# Part No. EC696

## SP4T RF Switch

100 MHz to 3000 MHz

Supports: Cellular, LTE/5G, BT, Wi-Fi, RFID, ISM, LPWA, LTE-M, NB-IoT


**Covering Cellular, LTE/5G, BT, LPWA, Wi-Fi, ISM, and RFID bands**

100 MHz to 3000 MHz

### KEY BENEFITS

**Operation Frequency:**

100 MHz to 3000 MHz

**RF Switch:**

Ultra-low loss SP4T (shunt less architecture )

Exceptional Linearity (II3P+ 80 dBm)

**End user advantages:**

Ability to re-tune the antenna across bands.

**System Approach-easy integration**

Total solution. The antenna, RFIC and algorithms are co-designed and optimized as a system to provide an easy to integrate, cost effective solution

### APPLICATIONS

- Wearables
- Tablets and Notebooks
- IoT/M2M Products
- Other Wireless Devices

KYOCERA AVX EC696 uses Ether Switch&Tune™ technology and high-performance RF switching to solve the challenges facing today's wireless industry and product designers. EC696 allows the RF front-end to cover global bands and seamlessly improve performance in a dynamically changing RF environment by employing active tuning. EC696 can be used in a variety of applications including wearables, cell phones, or IoT/M2M products.

Ether Switch&Tune™ technology and the EC696 provide wider global band coverage (including LTE/5G) with a single antenna element using parasitic loading and active tuning techniques to improve RF front-end performance, especially for stringent low band antenna efficiency requirements. Combining KYOCERA AVX extensive antenna systems expertise and proprietary algorithms, the EC696 can seamlessly adjust the characteristics of a wireless antenna to:

- Cover all 4G/5G cellular, LPWA, BT, Wi-Fi, ISM and RFID bands
- Retune the antenna for frequency shifts
- Reduce the antenna's physical volume by up to 50 percent without performance tradeoffs.

### Global Operation and Design Support

EC696 is supported by a full set of product documentation, and when needed, by the expertise of RF engineers who have integrated hundreds of antenna and RF system designs into wireless devices.

KYOCERA AVX global operations encompass an integrated network of design centers that provide local customer support.

### Mechanical Specifications & Ordering Part Number

| Ordering Part Number | EC696 |
|---|---|
| Dimensions (mm) | 1.10 x 1.50 x 0.45 |
| Operating Temperature (ºC) | -40 to + 85 |
| Package | 10- Pin LGA Package |

**SP4T RF switch specifications**
**KYOCERA AVX produces a wide variety of standard products to meet user needs**

## Main Specifications

Electrical specification at 25 ºc, Vdd = 2.8 V, 50 ohms Com= Ground
RF Performance measured using reflected power method through ports RF1 through FR4

| Parameter | Symbol | Min | Typ | Max | Unit | Conditions |
|---|---|---|---|---|---|---|
| Operating Frequency | f0 | 700 | | 3000 | MHz | |
| Startup Time | tsu | | | 30 | us | Time from VDD within specification to all performance within specification. DC path to ground at RF ports. |
| Ron | Ron | | 1.3 | | Ω | RFC to ON RF Port |
| Coff | Coff | | 200 | | fF | OFF RF Port to ground |
| Second Harmonic | 2f0 | -67 | | | dBm | f0 @ 836 MHz, + 35 dBm |
| Third Harmonic | 3f0 | -61 | | | dBm | f0 @ 836 MHz, + 35 dBm |
| Third Order Intercept Point | IIP3 | | 82 | | dBm | 836 MHz |
| | | | 75 | | dBm | 1910 MHz |
| Second Order Intercept Point | IIP2 | | 125 | | dBm | 836 MHz |
| | | | 126 | | dBm | 1950 MHz |
| Harmonic Knee Point | HKP | | 41 | | dBm | 836 MHz, OFF condition |
| Switching Time | tsw | | 5 | | us | 50% control to 10%/90% RF.<br>DC path to ground at RF ports. |



