SHF-0189(Z)

0.05GHz to 6GHz, 0.5WATT GaAs HFET

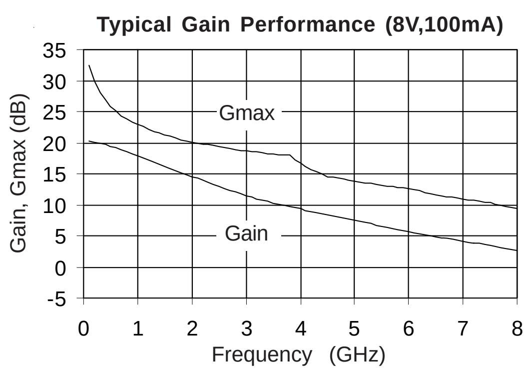
Package: SOT-89

Product Description

RFMD's SHF-0189 is a high performance AlGaAs/GaAs Heterostructure FET (HFET) housed in a low-cost surface-mount plastic package. The HFET technology improves breakdown voltage while minimizing Schottky leakage current resulting in higher PAE and improved linearity. Output power at 1dB compression for the SHF-0189 is +27dBm when biased for Class AB operation at 8V, 100mA. The +40dBm third order intercept makes it ideal for high dynamic range, high intercept point requirements. It is well suited for use in both analog and digital wireless communication infrastructure and subscriber equipment including 3G, cellular, PCS, fixed wireless, and pager systems.

Optimum Technology Matching® Applied

- ☐ GaAs HBT
- ☐ GaAs MESFET
- ☐ InGaP HBT
- ☐ SiGe BiCMOS
- ☐ Si BiCMOS
- ☐ SiGe HBT
- ☐ GaAs pHEMT
- ☐ Si CMOS
- ☐ Si BJT
- ☐ GaN HEMT
- ☐ InP HBT
- ☐ RF MEMS
- ☐ LDMOS



Features

- Available in RFMD Green, RoHS Compliant, and Pb-Free (Z Part Number)
- High Linearity Performance at 1.96GHz
  +27dBm P_{1dB}
  +40dBm Output IP_3
  +16.5dB Gain
- High Drain Efficiency

Applications

- Analog and Digital Wireless Systems
- 3G, Cellular, PCS
- Fixed Wireless, Pager Systems

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Maximum Available Gain		23.3		dB	0.90GHz, $Z_S=Z_S*$, $Z_L=Z_L*$
		20.1		dB	1.96GHz, $Z_S=Z_S*$, $Z_L=Z_L*$
Insertion Gain [1]	16.6	18.4	20.2	dB	0.90GHz, $Z_S=Z_L=50\Omega$
		14.7		dB	1.96GHz, $Z_S=Z_L=50\Omega$
Power Gain [1]		18.6		dBm	0.90GHz, Application Circuit
		16.7		dBm	1.96GHz, Application Circuit
Output Power at 1dB Compression[2		27.2		dBm	0.90GHz, Application Circuit
		27.5		dBm	1.96GHz, Application Circuit
Output Third Order Intercept Point[2]		40		dBm	0.90GHz and 1.96GHz, Application Circuit
Noise Figure		3.2		dB	1.96GHz, Application Circuit
Saturated Drain Current	204	294	384	mA	$V_{DS}=V_{DSP}$, $V_{GS}=0V$
Transconductance	144	198	252	mS	$V_{DS}=V_{DSP}$, $V_{GS}=-0.25V$
Pinch-Off Voltage [1]	-3.0	-1.9	-1.0	V	$V_{DS}=2.0V$, $I_{DS}=0.6mA$
Gate-Source Breakdown Voltage [1]		-17	-15	V	$I_{GS}=1.2mA$, drain open
Gate-Drain Breakdown Voltage [1]		-22	-17	V	$I_{GD}=1.2mA$, $V_{GS}=-5.0V$
Thermal Resistance, (Junction - Lead)		80		°C/W	
Operating Voltage [3]			8.0	V	drain-source
Operating Current [3]			160	mA	drain-source, quiescent
Power Dissipation [3]			0.8	W	

