2.4-GHz RF FRONT END

Check for Samples: CC2595

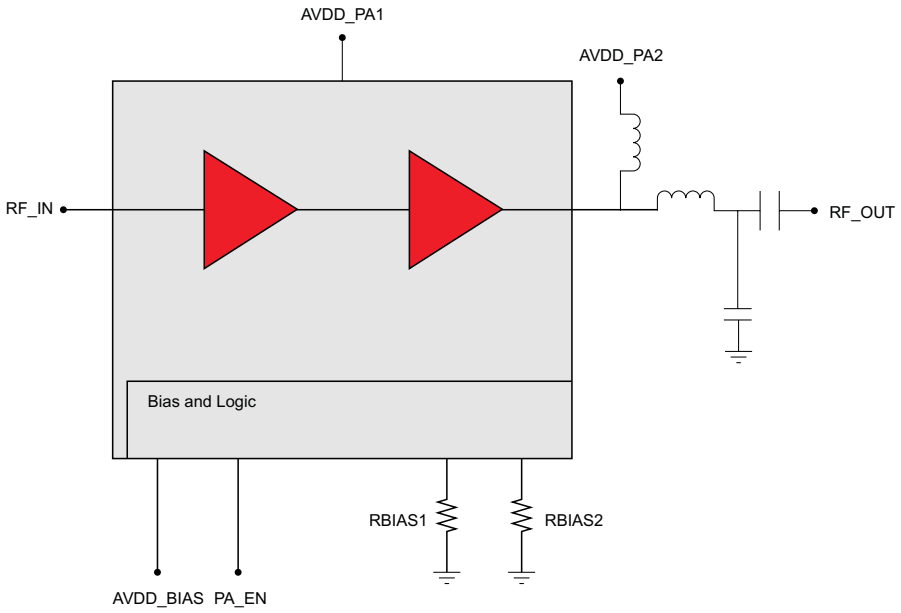
FEATURES

- **Low Cost and Small Package**
- **Very Few External Components**
- **2.0-V to 3.6-V Operation**
- **Less Than 1-µA Current Consumption in Power Down Mode**
- **Low Transmit Current Consumption**
- **98 mA at 3 V for +20.7 dBm Out (PAE = 40%)**
- **RoHS Compliant 3- x 3-mm QFN-16 Package**

DESCRIPTION

CC2595 is a PA solution that extends the range of any Zigbee or Bluetooth transceiver. It is a cost-effective and high performance RF front end for low-power and low-voltage wireless applications in the 2.4-GHz band. Its single-ended RF input and output make it compatible with any manufacturer's transceiver if appropriate external parts are used. When a transmit/receive (T/R) switch and a balun are used, it can interface with existing and future CC24XX and CC25XX transceiver products. CC2595 extends the link budget by providing a power amplifier for improved output power. It is highly effective for high (+20 dBm) output power making it suitable for battery-operated systems. CC2595 contains PA and RF-matching for simple design of high performance wireless applications. It is packaged in a 3- x 3-mm, 16-lead QFN package with exposed paddle.

