ASF153 Data Sheet

3.3 V IF Gain Block Amplifier MMIC over DC~1000 MHz

1. Product Overview

1.1 General Description

ASF153, 3.3V internally matched IF gain block amplifier MMIC, has excellent input and output return loss, high linearity, and low noise over a wide range of frequency DC~1000 MHz, being suitable for use in both receiver and transmitter of telecommunication systems up to 1 GHz. The amplifier is available in a SOT89 package and passes through the stringent 100% DC & RF test via an automated test handler.

1.2 Features

- 22.6 dB Gain at 150 MHz
- 20 dBm P1dB at 150 MHz
- 38 dBm Output IP3 at 150 MHz
- 2.0 dB NF at 150 MHz
- MTTF > 100 Years
- Minimum External Matching Components
- Single Supply: +3.3 V

1.3 Applications

- Base Station Infrastructure
- Repeater
- Telecommunication System

1.4 Package Profile & RoHS Compliance

	
SOT89, 4.5x4.0 mm^2, surface mount	RoHS-compliant

2. Summary on Product Performances

2.1 Typical Performance

Supply voltage = +3.3 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical					Unit
Frequency	70	150	300	450	900	MHz
Gain	22.7	22.6	22.4	22.1	20.8	dB
S11	-18	-21	-20	-17	-10	dB
S22	-25	-25	-25	-21	-11	dB
Noise Figure	1.7	2.0	2.0	2.0	2.0	dB
Output IP3[1)]	37	38	38	36	34	dBm
Output P1dB	20	20	20	20	19	dBm
Current	87					mA
Device Voltage	+3.3					V

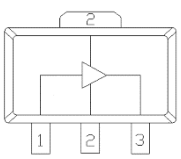
1) OIP3 is measured with two tones at the output power of +5 dBm/tone separated by 1 MHz.

2.2 Product Specification

Supply voltage = +3.3 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Min	Typ	Max	Unit
Frequency		150		MHz
Gain		22.6		dB
S11		-21		dB
S22		-25		dB
Noise Figure		2.0		dB
Output IP3		38		dBm
Output P1dB		20		dBm
Current		87		mA
Device Voltage		+3.3		V

2.3 Pin Configuration

Pin	Description	Simplified Outline
1	RF_IN	
2	Ground	
3	RF_OUT & Bias	

2.4 Absolute Maximum Ratings

Parameters	Max. Ratings
Operation Case Temperature	-40 to +85 °C
Storage Temperature	-40 to +150 °C
Device Voltage	+6 V
Operation Junction Temperature	+150 °C
Input RF Power (CW, 50 Ω matched)	+25 dBm

2.5 Thermal Resistance

Symbol	Description	Typ	Unit
R_{th}	Thermal resistance from junction to lead	45	°C/W

