FPD6836P70

Datasheet v3.0

LOW NOISE HIGH FREQUENCY PACKAGED PHEMT

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FEATURES:

- 22 dBm Output Power (P1dB)
- 15 dB Power Gain (G1dB) at 5.8 GHz
- 0.8 dB Noise Figure at 5.8 GHz
- 32 dBm Output IP3 at 5.8 GHz
- 45% Power-Added Efficiency at 5.8 GHz
- Useable Gain to 18 GHz

PACKAGE:

GENERAL DESCRIPTION:

The FPD6836P70 is a low parasitic, surface mountable packaged depletion mode pseudomorphic High Electron Mobility Transistor (pHEMT) optimised for low noise, high frequency applications.

TYPICAL APPLICATIONS:

- Gain blocks and medium power stages
- WiMax (2-11GHz)
- WLAN 802.11a (5.8GHz)
- Point-to-Point Radio (to 18GHz)

ELECTRICAL SPECIFICATIONS:

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Power at 1dB Gain Compression	P1dB	VDS = 5 V; IDS = 55mA		22		dBm
Small Signal Gain	SSG	VDS = 5 V; IDS = 55mA	14	16		dB
Power-Added Efficiency	PAE	VDS = 5 V; IDS = 55mA POUT = P1dB		45		%
Maximum Stable Gain (S21/S12) *f* = 12 GHz *f* = 18 GHz	MSG	VDS = 5 V; IDS = 55mA		 15 12		
Noise Figure	NF	VDS = 5 V; IDS = 55mA,		0.8		dB
Output Third-Order Intercept Point	IP3	VDS = 5V; IDS = 55mA POUT = 10 dBm SCL		32		dBm
Saturated Drain-Source Current	IDSS	VDS = 1.3 V; VGS = 0 V	90	105	135	mA
Maximum Drain-Source Current	IMAX	VDS = 1.3 V; VGS ≅ +1 V		215		mA
Transconductance	GM	VDS = 1.3 V; VGS = 0 V		140		mS
Gate-Source Leakage Current	IGSO	VGS = -5 V		1	10	μA
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 = 0.36mA	12	14		V
Gate-Drain Breakdown Voltage	|VBDGD|	IGD = 0.36 mA	14.5	16		V
Thermal Resistance	RθJC			275		°C/W

Note: $T_{AMBIENT}$ = 22°C; RF specification measured at f = 5.8 GHz using CW signal (except as noted)

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ABSOLUTE MAXIMUM RATING[1]:

PARAMETER	SYMBOL	TEST CONDITIONS	ABSOLUTE MAXIMUM
Drain-Source Voltage	VDS	-3V < VGS < +0V	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[2]	PIN	Under any acceptable bias state	16dBm
Channel Operating Temperature	TCH	Under any acceptable bias state	175°C
Storage Temperature	TSTG	Non-Operating Storage	-40°C to 150°C
Total Power Dissipation	PTOT	See De-Rating Note below	550mW
Simultaneous Combination of Limits[3]		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] Max. RF Input Limit must be further limited if input VSWR > 2.5:1

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

[4] Total Power Dissipation defined as: $P_{TOT} \equiv (P_{DC} + P_{IN}) - P_{OUT}$,

where P_{DC}: DC Bias Power, P_{IN}: RF Input Power, P_{OUT}: RF Output Power

Total Power Dissipation to be de-rated as follows above 22°C:

P_{TOT}= 550mW - (1/ RθJC) x T_{PACK}

where T_{PACK}= source tab lead temperature above 22°C

Example: For a 65°C carrier temperature: P_{TOT} = 550mW – (3.6 x (65 – 22)) = 323mW

BIASING GUIDELINES:

- Active bias circuits provide good performance stabilization over variations of operating temperature, but require a larger number of components compared to self-bias or dual-biased. Such circuits should include provisions to ensure that Gate bias is applied before Drain bias, otherwise the pHEMT may be induced to self-oscillate.
- Dual-bias circuits are relatively simple to implement, but will require a regulated negative voltage supply for depletion-mode devices such as the FPD6836P70.
- For standard Class A operation, a 50% of IDSS bias point is recommended. A small amount of RF gain expansion prior to the onset of compression is normal for this operating point. Class A/B bias of 25-33% IDSS offers an optimised solution for NF and OIP3.

