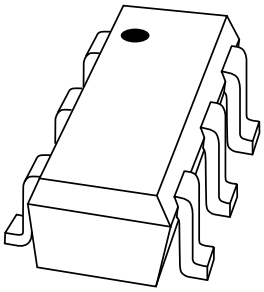
# DATA SHEET



# BF1206
## Dual N-channel dual-gate MOS-FET

Product specification

2003 Nov 17

# Dual N-channel dual-gate MOS-FET BF1206

## FEATURES

- Two low noise gain controlled amplifiers in a single package
- Superior cross-modulation performance during AGC
- High forward transfer admittance
- High forward transfer admittance to input capacitance ratio.

## APPLICATIONS

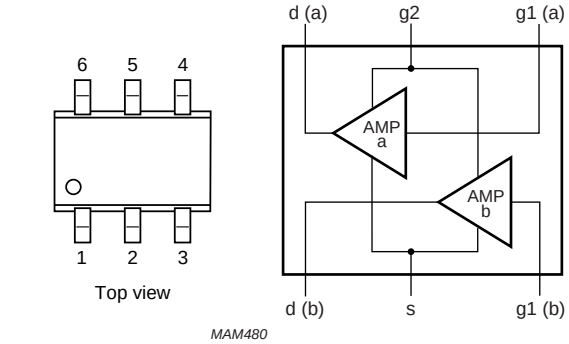
- Gain controlled low noise amplifiers for VHF and UHF applications with 5 V supply voltage, such as digital and analog television tuners.

## DESCRIPTION

The BF1206 is a combination of two different dual gate MOS-FET amplifiers with shared source and gate 2 leads. The source and substrate are interconnected. Internal bias circuits enable DC stabilization and a very good cross-modulation performance during AGC. Integrated diodes between the gates and source protect against excessive input voltage surges. The transistor is encapsulated in SOT363 micro-miniature plastic package.

## PINNING - SOT363

| PIN | DESCRIPTION |
|---|---|
| 1 | drain (b) |
| 2 | source |
| 3 | gate 1 (b) |
| 4 | gate 1 (a) |
| 5 | gate 2 |
| 6 | drain (a) |




**Marking code: L6-.**

Fig.1 Simplified outline and symbol.

## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| **Per MOS-FET; unless otherwise specified** | | | | | | |
| $V_{DS}$ | drain-source voltage | | – | – | 6 | V |
| $I_D$ | drain current (DC) | | – | – | 30 | mA |
| $\lvert y_{fs} \rvert$ | forward transfer admittance | amp. a: $I_D$ = 18 mA | 33 | 38 | 48 | mS |
| | | amp. b: $I_D$ = 12 mA | 29 | 34 | 44 | mS |
| $C_{ig1-s}$ | input capacitance at gate 1 | amp. a: $I_D$ = 18 mA; f = 1 MHz | – | 2.4 | 2.9 | pF |
| | | amp. b: $I_D$ = 12 mA; f = 1 MHz | – | 1.7 | 2.2 | pF |
| $C_{rss}$ | reverse transfer capacitance | f = 1 MHz | – | 15 | – | fF |
| $X_{mod}$ | cross-modulation | amp. a: input level for k = 1% at 40 dB AGC | 102 | 105 | – | dBμV |
| | | amp. b: input level for k = 1% at 40 dB AGC | 100 | 103 | – | dBμV |
| NF | noise figure | amp. a: f = 400 MHz; $I_D$ = 18 mA | – | 1.3 | 1.9 | dB |
| | | amp. b: f = 800 MHz; $I_D$ = 12 mA | – | 1.4 | 2.0 | dB |
| | | amp. a: f = 11 MHz; $I_D$ = 18 mA | – | 3 | – | dB |
| | | amp. b: f = 11 MHz; $I_D$ = 12 mA | – | 3.5 | – | dB |

# Dual N-channel dual-gate MOS-FET BF1206

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

## ORDERING INFORMATION

| TYPE NUMBER | PACKAGE | | |
|---|---|---|---|
| | NAME | DESCRIPTION | VERSION |
| BF1206 | – | plastic surface mounted package; 6 leads | SOT363 |

## LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| **Per MOS-FET; unless otherwise specified** | | | | | |
| $V_{DS}$ | drain-source voltage | | – | 6 | 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 | $T_s \leq 107$ °C; note 1 | – | 180 | mW |
| $T_{stg}$ | storage temperature | | −65 | +150 | °C |
| $T_j$ | junction temperature | | – | 150 | °C |

**Note**

1. $T_s$ is the temperature at the soldering point of the source lead.

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | VALUE | UNIT |
|---|---|---|---|
| $R_{th\ j\text{-}s}$ | thermal resistance from junction to soldering point | 240 | K/W |

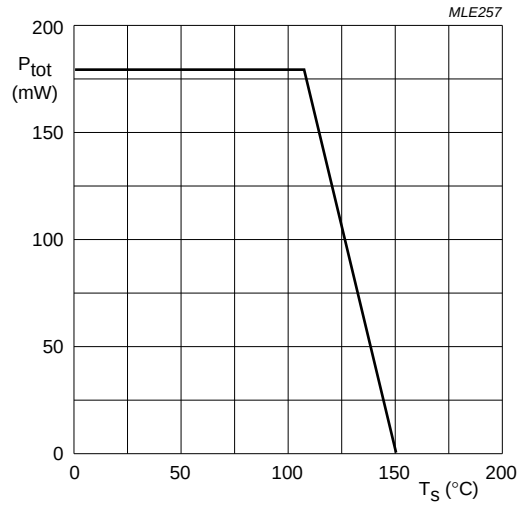



Fig.2 Power derating curve.

**STATIC CHARACTERISTICS**

$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| **Per MOS-FET unless otherwise specified** | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $V_{G1-S} = V_{G2-S} = 0$; $I_D$ = 10 μA | 6 | – | V |
| $V_{(BR)G1-SS}$ | gate-source breakdown voltage | $V_{GS} = V_{DS} = 0$; $I_{G1-S}$ = 10 mA | 6 | 10 | V |
| $V_{(BR)G2-SS}$ | gate-source breakdown voltage | $V_{GS} = V_{DS} = 0$; $I_{G2-S}$ = 10 mA | 6 | 10 | V |
| $V_{(F)S-G1}$ | forward source-gate voltage | $V_{G2-S} = V_{DS} = 0$; $I_{S-G1}$ = 10 mA | 0.5 | 1.5 | V |
| $V_{(F)S-G2}$ | forward source-gate voltage | $V_{G1-S} = V_{DS} = 0$; $I_{S-G2}$ = 10 mA | 0.5 | 1.5 | V |
| $V_{G1-S(th)}$ | gate-source threshold voltage | $V_{DS}$ = 5 V; $V_{G2-S}$ = 4 V; $I_D$ = 100 μA | 0.3 | 1 | V |
| $V_{G2-S(th)}$ | gate-source threshold voltage | $V_{DS}$ = 5 V; $V_{G1-S}$ = 5 V; $I_D$ = 100 μA | 0.35 | 1 | V |
| $I_{DSX}$ | drain-source current | amp. a:<br>$V_{G2-S}$ = 4 V; $V_{DS}$ = 5 V; $R_G$ = 91 kΩ; note 1 | 14 | 23 | mA |
| | | amp. b:<br>$V_{G2-S}$ = 4 V; $V_{DS}$ = 5 V; $R_G$ = 150 kΩ; note 1 | 9 | 17 | mA |
| $I_{G1-S}$ | gate cut-off current | $V_{G1-S}$ = 5 V; $V_{G2-S} = V_{DS} = 0$ | – | 50 | nA |
| $I_{G2-S}$ | gate cut-off current | $V_{G2-S}$ = 5 V; $V_{G1-S} = V_{DS} = 0$ | – | 20 | nA |

**Note**

1. $R_{G1}$ connects gate 1 to $V_{GG}$ = 5 V.

