CEL

NEC's 10 W L & S-BAND POWER GaAs MESFET

NE650103M

FEATURES

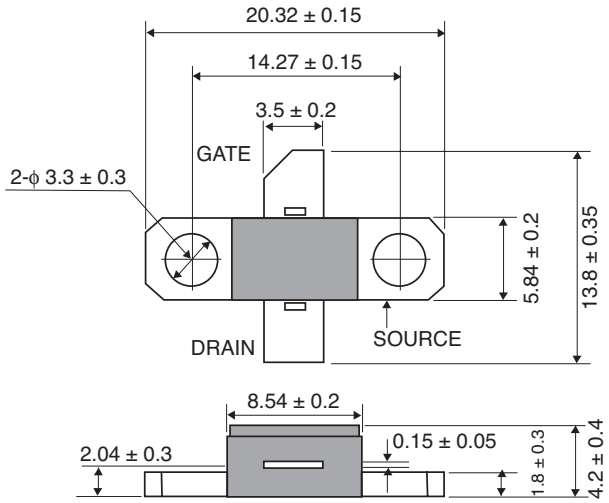
- **LOW COST PLASTIC PACKAGE**
- **USABLE TO 2.7 GHz:**
  PCS, W-CDMA, WLL, Satellite Uplink, BWA
- **HIGH OUTPUT POWER:**
  40 dBm TYP
- **HIGH POWER ADDED EFFICIENCY:**
  45 % TYP at 2.3 GHz
- **LOW THERMAL RESISTANCE:**
  4.0° C/W
- **LEAD-FREE**

DESCRIPTION

NEC's NE650103M is a 10 W GaAs MESFET designed for PCS, W-CDMA, WLL transmitter applications. It is capable of delivering 10 Watts of output power with high linear gain, high efficiency and excellent linearity. Reliability and performance uniformity are assured by NEC's stringent quality and control procedures

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE 3M



ELECTRICAL CHARACTERISTICS (T_C = 25°C)

PART NUMBER / PACKAGE OUTLINE				NE650103M 3M			
	SYMBOLS	CHARACTERISTICS	UNITS	MIN	TYP	MAX	TEST CONDITIONS
Functional Characteristics	P_{1dB}	Power Out at 1dB Gain Compression	dBm	39.0	40.0		f = 2.3 GHz, V_{DS} = 10.0 V Rg = 100 Ω I_{DSQ} ≤ 1.5 A (RF OFF)
	G_L	Linear Gain (at Pin ≤ 23 dBm)	dB	10.0	11.0		
	η_{ADD}	Power Added Efficiency	%		45		
Electrical DC Characteristics	I_{DSS}	Saturated Drain Current	A	2.0	5.0	7.0	V_{DS} = 2.5 V; V_{GS} = 0 V
	V_P	Pinch-Off Voltage	V	-4.0	-2.5	-1.0	V_{DS} = 2.5 V; I_{DS} = 23 mA
	R_{TH}	Thermal Resistance	°C/W		4.0	4.5	Channel to Case

ABSOLUTE MAXIMUM RATINGS[1] (T_C = 25 °C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{DS}	Drain to Source Voltage	V	15
V_{GD}	Gate to Drain Voltage	V	-18
V_{GS}	Gate to Source Voltage	V	-7.0
I_{DS}	Drain Current	A	5
I_{GF}	Gate Current	mA	45
P_T	Total Power Dissipation	W	33
T_{CH}	Channel Temperature	°C	175
T_{STG}	Storage Temperature	°C	-65 to +150

Note:
1. Operation in excess of any one of these parameters may result in permanent damage.

