

# BGA7124

400 MHz to 2700 MHz 0.25 W high linearity silicon amplifier

Rev. 3 — 9 September 2010

Product data sheet

## 1. Product profile

### 1.1 General description

The BGA7124 MMIC is a one-stage amplifier, available in a low-cost leadless surface-mount package. It delivers 25 dBm output power at 1 dB gain compression and superior performance up to 2700 MHz. Its power saving features include easy quiescent current adjustment enabling class-AB operation and logic-level shutdown control to reduce the supply current to 4  $\mu$ A.

### 1.2 Features and benefits

- 400 MHz to 2700 MHz frequency operating range
- 16 dB small signal gain at 2 GHz
- 25 dBm output power at 1 dB gain compression
- Integrated active biasing
- External matching allows broad application optimization of the electrical performance
- 3.3 V or 5 V single supply operation
- All pins ESD protected

### 1.3 Applications

- Wireless infrastructure (base station, repeater, backhaul systems)
- Broadband CPE/MoCA
- Industrial applications
- E-metering
- Satellite Master Antenna TV (SMATV)
- WLAN/ISM/RFID

### 1.4 Quick reference data

**Table 1. Quick reference data**

Input and output impedances matched to 50  $\Omega$ ,  $\overline{SHDN} = HIGH$  (shutdown disabled). Typical values at  $V_{CC} = 5$  V;  $I_{CC} = 130$  mA;  $T_{case} = 25$   $^{\circ}$ C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC}$	supply current	$V_{CC} = 5.0$ V	[1] 50	-	170	mA
f	frequency		[2] 400	-	2700	MHz
$G_p$	power gain	f = 2140 MHz	14.5	16	17.5	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	f = 2140 MHz	23.5	24.5	-	dBm
IP3 <sub>O</sub>	output third-order intercept point	f = 2140 MHz	[3] 34.5	37.5	-	dBm

[1] The supply current is adjustable; see [Section 8.1 "Supply current adjustment"](#).

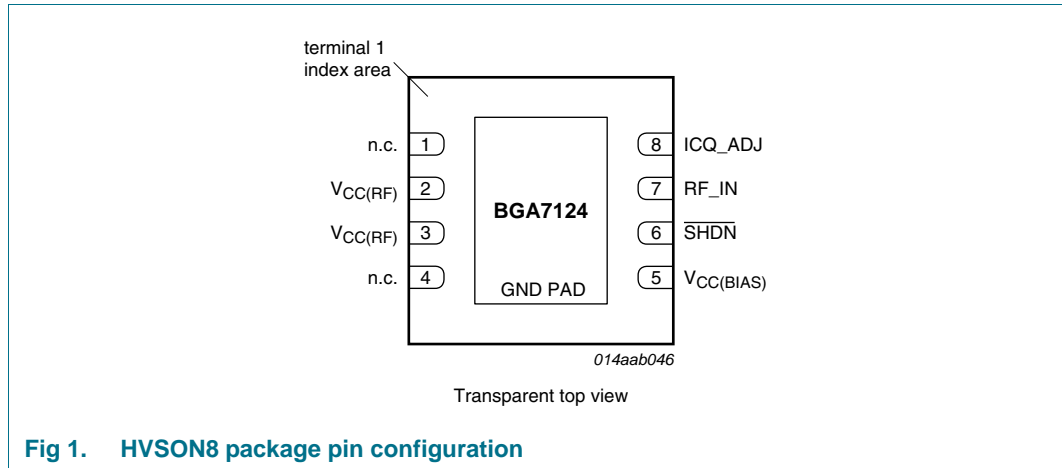
[2] Operation outside this range is possible but not guaranteed.

[3]  $P_L = 11$  dBm per tone; spacing = 1 MHz.



## 2. Pinning information

### 2.1 Pinning



### 2.2 Pin description

**Table 2. Pin description**

Symbol	Pin	Description
n.c.	1, 4	not connected
V <sub>CC(RF)</sub>	2, 3	RF output for the power amplifier and DC supply input for the RF transistor collector <a href="#">[1]</a>
V <sub>CC(BIAS)</sub>	5	bias supply voltage <a href="#">[2]</a>
SHDN	6	shutdown control function enabled/disabled
RF_IN	7	RF input for the power amplifier <a href="#">[1]</a>
ICQ_ADJ	8	quiescent collector current adjustment controlled by an external resistor
GND	GND pad	RF and DC ground <a href="#">[3]</a>

[1] This pin is DC-coupled and requires an external DC-blocking capacitor.

[2] RF decoupled.

[3] The center metal base of the SOT908-1 also functions as heatsink for the power amplifier.

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		Version
	Name	Description	
BGA7124	HVSON8	plastic thermal enhanced very thin small outline package; no leads; 8 terminals; body 3 × 3 × 0.85 mm	SOT908-1

### 4. Functional diagram

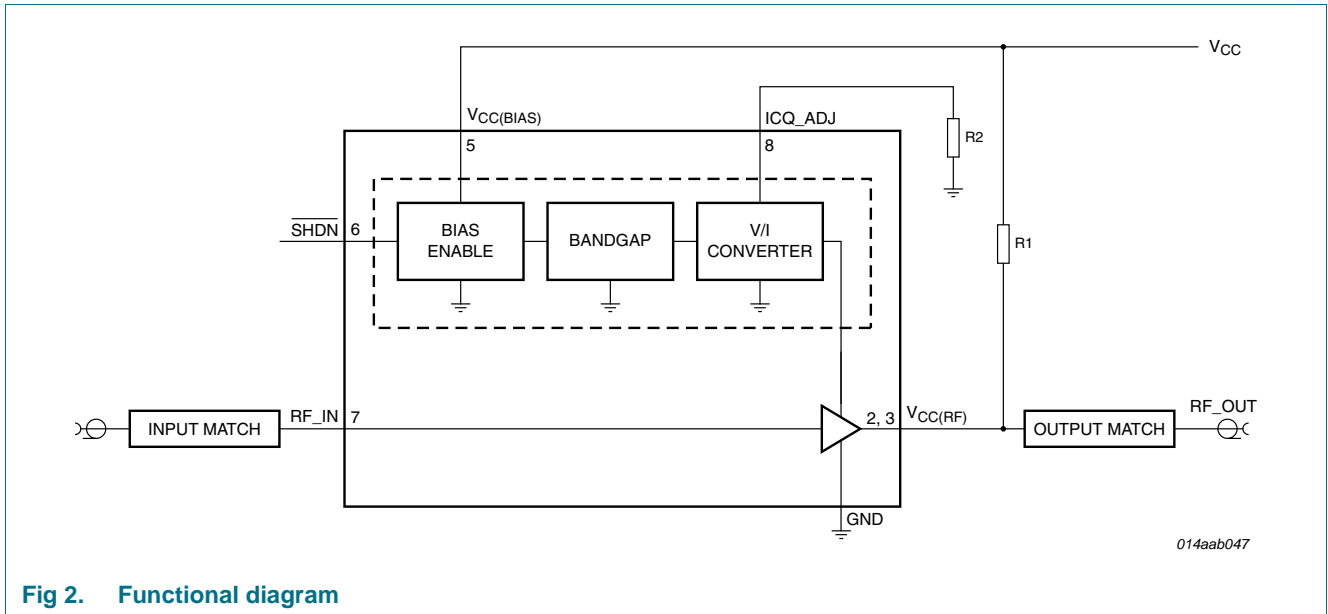


Fig 2. Functional diagram

### 5. Shutdown control

Table 4. Shutdown control settings

Mode	Mode description	Function description	Pin SHDN	V <sub>ctrl(sd)</sub> (V)		I <sub>ctrl(sd)</sub> (µA)	
				Min	Max	Min	Max
Idle	medium power MMIC fully off; minimal supply current	shutdown control enabled	0	0	0.7	-	2
TX	medium power MMIC transmit mode	shutdown control disabled	1	2.5	V <sub>CC(BIAS)</sub>	-	9

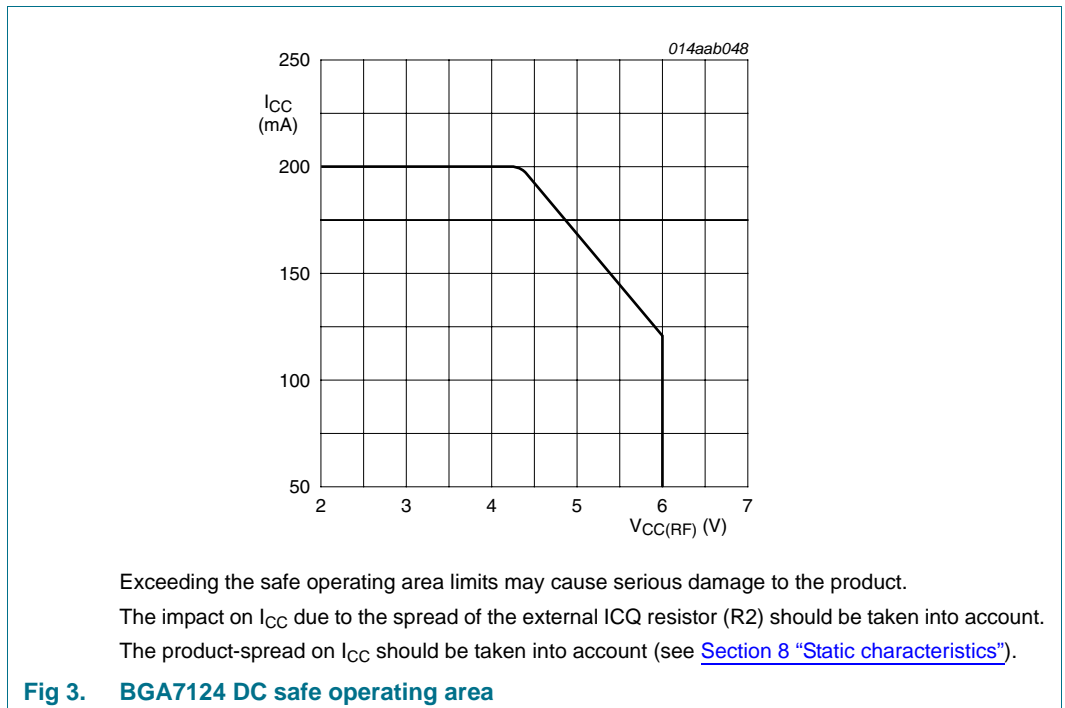
## 6. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC(RF)}$	RF supply voltage		[1] -	6.0	V
$V_{CC(BIAS)}$	bias supply voltage		[1] -	6.0	V
$I_{CC}$	supply current		[1][2] 50	200	mA
$V_{ctrl(sd)}$	shutdown control voltage		[3] 0.0	$V_{CC(BIAS)}$	V
$P_{i(RF)}$	RF input power		-	20	dBm
$T_{case}$	case temperature		-40	+85	°C
$T_j$	junction temperature		-	150	°C
$V_{ESD}$	electrostatic discharge voltage	Human Body Model (HBM); According JEDEC standard 22-A114E	-	2000	V
		Charged Device Model (CDM); According JEDEC standard 22-C101B	-	500	V

- [1] See [Figure 3](#) for safe operating area.
- [2] The supply current is adjustable; see [Section 8.1 "Supply current adjustment"](#).
- [3] If  $V_{ctrl(sd)}$  exceeds  $V_{CC(BIAS)}$ , the internal ESD circuit can be damaged. To prevent this, it is recommended that the  $I_{ctrl(sd)}$  is limited to 20 mA. If the SHDN function is not used, the SHDN pin should be connected to the  $V_{CC(BIAS)}$  pin.



## 7. Thermal characteristics

**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	$T_{case} = 85\text{ °C}$ ; $V_{CC} = 5\text{ V}$ ; $I_{CC} = 130\text{ mA}$	[1] 32	-	K/W

[1] defined as thermal resistance from junction to GND paddle.

## 8. Static characteristics

**Table 7. Characteristics**

Input and output impedances matched to  $50\ \Omega$ , pin  $\overline{SHDN} = HIGH$  (shutdown disabled). Typical values at  $V_{CC} = 3.3\text{ V}$  or  $V_{CC} = 5\text{ V}$ ;  $T_{case} = 25\text{ °C}$ ; unless otherwise specified.

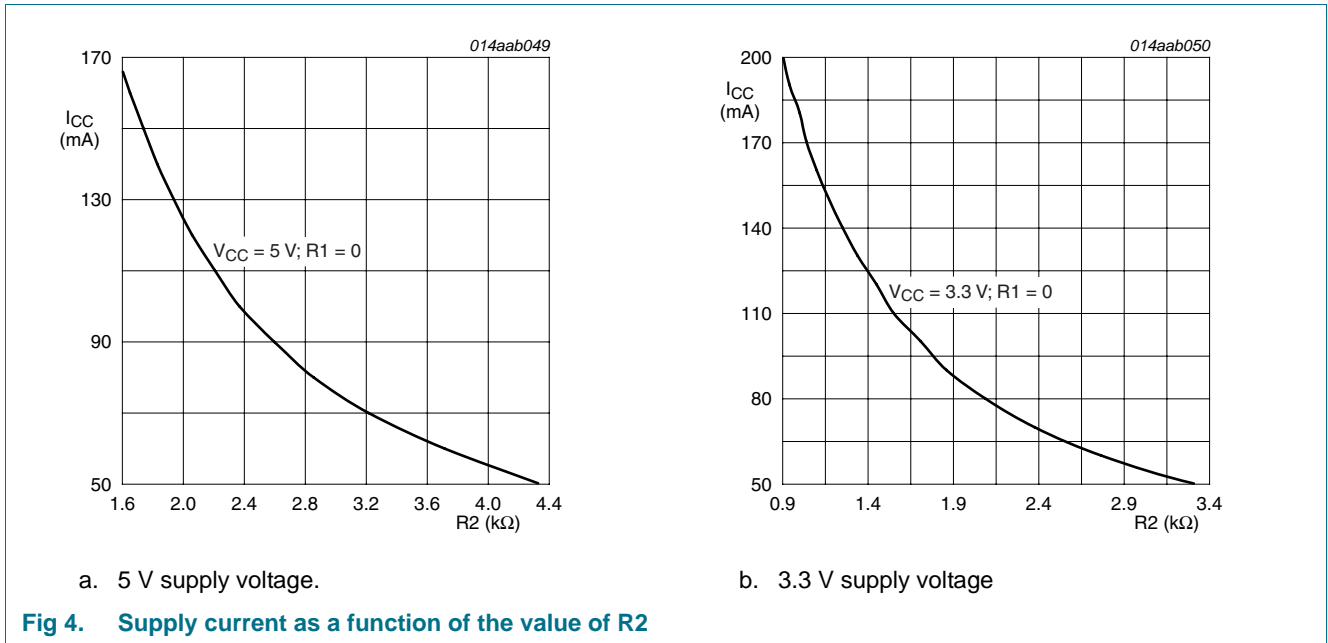
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC}$	supply current	$V_{CC} = 3.3\text{ V}$	[1] 50	-	200	mA
		$R1 = 0\ \Omega$ ; $R2 = 1330\ \Omega$	[2] 115	130	145	mA
		$R1 = 2.2\ \Omega$ ; $R2 = 1070\ \Omega$	[2] 135	160	185	mA
		$V_{CC} = 5.0\text{ V}$	[1] 50	-	170	mA
		$R1 = 0\ \Omega$ ; $R2 = 1960\ \Omega$	[2] 110	130	150	mA
		$R1 = 2.2\ \Omega$ ; $R2 = 1650\ \Omega$	[2] 125	150	175	mA
		during shutdown; pin $\overline{SHDN} = LOW$ (shutdown enabled)	-	4	6	$\mu A$

[1] The supply current is adjustable; see [Section 8.1 "Supply current adjustment"](#).