**DYNAMIC CHARACTERISTICS AMPLIFIER a**

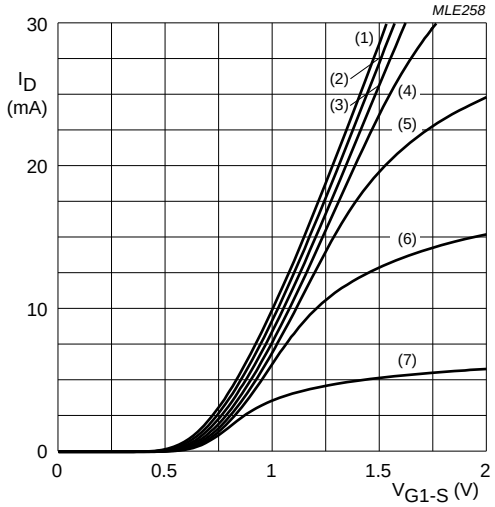
Common source; $T_{amb}$ = 25 °C; $V_{G2\text{-}S}$ = 4 V; $V_{DS}$ = 5 V; $I_D$ = 18 mA; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $\lvert y_{fs} \rvert$ | forward transfer admittance | pulsed; $T_j$ = 25 °C | 33 | 38 | 48 | mS |
| $C_{ig1\text{-}ss}$ | input capacitance at gate 1 | f = 1 MHz | – | 2.4 | 2.9 | pF |
| $C_{ig2\text{-}ss}$ | input capacitance at gate 2 | f = 1 MHz | – | 3.2 | – | pF |
| $C_{oss}$ | output capacitance | f = 1 MHz | – | 1.1 | – | pF |
| $C_{rss}$ | reverse transfer capacitance | f = 1 MHz | – | 15 | 30 | fF |
| NF | noise figure | f = 11 MHz; $G_S$ = 20 mS; $B_S$ = 0 | – | 3 | – | dB |
| | | f = 400 MHz; $Y_S = Y_{S\ opt}$ | – | 1.3 | 1.9 | dB |
| | | f = 800 MHz; $Y_S = Y_{S\ opt}$ | – | 1.6 | 2.2 | dB |
| $G_{tr}$ | power gain | f = 200 MHz; $G_S$ = 2 mS; $B_S = B_{S\ opt}$; $G_L$ = 0.5 mS; $B_L = B_{L\ opt}$; note 1 | – | 35 | – | dB |
| | | f = 400 MHz; $G_S$ = 2 mS; $B_S = B_{S\ opt}$; $G_L$ = 1 mS; $B_L = B_{L\ opt}$; note 1 | – | 30 | – | dB |
| | | f = 800 MHz; $G_S$ = 3.3 mS; $B_S = B_{S\ opt}$; $G_L$ = 1 mS; $B_L = B_{L\ opt}$; note 1 | – | 23 | – | dB |
| $X_{mod}$ | cross-modulation | input level for k = 1%; $f_w$ = 50 MHz; $f_{unw}$ = 60 MHz; note 2 | | | | |
| | | at 0 dB AGC | 90 | – | – | dBμV |
| | | at 10 dB AGC | – | 92 | – | dBμV |
| | | at 40 dB AGC | 102 | 105 | – | dBμV |

**Notes**

1. Calculated from measured s-parameters.
2. Measured in Fig.35 test circuit.

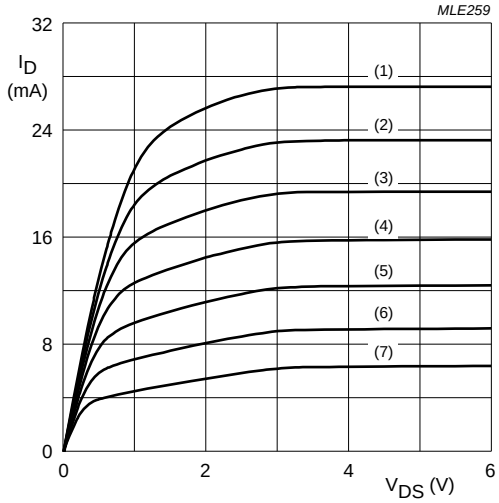
**GRAPHS FOR AMPLIFIER a**




$V_{DS}$ = 5 V; $T_j$ = 25 °C.

(1) $V_{G2-S}$ = 4 V.
(2) $V_{G2-S}$ = 3.5 V.
(3) $V_{G2-S}$ = 3 V.
(4) $V_{G2-S}$ = 2.5 V.
(5) $V_{G2-S}$ = 2 V.
(6) $V_{G2-S}$ = 1.5 V.
(7) $V_{G2-S}$ = 1 V.

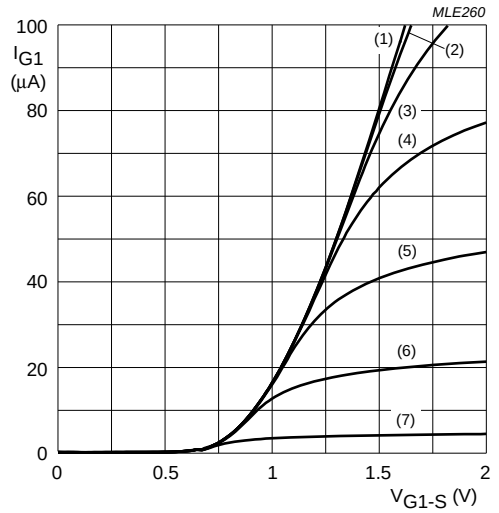
Fig.3 Transfer characteristics; typical values; amplifier a.




$V_{G2-S}$ = 4 V; $T_j$ = 25 °C.

(1) $V_{G1-S}$ = 1.5 V.
(2) $V_{G1-S}$ = 1.4 V.
(3) $V_{G1-S}$ = 1.3 V.
(4) $V_{G1-S}$ = 1.2 V.
(5) $V_{G1-S}$ = 1.1 V.
(6) $V_{G1-S}$ = 1 V.
(7) $V_{G1-S}$ = 0.9 V.

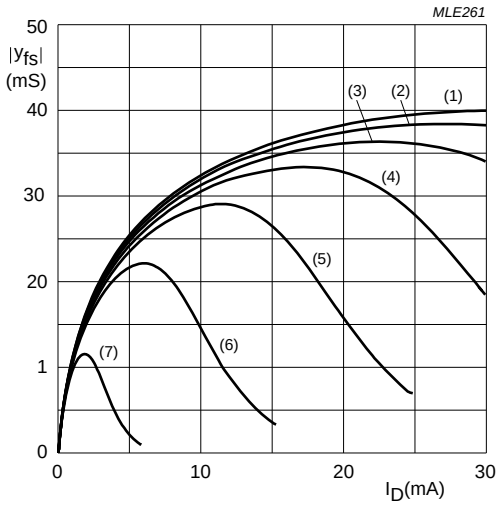
Fig.4 Output characteristics; typical values; amplifier a.




$V_{DS}$ = 5 V; $T_j$ = 25 °C.

(1) $V_{G2-S}$ = 4 V.
(2) $V_{G2-S}$ = 3.5 V.
(3) $V_{G2-S}$ = 3 V.
(4) $V_{G2-S}$ = 2.5 V.
(5) $V_{G2-S}$ = 2 V.
(6) $V_{G2-S}$ = 1.5 V.
(7) $V_{G2-S}$ = 1 V.