RECOMMENDED OPERATING LIMITS

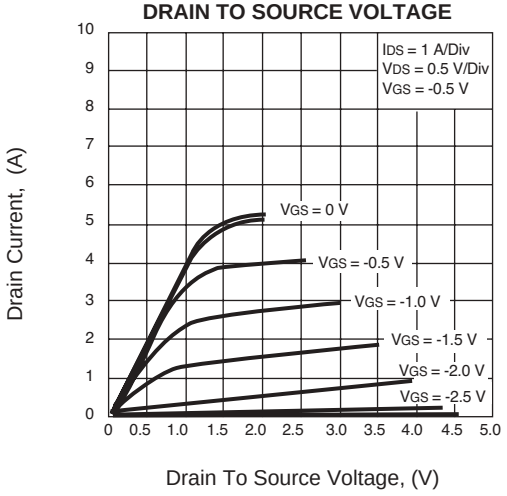
SYMBOLS	PARAMETERS	UNITS	TYP	MAX
V_{DS}	Drain to Source Voltage	V	10.0	10.0
T_{CH}	Channel Temperature	°C		150
G_{COMP}	Gain Compression	dB		3.0
R_g	Gate Resistance	Ω		100

ORDERING INFORMATION

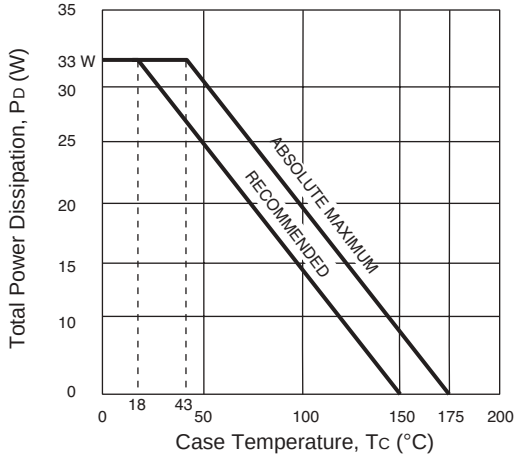
PART NUMBER	PACKAGE
NE650103M	3M

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

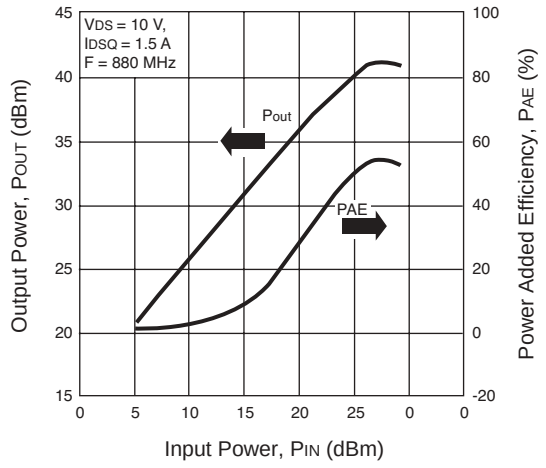


TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

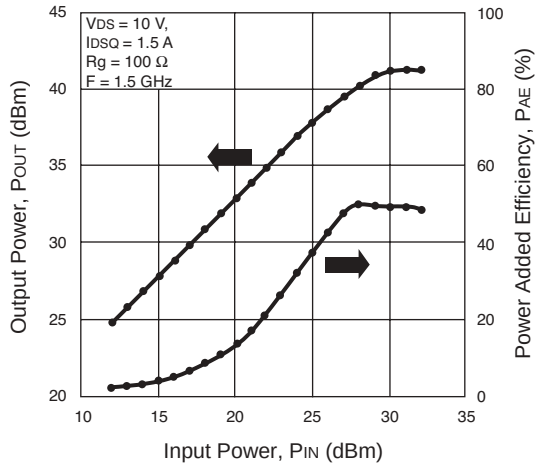


