Highlight of Innogration solution

- Industry leading density of LDMOS process and better thermal layout to enable the equivalent or better power and safety margin at lower Class E operation voltage，comparison in next page

业界领先的功率密度和散热布局,使得远创达LDMOS在E类放大条件下，能获得相当或者更好的功率和健壮安全性余量，见下页比较

- Run the device at reasonably lower operation drain voltage，Drain voltage adjustable from 32V to 40V to have more room of power and ruggedness trade off, 36V recommended

器件合理降额至稍低的工作电压，以确保足够的健壮性裕量。建议工作电压32V至40V可调，这样可以获得较多的设计空间，以同时平衡系统功率和健壮性,主要推荐36V

- 1:2 or 1:4 combination recommended as trade off of cost , performance and ruggedness according to different applications, in most cases, 1:4 recommended，so the key is to develop highly rugged 0.3-0.9KW pallet to be further combined with certain power margin, see next pages

推荐1比2到1比4进行合成，主要推荐1:4，以针对应用场景折衷成本/功率/健壮性等，重点实现300-900W级别的高健壮性待合成模块，具有一定的功率裕量，见后续框图

- 90 degree hybrid combination recommended，Phase alignment with each path play critical role on ruggedness

推荐90度正交合成，同时留意每路之间的相位差会对功率还有健壮性产生相应影响。

- Device recommended to be soldered then maximize the dissipated power at extreme mismatch conditions, and improve the production consistency

器件推荐焊接，这样可以在极端失配条件下，最大化散热能力，同时改善批量生产一致性。

Innogration Technologies

Core LDMOS transistors: 01 series @ 13.56MHz

Transistor	reference design	Frequency (MHz)	CW Power (W)	Voltage (V)	Transistor size (mm)
ITEV01600B4C	Class E	13.56	600/250	50/36	10*20
MQ011K3VPX	Class E	13.56	1300/600	50/36	10*41
MQ012K0VPX	Class E	13.56	2000/900	50/36	10*41
MF012K5VPX	Class E	13.56	2500/1200	50/36	10*47

高度平台化设计：

- Lower power preferred Class AB for simplicity

较低功率采用简单的AB类设计

- All Class E reference design use the same PCB layout and mechanical design, only BOM difference
- 所有E类放大器设计共享相同的PCB布局和结构件设计，仅有匹配元件值的不同

Innogration Technologies

Core LDMOS transistors: 01 series @ other bands

Transistor	reference design	2MHz	27.12MHz	40.68MHz	60MHz
MQ011K3VPX	Class E	Development	Ready	Development	Ready
MQ012K0VPX	Class E	Ready	Ready	Ready	Ready

Innogration Technologies

>2KW devices Performance Comparison

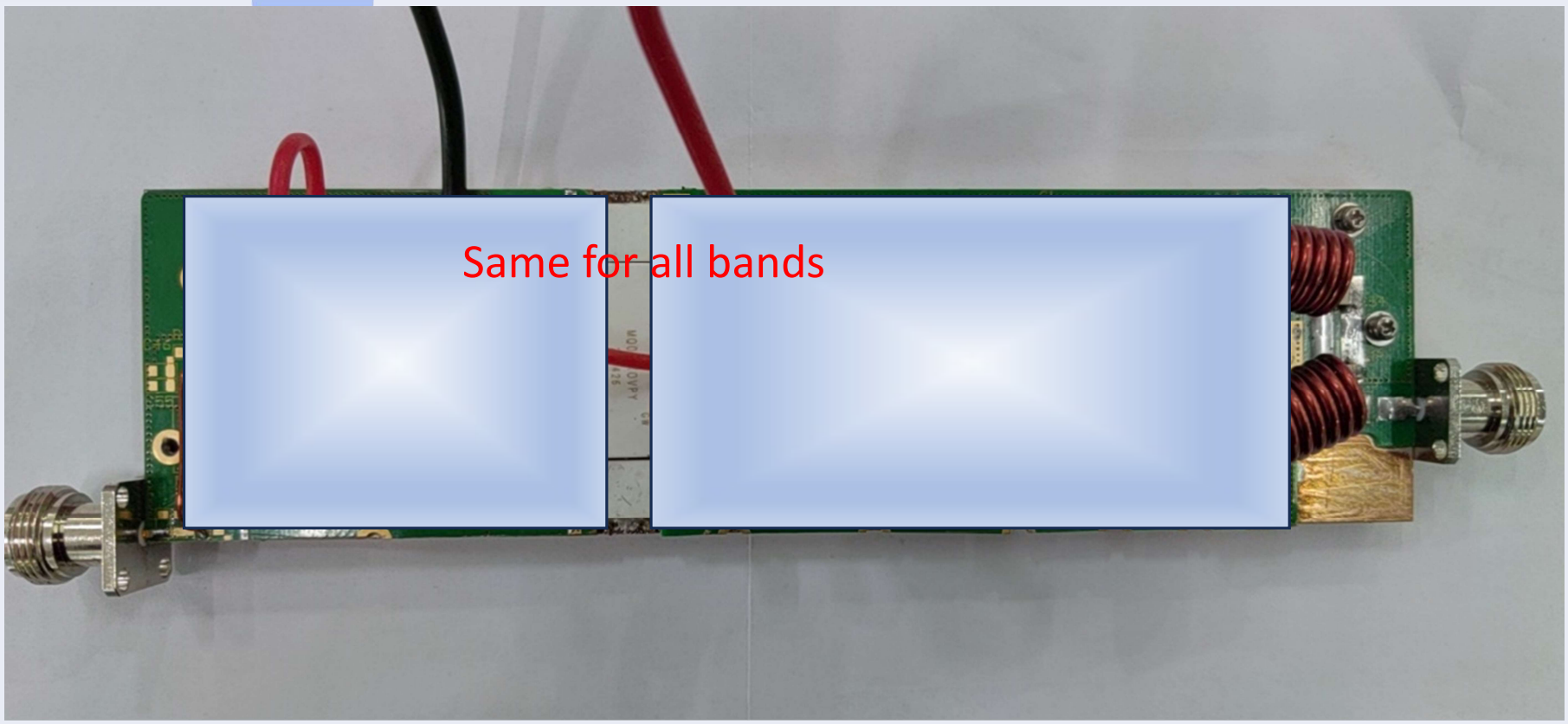
Features	Competitor	MQ012K0VPX	MF012K5VPX（New release）	MQ012K0UPX（Q3 released Sample available）
Vds(typical)	65V	50V	50V	60V
Power	2000W	2000W	2500W	2000W
Breakdown Voltage	200V	140V	140V	170V
VSWR @108MHz	65: 1	65: 1	65: 1	65: 1
Class E operation Power Watt/Voltage Volts @13.56MHz	1200W/56V	1200W/40V or 900W/36V	1200W/36V	1100W/42V or 850W/36V
Swing voltage/Safety margin	3.5	3.5 to 3.9	3.5	4
Class E Power*Margin	**4200**	**4200**	**4900**	**4400**
Class E Efficiency	**81%**	**83%**	**82%**	**81%**

Absolute Breakdown voltage doesn't mean everything in design, more important is as high as possible power at enough safety margin
设计选型中击穿电压绝对值不应该是设计的唯一考量，更为重要的是在足够的健壮性裕量条件下，获得足够高的功率输出

Flagship solution: MQ012K0VPX and its combination

- **Lump elements Class E reference design**

Example: MQ012K0VPX Class E board at a glance



Innogration Technologies

13.56MHz: MQ012K0VPX working at 36V--- RF

MQ012K0VPX VDS=36V Vgs=3.1V Idq =5mA CW								
Freq(MHz)	Pin (dBm)	Pout (dBm)	Pout (W)	IDS(A)	Gain (dB)	Eff(%)	2nd	3rd
13.560	42.1	60.00	1000	33.4	17.9	83.2	-44	-66
	41.1	59.94	986	33.0	18.8	83.0	/	/
	40.2	59.86	968	32.5	19.7	82.8	/	/
	39.2	59.76	946	32.0	20.6	82.1	/	/
	38.2	59.61	914	31.2	21.4	81.4	/	/
	37.2	59.36	863	30.0	22.2	79.9	/	/
	36.2	58.91	778	28.2	22.7	76.6	/	/
	35.2	58.18	658	25.5	23.0	71.6	/	/
	34.2	57.34	542	22.7	23.1	66.3	/	/
	33.2	56.54	451	20.1	23.3	62.3	/	/
	32.2	55.64	366	17.7	23.4	57.5	/	/
	31.2	54.44	278	15.3	23.2	50.5	/	/
	30.2	53.13	206	13.0	22.9	43.9	/	/

Application based on Dec 25 2023

13.56MHz：MQ012K0VPX output voltage

DEMO_2 MQ012K0VPX_V2 Drain voltage			
Freq(MHz)	VDD=36V		
	Pout=750W	Pout=800W	Pout=Psat
12.882	97V	98.5V	111V
13.56	94V	95V	107V
14.238	92V	94V	108V

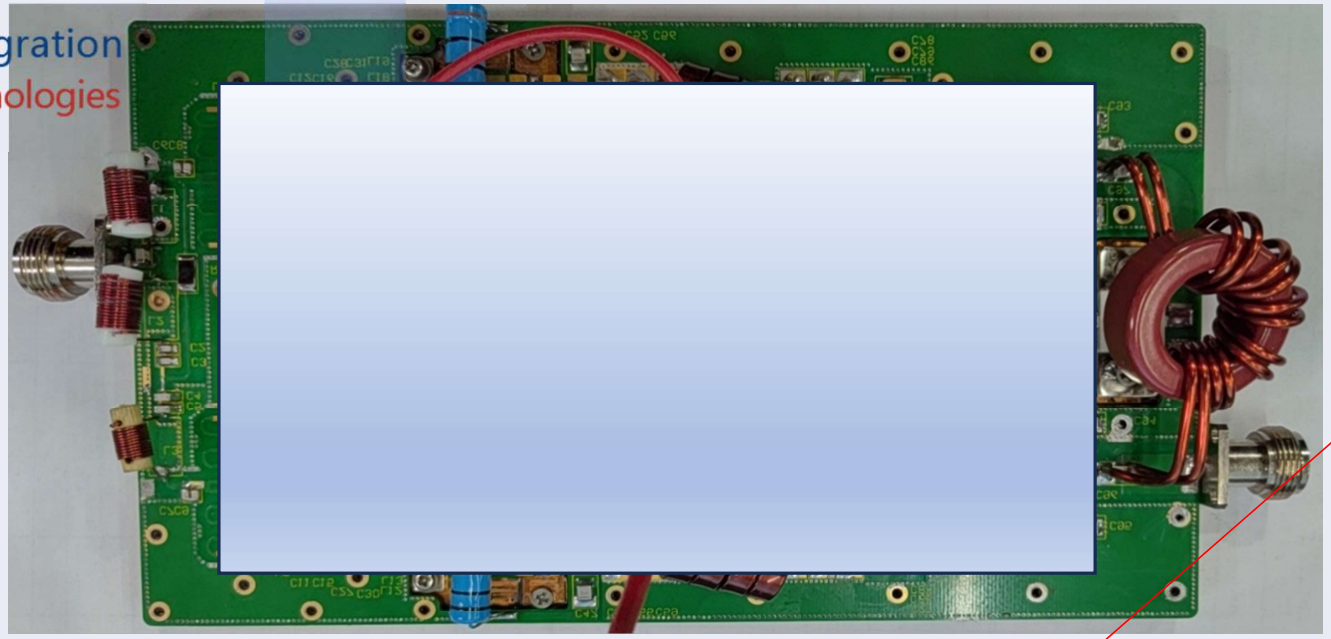
13.56MHz: MQ012K0VPX working at 36V--- Ruggedness

