

Description

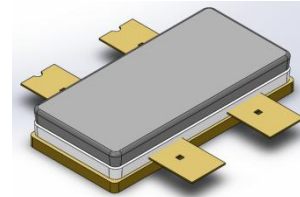
The HTH1D09P700S is an unmatched discrete GaN on SiC Power Amplifier with 700W saturated output power covering frequency range from 700 - 960 MHz.

Features

- Operating Frequency Range: 700 - 960 MHz
- Operating Drain Voltage: +48V
- Saturation Output Power: 700W
- Power Average: 112W
- 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: 67.77%@758MHz, WCDMA
- Gain: 17.9dB@758MHz, WCDMA

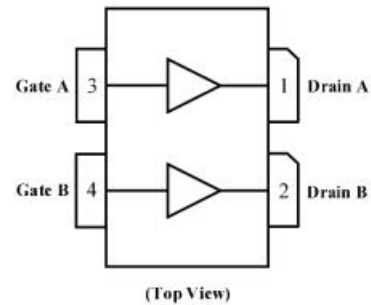
Applications

- 3GPP 5G NR FR1
n5/8/12/13/14/18/20/26/28/29/67/85/100
- 4G-LTE
B5/8/12/13/14/17/18/19/20/26/28/67/85/103
- Amplifier for Micro and Macro Base Stations
- Repeaters/DAS
- Mobile Infrastructure



ACS2110S-4L

Earless Flanged
Air Cavity Spliced Package; 4 Leads
HTH1D09P700S



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

Pin Connections

Ordering Information

Part Number	Description
HTH1D09P700S	Reel Package
HTH1D09P700SEVB	758 - 803 MHz EVB

Typical Performance

RF Characteristics (Pulsed CW)

Freq (MHz)	P5dB (dBm)	Gain (dB) @50.5dBm	Eff (%) @50.5dBm	IRL (dB)
758	58.64	19.66	68.95	10
780.5	58.78	19.35	68.39	15
803	58.57	18.97	65.63	20

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

RF Characteristics (WCDMA)

Freq (MHz)	Gain (dB)	Eff (%)	ACPR* @5MHz (dBc)	ACPR* @10MHz (dBc)
758	17.86	67.77	-24.67	-38.42
780.5	18.15	65.07	-26.36	-40.24
803	18.04	63.32	-27.82	-43.12

Test conditions unless otherwise noted: 25 °C, VVDD = +48Vdc, IDQ_Carrier= 350mA, Vgsp = -5.7V, PAVG = 50.5 dBm 1C-WCDMA 5MHz Signal, 8.5 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

Parameter	Conditions	Min	Typ	Max	Unit
Breakdown Voltage V _{(BR)DSS} [1]	Vgs=-8V, Ids=36mA	150	-	-	V
Gate-Source Threshold Voltage V _{GS(th)} [1]	Vds=10V, Ids=36mA	-3.0	-2.8	-1.4	V
Drain Leakage Current I _{DSS} [1]	Vgs=-10V, Vds=130V	-	-	36	mA
Gate Leakage Current I _{GSS} [1]	Vgs=-8V, Vds=0V	-	-	7.2	mA

[1] Carrier and Peak same values

**Load Mismatch Test**

Condition	Test Result
VSWR=10:1, at all Phase Angles, VDD = +48Vdc, IDQ_Carrier= 350mA, Vgsp = -5.7V, PAVG = 53.3 dBm, Frequency 758 - 803 MHz, 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, 1C-WCDMA 5MHz Signal, 7.6 dB PAR, PAVG = 50.5 dBm	0.94	°C /W

Load Pull Performance Carrier

Test conditions unless otherwise noted: 25 °C, VDD = +48Vdc, IDQ= 360mA, PW = 40us, DC= 4%

Max Output Power (Carrier)						
Freq (MHz)	Z _{source} (Ω)	Z _{load} [1] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
760	0.8-j*1.7	2.7-j*1.1	20.6	56.6	456	70.7
860	1.3-j*2.6	2.8-j*1.6	20.0	56.4	432	69.1
960	2.2-j*3.2	2.5-j*1.2	20.4	56.3	424	70.2

