TAS67534-Q1 1L Modulation, 52W, 2MHz Digital Input 4-Channel Automotive Class-D Audio Amplifier With Current Sense and Real-time Load Diagnostics

1 Features

- AEC-Q100 qualified for automotive applications
  - Temperature grade 1: –40°C to +125°C, T_A
- General operation
  - 4.5V to 19V supply voltage, 40V load dump
  - Low latency path reducing group delay by >70% at 48kHz
  - Support for 1.8V and 3.3V I/Os
  - I^2C control with 8 address options
- 1L Modulation
  - Requires only one inductor per channel saving four inductors versus a traditional design
  - Lower system component cost for inductors
  - Smaller PCB footprint
- Audio Performance
  - THD+N 0.02% (4Ω, 1W, 1kHz)
  - Output noise: 35μV_{RMS} at 14.4V, A-weighting
  - Efficiency > 90% at 4 × 25W, 4Ω, 14.4V
- Output current sensing by channel via I^2S/TDM
  - No external circuitry needed
- Real-time load diagnostics
  - Monitor output conditions while playing audio
  - Open Load, Shorted load, Short-to-power, and Short-to-ground detection
- DC and AC Standby load diagnostics
- Audio inputs
  - 2-4 channel I^2S or 4-16 channel TDM input
  - Input sample rates: 44.1, 48, 96, 192kHz
- Audio outputs
  - 4 channel bridge-tied load (BTL), configurable 2 channel parallel-BTL (PBTL)
  - 2MHz output switching frequency
  - 4 × 30W (4Ω, 14.4V, 1kHz, 10% THD+N)
  - 4 × 52W (2Ω, 14.4V, 1kHz, 10% THD+N)
- Advanced spread-spectrum and selectable phase offset
- Protection and monitoring
  - Cycle-by-cycle current limiting
  - Output short protection
  - Clip detection with configurable thresholds
  - Thermal foldback and PVDD foldback
  - I^2C temperature and supply voltage readout
  - Configurable overtemperature warning and individual channel shutdown
  - DC offset, undervoltage and overvoltage

2 Applications

- Automotive head unit
- Automotive external amplifier
- Acoustic vehicle alerting system (AVAS)

3 Description

The TAS67534-Q1 is a four-channel digital-input Class-D audio amplifier that implements 1L modulation only requiring one inductor per BTL channel reducing system size and cost by removing four inductors compared to a traditional design. Additionally, 1L modulation lowers switching losses compared to traditional Class-D modulation schemes.

The TAS67534-Q1 integrates DC and AC load diagnostics to determine the status of the connected loads. During audio playback this status can be monitored through Real-Time load diagnostics. The device also offers current sense for each channel and can report the measurement to a host processor through TDM with minimal delay. The device monitors the output load condition while playing audio through real-time load diagnostics independent of the host and audio input.

The TAS67534-Q1 device features an additional low latency signal path for each channel, providing up to 70% faster signal processing at 48kHz which enables time-sensitive active noise cancellation (ANC), road noise cancellation (RNC) applications.

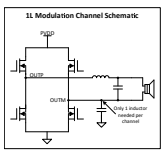
The device supports global temperature, channel temperature and PVDD values using I^2C readout for easy system level thermal management.

The device is offered in a 56-pin HSSOP package with the exposed thermal pad up.

Package Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE(2)
TAS67534-Q1	DKQ (HSSOP, 56)	18.42mm × 10.35mm

(1) For all available packages, see the Section 5.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Simplified Channel Schematic

An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

4 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

4.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* 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.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

4.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

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.

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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.

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PACKAGE OPTION ADDENDUM

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/Ball material (4)	MSL rating/Peak reflow (5)	Op temp (°C)	Part marking (6)
TAS67534QDKQRQ1	Preview	Preview	HSSOP (DKQ) | 56	1000 | LARGE T&R	Yes	NiPdAu	Level-3-260C-168 HR	-40 to 125	67534

(1) **Status:** For more details on status, see our product life cycle.
(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.
(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.
(4) **Lead finish/Ball material:** Parts 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.
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.
(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

