



AsahiKASEI
ASAHI KASEI MICRODEVICES

AK1223
8500MHz High Linearity Mixer

1. Overview

The AK1223 is high linearity mixer. RF and Lo frequency range coverage is from 3000 to 8500MHz and IF coverage is from 20 to 3000MHz. The RF input provides single-ended 50Ω interface. Lo ports are 50Ω matched and complementary input should be decoupled to the ground. IF output ports are differential open collector outputs. The linearity and power consumption performances can be optimized by the resistance connected to the BIAS Pin.

2. Feature

- ☐ Operating Frequency: 3000MHz to 8500MHz
- ☐ Linearity vs. Power selectable architecture
Power Consumption: 92mA, IIP3: +13dBm, Gain: -3dB, NF: 15dB
- ☐ Lo input level: 0dBm ±5dB
- ☐ Operating Supply Voltage: 4.75 to 5.25 V
- ☐ Package: 16pin UQFN (0.5mm pitch, 3mm × 3mm × 0.60mm)
- ☐ Operating Temperature Range: -40 to 85°C



3. Table contents

1. Overview	1
2. Feature	1
3. Table contents	2
4. System Diagram	3
5. Pin Functional Description	4
6. Absolute Maximum Ratings	5
7. Recommended Operating Range	5
8. Electrical Characteristics	6
9. Typical Performance	7
10. Typical Evaluation Board Schematic	14
11. LSI Interface Schematic	15
12. Outer Dimensions	16
13. Marking	17



4. System Diagram

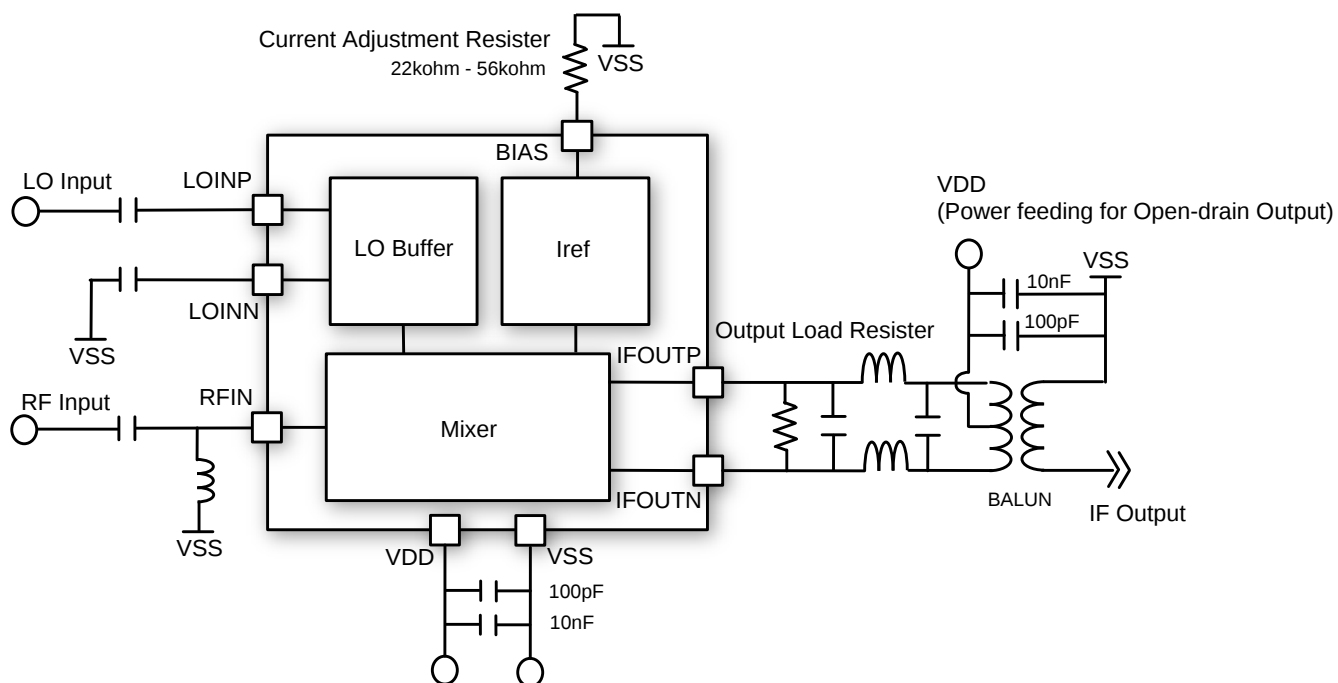


Fig. 1 System Diagram



5. Pin Functional Description

Table 1 Pin Function

No.	Name	I/O	Pin Functions	Remarks
1	VSS	G	Ground pin	
2	VSS	G	Ground pin	
3	VSS	G	Ground pin	
4	VSS	G	Ground pin	
5	VSS	G	Ground pin	
6	LOINN	AI	Lo Input Negative	
7	LOINP	AI	Lo Input Positive	
8	VDD	P	Power Supply	
9	VDD	P	Power Supply	
10	VDD	P	Power Supply	
11	IFOUTN	AO	IF Output Negative	This pin is open collector output. It needs power feeding via an inductor.
12	IFOUTP	AO	IF Output Positive	This pin is open collector output. It needs power feeding via an inductor.
13	BIAS	AIO	Resistance pin for current adjustment	Connecting a resistor between this pin and ground.
14	RFIN	AI	RF Input	Connecting an inductor between this pin and ground.
15	VSS	G	Ground pin	
16	VSS	G	Ground pin	

Note) The exposed pad at the center of the backside should be connected to ground.

