



## Gallium Nitride 50V, 500W, 3.3-3.6GHz RF Power Transistor

### Description

The STCV36500BY4V is a 500-watt, internally matched GaN HEMT, designed for 5G cellular applications with frequencies from 3.3-3.6GHz, **enabled by wide band VBW capability to support IBW ≥ 200MHz.**

It can be configured as asymmetrical Doherty for 4G or 5G application, delivering 55 to 70W average power, according to normal 8 to 9dB back off.

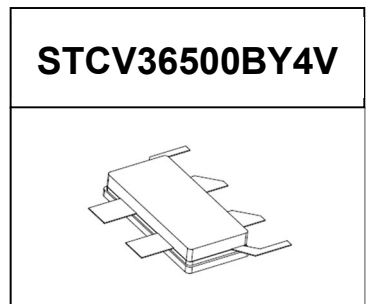
There is no guarantee of performance when this part is used in applications designed Outside of these frequencies.

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

$V_{DD} = 50 \text{ Vdc}$ ,  $I_{DQA} = 280 \text{ mA}$ ,  $V_{GSB} = -6 \text{ Vdc}$ ,

(1) Pulsed condition: 100us and 10%,

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



Freq (GHz)	Pulse CW Signal(1)			Pavg=47.5dBm WCDMA Signal(2)			Pavg=48.5dBm WCDMA Signal(2)		
	P1dB Gain (dB)	Psat (dBm)	Psat (W)	Gp (dB)	Eff(%)	ACPR5M (dBc)	Gp (dB)	Eff(%)	ACPR5M (dBc)
3.3	11.63	56.53	449.7	11.89	47.35	-34.76	11.89	49.97	-34.74
3.4	11.81	56.69	466.3	12.10	47.65	-33.49	12.10	50.19	-32.95
3.5	12.11	56.68	465.1	12.18	47.15	-35.95	12.18	49.21	-35.95
3.6	12.83	56.47	443.6	12.41	46.64	-35.42	12.41	48.73	-35.18

### Applications

- Asymmetrical Doherty amplifier within N78 5G band and B42 4G band
- S band power amplifier

### Important Note: Proper Biasing Sequence for GaN HEMT Transistors

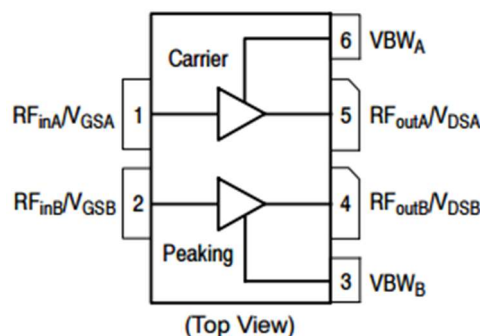
#### Turning the device ON

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	$I_{gs}$	22.4	Ma
Storage Temperature Range	$T_{stg}$	-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 $T_c=85^\circ\text{C}$ , $P_{out}=70\text{W}$ , 3.6GHz Doherty application board	$R_{\theta JC}$	1.2	°C /W

**Table 3. Electrical Characteristics (TA = 25°C unless otherwise noted)**

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

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$V_{GS}=-8\text{V}$ ; $I_{DS}=17\text{Ma}$	$V_{DSS}$		200		V
Gate Threshold Voltage	$V_{DS}=10\text{V}$ , $I_D=17\text{Ma}$	$V_{GS(th)}$	-4		-2	V
Gate Quiescent Voltage	$V_{DS}=50\text{V}$ , $I_{DS}=280\text{Ma}$ , Measured in Functional Test	$V_{GS(Q)}$		-3		V

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

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$V_{GS}=-8\text{V}$ ; $I_{DS}=34\text{Ma}$	$V_{DSS}$		200		V
Gate Threshold Voltage	$V_{DS}=10\text{V}$ , $I_D=34\text{Ma}$	$V_{GS(th)}$	-4		-2	V
Gate Quiescent Voltage	$V_{DS}=50\text{V}$ , $I_{DS}=560\text{Ma}$ , Measured in Functional Test	$V_{GS(Q)}$		-3		V

