



DRV632 可変ゲイン対応 DirectPath™ 2VRMS オーディオ・ライン・ドライバ

1 特長

- ステレオ DirectPath™オーディオ・ライン・ドライバ
 - 2Vrms (10kΩ 負荷、3.3V 電源)
- 低い THD+N : 0.01% 未満 (2Vrms、10kΩ 負荷)
- 高い SNR : 90dB 超
- 600Ω 出力負荷に対応
- 差動入力、シングルエンド出力
- 外付けのゲイン設定抵抗によりゲインを変更可能
- 低い DC オフセット : 1mV 未満
- グランドを基準とする出力により DC ブロッキング・コンデンサが不要
 - 基板面積の低減
 - 部品のコストを低減
 - THD+N 性能の向上
 - 出力コンデンサによる低域特性の悪化なし
- 短絡保護
- クリック音/ポップ音低減回路
- 外部低電圧ミュート
- アクティブなミュート制御によりオーディオのオン/オフ制御時のポップ音が発生しない
- 省スペースの TSSOP パッケージ

2 アプリケーション

- セットトップ・ボックス
- Blu-ray Disc™、DVD プレーヤ
- LCD および PDP TV
- ミニ/マイクロ・コンボ・システム
- サウンド・カード
- ノート PC

3 概要

DRV632 はポップフリーの 2V_{RMS} ステレオ・ライン・ドライバであり、出力 DC ブロッキングのコンデンサを必要としないため構成部品の数と費用を低減できます。DRV632 は、サイズとコストが重要な設計パラメータである単一電源の電子機器に理想的です。

TI が特許権を持つ DirectPath™ テクノロジを使用して設計された DRV632 は、3.3V 電源電圧で 10kΩ の負荷を 2V_{RMS} で駆動できます。このデバイスは差動入力を備えており、外付けのゲイン設定抵抗を使用して ±1V/V から ±10V/V までの範囲のゲインに対応します。このゲインは、各チャンネルごとに個別に設定できます。ライン出力は ±8kV IEC ESD に対して保護されており、抵抗とコンデンサによる単純な ESD 保護回路のみで十分です。

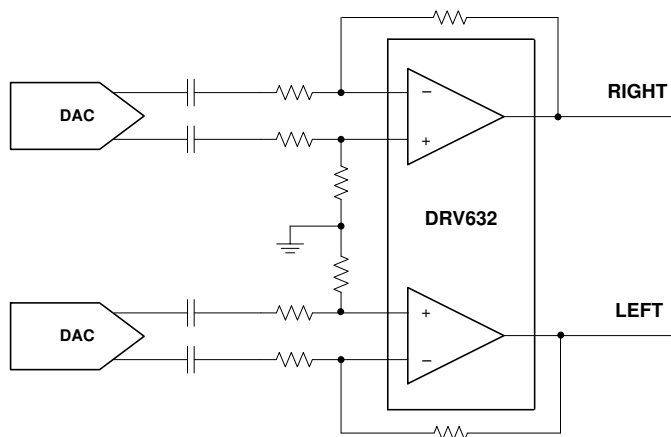
DRV632 にはアクティブ・ミュート制御が組み込まれているため、オーディオのオン/オフ制御時にポップ音が発生しません。DRV632 は、電源が切れたときに出力をミュートする外部低電圧検出器を備えているため、シャットダウン時にポップ音が発生しません。

製品情報⁽¹⁾

型番	パッケージ	本体サイズ(公称)
DRV632	TSSOP (14)	5.00mm×4.40mm

(1) 利用可能なすべてのパッケージについては、このデータシートの末尾にある注文情報を参照してください。

簡略ブロック図



目次

1	特長	1	10.1	Overview	9
2	アプリケーション	1	10.2	Functional Block Diagram	9
3	概要	1	10.3	Feature Description	10
4	改訂履歴	2	10.4	Device Functional Modes	12
5	概要 (続き)	3	11	Application and Implementation	13
6	Device Comparison Table	4	11.1	Application Information	13
7	Pin Configuration and Functions	5	11.2	Typical Application	13
8	Specifications	5	12	Power Supply Recommendations	15
8.1	Absolute Maximum Ratings	5	13	Layout	16
8.2	ESD Ratings	6	13.1	Layout Guidelines	16
8.3	Recommended Operating Conditions	6	13.2	Layout Example	16
8.4	Thermal Information	6	14	デバイスおよびドキュメントのサポート	17
8.5	Electrical Characteristics	6	14.1	デバイス・サポート	17
8.6	Operating Characteristics	7	14.2	コミュニティ・リソース	17
8.7	Typical Characteristics	8	14.3	商標	17
9	Parameter Measurement Information	8	14.4	静電気放電に関する注意事項	17
10	Detailed Description	9	14.5	Glossary	17
			15	メカニカル、パッケージ、および注文情報	17

4 改訂履歴

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

Revision B (August 2015) から Revision C に変更 Page

- Added link to DRV632EVM User's Guide..... 16

Revision A (June 2013) から Revision B に変更 Page

- 「ピン構成および機能」セクション、「ESD 定格」表、「機能説明」セクション、「デバイスの機能モード」セクション、「アプリケーションと実装」セクション、「電源に関する推奨事項」セクション、「レイアウト」セクション、「デバイスおよびドキュメントのサポート」セクション、「メカニカル、パッケージ、および注文情報」セクション 追加..... 1
- Added Device Comparison table. 4

2011年1月発行のものから更新 Page

- Changed description of UVP in *PIN FUNCTIONS* table 5
- Deleted min value for SNR and DNR in *OPERATING CHARACTERISTICS* table 7

5 概要（続き）

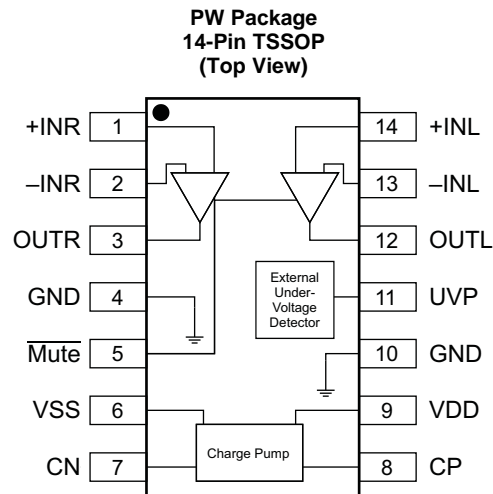
オーディオ製品に DRV632 を使用すると、 $2V_{\text{RMS}}$ 出力を生成する従来の方法と比べて部品数を大幅に減らすことができます。DRV632 は、 $5.6V_{\text{pp}}$ の出力を生成するのに $3.3V$ より高い電源を必要とせず、分割レール電源も必要としません。DRV632 には専用のチャージ・ポンプが内蔵され、クリーンでポップ音のないグラウンド・バイアスの $2V_{\text{RMS}}$ 出力を供給する負電源レールを生成できます。

DRV632 は、14 ピンの TSSOP で供給されます。

6 Device Comparison Table

DEVICE	INPUT OFFSET ($\pm\mu\text{V}$)	OUTPUT VOLTAGE (TYP) (VRMS)	MINIMUM LOAD IMPEDANCE (Ω)
DRV632	1000	2.4	600
DRV612	1000	2.2	600
DRV604	500	2.1	1000 (line output) / 8 (headphone output)
DRV603	1000	2.05 (VSS = 3.3 V) / 3.01 (VDD = 5 V)	600
DRV602	5000	2.05 (VSS = 3.3 V) / 3.01 (VDD = 5 V)	600
DRV601	8000	2.1 (VSS = 3.3 V) / 2.7 (VDD = 4.5 V)	100
DRV600	8000	2.1 (VSS = 3.3 V) / 2.7 (VDD = 4.5 V)	100

