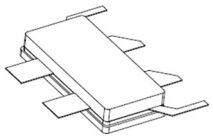
Gallium Nitride 50V, 450W,3.6-4.2GHz RF Power Transistor

Description

STCV40450BY4V



The STCV40450BY4V is a 450-watt, internally matched GaN HEMT, designed for 5G cellular applications with frequencies from 3.6-4.2GHz, **enabled by wide band VBW capability to support IBW≥200MHz.**

It can be configured as asymmetrical Doherty for 4G or 5G application, delivering 70W average power, according to normal 8dB back off.

- Typical Doherty Pulsed CW and 1C W--CDMA Characterization Performance:

(1)Pulsed condition: 20us and 10%,

(2)1C WCDMA; Signal PAR = 10 dB @ 0.01% Probability on CCDF.

Application 1： 3.7-4GHz

Freq (GHz)	Pulse CW Signal(1)			Pavg=48.5dBm WCDMA Signal(2)		
	Gain_P1 (dB)	P5dB (dBm)	P5dB (W)	Gp (dB)	Eff (%)	ACPR (dBc)
3.7	12.04	56.30	427	11.55	44.16	-35.05
3.8	12.05	56.52	449	11.97	42.70	-37.35
3.9	12.12	56.85	483	11.90	43.32	-35.60
4.0	12.75	56.49	446	11.80	43.03	-34.06

Application 2： 3.55-4GHz

Freq (GHz)	Pulse CW Signal(1)			Pavg=47.5dBm WCDMA Signal(2)		
	GainP1 (dB)	P3 (dBm)	P3 (W)	Gp (dB)	Eff (%)	ACPR (dBc)
3.55	11.61	56.23	419	11.97	40.74	-29.37
3.65	11.88	56.62	459	11.43	39.85	-32.05
3.75	11.79	56.76	473	12.00	40.63	-34.33
3.85	13.94	56.63	460	13.56	43.23	-36.78
3.95	12.97	56.43	439	12.14	41.54	-37.60
4.00	12.37	56.38	434	12.37	40.94	-35.20

Application 3：3.7-4.2GHz

Freq (GHz)	Pulse CW Signal(1)			Pavg=47.5dBm WCDMA Signal(2)		
	GainP1 (dB)	Psat (dBm)	Psat (W)	Gp (dB)	Eff (%)	ACPR5M (dBc)
3.7	12.04	56.45	441	12.26	40.80	-31.14
3.8	12.05	56.33	429	12.09	40.45	-34.36
3.9	12.12	56.30	426	12.66	41.76	-34.60
4.0	13.21	56.22	419	12.62	41.96	-37.67
4.1	12.59	56.16	413	12.12	40.20	-41.54
4.2	10.96	56.12	409	11.42	39.20	-35.59

Applications

- Asymmetrical Doherty amplifier within N77 5G band and S band power amplifier

Important Note: Proper Biasing Sequence for GaN HEMT Transistors

Turning the device ON

1. Set VGS to the pinch—off (VP) voltage, typically –5 V
2. Turn on VDS to nominal supply voltage
3. Increase VGS until IDS current is attained
4. Apply RF input power to desired level

Turning the device OFF

1. Turn RF power off
2. Reduce VGS down to VP, typically –5 V
3. Reduce VDS down to 0 V
4. Turn off VGS

Figure 1: Pin Connection definition

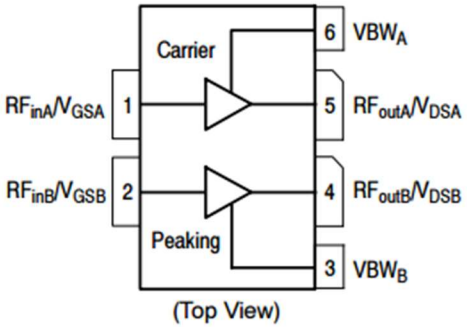


Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain—Source Voltage	V_{DSS}	+200	Vdc
Gate—Source Voltage	V_{GS}	-8 to +0.5	Vdc
Operating Voltage	V_{DD}	55	Vdc
Maximum gate current	Igs	55.6	mA
Storage Temperature Range	Tstg	-65 to +150	°C
Case Operating Temperature	T_C	+150	°C
Operating Junction Temperature	T_J	+225	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case by FEA T_C= 85°C, Pout=70W, 3.9GHz Doherty application board	$R_{\theta JC}$	1.2	°C /W