**Ruggedness Characteristics**

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Load mismatch capability	3.6GHz, $P_{out}=70\text{W}$ WCDMA 1 Carrier in Doherty circuit All phase, No device damages	VSWR		10:1		



Figure 2: Intermodulation Distortion Products versus Two-Tone Spacing

V<sub>dd</sub>=50V, P<sub>out</sub>=47.5dBm, Center Frequency=3.5GHz

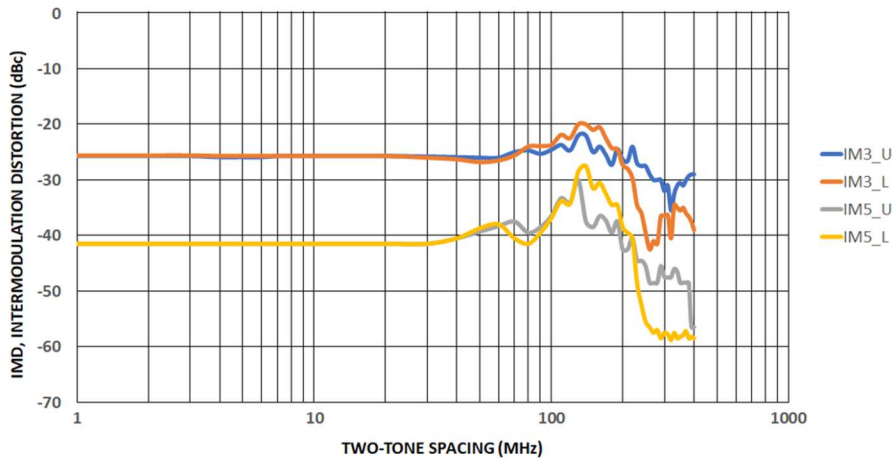


Figure 3: Efficiency and power gain as function of P<sub>out</sub> (3.3-3.6GHz Doherty)

