

LTC3649 60V, Low IQ Monolithic High Efficiency Step-Down Regulator

DESCRIPTION

Demonstration circuit 2112A is a high input voltage, high efficiency synchronous monolithic buck converter featuring the LTC3649 in a 28-lead UFD package. The DC2112A has wide input voltage range from 3.1V up to 60V. The output voltage of the DC2112A can be set as to 3.3V or 5V. However, the “USER SELECT” option of DC2112A allows output voltage to be as high as input voltage minus 0.5V, with certain modifications. DC2112A is capable of delivering up to 4A of output current. DC2112A supports three operation modes: Fixed-Frequency modulation and Burst Mode, user can synchronize it with an external clock also. Fixed-Frequency mode of operation maximizes the output current, reduces output voltage ripple, and yields a low noise switching spectrum. Burst Mode employs a variable frequency switching algorithm that minimizes the no-load input quiescent current and improves efficiency at light loads.

The DC2112A consumes less than 15 μ A of quiescent current during shutdown and it consumes less than 440 μ A at no load conditions in Burst Mode of operation. The DC2112A has a standard operating frequency of 500kHz, but can be adjusted in a range between 300kHz and as high as 3MHz. DC2112A is a monolithic step-down converter, LTC3649 integrates top and bottom N-channel MOSFETs, significantly reducing circuit footprint. DC2112A was designed to support multiple footprints of input/output capacitors and inductor to accommodate variety of applications. The data sheet of LTC3649 gives a complete description functionality of this regulator; also contains operation and application information and must be read in conjunction with this demo board manual for DC2112A.

Design files for this circuit board are available at <http://www.linear.com/demo/DC2112A>

All registered trademarks and trademarks are the property of their respective owners.

PERFORMANCE SUMMARY Specifications are at $T_A = 25^\circ\text{C}$

PARAMETER	CONDITIONS	VALUE
Minimum Input Voltage		4V
Maximum Input Voltage		60V
Output Voltage V_{OUT} Regulation	$V_{IN} = 4V - 60V$	$5V \pm 2\%$ or $3.3V \pm 2\%$
Maximum Continuous Output Current	V_{OUT}	4A
Preset Operating Frequency	$R10 = 200k\Omega$	500kHz
External Clock Sync. Frequency Range		300kHz – 3MHz
Efficiency	$V_{IN} = 12V, V_{OUT} = 5V$ $V_{IN} = 12V, V_{OUT} = 3.3V$	Up to 95% Up to 95%
Typical Output Ripple V_{OUT}	$V_{IN} = 12V, V_{OUT} = 5V, I_{OUT} = 4A$ (2MHz BW)	<15mV _{P-P}
Quiescent Current at Shutdown	$V_{IN} = 4V - 60V$	<14 μ A
Input Current at No Load	$V_{IN} = 4V - 60V$, Burst Mode	<430 μ A

QUICK START PROCEDURE

Demonstration circuit 2112A is easy to set up to evaluate the performance of the LTC3649. For proper measurement equipment configuration, set up the circuit according to the diagram in Figure 1. Before proceeding to test, insert shunt into JP2 (RUN) into OFF position, which connects the RUN pin to ground (GND), and thus, shutdown the output. Set jumper JP1 (MODE) into FCC (Forced Counties Conduction Mode) position. Set jumper JP3 (V_{OUT}) into 5.0V position.

NOTE: When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the V_{IN} or V_{OUT} and GND terminals. See Figure 2 for proper scope probe technique.

1. With the DC2112A set up according to the proper measurement and equipment in Figure 1, apply 12V at V_{IN} . Measure V_{OUT} ; it should read 0V. If desired, one can measure the shutdown supply current at this point. The supply current will be approximately 14 μ A, or less, in shutdown.
2. Turn on V_{OUT} of the circuit by inserting the shunt in header JP2 (RUN) into the ON position. The output

voltage should be regulating. Measure V_{OUT} it should measure 5.0V \pm 2% (Do not apply more than the rated maximum voltage of 60V to the board or the part may be damaged). Vary the V_{OUT} load, which should not exceed 4A. Vary the input voltage from 6V to 55V, the V_{OUT} it should measure 5.0V \pm 2%.

