ELM76xxxxxxxxC CMOS Voltage detector with delay function

■General description

ELM76xxxxxxxxC is CMOS voltage detector IC with delay function; external capacitor is unnecessary for the delay time circuit. There are 4 types of delay time selection of ELM76 series: Typ.50ms, Typ.150ms, Typ.250ms, Typ.500ms, and ELM76 series can also be made as semi-custom ICs within the range of 30ms to 500ms by 10ms step. There are two output styles of ELM76 series: N-ch open-drain and CMOS output. In addition, two output logic modes are available; RESET and $\overline{\text{RESET}}$. The output level is high for RESET mode and low for $\overline{\text{RESET}}$ mode when VDD is lower than detection voltage. The standard detection voltages are 1.6V, 2.5V, 2.7V, 3.0V, 4.0V and 5.5V and ELM76 series can also be made as semi-custom ICs within 1.6 to 5.5V by 0.1V step.

■Features

- Detection voltage range : 1.6V to 5.5V (by 0.1V)
- Low current consumption : Typ.0.4μA(Vdd=VdetN+1V)
- Accuracy of detection voltage : ±2.0%
- Delay time after Vdd recovery : Typ.50ms, Typ.150ms, Typ.250ms, Typ.500ms
- Hysteresis voltage : Typ.VdetN×1.04(Top=25°C)
- Package : SOT-23, SOT-25, SC-70-5(SOT-353)

■Application

- Reset for microcomputers
- Voltage power shortage detectors
- Switch of back-up power source
- Battery checkers

■Maximum absolute ratings

Parameter	Symbol	Limit	Unit
Power supply voltage	Vdd	Vss-0.3 to 8.0	V
Output voltage	Vout	Vss-0.3 to Vdd+0.3	V
Output current	Iout	100	mA
Power dissipation	Pd	250 (SOT-23)	mW
		300 (SOT-25)	
		150 (SC-70-5)(SOT-353)	
Operating temperature	Top	-40 to +85	°C
Storage temperature	Tstg	-55 to +125	°C

■Selection guide

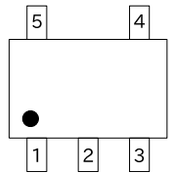
ELM76xxxxxxxxC-x

Symbol		
a, b	Detection voltage	e.g. : 16: VdetN=1.6V, 25: VdetN=2.5V 27: VdetN=2.7V, 30: VdetN=3.0V 40: VdetN=4.0V, 55: VdetN=5.5V
c	Output mode	L: $\overline{\text{RESET}}$ output mode H: RESET output mode
d	Output form	C : CMOS output N : N-ch open-drain output
e, f	Delay time	05: Typ.50ms, 15: Typ.150ms 25: Typ.250ms, 50: Typ.500ms
g	Package	B : SOT-23, SOT-25 C : SC-70-5(SOT-353)
h	Pin configuration type	1 : type1 2 : type2 3 : type3
i	Product version	C
j	Taping direction	S, N: Refer to PKG file

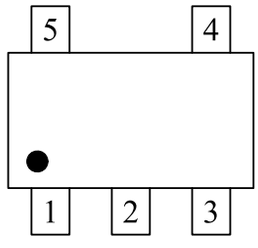
ELM76 x x x x x x x x C - x
↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑
a b c d e f g h i j

■Pin configuration

SC-70-5(TOP VIEW)

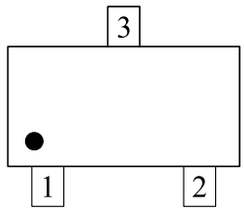


SOT-25(TOP VIEW)



Pin No.	Pin name (76xxxxxxC1C)	Pin name (76xxxxxxB3C)
1	NC	NC
2	VDD	NC
3	NC	VSS
4	OUT	OUT
5	VSS	VDD

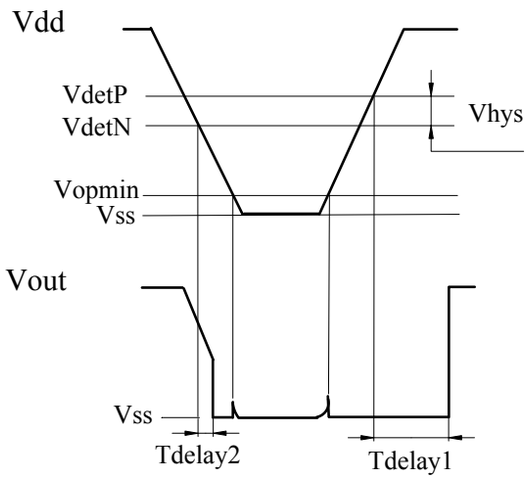
SOT-23(TOP VIEW)



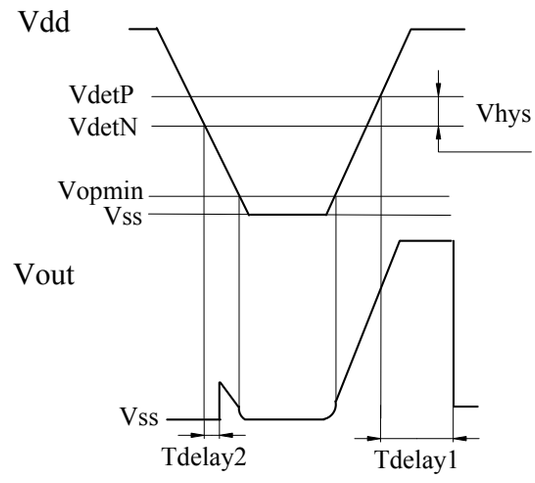
Pin No.	Pin name	
	(76xxxxxxB1C)	(76xxxxxxB2C)
1	OUT	VSS
2	VSS	OUT
3	VDD	VDD

■Timing chart

$\overline{\text{RESET}}$ output logic

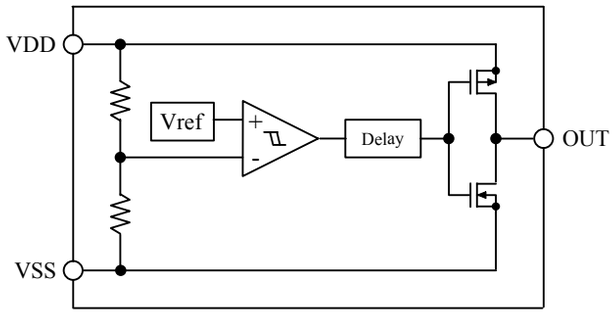


RESET output logic

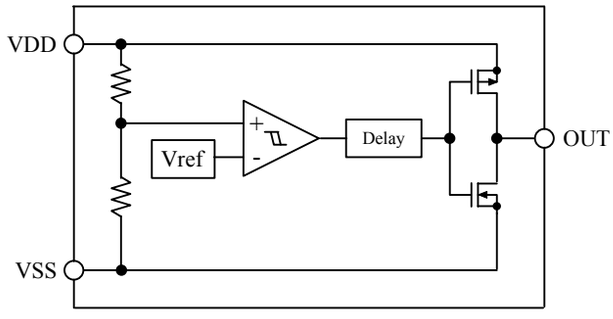


■Block diagram

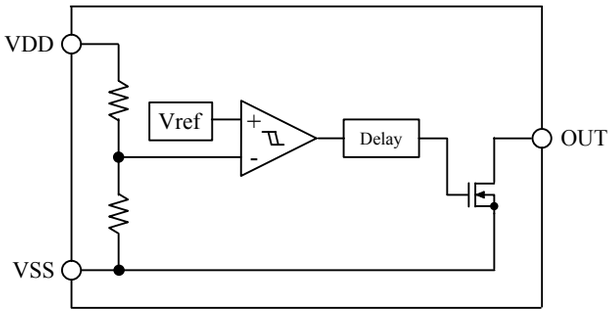
CMOS output for $\overline{\text{RESET}}$ output logic



