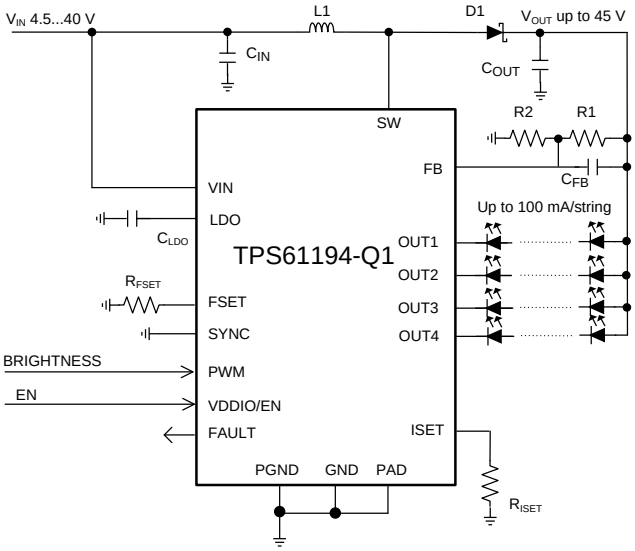
TPS61194-Q1 Low-EMI Automotive LED Driver With Four 100-mA Channels

1 Features

- Qualified for Automotive Applications
- AEC-Q100 Qualified With the Following Results:
  - Device Temperature Grade 1: –40°C to +125°C Ambient Operating Temperature Range
- Input Voltage Operating Range 4.5 V to 40 V
- Four High-Precision Current Sinks
  - Current Matching 1% (Typical)
  - LED String Current up to 100 mA per Channel
  - Outputs can be Combined Externally for Higher Current per String
- High Dimming Ratio of 10 000:1 at 100 Hz
- Integrated Boost/SEPIC Converter for LED String Power
  - Output Voltage up to 45 V
  - Switching Frequency 300 kHz to 2.2 MHz
  - Switching Synchronization Input
  - Spread Spectrum for Lower EMI
- Extensive Fault Detection Features
  - Fault Output
  - Input Voltage OVP and UVLO
  - Open and Shorted LED Fault Detection
  - Thermal Shutdown
- Minimum Number of External Components

Simplified Schematic



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2 Applications

- Backlight for:
  - Automotive Infotainment
  - Automotive Instrument Clusters
  - Smart Mirrors
  - Heads-Up Displays (HUD)
  - Central Information Displays (CID)
  - Audio-Video Navigation (AVN)

3 Description

The TPS61194-Q1 is an automotive high-efficiency, low-EMI, easy-to-use LED driver with integrated DC-DC converter. The DC-DC converter supports both boost and SEPIC mode operation. The device has four high-precision current sinks that can be combined for higher current capability.

The DC-DC converter has adaptive output voltage control based on the LED current sink headroom voltages. This feature minimizes the power consumption by adjusting the voltage to the lowest sufficient level in all conditions. For EMI reduction DC-DC supports spread spectrum for switching frequency and an external synchronization with dedicated pin. A wide-range adjustable frequency allows the TPS61194-Q1 to avoid disturbance for AM radio band.

The input voltage range for the TPS61194-Q1 is from 4.5 V to 40 V to support automotive stop/start and load dump condition. The TPS61194-Q1 integrates extensive fault detection features.

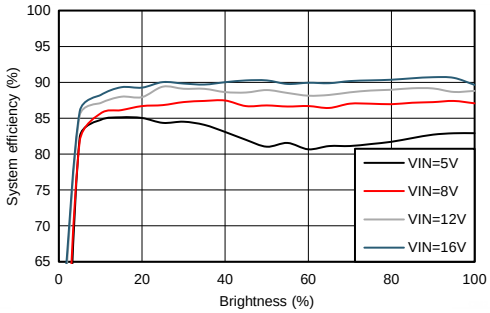
To request a full data sheet or other design resources: request TPS61194-Q1.

Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
TPS61194-Q1	HTSSOP (20)	6.50 mm × 4.40 mm

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

System Efficiency



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 Comparison Table

	LP8860-Q1	LP8862-Q1	LP8861-Q1	TPS61193-Q1	TPS61194-Q1	TPS61196-Q1
VIN range	3 V to 48 V	4.5 V to 40 V	4.5 V to 45 V	4.5 V to 40 V	4.5 V to 40 V	8 V to 30 V
Number of LED channels	4	2	4	3	4	6
LED current / channel	150 mA	160 mA	100 mA	100 mA	100 mA	200 mA
I2C/SPI support	Yes	No	No	No	No	No
SEPIC support	No	Yes	Yes	Yes	Yes	No

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5 Device and Documentation Support

5.1 Device Support

5.1.1 Development Support

Power Stage Designer™ Tool can be used for both boost and SEPIC: http://www.ti.com/tool/powerstage-designer

5.2 Documentation Support

5.2.1 Related Documentation

For related documentation see the following:

- *Using the TPS61194xEVM Evaluation Module*
- *PowerPAD™ Thermally Enhanced Package*
- *Understanding Boost Power Stages in Switch Mode Power Supplies*
- *Designing DC-DC Converters Based on SEPIC Topology*

5.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* 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.

5.4 Community Resources

The following links connect to TI community resources. Linked contents are 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.

TI E2E™ Online Community ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

5.5 Trademarks

Power Stage Designer, E2E are trademarks of Texas Instruments.
All other trademarks are the property of their respective owners.

5.6 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

5.7 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

6 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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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TPS61194PWPRQ1	ACTIVE	HTSSOP	PWP	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 125	61194Q	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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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OTHER QUALIFIED VERSIONS OF TPS61194-Q1 :

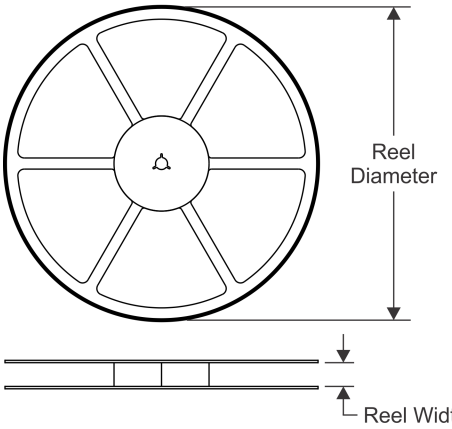
- Catalog: TPS61194

NOTE: Qualified Version Definitions:

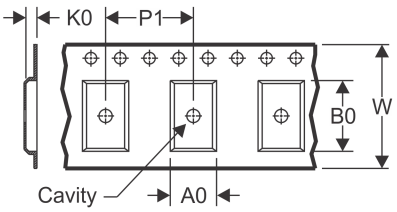
- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION

REEL DIMENSIONS

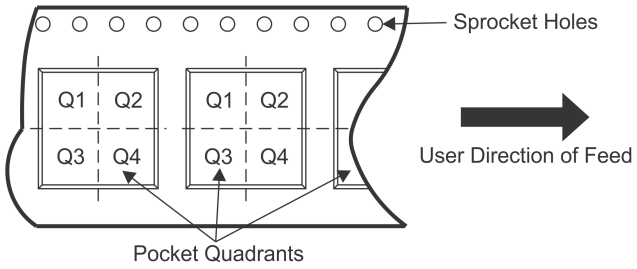


TAPE DIMENSIONS



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

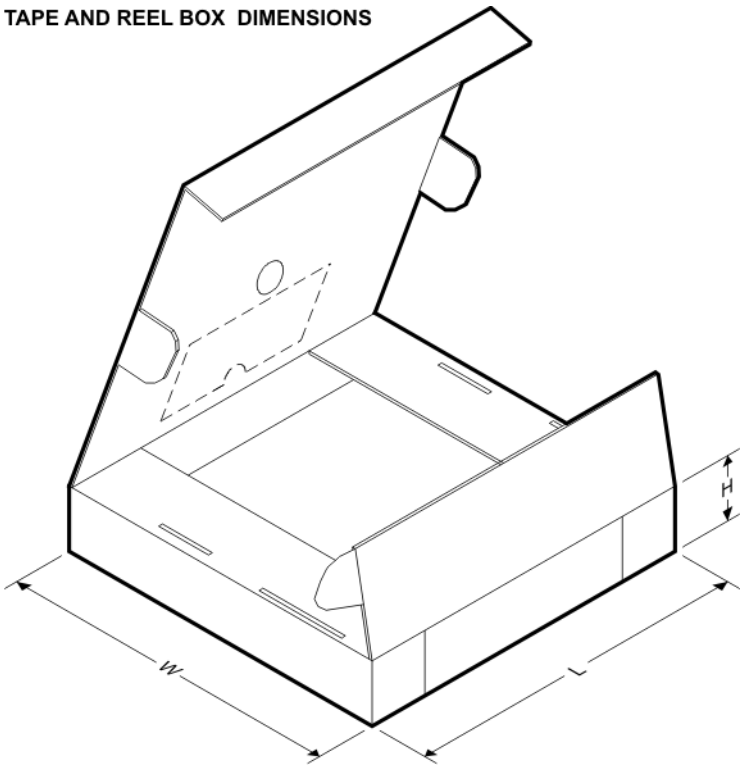
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TPS61194PWPRQ1	HTSSOP	PWP	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS61194PWPRQ1	HTSSOP	PWP	20	2000	367.0	367.0	38.0