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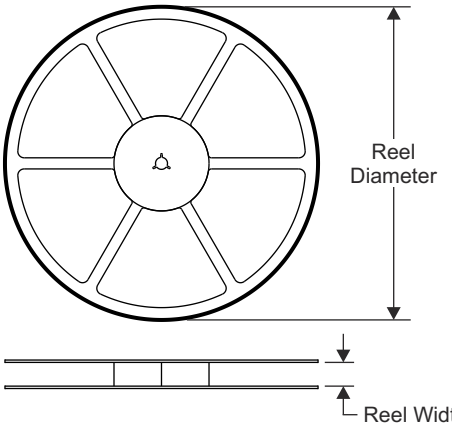
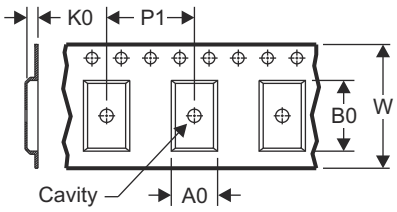
5.1 Tape and Reel Information

REEL DIMENSIONS

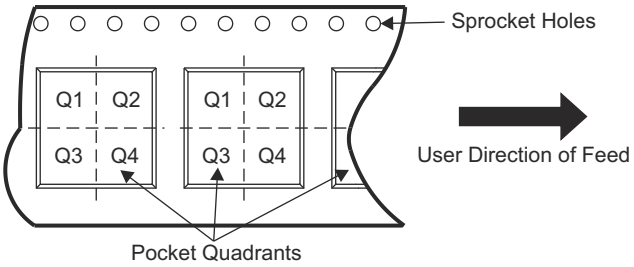


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
TAS67534QDKQRQ1	HSSOP	DKQ	56	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1

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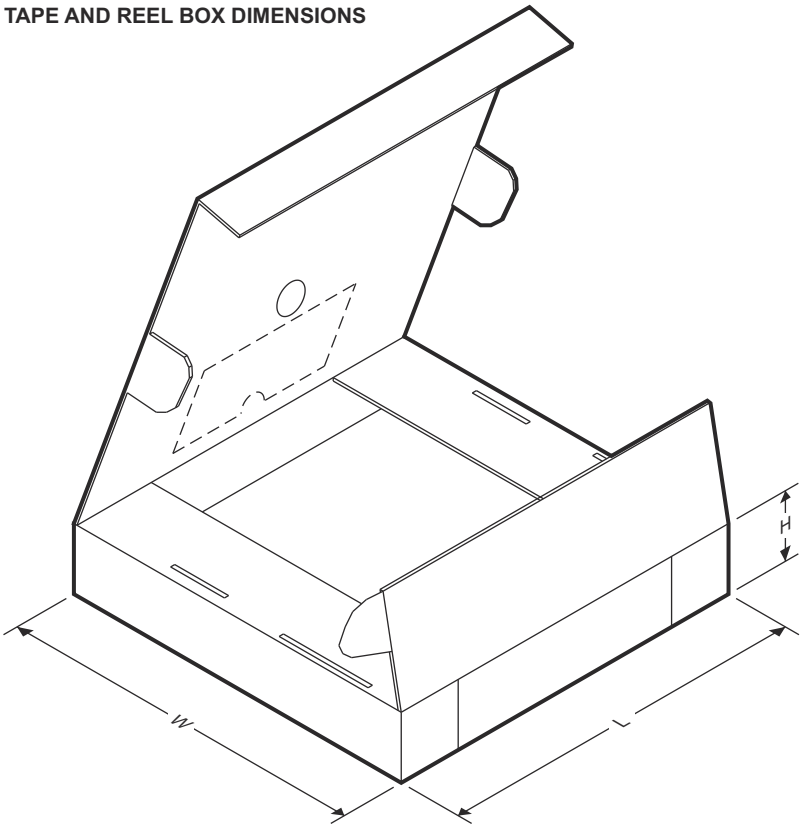
TAPE AND REEL BOX DIMENSIONS



Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TAS67534QDKQRQ1	HSSOP	DKQ	56	1000	367.0	367.0	55.0

