

# Prescaler Circuit 2.1 GHz

PMB 2314T

Version 1.5

Wireless Infrastructure



N e v e r   s t o p   t h i n k i n g .

**Edition 2003-12-04**

**Published by Infineon Technologies AG,  
St.-Martin-Strasse 53,  
81669 München, Germany**

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## Prescaler Circuit 2.1 GHz

Revision History:      **2003-12-04**

Version 1.2

Previous Version:      none

| Page | Subjects (major changes since last revision) |
|------|--|
| All  | Updated Format                               |
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# 1 Overview – Prescaler Circuit 2.1 GHz

## 1.1 Functional Description/ Application

The IC is designed for use in mobile radio communication devices up to 2100 MHz and upconversion systems up to 2500 MHz.

Due to low power consumption and low phase noise generation, the PMB2314T is suitable for use in battery powered handheld systems, e.g. GSM, cordless telephones and cordless consumer products, as well as in basestations.

Low supply voltage down to 2.7V. It can be switched to a low-power standby mode.

Internal current source at the emitter follower output. No external resistor needed in typical applications.

The divide ratio is 1:64/65 or 1:128/129 depending on the external circuit configuration.

## 1.2 Circuit Description

The differential inputs of the IC may be connected either balanced or single ended. In the latter case the unused input must be RF-grounded with a capacitor (about 10 pF) with a low serial inductance.

Depending on the logic level at SW input the basic divide ratio of the ECL-stages is fixed to 1:64/65 or 1:128/129. The MOD input determines whether modulus 1:n or 1:n+1 (n=64 or 128 according to SW-level) is active.

The IC can be switched to a low-power standby mode (input STB).

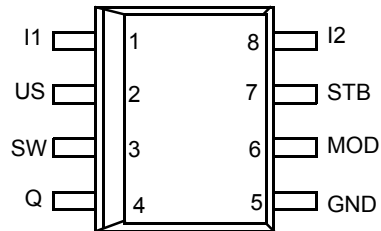
The MOD input is TTL/CMOS compatible.

The emitter follower output is CMOS compatible according to the application circuit on page 12. The minimum logic swing is  $0.8 V_{pp}$ .

**Table 1 Function Table**

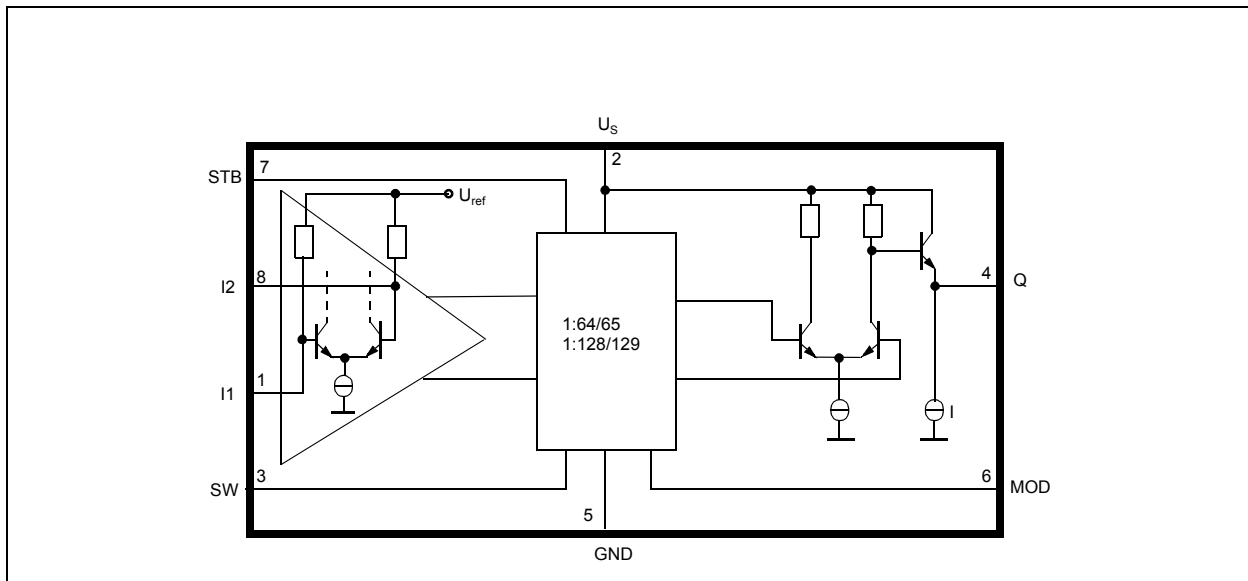
| Input pin  | Logic level   | Prescaler function              |
|------------|---|---------------------------------|
| <b>SW</b>  | HIGH = $U_S - 0.1 V$ to $U_S$<br>LOW = GND to 0.8 V or open | 1:64/65<br>1:128/129            |
| <b>MOD</b> | HIGH = 2.0 V to $U_S$ or open<br>LOW = GND to 0.8 V         | 1:64/1:128<br>1:65/1:129        |
| <b>STB</b> | HIGH = $U_S - 0.1 V$ to $U_S$<br>LOW = GND to 0.8 V         | Divider<br>Q=HIGH, STANDBY-mode |

