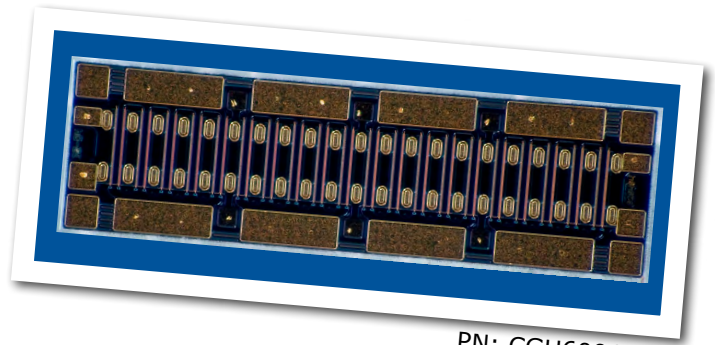


# CGH60060D

**60 W, 6.0 GHz, GaN HEMT Die**

Cree's CGH60060D is a gallium nitride (GaN) High Electron Mobility Transistor (HEMT). GaN has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity, and higher thermal conductivity. GaN HEMTs offer greater power density and wider bandwidths compared to Si and GaAs transistors.



PN: CGH60060D

## FEATURES

- 13 dB Typical Small Signal Gain at 4 GHz
- 12 dB Typical Small Signal Gain at 6 GHz
- 60 W Typical  $P_{SAT}$
- 28 V Operation
- High Breakdown Voltage
- High Temperature Operation
- Up to 6 GHz Operation
- High Efficiency

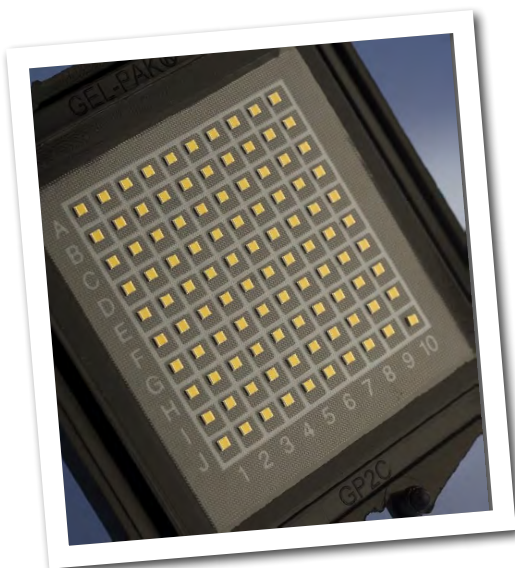
## APPLICATIONS

- 2-Way Private Radio
- Broadband Amplifiers
- Cellular Infrastructure
- Test Instrumentation
- Class A, AB, Linear amplifiers suitable for OFDM, W-CDMA, EDGE, CDMA waveforms



## Packaging Information

- Bare die are shipped in Gel-Pak® containers.
- Non-adhesive tacky membrane immobilizes die during shipment.



Large Signal Models Available for SiC & GaN



## Absolute Maximum Ratings (not simultaneous) at 25 °C

Parameter	Symbol	Rating	Units	Conditions
Drain-source Voltage	$V_{DS}$	84	VDC	25 °C
Gate-source Voltage	$V_{GS}$	-10, +2	VDC	25 °C
Storage Temperature	$T_{STG}$	-65, +150	°C	
Operating Junction Temperature	$T_J$	225	°C	
Maximum Forward Gate Current	$I_{GMAX}$	15	mA	25 °C
Maximum Drain Current <sup>1</sup>	$I_{DMAX}$	6	A	25 °C
Thermal Resistance, Junction to Case (packaged) <sup>2</sup>	$R_{\theta JC}$	2.8	°C/W	
Thermal Resistance, Junction to Case (die only)	$R_{\theta JC}$	1.5	°C/W	85 °C
Mounting Temperature (30 seconds)	$T_S$	320	°C	30 seconds

Note<sup>1</sup> Current limit for long term, reliable operation

Note<sup>2</sup> Eutectic die attach using 80/20 AuSn mounted to a 60 mil thick CuMoCu carrier.