[1] Load impedance for optimum P3dB pout

Max Drain Efficiency (Carrier)						
Freq (MHz)	Z _{source} (Ω)	Z _{load} [2] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
760	0.8-j*1.7	4.8+j*1.9	23.1	54.2	263	83.6
860	1.3-j*2.6	4.5+j*1.0	22.5	54.3	269	79.5
960	2.2-j*3.2	4.0+j*0.9	22.1	54.3	269	78.7

[2] Load impedance for optimum P3dB efficiency

Load Pull Performance Peak

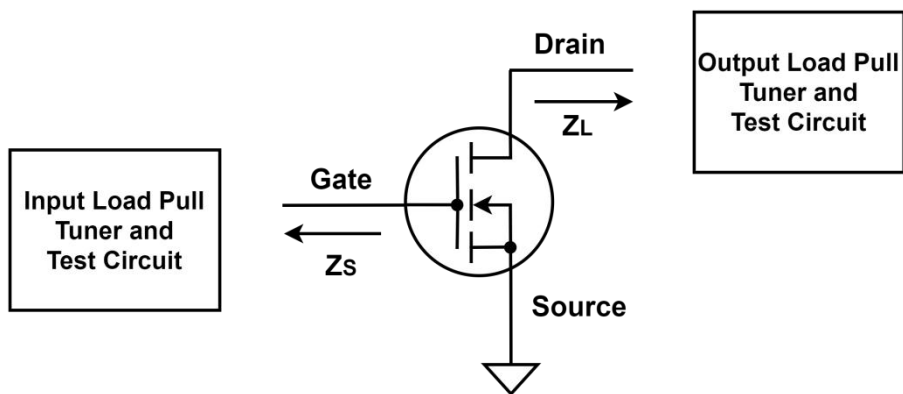
Test conditions unless otherwise noted: 25 °C, VDD = +48Vdc, IDQ= 550mA, PW = 40us, DC= 4%

Max Output Power (Peak)						
Freq (MHz)	Z_source (Ω)	Z_load [1] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
760	0.8-j*2.3	2.0-j*1.1	20.7	58.2	662	71.6
860	1.1-j*3.1	1.9-j*1.4	19.8	57.9	609	68.07
960	1.6-j*3.9	1.8-j*1.4	19.6	57.7	594	68.01

[1] Load impedance for optimum P3dB pout

Max Drain Efficiency (Peak)						
Freq (MHz)	Z_source (Ω)	Z_load [2] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
760	0.8-j*2.3	3.3+j*1.2	23.1	55.6	363	82.8
860	1.1-j*3.1	3.1+j*0.8	22.3	55.5	352	78.1
960	1.6-j*3.9	2.8-j*0.1	21.5	56.1	404	75.1

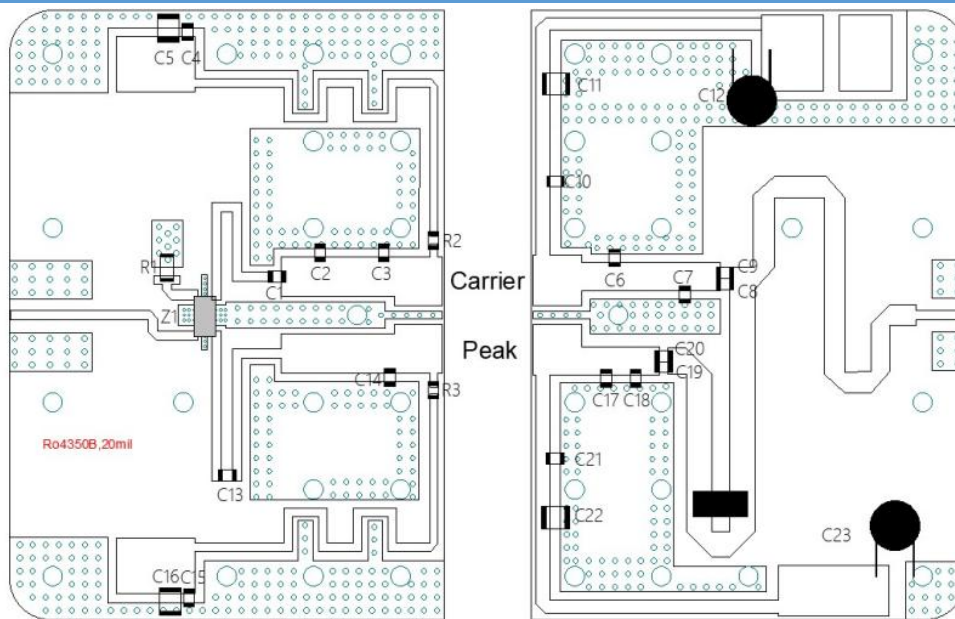
[2] Load impedance for optimum P3dB efficiency



