# Aluminum Capacitors
# SMD (Chip), High Temperature

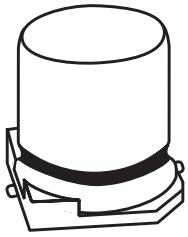
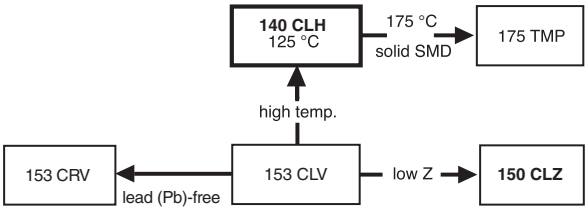


Fig.1 Component outline




## FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte, self healing
- SMD-version with base plate, reflow solderable
- High temperature, 1500 hours at 125 °C
- High capacitance values
- Charge and discharge proof, no peak current limitation
- Lead (Pb)-free
- ATTENTION: for maximum safe soldering conditions refer to fig.4

## APPLICATIONS

- SMD technology, for high mounting density
- Industrial and professional applications
- Automotive, general industrial
- Smoothing, filtering, buffering

## MARKING

- Rated capacitance (in µF)
- Rated voltage (in V)
- Date code, in accordance with IEC 60062
- Black mark or '–' sign indicating the cathode (the anode is identified by bevelled edges)
- Code indicating group number (H)

## PACKAGING

- Supplied in blister tape on reel

| QUICK REFERENCE DATA | |
|---|---|
| **DESCRIPTION** | **VALUE** |
| Nominal case sizes (L x W x H in mm) | 8 x 8 x 10 to 10 x 10 x 14 |
| Rated capacitance range, $C_R$ | 10 to 680 µF |
| Tolerance on $C_R$ | ± 20 % |
| Rated voltage range, $U_R$ | 6.3 to 63 V |
| Category temperature range | - 55 to + 125 °C |
| Endurance test at 125 °C | 1000 hours |
| Useful life at 125 °C | 1500 hours |
| Useful life at 40 °C; 1.8 x $I_R$ applied | 150 000 hours |
| Shelf life at 0 V, 125 °C | 1000 hours |
| Based on sectional specification | IEC 60384-18/CECC 32300 |
| Climatic category IEC 60068 | 55/125/56 |

**SELECTION CHART FOR $C_R$, $U_R$ AND RELEVANT NOMINAL CASE SIZES** (L x W x H in mm)

| $C_R$ (µF) | $U_R$ (V) | | | | | | |
|---|---|---|---|---|---|---|---|
| | **6.3** | **10** | **16** | **25** | **35** | **50** | **63** |
| 10 | - | - | - | - | - | - | 8 x 8 x 10 |
| 22 | - | - | - | - | - | - | 8 x 8 x 10 |
| 33 | - | - | - | - | - | - | 8 x 8 x 10 |
| 47 | - | - | - | - | - | 8 x 8 x 10 | 10 x 10 x 10 |
| 68 | - | - | - | - | 8 x 8 x 10 | 10 x 10 x 10 | 10 x 10 x 14 |
| 100 | - | - | - | 8 x 8 x 10 | 10 x 10 x 10 | 10 x 10 x 14 | - |
| 150 | - | - | 8 x 8 x 10 | - | 10 x 10 x 14 | - | - |
| 220 | - | 8 x 8 x 10 | - | 10 x 10 x 10 | - | - | - |
| 330 | 8 x 8 x 10 | 10 x 10 x 10 | 10 x 10 x 14 | - | - | - | - |
| 470 | 10 x 10 x 10 | 10 x 10 x 14 | - | - | - | - | - |
| 680 | 10 x 10 x 14 | - | - | - | - | - | - |

**Table 1**

| **DIMENSIONS** in millimeters **AND MASS** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **NOMINAL CASE SIZE L x W x H** | **CASE CODE** | **$L_{max.}$** | **$W_{max.}$** | **$H_{max.}$** | **Ø D** | **$B_{max.}$** | **S** | **$L_{1\ max.}$** | **MASS (g)** |
| 8 x 8 x 10 | 0810 | 8.5 | 8.5 | 10.5 | 8.0 | 1.0 | 3.1 | 9.9 | ≈ 1.0 |
| 10 x 10 x 10 | 1010 | 10.5 | 10.5 | 10.5 | 10.0 | 1.0 | 4.5 | 11.8 | ≈ 1.3 |
| 10 x 10 x 14 | 1014 | 10.5 | 10.5 | 14.3 | 10.0 | 1.0 | 4.5 | 11.8 | ≈ 1.5 |

