# BF1100; BF1100R

## Dual-gate MOS-FETs

Rev. 02 — 13 November 2007 Product data sheet

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# Dual-gate MOS-FETs BF1100; BF1100R

## FEATURES

- Specially designed for use at 9 to 12 V supply voltage
- Short channel transistor with high forward transfer admittance to input capacitance ratio
- Low noise gain controlled amplifier up to 1 GHz
- Superior cross-modulation performance during AGC.

## APPLICATIONS

- VHF and UHF applications such as television tuners and professional communications equipment.

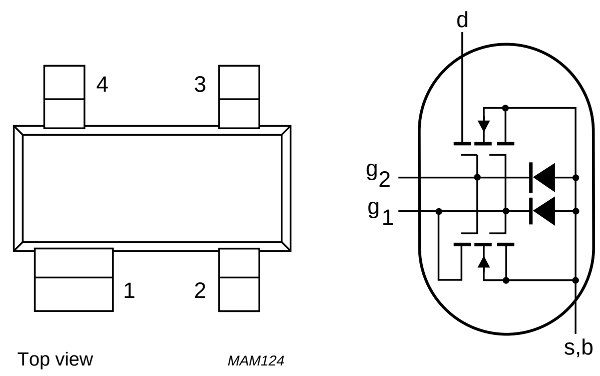
## DESCRIPTION

Enhancement type field-effect transistor in a plastic microminiature SOT143 or SOT143R package. The transistor consists of an amplifier MOS-FET with source and substrate interconnected and an internal bias circuit to ensure good cross-modulation performance during AGC.

| CAUTION |
|---|
| The device is supplied in an antistatic package. The gate-source input must be protected against static discharge during transport or handling. |

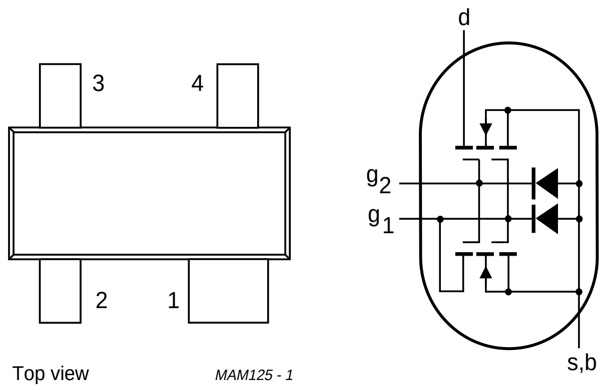
## PINNING

| PIN | SYMBOL | DESCRIPTION |
|---|---|---|
| 1 | s, b | source |
| 2 | d | drain |
| 3 | $g_2$ | gate 2 |
| 4 | $g_1$ | gate 1 |




**BF1100 marking code:** %MY.

Fig.1 Simplified outline (SOT143) and symbol.




**BF1100R marking code:** %MZ.

Fig.2 Simplified outline (SOT143R) and symbol.

## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | | – | – | 14 | V |
| $I_D$ | drain current | | – | – | 30 | mA |
| $P_{tot}$ | total power dissipation | | – | – | 200 | mW |
| $T_j$ | operating junction temperature | | – | – | 150 | °C |
| $\lvert y_{fs} \rvert$ | forward transfer admittance | | 24 | 28 | 33 | mS |
| $C_{ig1-s}$ | input capacitance at gate 1 | | – | 2.2 | 2.6 | pF |
| $C_{rs}$ | reverse transfer capacitance | f = 1 MHz | – | 25 | 35 | fF |
| F | noise figure | f = 800 MHz | – | 2 | – | dB |

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | | – | 14 | V |
| $I_D$ | drain current | | – | 30 | mA |
| $I_{G1}$ | gate 1 current | | – | ±10 | mA |
| $I_{G2}$ | gate 2 current | | – | ±10 | mA |
| $P_{tot}$ | total power dissipation | see Fig.3 | | | |
| | BF1100 | up to $T_{amb}$ = 50 °C; note 1 | – | 200 | mW |
| | BF1100R | up to $T_{amb}$ = 40 °C; note 1 | – | 200 | mW |
| $T_{stg}$ | storage temperature | | –65 | +150 | °C |
| $T_j$ | operating junction temperature | | – | +150 | °C |

### Note

1. Device mounted on a printed-circuit board.

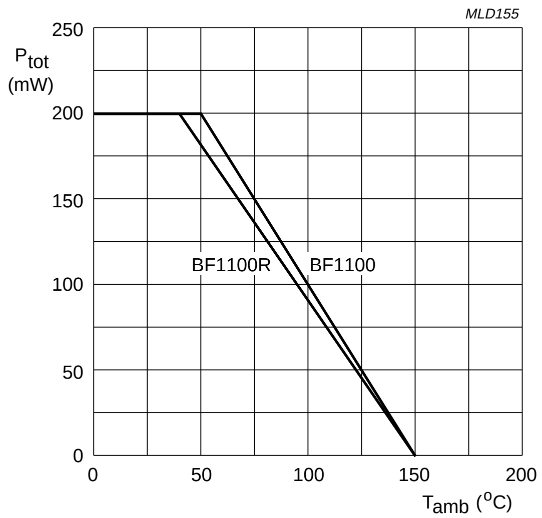



Fig.3 Power derating curves.

