

DATA SHEET

BF1201; BF1201R; BF1201WR
N-channel dual-gate PoLo
MOS-FETs

Product specification
Supersedes data of 1999 Dec 01

2000 Mar 29



N-channel dual-gate PoLo MOS-FETs

BF1201; BF1201R; BF1201WR

FEATURES

- Short channel transistor with high forward transfer admittance to input capacitance ratio
- Low noise gain controlled amplifier
- Partly internal self-biasing circuit to ensure good cross-modulation performance during AGC and good DC stabilization.

APPLICATIONS

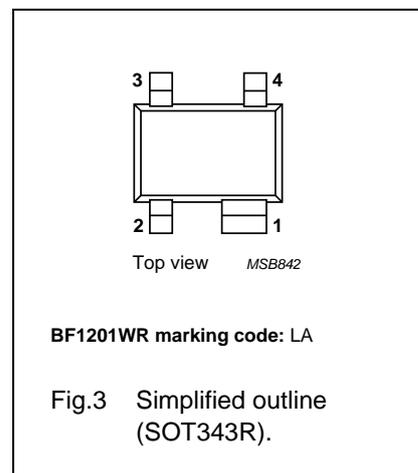
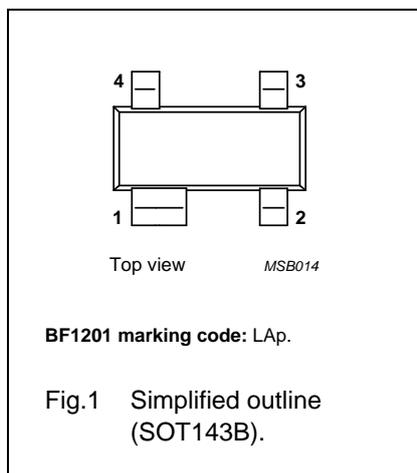
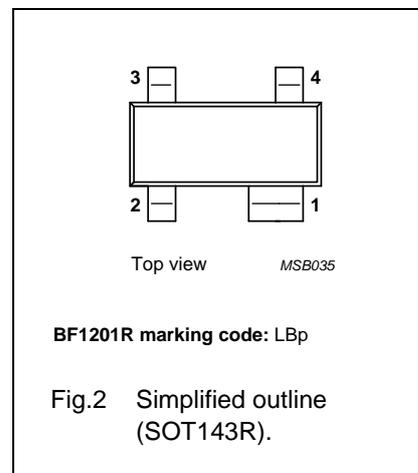
- VHF and UHF applications with 3 to 9 V supply voltage, such as digital and analogue television tuners and professional communications equipment.

DESCRIPTION

Enhancement type N-channel field-effect transistor with source and substrate interconnected. Integrated diodes between gates and source protect against excessive input voltage surges. The BF1201, BF1201R and BF1201WR are encapsulated in the SOT143B, SOT143R and SOT343R plastic packages respectively.

PINNING

| PIN | DESCRIPTION |
|-----|-------------|
| 1 | source |
| 2 | drain |
| 3 | gate 2 |
| 4 | gate 1 |



QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--------------|--------------------------------|--|------|------|------|------------|
| V_{DS} | drain-source voltage | | – | – | 10 | V |
| I_D | drain current | | – | – | 30 | mA |
| P_{tot} | total power dissipation | | – | – | 200 | mW |
| $ y_{fs} $ | forward transfer admittance | | 23 | 28 | 35 | mS |
| C_{ig1-ss} | input capacitance at gate 1 | | – | 2.6 | 3.1 | pF |
| C_{rss} | reverse transfer capacitance | $f = 1 \text{ MHz}$ | – | 15 | 30 | fF |
| F | noise figure | $f = 400 \text{ MHz}$ | – | 1 | 1.8 | dB |
| X_{mod} | cross-modulation | input level for $k = 1\%$ at 40 dB AGC | 105 | – | – | dB μ V |
| T_j | operating junction temperature | | – | – | 150 | °C |

CAUTION

This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling.

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LIMITING VALUES

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

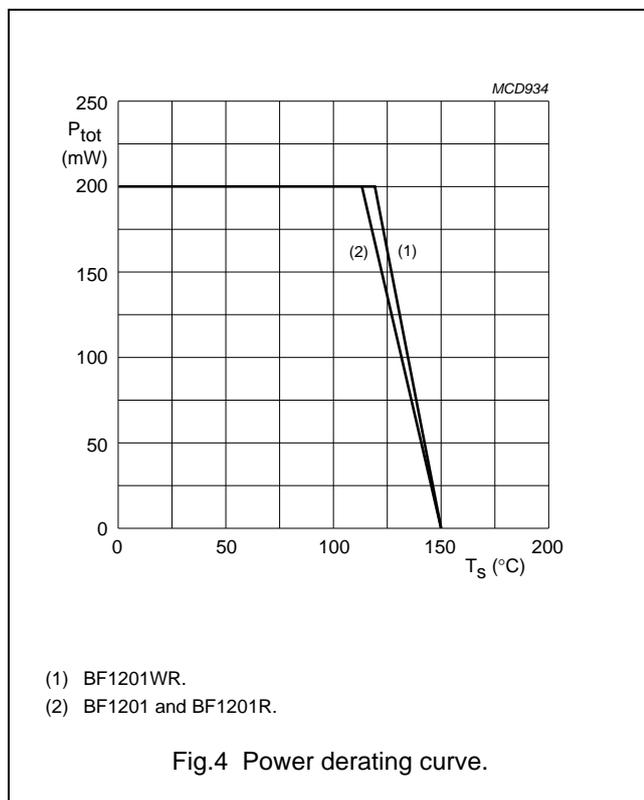
| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|-----------|--------------------------------|---|------|----------|------------------|
| V_{DS} | drain-source voltage | | – | 10 | V |
| I_D | drain current (DC) | | – | 30 | mA |
| I_{G1} | gate 1 current | | – | ± 10 | mA |
| I_{G2} | gate 2 current | | – | ± 10 | mA |
| P_{tot} | total power dissipation | | | | |
| | BF1201; BF1201R | $T_s \leq 113\text{ }^\circ\text{C}$; note 1 | – | 200 | mW |
| | BF1201WR | $T_s \leq 109\text{ }^\circ\text{C}$; note 1 | – | 200 | mW |
| T_{stg} | storage temperature | | –65 | +150 | $^\circ\text{C}$ |
| T_j | operating junction temperature | | – | 150 | $^\circ\text{C}$ |

Note

- T_s is the temperature of the soldering point of the source lead.

THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | VALUE | UNIT |
|---------------|---|-------|------|
| $R_{th\ j-s}$ | thermal resistance from junction to soldering point | | |
| | BF1201; BF1201R | 185 | K/W |
| | BF1201WR | 155 | K/W |



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STATIC CHARACTERISTICS

$T_j = 25\text{ }^\circ\text{C}$; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|-----------------|---------------------------------|---|------|------|------|
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $V_{G1-S} = V_{G2-S} = 0$; $I_D = 10\text{ }\mu\text{A}$ | 10 | – | V |
| $V_{(BR)G1-SS}$ | gate 1-source breakdown voltage | $V_{G2-S} = V_{DS} = 0$; $I_{G1-S} = 10\text{ mA}$ | 6 | – | V |
| $V_{(BR)G2-SS}$ | gate 2-source breakdown voltage | $V_{G1-S} = V_{DS} = 0$; $I_{G2-S} = 10\text{ mA}$ | 6 | – | V |
| $V_{(F)S-G1}$ | forward source-gate 1 voltage | $V_{G2-S} = V_{DS} = 0$; $I_{S-G1} = 10\text{ mA}$ | 0.5 | 1.5 | V |
| $V_{(F)S-G2}$ | forward source-gate 2 voltage | $V_{G1-S} = V_{DS} = 0$; $I_{S-G2} = 10\text{ mA}$ | 0.5 | 1.5 | V |
| $V_{G1-S(th)}$ | gate 1-source threshold voltage | $V_{G2-S} = 4\text{ V}$; $V_{DS} = 5\text{ V}$; $I_D = 100\text{ }\mu\text{A}$ | 0.3 | 1.0 | V |
| $V_{G2-S(th)}$ | gate 2-source threshold voltage | $V_{G1-S} = V_{DS} = 5\text{ V}$; $I_D = 100\text{ }\mu\text{A}$ | 0.3 | 1.2 | V |
| I_{DSX} | drain-source current | $V_{G2-S} = 4\text{ V}$; $V_{DS} = 5\text{ V}$; $R_{G1} = 62\text{ k}\Omega$; note 1 | 11 | 19 | mA |
| I_{G1-SS} | gate 1 cut-off current | $V_{G2-S} = V_{DS} = 0$; $V_{G1-S} = 5\text{ V}$ | – | 50 | nA |
| I_{G2-SS} | gate 2 cut-off current | $V_{G1-S} = V_{DS} = 0$; $V_{G2-S} = 4\text{ V}$ | – | 20 | nA |

Note

- R_{G1} connects G_1 to $V_{GG} = 5\text{ V}$.

DYNAMIC CHARACTERISTICS

Common source; $T_{amb} = 25\text{ }^\circ\text{C}$; $V_{G2-S} = 4\text{ V}$; $V_{DS} = 5\text{ V}$; $I_D = 15\text{ mA}$; unless otherwise specified.

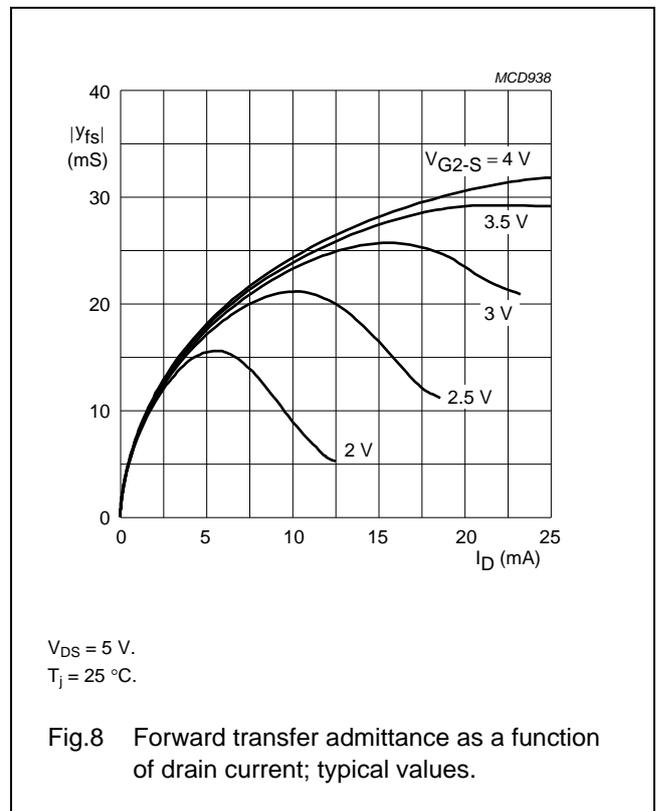
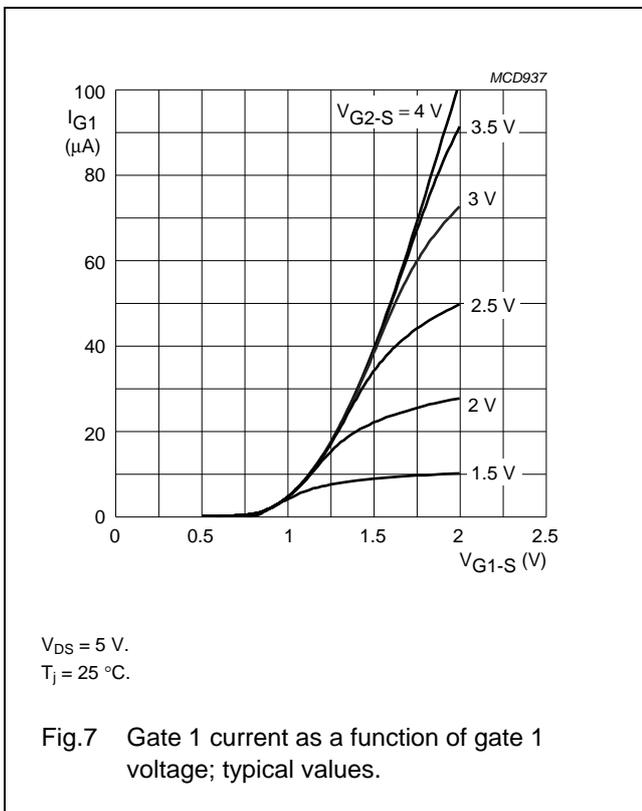
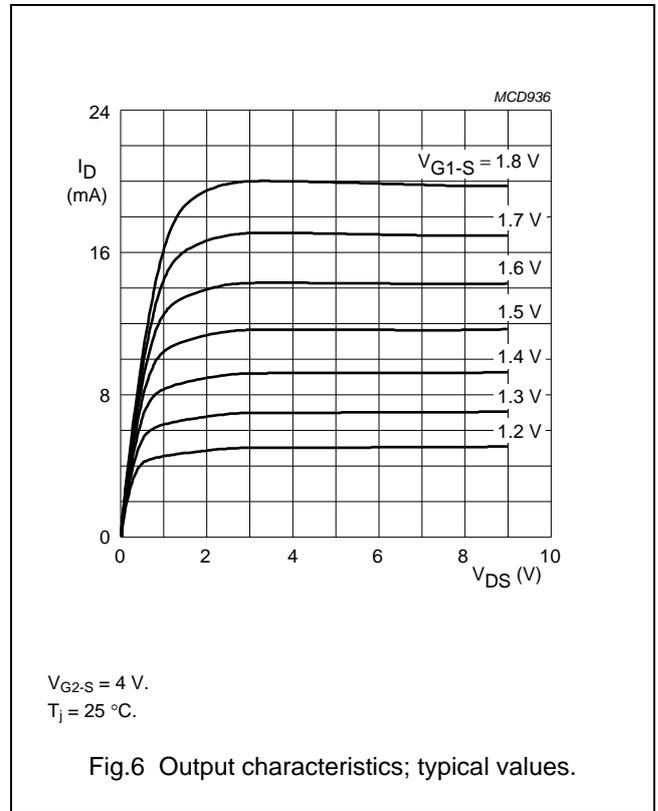
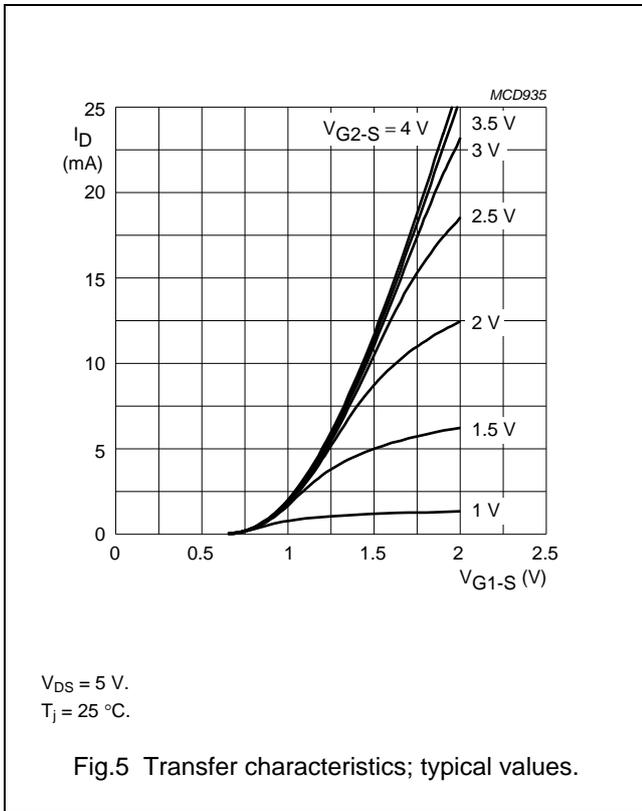
| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--------------|------------------------------|--|------|------|------|------------|
| $ y_{fs} $ | forward transfer admittance | pulsed; $T_j = 25\text{ }^\circ\text{C}$ | 23 | 28 | 35 | mS |
| C_{ig1-ss} | input capacitance at gate 1 | $f = 1\text{ MHz}$ | – | 2.6 | 3.1 | pF |
| C_{ig2-ss} | input capacitance at gate 2 | $f = 1\text{ MHz}$ | – | 1.1 | – | pF |
| C_{oss} | output capacitance | $f = 1\text{ MHz}$ | – | 0.9 | – | pF |
| C_{rss} | reverse transfer capacitance | $f = 1\text{ MHz}$ | – | 15 | 30 | fF |
| F | noise figure | $f = 10.7\text{ MHz}$; $G_S = 20\text{ mS}$; $B_S = 0$ | – | 5 | 7 | dB |
| | | $f = 400\text{ MHz}$; $Y_S = Y_{S\text{ opt}}$ | – | 1 | 1.8 | dB |
| | | $f = 800\text{ MHz}$; $Y_S = Y_{S\text{ opt}}$ | – | 1.9 | 2.5 | dB |
| G_{tr} | power gain | $f = 200\text{ MHz}$; $G_S = 2\text{ mS}$; $B_S = B_{S\text{ opt}}$; $G_L = 0.5\text{ mS}$; $B_L = B_{L\text{ opt}}$ | – | 33.5 | – | dB |
| | | $f = 400\text{ MHz}$; $G_S = 2\text{ mS}$; $B_S = B_{S\text{ opt}}$; $G_L = 1\text{ mS}$; $B_L = B_{L\text{ opt}}$ | – | 29 | – | dB |
| | | $f = 800\text{ MHz}$; $G_S = 3.3\text{ mS}$; $B_S = B_{S\text{ opt}}$; $G_L = 1\text{ mS}$; $B_L = B_{L\text{ opt}}$ | – | 24 | – | dB |
| X_{mod} | cross-modulation | input level for $k = 1\%$; $f_w = 50\text{ MHz}$; $f_{unw} = 60\text{ MHz}$; note 1 | | | | |
| | | at 0 dB AGC | 90 | – | – | dB μ V |
| | | at 10 dB AGC | – | 95 | – | dB μ V |
| | | at 40 dB AGC | 105 | – | – | dB μ V |

