

Description

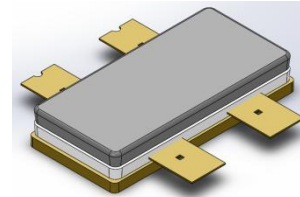
The HTH1D36P450H is an unmatched discrete GaN on SiC Power Amplifier with 400W saturated output power covering frequency range from 3.4 - 3.6 GHz.

Features

- Operating Frequency Range: 3.4 - 3.6 GHz
- Operating Drain Voltage: +48V
- Saturation Output Power: 400W
- Power Average: 55W
- Device can be used on a single-ended or in a push-pull configuration. Doherty application applicable
- Excellent thermal stability due to low thermal resistance package
- Enhanced robustness design without device degradation
- Efficiency: 48.7%@3.5GHz, WCDMA
- Gain: 14.6dB@3.5GHz, WCDMA

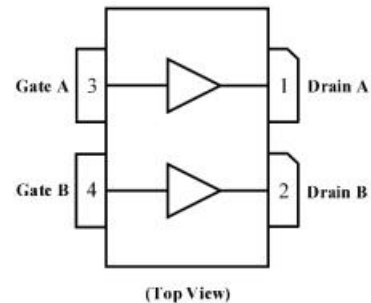
Applications

- 3GPP 5G NR FR1 n48/77/78
- 4G-LTE B42
- Amplifier for Micro and Macro Base Stations
- Repeaters/DAS
- Mobile Infrastructure



ACC2110S-4L RoHS compliant

Earless Flanged
Air Cavity Package; 4 Leads
HTH1D36P450H



Note: Exposed backside of the package is the source terminal for the transistor

Pin Connections

Ordering Information

Part Number	Description
HTH1D36P450H	Reel Package
HTH1D36P450HEVB	3.4 - 3.6 GHz EVB

Typical Performance

RF Characteristics (WCDMA)

Freq (GHz)	Gain (dB)	Eff (%)	ACPR_L* @5MHz (dBc)	ACPR_U* @5MHz (dBc)
3.4025	14.1	48.44	-24.6	-24.4
3.5000	14.6	48.69	-26.6	-26.6
3.5975	14.4	49.09	-28.2	-28.2

Test conditions unless otherwise noted: 25 °C, VVDD = +48Vdc, IDQ_Carrier= 240mA, Vgsp = -5.3V, PAVG = 47.4 dBm
1C-WCDMA 5MHz Signal, 9.9 dB PAR @ 0.01% CCDF test on WATECH Application Board

*Uncorrected DPD

Absolute Maximum Ratings

Parameter	Range/Value	Unit
Drain voltage (V _{DSS})	+150	V
Gate voltage (V _{GS})	-10 to +2.0	V
Storage Temperature (T _{STG})	-65 to +150	°C
Junction Temperature (T _J)	225	°C

Electrical Specification

DC Characteristics (Carrier)

Parameter	Conditions	Min	Typ	Max	Unit
Breakdown Voltage V _{(BR)DSS}	Vgs=-8V, Ids=24mA	150	-	-	V
Gate-Source Threshold Voltage V _{GS(th)}	Vds=10V, Ids=24mA	-3.6	-2.8	-2.2	V
Drain Leakage Current I _{DSS}	Vgs=-8V, Vds=50V	-	7.2	-	mA
Gate Leakage Current I _{GSS}	Vgs=-10V, Vds=0V	-	-2.4	-	mA

DC Characteristics (Peak)

Parameter	Conditions	Min	Typ	Max	Unit
Breakdown Voltage V _{(BR)DSS}	Vgs=-8V, Ids=33.6mA	150	-	-	V
Gate-Source Threshold Voltage V _{GS(th)}	Vds=10V, Ids=33.6mA	-3.6	-2.8	-2.2	V
Drain Leakage Current I _{DSS}	Vgs=-8V, Vds=50V	-	10	-	mA
Gate Leakage Current I _{GSS}	Vgs=-10V, Vds=0V	-	-3.6	-	mA



