3SK296

Silicon N-Channel Dual Gate MOS FET

HITACHI

ADE-208-388
1st. Edition

Application

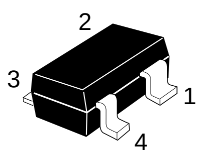
UHF RF amplifier

Features

- Low noise figure.
  NF = 2.0 dB Typ. at f = 900 MHz
- Capable of low voltage operation

Outline

CMPAK–4



1. Source
2. Gate1
3. Gate2
4. Drain

Absolute Maximum Ratings (Ta = 25°C)

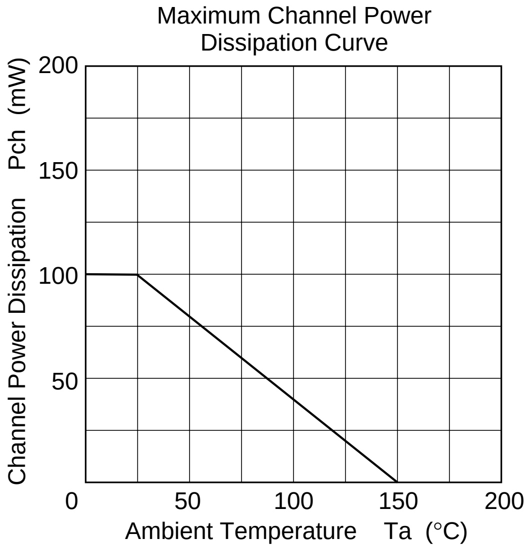
Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DS}	12	V
Gate 1 to source voltage	V_{G1S}	±8	V
Gate 2 to source voltage	V_{G2S}	±8	V
Drain current	I_D	25	mA
Channel power dissipation	Pch	100	mW
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

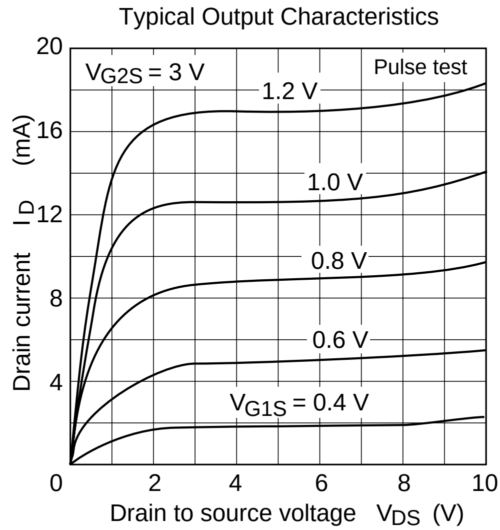
Attention: This device is very sensitive to electro static discharge.
It is recommended to adopt appropriate cautions when handling this transistor.

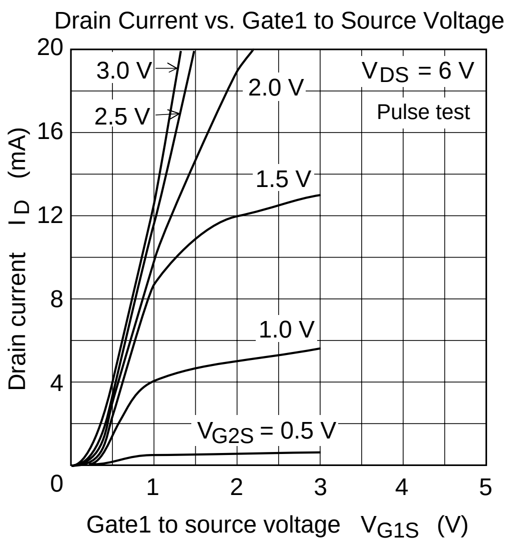
Electrical Characteristics (Ta = 25°C)

