DATA SHEET

ACA1216: 1218 MHz CATV MMIC Power Doubler

Features

- 1218 MHz specified performance
- 12 V MMIC power doubler with 28 dB gain
- Very low distortion
- Best-in-class input/output match 20 dB typical
- Low DC power consumption with current adjust
- Low noise figure of 4 dB typical
- Stable with high VSWR load conditions
- Surface-mount package compatible with automatic assembly
- RoHS-compliant packaging



Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04–0074.

Description

The ACA1216 surface-mount GaAs RF linear amplifier has been developed to provide a high-gain output stage for HFC/FTTC node and ORM RF amplifiers that require highest bit delivery efficiency, low power consumption, and a ultra-small landed product footprint. The MMIC consists of two parallel amplifiers, operating from a 12 volt power supply, forming the industry's lowest cost per bit delivered power doubler (PD). The balanced amplifier approach is optimized for exceptionally low distortion and noise figure, while providing flat gain and excellent input/output return loss.

The ACA1216 is designed as a single amplifier with similar total gain and output power as the combination of ACA1206 and ACA0862 or DOCSIS 3.1 compliant ACA1210 and ACA1216. ACA1216 provides a lower power dissipation solution than discrete amplifier cascades while providing better performance, error-free content delivery to 68 dBmV total composite power, smaller landed footprint, and lower BOM cost.

A block diagram of the ACA1216 is shown in Figure 1. The device package and pinout are shown in Figure 2. Signal pin assignments and functional pin descriptions are described in Table 1.

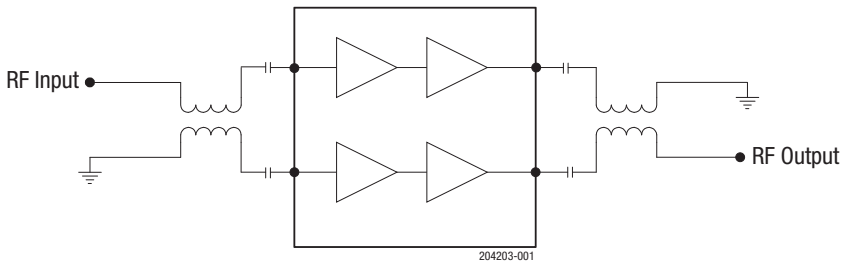


Figure 1. ACA1216 Block Diagram

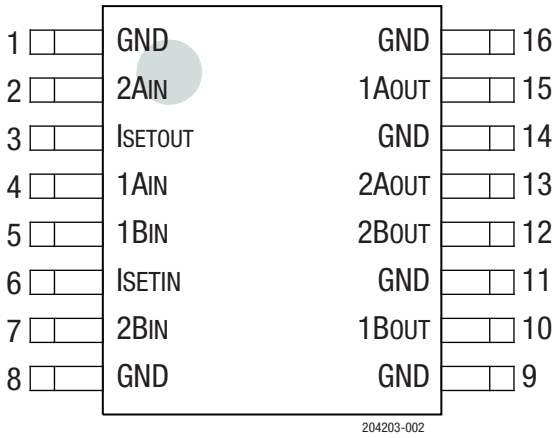


Figure 2. ACA1216 Pinout
(Top View)

Table 1. ACA1216 Signal Pin Descriptions

Pin	Name	Description	Pin	Name	Description
1	GND	Ground	9	GND	Ground
2	$2A_{IN}$	Amplifier 2A input	10	$1B_{OUT}$	Amplifier 1B output and supply
3	I_{SETOUT}	Current Adjust output amplifier	11	GND	Ground
4	$1A_{IN}$	Amplifier 1A input	12	$2B_{OUT}$	Amplifier 2B output and supply
5	$1B_{IN}$	Amplifier 1B input	13	$2A_{OUT}$	Amplifier 2A output and supply
6	I_{SETIN}	Current adjust input amplifier	14	GND	Ground
7	2BIN	Amplifier 2B input	15	1AOUT	Amplifier 1A output and supply
8	GND	Ground	16	GND	Ground

Electrical and Mechanical Specifications

The absolute maximum ratings of the ACA1216 are provided in Table 2.

