

XTR117 4~20mA 電流ループ トランスミッタ

1 特長

- 低い静止電流: 130μA
- 外部回路用の 5V レギュレータ
- 低いスパン誤差: 0.05%
- 低い非直線性誤差: 0.003%
- 幅広い電源電圧範囲: 7.5V~36V
- 温度範囲: -40°C~+125°C
- パッケージ: VSON-8 および VSSOP-8

2 アプリケーション

- 2 線式、4~20mA 電流ループ トランスミッタ
- スマート・トランスミッタ
- 産業用プロセス制御
- テスト・システム
- 電流アンプ
- 電圧電流アンプ

3 概要

XTR117 は、業界標準の電流ループを介してアナログ 4mA~20mA 信号を送信するように設計された高精度電流出力コンバータです。デバイスは、正確な電流スケーリングと出力電流制限機能を提供します。

オンチップ電圧レギュレータ (5V) を使用して、外部回路に電力を供給できます。電流帰還ピン (I_{RET}) は、外部回路で使用される電流を検出し、出力電流を正確に制御します。

XTR117 は、4mA~20mA の電流伝送を使用するスマートセンサの基本的なビルディングブロックです。

XTR117 は、拡張産業用温度範囲の -40°C~+125°C で動作が規定されています。

パッケージ情報

製品名	パッケージ (1)	パッケージ サイズ (2)
XTR117	DGK (VSSOP, 8)	3mm × 4.9mm
	DRB (VSON, 8)	3mm × 3mm

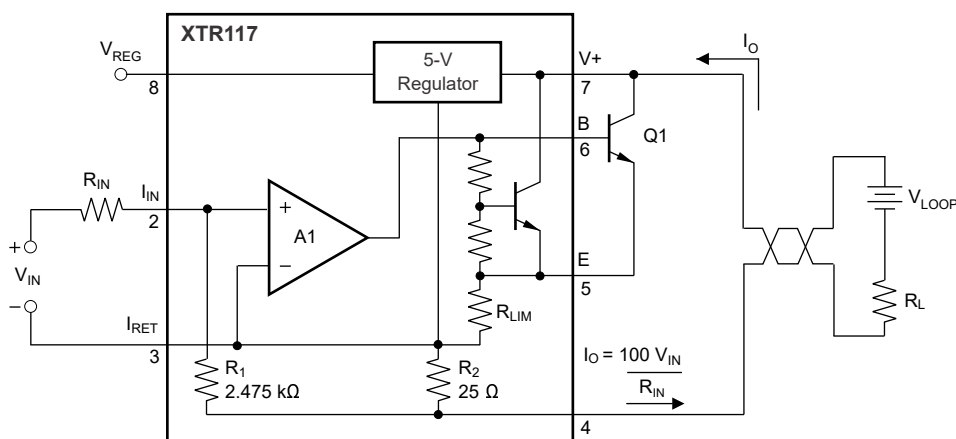
(1) 詳細については、[セクション 10](#) を参照してください。

(2) パッケージ サイズ (長さ×幅) は公称値であり、該当する場合はピンも含まれます。

関連する 4~20mA デバイス (1)

デバイス	説明
XTR115	5V レギュレータ出力および 2.5V リファレンス出力
XTR116	5V レギュレータ出力と 4.096V のリファレンス出力

(1) 4~20mA ブリッジおよび RTO コンディショナーの包括的なソリューションについては、www.ti.com の XTR 製品ファミリーをご覧ください。



代表的なアプリケーション



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4 Pin Configuration and Functions

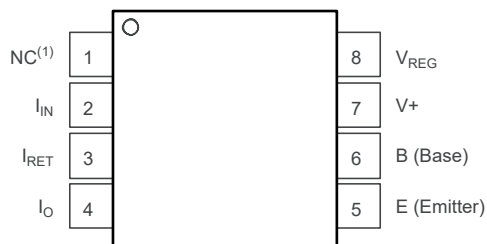


図 4-1. DGK Package, 8-Pin VSSOP (Top View)

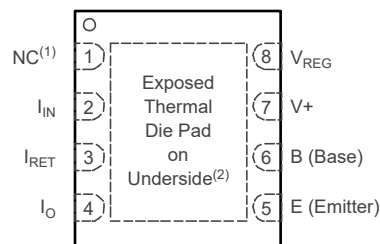


図 4-2. DRB Package, 8-Pin VSON (Top View)

(1) NC = No connection.

(2) Connect thermal die pad to I_{RET} or leave unconnected on PCB.

表 4-1. Pin Functions

PIN		TYPE ⁽¹⁾	DESCRIPTION
NAME	NO.		
I_{IN}	2	I	Current input pin
I_{RET}	3	I	Local ground return pin for V_{REG}
I_O	4	O	Regulated 4-mA to 20-mA current-loop output
E (Emitter)	5	I	Emitter connection for external transistor
B (Base)	6	O	Base connection for external transistor
V_+	7	P	Loop power supply
V_{REG}	8	O	5-V regulator voltage output
NC	1	—	Not connected.
Thermal Pad	Pad	—	Thermal Pad. Connect to I_{RET} or leave floating.

(1) I = Input, O = Output, I/O = Input or Output, G = Ground, P = Power.

5 Specifications

5.1 Absolute Maximum Ratings⁽¹⁾

		MIN	MAX	UNIT
V+	Power supply (referenced to I _O pin)		40	V
	Input voltage (referenced to I _{RET} pin)	0	V+	V
	Output current limit	Continuous		
	V _{REG} , short-circuit	Continuous		
	Operating temperature	–40	125	°C
	Storage temperature	–55	150	°C
	Junction temperature		165	°C

- (1) Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.

5.2 ESD Ratings

			VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human-body model (HBM)	2000	V
		Charged device model (CDM)	1000	

5.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
V+	Power supply voltage	7.5	24	40	V
T _A	Specified temperature	–40		125	°C

5.4 Thermal Information

THERMAL METRIC ⁽¹⁾		XTR117		UNIT
		DGK (VSSOP)	DRB (VSON)	
		8 PINS	8 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	173.9	60.7	°C/W
R _{θJB}	Junction-to-board thermal resistance	95.2	33.2	°C/W
Ψ _{JT}	Junction-to-top characterization parameter	11.1	4.7	°C/W
Ψ _{JB}	Junction-to-board characterization parameter	93.7	33.0	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	66.3	70.4	°C/W
R _{θJC(bottom)}	Junction-to-case (bottom) thermal resistance	N/A	17.8	°C/W

- (1) For information about traditional and new thermal metrics, see the [Semiconductor and IC package thermal metrics](#) application report.

