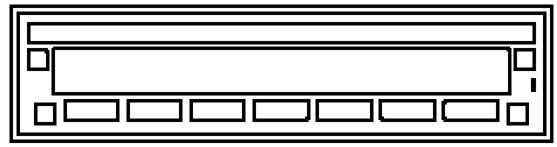
GD090 — 50V, DC – 3.7GHz, 90W GaN HEMT

FEATURES

- Operating Frequency Range: DC to 3.7GHz
- Operating Drain Voltage: 28V & 50V
- Maximum Output Power (P_{SAT}): 110W
- Bare die shipped in Gel-Pak containers
- Suitable for CW, Pulsed, Linear applications
- 100% KGD DC Production Tested



3.08 X 0.75 mm Die

DESCRIPTION

The GD090 is a 110W (P3dB) unmatched discrete GaN-on-SiC HEMT which operates from DC to 3.7GHz on a 50V supply rail. The wide bandwidth of the GD090 makes it suitable for a variety of applications including cellular infrastructure, radar, communications, and test instrumentation, and can support CW, linear and pulse operations.

Bare die are shipped in Gel-Pak containers for safe transport and storage.

Typical Performances Measured Loadpull 1 Tone pulsed CW (10% duty cycle, 100µs width) in DFN 6x3 package, *2nd Harmonics NOT optimized*

(1) Optimum Peak Power at 2.5dB in compression
(2) Optimum Peak Efficiency at 2.5dB in compression

Vds=50V, Idq= 109 mA, T_A = 25°C

Frequency (MHz)	Pout(1) (dBm)	Gain(2) (dB)	Eff(2) (%)
1000	50.4	25.5	66.3
1200	50.6	24.1	67
1400	50.7	23.5	67.7
1600	50.7	21.9	66
1800	50.8	21.9	67.6
2000	50.6	21.2	64.3
2200	50.6	21	64.4
2400	50.6	19.8	63.2
2600	50.8	19.1	67.8
2800	50.8	19.1	66.3

Vds=28V, Idq= 109 mA, T_A = 25°C

Frequency (MHz)	Pout(1) (dBm)	Gain(2) (dB)	Eff(2) (%)
1000	47.6	22.6	66.3
1200	47.8	22.9	68.4
1400	47.9	21.9	68.2
1600	47.9	20.3	67.4
1800	48	20.5	68.7
2000	48	19.3	66.3
2200	48	19.1	66.8
2400	47.8	18.2	65.3
2600	48.2	18	68.6
2800	48	17.6	67.1

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)