## 2 Pin Assignment



- Pin 1 RF-input I1
- Pin 2 supply voltage  $U_S$
- Pin 3 divide ratio 1:64/65 - 1:128/129 control input (SW)
- Pin 4 output Q
- Pin 5 GND
- Pin 6 modulus 1:n/n+1 (n=64 or 128) control input (MOD)
- Pin 7 standby mode control input (STB)
- Pin 8 RF-input I2

### 3 Block Diagram



## 4 Absolute Maximum Ratings

 $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$ 

| Parameter                            | Symbol                                | Limit Values |  | Unit             | Remarks            |
|--------------------------------------|---------------------------------------|--------------|--|------------------|--------------------|
|                                      |                                       | min.         | max.   |                  |                    |
| Supply voltage                       | $U_S$                                 | -0.3         | 6  | V                |                    |
| Input level<br>(Pin 1; Pin 8)        | $U_I$                                 |              | 2  | V                | $U_S=0V$           |
| Voltage swing<br>(Pin 1 to 8)        | $U_{I18}$                             | -2           | 2  | V                |                    |
| Input level<br>(Pin 3; Pin 6; Pin 7) | $U_{SW.}$<br>$U_{MOD.}$<br>$U_{STB.}$ | -0.3         | $U_S+0.7V$<br>or 5.5V if<br>$U_S+0.7V >$<br>5.5V | V                | $U_S=2.7\dots5.5V$ |
| Output level<br>(Pin 4)              | $U_O$                                 |              | $U_S$  | V                |                    |
| Output current<br>(Pin 4)            | $-I_O$                                |              | 5  | mA               |                    |
| Junction temperature                 | $T_j$                                 |              | 125  | $^\circ\text{C}$ |                    |
| Storage temperature                  | $T_s$                                 | -65          | 125  | $^\circ\text{C}$ |                    |
| Thermal resistance<br>system-ambient | $R_{thsa}$                            |              | 185  | K/W              |                    |

The maximum ratings may not be exceeded under any circumstances, not even momentarily and individually, as permanent damage to the IC will result.

**ESD-integrity ( according MIL-STD 883D, Meth. 3015.7): 500V**

## 5 Operating Range

| Parameter           | Symbol | Limit Values |      | Unit             | Remarks |
|---------------------|--------|--------------|------|------------------|---------|
|                     |        | min.         | max. |                  |         |
| Supply Voltage      | $U_S$  | 2.7          | 5.5  | V                |         |
| Input frequency     | $f$    | 100          | 2300 | MHz              |         |
| Ambient temperature | $T_A$  | -40          | 85   | $^\circ\text{C}$ |         |

Within the operational range the IC operates as described in the circuit description. The AC / DC characteristic limits are not guaranteed.



## 6 AC/DC Characteristics

**Supply voltage**  $V_S=2.7$  to  $5.5V$

**Ambient temperature**  $T_A = -20$  to  $85$  °C (referred to the test circuit)

| Parameter | Symbol | Limit Values |      |      | Unit | Test Condition |
|-----------|--------|--------------|------|------|------|----------------|
|           |        | min.         | typ. | max. |      |                |

