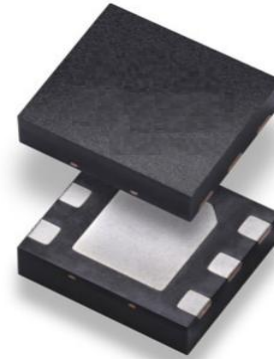
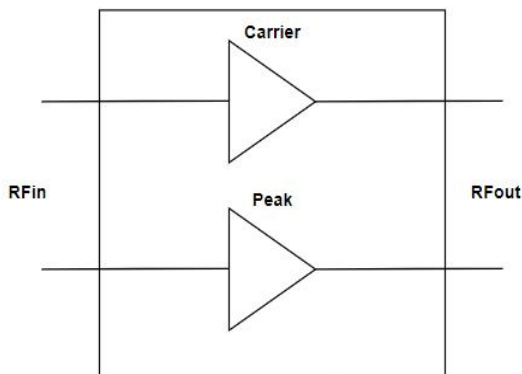


Description

This asymmetrical Doherty RF power GaN Transistor with saturation output power 56W is designed for cellular base station applications requiring very wide instantaneous bandwidth capability covering the frequency range of 3400 to 3800 MHz.



Block Diagram



Features

- Operating Frequency Range: 3.4 to 3.8 GHz
- Operating Drain Voltage: +48 V
- Saturation Output Power: 56 W
- Advanced Linearity Performance
- High Efficiency
- High terminal impedance for optimal broadband performance
- High reliability
- Small footprint package, DFN 7x6.5

Applications

- 3GPP 5G NR FR1 and 4G/LTE band.
- Power Amplifier for micro base station.
- Driver Amplifier for macro base stations.
- Active antenna array for 5G mMIMO.
- Repeaters/DAS.
- Mobile Infrastructure.

Order Information

Part Number	Description
HTH1D38P060P	Reel Package

Typical Performances

Freq(MHz)	P5dB(dBm)	Gain(dB)	Eff(%)	IRL(dB)
3400	47.6	15.3	51.4	-11
3600	48.0	15.4	52.1	-12
3800	47.6	14.2	53.5	-10

Test conditions: 25 °C, VDD=48V, IDQ=45mA, Vgsp=Vgp-1.9V@30mA, Pout=39dBm, Pulsed CW, 100 us, Duty Cycle = 10%, Test on Watech EVB.

Freq(MHz)	Gain(dB)	Eff(%)	ACPR 5MHz(dBc)	ACPR 10MHz(dBc)
3400	14.0	53.3	-25.2	-41.1
3600	14.5	52.0	-28.6	-44.1
3800	13.8	52.8	-30.7	-44.9

Test conditions: 25 °C, VDD=48V, IDQ=45mA, Vgsp=Vgp-1.9V@30mA, Pout=39dBm, single-carrier, 5MHz WCDMA signal with 9.9dB PAR @ 0.01% CCDF, 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)	-65 to 150	°C
Case Temperature (TC)	-40 to 150	°C
Junction Temperature (TJ)	275	°C

Electrical Specification

DC Characteristics

carrier

Parameter	Conditions	Min	Typ	Max	Units
Breakdown Voltage V(BR)DSS	VGS=-8V; IDS=3.3mA	150	-	-	V
Gate-Source threshold Voltage VGS(th)	VDS=10V; IDS=3.3mA	-3.6	-2.8	-2.0	V
Drain leakage Current IDSS	VDS=50V; VGS=-8V	-	0.15	-	mA
Gate leakage Current IGSS	VDS=0V; VGS=-10V	-	20	-	uA

Peak

Parameter	Conditions	Min	Typ	Max	Units
Breakdown Voltage V(BR)DSS	VGS=-8V; IDS=4.8mA	150	-	-	V
Gate-Source threshold Voltage VGS(th)	VDS=10V; IDS=4.8mA	-3.6	-2.8	-2.0	V
Drain leakage Current IDSS	VDS=50V; VGS=-8V	-	0.30	-	mA
Gate leakage Current IGSS	VDS=0V; VGS=-10V	-	40	-	uA

RF Characteristics (Pulsed CW)

Parameter	Min	Typ	Max	Units
Frequency Range	3.4	-	3.8	GHz
P5dB	47	47.5	-	dBm
Gain	13.0	13.5	14.5	dB
Eff	55	60	-	%
IRL	-10	-11	-	dB

Test conditions: 25 °C, VDD=48V, IDQ=45mA, Vgsp=Vgp-1.9V@30mA, Pout=39dBm, Pulsed CW, 100 us, Duty Cycle = 10%, Test on Watech Test Fixture with compensation.

