

Package Style: Bare Die

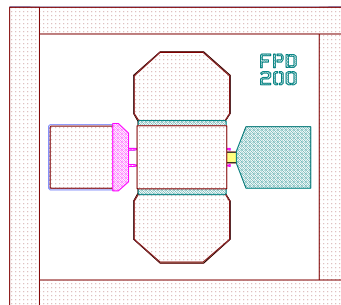


Product Description

The FPD200 is an AlGaAs/InGaAs pseudomorphic High Electron Mobility Transistor (pHEMT), featuring a $0.25\mu\text{m} \times 200\mu\text{m}$ 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 high-power applications.

Optimum Technology Matching® Applied

- ☐ GaAs HBT
- ☐ GaAs MESFET
- ☐ InGaP HBT
- ☐ SiGe BiCMOS
- ☐ Si BiCMOS
- ☐ SiGe HBT
- ☒ GaAs pHEMT
- ☐ Si CMOS
- ☐ Si BJT
- ☐ GaN HEMT
- ☐ InP HBT
- ☐ RF MEMS
- ☐ LDMOS



Features

- 19dBm Output P_{1dB}
- 13dB Power Gain at 12GHz
- 17 dB Maximum Stable Gain at 12GHz
- 12dB Maximum Stable Gain at 18GHz
- 45% Power-Added Efficiency

Applications

- Narrowband and Broadband High-Performance Amplifiers
- SATCOM Uplink Transmitters
- PCS/Cellular Low-Voltage High-Efficiency Output Amplifiers
- Medium-Haul Digital Radio Transmitters

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
P_{1dB} Gain Compression	18	19		dBm	$V_{DS}=5V, I_{DS}=50\% I_{DSS}$
Power Gain at P_{1dB} (G_{1dB})	11.0	13.0		dB	$V_{DS}=5V, I_{DS}=50\% I_{DSS}$
Noise Figure		1.2		dB	$V_{DS}=5V, I_{DS}=50\% I_{DSS}$
PAE		45		%	$V_{DS}=5V, I_{DS}=50\% I_{DSS}, P_{OUT}=P_{1dB}$
Maximum Stable Gain (S_{21}/S_{12})	16	17		dB	$V_{DS}=5V, I_{DS}=50\% I_{DSS}, f=12\text{GHz}$
	10.5	12		dB	$V_{DS}=5V, I_{DS}=50\% I_{DSS}, f=24\text{GHz}$
Saturated Drain-Source Current (I_{DSS})	45	60	75	mA	$V_{DS}=1.3V, V_{GS}=0V$
Maximum Drain-Source Current (I_{MAX})		120		mA	$V_{DS}=1.3V, V_{GS}\approx +1V$
Transconductance		80		ms	$V_{DS}=1.3V, V_{GS}=0V$
Gate-Source Leakage Current (I_{GSO})		1	10	μA	$V_{GS}=-5V$
Pinch-Off Voltage (V_P)	0.7	1.0	1.3	V	$V_{DS}=1.3V, I_{DS}=0.2\text{mA}$
Gate-Source Breakdown Voltage (V_{BDGS})	12.0	14.0		V	$I_{GS}=0.2\text{mA}$
Gate-Drain Breakdown Voltage (V_{BDGD})	14.5	16.0		V	$I_{GD}=0.2\text{mA}$
Thermal Resistivity (θ_{JC})		280		$^{\circ}\text{C}/\text{W}$	$V_{DS}>3V$

Note: $T_{AMBIENT}=22^{\circ}\text{C}$, RF specifications measured at $f=12\text{GHz}$ using CW signal on a sample basis.

Absolute Maximum Ratings¹

Parameter	Rating	Unit
Drain-Source Voltage (V_{DS}) ($-3V < V_{GS} < -0.5V$) ²	8	V
Gate-Source Voltage (V_{GS}) ($0V < V_{DS} < +8V$)	-3	V
Drain-Source Current (I_{DS}) (For $V_{DS} < 2V$)	I_{DSS}	
Gate Current (I_G) (Forward or reverse current)	10	mA
RF Input Power (P_{IN}) (Under any acceptable bias state)	20	dBm
Channel Operating Temperature (T_{CH}) (Under any acceptable bias state)	175	°C
Storage Temperature (T_{STG}) (Non-Operating Storage)	-65 to 150	°C
Total Power Dissipation (P_{TOT}) ^{3, 4, 5}	0.5	W
Gain Compression (under any bias conditions)	5	dB
Simultaneous Combination of Limits ⁶ (2 or more max. limits)	80	%

Notes:

¹ $T_{AMBIENT} = 22^\circ\text{C}$ unless otherwise noted; exceeding any one of these absolute maximum ratings may cause permanent damage to the device.

