



Gallium Nitride 50V, 600W, 3.4-3.8GHz RF Power Transistor

Description

The STCV38600BY4V is a 600-watt, internally matched GaN HEMT, designed for 5G cellular applications with frequencies from 3.4-3.8GHz, enabled by wide band VBW capability to support IBW up to 200MHz.

It can be configured as asymmetrical Doherty for 4G or 5G application, delivering 70 to 85 W average power, according to normal 8.5 to 9.5 dB 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:

3.4-3.8GHz full band Doherty $V_{DD} = 50$ Vdc, $I_{DQA} = 350$ mA, $V_{GSB} = -6$ Vdc,

Freq (GHz)	Pulse CW Signal ⁽¹⁾				$P_{avg}=48.5$ dBm WCDMA Signal ⁽²⁾		
	P3 (dBm)	P3 (W)	P5 (dBm)	P5 (W)	Gp (dB)	η_D (%)	ACPR _{5M} (dBc)
3.40	57.70	589	58.01	632	10.52	43.47	-29.25
3.50	57.92	620	58.10	645	10.98	42.37	-31.13
3.60	58.04	637	58.15	653	11.24	41.77	-32.47
3.70	57.73	593	57.95	623	11.44	42.37	-34.89
3.80	57.16	520	57.82	605	10.71	41.67	-37.18

3.4-3.8GHz full band Doherty $V_{DD} = 53$ Vdc, $I_{DQA} = 350$ mA, $V_{GSB} = -6$ Vdc,

Freq (GHz)	Pulse CW Signal ⁽¹⁾				$P_{avg}=48.5$ dBm WCDMA Signal ⁽²⁾		
	P3 (dBm)	P3 (W)	P5 (dBm)	P5 (W)	Gp (dB)	η_D (%)	ACPR _{5M} (dBc)
3.40	58.11	647	58.21	663	10.84	41.79	-28.43
3.50	58.22	663	58.32	679	11.33	41.38	-29.95
3.60	58.37	687	58.47	703	11.67	41.24	-31.43
3.70	58.17	655	58.27	671	11.97	42.28	-33.75
3.80	57.62	577	58.16	654	11.25	41.60	-36.67

Notes:

(1) Pulse Width=100 us, Duty cycle=20%

(2) WCDMA signal: 3GPP test model 1; 1 to 64 DPCH; Channel Bandwidth=3.84MHz, PAR =10.5 dB at 0.01 % probability on CCDF.

Applications

- Asymmetrical Doherty amplifier within N78/N77 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

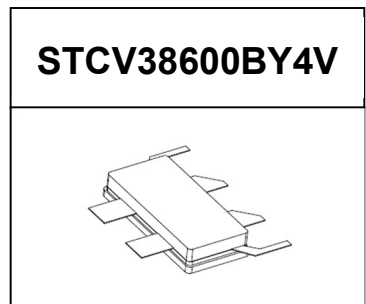


Figure 1: Pin Connection definition

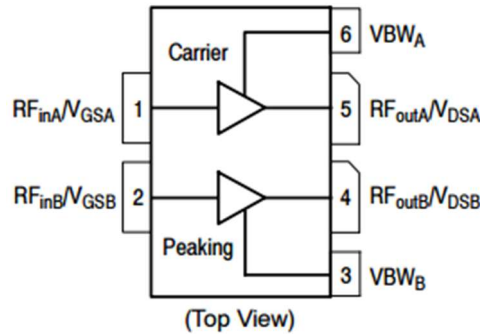


Table 1. Maximum Ratings

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}	77	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 $T_C = 85^\circ\text{C}$, $P_{out} = 100\text{W}$, 3.6GHz Doherty application board	$R_{\theta JC}$	1.05	°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	$V_{GS} = -8\text{V}$; $I_{DS} = 30\text{mA}$	V_{DSS}		200		V
Gate Threshold Voltage	$V_{DS} = 10\text{V}$, $I_D = 30\text{mA}$	$V_{GS(th)}$	-4		-2	V
Gate Quiescent Voltage	$V_{DS} = 50\text{V}$, $I_{DS} = 350\text{mA}$, Measured in Functional Test	$V_{GS(Q)}$		-3.23		V

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

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$V_{GS} = -8\text{V}$; $I_{DS} = 47\text{mA}$	V_{DSS}		200		V
Gate Threshold Voltage	$V_{DS} = 10\text{V}$, $I_D = 47\text{mA}$	$V_{GS(th)}$	-4		-2	V
Gate Quiescent Voltage	$V_{DS} = 50\text{V}$, $I_{DS} = 530\text{mA}$, Measured in Functional Test	$V_{GS(Q)}$		-3.23		V