5.5 Electrical Characteristics

at $T_A = 25^\circ\text{C}$, $V_+ = 24\text{ V}$, $R_{IN} = 20\text{ k}\Omega$, and TIP29C external transistor (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
OUTPUT						
I_O	Output current equation		$I_O = I_{IN} \times 100$			
	Output current, linear range		0.20		25	mA
I_{LIM}	Overscale limit			32		mA
I_{MIN}	Underscale limit	$I_{REG} = 0$		0.13	0.20	mA
SPAN						
S	Span (current gain)			100		A/A
	Error ⁽¹⁾	$I_O = 200\text{ }\mu\text{A to } 25\text{ mA}$		± 0.05	± 0.4	%
		$I_O = 200\text{ }\mu\text{A to } 25\text{ mA}$, $T_A = -40^\circ\text{C to } +125^\circ\text{C}$		± 3	± 20	ppm/ $^\circ\text{C}$
	Nonlinearity	$I_O = 200\text{ }\mu\text{A to } 25\text{ mA}$		± 0.003	± 0.02	%
INPUT						
V_{OS}	Offset voltage (op amp)	$I_{IN} = 40\text{ }\mu\text{A}$		± 100	± 500	μV
		$I_{IN} = 40\text{ }\mu\text{A}$, $T_A = -40^\circ\text{C to } +125^\circ\text{C}$		± 0.7	± 6	$\mu\text{V}/^\circ\text{C}$
		$I_{IN} = 40\text{ }\mu\text{A}$, $V_+ = 7.5\text{ V to } 36\text{ V}$		0.1	2	$\mu\text{V/V}$
I_B	Bias current			-35		nA
		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$		300		pA/ $^\circ\text{C}$
θ_n	Noise	0.1 Hz to 10 Hz		0.6		μV_{pp}
DYNAMIC RESPONSE						
	Small-signal bandwidth	$C_{LOOP} = 0$, $R_L = 0$		380		kHz
	Slew rate			3.2		mA/ μs
V_{REG}⁽²⁾						
	Voltage			5		V
	Voltage accuracy	$I_{REG} = 0\text{ mA}$		± 0.05	± 0.1	V
		$I_{REG} = 0\text{ mA}$, $T_A = -40^\circ\text{C to } +125^\circ\text{C}$		± 0.1		mV/ $^\circ\text{C}$
		$I_{REG} = 0\text{ mA}$, $V_+ = 7.5\text{ V to } 36\text{ V}$		1		mV/V
	Voltage accuracy vs V_{REG} current			See Figure 5-4		
	Short-circuit current			12		mA
POWER SUPPLY						
I_Q	Quiescent current			130	200	μA
		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$			250	

(1) Does not include initial error or temperature coefficient of R_{IN} .

(2) Voltage measured with respect to I_{RET} pin.

5.6 Typical Characteristics

At $T_A = +25^\circ\text{C}$, $V_+ = 24\text{ V}$, $R_{IN} = 20\text{ k}\Omega$, and TIP29C external transistor (unless otherwise noted)

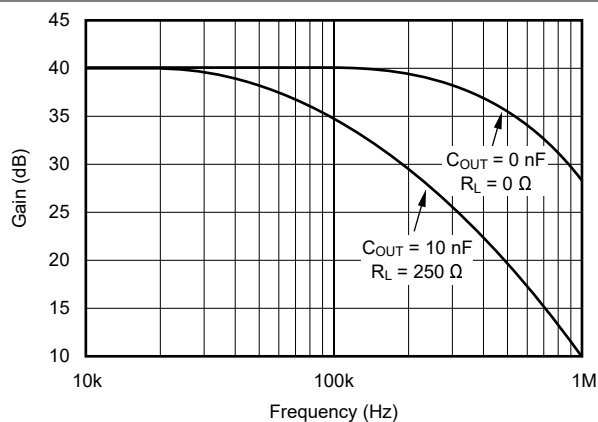


Figure 5-1. Current Gain vs Frequency

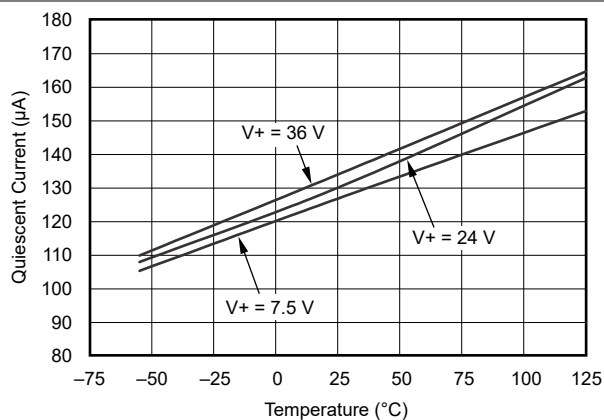


Figure 5-2. Quiescent Current vs Temperature

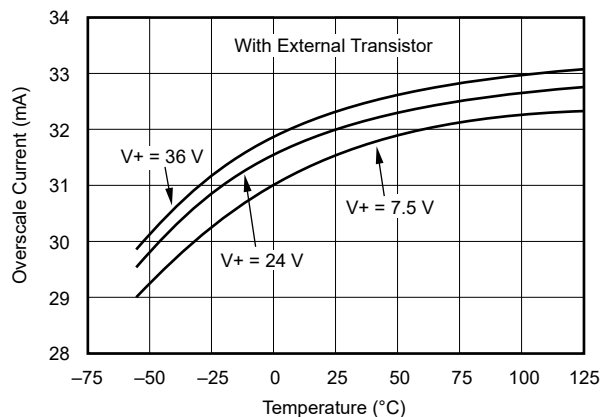


Figure 5-3. Overscale Current vs Temperature

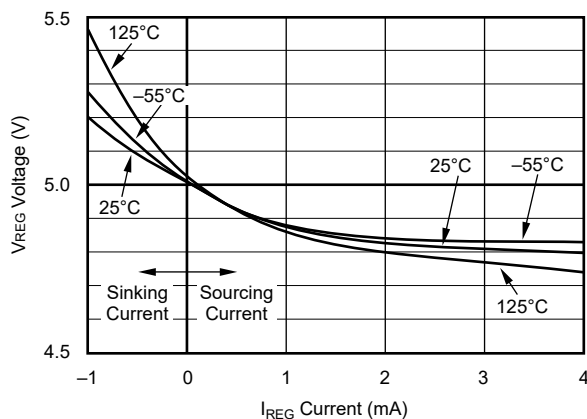


Figure 5-4. V_{REG} Voltage vs V_{REG} Current

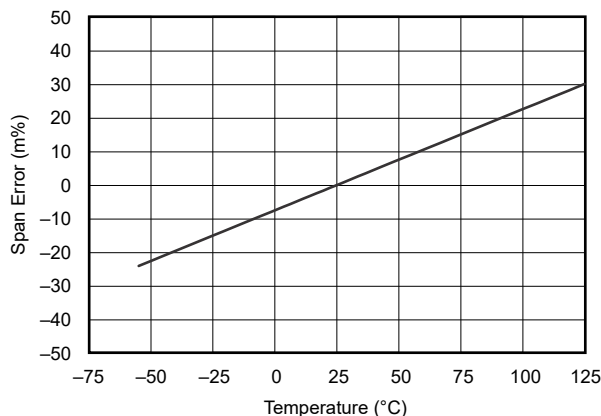


Figure 5-5. Span Error vs Temperature

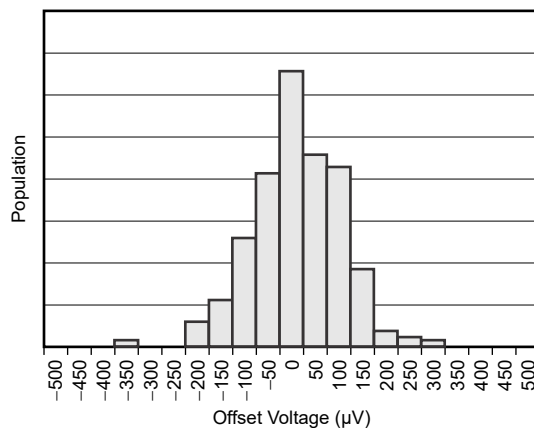


Figure 5-6. Offset Voltage Distribution

6 Detailed Description

6.1 Overview

The XTR117 is a precision current output converter designed to transmit analog 4 mA to 20 mA signals over an industry-standard current loop. Figure 6-1 shows basic circuit connections with representative simplified input circuitry. The XTR117 is a two-wire current transmitter. The input current (pin 2) controls the output current. A portion of the output current flows into the V+ power supply, pin 7. The remaining current flows in Q₁. External input circuitry connected to the XTR117 can be powered from V_{REG}. Current drawn from these terminals must be returned to I_{RET}, pin 3. The I_{RET} pin is a *local ground* for input circuitry driving the XTR117.