7 Pin Configuration and Functions



Pin Functions

PIN		TYPE ⁽¹⁾	DESCRIPTION
NAME	NO.		
CN	7	I/O	Charge-pump flying capacitor negative connection
CP	8	I/O	Charge-pump flying capacitor positive connection
GND	4, 10	P	Ground
-INL	13	I	Left-channel OPAMP negative input
+INL	14	I	Left-channel OPAMP positive input
-INR	2	I	Right-channel OPAMP negative input
+INR	1	I	Right-channel OPAMP positive input
Mute	5	I	Mute, active-low
OUTL	12	O	Left-channel OPAMP output
OTR	3	O	Right-channel OPAMP output
UVP	11	I	Undervoltage protection, internal pullup; unconnected if UVP function is unused.
VDD	9	P	Positive supply
VSS	6	P	Supply voltage

(1) I = input, O = output, P = power

8 Specifications

8.1 Absolute Maximum Ratings

over operating free-air temperature range ⁽¹⁾

	MIN	MAX	UNIT
Supply voltage, VDD to GND	-0.3	4	V
V _I Input voltage	V _{SS} - 0.3	VDD + 0.3	V
R _L Minimum load impedance – line outputs – OUTL, OTR		600	Ω
Mute to GND, UVP to GND	-0.3	VDD + 0.3	V
T _J Maximum operating junction temperature	-40	150	°C
T _{stg} Storage temperature	-40	150	°C

(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 under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

8.2 ESD Ratings

		VALUE	UNIT
V _(ESD) Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±1500	V
	Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±4000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

8.3 Recommended Operating Conditions

		MIN	NOM	MAX	UNIT
VDD Supply voltage	DC supply voltage	3	3.3	3.6	V
R _L Load impedance		0.6	10		kΩ
V _{IL} Low-level input voltage	Mute		40		% of VDD
V _{IH} High-level input voltage	Mute		60		% of VDD
T _A Operating free-air temperature		–40	25	85	°C

8.4 Thermal Information

THERMAL METRIC ⁽¹⁾		DRV632	UNIT
		PW (TSSOP)	
		14 PINS	
R _{θJA} Junction-to-ambient thermal resistance		130	°C/W
R _{θJC(top)} Junction-to-case (top) thermal resistance		49	°C/W
R _{θJB} Junction-to-board thermal resistance		63	°C/W
ψ _{JT} Junction-to-top characterization parameter		3.6	°C/W
ψ _{JB} Junction-to-board characterization parameter		62	°C/W

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

8.5 Electrical Characteristics

T_A = 25°C (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V _{OS} Output offset voltage	VDD = 3.3 V		0.5	1	mV
PSRR Power-supply rejection ratio			80		dB
V _{OH} High-level output voltage	VDD = 3.3 V	3.1			V
V _{OL} Low-level output voltage	VDD = 3.3 V			–3.0 5	V
V _{UVP_EX} External UVP detect voltage			1.25		V
V _{UVP_EX_HYSTERESIS} External UVP detect hysteresis current			5		μA
f _{CP} Charge pump switching frequency		200	300	400	kHz
I _{IH} High-level input current, Mute	VDD = 3.3 V, V _{IH} = VDD			1	μA
I _{IL} Low-level input current, Mute	VDD = 3.3 V, V _{IL} = 0 V			1	μA
I _{DD} Supply current	VDD = 3.3 V, no load, Mute = VDD	5	14	25	mA
	VDD = 3.3 V, no load, Mute = GND, disabled		14		

8.6 Operating Characteristics

VDD = 3.3 V, R_{DL} = 10 kΩ, R_{FB} = 30 kΩ, R_{IN} = 15 kΩ, T_A = 25°C, Charge pump: C_P = 1 μF (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V _O	Output voltage, outputs in phase	THD+N = 1%, VDD = 3.3 V, f = 1 kHz, R _L = 10 kΩ	2	2.4		V _{rms}
THD+N	Total harmonic distortion plus noise	V _O = 2 V _{RMS} , f = 1 kHz		0.002%		
SNR	Signal-to-noise ratio ⁽¹⁾	A-weighted		105		dB
DNR	Dynamic range	A-weighted		105		dB
V _N	Noise voltage	A-weighted		11		μV
Z _O	Output Impedance when muted	$\overline{\text{Mute}}$ = GND		110		mΩ
	Input-to-output attenuation when muted	$\overline{\text{Mute}}$ = GND		80		dB
	Crosstalk—L to R, R to L	V _O = 1 V _{rms}		–110		dB
I _{LIMIT}	Current limit			25		mA

(1) SNR is calculated relative to 2-V_{rms} output.

8.7 Typical Characteristics

$V_{DD} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$, $C_{(PUMP)} = C_{(VSS)} = 1\text{ }\mu\text{F}$, $C_{IN} = 2.2\text{ }\mu\text{F}$, $R_{IN} = 15\text{ k}\Omega$, $R_{fb} = 30\text{ k}\Omega$, $R_{OUT} = 32\text{ }\Omega$, $C_{OUT} = 1\text{ nF}$ (unless otherwise noted)

