# ON5088

## NPN wideband silicon germanium RF transistor

Rev. 3 — 12 December 2012 Product data sheet

## 1. Product profile

### 1.1 General description

NPN silicon germanium microwave transistor for high speed, low noise applications in a plastic, 4-pin dual-emitter SOT343F package.

**CAUTION**

This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

### 1.2 Features and benefits

- Low noise high gain microwave transistor
- High maximum stable gain 27 dB at 1.8 GHz
- 110 GHz $f_T$ silicon germanium technology

### 1.3 Applications

- 2nd and 3rd LNA stage in DBS LNBs
- Satellite radio
- Low noise amplifiers for microwave communications systems
- WLAN and WiMAX applications
- Analog/digital cordless applications

### 1.4 Quick reference data

**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CB}$ | collector-base voltage | open emitter | | - | - | 10 | V |
| $V_{CE}$ | collector-emitter voltage | open base | | - | - | 3.0 | V |
| | | shorted base | | - | - | 10 | V |
| $V_{EB}$ | emitter-base voltage | open collector | | - | - | 1.0 | V |
| $I_C$ | collector current | | | - | 25 | 40 | mA |
| $P_{tot}$ | total power dissipation | $T_{sp} \leq 90$ °C | [1] | - | - | 136 | mW |
| $h_{FE}$ | DC current gain | $I_C$ = 10 mA; $V_{CE}$ = 2 V; $T_j$ = 25 °C | | 160 | 280 | 400 | |
| $C_{CBS}$ | collector-base capacitance | $V_{CB}$ = 2 V; f = 1 MHz | | - | 70 | - | fF |

**Table 1. Quick reference data** *...continued*

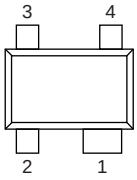
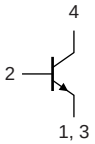
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $f_T$ | transition frequency | $I_C$ = 25 mA; $V_{CE}$ = 2 V; f = 2 GHz; $T_{amb}$ = 25 °C | | - | 55 | - | GHz |
| $G_{p(max)}$ | maximum power gain | $I_C$ = 25 mA; $V_{CE}$ = 2 V; f = 12 GHz; $T_{amb}$ = 25 °C | [2] | - | 13 | - | dB |
| NF | noise figure | $I_C$ = 5 mA; $V_{CE}$ = 2 V; f = 12 GHz; $\Gamma_S = \Gamma_{opt}$; $T_{amb}$ = 25 °C | | - | 1.1 | - | dB |

[1] $T_{sp}$ is the temperature at the solder point of the emitter lead.

[2] $G_{p(max)}$ is the maximum power gain, if K > 1. If K < 1 then $G_{p(max)}$ = Maximum Stable Gain (MSG).

## 2. Pinning information

**Table 2. Discrete pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| 1 | emitter |   |   mbb159 |
| 2 | base | | |
| 3 | emitter | | |
| 4 | collector | | |

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| ON5088 | - | plastic surface-mounted flat pack package; reverse pinning; 4 leads | SOT343F |

## 4. Marking

**Table 4. Marking**

| Type number | Marking | Description |
|---|---|---|
| ON5088 | *6N | * = p : made in Hong Kong |
| | | * = t : made in Malaysia |
| | | * = W : made in China |

## 5. Limiting values

**Table 5. Limiting values**

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CB}$ | collector-base voltage | open emitter | | - | 10 | V |
| $V_{CE}$ | collector-emitter voltage | open base | | - | 3.0 | V |
| | | shorted base | | - | 10 | V |
| $V_{EB}$ | emitter-base voltage | open collector | | - | 1.0 | V |
| $I_C$ | collector current | | | - | 40 | mA |
| $P_{tot}$ | total power dissipation | $T_{sp} \leq 90$ °C | [1] | - | 136 | mW |
| $T_{stg}$ | storage temperature | | | −65 | +150 | °C |
| $T_j$ | junction temperature | | | - | 150 | °C |

[1] $T_{sp}$ is the temperature at the solder point of the emitter lead.