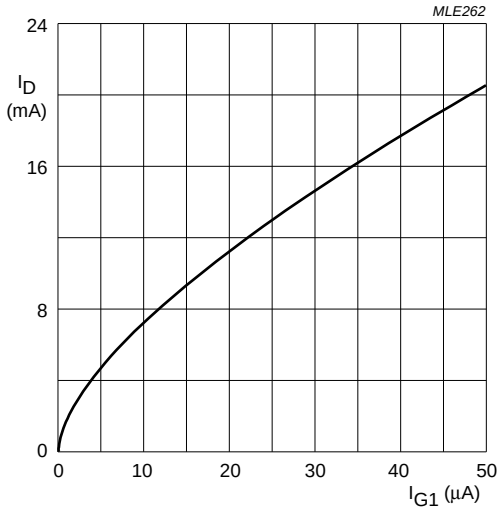
Fig.5 Gate 1 current as a function of gate 1 voltage; typical values; amplifier a.




$V_{DS}$ = 5 V; $T_j$ = 25 °C.

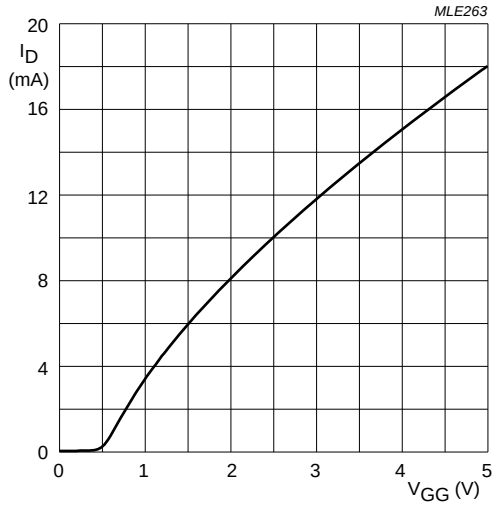
(1) $V_{G2-S}$ = 4 V.
(2) $V_{G2-S}$ = 3.5 V.
(3) $V_{G2-S}$ = 3 V.
(4) $V_{G2-S}$ = 2.5 V.
(5) $V_{G2-S}$ = 2 V.
(6) $V_{G2-S}$ = 1.5 V.
(7) $V_{G2-S}$ = 1 V.

Fig.6 Forward transfer admittance as a function of drain current; typical values; amplifier a.



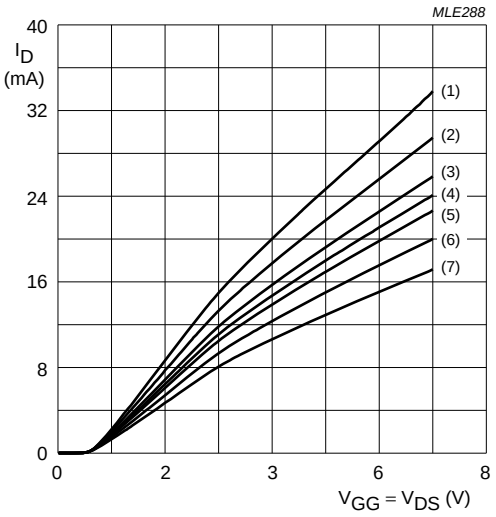

$V_{DS}$ = 5 V; $V_{G2-S}$ = 4 V; $T_j$ = 25 °C.

Fig.7 Drain current as a function of gate 1 current; typical values; amplifier a.




$V_{DS}$ = 5 V; $V_{G2-S}$ = 4 V; $T_j$ = 25 °C.
$R_{G1}$ = 91 kΩ (connected to $V_{GG}$); see Fig.35.

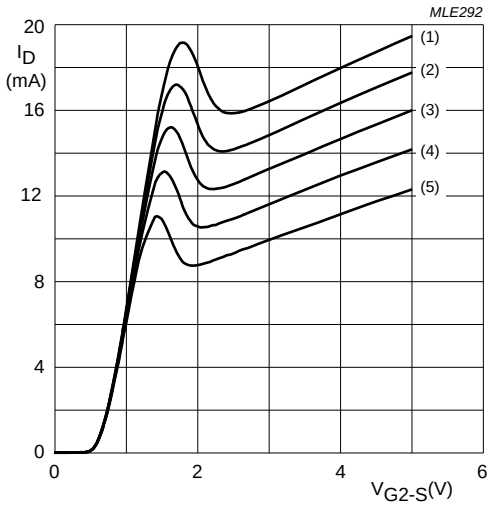
Fig.8 Drain current as a function of gate 1 supply voltage ($V_{GG}$); typical values; amplifier a.




$V_{G2-S}$ = 4 V; $T_j$ = 25 °C; $R_{G1}$ = 150 kΩ (connected to $V_{GG}$); see Fig.35.

(1) $R_{G1}$ = 56 kΩ.
(2) $R_{G1}$ = 68 kΩ.
(3) $R_{G1}$ = 82 kΩ.
(4) $R_{G1}$ = 91 kΩ.
(5) $R_{G1}$ = 100 kΩ.
(6) $R_{G1}$ = 120 kΩ.
(7) $R_{G1}$ = 150 kΩ.

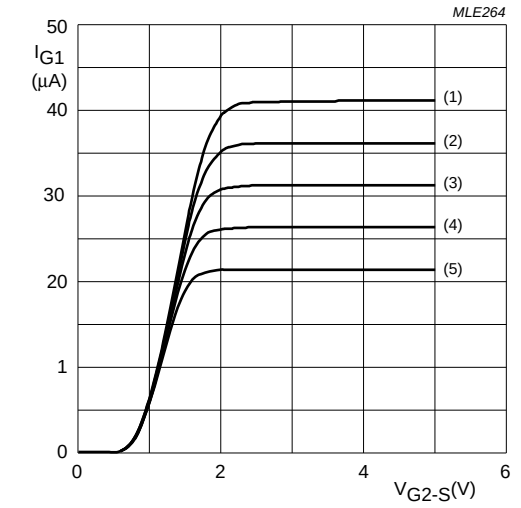
Fig.9 Drain current as a function of gate 1 ($V_{GG}$) and drain supply voltage; typical values; amplifier a.




$V_{DS}$ = 5 V; $T_j$ = 25 °C; $R_{G1}$ = 91 kΩ (connected to $V_{GG}$); see Fig.35.

(1) $V_{GG}$ = 5 V.
(2) $V_{GG}$ = 4.5 V.
(3) $V_{GG}$ = 4 V.
(4) $V_{GG}$ = 3.5 V.
(5) $V_{GG}$ = 3 V.

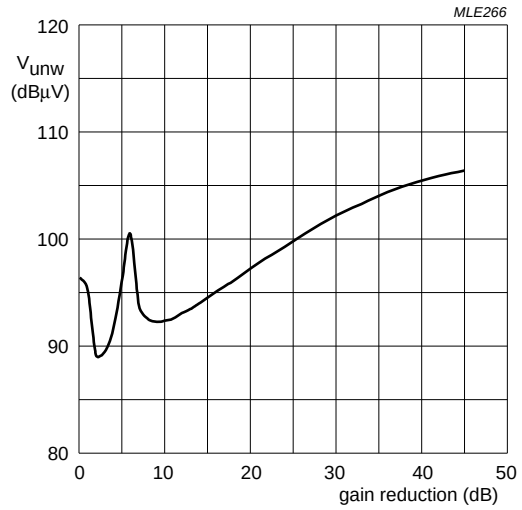
Fig.10 Drain current as a function of gate 2 voltage; typical values; amplifier a.




$V_{DS}$ 5 V; $T_j$ = 25 °C.
$R_{G1}$ = 91 kΩ (connected to $V_{GG}$); see Fig.35.

