

ASL5xxxyHz

Matrix LED Controller (MLC)

Rev. 1.0 — 24 May 2019 Product brief

1 General description

The ASL5xxxyHz family is a fully featured and flexible Matrix LED Controller (MLC). It provides a cost effective design solution, specifically targeting advanced automotive exterior lighting applications. The family consists of part numbers with different maximum currents and different driving modes, Smart and direct PWM.

Smart PWM part numbers determine PWM dimming duty cycle from information stored inside the MLC in the form of dimming polynomial curve coefficients. These coefficients are programmable by the customer according to the dimming profile they would like to see. The MLC uses these polynomial coefficients to calculate the PWM duty cycle to 12-bit resolution. The MLC also provides the capability to increase the speed of the PWM dimming curve dynamically or sequence several PWM dimming curves together.

It is possible to store polynomials for up to eight PWM dimming curves. By storing these polynomial coefficients internally, it is not necessary for the microcontroller to send updated PWM dimming information to each LED switch continuously. Instead, the microcontroller selects the PWM curve and LED to which it must be applied. Therefore, the PWM dimming information from the microcontroller is reduced, which reduces the volume of data transfer from the microcontroller to the MLC.

The MLC also provides the functionality to correct for LED brightness variations. This feature is especially useful to ensure a homogenous light output from LEDs that have luminance variations with the same LED current.

The MLC has many diagnostic features, including:

- Direct NTC feedback for monitoring the LED temperature
- Direct identification resistor input for PCB characterization
- Single LED open/short detection and protection
- Internal IC junction temperature monitoring
- Power-on-Reset (POR) monitoring; mandatory for off-board configuration and following safety requirements
- Power OK bit (POK) to ensure that the complete MLC is working as expected
- External components (NTC, ID resistor, charge pump capacitor) monitoring and fail detection
- Full communication diagnosis, including flagging illegal actions
- Possibility to clear Open Circuit (OC) and Short Circuit (SC) flags and reset the internal mosfets dynamically and without a need of a power-on-reset

All this diagnostic information is available to the microcontroller via the MLC interface. A microcontroller controls the MLC through a high-speed serial CAN interface. Through this interface, the microcontroller can control up to 32 MLCs, enabling control of up to 384 LEDs or segments.

The MLC has an internal 200 MHz oscillator that avoids the need of an external quartz (reducing system cost and providing better EMC behavior) for synchronization and clock

generation. All the internal clocks are synchronized with the internal oscillator and the trimming is done via the CAN message (CAN-ID). This process allows for a very accurate clock (accuracy < 0.25 %).

The MLC can be mounted close to the LEDs on an IMS PCB. Because the pinning has been optimized to avoid any crossing tracks, a single-layer PCB can be used. The ASL5xxxyHz family is available in automotive-qualified, thermally enhanced, 36-pin HVQFN and 48-pin HLQFP packages.

The device is designed to meet the stringent requirements of automotive applications, being fully AEC Q100 grade 1 and AEC Q006 qualified. It operates over the –40 °C to +125 °C ambient temperature range.

The Matrix LED Controller (MLC) also offers the possibility to be driven in direct PWM mode. In this mode, the microcontroller needs to update the PWM value in every channel with a certain cycle, determined by the system specifications. These part numbers, ASL5115yHz and ASL5108yHz, also offer 12-bit resolution to ensure a smooth dimming performance to avoid glitches in the output light.

The MLC family also offers two different maximum currents per switch. Part numbers ASL5008yHz and ASL5108yHz offer a maximum current per switch of 0.8 A. Part numbers ASL5015yHz and ASL5115yHz offer a maximum current per switch of 1.5 A.

All part numbers are pin-to-pin compatible, which offers a completely scalable and flexible system solution that can be adapted to any system requirements.

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2 Features

- Automotive grade product that is AEC-Q100 grade 1 and AEC-Q006 qualified
- Operating ambient temperature range of –40 °C to +125 °C
- Maximum junction temperature of 175 °C
- Operating input voltage 5 V ± 0.5 V. Vcc pin.
- Able to drive up to 12 LEDs / segments, with a string voltage range up to 57 V
- Able to drive multiple LEDs per switch (MTP configurable)
- 12 channels, arranged in 4 configurable blocks of 3 switches per block
- Each block of three can fully float up to 60 V with respect to ground and can be paralleled with any other block
- Each switch can control up to 1.5 A LED current in the ASL5x15yHz family and up to 0.8 A in the ASL5x08yHz family
- 100 mΩ (Rdson) switches for 1.5 A part numbers and 200 mΩ for 0.8 A part numbers
- PWM dimming with 12-bit resolution and built-in phase shifting for minimum losses
- Internal PWM duty cycle generator with incremental calculation for glitch-free operation in the ASL50xxyHz family—Smart
- On-chip storage of preprogrammed PWM curves to reduce data traffic in ASL50xxyHz family—Smart
- LED brightness variation correction functionality
- On-chip 200 MHz oscillator, avoiding need for external quartz
- CAN-based serial interface with optional external CAN physical layer
- Broadcast messages to reduce system latency and bus load
- Low Electromagnetic Emission (EME) and high Electromagnetic Immunity (EMI)
- Individual LED open and LED short-fault monitoring, with bypass feature on open condition
- NTC input with 6-bit resolution for LED temperature monitoring; directly connected to MLC
- Identification resistor input
- MLC can be used in a configuration of up to 32 ICs in a single CAN network
- Small package outline, leadless HVQFN package with improved Automated Optical Inspection (AOI) capability and leaded HLQFP package
- Low operational current consumption
- Sleep and wake-up modes available
- Standby current consumption < 1.35 mA
- Input under voltage protection
- 9-bit resolution IC junction temperature feedback via CAN interface
- Internally programmed Limp Home Mode (LHM) in case of communication failure
- Built-in charge pump failure operation mode (CPFSO)

3 Applications

- Automotive lighting
  - Matrix/pixel high beam (ADB / Glare-Free High Beam - GFHB)
  - Matrix/pixel low beam (ADB)
  - Dynamic turning indicator
  - Welcoming scenarios
  - Dynamic rear lights

