

### **General Description**

The MAX6394 low-power CMOS microprocessor ( $\mu P$ ) supervisory circuit is designed to monitor power supplies in  $\mu P$  and digital systems. It offers excellent circuit reliability by providing 1% accurate thresholds over temperature and by eliminating external components and adjustments. The MAX6394 also provides a debounced manual reset input.

This device performs a single function: it asserts a reset signal whenever the  $V_{CC}$  supply voltage falls below a preset threshold or whenever manual reset is asserted. RESET remains asserted for an internally programmed interval (reset timeout period) after  $V_{CC}$  has risen above the reset threshold or manual reset is deasserted. The MAX6394's open-drain RESET output can be pulled up to a voltage higher than  $V_{CC}$ .

The MAX6394 comes with factory-trimmed reset threshold voltages from 2.4V to 4.8V. Preset timeout periods of 0.7ms, 14ms, 105ms, and 826ms are also available. The device comes in a SOT143 package.

### **Applications**

Computers

Controllers

Intelligent Instruments

Critical µP and µC Power Monitoring

Portable/Battery-Powered Equipment

### \_\_\_\_\_Features

- **♦** ±0.6% Threshold Accuracy at T<sub>A</sub> = +25°C
- ♦ ±1.0% Threshold Accuracy from -40°C to +125°C
- ♦ Small SOT143 Package
- ♦ Open-Drain RESET Output Can Exceed Vcc
- ♦ Precision, Factory-Set V<sub>CC</sub> Reset Thresholds: Nine Options from 2.4V to 4.8V
- ♦ Four Reset Timeout Periods Available: 0.7ms, 14ms, 105ms, and 826ms (minimum)
- **♦ Immune to Short V<sub>CC</sub> Transients**
- ♦ 5µA Supply Current

### **Ordering Information**

PART	PIN-PACKAGE	PKG CODE
MAX6394USD_+T	4 SOT143-4	U4-1

**Note:** This device is specified over the -40°C to +125°C operating temperature range.

+Denotes a lead-free package.

**Note:** The "\_\_\_" is a placeholder for the input voltage thresholds. Nine threshold options are available. See Tables 1 and 2 for more information.

**Note:** The "\_" is a placeholder for the timeout option. Four options are available. See the Timeout Options section for more information.

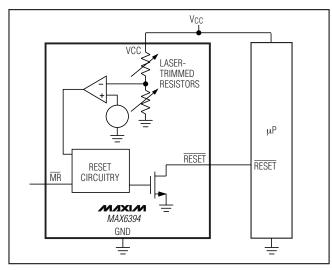
Four standard versions are available (see the Standard Versions Selector Guide section). Samples are generally available in standard versions. Contact factory for availability of nonstandard versions.

**Note:** All devices are available in tape-and-reel only. Tape and reel is offered in 2.5k increments.

### **Pin Configuration**

# TOP VIEW GND 1 4 VCC MAX6394 3 MR SOT143

### **Typical Operating Circuit**



Maxim Integrated Products

### **ABSOLUTE MAXIMUM RATINGS**

VCC	0.3V to +6.0V	Continuous Power Dissipation (T <sub>A</sub> = +70°C)
RESET	0.3V to +6.0V	SOT143 (derate 4mW/°C above +70°C)320mW
All Other Pins	0.3V to (V <sub>CC</sub> + 0.3V)	Operating Temperature Range40°C to +125°C
Input Current (V <sub>CC</sub> )	20mA	Storage Temperature Range65°C to +160°C
Output Current (RESET)	20mA	Lead Temperature (soldering, 10s)+300°C
Rate of Rise (Vcc)	100V/us	

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### **ELECTRICAL CHARACTERISTICS**

 $(V_{CC} = +2.4V \text{ to } +5.5V, T_A = -40^{\circ}\text{C} \text{ to } +125^{\circ}\text{C}, \text{ unless otherwise noted. Typical values are at } T_A = +25^{\circ}\text{C.})$ 