## Electrical Characteristics (Frequency = 4 GHz unless otherwise stated; $T_C = 25 °C$ )

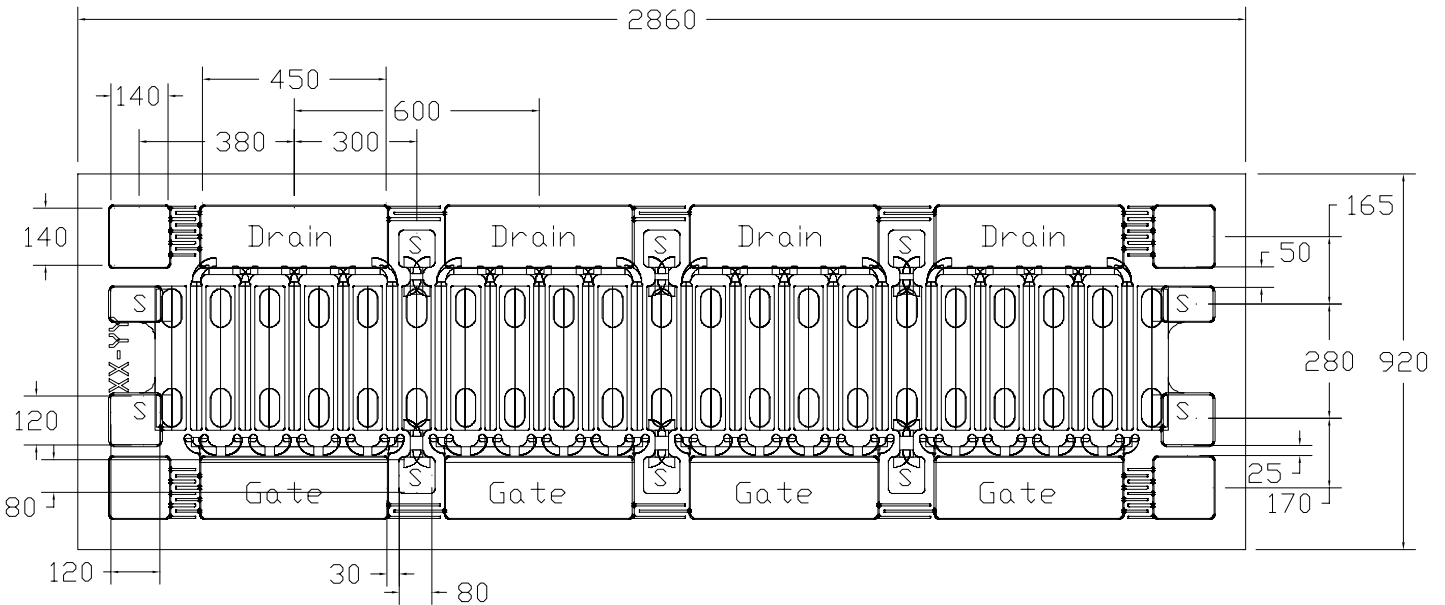
Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>DC Characteristics</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	-3.8	-3.0	-2.3	V	$V_{DS} = 10 V, I_D = 14.4 mA$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-2.7	-	V <sub>DC</sub>	$V_{DD} = 28 V, I_{DQ} = 400 mA$
Drain Current	$I_{DS}$	11.6	14.0	-	A	$V_{DS} = 6.0 V, V_{GS} = 2.0 V$
Drain-Source Breakdown Voltage	$V_{BD}$	120	-	-	V	$V_{GS} = -8 V, I_D = 14.4 mA$
On Resistance	$R_{ON}$	-	0.25	-	Ω	$V_{DS} = 0.1 V$
Gate Forward Voltage	$V_{G-ON}$	-	1.9	-	V	$I_{GS} = 14.4 mA$
<b>RF Characteristics</b>						
Small Signal Gain	$G_{SS}$	-	13	-	dB	$V_{DD} = 28 V, I_{DQ} = 400 mA$
Saturated Power Output <sup>1</sup>	$P_{SAT}$	-	60	-	W	$V_{DD} = 28 V, I_{DQ} = 400 mA$
Drain Efficiency <sup>2</sup>	$\eta$	-	65	-	%	$V_{DD} = 28 V, I_{DQ} = 400 mA, P_{SAT} = 60 W$
Intermodulation Distortion <sup>3</sup>	IM3	-	-30	-	dBc	$V_{DD} = 28 V, I_{DQ} = 400 mA,$ $P_{OUT} = 60 W PEP$
Output Mismatch Stress	VSWR	-	-	10 : 1	Ψ	No damage at all phase angles, $V_{DD} = 28 V, I_{DQ} = 400 mA,$ $P_{OUT} = 60 W CW$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{GS}$	-	17.0	-	pF	$V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz$
Output Capacitance	$C_{DS}$	-	3.5	-	pF	$V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz$
Feedback Capacitance	$C_{GD}$	-	0.8	-	pF	$V_{DS} = 28 V, V_{gs} = -8 V, f = 1 MHz$

