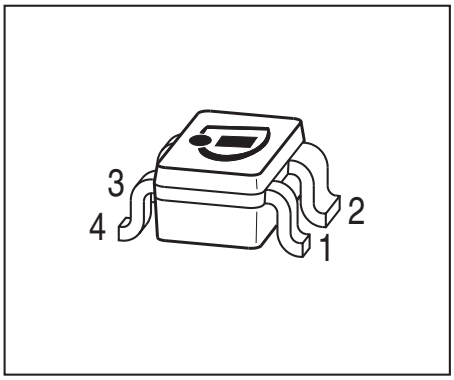
## NPN Silicon RF Transistor




- Low current device suitable e.g. for handhelds
- For high frequency oscillators e.g. DRO for LNB
- For ISM band applications like
  Automatic Meter Reading, Sensors etc.
- Transit frequency $f_T$ = 25 GHz
- Pb-free (RoHS compliant) package
- Qualified according AEC Q101

AEC Qualified RoHS

**ESD** (**E**lectro**s**tatic **d**ischarge) sensitive device, observe handling precaution!

| Type | Marking | Pin Configuration | | | | | | Package |
|---|---|---|---|---|---|---|---|---|
| BFP410 | AKs | 1=B | 2=E | 3=C | 4=E | - | - | SOT343 |

**Maximum Ratings** at $T_A$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Collector-emitter voltage | $V_{CEO}$ | | V |
| $T_A$ = 25 °C | | 4.5 | |
| $T_A$ = -55 °C | | 4.1 | |
| Collector-emitter voltage | $V_{CES}$ | 13 | |
| Collector-base voltage | $V_{CBO}$ | 13 | |
| Emitter-base voltage | $V_{EBO}$ | 1.5 | |
| Collector current | $I_C$ | 40 | mA |
| Base current | $I_B$ | 6 | |
| Total power dissipation[1)] | $P_{tot}$ | 150 | mW |
| $T_S \leq$ 100 °C | | | |
| Junction temperature | $T_J$ | 150 | °C |
| Ambient temperature | $T_A$ | -55 ... 150 | |
| Storage temperature | $T_{Stg}$ | -55 ... 150 | |

[1] $T_S$ is measured on the emitter lead at the soldering point to the pcb

**Thermal Resistance**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction - soldering point[1)] | $R_{thJS}$ | 335 | K/W |

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**Electrical Characteristics** at $T_A$ = 25°C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **DC Characteristics** | | | | | |
| Collector-emitter breakdown voltage<br>$I_C$ = 1 mA, $I_B$ = 0 | $V_{(BR)CEO}$ | 4.5 | 5 | - | V |
| Collector-emitter cutoff current<br>$V_{CE}$ = 2 V, $V_{BE}$ = 0<br>$V_{CE}$ = 5 V, $V_{BE}$ = 0 , $T_A$ = 85 °C<br>(verified by random sampling) | $I_{CES}$ | <br>-<br>- | <br>1<br>2 | <br>30<br>50 | nA |
| Collector-base cutoff current<br>$V_{CB}$ = 2 V, $I_E$ = 0 | $I_{CBO}$ | - | 1 | 30 | |
| Emitter-base cutoff current<br>$V_{EB}$ = 0.5 V, $I_C$ = 0 | $I_{EBO}$ | - | 0.001 | 0.6 | µA |
| DC current gain<br>$I_C$ = 13 mA, $V_{CE}$ = 2 V, pulse measured | $h_{FE}$ | 60 | 95 | 130 | - |

[1]For calculation of $R_{thJA}$ please refer to Application Note Thermal Resistance

