MGA-43013

High Linearity 728 - 756 MHz Power Amplifier Module

Data Sheet

Description

Avago Technologies' MGA-43013 is a fully matched power amplifier for use in the (728 – 756) MHz band. High linear output power at 5 V is achieved through the use of Avago Technologies' proprietary 0.25 µm GaAs Enhancement-mode pHEMT process. MGA-43013 is housed in a miniature 5.0 mm × 5.0 mm 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-43013 an ideal choice as a power amplifier for small cell BTS PA applications.

Applications

- Final stage high linearity amplifier for Picocell and Enterprise Femtocell PA targeted for small cell BTS downlink applications.

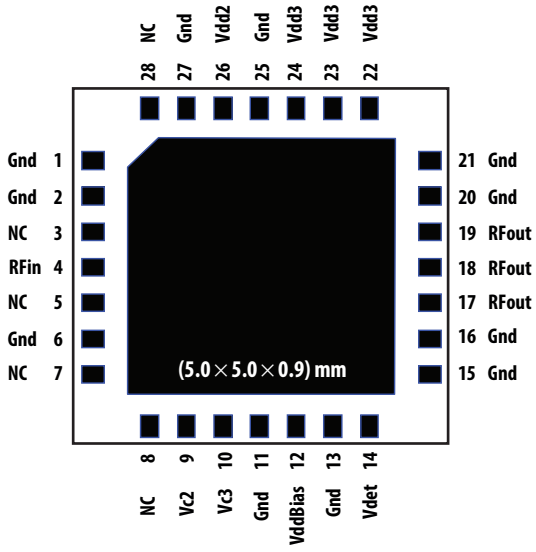
Component Image

TOP VIEW

5.0 × 5.0 × 0.9 mm Package Outline

Notes:
Package marking provides orientation and identification
"43013" = Device part number
"YYWW" = Year and work week
"XXXX" = Assembly lot number

Pin Configuration



Features

- High linearity performance: Max. -48 dBc ACLR1 [1] at 27 dBm linear output power (biased with 5 V supply)
- High Gain: 33.5 dB
- Good efficiency
- Fully matched
- Built-in detector
- GaAs E-pHEMT Technology [2]
- Low-cost small package size: (5.0 × 5.0 × 0.9) mm
- MSL3
- Lead-free/Halogen-free/RoHS compliance

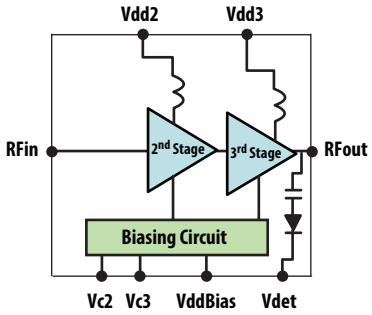
Specifications

751 MHz; 5.0 V, Idqtotal = 259 mA (typ), LTE DL 10MHz 50 RB ETM 1.1 downlink signal

- PAE : 16.5%
- 27 dBm linear P_{out} @ ACLR1 = -48 dBc [1]
- 33.5 dB Gain
- Detector range : 20 dB

Notes:
1. LTE DL 10 MHz 50 RB ETM 1.1
2. Enhancement mode technology employs positive V_{GS}, 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 = 400 V
Refer to Avago Application Note A004R:
Electrostatic Discharge, Damage and Control.

Absolute Maximum Rating [1] $T_A = 25$ °C

Symbol	Parameter	Units	Absolute Max.
V_{dd}, V_{ddBias}	Supply voltages, bias supply voltage	V	6
V_c	Control Voltage	V	(Vdd)
$P_{in,max}$	CW RF Input Power	dBm	20
P_{diss}	Total Power Dissipation [3]	W	4.9
T_j	Junction Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to 150

Thermal Resistance [2,3]

$\theta_{jc} = 15.7$ °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.
3. Board temperature (T_B) is 25 °C , for T_B > 73 °C derate the device power at 63 mW per °C rise in Board (package belly) temperature.

Electrical Specifications

$T_A = 25$ °C, Vdd = VddBias = 5.0 V, Vc2 = 3 V, Vc3 = 2.6 V, Idqtotal = 259 mA, RF performance at 751 MHz, LTE DL 10 MHz 50 RB ETM 1.1 downlink signal operation, unless otherwise stated

Symbol	Parameter and Test Condition	Frequency (MHz)	Units	Min.	Typ.	Max.
V_{dd}	Supply Voltage		V	-	5.0	-
$I_{dqtotal}$	Quiescent Supply Current		mA	-	259	-
Gain	Gain		dB	31	33.5	-
OP1dB	Output Power at 1 dB Gain Compression		dBm	-	36	-
ACLR1 @ P_{out} = 27 dBm	LTE DL 10MHz 50RB ETM1.1 downlink signal	733	dBc	-	-47	-
		739			-47	
		751			-48	
PAE	Power Added Efficiency		%	14	16.5	-
|S11|	Input Return Loss, 50 Ω source		dB	-	14	-
DetR	Detector RF dynamic range		dB	-	20	-
2fo	2fo Harmonics (LTE DL 10MHz 50RB ETM1.1 downlink signal)		dBc	-	-35	-

Product Consistency Distribution Charts [4]

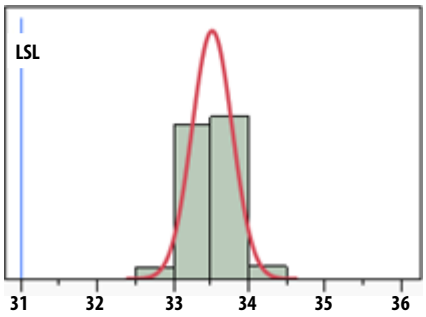


Figure 1. Gain at P_{out} = 27 dBm, LSL= 31 dB, nominal = 33.5 dB

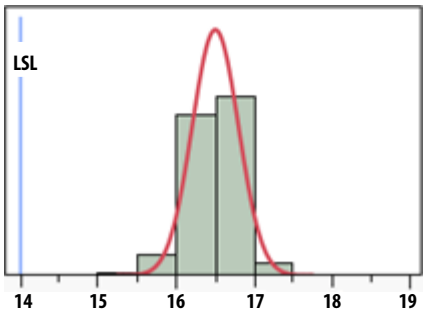


Figure 2. PAE at P_{out} =27 dBm, LSL = 14%, nominal = 16.5%

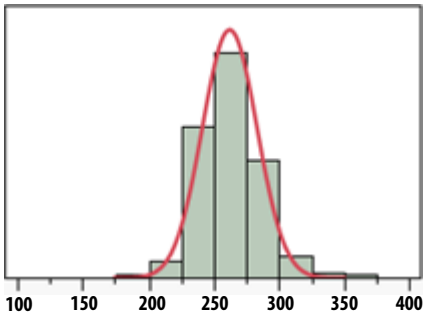


Figure 3. Idqtotal, Nominal = 259 mA

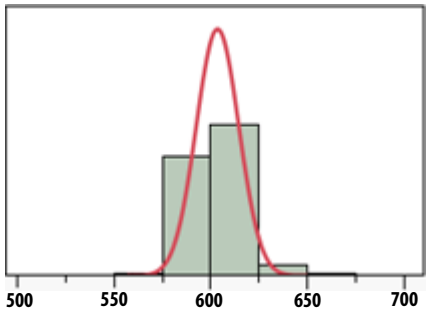


Figure 4. Idd_Total at P_{out} = 27 dBm, nominal = 602 mA

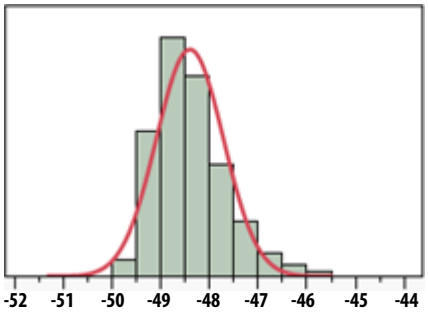


Figure 5. ACLR1 at P_{out} = 27 dBm, nominal = –48.5 dBc

Note:

4. Distribution data sample size is 3365 samples taken from three wafer lots. T_A = 25 °C, Vdd = VddBias = 5.0 V, Vc2 = 3 V, Vc3 = 2.6 V, RF performance at 751 MHz, unless otherwise stated. Future wafers allocated to this product may have nominal values anywhere between the upper and lower limits.

