NEC

S-BAND PARTIALLY MATCHED TWIN POWER GaAs MESFET

NES2427P-60

FEATURES

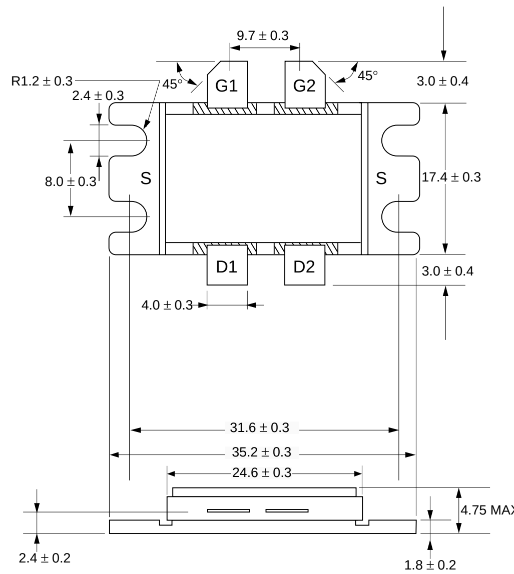
- **HIGH OUTPUT POWER:**
  60 W
- **LOW DISTORTION:**
  -45 dBc IM_3 at 36 dBm SCL
- **HIGH LINEAR GAIN:**
  12 dB
- **EFFICIENT LINEAR OPERATION:**
  6 A I_{DSQ} each side
- **WIDEBAND OPERATION:**
  2.5 to 2.7 GHz instantaneous bandwidth

DESCRIPTION

The NES2427P-60 is a 60 W twin GaAs MESFET with an internal matching network designed for High Power transmitter applications for MMDS systems. Its primary band is 2.5 to 2.7 GHz, but with different external matching, greater than 200 MHz of instantaneous bandwidth can be achieved anywhere from 2.1 to 2.8 GHz. The internal matching network provides partial matching, and an external circuit completes the match to 50 Ω and combines the two sides of the device in balanced or in push-pull configuration. The device contains four chips which employ 0.9 µm Tungsten Silicide gates, via holes, plated heat sink, and silicon dioxide passivation for superior performance, thermal characteristics, and reliability. This part is designed to be mass produced for low cost commercial applications.

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE T-92



G1, G2 : Gate
D1, D2 : Drain
S : Source

ELECTRICAL CHARACTERISTICS (T_C = 25°C)

	PART NUMBER / PACKAGE OUTLINE			NES2427P-60 / T-92			
	SYMBOLS	CHARACTERISTICS	UNITS	MIN	TYP	MAX	TEST CONDITIONS
Functional Characteristics	P_{1dB}	Power Out at 1 dB Gain Compression Point	dBm	47.0	48.0		V_{DS} = 10 V
	G_L	Linear Gain[1]	dB	10.0	12.0		f = 2.5 & 2.7 GHz
	η_{ADD}	Power-Added Efficiency at 1 dB Gain Compression	%		35		I_{DSQ} = 6.0 A (Each Side)
	I_{DSRF}	Drain-Source Current at 1 dB Gain Compression	A		16.0		R_G[2] = 5 Ω (Each Side)
	IM_3	3rd Order Intermodulation Distortion[2]	dBc		-45		P_{OUT} = 36 dBm/Tone
Electrical DC Characteristics	I_{DSS}	Saturated Drain Current, Each Side	A		18		V_{DS} = 2.5 V; V_{GS} = 0 V
	V_P	Pinch-off Voltage	V	-4.0	-2.1		V_{DS} = 2.5 V; I_{DS} = 84 mA (Each Side)
	R_{TH}	Channel-to-Flange, Total Thermal Resistance[3]	K/W		0.65	0.76	T_{CASE} = 25˚C, 10 V, 6.0 A (Each Side)

Notes:
1. Measured at P_{IN} = +32 dBm.
2. R_G is the series resistance between the gate supply and the FET gate.
3. To calculate R_{TH} versus T_F and T_{CH} (or P_{DISS}), see AN1032 "Microwave Power GaAs Device Thermal Resistance Basics" application note.

