



## NPN LOW POWER SILICON TRANSISTOR

**Qualified per MIL-PRF-19500/368**

Qualified Levels:  
JAN, JANTX,  
JANTXV and JANS

### DESCRIPTION

This family of 2N3439UA through 2N3440UA high-frequency, epitaxial planar transistors feature low saturation voltage. The UA package is hermetically sealed and provides a low profile for minimizing board height. These devices are also available in U4, TO-5 and TO-39 packaging. Microsemi also offers numerous other transistor products to meet higher and lower power ratings with various switching speed requirements in both through-hole and surface-mount packages.

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### FEATURES

- JEDEC registered 2N3439UA through 2N3440UA series.
- JAN, JANTX, JANTXV, and JANS qualifications are available per MIL-PRF-19500/368.
- RoHS compliant by design.
- $V_{CE(sat)} = 0.5 \text{ V @ } I_C = 50 \text{ mA}$ .
- Turn-On time  $t_{on} = 1.0 \mu\text{s max @ } I_C = 20 \text{ mA, } I_{B1} = 2.0 \text{ mA}$ .
- Turn-Off time  $t_{off} = 10 \mu\text{s max @ } I_C = 20 \text{ mA, } I_{B1} = -I_{B2} = 2.0 \text{ mA}$ .

### APPLICATIONS / BENEFITS

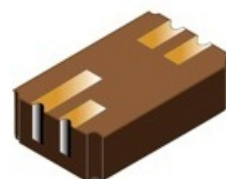
- General purpose transistors for medium power applications requiring high frequency switching and low package profile.
- Military and other high-reliability applications.

### MAXIMUM RATINGS ( $T_C = +25^\circ\text{C}$ unless otherwise noted)

| Parameters / Test Conditions                                                                                                                                      | Symbol                            | 2N3439UA    | 2N3440UA | Unit |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------|----------|------|
| Collector-Emitter Voltage                                                                                                                                         | V <sub>CEO</sub>                  | 350         | 250      | V    |
| Collector-Base Voltage                                                                                                                                            | V <sub>CBO</sub>                  | 450         | 300      | V    |
| Emitter-Base Voltage                                                                                                                                              | V <sub>EBO</sub>                  | 7.0         |          | V    |
| Collector Current                                                                                                                                                 | I <sub>C</sub>                    | 1.0         |          | A    |
| Total Power Dissipation      @ T <sub>A</sub> = +25 °C <sup>(1)</sup><br>@ T <sub>C</sub> = +25 °C <sup>(2)</sup><br>UA @ T <sub>SP</sub> = +25 °C <sup>(3)</sup> | P <sub>D</sub>                    | 0.8         |          | W    |
|                                                                                                                                                                   |                                   | 5.0         |          |      |
|                                                                                                                                                                   |                                   | 2.0         |          |      |
| Operating & Storage Junction Temperature Range                                                                                                                    | T <sub>J</sub> , T <sub>stg</sub> | -65 to +200 |          | °C   |

**Notes:**

1. Derate linearly @  $4.57 \text{ mW}/^\circ\text{C}$  for  $T_A > +25^\circ\text{C}$ .
2. Derate linearly @  $28.5 \text{ mW}/^\circ\text{C}$  for  $T_C > +25^\circ\text{C}$ .
3. Derate linearly @  $14 \text{ mW}/^\circ\text{C}$  for  $T_{SP} > +25^\circ\text{C}$ .



**UA Package**

Also available in:

**U4 package**  
(surface mount)

 [2N3439U4 – 2N3440U4](#)

**TO-5 package**  
(long leaded)

 [2N3439L – 2N3440L](#)

**TO-39 package**  
(leaded)

 [2N3439 – 2N3440](#)