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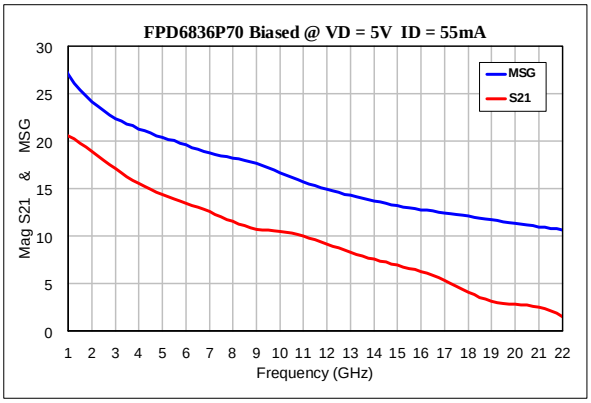
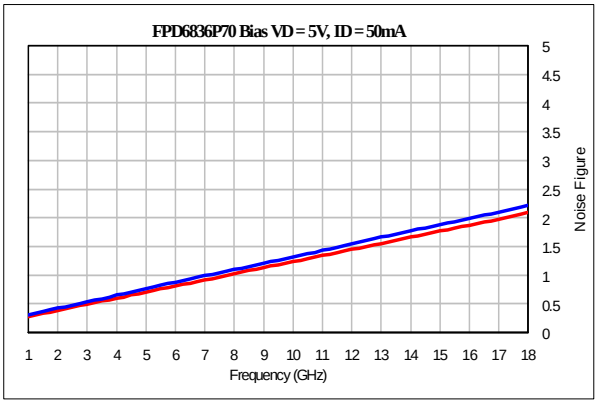
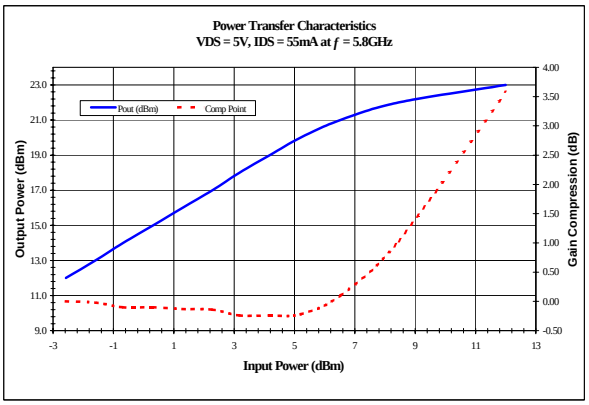
TYPICAL FREQUENCY RESPONSE

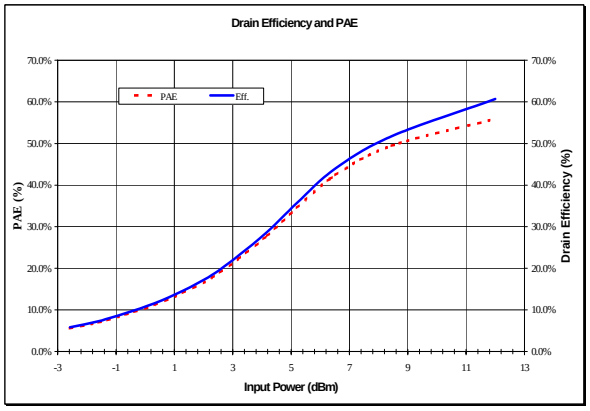


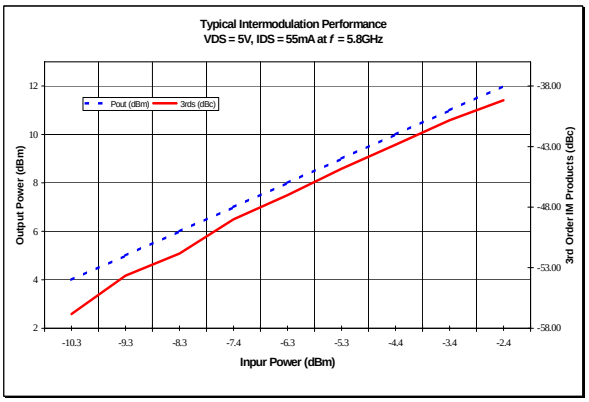


NOTE: Tuned Noise figure variation against frequency is shown above. The devices were biased nominally at V_{DS} = 5V, I_{DS} = 50mA. The test devices were tuned for minimum noise figure using tuners at the device input and output ports.