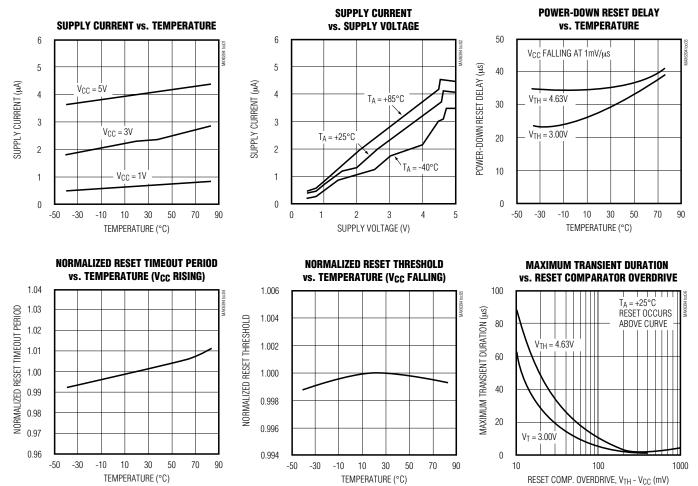
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
Operating Voltage Range	Vcc	$T_A = -40^{\circ}\text{C to } +125^{\circ}\text{C}$	1.0		5.5	V	
		$V_{CC} = 5.5V$ , no load (-40°C to +85°C)		5	12		
V Cupali Current	1	$V_{CC} = 5.5V$ , no load (-40°C to +125°C)			15	μΑ	
V <sub>CC</sub> Supply Current	Icc	$V_{CC} = 3.6V$ , no load (-40°C to +85°C)		4	10		
		V <sub>CC</sub> = 3.6V, no load (-40°C to +125°C)			12		
Decet Threehold (Note 1)	V	T <sub>A</sub> = +25°C (see Table 1)	V <sub>TH</sub> - 0.6%	V <sub>T</sub> H	V <sub>TH</sub> + 0.6%	V	
Reset Threshold (Note 1)	V <sub>TH</sub>	$T_A = -40$ °C to +125°C (see Table 2)	V <sub>TH</sub> - 1.0%		V <sub>TH</sub> + 1.0%		
Reset Threshold Tempco	ΔV <sub>TH</sub> /°C			60		ppm/°C	
V <sub>CC</sub> to Reset Delay		V <sub>CC</sub> = falling at 1mV/µs		35		μs	
		MAX6394USD1-T	0.7	1.4	2.0	- ms	
Reset Timeout Period	t <sub>RP</sub>	MAX6394USD2-T	14	28	40		
Reset Timeout Period		MAX6394USD3-T	105	200	280		
		MAX6394USD4-T	826	1570	2240		
MANUAL RESET INPUT							
	$V_{IL}$	V <sub>TH</sub> > 4.0V	0.8				
MR Input Threshold	VIH				2.4	V	
MR Input Threshold	$V_{IL}$	V <sub>TH</sub> < 4.0V	0.3 x V <sub>CC</sub>			7 V	
	V <sub>IH</sub>			(	0.7 x V <sub>CC</sub>		
MR Minimum Input Pulse			1			μs	
MR Glitch Rejection				100		ns	
MR to Reset Delay				500		ns	
MR Pullup Resistance			32	63	100	kΩ	
	V <sub>OL</sub>	$V_{CC} > 4.25V$ , $I_{SINK} = 3.2mA$			0.4		
RESET Output Voltage		V <sub>CC</sub> > 2.5V, I <sub>SINK</sub> = 1.2mA			0.3		
NESET Output voltage		$V_{CC} > 1.2V$ , $I_{SINK} = 0.5mA$ 0.3		0.3			
		$V_{CC} > 1.0V$ , $I_{SINK} = 80\mu A$			0.3		
RESET Output Leakage Current		V <sub>CC</sub> > V <sub>TH</sub> , RESET deasserted			1	μΑ	

Note 1: The MAX6394 monitors  $V_{CC}$  through an internal factory-trimmed voltage-divider that programs the nominal reset threshold. Other thresholds may be available. Contact factory for availability.

