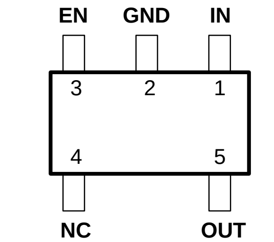
THE DATASHEET OF

TPS76150DBVR

www.win-source.net 0086-755-83957316

- **100-mA Low-Dropout Regulator**
- **Fixed Output Voltage Options: 5 V, 3.8 V, 3.3 V, 3.2 V, and 3 V**
- **Dropout Typically 170 mV at 100-mA**
- **Thermal Protection**
- **Less Than 1 μA Quiescent Current in Shutdown**
- **–40°C to 125°C Operating Junction Temperature Range**
- **5-Pin SOT-23 (DBV) Package**
- **ESD Protection Verified to 1.5 KV Human Body Model (HBM) per MIL-STD-883C**

DBV PACKAGE
(TOP VIEW)



NC – No internal connection

description

The TPS761xx is a 100 mA, low dropout (LDO) voltage regulator designed specifically for battery-powered applications. A proprietary BiCMOS fabrication process allows the TPS761xx to provide outstanding performance in all specifications critical to battery-powered operation.

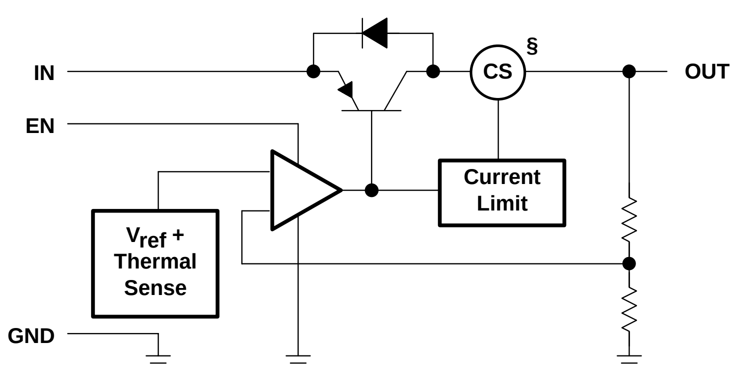
The TPS761xx is available in a space-saving SOT-23 (DBV) package and operates over a junction temperature range of –40°C to 125°C.

AVAILABLE OPTIONS

T_J	VOLTAGE	PACKAGE	PART NUMBER		SYMBOL
–40°C to 125°C	3 V	SOT-23 (DBV)	TPS76130DBVR†	TPS76130DBVT‡	PAEI
	3.2 V		TPS76132DBVR†	TPS76132DBVT‡	PAFI
	3.3 V		TPS76133DBVR†	TPS76133DBVT‡	PAII
	3.8 V		TPS76138DBVR†	TPS76138DBVT‡	PAKI
	5 V		TPS76150DBVR†	TPS76150DBVT‡	PALI

† The DBVR passive indicates tape and reel of 3000 parts.
‡ The DBVT passive indicates tape and reel of 250 parts.

functional block diagram



§ Current sense

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Terminal Functions

TERMINAL NAME	TERMINAL NO.	I/O	DESCRIPTION
EN	3	I	Enable input
GND	2		Ground
IN	1	I	Input voltage
NC	4		No connection
OUT	5	O	Regulated output voltage

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Input voltage range, V_I (see Note 1) . . . . –0.3 V to 16 V
Voltage range at EN . . . . –0.3 V to V_I + 0.3 V
Peak output current . . . . internally limited
Continuous total dissipation . . . . See Dissipation Rating Table
Operating junction temperature range, T_J . . . . –40°C to 150°C
Storage temperature range, T_{stg} . . . . –65°C to 150°C
ESD rating, HBM . . . . 1.5 kV

† 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 under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltages are with respect to device GND pin.

DISSIPATION RATING TABLE

BOARD	PACKAGE	$R_{\theta JC}$	$R_{\theta JA}$	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
Low K‡	DBV	65.8 °C/W	259 °C/W	3.9 mW/°C	386 mW	212 mW	154 mW
High K§	DBV	65.8 °C/W	180 °C/W	5.6 mW/°C	555 mW	305 mW	222 mW

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

recommended operating conditions

		MIN	NOM	MAX	UNIT
Input voltage, V_I	TPS76130	3.35		16	V
	TPS76132	3.58		16	
	TPS76133	3.68		16	
	TPS76138	4.18		16	
	TPS76150	5.38		16	
Continuous output current, I_O		0		100	mA
Operating junction temperature, T_J		–40		125	°C

electrical characteristics over recommended operating free-air temperature range, $V_I = V_{O(typ)} + 1$ V, $I_O = 1$ mA, EN = V_I, $C_o = 4.7$ µF (unless otherwise noted)