AI: Analog input pin	AO: Analog output pin	AIO: Analog I/O pin
P: Power supply pin	G: Ground pin	

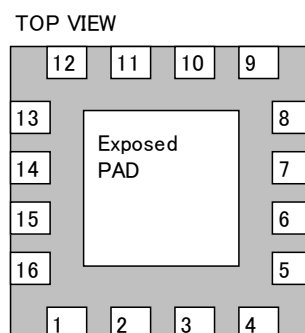


Fig. 2 Package Pin Layout



6. Absolute Maximum Ratings

Table 2 Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Remarks
Supply Voltage	VDD	-0.3	5.5	V	
RF Input Power	RFPOW		12	dBm	
LO Input Power	LOPOW		12	dBm	
IFOUTP, IFOUTN DC voltage	IFDC	VDD-1.5		V	
Storage Temperature	Tstg	-55	125	°C	

Exceeding these maximum ratings may result in damage to the AK1223. Normal operation is not guaranteed at these extremes. IFOUTP and IFOUTN should be connected to VDD via an inductor.

7. Recommended Operating Range

Table 3 Recommended Operating Range

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Operating Temperature	Ta	-40		85	°C	
Supply Voltage	VDD	4.75	5	5.25	V	

The specifications are applicable within the recommended operating range (supply voltage/operating temperature).



8. Electrical Characteristics

1. Analog Circuit Characteristics

Unless otherwise noted IF output=1000MHz, Lo Input Level=-5dBm to +5dBm,
Output Load Resistor (R_{Load})=270Ω, VDD=4.75 to 5.25V, Ta=-40°C to 85°C

Parameter		Min.	Typ.	Max.	Unit	Remarks
RF Input Frequency		3000		8500	MHz	
Lo Input Frequency		3000		8500	MHz	
IF output Frequency		20		3000	MHz	
Lo Input Power		-5		+5	dBm	Lo Input Frequency≤6GHz
		0		+5	dBm	Lo Input Frequency>6GHz
Current Adjustment Resistor(BIAS)		22		56	kΩ	
IDD	BIAS=22kΩ		114	174	mA	The total current of VDD pin, IFOUTP pin and IFOUTN pin.
	BIAS=33kΩ		92	144	mA	
	BIAS=56kΩ		73	119	mA	
RFIN=6000MHz, Current Adjustment Resistor =33kΩ						
Conversion Gain		-6	-3		dB	
SSB Noise Figure			15	18	dB	Design guarantee value
IP1dB		2	5		dBm	
IIP3		10	13		dBm	Design guarantee value

9. Typical Performance

Unless otherwise noted, RF input =6000MHz, LO input =5000MHz, IF output =1000MHz,
Output Load Resistor (R_{Load})=270Ω

1. Current Adjustment Resistor vs. IIP, NF, P1dB, Gain, IDD

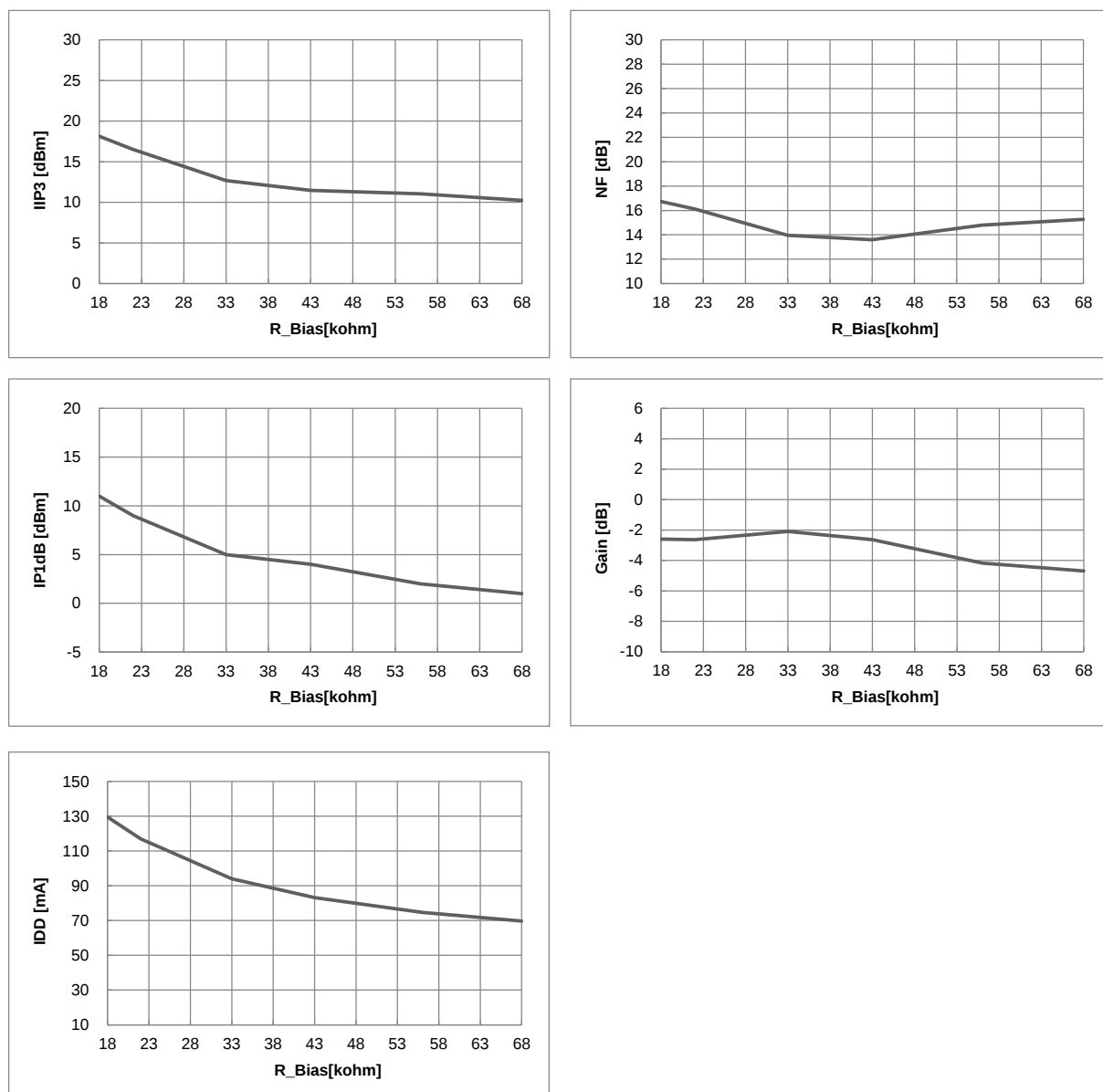


Fig. 3 Current Adjustment Resistor vs. IIP3, NF, P1dB, Gain, IDD

Note) A resistor with 5% tolerance are used.