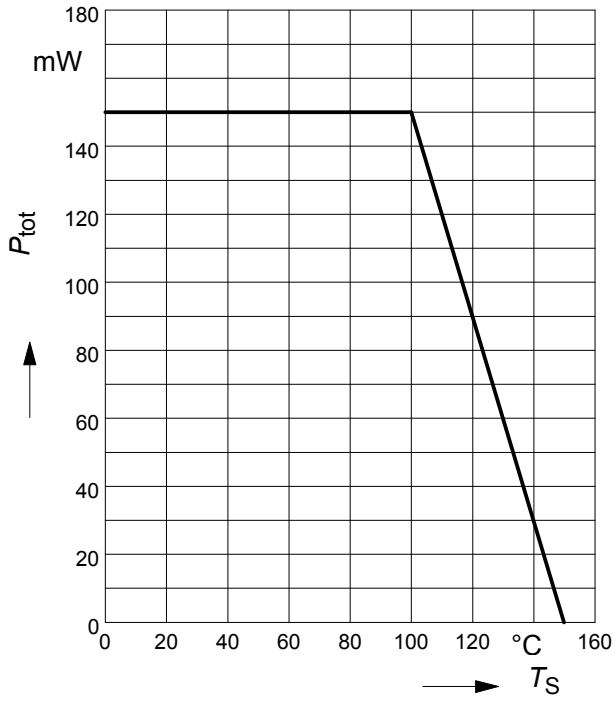
**Electrical Characteristics** at $T_A$ = 25°C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **AC Characteristics** (verified by random sampling) | | | | | |
| Transition frequency<br>$I_C$ = 20 mA, $V_{CE}$ = 2 V, $f$ = 2 GHz | $f_T$ | 18 | 25 | - | GHz |
| Collector-base capacitance<br>$V_{CB}$ = 2 V, $f$ = 1 MHz, $V_{BE}$ = 0 ,<br>emitter grounded | $C_{cb}$ | - | 0.09 | 0.17 | pF |
| Collector emitter capacitance<br>$V_{CE}$ = 2 V, $f$ = 1 MHz, $V_{BE}$ = 0 ,<br>base grounded | $C_{ce}$ | - | 0.35 | - | |
| Emitter-base capacitance<br>$V_{EB}$ = 0.5 V, $f$ = 1 MHz, $V_{CB}$ = 0 ,<br>collector grounded | $C_{eb}$ | - | 0.45 | - | |
| Noise figure<br>$I_C$ = 2 mA, $V_{CE}$ = 2 V, $f$ = 2 GHz, $Z_S = Z_{Sopt}$ | $F$ | - | 1.2 | - | dB |
| Power gain, maximum stable[1)]<br>$I_C$ = 20 mA, $V_{CE}$ = 2 V, $Z_S = Z_{Sopt}$,<br>$Z_L = Z_{Lopt}$ , $f$ = 2 GHz | $G_{ms}$ | - | 21.5 | - | dB |
| Insertion power gain<br>$V_{CE}$ = 2 V, $I_C$ = 20 mA, $f$ = 2 GHz,<br>$Z_S = Z_L$ = 50 Ω | $\lvert S_{21}\rvert^2$ | - | 18.5 | - | |
| Third order intercept point at output[2)]<br>$V_{CE}$ = 2 V, $I_C$ = 20 mA, $f$ = 2 GHz,<br>$Z_S = Z_L$ = 50 Ω | $IP_3$ | - | 23.5 | - | dBm |
| 1dB Compression point at output<br>$I_C$ = 20 mA, $V_{CE}$ = 2 V, $Z_S = Z_L$ = 50 Ω,<br>$f$ = 2 GHz | $P_{-1dB}$ | - | 10.5 | - | |

[1] $G_{ms} = |S_{21} / S_{12}|$

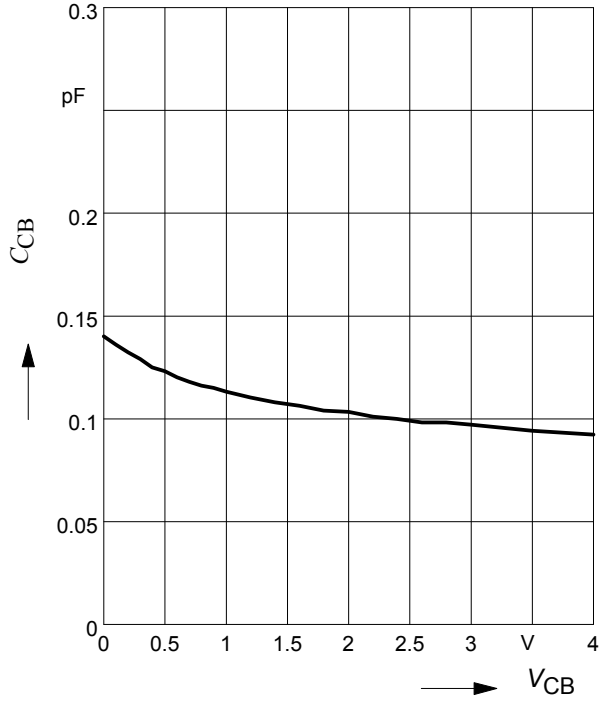
[2] IP3 value depends on termination of all intermodulation frequency components.
Termination used for this measurement is 50Ω from 0.1 MHz to 6 GHz

