ELM97xxxxA VOLTAGE DETECTOR

■ GENERAL DESCRIPTION

ELM 97xxxxA Series is a CMOS voltage detector IC for battery-operated portable devices. It consists of a very low-power-consumption reference voltage source, a comparator, an output driver, a hysteresis circuit, and detection voltage setting resistors. Output logic is positive, therefore output level is low when VDD is lower than detection voltage.

It can be used as a reset controller in microcomputer-based systems. And it can be widely applied to the devices, such as battery checkers, switching circuit of back-up power source, power failure detectors, etc. Two output styles are available, N-ch opendrain and CMOS output.

It is available in SOT-89 and SOT-23.

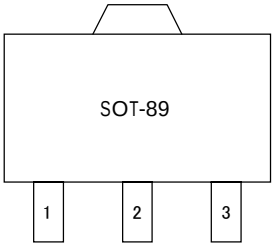
■ FEATURES

- Low power operation : TYP. 1.0 μA (VDD = 1.5V)
- Low voltage operation : Reset operation assured at 0.8V
- High accuracy of detection voltage : ±2.5%
- Low temperature coefficient : TYP. −300ppm/℃ (Detection voltage ＜2.0V)
  : TYP. −100ppm/℃ (Detection voltage ≧2.0V)
- Very small package : SOT-89, SOT-23

■ APPLICATION

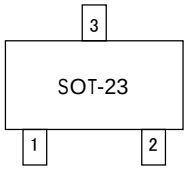
- Reset for microcomputer
- Battery checker
- Power failure detector
- Switching of back-up power source

■ PIN CONFIGURATION



(TOP VIEW)

Pin No.	Pin Name
1	OUT
2	VDD
3	VSS



(TOP VIEW)

Pin No.	Pin Name
1	OUT
2	VSS
3	VDD

■ SELECTION GUIDE

Symbol		
a, b	Detection Voltage	Ex 09 : VDETN = 0.9V 27 : VDETN = 2.7V 45 : VDETN = 4.5V
c	Output Form	C : CMOS Output N : N-ch Opendrain Output
d	Package	A : SOT-89 B : SOT-23
e	Product Version	A : A Version

ELM97 x x x x A
↑ ↑ ↑ ↑ ↑
a b c d e

■ SERIES

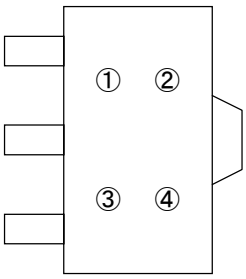
Model	Detection Voltage	Output Form	Package	Model	Detection Voltage	Output Form	Package
ELM9709NBA-S(N)	0.9V	N-ch	SOT-23	ELM9727CAA-S(N)	2.7V	CMOS	SOT-89
ELM9710NBA-S(N)	1.0V	N-ch	SOT-23	ELM9730CAA-S(N)	3.0V	CMOS	SOT-89
ELM9711NBA-S(N)	1.1V	N-ch	SOT-23	ELM9732CAA-S(N)	3.2V	CMOS	SOT-89
ELM9722CAA-S(N)	2.2V	CMOS	SOT-89	ELM9734CAA-S(N)	3.4V	CMOS	SOT-89
ELM9724CAA-S(N)	2.4V	CMOS	SOT-89	ELM9745CAA-S(N)	4.5V	CMOS	SOT-89
ELM9725CAA-S(N)	2.5V	CMOS	SOT-89	ELM9748CAA-S(N)	4.8V	CMOS	SOT-89

S type : Standard, N type : Reverse

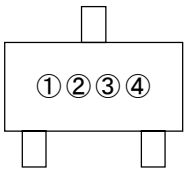
* Available 0.9V～5.0V detection voltage for N-ch output and 2.0V～5.0V detection voltage for CMOS output at 0.1V step as semi-custom-made IC.

