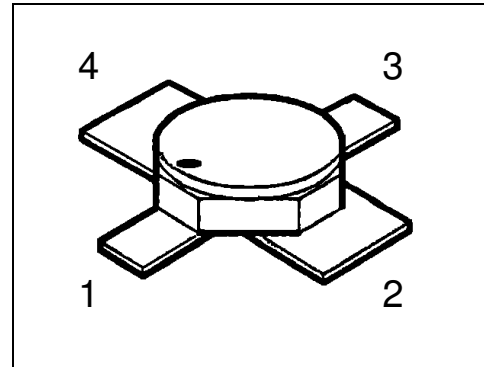


## HiRel K-Band GaAs Super Low Noise HEMT

- **HiRel Discrete and Microwave Semiconductor**

- Pseudo-morphic AlGaAs/InGaAs/GaAs HEMT
- For professional super low-noise amplifiers
- For frequencies from 500 MHz to > 20 GHz
- Hermetically sealed microwave package
- Super low noise figure, high associated gain



-  **ESA Space Qualified**

ESA/SCC Detail Spec. No.: 5613/004,  
Type Variant No.s 01 to 04, 05 foreseen (tbc.)

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

| Type           | Marking | Ordering Code | Pin Configuration |   |   |   | Package |
|----------------|---------|---------------|-------------------|---|---|---|---------|
|                |         |               | 1                 | 2 | 3 | 4 |         |
| CFY67-08 (ql)  | -       | see below     | G                 | S | D | S | Micro-X |
| CFY67-08P (ql) |         |               |                   |   |   |   |         |
| CFY67-10 (ql)  |         |               |                   |   |   |   |         |
| CFY67-10P (ql) |         |               |                   |   |   |   |         |

CFY67-nnl: specifies gain and output power levels (see electrical characteristics)

(ql) Quality Level:    P: Professional Quality  
                               H: High Rel Quality  
                               S: Space Quality  
                               ES: ESA Space Quality

(see order instructions for ordering example)

**Maximum Ratings**

| Parameter                                   | Symbol      | Values        | Unit |
|---------------------------------------------|-------------|---------------|------|
| Drain-source voltage                        | $V_{DS}$    | 3.5           | V    |
| Drain-gate voltage                          | $V_{DG}$    | 4.5           | V    |
| Gate-source voltage (reverse / forward)     | $V_{GS}$    | - 3... + 0.5  | V    |
| Drain current                               | $I_D$       | 60            | mA   |
| Gate forward current                        | $I_G$       | 2             | mA   |
| RF Input Power, C- and X-Band <sup>1)</sup> | $P_{RF,in}$ | + 10          | dBm  |
| Junction temperature                        | $T_J$       | 150           | °C   |
| Storage temperature range                   | $T_{stg}$   | - 65... + 150 | °C   |
| Total power dissipation <sup>2)</sup>       | $P_{tot}$   | 200           | mW   |
| Soldering temperature <sup>3)</sup>         | $T_{sol}$   | 230           | °C   |

**Thermal Resistance**

|                          |             |              |     |
|--------------------------|-------------|--------------|-----|
| Junction-soldering point | $R_{th JS}$ | ≤ 515 (tbc.) | K/W |
|--------------------------|-------------|--------------|-----|

**Notes.:**

- 1) For  $V_{DS} \leq 2$  V. For  $V_{DS} > 2$  V, derating is required.
- 2) At  $T_S = + 47$  °C. For  $T_S > + 47$  °C derating is required.
- 3) During 15 sec. maximum. The same terminal shall not be resoldered until 3 minutes have elapsed.

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

| Parameter                                                                             | Symbol             | Values |       |      | Unit          |
|---------------------------------------------------------------------------------------|--------------------|--------|-------|------|---------------|
|                                                                                       |                    | min.   | typ.  | max. |               |
| DC Characteristics                                                                    |                    |        |       |      |               |
| Drain-source saturation current<br>$V_{DS} = 2\text{ V}$ , $V_{GS} = 0\text{ V}$      | $I_{DSS}$          | 15     | 30    | 60   | mA            |
| Gate threshold voltage<br>$V_{DS} = 2\text{ V}$ , $I_D = 1\text{ mA}$                 | $-V_{Gth}$         | 0.2    | 0.7   | 2.0  | V             |
| Drain current at pinch-off<br>$V_{DS} = 1.5\text{ V}$ , $V_{GS} = -3\text{ V}$        | $I_{Dp}$           | -      | < 50  | -    | $\mu\text{A}$ |
| Gate leakage current at pinch-off<br>$V_{DS} = 1.5\text{ V}$ , $V_{GS} = -3\text{ V}$ | $-I_{Gp}$          | -      | < 50  | 200  | $\mu\text{A}$ |
| Transconductance<br>$V_{DS} = 2\text{ V}$ , $I_D = 15\text{ mA}$                      | $g_{m15}$          | 50     | 65    | -    | mS            |
| Gate leakage current at operation<br>$V_{DS} = 2\text{ V}$ , $I_D = 15\text{ mA}$     | $-I_{G15}$         | -      | < 0.5 | 2    | $\mu\text{A}$ |
| Thermal resistance<br>junction to soldering point                                     | $R_{th\text{ JS}}$ | -      | 450   | -    | K/W           |

