

# MGA-43528

## High Linearity (1.93 – 1.995) GHz Power Amplifier Module



### Data Sheet

#### Description

Avago Technologies' MGA-43528 is a fully matched power amplifier for use in the (1.93 – 1.995) GHz band. High linear output power at 5V is achieved through the use of Avago Technologies' proprietary 0.25um GaAs Enhancement-mode pHEMT process. MGA-43528 is housed in a miniature 5.0mm x 5.0mm molded-chip-on-board (MCOB) module package. A detector is also included on-chip. The compact footprint coupled with high gain, high linearity and good efficiency makes the MGA-43528 an ideal choice as a power amplifier for small cell BTS PA applications.

#### Applications

- Final and driver stage high linearity amplifier for Picocell and Enterprise Femtocell basestations

#### Component Image

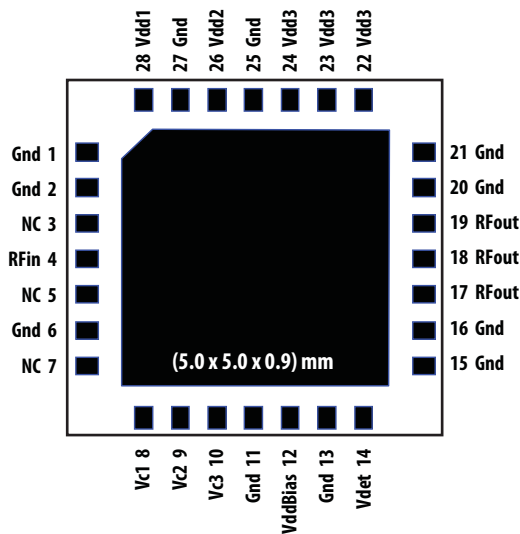


TOP VIEW

#### 5.0 x 5.0 x 0.9 mm Package Outline

Note:  
Package marking provides orientation and identification  
"43528" = Device part number  
"YYWW" = year and work week  
"XXXX" = assembly lot number

#### Pin Configuration



#### Features

- High linearity performance : Max -50dBc ACLR1 [1] at 27.2Bm linear output power (biased with 5V supply)
- High gain : 41.9dB
- Good efficiency
- Fully matched input and output
- Built-in RF detector
- GaAs E-pHEMT Technology [2]
- Low cost small package size: (5.0 x 5.0 x 0.9) mm
- MSL3
- Lead free/Halogen free/RoHS compliance

#### Specifications

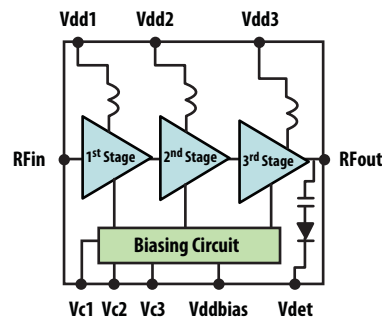
Freq=1.96GHz; Vdd= 5.0V, Idtotal=400mA (typ) [1]

- PAE : 13.6%
- 27.2dBm linear Pout @ ACLR1 = -50dBc
- 41.9dB Gain
- Detector range : 20dB

Note:

1. W-CDMA Test model #1, 64DPCH downlink signal.
2. Enhancement mode technology employs positive Vgs, thereby eliminating the need of negative gate voltage associated with conventional depletion mode devices.

#### Functional Block Diagram



**Attention: Observe precautions for handling electrostatic sensitive devices.**

ESD Machine Model = 60 V  
ESD Human Body Model = 430 V  
Refer to Avago Application Note A004R:  
Electrostatic Discharge, Damage and Control.

**Absolute Maximum Rating**<sup>[1]</sup>  $T_A = 25^\circ\text{C}$ 

Symbol	Parameter	Units	Absolute Max.
Vdd, VddBias	Supply voltages, bias supply voltage	V	6
Vc	Control Voltage	V	(Vdd)
P <sub>in,max</sub>	CW RF Input Power	dBm	20
P <sub>diss</sub>	Total Power Dissipation <sup>[3]</sup>	W	7.2
T <sub>j</sub>	Junction Temperature	°C	150
T <sub>STG</sub>	Storage Temperature	°C	-65 to 150

**Thermal Resistance**<sup>[2,3]</sup>

$\theta_{jc} = 13^\circ\text{C/W}$

Notes:

1. Operation of this device in excess of any of these limits may cause permanent damage.
2. Thermal resistance measured using Infra-Red Measurement Technique at Vdd = 5.5 V operating voltage.
3. Board temperature (TB) is 25° C, for TB > 56.4° C derate the device power at 77 mW per °C rise in Board (package belly) temperature.

**Electrical Specifications**

$T_A = 25^\circ\text{C}$ , Vdd = VddBias = 5.0V, Vc1 = 2.4V, Vc2 = 1.6V, Vc3 = 2.2V, Idqtotal = 400mA, RF performance at 1.96 GHz, W-CDMA Test model #1, 64DPCH downlink signal operation unless otherwise stated.

Symbol	Parameter and Test Condition	Units	Min.	Typ.	Max.
Vdd	Supply Voltage	V		5.0	
Idqtotal	Quiescent Supply Current	mA		400	600
Gain	Gain	dB	38	41.9	
OP1dB	Output Power at 1dB Gain Compression	dBm		37.2	
ACLR1 @ Pout = 27.2 dBm	W-CDMA Test model #1, 64DPCH downlink signal	dBc		-50	
PAE @ Pout = 27.2 dBm	Power Added Efficiency	%	11.5	13.6	
S11	Input Return Loss, 50 $\Omega$ source	dB		17.3	
DetR	Detector RF dynamic range	dB		20	

$T_A = 25^\circ\text{C}$ , Vdd = VddBias = 5.5V, Vc1 = 2.4V, Vc2 = 1.6V, Vc3 = 2.2V, Idqtotal = 490mA, RF performance at 1.96 GHz, W-CDMA Test model #1, 64DPCH downlink signal operation unless otherwise stated.

Symbol	Parameter and Test Condition	Units	Typ.
Vdd	Supply Voltage	V	5.5
Idqtotal	Quiescent Supply Current	mA	490
Gain	Gain	dB	41.9
OP1dB	Output Power at 1dB Gain Compression	dBm	37.6
ACLR1 @ Pout = 27.9 dBm	W-CDMA Test model #1, 64DPCH downlink signal	dBc	-50
PAE @ Pout = 27.9 dBm	Power Added Efficiency	%	13.2
S11	Input Return Loss, 50 $\Omega$ source	dB	17.5
DetR	Detector RF dynamic range	dB	20

## Product Consistency Distribution Charts [1]

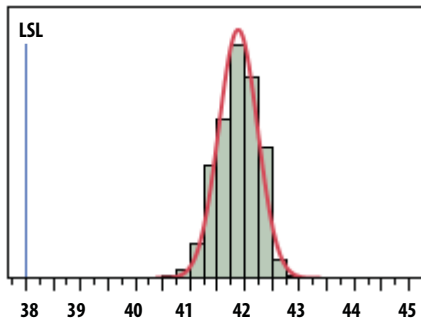


Figure 1. Gain at Pout=27.2dBm; LSL=38dB, Nominal = 41.9dB

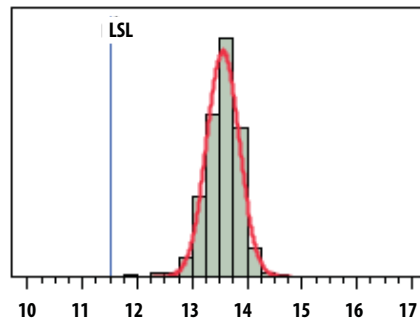


Figure 2. PAE at Pout=27.2dBm; LSL=11.5% Nominal = 13.6%

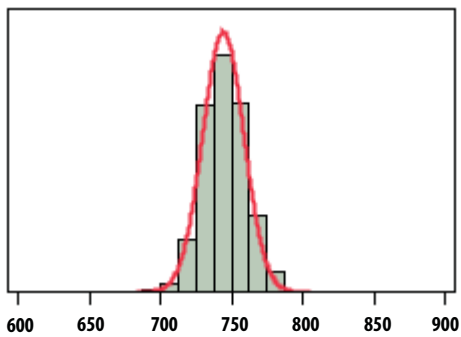


Figure 3. Idd\_Total at Pout=27.2dBm, Nominal = 755mA

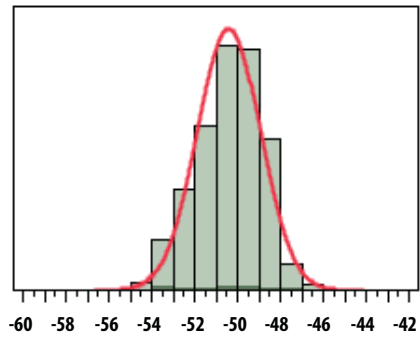


Figure 4. ACLR1 at Pout=27.2dBm, Nominal = -50.3dBc

### Note:

1. Distribution data sample size is 2600 samples taken from 3 different wafer lots. TA = 25°C, Vdd=VddBias = 5.0V, Vc1=2.4V, Vc2=1.6V, Vc3=2.2V, RF performance at 1.96GHz unless otherwise stated. Future wafers allocated to this product may have nominal values anywhere between the upper and lower limits.