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

HTH1D09P700S 758 - 803 MHz Reference Design



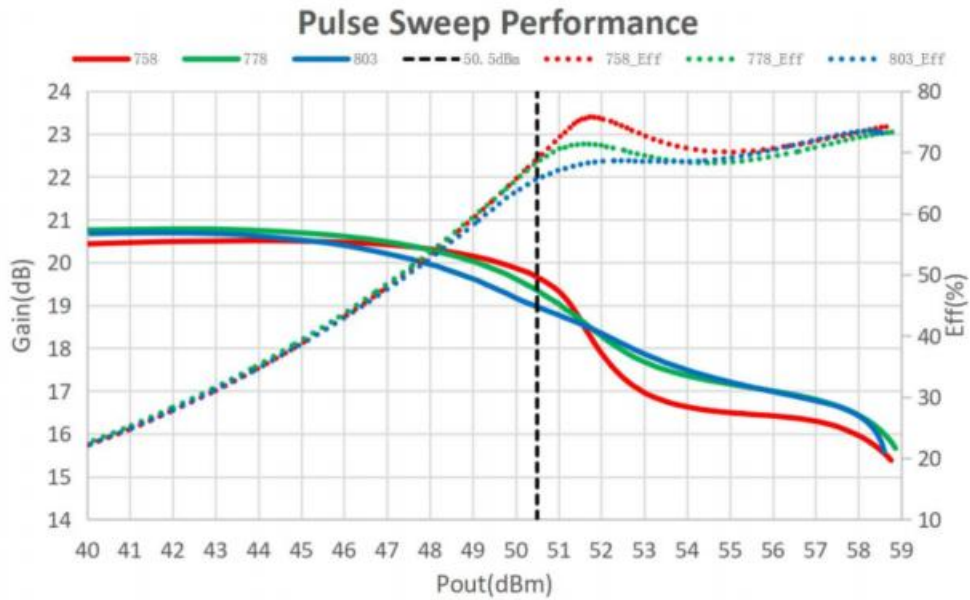
EVB Layout

Bill of Materials (BoM) - HTH1D09P700S

758 - 803 MHz Reference Design

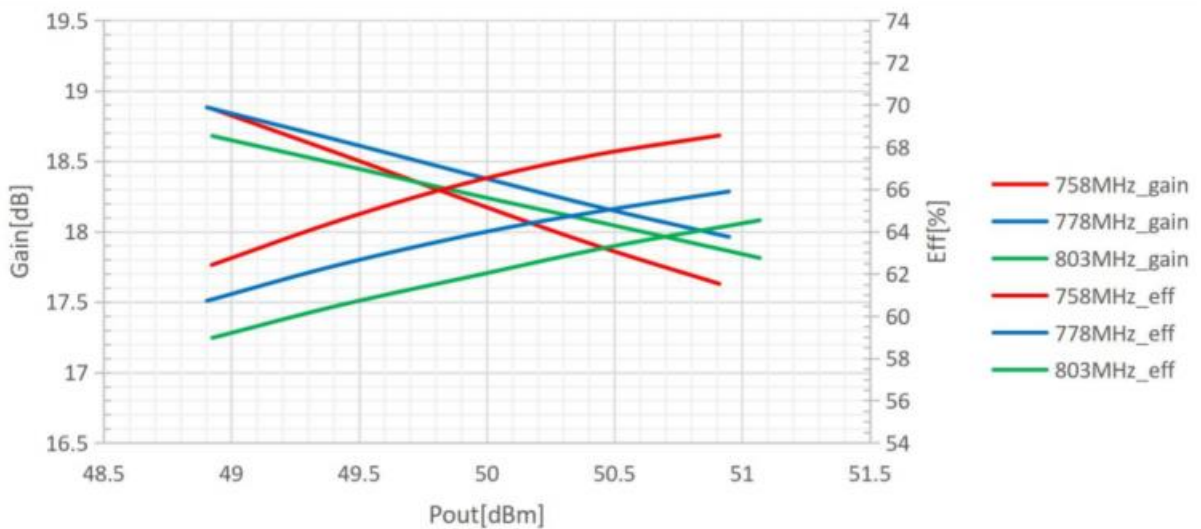
Reference	Value	Description	Manufacturer	P/N
Q1	-	700W, 700 - 960 MHz GaN on SiC PA	Watech	HTH1D09P700S
C1,C19,C20	27pF	MLCC	Murata	GQM2195C2E270JB12
C2,C3,C7,C18	10pF	MLCC	Murata	GQM2195C2E100JB12
C4,C8,C9,C1, C13,C15,C21	100pF	MLCC	Murata	GQM2195C2E101JB12
C6	2pF	MLCC	Murata	GQM2195G2E2R0BB12
