


# BGA6130

## 400 MHz to 2700 MHz 1 W high efficiency silicon amplifier

**Rev. 2 — 12 February 2014** **Product data sheet**

## 1. General description

The  MMIC is a one-stage amplifier, offered in a low-cost leadless surface-mount package. At 3.6 V it delivers 29.5 dBm output power at 3 dB gain compression with efficiency higher than 55 %. Its power saving features include simple quiescent current adjustment, which allows class-AB operation and logic-level shutdown control to reduce the supply current to 4 μA.

## 2. Features and benefits

- 400 MHz to 2700 MHz frequency operating range
- Integrated active biasing
- External matching allows broad application optimization of the electrical performance
- Efficiencies higher than 55 %
- 3.6 V single supply operation
- Power-down
- Excellent robustness:
  - All pins ESD protected (HBM 6 kV; CDM 2 kV)
  - Withstands mismatch of VSWR 50 : 1 through all phases
  - Withstands electrical over-stress peaks of 4.5 V on the supply voltage

## 3. Applications

In this data sheet two Industrial, Scientific and Medical (ISM) applications are described, namely ISM at 434 MHz and ISM at 915 MHz. The BGA6130 is also suited for a range of other applications:

- Broadband CPE / MoCA
- WLAN / ISM / RFID
- Wireless Sensor Network (WSN)
- Industrial applications
- Satellite Master Antenna TV (SMATV)

# 4. Quick reference data

**Table 1. Quick reference data**

*3.3 V ≤ $V_{SUP}$ ≤ 3.9 V; −40 °C ≤ $T_{case}$ ≤ +85 °C; $P_i$ < −20 dBm; R3 = 3900 Ω (tolerance 10 %); input and output impedances matched to 50 Ω (see Section 14); pin ENABLE = HIGH; unless otherwise specified.*

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{SUP}$ | supply voltage | | [1] | 3.3 | 3.6 | 3.9 | V |
| $I_{CC(tot)}$ | total supply current | | [2] | 50 | 70 | 90 | mA |
| | | 1 kΩ ≤ R3 ≤ 5 kΩ | [2] | 30 | - | 250 | mA |
| | | 1 kΩ ≤ R3 ≤ 5 kΩ; pin ENABLE = LOW | [2] | - | 4 | 6 | μA |
| $T_{case}$ | case temperature | | [3] | −40 | +25 | +85 | °C |
| f | frequency | | | 400 | - | 2700 | MHz |
| **Measured at ISM-434 MHz (see Section 14)** | | | | | | | |
| f | frequency | | | 433 | 434 | 435 | MHz |
| $G_p$ | power gain | 433 MHz ≤ f ≤ 435 MHz | | 14 | 17 | 20 | dB |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | 433 MHz ≤ f ≤ 435 MHz | | 25 | 28 | - | dBm |
| $P_{L(3dB)}$ | output power at 3 dB gain compression | 433 MHz ≤ f ≤ 435 MHz | | - | 29.5 | - | dBm |
| η | efficiency | 433 MHz ≤ f ≤ 435 MHz; at $P_{L(3dB)}$ | | - | 56 | - | % |
| **Measured at ISM-915 MHz (see Section 14)** | | | | | | | |
| f | frequency | | | 902 | 915 | 928 | MHz |
| $G_p$ | power gain | 902 MHz ≤ f ≤ 928 MHz | | 11 | 14 | 17 | dB |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | 902 MHz ≤ f ≤ 928 MHz | | 26 | 29 | - | dBm |
| $P_{L(3dB)}$ | output power at 3 dB gain compression | 902 MHz ≤ f ≤ 928 MHz | | - | 30 | - | dBm |
| η | efficiency | 902 MHz ≤ f ≤ 928 MHz; at $P_{L(3dB)}$ | | - | 60 | - | % |

[1] Supply voltage on pins RF_OUT and $V_{CC}$.

[2] Current through pins RF_OUT and $V_{CC}$.

[3] $T_{case}$ is the temperature at the soldering point of the exposed die pad.

# 5. Design support

**Table 2. Available design support**

*Download from the BGA6130 product page on http://www.nxp.com.*

| Support item | Available | | Remarks |
|---|---|---|---|
| Device models for Agilent EEsof EDA ADS | planned | [1] | Based on Mextram device model. |
| Device models for AWR Microwave Office | no | [1] | Based on Mextram device model. |
| Device models for ANSYS Ansoft designer | no | [1] | Based on Mextram device model. |
| SPICE model | planned | [1] | Based on Gummel-Poon device model. |
| S-parameters | yes | | |
| Noise parameters | yes | | |
| Customer evaluation kit | yes | | See Section 6 and Section 14. |
| Gerber files | yes | | Gerber files of boards provided with the customer evaluation kit. |
| Solder pattern | yes | | |

[1] See http://www.nxp.com/models.html.


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# 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BGA6130 | HVSON8 | plastic thermal enhanced very thin small outline package; no leads; 8 terminals; body 3 × 3 × 0.85 mm | SOT908-3 |
| OM7828/BGA6130/KIT | - | Customer evaluation kit for BGA6130 [1] | - |

[1] The customer evaluation kit contains the following:

a) Fully populated and matched RF evaluation board for ISM 434
b) Fully populated and matched RF evaluation board for ISM 915
c) Unpopulated Printed-Circuit Board (PCB)
d) Two SMA connectors for fitting unpopulated Printed-Circuit Board (PCB)
e) BGA6130 samples

# 7. Functional diagram

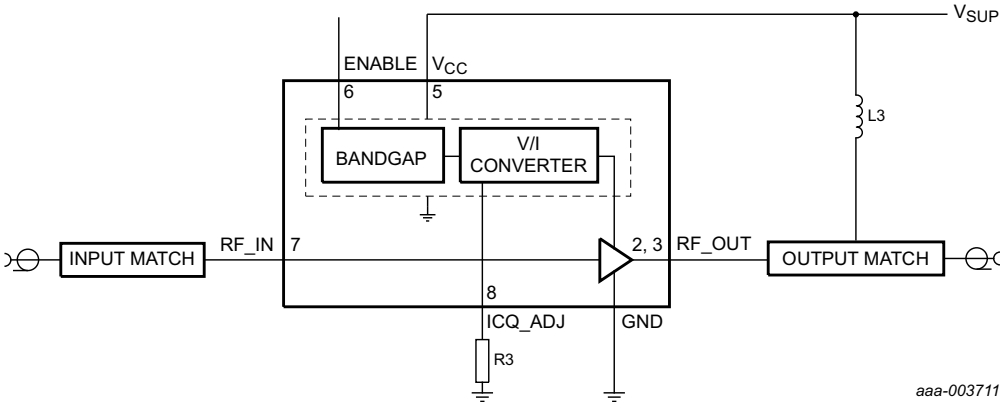


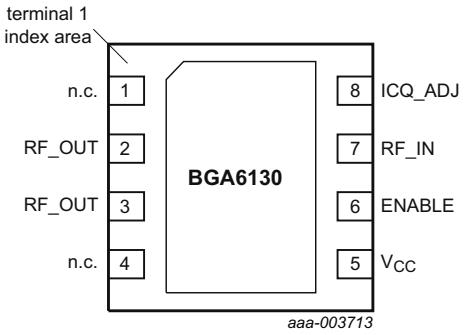

**Fig 1. Functional diagram**


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# 8. Pinning information

## 8.1 Pinning




Transparent top view

**Fig 2. Pin configuration**

## 8.2 Pin description

**Table 4. Pin description**

| Symbol | Pin | Description |
|---|---|---|
| n.c. | 1, 4 | not connected [1] |
| RF_OUT | 2, 3 | RF output and supply to the amplifier [2] |
| $V_{CC}$ | 5 | bias supply voltage [3] |
| ENABLE | 6 | enable |
| RF_IN | 7 | RF input [2] |
| ICQ_ADJ | 8 | quiescent collector current adjustment by an external resistor |
| GND | exposed die pad | ground [4] |

[1] This pin can be connected to ground.

[2] This pin requires an external DC-blocking capacitor.

[3] RF decoupled.

[4] The exposed die pad of the SOT908-3 also functions as heatsink for the power amplifier.

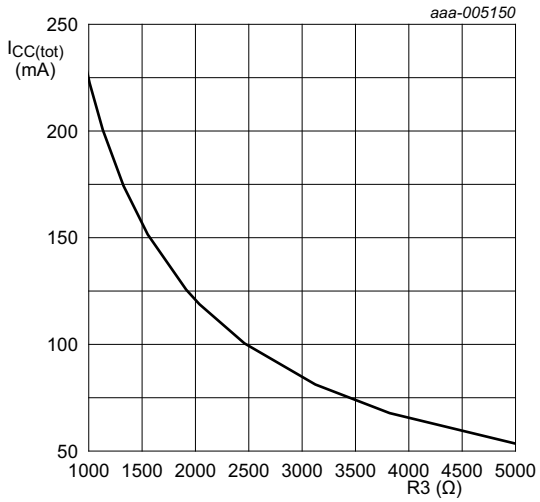
# 9. Functional description

## 9.1 Supply current adjustment

The supply current can be adjusted by changing the value of biasing resistor R3 which connects pin ICQ_ADJ (pin 8) to ground (see Figure 1).


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$V_{SUP}$ = 3.6 V; $T_{amb}$ = 25 °C.

**Fig 3. Supply current $I_{CC(tot)}$ as function of biasing resistor R3; typical values**

## 9.2 Enable control

The BGA6130 can be powered down using enable pin 6 (ENABLE). In case this control function is not needed the enable pin can be connected to the bias supply voltage pin 5 ($V_{CC}$). The current through the enable pin 6 should never exceed 20 mA as this might damage the ESD protection circuitry. This can be avoided either by preventing the voltage on this pin to exceed the supply voltage ($V_{SUP}$) or by adding a series resistor.