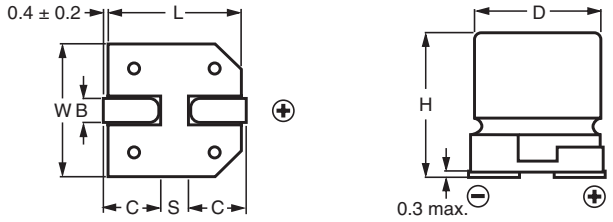



Fig.2 Dimensional outline

**Table 2**

| **TAPE AND REEL DIMENSIONS** in millimeters, **PACKAGING QUANTITIES** | | | | | | |
|---|---|---|---|---|---|---|
| **NOMINAL CASE SIZE L x W x H** | **CASE CODE** | **PITCH $P_1$** | **TAPE WIDTH W** | **TAPE THICKNESS $T_2$** | **REEL DIA.** | **PACKAGING QUANTITY PER REEL** |
| 8 x 8 x 10 | 0810 | 16 | 24 | 11.3 | 380 | 500 |
| 10 x 10 x 10 | 1010 | 16 | 24 | 11.3 | 380 | 500 |
| 10 x 10 x 14 | 1014 | 16 | 24 | 14.8 | 330 | 250 |

**Note**

1. Detailed tape dimensions see section “PACKAGING”.

## MOUNTING

The capacitors are designed for automatic placement on to printed-circuit boards.

Optimum dimensions of soldering pads depend amongst others on soldering method, mounting accuracy, print lay-out and/or adjacent components.

For recommended soldering pad dimensions, refer to Fig.3 and Table 3.

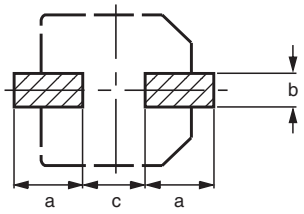



Fig. 3 Recommended solder pad dimensions

## SOLDERING

Soldering conditions are defined by the curve, temperature versus time, where the temperature is that measured on the soldering pad during processing.

For maximum conditions refer to Fig.4.

Any temperature versus time curve which does not exceed the specified maximum curves may be applied.

AS A GENERAL PRINCIPLE, TEMPERATURE AND DURATION SHALL BE THE **MINIMUM** NECESSARY REQUIRED TO ENSURE GOOD SOLDERING CONNECTIONS. HOWEVER, THE SPECIFIED MAXIMUM CURVES SHOULD NEVER BE EXCEEDED.

**Table 3**

| **RECOMMENDED SOLDERING PAD DIMENSIONS** in millimeters | | | |
|---|---|---|---|
| **CASE CODE** | **a** | **b** | **c** |
| 0810 | 3.5 | 2.5 | 3.0 |
| 1010 | 4.3 | 2.5 | 4.0 |
| 1014 | 4.3 | 2.5 | 4.0 |

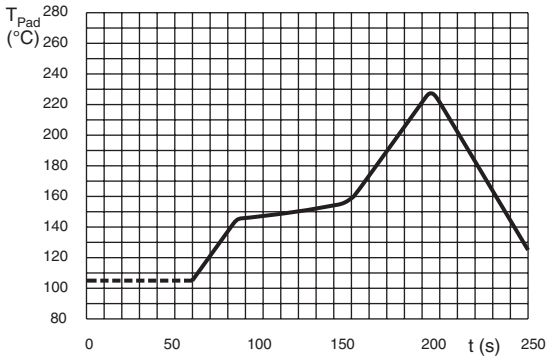



Fig. 4 Maximum temperature load during infrared reflow soldering measured on the soldering pad

| ELECTRICAL DATA | |
|---|---|
| SYMBOL | DESCRIPTION |
| $C_R$ | rated capacitance at 100 Hz, tolerance ± 20 % |
| $I_R$ | rated RMS ripple current at 100 kHz, 125 °C |
| $I_{L2}$ | max. leakage current after 2 minutes at $U_R$ |
| tan $\delta$ | max. dissipation factor at 100 Hz |
| Z | max. impedance at 100 kHz |

**Note**

Unless otherwise specified, all electrical values in Table 4 apply at $T_{amb}$ = 20 °C, P = 86 to 106 kPa, RH = 45 to 75 %.