### Notes:

<sup>1</sup>  $P_{SAT}$  is defined as  $I_G = 1.4 mA$ .

<sup>2</sup> Drain Efficiency =  $P_{OUT} / P_{DC}$ .

## DIE Dimensions (units in microns)



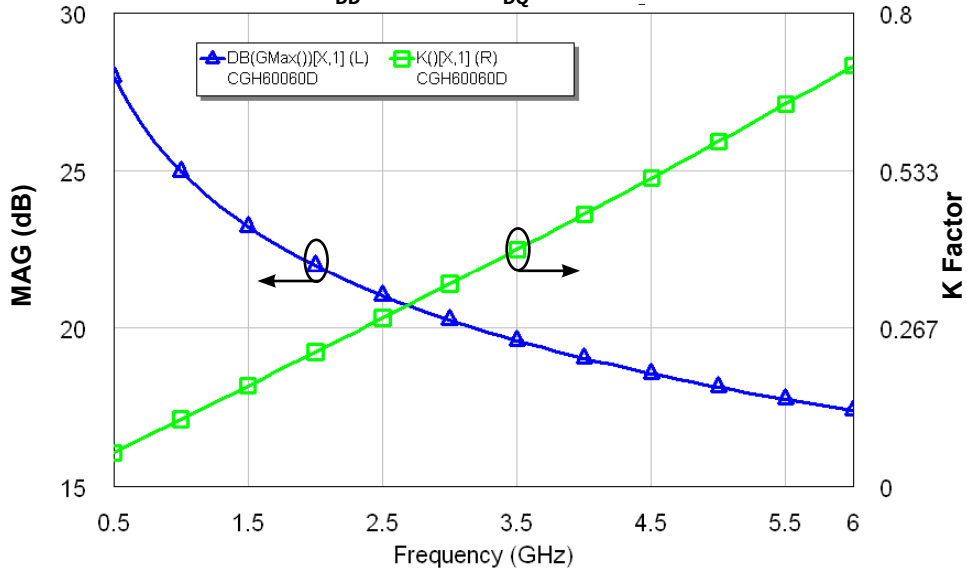
Overall die size 2860 x 920 (+0/-50) microns, die thickness 100 (+/- 10) microns.  
All Gate and Drain pads must be wire bonded for electrical connection.

### Assembly Notes:

- Recommended solder is AuSn (80/20) solder. Refer to Cree's website for the Eutectic Die Bond Procedure application note at [http://www.cree.com/products/wireless\\_documents.asp](http://www.cree.com/products/wireless_documents.asp)
- Vacuum collet is the preferred method of pick-up.
- The backside of the die is the Source (ground) contact.
- Die back side gold plating is 5 microns thick minimum.
- Thermosonic ball or wedge bonding are the preferred connection methods.
- Gold wire must be used for connections.
- Use the die label (XX-YY) for correct orientation.