MQ012K0VPX		
Test Signal @13.56MHz	VSWR(N:1) All phase	900W / Ids(A)
10% 100us	30:1	3.3A
		15 pcs from 3 Lots 100% survived

All phase Ruggedness test video upon request
全相位健壮性测试视频可联系获得

Innogration Technologies

MQ012K0VPX*2 at 13.56MHz



2000W reached, highly marginal over 1500W target power

MQ012K0VPX*2 VDS=36V Vgs=2.9V Idq =5mA CW								
Freq(MHz)	Pin（dBm）	Pout（dBm）	Pout（W）	IDS(A)	Gain（dB）	Eff(%)	2th	3th
13.560	46.1	63.05	2018	69.6	17.0	80.6	-51.5	-78.9
	45.1	62.89	1945	67.8	17.8	79.7	/	/
	44	62.65	1841	65.5	18.7	78.0	/	/
	43	62.25	1679	62.3	19.3	74.9	/	/
	42	61.80	1514	58.3	19.8	72.2	/	/
	41	61.24	1330	54.0	20.2	68.5	/	/
	40	60.65	1161	51.5	20.7	62.7	/	/
	39	60.00	1000	45.1	21.0	61.6	/	/
	38	59.00	794	39.1	21.0	56.4	/	/
	37	57.90	617	34.3	20.9	50.0	/	/
	36	56.80	479	29.6	20.8	44.9	/	/

Innogration Technologies

2MHz: MQ012K0VPX working at 36V--- RF

Freq (MHz)	Pin (dBm)	Pout (dBm)	Pout (W)	IDS (A)	Gain (dB)	Eff (%)	2nd	3rd
2	42.2	59.85	966	31.76	17.7	84.49	/	/
	41.7	59.76	946	31.34	18.1	83.87	-25	-37
	41	59.63	918	30.80	18.6	82.82	/	/
	40.1	59.5	891	30.30	19.4	81.71	/	/
	39.15	59.3	851	29.34	20.2	80.58	/	/
	38.18	59.02	798	28.25	20.8	78.47	/	/
	37.17	58.61	726	27.10	21.4	74.43	/	/
	36.18	57.9	617	26.00	21.7	65.88	/	/
	35.16	57.1	513	24.70	21.9	57.68	/	/
	34.24	56.36	433	23.25	22.1	51.67	/	/
	33.22	55.46	352	21.20	22.2	46.06	/	/
	32.22	54.4	275	18.80	22.2	40.69	/	/

Application based on April 19， 2024

Innogration Technologies

27.12MHz: MQ012K0VPX working at 36V--- RF

Freq(MHz)	Pin(dBm)	Pout(dBm)	Pout(W)	IDS(A)	Gain(dB)	Eff(%)	2nd	3rd
27.12	41.2	60.42	1102	35.50	19.2	86.19	-37	-60
	40.2	60.31	1074	35.12	20.1	84.95	/	/
	39.3	60.2	1047	34.52	20.9	84.26	/	/
	38.3	59.97	993	33.60	21.7	82.10	/	/
	37.3	59.6	912	32.00	22.3	79.17	/	/
	36.4	59.13	818	30.13	22.7	75.46	/	/
	35.4	58.5	708	27.60	23.1	71.25	/	/
	34.5	57.87	612	25.20	23.4	67.50	/	/
	33.5	57.2	525	22.90	23.7	63.66	/	/
	32.5	56.5	447	20.60	24.0	60.23	/	/
	31.5	55.5	355	18.40	24.0	53.56	/	/
	30.5	54.5	282	16.10	24.0	48.63	/	/

Application based on April 7, 2023

Innogration Technologies

40.68MHz: MQ012K0VPX working at 36V--- RF

Freq (MHz)	Pin (dBm)	Pout (dBm)	Pout (W)	IDS (A)	Gain (dB)	Eff (%)	2nd	3rd
40.68	43.89	60.12	1028	34.22	16.2	83.45	-35.3	-53.41
	42.9	60	1000	33.64	17.1	82.57	/	/
	41.9	59.79	953	32.70	17.9	80.94	/	/
	40.9	59.38	867	30.96	18.5	77.79	/	/
	40	58.78	755	28.71	18.8	73.06	/	/
	39	58.06	640	26.16	19.1	67.93	/	/
	38.1	57.34	542	23.62	19.2	63.74	/	/
	37.15	56.67	465	21.18	19.5	60.92	/	/
	36.27	56.11	408	19.12	19.8	59.32	/	/
	35.3	55.48	353	17.09	20.2	57.41	/	/
	34.3	54.66	292	15.12	20.4	53.72	/	/
	33.3	53.45	221	13	20.2	47.29	/	/

Application based on April 10，2024

Innogration Technologies

60MHz: MQ012K0VPX working at 36V--- RF

Freq(MHz)	Pin(dBm)	Pout(dBm)	Pout(W)	IDS(A)	Gain(dB)	Eff(%)	2nd	3rd
60	43.17	60.30	1072	33.5	17.1	80.0	/	/
	42.25	60.10	1023	32.5	17.9	78.7	/	/
	41.32	59.74	942	30.3	18.4	77.8	/	/
	40.38	59.20	832	28.9	18.8	72.1	/	/
	39.45	58.50	708	26.5	19.1	66.8	/	/
	38.62	57.87	612	24.3	19.3	63.0	/	/
	37.67	57.10	513	21.9	19.4	58.5	/	/
	36.7	56.30	427	19.6	19.6	54.4	/	/
	35.71	55.56	360	17.4	19.9	51.8	/	/
	34.74	54.70	295	15.3	20.0	48.2	/	/
	33.78	53.80	240	13.4	20.0	44.8	/	/