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– Dynamic cornering lights

4 Orderable parts

Table 1. Orderable part variations

Type number	Package		
	Name	Description	Version
ASL5015SHN	HVQFN36	Smart internal PWM generator with prestored curves (Smart – 1.5 A) – CAN	SOT1092-4
ASL5115SHN	HVQFN36	Direct PWM data for every channel (Direct – 1.5 A) – CAN	SOT1092-4
ASL5008SHN	HVQFN36	Smart internal PWM generator with prestored curves (Smart – 0.8 A) – CAN	SOT1092-4
ASL5108SHN	HVQFN36	Direct PWM data for every channel (Direct – 0.8 A) – CAN	SOT1092-4
ASL5015FHN	HVQFN36	Smart internal PWM generator with prestored curves (Smart – 1.5 A) – CAN-FD	SOT1092-4
ASL5115FHN	HVQFN36	Direct PWM data for every channel (Direct – 1.5 A) – CAN-FD	SOT1092-4
ASL5008FHN	HVQFN36	Smart internal PWM generator with prestored curves (Smart – 0.8 A) – CAN-FD	SOT1092-4
ASL5108FHN	HVQFN36	Direct PWM data for every channel (Direct – 0.8 A) – CAN-FD	SOT1092-4
ASL5015SHV	HLQFP48	Smart internal PWM generator with prestored curves (Smart – 1.5 A) – CAN	SOT1571-1
ASL5115SHV	HLQFP48	Direct PWM data for every channel (Direct – 1.5 A) – CAN	SOT1571-1
ASL5008SHV	HLQFP48	Smart internal PWM generator with prestored curves (Smart – 0.8 A) – CAN	SOT1571-1
ASL5108SHV	HLQFP48	Direct PWM data for every channel (Direct – 0.8 A) – CAN	SOT1571-1
ASL5015FHV	HLQFP48	Smart internal PWM generator with prestored curves (Smart – 1.5 A) – CAN-FD	SOT1571-1
ASL5115FHV	HLQFP48	Direct PWM data for every channel (Direct – 1.5 A) – CAN-FD	SOT1571-1
ASL5008FHV	HLQFP48	Smart internal PWM generator with prestored curves (Smart – 0.8 A) – CAN-FD	SOT1571-1
ASL5108FHV	HLQFP48	Direct PWM data for every channel (Direct – 0.8 A) – CAN-FD	SOT1571-1

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5 Application diagram

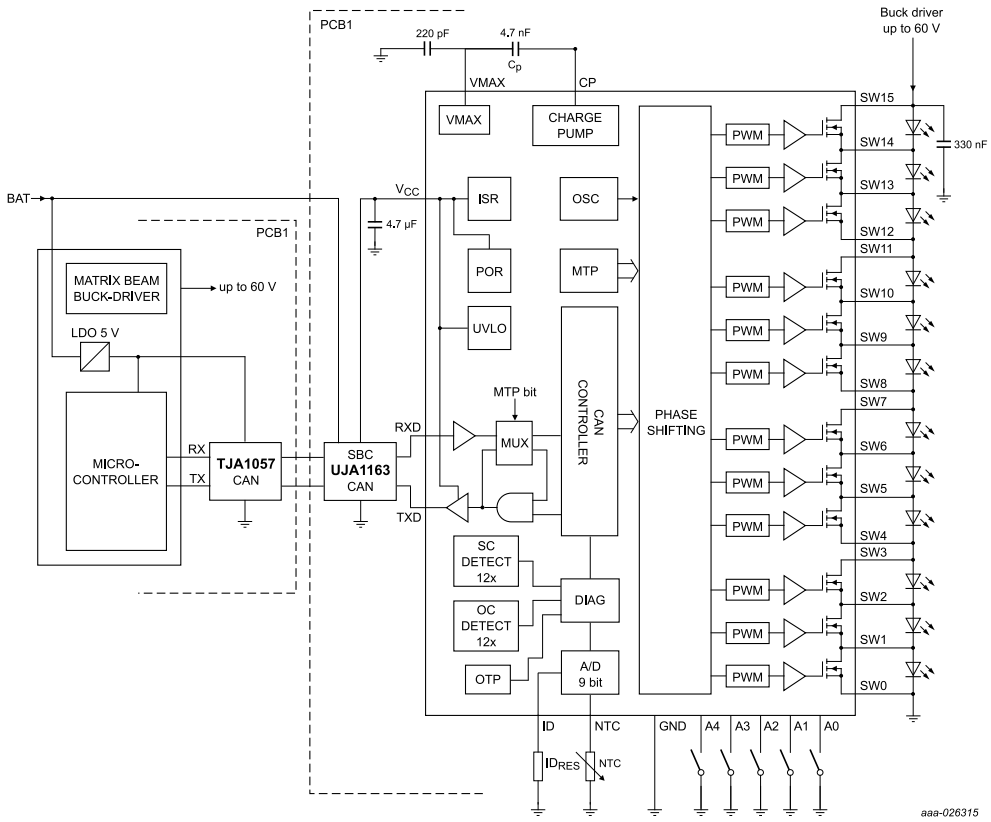


Figure 1. Application diagram for the ASL5xxxyHz family (OFF board configuration)