C14	20pF	MLCC	Murata	GQM2195C2E200JB12
C17	12pF	MLCC	Murata	GQM2195C2E120JB12
C5,C11,C16, C22	10uF /100V	MLCC	Murata	GRM32EC72A106KE05
R1	51Ω	High Frequency/RF Resistors	ANAREN	C8A50Z4B
R1, R3	7.5Ω	Thick Film Resistor	YAGEO	RC0603FR-077R5L
Z1	-	Hybrid Coupler 3dB, 90°	ANAREN	X3C07F1-03S
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



WCDMA, Gain and Efficiency vs Pout

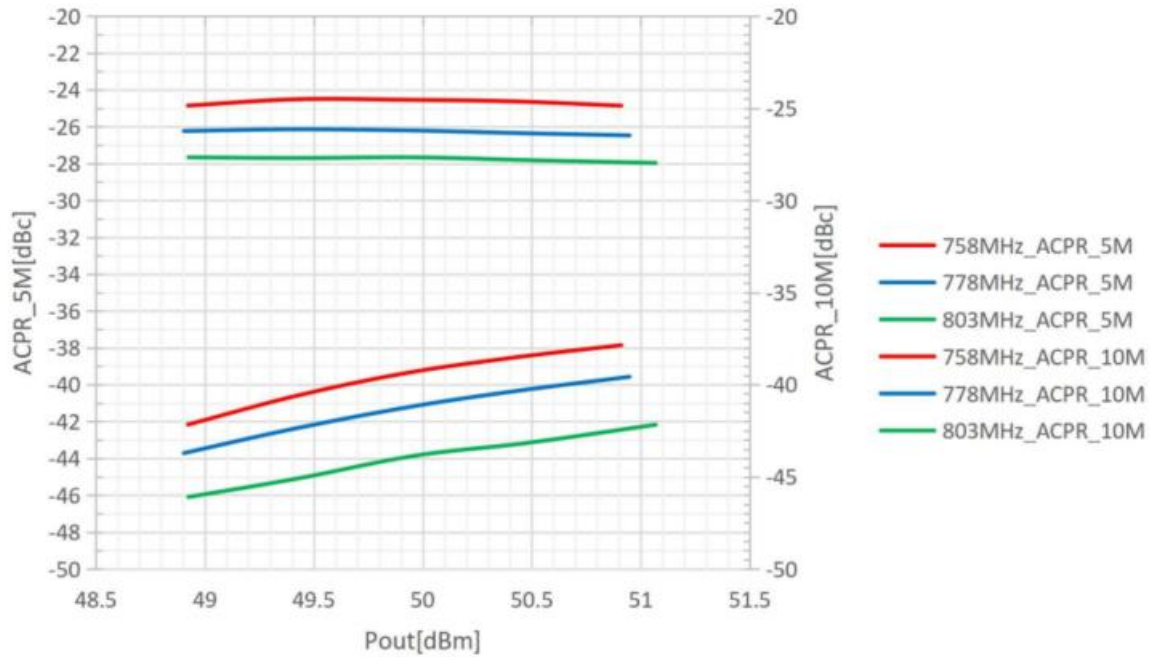
Test conditions unless otherwise noted: 25 °C, VDD = +48Vdc, IDQ = 350mA, Vgsp = -5.7V, 1C-WCDMA 5MHz Signal, 8.5 dB PAR @ 0.01% CCDF test on WATECH Application Board



