TG2H214120

2140MHz 120W WCDMA Power Amplifier

TriQuint SEMICONDUCTOR

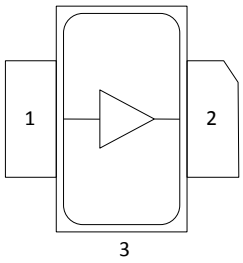
Applications

- High power and high linearity applications
- Wireless Base Station Amplifiers
- Tower-mounted amplifiers

Product Features

- Optimized for 2110 – 2170 MHz operation
- 70% Saturated CW Collector Efficiency
- P1dB > 120W
- Optimized for use in a Doherty amplifier
- Well suited for use with Envelope Tracking
- Internally matched for ease of use.
- Easily linearizable with Digital Pre-distortion
- 28V operation
- Mismatch tolerance at 28V: 10:1 CW all angles

Functional Block Diagram



General Description

The TG2H214120 is part of a series of internally matched High Voltage Hetero-junction Bipolar Transistors (HVHBT) suitable for a variety of next generation 3G & 4G base station applications.

These devices offer dramatic improvements in efficiency compared to conventional LDMOS transistors. The TG2H214120 typically provides 70% CW saturated collector efficiency. In WCDMA applications, this power amplifier typically provides 32% collector efficiency at 45 dBm average output power, and 16.5 dB of gain, while maintaining -60 dBc ACPR with Digital Predistortion. Efficiency climbs to a typical value of 55% when used in Doherty applications.

The TG2H214120 is an excellent choice for applications requiring high power and high efficiency.

The TG2H214120 is Lead -free and RoHS compliant

Pin Configuration

Pin #	Symbol
1	Base, Input DC Bias, RF input
2	Collector, Output DC Bias, RF output
3	Emitter, DC and RF Ground/Common

Ordering Information

Part No.	Description
TG2H214120-FS (1)	Power Amp, Earless Package
TG2H214120-FS-T/R (2)	Power Amp, Earless Package
TG2H214120-FL (1)	Power Amp, Eared Package
TG2H214120-FL-T/R (2)	Power Amp, Eared Package

(1): Shipment type = Bulk (tray)

(2): Shipment type = Tape and reel (quantity=250pcs)

Specifications

Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	-65 to 150 °C
VSWR @P1dB CW all phases	10:1
Collector – Base Voltage (VCES)	-0.5 to +65 V
Base – Emitter Voltage (VBE)	-4 to +2V
Operating Case Temperature (Tc)	+150 °C
Operating Junction Temperature (Tj)	+200 °C

Operation of this device outside the parameter ranges given above may cause permanent damage.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
V_{CE}	10	28	32	V
I_{cq}	500	550	600	mA
Thermal Resistance (Rth)		1.27		°C/W

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Test conditions: f=2110-2170MHz Bandwidth, V_{CE} = +28 V, I_{CQ} = 550 mA, Single-Ended Class AB 50 Ω matched fixture; T= 25 ºC

Parameter	Conditions	Min	Typical	Max	Units
Gain @P1dB	See Note 1		16.2		dB
Input Return Loss @P1dB	See Note 1		-16.0		dB
Output Power @P1dB	See Note 1		51.1		dBm
Collector Efficiency @P1dB	See Note 1		66		%

Test conditions: f=2110-2170MHz Bandwidth, V_{CE} = +28 V, I_{CQ} = 550 mA, Single-Ended Class AB 50 Ω matched fixture; T= 25 ºC

Parameter	Conditions	Min	Typical	Max	Units
Gain	See Note 2		16.6		dB
Input Return Loss	See Note 2		-20.6		dB
Collector Efficiency	See Note 2		32		%
Video Bandwidth	See Note 3		50		MHz
Adjacent Channel Power Ratio (ACP5)	See Note 2		-36		dBc

Notes:
1. Test signal = CW
2. Single carrier WCDMA 3GPP Test Model 1, 64 DPCH, , ±5 MHz, 50% clipping, PAR=7.1 dB @ 0.01% Probability, Pout = +45 dBm
3. Measured with two tones CW at constant output power for IM3 of -30dBc. Tone spacing varies from 100KHz to 100MHz. Video bandwidth measured for IM3 deviation of 3dB.

