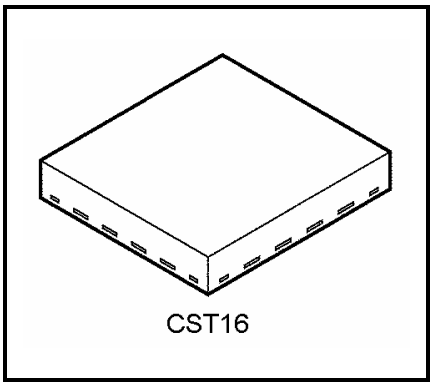
TOSHIBA Bipolar Linear Integrated Circuit SiGe Monolithic

TA4401CT

1.9 ~ 2.5 GHz Band Power Amplifier

PHS, Digital Cordless Telecommunication Application
Wireless LAN IEEE802.11b/g Application
Bluetooth Class 1 Application



Weight: 0.012 g (typ.)

Features

- Single voltage operation : V_{CC} = 3.0 V (typ.) for PHS
  : V_{CC} = 3.3 V (typ.) for IEEE802.11g
- Large output power : Pout = 22.5 dBmW (min.) for PHS
  : Pout = 18 dBmW (min.) for IEEE802.11g
- High power gain : Gp = 35 dB (typ.) for PHS
  : Gp = 27.5 dB (typ.) for IEEE802.11g
- Nano-amp shutdown mode: I_{CC_OFF} = 20 nA (typ.) when V_{CON} = 0 V
- Small package : CST16 (CSON16-P-0303-0.50) package
  (2.9 mm × 2.9 mm × 0.48 mm)

Absolute Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V_{CC} (Note1)	3.6	V
	V_{CON} (Note2)	3.6	V
Input power	Pin	–3	dBmW
Power dissipation	Pd (Note3)	1	W
Operating temperature range	Topr	–40 to +85	°C
Storage temperature range	Tstg	–55 to +150	°C

Note 1: V_{CC} = V_{CC1} = V_{CC2} = V_{CC3}

Note 2: V_{CON} = V_{CON12} = V_{CON3}

Note 3: When mounted on 30 mm × 35 mm × 0.4 mm FR4 substrate at Ta = 25°C (double-sided substrate: the reverse side is the ground connection.)

Caution

This product is a Lead (Pb)-free article.
This device is sensitive to electrostatic discharge. When handling this product, ensure that the environment is protected against electrostatic discharge by using an earth strap, a conductive mat and an ionizer.

Electrical Characteristics (22.5 dBmW for PHS)

V_{CC} = 3 V, V_{CON} = 2.7 V, f = 1.92 GHz, Ta = 25 °C, Zs = Zl = 50 Ω, unless otherwise noted.

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Operating frequency	f	—	1.880	—	1.920	GHz
Operating supply voltage	V_{CC}	—	2.7	3.0	3.3	V
Shutdown mode leakage current	I_{CC_OFF}	V_{CON} = 0 V, No RF input (Pin = 0 mW)	—	20	—	nA
Supply current	I_{CC}	384-kbps π/4-QPSK modulated signal, Pout = 22.5 dBmW, Pin = adjusted (Pin1)	—	200	225	mA
Control current	I_{CON}		—	4	6	mA
Power gain	Gp		32	35	—	dB
Adjacent channel leakage power ratio	ACPR1	Δf = 600 kHz	—	−65	−55	dB
	ACPR2	Δf = 900 kHz	—	−70	−60	dB
Harmonics	2fo		—	−45	−30	dB
	3fo		—	−60	−30	dB
Output deviation	| ΔPout |	384-kbps π/4-QPSK modulated signal, f = 1880, 1920 MHz, Pin = Pin1	—	0.5	1	dB
Input VSWR	VSWRin	CW signal, Pin = -30 dBmW	—	1.5	2.5	—
Stability	—	V_{CC} = 3.0 ~ 3.6 V, V_{CON} = 2.7 V, Pout = 22.5 dBmW @ Zl = 50 Ω, Pin = adjusted, Zs = 50 Ω, VSWR Load = 6:1 all phases, Ta = -40 ~ +85°C	No spurious			—
Load mismatch	—	V_{CC} = 3.6 V, V_{CON} = 2.7 V, Pin = -6 dBmW, Zs = 50 Ω, VSWR Load = 6:1 all phases	No degradation			—