## Typical Performance

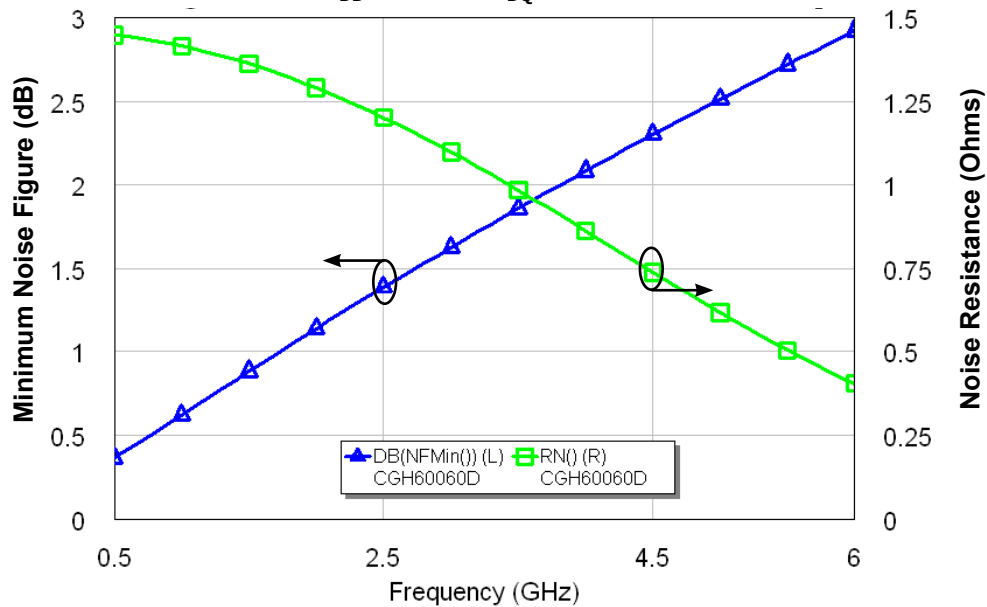
**Simulated Maximum Available Gain and K Factor of the CGH60060D**  
 $V_{DD} = 28\text{ V}, I_{DQ} = 400\text{ mA}$



Intrinsic die parameters - reference planes at centers of gate and drain bonding pads. No wire bonds assumed.

## Typical Noise Performance

**Simulated Minimum Noise Figure and Noise Resistance vs Frequency of the CGH60060D**  
 $V_{DD} = 28\text{ V}, I_{DQ} = 400\text{ mA}$