Note

- Measured in Fig.21 test circuit.

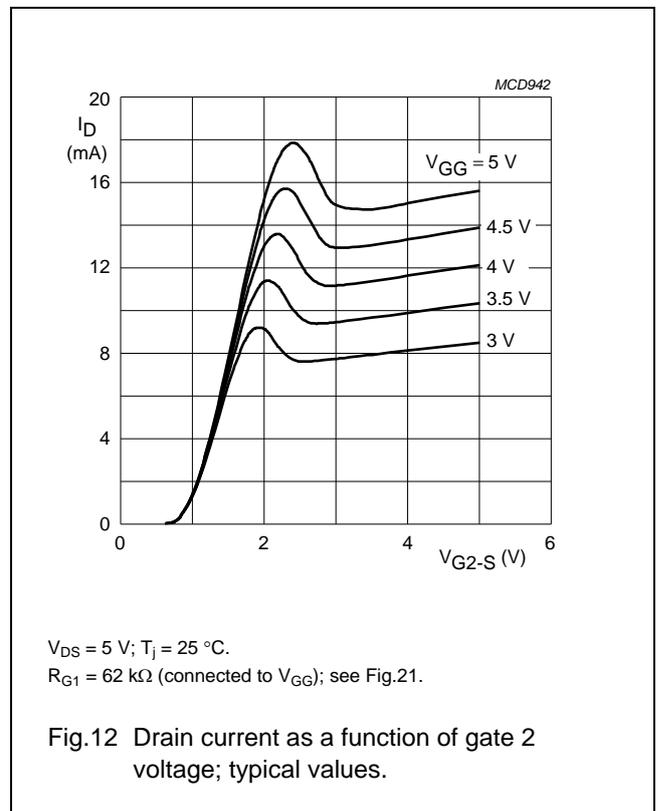
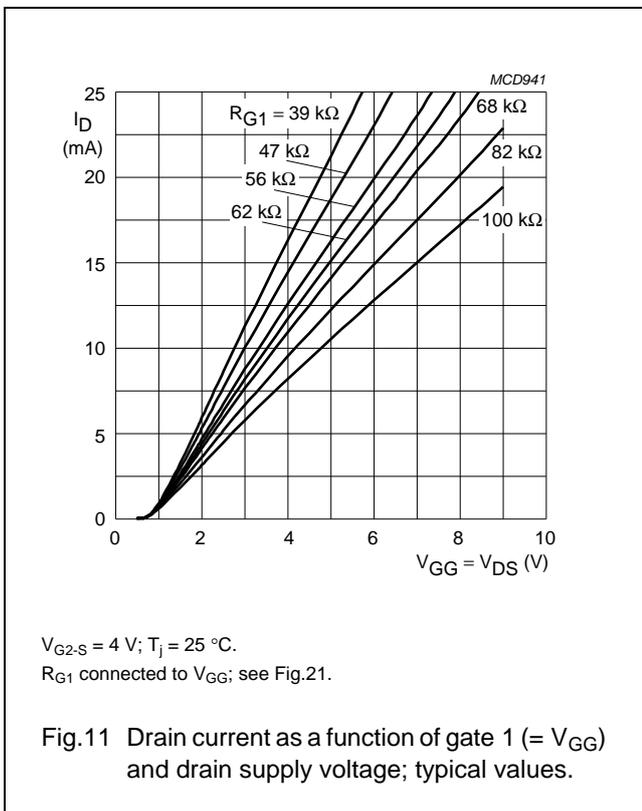
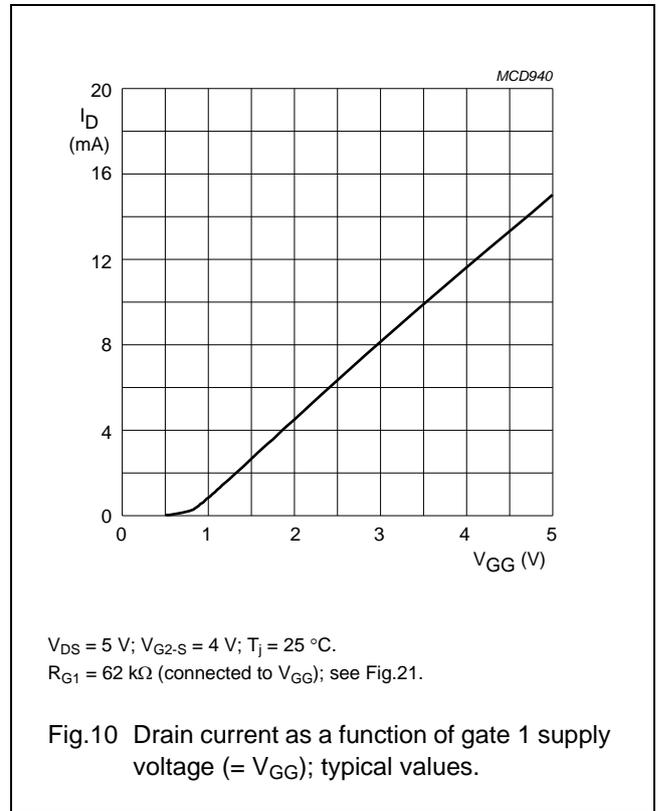
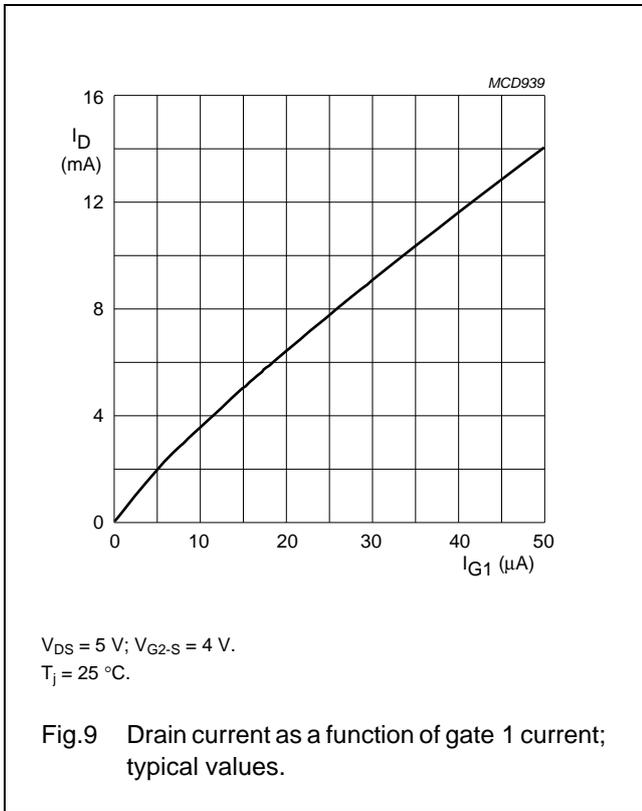
N-channel dual-gate PoLo MOS-FETs