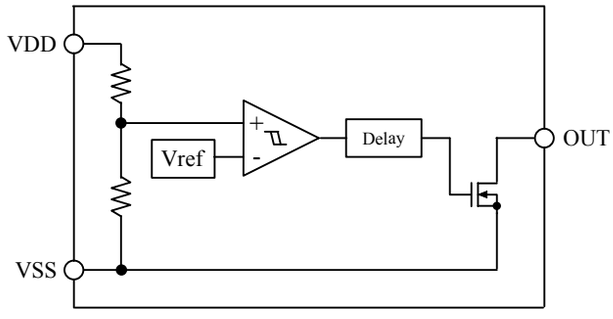
CMOS output for RESET output logic



N-ch open-drain output for $\overline{\text{RESET}}$ output logic



N-ch open-drain output for RESET output logic



■Electrical characteristics

VdetN=1.6V(ELM7616xxxxxxC) Vss=0V, Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Detection voltage	VdetN		1.568	1.600	1.632	V	2
Hysteresis width	Vhys		VdetN ×0.02	VdetN ×0.04	VdetN ×0.08	V	2
Current consumption	Iss	Vdd=2.6V		0.4	1.8	µA	1
Power voltage	Vdd		0.9		6.0	V	2
$\overline{\text{RESET}}$ output current	IoutN	Vdd=0.9V, Vds=0.3V	0.2	1.7		mA	3-(1)
		Vdd=1.0V, Vds=0.3V	1.0	3.1			
	IoutP	Vdd=3.0V, Vds=0.4V	0.5	1.1		mA	3-(2)
RESET output curernt	IoutN	Vdd=3.0V, Vds=0.4V	15.0	30.0		mA	3-(1)
	IoutP	Vdd=1.5V, Vds=0.4V	0.1	0.3		mA	3-(2)
Delay time(50ms)	Tdelay1	Vdd=1.0V → 3.0V	40	50	60	ms	4
	Tdelay2	Vdd=3.0V → 1.0V		10		µs	
Delay time(150ms)	Tdelay1	Vdd=1.0V → 3.0V	120	150	180	ms	4
	Tdelay2	Vdd=3.0V → 1.0V		10		µs	
Delay time(250ms)	Tdelay1	Vdd=1.0V → 3.0V	200	250	300	ms	4
	Tdelay2	Vdd=3.0V → 1.0V		10		µs	
Delay time(500ms)	Tdelay1	Vdd=1.0V → 3.0V	400	500	600	ms	4
	Tdelay2	Vdd=3.0V → 1.0V		10		µs	
Temperature characteristic of VdetN	$\frac{\Delta VdetN}{\Delta Top}$	Top=-40°C to +85°C		+30		ppm/°C	

∗ Note: Test circuit No., IoutP is applied only for CMOS output products.

VdetN=2.5V(ELM7625xxxxxxC) Vss=0V, Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Detection voltage	VdetN		2.450	2.500	2.550	V	2
Hysteresis width	Vhys		VdetN ×0.02	VdetN ×0.04	VdetN ×0.08	V	2
Current consumption	Iss	Vdd=3.5V		0.4	1.8	µA	1
Power voltage	Vdd		0.9		6.0	V	2
$\overline{\text{RESET}}$ output current	IoutN	Vdd=0.9V, Vds=0.3V	0.2	1.7		mA	3-(1)
		Vdd=1.0V, Vds=0.3V	1.0	3.1			
	IoutP	Vdd=3.0V, Vds=0.4V	0.5	1.1		mA	3-(2)
RESET output curernt	IoutN	Vdd=3.0V, Vds=0.4V	15.0	30.0		mA	3-(1)
	IoutP	Vdd=1.5V, Vds=0.4V	0.1	0.3		mA	3-(2)
Delay time(50ms)	Tdelay1	Vdd=1.0V → 3.0V	40	50	60	ms	4
	Tdelay2	Vdd=3.0V → 1.0V		10		µs	
Delay time(150ms)	Tdelay1	Vdd=1.0V → 3.0V	120	150	180	ms	4
	Tdelay2	Vdd=3.0V → 1.0V		10		µs	
Delay time(250ms)	Tdelay1	Vdd=1.0V → 3.0V	200	250	300	ms	4
	Tdelay2	Vdd=3.0V → 1.0V		10		µs	
Delay time(500ms)	Tdelay1	Vdd=1.0V → 3.0V	400	500	600	ms	4
	Tdelay2	Vdd=3.0V → 1.0V		10		µs	
Temperature characteristic of VdetN	$\frac{\Delta VdetN}{\Delta Top}$	Top=-40°C to +85°C		+30		ppm/°C	

∗ Note: Test circuit No., IoutP is applied only for CMOS output products.

VdetN=2.7V(ELM7627xxxxxxC) Vss=0V, Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Detection voltage	VdetN		2.646	2.700	2.754	V	2
Hysteresis width	Vhys		VdetN ×0.02	VdetN ×0.04	VdetN ×0.08	V	2
Current consumption	Iss	Vdd=3.7V		0.4	1.8	µA	1
Power voltage	Vdd		0.9		6.0	V	2
$\overline{\text{RESET}}$ output current	IoutN	Vdd=0.9V, Vds=0.3V	0.2	1.7		mA	3-(1)
		Vdd=1.0V, Vds=0.3V	1.0	3.1			
	IoutP	Vdd=4.5V, Vds=0.4V	0.8	1.5		mA	3-(2)
RESET output curernt	IoutN	Vdd=4.5V, Vds=0.4V	20.0	40.0		mA	3-(1)
	IoutP	Vdd=1.5V, Vds=0.4V	0.1	0.3		mA	3-(2)
Delay time(50ms)	Tdelay1	Vdd=1.0V → 4.5V	40	50	60	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Delay time(150ms)	Tdelay1	Vdd=1.0V → 4.5V	120	150	180	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Delay time(250ms)	Tdelay1	Vdd=1.0V → 4.5V	200	250	300	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Delay time(500ms)	Tdelay1	Vdd=1.0V → 4.5V	400	500	600	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Temperature characteristic of VdetN	$\frac{\Delta VdetN}{\Delta Top}$	Top=-40°C to +85°C		+30		ppm/°C	

∗ Note: Test circuit No., IoutP is applied only for CMOS output products.

