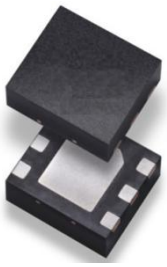
HTH1D38S010P
10 W, 2.3-4.0 GHz GaN Amplifier

Product Datasheet

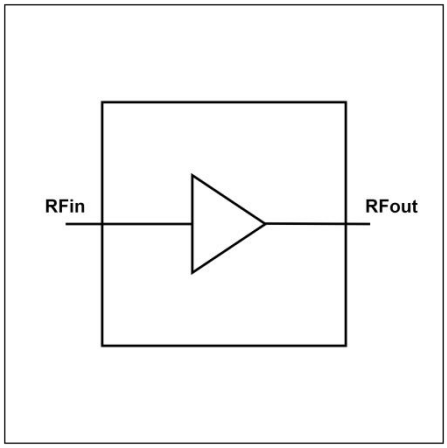
Description

The HTH1D38S010P is a GaN Power Transistor designed for cellular base station applications with 10W saturation output power covering frequency range from 2.3 to 4.0 GHz.



RoHS compliant

Block Diagram



Features

- Operating Frequency Range: 2.3 to 4.0 GHz
- Operating Drain Voltage: +48 V
- Saturation Output Power: 10 W
- Advanced Linearity Performance
- High Efficiency
- High Gain over the Frequency Range
- Small footprint package, DFN 4x4-6L

Applications

- 3GPP 5G NR FR1 n41/n78 and 4G/LTE band B40/41/42/43.
- Power Amplifier for Small cells.
- Driver Amplifier for macro base stations.
- Active antenna array for 5G mMIMO.
- Repeaters/DAS.

Order Information

Part Number	Description
HTH1D38S010P	Reel Package

Typical Performances

Freq(MHz)	P3dB(dBm)	Gain(dB)	Eff(%)	IRL(dB)
2300	40.6	19.9	60.7	12
2700	40.6	19.6	58.7	11
3600	40.0	19.5	63.3	10
4000	39.8	18.6	58.6	10

Test conditions: 25 °C, VDD = 48 Vdc, IDQ = 20 mA, Pulsed CW, 100 us, Duty Cycle = 10%, Test on Watech EVB.

Freq(MHz)	Gain(dB)	Eff(%)	ACPR 5MHz(dBc)	ACPR 10MHz(dBc)
2300	19.7	15.7	-42.8	-53.4
2700	19.4	16.2	-40.8	-52.4
3600	19.3	17.8	-41.3	-54.3
4000	18.4	16.5	-44.9	-57.6

Test conditions: 25 °C, VDD = 48 Vdc, IDQ = 20 mA, Pout = 27 dBm, single-carrier, 5MHz WCDMA signal with 9.9 dB PAR @ 0.01%, Test on Watech EVB.

Absolute Maximum Ratings

Parameter	Range/Value	Units
Drain voltage (VDSS)	0 to 150	V
Gate voltage (VGS)	-10 to 2	V
Storage Temperature (TSTG)	-55 to 150	°C
Case Temperature (TC)	-40 to 150	°C
Junction Temperature (TJ)	-40 to 225	°C

Electrical Specification

DC Characteristics

Parameter	Conditions	Min	Typ	Max	Units
Breakdown Voltage V(BR)DSS	VGS=-8V; IDS=1.1mA	120	150	-	V
Gate-Source Threshold Voltage VGS(th)	VDS=10V; IDS=1.1mA	-3.6	-2.8	-2.3	V
Drain Leakage Current IDSS	VDS=50V; VGS=-8V	-	0.1	-	mA
Gate Leakage Current IGSS	VDS=0V; VGS=-10V	-	10	-	uA

RF Characteristics (Pulsed CW)

Parameter	Min	Typ	Max	Units
Frequency Range	3.4	-	4.0	GHz
P3dB	39.5	40	-	dBm
Gain	18	19	-	dB
Eff	56	59	-	%
IRL	-	10	-	dB

Test conditions: 25 °C, V_{DD} = 48 Vdc, I_{DQ} = 20 mA, Pulse CW, 100 us, Duty Cycle = 10%, test on Watech Test Fixture with compensation.