[2] See [Section 12 "Application information"](#).

### 8.1 Supply current adjustment

The supply current can be adjusted by changing the value of external ICQ resistor (R2); (see [Figure 4](#)).



## 9. Dynamic characteristics

**Table 8. Characteristics at V<sub>CC</sub> = 5 V**

Input and output impedances matched to 50 Ω, pin  $\overline{SHDN}$  = HIGH (shutdown disabled). Typical values at V<sub>CC</sub> = 5 V; I<sub>CC</sub> = 130 mA; T<sub>case</sub> = 25 °C; see [Section 12 “Application information”](#); unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f	frequency		[1] 400	-	2700	MHz
G <sub>p</sub>	power gain	for small signals				
		f = 940 MHz	-	22.7	-	dB
		f = 1960 MHz	-	16.4	-	dB
		f = 2140 MHz	14.5	16.0	17.5	dB
		f = 2445 MHz	[2]	14.2	-	dB
P <sub>L(1dB)</sub>	output power at 1 dB gain compression	f = 940 MHz	-	25.0	-	dBm
		f = 1960 MHz	-	24.5	-	dBm
		f = 2140 MHz	23.5	24.5	-	dBm
		f = 2445 MHz	[2]	23.5	-	dBm
IP <sub>3O</sub>	output third-order intercept point	f = 940 MHz	[3]	38.5	-	dBm
		f = 1960 MHz	[3]	38.0	-	dBm
		f = 2140 MHz	[3]	34.5	37.5	dBm
		f = 2445 MHz	[2][3]	36.0	-	dBm
NF	noise figure	f = 940 MHz	[4]	5.2	-	dB
		f = 1960 MHz	[4]	4.6	-	dB
		f = 2140 MHz	[4]	4.8	6.5	dB
		f = 2445 MHz	[2][4]	5.4	-	dB

**Table 8.** Characteristics at  $V_{CC} = 5\text{ V}$  ...continued

Input and output impedances matched to  $50\ \Omega$ , pin  $\overline{SHDN} = \text{HIGH}$  (shutdown disabled). Typical values at  $V_{CC} = 5\text{ V}$ ;  $I_{CC} = 130\text{ mA}$ ;  $T_{case} = 25\text{ }^\circ\text{C}$ ; see [Section 12 "Application information"](#); unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$RL_{in}$	input return loss	$f = 940\text{ MHz}$	-	-15	-	dB
		$f = 1960\text{ MHz}$	-	-11	-	dB
		$f = 2140\text{ MHz}$	-	-17	-	dB
		$f = 2445\text{ MHz}$	[2]	-13	-	dB
$RL_{out}$	output return loss	$f = 940\text{ MHz}$	-	-8	-	dB
		$f = 1960\text{ MHz}$	-	-12	-	dB
		$f = 2140\text{ MHz}$	-	-15	-	dB
		$f = 2445\text{ MHz}$	[2]	-25	-	dB

[1] Operation outside this range is possible but not guaranteed.

[2]  $I_{CC} = 150\text{ mA}$ ; see [Section 12 "Application information"](#).

[3]  $P_L = 11\text{ dBm}$  per tone; spacing = 1 MHz.

[4] Defined at  $P_1 = -40\text{ dBm}$ ; small signal conditions.

**Table 9. Characteristics at  $V_{CC} = 3.3$  V**

Input and output impedances matched to  $50 \Omega$ , pin  $\overline{SHDN} = HIGH$  (shutdown disabled). Typical values at  $V_{CC} = 3.3$  V;  $I_{CC} = 130$  mA;  $T_{case} = 25$  °C, see [Section 12 "Application information"](#); unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
f	frequency		[1] 400	-	2700	MHz	
$G_p$	power gain	for small signals					
		f = 940 MHz	-	22.5	-	dB	
		f = 2445 MHz	[2]	-	13.8	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	f = 940 MHz	-	23.5	-	dBm	
		f = 2445 MHz	[2]	-	22.0	-	dBm
IP3O	output third-order intercept point	f = 940 MHz	[3]	-	36.4	-	dBm
		f = 2445 MHz	[2][3]	-	35.2	-	dBm
NF	noise figure	f = 940 MHz	[4]	-	5.5	-	dB
		f = 2445 MHz	[2][4]	-	5.5	-	dB
RL <sub>in</sub>	input return loss	f = 940 MHz	-	-15	-	dB	
		f = 2445 MHz	[2]	-	-10	-	dB
RL <sub>out</sub>	output return loss	f = 940 MHz	-	-9	-	dB	
		f = 2445 MHz	[2]	-	-25	-	dB

[1] Operation outside this range is possible but not guaranteed.

[2]  $I_{CC} = 160$  mA; see [Section 12 "Application information"](#).

[3]  $P_L = 11$  dBm per tone; spacing = 1 MHz.

[4] Defined at  $P_1 = -40$  dBm; small signal conditions.



## 9.1 Scattering parameters

**Table 10. Scattering parameters at 5 V, MMIC only**

$V_{CC} = 5\text{ V}$ ;  $I_{CC} = 130\text{ mA}$ ;  $T_{case} = 25\text{ }^{\circ}\text{C}$ .

f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	Magnitude (ratio)	Angle (degree)	Magnitude (ratio)	Angle (degree)	Magnitude (ratio)	Angle (degree)	Magnitude (ratio)	Angle (degree)
400	0.85	161.56	22.94	82.35	0.01	17.02	0.46	-156.50
500	0.90	159.44	11.82	82.58	0.01	27.08	0.63	176.13
600	0.90	152.15	9.98	73.86	0.01	24.10	0.64	169.61
700	0.89	145.75	8.59	66.00	0.01	21.41	0.64	164.34
800	0.88	139.33	7.55	58.86	0.02	18.47	0.65	159.29
900	0.87	133.19	6.74	51.66	0.02	14.00	0.65	154.44
1000	0.87	127.07	6.14	45.11	0.02	11.25	0.65	149.58
1100	0.87	120.67	5.61	38.20	0.02	7.99	0.65	144.25
1200	0.87	114.18	5.19	31.60	0.02	4.20	0.64	139.60
1300	0.86	107.68	4.82	25.08	0.02	0.31	0.64	134.85
1400	0.86	100.86	4.51	18.49	0.02	-4.01	0.63	130.13
1500	0.86	94.14	4.23	11.74	0.02	-8.65	0.63	125.02
1600	0.86	87.48	3.99	5.25	0.03	-13.15	0.63	120.13
1700	0.86	80.83	3.77	-1.50	0.03	-18.16	0.62	114.98
1800	0.86	74.14	3.56	-8.13	0.03	-23.28	0.62	109.78
1900	0.86	67.39	3.37	-14.94	0.03	-28.54	0.62	104.46
2000	0.86	60.70	3.19	-21.68	0.03	-33.68	0.63	99.01
2100	0.86	53.97	3.02	-28.68	0.03	-39.37	0.63	93.58
2200	0.86	47.78	2.85	-35.14	0.03	-44.84	0.63	88.17
2300	0.86	41.57	2.69	-41.70	0.03	-50.27	0.64	83.06
2400	0.86	35.43	2.54	-48.11	0.03	-55.62	0.64	78.10
2500	0.86	29.74	2.39	-54.19	0.04	-60.71	0.65	73.31
2600	0.86	24.79	2.27	-60.06	0.04	-65.48	0.65	68.64
2700	0.85	19.58	2.15	-66.14	0.04	-70.66	0.66	64.16

**Table 11. Scattering parameters at 3.3 V, MMIC only** $V_{CC} = 3.3\text{ V}$ ;  $I_{CC} = 130\text{ mA}$ ;  $T_{case} = 25\text{ }^{\circ}\text{C}$ .

f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	Magnitude (ratio)	Angle (degree)	Magnitude (ratio)	Angle (degree)	Magnitude (ratio)	Angle (degree)	Magnitude (ratio)	Angle (degree)
400	0.84	161.94	21.25	73.81	0.01	17.66	0.57	-154.41
500	0.91	159.25	11.56	79.01	0.01	28.15	0.65	178.05
600	0.90	151.98	9.67	70.71	0.01	24.80	0.66	171.32
700	0.90	145.57	8.29	63.37	0.01	21.89	0.66	165.59
800	0.89	139.18	7.26	56.54	0.02	19.04	0.66	160.37
900	0.88	132.87	6.48	49.74	0.02	15.35	0.66	155.28
1000	0.88	126.78	5.90	43.30	0.02	11.89	0.66	150.23
1100	0.87	120.46	5.39	36.53	0.02	8.33	0.66	144.88
1200	0.87	113.94	4.97	30.05	0.02	4.50	0.65	140.03
1300	0.87	107.48	4.62	23.62	0.02	0.35	0.65	135.35
1400	0.87	100.69	4.32	17.15	0.02	-3.92	0.64	130.48
1500	0.86	93.93	4.05	10.48	0.02	-8.62	0.64	125.46
1600	0.86	87.28	3.81	4.05	0.03	-13.28	0.64	120.31
1700	0.86	80.71	3.61	-2.66	0.03	-18.26	0.64	115.13
1800	0.86	74.00	3.40	-9.21	0.03	-23.51	0.64	109.99
1900	0.86	67.27	3.22	-15.97	0.03	-28.87	0.63	104.66
2000	0.86	60.64	3.05	-22.71	0.03	-34.22	0.64	99.36
2100	0.86	53.84	2.89	-29.68	0.03	-39.95	0.64	93.93
2200	0.86	47.60	2.72	-36.12	0.03	-45.44	0.64	88.55
2300	0.86	41.43	2.57	-42.66	0.03	-51.06	0.65	83.38
2400	0.86	35.35	2.42	-49.01	0.04	-56.53	0.65	78.44
2500	0.85	29.64	2.28	-55.12	0.04	-61.72	0.66	73.56
2600	0.85	24.72	2.16	-60.91	0.04	-66.76	0.66	68.80
2700	0.85	19.59	2.04	-66.91	0.04	-71.84	0.67	64.30

## 10. Reliability information

**Table 12. Reliability**

Life test	Conditions	Intrinsic failure rate
HTOL	According JESD85; confidence level 60 %; $T_j = 55\text{ }^{\circ}\text{C}$ ; activation energy = 0.7 eV; acceleration factor determined according Arrhenius	4