Test Conditions: $V_{DS}=8V$, $I_{DQ}=100mA$ (unless otherwise noted) [1] 100% Tested - Insertion gain tested using a 50Ω contact board (no matching circuitry) during final production test. [2] Sample Tested - Samples pulled from each wafer/package lot. Sample test specifications are based on statistical data from sample test measurements. The test fixture is an engineering application circuit board. The application circuit was designed for the optimum combination of linearity, P_{1dB} and VSWR. [3] Maximum recommended power dissipation is specified to maintain $T_J<150°C$ at $T_L=85°C$. $V_{DS}*I_{DQ}<0.8W$ is recommended for continuous reliable operation.

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Absolute Maximum Ratings

Parameter	Rating	Unit
Drain Current (I_{DS})	200	mA
Forward Gate Current (I_{GSF})	1.2	mA
Reverse Gate Current (I_{GSR})	1.2	mA
Drain-to-Source Voltage (V_{DS})	+9.0	V
Gate-to-Source Voltage (V_{GS})	<-5 or >0	V
RF Input Power (P_{IN})	200	mW
Operating Lead Temperature (T_L)	See graph	°C
Storage Temperature Range (T_{stor})	-40 to +150	°C
Power Dissipation (P_{DISS})	See graph	W
Channel Temperature (T_J)	+165	°C
Moisture Sensitivity Level	MSL 2	

Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation, the device voltage and current must not exceed the maximum operating values specified in the table on page one.

MTTF is inversely proportional to the device junction temperature. MTTF at T_J=150°C exceeds 1E7 hours. For junction temperature. For junction temperature and MTTF considerations the bias condition should also satisfy the following expressions:

$P_{DC}<(T_J - T_L)/R_{TH}$ where $R_{DC}=I_{DS}*V_{DS}$(W), T_J=Junction Temperature (°C), T_L=Lead Temperature (pin 4) (°C), R_{TH}=Thermal Resistance (°C/W)

Caution! ESD sensitive device.

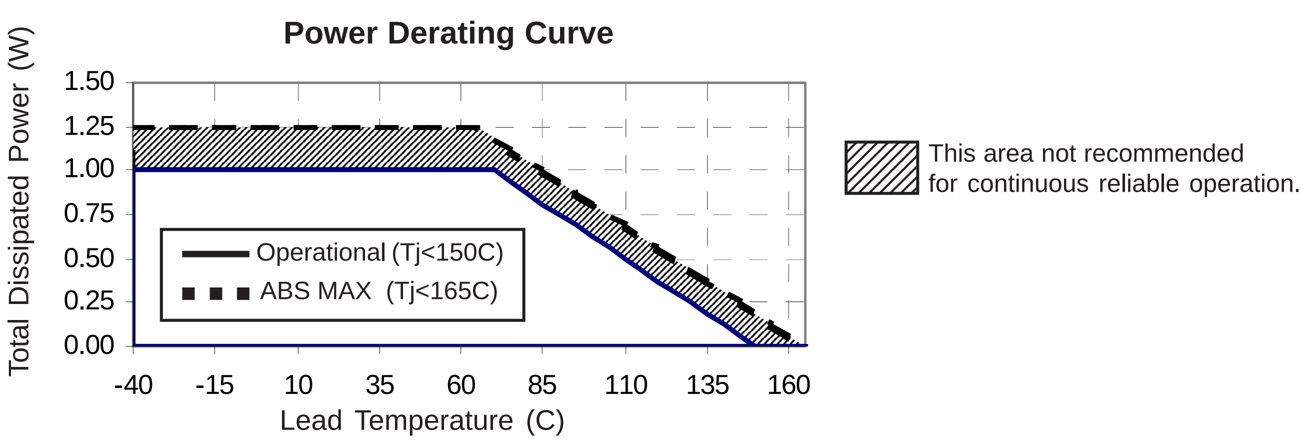
Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EU Directive 2002/95/EC (at time of this document revision).

