

# MGA-43628

## High Linearity (2.0 – 2.2) GHz Power Amplifier Module



### Data Sheet

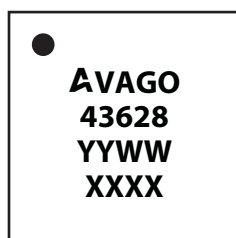
#### Description

Avago Technologies' MGA-43628 is a fully matched power amplifier for use in the (2.0-2.2) GHz band. High linear output power at 5 V is achieved through the use of Avago Technologies' proprietary 0.25  $\mu\text{m}$  GaAs Enhancement-mode pHEMT process. MGA-43628 is housed in a miniature 5.0 mm x 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-43628 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

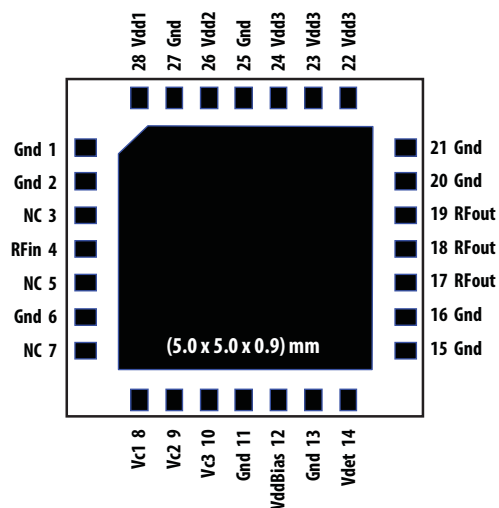


TOP VIEW

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

Note:  
Package marking provides orientation and identification  
"43628" = Device part number  
"YYWW" = year and work week  
"XXXX" = assembly lot number

#### Pin Configuration



#### Features

- High linearity performance: Typ -50 dBc ACLR1<sup>[1]</sup> at 27.2 dBm linear output power (biased with 5.0 V operating voltage)
- High Gain: 41.5 dB
- Good efficiency
- Fully matched
- Built-in detector
- GaAs E-pHEMT Technology<sup>[2]</sup>
- Low cost small package size: 5.0 x 5.0 x 0.9 mm
- MSL3
- Lead free/Halogen free RoHS compliance

#### Specifications

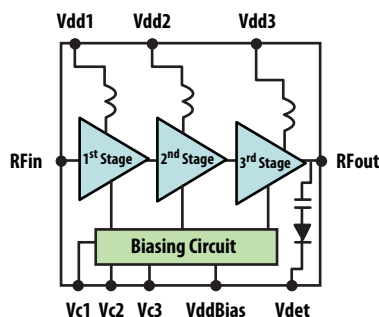
2.14 GHz; 5.0 V, Idqtotal = 440 mA (typ), W-CDMA Test model #1, 64 DPCH downlink signal

- PAE: 14%
- 27.2 dBm linear Pout @ ACLR1 = -50 dBc<sup>[1]</sup>
- 41.5 dB Gain
- Detector range: 20 dB

Note:

- W-CDMA Test model #1, 64DPCH downlink signal.
- 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 = 450 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 = 5.0 V, Vc1=2.4V, Vc2=1.6V, Vc3=2.2V, Idqtotal = 440 mA, RF performance at 2.14 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    |      | 440  | 600  |
| Gain                    | Gain                                         | dB    | 38   | 41.5 |      |
| OP1dB                   | Output Power at 1dB Gain Compression         | dBm   |      | 36.8 |      |
| 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 | 14   |      |
| S11                     | Input Return Loss, 50 $\Omega$ source        | dB    |      | 15.8 |      |
| DetR                    | Detector RF dynamic range                    | dB    |      | 20   |      |

$T_A = 25^\circ\text{C}$ , Vdd = VddBias = 5.5 V, Vc1=2.4V, Vc2=1.6V, Vc3=2.2V, Idqtotal = 490 mA, RF performance at 2.14 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    | 41.5 |
| 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    | 16.1 |
| DetR                    | Detector RF dynamic range                    | dB    | 20   |

## Product Consistency Distribution Charts<sup>[4]</sup>

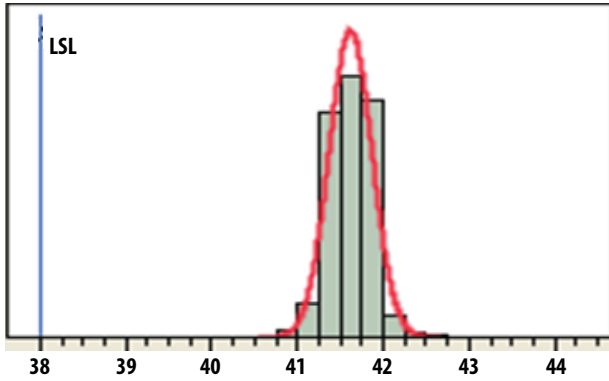


Figure 1. Gain at Pout=27.2dBm; LSL=38dB, Nominal = 41.5dB

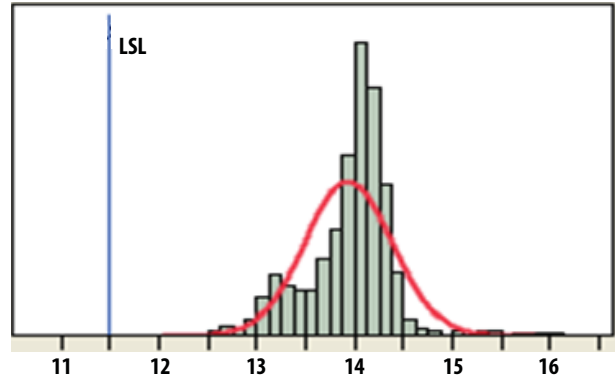


Figure 2. PAE at Pout=27.2dBm; LSL=11.5%, Nominal = 14%

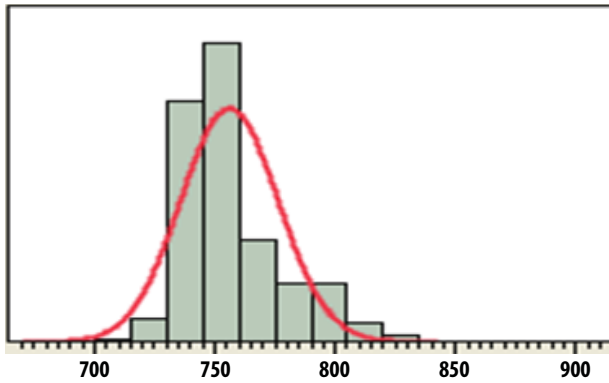


Figure 3. Idd\_Total at Pout = 27.2 dBm, Nominal = 750 mA

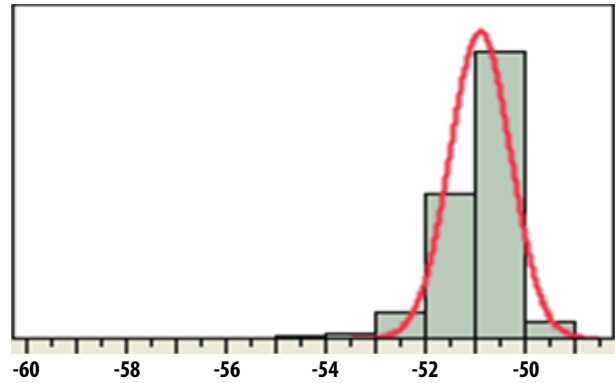


Figure 4. ACLR1 at Pout = 27.2 dBm, Nominal = -50.8 dBc

Note:

4. Distribution data sample size is 1500 samples taken from 3 different wafer lots.  $T_A = 25^\circ\text{C}$ ,  $V_{dd} = V_{ddBias} = 5.0\text{ V}$ ,  $V_{c1} = 2.4\text{ V}$ ,  $V_{c2} = 1.6\text{ V}$ ,  $V_{c3} = 2.2\text{ V}$ , RF performance at 2.14 GHz unless otherwise stated. Future wafers allocated to this product may have nominal values anywhere between the upper and lower limits.

MGA-43628 typical over-temperature performance at  $V_{c1} = 2.4\text{ V}$ ,  $V_{c2} = 1.6\text{ V}$ ,  $V_{c3} = 2.2\text{ V}$  as shown in Figure 30 unless otherwise stated

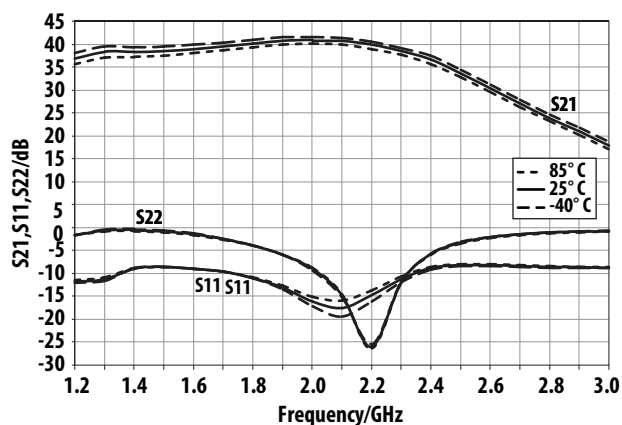


Figure 5. Small-signal performance Over-temperature  
 $V_{dd} = V_{ddBias} = 5.0\text{ V}$  operating voltage

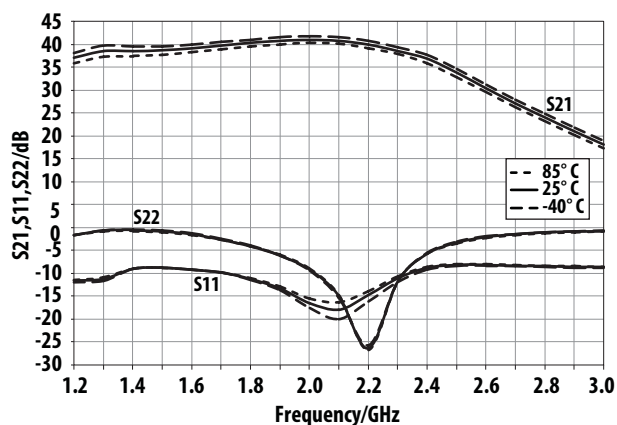


Figure 6. Small-signal performance Over-temperature  
 $V_{dd} = V_{ddBias} = 5.5\text{ V}$  operating voltage

