# GTH0-0037080S 50V, DC – 3.7GHz, 80W GaN HEMT

## FEATURES

- Operating Frequency Range: DC to 3.7GHz
- Operating Drain Voltage: 28V & 50V
- Maximum Output Power ($P_{SAT}$): 80W
- Air Cavity Ceramic package
- Suitable for CW, Pulsed, Linear applications
- 100% DC & RF Production Tested


NI-360 Ceramic Package

## DESCRIPTION

The GTH0-0037080S is a 80W (P3dB) unmatched discrete GaN-on-SiC HEMT which operates from DC to 3.7GHz on a 50V supply rail. The wide bandwidth of the GTH0-0037080S makes it suitable for a variety of applications including cellular infrastructure, radar, communications, and test instrumentation, and can support CW, linear and pulse operations.

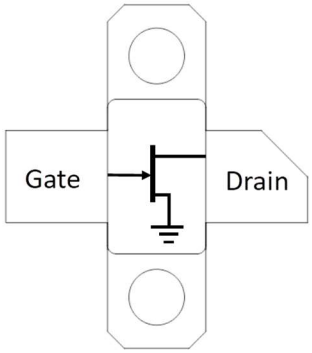
The device is housed in an industry-standard NI-360 Air Cavity Ceramic package. Lead-free and RoHS compliant.

## ABSOLUTE MAXIMUM RATINGS(1, 2)

| Parameter | Rating | Symbols and Units |
|---|---|---|
| Drain Source Voltage | 150 | $V_{DS}$ (V) |
| Gate Source Voltage | -8 to +2 | $V_{GS}$ (V) |
| Operating Voltage | 55 | $V_{dsq}$ (V) |
| Junction Temperature | +225 | $T_{JUNC}$(°C) |
| Storage Temperature | -65 to +150 | $T_{STORAGE}$(°C) |
| Case Operating Temperature | -40 to +105 | $T_{CASE}$(°C) |

1. Exceeding any of these limits may cause permanent damage to this device or seriously limit the life time (MTTF)
2. GalliumSemi does not recommend sustained operation above maximum operating conditions.

## BLOCK DIAGRAM



## ELECTRICAL SPECIFICATIONS: $T_A$ = 25°C

| Parameter | Min. | Typ. | Max. | Symbols and Units | Test conditions |
|---|---|---|---|---|---|
| Frequency Range | DC | | 3700 | MHz | |
| **DC Characteristics** | | | | | |
| Drain Source Breakdown Voltage | 150 | | | $V_{BDSS}$ (V) | |
| Drain Source Leakage Current | | | | $I_{DLK}$ (mA) | Vgs = -8V, Vds = 50V |
| Gate Source Leakage Current | | | | $I_{GLK}$ (mA) | Vgs = -8V, Vds = 50V |
| Gate Threshold Voltage | -3.4 | | -1.5 | $V_{GS}$ (V) | Vds = 50V |
| **Operating Conditions** | | | | | |
| Gate Bias Voltage | | -2.5 | | $V_{GSQ}$ (V) | |
| Drain Voltage | | 50 | | $V_{DSQ}$ (V) | |
| Quiescent Drain Current | | 78 | | $I_{DQ}$ (mA) | |

## RF ELECTRICAL SPECIFICATIONS: $T_A$ = 25°C, VDS = 50 V, IDQ = 78 mA, Freq= 3600MHz
## Note: Performance(1) in GalliumSemi Production Test Fixture, 50 Ω system