## 11. Moisture sensitivity

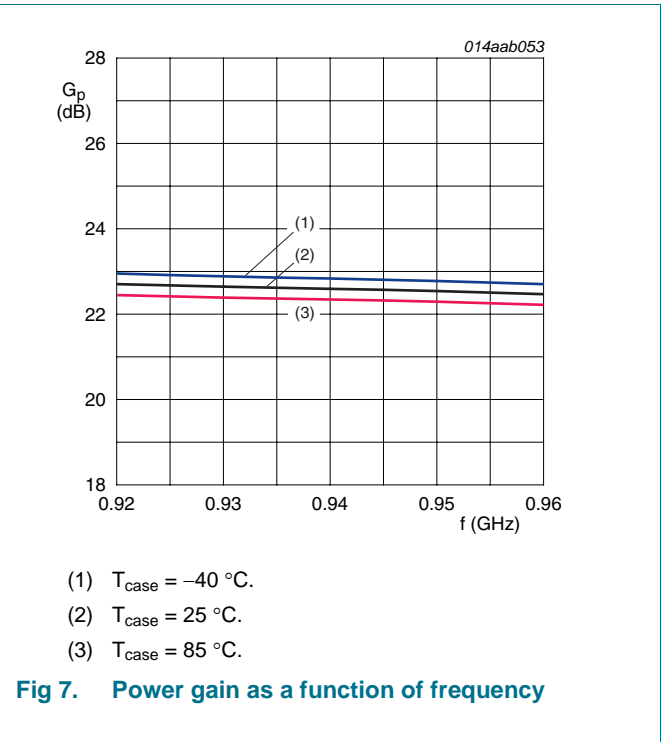
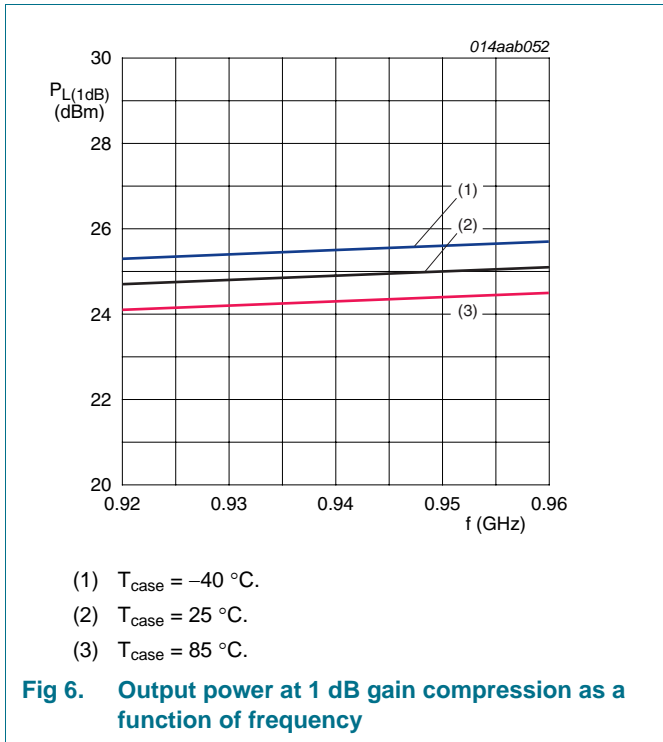
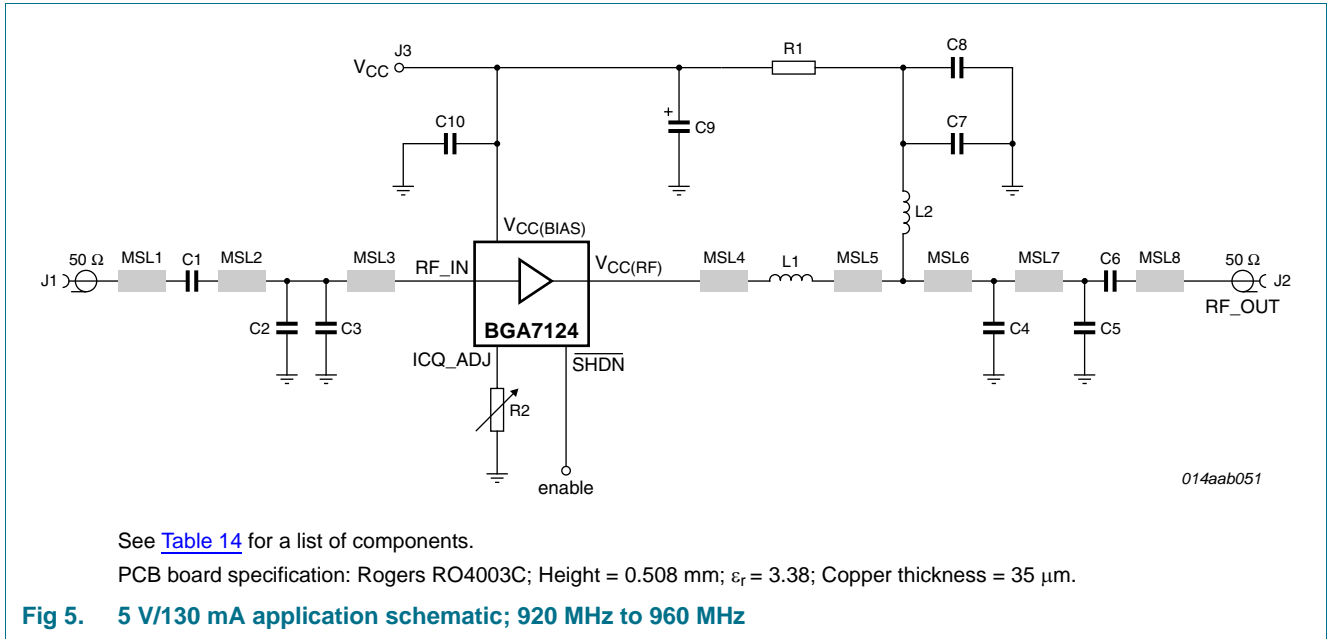
**Table 13. Moisture sensitivity level**

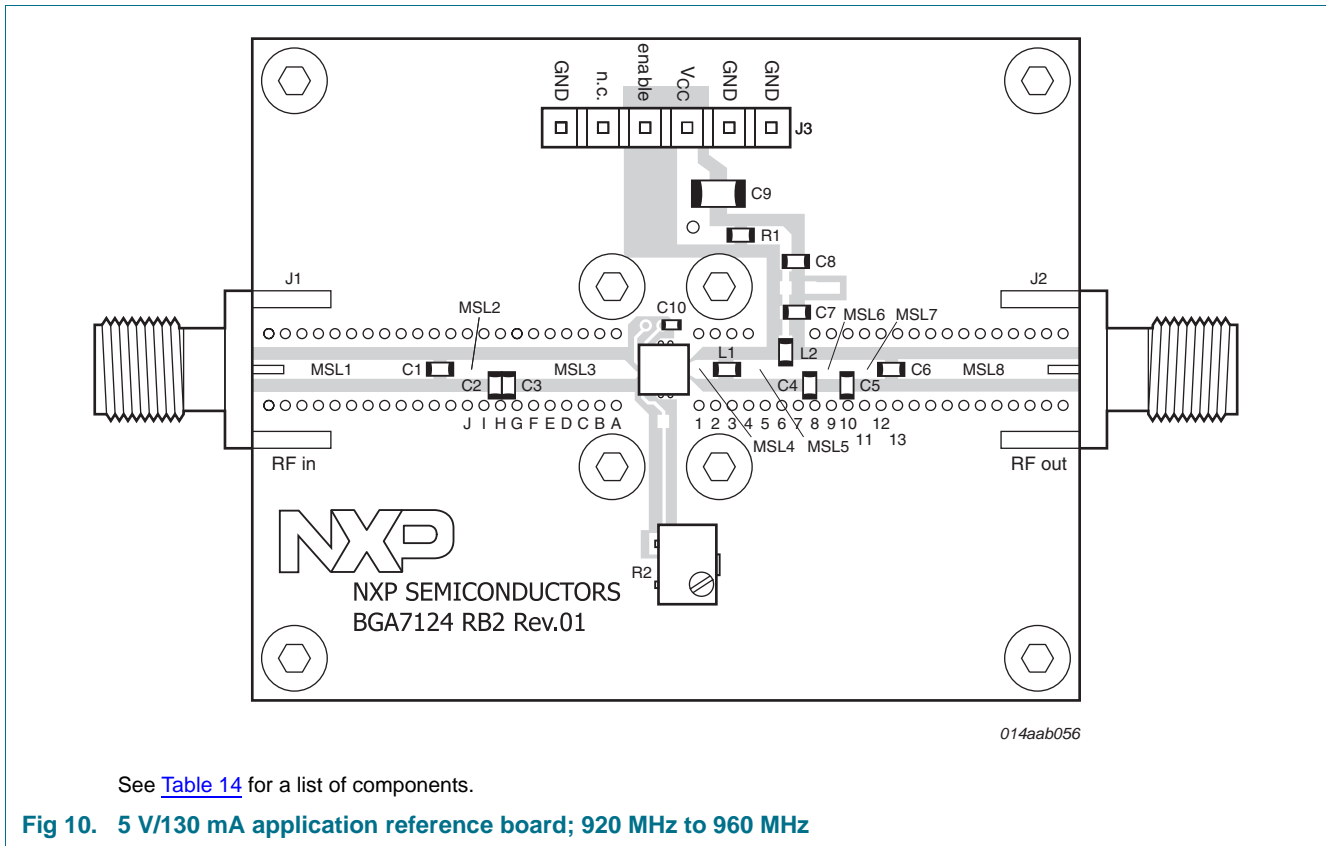
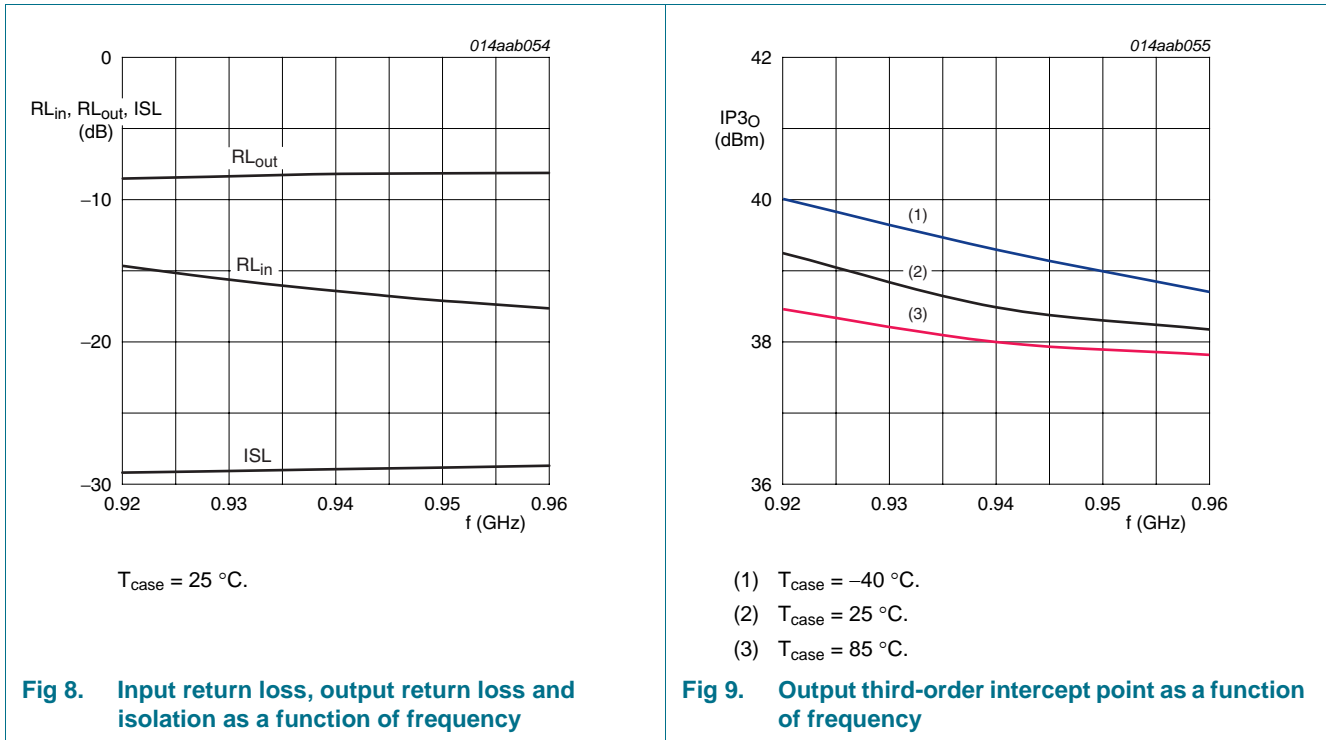
Test methodology	Class
JESD-22-A113	1

## 12. Application information

### 12.1 5 V applications

#### 12.1.1 920 MHz to 960 MHz





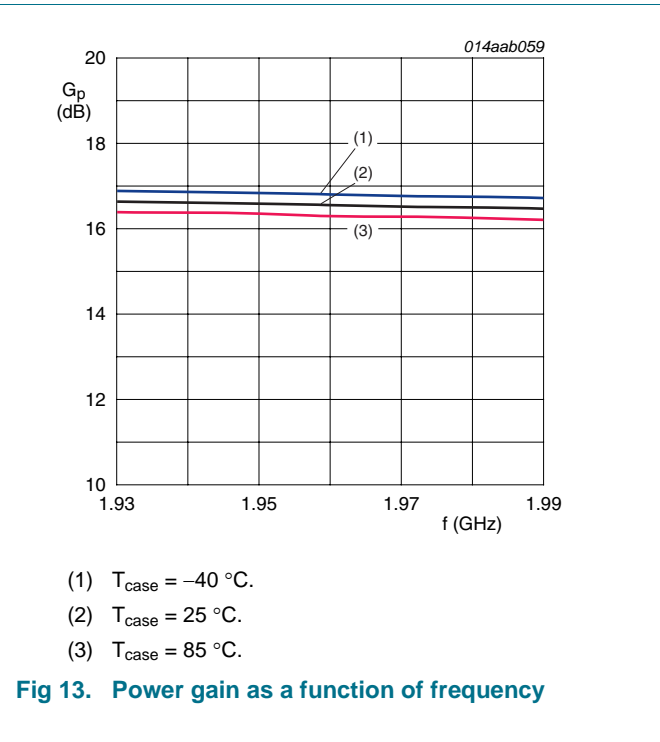
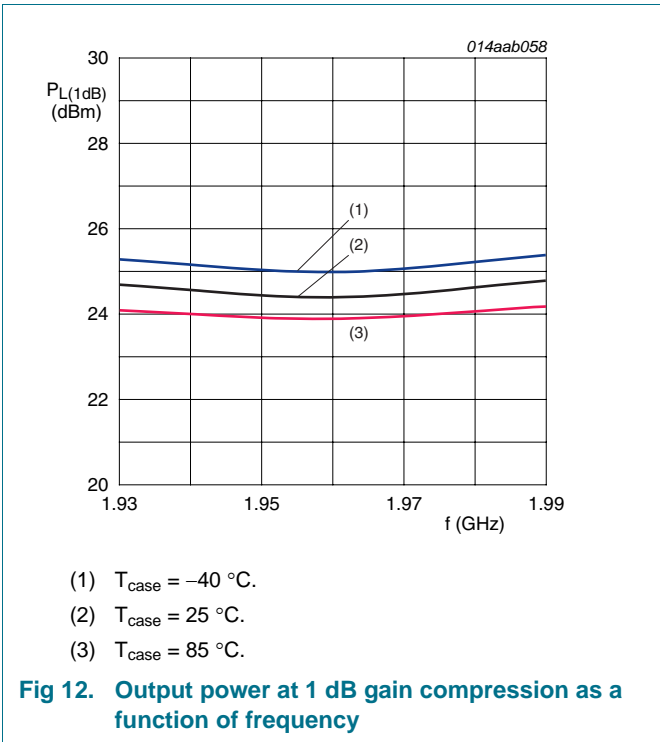
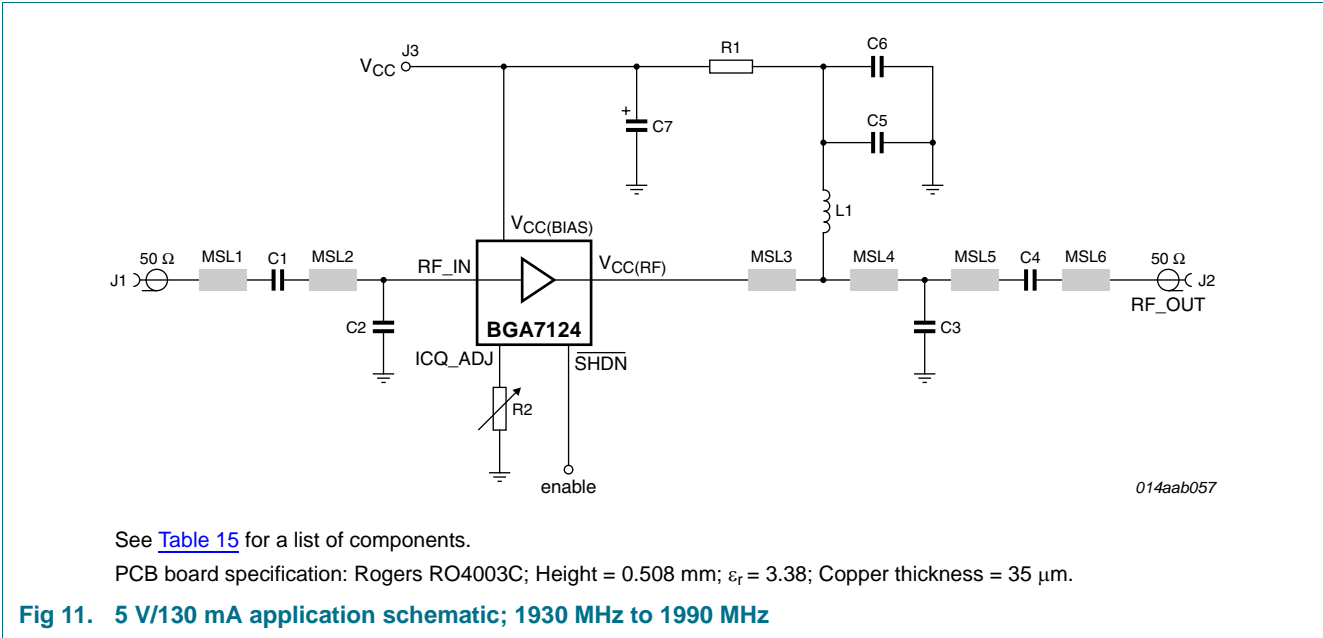
**Table 14. 5 V/130 mA application list of components; 920 MHz to 960 MHz**