3. Set JP2 (RUN) into OFF and then jumper JP3 (V_{OUT}) into 3.3V position.
4. Turn on V_{OUT2} of the circuit by inserting the shunt in header JP2 (RUN) into the ON position. The output voltage should be regulating. Measure V_{OUT} it should measure 3.3V \pm 2% (Do not apply more than the rated maximum voltage of 60V to the board or the part may be damaged). Vary the V_{OUT} load, which should not exceed 4A. Vary the input voltage from 16- 55V, the V_{OUT} it should measure 3.3V \pm 2%
5. Set output current to zero and move jumper JP1 (MODE) into BURST position and measure V_{OUT} for 3.3V.
6. Set output current to zero and move jumper JP1 (MODE) into BURST position and measure V_{OUT} for 5.0V.

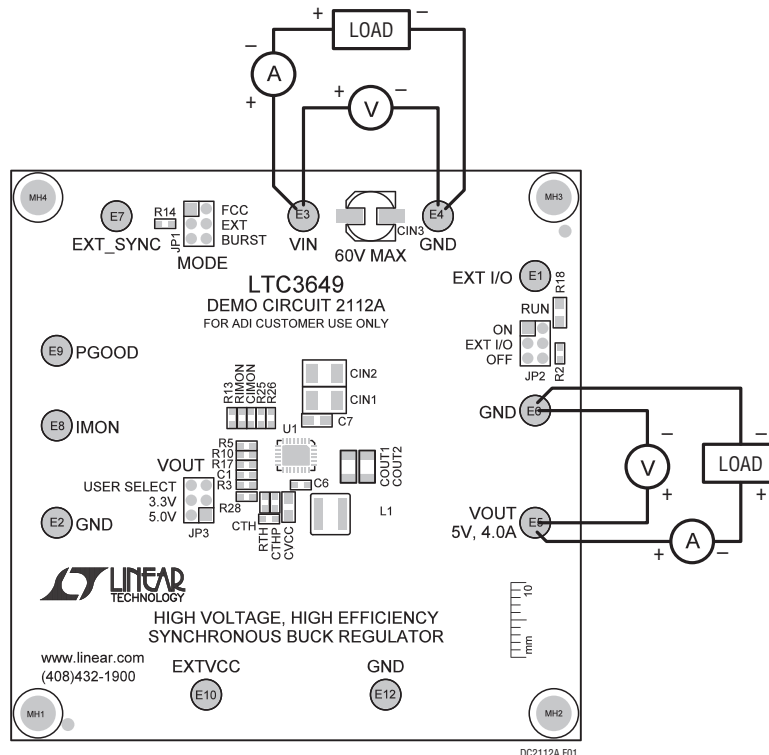


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

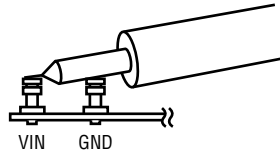
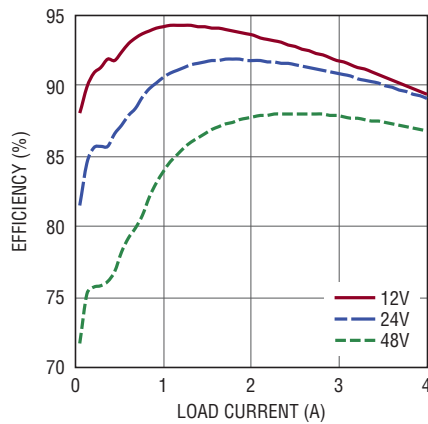


Figure 2. Measuring Input or Output Ripple



DC2112A F03

Figure 3. Efficiency vs Input Voltage and Load Current, V_{OUT} 5V, Burst Mode Operation