VdetN=3.0V(ELM7630xxxxxxC) Vss=0V, Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Detection voltage	VdetN		2.940	3.000	3.060	V	2
Hysteresis width	Vhys		VdetN ×0.02	VdetN ×0.04	VdetN ×0.08	V	2
Current consumption	Iss	Vdd=4.0V		0.4	1.8	µA	1
Power voltage	Vdd		0.9		6.0	V	2
$\overline{\text{RESET}}$ output current	IoutN	Vdd=0.9V, Vds=0.3V	0.2	1.7		mA	3-(1)
		Vdd=1.0V, Vds=0.3V	1.0	3.1			
	IoutP	Vdd=4.5V, Vds=0.4V	0.8	1.5		mA	3-(2)
RESET output curernt	IoutN	Vdd=4.5V, Vds=0.4V	20.0	40.0		mA	3-(1)
	IoutP	Vdd=1.5V, Vds=0.4V	0.1	0.3		mA	3-(2)
Delay time(50ms)	Tdelay1	Vdd=1.0V → 4.5V	40	50	60	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Delay time(150ms)	Tdelay1	Vdd=1.0V → 4.5V	120	150	180	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Delay time(250ms)	Tdelay1	Vdd=1.0V → 4.5V	200	250	300	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Delay time(500ms)	Tdelay1	Vdd=1.0V → 4.5V	400	500	600	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Temperature characteristic of VdetN	$\frac{\Delta VdetN}{\Delta Top}$	Top=-40°C to +85°C		+30		ppm/°C	

∗ Note: Test circuit No., IoutP is applied only for CMOS output products.

VdetN=4.0V(ELM7640xxxxxxC) Vss=0V, Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Detection voltage	VdetN		3.920	4.000	4.080	V	2
Hysteresis width	Vhys		VdetN ×0.02	VdetN ×0.04	VdetN ×0.08	V	2
Current consumption	Iss	Vdd=5.0V		0.4	1.8	µA	1
Power voltage	Vdd		0.9		6.0	V	2
$\overline{\text{RESET}}$ output current	IoutN	Vdd=0.9V, Vds=0.3V	0.2	1.7		mA	3-(1)
		Vdd=1.0V, Vds=0.3V	1.0	3.1			
	IoutP	Vdd=4.5V, Vds=0.4V	0.8	1.5		mA	3-(2)
RESET output curernt	IoutN	Vdd=4.5V, Vds=0.4V	20.0	40.0		mA	3-(1)
	IoutP	Vdd=1.5V, Vds=0.4V	0.1	0.3		mA	3-(2)
Delay time(50ms)	Tdelay1	Vdd=1.0V → 4.5V	40	50	60	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Delay time(150ms)	Tdelay1	Vdd=1.0V → 4.5V	120	150	180	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Delay time(250ms)	Tdelay1	Vdd=1.0V → 4.5V	200	250	300	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Delay time(500ms)	Tdelay1	Vdd=1.0V → 4.5V	400	500	600	ms	4
	Tdelay2	Vdd=4.5V → 1.0V		10		µs	
Temperature characteristic of VdetN	$\frac{\Delta VdetN}{\Delta Top}$	Top=-40°C to +85°C		+30		ppm/°C	

∗ Note: Test circuit No., IoutP is applied only for CMOS output products.

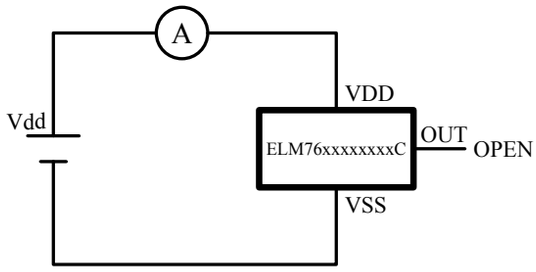
VdetN=5.5V(ELM7655xxxxxxC) Vss=0V, Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Detection voltage	VdetN		5.390	5.500	5.610	V	2
Hysteresis width	Vhys		VdetN ×0.02	VdetN ×0.04	VdetN ×0.08	V	2
Current consumption	Iss	Vdd=6.0V		0.4	1.8	µA	1
Power voltage	Vdd		0.9		6.0	V	2
$\overline{\text{RESET}}$ output current	IoutN	Vdd=0.9V, Vds=0.3V	0.2	1.7		mA	3-(1)
		Vdd=1.0V, Vds=0.3V	1.0	3.1			
	IoutP	Vdd=6.0V, Vds=0.4V	1.0	1.7		mA	3-(2)
RESET output curernt	IoutN	Vdd=6.0V, Vds=0.4V	25.0	50.0		mA	3-(1)
	IoutP	Vdd=1.5V, Vds=0.4V	0.1	0.3		mA	3-(2)
Delay time(50ms)	Tdelay1	Vdd=1.0V → 6.0V	40	50	60	ms	4
	Tdelay2	Vdd=6.0V → 1.0V		10		µs	
Delay time(150ms)	Tdelay1	Vdd=1.0V → 6.0V	120	150	180	ms	4
	Tdelay2	Vdd=6.0V → 1.0V		10		µs	
Delay time(250ms)	Tdelay1	Vdd=1.0V → 6.0V	200	250	300	ms	4
	Tdelay2	Vdd=6.0V → 1.0V		10		µs	
Delay time(500ms)	Tdelay1	Vdd=1.0V → 6.0V	400	500	600	ms	4
	Tdelay2	Vdd=6.0V → 1.0V		10		µs	
Temperature characteristic of VdetN	$\frac{\Delta VdetN}{\Delta Top}$	Top=-40°C to +85°C		+30		ppm/°C	

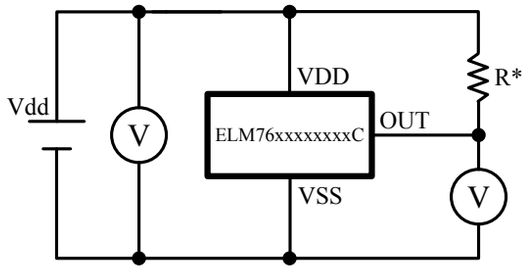
∗ Note: Test circuit No., IoutP is applied only for CMOS output products.