RF Characteristics (WCDMA)

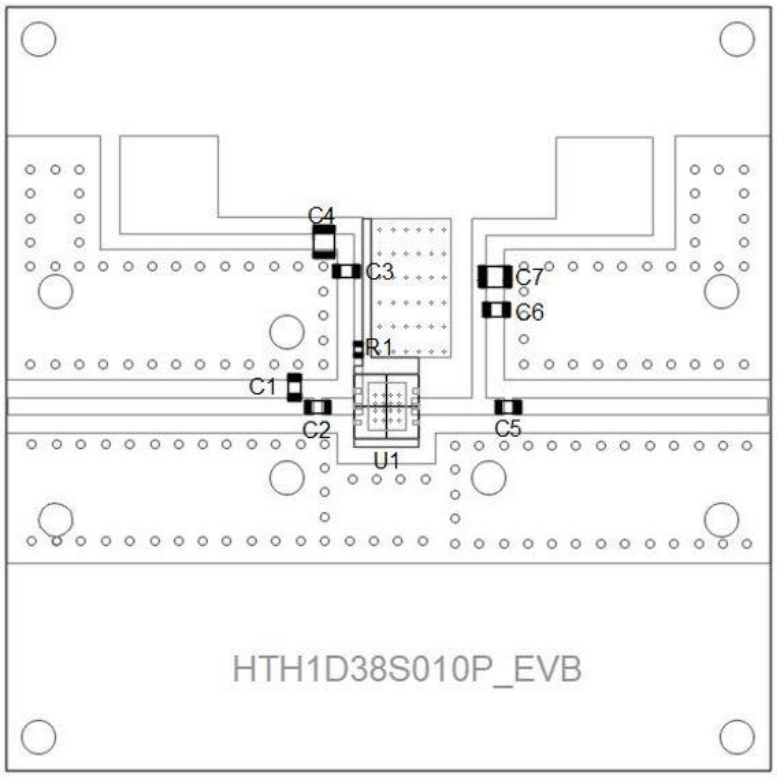
Parameter	Min	Typ	Max	Units
Frequency Range	3.4	-	4.0	GHz
Gain	18	19	-	dB
Eff	15	15.5	-	%
IRL	-	10	-	dB
ACLR@5MHz (Uncorrected)	-	-43.5	-40	dBc

Test conditions, unless otherwise noted: 25 °C, V_{DD} = 48 Vdc, I_{DQ} = 20 mA, Pout = 27 dBm, 5MHz WCDMA signal with 9.9 dB PAR @ 0.01% CCDF, test on Watech Test Fixture with compensation.

Thermal Information

Parameter	Condition	Value (Typ)	Units
Thermal Resistance Junction to Case (RTH)	Active die surface to Case (Rth) T-Case = 105℃, Pdis = 2.7W	9	K/W

