



# BF1205C

Dual N-channel dual gate MOS-FET

Rev. 3 — 7 September 2011

Product data sheet

## 1. Product profile

### 1.1 General description

The BF1205C is a combination of two dual gate MOS-FET amplifiers with shared source and gate 2 leads and an integrated switch. The integrated switch is operated by the gate 1 bias of amplifier b.

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 has a SOT363 micro-miniature plastic package.

#### CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

### 1.2 Features and benefits

- Two low noise gain controlled amplifiers in a single package; one with a fully integrated bias and one with a partly integrated bias
- Internal switch to save external components
- Superior cross-modulation performance during AGC
- High forward transfer admittance
- High forward transfer admittance to input capacitance ratio.

### 1.3 Applications

- Gain controlled low noise amplifiers for VHF and UHF applications with 5 V supply voltage
  - ◆ digital and analog television tuners
  - ◆ professional communication equipment.



## 1.4 Quick reference data

**Table 1. Quick reference data**

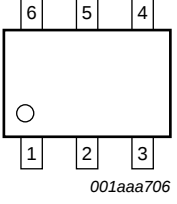
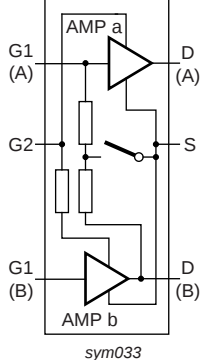
Per MOS-FET unless otherwise specified.

| Symbol       | Parameter                    | Conditions                                | Min | Typ | Max | Unit               |
|--------------|------------------------------|-------------------------------------------|-----|-----|-----|--------------------|
| $V_{DS}$     | drain-source voltage         |                                           | -   | -   | 6   | V                  |
| $I_D$        | drain current (DC)           |                                           | -   | -   | 30  | mA                 |
| $P_{tot}$    | total power dissipation      | $T_{sp} \leq 107\text{ }^{\circ}\text{C}$ | [1] | -   | 180 | mW                 |
| $ y_{fs} $   | forward transfer admittance  | $f = 1\text{ MHz}$                        |     |     |     |                    |
|              |                              | amplifier a; $I_D = 19\text{ mA}$         | 26  | 31  | 41  | mS                 |
|              |                              | amplifier b; $I_D = 13\text{ mA}$         | 28  | 33  | 43  | mS                 |
| $C_{ig1-ss}$ | input capacitance at gate 1  | $f = 1\text{ MHz}$                        |     |     |     |                    |
|              |                              | amplifier a                               | -   | 2.2 | 2.7 | pF                 |
|              |                              | amplifier b                               | -   | 2.0 | 2.5 | pF                 |
| $C_{rss}$    | reverse transfer capacitance | $f = 1\text{ MHz}$                        | -   | 20  | -   | fF                 |
| NF           | noise figure                 | amplifier a; $f = 400\text{ MHz}$         | -   | 1.3 | 1.9 | dB                 |
|              |                              | amplifier b; $f = 800\text{ MHz}$         | -   | 1.4 | 2.1 | dB                 |
| $X_{mod}$    | cross-modulation             | input level for $k = 1\%$ at 40 dB AGC    |     |     |     |                    |
|              |                              | amplifier a                               | 100 | 105 | -   | dB $\mu$ V         |
|              |                              | amplifier b                               | 100 | 103 | -   | dB $\mu$ V         |
| $T_j$        | junction temperature         |                                           | -   | -   | 150 | $^{\circ}\text{C}$ |

[1]  $T_{sp}$  is the temperature at the soldering point of the source lead.

## 2. Pinning information

**Table 2. Discrete pinning**

| Pin | Description | Simplified outline                                                                                     | Symbol                                                                                              |
|-----|-------------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 1   | gate 1 (a)  |  <p>001aaa706</p> |  <p>sym033</p> |
| 2   | gate 2      |                                                                                                        |                                                                                                     |
| 3   | gate 1 (b)  |                                                                                                        |                                                                                                     |
| 4   | drain (b)   |                                                                                                        |                                                                                                     |
| 5   | source      |                                                                                                        |                                                                                                     |
| 6   | drain (a)   |                                                                                                        |                                                                                                     |

### 3. Ordering information

Table 3. Ordering information

| Type number | Package |                                          |         |
|-------------|---------|------------------------------------------|---------|
|             | Name    | Description                              | Version |
| BF1205C     | -       | plastic surface mounted package; 6 leads | SOT363  |

### 4. Marking

Table 4. Marking

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| BF1205C     | M6*                         |

- [1] \* = p or -: made in Hong Kong.  
 \* = t: made in Malaysia.  
 \* = W: made in China.

### 5. Limiting values

Table 5. Limiting values

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

| Symbol             | Parameter               | Conditions                                 | Min | Max  | Unit |
|--------------------|-------------------------|--------------------------------------------|-----|------|------|
| <b>Per MOS-FET</b> |                         |                                            |     |      |      |
| $V_{DS}$           | 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 | $T_{sp} \leq 107\text{ °C}$ <sup>[1]</sup> | -   | 180  | mW   |
| $T_{stg}$          | storage temperature     |                                            | -65 | +150 | °C   |
| $T_j$              | junction temperature    |                                            | -   | 150  | °C   |

- [1]  $T_{sp}$  is the temperature at the soldering point of the source lead.

### 6. Thermal characteristics

Table 6. Thermal characteristics

| Symbol        | Parameter                                           | Conditions | Typ | Unit |
|---------------|-----------------------------------------------------|------------|-----|------|
| $R_{th(j-s)}$ | thermal resistance from junction to soldering point |            | 240 | K/W  |

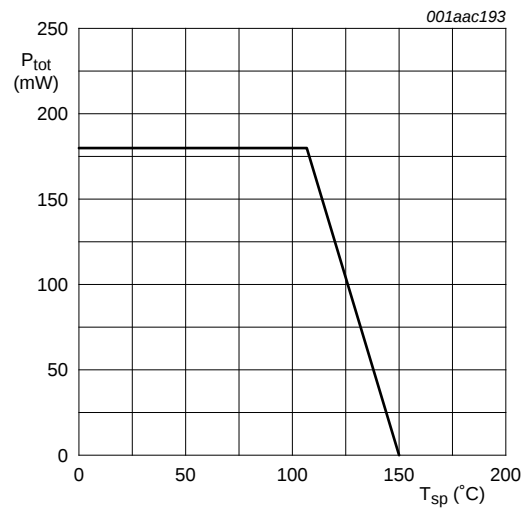


Fig 1. Power derating curve.

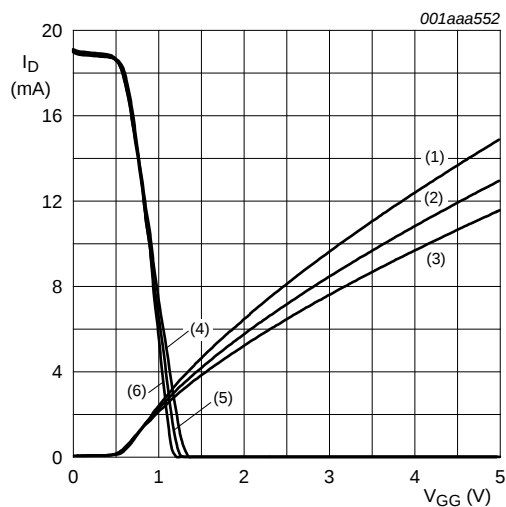
## 7. Static characteristics

Table 7. Static characteristics

 $T_j = 25\text{ }^{\circ}\text{C}$ .

