



**THE DATASHEET OF
TPS71433DCKR**



80mA, 10V, 3.2 μ A Quiescent Current LOW-DROPOUT LINEAR REGULATOR in SC70 or SON 2x2

FEATURES

- **Wide Input Voltage Range: 2.5V to 10V**
- **Low Quiescent Current: 3.2 μ A at 80mA**
- **Stable with any Capacitor > 0.47 μ F**
- **Output Current: 80mA**
- **Dropout Voltage: 415mV at 50mA Load**
- **Available in Fixed 3.3V or Adjustable (1.2V to 8.8V) Versions**
- **Current Limit**
- **SC70-5 and 2mm x 2mm SON-6 Packages**
- **Specified Junction Temperature Range: –40°C to +125°C**
- **For MSP430-Specific Output Voltages, see the [TPS715xx](#)**

APPLICATIONS

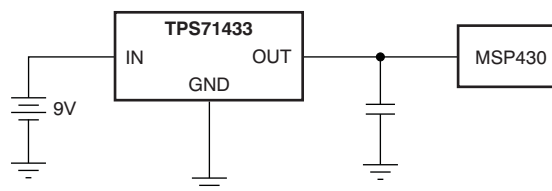
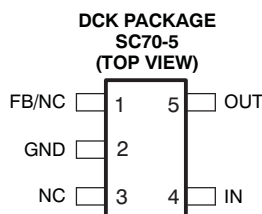
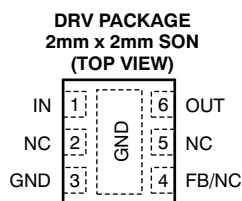
- **Ultralow-Power Microcontrollers**
- **Industrial/Automotive Applications**
- **PDA's**
- **Portable, Battery-Powered Equipment**

DESCRIPTION

The TPS714xx low-dropout (LDO) voltage regulators offer the benefits of wide input voltage range, low-dropout voltage, low-power operation, and miniaturized packaging. These devices, which operate over an input range of 2.5V to 10V, are stable with any capacitor $\geq 0.47\mu\text{F}$. The 2.5V to 10V input voltage range, combined with 3.2 μA quiescent current, makes this device particularly well-suited for two-cell alkaline, and two-cell lithium, and other low quiescent current sensitive battery applications. The low dropout voltage and low quiescent current allow operation at extremely low power levels. Therefore, the devices are ideal for power battery management ICs. Specifically, because the device is enabled as soon as the applied voltage reaches the minimum input voltage, the output is quickly available to power continuously-operating, battery-charging ICs.

The typical PNP pass transistor has been replaced by a PMOS pass element. Because the PMOS pass element behaves as a low-value resistor, the low dropout voltage (typically 415mV at 50mA of load current) is directly proportional to the load current. The quiescent current (3.2 μA , typical) is stable over the entire range of the output load current (0mA to 80mA).

The TPS714xx is available in a 2mm x 2mm SON-6 package ideal for high power dissipation, or an SC70-5 package ideal for handheld and ultra-portable applications.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

All trademarks are the property of their respective owners.



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.

AVAILABLE OPTIONS⁽¹⁾

PRODUCT	V _{OUT} ⁽²⁾
TPS714xxyyyz	XX is nominal output voltage (for example 33 = 3.3V, 01 = Adjustable) YYY is Package Designator Z is Package Quantity

- (1) For the most current package and ordering information see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
- (2) Custom output voltages are available on a quick-turn basis for prototyping. Production quantities are available; minimum package order quantities apply. Contact factory for details and availability.

ABSOLUTE MAXIMUM RATINGS

Over operating temperature range, unless otherwise noted.⁽¹⁾

PARAMETER	TPS714xx	UNIT
V _{IN} range	–0.3 to +24	V
V _{OUT} range	–0.3 to +9.9	V
V _{FB} range	–0.3 to +4	V
Peak output current	Internally limited	
Continuous total power dissipation	See Power Dissipation Rating table	
Junction temperature range, T _J	–40 to +125	°C
Storage temperature range	–65 to +150	°C
ESD rating	Human body model (HBM)	2 kV
	Charged device model (CDM)	500 V

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

POWER DISSIPATION RATING TABLE

BOARD	PACKAGE	R _{θJA} °C/W	DERATING FACTOR ABOVE T _A = +25°C	T _A ≤ 25°C POWER RATING	T _A = +70°C POWER RATING	T _A = +85°C POWER RATING
High-K ⁽¹⁾	DCK	315	3.18mW/°C	320mW	175mW	100mW
High-K ⁽¹⁾	DRV	65	15.4mW/°C	1.54W	850mW	0.62W

- (1) The JEDEC High-K (2s2p) board design used to derive this data was a 3 inch × 3 inch, multilayer board with 1-ounce internal power and ground planes and 2-ounce copper traces on top and bottom of the board.

ELECTRICAL CHARACTERISTICS

Over the operating junction temperature range ($T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$), $V_{IN} = V_{OUT(NOM)} + 1\text{V}$, $I_{OUT} = 1\text{mA}$, and $C_{OUT} = 1\mu\text{F}$, unless otherwise noted. The adjustable version is tested with $V_{OUT} = 2.8\text{V}$. Typical values are at $T_J = +25^\circ\text{C}$.