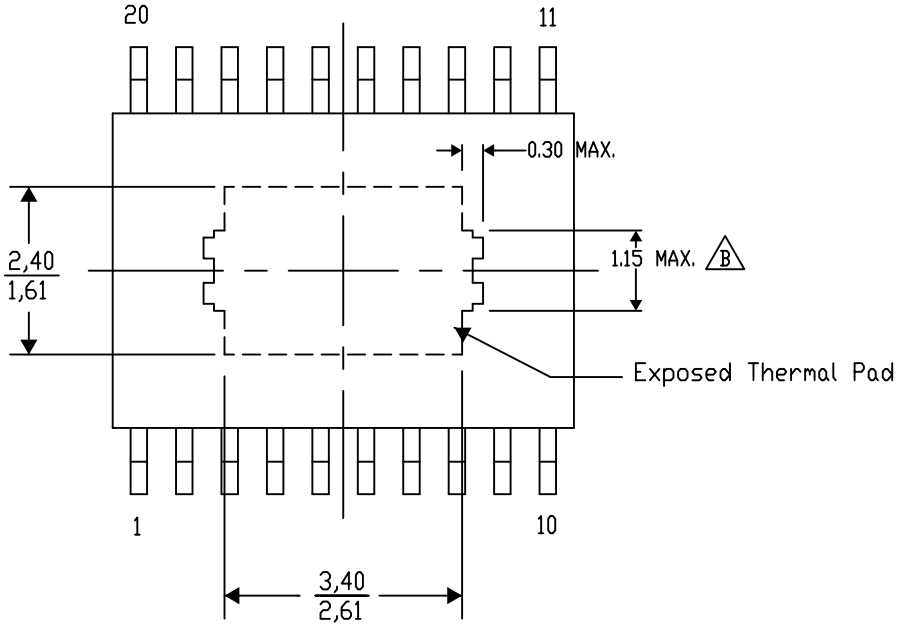
PWP (R–PDSO–G20) PowerPAD™ SMALL PLASTIC OUTLINE

THERMAL INFORMATION

This PowerPAD™ package incorporates an exposed thermal pad that is designed to be attached to a printed circuit board (PCB). The thermal pad must be soldered directly to the PCB. After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For additional information on the PowerPAD package and how to take advantage of its heat dissipating abilities, refer to Technical Brief, PowerPAD Thermally Enhanced Package, Texas Instruments Literature No. SLMA002 and Application Brief, PowerPAD Made Easy, Texas Instruments Literature No. SLMA004. Both documents are available at www.ti.com.

The exposed thermal pad dimensions for this package are shown in the following illustration.



