ELM99xxxxxC CMOS middle current voltage regulator

■General description

ELM99xxxxxC is CMOS middle current voltage regulator which consists of reference voltage source, error amplifier, low resistance output transistor, short-circuit protection circuit, thermal protection circuit, output voltage setting resisters and chip-enable circuit. ELM99 series is characterized with small input/output voltage difference (with its low resistance output transistor) and high load stability (with its high gain error amplifier). There are 3 types of CE selection of ELM99 series: non-chip enable function, “L” active and “H” active. The standard output voltages are 3.3V, 5.0V; these output voltages are fixed internally with high accuracy. ELM99 series can also be made as semi-custom IC within the range of 1.5V to 15.0V by 0.1V step.

■Features

- Output voltage range : 1.5V to 15.0V (by 0.1V)
- Max. output current : 300mA(Current is limited internally)
- Stand-by current consumption : Max.0.1μA(ELM99033xxC)
- Input stability : Typ.0.1%/V(Iout=40mA)
- Load stability : Typ.5mV(1mA≤Iout≤100mA)
- Accuracy of output voltage : ±2.0%
- Protection circuit : Thermal protection, Short protection
- Package : SOT-89, SOT-89-5, SOT-23, SOT-25

■Application

- Battery operated devices
- Digital cameras
- Video recorders
- Reference voltage source

■Maximum absolute ratings

Parameter	Symbol	Limit		Unit
Input voltage	Vin	20		V
CE/CE Input voltage	Vce	Vss-0.3 to Vin+0.3		V
Output voltage	Vout	Vss-0.3 to Vin+0.3		V
Output current	Iout	500 (*1)		mA
Power dissipation (Ta=25°C)	Pd	SOT-89	500 (*2)	mW
			1000 (*3)	
		SOT-89-5	500 (*2)	
			1000 (*3)	
		SOT-23	250 (*2)	
			500 (*3)	
		SOT-25	250 (*2)	
			600 (*3)	
Operationg temperature	Top	-40 to +85		°C
Storage temperature	Tstg	-55 to +125		°C

* 1. Output current must not exceed power dissipation specified in maximum absolute ratings.
* 2. No mounted, IC alone.
* 3. Mounted on glass epoxy board (FR-4). (76.2mm×114.3mm×1.6mm : based on EIJ/JEDEC standard size), 2layers, Cu thickness 35μm, Cu area : top side 20%, back side 100%.

■Selection guide

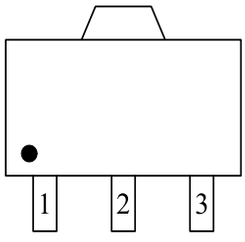
ELM99xxxxxC-x

Symbol		
a, b, c	Output voltage	e.g. : 033: Vout=3.3V, 050: Vout=5.0V
d	CE selection	1: No CE 2: $\overline{CE}$="L" active 3: CE="H" active
e	Package	A: SOT-89, SOT-89-5 B: SOT-23, SOT-25
f	Product version	C
g	Taping direction	S, N: Refer to PKG file

ELM99 x x x x x C - x
↑ ↑ ↑ ↑ ↑ ↑ ↑
a b c d e f g

■Pin configuration

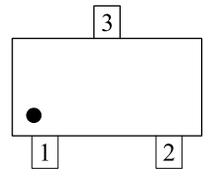
SOT-89(TOP VIEW)



ELM99xxx1AC

Pin No.	Pin name
1	VSS
2	VIN
3	VOUT

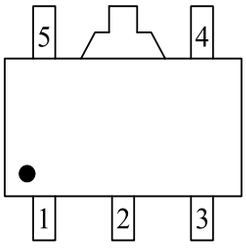
SOT-23(TOP VIEW)



ELM99xxx1BC

Pin No.	Pin name
1	VIN
2	VOUT
3	VSS

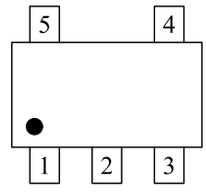
SOT-89-5(TOP VIEW)



ELM99xxx2AC
ELM99xxx3AC

Pin No.	Pin name
1	VSS
2	VIN
3	VOUT
4	NC
5	$\overline{CE}$/CE

SOT-25(TOP VIEW)

