

DATA SHEET

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REPLACEMENT
of **LM393**

MIK393 • LOW POWER LOW OFFSET VOLTAGE DUAL COMPARATORS



MIK393

LOW POWER LOW OFFSET VOLTAGE DUAL COMPARATORS

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GENERAL DESCRIPTION

The MIK393 consists of two independent precision voltage comparators which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common-mode voltage range includes ground, even though operated from a single power supply voltage.

Application areas include limit comparators, simple analog to digital converters; pulse, squarewave and time delay generators; wide range VCO; MOS clock timers; multivibrators and high voltage digital logic gates. The MIK393 series was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, the MIK393 series will directly interface with MOS logic where their low power drain is a distinct advantage over standard comparators.

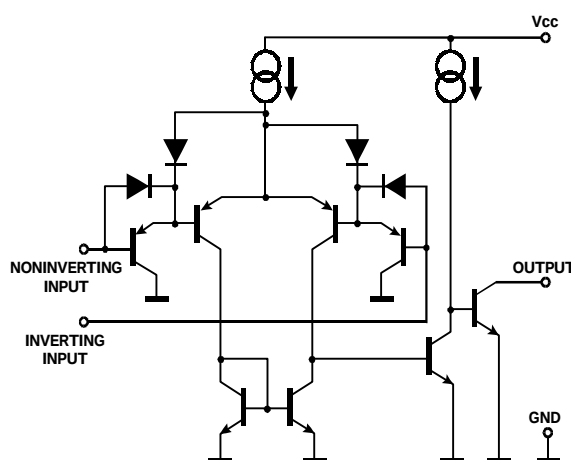
FEATURES

- Wide supply voltage range 2.0V to 32V.
- Low supply current drain independent of supply voltage.
- Low input biasing current: 25 nA typ.
- Low input offset current: 5 nA typ.
- Low input offset voltage: 2 mV typ.
- Input common-mode voltage range includes GND.
- Differential input voltage range equal to the power supply voltage.
- Low output saturation voltage.
- Output voltage compatible with TTL, MOS and CMOS logic.

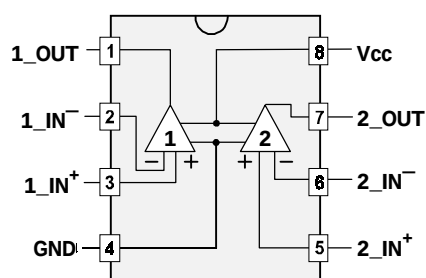
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SCHEMATIC DIAGRAM (½ MIK393)

SOP-8  MIK393MDIP-8  MIK393N

PIN CONNECTIONS (top view)



ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	VALUE	UNIT
V _{CC}	SUPPLY VOLTAGE	36	V
V _{IDR}	DIFFERENTIAL INPUT VOLTAGE	36	V
V _{IN}	INPUT VOLTAGE	-0,3 ÷ +36	V
I _O	INPUT CURRENT	20	mA
POWER DISSIPATION (Note 1)			
	Molded DIP	780	mW
	Small Outline Package	510	mW
I _{OS}	OUTPUT SHORT-CIRCUIT TO GROUND	Continuous	
T _A	OPERATING TEMPERATURE RANGE	0 to +70	°C
T _{stg}	STORAGE TEMPERATURE RANGE	-65 to +150	°C

NOTE 1: For operating at high temperatures, the MIK393 must be derated based on a 125°C maximum junction temperature and a thermal resistance of 170°C/W which applies for the device soldered in a printed circuit board, operating in a still air ambient. The low bias dissipation and the "ON-OFF" characteristic of the outputs keeps the chip dissipation very small ($P_D \leq 100$ mW), provided the output transistors are allowed to saturate.

SWITCHING CHARACTERISTICS V_{CC}=5V; T_A=25°C

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Response time	R _L connected to 5V through 5.1 kΩ; C _L =15pF* (See Note1)	100-mV input step with 5-mV overdrive		1.3		μs
		TTL-level input step		0.3		

* C_L includes probe and jig capacitance.

NOTE 1: The response time specified is the interval between the input step function and the instant when the output crosses 1.4V.