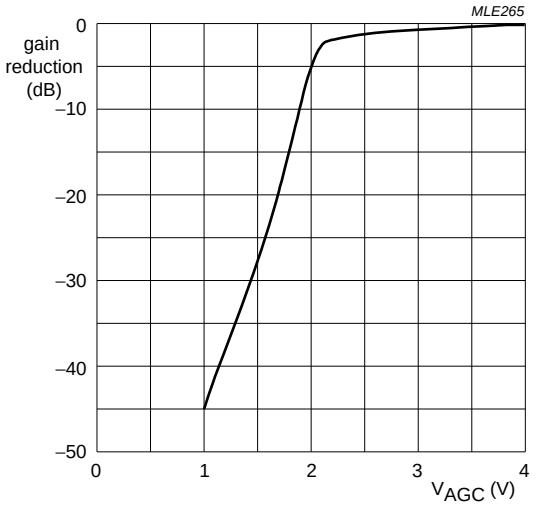
(1) $V_{GG}$ = 5 V.
(2) $V_{GG}$ = 4.5 V.
(3) $V_{GG}$ = 4 V.
(4) $V_{GG}$ = 3.5 V.
(5) $V_{GG}$ = 3 V.

Fig.11 Gate 1 current as a function of gate 2 voltage; typical values; amplifier a.



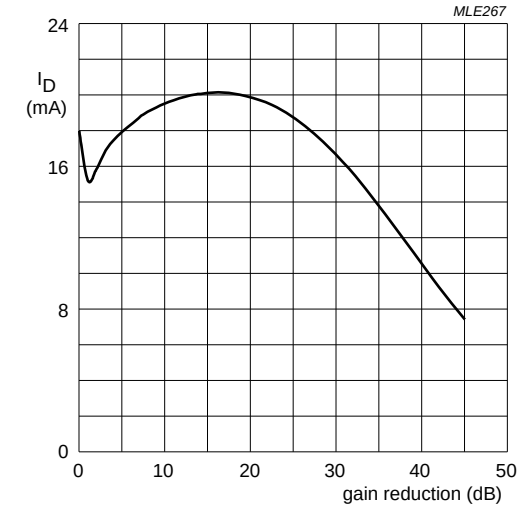

$V_{DS}$ = 5 V; $V_{GG}$ = 5 V; $R_{G1}$ = 91 kΩ; f = 50 MHz; $f_{unw}$ = 60 MHz; $T_{amb}$ = 25 °C; see Fig.35.

Fig.12 Unwanted voltage for 1% cross-modulation as a function of gain reduction; typical values; amplifier a.



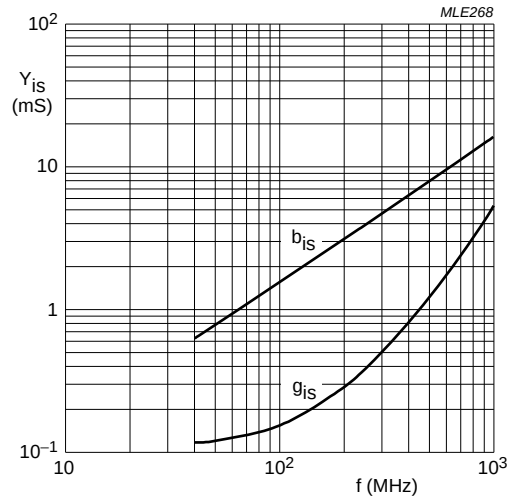

$V_{DS}$ = 5 V; $V_{GG}$ = 5 V; $R_{G1}$ = 91 kΩ; f = 50 MHz; $T_{amb}$ = 25 °C; see Fig.35.

Fig.13 Typical gain reduction as a function of AGC voltage; typical values; amplifier a.



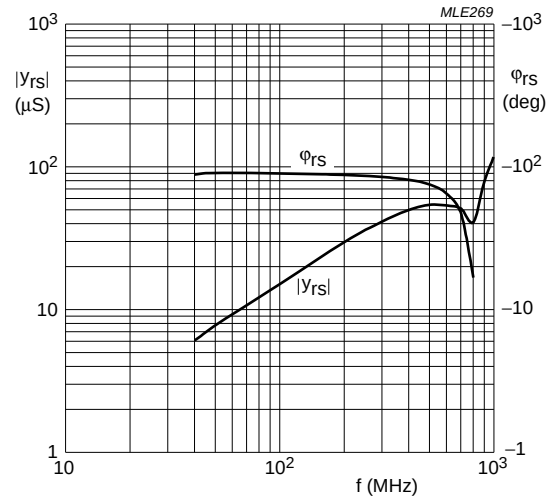

$V_{DS}$ = 5 V; $V_{GG}$ = 5 V; $R_{G1}$ = 91 kΩ; f = 50 MHz; $T_{amb}$ = 25 °C; see Fig.35.

Fig.14 Drain current as a function of gain reduction; typical values; amplifier a.



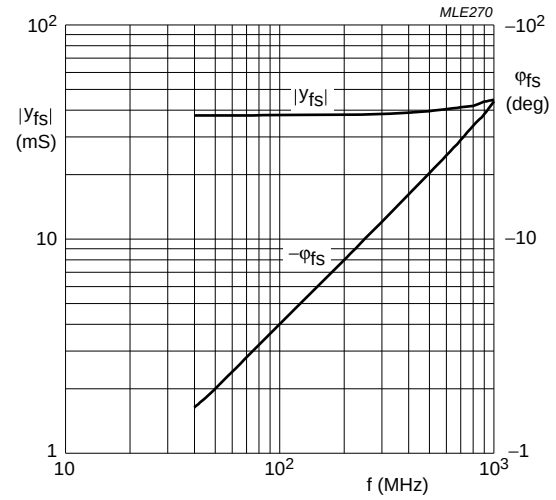

$V_{DS}$ = 5 V; $V_{G2}$ = 4 V; $I_D$ = 18 mA; $T_{amb}$ = 25 °C.

Fig.15 Input admittance as a function of frequency; typical values; amplifier a.



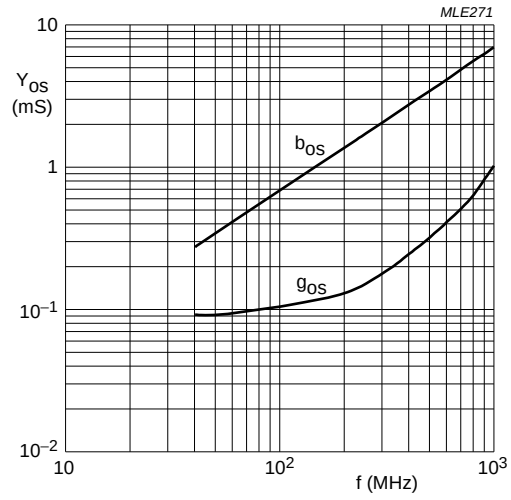

$V_{DS}$ = 5 V; $V_{G2}$ = 4 V; $I_D$ = 18 mA; $T_{amb}$ = 25 °C.

Fig.16 Reverse transfer admittance and phase as a function of frequency; typical values; amplifier a.




$V_{DS}$ = 5 V; $V_{G2}$ = 4 V; $I_D$ = 18 mA; $T_{amb}$ = 25 °C.

Fig.17 Forward transfer admittance and phase as a function of frequency; typical values; amplifier a.




$V_{DS}$ = 5 V; $V_{G2}$ = 4 V; $I_D$ = 18 mA; $T_{amb}$ = 25 °C.

Fig.18 Output admittance as a function of frequency; typical values; amplifier a.