The XTR117 is a current-input device with a gain of 100. A current flowing into pin 2 produces $I_O = 100 \times I_{IN}$. The input voltage at the I_{IN} pin is zero (referred to the I_{RET} pin). A voltage input is converted to an input current with an external input resistor, R_{IN}, as shown in Figure 6-1. Typical full-scale input voltages range from 1 V and upward. Full-scale inputs greater than 0.5 V are recommended to minimize the effects of offset voltage and drift of A1.

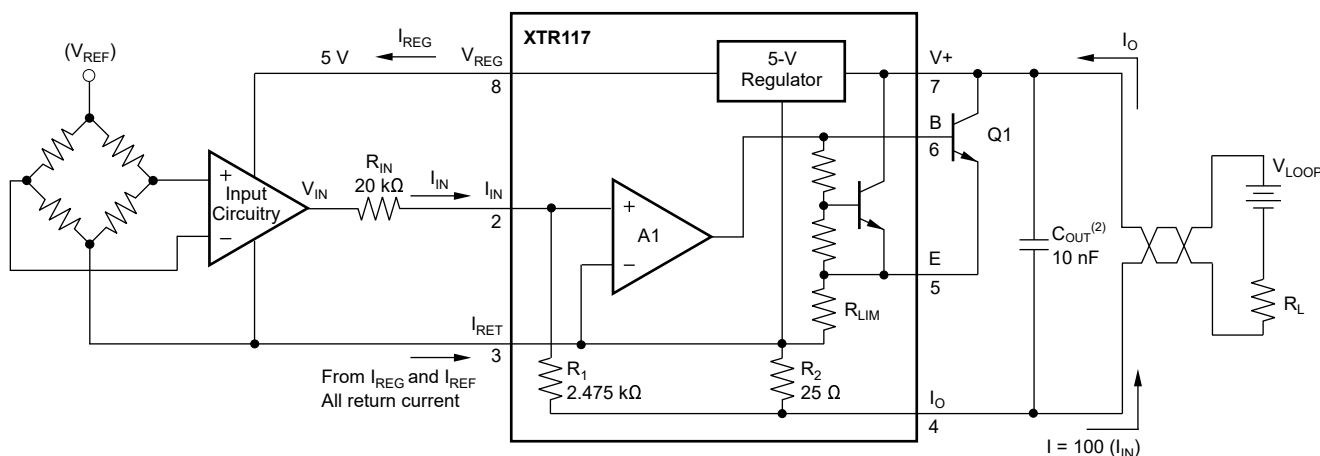
For improved precision use an external voltage reference:

DEVICE	VOLTAGE
REF35409	4.096 V
REF35300	3.0 V
REF35250	2.5 V

Use REF34xx for lower drift.

Possible choices for Q1⁽¹⁾

TYPE	PACKAGE
2N4922G	TO-126
FCX690BTA	SOT-89-3
MMBTA28-7-F	SOT-23-3

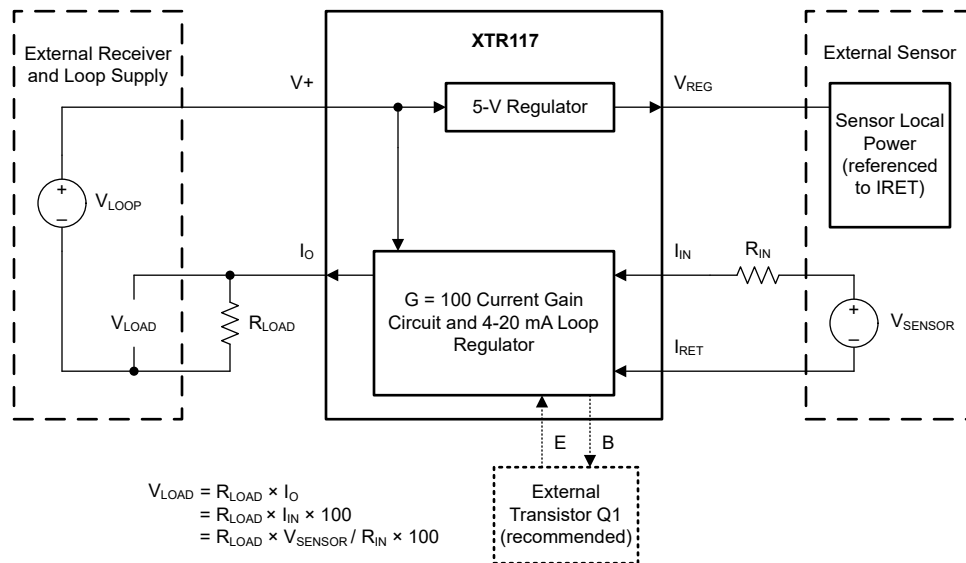


(1) See セクション 7.1.1.

(2) See セクション 7.1.6.

Figure 6-1. Basic Circuit Connections

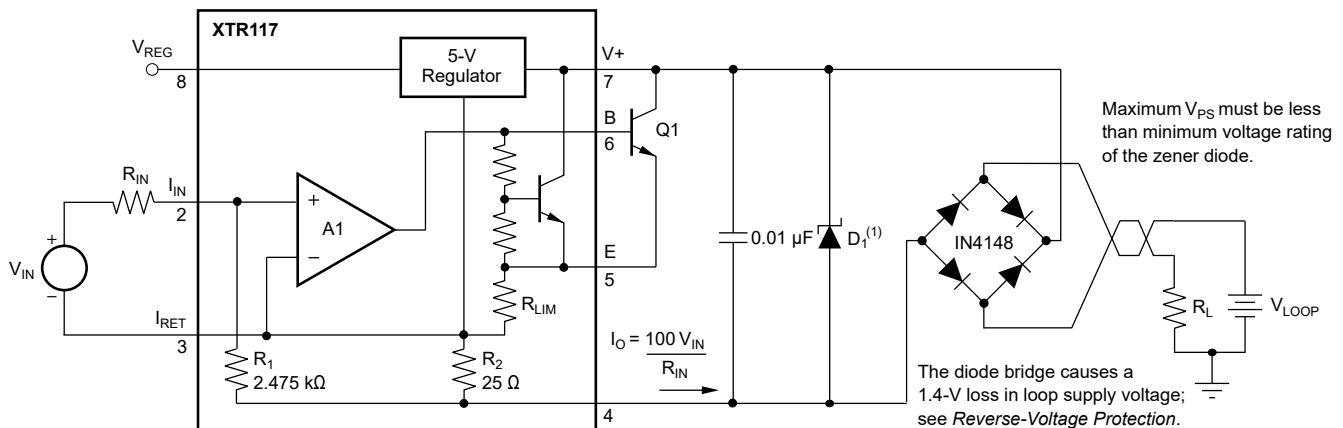
6.2 Functional Block Diagram



6.3 Feature Description

6.3.1 Reverse-Voltage Protection

The XTR117 low compliance voltage rating (minimum operating voltage) of 7.5 V permits the use of various voltage protection methods without compromising operating range. 6-2 shows a diode bridge circuit that allows normal operation even when the voltage connection lines are reversed. The bridge causes a two-diode drop (approximately 1.4 V) loss in loop supply voltage. This voltage drop results in a compliance voltage of approximately 9 V—satisfactory for most applications. A diode can be inserted in series with the loop supply voltage and the V+ pin to protect against reverse output connection lines with only a 0.7-V loss in loop supply voltage.



