

DRV325x-Q1 Integrated 3-Phase 48-V Automotive Gate Driver Unit (GDU) with Advanced Protection and Diagnostics

1 Features

- AEC-Q100 Test Guidance for automotive applications:
 - Device ambient temperature grade 0: -40°C to $+150^{\circ}\text{C}$
 - Device HBM ESD classification level 2
 - Device CDM ESD classification level C4B
- **Functional Safety-Compliant** targeted
 - Developed for functional safety applications
 - Documentation to aid ISO 26262 system design will be available upon production release
 - Systematic capability up to ASIL D targeted
- Three N-Channel half-bridge gate driver
 - 3.5-A/4.5-A max peak gate drive current
 - Power architecture optimized for 48-V applications
 - 12-V/48-V split supply architecture
 - 90-V MOSFET operating voltage range
 - Bootstrap with charge pump for 100% duty cycle
- Device configurations options
 - DRV3255-Q1: 3.5-A/4.5-A gate drive current
 - DRV3256-Q1 (Preview): 2-A/2.5-A gate drive current and 3x current shunt amplifiers
- Integrated configurable Active Short Circuit (ASC) function
 - Low-side and High-side ASC support
 - Device pin control available
 - Fault handling capability
- Serial peripheral interface (SPI) with CRC
- Supports 3.3-V and 5-V logic inputs
- Advanced protection features
 - Battery voltage monitors
 - MOSFET V_{DS} overcurrent monitors
 - R_{shunt} overcurrent monitors
 - MOSFET V_{GS} gate fault monitors
 - Analog built in self test
 - Internal regulator and clock monitors
 - Device thermal warning and shutdown
 - Fault condition indicator pins

- eTurbos and eBoosters
- HVAC compressors and fans
- Transmission control and actuation
- Oil, transmission, and water pumps

3 Description

The DRV325x-Q1 family of devices are integrated three phase gate drivers for 48-V automotive motor drive applications. These devices are specifically designed to support high-power motor drive applications by providing 3.5-A peak source and 4.5-A peak sink gate drive currents, 90-V MOSFET transient over voltage support, and using a highly efficient bootstrap architecture that minimizes power losses and self-heating of the gate drivers. A charge pump allows for the gate drivers to support 100% PWM duty cycle control.

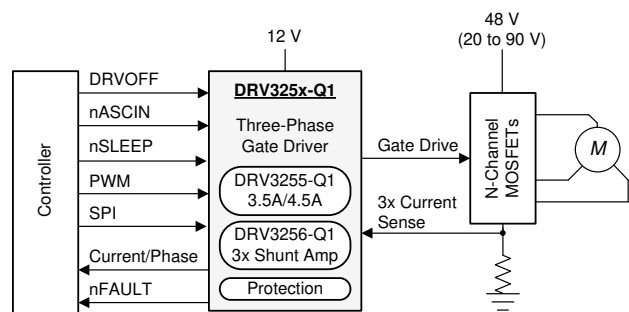
A wide range of diagnostics, monitoring, and protection features supports a robust motor drive system design. A highly configurable Active Short Circuit (ASC) function which enables selected external MOSFETs is integrated to achieve the fast response to system faults and to eliminate the needs of external components.

Three low-side current shunt amplifiers are optionally provided (DRV3256-Q1) to support resistor based low-side current sensing.

Device Information (1)

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|-------------|------------|---------------------|
| DRV3255-Q1 | HTQFP (64) | 10.00 mm × 10.00 mm |

- (1) For all available packages, see the orderable addendum at the end of the data sheet.



