

## GENERAL PURPOSE PHEMT DIE

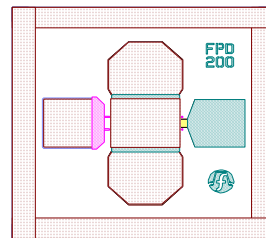
### FEATURES:

- 19 dBm Output Power (P1dB)
- 13 dB Power Gain at 12 GHz
- 17 dB Maximum Stable Gain at 12 GHz
- 12 dB Maximum Stable Gain at 18 GHz
- 45% Power-Added Efficiency

### GENERAL DESCRIPTION:

The FPD200 is an AlGaAs/InGaAs pseudomorphic High Electron Mobility Transistor (pHEMT), featuring a 0.25  $\mu\text{m}$  by 200  $\mu\text{m}$  Schottky barrier gate, defined by high-resolution stepper-based photolithography. The recessed gate structure minimizes parasitics to optimize performance. The epitaxial structure and processing have been optimized for reliable medium-power applications.

### LAYOUT:



### TYPICAL APPLICATIONS:

- Narrowband and broadband high-performance amplifiers
- SATCOM uplink transmitters
- PCS/Cellular low-voltage high-efficiency output amplifiers
- Medium-haul digital radio transmitters

### ELECTRICAL SPECIFICATIONS<sup>1</sup>:

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Power at 1dB Gain Compression	P1dB	VDS = 5 V; IDS = 50% IDSS	18	19		dBm
Power Gain at P1dB	G1dB	VDS = 5 V; IDS = 50% IDSS	11.0	13.0		dB
Noise Figure	N.F.min	VDS = 5 V; IDS = 50% IDSS		1.2		dB
Power-Added Efficiency	PAE	VDS = 5V; IDS = 50% IDSS; POUT = P1dB		45		%
Maximum Stable Gain (S21/S12)	MSG	VDS = 5 V; IDS = 50% IDSS				
$f = 12$ GHz			16	17		dB
$f = 24$ GHz			10.5	12		dB
Saturated Drain-Source Current	IDSS	VDS = 1.3 V; VGS = 0 V	45	60	75	mA
Maximum Drain-Source Current	IMAX	VDS = 1.3 V; VGS = +1 V		120		mA
Transconductance	GM	VDS = 1.3 V; VGS = 0 V		80		mS
Gate-Source Leakage Current	IGSO	VGS = -5 V		1	10	$\mu\text{A}$
Pinch-Off Voltage	VP	VDS = 1.3 V; IDS = 0.2 mA	0.7	1.0	1.3	V
Gate-Source Breakdown Voltage	VBDGS	IGS = 0.2 mA	12.0	14.0		V
Gate-Drain Breakdown Voltage	VBDGD	IGD = 0.2 mA	14.5	16.0		V
Thermal Resistivity	$\theta_{\text{JC}}$	VDS > 3V		280		$^{\circ}\text{C/W}$

Note: <sup>1</sup> T<sub>Ambient</sub> = 22°C; RF specifications measured at  $f = 12$  GHz using CW signal on a sample basis

**ABSOLUTE MAXIMUM RATING<sup>1</sup>:**

PARAMETER	SYMBOL	TEST CONDITIONS	ABSOLUTE MAXIMUM
Drain-Source Voltage	VDS	-3V < VGS < -0.5V <sup>6</sup>	8V
Gate-Source Voltage	VGS	0V < VDS < +8V	-3V
Drain-Source Current	IDS	For VDS < 2V	IDSS
Gate Current	IG	Forward or reverse current	10mA
RF Input Power	PIN	Under any acceptable bias state	20dBm
Channel Operating Temperature	TCH	Under any acceptable bias state	175°C
Storage Temperature	TSTG	Non-Operating Storage	-65°C to 150°C
Total Power Dissipation	PTOT	See De-Rating Note below	0.5W
Gain Compression	Comp.	Under any bias conditions	5dB
Simultaneous Combination of Limits <sup>4</sup>		2 or more Max. Limits	80%

**Notes:**

<sup>1</sup>T<sub>Ambient</sub> = 22°C unless otherwise noted; exceeding any one of these absolute maximum ratings may cause permanent damage to the device

<sup>2</sup>Total Power Dissipation defined as:  $P_{TOT} \equiv (P_{DC} + P_{IN}) - P_{OUT}$ ,  
where P<sub>DC</sub>: DC Bias Power, P<sub>IN</sub>: RF Input Power, P<sub>OUT</sub>: RF Output Power