FUNCTIONAL BLOCK DIAGRAM



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

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PIN ASSIGNMENTS

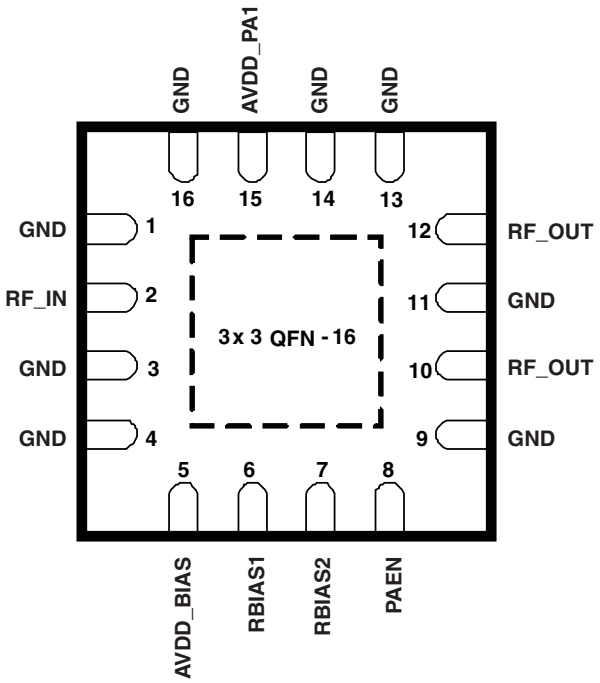


Figure 1. CC2595 Pinout

Table 1. Pin Descriptions for CC2595

PIN NO.	PIN NAME	TYPE	DESCRIPTION
1	GND	GND	
2	RF_IN	RF in/out	RF single-ended input
3	GND	GND	
4	GND	GND	
5	AVDD_BIAS	Power	Supply voltage, analog and logic
6	RBIAS1	Analog	Bias set resistor, stage 1
7	RBIAS2	Analog	Bias set resistor, stage 2
8	PAEN	Digital in	Chip enable: high = PA on
9	GND	GND	
10	RF_OUT	RF in/out	RF single-ended output (1 of 2)
11	GND	GND	
12	RF_OUT	RF in/out	RF single-ended output (2 of 2)
13	GND	GND	
14	GND	GND	
15	AVDD_PA1	Power	Supply voltage, PA stage 1
16	GND	GND	

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Table 2. ORDERING INFORMATION(1)

T_A	PACKAGE(2)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40ºC to 85ºC	RGT (QFN)	CC2595RGTR	C2595

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

ABSOLUTE MAXIMUM RATINGS(1)

Over operating free-air temperature range (unless otherwise noted).

				VALUE	UNIT
	Supply voltage range			-0.3 to 3.6	V
	Voltage on any digital pin			-0.3 to V_{DD} + 0.3, max 3.6	V
	RF input power RF_IN			+10	dBm
T_{STG}	Storage temperature range			–50 to 150	°C
T_J	Junction temperature			150	°C
	ESD	RF pins	HBM (Human Body Model)	1500	V
		Excluding RF pins		2000	

(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.

RECOMMENDED OPERATING CONDITIONS

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

		MIN	NOM	MAX	UNIT
	Operating supply voltage	2		3.6	V
T_A	Operating free air temperature range	–40		85	°C

ELECTRICAL CHARACTERISTICS

T_J = 25°C, V_{DD} = 3 V (unless otherwise specified)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Current consumption	No input signal		30		mA
Power down current	EN = LOW			1	µA
High input level (control pin)		1.3		V_{DD}	V
Low input level (control pin)				0.3	V
Power down → Transmit	Time from EN goes HIGH to settled in TX			1	µs

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RF CHARACTERISTICS

T_J = 25°C, V_{DD} = 3 V (unless otherwise specified)

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
f	Frequency range of operation			2400		2483.5	MHz
P_{OUT}	Output power		Pin = 0 dBm	+20	+20.7		dBm
PAE	Power added efficiency		Pin = 0 dBm		40		%
P_{OUTHI}	Output power (high)		V_{DD} = 3.3 V, Pin = +3 dBm	+22	+22.5		dBm
PAE_{HI}	Power added efficiency (high)		V_{DD} = 3.3 V, Pin = +3 dBm		45		%
P_{1dB}	Output 1-dB compression point				+17		dBm
IRL	Input return loss			10	15		dB
ORL	Output return loss			8	10		dB
	Output power variation over frequency		2400 MHz to 2483.5 MHz		0.5		dB
	Output power variation over supply voltage		2 V to 3.6 V		4		dB
	Output power variation over temperature		-40°C to 85°C		1		dB
	Harmonics	2nd harmonic	The harmonics can be further reduced by using an external LC filter and antenna.	Compliant with international regulatory standards			
		3rd harmonic		Compliant with international regulatory standards			
K	Stability			Unconditionally stable			
	Load mismatch		No damage at 10:1 VSWR condition; all phases				

