

## FEATURES

- Operates from a Single 3.3V Supply
- Low Supply Current:  $I_{CC} = 200\mu\text{A}$
- ESD Protection Over  $\pm 10\text{kV}$
- Available in 16-Pin SOIC Narrow Package
- Uses Small Capacitors:  $0.1\mu\text{F}$
- Operates to 120kbaud
- Output Overvoltage Does Not Force Current Back into Supplies
- EIA/TIA562 I/O Lines Can Be Forced to  $\pm 25\text{V}$  Without Damage
- Pin Compatible with LT1181A


## APPLICATIONS

- Notebook Computers
- Palmtop Computers

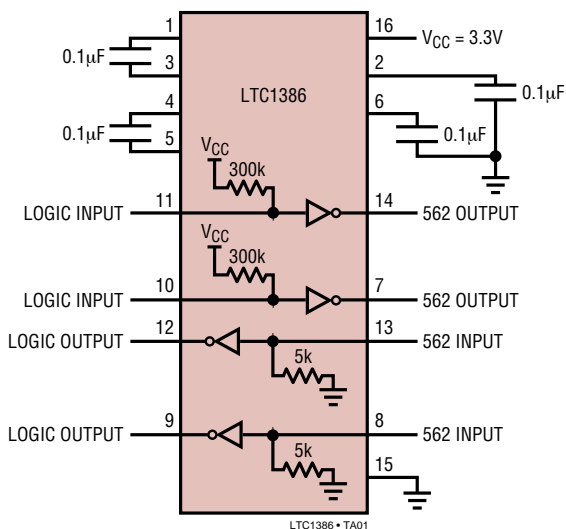
## DESCRIPTION

The LTC<sup>®</sup>1386 is an ultra-low power 2-driver/2-receiver EIA/TIA562 transceiver that operates from a single 3.3V supply. The charge pump requires only four space-saving  $0.1\mu\text{F}$  capacitors. The supply current ( $I_{CC}$ ) of the transceiver is only  $200\mu\text{A}$  with driver outputs unloaded.

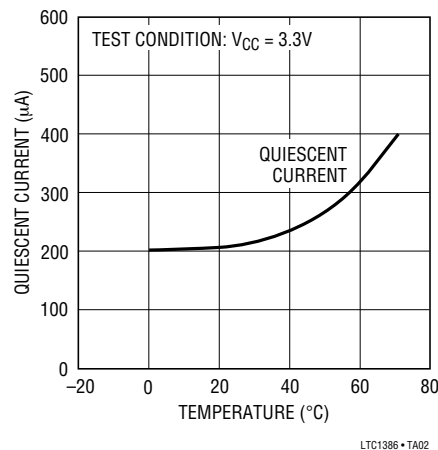
The LTC1386 is fully compliant with all data rate and overvoltage EIA/TIA562 specifications. The transceiver can operate up to 120kbaud with a  $1000\text{pF}$ ,  $3\text{k}\Omega$  load. Both driver outputs and receiver inputs can be forced to  $\pm 25\text{V}$  without damage and can survive multiple  $\pm 10\text{kV}$  ESD strikes.