#### **MSC – Lawrence**

6 Lake Street,  
Lawrence, MA 01841  
Tel: 1-800-446-1158 or  
(978) 620-2600  
Fax: (978) 689-0803

#### **MSC – Ireland**

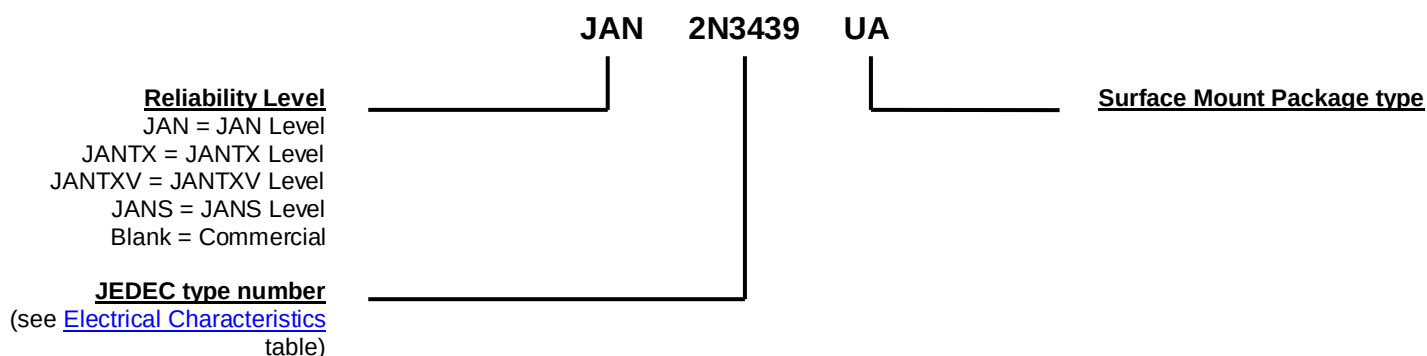
Gort Road Business Park,  
Ennis, Co. Clare, Ireland  
Tel: +353 (0) 65 6840044  
Fax: +353 (0) 65 6822298

**Website:**

[www.microsemi.com](http://www.microsemi.com)

**MECHANICAL and PACKAGING**

- CASE: Hermetically sealed ceramic package.
- TERMINALS: Gold plate over nickel.
- MARKING: Manufacturer's ID, date code, part number.
- POLARITY: NPN (see package outline).
- TAPE & REEL option: Per EIA-481. Consult factory for quantities.
- WEIGHT: 0.12 grams.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**SYMBOLS & DEFINITIONS**

| Symbol    | Definition                                                  |
|-----------|-------------------------------------------------------------|
| $C_{ibo}$ | Common-base open-circuit input capacitance.                 |
| $C_{obo}$ | Common-base open-circuit output capacitance.                |
| $I_{CEO}$ | Collector cutoff current, base open.                        |
| $I_{CEX}$ | Collector cutoff current, circuit between base and emitter. |
| $I_{EBO}$ | Emitter cutoff current, collector open.                     |
| $h_{FE}$  | Common-emitter static forward current transfer ratio.       |
| $V_{BE}$  | Base-emitter voltage, dc .                                  |
| $V_{CE}$  | Collector-emitter voltage, dc.                              |
| $V_{CEO}$ | Collector-emitter voltage, base open.                       |
| $V_{CBO}$ | Collector-emitter voltage, emitter open.                    |
| $V_{EB}$  | Emitter-base voltage, dc .                                  |
| $V_{EBO}$ | Emitter-base voltage, collector open.                       |

**ELECTRICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

**OFF CHARACTERISTICS**

| Parameters / Test Conditions                                                                                                                                          | Symbol        | Min.       | Max.                     | Unit          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------|--------------------------|---------------|
| Collector-Emitter Breakdown Voltage<br>$I_C = 10\text{ mA}$<br>$R_{BB1} = 470\ \Omega$ ; $V_{BB1} = 6\text{ V}$<br>$L = 25\text{ mH (min)}$ ; $f = 30 - 60\text{ Hz}$ | $V_{(BR)CEO}$ | 350<br>250 |                          | V             |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 300\text{ V}$<br>$V_{CE} = 200\text{ V}$                                                                                | $I_{CEO}$     |            | 2.0<br>2.0               | $\mu\text{A}$ |
| Emitter-Base Cutoff Current<br>$V_{EB} = 7.0\text{ V}$                                                                                                                | $I_{EBO}$     |            | 10                       | $\mu\text{A}$ |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 450\text{ V}$ , $V_{BE} = -1.5\text{ V}$<br>$V_{CE} = 300\text{ V}$ , $V_{BE} = -1.5\text{ V}$                          | $I_{CEX}$     |            | 5.0<br>5.0               | $\mu\text{A}$ |
| Collector-Base Cutoff Current<br>$V_{CB} = 360\text{ V}$<br>$V_{CB} = 250\text{ V}$<br>$V_{CB} = 450\text{ V}$<br>$V_{CB} = 300\text{ V}$                             | $I_{CBO}$     |            | 2.0<br>2.0<br>5.0<br>5.0 | $\mu\text{A}$ |