Recommended operating conditions are specified in Table 3, and electrical specifications are provided in Table 4.

Table 2. ACA1216 Absolute Maximum Ratings[1]

Parameter	Minimum	Maximum	Units
Supply (pins 10, 12, 13, 15)	0	+15	VDC
Current adjust (pins 6, 3)	0	+4	VDC
RF power at inputs (pins 2, 4, 5, 7)[2]		+75	dBmV
Storage temperature	-65	+150	°C
Soldering temperature		+260	°C
Soldering time		5.0	Sec

[1] Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

[2] Pins 2, 4, 5, and 7 should be AC-coupled. No external DC bias should be applied.

***ESD HANDLING**: Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

Table 3. ACA1216 Recommended Operating Conditions[1]

Parameter	Symbol	Min	Typ	Max	Units
Supply: V_{DD} (pins 12 and 13)	f		+12		VDC
Current adjust (pins 3 and 6)	V_{DD}		+3		VDC
RF frequency	T_A	40		1218	MHz
Case temperature		-40		+110	°C

[1] Performance is guaranteed only under the conditions listed in this table.

Table 4. ACA1216 Electrical Specifications[1]
(T_A = +25 °C, VDD = +12 VDC, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Gain[1]	G	50 to 1218 MHz	26.5	27.5	28.5	dB
Gain flatness[1]		± 0.8 dB max relative to slope line; 50 to 1218 MHz		±0.5		dB
Cable equivalent slope[1]		50 to 1218 MHz		2.5		dB
Return loss (input/output)[1]	RL	50 to 870 MHz		-20	-18	dB
		870 to 1218 MHz		-18		dB
Noise figure[1]	NF	50 to 1218 MHz		4		dB
CTB[1,2]	CTB	+56 dBmV RFout		-78	-74	dBc
CIN[1,2]		+56 dBmV RFout		-64	-57	dBc
CSO[1,2]	CSO	+56 dBmV RFout		-70	-68	dBc
XMOD[1,2]	ACLR	+56 dBmV RFout		-66		dBc
CCNR[1,2]		+56 dBmV RFout		-60		dBc
Supply current			670	725	770	mA
Thermal resistance	θ_{JC}			3.0		°C/W

[1] Measured with a balun on input and output of the device.

[2] Measured using 77 NTSC analog channels from 55.25 MHz to 547.25 MHz plus 77 SC-256_QAM channels from 550 MHz to 1000 MHz at -6 dB down from analog carrier reference level, +56 dBmV output power @ 1000 MHz with 15.5 dB tilt from 50 to 1000 MHz.

Evaluation Board Description

The ACA1216 Evaluation Board is used to test the performance of the ACA1216 device. An Evaluation Board schematic is provided in Figure 3. Table 6 provides the Bill of Materials (BOM) list for Evaluation Board components.