ELECTRICAL CHARACTERISTICS

electrical characteristics at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS*	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	$V_{CC} = 5\text{ V to } 30\text{ V};$ $V_{IC} = V_{ICR\text{ min}};$ $V_O = 1.4$	25 °C	2.0	5.0	mV
			Full range		9.0	
I_{IO}	Input offset current	$V_O = 1.4\text{ V}$	25 °C	5.0	50.0	nA
			Full range		150.0	
I_{IB}	Input bias current	$V_O = 1.4\text{ V}$	25 °C	-25.0	-250.0	nA
			Full range		-400.0	
V_{ICR}	Common-mode input voltage range**		25 °C	0 to $V_{CC} - 1.5$		V
			Full range	0 to $V_{CC} - 2.0$		
A_{VD}	Large-signal differential voltage amplification	$V_{CC} = 15\text{ V};$ $V_O = 1.4\text{ V to } 11.4\text{ V};$ $R_L \geq 15\text{ k}\Omega\text{ to } V_{CC}$	25 °C	50.0	200.0	V/mV
I_{OH}	High-level output current	$V_{OH} = 5\text{ V}; V_{ID} = 1\text{ V}$	25 °C	0.1	50.0	nA
		$V_{OH} = 30\text{ V}; V_{ID} = 1\text{ V}$	Full range		1.0	μA
V_{OL}	Low-level output voltage	$I_{OL} = 4\text{ mA}; V_{ID} = -1\text{ V}$	25 °C	150.0	400.0	mV
			Full range		700.0	
I_{OL}	Low-level output current	$V_{OL} = 1.5\text{ V}; V_{ID} = -1\text{ V}$	25 °C	6.0		mA
I_{CC}	Supply current	$R_L = \infty$ $V_{CC} = 5\text{ V}$	25 °C	0.8	1.0	mA
		$V_{CC} = 30\text{ V}$	Full range		2.5	

* Full range (MIN to MAX), for the MIK393 is 0°C to 70°C. All characteristics are measured with zero common-mode input voltage unless otherwise specified.

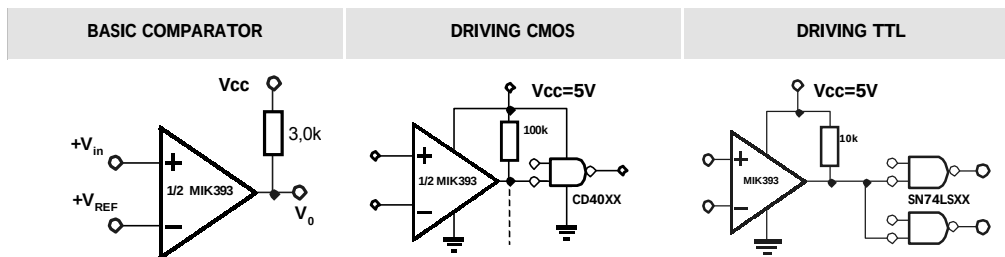
** The voltage at either input or common-mode should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is $V_{CC} - 1.5\text{ V}$, but either or both inputs can go to 30V without damage.

TYPICAL APPLICATIONS ($V_{CC} = 5\text{ V}$)

These dual comparators feature high gain, wide bandwidth characteristics. This gives the device oscillation tendencies if the outputs are capacitively coupled to the inputs via stray capacitance. This oscillation manifests itself during output transitions (V_{OL} to V_{OH}). To alleviate this situation, input resistors $<10\text{ k}\Omega$ should be used.

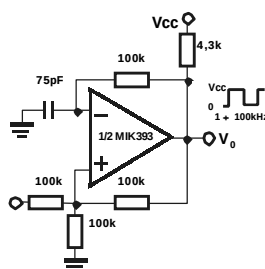
The addition of positive feedback ($<10\text{ mV}$) is also recommended. It is good design practice to ground all unused pins.

Differential input voltages may be larger than supply voltage without damaging the comparator's inputs. Voltages more negative than -0.3 V should not be used.