2. Over temperature vs. IIP3, NF, P1dB, Gain, IDD

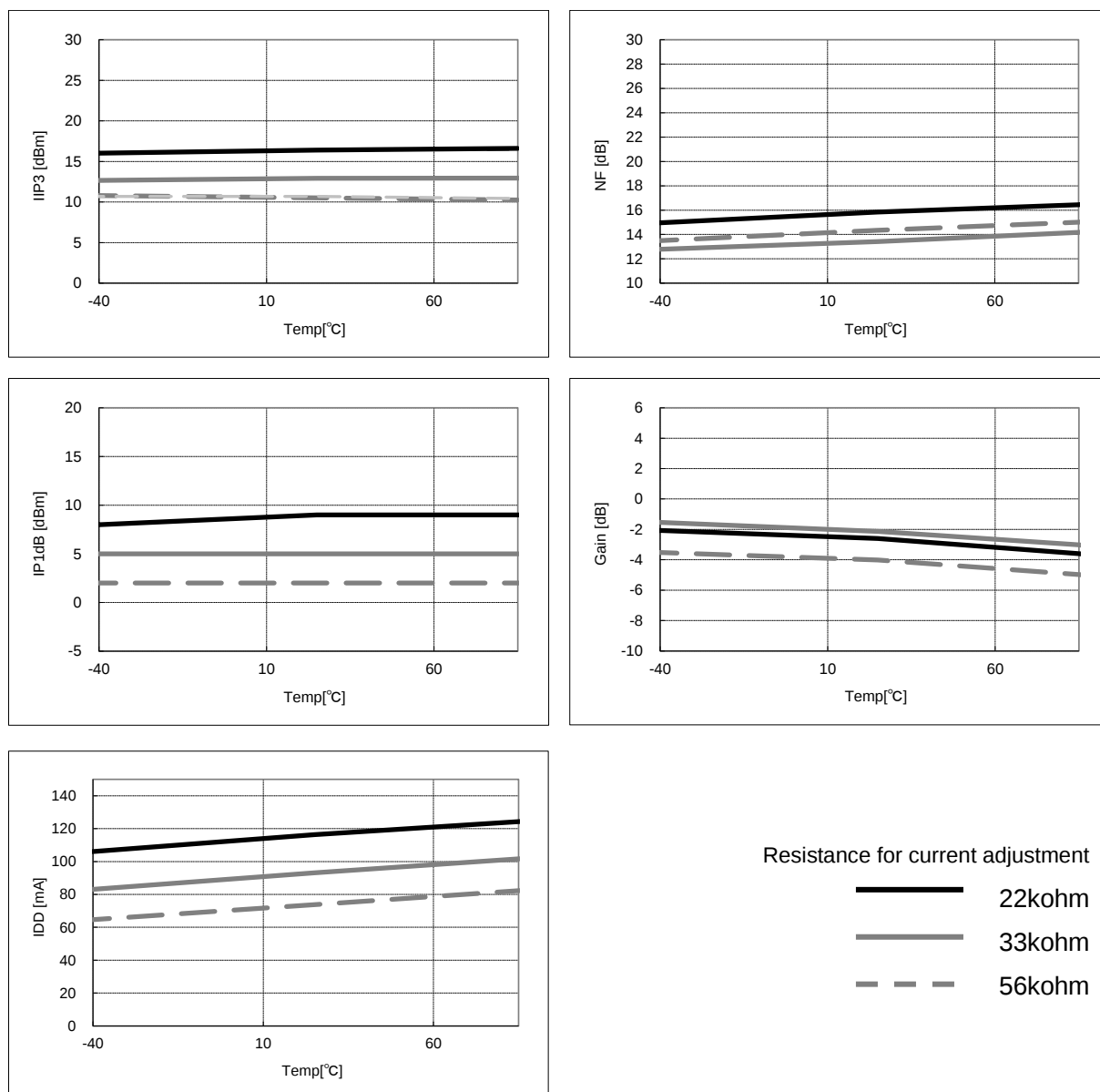


Fig. 4 Over temperature vs. IIP3, NF, IP1dB, Gain, IDD

3. Over temperature vs. IIP3, NF, P1dB, Gain, IDD

