

# BF1215

## Dual N-channel dual gate MOSFET

Rev. 01 — 6 May 2010

Product data sheet

## 1. Product profile

### 1.1 General description

The BF1215 is a combination of two dual gate MOSFET amplifiers with shared source lead, shared gate2 lead and an integrated switch.

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 available as 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 full internal bias and one with partial internal bias
- Superior cross modulation performance during AGC
- High forward transfer admittance to input capacitance ratio
- Suitable for VHF and UHF applications: both amplifiers are optimized for VHF applications.
- Internal switch reduces external components

### 1.3 Applications

- Gain controlled low noise amplifiers for VHF and UHF applications with a 5 V supply
  - ◆ Digital and analog television tuners
  - ◆ Professional communication equipment



## 1.4 Quick reference data

**Table 1. Quick reference data for amplifier A and B**

| Symbol        | Parameter                    | Conditions  | Min | Typ | Max | Unit             |            |
|---------------|------------------------------|---|-----|-----|-----|------------------|------------|
| $V_{DS}$      | drain-source voltage         | DC  | -   | -   | 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  | $f = 100\text{ MHz}$ ; $T_j = 25\text{ }^\circ\text{C}$ ;<br>$I_D = 19\text{ mA}$               | 23  | 27  | 38  | mS               |            |
| $C_{iss(G1)}$ | input capacitance at gate1   | $f = 100\text{ MHz}$  | [2] | -   | 2.5 | pF               |            |
| $C_{rss}$     | reverse transfer capacitance | $f = 100\text{ MHz}$  | [2] | -   | 27  | fF               |            |
| NF            | noise figure                 | $f = 400\text{ MHz}$ ; $Y_S = Y_{S(opt)}$   | -   | 1.5 | -   | dB               |            |
|               |                              | $f = 800\text{ MHz}$ ; $Y_S = Y_{S(opt)}$   | -   | 1.9 | -   | dB               |            |
| Xmod          | cross modulation             | input level for $k = 1\%$ at<br>40 dB AGC; $f_w = 50\text{ MHz}$ ;<br>$f_{unw} = 60\text{ MHz}$ | [3] | 105 | 107 | -                | dB $\mu$ V |
| $T_j$         | junction temperature         |   | -   | -   | 150 | $^\circ\text{C}$ |            |

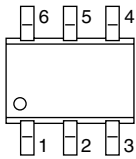
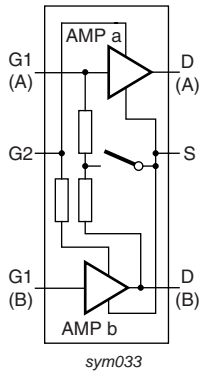
[1]  $T_{sp}$  is the temperature at the soldering point of the source lead.

[2] Calculated from S-parameters.

[3] Measured in [Figure 32](#) and [Figure 33](#) test circuits.

## 2. Pinning information

**Table 2. Discrete pinning**

| Pin | Description         | Simplified outline  | Graphic symbol  |
|-----|---------------------|---|---|
| 1   | gate1 (amplifier A) |  |  |
| 2   | gate2               |   |   |
| 3   | gate1 (amplifier B) |   |   |
| 4   | drain (amplifier B) |   |   |
| 5   | source              |   |   |
| 6   | drain (amplifier A) |   |   |

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package |  | Version |
|-------------|---------|--|---------|
|             | Name    | Description                              |         |
| BF1215      | -       | plastic surface-mounted package; 6 leads | SOT363  |

## 4. Marking

Table 4. Marking

| Type number | Marking | Description       |
|-------------|---------|-------------------|
| BF1215      | M4p     | made in Hong Kong |
|             | M4t     | made in Malaysia  |
|             | M4w     | 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 MOSFET</b> |                         |                                 |     |          |      |
| $V_{DS}$          | drain-source voltage    | DC                              | -   | 6        | V    |
| $I_D$             | drain current           | DC                              | -   | 30       | mA   |
| $I_{G1}$          | gate1 current           |                                 | -   | $\pm 10$ | mA   |
| $I_{G2}$          | gate2 current           |                                 | -   | $\pm 10$ | mA   |
| $P_{tot}$         | total power dissipation | $T_{sp} \leq 107\text{ °C}$ [1] | -   | 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.