MGA-43013 typical over-temperature performance at Vc2 = 3 V, Vc3 = 2.6 V (Vdd = VddBias = 5 V) as shown in Figure 27 and Vc2 = 2.9 V, Vc3 = 2.3 V (Vdd = VddBias = 5.5 V), unless otherwise stated

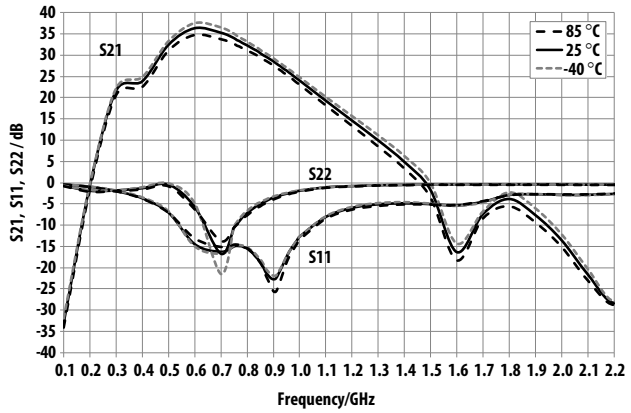


Figure 6. Small-signal performance Over-temperature
Vdd = VddBias = 5.0 V operating voltage

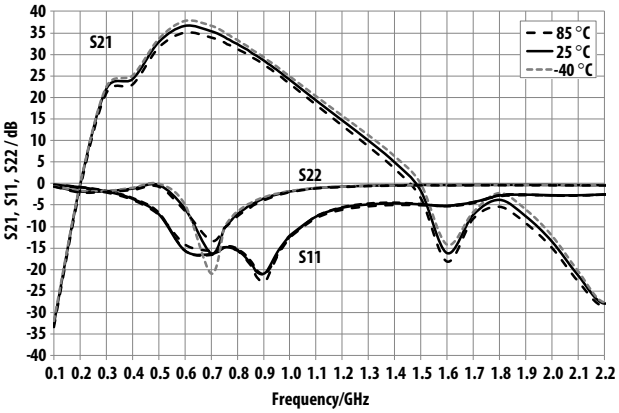


Figure 7. Small-signal performance Over-temperature
Vdd = VddBias = 5.5 V operating voltage

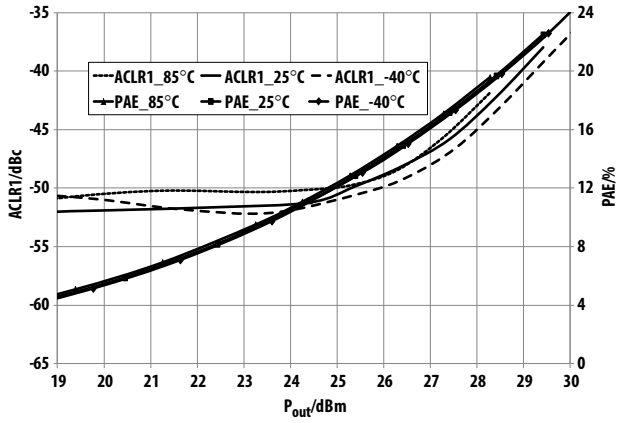


Figure 8. Over-temperature ACLR1, PAE vs. P_{out} @ 733 MHz
Vdd = VddBias = 5.0 V operating voltage

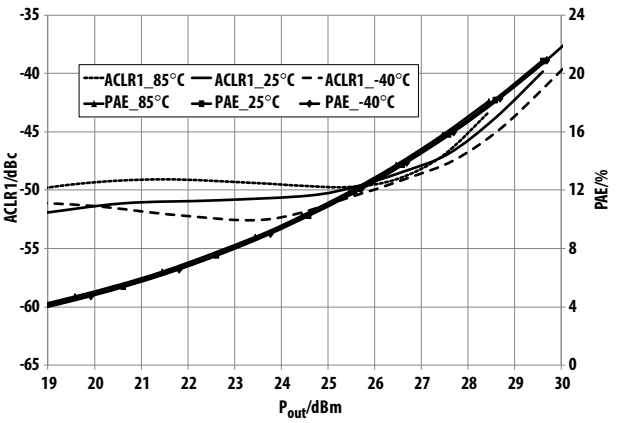


Figure 9. Over-temperature ACLR1, PAE vs. P_{out} @ 733 MHz
Vdd = VddBias = 5.5 V operating voltage

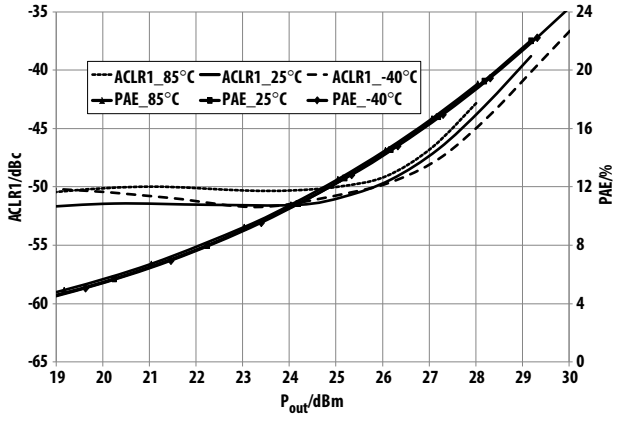


Figure 10. Over-temperature ACLR1, PAE vs. P_{out} @ 739 MHz
Vdd = VddBias = 5.0 V operating voltage

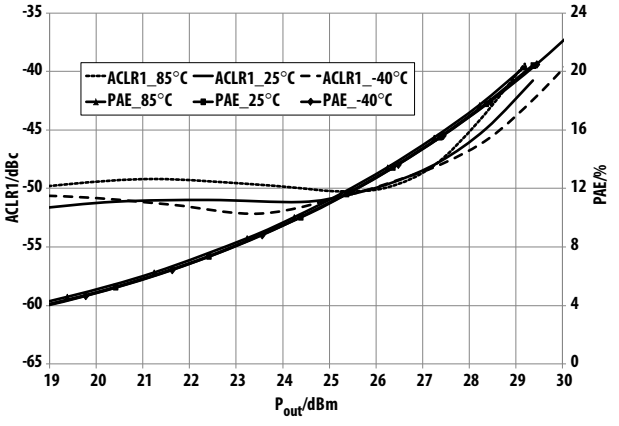


Figure 11. Over-temperature ACLR1, PAE vs. P_{out} @ 739 MHz
Vdd = VddBias = 5.5 V operating voltage

MGA-43013 typical over-temperature performance at Vc2 = 3 V, Vc3 = 2.6 V (Vdd = VddBias = 5 V) as shown in Figure 27 and Vc2 = 2.9 V, Vc3 = 2.3 V (Vdd = VddBias = 5.5 V), unless otherwise stated

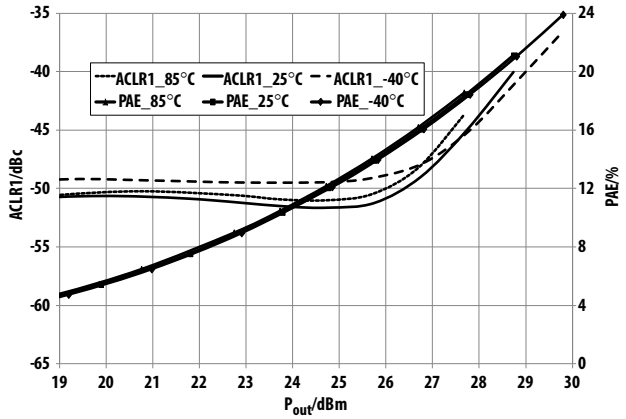


Figure 12. Over-temperature ACLR1, PAE vs. P_{out} @ 751 MHz
Vdd = VddBias = 5.0 V operating voltage

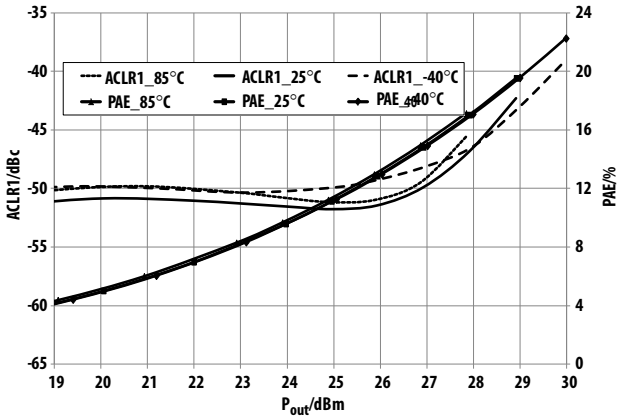


Figure 13. Over-temperature ACLR1, PAE vs. P_{out} @ 751 MHz
Vdd = VddBias = 5.5 V operating voltage

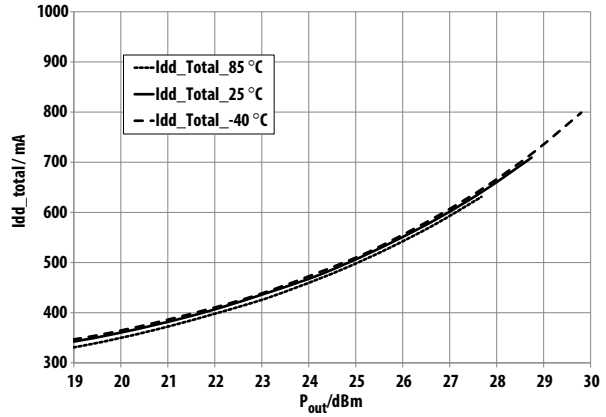


Figure 14. Over-temperature Idd_Total vs. P_{out} @ 751 MHz
Vdd = VddBias = 5.0 V operating voltage