(1) 36-V Zener diode, such as 1N4753A or P6KE39A. Use lower-voltage Zener diodes with loop power-supply voltages < 30 V for increased protection; see セクション 6.3.2.

6-2. Reverse Voltage Operation and Over-Voltage Surge Protection

6.3.2 Overvoltage Surge Protection

Remote connections to current transmitters can sometimes be subjected to voltage surges. Best practice is to limit the maximum surge voltage applied to the XTR117 to as low as practical. Various Zener diode and surge clamping diodes are specially designed for this purpose. Select a clamp diode with as low a voltage rating as possible for best protection. The absolute maximum power-supply rating on the XTR117 is specified at 40 V. Keep overvoltages and transients less than 40 V to maintain reliable operation when the supply returns to normal (7.5 V to 36 V).

Most surge protection Zener diodes have a diode characteristic in the forward direction that conducts excessive current, possibly damaging receiving-side circuitry if the loop connections are reversed. If a surge-protection diode is used, use a series diode or diode bridge for protection against reversed connections.

6.3.3 VSON Package

The XTR117 is offered in a VSON-8 package (also known as SON or DFN). The VSON is a QFN package with lead contacts on only two sides of the bottom of the package. This leadless package maximizes board space and enhances thermal and electrical characteristics through an exposed pad.

VSON packages are physically small, have a smaller routing area, improved thermal performance, and improved electrical parasitics. Additionally, the absence of external leads eliminates bent-lead issues.

The VSON package can be easily mounted using standard printed circuit board (PCB) assembly techniques. See the [QFN/SON PCB Attachment](#) and [Quad Flatpack No-Lead Logic Packages](#) application notes, both available for download at www.ti.com.

Connect the exposed leadframe die pad on the bottom of the package to I_{RET} or leave unconnected.

6.4 Device Functional Modes

The device has one mode of operation that applies when operated within the *Recommended Operating Conditions*.

7 Application and Implementation

注

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, as well as validating and testing their design implementation to confirm system functionality.

7.1 Application Information

7.1.1 External Transistor

The external transistor, Q_1 , conducts the majority of the full-scale output current. Power dissipation in this transistor can approach 0.8 W with high loop voltage (40 V) and 20-mA output current. The XTR117 is designed to use an external transistor to avoid on-chip, thermal-induced errors. Heat produced by Q_1 still causes ambient temperature changes that can influence the XTR117 performance. To minimize these effects, locate Q_1 away from sensitive analog circuitry, including the XTR117. Mount Q_1 so that heat is conducted to the outside of the transducer housing.

The XTR117 is designed to use virtually any NPN transistor with sufficient voltage, current, and power rating. Case style and thermal mounting considerations often influence the choice for any given application. Several possible choices are listed in [Figure 6-1](#). A MOSFET transistor does not improve the accuracy of the XTR117 and is not recommended. Although the XTR117 can be used without an additional external transistor, this configuration is not always practical at higher loop voltages and currents because of self-heating concerns.

7.1.2 Minimum Output Current

The quiescent current of the XTR117 (typically 130 μ A) is the lower limit of the output current. Zero input current ($I_{IN} = 0$) produces an I_O equal to the quiescent current. Output current does not begin to increase until $I_{IN} = I_Q/100$. Current drawn from V_{REG} is added to this minimum output current. Up to 3.8 mA is available to power external circuitry while still allowing the output current to go to less than 4 mA.

7.1.3 Offsetting the Input

A low-scale output of 4 mA is produced by creating a 40- μ A input current. [Figure 7-1](#) shows how this input current is created with the proper value resistor from an external reference voltage (V_{REF}). V_{REG} is used as shown in [Figure 7-1](#), but does not have the temperature stability of a high-quality reference, such as the [REF3425](#).

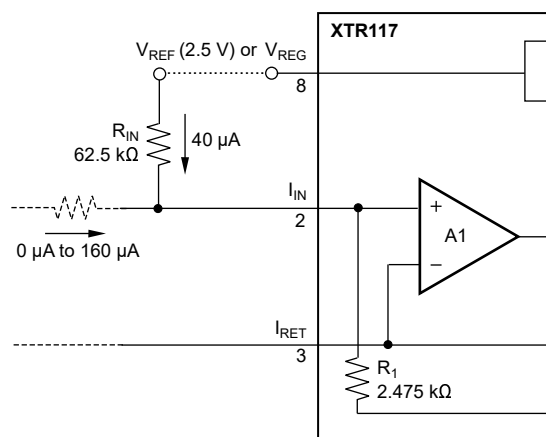


Figure 7-1. Creating Low-Scale Offset

7.1.4 Radio Frequency Interference

The long wire lengths of current loops invite radio-frequency (RF) interference. RF interference can be rectified by the input circuitry of the XTR117 or preceding circuitry. This effect generally appears as an unstable output current that varies with the position of loop supply or input wiring. Interference can also enter at the input terminals. For integrated transmitter assemblies with short connections to the sensor, the interference more likely comes from the current-loop connections.