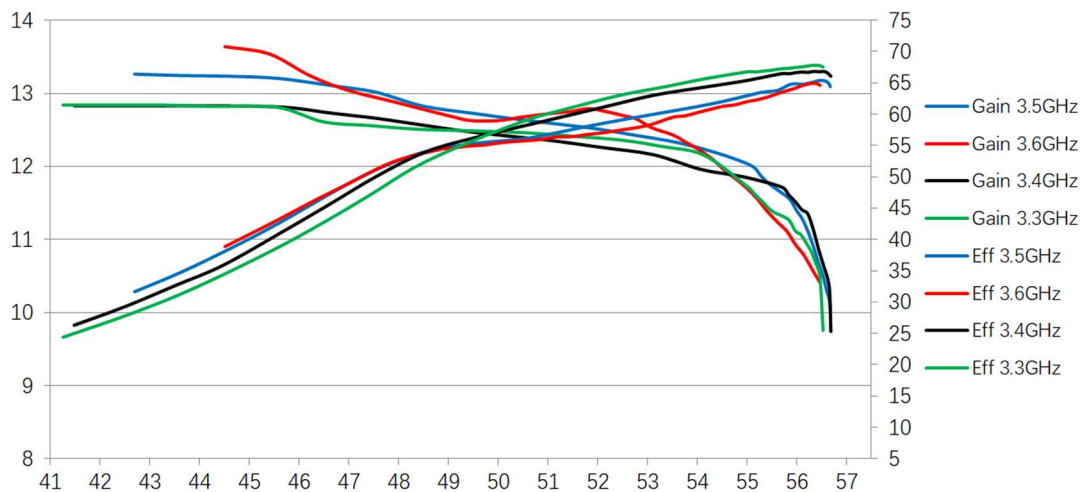
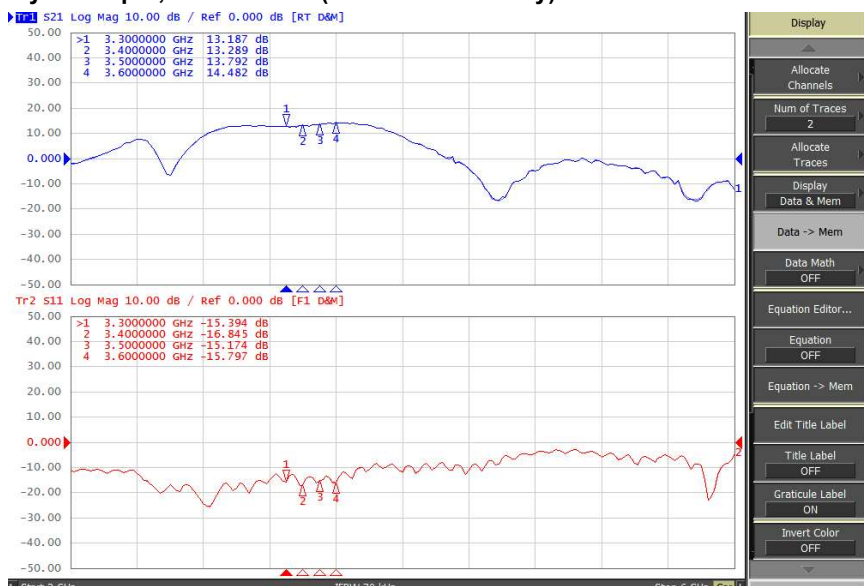
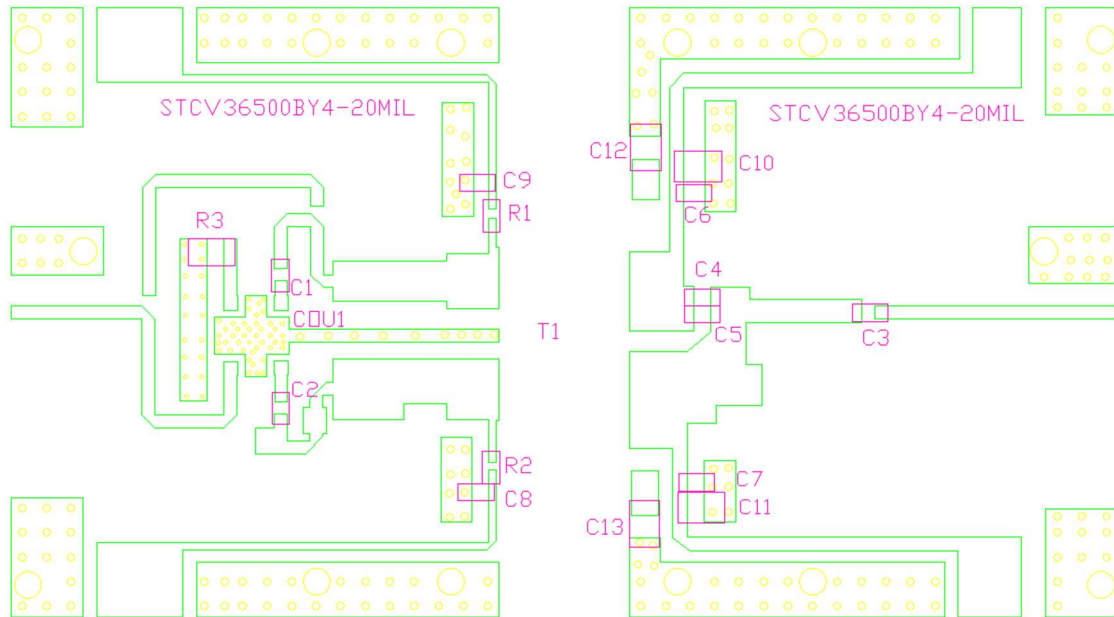


Figure 4: Network analyzer output, S11 and S21 (3.3-3.6GHz Doherty)