**ON CHARACTERISTICS** <sup>(1)</sup>

| Parameters / Test Conditions                                                                                                                                                        | Symbol        | Min.           | Max. | Unit |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|------|------|
| Forward-Current Transfer Ratio<br>$I_C = 20\text{ mA}$ , $V_{CE} = 10\text{ V}$<br>$I_C = 2.0\text{ mA}$ , $V_{CE} = 10\text{ V}$<br>$I_C = 0.2\text{ mA}$ , $V_{CE} = 10\text{ V}$ | $h_{FE}$      | 40<br>30<br>10 | 160  |      |
| Collector-Emitter Saturation Voltage<br>$I_C = 50\text{ mA}$ , $I_B = 4.0\text{ mA}$                                                                                                | $V_{CE(sat)}$ |                | 0.5  | V    |
| Base-Emitter Saturation Voltage<br>$I_C = 50\text{ mA}$ , $I_B = 4.0\text{ mA}$                                                                                                     | $V_{BE(sat)}$ |                | 1.3  | V    |

**DYNAMIC CHARACTERISTICS**

| Parameters / Test Conditions                                                                                                                                  | Symbol     | Min. | Max. | Unit |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|------|------|
| Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C = 10\text{ mA}$ , $V_{CE} = 10\text{ V}$ , $f = 5.0\text{ MHz}$ | $ h_{fe} $ | 3.0  | 15   |      |
| Forward Current Transfer Ratio<br>$I_C = 5.0\text{ mA}$ , $V_{CE} = 10\text{ V}$ , $f = 1.0\text{ kHz}$                                                       | $h_{fe}$   | 25   |      |      |
| Output Capacitance<br>$V_{CB} = 10\text{ V}$ , $I_E = 0$ , $100\text{ kHz} \leq f \leq 1.0\text{ MHz}$                                                        | $C_{obo}$  |      | 10   | pF   |
| Input Capacitance<br>$V_{CB} = 5.0\text{ V}$ , $I_E = 0$ , $100\text{ kHz} \leq f \leq 1.0\text{ MHz}$                                                        | $C_{ibo}$  |      | 75   | pF   |

(1) Pulse Test: Pulse Width = 300  $\mu\text{s}$ , duty cycle  $\leq 2.0\%$ .

**ELECTRICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ , unless otherwise noted) continued

**SWITCHING CHARACTERISTICS**

| Parameters / Test Conditions                                                                   | Symbol    | Min. | Max. | Unit          |
|------------------------------------------------------------------------------------------------|-----------|------|------|---------------|
| Turn-On Time<br>$V_{CC} = 200\text{ V}; I_C = 20\text{ mA}, I_{B1} = 2.0\text{ mA}$            | $t_{on}$  |      | 1.0  | $\mu\text{s}$ |
| Turn-Off Time<br>$V_{CC} = 200\text{ V}; I_C = 20\text{ mA}, I_{B1} = -I_{B2} = 2.0\text{ mA}$ | $t_{off}$ |      | 10   | $\mu\text{s}$ |