2.6 ESD Classification & Moisture Sensitivity Level

ESD Classification

HBM	Class 1B	Voltage Level: 500 ~ 1000 V
MM	Class A	Voltage Level: <200 V

CAUTION: Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

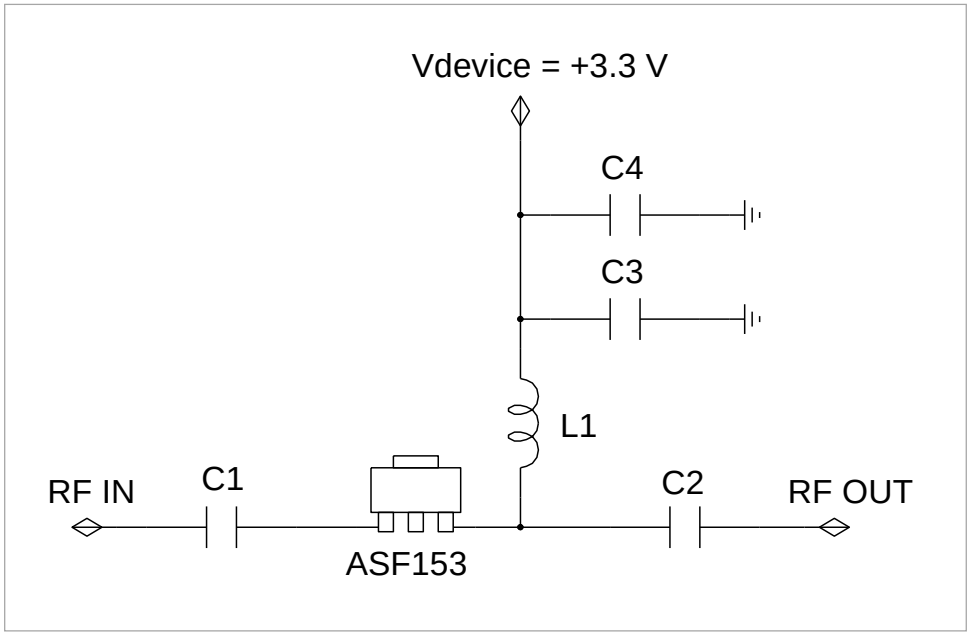
Moisture Sensitivity Level

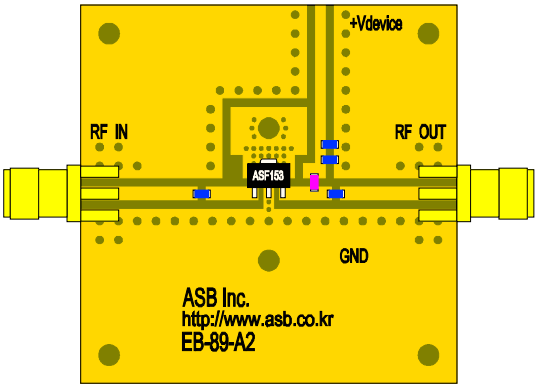
MSL 3 at 260 °C reflow

(Intentionally Blanked)

3. Application: 50 ~ 1000 MHz (IF, V_{supply} = +3.3 V)

3.1 Application Circuit & Evaluation Board





PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	40x40
EB No.	EB-89-A2

Bill of Material

Symbol	Value	Size	Description	Manufacturer
ASF153	-	-	MMIC Amplifier	ASB
C1, C2	1 nF	0603	DC blocking capacitor	Murata
C3	100 pF	0603	Bypass capacitor	Murata
C4	1 μF	0603	Decoupling capacitor	Murata
L1	680 nH	0603	RF choke inductor	Samsung