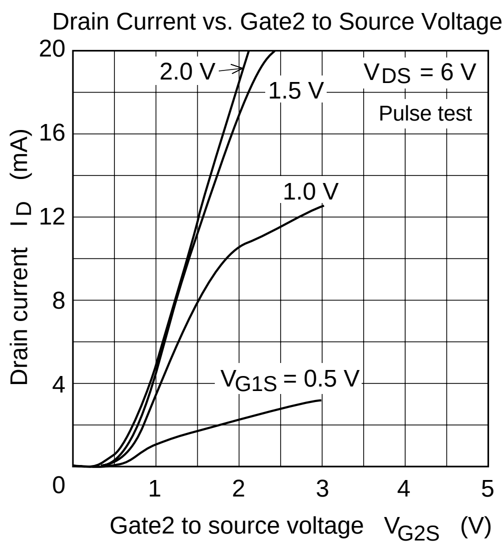
Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSX}$	12	—	—	V	I_D = 200 µA , V_{G1S} = –3 V, V_{G2S} = –3 V
Gate 1 to source breakdown voltage	$V_{(BR)G1SS}$	±8	—	—	V	I_{G1} = ±10 µA, V_{G2S} = V_{DS} = 0
Gate 2 to source breakdown voltage	$V_{(BR) G2SS}$	±8	—	—	V	I_{G2} = ±10 µA, V_{G1S} = V_{DS} = 0
Gate 1 cutoff current	I_{G1SS}	—	—	±100	nA	V_{G1S} = ±6 V, V_{G2S} = V_{DS} = 0
Gate 2 cutoff current	I_{G2SS}	—	—	±100	nA	V_{G2S} = ±6 V, V_{G1S} = V_{DS} = 0
Drain current	$I_{DS(on)}$	0.5	—	10	mA	V_{DS} = 6 V, V_{G1S} = 0.5V, V_{G2S} = 3 V
Gate 1 to source cutoff voltage	$V_{G1S(off)}$	–0.5	—	+0.5	V	V_{DS} = 10 V, V_{G2S} = 3V, I_D = 100 µA
Gate 2 to source cutoff voltage	$V_{G2S(off)}$	0	—	+1.0	V	V_{DS} = 10 V, V_{G1S} = 3V, I_D = 100 µA
Forward transfer admittance	$\|y_{fs}\|$	16	20.8	—	mS	V_{DS} = 6 V, V_{G2S} = 3V, I_D = 10 mA, f = 1 kHz
Input capacitance	Ciss	1.2	1.5	2.2	pF	V_{DS} = 6 V, V_{G2S} = 3V, I_D = 10 mA, f = 1 MHz
Output capacitance	Coss	0.6	0.9	1.2	pF	
Reverse transfer capacitance	Crss	—	0.01	0.03	pF	
Power gain	PG	16	19.5	—	dB	V_{DS} = 4 V, V_{G2S} = 3V, I_D = 10 mA, f = 900 MHz
Noise figure	NF	—	2.0	3	dB	

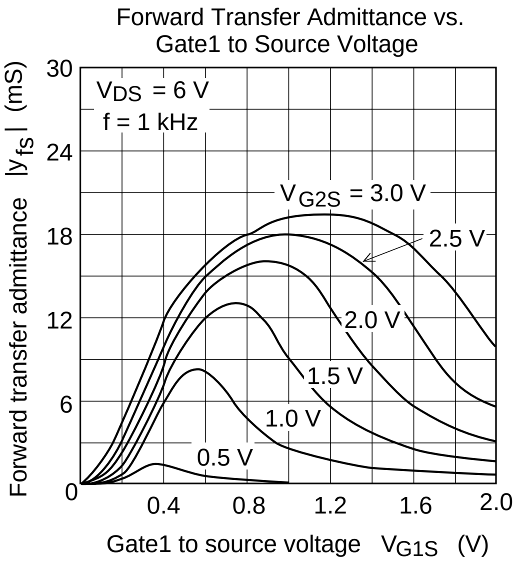
Note: Marking is “ZQ–”

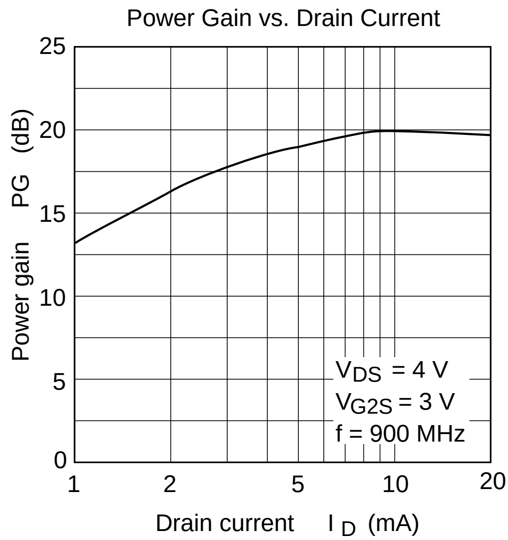

Maximum Channel Power
Dissipation Curve
Channel Power Dissipation Pch (mW)
200
150
100
50
0
50
100
150
200
Ambient Temperature Ta (°C)