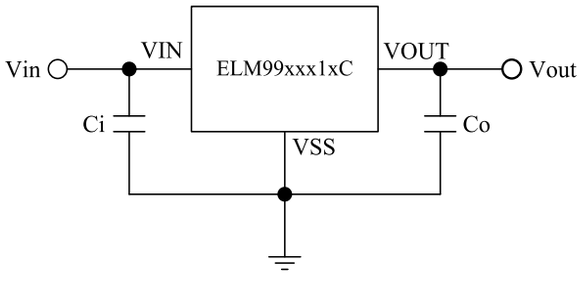


ELM99xxx2BC
ELM99xxx3BC

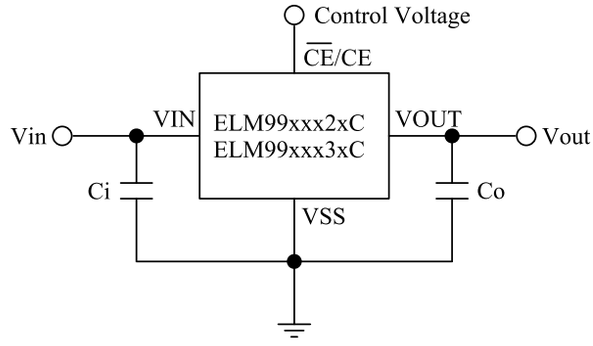
Pin No.	Pin name
1	VIN
2	VSS
3	NC
4	$\overline{CE}$/CE
5	VOUT

■Standard circuit

ELM99xxx1xC



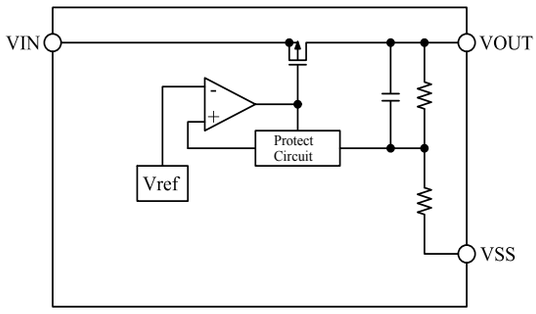
ELM99xxx2xC: $\overline{CE}$, ELM99xxx3xC: CE



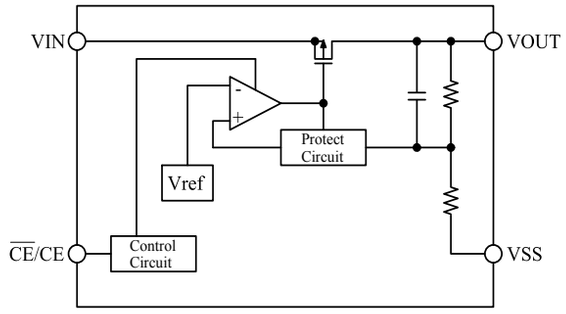
∗ Please connect 1.0μF at minimum for Ci and Co. Ceramic capacitors with 2.2μF or greater are recommended for stability operation.

■Block diagram

ELM99xxx1xC



ELM99xxx2xC: $\overline{CE}$, ELM99xxx3xC: CE



■Electrical characteristics (ELM99xxx1xC)

Vout=3.3V(ELM990331xC), No CE pin Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=4.3V, Iout=40mA	3.234	3.300	3.366	V
Output current	Iout	Vin=4.3V	170	300		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 4.3V≤Vin≤18.0V		0.02	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≤Iout≤100mA, Vin=4.3V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		110	265	mV
Current consumption	Iss	Vin=4.3V, No-load		25	45	μA
Input voltage	Vin		2.2		18.0	V
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=4.3V, Iout=40mA, Top=-40°C~+85°C		±100		ppm/°C
Short circuit current	Ilim	Vin=4.3V, Vout=0V		40		mA
Ripple rejection ratio	RR	Vin=4.3V, f=1kHz, Iout=40mA		60		dB
Thermal shutdown temperature	Tsd			160		°C
Output noise	Vno	Vin=4.3V, BW=10Hz~100kHz		30		μVrms

Vout=5.0V(ELM990501xC), No CE pin Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=6.0V, Iout=40mA	4.900	5.000	5.100	V
Output current	Iout	Vin=6.0V	200	330		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 6.0V≤Vin≤18.0V		0.02	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≤Iout≤100mA, Vin=6.0V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		85	220	mV
Current consumption	Iss	Vin=6.0V, No-load		30	55	μA
Input voltage	Vin		2.2		18.0	V
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=6.0V, Iout=40mA, Top=-40°C~+85°C		±100		ppm/°C
Short circuit current	Ilim	Vin=6.0V, Vout=0V		40		mA
Ripple rejection ratio	RR	Vin=6.0V, f=1kHz, Iout=40mA		60		dB
Thermal shutdown temperature	Tsd			160		°C
Output noise	Vno	Vin=6.0V, BW=10Hz~100kHz		30		μVrms

