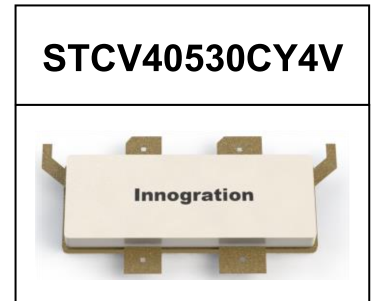
# Gallium Nitride 50V, 530W, 3.7-4.2GHz RF Power Transistor

## STCV40530CY4V




## Description

The STCV40530CY4V is a 530-watt, internally matched GaN HEMT, designed for 5G cellular applications with frequencies from 3.7-4.2GHz, **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 55-70W average power, according to normal 8.5 to 9dB back off.

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

- Typical 3.7-4.0GHz Doherty Pulsed CW and 1C W--CDMA Characterization Performance:

$V_{DD}$ = 48 Vdc, $I_{DQA}$ =270 mA, $V_{GSB}$ = –5.2Vdc,1C WCDMA; Signal PAR = 10 dB @ 0.01% Probability on CCDF.

| Freq (GHz) | Pulse CW Signal(1) | | | | $P_{avg}$=48.5dBm WCDMA Signal(2) | | |
|---|---|---|---|---|---|---|---|
| | P3 (dBm) | P3 (W) | P4.5 (dBm) | P4.5 (W) | Gp (dB) | $\eta_D$ (%) | $ACPR_{5M}$ (dBc) |
| 3.7 | 57.13 | 517 | 57.40 | 550 | 11.47 | 43.00 | -28.74 |
| 3.8 | 56.45 | 442 | 57.20 | 525 | 12.12 | 45.64 | -32.33 |
| 3.9 | 56.35 | 429 | 57.18 | 523 | 11.90 | 44.38 | -36.40 |
| 4.0 | 56.73 | 471 | 57.10 | 513 | 12.09 | 42.20 | -40.24 |

- Typical 3.8-4.2GHz Doherty Pulsed CW and 1C W--CDMA Characterization Performance:

$V_{DD}$ = 50 Vdc, $I_{DQA}$ =280 mA, $V_{GSB}$ = –5.2Vdc,1C WCDMA; Signal PAR = 10 dB @ 0.01% Probability on CCDF.

| Freq (GHz) | Pulse CW Signal(1) | | | | $P_{avg}$=47.5dBm WCDMA Signal(2) | | |
|---|---|---|---|---|---|---|---|
| | P3 (dBm) | P3 (W) | P5 (dBm) | P5 (W) | Gp (dB) | $\eta_D$ (%) | $ACPR_{5M}$ (dBc) |
| 3.8 | 56.60 | 457 | 57.22 | 527 | 11.40 | 39.96 | -31.66 |
| 3.9 | 56.30 | 425 | 57.23 | 528 | 12.30 | 42.50 | -33.67 |
| 4.0 | 56.60 | 457 | 57.30 | 537 | 12.20 | 41.80 | -37.25 |
| 4.1 | 57.27 | 533 | 57.28 | 534 | 12.00 | 40.80 | -43.23 |
| 4.2 | 57.20 | 525 | 57.22 | 527 | 11.85 | 38.10 | -36.56 |

- Typical 3.4-4.1GHz Doherty Pulsed CW and 1C W--CDMA Characterization Performance:

$V_{DD}$ = 50 Vdc, $I_{DQA}$ =280 mA, $V_{GSB}$ = –5.2Vdc,1C WCDMA; Signal PAR = 10 dB @ 0.01% Probability on CCDF.

| Freq (GHz) | Pulse CW Signal(1) | | | | $P_{avg}$=48.5dBm WCDMA Signal(2) | | |
|---|---|---|---|---|---|---|---|
| | P3 (dBm) | P3 (W) | P3.5 (dBm) | P3.5 (W) | Gp (dB) | $\eta_D$ (%) | $ACPR_{5M}$ (dBc) |
| 3.4 | 56.95 | 495.4 | 57.10 | 513.0 | 10.85 | 39.10 | -30.6 |
| 3.7 | 57.36 | 544.0 | 57.57 | 572.0 | 11.02 | 42.31 | -33.24 |
| 4.1 | 57.15 | 519.3 | 57.18 | 522.0 | 10.91 | 38.60 | -35.8 |

## Applications

- Asymmetrical Doherty amplifier within N77/78 5G 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**