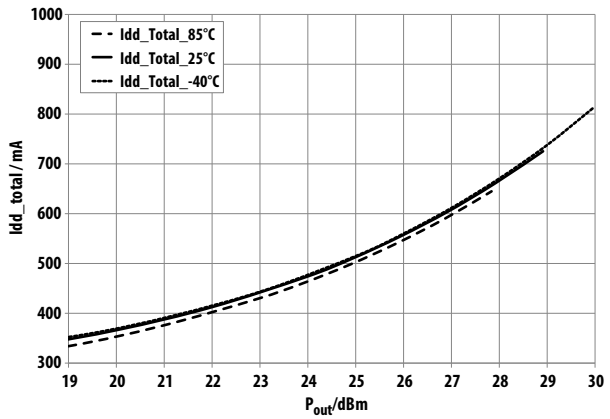


Figure 15. Over-temperature Idd_Total vs. P_{out} @ 751 MHz
Vdd=VddBias=5.5 V operating voltage

MGA-43013 typical over-temperature performance at Vc2 = 3 V, Vc3 = 2.6 V (Vdd = VddBias = 5 V) as shown in Figure 27 and Vc2 = 2.9 V, Vc3 = 2.3 V (Vdd = VddBias = 5.5 V), unless otherwise stated

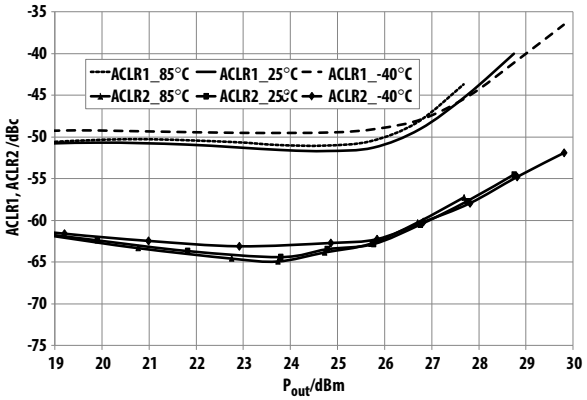


Figure 16. Over-temperature ACLR1, ACLR2 P_{out} @ 751 MHz
Vdd = VddBias = 5.0 V operating voltage

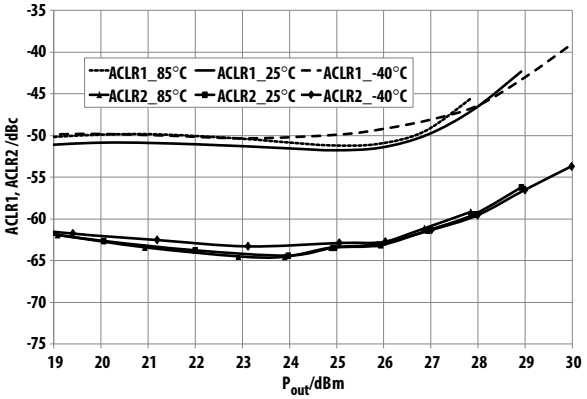


Figure 17. Over-temperature ACLR1, ACLR2 vs. P_{out} @ 751 MHz
Vdd = VddBias = 5.5 V operating voltage

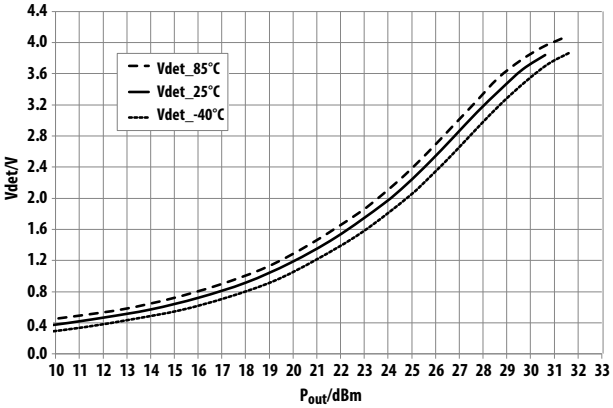


Figure 18. Over-temperature Vdet vs. P_{out} @ 751 MHz
Vdd=VddBias=5.0 V operating voltage

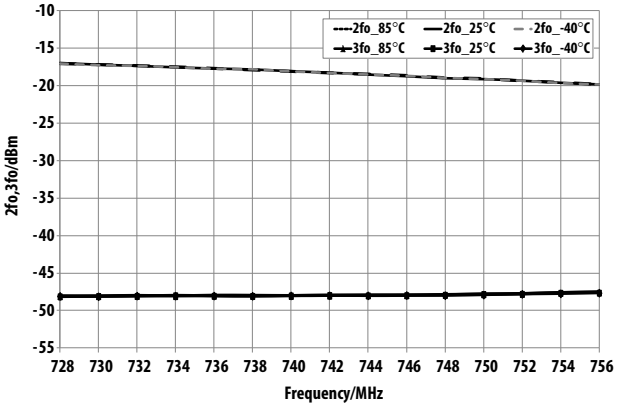


Figure 19. Over-temperature 2nd, 3rd Harmonics vs. Freq at P_{out} = 27 dBm,
Vdd = VddBias = 5.0 V operating voltage

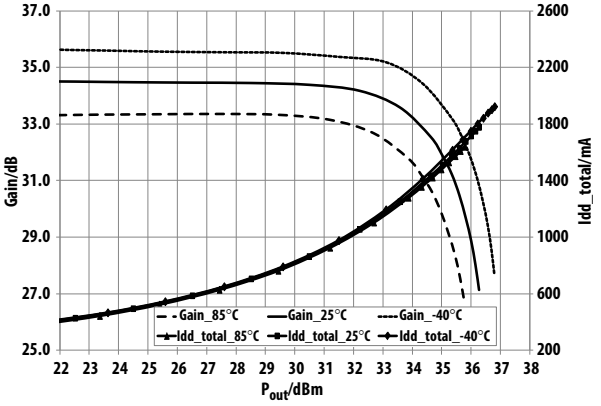


Figure 20. Over-temperature Gain, Idd_Total vs. P_{out} @ 733 MHz
Vdd = VddBias = 5.0 V operating voltage

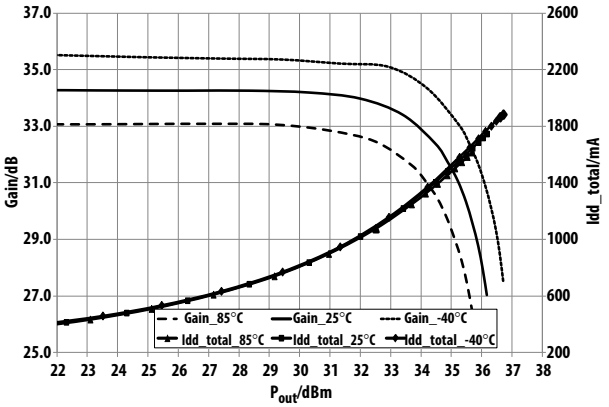


Figure 21. Over-temperature Gain, Idd_Total vs. P_{out} @ 739 MHz
Vdd = VddBias = 5.0 V voltage

MGA-43013 typical over-temperature performance at Vc2 = 3 V, Vc3 = 2.6 V (Vdd = VddBias = 5 V) as shown in Figure 27 and Vc2 = 2.9 V, Vc3 = 2.3 V (Vdd = VddBias = 5.5 V), unless otherwise stated

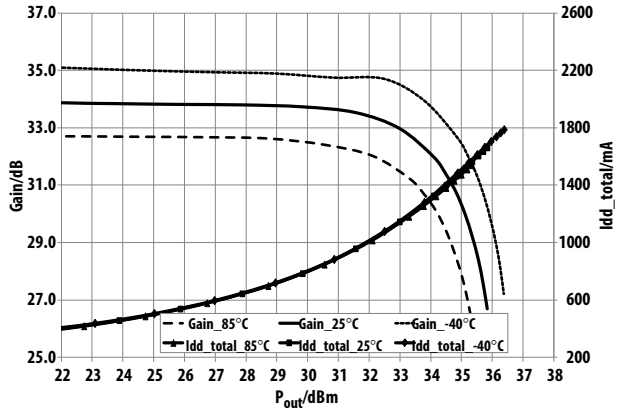


Figure 22. Over-temperature Gain, Idd_Total vs. P_{out} @ 751 MHz
Vdd = VddBias = 5.0 V operating voltage

MGA-43013 typical LTE DL 10 MHz 50 RB ETM 1.1 Spectrum Emission Mask performance at Vdd = VddBias = 5.0 V, Vc2 = 3 V, Vc3 = 2.6 V, unless otherwise stated