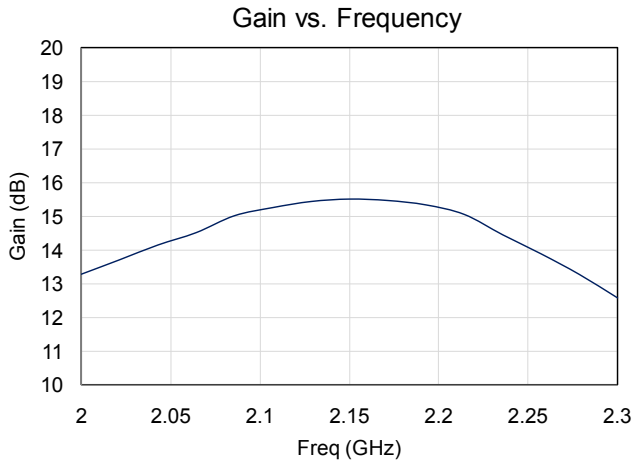
Test conditions: DC, V_{CC} = +28 V, I_{CQ} = 550 mA,

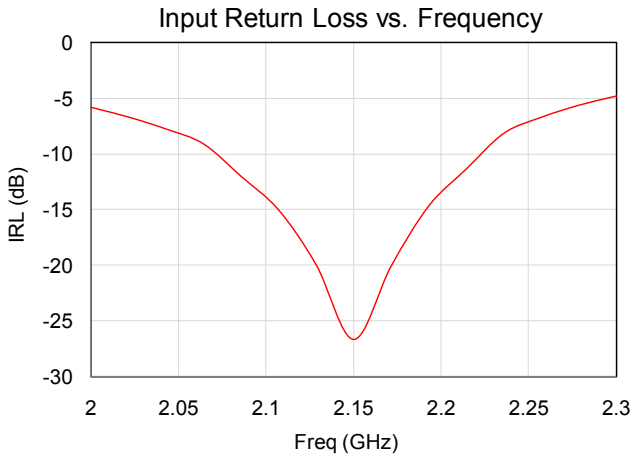
Parameter	Conditions	Min	Typical	Max	Units
Collector - Base Lkge Current (ICBO)	Vcb=65V, E open			90	uA
Collector – Emitter Lkge Current (ICES)	Vce=28V, Vbe=0V			4	uA
Base Quiescent Voltage (VBQ)	Vce=28V, Ic=550mA		1.26		V
Output Capacitance (COUT)			300		pF

Typical Performance Plots 2110-2170 MHz

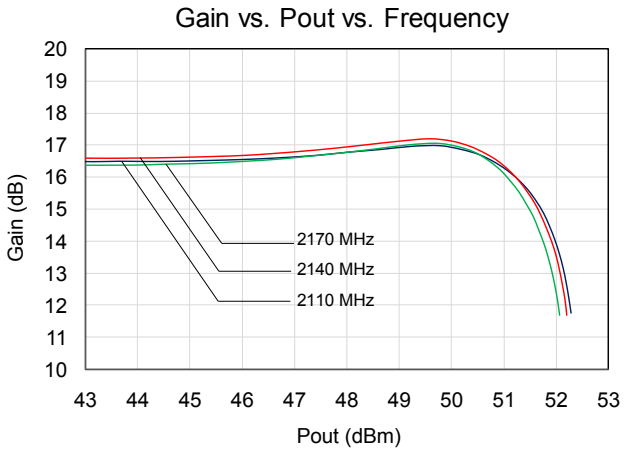
Test conditions: VCE = +28 V, ICQ = 550 mA; T= 25 ºC, Test signal = CW.