**SAFE OPERATING AREA** (See graph below and also reference test method 3053 of [MIL-STD-750](#).)

**DC Tests**

$T_C = +25^\circ\text{C}$ , 1 Cycle,  $t = 1.0\text{ s}$

**Test 1**

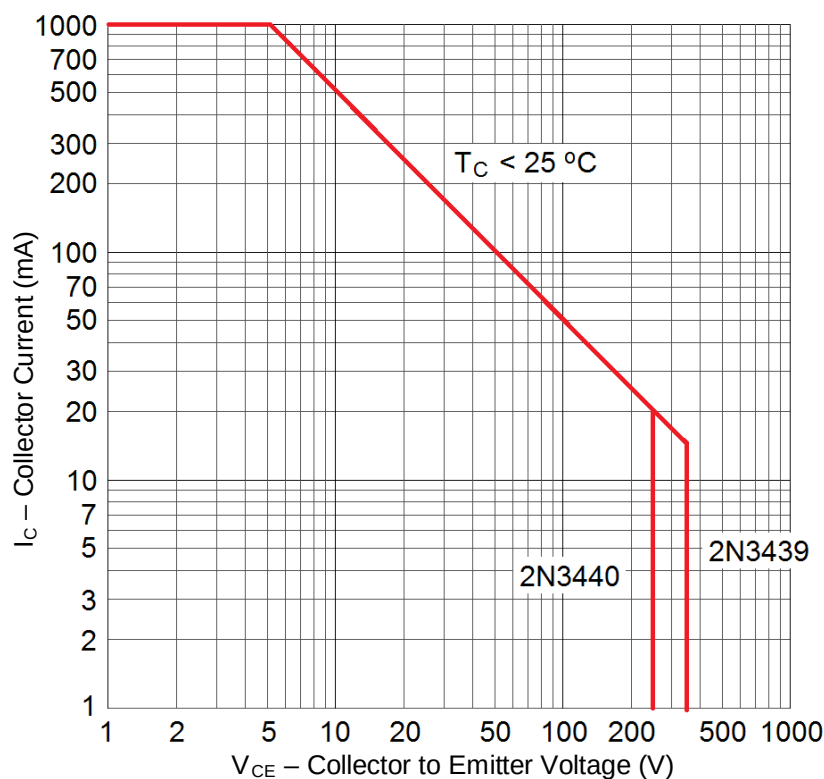
$V_{CE} = 5.0\text{ V}, I_C = 1.0\text{ A}$  Both Types