TYPICAL RF PERFORMANCE







NOTE: Typical Power, Efficiency and Intermodulation is shown above. The devices were biased nominally at V_{DS} = 5V, I_{DS} = 55mA at a test frequency of 5.8 GHz. The test devices were Tuned using slide tuners at the input and the output ports of the device.

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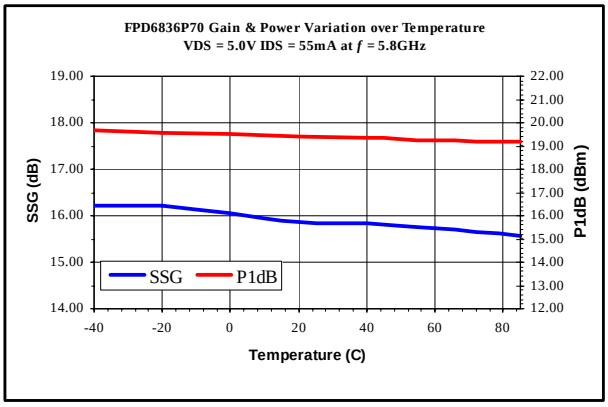
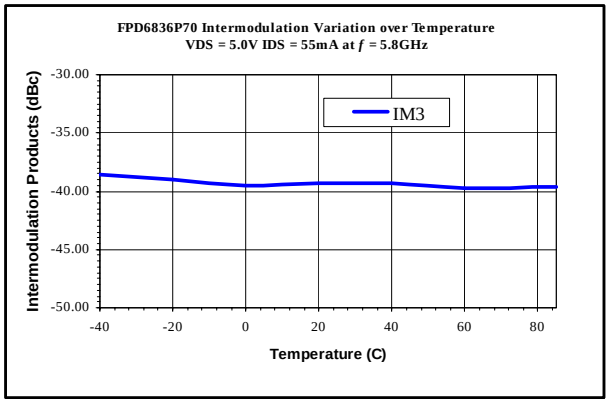
TEMPERATURE RESPONSE:





NOTE: Typical power, gain and Inter-modulation variation over temperature is shown above. The devices were biased nominally at V_{DS} = 5V, I_{DS} = 55mA at a test frequency of 5.8 GHz on eval board. The eval board is tuned for minimum noise and maximum gain. The 1dB compression point is lower than the typical number due to the change in matching.

NOISE PARAMETERS:

Bias 5V, 50mA

Freq (GHz)	Mag	Angle	Rn/50
0.90	0.747	15.70	0.165
1.80	0.623	24.95	0.176
2.40	0.795	37.45	0.158
2.60	0.640	47.15	0.159
2.80	0.670	47.90	0.160
3.20	0.617	51.20	0.156
4.00	0.542	68.70	0.141
5.00	0.465	85.00	0.120
5.50	0.431	91.10	0.114
6.00	0.366	101.15	0.107
7.00	0.262	122.10	0.096
8.00	0.188	153.60	0.100
9.00	0.135	-165.60	0.121
10.00	0.162	-126.80	0.138
11.00	0.183	-85.95	0.187
12.00	0.270	-68.40	0.239
13.00	0.343	-50.25	0.355
14.00	0.431	-43.95	0.461
15.00	0.573	-25.80	0.604