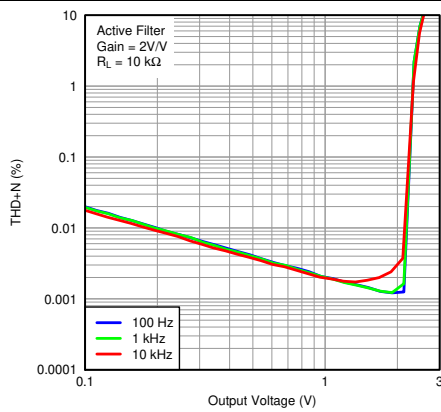


Figure 1. Total Harmonic Distortion and Noise vs Output Voltage

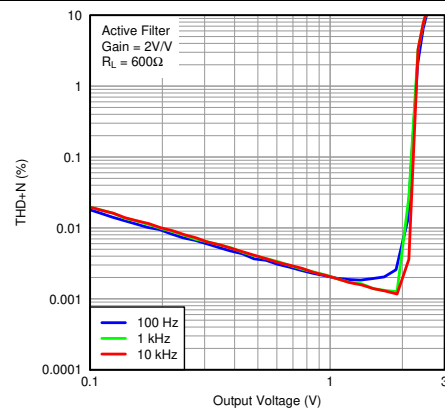


Figure 2. Total Harmonic Distortion and Noise vs Output Voltage

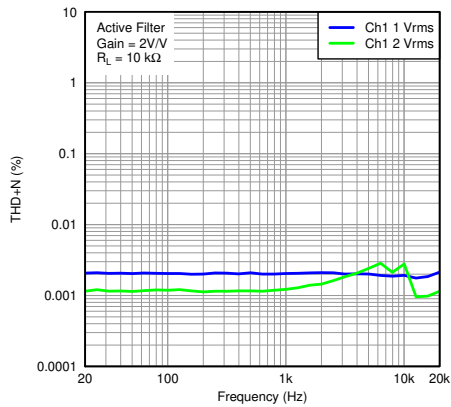


Figure 3. Total Harmonic Distortion and Noise vs Frequency

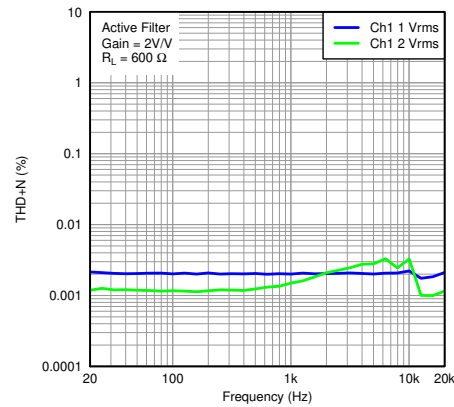


Figure 4. Total Harmonic Distortion and Noise vs Frequency

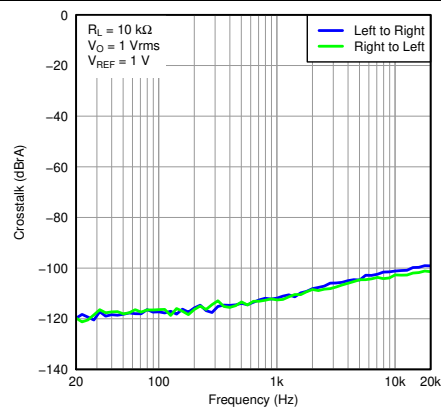


Figure 5. Crosstalk vs Frequency

9 Parameter Measurement Information

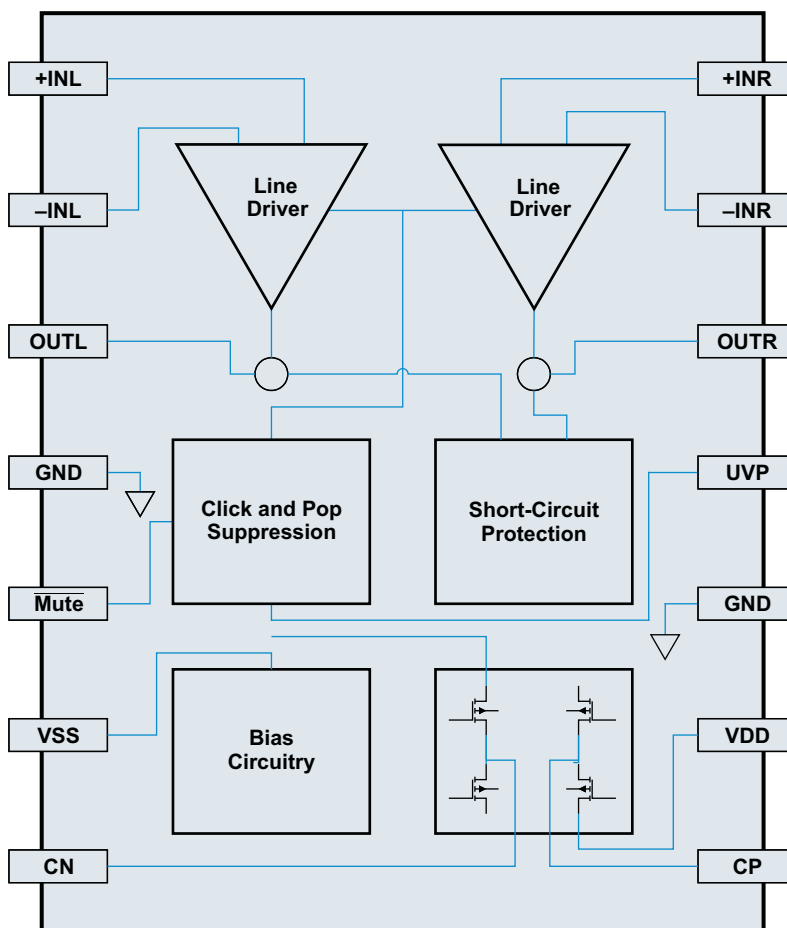
All parameters are measured according to the conditions described in [Specifications](#).

10 Detailed Description

10.1 Overview

Combining the TI's patented DirectPath technology with the built-in click and pop reduction circuit, the DRV632 is a 2-VRMS pop-free stereo line driver designed to avoid the use of the output DC-blocking capacitors, resulting in reduced component count and cost. The DRV632 is capable of driving 2-VRMS into a line load of 600 Ω to 10 k Ω with a 3.3-V supply voltage. The use of charge-pump flying, PVSS, and decoupling capacitors ensure the performance of the amplifier. The device has two channels with differential inputs that require DC input-blocking capacitors to block the DC portion of the audio source. These allow the DRV632 inputs to be properly biased to provide maximum performance. The DRV632 allows external gain-setting resistors to support a gain range of ± 1 V/V to ± 10 V/V. The gain can be configured individually for each channel. Additionally, both channels can be used as a second-order filter when the removal of out-of-band noise is required. The DRV632 has a built-in active-mute control for pop-free audio on/off, and avoids the click and pop generation by using external undervoltage detection. The device does not generate a pop or click when the power supply is removed or placed.

10.2 Functional Block Diagram



10.3 Feature Description

10.3.1 Line Driver Amplifiers

Single-supply line-driver amplifiers typically require dc-blocking capacitors. The top drawing in [Figure 6](#) illustrates the conventional line-driver amplifier connection to the load and output signal. DC blocking capacitors are often large in value. The line load (typical resistive values of 600 Ω to 10 k Ω) combines with the dc blocking capacitors to form a high-pass filter. [Equation 1](#) shows the relationship between the load impedance (R_L), the capacitor (C_O), and the cutoff frequency (f_c).

$$f_c = \frac{1}{2\pi R_L C_O} \quad (1)$$

C_O can be determined using [Equation 2](#), where the load impedance and the cutoff frequency are known.

$$C_O = \frac{1}{2\pi R_L f_c} \quad (2)$$

If f_c is low, the capacitor must then have a large value because the load resistance is small. Large capacitance values require large package sizes. Large package sizes consume PCB area, stand high above the PCB, increase cost of assembly, and can reduce the fidelity of the audio output signal.

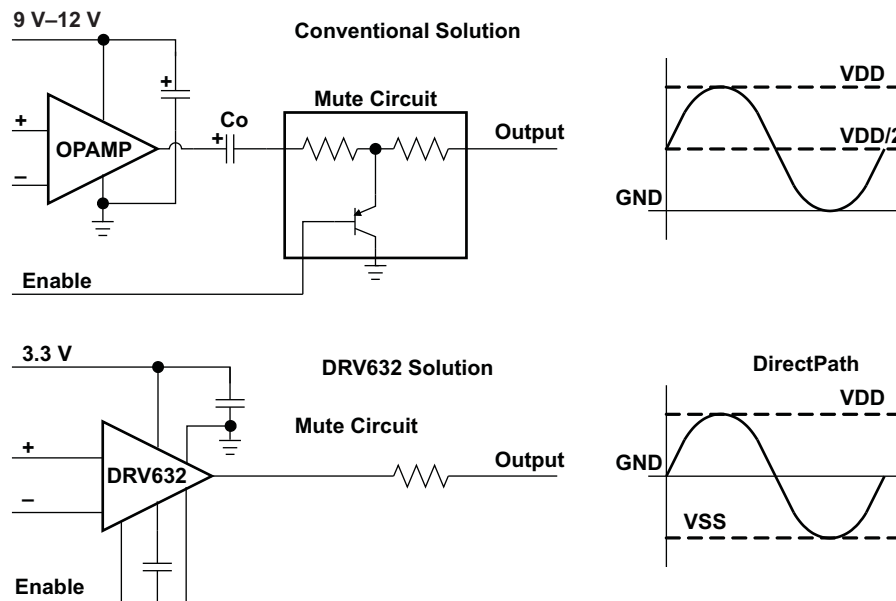


Figure 6. Conventional and DirectPath Line Drivers

The DirectPath amplifier architecture operates from a single supply but makes use of an internal charge pump to provide a negative voltage rail. Combining the user-provided positive rail and the negative rail generated by the IC, the device operates in what is effectively a split-supply mode. The output voltages are now centered at zero volts with the capability to swing to the positive rail or negative rail. Combining this with the built-in click and pop reduction circuit, the DirectPath amplifier requires no output dc blocking capacitors. The bottom block diagram and waveform of [Figure 6](#) illustrate the ground-referenced line-driver architecture. This is the architecture of the DRV632.