Application based on March 13， 2024

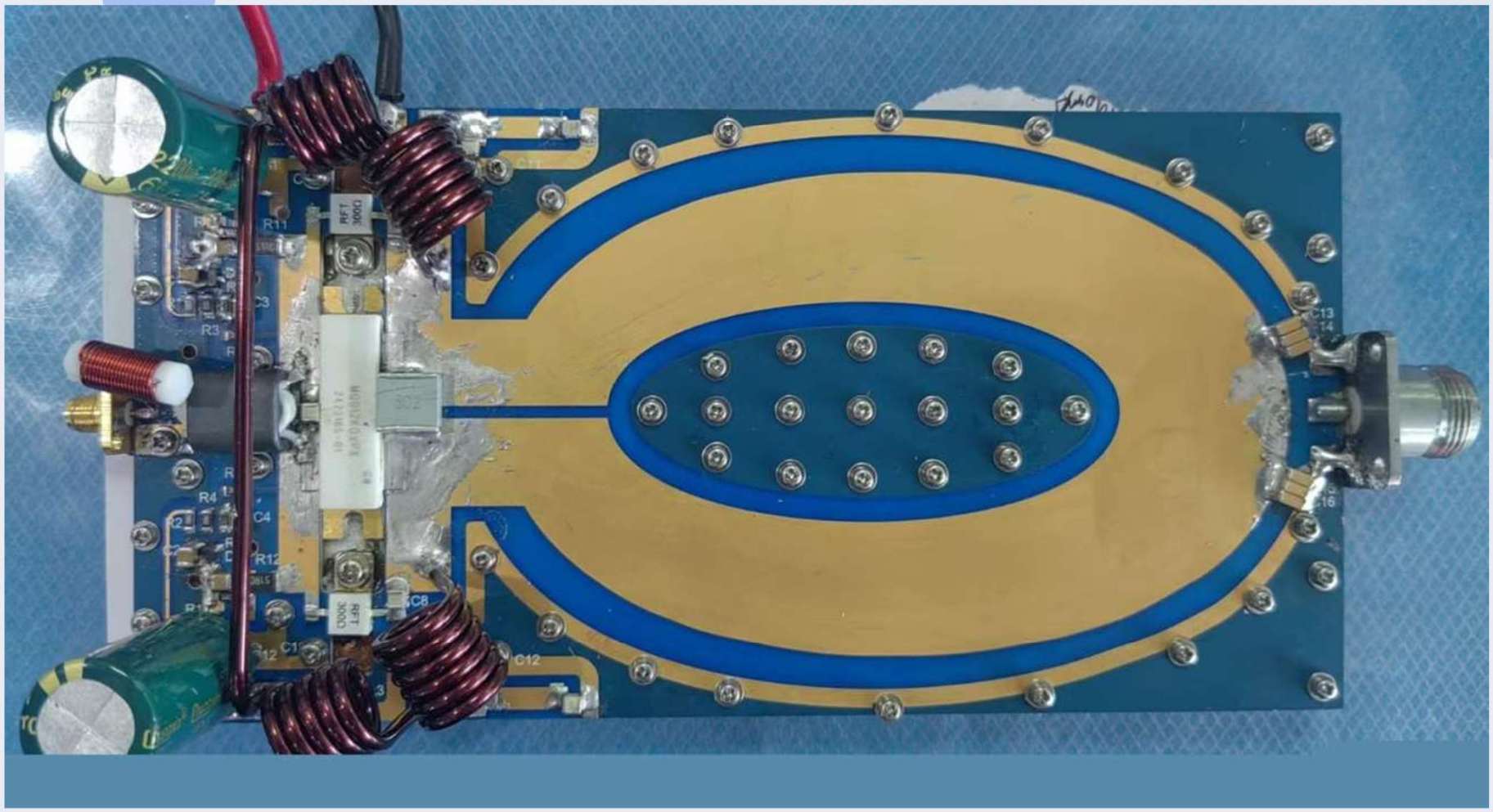
Innogration Technologies

Flagship solution: MQ012K0VPX

- **Microstrip Balun Class E reference design**

Innogration Technologies

Simpler elliptical balun design @13.56M



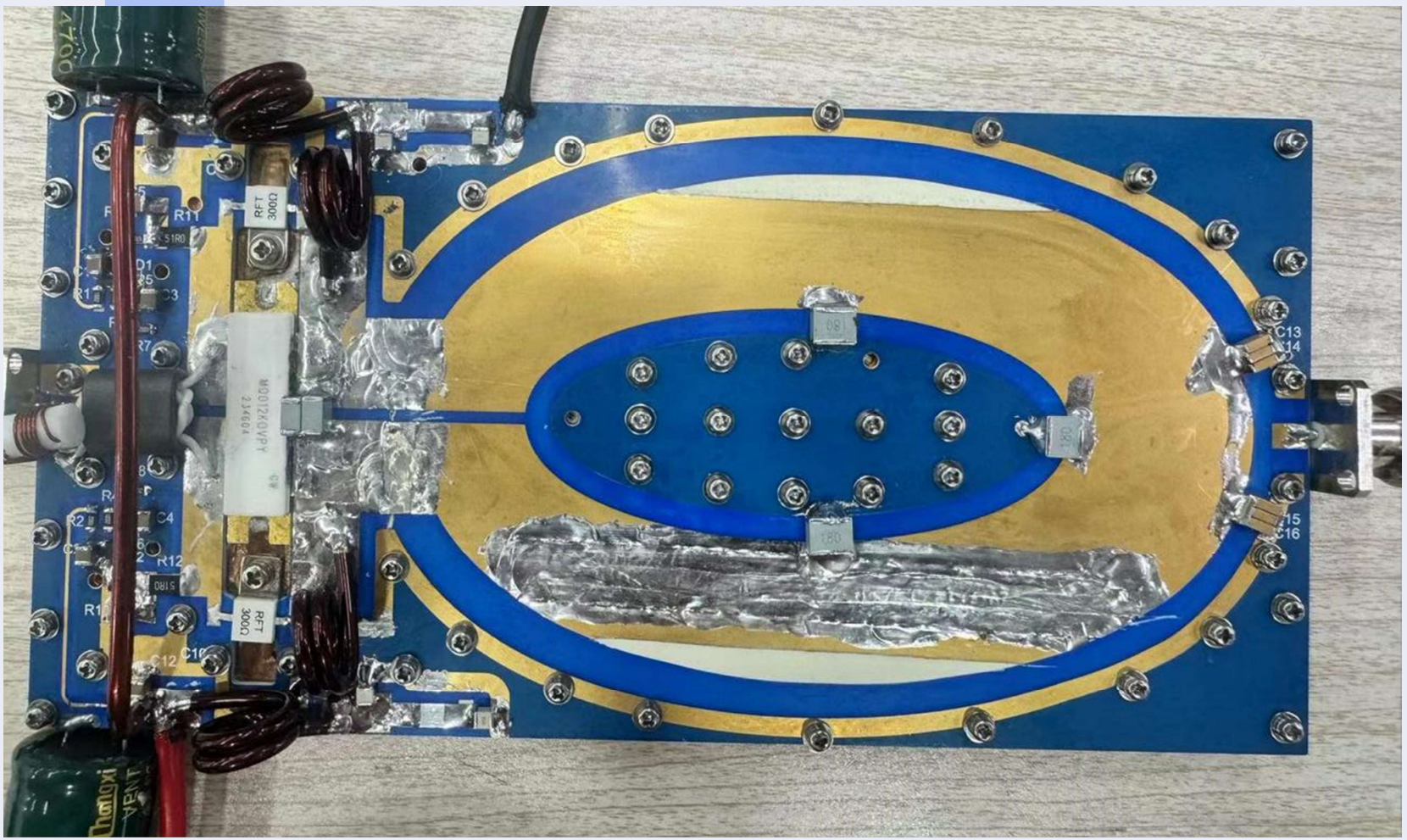
Innogration Technologies

Simpler design：elliptical balun design @13.56M

MQ012K0VPX VDS=36V IDQ=120mA CW						
Freq (MHz)	Pout (dBm)	Pout (W)	IDS (A)	Pin (dBm)	Gain (dB)	Eff(%)
12.882	60.04	1009.3	33.16	36.67	23.37	84.54
13.56	60.15	1035.1	33.90	35.73	24.42	84.82
14.238	60.37	1088.9	35.50	35.75	24.62	85.21

Innogration Technologies

Simpler elliptical balun design @27.12M



Innogration Technologies

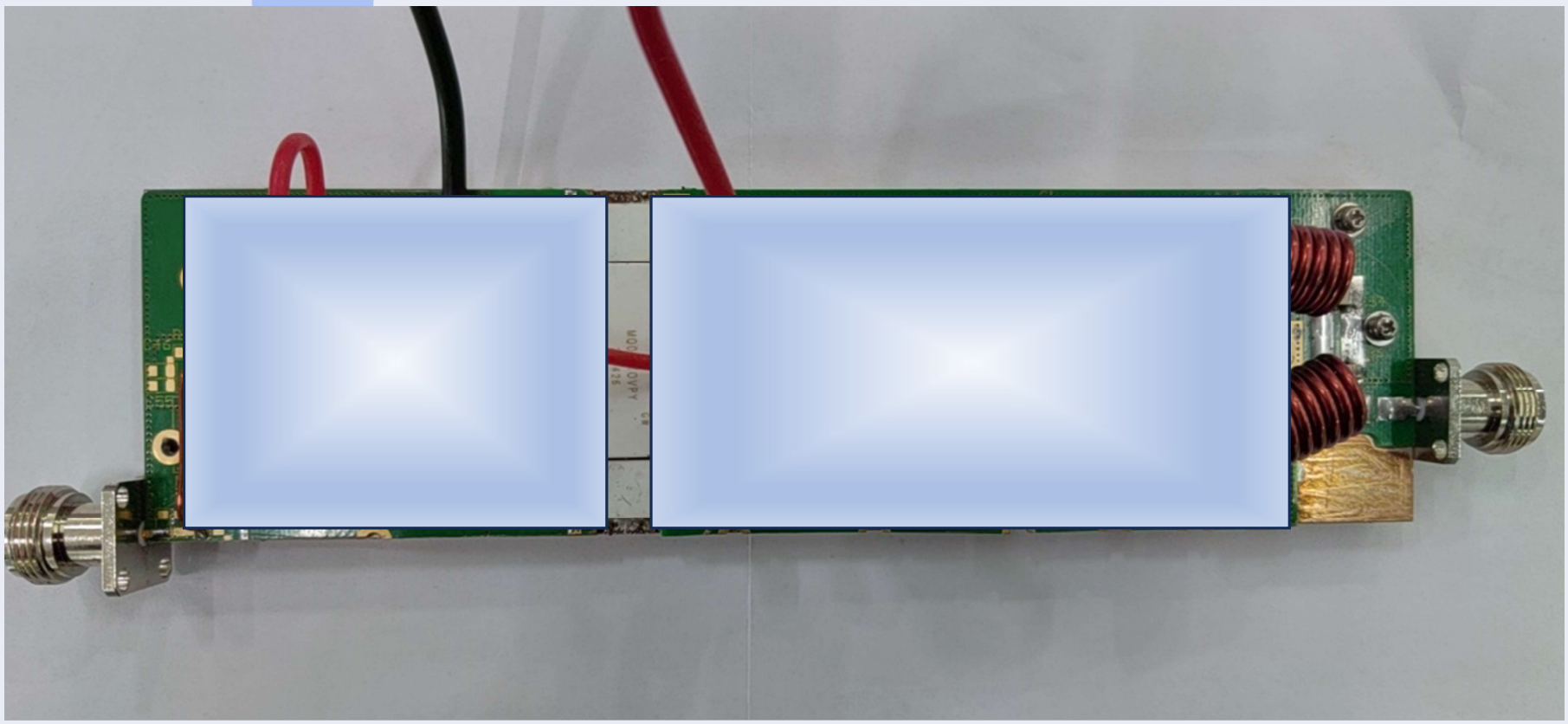
Simpler elliptical balun design @27.12M

MQ012K0VPY^{GW} VGS=3.30V VDS=36V IDQ=540mA CW								
Freq (MHz)	Psat (dBm)	Psat (W)	IDS (A)	Pin (dBm)	Gain (dB)	Eff(%)	2th（dBc）	3th（dBc）
27.12	60.31	1074.0	36.20	37.73	22.58	82.41	-47.3	-35.0
	60.21	1049.5	35.80	36.75	23.46	81.44	/	/
	60.07	1016.2	35.23	35.85	24.22	80.13	/	/
	59.83	961.6	34.26	34.85	24.98	77.97	/	/
	59.37	865.0	32.40	33.85	25.52	74.16	/	/
	58.75	749.9	30.09	32.85	25.90	69.23	/	/
	58.01	632.4	27.63	31.84	26.17	63.58	/	/
	57.23	528.4	25.30	30.84	26.39	58.02	/	/
	56.39	435.5	23.04	29.83	26.56	52.51	/	/
	55.51	355.6	20.87	28.80	26.71	47.33	/	/
	54.63	290.4	18.91	27.80	26.83	42.66	/	/
	53.68	233.3	16.99	26.80	26.88	38.15	/	/
	52.68	185.4	15.24	25.80	26.88	33.78	/	/
	51.57	143.5	13.40	24.80	26.77	29.76	/	/

Innogration Technologies

Flagship solution: MQ011K3VPX and its combination

Example：MQ011K3VPX Class E board at a glance



Application based on Jan 8 2023

Innogration Technologies

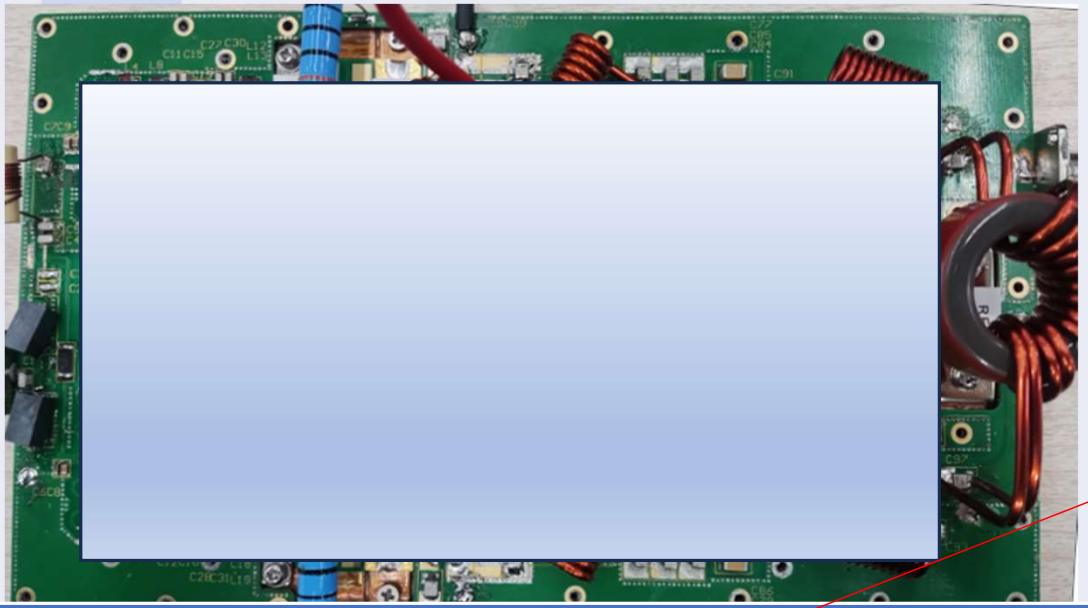
13.56MHz: MQ011K3VPX working at 36V--- RF