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TYPICAL CHARACTERISTICS

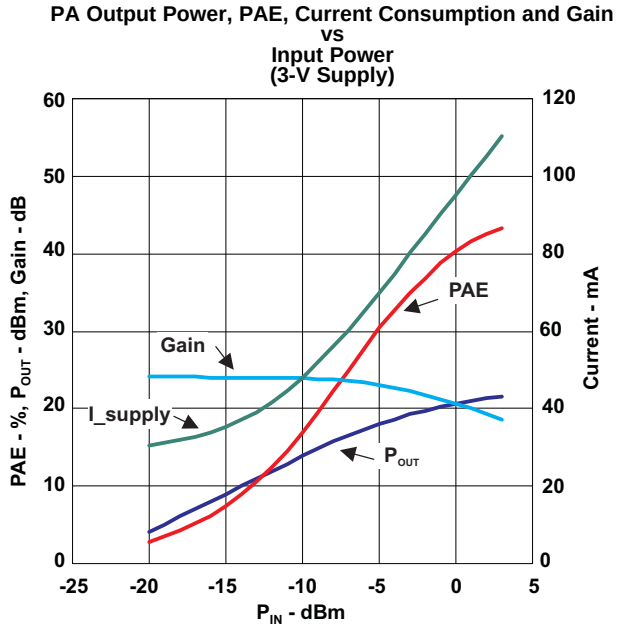


Figure 2.

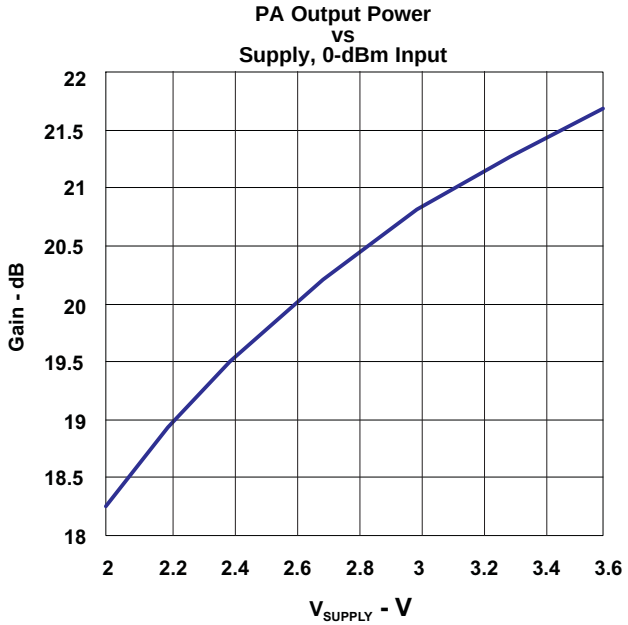


Figure 3.

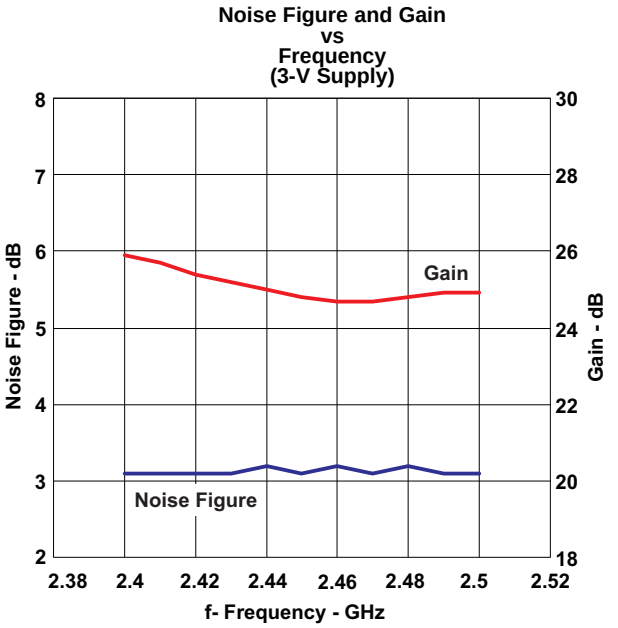


Figure 4.