**Amplifier a scattering parameters**

$V_{DS}$ = 5 V; $V_{G2\text{-}S}$ = 4 V; $I_D$ = 18 mA; $T_{amb}$ = 25 °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 | 0.988 | −4.62 | 3.72 | 174.72 | 0.0008 | 86.73 | 0.991 | −2.07 |
| 100 | 0.984 | −9.23 | 3.71 | 169.42 | 0.0015 | 84.39 | 0.989 | −4.16 |
| 200 | 0.971 | −18.33 | 3.66 | 159.05 | 0.0029 | 79.96 | 0.986 | −8.24 |
| 300 | 0.951 | −27.32 | 3.58 | 148.77 | 0.0038 | 76.62 | 0.980 | −12.32 |
| 400 | 0.926 | −36.04 | 3.47 | 138.74 | 0.0044 | 74.42 | 0.973 | −16.33 |
| 500 | 0.896 | −44.50 | 3.36 | 129.05 | 0.0046 | 74.84 | 0.965 | −20.25 |
| 600 | 0.865 | −52.63 | 3.23 | 119.67 | 0.0043 | 79.73 | 0.958 | −24.20 |
| 700 | 0.832 | −60.47 | 3.09 | 110.43 | 0.0038 | 92.63 | 0.951 | −28.14 |
| 800 | 0.797 | −67.66 | 2.91 | 101.40 | 0.0028 | 118.47 | 0.937 | −32.14 |
| 900 | 0.769 | −75.01 | 2.83 | 93.09 | 0.0051 | 146.61 | 0.940 | −35.76 |
| 1000 | 0.732 | −81.73 | 2.67 | 84.05 | 0.0071 | 159.78 | 0.937 | −39.86 |

**Noise data**

$V_{DS}$ = 5 V; $V_{G2\text{-}S}$ = 4 V; $I_D$ = 18 mA; $T_{amb}$ = 25 °C

| f (MHz) | $F_{min}$ (dB) | $\Gamma_{opt}$ | | $R_n$ (Ω) |
|---|---|---|---|---|
| | | (ratio) | (deg) | |
| 400 | 1.3 | 0.618 | 22.7 | 26.7 |
| 800 | 1.6 | 0.593 | 44.1 | 29.7 |

**DYNAMIC CHARACTERISTICS AMPLIFIER b**

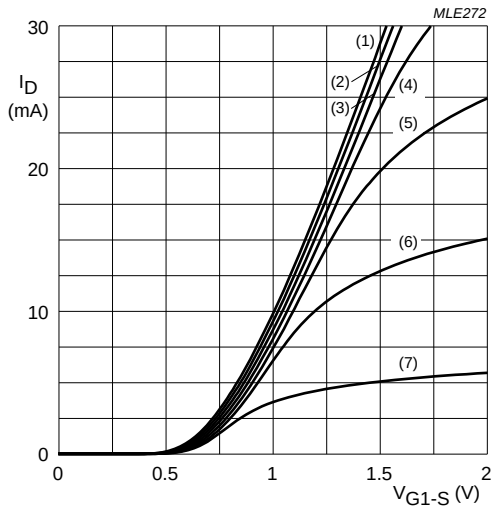
Common source; $T_{amb}$ = 25 °C; $V_{G2-S}$ = 4 V; $V_{DS}$ = 5 V; $I_D$ = 12 mA; unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $\lvert y_{fs} \rvert$ | forward transfer admittance | pulsed; $T_j$ = 25 °C | 29 | 34 | 44 | mS |
| $C_{ig1-ss}$ | input capacitance at gate 1 | f = 1 MHz | – | 1.7 | 2.2 | pF |
| $C_{ig2-ss}$ | input capacitance at gate 2 | f = 1 MHz | – | 4.2 | – | pF |
| $C_{oss}$ | output capacitance | f = 1 MHz | – | 0.85 | – | pF |
| $C_{rss}$ | reverse transfer capacitance | f = 1 MHz | – | 15 | 30 | fF |
| F | noise figure | f = 11 MHz; $G_S$ = 20 mS; $B_S$ = 0 | – | 3.5 | – | dB |
| | | f = 400 MHz; $Y_S = Y_{S\ opt}$ | – | 1.3 | 1.9 | dB |
| | | f = 800 MHz; $Y_S = Y_{S\ opt}$ | – | 1.4 | 2 | dB |
| $G_{tr}$ | power gain | f = 200 MHz; $G_S$ = 2 mS; $B_S = B_{S\ opt}$; $G_L$ = 0.5 mS; $B_L = B_{L\ opt}$; note 1 | – | 35 | – | dB |
| | | f = 400 MHz; $G_S$ = 2 mS; $B_S = B_{S\ opt}$; $G_L$ = 1 mS; $B_L = B_{L\ opt}$; note 1 | – | 31 | – | dB |
| | | f = 800 MHz; $G_S$ = 3.3 mS; $B_S = B_{S\ opt}$; $G_L$ = 1 mS; $B_L = B_{L\ opt}$; note 1 | – | 27 | – | dB |
| $X_{mod}$ | cross-modulation | input level for k = 1%; $f_w$ = 50 MHz; $f_{unw}$ = 60 MHz; note 2 | | | | |
| | | at 0 dB AGC | 90 | – | – | dBμV |
| | | at 10 dB AGC | – | 90 | – | dBμV |
| | | at 40 dB AGC | 100 | 103 | – | dBμV |

**Notes**

1. Calculated from measured s-parameters.
2. Measured in Fig.35 test circuit.

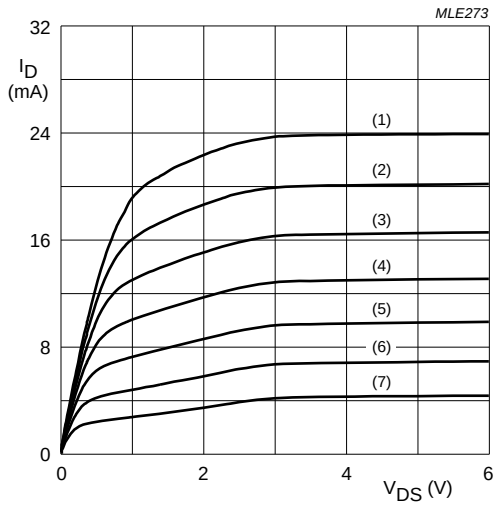
**GRAPHS FOR AMPLIFIER b**




$V_{DS}$ = 5 V; $T_j$ = 25 °C.

(1) $V_{G2-S}$ = 4 V.
(2) $V_{G2-S}$ = 3.5 V.
(3) $V_{G2-S}$ = 3 V.
(4) $V_{G2-S}$ = 2.5 V.
(5) $V_{G2-S}$ = 2 V.
(6) $V_{G2-S}$ = 1.5 V.
(7) $V_{G2-S}$ = 1 V.

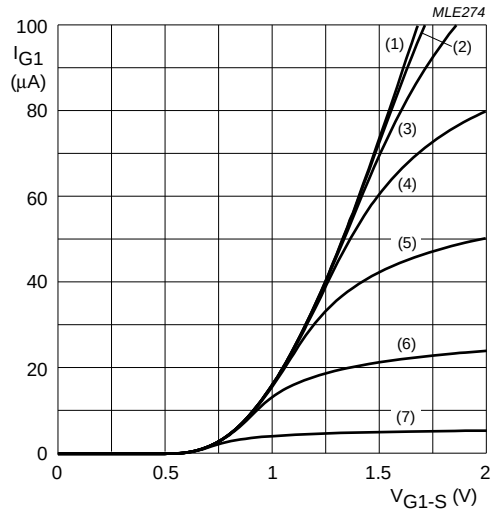
Fig.19 Transfer characteristics; typical values; amplifier b.




$V_{G2-S}$ = 4 V; $T_j$ = 25 °C.

(1) $V_{G1-S}$ = 1.5 V.
(2) $V_{G1-S}$ = 1.4 V.
(3) $V_{G1-S}$ = 1.3 V.
(4) $V_{G1-S}$ = 1.2 V.
(5) $V_{G1-S}$ = 1.1 V.
(6) $V_{G1-S}$ = 1 V.
(7) $V_{G1-S}$ = 0.9 V.