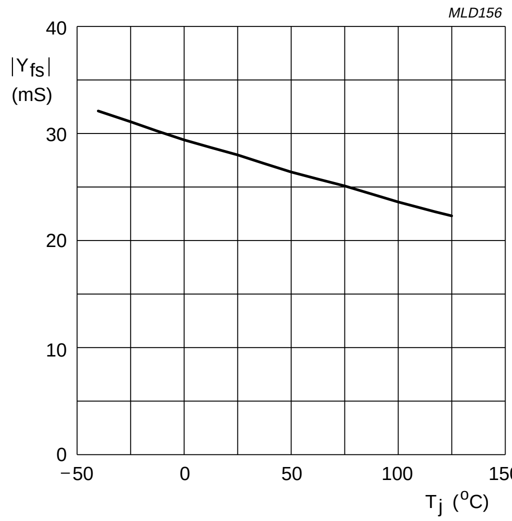



Fig.4 Forward transfer admittance as a function of junction temperature; typical values.

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}a}$ | thermal resistance from junction to ambient | note 1 | | |
| | BF1100 | | 500 | K/W |
| | BF1100R | | 550 | K/W |
| $R_{th\ j\text{-}s}$ | thermal resistance from junction to soldering point | note 2 | | |
| | BF1100 | $T_s$ = 92 °C | 290 | K/W |
| | BF1100R | $T_s$ = 78 °C | 360 | K/W |

### Notes

1. Device mounted on a printed-circuit board.
2. $T_s$ is the temperature at the soldering point of the source lead.

## STATIC CHARACTERISTICS

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{(BR)G1\text{-}SS}$ | gate 1-source breakdown voltage | $V_{G2\text{-}S} = V_{DS} = 0$; $I_{G1\text{-}S}$ = 1 mA | 13.2 | 20 | V |
| $V_{(BR)G2\text{-}SS}$ | gate 2-source breakdown voltage | $V_{G1\text{-}S} = V_{DS} = 0$; $I_{G2\text{-}S}$ = 1 mA | 13.2 | 20 | V |
| $V_{(F)S\text{-}G1}$ | forward source-gate 1 voltage | $V_{G2\text{-}S} = V_{DS} = 0$; $I_{S\text{-}G1}$ = 10 mA | 0.5 | 1.5 | V |
| $V_{(F)S\text{-}G2}$ | forward source-gate 2 voltage | $V_{G1\text{-}S} = V_{DS} = 0$; $I_{S\text{-}G2}$ = 10 mA | 0.5 | 1.5 | V |
| $V_{G1\text{-}S(th)}$ | gate 1-source threshold voltage | $V_{G2\text{-}S}$ = 4 V; $V_{DS}$ = 9 V; $I_D$ = 20 μA | 0.3 | 1 | V |
| | | $V_{G2\text{-}S}$ = 4 V; $V_{DS}$ = 12 V; $I_D$ = 20 μA | 0.3 | 1 | V |
| $V_{G2\text{-}S(th)}$ | gate 2-source threshold voltage | $V_{G1\text{-}S}$ = 4 V; $V_{DS}$ = 9 V; $I_D$ = 20 μA | 0.3 | 1.2 | V |
| | | $V_{G1\text{-}S}$ = 4 V; $V_{DS}$ = 12 V; $I_D$ = 20 μA | 0.3 | 1.2 | V |
| $I_{DSX}$ | drain-source current | $V_{G2\text{-}S}$ = 4 V; $V_{DS}$ = 9 V; $R_{G1}$ = 180 kΩ; note 1 | 8 | 13 | mA |
| | | $V_{G2\text{-}S}$ = 4 V; $V_{DS}$ = 12 V; $R_{G1}$ = 250 kΩ; note 2 | 8 | 13 | mA |
| $I_{G1\text{-}SS}$ | gate 1 cut-off current | $V_{G2\text{-}S} = V_{DS} = 0$; $V_{G1\text{-}S}$ = 12 V | – | 50 | nA |
| $I_{G2\text{-}SS}$ | gate 2 cut-off current | $V_{G1\text{-}S} = V_{DS} = 0$; $V_{G2\text{-}S}$ = 12 V | – | 50 | nA |

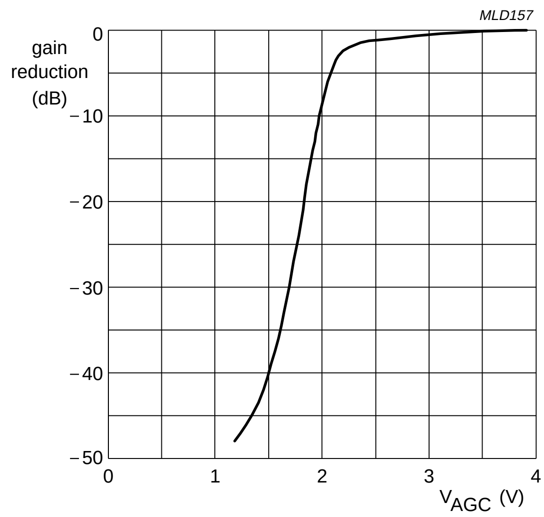
### Notes

1. $R_{G1}$ connects gate 1 to $V_{GG}$ = 9 V; see Fig.27.
2. $R_{G1}$ connects gate 1 to $V_{GG}$ = 12 V; see Fig.27.