Ruggedness Characteristics

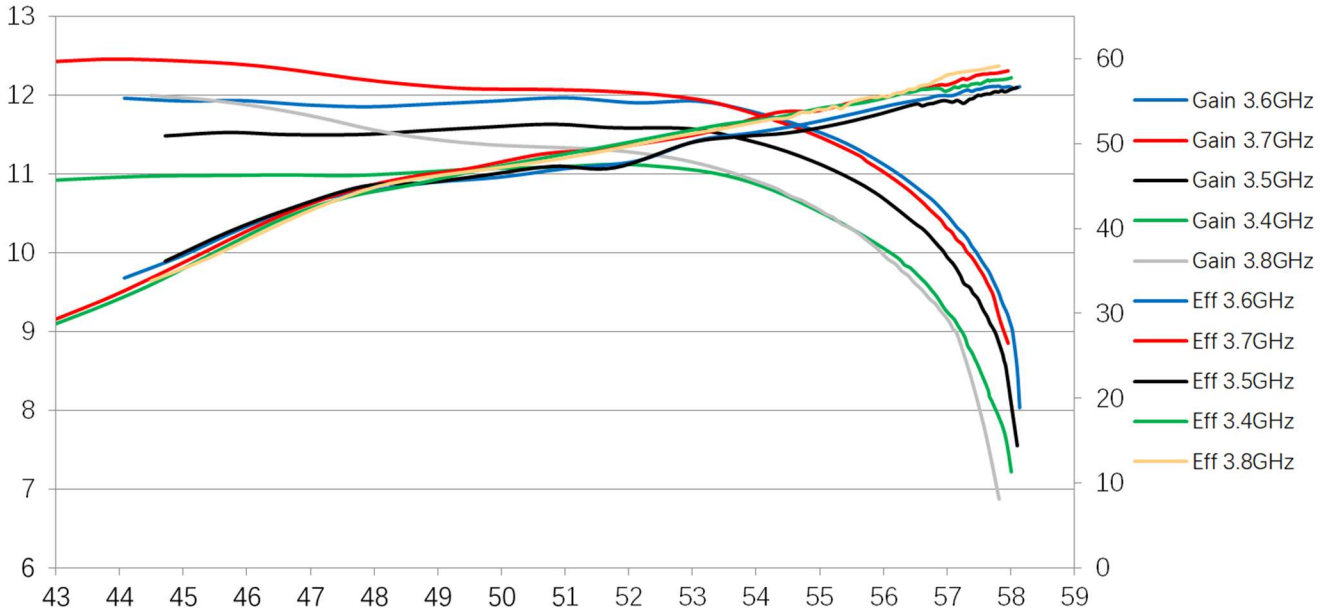
Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Load mismatch capability	3.6GHz, $P_{out} = 70\text{W}$ WCDMA 1 Carrier in Doherty circuit All phase, No device damages	VSWR		10:1		



3.4-3.8GHz full band tuning

Figure 3: Efficiency and power gain as function of Pout (3.4-3.8GHz Doherty)