MGA-43528 typical over-temperature performance at  $V_{c1}=2.4V$ ,  $V_{c2}=1.6V$ ,  $V_{c3}=2.2V$  as shown in Figure 30 unless otherwise stated

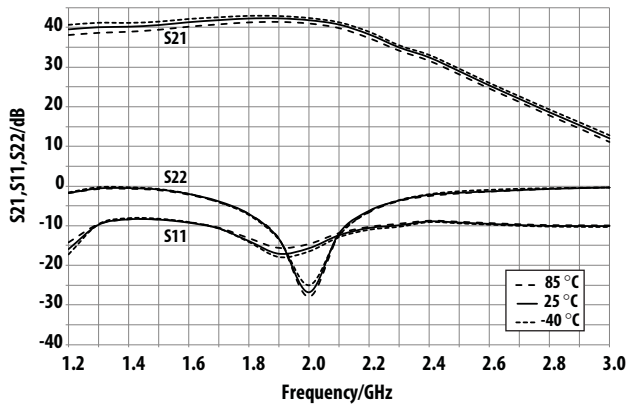


Figure 5. Small-signal performance Over-temperature  $V_{dd}=V_{ddBias}=5.0V$  operating voltage

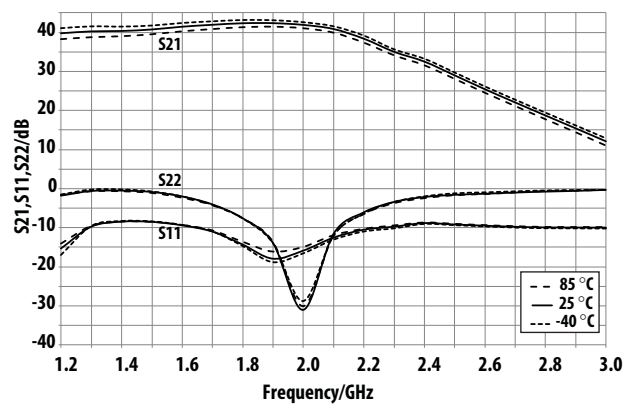


Figure 6. Small-signal performance Over-temperature  $V_{dd}=V_{ddBias}=5.5V$  operating voltage

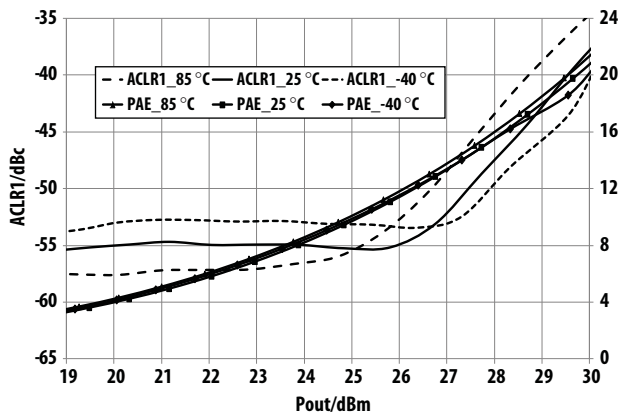


Figure 7. Over-temperature ACLR1, PAE vs  $P_{out}$  @ 1.93GHz  $V_{dd}=V_{ddBias}=5.0V$  operating voltage

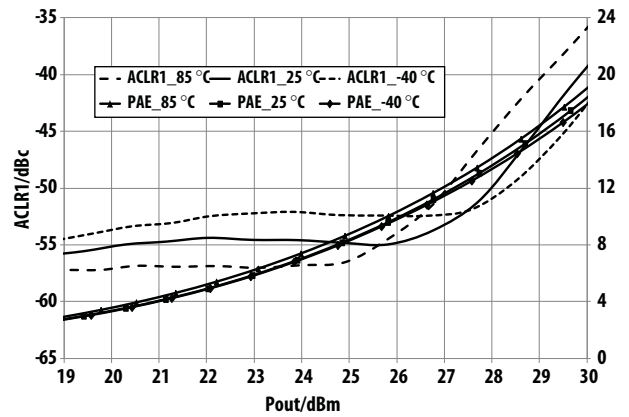


Figure 8. Over-temperature ACLR1, PAE vs  $P_{out}$  @ 1.93GHz  $V_{dd}=V_{ddBias}=5.5V$  operating voltage

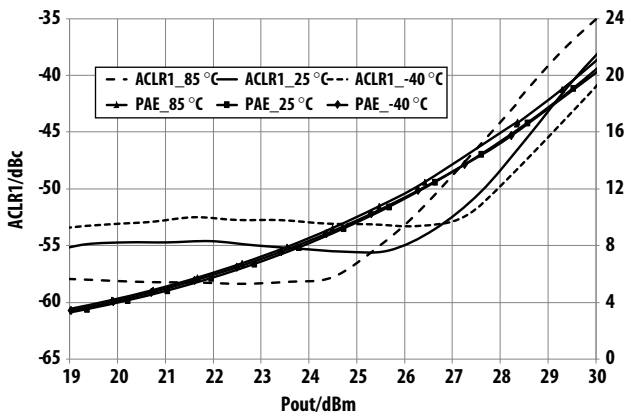


Figure 9. Over-temperature ACLR1, PAE vs  $P_{out}$  @ 1.96GHz  $V_{dd}=V_{ddBias}=5.0V$  operating voltage

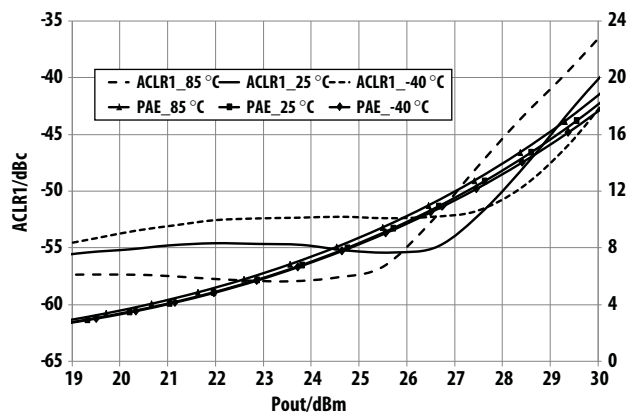
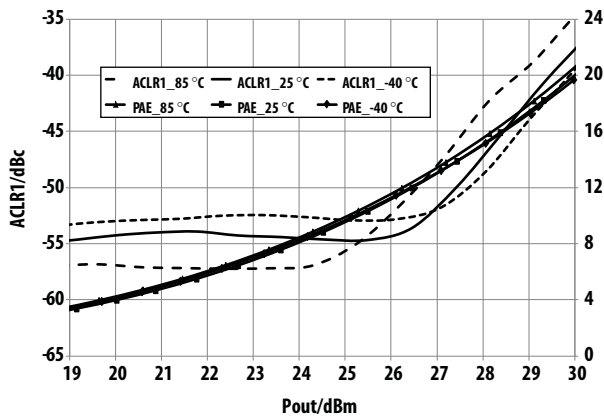
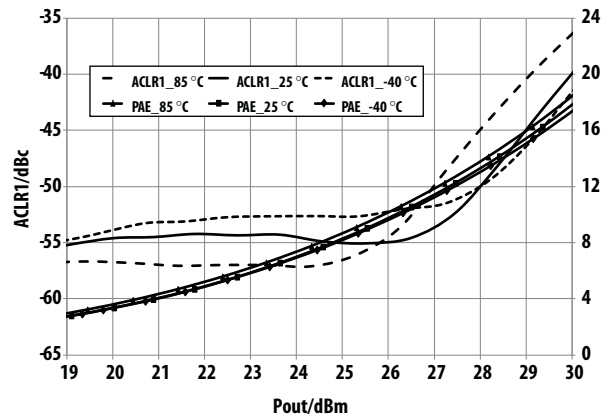


Figure 10. Over-temperature ACLR1, PAE vs  $P_{out}$  @ 1.96GHz  $V_{dd}=V_{ddBias}=5.5V$  operating voltage

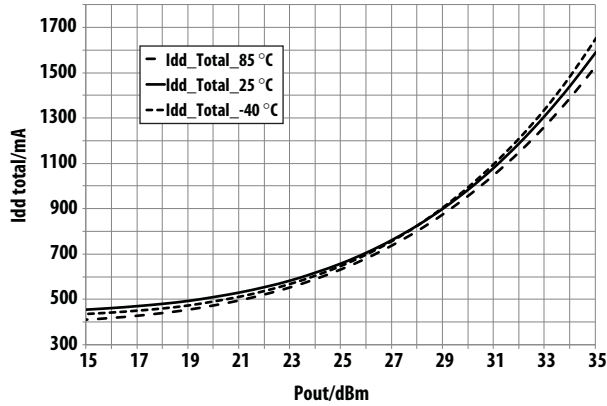
**MGA-43528 typical over-temperature performance at Vc1=2.4V, Vc2=1.6V, Vc3=2.2V unless otherwise stated**