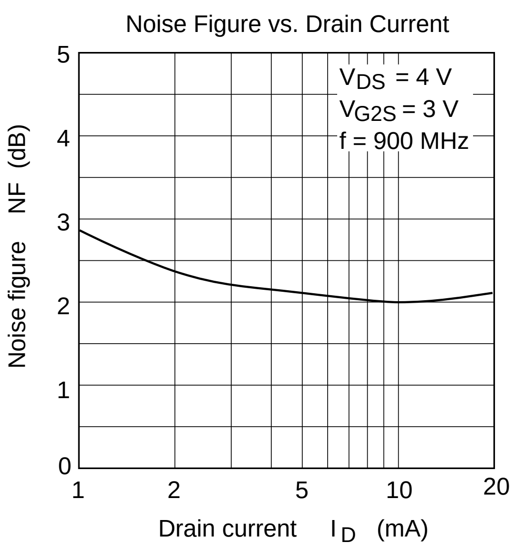

Typical Output Characteristics
VG2S = 3 V
Pulse test
1.2 V
1.0 V
0.8 V
0.6 V
VG1S = 0.4 V
Drain current ID (mA)
20
16
12
8
4
0
2
4
6
8
10
Drain to source voltage VDS (V)

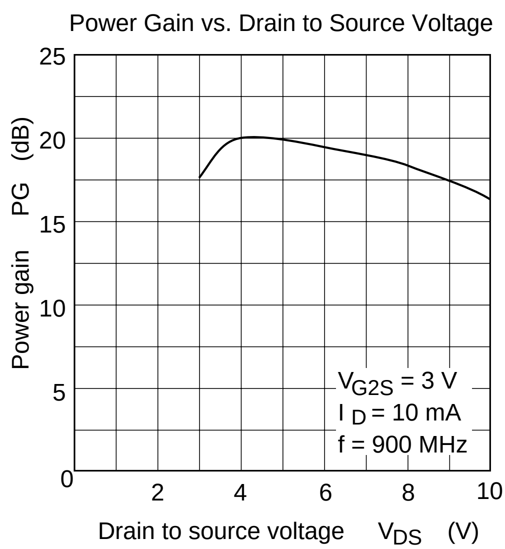

Drain Current vs. Gate1 to Source Voltage
3.0 V
2.5 V
2.0 V
1.5 V
1.0 V
VG2S = 0.5 V
VDS = 6 V
Pulse test
Drain current ID (mA)
20
16
12
8
4
0
1
2
3
4
5
Gate1 to source voltage VG1S (V)

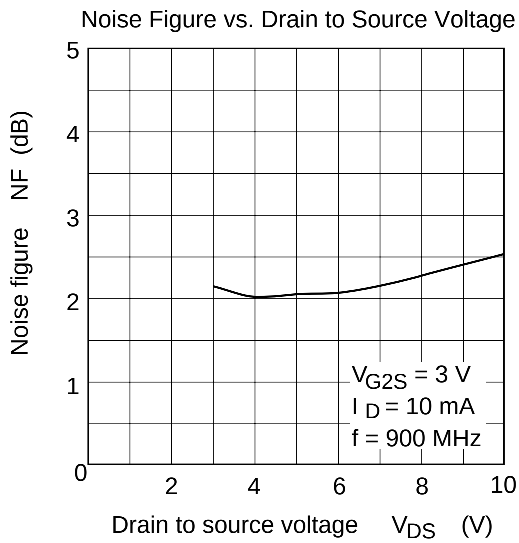

Drain Current vs. Gate2 to Source Voltage
2.0 V
1.5 V
1.0 V
VG1S = 0.5 V
VDS = 6 V
Pulse test
Drain current ID (mA)
20
16
12
8
4
0
1
2
3
4
5
Gate2 to source voltage VG2S (V)


Forward Transfer Admittance vs.
Gate1 to Source Voltage
Forward transfer admittance |yfs| (mS)
VDS = 6 V
f = 1 kHz
VG2S = 3.0 V
2.5 V
2.0 V
1.5 V
1.0 V
0.5 V
0
6
12
18
24
30
0.4
0.8
1.2
1.6
2.0
Gate1 to source voltage VG1S (V)