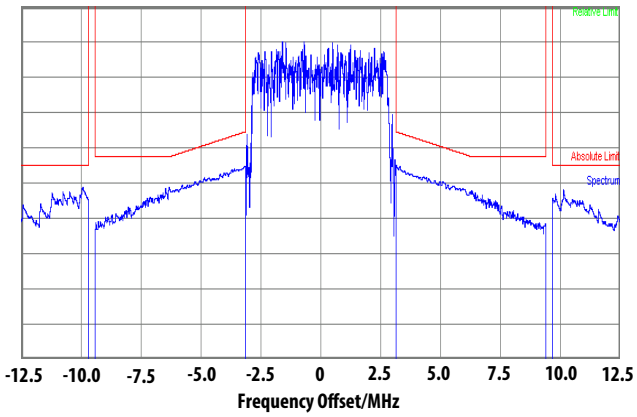


Figure 23. SEM at P_{out} = 31 dBm @ 733 MHz

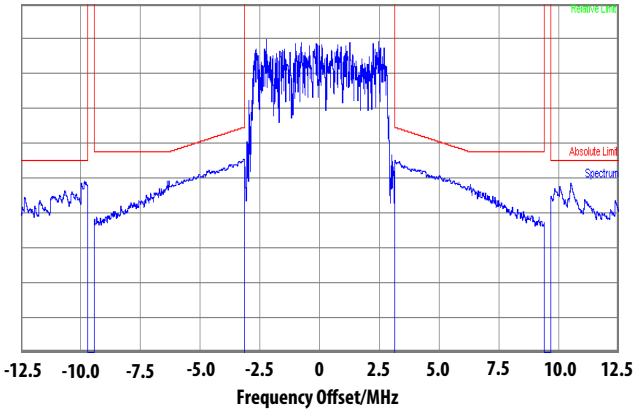


Figure 24. SEM at P_{out} = 31 dBm @ 739 MHz

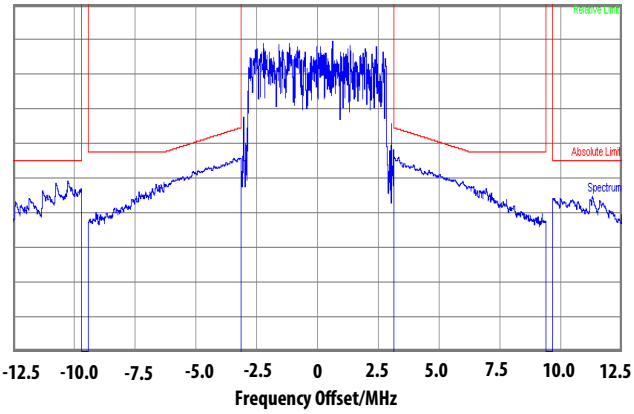


Figure 25. SEM at P_{out} = 31 dBm @ 751 MHz

S-Parameter [5] (Vdd = VddBias = 5.0 V, Vc2 = 3 V, Vc3 = 2.6 V, T_A=25 °C, 50 Ω)

Freq (GHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
0.1	-0.355	160.899	-31.44	1.288	-52.928	104.298	-0.834	172.431
0.2	-0.673	139.88	-1.028	-45.497	-62.974	24.319	-1.731	168.289
0.3	-1.354	113.974	20.626	-148.403	-62.389	-134.989	-1.486	-179.014
0.4	-3.001	76.971	23.98	105.855	-66.44	-135.611	-0.802	162.018
0.5	-7.047	7.635	32.028	82.124	-66.234	-42.776	-0.338	154.451
0.6	-18.752	-94.341	36.398	-24.156	-52.697	-175.508	-4.935	123.769
0.65	-24.535	-116.513	36.278	-68.029	-51.737	136.001	-10.466	124.306
0.66	-25.141	-112.66	36.154	-76.263	-52.16	128.96	-11.904	127.93
0.67	-24.484	-107.406	36.009	-84.231	-50.564	130.612	-13.425	134.675
0.68	-23.588	-103.761	35.834	-92.057	-52.025	123.248	-14.788	144.632
0.69	-22.564	-102.535	35.636	-99.707	-52.512	116.999	-15.749	158.087
0.70	-21.511	-103.368	35.418	-107.194	-51.653	111.879	-16.043	173.517
0.71	-20.503	-105.12	35.178	-114.562	-51.878	102.079	-15.544	-171.962
0.72	-19.536	-109.06	34.927	-121.697	-50.854	103.77	-14.456	-161.408
0.73	-18.853	-112.625	34.656	-128.669	-49.767	98.627	-13.243	-153.92
0.74	-18.249	-116.591	34.396	-135.546	-49.435	87.965	-12.088	-148.64
0.75	-17.725	-121.092	34.122	-142.277	-49.933	76.574	-11.024	-145.127
0.76	-17.369	-125.833	33.771	-148.75	-50.981	71.436	-10.032	-143.096
0.77	-17.141	-130.362	33.456	-155.196	-50.448	71.661	-9.153	-142.035
0.78	-17.029	-134.692	33.127	-161.468	-51.416	68.725	-8.401	-141.457
0.79	-17.011	-139.192	32.791	-167.652	-52.043	66.924	-7.712	-141.196
0.80	-17.099	-143.665	32.447	-173.75	-51.895	62.79	-7.086	-141.214
0.81	-17.326	-147.579	32.091	-179.715	-51.706	49.045	-6.546	-141.539
0.82	-17.713	-150.868	31.733	174.51	-51.655	42.253	-6.03	-142.06
0.83	-18.269	-154.108	31.363	168.817	-50.662	36.956	-5.583	-142.601
0.84	-18.962	-156.806	30.98	163.178	-50.518	31.651	-5.17	-143.213
0.85	-19.803	-158.849	30.59	157.626	-51.34	28.663	-4.789	-143.896
0.86	-20.839	-160.31	30.199	152.219	-52.375	31.276	-4.448	-144.619
0.87	-22.16	-160.016	29.797	146.888	-51.749	14.743	-4.124	-145.52
0.88	-23.719	-156.712	29.395	141.645	-51.383	14.104	-3.834	-146.425
0.89	-25.5	-148.756	28.985	136.507	-51.346	12.416	-3.564	-147.309
0.90	-27.188	-134.535	28.564	131.469	-51.543	7.359	-3.314	-148.173
0.95	-20.608	-67.168	26.381	107.544	-53.081	-5.71	-2.31	-152.629
1.0	-14.278	-68.437	24.115	86.219	-56.217	-38.52	-1.646	-156.822
1.1	-8.797	-87.737	19.53	49.754	-58.556	-66.677	-0.885	-163.901
1.2	-6.323	-108.921	14.868	17.918	-61.599	-78.028	-0.526	-169.849
1.3	-5.214	-125.38	10.143	-10.899	-62.654	-105.222	-0.353	-174.627
1.4	-4.829	-137.802	4.961	-38.688	-62.275	-143.392	-0.248	-178.523
1.5	-4.982	-145.809	-2.066	-66.498	-64.696	-178.348	-0.182	178.012
1.6	-5.131	-147.151	-17.062	-49.283	-60.97	144.122	-0.158	174.823
1.7	-4.166	-144.989	-6.543	26.964	-62.539	158.517	-0.177	172.046
1.8	-2.519	-153.421	-3.589	-32.511	-71.298	114.408	-0.164	169.395

S-Parameter [5] (Vdd = VddBias = 5.0 V, Vc2 = 3 V, Vc3 = 2.6 V, T_A=25 °C, 50 Ω) cont.