PARAMETER	TEST CONDITIONS	TPS714xx			UNIT	
		MIN	TYP	MAX		
Input voltage range ⁽¹⁾	V_{IN}	$I_{OUT} = 10\text{mA}$	2.5	10	V	
		$I_{OUT} = 80\text{mA}$	3	10		
Output voltage range (TPS71401)	V_{OUT}		V_{FB}	8.8	V	
Internal reference (TPS71401)	V_{FB}		1.12	1.20	1.24	V
Output voltage accuracy ⁽¹⁾	TPS71433 over V_{IN} , I_{OUT} , and Temp $4.3\text{V} < V_{IN} < 10\text{V}$, $1\text{mA} \leq I_{OUT} \leq 80\text{mA}$		3.135	3.3	3.465	V
Output voltage line regulation ⁽¹⁾	$\Delta V_{OUT}/\Delta V_{IN}$ $V_{OUT} + 1\text{V} < V_{IN} \leq 10\text{V}$			5		mV
Load regulation	$\Delta V_{OUT}/\Delta I_{OUT}$ $I_{OUT} = 1\text{mA}$ to 80mA			30		mV
Feedback pin bias current	$I_{FB\ BIAS}$ $I_{OUT} = 0\text{mA}$, $V_{IN} = 3\text{V}$ to 10V , $V_{OUT} = 1.2\text{V}$,			2		nA
Dropout voltage	V_{DO} $I_{OUT} = 80\text{mA}$, $V_{IN} = V_{OUT(NOM)} - 0.1\text{V}$			670	1300	mV
Output current limit	I_{CL} $V_{OUT} = 0\text{V}$			100	1100	mA
Ground pin current	I_{GND}	$T_J = -40^\circ\text{C}$ to $+85^\circ\text{C}$, $1\text{mA} \leq I_{OUT} \leq 80\text{mA}$		3.2	4.2	μA
		$1\text{mA} \leq I_{OUT} \leq 80\text{mA}$		3.2	5.8	
		$V_{IN} = 10\text{V}$, $1\text{mA} \leq I_{OUT} \leq 80\text{mA}$			7.4	
Power-supply ripple rejection	PSRR $f = 100\text{kHz}$, $C_{OUT} = 10\mu\text{F}$			60		dB
Output noise voltage	V_{IN} BW = 200Hz to 100kHz, $C_{OUT} = 10\mu\text{F}$, $I_{OUT} = 50\text{mA}$			575		μVrms

(1) Minimum $V_{IN} = V_{OUT} + V_{DO}$, or the value shown for Input voltage, whichever is greater.

PIN CONFIGURATION

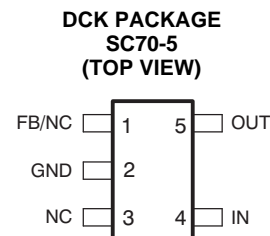
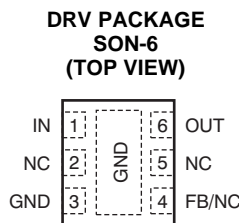


Table 1. Pin Descriptions

TPS714xx					DESCRIPTION
NAME	DCK		DRV		
	FIXED	ADJ.	FIXED	ADJ.	
FB/NC	-	1	-	4	Adjustable version only. This pin is used to set the output voltage.
GND	2	2	3, Pad	3, Pad	Ground
NC	1,3	3	2, 4, 5	2, 5	No connection. May be left open or tied to ground for improved thermal performance.
IN	4	4	1	1	Unregulated input voltage.
OUT	5	5	6	6	Regulated output voltage. Any output capacitor $\geq 0.47\mu\text{F}$ can be used for stability.