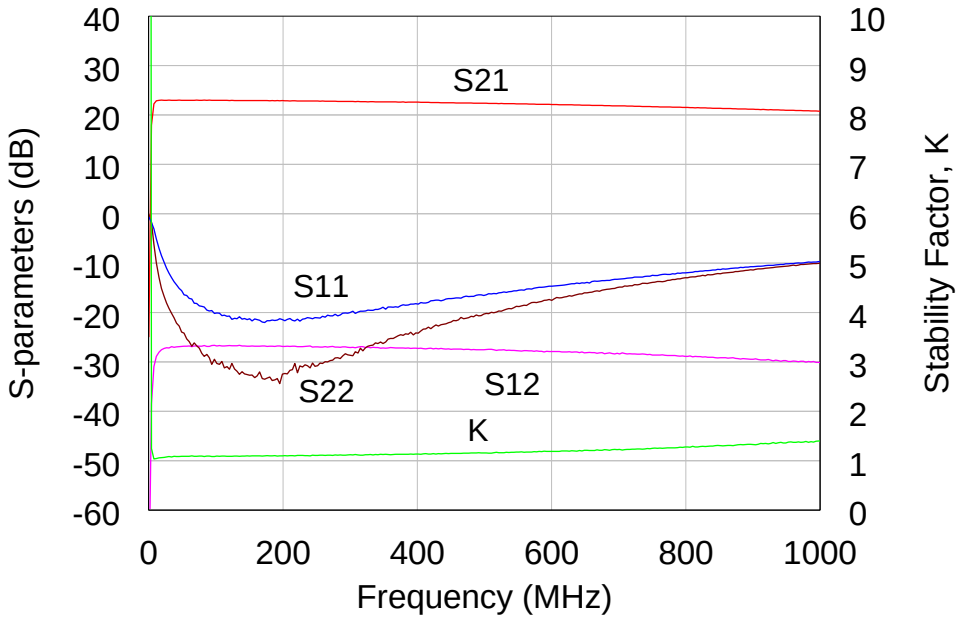
3.2 Performance Table

Supply voltage = +3.3 V, T_A = +25 °C, Z_O = 50 Ω.

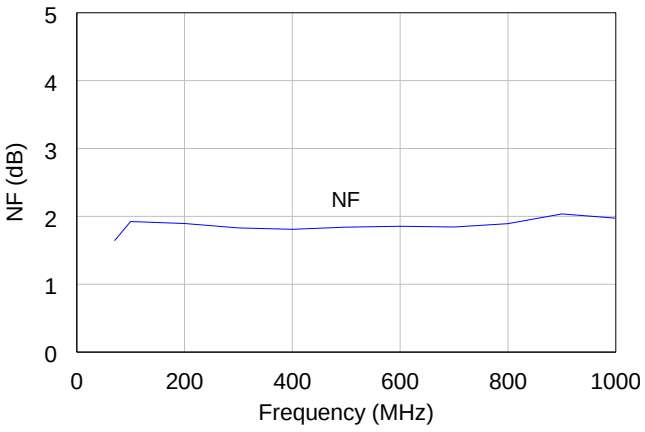
Parameter	Typical					Unit
Frequency	70	150	300	450	900	MHz
Gain	22.7	22.6	22.4	22.1	20.8	dB
S11	-18	-21	-20	-17	-10	dB
S22	-25	-25	-25	-21	-11	dB
Noise Figure	1.7	2.0	2.0	2.0	2.0	dB
Output IP3[1)]	37	38	38	36	34	dBm
Output P1dB	20	20	20	20	19	dBm
Current	87					mA
Device Voltage	+3.3					V

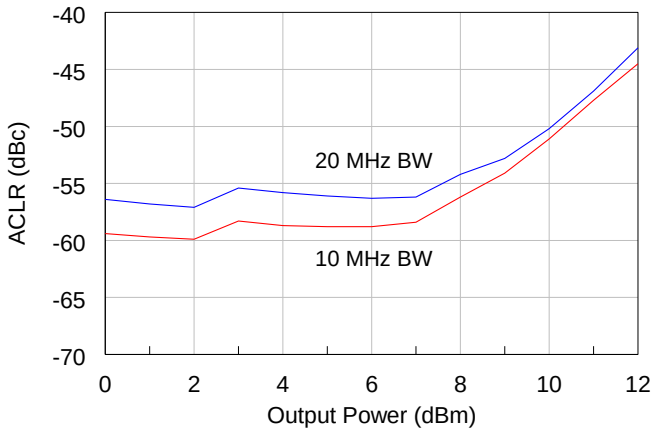
1) OIP3 is measured with two tones at the output power of +5 dBm/tone separated by 1 MHz.

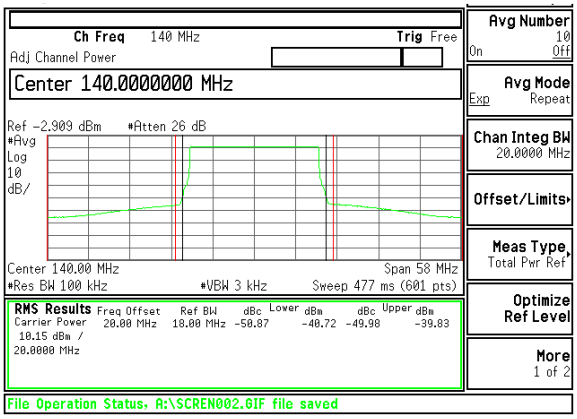
3.3 Plot of S-parameter & Stability Factor



