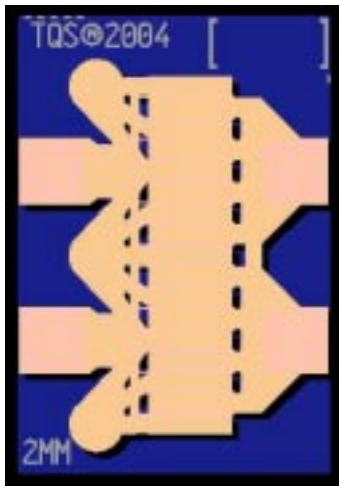
TriQuint SEMICONDUCTOR

Advance Product Information
September 19, 2005

DC - 12 GHz Discrete power pHEMT TGF2021-02



Key Features and Performance

- Frequency Range: DC - 12 GHz
- > 33 dBm Nominal Psat
- 59% Maximum PAE
- 11 dB Nominal Power Gain
- Suitable for high reliability applications
- 2mm x 0.35µm Power pHEMT
- Nominal Bias Vd = 8-12V, Idq = 150-250mA (Under RF Drive, Id rises from 150mA to 480mA)
- Chip Dimensions: 0.57 x 0. 79 x 0.10 mm (0.022 x 0.031 x 0.004 in)

Product Description

The TriQuint TGF2021-02 is a discrete 2 mm pHEMT which operates from DC-12 GHz. The TGF2021-02 is designed using TriQuint's proven standard 0.35um power pHEMT production process.

The TGF2021-02 typically provides > 33 dBm of saturated output power with power gain of 11 dB. The maximum power added efficiency is 59% which makes the TGF2021-02 appropriate for high efficiency applications.

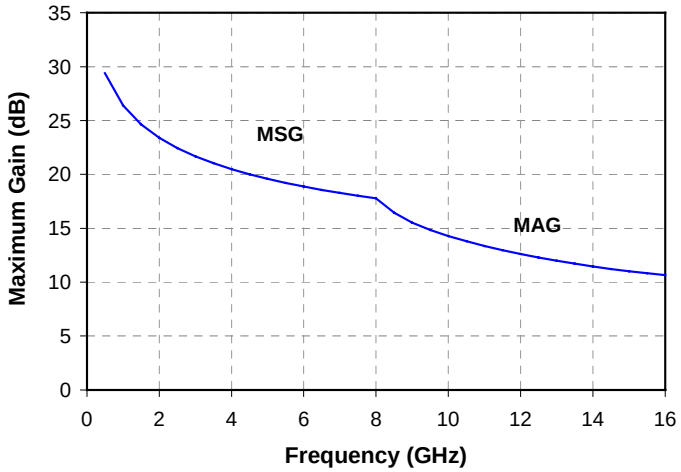
The TGF2021-02 is also ideally suited for Point-to-point Radio, High-reliability space, and Military applications.

The TGF2021-02 has a protective surface passivation layer providing environmental robustness.

Lead-free and RoHS compliant

Primary Applications

- Point-to-point Radio
- High-reliability space
- Military
- Base Stations
- Broadband Wireless Applications



Note: This device is early in the characterization process prior to finalizing all electrical specifications. Specifications are subject to change without notice.

TriQuint Semiconductor Texas: Phone (972)994-8465 Fax (972)994-8504 Email: Info-mmw@tqs.com Web: www.triquint.com

TABLE I
MAXIMUM RATINGS

Symbol	Parameter 1/	Value	Notes
V^+	Positive Supply Voltage	12.5 V	2/
V^-	Negative Supply Voltage Range	-5V to 0V	
I^+	Positive Supply Current	940 mA	2/
$\| I_G \|$	Gate Supply Current	14 mA	
P_{IN}	Input Continuous Wave Power	28 dBm	2/
P_D	Power Dissipation	See note 3	2/ 3/
T_{CH}	Operating Channel Temperature	150 °C	4/
T_M	Mounting Temperature (30 Seconds)	320 °C	
T_{STG}	Storage Temperature	-65 to 150 °C	

1/ These ratings represent the maximum operable values for this device.