<sup>3</sup>Total Power Dissipation to be de-rated as follows above 22°C:

$$P_{TOT} = 500\text{mW} - (3.6\text{mW}/^\circ\text{C}) \times T_{HS}$$

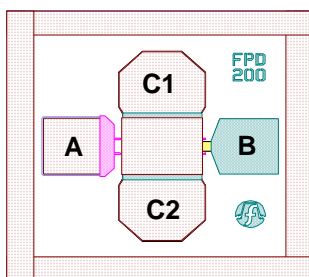
where T<sub>HS</sub> = heatsink or ambient temperature above 22°C

Example: For a 85°C carrier temperature:  $P_{TOT} = 500 - (3.6\text{mW} \times (85 - 22)) = 0.27\text{W}$

<sup>4</sup>Users should avoid exceeding 80% of 2 or more Limits simultaneously

<sup>5</sup> Thermal Resistivity specification assumes a Au/Sn eutectic die attach onto a Au-plated copper heatsink or rib.

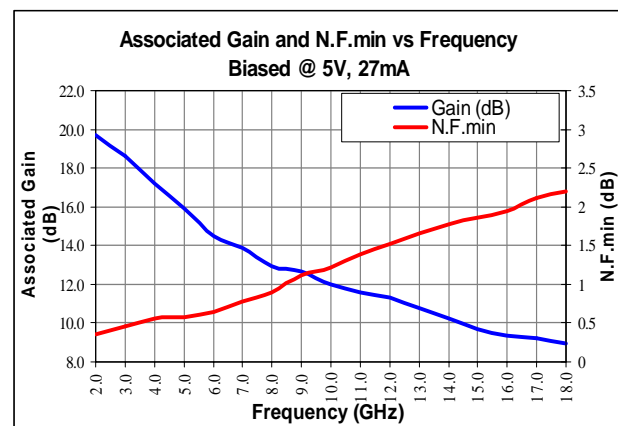
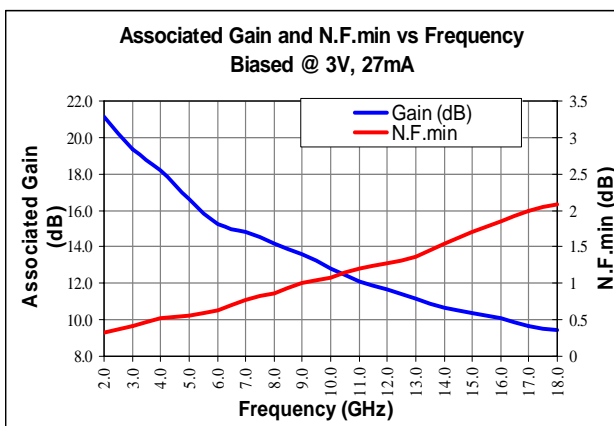
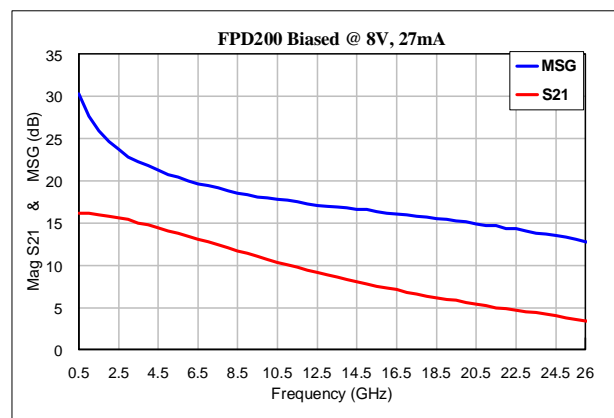
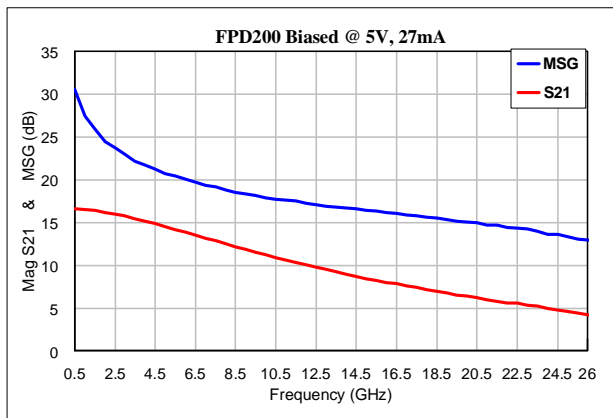
<sup>6</sup> Operating at absolute maximum VD continuously is not recommended. If operation at 8V is considered then IDS must be reduced in order to keep the part within its thermal power dissipation limits. Therefore VGS is restricted to < -0.5V.