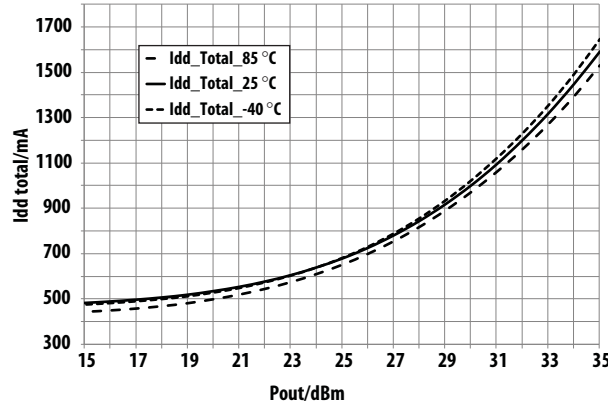
**Figure 11. Over-temperature ACLR1, PAE vs Pout @ 1.995GHz  
Vdd=VddBias=5.0V operating voltage**



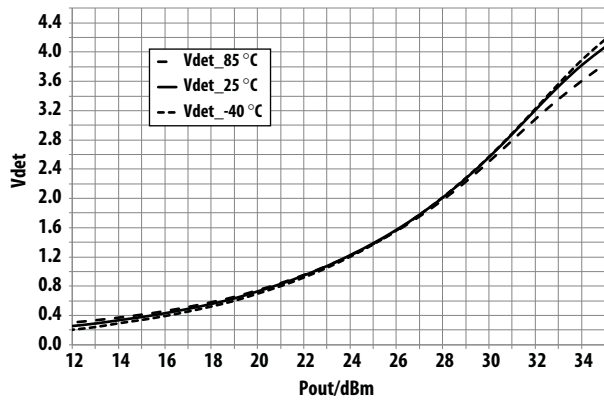
**Figure 12. Over-temperature ACLR1, PAE vs Pout @ 1.995GHz  
Vdd=VddBias=5.5V operating voltage**



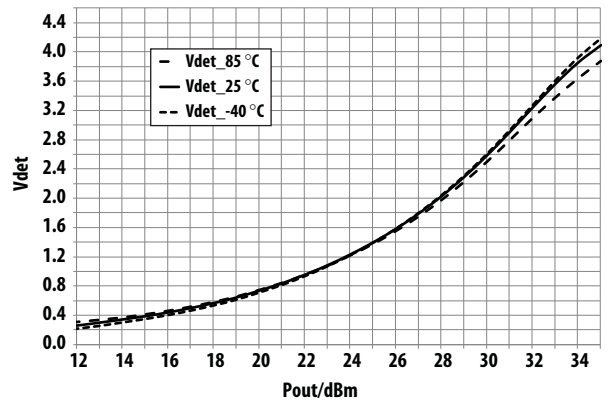
**Figure 13. Over-temperature Idd\_total vs Pout @ 1.96GHz  
Vdd=VddBias=5.0V operating voltage**



**Figure 14. Over-temperature Idd\_total vs Pout @ 1.96GHz  
Vdd=VddBias=5.5V operating voltage**

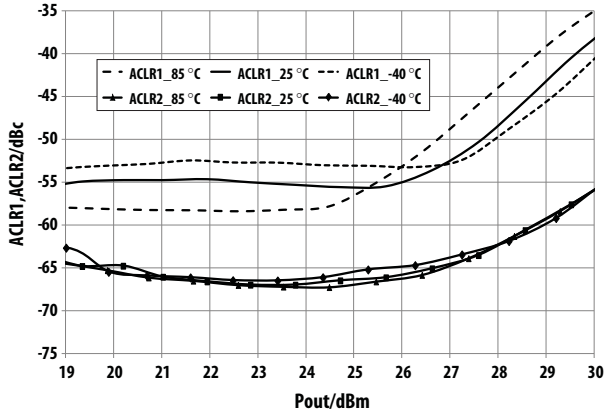


**Figure 15. Over-temperature Vdet vs Pout @ 1.96GHz Vdd=VddBias=5.0V operating voltage**

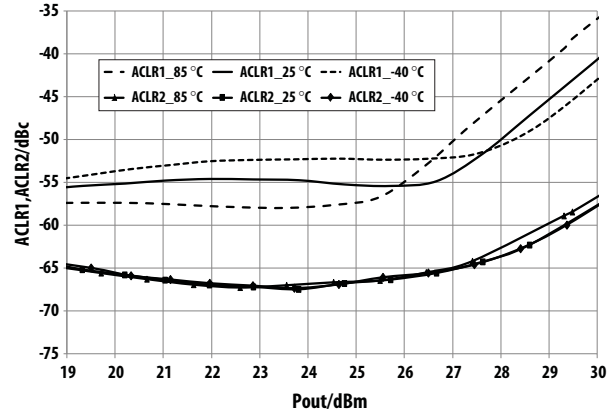


**Figure 16. Over-temperature Vdet vs Pout @ 1.96GHz Vdd=VddBias=5.5V operating voltage**

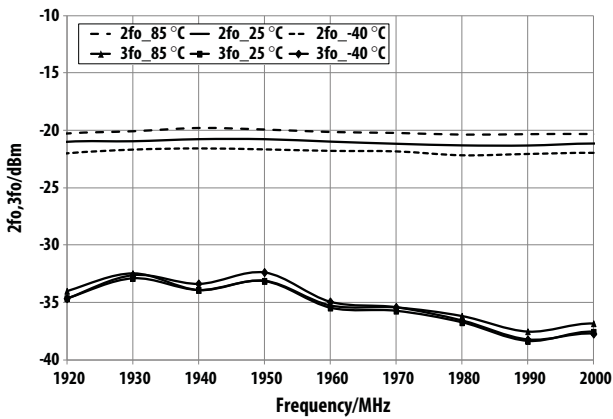
**MGA-43528 typical over-temperature performance at Vc1=2.4V, Vc2=1.6V, Vc3=2.2V unless otherwise stated**



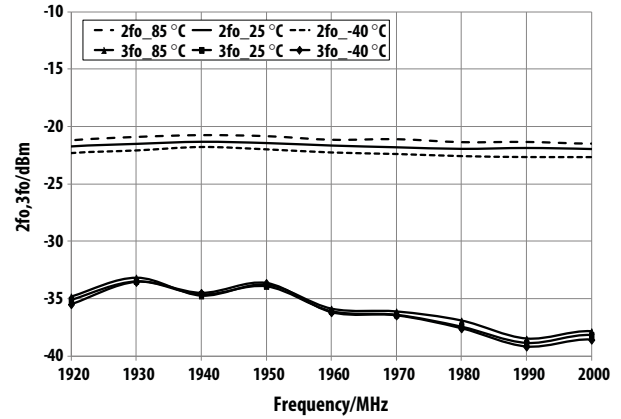
**Figure 17. Over-temperature ACLR1, ACLR2 Pout @ 1.96GHz  
Vdd=VddBias=5.0V operating voltage**



**Figure 18. Over-temperature ACLR1, ACLR2 vs Pout @ 1.96GHz  
Vdd=VddBias=5.5V operating voltage**



**Figure 19. Over-temperature 2nd, 3rd Harmonics vs Freq at Pout=27.2dBm,  
Vdd=VddBias=5.0V operating voltage**



**Figure 20. Over-temperature 2nd, 3rd Harmonics vs Freq at Pout=27.2dBm,  
Vdd=VddBias=5.5V operating voltage**

MGA-43528 typical over-temperature performance at Vc1=2.4V, Vc2=1.6V, Vc3=2.2V unless otherwise stated

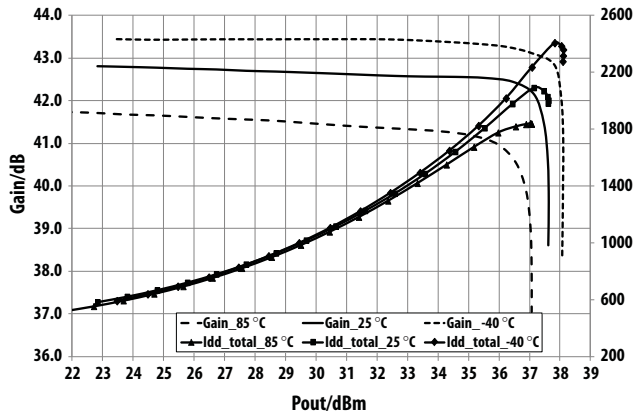


Figure 21. Over-temperature Gain, Idd\_total vs Pout @ 1.96GHz  
Vdd=VddBias=5.0V operating voltage

