



# Optocoupler, Phototransistor Output, High Reliability, 5300 V<sub>RMS</sub>



## FEATURES

- Excellent CTR linearity depending on forward current
- Isolation test voltage, 5300 V<sub>RMS</sub>
- Fast switching times
- Low CTR degradation
- Low coupling capacitance
- Material categorization:  
For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## DESCRIPTION

The SFH615A feature a variety of transfer ratios, low coupling capacitance and high isolation voltage. These couplers have a GaAs infrared diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a plastic DIP-4 package.

The coupling devices are designed for signal transmission between two electrically separated circuits.





The couplers are end-stackable with 2.54 mm lead spacing. Creepage and clearance distances of > 8 mm are achieved with option 6. This version complies with IEC 60950 (DIN VDE 0805) for reinforced insulation up to an operation voltage of 400 V<sub>RMS</sub> or DC. Specifications subject to change.

## APPLICATIONS

- Switchmode power supply
- Telecom
- Battery powered equipment

## AGENCY APPROVALS

- UL file no. E52744
- cUL tested to CSA 22.2 bulletin 5A
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1
- BSI EN 60950; EN 60065
- FIMKO
- CQC

| ORDERING INFORMATION   |   |   |   |  |
|--|---|---|---|--|
| <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">S</div> <div style="border: 1px solid black; padding: 2px 5px;">F</div> <div style="border: 1px solid black; padding: 2px 5px;">H</div> <div style="border: 1px solid black; padding: 2px 5px;">6</div> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">5</div> <div style="border: 1px solid black; padding: 2px 5px;">A</div> <div style="border: 1px solid black; padding: 2px 5px;">-</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">X</div> <div style="border: 1px solid black; padding: 2px 5px;">0</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">T</div> </div> <p style="text-align: center; margin-top: 5px;">PART NUMBER</p> <p style="text-align: center; margin-top: 5px;">CTR BIN</p> <p style="text-align: center; margin-top: 5px;">PACKAGE OPTION</p> <p style="text-align: center; margin-top: 5px;">TAPE AND REEL</p> | <br>DIP-4<br>7.62 mm | <br>Option 6<br>10.16 mm | <br>Option 7<br>> 8 mm | <br>Option 9<br>8 mm typ. |
| AGENCY CERTIFIED/PACKAGE   | CTR (%)   |   |   |  |
| UL, cUL, BSI, FIMKO  | 40 to 80  | 63 to 125   | 100 to 200  | 160 to 320   |
| DIP-4  | SFH615A-1   | SFH615A-2   | SFH615A-3   | SFH615A-4  |
| DIP-4, 400 mil, option 6   | SFH615A-1X006   | SFH615A-2X006   | SFH615A-3X006   | -  |
| SMD-4, option 7  | -   | -   | SFH615A-3X007T <sup>(1)</sup>   | -  |
| SMD-4, option 9  | -   | SFH615A-2X009T  | SFH615A-3X009T <sup>(1)</sup>   | SFH615A-4X009  |
| UL, cUL, VDE, BSI, FIMKO   | 40 to 80  | 63 to 125   | 100 to 200  | 160 to 320   |
| DIP-4  | SFH615A-1X001   | SFH615A-2X001   | SFH615A-3X001   | SFH615A-4X001  |
| DIP-4, 400 mil, option 6   | SFH615A-1X016   | SFH615A-2X016   | SFH615A-3X016   | SFH615A-4X016  |
| SMD-4, option 7  | SFH615A-1X017T <sup>(1)</sup>   | SFH615A-2X017T <sup>(1)</sup>   | SFH615A-3X017   | SFH615A-4X017T <sup>(1)</sup>  |
| SMD-4, option 9  | -   | SFH615A-2X019T  | -   | -  |
|  |   | SFH615A-2X019T3 <sup>(2)</sup>  |   |  |

## Notes

- Additional options may be possible, please contact sales office.
- <sup>(1)</sup> Also available in tubes; do not add T to end.
- <sup>(2)</sup> T3 rotation in tape and reel packaging.



| ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified) |  |                   |                    |                  |
|---|--|-------------------|--------------------|------------------|
| PARAMETER   | TEST CONDITION                                     | SYMBOL            | VALUE              | UNIT             |
| <b>INPUT</b>  |  |                   |                    |                  |
| Reverse voltage   |  | V <sub>R</sub>    | 6                  | V                |
| DC forward current  |  | I <sub>F</sub>    | 60                 | mA               |
| Forward surge current   | t <sub>p</sub> ≤ 10 μs                             | I <sub>FSM</sub>  | 2.5                | A                |
| LED power dissipation   | at 25 °C   | P <sub>diss</sub> | 70                 | mW               |
| <b>OUTPUT</b>   |  |                   |                    |                  |
| Collector emitter voltage   |  | V <sub>CEO</sub>  | 70                 | V                |
| Emitter collector voltage   |  | V <sub>ECO</sub>  | 7                  | V                |
| Collector current   |  | I <sub>C</sub>    | 50                 | mA               |
| Collector peak current  | t <sub>p</sub> /T = 0.5, t <sub>p</sub> ≤ 10 ms    | I <sub>CM</sub>   | 100                | mA               |
| Output power dissipation  | at 25 °C   | P <sub>diss</sub> | 150                | mW               |
| <b>COUPLER</b>  |  |                   |                    |                  |
| Isolation test voltage between emitter and detector                             | t = 1 s  | V <sub>ISO</sub>  | 5300               | V <sub>RMS</sub> |
| Creepage distance   |  |                   | ≥ 7                | mm               |
| Clearance distance  |  |                   | ≥ 7                | mm               |
| Isolation thickness between emitter and detector                                |  |                   | ≥ 0.4              | mm               |
| Comparative tracking index per DIN IEC 112/VDE 0303, part 1                     |  | CTI               | ≥ 175              |                  |
| Isolation resistance  | V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 25 °C  | R <sub>IO</sub>   | ≥ 10 <sup>12</sup> | Ω                |
|   | V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 100 °C | R <sub>IO</sub>   | ≥ 10 <sup>11</sup> | Ω                |
| Operation temperature   |  | T <sub>amb</sub>  | -55 to +100        | °C               |
| Storage temperature range   |  | T <sub>stg</sub>  | -55 to +150        | °C               |
| Soldering temperature <sup>(1)</sup>  | 2 mm from case, ≤ 10 s                             | T <sub>slid</sub> | 260                | °C               |

**Notes**

- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

<sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

| ELECTRICAL CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified) |                                   |           |                    |      |      |      |      |
|---|-----------------------------------|-----------|--------------------|------|------|------|------|
| PARAMETER   | TEST CONDITION                    | PART      | SYMBOL             | MIN. | TYP. | MAX. | UNIT |
| <b>INPUT</b>  |                                   |           |                    |      |      |      |      |
| Forward voltage   | I <sub>F</sub> = 60 mA            |           | V <sub>F</sub>     |      | 1.35 | 1.65 | V    |
| Reverse current   | V <sub>R</sub> = 6 V              |           | I <sub>R</sub>     |      | 0.01 | 10   | μA   |
| Capacitance   | V <sub>R</sub> = 0 V, f = 1 MHz   |           | C <sub>O</sub>     |      | 13   |      | pF   |
| <b>OUTPUT</b>   |                                   |           |                    |      |      |      |      |
| Collector emitter capacitance   | V <sub>CE</sub> = 5 V, f = 1 MHz  |           | C <sub>CE</sub>    |      | 5.2  |      | pF   |
| Collector emitter leakage current   | V <sub>CE</sub> = 10 V            | SFH615A-1 | I <sub>CEO</sub>   |      | 2    | 50   | nA   |
|   |                                   | SFH615A-2 | I <sub>CEO</sub>   |      | 2    | 50   | nA   |
|   |                                   | SFH615A-3 | I <sub>CEO</sub>   |      | 5    | 100  | nA   |
|   |                                   | SFH615A-4 | I <sub>CEO</sub>   |      | 5    | 100  | nA   |
| <b>COUPLER</b>  |                                   |           |                    |      |      |      |      |
| Collector emitter saturation voltage  | I <sub>F</sub> = 10 mA, f = 1 MHz |           | V <sub>CEsat</sub> |      | 0.25 | 0.4  | V    |
| Coupling capacitance  |                                   |           | C <sub>C</sub>     |      | 0.4  |      | pF   |