HTH1D38S010P 2.5-2.7 GHz Reference Design



EVB Layout

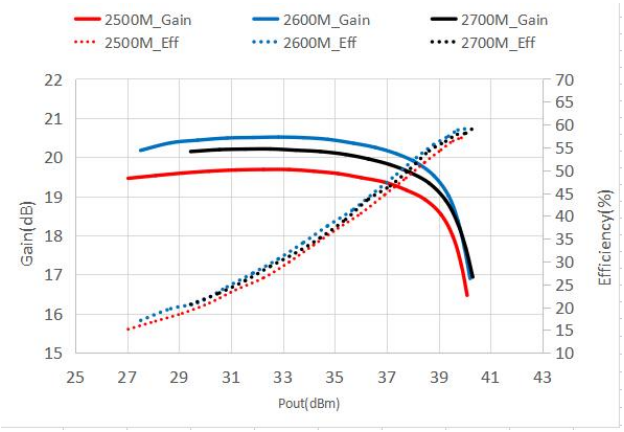
- Rogers 4350B, thickness = 20 mil

- PCB is soldered on a 47 mm by 47 mm copper base plate with 8 mm thickness

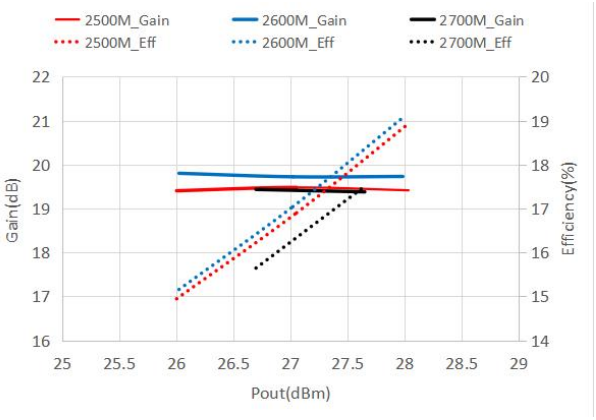
BOM-HTH1D38S010P 2.5-2.7 GHz Reference Design

Component	Type	Value	Description	Manufacturer	P/N
C1	Capacitor	2.4pF	SMT 0603	Murata	GQM1875C2E2R4BB12D
C2, C3, C6	Capacitor	9pF	SMT 0603	Murata	GQM1875C2E9R0BB12D
C4, C7	Capacitor	1uF	SMT 0805	Murata	GCM21BC72A105KE36L
C5	Capacitor	1.5pF	SMT 0603	Murata	GQM1875C2E1R5BB12D
R1	Resistor	10 Ohm, 1/8W	SMT 0402	-	-
U1	Transistor	-	Transistor	-	-

Performance Plots

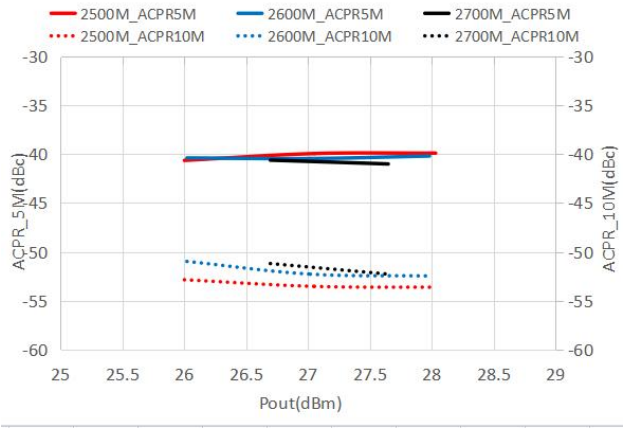


Pulsed-CW performance(Gain+Eff)

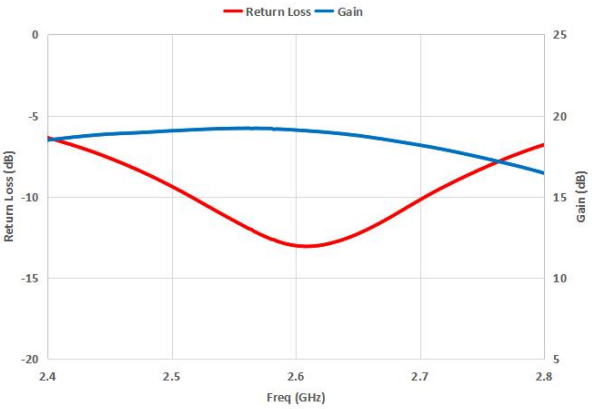


WCDMA performance(Gain+Eff)