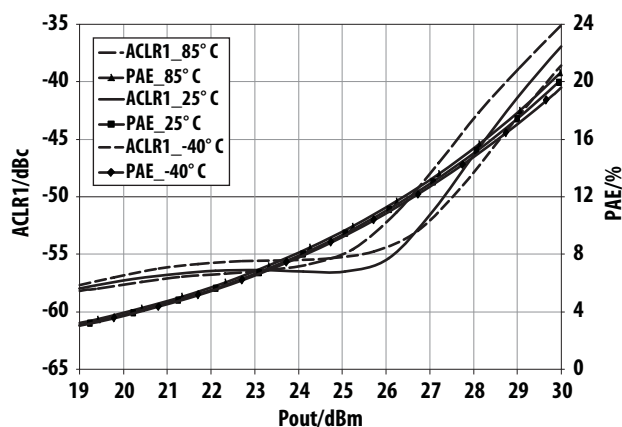


Figure 7. Over-temperature ACLR1, PAE vs Pout @ 2.11 GHz  
 $V_{dd} = V_{ddBias} = 5.0\text{ V}$  operating voltage

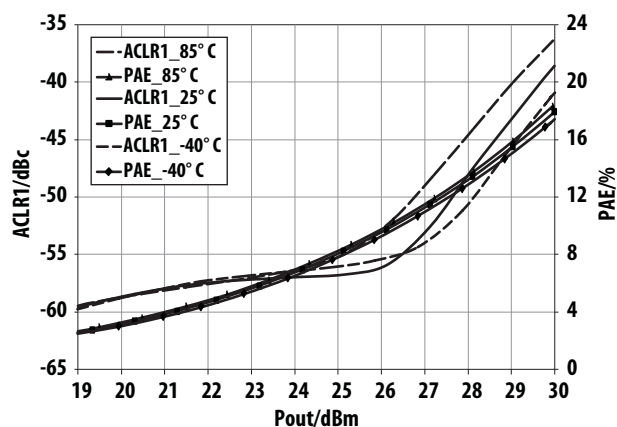


Figure 8. Over-temperature ACLR1, PAE vs Pout @ 2.11 GHz  
 $V_{dd} = V_{ddBias} = 5.5\text{ V}$  operating voltage

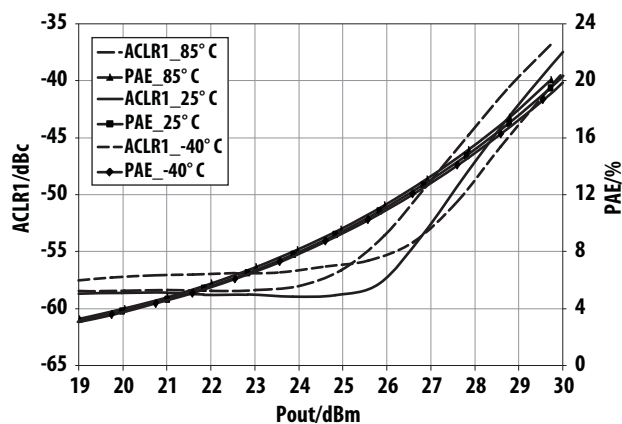


Figure 9. Over-temperature ACLR1, PAE vs Pout @ 2.14 GHz  
 $V_{dd} = V_{ddBias} = 5.0\text{ V}$  operating voltage

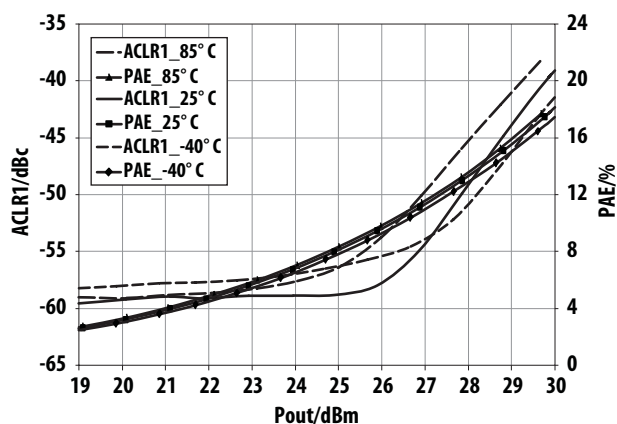


Figure 10. Over-temperature ACLR1, PAE vs Pout @ 2.14 GHz  
 $V_{dd} = V_{ddBias} = 5.5\text{ V}$  operating voltage

MGA-43628 typical over-temperature performance at  $V_{c1} = 2.4\text{ V}$ ,  $V_{c2} = 1.6\text{ V}$ ,  $V_{c3} = 2.2\text{ V}$  unless otherwise stated

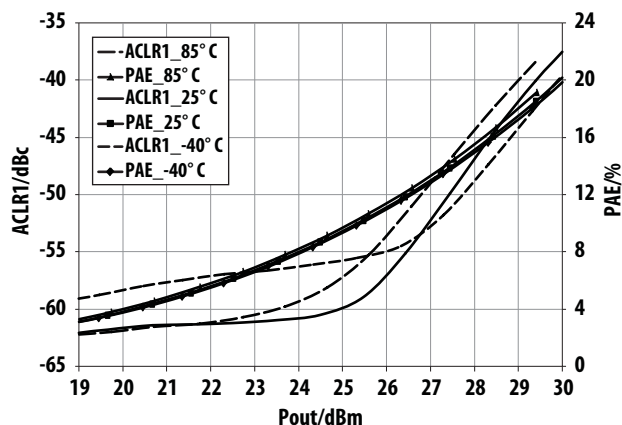


Figure 11. Over-temperature ACLR1, PAE vs Pout @ 2.17 GHz  
Vdd = VddBias = 5.0 V operating voltage

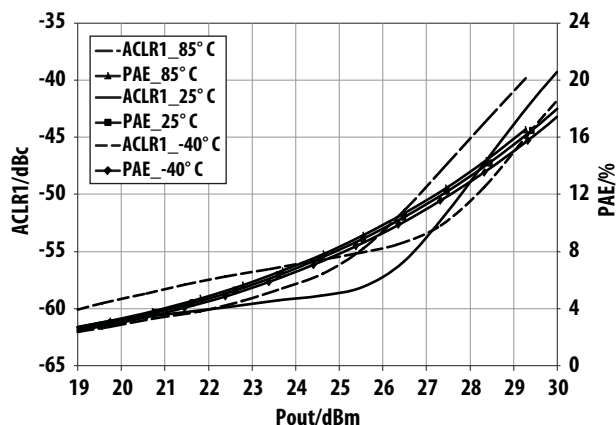


Figure 12. Over-temperature ACLR1, PAE vs Pout @ 2.17 GHz  
Vdd = VddBias = 5.5 V operating voltage

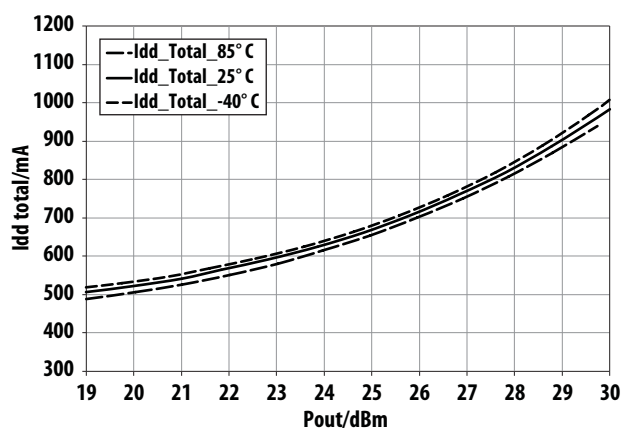


Figure 13. Over-temperature Idd\_Total vs Pout @ 2.14 GHz  
Vdd = VddBias = 5.0 V operating voltage

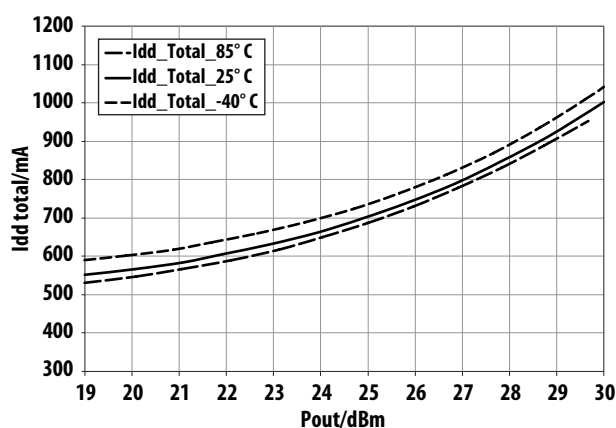


Figure 14. Over-temperature Idd\_Total vs Pout @ 2.14 GHz  
Vdd = VddBias = 5.5 V operating voltage

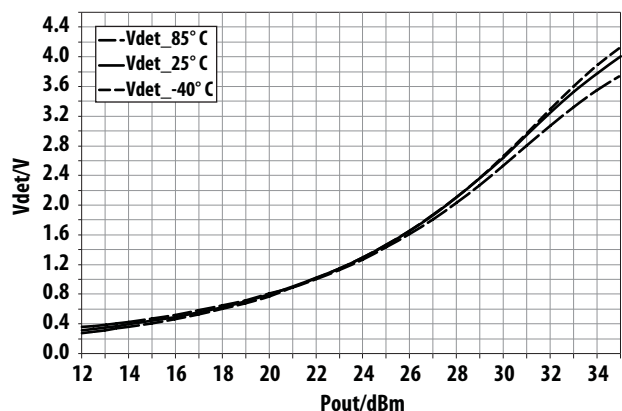


Figure 15. Over-temperature Vdet vs Pout @ 2.14 GHz  
Vdd = VddBias = 5.0 V operating voltage

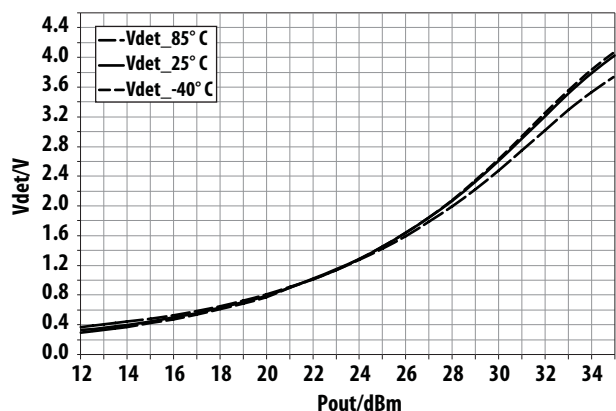


Figure 16. Over-temperature Vdet vs Pout @ 2.14 GHz  
Vdd = VddBias = 5.5 V operating voltage