## DYNAMIC CHARACTERISTICS

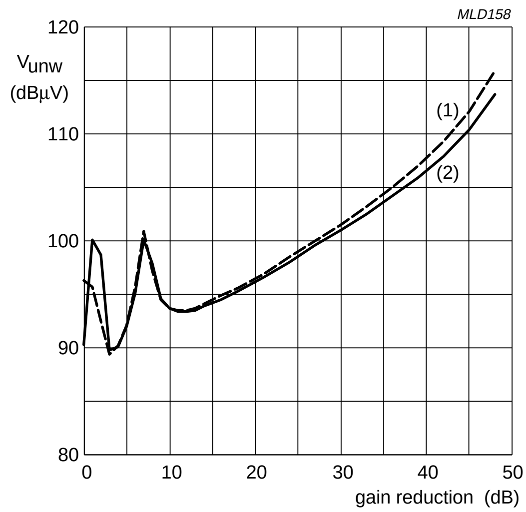
Common source; $T_{amb}$ = 25 °C; $V_{G2-S}$ = 4 V; $I_D$ = 10 mA; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $\|y_{fs}\|$ | forward transfer admittance | pulsed; $T_j$ = 25 °C | | | | |
| | | $V_{DS}$ = 9 V | 24 | 28 | 33 | mS |
| | | $V_{DS}$ = 12 V | 24 | 28 | 33 | mS |
| $C_{ig1-s}$ | input capacitance at gate 1 | f = 1 MHz | | | | |
| | | $V_{DS}$ = 9 V | – | 2.2 | 2.6 | pF |
| | | $V_{DS}$ = 12 V | – | 2.2 | 2.6 | pF |
| $C_{ig2-s}$ | input capacitance at gate 2 | f = 1 MHz | | | | |
| | | $V_{DS}$ = 9 V | – | 1.6 | – | pF |
| | | $V_{DS}$ = 12 V | – | 1.4 | – | pF |
| $C_{os}$ | drain-source capacitance | f = 1 MHz | | | | |
| | | $V_{DS}$ = 9 V | – | 1.4 | 1.8 | pF |
| | | $V_{DS}$ = 12 V | – | 1.1 | 1.5 | pF |
| $C_{rs}$ | reverse transfer capacitance | f = 1 MHz | | | | |
| | | $V_{DS}$ = 9 V | – | 25 | 35 | fF |
| | | $V_{DS}$ = 12 V | – | 25 | 35 | fF |
| F | noise figure | f = 800 MHz; $G_S = G_{Sopt}$; $B_S = B_{Sopt}$ | | | | |
| | | $V_{DS}$ = 9 V | – | 2 | 2.8 | dB |
| | | $V_{DS}$ = 12 V | – | 2 | 2.8 | dB |



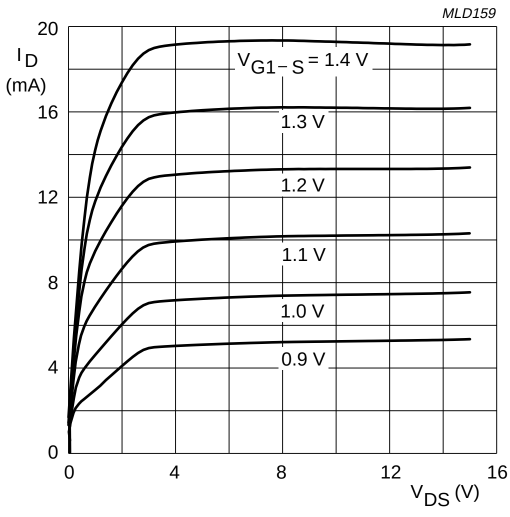

f = 50 MHz.
$T_j$ = 25 °C.

Fig.5 Gain reduction as a function of the AGC voltage; typical values.



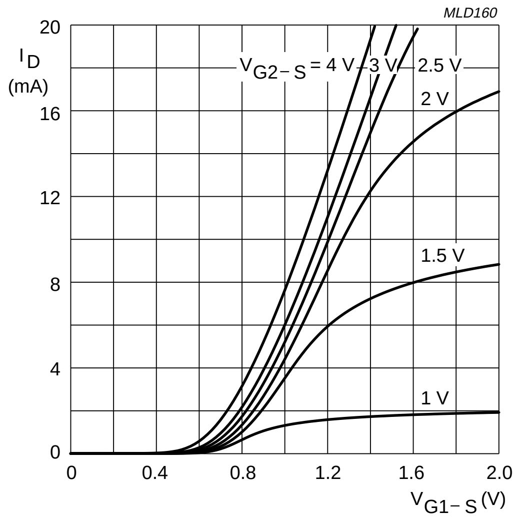

(1) $R_G$ = 250 kΩ to $V_{GG}$ = 12 V
(2) $R_G$ = 180 kΩ to $V_{GG}$ = 9 V
$f_w$ = 50 MHz; $f_{unw}$ = 60 MHz; $T_{amb}$ = 25 °C.

Fig.6 Unwanted voltage for 1% cross-modulation as a function of gain reduction; typical values; see Fig.27.



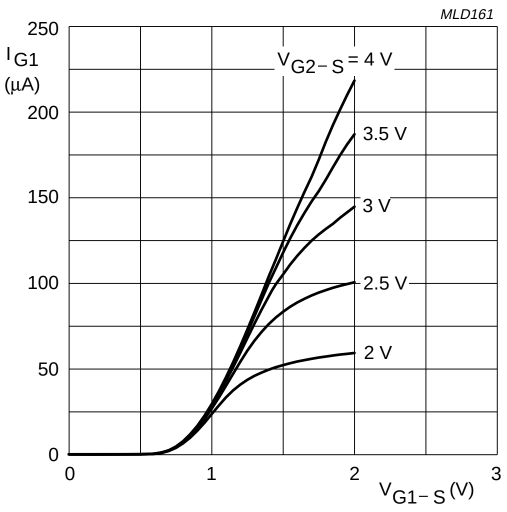

$V_{G2\text{-}S}$ = 4 V.
$T_j$ = 25 °C.

Fig.7 Output characteristics; typical values.