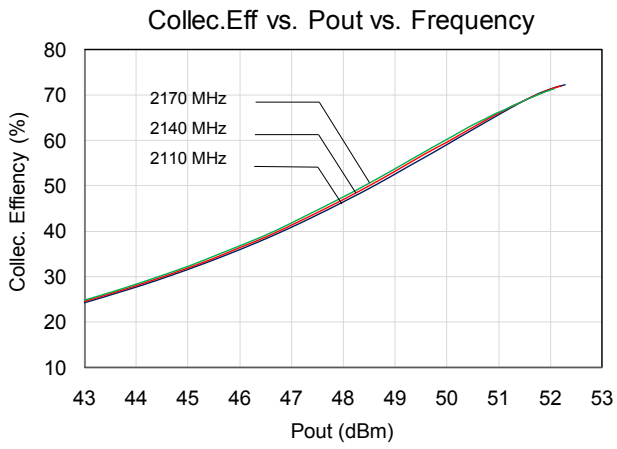
Small Signal Frequency Response





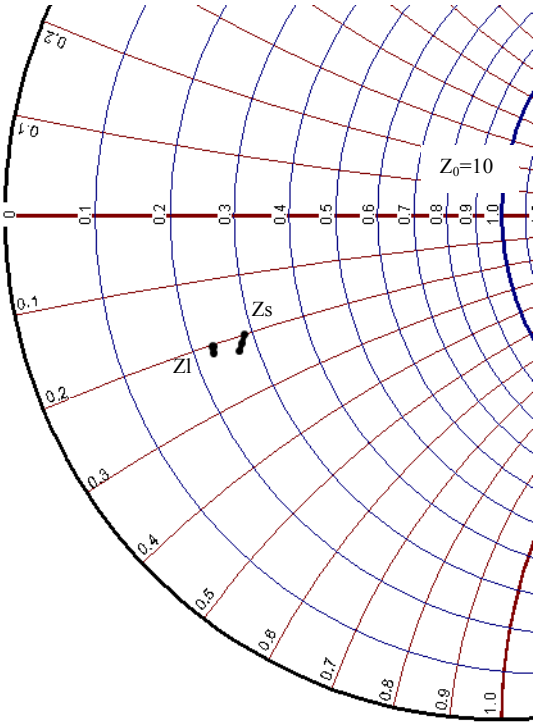
Power Sweeps



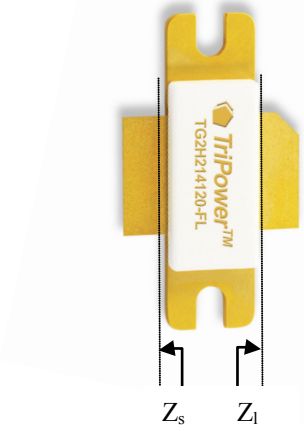


Load Pull Impedances

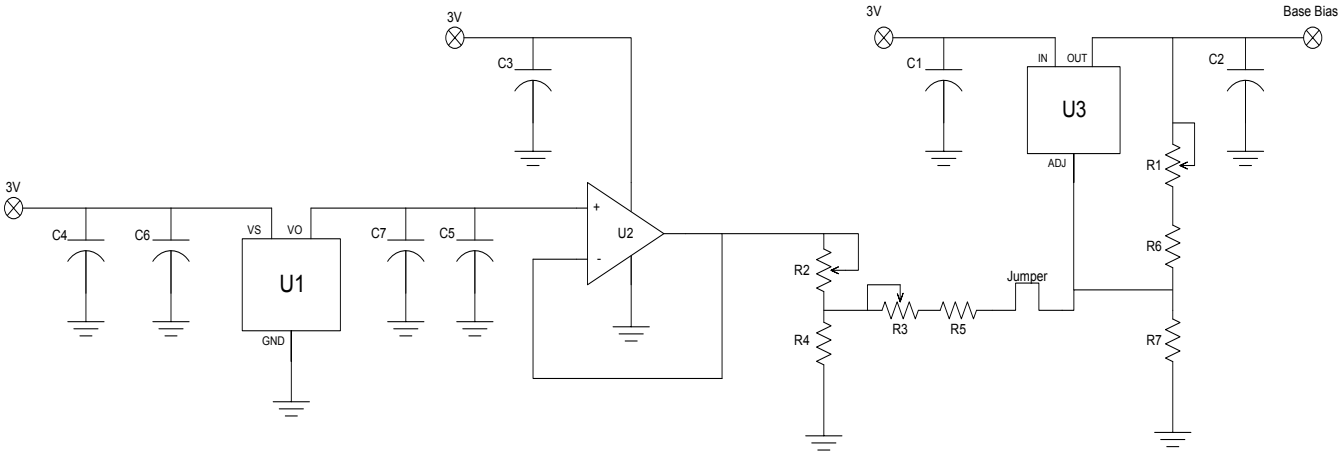
Test conditions: VCE = +28 V, ICQ = 550 mA; T= 25 ºC, Test signal = CW, max. output power



F MHz	Z_{source} Ω	Z_{load} Ω
2110	2.70-j*2.20	2.32-j*2.00
2140	2.78-j*2.09	2.29-j*2.10
2170	2.86-j*1.97	2.31-j*2.00



Temperature Compensation Biasing Circuit



Bill of Material

Reference	Value	Description	Manufacturer	Part Number
C1, C2, C3	10uF	Capacitor, 1206, 25V	Panasonic-ECG	ECJ-3YB1E106M
C4, C5	1uF	Capacitor, 1206, 25V	Panasonic - ECG	ECJ-3YB1E105K
C6, C7	8.2 pF	Capacitor, 0603 SMD, 250V	AVX Corp.	SQCSVA8R2CAT1A