MGA-43628 typical over-temperature performance at  $V_{c1} = 2.4\text{ V}$ ,  $V_{c2} = 1.6\text{ V}$ ,  $V_{c3} = 2.2\text{ V}$  unless otherwise stated

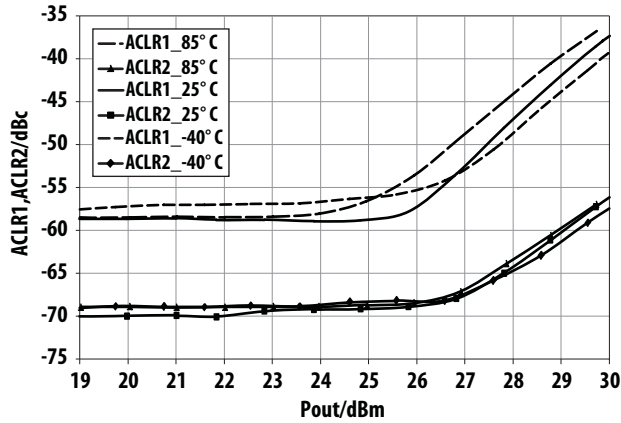


Figure 17. Over-temperature ACLR1, ACLR2 Pout @ 2.14 GHz  
 $V_{dd} = V_{ddBias} = 5.0\text{ V}$  operating voltage

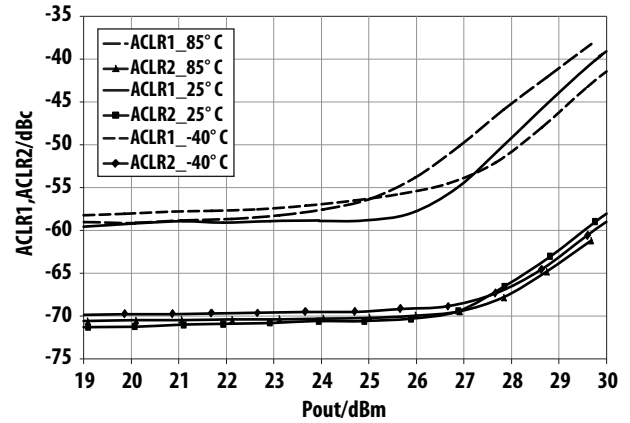


Figure 18. Over-temperature ACLR1, ACLR2 vs Pout @ 2.14 GHz  
 $V_{dd} = V_{ddBias} = 5.5\text{ V}$  operating voltage

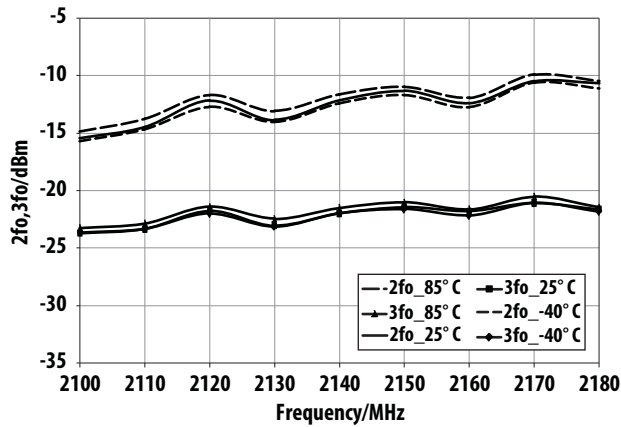


Figure 19. Over-temperature 2nd, 3rd Harmonics vs Freq at Pout = 27.2 dBm,  
 $V_{dd} = V_{ddBias} = 5.0\text{ V}$  operating voltage

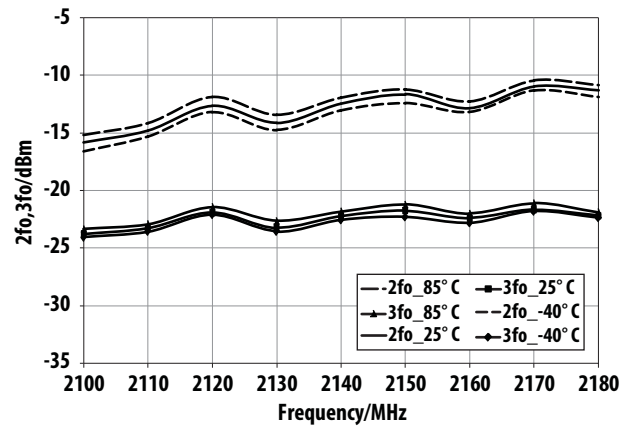


Figure 20. Over-temperature 2nd, 3rd Harmonics vs Freq at Pout = 27.2 dBm,  
 $V_{dd} = V_{ddBias} = 5.5\text{ V}$  operating voltage

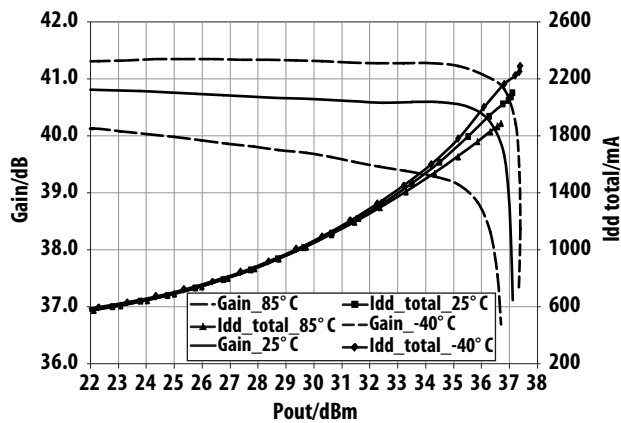


Figure 21. Over-temperature Gain, Idd\_total vs Pout @ 2.14 GHz  
 $V_{dd} = V_{ddBias} = 5.0\text{ V}$  operating voltage

MGA-43628 typical over-temperature performance at  $V_{c1} = 2.4\text{ V}$ ,  $V_{c2} = 1.6\text{ V}$ ,  $V_{c3} = 2.2\text{ V}$  unless otherwise stated

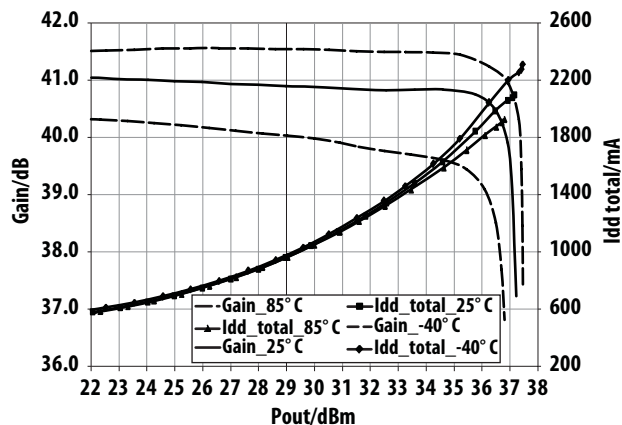


Figure 22. Over-temperature Gain,  $I_{dd\_total}$  vs  $P_{out}$  @ 2.11 GHz  
 $V_{dd} = V_{ddBias} = 5.0\text{ V}$  operating voltage

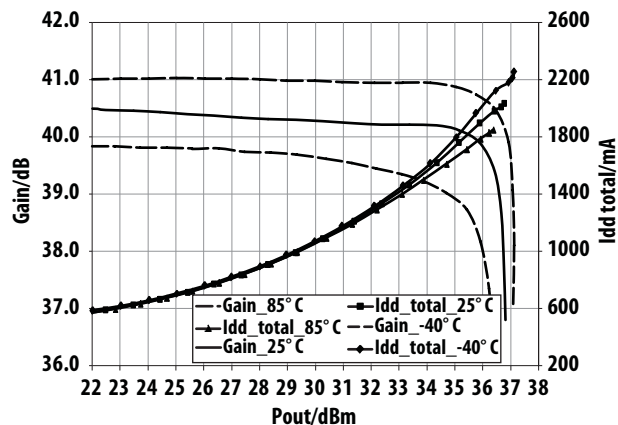


Figure 23. Over-temperature Gain,  $I_{dd\_total}$  vs  $P_{out}$  @ 2.17 GHz  
 $V_{dd} = V_{ddBias} = 5.0\text{ V}$  operating voltage

MGA-43628 typical 3GPP W-CDMA Test model #1 Spectrum Emission Mask performance at  $V_{dd} = V_{ddBias} = 5.0\text{ V}$ ,  $V_{c1} = 2.4\text{ V}$ ,  $V_{c2} = 1.6\text{ V}$ ,  $V_{c3} = 2.2\text{ V}$  unless otherwise stated