## ORDERING EXAMPLE

Electrolytic capacitor 140 CLH series

100 µF/50 V; ± 20 %

Nominal case size:
10 x 10 x 14 mm; taped on reel

Ordering code: MAL214095102E3
Former 12NC: 2222 140 95102

**Table 4**

| ELECTRICAL DATA AND ORDERING INFORMATION | | | | | | | |
|---|---|---|---|---|---|---|---|
| $U_R$ (V) | $C_R$ (µF) | NOMINAL CASE SIZE L x W x H (mm) | $I_R$ 100 kHz 125 °C (mA) | $I_{L2}$ 2 min (µA) | tan $\delta$ | Z 100 kHz + 20 °C ($\Omega$) | ORDERING CODE MAL2140..... |
| 6.3 | 330 | 8 x 8 x 10 | 180 | 21 | 0.30 | 0.65 | 95303E3 |
| | 470 | 10 x 10 x 10 | 300 | 30 | 0.30 | 0.17 | 95301E3 |
| | 680 | 10 x 10 x 14 | 430 | 43 | 0.30 | 0.12 | 95302E3 |
| 10 | 220 | 8 x 8 x 10 | 180 | 22 | 0.26 | 0.65 | 95403E3 |
| | 330 | 10 x 10 x 10 | 300 | 33 | 0.26 | 0.17 | 95401E3 |
| | 470 | 10 x 10 x 14 | 430 | 47 | 0.26 | 0.12 | 95402E3 |
| 16 | 150 | 8 x 8 x 10 | 180 | 24 | 0.22 | 0.65 | 95502E3 |
| | 330 | 10 x 10 x 14 | 430 | 53 | 0.22 | 0.12 | 95501E3 |
| 25 | 100 | 8 x 8 x 10 | 180 | 25 | 0.18 | 0.65 | 95602E3 |
| | 220 | 10 x 10 x 10 | 300 | 55 | 0.18 | 0.19 | 95601E3 |
| 35 | 68 | 8 x 8 x 10 | 180 | 24 | 0.14 | 0.65 | 95003E3 |
| | 100 | 10 x 10 x 10 | 255 | 35 | 0.14 | 0.40 | 95001E3 |
| | 150 | 10 x 10 x 14 | 317 | 53 | 0.14 | 0.30 | 95002E3 |
| 50 | 47 | 8 x 8 x 10 | 145 | 24 | 0.12 | 1.00 | 95103E3 |
| | 68 | 10 x 10 x 10 | 205 | 34 | 0.12 | 0.56 | 95101E3 |
| | 100 | 10 x 10 x 14 | 255 | 50 | 0.12 | 0.42 | 95102E3 |
| 63 | 10 | 8 x 8 x 10 | 145 | 6.3 | 0.12 | 1.00 | 95805E3 |
| | 22 | 8 x 8 x 10 | 145 | 14 | 0.12 | 1.00 | 95803E3 |
| | 33 | 8 x 8 x 10 | 145 | 21 | 0.12 | 1.00 | 95804E3 |
| | 47 | 10 x 10 x 10 | 205 | 30 | 0.12 | 0.56 | 95801E3 |
| | 68 | 10 x 10 x 14 | 255 | 43 | 0.12 | 0.42 | 95802E3 |

| ADDITIONAL ELECTRICAL DATA | | |
|---|---|---|
| PARAMETER | CONDITIONS | VALUE |
| **Voltage** | | |
| Surge voltage for short periods | IEC 60384-18, subclause 4.14 | $U_s \leq 1.15 \times U_R$ |
| Reverse voltage for short periods | IEC 60384-18, subclause 4.16 | $U_{rev} \leq 0.5$ V |
| **Current** | | |
| Leakage current | after 2 minutes at $U_R$ | $I_{L2} \leq 0.01 \times C_R \times U_R$ |
| **Inductance** | | |
| Equivalent series inductance (ESL) | | typ. 16 nH |
| **Resistance** | | |
| Equivalent series resistance (ESR) at 100 Hz | calculated from tan $\delta_{max.}$ and $C_R$ (see Table 4) | ESR = tan $\delta/2\ \pi f\ C_R$ |