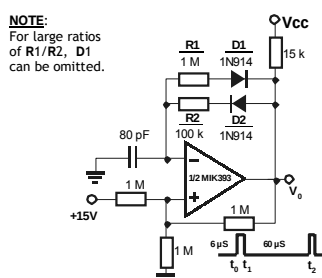


TYPICAL APPLICATIONS $V_{CC} = 5\text{ V}$ (CONTINUED)

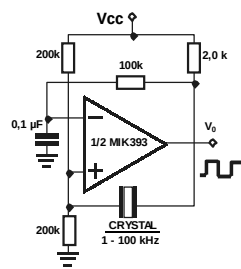
SQUARE-WAVE OSCILLATOR



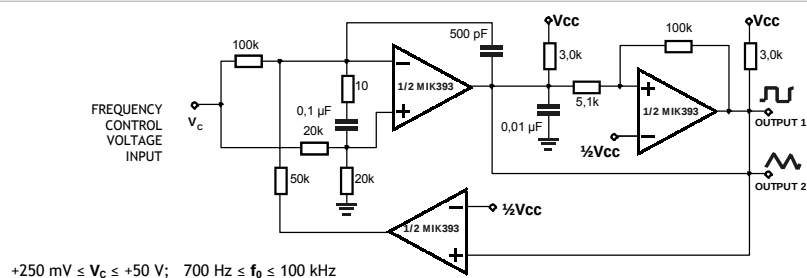
PULSE GENERATOR



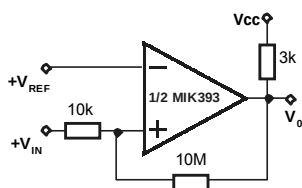
CRYSTAL CONTROLLED OSCILLATOR



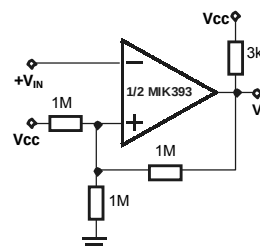
TWO-DECADE HIGH FREQUENCY VCO

 $+250\text{ mV} \leq V_c \leq +50\text{ V}; 700\text{ Hz} \leq f_0 \leq 100\text{ kHz}$

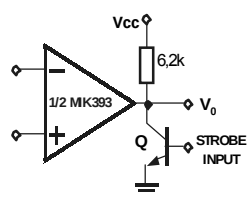
NON-INVERTING COMPARATOR WITH HYSTERESIS



INVERTING COMPARATOR WITH HYSTERESIS

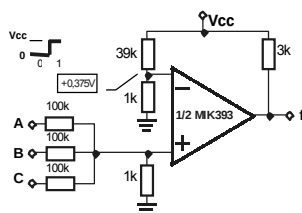


OUTPUT STROBING

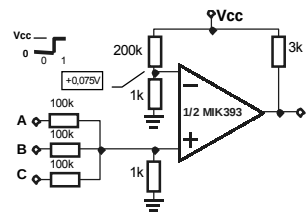


Q or Logic Gate without Pull-Up resistor

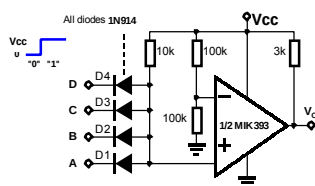
AND GATE



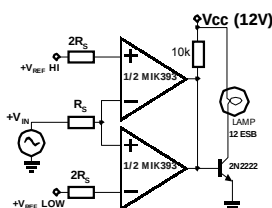
OR GATE



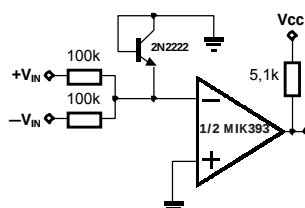
LARGE FAN-IN AND GATE



LIMIT COMPARATOR



COMPARING INPUT VOLTAGES OF OPPOSITE POLARITY

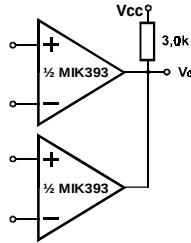




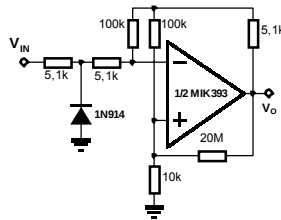
TYPICAL APPLICATIONS $V_{CC} = 5\text{ V}$

(CONTINUED)