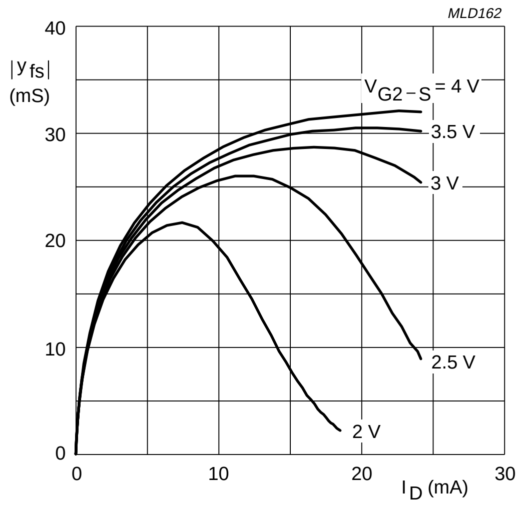

$V_{DS}$ = 9 to 12 V.
$T_j$ = 25 °C.

Fig.8 Transfer characteristics; typical values.



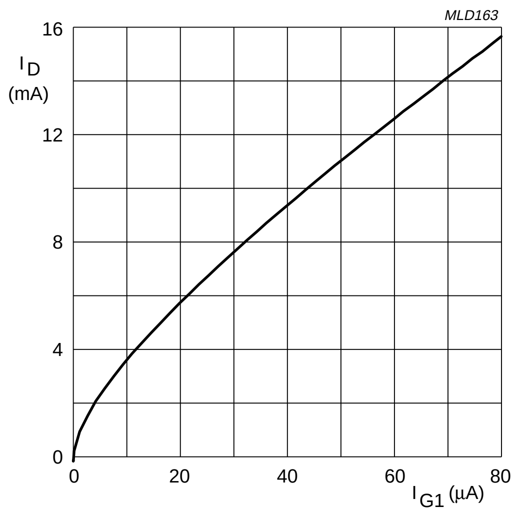

$V_{DS}$ = 9 to 12 V.
$T_j$ = 25 °C.

Fig.9 Gate 1 current as a function of gate 1 voltage; typical values.



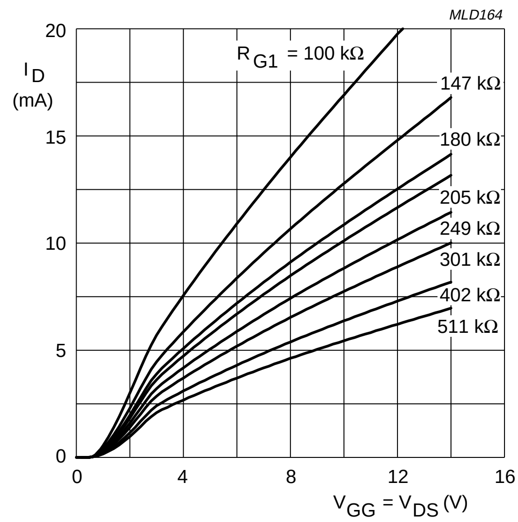

$V_{DS}$ = 9 to 12 V.
$T_j$ = 25 °C.

Fig.10 Forward transfer admittance as a function of drain current; typical values.



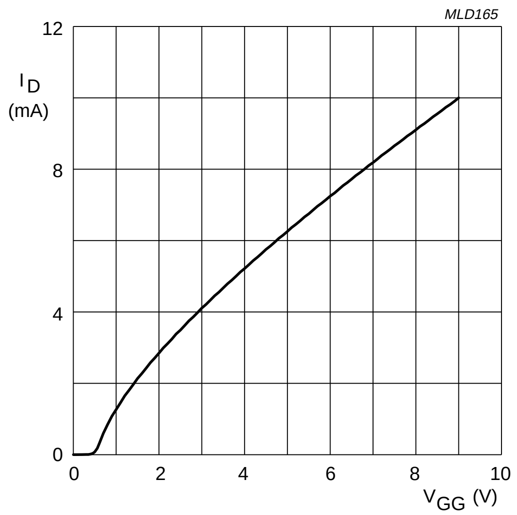

$V_{DS}$ = 9 to 12 V.
$V_{G2-S}$ = 4 V.
$T_j$ = 25 °C.

Fig.11 Drain current as a function of gate 1 current; typical values.



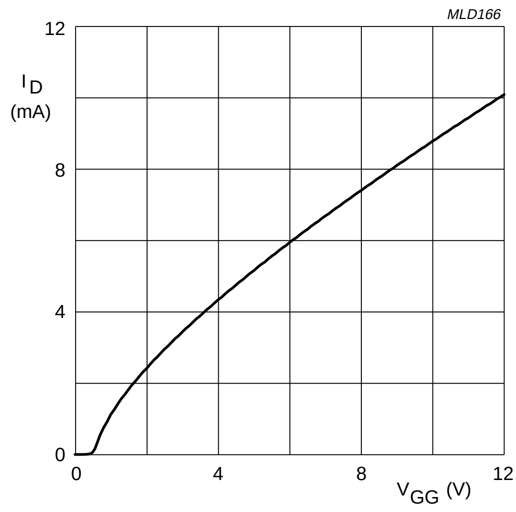

$V_{G2-S}$ = 4 V.
$R_{G1}$ connected to $V_{GG}$.
$T_j$ = 25 °C.

Fig.12 Drain current as a function of gate 1 supply voltage (= $V_{GG}$) and drain supply voltage; typical values; see Fig.27.