6 Packaging

6.1 Package mechanical dimensions

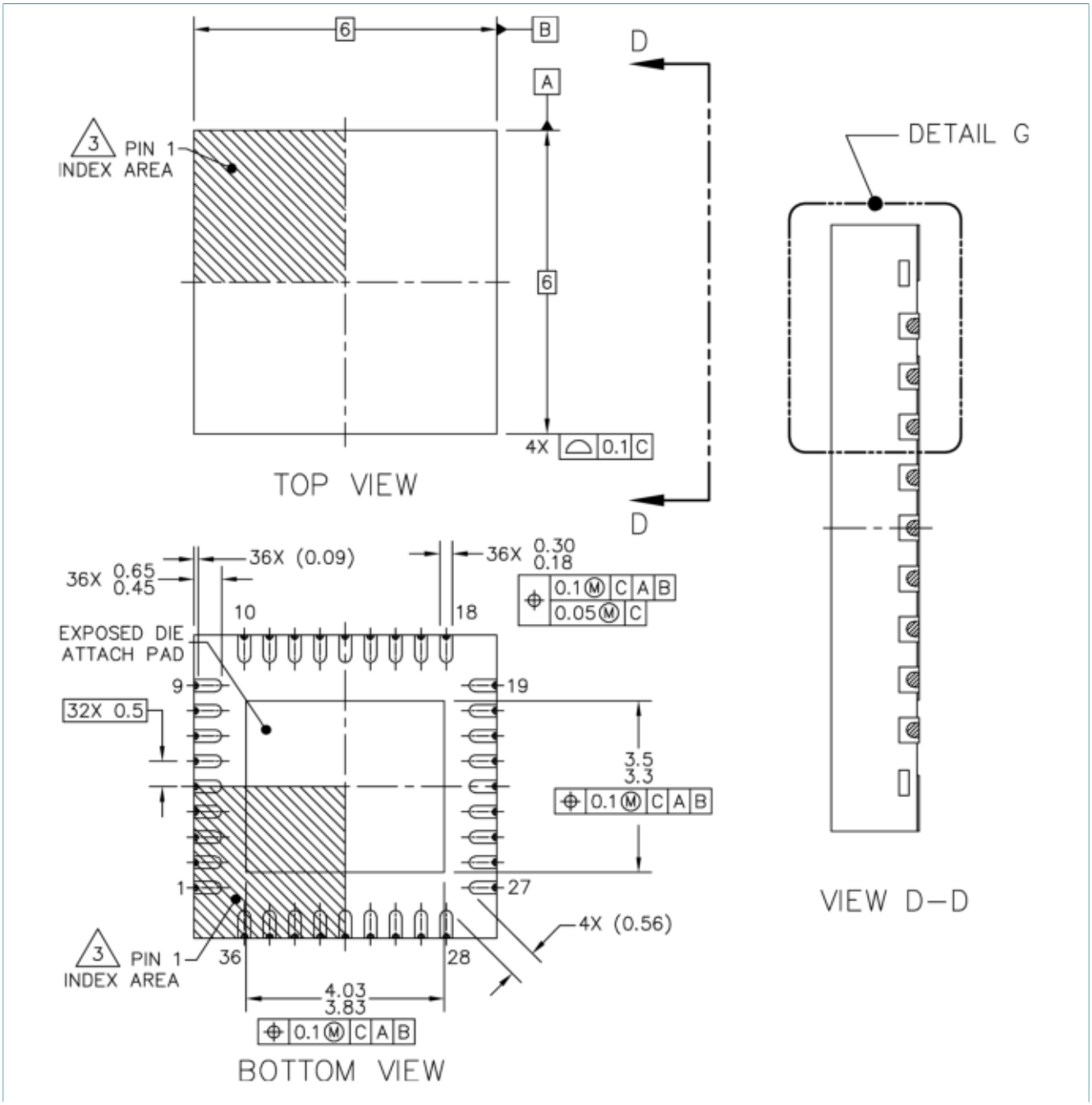
Package dimensions are provided in package drawings. To find the most current package outline drawing, go to www.nxp.com and perform a keyword search for the drawing's document number.

Table 2. Package Outline

Package	Package outline drawing number
36-pin HVQFN	SOT1092-4
48-pin HLQFP	SOT1571-1