FUNCTIONAL BLOCK DIAGRAMS

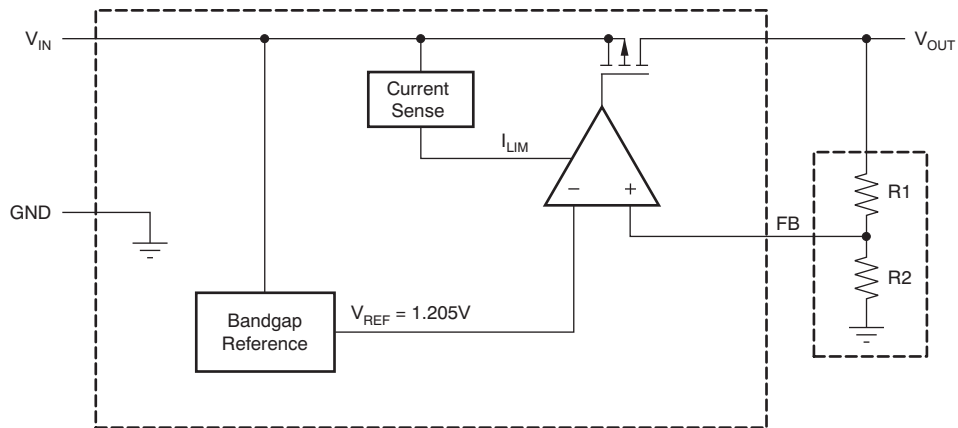


Figure 1. Adjustable Voltage Version

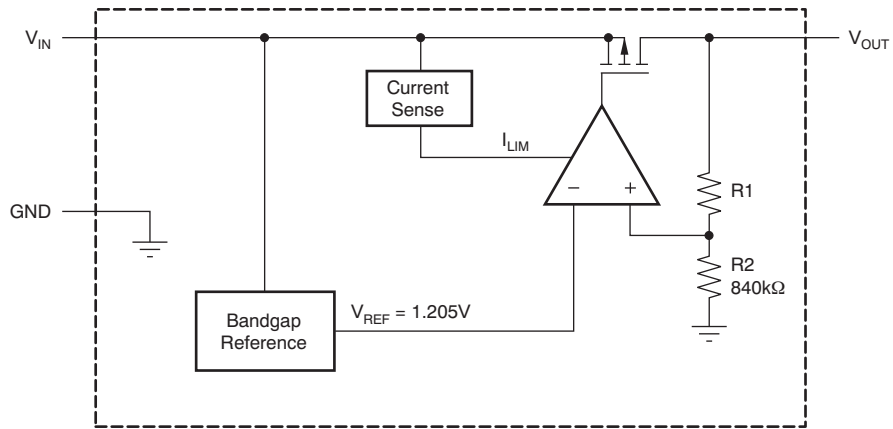


Figure 2. Fixed Voltage Version

TYPICAL CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, unless otherwise noted.

**TPS71433
OUTPUT VOLTAGE
vs
OUTPUT CURRENT**

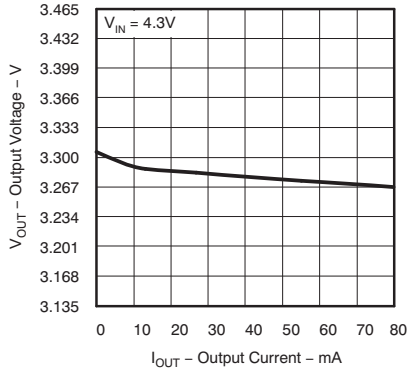


Figure 3.

**TPS71433
OUTPUT VOLTAGE
vs
JUNCTION TEMPERATURE**

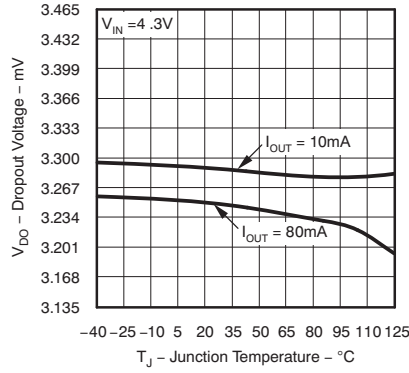


Figure 4.

**TPS71433
QUIESCENT CURRENT
vs
JUNCTION TEMPERATURE**

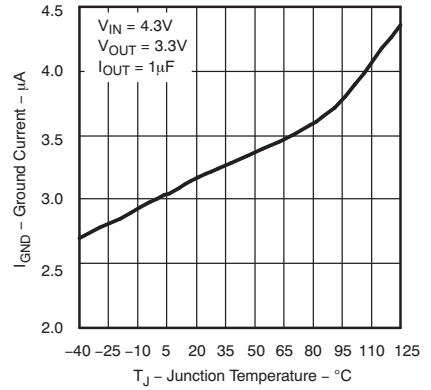


Figure 5.

**TPS71433
OUTPUT SPECTRAL NOISE DENSITY
vs
FREQUENCY**

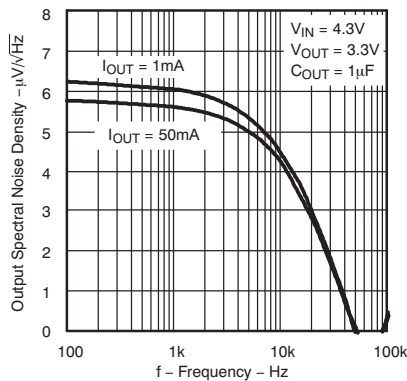


Figure 6.

**TPS71433
OUTPUT IMPEDANCE
vs
FREQUENCY**

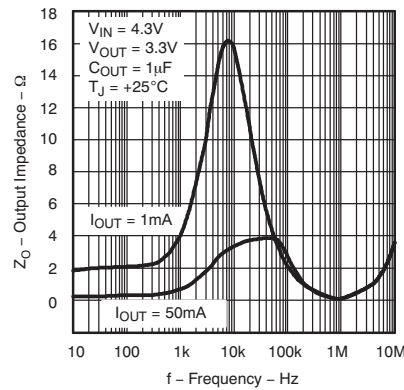


Figure 7.