**Electrical Characteristics** (continued)

| Parameter                                                                                                                                            | Symbol           | Values       |              |            | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------|--------------|------------|------|
|                                                                                                                                                      |                  | min.         | typ.         | max.       |      |
| AC Characteristics                                                                                                                                   |                  |              |              |            |      |
| Noise figure <sup>1)</sup><br>V <sub>DS</sub> = 2 V, I <sub>D</sub> = 15 mA, f = 12 GHz<br>CFY67-08, -08P<br>CFY67-10, 10P                           | NF               | -<br>-       | 0.7<br>0.9   | 0.8<br>1.0 | dB   |
| Associated gain. <sup>1)</sup><br>V <sub>DS</sub> = 2 V, I <sub>D</sub> = 15 mA, f = 12 GHz<br>CFY67-08, -08P<br>CFY67-10, 10P                       | G <sub>a</sub>   | 11.0<br>10.5 | 11.5<br>11.0 | -<br>-     | dB   |
| Output power at 1 dB gain compression <sup>2)</sup><br>V <sub>DS</sub> = 2 V, I <sub>D</sub> = 20 mA, f = 12 GHz<br>CFY67-08, -10<br>CFY67-08P, -10P | P <sub>1dB</sub> | -<br>10.0    | 11.0<br>11.0 | -<br>-     | dBm  |