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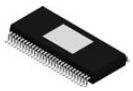
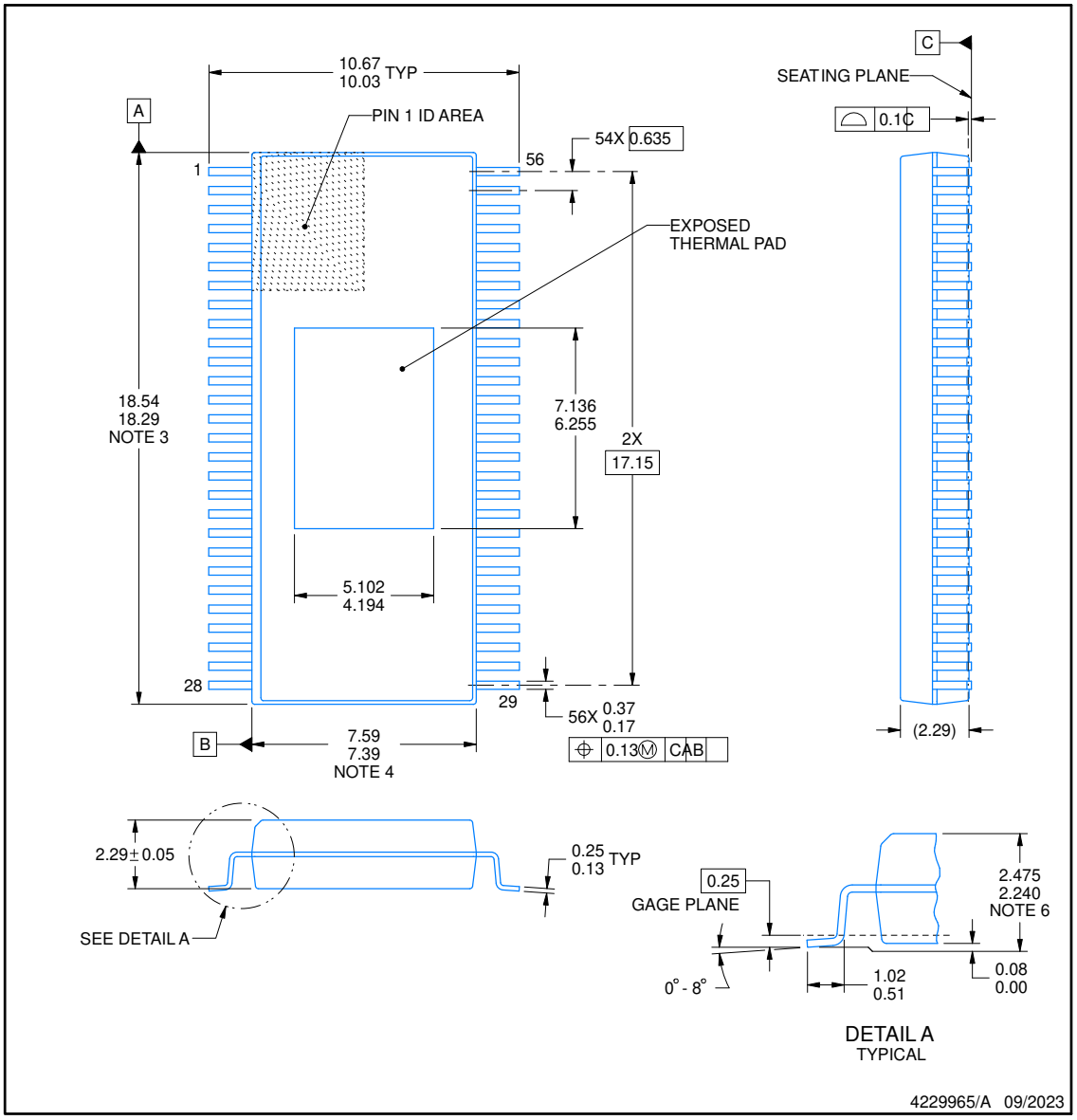
5.2 Mechanical Data



PACKAGE OUTLINE

DKQ0056D — PowerPAD ™ HSSOP - 2.475 mm max height

PLASTIC SMALL OUTLINE



PowerPAD is a trademark of Texas Instruments.

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold }402ash, protrusions, or gate burrs. Mold }402ash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead }402ash. Interlead }402ash shall not exceed 0.25 mm per side.
5. The exposed thermal pad is designed to be attached to an external heatsink.
6. For clamped heatsink design, refer to overall package height above the seating plane as 2.325 +/- 0.075 and molded body thickness dimension.