■Test circuits

1) Current consumption

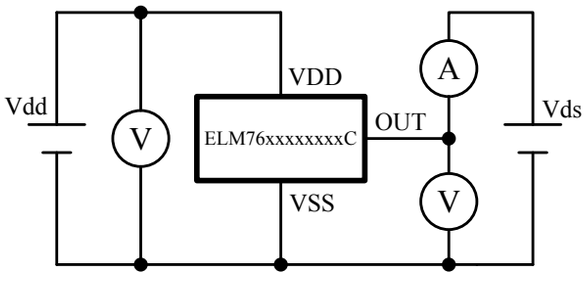


2) Detection voltage

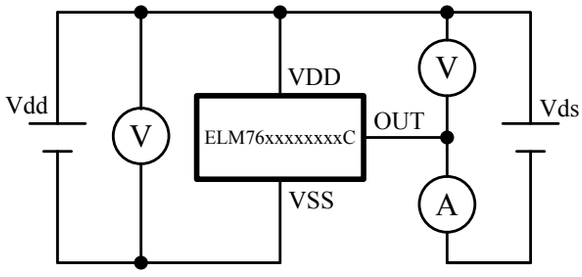


* Pull up circuit is necessary for N-ch output only.
* R=100kΩ(R=2MΩ for Vdd min measurement)

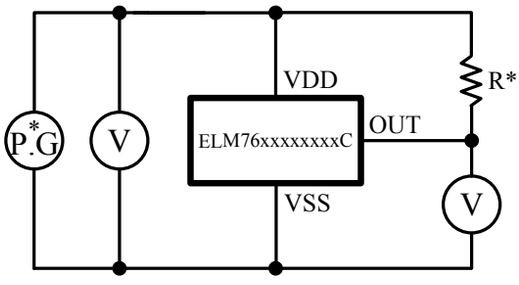
3)-(1) Output current (N-ch)



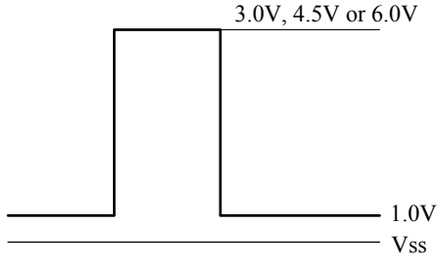
3)-(2) Output current (P-ch)



4) Delay time



* Pull up circuit is necessary for N-ch output only.
* R=100kΩ

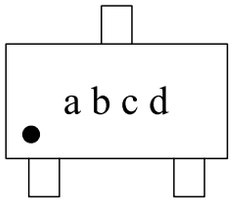


∗ Input pulse

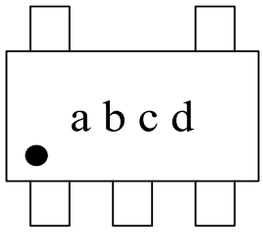
■Marking

• SOT-23, SOT-25 package

SOT-23



SOT-25



a,b : “Reset logic” and “Output type” and “Pin config” and “Detection voltage range”

Mark	Reset logic	Output type	Pin config	Detection voltage range (V)
57	Low	CMOS	1	1.6 to 3.0
58				3.1 to 5.5
59			2	1.6 to 3.0
5A				3.1 to 5.5
5B		N-ch	1	1.6 to 3.0
5C				3.1 to 5.5
5D			2	1.6 to 3.0
5E				3.1 to 5.5
5F	High	CMOS	1	1.6 to 3.0
5G				3.1 to 5.5
5H			2	1.6 to 3.0
5J				3.1 to 5.5
5K		N-ch	1	1.6 to 3.0
5L				3.1 to 5.5
5M			2	1.6 to 3.0
5N				3.1 to 5.5
5F	Low	CMOS	3	1.6 to 3.0
5G				3.1 to 5.5
5H		N-ch		1.6 to 3.0
5J				3.1 to 5.5
5K	High	CMOS		1.6 to 3.0
5L				3.1 to 5.5
5M		N-ch		1.6 to 3.0
5N				3.1 to 5.5

c : “Detection voltage”

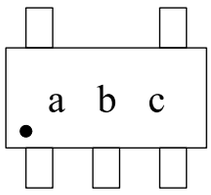
Mark	Detection voltage (V)		Mark	Detection voltage (V)		Mark	Detection voltage (V)	
1	-	3.1	A	-	4.1	L	2.1	5.1
2	-	3.2	B	-	4.2	M	2.2	5.2
3	-	3.3	C	-	4.3	N	2.3	5.3
4	-	3.4	D	-	4.4	P	2.4	5.4
5	-	3.5	E	-	4.5	Q	2.5	5.5
6	-	3.6	F	1.6	4.6	R	2.6	-
7	-	3.7	G	1.7	4.7	S	2.7	-
8	-	3.8	H	1.8	4.8	T	2.8	-
9	-	3.9	J	1.9	4.9	U	2.9	-
0	-	4.0	K	2.0	5.0	V	3.0	-

d : Assembly lot No.

Mark
0 to 9 and A to Z (I, O, X excepted)

• SC-70-5 package

SC-70-5



a : “Reset logic” and “Output type” and “Detection voltage range”

Mark	Reset logic	Output type	Detection voltage range (V)
0	Low	CMOS	1.6 to 3.0
A			3.1 to 5.5
B		N-ch	1.6 to 3.0
C			3.1 to 5.5
D	High	CMOS	1.6 to 3.0
E			3.1 to 5.5
F		N-ch	1.6 to 3.0
G			3.1 to 5.5

b : “Detection voltage”

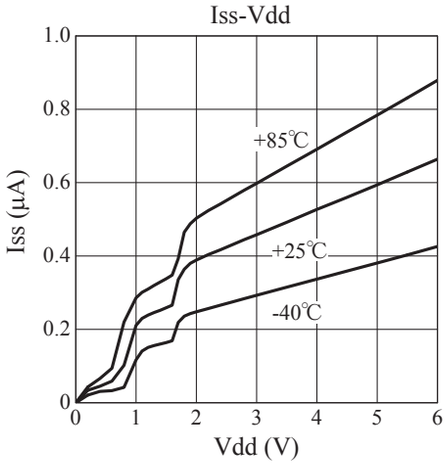
Mark	Detection voltage (V)		Mark	Detection voltage (V)	
1	-	3.1	F	1.6	4.6
2	-	3.2	G	1.7	4.7
3	-	3.3	H	1.8	4.8
4	-	3.4	J	1.9	4.9
5	-	3.5	K	2.0	5.0
6	-	3.6	L	2.1	5.1
7	-	3.7	M	2.2	5.2
8	-	3.8	N	2.3	5.3
9	-	3.9	P	2.4	5.4
0	-	4.0	Q	2.5	5.5
A	-	4.1	R	2.6	-
B	-	4.2	S	2.7	-
C	-	4.3	T	2.8	-
D	-	4.4	U	2.9	-
E	-	4.5	V	3.0	-

c : Assembly lot No.