10.3.2 Charge-Pump Flying Capacitor and PVSS Capacitor

The charge-pump flying capacitor serves to transfer charge during the generation of the negative supply voltage. The PVSS capacitor must be at least equal to the charge-pump capacitor in order to allow maximum charge transfer. Low-ESR capacitors are an ideal selection, and a value of 1 μ F is typical. Capacitor values that are smaller than 1 μ F can be used, but the maximum output voltage may be reduced and the device may not operate to specifications. If the DRV632 is used in highly noise-sensitive circuits, TI recommends adding a small LC filter on the VDD connection.

Feature Description (continued)

10.3.3 Decoupling Capacitors

The DRV632 is a DirectPath line-driver amplifier that requires adequate power supply decoupling to ensure that the noise and total harmonic distortion (THD) are low. A good, low equivalent-series-resistance (ESR) ceramic capacitor, typically 1 μ F, placed as close as possible to the device VDD lead works best. Placing this decoupling capacitor close to the DRV632 is important for the performance of the amplifier. For filtering lower-frequency noise signals, a 10- μ F or greater capacitor placed near the audio power amplifier would also help, but it is not required in most applications because of the high PSRR of this device.

10.3.4 Gain-Setting Resistor Ranges

The gain-setting resistors, R_{IN} and R_{fb} , must be chosen so that noise, stability, and input capacitor size of the DRV632 are kept within acceptable limits. Voltage gain is defined as R_{fb} divided by R_{IN} .

Selecting values that are too low demands a large input ac-coupling capacitor, C_{IN} . Selecting values that are too high increases the noise of the amplifier. [Table 1](#) lists the recommended resistor values for different inverting-input gain settings.

Table 1. Recommended Resistor Values

GAIN	INPUT RESISTOR VALUE, R_{IN}	FEEDBACK RESISTOR VALUE, R_{fb}
–1 V/V	10 k Ω	10 k Ω
–1.5 V/V	8.2 k Ω	12 k Ω
–2 V/V	15 k Ω	30 k Ω
–10 V/V	4.7 k Ω	47 k Ω

10.3.5 Input-Blocking Capacitors

DC input-blocking capacitors are required to be added in series with the audio signal into the input pins of the DRV632. These capacitors block the dc portion of the audio source and allow the DRV632 inputs to be properly biased to provide maximum performance.

These capacitors form a high-pass filter with the input resistor, R_{IN} . The cutoff frequency is calculated using [Equation 3](#). For this calculation, the capacitance used is the input-blocking capacitor, and the resistance is the input resistor chosen from [Table 1](#); then the frequency and/or capacitance can be determined when one of the two values is given.

It is recommended to use electrolytic capacitors or high-voltage-rated capacitors as input blocking capacitors to ensure minimal variation in capacitance with input voltages. Such variation in capacitance with input voltages is commonly seen in ceramic capacitors and can increase low-frequency audio distortion.

$$f_{cIN} = \frac{1}{2\pi R_{IN} C_{IN}} \quad \text{or} \quad C_{IN} = \frac{1}{2\pi f_{cIN} R_{IN}} \quad (3)$$

10.3.6 DRV632 UVP Operation

The shutdown threshold at the UVP pin is 1.25 V. The customer must use a resistor divider to obtain the shutdown threshold and hysteresis desired for a particular application. The customer-selected thresholds can be determined as follows:

10.3.7 External Undervoltage Detection

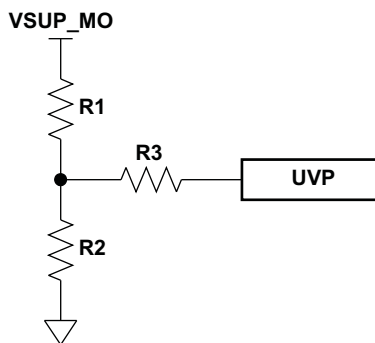
External undervoltage detection can be used to mute/shut down the DRV632 before an input device can generate a pop.

The shutdown threshold at the UVP pin is 1.25 V. The user selects a resistor divider to obtain the shutdown threshold and hysteresis for the specific application. The thresholds can be determined as follows:

$$V_{UVP} = (1.25 - 6 \mu A \times R3) \times (R1 + R2) / R2$$

$$\text{Hysteresis} = 5 \mu A \times R3 \times (R1 + R2) / R2$$

For example, to obtain $V_{UVP} = 3.8$ V and 1-V hysteresis, use $R1 = 3$ k Ω , $R2 = 1$ k Ω , and $R3 = 50$ k Ω .


Figure 7. UVP Resistor Divider

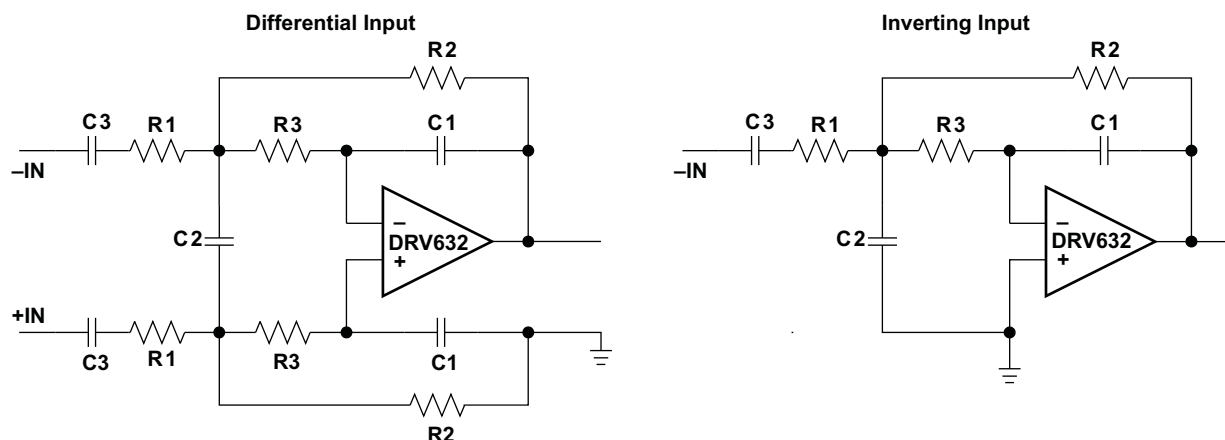
10.4 Device Functional Modes

10.4.1 Using the DRV632 as a Second-Order Filter

Several audio DACs used today require an external low-pass filter to remove out-of-band noise. This is possible with the DRV632, as it can be used like a standard operational amplifier. Several filter topologies can be implemented, both single-ended and differential. In Figure 8, multi-feedback (MFB) with differential input and single-ended input are shown.

An ac-coupling capacitor to remove dc content from the source is shown; it serves to block any dc content from the source and lowers the dc gain to 1, helping to reduce the output dc offset to a minimum.

To calculate the component values, use the TI WEBENCH® Filter Designer (www.ti.com/filterdesigner).


Figure 8. Second-Order Active Low-Pass Filter

The resistor values should have a low value for obtaining low noise, but should also have a high enough value to get a small-size ac-coupling capacitor. With the proposed values of $R1 = 15\text{ k}\Omega$, $R2 = 30\text{ k}\Omega$, and $R3 = 43\text{ k}\Omega$, a dynamic range (DYR) of 106 dB can be achieved with a $1\text{-}\mu\text{F}$ input ac-coupling capacitor.