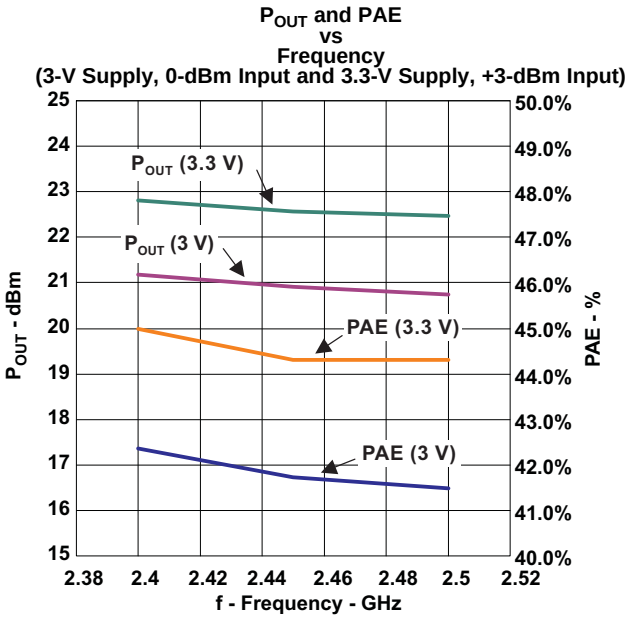


Figure 5.

TYPICAL CHARACTERISTICS (continued)

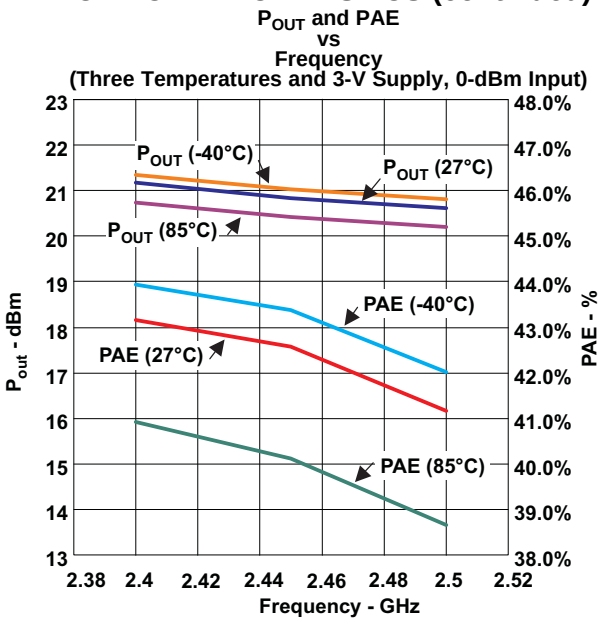


Figure 6.

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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)
CC2595RGTR	Active	Production	VQFN (RGT) | 16	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	C2595
CC2595RGTR.B	Active	Production	VQFN (RGT) | 16	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	C2595
CC2595RGTT	Active	Production	VQFN (RGT) | 16	250 | SMALL T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	C2595
CC2595RGTT.B	Active	Production	VQFN (RGT) | 16	250 | SMALL T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	C2595

(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.