MQ011K3VPX VDS=36V Vgs=2.758V Idq =0mA CW DEMO3								
Freq(MHz)	Pin （dBm）	Pout （dBm）	Pout （W）	IDS(A)	Gain （dB）	Eff(%)	2nd	3rd
13.560	40.95	58.89	774	26.70	17.9	80.6	-44.8	-65
	39.95	58.80	759	26.32	18.9	80.1	/	/
	39.03	58.68	738	25.82	19.7	79.4	/	/
	38.03	58.48	705	25.07	20.5	78.1	/	/
	37.03	58.17	656	23.93	21.1	76.2	/	/
	36.03	57.66	583	22.23	21.6	72.9	/	/
	35.03	57.01	502	20.14	22.0	69.3	/	/
	34.03	56.29	426	17.99	22.3	65.7	/	/
	33.03	55.48	353	15.94	22.5	61.5	/	/
	32.03	54.33	271	13.72	22.3	54.9	/	/
	31.03	52.95	197	11.50	21.9	47.6	/	/
	30.03	51.61	145	9.59	21.6	42.0	/	/
	29.03	50.35	108	8.02	21.3	37.5	/	/

Application based on Jan 8 2023

Innogration Technologies

MQ011K3VPX*2 at 13.56MHz



1400W reached, highly marginal over 1000W target power

MQ011K3VPX*2 VDS=36V Vgs=2.99V Idq =20mA CW								
Freq(MHz)	Pin （dBm）	Pout （dBm）	Pout （W）	IDS(A)	Gain （dB）	Eff(%)	2th	3th
13.560	46.3	61.68	1472	51.60	15.4	79.3	-48	-70.7
	45.44	61.54	1426	50.53	16.1	78.4	/	/
	44.49	61.30	1349	48.80	16.8	76.8	/	/
	43.52	60.96	1247	46.38	17.4	74.7	/	/
	42.55	60.55	1135	43.48	18.0	72.5	/	/
	41.55	60.03	1007	40.30	18.5	69.4	/	/
	40.55	59.28	847	36.45	18.7	64.6	/	/
	39.57	58.39	690	32.31	18.8	59.3	/	/
	38.57	57.45	556	28.24	18.9	54.7	/	/
	37.58	56.51	448	24.66	18.9	50.4	/	/

13.56MHz: MQ011K3VPX working at 36V--- Ruggedness

MQ012K0VPX		
Test Signal @13.56MHz	VSWR(N:1) All phase	900W / Ids(A)
10% 100us	30:1	2.4A
		15 pcs from 3 Lots 100% survived

All phase Ruggedness test video upon request
全相位健壮性测试视频可联系获得

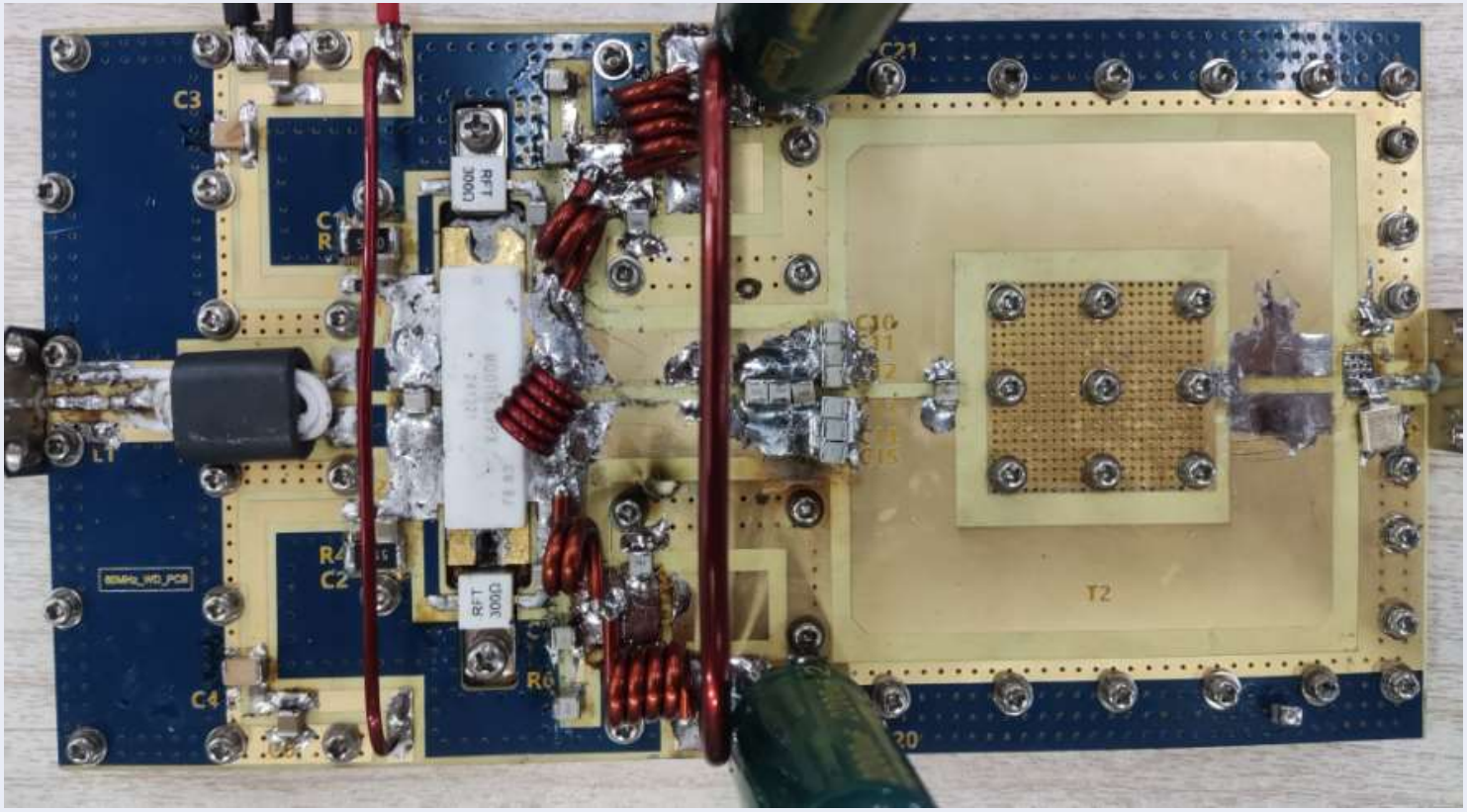
Innogration Technologies

27.12MHz: MQ011K3VPX working at 36V--- RF

MQ011K3VPX VDS=36V Vgs=3.2V Idq =300mA CW								
Freq (MHz)	Pin (dBm)	Pout (dBm)	Pout (W)	IDS(A)	Gain (dB)	Eff(%)	2nd	3rd
27.120	45.33	58.95	785	26.24	13.6	83.1	-41.3	-64.3
	44.3	58.91	778	26.20	14.6	82.5	/	/
	43.27	58.88	773	26.05	15.6	82.4	/	/
	42.24	58.82	762	25.92	16.6	81.7	/	/
	41.22	58.75	750	25.70	17.5	81.1	/	/
	40.23	58.64	731	25.32	18.4	80.2	/	/
	39.26	58.46	701	24.37	19.2	80.0	/	/
	38.3	58.17	656	23.65	19.9	77.1	/	/
	37.3	57.72	592	22.18	20.4	74.1	/	/
	36.43	57.21	526	20.60	20.8	70.9	/	/
	35.43	56.57	454	18.67	21.1	67.5	/	/
	34.44	55.94	393	16.84	21.5	64.8	/	/
	33.44	55.26	336	15.14	21.8	61.6	/	/
	32.44	54.38	274	13.47	21.9	56.5	/	/
	31.44	53.31	214	11.80	21.9	50.4	/	/

Application based on May 6, 2024, FR-4 board materials

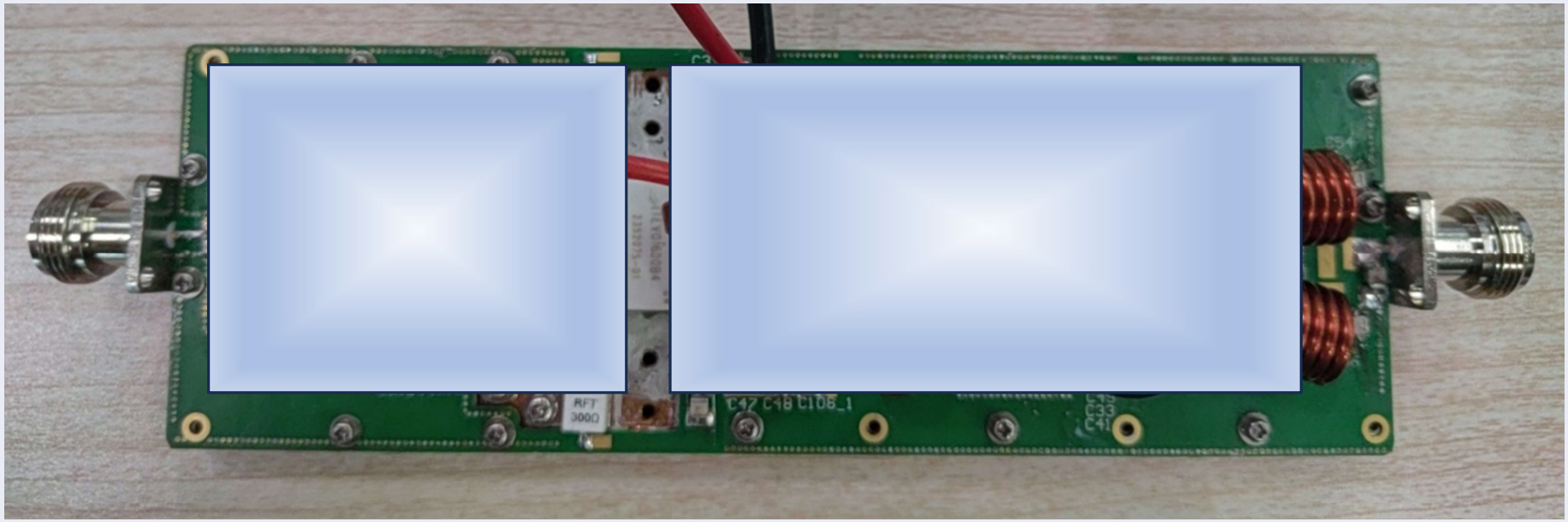
Another simpler design：Microstrip balun design @60M



Application based on May 30, 2024

Flagship solution: ITEV01600B4C (Low cost by Plastic open cavity)