Test conditions: 25 °C, V_{DD} = 48 Vdc, I_{DQ} = 20 mA



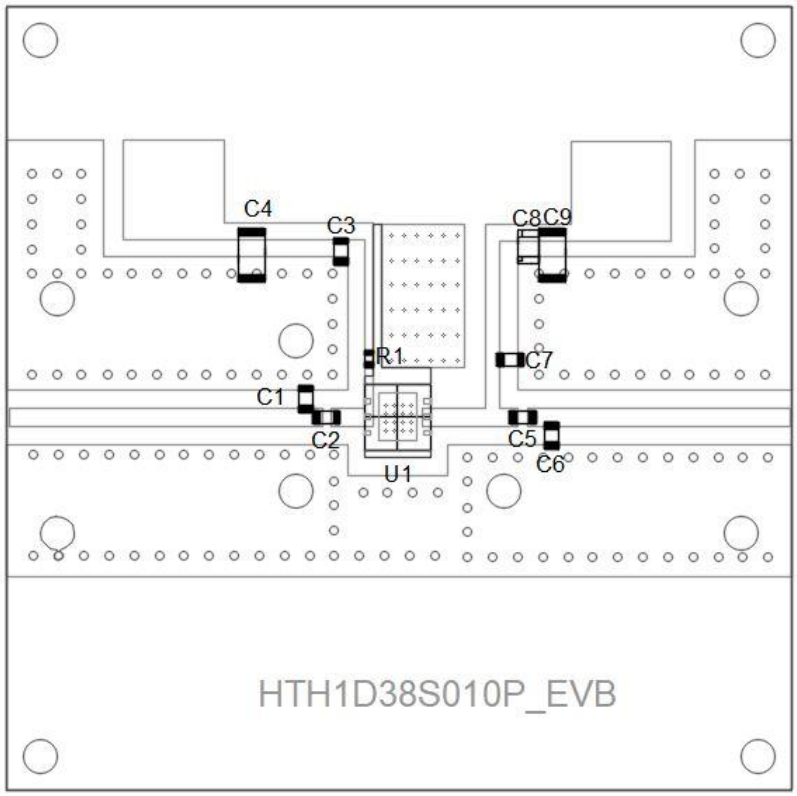
ACPR



S-Parameter

Test conditions: 25 °C, V_{DD} = 48 Vdc, I_{DQ} = 20 mA

HTH1D38S010P 3.4-3.8 GHz Reference Design



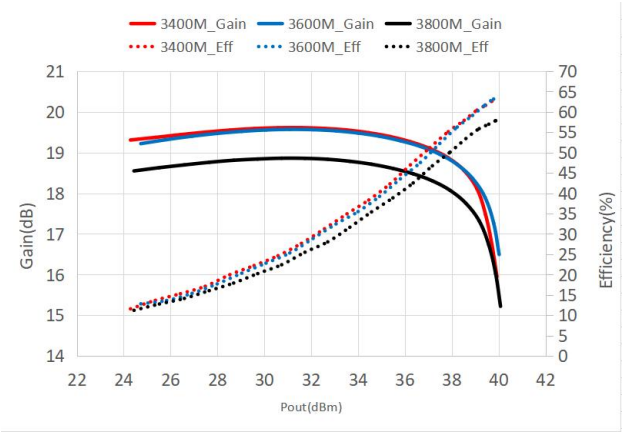
- Rogers 4350B, thickness = 20 mil

- PCB is soldered on a 47 mm by 47 mm copper base plate with 8 mm thickness

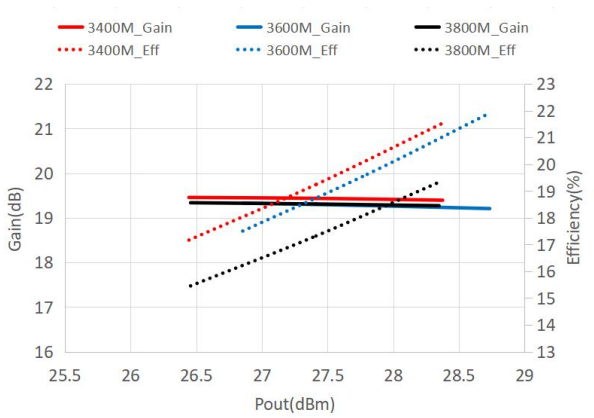
BOM-HTH1D38S010P 3.4-3.8 GHz Reference Design

Component	Type	Value	Description	Manufacturer	P/N
C1	Capacitor	0.7pF	SMT 0603	Murata	GQM1875C2E0R7BB12D
C2, C3, C5,C7	Capacitor	9pF	SMT 0603	Murata	GQM1875C2E9R0BB12D
C4, C9	Capacitor	4.7uF	SMT 1206	Murata	GRM31CC72A475ME11L
C6	Capacitor	0.3pF	SMT 0603	Murata	GQM1875C2E0R3BB12D
C8	Capacitor	100pF	SMT 0805	Murata	GQM2195C2E101GB2D
R1	Resistor	10 Ohm, 1/8W	SMT 0402	-	-
U1	Transistor	-	Transistor	-	-