**TPS71433
DROPOUT VOLTAGE
vs
OUTPUT CURRENT**

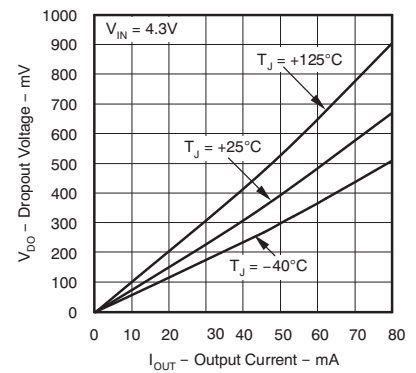


Figure 8.

TYPICAL CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, unless otherwise noted.

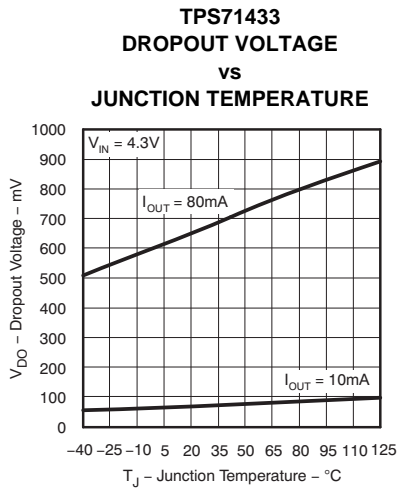


Figure 9.

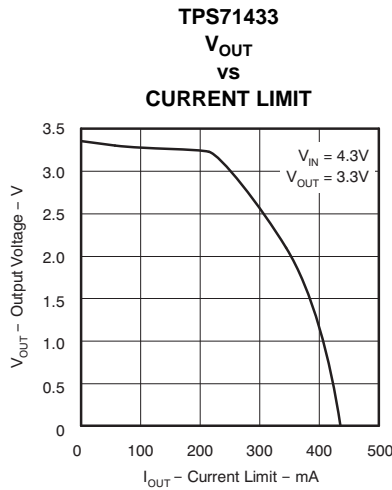


Figure 10.

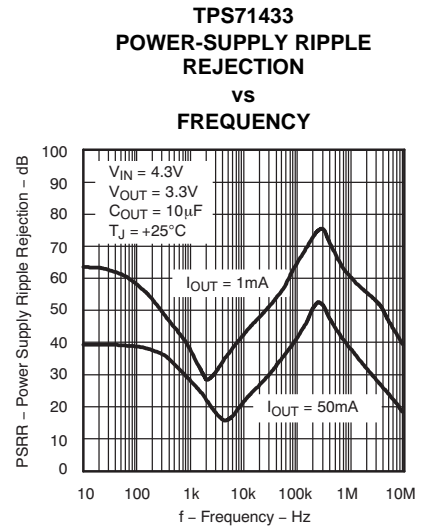


Figure 11.

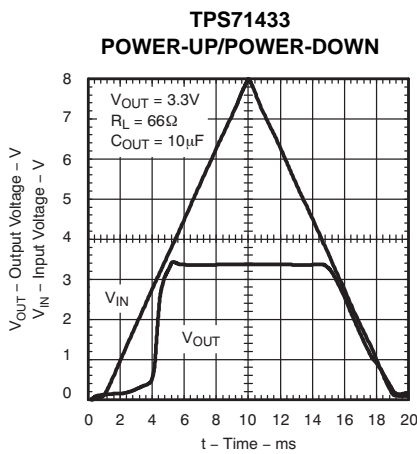


Figure 12.

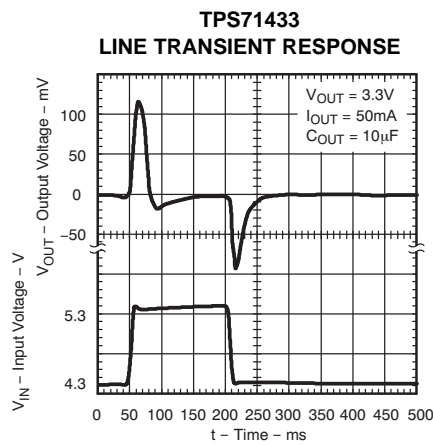


Figure 13.

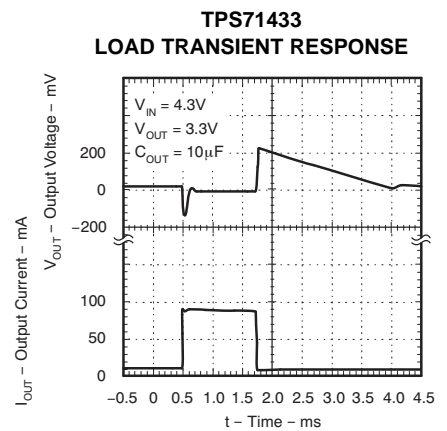


Figure 14.

APPLICATION INFORMATION

The TPS714xx family of LDO regulators has been optimized for ultralow power applications such as the [MSP430](#) microcontroller. Its ultralow supply current maximizes efficiency at light loads, and its high input voltage range makes it suitable for supplies such as unconditioned solar panels.