²Operating at absolute maximum V_D continuously is not recommended. If operation at 8V is considered then I_{DS} must be reduced in order to keep the part within its thermal power dissipation limits. Therefore V_{GS} is restricted to $< -0.5V$.

³Total 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_{HS} = heatsink or ambient temperature above 22°C .
Example: For a 85°C carrier temperature: $P_{TOT} = 500 - (3.6\text{mW} \times (85 - 22)) = .27\text{W}$

⁴Total Power Dissipation (P_{TOT}) defined as $(P_{DC} + P_{IN}) - P_{OUT}$, where P_{DC} : DC Bias Power, P_{IN} : RF Input Power, P_{OUT} : RF Output Power.

⁵Users should avoid exceeding 80% of 2 or more Limits simultaneously.

⁶Thermal Resistivity specification assumes a Au/Sn eutectic die attach onto an Au-plated copper heatsink or rib.



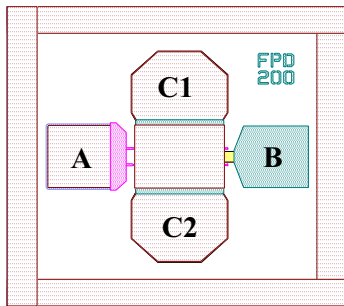
Caution! ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EUDirective 2002/95/EC (at time of this document revision).

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Pad Layout

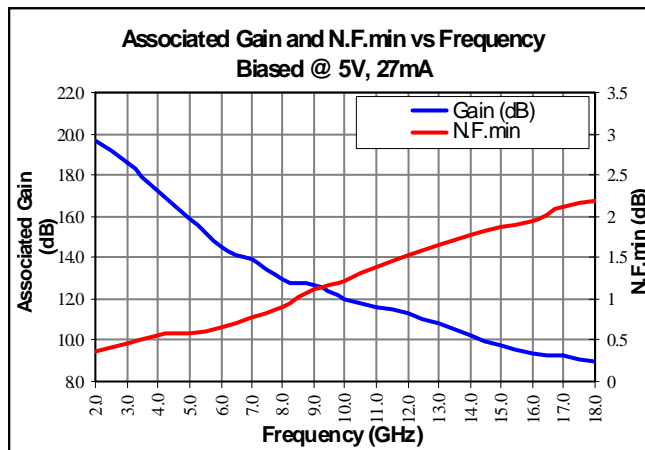
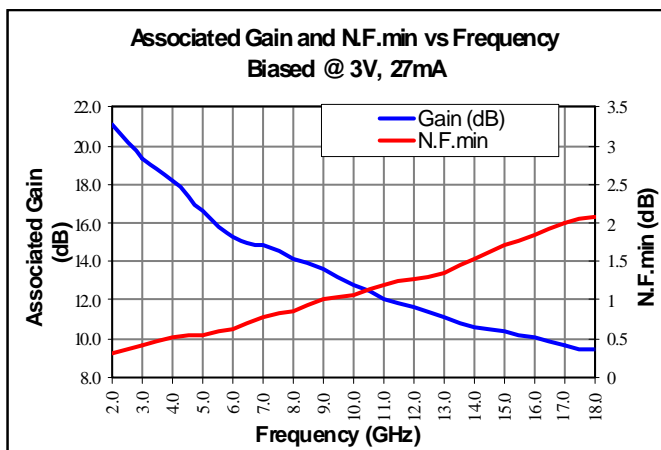
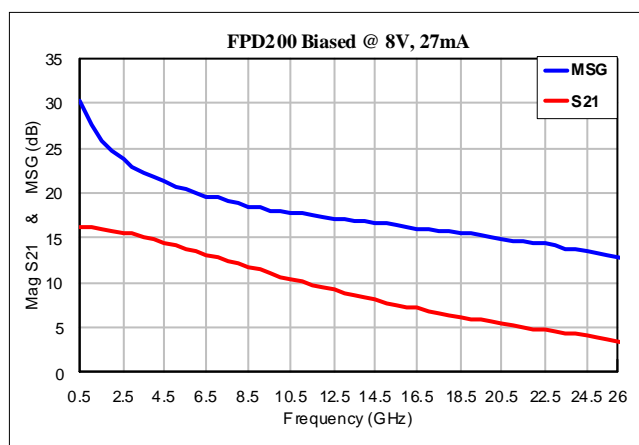
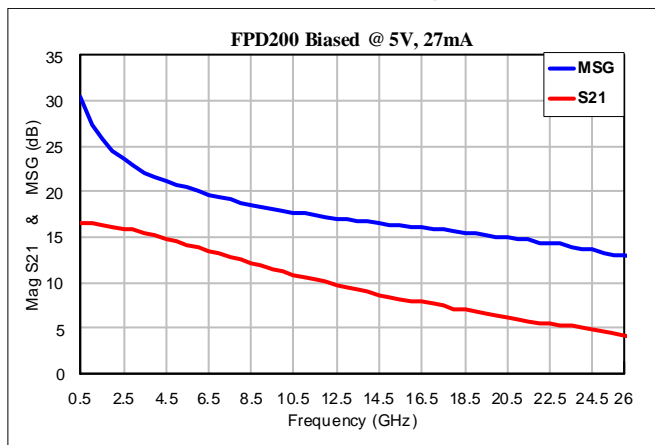


