# TOSHIBA

*MICROWAVE SEMICONDUCTOR*

TECHNICAL DATA

MICROWAVE POWER GaAs FET

## JS8850A-AS

### FEATURES:

- HIGH POWER
  $P_{1dB}$ = 21.5 dBm at f = 15 GHz
- HIGH GAIN
  $G_{1dB}$ = 9.0 dB at f = 15 GHz
- SUITABLE FOR Ku-BAND AMPLIFIER
- ION IMPLANTATION
- CHIP FORM

### RF PERFORMANCE SPECIFICATIONS (Ta = 25° C)

| CHARACTERISTIC | SYMBOL | CONDITION | | UNIT | MIN. | TYP. | MAX. |
|---|---|---|---|---|---|---|---|
| | | f | $V_{DS}$ | | | | |
| Output Power at 1dB Compression Point | $P_{1dB}$ | 15GHz | 10V | dBm | 20.5 | 21.5 | - |
| | | | 8 V | | - | 20.5 | - |
| | | 18GHz | 10V | | - | 21.0 | - |
| | | | 8 V | | - | 20.0 | - |
| Power Gain at 1dB Compression Point | $G_{1dB}$ | 15GHz | 10V | dB | 8.0 | 9.0 | - |
| | | | 8 V | | - | 9.0 | - |
| | | 18GHz | 10V | | - | 8.5 | - |
| | | | 8 V | | - | 8.5 | - |
| Drain Current | $I_{DS}$ | 15GHz | 10,8 V | A | - | 0.06 | 0.09 |
| | | 18GHz | 10,8 V | | - | 0.06 | 0.09 |
| Power Added Efficiency | $\eta_{add}$ | 15GHz | 10V | % | - | 21 | - |
| | | | 8 V | | - | 20 | - |
| | | 18GHz | 10V | | - | 19 | - |
| | | | 8 V | | - | 18 | - |

### ELECTRICAL CHARACTERISTICS (Ta = 25° C)

| CHARACTERISTIC | SYMBOL | CONDITION | UNIT | MIN. | TYP. | MAX. |
|---|---|---|---|---|---|---|
| Trans-Conductance | $g_m$ | $V_{DS}$=3V $I_{DS}$=45mA | mS | - | 30 | - |
| Pinch-off Voltage | $V_{GSoff}$ | $V_{DS}$=3V $I_{DS}$=1.5mA | V | -2.5 | -3.5 | -5 |
| Saturated Drain Current | $I_{DSS}$ | $V_{DS}$=3V $V_{GS}$=0V | A | - | 0.1 | 0.125 |
| Gate to Source Breakdown Voltage | $V_{GSO}$ | $I_{GS}$=-1.5μA | V | -5 | - | - |
| Thermal Resistance | Rth(c-c) | Channel to Case | °C/W | - | 90 | 150 |


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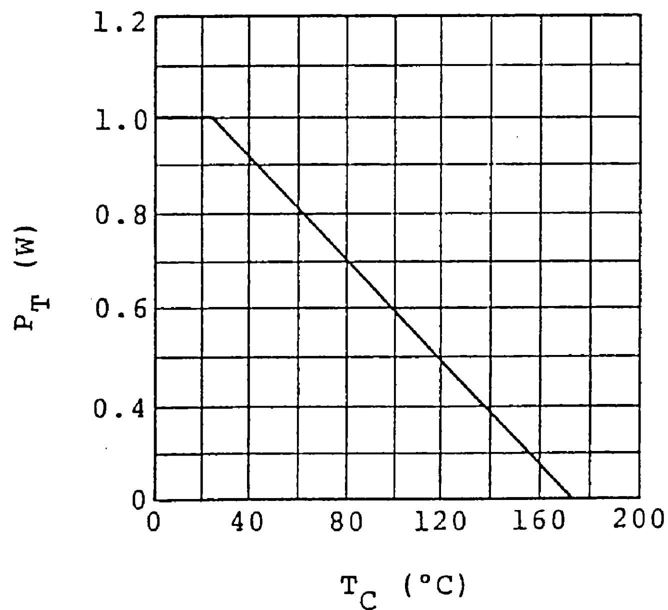
★ The information contained herein may be changed without prior notice. It is therefore advisable to contact TOSHIBA before proceeding with the design of equipment incorporating this product.

