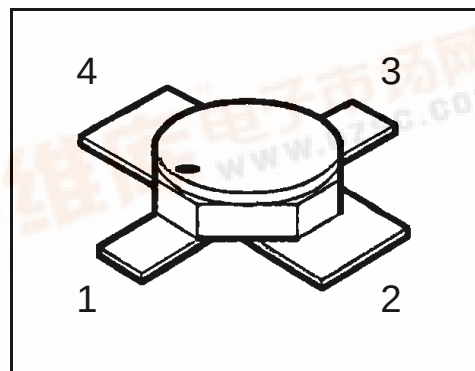


## HiRel X-Band GaAs Low Noise / General Purpose MESFET

- **HiRel Discrete and Microwave Semiconductor**
- For professional pre- and driver-amplifiers
- For frequencies from 500 MHz to 20 GHz
- Hermetically sealed microwave package
- Low noise figure, high gain, moderate power
-  **ESA Space Qualification Expected 1998**  
ESA/SCC Detail Spec. No.: 5613/008,  
Type Variant No.s 01 to 05



**ESD:** Electrostatic discharge sensitive device, observe handling precautions!

| Type           | Marking | Ordering Code | Pin Configuration |   |   |   | Package |
|----------------|---------|---------------|-------------------|---|---|---|---------|
|                |         |               | 1                 | 2 | 3 | 4 |         |
| CFY25-P (ql)   | -       | see below     | G                 | S | D | S | Micro-X |
| CFY25-23 (ql)  |         |               |                   |   |   |   |         |
| CFY25-23P (ql) |         |               |                   |   |   |   |         |
| CFY25-20 (ql)  |         |               |                   |   |   |   |         |
| CFY25-20P (ql) |         |               |                   |   |   |   |         |

CFY25-nnl: specifies noise, gain and output power level (see electrical characteristics)

|                     |                          |                |            |
|---------------------|--------------------------|----------------|------------|
| (ql) Quality Level: | P: Professional Quality, | Ordering Code: | Q62703F120 |
|                     | H: High Rel Quality,     | Ordering Code: | on request |
|                     | S: Space Quality,        | Ordering Code: | on request |
|                     | ES: ESA Space Quality,   | Ordering Code: | Q62703F119 |

(see order instructions for ordering example)

## Maximum Ratings

| Parameter                                   | Symbol      | Values        | Unit |
|---------------------------------------------|-------------|---------------|------|
| Drain-source voltage                        | $V_{DS}$    | 5             | V    |
| Drain-gate voltage                          | $V_{DG}$    | 7             | V    |
| Gate-source voltage (reverse / forward)     | $V_{GS}$    | - 5... + 0.5  | V    |
| Drain current                               | $I_D$       | 80            | mA   |
| Gate forward current                        | $I_G$       | 1.5           | mA   |
| RF Input Power, C- and X-Band <sup>1)</sup> | $P_{RF,in}$ | + 17          | dBm  |
| Junction temperature                        | $T_J$       | 175           | °C   |
| Storage temperature range                   | $T_{stg}$   | - 65... + 175 | °C   |
| Total power dissipation <sup>2)</sup>       | $P_{tot}$   | 250           | mW   |
| Soldering temperature <sup>3)</sup>         | $T_{sol}$   | 230           | °C   |

## Thermal Resistance

|                          |             |       |     |
|--------------------------|-------------|-------|-----|
| Junction-soldering point | $R_{th JS}$ | ≤ 410 | K/W |
|--------------------------|-------------|-------|-----|

### **Notes.:**

- 1) For  $V_{DS} \leq 3$  V. For  $V_{DS} > 3$  V, derating is required.
- 2) At  $T_S = + 72.5$  °C. For  $T_S > + 72.5$  °C derating is required.
- 3) During 15 sec. maximum. The same terminal shall not be resoldered until 3 minutes have elapsed.