\_\_\_\_\_\_MIXI/M

### **Typical Operating Characteristics**

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



### **Pin Description**

PIN	NAME	FUNCTION
1	GND	Ground
2	RESET	Active-Low Open-Drain Output. Connect to an external pullup resistor. Can be pulled up to a voltage higher than $V_{CC}$ , but less than 6V.
3	MR	Manual Reset Input. A logic-low on $\overline{\text{MR}}$ asserts reset. Reset remains asserted as long as $\overline{\text{MR}}$ is low, and for the reset timeout period (t <sub>RP</sub> ) after the reset conditions are terminated. Connect to VCC if not used.
4	VCC	Supply Voltage and Reset Threshold Monitor Input

### **Detailed Description**

### **Reset Output**

A microprocessor's (µP's) reset input starts the µP in a known state. The MAX6394 asserts a reset signal to prevent code-execution errors during power-up, power-down, or brownout conditions. RESET is guaranteed to be a logic-low for VCC > 1V (see the *Electrical Characteristics* table). Once VCC exceeds the reset threshold, the internal timer keeps  $\overline{\text{RESET}}$  asserted for the reset timeout period (tRP); after this interval  $\overline{\text{RESET}}$  goes high. If a brownout condition occurs (monitored voltage dips below its programmed reset threshold),  $\overline{\text{RESET}}$  goes low. Any time VCC dips below the reset threshold, the internal timer resets to zero and  $\overline{\text{RESET}}$  goes low. The internal timer starts when VCC returns above the reset threshold, and  $\overline{\text{RESET}}$  remains low for the reset timeout period.

The MAX6394's  $\overline{\text{RESET}}$  output structure is a simple open-drain n-channel MOSFET switch. Connect a pullup resistor to any supply in the 0 to +6V range. Select a resistor value large enough to register a logic-low when  $\overline{\text{RESET}}$  is asserted (see the *Electrical Characteristics* table), and small enough to register a logic-high while supplying all input current and leakage paths connected to the  $\overline{\text{RESET}}$  line. A  $10\text{k}\Omega$  pullup is sufficient in most applications.

Often, the pullup connected to the MAX6394's RESET output connects to the supply voltage monitored at the IC's VCC pin. However, some systems may use the open-drain output to level-shift from the monitored supply to reset circuitry powered by some other supply (Figure 1). This is one useful feature of an open-drain output. Keep in mind that as the MAX6394's VCC decreases below 1V, so does the IC's ability to sink current at RESET. Finally, with any pullup, RESET is pulled high as VCC decays toward 0V. The voltage where this occurs depends on the pullup resistor value and the voltage to which it connects (see the *Electrical Characteristics* table).

### Manual-Reset Input

Many  $\mu P$ -based products require manual-reset capability, allowing the operator, a test technician, or external logic circuitry to initiate a reset. A logic-low on  $\overline{MR}$  asserts reset.  $\overline{RESET}$  remains asserted while  $\overline{MR}$  is low, and for the reset active timeout period after  $\overline{MR}$  returns high.

 $\overline{\text{MR}}$  has an internal  $63\text{k}\Omega$  pullup resistor, so it can be left open if not used. Connect a normally open momen-

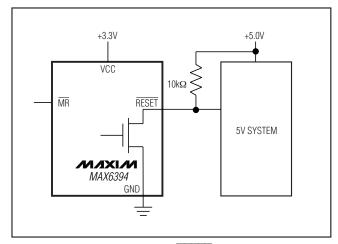


Figure 1. MAX6394 Open-Drain RESET Output Allows Use with Multiple Supplies

tary switch from  $\overline{MR}$  to GND to create a manual reset function; external debounce circuitry is not required. If  $\overline{MR}$  is driven from long cables or if the device is used in a noisy environment, connecting a 0.1 $\mu$ F capacitor from  $\overline{MR}$  to ground provides additional noise immunity.

