## RF POWER TRANSISTORS 800-960 MHz CELLULAR BASE STATION

v GOLD METALLIZATION

- DIFFUSED EMITTER BALLASTING
- INTERNAL INPUT/OUTPUT MATCHING
- COMMON EMITTER CONFIGURATION
v DESIGNED FOR LINEAR OPERATION HIGH SATURATED POWER CAPABILITY 26 VOLT, 900 MHz PERFORMANCE
, POUT = 150 W MIN.
GAIN $=8.5 \mathrm{~dB}$ MIN.
$\mathrm{IMD}_{3}=-28 \mathrm{~dB}$ MAX. @ Pout = 150W PEP
v INHERENT RUGGEDNESS:
LOAD MISMATCH TOLERANCE OF 5:1 MIN. VSWR
3 dB OVERDRIVE CAPABILITY
v ESD SENSITIVITY, CLASS 3 (MIL STD-883D METHOD 3015)


## DESCRIPTION

The SD4590 is designed for both analog and digital cellular base stations over the 800 to 960 MHz frequency range, specifically those systems requiring the high linearity and efficiency afforded by class $A B$ operation. Integrated input/output pre-matching simplifies amplifier design. Ruggedness, MTTF, and linearity are enhanced using diffused emitter resistors and refractory/gold metallization.

## ABSOLUTE MAXIMUM RATINGS ( $\mathrm{T}_{\text {case }}=25^{\circ} \mathrm{C}$ )

| Symbol | Parameter | Value | Unit |
| :---: | :--- | :---: | :---: |
| $\mathrm{V}_{\text {CBO }}$ | Collector-Base Voltage | 65 | V |
| $\mathrm{~V}_{\text {CEO }}$ | Collector-Emitter Voltage | 28 | V |
| $\mathrm{~V}_{\text {EBO }}$ | Emitter-Base Voltage | 3.5 | V |
| $\mathrm{I}_{\mathrm{C}}$ | Device Current | 25 | A |
| $\mathrm{P}_{\text {DISS }}$ | Power Dissipation | 300 | W |
| $\mathrm{~T}_{\mathrm{j}}$ | Max. Operating Junction Temperature | 200 | ${ }^{\circ} \mathrm{C}$ |
| $\mathrm{T}_{\text {STG }}$ | Storage Temperature | -65 to 150 | ${ }^{\circ} \mathrm{C}$ |

THERMAL DATA

| $\mathrm{R}_{\mathrm{th}(\mathrm{j}-\mathrm{c})}$ | Junction-Case Thermal Resistance | 0.60 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| :---: | :--- | :---: | :---: |

## ELECTRICAL SPECIFICATION $\left(T_{\text {case }}=25^{\circ} \mathrm{C}\right.$ )

## STATIC

| Symbol |  | Parameter | Min. | Typ. | Max. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| BV ${ }_{\text {cbo }}$ | $\mathrm{IC}=100 \mathrm{~mA}$ | $\mathrm{V}_{\mathrm{BE}}=0 \mathrm{~V}$ | 65 | 80 |  | V |
| BV ${ }_{\text {ceo }}$ | $\mathrm{IC}=100 \mathrm{~mA}$ | l B $=0 \mathrm{~mA}$ | 28 | 30 |  | V |
| BV ${ }_{\text {cer }}$ | $\mathrm{IC}=100 \mathrm{~mA}$ | $\mathrm{R}_{\mathrm{BE}}=80 \Omega$ | 33 | 40 |  | V |
| $B V_{\text {Ebo }}$ | $\mathrm{IC}_{\mathrm{C}}=50 \mathrm{~mA}$ | $\mathrm{I}_{\mathrm{C}}=0 \mathrm{~mA}$ | 3.5 | 4.0 |  | V |
| Iceo | $\mathrm{V}_{\text {CE }}=26 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{BE}}=0 \mathrm{~V}$ |  |  | 10 | mA |
| Iceo | $\mathrm{V}_{\text {CE }}=10 \mathrm{~V}$ | $\mathrm{V}_{\mathrm{BE}}=0 \mathrm{~V}$ |  |  | 0.5 | mA |
| Iebo | $\mathrm{V}_{\mathrm{BE}}=1 \mathrm{~V}$ | $\mathrm{V}_{\text {CE }}=0 \mathrm{~V}$ |  |  | 0.1 | mA |
| Iebo | $\mathrm{V}_{\mathrm{BE}}=2.5 \mathrm{~V}$ | $\mathrm{V}_{\text {ce }}=0 \mathrm{~V}$ |  |  | 3 | mA |
| hFE | $V_{C E}=5 \mathrm{~V}$ | $\mathrm{lc}=6 \mathrm{~A}$ | 25 | 45 | 120 |  |