PARAMETER			TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_O	Output voltage	TPS76130	T_J = 25°C		2.96	3	3.04	V
			T_J = 25°C,	1 mA < I_O < 100 mA	2.9		3.04	
			1 mA < I_O < 100 mA		2.89		3.07	
		TPS76132	T_J = 25°C		3.16	3.2	3.24	V
			T_J = 25°C,	1 mA < I_O < 100 mA	3.11		3.24	
			1 mA < I_O < 100 mA		3.08		3.3	
		TPS76133	T_J = 25°C		3.26	3.3	3.34	V
			T_J = 25°C,	1 mA < I_O < 100 mA	3.21		3.34	
			1 mA < I_O < 100 mA		3.18		3.4	
		TPS76138	T_J = 25°C		3.76	3.8	3.84	V
			T_J = 25°C,	1 mA < I_O < 100 mA	3.71		3.84	
			1 mA < I_O < 100 mA		3.68		3.9	
		TPS76150	T_J = 25°C		4.95	5	5.05	V
			T_J = 25°C,	1 mA < I_O < 100 mA	4.88		5.05	
			1 mA < I_O < 100 mA		4.86		5.1	
$I_{I(standby)}$	Standby current		EN = 0 V				1	µA
	Quiescent current (GND current)		I_O = 0 mA,	T_J = 25°C		90	115	µA
			I_O = 0 mA				130	
			I_O = 1 mA,	T_J = 25°C		100	130	
			I_O = 1 mA				170	
			I_O = 10 mA,	T_J = 25°C		190	220	
			I_O = 10 mA				260	
			I_O = 50 mA,	T_J = 25°C		850	1100	
			I_O = 50 mA				1200	
			I_O = 100 mA,	T_J = 25°C		2600	3600	
			I_O = 100 mA				4000	
	Input regulation	TPS76130	4 V < V_I < 16,	I_O = 1 mA		3	10	mV
		TPS76132	4.2 V < V_I < 16,	I_O = 1 mA		3	10	
		TPS76133	4.3 V < V_I < 16,	I_O = 1 mA		3	10	
		TPS76138	4.8 V < V_I < 16,	I_O = 1 mA		3	10	
		TPS76150	6 V < V_I < 16	I_O = 1 mA		3	10	
V_n	Output noise voltage		BW = 300 Hz to 50 kHz	C_o = 10 µF, T_J = 25°C		190		µVrms
	Ripple rejection		f = 1 kHz, C_o = 10 µF,	T_J = 25°C		63		dB

electrical characteristics over recommended operating free-air temperature range, $V_I = V_{O(typ)} + 1$ V, $I_O = 1$ mA, EN = V_I, $C_o = 4.7$ µF (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
	Dropout voltage	I_O = 0 mA,	T_J = 25°C		1	3	mV
		I_O = 0 mA				5	
		I_O = 1 mA,	T_J = 25°C		7	10	
		I_O = 1 mA				15	
		I_O = 10 mA,	T_J = 25°C		40	60	
		I_O = 10 mA				90	
		I_O = 50 mA,	T_J = 25°C		120	150	
		I_O = 50 mA				180	
		I_O = 100 mA,	T_J = 25°C		170	240	
		I_O = 100 mA				280	
	Peak output current/current limit			100	125	135	mA
	High level enable input			2			V
	Low level enable input					0.8	V
I_I	Input current (EN)	EN = 0 V		–1	0	1	µA
		EN = V_I			2.5	5	

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V_O	Output voltage	vs Output current	1, 2, 3
		vs Free-air temperature	4, 5, 6
	Ground current	vs Free-air temperature	7, 8, 9
	Output noise	vs Frequency	10
Z_o	Output impedance	vs Frequency	11
V_{DO}	Dropout voltage	vs Free-air temperature	12
	Line transient response		13, 15
	Load transient response		14, 16