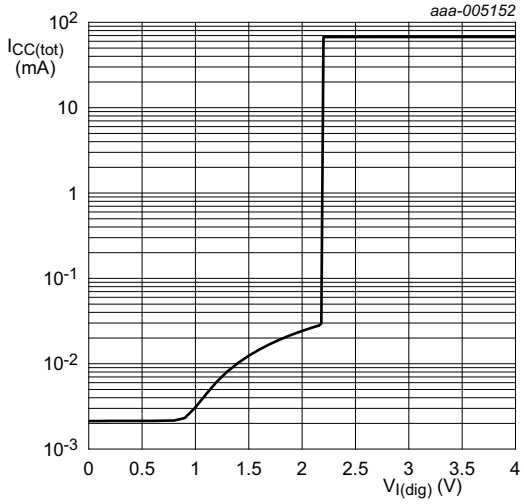
**Table 5. Enable truth table**

*See Table 8.*

| Logic level on pin ENABLE (pin 6) | Status BGA6130 |
|---|---|
| LOW | powered down |
| HIGH | powered on |


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$V_{SUP}$ = 3.6 V; $T_{amb}$ = 25 °C.

**Fig 4. Total supply current as function of voltage on pin ENABLE; typical values**

## 10. Limiting values

**Table 6. Limiting values**

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{SUP}$ | supply voltage | | [1] | −0.2 | +4.5 | V |
| $V_{I(dig)}$ | digital input voltage | | [2][4] | 0 | $V_{SUP}$ + 0.3 | V |
| $I_{I(dig)}$ | digital input current | | [3][4] | −20 | +20 | mA |
| $I_{CC(tot)}$ | total supply current | | | - | 350 | mA |
| $P_{i(RF)}$ | RF input power | f = 434 MHz; switched | | - | 15 | dBm |
| | | f = 915 MHz; switched | | - | 15 | dBm |
| $T_{stg}$ | storage temperature | | | −65 | +150 | °C |
| $T_j$ | junction temperature | | | - | 150 | °C |
| $V_{ESD}$ | electrostatic discharge voltage | Human Body Model (HBM); According JEDEC standard 22-A114E | | - | 6 | kV |
| | | Charged Device Model (CDM); According JEDEC standard 22-C101B | | - | 2 | kV |

[1] Absolute maximum DC voltage on pins RF_OUT, ICQ_ADJ and $V_{CC}$.

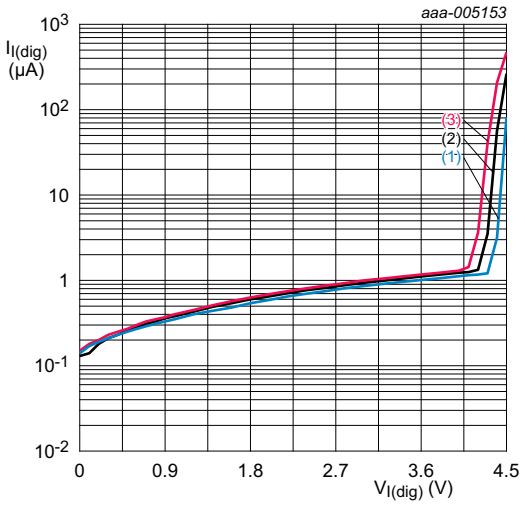
[2] Absolute maximum DC voltage on pin ENABLE.

[3] Absolute maximum DC current through pin ENABLE.

[4] If $V_{I(dig)}$ exceeds $V_{SUP}$ the internal ESD protection circuit can be damaged (see Figure 5). The pin ENABLE can be connected to $V_{CC}$ in case the enable control function is not used (see Section 9.2).


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$V_{SUP}$ = 3.6 V.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 5. Current through pin ENABLE as a function of voltage on pin ENABLE at a supply voltage $V_{SUP}$ of 3.6 V; typical values**

## 11. Thermal characteristics

**Table 7. Thermal characteristics**

| Symbol | Parameter | Conditions | Typ | Unit |
|---|---|---|---|---|
| $R_{th(j\text{-}case)}$ | thermal resistance from junction to case | $T_{case}$ < 85 °C | 6 | K/W |

## 12. Static characteristics

**Table 8. Static characteristics**

*3.3 V ≤ $V_{SUP}$ ≤ 3.9 V; −40 °C ≤ $T_{case}$ ≤ +85 °C; $P_i$ < −20 dBm; R3 = 3900 Ω (tolerance 10 %); input and output impedances matched to 50 Ω (see Section 14); pin ENABLE = HIGH; unless otherwise specified.*

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{SUP}$ | supply voltage | | [1] | 3.3 | 3.6 | 3.9 | V |
| $I_{CC(tot)}$ | total supply current | | [2] | 55 | 70 | 85 | mA |
| | | 1 kΩ ≤ R3 ≤ 5 kΩ | [2] | 30 | - | 250 | mA |
| | | 1 kΩ ≤ R3 ≤ 5 kΩ; pin ENABLE = LOW | [2] | - | 4 | 6 | μA |
| $T_{case}$ | case temperature | | [3] | −40 | +25 | +85 | °C |


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**Table 8. Static characteristics** *...continued*

*3.3 V ≤ $V_{SUP}$ ≤ 3.9 V; −40 °C ≤ $T_{case}$ ≤ +85 °C; $P_i$ < −20 dBm; R3 = 3900 Ω (tolerance 10 %); input and output impedances matched to 50 Ω (see Section 14); pin ENABLE = HIGH; unless otherwise specified.*

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_{CC}$ | supply current | on pin RF_OUT | | - | 63 | - | mA |
| | | on pin $V_{CC}$ | | - | 7 | - | mA |
| | | on pin ENABLE | | - | - | 3 | μA |
| $V_{IL}$ | LOW-level input voltage | | [4] | 0 | - | 0.7 | V |
| $V_{IH}$ | HIGH-level input voltage | | [4] | 2.5 | - | $V_{SUP}$ | V |

[1] Supply voltage on pins RF_OUT and $V_{CC}$.

[2] Current through pins RF_OUT and $V_{CC}$.

[3] $T_{case}$ is the temperature at the soldering point of the exposed die pad.

[4] On digital input pin ENABLE.

# 13. Dynamic characteristics

**Table 9. Dynamic characteristics**

*3.3 V ≤ $V_{SUP}$ ≤ 3.9 V; −40 °C ≤ $T_{case}$ ≤ +85 °C; $P_i$ < −20 dBm; R3 = 3900 Ω (tolerance 10 %); input and output impedances matched to 50 Ω (see Section 14); pin ENABLE = HIGH; unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| f | frequency | | 400 | - | 2700 | MHz |
| **Measured at ISM-434 MHz (see Section 14)** | | | | | | |
| f | frequency | | 433 | 434 | 435 | MHz |
| $G_p$ | power gain | 433 MHz ≤ f ≤ 435 MHz | 14 | 17 | 20 | dB |
| | | 433 MHz ≤ f ≤ 435 MHz; pin ENABLE = LOW | - | −17 | - | dB |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | 433 MHz ≤ f ≤ 435 MHz | 25 | 28 | - | dBm |
| $P_{L(3dB)}$ | output power at 3 dB gain compression | 433 MHz ≤ f ≤ 435 MHz | - | 29.5 | - | dBm |
| IMD3 | third-order intermodulation distortion | 433 MHz ≤ f ≤ 435 MHz; $P_L$ = 15 dBm per tone; tone spacing = 1 MHz | - | −34 | - | dBc |
| NF | noise figure | 433 MHz ≤ f ≤ 435 MHz | - | 4.5 | - | dB |
| $RL_{in}$ | input return loss | 433 MHz ≤ f ≤ 435 MHz | 8 | 10 | - | dB |
| | | 433 MHz ≤ f ≤ 435 MHz; pin ENABLE = LOW | - | 4.5 | - | dB |
| $RL_{out}$ | output return loss | 433 MHz ≤ f ≤ 435 MHz | 6 | 8 | - | dB |
| | | 433 MHz ≤ f ≤ 435 MHz; pin ENABLE = LOW | - | 0.5 | - | dB |
| ISL | isolation | 433 MHz ≤ f ≤ 435 MHz | - | 28 | - | dB |
| | | 433 MHz ≤ f ≤ 435 MHz; pin ENABLE = LOW | - | −17 | - | dB |
| η | efficiency | 433 MHz ≤ f ≤ 435 MHz; at $P_{L(3dB)}$ | - | 56 | - | % |
| $t_{d(pu)}$ | power-up delay time | after pin ENABLE is switched to logic HIGH; to within 0.1 dB of final gain state. | - | 2.2 | - | μs |
| $t_{d(pd)}$ | power-down delay time | after pin ENABLE is switched to logic LOW; to within 0.1 dB of final gain state. | - | 0.5 | - | μs |


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**Table 9. Dynamic characteristics** *...continued*