Performance Plots

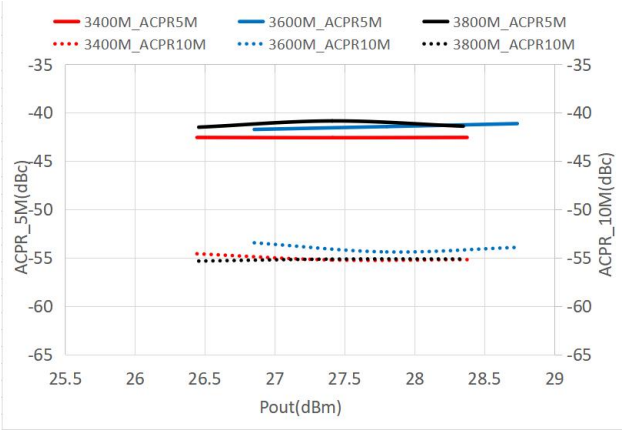


Pulsed-CW performance(Gain+Eff)

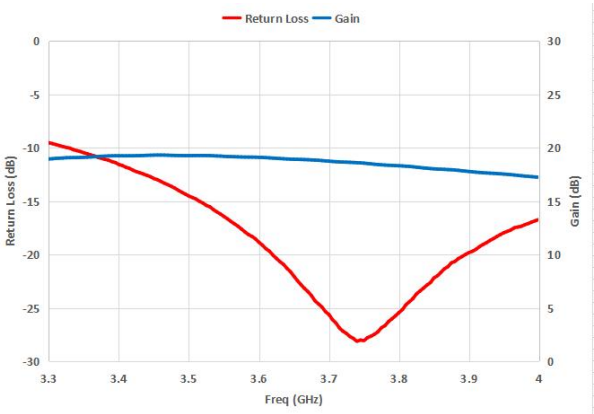


WCDMA performance(Gain+Eff)

Test conditions: 25 °C, V_{DD} = 48 Vdc, I_{DQ} = 20 mA



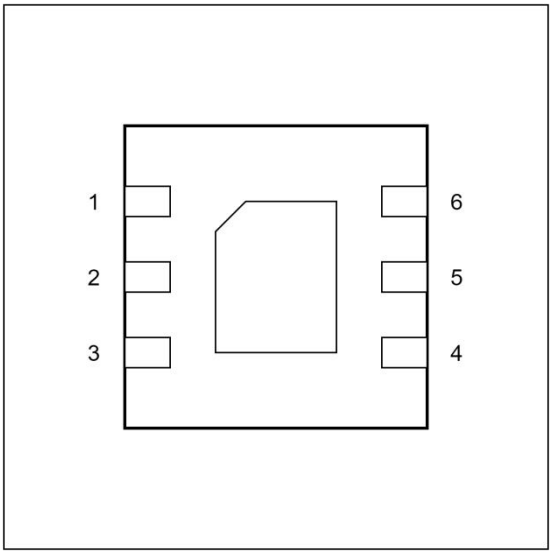
ACPR



S-Parameter

Test conditions: 25 °C, V_{DD} = 48 Vdc, I_{DQ} = 20 mA

Pin Configuration and Description



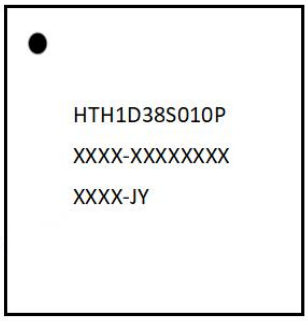
Pin Configuration		
Pin Number	**Label**	**Description**
1	NC	
2	RFin+Vgs	RF Input/Vgs
3	NC	
4	NC	
5	RFout+Vdd	RF Output/Vdd
6	NC	