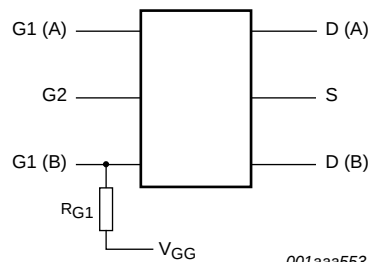
| Symbol                                         | Parameter                       | Conditions                                                                                                        | Min    | Typ | Max | Unit |
|------------------------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------|--------|-----|-----|------|
| <b>Per MOS-FET; unless otherwise specified</b> |                                 |                                                                                                                   |        |     |     |      |
| $V_{(BR)DSS}$                                  | drain-source breakdown voltage  | $V_{G1-S} = V_{G2-S} = 0\text{ V}$ ; $I_D = 10\text{ }\mu\text{A}$                                                |        |     |     |      |
|                                                |                                 | amplifier a                                                                                                       | 6      | -   | -   | V    |
|                                                |                                 | amplifier b                                                                                                       | 6      | -   | -   | V    |
| $V_{(BR)G1-SS}$                                | gate 1-source breakdown voltage | $V_{GS} = V_{DS} = 0\text{ V}$ ; $I_{G1-S} = 10\text{ mA}$                                                        | 6      | -   | 10  | V    |
| $V_{(BR)G2-SS}$                                | gate 2-source breakdown voltage | $V_{GS} = V_{DS} = 0\text{ V}$ ; $I_{G2-S} = 10\text{ mA}$                                                        | 6      | -   | 10  | V    |
| $V_{(F)S-G1}$                                  | forward source-gate 1 voltage   | $V_{G2-S} = V_{DS} = 0\text{ V}$ ; $I_{S-G1} = 10\text{ mA}$                                                      | 0.5    | -   | 1.5 | V    |
| $V_{(F)S-G2}$                                  | forward source-gate 2 voltage   | $V_{G1-S} = V_{DS} = 0\text{ V}$ ; $I_{S-G2} = 10\text{ mA}$                                                      | 0.5    | -   | 1.5 | V    |
| $V_{G1-S(th)}$                                 | gate 1-source threshold voltage | $V_{DS} = 5\text{ V}$ ; $V_{G2-S} = 4\text{ V}$ ; $I_D = 100\text{ }\mu\text{A}$                                  | 0.3    | -   | 1.0 | V    |
| $V_{G2-S(th)}$                                 | gate 2-source threshold voltage | $V_{DS} = 5\text{ V}$ ; $V_{G1-S} = 5\text{ V}$ ; $I_D = 100\text{ }\mu\text{A}$                                  | 0.4    | -   | 1.0 | V    |
| $I_{DSX}$                                      | drain-source current            | $V_{G2-S} = 4\text{ V}$ ; $V_{DS(b)} = 5\text{ V}$ ; $R_{G1} = 150\text{ k}\Omega$                                |        |     |     |      |
|                                                |                                 | amplifier a; $V_{DS(a)} = 5\text{ V}$                                                                             | [1] 14 | -   | 24  | mA   |
|                                                |                                 | amplifier b                                                                                                       | [2] 9  | -   | 17  | mA   |
| $I_{G1-S}$                                     | gate 1 cut-off current          | $V_{G2-S} = V_{DS(a)} = 0\text{ V}$                                                                               |        |     |     |      |
|                                                |                                 | amplifier a; $V_{G1-S(a)} = 5\text{ V}$ ; $I_{D(b)} = 0\text{ A}$                                                 | -      | -   | 50  | nA   |
|                                                |                                 | amplifier b; $V_{G1-S(b)} = 5\text{ V}$ ; $V_{DS(b)} = 0\text{ V}$                                                | -      | -   | 50  | nA   |
| $I_{G2-S}$                                     | gate 2 cut-off current          | $V_{G2-S} = 4\text{ V}$ ;<br>$V_{G1-S(a)} = V_{DS(a)} = V_{DS(b)} = 0\text{ V}$ ;<br>$V_{G1-S(b)} = 0\text{ V}$ ; | -      | -   | 20  | nA   |

[1]  $R_{G1}$  connects gate 1 (b) to  $V_{GG} = 0\text{ V}$  (see Figure 3).[2]  $R_{G1}$  connects gate 1 (b) to  $V_{GG} = 5\text{ V}$  (see Figure 3).



- (1)  $I_{D(b)}$ ;  $R_{G1} = 120 \text{ k}\Omega$ .
- (2)  $I_{D(b)}$ ;  $R_{G1} = 150 \text{ k}\Omega$ .
- (3)  $I_{D(b)}$ ;  $R_{G1} = 180 \text{ k}\Omega$ .
- (4)  $I_{D(a)}$ ;  $R_{G1} = 180 \text{ k}\Omega$ .
- (5)  $I_{D(a)}$ ;  $R_{G1} = 150 \text{ k}\Omega$ .
- (6)  $I_{D(a)}$ ;  $R_{G1} = 120 \text{ k}\Omega$ .

**Fig 2.** Drain currents of MOS-FET a and b as function of  $V_{GG}$ .



$V_{GG} = 5 \text{ V}$ : amplifier a is off; amplifier b is on  
 $V_{GG} = 0 \text{ V}$ : amplifier a is on; amplifier b is off.

**Fig 3.** Functional diagram.

## 8. Dynamic characteristics

### 8.1 Dynamic characteristics for amplifier a

**Table 8.** Dynamic characteristics for amplifier a<sup>[1]</sup>

Common source;  $T_{amb} = 25 \text{ }^{\circ}\text{C}$ ;  $V_{G2-S} = 4 \text{ V}$ ;  $V_{DS} = 5 \text{ V}$ ;  $I_D = 19 \text{ mA}$ .

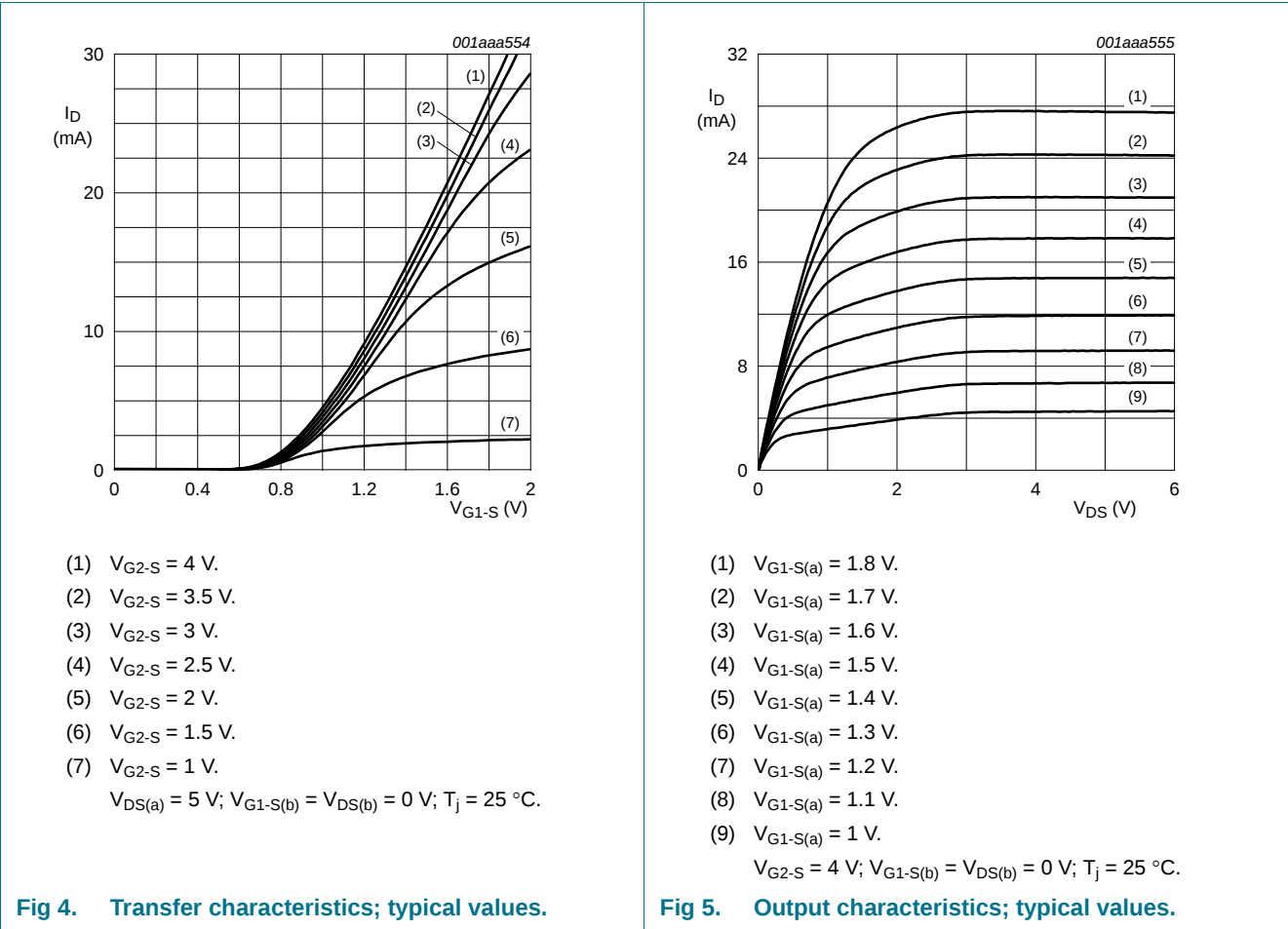
| Symbol       | Parameter                    | Conditions                                                            | Min | Typ | Max | Unit |
|--------------|------------------------------|-----------------------------------------------------------------------|-----|-----|-----|------|
| $ y_{fs} $   | forward transfer admittance  | $T_j = 25 \text{ }^{\circ}\text{C}$                                   | 26  | 31  | 41  | mS   |
| $C_{ig1-ss}$ | input capacitance at gate 1  | $f = 1 \text{ MHz}$                                                   | -   | 2.2 | 2.7 | pF   |
| $C_{ig2-ss}$ | input capacitance at gate 2  | $f = 1 \text{ MHz}$                                                   | -   | 3.0 | -   | pF   |
| $C_{oss}$    | output capacitance           | $f = 1 \text{ MHz}$                                                   | -   | 0.9 | -   | pF   |
| $C_{rss}$    | reverse transfer capacitance | $f = 1 \text{ MHz}$                                                   | -   | 20  | -   | fF   |
| $G_{tr}$     | power gain                   | $B_S = B_{S(opt)}$ ; $B_L = B_{L(opt)}$                               |     |     |     |      |
|              |                              | $f = 200 \text{ MHz}$ ; $G_S = 2 \text{ mS}$ ; $G_L = 0.5 \text{ mS}$ | 31  | 35  | 39  | dB   |
|              |                              | $f = 400 \text{ MHz}$ ; $G_S = 2 \text{ mS}$ ; $G_L = 1 \text{ mS}$   | 26  | 30  | 34  | dB   |
|              |                              | $f = 800 \text{ MHz}$ ; $G_S = 3.3 \text{ mS}$ ; $G_L = 1 \text{ mS}$ | 21  | 25  | 29  | dB   |
| NF           | noise figure                 | $f = 11 \text{ MHz}$ ; $G_S = 20 \text{ mS}$ ; $B_S = 0 \text{ S}$    | -   | 3.0 | -   | dB   |
|              |                              | $f = 400 \text{ MHz}$ ; $Y_S = Y_{S(opt)}$                            | -   | 1.3 | 1.9 | dB   |
|              |                              | $f = 800 \text{ MHz}$ ; $Y_S = Y_{S(opt)}$                            | -   | 1.4 | 2.1 | dB   |