3.4 Plots of Noise Figure, ACLR (for LTE) and Performances with Temperature

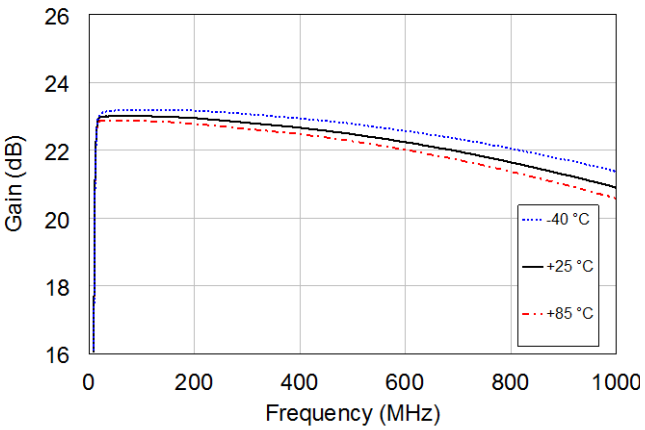


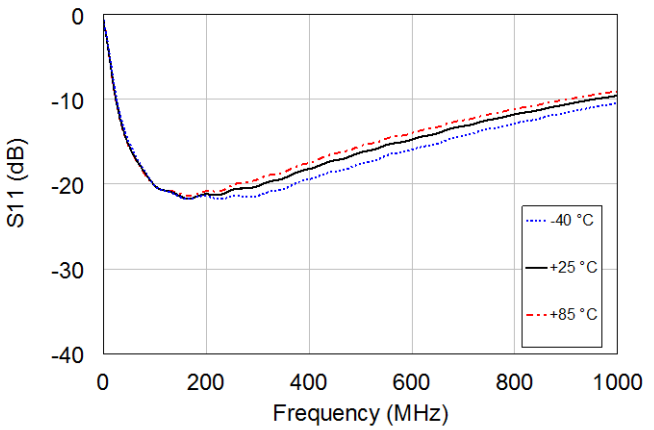


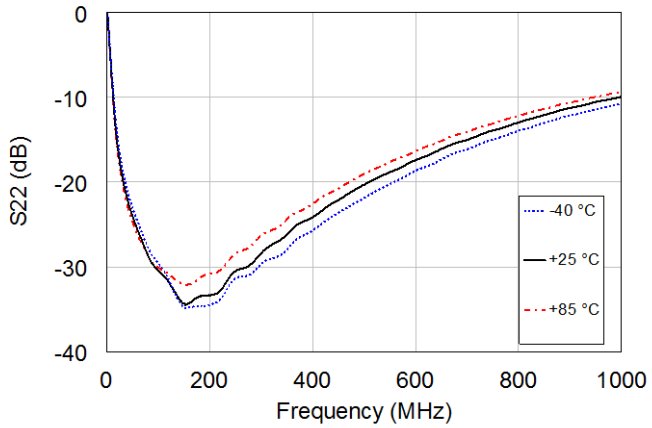


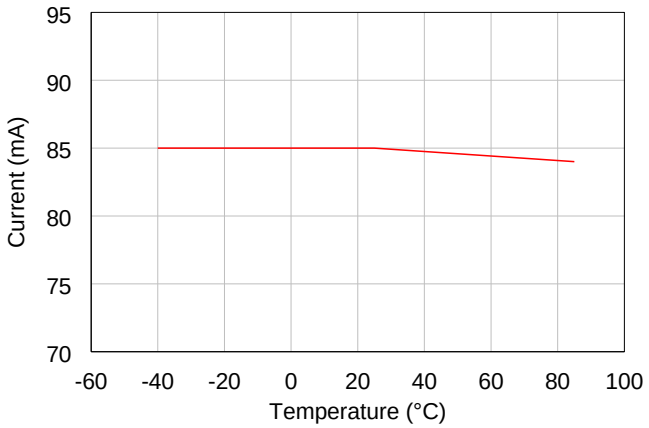
Note that ACLR test conditions are as follows;