### Supply Current

|                                 |           |  |     |     |    |   |
|---------------------------------|-----------|--|-----|-----|----|---|
| Supply current normal operation | $I_S$     |  | 2.7 | 3.3 | mA | inputs RF-grounded, $U_S=2.7$ , $T_A = 25$ °C, STB= $V_S$ output open |
|                                 | $I_S$     |  | 2.8 | 3.4 | mA | inputs RF-grounded, $U_S=4.0$ , $T_A = 25$ °C, STB= $V_S$ output open |
|                                 | $I_S$     |  | 2.9 | 3.5 | mA | inputs RF-grounded, $V_S=5.5$ , $T_A = 25$ °C, STB= $V_S$ output open |
| Supply current standby-mode     | $I_{STB}$ |  |     | 0.1 | mA | inputs RF-grounded, output open, STB = GND                            |

### RF Input I1,I2

|                           |          |     |  |    |     |                         |
|---------------------------|----------|-----|--|----|-----|-------------------------|
| Input level dynamic range | $P_{in}$ | -20 |  | 4  | dBm | 100-1500MHz (sine wave) |
|                           | $P_{in}$ | -20 |  | -3 | dBm | 2100 MHz ( diagram 2 )  |

### Output Q

|                    |       |     |     |  |     |                                  |
|--------------------|-------|-----|-----|--|-----|----------------------------------|
| Output logic swing | $U_Q$ | 1   | 1.1 |  | VPP | $C_L \leq 12pF$ , $R_L=2k\Omega$ |
|                    | $U_Q$ | 0.8 | 1.1 |  | VPP | $C_L \leq 8pF$                   |

|                         |   |  |     |  |         |                   |
|-------------------------|---|--|-----|--|---------|-------------------|
| Internal current source | I |  | 400 |  | $\mu A$ | see block diagram |
|-------------------------|---|--|-----|--|---------|-------------------|

### Divider Ratio Control Input SW

|                    |            |           |  |       |         |           |
|--------------------|------------|-----------|--|-------|---------|-----------|
| age high           | $V_{SWH}$  | $V_S-0.1$ |  | $V_S$ | V       |           |
| Voltage low        | $V_{SWL}$  | GND       |  | 0.8   | V       |           |
| Input current high | $I_{SWH}$  |           |  | 60    | $\mu A$ | SW= $V_S$ |
| Input current low  | $-I_{SWL}$ |           |  | 30    | $\mu A$ | SW=GND    |

### Modulus Control Input MOD

|                    |             |     |  |       |         |            |
|--------------------|-------------|-----|--|-------|---------|------------|
| Voltage high       | $V_{MODH}$  | 2.3 |  | $V_S$ | V       |            |
| Voltage low        | $V_{MODL}$  | GND |  | 0.8   | V       |            |
| Input current high | $I_{MODH}$  |     |  | 50    | $\mu A$ | MOD= $V_S$ |
| Input current low  | $-I_{MODL}$ |     |  | 120   | $\mu A$ | MOD=GND    |

