

FEATURES

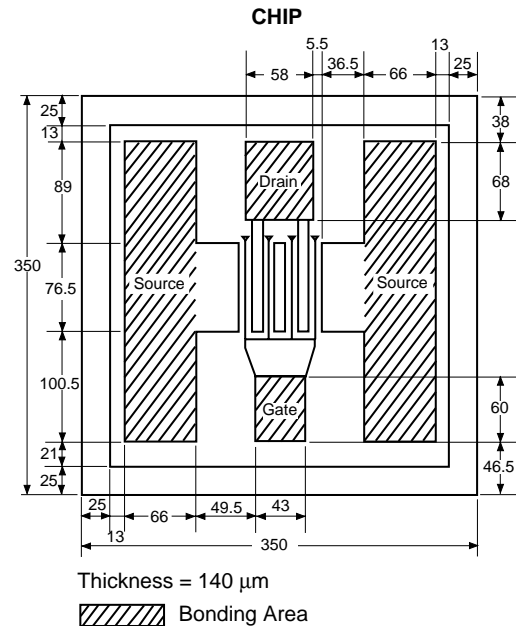
- **SUPER LOW NOISE FIGURE:**
0.45 dB TYP at 12 GHz
- **HIGH ASSOCIATED GAIN:**
12.5 dB TYP at 12 GHz
- **GATE LENGTH: $L_G = 0.20 \mu\text{m}$**
- **GATE WIDTH: $W_G = 200 \mu\text{m}$**

DESCRIPTION

The NE32500 is a Hetero-Junction FET chip that uses the junction between Si-doped AlGaAs and undoped InGaAs to create very high mobility electrons. Its excellent low noise figure and high associated gain make it suitable for commercial systems and industrial applications.

NEC's stringent quality assurance and test procedures assure the highest reliability and performance.

OUTLINE DIMENSIONS (Units in μm)



ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

| PART NUMBER PACKAGE OUTLINE | | | NE32500 00 (Chip) | | |
|--------------------------------|---|--------------------|----------------------|------|------|
| SYMBOLS | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX |
| NF | Noise Figure, $V_{DS} = 2 \text{ V}$, $I_{DS} = 10 \text{ mA}$, $f = 12 \text{ GHz}$ | dB | | 0.45 | 0.55 |
| GA | Associated Gain, $V_{DS} = 2 \text{ V}$, $I_{DS} = 10 \text{ mA}$, $f = 12 \text{ GHz}$ | dB | 11.0 | 12.5 | |
| I_{DSS} | Saturated Drain Current, $V_{DS} = 2 \text{ V}$, $V_{GS} = 0 \text{ V}$ | mA | 20 | 60 | 90 |
| g_m | Transconductance, $V_{DS} = 2 \text{ V}$, $I_D = 10 \text{ mA}$ | mS | 45 | 60 | |
| I_{GSO} | Gate to Source Leakage Current, $V_{GS} = -3 \text{ V}$ | μA | | 0.5 | 10.0 |
| $V_{GS(off)}$ | Gate to Source Cutoff Voltage, $V_{DS} = 2 \text{ V}$, $I_D = 100 \mu\text{A}$ | V | -0.2 | -0.7 | -2.0 |
| $R_{TH(CH-C)}$ | Thermal Resistance ¹ (Channel to Case) | $^\circ\text{C/W}$ | | | 260 |

Note:

1. RF performance is determined by packaging and testing 10 chips per wafer.
Wafer rejection criteria for standard devices is 2 rejects per 10 samples.

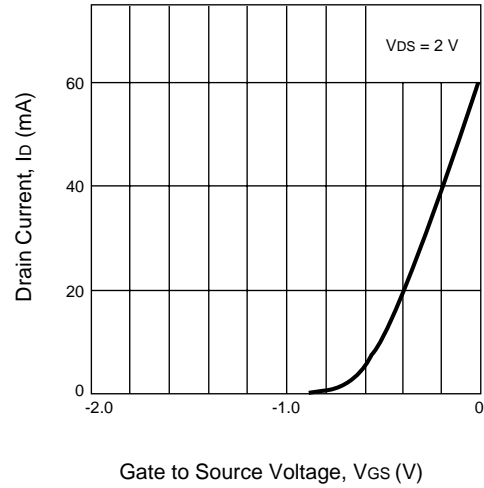
ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|------------------|--------------------------------------|-------|------------------|
| V _{DS} | Drain to Source Voltage | V | 4.0 |
| V _{GS} | Gate to Source Voltage | V | -3.0 |
| I _{DS} | Drain Current | mA | I _{DSS} |
| P _T | Total Power Dissipation ² | mW | 200 |
| T _{CH} | Channel Temperature | °C | 175 |
| T _{STG} | Storage Temperature | °C | -65 to +175 |

Note:

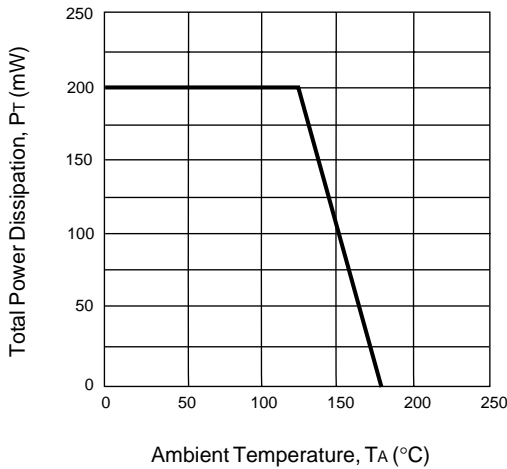
1. Operation in excess of any one of these parameters may result in permanent damage.
2. Chip mounted on Alumina heatsink (size: 3 x 3 x 0.6[†])

DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE

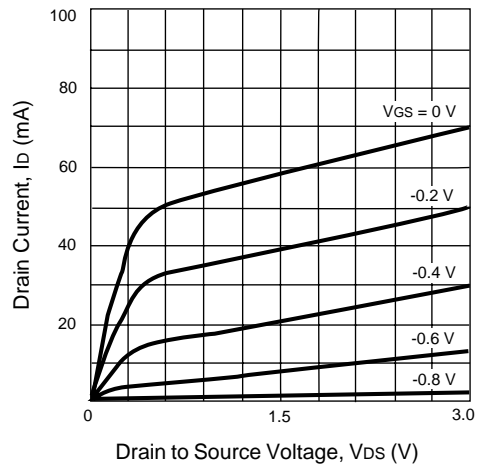


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

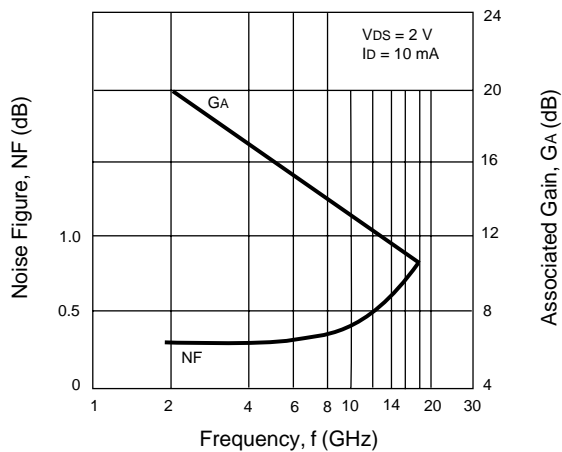
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



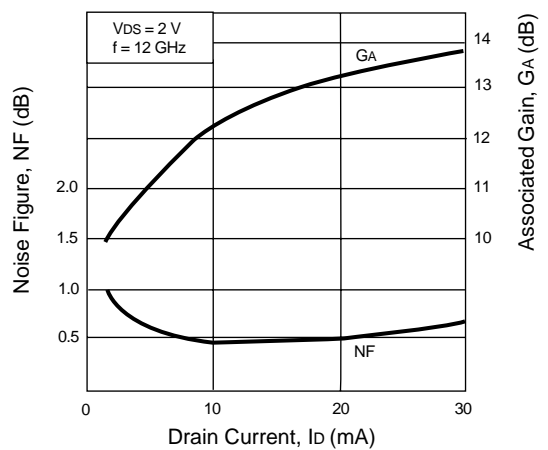
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



NOISE FIGURE AND ASSOCIATED GAIN vs. FREQUENCY



NOISE FIGURE AND ASSOCIATED GAIN vs. DRAIN CURRENT



TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

NE32500

V_{DS} = 2 V, I_{DS} = 10 mA

| FREQUENCY (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|--------------------|-----------------|------|-----------------|-----|-----------------|-----|-----------------|-----|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 0.5 | 0.999 | -4 | 4.34 | 177 | 0.006 | 82 | 0.564 | -3 |
| 1.0 | 0.998 | -7 | 4.33 | 174 | 0.012 | 84 | 0.562 | -6 |
| 2.0 | 0.996 | -14 | 4.28 | 168 | 0.025 | 81 | 0.559 | -11 |
| 3.0 | 0.992 | -20 | 4.24 | 163 | 0.037 | 76 | 0.557 | -17 |
| 4.0 | 0.976 | -28 | 4.169 | 158 | 0.048 | 71 | 0.551 | -23 |
| 5.0 | 0.962 | -36 | 4.11 | 152 | 0.060 | 66 | 0.546 | -29 |
| 6.0 | 0.962 | -42 | 4.06 | 148 | 0.070 | 62 | 0.539 | -34 |
| 7.0 | 0.943 | -48 | 3.95 | 143 | 0.079 | 58 | 0.533 | -40 |
| 8.0 | 0.928 | -55 | 3.83 | 139 | 0.087 | 55 | 0.526 | -44 |
| 9.0 | 0.920 | -60 | 3.73 | 134 | 0.095 | 51 | 0.519 | -49 |
| 10.0 | 0.900 | -67 | 3.58 | 129 | 0.104 | 47 | 0.508 | -54 |
| 11.0 | 0.881 | -72 | 3.46 | 126 | 0.109 | 43 | 0.503 | -58 |
| 12.0 | 0.869 | -77 | 3.334 | 122 | 0.114 | 40 | 0.494 | -62 |
| 13.0 | 0.856 | -82 | 3.23 | 118 | 0.120 | 37 | 0.488 | -66 |
| 14.0 | 0.839 | -86 | 3.11 | 115 | 0.123 | 34 | 0.483 | -69 |
| 15.0 | 0.831 | -91 | 3.01 | 112 | 0.127 | 32 | 0.476 | -72 |
| 16.0 | 0.818 | -96 | 2.88 | 108 | 0.131 | 29 | 0.472 | -76 |
| 17.0 | 0.804 | -99 | 2.78 | 105 | 0.134 | 27 | 0.468 | -79 |
| 18.0 | 0.796 | -103 | 2.68 | 103 | 0.137 | 24 | 0.464 | -81 |
| 19.0 | 0.784 | -106 | 2.59 | 100 | 0.0141 | 22 | 0.460 | -84 |
| 20.0 | 0.782 | -111 | 2.49 | 96 | 0.142 | 20 | 0.456 | -88 |

Note:

1. Gain Calculation:

$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} \left(K \pm \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

ORDERING INFORMATION

| PART | I _{DSS} SELECTION (mA) |
|----------|---------------------------------|
| NE32500 | 20 to 90 (Standard) |
| NE32500N | 20 to 60 |
| NE32500M | 50 to 90 |

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