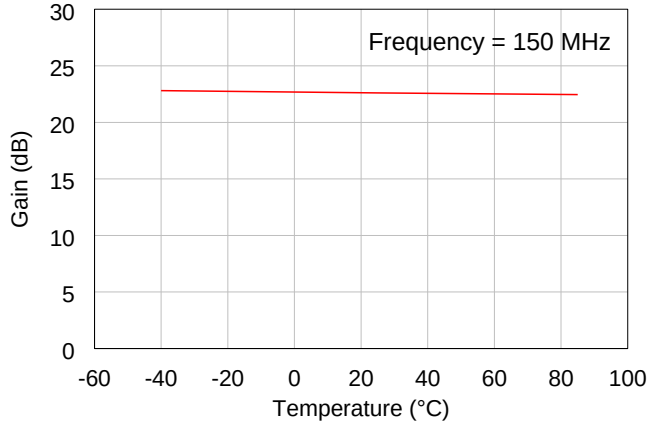
1) Test Source: LTE_FDD_test model 3.1, BW: 10 MHz & 20 MHz, Test Frequency: 140 MHz
2) Test Source: LTE_FDD_test model 3.1, BW: 20 MHz, Test Frequency: 140 MHz

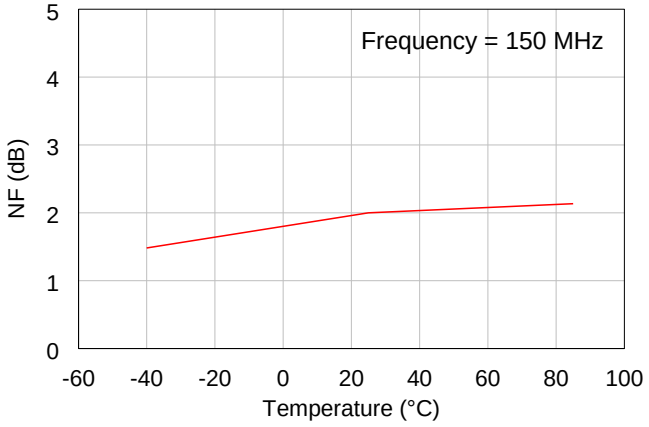


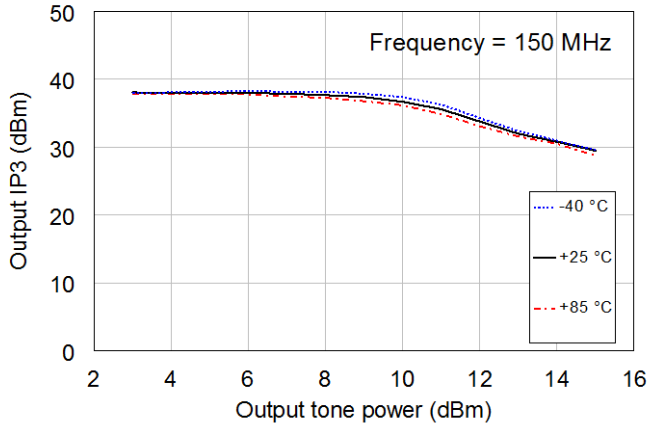


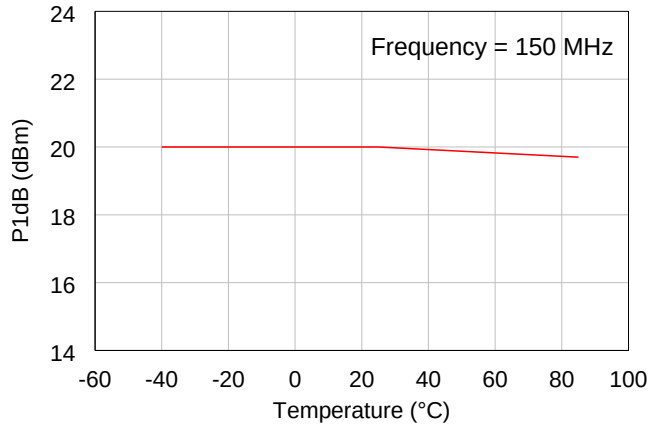

S22 (dB)
0
-10
-20
-30
-40
0
200
400
600
800
1000
Frequency (MHz)
-40 °C
+25 °C
+85 °C