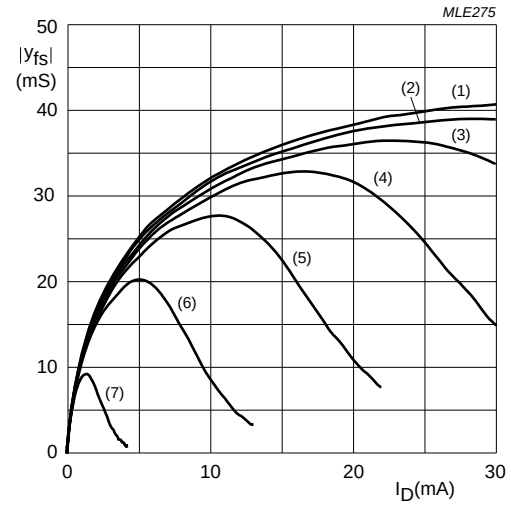
Fig.20 Output characteristics; typical values; amplifier b.




$V_{DS}$ = 5 V; $T_j$ = 25 °C.

(1) $V_{G2-S}$ = 4 V.
(2) $V_{G2-S}$ = 3.5 V.
(3) $V_{G2-S}$ = 3 V.
(4) $V_{G2-S}$ = 2.5 V.
(5) $V_{G2-S}$ = 2 V.
(6) $V_{G2-S}$ = 1.5 V.
(7) $V_{G2-S}$ = 1 V.

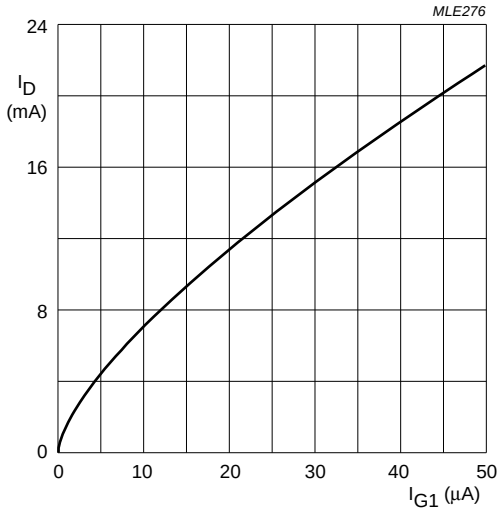
Fig.21 Gate 1 current as a function of gate 1 voltage; typical values; amplifier b.




$V_{DS}$ = 5 V; $T_j$ = 25 °C.

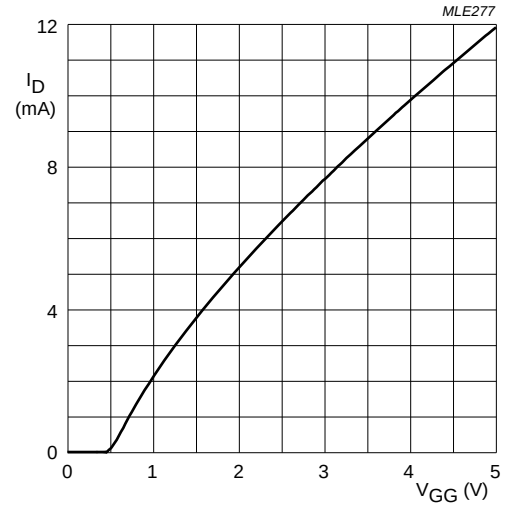
(1) $V_{G2-S}$ = 4 V.
(2) $V_{G2-S}$ = 3.5 V.
(3) $V_{G2-S}$ = 3 V.
(4) $V_{G2-S}$ = 2.5 V.
(5) $V_{G2-S}$ = 2 V.
(6) $V_{G2-S}$ = 1.5 V.
(7) $V_{G2-S}$ = 1 V.

Fig.22 Forward transfer admittance as a function of drain current; typical values; amplifier b.



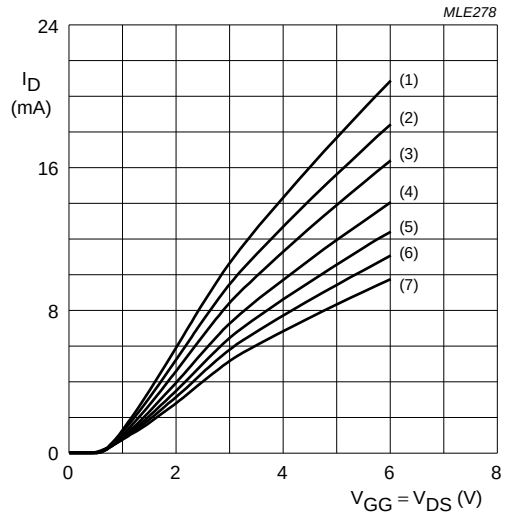

$V_{DS}$ = 5 V; $V_{G2-S}$ = 4 V; $T_j$ = 25 °C.

Fig.23 Drain current as a function of gate 1 current; typical values; amplifier b.




$V_{DS}$ = 5 V; $V_{G2-S}$ = 4 V; $T_j$ = 25 °C.
$R_{G1}$ = 150 kΩ (connected to $V_{GG}$); see Fig.35.

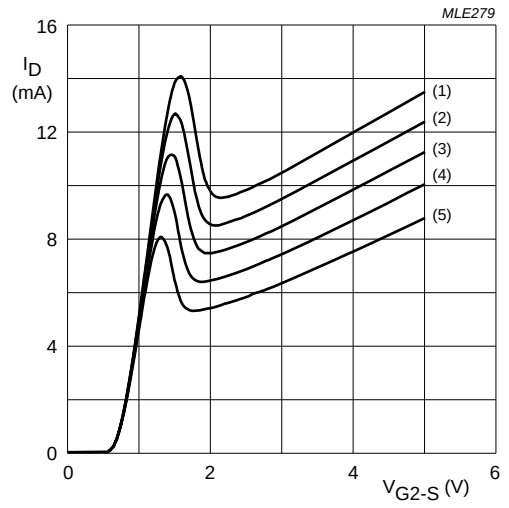
Fig.24 Drain current as a function of gate 1 supply voltage ($V_{GG}$); typical values; amplifier b.




$V_{G2-S}$ = 4 V; $T_j$ = 25 °C.
$R_{G1}$ = 150 kΩ (connected to $V_{GG}$); see Fig.35.

(1) $R_{G1}$ = 270 kΩ.
(2) $R_{G1}$ = 220 kΩ.
(3) $R_{G1}$ = 180 kΩ.
(4) $R_{G1}$ = 150 kΩ.
(5) $R_{G1}$ = 120 kΩ.
(6) $R_{G1}$ = 100 kΩ.
(7) $R_{G1}$ = 82 kΩ.

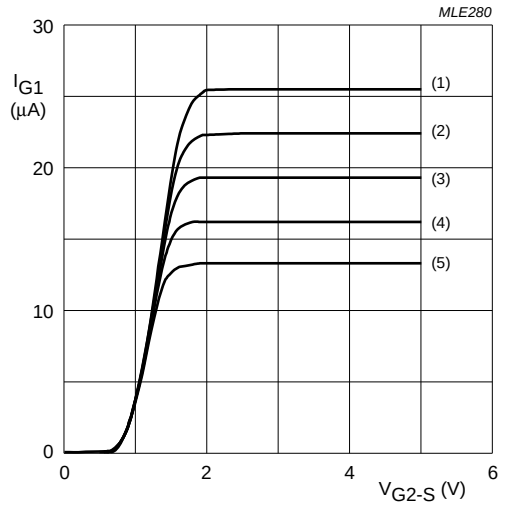
Fig.25 Drain current as a function of gate 1 ($V_{GG}$) and drain supply voltage; typical values; amplifier b.




$V_{DS}$ = 5 V; $T_j$ = 25 °C.
$R_{G1}$ = 150 kΩ (connected to $V_{GG}$); see Fig.35.

(1) $V_{GG}$ = 5 V.
(2) $V_{GG}$ = 4.5 V.
(3) $V_{GG}$ = 4 V.
(4) $V_{GG}$ = 3.5 V.
(5) $V_{GG}$ = 3 V.