ABSOLUTE MAXIMUM RATINGS[1]

(T_C = 25 °C unless otherwise noted)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{DSO}	Drain to Source Voltage	V	15
V_{GDO}	Gate to Drain Voltage	V	-18
V_{GS}	Gate to Source Voltage	V	-7
I_{DS}	Drain Current	A	27 (Each Side)
I_{GS}	Gate Current	mA	±180 (Each Side)
P_T	Total Power Dissipation[2]	W	200
T_{CH}	Channel Temperature	°C	175
T_{STG}	Storage Temperature	°C	-65 to +175

Notes:
1. Operation in excess of any one of these parameters may result in permanent damage.
2. T_C = 25°C

RECOMMENDED OPERATING LIMITS

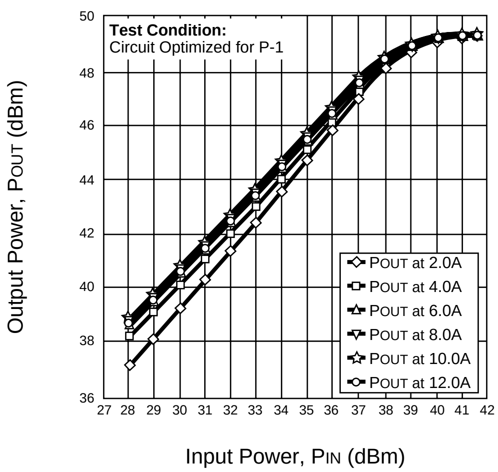
(Recommended operating conditions for reliable operation, i.e. > 10^6 hrs MTTF)

SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V_{DS}	Drain to Source Voltage	V		10.0	10.0
T_{CH}	Channel Temperature	˚C			150
G_{COMP}	Gain Compression	dB			3.0
Rg[1]	Gate Resistance	Ω	3	5	10 (Each Side)
I_{DSQ}	Drain Current (RF OFF)	A			6.0 (Each Side)

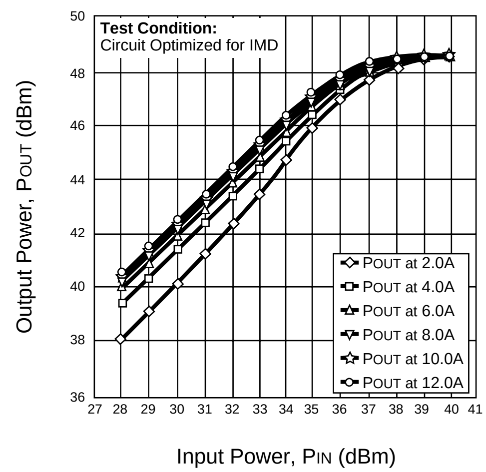
Note:
1. R_G is the series resistance between the gate supply and the FET gate.

TYPICAL PERFORMANCE CURVES IN A 2.5-2.7 GHz INSTANTANEOUS BANDWIDTH CIRCUIT (V_{DS} = 10.0 V and T_C = 25°C)

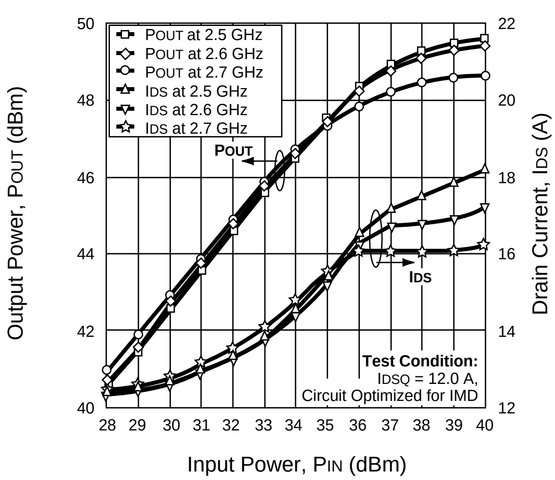
OUTPUT POWER vs. INPUT POWER AND I_{DSQ} AT 2.7 GHz



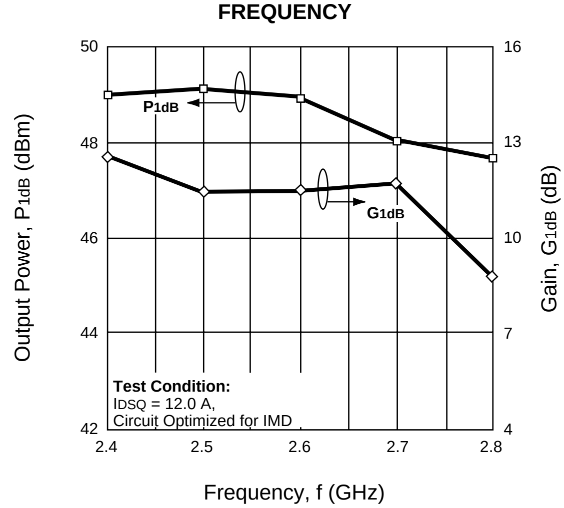
OUTPUT POWER vs. INPUT POWER AND I_{DSQ} AT 2.7 GHz