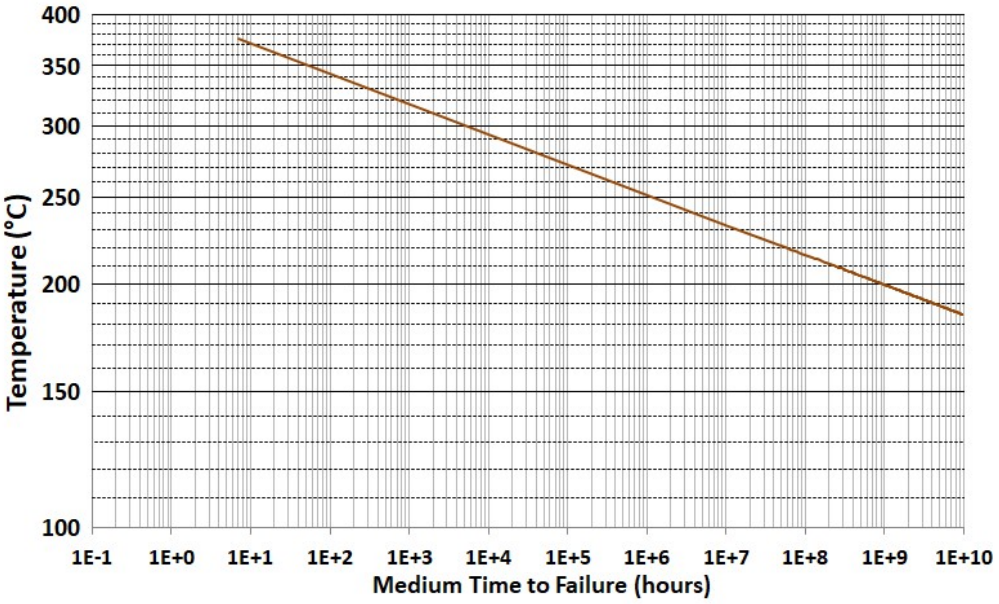
| Parameter | Symbol | Min. | Typ. | Max. | Units | Notes |
|---|---|---|---|---|---|---|
| Small Signal Gain | $G_{ss}$ | | tbd | | dB | |
| Power Gain | $G_{SAT}$ | | tbd | | dB | |
| Saturated Drain Efficiency | $DEff_{SAT}$ | | tbd | | % | |
| Saturated Output Power | $P_{SAT}$ | | tbd | | dBm | |
| Ruggedness Output mismatch | Ψ | VSWR = 10:1, all angles | | | | No damage or shift in performances |

1. 1 Tone Pulse CW, pulse width 100us, duty cycle 10%

## THERMAL AND RELABILITY INFORMATION -CW [1, 2]: $T_c$ = 85°C

| Parameter | Test condition | Value | Units | Notes |
|---|---|---|---|---|
| | | | | |
| Channel Temperature, Tch | Pdiss 15 W | 148 | °C | |
| Rth | | 4.2 | ºC/W | |
| MTTF | | > 1.0E10 | Hrs | |
| | | | | |
| Channel Temperature, Tch | Pdiss 30 W | 220 | °C | |
| Rth | | 4.5 | ºC/W | |
| MTTF | | 6.0E7 | Hrs | |
| | | | | |
| Channel Temperature, Tch | Pdiss 47 W | 315 | °C | |
| Rth | | 4.9 | ºC/W | |
| MTTF | | 1100 | Hrs | |

1.Using 5um thermal grease - 4W/m-K.
2.Thermal Resistance using Finite Element Analysis (FEA) simulation, calibrated with Infrared measurement on surface temperature.
3.Rth vs Dissipated Power can be generalized with the following equation: Rth(ºC/W) = 0.0227 x Pdiss(W) + 3.8258