### Applications Information

### **Negative-Going Vcc Transients**

In addition to issuing a reset to the µP during power-up, power-down, and brownout conditions, these devices are relatively immune to short-duration negative-going transients (glitches). The Typical Operating Characteristics show the Maximum Transient Duration vs. Reset Threshold Overdrive, for which reset pulses are not generated. The graph was produced using negativegoing pulses, starting at VRST max and ending below the programmed reset threshold by the magnitude indicated (reset threshold overdrive). The graph shows the maximum pulse width that a negative-going VCC transient may typically have without causing a reset pulse to be issued. As the transient amplitude increases (i.e., goes farther below the reset threshold), the maximum allowable pulse width decreases. A 0.1µF bypass capacitor mounted close to VCC provides additional transient immunity.

### **Chip Information**

**TRANSISTOR COUNT: 519** 

Table 1. ±0.6% of Thresholds

±0.6% OF THRESHOLD (V)					
SUFFIX MIN TYP MAX					
480	4.771	4.800	4.829		
470	4.672	4.700	4.728		
455	4.523	4.550	4.577		
445	4.423	4.450 4.477			
317	3.149	3.168 3.187			
310	3.083	3.102	3.121		
300	2.985	2.985 3.003 3.021			
294	2.919	2.937 2.955			
240	2.386	2.400	2.414		

Table 2. ±1% of Thresholds

±1% OF THRESHOLD (V)							
SUFFIX	SUFFIX MIN TYP MAX						
480	4.752	4.752 4.800 4.84					
470	4.653	4.700	4.747				
455	4.505	4.550	4.596				
445	4.406 4.450		4.495				
317	3.136	3.168	3.200				
310	3.071	071 3.102 3.133					
300	2.973 3.003 3.0		3.033				
294	2.908	2.908 2.937 2.96					
240	2.376	2.400	2.424				

### **Timeout Options**

SUFFIX	SUFFIX MIN (ms) TYP (ms)		MAX (ms)	
D1	0.7	1.4	2	
D2	14	28	40	
D3	105	200	280	
D4	826	1570	2240	

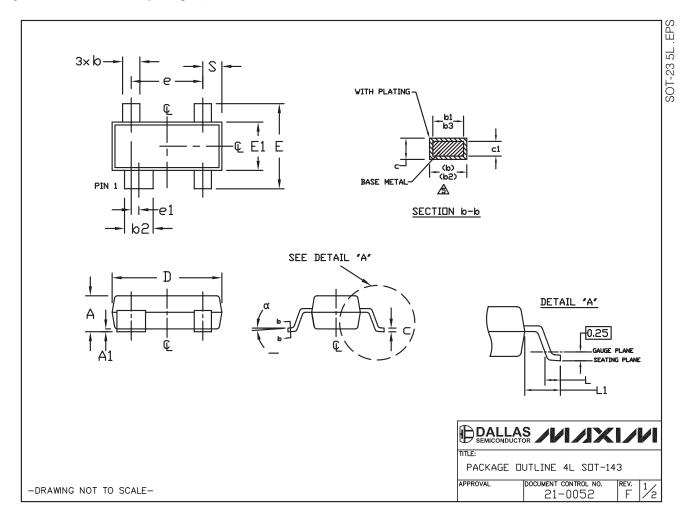
### Standard Versions Selector Guide

STANDARD VERSIONS	6
480	
455	D3
310	טט
240	

**Note:** Samples are generally available in standard versions. Contact factory for availability of nonstandard versions.

### **Package Information**

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to <a href="https://www.maxim-ic.com/packages">www.maxim-ic.com/packages</a>.)



### **Package Information (continued)**

MILL IMETERS

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to www.maxim-ic.com/packages.)

1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm (.006').
3. CONTROLLING DIMENSION: MILLIMETERS.

4. MEETS JEDEC TO253.

THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08mm AND 0.15mm FROM THE LEAD TIP.