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## Operating Ranges

Operation should be restricted to the limits in the Operating Ranges table.

| Parameter | Symbol | Min | Typ | Max | Unit | Conditions |
|---|---|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | 2.5 | 2.8 | 3 | V | |
| Supply Current | $I_{DD}$ | | 94 | | µA | |
| Control Voltage High | $V_{IH}$ | 1.8 | | $V_{dd}$ | V | |
| Control Voltage Low | $V_{IL}$ | | | 0.4 | V | |
| Operating Temperature | $T_{OP}$ | -40 | | +85 | °C | |
| Storage Temperature | $T_{ST}$ | -65 | | +150 | °C | |
| Input Control Current | $V_{IH}$ | | | 1 | µA | High Control State |

## Absolute Maximum Ratings

Exceeding maximum ratings may cause permanent damage.

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage | VDD | 0 | 3 | V |
| Control Voltage | VI | 0 | 3 | V |
| ESD Voltage | HBM | 1k | | V |



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## Digital Interface

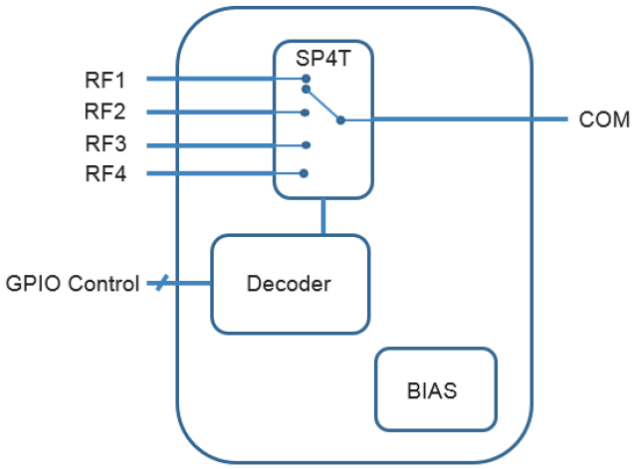
The EC696 supports a GPIO digital interface.

## RF Switch Truth Table

| S1 | S0 | RF1 | RF2 | RF3 | RF4 |
|---|---|---|---|---|---|
| Low | Low | ON | OFF | OFF | OFF |
| Low | High | OFF | ON | OFF | OFF |
| High | Low | OFF | OFF | ON | OFF |
| High | High | OFF | OFF | OFF | ON |

## Block Diagram

The EC696 block diagram provides a versatile implementation for many antenna configurations supported by KYOCERA AVX antennas.



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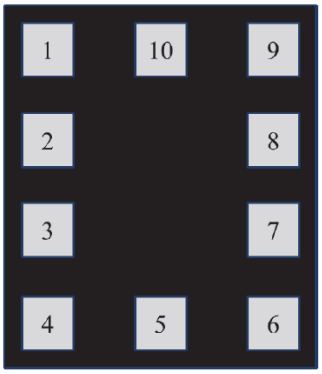
## Mechanical Overview and Pin Configuration (Top View)

| | |
|---|---|
| Size (mm) | 1.10 x 1.50 x 0.45 |
| Mounting | Surface Mount |
| Packaging | Tape & Reel |




EC696 Footprint
-Top View-

## Pin Description

| Pin Number | Pin Name | Pin Type | Description |
|---|---|---|---|
| 1 | RF1 | RF | RF Switch Port1 |
| 2 | RF2 | RF | RF Switch Port2 |
| 3 | GND | Ground | Ground |
| 4 | VDD | Power | Power Supply |
| 5 | GPIO0 | RF | Switch Control 0 |
| 6 | GPIO1 | RF | Switch Control 1 |
| 7 | GND | Ground | Ground |
| 8 | RF4 | RF | RF Switch Port 4 |
| 9 | RF3 | RF | RF Switch Port 3 |
| 10 | COM | RF | RF Common |