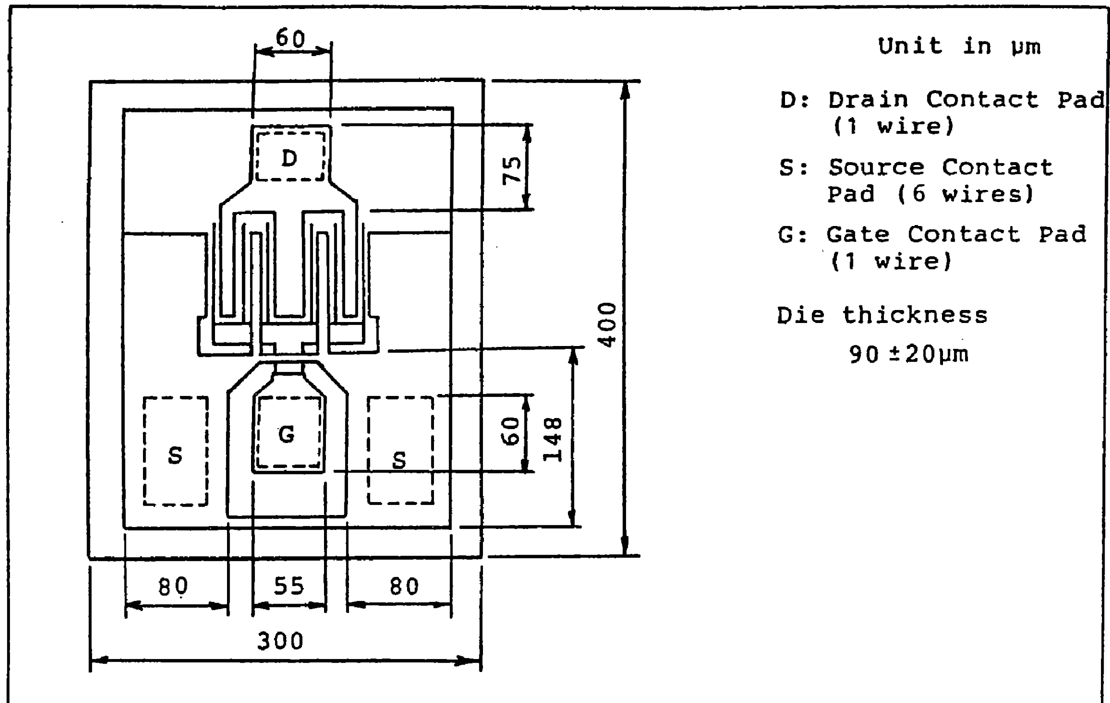
## ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

| TYPE NUMBER (PACKAGE CODE) | | | JS8850A-AS (CHIP) |
|---|---|---|---|
| CHARACTERISTIC | SYMBOL | UNIT | RATING |
| Drain-Source Voltage | $V_{DS}$ | V | 15 |
| Gate-Source Voltage | $V_{GS}$ | V | -5 |
| Drain Current | $I_D$ | A | 0.125 |
| Total Power Dissipation (Tc=25°C) | $P_T$ | W | 1 |
| Channel Temperature | $T_{ch}$ | °C | 175 |
| Storage Temperature | $T_{stg}$ | °C | -65∿175 |

## POWER DISSIPATION VS. CASE TEMPERATURE



## CHIP OUTLINE




ASSEMBLY PRECAUTIONS FOR CHIP

The operations must be performed in a clean and dry environment. The chips must be kept in the same environment when they are not used. All test instruments, assembly machines, benches, tweezers and operators should be grounded to avoid damage due to electrostatic discharge. Careful attention must be paid in handling chips with tweezers because GaAs is more brittle than Si.