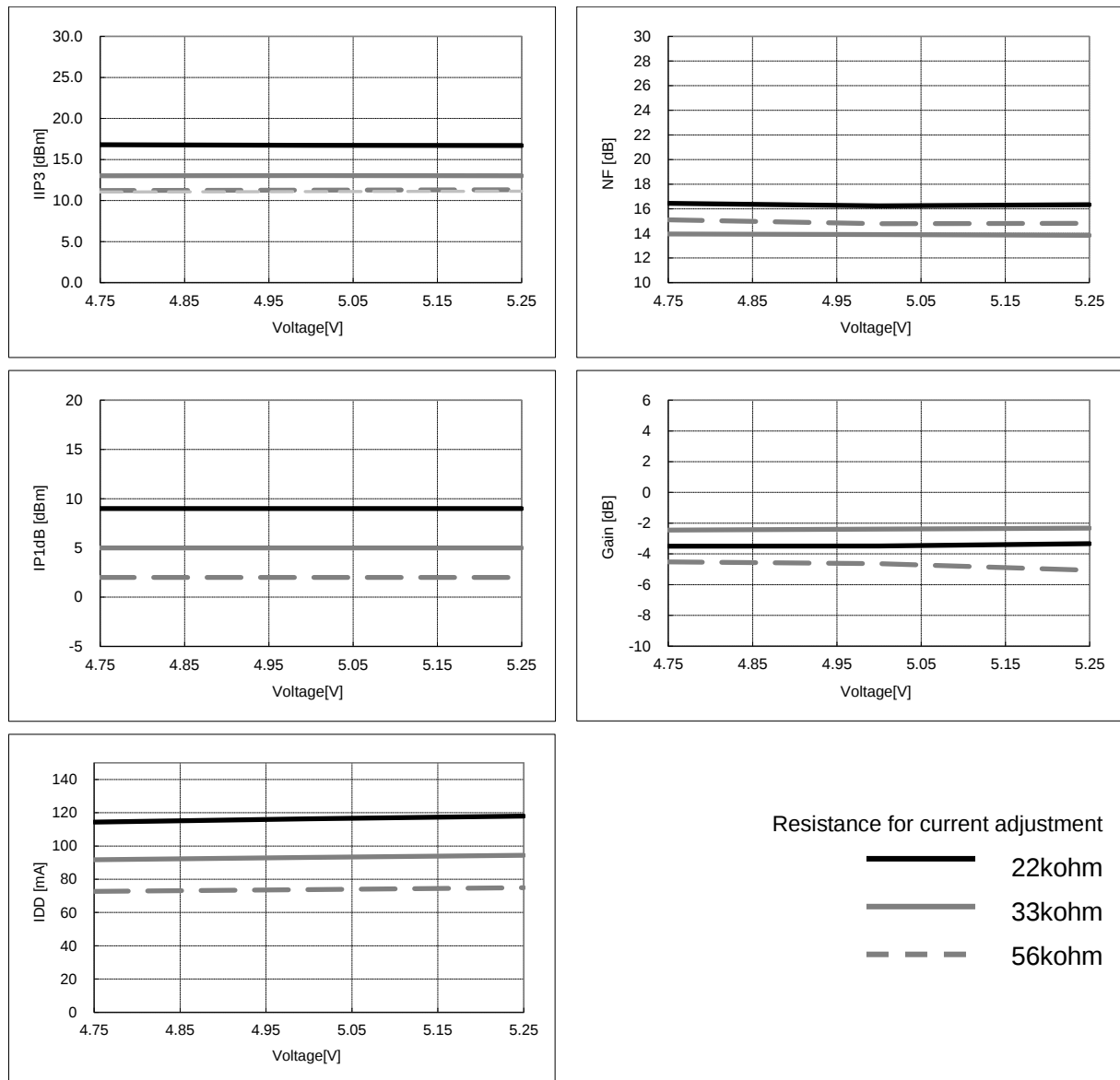


Fig. 5 Supply voltage vs. IIP3, NF, IP1dB, Gain, IDD

4. RF input frequency vs. IIP3, NF, Gain

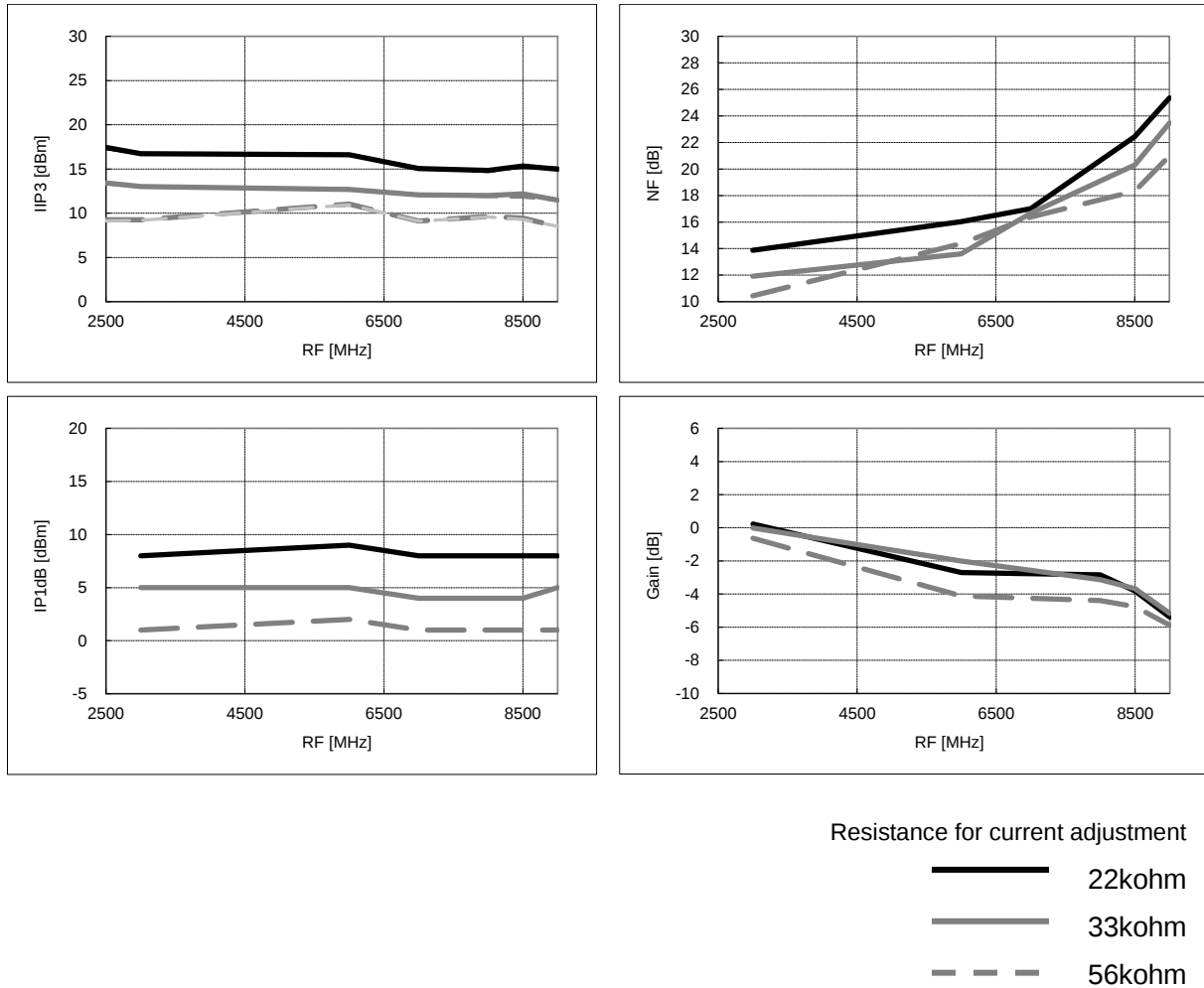