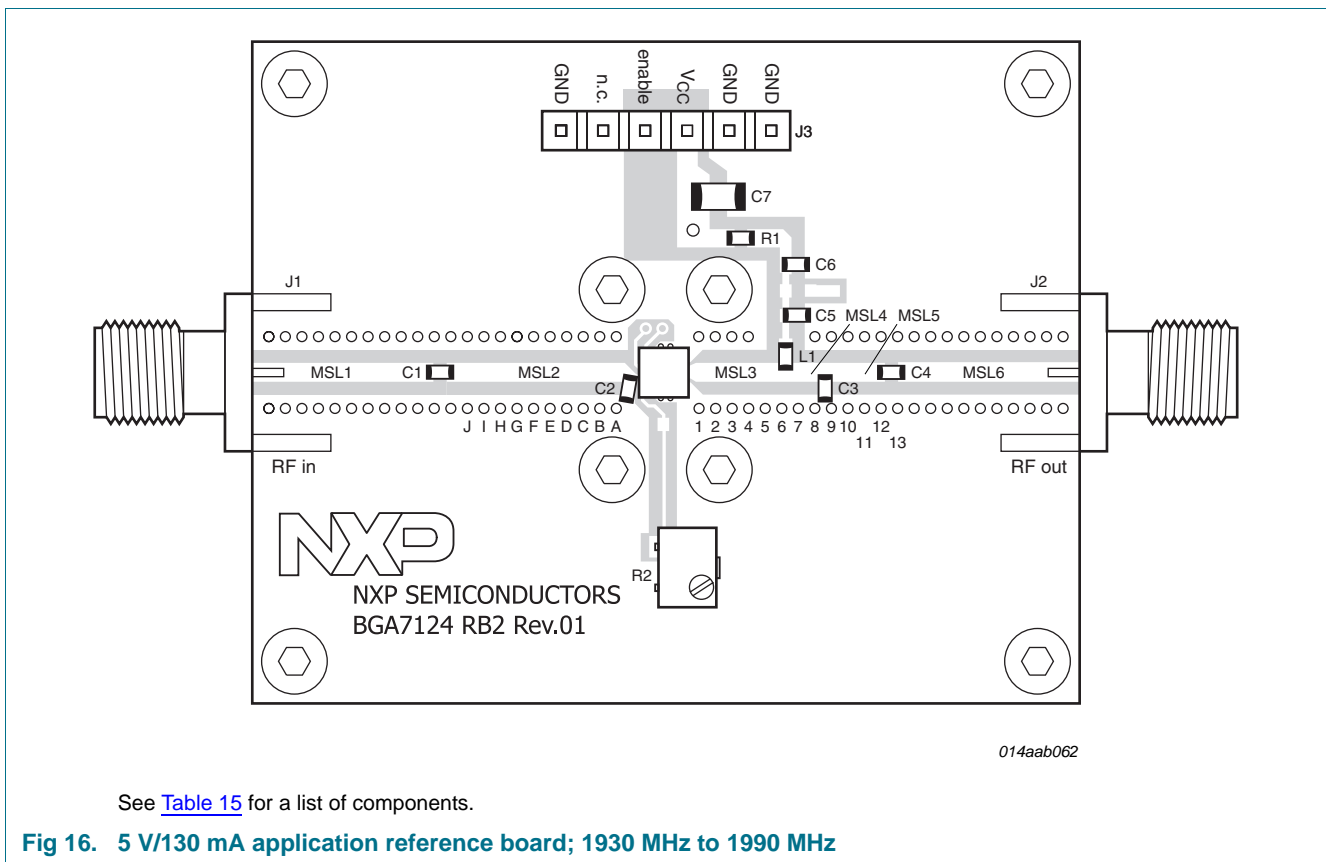
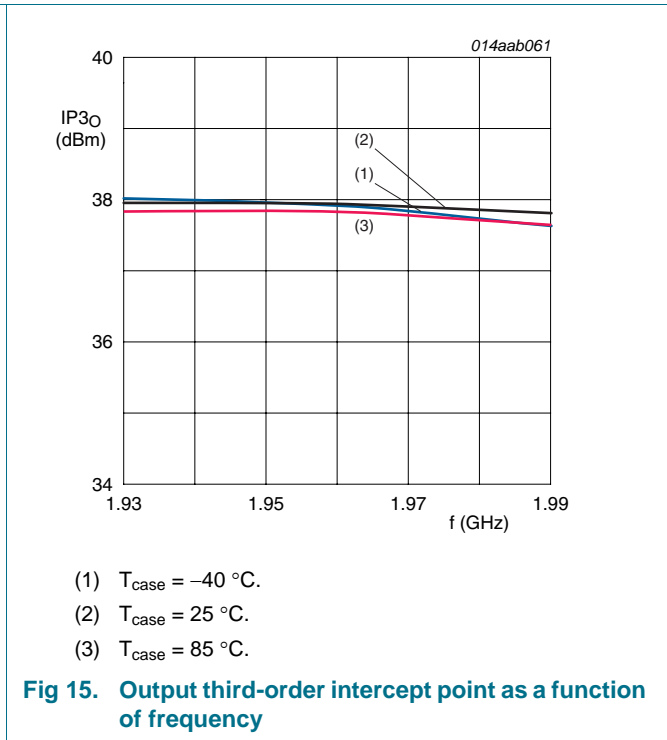
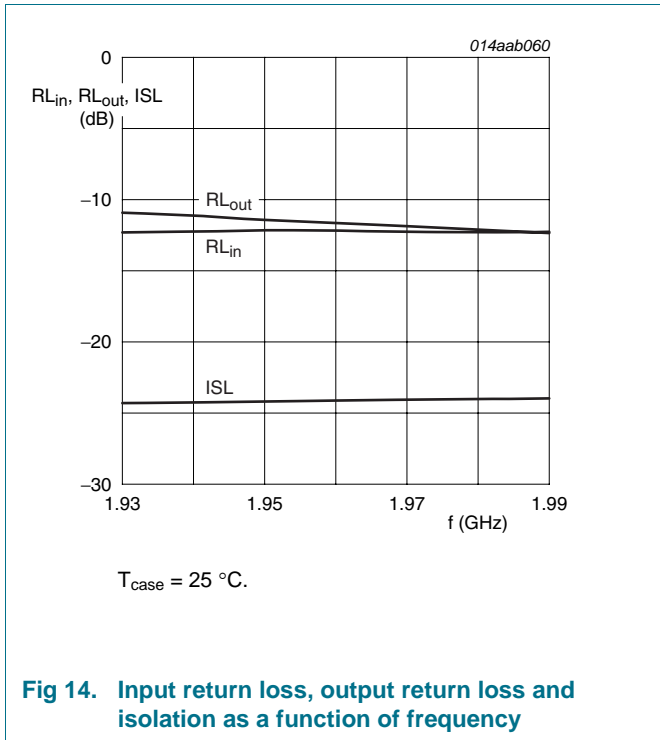
See [Figure 5](#) and [Figure 10](#) for component layout. Printed-Circuit Board (PCB): Rogers RO4003C stack; height = 0.508 mm; copper plating thickness = 35  $\mu\text{m}$ .

Component	Description	Value	Function	Remarks
C1, C6	capacitor	68 pF	DC blocking	Murata GRM1885C1H680JA01D
C2, C3	capacitor	3.3 pF	input match	Murata GRM1885C1H3R3CZ01D
C4	capacitor	3.9 pF	output match	Murata GRM1885C1H3R9CZ01D
C5	capacitor	1.0 pF	output match	Murata GRM1885C1H1R0CZ01D
C7	capacitor	68 pF	RF decoupling	Murata GRM1885C1H680JA01D
C8	capacitor	100 nF	DC decoupling	AVX 0603YC104KAT2A
C9	capacitor	10 $\mu\text{F}$	DC decoupling	AVX 1206ZG106ZAT2A
C10	capacitor	12 pF	noise decoupling	Murata GRM1555C1H120JZ01D
J1, J2	RF connector	SMA		Emerson Network Power 142-0701-841
J3	DC connector	6-pins		MOLEX
L1	inductor	2.2 nH	output match	Tyco electronics 36501J2N2JTDG
L2	inductor	22 nH	DC feed	Tyco electronics 36501J022JTDG
MSL1 <sup>[1]</sup>	micro stripline	1.14 mm $\times$ 0.8 mm $\times$ 10.95 mm	input match	
MSL2 <sup>[1]</sup>	micro stripline	1.14 mm $\times$ 0.8 mm $\times$ 2.95 mm	input match	
MSL3 <sup>[1]</sup>	micro stripline	1.14 mm $\times$ 0.8 mm $\times$ 7.75 mm	input match	
MSL4 <sup>[1]</sup>	micro stripline	1.14 mm $\times$ 0.8 mm $\times$ 23.4 mm	output match	
MSL5 <sup>[1]</sup>	micro stripline	1.14 mm $\times$ 0.8 mm $\times$ 2.2 mm	output match	
MSL6 <sup>[1]</sup>	micro stripline	1.14 mm $\times$ 0.8 mm $\times$ 3.15 mm	output match	
MSL7 <sup>[1]</sup>	micro stripline	1.14 mm $\times$ 0.8 mm $\times$ 2.3 mm	output match	
MSL8 <sup>[1]</sup>	micro stripline	1.14 mm $\times$ 0.8 mm $\times$ 10.95 mm	output match	
R1	resistor	0 $\Omega$		Multicomp MC 0.063W 0603 0R
R2	resistor (trimmer)	2 k $\Omega$	bias adjustment	Bourns 3214W-1-202E

[1] MSL1 to MSL8 dimensions specified as Width (W), Spacing (S) and Length (L).

12.1.2 1930 MHz to 1990 MHz





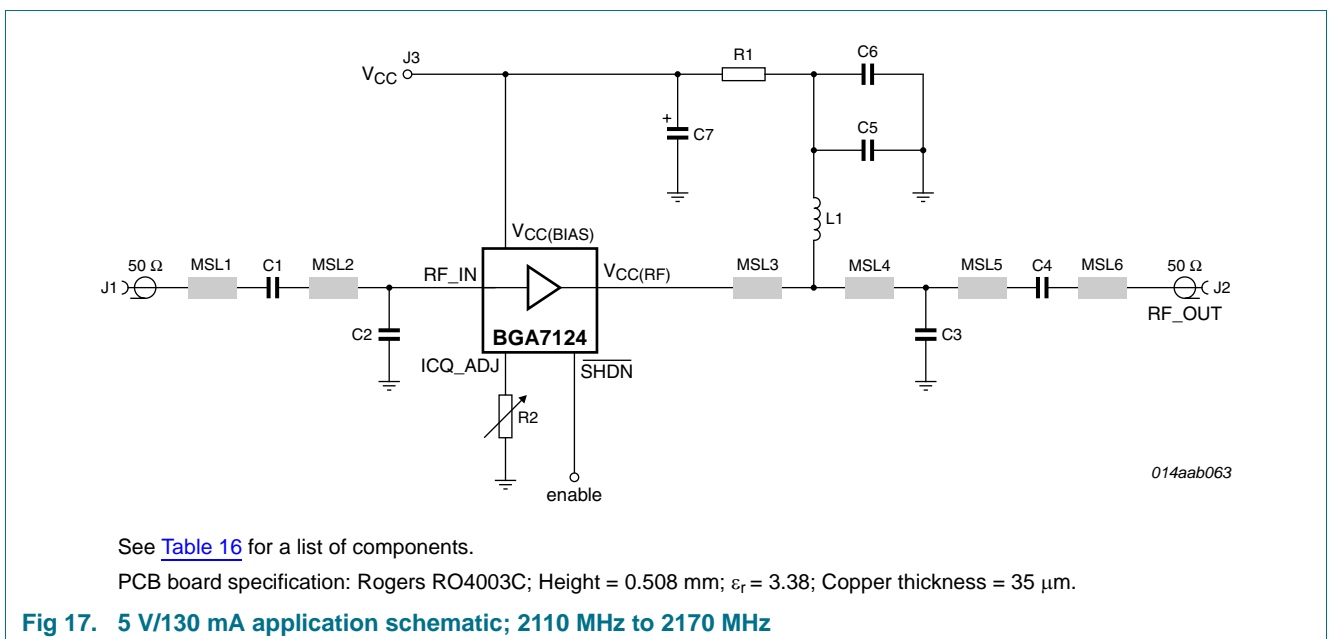
**Table 15. 5 V/130 mA application list of components; 1930 MHz to 1990 MHz**

See [Figure 11](#) and [Figure 16](#) for component layout. Printed-Circuit Board (PCB): Rogers RO4003C stack; height = 0.508 mm; copper plating thickness = 35 μm.