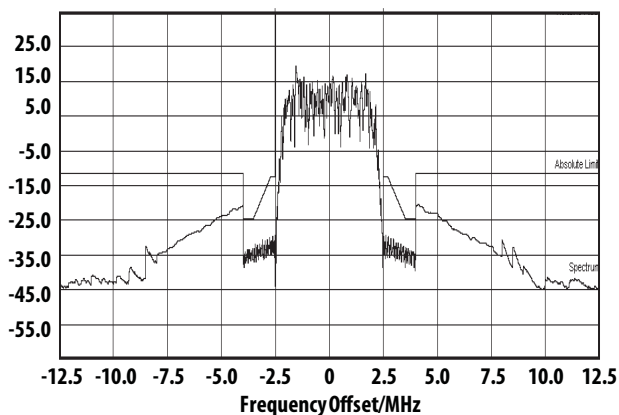


Figure 24. SEM at  $P_{out} = 28\text{ dBm}$  @ 2.11 GHz

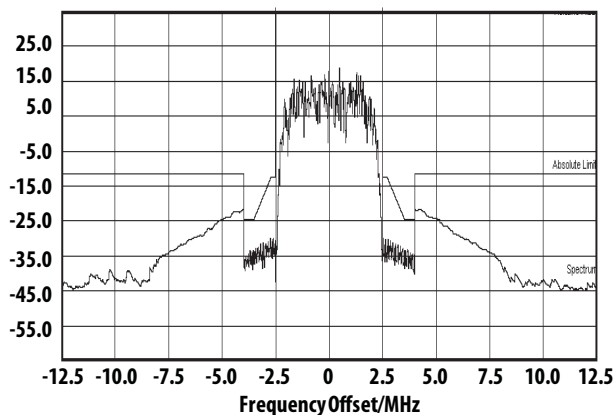


Figure 25. SEM at  $P_{out} = 28\text{ dBm}$  @ 2.14 GHz

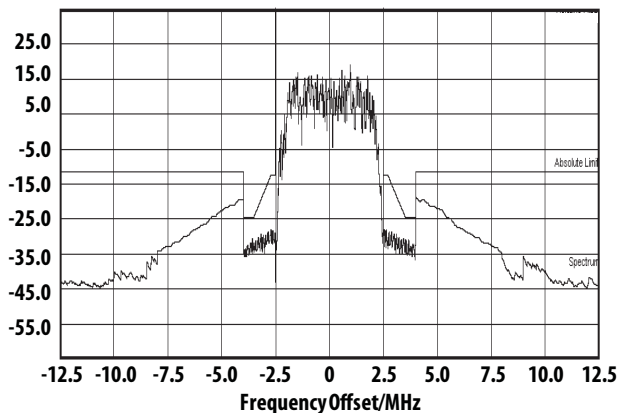


Figure 26. SEM at  $P_{out} = 28\text{ dBm}$  @ 2.17 GHz

MGA-43628 typical LTE Downlink (E-TM1.1) 10 MHz 50RB performance at  $V_{dd} = V_{ddBias} = 5.0\text{ V}$ ,  $V_{c1} = 2.2\text{ V}$ ,  $V_{c2} = 1.6\text{ V}$ ,  $V_{c3} = 2.0\text{ V}$  unless otherwise stated

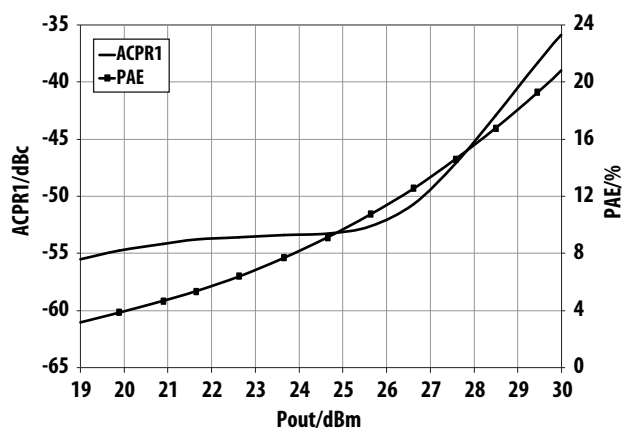


Figure 27. ACPR1, PAE vs Pout @ 2.11 GHz

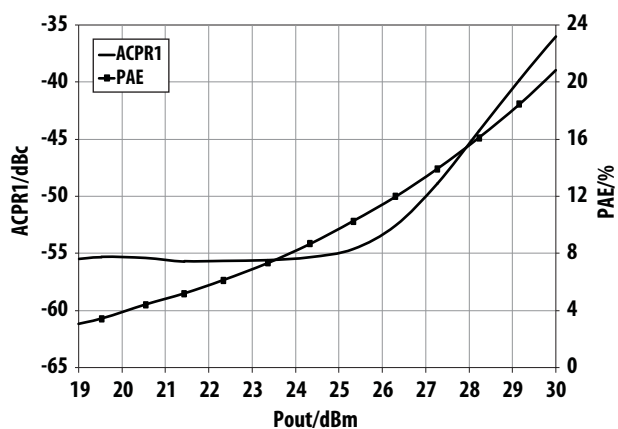


Figure 28. ACPR1, PAE vs Pout @ 2.14 GHz

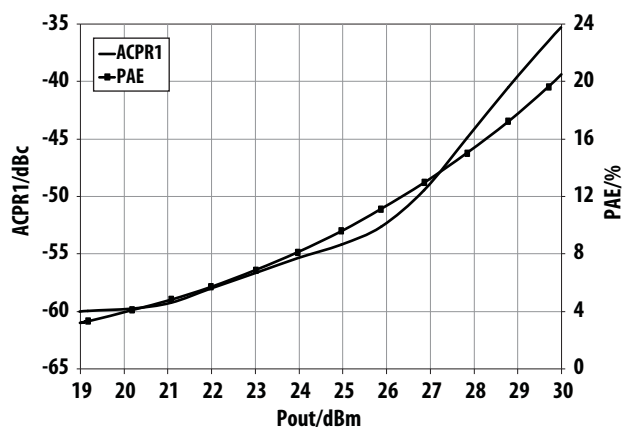


Figure 29. ACPR1, PAE vs Pout @ 2.17 GHz

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

| Freq<br>(GHz) | S11<br>(dB) | S11<br>(ang) | S21<br>(dB) | S21<br>(ang) | S12<br>(dB) | S12<br>(ang) | S22<br>(dB) | S22<br>(ang) |
|---------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| 0.1           | -0.30       | 175.06       | -57.18      | -39.10       | -61.12      | -112.05      | -0.58       | 175.26       |
| 0.2           | -0.35       | 164.36       | -52.55      | -85.61       | -60.63      | 41.83        | -0.92       | 173.40       |
| 0.3           | -0.38       | 154.98       | -43.76      | -73.69       | -63.55      | 2.56         | -1.12       | 172.26       |
| 0.4           | -0.37       | 145.35       | -28.46      | -63.76       | -66.27      | 12.15        | -1.23       | 171.46       |
| 0.5           | -0.95       | 135.17       | -14.76      | -162.07      | -64.90      | -2.49        | -1.26       | 171.49       |
| 0.6           | -0.71       | 125.36       | -15.52      | -98.77       | -64.53      | 9.15         | -0.98       | 167.57       |
| 0.7           | -0.71       | 110.04       | 3.08        | -114.53      | -63.24      | 122.31       | -1.43       | 165.91       |
| 0.8           | -2.40       | 80.38        | 18.79       | 33.00        | -64.55      | 105.07       | -1.65       | 165.48       |
| 0.9           | -5.66       | 100.45       | 21.40       | 65.15        | -63.61      | 117.52       | -1.87       | 165.69       |
| 1.0           | -3.66       | 83.17        | 12.70       | 19.21        | -65.73      | 73.37        | -1.60       | 167.15       |
| 1.1           | -3.96       | 48.86        | 23.94       | 84.77        | -65.29      | 57.70        | -2.60       | 166.85       |
| 1.2           | -15.39      | 24.98        | 34.54       | 26.80        | -62.86      | 83.98        | -1.00       | 166.58       |
| 1.3           | -10.88      | 62.04        | 36.69       | -45.42       | -64.73      | 78.44        | -0.50       | 161.28       |
| 1.4           | -9.98       | 35.77        | 37.12       | -92.22       | -63.37      | 84.70        | -0.44       | 155.07       |
| 1.5           | -10.60      | 6.13         | 37.64       | -129.25      | -61.88      | 85.23        | -0.65       | 148.97       |
| 1.6           | -11.17      | -26.64       | 38.37       | -162.53      | -61.45      | 89.51        | -1.08       | 142.44       |
| 1.7           | -11.06      | -63.12       | 39.17       | 164.66       | -58.50      | 93.36        | -1.92       | 136.10       |
| 1.8           | -10.93      | -95.47       | 40.04       | 131.88       | -56.84      | 93.39        | -3.06       | 129.46       |
| 1.9           | -11.16      | -123.23      | 40.80       | 96.99        | -54.06      | 67.27        | -4.93       | 122.82       |
| 2.0           | -13.07      | -140.18      | 41.05       | 60.01        | -53.63      | 53.98        | -7.77       | 118.32       |
| 2.1           | -15.03      | -131.53      | 40.67       | 21.57        | -52.49      | 38.60        | -12.94      | 117.59       |
| 2.2           | -11.88      | -115.12      | 39.82       | -11.45       | -53.38      | 22.51        | -22.70      | -83.11       |
| 2.3           | -8.23       | -127.01      | 38.74       | -52.24       | -51.99      | 4.48         | -8.54       | -123.11      |
| 2.4           | -6.74       | -145.02      | 36.01       | -89.38       | -54.52      | -15.90       | -4.13       | -138.34      |
| 2.5           | -6.53       | -159.78      | 32.66       | -118.56      | -57.12      | -30.73       | -2.27       | -150.84      |
| 2.6           | -6.71       | -170.51      | 29.37       | -141.53      | -57.17      | -23.86       | -1.39       | -160.05      |
| 2.7           | -7.10       | -106.47      | 26.22       | -161.19      | -60.58      | -29.76       | -0.93       | -166.90      |
| 2.8           | -7.53       | 175.59       | 23.23       | -178.10      | -60.20      | -33.50       | -0.67       | -172.14      |
| 2.9           | -7.87       | 171.12       | 20.39       | 166.93       | -63.97      | -48.10       | -0.50       | -176.37      |
| 3.0           | -8.18       | 167.41       | 17.69       | 153.18       | -63.52      | -47.65       | -0.39       | -35.98       |
| 3.1           | -8.42       | 164.27       | 15.05       | 140.45       | -65.05      | -29.66       | -0.31       | 176.88       |
| 3.2           | -8.62       | 161.29       | 12.44       | 128.26       | -67.98      | 44.67        | -0.26       | 173.94       |
| 3.3           | -8.79       | 158.64       | 9.75        | 116.69       | -66.94      | 56.68        | -0.23       | 171.25       |
| 3.4           | -8.93       | 156.09       | 6.99        | 105.56       | -65.82      | 46.96        | -0.21       | 168.65       |
| 3.5           | -9.03       | 153.75       | 3.97        | 94.82        | -67.24      | -32.48       | -0.19       | 166.15       |
| 3.6           | -9.12       | 151.35       | 0.44        | 84.83        | -66.22      | 80.49        | -0.18       | 163.60       |
| 3.7           | -9.19       | 149.35       | -4.16       | 77.06        | -68.40      | 16.02        | -0.19       | 161.14       |
| 3.8           | -9.23       | 147.53       | -11.49      | 83.61        | -64.92      | 94.39        | -0.19       | 158.71       |
| 3.9           | -9.24       | 146.05       | -15.57      | -1.69        | -65.83      | 51.09        | -0.20       | 156.25       |
| 4.0           | -9.16       | 144.81       | -8.70       | -35.16       | -62.72      | 67.81        | -0.23       | 153.69       |
| 4.1           | -9.01       | 143.67       | -3.80       | 170.21       | -64.35      | 63.03        | -0.26       | 151.25       |
| 4.2           | -8.77       | 142.00       | -0.97       | 148.25       | -60.54      | 50.84        | -0.31       | 148.89       |