VDD=50V



VDD=53V

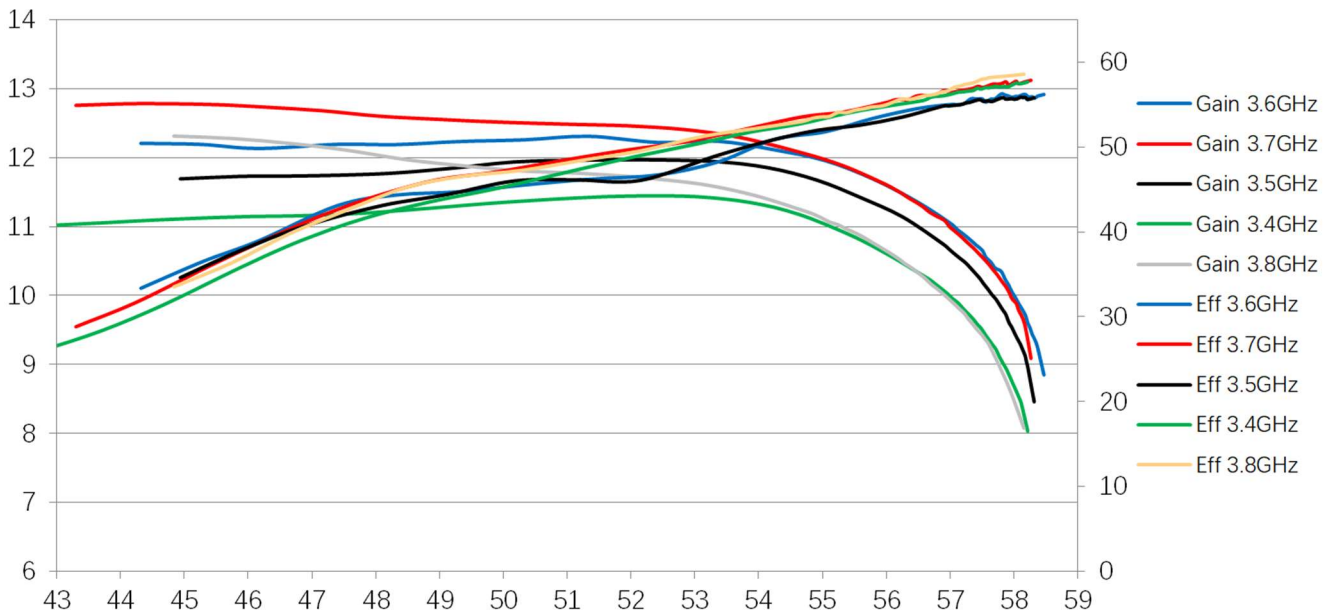


Figure 4: Network analyzer output, S11 and S21 (3.4-3.8GHz Doherty)