Example：ITEV01600B4C Class E board at a glance



Application based on June 18 2024

Innogration Technologies

13.56MHz: ITEV01600B4C working at 36V--- RF

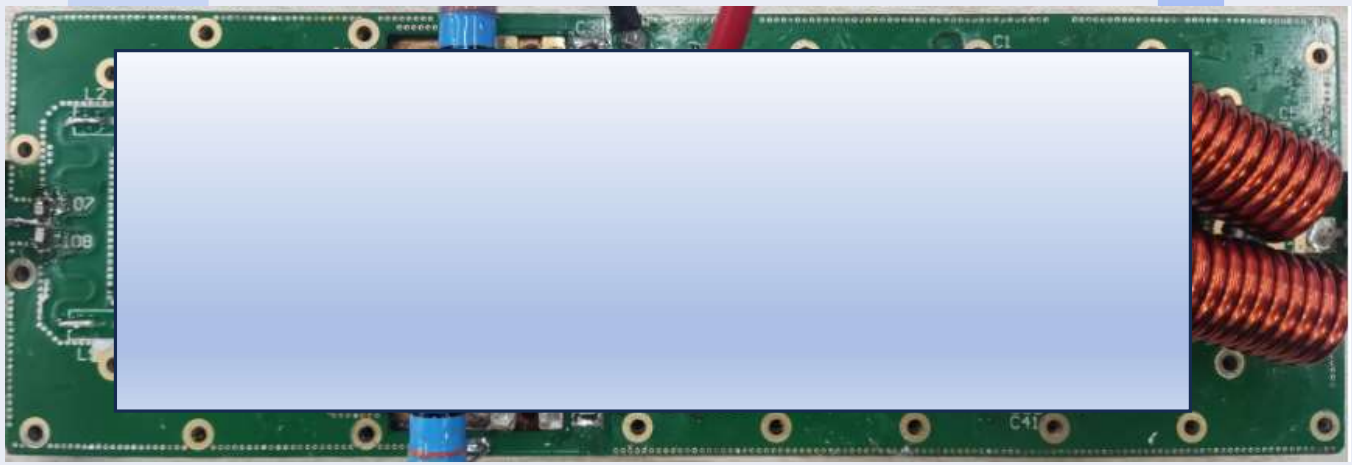
Freq (MHz)	Pin (dBm)	Pout (dBm)	Pout (W)	IDS (A)	Gain (dB)	Eff (%)	2nd	3rd
13.56	37.1	55.15	327	11.00	18.1	82.66	-34.5	-58.1
	36.1	55.03	318	10.81	18.9	81.82	/	/
	35	54.87	307	10.54	19.9	80.88	/	/
	34	54.66	292	10.20	20.7	79.63	/	/
	33	54.4	275	9.81	21.4	77.99	/	/
	31.9	54.1	257	9.36	22.2	76.28	/	/
	30.9	53.7	234	8.84	22.8	73.66	/	/
	29.8	53.24	211	8.25	23.4	71.00	/	/
	28.8	52.55	180	7.50	23.8	66.62	/	/
	27.7	51.2	132	6.70	23.5	54.65	/	/

Application based on June 18 2024

Innogration Technologies

MF012K5VPX---Potential cost down and size reduction

Innogration Technologies



The same PCB size as MQ011K3VPX and MQ012K0VPX but more power

May 15th 2024

F(MHz)	Pin（dBm）	Pout（dBm）	Pout（W）	I(A)	Gain（dB）	Eff(%)	2nd	3rd
13.560	42.1	61.14	1300	44.00	19.0	82.08	-45.1	-64
	41.1	61.03	1268	43.30	19.9	81.32	/	/
	40.1	60.91	1233	42.60	20.8	80.41	/	/
	39.2	60.76	1191	41.60	21.6	79.54	/	/
	38.2	60.5	1122	40.20	22.3	77.53	/	/
	37.2	60.3	1072	38.40	23.1	77.51	/	/
	36.2	59.8	955	35.80	23.6	74.10	/	/
	35.2	59	794	32.40	23.8	68.10	/	/
	34.2	58.1	646	28.70	23.9	62.49	/	/
	33.2	57.2	525	25.40	24.0	57.39	/	/
	32.2	56.2	417	22.40	24.0	51.70	/	/

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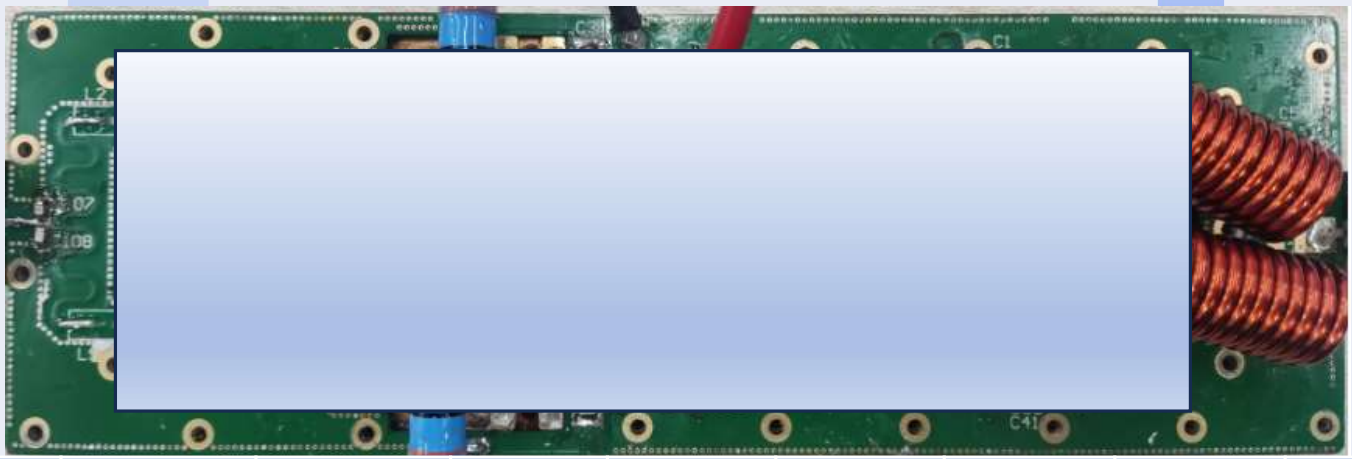
MQ012K0UPX---Potential more rugged solution with higher breakdown voltage up to 170V

Innogration Technologies



The same PCB size as MQ011K3VPX and MQ012K0VPX but more ruggedness margin

May 29th 2024

Freq(MHz)	Pin(dBm)	Pout(dBm)	Pout(W)	IDS(A)	Gain(dB)	Eff(%)	2nd(dBc)	3rd(dBc)
13.56	44	59.34	859	29.33	15.3	81.4	-44.5	-65.1
	43	59.28	847	29.12	16.3	80.8	/	/
	42	59.22	836	28.87	17.2	80.4	/	/
	41	59.15	822	28.60	18.2	79.9	/	/
	40	59.07	807	28.20	19.1	79.5	/	/
	39.1	58.96	787	27.70	19.9	78.9	/	/
	38.08	58.80	759	26.90	20.7	78.3	/	/
	37.06	58.50	708	25.64	21.4	76.7	/	/
	36.06	57.97	627	23.76	21.9	73.3	/	/
	35.06	57.25	531	21.50	22.2	68.6	/	/
	34	56.48	445	19.25	22.5	64.2	/	/
	33	55.66	368	17.10	22.7	59.8	/	/
	31.9	54.68	294	15.00	22.8	54.4	/	/

Driver and predrivers all by plastic devices

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Driver options for all bands

Part number	Matching	Power （W)	Voltage(V)	Supplier
BT09AG	50ohm	0.3	5	Berex
LTC6433-15	50ohm	0.1	5	ADI
IMEN0001-5	50ohm	5	12	Innogration
ITGV22010C6	External	5	36	Innogration
IMGV0001-15	50ohm	15	36	Innogration
ITGV10030C6	External	20	36	Innogration
ITGV10050C6	External	30	36	Innogration
ITEV01150C9	External	75	36	Innogration
ITEV01300C9 or ITEV01151C9A +B	External	150	36	Innogration

Low voltage driver Integrated with VCO

high voltage driver Integrated with Final stage

5V IF amplifier from open market

BEREX

BT09AG

5-4000 MHz Wideband Medium Power Amplifier

Device Features

- OIP3 = 43.0 dBm @ 900 MHz
- Gain = 20.0 dB @ 900 MHz
- Output P1 dB = 24.5 dBm @ 900 MHz
- RoHS2-compliant SOT-89 SMT package

Product Description

BeRex's BT09AG is a high performance and a high dynamic range amplifier in a low cost surface mount package(SOT-89) with a RoHS2-compliant, that incorporates reliable heterojunction-bipolar-transistor (HBT) devices fabricated with InGaP GaAs technology. This device is designed for use where high linearity is required and features high OIP3 and P1 with low consumption current(85mA) and requires a few external matching components such as a DC blocking capacitors on the In/Output pin, a bypass capacitor and a RF choke for the out port.

All devices are 100% RF/DC tested.

Applications

- Base station Infrastructure/RFID
- Commercial/Industrial/Military wireless system
- Wireless LAN

Electrical Specifications

Device performance _ measured on a BeRex evaluation board at 25°C, Vc=5V, 50 Ω system.

Parameter	Conditions	Min	Typ	Max	Unit
Operational Frequency Range		5		4000	MHz
Test Frequency			900		MHz
Gain		17.5	20.0		dB
Input Return Loss			-17.0		dB
Output Return Loss			-14.0		dB
Output IP3	13 dBm/tone, Δf=1 MHz	40.0	43.0		dBm
Output P1dB		23.5	24.5		dBm
Noise Figure			4.2		dB

Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
Bandwidth	5		4000	MHz
I_C @ (Vc = 5V)	130	160	190	mA
V_C	4.75	5.0	5.25	V
R_{TH}		50		°C/W
Operating Case Temperature	-40		+85	°C

Electrical specifications are measured at specified test conditions.

Specifications are not guaranteed over all recommended operating conditions.

LINEAR TECHNOLOGY

LTC6433-15

Low Frequency to 1.4GHz
50Ω Gain Block IF Amplifier

FEATURES

- **Low Frequency to 1.4GHz Bandwidth**
- **100kHz to 1GHz Flat Gain from a Single Demo Circuit**
- **Low Frequency Cutoff Is User Defined**
- **15.9dB Power Gain**
- **52dBm OIP3 at 1MHz**
- **47dBm OIP3 at 150MHz**
- **NF = 3.22dB at 150MHz**
- **1nV/√Hz Total Input Noise Density at 150MHz**
- **S11 < –10dB Up to 1.2GHz**
- **S22 < –10dB Up to 1.0GHz**
- **>2V_{P-P} Linear Output Swing**
- **P1dB =19.2dBm**
- **DC Power = 475mW**
- 50Ω Single-Ended Operation
- Insensitive to V_{CC} Variation
- A-Grade 100% OIP3 Tested at 150MHz
- Input/Output Internally Matched to 50Ω
- Single 5V Supply
- Unconditionally Stable

APPLICATIONS

- Single-Ended IF Amplifier
- ADC Driver
- CATV
- Test Equipment

DESCRIPTION

The LTC®6433-15 is a gain-block amplifier with excellent linearity at frequencies below 100kHz to beyond 1000MHz and with low associated output noise.

The unique combination of high linearity, low noise and low power dissipation makes this an ideal candidate for many signal-chain applications. The LTC6433-15 is easy to use, requiring a minimum of external components. It is internally input/output matched to 50Ω and it draws only 95mA from a single 5V supply.

The LTC6433-15 operates over a wide bandwidth. A single demonstration circuit offers flat gain from 100kHz to 1GHz.