$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		INCHES   MILLIMETERS				-K2	
A1         0.000         0.0022         0.006         0.01         0.056         0.15           b         0.014         0.0157         0.020         0.35         0.400         0.50           b1         0.012         0.018         0.30         0.455           b2         0.030         0.0323         0.035         0.76         0.820         0.89           b3         0.012         0.033         0.76         0.820         0.89           c         0.003         0.0051         0.008         0.08         0.130         0.20           c1         0.003         0.0051         0.006         0.08         0.130         0.20           D         0.110         0.1150         0.120         2.80         2.920         3.04           E         0.083         0.0933         0.104         2.10         2.370         2.64           E1         0.047         0.0512         0.055         1.20         1.300         1.40           e         0.076         BSC.         1.92         BSC.           e1         0.008         BSC.         0.20         BSC.           L         0.016         0.024         0.40	DIM	MIN	NDM	MAX	MIN	NDM	MAX
b         0.014         0.0157         0.020         0.35         0.400         0.50           b1         0.012         0.018         0.30         0.455           b2         0.030         0.0323         0.035         0.76         0.820         0.89           b3         0.012         0.033         0.76         0.820         0.89           c         0.003         0.0051         0.008         0.08         0.130         0.20           c1         0.003         0.006         0.08         0.130         0.20           D         0.110         0.1150         0.120         2.80         2.920         3.04           E         0.083         0.0933         0.104         2.10         2.370         2.64           E1         0.047         0.0512         0.055         1.20         1.300         1.40           e         0.076         BSC.         1.92         BSC.           c1         0.018         0.024         0.40         0.54         REF.           S         0.018         0.0207         0.024         0.45         0.525         0.60           α         0°         2°         8°         0°<	Α	0.031	0.0394	0.048	0.80	1.000	1.22
b1         0.012         0.018         0.30         0.45           b2         0.030         0.0323         0.035         0.76         0.820         0.89           b3         0.012         0.033         0.76         0.820         0.84           c         0.003         0.0051         0.008         0.08         0.130         0.20           c1         0.003         0.006         0.08         0.130         0.20           D         0.110         0.1150         0.120         2.80         2.920         3.04           E         0.083         0.0933         0.104         2.10         2.370         2.64           E1         0.047         0.0512         0.055         1.20         1.300         1.40           e         0.076         BSC.         1.92         BSC.           c1         0.018         0.024         0.40         0.54         REF.           S         0.018         0.0207         0.024         0.45         0.525         0.60           α         0°         2°         8°         0°         2°         8°	A1	0.000	0.0022	0.006	0.01	0.056	0.15
b2         0.030         0.0323         0.035         0.76         0.820         0.89           b3         0.012         0.033         0.76         0.84           c         0.003         0.0051         0.008         0.08         0.130         0.20           c1         0.003         0.006         0.08         0.04         0.16           D         0.110         0.1150         0.120         2.80         2.920         3.04           E         0.083         0.0933         0.104         2.10         2.370         2.64           E1         0.047         0.0512         0.055         1.20         1.300         1.40           e         0.076         BSC.         1.92         BSC.           c1         0.008         BSC.         0.20         BSC.           L         0.016         0.024         0.40         0.54         REF.           S         0.018         0.0207         0.024         0.45         0.525         0.60           α         0°         2°         8°         0°         2°         8°	b	0.014	0.0157	0.020	0.35	0.400	0.50