Pad	Description	Pin Coordinates (μm)
A	Gate Pad	90, 200
B	Drain Pad	320, 200
C1/C2	Source Pad	200, 290/110

Note: Coordinates are referenced from the bottom left hand corner of the die to the center of the bond pad opening.

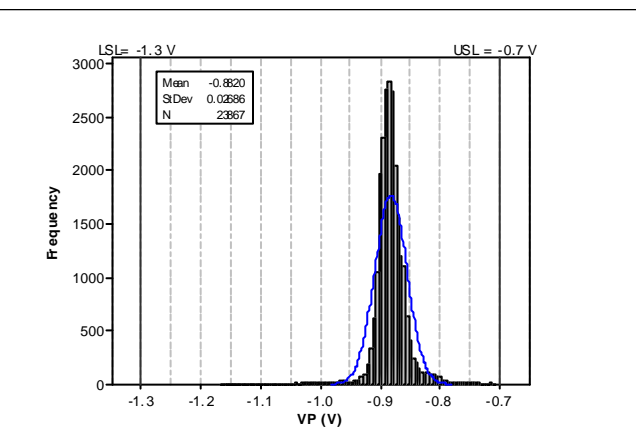
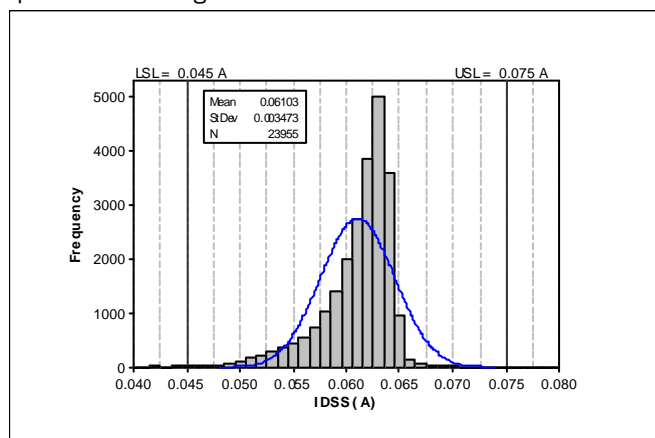
Die Size (μm)	Die Thickness (μm)	Min. Bond Pad Opening ($\mu\text{m} \times \mu\text{m}$)
400x400	75	75x80

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	N.F.min	Rn/50	Gamma Opt.	
GHz	dB	Ω	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 back of the die is metallized and the recommended mounting method is by the use of conductive epoxy. Epoxy should be applied to the attachment surface uniformly and sparingly to avoid encroachment of epoxy on to the top face of the die and ideally should not exceed half the chip height. For automated dispense Ablestick LMISR4 is recommended. For manual dispense Ablestick 84-1 LMI or 84-1 LMIT are recommended. These should be cured at a temperature of 150 °C for 1 hour in an oven especially set aside for epoxy curing only. If possible, the curing oven should be flushed with dry nitrogen. The gold-tin (80% Au 20% Sn) eutectic die attach has a melting point of approximately 280 °C but the absolute temperature being used depends on the leadframe material used and the particular application. The maximum time should be kept to a minimum.

This part has gold (Au) bond pads requiring the use of gold (99.99% pure) bondwire. It is recommended that 25.4mm diameter gold wire be used. Recommended lead bond technique is thermocompression wedge bonding with 0.001" (25µm) diameter wire. Bond force, time stage temperature, and ultrasonics are all critical parameters and the settings are dependant on the setup and application being used. Ultrasonic or thermosonic bonding is not recommended.

Bonds should be made from the die first and then to the mounting substrate or package. The physical length of the bondwires should be minimized especially when making RF or ground connections.

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.

ESD/MSL Rating

These devices should be treated as Class 0 (0V to 250V) 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 and Design Data

Application Notes and design data including S-parameters, noise parameters, and device model are available on request and from www.rfmd.com.

Reliability

An MTTF of 4.2 million hours at a channel temperature of 150 °C is achieved for the process used to manufacture this device.

Disclaimers

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

Ordering Information

Delivery Quantity	Ordering Code
Full Pack (100)	FPD200-000
Small Quantity (25)	FPD200-000SQ
Sample Quantity (3)	FPD200-000S3