**Electrical Characteristics** (at  $T_A=25^{\circ}\text{C}$ ; unless otherwise specified)

| Parameter                                                                           | Symbol             | Values |       |      | Unit          |
|-------------------------------------------------------------------------------------|--------------------|--------|-------|------|---------------|
|                                                                                     |                    | min.   | typ.  | max. |               |
| DC Characteristics                                                                  |                    |        |       |      |               |
| Drain-source saturation current<br>$V_{DS} = 3\text{ V}$ , $V_{GS} = 0\text{ V}$    | $I_{DSS}$          | 15     | 30    | 60   | mA            |
| Gate threshold voltage<br>$V_{DS} = 3\text{ V}$ , $I_D = 1\text{ mA}$               | $-V_{Gth}$         | 0.3    | 1.0   | 3.0  | V             |
| Drain current at pinch-off<br>$V_{DS} = 3\text{ V}$ , $V_{GS} = -4\text{ V}$        | $I_{Dp}$           | -      | < 100 | -    | $\mu\text{A}$ |
| Gate leakage current at pinch-off<br>$V_{DS} = 3\text{ V}$ , $V_{GS} = -4\text{ V}$ | $-I_{Gp}$          | -      | < 100 | 200  | $\mu\text{A}$ |
| Transconductance<br>$V_{DS} = 3\text{ V}$ , $I_D = 15\text{ mA}$                    | $g_{m15}$          | 35     | 40    | -    | mS            |
| Gate leakage current at operation<br>$V_{DS} = 3\text{ V}$ , $I_D = 15\text{ mA}$   | $-I_{G15}$         | -      | < 1   | 2    | $\mu\text{A}$ |
| Thermal resistance<br>junction to soldering point                                   | $R_{th\text{ JS}}$ | -      | 370   | -    | K/W           |

**Electrical Characteristics (continued)**

| Parameter                                                                                                                                                                      | Symbol           | Values               |                          |                  | Unit |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------|--------------------------|------------------|------|
|                                                                                                                                                                                |                  | min.                 | typ.                     | max.             |      |
| AC Characteristics                                                                                                                                                             |                  |                      |                          |                  |      |
| Noise figure <sup>1)</sup><br>V <sub>DS</sub> = 3 V, I <sub>D</sub> = 15 mA, f = 12 GHz<br>CFY25-P<br>CFY25-20, -20P<br>CFY25-23, -23P                                         | NF               | -<br>-<br>-          | < 2.3<br>1.9<br>2.2      | -<br>2.1<br>2.4  | dB   |
| Associated gain. <sup>1)</sup><br>V <sub>DS</sub> = 3 V, I <sub>D</sub> = 15 mA, f = 12 GHz<br>CFY25-P<br>CFY25-20, -20P<br>CFY25-23, -23P                                     | G <sub>a</sub>   | -<br>8.5<br>8.0      | > 8.5<br>9<br>8.7        | -<br>-<br>-      | dB   |
| Output power at 1 dB gain compression <sup>2)</sup><br>V <sub>DS</sub> = 3 V, I <sub>D(RF off)</sub> = 20 mA, f = 12 GHz<br>CFY25-20, -23<br>CFY25-20P, 23P, -P                | P <sub>1dB</sub> | -<br>14              | 15<br>15                 | -<br>-           | dBm  |
| Linear power gain <sup>2)</sup><br>V <sub>DS</sub> = 3 V, I <sub>D</sub> = 20 mA, f = 12 GHz,<br>P <sub>in</sub> = 0 dBm<br>CFY25-20<br>CFY25-23<br>CFY25-20P, -P<br>CFY25-23P | G <sub>lp</sub>  | -<br>-<br>8.5<br>8.0 | 9.2<br>8.5<br>9.2<br>8.5 | -<br>-<br>-<br>- | dB   |

**Notes.:**

1) Noise figure / associated gain characteristics given for minimum noise figure matching conditions (fixed generic matching, no fine-tuning).

2) Output power / linear power gain characteristics given for optimum output power matching conditions (fixed generic matching, no fine-tuning).