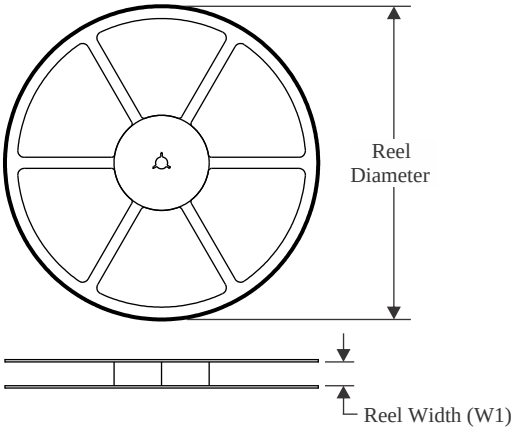
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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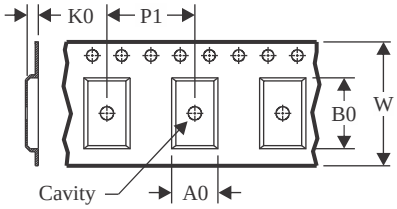
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TAPE AND REEL INFORMATION

REEL DIMENSIONS

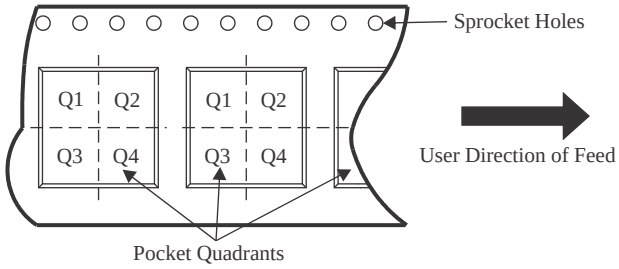


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

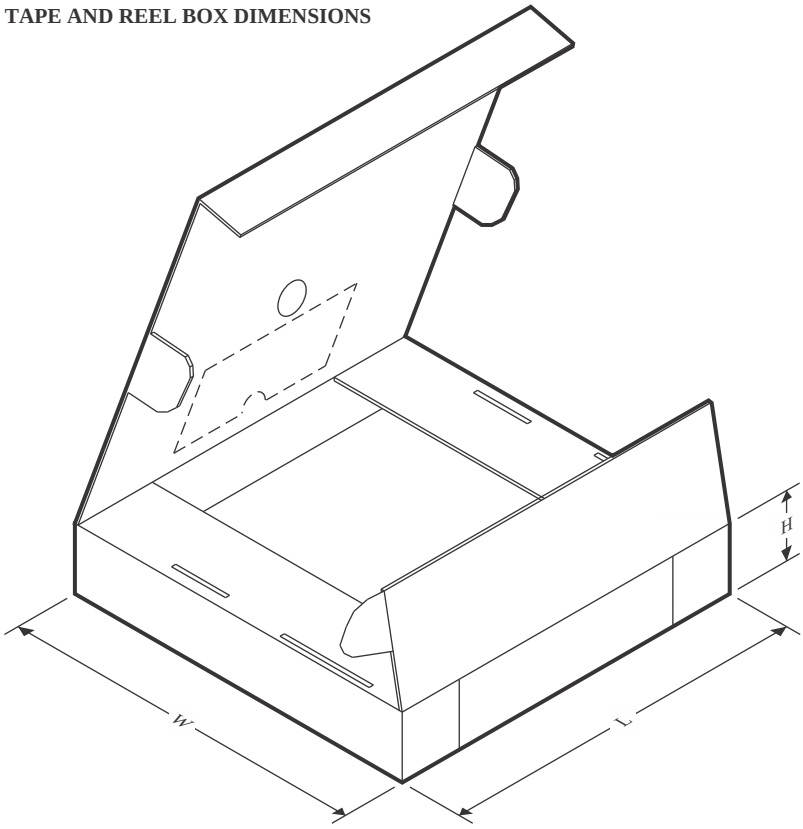
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CC2595RGTR	VQFN	RGT	16	3000	330.0	12.4	3.3	3.3	1.1	8.0	12.0	Q2