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

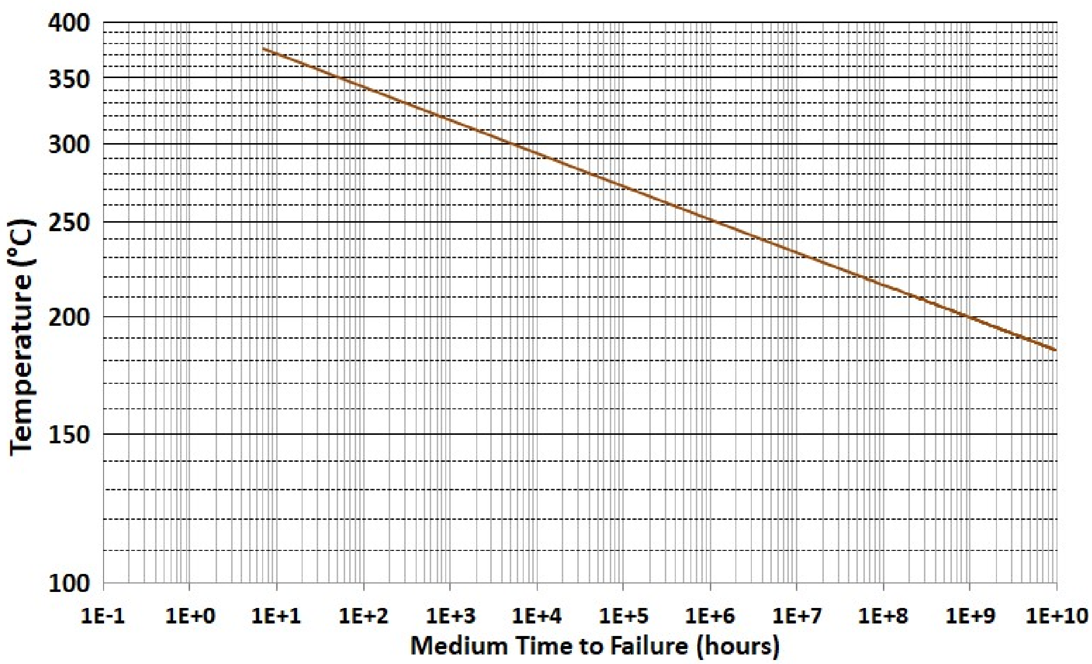
ELECTRICAL SPECIFICATIONS: T_A = 25°C

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		4.4		I_{DLK} (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		109		I_{DQ} (mA)	

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

Parameter	Test condition	Value	Units	Notes
Channel Temperature, Tch	Pdiss 22 W	138.2	°C	
Rth die		1.23	ºC/W	
MTTF		>1.0E+10	Hrs	
Channel Temperature, Tch	Pdiss 44 W	199.4	°C	
Rth die		1.38	ºC/W	
MTTF		1.0E+09	Hrs	
Channel Temperature, Tch	Pdiss 66 W	272.5	°C	
Rth die		1.60	ºC/W	
MTTF		1.0E+05	Hrs	

1.Assumes eutectic attach using 1mil low temp solder, mounted to a 8 mil DFN package.
2:Thermal Resistance using Finite Element Analysis (FEA) simulation, calibrated with Infrared measurement on surface temperature.



LOADPULL MEASUREMENT, Vds= 50V Idq = 109 mA

Die packaged in DFN 6x3, Measured 1 Tone Pulse CW, pulse width 100us, duty cycle 10%

For Optimum Peak Power @ 2.5dB Compression

Freq-MHz	Zin_F0	Zl_F0	Gain-dB	Pout-dBm	Pout-W	Eff-%	AMPM-deg
1000	1.4 j -5.7	7.3 j 0.9	22.6	50.4	112	52.8	3.6
1200	1.1 j -4.2	9.0 j 1.4	22.5	50.6	114.8	59.1	2.8
1400	0.9 j -3.3	6.6 j 1.4	21.8	50.7	118.1	55.4	2
1600	0.8 j -2.3	6.4 j 2.0	21.2	50.7	119.7	56.8	1.2
1800	0.9 j -1.5	6.4 j 1.8	20.4	50.8	121.2	57.1	1.2
2000	0.7 j -1.0	6.4 j 1.8	19.6	50.6	116.9	56.1	0.9
2200	0.8 j -0.6	5.1 j 1.4	19.2	50.6	116.9	54.7	0.5
2400	0.8 j -0.0	5.4 j 1.4	18.2	50.6	116.1	55.4	0.4
2600	0.8 j 0.6	5.6 j 1.7	18	50.8	121.4	60.3	-0.3
2800	0.8 j 1.0	5.1 j 1.4	17.5	50.8	121.3	58.5	-0.2

For Optimum Peak Efficiency @ 2.5dB Compression

Freq-MHz	Zin_F0	Zl_F0	Gain-dB	Pout-dBm	Pout-W	Eff-%	AMPM-deg
1000	0.8 j -4.5	14.4 j 9.0	25.5	48.8	75.3	66.3	0.5
1200	0.8 j -3.4	13.2 j 9.4	24.1	48.8	76.1	67	1.7
1400	0.7 j -2.5	10.6 j 9.9	23.5	48.7	73.6	67.7	1.5
1600	0.7 j -1.4	9.2 j 10.2	21.9	48.4	68.3	66	1.1
1800	0.6 j -0.9	8.2 j 8.6	21.9	49	80	67.6	-0.1
2000	0.5 j -0.5	6.1 j 6.4	21.2	49.5	88.9	64.3	-2.6
2200	0.5 j -0.1	5.7 j 5.3	21	49.6	92.3	64.4	-2
2400	0.5 j 0.5	5.1 j 5.7	19.8	49.1	81.3	63.2	-2
2600	0.6 j 1.0	5.0 j 5.2	19.1	49.7	92.7	67.8	-2.2
2800	0.5 j 1.4	4.2 j 4.8	19.1	49.4	86.1	66.3	-2.3