2/ Combinations of supply voltage, supply current, input power, and output power shall not exceed P_D.

3/ For a median life time of 1E+6 hrs, Power dissipation is limited to:
$P_D(max) = (150\ °C – TBASE\ °C) / 43.3\ (°C/W)$

4/ Junction operating temperature will directly affect the device median time to failure (T_M). For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.

TABLE II
DC PROBE CHARACTERISTICS
(T_A = 25 °C, Nominal)

Symbol	Parameter	Minimum	Typical	Maximum	Unit
Idss	Saturated Drain Current	-	600	-	mA
Gm	Transconductance	-	750	-	mS
V_P	Pinch-off Voltage	-1.5	-1	-0.5	V
V_{BGS}	Breakdown Voltage Gate-Source	-30	-	-14	V
V_{BGD}	Breakdown Voltage Gate-Drain	-30	-	-14	V

Note: For TriQuint's 0.35um power pHEMT devices, RF breakdown >> DC breakdown

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TABLE III
RF CHARACTERIZATION TABLE 1/
(T_A = 25 °C, Nominal)

SYMBOL	PARAMETER	Vd = 10V Idq = 150mA	Vd = 12V Idq = 150mA	UNITS
Power Tuned:				
Psat	Saturated Output Power	33.8	34.5	dBm
PAE	Power Added Efficiency	50	48	%
Gain	Power Gain	11	11	dB
Rp 2/	Parallel Resistance	13.30	15.97	Ω
Cp 2/	Parallel Capacitance	0.927	0.953	pF
Γ_L 3/,4/	Load Reflection coefficient	0.719 ∠ 164.9	0.720 ∠ 161.4	-
Efficiency Tuned:				
Psat	Saturated Output Power	33	33.7	dBm
PAE	Power Added Efficiency	59	55	%
Gain	Power Gain	11.5	11	dB
Rp 2/	Parallel Resistance	24.50	27.79	Ω
Cp 2/	Parallel Capacitance	1.077	1.011	pF
Γ_L 3/, 4/	Load Reflection coefficient	0.778 ∠ 155.2	0.774 ∠ 152.7	-

1/ Values in this table are scaled from measurements taken from a 1mm unit pHEMT cell at 10 GHz

2/ Large signal equivalent pHEMT output network

3/ Optimum load impedance for maximum power or maximum PAE at 10 GHz

4 The reflection coefficients for this device have been calculated from the scaled large signal Rp & Cp. The series resistance and inductance (Rd and Ld) shown in the Figure on page 4 is excluded

TABLE IV
THERMAL INFORMATION

Parameter	Test Conditions	T_{CH} (°C)	θ_{JC} (°C/W)	T_M (HRS)
θ_{JC} Thermal Resistance (channel to backside of carrier)	Vd = 12 V Idq = 150 mA Pdiss = 1.8 W	148	43.3	1.2 E+6

Note: Assumes eutectic attach using 1.5 mil 80/20 AuSn mounted to a 20 mil CuMo Carrier at 70°C baseplate temperature.

