

# PARAGON GA3224

## Preconfigured DSP System for Hearing Aids

### Description

The Paragon GA3224 hybrid is a programmable DSP system based on a two-channel compression circuit. It can be used as a platform for a wide range of hearing aid applications. Its extensive programmability and compact size make it ideal for sophisticated CIC applications. The reflowable thinSTAX<sup>®</sup> packaging enables easy use in BTE applications. This very versatile DSP hybrid is capable of multiple configurations and has a wide range of functions.

The Paragon GA3224 hybrid contains the GC5057 controller chip featuring Power On Reset (POR).

The Paragon GA3224 hybrid code programmed into the GC5057 controller chip is "8".

### Features

- Highly Configurable, Versatile DSP Platform
- High Quality, Two-channel AGC Signal Processing
- High Performance Data Converters – Dual, Over-sampled A/Ds; Over-sampled D/A with Efficient Switched-mode Output Power Amp
- High-fidelity Audio Quality
- Drives Zero-bias 2-terminal Receivers
- Multiple Communication Rates up to 85.3 kb/s
- thinSTAX Packaging – CIC Size
- Multi-memory
- Internal/External Volume Control
- Volume Control Taper determined by External VC
- Tri-state Memory Select Operation
- Audible Memory Change Indicator
- Also Available as E1 RoHS Compliant Hybrid

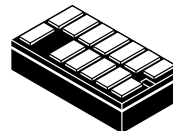
### thinSTAX Packaging

- Hybrid Typical Dimensions:  
0.227 x 0.125 x 0.060 in  
(5.76 x 3.18 x 1.52 mm)



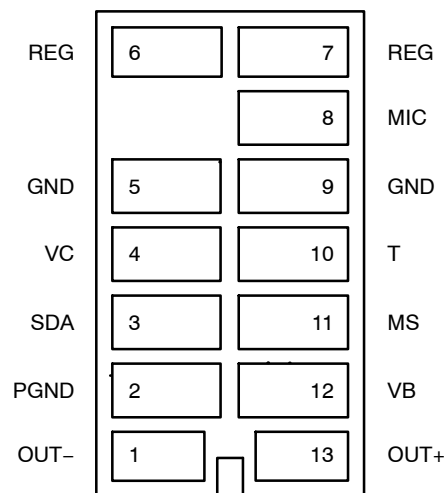
**ON Semiconductor<sup>®</sup>**

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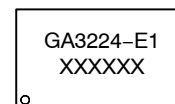
**13 PAD  
PARAGON  
CASE TBD**

### PAD CONNECTION



(Bottom View)

### MARKING DIAGRAM



GA3224 = Specific Device Code  
E1 = RoHS Compliant Hybrid  
XXXXXX = Work Order Number

### ORDERING INFORMATION

| Device      | Shipping <sup>†</sup>   |
|-------------|-------------------------|
| GA3224-E1   | 25 Units / Bubble Pack  |
| GA3224-E1-T | 500 Units / Tape & Reel |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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## BLOCK DIAGRAM

