM TO ANSI Y14.4M-1994.
3. ALL DIMENSIONS ARE IN MILLIMETERS (INCHES). ANGLES ARE IN DEGREES.
4. DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS, WHICH SHALL NOT EXCEED .15mm(.006in) PER SIDE.
5. DEVIATION FROM JEDEC MS-012 STANDARD.
6. LENGTH OF TERMINAL FOR SOLDERING TO A SUBSTRATE.
7. DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSIONS, WHICH SHALL NOT EXCEED .25mm(.010in) PER SIDE.

SYMBOL	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
5 A	1.42	1.52	1.62	.056	.060	.064
5 A1	0	.05	.10	0	.002	.004
5 B	.38	.41	.43	.015	.016	.017
C	.19	.20	.25	.007	.008	.010
D	4.80	4.90	5.00	.189	.193	.197
E	3.80	3.90	4.00	.150	.154	.157
e	1.27 BSC			.050 BSC		
H	5.80	6.0	6.20	.228	.236	.244
h	.25	.33	.50	.01	.013	.02
L	.40	.84	1.27	.016	.033	.050
5 M	2.21	2.34	2.47	.087	.092	.097
5 N	2.08	2.21	2.34	.082	.087	.092
α	0	4°	8°	0	4°	8°

PCB Mounting Pattern



Notes:
1. A heat sink underneath the area of the PCB for the mounted device is strictly required for proper thermal operation. Damage to the device can occur without the use of one.
2. Ground / thermal vias are critical for the proper performance of this device. Vias should use a .35mm (#80 / .0135") diameter drill and have a final plated thru diameter of .25 mm (.010") or equivalent.
3. Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
4. Mounting screws can be added near the part to fasten the board to a heat sink. Ensure that the ground / thermal via region contact the heat sink.
5. Do not put solder mask on the backside of the PC board in the region where the board contacts the heat sink.
6. RF Trace width depends upon the PC board material and construction.
7. Use 1 oz. Copper minimum.
8. All dimensions are in millimeters (inches). Angles are in degrees.

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Product Compliance Information

ESD Sensitivity Ratings

Caution! ESD-Sensitive Device

ESD Rating: Class 1C
Value: ≥ 1000 V to < 2000 V
Test: Human Body Model (HBM)
Standard: ESDA/JEDEC Standard JS-001-2012

ESD Rating: Class C3
Value: ≥ 1000 V
Test: Charged Device Model (CDM)
Standard: JEDEC Standard JESD22-C101F

MSL Rating

MSL Rating: Level 2
Test: 260 °C convection reflow
Standard: JEDEC Standard J-STD-020

Solderability

Compatible with both lead-free (260°C max. reflow temperature) and tin/lead (245°C max. reflow temperature) soldering processes.

Package contact plating: NiPdAu

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.triquint.com **Tel: 1-844-890-8163**
Email: customer.support@qorvo.com

For information about the merger of RFMD and TriQuint as Qorvo:

Web: www.qorvo.com

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