Freq (GHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
1.9	-2.34	-163.567	-7.159	-76.259	-60.219	118.865	-0.152	166.664
2.0	-2.457	-169.222	-12.686	-105.145	-58.989	128.397	-0.149	163.852
2.1	-2.409	-173.062	-19.789	-121.336	-62.194	92.489	-0.139	160.95
2.2	-2.219	-176.184	-28.508	-100.025	-62.194	106.657	-0.155	157.821
2.3	-1.915	-179.949	-25.832	-54.447	-62.829	81.052	-0.179	154.426
2.4	-1.548	174.507	-18.971	-79.725	-68.022	113.86	-0.203	150.515
2.5	-1.95	169.971	-20.041	-174.686	-58.067	85.64	-0.248	145.976
2.6	-1.774	167.746	-18.284	124.246	-57.929	81	-0.349	140.025
2.7	-1.631	163.259	-5.855	47.646	-51.442	36.301	-0.965	132.17
2.8	-1.755	161.177	-3.183	-76.71	-59.276	-56.859	-1.188	127.113
2.9	-1.653	158.351	-6.914	153.255	-61.02	100.046	-1.736	128.7
3.0	-1.538	155.46	-22.08	98.288	-57.85	42.785	-1.035	111.504
3.5	-1.322	141.65	-17.872	22.299	-57.609	-35.372	-2.144	-94.789
4.0	-1.267	131.161	-42.932	-133.036	-71.604	-153.261	-0.358	-160.398
4.5	-1.35	122.067	-56.173	36.758	-67.228	102.214	-0.17	-175.537
5.0	-1.602	110.325	-66.918	-96.396	-72.144	101.01	-0.104	176.735
5.5	-2.191	88.118	-62.286	-128.67	-67.875	130.204	-0.108	170.559
6.0	-2.562	67.873	-60.672	-138.942	-64.112	100.455	-0.146	164.429
7.0	-1.387	39.826	-48.48	9.994	-67.568	-4.299	-0.35	151.674
8.0	-1.653	31.312	-44.523	-89.309	-68.756	138.891	-0.35	138.008
9.0	-3.287	5.787	-42.755	144.041	-61.954	110.497	-0.094	127.867
10.0	-3.471	-55.343	-47.43	87.431	-57.374	90.638	-0.47	120.072
11.0	-2.827	-104.854	-46.516	50.459	-54.803	31.06	-1.449	113.045
12.0	-3.59	-152.852	-42.637	2.35	-60.129	-115.67	-0.727	94.311
13.0	-5.839	154.742	-39.08	-88.445	-58.841	-104.157	-0.834	62.45
14.0	-18.964	-176.045	-40.759	109.569	-50.763	50.502	-1.294	25.88
15.0	-4.422	160.804	-60.914	-121.949	-43.659	-32.968	-2.417	-10.161
16.0	-1.443	127.588	-38.159	105.708	-47.648	-113.077	-4.933	-73.351
17.0	-2.063	105.554	-30.527	-101.519	-38.785	-145.514	-14.138	-100.468
18.0	-3.483	62.786	-35.413	134.42	-42.874	115.741	-7.145	-59.924
19.0	-3.865	38.428	-42.134	88.917	-45.644	134.054	-4.922	-101.388
20.0	-3.113	34.181	-44.385	4.926	-51.035	59.868	-6.044	-90.49

Note:
5. S-parameter is measured with de-embedded reference plane at DUT RFin and RFout pins.

S-Parameter [5] (Vdd = VddBias = 5.5 V, Vc2 = 2.9 V, Vc3 = 2.3 V, T_A=25 °C, 50 Ω)

Freq (GHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
0.1	-0.355	160.921	-31.244	0.426	-59.056	-141.277	-0.841	172.412
0.2	-0.68	139.916	-0.655	-45.097	-58.093	148.034	-1.746	168.181
0.3	-1.351	114.015	21.087	-148.054	-70.545	-32.978	-1.518	-178.51
0.4	-3.003	76.981	24.469	105.423	-62.968	-112.645	-0.777	162.138
0.5	-7.245	7.005	32.56	80.99	-69.41	-52.357	-0.289	154.286
0.6	-21.054	-94.875	36.757	-26.503	-51.217	179.867	-5.114	123.985
0.65	-28.556	-98.713	36.527	-70.178	-51.902	143.057	-10.634	126.441
0.66	-28.01	-88.514	36.39	-78.345	-51.293	142.165	-12.064	130.736
0.67	-26.419	-83.965	36.23	-86.24	-50.245	136.933	-13.421	138.202
0.68	-24.886	-82.922	36.046	-93.991	-50.194	126.365	-14.539	148.561
0.69	-23.337	-84.612	35.838	-101.575	-50.503	119.2	-15.258	161.253
0.70	-21.913	-87.857	35.611	-108.999	-50.871	112.858	-15.417	174.908
0.71	-20.78	-91.222	35.366	-116.289	-51.169	98.483	-14.949	-172.47
0.72	-19.805	-96.941	35.109	-123.328	-52.082	101.319	-13.97	-162.471
0.73	-18.992	-101.997	34.834	-130.232	-52.781	94.207	-12.896	-155.413
0.74	-18.392	-106.94	34.572	-137.044	-52.508	85.471	-11.85	-150.354
0.75	-17.949	-112.031	34.299	-143.713	-51.58	78.257	-10.872	-146.864
0.76	-17.566	-117.325	33.956	-150.136	-50.864	72.125	-9.967	-144.738
0.77	-17.389	-122.195	33.638	-156.521	-50.292	56.814	-9.138	-143.645
0.78	-17.3	-127.038	33.311	-162.773	-49.755	64.066	-8.39	-142.916
0.79	-17.311	-131.366	32.976	-168.927	-50.263	61.392	-7.732	-142.419
0.80	-17.43	-135.217	32.633	-174.985	-51.141	48.115	-7.146	-142.198
0.81	-17.662	-138.954	32.282	179.073	-50.477	42.836	-6.602	-142.373
0.82	-18.085	-142.366	31.925	173.308	-50.695	47.616	-6.101	-142.777
0.83	-18.638	-145.038	31.559	167.647	-51.213	43.359	-5.653	-143.154
0.84	-19.319	-146.952	31.181	162.037	-51.608	34.804	-5.229	-143.615
0.85	-20.138	-147.912	30.794	156.49	-51.653	27.502	-4.839	-144.209
0.86	-21.111	-147.607	30.4	151.057	-51.302	27.146	-4.506	-144.944
0.87	-22.247	-144.79	29.997	145.746	-50.545	26.442	-4.183	-145.832
0.88	-23.481	-139.057	29.593	140.493	-51.618	20.333	-3.883	-146.63
0.89	-24.562	-128.921	29.184	135.348	-52.379	13.798	-3.61	-147.446
0.90	-25.146	-114.927	28.766	130.306	-52.514	10.563	-3.362	-148.283
0.95	-18.891	-70.252	26.577	106.356	-54.066	-11.845	-2.336	-152.597
1.0	-13.485	-71.46	24.299	84.995	-56.899	-33.034	-1.66	-156.701
1.1	-8.444	-89.696	19.689	48.574	-57.154	-48.972	-0.881	-163.818
1.2	-6.114	-110.276	14.995	16.786	-60.905	-91.638	-0.527	-169.834
1.3	-5.056	-126.461	10.244	-11.87	-61.957	-124.268	-0.344	-174.639
1.4	-4.712	-138.645	5.034	-39.455	-60.057	-154.796	-0.244	-178.529
1.5	-4.876	-146.55	-2.007	-66.99	-63.765	-168.166	-0.182	178.015
1.6	-5.062	-148.006	-16.977	-49.038	-70.82	123.355	-0.157	174.849
1.7	-4.133	-145.884	-6.416	26.304	-63.323	168.823	-0.172	172.056
1.8	-2.513	-154.074	-3.529	-32.863	-66.593	161.509	-0.164	169.404

S-Parameter [5] (Vdd = VddBias = 5.5 V, Vc2 = 2.9 V, Vc3 = 2.3 V, T_A=25 °C, 50 Ω) Cont.

Freq (GHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
1.9	-2.337	-163.993	-7.116	-76.35	-68.941	139.207	-0.149	166.691
2.0	-2.446	-169.628	-12.596	-104.855	-67.804	134.671	-0.147	163.904
2.1	-2.416	-173.397	-19.68	-120.692	-58.891	94.506	-0.139	161.034
2.2	-2.226	-176.47	-28.348	-98.788	-61.505	136.493	-0.15	157.861
2.3	-1.916	179.886	-25.506	-55.071	-66.732	36.482	-0.173	154.49
2.4	-1.53	174.257	-18.849	-80.281	-63.539	89.206	-0.196	150.578
2.5	-1.948	169.775	-19.915	-174.355	-62.576	95.689	-0.24	146.016
2.6	-1.777	167.552	-18.034	124.397	-54.279	86.492	-0.334	140.069
2.7	-1.628	163.088	-5.649	47.622	-50.57	37.232	-0.955	132.224
2.8	-1.759	161	-2.987	-76.428	-60.106	-73.908	-1.182	127.134
2.9	-1.658	158.182	-6.751	153.594	-61.192	114.97	-1.717	128.691
3.0	-1.542	155.347	-21.902	99.011	-58.067	61.654	-1.023	111.465
3.5	-1.329	141.535	-17.66	22.178	-59.619	-35.077	-2.14	-94.818
4.0	-1.275	131.158	-43.136	-134.279	-69.215	29.025	-0.338	-160.499
4.5	-1.354	122.091	-56.788	27.458	-69.182	75.91	-0.157	-175.661
5.0	-1.593	110.321	-69.859	-144.892	-71.595	70.617	-0.092	176.779
5.5	-2.169	88.01	-63.441	-86.408	-72.66	-176.71	-0.092	170.755
6.0	-2.575	67.391	-58.769	-140.71	-65.318	99.708	-0.132	164.589
7.0	-1.411	40.073	-48.839	12.85	-65.308	28.39	-0.311	151.27
8.0	-1.67	31.565	-45.155	-88.975	-72.126	100.025	-0.296	137.594
9.0	-3.36	5.825	-42.395	142.976	-61.051	121.156	-0.085	128.17
10.0	-3.552	-54.909	-46.741	87.537	-56.599	105.707	-0.561	119.235
11.0	-2.863	-104.198	-47.844	51.858	-56.511	34.143	-1.747	111.705
12.0	-3.654	-151.874	-42.841	1.013	-59.274	-112.558	-0.784	94.571
13.0	-5.806	155.954	-39.422	-89.244	-58.696	-127.726	-0.91	63.243
14.0	-19.616	178.527	-40.831	110.89	-49.754	50.315	-1.45	27.58
15.0	-4.624	160.575	-55.905	-101.656	-44.806	-33.658	-2.454	-9.947
16.0	-1.475	128.243	-37.705	113.423	-47.565	-116.474	-4.948	-71.917
17.0	-2.062	106.317	-30.305	-97.016	-38.839	-141.969	-14.295	-101.219
18.0	-3.464	64.155	-35.01	136.292	-43.16	117.213	-7.172	-59.553
19.0	-3.855	39.571	-42.274	88.072	-45.6	134.029	-4.911	-100.228
20.0	-3.099	35.09	-44.02	6.838	-49.794	64.537	-6.113	-90.074

Note:
5. S-parameter is measured with de-embedded reference plane at DUT RFin and RFout pins.