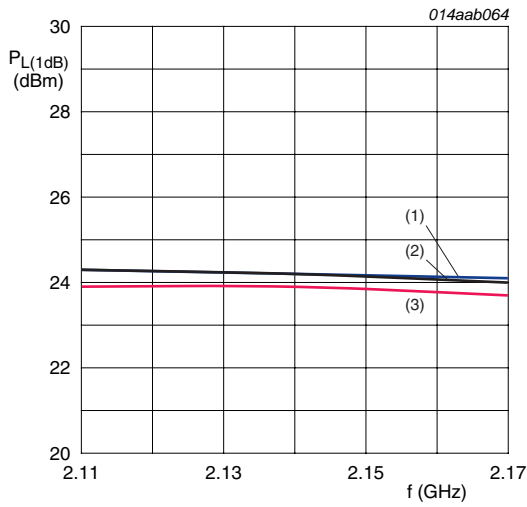
Component	Description	Value	Function	Remarks
C1, C4	capacitor	15 pF	DC blocking	Murata GRM1885C1H150JA01D
C2	capacitor	2.2 pF	input match	Murata GRM1885C1H2R2CZ01D
C3	capacitor	1.2 pF	output match	Murata GRM1885C1H1R2CZ01D
C5	capacitor	15 pF	RF decoupling	Murata GRM1885C1H150JA01D
C6	capacitor	100 nF	DC decoupling	AVX 0603YC104KAT2A
C7	capacitor	10 μF	DC decoupling	AVX 1206ZG106ZAT2A
J1, J2	RF connector	SMA		Emerson Network Power 142-0701-841
J3	DC connector	6-pins		MOLEX
L1	inductor	22 nH	DC feed	Tyco electronics 36501J022JTDG
MSL1 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.95 mm	input match	
MSL2 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.8 mm	input match	
MSL3 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 5.8 mm	output match	
MSL4 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 2.2 mm	output match	
MSL5 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 3.7 mm	output match	
MSL6 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.95 mm	output match	
R1	resistor	0 Ω		Multicomp MC 0.063W 0603 0R
R2	resistor (trimmer)	2 kΩ	bias adjustment	Bourns 3214W-1-202E

[1] MSL1 to MSL6 dimensions specified as Width (W), Spacing (S) and Length (L).

### 12.1.3 2110 MHz to 2170 MHz

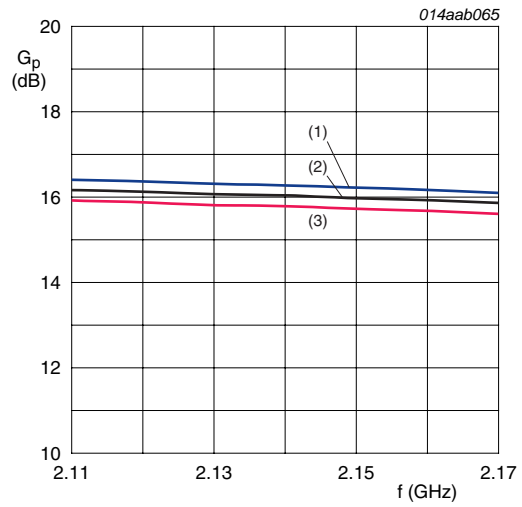






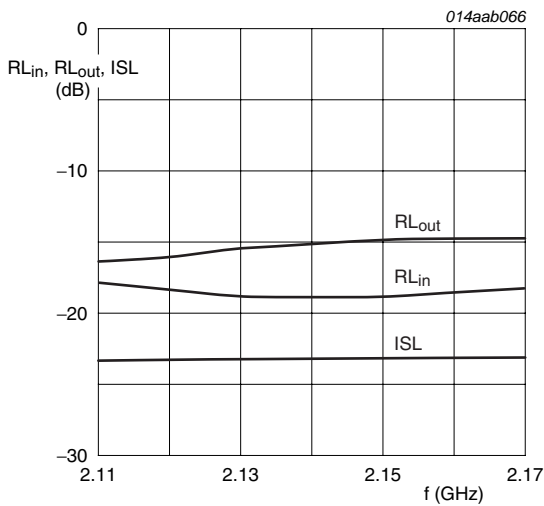
- (1)  $T_{case} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{case} = 25\text{ }^{\circ}\text{C}$ .
- (3)  $T_{case} = 85\text{ }^{\circ}\text{C}$ .

Fig 18. Output power at 1 dB gain compression as a function of frequency



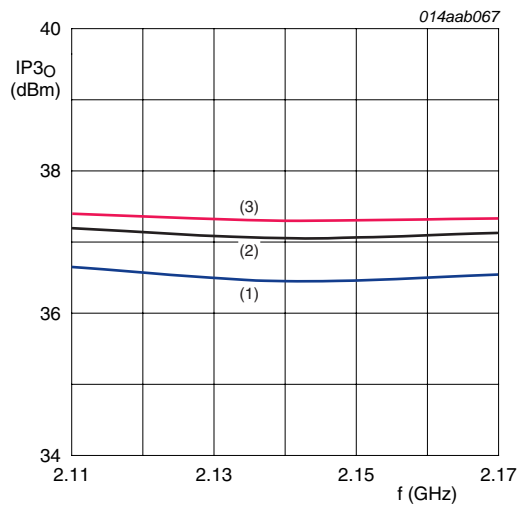
- (1)  $T_{case} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{case} = 25\text{ }^{\circ}\text{C}$ .
- (3)  $T_{case} = 85\text{ }^{\circ}\text{C}$ .

Fig 19. Power gain as a function of frequency



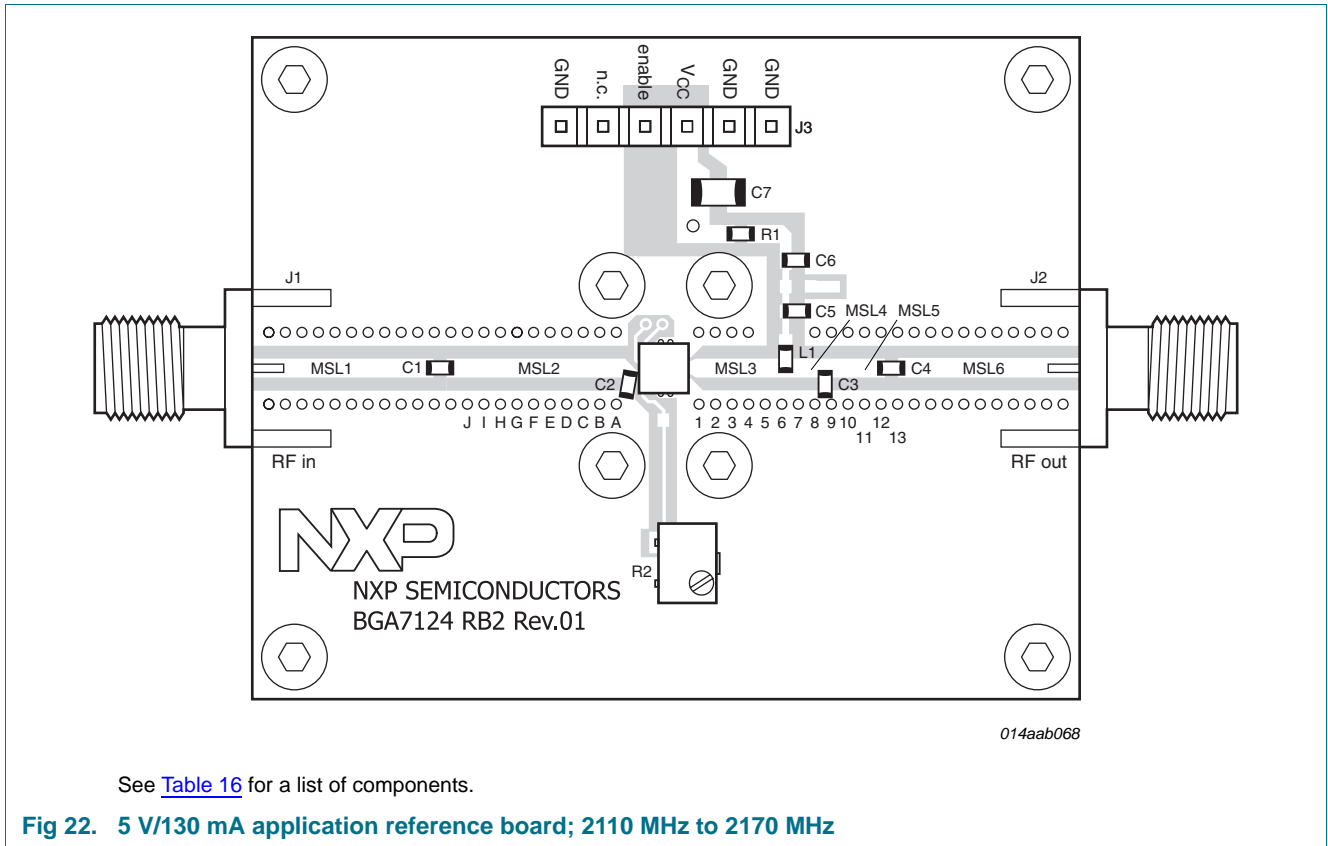
$T_{case} = 25\text{ }^{\circ}\text{C}$ .

Fig 20. Input return loss, output return loss and isolation as a function of frequency



- (1)  $T_{case} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{case} = 25\text{ }^{\circ}\text{C}$ .
- (3)  $T_{case} = 85\text{ }^{\circ}\text{C}$ .

Fig 21. Output third-order intercept point as a function of frequency



**Table 16. 5 V/130 mA application list of components; 2110 MHz to 2170 MHz**

See [Figure 17](#) and [Figure 22](#) for component layout. Printed-Circuit Board (PCB): Rogers RO4003C stack; height = 0.508 mm; copper plating thickness = 35 μm.

Component	Description	Value	Function	Remarks
C1, C4	capacitor	15 pF	DC blocking	Murata GRM1885C1H150JA01D
C2	capacitor	2.7 pF	input match	Murata GRM1885C1H2R7CZ01D
C3	capacitor	1.5 pF	output match	Murata GRM1885C1H1R5CZ01D
C5	capacitor	15 pF	RF decoupling	Murata GRM1885C1H150JA01D
C6	capacitor	100 nF	DC decoupling	AVX 0603YC104KAT2A
C7	capacitor	10 μF	DC decoupling	AVX 1206ZG106ZAT2A
J1, J2	RF connector	SMA		Emerson Network Power 142-0701-841
J3	DC connector	6-pins		MOLEX
L1	inductor	22 nH	DC feed	Tyco electronics 36501J022JTDG
MSL1 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.95 mm	input match	
MSL2 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.8 mm	input match	
MSL3 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 5.8 mm	output match	
MSL4 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 2.5 mm	output match	
MSL5 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 3.5 mm	output match	

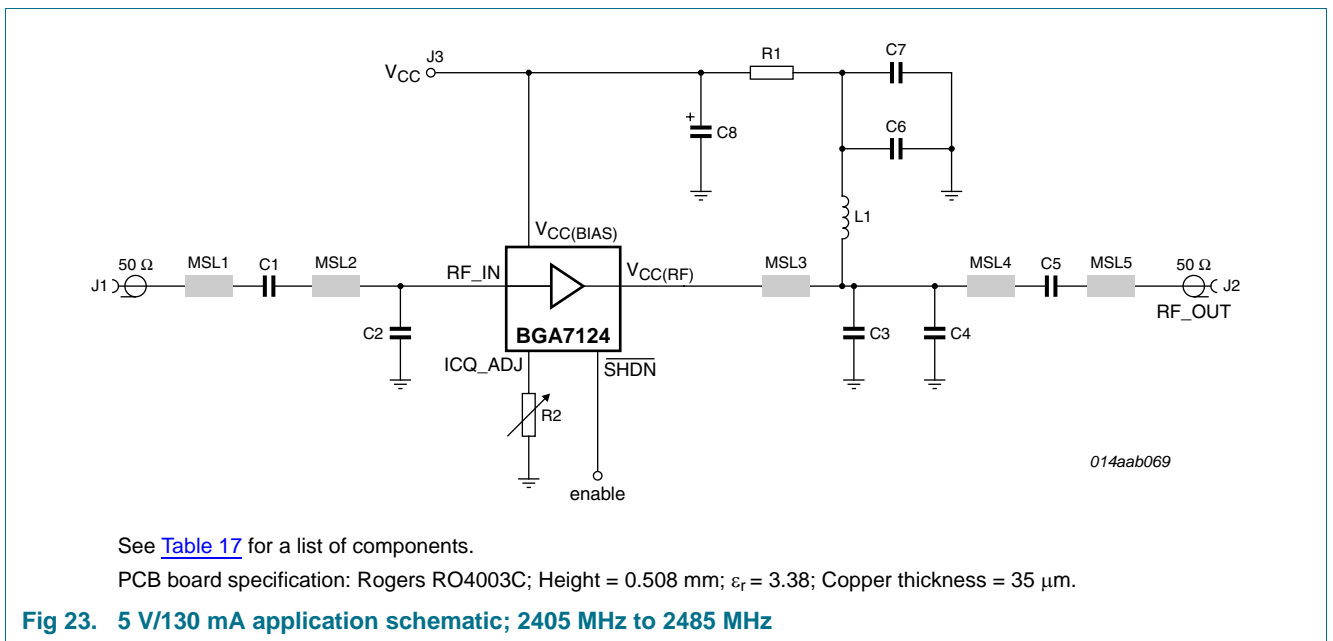
**Table 16. 5 V/130 mA application list of components; 2110 MHz to 2170 MHz ...continued**

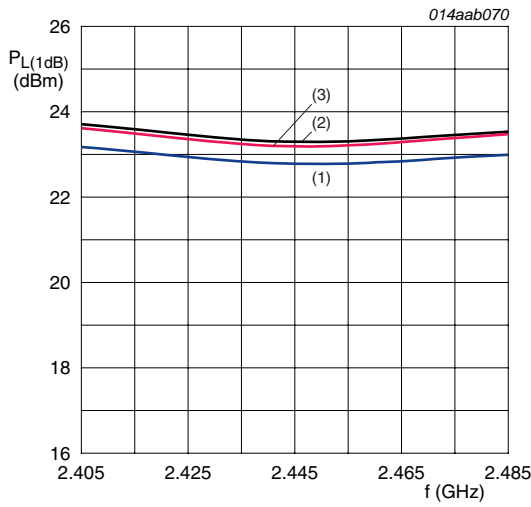
See [Figure 17](#) and [Figure 22](#) for component layout. Printed-Circuit Board (PCB): Rogers RO4003C stack; height = 0.508 mm; copper plating thickness = 35 μm.