**Typical Die S-Parameters (Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 400\text{ mA}$ , magnitude / angle)**

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.958	-168.55	7.79	88.19	0.012	-1.00	0.654	-172.20
600 MHz	0.958	-170.42	6.48	85.81	0.012	-3.22	0.657	-172.35
700 MHz	0.958	-171.76	5.54	83.69	0.012	-5.16	0.661	-172.29
800 MHz	0.959	-172.76	4.83	81.75	0.012	-6.94	0.664	-172.13
900 MHz	0.959	-173.54	4.28	79.93	0.012	-8.59	0.668	-171.90
1.0 GHz	0.959	-174.16	3.83	78.20	0.012	-10.15	0.672	-171.63
1.1 GHz	0.960	-174.67	3.47	76.54	0.012	-11.65	0.676	-171.34
1.2 GHz	0.960	-175.09	3.16	74.94	0.012	-13.09	0.681	-171.05
1.3 GHz	0.960	-175.45	2.90	73.38	0.012	-14.48	0.686	-170.76
1.4 GHz	0.961	-175.76	2.68	71.86	0.012	-15.83	0.691	-170.47
1.5 GHz	0.961	-176.03	2.48	70.38	0.012	-17.15	0.696	-170.20
1.6 GHz	0.962	-176.27	2.31	68.93	0.012	-18.43	0.701	-169.95
1.7 GHz	0.962	-176.48	2.16	67.51	0.012	-19.68	0.706	-169.71
1.8 GHz	0.963	-176.67	2.02	66.13	0.012	-20.91	0.712	-169.49
1.9 GHz	0.963	-176.84	1.90	64.77	0.011	-22.10	0.718	-169.29
2.0 GHz	0.964	-177.00	1.79	63.43	0.011	-23.27	0.723	-169.11
2.1 GHz	0.964	-177.14	1.69	62.13	0.011	-24.41	0.729	-168.95
2.2 GHz	0.965	-177.27	1.60	60.85	0.011	-25.52	0.735	-168.81
2.3 GHz	0.965	-177.40	1.51	59.59	0.011	-26.62	0.740	-168.69
2.4 GHz	0.966	-177.51	1.44	58.36	0.011	-27.68	0.746	-168.59
2.5 GHz	0.966	-177.62	1.37	57.15	0.011	-28.73	0.752	-168.50
2.6 GHz	0.967	-177.72	1.30	55.96	0.011	-29.75	0.757	-168.43
2.7 GHz	0.967	-177.82	1.24	54.80	0.011	-30.74	0.763	-168.38
2.8 GHz	0.968	-177.92	1.18	53.66	0.010	-31.72	0.768	-168.34
2.9 GHz	0.969	-178.01	1.13	52.54	0.010	-32.67	0.774	-168.32
3.0 GHz	0.969	-178.09	1.08	51.45	0.010	-33.60	0.779	-168.31
3.2 GHz	0.970	-178.26	0.99	49.32	0.010	-35.40	0.789	-168.33
3.4 GHz	0.971	-178.41	0.91	47.27	0.010	-37.11	0.800	-168.40
3.6 GHz	0.972	-178.56	0.84	45.30	0.009	-38.75	0.809	-168.50
3.8 GHz	0.973	-178.70	0.78	43.41	0.009	-40.31	0.818	-168.63
4.0 GHz	0.974	-178.84	0.73	41.59	0.009	-41.79	0.827	-168.79
4.2 GHz	0.975	-178.97	0.67	39.85	0.009	-43.21	0.835	-168.97
4.4 GHz	0.976	-179.09	0.63	38.16	0.009	-44.56	0.843	-169.16
4.6 GHz	0.976	-179.22	0.59	36.54	0.008	-45.85	0.851	-169.37
4.8 GHz	0.977	-179.34	0.55	34.98	0.008	-47.08	0.858	-169.59
5.0 GHz	0.978	-179.46	0.52	33.48	0.008	-48.25	0.864	-169.83
5.2 GHz	0.979	-179.58	0.49	32.03	0.008	-49.37	0.870	-170.06
5.4 GHz	0.979	-179.69	0.46	30.63	0.008	-50.43	0.876	-170.30
5.6 GHz	0.980	-179.80	0.43	29.28	0.007	-51.45	0.882	-170.55
5.8 GHz	0.980	-179.91	0.41	27.97	0.007	-52.42	0.887	-170.79
6.0 GHz	0.981	-179.98	0.39	26.71	0.007	-53.35	0.892	-171.04

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**Typical Die S-Parameters (Small Signal,  $V_{DS} = 28\text{ V}$ ,  $I_{DQ} = 800\text{ mA}$ , magnitude / angle)**