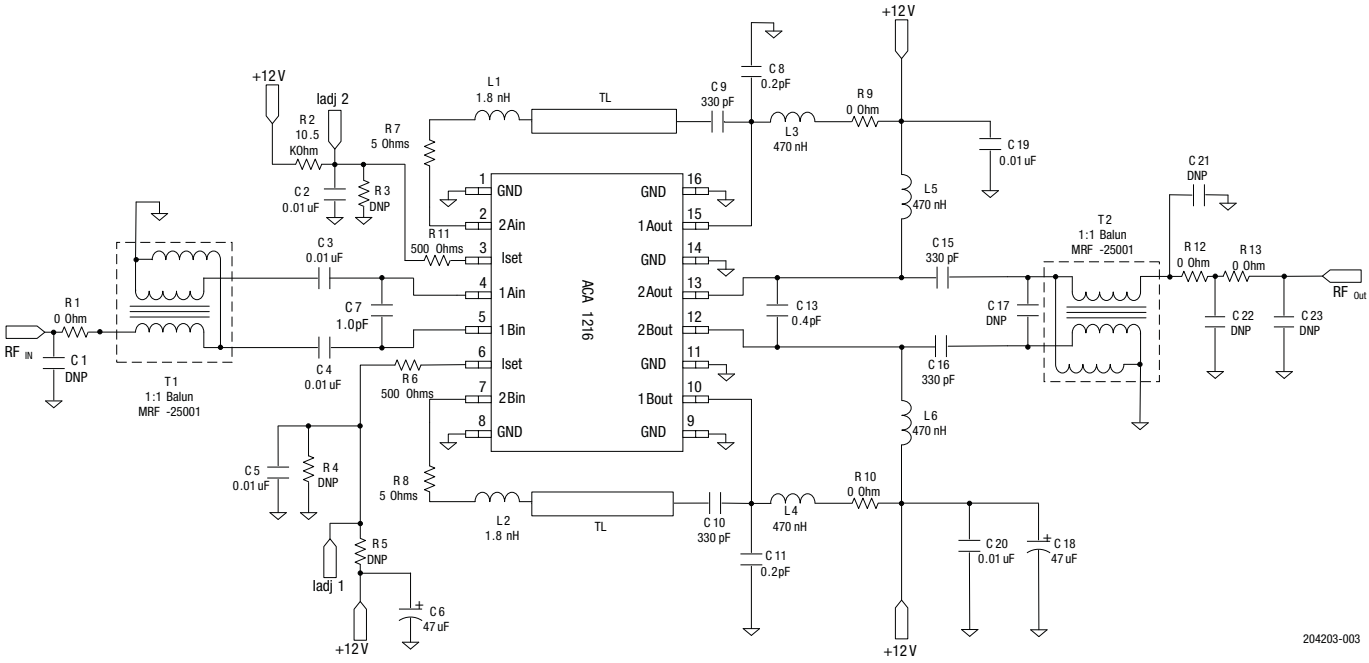


Figure 3. ACA1216 Evaluation Board Schematic

Table 6. ACA1216 Evaluation Board Bill of Materials (BOM)

Component	Description	Manufacturer	Mfr Part Number
C1, C17, C21, C22, C23	Shunt tuning	N/A	N/A
C2, C3, C4, C5, C19, C20	0.01 uF capacitor (0402)	Murata	GRM
C6, C18	47 uF electrolytic cap	Panasonic	ECEA1HGE470
C8, C11	0.2 pF (0402)	Murata	GRM1555C1HR20BA01D
C13	0.4 pF (0402)	Murata	GRM1555C1HR40BA01D
C9, C10, C15, C16	330 pF (0402)	Murata	GRM155R71H331KA01D
L1, L2	1.8 nH (0402)	Murata	
L3, L4, L5, L6	470 nH (0805)	Murata	LQH31CNR47M03L
R2	10.5 kΩ (0402)		
R3, R4, R5	DNP		
R6, R11	500 Ω (0402)		
R1, R9, R10, R12, R13	0 Ω (0402)	Koa Speer	RK73Z1ETTP
R7, R8	5 Ω (0402)		
T1, T2	1:1 Balun	Minntronix	MRF-25001