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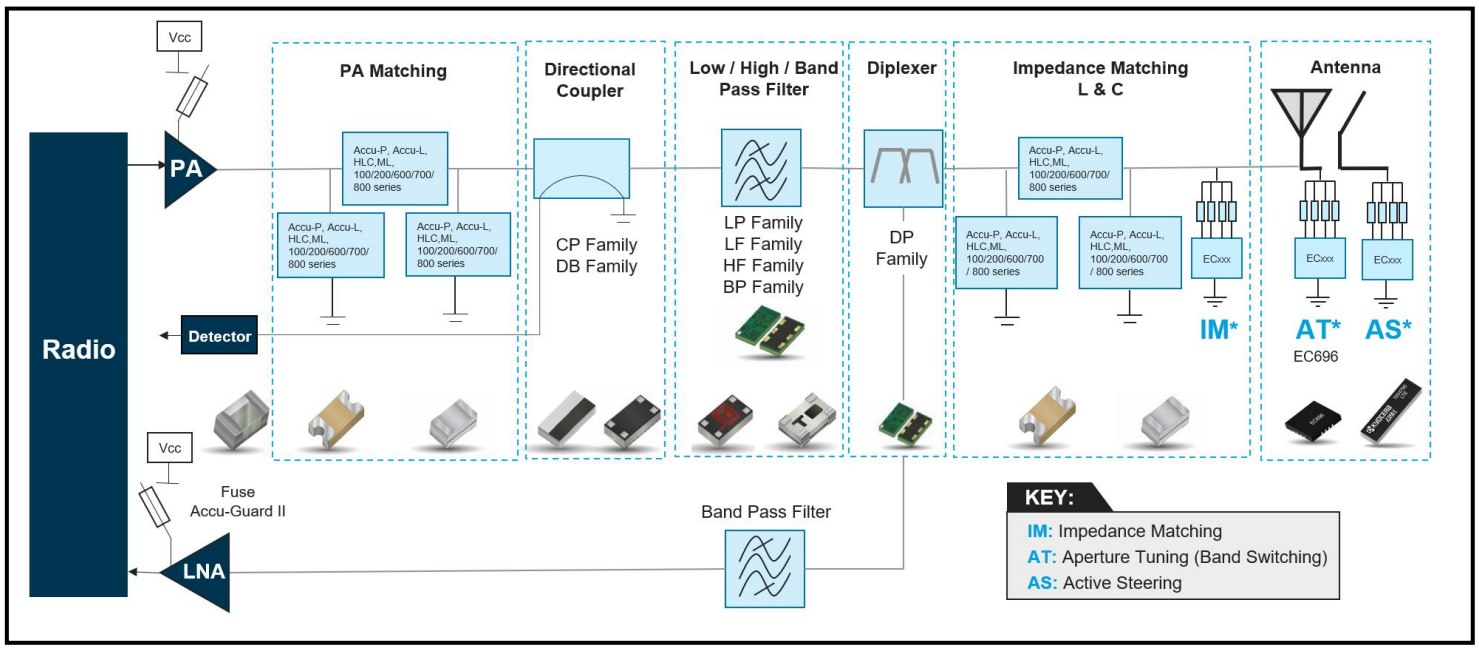
## Application Support

KYOCERA AVX provides a broad range of components and products to meet the needs of high-performance RF front-end solutions across the increasing diversity of wireless applications. Supported applications and functions include power amplifier matching, directional coupling, filtering and duplexing, impedance matching, and active and passive antenna solutions.

As shown in the diagram below, the EC696 RF switch is particularly well-suited for active antenna tuning applications. KYOCERA AVX will work with your engineering team to create an optimal solution for your application, including custom antennas (using KYOCERA AVX's proprietary antenna technology), custom software as needed, and an EC696 implementation configured for your specific performance requirements.