Frequency	Mag S11	Ang S11	Mag S21	Ang S21	Mag S12	Ang S12	Mag S22	Ang S22
500 MHz	0.966	-169.62	7.61	88.58	0.010	-0.60	0.693	-174.43
600 MHz	0.966	-171.35	6.34	86.43	0.010	-2.57	0.696	-174.53
700 MHz	0.966	-172.58	5.42	84.54	0.010	-4.29	0.698	-174.48
800 MHz	0.966	-173.51	4.73	82.80	0.010	-5.85	0.700	-174.35
900 MHz	0.967	-174.23	4.20	81.17	0.010	-7.31	0.703	-174.16
1.0 GHz	0.967	-174.81	3.76	79.62	0.010	-8.68	0.706	-173.95
1.1 GHz	0.967	-175.29	3.41	78.13	0.010	-10.00	0.709	-173.72
1.2 GHz	0.967	-175.69	3.11	76.69	0.010	-11.27	0.712	-173.47
1.3 GHz	0.967	-176.03	2.86	75.28	0.009	-12.51	0.715	-173.23
1.4 GHz	0.968	-176.32	2.64	73.91	0.009	-13.70	0.718	-172.99
1.5 GHz	0.968	-176.58	2.45	72.57	0.009	-14.87	0.722	-172.75
1.6 GHz	0.968	-176.80	2.29	71.26	0.009	-16.01	0.726	-172.52
1.7 GHz	0.969	-177.00	2.14	69.97	0.009	-17.13	0.729	-172.30
1.8 GHz	0.969	-177.18	2.01	68.71	0.009	-18.22	0.733	-172.09
1.9 GHz	0.969	-177.35	1.89	67.46	0.009	-19.30	0.737	-171.90
2.0 GHz	0.970	-177.49	1.78	66.24	0.009	-20.35	0.741	-171.72
2.1 GHz	0.970	-177.63	1.69	65.04	0.009	-21.38	0.746	-171.55
2.2 GHz	0.970	-177.76	1.60	63.85	0.009	-22.39	0.750	-171.39
2.3 GHz	0.971	-177.88	1.52	62.69	0.009	-23.38	0.754	-171.25
2.4 GHz	0.971	-177.99	1.44	61.55	0.009	-24.35	0.758	-171.12
2.5 GHz	0.971	-178.09	1.37	60.42	0.009	-25.31	0.763	-171.00
2.6 GHz	0.972	-178.19	1.31	59.31	0.009	-26.25	0.767	-170.90
2.7 GHz	0.972	-178.28	1.25	58.22	0.009	-27.16	0.771	-170.81
2.8 GHz	0.972	-178.37	1.20	57.15	0.008	-28.07	0.776	-170.73
2.9 GHz	0.973	-178.45	1.15	56.09	0.008	-28.95	0.780	-170.66
3.0 GHz	0.973	-178.54	1.10	55.05	0.008	-29.82	0.784	-170.60
3.2 GHz	0.974	-178.69	1.01	53.02	0.008	-31.50	0.793	-170.52
3.4 GHz	0.974	-178.83	0.93	51.06	0.008	-33.12	0.801	-170.48
3.6 GHz	0.975	-178.97	0.87	49.17	0.008	-34.67	0.809	-170.48
3.8 GHz	0.976	-179.10	0.80	47.33	0.008	-36.16	0.817	-170.51
4.0 GHz	0.977	-179.22	0.75	45.56	0.007	-37.59	0.824	-170.56
4.2 GHz	0.977	-179.35	0.70	43.84	0.007	-38.96	0.831	-170.64
4.4 GHz	0.978	-179.46	0.66	42.18	0.007	-40.27	0.838	-170.74
4.6 GHz	0.978	-179.58	0.61	40.57	0.007	-41.53	0.845	-170.86
4.8 GHz	0.979	-179.69	0.58	39.02	0.007	-42.74	0.852	-170.99
5.0 GHz	0.980	-179.80	0.54	37.51	0.007	-43.90	0.858	-171.13
5.2 GHz	0.980	-179.90	0.51	36.06	0.007	-45.01	0.863	-171.29
5.4 GHz	0.981	179.99	0.48	34.65	0.006	-46.07	0.869	-171.46
5.6 GHz	0.981	179.89	0.46	33.28	0.006	-47.09	0.874	-171.63
5.8 GHz	0.982	179.79	0.43	31.96	0.006	-48.06	0.879	-171.81
6.0 GHz	0.982	179.69	0.41	30.67	0.006	-49.00	0.884	-171.99

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Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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**Факс:** 8 (812) 320-02-42

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