■Electrical characteristics (ELM99xxx2xC)

Vout=3.3V(ELM990332xC), $\overline{CE}$="L"active Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=4.3V, Iout=40mA	3.234	3.300	3.366	V
Output current	Iout	Vin=4.3V	170	300		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 4.3V≤Vin≤18.0V		0.02	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≤Iout≤100mA, Vin=4.3V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		110	265	mV
Current consumption	Iss	Vin=4.3V, Vce=Vss, No-load		25	45	μA
Stand-by current consumption	Istandby	Vin=Vce=4.3V		0.0	0.1	μA
Input voltage	Vin		2.2		18.0	V
$\overline{CE}$ Input voltage High	Vceh	Vin=18.0V	1.80		Vin	V
$\overline{CE}$ Input voltage Low	Vcel	Vin=2.2V	0.00		0.25	
$\overline{CE}$ Input current High	Iceh	Vin=Vce=18V	-0.2		0.2	μA
$\overline{CE}$ Input current Low	Icel	Vin=18V, Vce=Vss	-0.2		0.2	
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=4.3V, Iout=40mA, Top=-40°C~+85°C		±100		ppm/°C
Short circuit current	Ilim	Vin=4.3V, Vout=0V		40		mA
Ripple rejection ratio	RR	Vin=4.3V, f=1kHz, Iout=40mA		60		dB
Thermal shutdown temperature	Tsd			160		°C
Output noise	Vno	Vin=4.3V, BW=10Hz~100kHz		30		μVrms

Vout=5.0V(ELM990502xC), $\overline{CE}$="L"active Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=6.0V, Iout=40mA	4.900	5.000	5.100	V
Output current	Iout	Vin=6.0V	200	330		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 6.0V≤Vin≤18.0V		0.02	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≤Iout≤100mA, Vin=6.0V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		85	220	mV
Current consumption	Iss	Vin=6.0V, Vce=Vss, No-load		30	55	μA
Stand-by current consumption	Istandby	Vin=6.0V, Vce=Vss		0.0	0.1	μA
Input voltage	Vin		2.2		18.0	V
$\overline{CE}$ Input voltage High	Vceh	Vin=18.0V	1.80		Vin	V
$\overline{CE}$ Input voltage Low	Vcel	Vin=2.2V	0.00		0.25	
$\overline{CE}$ Input current High	Iceh	Vin=Vce=18V	-0.2		0.2	μA
$\overline{CE}$ Input current Low	Icel	Vin=18, Vce=Vss	-0.2		0.2	
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=6.0V, Iout=40mA, Top=-40°C~+85°C		±100		ppm/°C
Short circuit current	Ilim	Vin=6.0V, Vout=0V		40		mA
Ripple rejection ratio	RR	Vin=6.0V, f=1kHz, Iout=40mA		60		dB
Thermal shutdown temperature	Tsd			160		°C
Output noise	Vno	Vin=6.0V, BW=10Hz~100kHz		30		μVrms

■Electrical characteristics (ELM99xxx3xC)

Vout=3.3V(ELM990333xC), CE="H"active Top=25°C

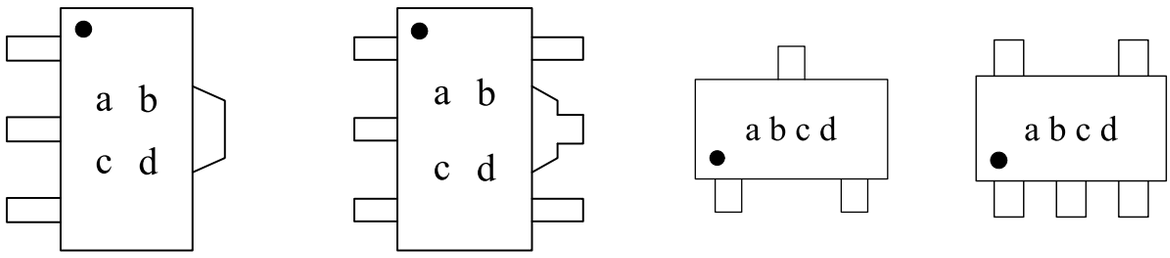
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=4.3V, Iout=40mA	3.234	3.300	3.366	V
Output current	Iout	Vin=4.3V	170	300		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 4.3V≤Vin≤18.0V		0.02	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≤Iout≤100mA, Vin=4.3V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		110	265	mV
Current consumption	Iss	Vin=Vce=4.3V, No-load		25	45	μA
Stand-by current consumption	Istandby	Vin=Vce=4.3V		0.0	0.1	μA
Input voltage	Vin		2.2		18.0	V
CE Input voltage High	Vceh	Vin=18.0V	1.80		Vin	V
CE Input voltage Low	Vcel	Vin=2.2V	0.00		0.25	
CE Input current High	Iceh	Vin=Vce=18.0V	-0.2		0.2	μA
CE Input current Low	Icel	Vin=18V, Vce=Vss	-0.2		0.2	
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=4.3V, Iout=40mA, Top=-40°C~+85°C		±100		ppm/°C
Short circuit current	Ilim	Vin=4.3V, Vout=0V		40		mA
Ripple rejection ratio	RR	Vin=4.3V, f=1kHz, Iout=40mA		60		dB
Thermal shutdown temperature	Tsd			160		°C
Output noise	Vno	Vin=4.3V, BW=10Hz~100kHz		30		μVrms