## 6. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | Typ | Unit |
|---|---|---|---|---|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | 440 | K/W |

## 7. Characteristics

**Table 7. Characteristics**

*$T_j$ = 25 °C unless otherwise specified.*

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C$ = 2.5 μA; $I_E$ = 0 mA | | 10 | - | - | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C$ = 1 mA; $I_B$ = 0 mA | | 3.0 | - | - | V |
| $I_C$ | collector current | | | - | 25 | 40 | mA |
| $I_{CBO}$ | collector-base cut-off current | $I_E$ = 0 mA; $V_{CB}$ = 4.5 V | | - | - | 100 | nA |
| $h_{FE}$ | DC current gain | $I_C$ = 10 mA; $V_{CE}$ = 2 V | | 160 | 280 | 400 | |
| $C_{CES}$ | collector-emitter capacitance | $V_{CB}$ = 2 V; f = 1 MHz | | - | 268 | - | fF |
| $C_{EBS}$ | emitter-base capacitance | $V_{EB}$ = 0.5 V; f = 1 MHz | | - | 400 | - | fF |
| $C_{CBS}$ | collector-base capacitance | $V_{CB}$ = 2 V; f = 1 MHz | | - | 70 | - | fF |
| $f_T$ | transition frequency | $I_C$ = 25 mA; $V_{CE}$ = 2 V; f = 2 GHz; $T_{amb}$ = 25 °C | | - | 55 | - | GHz |
| $G_{p(max)}$ | maximum power gain | $I_C$ = 25 mA; $V_{CE}$ = 2 V; $T_{amb}$ = 25 °C | [1] | | | | |
| | | f = 1.8 GHz | | - | 27 | - | dB |
| | | f = 12 GHz | | - | 13 | - | dB |
| $\lvert s_{21}\rvert^2$ | insertion power gain | $I_C$ = 25 mA; $V_{CE}$ = 2 V; $T_{amb}$ = 25 °C | | | | | |
| | | f = 1.8 GHz | | - | 25.4 | - | dB |
| | | f = 12 GHz | | - | 9.3 | - | dB |