Package Dimensions

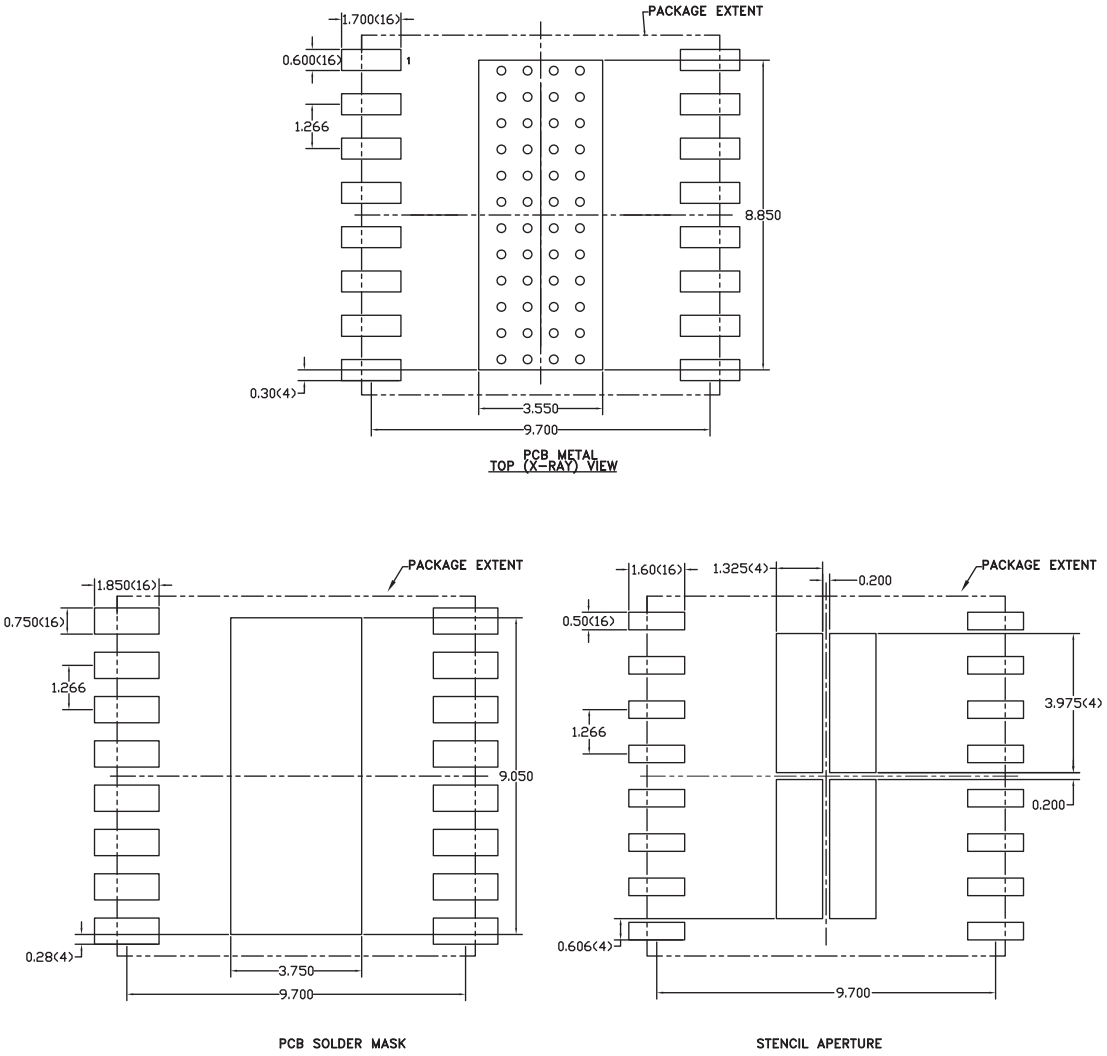
The PCB layout footprint drawing for the ACA1216 is shown in Figure 4. The package dimensions for the ACA1216 are shown in Figure 5. The tape and reel dimensions are provided in Figure 6.

Package and Handling Information

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The ACA1216 is rated to Moisture Sensitivity Level 2 (MSL2) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.



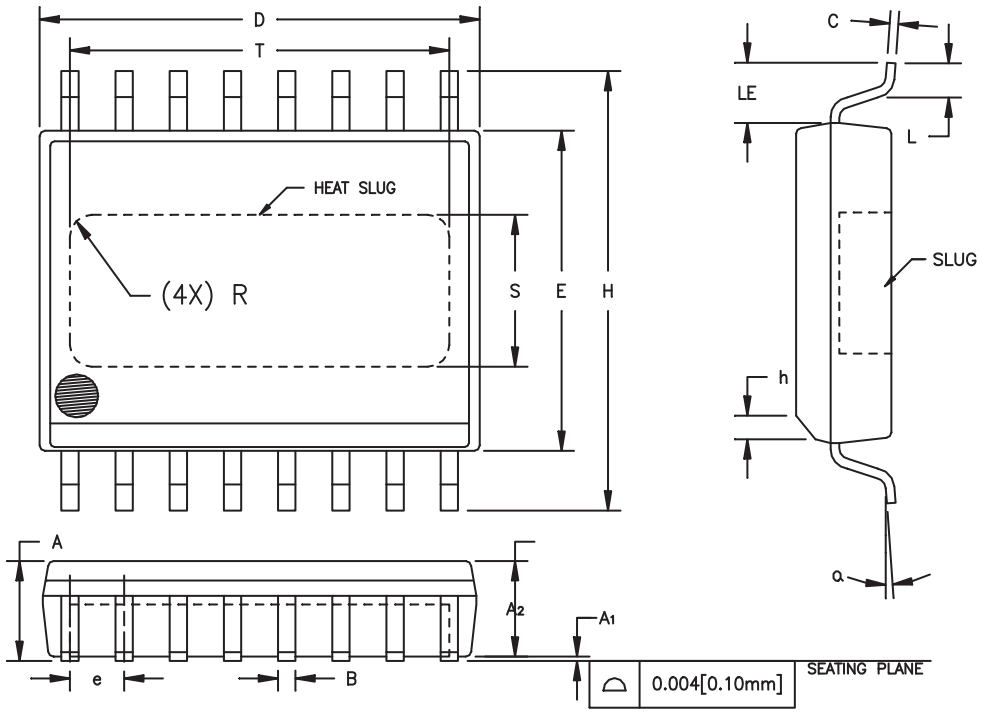
NOTES:
(1) UNLESS SPECIFIED DIMENSIONS ARE SYMMETRICAL ABOUT CENTER LINES SHOWN.