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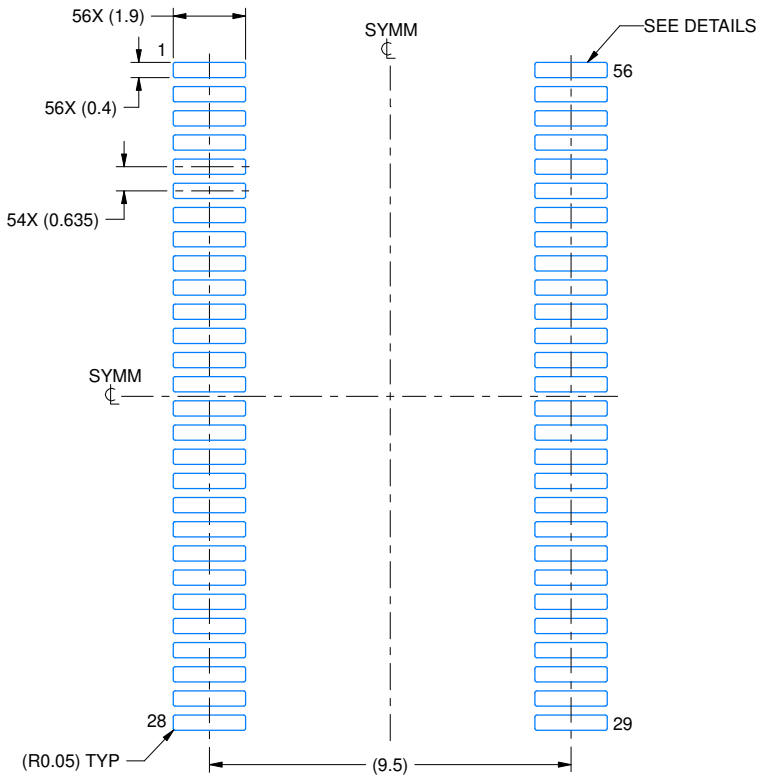
EXAMPLE BOARD LAYOUT

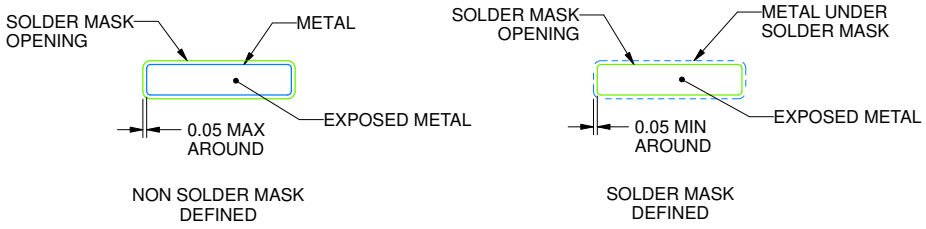
DKQ0056D

PowerPAD ™ HSSOP - 2.475 mm max height

PLASTIC SMALL OUTLINE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X



SOLDER MASK DETAILS
NOT TO SCALE

4229965/A 09/2023

NOTES: (continued)

7. Publication IPC-7351 may have alternate designs.
8. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
9. Size of metal pad may vary due to creepage requirement.

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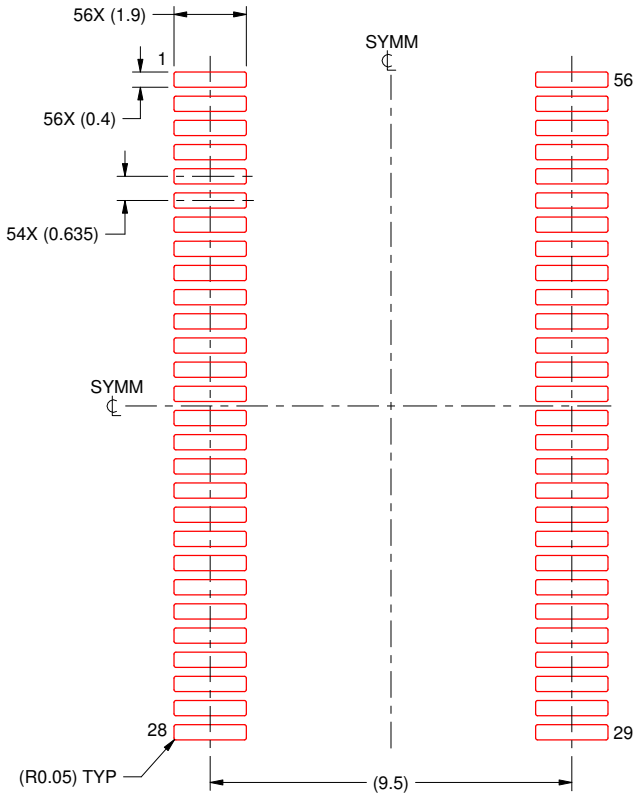
EXAMPLE STENCIL DESIGN