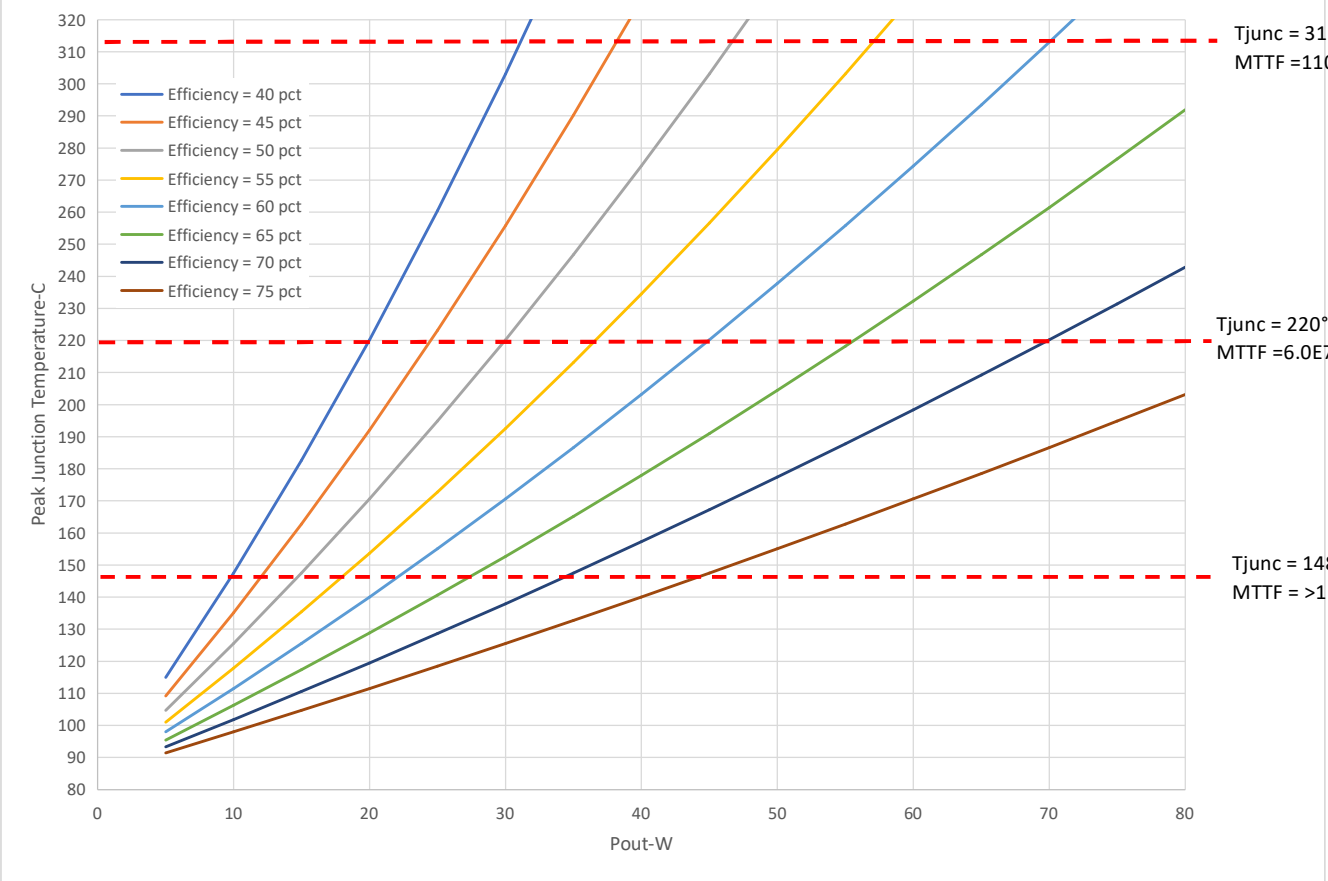


## CW OPERATION

The device can withstand CW operation with respect to the application's MTTF ( Life time vs. Peak Junction Temperature).

The graph(1,2) below shows the Peak Junction Temperature vs. the Output Power & Efficiency trade-off, using the following equations:
- Tjunc(ºC) = Pdiss(w) x Rth(ºC/W)
- Pdiss(W) = (Pout(w)/ Efficiency(%)) - Pout(w)

E.g.: The device can be used for Pout = 56W CW with Efficiency of 55%, Tjunc will be 315ºC, leading to a LifeTime ( MTTF) of 1100 Hrs.

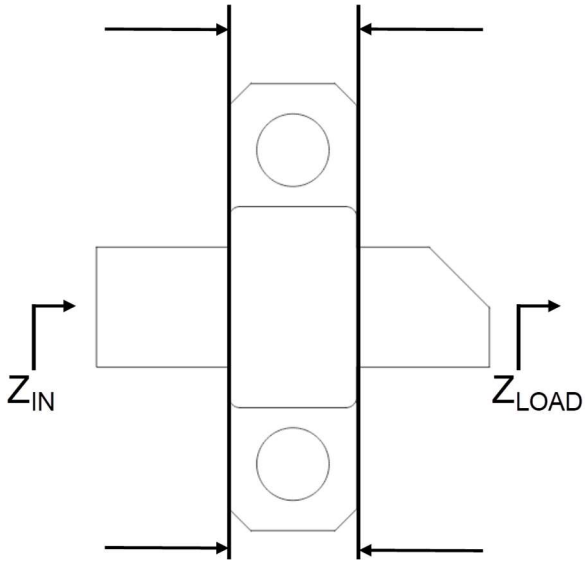



Notes:
5um thermal grease - 4W/m-K
Back of pkg is 85°C infinite heat sink

## LOADPULL MEASUREMENT NOTES

Source and Load impedance @ 2nd Harmonic are set to 10 Ohms
With proper 2nd Harmonic termination, expect +5% Efficiency for Source and similar with Drain 2nd Harmonic.
$Z_{LOAD}$: Measured Impedance presented to the output of the device in the reference plane
$Z_{IN}$: Measured input Impedance at the input of the device in the reference plane

**Impedance Reference Plane**




Raw data and full Loadpull measurement report available at request: sales@galliumsemi.com