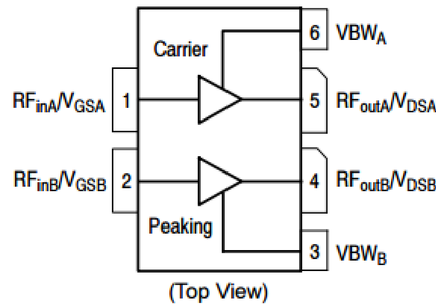



**Table 1. Maximum Ratings**

| 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 | Igs | 65.2 | 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<br>$T_C$= 85°C, Pout=70W, 3.8GHz Doherty application board | $R_{\theta JC}$ | 0.9 | °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=25mA | $V_{DSS}$ | | 200 | | V |
| Gate Threshold Voltage | VDS =10V, ID = 25mA | $V_{GS(th)}$ | -4 | | -2 | V |
| Gate Quiescent Voltage | VDS =50V, IDS=270mA,<br>Measured in Functional Test | $V_{GS(Q)}$ | | -3.3 | | V |

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

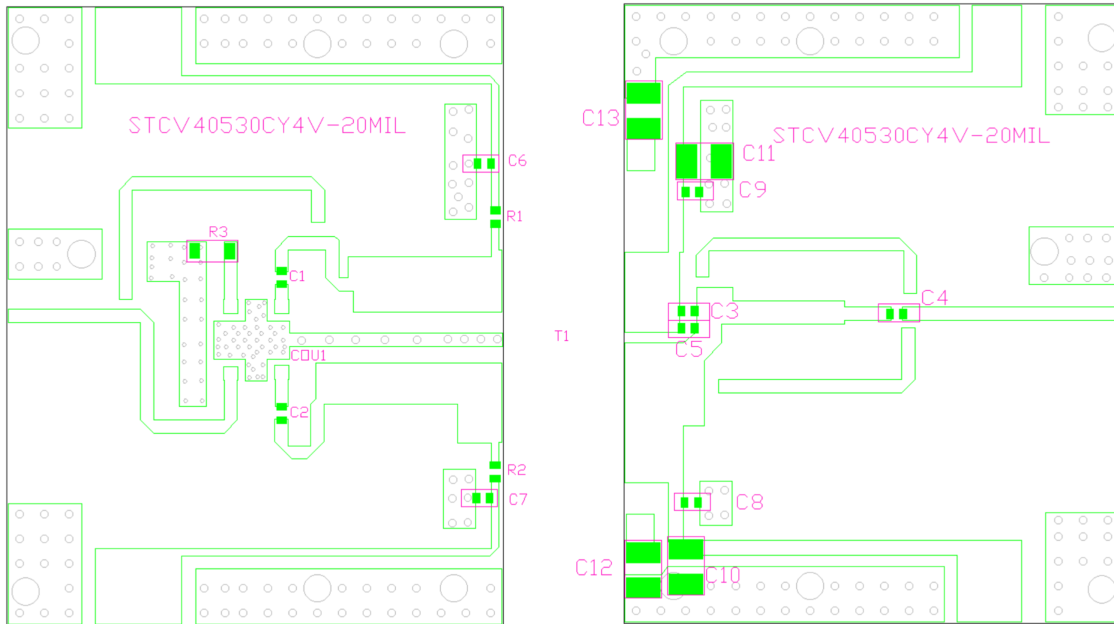
| Characteristic | Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | VGS=-8V; IDS=40mA | $V_{DSS}$ | | 200 | | V |
| Gate Threshold Voltage | VDS =10V, ID = 40mA | $V_{GS(th)}$ | -4 | | -2 | V |
| Gate Quiescent Voltage | VDS =50V, IDS=400mA<br>Measured in Functional Test | $V_{GS(Q)}$ | | -3.3 | | V |

**Ruggedness Characteristics**

| Characteristic | Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Load mismatch capability | 3.8GHz, Pout=70W WCDMA 1 Carrier in Doherty circuit All phase, No device damages | VSWR | | 10:1 | | |