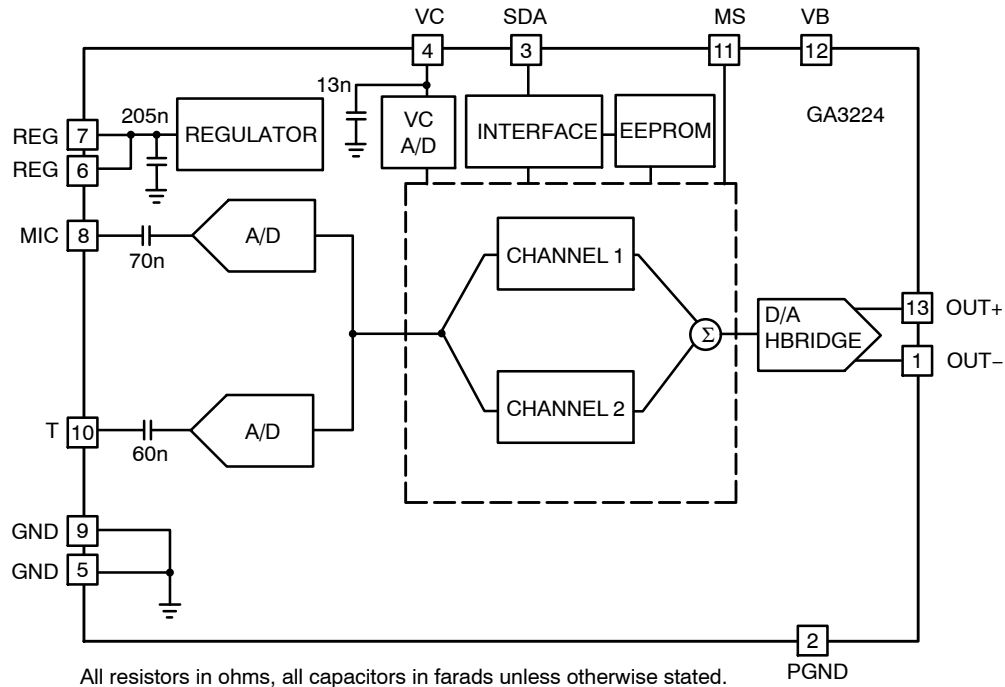


Figure 1. Paragon GA3224 Block Diagram

Table 1. ABSOLUTE MAXIMUM RATINGS

| Parameter                          | Value      | Units |
|------------------------------------|------------|-------|
| Operating Temperature Range        | -10 to +40 | °C    |
| Storage Temperature Range          | -20 to +70 | °C    |
| Absolute Maximum Power Dissipation | 25         | mW    |
| Maximum Operating Supply Voltage   | 1.5        | VDC   |
| Absolute Maximum Supply Voltage    | 2          | VDC   |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**WARNING:** Electrostatic Sensitive Device – Do not open packages or handle except at a static-free workstation.

**WARNING:** Moisture Sensitive Device – Non-RoHS Compliant – Level 3 MSL; RoHS Compliant – Level 4 MSL. Do not open packages except under controlled conditions.

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**Table 2. ELECTRICAL CHARACTERISTICS** (Conditions:  $V_B = 1.3\text{ V}$ ; Temperature =  $25^\circ\text{C}$ )

| Parameter                           | Symbol           | Conditions                                                       | Min   | Typ   | Max   | Units         |
|-------------------------------------|------------------|------------------------------------------------------------------|-------|-------|-------|---------------|
| Hybrid Current                      | $I_{AMP}$        | See current consumption section                                  | –     | 700   | –     | $\mu\text{A}$ |
| Minimum Operating Supply Voltage    | $V_{BOFF}$       | Ramp down                                                        | 0.94  | 1.0   | 1.05  | V             |
| Supply Voltage Turn On Threshold    | $V_{BON}$        | Ramp up                                                          | 1.06  | 1.10  | 1.16  | V             |
| Supply Voltage Hysteresis           | –                | –                                                                | 90    | 100   | 110   | mV            |
| Supply Voltage during Communication | $V_{BC}$         | During Communication                                             | 1.19  | 1.35  | 1.5   | V             |
| Hybrid Current during Communication | $I_P$            | Programming (<5 ms)                                              | –     | 3.7   | –     | mA            |
| EEPROM Burn Cycles                  | –                | (Note 2)                                                         | 100 k | –     | –     | cycles        |
| Low Frequency System Bandwidth      | –                | –                                                                | 100   | 140   | 225   | Hz            |
| High Frequency System Bandwidth     | –                | –                                                                | 15.2  | 16    | 16.8  | kHz           |
| Total Maximum System Gain           | $A_V$            | $V_{IN} = -95\text{ dBV}$ at 3 kHz;<br>squelch disabled (Note 1) | 81    | 83    | 85    | dB            |
| Converter Gain                      | $A_{CONV}$       | A/D + D/A gain                                                   | 27    | 29    | 31    | dB            |
| Total Harmonic Distortion           | THD              | $V_{IN} = -40\text{ dBV}$                                        | –     | 0.05  | 1     | %             |
| THD at Maximum Input                | THD <sub>M</sub> | $V_{IN} = -15\text{ dBV}$ , HRX – ON                             | –     | 1.5   | 3     | %             |
| Clock Frequency                     | $f_{clk}$        | –                                                                | 1.945 | 2.048 | 2.151 | MHz           |

## REGULATOR

|                            |                     |   |      |      |      |    |
|----------------------------|---------------------|---|------|------|------|----|
| Regulator Voltage          | $V_{REG}$           | – | 0.90 | 0.95 | 1.00 | V  |
| Regulator Supply Rejection | PSRR <sub>REG</sub> | – | –    | 50   | –    | dB |