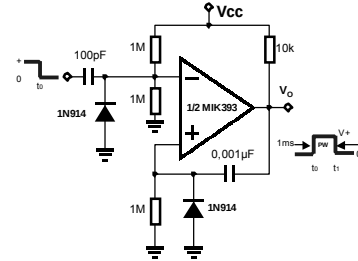
ORing THE OUTPUTS



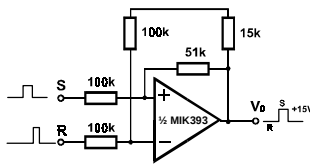
ZERO CROSSING DETECTOR (SINGLE POWER SUPPLY)



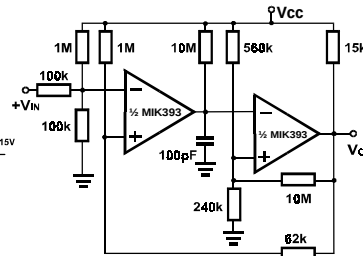
ONE-SHOT MULTIVIBRATOR



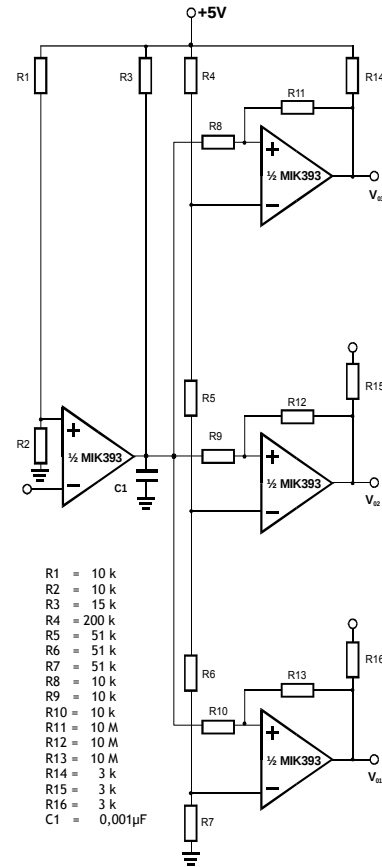
BI-STABLE MULTIVIBRATOR



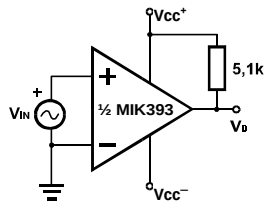
ONE-SHOT MULTIVIBRATOR WITH INPUT LOCK OUT



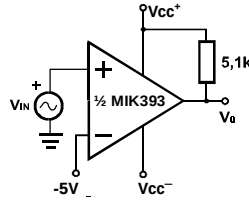
TIME DELAY GENERATOR



ZERO CROSSING DETECTOR

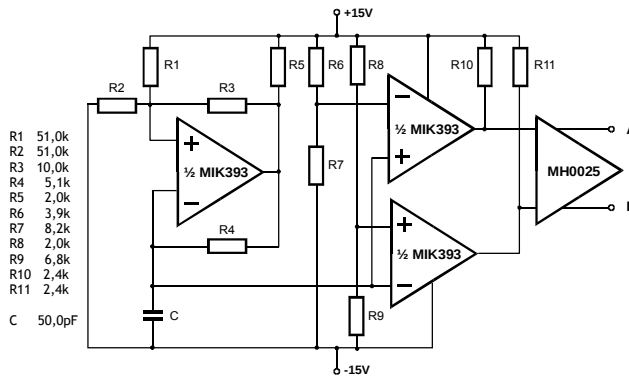


COMPARATOR WITH A NEGATIVE REFERENCE