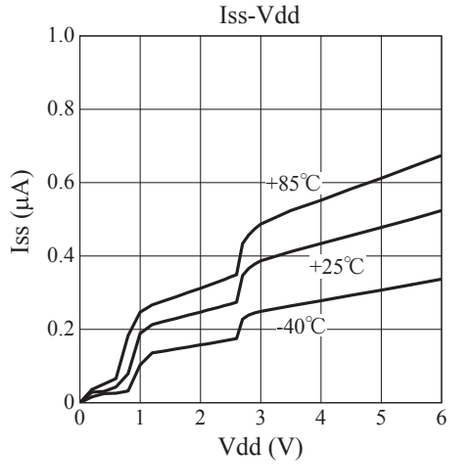
Mark
0 to 9 and A to Z (I, O, X excepted)

■Current consumption characteristics

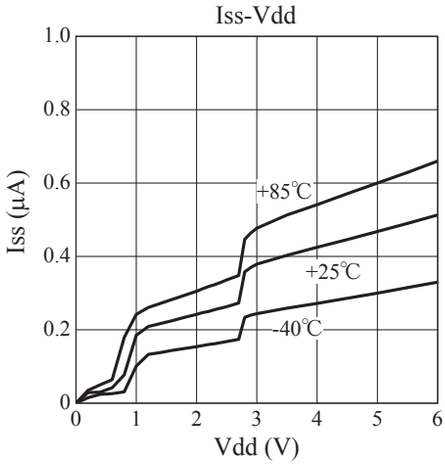
• VdetN=1.6V(ELM7616xxxxxxC)



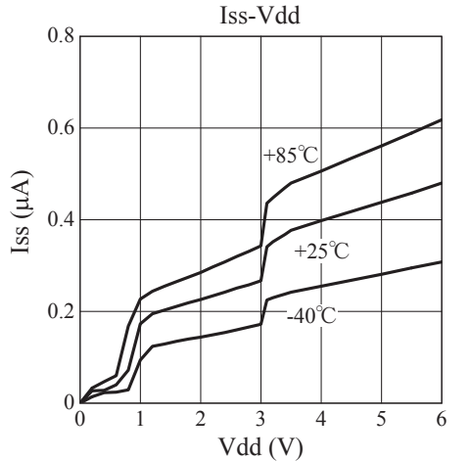
• VdetN=2.5V(ELM7625xxxxxxC)



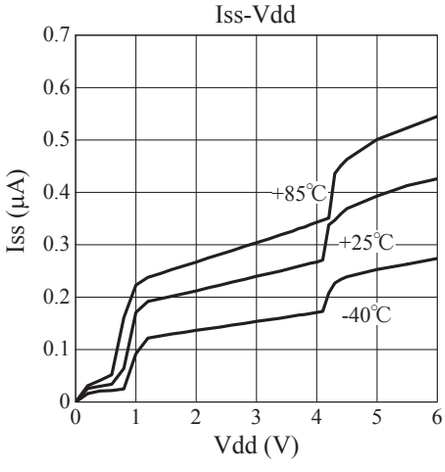
• VdetN=2.7V(ELM7627xxxxxxC)



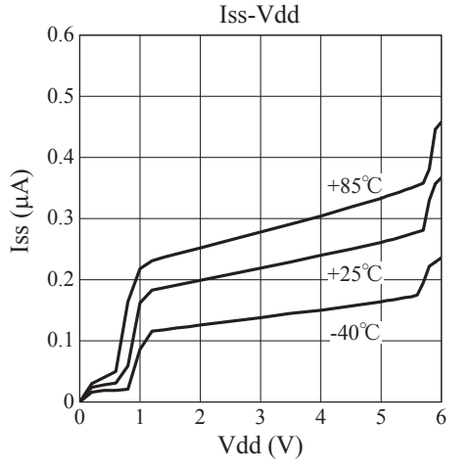
• VdetN=3.0V(ELM7630xxxxxxC)



• VdetN=4.0V(ELM7640xxxxxxC)

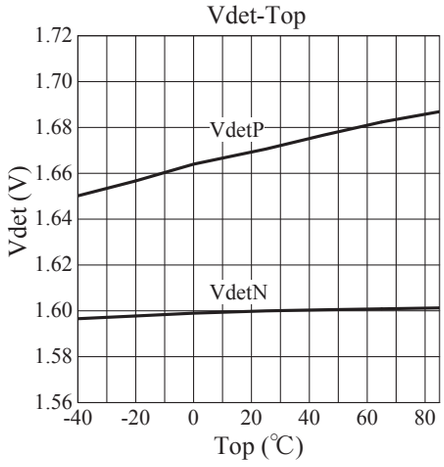


• VdetN=5.5V(ELM7655xxxxxxC)

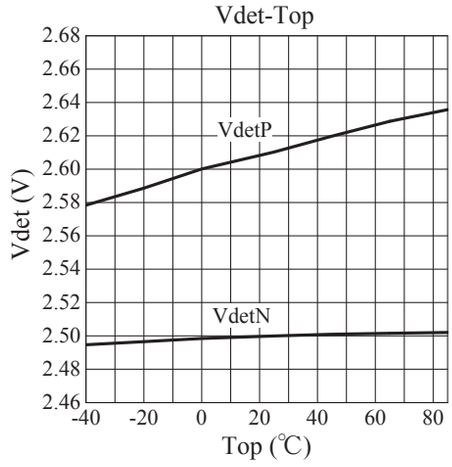


■Detection voltage characteristics

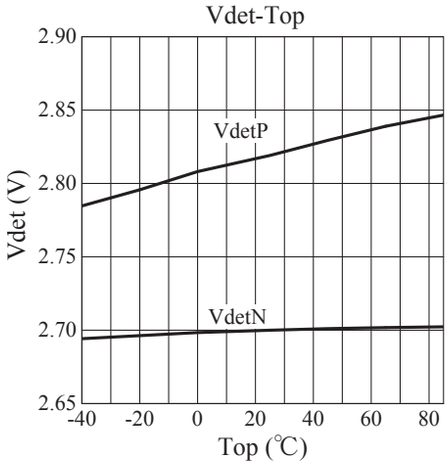
• VdetN=1.6V(ELM7616xxxxxxC)



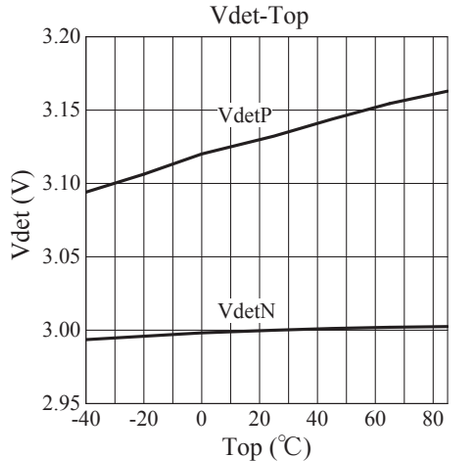
• VdetN=2.5V(ELM7625xxxxxxC)



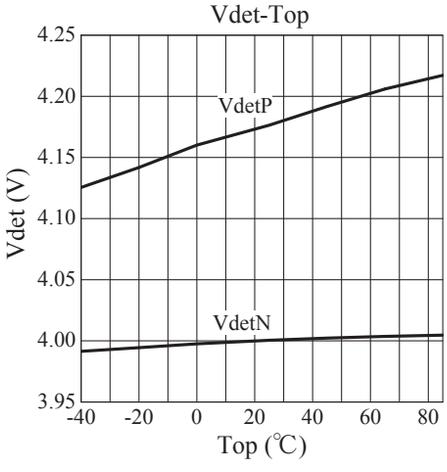
• VdetN=2.7V(ELM7627xxxxxxC)