**Typical Common Source S-Parameters CFY25-20**

| $V_{DS} = 3 \text{ V}, I_D = 15 \text{ mA}, Z_o = 50 \text{ } \Omega$ |               |                 |               |                 |               |                 |               |                 |                  |                         |             |
|-----------------------------------------------------------------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|------------------|-------------------------|-------------|
| f<br>[GHz]                                                            | S11 <br>[mag] | <S11<br>[angle] | S21 <br>[mag] | <S21<br>[angle] | S12 <br>[mag] | <S12<br>[angle] | S22 <br>[mag] | <S22<br>[angle] | k-Fact.<br>[mag] | $S_{21}/S_{12}$<br>[dB] | MAG<br>[dB] |
| 0,5                                                                   | 0,958         | -22             | 3,301         | 160             | 0,0170        | 71              | 0,683         | -14             | 0,44             | 22,9                    |             |
| 1,0                                                                   | 0,931         | -28             | 3,208         | 155             | 0,0287        | 64              | 0,673         | -18             | 0,50             | 20,5                    |             |
| 1,5                                                                   | 0,901         | -36             | 3,107         | 148             | 0,0398        | 59              | 0,660         | -23             | 0,54             | 18,9                    |             |
| 2,0                                                                   | 0,875         | -45             | 3,016         | 139             | 0,0502        | 53              | 0,648         | -29             | 0,56             | 17,8                    |             |
| 2,5                                                                   | 0,858         | -56             | 2,950         | 130             | 0,0602        | 47              | 0,635         | -35             | 0,55             | 16,9                    |             |
| 3,0                                                                   | 0,838         | -67             | 2,877         | 120             | 0,0691        | 42              | 0,621         | -41             | 0,56             | 16,2                    |             |
| 3,5                                                                   | 0,815         | -78             | 2,795         | 111             | 0,0767        | 36              | 0,603         | -48             | 0,58             | 15,6                    |             |
| 4,0                                                                   | 0,794         | -88             | 2,708         | 102             | 0,0834        | 31              | 0,590         | -54             | 0,61             | 15,1                    |             |
| 4,5                                                                   | 0,776         | -98             | 2,621         | 93              | 0,0893        | 25              | 0,573         | -60             | 0,64             | 14,7                    |             |
| 5,0                                                                   | 0,760         | -108            | 2,537         | 84              | 0,0939        | 20              | 0,562         | -67             | 0,66             | 14,3                    |             |
| 5,5                                                                   | 0,746         | -117            | 2,451         | 76              | 0,0975        | 15              | 0,549         | -73             | 0,69             | 14,0                    |             |
| 6,0                                                                   | 0,732         | -126            | 2,365         | 68              | 0,1000        | 10              | 0,539         | -80             | 0,72             | 13,7                    |             |
| 6,5                                                                   | 0,718         | -135            | 2,281         | 60              | 0,1017        | 5               | 0,529         | -86             | 0,77             | 13,5                    |             |
| 7,0                                                                   | 0,703         | -143            | 2,202         | 52              | 0,1035        | 1               | 0,521         | -91             | 0,81             | 13,3                    |             |
| 7,5                                                                   | 0,689         | -150            | 2,133         | 45              | 0,1049        | -3              | 0,511         | -96             | 0,87             | 13,1                    |             |
| 8,0                                                                   | 0,674         | -158            | 2,072         | 38              | 0,1056        | -6              | 0,504         | -101            | 0,92             | 12,9                    |             |
| 8,5                                                                   | 0,661         | -166            | 2,020         | 30              | 0,1063        | -10             | 0,495         | -106            | 0,97             | 12,8                    |             |