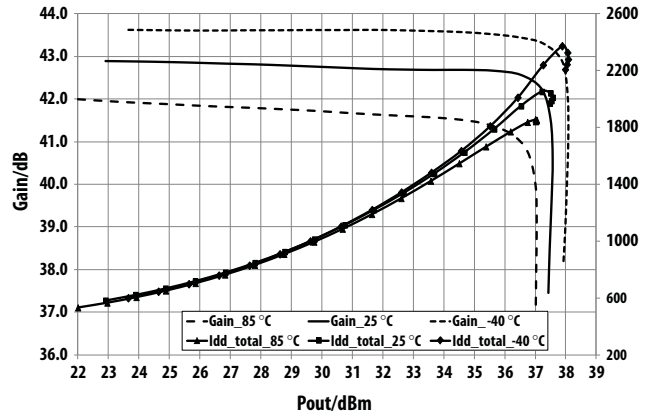


Figure 22. Over-temperature Gain, Idd\_total vs Pout @ 1.93GHz  
Vdd=VddBias=5.0V voltage

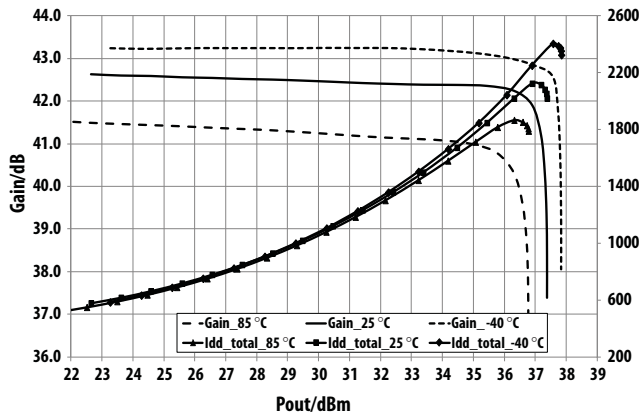


Figure 23. Over-temperature Gain, Idd\_total vs Pout @ 1.995GHz  
Vdd=VddBias=5.0V operating voltage

**MGA-43528 typical 3GPP W-CDMA Test model #1 Spectrum Emission Mask performance at Vdd=VddBias=5.0V, Vc1=2.4V, Vc2=1.6V, Vc3=2.2V unless otherwise stated**

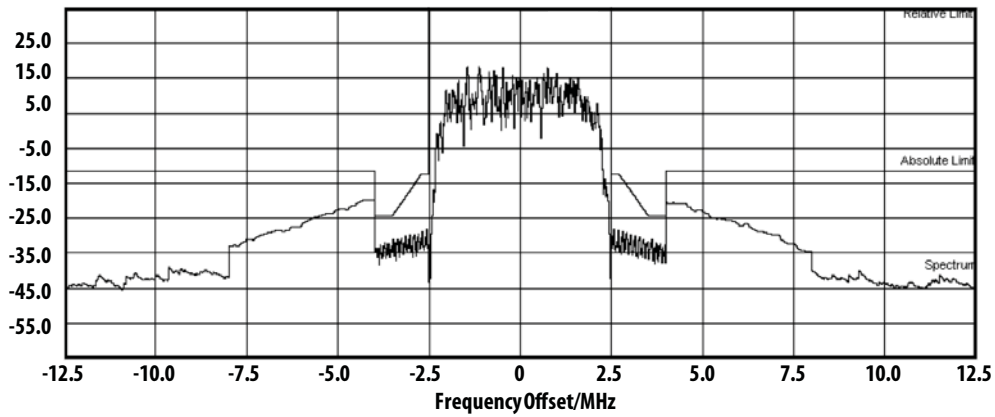


Figure 24. SEM at Pout=28dBm @ 1.93GHz

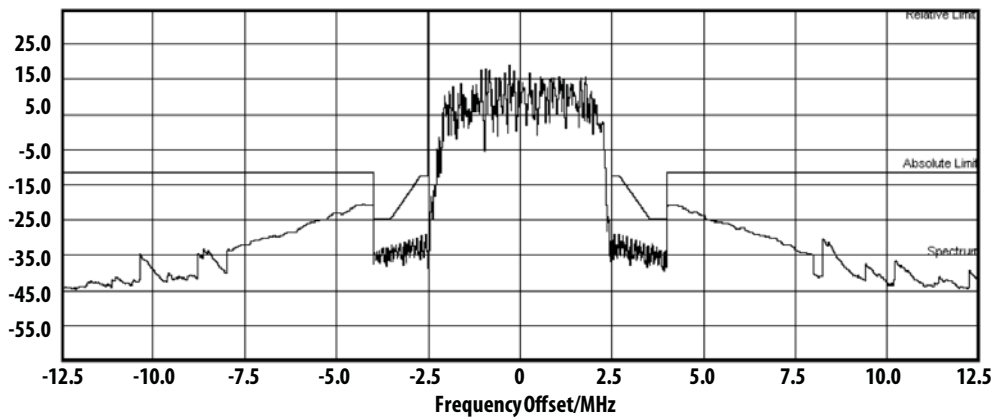


Figure 25. SEM at Pout=28dBm @ 1.96GHz

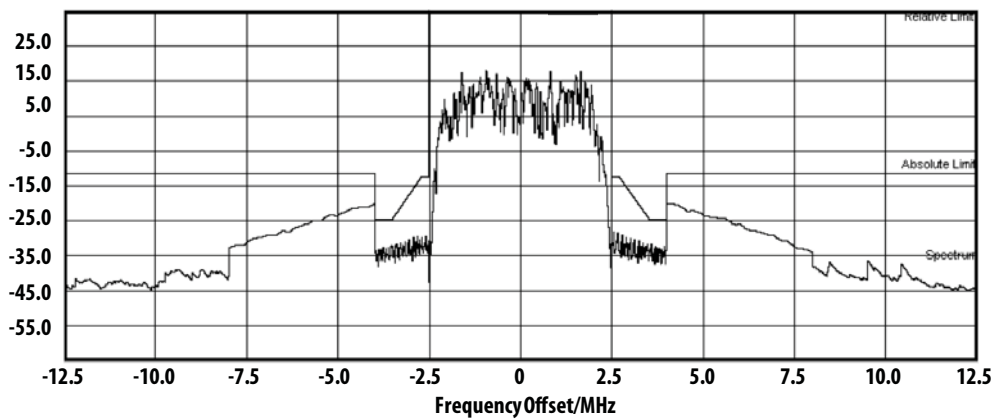


Figure 26. SEM at Pout=28dBm @ 1.995GHz



**MGA-43528 typical LTE Downlink (E-TM1.1) 10MHz 50RB performance at Vdd=VddBias=5.0V, Vc1=2.4V, Vc2=1.6V, Vc3=1.9V unless otherwise stated**