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

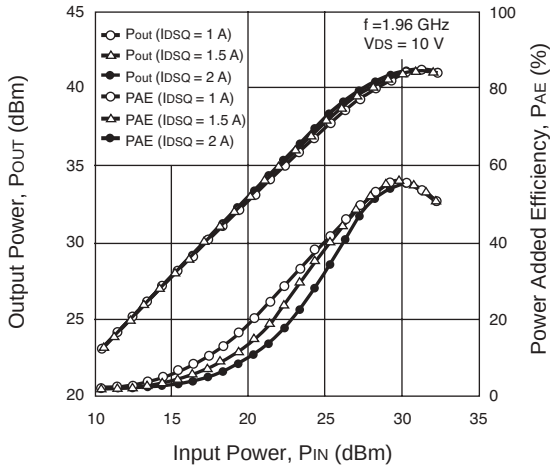
OUTPUT POWER AND POWER ADDED EFFICIENCY



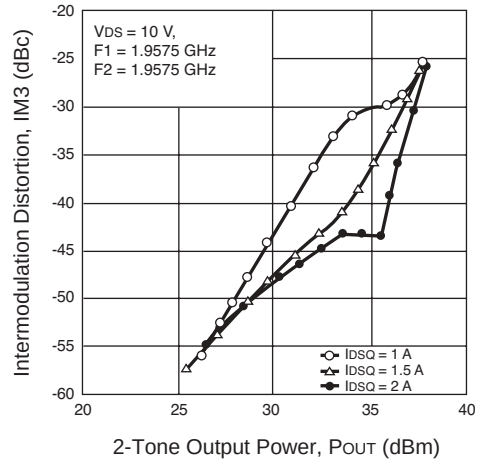
OUTPUT POWER AND POWER ADDED EFFICIENCY

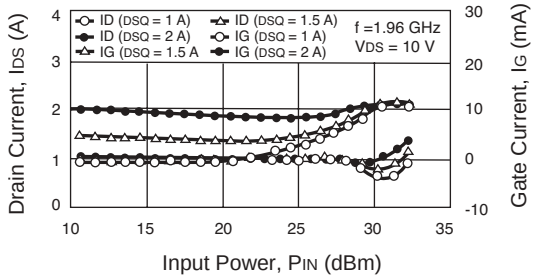


OUTPUT POWER AND POWER ADDED EFFICIENCY



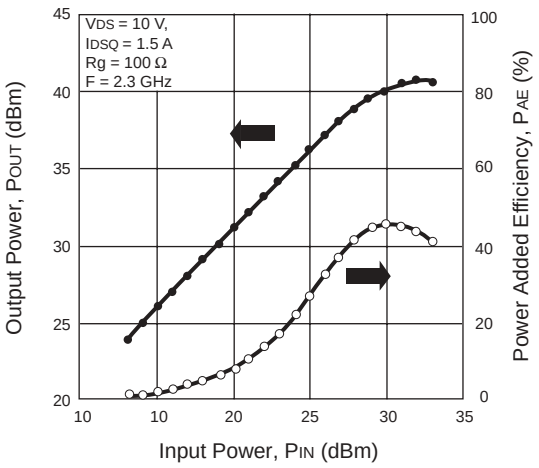
THIRD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER



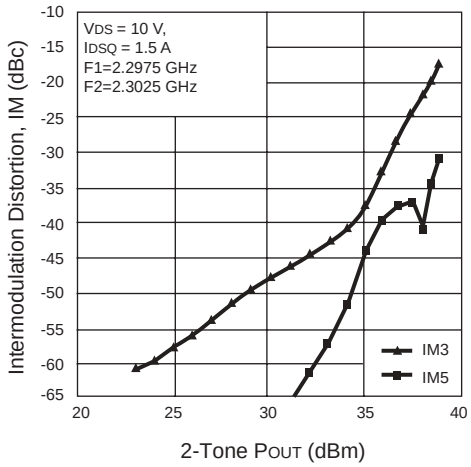


TYPICAL PERFORMANCE CURVES (T_A = 25°C)