TYPICAL CHARACTERISTICS

TPS76130
OUTPUT VOLTAGE
vs
OUTPUT CURRENT

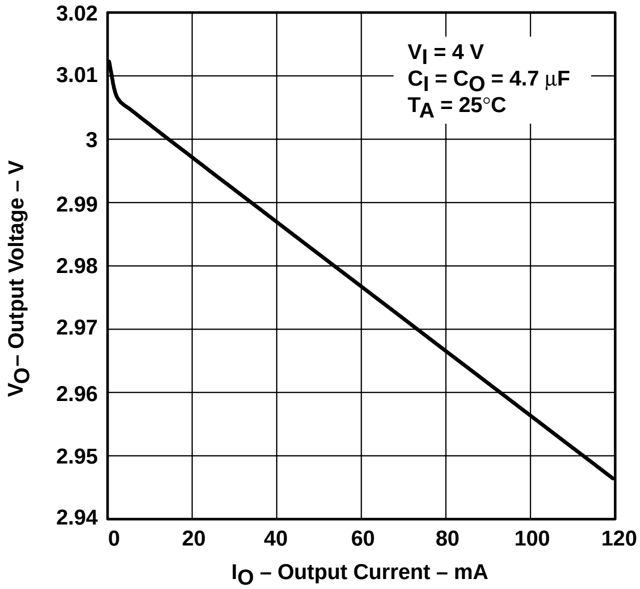

Figure 1

TPS76133
OUTPUT VOLTAGE
vs
OUTPUT CURRENT

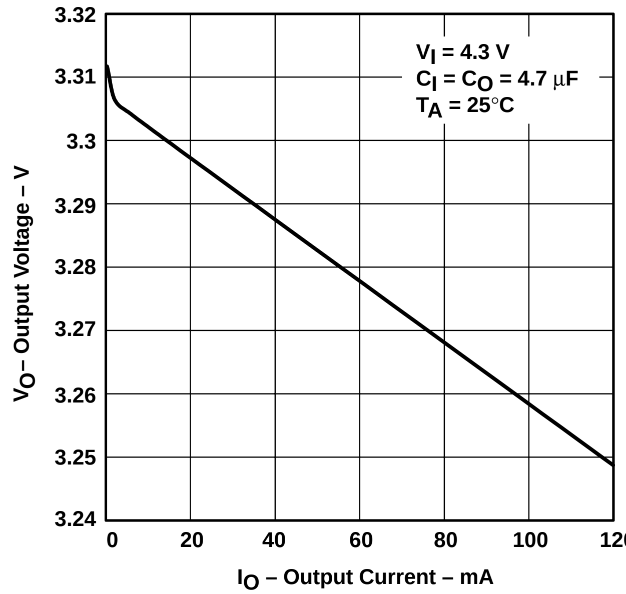

Figure 2

TPS76150
OUTPUT VOLTAGE
vs
OUTPUT CURRENT

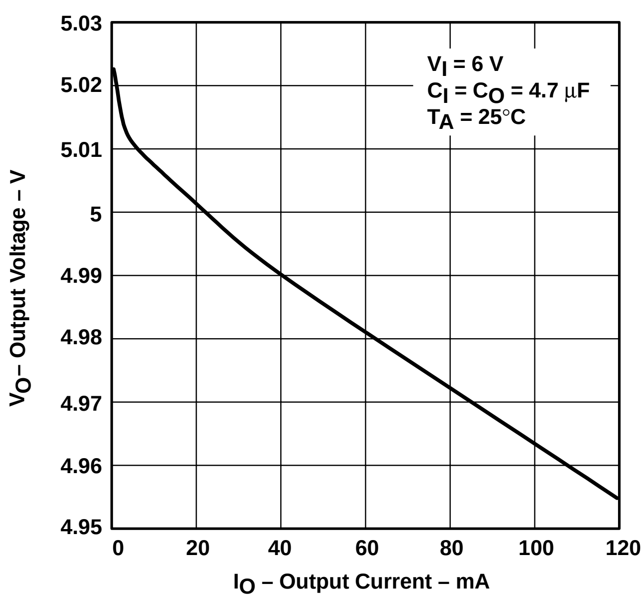

Figure 3

TPS76130
OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

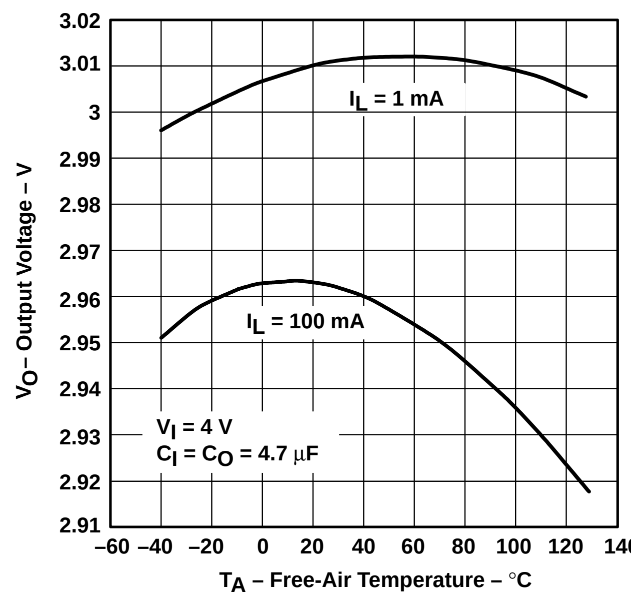

Figure 4

TYPICAL CHARACTERISTICS

TPS76133
OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

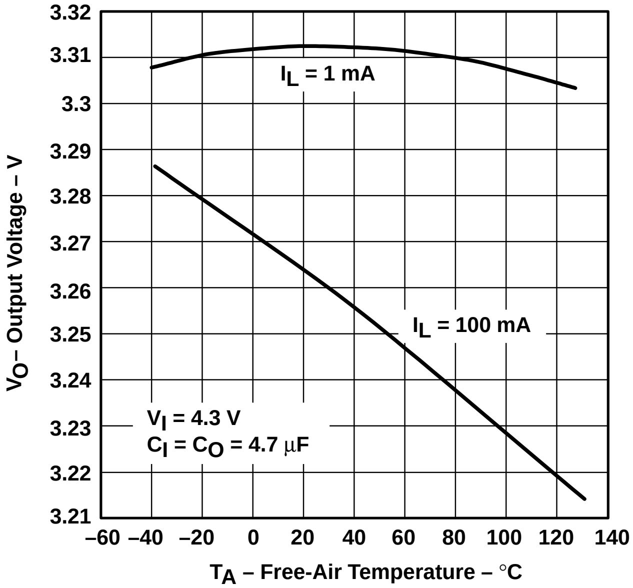

Figure 5

TPS76150
OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

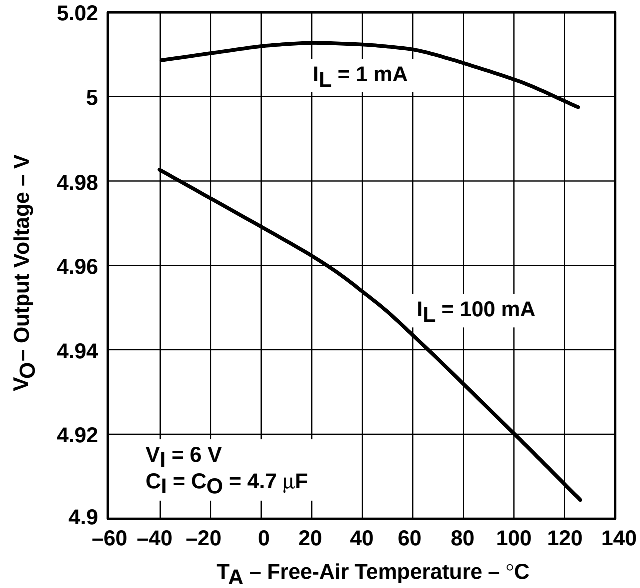

Figure 6

TPS76130
GROUND CURRENT
vs
FREE-AIR TEMPERATURE

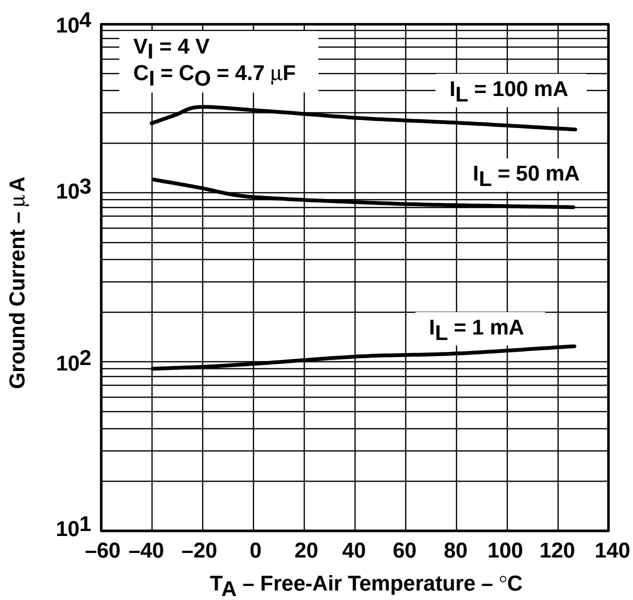

Figure 7

TPS76133
GROUND CURRENT
vs
FREE-AIR TEMPERATURE

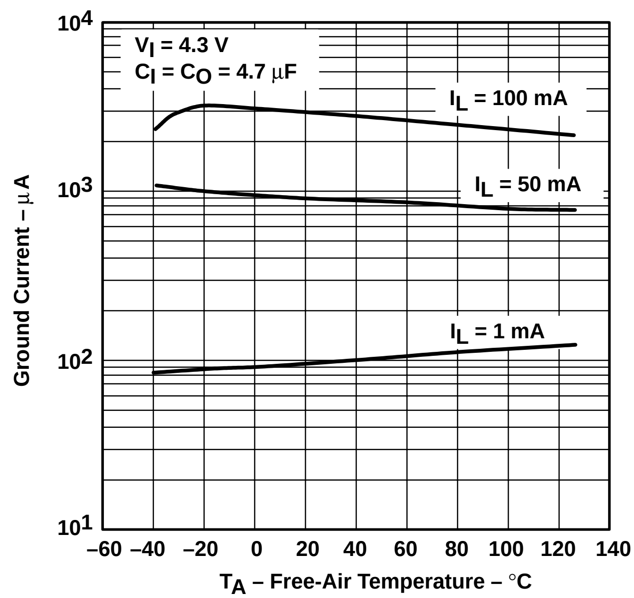

Figure 8

TYPICAL CHARACTERISTICS

TPS76150
GROUND CURRENT
vs
FREE-AIR TEMPERATURE

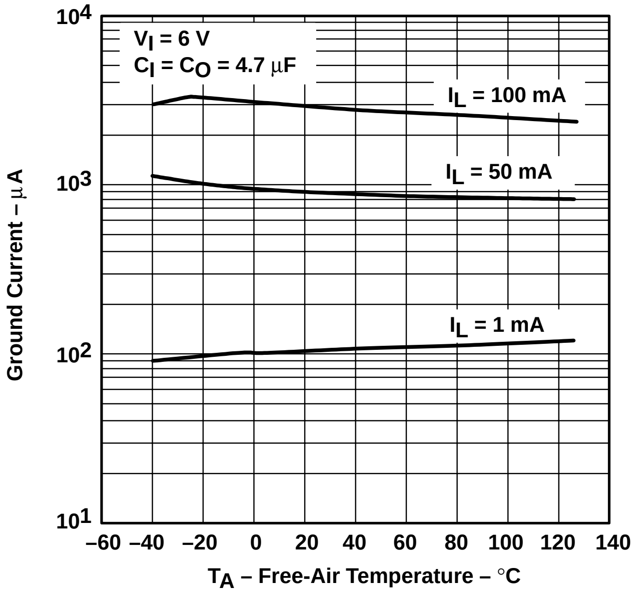

Figure 9

OUTPUT NOISE
vs
FREQUENCY

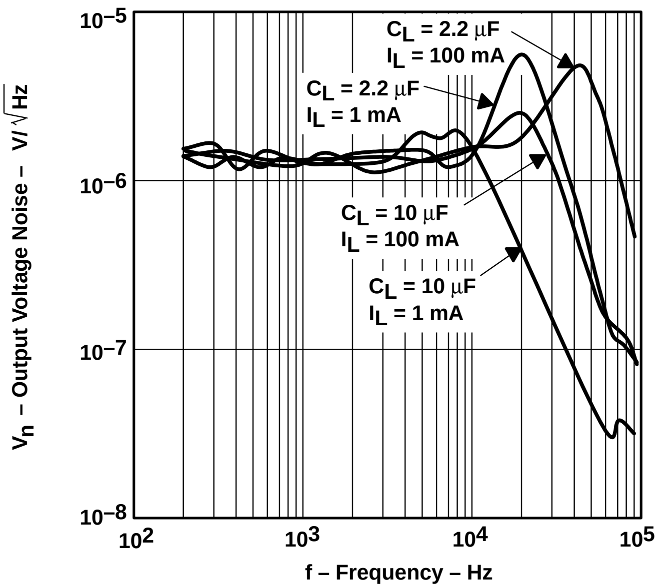

Figure 10

OUTPUT IMPEDANCE
vs
FREQUENCY

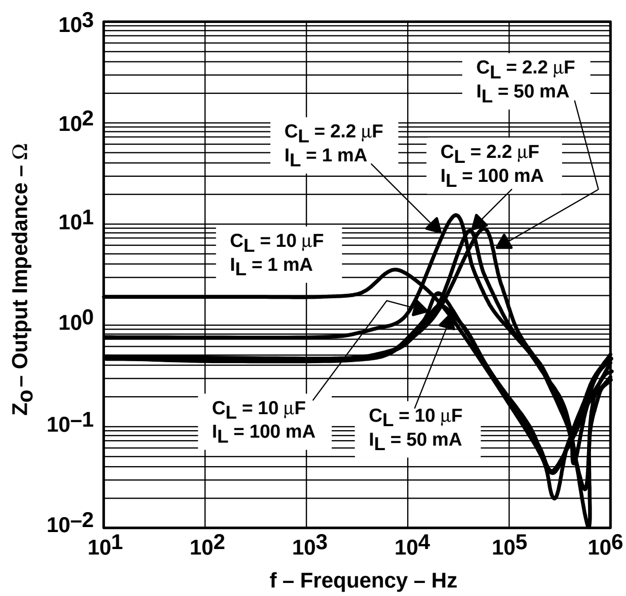

Figure 11

TPS76130
DROPOUT VOLTAGE
vs
FREE-AIR TEMPERATURE

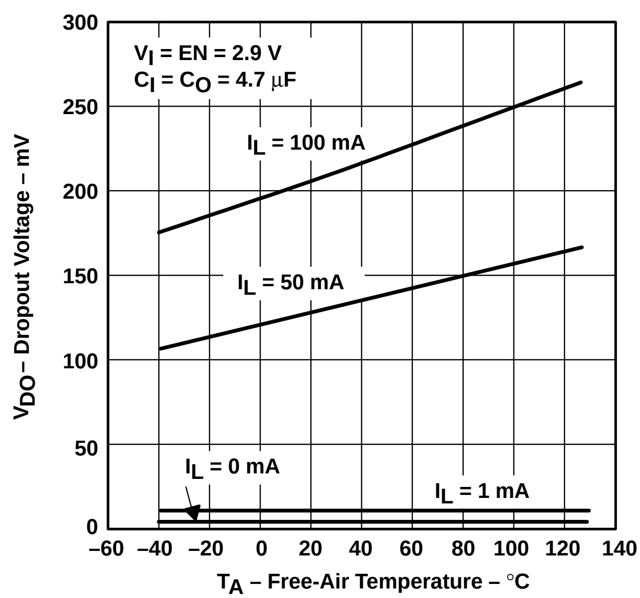

Figure 12

TYPICAL CHARACTERISTICS

TPS76130
LINE TRANSIENT RESPONSE