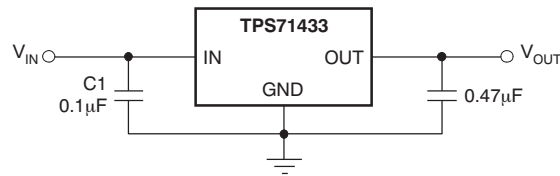


Figure 15. Typical Application Circuit (Fixed Voltage Version)

External Capacitor Requirements

Although not required, a 0.047µF or larger input bypass capacitor, connected between IN and GND and located close to the device, is recommended to improve transient response and noise rejection of the power supply as a whole. A higher-value input capacitor may be necessary if large, fast-rise-time load transients are anticipated and if the device is located several inches from the power source.

The TPS714xx requires an output capacitor connected between OUT and GND to stabilize the internal control loop. Any capacitor (including ceramic and tantalum) that is greater than or equal to 0.47µF properly stabilizes this loop.

Power Dissipation and Junction Temperature

To ensure reliable operation, worst-case junction temperature should not exceed +125°C. This restriction limits the power dissipation that the regulator can manage in any given application. To ensure the junction temperature is within acceptable limits, calculate the maximum allowable dissipation, $P_{D(MAX)}$, and the actual dissipation, P_D , which must be less than or equal to $P_{D(max)}$.

The maximum-power-dissipation limit is determined using [Equation 1](#):

$$P_{D(max)} = \frac{T_{Jmax} - T_A}{R_{\theta JA}}$$

Where:

- T_{Jmax} is the maximum allowable junction temperature.
- $R_{\theta JA}$ is the thermal resistance junction-to-ambient for the package (see the [Power Dissipation Rating](#) table).
- T_A is the ambient temperature.

(1)

The regulator dissipation is calculated using [Equation 2](#):

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$$

(2)

Power dissipation resulting from quiescent current is negligible.

Regulator Protection

The TPS714xx PMOS-pass transistor has a built-in back diode that conducts reverse current when the input voltage drops below the output voltage (for example, during power-down). Current is conducted from the output to the input and is not internally limited. If extended reverse voltage operation is anticipated, external limiting might be appropriate.

The TPS714xx features internal current limiting. During normal operation, the TPS714xx limits output current to approximately 500mA. When current limiting engages, the output voltage scales back linearly until the over-current condition ends. There is no internal thermal shutdown circuit in this device; therefore, care must be taken not to exceed the power dissipation ratings of the package during a fault condition. This device does not have undervoltage lockout; therefore, this constraint should be taken into consideration for specific applications.

Programming the TPS71401 Adjustable LDO Regulator

The output voltage of the TPS71401 adjustable regulator is programmed using an external resistor divider as shown in Figure 16. The output voltage is calculated using Equation 3:

$$V_{OUT} = V_{REF} \times \left(1 + \frac{R1}{R2} \right) \tag{3}$$

where:

$$V_{REF} = 1.20V \text{ typ (the internal reference voltage)}$$

Resistors R1 and R2 should be chosen for approximately a 1.5µA divider current. Lower value resistors can be used for improved noise performance, but the solution consumes more power. Higher resistor values should be avoided because leakage current out of the FB pin across R1/R2 creates an offset voltage that artificially increases the feedback voltage and thus erroneously decreases V_{OUT}. The recommended design procedure is to choose R2 = 1MΩ to set the divider current at 1.5µA, and then calculate R1 using Equation 4:

$$R1 = \left(\frac{V_{OUT}}{V_{REF}} - 1 \right) \times R2 \tag{4}$$

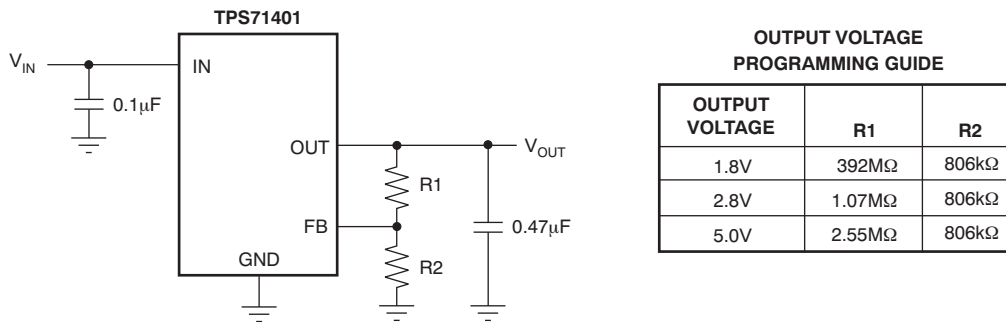


Figure 16. TPS71401 Adjustable LDO Regulator Programming

REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision B (December, 2009) to Revision C **Page**

- Changed *Ground pin current* maximum specifications **3**
-

Changes from Revision A (April, 2009) to Revision B **Page**

- Changed battery type shown in typical circuit illustration **1**
 - Changed V_{IN} range absolute maximum rating from +11.5V to +24V **2**
-

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
TPS71401DCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	CVG	Samples
TPS71401DCKT	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	CVG	Samples
TPS71401DRVR	ACTIVE	WSON	DRV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	CVG	Samples
TPS71401DRVT	ACTIVE	WSON	DRV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	CVG	Samples
TPS71433DCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	CVH	Samples
TPS71433DCKT	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	CVH	Samples
TPS71433DRVR	ACTIVE	WSON	DRV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	CVH	Samples
TPS71433DRVT	ACTIVE	WSON	DRV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	CVH	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.