**Notes.:**

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

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

**Typical Common Source S-Parameters**

| CFY67-08: $V_{DS} = 2\text{ V}$ , $I_D = 15\text{ mA}$ , $Z_o = 50\ \Omega$ |               |                 |               |                 |               |                 |               |                 |                  |                         |             |
|-----------------------------------------------------------------------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|------------------|-------------------------|-------------|
| 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                                                                         | 0,963         | -15             | 5,315         | 165             | 0,0111        | 74              | 0,655         | -14             | 0,40             | 26,8                    |             |
| 1,0                                                                         | 0,938         | -23             | 5,182         | 159             | 0,0225        | 68              | 0,639         | -18             | 0,39             | 23,6                    |             |
| 1,5                                                                         | 0,913         | -33             | 5,060         | 150             | 0,0317        | 62              | 0,625         | -23             | 0,42             | 22,0                    |             |
| 2,0                                                                         | 0,889         | -42             | 4,940         | 142             | 0,0411        | 57              | 0,611         | -28             | 0,43             | 20,8                    |             |
| 2,5                                                                         | 0,865         | -52             | 4,824         | 133             | 0,0509        | 53              | 0,596         | -35             | 0,43             | 19,8                    |             |
| 3,0                                                                         | 0,844         | -62             | 4,715         | 124             | 0,0585        | 46              | 0,582         | -41             | 0,45             | 19,1                    |             |
| 3,5                                                                         | 0,823         | -72             | 4,591         | 115             | 0,0650        | 41              | 0,567         | -47             | 0,47             | 18,5                    |             |
| 4,0                                                                         | 0,800         | -81             | 4,450         | 107             | 0,0714        | 36              | 0,552         | -53             | 0,50             | 17,9                    |             |
| 4,5                                                                         | 0,779         | -91             | 4,319         | 99              | 0,0768        | 31              | 0,534         | -60             | 0,52             | 17,5                    |             |
| 5,0                                                                         | 0,761         | -100            | 4,183         | 91              | 0,0811        | 25              | 0,520         | -66             | 0,54             | 17,1                    |             |
| 5,5                                                                         | 0,743         | -109            | 4,043         | 83              | 0,0850        | 20              | 0,500         | -72             | 0,58             | 16,8                    |             |
| 6,0                                                                         | 0,725         | -117            | 3,906         | 75              | 0,0885        | 15              | 0,490         | -77             | 0,60             | 16,4                    |             |
| 6,5                                                                         | 0,708         | -125            | 3,769         | 68              | 0,0917        | 11              | 0,477         | -83             | 0,63             | 16,1                    |             |
| 7,0                                                                         | 0,690         | -132            | 3,640         | 61              | 0,0942        | 7               | 0,467         | -88             | 0,67             | 15,9                    |             |
| 7,5                                                                         | 0,673         | -139            | 3,529         | 54              | 0,0962        | 3               | 0,455         | -93             | 0,71             | 15,6                    |             |
| 8,0                                                                         | 0,656         | -146            | 3,427         | 48              | 0,0978        | -1              | 0,442         | -97             | 0,76             | 15,4                    |             |
| 8,5                                                                         | 0,640         | -153            | 3,344         | 41              | 0,0998        | -5              | 0,430         | -101            | 0,79             | 15,3                    |             |
| 9,0                                                                         | 0,625         | -160            | 3,271         | 34              | 0,1010        | -9              | 0,417         | -104            | 0,84             | 15,1                    |             |
| 9,5                                                                         | 0,611         | -168            | 3,202         | 28              | 0,1027        | -12             | 0,406         | -108            | 0,87             | 14,9                    |             |
| 10,0                                                                        | 0,597         | -175            | 3,143         | 21              | 0,1033        | -16             | 0,393         | -113            | 0,91             | 14,8                    |             |
| 10,5                                                                        | 0,586         | 177             | 3,089         | 15              | 0,1044        | -20             | 0,381         | -118            | 0,94             | 14,7                    |             |
| 11,0                                                                        | 0,576         | 169             | 3,041         | 8               | 0,1056        | -24             | 0,370         | -123            | 0,96             | 14,6                    |             |
| 11,5                                                                        | 0,564         | 161             | 3,002         | 1               | 0,1068        | -28             | 0,358         | -129            | 0,98             | 14,5                    |             |
| 12,0                                                                        | 0,554         | 154             | 2,960         | -5              | 0,1070        | -32             | 0,351         | -134            | 1,01             | 14,4                    | 13,8        |
| 12,5                                                                        | 0,547         | 146             | 2,923         | -12             | 0,1076        | -36             | 0,343         | -140            | 1,03             | 14,3                    | 13,3        |
| 13,0                                                                        | 0,536         | 139             | 2,886         | -19             | 0,1076        | -41             | 0,336         | -146            | 1,06             | 14,3                    | 12,7        |
| 13,5                                                                        | 0,529         | 131             | 2,848         | -26             | 0,1081        | -45             | 0,330         | -151            | 1,09             | 14,2                    | 12,4        |
| 14,0                                                                        | 0,522         | 124             | 2,815         | -33             | 0,1087        | -50             | 0,325         | -156            | 1,11             | 14,1                    | 12,1        |
| 14,5                                                                        | 0,517         | 116             | 2,787         | -40             | 0,1087        | -55             | 0,320         | -161            | 1,13             | 14,1                    | 11,9        |
| 15,0                                                                        | 0,510         | 108             | 2,765         | -46             | 0,1093        | -60             | 0,315         | -167            | 1,14             | 14,0                    | 11,7        |
| 15,5                                                                        | 0,505         | 99              | 2,751         | -54             | 0,1090        | -65             | 0,311         | -172            | 1,16             | 14,0                    | 11,6        |
| 16,0                                                                        | 0,502         | 91              | 2,735         | -61             | 0,1090        | -71             | 0,305         | -177            | 1,18             | 14,0                    | 11,4        |
| 16,5                                                                        | 0,499         | 82              | 2,719         | -68             | 0,1091        | -77             | 0,301         | 177             | 1,19             | 14,0                    | 11,3        |
| 17,0                                                                        | 0,498         | 74              | 2,722         | -75             | 0,1097        | -82             | 0,297         | 172             | 1,19             | 13,9                    | 11,3        |
| 17,5                                                                        | 0,498         | 68              | 2,741         | -80             | 0,1103        | -87             | 0,294         | 168             | 1,18             | 14,0                    | 11,4        |
| 18,0                                                                        | 0,498         | 62              | 2,760         | -84             | 0,1107        | -90             | 0,290         | 165             | 1,17             | 14,0                    | 11,5        |