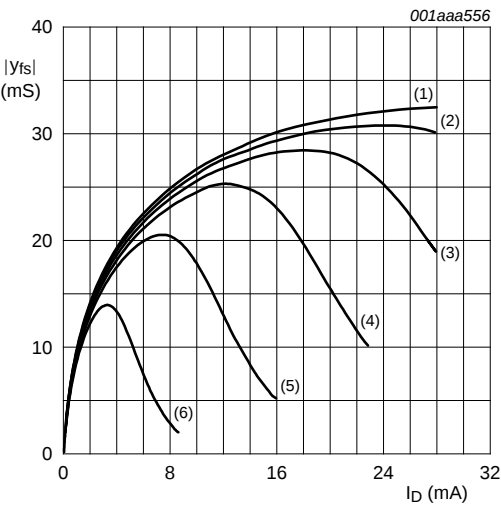
Table 8. Dynamic characteristics for amplifier a[1] ...continued  
Common source;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS} = 5\text{ V}$ ;  $I_D = 19\text{ mA}$ .

| Symbol    | Parameter        | Conditions                                                                               | Min | Typ | Max | Unit       |
|-----------|------------------|------------------------------------------------------------------------------------------|-----|-----|-----|------------|
| $X_{mod}$ | cross-modulation | input level for $k = 1\text{ }%$ ; $f_w = 50\text{ MHz}$ ; $f_{unw} = 60\text{ MHz}$ [2] |     |     |     |            |
|           |                  | at 0 dB AGC                                                                              | 90  | -   | -   | dB $\mu$ V |
|           |                  | at 10 dB AGC                                                                             | -   | 90  | -   | dB $\mu$ V |
|           |                  | at 20 dB AGC                                                                             | -   | 99  | -   | dB $\mu$ V |
|           |                  | at 40 dB AGC                                                                             | 100 | 105 | -   | dB $\mu$ V |

- [1] For the MOS-FET not in use:  $V_{G1-S(b)} = 0\text{ V}$ ;  $V_{DS(b)} = 0\text{ V}$ .  
[2] Measured in Figure 33 test circuit.

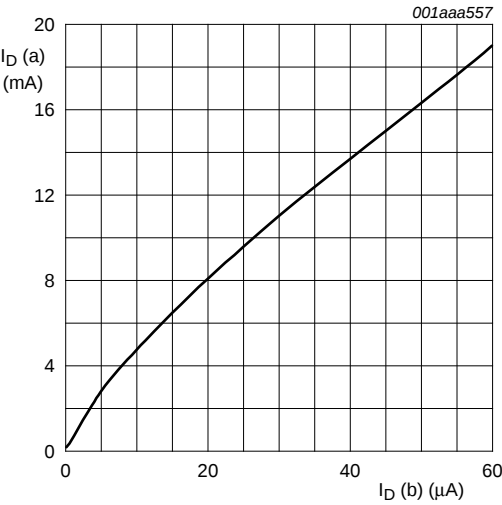
8.1.1 Graphs for amplifier a





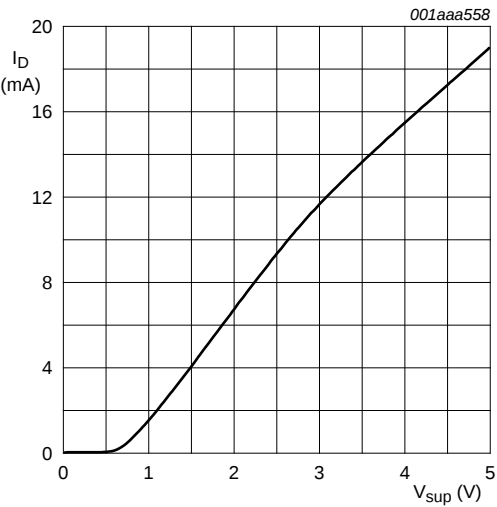
(1)  $V_{G2-S} = 4\text{ V}$ .  
(2)  $V_{G2-S} = 3.5\text{ V}$ .  
(3)  $V_{G2-S} = 3\text{ V}$ .  
(4)  $V_{G2-S} = 2.5\text{ V}$ .  
(5)  $V_{G2-S} = 2\text{ V}$ .  
(6)  $V_{G2-S} = 1.5\text{ V}$ .  
 $V_{DS(a)} = 5\text{ V}$ ;  $V_{G1-S(b)} = V_{DS(b)} = 0\text{ V}$ ;  $T_j = 25\text{ }^{\circ}\text{C}$ .

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



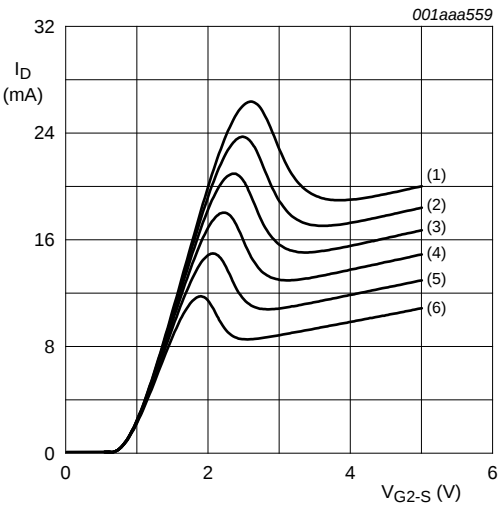
$V_{DS(a)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(b)} = 5\text{ V}$ ;  $V_{G1-S(b)} = 0\text{ V}$ ;  
 $T_j = 25\text{ }^{\circ}\text{C}$ .

**Fig 7. Drain current as a function of internal G1 current (current in pin drain (b) if MOS-FET (b) is switched off); typical values.**



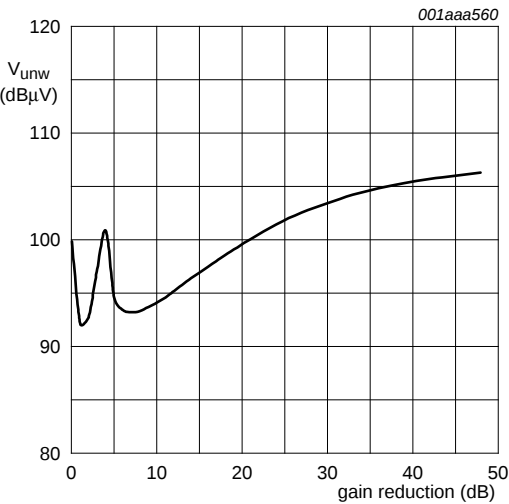
$V_{DS(a)} = V_{DS(b)} = V_{supply}$ ,  $V_{G2-S} = 4\text{ V}$ ,  $T_j = 25\text{ }^{\circ}\text{C}$ ,  
 $R_{G1(b)} = 150\text{ k}\Omega$  (connected to ground); see [Figure 3](#).

Fig 8. Drain current of amplifier a as a function of supply voltage of a and b amplifier; typical values.



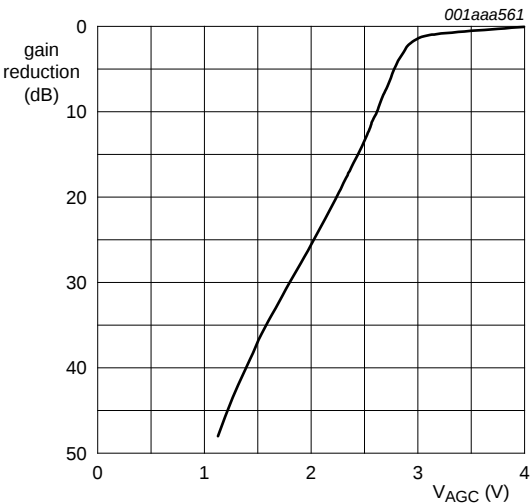
- (1)  $V_{DS(b)} = 5\text{ V}$ .
  - (2)  $V_{DS(b)} = 4.5\text{ V}$ .
  - (3)  $V_{DS(b)} = 4\text{ V}$ .
  - (4)  $V_{DS(b)} = 3.5\text{ V}$ .
  - (5)  $V_{DS(b)} = 3\text{ V}$ .
  - (6)  $V_{DS(b)} = 2.5\text{ V}$ .
- $V_{DS(a)} = 5\text{ V}$ ;  $V_{G1-S(b)} = 0\text{ V}$ ; gate 1 (a) = open;  
 $T_j = 25\text{ }^{\circ}\text{C}$ .