Top View

Exposed Thermal Pad Dimensions

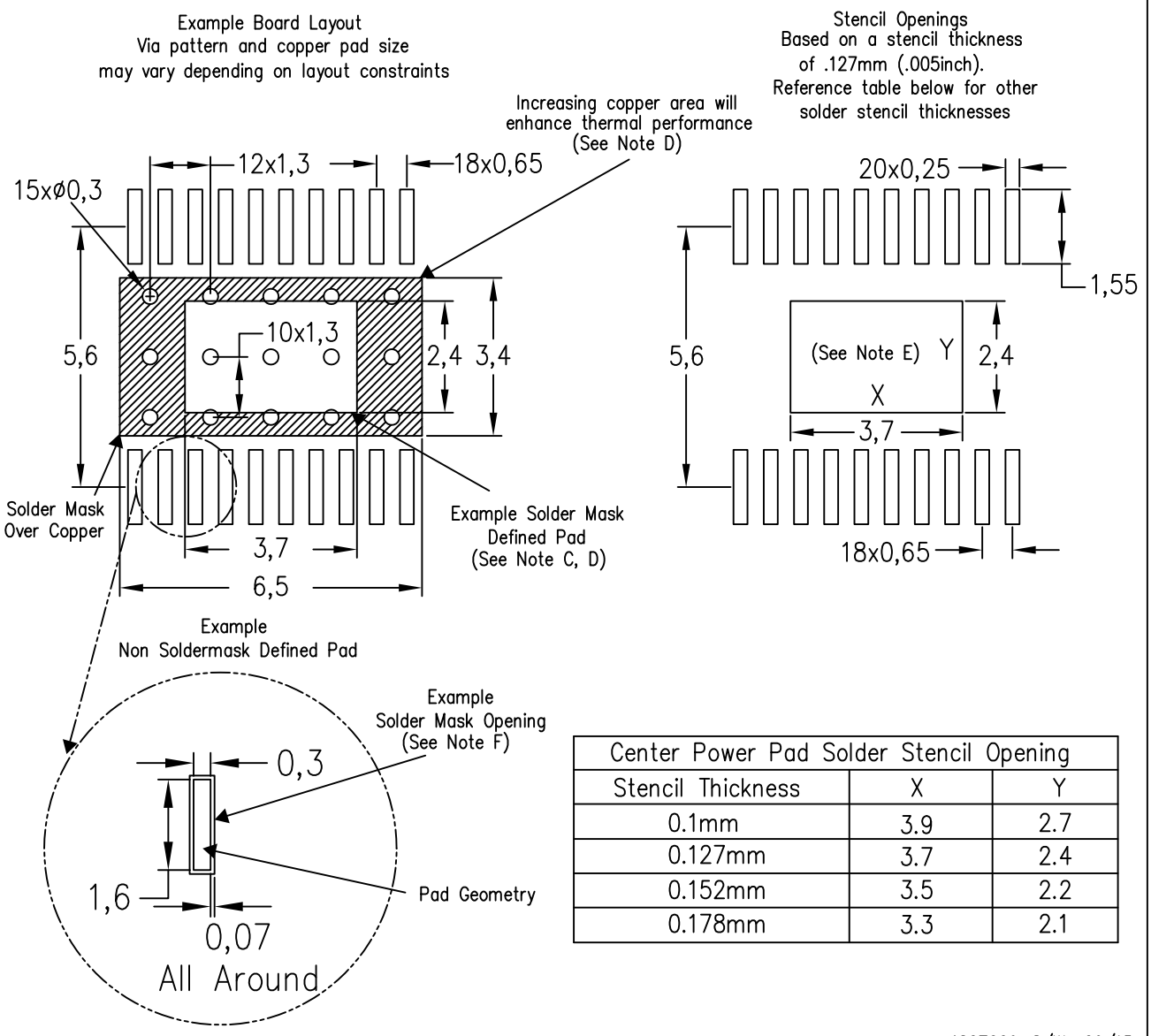
4206332–15/AO 01/16

NOTE: A. All linear dimensions are in millimeters

B Exposed tie strap features may not be present.

PowerPAD is a trademark of Texas Instruments

PWP (R–PDSO–G20) PowerPAD™ PLASTIC SMALL OUTLINE



Center Power Pad Solder Stencil Opening		
Stencil Thickness	X	Y
0.1mm	3.9	2.7
0.127mm	3.7	2.4
0.152mm	3.5	2.2
0.178mm	3.3	2.1

4207609–8/W 09/15

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. This package is designed to be soldered to a thermal pad on the board. Refer to Technical Brief, PowerPad Thermally Enhanced Package, Texas Instruments Literature No. SLMA002, SLMA004, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at www.ti.com <http://www.ti.com>. Publication IPC–7351 is recommended for alternate designs.
E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC–7525 for other stencil recommendations.
F. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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