HTH1D09P700S

700W, 700 - 960 MHz GaN Amplifier

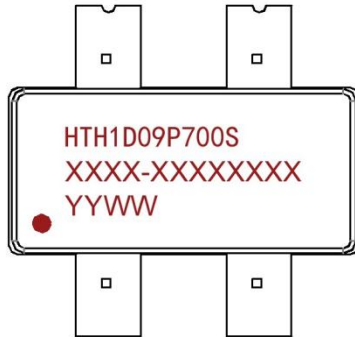
Product datasheet



WCDMA, ACPR_5MHz, ACPR_10MHz vs Pout

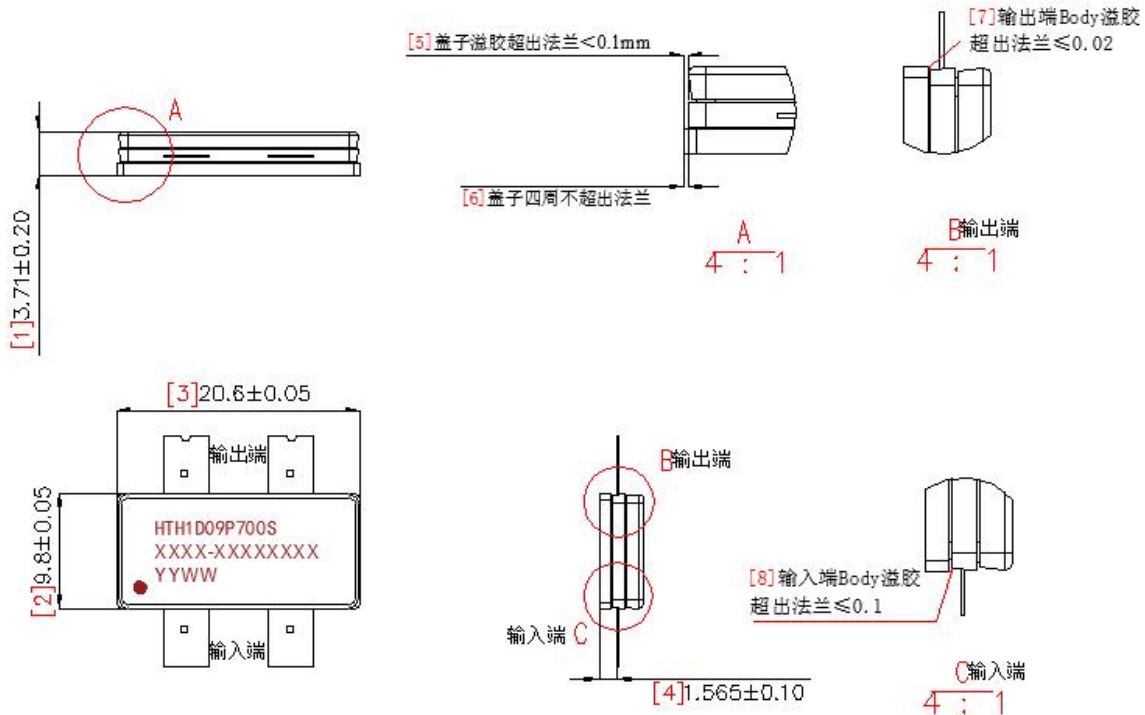
Test conditions unless otherwise noted: 25 °C, VDD = +48Vdc, IDQ= 350mA, Vgsp = -5.7V, 1C-WCDMA 5MHz Signal, 8.5 dB PAR @ 0.01% CCDF test on WATECH Application Board