**Note**

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.



| <b>CURRENT TRANSFER RATIO</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |  |           |        |      |      |      |      |
|--|--|-----------|--------|------|------|------|------|
| PARAMETER  | TEST CONDITION                               | PART      | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| $I_C/I_F$  | $I_F = 10\text{ mA}$ , $V_{CE} = 5\text{ V}$ | SFH615A-1 | CTR    | 40   |      | 80   | %    |
|  |  | SFH615A-2 | CTR    | 63   |      | 125  | %    |
|  |  | SFH615A-3 | CTR    | 100  |      | 200  | %    |
|  |  | SFH615A-4 | CTR    | 160  |      | 320  | %    |
|  | $I_F = 1\text{ mA}$ , $V_{CE} = 5\text{ V}$  | SFH615A-1 | CTR    | 13   | 30   |      | %    |
|  |  | SFH615A-2 | CTR    | 22   | 45   |      | %    |
|  |  | SFH615A-3 | CTR    | 34   | 70   |      | %    |
|  |  | SFH615A-4 | CTR    | 56   | 90   |      | %    |

| <b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |   |           |           |      |      |      |               |
|---|---|-----------|-----------|------|------|------|---------------|
| PARAMETER   | TEST CONDITION  | PART      | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| <b>NON-SATURATED</b>  |   |           |           |      |      |      |               |
| Turn-on time  | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |           | $t_{on}$  |      | 3    |      | $\mu\text{s}$ |
| Rise time   | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |           | $t_r$     |      | 2    |      | $\mu\text{s}$ |
| Turn-off time   | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |           | $t_{off}$ |      | 2.3  |      | $\mu\text{s}$ |
| Fall time   | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |           | $t_f$     |      | 2    |      | $\mu\text{s}$ |
| Cut-off frequency   | $I_F = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 75\text{ }\Omega$ |           | $f_{CO}$  |      | 100  |      | kHz           |
| <b>SATURATED</b>  |   |           |           |      |      |      |               |
| Turn-on time  | $I_F = 20\text{ mA}$  | SFH615A-1 | $t_{on}$  |      | 3    |      | $\mu\text{s}$ |
|   | $I_F = 10\text{ mA}$  | SFH615A-2 | $t_{on}$  |      | 4.2  |      | $\mu\text{s}$ |
|   |   | SFH615A-3 | $t_{on}$  |      | 4.2  |      | $\mu\text{s}$ |
|   | $I_F = 5\text{ mA}$   | SFH615A-4 | $t_{on}$  |      | 6    |      | $\mu\text{s}$ |
| Rise time   | $I_F = 20\text{ mA}$  | SFH615A-1 | $t_r$     |      | 2    |      | $\mu\text{s}$ |
|   | $I_F = 10\text{ mA}$  | SFH615A-2 | $t_r$     |      | 3    |      | $\mu\text{s}$ |
|   |   | SFH615A-3 | $t_r$     |      | 3    |      | $\mu\text{s}$ |
|   | $I_F = 5\text{ mA}$   | SFH615A-4 | $t_r$     |      | 4    |      | $\mu\text{s}$ |
| Turn-off time   | $I_F = 20\text{ mA}$  | SFH615A-1 | $t_{off}$ |      | 18   |      | $\mu\text{s}$ |
|   | $I_F = 10\text{ mA}$  | SFH615A-2 | $t_{off}$ |      | 23   |      | $\mu\text{s}$ |
|   |   | SFH615A-3 | $t_{off}$ |      | 23   |      | $\mu\text{s}$ |
|   | $I_F = 5\text{ mA}$   | SFH615A-4 | $t_{off}$ |      | 25   |      | $\mu\text{s}$ |
| Fall time   | $I_F = 20\text{ mA}$  | SFH615A-1 | $t_f$     |      | 11   |      | $\mu\text{s}$ |
|   | $I_F = 10\text{ mA}$  | SFH615A-2 | $t_f$     |      | 14   |      | $\mu\text{s}$ |
|   |   | SFH615A-3 | $t_f$     |      | 14   |      | $\mu\text{s}$ |
|   | $I_F = 5\text{ mA}$   | SFH615A-4 | $t_f$     |      | 15   |      | $\mu\text{s}$ |