Note 4: $I_{CON} = I_{CON12} + I_{CON3}$

Note 5: Load condition for stability and load mismatch tests is formed with appropriate short stab connected to P_{OUT} (Pin No.10) and adjusted to all phases.

Note 6: All tests for the above electrical characteristics are measured using “Test Board 1”, shown below.

Note 7: 1/2 duty operation.

Typical Electrical Characteristics for Reference 1 (21 dBmW for PHS)

V_{CC} = 3 V, V_{CON} = 2.7 V, f = 1.92 GHz, Ta = 25 °C, Zs = Zl = 50 Ω, unless otherwise noted.

Characteristic	Symbol	Test Condition	Typ	Unit
Supply current	I_{CC}	384-kbps π/4-QPSK modulated signal, Pout = 21 dBmW, Pin = adjusted	185	mA
Power gain	Gp		36	dB
Adjacent channel leakage power ratio	ACPR1	Δf = 600 kHz	−70	dB
	ACPR2	Δf = 900 kHz	−75	dB
Harmonics	2fo		−45	dB
	3fo		−60	dB

Note 8: All tests for the above typical electrical characteristics are measured using “Test Board 1”, shown below.

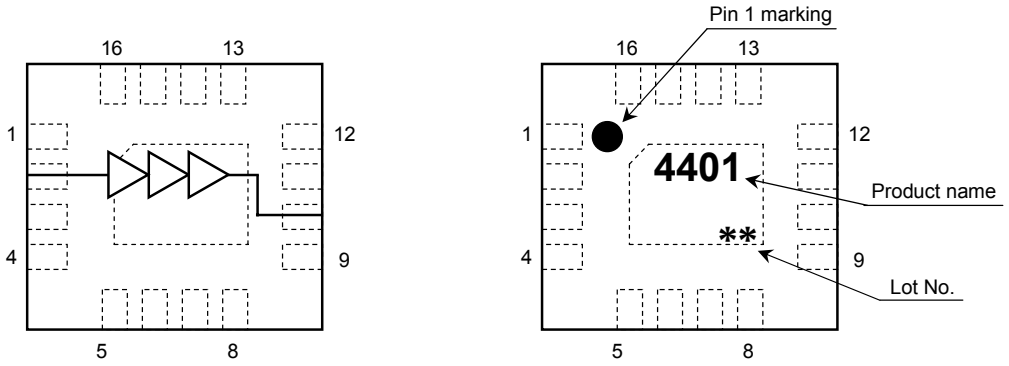
Typical Electrical Characteristics for Reference 2 (18 dBmW for IEEE802.11g)

V_{CC} = 3.3 V, V_{CON12} = 2.5 V, V_{CON3} = 1.7 V, f = 2.45 GHz, Ta = 25 °C, Zs = Zl = 50 Ω, unless otherwise noted.

Characteristic	Symbol	Test Condition		Typ	Unit
Operating frequency	f	—		2.45	GHz
Operating supply voltage	V_{CC}	—		3.3	V
Shutdown mode leakage current	I_{CC_OFF}	V_{CON} = 0 V, No RF input (Pin = 0 mW)		20	nA
Supply current	I_{CC}	54-Mbps 64QAM OFDM framed signal, Pout = 18 dBmW (when unframed), Pin = adjusted		125	mA
Control current	I_{CON}			3	mA
Power gain	Gp			27.5	dB
Error vector magnitude	EVM			3	%
Adjacent channel leakage power ratio	ACPR1	Δf = 20 MHz	54-Mbps 64QAM OFDM unframed signal, Pout = 18 dBmW, Pin = adjusted	−37	dB
	ACPR2	Δf = 40 MHz		−55	dB
Harmonics	2fo	CW signal, Pout = 18 dBmW, Pin = adjusted		−48	dB
	3fo			−55	dB

Note9: All tests for the above typical electrical characteristics are measured using “Test Board 2”, shown below.