*3.3 V ≤ $V_{SUP}$ ≤ 3.9 V; −40 °C ≤ $T_{case}$ ≤ +85 °C; $P_i$ < −20 dBm; R3 = 3900 Ω (tolerance 10 %); input and output impedances matched to 50 Ω (see Section 14); pin ENABLE = HIGH; unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Measured at ISM-915 MHz (see Section 14)** | | | | | | |
| f | frequency | | 902 | 915 | 928 | MHz |
| $G_p$ | power gain | 902 MHz ≤ f ≤ 928 MHz | 11 | 14 | 17 | dB |
| | | 902 MHz ≤ f ≤ 928 MHz; pin ENABLE = LOW | - | −16.5 | - | dB |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | 902 MHz ≤ f ≤ 928 MHz | 26 | 29 | - | dBm |
| $P_{L(3dB)}$ | output power at 3 dB gain compression | 902 MHz ≤ f ≤ 928 MHz | - | 30 | - | dBm |
| IMD3 | third-order intermodulation distortion | 902 MHz ≤ f ≤ 928 MHz; $P_L$ = 15 dBm per tone; tone spacing = 1 MHz | - | −34 | - | dBc |
| NF | noise figure | 902 MHz ≤ f ≤ 928 MHz | - | 4 | - | dB |
| $RL_{in}$ | input return loss | 902 MHz ≤ f ≤ 928 MHz | 8 | 10 | - | dB |
| | | 902 MHz ≤ f ≤ 928 MHz; pin ENABLE = LOW | - | 2.5 | - | dB |
| $RL_{out}$ | output return loss | 902 MHz ≤ f ≤ 928 MHz | 6 | 8 | - | dB |
| | | 902 MHz ≤ f ≤ 928 MHz; pin ENABLE = LOW | - | 0.5 | - | dB |
| ISL | isolation | 902 MHz ≤ f ≤ 928 MHz | - | 28 | - | dB |
| | | 902 MHz ≤ f ≤ 928 MHz; pin ENABLE = LOW | - | −16.5 | - | dB |
| η | efficiency | 902 MHz ≤ f ≤ 928 MHz; at $P_{L(3dB)}$ | - | 60 | - | % |
| $t_{d(pu)}$ | power-up delay time | after pin ENABLE is switched to logic HIGH; to within 0.1 dB of final gain state. | - | 2.5 | - | µs |
| $t_{d(pd)}$ | power-down delay time | after pin ENABLE is switched to logic LOW; to within 0.1 dB of final gain state. | - | 0.5 | - | µs |

# 14. Application information

The BGA6130 can be used for a wide variety of applications. This section describes two example applications in the Industrial, Scientific and Medical (ISM) frequency bands at 434 MHz and at 915 MHz. The ISM-434 band is used in region 1, Europe, Africa, the Middle East west of the Persian Gulf including Iraq, the former Soviet Union and Mongolia, whereas the ISM-915 band is used in region 2, Americas, Greenland and some of the eastern Pacific Islands. Example ISM applications are Wireless Sensor Networks (WSN), ZigBee and WLAN.

## 14.1 Application board

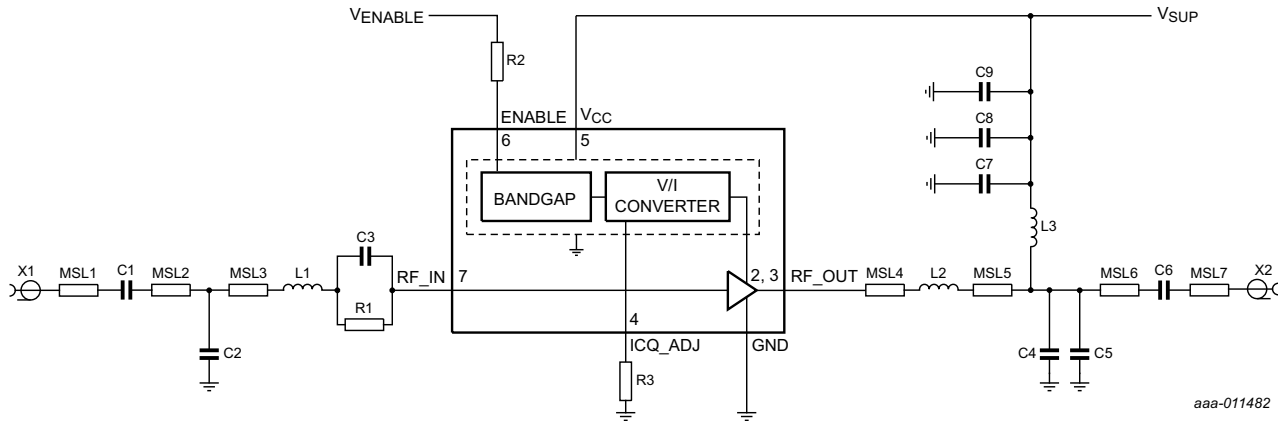
Customer evaluation boards are available from NXP (see Section 6 “Ordering information”). The BGA6130 shall be decoupled and matched as depicted in Figure 6. The ground leads and exposed paddle should be connected directly to the ground plane. Enough via holes should be provided to connect top and bottom ground planes in the final application board. Sufficient cooling should be provided preventing the temperature of the exposed die pad from exceeding 85 °C.

The ISM-434 and ISM-915 application boards have the same input and output matching topology, but differ in component values. Resistor R3 is used to set the bias current. Note resistor R2 which can be used to limit the current through the ESD protection circuit in


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case the voltage on pin ENABLE exceeds the supply voltage on pin $V_{CC}$. L3, C8, C9 and C10 are used to feed a DC current to the RF transistor. The other passive components are used for input and an output matching.




See Table 10 for list of components.

**Fig 6. Application diagram of customer evaluation board for ISM-434 and ISM-915 application**

The Printed-Circuit Board (PCB) is a four metal layer substrate board as described in Figure 7. The width and the gap between the strip-line and ground plane are configured such that a 50 ohm transmission line is obtained.

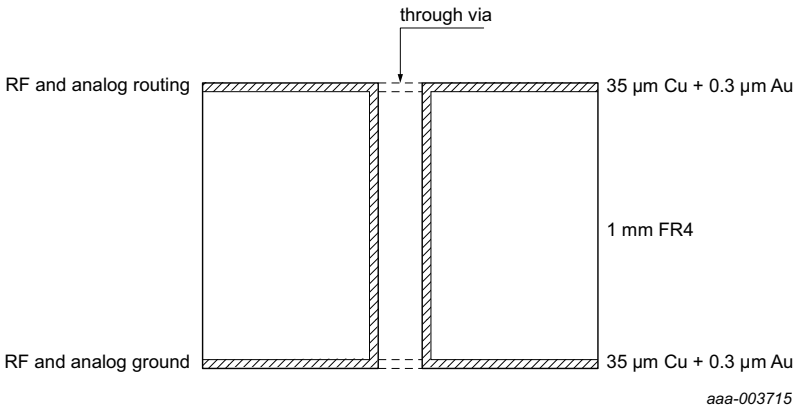



**Fig 7. Printed-Circuit Board (PCB) stack build**


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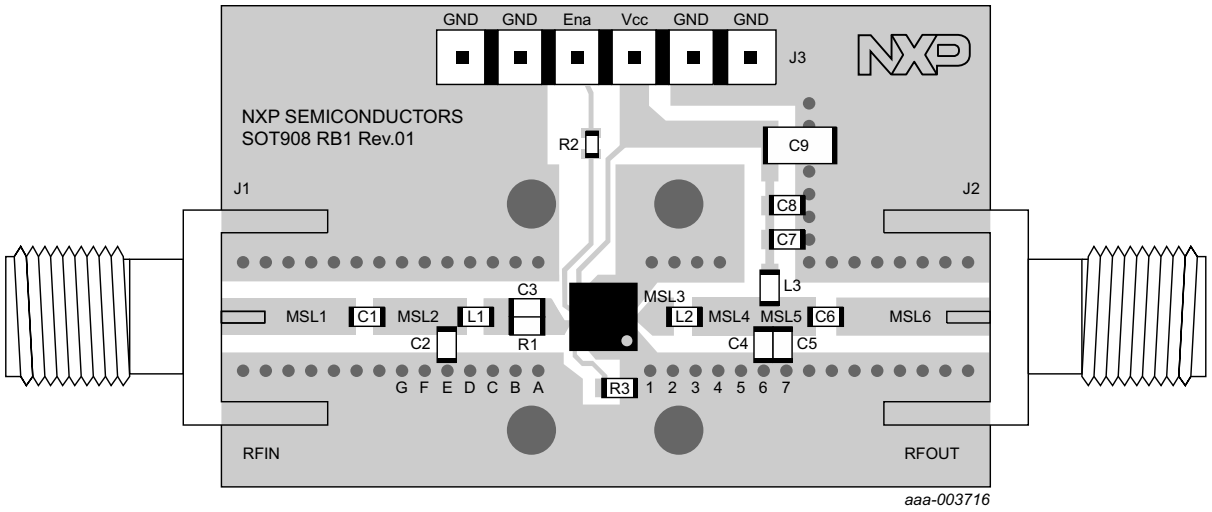



**Fig 8. Top view of populated ISM-434 Printed-Circuit Board (PCB)**

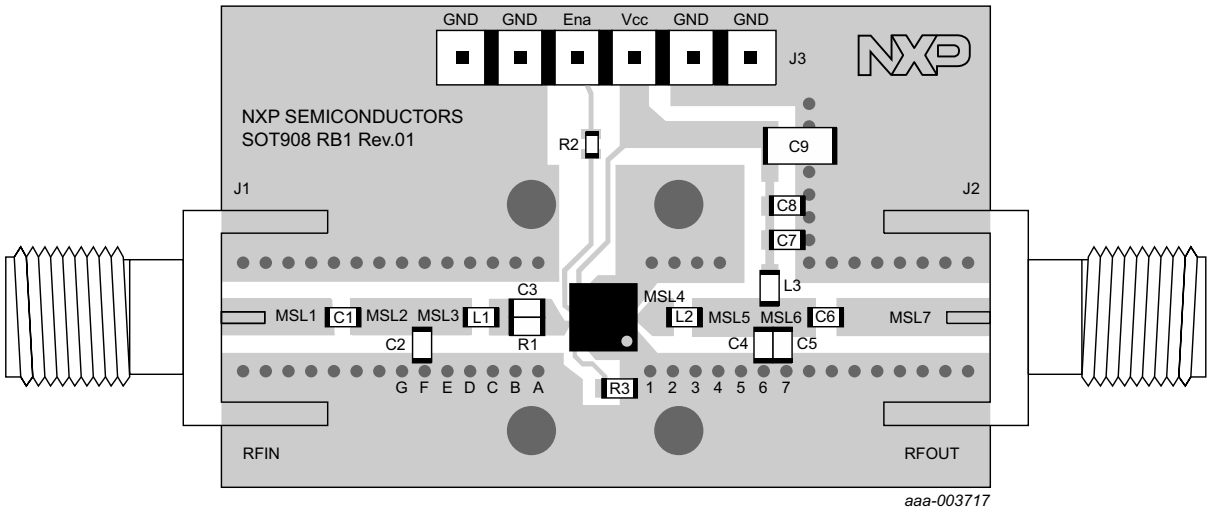



**Fig 9. Top view of populated ISM-915 Printed-Circuit Board (PCB)**


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**Table 10. List of components**