LOADPULL MEASUREMENT, Vds= 28V Idq = 109 mA

Die packaged in DFN 6x3, Measured 1 Tone Pulse CW, pulse width 100us, duty cycle 10%

For Optimum Peak Power @ 2.5dB Compression

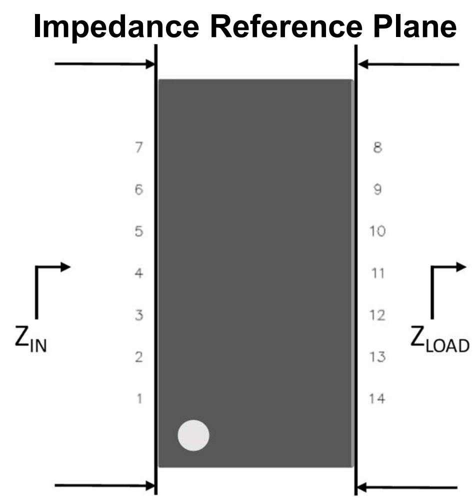
Freq-MHz	Zin_F0	Zl_F0	Gain-dB	Pout-dBm	Pout-W	Eff-%	AMPM-deg
1000	1.3 j -5.3	6.1 j -0.2	22.4	47.6	57.8	59.6	1.5
1200	1.2 j -4.4	4.7 j -0.5	20.9	47.8	61.6	55.5	1
1400	0.8 j -3.3	4.3 j -0.1	20.5	47.9	62.4	56.2	0.4
1600	0.8 j -2.1	5.5 j 0.3	20	47.9	62.9	62.4	0.1
1800	0.8 j -1.4	5.4 j -0.1	19.3	48	63.2	61.5	-0.2
2000	0.8 j -1.0	5.1 j -1.1	17.2	48	62.4	56	0.6
2200	0.7 j -0.5	4.2 j -0.3	17.5	48	64.2	58.8	0.3
2400	0.6 j 0.1	4.4 j 0.0	17.5	47.8	60.4	60.2	-1.2
2600	0.7 j 0.6	4.7 j -1.1	15.7	48.2	65.5	59.1	-0.1
2800	0.7 j 1.1	4.4 j -0.3	16.5	48	62.6	62.1	-1.7

For Optimum Peak Efficiency @ 2.5dB Compression

Freq-MHz	Zin_F0	Zl_F0	Gain-dB	Pout-dBm	Pout-W	Eff-%	AMPM-deg
1000	1.0 j -4.5	8.9 j 2.1	22.6	46.8	47.3	66.3	-0.5
1200	0.7 j -3.5	7.9 j 2.6	22.9	47	50.6	68.4	0.2
1400	0.6 j -2.1	7.8 j 4.7	21.9	46.1	41.9	68.2	-1.6
1600	0.7 j -1.4	7.8 j 3.9	20.3	46.4	44.3	67.4	-1.3
1800	0.5 j -0.9	6.2 j 2.9	20.5	47	51.3	68.7	-1.9
2000	0.5 j -0.5	6.2 j 2.9	19.3	46.9	49.1	66.3	-1.8
2200	0.5 j -0.0	5.1 j 2.6	19.1	46.7	47.9	66.8	-2.2
2400	0.5 j 0.4	4.6 j 2.1	18.2	46.9	49.3	65.3	-2.5
2600	0.5 j 1.1	4.0 j 2.3	18	46.8	48.6	68.6	-3.9
2800	0.5 j 1.4	3.8 j 2.0	17.6	46.7	47.3	67.1	-3.7