b3         0.012         0.033         0.76         0.84           c         0.003         0.0051         0.008         0.08         0.130         0.20           c1         0.003         0.006         0.08         0.16         0.16           D         0.110         0.150         0.120         2.80         2.920         3.04           E         0.083         0.0933         0.104         2.10         2.370         2.64           E1         0.047         0.0512         0.055         1.20         1.300         1.40           e         0.076         BSC.         1.92         BSC.           e1         0.008         BSC.         0.20         BSC.           L         0.016         0.024         0.40         0.50         BSC.           L         0.016         0.024         0.40         0.54         REF.           S         0.018         0.0207         0.024         0.45         0.525         0.60           α         0°         2°         8°	b1	0.012		0.018	0.30		0.45
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	b2	0.030	0.0323	0.035	0.76	0.820	0.89
C1         0.003         0.006         0.08         0.16           D         0.110         0.1150         0.120         2.80         2.920         3.04           E         0.083         0.0933         0.104         2.10         2.370         2.64           E1         0.047         0.0512         0.055         1.20         1.300         1.40           e         0.076         BSC.         1.92         BSC.           e1         0.008         BSC.         0.20         BSC.           L         0.016         0.024         0.40         0.60           L1         0.021         REF.         0.54         REF.           S         0.018         0.0207         0.024         0.45         0.525         0.60           α         0*         2*         8*         0*         2*         8*	b3	0.012		0.033	0.76		0.84
D         0.110         0.1150         0.120         2.80         2.920         3.04           E         0.083         0.0933         0.104         2.10         2.370         2.64           E1         0.047         0.0512         0.055         1.20         1.300         1.40           e         0.076 BSC.         1.92 BSC.           e1         0.008 BSC.         0.20 BSC.           L         0.016         0.024         0.40         0.60           L1         0.021 REF.         0.54 REF.           S         0.018         0.0207         0.024         0.45         0.525         0.60           α         0*         2*         8*         0*         2*         8*	C	0.003	0.0051	0.008	0.08	0.130	0.20
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	⊂1	0.003		0.006	0.08		0.16
E1       0.047       0.0512       0.055       1.20       1.300       1.40         e       0.076 BSC.       1.92 BSC.         e1       0.008 BSC.       0.20 BSC.         L       0.016       0.024       0.40       0.60         L1       0.021 REF.       0.54 REF.         S       0.018       0.0207       0.024       0.45       0.525       0.60         α       0°       2°       8°       0°       2°       8°	D	0.110	0.1150	0.120	2.80	2.920	3.04
e     0.076 BSC.     1.92 BSC.       e1     0.008 BSC.     0.20 BSC.       L     0.016     0.024 0.40     0.60       L1     0.021 REF.     0.54 REF.       S     0.018     0.0207 0.024 0.45 0.525 0.60       α     0°     2°     8°     0°     2°     8°	Ε	0.083	0.0933	0.104	2.10	2.370	2.64
e1     0.008 BSC.     0.20 BSC.       L     0.016     0.024     0.40     0.60       L1     0.021 REF.     0.54 REF.       S     0.018     0.0207     0.024     0.45     0.525     0.60       α     0°     2°     8°     0°     2°     8°	E1	0.047	0.0512	0.055	1.20	1.300	1.40
L     0.016     0.024     0.40     0.60       L1     0.021 REF.     0.54 REF.       S     0.018     0.0207     0.024     0.45     0.525     0.60       α     0°     2°     8°     0°     2°     8°	е	0.	076 BS	C.	1.5	92 BSC.	
L1     0.021 REF.     0.54 REF.       S     0.018     0.0207     0.024     0.45     0.525     0.60       α     0°     2°     8°     0°     2°     8°	e1	0.	.008 BSC.		0.	20 BSC.	
S         0.018         0.0207         0.024         0.45         0.525         0.60           α         0°         2°         8°         0°         2°         8°	L	0.016		0.024	0.40		0.60
α 0° 2° 8° 0° 2° 8°	L1	0.021 REF.		0.54 REF.		-	
	S	0.018	0.0207	0.024	0.45	0.525	0.60
PKG CODES: U4-1, U4-2	α	0*	2*	8*	0*	2*	8*
	PK	PKG C□DES: U4-1, U4-2					

DALLAS ///

PACKAGE DUTLINE 4L SDT-143

APPROVAL DOCUMENT CONTROL NO. 21-0052

-DRAWING NOT TO SCALE-

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

### **ПОСТАВКА** ЭЛЕКТРОННЫХ КОМПОНЕНТОВ

многоканальный

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001 Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

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### http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

### Офис по работе с юридическими лицами:

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