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

| Freq<br>(GHz) | S11<br>(dB) | S11<br>(ang) | S21<br>(dB) | S21<br>(ang) | S12<br>(dB) | S12<br>(ang) | S22<br>(dB) | S22<br>(ang) |
|---------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| 4.3           | -8.63       | 139.37       | 0.00        | 117.18       | -60.96      | 33.65        | -0.39       | 146.77       |
| 4.4           | -8.73       | 138.13       | -1.86       | 82.59        | -61.12      | 41.98        | -0.42       | 145.05       |
| 4.5           | -8.63       | 139.55       | -7.11       | 57.81        | -60.99      | 35.39        | -0.39       | 143.24       |
| 4.6           | -8.00       | 141.12       | -14.73      | 75.62        | -64.30      | -0.11        | -0.36       | 141.15       |
| 4.7           | -7.06       | 140.09       | -12.06      | 116.77       | -63.38      | 52.25        | -0.34       | 138.99       |
| 4.8           | -6.14       | 136.11       | -8.35       | 108.34       | -63.94      | 51.05        | -0.33       | 136.93       |
| 4.9           | -5.49       | 129.96       | -6.96       | 88.89        | -61.63      | 15.61        | -0.33       | 135.04       |
| 5.0           | -5.15       | 123.56       | -6.93       | 67.14        | -64.21      | 11.62        | -0.34       | 132.96       |
| 5.1           | -5.15       | 118.26       | -8.09       | 42.27        | -61.39      | 30.39        | -0.36       | 130.76       |
| 5.2           | -5.38       | 115.24       | -12.24      | 20.44        | -63.82      | 37.09        | -0.35       | 129.09       |
| 5.3           | -5.20       | 111.70       | -15.65      | 31.78        | -61.86      | 41.29        | -0.34       | 127.50       |
| 5.4           | -5.31       | 107.33       | -17.07      | 28.94        | -62.86      | 45.83        | -0.35       | 126.09       |
| 5.5           | -5.44       | 104.12       | -19.23      | 42.79        | -63.68      | 31.55        | -0.33       | 124.79       |
| 5.6           | -5.47       | 100.09       | -15.63      | 59.85        | -63.14      | 25.77        | -0.33       | 123.57       |
| 5.7           | -5.93       | 95.36        | -12.43      | 29.97        | -64.74      | -0.40        | -0.32       | 122.56       |
| 5.8           | -6.49       | 93.92        | -13.43      | 1.76         | -63.65      | 43.77        | -0.31       | 121.60       |
| 5.9           | -6.85       | 93.51        | -15.03      | -16.43       | -63.91      | 30.65        | -0.30       | 120.59       |
| 6.0           | -7.11       | 93.13        | -16.18      | -30.70       | -62.57      | 28.50        | -0.29       | 119.75       |
| 7.0           | -8.31       | 93.81        | -25.85      | 91.56        | -61.89      | 35.51        | -0.19       | 113.46       |
| 8.0           | -8.99       | 89.60        | -27.22      | 44.19        | -58.70      | 26.63        | -0.28       | 97.34        |
| 9.0           | -10.05      | 67.30        | -29.18      | -3.94        | -55.56      | 0.62         | -0.36       | 70.05        |
| 10.0          | -9.22       | 47.21        | -31.93      | -41.22       | -57.23      | -15.48       | -0.18       | 49.73        |
| 11.0          | -7.02       | 50.16        | -34.57      | -71.69       | -59.39      | -20.92       | -0.59       | 30.91        |
| 12.0          | -7.25       | 44.19        | -36.85      | -96.94       | -57.36      | -39.60       | -1.55       | 13.59        |
| 13.0          | -11.42      | 33.20        | -37.80      | -130.84      | -57.77      | -29.55       | -0.08       | -11.14       |
| 14.0          | -10.76      | 1.42         | -38.32      | -173.87      | -54.03      | -26.41       | -0.42       | -36.80       |
| 15.0          | -9.44       | -38.08       | -41.32      | 128.69       | -47.98      | -33.03       | -0.59       | -51.91       |
| 16.0          | -10.44      | -116.93      | -41.46      | 33.62        | -44.76      | -58.79       | -0.63       | -61.94       |
| 17.0          | -8.09       | 125.59       | -39.66      | -72.54       | -40.64      | -96.96       | -0.58       | -70.62       |
| 18.0          | -4.68       | 71.47        | -45.58      | -129.22      | -44.72      | -136.92      | -0.46       | -81.73       |
| 19.0          | -3.84       | 41.22        | -47.82      | -144.14      | -47.25      | -140.61      | -0.40       | -91.57       |
| 20.0          | -4.71       | 5.60         | -45.55      | -128.30      | -42.88      | -131.48      | -0.55       | -102.61      |

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

| Freq<br>(GHz) | S11<br>(dB) | S11<br>(ang) | S21<br>(dB) | S21<br>(ang) | S12<br>(dB) | S12<br>(ang) | S22<br>(dB) | S22<br>(ang) |
|---------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| 0.1           | -0.29       | 175.00       | -59.13      | 53.94        | -54.17      | -51.13       | -0.55       | 175.32       |
| 0.2           | -0.35       | 164.39       | -52.00      | -67.58       | -61.93      | -4.25        | -0.88       | 173.48       |
| 0.3           | -0.39       | 154.95       | -44.30      | -73.44       | -61.17      | 25.89        | -1.07       | 172.31       |
| 0.4           | -0.38       | 145.31       | -28.19      | -65.50       | -62.11      | -1.81        | -1.18       | 171.50       |
| 0.5           | -0.95       | 135.10       | -14.60      | -163.35      | -63.80      | 0.21         | -1.22       | 171.42       |
| 0.6           | -0.73       | 125.24       | -15.28      | -100.32      | -63.69      | 144.82       | -0.94       | 167.60       |
| 0.7           | -0.74       | 109.90       | 3.29        | -116.04      | -64.98      | 94.53        | -1.38       | 165.96       |
| 0.8           | -2.45       | 80.34        | 18.98       | 103.41       | -65.62      | 77.81        | -1.60       | 165.47       |
| 0.9           | -5.64       | 100.04       | 21.57       | 63.89        | -66.07      | 71.12        | -1.82       | 165.61       |
| 1.0           | -3.72       | 82.61        | 12.93       | 18.44        | -64.05      | 77.11        | -1.56       | 166.94       |
| 1.1           | -4.05       | 48.45        | 24.05       | 81.53        | -66.96      | 33.57        | -2.46       | 166.68       |
| 1.2           | -15.24      | 24.79        | 34.58       | 25.03        | -63.67      | 103.84       | -0.99       | 166.08       |
| 1.3           | -11.04      | 59.95        | 36.75       | -46.85       | -64.92      | 100.47       | -0.51       | 161.00       |
| 1.4           | -10.22      | 33.58        | 37.18       | -93.55       | -61.17      | 96.39        | -0.46       | 154.81       |
| 1.5           | -10.87      | 3.51         | 37.69       | -130.50      | -60.08      | 89.89        | -0.67       | 148.74       |
| 1.6           | -11.39      | -29.72       | 38.41       | -163.70      | -58.91      | 93.27        | -1.13       | 142.28       |
| 1.7           | -11.18      | -66.47       | 39.21       | 163.61       | -58.71      | 87.79        | -1.97       | 136.01       |
| 1.8           | -10.97      | -98.68       | 40.09       | 130.92       | -56.45      | 82.16        | -3.14       | 129.48       |
| 1.9           | -11.21      | -125.81      | 40.85       | 96.09        | -54.29      | 69.54        | -5.02       | 123.03       |
| 2.0           | -13.12      | -142.38      | 41.11       | 59.18        | -53.68      | 57.14        | -7.86       | 119.02       |
| 2.1           | -15.16      | -132.37      | 40.74       | 20.77        | -52.35      | 41.28        | -12.99      | 118.88       |
| 2.2           | -11.88      | -115.08      | 39.91       | -12.30       | -51.99      | 20.58        | -22.19      | -81.64       |
| 2.3           | -8.15       | -127.35      | 38.83       | -53.32       | -52.95      | 1.96         | -8.48       | -123.43      |
| 2.4           | -6.65       | -145.31      | 36.07       | -90.57       | -54.08      | -15.77       | -4.08       | -138.45      |
| 2.5           | -6.43       | -160.23      | 32.70       | -119.74      | -55.17      | -28.59       | -2.25       | -151.01      |
| 2.6           | -6.64       | -170.77      | 29.39       | -142.69      | -59.92      | -42.79       | -1.38       | -160.16      |
| 2.7           | -7.03       | -106.67      | 26.23       | -162.29      | -59.60      | -39.99       | -0.92       | -166.99      |
| 2.8           | -7.45       | 175.50       | 23.23       | -107.13      | -62.52      | -45.10       | -0.67       | -172.20      |
| 2.9           | -7.79       | 171.07       | 20.38       | 165.96       | -61.92      | -33.21       | -0.50       | -176.43      |
| 3.0           | -8.08       | 167.41       | 17.67       | 152.25       | -66.53      | -14.36       | -0.39       | -36.04       |
| 3.1           | -8.32       | 164.27       | 15.03       | 139.59       | -66.73      | -61.70       | -0.31       | 176.81       |
| 3.2           | -8.51       | 161.24       | 12.41       | 127.46       | -67.40      | -33.90       | -0.26       | 173.89       |
| 3.3           | -8.68       | 158.61       | 9.73        | 115.94       | -66.40      | 56.83        | -0.23       | 171.20       |
| 3.4           | -8.80       | 156.09       | 6.97        | 104.85       | -68.41      | 52.44        | -0.22       | 168.60       |
| 3.5           | -8.89       | 153.71       | 3.94        | 94.15        | -67.97      | -1.70        | -0.19       | 166.11       |
| 3.6           | -8.98       | 151.23       | 0.40        | 84.19        | -65.80      | -28.66       | -0.18       | 163.54       |
| 3.7           | -9.04       | 149.19       | -4.21       | 76.52        | -67.70      | 8.32         | -0.19       | 161.10       |
| 3.8           | -9.07       | 147.35       | -11.55      | 83.46        | -66.16      | 44.47        | -0.19       | 158.64       |
| 3.9           | -9.07       | 145.84       | -15.48      | -1.64        | -62.34      | 101.92       | -0.20       | 156.17       |
| 4.0           | -9.00       | 144.52       | -8.63       | 36.00        | -66.96      | 61.84        | -0.22       | 153.64       |
| 4.1           | -8.83       | 143.24       | -3.77       | 169.25       | -62.86      | 73.11        | -0.25       | 151.19       |
| 4.2           | -8.60       | 141.45       | -0.97       | 147.17       | -62.59      | 42.78        | -0.31       | 148.83       |