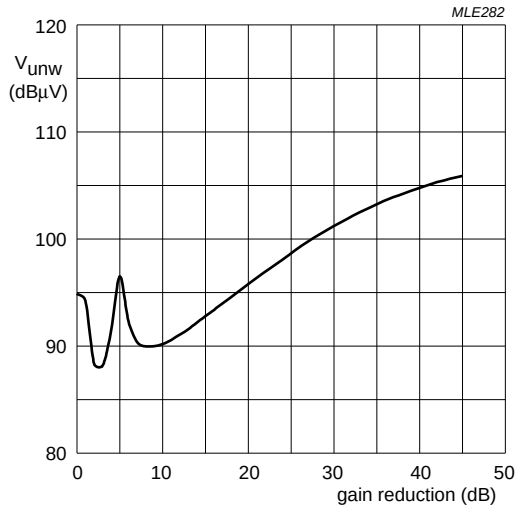
Fig.26 Drain current as a function of gate 2 voltage; typical values; amplifier b.




$V_{DS}$ 5 V; $T_j$ = 25 °C.
$R_{G1}$ = 150 kΩ (connected to $V_{GG}$); see Fig.35.

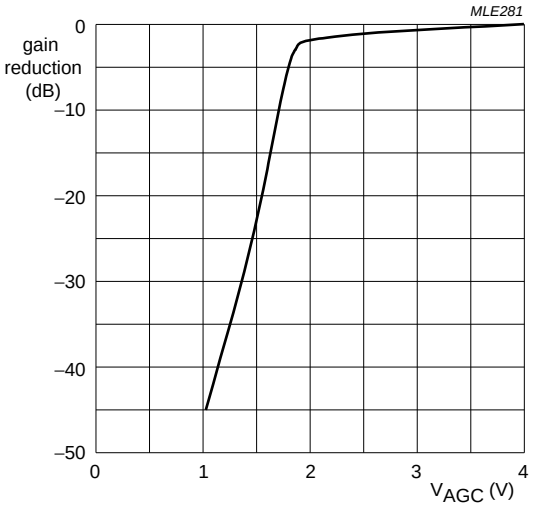
(1) $V_{GG}$ = 5 V.
(2) $V_{GG}$ = 4.5 V.
(3) $V_{GG}$ = 4 V.
(4) $V_{GG}$ = 3.5 V.
(5) $V_{GG}$ = 3 V.

Fig.27 Gate 1 current as a function of gate 2 voltage; typical values; amplifier b.



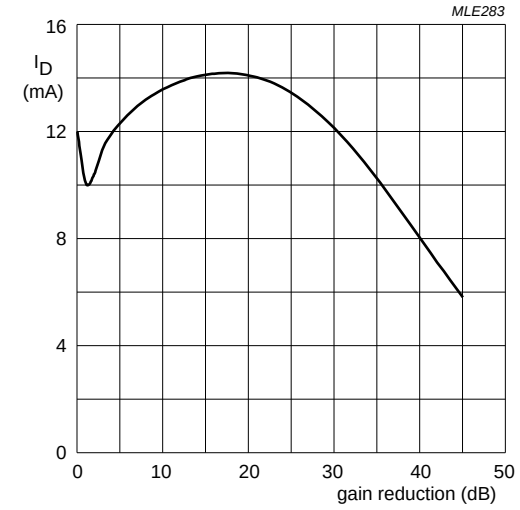

$V_{DS}$ = 5 V; $V_{GG}$ = 5 V; $R_{G1}$ = 150 kΩ; f = 50 MHz; $f_{unw}$ = 60 MHz; $T_{amb}$ = 25 °C; see Fig.35.

Fig.28 Unwanted voltage for 1% cross-modulation as a function of gain reduction; typical values; amplifier b.



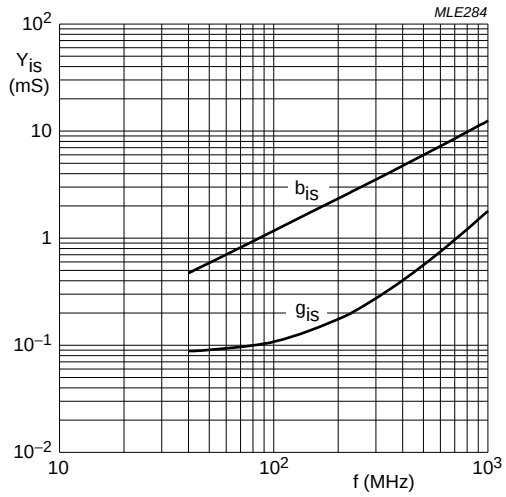

$V_{DS}$ = 5 V; $V_{GG}$ = 5 V; $R_{G1}$ = 150 kΩ; f = 50 MHz; $T_{amb}$ = 25 °C; see Fig.35.

Fig.29 Typical gain reduction as a function of AGC voltage; typical values; amplifier b.



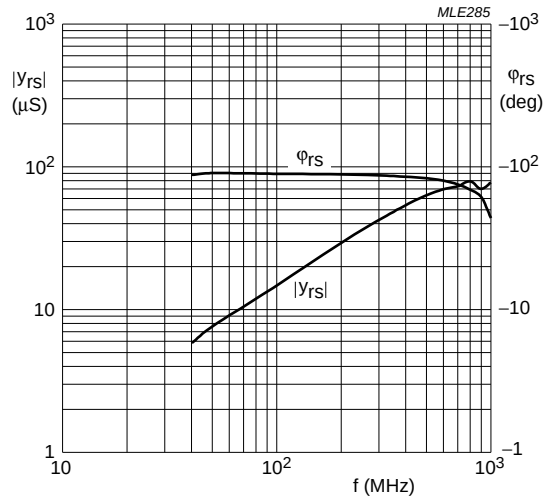

$V_{DS}$ = 5 V; $V_{GG}$ = 5 V; $R_{G1}$ = 150 kΩ; f = 50 MHz; $T_{amb}$ = 25 °C; see Fig.35.

Fig.30 Drain current as a function of gain reduction; typical values; amplifier b.



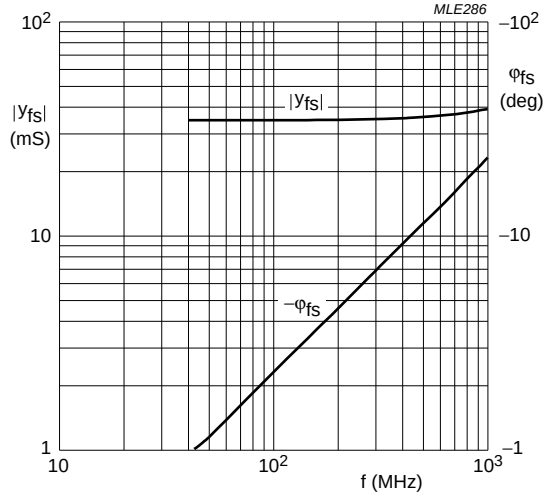

$V_{DS}$ = 5 V; $V_{G2}$ = 4 V; $I_D$ = 12 mA; $T_{amb}$ = 25 °C.

Fig.31 Input admittance as a function of frequency; typical values; amplifier b.



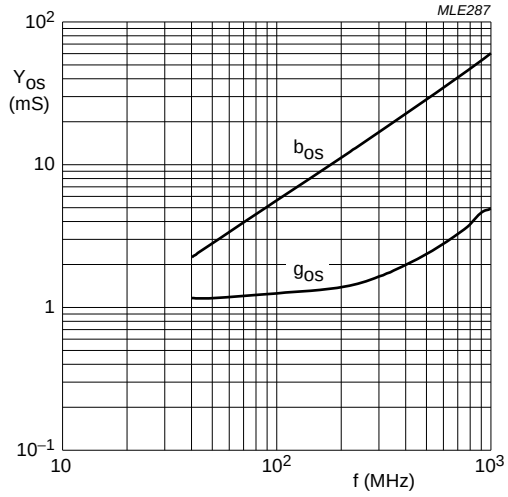

$V_{DS}$ = 5 V; $V_{G2}$ = 4 V; $I_D$ = 12 mA; $T_{amb}$ = 25 °C.