Component	Description	Value	Function	Remarks
MSL6 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.95 mm	output match	
R1	resistor	0 Ω		Multicomp MC 0.063W 0603 0R
R2	resistor (trimmer)	2 kΩ	bias adjustment	Bourns 3214W-1-202E

[1] MSL1 to MSL6 dimensions specified as Width (W), Spacing (S) and Length (L).

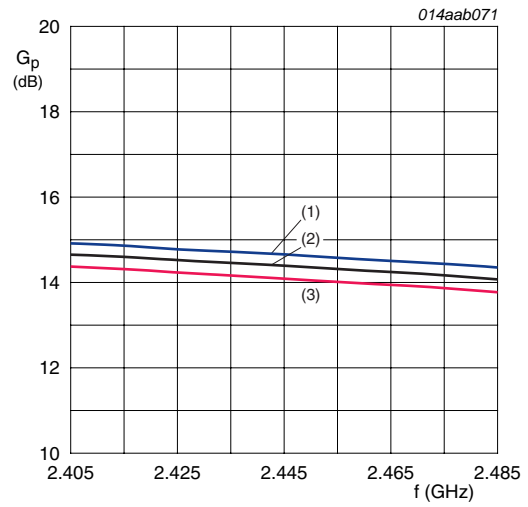
**12.1.4 2405 MHz to 2485 MHz**





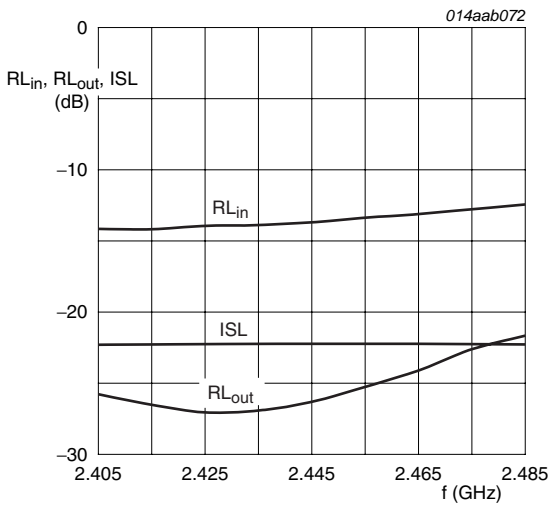
- (1) T<sub>case</sub> = -40 °C.
- (2) T<sub>case</sub> = 25 °C.
- (3) T<sub>case</sub> = 85 °C.

Fig 24. Output power at 1 dB gain compression as a function of frequency



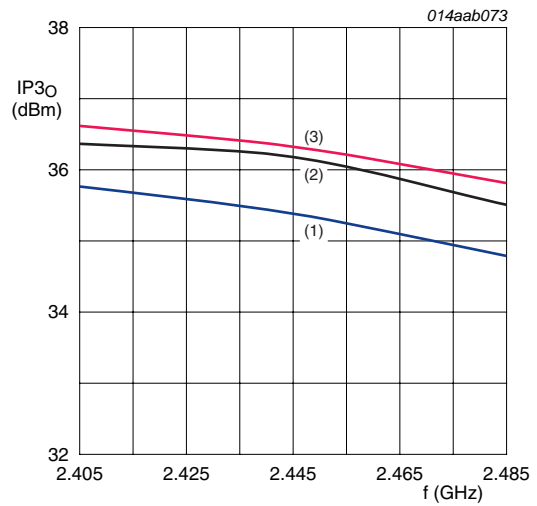
- (1) T<sub>case</sub> = -40 °C.
- (2) T<sub>case</sub> = 25 °C.
- (3) T<sub>case</sub> = 85 °C.

Fig 25. Power gain as a function of frequency



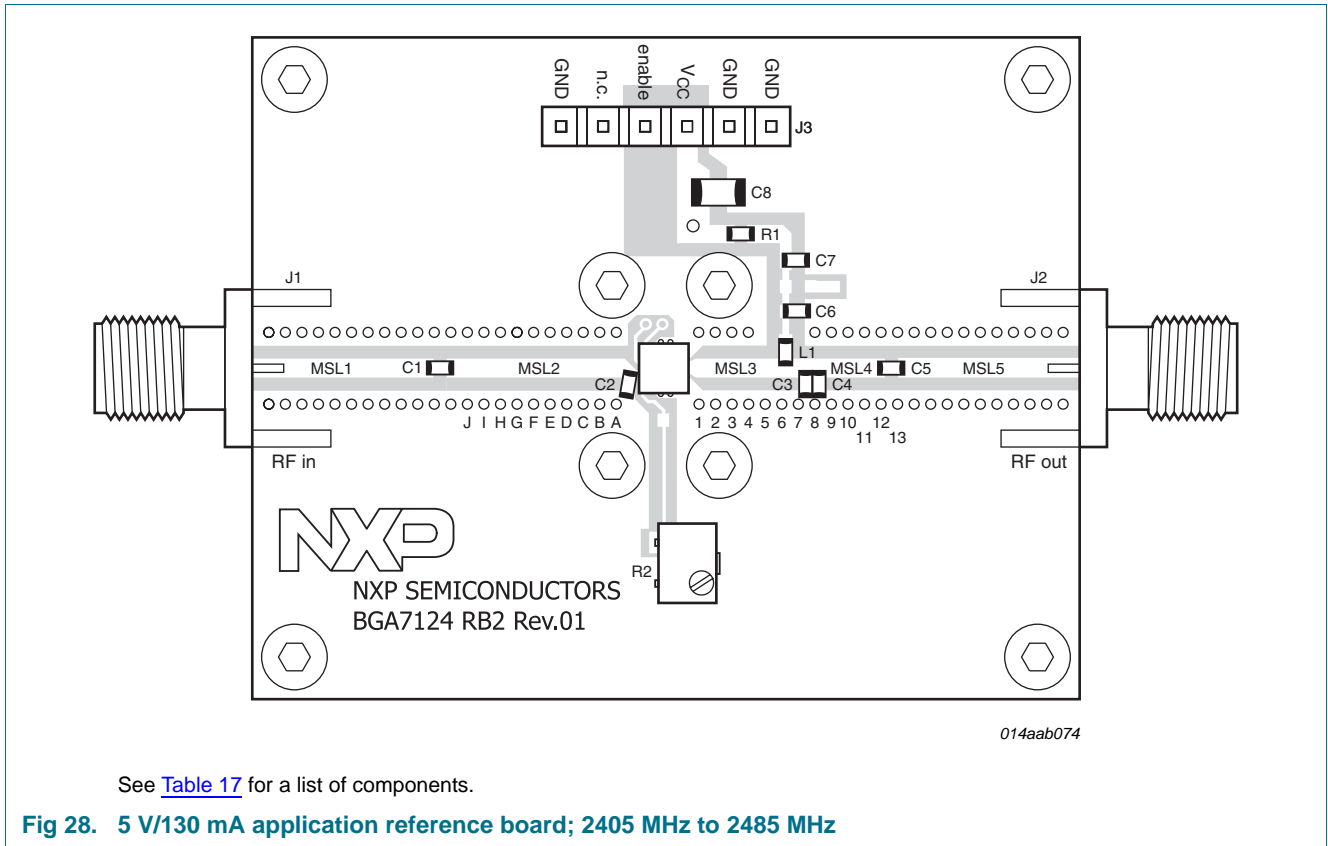
T<sub>case</sub> = 25 °C.

Fig 26. Input return loss, output return loss and isolation as a function of frequency



- (1) T<sub>case</sub> = -40 °C.
- (2) T<sub>case</sub> = 25 °C.
- (3) T<sub>case</sub> = 85 °C.

Fig 27. Output third-order intercept point as a function of frequency



**Table 17. 5 V/130 mA application list of components; 2405 MHz to 2485 MHz**

See [Figure 23](#) and [Figure 28](#) for component layout. Printed-Circuit Board (PCB): Rogers RO4003C stack; height = 0.508 mm; copper plating thickness = 35 μm.

Component	Description	Value	Function	Remarks
C1, C5	capacitor	12 pF	DC blocking	Murata GRM1885C1H120JA01D
C2	capacitor	2.2 pF	input match	Murata GRM1885C1H2R2CZ01D
C3	capacitor	0.82 pF	output match	Murata GRM1885C1HR82CZ01D
C4	capacitor	0.68 pF	output match	Murata GRM1885C1HR68CZ01D
C6	capacitor	12 pF	RF decoupling	Murata GRM1885C1H120JA01D
C7	capacitor	100 nF	DC decoupling	AVX 0603YC104KAT2A
C8	capacitor	10 μF	DC decoupling	AVX 1206ZG106ZAT2A
J1, J2	RF connector	SMA		Emerson Network Power 142-0701-841
J3	DC connector	6-pins		MOLEX
L1	inductor	22 nH	DC feed	Tyco electronics 36501J022JTDG
MSL1 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.95 mm	input match	
MSL2 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.8 mm	input match	
MSL3 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 7.3 mm	output match	
MSL4 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 4.3 mm	output match	

**Table 17. 5 V/130 mA application list of components; 2405 MHz to 2485 MHz ...continued**

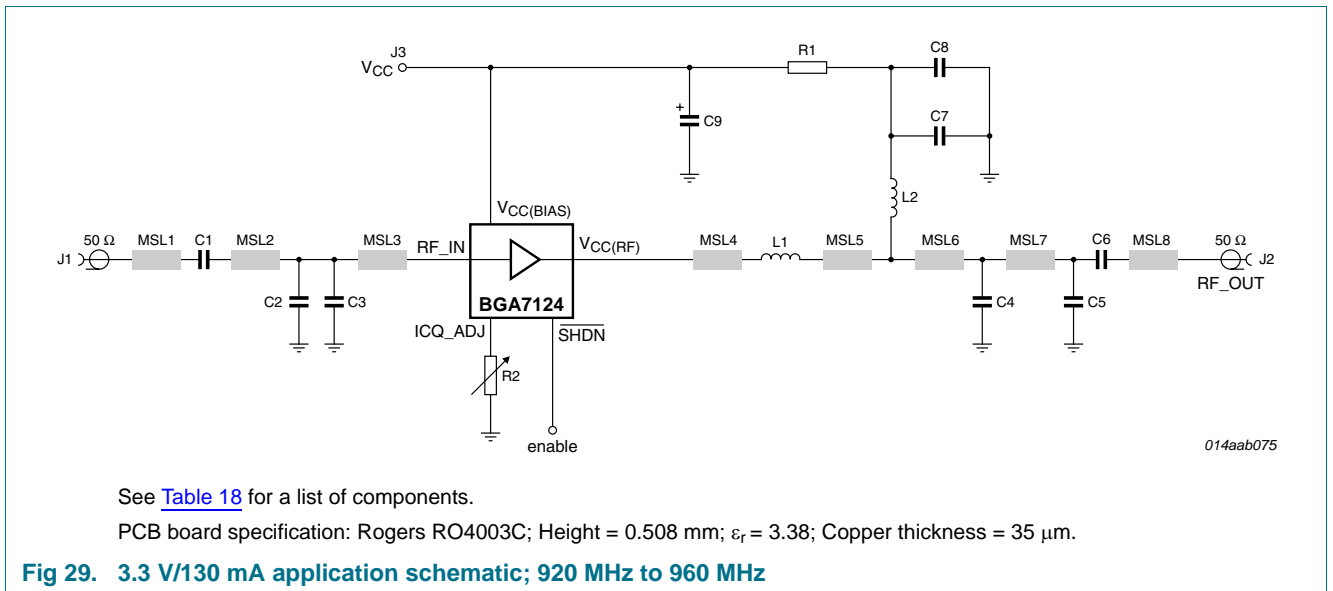
See [Figure 23](#) and [Figure 28](#) for component layout. Printed-Circuit Board (PCB): Rogers RO4003C stack; height = 0.508 mm; copper plating thickness = 35 μm.

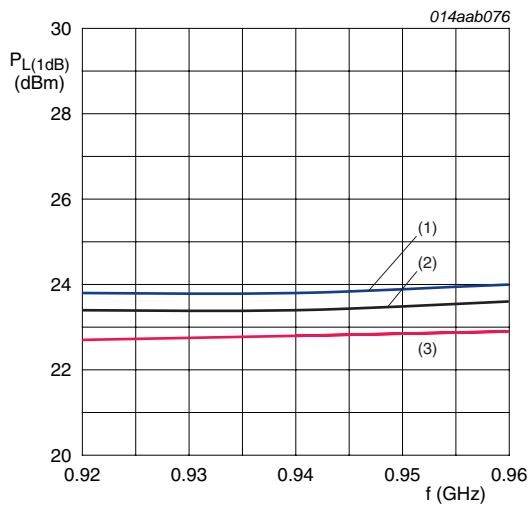
Component	Description	Value	Function	Remarks
MSL5 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.95 mm	output match	
R1	resistor	2.2 Ω		Multicomp MC 0.063W 0603 2R2
R2	resistor (trimmer)	2 kΩ	bias adjustment	Bourns 3214W-1-202E

[1] MSL1 to MSL5 dimensions specified as Width (W), Spacing (S) and Length (L).

## 12.2 3.3 V applications

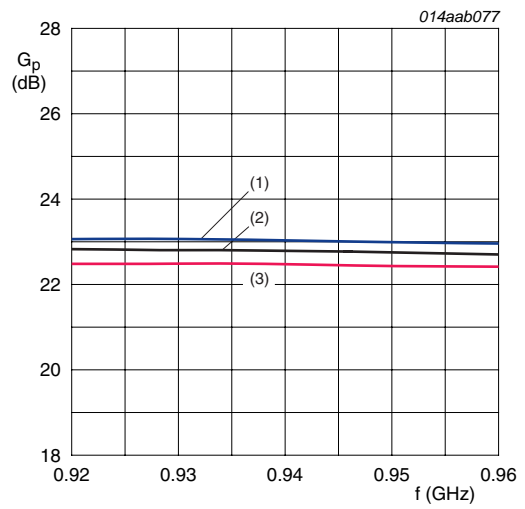
### 12.2.1 920 MHz to 960 MHz





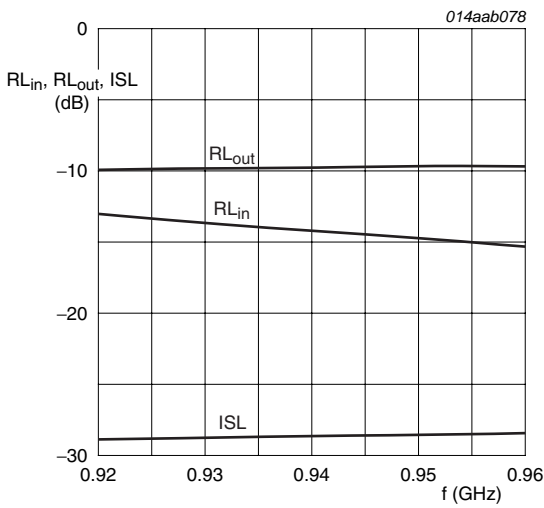
- (1)  $T_{case} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{case} = 25\text{ }^{\circ}\text{C}$ .
- (3)  $T_{case} = 85\text{ }^{\circ}\text{C}$ .