DKQ0056D PowerPAD ™ HSSOP - 2.475 mm max height

PLASTIC SMALL OUTLINE



SOLDER PASTE EXAMPLE
BASED ON 0.125 MM THICK STENCIL
SCALE:6X

4229965/A 09/2023

NOTES: (continued)

10. Laser cutting apertures with trapezoidal walls and rounded corners may o}400er better paste release. IPC-7525 may have alt~~e~~ate design recommendations.
11. Board assembly site may have di}400erent recommendations for stencil design.

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PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TAS67534QDKQRQ1	Active	Production	HSSOP (DKQ) | 56	1000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	67534

(1) **Status:** For more details on status, see our product life cycle.

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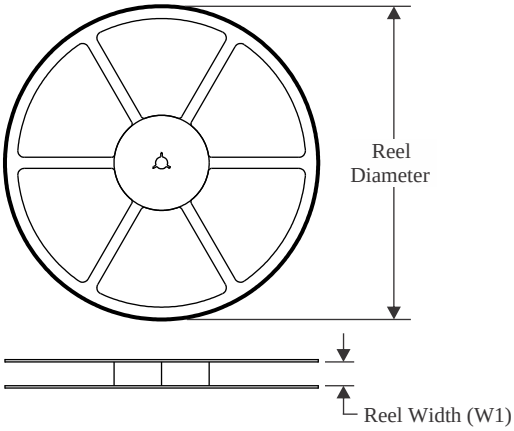
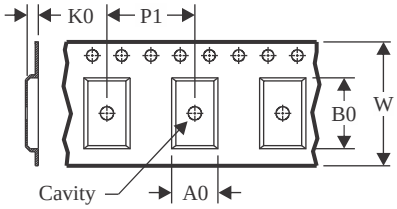
TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
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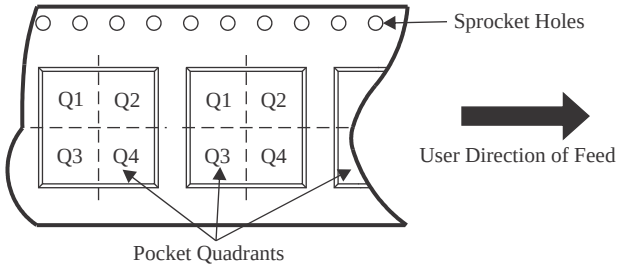
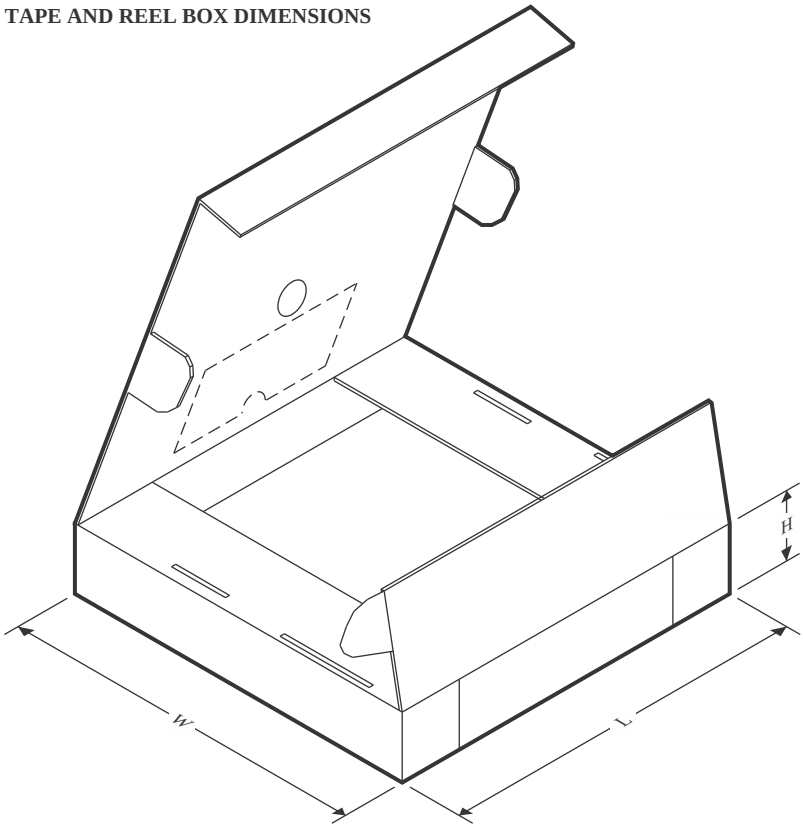
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