TAPE AND REEL BOX DIMENSIONS

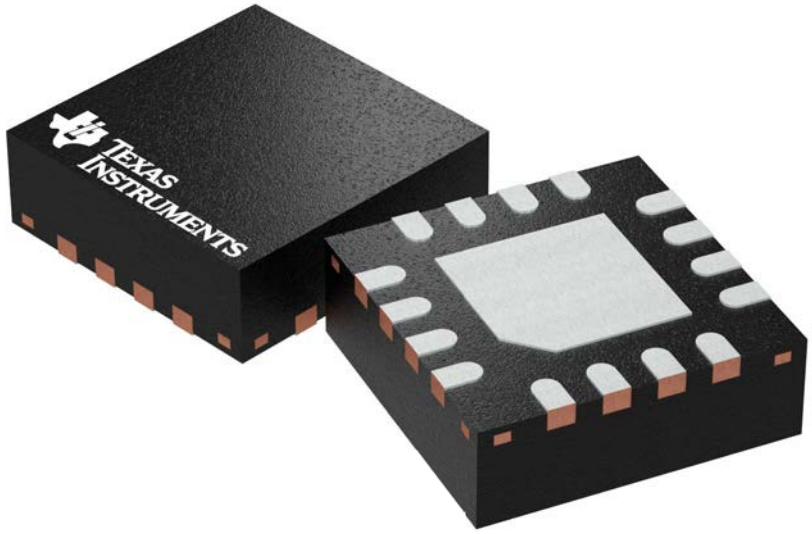


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CC2595RGTR	VQFN	RGT	16	3000	350.0	350.0	43.0

RGT 16 VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



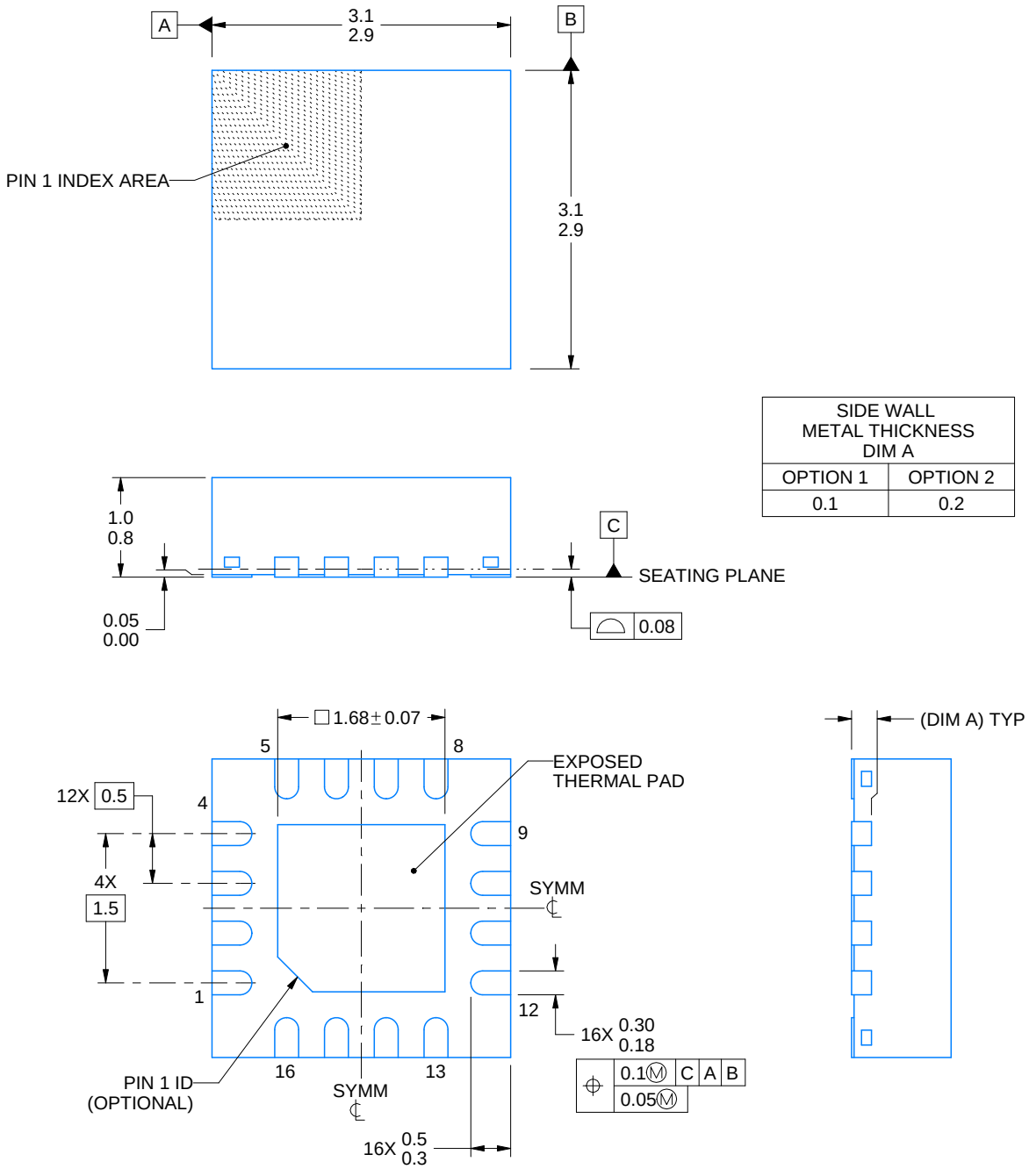
Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