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## TYPICAL APPLICATION



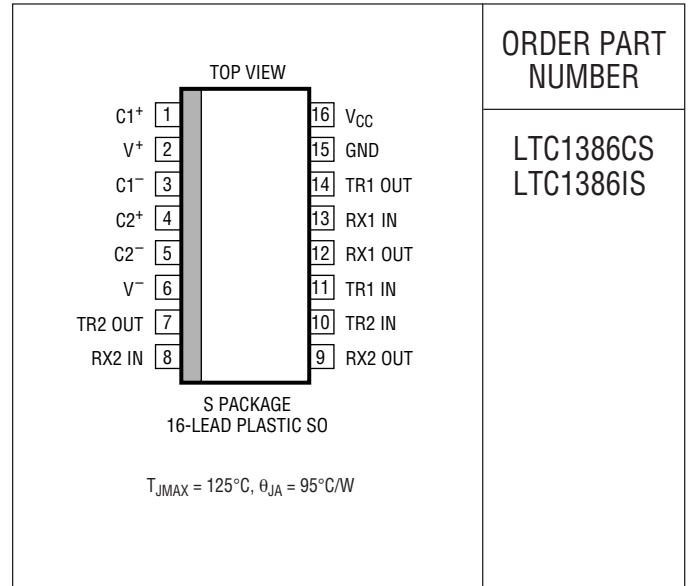
Quiescent Supply Current vs Temperature



## ABSOLUTE MAXIMUM RATINGS

Supply Voltage ( $V_{CC}$ )	5V
Input Voltage	
Driver	-0.3V to $V_{CC} + 0.3V$
Receiver	-25V to 25V
Digital Input	-0.3V to $V_{CC} + 0.3V$
Output Voltage	
Driver	-25V to 25V
Receiver	-0.3V to $V_{CC} + 0.3V$
Short-Circuit Duration	
$V^+$	30 sec
$V^-$	30 sec
Driver Output	Indefinite
Receiver Output	Indefinite
Operating Temperature Range	
LTC1386C	0°C to 70°C
LTC1386I	-40°C to 85°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature (Soldering, 10 sec)	300°C

## PACKAGE/ORDER INFORMATION



ORDER PART NUMBER

LTC1386CS  
LTC1386IS

Consult LTC Marketing for parts specified with wider operating temperature ranges.

## DC ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range.  $V_{CC} = 3.3V$ ,  $C1 = C2 = C3 = C4 = 0.1\mu F$ , unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Any Driver</b>					
Output Voltage Swing	3k to GND	● 3.7	4.5		V
	Positive	● -3.7	-4.5		V
	Negative				
Logic Input Voltage Level	Input Low Level ( $V_{OUT} = \text{High}$ )	● 2.0	1.4	0.8	V
	Input High Level ( $V_{OUT} = \text{Low}$ )	● 2.0	1.4		V
Logic Input Current	$V_{IN} = V_{CC}$	●		5	$\mu A$
	$V_{IN} = 0V$	●	-20	-40	$\mu A$
Output Short-Circuit Current	$V_{OUT} = 0V$	±9	±10		mA
<b>Any Receiver</b>					
Input Voltage Thresholds	Input Low Threshold	● 0.8	1.3		V
	Input High Threshold	●	1.7	2.4	V
Hysteresis		● 0.1	0.4	1	V
Input Resistance	$-10V \leq V_{IN} \leq 10V$	3	5	7	k $\Omega$
Output Voltage	Output Low, $I_{OUT} = -1.6mA$ ( $V_{CC} = 3.3V$ )	● 3.0	0.2	0.4	V
	Output High, $I_{OUT} = 160\mu A$ ( $V_{CC} = 3.3V$ )	●	3.2		V
Output Short-Circuit Current	Sinking Current, $V_{OUT} = V_{CC}$	-5	-20		mA
	Sourcing Current, $V_{OUT} = GND$	2	7		mA
<b>Power Supply Generator</b>					
$V^+$ Output Voltage	$I_{OUT} = 0mA$		5.7		V
	$I_{OUT} = 5mA$		5.5		V
$V^-$ Output Voltage	$I_{OUT} = 0mA$		-5.3		V
	$I_{OUT} = -5mA$		-5.0		V
<b>Power Supply</b>					
$V_{CC}$ Supply Current	No Load (Note 2), 0°C to 70°C	● 0.2	0.5		mA
	No Load (Note 2), -40°C to 85°C	● 0.35	1.0		mA