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
TAS67534QDKQRQ1	HSSOP	DKQ	56	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1

TAPE AND REEL BOX DIMENSIONS

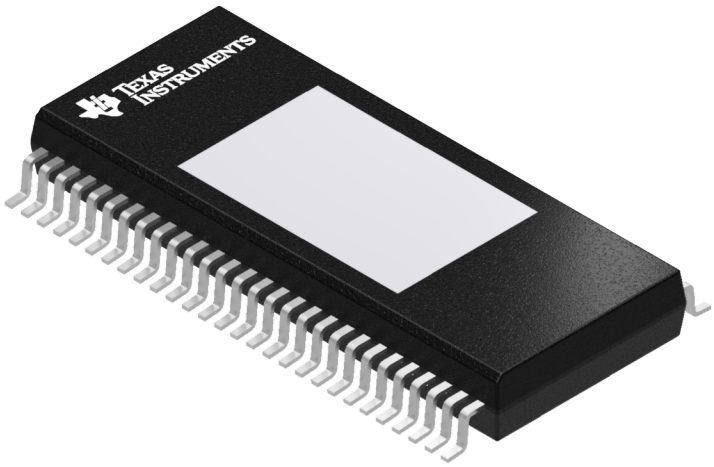


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TAS67534QDKQRQ1	HSSOP	DKQ	56	1000	356.0	356.0	53.0