| 9,0                                                                   | 0,650         | -174            | 1,976         | 23              | 0,1068        | -13             | 0,484         | -111            | 1,02             | 12,7                    | 11,7        |
| 9,5                                                                   | 0,640         | 178             | 1,933         | 16              | 0,1076        | -16             | 0,474         | -116            | 1,06             | 12,5                    | 11,0        |
| 10,0                                                                  | 0,629         | 170             | 1,896         | 9               | 0,1080        | -20             | 0,463         | -121            | 1,11             | 12,4                    | 10,4        |
| 10,5                                                                  | 0,620         | 162             | 1,859         | 2               | 0,1084        | -23             | 0,452         | -127            | 1,16             | 12,3                    | 9,9         |
| 11,0                                                                  | 0,613         | 153             | 1,826         | -5              | 0,1090        | -26             | 0,443         | -133            | 1,19             | 12,2                    | 9,6         |
| 11,5                                                                  | 0,607         | 145             | 1,797         | -13             | 0,1097        | -29             | 0,436         | -140            | 1,22             | 12,1                    | 9,3         |
| 12,0                                                                  | 0,600         | 137             | 1,767         | -20             | 0,1105        | -33             | 0,431         | -147            | 1,24             | 12,0                    | 9,1         |
| 12,5                                                                  | 0,593         | 130             | 1,738         | -27             | 0,1114        | -36             | 0,426         | -153            | 1,27             | 11,9                    | 8,8         |
| 13,0                                                                  | 0,587         | 122             | 1,708         | -34             | 0,1125        | -40             | 0,421         | -159            | 1,30             | 11,8                    | 8,5         |
| 13,5                                                                  | 0,580         | 114             | 1,678         | -41             | 0,1138        | -43             | 0,419         | -166            | 1,32             | 11,7                    | 8,3         |
| 14,0                                                                  | 0,575         | 106             | 1,651         | -49             | 0,1149        | -47             | 0,417         | -172            | 1,34             | 11,6                    | 8,1         |
| 14,5                                                                  | 0,572         | 98              | 1,627         | -56             | 0,1161        | -51             | 0,413         | -178            | 1,36             | 11,5                    | 7,9         |
| 15,0                                                                  | 0,568         | 90              | 1,607         | -63             | 0,1180        | -55             | 0,410         | 176             | 1,37             | 11,3                    | 7,7         |
| 15,5                                                                  | 0,565         | 82              | 1,589         | -70             | 0,1198        | -59             | 0,408         | 170             | 1,37             | 11,2                    | 7,6         |
| 16,0                                                                  | 0,565         | 73              | 1,570         | -78             | 0,1219        | -64             | 0,404         | 164             | 1,37             | 11,1                    | 7,5         |
| 16,5                                                                  | 0,564         | 65              | 1,552         | -86             | 0,1242        | -69             | 0,402         | 157             | 1,36             | 11,0                    | 7,4         |
| 17,0                                                                  | 0,564         | 57              | 1,548         | -92             | 0,1266        | -74             | 0,398         | 152             | 1,35             | 10,9                    | 7,4         |
| 17,5                                                                  | 0,564         | 51              | 1,554         | -98             | 0,1292        | -78             | 0,396         | 147             | 1,32             | 10,8                    | 7,4         |
| 18,0                                                                  | 0,567         | 47              | 1,562         | -102            | 0,1319        | -81             | 0,394         | 143             | 1,28             | 10,7                    | 7,6         |