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.

TAPE AND REEL INFORMATION

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
TPS71401DCKR	SC70	DCK	5	3000	180.0	8.4	2.41	2.41	1.2	4.0	8.0	Q3
TPS71401DCKT	SC70	DCK	5	250	180.0	8.4	2.41	2.41	1.2	4.0	8.0	Q3
TPS71401DRVR	WS0N	DRV	6	3000	179.0	8.4	2.2	2.2	1.2	4.0	8.0	Q2
TPS71401DRVT	WS0N	DRV	6	250	179.0	8.4	2.2	2.2	1.2	4.0	8.0	Q2
TPS71433DCKR	SC70	DCK	5	3000	180.0	8.4	2.41	2.41	1.2	4.0	8.0	Q3
TPS71433DCKT	SC70	DCK	5	250	180.0	8.4	2.41	2.41	1.2	4.0	8.0	Q3
TPS71433DRVR	WS0N	DRV	6	3000	179.0	8.4	2.2	2.2	1.2	4.0	8.0	Q2
TPS71433DRVT	WS0N	DRV	6	250	179.0	8.4	2.2	2.2	1.2	4.0	8.0	Q2

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS71401DCKR	SC70	DCK	5	3000	183.0	183.0	20.0
TPS71401DCKT	SC70	DCK	5	250	183.0	183.0	20.0
TPS71401DRVR	WSON	DRV	6	3000	203.0	203.0	35.0
TPS71401DRVT	WSON	DRV	6	250	203.0	203.0	35.0
TPS71433DCKR	SC70	DCK	5	3000	183.0	183.0	20.0
TPS71433DCKT	SC70	DCK	5	250	183.0	183.0	20.0
TPS71433DRVR	WSON	DRV	6	3000	203.0	203.0	35.0
TPS71433DRVT	WSON	DRV	6	250	203.0	203.0	35.0

DCK (R-PDSO-G5)

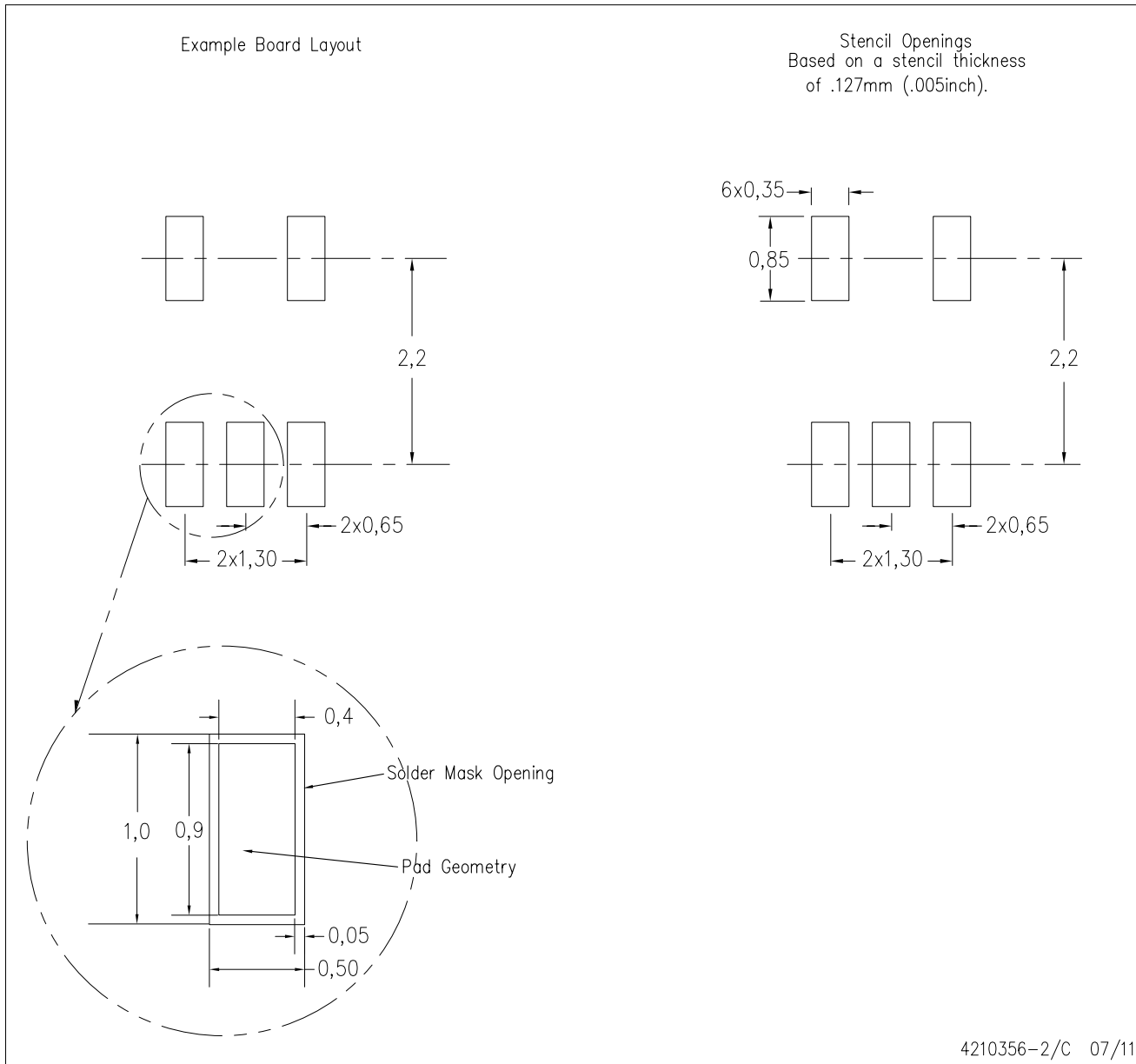
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - D. Falls within JEDEC MO-203 variation AA.