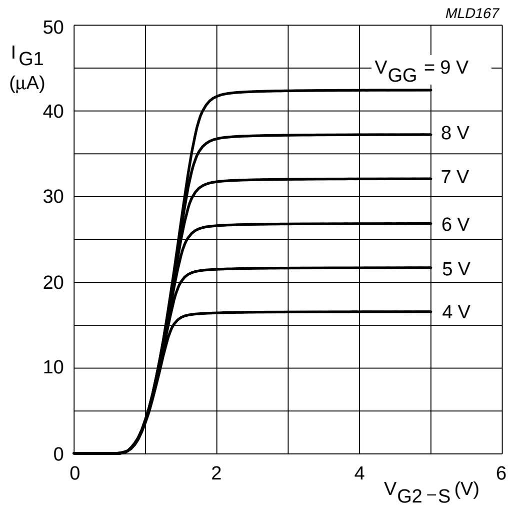

$V_{DS}$ = 9 V; $V_{G2-S}$ = 4 V.
$R_{G1}$ = 180 kΩ (connected to $V_{GG}$); $T_j$ = 25 °C.

Fig.13 Drain current as a function of gate 1 voltage (= $V_{GG}$); typical values; see Fig.27.



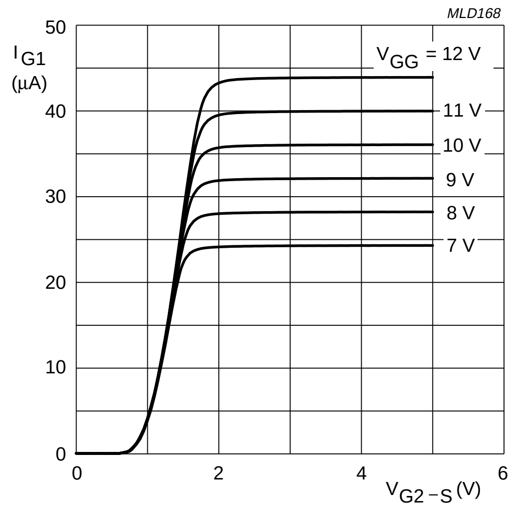

$V_{DS}$ = 12 V; $V_{G2-S}$ = 4 V.
$R_{G1}$ = 250 kΩ (connected to $V_{GG}$); $T_j$ = 25 °C.

Fig.14 Drain current as a function of gate 1 voltage; (= $V_{GG}$); typical values; see Fig.27.



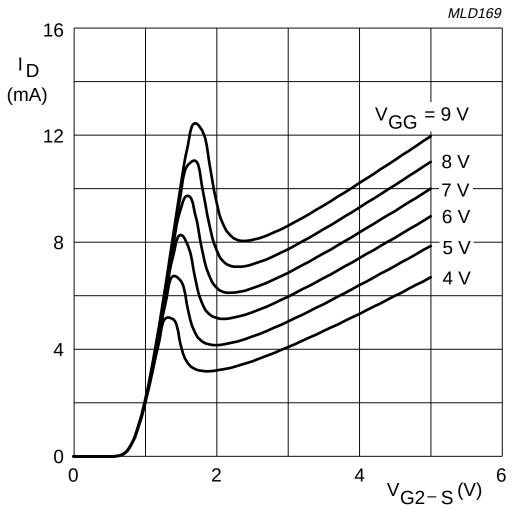

$V_{DS}$ = 9 V.
$R_{G1}$ = 180 kΩ (connected to $V_{GG}$).
$T_j$ = 25 °C.

Fig.15 Gate 1 current as a function of gate 2 voltage; typical values.



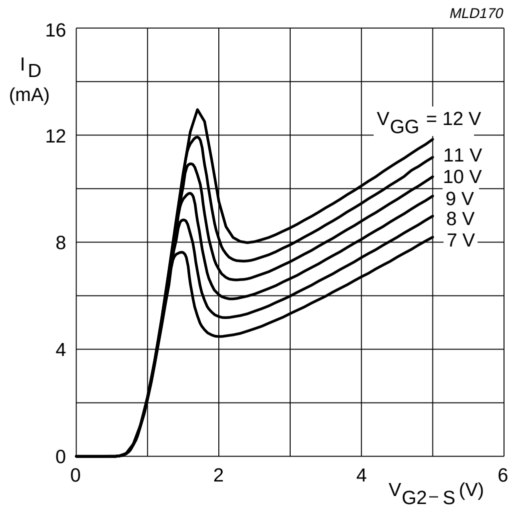

$V_{DS}$ = 12 V.
$R_{G1}$ = 250 kΩ (connected to $V_{GG}$).
$T_j$ = 25 °C.

Fig.16 Gate 1 current as a function of gate 2 voltage; typical values.



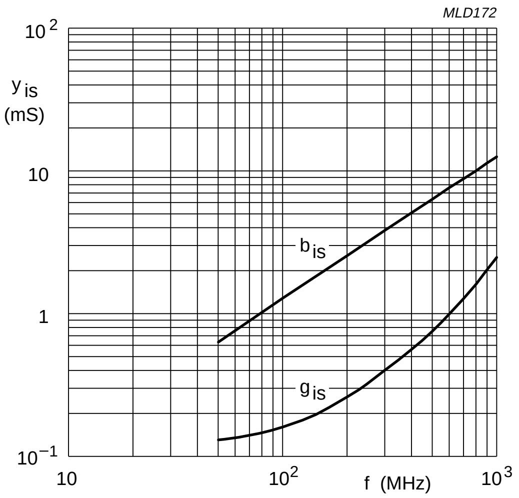

$V_{DS}$ = 9 V.
$R_{G1}$ = 180 kΩ (connected to $V_{GG}$).
$T_j$ = 25 °C.

Fig.17 Drain current as a function of the gate 2 voltage; typical values; see Fig.27.