**KYOCERA AVX RF Front-End Product Families**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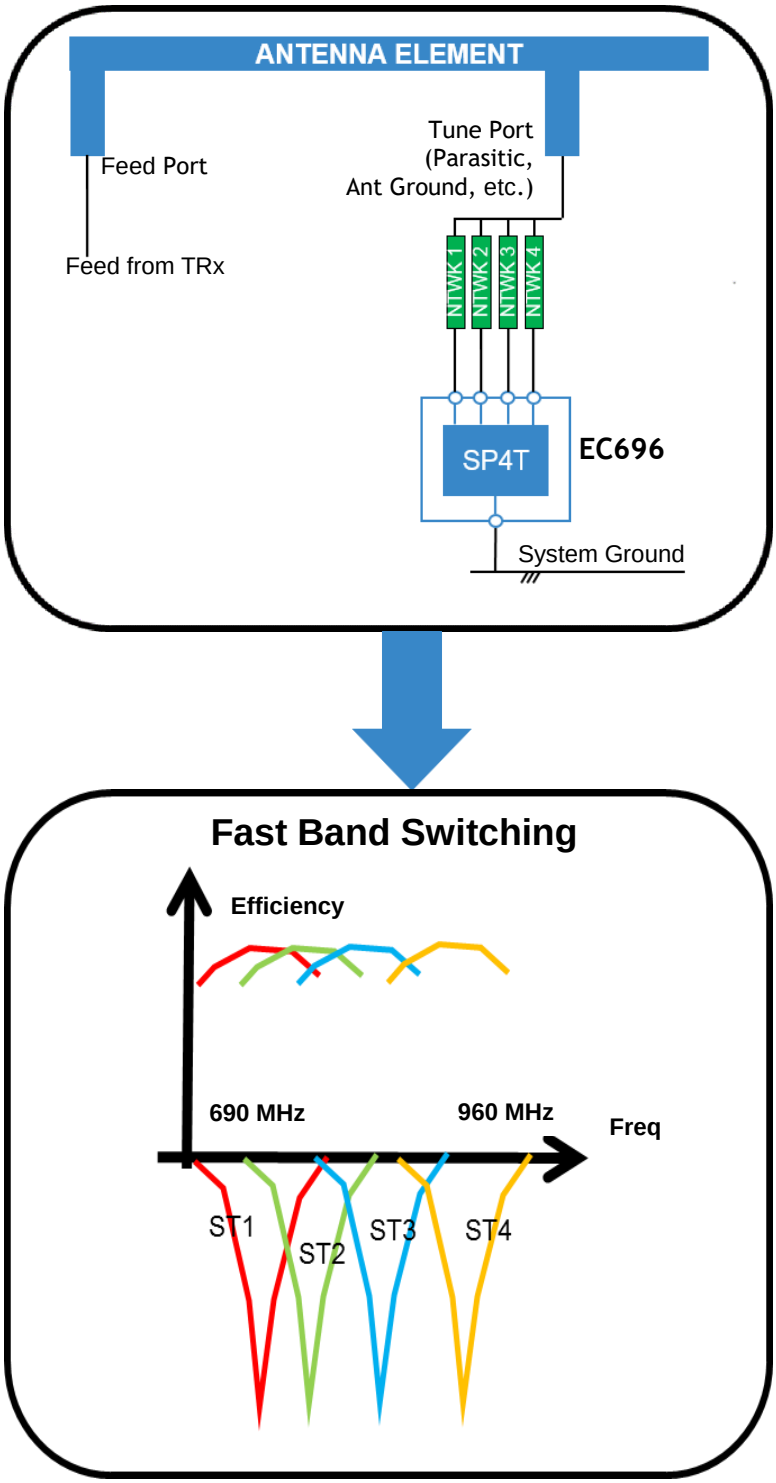
## Application Example




NTWK 1-4 are tuning networks (Typically Single L, C or an open)
Only RF connections shown

Grounding the RFC port is the recommended configuration providing high integrity RF board layout and best performance.