DCK (R-PDSO-G5)

PLASTIC SMALL OUTLINE



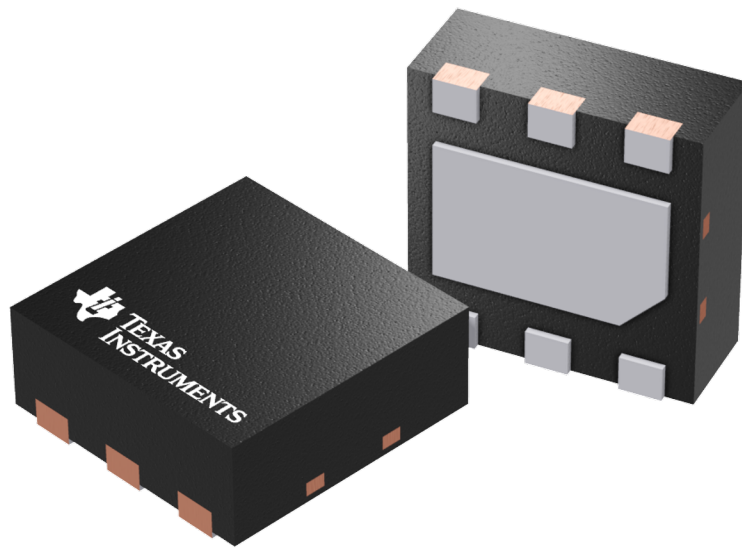
- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
 - D. Publication IPC-7351 is recommended for alternate designs.
 - 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.

GENERIC PACKAGE VIEW

DRV 6

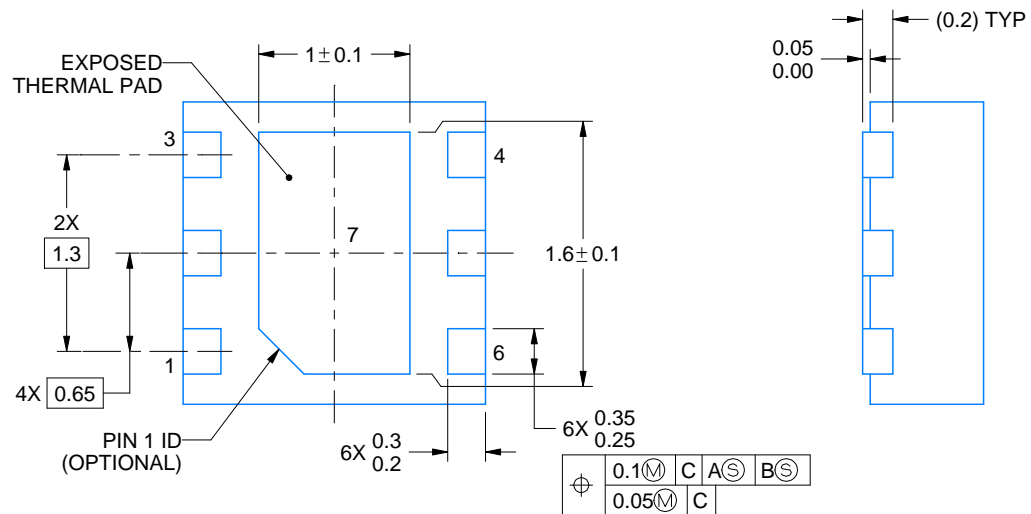
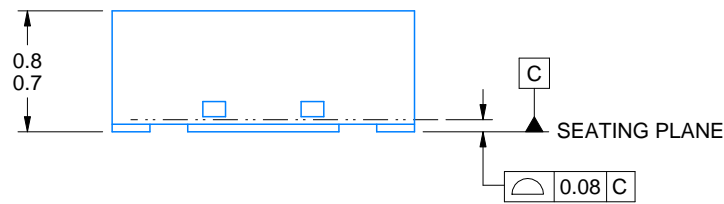
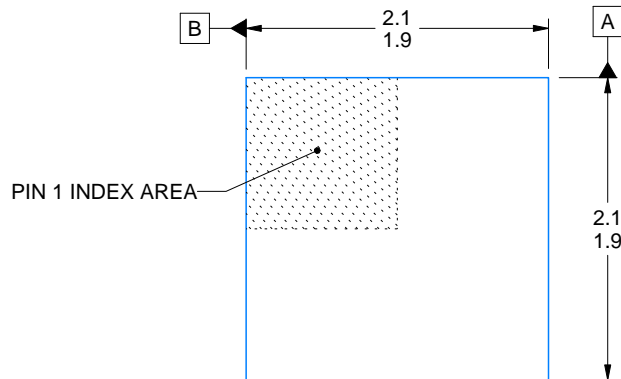
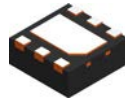
WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