BF1201; BF1201R; BF1201WR



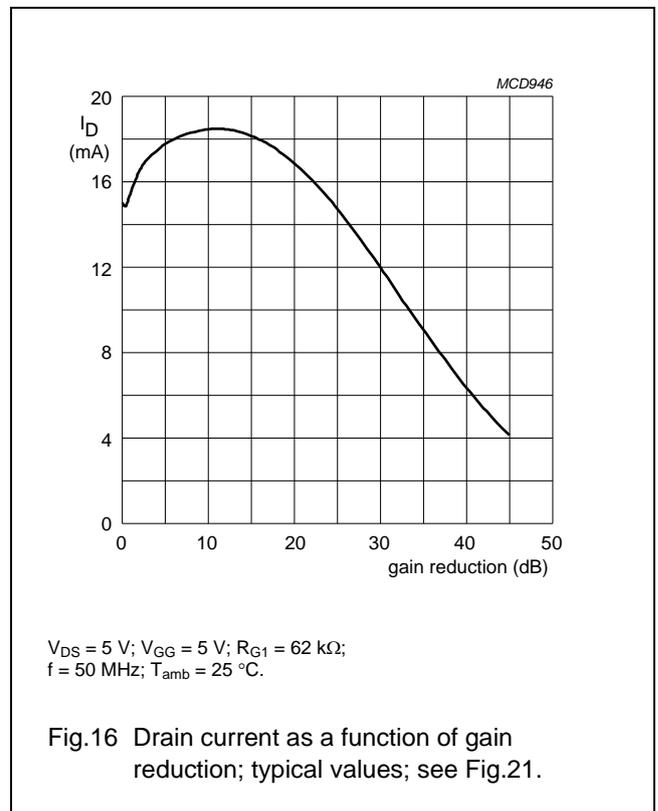
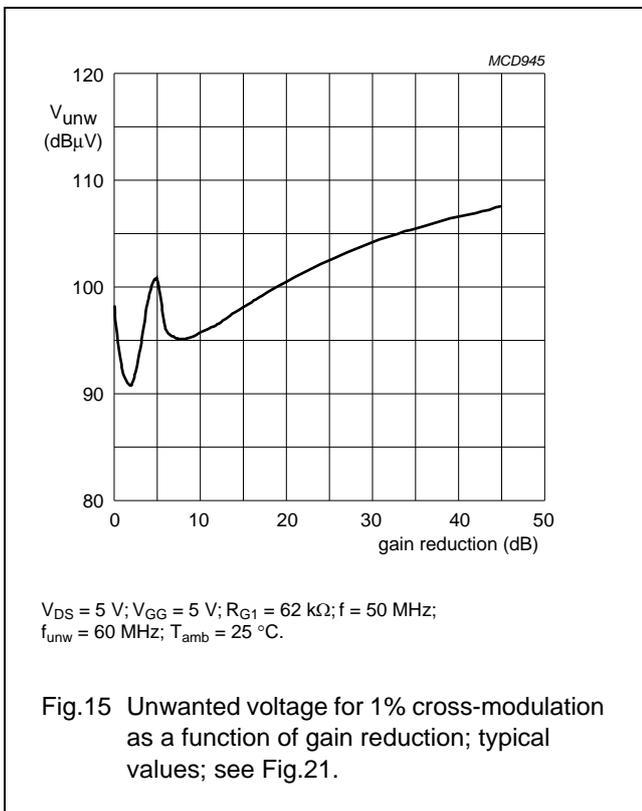
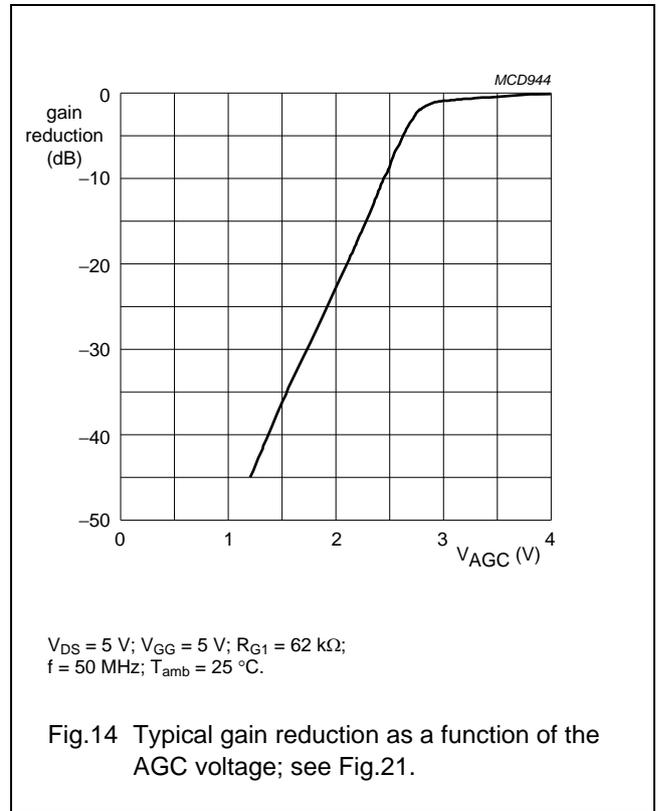
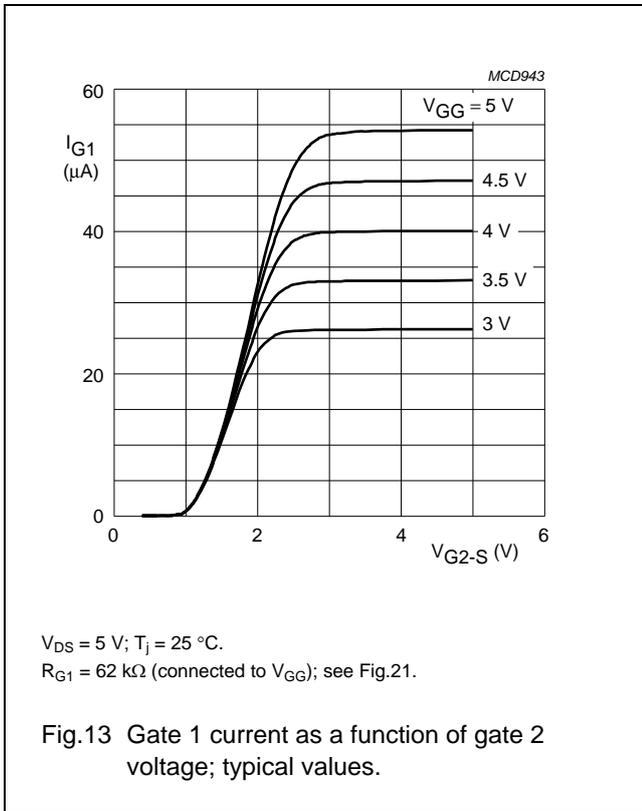
N-channel dual-gate PoLo MOS-FETs