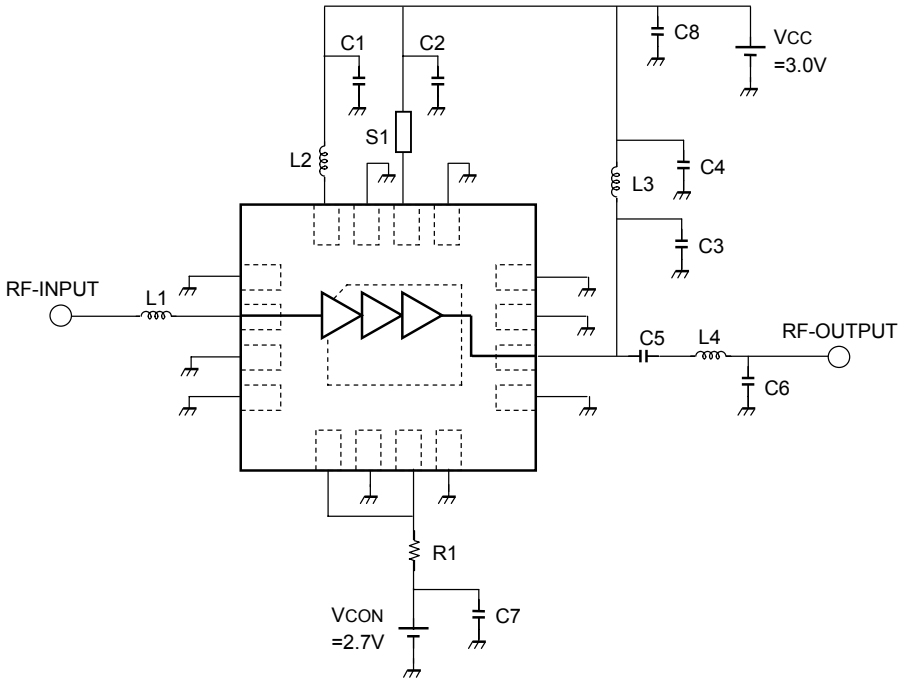
Block Diagram and Marking (Top View)



Pin Description

Number of pin	Name of pin	Description
1	NC	Not connected to the pellet. Please connect to ground.
2	PIN	RF input. DC block capacitor is built in.
3	NC	Not connected to the pellet. Please connect to ground.
4	NC	Not connected to the pellet. Please connect to ground.
5	VCON12	Control pin of 1st stage and 2nd stage amplifiers.
6	NC	Not connected to the pellet. Please connect to ground.
7	VCON3	Control pin of 3rd stage amplifier.
8	NC	Not connected to the pellet. Please connect to ground.
9	NC	Not connected to the pellet. Please connect to ground.
10	VCC3/POUT	Supply pin of 3rd stage amplifier/RF output pin.
11	NC	Not connected to the pellet. Please connect to ground.
12	NC	Not connected to the pellet. Please connect to ground.
13	NC	Not connected to the pellet. Please connect to ground.
14	VCC2	Supply pin of 2nd stage amplifier.
15	NC	Not connected to the pellet. Please connect to ground.
16	VCC1	Supply pin of 1st stage amplifier.
–	GND_Bed	Ground. This pin also works as heat dissipation pad.

