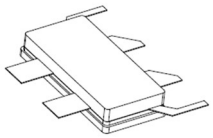
Gallium Nitride 50V, 450W,4.6-5GHz RF Power Transistor

STCV50450BY4V



Description

The STCV50450BY4V is a 450-watt, internally matched GaN HEMT, designed for 5G cellular applications with frequencies from 4.6-5.0GHz, **enabled by wide band VBW capability to support IBW⩾200MHz.**

It can be configured as asymmetrical Doherty for 5G application, delivering 55W average power, according to normal 9dB back off.

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

(1)Pulsed condition: 100us and 10% (2)1C WCDMA; Signal PAR = 10 dB @ 0.01% Probability on CCDF.

VDS= 50V, IDQ-main=230 mA Vgs-main=-3.0V. Vgs-peak=-6.5V

Asymmetrical Doherty amplifier within N79 5G band and S band power amplifier

Freq (GHz)	Pulse CW Signal(1)			P_{avg}=47.5dBm WCDMA Signal(2)		
	GainP1 (dB)	P3 (dBm)	P3 (W)	Gp (dB)	η_D (%)	$ACPR_{5M}$ (dBc)
4.6	9.56	56.79	478	9.95	39.96	-33.33
4.7	9.95	56.80	478	10.31	41.78	-36.84
4.8	10.56	56.59	456	10.39	41.84	-36.44
4.9	10.36	56.45	442	10.18	41.37	-34.74
5.0	9.90	56.35	431	9.57	39.53	-32.38

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

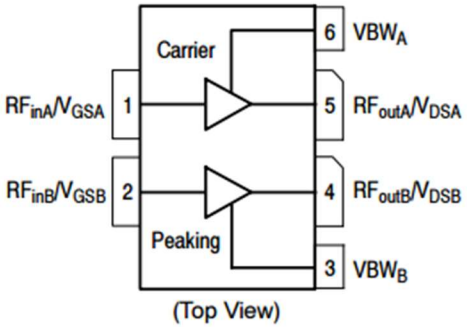


Table 1. Maximum Ratings

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=90W, 4.9GHz Doherty application board	$R_{\theta JC}$	1.3	°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=280mA, Measured in Functional Test	$V_{GS(Q)}$		-3.07		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=280mA Measured in Functional Test	$V_{GS(Q)}$		-3.3		V

Ruggedness Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Load mismatch capability	4.9GHz, Pout=55W WCDMA 1 Carrier in Doherty circuit All phase, No device damages	VSWR		10:1		

Typical performance

4600-5000MHz Doherty

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

Vdd=50V, Pout=47.5dBm, Center Frequency=4.9GHz

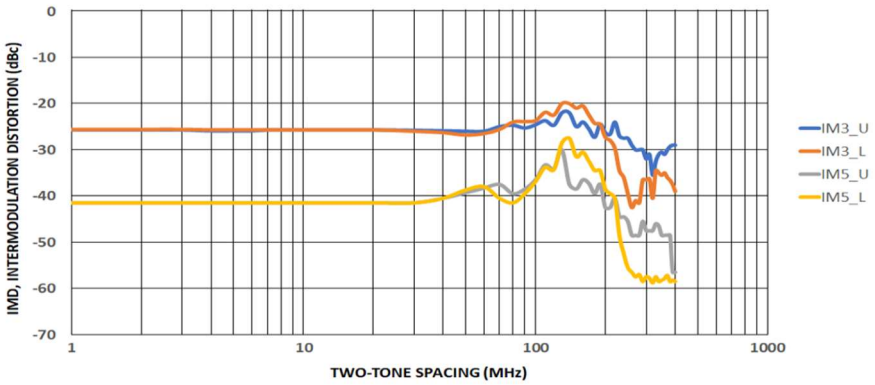


Figure 3: Efficiency and power gain as function of Pout (4.6-5GHz Doherty)

