

UHF power amplifier **PA-TR3-400M**



Operation Guide

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Notice:

The PA-TR3-400M is a product which is difficult to handle. Practical experience and knowledge in high frequency circuit and design are needed to bring out the performance of the products in your application. You are requested to get approval of the manufacture for use of the product through local distributors. The manufacture may refuse use of the product. Unless the manufacturer approves the use, you are not authorized to have the technical support of the manufacture and warranty.

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GENERAL DESCRIPTION & FEATURES

General Description

The PA-TR3-400M is a power amplifier module operating in the UHF frequency band and designed to be connected to Circuit Design's RF modules for applications requiring higher power transmission.

The Amplifier/Through Line selectable circuit allows operation in half-duplex applications.

The module operates with only 3 V power supply and has a gain up to 17 dB which is adjustable with the adjustment volume.

The small-thin package (5 mm high) enables installation in compact equipment.

Features

- 3 V operation
- Connectable to transceivers
- Amplifier/Through Line selectable
- Small, thin package
- RoHS compliant

Applications

- Telemetry
 - Water level monitor for rivers, dams, etc
 - Monitoring systems for environmental data such as temperature, humidity, etc.
 - Security alarm monitoring, long-range data transmission
 - Various tracking systems
- Telecontrol
 - Industrial remote control systems
- Security
 - Security alarm systems

Caution

- ◆ It is prohibited to use radio devices with output power exceeding the limits specified by radio laws and regulations in each country. Before using this power amplifier, it is recommended to contact the regulatory authority in each country to verify conformity with the legal requirements for the intended frequency range.
- ◆ Continuous transmission using the power amplifier may cause a rise in temperature of the device. For use of the power amplifier, good thermal design and operating conditions, in which the temperature at the surface of the shield case does not exceed 65 °C, will be required. Damage may be caused if this temperature limit is exceeded.
- ◆ The operating voltage range of this power amplifier is from 2.8 V to 3.2 V. Exceeding the specified maximum limit may cause damage to the device.
- ◆ The customer is urged to perform environmental tests relevant to their application before deciding on using this power amplifier.

SPECIFICATIONS

PA-TR3-400M

Absolute maximum ratings (Ta = 25 °C)

Parameter	Symbol	Rating	Unit	
Supply voltage	VCC	3.3	V	
Operating current	ID	650	mA	
Total Power dissipation	Ptot	1.5	W	RF input +10 dBm, Output +27 dBm (50 Ω terminal)
Maximum operating temperature	Tmax	70	°C	At the top surface of the shield case (including self heating)

PA-TR3-400M should be used under thermal conditions such that the temperature of the top surface of the shield case does not exceed 65 °C.

Electrical specifications (Ta = 25 °C)

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating voltage range		2.8	3	3.2	V
Consumption current	AMP operation (25 °C)		450	550	mA
	Idling with AMP setting (RF input off)		20		mA
	Through-Line setting		300		uA
Output impedance	Un-balanced		50		Ω
Input impedance	Un-balanced		50		Ω
Output VSWR				1.5	
Input VSWR				1.5	
ANT VSWR	At operating frequency ^{*1}			1.5	
Operating frequency range		418	434	463	MHz
Input power			10	13	dBm
Output power	VCC = 3 V, 434 MHz, Pin = +10 dBm 25 °C, 50 ohm terminated		26		dBm
Power gain	VCC = 3 V, 434 MHz, Pin = +10 dBm 25 °C, 50 ohm terminated		16	17	dB
Spurious ratio	Carrier/2nd harmonics 25 °C, 50 ohm terminated		70		dBc
Insertion loss	Power amplifier Off	1.0	2.0	3.0	dB
Operating temperature range	At the top surface of the shield case ^{*2}	-20		65	°C
Dimensions	W x L x H	26.6	18.6	5	mm

^{*1} Install an antenna for the 400 MHz band to the output of the PA-TR3-400M. Using without connecting an antenna may cause damage to the device.

^{*2} The operation temperature range is defined as 'ambient temperature + self-heating temperature'. This limitation must be taken into consideration in thermal design.
Special caution is needed for using the power amplifier at a high ambient temperature and with continuous transmission.

Note: Permanent damage or significant reduction in product life may be caused if the PA-TR3-400M is used exceeding the specification.

The power amplifier module has large self-heating. Perform temperature verification in the actual application to ensure it is used within the operating temperature range.