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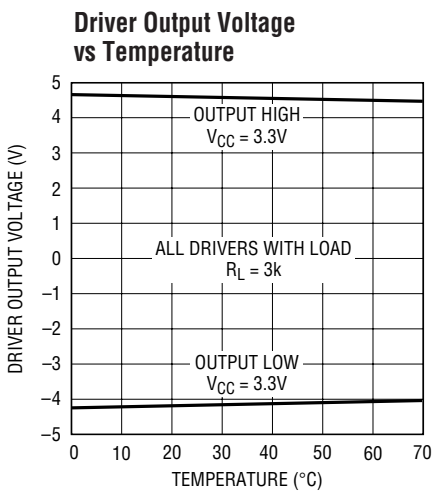
**AC CHARACTERISTICS** The ● denotes specifications which apply over the full operating temperature range.  
 $V_{CC} = 3.3V$ ,  $C_1 = C_2 = C_3 = C_4 = 0.1\mu F$ , unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Slew Rate	$R_L = 3k$ , $C_L = 51pF$		8	30	$V/\mu S$
	$R_L = 3k$ , $C_L = 1000pF$	3	5		$V/\mu S$
Driver Propagation Delay (TTL to EIA/TIA562)	$t_{HLD}$ (Figure 1)	●	2	3.5	$\mu S$
	$t_{LHD}$ (Figure 1)	●	2	3.5	$\mu S$
Receiver Propagation Delay (EIA/TIA562 to TTL)	$t_{HLR}$ (Figure 2)	●	0.3	0.8	$\mu S$
	$t_{LHR}$ (Figure 2)	●	0.3	0.8	$\mu S$

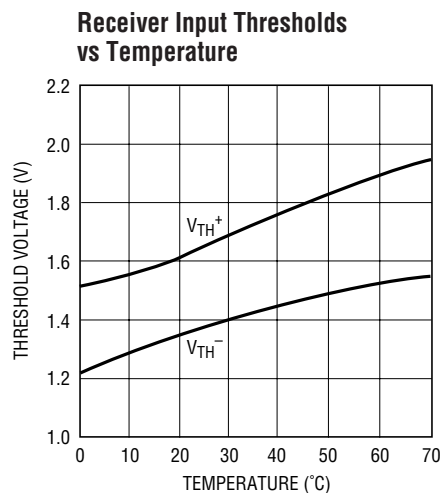
**Note 1:** Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.  
**Note 2:** Supply current is measured with driver and receiver outputs unloaded.