Table 3. Electrical Characteristics (TA = 25℃ unless otherwise noted)

DC Characteristics (main path, measured on wafer prior to packaging)

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	VGS=-8V; IDS=21.6mA	V_{DSS}		200		V
Gate Threshold Voltage	VDS =10V, ID = 21.6mA	$V_{GS(th)}$	-4		-2	V
Gate Quiescent Voltage	VDS =50V, IDS=260mA, Measured in Functional Test	$V_{GS(Q)}$		-3.05		V

DC Characteristics (peak path, measured on wafer prior to packaging)

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit

Drain-Source Breakdown Voltage	VGS=-8V; IDS=34mA	V_{DSS}		200		V
Gate Threshold Voltage	VDS =10V, ID = 34mA	$V_{GS(th)}$	-4		-2	V
Gate Quiescent Voltage	VDS =50V, IDS=260mA Measured in Functional Test	$V_{GS(Q)}$		-3.3		V

Ruggedness Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Load mismatch capability	3.9GHz, Pout=70W WCDMA 1 Carrier in Doherty circuit All phase, No device damages	VSWR		10:1		

Typical performance

3700-4000MHz Doherty

Figure 2: Intermodulation Distortion Products versus Two--Tone Spacing

Vdd=50V, Pout=48.5dBm, Center Frequency=3.9GHz

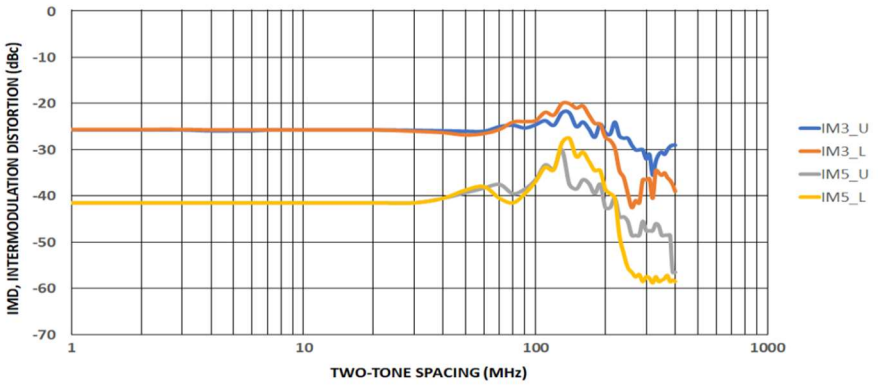


Figure 3: Efficiency and power gain as function of Pout (3.7-4GHz Doherty)

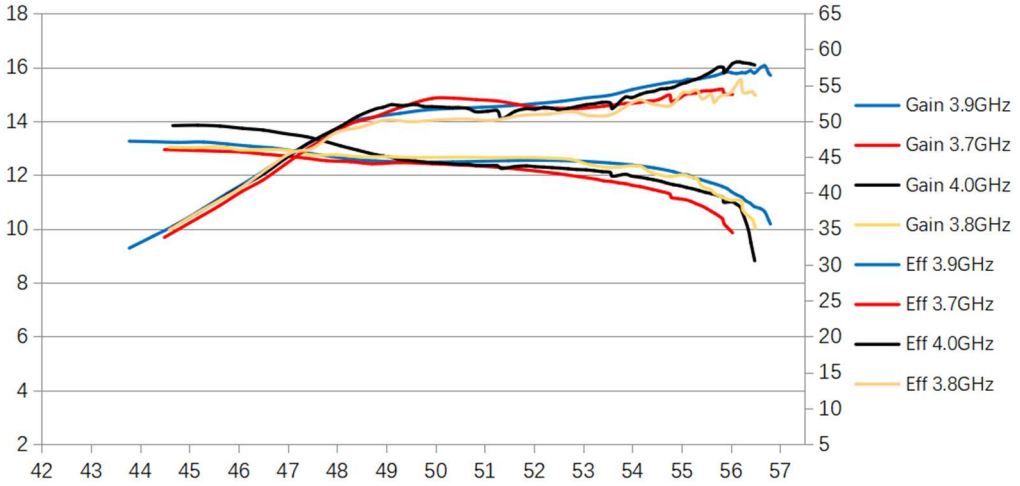


Figure 4: Network analyzer output, S11 and S21 (3.7-4GHz Doherty)