**Typical Common Source S-Parameters CFY25-20 (continued)**

| $V_{DS} = 3 \text{ V}, I_D = 30 \text{ mA}, Z_o = 50 \text{ } \Omega$ |       |       |       |       |        |       |       |       |         |                 |      |
|-----------------------------------------------------------------------|-------|-------|-------|-------|--------|-------|-------|-------|---------|-----------------|------|
| f                                                                     | S11   | <S11  | S21   | <S21  | S12    | <S12  | S22   | <S22  | k-Fact. | $S_{21}/S_{12}$ | MAG  |
| [GHz]                                                                 | [mag] | [ang] | [mag] | [ang] | [mag]  | [ang] | [mag] | [ang] | [mag]   | [dB]            | [dB] |
| 0,5                                                                   | 0,953 | -24   | 3,987 | 159   | 0,0140 | 74    | 0,657 | -15   | 0,49    | 24,5            |      |
| 1,0                                                                   | 0,921 | -30   | 3,858 | 153   | 0,0246 | 67    | 0,647 | -18   | 0,53    | 22,0            |      |
| 1,5                                                                   | 0,892 | -39   | 3,714 | 146   | 0,0346 | 60    | 0,634 | -23   | 0,56    | 20,3            |      |
| 2,0                                                                   | 0,861 | -49   | 3,583 | 138   | 0,0444 | 55    | 0,621 | -28   | 0,59    | 19,1            |      |
| 2,5                                                                   | 0,836 | -60   | 3,484 | 128   | 0,0543 | 49    | 0,608 | -35   | 0,58    | 18,1            |      |
| 3,0                                                                   | 0,814 | -72   | 3,374 | 118   | 0,0621 | 43    | 0,594 | -41   | 0,60    | 17,4            |      |
| 3,5                                                                   | 0,790 | -83   | 3,254 | 108   | 0,0684 | 38    | 0,576 | -47   | 0,63    | 16,8            |      |
| 4,0                                                                   | 0,768 | -94   | 3,129 | 99    | 0,0736 | 32    | 0,557 | -53   | 0,67    | 16,3            |      |
| 4,5                                                                   | 0,749 | -104  | 3,007 | 90    | 0,0779 | 27    | 0,541 | -59   | 0,70    | 15,9            |      |
| 5,0                                                                   | 0,731 | -114  | 2,890 | 82    | 0,0810 | 22    | 0,527 | -65   | 0,74    | 15,5            |      |
| 5,5                                                                   | 0,714 | -124  | 2,776 | 73    | 0,0844 | 18    | 0,515 | -72   | 0,78    | 15,2            |      |
| 6,0                                                                   | 0,699 | -133  | 2,662 | 65    | 0,0863 | 14    | 0,505 | -78   | 0,83    | 14,9            |      |
| 6,5                                                                   | 0,683 | -141  | 2,556 | 57    | 0,0880 | 10    | 0,498 | -84   | 0,88    | 14,6            |      |
| 7,0                                                                   | 0,669 | -149  | 2,458 | 50    | 0,0893 | 6     | 0,492 | -89   | 0,93    | 14,4            |      |
| 7,5                                                                   | 0,657 | -157  | 2,374 | 42    | 0,0904 | 3     | 0,486 | -94   | 0,98    | 14,2            |      |
| 8,0                                                                   | 0,645 | -165  | 2,299 | 35    | 0,0918 | 0     | 0,480 | -99   | 1,02    | 14,0            | 13,1 |
| 8,5                                                                   | 0,632 | -173  | 2,233 | 28    | 0,0933 | -2    | 0,474 | -103  | 1,07    | 13,8            | 12,2 |
| 9,0                                                                   | 0,620 | 179   | 2,174 | 21    | 0,0945 | -5    | 0,467 | -108  | 1,11    | 13,6            | 11,6 |
| 9,5                                                                   | 0,609 | 171   | 2,120 | 14    | 0,0960 | -8    | 0,459 | -112  | 1,15    | 13,4            | 11,1 |
| 10,0                                                                  | 0,600 | 163   | 2,071 | 7     | 0,0976 | -10   | 0,453 | -118  | 1,18    | 13,3            | 10,7 |
| 10,5                                                                  | 0,592 | 154   | 2,026 | 0     | 0,0990 | -13   | 0,446 | -123  | 1,21    | 13,1            | 10,4 |
| 11,0                                                                  | 0,586 | 146   | 1,984 | -7    | 0,1006 | -16   | 0,441 | -129  | 1,23    | 12,9            | 10,1 |
| 11,5                                                                  | 0,579 | 138   | 1,947 | -14   | 0,1026 | -19   | 0,436 | -136  | 1,24    | 12,8            | 9,8  |
| 12,0                                                                  | 0,574 | 130   | 1,910 | -21   | 0,1047 | -22   | 0,432 | -142  | 1,25    | 12,6            | 9,6  |
| 12,5                                                                  | 0,571 | 123   | 1,876 | -29   | 0,1066 | -25   | 0,428 | -149  | 1,26    | 12,5            | 9,4  |
| 13,0                                                                  | 0,566 | 115   | 1,842 | -36   | 0,1088 | -28   | 0,425 | -155  | 1,27    | 12,3            | 9,2  |
| 13,5                                                                  | 0,563 | 107   | 1,806 | -43   | 0,1108 | -32   | 0,424 | -161  | 1,28    | 12,1            | 9,0  |
| 14,0                                                                  | 0,561 | 99    | 1,774 | -50   | 0,1140 | -35   | 0,422 | -167  | 1,27    | 11,9            | 8,8  |
| 14,5                                                                  | 0,559 | 91    | 1,745 | -57   | 0,1170 | -39   | 0,421 | -173  | 1,26    | 11,7            | 8,7  |
| 15,0                                                                  | 0,556 | 83    | 1,719 | -64   | 0,1199 | -43   | 0,419 | -179  | 1,26    | 11,6            | 8,5  |
| 15,5                                                                  | 0,556 | 75    | 1,698 | -72   | 0,1229 | -48   | 0,417 | 175   | 1,24    | 11,4            | 8,4  |
| 16,0                                                                  | 0,556 | 66    | 1,676 | -79   | 0,1257 | -53   | 0,414 | 168   | 1,23    | 11,2            | 8,3  |
| 16,5                                                                  | 0,557 | 58    | 1,653 | -87   | 0,1286 | -58   | 0,412 | 162   | 1,23    | 11,1            | 8,2  |
| 17,0                                                                  | 0,559 | 50    | 1,646 | -93   | 0,1320 | -63   | 0,410 | 157   | 1,20    | 11,0            | 8,3  |
| 17,5                                                                  | 0,561 | 45    | 1,649 | -99   | 0,1350 | -67   | 0,409 | 152   | 1,16    | 10,9            | 8,4  |
| 18,0                                                                  | 0,565 | 40    | 1,656 | -103  | 0,1376 | -71   | 0,407 | 148   | 1,13    | 10,8            | 8,6  |