**Total power dissipation** $P_{tot} = f(T_S)$




**Collector-base capacitance** $C_{cb} = f(V_{CB})$

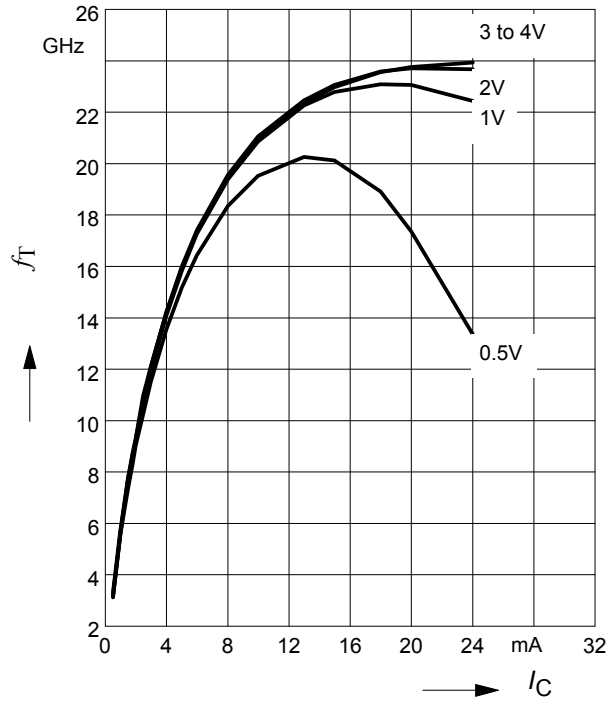
$f$ = 1MHz




**Transition frequency** $f_T = f(I_C)$

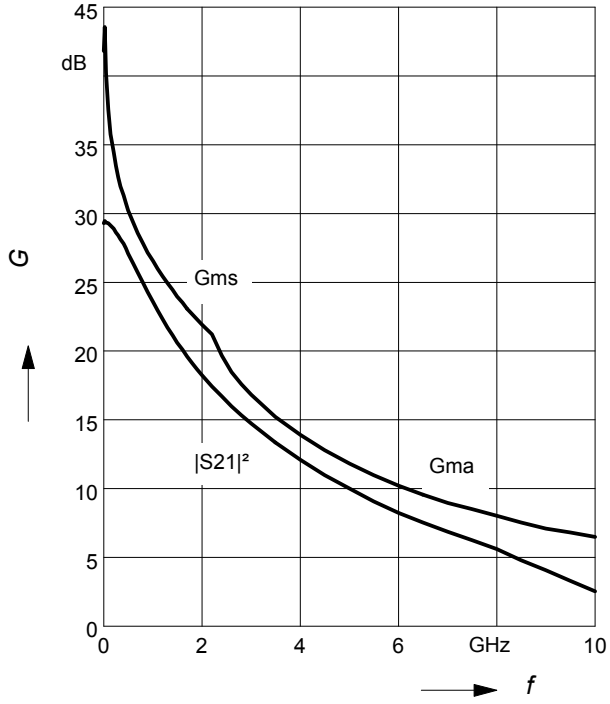
$f$ = 2 GHz

$V_{CE}$ = parameter in V




**Power gain** $G_{ma}$, $G_{ms}$, $|S_{21}|^2 = f(f)$

$V_{CE}$ = 2 V, $I_C$ = 13 mA

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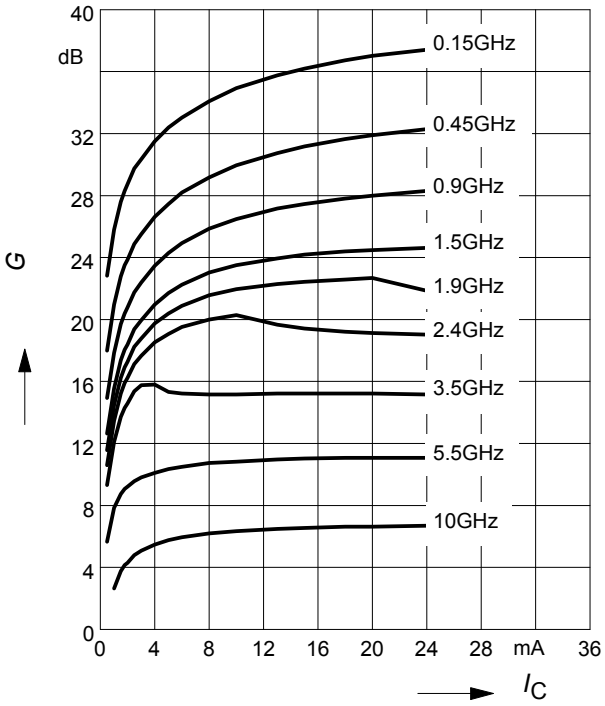
**Power gain** $G_{ma}$, $G_{ms}$ = $f$ ($I_C$)