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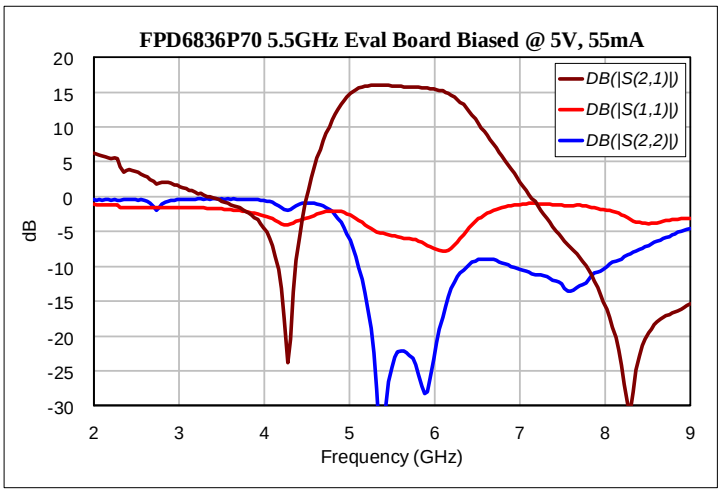
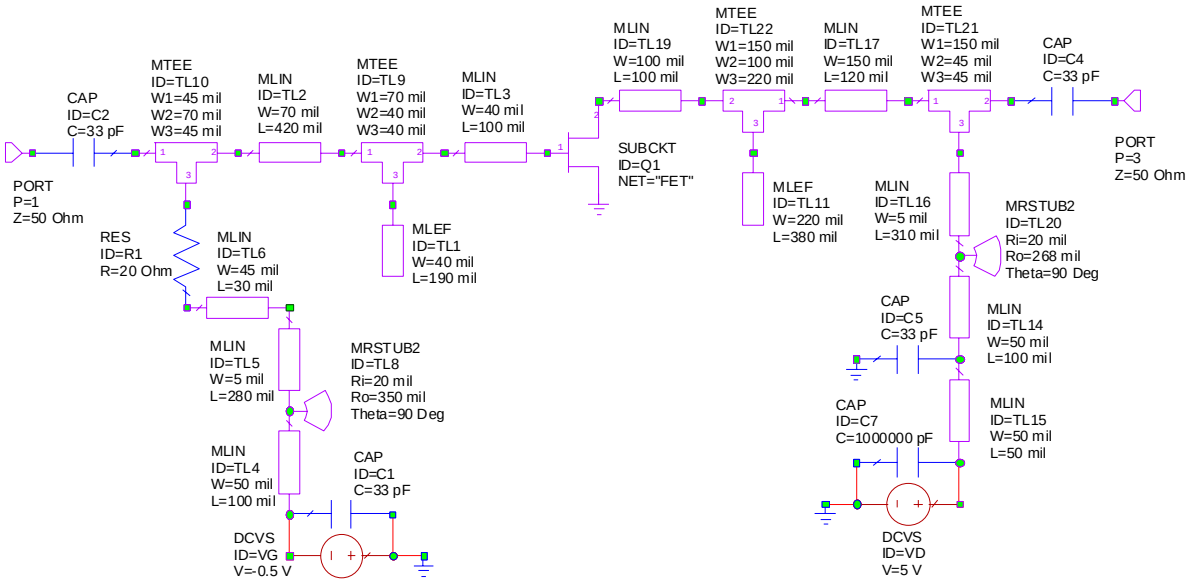
REFERENCE DESIGN 5.15 TO 5.85 GHZ:

FREQUENCY	GHZ	5.5
Gain	dB	16
N.F.	dB	1.0
P1dB	dBm	19.5
IP3	dBm	30
S11	dB	-6
S22	dB	-26
Vd	V	5
Vg	V	-0.4 to -0.6
Id	mA	55



SCHEMATIC



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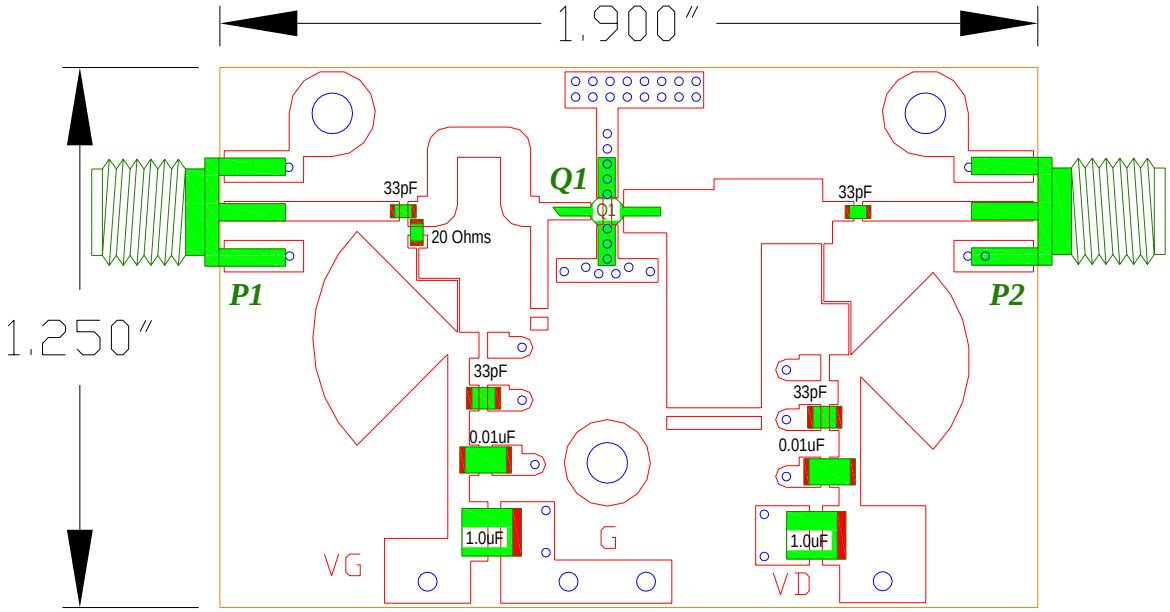
BOARD LAYOUT