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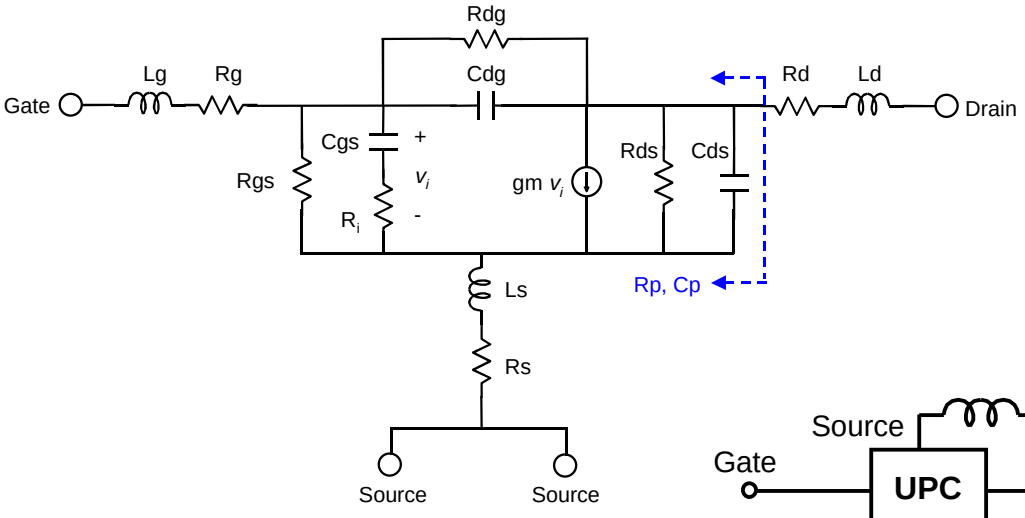
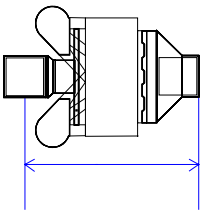
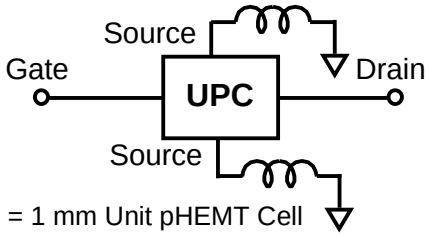
Linear Model for 1mm Unit pHEMT cell





Unit pHEMT cell Reference Plane



UPC = 1 mm Unit pHEMT Cell

MODEL PARAMETER	Vd = 8V Idq = 75mA	Vd = 8V Idq = 100mA	Vd = 8V Idq = 125mA	Vd = 10V Idq = 75mA	Vd = 10V Idq = 100mA	Vd = 12V Idq = 75mA	UNITS
Rg	0.45	0.45	0.45	0.45	0.450	0.45	Ω
Rs	0.14	0.14	0.14	0.17	0.160	0.19	Ω
Rd	0.41	0.43	0.46	0.41	0.450	0.410	Ω
gm	0.310	0.318	0.314	0.296	0.303	0.286	S
Cgs	2.39	2.58	2.70	2.61	2.74	2.72	pF
Ri	1.22	1.19	1.20	1.24	1.23	1.27	Ω
Cds	0.20	0.201	0.201	0.198	0.199	0.196	pF
Rds	149.1	152.3	158.8	171.8	173.7	187.9	Ω
Cgd	0.115	0.107	0.101	0.101	0.098	0.096	pF
Tau	6.29	6.63	6.99	7.19	7.410	7.79	pS
Ls	0.009	0.009	0.009	0.009	0.010	0.010	nH
Lg	0.089	0.089	0.089	0.089	0.089	0.089	nH
Ld	0.120	0.120	0.120	0.120	0.120	0.120	nH
Rgs	33000	33000	35100	28900	35700	24400	Ω
Rgd	349000	425000	405000	305000	366000	238000	Ω