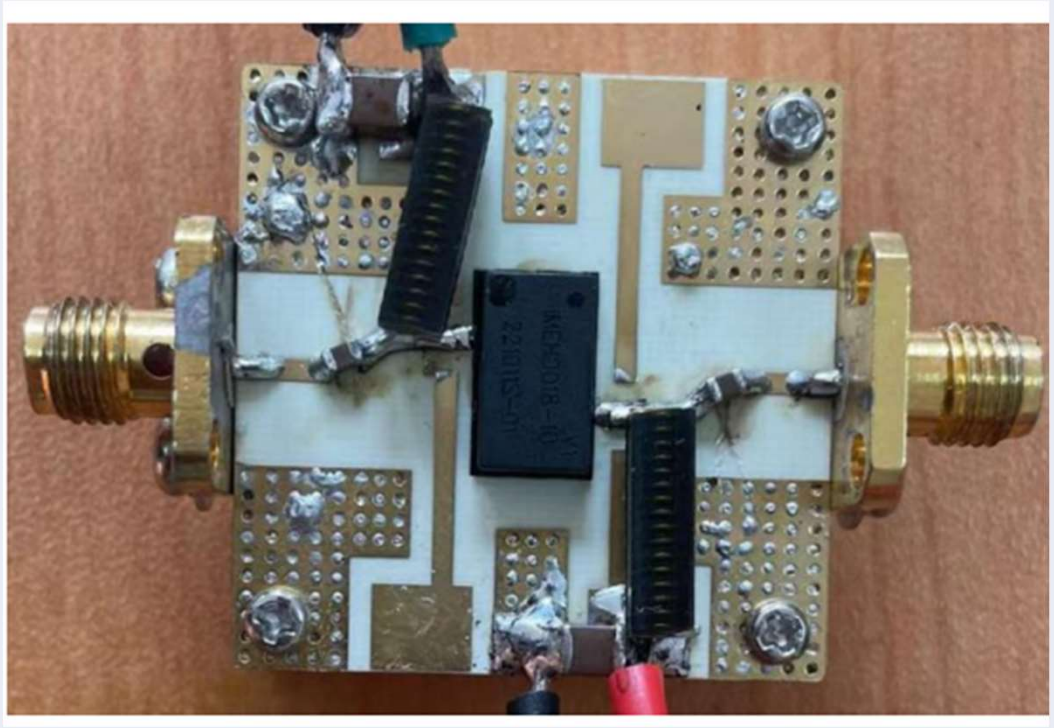
While this device is not capable of DC coupled operation, users can define the low frequency cut-off by appropriate choice of external components.

On-chip bias and temperature compensation maintain performance over environmental changes.

The LTC6433-15 uses a high performance SiGe BiCMOS process for excellent repeatability compared with similar GaAs amplifiers. All A-grade LTC6433-15 devices are tested and guaranteed for OIP3 at 150MHz. The LTC6433-15 is housed in a 4mm × 4mm 24-lead QFN package with an exposed pad for thermal management and low inductance.

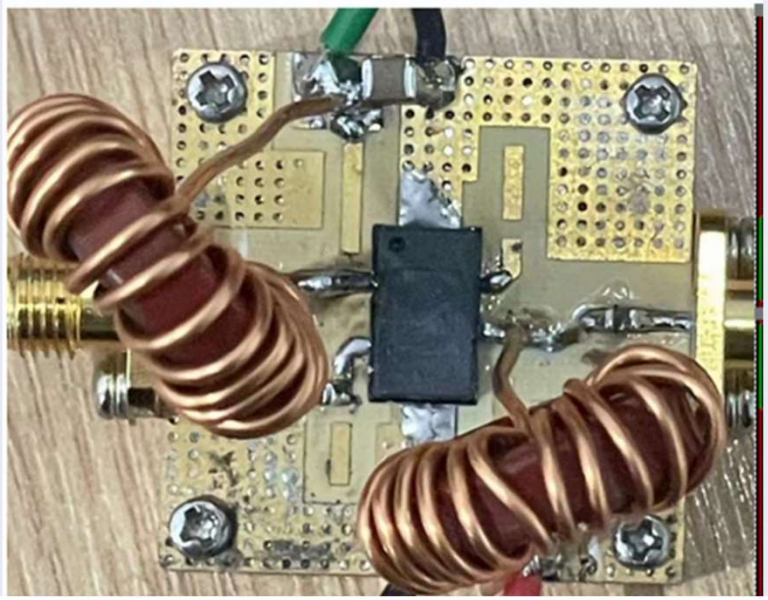
IMEN0001-5:12V 5W Fully matched for all bands (under development)

- Lower cost and simpler
- Support 10-100M all bands
- >17dB power gain, 65% efficiency @5W (Target)



Innogration Technologies

IMGV0001-15:36V 15W Fully matched for all bands



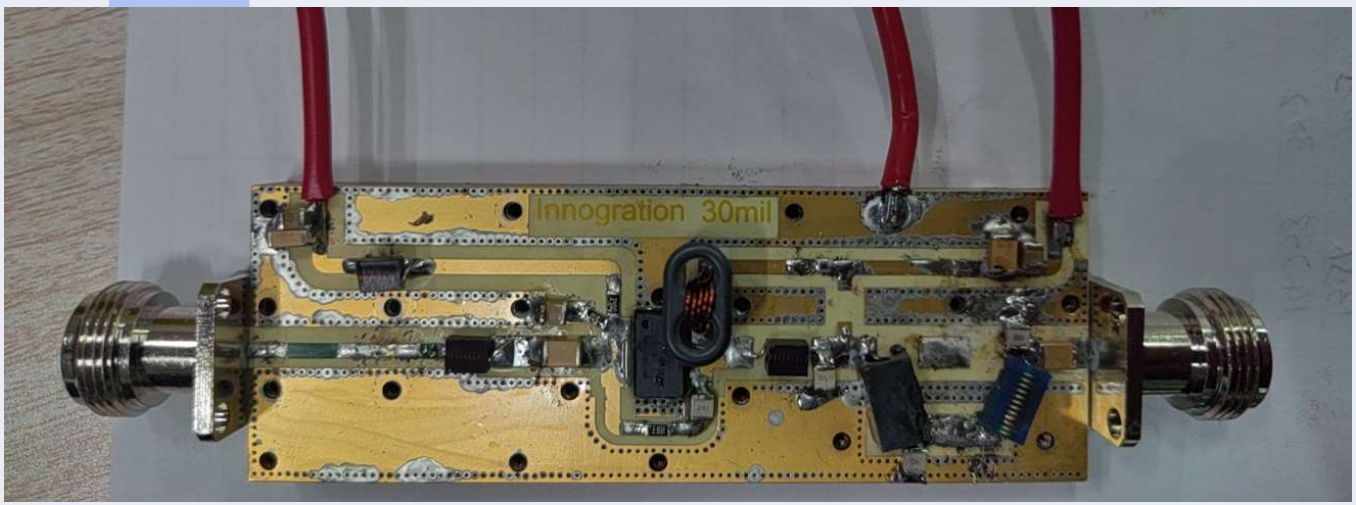
V_{DS}= 36V, I_{DQ}=225 mA

Vgs =3.75V

Parameter	13.56MHz	27.12MHz	40.68MHz	60MHz	128MHz	150MHz	Units
Linear Gain	19.1	19.5	19.9	20.7	20.0	19.6	dB
Gain@Pin=26dBm	15.7	15.6	15.7	15.8	15.6	15.6	dB
Pout@Pin=26dBm	14.9	14.6	14.6	15.0	14.5	14.4	W
Eff@Pin=26dBm	73	75	76	77	70	67	%

Innogration Technologies

ITGV22010C6 one design for all bands

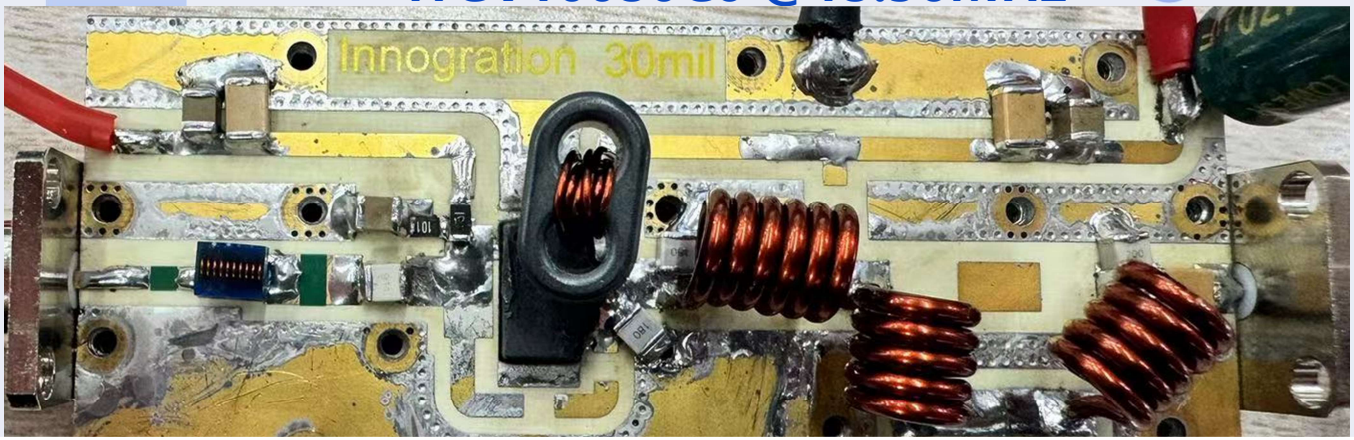


Vds=36V, Idq=50mA

F(MHz)	Pin （dBm）	Pout （dBm）	Pout （W）	I(A)	Gain （dB）
2	25.2	37.80	6.0	0.39	12.6
13.56	24.1	38.3	6.7	0.32	14.2
27.12	24.9	38.10	6.5	0.30	13.2
40.68	25.1	37.70	5.9	0.37	12.6

Innogration Technologies

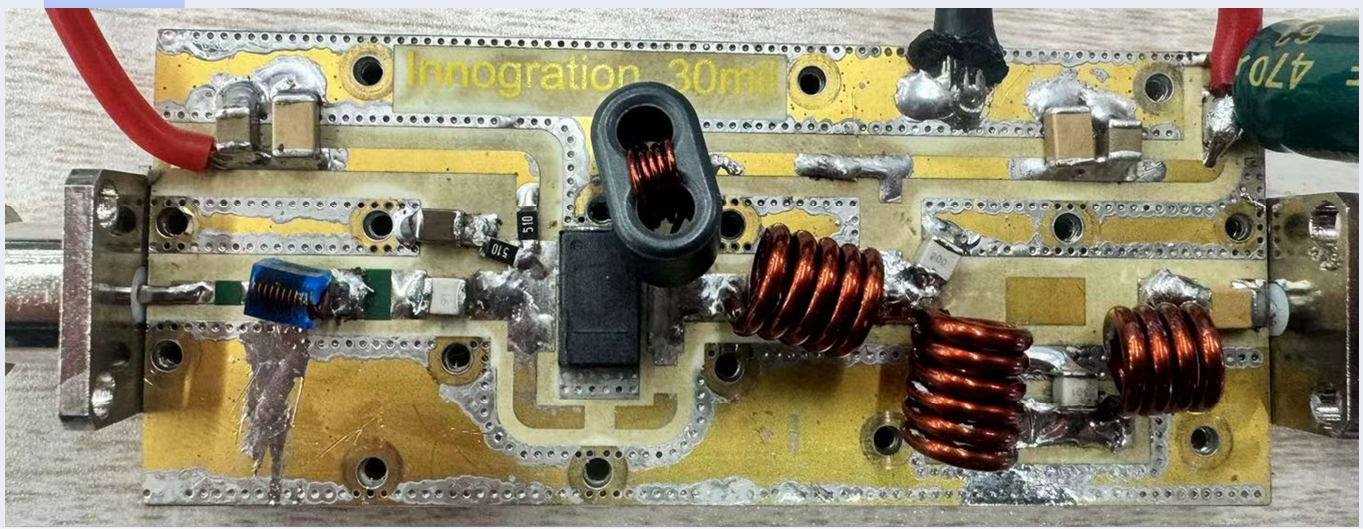
ITGV10030C6 @13.56MHz



ITGV10030C6 VGS=3.40V VDS=36V IDQ=50mA CW								
Freq (MHz)	Pout (dBm)	Pout (W)	IDS (A)	Pin (dBm)	Gain (dB)	Eff(%)	2nd （dBc）	3rd （dBc）
13.56	43.60	22.9	0.78	22.10	21.50	81.58	-11.3	-15.1
	43.49	22.3	0.77	21.10	22.39	80.58	/	/
	43.33	21.5	0.76	20.10	23.23	78.68	/	/
	43.07	20.3	0.73	19.11	23.96	77.16	/	/
	42.69	18.6	0.70	18.11	24.58	73.72	/	/
	42.24	16.7	0.67	17.11	25.13	69.44	/	/
	41.79	15.1	0.63	16.11	25.68	66.58	/	/
	41.24	13.3	0.59	15.12	26.12	62.64	/	/
	40.37	10.9	0.53	14.12	26.25	57.07	/	/
	39.18	8.3	0.47	13.12	26.06	48.93	/	/