## INPUT

|                                              |          |                                                             |      |      |      |            |
|----------------------------------------------|----------|-------------------------------------------------------------|------|------|------|------------|
| Input Referred Noise                         | IRN      | Bandwidth 100 Hz – 8 kHz                                    | –    | –108 | –106 | dBV        |
| Input Impedance                              | $Z_{IN}$ | –                                                           | 11.2 | 16   | 22   | k $\Omega$ |
| Anti-alias Filter Rejection (input referred) | –        | $f = f_{clk} - 8\text{ kHz}$ ,<br>$V_{IN} = -40\text{ dBV}$ | –    | 80   | –    | dB         |
| Maximum Input Level                          | –        | –                                                           | –    | –15  | –    | dBV        |
| Input Dynamic Range                          | –        | HRX – ON,<br>Bandwidth 100 Hz – 8 kHz                       | –    | 93   | –    | dB         |
| Audio Sample Rate                            | –        | –                                                           | 30.4 | 32   | 33.6 | kHz        |
| A/D Dynamic Range                            | –        | Bandwidth 100 Hz – 8 kHz                                    | –    | 86   | –    | dB         |

## OUTPUT

|                            |           |                           |    |    |    |          |
|----------------------------|-----------|---------------------------|----|----|----|----------|
| Maximum RMS Output Voltage | –         | 0 dBFS $f = 1\text{ kHz}$ | –3 | –1 | 1  | dBV      |
| D/A Dynamic Range          | –         | Bandwidth 100 Hz – 8 kHz  | 80 | –  | –  | dB       |
| Output Impedance           | $Z_{OUT}$ | (Note 2)                  | –  | –  | 20 | $\Omega$ |

## VOLUME CONTROL

|                           |            |   |      |     |      |            |
|---------------------------|------------|---|------|-----|------|------------|
| Volume Control Resistance | $R_{VC}$   | – | 160  | 200 | 240  | k $\Omega$ |
| Volume Control Range      | $\Delta A$ | – | 47.5 | 48  | 48.5 | dB         |

## MS INPUT

|            |    |   |              |   |              |   |
|------------|----|---|--------------|---|--------------|---|
| Low State  | Lo | – | 0            | – | $V_{REG}/3$  | V |
| Open State | Z  | – | $V_{REG}/3$  | – | $2V_{REG}/3$ | V |
| High State | Hi | – | $2V_{REG}/3$ | – | $V_B$        | V |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

- Total System Gain consists of: Wideband System Gain + High and Low Independent Channel Gains + Converter Gain.  
Total System Gain is calibrated during Cal/Config process.
- Sample tested.

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**Table 2. ELECTRICAL CHARACTERISTICS** (Conditions:  $V_B = 1.3$  V; Temperature = 25°C)

| Parameter                                             | Symbol            | Conditions | Min   | Typ   | Max   | Units |
|-------------------------------------------------------|-------------------|------------|-------|-------|-------|-------|
| <b>SDA INPUT</b>                                      |                   |            |       |       |       |       |
| Logic 0 Voltage                                       | –                 | (Note 2)   | 0     | –     | 0.3   | V     |
| Logic 1 Voltage                                       | –                 | (Note 2)   | 1     | –     | 1.3   | V     |
| <b>SDA OUTPUT</b>                                     |                   |            |       |       |       |       |
| Standby Pull Up Current                               | –                 | –          | 1.4   | 2     | 2.6   | μA    |
| Sync Pull Up Current                                  | –                 | –          | 450   | 500   | 550   | μA    |
| Logic 0 Current (Pull Down)                           | –                 | –          | 225   | 250   | 275   | μA    |
| Logic 1 Current (Pull Up)                             | –                 | –          | 225   | 250   | 275   | μA    |
| Synchronization Time<br>(Synchronization Pulse Width) | T <sub>SYNC</sub> | Baud = 0   | 237   | 250   | 263   | μs    |
|                                                       |                   | Baud = 1   | 118   | 125   | 132   |       |
|                                                       |                   | Baud = 2   | 59    | 62.5  | 66    |       |
|                                                       |                   | Baud = 3   | 29.76 | 31.25 | 32.81 |       |
|                                                       |                   | Baud = 4   | 14.88 | 15.63 | 16.41 |       |
|                                                       |                   | Baud = 5   | 7.44  | 7.81  | 8.20  |       |
|                                                       |                   | Baud = 6   | 3.72  | 3.91  | 4.10  |       |
|                                                       |                   | Baud = 7   | 1.86  | 1.95  | 2.05  |       |