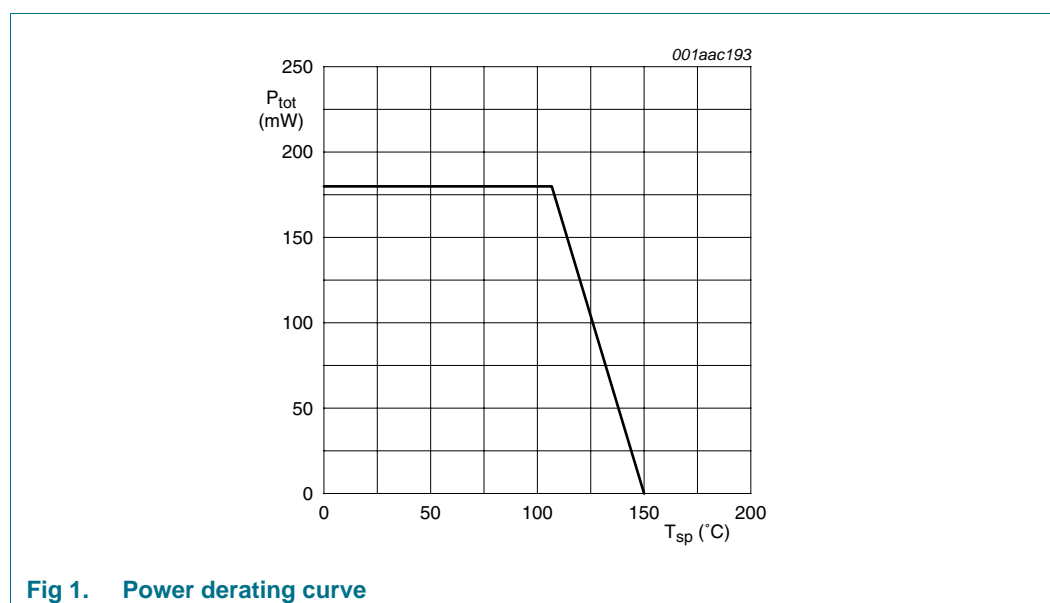


Fig 1. Power derating curve

## 6. Thermal characteristics

Table 6. Thermal characteristics

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

## 7. Static characteristics

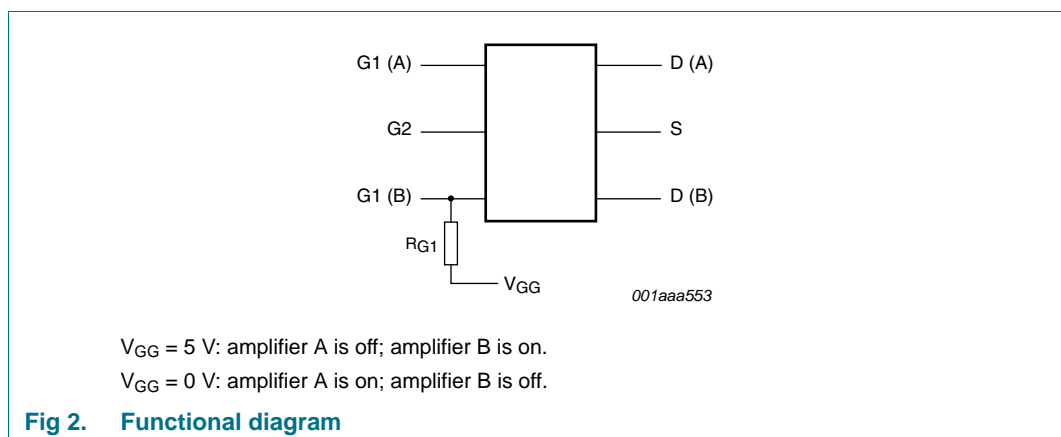
Table 7. Static characteristics

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

| Symbol  | Parameter                      | Conditions   | Min | Typ | Max | Unit |    |
|---|--------------------------------|--|-----|-----|-----|------|----|
| <b>Per MOSFET; 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    |    |
| $V_{(BR)G1-SS}$                               | gate1-source breakdown voltage | $V_{G2-S} = V_{DS} = 0\text{ V}$ ; $I_{G1-S} = 10\text{ mA}$   | 6   | -   | 10  | V    |    |
| $V_{(BR)G2-SS}$                               | gate2-source breakdown voltage | $V_{G1-S} = V_{DS} = 0\text{ V}$ ; $I_{G2-S} = 10\text{ mA}$   | 6   | -   | 10  | V    |    |
| $V_{F(S-G1)}$                                 | forward source-gate1 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-gate2 voltage   | $V_{G1-S} = V_{DS} = 0\text{ V}$ ; $I_{S-G2} = 10\text{ mA}$   | 0.5 | -   | 1.5 | V    |    |
| $V_{G1-S(th)}$                                | gate1-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    |    |
| $V_{G2-S(th)}$                                | gate2-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    |    |
| $I_{DS}$                                      | drain-source current           | $V_{G2-S} = 4\text{ V}$ ; $V_{DS(B)} = 5\text{ V}$ ; $R_{G1} = 39\text{ k}\Omega$                            |     |     |     |      |    |
|   |                                | amplifier A: $V_{DS(A)} = 5\text{ V}$  | [1] | -   | -   | 19.5 | mA |
|   |                                | amplifier B  | [2] | -   | -   | 23   | mA |
| $I_{G1-S}$                                    | gate1 cut-off current          | $V_{G2-S} = 0\text{ V}$ ; $V_{DS(A)} = V_{DS(B)} = 0\text{ V}$   |     |     |     |      |    |
|   |                                | amplifier A: $V_{G1-S(A)} = 5\text{ V}$  | -   | -   | 50  | nA   |    |
|   |                                | amplifier B: $V_{G1-S(B)} = 5\text{ V}$  | -   | -   | 50  | nA   |    |
| $I_{G2-S}$                                    | gate2 cut-off current          | $V_{G2-S} = 4\text{ V}$ ; $V_{DS(A)} = V_{DS(B)} = 0\text{ V}$ ;<br>$V_{G1-S(A)} = V_{G1-S(B)} = 0\text{ V}$ | -   | -   | 20  | nA   |    |

[1]  $R_{G1}$  connects gate1 amplifier B to  $V_{GG} = 0\text{ V}$ , see [Figure 2](#).

[2]  $R_{G1}$  connects gate1 amplifier B to  $V_{GG} = 5\text{ V}$ , see [Figure 2](#).



## 8. Dynamic characteristics

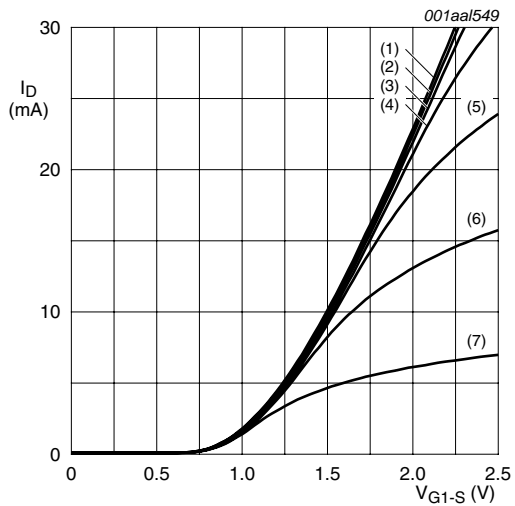
**Table 8. Dynamic characteristics for amplifier A and B**

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

| Symbol        | Parameter                    | Conditions   | Min | Typ | Max | Unit       |
|---------------|------------------------------|--|-----|-----|-----|------------|
| $ y_{fs} $    | forward transfer admittance  | $f = 100\text{ MHz}$ ; $T_j = 25\text{ °C}$                                      | 23  | 27  | 38  | mS         |
| $C_{iss(G1)}$ | input capacitance at gate1   | $f = 100\text{ MHz}$   | [1] | 2.5 | -   | pF         |
| $C_{iss(G2)}$ | input capacitance at gate2   | $f = 100\text{ MHz}$   | [1] | 2.5 | -   | pF         |
| $C_{oss}$     | output capacitance           | $f = 100\text{ MHz}$   | [1] | 0.8 | -   | pF         |
| $C_{rss}$     | reverse transfer capacitance | $f = 100\text{ MHz}$   | [1] | 27  | -   | fF         |
| $G_{tr}$      | transducer power gain        | amplifier A: $B_S = B_{S(opt)}$ ; $B_L = B_{L(opt)}$                             | [1] |     |     |            |
|               |                              | $f = 200\text{ MHz}$ ; $G_S = 2\text{ mS}$ ; $G_L = 0.5\text{ mS}$               | 30  | 34  | 38  | dB         |
|               |                              | $f = 400\text{ MHz}$ ; $G_S = 2\text{ mS}$ ; $G_L = 1\text{ mS}$                 | 26  | 30  | 34  | dB         |
|               |                              | $f = 800\text{ MHz}$ ; $G_S = 3.3\text{ mS}$ ; $G_L = 1\text{ mS}$               | 22  | 26  | 30  | dB         |
|               |                              | amplifier B: $B_S = B_{S(opt)}$ ; $B_L = B_{L(opt)}$                             | [1] |     |     |            |
|               |                              | $f = 200\text{ MHz}$ ; $G_S = 2\text{ mS}$ ; $G_L = 0.5\text{ mS}$               | 30  | 34  | 38  | dB         |
|               |                              | $f = 400\text{ MHz}$ ; $G_S = 2\text{ mS}$ ; $G_L = 1\text{ mS}$                 | 26  | 31  | 34  | dB         |
| NF            | noise figure                 | $f = 11\text{ MHz}$ ; $G_S = 20\text{ mS}$ ; $B_S = 0\text{ S}$                  | -   | -   | 6   | dB         |
|               |                              | $f = 400\text{ MHz}$ ; $Y_S = Y_{S(opt)}$  | -   | 1.5 | -   | dB         |
|               |                              | $f = 800\text{ MHz}$ ; $Y_S = Y_{S(opt)}$  | -   | 1.9 | -   | dB         |
| Xmod          | cross modulation             | input level for $k = 1\%$ ; $f_w = 50\text{ MHz}$ ;<br>$f_{unw} = 60\text{ MHz}$ | [2] |     |     |            |
|               |                              | at 0 dB AGC  | 95  | 104 | -   | dB $\mu$ V |
|               |                              | at 10 dB AGC   | -   | 100 | -   | dB $\mu$ V |
|               |                              | at 20 dB AGC   | -   | 104 | -   | dB $\mu$ V |
|               |                              | at 40 dB AGC   | 105 | 107 | -   | dB $\mu$ V |

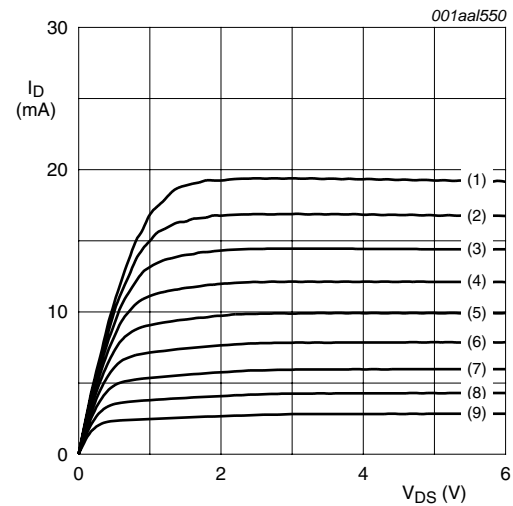
[1] Calculated from S-parameters.

[2] Measured in [Figure 32](#) and [Figure 33](#) test circuits.