### Standby Mode Control Input STB

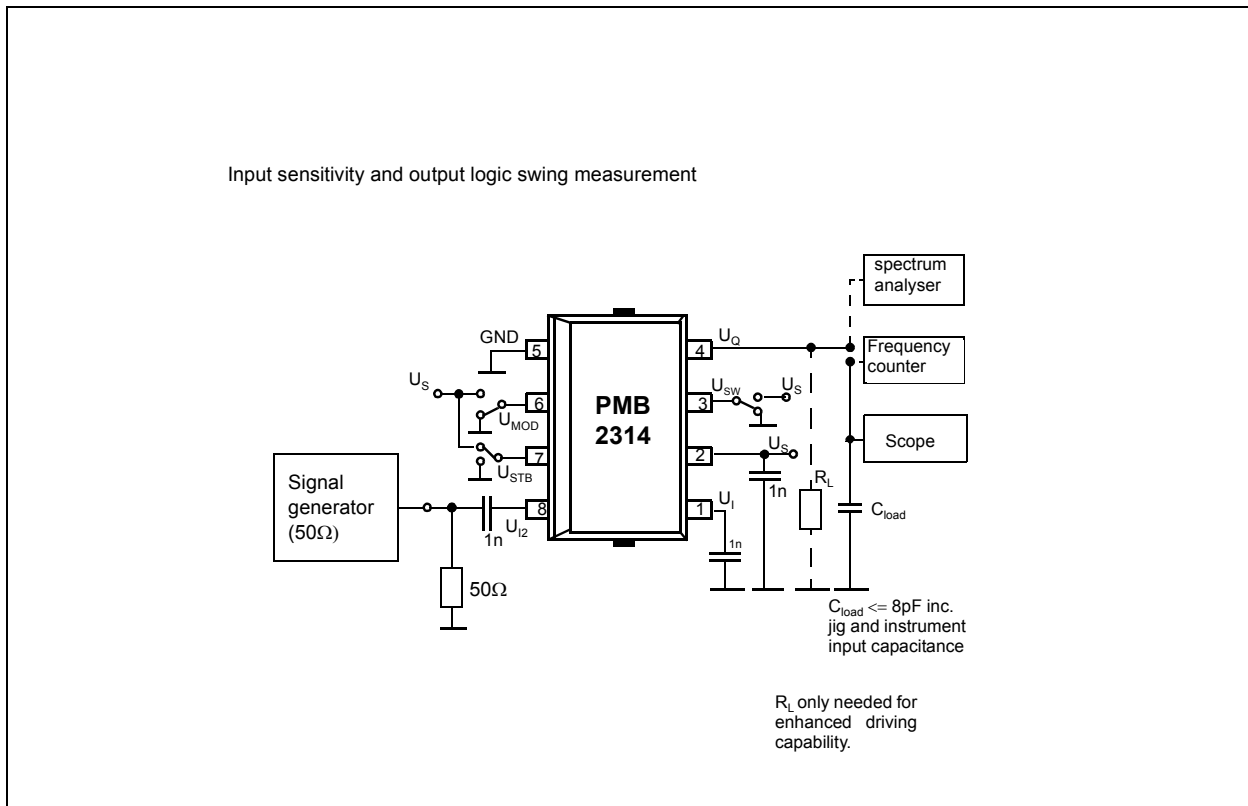
|                    |             |           |  |       |         |            |
|--------------------|-------------|-----------|--|-------|---------|------------|
| Voltage high       | $V_{STBH}$  | $U_S-0.1$ |  | $V_S$ | V       |            |
| Voltage low        | $V_{STBL}$  | GND       |  | 0.8   | V       |            |
| Input current high | $I_{STBH}$  |           |  | 30    | $\mu A$ | STB= $V_S$ |
| Input current low  | $-I_{STBL}$ |           |  | 60    | $\mu A$ | STB=GND    |

### Delay times

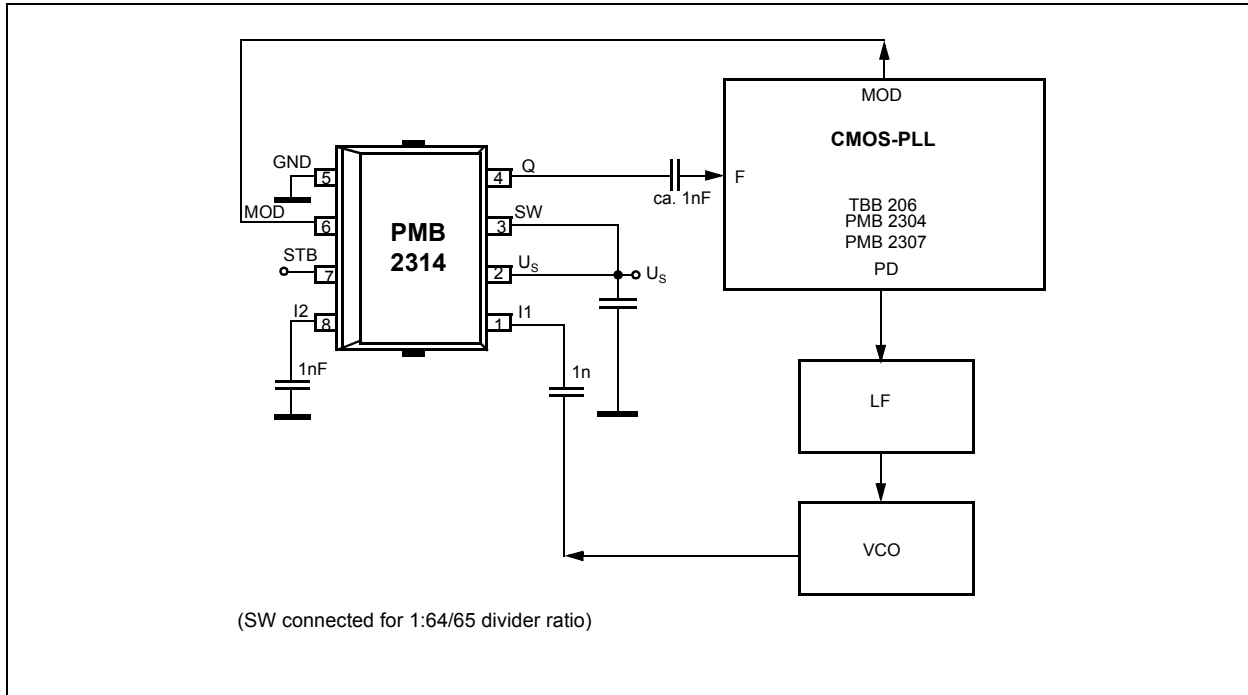
|                            |           |  |   |    |    |  |
|----------------------------|-----------|--|---|----|----|--|
| MOD setup time (diagram 1) | $t_{set}$ |  | 8 | 14 | ns |  |
|----------------------------|-----------|--|---|----|----|--|