There are many potential applications. In the commonly used low band, band switching example shown, application designs must be adjusted to the specific antenna characteristics.

Please contact our FAE for additional support.



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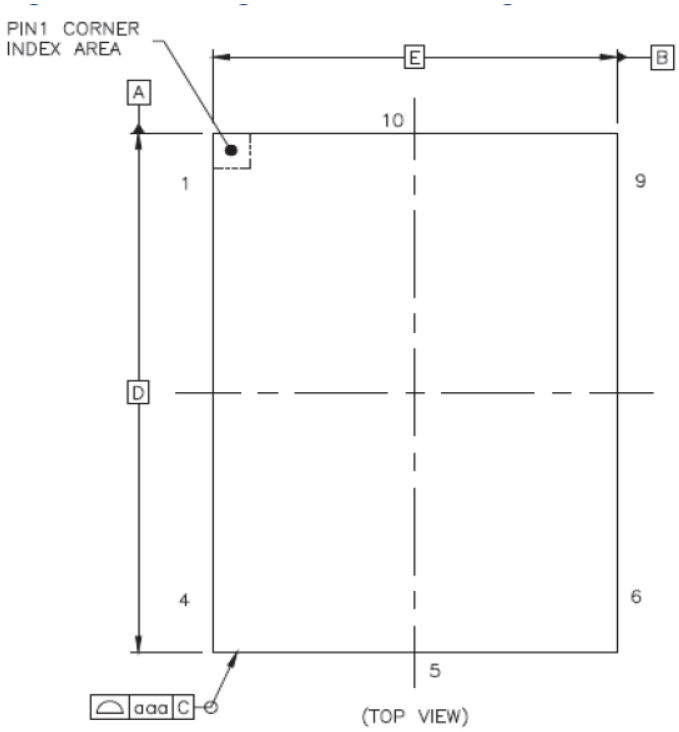
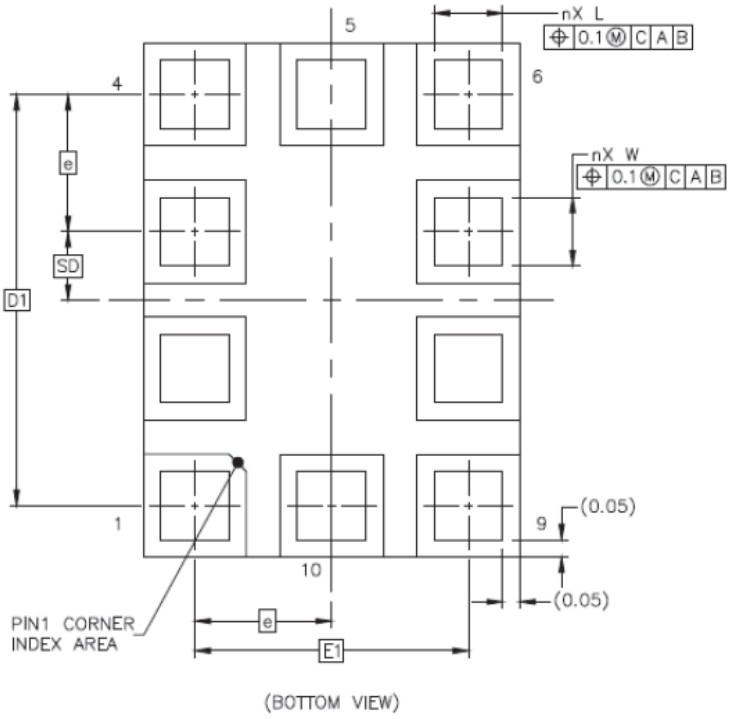
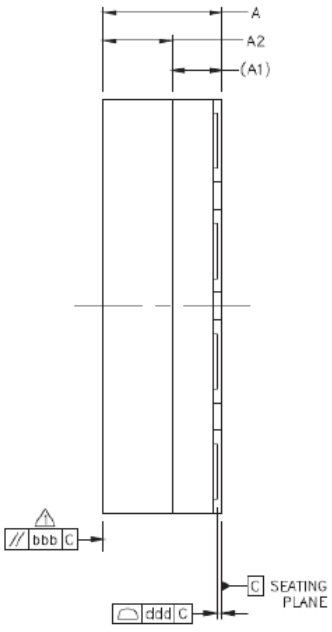
## Package Outline Drawing