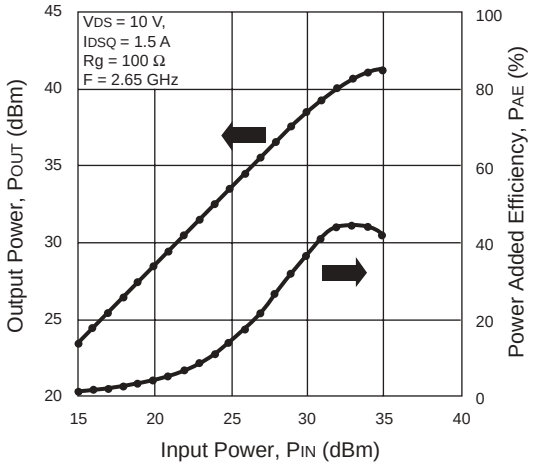
OUTPUT POWER AND POWER ADDED EFFICIENCY



INTERMODULATION DISTORTION vs. OUTPUT POWER



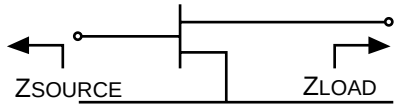
OUTPUT POWER AND POWER ADDED EFFICIENCY



LARGE SIGNAL IMPEDANCES

(V_{DS} = 10 V, I_{DSQ} = 1.5 A)

f (GHz)	Z_{SOURCE} (Ω)	Z_{LOAD} (Ω)
1.45	4.96 - j3.16	5.60 - j5.02
1.50	3.97 - j2.10	4.94 - j3.49
1.55	2.99 - j1.0	4.32 - j2.22
2.57	2.71 + j0.23	5.50 - j5.58
2.60	2.64 + j0.75	5.36 - j5.07
2.63	2.54 + j1.26	5.16 - j4.59



Z_{SOURCE} = Impedance of the input circuit as seen by the Gate
Z_{LOAD} = Impedance of the output circuit as seen by the Drain