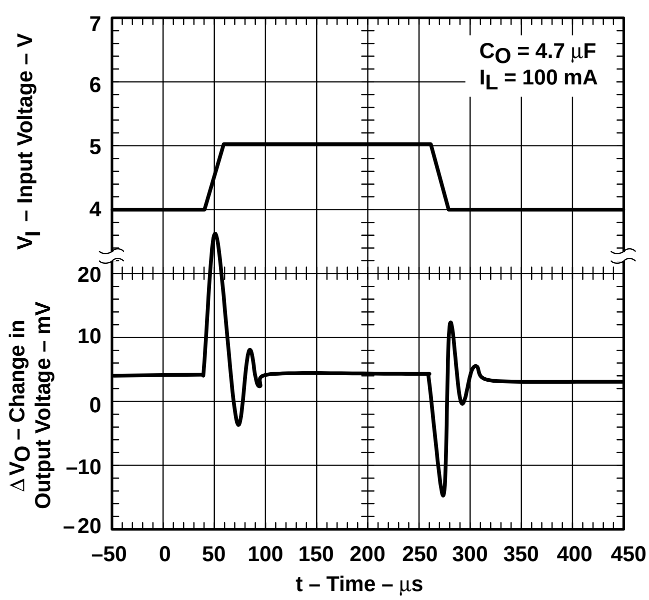

Figure 13

TPS76130
LOAD TRANSIENT RESPONSE

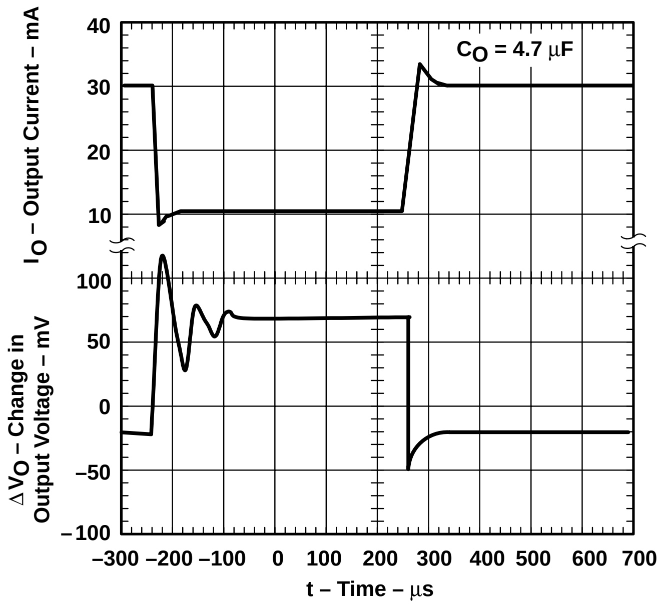

Figure 14

TPS76150
LINE TRANSIENT RESPONSE

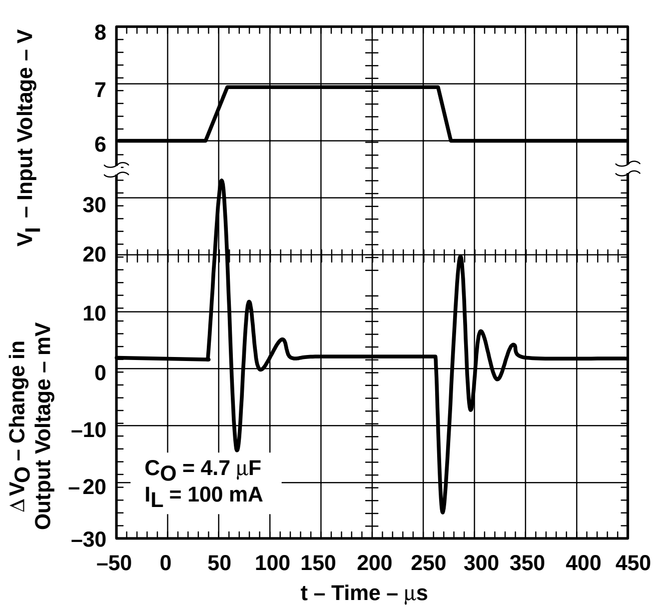

Figure 15

TPS76150
LOAD TRANSIENT RESPONSE

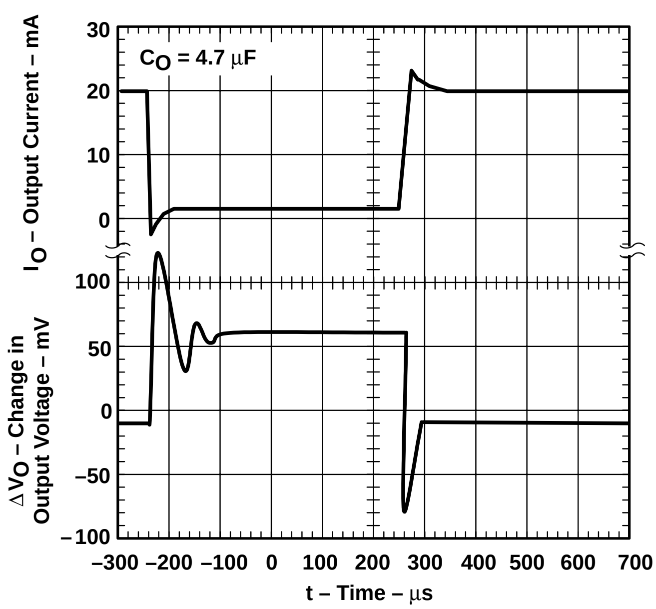

Figure 16

APPLICATION INFORMATION

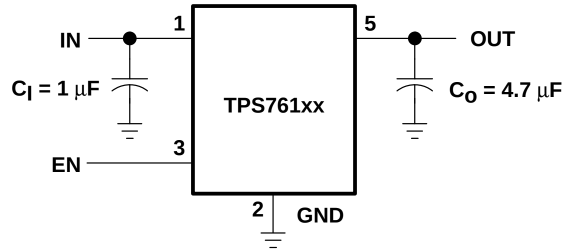

Figure 17. TPS761xx Typical Application

over current protection

The over current protection circuit forces the TPS761xx into a constant current output mode when the load is excessive or the output is shorted to ground. Normal operation resumes when the fault condition is removed.

NOTE:
An overload or short circuit may also activate the over temperature protection if the fault condition persists.

over temperature protection

The thermal protection system shuts the TPS761xx down when the junction temperature exceeds 160°C. The device recovers and operates normally when the temperature drops below 150°C.

input capacitor

A 1-µF or larger ceramic decoupling capacitor with short leads connected between IN and GND is recommended. The decoupling capacitor may be omitted if there is a 1 µF or larger electrolytic capacitor connected between IN and GND and located reasonably close to the TPS761xx. However, the small ceramic device is desirable even when the larger capacitor is present, if there is a lot of high frequency noise present in the system.