Fig. 6 RF input frequency vs. IIP3, NF, Gain

5. IF input frequency vs. IIP3, NF, Gain

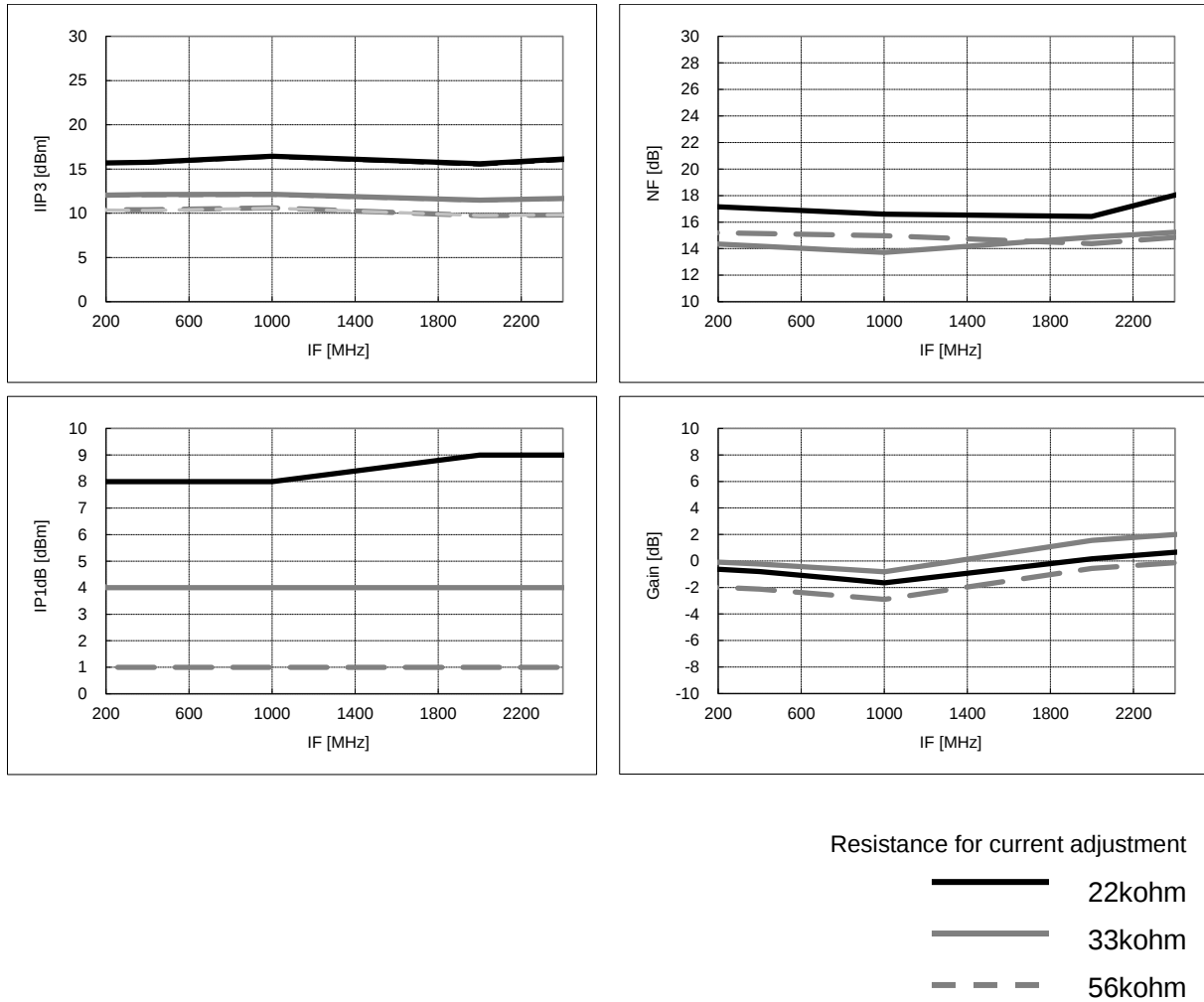
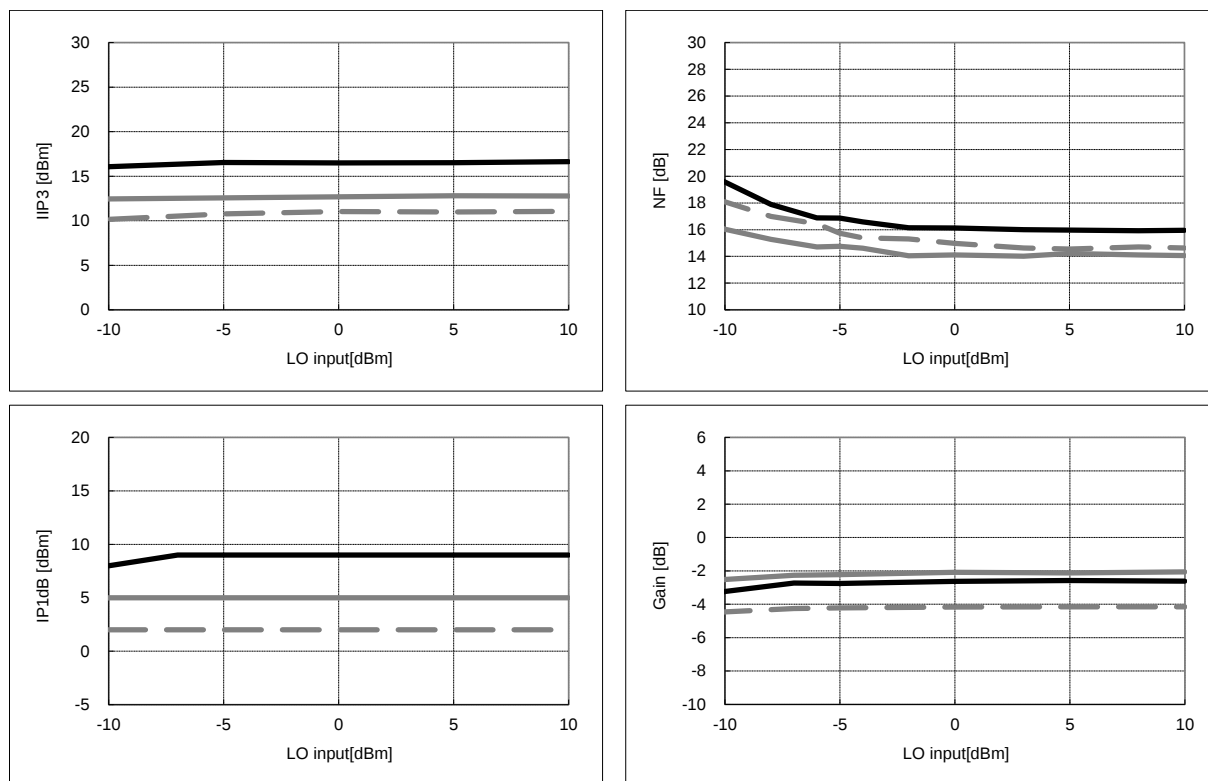