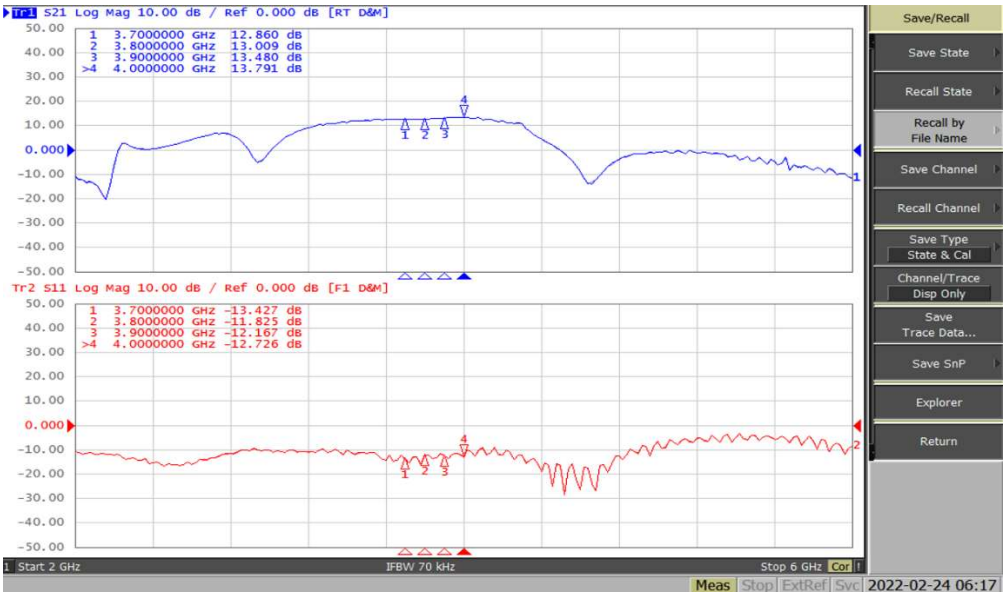


Figure 5: Picture of application board Doherty circuit for 3.7-4GHz

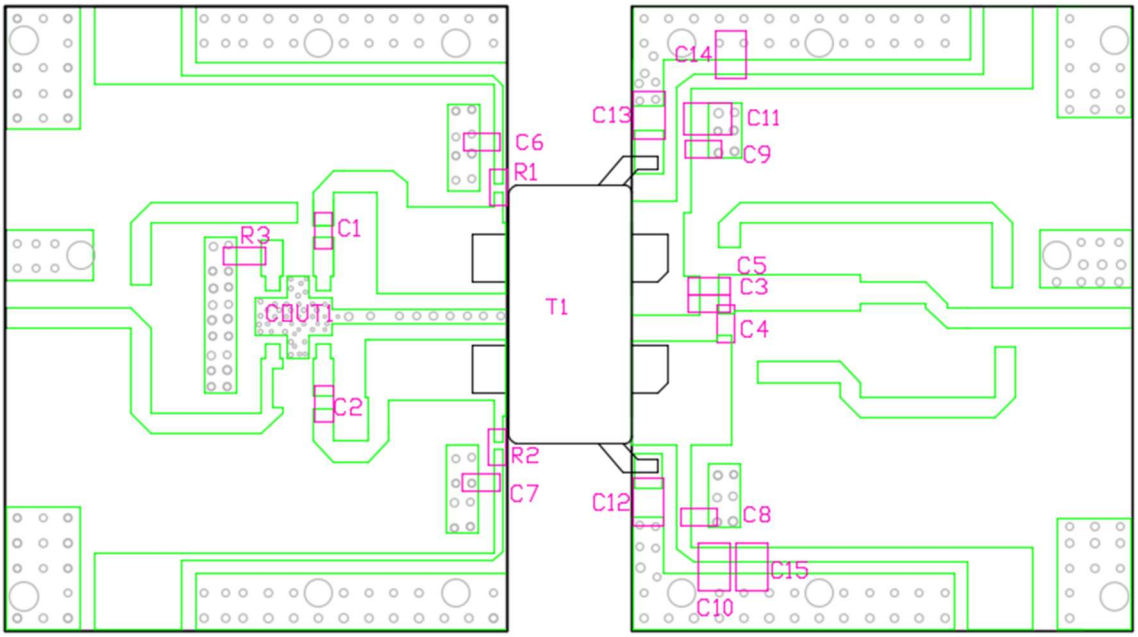


Table 4. Bill of materials of application board (PCB layout upon request, RO4350B 30mils)