10.4.2 Mute Mode

The DRV632 can be muted using the low-active Mute pin (pin 5). The click-and-pop suppression capacity ensures that when the mute mode is used, it does not generate an additional click or pop.

11 Application and Implementation

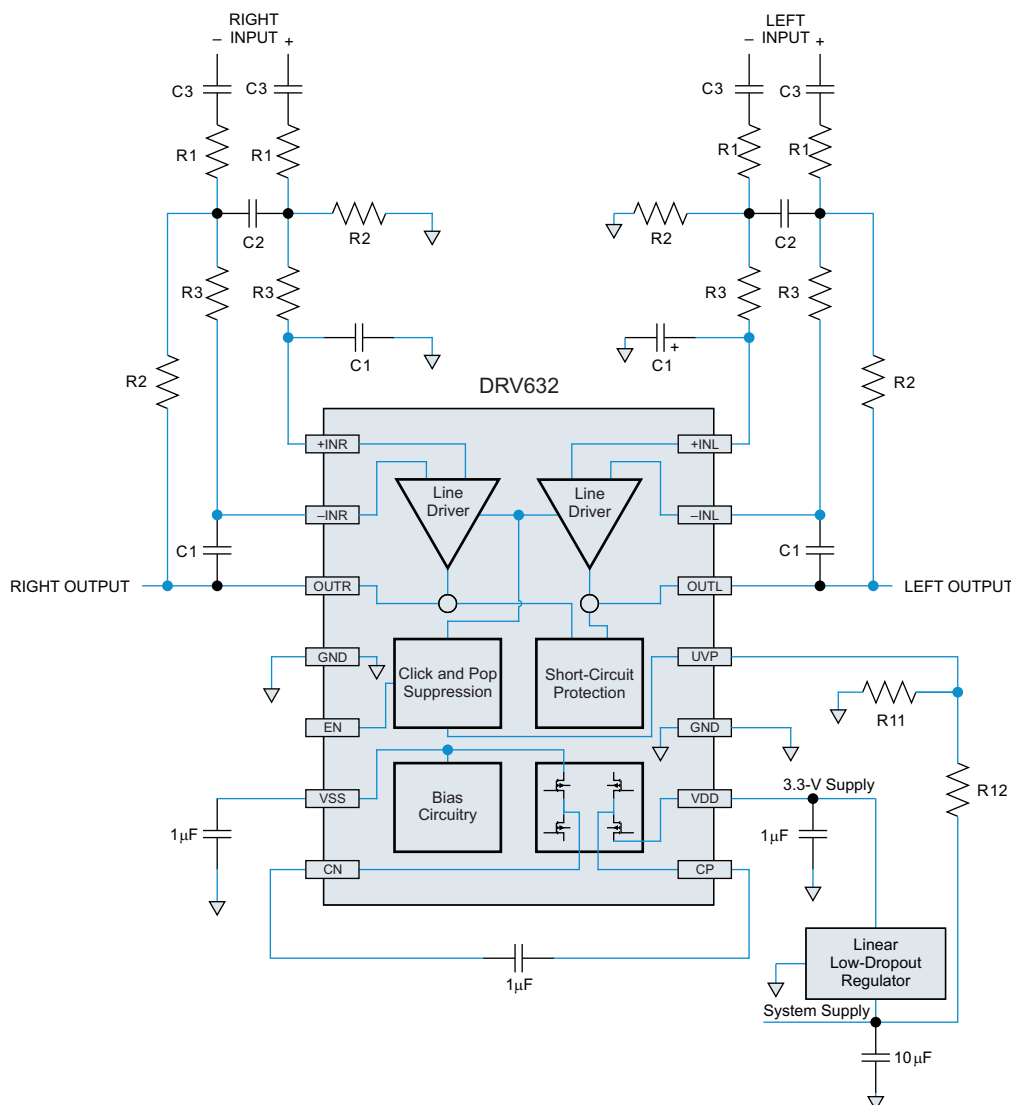
NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

11.1 Application Information

This typical connection diagram highlights the required external components and system-level connections for proper operation of the device. This configuration can be realized using the Evaluation Module (EVM) of the device. This flexible module allows full evaluation of the device in all available modes of operation. Also see the DRV632 product page for information on ordering the EVM.

11.2 Typical Application



R1 = 15 kΩ, R2 = 30 kΩ, R3 = 43 kΩ, C1 = 47 pF, C2 = 180 pF
Differential-input, single-ended output, second-order filter

Figure 9. Typical Application Schematic

Typical Application (continued)

11.2.1 Design Requirements

In this design example, use the parameters listed in [Table 2](#).

Table 2. Design Parameters

KEY PARAMETERS	VALUE
Supply Voltage	3.3 V
Supply Current	0.10 A
Load Impedance	600 Ω (minimum)

11.2.2 Detailed Design Procedure

11.2.2.1 Charge-Pump Flying, PVSS and Decoupling Capacitors

To transfer charge during the generation of the negative supply voltage, an 1- μ F low equivalent-series-resistance (ESR) charge-pump flying capacitor is used for this design. Similar 1- μ F capacitors are placed in VSS, and as close as possible to VDD. See [Charge-Pump Flying Capacitor and PVSS Capacitor](#) and [Decoupling Capacitors](#) for details.

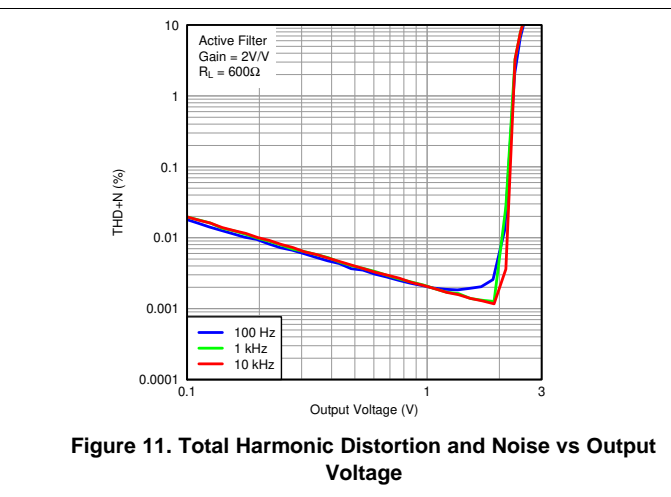
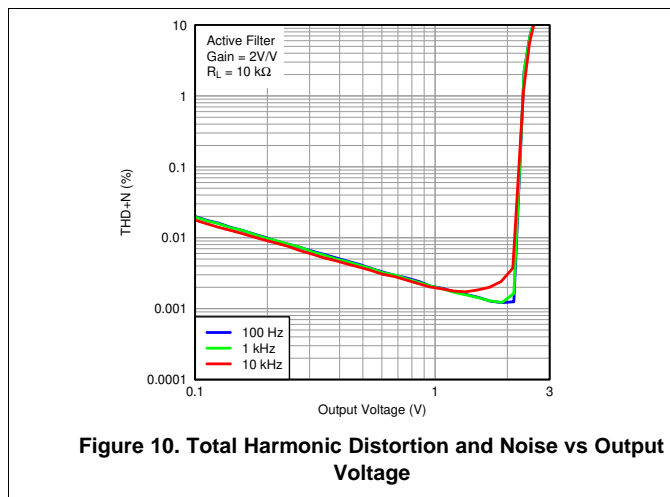
11.2.2.2 Second-Order Active Low-Pass Filters

With the help of the TI WEBENCH Filter Designer (www.ti.com/filterdesigner), the values of $R_1 = 15\text{ k}\Omega$, $R_2 = 30\text{ k}\Omega$, $R_3 = 43\text{ k}\Omega$, $C_1 = 47\text{ pF}$, and $C_2 = 180\text{ pF}$ are proposed to design a second-order low-pass filter with a differential-input and a single-ended output. See [Using the DRV632 as a Second-Order Filter](#) for details.