R1, R2	5kΩ	Potentiometer	Copal Electronics Inc.	ST5ETW502
R3	20kΩ	Potentiometer	Copal Electronics Inc.	ST5ETW203
R4	392Ω	Resistor, 1206, 1/4W, 5%	Rohm Semiconductor	MCR18EZHF3920
R5, R6	15kΩ	Resistor, 1206, 1/4W, 5%	Panasonic - ECG	ERJ-8GEYJ153V
R7	3.3kΩ	Resistor, 1206, 1/4W, 5%	Rohm Semiconductor	MCR18EZHF3301
U1		LM60BIM3CTND Temperature Sensor	National Semiconductor	LM60BIM3/NOPB
U2		Operational Amplifier	Linear Technology	LT6220CS5#TRMPBF
U3		Voltage Regulator	Linear Technology	LT3021ES8#PBF

Bias Guidelines

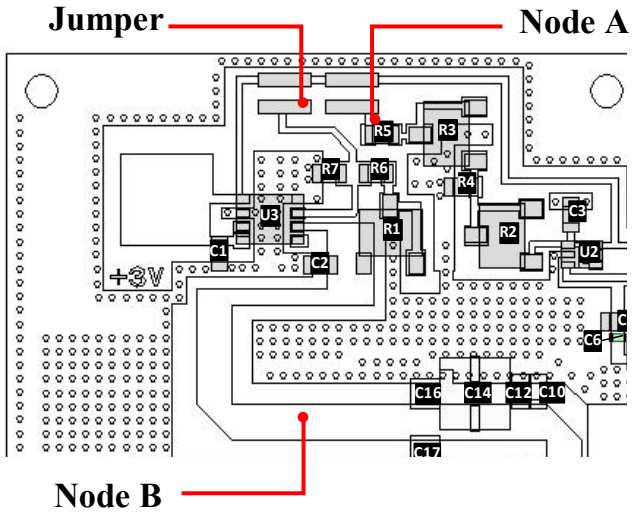
Base (Input) Bias

Use a +3.0V supply.
Ensure the power supply voltage sense is used to maintain a solid +3.00V at the EVB for all RF drive levels.
Maximum base current demand is approximately 200mA at 52dBm CW output power.