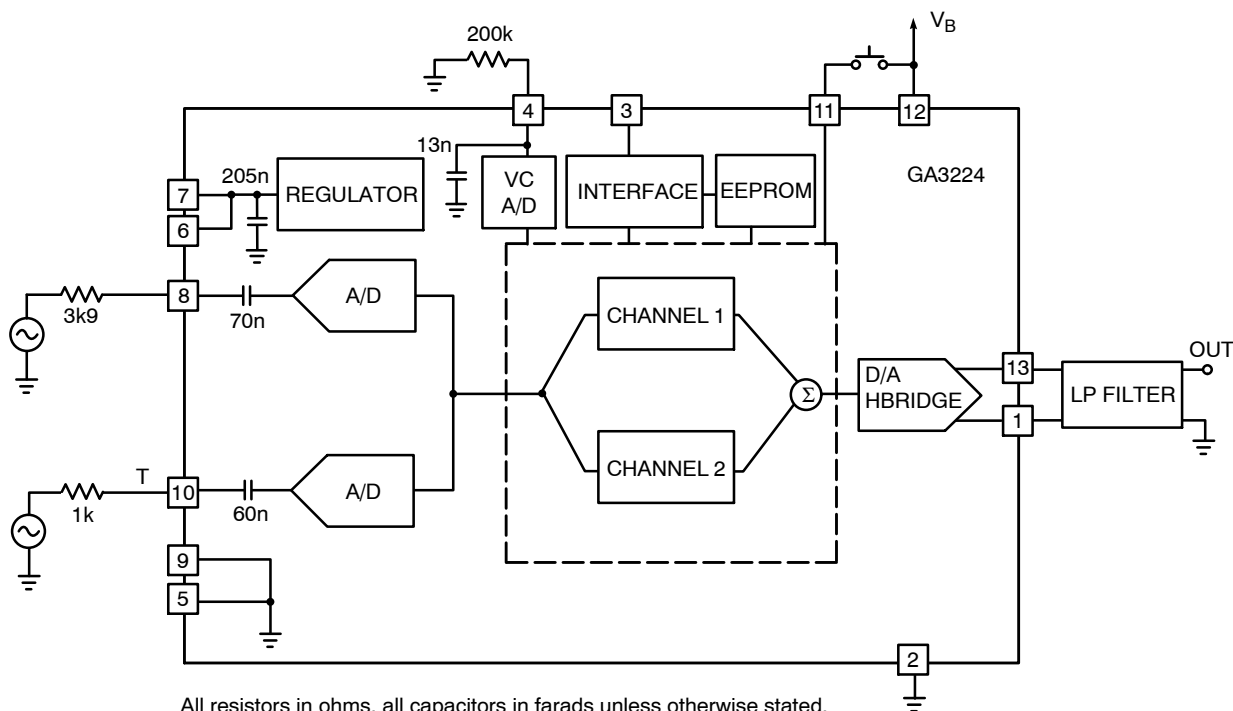
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1. Total System Gain consists of: Wideband System Gain + High and Low Independent Channel Gains + Converter Gain.  
Total System Gain is calibrated during Cal/Config process.
2. Sample tested.

## Support Software

Paragon GA3224 is fully supported ON Semiconductor's software tools available from ARKonline® website <http://ark.onsemi.com/>.