Package Marking and Dimensions

Marking Spec No.	HTH1D38S010P Marking spec_A

Marking Spec

marking sample
↓



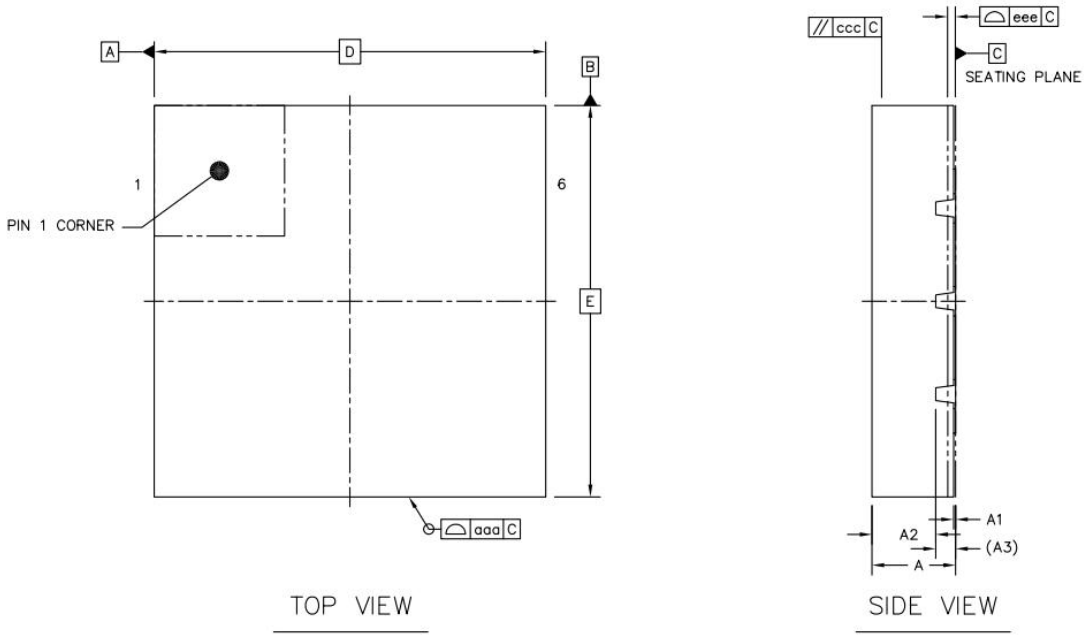
Line1: fixed : device name in W/O

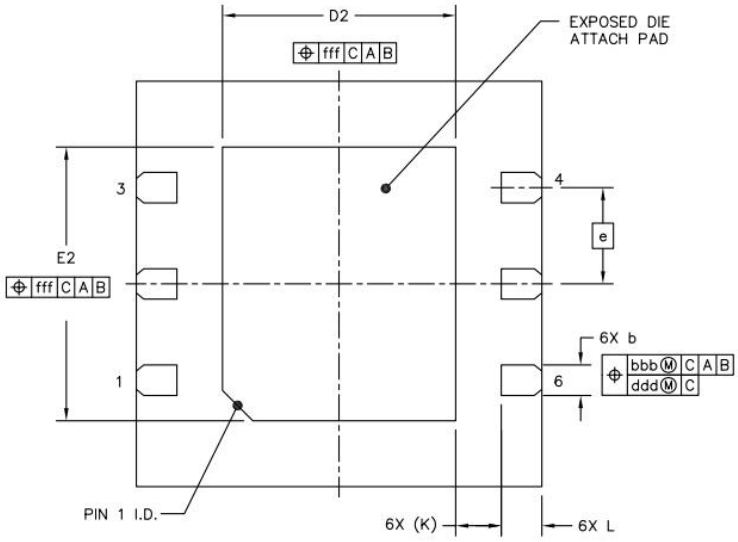
Line2 :unfixed : Marking Lot No in W/O (Sample:E596-20140001)