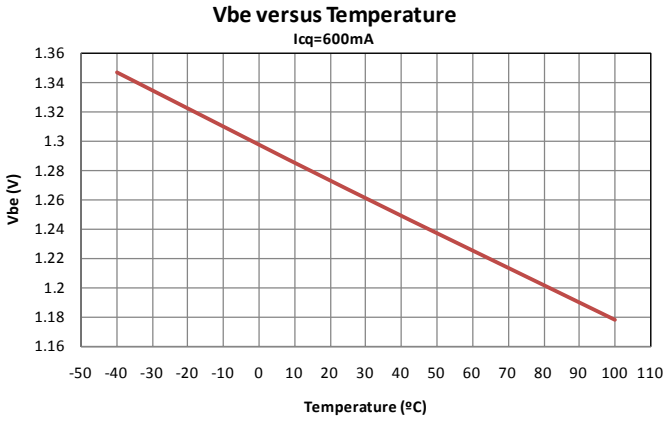
Bias the amplifier at 550mA.
To operate the temperature compensation bias circuit, follow the steps below:

1. Ensure +3.0 VDC is applied to the input bias circuits.
2. Remove jumper and adjust R2 for 200 mV at Node A at 25°C.
3. Re-install jumper.
4. Adjust R1 at 25°C for Icq 550 mA Node B: typ. 1.26 V, 25°C.
5. Adjust R3 at 100°C for Icq 550 mA Node B: typ. 1.17 V, 100°C.

Temperature compensation can be bypassed by simply removing the jumper and adjusting R1 for the quiescent point of interest.



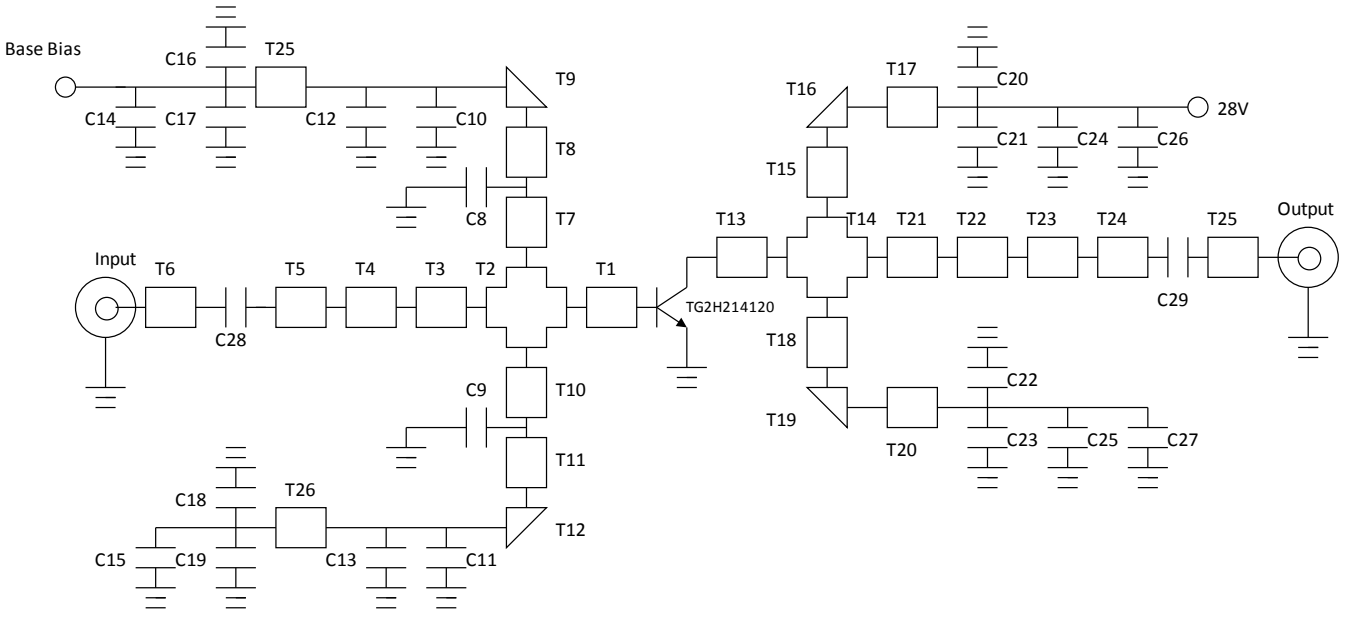
Thermal Coefficient= -1.21mV/°C
Conditions: Constant Icq of 600mA across temperature.