**8.1 Graphics for amplifier A**

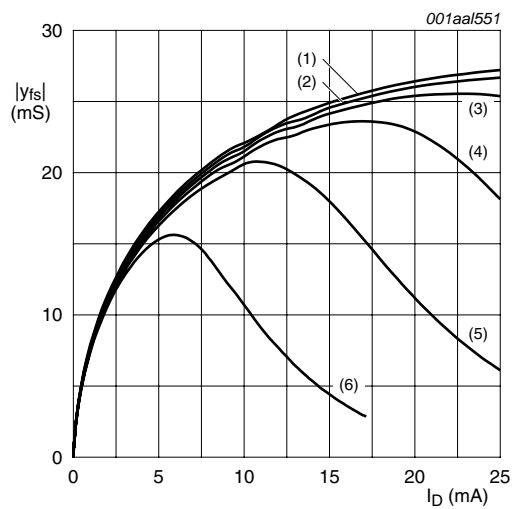
- (1)  $V_{G2-S} = 4 \text{ V}$ .  
 (2)  $V_{G2-S} = 3.5 \text{ V}$ .  
 (3)  $V_{G2-S} = 3 \text{ V}$ .  
 (4)  $V_{G2-S} = 2.5 \text{ V}$ .  
 (5)  $V_{G2-S} = 2 \text{ V}$ .  
 (6)  $V_{G2-S} = 1.5 \text{ V}$ .  
 (7)  $V_{G2-S} = 1 \text{ V}$ .  
 $V_{DS(A)} = 5 \text{ V}$ ;  $V_{G1-S(B)} = V_{DS(B)}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

**Fig 3. Amplifier A transfer characteristics; typical values**



- (1)  $V_{G1-S(A)} = 1.9 \text{ V}$ .  
 (2)  $V_{G1-S(A)} = 1.8 \text{ V}$ .  
 (3)  $V_{G1-S(A)} = 1.7 \text{ V}$ .  
 (4)  $V_{G1-S(A)} = 1.6 \text{ V}$ .  
 (5)  $V_{G1-S(A)} = 1.5 \text{ V}$ .  
 (6)  $V_{G1-S(A)} = 1.4 \text{ V}$ .  
 (7)  $V_{G1-S(A)} = 1.3 \text{ V}$ .  
 (8)  $V_{G1-S(A)} = 1.2 \text{ V}$ .  
 (9)  $V_{G1-S(A)} = 1.1 \text{ V}$ .  
 $V_{G2-S} = 4 \text{ V}$ ;  $V_{G1-S(B)} = V_{DS(B)} = 0 \text{ V}$ ;  $T_j = 25 \text{ }^\circ\text{C}$ .

**Fig 4. Amplifier A output characteristics; typical values**



(1)  $V_{G2-S} = 4 \text{ V}$ .

(2)  $V_{G2-S} = 3.5 \text{ V}$ .

(3)  $V_{G2-S} = 3 \text{ V}$ .

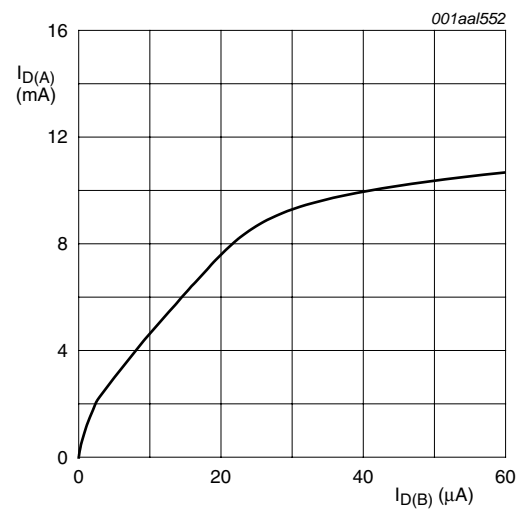
(4)  $V_{G2-S} = 2.5 \text{ V}$ .

(5)  $V_{G2-S} = 2 \text{ V}$ .

(6)  $V_{G2-S} = 1.5 \text{ V}$ .

$V_{DS(A)} = 5 \text{ V}$ ;  $V_{G1-S(B)} = V_{DS(B)} = 0 \text{ V}$ ;  $T_j = 25 \text{ }^\circ\text{C}$ .

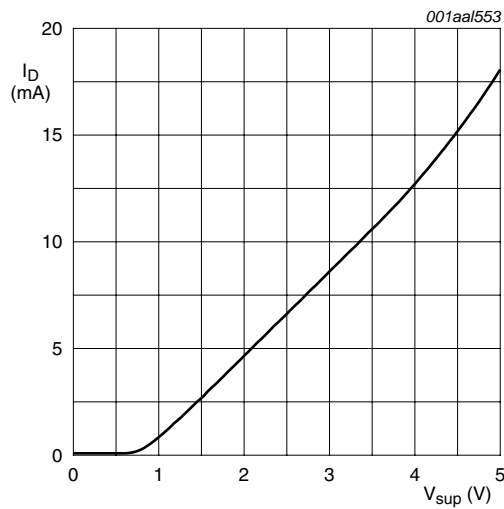
**Fig 5. Amplifier A forward transfer admittance as a function of drain current; typical values**



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

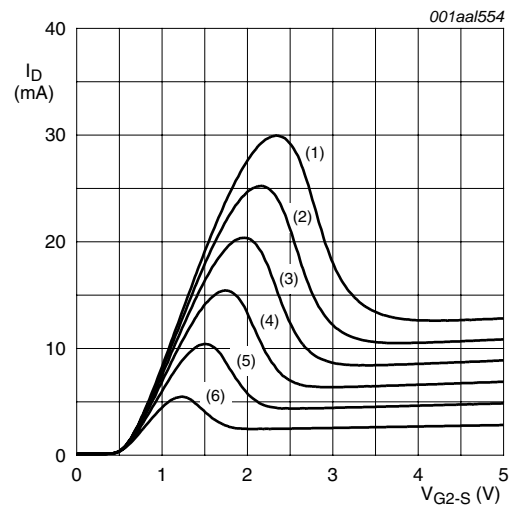
$I_{D(B)}$  = internal gate1 current = current on pin drain (amplifier B) if MOSFET (B) is switched off.

**Fig 6. Amplifier A drain current as a function of internal gate1 current; typical values**



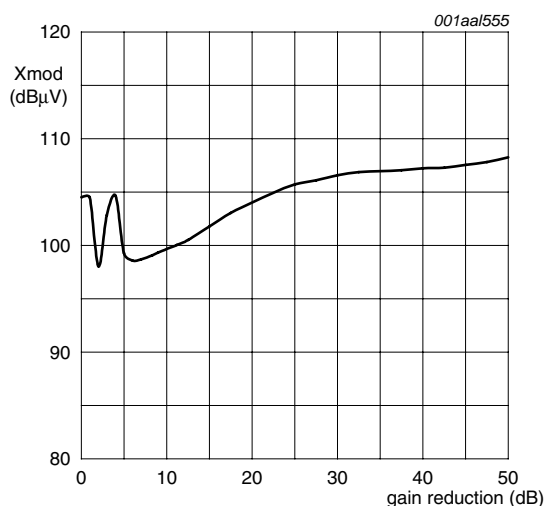
$V_{DS(A)} = V_{DS(B)} = V_{sup}$ ;  $V_{G2-S} = 4$  V;  $T_j = 25$  °C;  
 $R_{G1} = 39$  k $\Omega$  (connected to ground); see [Figure 2](#).

**Fig 7. Amplifier A drain current as a function of the supply voltage to amplifiers A and B; typical values**



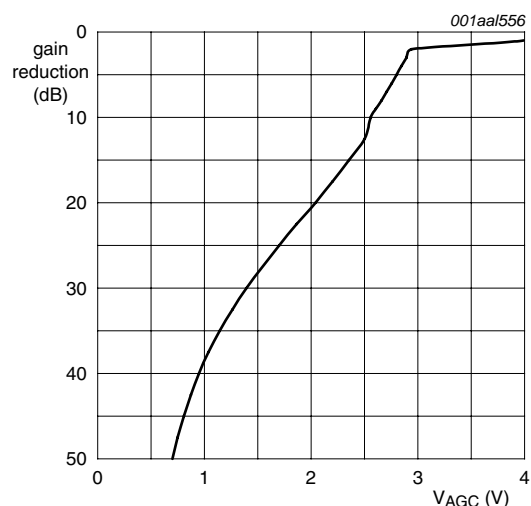
- (1)  $V_{DS(B)} = 4$  V.
  - (2)  $V_{DS(B)} = 3.5$  V.
  - (3)  $V_{DS(B)} = 3$  V.
  - (4)  $V_{DS(B)} = 2.5$  V.
  - (5)  $V_{DS(B)} = 2$  V.
  - (6)  $V_{DS(B)} = 1.5$  V.
- $V_{DS(A)} = 5$  V;  $V_{G1-S(B)} = 0$  V; gate1 (amplifier A) is open;  
 $T_j = 25$  °C.

**Fig 8. Amplifier A drain current as a function of gate2 voltage; typical values**



$V_{DS(A)} = V_{DS(B)} = 5$  V;  $V_{G1-S(B)} = 0$  V;  $f_w = 50$  MHz;  
 $f_{unw} = 60$  MHz;  $T_{amb} = 25$  °C; see [Figure 32](#).