Part	Quantity	Description	Part Number	Manufacture
C1,C2,C6, C7,C8,C9	6	8.2pFHigh Q Capacitor	251SHS8R2BSE	TEMEX
C3,C5	1	0.9pFHigh Q Capacitor	ATC600S0R9	ATC
C4	1	3.0pFHigh Q Capacitor	ATC600F3R0	ATC
C10,C11,C12,C13,C14,C15	6	10uF MLCC	RS80R2A106M	MARUWA
R1,R2	2	5.1Ω Power Resistor	ESR03EZPF5R10	ROHM
R3	1	51Ω Power Resistor	S1206N	RN2
COUT1	1	3 dB Bridge	XC3500P-03S	ANAREN
T1	1	450W GaN Dual Transistor	STCV40450BY4V	Innogration

Typical performance

3550-4000MHz Doherty

Figure 6: Efficiency and power gain as function of Pout (3.55-4GHz Doherty)

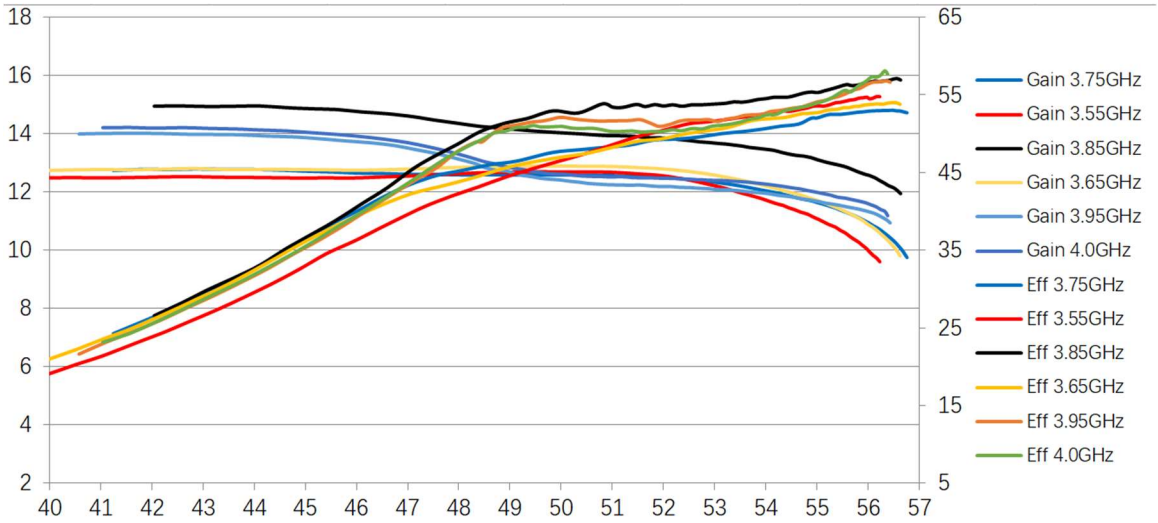


Figure 7: Network analyzer output, S11 and S21 (3.55-4GHz Doherty)