Vout=5.0V(ELM990503xC), CE="H"active Top=25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=6.0V, Iout=40mA	4.900	5.000	5.100	V
Output current	Iout	Vin=6.0V	200	330		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 6.0V≤Vin≤18.0V		0.02	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≤Iout≤100mA, Vin=6.0V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		85	220	mV
Current consumption	Iss	Vin=Vce=6.0V, No-load		30	55	μA
Stand-by current consumption	Istandby	Vin=6.0V, Vce=Vss		0.0	0.1	μA
Input voltage	Vin		2.2		18.0	V
CE Input voltage High	Vceh	Vin=18.0V	1.80		Vin	V
CE Input voltage Low	Vcel	Vin=2.2V	0.00		0.25	
CE Input current High	Iceh	Vin=Vce=18.0V	-0.1		0.1	μA
CE Input current Low	Icel	Vin=18.0V, Vce=Vss	-0.1		0.1	
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=6.0V, Iout=40mA, Top=-40°C~+85°C		±100		ppm/°C
Short circuit current	Ilim	Vin=6.0V, Vout=0V		40		mA
Ripple rejection ratio	RR	Vin=6.0V, f=1kHz, Iout=40mA		60		dB
Thermal shutdown temperature	Tsd			160		°C
Output noise	Vno	Vin=6.0V, BW=10Hz~100kHz		30		μVrms

■Marking

SOT-89 SOT-89-5 SOT-23 SOT-25



a, b : Represents Output voltage range , Package type and CE type.

Symbol	Output voltage range (V)	Package	CE Type
60	1.5~4.0	SOT-89	No CE
61	4.1~7.0	SOT-89	No CE
62	7.1~10.0	SOT-89	No CE
63	10.1~13.0	SOT-89	No CE
64	13.1~15.0	SOT-89	No CE
65	1.5~4.0	SOT-89-5	CE=Lo
66	4.1~7.0	SOT-89-5	CE=Lo
67	7.1~10.0	SOT-89-5	CE=Lo
68	10.1~13.0	SOT-89-5	CE=Lo
69	13.1~15.0	SOT-89-5	CE=Lo
6A	1.5~4.0	SOT-89-5	CE=High
6B	4.1~7.0	SOT-89-5	CE=High
6C	7.1~10.0	SOT-89-5	CE=High
6D	10.1~13.0	SOT-89-5	CE=High
6E	13.1~15.0	SOT-89-5	CE=High
6F	1.5~4.0	SOT-23	No CE
6G	4.1~7.0	SOT-23	No CE
6H	7.1~10.0	SOT-23	No CE
6J	10.1~13.0	SOT-23	No CE
6K	13.1~15.0	SOT-23	No CE
6L	1.5~4.0	SOT-25	CE=Lo
6M	4.1~7.0	SOT-25	CE=Lo
6N	7.1~10.0	SOT-25	CE=Lo
6P	10.1~13.0	SOT-25	CE=Lo
6Q	13.1~15.0	SOT-25	CE=Lo
6R	1.5~4.0	SOT-25	CE=High
6S	4.1~7.0	SOT-25	CE=High
6T	7.1~10.0	SOT-25	CE=High
6U	10.1~13.0	SOT-25	CE=High
6V	13.1~15.0	SOT-25	CE=High

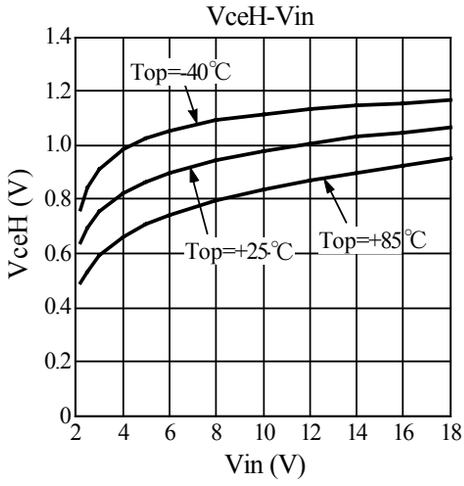
c : Represents Output voltage.