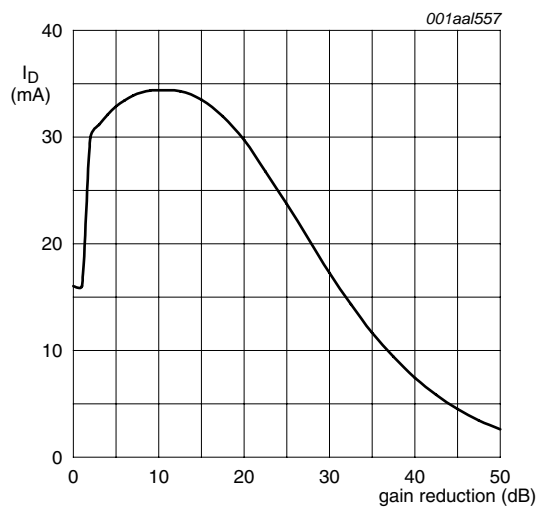
**Fig 9. Amplifier A unwanted voltage for 1% cross modulation as a function of gain reduction; typical values**



$V_{DS(A)} = V_{DS(B)} = 5$  V;  $V_{G1-S(B)} = 0$  V;  $f = 50$  MHz;  
 $T_j = 25$  °C; see [Figure 32](#).

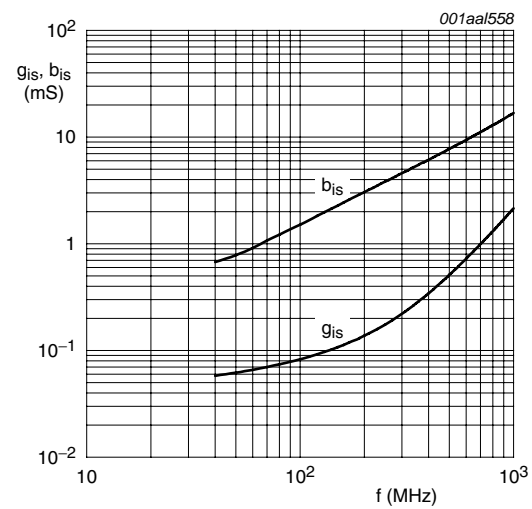
**Fig 10. Amplifier A gain reduction as a function of AGC voltage; typical values**





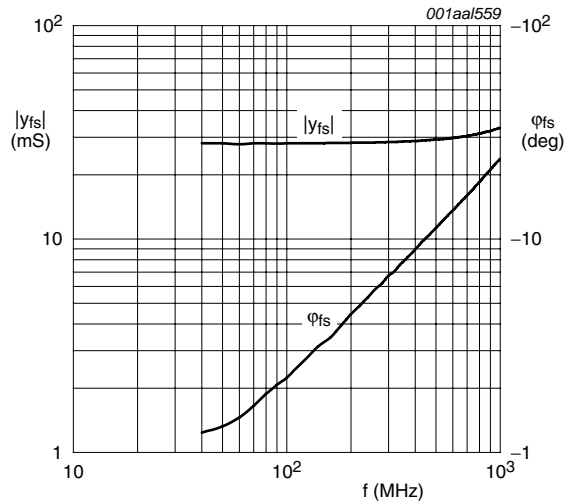
$V_{DS(A)} = V_{DS(B)} = 5\text{ V}$ ;  $V_{G1-S(B)} = 0\text{ V}$ ;  $f = 50\text{ MHz}$ ;  
 $T_j = 25\text{ }^\circ\text{C}$ ; see [Figure 32](#).

**Fig 11. Amplifier A drain current as a function of gain reduction; typical values**



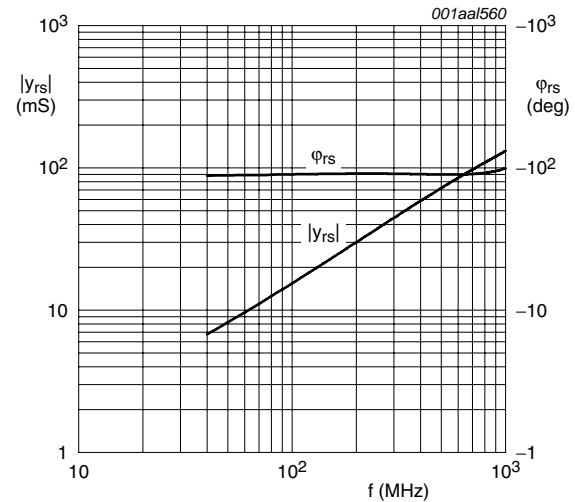
$V_{DS(A)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(B)} = V_{G1-S(B)} = 0\text{ V}$ ;  
 $I_{D(A)} = 19\text{ mA}$ ;  $T_j = 25\text{ }^\circ\text{C}$ .

**Fig 12. Amplifier A input admittance as a function of frequency; typical values**



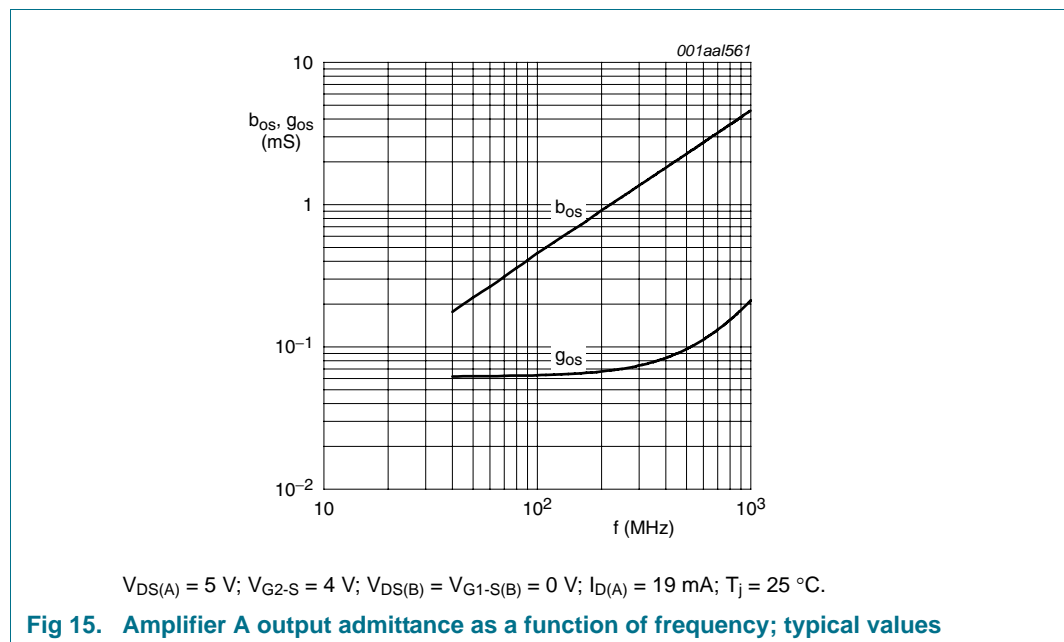
$V_{DS(A)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(B)} = V_{G1-S(B)} = 0\text{ V}$ ;  
 $I_{D(A)} = 19\text{ mA}$ ;  $T_j = 25\text{ }^\circ\text{C}$ .

**Fig 13. Amplifier A forward transfer admittance and phase as a function of frequency; typical values**



$V_{DS(A)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(B)} = V_{G1-S(B)} = 0\text{ V}$ ;  
 $I_{D(A)} = 19\text{ mA}$ ;  $T_j = 25\text{ }^\circ\text{C}$ .

**Fig 14. Amplifier A reverse transfer admittance and phase as a function of frequency; typical values**



## 8.2 Scattering parameters for amplifier A

**Table 9. Scattering parameters for amplifier A**

$V_{DS(A)} = 5 \text{ V}; V_{G2-S} = 4 \text{ V}; I_{D(A)} = 19 \text{ mA}; V_{DS(B)} = 0 \text{ V}; V_{G1-S(B)} = 0 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C};$  typical values.