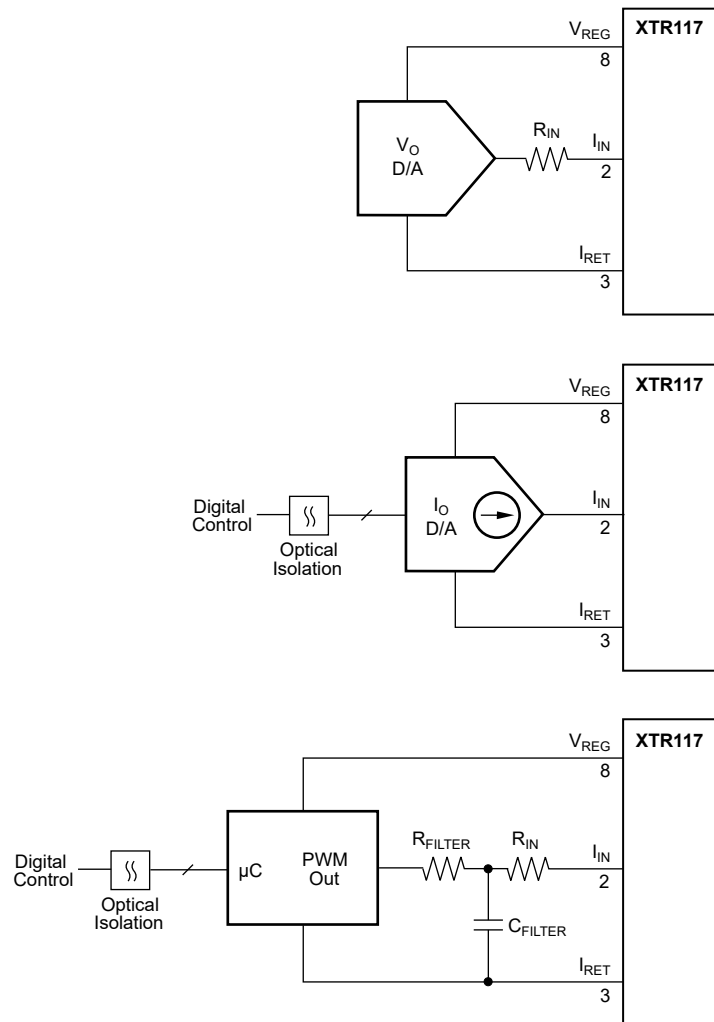


図 7-2. Digital Control Methods

7.1.5 Maximum Output Current

The XTR117 provides accurate, linear output up to 25 mA. Internal circuitry limits the output current to approximately 32 mA to protect the transmitter and loop power or measurement circuitry.

Extending the output current range of the XTR117 is possible by connecting an external resistor from pin 3 to pin 5 to change the current limit value.

注意

All output current must flow through internal resistors; therefore, damage is possible with excessive current. Output currents greater than 45 mA can cause permanent damage.

8 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

8.1 Related Documentation

For related documentation see the following:

- Texas Instruments, [Special Function Amplifiers Precision Labs video series](#) on Current Loop Transmitters
- Texas Instruments, [TIPD126 Bridge Sensor Signal Conditioner with Current Loop Output and EMC Protection Reference Design](#) with XTR117

8.2 ドキュメントの更新通知を受け取る方法

ドキュメントの更新についての通知を受け取るには、www.tij.co.jp のデバイス製品フォルダを開いてください。[通知] をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取ることができます。変更の詳細については、改訂されたドキュメントに含まれている改訂履歴をご覧ください。

8.3 サポート・リソース

テキサス・インスツルメンツ E2E™ サポート・フォーラムは、エンジニアが検証済みの回答と設計に関するヒントをエキスパートから迅速かつ直接得ることができる場所です。既存の回答を検索したり、独自の質問をしたりすることで、設計に必要な支援を迅速に得ることができます。

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8.4 Trademarks

テキサス・インスツルメンツ E2E™ is a trademark of Texas Instruments.
すべての商標は、それぞれの所有者に帰属します。

8.5 静電気放電に関する注意事項



この IC は、ESD によって破損する可能性があります。テキサス・インスツルメンツは、IC を取り扱う際には常に適切な注意を払うことを推奨します。正しい取り扱いおよび設置手順に従わない場合、デバイスを破損するおそれがあります。

ESD による破損は、わずかな性能低下からデバイスの完全な故障まで多岐にわたります。精密な IC の場合、パラメータがわずかに変化するだけで公表されている仕様から外れる可能性があるため、破損が発生しやすくなっています。

8.6 用語集

[テキサス・インスツルメンツ用語集](#)

この用語集には、用語や略語の一覧および定義が記載されています。

9 Revision History

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。

Changes from Revision C (May 2012) to Revision D (November 2023)	Page
ドキュメント全体にわたって表、図、相互参照の採番方法を更新.....	1
「特長」、「仕様」、およびドキュメント全体で、推奨ループ電源電圧の最大範囲を 40V から 36V に変更	1
ドキュメント全体を通してパッケージ名を MSOP から VSSOP に、DFN を VSON に変更.....	1
「製品情報」表のタイトルを「パッケージ情報」に変更して、内容を更新.....	1
Added <i>Pin Configurations and Functions, ESD Ratings, Recommended Operating Conditions, Thermal Information, Detailed Description, Overview, Functional Block Diagram, Feature Description, Application and Implementation Typical Application, Device and Documentation Support, Related Documentation, and Mechanical, Packaging, and Orderable Information</i> sections.....	2
Changed absolute maximum loop supply voltage range from 50 V to 40 V in <i>Absolute Maximum Ratings</i> and throughout the document.....	3
Changed operating temperature minimum value from –55°C to –40°C in <i>Absolute Maximum Ratings</i> and <i>Electrical Characteristics</i>	3
Moved thermal resistance content from <i>Electrical Characteristics</i> to new <i>Thermal Information</i>	3
Changed thermal resistance from $\theta_{JA} = 150^{\circ}\text{C/W}$ (MSOP) and 53°C/W (DFN) to $R_{\theta JA} = 173.9^{\circ}\text{C/W}$ (VSSOP) and 60.7°C/W (VSON), respectively.....	3
Changed bias current vs temperature from 150 pA/°C to 300 pA/°C in <i>Electrical Characteristics</i>	4
Changed V_{REG} vs output current parameter name to Voltage accuracy vs V_{REG} current, in <i>Electrical Characteristics</i>	4
Deleted redundant temperature range content already stated in the <i>Absolute Maximum Ratings</i> and new <i>Recommended Operating Conditions</i>	4
Updated <i>Typical Characteristics</i> title to remove typo.....	5
Changed Figure 7-1, <i>Basic Circuit Connections</i>	6
Changed suggested Zener diode part numbers in Figure 7-2, <i>Reverse Voltage Operation and Overvoltage Surge Protection</i>	7
Changed <i>External Transistor</i> applications information section to incorporate additional guidance regarding transistor power dissipation and thermal concerns.....	9
Added <i>Circuit Stability</i> section.....	11

10 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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)
XTR117AIDGKR	Active	Production	VSSOP (DGK) 8	2500 LARGE T&R	Yes	Call TI Nipdau	Level-3-260C-168 HR	-40 to 125	BOZ
XTR117AIDGKR.B	Active	Production	VSSOP (DGK) 8	2500 LARGE T&R	Yes	Call TI	Level-3-260C-168 HR	-40 to 125	BOZ
XTR117AIDGKT	Obsolete	Production	VSSOP (DGK) 8	-	-	Call TI	Call TI	-40 to 125	BOZ
XTR117AIDRBR	Active	Production	SON (DRB) 8	3000 LARGE T&R	Yes	FULL NIPDAU	Level-2-260C-1 YEAR	-40 to 125	BOY
XTR117AIDRBR.B	Active	Production	SON (DRB) 8	3000 LARGE T&R	Yes	FULL NIPDAU	Level-2-260C-1 YEAR	-40 to 125	BOY
XTR117AIDRBT	Obsolete	Production	SON (DRB) 8	-	-	Call TI	Call TI	-40 to 125	BOY

⁽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.

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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.