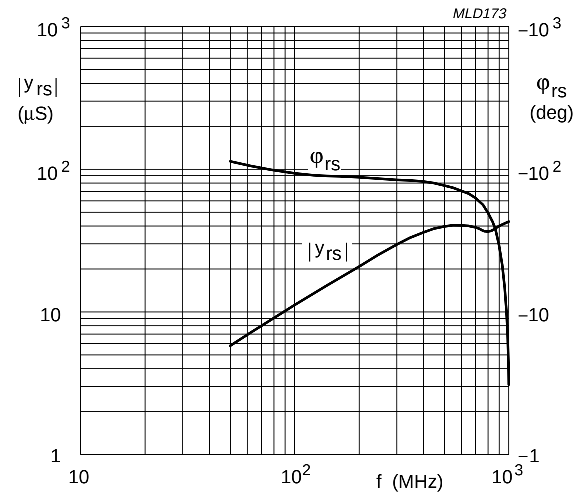

$V_{DS}$ = 12 V.
$R_{G1}$ = 250 kΩ (connected to $V_{GG}$).
$T_j$ = 25 °C.

Fig.18 Drain current as a function of the gate 2 voltage; typical values; see Fig.27.



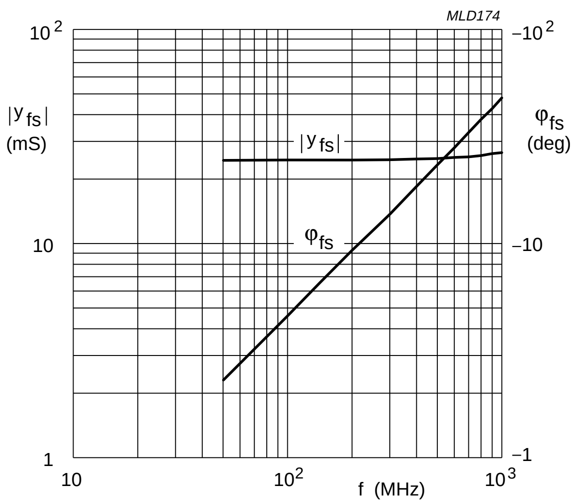

$V_{DS}$ = 9 V; $V_{G2}$ = 4 V.
$I_D$ = 10 mA; $T_{amb}$ = 25 °C.

Fig.19 Input admittance as a function of frequency; typical values.



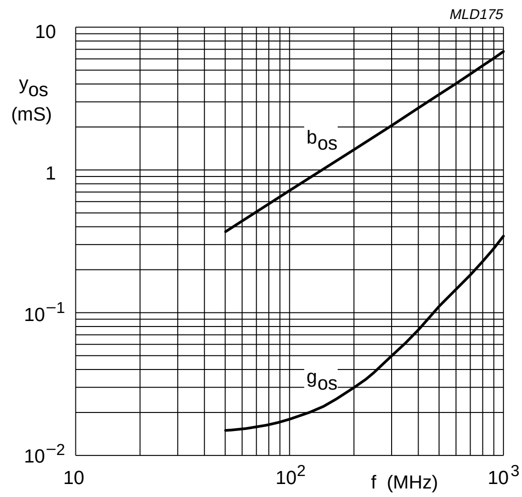

$V_{DS}$ = 9 V; $V_{G2}$ = 4 V.
$I_D$ = 10 mA; $T_{amb}$ = 25 °C.

Fig.20 Reverse transfer admittance and phase as a function of frequency; typical values.



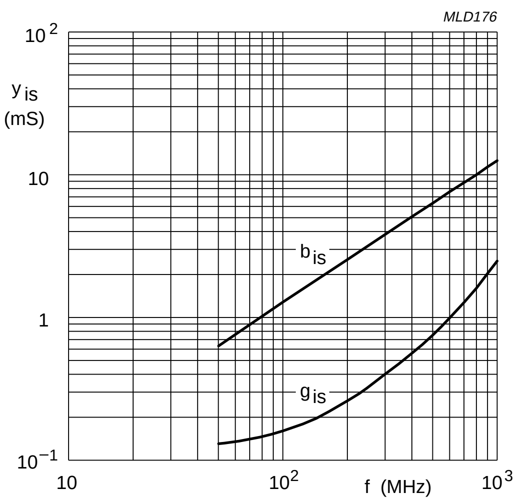

$V_{DS}$ = 9 V; $V_{G2}$ = 4 V.
$I_D$ = 10 mA; $T_{amb}$ = 25 °C.

Fig.21 Forward transfer admittance and phase as a function of frequency; typical values.



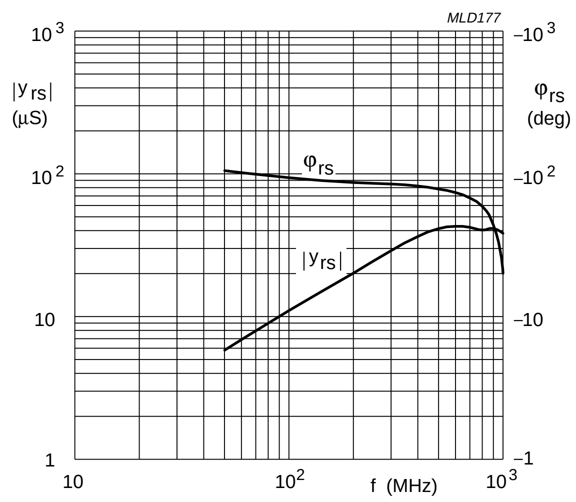

$V_{DS}$ = 9 V; $V_{G2}$ = 4 V.
$I_D$ =10 mA; $T_{amb}$ = 25 °C.

Fig.22 Output admittance as a function of frequency; typical values.