Collector (Output) Bias

Use +28V supply for collector bias.
Ensure the power supply voltage sense is used to maintain a solid +28.00V at the EVB for all RF drive levels.
Collector current demand is approximately 8.5A at 52 dBm CW output power.

Single Ended Class AB Test Fixture Schematic



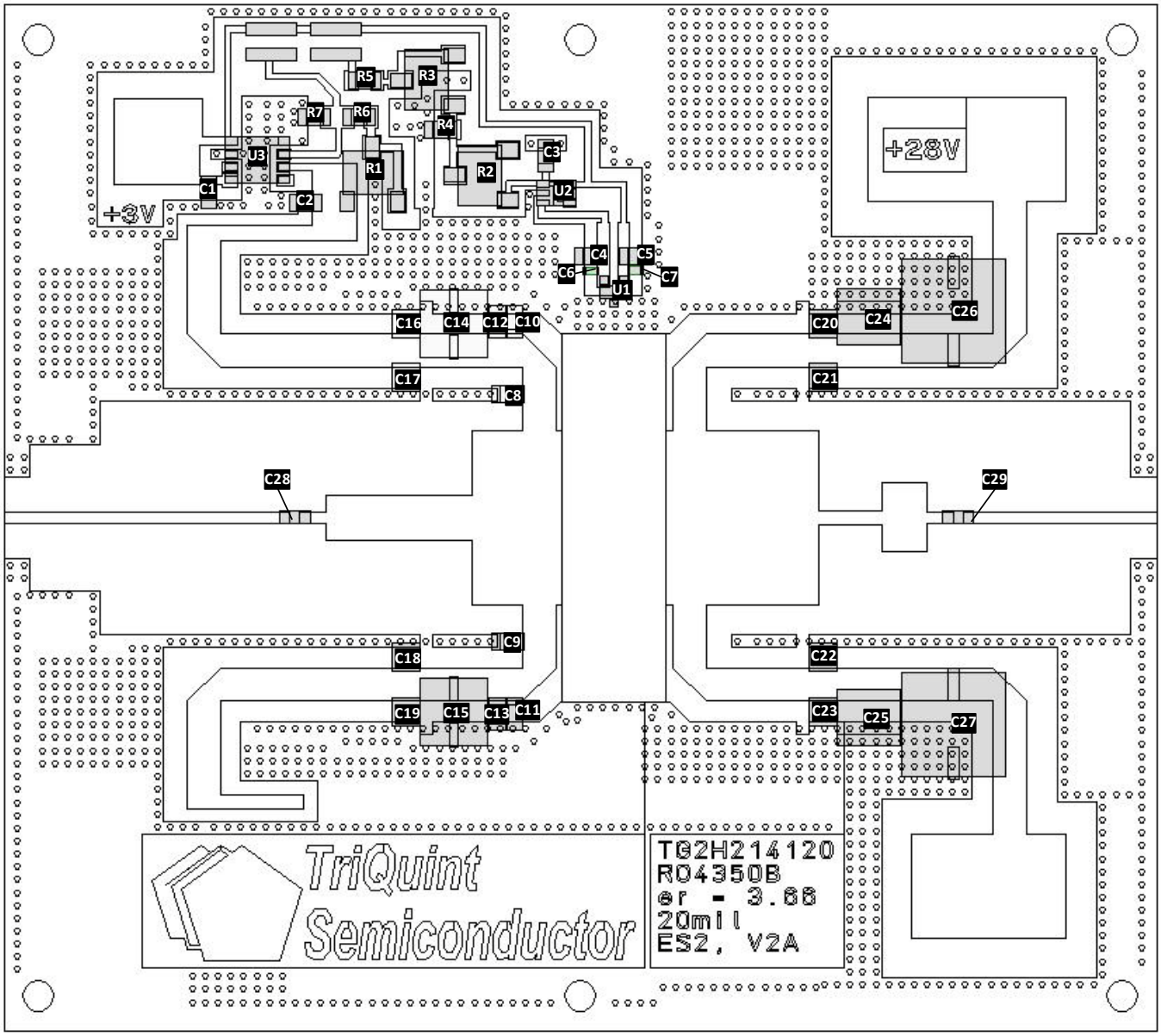
PCB: 20mil Rogers 4350B, Er = 3.66, Loss Tangent = 0.004
All dimensions in mils (W x L)
T1, T13: 682 x 25
T2, T14: 682 x 130 (Cross)
T3: 682 x 195
T4: 172 x 575
T5: 45 x 100
T6: 45 x 1115