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

4206925/F



4222173/B 04/2018

NOTES:

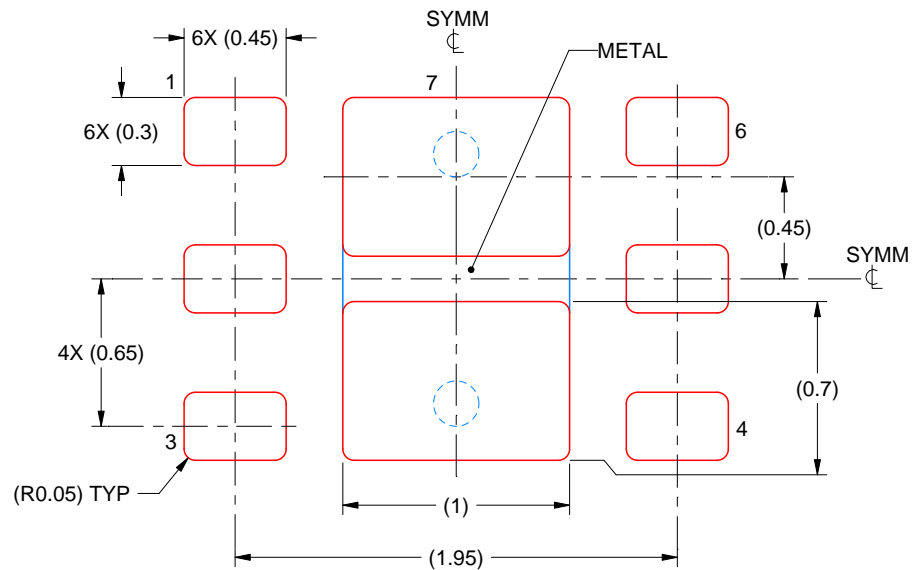
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

EXAMPLE STENCIL DESIGN

DRV0006A

WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD #7
88% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:30X

4222173/B 04/2018

NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

IMPORTANT NOTICE

Texas Instruments Incorporated (TI) reserves the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

TI's published terms of sale for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>) apply to the sale of packaged integrated circuit products that TI has qualified and released to market. Additional terms may apply to the use or sale of other types of TI products and services.

Reproduction of significant portions of TI information in TI data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such reproduced documentation. Information of third parties may be subject to additional restrictions. Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyers and others who are developing systems that incorporate TI products (collectively, "Designers") understand and agree that Designers remain responsible for using their independent analysis, evaluation and judgment in designing their applications and that Designers have full and exclusive responsibility to assure the safety of Designers' applications and compliance of their applications (and of all TI products used in or for Designers' applications) with all applicable regulations, laws and other applicable requirements. Designer represents that, with respect to their applications, Designer has all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. Designer agrees that prior to using or distributing any applications that include TI products, Designer will thoroughly test such applications and the functionality of such TI products as used in such applications.

TI's provision of technical, application or other design advice, quality characterization, reliability data or other services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using TI Resources in any way, Designer (individually or, if Designer is acting on behalf of a company, Designer's company) agrees to use any particular TI Resource solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

Designer is authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS. TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY DESIGNER AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Unless TI has explicitly designated an individual product as meeting the requirements of a particular industry standard (e.g., ISO/TS 16949 and ISO 26262), TI is not responsible for any failure to meet such industry standard requirements.

Where TI specifically promotes products as facilitating functional safety or as compliant with industry functional safety standards, such products are intended to help enable customers to design and create their own applications that meet applicable functional safety standards and requirements. Using products in an application does not by itself establish any safety features in the application. Designers must ensure compliance with safety-related requirements and standards applicable to their applications. Designer may not use any TI products in life-critical medical equipment unless authorized officers of the parties have executed a special contract specifically governing such use. Life-critical medical equipment is medical equipment where failure of such equipment would cause serious bodily injury or death (e.g., life support, pacemakers, defibrillators, heart pumps, neurostimulators, and implantables). Such equipment includes, without limitation, all medical devices identified by the U.S. Food and Drug Administration as Class III devices and equivalent classifications outside the U.S.

TI may expressly designate certain products as completing a particular qualification (e.g., Q100, Military Grade, or Enhanced Product). Designers agree that it has the necessary expertise to select the product with the appropriate qualification designation for their applications and that proper product selection is at Designers' own risk. Designers are solely responsible for compliance with all legal and regulatory requirements in connection with such selection.

Designer will fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of Designer's non-compliance with the terms and provisions of this Notice.

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View TPS71433DCKR](#) on WIN SOURCE

 [Texas Instruments](#) Information

Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management