(2) DIMENSIONS IN MILLIMETERS.

(3) VIAS SHOWN IN PCB METAL VIEW ARE FOR REFERENCE ONLY. NUMBER & SIZE OF THERMAL VIAS REQUIRED DEPENDENT ON HEA DISSIPATION REQUIREMENT AND THE PC PROC SS CAPABILITY.

(4) RECOMMENDED STENCIL THICKNESS: APPROX. 0.125mm (5 Mils)

Figure 4. ACA1216 PCB Layout Footprint Dimensions

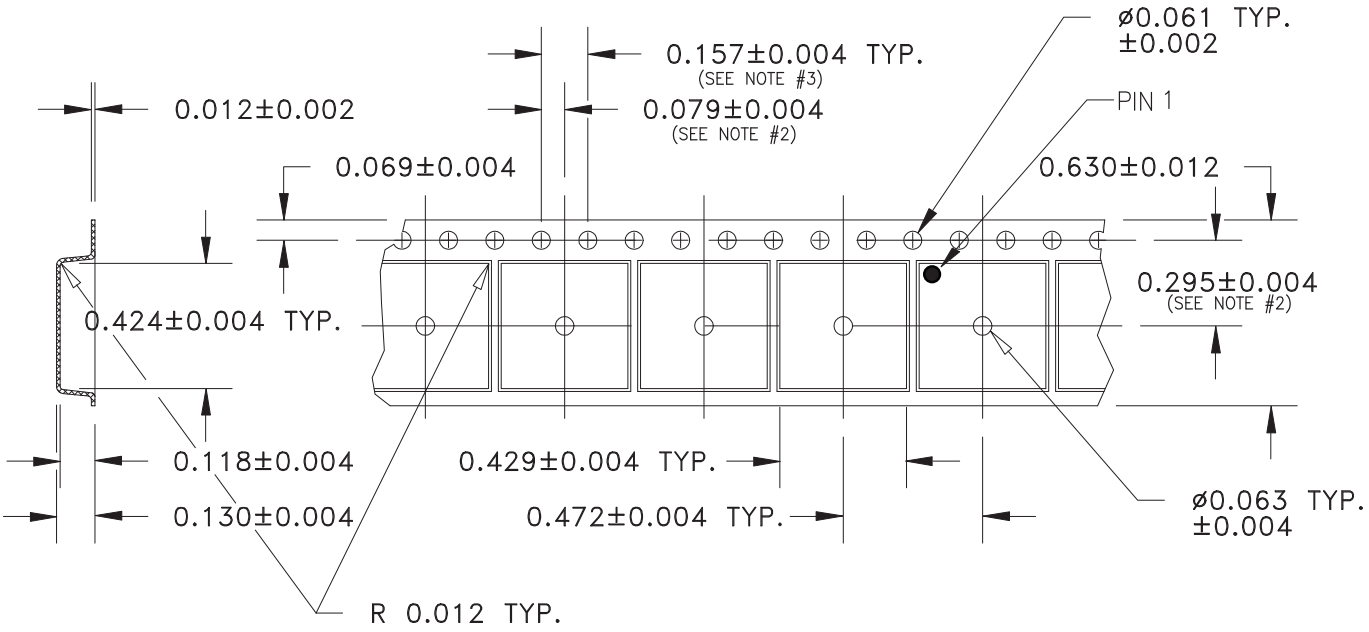


SYMBOL	INCHES		MILLIMETERS		NOTE
	MIN.	MAX.	MIN.	MAX.	
A	0.087	0.098	2.21	2.49	
A_1	0.000	0.004	0.00	0.10	6
A_2	0.087	0.094	2.21	2.39	
B	0.013	0.019	0.33	0.48	
C	0.007	0.009	0.18	0.23	
D	0.398	0.412	10.11	10.46	2
E	0.290	0.300	7.37	7.62	3
e	0.050 BSC		1.27 BSC		4
H	0.394	0.418	10.01	10.62	
h	0.010	0.028	0.25	0.71	
L	0.024	0.040	0.61	1.02	
LE	0.052	—	1.32	—	
α	0°	8°	0°	8°	
S	0.120	0.140	3.05	3.56	5
T	0.330	0.350	8.38	8.89	5
R	REF. 0.015		REF. 0.38		5

NOTES:

1. CONTROLLING DIMENSION: INCHES
2. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED 0.006 [0.15mm] PER SIDE.
3. DIMENSION "E" DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED 0.010 [0.25mm] PER SIDE.
4. MAXIMUM LEAD TWIST/SKEW TO BE ±0.005 [0.13mm].
5. DIMENSIONS "S", "T" AND "R" INDICATE EXPOSED SLUG AREA.
6. STANDOFF HEIGHT (A_1) MEASURED FROM BOTTOM OF SLUG.

Figure 5. ACA1216 Package Dimensions



NOTES:
1. MATERIAL – CONDUCTIVE POLYSTYRENE.
2. MEASURED FROM CENTERLINE OF SPROCKET HOLE TO CENTERLINE OF POCKET.
3. CUMULATIVE TOLERANCE OF 10 SPROCKET HOLES IS ± 0.008.

204202-006

Figure 6. ACA1216 Tape and Reel Dimensions

Ordering Information

Model Number	Package Description	Component Packaging
ACA1216P2	16-pin wide body SOIC with heat slug	1500-piece tape and reel
EVB1216		Evaluation Board part number

Copyright © 2017-2018 Skyworks Solutions, Inc. All Rights Reserved.

Information in this document is provided in connection with Skyworks Solutions, Inc. (“Skyworks”) products or services. These materials, including the information contained herein, are provided by Skyworks as a service to its customers and may be used for informational purposes only by the customer. Skyworks assumes no