output capacitor

Like all low dropout regulators, the TPS761xx requires an output capacitor connected between OUT and GND to stabilize the internal control loop. The minimum recommended capacitance value is 4.7 µF and the ESR (equivalent series resistance) must be between 0.1 Ω and 10 Ω. Solid tantalum electrolytic, aluminum electrolytic, and multilayer ceramic capacitors are all suitable, provided they meet the requirements described above. Most of the commercially available 4.7-µF surface-mount solid-tantalum capacitors, including devices from Sprague, Kemet, and Nichicon, meet the ESR requirements stated above. Multilayer ceramic capacitors should have minimum values of 4.7 µF over the full operating temperature range of the equipment.

enable (EN)

A logic zero on the enable input shuts the TPS761xx off and reduces the supply current to less than 1 µA. Pulling the enable input high causes normal operation to resume. If the enable feature is not used, EN should be connected to IN to keep the regulator on all of the time. The EN input must not be left floating.

reverse current path

The power transistor used in the TPS761xx has an inherent diode connected between IN and OUT as shown in the functional block diagram. This diode conducts current from the OUT terminal to the IN terminal whenever IN is lower than OUT by a diode drop. This condition does not damage the TPS761xx provided the current is limited to 150 mA.

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
TPS76130DBVR	ACTIVE	SOT-23	DBV	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	PAEI	Samples
TPS76130DBVT	ACTIVE	SOT-23	DBV	5	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	PAEI	Samples
TPS76132DBVR	ACTIVE	SOT-23	DBV	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	PAFI	Samples
TPS76132DBVT	ACTIVE	SOT-23	DBV	5	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	PAFI	Samples
TPS76133DBVR	ACTIVE	SOT-23	DBV	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	PAII	Samples
TPS76138DBVR	ACTIVE	SOT-23	DBV	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	PAKI	Samples
TPS76138DBVT	ACTIVE	SOT-23	DBV	5	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	PAKI	Samples
TPS76150DBVR	ACTIVE	SOT-23	DBV	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	PALI	Samples
TPS76150DBVRG4	ACTIVE	SOT-23	DBV	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	PALI	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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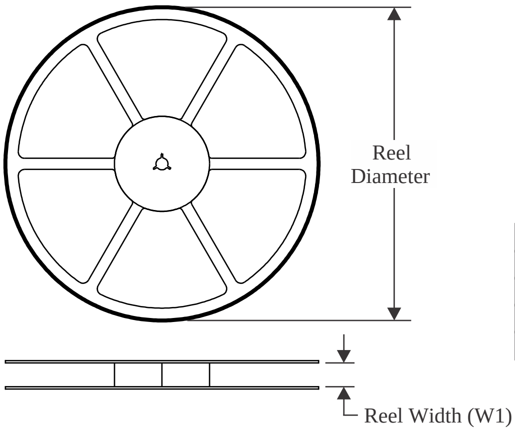
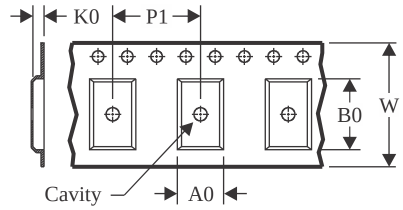
TAPE AND REEL INFORMATION