*See Figure 6 for schematics.*

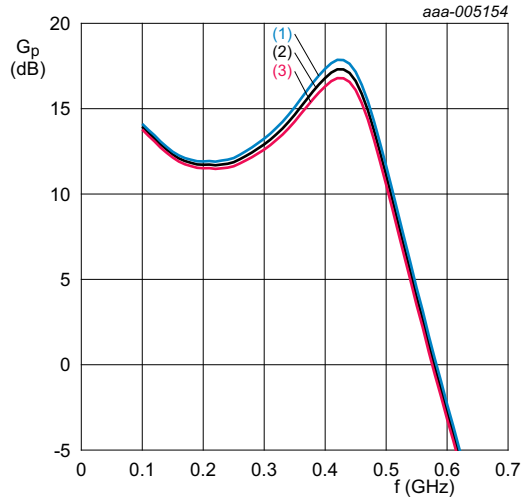
| Component | Description | Value | | | Remarks |
|---|---|---|---|---|---|
| | | ISM-434 | ISM-915 | | |
| C1 | capacitor | 1 nF | 1 nF | | Murata GRM series |
| C2 | capacitor | 15 pF | 10 pF | | Murata GRM series |
| C3 | capacitor | 15 pF | 12 pF | | Murata GRM series |
| C4 | capacitor | 2 pF | 2.7 pF | | Murata GRM series |
| C5 | capacitor | 15 pF | 5.6 pF | | Murata GRM series |
| C6 | capacitor | 1 nF | 1 nF | | Murata GRM series |
| C7 | capacitor | 1 nF | 1 nF | | Murata GRM series |
| C8 | capacitor | 100 nF | 100 nF | | Murata GRM series |
| C9 | capacitor | 10 μF | 10 μF | | Murata GRM series |
| IC1 | BGA6130 | - | - | | NXP |
| MSL1 | micro stripline | 5.9 mm | 5.9 mm | [1] | |
| MSL2 | micro stripline | 3.1 mm | 1.8 mm | [1] | |
| MSL3 | micro stripline | - | 1.7 mm | [1] | |
| MSL4 | micro stripline | 1.7 mm | 1.8 mm | [1] | |
| MSL5 | micro stripline | 3.1 mm | 3.2 mm | [1] | |
| MSL6 | micro stripline | 1.7 mm | 1.5 mm | [1] | |
| MSL7 | micro stripline | 6.8 mm | 6.8 mm | [1] | |
| R1 | resistor | 220 Ω | 220 Ω | | |
| R2 | resistor | 270 Ω | 270 Ω | | |
| R3 | resistor | 3900 Ω | 3900 Ω | | |
| L1 | inductor | 15 nH | 1.5 nH | | Murata LQW series |
| L2 | inductor | 5.6 nH | 1.5 nH | | Murata LQW series |
| L3 | RF choke | 68 nH | 27 nH | | Murata LQW series |
| X1, X2 | SMA connector | - | - | | |

[1] Length (L) is specified, width (W) = 1.6 mm and spacing (S) = 0.8 mm.


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## 14.2 Characteristics ISM-434



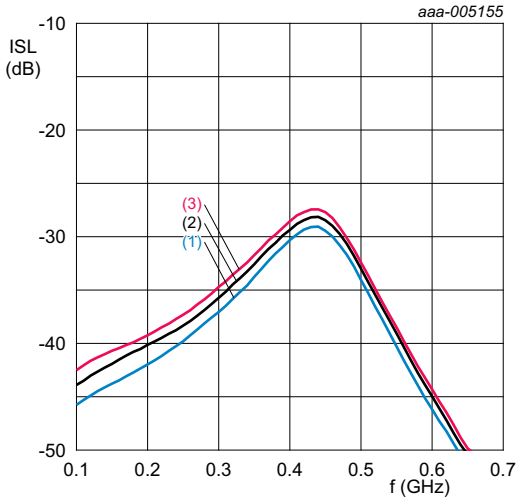

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 10. Power gain as a function of frequency for ISM-434 application; typical values**



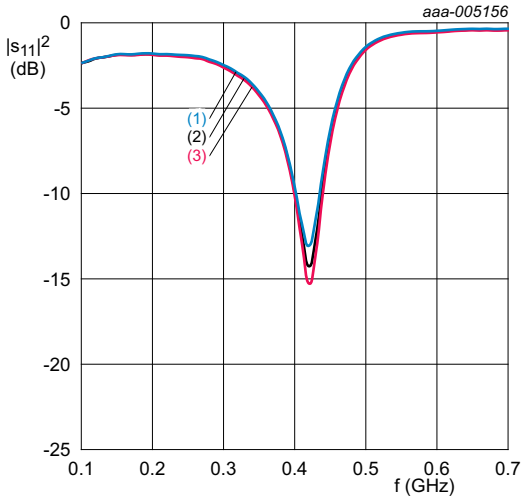

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 11. Isolation as a function of frequency for ISM-434 application; typical values**



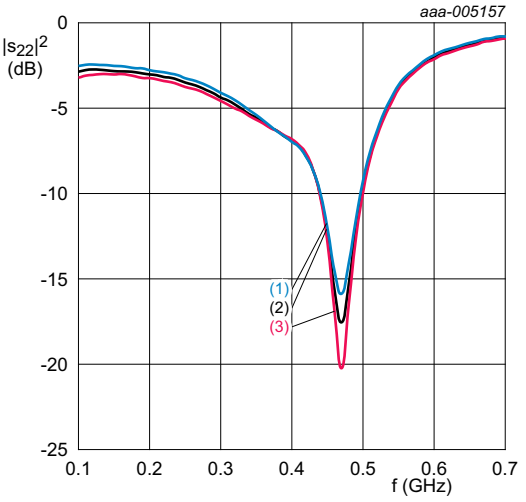

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 12. Input return loss as a function of frequency for ISM-434 application; typical values**




$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

(1) $T_{amb}$ = −40 °C

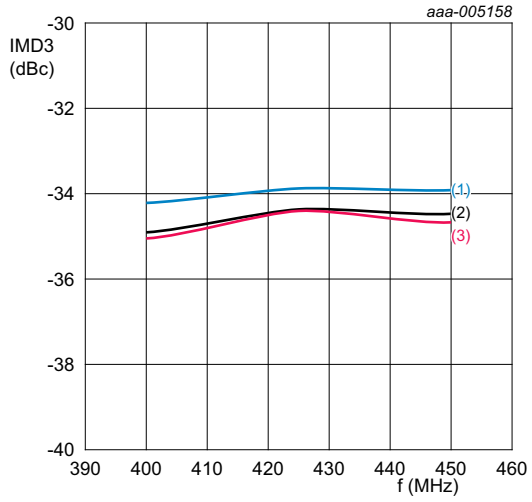
(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 13. Output return loss as a function of frequency for ISM-434 application; typical values**


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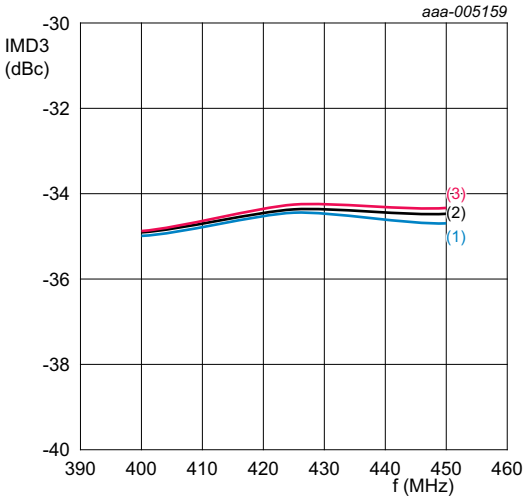

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; $P_L$ = 15 dBm per tone; $\Delta f$ = 1 MHz; matched for ISM-434.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 14. Third order intermodulation distortion as a function of frequency for ISM-434 application; different temperatures; typical values**



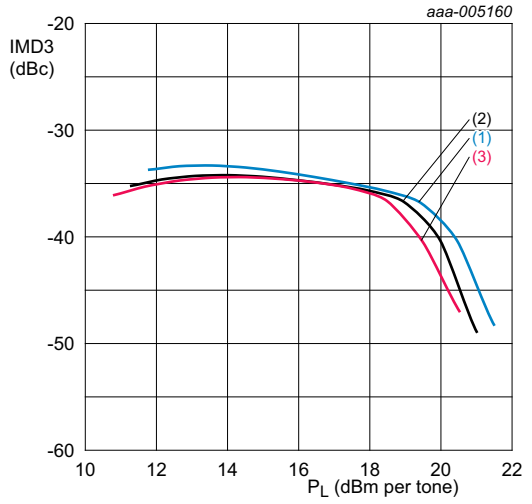

$T_{amb}$ = 25 °C; $I_{CC(tot)}$ = 70 mA; $P_L$ = 15 dBm per tone; $\Delta f$ = 1 MHz; matched for ISM-434.