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400W, 3.4 - 3.6 GHz GaN Amplifier

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RF Characteristics (Pulsed CW)

Parameter	Freq (GHz)	Min	Typ.	Max	Unit
P1dB	3.5	-	50.6	-	dBm
P5dB	3.5	50	55.8	57	dBm
Gain Flatness	3.4 - 3.6 PAVG = 47.4 dBm	-	0.5	-	dB

Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ_Carrier= 300mA, Vgsp = -5.3V, Pulse Width = 1ms, Duty Cycle = 10% test on WATECH Production Board

RF Characteristics (WCDMA)

Parameter	Conditions	Min	Typ.	Max	Unit
Frequency		3.5			GHz
Gain	PAVG = 47.4 dBm	10	14.6	20	dB
Eff	PAVG = 47.4 dBm	33	48.7	70	%
ACPR@5MHz*	PAVG = 47.4 dBm	-40	-26.6	-20	dBc

Test conditions unless otherwise noted: 25 °C, VVDD = +48Vdc, IDQ_Carrier= 240mA, Vgsp = -5.3V, 1C-WCDMA 5MHz Signal, 9.9 dB PAR @ 0.01% CCDF test on WATECH Application Board

*Uncorrected DPD, ACPR measured in 3.84MHz Channel Bandwidth @± 5MHz Offset

Load Mismatch Test

Condition	Test Result
VSWR=10:1, at all Phase Angles, VDD = +48Vdc, IDQ_Carrier= 240mA, 1C-WCDMA 5MHz Signal, 9.9 dB PAR, PAVG = 47.4 dBm, Frequency 3.4 - 3.6 GHz, test on WATECH Application Board	No Device Degradation

Thermal Information

Parameter	Condition	Value (Typ)	Unit
Thermal Resistance Junction to Case (R _{TH})	T _{CASE} = 80°C, VDD = +48Vdc, IDQ_Carrier= 240mA, 1C-WCDMA 5MHz Signal, 9.9 dB PAR, PAVG = 47.4 dBm	0.88	°C /W



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Load Pull Performance Carrier

Test conditions unless otherwise noted: 25 °C, VDD = +48Vdc, IDQ= 200mA, PW = 40us, DC= 4%

Max Output Power (Carrier)						
Freq (GHz)	Z_source (Ω)	Z_load [1] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
3.4	8.34-j*23.84	11.4-j*2.98	17.6	54.04	254	52.1
3.6	22.66-j*24.66	10.6+j*0.06	18.1	54.18	262	52.3

[1] Load impedance for optimum P3dB pout

Max Drain Efficiency (Carrier)						
Freq (GHz)	Z_source (Ω)	Z_load [2] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
3.4	8.34-j*23.84	9.69-j*14.48	18.8	52.1	162	71.3
3.6	22.66-j*24.66	16.56-j*10.32	19.6	52.3	170	71.8

[2] Load impedance for optimum P3dB efficiency

Load Pull Performance Peak

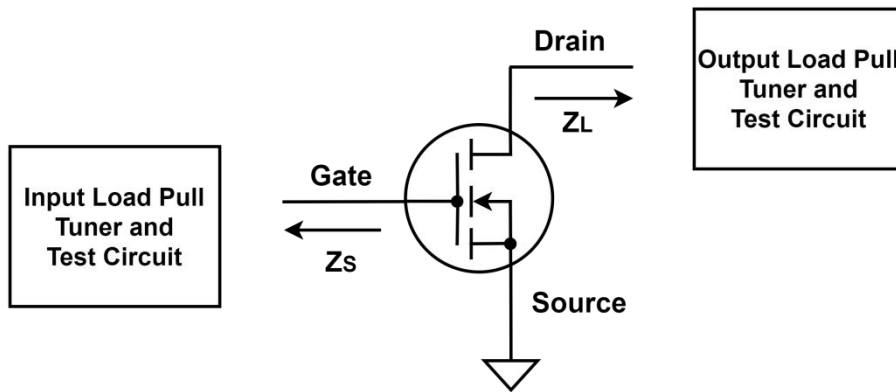
Test conditions unless otherwise noted: 25 °C, VDD = +48Vdc, IDQ= 300mA, PW = 40us, DC= 4%