SPLIT-SUPPLY APPLICATIONS

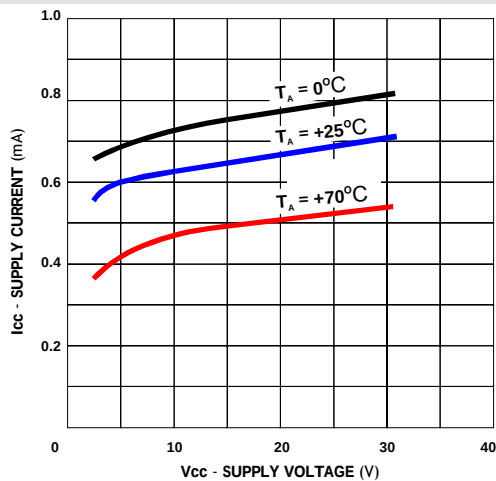
MOS CLOCK DRIVER



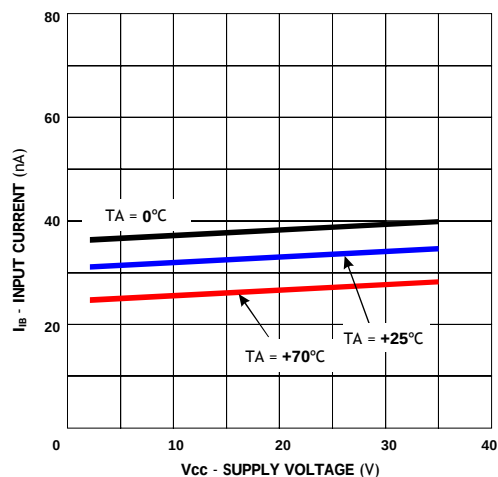


TYPICAL PERFORMANCE CHARACTERISTICS

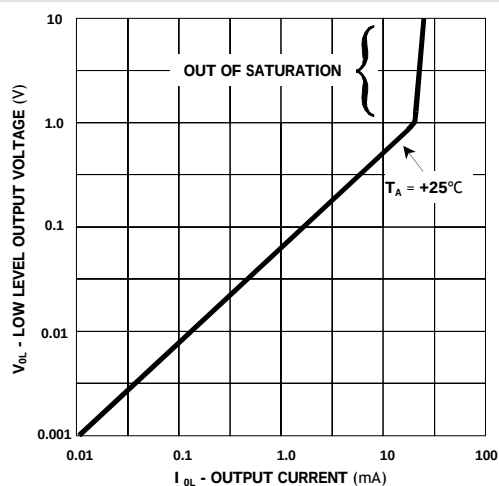
SUPPLY CURRENT



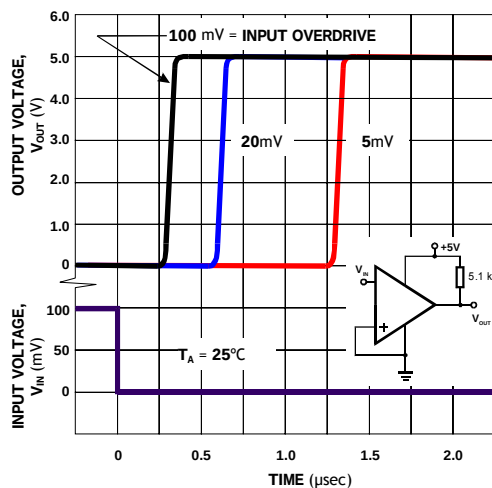
INPUT CURRENT



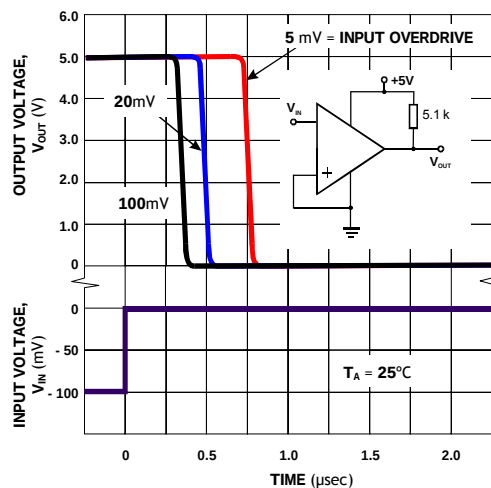
LOW LEVEL OUTPUT VOLTAGE



RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - POSITIVE TRANSITION



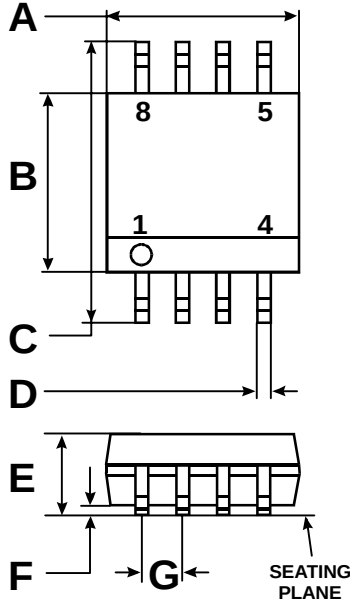
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - NEGATIVE TRANSITION