Typical Performance with Engineering Application Circuits

Freq (MHz)	VDS (V)	IDQ (mA)	P1dB (dBm)	OIP3* (dBm)	Gain (dB)	S11 (dB)	S22 (dB)	NF (dB)
900	8	100	27.2	40	18.6	-25	-13	4.7
1960	8	100	27.6	40	16.7	-20	-8	3.2
2140	8	100	27.5	40	15.2	-24	-14	3.8
2450	8	100	27.3	40	15.2	-16	-14	3.1

*P_{OUT}=+15dBm per tone, 1MHz tone spacing



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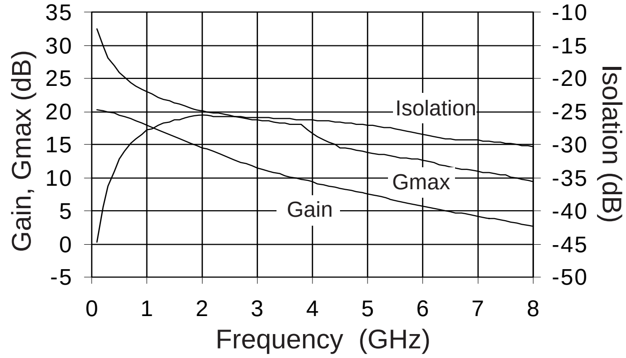
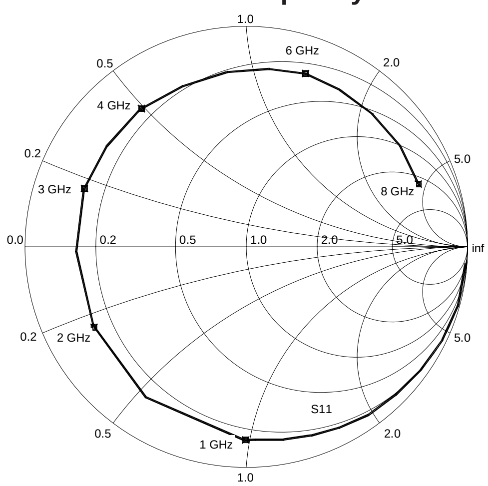
De-embedded S-Parameters (Z_S=Z_L=50 Ohms, V_{DS}=8V, I_{DS}=100mA, 25°C)