$V_{CE}$ = 2V

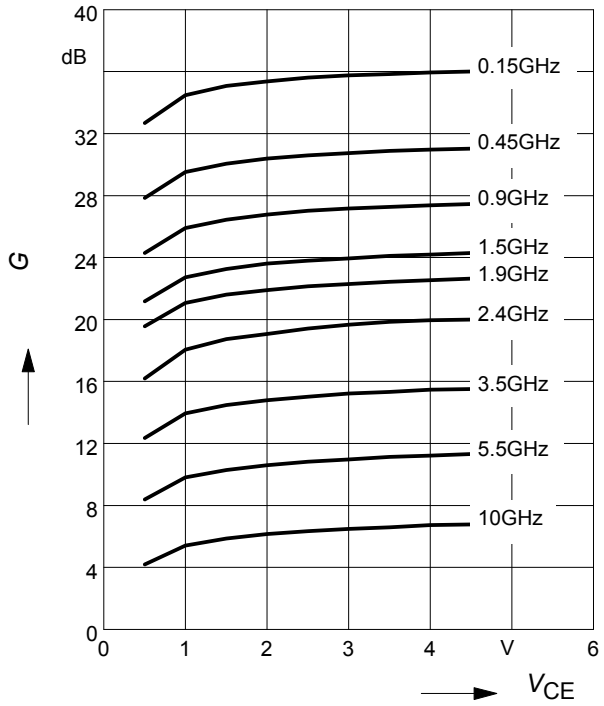
$f$ = parameter in GHz




**Power gain** $G_{ma}$, $G_{ms}$ = $f$ ($V_{CE}$)

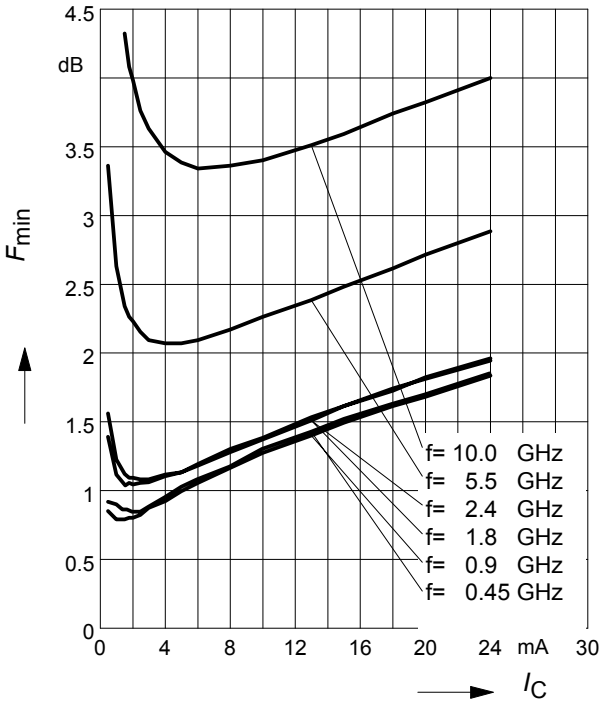
$I_C$ = 13 mA

$f$ = parameter in GHz



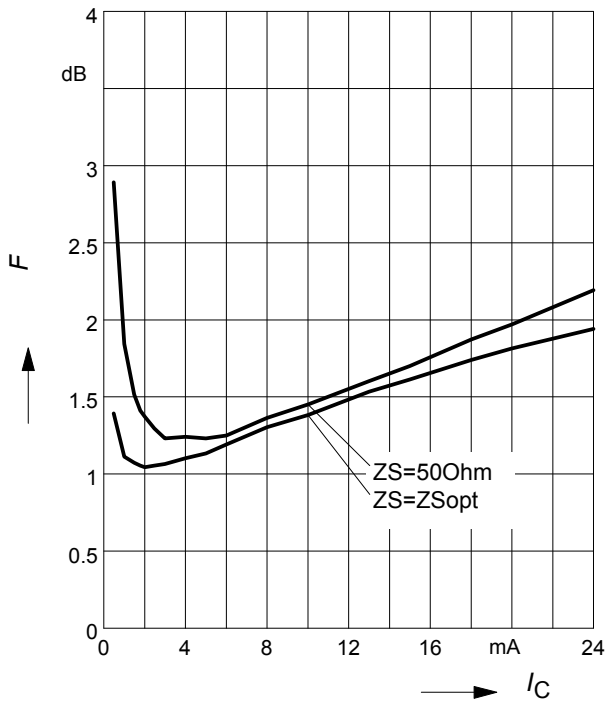

**Noise figure** $F$ = $f(I_C)$

$V_{CE}$ = 2 V, $Z_S$ = $Z_{Sopt}$



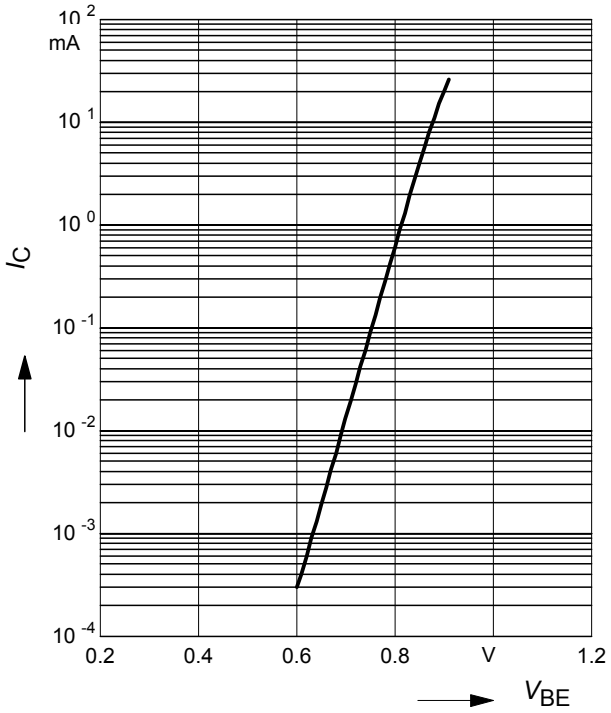