## 3.7-4.0GHz

**Figure 3: Picture of application board Doherty circuit for 3.7-4GHz**




| Part | Quantity | Description | Part Number | Manufacture |
|---|---|---|---|---|
| C1,C2,C4,C6, C7,C8,C9 | 7 | 8.2pFHigh Q Capacitor | 251SHS8R2BSE | TEMEX |
| C3,C5 | 2 | 1.0pFHigh Q Capacitor | ATC600S1R1 | ATC |
| | | | | |
| C10,C11,C12,C13 | 4 | 10uF MLCC | RS80R2A106M | MARUWA |
| | | | | |
| R1,R2 | 2 | 10Ω Power Resistor | ESR03EZPF100 | ROHM |
| R3 | 1 | 51Ω Power Resistor | RFR50-20CT0421B | YT |
| COUT1 | 1 | 3 dB Bridge | XC3500P-03S | ANAREN |
| T1 | 1 | 530W GaN Dual Transistor | STCV404530CY4V | Innogration |

**Figure 4: Efficiency and power gain as function of Pout**

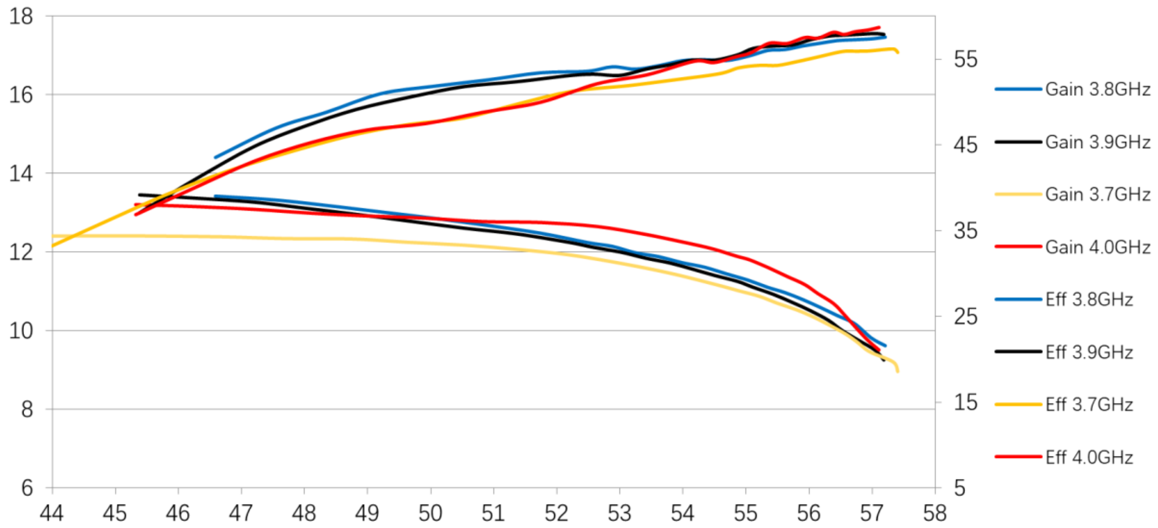
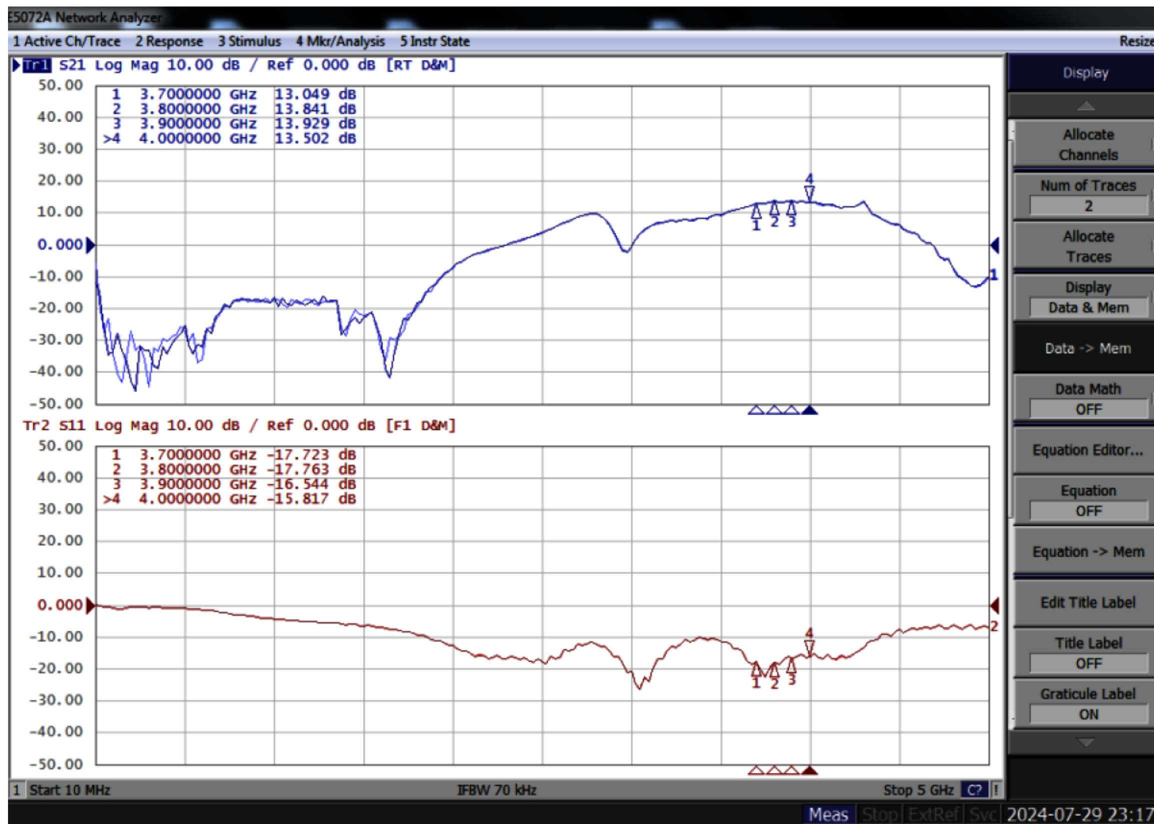
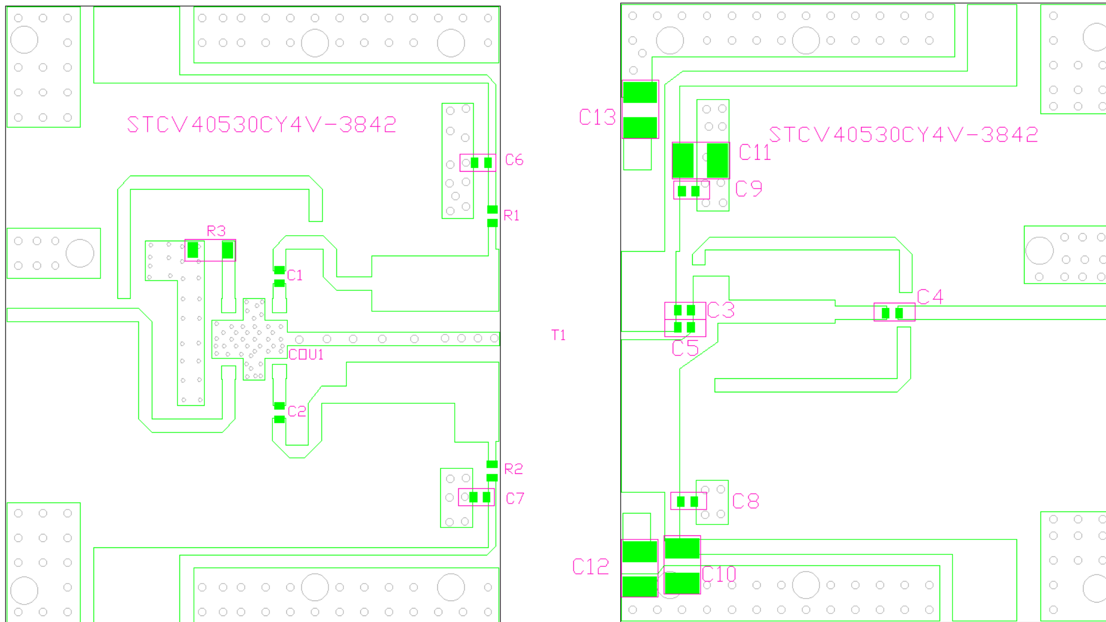