(1) $V_{SUP}$ = 3.3 V

(2) $V_{SUP}$ = 3.6 V

(3) $V_{SUP}$ = 3.9 V

**Fig 15. Third order intermodulation distortion as a function of frequency for ISM-434 application; different supply voltages; typical values**



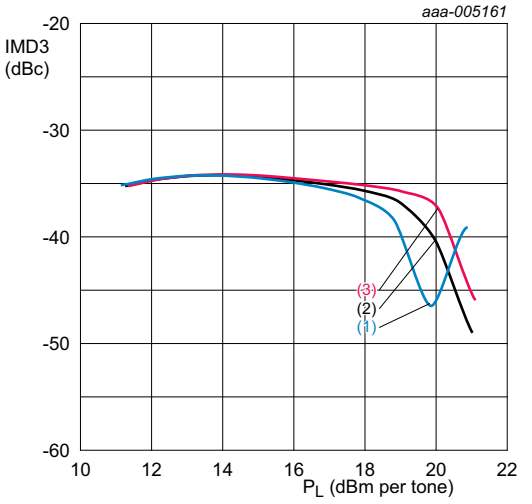

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; $\Delta f$ = 1 MHz; matched for ISM-434.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 16. Third order intermodulation distortion as a function of output power for ISM-434 application; different temperatures; typical values**




$T_{amb}$ = 25 °C; $I_{CC(tot)}$ = 70 mA; $\Delta f$ = 1 MHz; matched for ISM-434.

(1) $V_{SUP}$ = 3.3 V

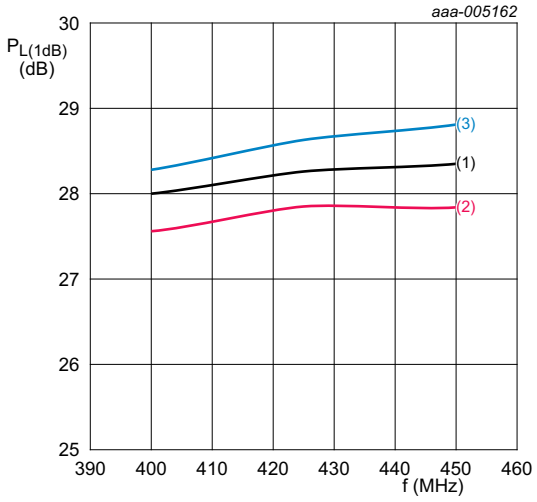
(2) $V_{SUP}$ = 3.6 V

(3) $V_{SUP}$ = 3.9 V

**Fig 17. Third order intermodulation distortion as a function of output power for ISM-434 application; different supply voltages; typical values**


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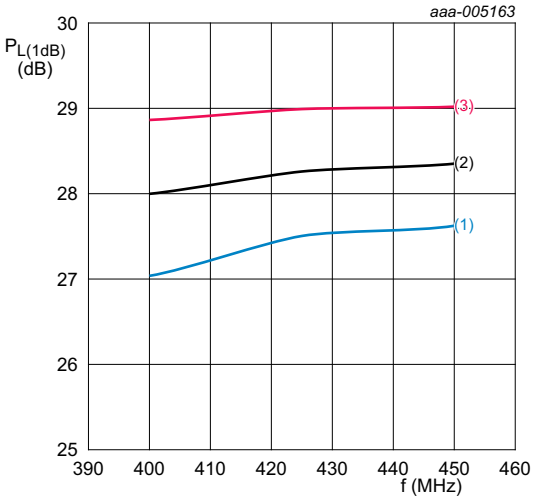

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 18. Output power at 1 dB gain compression as a function of frequency for ISM-434 application; different temperatures; typical values**



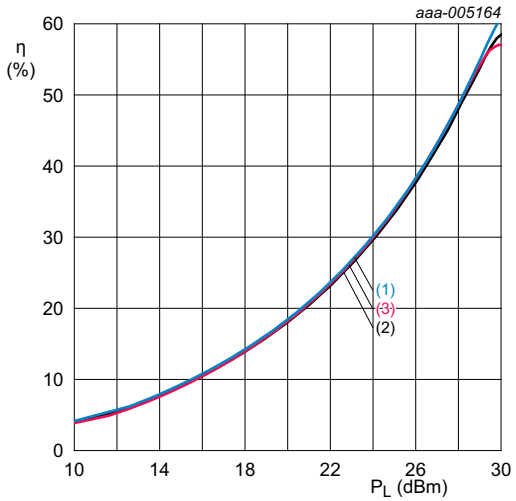

$T_{amb}$ = 25 °C; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

(1) $V_{SUP}$ = 3.3 V

(2) $V_{SUP}$ = 3.6 V

(3) $V_{SUP}$ = 3.9 V

**Fig 19. Output power at 1 dB gain compression as a function of frequency for ISM-434 application; different supply voltages; typical values**



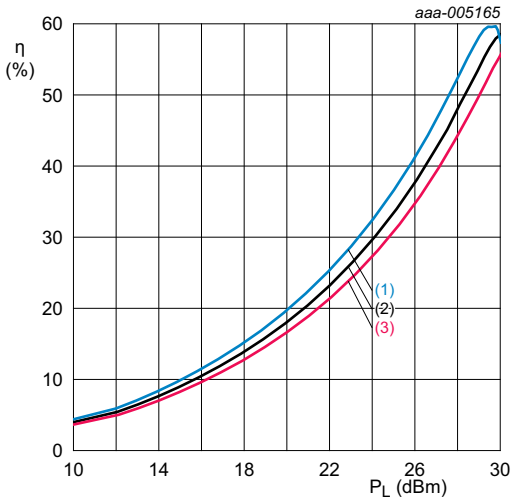

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 20. Efficiency as a function of output power for ISM-434 application; different temperatures; typical values**




$T_{amb}$ = 25 °C; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

(1) $V_{SUP}$ = 3.3 V

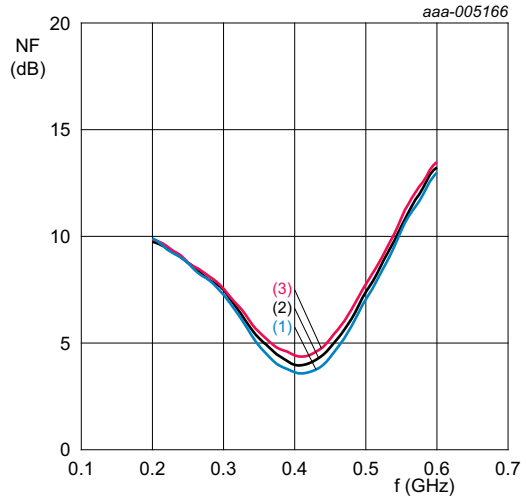
(2) $V_{SUP}$ = 3.6 V

(3) $V_{SUP}$ = 3.9 V

**Fig 21. Efficiency as a function of output power for ISM-434 application; different supply voltages; typical values**


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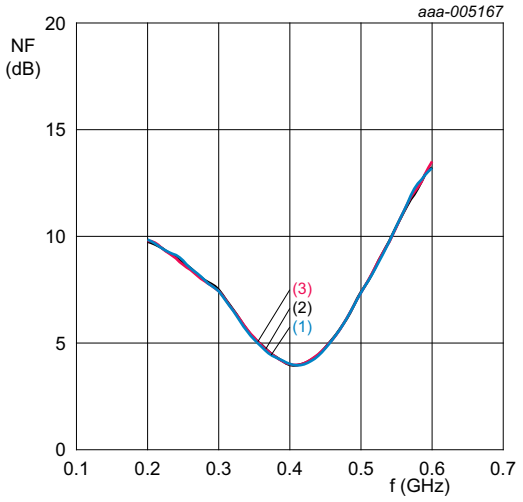

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 22. Noise figure as a function of frequency for ISM-434 application; different temperatures; typical values**



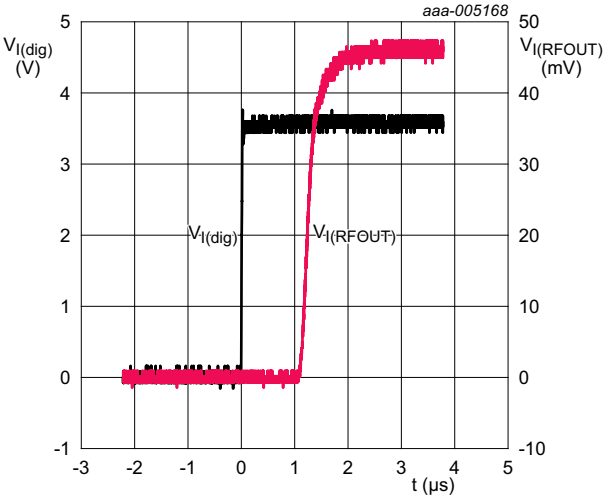

$T_{amb}$ = 25 °C; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

(1) $V_{SUP}$ = 3.3 V

(2) $V_{SUP}$ = 3.6 V

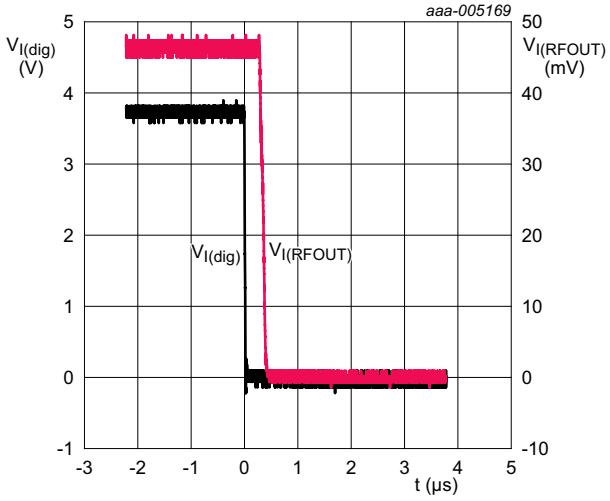
(3) $V_{SUP}$ = 3.9 V

**Fig 23. Noise figure as a function of frequency for ISM-434 application; different supply voltages; typical values**




$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

**Fig 24. Power-on delay time; typical values**

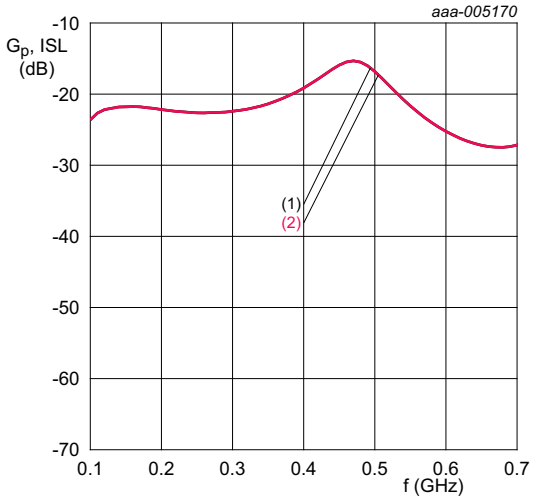



$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-434.