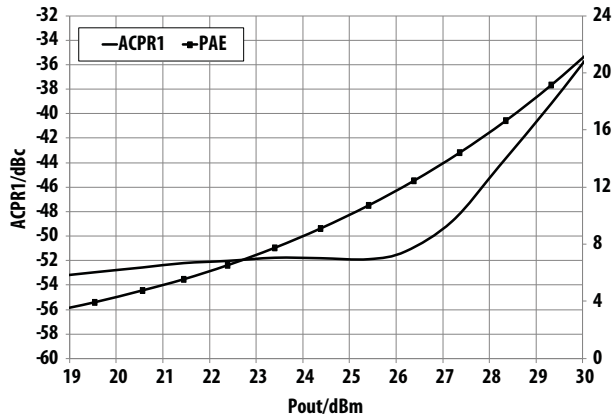


Figure 27. ACPR1, PAE vs Pout @ 1.93GHz

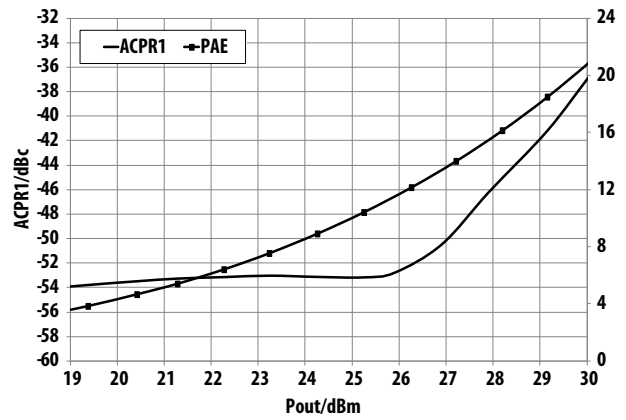


Figure 28. ACPR1, PAE vs Pout @ 1.96GHz

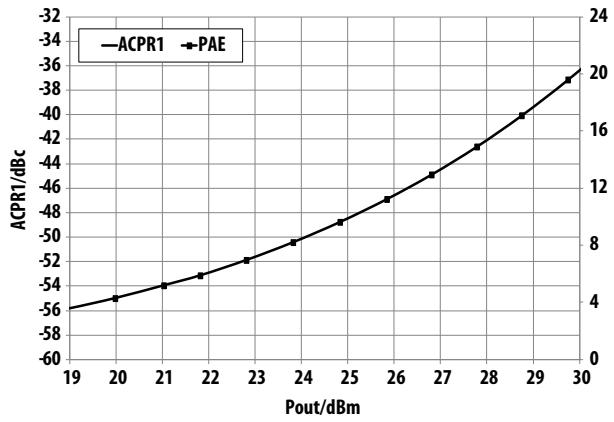


Figure 29. ACPR1, PAE vs Pout @ 1.995GHz

**S-Parameter<sup>[5]</sup> (Vdd=VddBias=5.0V, Vc1=2.4V, Vc2=1.6V, Vc3=2.2V, T<sub>A</sub>=25 °C, 50ohm)**

<b>Freq</b>	<b>S11</b>	<b>S11</b>	<b>S21</b>	<b>S21</b>	<b>S12</b>	<b>S12</b>	<b>S22</b>	<b>S22</b>
<b>(GHz)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>
0.1	-0.32	175.23	-62.12	-18.03	-61.87	23.78	-0.38	175.18
0.2	-0.38	164.70	-52.48	-79.03	-66.95	-1.91	-0.73	173.05
0.3	-0.40	155.28	-43.73	-74.75	-70.02	42.24	-0.97	171.92
0.4	-0.37	145.17	-25.81	-68.05	-66.93	80.19	-1.11	171.22
0.5	-0.76	136.74	-20.16	-55.95	-68.15	56.92	-1.15	171.16
0.6	-0.64	125.22	-12.54	-97.25	-67.11	105.81	-1.05	167.66
0.7	-0.67	109.43	4.80	-127.32	-64.82	80.97	-1.43	166.90
0.8	-3.55	82.81	18.60	143.03	-65.84	42.57	-1.53	167.01
0.9	-3.85	95.70	12.33	55.55	-69.45	95.87	-1.40	166.13
1.0	-3.27	70.38	13.65	139.70	-68.39	89.04	-2.05	163.24
1.1	-8.79	21.48	33.82	86.70	-63.57	105.91	-1.92	167.70
1.2	-11.82	84.30	37.98	-5.72	-61.95	87.04	-1.00	168.26
1.3	-8.94	60.71	38.51	-64.14	-64.29	61.98	-0.33	161.94
1.4	-9.41	32.73	38.93	-107.65	-63.77	84.35	-0.26	154.31
1.5	-10.60	-0.94	39.61	-145.81	-62.03	93.31	-0.71	146.15
1.6	-12.04	-40.08	40.43	178.25	-58.65	95.29	-1.52	138.11
1.7	-13.05	-81.89	41.29	141.53	-56.87	83.21	-3.02	129.41
1.8	-14.18	-117.61	42.02	103.33	-54.84	70.36	-5.62	122.69
1.9	-17.84	-134.67	42.28	62.29	-52.33	49.84	-10.31	120.19
2.0	-17.75	-100.78	41.97	19.48	-53.33	34.80	-18.27	55.45
2.1	-11.42	-101.25	40.55	-24.36	-54.37	7.76	-9.24	-135.06
2.2	-8.12	-123.79	37.89	-65.92	-54.51	-6.74	-4.36	-142.68
2.3	-7.38	-144.23	34.11	-99.75	-56.16	-27.50	-2.25	-154.14
2.4	-7.20	-156.62	30.56	-123.03	-58.38	-32.80	-1.32	-162.80
2.5	-7.22	-167.62	27.45	-144.94	-63.09	-62.40	-0.84	-169.37
2.6	-7.65	-176.43	24.27	-165.44	-65.13	-26.75	-0.59	-174.38
2.7	-8.17	57.93	21.08	176.86	-65.97	-53.14	-0.44	-178.37
2.8	-8.65	174.17	17.97	160.96	-67.09	0.32	-0.35	178.33
2.9	-9.04	171.62	14.90	146.20	-67.33	-50.66	-0.29	175.37
3.0	-9.39	169.77	11.79	132.11	-69.50	18.57	-0.25	172.81
3.1	-9.65	168.70	8.51	118.43	-71.47	49.12	-0.22	170.34
3.2	-9.85	168.03	4.87	105.10	-68.50	92.90	-0.19	167.97
3.3	-9.95	167.89	0.52	92.43	-72.55	127.85	-0.19	165.70
3.4	-9.96	167.99	-5.47	82.57	-68.48	106.89	-0.18	163.46
3.5	-9.82	168.39	-15.63	98.57	-64.48	87.56	-0.16	161.16
3.6	-9.53	168.56	-14.55	56.95	-65.13	62.26	-0.18	158.83
3.7	-9.10	168.17	-10.79	55.00	-64.28	90.35	-0.20	156.58
3.8	-8.58	167.41	-12.92	57.55	-65.68	75.41	-0.22	154.35
3.9	-7.85	166.38	-10.15	-147.34	-63.83	62.25	-0.24	152.34
4.0	-6.88	162.75	-5.28	-161.63	-62.87	57.01	-0.22	150.18

**S-Parameter<sup>[5]</sup> (Vdd=VddBias=5.0V, Vc1=2.4V, Vc2=1.6V, Vc3=2.2V, T<sub>A</sub>=25 °C, 50ohm) Continued.**

<b>Freq</b>	<b>S11</b>	<b>S11</b>	<b>S21</b>	<b>S21</b>	<b>S12</b>	<b>S12</b>	<b>S22</b>	<b>S22</b>
<b>(GHz)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>
4.1	-6.17	156.56	-5.11	-60.12	-62.23	60.24	-0.23	147.84
4.2	-5.67	151.09	-2.76	-162.33	-60.54	25.61	-0.33	145.49
4.3	-5.24	143.47	0.23	145.19	-65.83	28.57	-0.28	144.50
4.4	-4.77	137.32	-0.87	130.26	-64.65	69.93	-0.21	142.13
4.5	-4.80	127.75	-1.47	102.85	-63.28	49.76	-0.20	139.91
4.6	-5.16	121.60	-3.61	82.66	-62.73	46.52	-0.19	137.88
4.7	-5.44	117.07	-5.77	67.70	-64.31	34.41	-0.19	135.93
4.8	-5.66	113.10	-7.86	55.04	-64.04	62.51	-0.18	134.03
4.9	-5.86	109.67	-9.93	43.69	-62.93	37.49	-0.18	132.28
5.0	-5.95	107.76	-12.02	33.75	-63.71	28.36	-0.17	130.76
5.1	-5.94	106.98	-14.12	24.61	-63.79	41.23	-0.17	129.32
5.2	-6.09	104.73	-16.21	14.90	-65.15	33.13	-0.17	127.67
5.3	-6.23	102.84	-18.26	5.00	-62.10	57.07	-0.17	126.09
5.4	-6.36	101.15	-20.17	-5.69	-63.77	42.77	-0.17	124.54
5.5	-6.46	99.72	-21.69	-18.25	-64.95	38.89	-0.19	122.92
5.6	-6.57	98.51	-22.21	-34.49	-64.55	50.48	-0.22	121.19
5.7	-6.70	97.49	-20.55	-57.81	-64.27	37.53	-0.35	119.08
5.8	-6.80	96.65	-16.08	-101.69	-64.82	50.74	-0.89	118.03
5.9	-6.91	96.00	-15.67	67.84	-62.44	68.16	-0.84	122.29
6.0	-7.01	95.46	-19.42	150.39	-62.72	65.23	-0.34	121.26
7.0	-8.00	95.00	-24.18	86.85	-60.28	36.74	-0.16	108.75
8.0	-9.30	90.62	-25.18	42.64	-58.26	34.53	-0.20	94.77
9.0	-10.28	69.33	-27.57	-4.04	-55.74	5.41	-0.31	68.68
10.0	-8.83	49.01	-30.69	-41.90	-57.94	-18.02	-0.31	43.75
11.0	-7.53	45.60	-33.57	-70.43	-57.31	-23.67	-0.30	28.60
12.0	-7.93	46.29	-35.36	-97.18	-56.83	-30.16	-0.39	12.02
13.0	-9.80	34.95	-36.78	-130.00	-56.48	-32.58	-0.58	-14.26
14.0	-10.50	3.47	-38.47	-172.40	-53.41	-25.63	-0.52	-38.60
15.0	-9.38	-35.25	-40.91	133.94	-47.54	-32.80	-0.40	-54.35
16.0	-9.65	-103.06	-42.11	40.34	-43.56	-60.16	-0.48	-68.19
17.0	-7.84	137.29	-41.46	-79.68	-41.04	-101.45	-0.55	-76.71
18.0	-4.47	76.80	-43.83	-114.72	-43.14	-128.03	-0.35	-83.70
19.0	-3.86	44.16	-45.04	-155.19	-44.54	-150.40	-0.45	-94.59
20.0	-4.16	12.48	-46.01	-147.83	-43.53	-143.97	-0.82	-108.98

**S-Parameter<sup>[5]</sup> (Vdd=VddBias=5.5V, Vc1=2.4V, Vc2=1.6V, Vc3=2.2V, T<sub>A</sub>=25 °C, 50ohm)**

<b>Freq</b>	<b>S11</b>	<b>S11</b>	<b>S21</b>	<b>S21</b>	<b>S12</b>	<b>S12</b>	<b>S22</b>	<b>S22</b>
<b>(GHz)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>
0.1	-0.31	175.25	-59.11	-31.72	-59.94	18.89	-0.39	175.22
0.2	-0.37	164.70	-53.56	-87.44	-67.07	32.62	-0.73	173.16
0.3	-0.39	155.23	-43.79	-73.62	-65.27	60.10	-0.95	171.99
0.4	-0.37	145.14	-25.46	-69.21	-67.79	124.24	-1.09	171.23
0.5	-0.76	136.65	-19.93	-57.08	-68.48	-12.27	-1.13	171.10
0.6	-0.65	125.11	-12.26	-98.38	-72.70	9.58	-1.04	167.70
0.7	-0.69	109.25	5.06	-128.49	-66.37	88.14	-1.40	166.88
0.8	-3.60	82.79	18.84	141.92	-66.68	64.82	-1.50	166.89
0.9	-3.89	95.32	12.66	55.07	-64.16	79.87	-1.39	165.97
1.0	-3.35	69.94	14.04	137.44	-66.20	100.05	-2.01	163.17
1.1	-8.93	21.64	33.98	84.80	-64.58	100.68	-1.90	167.28
1.2	-11.90	82.99	38.17	-7.11	-64.00	80.58	-1.00	167.82
1.3	-9.11	59.19	38.70	-65.56	-62.81	72.07	-0.35	161.54
1.4	-9.65	30.65	39.10	-109.06	-65.11	92.32	-0.30	153.96
1.5	-10.92	-4.32	39.77	-147.18	-65.32	107.70	-0.75	145.75
1.6	-12.28	-44.26	40.56	176.94	-59.67	93.96	-1.60	137.84
1.7	-13.15	-86.63	41.41	140.30	-57.76	82.21	-3.13	129.27
1.8	-14.23	-121.70	42.12	102.22	-55.24	61.87	-5.75	123.34
1.9	-18.06	-138.45	42.38	61.35	-52.72	53.87	-10.49	121.46
2.0	-18.04	-99.87	42.08	18.68	-52.83	27.70	-17.96	56.99
2.1	-11.36	-101.18	40.69	-25.14	-53.62	8.58	-9.22	-135.57
2.2	-8.04	-124.33	38.03	-66.86	-55.72	-10.14	-4.34	-142.82
2.3	-7.31	-144.79	34.23	-100.75	-57.41	-28.84	-2.25	-154.23
2.4	-7.12	-157.17	30.68	-124.03	-58.92	-29.15	-1.31	-162.87
2.5	-7.17	-168.10	27.54	-145.93	-63.78	-40.26	-0.84	-169.43
2.6	-7.61	-176.64	24.35	-166.36	-64.13	-45.96	-0.59	-174.45
2.7	-8.10	57.79	21.15	176.01	-64.71	-37.21	-0.45	-178.43
2.8	-8.57	174.17	18.04	160.22	-65.84	-33.50	-0.35	178.30
2.9	-8.94	171.56	14.97	145.52	-69.88	-97.04	-0.30	175.35
3.0	-9.27	169.77	11.86	131.50	-68.57	-14.49	-0.25	172.78
3.1	-9.50	168.60	8.57	117.89	-70.78	-92.21	-0.22	170.31
3.2	-9.69	167.81	4.93	104.62	-71.32	55.07	-0.19	167.93
3.3	-9.79	167.54	0.58	92.00	-74.88	88.94	-0.19	165.68
3.4	-9.79	167.46	-5.42	82.24	-66.48	58.89	-0.18	163.45
3.5	-9.65	167.67	-15.56	98.87	-71.76	93.16	-0.17	161.13
3.6	-9.37	167.67	-14.36	56.54	-66.00	89.46	-0.18	158.82
3.7	-8.97	167.03	-10.67	54.34	-63.83	67.57	-0.20	156.56
3.8	-8.48	166.20	-12.79	57.30	-64.68	68.16	-0.23	154.34
3.9	-7.78	165.22	-9.94	-148.35	-65.17	70.12	-0.24	152.31
4.0	-6.84	161.65	-5.21	-162.88	-64.34	69.66	-0.23	150.17

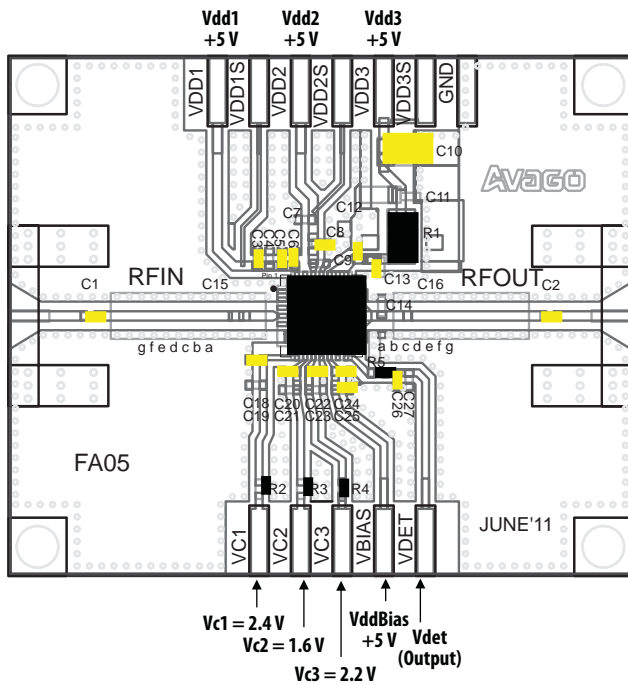
**S-Parameter<sup>[5]</sup> (Vdd=VddBias=5.5V, Vc1=2.4V, Vc2=1.6V, Vc3=2.2V, T<sub>A</sub>=25 °C, 50ohm) Continued.**

<b>Freq</b>	<b>S11</b>	<b>S11</b>	<b>S21</b>	<b>S21</b>	<b>S12</b>	<b>S12</b>	<b>S22</b>	<b>S22</b>
<b>(GHz)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>	<b>(dB)</b>	<b>(ang)</b>
4.1	-6.16	155.60	-5.11	-60.94	-62.35	62.87	-0.23	147.81
4.2	-5.67	150.30	-2.63	-163.27	-61.37	18.23	-0.33	145.45
4.3	-5.25	142.91	0.19	144.63	-69.72	29.64	-0.28	144.46
4.4	-4.77	136.86	-0.83	129.87	-62.20	50.42	-0.21	142.08
4.5	-4.79	127.39	-1.45	102.40	-62.78	37.18	-0.20	139.88
4.6	-5.15	121.37	-3.59	82.30	-62.05	37.76	-0.20	137.85
4.7	-5.42	116.88	-5.75	67.39	-64.22	35.08	-0.19	135.90
4.8	-5.63	112.97	-7.83	54.81	-64.42	40.65	-0.18	133.99
4.9	-5.83	109.63	-9.90	43.53	-64.04	31.57	-0.18	132.25
5.0	-5.90	107.72	-11.99	33.60	-62.60	45.74	-0.17	130.71
5.1	-5.89	106.96	-14.09	24.52	-65.73	55.61	-0.17	129.27
5.2	-6.03	104.72	-16.17	14.78	-64.48	50.98	-0.17	127.64
5.3	-6.16	102.82	-18.21	4.91	-64.36	48.07	-0.17	126.06
5.4	-6.29	101.15	-20.12	-5.76	-65.09	46.72	-0.17	124.49
5.5	-6.39	99.72	-21.62	-18.41	-64.64	53.90	-0.19	122.87
5.6	-6.50	98.51	-22.14	-34.80	-63.47	44.02	-0.22	121.15
5.7	-6.61	97.43	-20.46	-58.12	-63.65	41.19	-0.35	119.04
5.8	-6.71	96.60	-16.04	-102.57	-63.02	60.60	-0.90	118.10
5.9	-6.82	95.91	-15.72	67.43	-63.18	61.73	-0.83	122.26
6.0	-6.92	95.37	-19.42	150.46	-62.87	52.91	-0.34	121.21
7.0	-7.90	94.46	-24.14	87.10	-61.33	47.84	-0.16	108.71
8.0	-9.25	89.54	-25.12	43.09	-58.74	31.66	-0.21	94.70
9.0	-10.26	67.70	-27.49	-3.53	-55.72	7.83	-0.32	68.56
10.0	-8.85	47.50	-30.58	-41.62	-57.84	-17.31	-0.32	43.61
11.0	-7.63	44.42	-33.45	-70.31	-57.89	-18.95	-0.31	28.45
12.0	-8.14	45.54	-35.33	-97.91	-57.37	-30.63	-0.41	11.84
13.0	-10.12	34.80	-36.75	-130.64	-56.43	-29.40	-0.60	-14.47
14.0	-10.87	3.26	-38.30	-173.09	-53.64	-28.22	-0.53	-38.81
15.0	-9.69	-35.76	-40.80	135.47	-47.66	-35.55	-0.41	-54.56
16.0	-9.89	-104.65	-42.00	40.06	-43.56	-60.53	-0.49	-68.38
17.0	-7.74	135.77	-41.55	-79.65	-40.88	-101.72	-0.56	-76.90
18.0	-4.39	76.12	-44.09	-111.55	-42.76	-128.56	-0.36	-83.92
19.0	-3.82	43.51	-45.42	-154.29	-44.91	-148.31	-0.46	-94.77
20.0	-4.15	11.74	-45.64	-147.49	-43.61	-145.55	-0.83	-109.16

Notes:

5. S-parameter is measured with deembedded reference plane at DUT RFin and RFout pins.

### Demonstration Board Top View (Vdd=VddBias=5.0V, Vdd=VddBias=5.5V operating voltage)



Component	Value	Part Number
C1, C2	8.2 pF +/- 0.5 pF	GJM1555C1H8R2WB01D
C3, C8, C13, C25	0.1 μF +/- 10%	GRM155R71C104KA88D
C5, C9	82 pF +/- 5%	GRM1555C1H820JA01D
C6, C18, C20, C22	8.2 pF +/- 0.5 pF	GJM1555C1H8R2WB01D
C24	4.3 pF +/- 0.25 pF	GJM1555C1H3R6CB01D
C10	2.2 μF +/- 10%	GRM21BR71E225KA73L
C26	22 nF +/- 10%	CM05X7R223K16AHF
R1	0 Ω	RMC1/10 JPTP
R2, R3, R4, R5	0 Ω	RMC1/16S JPTH

Note:

For performance optimization control voltage for individual stages can be adjusted by varying R2, R3 and R4 resistor value.

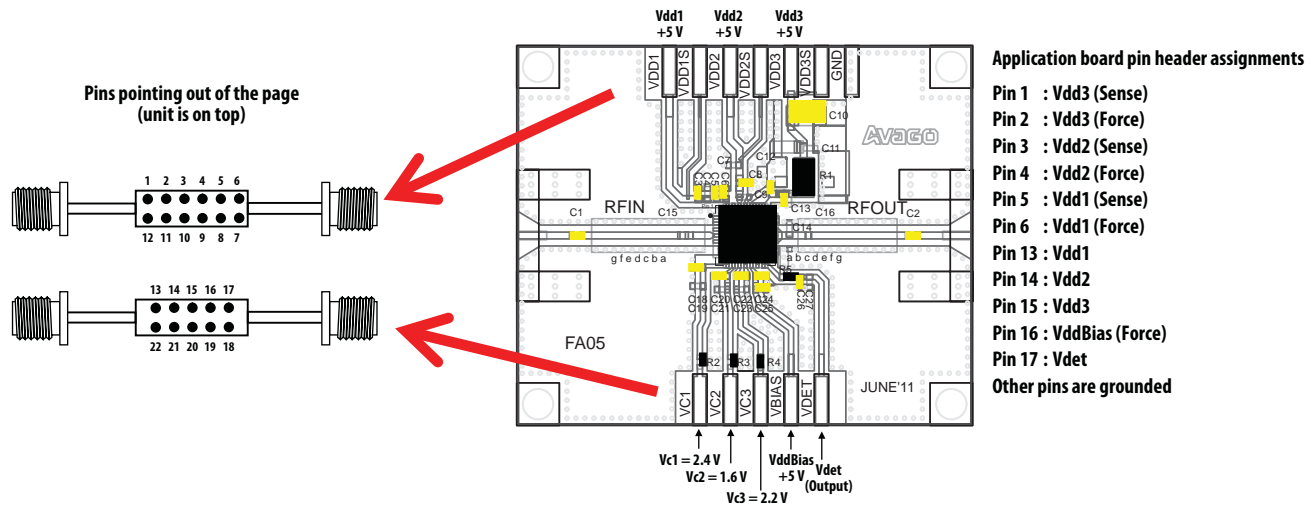


Figure 30. Demonstration board application circuit for MGA-43628 module

## Application Schematic

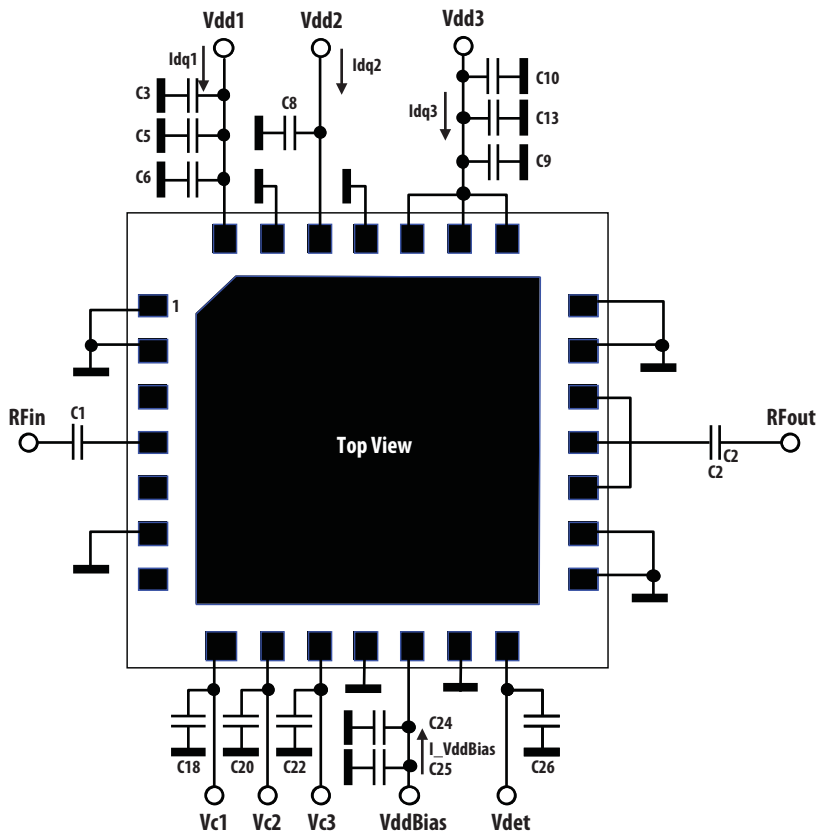


Figure 31. Application schematic in demonstration board

### Notes

1. All capacitors on supply lines are bypass capacitors
2. C1 / C2 are RF coupling capacitors.
3.  $I_{dq1} = 60.0\text{mA}$ ,  $I_{dq2} = 110\text{mA}$ ,  $I_{dq3} = 270.0\text{mA}$ ,  $I_{VddBias} = 14.0\text{mA}$ .  $I_{dq1/2/3}$  are adjusted by voltages to CMOS-compatible control pins Vc1/2/3 respectively. These typical bias currents were obtained with Vc1/2/3 voltages in Figure 30 above. Adjustment of these currents enable optimum bias conditions to be achieved for best linearity and efficiency for a given modulation type.

**MGA-43528 typical  $I_{c1}$ ,  $I_{c2}$ ,  $I_{c3}$  Vs  $V_c$  performance unless otherwise stated**

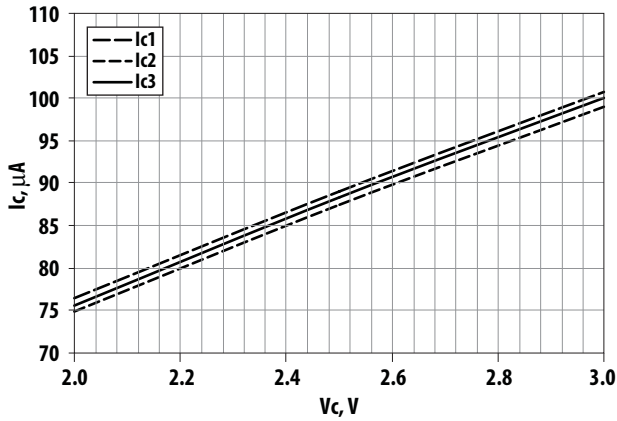


Figure 32.  $I_c$  Versus  $V_c$  at  $V_{dd}=V_{ddBias}=5.0V$

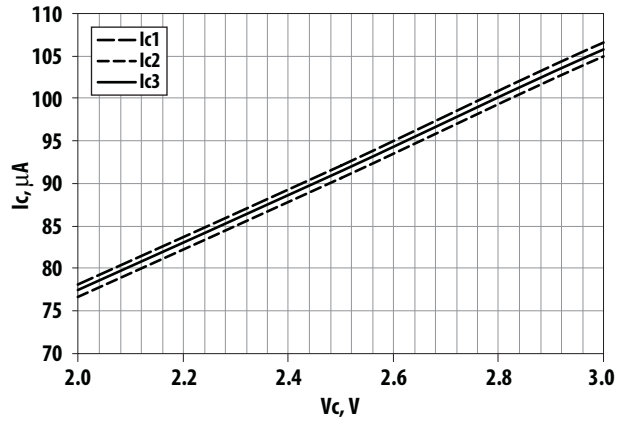
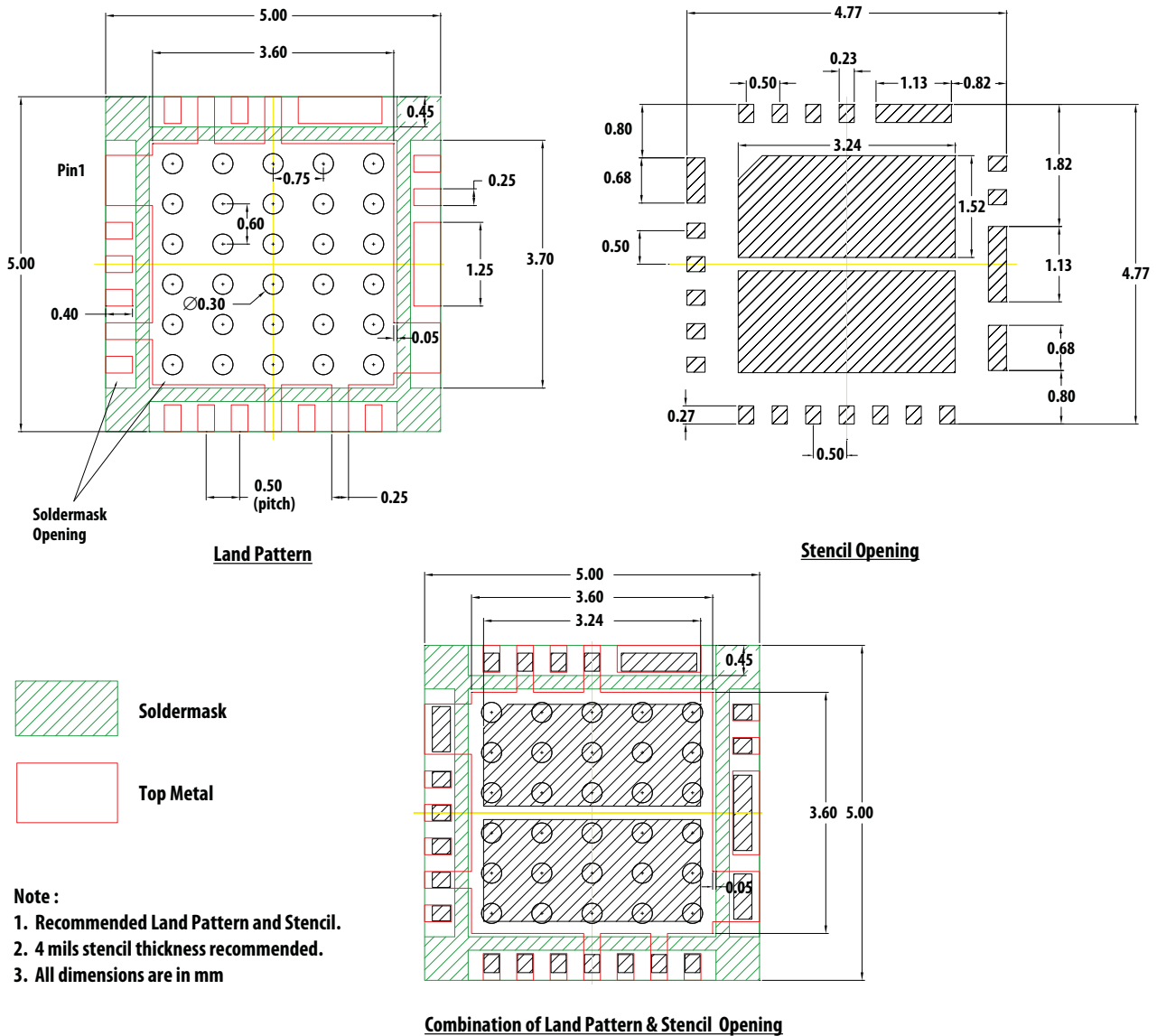


Figure 33.  $I_c$  Versus  $V_c$  at  $V_{dd}=V_{ddBias}=5.5V$

**PCB Land Pattern and Stencil Outline**

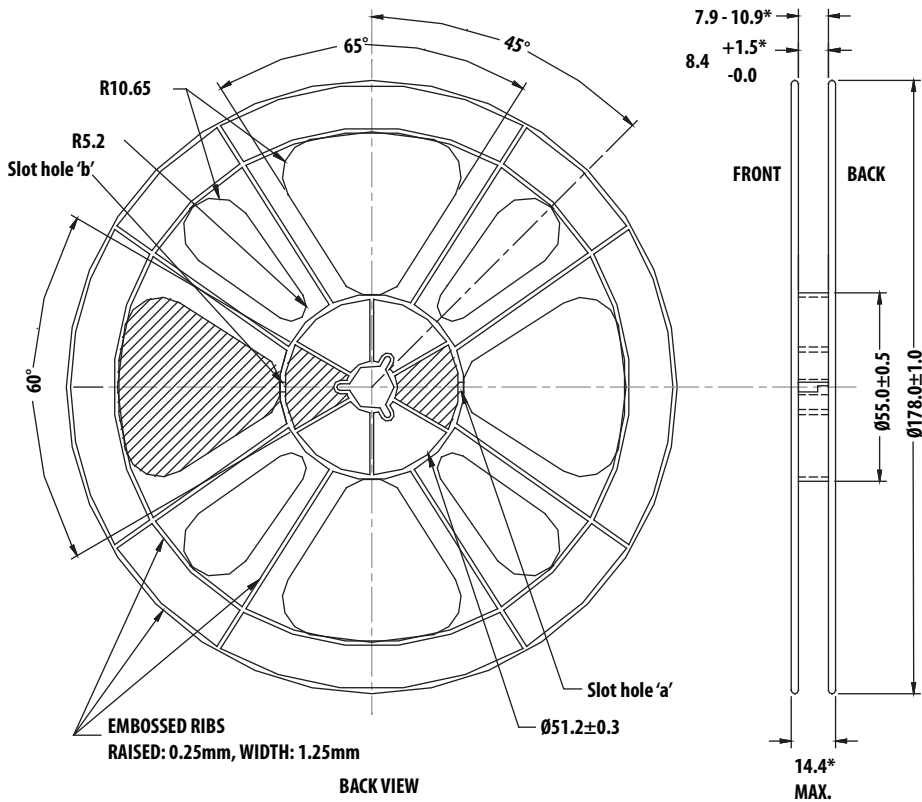
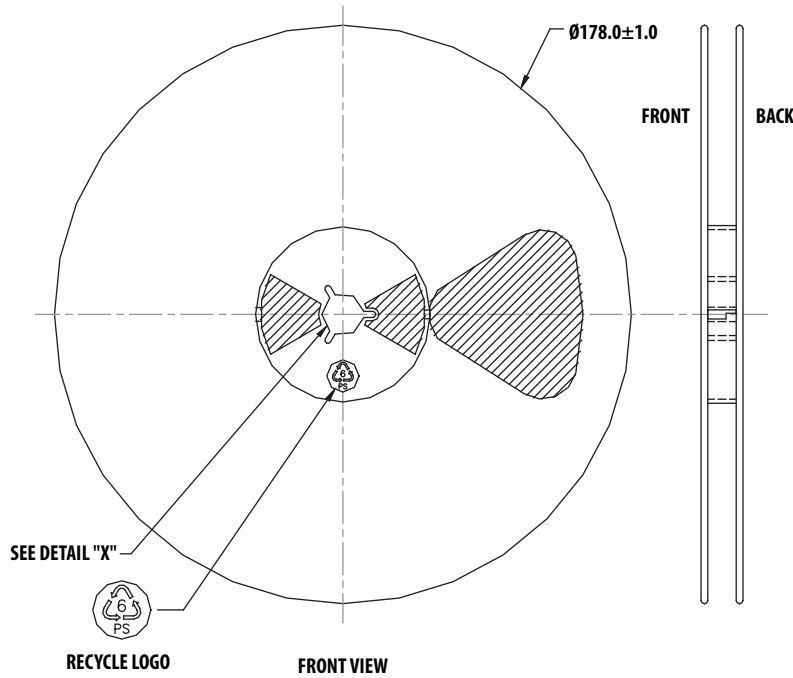








# Reel Dimensions (7" reel)



For product information and a complete list of distributors, please go to our web site: [www.avagotech.com](http://www.avagotech.com)

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