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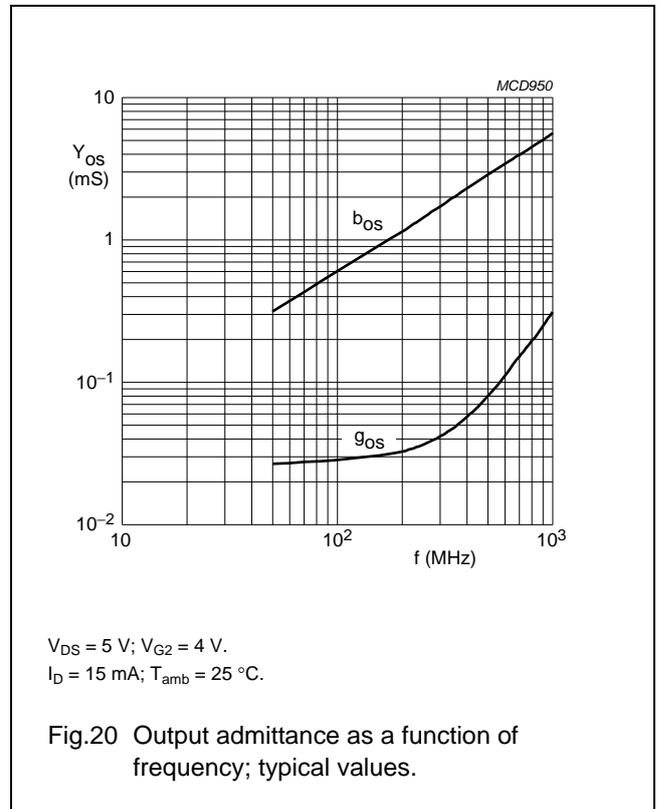
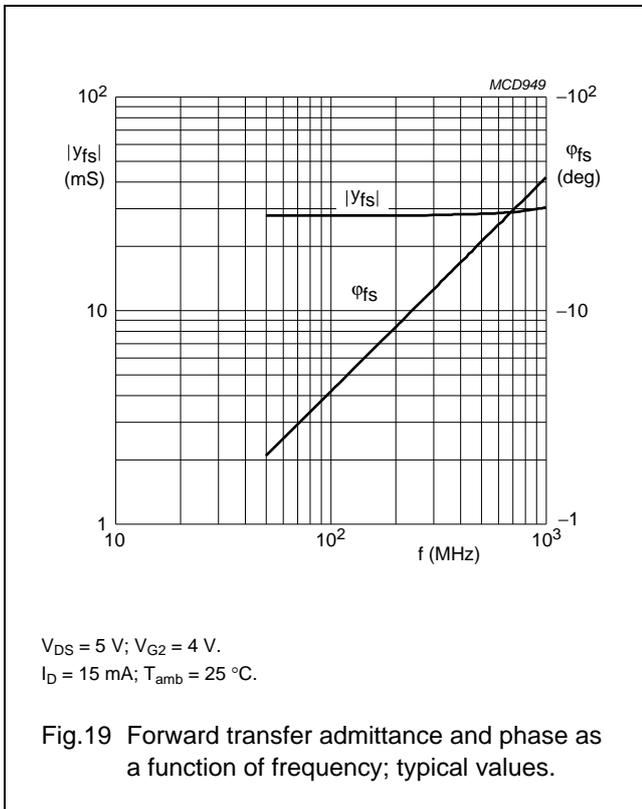
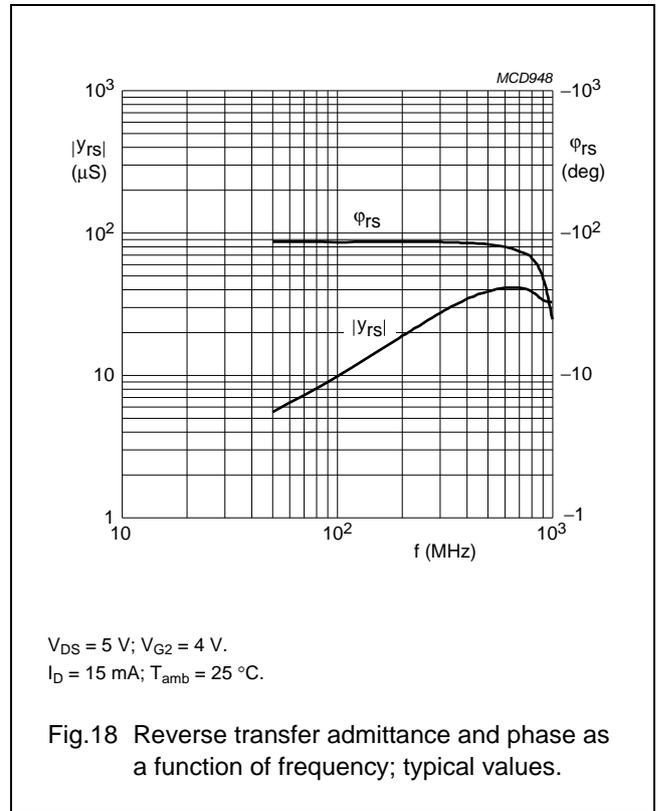
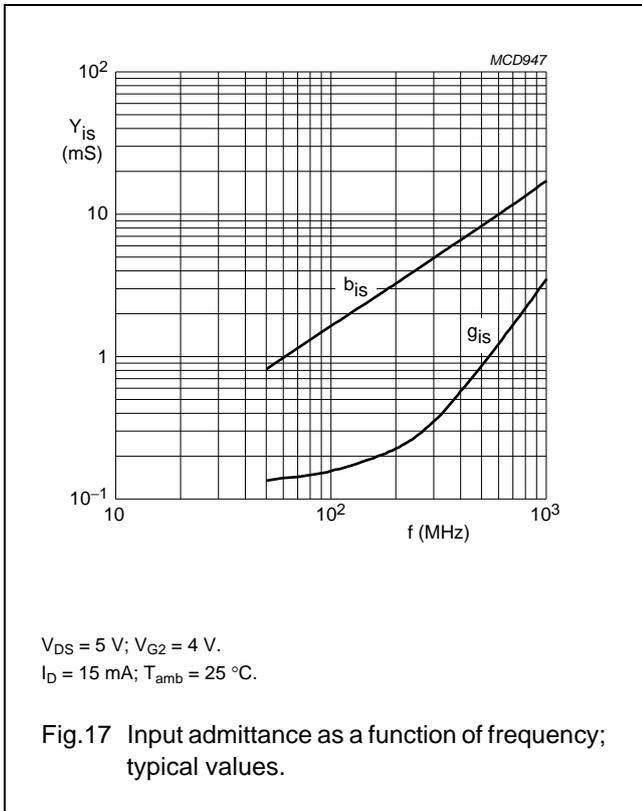
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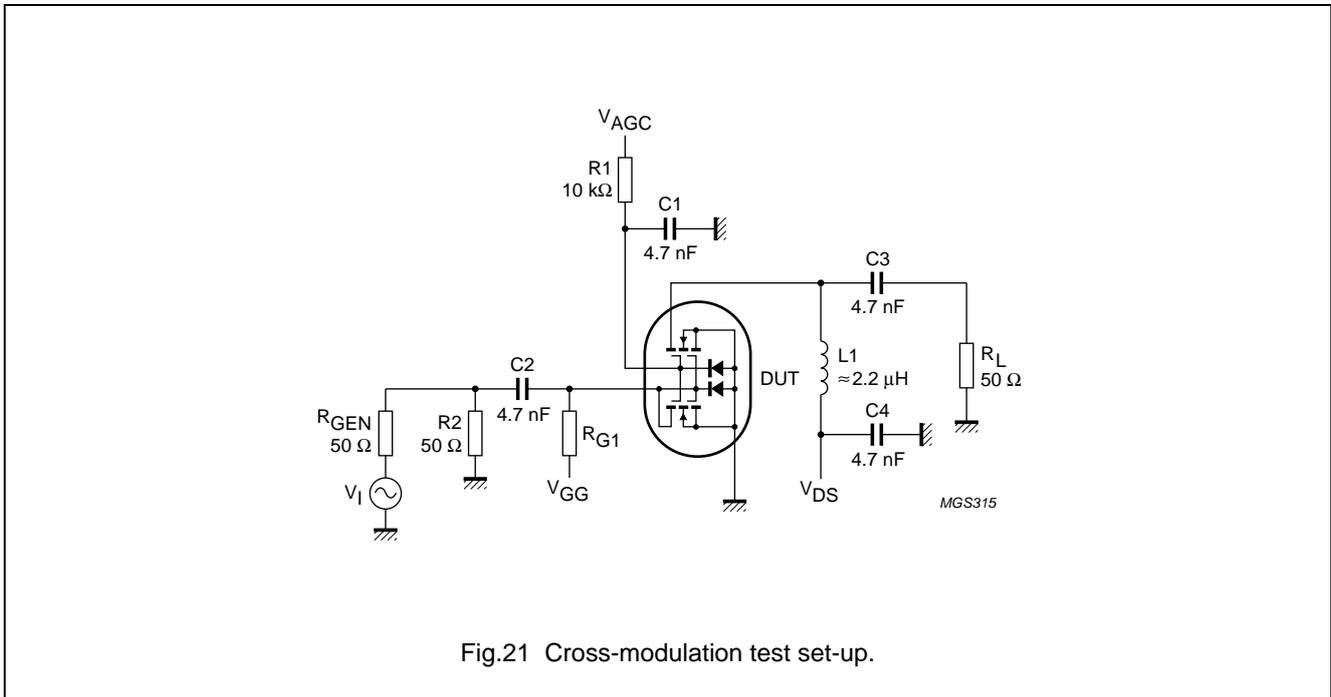


Fig.21 Cross-modulation test set-up.