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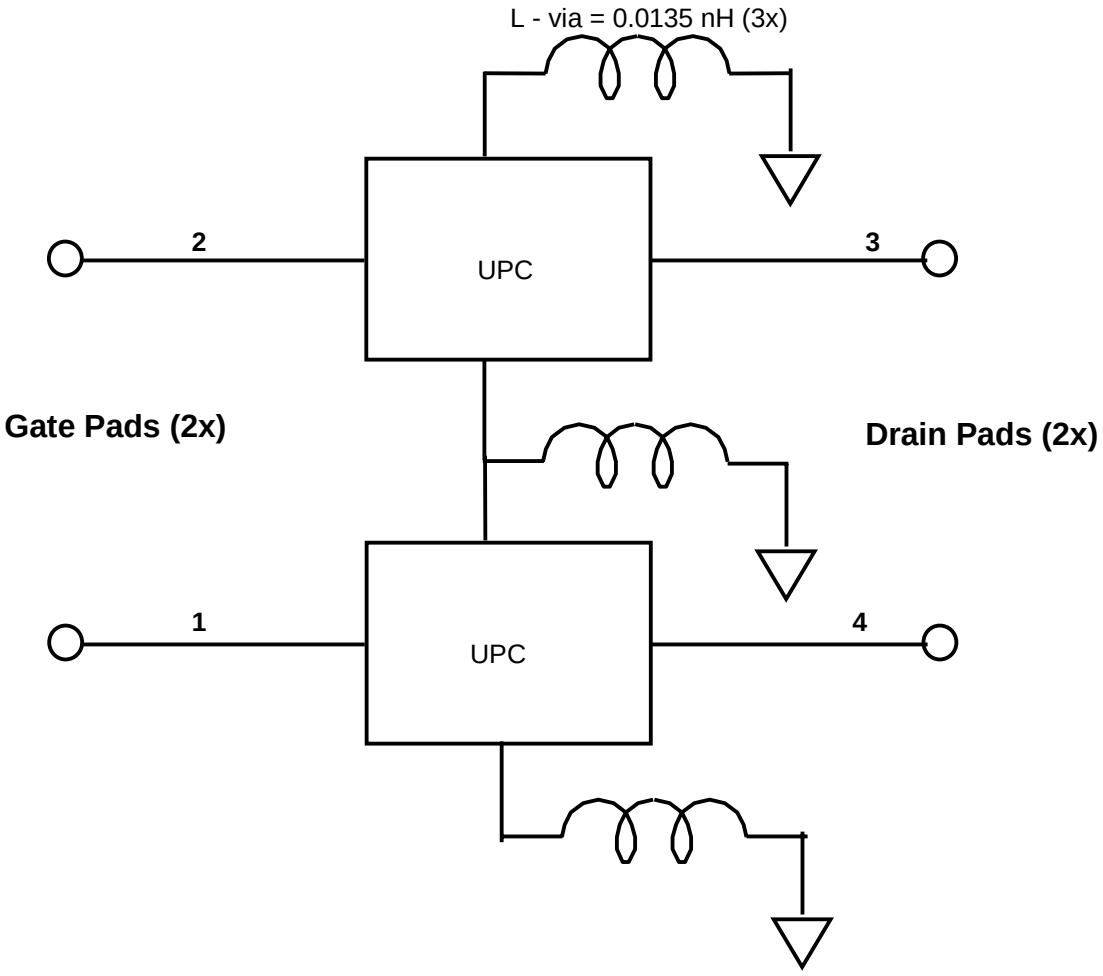
Linear Model for 2mm pHEMT



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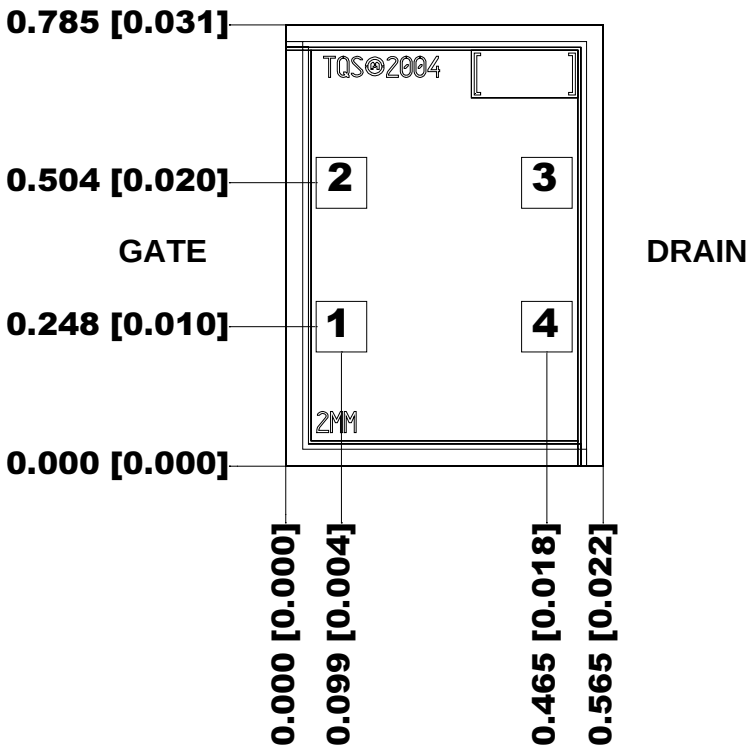
Unmatched S-parameter for 2mm pHEMT