**Order Instructions:**

Full type variant including quality level must be specified by the orderer. For *HiRel* Discrete and Microwave Semiconductors the ordering code specifies device family and quality level only.

Ordering Form:

Ordering Code: Q.....  
CFY25- (nnl) (ql)  
(nnl): Noise/Gain/Power Level  
(ql): Quality Level

Ordering Example:

Ordering Code: Q62703F119  
CFY25-20P  
For CFY25, Noise/Gain/Power Level 20P:  
NF < 2.1dB,  $G_a > 8.5$  dB,  $P_{1dB} > 14$  dBm @ 12 GHz  
in ESA Space Quality Level

**Further Informations:**

See our WWW-Pages:

- Discrete and RF-Semiconductors (Small Signal Semiconductors)

[www.siemens.de/semiconductor/products/35/35.htm](http://www.siemens.de/semiconductor/products/35/35.htm)

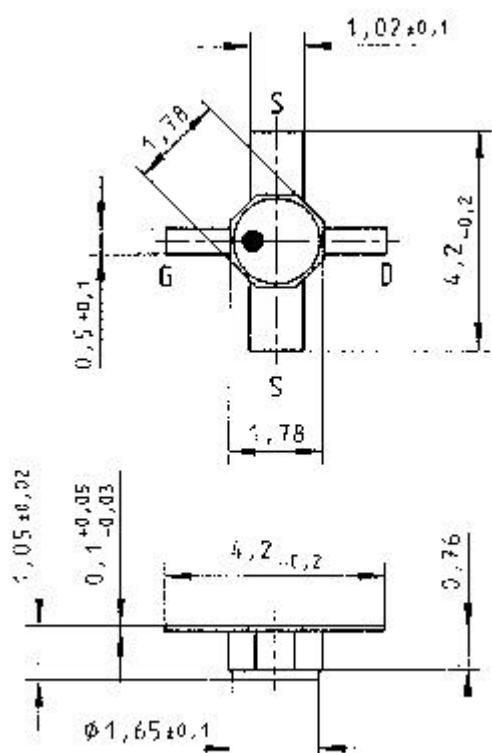
- *HiRel* Discrete and Microwave Semiconductors

[www.siemens.de/semiconductor/products/35/353.htm](http://www.siemens.de/semiconductor/products/35/353.htm)

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## Micro-X Package



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