PACKAGE OUTLINE

RGT0016C

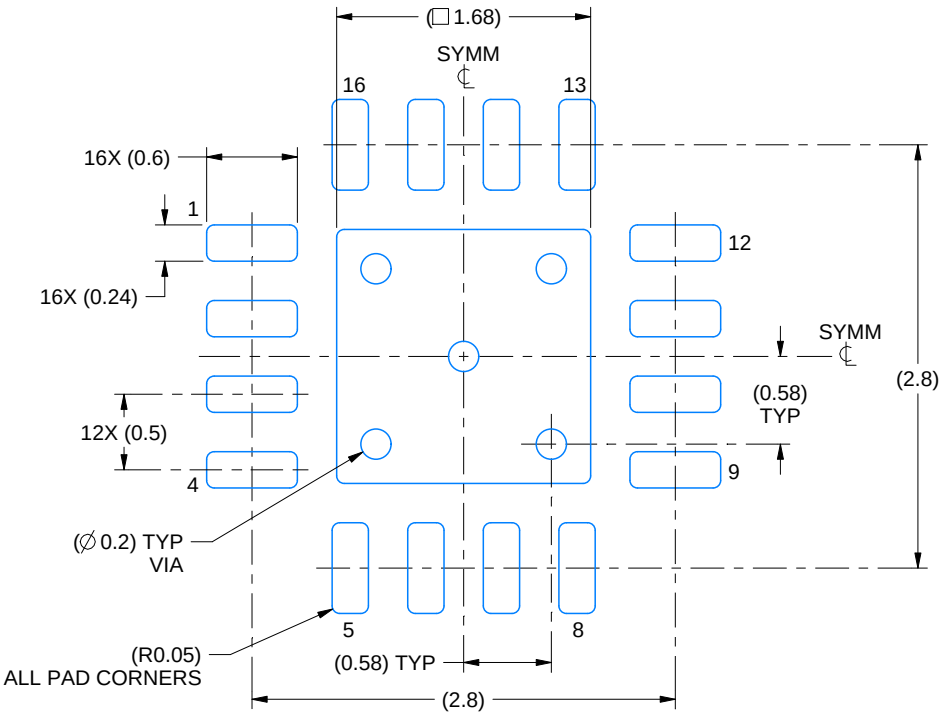
VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

