

DUAL N-CHANNEL FETS

Dual symmetrical n-channel silicon planar epitaxial junction field-effect transistors in a TO-71 metal envelope, with electrically insulated gates and a common substrate connected to the envelope; intended for high performance low level differential amplifiers.

QUICK REFERENCE DATA

Characteristics measured at $T_{amb} = 25^{\circ}\text{C}$; $I_D = 200\ \mu\text{A}$; $V_{DG} = 15\ \text{V}$

		BFQ10	11	12	13	14	15	16	
Difference in gate current	$ \Delta I_G $	< 10	10	10	10	10	10	10	pA
Gate-source voltage difference	$ \Delta V_{GS} $	< 5	10	10	10	15	20	50	mV
Thermal drift of gate-source voltage difference	$\left \frac{d\Delta V_{GS}}{dT} \right $	< 5	5	10	20	20	40	50	$\mu\text{V/K}$
Transfer conductance ratio	$\frac{g1}{g2}$	> 0.98	0.98	0.98	0.98	0.98	0.95	0.95	
	$\frac{g2}{g1}$	< 1.02	1.02	1.02	1.02	1.02	1.05	1.05	
Difference in transfer impedance	$\left \Delta \frac{1}{g_{fs}} \right $	< 6	6	12	12	12	20	30	Ω
Difference in penetration factor	$\left \Delta \frac{g_{os}}{g_{fs}} \right $	< 18	30	40	50	60	70	100	$\mu\text{V/V}$
Common mode rejection ratio	CMRR	> 95	90	85	85	80	80	80	dB

MECHANICAL DATA

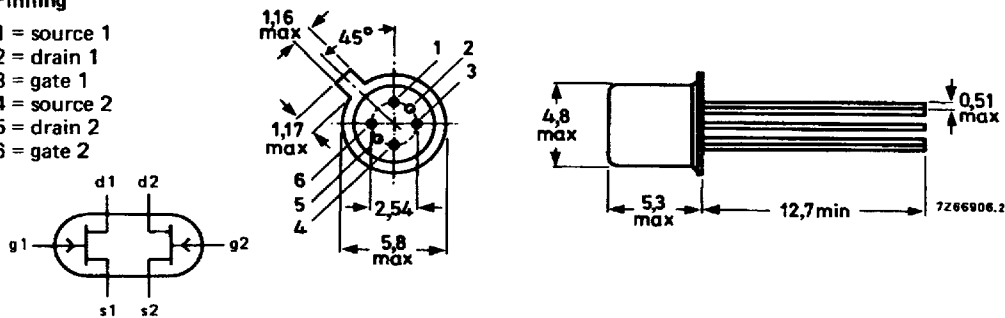
Dimensions in mm

Fig. 1 TO-71.

All leads insulated from the case.

Pinning

- 1 = source 1
- 2 = drain 1
- 3 = gate 1
- 4 = source 2
- 5 = drain 2
- 6 = gate 2



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	$\pm V_{DS}$	max.	30 V
Drain-gate voltage (open source)	V_{DGO}	max.	30 V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	30 V
Voltage between gate 1 and gate 2	$\pm V_{1G-2G}$	max.	40 V
Drain current	I_D	max.	30 mA
Gate current	I_G	max.	10 mA
Total power dissipation up to $T_{amb} = 75\text{ }^{\circ}\text{C}$	P_{tot}	max.	250 mW
Storage temperature range	T_{stg}		-65 to + 200 $^{\circ}\text{C}$
Junction temperature	T_j	max.	200 $^{\circ}\text{C}$

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	500 K/W
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CHARACTERISTICS (total device) $T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specifiedMeasured at: $I_D = 200\text{ }\mu\text{A}$; $V_{DG} = 15\text{ V}$ except for drain current ratio.