Fig.32 Reverse transfer admittance and phase as a function of frequency; typical values; amplifier b.




$V_{DS}$ = 5 V; $V_{G2}$ = 4 V; $I_D$ = 12 mA; $T_{amb}$ = 25 °C.

Fig.33 Forward transfer admittance and phase as a function of frequency; typical values; amplifier b.




$V_{DS}$ = 5 V; $V_{G2}$ = 4 V; $I_D$ = 12 mA; $T_{amb}$ = 25 °C.

Fig.34 Output admittance as a function of frequency; typical values; amplifier b.

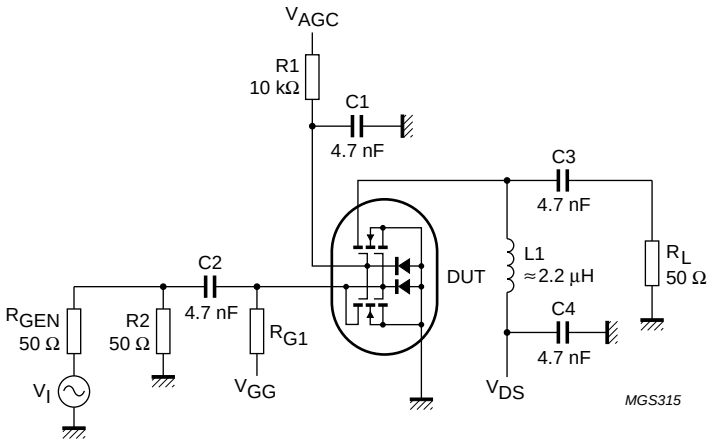



Fig.35 Cross-modulation test set-up (for one MOS-FET).

**Amplifier b scattering parameters**

$V_{DS}$ = 5 V; $V_{G2\text{-}S}$ = 4 V; $I_D$ = 12 mA; $T_{amb}$ = 25 °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 | 0.991 | −3.43 | 3.44 | 176.33 | 0.0008 | 86.54 | 0.988 | −1.69 |
| 100 | 0.989 | −6.84 | 3.43 | 172.66 | 0.0015 | 84.92 | 0.987 | −3.38 |
| 200 | 0.982 | −13.61 | 3.41 | 165.44 | 0.0029 | 80.95 | 0.985 | −6.72 |
| 300 | 0.973 | −20.37 | 3.38 | 158.20 | 0.0041 | 77.63 | 0.982 | −10.08 |
| 400 | 0.961 | −27.05 | 3.34 | 151.04 | 0.0051 | 74.43 | 0.978 | −13.46 |
| 500 | 0.947 | −33.68 | 3.29 | 144.02 | 0.0058 | 71.86 | 0.973 | −16.83 |
| 600 | 0.933 | −40.17 | 3.23 | 137.12 | 0.0062 | 70.28 | 0.969 | −20.25 |
| 700 | 0.919 | −46.54 | 3.16 | 130.22 | 0.0063 | 70.72 | 0.965 | −23.68 |
| 800 | 0.905 | −52.86 | 3.09 | 123.22 | 0.0065 | 72.37 | 0.960 | −27.22 |
| 900 | 0.890 | −58.60 | 3.02 | 116.84 | 0.0055 | 75.91 | 0.958 | −30.57 |
| 1000 | 0.881 | −64.34 | 2.94 | 110.20 | 0.0058 | 89.82 | 0.958 | −34.14 |

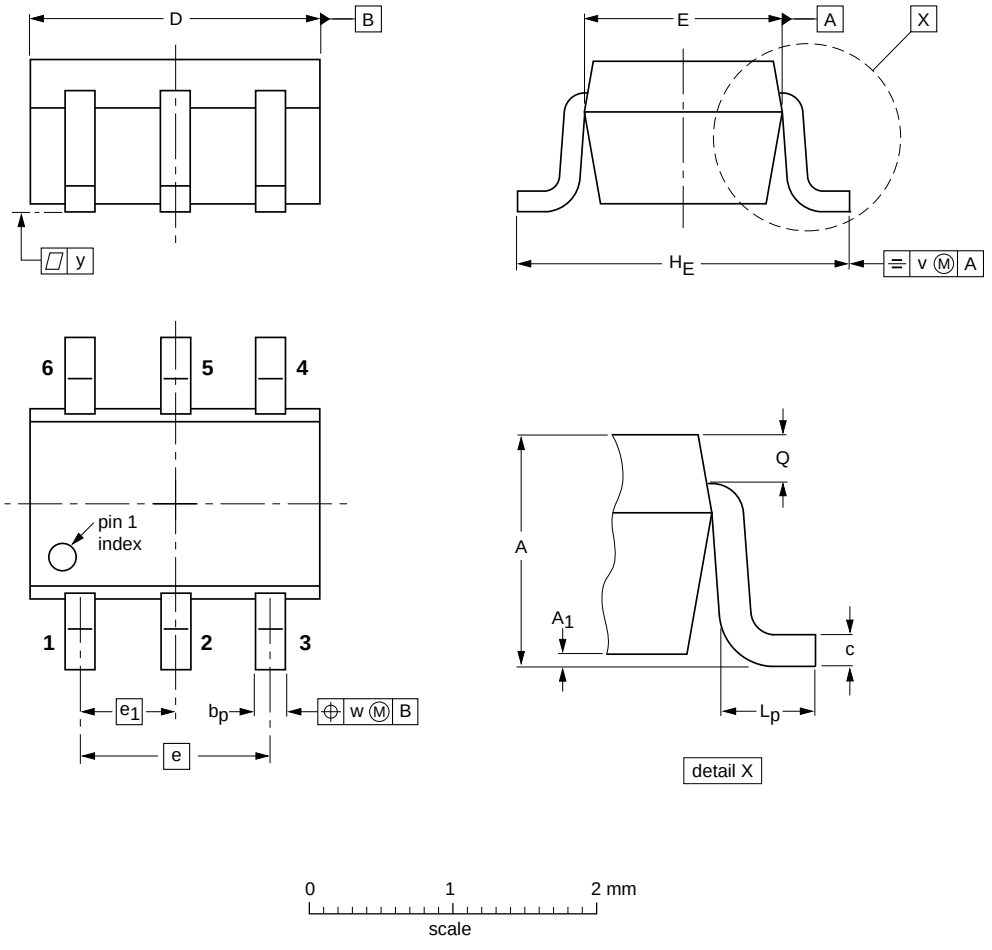
**Noise data**

$V_{DS}$ = 5 V; $V_{G2\text{-}S}$ = 4 V; $I_D$ = 12 mA; $T_{amb}$ = 25 °C

| f (MHz) | $F_{min}$ (dB) | $\Gamma_{opt}$ | | $R_n$ (Ω) |
|---|---|---|---|---|
| | | (ratio) | (deg) | |
| 400 | 1.3 | 0.648 | 14.4 | 28.8 |
| 800 | 1.4 | 0.604 | 31.1 | 27.9 |

## PACKAGE OUTLINE

**Plastic surface-mounted package; 6 leads** **SOT363**




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

| UNIT | A | $A_1$ max | $b_p$ | c | D | E | e | $e_1$ | $H_E$ | $L_p$ | Q | v | w | y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1<br>0.8 | 0.1 | 0.30<br>0.20 | 0.25<br>0.10 | 2.2<br>1.8 | 1.35<br>1.15 | 1.3 | 0.65 | 2.2<br>2.0 | 0.45<br>0.15 | 0.25<br>0.15 | 0.2 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT363 | | | SC-88 | | | ~~04-11-08~~<br>06-03-16 |

## 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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