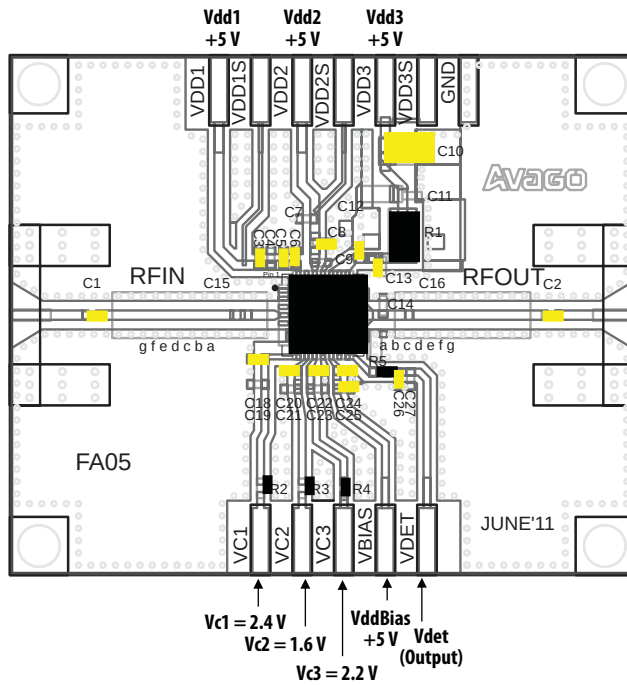
**S-Parameter<sup>[5]</sup> (Vdd = VddBias = 5.5 V, Vc1 = 2.4 V, Vc2 = 1.6 V, Vc3 = 2.2 V, T<sub>A</sub> = 25° C, 50ohm) continued**

| Freq<br>(GHz) | S11<br>(dB) | S11<br>(ang) | S21<br>(dB) | S21<br>(ang) | S12<br>(dB) | S12<br>(ang) | S22<br>(dB) | S22<br>(ang) |
|---------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| 4.3           | -8.47       | 138.73       | -0.05       | 116.04       | -60.02      | 41.20        | -0.38       | 146.72       |
| 4.4           | -8.58       | 137.44       | -1.99       | 81.68        | -60.51      | 14.80        | -0.40       | 145.00       |
| 4.5           | -8.49       | 138.69       | -7.28       | 57.51        | -61.97      | 18.14        | -0.38       | 143.17       |
| 4.6           | -7.89       | 140.10       | -14.78      | 76.52        | -65.41      | 43.49        | -0.34       | 141.04       |
| 4.7           | -6.99       | 139.03       | -11.98      | 116.38       | -63.72      | 52.82        | -0.33       | 138.90       |
| 4.8           | -6.11       | 135.16       | -8.34       | 107.69       | -62.39      | 36.90        | -0.31       | 136.85       |
| 4.9           | -5.49       | 129.19       | -6.98       | 88.27        | -61.97      | 40.51        | -0.30       | 134.96       |
| 5.0           | -5.15       | 123.03       | -6.97       | 66.51        | -62.93      | 34.28        | -0.32       | 132.89       |
| 5.1           | -5.16       | 117.93       | -8.15       | 41.56        | -63.10      | 32.09        | -0.33       | 130.68       |
| 5.2           | -5.37       | 115.08       | -12.41      | 20.17        | -62.46      | 45.10        | -0.32       | 129.01       |
| 5.3           | -5.19       | 111.51       | -15.67      | 31.89        | -61.14      | 41.14        | -0.32       | 127.41       |
| 5.4           | -5.30       | 107.26       | -17.14      | 29.01        | -63.03      | 38.26        | -0.32       | 126.03       |
| 5.5           | -5.41       | 104.10       | -19.21      | 43.42        | -61.06      | 30.74        | -0.31       | 124.71       |
| 5.6           | -5.43       | 100.03       | -15.47      | 59.16        | -62.20      | 10.54        | -0.30       | 123.49       |
| 5.7           | -5.89       | 95.45        | -12.44      | 28.99        | -62.44      | 33.84        | -0.30       | 122.48       |
| 5.8           | -6.43       | 94.02        | -13.48      | 1.22         | -64.78      | 57.64        | -0.28       | 121.52       |
| 5.9           | -6.77       | 93.62        | -15.07      | -16.78       | -63.66      | 30.94        | -0.28       | 120.51       |
| 6.0           | -7.01       | 93.20        | -16.20      | -31.04       | -64.00      | 47.41        | -0.27       | 119.66       |
| 7.0           | -8.18       | 93.27        | -25.88      | 91.47        | -59.95      | 50.54        | -0.18       | 113.38       |
| 8.0           | -8.89       | 88.46        | -27.26      | 44.60        | -57.94      | 34.92        | -0.28       | 97.21        |
| 9.0           | -10.00      | 65.66        | -29.14      | -3.68        | -55.93      | 3.04         | -0.37       | 69.88        |
| 10.0          | -9.25       | 45.56        | -31.82      | -41.17       | -58.35      | -23.54       | -0.17       | 49.51        |
| 11.0          | -7.15       | 48.91        | -34.52      | -72.20       | -57.79      | -19.00       | -0.57       | 30.67        |
| 12.0          | -7.48       | 43.14        | -36.79      | -97.15       | -58.73      | -33.66       | -1.54       | 13.34        |
| 13.0          | -11.85      | 32.74        | -37.74      | -130.74      | -54.91      | -27.79       | -0.09       | -11.44       |
| 14.0          | -11.17      | 1.06         | -38.45      | -172.97      | -54.05      | -29.57       | -0.42       | -37.14       |
| 15.0          | -9.80       | -38.75       | -41.52      | 129.09       | -47.98      | -32.68       | -0.59       | -52.23       |
| 16.0          | -10.70      | -119.43      | -41.53      | 33.60        | -44.08      | -59.74       | -0.61       | -62.26       |
| 17.0          | -7.95       | 124.07       | -39.52      | -72.70       | -40.66      | -96.97       | -0.56       | -70.91       |
| 18.0          | -4.58       | 70.71        | -45.94      | -132.50      | -44.68      | -134.82      | -0.46       | -82.04       |
| 19.0          | -3.82       | 40.60        | -47.04      | -144.31      | -47.32      | -138.16      | -0.42       | -91.85       |
| 20.0          | -4.71       | 4.74         | -46.00      | -129.98      | -42.95      | -132.97      | -0.56       | -102.95      |

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 $\mu$ F +/- 10% | GRM155R71C104KA88D |
| C5, C9            | 82 pF +/- 5%        | GRM1555C1H820JA01D |
| C6, C18, C20, C22 | 8.2 pF +/- 0.5 pF   | GJM1555C1H8R2WB01D |
| C24               | 3.6 pF +/- 0.25 pF  | GJM1555C1H3R6CB01D |
| C10               | 2.2 $\mu$ F +/- 10% | GRM21BR71E225KA73L |
| C26               | 22 nF +/- 10%       | CM05X7R223K16AHF   |
| R1                | 0 $\Omega$          | RMC1/10 JPTP       |
| R2, R3, R4, R5    | 0 $\Omega$          | RMC1/16S JPTH      |

Note:

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

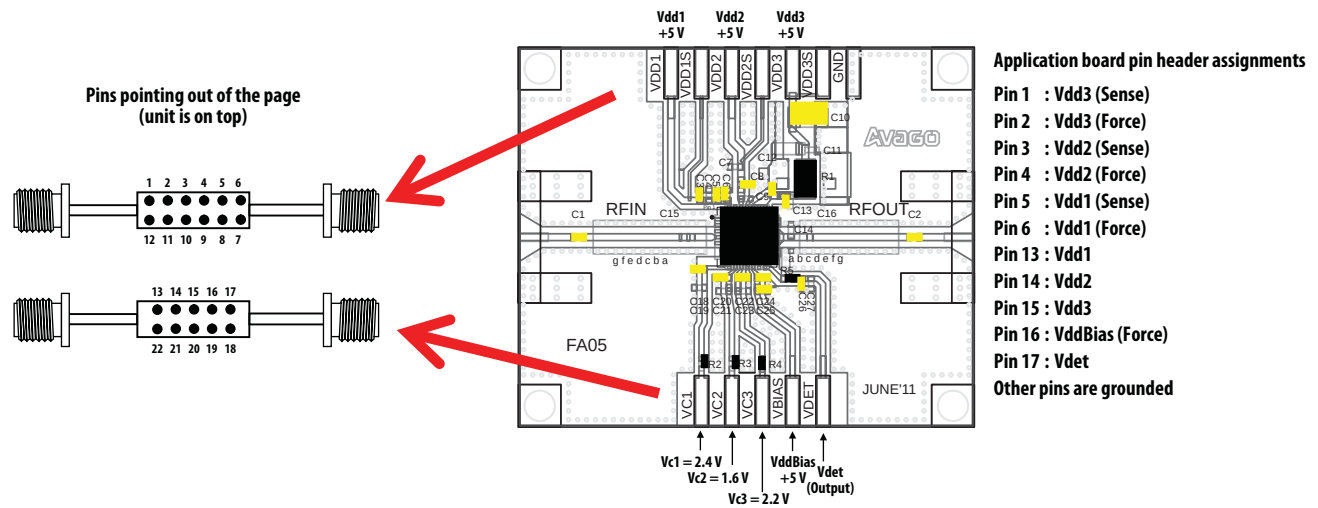
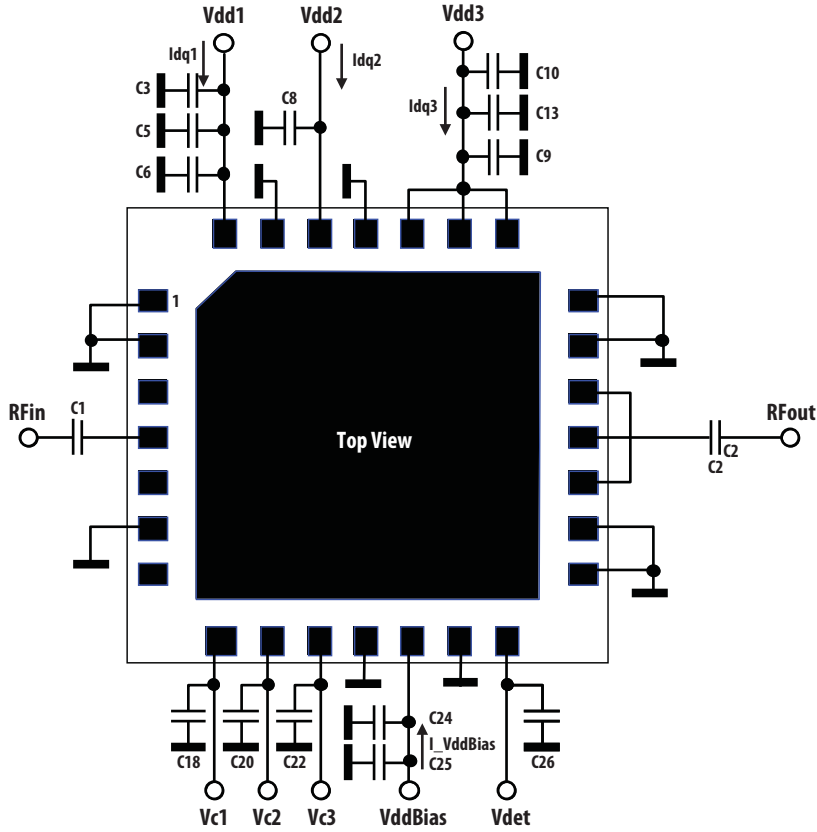