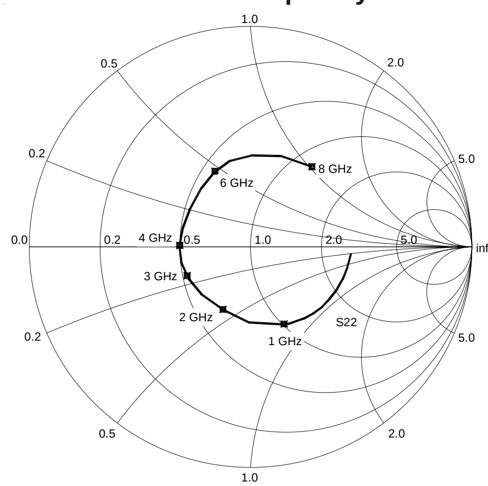
Gain & Isolation



S11 vs Frequency

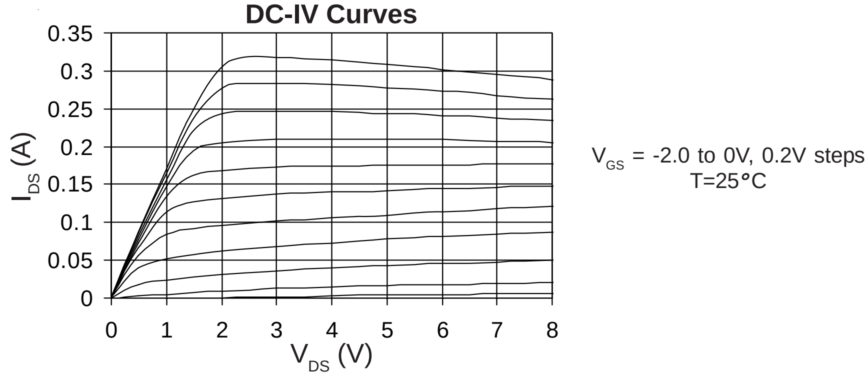


S22 vs Frequency



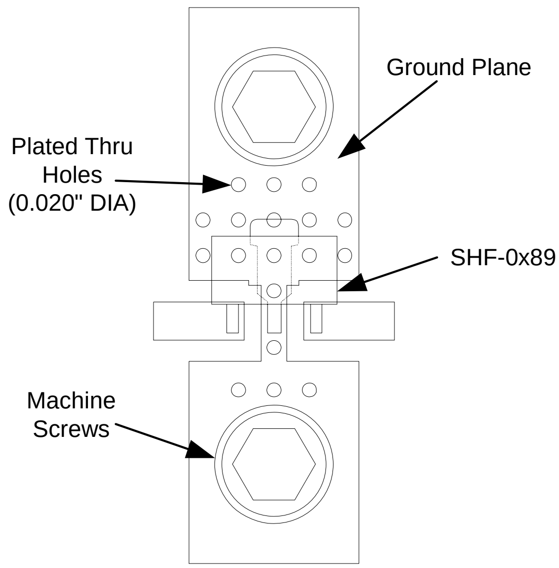
Note: S-parameters are de-embedded to the device leads with Z_S=Z_L=50Ω. The data represents typical performace of the device. De-embedded s-parameters can be downloaded from our website

DC-IV Curves



Pin	Function	Description
1	Gate	RF input.
2	Source	Connection to ground. Use via holes to reduce lead inductance. Place via holes as close to ground leads as possible.
3	Drain	RF output.
4	Source	Same as pin 2.

Recommended Mounting Configuration for Optimum RF and Thermal Performance



Mounting and Thermal Considerations

It is very important that adequate heat sinking be provided to minimize the device junction temperature. The following items should be implemented to maximize MTTF and RF performance.

1. Multiple solder-filled vias are required directly below the ground tab (pin 4). [CRITICAL]

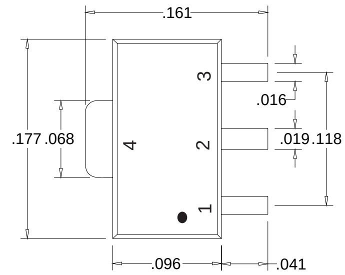
2. Incorporate a large ground pad area with multiple plated-through vias around pin 4 of the device. [CRITICAL]

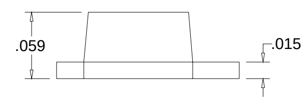
3. Use two point board seating to lower the thermal resistance between the PCB and mounting plate. Place machine screws as close to the ground tab (pin 4) as possible. [RECOMMENDED]

4. Use 2 ounce copper to improve the PCB's heat spreading capability. [RECOMMENDED]

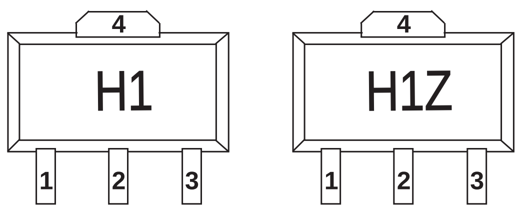
Package Drawing

Dimensions in inches (millimeters)
Refer to drawing posted at www.rfmd.com for tolerances.





Part Symbolization



Alternate marking is SHF0189 or SHF0189Z on line 1 with Trace Code on line 2.

Ordering Information

Part Number	Reel Size	Devices/Reel
SHF-0189	7”	1000
SHF-0189Z	7”	1000

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