T7, T8, T10, T11: 122.5 x 130
T9, T12, T16, T19: 130 x 90 (Bend, Miter = 0.52)
T15, T18: 130 x 245
T17, T20, T25, T26: 130 x 400
T21: 682 x 442.5
T22: 55 x 244
T23: 270 x 178
T24: 45 x 100
T25: 45 x 755.5

Bill of Material

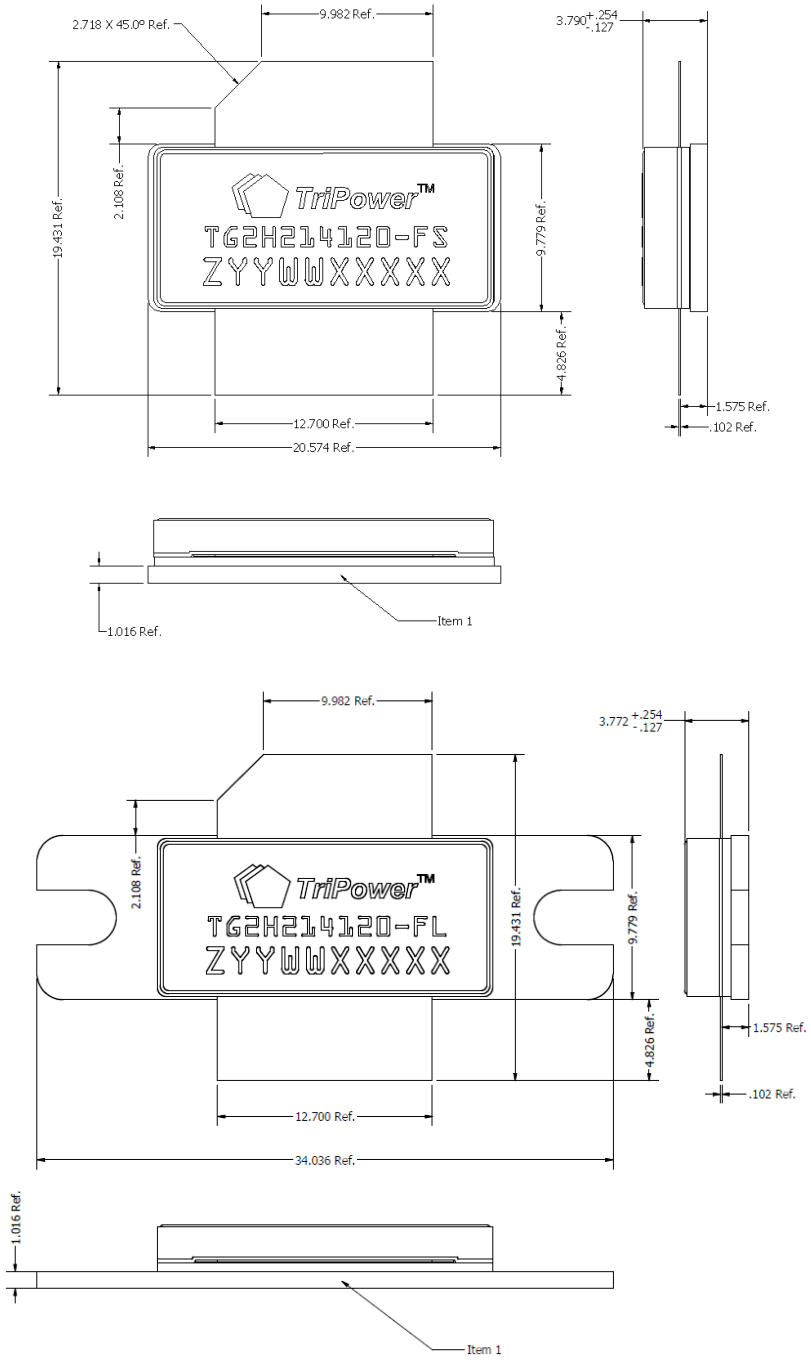
Reference	Value	Description	Manufacturer	Part Number
C8, C9	1000pF	Capacitor, 1206, 630V	Murata Elect. North America	GRM31BR72J102KW01L
C10, C11	0.01uF	Capacitor, 1206, 630V	Murata Elect. North America	GRM31BR72J103KW01L
C12, C13	10uF	Capacitor, 1206, 25V	Panasonic - ECG	ECJ-3YB1E106M
C14, C15	220uF	Capacitor, 16V	Nichicon	UUD1C221MCL1GS
C16 – C23	8.2pF	Capacitor	ATC	100B8R2CW 500 X
C24, C25	1uF	Capacitor , low ESL / ESR	ATC	920C105KW 100 T
C26, C27	220uF	Capacitor, 50V	Nichicon	UUD1H221MNL1GS
C28, C29	33pF	Capacitor, 250V	ATC	600F330FW250X

Class AB Single Ended Test Fixture PCB Layout



PCB: Rogers 4350B, 0.020", Er=3.66, Loss Tangent=0.004

Mechanical Information



Notes:
1. Unless specified otherwise, dimensions are in millimeters
2. Unless specified otherwise, tolerances are ±0.127

Product Compliance Information

ESD Information

Caution! ESD-Sensitive Device

ESD Rating:	Class 1A
Value:	Passes ≥ 350 V min.
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114

MSL Rating

Level 1 at +260 °C convection reflow
The part is rated Moisture Sensitivity Level1 at 260°C per JEDEC standard IPC/JEDEC J-STD-020.

Solderability

Compatible with the latest version of J-STD-020, Lead free solder, 260°

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

Web: www.triquint.com **Tel:** +1.503.615.9000
Email: info-sales@tqs.com **Fax:** +1.503.615.8902

For technical questions and application information:

Email: Info-tripower@tqs.com

Important Notice

The information contained herein is believed to be reliable. TriQuint makes no warranties regarding the information contained herein. TriQuint assumes no responsibility or liability whatsoever for any of the information contained herein. TriQuint assumes no responsibility or liability whatsoever for the use of the information contained herein. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the user. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for TriQuint products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information.

TriQuint products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death.