RF Characteristics (WCDMA)

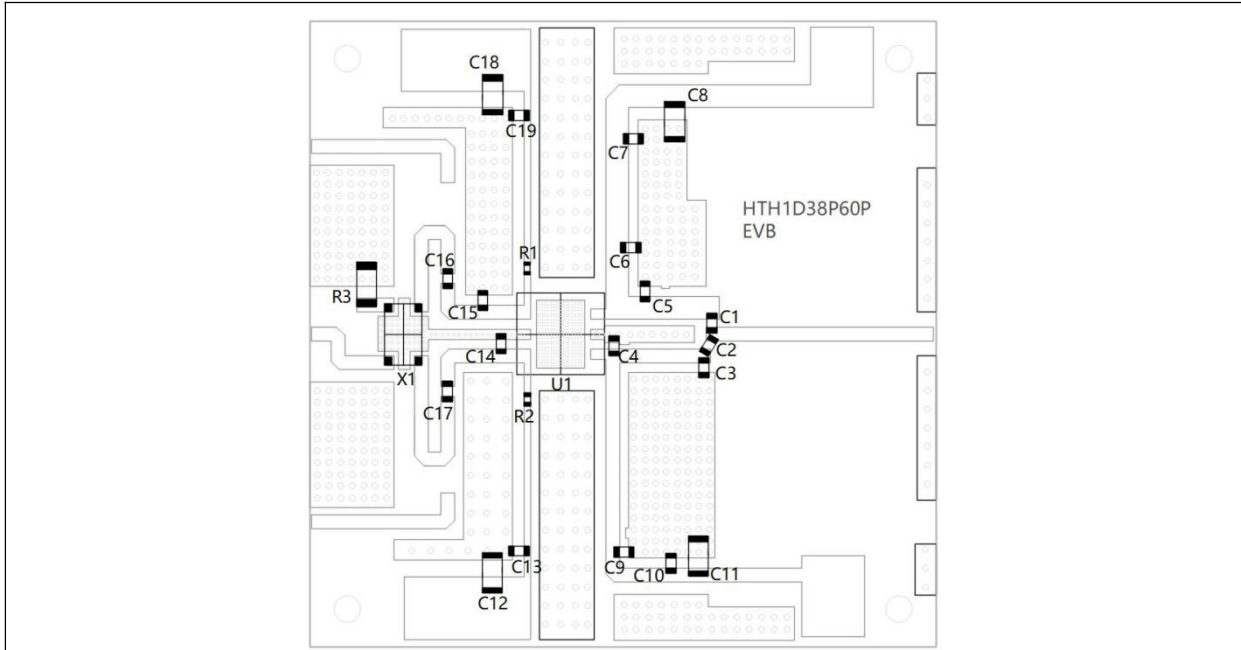
Parameter	Min	Typ	Max	Units
Frequency Range	3.4	-	3.8	GHz
Gain	13.0	13.5	14.5	dB
Eff	51	52	-	%
IRL	-10	-11	-	dB
ACLR@5MHz	-	-31.0	-29.0	dBc

Test conditions: 25 °C, VDD=48V, IDQ=45mA, Vgsp=Vgp-1.9V@30mA, Pout=39dBm, single-carrier, 5MHz WCDMA signal with 9.9dB PAR @ 0.01% CCDF, Test on Watech Test Fixture with compensation.

Thermal Information

Parameter	Condition	Value (Typ)	Units
Thermal Resistance	Active die surface to Case (Rth) T-Case = 105 °C, Pdis = 6.7W	4.5	K/W