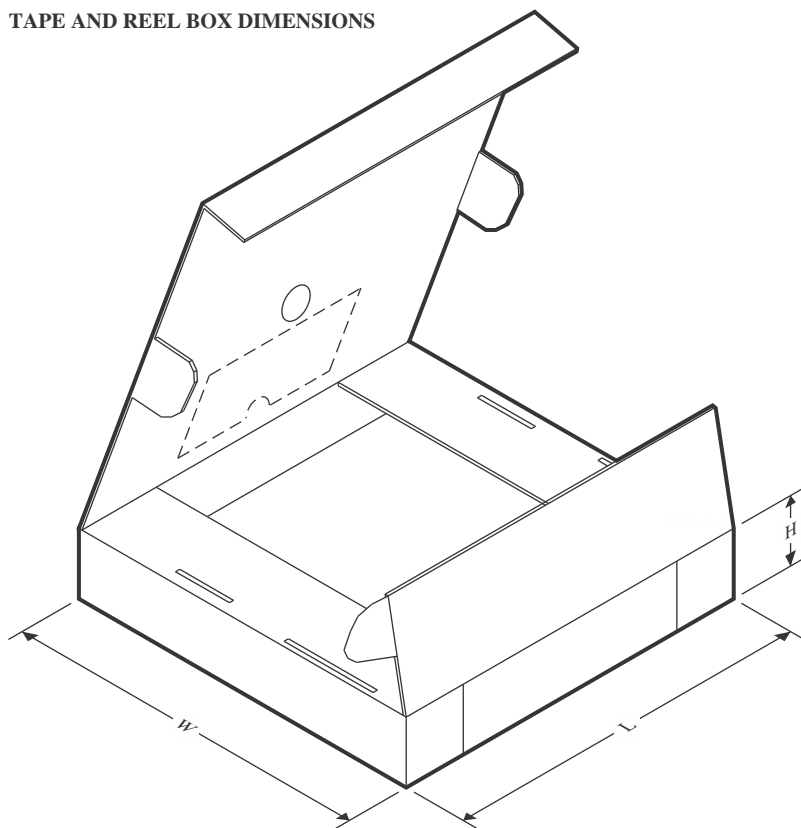
TAPE AND REEL INFORMATION



*All dimensions are nominal

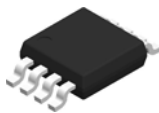
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
XTR117AIDGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
XTR117AIDRBR	SON	DRB	8	3000	330.0	12.4	3.3	3.3	1.1	8.0	12.0	Q2

TAPE AND REEL BOX DIMENSIONS

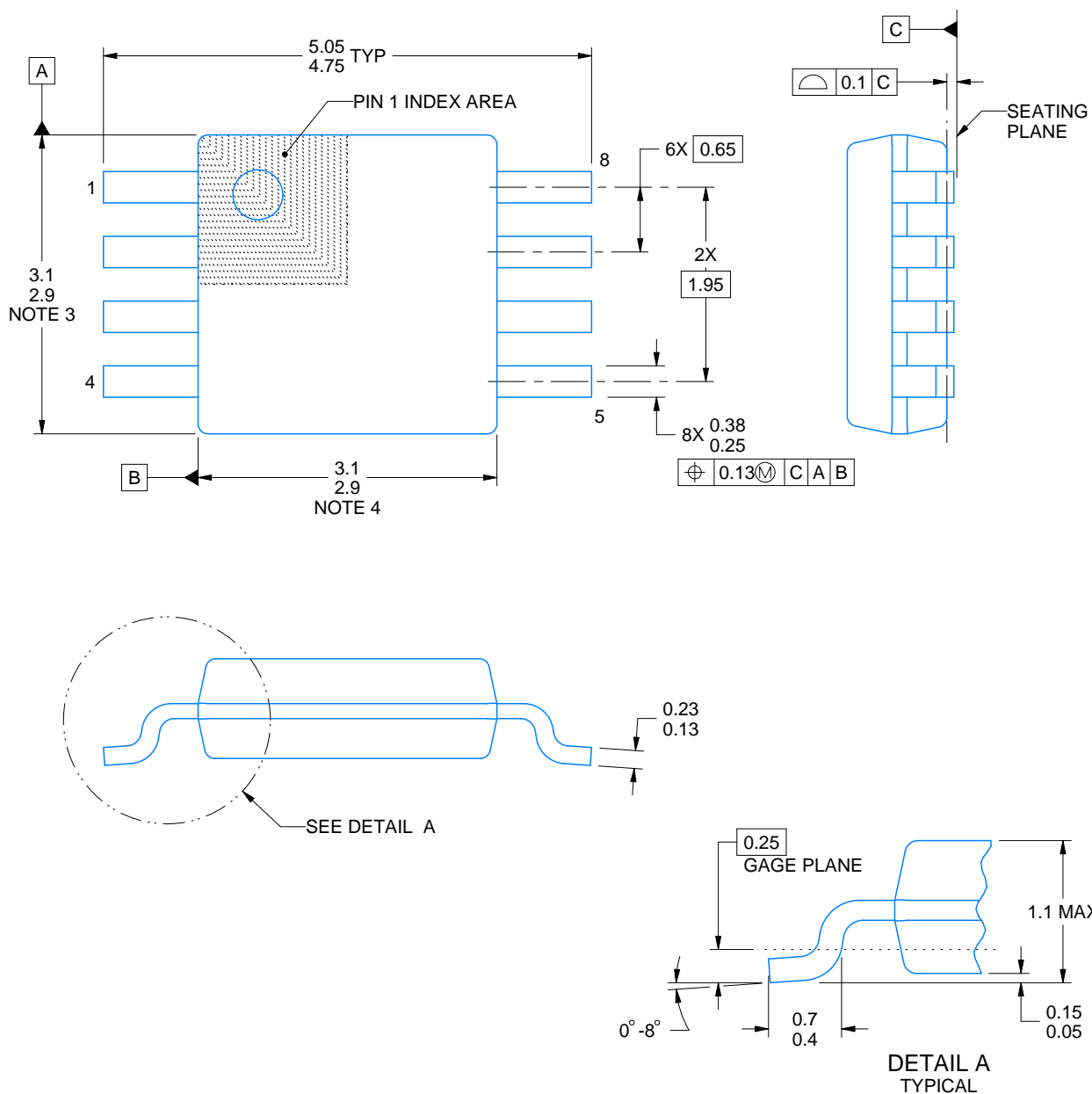


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
XTR117AIDGKR	VSSOP	DGK	8	2500	353.0	353.0	32.0
XTR117AIDRBR	SON	DRB	8	3000	367.0	367.0	35.0

DGK0008A**PACKAGE OUTLINE****VSSOP - 1.1 mm max height**

SMALL OUTLINE PACKAGE



4214862/A 04/2023

NOTES:

PowerPAD is a trademark of Texas Instruments.