Fig 30. Output power at 1 dB gain compression as a function of frequency



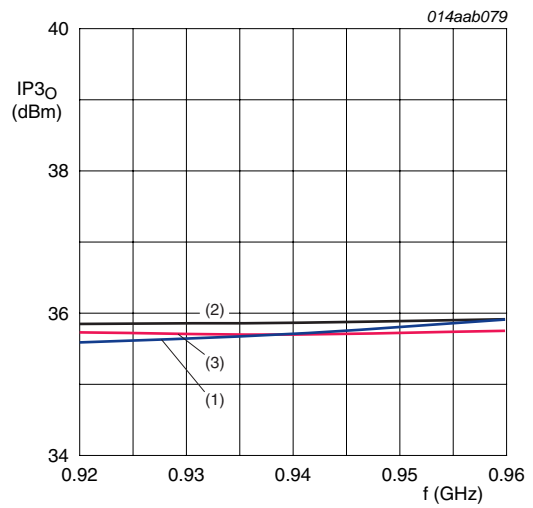
- (1)  $T_{case} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{case} = 25\text{ }^{\circ}\text{C}$ .
- (3)  $T_{case} = 85\text{ }^{\circ}\text{C}$ .

Fig 31. Power gain as a function of frequency



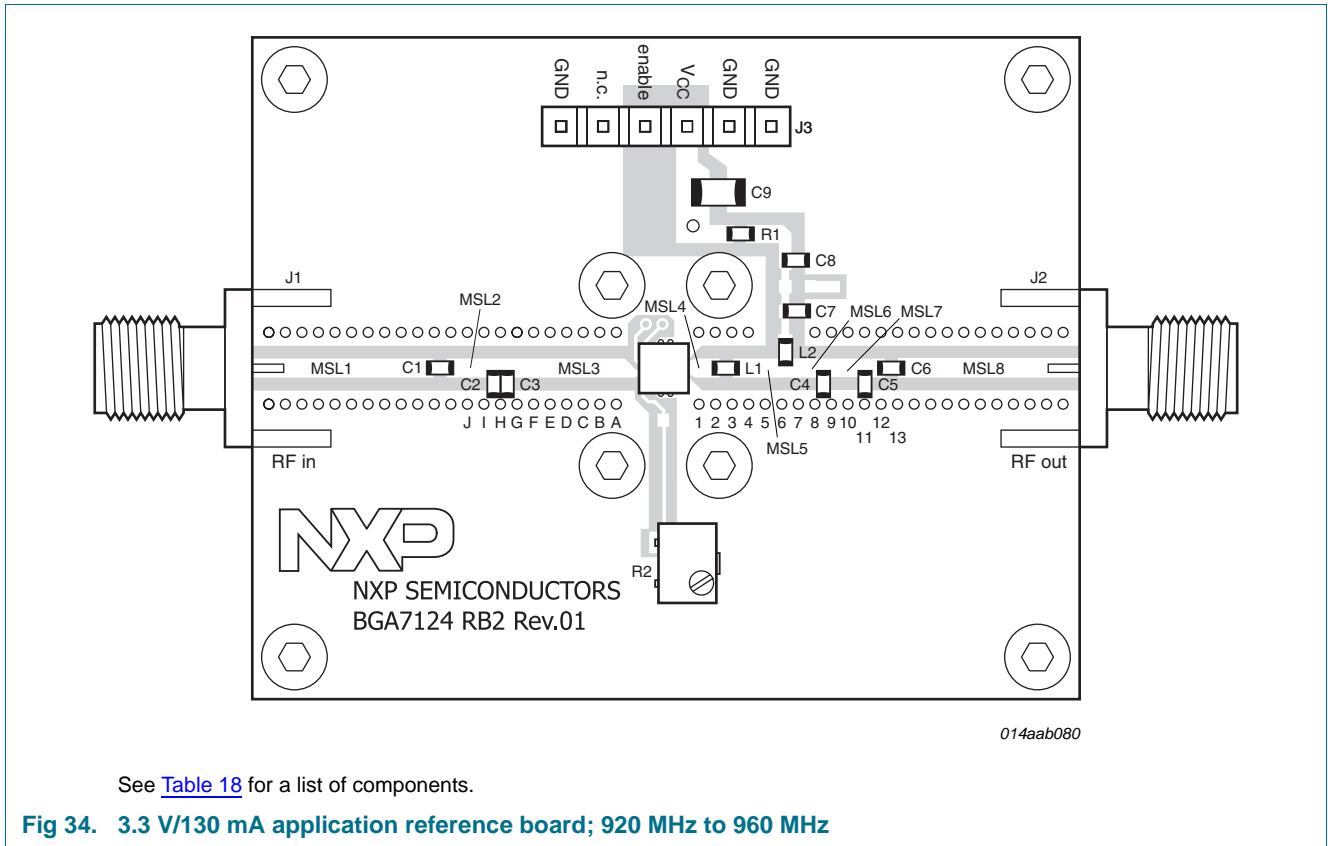
$T_{case} = 25\text{ }^{\circ}\text{C}$ .

Fig 32. Input return loss, output return loss and isolation as a function of frequency



- (1)  $T_{case} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{case} = 25\text{ }^{\circ}\text{C}$ .
- (3)  $T_{case} = 85\text{ }^{\circ}\text{C}$ .

Fig 33. Output third-order intercept point as a function of frequency



**Table 18. 3.3 V/130 mA application list of components; 920 MHz to 960 MHz**

See [Figure 29](#) and [Figure 34](#) for component layout. Printed-Circuit Board (PCB): Rogers RO4003C stack; height = 0.508 mm; copper plating thickness = 35 μm.

Component	Description	Value	Function	Remarks
C1, C6	capacitor	68 pF	DC blocking	Murata GRM1885C1H680JA01D
C2, C3	capacitor	3.3 pF	input match	Murata GRM1885C1H3R3CZ01D
C4	capacitor	3.9 pF	output match	Murata GRM1885C1H3R9CZ01D
C5	capacitor	1.0 pF	output match	Murata GRM1885C1H1R0CZ01D
C7	capacitor	68 pF	RF decoupling	Murata GRM1885C1H680JA01D
C8	capacitor	100 nF	DC decoupling	AVX 0603YC104KAT2A
C9	capacitor	10 μF	DC decoupling	AVX 1206ZG106ZAT2A
J1, J2	RF connector	SMA		Emerson Network Power 142-0701-841
J3	DC connector	6-pins		MOLEX
L1	inductor	2.2 nH	output match	Tyco electronics 36501J2N2JTDG
L2	inductor	22 nH	DC feed	Tyco electronics 36501J022JTDG
MSL1 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.95 mm	input match	
MSL2 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 2.95 mm	input match	
MSL3 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 7.75 mm	input match	
MSL4 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 23.4 mm	output match	
MSL5 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 2.2 mm	output match	



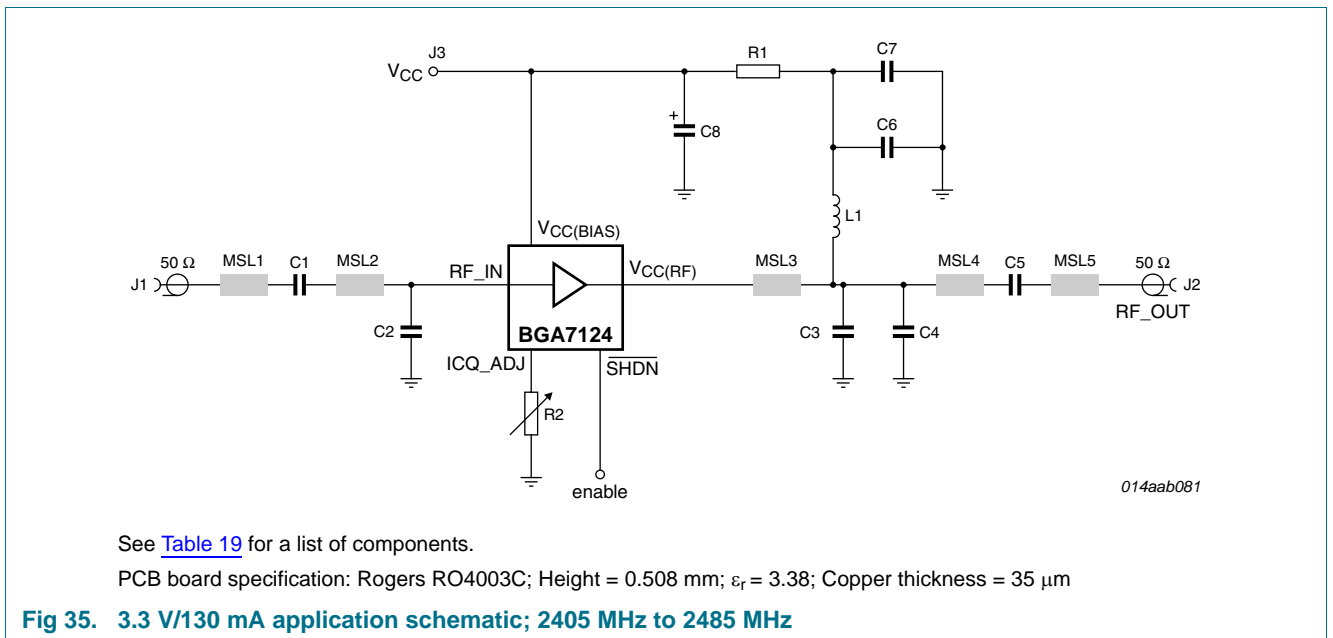
**Table 18. 3.3 V/130 mA application list of components; 920 MHz to 960 MHz ...continued**

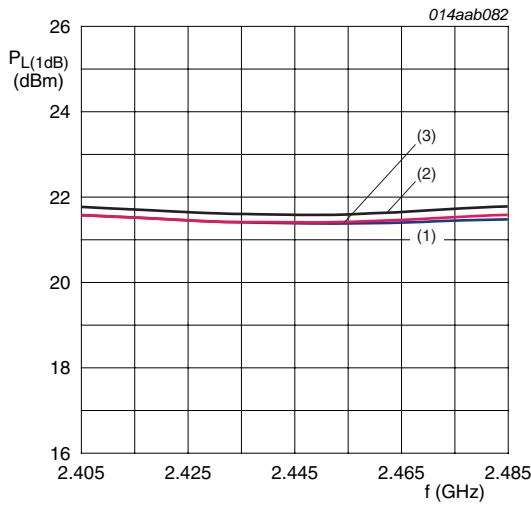
See [Figure 29](#) and [Figure 34](#) for component layout. Printed-Circuit Board (PCB): Rogers RO4003C stack; height = 0.508 mm; copper plating thickness = 35 μm.

Component	Description	Value	Function	Remarks
MSL6 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 2.4 mm	output match	
MSL7 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 2.3 mm	output match	
MSL8 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.95 mm	output match	
R1	resistor	0 Ω		Multicomp MC 0.063W 0603 0R
R2	resistor (trimmer)	2 kΩ	bias adjustment	Bourns 3214W-1-202E

[1] MSL1 to MSL8 dimensions specified as Width (W), Spacing (S) and Length (L).

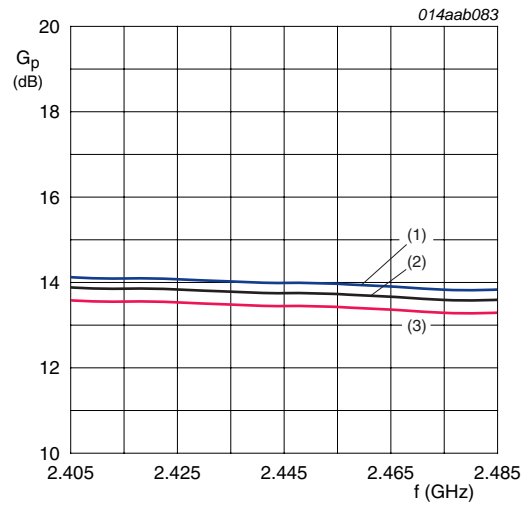
**12.2.2 2405 MHz to 2485 MHz**





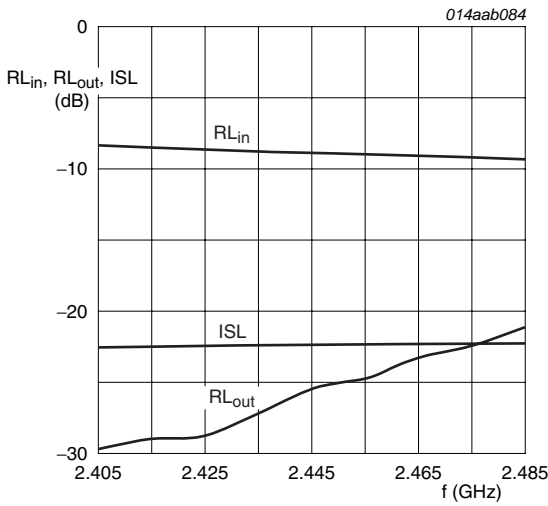
- (1)  $T_{case} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{case} = 25\text{ }^{\circ}\text{C}$ .
- (3)  $T_{case} = 85\text{ }^{\circ}\text{C}$ .

Fig 36. Output power at 1 dB gain compression as a function of frequency



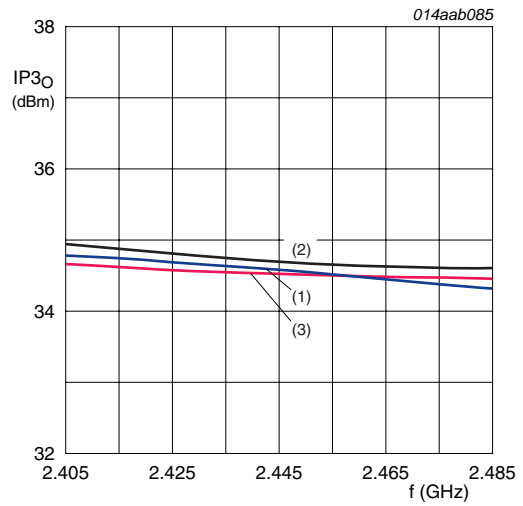
- (1)  $T_{case} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{case} = 25\text{ }^{\circ}\text{C}$ .
- (3)  $T_{case} = 85\text{ }^{\circ}\text{C}$ .

