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FPD7612

GENERAL PURPOSE pHEMT

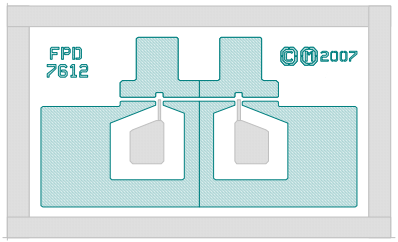
Package Style: Bare Die

Product Description

The FPD7612 is an AlGaAs/InGaAs pseudomorphic High Electron Mobility Transistor (pHEMT), featuring a 0.25µmx200µm 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

- 20.5dBm Output P_{1dB}
- 13dB Power Gain at 12GHz
- 17dB Maximum Stable Gain at 12GHz
- 11dB 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.		
Electrical Specifications					
P_{1dB} Gain Compression	19	20.5		dBm	V_{DS}=5V, I_{DS}=50% I_{DSS}
Small Signal Gain	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}
Power-Added Efficiency (PAE)		45		%	V_{DS}=5V, I_{DS}=50% I_{DSS}, P_{OUT}=P_{1dB}
Maximum Stable Gain (S21/S12)	16	17		dB	V_{DS}=5V, I_{DS}=50% I_{DSS}, f=12GHz
	9.5	11		dB	V_{DS}=5V, I_{DS}=50% I_{DSS}, f=24GHz
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}≈+1V
Transconductance (G_M)		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}=0.2mA
Gate-Source Breakdown Voltage (V_{BDGS})	|12.0|	|14.0|		V	I_{GS}=0.2mA
Gate-Drain Breakdown Voltage (V_{BDGD})	|14.5|	|16.0|		V	I_{GD}=0.2mA
Thermal Resistivity (θJC)		280		°C/W	V_{DS}>3V
Thermal Resistivity (θJC)		20		°C/W	V_{DS}>6V

Note: $T_{AMBIENT}$=22°C, RF specifications measured at f=12GHz using CW signal.

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Absolute Maximum Ratings[1]

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

[2] Operating 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.

[3] Total Power Dissipation to be de-rated as follows above 22 °C: $P_{TOT}=0.5-(0.0036W/°C)xT_{HS}$, where T_{HS} = heatsink or ambient temperature above 22 °C.
Example: For a 85 °C carrier temperature: $P_{TOT}=0.5-(0.0036x(85-22))=0.27W$

[4] Total 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.

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

[6] Thermal 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 EUDirective2002/95/EC (at time of this document revision).

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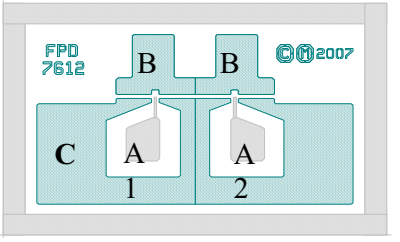
Pad Layout



Pad	Description	Pin Coordinates (μm)
A1	Gate Pad	190, 120
A2	Gate Pad	330, 120
B1	Drain Pad	200, 240
B2	Drain Pad	320, 240
C	Source Pad	

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 (μmxμm)
520x335	75	48x50

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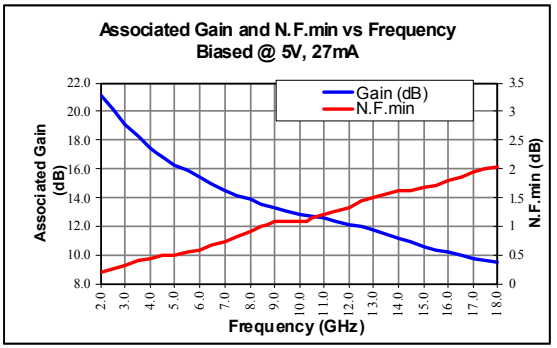
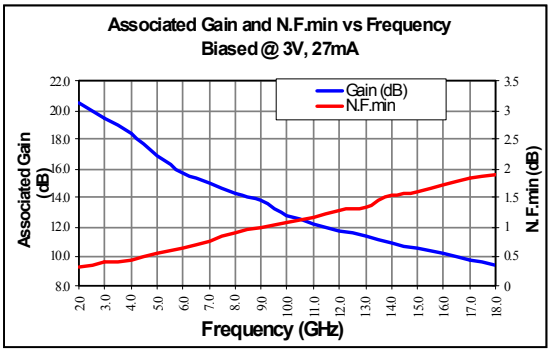
Typical Measured Performance





Noise Parameters (Biased at V_{DS}=3.0V, I_{DS}=27mA)

Freq	N.F.min	Rn/50	Gamma Opt.	
GHz	dB	Ω	Mag.	Angle
2.00	0.31	0.28	0.78	9.63
3.00	0.39	0.28	0.70	18.43
4.00	0.44	0.26	0.74	28.57
5.00	0.54	0.24	0.61	35.40
6.00	0.65	0.23	0.63	44.37
7.00	0.75	0.23	0.54	51.10
8.00	0.90	0.22	0.49	58.43
9.00	1.07	0.21	0.44	68.47
10.00	1.08	0.20	0.43	73.30
11.00	1.09	0.20	0.44	80.63
12.00	1.28	0.20	0.38	92.87
13.00	1.55	0.19	0.34	104.10
14.00	1.66	0.17	0.32	111.83
15.00	1.60	0.15	0.30	120.60
16.00	1.72	0.15	0.32	124.47
17.00	1.83	0.14	0.28	144.77
18.00	1.90	0.13	0.20	158.23

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 25.4 mm diameter gold wire be used. Recommended lead bond technique is thermocompression wedge bonding with 0.001" (25 µm) 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.

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)	FPD7612-000
Small Quantity (25)	FPD7612-000SQ
Sample Quantity (3)	FPD7612-000S3

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