HTH1D38P060P 3.4-3.8 GHz Reference Design



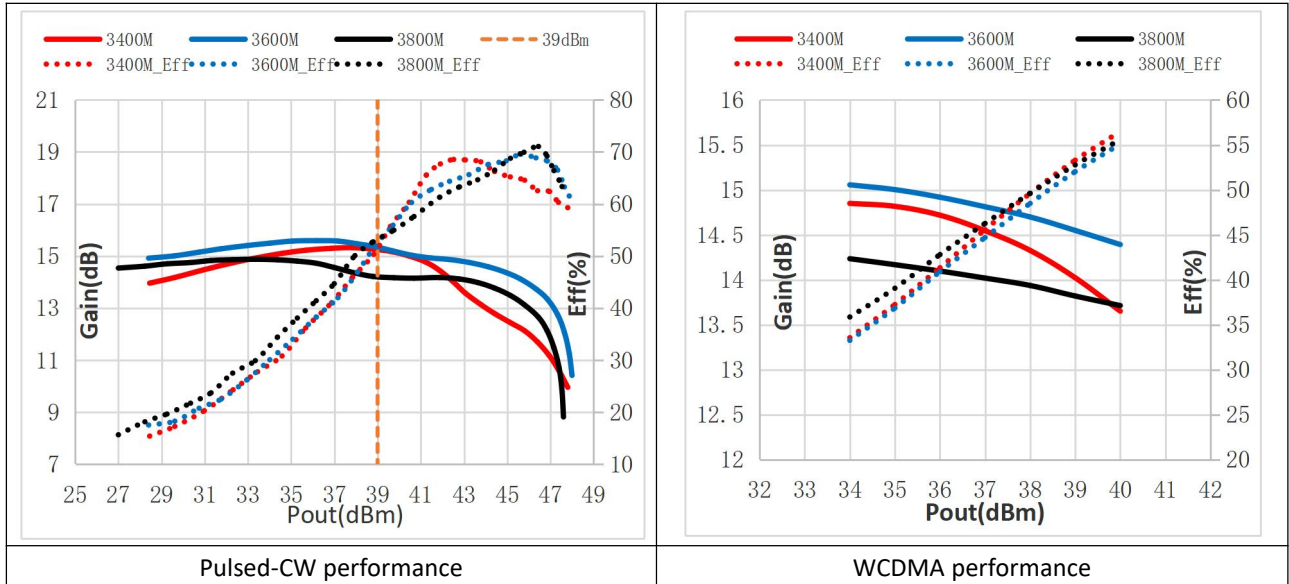
Rogers 4350B, thickness=20mil

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

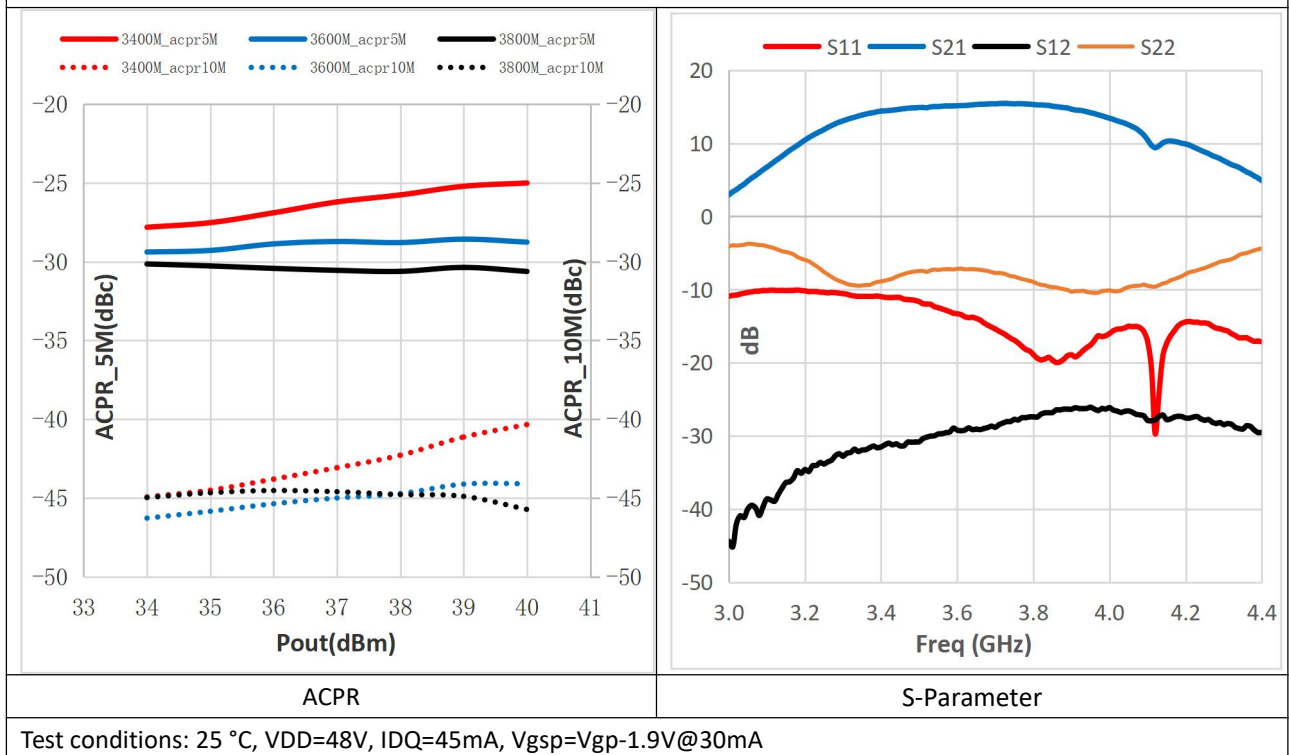
BOM-HTH1D38P060P 3.4 – 3.8 GHz Reference Design