Fig 9. Drain current as a function of gate 2 and drain supply voltage; typical values.



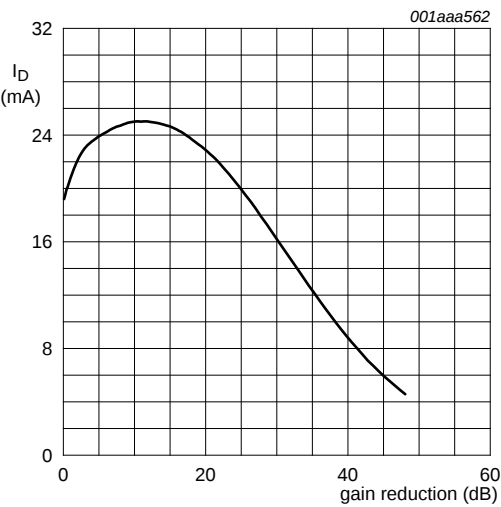
$V_{DS(a)} = V_{DS(b)} = 5\text{ V}$ ;  $V_{G1-S(b)} = 0\text{ V}$ ;  $f_w = 50\text{ MHz}$ ;  
 $f_{unw} = 60\text{ MHz}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ; see [Figure 33](#).

Fig 10. Unwanted voltage for 1 % cross-modulation as a function of gain reduction; typical values.



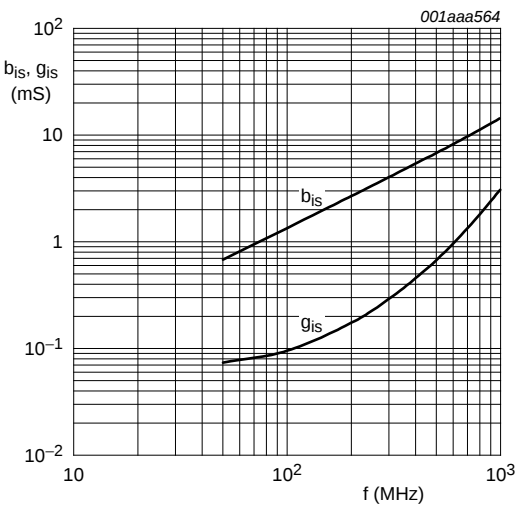
$V_{DS(a)} = V_{DS(b)} = 5\text{ V}$ ;  $V_{G1-S(b)} = 0\text{ V}$ ;  $f = 50\text{ MHz}$ ; see [Figure 33](#).

Fig 11. Gain reduction as a function of AGC voltage; typical values.



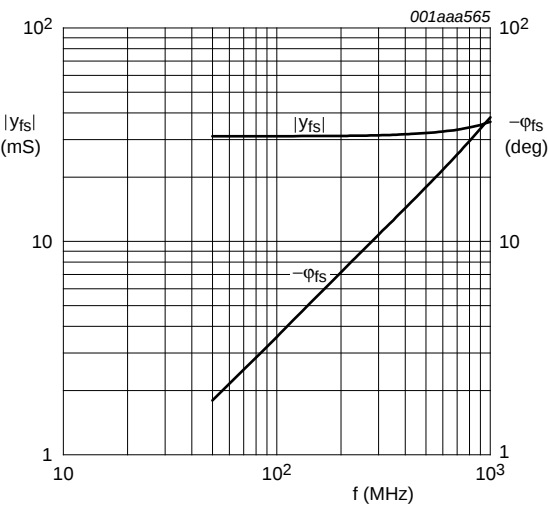
$V_{DS(a)} = V_{DS(b)} = 5\text{ V}$ ;  $V_{G1-S(b)} = 0\text{ V}$ ;  $f = 50\text{ MHz}$ ;  
 $T_{amb} = 25\text{ }^{\circ}\text{C}$ ; see [Figure 33](#).

Fig 12. Drain current as a function of gain reduction; typical values.



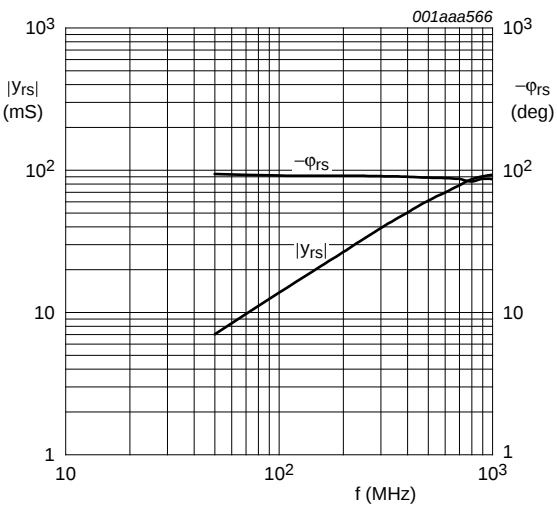
$V_{DS(a)} = 5\text{ V}$ ;  $V_{G2-S(a)} = 4\text{ V}$ ;  $V_{DS(b)} = V_{G1-S(b)} = 0\text{ V}$ ;  
 $I_{D(a)} = 19\text{ mA}$ .

Fig 13. Input admittance as a function of frequency; typical values.



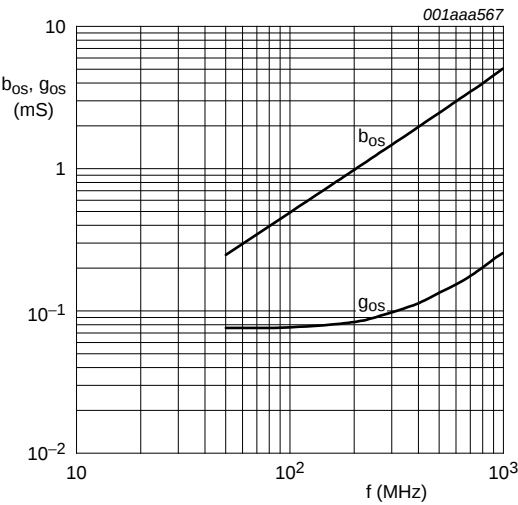
$V_{DS(a)} = 5\text{ V}$ ;  $V_{G2-S(a)} = 4\text{ V}$ ;  $V_{DS(b)} = V_{G1-S(b)} = 0\text{ V}$ ;  
 $I_{D(a)} = 19\text{ mA}$ .

Fig 14. Forward transfer admittance and phase as a function of frequency; typical values.



$V_{DS(a)} = 5\text{ V}$ ;  $V_{G2-S(a)} = 4\text{ V}$ ;  $V_{DS(b)} = V_{G1-S(b)} = 0\text{ V}$ ;  
 $I_{D(a)} = 19\text{ mA}$ .

Fig 15. Reverse transfer admittance and phase as a function of frequency; typical values.



$V_{DS(a)} = 5\text{ V}$ ;  $V_{G2-S(a)} = 4\text{ V}$ ;  $V_{DS(b)} = V_{G1-S(b)} = 0\text{ V}$ ;  $I_{D(a)} = 19\text{ mA}$ .

Fig 16. Output admittance as a function of frequency; typical values.

8.1.2 Scattering parameters for amplifier a

Table 9. Scattering parameters for amplifier a

$V_{DS(a)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_{D(a)} = 19\text{ mA}$ ;  $V_{DS(b)} = 0\text{ V}$ ;  $V_{G-1S(b)} = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

| f<br>(MHz) | S <sub>11</sub>    |                | S <sub>21</sub>    |                | S <sub>12</sub>    |                | S <sub>22</sub>    |                |
|------------|--------------------|----------------|--------------------|----------------|--------------------|----------------|--------------------|----------------|
|            | Magnitude<br>ratio | Angle<br>(deg) | Magnitude<br>ratio | Angle<br>(deg) | Magnitude<br>ratio | Angle<br>(deg) | Magnitude<br>ratio | Angle<br>(deg) |
| 50         | 0.992              | -3.91          | 3.07               | 175.56         | 0.0007             | 83.61          | 0.992              | -1.47          |
| 100        | 0.990              | -7.76          | 3.06               | 171.18         | 0.0017             | 83.19          | 0.992              | -2.93          |
| 200        | 0.982              | -15.42         | 3.04               | 162.42         | 0.0026             | 78.19          | 0.990              | -5.84          |
| 300        | 0.971              | -22.99         | 3.01               | 153.79         | 0.0037             | 73.75          | 0.988              | -8.71          |
| 400        | 0.956              | -30.52         | 2.96               | 145.22         | 0.0047             | 69.82          | 0.985              | -11.59         |
| 500        | 0.938              | -37.83         | 2.90               | 136.78         | 0.0055             | 66.12          | 0.982              | -14.48         |
| 600        | 0.917              | -45.14         | 2.83               | 128.46         | 0.0061             | 62.11          | 0.979              | -17.31         |
| 700        | 0.893              | -52.31         | 2.76               | 120.20         | 0.0065             | 58.86          | 0.975              | -20.14         |
| 800        | 0.867              | -59.47         | 2.69               | 111.98         | 0.0068             | 58.28          | 0.972              | -22.98         |
| 900        | 0.838              | -66.23         | 2.60               | 103.90         | 0.0067             | 50.64          | 0.968              | -25.85         |
| 1000       | 0.807              | -73.10         | 2.52               | 95.875         | 0.0065             | 47.28          | 0.966              | -28.74         |