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

NE650103M

V_{DS} = 10 V, I_{DS} = 1.5 A

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.500	0.950	-166.801	3.606	95.956	0.012	37.157	0.793	177.824
0.550	0.948	-168.706	3.254	96.181	0.012	40.003	0.793	177.500
0.600	0.948	-170.446	2.975	94.737	0.012	40.653	0.792	176.943
0.650	0.949	-171.829	2.764	94.806	0.013	43.353	0.791	176.613
0.700	0.948	-173.218	2.567	93.386	0.013	44.351	0.791	176.249
0.750	0.948	-174.376	2.371	94.237	0.013	47.341	0.790	175.759
0.800	0.947	-175.359	2.237	92.721	0.013	47.348	0.791	175.507
0.850	0.946	-176.410	2.114	93.772	0.014	51.122	0.790	175.214
0.900	0.947	-177.310	1.946	91.986	0.014	50.382	0.789	174.632
0.950	0.946	-178.122	1.908	94.011	0.014	54.063	0.790	174.326
1.000	0.945	-178.884	1.754	92.389	0.014	54.549	0.788	174.018
1.050	0.945	-179.680	1.726	93.634	0.015	56.452	0.790	173.560
1.100	0.944	179.680	1.619	92.849	0.015	58.370	0.788	173.352
1.150	0.946	179.018	1.587	93.493	0.015	59.352	0.788	172.912
1.200	0.944	178.494	1.520	92.255	0.016	60.851	0.789	172.696
1.250	0.946	177.696	1.474	93.864	0.016	63.069	0.789	172.332
1.300	0.945	177.377	1.418	90.651	0.016	63.459	0.788	172.058
1.350	0.943	176.713	1.372	93.609	0.017	66.542	0.789	171.750
1.400	0.946	176.203	1.314	90.644	0.016	66.628	0.788	171.399
1.450	0.945	175.694	1.305	92.051	0.017	68.207	0.790	171.112
1.500	0.946	175.206	1.232	90.661	0.017	71.154	0.789	170.825
1.550	0.943	174.704	1.197	90.751	0.018	71.630	0.789	170.545
1.600	0.944	174.267	1.171	90.113	0.018	73.962	0.791	170.233
1.650	0.947	173.803	1.116	91.168	0.018	75.812	0.790	169.870
1.700	0.945	173.482	1.099	88.995	0.018	75.292	0.790	169.605
1.750	0.941	173.181	1.057	90.847	0.020	79.421	0.787	169.410
1.800	0.942	172.614	0.984	90.126	0.018	78.550	0.788	168.907
1.850	0.943	172.143	1.064	91.207	0.021	80.963	0.790	168.664
1.900	0.943	171.848	0.946	89.272	0.019	83.259	0.787	168.308
1.950	0.941	171.587	0.954	90.467	0.021	83.928	0.789	167.842
2.000	0.941	170.947	0.938	91.322	0.021	84.768	0.787	167.763
2.050	0.941	170.731	0.926	90.115	0.022	87.503	0.787	167.195
2.100	0.940	170.251	0.867	88.345	0.022	84.489	0.788	166.953
2.150	0.943	169.966	0.889	94.627	0.024	90.596	0.788	166.278
2.200	0.940	169.653	0.850	87.056	0.023	85.732	0.789	166.119
2.250	0.937	169.091	0.861	93.588	0.025	91.344	0.787	165.605
2.300	0.941	168.801	0.800	87.432	0.023	87.688	0.788	165.134
2.350	0.940	168.429	0.811	92.862	0.025	91.528	0.789	164.845
2.400	0.938	167.943	0.804	90.651	0.025	89.490	0.788	164.526
2.450	0.936	167.735	0.774	92.677	0.025	95.790	0.789	164.073
2.500	0.934	167.016	0.798	86.676	0.026	88.876	0.790	163.916
2.550	0.936	166.910	0.717	97.704	0.026	99.096	0.787	163.497
2.600	0.931	166.433	0.810	84.892	0.025	90.685	0.788	162.977
2.650	0.932	165.903	0.714	93.323	0.028	99.262	0.787	162.952
2.700	0.933	165.503	0.722	87.855	0.025	96.290	0.788	162.439
2.750	0.928	165.138	0.729	91.627	0.028	98.301	0.787	162.298
2.800	0.931	164.518	0.718	88.300	0.027	100.075	0.785	161.656
2.850	0.929	164.260	0.654	90.099	0.027	101.006	0.787	161.336
2.900	0.926	163.713	0.726	88.885	0.028	100.851	0.783	161.071
2.950	0.926	163.395	0.628	91.463	0.028	107.334	0.782	160.580
3.000	0.919	162.849	0.673	87.232	0.027	102.471	0.781	160.196

Note:

1. Gain Calculations:

MAG = $\frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right)$. When K ≤ 1, MAG is undefined and MSG values are used. MSG = $\frac{|S_{21}|}{|S_{12}|}$, K = $\frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}\,S_{21}|}$, $\Delta = S_{11}\,S_{22} - S_{21}\,S_{12}$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