**PAD LAYOUT:**


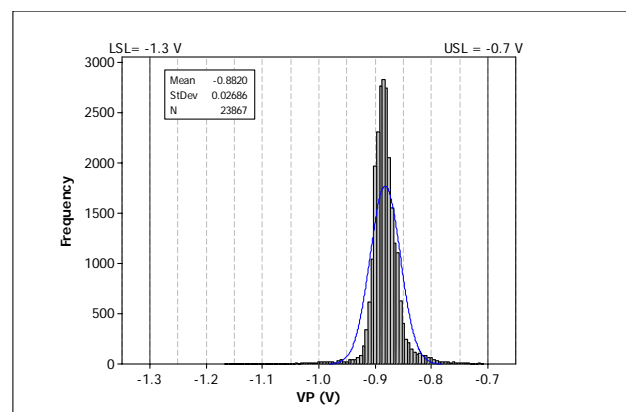
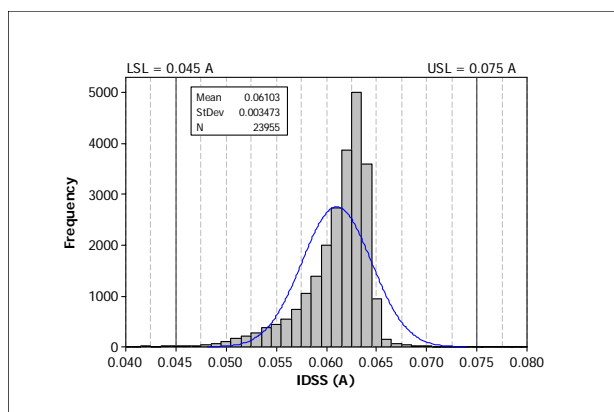
PAD	DESCRIPTION	PIN COORDINATES (μm)
A	Gate Pad	90, 200
B	Drain Pad	320, 200
C1/C2	Source Pad	200, 290/110

Note: Co-ordinates are referenced from the bottom left hand corner of the die to the centre of bond pad opening

DIE SIZE (μm)	DIE THICKNESS (μm)	MIN. BOND PAD OPENING (μm x μm)
400 x 400	75	70 x 80

**TYPICAL MEASURED PERFORMANCE :**

**TYPICAL WAFER DISTRIBUTIONS:**

Note: Data taken from a typical wafer at ambient temperature. Future wafers may have nominal values anywhere within the specifications range.



**NOISE PARAMETERS :**

 (Biased @  $V_{DS}=3V$ ,  $I_{DS}=27mA$ )

Freq (GHz)	N.F.min (dB)	Rn/50 (Ohms)	Gamma Opt.	
			Mag	Angle
2.00	0.32	0.31	0.75	6.70
3.00	0.41	0.31	0.71	14.60
4.00	0.52	0.29	0.74	22.60
5.00	0.55	0.28	0.62	27.90
6.00	0.62	0.26	0.63	34.90
7.00	0.78	0.26	0.54	41.50
8.00	0.87	0.26	0.48	47.50
9.00	1.00	0.25	0.43	54.40
10.00	1.08	0.24	0.41	60.20
11.00	1.20	0.24	0.41	65.70
12.00	1.28	0.24	0.34	78.60
13.00	1.37	0.24	0.28	89.70
14.00	1.55	0.22	0.24	95.90
15.00	1.70	0.20	0.23	103.70
16.00	1.85	0.20	0.24	113.50
17.00	1.99	0.19	0.17	137.10
18.00	2.09	0.18	0.20	156.80

**PREFERRED ASSEMBLY INSTRUCTIONS:**

GaAs devices are fragile and should be handled with great care. Specially designed collets should be used where possible.

The recommended die attach is gold/tin eutectic solder under a nitrogen atmosphere. Stage temperature should be 280-290°C; maximum time at temperature is one minute. The recommended wire bond method is thermo-compression wedge bonding with 0.7 or 1.0 mil (0.018 or 0.025 mm) gold wire. Stage temperature should be 250-260°C.

**HANDLING PRECAUTIONS:**

To avoid damage to the devices care should be exercised during handling.



Proper Electrostatic Discharge (ESD) precautions should be observed at all stages of storage, handling, assembly, and testing. These devices should be treated as Class 0 (0-250 V) as defined in JEDEC Standard No. 22-A114. Further information on ESD control measures can be found in MIL-STD-1686 and MIL-HDBK-263.

**APPLICATION NOTES & DESIGN DATA:**

Application Notes and design data including S-parameters, noise parameters and device model are available on request

**DISCLAIMERS:**

This product is not designed for use in any space based or life sustaining/supporting equipment.

**ORDERING INFORMATION:**

PART NUMBER	DESCRIPTION
FPD200	Die