DKQ 56 PowerPAD™ SSOP - 2.34 mm max height

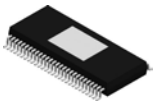
PLASTIC SMALL OUTLINE



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

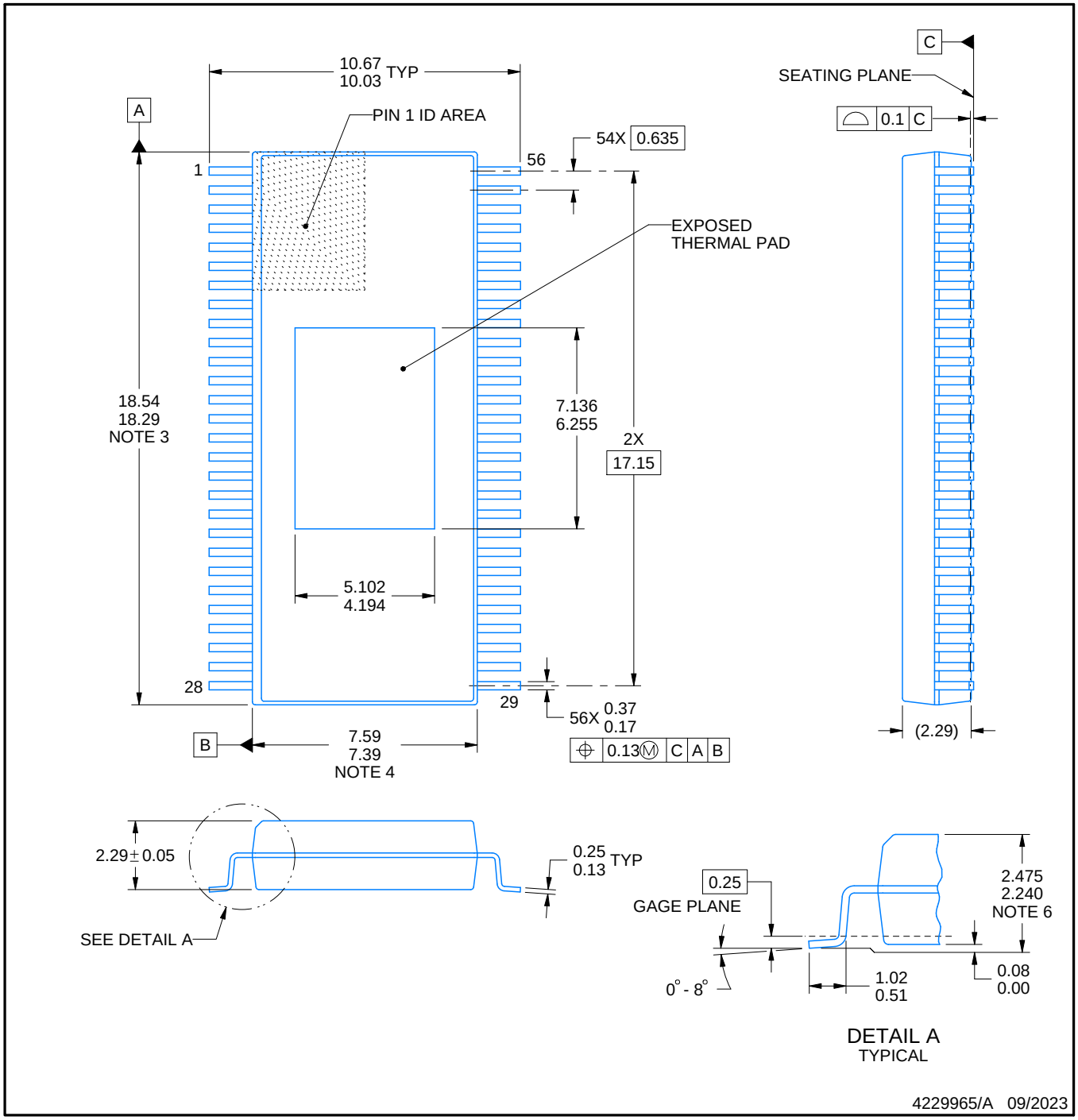
PACKAGE OUTLINE

DKQ0056D



PowerPAD™ HSSOP - 2.475 mm max height

PLASTIC SMALL OUTLINE



PowerPAD is a trademark of Texas Instruments.

NOTES:

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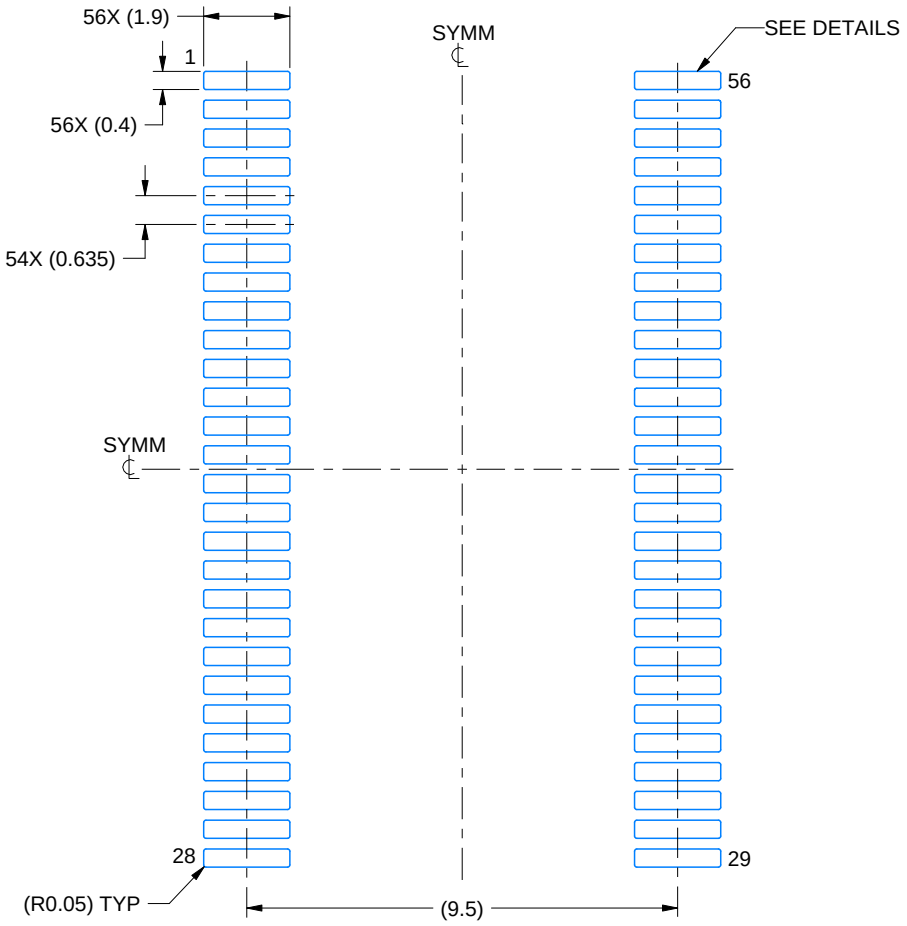
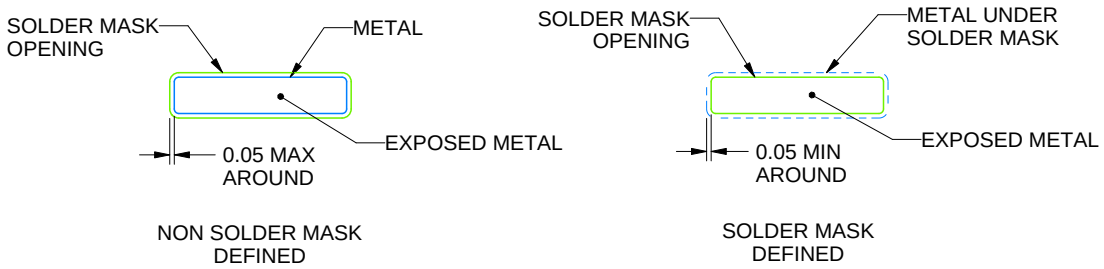
6. For clamped heatsink design, refer to overall package height above the seating plane as 2.325 +/- 0.075 and molded body thickness dimension.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X