responsibility for errors or omissions in these materials or the information contained herein. Skyworks may change its documentation, products, services, specifications or product descriptions at any time, without notice. Skyworks makes no commitment to update the materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

No license, whether express, implied, by estoppel or otherwise, is granted to any intellectual property rights by this document. Skyworks assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Skyworks products, information or materials, except as may be provided in Skyworks Terms and Conditions of Sale.

THE MATERIALS, PRODUCTS AND INFORMATION ARE PROVIDED “AS IS” WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. SKYWORKS DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. SKYWORKS SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Skyworks products are not intended for use in medical, lifesaving or life-sustaining applications, or other equipment in which the failure of the Skyworks products could lead to personal injury, death, physical or environmental damage. Skyworks customers using or selling Skyworks products for use in such applications do so at their own risk and agree to fully indemnify Skyworks for any damages resulting from such improper use or sale.

Customers are responsible for their products and applications using Skyworks products, which may deviate from published specifications as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Skyworks assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Skyworks products outside of stated published specifications or parameters.

Skyworks and the Skyworks symbol are trademarks or registered trademarks of Skyworks Solutions, Inc. or its subsidiaries in the United States and other countries. Third-party brands and names are for identification purposes only, and are the property of their respective owners. Additional information, including relevant terms and conditions, posted at www.skyworksinc.com, are incorporated by reference.