DIE ATTACHMENT

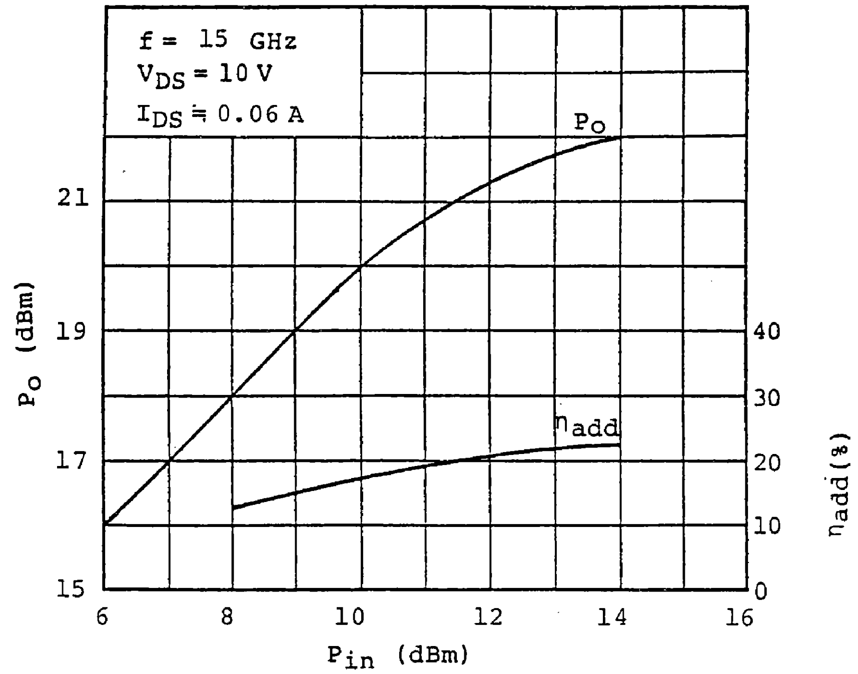
Die attachment can be accomplished with Au-Sn preform in nitrogen atmosphere. The operating temperature must be 290±10°C for the preform to be well melted. The operating time should be kept within one minute.

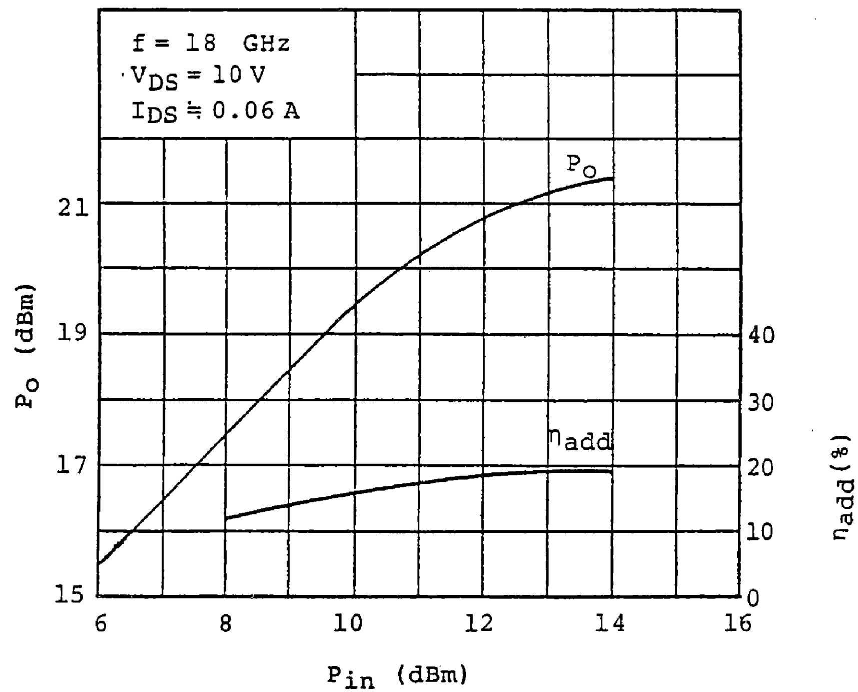
WIRE BONDING

Bonding should be performed with thermal compression wedge bonder in nitrogen atmosphere. The recommended conditions of wire bonding are as follows:

(1) Operating temperature ....... 200 ± 10°C
(2) Operating time .............. 5 minutes max.
(3) Bonding wire ................ 25 μm diameter pure Au