## CAPACITANCE (C)

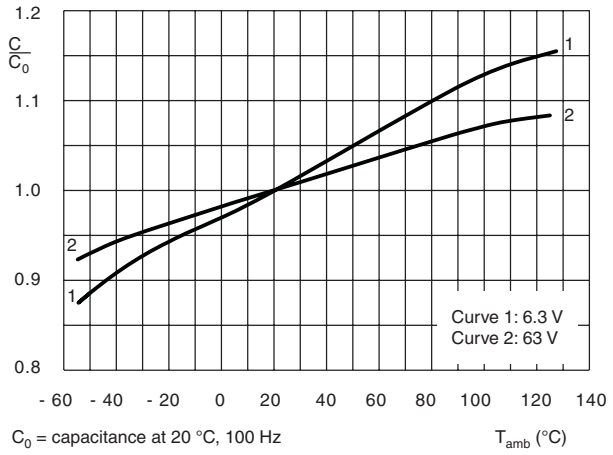



Fig.5 Typical multiplier of capacitance as a function of frequency of ambient temperature

## DISSIPATION FACTOR (tan δ)

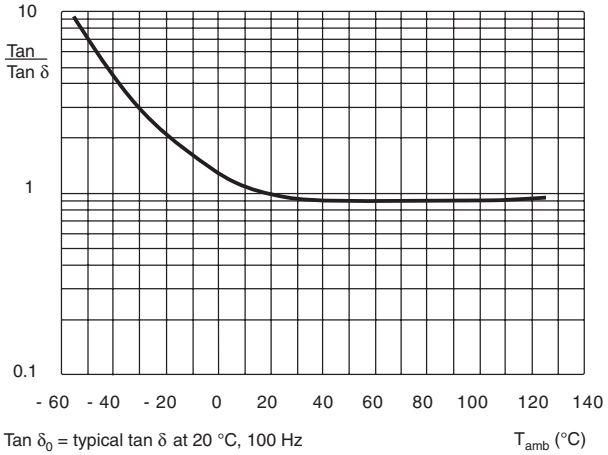



Fig.6 Typical multiplier of dissipation factor (Tan δ) as a function of ambient temperature