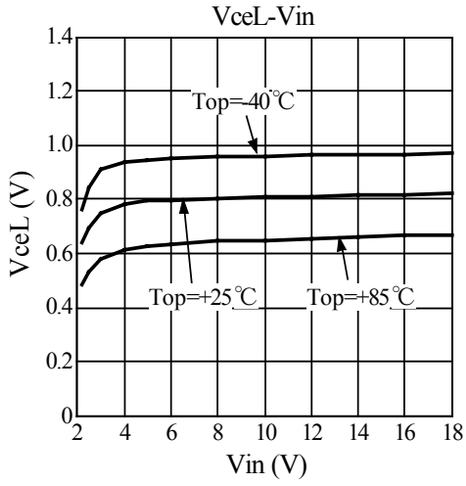
Symbol	Output voltage(V)				
1		4.1	7.1	10.1	13.1
2		4.2	7.2	10.2	13.2
3		4.3	7.3	10.3	13.3
4		4.4	7.4	10.4	13.4
5	1.5	4.5	7.5	10.5	13.5
6	1.6	4.6	7.6	10.6	13.6
7	1.7	4.7	7.7	10.7	13.7
8	1.8	4.8	7.8	10.8	13.8
9	1.9	4.9	7.9	10.9	13.9
0	2.0	5.0	8.0	11.0	14.0
A	2.1	5.1	8.1	11.1	14.1
B	2.2	5.2	8.2	11.2	14.2
C	2.3	5.3	8.3	11.3	14.3
D	2.4	5.4	8.4	11.4	14.4
E	2.5	5.5	8.5	11.5	14.5
F	2.6	5.6	8.6	11.6	14.6
G	2.7	5.7	8.7	11.7	14.7
H	2.8	5.8	8.8	11.8	14.8
J	2.9	5.9	8.9	11.9	14.9
K	3.0	6.0	9.0	12.0	15.0
L	3.1	6.1	9.1	12.1	
M	3.2	6.2	9.2	12.2	
N	3.3	6.3	9.3	12.3	
P	3.4	6.4	9.4	12.4	
Q	3.5	6.5	9.5	12.5	
R	3.6	6.5	9.6	12.6	
S	3.7	6.7	9.7	12.7	
T	3.8	6.8	9.8	12.8	
U	3.9	6.9	9.9	12.9	
V	4.0	7.0	10.0	13.0	

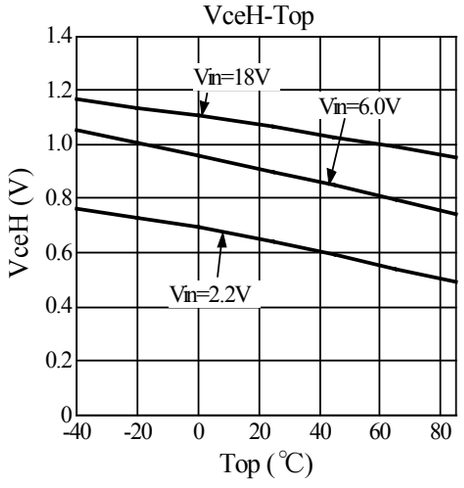
d : Represents the assembly lot number
1~0, A~Z repeated (I,O,X excepted)