11.2.2.3 UVP Resistor Divider

R_{11} and R_{12} are placed to design a resistor divider. The shutdown threshold at the UVP pin is 1.25 V. See [External Undervoltage Detection](#) for details.

11.2.3 Application Curves



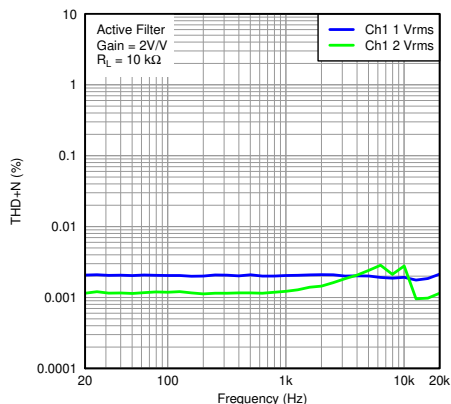


Figure 12. Total Harmonic Distortion and Noise vs Frequency

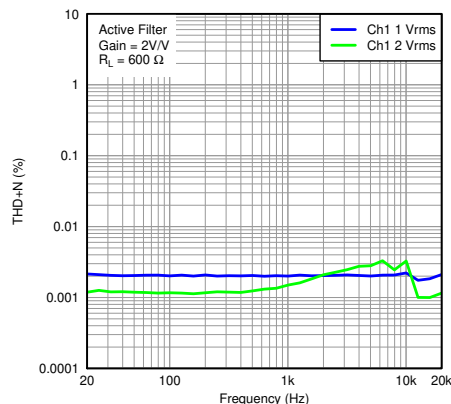


Figure 13. Total Harmonic Distortion and Noise vs Frequency

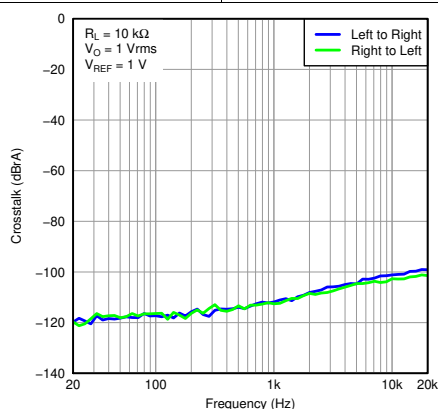


Figure 14. Crosstalk vs Frequency

12 Power Supply Recommendations

The device is designed to operate from an input voltage supply range between 3 V and 3.6 V. This input supply must be well-regulated. If the input supply is located more than a few inches from the DRV632 device, additional bulk capacitance may be required in addition to the ceramic bypass capacitors. An electrolytic capacitor with a value of 47 μ F is a typical choice.

Placing a decoupling capacitor close to the DRV632 improves the performance of the line-driver amplifier. A low equivalent-series-resistance (ESR) ceramic capacitor with a value of 1 μ F is a typical choice.

If the DRV632 is used in highly noise-sensitive circuits, TI recommends adding a small LC filter on the VDD connection.

13 Layout

13.1 Layout Guidelines

13.1.1 Gain-Setting Resistors

The gain-setting resistors, R_{IN} and R_{fb} , must be placed close to pins 13 and 17, respectively, to minimize capacitive loading on these input pins and to ensure maximum stability of the DRV632. For the recommended PCB layout, see the [DRV632EVM User's Guide](#).

13.2 Layout Example

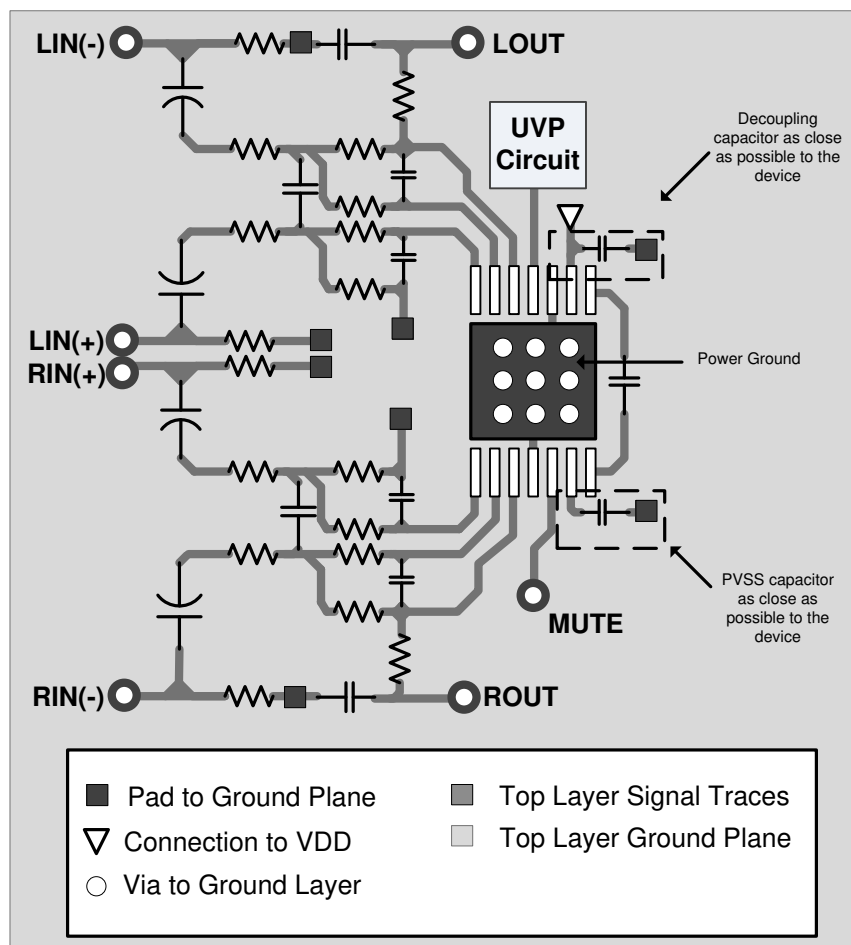


Figure 15. DRV632 Layout Example

14 デバイスおよびドキュメントのサポート

14.1 デバイス・サポート

14.1.1 開発サポート

DRV632EVM とガーバー・ファイルについては、www.tij.co.jp/tool/jp/DRV632EVM を参照してください。

14.2 コミュニティ・リソース

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.

14.3 商標

DirectPath, E2E are trademarks of Texas Instruments.
WEBENCH is a registered trademark of Texas Instruments.
Blu-ray Disc is a trademark of Blu-ray Disc Association.
All other trademarks are the property of their respective owners.

14.4 静電気放電に関する注意事項



これらのデバイスは、限定的なESD(静電破壊)保護機能を内蔵しています。保存時または取り扱い時は、MOSゲートに対する静電破壊を防止するために、リード線同士をショートさせておくか、デバイスを導電フォームに入れる必要があります。

14.5 Glossary

[SLYZ022](#) — *TI Glossary*.