8.1.3 Noise data for amplifier a

Table 10. Noise data for amplifier a

$V_{DS(a)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_{D(a)} = 19\text{ mA}$ ;  $V_{DS(b)} = 0\text{ V}$ ;  $V_{G-1S(b)} = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

| f<br>(MHz) | F <sub>min</sub><br>(dB) | Γ <sub>opt</sub> |       | r <sub>n</sub><br>(Ω) |
|------------|--------------------------|------------------|-------|-----------------------|
|            |                          | ratio            | (deg) |                       |
| 400        | 1.3                      | 0.718            | 16.06 | 0.683                 |
| 800        | 1.4                      | 0.677            | 37.59 | 0.681                 |

## 8.2 Dynamic characteristics for amplifier b

**Table 11. Dynamic characteristics for amplifier b**

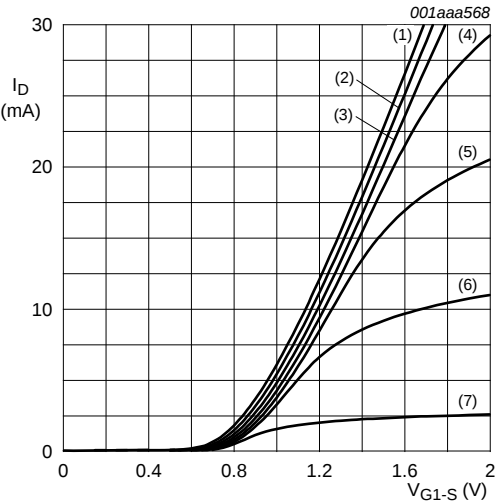
Common source;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS} = 5\text{ V}$ ;  $I_D = 13\text{ mA}$ .

| Symbol       | Parameter                    | Conditions                                                                    | Min                 | Typ  | Max | Unit       |
|--------------|------------------------------|-------------------------------------------------------------------------------|---------------------|------|-----|------------|
| $ y_{fs} $   | forward transfer admittance  | $T_j = 25\text{ }^{\circ}\text{C}$                                            | 28                  | 33   | 43  | mS         |
| $C_{ig1-ss}$ | input capacitance at gate 1  | $f = 1\text{ MHz}$                                                            | -                   | 2.0  | 2.5 | pF         |
| $C_{ig2-ss}$ | input capacitance at gate 2  | $f = 1\text{ MHz}$                                                            | -                   | 3.4  | -   | pF         |
| $C_{oss}$    | output capacitance           | $f = 1\text{ MHz}$                                                            | -                   | 0.85 | -   | pF         |
| $C_{rss}$    | reverse transfer capacitance | $f = 1\text{ MHz}$                                                            | -                   | 20   | -   | fF         |
| $G_{tr}$     | power gain                   | $B_S = B_{S(opt)}$ ; $B_L = B_{L(opt)}$                                       | <a href="#">[1]</a> |      |     |            |
|              |                              | $f = 200\text{ MHz}$ ; $G_S = 2\text{ mS}$ ; $G_L = 0.5\text{ mS}$            | 31                  | 35   | 39  | dB         |
|              |                              | $f = 400\text{ MHz}$ ; $G_S = 2\text{ mS}$ ; $G_L = 1\text{ mS}$              | 28                  | 32   | 36  | dB         |
|              |                              | $f = 800\text{ MHz}$ ; $G_S = 3.3\text{ mS}$ ; $G_L = 1\text{ mS}$            | 24                  | 28   | 32  | dB         |
| NF           | noise figure                 | $f = 11\text{ MHz}$ ; $G_S = 20\text{ mS}$ ; $B_S = 0\text{ S}$               | -                   | 5    | -   | dB         |
|              |                              | $f = 400\text{ MHz}$ ; $Y_S = Y_{S(opt)}$                                     | -                   | 1.3  | 1.9 | dB         |
|              |                              | $f = 800\text{ MHz}$ ; $Y_S = Y_{S(opt)}$                                     | -                   | 1.4  | 2.1 | dB         |
| $X_{mod}$    | cross-modulation             | input level for $k = 1\%$ ; $f_w = 50\text{ MHz}$ ; $f_{unw} = 60\text{ MHz}$ | <a href="#">[2]</a> |      |     |            |
|              |                              | at 0 dB AGC                                                                   | 90                  | -    | -   | dB $\mu$ V |
|              |                              | at 10 dB AGC                                                                  | -                   | 88   | -   | dB $\mu$ V |
|              |                              | at 20 dB AGC                                                                  | -                   | 94   | -   | dB $\mu$ V |
|              |                              | at 40 dB AGC                                                                  | 100                 | 103  | -   | dB $\mu$ V |

[1] For the MOS-FET not in use:  $V_{G1-S(a)} = 0\text{ V}$ ;  $V_{DS(a)} = 0\text{ V}$ .

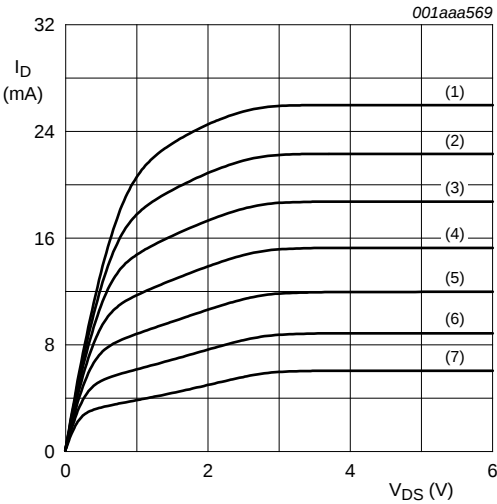
[2] Measured in [Figure 34](#) test circuit.

8.2.1 Graphs for amplifier b



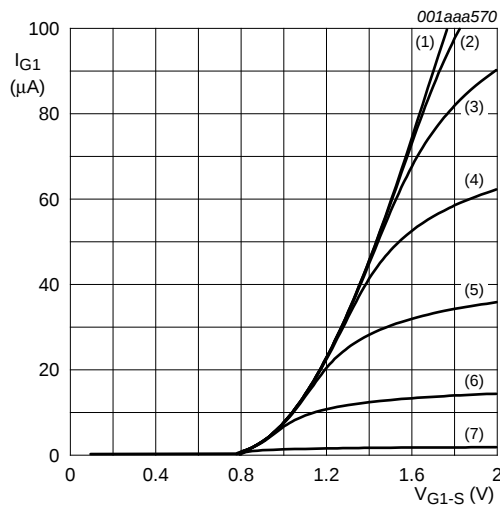
- (1)  $V_{G2-S} = 4 \text{ V}$ .
  - (2)  $V_{G2-S} = 3.5 \text{ V}$ .
  - (3)  $V_{G2-S} = 3 \text{ V}$ .
  - (4)  $V_{G2-S} = 2.5 \text{ V}$ .
  - (5)  $V_{G2-S} = 2 \text{ V}$ .
  - (6)  $V_{G2-S} = 1.5 \text{ V}$ .
  - (7)  $V_{G2-S} = 1 \text{ V}$ .
- $V_{DS(b)} = 5 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  $T_j = 25 \text{ }^\circ\text{C}$ .

Fig 17. Transfer characteristics; typical values.



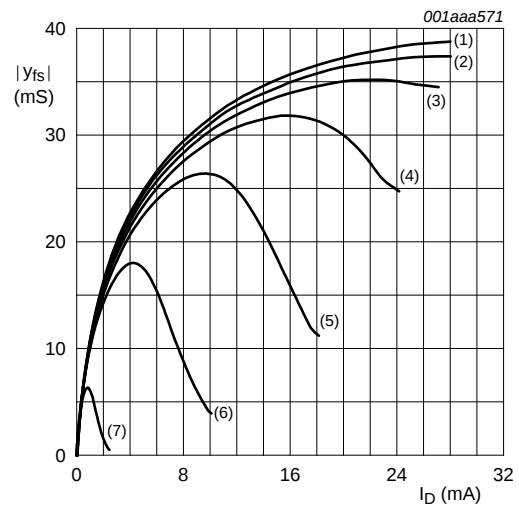
- (1)  $V_{G1-S(b)} = 1.6 \text{ V}$ .
  - (2)  $V_{G1-S(b)} = 1.5 \text{ V}$ .
  - (3)  $V_{G1-S(b)} = 1.4 \text{ V}$ .
  - (4)  $V_{G1-S(b)} = 1.3 \text{ V}$ .
  - (5)  $V_{G1-S(b)} = 1.2 \text{ V}$ .
  - (6)  $V_{G1-S(b)} = 1.1 \text{ V}$ .
  - (7)  $V_{G1-S(b)} = 1 \text{ V}$ .
- $V_{G2-S} = 4 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  $T_j = 25 \text{ }^\circ\text{C}$ .