**Test 2**

$V_{CE} = 350\text{ V}, I_C = 14\text{ mA}$  2N3439UA

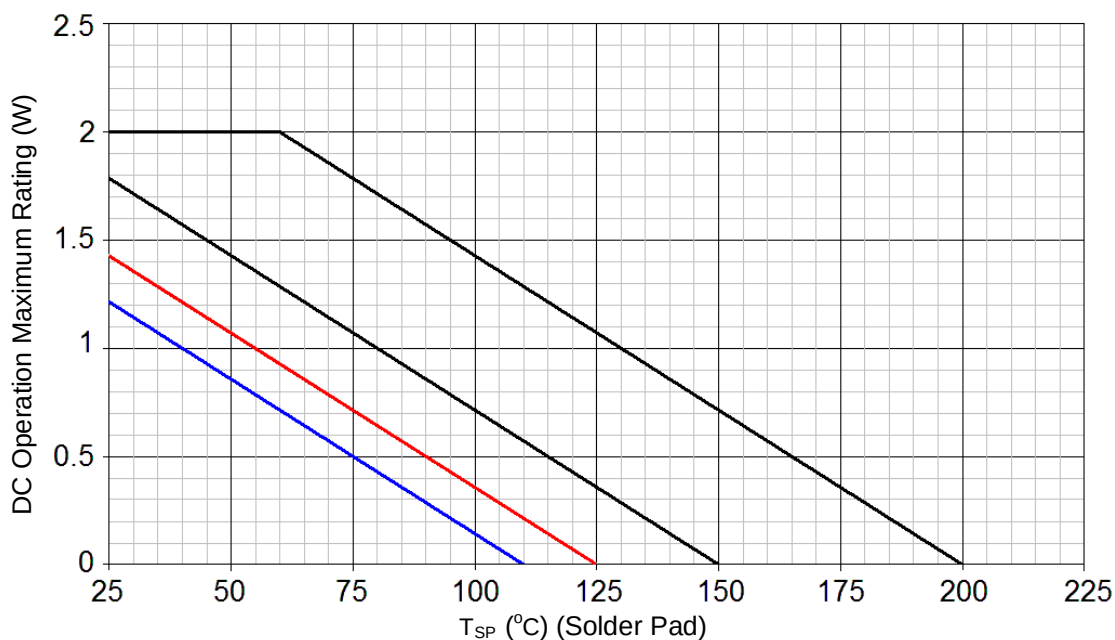
**Test 3**

$V_{CE} = 250\text{ V}, I_C = 20\text{ mA}$  2N3440UA



Maximum Safe Operating graph (continuous dc)