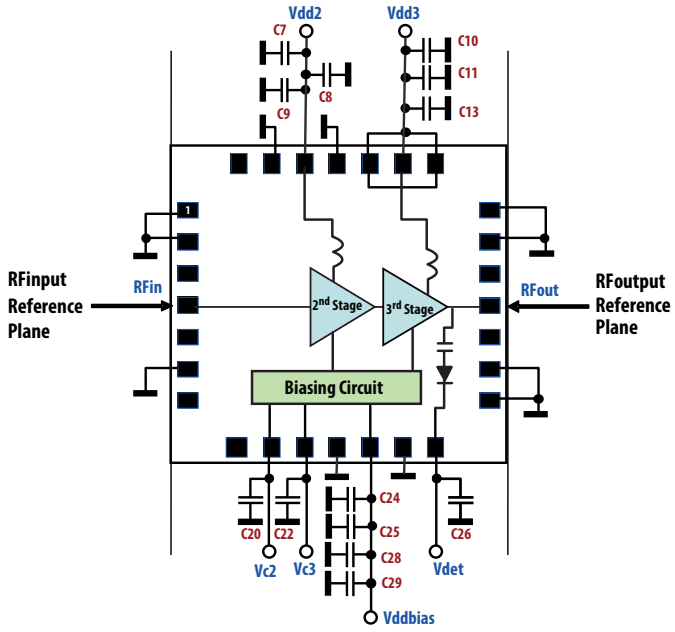
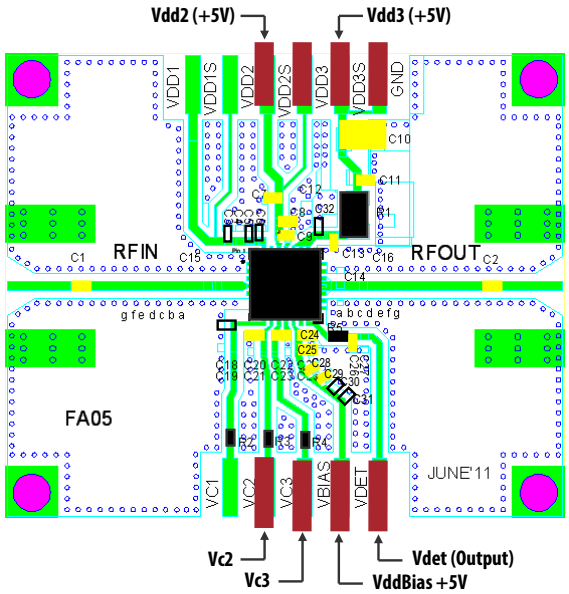


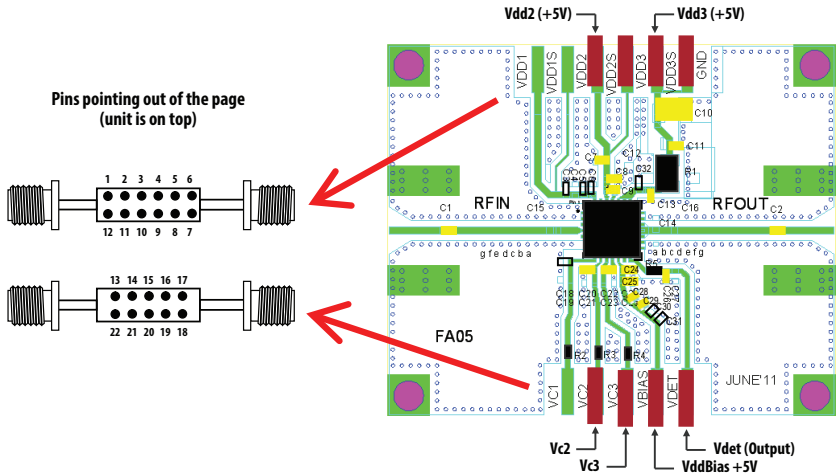
Figure 26. RFinput and RFoutput Reference Plane

Demonstration Board Top View (Vdd = VddBias = 5.0 V, Vc2 = 3 V, Vc3 = 2.6 V)



Component	Value	Part Number
C1, C2, C20, C22	56 pF ± 5%	GRM1555C1H056JA01D
C11, C29	0.1 µF ± 10%	GRM155R71C104KA88D
C24	82 pF ± 5%	GRM1555C1H820JA01D
C8, C25	2200 pF ± 10%	GRM155R71H222KA01D
C7, C13, C28	0.047 µF ± 10%	GRM155R71E473KA88D
C9	12 pF ± 5%	GJM1555C1H120JB01D
C26	22 nF ± 10%	CM05X7R223K16AHF
C10	2.2 µF ±10%	GRM21BR71E225KA73L
R1	0 Ω	RMC1/10 JPTP
R3, R4, R5	0 Ω	RMC1/16S JPTH

Note:
For performance optimization control voltage for individual stages can be adjusted by varying R3 and R4 resistor values.



Application board pin header assignments

Pin 1 : Vdd3 (Sense)
Pin 2 : Vdd3 (Force)
Pin 3 : Vdd2 (Sense)
Pin 4 : Vdd2 (Force)
Pin 5 : Vdd1 (Sense) – not used
Pin 6 : Vdd1 (Force) – not used
Pin 13 : Vc1 – not used
Pin 14 : Vc2
Pin 15 : Vc3
Pin 16 : VddBias
Pin 17 : Vdet

Other pins are grounded

Figure 27. Demonstration board application circuit for MGA-43013 module

Application Schematic

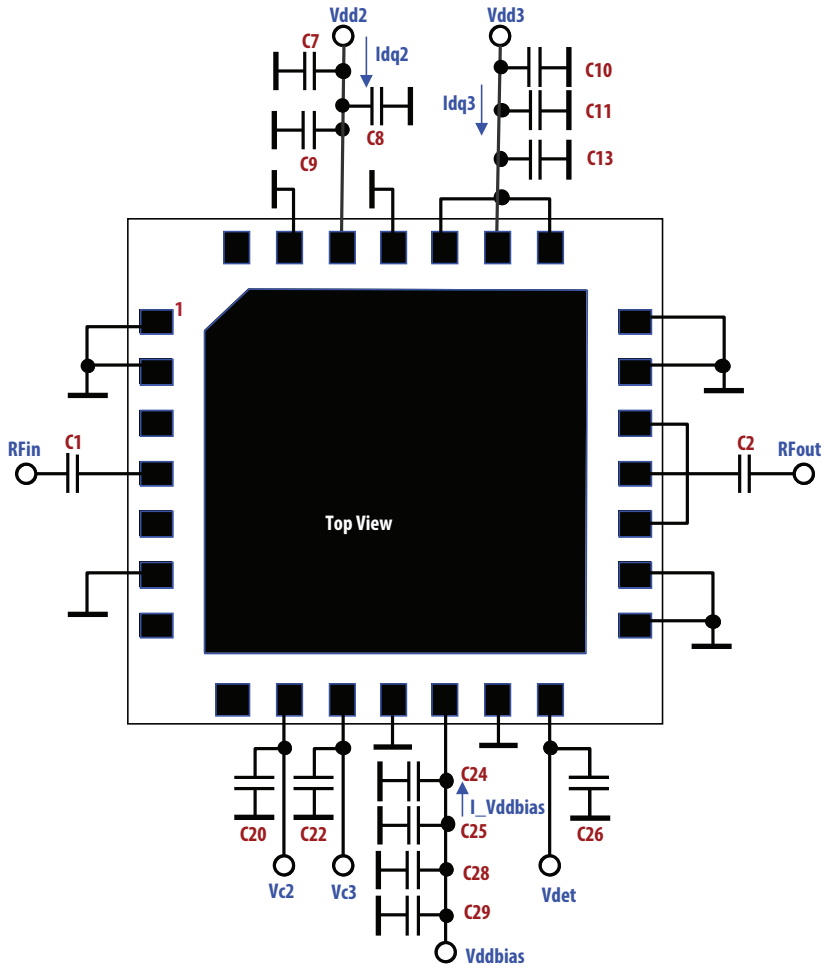


Figure 28. Application schematic in demonstration board

Notes:
1. All capacitors on supply lines are bypass capacitors.
2. C1 and C2 are RF coupling capacitors.
3. For Vdd = VddBias = 5 V, Idq2 = 68 mA, Idq3 = 191 mA, I_VddBias = 14 mA. Idq2 and Idq3 are adjusted by voltages to CMOS-compatible control pins Vc2 and Vc3, respectively. These typical bias currents were obtained with Vc2 and Vc3 voltages in Figure 26. Adjustment of these currents enable optimum bias conditions to be achieved for best linearity and efficiency for a given modulation type.