**Note 3:** Measurements made in the shutdown mode are performed with  $V_{ON/OFF} = 0V$ .

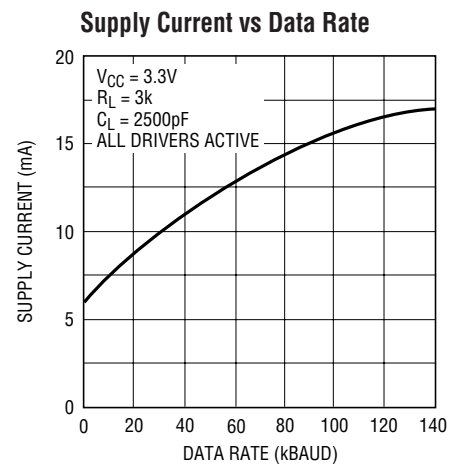
**TYPICAL PERFORMANCE CHARACTERISTICS**



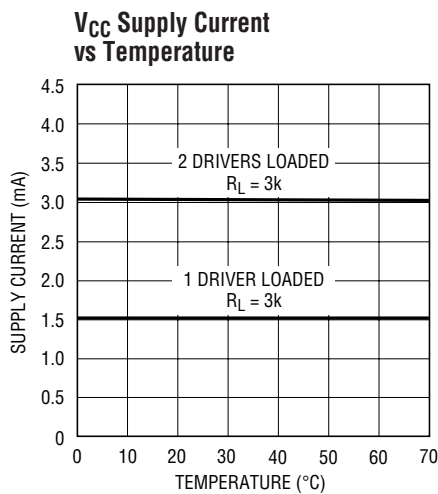
LTC1386 • TPC01



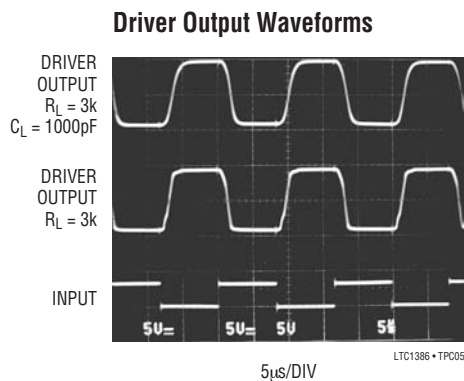
LTC1386 • TPC02



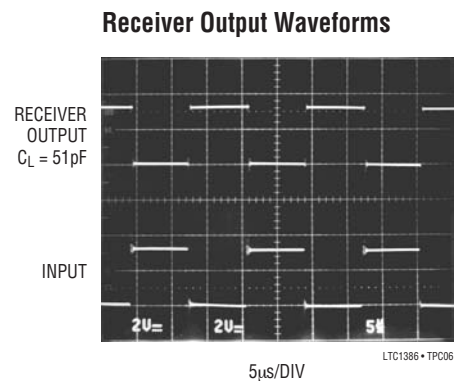
LTC1386 • TPC03



LTC1386 • TPC04



LTC1386 • TPC05



LTC1386 • TPC06

## PIN FUNCTIONS

**V<sub>CC</sub>**: 3.3V Input Supply Pin. This pin should be decoupled with a 0.1 $\mu$ F ceramic capacitor.

**GND**: Ground Pin.

**V<sup>+</sup>**: Positive Supply Output (EIA/TIA562 Drivers).  $V^+ \cong 2V_{CC} - 1V$ . This pin requires an external capacitor  $C = 0.1\mu F$  for charge storage. The capacitor may be tied to ground or  $V_{CC}$ . With multiple devices, the  $V^+$  and  $V^-$  pins may share a common capacitor. For large numbers of devices, increasing the size of the shared common storage capacitors is recommended to reduce ripple.

**V<sup>-</sup>**: Negative Supply Output (RS232 Drivers).  $V^- \cong -(2V_{CC} - 1.3V)$ . This pin requires an external capacitor  $C = 0.1\mu F$  for charge storage.

**C1<sup>+</sup>, C1<sup>-</sup>, C2<sup>+</sup>, C2<sup>-</sup>**: Commutating Capacitor Inputs. These pins require two external capacitors  $C = 0.1\mu F$ : one from C1<sup>+</sup> to C1<sup>-</sup> and another from C2<sup>+</sup> to C2<sup>-</sup>. To maintain

charge pump efficiency, the capacitor's effective series resistance should be less than 2 $\Omega$ .

**TR IN**: EIA/TIA562 Driver Input Pins. Inputs are TTL/CMOS compatible. The inputs of unused drivers can be left unconnected since 300k input pull-up resistors to  $V_{CC}$  are included on chip.

**TR OUT**: Driver Outputs at EIA/TIA562 Voltage Levels. The driver outputs are protected against ESD to  $\pm 10kV$  for human body model discharges.

**RX IN**: Receiver Inputs. These pins can be forced to  $\pm 25V$  without damage. The receiver inputs are protected against ESD to  $\pm 10kV$  for human body model discharges. Each receiver provides 0.4V of hysteresis for noise immunity.

**RX OUT**: Receiver Outputs with TTL/CMOS Voltage Levels.

## SWITCHING TIME WAVEFORMS

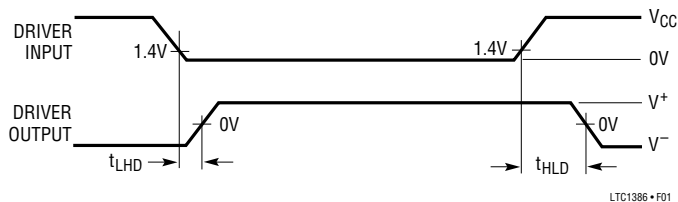


Figure 1. Driver Propagation Delay Timing

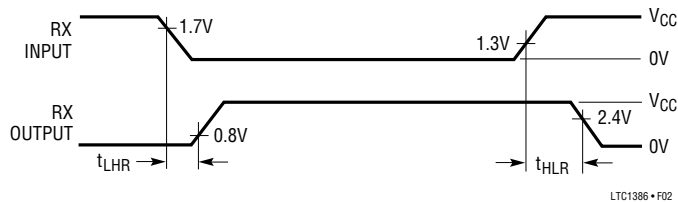
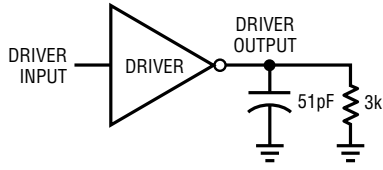