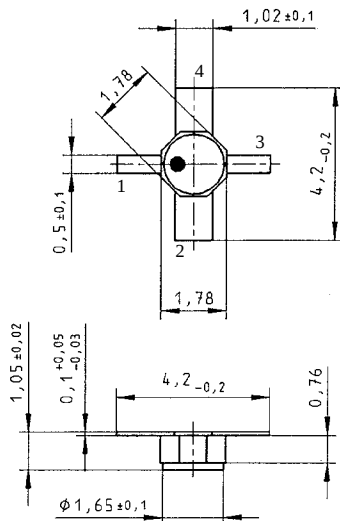
**Typical Common Source S-Parameters** (continued)

| CFY67-06: $V_{DS} = 2\text{ V}$ , $I_D = 15\text{ mA}$ , $Z_o = 50\ \Omega$ |       |       |       |       |        |       |       |       |         |                 |      |
|-----------------------------------------------------------------------------|-------|-------|-------|-------|--------|-------|-------|-------|---------|-----------------|------|
| 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                                                                         | 0,962 | -13   | 6,112 | 166   | 0,0111 | 76    | 0,539 | -15   | 0,42    | 27,4            |      |
| 1,0                                                                         | 0,937 | -22   | 5,956 | 159   | 0,0211 | 69    | 0,525 | -19   | 0,42    | 24,5            |      |
| 1,5                                                                         | 0,913 | -33   | 5,810 | 150   | 0,0302 | 64    | 0,511 | -24   | 0,44    | 22,8            |      |
| 2,0                                                                         | 0,889 | -41   | 5,690 | 142   | 0,0394 | 58    | 0,498 | -30   | 0,46    | 21,6            |      |
| 2,5                                                                         | 0,860 | -51   | 5,522 | 133   | 0,0484 | 53    | 0,484 | -36   | 0,48    | 20,6            |      |
| 3,0                                                                         | 0,834 | -61   | 5,386 | 124   | 0,0567 | 48    | 0,469 | -43   | 0,50    | 19,8            |      |
| 3,5                                                                         | 0,810 | -71   | 5,236 | 116   | 0,0637 | 43    | 0,456 | -49   | 0,52    | 19,1            |      |
| 4,0                                                                         | 0,784 | -80   | 5,067 | 107   | 0,0702 | 38    | 0,440 | -55   | 0,55    | 18,6            |      |
| 4,5                                                                         | 0,761 | -90   | 4,911 | 99    | 0,0760 | 33    | 0,423 | -61   | 0,58    | 18,1            |      |
| 5,0                                                                         | 0,740 | -99   | 4,752 | 91    | 0,0809 | 28    | 0,410 | -67   | 0,60    | 17,7            |      |
| 5,5                                                                         | 0,720 | -107  | 4,586 | 84    | 0,0851 | 24    | 0,397 | -73   | 0,63    | 17,3            |      |
| 6,0                                                                         | 0,701 | -116  | 4,420 | 76    | 0,0889 | 19    | 0,385 | -79   | 0,66    | 17,0            |      |
| 6,5                                                                         | 0,682 | -124  | 4,260 | 69    | 0,0918 | 15    | 0,373 | -84   | 0,69    | 16,7            |      |
| 7,0                                                                         | 0,663 | -131  | 4,107 | 62    | 0,0941 | 11    | 0,362 | -89   | 0,73    | 16,4            |      |
| 7,5                                                                         | 0,644 | -139  | 3,974 | 55    | 0,0962 | 7     | 0,351 | -93   | 0,77    | 16,2            |      |
| 8,0                                                                         | 0,627 | -148  | 3,852 | 49    | 0,0980 | 3     | 0,343 | -98   | 0,80    | 15,9            |      |
| 8,5                                                                         | 0,611 | -157  | 3,747 | 42    | 0,0995 | -1    | 0,333 | -102  | 0,83    | 15,8            |      |
| 9,0                                                                         | 0,595 | -165  | 3,659 | 35    | 0,1008 | -5    | 0,323 | -107  | 0,86    | 15,6            |      |
| 9,5                                                                         | 0,581 | -173  | 3,571 | 29    | 0,1022 | -9    | 0,313 | -112  | 0,90    | 15,4            |      |
| 10,0                                                                        | 0,567 | 178   | 3,497 | 22    | 0,1039 | -13   | 0,303 | -116  | 0,92    | 15,3            |      |
| 10,5                                                                        | 0,556 | 170   | 3,430 | 16    | 0,1049 | -17   | 0,293 | -121  | 0,95    | 15,1            |      |
| 11,0                                                                        | 0,546 | 163   | 3,368 | 9     | 0,1064 | -21   | 0,284 | -127  | 0,98    | 15,0            |      |
| 11,5                                                                        | 0,537 | 155   | 3,317 | 3     | 0,1078 | -26   | 0,274 | -131  | 1,00    | 14,9            |      |
| 12,0                                                                        | 0,528 | 149   | 3,265 | -4    | 0,1093 | -30   | 0,265 | -135  | 1,02    | 14,8            | 13,8 |
| 12,5                                                                        | 0,520 | 142   | 3,216 | -10   | 0,1105 | -35   | 0,255 | -139  | 1,05    | 14,6            | 13,3 |
| 13,0                                                                        | 0,513 | 135   | 3,169 | -17   | 0,1116 | -39   | 0,246 | -143  | 1,07    | 14,5            | 12,9 |
| 13,5                                                                        | 0,506 | 128   | 3,120 | -24   | 0,1126 | -44   | 0,235 | -146  | 1,10    | 14,4            | 12,5 |
| 14,0                                                                        | 0,498 | 121   | 3,080 | -30   | 0,1137 | -49   | 0,225 | -150  | 1,12    | 14,3            | 12,2 |
| 14,5                                                                        | 0,492 | 113   | 3,044 | -37   | 0,1151 | -54   | 0,215 | -155  | 1,14    | 14,2            | 12,0 |
| 15,0                                                                        | 0,489 | 106   | 3,014 | -44   | 0,1160 | -59   | 0,207 | -159  | 1,15    | 14,1            | 11,8 |
| 15,5                                                                        | 0,484 | 98    | 2,990 | -51   | 0,1171 | -65   | 0,200 | -163  | 1,16    | 14,1            | 11,6 |
| 16,0                                                                        | 0,485 | 91    | 2,967 | -58   | 0,1185 | -71   | 0,193 | -167  | 1,17    | 14,0            | 11,5 |
| 16,5                                                                        | 0,485 | 83    | 2,945 | -65   | 0,1197 | -77   | 0,187 | -171  | 1,17    | 13,9            | 11,4 |
| 17,0                                                                        | 0,485 | 75    | 2,947 | -71   | 0,1206 | -82   | 0,182 | -175  | 1,17    | 13,9            | 11,4 |
| 17,5                                                                        | 0,487 | 69    | 2,961 | -77   | 0,1215 | -87   | 0,177 | -178  | 1,16    | 13,9            | 11,5 |
| 18,0                                                                        | 0,490 | 64    | 2,979 | -81   | 0,1230 | -90   | 0,174 | 179   | 1,14    | 13,8            | 11,6 |