Current (mA)
95
90
85
80
75
70
-60
-40
-20
0
20
40
60
80
100
Temperature (°C)


Gain (dB)
30
25
20
15
10
5
0
-60
-40
-20
0
20
40
60
80
100
Temperature (°C)
Frequency = 150 MHz

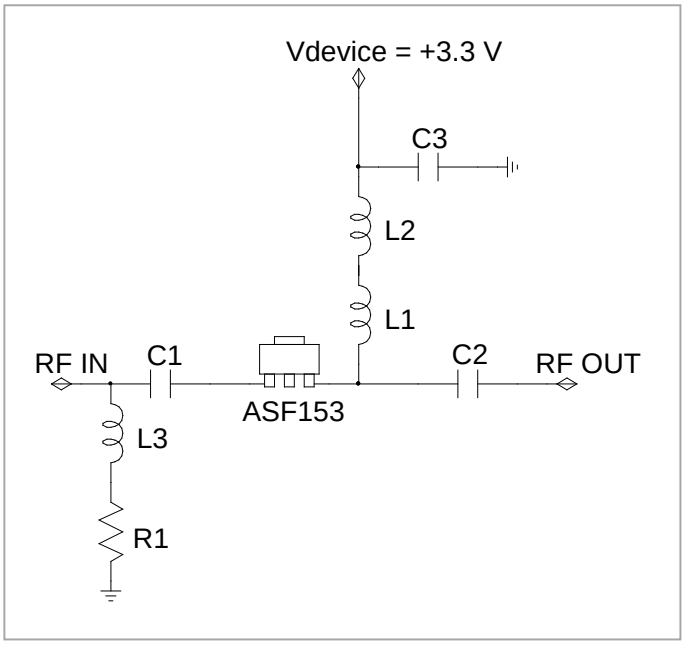

NF (dB)
5
4
3
2
1
0
-60
-40
-20
0
20
40
60
80
100
Temperature (°C)
Frequency = 150 MHz

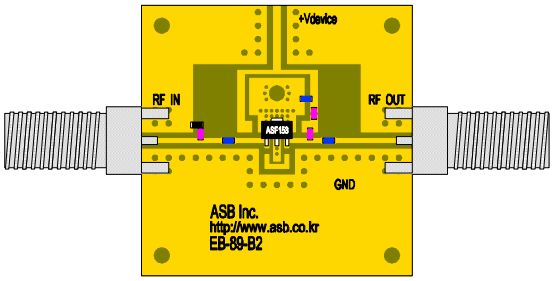

Output IP3 (dBm)
50
40
30
20
10
0
2
4
6
8
10
12
14
16
Output tone power (dBm)
Frequency = 150 MHz
-40 °C
+25 °C
+85 °C


P1dB (dBm)
24
22
20
18
16
14
-60
-40
-20
0
20
40
60
80
100
Temperature (°C)
Frequency = 150 MHz

4. Application: 5 ~ 1000 MHz (75 Ω CATV, V_{supply} = +3.3 V)

4.1 Application Circuit & Evaluation Board





PCB Information	
Material	FR4
Thickness (mm)	0.8
Size (mm)	40x40
EB No.	EB-89-B2

Bill of Material

Symbol	Value	Size	Description	Manufacturer
ASF153	-	-	MMIC Amplifier	ASB
C1, C2	1 μF	0603	DC blocking capacitor	Murata
C3	100 pF	0603	Bypass capacitor	Murata
C4	10 μF	0603	Decoupling capacitor	Murata
L1, L2	1 μH	1206	RF choke inductor	Murata
L3	4.7 μH	1206	Matching inductor	Murata
R1	150 Ω	0603	Matching resistor	Samsung