Table 1 Scattering parameters: $V_{DS} = 5\text{ V}$; $V_{G2-S} = 4\text{ V}$; $I_D = 15\text{ mA}$; $T_{amb} = 25\text{ }^\circ\text{C}$

| f (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|------------|----------------------|----------------|----------------------|----------------|----------------------|----------------|----------------------|----------------|
| | MAGNITUDE (ratio) | ANGLE (deg) | MAGNITUDE (ratio) | ANGLE (deg) | MAGNITUDE (ratio) | ANGLE (deg) | MAGNITUDE (ratio) | ANGLE (deg) |
| 50 | 0.987 | -4.72 | 2.775 | 174.6 | 0.0006 | 88.8 | 0.997 | -1.84 |
| 100 | 0.985 | -9.39 | 2.774 | 169.5 | 0.0010 | 86.7 | 0.997 | -3.37 |
| 200 | 0.978 | -18.59 | 2.731 | 159.1 | 0.0019 | 79.7 | 0.996 | -6.72 |
| 300 | 0.976 | -27.74 | 2.671 | 148.8 | 0.0026 | 74.2 | 0.994 | -10.02 |
| 400 | 0.949 | -36.59 | 2.599 | 138.8 | 0.0032 | 69.9 | 0.992 | -13.33 |
| 500 | 0.928 | -45.08 | 2.501 | 129.1 | 0.0035 | 65.9 | 0.989 | -16.55 |
| 600 | 0.905 | -53.26 | 2.400 | 119.8 | 0.0035 | 64.6 | 0.986 | -19.64 |
| 700 | 0.882 | -61.07 | 2.297 | 110.9 | 0.0033 | 65.7 | 0.982 | -22.63 |
| 800 | 0.860 | -68.48 | 2.199 | 102.4 | 0.0029 | 69.1 | 0.979 | -25.54 |
| 900 | 0.838 | -75.55 | 2.096 | 94.2 | 0.0024 | 83.3 | 0.975 | -28.44 |
| 1000 | 0.818 | -82.23 | 1.997 | 86.3 | 0.0021 | 103.8 | 0.971 | -31.42 |

Table 2 Noise data: $V_{DS} = 5\text{ V}$; $V_{G2-S} = 4\text{ V}$; $I_D = 15\text{ mA}$; $T_{amb} = 25\text{ }^\circ\text{C}$

| f (MHz) | F _{min} (dB) | Γ _{opt} | | R _n (Ω) |
|------------|--------------------------|------------------|-------|-----------------------|
| | | (ratio) | (deg) | |
| 400 | 1 | 0.825 | 38.93 | 50 |
| 800 | 1.9 | 0.753 | 70.65 | 38.75 |