**Fig 25. Power-down delay time; typical values**


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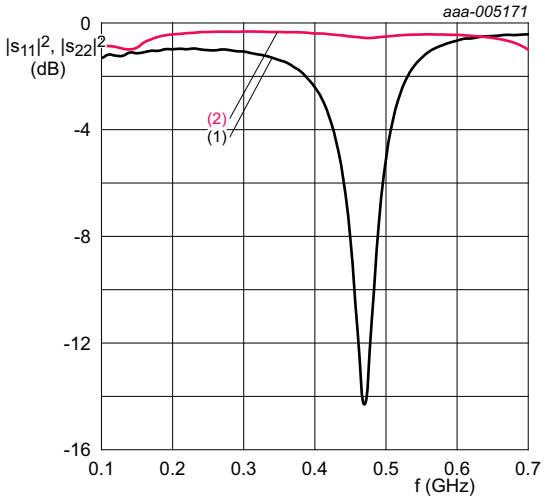



$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; pin ENABLE = LOW; matched for ISM-434.

(1) $G_p$

(2) ISL

**Fig 26. Isolation in power-down mode; typical values**



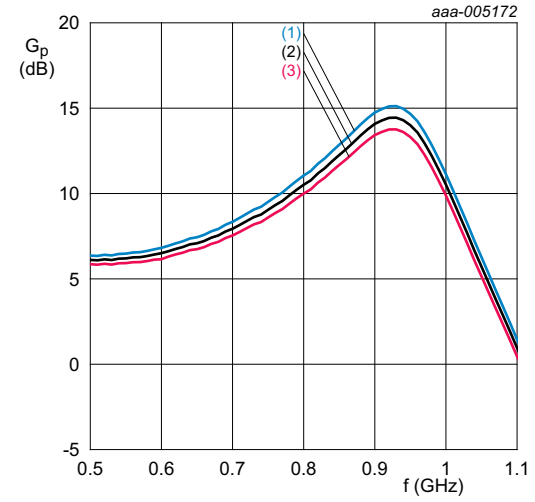

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; pin ENABLE = LOW; matched for ISM-434.

(1) $|s_{11}|^2$

(2) $|s_{22}|^2$

**Fig 27. Return loss in power-down mode; typical values**

## 14.3 Characteristics ISM-915



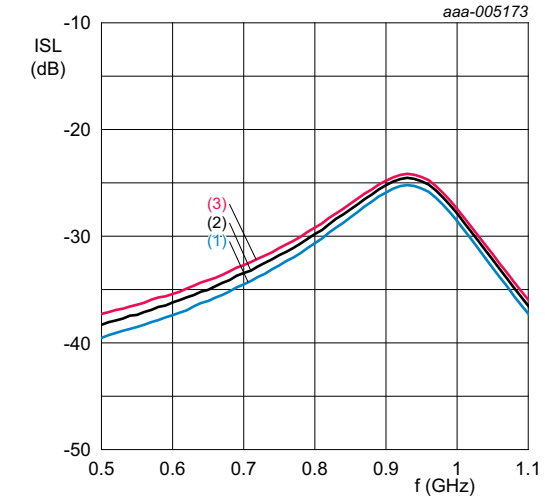

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 28. Power gain as a function of frequency for ISM-915 application; typical values**




$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

(1) $T_{amb}$ = −40 °C

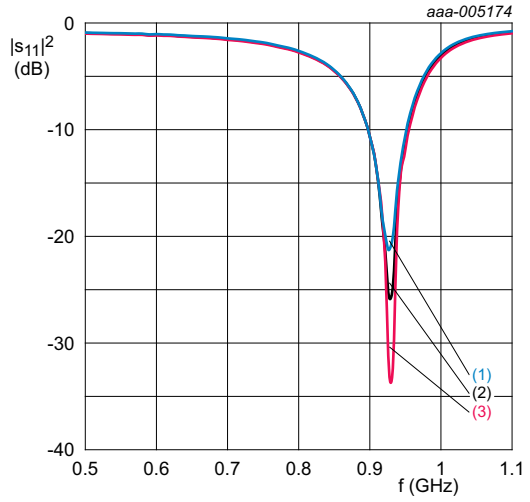
(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 29. Isolation as a function of frequency for ISM-915 application; typical values**


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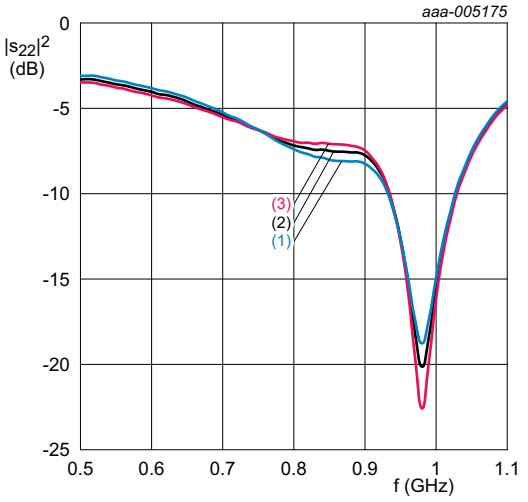

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 30. Input return loss as a function of frequency for ISM-915 application; typical values**



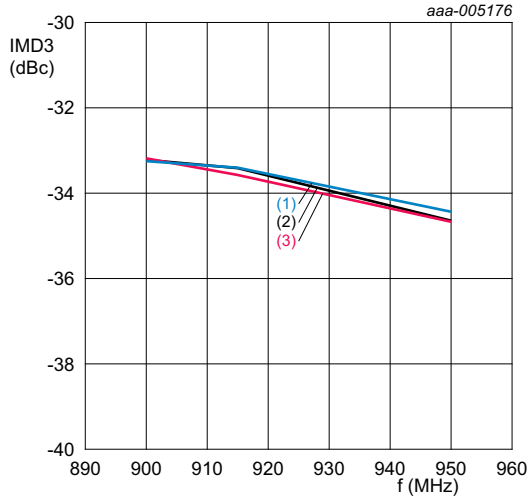

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 31. Output return loss as a function of frequency for ISM-915 application; typical values**



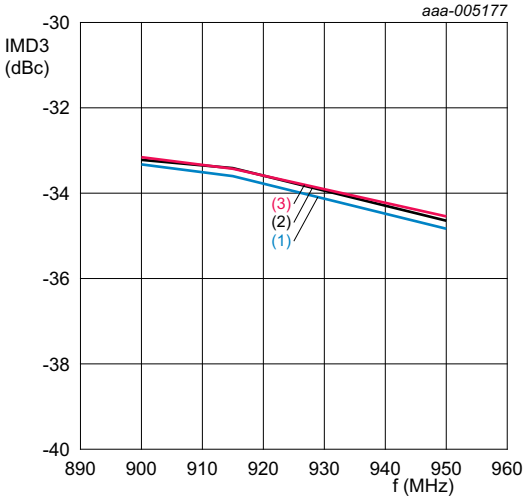

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; $P_L$ = 15 dBm per tone; $\Delta f$ = 1 MHz; matched for ISM-915.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 32. Third order intermodulation distortion as a function of frequency for ISM-915 application; different temperatures; typical values**




$T_{amb}$ = 25 °C; $I_{CC(tot)}$ = 70 mA; $P_L$ = 15 dBm per tone; $\Delta f$ = 1 MHz; matched for ISM-915.

(1) $V_{SUP}$ = 3.3 V

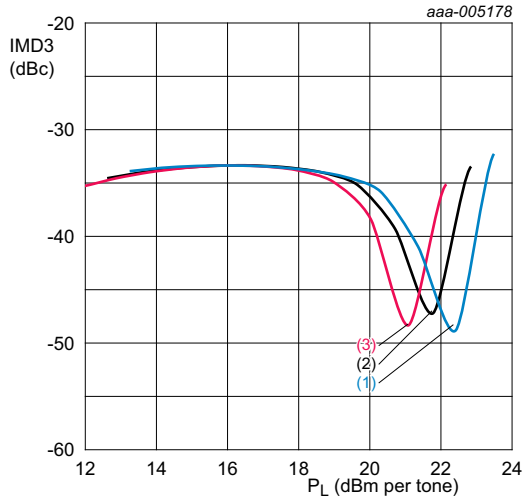
(2) $V_{SUP}$ = 3.6 V

(3) $V_{SUP}$ = 3.9 V

**Fig 33. Third order intermodulation distortion as a function of frequency for ISM-915 application; different supply voltages; typical values**


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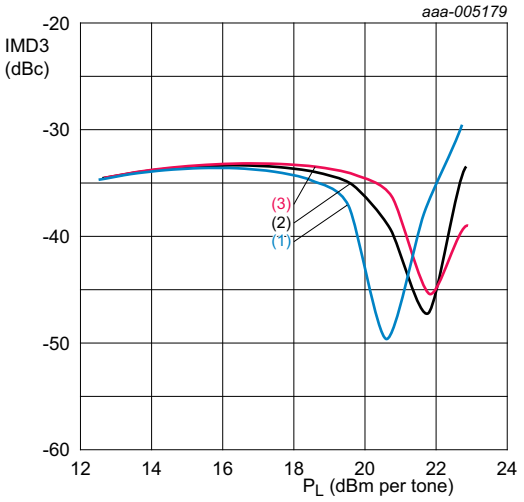