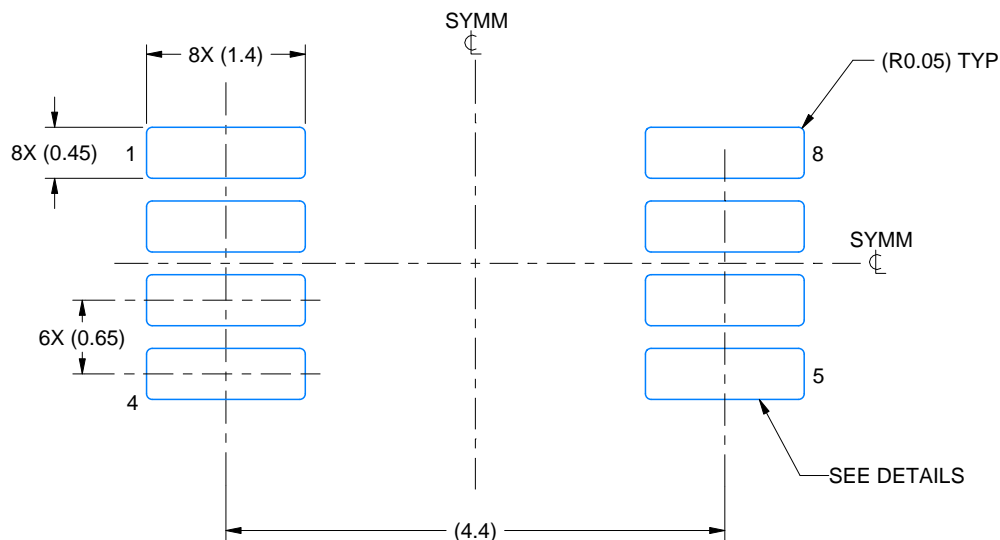
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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-187.

EXAMPLE BOARD LAYOUT

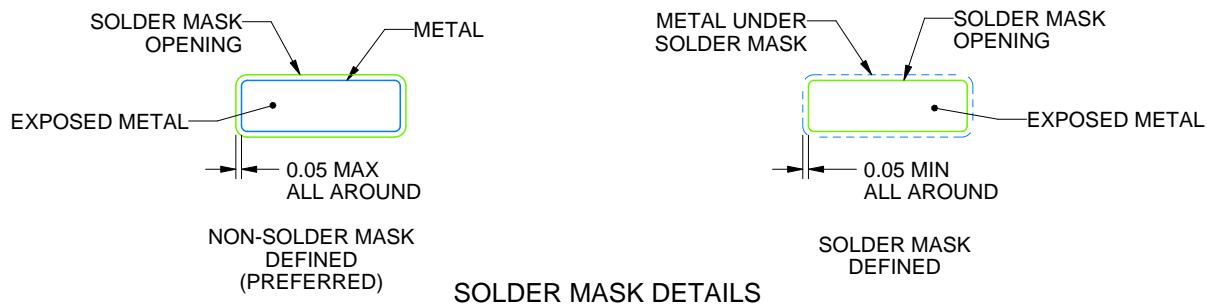
DGK0008A

™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 15X



SOLDER MASK DETAILS

4214862/A 04/2023

NOTES: (continued)

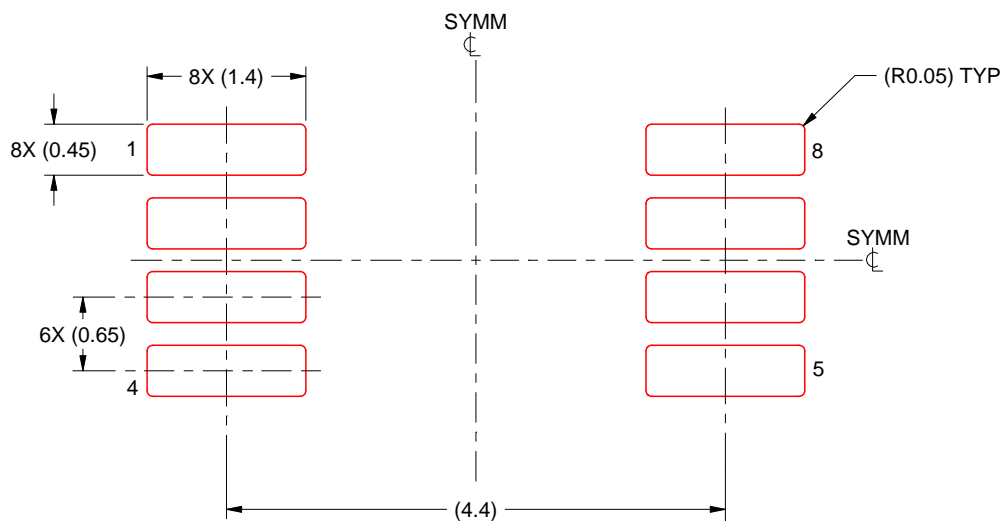
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.
9. Size of metal pad may vary due to creepage requirement.

EXAMPLE STENCIL DESIGN

DGK0008A

™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
SCALE: 15X

4214862/A 04/2023

NOTES: (continued)

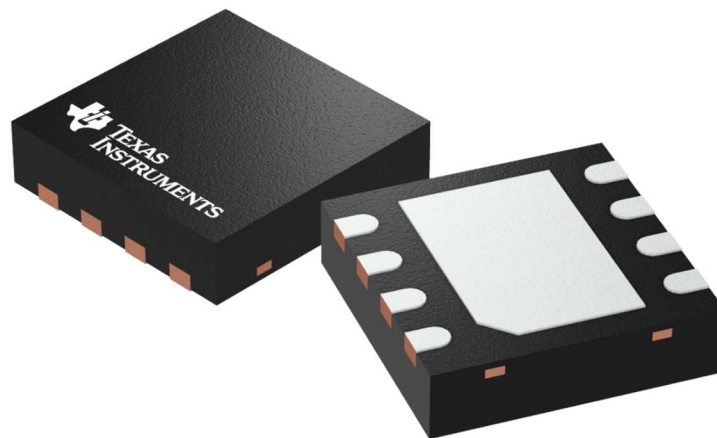
11. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
12. Board assembly site may have different recommendations for stencil design.