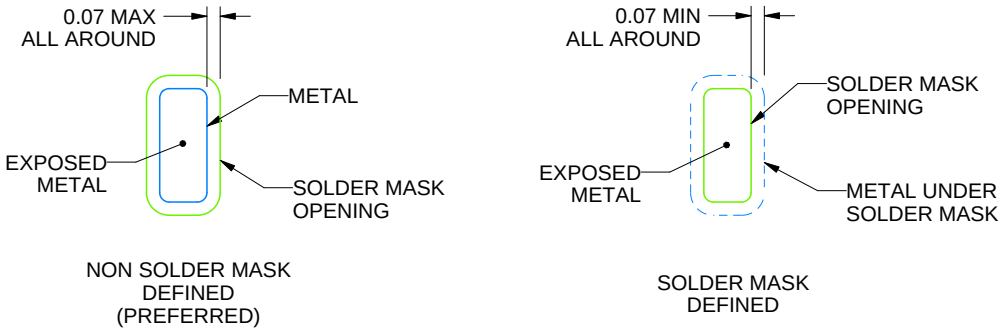


NOTES:

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.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:20X

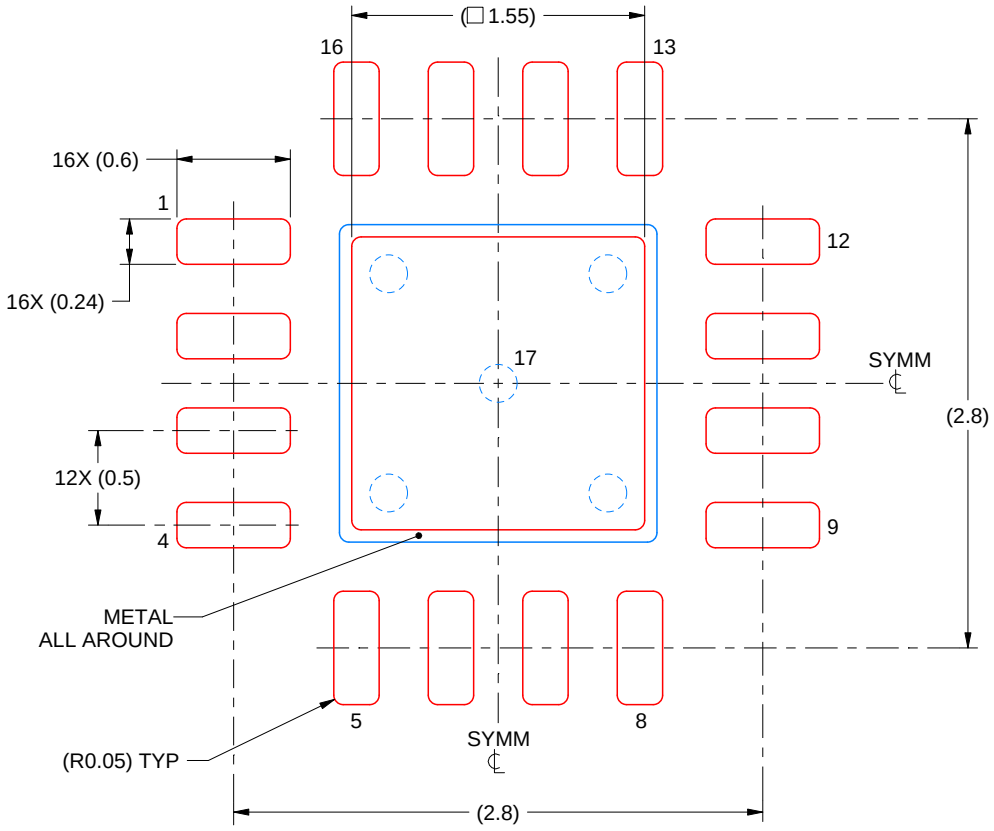


SOLDER MASK DETAILS

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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/slua271).
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.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 17:
85% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:25X

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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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