## EQUIVALENT SERIES RESISTANCE (ESR)

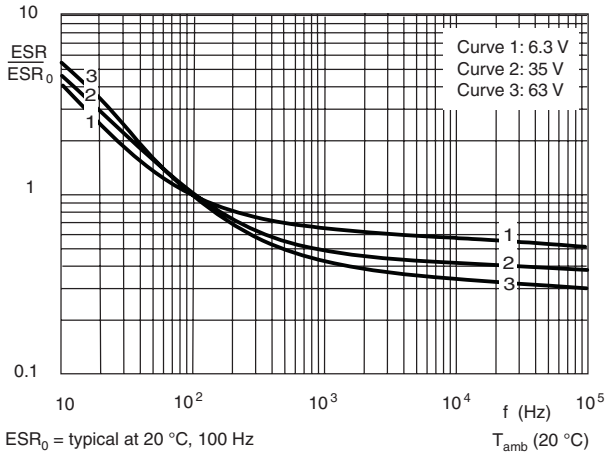



Fig.7 Typical multiplier of ESR as a function of frequency

## IMPEDANCE (Z)

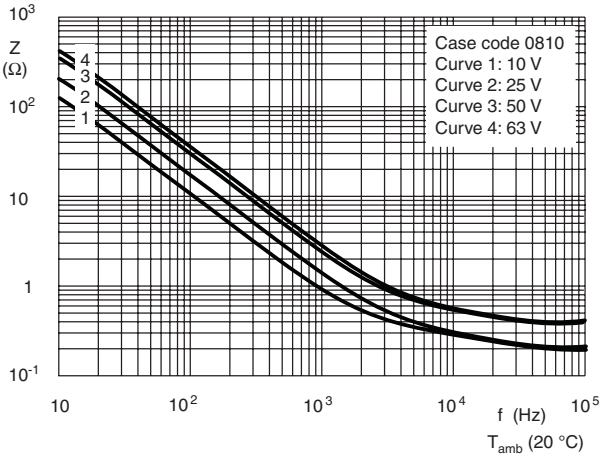



Fig.8 Typical multiplier of ESR as a function of frequency

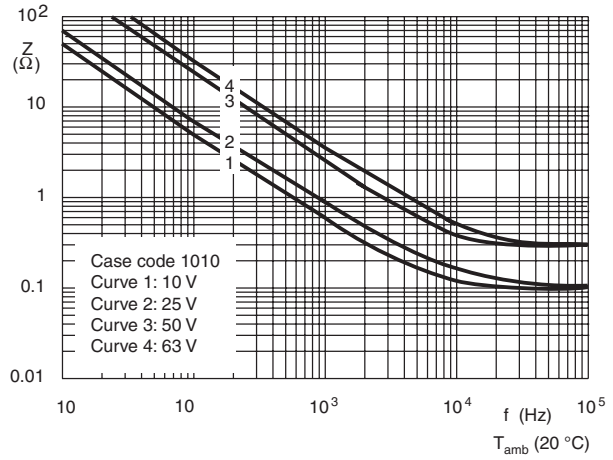



Fig.9 Typical impedance as a function of frequency

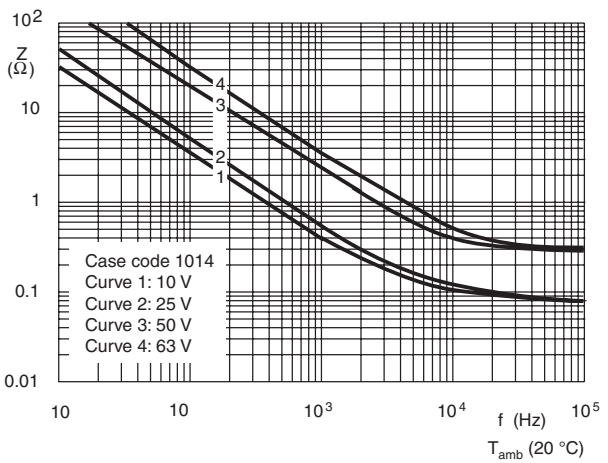
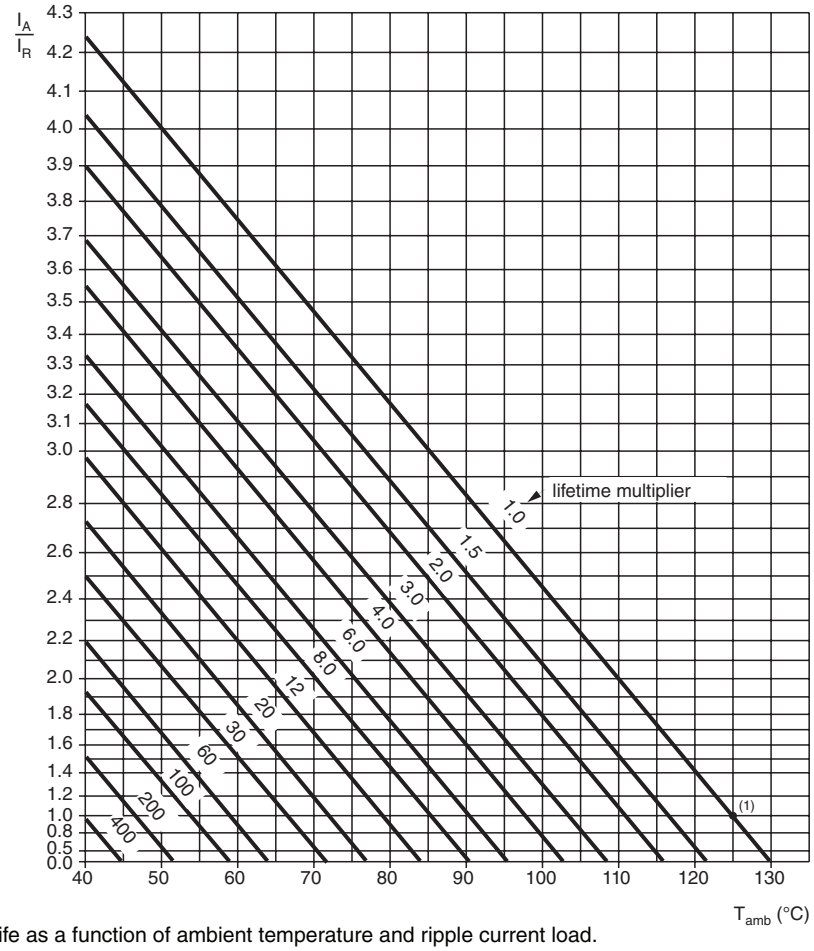