Component	Type	Value	Description	Manufacturer	P/N
C1	0603	0.9pF	MLCC	Murata	GQM1875G2ER90BB12D
C2	0603	2.7pF	MLCC	Murata	GQM1875G2E2R70BB12D
C3,C14	0603	0.4pF	MLCC	Murata	GQM1875G2ER40BB12D
C4	0603	1.6pF	MLCC	Murata	GQM1875G2E1R60BB12D
C5,C15	0603	0.7pF	MLCC	Murata	GQM1875G2ER70BB12D
C6,C9,C13,C16,C17,C19	0603	3.3pF	MLCC	Murata	GQM1875G2E3R30BB12D
C7,C10	0805	1uF	MLCC	Murata	
C8,C11,C12,C18	1210	10uF	MLCC	Murata	
R1,R2	0402	8.2 Ω	Resistor	/	
R3	/	50 Ω	Load	/	C16A50Z4
X1	/	3dB	Hybrid Coupler	/	X3C35F103S

Performance Plots



Test conditions: 25 °C, VDD=48V, IDQ=45mA, Vgsp=Vgp-1.9V@30mA



Test conditions: 25 °C, VDD=48V, IDQ=45mA, Vgsp=Vgp-1.9V@30mA

Typical Performances for 3.4-4.0GHz Broadband

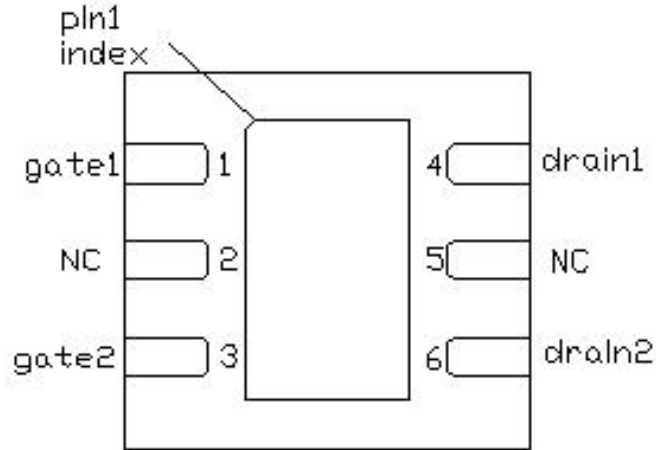
Freq(MHz)	P5dB(dBm)	Gain(dB)	Eff(%)	IRL(dB)
3400	47.1	13.9	54.2	-11
3600	48.1	14.2	61.8	-12
3800	47.6	13.9	62.6	-10
4000	47.2	12.4	57.7	-9

Test conditions: 25 °C, VDD=48V, IDQ=45mA, Vgsp=Vgp-1.9V@30mA, Pout=39dBm, Pulsed CW, 100 us, Duty Cycle = 10%, Test on Watech EVB.

Freq(MHz)	Gain(dB)	Eff(%)	ACPR 5MHz(dBc)	ACPR 10MHz(dBc)
3400	12.7	48.9	-26.4	-41.1
3600	12.9	48.0	-30.1	-43.6
3800	12.3	50.9	-28.6	-41.7
4000	10.7	48.5	-30.6	-40.4

Test conditions: 25 °C, VDD=48V, IDQ=45mA, Vgsp=Vgp-1.9V@30mA, Pout=39dBm, single-carrier, 5MHz WCDMA signal with 9.9dB PAR @ 0.01% CCDF, Test on Watech EVB.