PIN DESCRIPTION & FUNCTIONS

Pin Name		Description
IN	(RF IN)	RF input terminal. Max. input level 13 dBm This terminal can be used as an RF I/O terminal, when the PAON terminal is open to select Through Line.
G	(GND)	GROUND terminal. The three GND pins and the three feet of the shield case should be connected to the wide GND pattern. The RF output level may be reduced if the GND pattern is not enough.
ON	(PAON)	POWER AMP ON terminal. The Power Amplifier is active when PAON is GND level, and off when PAON is OPEN. For reception, the Power Amplifier should be turned off by setting this terminal to OPEN.
V	(VCC)	Power supply terminal. DC 2.8 to 3.2 V
OUT	(RFOUT)	RF output terminal This terminal can be used as an RF I/O terminal, when the PAON terminal is open to select Through Line. Care should be taken to ensure that DC voltage is not applied.

Gain adjustment volume

The RF output power can be adjusted with this volume.

The factory gain setting is +8 dBm for input power and +25 dBm for output power at 434MHz with Vcc 3.0 V.

The factory setting of the idling current is 20 mA.

The initial tuning position of the volume is shown below.

To tune back to the factory setting, adjust the volume so that the idling current with the RF input off becomes 20 mA.

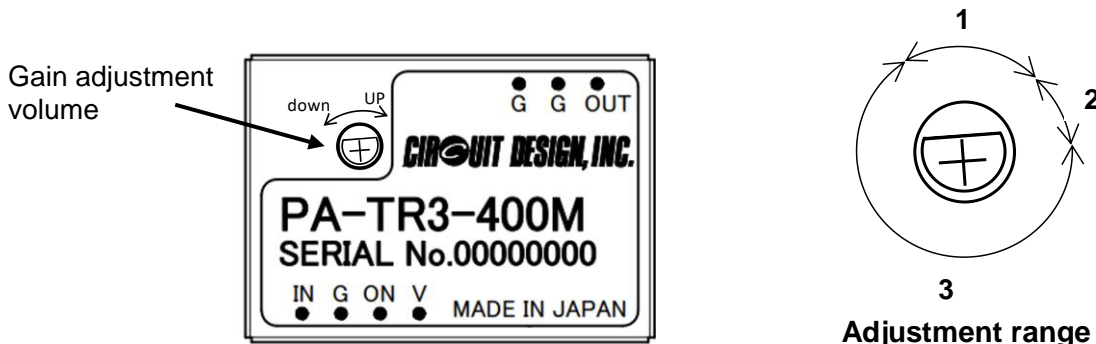
Adjustment range

The range 1 shows the adjustable range. Turn clockwise to increase the RF power and turn counterclockwise for decreasing. Note that this volume can be fully turned round.

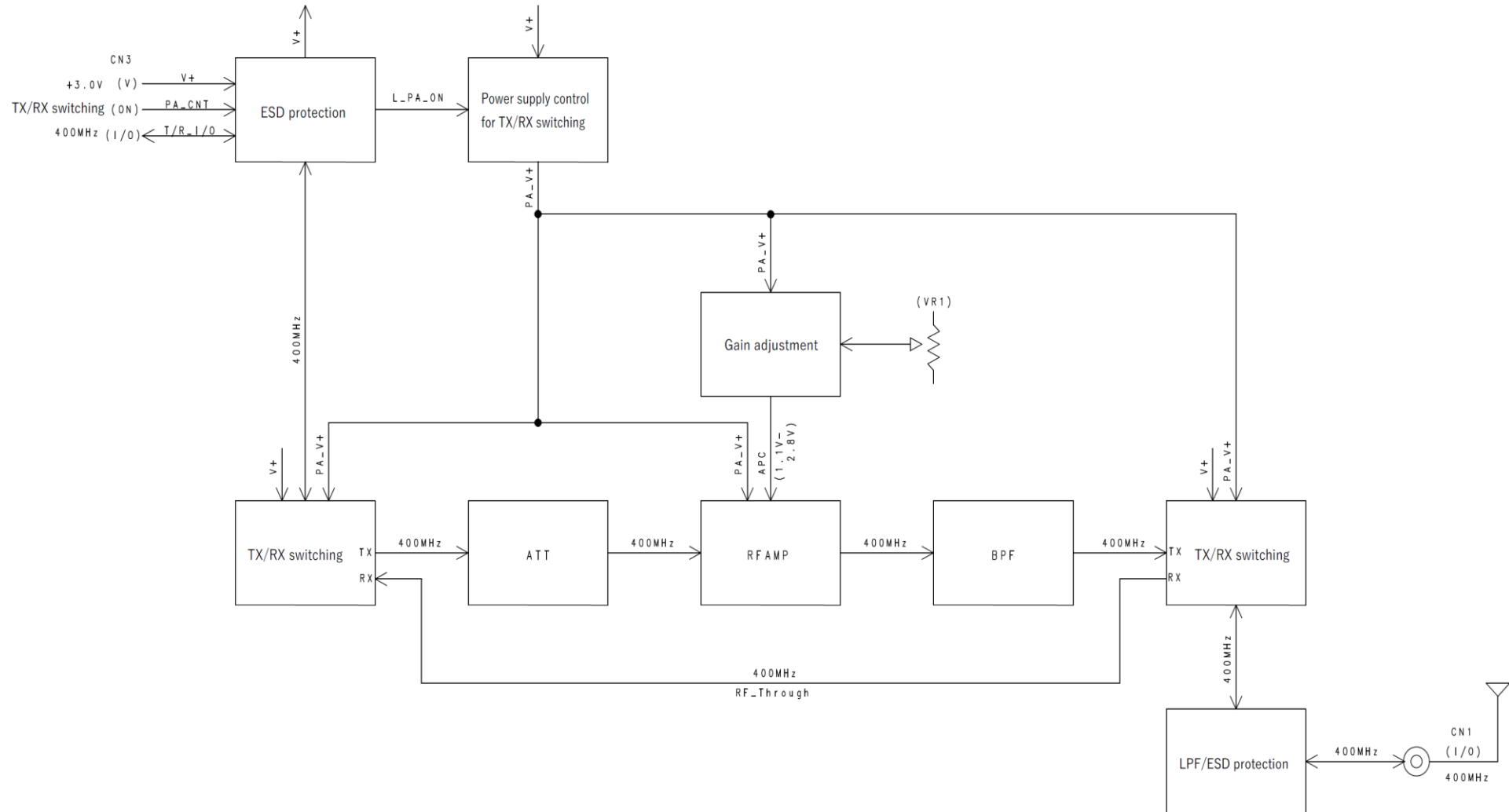
Within the range 2, the RF power reaches to the maximum and cannot be adjusted, but current consumption and idling current will be increased more than necessary.