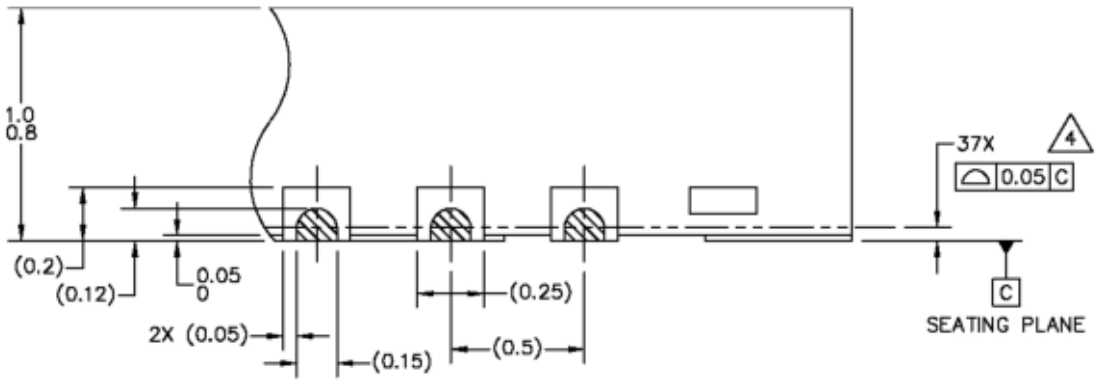
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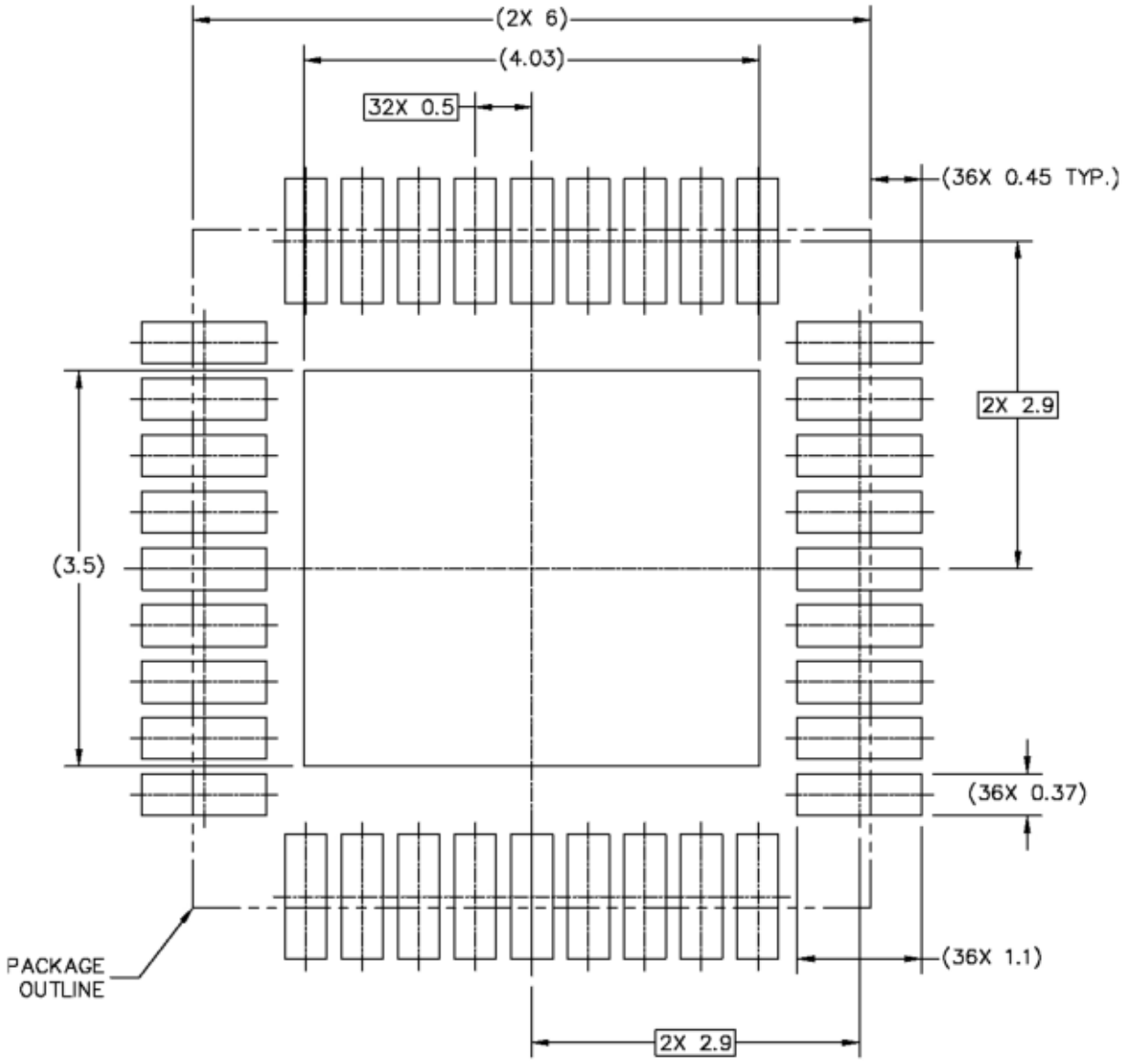
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DETAIL G
VIEW ROTATED 90° CW

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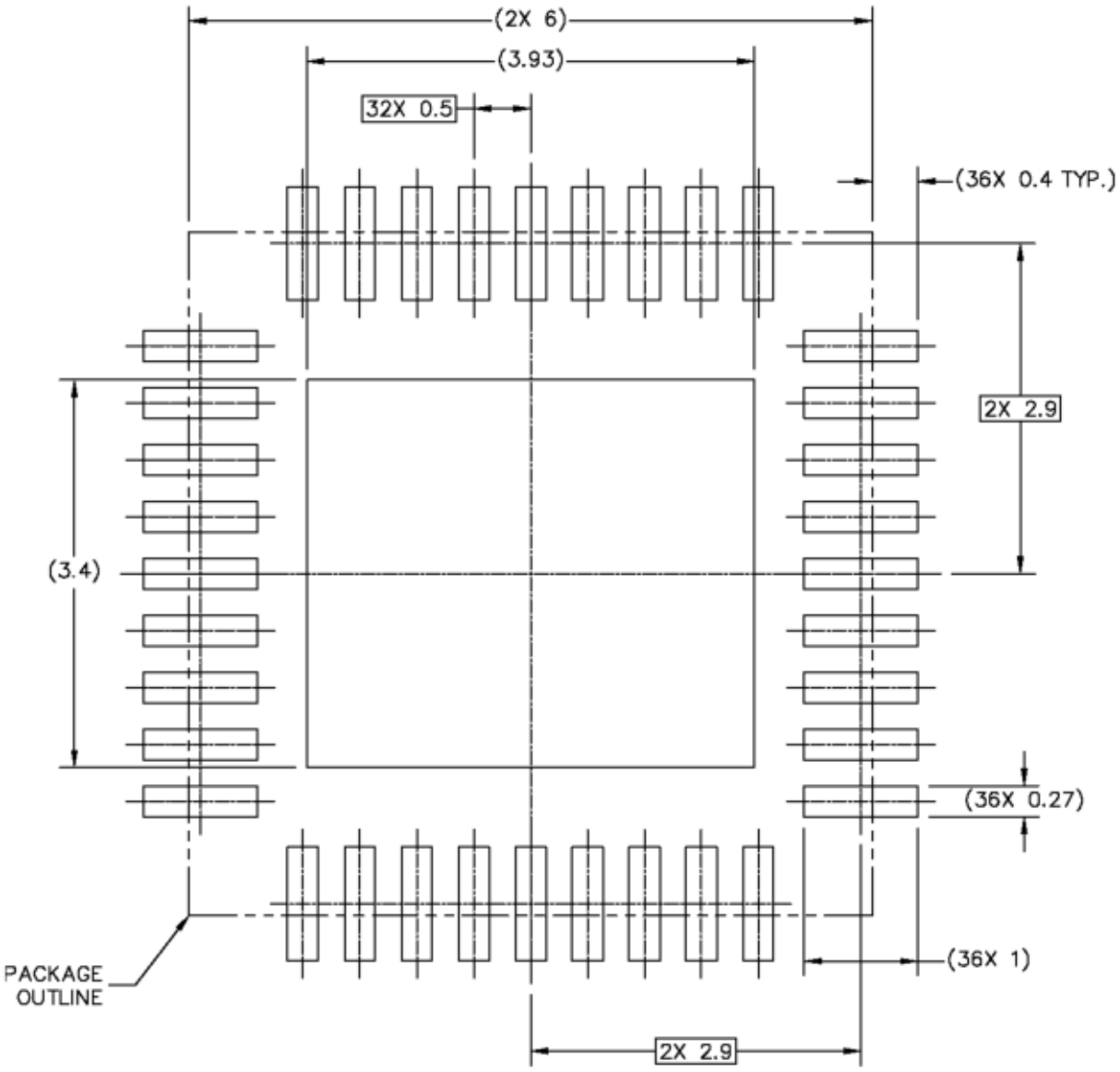