| | Symbols | Dimensions in Millimeters | | |
|---|---|---|---|---|
| | | MIN | NOM | MAX |
| Total thickness | A | --- | --- | 0.5 |
| Substrate Thickness | A1 | 0 | 0.18 | REF |
| Mold thickness | A2 | | 0.25 | REF |
| Body size | D | 1.5 | | BSC |
| | E | 1.1 | | BSC |
| Lead pitch | e | 0.4 BSC | | |
| Lead length | L | 0.15 | 0.2 | 0.25 |
| Lead Width | W | 0.15 | 0.2 | 0.25 |
| Lead Count | n | 10 | | |
| EDGE BALL CENTER TO CENTER | D1 | 1.2 BSC | | |
| | E1 | 0.8 BSC | | |
| BODY CENTER TO CONTACT BALL | SD | 0.2 BSC | | |
| | SE | --- BSC | | |
| Package edge tolerance | aaa | 0.1 | | |
| Mold flatness | bbb | 0.1 | | |
| Coplanarity | ddd | 0.08 | | |



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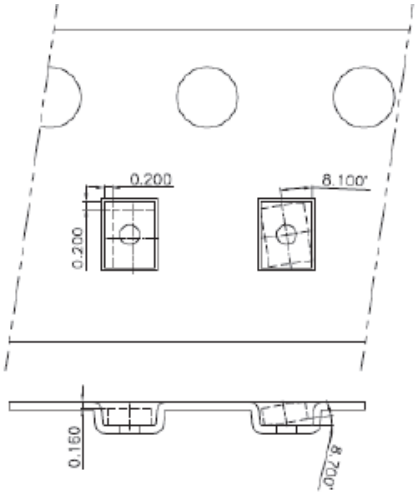
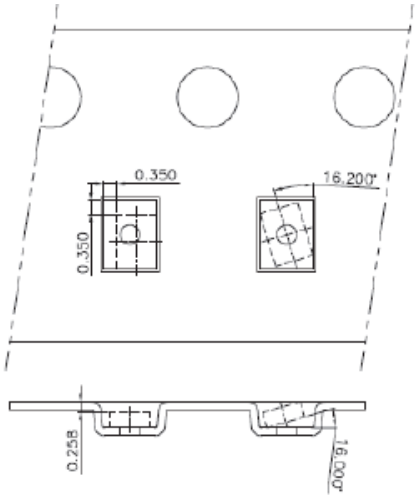
## Packaging Information