Max Output Power (Peak)						
Freq (GHz)	Z_source (Ω)	Z_load [1] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
3.4	8.21-j*21.17	13.38-j*6.45	17.4	55.6	363	63.2
3.6	21.51-j*17.67	14.39-j*0.08	17.3	55.6	363	58.7

[1] Load impedance for optimum P3dB pout

Max Drain Efficiency (Peak)						
Freq (GHz)	Z_source (Ω)	Z_load [2] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
3.4	8.21-j*21.17	9.33-j*12.89	18.7	54.6	288	69.8
3.6	21.51-j*17.67	14.79-j*10.75	19.3	54.4	275	68.3

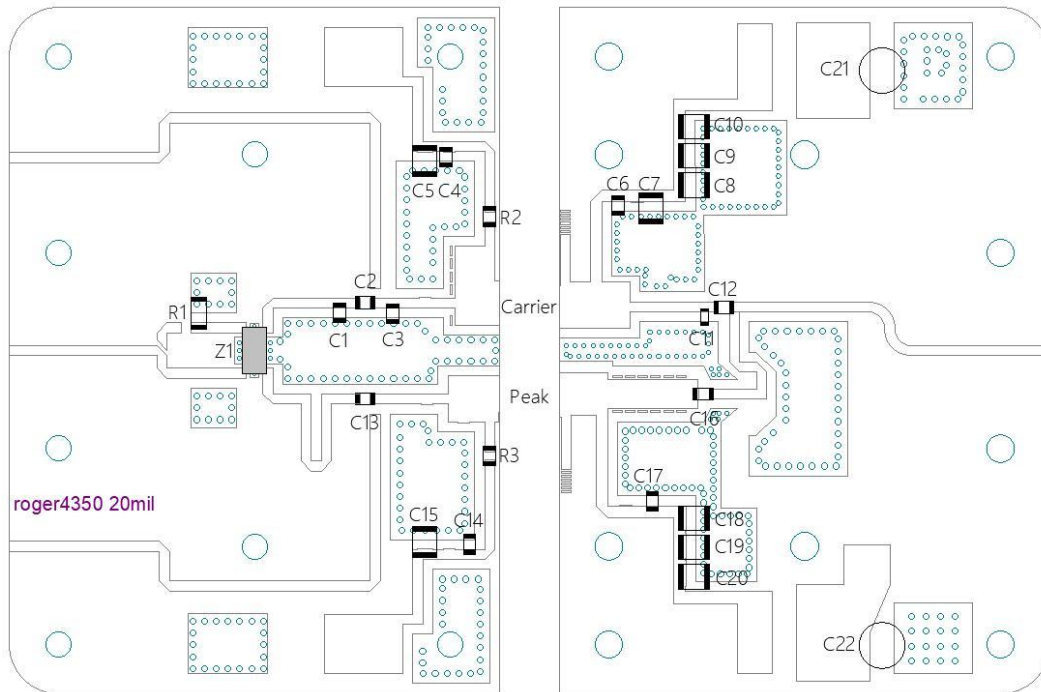
[2] Load impedance for optimum P3dB efficiency



Z_source : Measured impedance presented to the input of the device at the package reference plane

Z_load : Measured impedance presented to the output of the device at the package reference plane