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

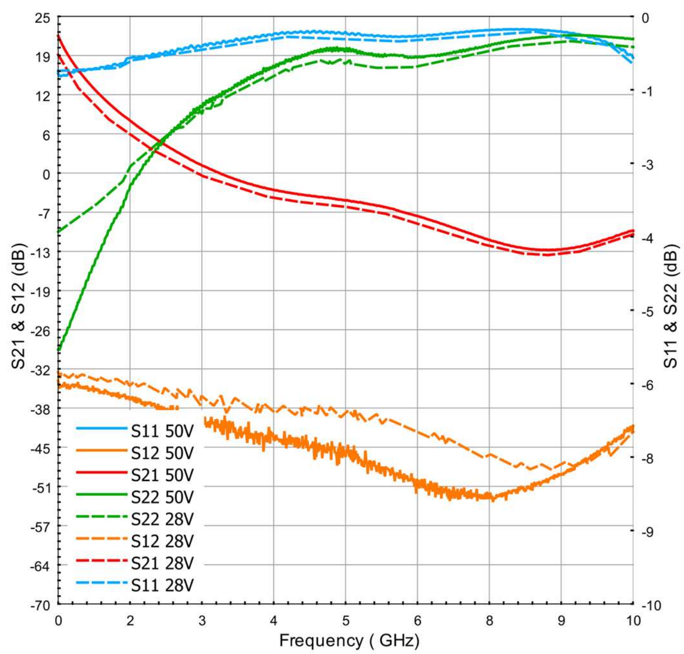


Raw data and full Loadpull measurement report available at request: sales@galliumsemi.com

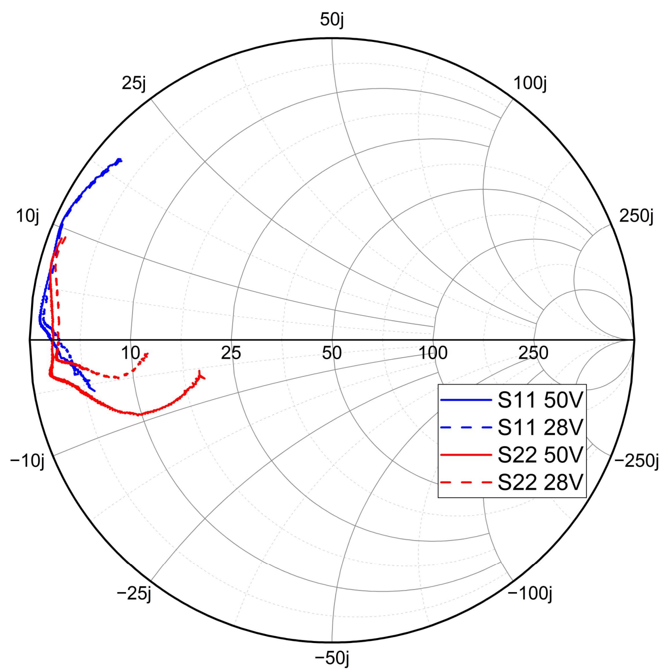
BROADBAND S-PARAMETERS MEASUREMENT, Vds= 28 & 50V Idq = 109 mA

Die packaged in DFN 6x3, Measured 1 Tone CW

S Parameters (Mag-dB)