Figure 2. Receiver Propagation Delay Timing

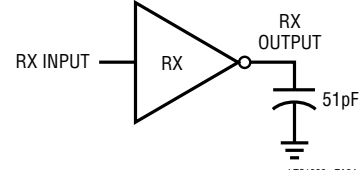
# TEST CIRCUITS

Driver Timing Test Load



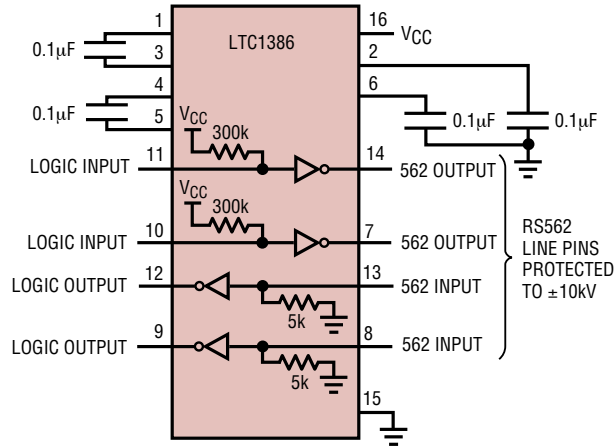
LTC1386 • TA03

Receiver Timing Test Load



LTC1386 • TA04

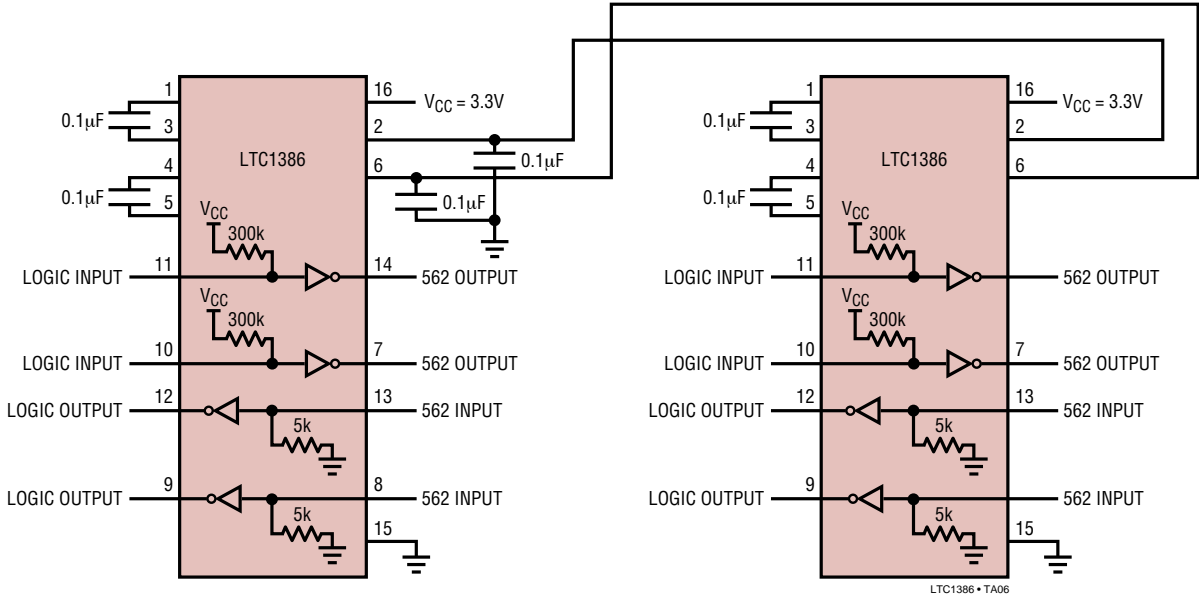
ESD Test Circuit



1386 TA05

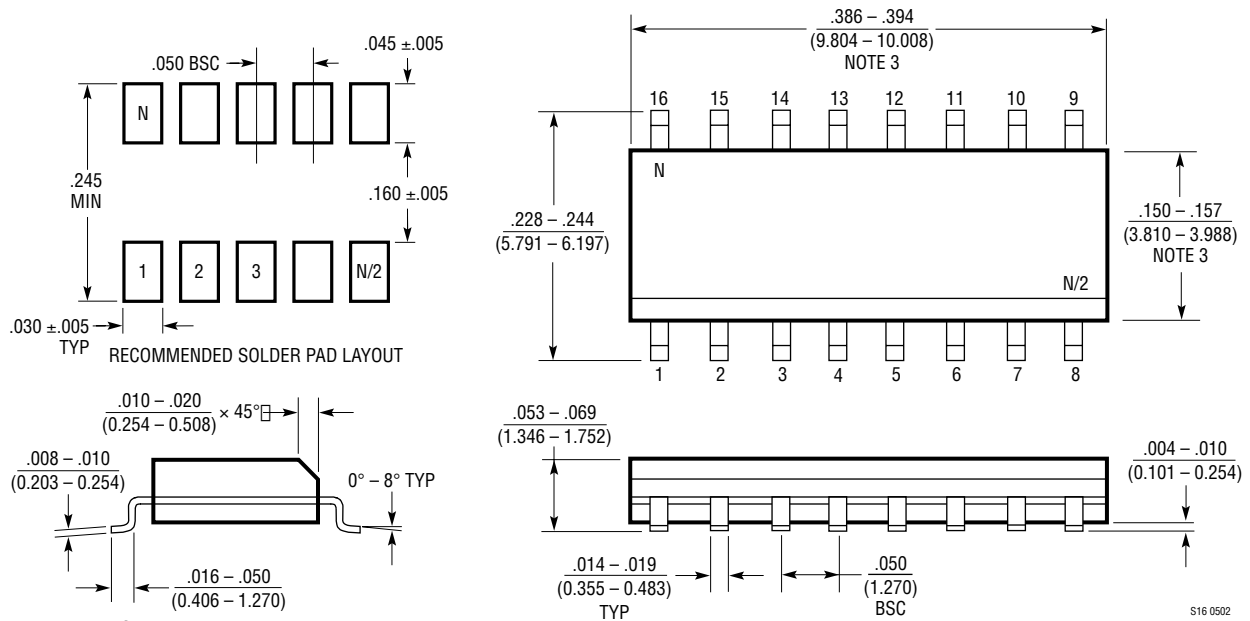
# TYPICAL APPLICATIONS

Paralleling Power Supply Generator with Common Storage Capacitors



# PACKAGE DESCRIPTION

## S Package 16-Lead Plastic Small Outline (Narrow .150 Inch) (Reference LTC DWG # 05-08-1610)



- NOTE:
1. DIMENSIONS IN  $\frac{\text{INCHES}}{\text{MILLIMETERS}}$
  2. DRAWING NOT TO SCALE
  3. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)

S16 0502

**RELATED PARTS**

<b>PART NUMBER</b>	<b>DESCRIPTION</b>	<b>COMMENTS</b>
LT1780/LT1781	5V, 2 Driver, 2 Receiver RS232 Transceivers	± 15kV ESD per IEC 1000-4
LTC1327	3.3V, 3 Driver, 5 Receiver RS562 Transceiver	300µA Supply Current, 0.2µA in Shutdown
LTC1348	3.3V to 5V, 3 Driver, 5 Receiver RS232 Transceiver	True RS232 on 3.3V, 5 Receivers Active in Shutdown
LTC1382	5V, 2 Driver, 2 Receiver RS232 Transceiver	220µA Supply Current, 0.2µA in Shutdown
LTC1383	5V, 2 Driver, 2 Receiver RS232 Transceiver	220µA Supply Current, Narrow 16-pin SO
LTC1384	5V, 2 Driver, 2 Receiver RS232 Transceiver	220µA Supply Current, 2 Receivers Active in Shutdown
LTC1385	3.3V, 2 Driver, 2 Receiver RS562 Transceiver	220µA Supply Current, 2 Receivers Active in Shutdown



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### Офис по работе с юридическими лицами:

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

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