HTH1D36P450H 3.4 - 3.6 GHz Reference Design



EVB Layout

Bill of Materials (BoM) - HTH1D36P450H

3.4 - 3.6 GHz Reference Design

Reference	Value	Description	Manufacturer	P/N
Q1	-	400W, 3.4 - 3.6 GHz GaN on SiC PA	Watech	HTH1D36P450H
C1	0p3F	MLCC	Murata	GQM2195G2ER30BB12
C3	0p7F	MLCC	Murata	GQM2195G2ER70BB12
C2, C13, C17	16pF	MLCC	Murata	GQM2195C2E160JB12
C4, C12, C14	4p7F	MLCC	Murata	GQM2195G2E4R7BB12
C16	6p8F	MLCC	Murata	GQM2195G2E6R8BB12
C11	0p1F	MLCC	Murata	GQM1875C2ER10BB12
C16	3pF	MLCC	Murata	GQM2195G2E3R0BB12
C5, C7, C8, C9, C10 C15, C18, C19, C20	10uF /100V	MLCC	Murata	GRM32EC72A106KE05L



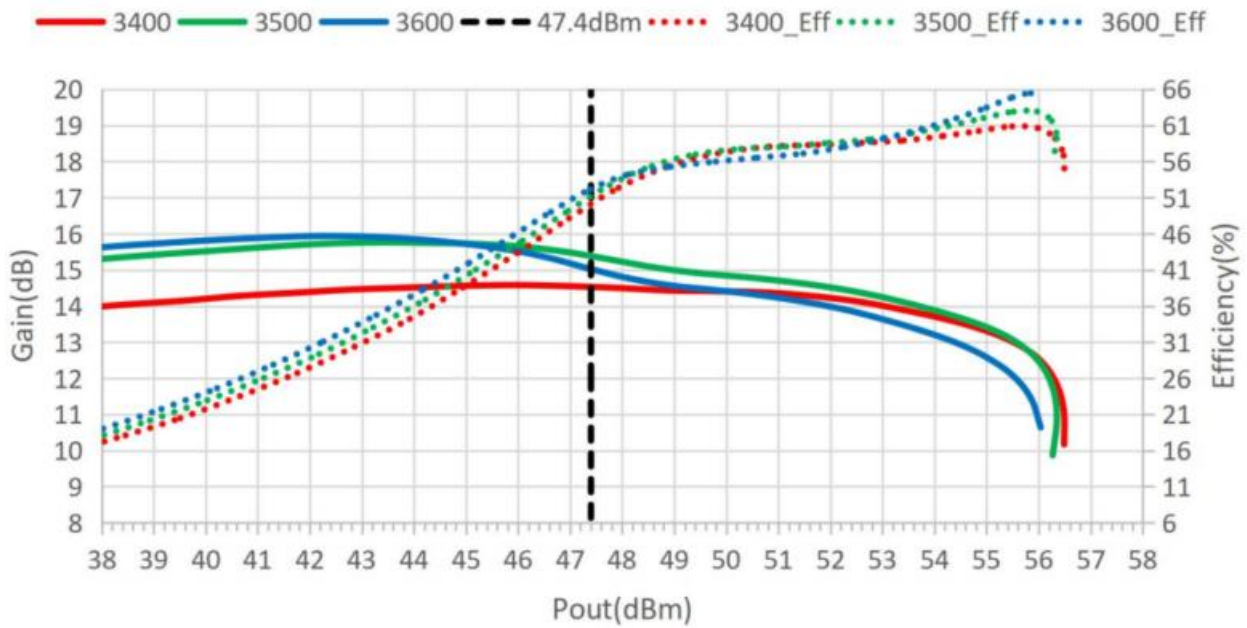
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Reference	Value	Description	Manufacturer	P/N
C21, C22	220uF/ 100V	Electrolytic Capacitor	Vishay	MAL213669221E3
R1	51Ω	High Frequency/RF Resistors	ANAREN	C8A50Z4B
R1, R3	20Ω	Thick Film Resistor	YAGEO	RC0603FR-0720RL
Z1	-	Hybrid Coupler 3dB, 90°	ANAREN	X3C35F1-03S
PCB	Rogers 4350B (er = 3.66), 20 mil (0.508 mm), 35 μm (1oz)			