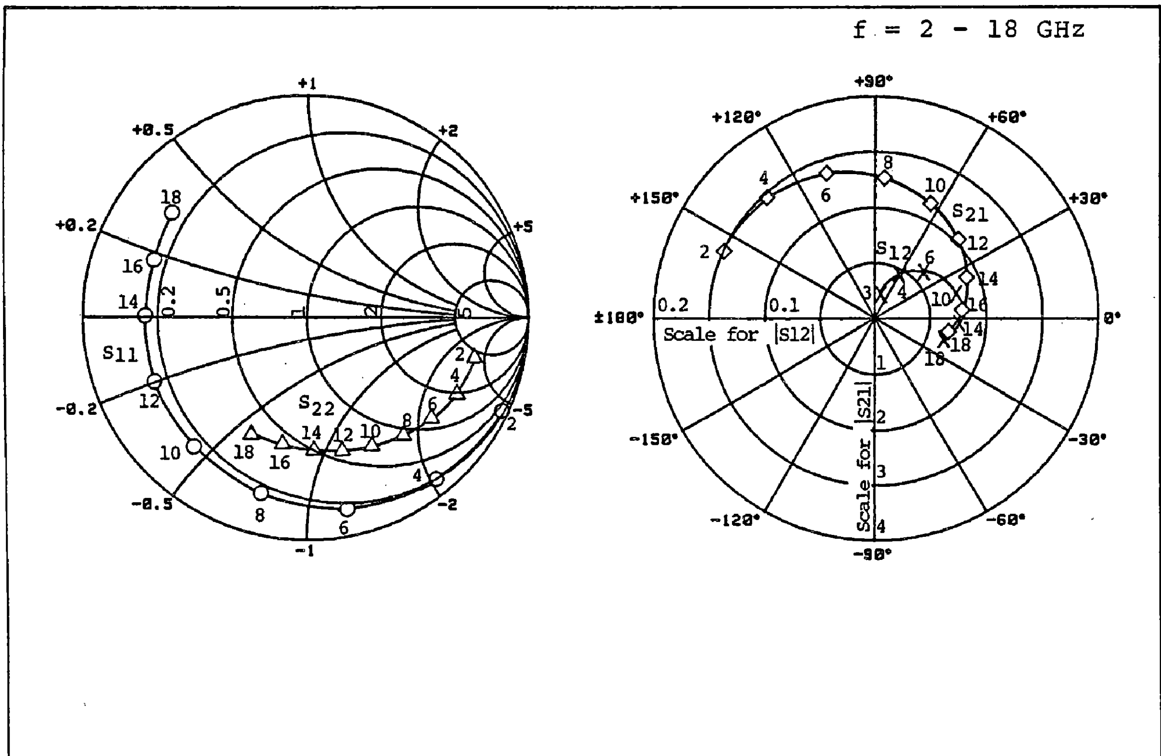
## RF PERFORMANCES



## JS8850A-AS S-PARAMETERS
## (MAGN. and ANGLES)

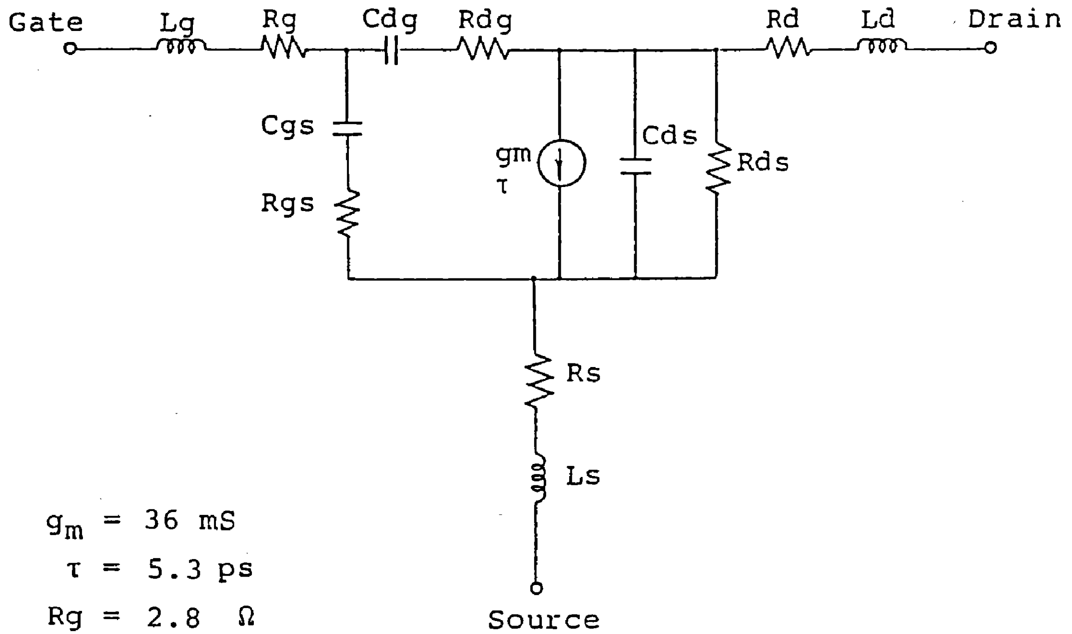
$V_{DS}$ = 10 V, $I_{DS}$ = 50 mA




| FREQUENCY (GHz) | $S_{11}$ | | $S_{12}$ | | $S_{21}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| 2 | 0.98 | -25 | 0.023 | 74 | 3.00 | 156 | 0.78 | -13 |
| 3 | 0.96 | -38 | 0.034 | 66 | 2.96 | 144 | 0.77 | -19 |
| 4 | 0.94 | -51 | 0.044 | 58 | 2.91 | 132 | 0.76 | -26 |
| 5 | 0.91 | -64 | 0.053 | 51 | 2.84 | 121 | 0.74 | -32 |
| 6 | 0.88 | -77 | 0.061 | 43 | 2.75 | 109 | 0.72 | -38 |
| 7 | 0.84 | -90 | 0.068 | 36 | 2.65 | 97 | 0.70 | -44 |
| 8 | 0.81 | -104 | 0.073 | 29 | 2.54 | 86 | 0.68 | -50 |
| 9 | 0.78 | -118 | 0.076 | 22 | 2.43 | 75 | 0.66 | -56 |
| 10 | 0.76 | -131 | 0.078 | 16 | 2.30 | 64 | 0.64 | -62 |
| 11 | 0.74 | -144 | 0.079 | 10 | 2.18 | 54 | 0.63 | -68 |