Figure 30. Demonstration board application circuit for MGA-43628 module

## 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.  $I_{dq1} = 60.0 \text{ mA}$ ,  $I_{dq2} = 110 \text{ mA}$ ,  $I_{dq3} = 270.0 \text{ mA}$ ,  $I_{V_{ddBias}} = 14.0 \text{ mA}$ .  $I_{dq1/2/3}$  are adjusted by voltages to CMOS-compatible control pins  $V_{c1/2/3}$  respectively. These typical bias currents were obtained with  $V_{c1/2/3}$  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-43628 typical $I_{c1}$ , $I_{c2}$ , $I_{c3}$ Vs $V_c$ performance unless otherwise stated

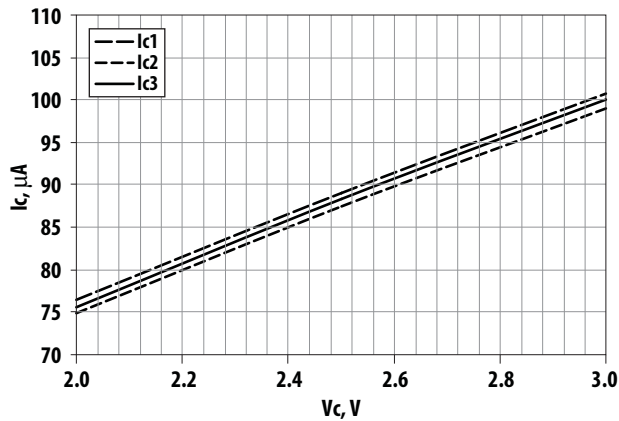


Figure 32.  $I_c$  Versus  $V_c$  at  $V_{dd} = V_{ddBias} = 5.0$  V

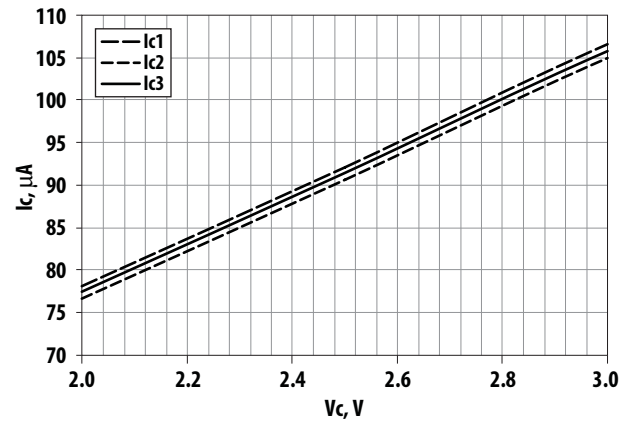
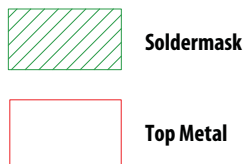
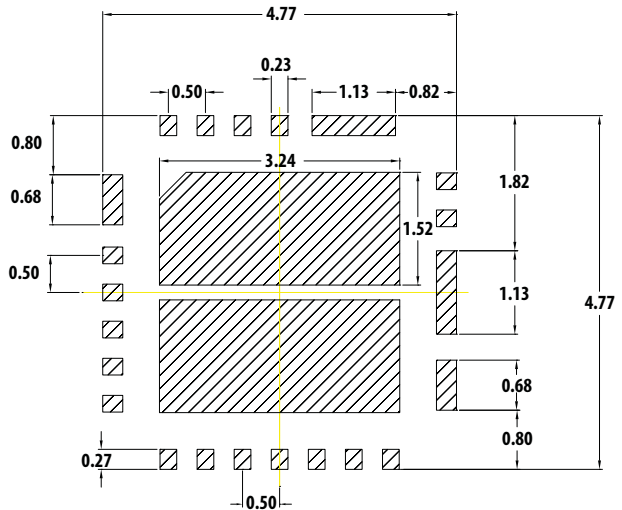
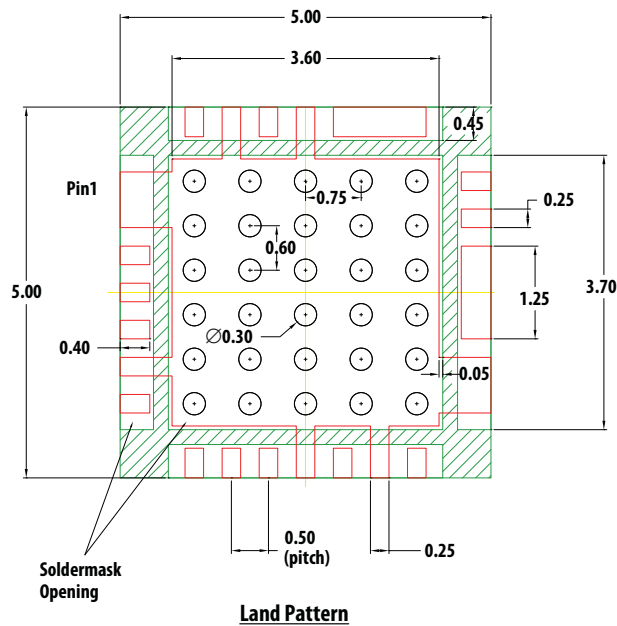


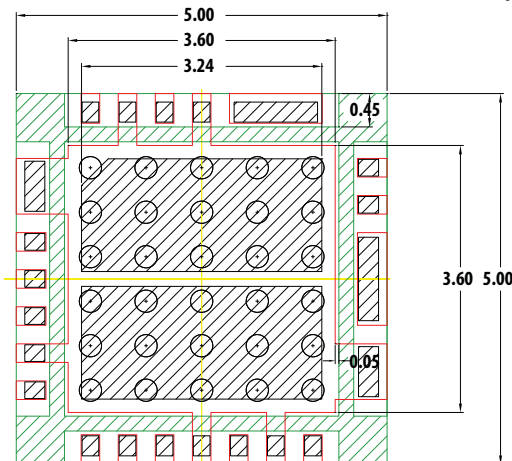
Figure 33.  $I_c$  Versus  $V_c$  at  $V_{dd} = V_{ddBias} = 5.5$  V