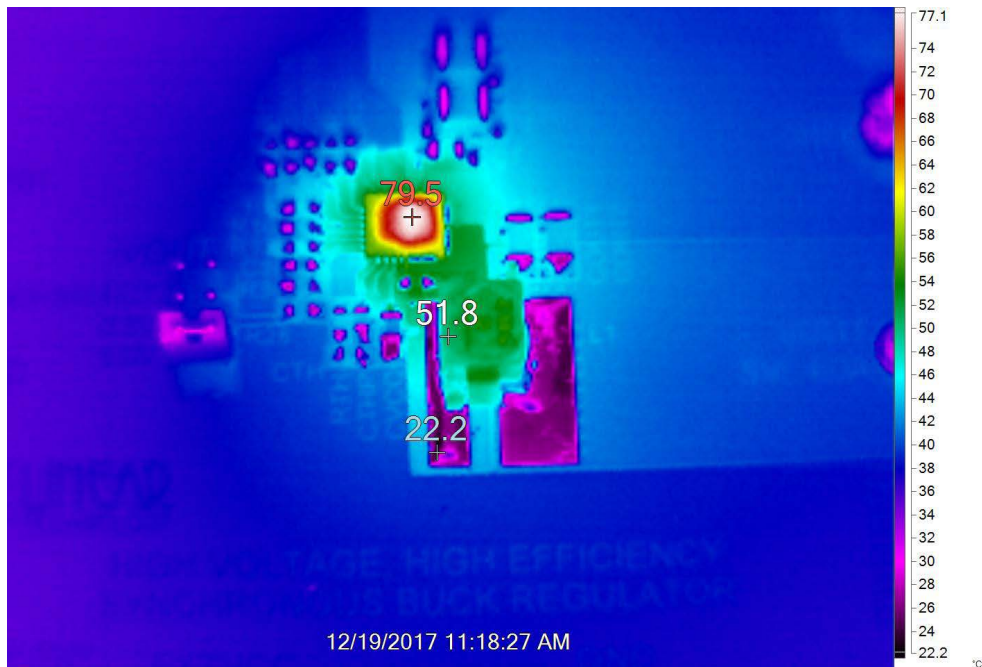


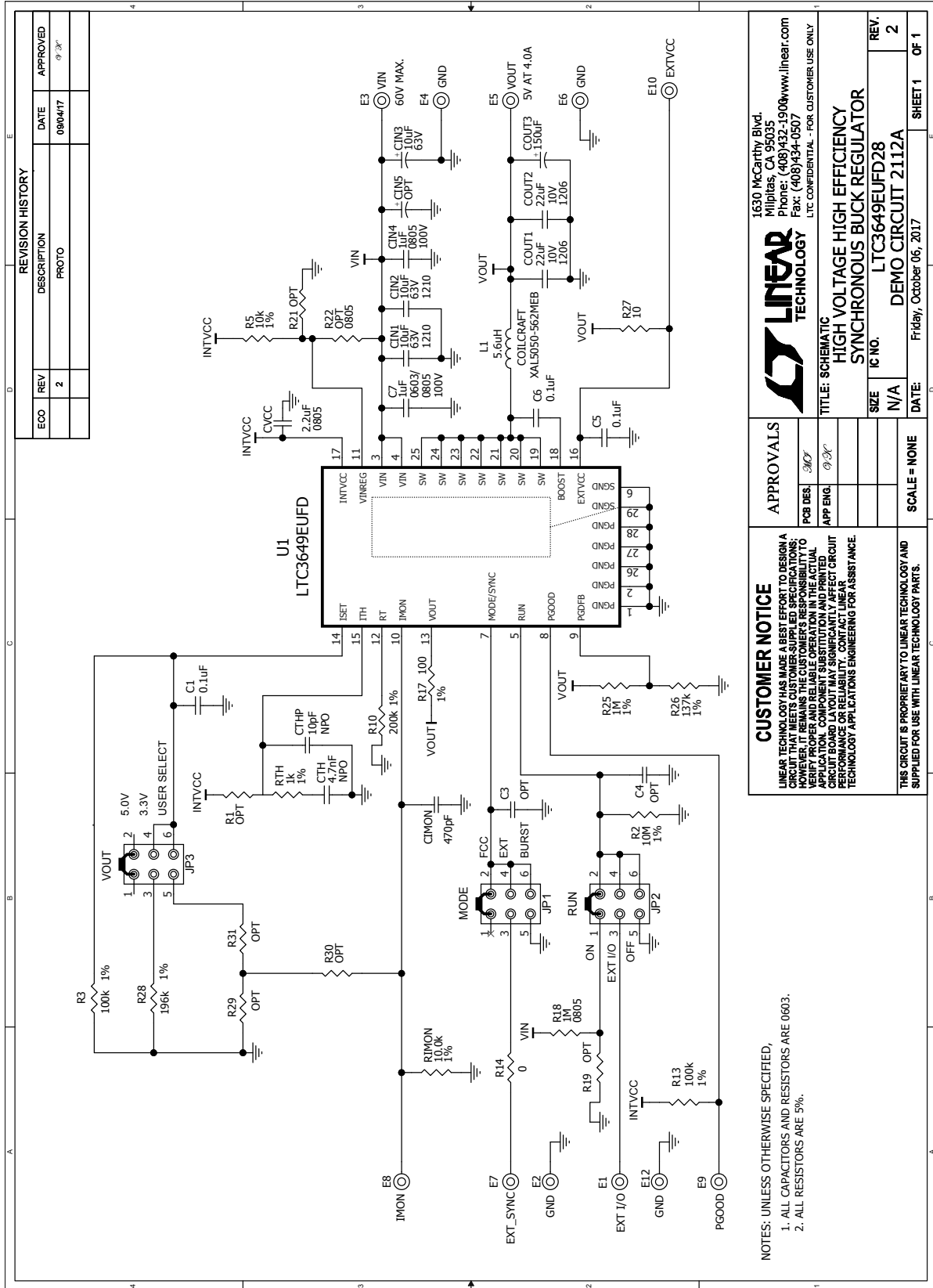
Figure 4. Thermal Map, V_{IN} 14V, I_{OUT} 1 5V at 4A, No Air Flow