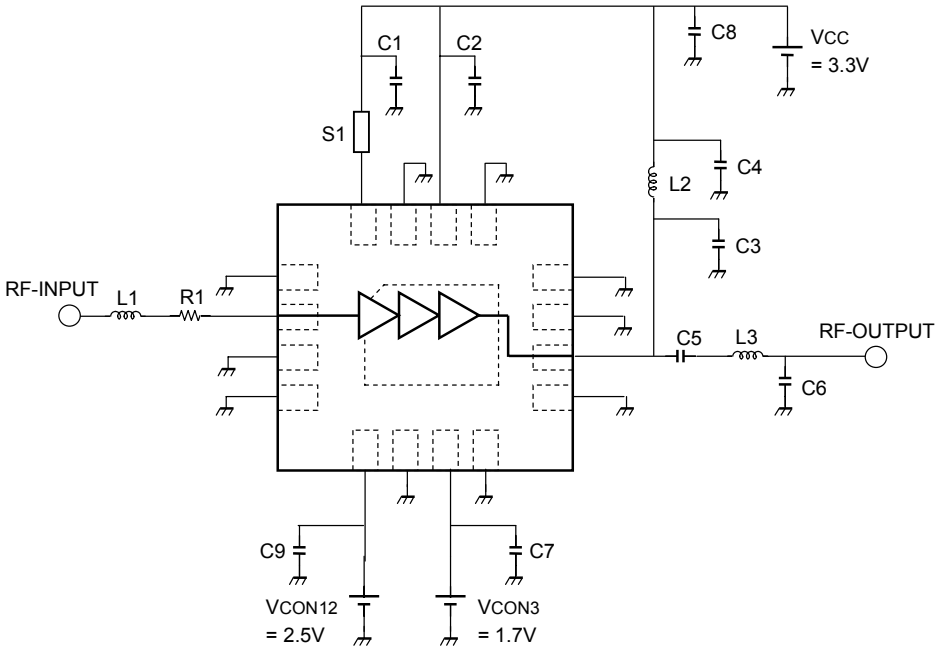
Circuit Diagram for PHS Application (Test Board 1)



List of External Components

Part Number	Value	Chip Series	Manufacturer	Description
C1	0.1 uF	GRM15 series	MURATA	Decoupling capacitor
C2	0.1 uF	GRM15 series	MURATA	Decoupling capacitor
C3	1.5 pF	GRM15 series	MURATA	Harmonics reduction capacitor
C4	0.1 uF	GRM15 series	MURATA	Decoupling capacitor
C5	10 pF	GRM15 series	MURATA	DC blocking capacitor
C6	2 pF	GRM15 series	MURATA	PA output matching
C7	0.1 uF	GRM15 series	MURATA	Decoupling capacitor
C8	10 uF	GRM21 series	MURATA	Decoupling capacitor
L1	3 nH	LQG15HN series	MURATA	PA input matching
L2	1 nH	LQG15HN series	MURATA	PA matching
L3	27 nH	LQG15HN series	MURATA	PA output matching
L4	2 nH	LQG15HN series	MURATA	PA output matching
R1	51 Ω	MCR01 series	ROHM	VCON buffering resistor
S1	-	-	-	Micro-strip line (length = 1.2 mm, width = 0.4 mm)

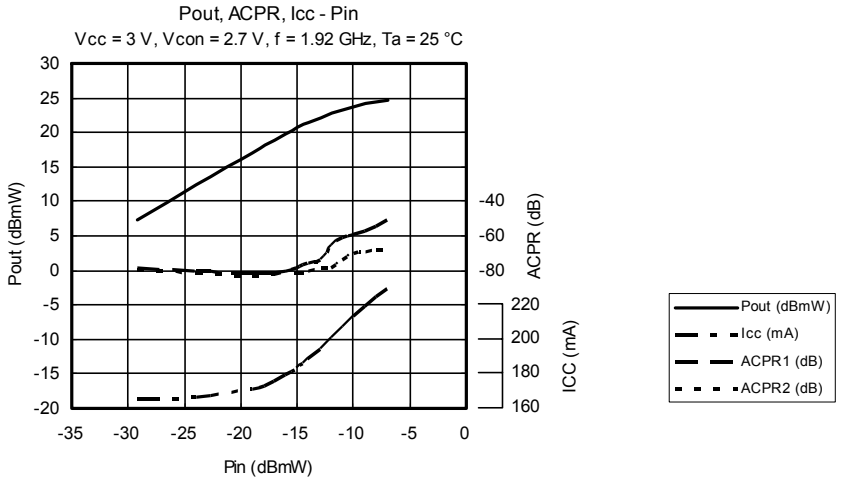
Circuit Diagram for 2.45-GHz Wireless LAN Application (Test Board 2)