**Noise figure** $F$ = $f(I_C)$

$V_{CE}$ = 2 V, $f$ = 2 GHz



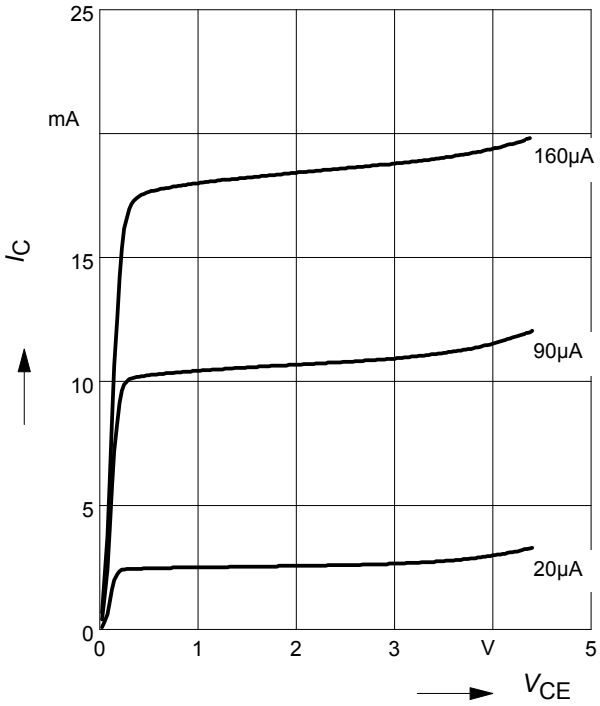
**Collector current $I_C = f(V_{BE})$**

$V_{CE}$ =2 V



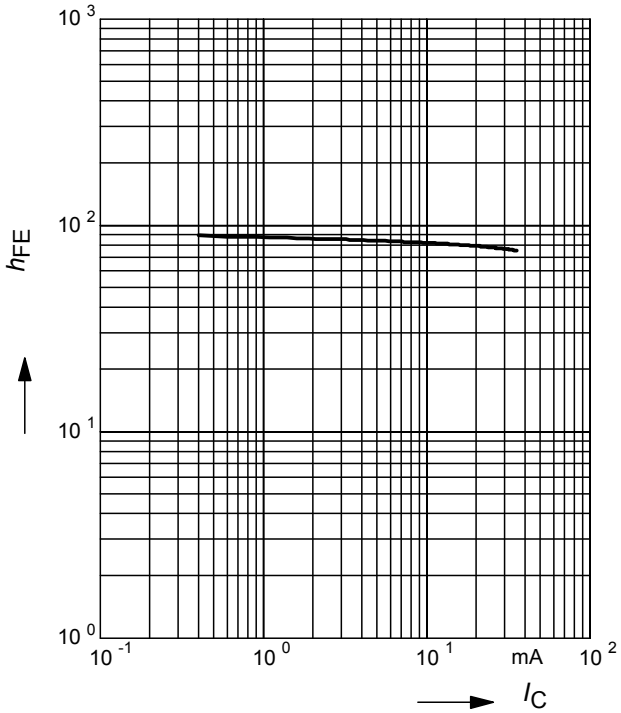

**Collector current $I_C = f(V_{CE})$**

Parameter $I_B$

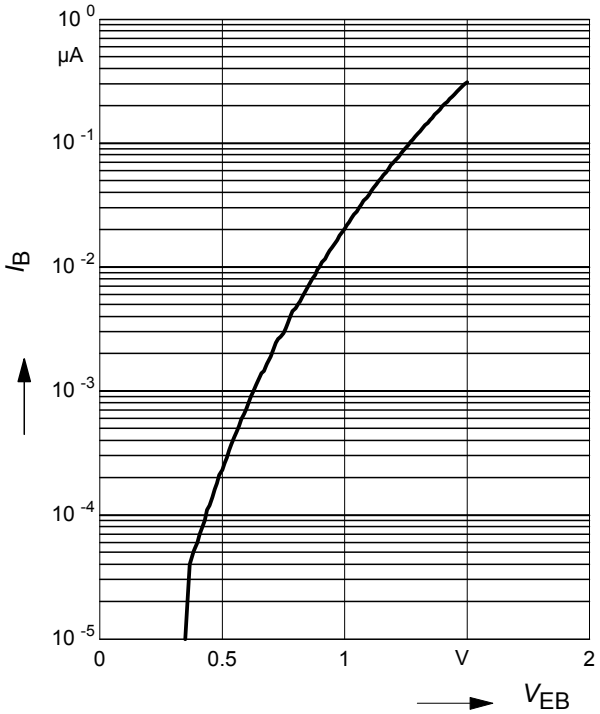



**DC current gain $h_{FE} = f(I_C)$**

$V_{CE}$ =2 V




**Base current reverse $I_B = f(V_{EB})$**