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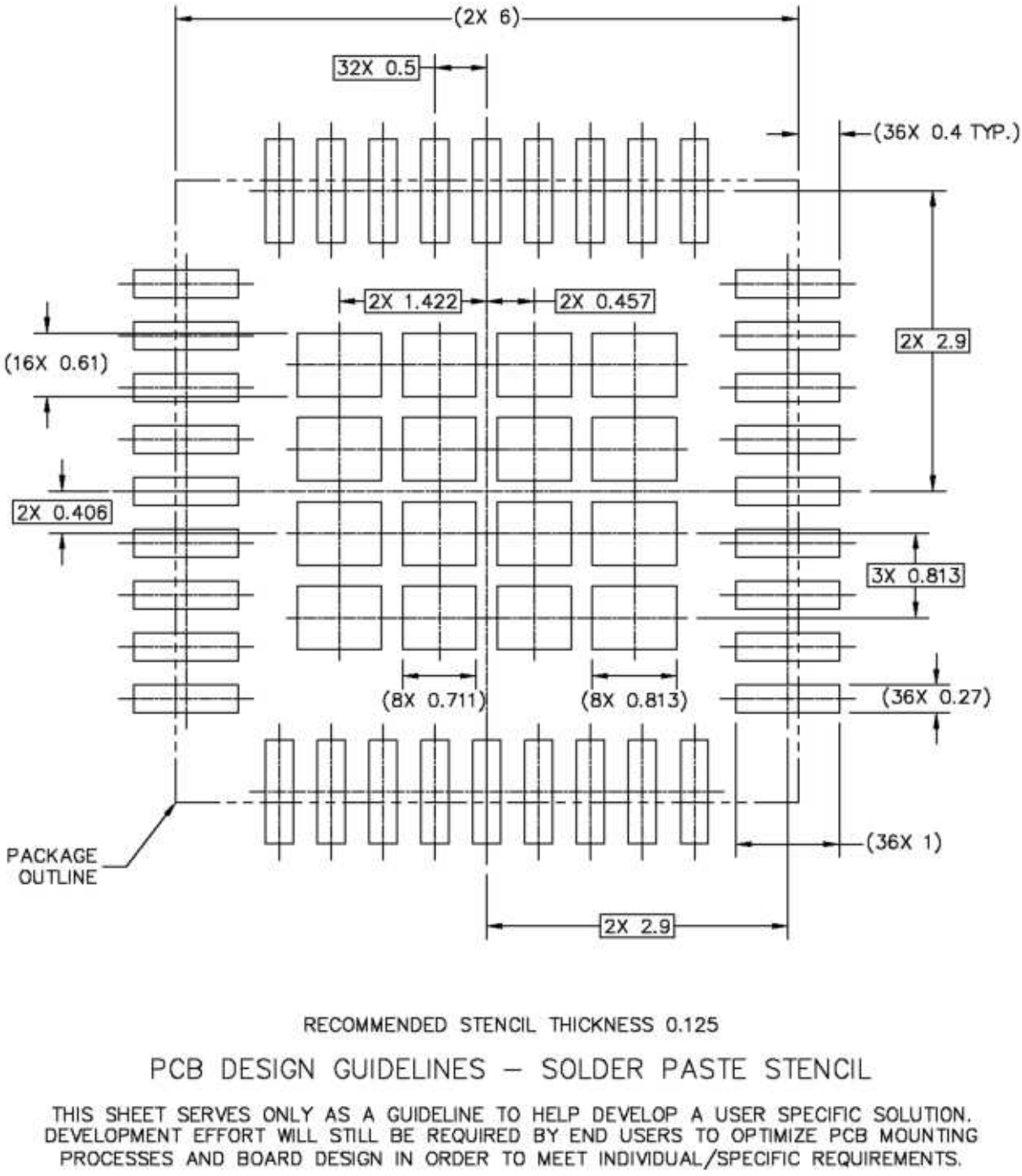
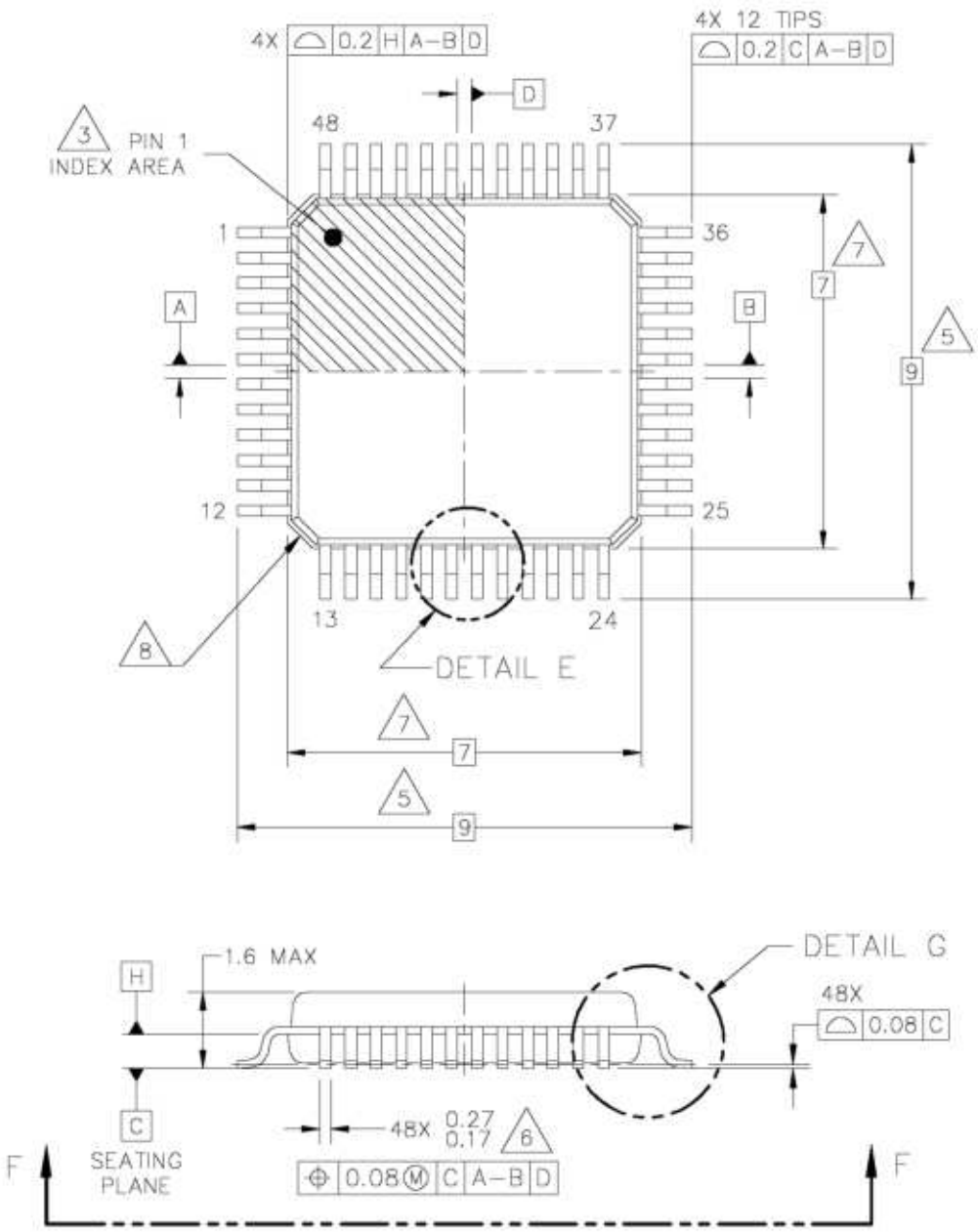