**Table 7. Characteristics** *...continued*

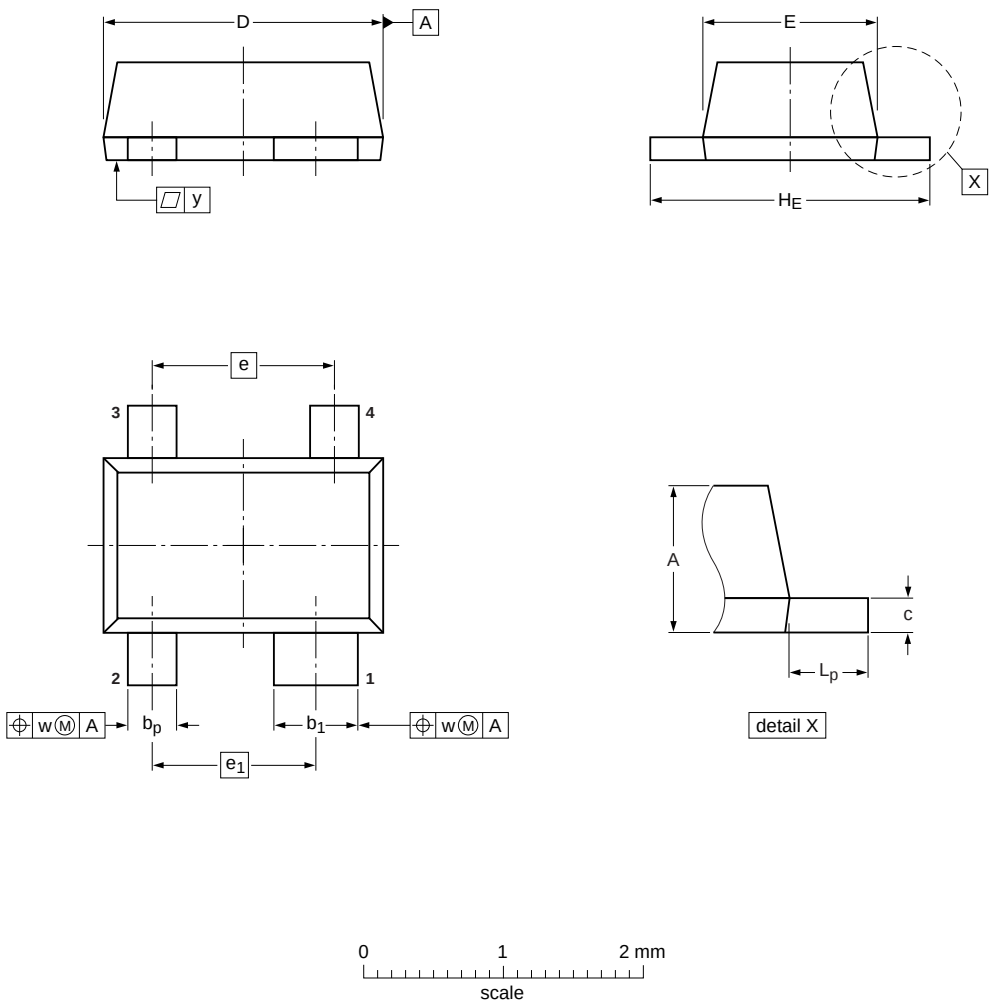
*$T_j$ = 25 °C unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| NF | noise figure | $I_C$ = 5 mA; $V_{CE}$ = 2 V; $\Gamma_S = \Gamma_{opt}$; $T_{amb}$ = 25 °C | | | | |
| | | f = 1.8 GHz | - | 0.43 | - | dB |
| | | f = 12 GHz | - | 1.1 | - | dB |
| $G_{ass}$ | associated gain | $I_C$ = 5 mA; $V_{CE}$ = 2 V; $\Gamma_S = \Gamma_{opt}$; $T_{amb}$ = 25 °C | | | | |
| | | f = 1.8 GHz | - | 22 | - | dB |
| | | f = 12 GHz | - | 10 | - | dB |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | $I_C$ = 25 mA; $V_{CE}$ = 2 V; $Z_S = Z_L$ = 50 Ω; $T_{amb}$ = 25 °C; f = 1.8 GHz | - | 9 | - | dBm |
| IP3 | third-order intercept point | $I_C$ = 25 mA; $V_{CE}$ = 2 V; $Z_S = Z_L$ = 50 Ω; $T_{amb}$ = 25 °C; $f_2 = f_1$ + 1 MHz; $f_1$ = 1.8 GHz | - | 17 | - | dBm |

[1] $G_{p(max)}$ is the maximum power gain, if K > 1. If K < 1 then $G_{p(max)}$ = MSG.

## 8. Package outline

**Plastic surface-mounted flat pack package; reverse pinning; 4 leads** **SOT343F**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max | $b_p$ | $b_1$ | c | D | E | e | $e_1$ | $H_E$ | $L_p$ | w | y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 0.75<br>0.65 | 0.4<br>0.3 | 0.7<br>0.5 | 0.25<br>0.10 | 2.2<br>1.8 | 1.35<br>1.15 | 1.3 | 1.15 | 2.2<br>2.0 | 0.48<br>0.38 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT343F | | | | | | ~~05-07-12~~<br>06-03-16 |

**Fig 1. Package outline SOT343F**

# 9. Abbreviations

Table 8. Abbreviations

| Acronym | Description |
|---|---|
| DBS | Direct Broadcast Satellite |
| DC | Direct Current |
| DRO | Dielectric Resonator Oscillator |
| LNA | Low Noise Amplifier |
| LNB | Low Noise Block |
| NPN | Negative-Positive-Negative |
| RF | Radio Frequency |
| WLAN | Wireless Local Area Network |
| WiMAX | Worldwide Interoperability for Microwave Access |

# 10. Revision history

Table 9. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| ON5088 v.3 | 20121212 | Product data sheet | - | ON5088 v.2 |
| Modifications: | • Table 1 on page 1: some changes have been made.<br>• Table 5 on page 3: some changes have been made.<br>• Table 7 on page 3: The minimum value for $V_{(BR)CEO}$ has been changed. | | | |
| ON5088 v.2 | 20111222 | Product data sheet | - | ON5088 v.1 |
| ON5088 v.1 | 20100422 | Product data sheet | - | - |

# 11. Legal information

## 11.1 Data sheet status

| 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. |
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[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".

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