TESTED PER SIDE
REF 1016365E

## DYNAMIC

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
| :---: | :--- | :---: | :---: | :---: | :---: |
| Cob | $\mathrm{f}=1 \mathrm{MHz}$ <br> for information only - this part is collector matched |  | 75 |  | pF |

## DYNAMIC (CW)

| Symbol | Parameter |  |  | Min. | Typ. | Max. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Pin | $\mathrm{f}=900 \mathrm{MHz} \mathrm{V}_{\text {CE }}=26 \mathrm{~V}$ | $\mathrm{ICQ}_{\mathrm{CQ}}=2 \times 200 \mathrm{~mA}$ | Pout $=150 \mathrm{~W}$ |  |  | 21 | W |
| Pout | $\mathrm{f}=900 \mathrm{MHz} \quad \mathrm{V}_{\text {Ce }}=26 \mathrm{~V}$ | $\mathrm{ICQ}^{\text {a }}=2 \times 200 \mathrm{~mA}$ | PIN $=21 \mathrm{~W}$ | 150 | 175 |  | W |
| Gp | $\mathrm{f}=900 \mathrm{MHz} \mathrm{V}_{\text {CE }}=26 \mathrm{~V}$ | $\mathrm{I}_{\mathrm{CQ}}=2 \times 200 \mathrm{~mA}$ | Pout $=150 \mathrm{~W}$ | 8.5 | 9.5 |  | dB |
| $\eta \mathrm{C}$ | $\mathrm{f}=900 \mathrm{MHz} \quad \mathrm{V}_{\text {CE }}=26 \mathrm{~V}$ | $\mathrm{I}_{\mathrm{CQ}}=2 \times 200 \mathrm{~mA}$ | Pout $=150 \mathrm{~W}$ | 50 | 55 |  | \% |
| $\mathrm{P}_{1 \mathrm{~dB}}$ | $\mathrm{f}=900 \mathrm{MHz} \quad \mathrm{V}_{\text {CE }}=26 \mathrm{~V}$ | $\mathrm{I}_{\mathrm{CQ}}=2 \times 200 \mathrm{~mA}$ |  | 150 | 160 |  | W |
| OVD | $\begin{aligned} & \mathrm{f}=900 \mathrm{MHz} \quad \mathrm{~V}_{\mathrm{CE}}=26 \mathrm{~V} \\ & \text { Set Pout }=150 \mathrm{~W} \text { PEP; } \mathrm{Ir} \end{aligned}$ | $\begin{aligned} & I_{\mathrm{CQ}}=2 \times 200 \mathrm{~mA} \\ & \text { rease PIN } 3 \mathrm{~dB} \end{aligned}$ |  |  | egrat Perf | $\begin{aligned} & \text { on in D } \\ & \text { nance } \end{aligned}$ |  |

## DYNAMIC (Two-Tone)

| Symbol | Parameter |  |  | Min. | Typ. | Max. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| *Gp | $\mathrm{V}_{\text {ce }}=26 \mathrm{~V}$ | $\mathrm{ICQ}=2 \times 200 \mathrm{~mA}$ | Pout = 150 W PEP | 8.5 | 9.5 |  | dB |
| * $\eta$ c | $\mathrm{V}_{\text {Ce }}=26 \mathrm{~V}$ | $\mathrm{ICQ}=2 \times 200 \mathrm{~mA}$ | Pout = 150 W PEP | 30 | 35 |  | \% |
| * $\mathrm{MDD}_{3}$ | $\mathrm{V}_{\text {CE }}=26 \mathrm{~V}$ | $\mathrm{I}_{\mathrm{CQ}}=2 \times 200 \mathrm{~mA}$ | Pout = 150 W PEP |  | -32 | -28 | dBT |
| *Load Mismatch | $\mathrm{V}_{\text {CE }}=26 \mathrm{~V} \quad \mathrm{I}_{\mathrm{CQ}}=2 \times 200 \mathrm{~mA} \quad$ POUT $=150 \mathrm{~W}$ PEP VSWR = 5:1 MIN @ All Phase Angles |  |  | No Degratation in Device Performance |  |  |  |
| *OVD | $\begin{aligned} & \mathrm{V}_{\mathrm{CE}}=26 \mathrm{~V} \quad \mathrm{I}_{\mathrm{CQ}}=2 \times 200 \mathrm{~mA} \\ & \text { Set Pout }=150 \mathrm{~W} \text { PEP; Increase PIN } 3 \mathrm{~dB} \end{aligned}$ |  |  | No Degratation in Device Performance |  |  |  |