## Typical Common Source Noise-Parameters

| CFY67-08: $V_{DS} = 2 \text{ V}$ , $I_D = 15 \text{ mA}$ , $Z_o = 50 \text{ } \Omega$ |                    |                       |                             |                       |
|---------------------------------------------------------------------------------------|--------------------|-----------------------|-----------------------------|-----------------------|
| f<br>[GHz]                                                                            | $NF_{min}$<br>[dB] | $ S_{opt} $<br>[magn] | $\angle S_{opt}$<br>[angle] | $R_n$<br>[ $\Omega$ ] |
| 1                                                                                     | 0,29               | 0,756                 | 14                          | 15,60                 |
| 2                                                                                     | 0,30               | 0,690                 | 28                          | 14,65                 |
| 3                                                                                     | 0,34               | 0,643                 | 43                          | 13,56                 |
| 4                                                                                     | 0,38               | 0,606                 | 58                          | 12,10                 |
| 5                                                                                     | 0,41               | 0,578                 | 73                          | 10,53                 |
| 6                                                                                     | 0,46               | 0,553                 | 87                          | 8,86                  |
| 7                                                                                     | 0,50               | 0,534                 | 102                         | 7,16                  |
| 8                                                                                     | 0,55               | 0,518                 | 116                         | 5,62                  |
| 9                                                                                     | 0,60               | 0,505                 | 131                         | 4,29                  |
| 10                                                                                    | 0,64               | 0,495                 | 145                         | 3,23                  |
| 11                                                                                    | 0,69               | 0,486                 | 159                         | 2,53                  |
| 12                                                                                    | 0,73               | 0,476                 | 173                         | 2,22                  |
| 13                                                                                    | 0,78               | 0,467                 | -173                        | 2,37                  |
| 14                                                                                    | 0,84               | 0,455                 | -160                        | 2,96                  |
| 15                                                                                    | 0,88               | 0,443                 | -146                        | 4,01                  |
| 16                                                                                    | 0,93               | 0,428                 | -132                        | 5,47                  |
| 17                                                                                    | 0,99               | 0,412                 | -118                        | 7,26                  |
| 18                                                                                    | 1,05               | 0,394                 | -103                        | 9,61                  |

## Micro-X Package



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