		BFQ10	11	12	13	14	15	16
Drain current ratio (note 1) $V_{DG} = 15\text{ V}$; $V_{GS} = 0$	$I_{1D-1SS} > 0.97$	0.95	0.95	0.95	0.92	0.90	0.80	
	$I_{2D-2SS} < 1.03$	1.05	1.05	1.05	1.08	1.10	1.20	
Difference in gate current	$ \Delta I_G < 10$	10	10	10	10	10	10	pA
Gate-source voltage difference	$ \Delta V_{GS} < 5$	10	10	10	15	20	50	mV
Thermal drift of gate-source voltage difference	$\left \frac{d\Delta V_{GS}}{dT} \right < 5$	5	10	20	20	40	50	$\mu\text{V/K}$
Transfer conductance ratio	$\frac{g_{1fs}}{g_{2fs}} > 0.98$	0.98	0.98	0.98	0.98	0.95	0.95	
	$\frac{g_{1fs}}{g_{2fs}} < 1.02$	1.02	1.02	1.02	1.02	1.05	1.05	
Difference in transfer impedance (note 2)	$\left \Delta \frac{1}{g_{fs}} \right < 6$	6	12	12	12	20	30	Ω
Difference in penetration factor (note 3)	$\left \Delta \frac{g_{os}}{g_{fs}} \right < 18$	30	40	50	60	70	100	$\mu\text{V/V}$
Common mode rejection ratio (note 4)	CMRR > 95	90	85	85	80	80	80	dB

Notes

- Measured under pulse conditions.
- The difference in transfer impedance is equal to the ratio of the change of the gate-source voltage difference to the change of drain current, at constant drain-gate voltage.

$$\left(\Delta \frac{1}{g_{fs}} = \frac{d\Delta V_{GS}}{dI_D} \text{ at } V_{DG} = \text{constant} \right).$$
- The difference in penetration factor is equal to the ratio of the change of the gate-source voltage difference to the change of drain-gate voltage, at constant drain current.

$$\left(\Delta \frac{g_{os}}{g_{fs}} = \frac{d\Delta V_{GS}}{dV_{DG}} \text{ at } I_D = \text{constant} \right).$$

- Common mode rejection ratio:

$$\text{CMRR (in dB)} = -20 \log \left| \Delta \frac{g_{os}}{g_{fs}} \right|.$$

CHARACTERISTICS (Individual transistor) $T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

Gate cut-off current

 $-V_{GS} = 20\text{ V}; V_{DS} = 0$ $-I_{GSS} < 100\text{ pA}$ $-V_{GS} = 20\text{ V}; V_{DS} = 0; T_{amb} = 125\text{ }^{\circ}\text{C}$ $-I_{GSS} < 20\text{ nA}$

Gate current

 $I_D = 200\text{ }\mu\text{A}; V_{DG} = 15\text{ V}; T_{amb} = 125\text{ }^{\circ}\text{C}$ $I_G < 10\text{ nA}$

Drain current (note 1)

 $V_{DS} = 15\text{ V}; V_{GS} = 0$ $I_{DSS} \quad 0.5\text{ to }10\text{ mA}$

Gate-source voltage

 $I_D = 200\text{ }\mu\text{A}; V_{DG} = 15\text{ V}$ $-V_{GS} < 2.7\text{ V}$

Gate-source cut-off voltage

 $I_D = 1\text{ nA}; V_{DG} = 15\text{ V}$ $-V_{(P)GS} \quad 0.5\text{ to }3.5\text{ V}$ Transfer conductance at $f = 1\text{ kHz}$ $I_D = 200\text{ }\mu\text{A}; V_{DG} = 15\text{ V}$ $g_{fs} > 1.0\text{ mS}$ Output conductance at $f = 1\text{ kHz}$ $I_D = 200\text{ }\mu\text{A}; V_{DG} = 15\text{ V}$ $g_{os} < 5\text{ }\mu\text{S}$ Input capacitance at $f = 1\text{ MHz}$ (note 2) $I_D = 200\text{ }\mu\text{A}; V_{DG} = 15\text{ V}$ $C_{is} < 8\text{ pF}$ Feedback capacitance at $f = 1\text{ MHz}$ (note 2) $I_D = 200\text{ }\mu\text{A}; V_{DG} = 15\text{ V}$ $C_{rs} < 1.0\text{ pF}$

Equivalent noise voltage

 $I_D = 200\text{ }\mu\text{A}; V_{DS} = 15\text{ V};$ $B = 0.6\text{ to }100\text{ Hz}$ $V_n < 0.5\text{ }\mu\text{V}$ **Notes**

1. Measured under pulse conditions.
2. Measured with case grounded.