Fig.10 Typical impedance as a function of frequency

## RIPPLE CURRENT AND USEFUL LIFE




$I_A$ = actual ripple current at 100 kHz

$I_R$ = rated ripple current at 100 kHz, 125 °C

(1) Useful life at 125 °C and $I_R$ applied:
1500 hours

Fig.11 Multiplier of useful life as a function of ambient temperature and ripple current load.

**Table 5**

| MULTIPLIER OF RIPPLE CURRENT ($I_R$) AS A FUNCTION OF FREQUENCY | | | |
|---|---|---|---|
| FREQUENCY (Hz) | $I_R$ MULTIPLIER | | |
| | $U_R$ = 6.3 to 25 V | $U_R$ = 35 and 50 V | $U_R$ = 63 V |
| 50 | 0.60 | 0.45 | 0.40 |
| 100 | 0.70 | 0.60 | 0.55 |
| 300 | 0.80 | 0.75 | 0.70 |
| 1000 | 0.85 | 0.85 | 0.85 |
| 3000 | 0.90 | 0.90 | 0.90 |
| 10 000 | 0.95 | 0.95 | 0.95 |
| 30 000 | 0.97 | 0.97 | 0.97 |
| 100 000 | 1.00 | 1.00 | 1.00 |

**Table 6**

| TEST PROCEDURES AND REQUIREMENTS | | | |
|---|---|---|---|
| **TEST** | | **PROCEDURE (quick reference)** | **REQUIREMENTS** |
| **NAME OF TEST** | **REFERENCE** | | |
| Mounting | IEC 60384-18, subclause 4.3 | shall be performed prior to tests mentioned below;<br>reflow soldering;<br>for maximum temperature load refer to chapter “Mounting” | $\Delta C/C$: ± 5 %<br>tan $\delta \leq$ spec. limit<br>$I_{L2} \leq$ spec. limit |
| Endurance | IEC 60384-18/ CECC 32 300, subclause 4.15 | $T_{amb}$ = 125 °C; $U_R$ applied;<br>1000 hours | $U_R$ = 6.3 V; $\Delta C/C$: ± 25 %<br>$U_R \geq$ 10 V; $\Delta C/C$: ± 20 %<br>tan $\delta \leq$ 2 x spec. limit<br>$I_{L2} \leq$ spec. limit |
| Useful life | CECC 30301, subclause 1.8.1 | $T_{amb}$ = 125 °C; $U_R$ and $I_R$ applied;<br>1500 hours | $\Delta C/C$: ± 50 %<br>tan $\delta \leq$ 3 x spec. limit<br>$I_{L2} \leq$ spec. limit<br>no short or open circuit<br>total failure percentage: ≤ 1 % |
| Shelf life (storage at high temperature) | IEC 60384-18/ CECC 32 300, subclause 4.17 | $T_{amb}$ = 125 °C; no voltage applied;<br>1000 hours<br>after test: $U_R$ to be applied for 30 minutes, 24 to 48 hours before measurement | for requirements see ‘Endurance test’ above |
| Reverse voltage | IEC 60384-18/ CECC 32 300, subclause 4.16 | $T_{amb}$ = 125 °C:<br>125 hours at U = - 0.5 V,<br>followed by 125 hours at $U_R$ | $\Delta C/C$: ± 15 %<br>tan $\delta \leq$ 1.5 x spec. limit<br>$I_{L2} \leq$ spec. limit |

# Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.

# OCEAN CHIPS
## Океан Электроники
## Поставка электронных компонентов

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**».

AVIC 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).

FORSTAR®

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