Power Gain vs. Drain Current
Power gain PG (dB)
VDS = 4 V
VG2S = 3 V
f = 900 MHz
0
5
10
15
20
25
1
2
5
10
20
Drain current ID (mA)

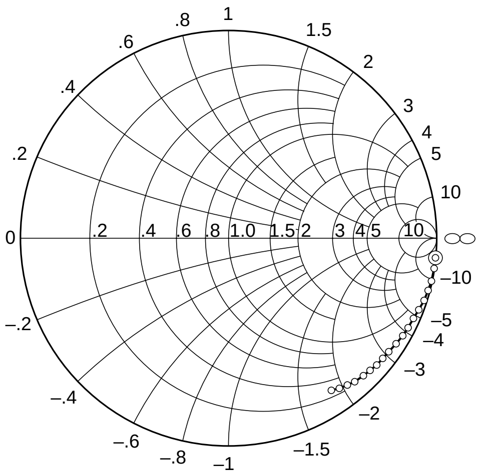

Noise Figure vs. Drain Current
Noise figure NF (dB)
VDS = 4 V
VG2S = 3 V
f = 900 MHz
0
1
2
3
4
5
1
2
5
10
20
Drain current ID (mA)


Power Gain vs. Drain to Source Voltage
Power gain PG (dB)
VG2S = 3 V
ID = 10 mA
f = 900 MHz
0
5
10
15
20
25
2
4
6
8
10
Drain to source voltage VDS (V)



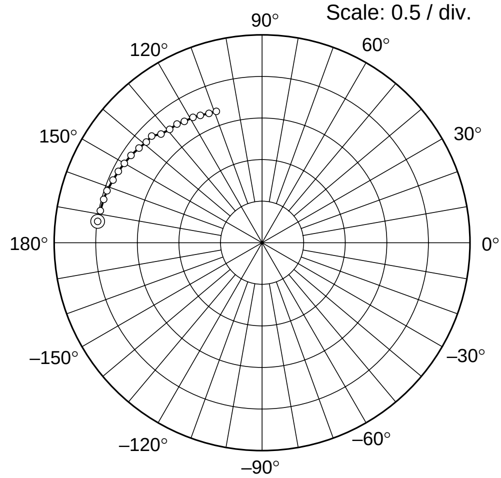
Noise Figure vs. Drain to Source Voltage
Noise figure NF (dB)
5
4
3
2
1
0
2
4
6
8
10
Drain to source voltage V_{DS} (V)
V_{G2S} = 3 V
I_D = 10 mA
f = 900 MHz

S11 Parameter vs. Frequency



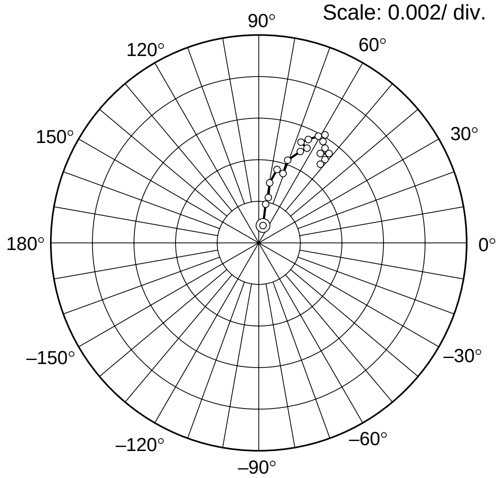
Condition: V_{DS}= 4 V , V_{G2S} = 3 V
I_D= 10 mA , Zo = 50 Ω
100 to 1000 MHz (50 MHz step)

S21 Parameter vs. Frequency



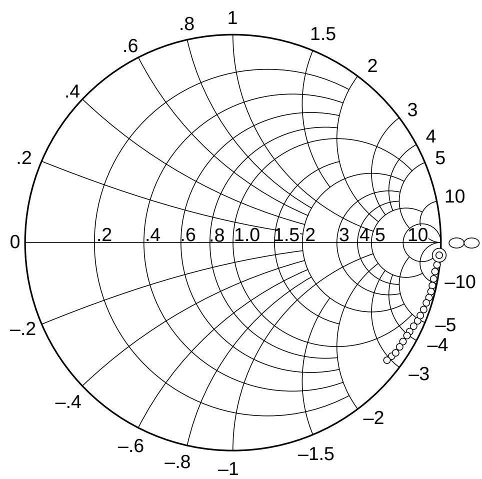
Condition: V_{DS}= 4 V , V_{G2S} = 3 V
I_D= 10 mA , Zo = 50 Ω
100 to 1000 MHz (50 MHz step)