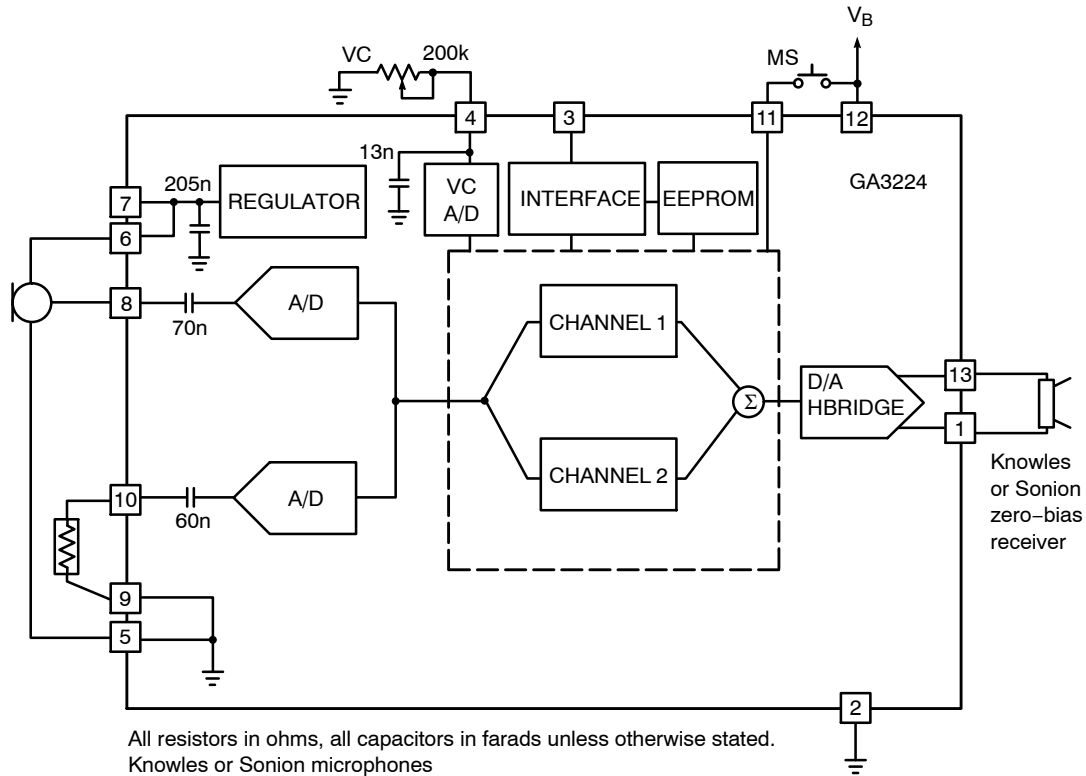
## TYPICAL APPLICATIONS



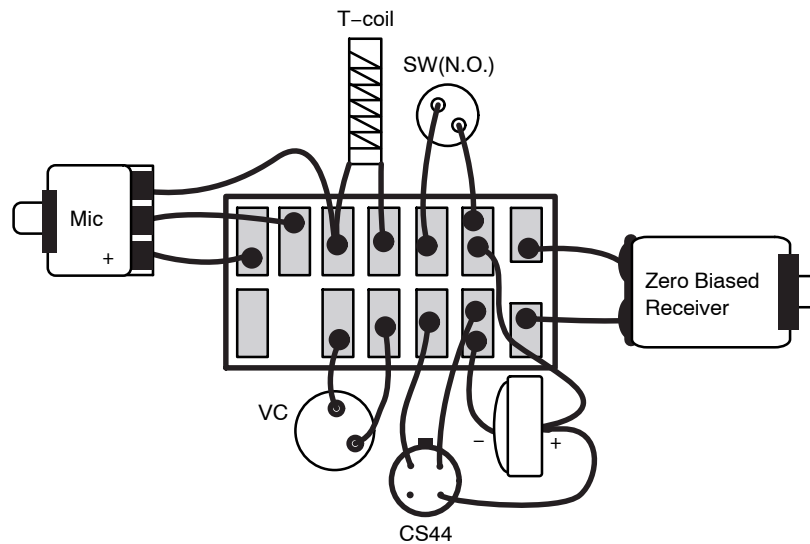
### Figure 2. Test Circuit

# PARAGON GA3224

## TYPICAL APPLICATIONS (Continued)



**Figure 3. Sample Application Circuit**



**Figure 4. Assembly Diagram**

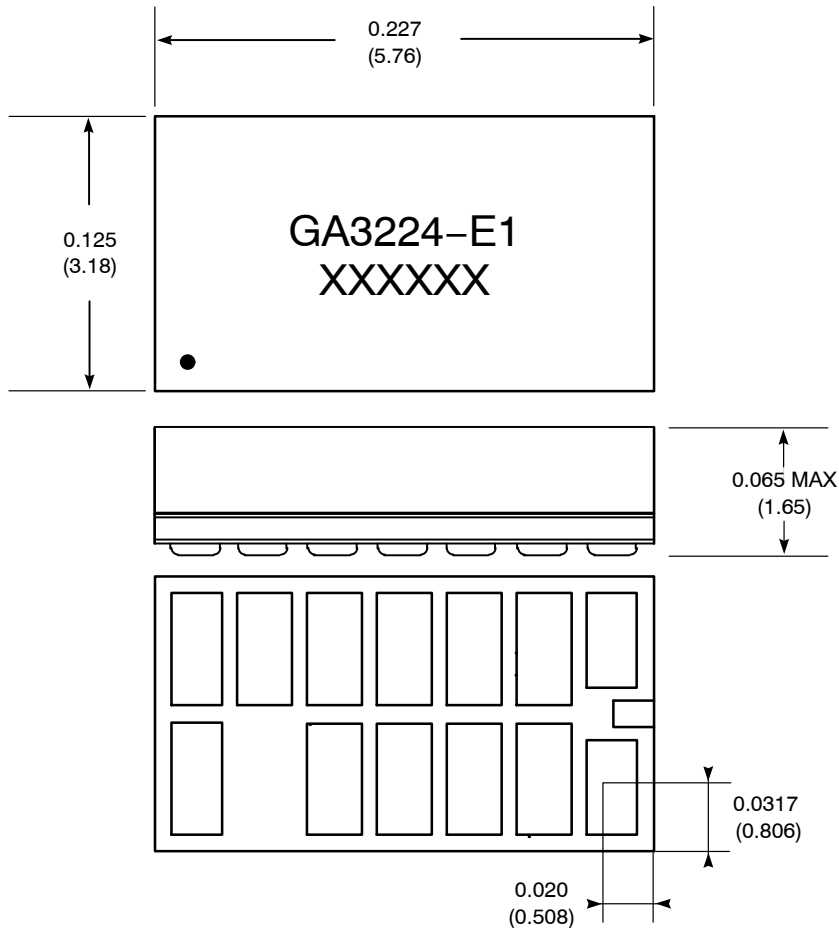
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**Table 3. PAD POSITION AND DIMENSIONS**

| Pad No. | Pad Position |       | Pad Dimensions |            |
|---------|--------------|-------|----------------|------------|
|         | X            | Y     | Xdim (mil)     | Ydim (mil) |
| 1       | 0            | 0     | 23.0           | 40.5       |
| 2       | -31.5        | 3     | 24.0           | 46.5       |
| 3       | -63.0        | 3     | 23.0           | 46.5       |
| 4       | -94.0        | 3     | 23.0           | 46.5       |
| 5       | -125.0       | 3     | 23.0           | 46.5       |
| 6       | -187.0       | 3     | 23.0           | 46.5       |
| 7       | -187.0       | 64.5  | 23.0           | 46.5       |
| 8       | -156.0       | 64.5  | 23.0           | 46.5       |
| 9       | -125.0       | 64.5  | 23.0           | 46.5       |
| 10      | -94.0        | 64.5  | 23.0           | 46.5       |
| 11      | -63.0        | 64.5  | 23.0           | 46.5       |
| 12      | -31.5        | 64.5  | 24.0           | 46.5       |
| 13      | 0            | 67.5  | 23.0           | 40.5       |