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S-PARAMETERS BIASED @ 5V, 55mA:

FREQ[GHz]	S11m	S11a	S21m	S21a	S12m	S12a	S22m	S22a
0.500	0.976	-20.9	11.395	161.5	0.011	78.3	0.635	-11.5
0.750	0.953	-31.4	11.087	153.2	0.016	72.8	0.626	-17.0
1.000	0.925	-41.3	10.729	145.1	0.021	67.8	0.614	-22.2
1.250	0.894	-51.2	10.279	137.3	0.025	62.9	0.598	-26.9
1.500	0.860	-60.7	9.807	130.0	0.029	58.6	0.583	-30.9
1.750	0.827	-69.7	9.315	123.1	0.032	54.8	0.567	-34.6
2.000	0.796	-78.2	8.842	116.7	0.034	51.4	0.553	-37.9
2.250	0.767	-86.3	8.385	110.6	0.036	48.1	0.540	-40.8
2.500	0.742	-93.6	7.951	104.9	0.038	46.0	0.528	-43.6
2.750	0.718	-100.5	7.554	99.5	0.040	42.6	0.517	-46.2
3.000	0.694	-106.8	7.180	94.5	0.041	40.4	0.506	-48.9
3.250	0.672	-112.6	6.833	89.6	0.042	38.5	0.496	-51.2
3.500	0.650	-117.8	6.521	85.1	0.043	36.3	0.487	-53.5
3.750	0.629	-122.6	6.232	80.9	0.043	34.7	0.479	-55.5
4.000	0.614	-127.3	6.002	76.7	0.044	33.9	0.475	-57.7
4.250	0.600	-132.1	5.788	72.7	0.045	33.4	0.471	-59.5
4.500	0.587	-136.8	5.605	68.5	0.046	32.1	0.467	-62.3
4.750	0.571	-142.0	5.418	64.2	0.048	30.0	0.460	-64.6
5.000	0.555	-147.0	5.249	60.3	0.048	28.4	0.453	-66.4
5.250	0.540	-152.4	5.096	56.3	0.048	26.8	0.447	-68.2
5.500	0.529	-158.0	4.967	52.3	0.049	26.0	0.443	-70.0
5.750	0.521	-163.8	4.850	48.1	0.051	25.4	0.441	-72.6
6.000	0.511	-170.2	4.729	43.7	0.052	23.3	0.438	-76.0
6.250	0.504	-176.6	4.606	39.5	0.054	21.1	0.428	-78.8
6.500	0.499	177.0	4.498	35.3	0.055	19.2	0.418	-81.2
6.750	0.496	170.4	4.377	31.0	0.056	17.0	0.405	-84.3
7.000	0.493	163.9	4.261	26.8	0.057	14.0	0.391	-87.6
7.250	0.492	157.5	4.135	22.5	0.057	11.9	0.376	-90.7
7.500	0.491	151.2	4.007	18.4	0.058	9.4	0.361	-93.6
7.750	0.483	145.5	3.876	14.8	0.057	7.6	0.348	-96.1
8.000	0.486	140.4	3.784	11.2	0.057	6.4	0.340	-99.1
8.250	0.483	135.3	3.679	7.5	0.057	4.8	0.333	-101.7
8.500	0.479	130.8	3.588	4.1	0.058	5.0	0.331	-104.6
8.750	0.475	126.5	3.509	0.9	0.058	4.5	0.330	-107.2
9.000	0.473	122.5	3.448	-2.4	0.059	5.2	0.332	-109.6
9.250	0.473	118.4	3.415	-5.6	0.062	5.6	0.340	-112.7
9.500	0.476	114.1	3.397	-9.1	0.066	5.0	0.347	-116.0
9.750	0.483	109.1	3.376	-13.2	0.070	3.1	0.354	-120.7
10.000	0.488	103.4	3.339	-17.3	0.073	0.9	0.355	-124.8
10.250	0.495	97.7	3.312	-21.4	0.077	-1.5	0.360	-129.3
10.500	0.507	91.7	3.279	-25.9	0.080	-3.5	0.360	-134.3
10.750	0.521	85.7	3.229	-30.4	0.083	-6.7	0.357	-139.9
11.000	0.539	79.8	3.166	-35.0	0.086	-10.1	0.349	-145.6
11.250	0.560	74.3	3.091	-39.4	0.089	-12.3	0.338	-151.3
11.500	0.581	69.2	3.021	-43.7	0.091	-15.6	0.327	-157.2
11.750	0.603	64.8	2.945	-47.8	0.093	-18.5	0.316	-163.3
12.000	0.626	60.8	2.877	-51.9	0.095	-21.4	0.307	-169.6
12.250	0.645	57.1	2.804	-56.0	0.096	-24.2	0.300	-176.1
12.500	0.662	53.7	2.738	-60.1	0.097	-26.8	0.295	177.6
12.750	0.675	50.5	2.666	-64.2	0.098	-29.7	0.293	171.3
13.000	0.685	47.6	2.604	-68.2	0.100	-32.5	0.295	165.3