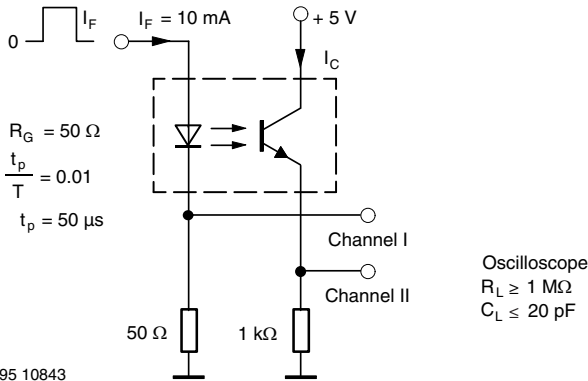


95 10804-3

Fig. 1 - Test Circuit, Non-Saturated Operation



Fig. 3 - Switching Times



95 10843

Fig. 2 - Test Circuit, Saturated Operation

| SAFETY AND INSULATION RATINGS                        |                        |            |      |           |      |      |
|--|------------------------|------------|------|-----------|------|------|
| PARAMETER  | TEST CONDITION         | SYMBOL     | MIN. | TYP.      | MAX. | UNIT |
| Climatic classification (according to IEC 68 part 1) |                        |            |      | 55/100/21 |      |      |
| Comparative tracking index                           |                        | CTI        | 175  |           | 399  |      |
| Rated impulse voltage                                |                        | $V_{IOTM}$ |      |           | 8    | kV   |
| Maximum working voltages                             | Recurring peak voltage | $V_{IORM}$ |      |           | 890  | V    |
| Forward current                                      |                        | $I_{SI}$   |      |           | 275  | mA   |
| Power dissipation                                    |                        | $P_{SO}$   |      |           | 400  | mW   |
| Safety temperature                                   |                        | $T_{SI}$   |      |           | 175  | °C   |
| Creepage distance                                    |                        |            | 7.0  |           |      | mm   |
| Clearance distance                                   |                        |            | 7.0  |           |      | mm   |
| Isolation distance                                   | per IEC 60950 2.10.5.1 |            | 0.4  |           |      | mm   |

**Note**

- According to DIN EN 60747-5-5 (VDE 0884-5). These optocouplers are suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

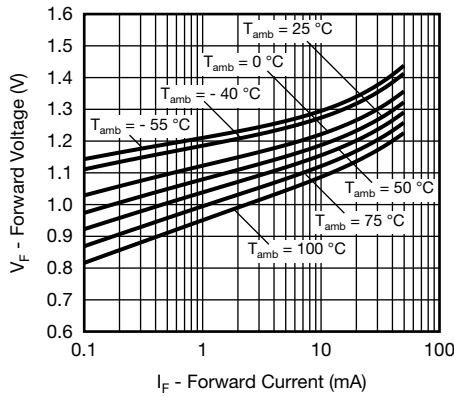


Fig. 4 - Forward Voltage vs. Forward Current



Fig. 7 - Leakage Current vs. Ambient Temperature

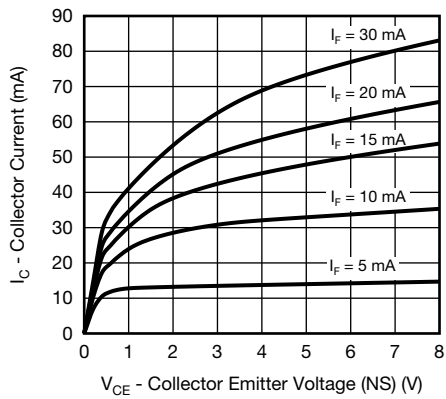


Fig. 5 - Collector Current vs. Collector Emitter Voltage (NS)