## GaN HEMT BIASING SEQUENCE

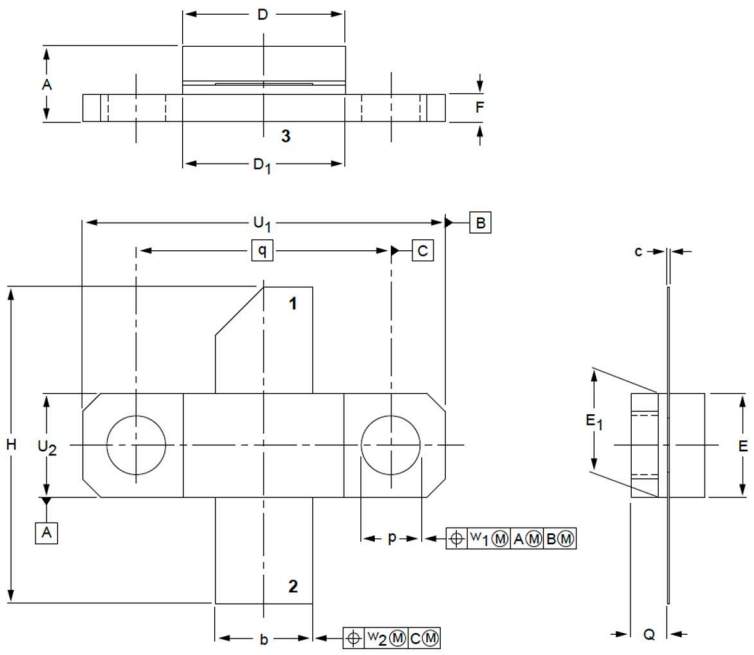
**To turn the transistor ON**

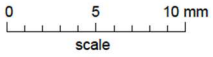
1. Set $V_{GS}$ to -5V
2. Turn on $V_{DS}$ to normal operation voltage (50V)
3. Slowly increase $V_{GS}$ to set $I_{DQ}$ current (78 mA)
4. Apply RF power

**To turn the transistor OFF**

1. Turn the RF power off
2. Decrease $V_{GS}$ to -5V
3. Turn off $V_{D.}$ Wait a few seconds for drain capacitor to discharge
4. Turn off $V_{GS}$

## PACKAGE DIMENSIONS




DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

| UNIT | A | b | c | D | $D_1$ | E | $E_1$ | F | H | p | Q | q | $U_1$ | $U_2$ | $w_1$ | $w_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.67<br>3.94 | 5.59<br>5.33 | 0.15<br>0.10 | 9.25<br>9.04 | 9.27<br>9.02 | 5.92<br>5.77 | 5.97<br>5.72 | 1.65<br>1.40 | 18.54<br>17.02 | 3.43<br>3.18 | 2.21<br>1.96 | 14.27 | 20.45<br>20.19 | 5.97<br>5.72 | 0.25 | 0.51 |
| inch | 0.184<br>0.155 | 0.220<br>0.210 | 0.006<br>0.004 | 0.364<br>0.356 | 0.365<br>0.355 | 0.233<br>0.227 | 0.235<br>0.225 | 0.065<br>0.055 | 0.73<br>0.67 | 0.135<br>0.125 | 0.087<br>0.077 | 0.562 | 0.805<br>0.795 | 0.235<br>0.225 | 0.010 | 0.020 |

## PIN CONFIGURATION

| Pin | Input/Output |
|---|---|
| 1 | RF Output / Drain Voltage |
| 2 | RF Input / Gate Voltage |
| 3 (flange) | Ground |

## DEVICE LABEL

| | | |
|---|---|---|
| Line 1: | COMPANY NAME: | GALLIUM |
| Line 2: | PART NUMBER - WAFER # | |
| Line 3: | AA: | Assembly Code |
| | YYWW: | Assembly Date Code |
| | R: | Reserved code |

## HANDLING PRECAUTIONS

| Parameter | Symbol | Class | Test Methodology |
|---|---|---|---|
| ESD – Human Body Model | HBM | Class 1A (250 V) | ANSI/ESDA/JEDEC Standard JS-001 |
| ESD – Charged Device Model | CDM | Class C3 (1500 V) | ANSI/ESDA/JEDEC Standard JS-002 |
| MSL – Moisture Sensitivity Level | MSL | MSL 1 | IPC/JEDEC Standard J-STD-020 |


## RoHS COMPLIANCE

Gallium Semiconductor's Policy on EU RoHS available online:
https://www.galliumsemi.com/_files/ugd/3748d3_1107b9788f9845f78f45d424097c4c97.pdf

## CONTACT INFORMATION

To request latest information and samples, please contact us at:

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