| 12 | 0.73 | -157 | 0.079 | 4 | 2.05 | 44 | 0.61 | -74 |
| 13 | 0.72 | -169 | 0.078 | -1 | 1.93 | 34 | 0.60 | -80 |
| 14 | 0.72 | 179 | 0.077 | -5 | 1.80 | 24 | 0.59 | -86 |
| 15 | 0.73 | 169 | 0.074 | -9 | 1.68 | 15 | 0.58 | -93 |
| 16 | 0.73 | 159 | 0.072 | -12 | 1.57 | 5 | 0.57 | -100 |
| 17 | 0.74 | 150 | 0.069 | -15 | 1.46 | -3 | 0.57 | -107 |
| 18 | 0.76 | 142 | 0.066 | -17 | 1.35 | -12 | 0.57 | -115 |

## EQUIVALENT CIRCUIT
(Includes normal bonding wires)

JS8850A-AS : $V_{DS}$ = 10, $I_{DS}$ = 50 mA




$g_m$ = 36 mS
τ = 5.3 ps
Rg = 2.8 Ω
Rs = 1.5 Ω
Rd = 2.6 Ω
Rgs= 2.5 Ω
Rdg= 0.01 Ω
Rds= 405 Ω
Cgs= 0.31 pF
Cdg= 0.02 pF
Cds= 0.13 pF
Lg = 0.37 nH
Ls = 0.02 nH
Ld = 0.23 nH

Bonding wire condition

| | Number (pcs) | Length (Approx.) (mm) | Dia. (μm) |
|---|---|---|---|
| Source | 6 | 0.3 | φ25 |
| Drain | 1 | 0.4 | φ25 |
| Gate | 1 | 0.4 | φ25 |