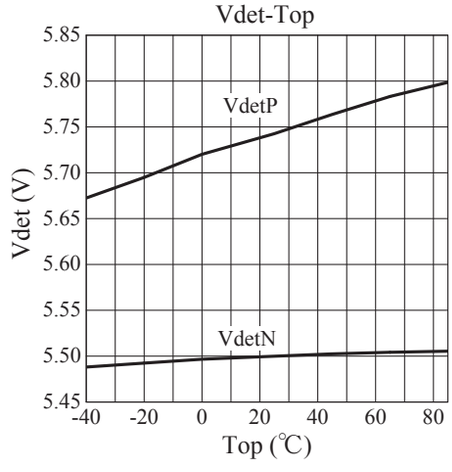
• VdetN=3.0V(ELM7630xxxxxxC)



• VdetN=4.0V(ELM7640xxxxxxC)

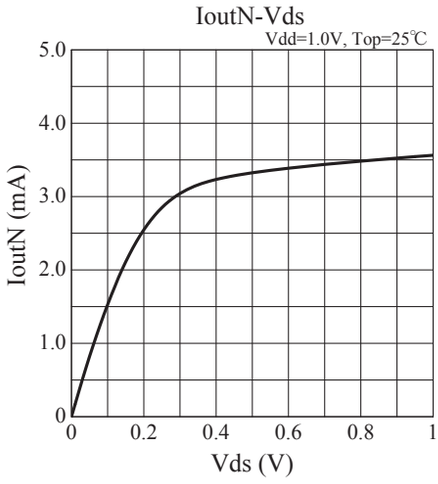


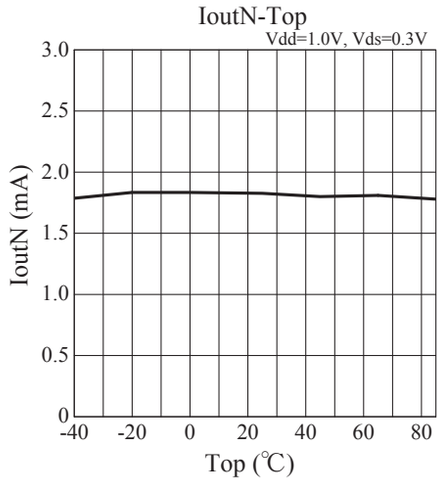
• VdetN=5.5V(ELM7655xxxxxxC)