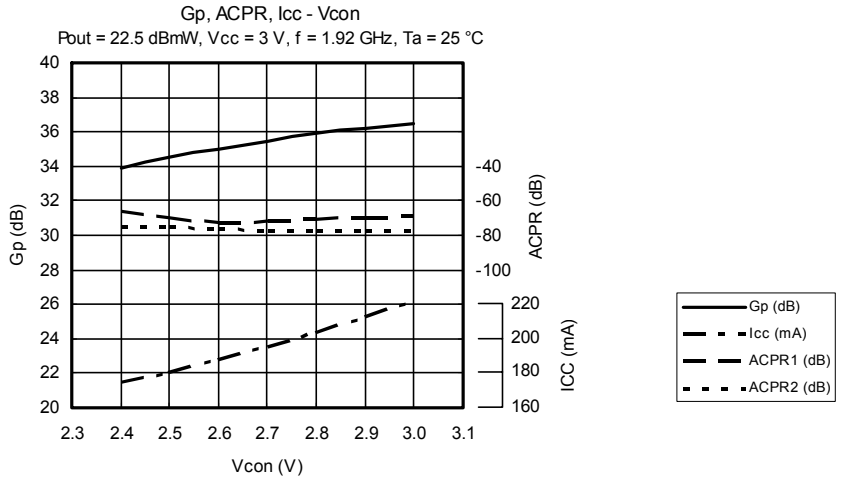


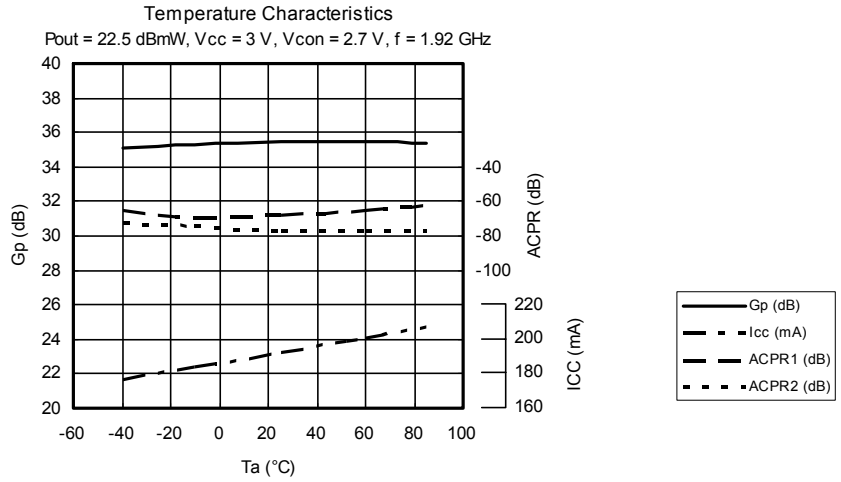
List of External Components

Part Number	Value	Chip Series	Manufacturer	Description
C1	0.1 uF	GRM15 series	MURATA	Decoupling capacitor
C2	0.1 uF	GRM15 series	MURATA	Decoupling capacitor
C3	1.5 pF	GRM15 series	MURATA	Harmonics reduction capacitor
C4	0.1 uF	GRM15 series	MURATA	Decoupling capacitor
C5	10 pF	GRM15 series	MURATA	DC blocking capacitor
C6	1 pF	GRM15 series	MURATA	PA output matching
C7	0.1 uF	GRM15 series	MURATA	Decoupling capacitor
C8	10 uF	GRM21 series	MURATA	Decoupling capacitor
C9	0.1 uF	GRM15 series	MURATA	Decoupling capacitor
L1	2 nH	LQG15HN series	MURATA	PA input matching
L2	27 nH	LQG15HN series	MURATA	PA output matching
L3	1 nH	LQG15HN series	MURATA	PA output matching
R1	10 Ω	MCR01 series	ROHM	PA input matching
S1	-	-	-	Micro-strip line (length = 2 mm, width = 0.4 mm)

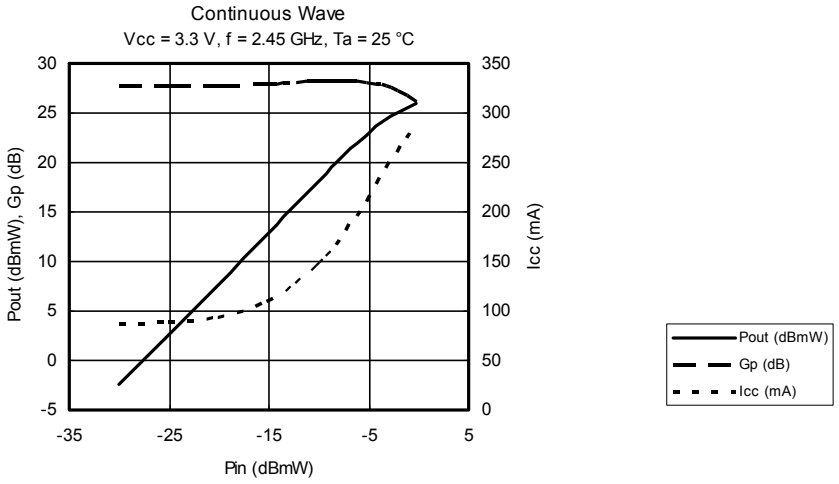
Typical Operating Characteristics of Test Board 1 (PHS)