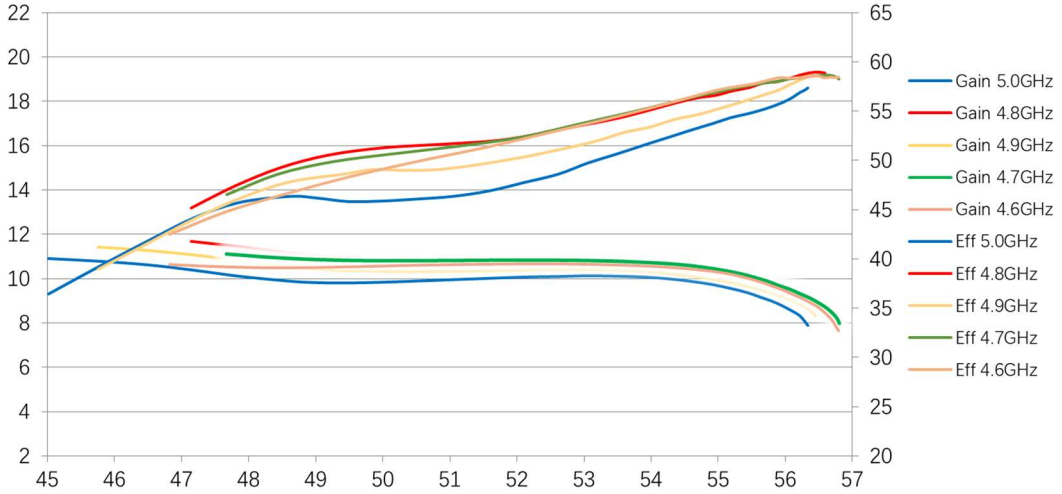


Figure 4: Network analyzer output, S11 and S21 (4.6-5GHz Doherty)