OUTPUT POWER AND I_{DS} vs. INPUT POWER AND FREQUENCY

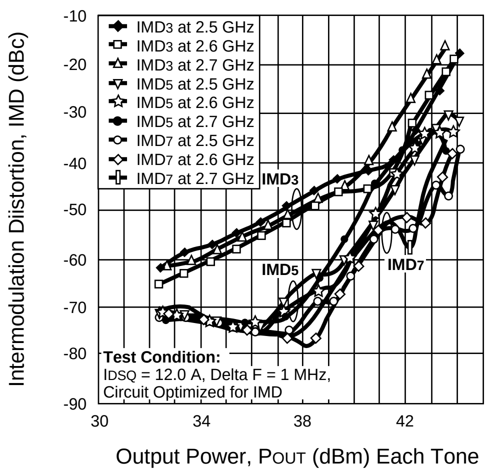


OUTPUT POWER AND GAIN AT 1dB COMPRESSION POINT vs. FREQUENCY

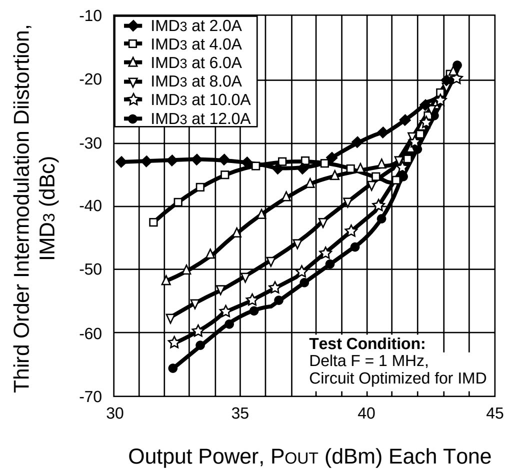


TYPICAL PERFORMANCE CURVES
IN A 2.5-2.7 GHz INSTANTANEOUS BANDWIDTH CIRCUIT (VDS = 10.0 V and TCASE = 25°C)

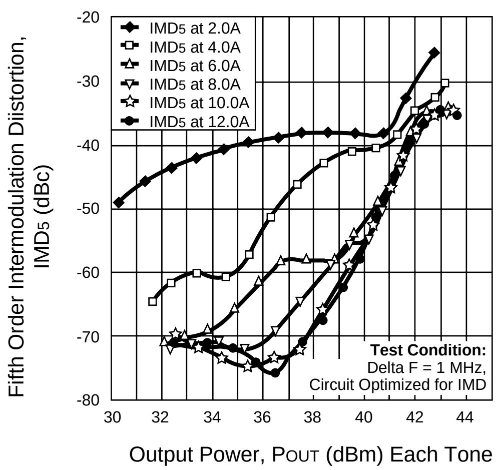
INTERMODULATION DISTORTION vs. OUTPUT POWER AND FREQUENCY



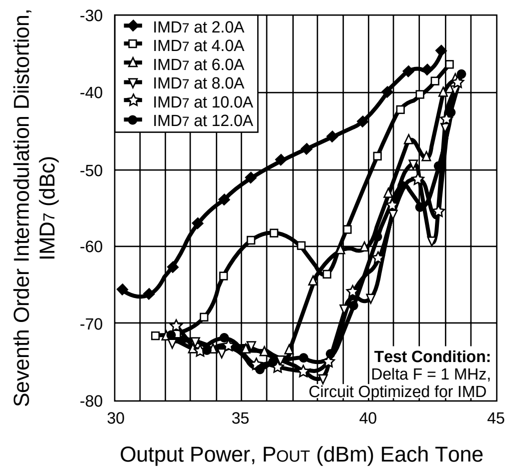
THIRD ORDER INTERMODULATION DISTORTION vs. IDSQ AND OUTPUT POWER AT 2.7 GHz



FIFTH ORDER INTERMODULATION DISTORTION vs. IDSQ AND OUTPUT POWER AT 2.7 GHz



SEVENTH ORDER INTERMODULATION DISTORTION vs. IDSQ AND OUTPUT POWER AT 2.7 GHz



TYPICAL SCATTERING PARAMETERS, (FOR EACH SIDE)

