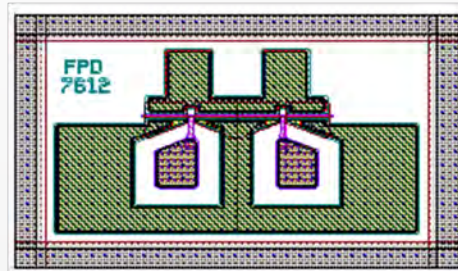


II-VI



FPD7612

General Purpose pHEMT

GENERAL DESCRIPTION

The FPD7612 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.

Bare Die

0.52mm x 0.335mm x 0.075mm



**100% RoHS
Compliant**

Key Characteristics

- 20.5 dBm Output P1dB
- 13 dB Power Gain at 12GHz
- 17 dB Maximum Stable Gain at 12 GHz
- 11 dB Maximum Stable gain at 18 GHz
- 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

General Purpose pHEMT

Typical Performance

SPECIFICATION

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	CONDITIONS
P1dB Gain Compression	P_{1dB}	19	20.5		dBm	$V_{DS} = 5V, I_{DS} = 50\% I_{DSS}$
Power Gain at P_{1dB}	G_{1dB}	11.0	13.0		dB	$V_{DS} = 5V, I_{DS} = 50\% I_{DSS}$
Power-Added Efficiency	PAE		45		%	$V_{DS} = 5V, I_{DS} = 50\% I_{DSS}, P_{OUT} = P_{1dB}$
Maximum Stable Gain (S21/S12)	MSG	16	17		dB	$V_{DS} = 5V, I_{DS} = 50\% I_{DSS}, f=12GHz$
			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	$V_{DS} = 1.3V, V_{GS} \approx +1V$
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	$V_{DS} = 1.3V, I_{DSS} = 0.2mA$
Gate-Source Breakdown Voltage	BV_{GS}	12.0	14.0		V	$I_{GS} = 0.2mA$
Gate-Drain Breakdown Voltage	BV_{GD}	14.5	16.0		V	$I_{GD} = 0.2mA$
Thermal Resistivity	θ_{JC}		280		$^{\circ}C/W$	$6V > V_{DS} > 3V$
Noise Figure	NF		1.2		dB	$V_{DS} = 5V, I_{DS} = 50\% I_{DSS}$

Note: $T_{AMBIENT} = 22^{\circ}C$

Absolute Maximum Ratings¹

PARAMETER	SYMBOL	TEST CONDITIONS	ABSOLUTE MAXIMUM
Drain Source Voltage	V_{DS}	$-3V < V_{GS} < -0.5V^2$	8V
Gate-Source Voltage	V_{GS}	$0V < V_{DS} < +8V$	-3V
Drain Source Current	I_{DS}		I_{DSS}
Gate Current	I_G	Forward or reverse current	10mA
RF Input Power	P_{IN}	Under any acceptable bias state	20dBm
Channel Operating Temperature	T_{CH}	Under any acceptable bias state	175 $^{\circ}C$
Storage temperature	T_{STG}	Non-Operating Storage	-65 $^{\circ}C$ to 150 $^{\circ}C$
Total Power Dissipation ^{3,4,5}	P_{TOT}	See De-Rating Note below	0.5W
Gain Compression		Under any bias conditions	5dB
Simultaneous Combination of Limits ⁶		2 or more max. limits	80%

Notes:

¹ $T_{AMBIENT} = 22^{\circ}C$ 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 $^{\circ}C$: $P_{TOT} = 0.5 - (0.0036W/^{\circ}C) \times T_{HS}$, where

T_{HS} = heatsink or ambient temperature above 22 $^{\circ}C$. Example: For a 85 $^{\circ}C$ carrier temperature:

$$P_{TOT} = 0.5 - (0.0036 \times (85 - 22)) = 0.27W$$

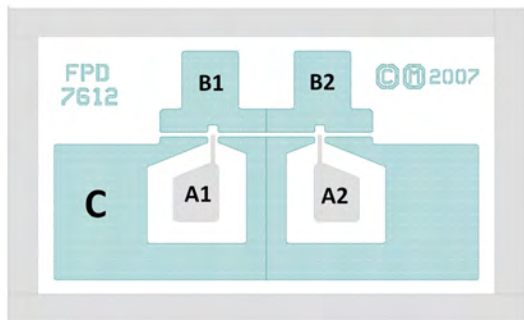
⁴ Total Power Dissipation (P_{TOT}) defined as $(P_{DC} + P_{IN}) - P_{OUT}$, where P_{DC} : DC Bias Power, P_{IN} : RF Input Power, P_{OUT} : RF Output Power.

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 heat sink or rib.

General Purpose pHEMT

Die Layout



Pad Layout

NAME	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: co-ordinates are referenced from the bottom left hand corner of the die to the centre of the bond pad opening.

DIE SIZE (μm)	DIE THICKNESS (μm)	MIN. BOND PAD OPENING (μm x μm)
500 x 335	75	48 x 50



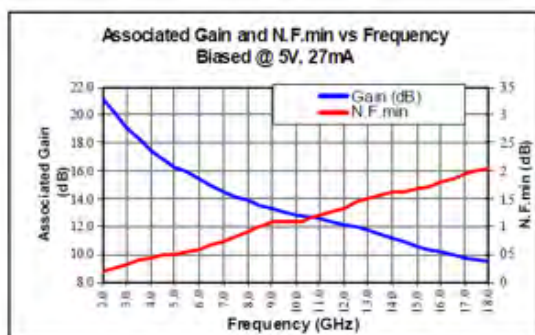
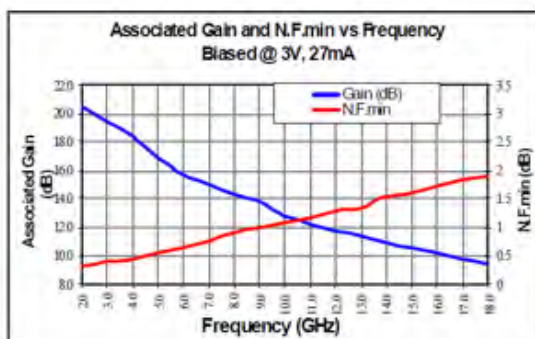
Caution! ESD sensitive device

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).

The information in this publication is believed to be accurate and reliable. However, no responsibility is assumed by II-VI Compound Semiconductors Ltd for its use, nor for any infringement of patents, or other rights of third parties, resulting from its use. No license is granted by implication or otherwise under any patent or patent rights of II-VI Compound Semiconductors Ltd. II-VI Compound Semiconductors Ltd reserves the right to change component circuitry, recommended application circuitry and specifications at any time without prior notice.

Typical Measured Performance



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

Freq GHz	N.F.min dB	Rn/50 Ω	Gamma Opt. Mag.	Gamma Opt. 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

General Purpose pHEMT

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 one 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 time at maximum temperature 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 25µm 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 dependent 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 0B (125V to <250V) as defined in JEDEC Standard No. JS-001 and subsequent revisions. Further information on ESD control measures can be found in MIL-STD-1686 and MIL-HDBK-263.

Reliability

An MTTF in excess of 4 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)	FPD7612 - 100
Small Quantity (25)	FPD7612 - 025
Sample Quantity (3)	FPD7612 - 003