Fig 18. Output characteristics; typical values.



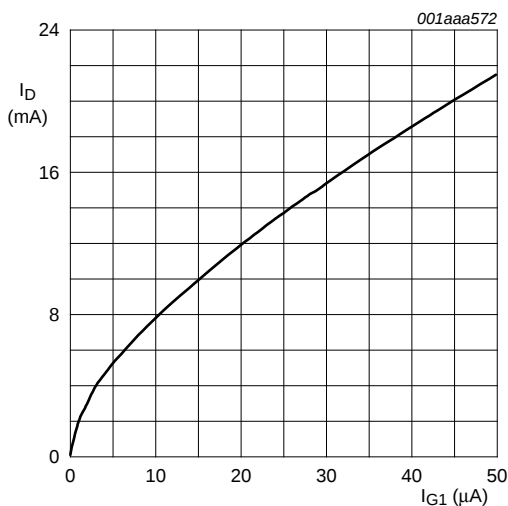
- (1)  $V_{G2-S} = 4 \text{ V}$ .
  - (2)  $V_{G2-S} = 3.5 \text{ V}$ .
  - (3)  $V_{G2-S} = 3 \text{ V}$ .
  - (4)  $V_{G2-S} = 2.5 \text{ V}$ .
  - (5)  $V_{G2-S} = 2 \text{ V}$ .
  - (6)  $V_{G2-S} = 1.5 \text{ V}$ .
  - (7)  $V_{G2-S} = 1 \text{ V}$ .
- $V_{DS(b)} = 5 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  $T_j = 25 \text{ }^{\circ}\text{C}$ .

**Fig 19. Gate 1 current as a function of gate 1 voltage; typical values.**



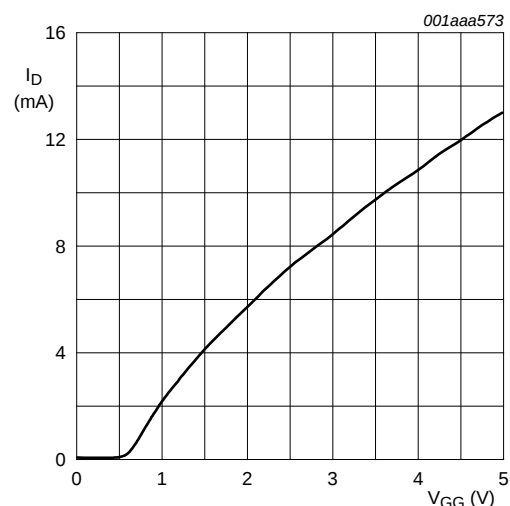
- (1)  $V_{G2-S} = 4 \text{ V}$ .
  - (2)  $V_{G2-S} = 3.5 \text{ V}$ .
  - (3)  $V_{G2-S} = 3 \text{ V}$ .
  - (4)  $V_{G2-S} = 2.5 \text{ V}$ .
  - (5)  $V_{G2-S} = 2 \text{ V}$ .
  - (6)  $V_{G2-S} = 1.5 \text{ V}$ .
  - (7)  $V_{G2-S} = 1 \text{ V}$ .
- $V_{DS(b)} = 5 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  $T_j = 25 \text{ }^{\circ}\text{C}$ .

**Fig 20. Forward transfer admittance as a function of drain current; typical values.**



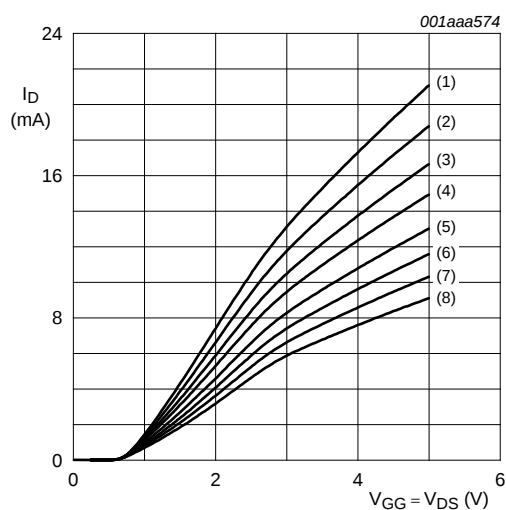
$V_{DS(b)} = 5 \text{ V}$ ;  $V_{G2-S} = 4 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  
 $T_j = 25 \text{ }^{\circ}\text{C}$ .

**Fig 21. Drain current as a function of gate 1 current; typical values.**



$V_{DS(b)} = 5 \text{ V}$ ;  $V_{G2-S} = 4 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  
 $T_j = 25 \text{ }^{\circ}\text{C}$ ;  $R_{G1(b)} = 150 \text{ k}\Omega$  (connected to  $V_{GG}$ ); see [Figure 3](#).

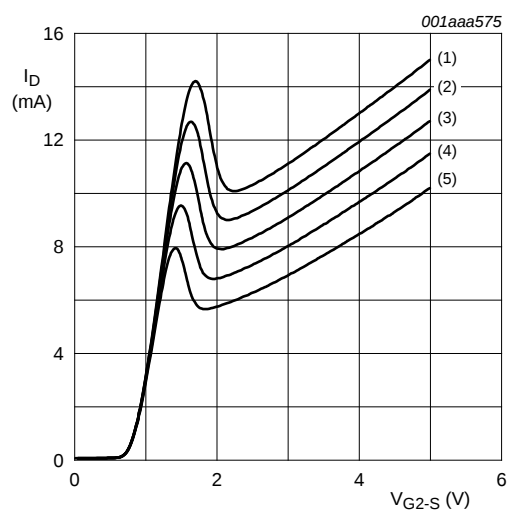
**Fig 22. Drain current as a function of gate 1 supply voltage ( $V_{GG}$ ); typical values.**



- (1)  $R_{G1(b)} = 68 \text{ k}\Omega$ .
- (2)  $R_{G1(b)} = 82 \text{ k}\Omega$ .
- (3)  $R_{G1(b)} = 100 \text{ k}\Omega$ .
- (4)  $R_{G1(b)} = 120 \text{ k}\Omega$ .
- (5)  $R_{G1(b)} = 150 \text{ k}\Omega$ .
- (6)  $R_{G1(b)} = 180 \text{ k}\Omega$ .
- (7)  $R_{G1(b)} = 220 \text{ k}\Omega$ .
- (8)  $R_{G1(b)} = 270 \text{ k}\Omega$ .

$V_{G2-S} = 4 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  $T_j = 25 \text{ }^\circ\text{C}$ ;  $R_{G1(b)}$  is connected to  $V_{GG}$ ; see [Figure 3](#).

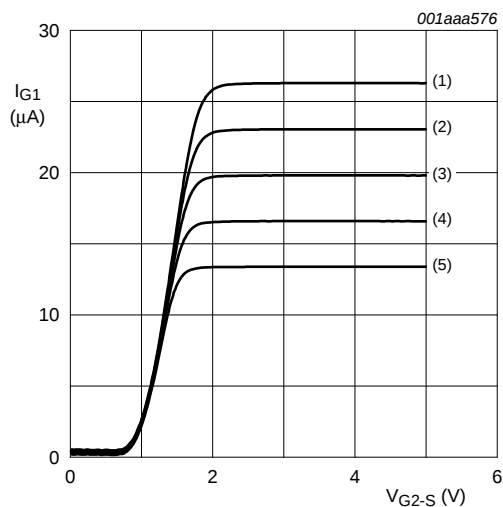
**Fig 23. Drain current as a function of gate 1 ( $V_{GG}$ ), drain supply voltage and value of  $R_{G1}$ ; typical values.**



- (1)  $V_{GG} = 5.0 \text{ V}$ .
- (2)  $V_{GG} = 4.5 \text{ V}$ .
- (3)  $V_{GG} = 4.0 \text{ V}$ .
- (4)  $V_{GG} = 3.5 \text{ V}$ .
- (5)  $V_{GG} = 3.0 \text{ V}$ .

$V_{DS(b)} = 5 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  $T_j = 25 \text{ }^\circ\text{C}$ ;  
 $R_{G1(b)} = 150 \text{ k}\Omega$  (connected to  $V_{GG}$ ); see [Figure 3](#).

**Fig 24. Drain current as a function of gate 2 voltage; typical values.**



(1)  $V_{GG} = 5.0 \text{ V}$ .

(2)  $V_{GG} = 4.5 \text{ V}$ .

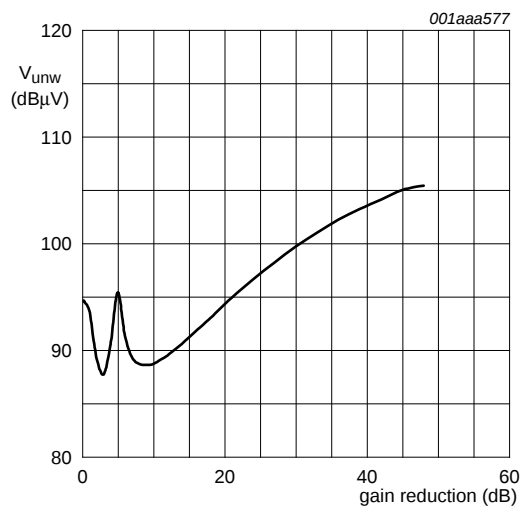
(3)  $V_{GG} = 4.0 \text{ V}$ .