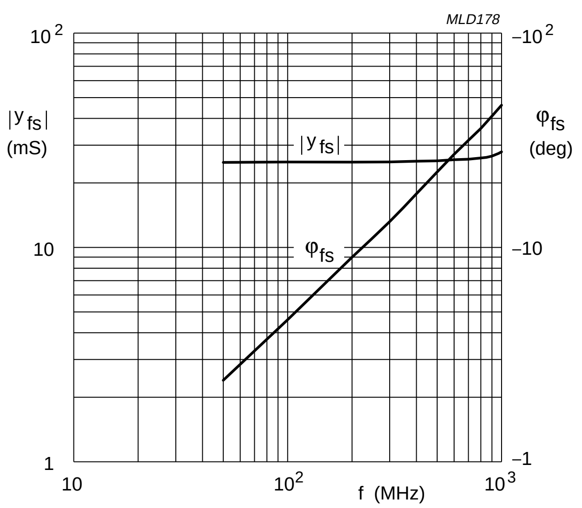

$V_{DS}$ = 12 V; $V_{G2}$ = 4 V.
$I_D$ = 10 mA; $T_{amb}$ = 25 °C.

Fig.23 Input admittance as a function of frequency; typical values.



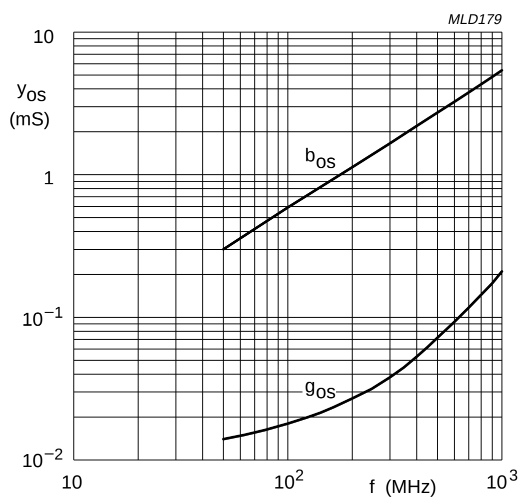

$V_{DS}$ = 12 V; $V_{G2}$ = 4 V.
$I_D$ = 10 mA; $T_{amb}$ = 25 °C.

Fig.24 Reverse transfer admittance and phase as a function of frequency; typical values.



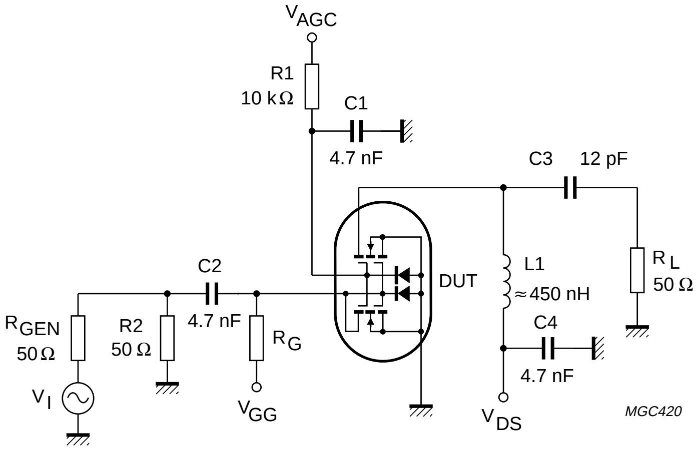

$V_{DS}$ = 12 V; $V_{G2}$ = 4 V.
$I_D$ = 10 mA; $T_{amb}$ = 25 °C.

Fig.25 Forward transfer admittance and phase as a function of frequency; typical values.




$V_{DS}$ = 12 V; $V_{G2}$ = 4 V.
$I_D$ = 10 mA; $T_{amb}$ = 25 °C.

Fig.26 Output admittance as a function of frequency; typical values.




For $V_{GG} = V_{DS} = 9$ V, $R_G = 180$ kΩ.
For $V_{GG} = V_{DS} = 12$ V, $R_G = 250$ kΩ.

Fig.27 Cross-modulation test set-up.

**Table 1** Scattering parameters: $V_{DS}$ = 9 V; $V_{G2\text{-}S}$ = 4 V; $I_D$ = 10 mA

| 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 | 0.986 | –3.6 | 2.528 | 174.4 | 0.001 | 63.7 | 1.000 | –2.0 |
| 100 | 0.983 | –7.4 | 2.531 | 169.8 | 0.001 | 80.7 | 1.000 | –4.2 |
| 200 | 0.974 | –14.7 | 2.490 | 159.5 | 0.002 | 81.0 | 0.996 | –8.1 |
| 300 | 0.960 | –21.8 | 2.446 | 149.8 | 0.002 | 80.3 | 0.994 | –11.9 |
| 400 | 0.953 | –28.7 | 2.412 | 139.8 | 0.003 | 76.3 | 0.992 | –15.7 |
| 500 | 0.933 | –35.4 | 2.341 | 130.1 | 0.003 | 76.5 | 0.987 | –19.4 |
| 600 | 0.915 | –42.0 | 2.283 | 120.4 | 0.004 | 79.0 | 0.984 | –23.0 |
| 700 | 0.895 | –47.9 | 2.205 | 111.6 | 0.003 | 81.5 | 0.981 | –26.7 |
| 800 | 0.880 | –53.5 | 2.146 | 102.9 | 0.003 | 90.8 | 0.978 | –30.3 |
| 900 | 0.864 | –59.6 | 2.087 | 93.4 | 0.003 | 106.6 | 0.974 | –33.9 |
| 1000 | 0.839 | –65.0 | 1.998 | 84.4 | 0.003 | 135.4 | 0.971 | –37.6 |

**Table 2** Noise data: $V_{DS}$ = 9 V; $V_{G2\text{-}S}$ = 4 V; $I_D$ = 10 mA

| f (MHz) | $F_{min}$ (dB) | $\Gamma_{opt}$ | | $r_n$ |
|---|---|---|---|---|
| | | (ratio) | (deg) | |
| 800 | 2.00 | 0.67 | 43.9 | 0.89 |