■ MARKING

SOT-89



SOT-23



Rule 1

①: Represents the integer digit of the detection voltage

Symbol	Detection Voltage	Symbol	Detection Voltage
A	0.*V (N-ch)	P	2.*V (CMOS)
B	1.*V (N-ch)	R	3.*V (CMOS)
C	2.*V (N-ch)	S	4.*V (CMOS)
D	3.*V (N-ch)	T	5.*V (CMOS)
E	4.*V (N-ch)		
F	5.*V (N-ch)		

②: Represents the decimal digit of the detection voltage

Symbol	Detection Voltage	Symbol	Detection Voltage
0	*.0V	5	*.5V
1	*.1V	6	*.6V
2	*.2V	7	*.7V
3	*.3V	8	*.8V
4	*.4V	9	*.9V

③ : Represents the assembly lot number

A ～ Z repeated (I,O,X excepted)

④ : Represents the assembly lot number

0 ～ 9 repeated

Rule 2

①: Represents the ELM97xxxxA series

ELM97xxxxA series = A

②: Represents the integer digit of the detection voltage

Symbol	Detection Voltage	Symbol	Detection Voltage
0	0.*V (N-ch)	Y	2.*V (CMOS)
1	1.*V (N-ch)	W	3.*V (CMOS)
2	2.*V (N-ch)	U	4.*V (CMOS)
3	3.*V (N-ch)	V	5.*V (CMOS)
4	4.*V (N-ch)		
5	5.*V (N-ch)		

③ : Represents the decimal digit of the detection voltage

Symbol	Detection Voltage	Symbol	Detection Voltage
0	*.0V	5	*.5V
1	*.1V	6	*.6V
2	*.2V	7	*.7V
3	*.3V	8	*.8V
4	*.4V	9	*.9V

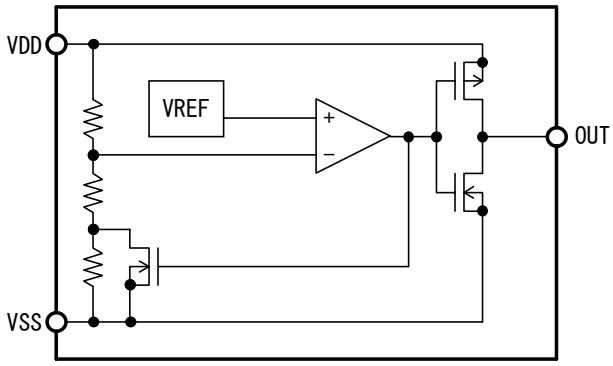
④ : Represents the assembly lot number

0 ～ 9, A ～ Z repeated (I,O,X excepted)

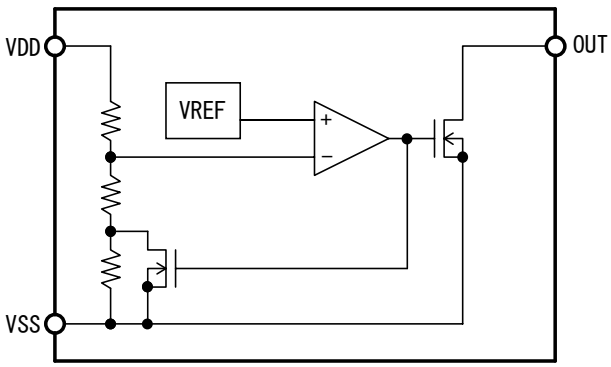
*Remarks --- ELM97xxxxA series have two kind of mraking rules each package.

■ BLOCK DIAGRAM

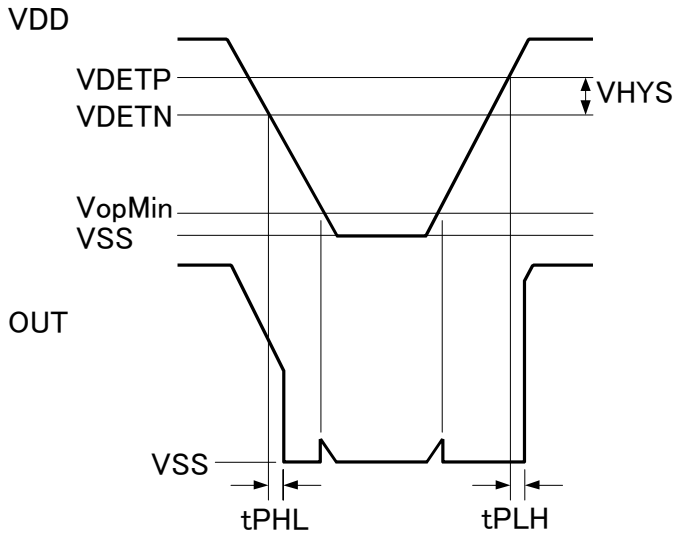
1. CMOS Output



2. N-ch Opendrain Output



■ TIMING CHART



■ MAXIMUM ABSOLUTE RATINGS

(VSS=0V)