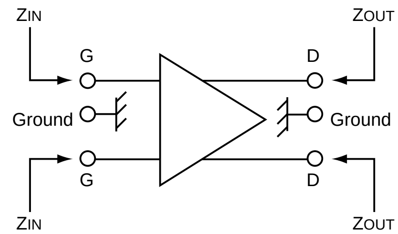
V_{DS} = 10 V, I_{DS} = 6.0 A, Z_O = 50 Ω, T_F = 25°C

FREQUENCY	S11		S21		S12		S22	
(GHz)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)
1.5	0.916	146.9	0.753	-19.8	0.005	-27.9	0.900	161.7
1.6	0.890	141.1	0.902	-30.9	0.006	-38.8	0.889	159.8
1.7	0.849	133.2	1.120	-44.2	0.008	-54.8	0.873	157.6
1.8	0.778	121.6	1.410	-59.0	0.010	-79.7	0.867	156.9
1.9	0.644	103.3	1.904	-78.7	0.013	-103.6	0.868	153.5
2.0	0.399	69.5	2.536	-105.8	0.017	-138.4	0.846	148.9
2.1	0.237	-32.3	3.116	-139.7	0.023	179.7	0.788	143.1
2.2	0.516	-110.0	3.191	-175.5	0.026	136.4	0.687	139.3
2.3	0.733	-141.2	2.949	154.9	0.027	99.2	0.586	139.5
2.4	0.833	-159.9	2.710	130.7	0.028	70.2	0.507	142.7
2.5	0.872	-173.6	2.622	109.1	0.031	45.7	0.438	147.6
2.6	0.870	174.6	2.673	87.7	0.035	21.8	0.380	158.7
2.7	0.798	162.9	2.783	63.5	0.041	-4.6	0.378	175.1
2.8	0.664	152.3	2.953	36.6	0.048	-32.7	0.469	-170.2
2.9	0.451	148.1	3.039	5.0	0.055	-65.2	0.645	-169.1
3.0	0.309	175.3	2.795	-29.2	0.055	-100.1	0.793	-178.9
3.1	0.426	-160.7	2.334	-60.2	0.049	-129.5	0.825	169.7
3.2	0.587	-161.7	1.890	-86.7	0.043	-154.2	0.808	160.9
3.3	0.692	-169.1	1.550	-109.8	0.038	-175.9	0.760	153.4
3.4	0.742	-178.6	1.319	-130.9	0.033	168.2	0.711	147.0
3.5	0.738	171.0	1.182	-153.3	0.031	154.8	0.661	138.4

HALF (EACH SIDE) DEVICE OPTIMAL INPUT AND OUTPUT IMPEDANCES

(V_{DS} = 10 V and I_{DS} = 6.0 A half of the device)

$Z_{IN} = R_{IN} + jX_{IN}$ (Conjugate of source impedance).
$Z_{OUT} = R_{OUT} + jX_{OUT}$ (Conjugate of load impedance).
Z_{IN} is the optimal gate-to-ground input impedance of half of the device.
Z_{OUT} is the optimal drain-to-ground output impedance of half of the device.
The input circuit is optimized for the input return loss.



Frequency (GHz)	R_{IN} (Ohm)	X_{IN} (Ohm)	R_{OUT} (Ohm)	X_{OUT} (Ohm)
2.4	4.9	-9.1	17.2	16.4
2.5	4.0	-4.2	21.9	12.3
2.6	8.0	1.7	18.4	10.1
2.7	6.7	-2.4	16.8	11.1

The output circuit is optimized for IMD_3 when the output power is 37 dBm each tone for half the device.

Frequency (GHz)	R_{IN} (Ohm)	X_{IN} (Ohm)	R_{OUT} (Ohm)	X_{OUT} (Ohm)
2.4	5.0	-8.7	21.6	9.5
2.5	3.9	-4.9	17.7	5.8
2.6	4.8	-1.7	15.9	3.1
2.7	5.4	3.0	13.5	3.6
2.8	5.9	2.7	11.3	4.0

The output circuit is optimized for the output power at 1dB gain compression.

NES2427P-60 BALANCED TEST FIXTURE (2.5 - 2.7 GHz) OPTIMIZED FOR IMD

(Artwork available from CEL engineering)