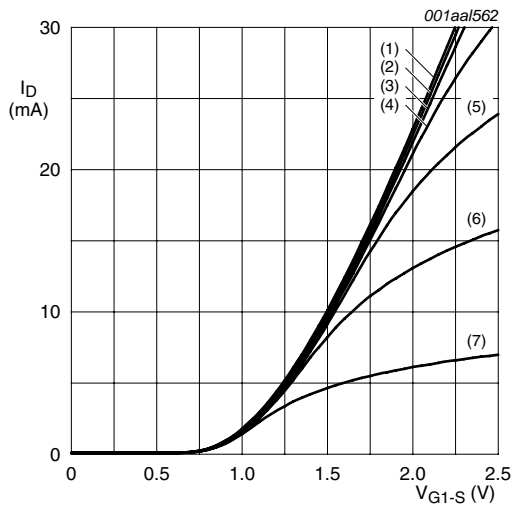
| f (MHz) | S <sub>11</sub>   |                | S <sub>21</sub>   |                | S <sub>12</sub>   |                | S <sub>22</sub>   |                |
|---------|-------------------|----------------|-------------------|----------------|-------------------|----------------|-------------------|----------------|
|         | Magnitude (ratio) | Angle (degree) | Magnitude (ratio) | Angle (degree) | Magnitude (ratio) | Angle (degree) | Magnitude (ratio) | Angle (degree) |
| 50      | 0.992             | -4.61          | 2.80              | 175.87         | 0.00078           | 95.65          | 0.993             | -1.38          |
| 100     | 0.991             | -8.79          | 2.80              | 172.12         | 0.00145           | 83.73          | 0.994             | -2.76          |
| 200     | 0.986             | -17.57         | 2.77              | 164.25         | 0.00292           | 78.53          | 0.992             | -5.50          |
| 300     | 0.977             | -26.11         | 2.74              | 156.52         | 0.00415           | 73.60          | 0.991             | -8.21          |
| 400     | 0.966             | -34.46         | 2.69              | 148.98         | 0.00528           | 69.27          | 0.989             | -10.91         |
| 500     | 0.952             | -42.75         | 2.64              | 141.49         | 0.00620           | 64.79          | 0.986             | -13.58         |
| 600     | 0.936             | -50.92         | 2.58              | 134.13         | 0.00691           | 60.71          | 0.984             | -16.22         |
| 700     | 0.920             | -58.79         | 2.50              | 127.01         | 0.00733           | 57.37          | 0.982             | -18.86         |
| 800     | 0.902             | -66.40         | 2.43              | 120.04         | 0.00758           | 54.40          | 0.979             | -21.47         |
| 900     | 0.881             | -73.87         | 2.36              | 113.24         | 0.00763           | 52.13          | 0.978             | -24.00         |
| 1000    | 0.861             | -81.10         | 2.28              | 106.69         | 0.00749           | 50.46          | 0.976             | -26.55         |

## 8.3 Noise data for amplifier A

**Table 10. Noise data for amplifier A**

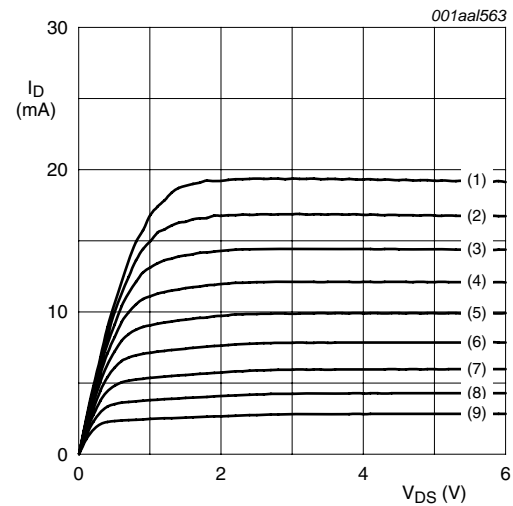
$V_{DS(A)} = 5 \text{ V}; V_{G2-S} = 4 \text{ V}; I_{D(A)} = 19 \text{ mA}; V_{DS(B)} = 0 \text{ V}; V_{G1-S(B)} = 0 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C};$  typical values; unless otherwise specified.

| f (MHz) | NF <sub>min</sub> (dB) | Γ <sub>opt</sub> |          | r <sub>n</sub> (ratio) |
|---------|------------------------|------------------|----------|------------------------|
|         |                        | (ratio)          | (degree) |                        |
| 400     | 0.9                    | 0.810            | 27.95    | 0.884                  |
| 800     | 1.4                    | 0.697            | 56.50    | 0.717                  |

**8.4 Graphics for amplifier B**

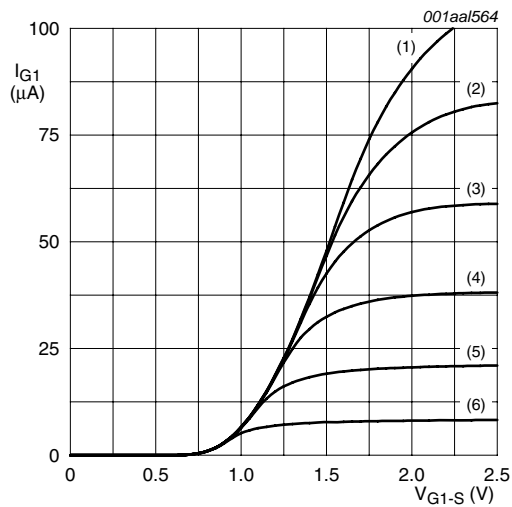
- (1)  $V_{G2-S} = 4 \text{ V}$ .  
 (2)  $V_{G2-S} = 3.5 \text{ V}$ .  
 (3)  $V_{G2-S} = 3 \text{ V}$ .  
 (4)  $V_{G2-S} = 2.5 \text{ V}$ .  
 (5)  $V_{G2-S} = 2 \text{ V}$ .  
 (6)  $V_{G2-S} = 1.5 \text{ V}$ .  
 (7)  $V_{G2-S} = 1 \text{ V}$ .  
 $V_{DS(B)} = 5 \text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)}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

**Fig 16. Amplifier B transfer characteristics; typical values**



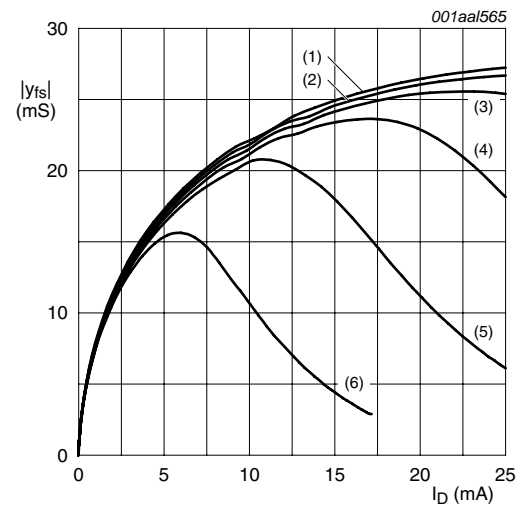
- (1)  $V_{G1-S(B)} = 1.9 \text{ V}$ .  
 (2)  $V_{G1-S(B)} = 1.8 \text{ V}$ .  
 (3)  $V_{G1-S(B)} = 1.7 \text{ V}$ .  
 (4)  $V_{G1-S(B)} = 1.6 \text{ V}$ .  
 (5)  $V_{G1-S(B)} = 1.5 \text{ V}$ .  
 (6)  $V_{G1-S(B)} = 1.4 \text{ V}$ .  
 (7)  $V_{G1-S(B)} = 1.3 \text{ V}$ .  
 (8)  $V_{G1-S(B)} = 1.2 \text{ V}$ .  
 (9)  $V_{G1-S(B)} = 1.1 \text{ V}$ .  
 $V_{G2-S} = 4 \text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)} = 0 \text{ V}$ ;  $T_j = 25 \text{ }^\circ\text{C}$ .

**Fig 17. Amplifier B output characteristics; typical values**



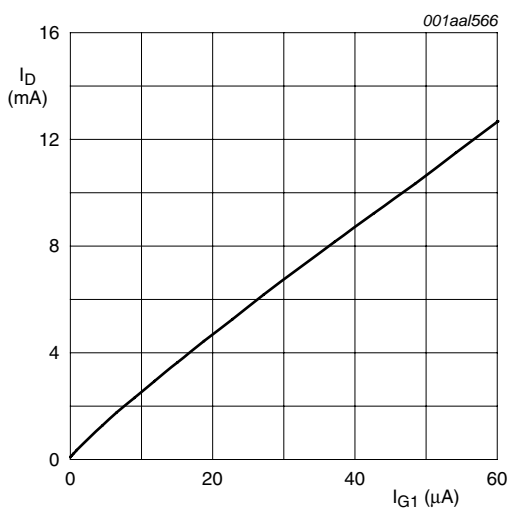
- (1)  $V_{G2-S} = 4 \text{ V}$ .  
 (2)  $V_{G2-S} = 3.5 \text{ V}$ .  
 (3)  $V_{G2-S} = 3 \text{ V}$ .  
 (4)  $V_{G2-S} = 2.5 \text{ V}$ .  
 (5)  $V_{G2-S} = 2 \text{ V}$ .  
 (6)  $V_{G2-S} = 1.5 \text{ V}$ .  
 (7)  $V_{G2-S} = 1 \text{ V}$ .  
 $V_{DS(B)} = 5 \text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)}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