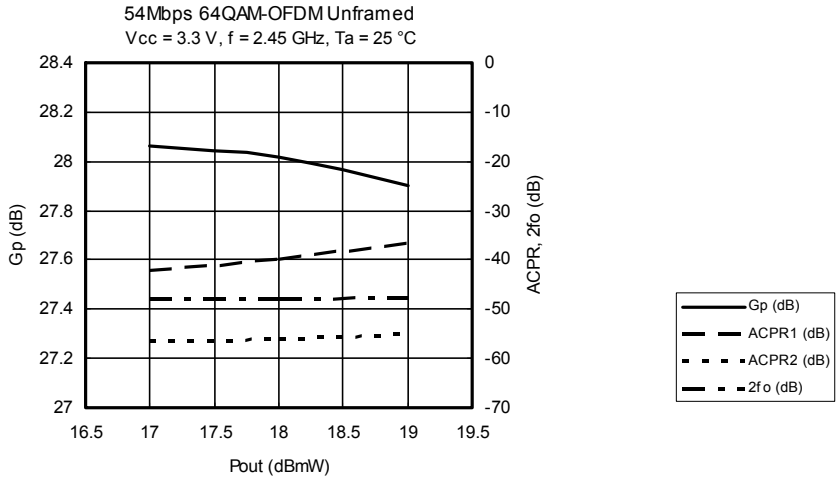


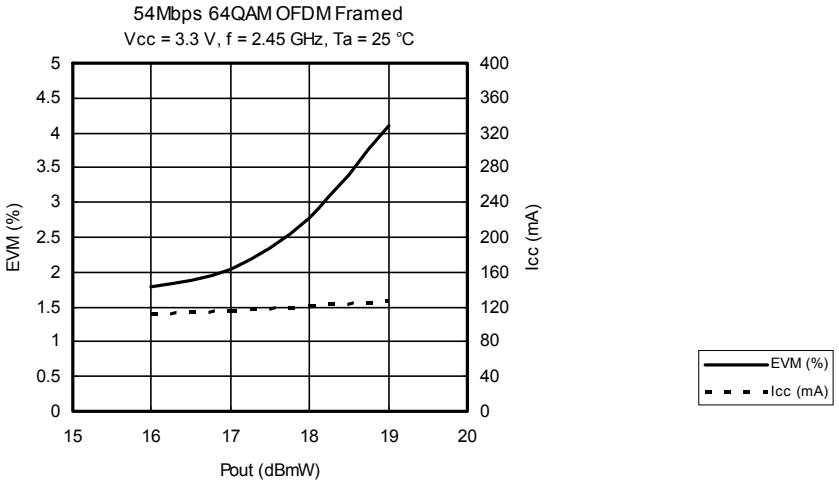




Typical Operating Characteristics of Test Board 2 (IEEE802.11g)







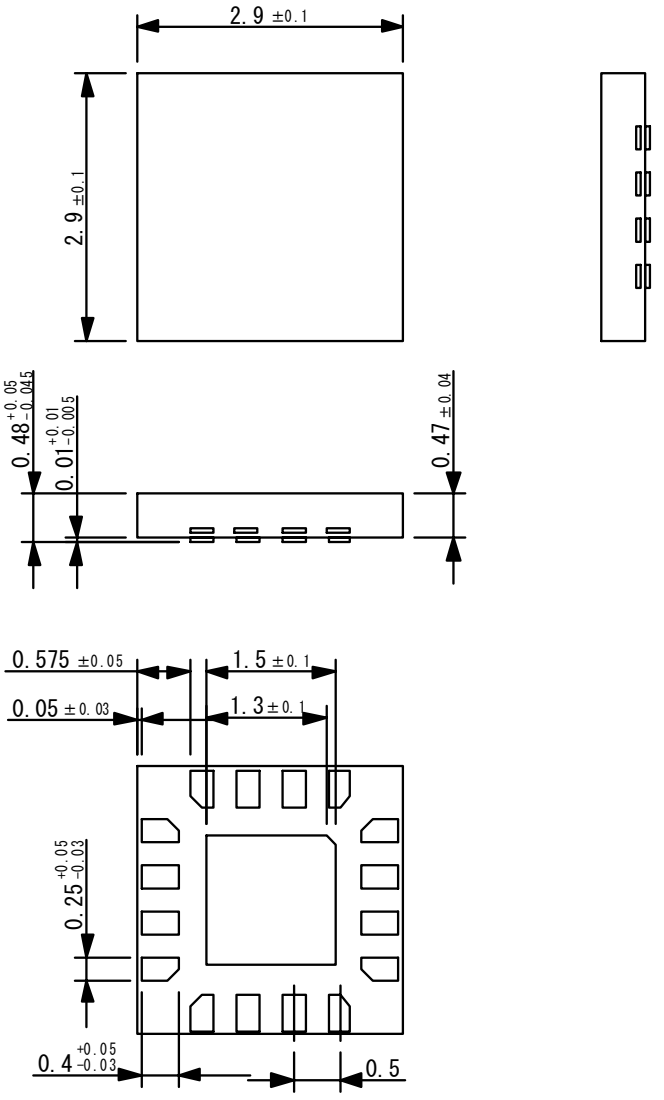
Notice

The circuits and measurements contained in this document are given only in the context of examples of applications for these products.
Moreover, these example application circuits are not intended for mass production, since the high-frequency characteristics (the AC characteristics) of these devices will be affected by the external components which the customer uses, by the design of the circuit and by various other conditions.
It is the responsibility of the customer to design external circuits which correctly implement the intended application, and to check the characteristics of the design.
TOSHIBA assume no responsibility for the integrity of customer circuit designs or applications.

Package Physical Dimensions

CST16

Unit: mm



Weight: 0.012 g (typ.)

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