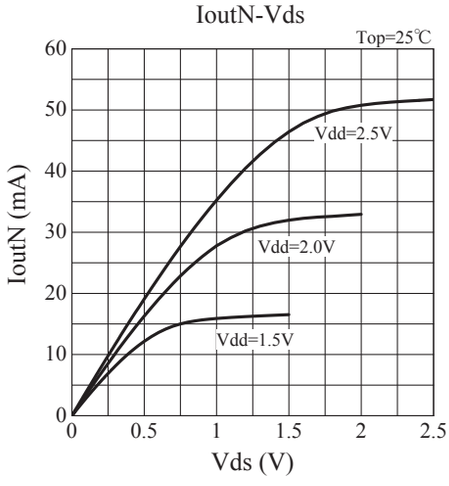


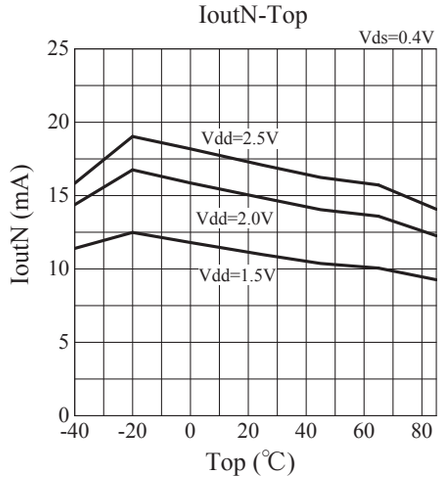
■N-ch output current characteristics

• ELM76xxLxxxxxC

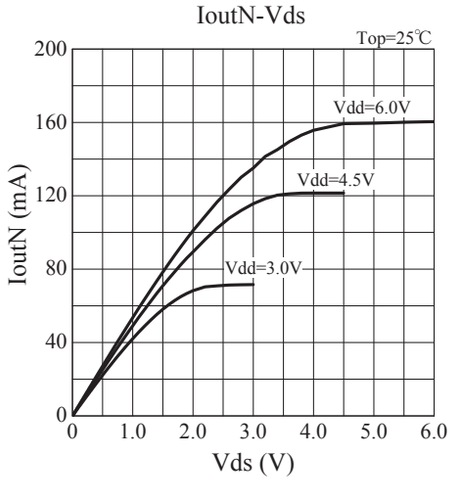


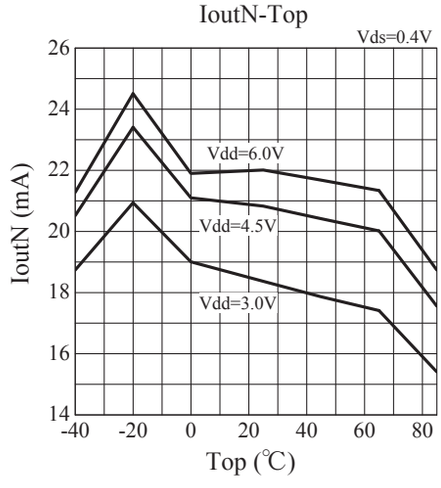






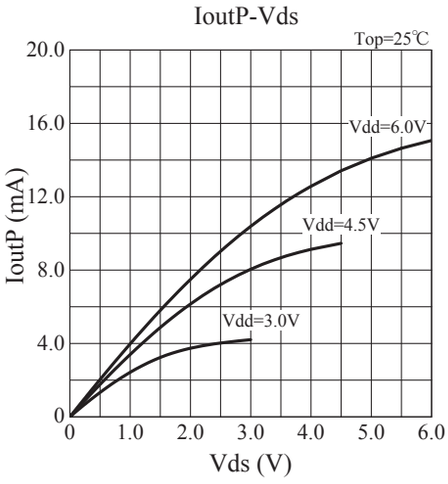
• ELM76xxHxxxxxC

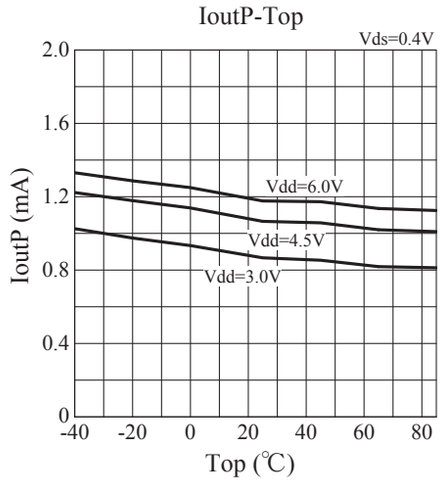




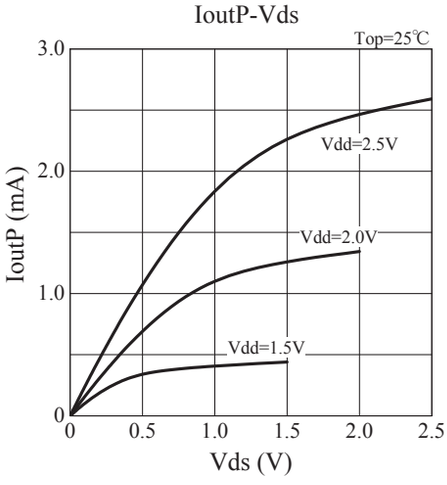
■P-ch output current characteristics

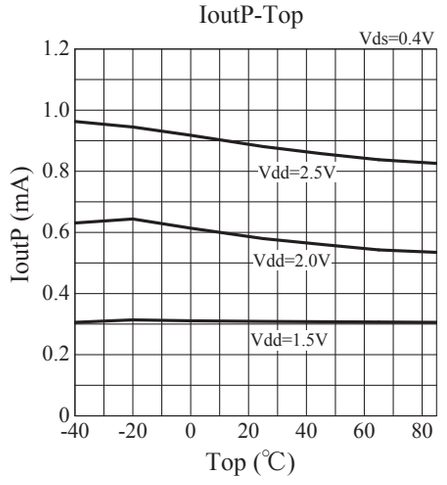
• ELM76xxLxxxxxC





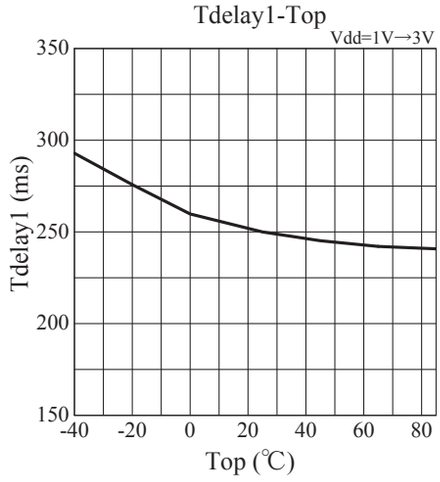
• ELM76xxHxxxxxC

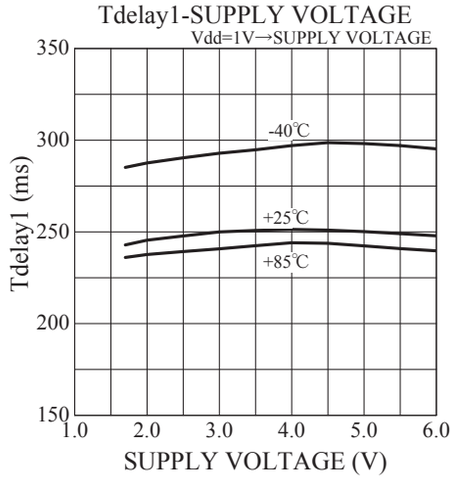




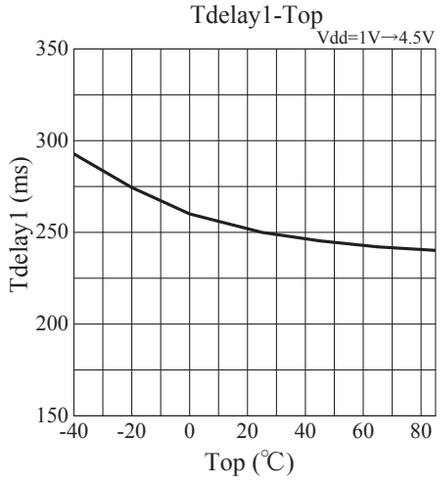
■Delay time characteristics (Tdelay1)

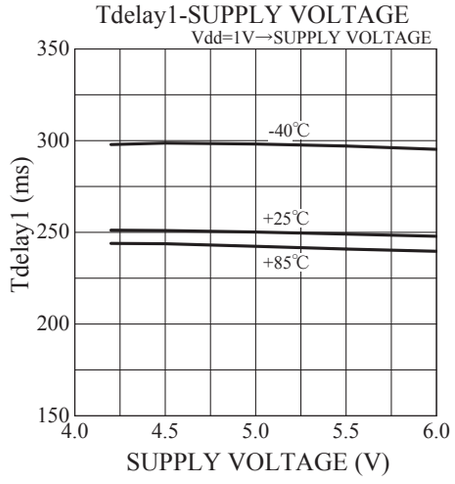
- VdetN=1.6V, VdetN=2.5V (delay time : 250ms)



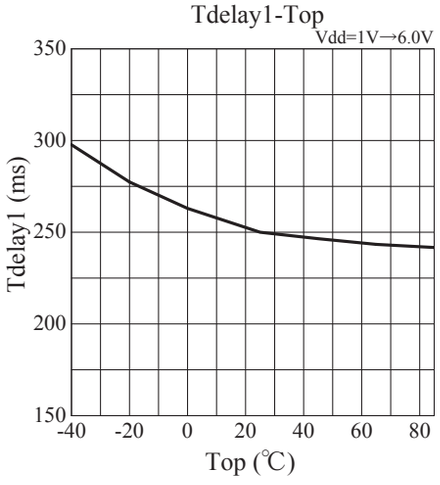


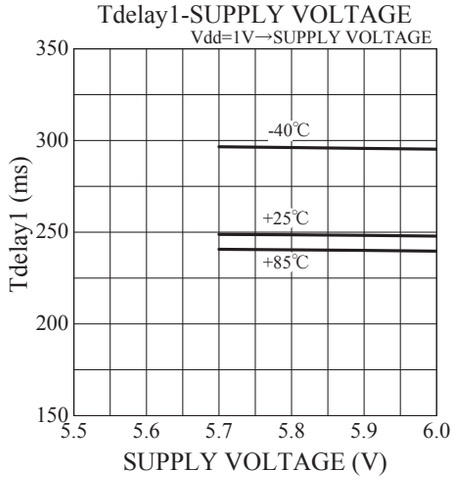
- VdetN=2.7V, VdetN=3.0V, VdetN=4.0V (delay time : 250ms)





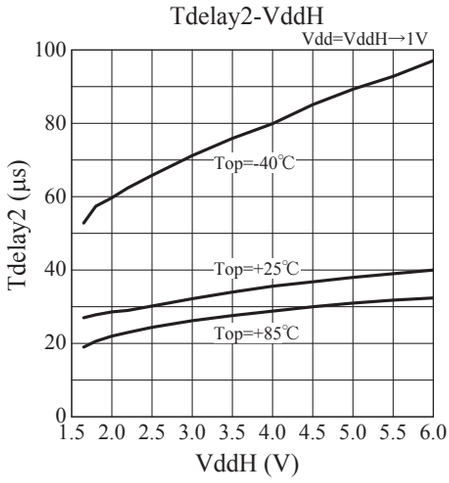
- VdetN=5.5V (delay time : 250ms)