**Fig 18. Amplifier B gate1 current as a function of gate1 voltage; typical values**



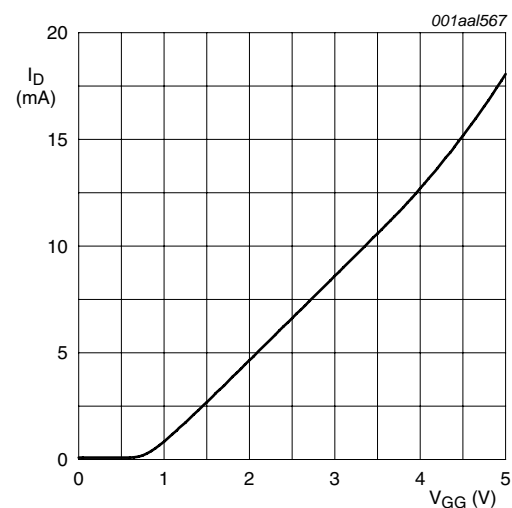
- (1)  $V_{G2-S} = 4 \text{ V}$ .  
 (2)  $V_{G2-S} = 3.5 \text{ V}$ .  
 (3)  $V_{G2-S} = 3 \text{ V}$ .  
 (4)  $V_{G2-S} = 2.5 \text{ V}$ .  
 (5)  $V_{G2-S} = 2 \text{ V}$ .  
 (6)  $V_{G2-S} = 1.5 \text{ V}$ .  
 $V_{DS(B)} = 5 \text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)} = 0 \text{ V}$ ;  $T_j = 25 \text{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

**Fig 19. Amplifier B forward transfer admittance as a function of drain current; typical values**



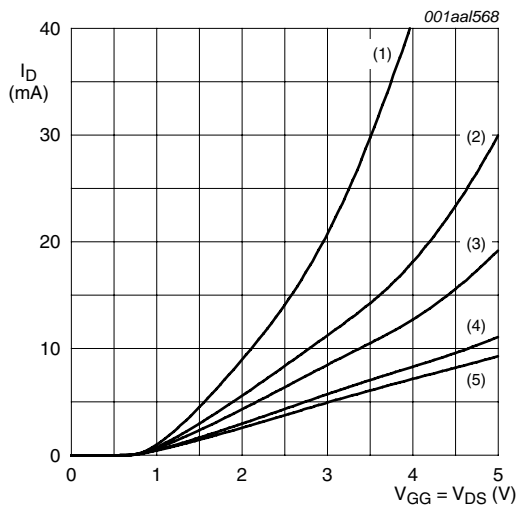
$V_{DS(B)} = 5 \text{ V}$ ;  $V_{G2-S} = 4 \text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)} = 0 \text{ V}$ ;  
 $T_j = 25 \text{ }^\circ\text{C}$ .

**Fig 20. Amplifier B drain current as a function of gate1 current; typical values**



$V_{DS(B)} = 5 \text{ V}$ ;  $V_{G2-S} = 4 \text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)} = 0 \text{ V}$ ;  
 $T_j = 25 \text{ }^\circ\text{C}$ ;  $R_{G1} = 39 \text{ k}\Omega$  (connected to  $V_{GG}$ ); see [Figure 2](#).

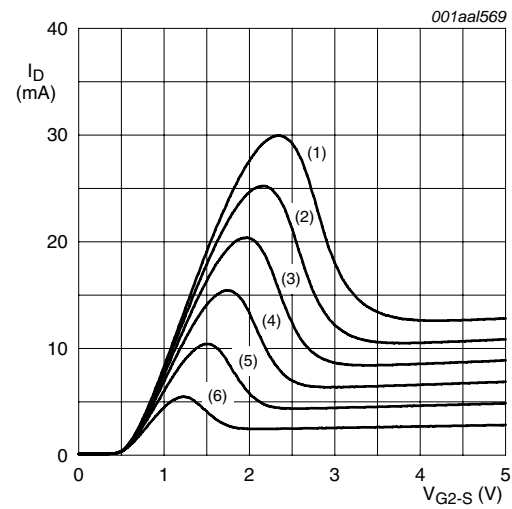
**Fig 21. Amplifier B drain current as a function of gate1 supply voltage; typical values**



- (1)  $R_{G1} = 12 \text{ k}\Omega$ .
- (2)  $R_{G1} = 27 \text{ k}\Omega$ .
- (3)  $R_{G1} = 39 \text{ k}\Omega$ .
- (4)  $R_{G1} = 67 \text{ k}\Omega$ .
- (5)  $R_{G1} = 80 \text{ k}\Omega$ .

$V_{G2-S} = 4 \text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)} = 0 \text{ V}$ ;  $T_j = 25 \text{ }^\circ\text{C}$ ;  $R_{G1}$  is connected to  $V_{GG}$ ; see [Figure 2](#).

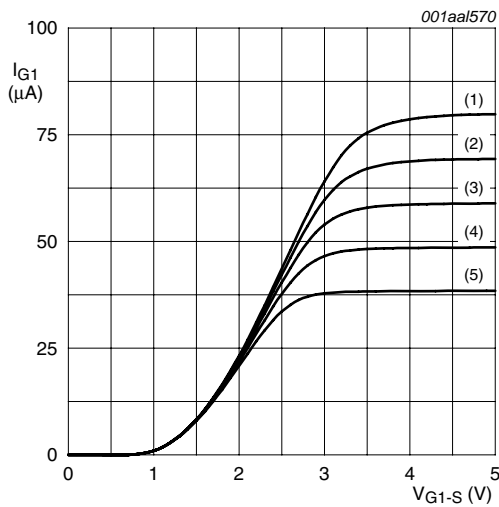
**Fig 22. Amplifier B drain current as a function of gate1 supply voltage and drain supply voltage; typical values**



- (1)  $V_{GG} = 4.0 \text{ V}$ .
- (2)  $V_{GG} = 3.5 \text{ V}$ .
- (3)  $V_{GG} = 3.0 \text{ V}$ .
- (4)  $V_{GG} = 2.5 \text{ V}$ .
- (5)  $V_{GG} = 2.0 \text{ V}$ .
- (6)  $V_{GG} = 1.5 \text{ V}$ .

$V_{DS(B)} = 5 \text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)} = 0 \text{ V}$ ;  $T_j = 25 \text{ }^\circ\text{C}$ ;  $R_{G1} = 39 \text{ k}\Omega$  (connected to  $V_{GG}$ ); see [Figure 2](#).

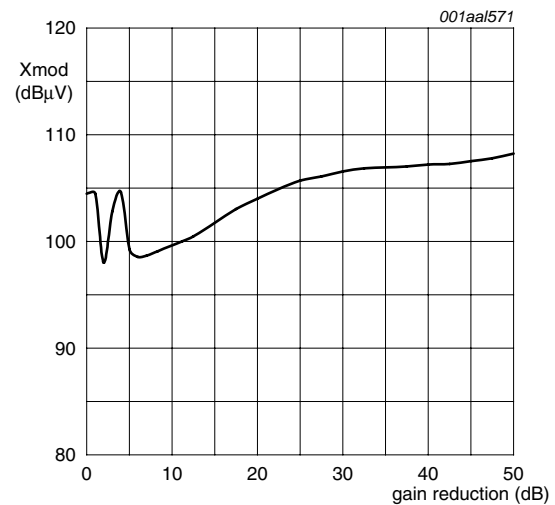
**Fig 23. Amplifier B drain current as a function of gate2 voltage; typical values**



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

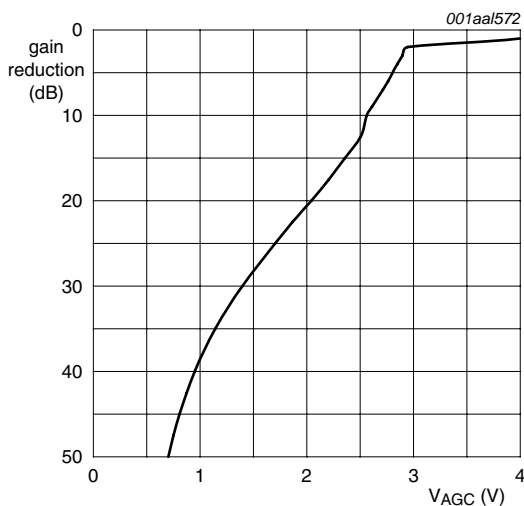
$V_{DS(B)} = 5$  V;  $V_{DS(A)} = V_{G1-S(A)} = 0$  V;  $T_j = 25$  °C;  
 $R_{G1} = 39$  k $\Omega$  (connected to  $V_{GG}$ ); see [Figure 2](#).