Parameter	Symbol		Limits	Units
Power Supply Voltage	VDD		10	V
Output Voltage	VOUT	CMOS	VSS-0.3～VDD+0.3	V
		N-ch	VSS-0.3～+10	
Output Current	IOUT		50	mA
Power Dissipation	Pd	SOT-89	300	mW
		SOT-23	200	
Operating Temperature	Top		-30～+80	℃
Storage Temperature	Tstg		-40～+125	

■ ELECTRICAL CHARACTERISTICS

ELM9709NBA

(Top=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		0.878	0.900	0.922	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=1.5V	-	1.0	3.0	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=0.8V, VDS=0.5V	0.02	0.1	-	mA	3
Delay Time	tPHL			2.0		mS	5
Temperature Characteristics of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.27	-	mV/℃	-

Remarks) Test circuit No.

ELM9710NBA

(Top=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		0.975	1.000	1.025	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=1.5V	-	1.0	3.0	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=0.8V, VDS=0.5V	0.02	0.1	-	mA	3
Delay Time	tPHL			2.0		mS	5
Temperature Characteristic of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.30	-	mV/℃	-

Remarks) Test circuit No.

ELM9711NBA

(Top=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		1.073	1.100	1.127	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=1.5V	-	1.0	3.0	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=0.8V, VDS=0.5V	0.02	0.1	-	mA	3
Delay Time	tPHL			2.0		mS	5
Temperature Characteristic of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.33	-	mV/℃	-

Remarks) Test circuit No.

ELM9722CAA

(Top=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		2.145	2.200	2.255	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=3.0V	-	1.5	4.5	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=1.5V, VDS=0.5V	1.0	2.0	-	mA	3
	IOUTP	VDD=4.5V, VDS=2.1V	0.5	1.5	-	mA	4
Delay Time	tPHL			0.1		mS	5
Temperature Characteristic of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.22	-	mV/℃	-

Remarks) Test circuit No.

ELM9724CAA

(Top=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		2.340	2.400	2.460	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=3.0V	-	1.5	4.5	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=1.5V, VDS=0.5V	1.0	2.0	-	mA	3
	IOUTP	VDD=4.5V, VDS=2.1V	0.5	1.5	-	mA	4
Delay Time	tPHL			0.1		mS	5
Temperature Characteristic of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.24	-	mV/℃	-

Remarks) Test circuit No.

ELM9725CAA

(Top=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		2.438	2.500	2.562	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=3.0V	-	1.5	4.5	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=1.5V, VDS=0.5V	1.0	2.0	-	mA	3
	IOUTP	VDD=4.5V, VDS=2.1V	0.5	1.5	-	mA	4
Delay Time	tPHL			0.1		mS	5
Temperature Characteristic of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.25	-	mV/℃	-

Remarks) Test circuit No.

ELM9727CAA

(Top=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		2.633	2.700	2.767	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=4.5V	-	1.5	4.5	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=1.5V, VDS=0.5V	1.0	2.0	-	mA	3
	IOUTP	VDD=4.5V, VDS=2.1V	0.5	1.5	-	mA	4
Delay Time	tPHL			0.1		mS	5
Temperature Characteristic of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.27	-	mV/℃	-

Remarks) Test circuit No.

ELM9730CAA

(Top=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		2.925	3.000	3.075	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=4.5V	-	1.5	4.5	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=1.5V, VDS=0.5V	1.0	2.0	-	mA	3
	IOUTP	VDD=4.5V, VDS=2.1V	0.5	1.5	-	mA	4
Delay Time	tPHL			0.1		mS	5
Temperature Characteristic of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.30	-	mV/℃	-

Remarks) Test circuit No.

ELM9732CAA

(Top=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		3.120	3.200	3.280	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=4.5V	-	1.5	4.5	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=1.5V, VDS=0.5V	1.0	2.0	-	mA	3
	IOUTP	VDD=4.5V, VDS=2.1V	0.5	1.5	-	mA	4
Delay Time	tPHL			0.1		mS	5
Temperature Characteristic of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.32	-	mV/℃	-

Remarks) Test circuit No.

ELM9734CAA

(Top=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		3.315	3.400	3.485	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=4.5V	-	1.5	4.5	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=1.5V, VDS=0.5V	1.0	2.0	-	mA	3
	IOUTP	VDD=4.5V, VDS=2.1V	0.5	1.5	-	mA	4
Delay Time	tPHL			0.1		mS	5
Temperature Characteristic of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.34	-	mV/℃	-

Remarks) Test circuit No.

ELM9745CAA

(Top=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		4.388	4.500	4.612	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=6.0V	-	1.5	4.5	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=1.5V, VDS=0.5V	1.0	2.0	-	mA	3
	IOUTP	VDD=6.0V, VDS=2.1V	0.5	2.0	-	mA	4
Delay Time	tPHL			0.1		mS	5
Temperature Characteristic of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.45	-	mV/℃	-

Remarks) Test circuit No.

ELM9748CAA

(Top=25℃)

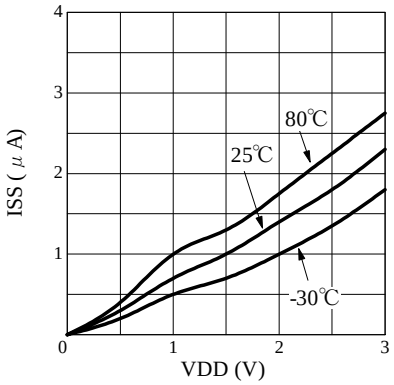
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Remarks
Detection Voltage	VDETN		4.680	4.800	4.920	V	2
Hysteresis width	VHYS		VDETN ×0.02	-	VDETN ×0.08	V	2
Current Consumption	ISS	VDD=6.0V	-	1.5	4.5	μA	1
Operating Voltage	VDD		0.8	-	6.0	V	2
Output Current	IOUTN	VDD=1.5V, VDS=0.5V	1.0	2.0	-	mA	3
	IOUTP	VDD=6.0V, VDS=2.1V	0.5	2.0	-	mA	4
Delay Time	tPHL			0.1		mS	5
Temperature Characteristic of VDETN	$\frac{\triangle VDETN}{\triangle Top}$	Top=-30～+80℃	-	-0.48	-	mV/℃	-

Remarks) Test circuit No.

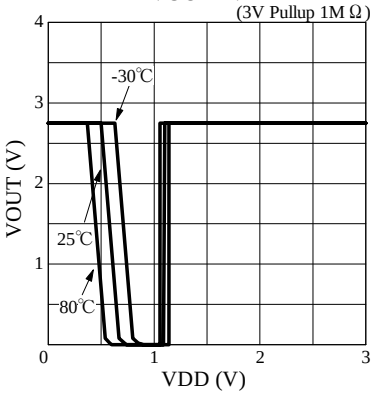
■ TYPICAL CHARACTERISTICS

● ELM9711NxA

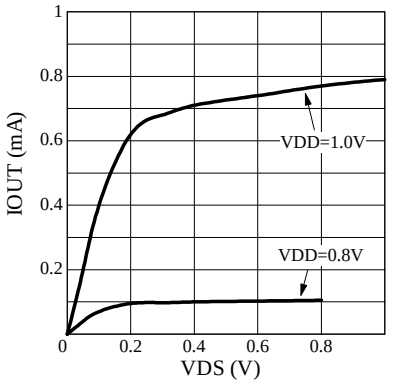
ISS - VDD



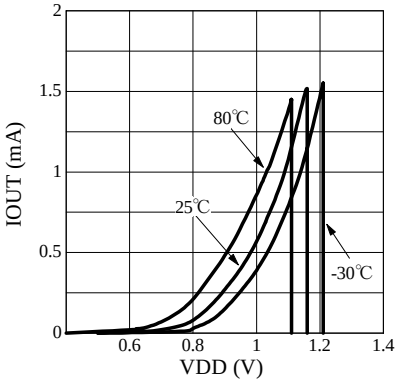
VOUT - VDD (3V Pullup 1M Ω)