Bias Conditions: Vd=12V, Idq=150mA

Frequency	s11	s11 ang	s21	s21 ang	s12	s12 ang	s22	s22 ang
(GHz)	dB	deg	dB	deg	dB	deg	dB	deg
0.5	-0.444	-108.860	26.175	121.91	-32.618	34.41	-11.025	-98.11
1	-0.572	-140.91	21.362	103.42	-31.423	18.42	-11.493	-127.41
1.5	-0.605	-153.69	18.095	94.44	-31.187	11.96	-11.428	-137.24
2	-0.616	-160.46	15.676	88.41	-31.135	8.45	-11.181	-140.97
2.5	-0.620	-164.67	13.761	83.63	-31.146	6.22	-10.844	-142.33
3	-0.621	-167.58	12.175	79.50	-31.191	4.65	-10.455	-142.71
3.5	-0.619	-169.72	10.819	75.76	-31.257	3.50	-10.037	-142.70
4	-0.617	-171.39	9.632	72.27	-31.340	2.63	-9.606	-142.57
4.5	-0.613	-172.74	8.574	68.95	-31.437	1.98	-9.173	-142.48
5	-0.610	-173.86	7.619	65.77	-31.546	1.49	-8.745	-142.47
5.5	-0.605	-174.82	6.745	62.70	-31.666	1.16	-8.329	-142.57
6	-0.600	-175.66	5.939	59.71	-31.795	0.96	-7.926	-142.80
6.5	-0.595	-176.41	5.190	56.80	-31.933	0.89	-7.540	-143.14
7	-0.589	-177.09	4.488	53.96	-32.077	0.95	-7.172	-143.58
7.5	-0.584	-177.71	3.828	51.18	-32.228	1.13	-6.821	-144.12
8	-0.578	-178.28	3.203	48.45	-32.384	1.44	-6.489	-144.73
8.5	-0.572	-178.81	2.610	45.78	-32.543	1.87	-6.174	-145.42
9	-0.566	-179.32	2.044	43.16	-32.704	2.42	-5.876	-146.17
9.5	-0.559	-179.80	1.503	40.59	-32.865	3.11	-5.595	-146.97
10	-0.553	179.75	0.984	38.06	-33.025	3.92	-5.330	-147.81
10.5	-0.547	179.31	0.485	35.58	-33.182	4.85	-5.079	-148.69
11	-0.541	178.88	0.005	33.15	-33.333	5.92	-4.842	-149.59
11.5	-0.535	178.47	-0.459	30.75	-33.478	7.10	-4.619	-150.52
12	-0.528	178.08	-0.908	28.40	-33.614	8.41	-4.409	-151.46
12.5	-0.522	177.69	-1.343	26.09	-33.738	9.83	-4.210	-152.42
13	-0.516	177.31	-1.765	23.82	-33.849	11.36	-4.022	-153.39
13.5	-0.510	176.94	-2.175	21.59	-33.946	12.98	-3.844	-154.36
14	-0.505	176.57	-2.574	19.39	-34.026	14.69	-3.677	-155.34
14.5	-0.499	176.21	-2.963	17.23	-34.088	16.48	-3.518	-156.32
15	-0.493	175.86	-3.341	15.10	-34.130	18.32	-3.368	-157.29
15.5	-0.488	175.51	-3.710	13.01	-34.153	20.21	-3.226	-158.27
16	-0.483	175.16	-4.071	10.95	-34.154	22.13	-3.091	-159.24
16.5	-0.477	174.82	-4.424	8.93	-34.135	24.06	-2.964	-160.21
17	-0.472	174.49	-4.769	6.93	-34.095	25.99	-2.843	-161.17
17.5	-0.467	174.15	-5.107	4.97	-34.035	27.90	-2.728	-162.13
18	-0.463	173.82	-5.439	3.03	-33.956	29.77	-2.619	-163.07
18.5	-0.458	173.49	-5.764	1.13	-33.859	31.60	-2.515	-164.02
19	-0.453	173.17	-6.083	-0.75	-33.745	33.37	-2.416	-164.95
19.5	-0.449	172.85	-6.396	-2.61	-33.615	35.08	-2.323	-165.87
20	-0.445	172.53	-6.704	-4.44	-33.473	36.72	-2.233	-166.79
20.5	-0.441	172.21	-7.007	-6.24	-33.318	38.28	-2.148	-167.69
21	-0.437	171.89	-7.306	-8.03	-33.153	39.75	-2.067	-168.59
21.5	-0.433	171.58	-7.600	-9.79	-32.979	41.15	-1.989	-169.48
22	-0.429	171.26	-7.890	-11.53	-32.798	42.46	-1.915	-170.36
22.5	-0.425	170.95	-8.176	-13.25	-32.611	43.68	-1.845	-171.23
23	-0.422	170.64	-8.459	-14.95	-32.419	44.83	-1.777	-172.10
23.5	-0.418	170.34	-8.738	-16.63	-32.224	45.89	-1.713	-172.95
24	-0.415	170.03	-9.015	-18.29	-32.026	46.87	-1.651	-173.79
24.5	-0.412	169.72	-9.288	-19.94	-31.826	47.79	-1.591	-174.63
25	-0.409	169.42	-9.559	-21.57	-31.626	48.63	-1.534	-175.46
25.5	-0.406	169.12	-9.828	-23.19	-31.426	49.40	-1.480	-176.28
26	-0.403	168.82	-10.094	-24.79	-31.226	50.10	-1.427	-177.09