Figure 2. Package outline – HVQFN package

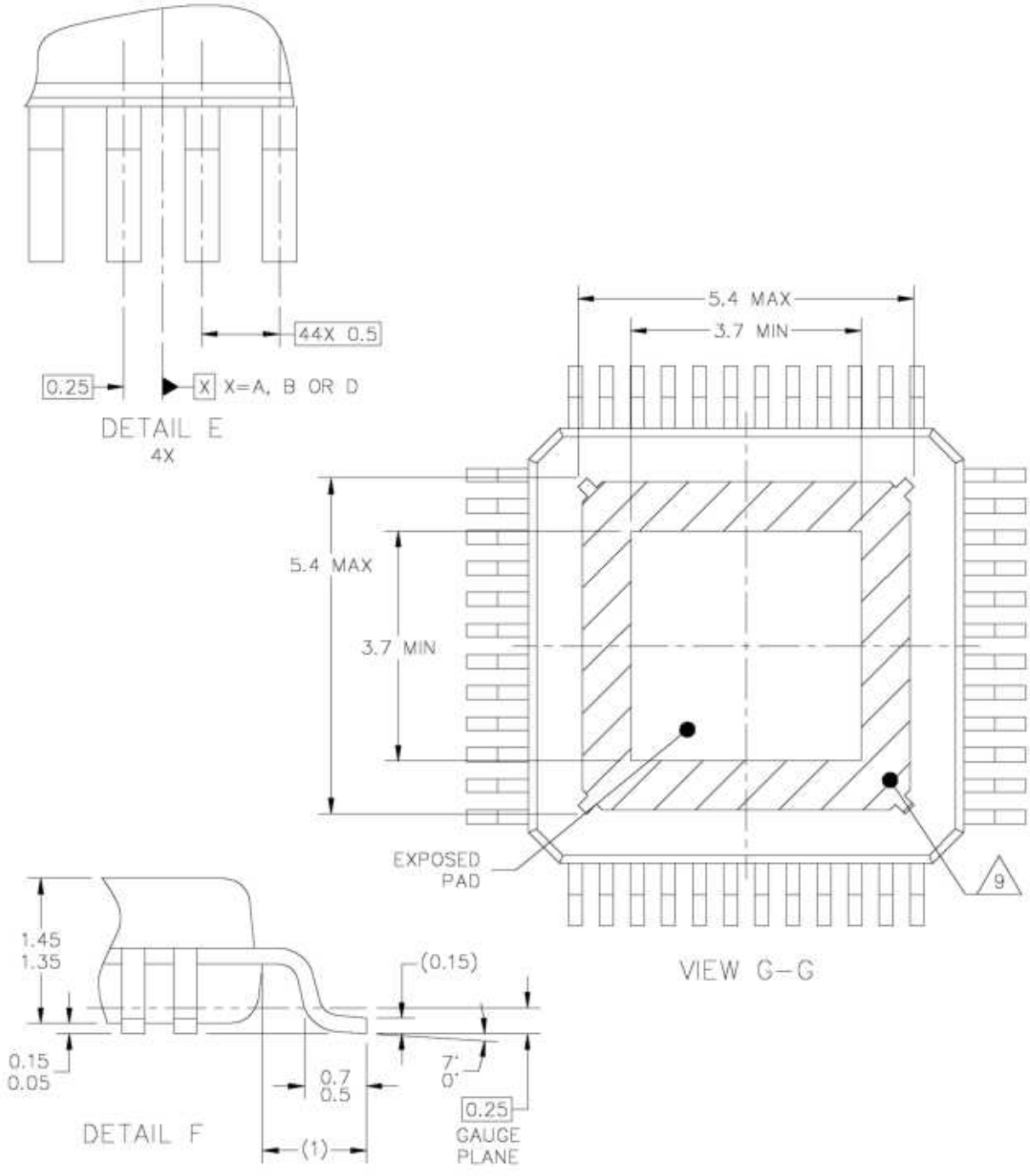
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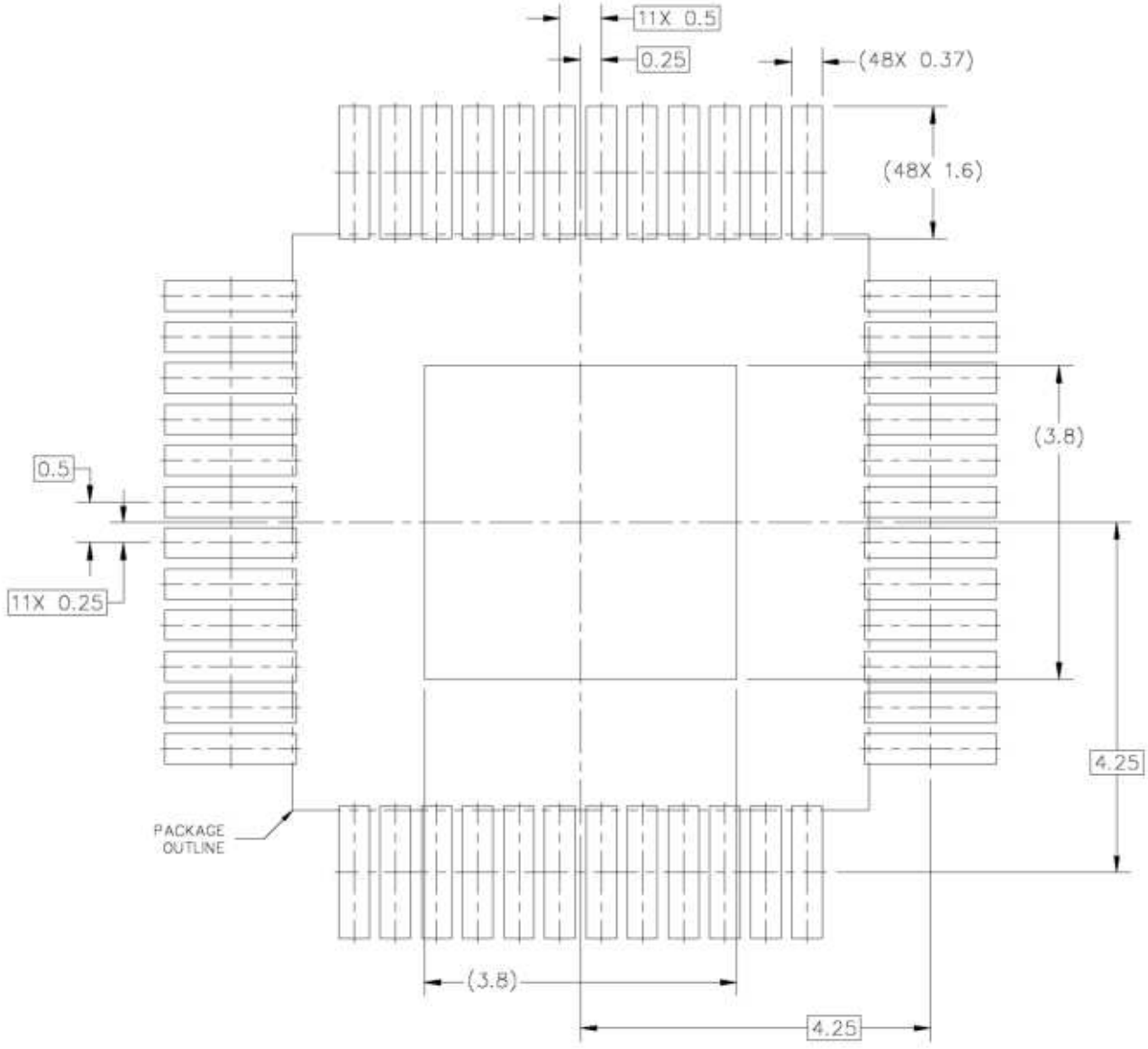
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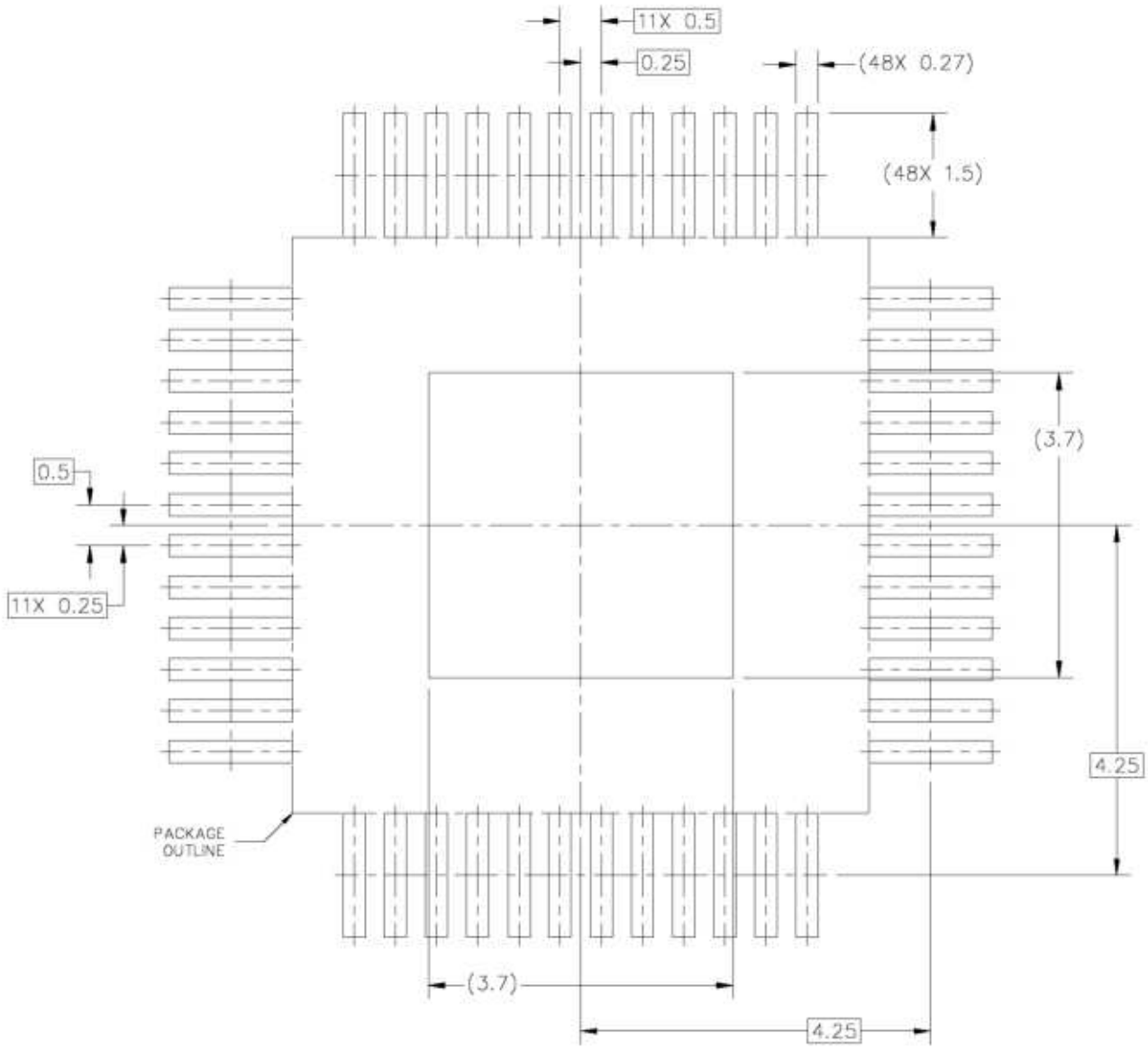


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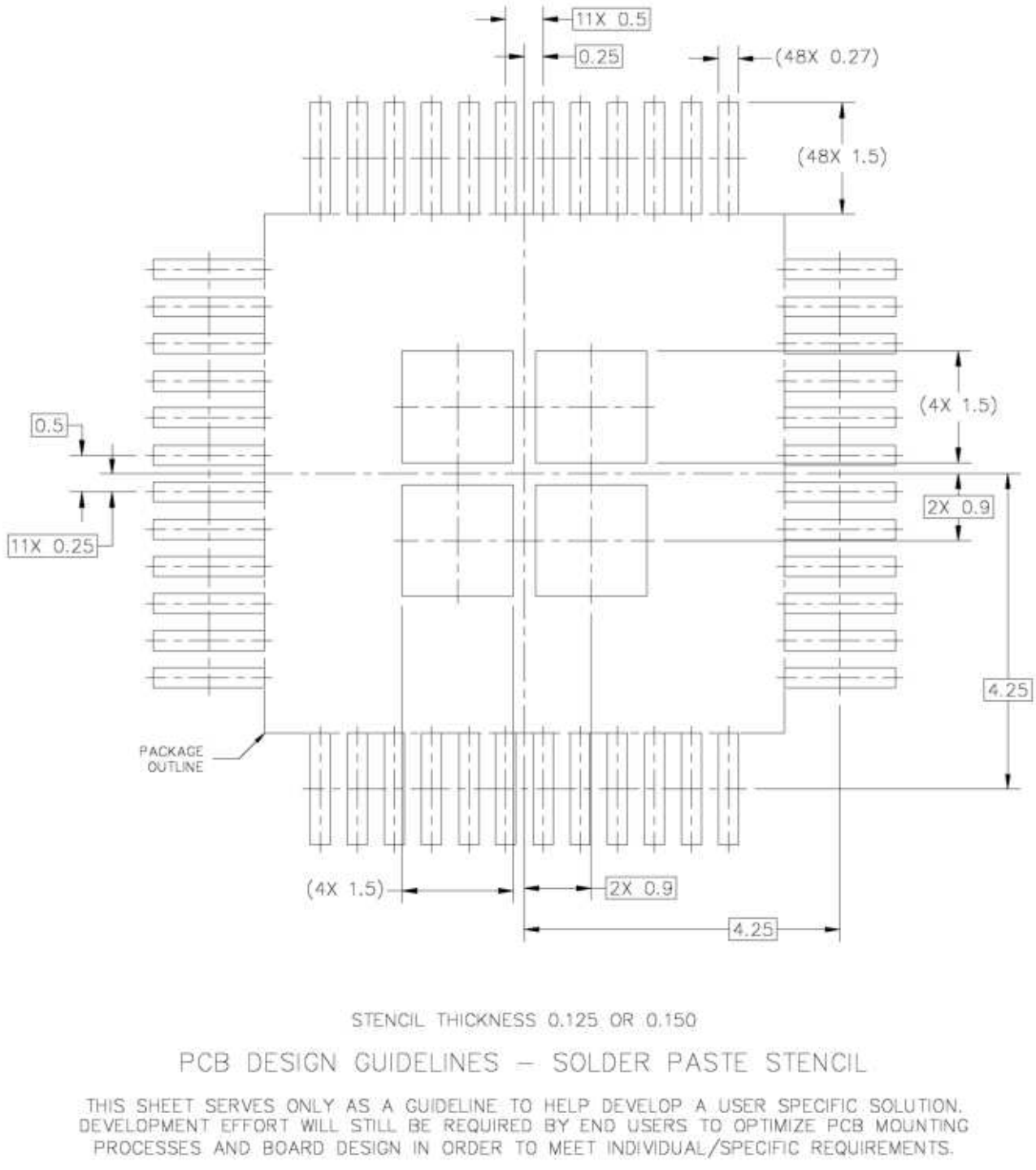


Figure 3. Package outline – HLQFP package

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