**Fig 24. Amplifier B gate1 current as a function of gate2 voltage; typical values**



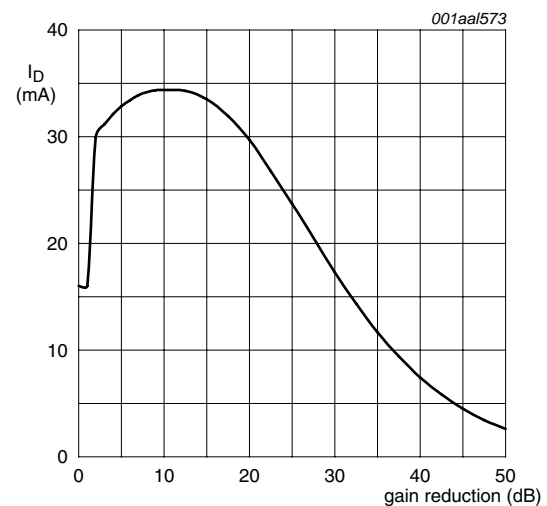
$V_{DS(B)} = 5$  V;  $V_{GG} = 5$  V;  $V_{DS(A)} = V_{G1-S(A)} = 0$  V;  
 $R_{G1} = 39$  k $\Omega$  (connected to  $V_{GG}$ );  $f_w = 50$  MHz;  
 $f_{unw} = 60$  MHz;  $T_{amb} = 25$  °C; see [Figure 33](#).

**Fig 25. Amplifier B unwanted voltage for 1% cross modulation as a function of gain reduction; typical values**



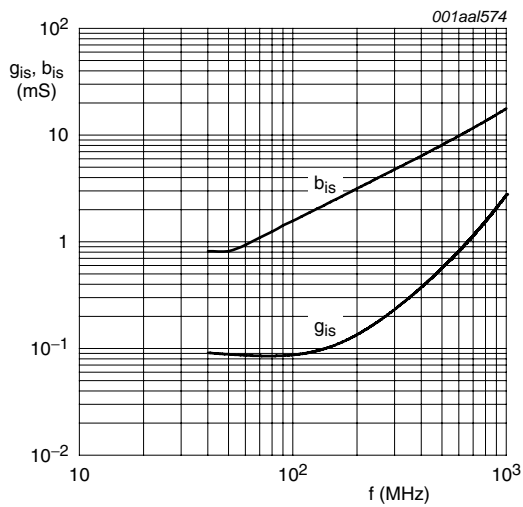
$V_{DS(B)} = 5$  V;  $V_{GG} = 5$  V;  $V_{DS(A)} = V_{G1-S(A)} = 0$  V;  
 $R_{G1} = 39$  k $\Omega$  (connected to  $V_{GG}$ );  $f = 50$  MHz;  
 $T_{amb} = 25$  °C; see [Figure 33](#).

**Fig 26. Amplifier B gain reduction as a function of AGC voltage; typical values**



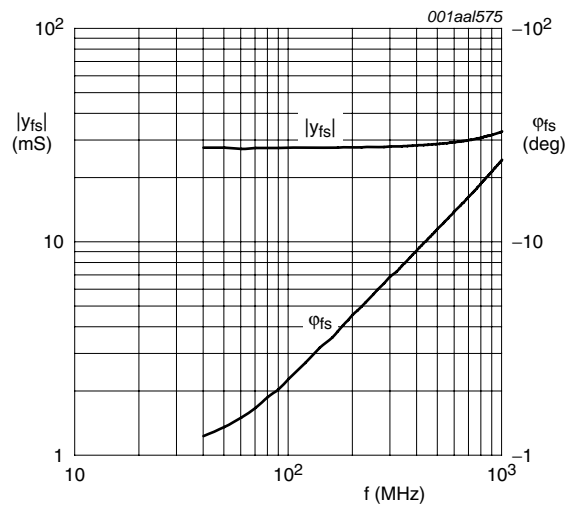
$V_{DS(B)} = 5$  V;  $V_{GG} = 5$  V;  $V_{DS(A)} = V_{G1-S(A)} = 0$  V;  
 $R_{G1} = 39$  k $\Omega$  (connected to  $V_{GG}$ );  $f = 50$  MHz;  
 $T_{amb} = 25$  °C; see [Figure 33](#).

**Fig 27. Amplifier B drain current as a function of gain reduction; typical values**



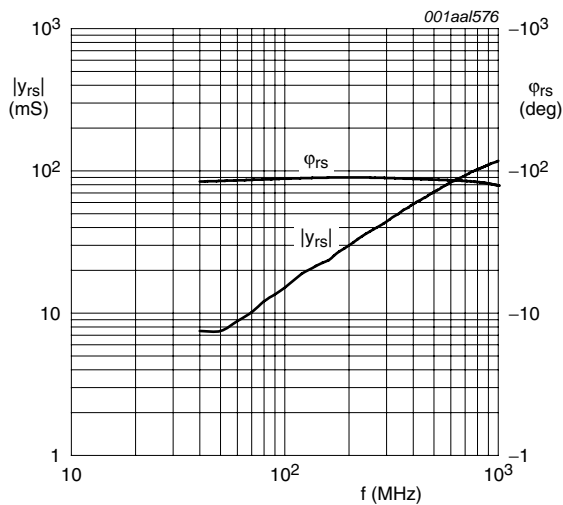
$V_{DS(B)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)} = 0\text{ V}$ ;  
 $I_{D(B)} = 19\text{ mA}$ ;  $T_j = 25\text{ }^\circ\text{C}$ .

**Fig 28. Input admittance as a function of frequency; typical values**



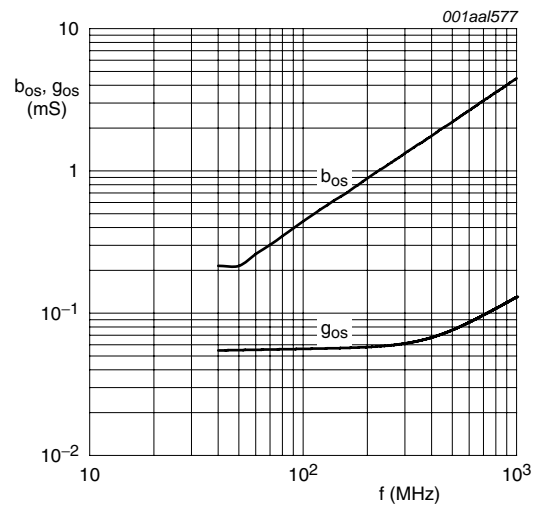
$V_{DS(B)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)} = 0\text{ V}$ ;  
 $I_{D(B)} = 19\text{ mA}$ ;  $T_j = 25\text{ }^\circ\text{C}$ .

**Fig 29. Forward transfer admittance and phase as a function of frequency; typical values**



$V_{DS(B)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)} = 0\text{ V}$ ;  
 $I_{D(B)} = 19\text{ mA}$ ;  $T_j = 25\text{ }^\circ\text{C}$ .

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



$V_{DS(B)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $V_{DS(A)} = V_{G1-S(A)} = 0\text{ V}$ ;  
 $I_{D(B)} = 19\text{ mA}$ ;  $T_j = 25\text{ }^\circ\text{C}$ .

**Fig 31. Output admittance as a function of frequency; typical values**

## 8.5 Scattering parameters for amplifier B

**Table 11. Scattering parameters for amplifier B**

$V_{DS(B)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_{D(B)} = 15\text{ mA}$ ;  $V_{DS(A)} = 0\text{ V}$ ;  $V_{G1-S(A)} = 0\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ ; typical values.