Innogration Technologies

ITGV10050C6 @13.56MHz



ITGV10050C6^{V0} VGS=3.40V VDS=36V IDQ=100mA CW								
Freq (MHz)	Pout (dBm)	Pout (W)	IDS (A)	Pin (dBm)	Gain (dB)	Eff(%)	2nd （dBc）	3rd （dBc）
13.56	45.27	33.7	1.11	24.28	20.99	84.21	-11.7	-21.3
	45.14	32.7	1.10	23.28	21.86	82.47	/	/
	44.78	30.1	1.06	22.28	22.50	78.78	/	/
	44.29	26.9	1.01	21.27	23.02	73.85	/	/
	43.81	24.0	0.96	20.27	23.54	69.57	/	/
	43.19	20.8	0.89	19.27	23.92	65.06	/	/
	42.12	16.3	0.79	18.27	23.85	57.29	/	/
	40.85	12.2	0.68	17.27	23.58	49.68	/	/
	39.57	9.1	0.60	16.27	23.30	41.93	/	/

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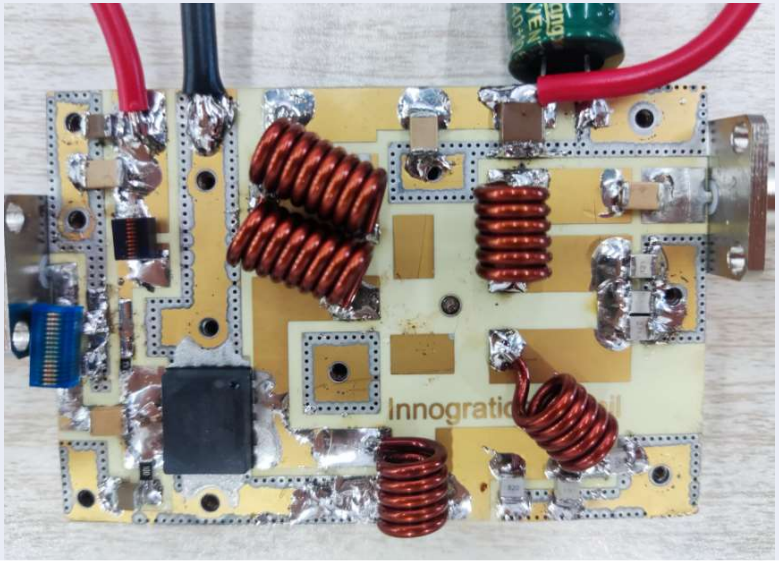
ITEV01150C9 @13.56MHz



ITEV01150C9^{V0} VDS=50V VGS=3.47V IDQ=95mA CW								
Freq (MHz)	Psat (dBm)	Psat (W)	IDS (A)	Pin (dBm)	Gain (dB)	Eff(%)	2th (dBc)	3th (dBc)
13.56	52.32	170.6	4.23	33.60	18.72	80.67	-14.1	-22.0
	52.19	165.6	4.18	32.60	19.59	79.22	/	/
	51.97	157.4	4.10	31.55	20.42	76.78	/	/
	51.64	145.9	3.99	30.55	21.09	73.12	/	/
	51.28	134.3	3.84	29.55	21.73	69.94	/	/
	50.63	115.6	3.55	28.50	22.13	65.13	/	/
	49.69	93.1	3.14	27.50	22.19	59.31	/	/
	48.61	72.6	2.71	26.30	22.31	53.59	/	/
	47.43	55.3	2.27	25.10	22.33	48.75	/	/

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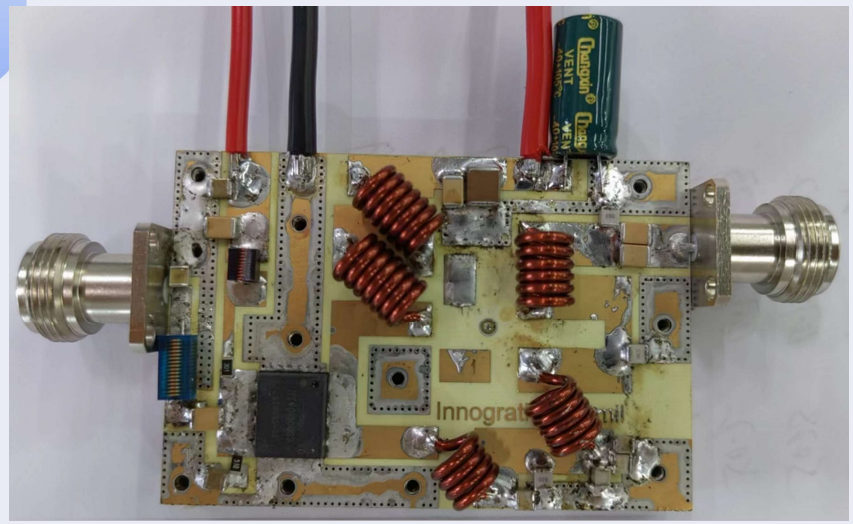
ITEV01300C9 @13.56MHz



ITEV01300C9 VDS=50V Idq=50mA Vgs=3.2V CW						
F(MHz)	Pin（dBm）	Psat（dBm）	Psat（W）	I(A)	Gain（dB）	Eff(%)
13.56	32.2	54.94	312	8.20	22.7	76.1
	31.2	54.86	306	8.16	23.7	75.0
	30.2	54.76	299	8.10	24.6	73.9
	29.2	54.58	287	8.00	25.4	71.8
	28.2	54.23	265	7.83	26.0	67.7
	27.2	53.75	237	7.58	26.6	62.6
	26.2	53.22	210	7.21	27.0	58.2
	25.2	52.56	180	6.69	27.4	53.9
	24.2	51.80	151	6.06	27.6	50.0
	23.2	51.00	126	5.33	27.8	47.2
	22.2	49.90	98	4.54	27.7	43.1

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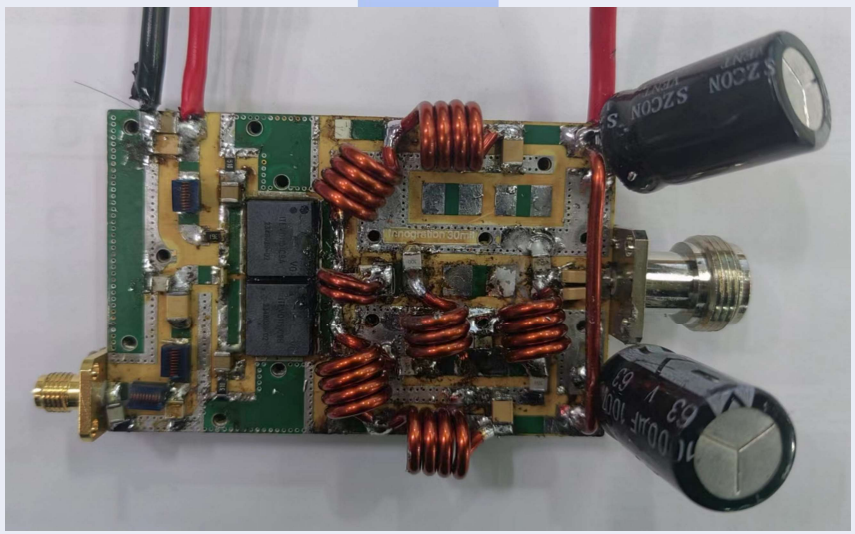
ITEV01151C9A+B @13.56MHz



Vds=36V, Idq=30mA

F(MHz)	Pin（dBm）	Psat（dBm）	Psat（W）	I(A)	Gain（dB）	Eff(%)
13.56	32	52.13	163	5.44	20.1	83.39
	31	52.1	162	5.43	21.1	82.97
	30	52.04	160	5.41	22.0	82.13
	28.9	51.95	157	5.34	23.1	81.50
	27.8	51.8	151	5.26	24.0	79.93
	26.7	51.57	144	5.12	24.9	77.88
	25.6	51.25	133	4.92	25.7	75.29
	24.5	50.55	114	4.47	26.1	70.53
	23.4	49.43	88	3.90	26.0	62.46
	22.3	48.12	65	3.29	25.8	54.76