Fig. 7 IF input frequency vs. IIP3, NF, Gain

6. Lo input power vs. IIP3, NF, Gain



Resistance for current adjustment

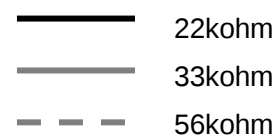
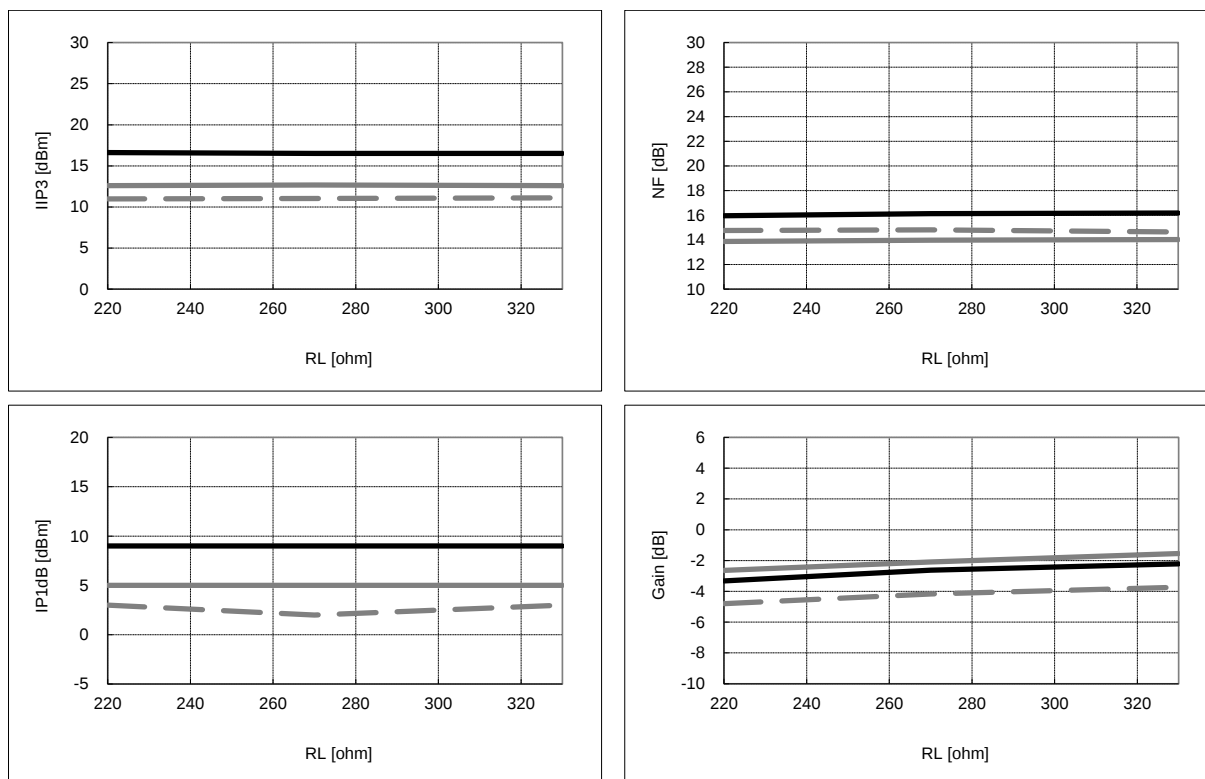