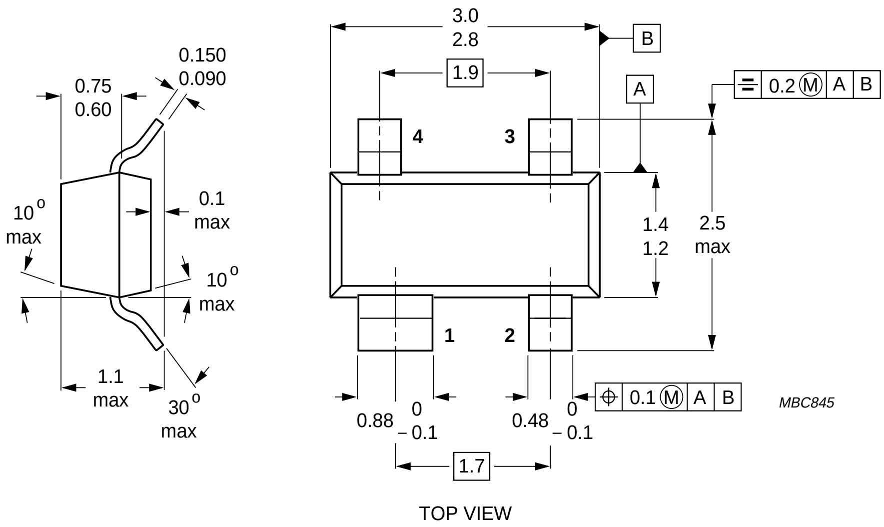
**Table 3** Scattering parameters: $V_{DS}$ = 12 V; $V_{G2\text{-}S}$ = 4 V; $I_D$ = 10 mA

| 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 | 0.986 | –3.7 | 2.478 | 174.7 | 0.001 | 72.2 | 1.000 | –1.6 |
| 100 | 0.984 | –7.4 | 2.480 | 170.3 | 0.001 | 80.9 | 1.000 | –3.5 |
| 200 | 0.974 | –14.6 | 2.440 | 160.6 | 0.002 | 82.7 | 0.997 | –6.6 |
| 300 | 0.960 | –21.8 | 2.400 | 151.4 | 0.002 | 79.9 | 0.996 | –9.7 |
| 400 | 0.953 | –28.7 | 2.371 | 141.9 | 0.003 | 77.7 | 0.994 | –12.8 |
| 500 | 0.933 | –35.3 | 2.306 | 132.7 | 0.003 | 77.1 | 0.991 | –15.8 |
| 600 | 0.915 | –41.9 | 2.255 | 123.6 | 0.004 | 77.1 | 0.989 | –18.7 |
| 700 | 0.894 | –47.8 | 2.183 | 115.3 | 0.004 | 79.3 | 0.986 | –21.7 |
| 800 | 0.879 | –53.5 | 2.131 | 107.2 | 0.003 | 83.9 | 0.984 | –24.6 |
| 900 | 0.863 | –59.5 | 2.080 | 98.2 | 0.003 | 95.1 | 0.982 | –27.5 |
| 1000 | 0.838 | –65.0 | 1.999 | 89.7 | 0.003 | 115.8 | 0.980 | –30.4 |

**Table 4** Noise data: $V_{DS}$ = 12 V; $V_{G2\text{-}S}$ = 4 V; $I_D$ = 10 mA

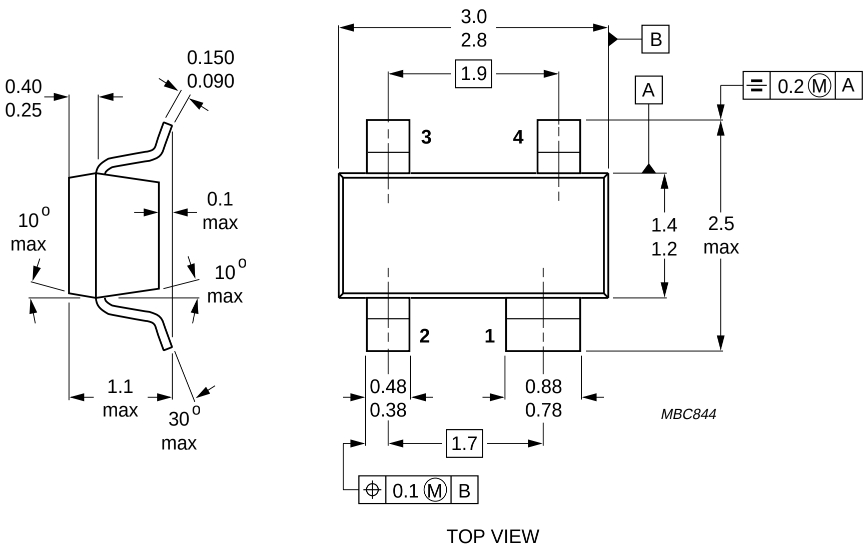
| f (MHz) | $F_{min}$ (dB) | $\Gamma_{opt}$ | | $r_n$ |
|---|---|---|---|---|
| | | (ratio) | (deg) | |
| 800 | 2.00 | 0.66 | 43.3 | 0.97 |

## PACKAGE OUTLINES




Dimensions in mm.

Fig.28 SOT143.




Dimensions in mm.

Fig.29 SOT143R.

# Legal information

## 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".

[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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# Revision history

## Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BF1100_N_2 | 20071113 | Product data sheet | - | BF1100_1 |
| Modifications: | • Fig. 1 and 2 on page 2; Figure note changed | | | |
| BF1100_1 | 19950425 | Product specification | - | - |



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