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

15 メカニカル、パッケージ、および注文情報

以降のページには、メカニカル、パッケージ、および注文に関する情報が記載されています。この情報は、そのデバイスについて利用可能な最新のデータです。このデータは予告なく変更されることがあり、ドキュメントが改訂される場合もあります。本データシートのブラウザ版を使用されている場合は、画面左側の説明をご覧ください。

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)
DRV632PW	Active	Production	TSSOP (PW) 14	90 TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	DRV632
DRV632PW.A	Active	Production	TSSOP (PW) 14	90 TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	DRV632
DRV632PWR	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	DRV632
DRV632PWR.A	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	DRV632

⁽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.

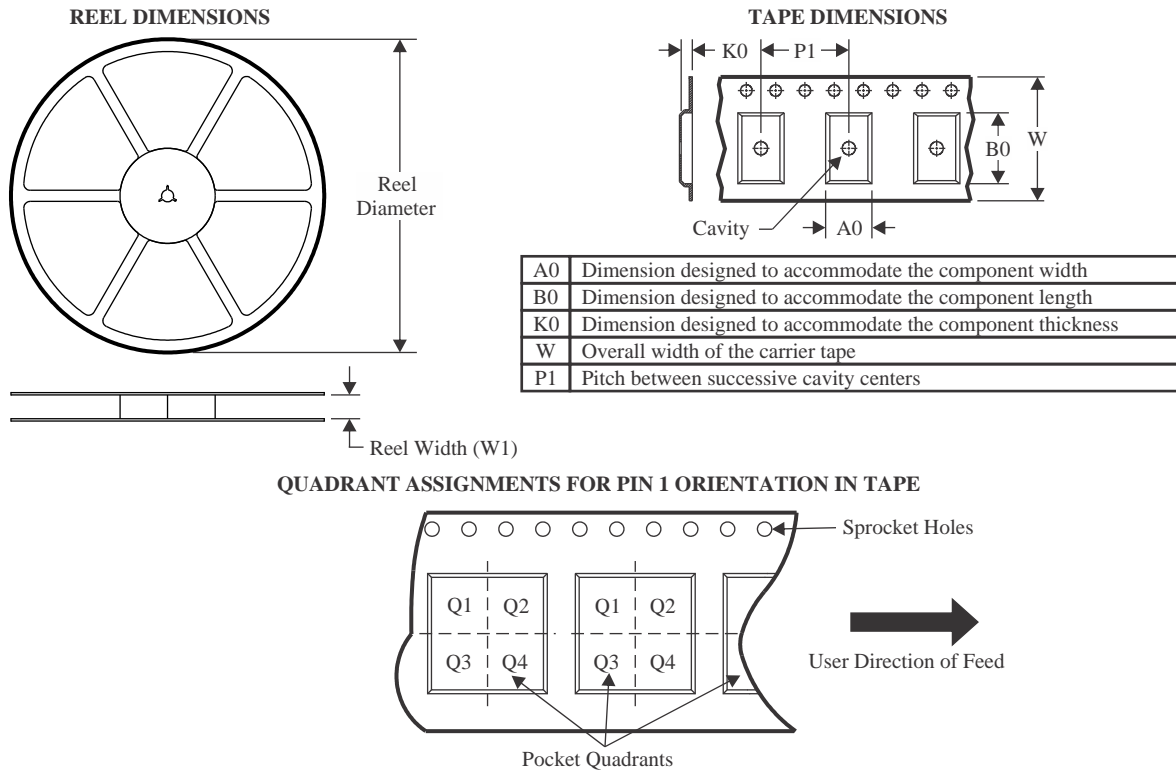
⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

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.

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



*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
DRV632PWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

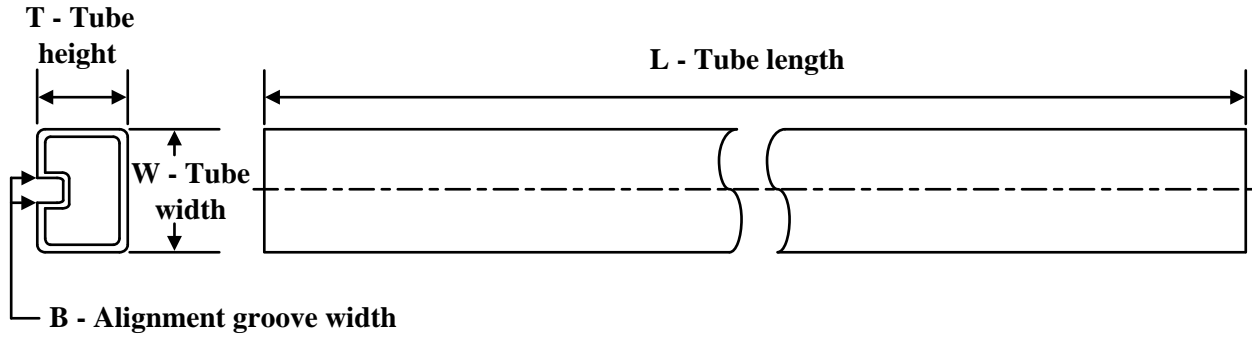
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

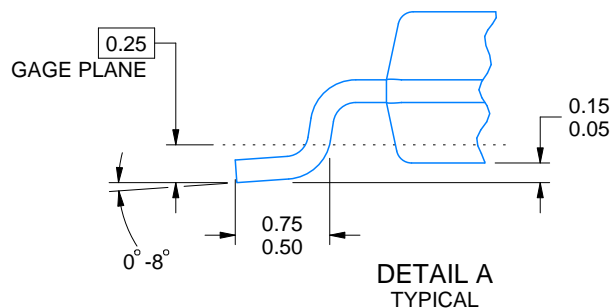
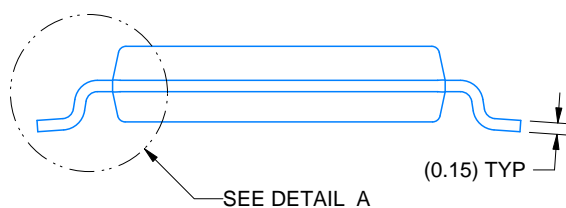
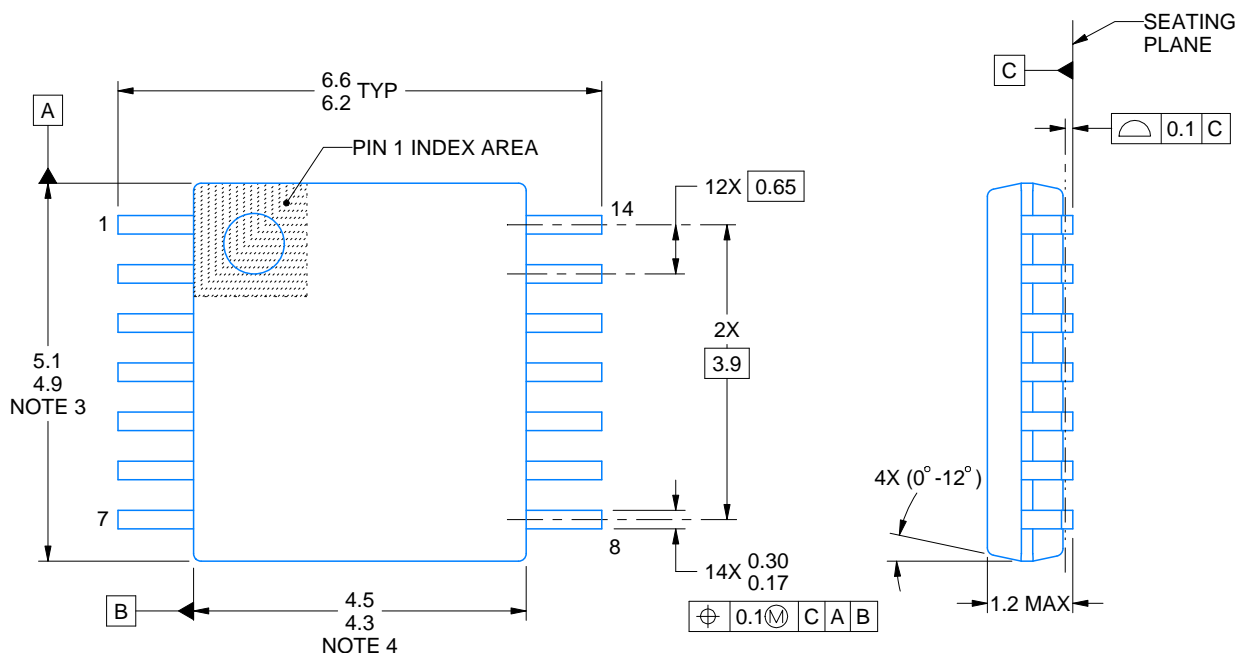
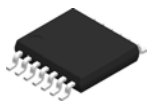
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DRV632PWR	TSSOP	PW	14	2000	350.0	350.0	43.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
DRV632PW	PW	TSSOP	14	90	530	10.2	3600	3.5
DRV632PW.A	PW	TSSOP	14	90	530	10.2	3600	3.5