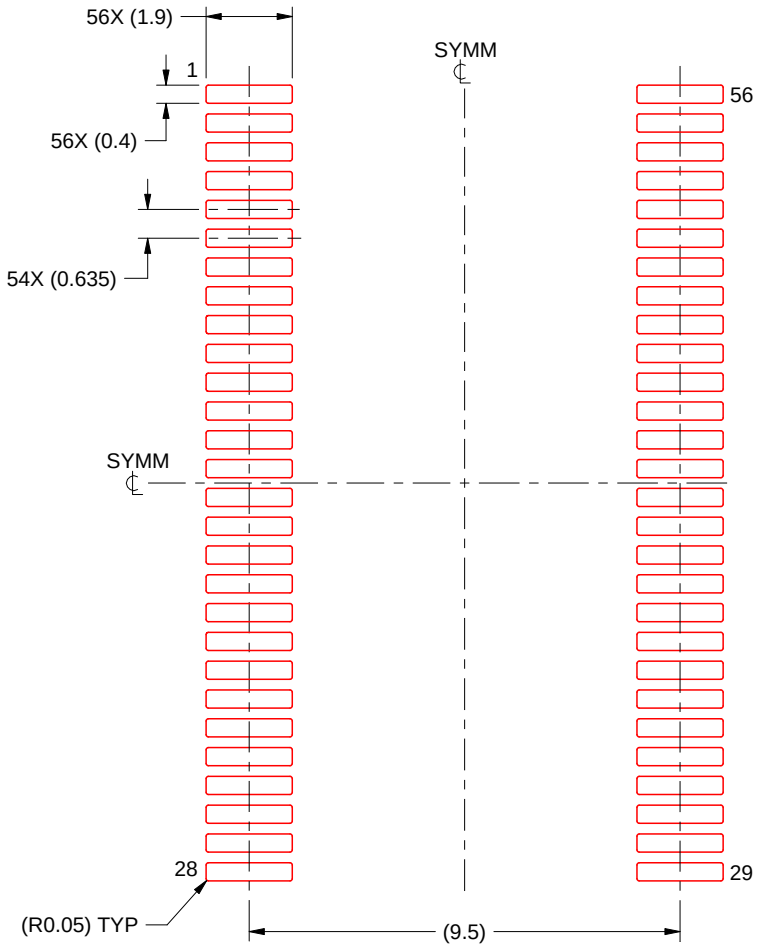


SOLDER MASK DETAILS
NOT TO SCALE

4229965/A 09/2023

NOTES: (continued)

7. Publication IPC-7351 may have alternate designs.
8. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
9. Size of metal pad may vary due to creepage requirement.



SOLDER PASTE EXAMPLE
BASED ON 0.125 MM THICK STENCIL
SCALE:6X

4229965/A 09/2023

NOTES: (continued)

10. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
11. Board assembly site may have different recommendations for stencil design.

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