AC /DC characteristics involve the spread of values guaranteed within the specified supply voltage and ambient temperature range. Typical characteristics are the median of the production.

## 7 Test Circuit



## 8 Application Circuit



## 9 Diagrams

Diagram 1 - Definition of Modulus Set-Up Time

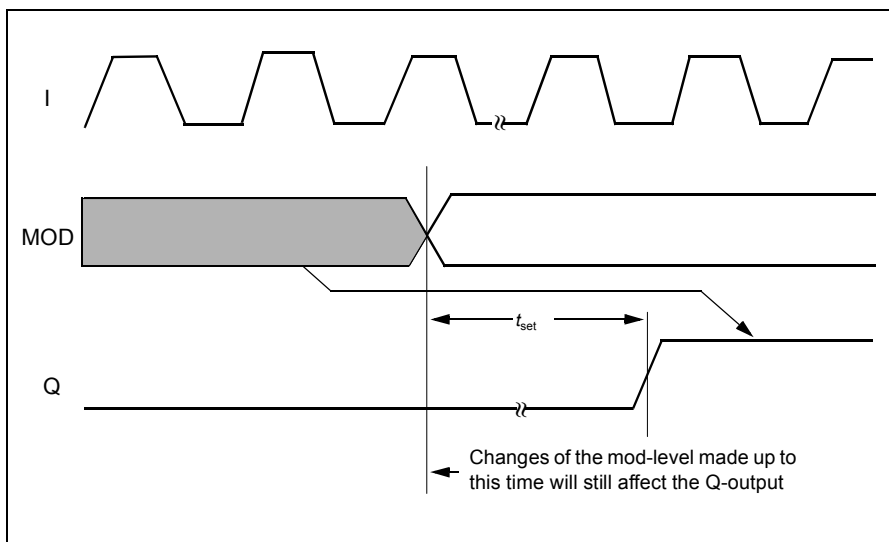
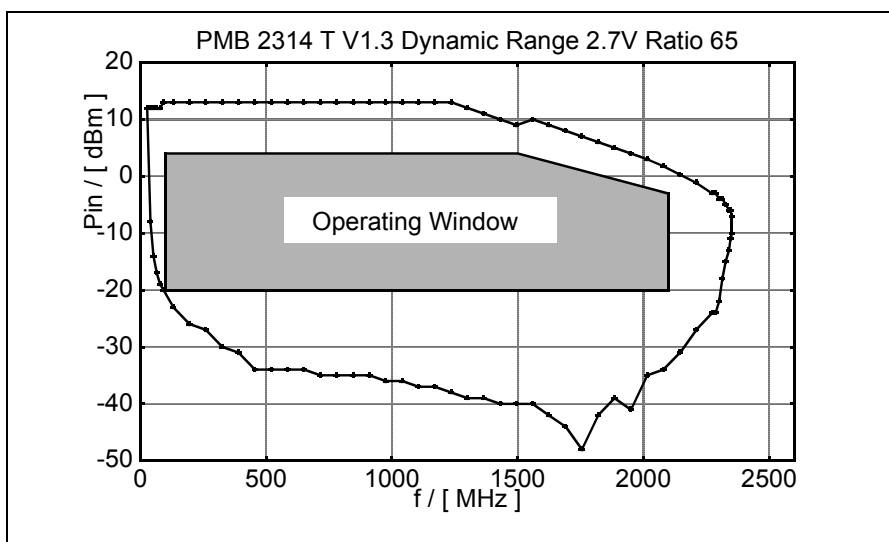
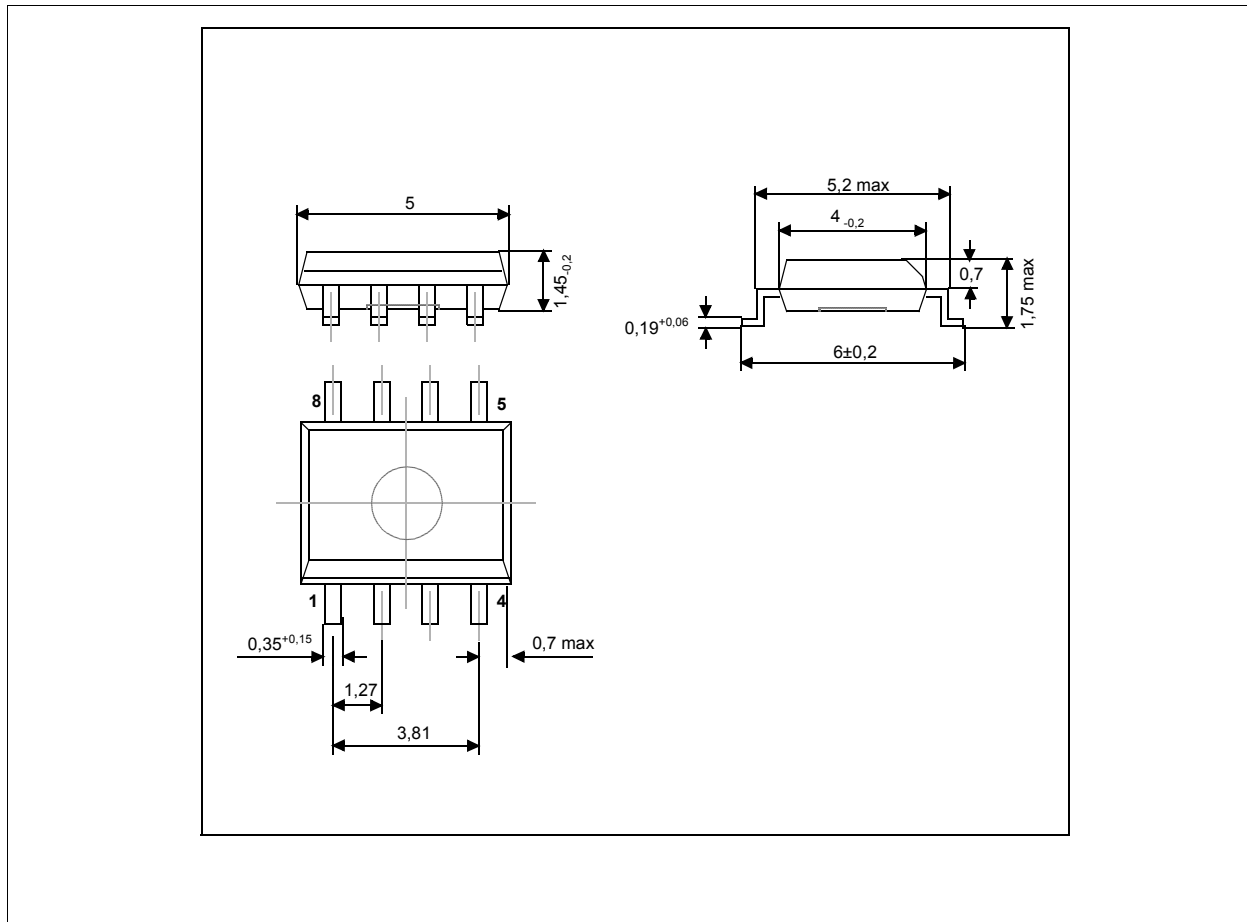


Diagram 2 - Input Dynamic Range



## 10 Package Outlines



Plastic Package, P-DSO-8, Dual-in-Line-Package, 20 A 8 DIN 41870 T16 (SMD)

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