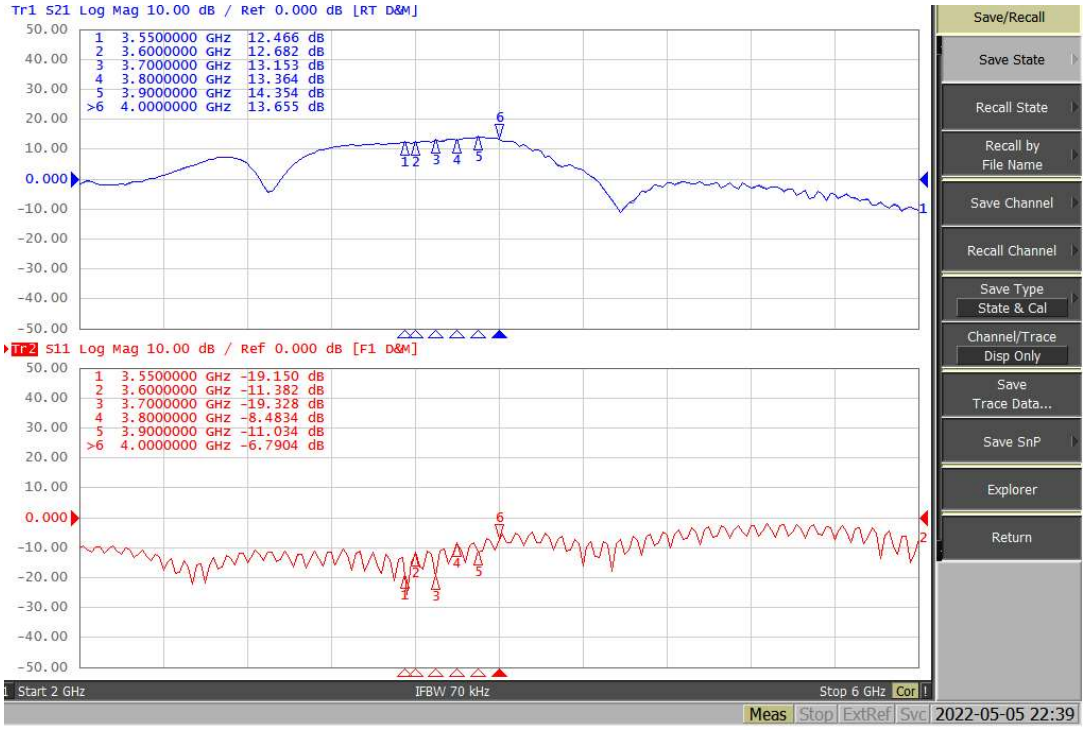
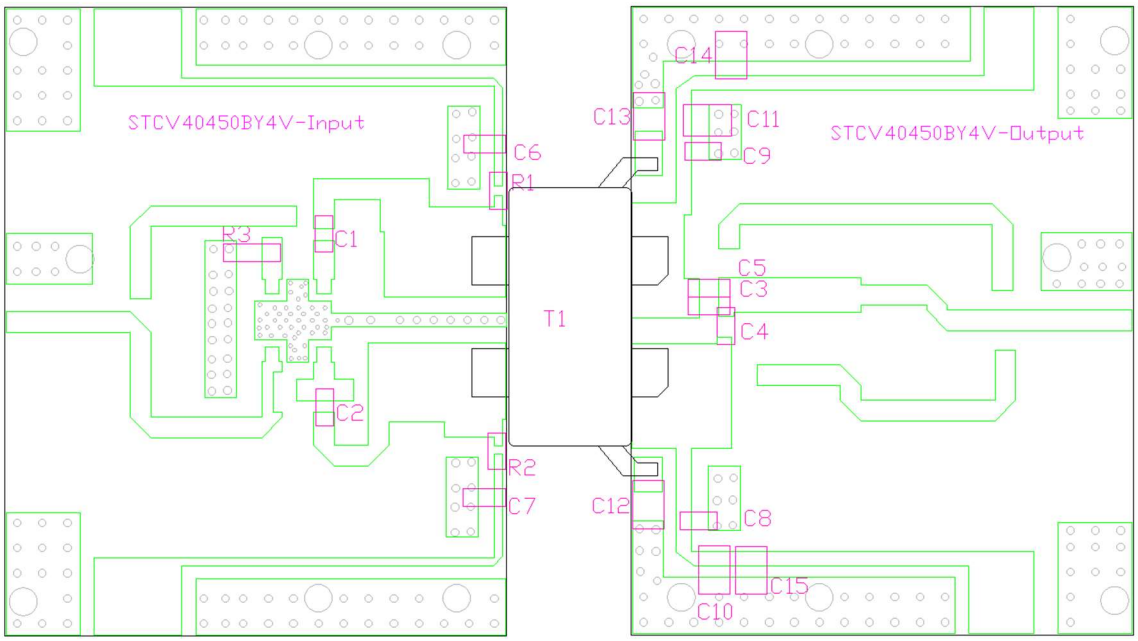


Figure 8: Picture of application board Doherty circuit for 3.55-4GHz



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Part	Quantity	Description	Part Number	Manufacture
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C3,C5	2	1.0pFHigh Q Capacitor	ATC600S1R0	ATC
C4	1	3.0pFHigh Q Capacitor	ATC600F3R0	ATC
C10,C11,C12,C13,C14,C15	6	10uF MLCC	GRM32EC72A10	Murata
R1,R2	2	5.1Ω Power Resistor	ESR03EZPF5R10	ROHM
R3	1	51Ω Power Resistor	S1206N	RN2
COUT1	1	3 dB Bridge	XC3500P-03S	ANAREN
T1	1	450W GaN Dual Transistor	STCV40450BY4V	Innogration