Fig. 8 LO input power vs. IIP3, NF, Gain

7. Output Load Resistor (R_{Load}) vs. IIP3, NF, Gain



Resistance for current adjustment

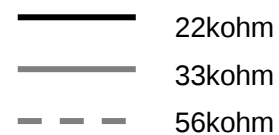


Fig. 9 Output Load Resistor (R_{Load}) vs. IIP3, NF, Gain



10. Typical Evaluation Board Schematic

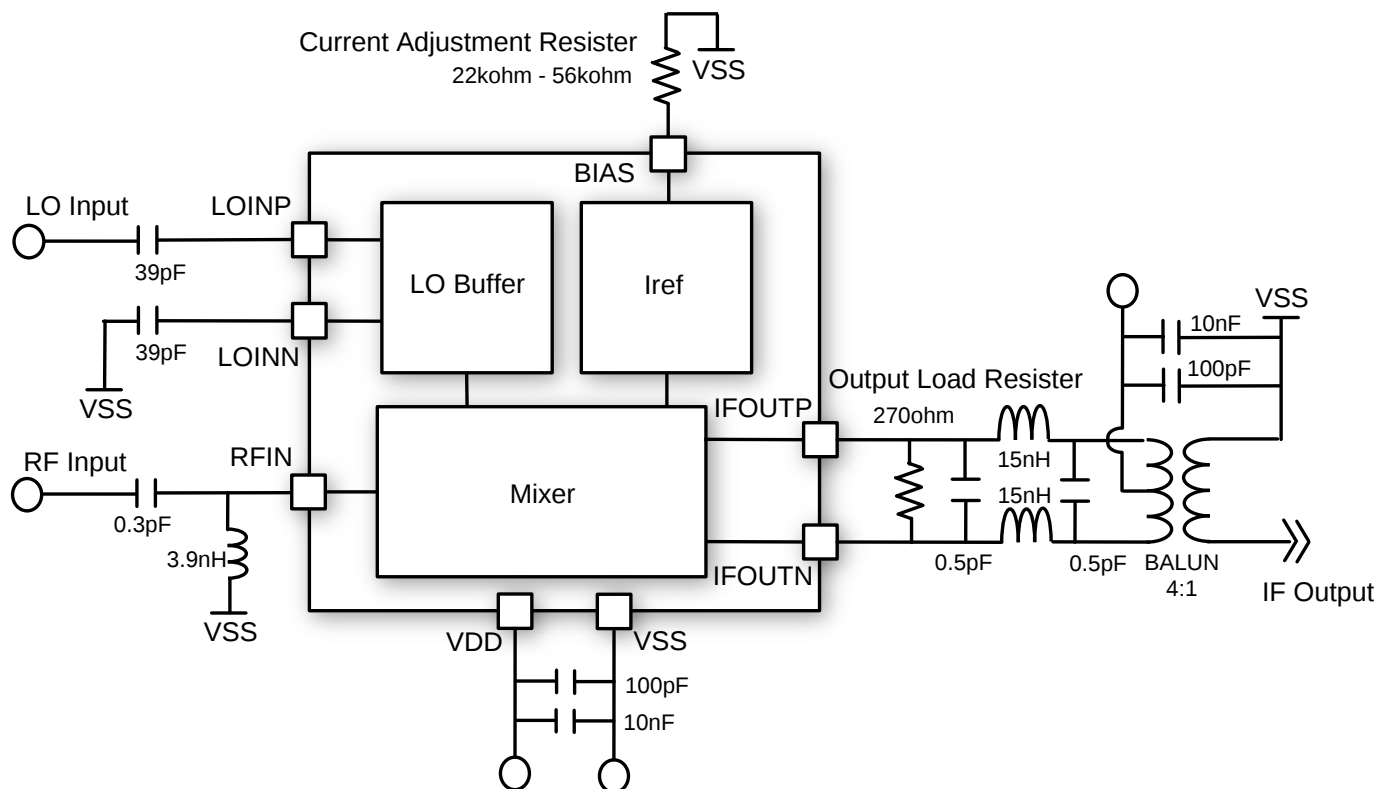
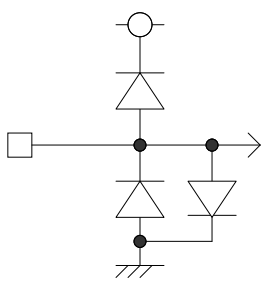
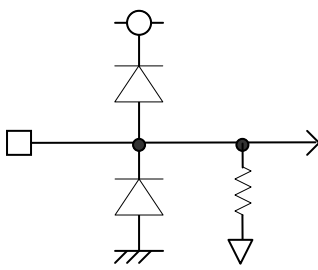
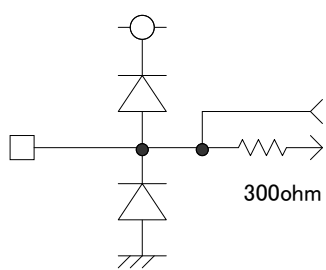
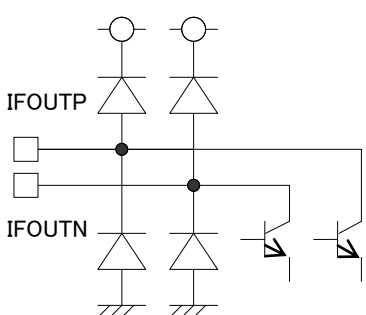


Fig.10 Typical Evaluation Board Schematic (RF:6GHz,IF:1GHz)

- Note 1) The exposed pad at the center of the backside should be connected to ground.
- Note 2) The collector drain output needs power feeding via a inductor. (IFOUTP pin and IFOUTN pin)
- Note 3) It is necessary to adjust impedance matching as to its setting frequency. (RF input and IF output)

11. LSI Interface Schematic

Pin No.	Pin Name	I/O	Function
14	RFIN	I	RF Input pin 
6	LOINN	I	LO Input pins 
7	LOINP		
13	BIAS	I/O	Analog I/O pin 
11	IFOUTN	O	IF Output pins 
12	IFOUTP		