DRB 8

GENERIC PACKAGE VIEW

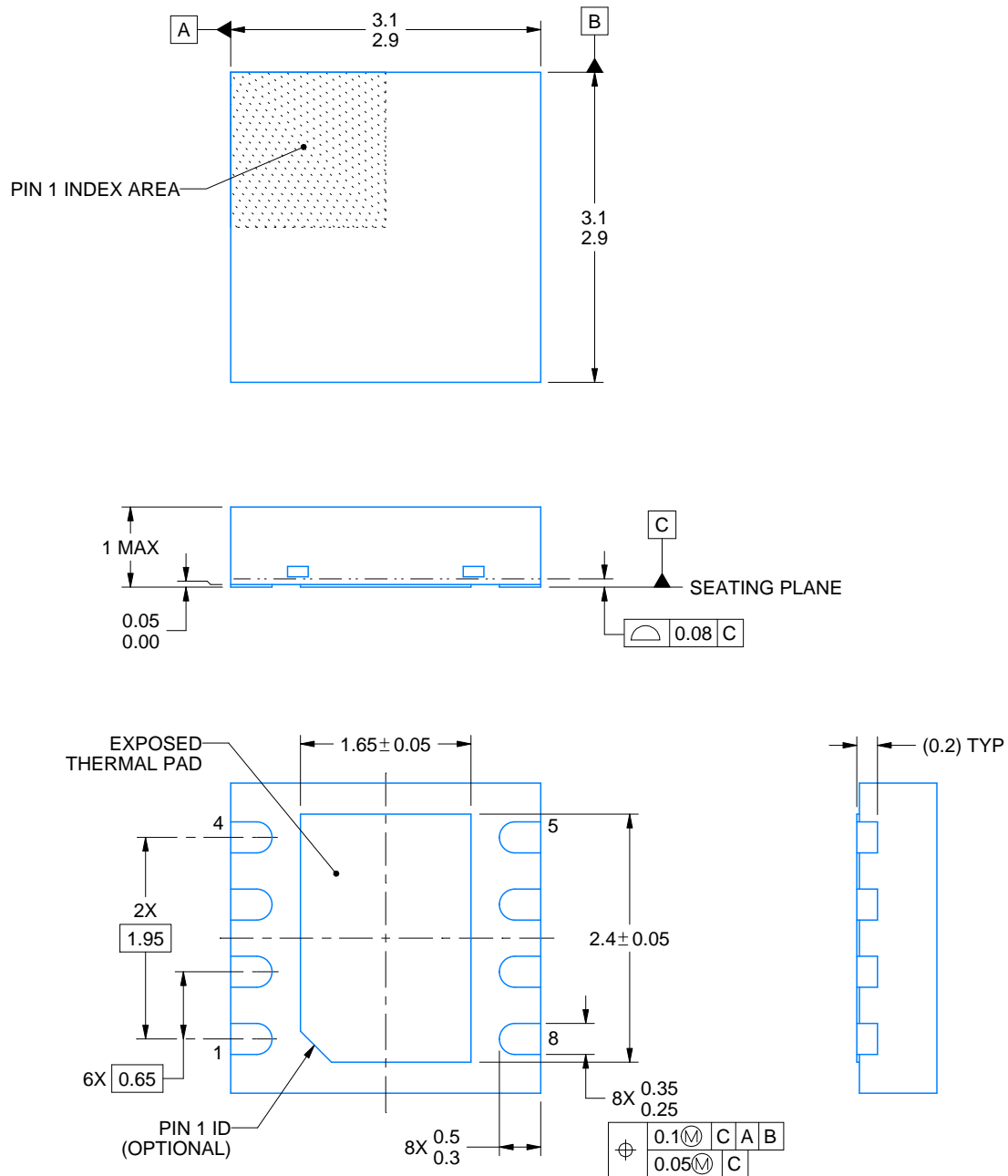
VSON - 1 mm max height

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.

4203482/L



4218876/A 12/2017

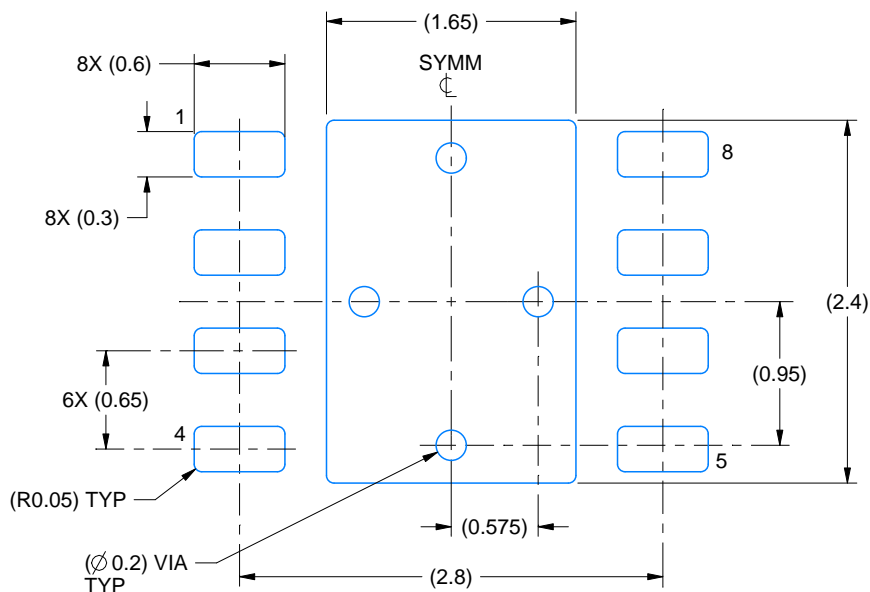
NOTES:

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.

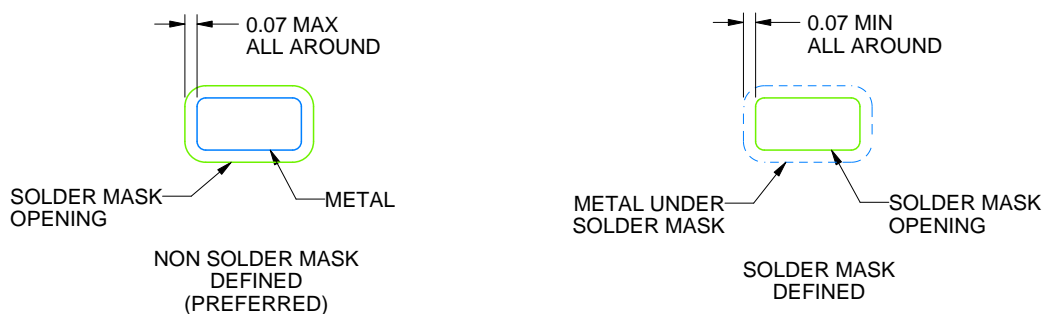
DRB0008B

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
SCALE:20X



SOLDER MASK DETAILS

4218876/A 12/2017

NOTES: (continued)

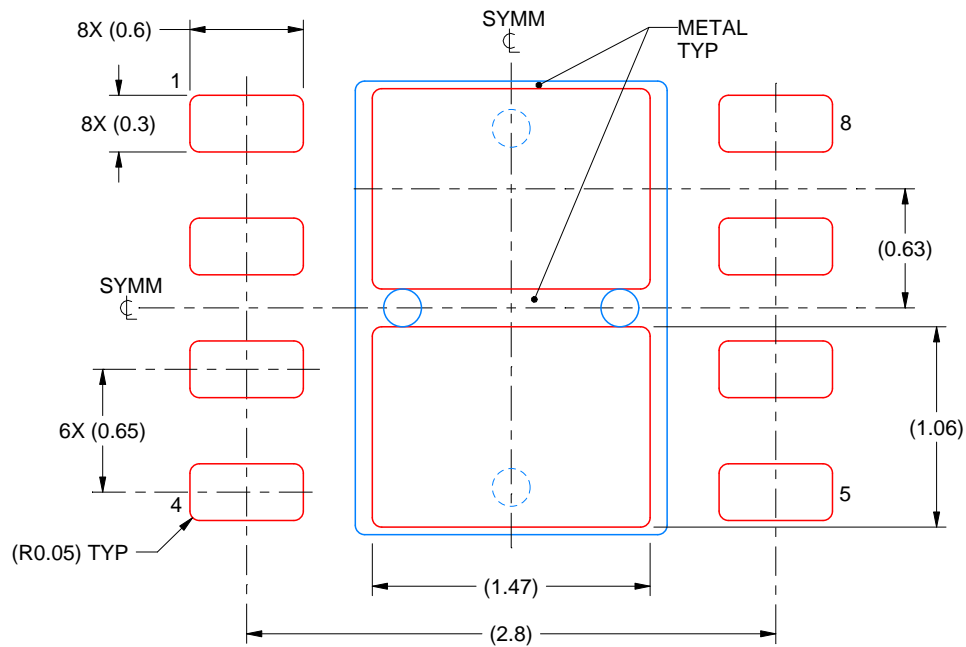
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/sluea271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

DRB0008B

VSON - 1 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
81% PRINTED SOLDER COVERAGE BY AREA
SCALE:25X

4218876/A 12/2017

NOTES: (continued)

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

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