DEMO MANUAL DC2112A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	CIN1, CIN2	CAP, 1210 10 μ F 10% 63V X7R	MURATA GRM32ER71J106KA12L
2	1	CIN3	CAP, 10 μ F 20% 63V ELEC	SUN ELECT. 63CE10KX
3	2	CIN4, C7	CAP, 0805 1 μ F 10% 100V X7S	TDK C2012X7S2A105K
4	2	COUT1, COUT2	CAP, 1210 22 μ F 10% 25V X7R	MURATA GRM32ER71E226KE15L
5	1	COUT3	CAP, 3528 150 μ F 20% 6.3V POSCAP	PANASONIC 6TPE150MAZB
6	1	CTH	CAP, 0603 4700pF 10% 25V X7R	AVX 06033C472KAT2A
7	1	CTHP	CAP, 0603 10pF 5% 25V C0G	AVX 06033A100JAT2A
8	1	CVCC	CAP, 0805 2.2 μ F 10% 16V X7R	AVX 0805YC225KAT2A
9	1	C1	CAP, 0603 0.01 μ F 10% 50V X7R	AVX 06035C103KAT4A
10	1	C5	CAP, 0603 1 μ F 10% 16V X5R	AVX 0603YD105KAT2A
11	1	C6	CAP, 0603 0.1 μ F 10% 50V X7R	AVX 06035C104KAT2A
12	1	L1	IND, 5.6 μ H	COILCRAFT XAL5050-562MEB
13	1	RIMON	RES, 0603 10k Ω 1% 1/10W	VISHAY CRCW060310K0FKEA
14	1	RTH	RES, 0603 1.0k Ω 1% 1/10W	VISHAY CRCW06031K00FKEA
15	1	R2	RES, 0603 10M Ω 1% 1/10W	VISHAY CRCW060310M0FKEA
16	1	R3	RES, 0603 100k Ω 1% 1/10W	VISHAY CRCW0603100KFKEA
17	1	R5	RES, 0603 10k Ω 5% 1/10W	VISHAY CRCW060310K0JNEA
18	1	R10	RES, 0603 340k Ω 1% 1/10W	VISHAY CRCW0603340KFKEA
19	1	R13	RES, 0603 100k Ω 5% 1/10W	VISHAY CRCW0603100KJNEA
20	1	R14	RES, 0603 0 Ω JUMPER	VISHAY CRCW06030000Z0EA
	1	R17	RES, 0603 100 Ω 1% 1/10W	VISHAY CRCW0603100RFKEA
21	1	R18	RES, 0805 1M Ω 1% 1/8W	VISHAY CRCW08051M00FKEA
22	1	R25	RES, 0603 1M Ω 1% 1/10W	VISHAY CRCW06031M00FKEA
	1	R27	RES, 0603 10 Ω 1% 0.1W	VISHAY CRCW060310R0FKEA
23	1	R26	RES, 0603 137k Ω 1% 0.063W	VISHAY CRCW0603137KFKEA
24	1	R28	RES, 0603 196k Ω 1% 1/10W	VISHAY CRCW0603196KFKEA
25	1	U1	IC, SYNCHRONOUS BUCK REGULATOR	LINEAR TECH. LTC3649EUFDF#PBF
Additional Demo Board Circuit Components				
		R1, R19, R21, R29, R30, R31	RES, 0603 OPTION	OPTION
		R22	RES, 0805 OPTION	VISHAY CRCW08051M00FKEA
		C3, C4	CAP, 0603 OPTION	OPTION
		CIN5	CAP, OPTION	OPTION
Hardware: For Demo Board Only				
	11	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E12	TURRET	MILL MAX 2501-2-00-80-00-00-07-0
	3	JP1, JP2, JP3	HEADER, 3-PIN, DBL ROW 2mm	SULLINS, NRPN032PAEN
	4	MH1, MH2, MH3, MH4	STANDOFF, SNAP ON	KEYSTONE 8833
	3	XJP1, XJP2, XJP3	SHUNT	SAMTEC 2SN-BK-G

SCHEMATIC DIAGRAM





ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.

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

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: ocean@oceanchips.ru

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А