REEL DIMENSIONS

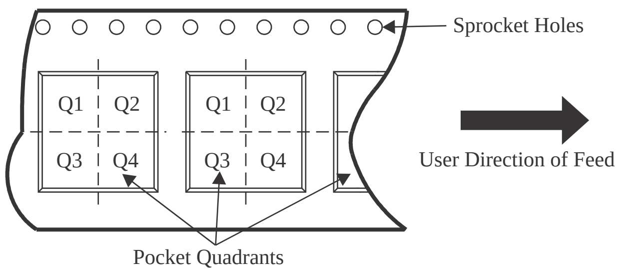


TAPE DIMENSIONS



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

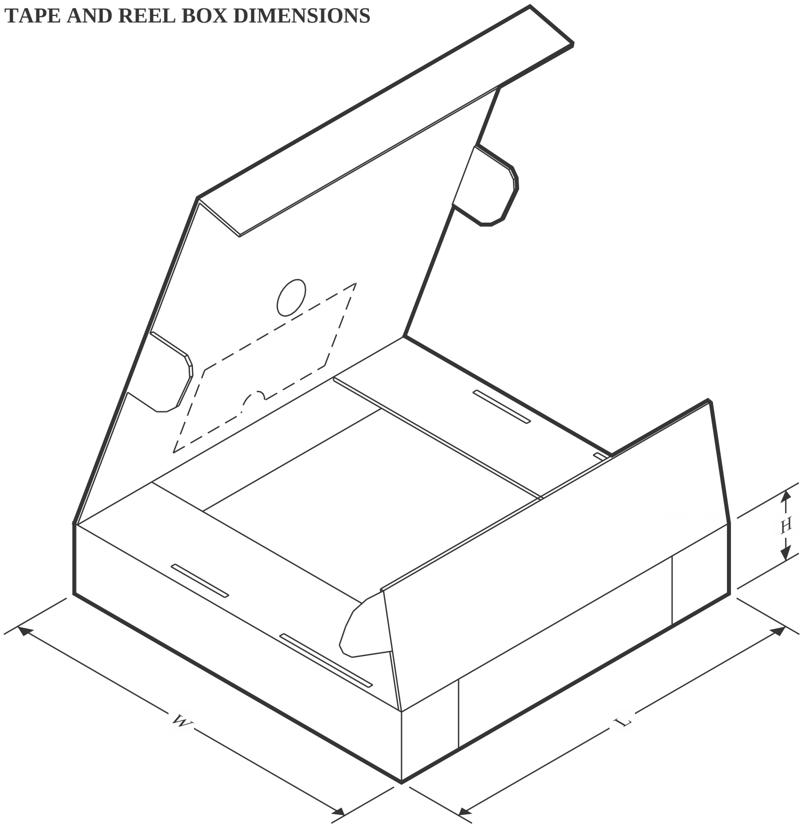
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

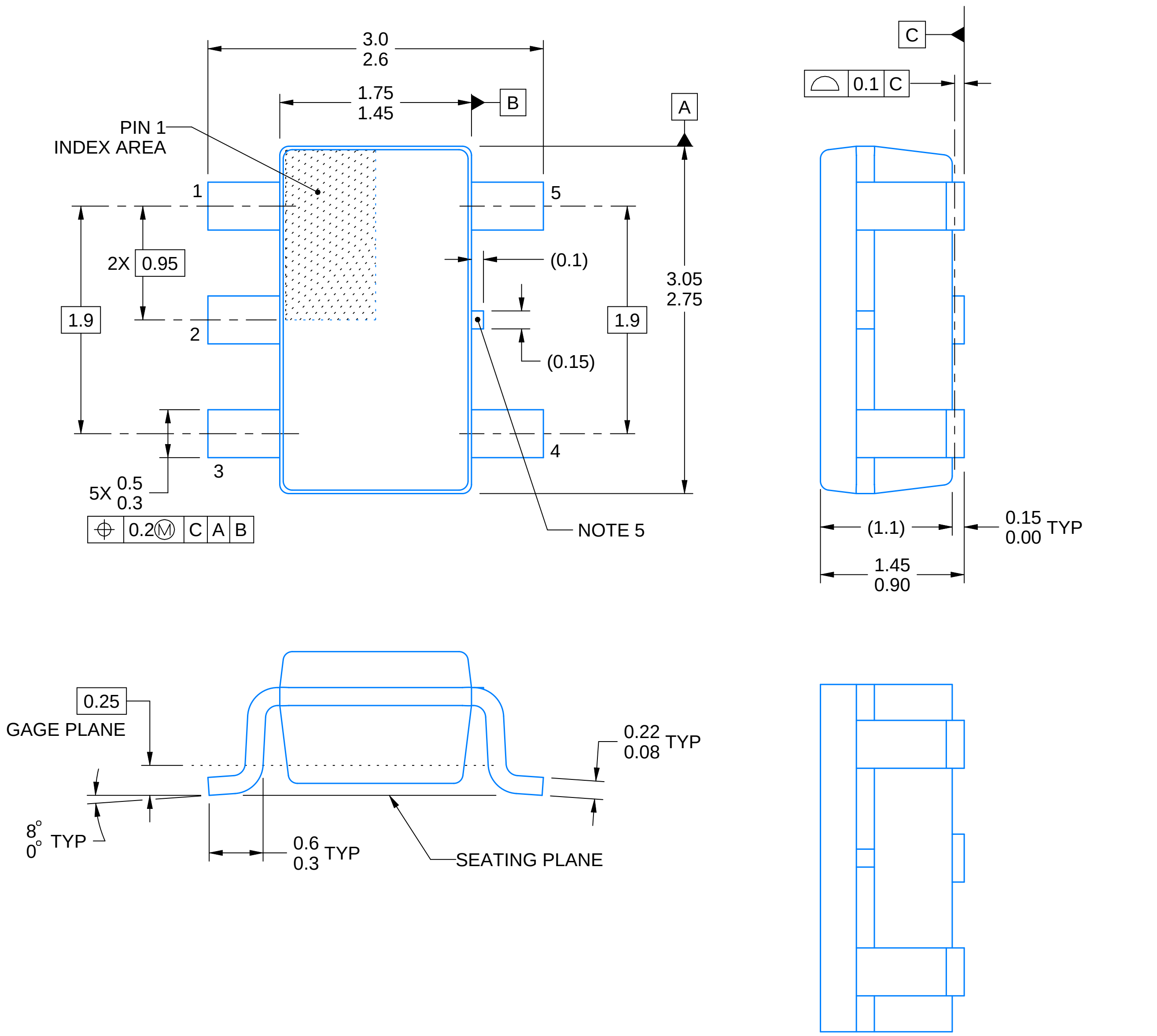
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TPS76130DBVR	SOT-23	DBV	5	3000	180.0	9.0	3.15	3.2	1.4	4.0	8.0	Q3
TPS76130DBVT	SOT-23	DBV	5	250	180.0	9.0	3.15	3.2	1.4	4.0	8.0	Q3
TPS76132DBVR	SOT-23	DBV	5	3000	180.0	9.0	3.15	3.2	1.4	4.0	8.0	Q3
TPS76132DBVT	SOT-23	DBV	5	250	180.0	9.0	3.15	3.2	1.4	4.0	8.0	Q3
TPS76133DBVR	SOT-23	DBV	5	3000	180.0	9.0	3.15	3.2	1.4	4.0	8.0	Q3
TPS76138DBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS76138DBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS76150DBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS76130DBVR	SOT-23	DBV	5	3000	182.0	182.0	20.0
TPS76130DBVT	SOT-23	DBV	5	250	182.0	182.0	20.0
TPS76132DBVR	SOT-23	DBV	5	3000	182.0	182.0	20.0
TPS76132DBVT	SOT-23	DBV	5	250	182.0	182.0	20.0
TPS76133DBVR	SOT-23	DBV	5	3000	182.0	182.0	20.0
TPS76138DBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS76138DBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS76150DBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0