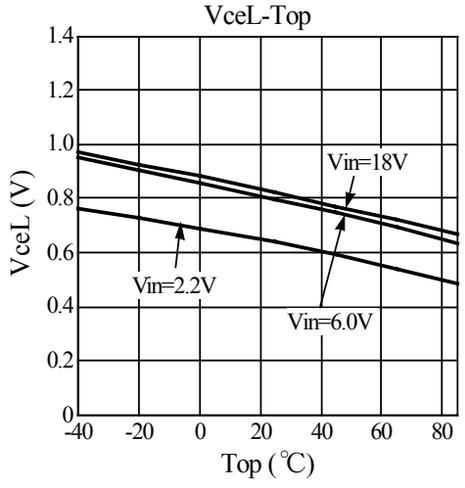
■Typical characteristics

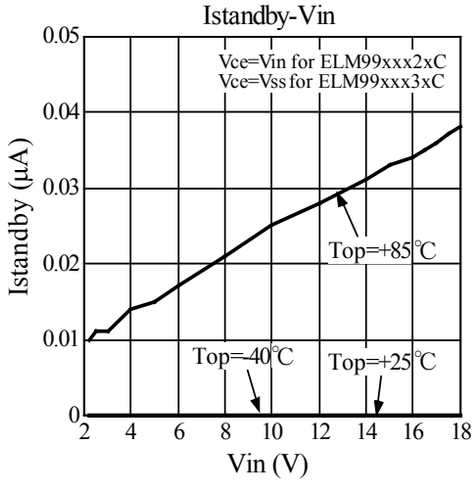
• ELM99xxx2xC, ELM99xxx3xC)