Within the range 3, the RF power does not output.

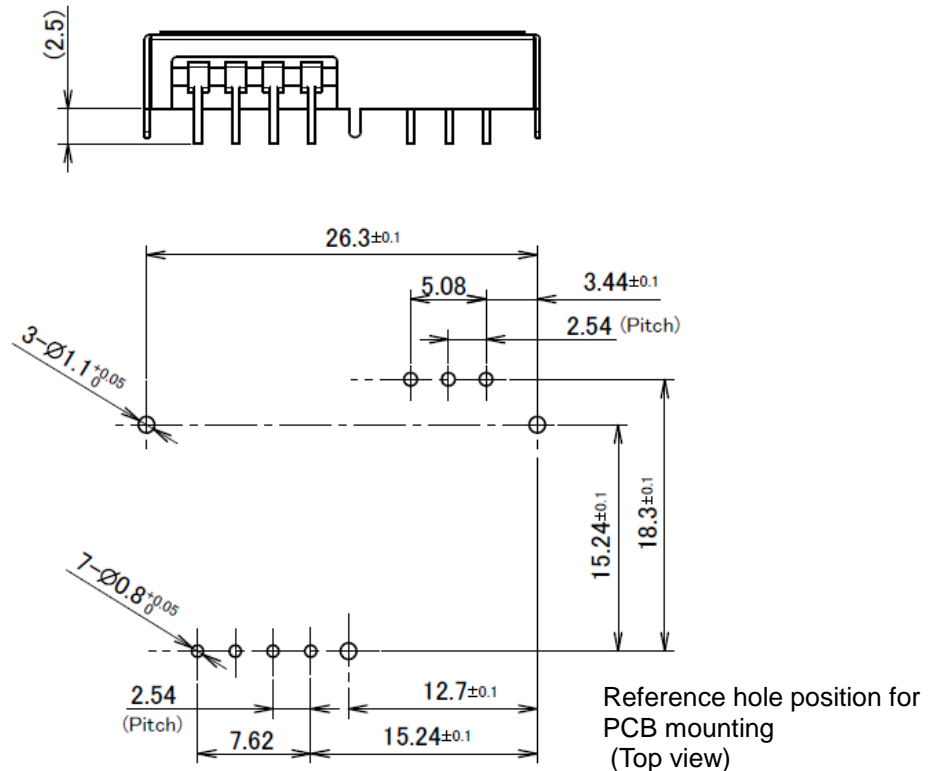
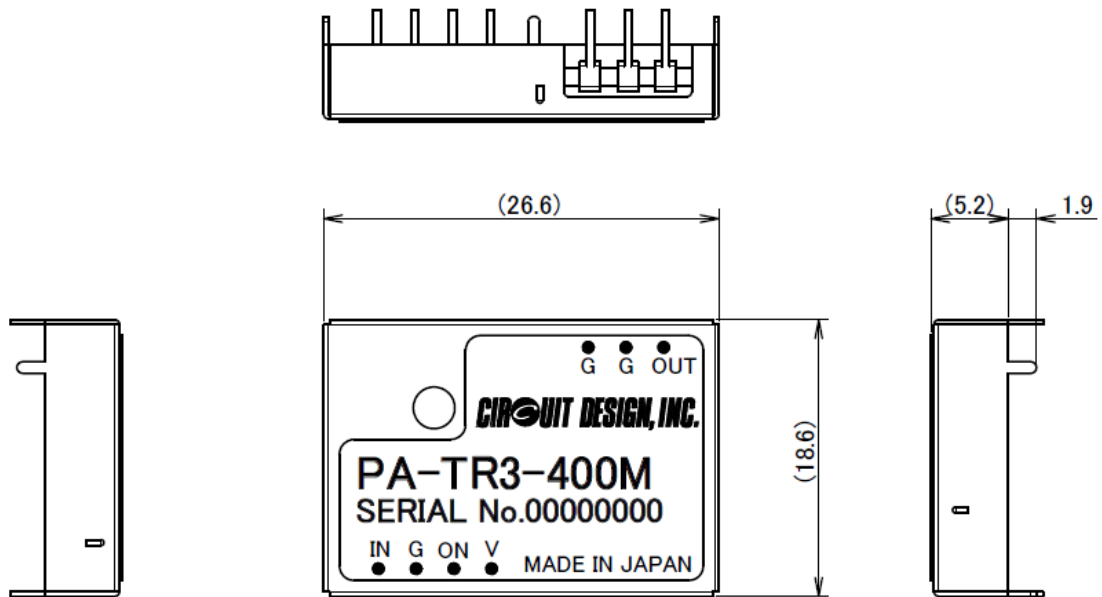
Caution: This volume is mainly for factory tuning. Turning too much or applying overload may damage it. Use a suitable adjustment driver and tune carefully.