NE650103M
V_{DS} = 12 V, I_{DS} = 1.5 A

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.50	0.953	-165.8	3.860	95.8	0.010	31.4	0.754	179.0
0.55	0.954	-167.4	3.516	96.4	0.010	32.0	0.755	178.5
0.60	0.954	-168.9	3.201	94.9	0.010	34.3	0.756	178.2
0.65	0.954	-170.2	3.003	95.1	0.010	35.7	0.755	178.0
0.70	0.955	-171.3	2.775	93.8	0.011	37.5	0.754	177.7
0.75	0.953	-172.3	2.566	94.6	0.011	37.8	0.754	177.4
0.80	0.951	-173.3	2.442	92.9	0.011	40.9	0.755	177.2
0.85	0.953	-174.3	2.281	94.5	0.011	41.2	0.755	176.9
0.90	0.951	-175.0	2.132	92.1	0.011	43.1	0.755	176.6
0.95	0.952	-175.7	2.062	94.7	0.011	47.8	0.755	176.4
1.00	0.954	-176.2	1.932	92.5	0.011	46.6	0.756	176.1
1.05	0.953	-176.7	1.876	93.7	0.011	51.1	0.755	175.9
1.10	0.954	-177.4	1.797	93.2	0.011	50.5	0.756	175.8
1.15	0.952	-177.8	1.723	93.3	0.012	53.5	0.756	175.4
1.20	0.949	-178.4	1.675	92.4	0.012	54.7	0.756	175.4
1.25	0.952	-178.9	1.608	93.4	0.012	57.7	0.757	175.1
1.30	0.95	-179.2	1.559	90.8	0.012	56.6	0.758	174.8
1.35	0.952	-179.8	1.500	92.6	0.013	60.4	0.756	174.6
1.40	0.954	179.9	1.433	90.5	0.012	60.9	0.755	174.2
1.45	0.951	179.6	1.428	91.1	0.013	61.7	0.757	174.0
1.50	0.951	179.0	1.330	90.2	0.013	65.5	0.757	173.7
1.55	0.951	178.7	1.315	89.8	0.013	65.0	0.757	173.3
1.60	0.949	178.4	1.254	89.9	0.013	66.5	0.758	173.1
1.65	0.953	178.0	1.209	90.6	0.013	69.5	0.757	172.6
1.70	0.951	177.8	1.182	88.6	0.013	72.2	0.758	172.4
1.75	0.949	177.4	1.141	91.1	0.014	70.3	0.758	172.0
1.80	0.952	177.0	1.060	89.1	0.014	76.5	0.759	171.8
1.85	0.951	176.7	1.142	92.1	0.014	74.7	0.76	171.7
1.90	0.948	176.3	1.021	89.1	0.015	78.3	0.759	171.3
1.95	0.951	175.9	1.024	91.2	0.014	79.4	0.76	171.0
2.00	0.951	175.7	1.020	91.5	0.015	79.7	0.759	170.9
2.05	0.95	175.3	0.995	90.8	0.015	79.8	0.759	170.5
2.10	0.953	175.0	0.963	88.6	0.016	82.9	0.763	170.4
2.15	0.951	174.8	0.956	94.9	0.015	81.1	0.759	170.0
2.20	0.947	174.3	0.947	86.9	0.017	84.6	0.76	169.7
2.25	0.95	174.0	0.934	93.5	0.015	88.7	0.76	169.3
2.30	0.948	173.8	0.895	87.5	0.017	85.4	0.759	169.1
2.35	0.948	173.2	0.880	91.5	0.016	91.6	0.76	169.0
2.40	0.952	173.2	0.894	90.3	0.017	90.5	0.756	168.4
2.45	0.946	172.8	0.845	90.5	0.016	94.2	0.758	167.8
2.50	0.947	172.2	0.887	86.2	0.019	90.3	0.757	167.8
2.55	0.944	172.0	0.778	94.2	0.018	101.1	0.756	167.0
2.60	0.94	171.5	0.889	84.5	0.018	88.5	0.756	166.6
2.65	0.943	171.0	0.773	90.5	0.020	100.4	0.754	166.2
2.70	0.944	170.8	0.777	86.5	0.017	95.2	0.754	165.6
2.75	0.939	170.5	0.785	89.9	0.020	96.1	0.752	165.2
2.80	0.941	169.8	0.761	86.9	0.019	98.1	0.75	164.6
2.85	0.938	169.5	0.707	88.1	0.020	100.5	0.751	164.2
2.90	0.931	169.0	0.765	88.3	0.019	97.2	0.746	163.8
2.95	0.932	168.4	0.675	90.0	0.021	103.4	0.746	163.0
3.00	0.932	168.1	0.718	86.3	0.018	104.3	0.743	162.9

Note:

1. Gain Calculations:

MAG = $\frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right)$. When K ≤ 1, MAG is undefined and MSG values are used. MSG = $\frac{|S_{21}|}{|S_{12}|}$, K = $\frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2\,|S_{12}\,S_{21}|}$, $\Delta = S_{11}\,S_{22} - S_{21}\,S_{12}$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain