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Trademarks

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1 Hardware Overview

The *Guitar SideGig* turns audio Class-D amplifier EVMs into a guitar or instrument amplifier.

The board features selectable *CLEAN* and *DRIVE* channels for traditional and overdriven guitar sounds. The *CLEAN* channel offers volume, treble, middle, bass, and mid-boost switch to tune the sound of the instrument. The *DRIVE* channel offers additional controls for drive, tone, and level for overdrive characteristics. A ¼-inch mono input jack is used for standard instrument cables.

1.1 Features

The SideGig-GuitarEVM has the following features:

- A ¼-inch mono instrument input jack
- Self-powered when connected to audio Class-D EVM
- 2-channel instrument preamplifier with *DRIVE* and *CLEAN*
- The *CLEAN* channel with treble, middle, bass, and volume controls
- The *DRIVE* channel adds drive, tone, and level controls
- RC4558 and NE5532 op-amps
- 4- V_{RMS} differential analog output to drive analog input Class-D amplifiers
- Supports 1 BTL channel or PBTL Class-D amplifier output

1.2 Class-D EVM Compatibility

The SideGig-GuitarEVM is compatible with analog input Class-D EVMs designed with the Audio Interface Board (AIB) connector. This includes TPA3244, TPA3245, and TPA3255 EVMs. See [Table 1](#) for details.

Table 1. SideGig Compatibility

SideGig Output Type	Class-D EVM Input Type	Supported Class-D Speaker Configurations
1x differential analog	Analog	1 x BTL (A/AB channel only) PBTL

1.2.1 SideGig Output Type

The SideGig-GuitarEVM drives a single differential analog output capable of over 4- V_{RMS} .

1.2.2 Class-D EVM Input Type

The SideGig-GuitarEVM is only compatible with analog input Class-D EVMs with the AIB connector.

1.2.3 Supported Class-D Speaker Configurations

- Since the SideGig-GuitarEVM is a single differential analog output, the connected Class-D EVM should be configured as BTL output (where only BTL channel A/AB is driven)
- PBTL output configuration can also be supported with the SideGig-GuitarEVM

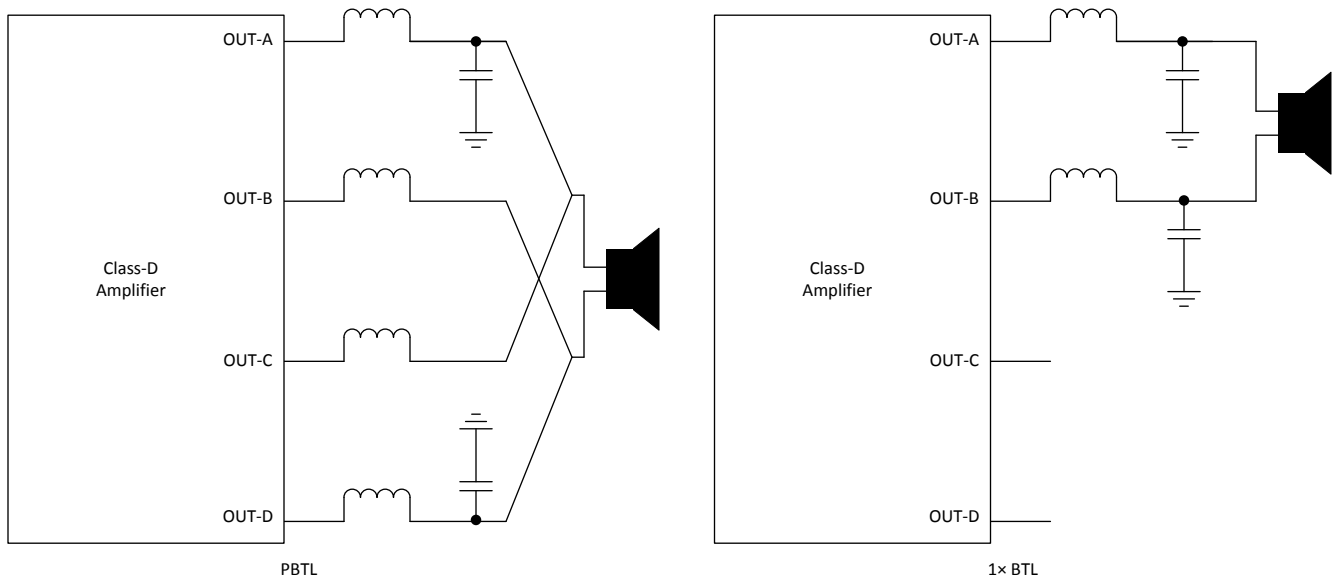


Figure 2. Class-D Output Drawings

NOTE: Consult the *Class-D EVM User's Guide* for proper Class-D EVM configuration.

1.3 AIB Pinout

This section shows the AIB connector pinout used by the *Guitar SideGig Module*. Any pin names not indicated in this section are unused by this SideGig module.

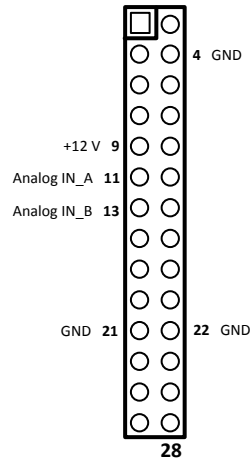


Figure 3. AIB Connector for SideGig Module

Table 2. AIB Connector Pin Descriptions

Pin Number	Function	Description	Audio EVM Input/Output	SideGig Input/Output
4	GND	Ground reference between the <i>Guitar SideGig</i> and an audio Class-D EVM	-	-
9	+12 V	12-V supply used to power the <i>Guitar SideGig</i> when plugged into an audio Class-D EVM	O	I
11	Analog IN_A	Positive (+) Analog input to audio Class-D EVM. (IN_A and IN_B are driven differentially by the <i>Guitar SideGig</i>)	I	O
13	Analog IN_B	Negative (-) Analog input to audio Class-D EVM. (IN_A and IN_B are driven differentially by the <i>Guitar SideGig</i>)	I	O
21	GND	Ground reference between the SideGig and audio Class-D EVM	-	-
22	GND	Ground reference between the SideGig and audio Class-D EVM	-	-

2 Guitar SideGig Setup

This section describes the setup and use of the *Guitar SideGig Module*.

2.1 Guitar SideGig Setup

The *Guitar SideGig Module* plugs into any analog input audio Class-D EVM using the AIB connector.

To plug the board in, simply align the AIB connector on the *Guitar SideGig Module* and the audio EVM and press into place. No additional setup is required. The *Guitar SideGig* will be automatically powered when the Class-D EVM is powered.

1. Configure the Class-D amplifier EVM in either BTL or PBTl output mode to support the Guitar SideGig.
2. With the Class-D amplifier EVM not powered, connect the Guitar SideGig to the AIB connector. **Take care not to misalign the connector, otherwise damage to the SideGig or Class-D EVM can occur.**
3. Connect the EVM speaker outputs to a guitar speaker or cabinet.
4. Power the Class-D EVM. The Guitar SideGig is automatically powered.
5. Plug in a ¼-inch mono instrument cable between the electric instrument and SideGig.
6. Adjust knobs for desired sound

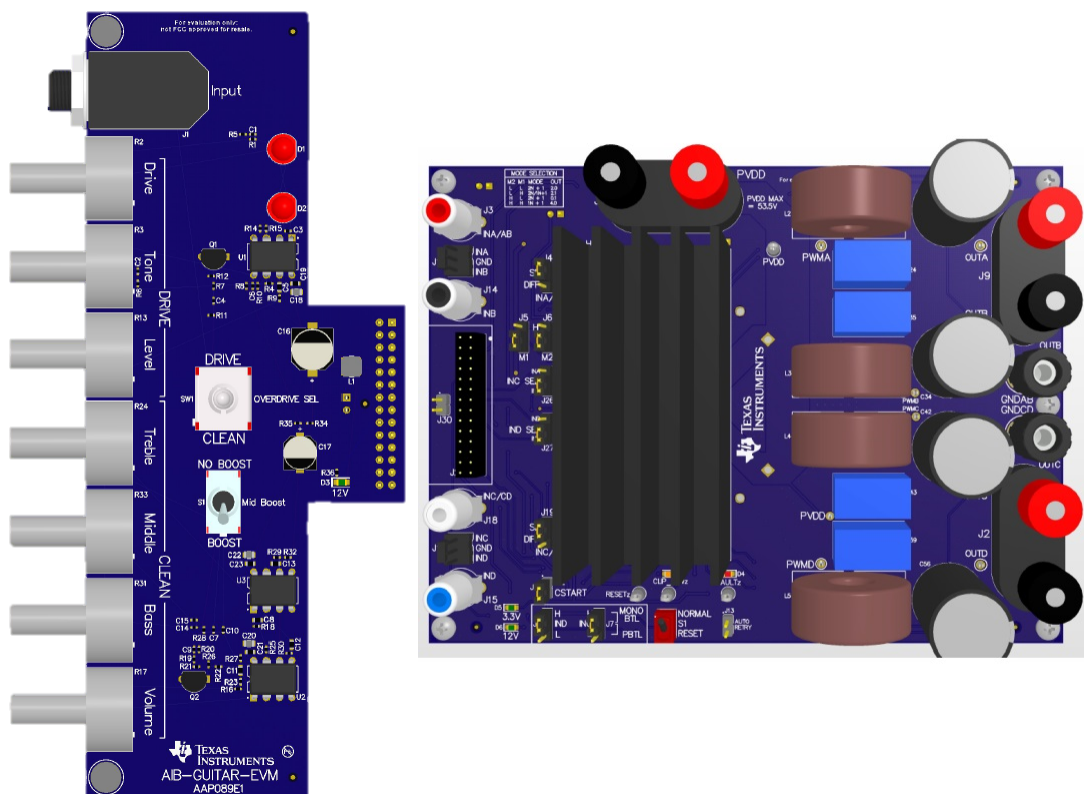


Figure 4. Plug-In Illustration

NOTE: Misalignment of the *SideGig Module* on the AIB connector can damage both the SideGig and the Audio EVM. It is recommended to connect the SideGig module to the EVM before powering the audio Class-D EVM.

2.2 Guitar SideGig Controls and Circuits

This section describes the controls and use of the *Guitar SideGig Module*. [Figure 5](#) is an illustration of the Guitar SideGig controls.

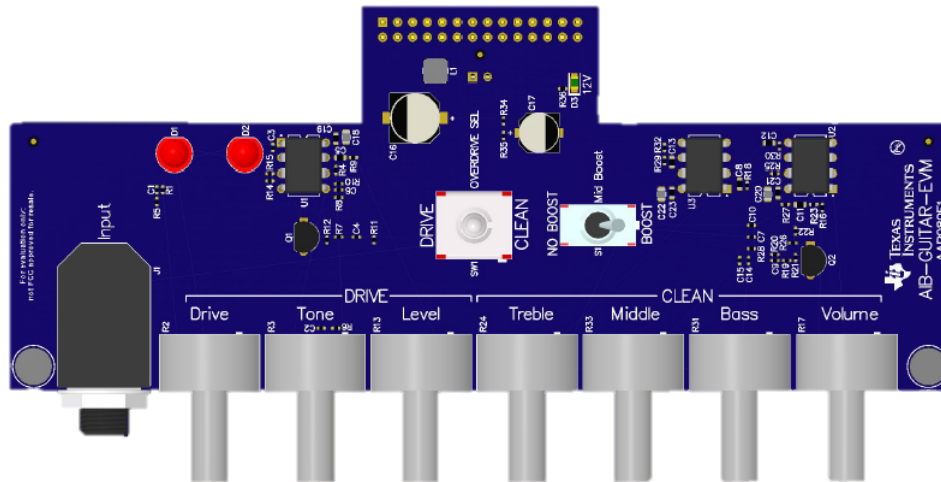
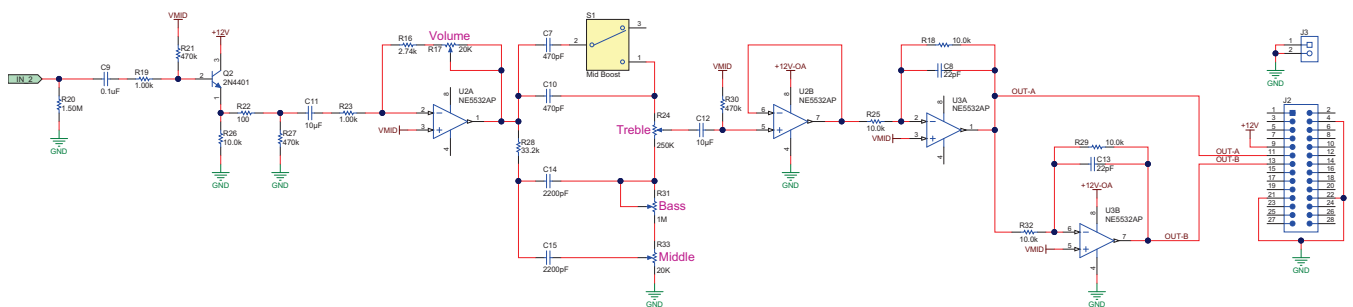


Figure 5. Guitar SideGig Controls

2.2.1 CLEAN Channel

This channel offers undistorted sounds for guitars and other musical instruments. A preamplifier is used to boost the guitar signal in order to get large signals to drive the input of analog Class-D EVMs. The CLEAN preamplifier also includes controls to shape the sound of the instrument as well as control VOLUME.

- *Treble* – adjusts the high-frequency EQ of the instrument
- *Middle* – adjusts the mid-frequency EQ of the instrument
- *Bass* – adjusts the low-frequency EQ of the instrument
- *Volume* – adjusts the output signal level for louder or quieter sounds



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Figure 6. CLEAN Channel Schematic

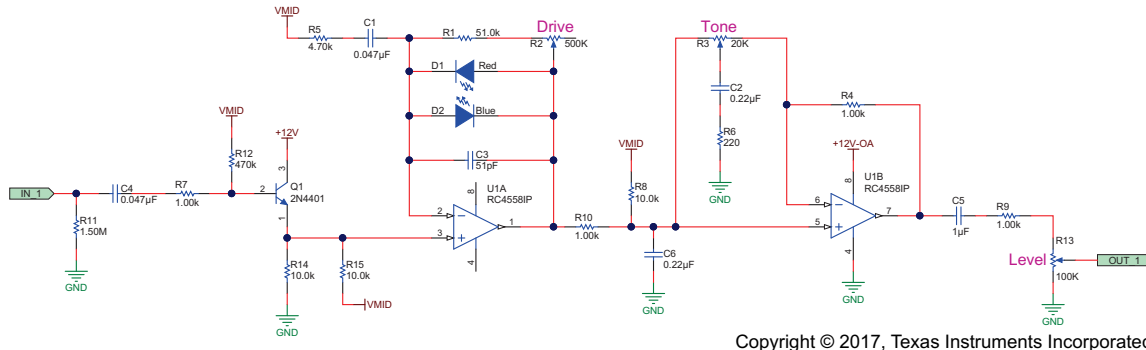
The CLEAN channel schematic in [Figure 6](#) consists of buffer (Q2), preamplifier (U2A), tone controls (treble, bass, middle), buffer (U2B), and a single-ended to differential converter using U3A and U3B. When the drive channel is active, the drive channel output is connected to the clean channel input. All op-amps are NE5532AP devices for low distortion.

The volume control on the preamplifier circuit controls the overall level of the guitar and will control the output power of the Class-D EVM connected to the SideGig. The passive tone controls offer flexibility in the sound of the instrument and are highly interactive. That is, the effect each control has over the sound is dependent on the positions of the other controls.

2.2.2 DRIVE Channel

When this channel is active, an additional preamplifier is added in front of the CLEAN channel. This DRIVE preamplifier circuit uses a pair of LEDs for clipping. The LEDs have different threshold voltages for a mixture of even and odd order distortion to mimic the sounds of traditional tube guitar amplifiers. With the *DRIVE* channel active, all of the controls in the *CLEAN* channel are still in use.

- *Drive* – Controls the gain of the LED clipping circuit to add more or less distortion
- *Tone* – EQ control of the *DRIVE* channel
- *Level* – Controls the volume of the *DRIVE* channel. Higher level settings can make the *DRIVE* control more pronounced.



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Figure 7. DRIVE Channel Schematic

The DRIVE channel schematic shown in [Figure 7](#) consists of buffer (Q1), clipping circuit (U1A), and tone circuit (U1B). The clipping circuit uses one-half of the dual channel RC4558IP op-amp with LEDs D1 and D2 in the feedback loop.

By using 2 different color diodes (red and blue), the V_{th} of each diode is different causing asymmetrical clipping. This creates a mix of even and odd order distortion to simulate the complex distortion characteristics of tube amplifier, which are generally comprised of both Class-A preamplifier circuitry and a Class-AB output stage.

2.2.3 Toggle Switches

This section includes descriptions of the toggle switch functions:

- *OVERDRIVE SEL* - Toggle switch selects if the *DRIVE* channel is active
- *Mid Boost* – Sets an EQ boost on the tone stack of the *CLEAN* channel

2.2.4 Input

A ¼-inch mono instrument cable input.

3 Board Layouts, Bill of Materials, and Schematic

This section includes the board layouts, board dimensions, bill of materials (BOM), and schematics.

3.1 Schematic

Figure 8 illustrates the SideGig-GuitarEVM schematic.

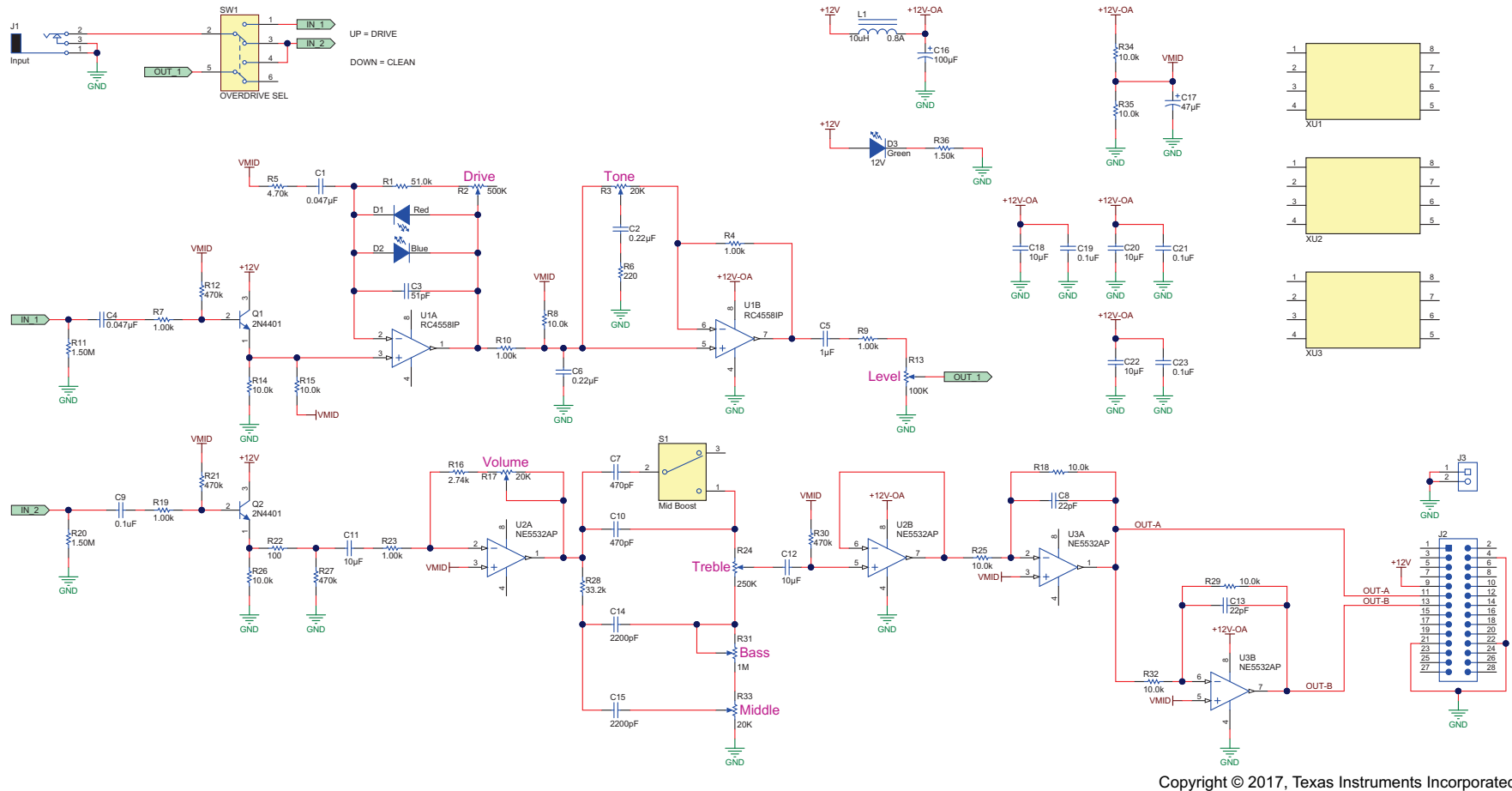


Figure 8. SideGig-GuitarEVM Schematic

3.2 SideGig-GuitarEVM Board Layouts

Figure 9 through Figure 15 illustrate the EVM board layouts.

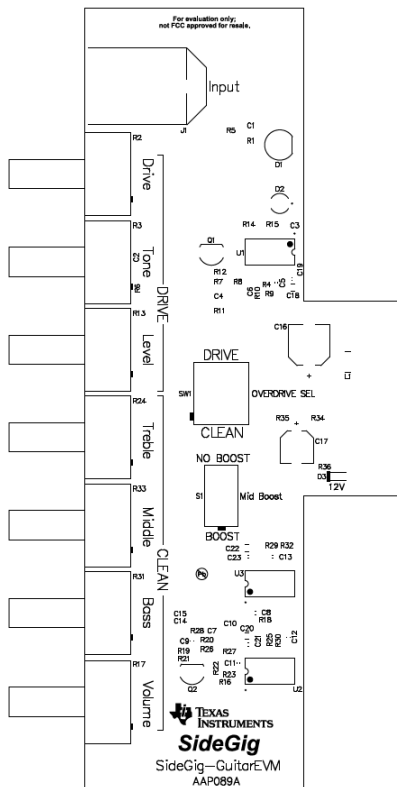


Figure 9. Top Overlay

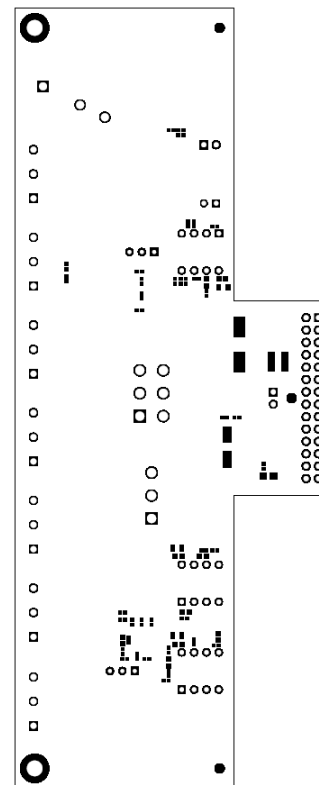


Figure 10. Top Solder Mask

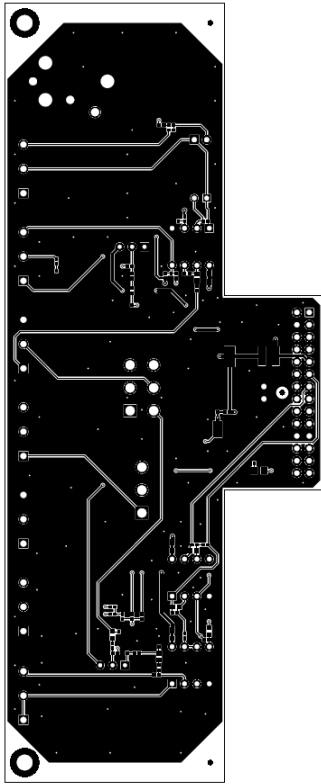


Figure 11. Top Layer

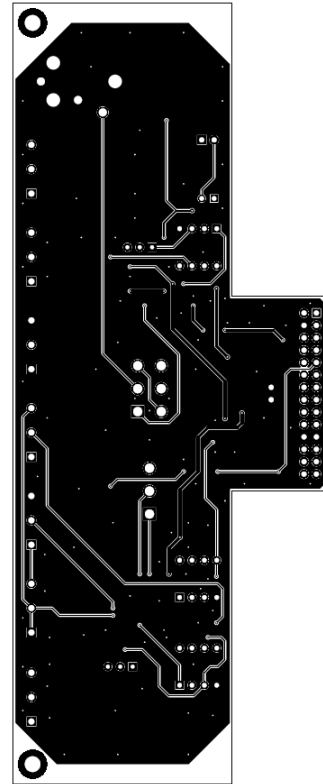


Figure 12. Bottom Layer

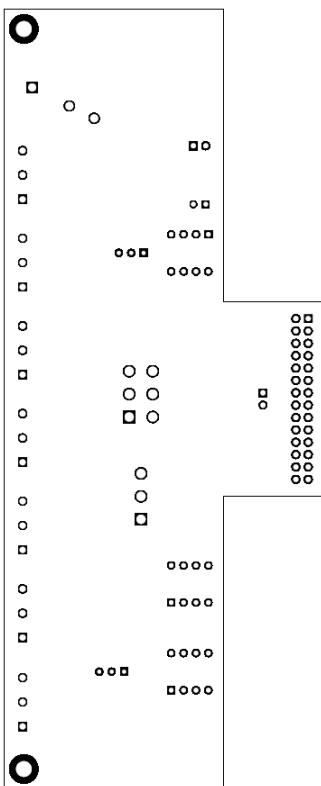


Figure 13. Bottom Solder

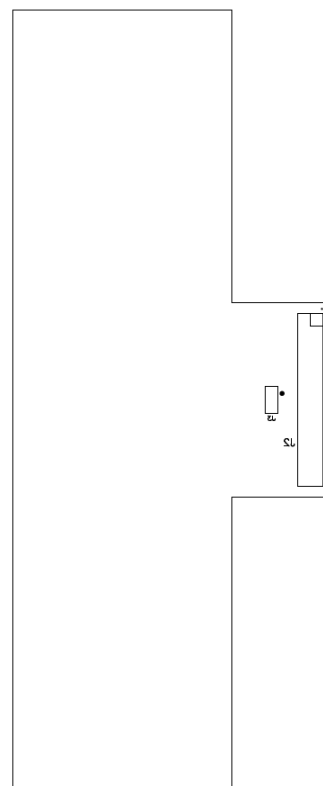


Figure 14. Bottom Overlay



Figure 15. Drill Drawing

3.3 Board Dimensions

Figure 16 illustrates the board dimension drawing.

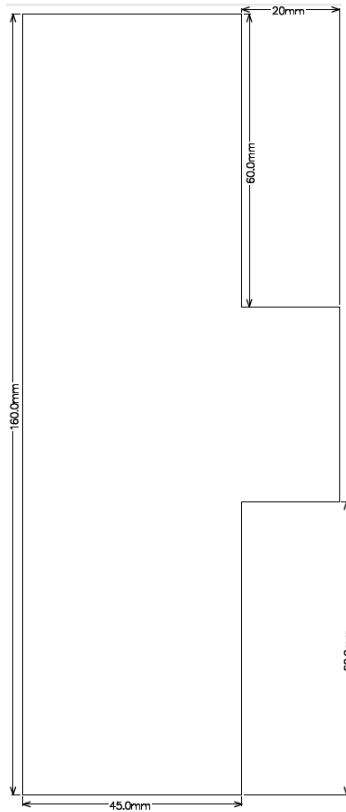


Figure 16. Board Dimensions (Image is not Actual Size)

3.4 Bill of Materials

Table 3 lists the SideGig-GuitarEVM BOM.

Table 3. Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
!PCB1	1		Printed Circuit Board		AAP089	Any	-	-
C1, C4	2	0.047uF	CAP, CERM, 0.047 μ F, 25 V, +/- 10%, X7R, 0402	0402	GRM155R71E473KA88D	Murata		
C2, C6	2	0.22uF	CAP, CERM, 0.22 μ F, 16 V, +/- 10%, X7R, 0402	0402	GRM155R71C224KA12D	Murata		
C3	1	51pF	CAP, CERM, 51 pF, 50 V, +/- 5%, C0G/NP0, 0402	0402	GRM1555C1H510JA01D	Murata		
C5	1	1uF	CAP, CERM, 1 μ F, 50 V, +/- 10%, X7R, 0603	0603	UMK107AB7105KA-T	Taiyo Yuden		
C7, C10	2	470pF	CAP, CERM, 470 pF, 50 V, +/- 5%, C0G/NP0, 0402	0402	GRM1555C1H471JA01D	Murata		
C8, C13	2	22pF	CAP, CERM, 22 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C1H220JA01D	Murata		
C9, C19, C21, C23	4	0.1uF	CAP, CERM, 0.1 μ F, 50 V, +/- 10%, X7R, 0603	0603	C0603C104K5RACTU	Kemet		
C11, C12	2	10uF	CAP, CERM, 10 μ F, 10 V, +/- 20%, X5R, 0603	0603	GRM188R61A106ME69D	Murata		
C14, C15	2	2200pF	CAP, CERM, 2200 pF, 50 V, +/- 10%, X7R, 0402	0402	GRM155R71H222KA01D	Murata		
C16	1	100uF	CAP, AL, 100 μ F, 25 V, +/- 20%, 0.3 ohm, SMD	SMT Radial F	EEE-FC1E101P	Panasonic		
C17	1	47uF	CAP, AL, 47 μ F, 16 V, +/- 20%, 0.36 ohm, SMD	SMT Radial D	EEE-FK1C470P	Panasonic		
C18, C20, C22	3	10uF	CAP, CERM, 10 μ F, 16 V, +/- 10%, X5R, 0805	0805	EMK212BJ106KG-T	Taiyo Yuden		
D1	1	Red	LED, Red, TH	T-1 3/4 LED, TH	HLMP-3316	Avago		
D2	1	Blue	LED, Blue, TH	D3.1mm	LTL1CHTBK4	Lite-On		
D3	1	Green	LED, Green, SMD	LED_0805	LTST-C171GKT	Lite-On		
H1, H2	2		MACHINE SCREW PAN PHILLIPS 4-40	Machine Screw, 4-40, 1/4 inch	PMSSS 440 0025 PH	B&F Fastener Supply		
H3, H4	2		1/4 Round Female Standoff, Alum, 1-1/2"	3483, 1/4 Round Female Standoff, 1-1/2"	3483	Keystone		
J1	1		Audio Jack, 1/4", Headphone Phone Jack Mono, R/A, Black, TH	Audio Jack, 3-Pos, R/A, TH	RN112APC	Switchcraft		
J2	1		Header, 100mil, 14x2, Gold, TH	14x2 Header	TSW-114-07-G-D	Samtec		
J3	1		Receptacle, 100mil, 2x1, Tin, TH	Receptacle, 2x1, 100mil, Tin	PPTC021LFBN-RC	Sullins Connector Solutions		
L1	1	10uH	Inductor, Wirewound, 10 μ H, 0.8 A, 0.204 ohm, SMD	2-Pin SMD, Body 4 x 4 mm, Height 1.2 mm	NRS4012T100MDGJV	Taiyo Yuden		
Q1, Q2	2	40 V	Transistor, NPN, 40 V, 0.5 A, TO-92AP	TO-92AP	2N4401-AP	Micro Commercial Components		
R1	1	51.0k	RES, 51.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2RKF5102X	Panasonic		
R2	1	500K	Potentiometer 500K 20% 16MM ROTARY POT, TH	17x24.5mm	P160KN-0QC15A500K	TT-Electronics-BI-Technologies		
R3, R17, R33	3	20K	Potentiometer 20K 20% 16MM ROTARY POT, TH	17x24.5mm	P160KN-0QC15B20K	TT-Electronics-BI-Technologies		

Table 3. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
R4, R7, R9, R10, R19, R23	6	1.00k	RES, 1.00 k, 1%, 0.063 W, 0402	0402	CRCW04021K00FKED	Vishay-Dale		
R5	1	4.70k	RES, 4.70 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF4701X	Panasonic		
R6	1	220	RES, 220, 1%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2RKF2200X	Panasonic		
R8, R14, R15, R18, R25, R26, R29, R32, R34, R35	10	10.0k	RES, 10.0 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF1002X	Panasonic		
R11, R20	2	1.50Meg	RES, 1.50 M, 1%, 0.063 W, 0402	0402	CRCW04021M50FKED	Vishay-Dale		
R12, R21, R27, R30	4	470k	RES, 470 k, 1%, 0.0625 W, 0402	0402	RC0402FR-07470KL	Yageo America		
R13	1	100K	Potentiometer 100K 20% 16MM ROTARY POT, TH	17x24.5mm	P160KN-QQC15A100K	TT-Electronics-BI-Technologies		
R16	1	2.74k	RES, 2.74 k, 1%, 0.063 W, 0402	0402	CRCW04022K74FKED	Vishay-Dale		
R22	1	100	RES, 100, 1%, 0.063 W, 0402	0402	CRCW0402100RFKED	Vishay-Dale		
R24	1	250K	Potentiometer 250K 20% 16MM ROTARY POT, TH	17x24.5mm	P160KN-QQC15B250K	TT-Electronics-BI-Technologies		
R28	1	33.2k	RES, 33.2 k, 1%, 0.063 W, 0402	0402	CRCW040233K2FKED	Vishay-Dale		
R31	1	1M	Potentiometer 1Meg 20% 16MM ROTARY POT, TH	17x24.5mm	P160KN-QQC15A1MEG	TT-Electronics-BI-Technologies		
R36	1	1.50k	RES, 1.50 k, 1%, 0.063 W, 0402	0402	CRCW04021K50FKED	Vishay-Dale		
S1	1		Switch, SPDT, On-On, 5 A, 120 VAC, 28 VDC, TH	12.7x6.86mm	100SP1T1B1M2QEH	E-Switch		
SW1	1		Switch, DPDT, On-On, 5 A, 120 VAC, 28 VDC, TH	12.7x11.43mm	100DP1T1B1M2QEH	E-Switch		
U1	1		Dual General-Purpose Operational Amplifier, 10 to 30 V, -40 to 85 degC, 8-pin DIP (P0008A), Pb-Free (RoHS)	P0008A	RC4558IP	Texas Instruments	Equivalent	Texas Instruments
U2, U3	2		Dual Low-Noise Operational Amplifier, 10 to 30 V, 0 to 70 degC, 8-pin DIP (P0008A), Pb-Free (RoHS)	P0008A	NE5532AP	Texas Instruments	Equivalent	Texas Instruments
XU1, XU2, XU3	3		Socket, DIP-8, 2.54 mm Pitch	Socket, DIP-8, 2.54 mm Pitch	210-1-08-003	CnC Tech		
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A		
Notes:			Unless otherwise noted in the Alternate Part Number or Alternate Manufacturer columns, all parts may be substituted with equivalents.					

Revision History

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

Changes from Original (February 2017) to A Revision	Page
• Changed format of front matter.	1
• Changed <i>Guitar SideGig Controls</i> title to <i>Guitar SideGig Controls and Circuits</i>	7
• Expanded <i>CLEAN Channel</i> section.	7
• Expanded <i>DRIVE Channel</i> section.....	8

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductor products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.
3. *Regulatory Notices:*
 - 3.1 *United States*
 - 3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.
 - 3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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