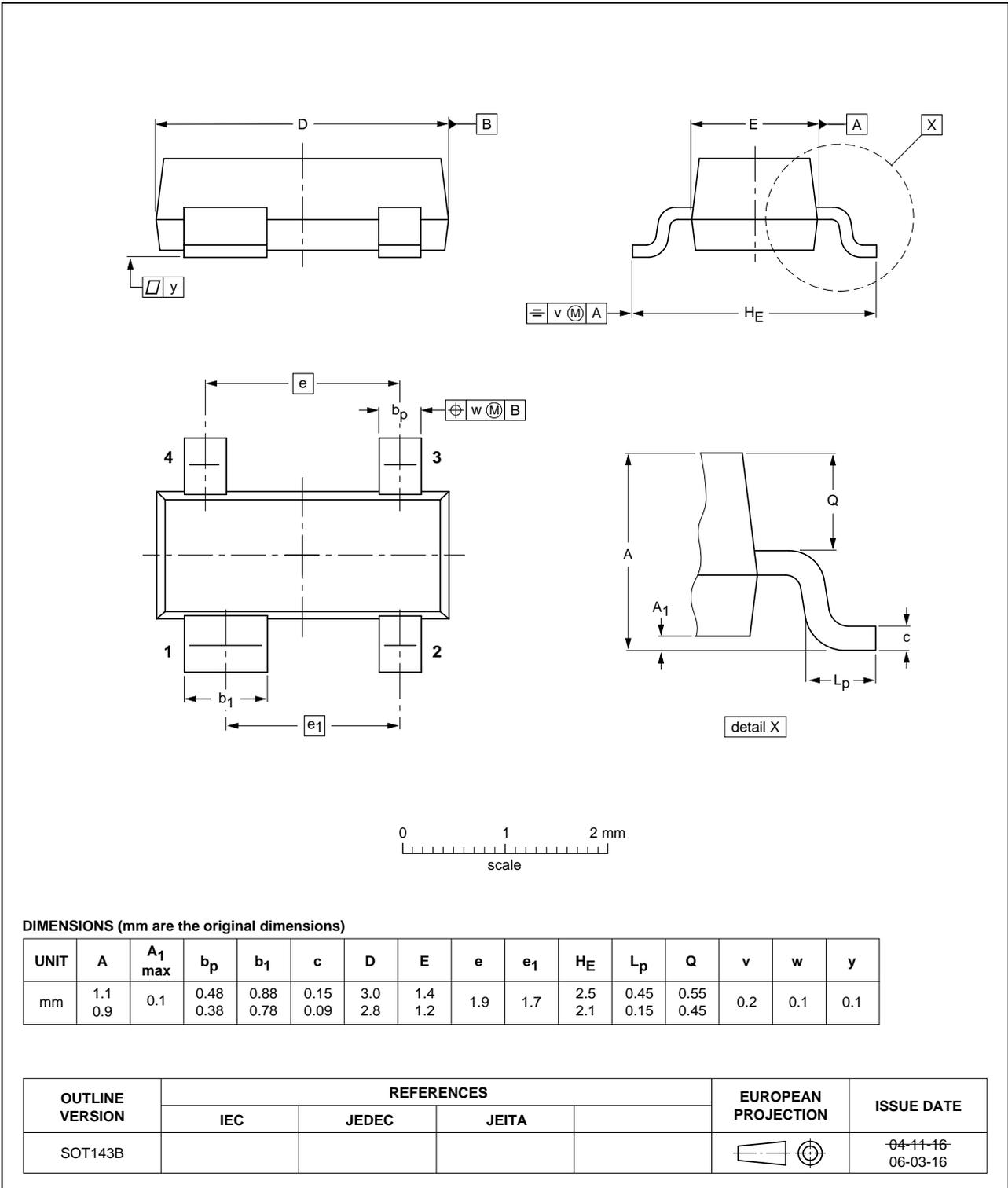
N-channel dual-gate PoLo MOS-FETs

BF1201; BF1201R; BF1201WR

PACKAGE OUTLINES

Plastic surface-mounted package; 4 leads

SOT143B

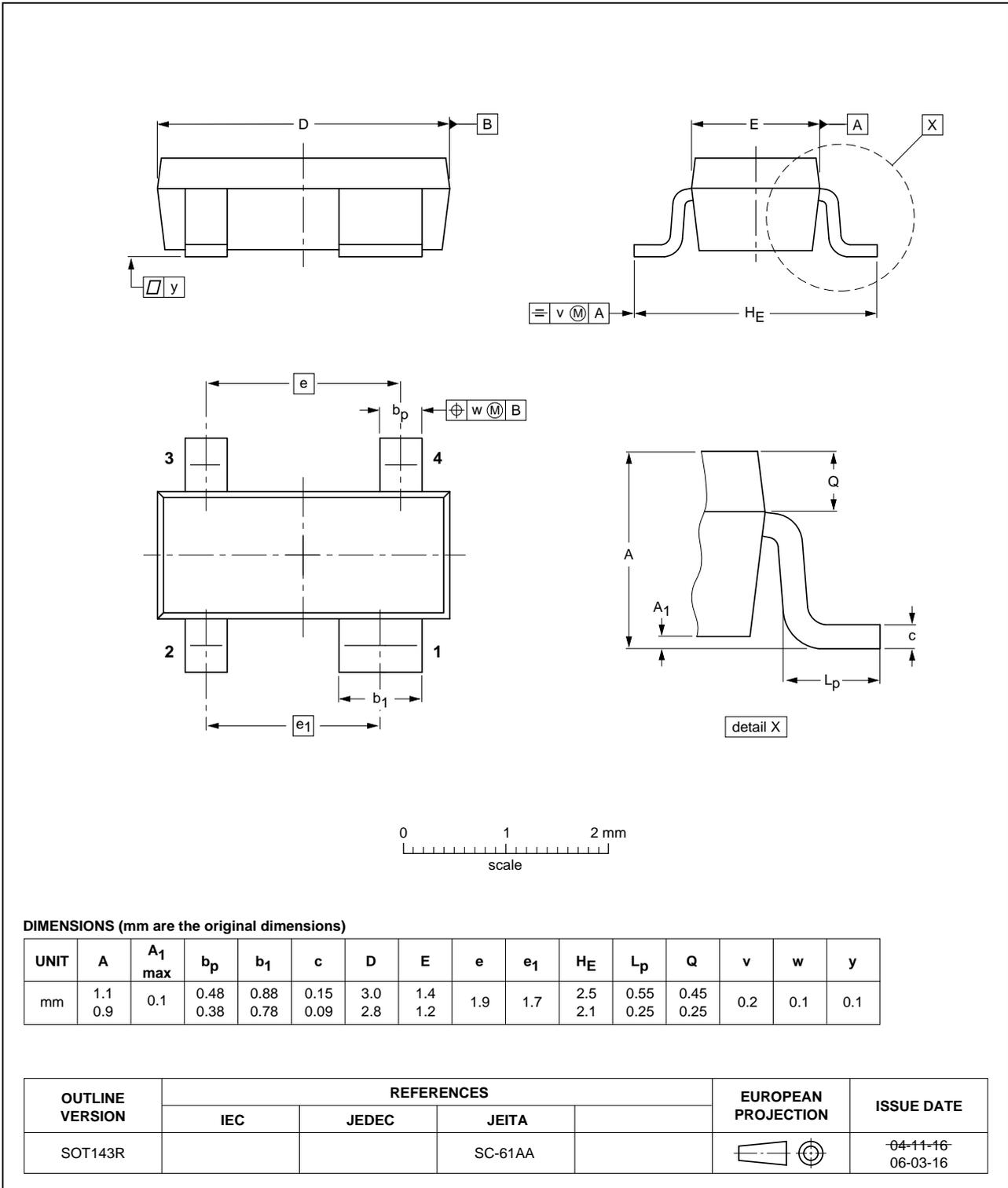


N-channel dual-gate PoLo MOS-FETs

BF1201; BF1201R; BF1201WR

Plastic surface-mounted package; reverse pinning; 4 leads

SOT143R

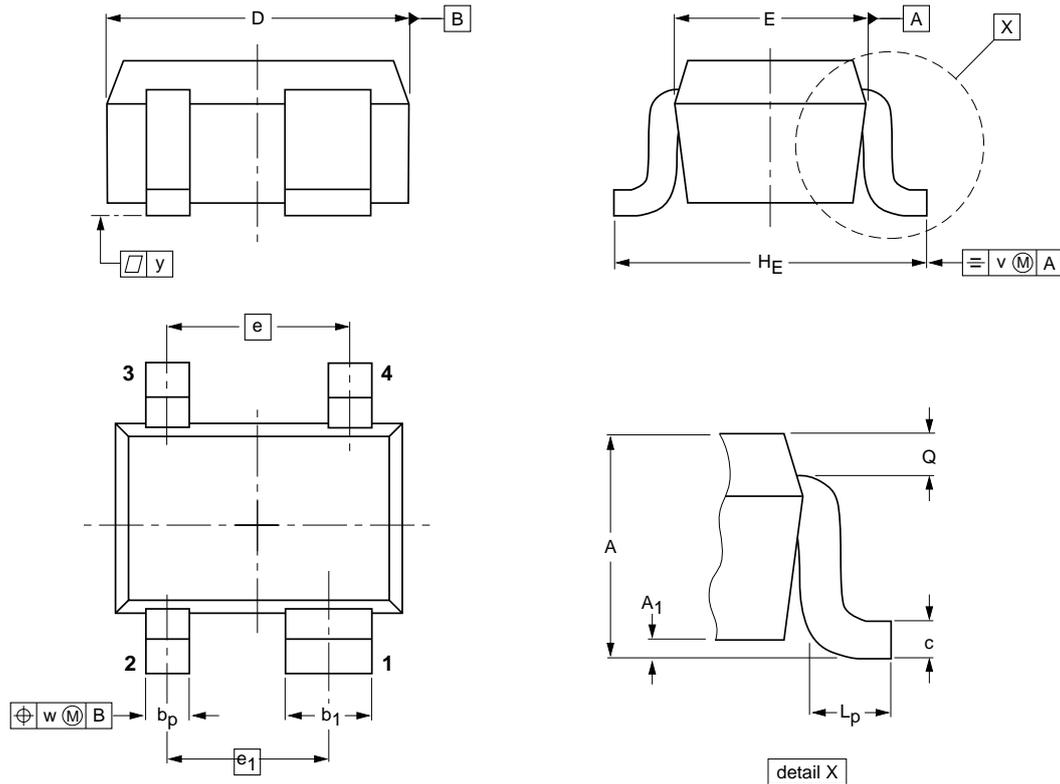


N-channel dual-gate PoLo MOS-FETs

BF1201; BF1201R; BF1201WR

Plastic surface-mounted package; reverse pinning; 4 leads

SOT343R



DIMENSIONS (mm are the original dimensions)

| UNIT | A | A ₁ max | b _p | b ₁ | c | D | E | e | e ₁ | H _E | L _p | Q | v | w | y |
|------|------------|-----------------------|----------------|----------------|--------------|------------|--------------|-----|----------------|----------------|----------------|--------------|-----|-----|-----|
| mm | 1.1 0.8 | 0.1 | 0.4 0.3 | 0.7 0.5 | 0.25 0.10 | 2.2 1.8 | 1.35 1.15 | 1.3 | 1.15 | 2.2 2.0 | 0.45 0.15 | 0.23 0.13 | 0.2 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|--------------------|------------|-------|------|--|------------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT343R | | | | | | 97-05-21 06-03-16 |

N-channel dual-gate PoLo MOS-FETs

BF1201; BF1201R; BF1201WR

DATA SHEET STATUS

| DOCUMENT STATUS ⁽¹⁾ | PRODUCT STATUS ⁽²⁾ | DEFINITION |
|--------------------------------|-------------------------------|---|
| Objective data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary data sheet | Qualification | This document contains data from the preliminary specification. |
| Product data sheet | Production | This document contains the product specification. |

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Contact information

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