(4)  $V_{GG} = 3.5 \text{ V}$ .

(5)  $V_{GG} = 3.0 \text{ V}$ .

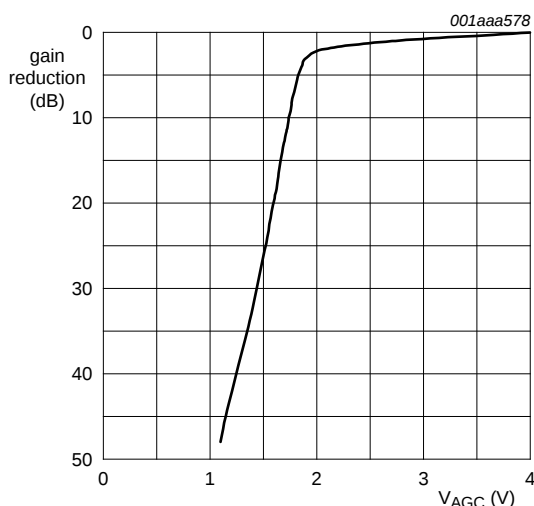
$V_{DS(b)} = 5 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  $T_J = 25^\circ\text{C}$ ;  
 $R_{G1(b)} = 150 \text{ k}\Omega$  (connected to  $V_{GG}$ ); see [Figure 3](#).

**Fig 25. Gate 1 current as a function of gate 2 voltage; typical values.**



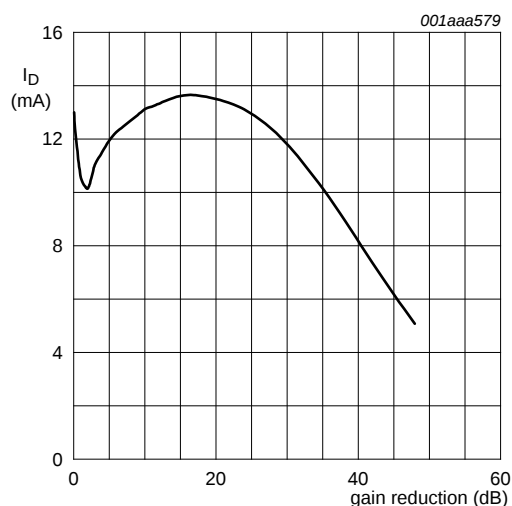
$V_{DS(b)} = 5 \text{ V}$ ;  $V_{GG} = 5 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  
 $R_{G1(b)} = 150 \text{ k}\Omega$  (connected to  $V_{GG}$ );  $f_w = 50 \text{ MHz}$ ;  
 $f_{unw} = 60 \text{ MHz}$ ;  $T_{amb} = 25^\circ\text{C}$ ; see [Figure 34](#).

**Fig 26. Unwanted voltage for 1 % cross-modulation as a function of gain reduction; typical values.**



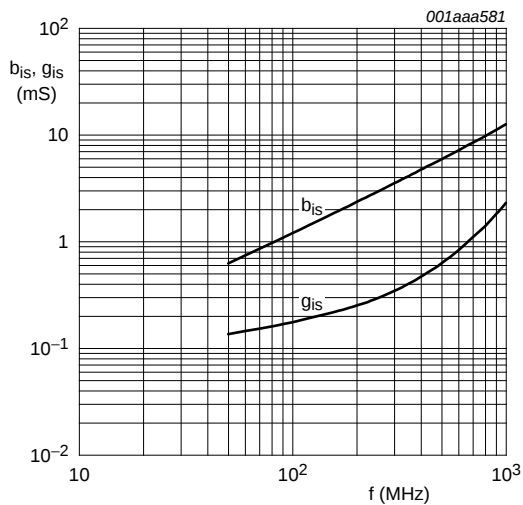
$V_{DS(b)} = 5 \text{ V}$ ;  $V_{GG} = 5 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  
 $R_{G1(b)} = 150 \text{ k}\Omega$  (connected to  $V_{GG}$ );  $f = 50 \text{ MHz}$ ;  
 $T_{amb} = 25^\circ\text{C}$ ; see [Figure 34](#).

**Fig 27. Typical gain reduction as a function of AGC voltage.**



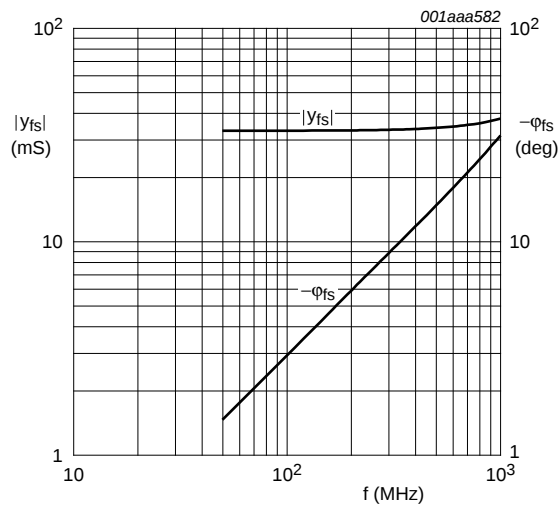
$V_{DS(b)} = 5 \text{ V}$ ;  $V_{GG} = 5 \text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0 \text{ V}$ ;  
 $R_{G1(b)} = 150 \text{ k}\Omega$  (connected to  $V_{GG}$ );  $f = 50 \text{ MHz}$ ;  
 $T_{amb} = 25^\circ\text{C}$ ; see [Figure 34](#).

**Fig 28. Drain current as a function of gain reduction; typical values.**



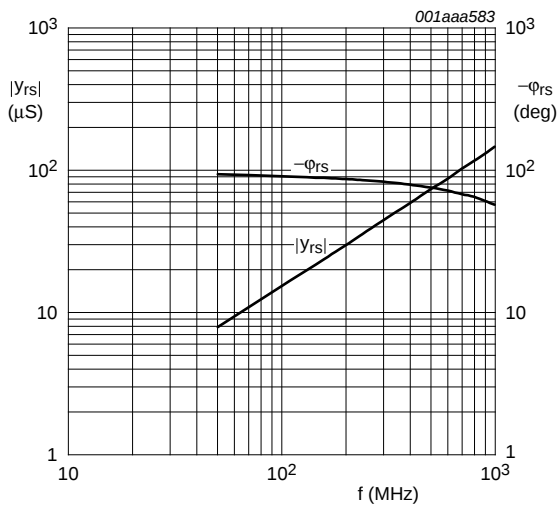
$V_{DS(b)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0\text{ V}$ ;  $I_{D(b)} = 13\text{ mA}$ .

Fig 29. Input admittance as a function of frequency; typical values.



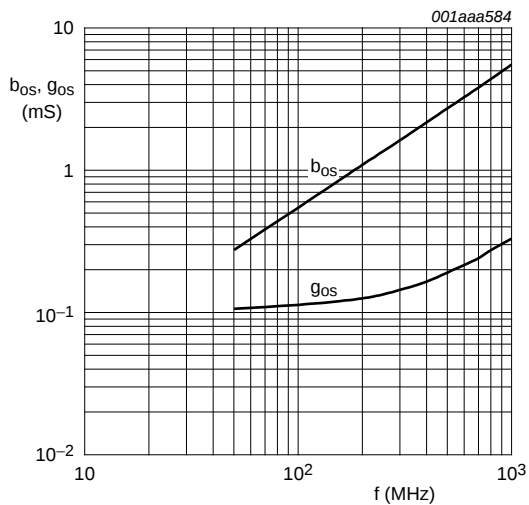
$V_{DS(b)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0\text{ V}$ ;  $I_{D(b)} = 13\text{ mA}$ .

Fig 30. Forward transfer admittance and phase as a function of frequency; typical values.



$V_{DS(b)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0\text{ V}$ ;  $I_{D(b)} = 13\text{ mA}$ .

Fig 31. Reverse transfer admittance and phase as a function of frequency; typical values.



$V_{DS(b)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(a)} = V_{G1-S(a)} = 0\text{ V}$ ;  $I_{D(b)} = 13\text{ mA}$ .

Fig 32. Output admittance as a function of frequency; typical values.