4220202/B 12/2023

NOTES:

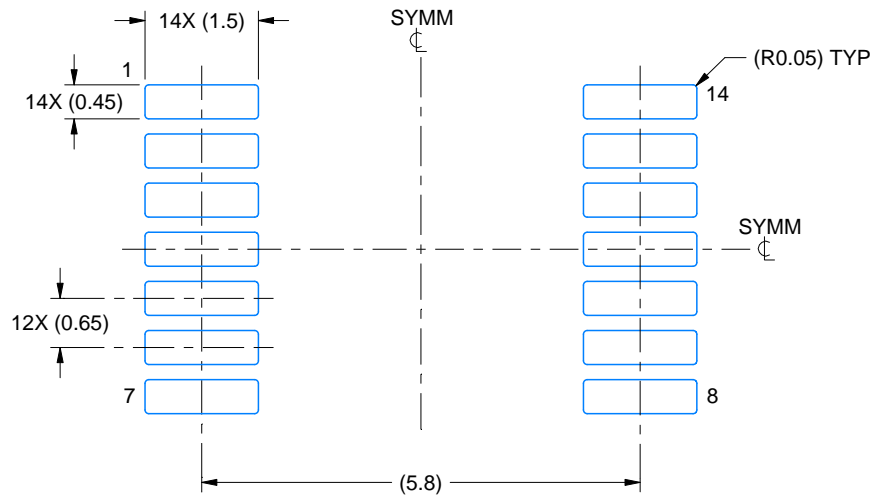
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

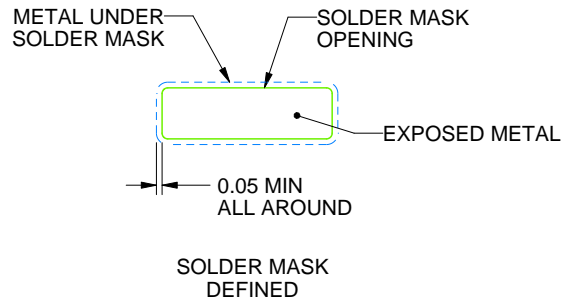
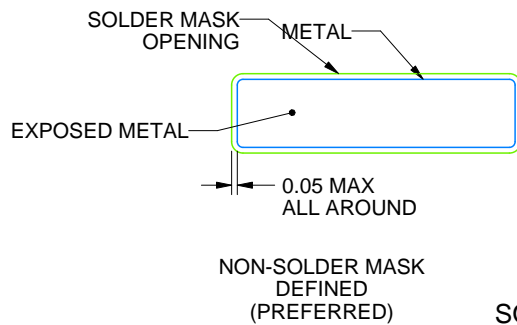
PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220202/B 12/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

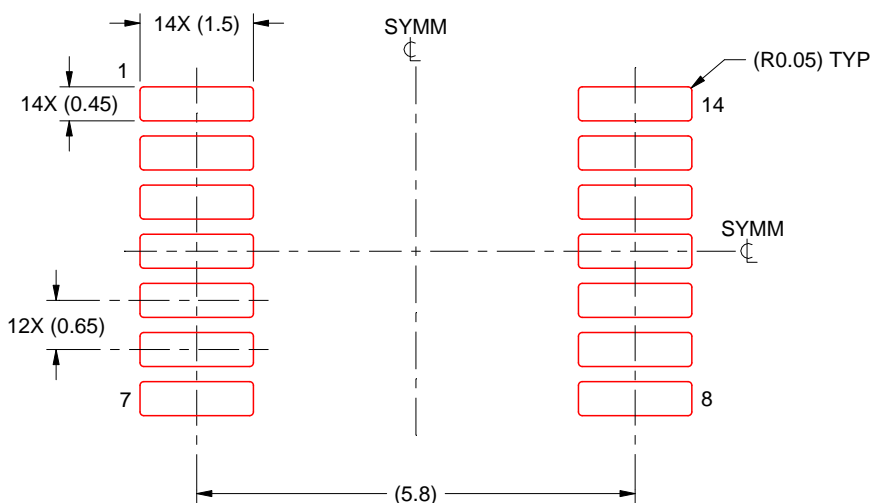
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220202/B 12/2023

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.

重要なお知らせと免責事項

TI は、技術データと信頼性データ (データシートを含みます)、設計リソース (リファレンス デザインを含みます)、アプリケーションや設計に関する各種アドバイス、Web ツール、安全性情報、その他のリソースを、欠陥が存在する可能性のある「現状のまま」提供しており、商品性および特定目的に対する適合性の黙示保証、第三者の知的財産権の非侵害保証を含むいかなる保証も、明示的または黙示的にかかわらず拒否します。

これらのリソースは、TI 製品を使用する設計の経験を積んだ開発者への提供を意図したものです。(1) お客様のアプリケーションに適した TI 製品の選定、(2) お客様のアプリケーションの設計、検証、試験、(3) お客様のアプリケーションに該当する各種規格や、その他のあらゆる安全性、セキュリティ、規制、または他の要件への確実な適合に関する責任を、お客様のみが単独で負うものとし、TI は一切の責任を拒否します。

上記の各種リソースは、予告なく変更される可能性があります。これらのリソースは、リソースで説明されている TI 製品を使用するアプリケーションの開発の目的でのみ、TI はその使用をお客様に許諾します。これらのリソースに関して、他の目的で複製することや掲載することは禁止されています。TI や第三者の知的財産権のライセンスが付与されている訳ではありません。お客様は、これらのリソースを自身で使用した結果発生するあらゆる申し立て、損害、費用、損失、責任について、TI およびその代理人を完全に補償するものとし、TI は一切の責任を拒否します。

TI の製品は、[TI の販売条件](#)、[TI の総合的な品質ガイドライン](#)、[ti.com](https://www.ti.com) または TI 製品などに関連して提供される他の適用条件に従い提供されます。TI がこれらのリソースを提供することは、適用される TI の保証または他の保証の放棄の拡大や変更を意味するものではありません。TI がカスタム、またはカスタマー仕様として明示的に指定していない限り、TI の製品は標準的なカタログに掲載される汎用機器です。

お客様がいかなる追加条項または代替条項を提案する場合も、TI はそれらに異議を唱え、拒否します。

Copyright © 2025, Texas Instruments Incorporated

最終更新日：2025 年 10 月