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; $\Delta f$ = 1 MHz; matched for ISM-915.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 34. Third order intermodulation distortion as a function of output power for ISM-915 application; different temperatures; typical values**



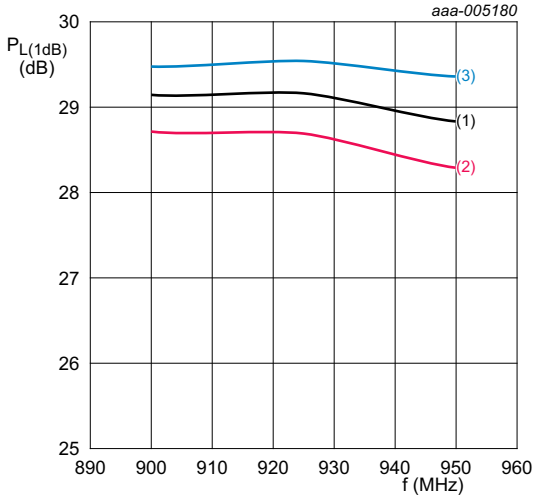

$T_{amb}$ = 25 °C; $I_{CC(tot)}$ = 70 mA; $\Delta f$ = 1 MHz; matched for ISM-915.

(1) $V_{SUP}$ = 3.3 V

(2) $V_{SUP}$ = 3.6 V

(3) $V_{SUP}$ = 3.9 V

**Fig 35. Third order intermodulation distortion as a function of output power for ISM-915 application; different supply voltages; typical values**



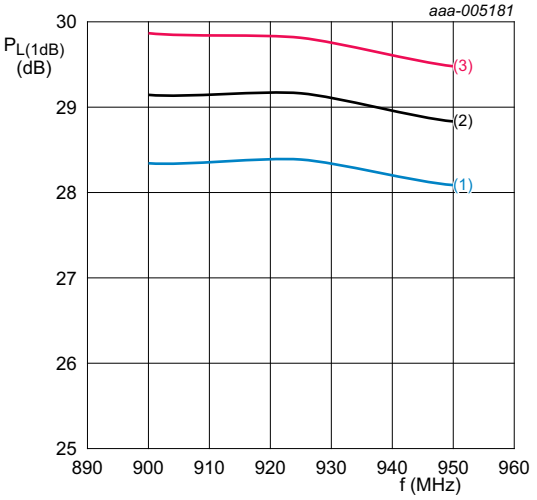

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 36. Output power at 1 dB gain compression as a function of frequency for ISM-915 application; different temperatures; typical values**




$T_{amb}$ = 25 °C; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

(1) $V_{SUP}$ = 3.3 V

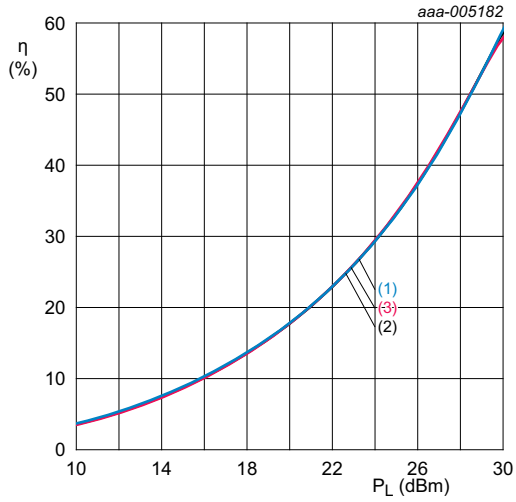
(2) $V_{SUP}$ = 3.6 V

(3) $V_{SUP}$ = 3.9 V

**Fig 37. Output power at 1 dB gain compression as a function of frequency for ISM-915 application; different supply voltages; typical values**


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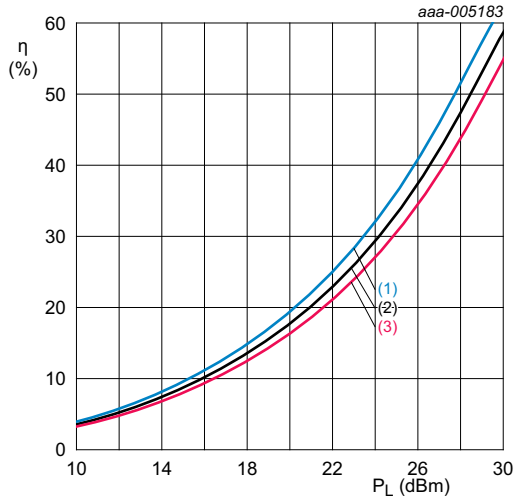

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 38. Efficiency as a function of output power for ISM-915 application; different temperatures; typical values**



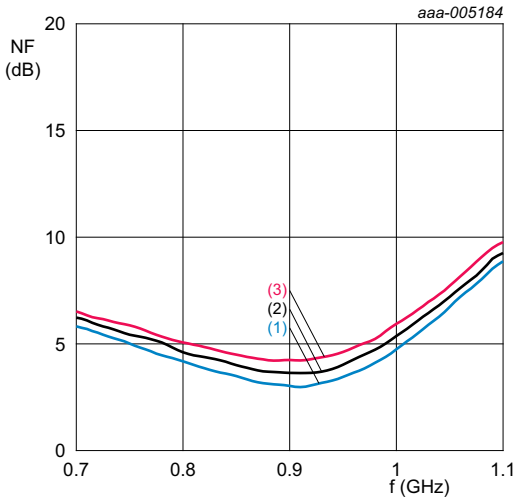

$T_{amb}$ = 25 °C; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

(1) $V_{SUP}$ = 3.3 V

(2) $V_{SUP}$ = 3.6 V

(3) $V_{SUP}$ = 3.9 V

**Fig 39. Efficiency as a function of output power for ISM-915 application; different supply voltages; typical values**



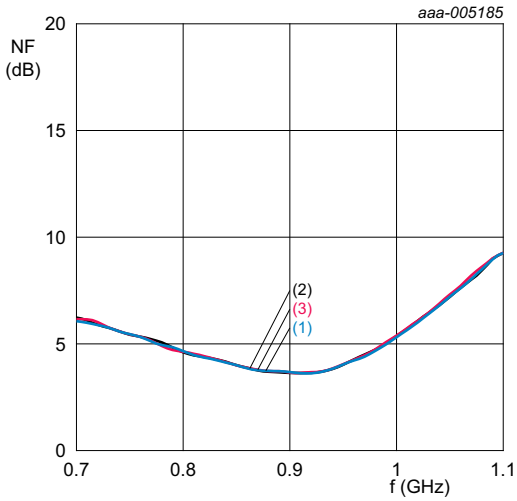

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

(1) $T_{amb}$ = −40 °C

(2) $T_{amb}$ = +25 °C

(3) $T_{amb}$ = +85 °C

**Fig 40. Noise figure as a function of frequency for ISM-915 application; different temperatures; typical values**




$T_{amb}$ = 25 °C; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

(1) $V_{SUP}$ = 3.3 V

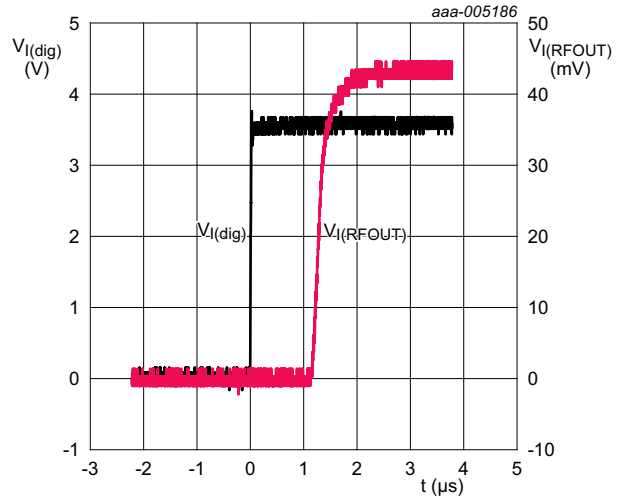
(2) $V_{SUP}$ = 3.6 V

(3) $V_{SUP}$ = 3.9 V

**Fig 41. Noise figure as a function of frequency for ISM-915 application; different supply voltages; typical values**

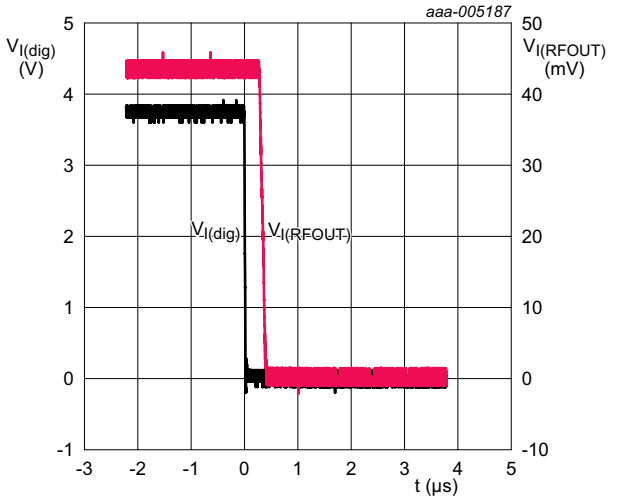

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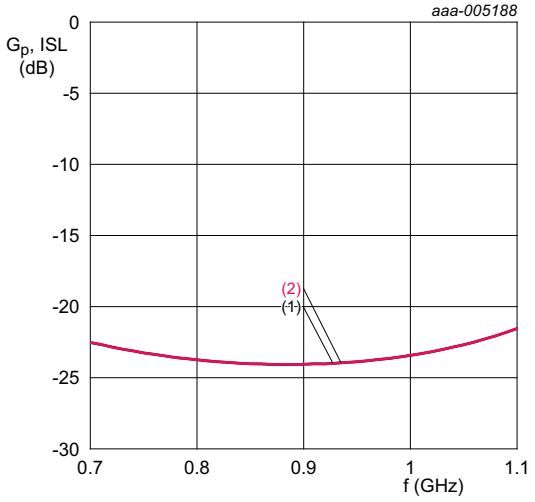

$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

**Fig 42. Power-on delay time; typical values**




$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; matched for ISM-915.