## 8.2.2 Scattering parameters for amplifier b

**Table 12. Scattering parameters for amplifier b**

$V_{DS(b)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_{D(b)} = 13\text{ mA}$ ;  $V_{DS(a)} = 0\text{ V}$ ;  $V_{G1-S(a)} = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

| f<br>(MHz) | S <sub>11</sub>    |                | S <sub>21</sub>    |                | S <sub>12</sub>    |                | S <sub>22</sub>    |                |
|------------|--------------------|----------------|--------------------|----------------|--------------------|----------------|--------------------|----------------|
|            | Magnitude<br>ratio | Angle<br>(deg) | Magnitude<br>ratio | Angle<br>(deg) | Magnitude<br>ratio | Angle<br>(deg) | Magnitude<br>ratio | Angle<br>(deg) |
| 50         | 0.986              | -3.66          | 3.26               | 175.93         | 0.0008             | 84.23          | 0.988              | -1.65          |
| 100        | 0.982              | -7.01          | 3.24               | 172.04         | 0.0015             | 84.91          | 0.988              | -3.27          |
| 200        | 0.975              | -13.71         | 3.22               | 164.24         | 0.0029             | 83.96          | 0.986              | -6.50          |
| 300        | 0.966              | -20.36         | 3.19               | 156.53         | 0.0042             | 82.86          | 0.984              | -9.69          |
| 400        | 0.955              | -27.04         | 3.15               | 148.86         | 0.0055             | 81.88          | 0.982              | -12.88         |
| 500        | 0.943              | -33.62         | 3.10               | 141.24         | 0.0066             | 80.92          | 0.978              | -16.07         |
| 600        | 0.927              | -40.16         | 3.05               | 133.70         | 0.0076             | 80.15          | 0.975              | -19.21         |
| 700        | 0.909              | -46.70         | 2.99               | 126.13         | 0.0086             | 79.68          | 0.972              | -22.35         |
| 800        | 0.891              | -52.07         | 2.92               | 118.64         | 0.0094             | 78.28          | 0.968              | -25.52         |
| 900        | 0.868              | -59.48         | 2.84               | 111.09         | 0.0100             | 78.28          | 0.965              | -28.65         |
| 1000       | 0.846              | -65.86         | 2.77               | 103.58         | 0.0107             | 78.15          | 0.961              | -31.85         |

## 8.2.3 Noise data for amplifier b

**Table 13. Noise data for amplifier b**

$V_{DS(b)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_{D(b)} = 13\text{ mA}$ ;  $V_{DS(a)} = 0\text{ V}$ ;  $V_{G1-S(a)} = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

| f<br>(MHz) | F <sub>min</sub><br>(dB) | Γ <sub>opt</sub> |       | r <sub>n</sub><br>(Ω) |
|------------|--------------------------|------------------|-------|-----------------------|
|            |                          | ratio            | (deg) |                       |
| 400        | 1.3                      | 0.695            | 13.11 | 0.694                 |
| 800        | 1.4                      | 0.674            | 32.77 | 0.674                 |

9. Test information

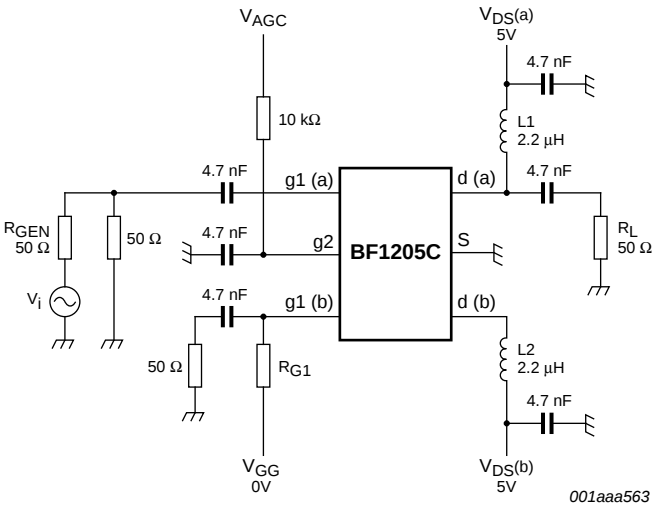


Fig 33. Cross-modulation test set-up for amplifier a.

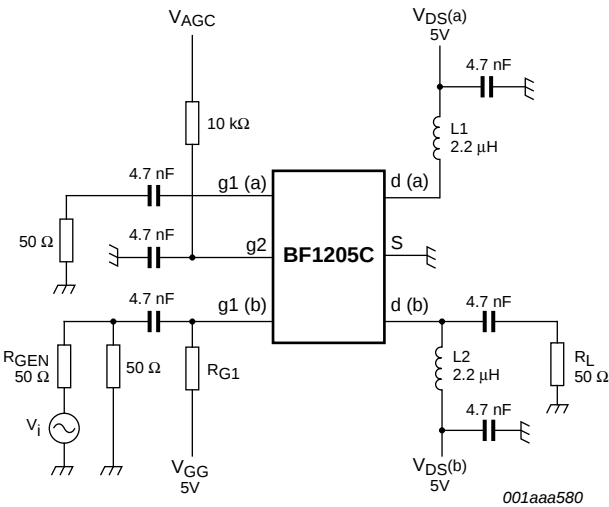


Fig 34. Cross-modulation test set-up for amplifier b.

10. Package outline

Plastic surface-mounted package; 6 leadsSOT363

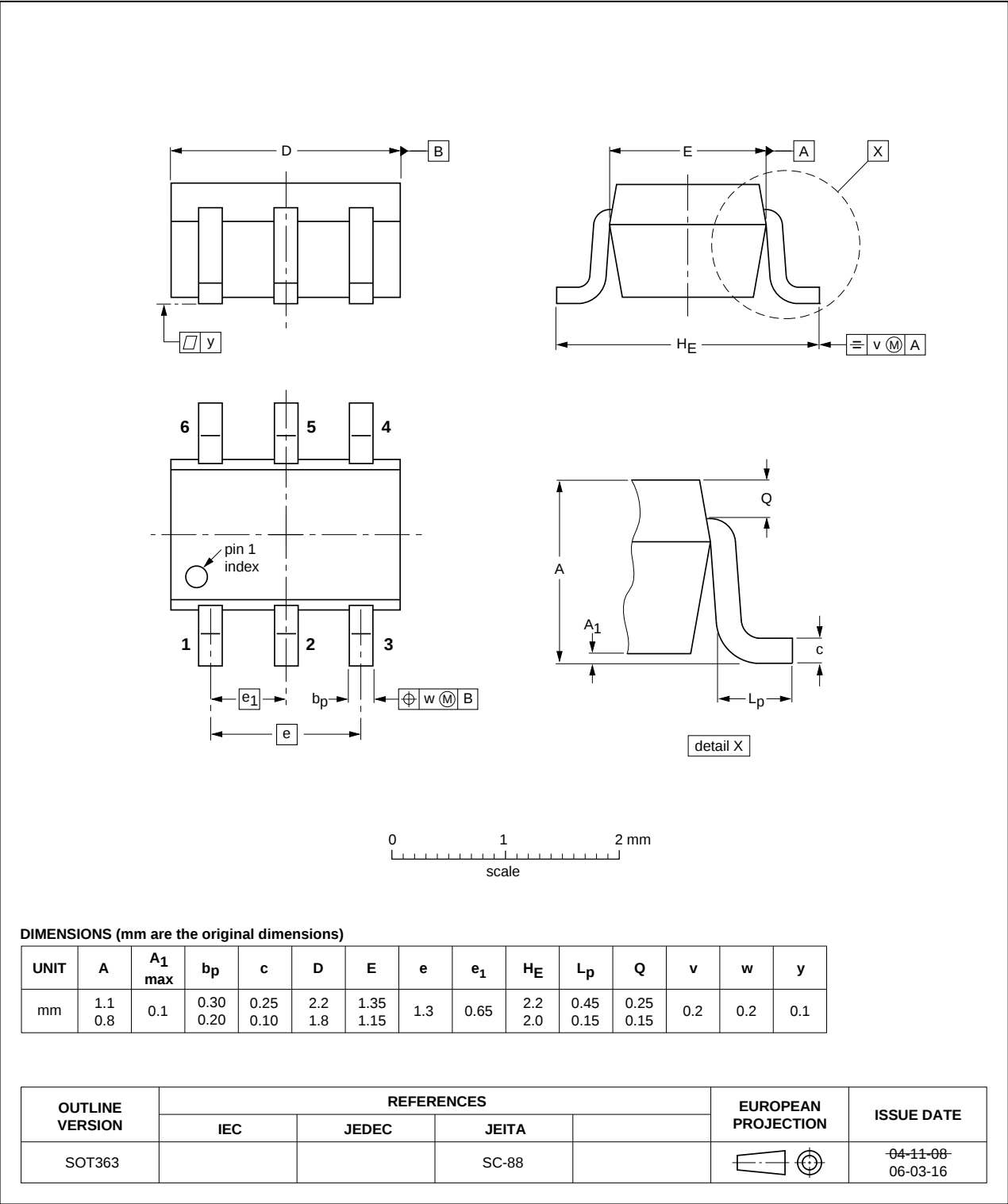


Fig 35. Package outline.

## 11. Revision history

Table 14. Revision history

| Document ID                     | Release date                                                                                                                                                                                                                                         | Data sheet status  | Change notice | Supersedes  |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|-------------|
| BF1205C v.3                     | 20110907                                                                                                                                                                                                                                             | Product data sheet | -             | BF1205C v.2 |
| Modifications:                  | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>Legal texts have been adapted to the new company name where appropriate.</li></ul> |                    |               |             |
| BF1205C v.2                     | 20060815                                                                                                                                                                                                                                             | Product data sheet | -             | BF1205C v.1 |
| BF1205C v.1<br>(9397 750 13005) | 20040518                                                                                                                                                                                                                                             | Product data sheet | -             | -           |

## 12. Legal information

### 12.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

[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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