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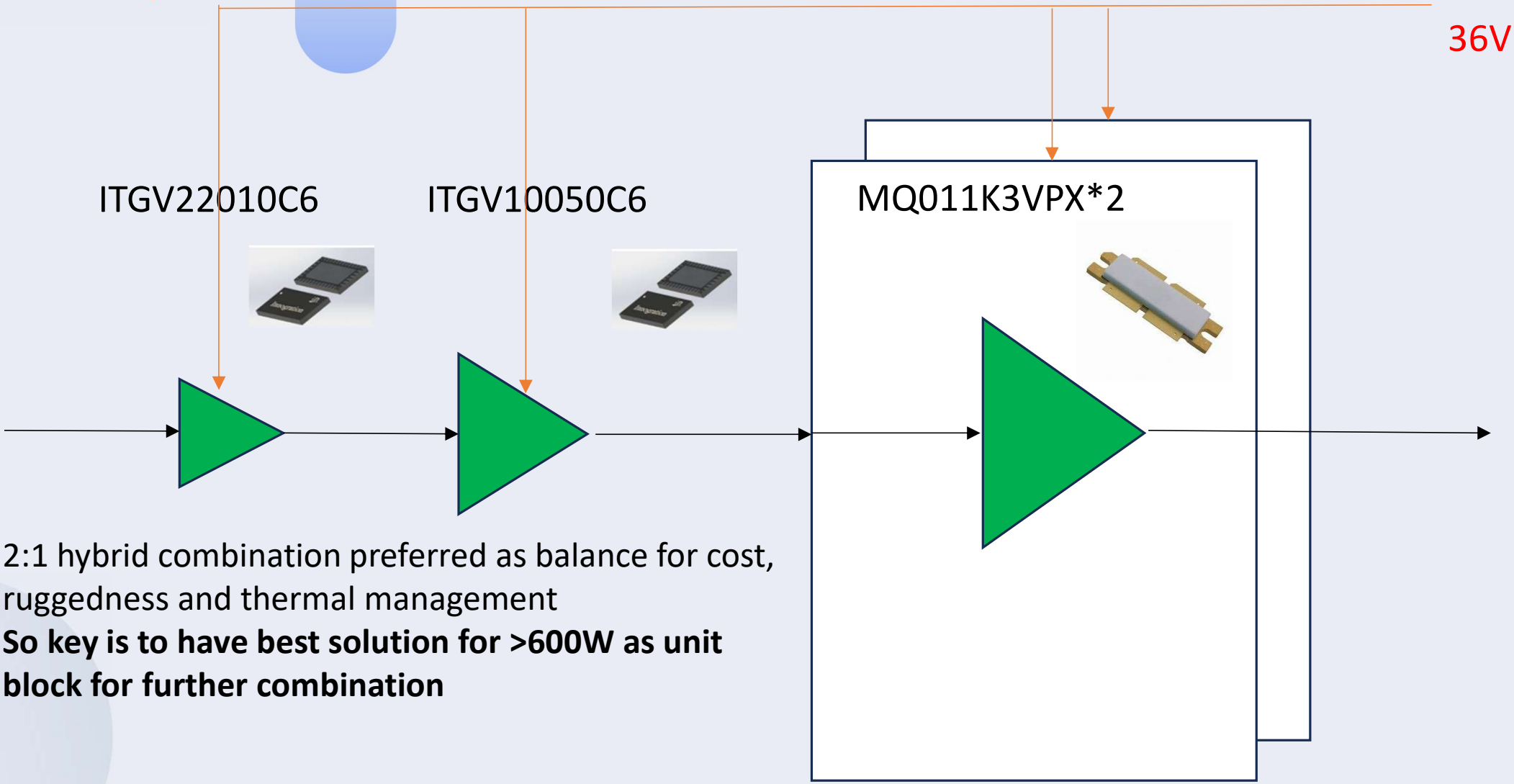
System configuration suggestion

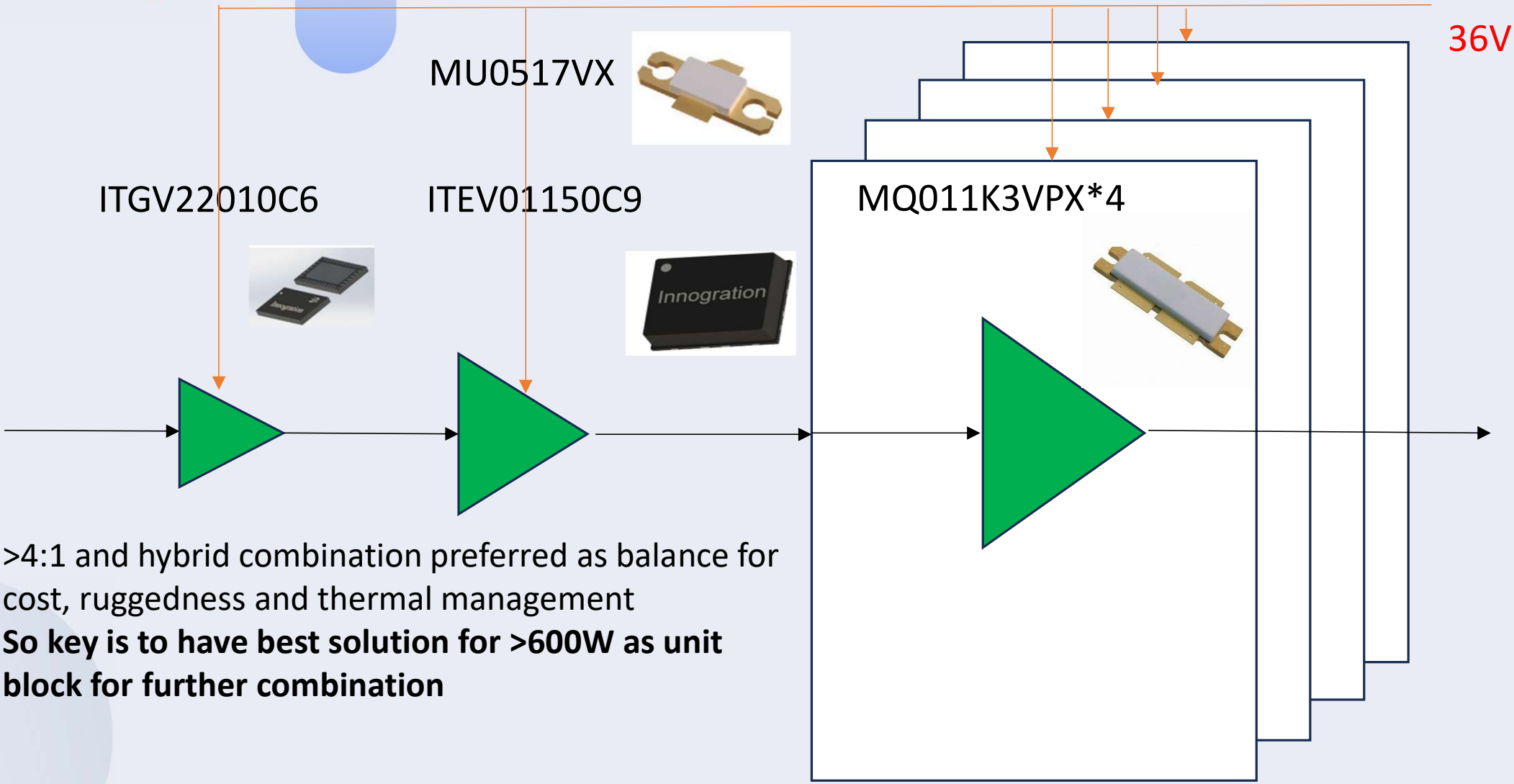
备注：合路方式可根据成本，体积， 应用场合等不同要求进行调整

Rugged 1KW 13.56MHz Generator Lineup



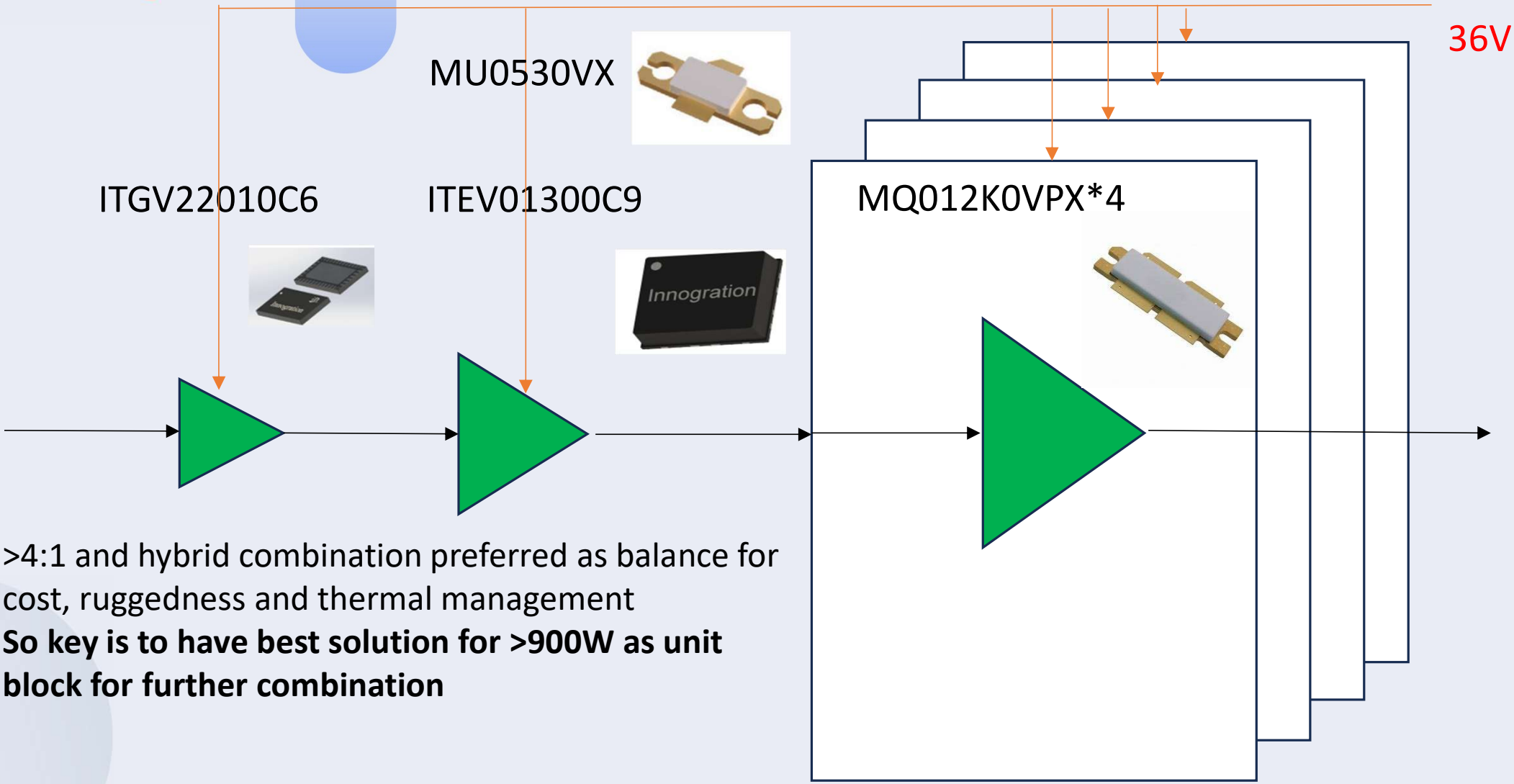
- 2:1 hybrid combination preferred as balance for cost, ruggedness and thermal management
- **So key is to have best solution for >600W as unit block for further combination**

Rugged 2KW 13.56MHz Generator Lineup



- >4:1 and hybrid combination preferred as balance for cost, ruggedness and thermal management
- **So key is to have best solution for >600W as unit block for further combination**

Rugged 3KW 13.56MHz Generator Lineup



- >4:1 and hybrid combination preferred as balance for cost, ruggedness and thermal management
- **So key is to have best solution for >900W as unit block for further combination**

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Supporting Materials

- Schematic, BOM and layout of Class E Final stage: MQ0170VPX, MQ011K3VPX, MQ012K0VPX
  用于末级的E类放大器原理图，元器件表，布局图
- Schematic, BOM and layout of Class AB driver stage: ITEV01150C9/ITEV01300C9 or MU0517VX/MU0530VX
  用于驱动的AB类放大器原理图，元器件表，布局图
- Soldering guidance of LDMOS:
  LDMOS器件焊接指导
- Application note:应用文档

✓ Ruggedness consideration of power combination of multi path class E power amplifier
  多路E类放大器合并方式对于健壮性的影响