Pin Configuration and Description

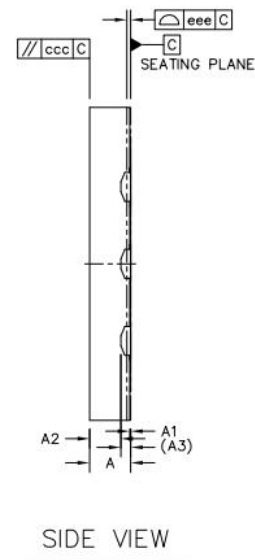
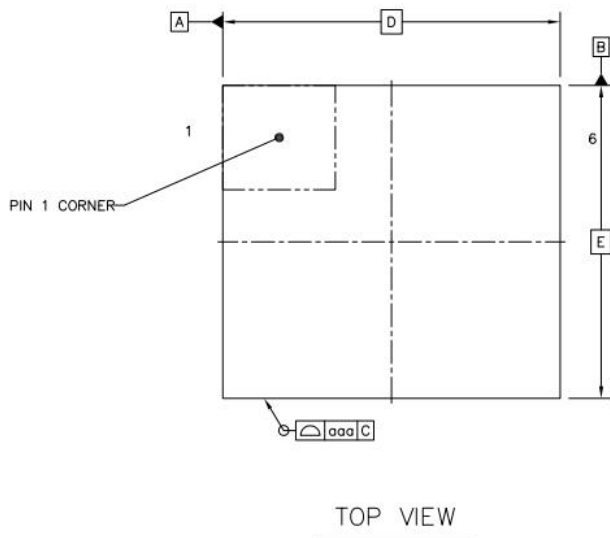


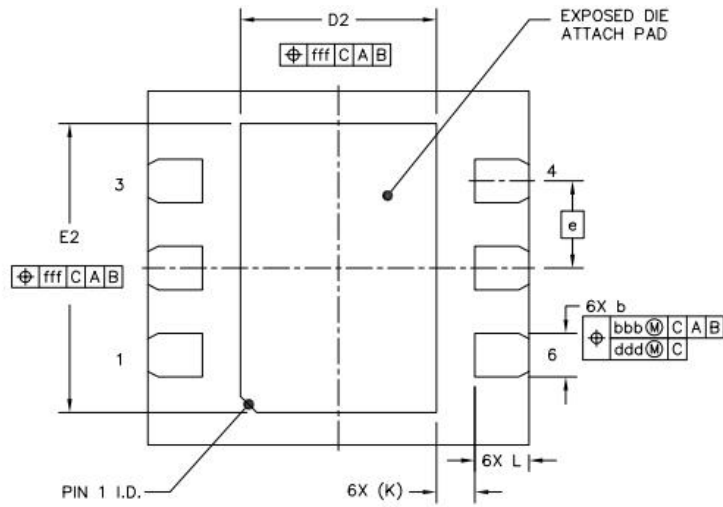
Pin Configuration		
Pin Number	Label	Description
1	Gate1(carrier)	Gate-Source voltage of carrier
2	NC	NC
3	Gate2(peak)	Gate-Source voltage of peak
4	Drain1(carrier)	Drain-Source voltage of carrier
5	NC	NC
6	Drain2(peak)	Drain-Source voltage of peak

Package Marking and Dimensions

Marking Spec No.	HDT082 HTH1D38P60P Marking spec_A
Marking Spec	
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="border: 1px solid #ccc; padding: 5px; background-color: #f0f0f0;"> marking sample ↓ </div> <div style="border: 1px solid #ccc; padding: 10px; width: 80%;"> <div style="display: flex; justify-content: space-between; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 10px; width: 40%;"> <p style="text-align: center;">●</p> <p style="text-align: center;">HTH1D38P60P XXXX-XXXXXXX XXXX-JY</p> </div> <div style="width: 55%;"> <div style="background-color: #ccc; padding: 5px; margin-bottom: 10px;"> Line1: fixed : device name in W/O </div> <div style="background-color: #ccc; padding: 5px; margin-bottom: 10px;"> Line2 :unfixed : Marking Lot No in W/O (Sample:E596-20140001) </div> <div style="background-color: #ccc; padding: 5px;"> Line3 :unfixed : Date Code+ JY </div> </div> </div> </div> <p>●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".</p> </div>	

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	0.75	0.8	0.85
BODY SIZE	X	D	7 BSC		
	Y	E	6.5 BSC		
LEAD PITCH		e	1.6 BSC		
EP SIZE	X	D2	3.5	3.6	3.7
	Y	E2	5.21	5.31	5.41
LEAD LENGTH		L	0.9	1	1.1
LEAD TIP TO EXPOSED PAD EDGE		K	0.7 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

Handling Precautions

Parameter	Rating	Standard	
ESD – Human Body Model (HBM)	1A	ANSI/ESDA/JEDEC Standard JS-001	
ESD – Charged Device Model (CDM)	C2A	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
HTH1D38P060P	Preliminary Rev.0.1	2022-12-01	Initial Version
HTH1D38P060P	Preliminary Rev.0.3	2022-12-26	Update Reference Design and Performance Plots
HTH1D38P060P	Product Rev.1.0	2023-04-13	Update RF data and add package information
HTH1D38P060P	Product Rev.2.0	2024-03-08	Change part number

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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