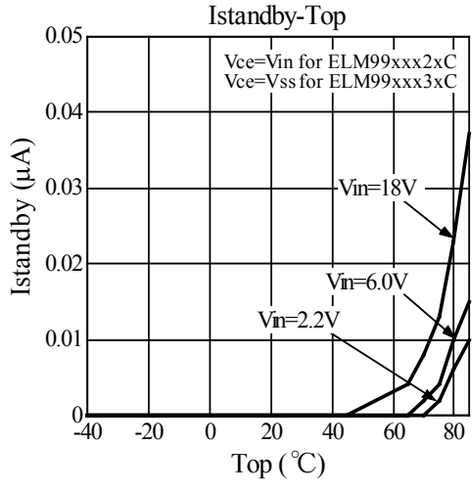




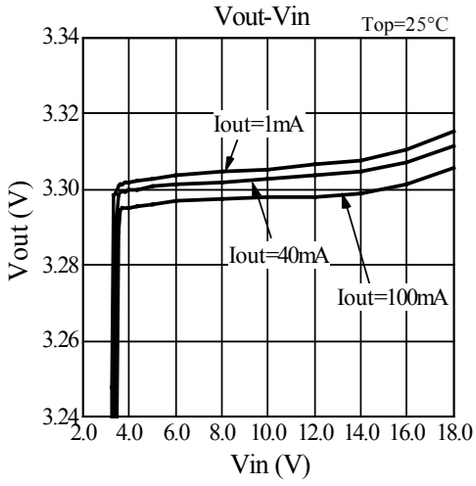


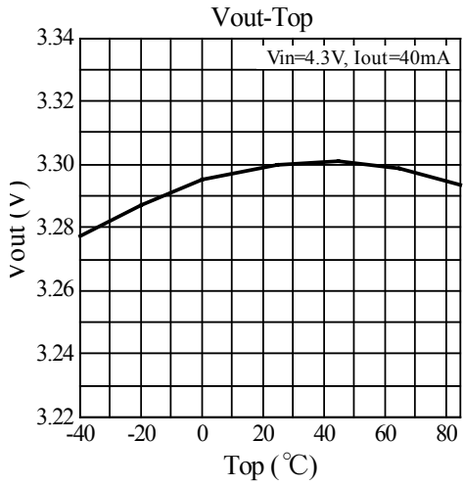


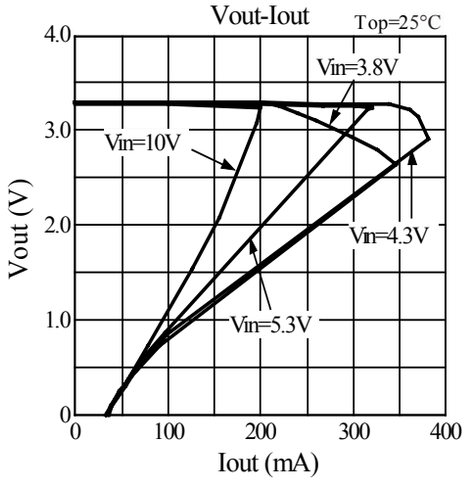


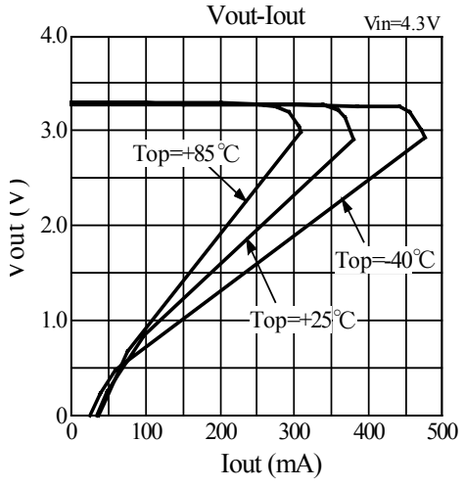


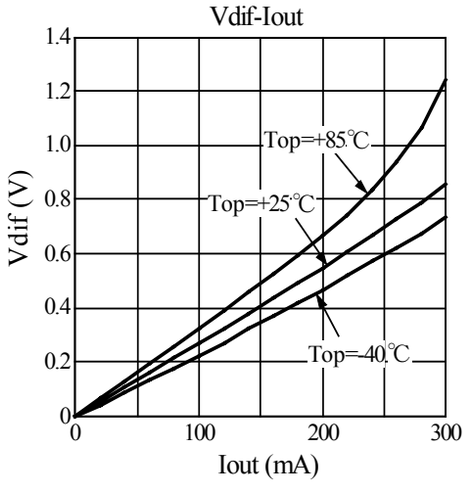
• Vout=3.3V(ELM99033xxC)