Typical performance

3700-4200MHz Doherty

Figure 6: Efficiency and power gain as function of Pout (3.7-4.2GHz Doherty)

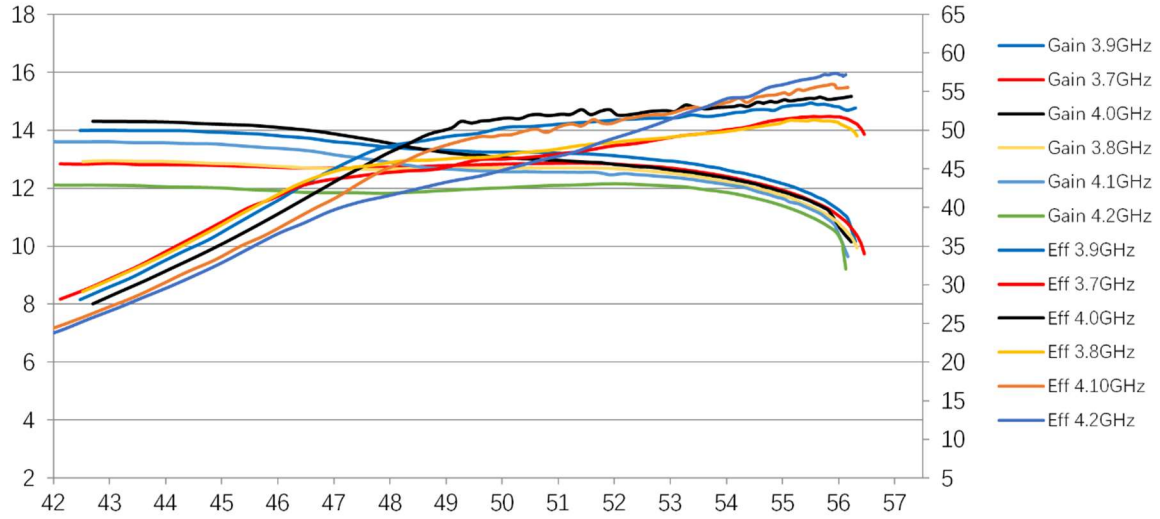


Figure 7: Network analyzer output, S11 and S21 (3.7-4.2GHz Doherty)