12. Outer Dimensions

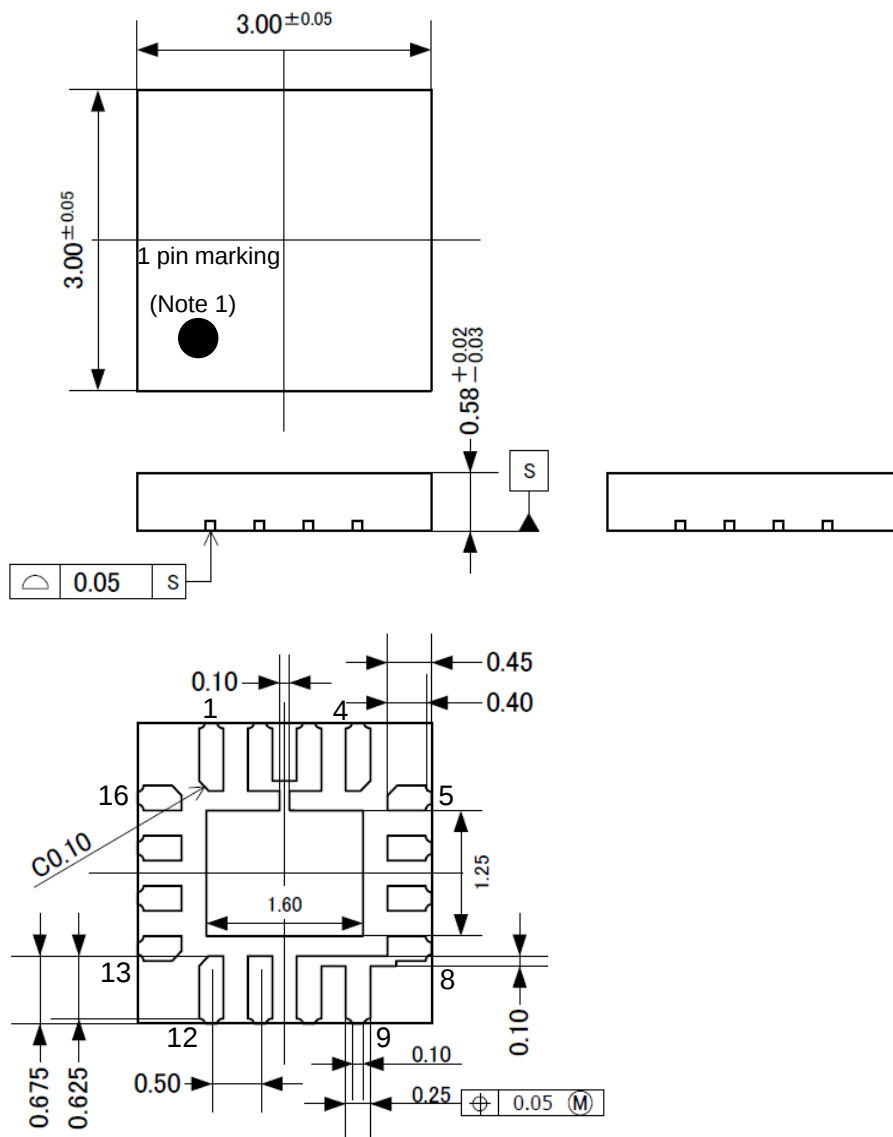


Fig.11 Outer Dimensions

Note 1. 1 pin marking is only a reference for the 1 pin location on the top of package.



13. Marking

- (a) Style : UQFN
- (b) Number of pins : 16
- (c) 1 pin marking: : ○
- (d) Product number : 1223
- (e) Date code : YWWL (4 digits)
- Y : Lower 1 digit of calendar year (Year 2012 → 2, 2013 → 3 ...)
- WW : Week
- L : Lot identification, given to each product lot which is made in a week
→ LOT ID is given in alphabetical order (A, B, C...).

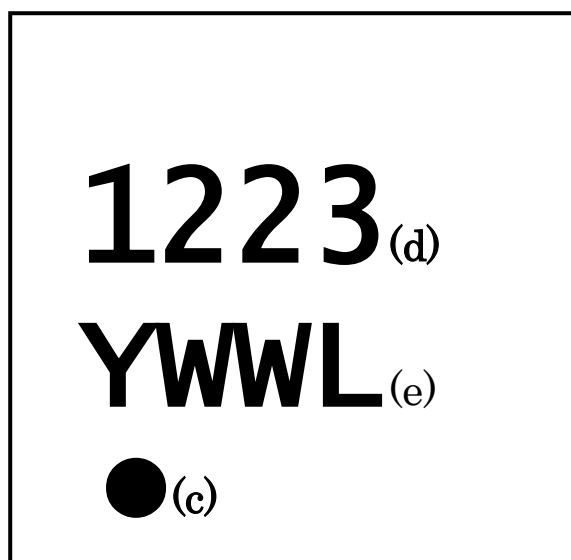


Fig. 12 Marking

IMPORTANT NOTICE

0. Asahi Kasei Microdevices Corporation (“AKM”) reserves the right to make changes to the information contained in this document without notice. When you consider any use or application of AKM product stipulated in this document (“Product”), please make inquiries the sales office of AKM or authorized distributors as to current status of the Products.
1. All information included in this document are provided only to illustrate the operation and application examples of AKM Products. AKM neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of AKM or any third party with respect to the information in this document. You are fully responsible for use of such information contained in this document in your product design or applications. **AKM ASSUMES NO LIABILITY FOR ANY LOSSES INCURRED BY YOU OR THIRD PARTIES ARISING FROM THE USE OF SUCH INFORMATION IN YOUR PRODUCT DESIGN OR APPLICATIONS.**
2. The Product is neither intended nor warranted for use in equipment or systems that require extraordinarily high levels of quality and/or reliability and/or a malfunction or failure of which may cause loss of human life, bodily injury, serious property damage or serious public impact, including but not limited to, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. Do not use Product for the above use unless specifically agreed by AKM in writing.
3. Though AKM works continually to improve the Product’s quality and reliability, you are responsible for complying with safety standards and for providing adequate designs and safeguards for your hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of the Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption.
4. Do not use or otherwise make available the Product or related technology or any information contained in this document for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). When exporting the Products or related technology or any information contained in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. The Products and related technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
5. Please contact AKM sales representative for details as to environmental matters such as the RoHS compatibility of the Product. Please use the Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. AKM assumes no liability for damages or losses occurring as a result of noncompliance with applicable laws and regulations.
6. Resale of the Product with provisions different from the statement and/or technical features set forth in this document shall immediately void any warranty granted by AKM for the Product and shall not create or extend in any manner whatsoever, any liability of AKM.
7. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of AKM.