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S-PARAMETERS BIASED AT 5V, 55mA CONTINUED:

FREQ[GHz]	S11m	S11a	S21m	S21a	S12m	S12a	S22m	S22a
13.250	0.693	44.9	2.545	-72.1	0.101	-35.0	0.299	159.0
13.500	0.701	42.1	2.488	-76.1	0.102	-37.8	0.302	153.3
13.750	0.711	39.3	2.434	-79.9	0.103	-40.4	0.308	147.9
14.000	0.724	36.2	2.392	-83.8	0.106	-43.3	0.312	142.7
14.250	0.738	32.8	2.347	-87.7	0.107	-46.7	0.314	138.2
14.500	0.755	29.1	2.307	-91.8	0.107	-48.9	0.317	133.8
14.750	0.771	25.2	2.262	-95.7	0.109	-51.8	0.318	129.6
15.000	0.787	20.9	2.225	-99.7	0.109	-55.1	0.320	125.4
15.250	0.800	17.0	2.184	-103.8	0.110	-58.6	0.323	120.5
15.500	0.808	13.2	2.144	-107.9	0.112	-61.9	0.326	115.7
15.750	0.813	9.2	2.110	-112.2	0.112	-65.3	0.334	110.0
16.000	0.818	5.2	2.067	-116.6	0.112	-68.4	0.340	103.9
16.250	0.822	1.3	2.024	-121.1	0.113	-71.6	0.348	97.3
16.500	0.822	-2.4	1.973	-125.6	0.112	-75.7	0.357	90.3
16.750	0.824	-5.9	1.915	-130.0	0.111	-78.8	0.366	82.9
17.000	0.831	-9.6	1.855	-134.4	0.108	-83.5	0.373	76.1
17.250	0.839	-12.5	1.788	-138.4	0.108	-86.4	0.379	69.3
17.500	0.845	-15.3	1.721	-142.1	0.106	-88.7	0.387	63.5
17.750	0.852	-17.6	1.663	-145.7	0.105	-92.6	0.396	58.6
18.000	0.852	-19.5	1.603	-148.6	0.103	-94.2	0.406	54.7
18.250	0.848	-20.5	1.553	-151.4	0.102	-96.3	0.418	51.6
18.500	0.841	-20.9	1.508	-154.2	0.102	-98.6	0.429	48.5
18.750	0.829	-20.6	1.473	-156.6	0.100	-100.6	0.437	46.0
19.000	0.815	-20.5	1.440	-159.3	0.102	-103.0	0.449	43.1
19.250	0.805	-20.7	1.415	-161.9	0.102	-105.7	0.456	40.7
19.500	0.796	-21.6	1.398	-164.8	0.102	-107.4	0.456	39.3
19.750	0.786	-23.6	1.389	-167.6	0.104	-110.4	0.460	38.7
20.000	0.780	-26.8	1.382	-171.2	0.106	-113.5	0.460	37.9
20.250	0.778	-30.7	1.375	-175.1	0.107	-118.2	0.455	36.9
20.500	0.776	-35.6	1.369	-179.4	0.109	-121.5	0.452	35.7
20.750	0.777	-41.3	1.356	175.9	0.109	-126.2	0.444	34.4
21.000	0.779	-46.8	1.333	171.2	0.109	-130.7	0.438	31.4
21.250	0.782	-52.0	1.309	166.1	0.110	-135.0	0.432	26.9
21.500	0.784	-56.4	1.279	161.1	0.108	-140.3	0.424	20.6
21.750	0.785	-59.8	1.241	156.3	0.109	-144.2	0.421	13.6
22.000	0.786	-62.1	1.195	152.0	0.110	-148.4	0.417	6.0
22.250	0.783	-63.5	1.162	147.9	0.108	-152.0	0.420	-1.5
22.500	0.777	-65.4	1.124	144.2	0.108	-155.3	0.426	-7.9
22.750	0.772	-67.7	1.098	140.5	0.108	-159.3	0.428	-12.7
23.000	0.774	-70.1	1.073	137.2	0.108	-162.4	0.428	-16.5
23.250	0.771	-73.2	1.054	133.8	0.109	-164.5	0.436	-19.5
23.500	0.755	-76.1	1.043	130.5	0.112	-169.1	0.434	-22.0
23.750	0.750	-79.2	1.028	127.1	0.110	-171.7	0.443	-25.3
24.000	0.744	-81.7	1.025	123.5	0.112	-175.2	0.433	-29.0
24.250	0.741	-84.1	1.027	120.0	0.116	-178.7	0.429	-33.5
24.500	0.732	-86.5	1.031	116.1	0.120	178.5	0.418	-36.8
24.750	0.718	-89.2	1.047	112.0	0.127	174.2	0.407	-41.2
25.000	0.704	-90.9	1.061	107.3	0.132	170.0	0.396	-46.5
25.250	0.688	-95.1	1.074	102.3	0.135	165.2	0.372	-50.7
25.500	0.677	-99.6	1.080	97.0	0.143	159.3	0.349	-57.2
25.750	0.673	-105.6	1.086	90.9	0.146	154.0	0.327	-64.2
26.000	0.677	-111.1	1.065	85.8	0.148	147.8	0.298	-71.0