Package Marking and Dimensions



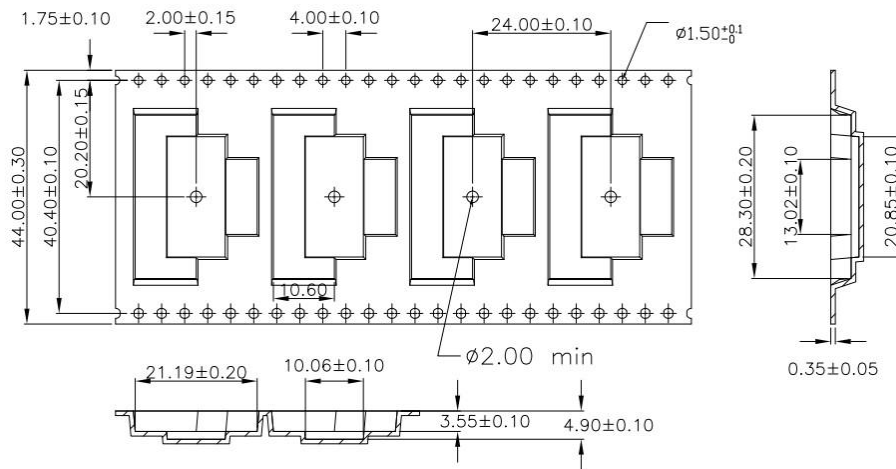
- Line1 (fixed): Device name in W/O
 - Line2 (unfixed): Marking Lot No in W/O
(Sample: E596-20140001)
 - Line3 (unfixed): Date Code + JY
- This Marking SPEC only stipulates the content of Marking. For marking requirements such as font and size, please refer to the latest version of “Watech Product Printing Specification”

Marking



Package Dimensions

Tape and Reel Information



Tape & Reel Packaging Descriptions

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

Revision history

Document ID	Datasheet Status	Release Date	Revision Version
Rev 0.1	Preliminary	Sept. 2021	Preliminary
Rev 0.2	Preliminary	March 2022	LP data upgrade
Rev 1.0	Preliminary	June 2022	Add Thermal Resistance; Load Mismatch Test; Updated RF Test performance;
Rev 1.1	Preliminary	June 2022	Company Logo and English name
Rev 1.2	Preliminary	June 2022	DC Characteristic Data upgrade
Rev 1.3	Product	March 2023	New format based on English version datasheet



HTH1D09P700S

700W, 700 - 960 MHz GaN Amplifier

Product datasheet

Contact Information

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

- Web: www.watechelectronics.com
- Email: MKT@huatai-elec.com

For technical questions and application information:

- Email: MKT@huatai-elec.com

Important Notice

Information in this document is believed to be accurate and reliable. However, WATECH does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

“Typical” parameters are the average values expected by WATECH in large quantities and are provided for information purposes only. All information and specifications contained herein are subject to change without notice and customers should obtain and verify the latest relevant information before placing orders for WATECH 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.

Applications that are described herein for any of these products are for illustrative purposes only. WATECH makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification. Customers are responsible for the design and operation of their applications and products using WATECH products, and WATECH accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the WATECH product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third-party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

WATECH products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of a WATECH product can reasonably be expected to result in personal injury, death or severe property or environmental damage. This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.