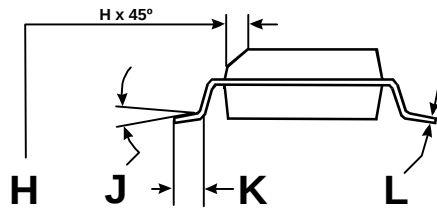


PHYSICAL DIMENSIONS AND MARKING DIAGRAMS

SOP-8 PACKAGE

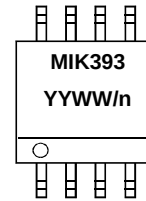


DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	4.80	5.00	0.189	0.197
B	5.80	6.20	0.228	0.244
C	5.80	6.20	0.228	0.244
D	0.33	0.51	0.013	0.020
E	1.35	1.75	0.053	0.069
F	0.10	0.25	0.004	0.010
G	1.27 BSC		0.050 BSC	
H	0.25	0.50	0.010	0.020
J	0°	8°	0°	8°
K	0.40	1.27	0.016	0.050
L	0.19	0.25	0.007	0.010

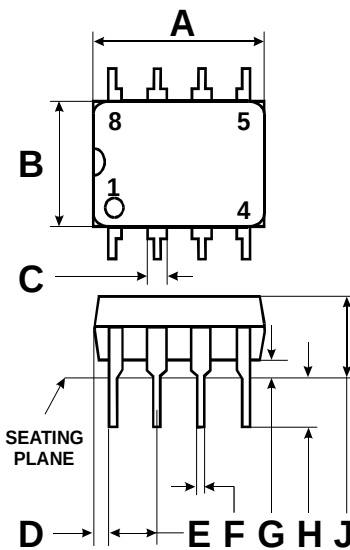


SOP-8 MARKING DIAGRAM

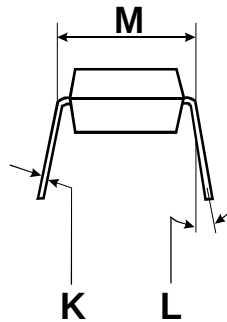
ABBREVIATION	ABBREVIATION EXPANSION
YY	Year
WW	Work Week
n	Assembly Location



DIP-8 PACKAGE

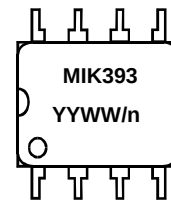


DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	1.02	1.78	0.040	0.070
D	0.76	1.27	0.030	0.050
E	2.54 BSC		0.100 BSC	
F	0.38	0.51	0.015	0.020
G	0.76	1.01	0.030	0.040
H	2.92	3.43	0.115	0.135
J	3.94	4.45	0.155	0.175
K	0.20	0.30	0.008	0.012
L	—	10°	—	10°
M	7.62 BSC		0.300 BSC	



DIP-8 MARKING DIAGRAM

ABBREVIATION	ABBREVIATION EXPANSION
YY	Year
WW	Work Week
n	Assembly Location





ORDERING INFORMATION

DEVICE	PACKAGE	SHIPPING
MIK393M	SOP-8	98 Units / Rail
		2500 Units / Reel
MIK393N	DIP-8	50 Units / Rail

NOTE: The form of packing is stipulated in the contract.

MIKRON does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and MIKRON reserves the right at any time without notice to change said circuitry and specifications.

MIKRON JSC Head Office

 **Address:** 1ST Zapadny Proezd 12, Building 1, Zelenograd, Moscow, Russia, 124460
 **Telephone:** +7 (095) 535-23-43; 536-85-44
 **Fax:** +7 (095) 530-92-01
 **Email:** export@mikron.ru

MIKRON ShenZhen Office

 **Tel/Fax:** +86-755-329-7574
 **Voice:** +86-755-329-7573
 **Email:** miksz@963.net