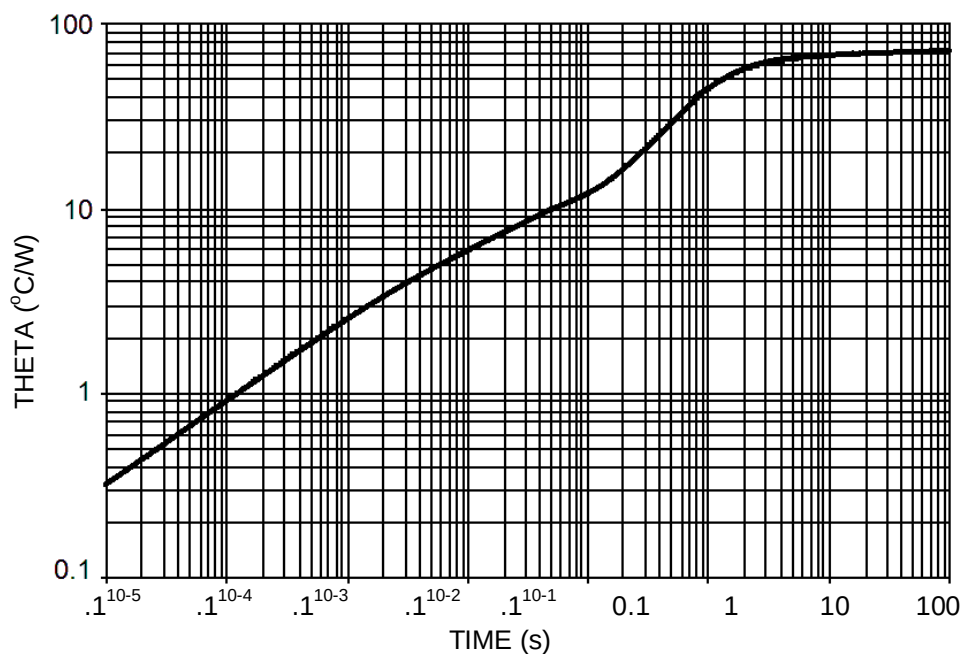
# GRAPHS



**FIGURE 1**

## Temperature-Power Derating Curve

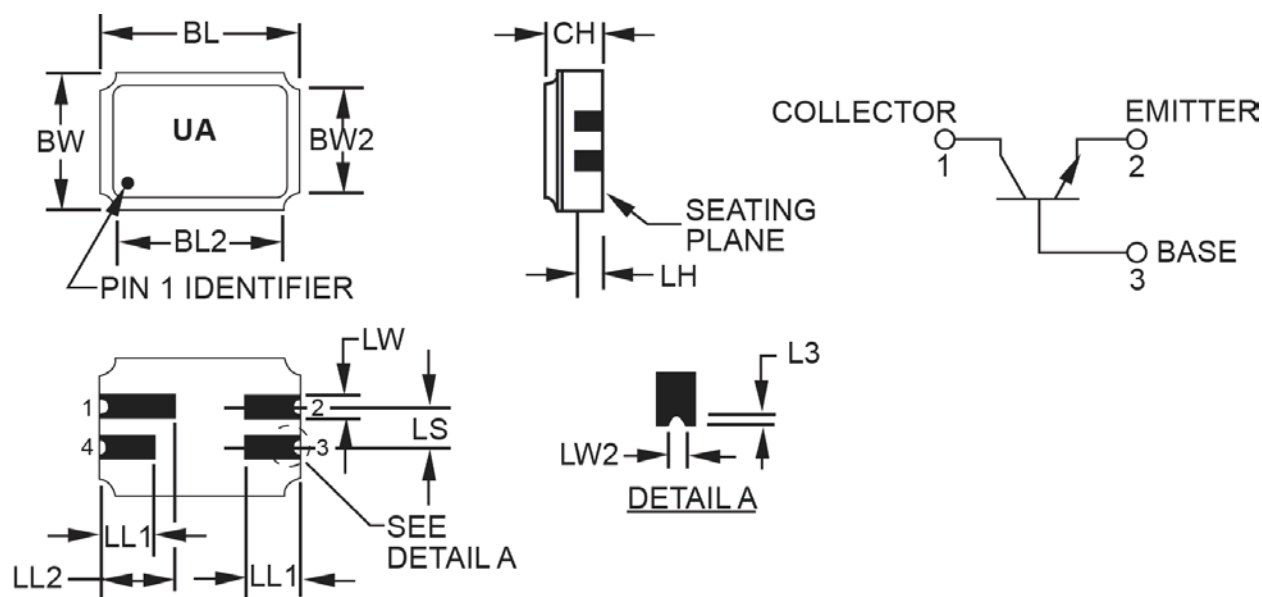
**NOTES:** Thermal Resistance Junction to Solder Pad = 70.0 °C/W  
Max Finish-Alloy Temp = 175.0 °C



**FIGURE 2**

## Maximum Thermal Impedance

**NOTE:** T<sub>C</sub> = +25 °C, Thermal Resistance R<sub>θJSP</sub> = 70.0 °C/W, P<sub>diss</sub> = 2 W.

**PACKAGE DIMENSIONS**

**NOTES:**

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimension "CH" controls the overall package thickness. When a window lid is used, dimension "CH" must increase by a minimum of .010 inch (0.254 mm) and a maximum of .040 inch (1.020 mm).
4. The corner shape (square, notch, radius, etc.) may vary at the manufacturer's option, from that shown on the drawing.
5. Dimensions "LW2" minimum and "L3" minimum and the appropriate castellation length define an unobstructed three-dimensional space traversing all of the ceramic layers in which a castellation was designed. (Castellations are required on bottom two layers, optional on top ceramic layer.) Dimension "LW2" maximum and "L3" maximum define the maximum width and depth of the castellation at any point on its surface. Measurement of these dimensions may be made prior to solder dipping.
6. The co-planarity deviation of all terminal contact points, as defined by the device seating plane, shall not exceed .006 inch (0.15mm) for solder dipped leadless chip carriers.
7. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi$ x symbology.

| Symbol | Dimensions |       |             |      | Note |
|--------|------------|-------|-------------|------|------|
|        | Inches     |       | Millimeters |      |      |
|        | Min        | Max   | Min         | Max  |      |
| BL     | 0.215      | 0.225 | 5.46        | 5.71 |      |
| BL2    |            | 0.225 |             | 5.71 |      |
| BW     | 0.145      | 0.155 | 3.68        | 3.93 |      |
| BW2    |            | 0.155 |             | 3.93 |      |
| CH     | 0.061      | 0.075 | 1.55        | 1.90 | 3    |
| L3     | 0.003      | 0.007 | 0.08        | 0.18 | 5    |
| LH     | 0.029      | 0.042 | 0.74        | 1.07 |      |
| LL1    | 0.032      | 0.048 | 0.81        | 1.22 |      |
| LL2    | 0.072      | 0.088 | 1.83        | 2.23 |      |
| LS     | 0.045      | 0.055 | 1.14        | 1.39 |      |
| LW     | 0.022      | 0.028 | 0.56        | 0.71 |      |
| LW2    | 0.006      | 0.022 | 0.15        | 0.56 | 5    |

|  |            |           |         |      |     |
|--|------------|-----------|---------|------|-----|
|  | Pin no.    | 1         | 2       | 3    | 4   |
|  | Transistor | Collector | Emitter | Base | N/C |

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105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

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