**Figure 5: Network analyzer output, S11 and S21**



## 3.8-4.2GHz

**Figure 6: Picture of application board Doherty circuit for 3.8-4.2GHz**




| Part | Quantity | Description | Part Number | Manufacturer |
|---|---|---|---|---|
| C1,C2 ,C4,C6,C7,C8,C9 | 7 | 8.2pFHigh Q Capacitor | 251SHS8R2BSE | TEMEX |
| C3,C5 | 2 | 0.8pFHigh Q Capacitor | 251SHS0R8BSE | TEMEX |
| C10,C11,C12,C13 | 4 | 10uF MLCC | GRM32EC72A106ME05 | Murata |
| | | | | |
| R1,R2 | 2 | 10Ω Power Resistor | ESR03EZPF10R0 | ROHM |
| R3 | 1 | 51Ω Power Resistor | RFR50-20CT0421B | YT |
| COUT1 | 1 | 3 dB Bridge | XC3500P-03S | ANAREN |
| T1 | 1 | 530W GaN Dual Transistor | STCV40530CY4V | Innogration |

**Figure 7: Efficiency and power gain as function of Pout**

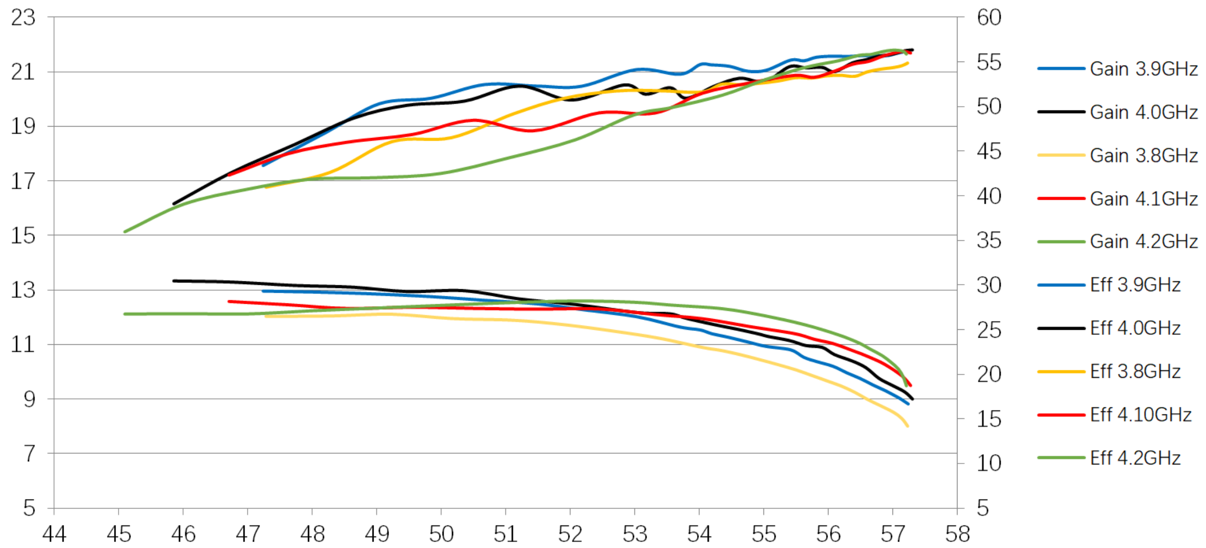
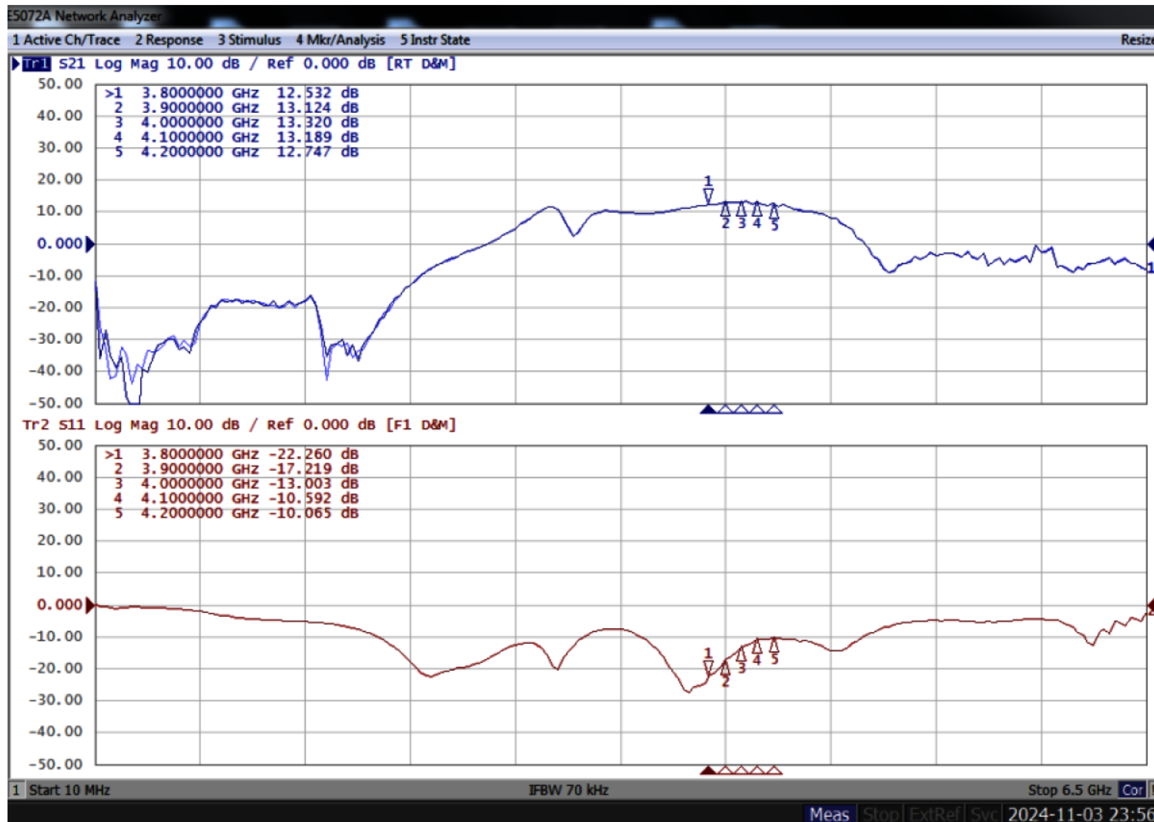
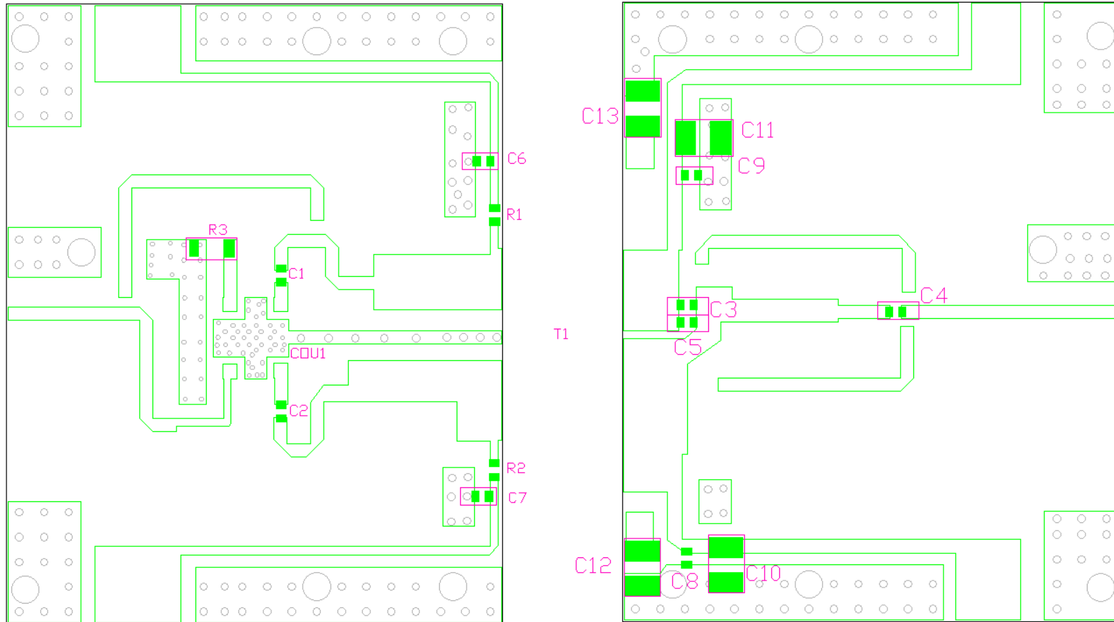