4.2 Performance Table

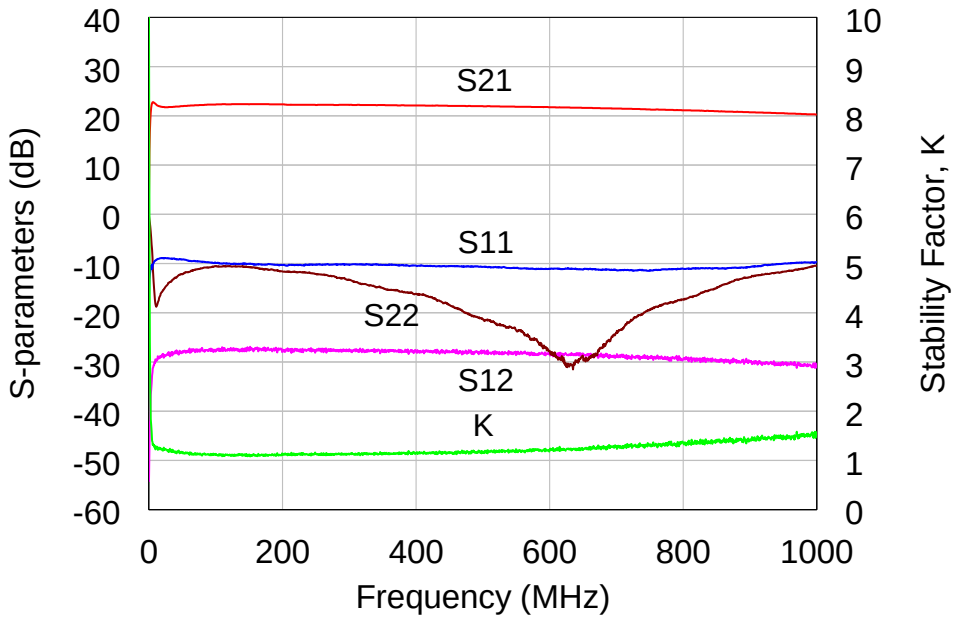
Supply voltage = +3.3 V, T_A = +25 °C, Z_O = 50 Ω.

Parameter	Typical			Unit
Frequency	5	500	1000	MHz
Gain	22.3	21.5	20.0	dB
S11	-10	-10	-9	dB
S22	-7	-18	-10	dB
Noise Figure	4.0	2.4	2.6	dB
Output IP3[1)]	29	34	32	dBm
Output IP2[1),2)]	44	51	44	dBm
Output P1dB	14	18	17	dBm
Current	87			mA
Device Voltage	+3.3			V

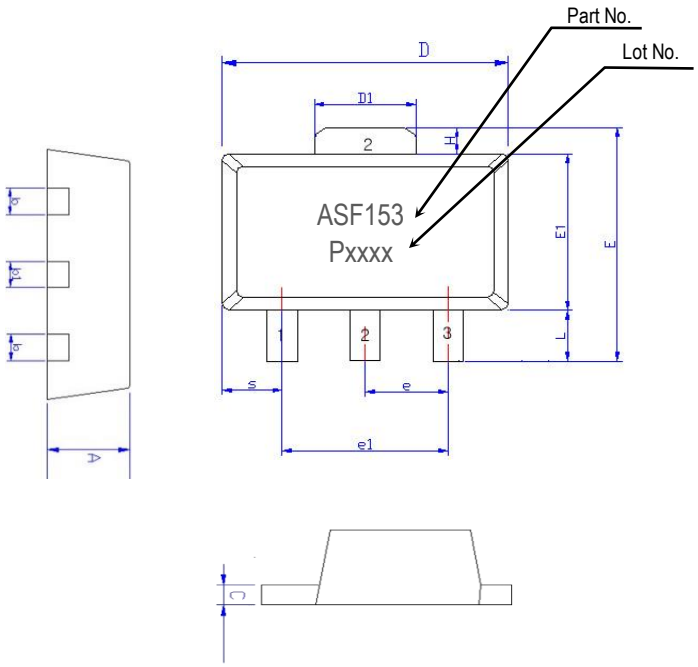
1) OIP3 and OIP2 are measured with two tones at the output power of +5 dBm/tone separated by 6 MHz.