Simplified Schematic

2 Applications

- Automotive 48-V Mild Hybrid Motor Drives
 - Belt and integrated starter generators, and Motor generators



4 Device and Documentation Support

4.1 Documentation Support

4.1.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Subscribe to updates* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

4.2 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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4.3 Trademarks

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4.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

4.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

5 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

5.1 Package Option Addendum

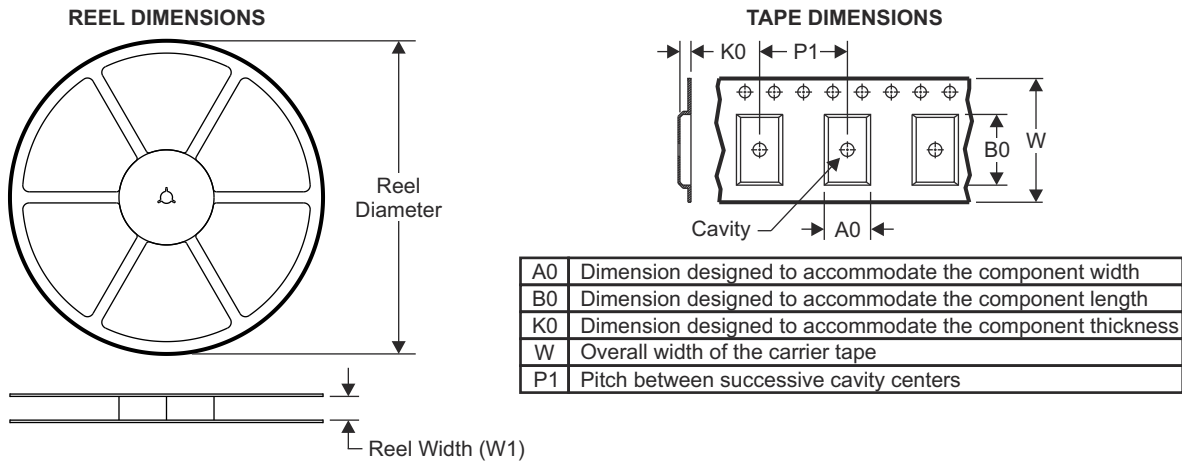
Packaging Information

| Orderable Device | Status | Package Type | Package Drawing | Pins | Package Qty | Eco Plan | Lead/Ball Finish | MSL Peak Temp | Op Temp (°C) | Device Marking |
|------------------|---------|--------------|-----------------|------|-------------|----------|------------------|---------------|--------------|----------------|
| PDRV3255EPA PRQ1 | PREVIEW | HTQFP | PAP | 64 | 1000 | TBD | Call TI | Call TI | -40 to 150 | P2DRV3255 |

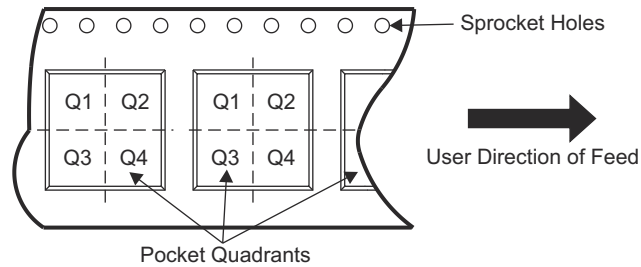
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5.2 Tape and Reel Information