Tape & Reel specifications



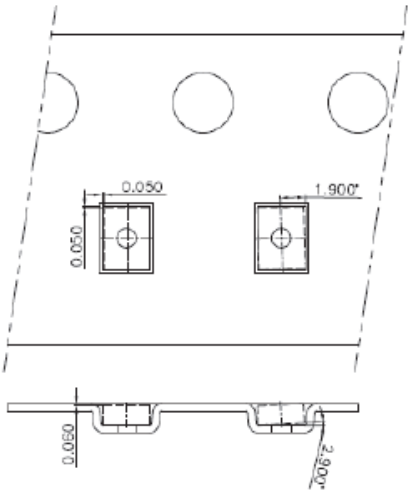

NOM POCKET
Ao = 1.30
Bo = 1.70
Ko = 0.61

NOM PART
E = 1.10
D = 1.50
A = 0.45




MAX POCKET
Ao = 1.35
Bo = 1.75
Ko = 0.66

MIN PART
E = 1.00
D = 1.40
A = 0.40




MIN POCKET
Ao = 1.25
Bo = 1.65
Ko = 0.56

MAX PART
E = 1.20
D = 1.60
A = 0.50



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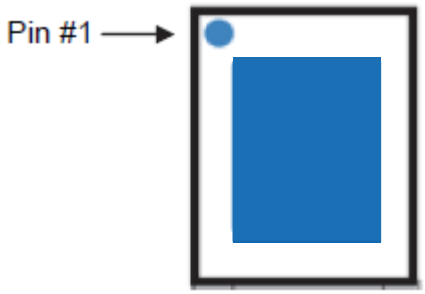
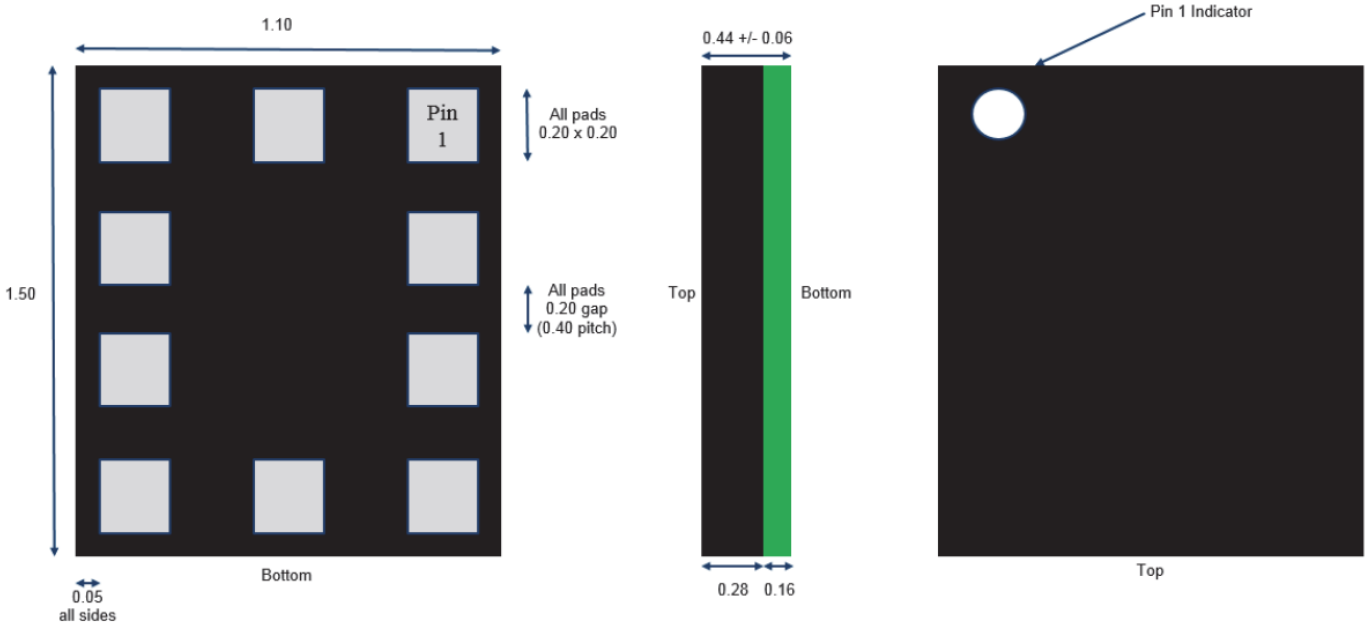
## Product Marking Codes and Ordering Information

A Marking Code can be found on the EC696 and it's referring to the Production Date.




| Order Code | Package | Model Description | Shipping Method |
|---|---|---|---|
| EC696 | 10-Lead SMT 1.10 X 1.50 X 0.45 $mm^3$ | GPIO | 3000 units/T&R |

## Mechanical Specification



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