| f (MHz) | S <sub>11</sub>   |                | S <sub>21</sub>   |                | S <sub>12</sub>   |                | S <sub>22</sub>   |                |
|---------|-------------------|----------------|-------------------|----------------|-------------------|----------------|-------------------|----------------|
|         | Magnitude (ratio) | Angle (degree) | Magnitude (ratio) | Angle (degree) | Magnitude (ratio) | Angle (degree) | Magnitude (ratio) | Angle (degree) |
| 50      | 0.987             | -4.68          | 2.77              | 175.73         | 0.00074           | 100.59         | 0.992             | -1.47          |
| 100     | 0.983             | -8.74          | 2.75              | 171.97         | 0.00147           | 85.47          | 0.992             | -3.03          |
| 200     | 0.979             | -17.33         | 2.73              | 164.04         | 0.00291           | 83.85          | 0.991             | -6.07          |
| 300     | 0.970             | -25.74         | 2.70              | 156.20         | 0.00422           | 82.04          | 0.989             | -9.06          |
| 400     | 0.961             | -33.99         | 2.66              | 148.55         | 0.00547           | 80.56          | 0.987             | -12.03         |
| 500     | 0.948             | -42.21         | 2.60              | 140.92         | 0.00654           | 79.15          | 0.986             | -14.99         |
| 600     | 0.932             | -50.29         | 2.54              | 133.41         | 0.00744           | 78.33          | 0.983             | -17.97         |
| 700     | 0.917             | -58.13         | 2.47              | 126.14         | 0.00822           | 78.46          | 0.981             | -20.93         |
| 800     | 0.900             | -65.75         | 2.40              | 119.00         | 0.00890           | 78.92          | 0.978             | -23.84         |
| 900     | 0.981             | -73.19         | 2.33              | 112.02         | 0.00947           | 80.11          | 0.977             | -26.71         |
| 1000    | 0.962             | -80.36         | 2.25              | 105.26         | 0.00997           | 81.84          | 0.975             | -29.63         |

## 8.6 Noise data for amplifier B

**Table 12. Noise data for amplifier B**

$V_{DS(B)} = 5\text{ V}$ ;  $V_{G2-S} = 4\text{ V}$ ;  $I_{D(B)} = 19\text{ mA}$ ;  $V_{DS(A)} = 0\text{ V}$ ;  $V_{G1-S(A)} = 0\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ ; typical values; unless otherwise specified.

| f (MHz) | NF <sub>min</sub> (dB) | Γ <sub>opt</sub> |       | r <sub>n</sub> (Ω) |
|---------|------------------------|------------------|-------|--------------------|
|         |                        | (ratio)          | (deg) |                    |
| 400     | 1.1                    | 0.755            | 27.61 | 0.860              |
| 800     | 1.6                    | 0.659            | 56.19 | 0.712              |



## 9. Test information

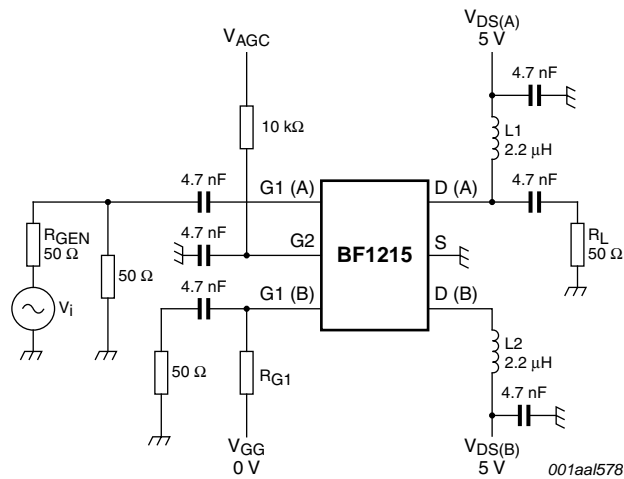


Fig 32. Cross-modulation test set-up for amplifier A.

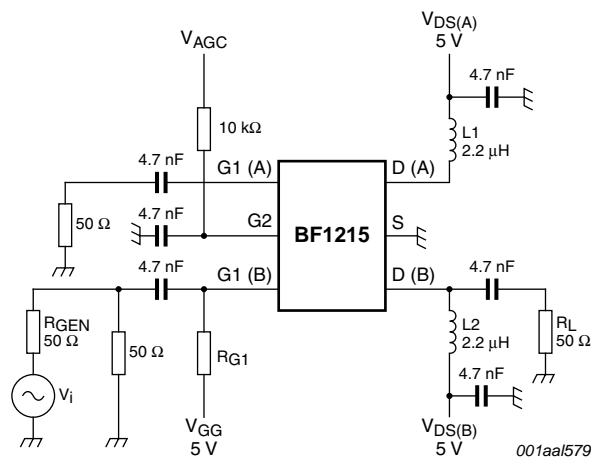


Fig 33. Cross-modulation test set-up for amplifier B.

**10. Package outline**

Plastic surface-mounted package; 6 leads

SOT363

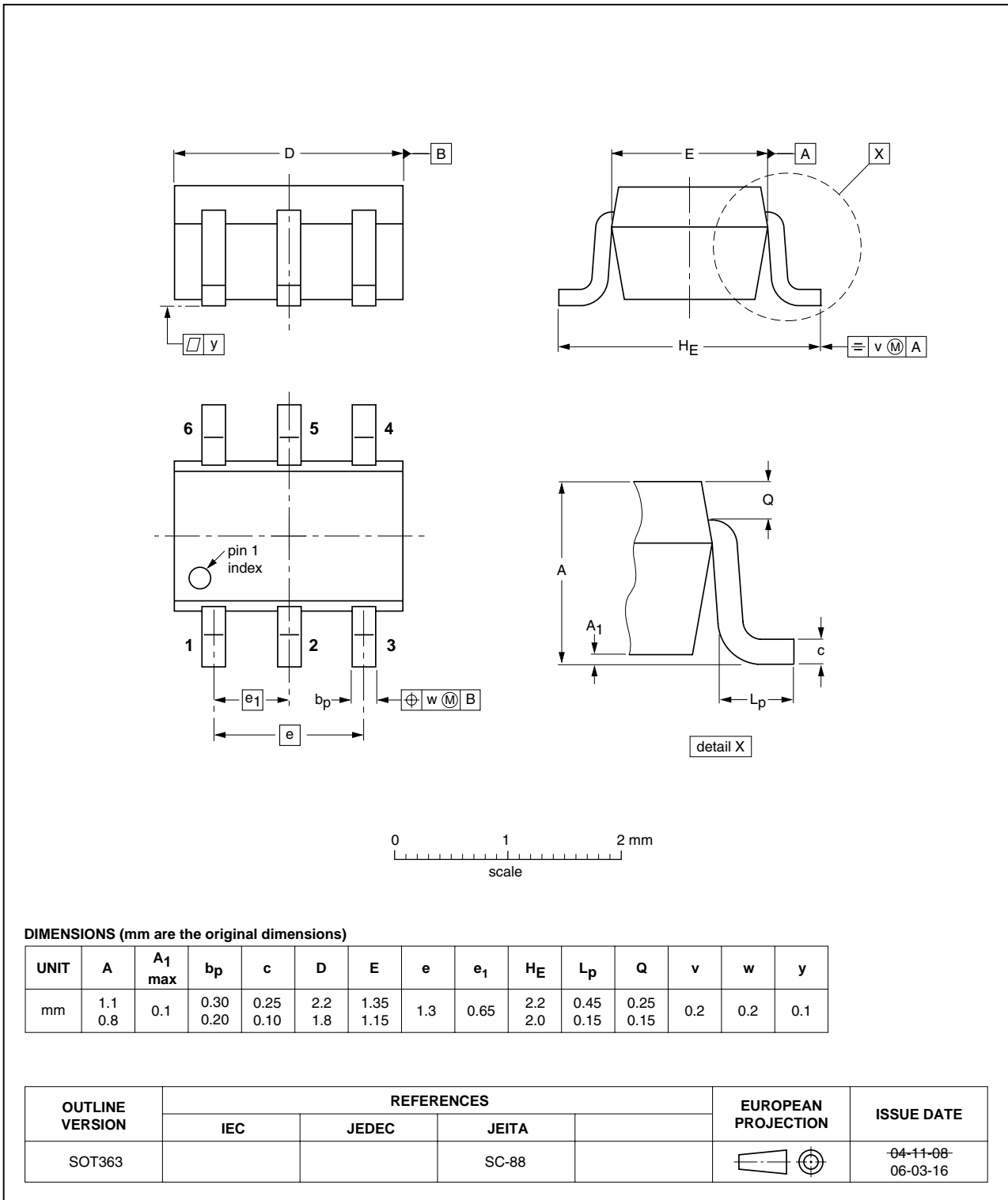


Fig 34. Package outline SOT363

## 11. Abbreviations

**Table 13. Abbreviations**

| Acronym | Description                                       |
|---------|---|
| AGC     | Automatic Gain Control                            |
| DC      | Direct Current                                    |
| MOSFET  | Metal-Oxide-Semiconductor Field-Effect Transistor |
| UHF     | Ultra High Frequency                              |
| VHF     | Very High Frequency                               |

## 12. Revision history

**Table 14. Revision history**

| Document ID | Release date | Data sheet status  | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| BF1215_1    | 20100506     | Product data sheet | -             | -          |

## 13. Legal information

### 13.1 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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For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

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Date of release: 6 May 2010

Document identifier: BF1215\_1