ALTERNATIVE PACKAGE SINGULATION VIEW

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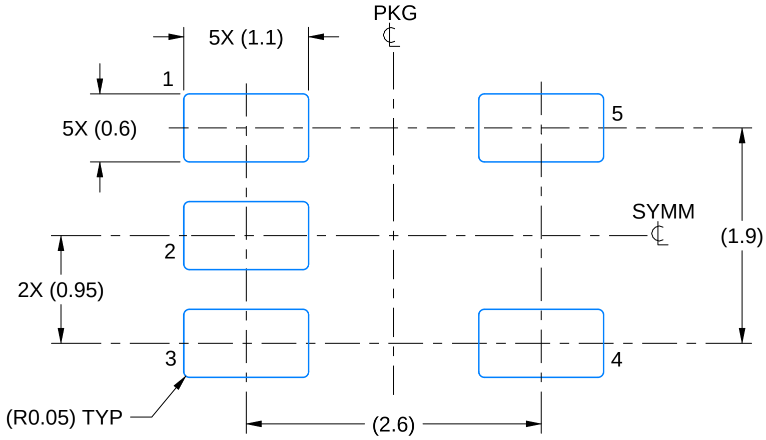
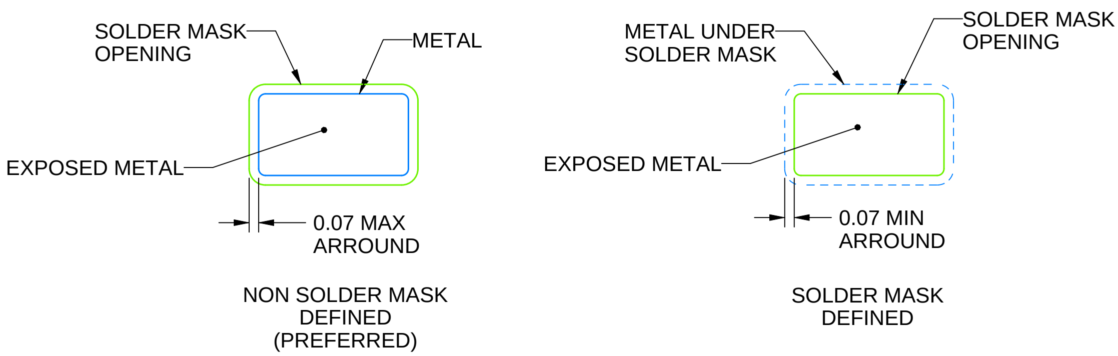
NOTES:

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. Refernce JEDEC MO-178.
4. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25 mm per side.
5. Support pin may differ or may not be present.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

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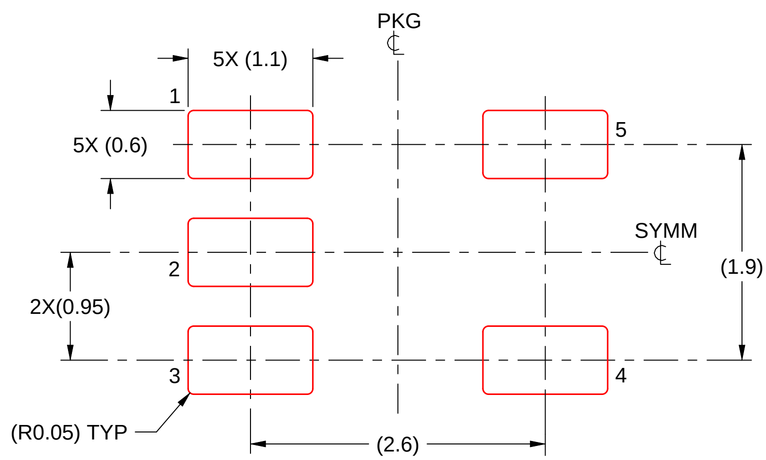
NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

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NOTES: (continued)

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

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