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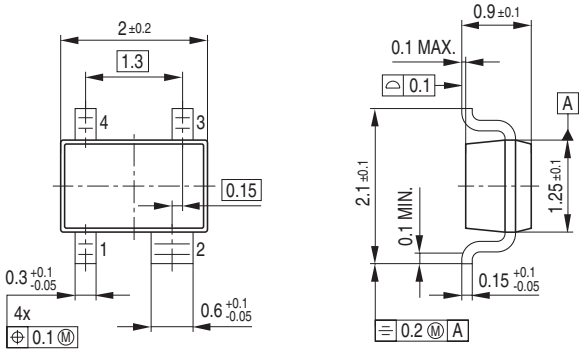
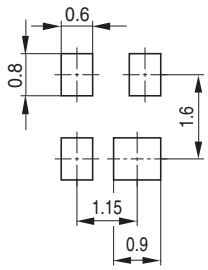
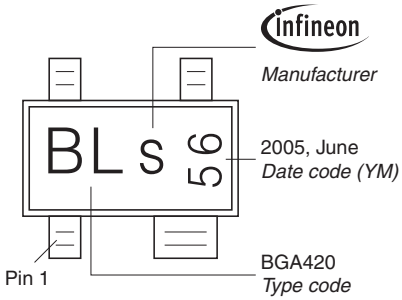
## Package Outline




## Foot Print

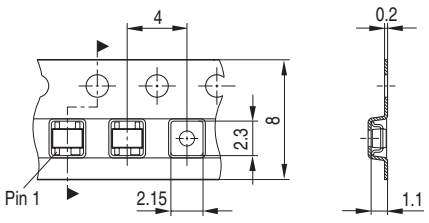



## Marking Layout (Example)




## Standard Packing

Reel ø180 mm = 3.000 Pieces/Reel
Reel ø330 mm = 10.000 Pieces/Reel

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