MGA-43013 typical Ic2, Ic3 vs. Vc performance, unless otherwise stated

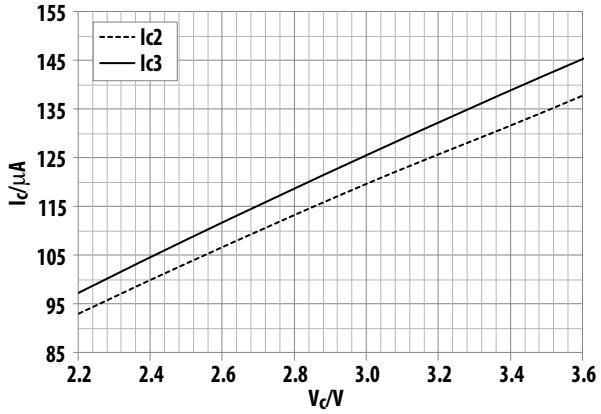


Figure 29. I_c vs. V_c at $V_{dd} = V_{ddBias} = 5.0$ V

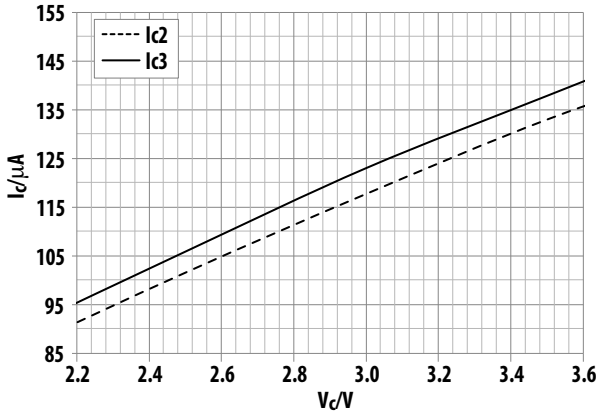
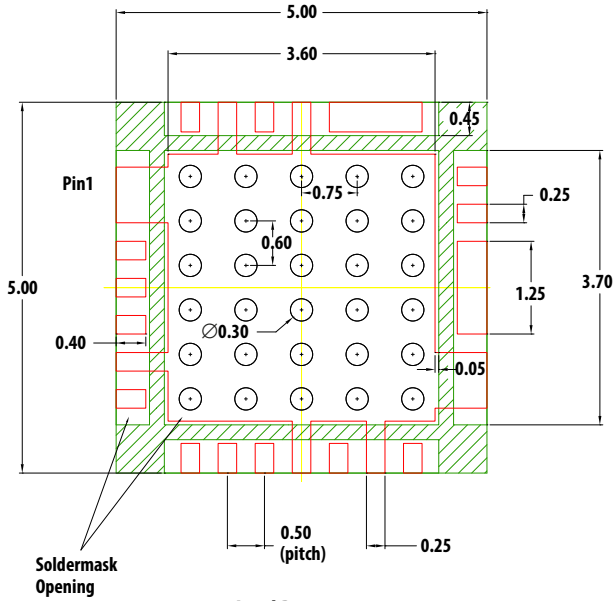
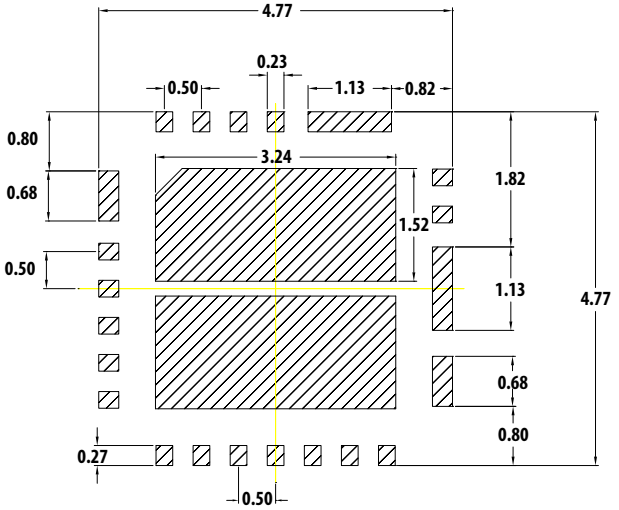


Figure 30. I_c vs. V_c at $V_{dd} = V_{ddBias} = 5.5$ V

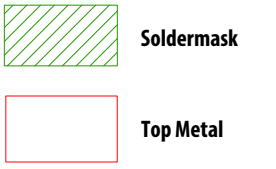
PCB Land Pattern and Stencil Outline

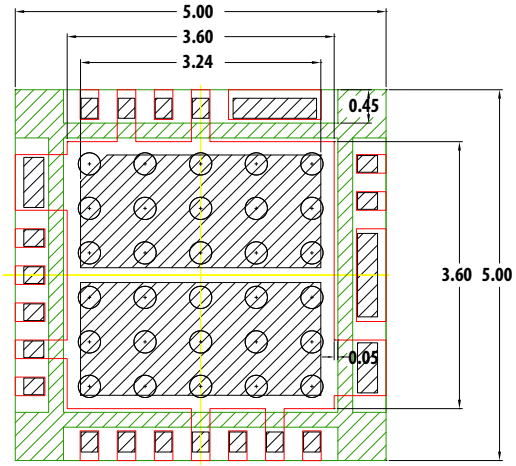


Land Pattern



Stencil Opening

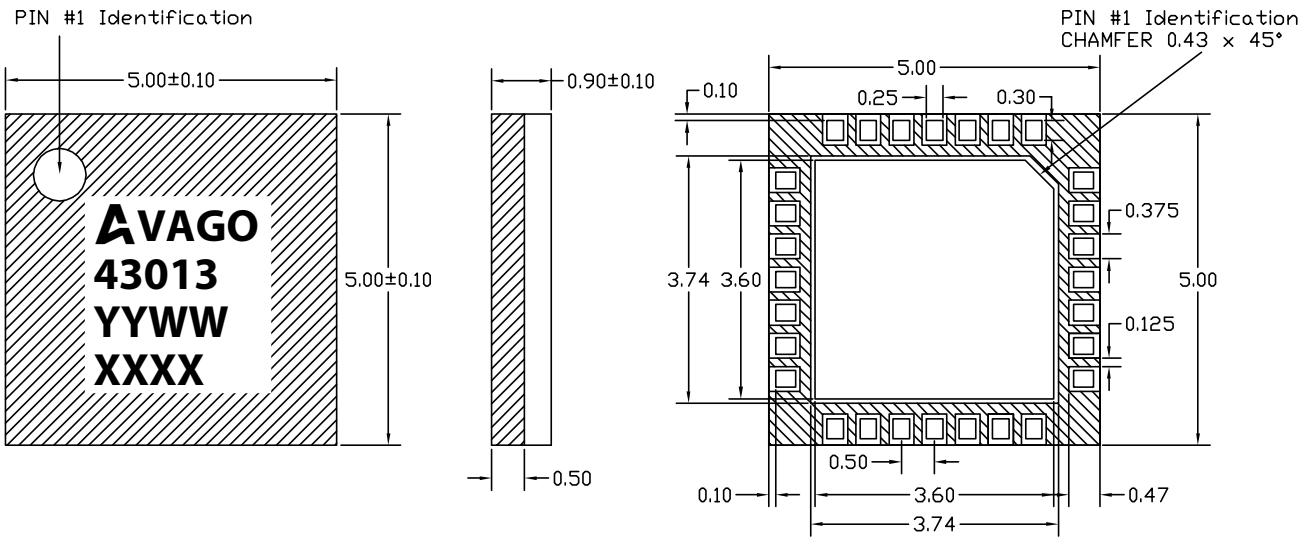




Combination of Land Pattern & Stencil Opening

Notes:
1. Recommended Land Pattern and Stencil
2. 4 mils stencil thickness recommended
3. All dimensions are in mm