S12 Parameter vs. Frequency



Condition: V_{DS}= 4 V , V_{G2S} = 3 V
I_D= 10 mA , Zo = 50 Ω
100 to 1000 MHz (50 MHz step)

S22 Parameter vs. Frequency

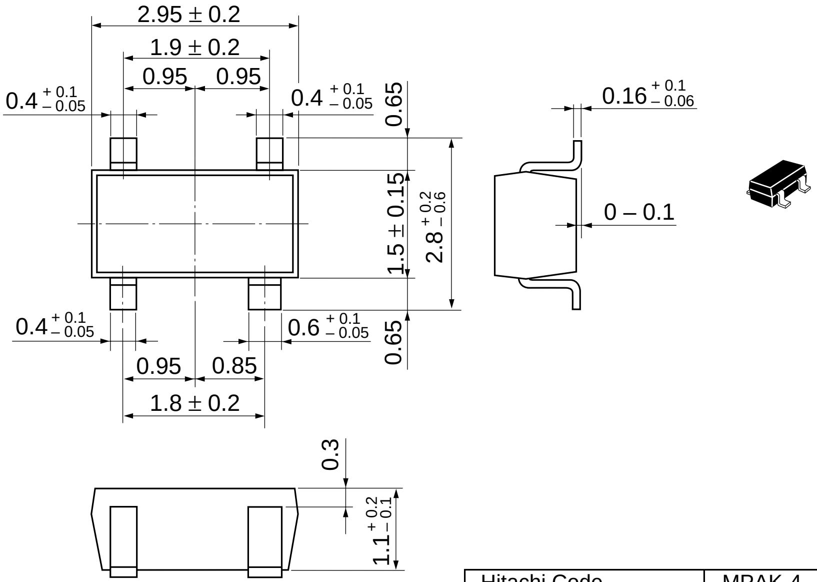


Condition: V_{DS}= 4 V , V_{G2S} = 3 V
I_D= 10 mA , Zo = 50 Ω
100 to 1000 MHz (50 MHz step)

S Parameter (V_{DS} = 4 V, V_{G2S} = 3 V, I_D = 10 mA, Z_O = 50)

Freq.	S11		S21		S12		S22	
(MHz)	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.999	–6.1	1.98	172.2	0.00094	79.2	0.989	–4.2
150	0.998	–9.1	1.97	168.4	0.00189	80.4	0.987	–6.1
200	0.992	–11.9	1.96	165.0	0.00230	79.5	0.986	–7.9
250	0.988	–14.8	1.96	161.0	0.00286	79.9	0.984	–9.8
300	0.985	–17.9	1.94	157.1	0.00364	75.2	0.981	–11.5
350	0.976	–20.6	1.92	153.7	0.00353	71.8	0.978	–13.4
400	0.971	–23.2	1.91	149.9	0.00419	70.7	0.975	–15.2
450	0.964	–26.3	1.88	146.8	0.00495	65.5	0.972	–17.2
500	0.961	–29.1	1.87	142.8	0.00509	62.7	0.968	–19.1
550	0.951	–32.2	1.86	139.4	0.00530	66.6	0.963	–20.8
600	0.949	–35.0	1.86	136.1	0.00550	63.8	0.960	–22.8
650	0.935	–37.6	1.81	132.9	0.00601	58.2	0.956	–24.5
700	0.933	–40.5	1.78	129.4	0.00582	60.6	0.950	–26.3
750	0.923	–42.9	1.77	125.7	0.00572	58.5	0.945	–28.0
800	0.916	–45.8	1.75	122.6	0.00553	56.3	0.941	–29.9
850	0.908	–49.0	1.72	119.1	0.00514	56.3	0.936	–31.7
900	0.900	–51.2	1.70	115.8	0.00543	52.9	0.930	–33.4
950	0.890	–54.0	1.67	112.6	0.00506	52.4	0.924	–35.2
1000	0.876	–56.4	1.65	109.3	0.00469	51.9	0.919	–37.0

Unit: mm



Hitachi Code	MPAK-4
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.013 g

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