[^0]
## TYPICAL PERFORMANCE

Output Power vs Input Power


Output Power vs Supply Voltage


## Power Gain vs Output Power



Output Power vs Frequency


Intermodulation Distortion vs Output Power


## Broadband Performance


—— BROADBAND TUNING: $800-960 \mathrm{MHz}$

- OPTIMIZED TUNING: JDC/ADC/GSM

SERIES EQUIVALENT INPUT/OUTPUT IMPEDANCES


| FREQ. | $Z_{\text {IN }}(\Omega)$ | $Z_{\mathrm{CL}}(\Omega)$ |
| :--- | :--- | :--- |
| 800 MHz | $4.25+\mathrm{j} 12.25$ | $5.75-\mathrm{j} 4.25$ |
| 820 MHz | $4.75+\mathrm{j} 13.25$ | $5.00-\mathrm{j} 2.75$ |
| 840 MHz | $5.25+\mathrm{j} 12.50$ | $5.50-\mathrm{j} 2.50$ |
| 860 MHz | $4.75+\mathrm{j} 10.25$ | $5.00-\mathrm{j} 3.00$ |
| 880 MHz | $6.25+\mathrm{j} 9.00$ | $4.60-\mathrm{j} 2.90$ |
| 900 MHz | $7.75+\mathrm{j} 10.25$ | $4.25-\mathrm{j} 2.90$ |
| 920 MHz | $6.50+\mathrm{j} 11.50$ | $3.95-\mathrm{j} 2.90$ |
| 940 MHz | $6.50+\mathrm{j} 10.25$ | $3.80-\mathrm{j} 2.80$ |
| 960 MHz | $8.50+\mathrm{j} 9.50$ | $3.40-\mathrm{j} 2.85$ |
| 980 MHz | $9.25+\mathrm{j} 11.50$ | $3.10-\mathrm{j} 3.00$ |
| 1000 MHz | $8.50+\mathrm{j} 13.25$ | $2.75-\mathrm{j} 3.15$ |

TEST CIRCUIT SCHEMATIC


TEST CIRCUIT COMPONENT PART LIST

| PCB | ROGERS, $\boldsymbol{E}_{\mathrm{r}}=2.55$, Height $=31.25$ mil 1 oz. Cu. |
| :--- | :--- |
| Balun 1,2 | $50 \Omega$ Coaxial Cable Lenght $2.2 "$ attached to $2 \times 50 \Omega$ printed microstrip <br> transmission lines (see photomaster) |
| C1, C2, C23, C25 | 75 pF Ceramic Chip ATC B |
| C3, C4, C21, C22 | $2 \times 47 \mathrm{pF}$ Ceramic Chip, ATC B |
| C5, C16 | 0.8 - 8pF Variable, JOHANSON Giga - Trim |
| C6, C9 | 750 pF Ceramic Chip, ATC B |
| C7, C10 | 39 nF Ceramic Chip, ATCB |
| C8, C11, C24, C26 | $47 \mu \mathrm{~F}, 50 \mathrm{~V}$ Electrolytic |
| C13, C17 | $100 \mu$ F, 50V Electrolytic |
| C12 | 9.1 pF, Ceramic Chip, ATC A |
| C14, C18 | $39 n F$ Ceramic Chip (OPTIONAL) |
| C15, C19 | 750 pF Ceramic Chip (OPTIONAL) |
| C20 | $1.3 p F$ Ceramic Chip, ATC B |
| L1, L4, L5, L8 | 12 Turns, \#200 AWG, 0.15" I.D. (Tight) |
| L2, L3, L6, L7 | 4 Turns, \#20AWG, 0.13" I.D. (1:1) |
| R1, R2, R3, R4 | 5 X 50 $\Omega$ Chip Resistor |

TEST CIRCUIT PHOTOMASTER


## M 208 (. 400 X . 860 WIDE 2/L N/HERM W/FLG) MECHANICAL DATA

| DIM. | mm |  |  | inch |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 5.59 |  | 5.84 | . 200 |  | . 230 |
| B |  | 5.33 |  |  | . 210 |  |
| C | 3.05 |  | 3.30 | . 120 |  | . 130 |
| D | 9.65 |  | 9.91 | . 380 |  | . 390 |
| E | 19.81 |  | 20.83 | . 780 |  | . 820 |
| F |  | 11.05 |  |  | . 435 |  |
| G |  | 27.94 |  |  | 1.100 |  |
| H | 33.91 |  | 34.16 | 1.335 |  | 1.345 |
| 1 | 0.08 |  | 0.18 | . 003 |  | . 007 |
| J | 1.52 |  | 1.78 | . 060 |  | . 070 |
| K | 2.08 |  | 2.54 | . 082 |  | . 100 |
| L |  |  | 5.21 |  |  | . 205 |
| M | 10.03 |  | 10.34 | . 395 |  | . 407 |
| N | 21.59 |  | 22.10 | . 850 |  | . 870 |



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[^0]:    Note : $\mathrm{f}_{1}=900.00 \mathrm{MHz}$
    $f_{2}=900.10 \mathrm{MHz}$