MCOB (5.0 × 5.0 × 0.9) mm 28-Lead Package Dimensions



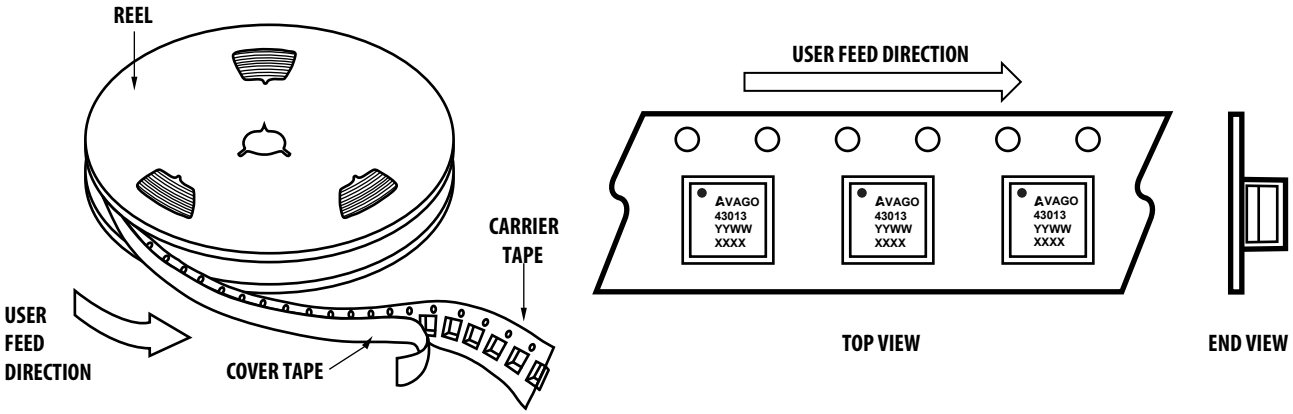
Top View **Side View** **Bottom View**

Notes:
1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating.
3. Dimensions are exclusive of mold flash and metal burr.

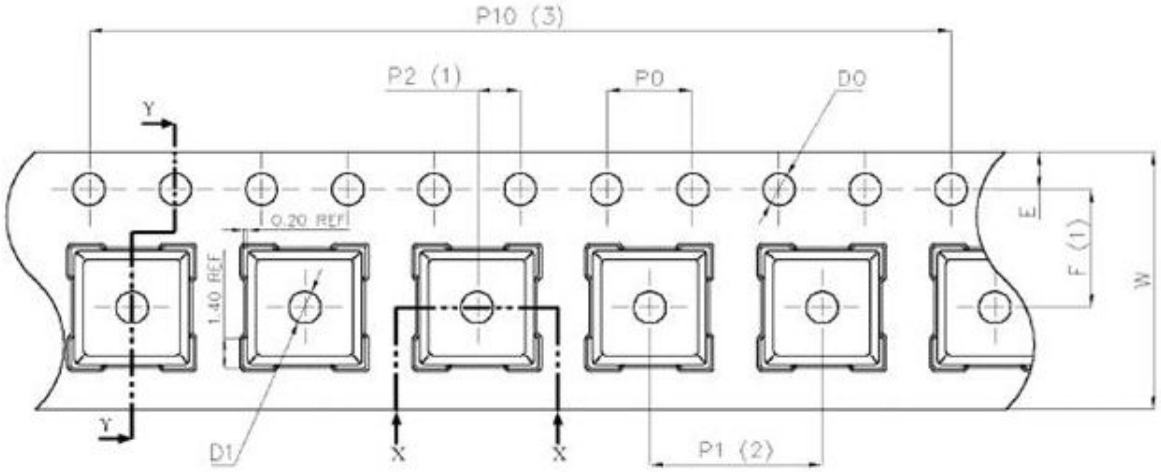
Part Number Ordering Information

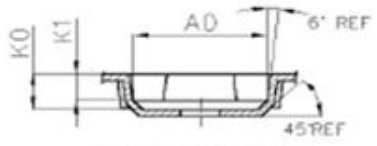
Part Number	Qty	Container
MGA-43013-BLKG	100	Antistatic Bag
MGA-43013-TR1G	1000	7″ Reel

Device Orientation

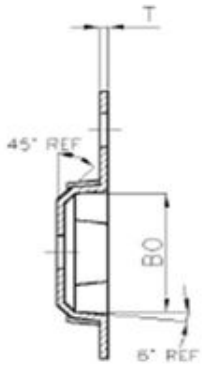


Tape Dimensions





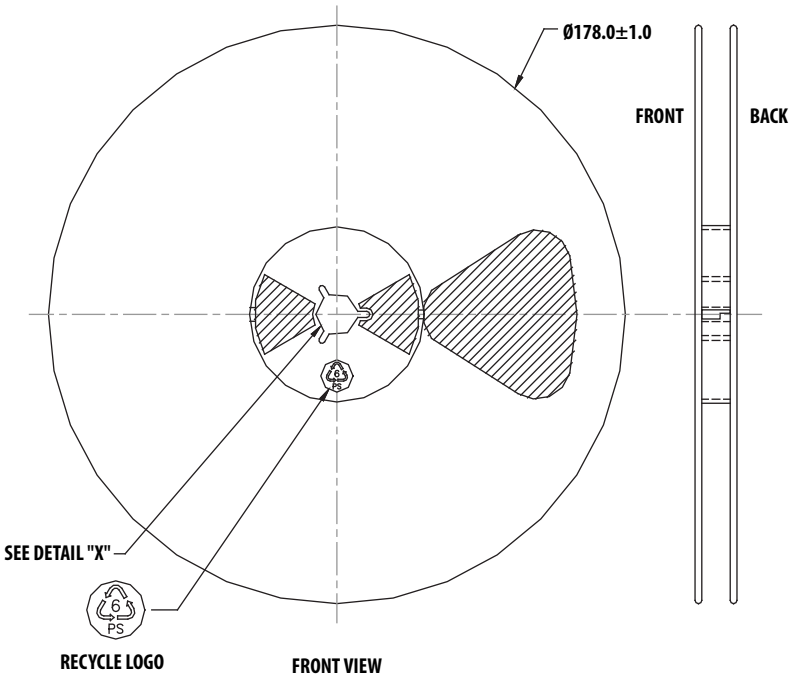
SECTION X-X

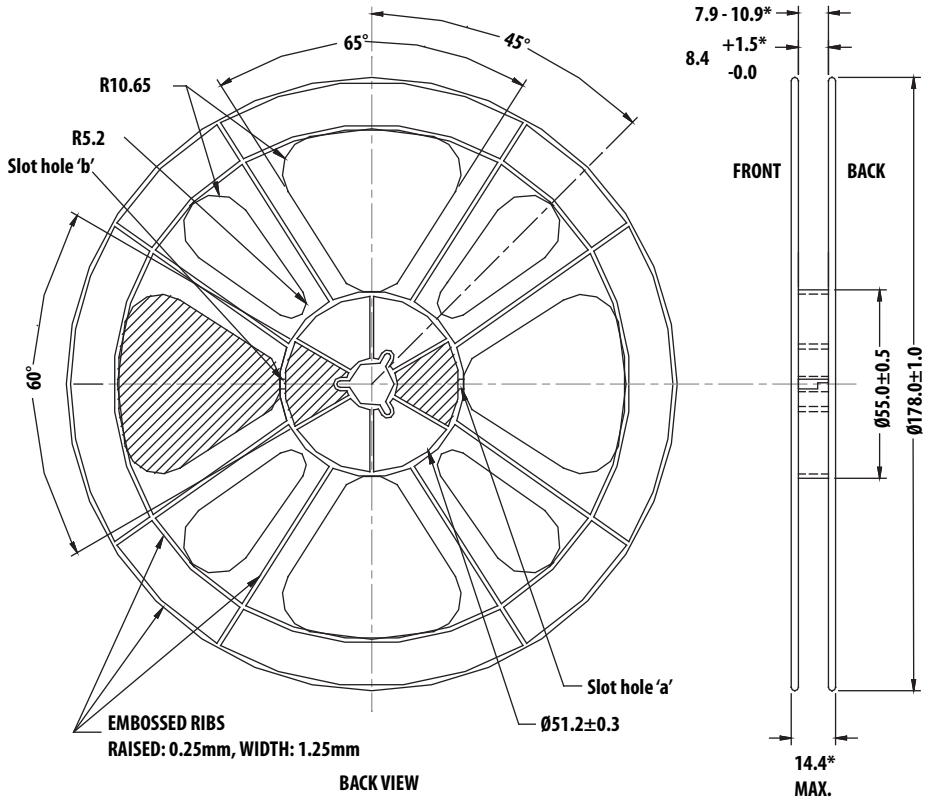


SECTION Y-Y

Dimension List			
Annote	Milimeter	Annote	Milimeter
A0	5.40±0.10	P0	4.00±0.10
B0	5.40±0.10	P2	2.00±0.10
D0	$1.50^{+0.10}_{-0}$	P10	40.00±0.20
D1	1.60±0.10	E	1.75±0.10
K0	1.90±0.10	F	5.50±0.10
K1	1.50±0.10	T	0.30±0.03
P1	8.00±0.10	W	12.00±0.30

Reel Dimensions (7″ reel)





For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

AV02-4454EN - April 22, 2014