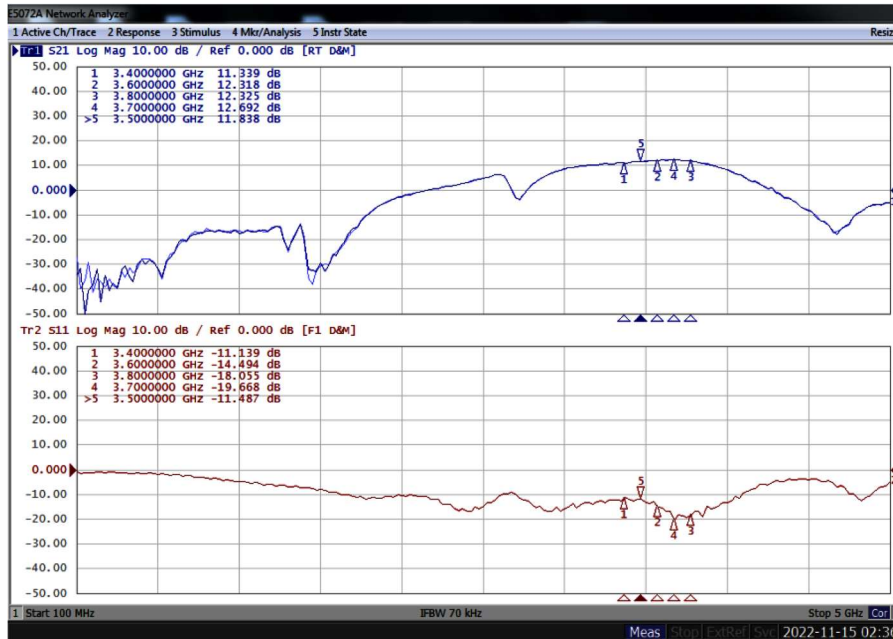


Figure 5: Picture of application board Doherty circuit for 3.4-3.8GHz

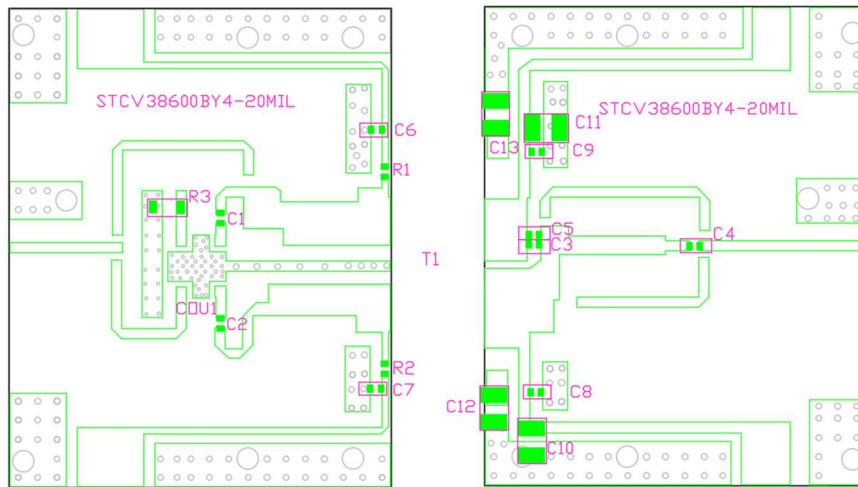
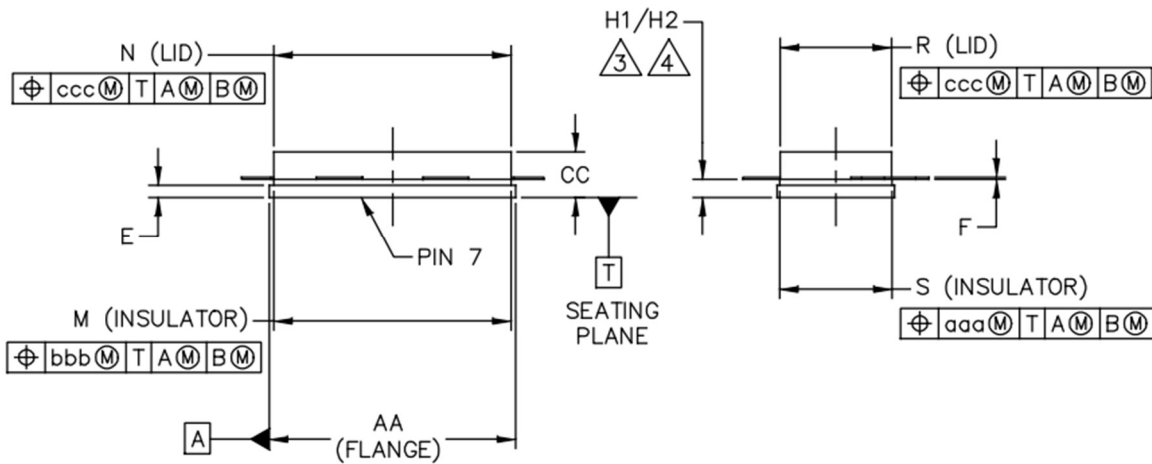
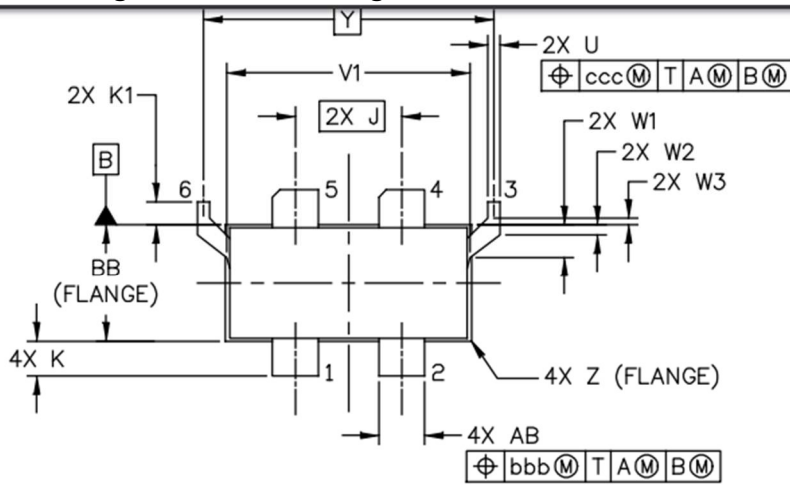


Table 4. Bill of materials of application board (PCB layout upon request, RO4350B 20mils)

Part	Quantity	Description	Part Number	Manufacture
C1,C2,C4,C6, C7,C8,C9	7	8.2pF High Q Capacitor	251SHS8R2BSE	TEMEX
C3,C5	2	1.0pF High Q Capacitor	ATC600S1R0	ATC
C10,C11,C12,C13	4	10uF MLCC	GRM32EC72A106ME05	Murata
R1,R2	2	10 Ω Power Resistor	ESR03EZPF100	ROHM
R3	1	51 Ω Power Resistor	S1206N	RN2
COU1	1	3 dB Bridge	XC3500P-03S	ANAREN
T1	1	600W GaN Dual Transistor	STCV38600BY4V	Innegration



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
2022/11/15	V1.0	Preliminary Datasheet Creation
2023/4/3	V1.1	Modify the Pout=100W in table 2

Application data based on LWH-22-19

Notice

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