**Fig 43. Power-down delay time; typical values**

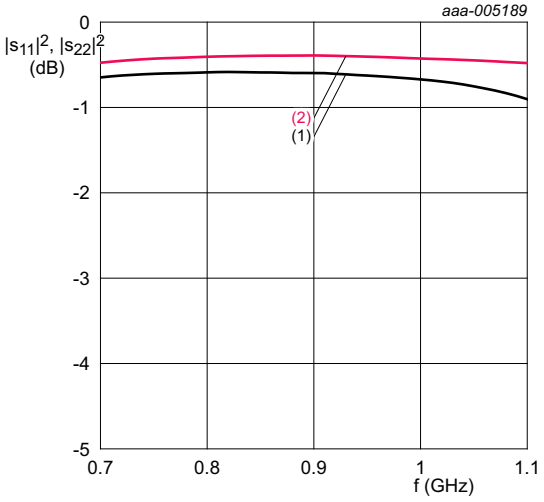



$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; pin ENABLE = LOW; matched for ISM-915.

(1) $G_p$

(2) ISL

**Fig 44. Isolation in power-down mode; typical values**




$V_{SUP}$ = 3.6 V; $I_{CC(tot)}$ = 70 mA; pin ENABLE = LOW; matched for ISM-915.

(1) $|s_{11}|^2$

(2) $|s_{22}|^2$

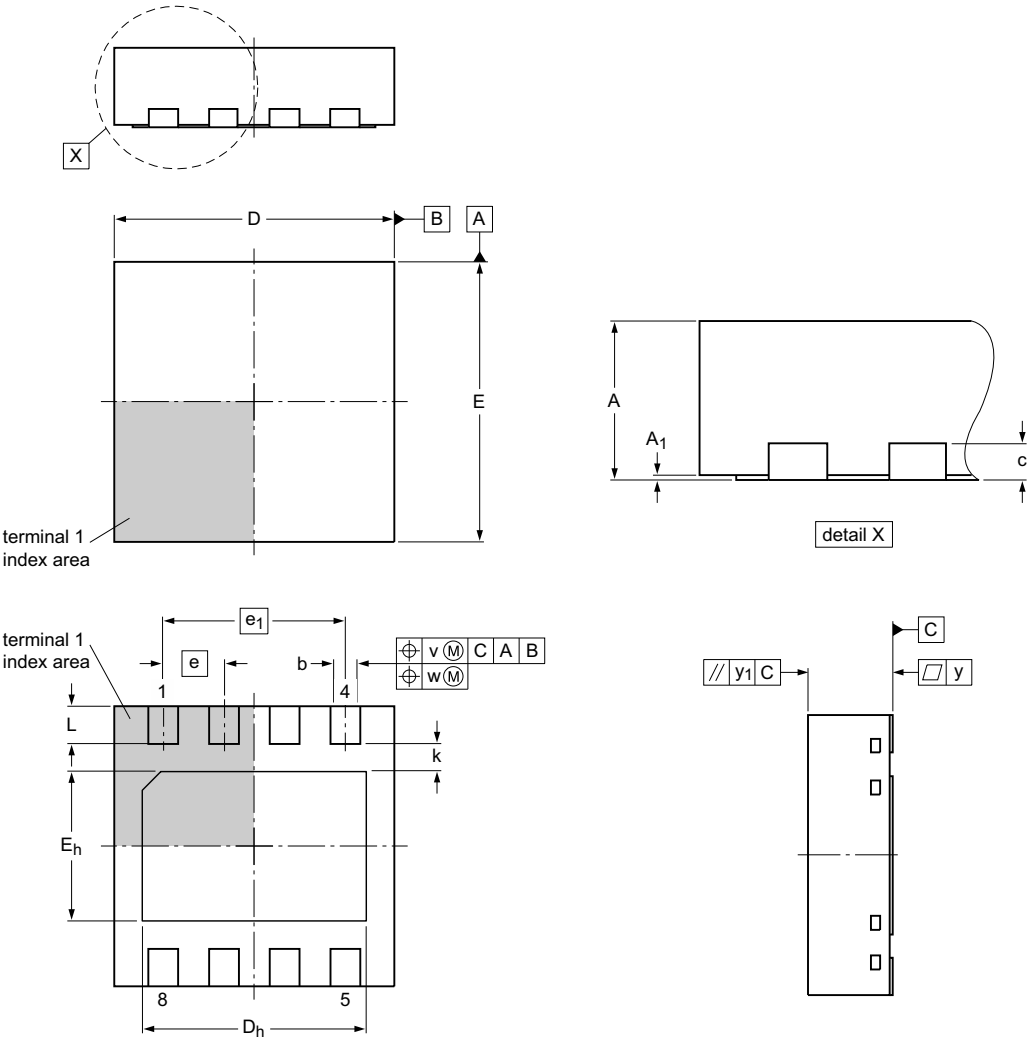
**Fig 45. Return loss in power-down mode; typical values**


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## 15. Package outline

**HVSON8: plastic thermal enhanced very thin small outline package; no leads; 8 terminals; body 3 x 3 x 0.85 mm** **SOT908-3**




Dimensions (mm are the original dimensions)

| Unit | | $A^{(1)}$ | $A_1$ | b | c | $D^{(1)}$ | $D_h$ | $E^{(1)}$ | $E_h$ | e | $e_1$ | k | L | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | max | 1.00 | 0.05 | 0.30 | | 3.1 | 2.45 | 3.1 | 1.75 | | | 0.30 | 0.45 | | | | |
| mm | nom | 0.85 | 0.03 | 0.25 | 0.2 | 3.0 | 2.40 | 3.0 | 1.70 | 0.5 | 1.5 | 0.25 | 0.40 | 0.1 | 0.05 | 0.05 | 0.1 |
| | min | 0.80 | 0.00 | 0.20 | | 2.9 | 2.35 | 2.9 | 1.65 | | | 0.20 | 0.35 | | | | |

Note
1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

*sot908-3_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT908-3 | - - - | MO-229 | - - - | | | ~~11-12-18~~ 12-06-18 |

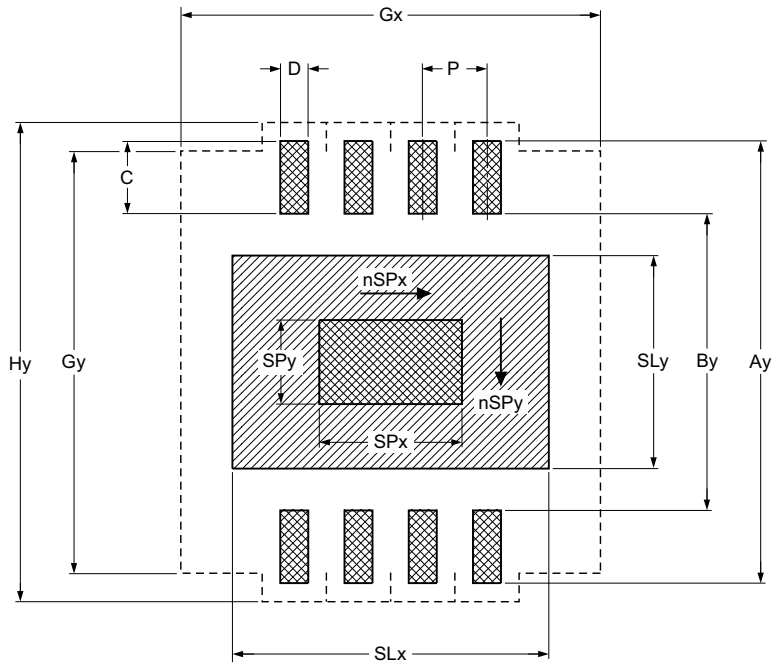
**Fig 46. Package outline SOT908-3 (HVSON8)**


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# 16. Soldering

**Footprint information for reflow soldering of HVSON8 package** **SOT908-3**




solder land

solder paste deposit

solder land plus solder paste

occupied area

DIMENSIONS in mm

| P | Ay | By | C | D | SLx | SLy | SPx | SPy | Gx | Gy | Hy | nSPx | nSPy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5 | 3.45 | 2.25 | 0.6 | 0.25 | 2.45 | 1.65 | 1.1 | 0.65 | 3.25 | 3.25 | 3.7 | 1 | 1 |

Issue date ~~12-07-03~~ 12-07-12

*sot908-3_fr*

**Fig 47. Reflow soldering footprint**


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## 17. Abbreviations

**Table 11. Abbreviations**

| Acronym | Description |
|---|---|
| CDM | Charged Device Model |
| CPE | Customer-Premises Equipment |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MMIC | Monolithic Microwave Integrated Circuit |
| MoCA | Multimedia over Coax Alliance |
| RFID | Radio Frequency IDentification |
| SMA | Sub-Miniature version A |
| VSWR | Voltage Standing-Wave Ratio |
| WLAN | Wireless Local Area Network |

## 18. Revision history

**Table 12. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BGA6130 v.2 | 20140212 | Product data sheet | - | BGA6130 v.1 |
| Modifications | • Figure 6 on page 10: figure updated<br>• Table 10 on page 12: table updated | | | |
| BGA6130 v.1 | 20121009 | Product data sheet | - | - |


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| Document status[1][2] | Product status[3] | 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.

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