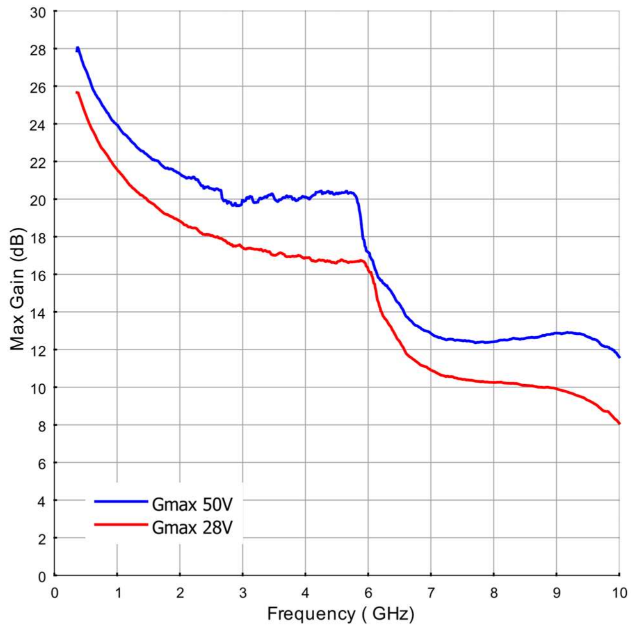
S11 & S22 0.4-10 GHz



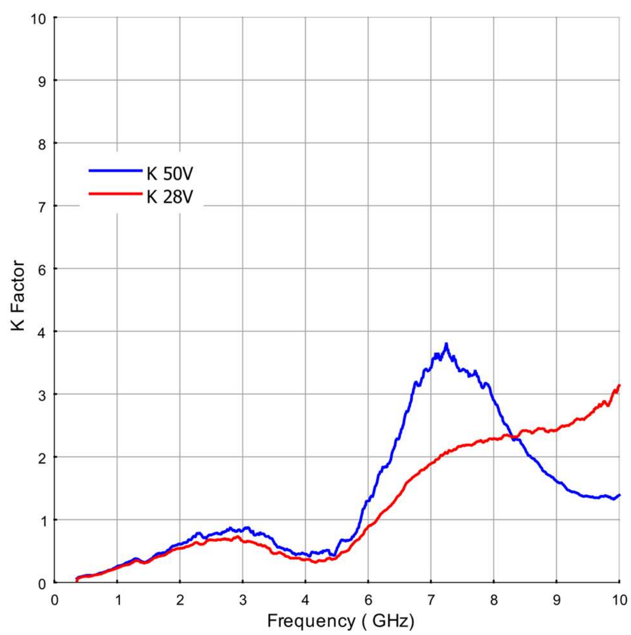
BROADBAND S-PARAMETERS MEASUREMENT, Vds= 28 & 50V Idq = 109 mA

Die packaged in DFN 6x3, Measured 1 Tone CW

Maximum Available Gain



K Factor



GaN HEMT BIASING SEQUENCE

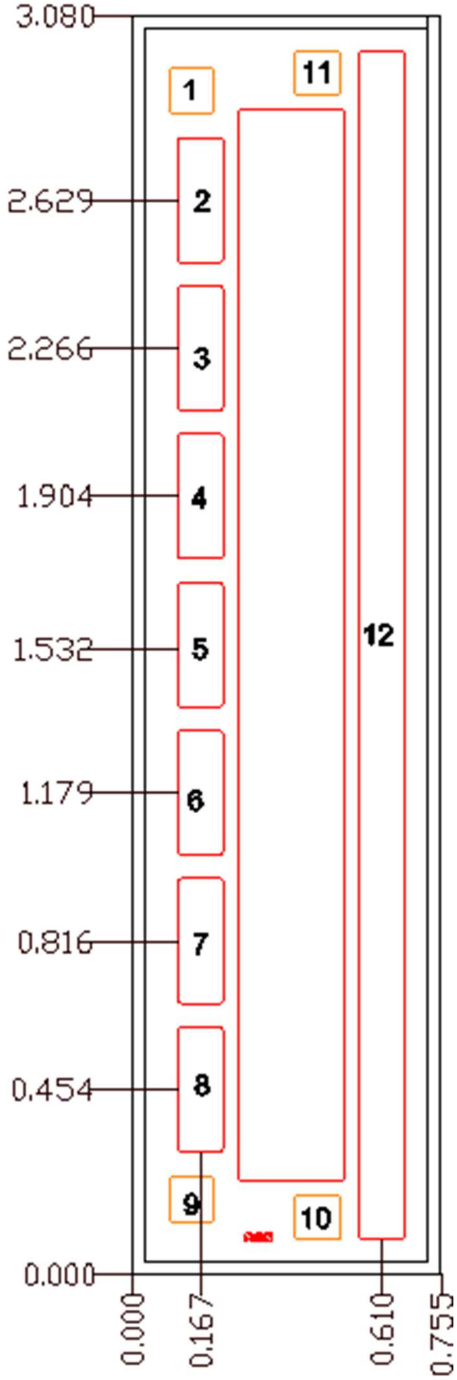
To turn the transistor ON

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 (109mA)
4. Apply RF power

To turn the transistor OFF

1. Turn the RF power off
2. Decrease V_{GS} to -1.5V
3. Turn off $V_{D.}$ Wait a few seconds for drain capacitor to discharge
4. Turn off V_{GS}

DIE DIMENSIONS



Bond Pads

Pad nb.	Description	Dimensions
1, 9, 10, 11	Not connected	
2, 3, 4, 5, 6, 7, 8	RF Input / Gate Voltage	0.110 x 0.305
12	RF Output / Drain Voltage	0.110 x 2.909
Backside	Source/ Ground	0.755 x 3.08

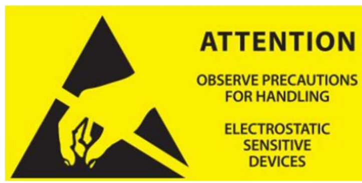
Notes:

1. All dimensions are in millimeter
2. Die thickness is 75 um
3. Bond pad metallization: gold
4. Backside metallization: gold

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

* Tested in DFN 3x6 package



CONTACT INFORMATION

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

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