BLOCK DIAGRAM



DIMENSIONS



Caution for PCB layout

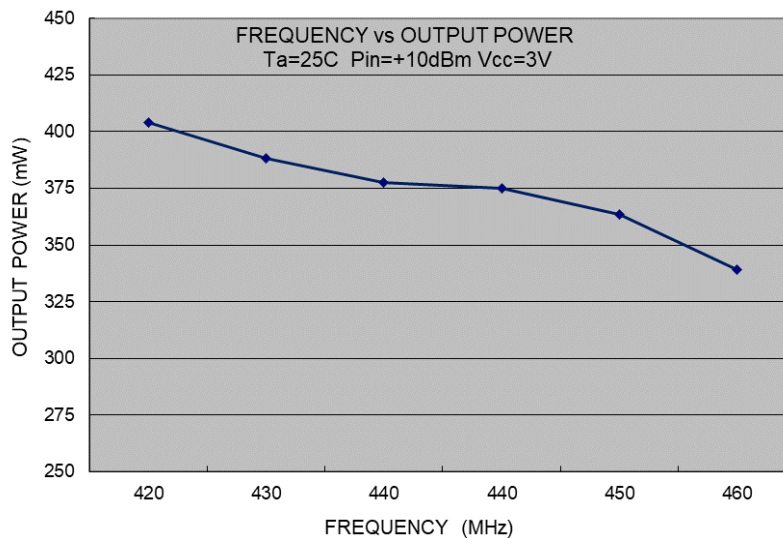
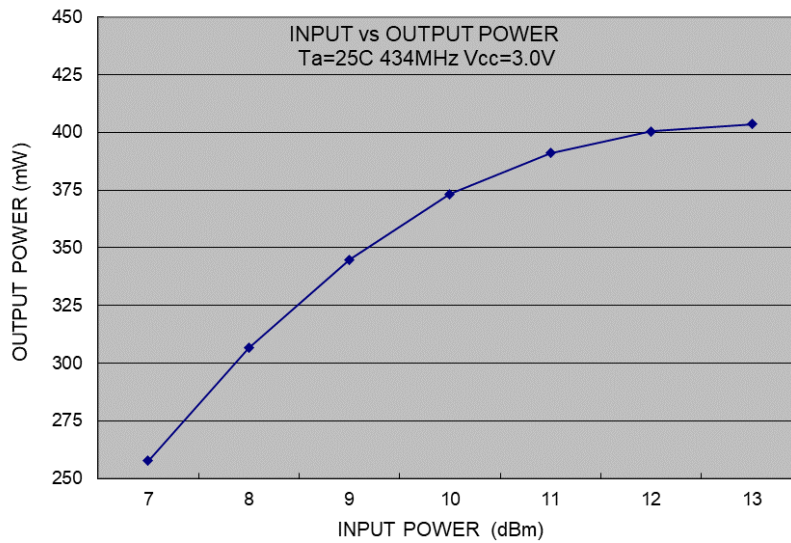
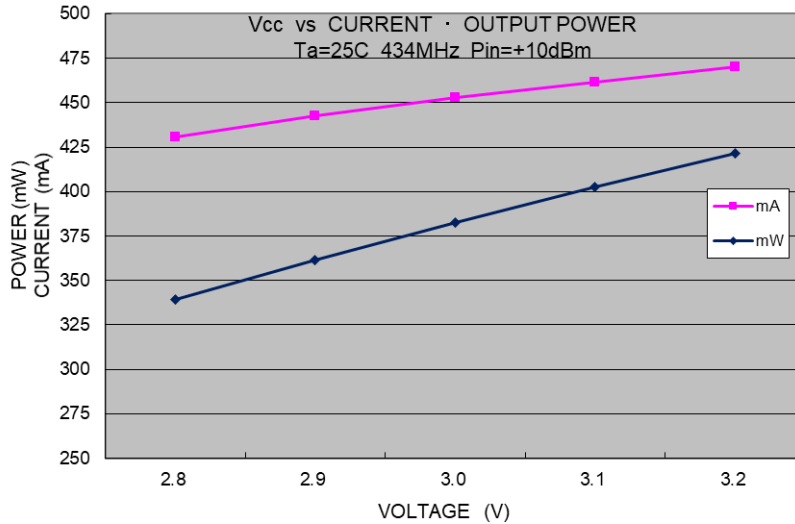
The PA-TR3-400M is supposed to generate heat. The three GND pins and the three feet of the shield case should be connected to as wide a GND pattern as possible to help dissipate heat. In PCB layout design, RF should be taken into consideration. Ensure that this power amplifier module is connected to a wide solid ground plane and the ground wiring is kept as short as possible to avoid any effect to RF.