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





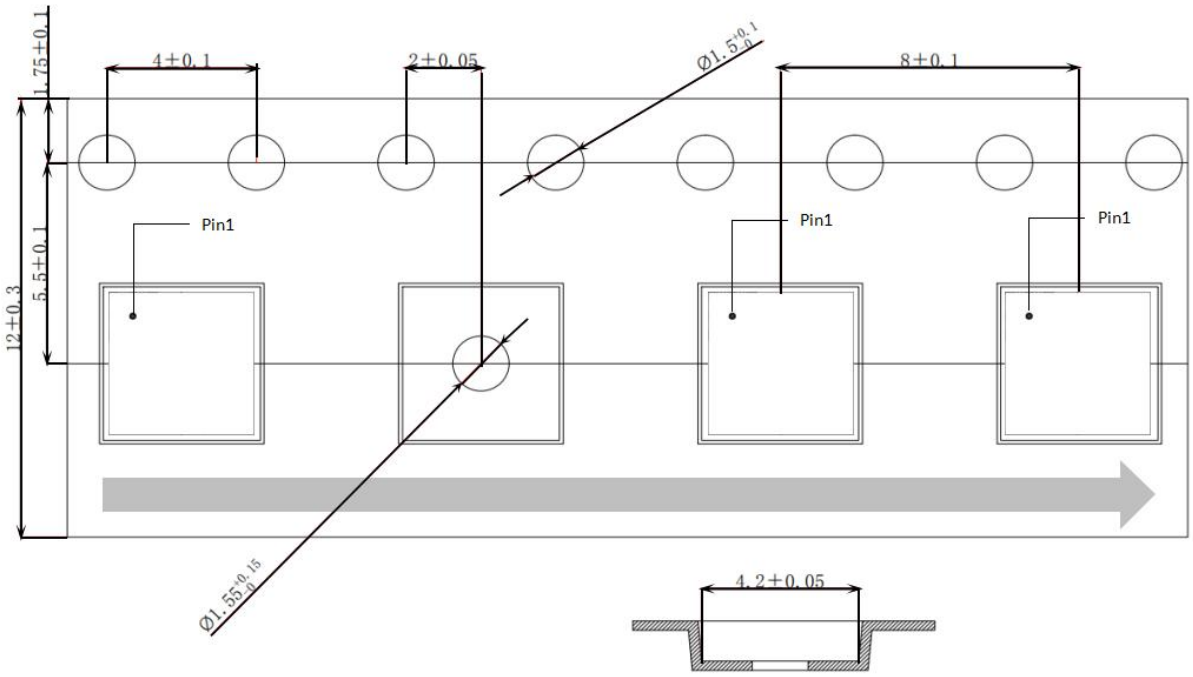
BOTTOM VIEW

		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.8	0.85	0.9
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.65	---
L/F THICKNESS		A3		0.203 REF	
LEAD WIDTH		b	0.25	0.3	0.35
BODY SIZE	X	D		4 BSC	
	Y	E		4 BSC	
LEAD PITCH		e		0.95 BSC	
EP SIZE	X	D2	2.2	2.3	2.4
	Y	E2	2.6	2.7	2.8
LEAD LENGTH		L	0.3	0.4	0.5
LEAD TIP TO EXPOSED PAD EDGE		K		0.45 REF	
PACKAGE EDGE TOLERANCE		aaa		0.1	
MOLD FLATNESS		ccc		0.1	
COPLANARITY		eee		0.08	
LEAD OFFSET		bbb		0.1	
		ddd		0.05	
EXPOSED PAD OFFSET		fff		0.1	

Package Dimensions

Packing Information

Package Type	Reel Size(inch)	Qty/Reel(pcs)	Qty/Box(pcs)	Qty/Carton(pcs)
DFN4*4	13	5000	5000	25000



Tape & Reel

Handling Precautions

Parameter	Rating	Standard	
ESD – Human Body Model (HBM)	1A	ANSI/ESDA/JEDEC Standard JS-001	
ESD – Charged Device Model (CDM)	C2B	ANSI/ESDA/JEDEC Standard JS-002	
MSL – 260°C Convection Reflow	MSL3	IPC/JEDEC Standard J-STD-020	

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

Revision history

Document ID	Datasheet status	Release date	Version revision record
HTH1D38S010P	Preliminary Rev.0.1	2022-12-01	Initial Version
HTH1D38S010P	Preliminary Rev.0.2	2022-12-20	Update Case Temperature
HTH1D38S010P	Preliminary Rev.0.3	2022-12-26	Update Reference Design and Performance Plots
HTH1D38S010P	Product Rev.1.0	2023-04-13	Update RF data

Abbreviations

Acronym	Definition
LDMOS	Laterally-diffused metal-oxide semiconductor
GaN	Gallium Nitride
CW	Continuous Waveform
VSWR	Voltage Standing Wave Ratio

Contact Information

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

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- Email: MKT@watechelectronics.com

For technical questions and application information:

- Email: MKT@watechelectronics.com

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