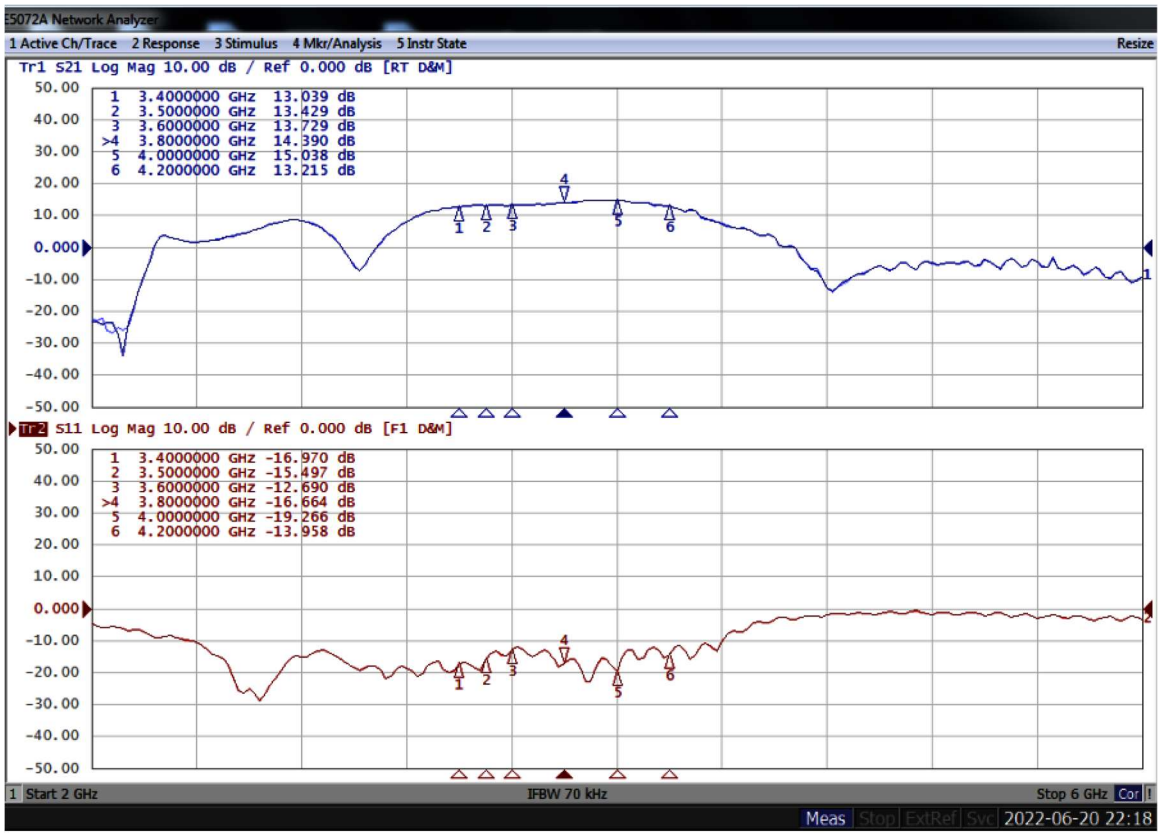
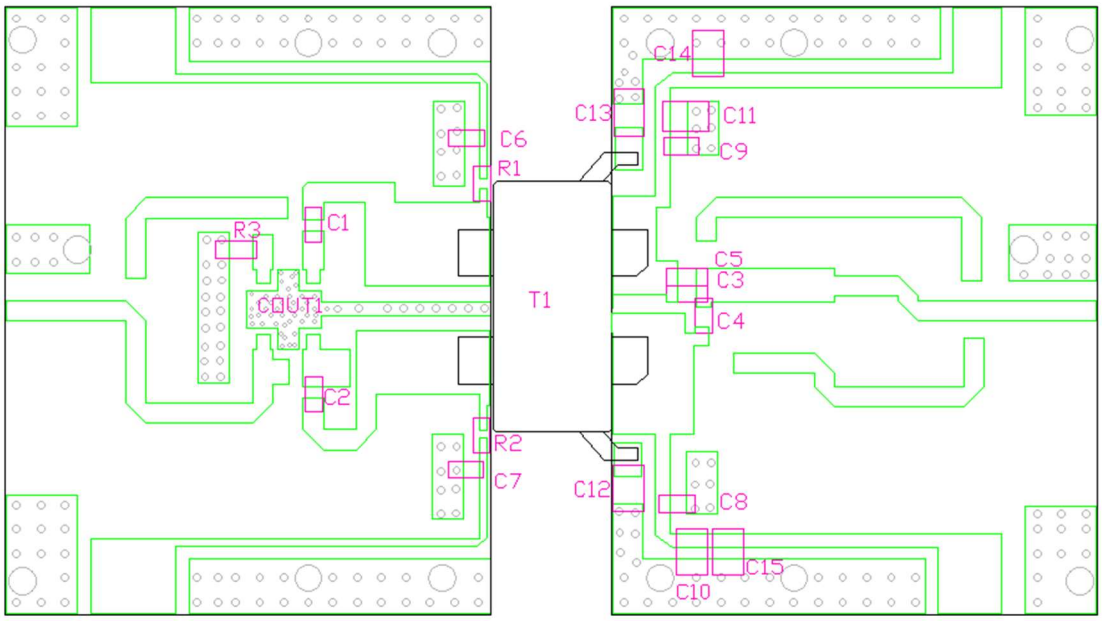