| Pad No. | X            | Y     | Xdim (mm)      | Ydim (mm)  |
| 1       | 0            | 0     | 0.584          | 1.029      |
| 2       | -0.800       | 0.076 | 0.610          | 1.181      |
| 3       | -1.600       | 0.076 | 0.584          | 1.181      |
| 4       | -2.388       | 0.076 | 0.584          | 1.181      |
| 5       | -3.175       | 0.076 | 0.584          | 1.181      |
| 6       | -4.750       | 0.076 | 0.584          | 1.181      |
| 7       | -4.750       | 1.638 | 0.584          | 1.181      |
| 8       | -3.962       | 1.638 | 0.584          | 1.181      |
| 9       | -3.175       | 1.638 | 0.584          | 1.181      |
| 10      | -2.388       | 1.638 | 0.584          | 1.181      |
| 11      | -1.600       | 1.638 | 0.584          | 1.181      |
| 12      | -0.800       | 1.638 | 0.610          | 1.181      |
| 13      | 0            | 1.715 | 0.584          | 1.029      |

# PARAGON GA3224

## PACKAGE DIMENSIONS



Dimension units are in inches.

Dimensions in parentheses are in millimeters, converted from inches and include minor rounding errors.

1.000 inches = 25.4 mm

Dimension tolerances:  $\pm 0.003$  ( $\pm 0.08$ ) unless otherwise stated.

• = location of Pin 1

RoHS compliant hybrid, MSL#4

This Hybrid is designed for either point-to-point manual soldering or for reflow according to ON Semiconductor's reflow process.

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