2) OIP2 is measured at F1 + F2 Frequency.

4.3 Plot of S-parameter & Stability Factor

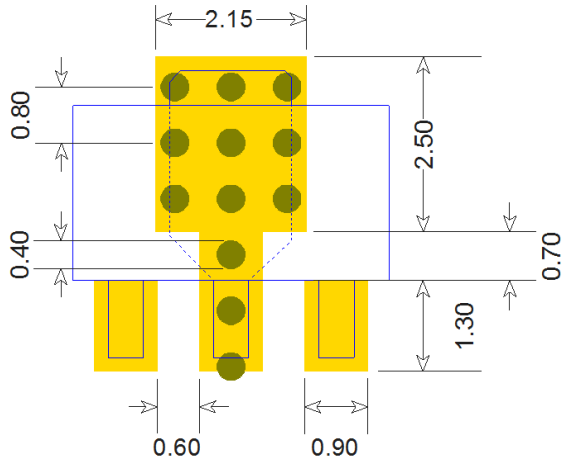


5. Package Outline (SOT89, 4.5x4.0x1.5 mm)



Symbols	Dimensions (In mm)		
	MIN	NOM	MAX
A	1.40	1.50	1.60
L	0.89	1.04	1.20
b	0.36	0.42	0.48
b1	0.41	0.47	0.53
C	0.38	0.40	0.43
D	4.40	4.50	4.60
D1	1.40	1.60	1.75
E	3.64	---	4.25
E1	2.40	2.50	2.60
e1	2.90	3.00	3.10
H	0.35	0.40	0.45
S	0.65	0.75	0.85
e	1.40	1.50	1.60

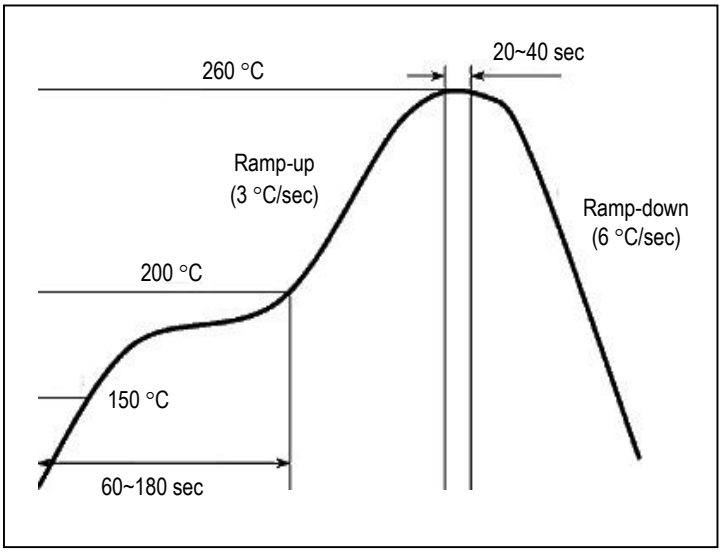
6. Surface Mount Recommendation (In mm)



NOTE

1. The number and size of ground via holes in a circuit board are critical for thermal and RF grounding considerations.
2. We recommend that the ground via holes be placed on the bottom of the lead pin 2 and exposed pad of the device for better RF and thermal performance, as shown in the drawing at the left side.

7. Recommended Soldering Reflow Profile



(End of Datasheet)