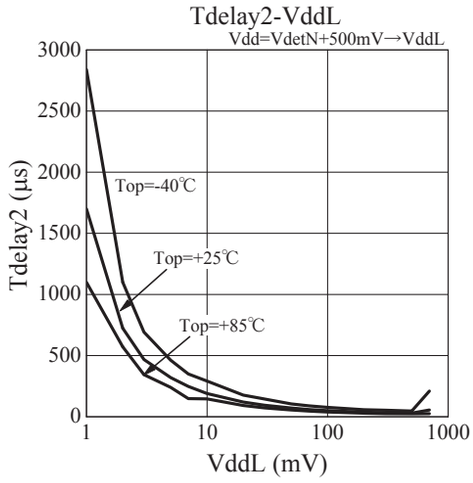




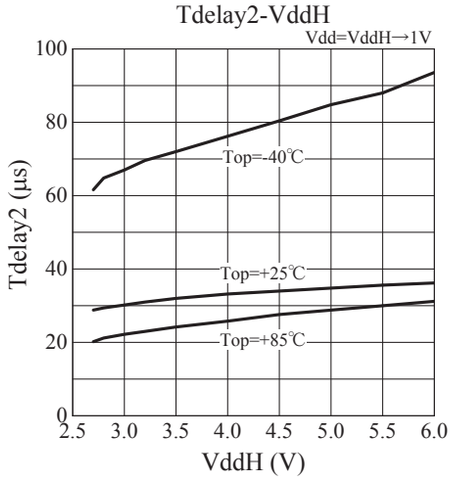
■Delay time characteristics (Tdelay2)

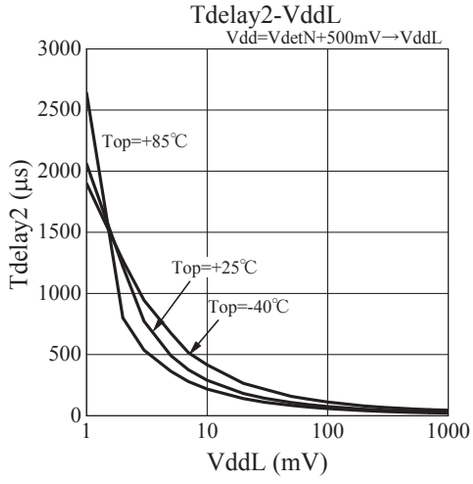
- VdetN=1.6V (ELM7616xxxxxxC)



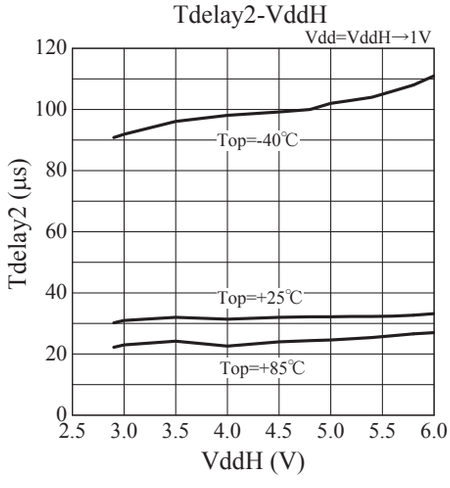


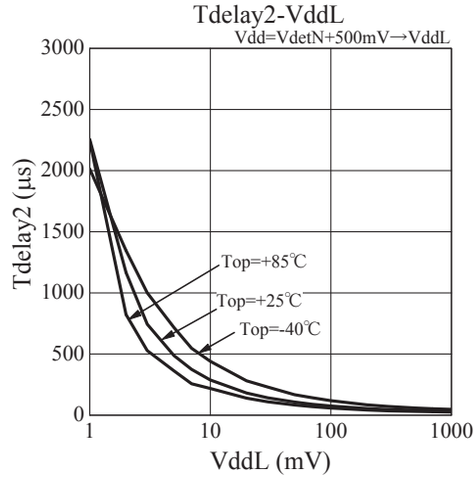
- VdetN=2.5V (ELM7625xxxxxxC)



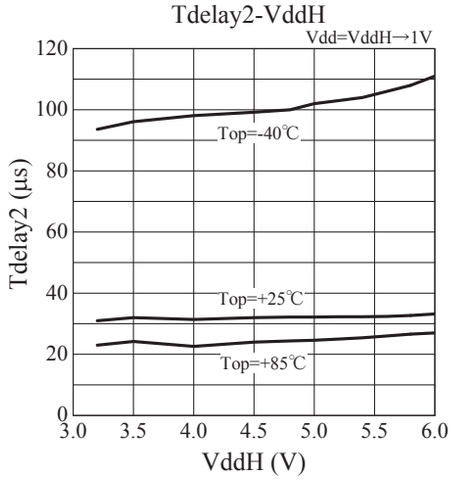


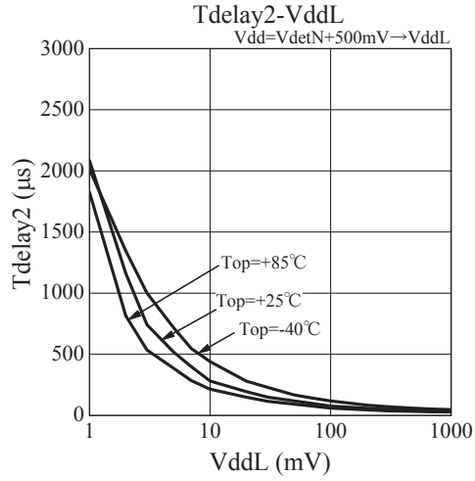
- VdetN=2.7V (ELM7627xxxxxxC)



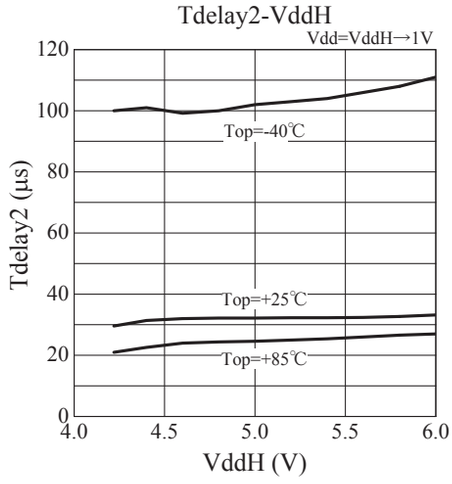


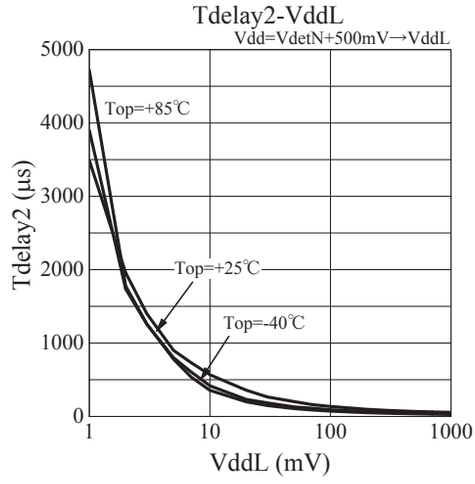
- VdetN=3.0V (ELM7630xxxxxxC)





- VdetN=4.0V (ELM7640xxxxxxC)





- VdetN=5.5V (ELM7655xxxxxxC)