**Figure 5: Picture of application board Doherty circuit for 3.3-3.6GHz**

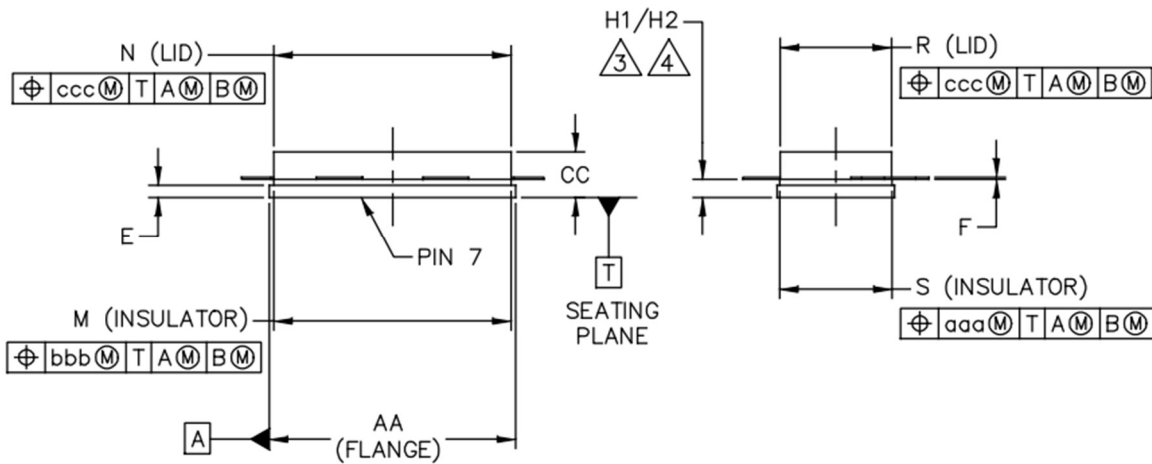
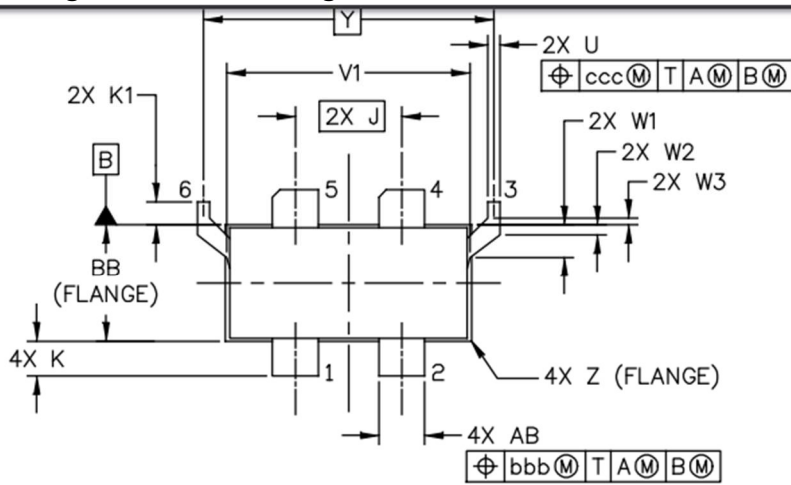


**Table 4. Bill of materials of application board (PCB layout upon request, RO4350B 30mils)**

Part	Quantity	Description	Part Number	Manufacture
C1,C2,C3,C6, C7,C8,C9	7	8.2pF High Q Capacitor	251SHS8R2BSE	TEMEX
C4	1	2.0pF High Q Capacitor	ATC600F2R0	ATC
C5	1	2.0pF High Q Capacitor	ATC600F2R0	ATC
C10,C11,C12,C13	4	10uF MLCC	GRM32EC72A106ME05	Murata
R1,R2	2	10 Ω Power Resistor	MCR10EZJ100	ROHM
R3	1	51 Ω Power Resistor	S1206N	RN2
COU1	1	3 dB Bridge	XC3500P-03S	ANAREN
T1	1	500W GaN Dual Transistor	STCV36500BY4V	Innogrations



**Earless Flanged Ceramic Package; 6 leads- BY4V**



DIM	INCH		MILLIMETER		DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	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
2022/5/18	V1.0	Preliminary Datasheet Creation

Application data based on LWH-22-14

## Notice

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