Fig 37. Power gain as a function of frequency



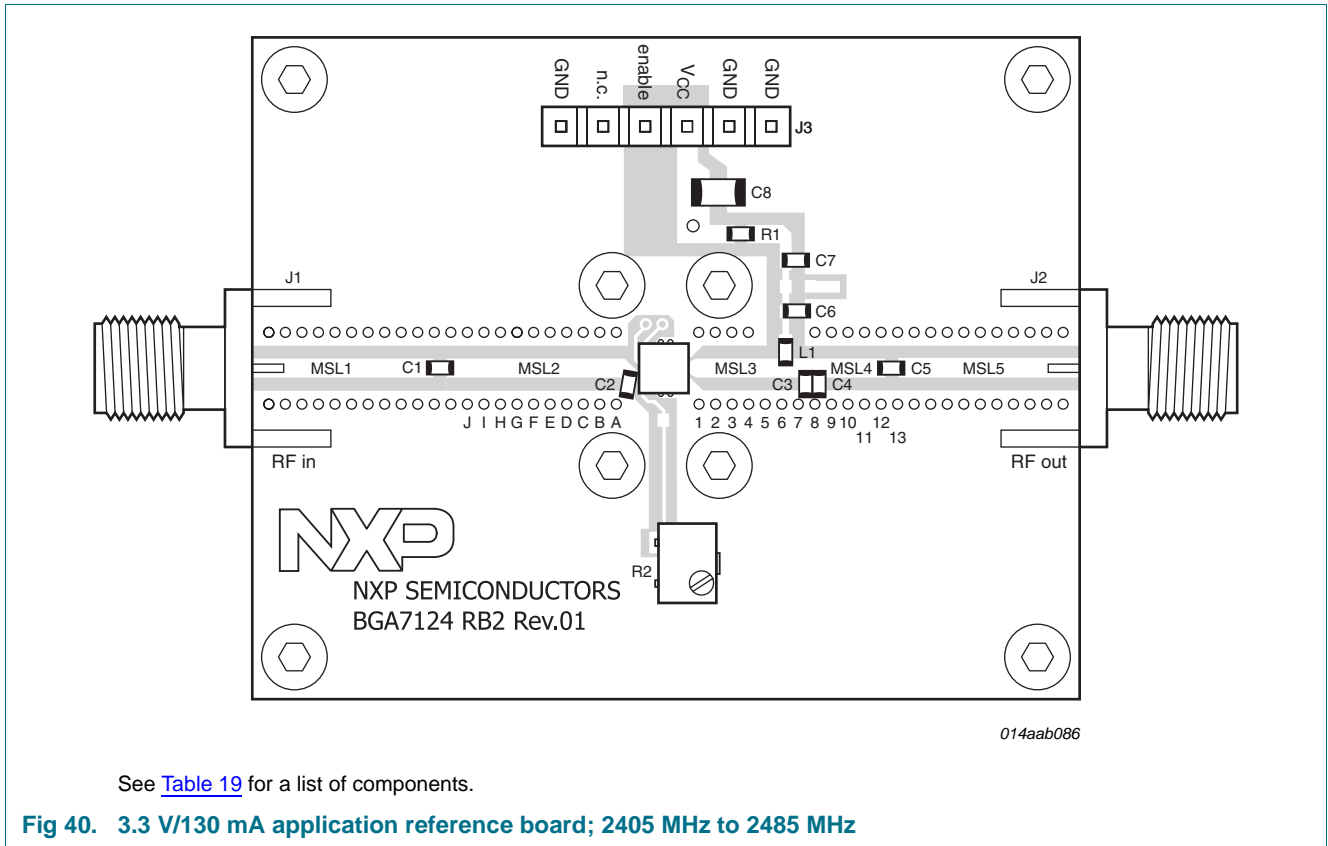
$T_{case} = 25\text{ }^{\circ}\text{C}$ .

Fig 38. Input return loss, output return loss and isolation as a function of frequency



- (1)  $T_{case} = -40\text{ }^{\circ}\text{C}$ .
- (2)  $T_{case} = 25\text{ }^{\circ}\text{C}$ .
- (3)  $T_{case} = 85\text{ }^{\circ}\text{C}$ .

Fig 39. Output third-order intercept point as a function of frequency



**Table 19. 3.3 V/130 mA application list of components; 2405 MHz to 2485 MHz**

See [Figure 35](#) and [Figure 40](#) for component layout. Printed-Circuit Board (PCB): Rogers RO4003C stack; height = 0.508 mm; copper plating thickness = 35 μm.

Component	Description	Value	Function	Remarks
C1, C5	capacitor	12 pF	DC blocking	Murata GRM1885C1H120JA01D
C2	capacitor	2.2 pF	input match	Murata GRM1885C1H2R2CZ01D
C3	capacitor	0.82 pF	output match	Murata GRM1885C1HR82CZ01D
C4	capacitor	0.68 pF	output match	Murata GRM1885C1HR68CZ01D
C6	capacitor	12 pF	RF decoupling	Murata GRM1885C1H120JA01D
C7	capacitor	100 nF	DC decoupling	AVX 0603YC104KAT2A
C8	capacitor	10 μF	DC decoupling	AVX 1206ZG106ZAT2A
J1, J2	RF connector	SMA		Emerson Network Power 142-0701-841
J3	DC connector	6-pins		MOLEX
L1	inductor	22 nH	DC feed	Tyco electronics 36501J022JTDG
MSL1 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.95 mm	input match	
MSL2 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.8 mm	input match	
MSL3 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 7.3 mm	output match	
MSL4 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 4.3 mm	output match	

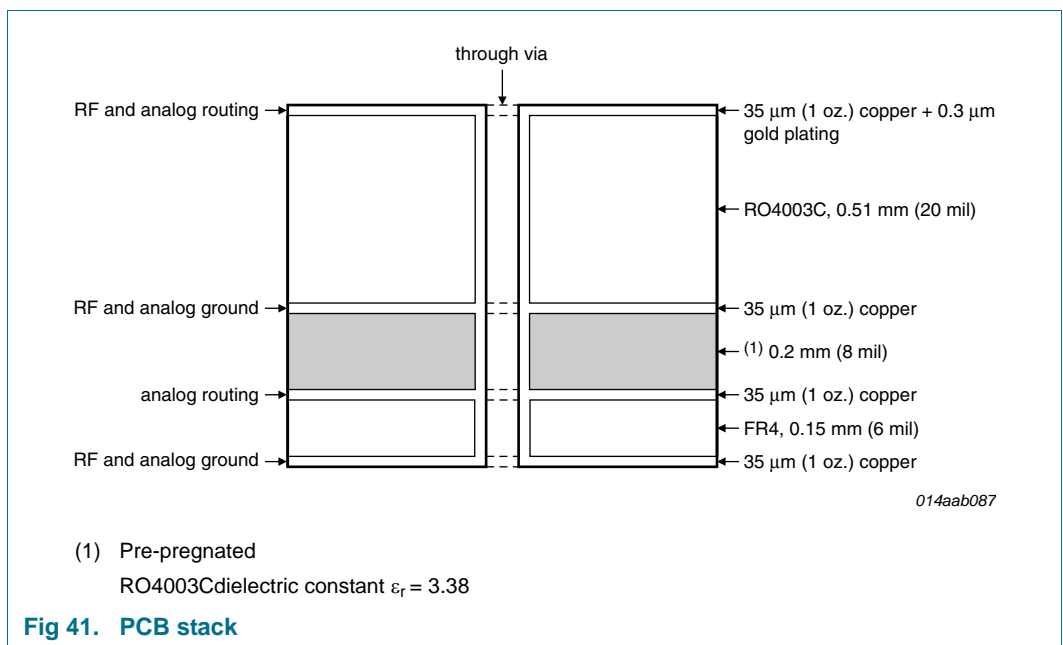
**Table 19. 3.3 V/130 mA application list of components; 2405 MHz to 2485 MHz ...continued**

See [Figure 35](#) and [Figure 40](#) for component layout. Printed-Circuit Board (PCB): Rogers RO4003C stack; height = 0.508 mm; copper plating thickness = 35 μm.

Component	Description	Value	Function	Remarks
MSL5 <sup>[1]</sup>	micro stripline	1.14 mm × 0.8 mm × 10.95 mm	output match	
R1	resistor	2.2 Ω		Multicomp MC 0.063W 0603 2R2
R2	resistor (trimmer)	2 kΩ	bias adjustment	Bourns 3214W-1-202E

[1] MSL1 to MSL5 dimensions specified as Width (W), Spacing (S) and Length (L).

### 12.3 PCB stack



**Fig 41. PCB stack**

13. Package outline

HVSON8: plastic thermal enhanced very thin small outline package; no leads; 8 terminals; body 3 x 3 x 0.85 mm

SOT908-1

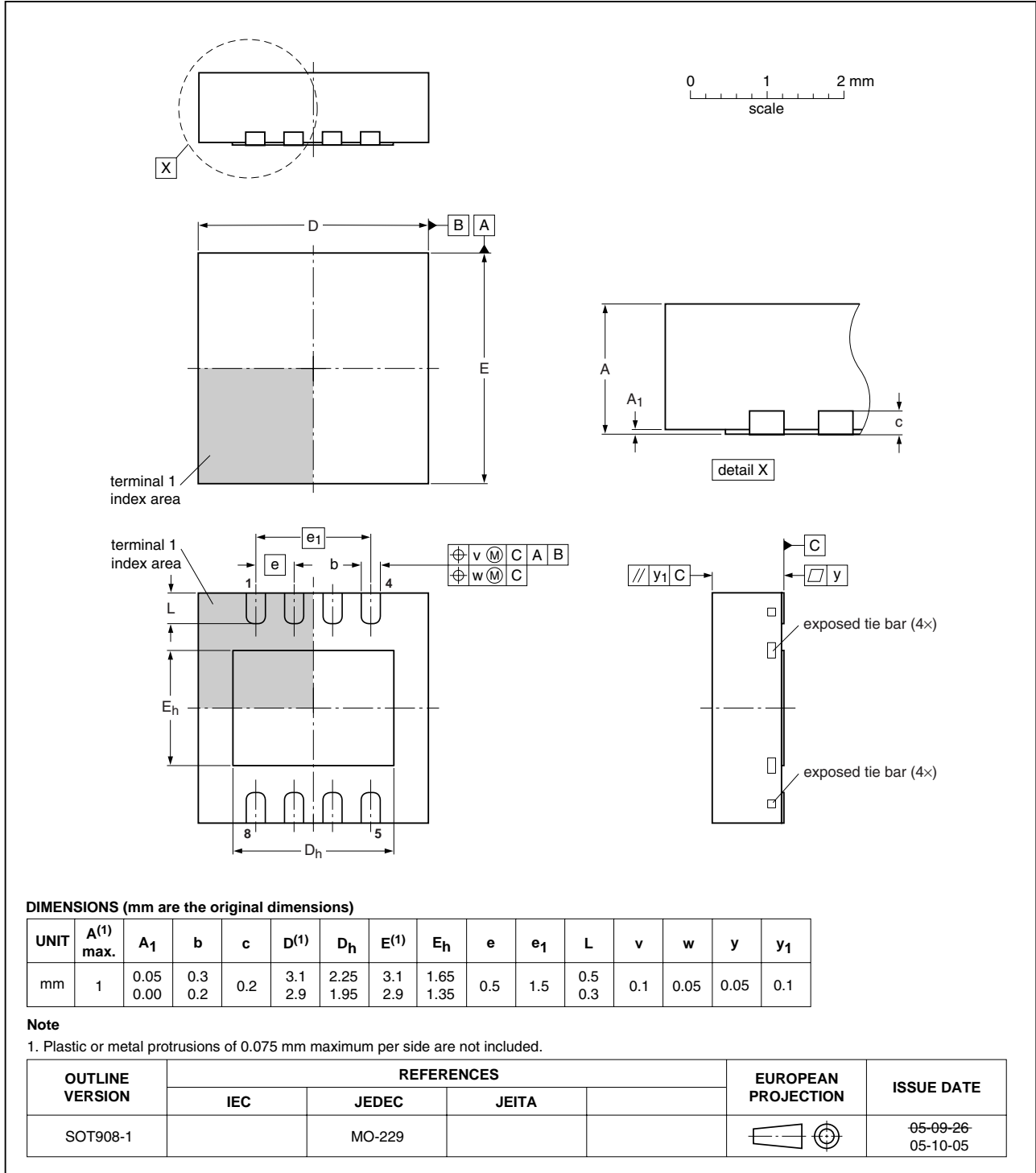


Fig 42. Package outline SOT908-1 (HVSON8)

## 14. Abbreviations

Table 20. Abbreviations

Acronym	Description
CPE	Customer-Premises Equipment
DC	Direct Current
ESD	ElectroStatic Discharge
HTOL	High Temperature Operating Life
ISM	Industrial, Scientific and Medical
MMIC	Monolithic Microwave Integrated Circuit
MoCA	Multimedia over Coax Alliance
RFID	Radio Frequency IDentification
SMA	SubMiniature version A
TX	Transmit
WLAN	Wireless Local Area Network

## 15. Revision history

Table 21. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGA7124 v.3	20100909	Product data sheet	-	BGA7124 v.2
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Figure 5 on page 11</a>: MSL symbols have been corrected.</li> <li>• <a href="#">Figure 11 on page 14</a>: MSL symbols have been corrected.</li> <li>• <a href="#">Figure 17 on page 16</a>: MSL symbols have been corrected.</li> <li>• <a href="#">Figure 23 on page 19</a>: MSL symbols have been corrected.</li> <li>• <a href="#">Figure 29 on page 22</a>: MSL symbols have been corrected.</li> <li>• <a href="#">Figure 35 on page 25</a>: MSL symbols have been corrected.</li> </ul>			
BGA7124 v.2	20100623	Product data sheet	-	BGA7124 v.1
BGA7124 v.1	20100421	Product data sheet	-	-

## 16. Legal information

### 16.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

### 16.2 Definitions

**Draft** — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

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