Figure 8: Picture of application board Doherty circuit for 3.7-4.2GHz



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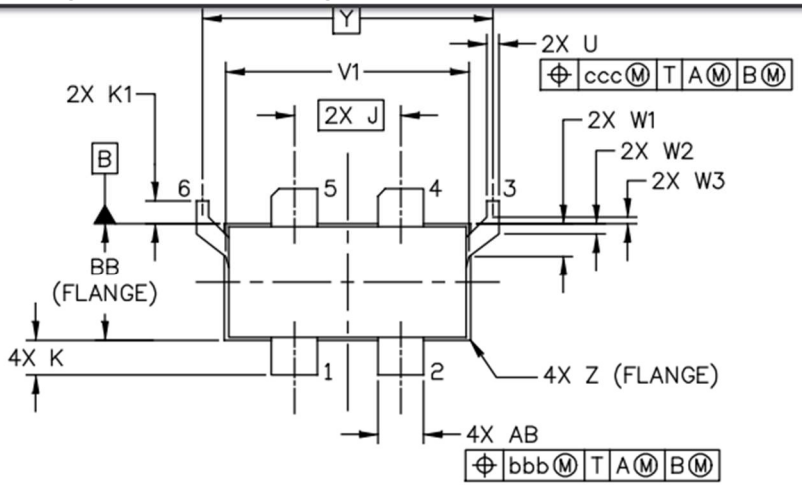
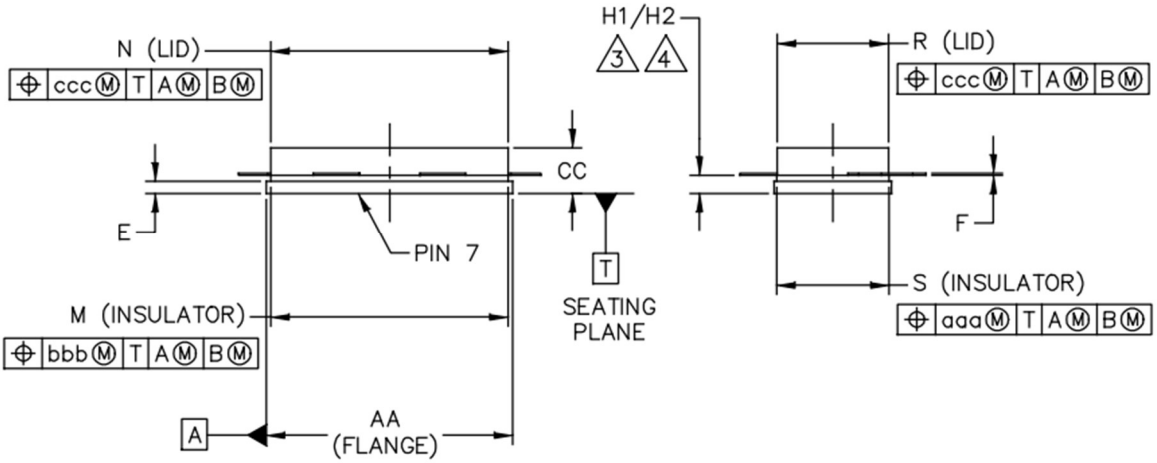
C3,C5	1	0.9pF High Q Capacitor	ATC600S0R9	ATC
C4	1	2.0pF High Q Capacitor	ATC600F3R0	ATC
C10,C11,C12,C13,C14,C15	6	10uF MLCC	RS80R2A106M	MARUWA
R1,R2	2	5.1Ω Power Resistor	ESR03EZPF5R10	ROHM
R3	1	51Ω Power Resistor	S1206N	RN2
COUT1	1	3 dB Bridge	XC3500P-03S	ANAREN
T1	1	450W GaN Dual Transistor	STCV40450BY4V	Innogration

Earless Flanged Ceramic Package; 6 leads- BY4V





DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX	DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX
AA	.805	.815	20.45	20.70	R	.365	.375	9.27	9.53
BB	.380	.390	9.65	9.91	S	.365	.375	9.27	9.53
CC	.125	.170	3.18	4.32	U	.035	.045	0.89	1.14
E	.035	.045	0.89	1.14	V1	.795	.805	20.19	20.45
F	.004	.007	0.10	0.18	W1	.0975	.1175	2.48	2.98
H1	.057	.067	1.45	1.70	W2	.0225	.0425	0.57	1.08
H2	.054	.070	1.37	1.78	W3	.0125	.0325	0.32	0.83
J	.350 BSC		8.89 BSC		Y	.956 BSC		24.28 BSC	
K	.0995	.1295	2.53	3.29	Z	R.000	R.040	R0.00	R1.02
K1	.070	.090	1.78	2.29	AB	.145	.155	3.68	3.94
M	.774	.786	19.66	19.96	aaa	.005		0.13	
N	.772	.788	19.61	20.02	bbb	.010		0.25	
					ccc	.015		0.38	

Revision history

Table 4. Document revision history

Date	Revision	Datasheet Status
2022/2/26	V1.0	Preliminary Datasheet Creation
2022/5/7	V1.1	Add 3.55-4GHz application data，and change the lower limit of supported band
2022/6/21	V1.2	Add 3.7-4.2GHz application data, and change the upper limit of supported band

Application data based on LWH-22-05/11/18

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