Performance Plots



Pulsed CW, Gain and Efficiency vs Pout

Test conditions unless otherwise noted: 25 °C, VDD = +48Vdc, IDQ= 350mA, Vgsp = -5.7V, PW = 100us, DC= 10% test on WATECH Application Board

Package Marking and Dimensions

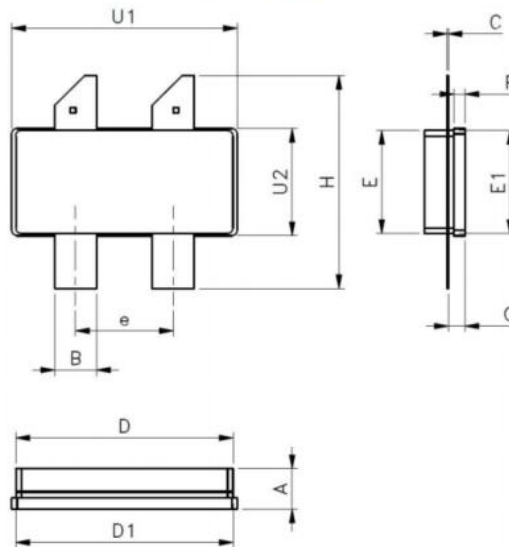


- Line1 (fixed): Device name in W/O
- Line2 (unfixed): Marking Lot No in W/O (Sample: E596-EERA0001)
- Line3 (unfixed): Date Code

This Marking SPEC only stipulates the content of Marking. For marking requirements such as font and size, please refer to the latest version of “Watech Product Printing Specification”

Marking

ACC2110S-4L




Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Mon.	Max.	Min.	Mon.	Max.
A	3.55	3.71	3.86	0.140	0.146	0.152
B	3.68	3.81	3.94	0.145	0.150	0.155
C	0.04	0.11	0.18	0.002	0.004	0.007
D	19.61	19.81	20.01	0.772	0.780	0.788
D1	19.61	19.81	20.01	0.772	0.780	0.788
E	9.28	9.40	9.52	0.365	0.370	0.375
E1	9.28	9.40	9.52	0.365	0.370	0.375
e	-	8.89	-	-	0.35	-
F	0.95	1.02	1.09	0.037	0.040	0.043
H	18.93	19.43	19.93	0.745	0.765	0.785
H1	12.57	12.70	12.83	0.495	0.500	0.505
L	4.71	4.83	4.95	0.185	0.190	0.195
Q	1.43	1.53	1.63	0.056	0.060	0.064
U1	20.51	20.58	20.65	0.807	0.810	0.813
U2	9.71	9.78	9.85	0.382	0.385	0.388

Package Dimensions

Handling Precautions

Parameter	Grade
Moisture Sensitivity Level MSL	3

Parameter	Rating	Standard	
ESD – Human Body Model (HBM)	Class 1B	JESD22-A114	
ESD – Human Body Model (MM)	Class A	EIA/JESD22-A115	
ESD – Charged Device Model (CDM)	Class III	JESD22-C101	

RoHS Compliance

This product is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

Datasheet Status

Document status	Product status	Definition
Objective Datasheet	Design simulation	Product objective specification
Preliminary Datasheet	Customer sample	Engineering samples and first test results
Product Datasheet	Mass production	Final product specification

Abbreviations

Acronym	Definition
GaN on SiC	Gallium Nitride on Silicon Carbide
CW	Continuous Waveform



HTH1D36P450H
400W, 3.4 - 3.6 GHz GaN Amplifier
Product datasheet

Revision history

Document ID	Datasheet Status	Release Date	Revision Version
Rev 1.1	Preliminary	Febr. 2021	Preliminary
Rev 1.2	Preliminary	Sept. 2021	Demo EVB upgrade
Rev 1.3	Product	March 2023	New format based on English version datasheet



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Contact Information

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- Email: MKT@huatai-elec.com

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