DATA

PA-TR3-400M typical characteristics

Gain level (factory setting)

Pin=+8 dBm (6 mW), OutPut Power =+25 dBm (300 mW) @434 MHz, Vcc 3.0 V



Cautions

- As the product communicates using electronic radio waves, there are cases where transmission will be temporarily cut off due to the surrounding environment and method of usage. The manufacturer is exempt from all responsibility relating to resulting harm to personnel or equipment and other secondary damage.
- Do not use the equipment within the vicinity of devices that may malfunction as a result of electronic radio waves from the product.
- The manufacturer is exempt from all responsibility relating to secondary damage resulting from the operation, performance and reliability of equipment connected to the product.
- Communication performance will be affected by the surrounding environment, so communication tests should be carried out before actual use.
- Ensure that the power supply for the product is within the specified rating. Short circuits and reverse connections may result in overheating and damage and must be avoided at all costs.
- Ensure that the power supply has been switched off before attempting any wiring work.
- The case is connected to the GND terminal of the internal circuit, so do not make contact between the '+' side of the power supply terminal and the case.
- When batteries are used as the power source, avoid short circuits, recharging, dismantling, and pressure. Failure to observe this caution may result in the outbreak of fire, overheating and damage to the equipment. Remove the batteries when the equipment is not to be used for a long period of time. Failure to observe this caution may result in battery leaks and damage to the equipment.
- Do not use this product in vehicles with the windows closed, in locations where it is subject to direct sunlight, or in locations with extremely high humidity.
- The product is neither waterproof nor splash proof. Ensure that it is not splashed with soot or water. Do not use the equipment if water or other foreign matter has entered the case.
- Do not drop the product or otherwise subject it to strong shocks.
- Do not subject the equipment to condensation (including moving it from cold locations to locations with a significant increase in temperature.)
- Do not use the equipment in locations where it is likely to be affected by acid, alkalis, organic agents or corrosive gas.
- The GND for the product will also affect communication performance. If possible, ensure that the case GND and the circuit GND are connected to a large GND pattern.

Warnings

- Do not take apart or modify the equipment.
- Do not remove the product label (the label attached to the upper surface of the product.) Using a product from which the label has been removed is prohibited.

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Circuit Design, Inc. believes the furnished information is accurate and reliable. However, Circuit Design, Inc. reserves the right to make changes to this product without notice.

REVISION HISTORY

Version	Date	Description	Remark
0.9	Dec. 2021	Preliminary	
1.0	Apr. 2022	First edition	