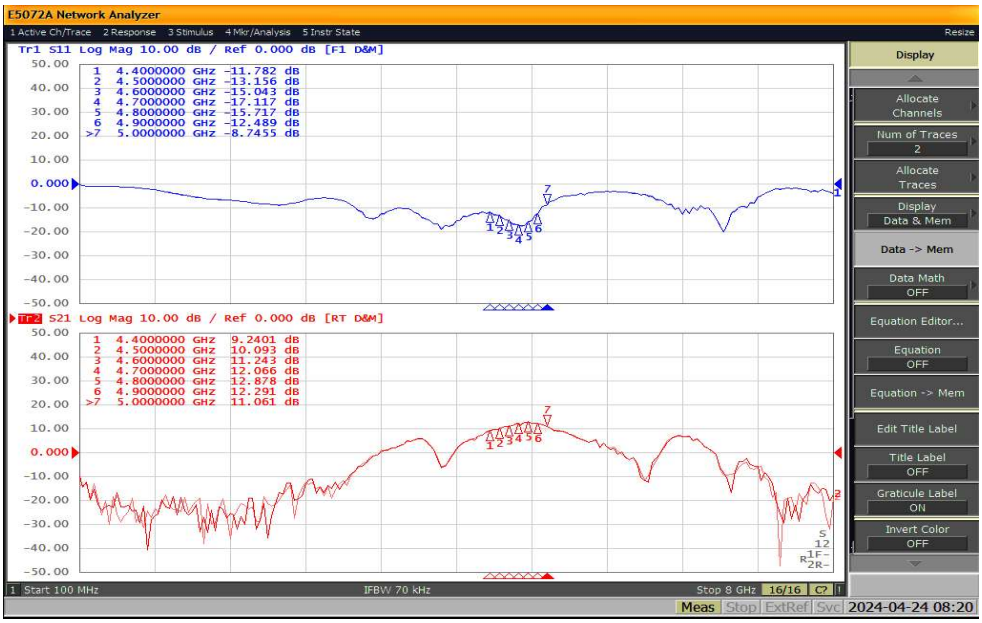


Figure 5: Picture of application board Doherty circuit for 4.6-5GHz

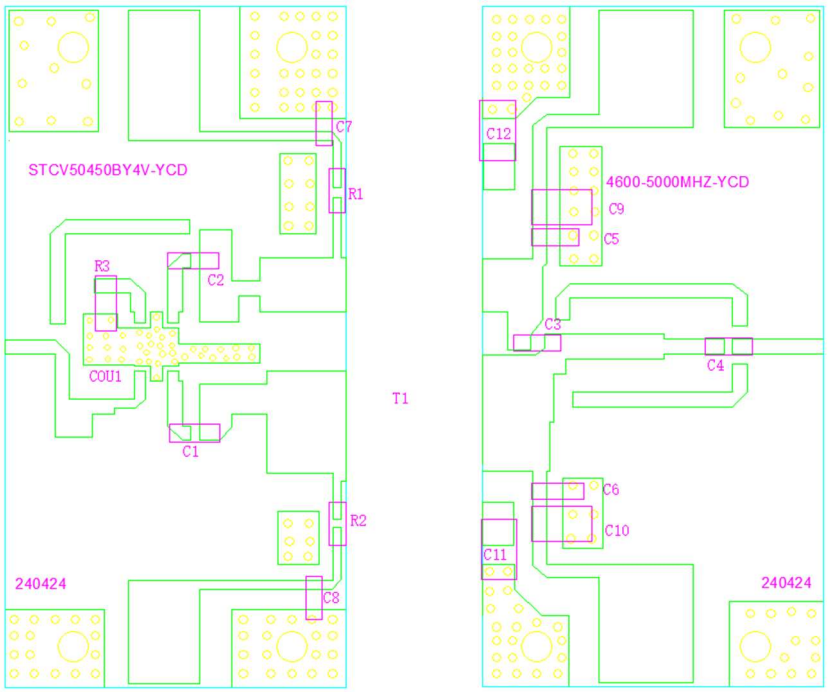
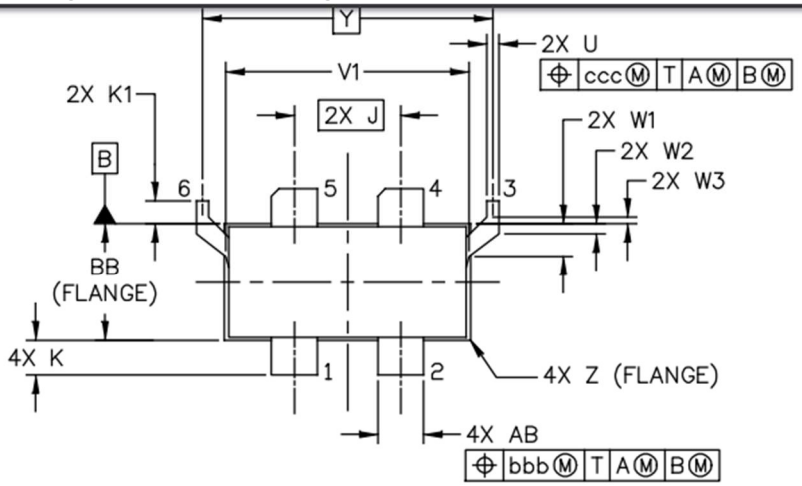
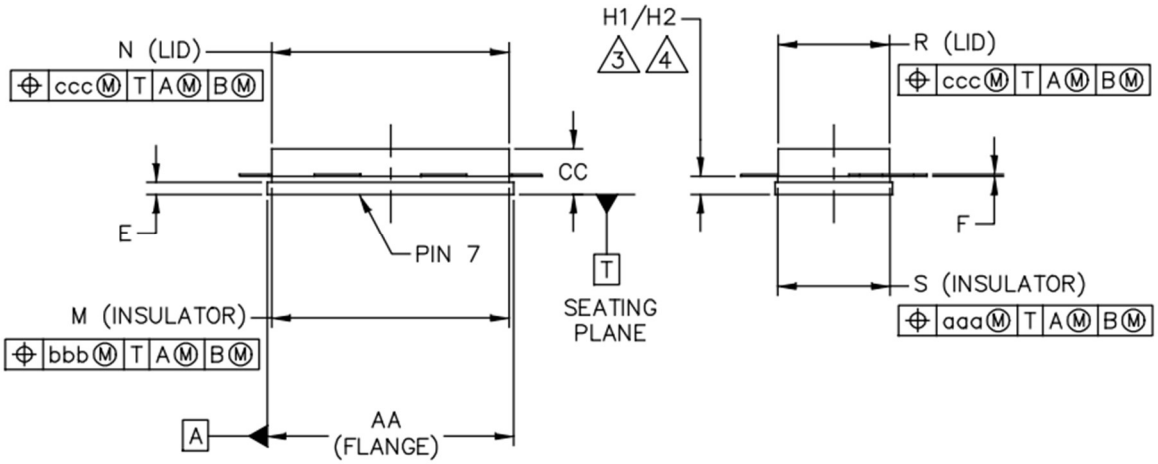


Table 4. Bill of materials of application board (PCB layout upon request, RO4350B 20mils)

Part	Quantity	Description	Part Number	Supplier
C1,C2,C4,C5,C6, C7,C8	7	3.9pFHigh Q Capacitor	251SHS3R9BSE	TEMEX
C3	1	0.9pFHigh Q Capacitor	251SHS0R9BSE	TEMEX
C9,C10,C11,C12	4	10uF MLCC	GRM32EC72A106M E05	Murata
R1,R2	2	10Ω Power Resistor	ESR03EZPF100	ROHM
R3	1	51Ω Power Resistor	S1206N	RN2
COUT1	1	3 dB Hybrid	X3C45F1-03S	Anaren
T1	1	450W GaN Dual Transistor	STCV50450BY4V	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
2023/5/31	**V2.0**	**Preliminary Datasheet Creation ,according to latest application result**
2024/4/25	**V2.1**	**Modify application data according to improvement**

Application data based on LWH-23-12/24-14

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