Fig. 8 - Normalized CTR (NS) vs. Ambient Temperature

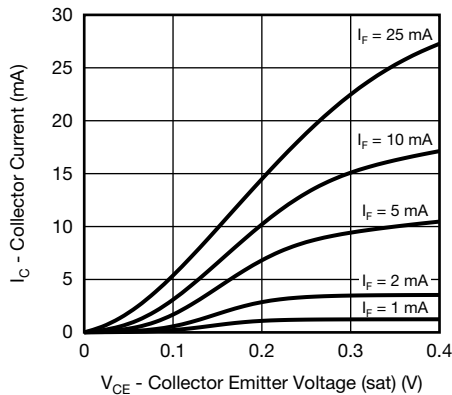


Fig. 6 - Collector Current vs. Collector Emitter Voltage (sat)

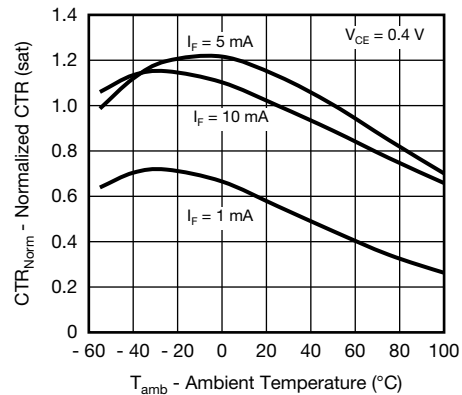


Fig. 9 - Normalized CTR (sat) vs. Ambient Temperature



Fig. 10 - Normalized CTR (NS) vs. Forward Current



Fig. 13 - CTR Frequency vs. Collector Current



Fig. 11 - Normalized CTR (sat) vs. Forward Current



Fig. 14 - Switching Time vs. Load Resistance



Fig. 12 - CTR Frequency vs. Phase Angle



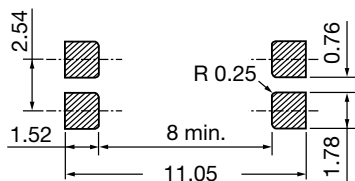
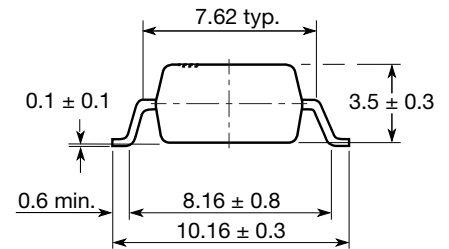
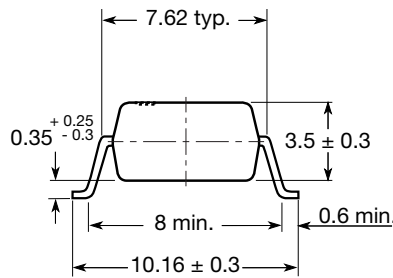
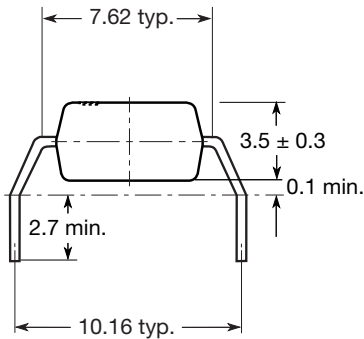
PACKAGE DIMENSIONS in millimeters



Option 6

Option 7

Option 9



20802-28

PACKAGE MARKING (Example)



Notes

- VDE logo is only marked on option 1 parts. Option information is not marked on the part.
- Tape and reel suffix (T) is not part of the package marking.

**PACKING INFORMATION**

| DEVICE PER TUBE |            |           |           |
|-----------------|------------|-----------|-----------|
| TYPE            | UNITS/TUBE | TUBES/BOX | UNITS/BOX |
| DIP-4           | 100        | 40        | 4000      |



Fig. 15 - Tape and Reel Shipping Medium



Fig. 16 - Tape and Packing for Option 7 and Option 9



Fig. 17 - Tape Packing for Option 7 and Option 9, T3 Rotation (2000 units per reel)





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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**

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Наши преимущества:

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- 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;
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- 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).



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