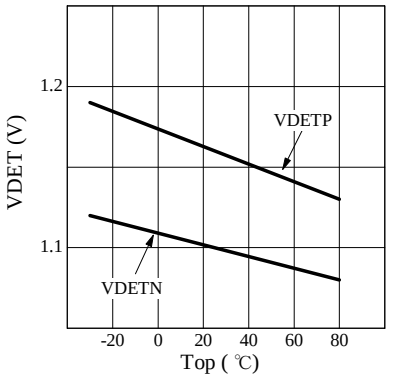
IOUT - VDS



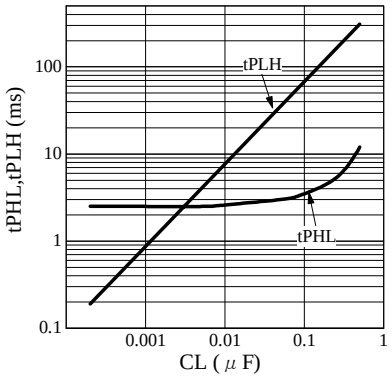
IOUT - VDD



VDET - Top

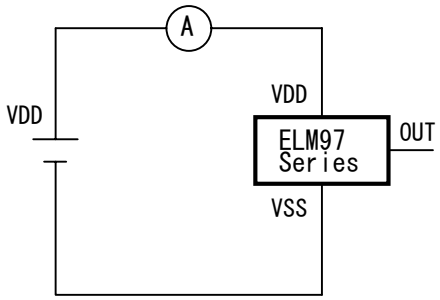


tPHL,tPLH - VDD

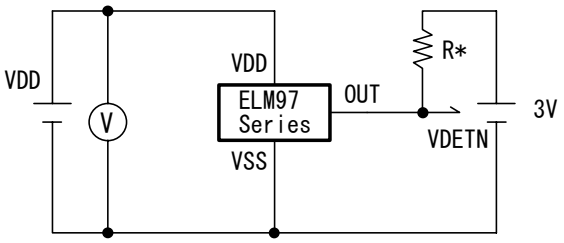


■ TEST CIRCUITS

1. Current Consumption

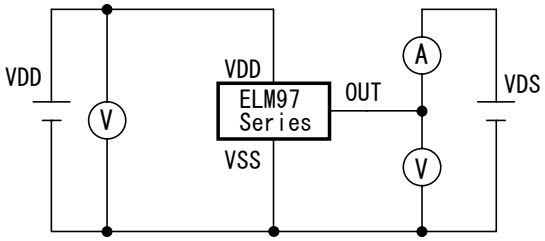


2. Detection Voltage

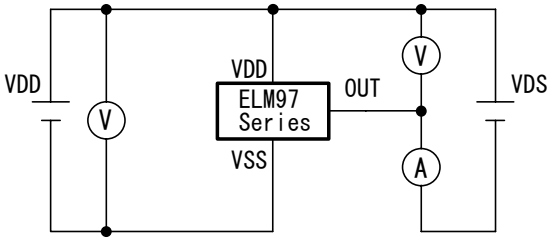


＊ R=1MΩ

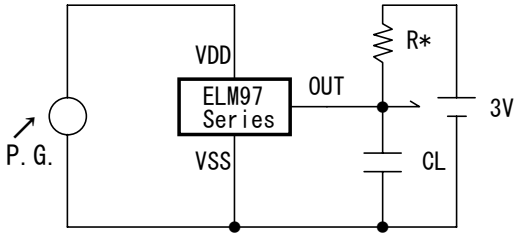
3. Output Current (N-ch)



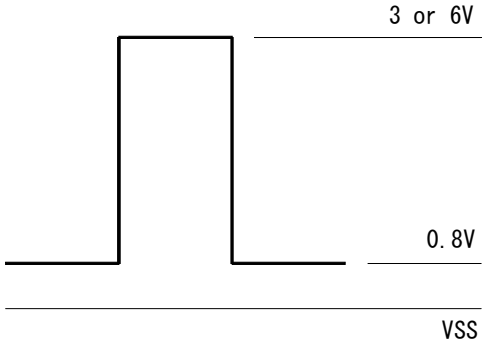
4. Output Current (P-ch)



5. Delay Time



Input Pulse



＊ R=1MΩ
R is unnecessary for CMOS output products.