Note: The s-parameters are calculated by connecting nodes 1-2 together, and nodes 3-4 together to form a 2-port network.

Mechanical Drawing



Units: millimeters (inches)
Thickness: 0.100 (0.004)
Chip edge to bond pad dimensions are shown to center of bond pad
Chip size tolerance: +/- 0.051 (0.002)

GND IS BACKSIDE OF MMIC

Bond pads #1-2: (Gate) 0.090 x 0.090 (0.004 x 0.004)
Bond pads #3-4: (Drain) 0.090 x 0.090 (0.004 x 0.004)

GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handing, assembly and test.

Assembly Process Notes

Reflow process assembly notes:

- Use AuSn (80/20) solder with limited exposure to temperatures at or above 300 °C for 30 sec
- An alloy station or conveyor furnace with reducing atmosphere should be used.
- Do not use flux
- Coefficient of thermal expansion matching is critical for long-term reliability.
- Devices must be stored in a dry nitrogen atmosphere.

Component placement and adhesive attachment assembly notes:

- Vacuum pencils and/or vacuum collets are the preferred method of pick up.
- Air bridges must be avoided during placement.
- The force impact is critical during auto placement.
- Organic attachment can be used in low-power applications.
- Curing should be done in a convection oven; proper exhaust is a safety concern.
- Microwave or radiant curing should not be used because of differential heating.
- Coefficient of thermal expansion matching is critical.

Interconnect process assembly notes:

- Thermosonic ball bonding is the preferred interconnect technique.
- Force, time, and ultrasonics are critical parameters.
- Aluminum wire should not be used.
- Devices with small pad sizes should be bonded with 0.0007-inch wire.
- Maximum stage temperature is 200 °C.

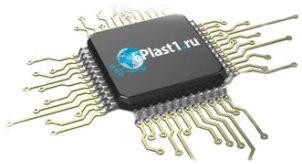
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

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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