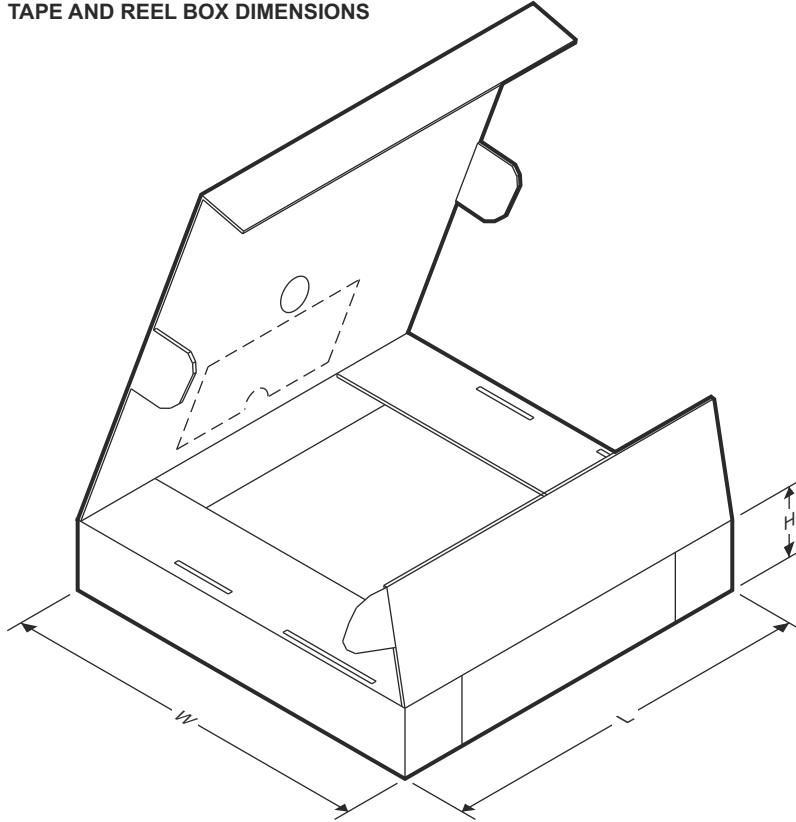


QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| PDRV3255EPAPRQ1 | HTQFP | PAP | 64 | 1000 | 330.0 | 24.4 | 13.0 | 13.0 | 1.5 | 16.0 | 24.0 | Q2 |

TAPE AND REEL BOX DIMENSIONS



| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| PDRV3255EPAPRQ1 | HTQFP | PAP | 64 | 1000 | 367.0 | 367.0 | 55.0 |

ADVANCE INFORMATION

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|---------|
| PDRV3255EPAPRQ1 | ACTIVE | HTQFP | PAP | 64 | 1 | TBD | Call TI | Call TI | -40 to 150 | | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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GENERIC PACKAGE VIEW

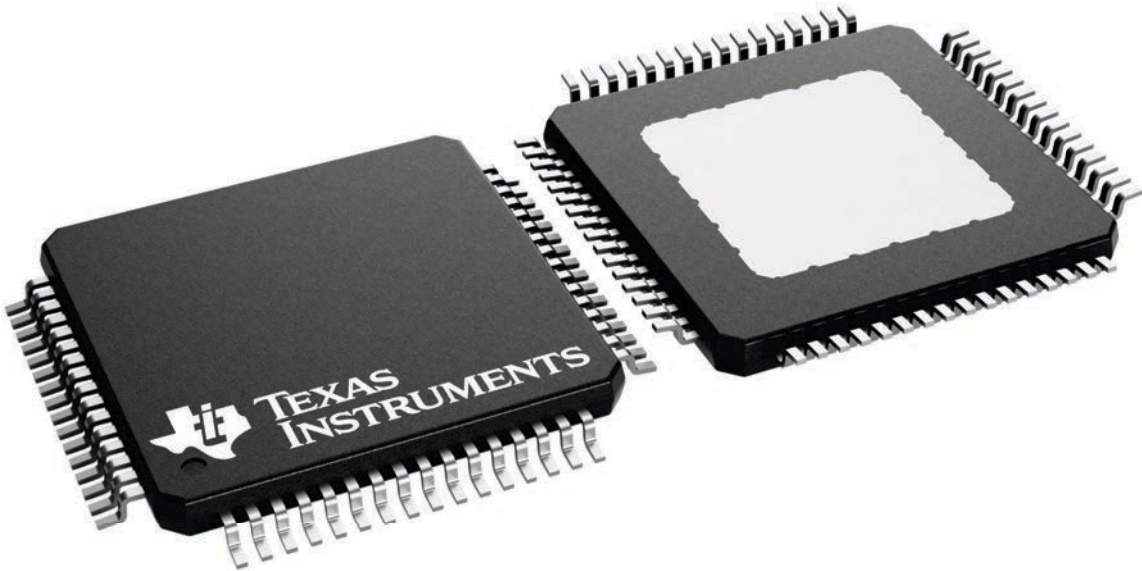
PAP 64

HTQFP - 1.2 mm max height

10 x 10, 0.5 mm pitch

QUAD FLATPACK

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



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