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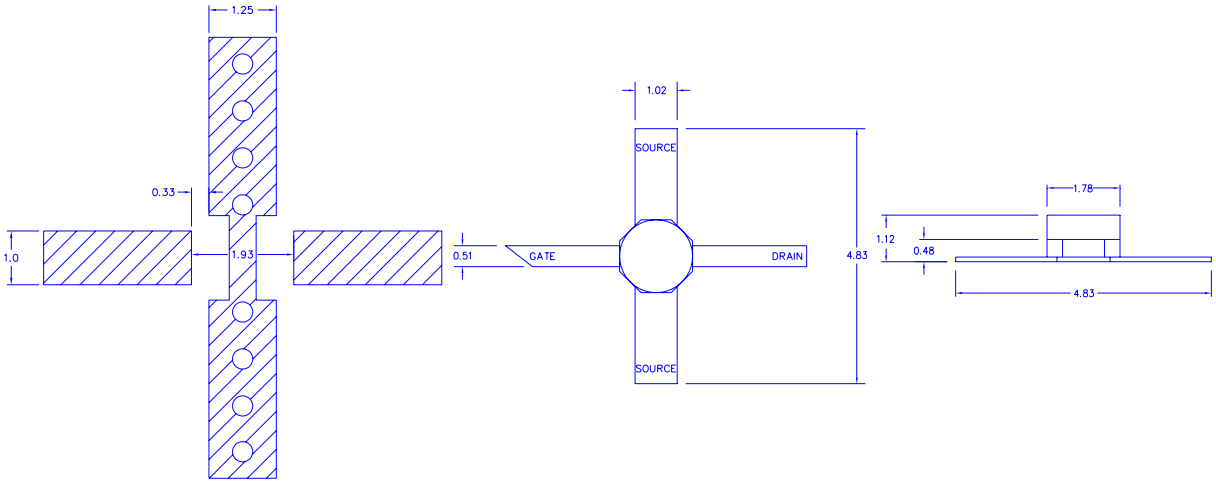
PACKAGE OUTLINE:

(dimensions in millimeters – mm)



PREFERRED ASSEMBLY INSTRUCTIONS:

Available on request.

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-B (Human Body Model) and Class 0 (0-250V) per JESD22-A115-A (Machine Model). 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 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
FPD6836P70	Packaged pHEMT

Specifications subject to change without notice
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