**Figure 8: Network analyzer output, S11 and S21**



## 3.4-4.1GHz

**Figure 9: Picture of application board Doherty circuit for 3.4-4.1GHz**




| Part | Quantity | Description | Part Number | Manufacture |
|---|---|---|---|---|
| C1,C2,C4,C6, C7,C8,C9 | 7 | 8.2pFHigh Q Capacitor | 251SHS8R2BSE | TEMEX |
| C3,C5 | 2 | 1.3pFHigh Q Capacitor | ATC600S1R3 | ATC |
| | | | | |
| C10,C11,C12,C13 | 4 | 10uF MLCC | RS80R2A106M | MARUWA |
| | | | | |
| R1,R2 | 2 | 10Ω Power Resistor | ESR03EZPF100 | ROHM |
| R3 | 1 | 51Ω Power Resistor | RFR50-20CT0421B | YT |
| COUT1 | 1 | 3 dB Bridge | XC3500P-03S | ANAREN |
| T1 | 1 | 530W GaN Dual Transistor | STCV404530CY4V | Innogration |

**Figure 10: Efficiency and power gain as function of Pout**

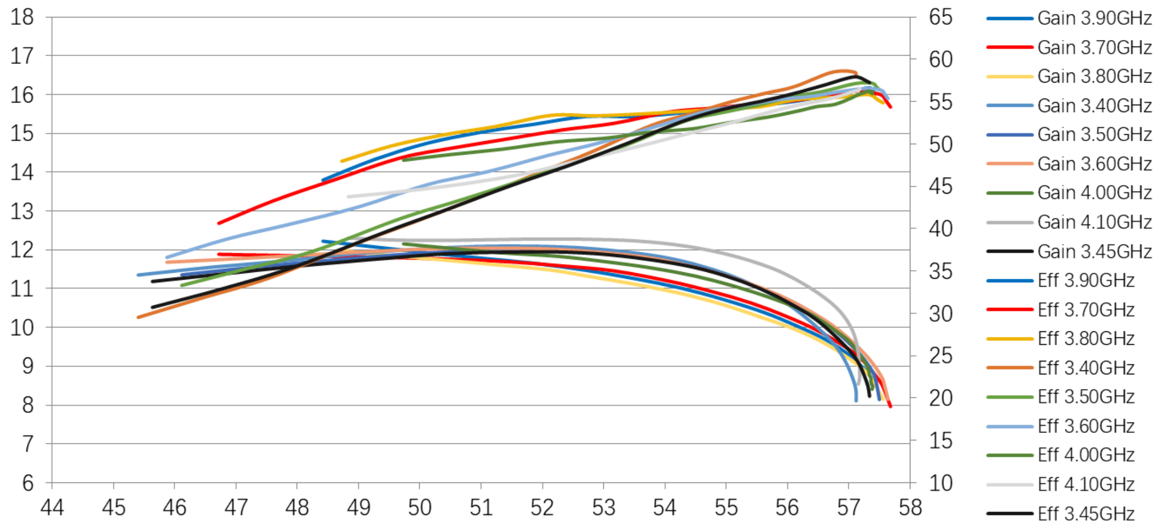
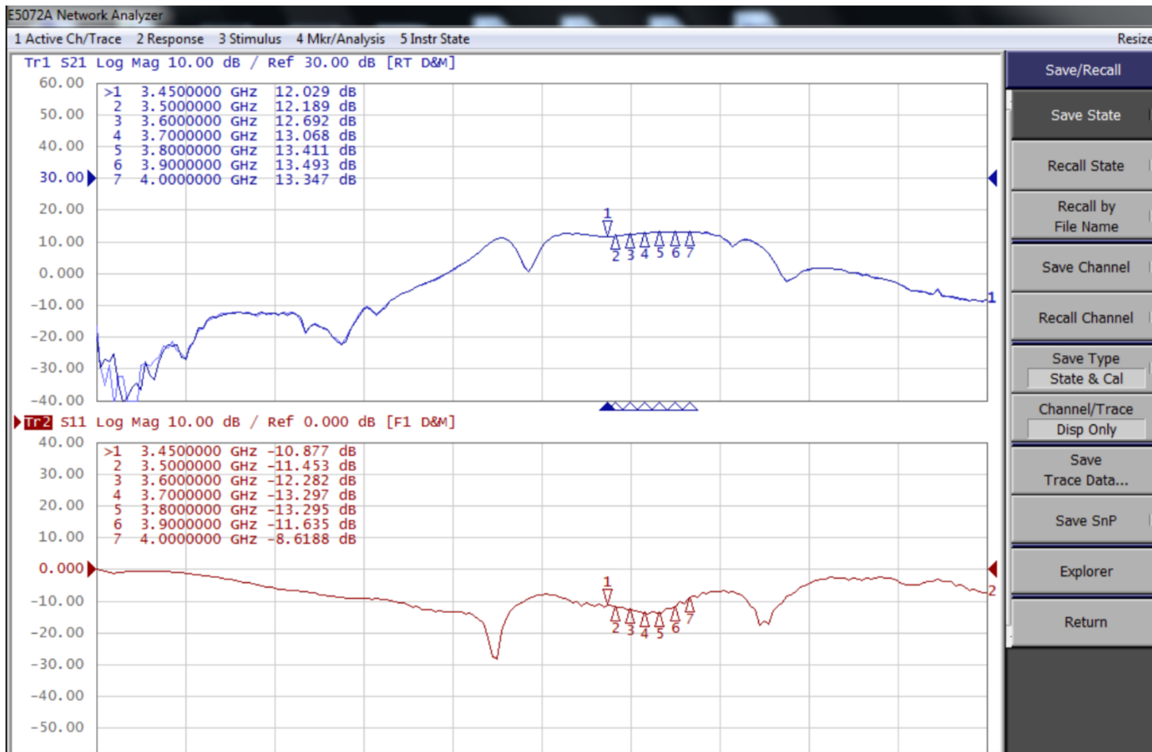
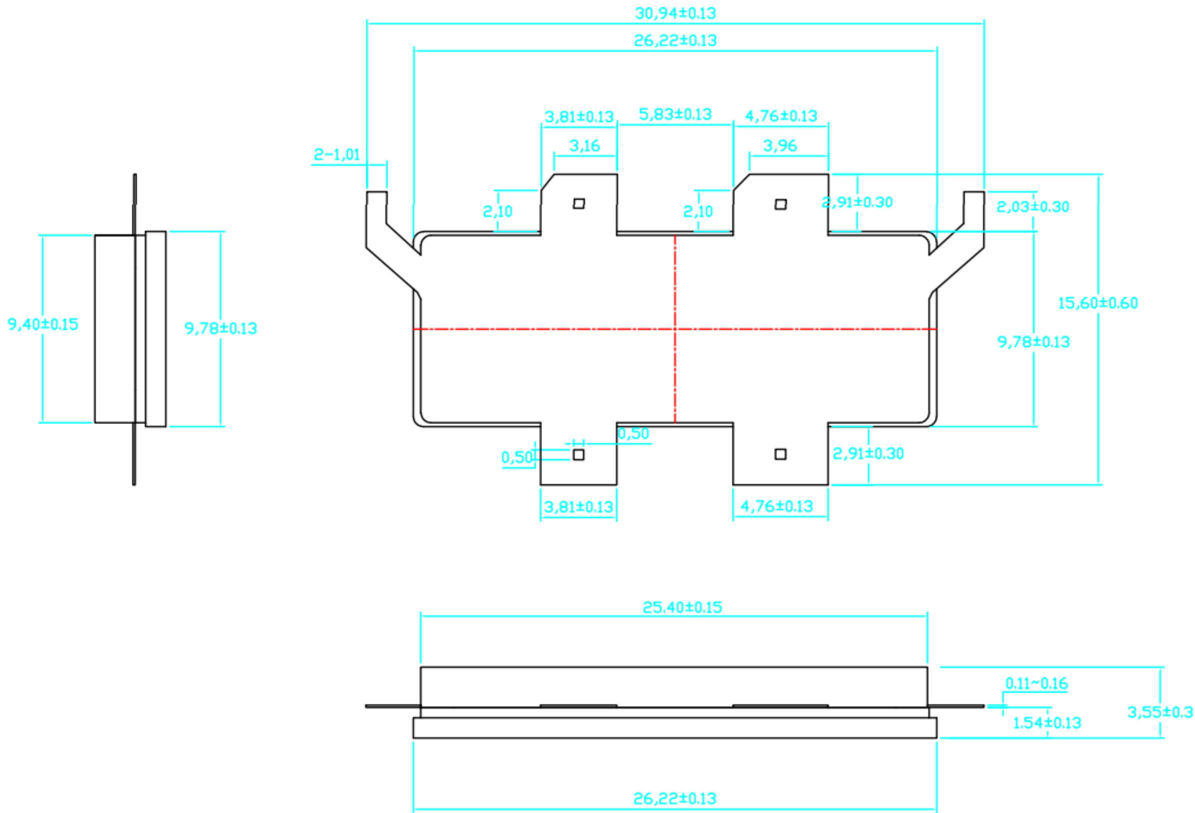



**Figure 11: Network analyzer output, S11 and S21**



**Earless Flanged Ceramic Package; 6 leads- CY4V**




## Revision history

**Table 4. Document revision history**

| Date | Revision | Datasheet Status |
|---|---|---|
| 2024/7/30 | V1.0 | Preliminary Datasheet Creation |
| 2024/11/5 | V2.0 | Extend to 4.2GHz support |
| 2025/11/17 | V2.1 | Add its 3.4-4.1G application data |
| | | |

**Application data based on LWH-24-27/40/25-41**

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