## PCB Land Pattern and Stencil Outline

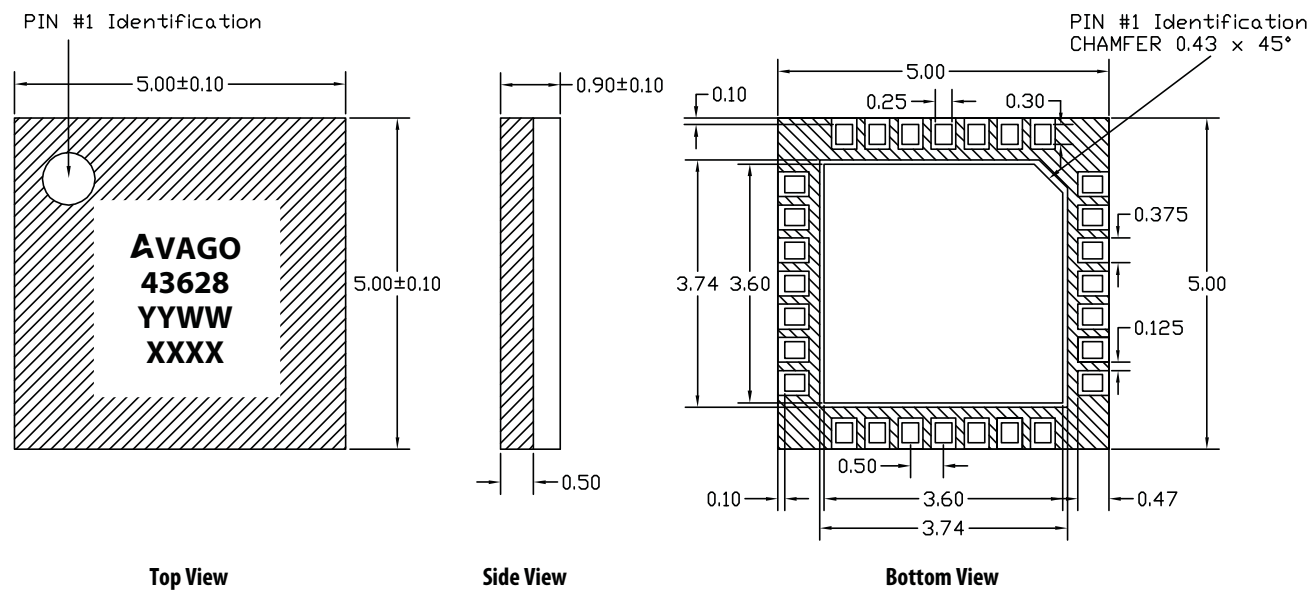


### Note :

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



## MCOB (5.0 x 5.0 x 0.9) mm 28-Lead Package Dimensions



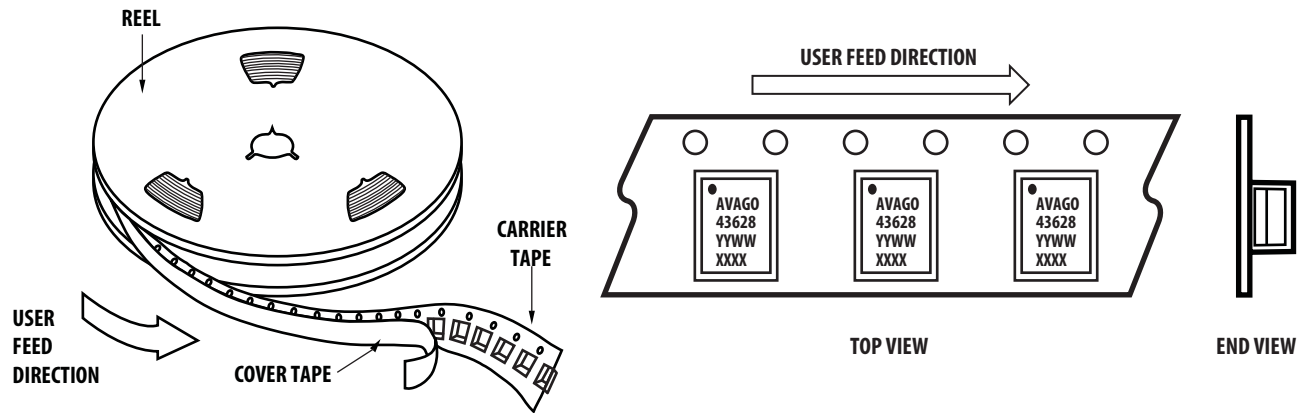
### Note

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

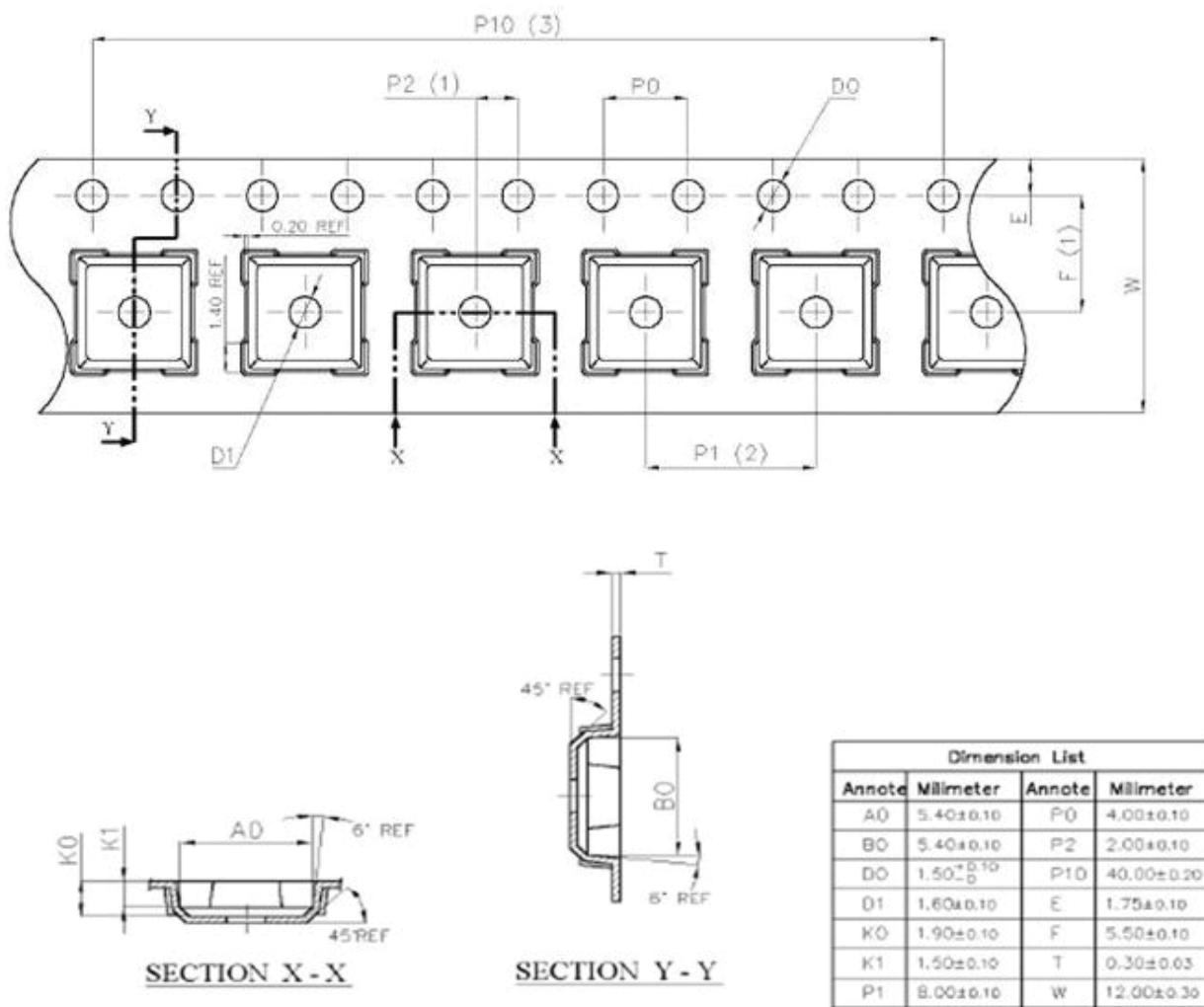
### Part Number Ordering Information

| Part Number    | Qty  | Container      |
|----------------|------|----------------|
| MGA-43628-BLKG | 100  | Antistatic Bag |
| MGA-43628-TR1G | 1000 | 7" Reel        |

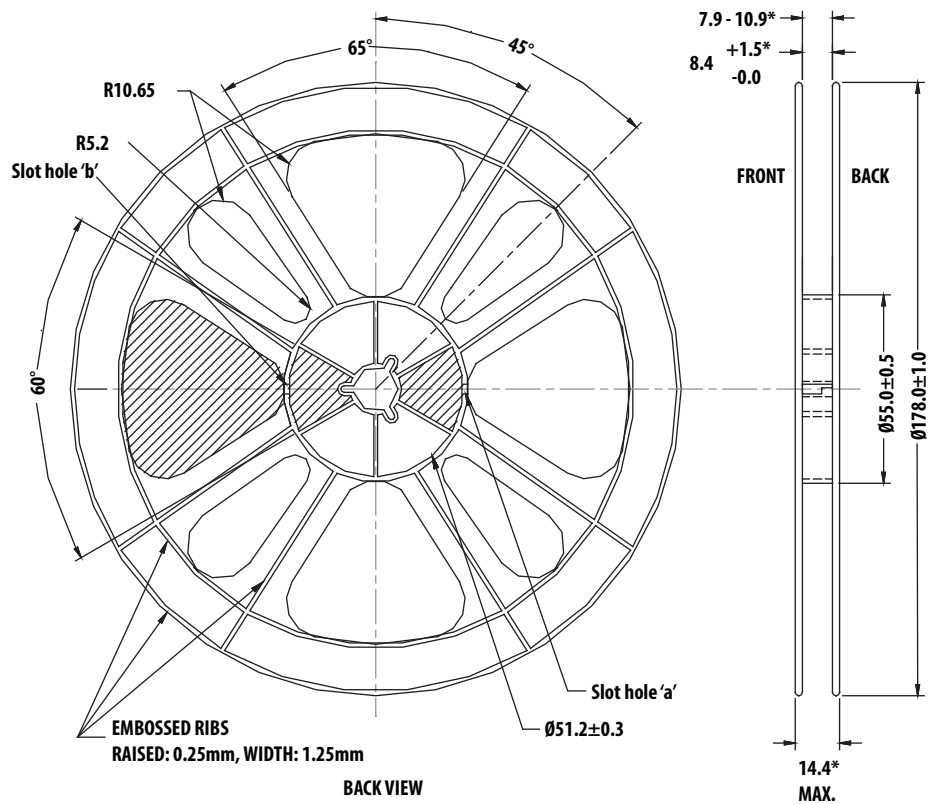
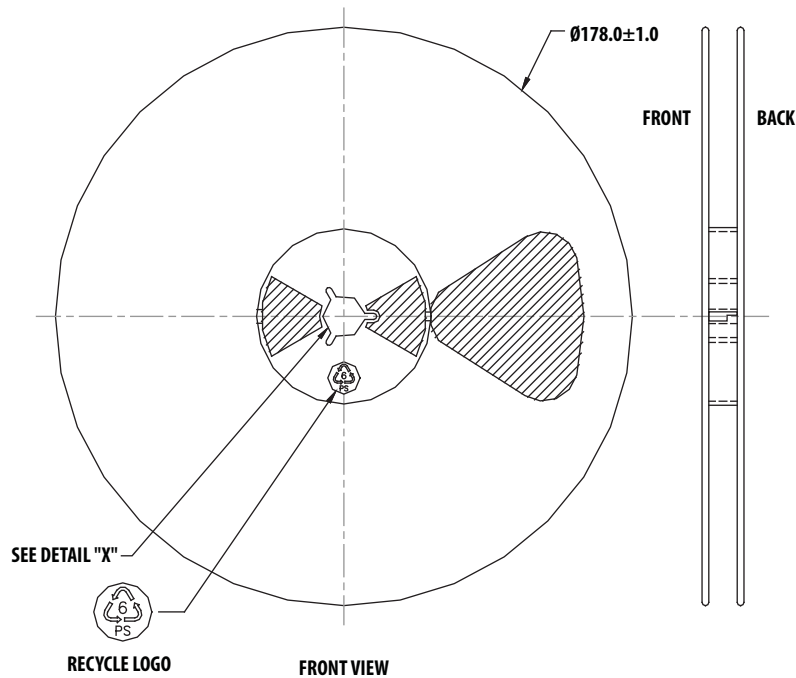
## Device Orientation



## Tape Dimensions



## 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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