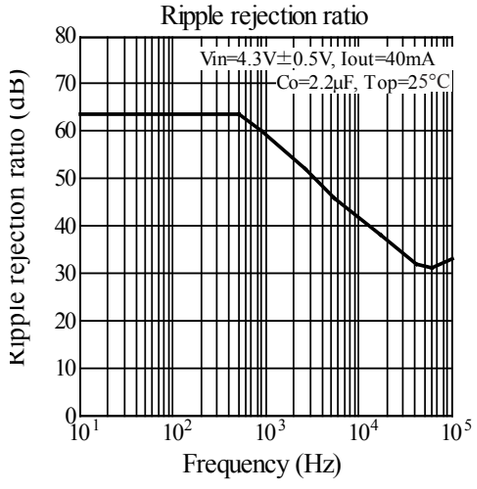


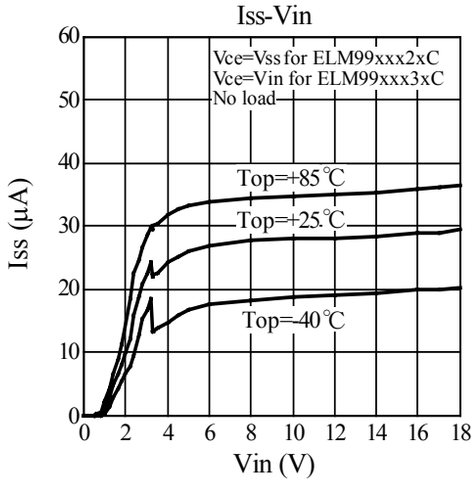


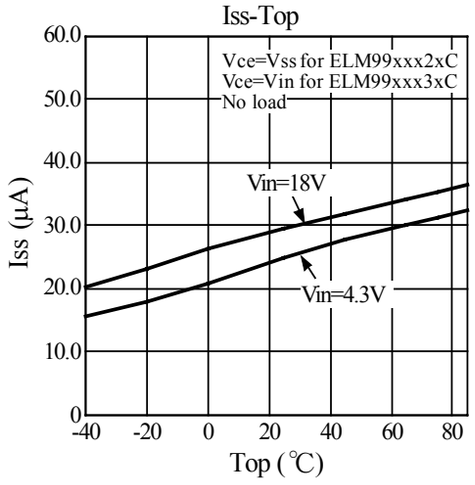


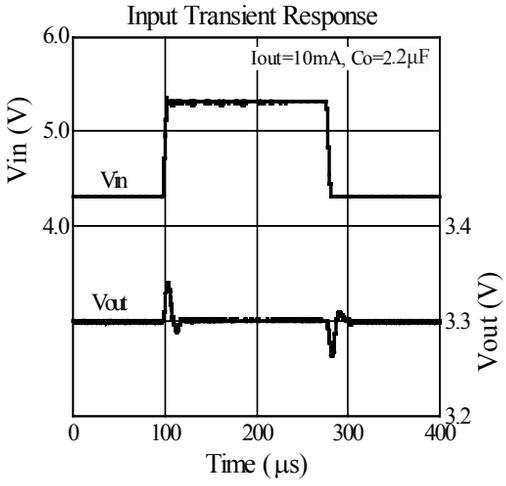


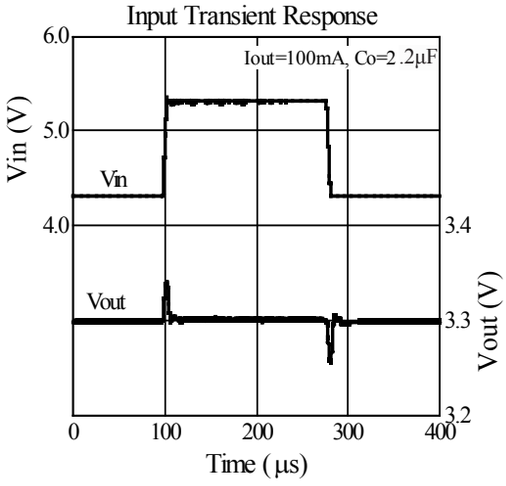


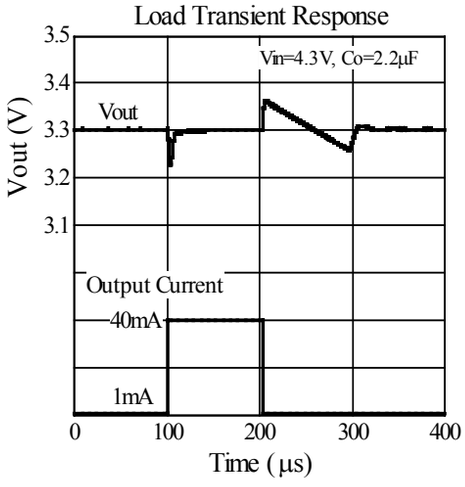


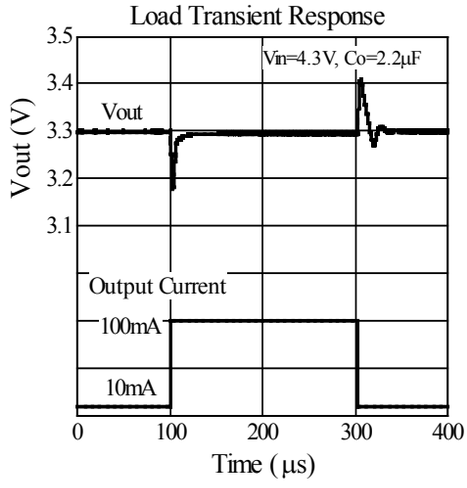

Iss-Vin
Vce=Vss for ELM99xxx2xC
Vce=Vin for ELM99xxx3xC
No load
Top=+85℃
Top=+25℃
Top=-40℃
Iss (μA)
Vin (V)


Iss-Top
Vce=Vss for ELM99xxx2xC
Vce=Vin for ELM99xxx3xC
No load
Vin=18V
Vin=4.3V
Iss (μA)
Top (℃)

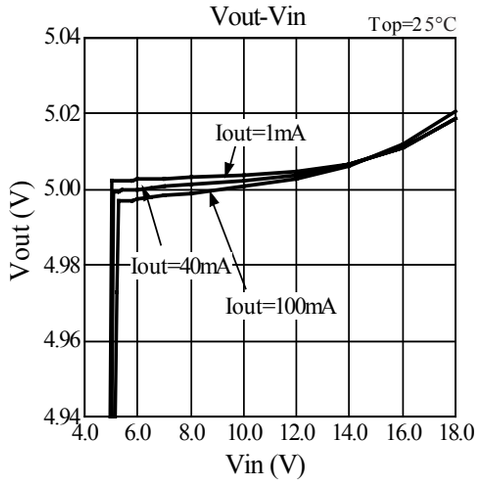

Input Transient Response
Iout=10mA, Co=2.2μF
Vin
Vout
Vin (V)
Vout (V)
Time (μs)

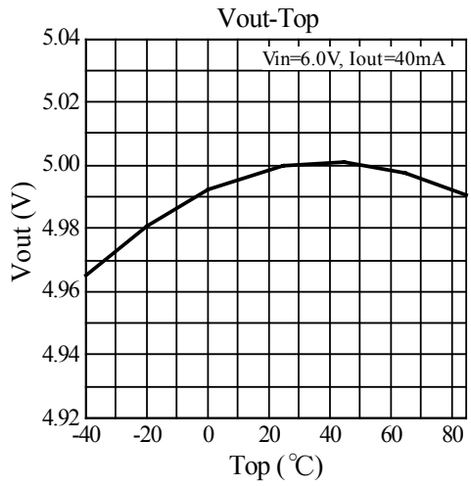

Input Transient Response
Iout=100mA, Co=2.2μF
Vin
Vout
Vin (V)
Vout (V)
Time (μs)

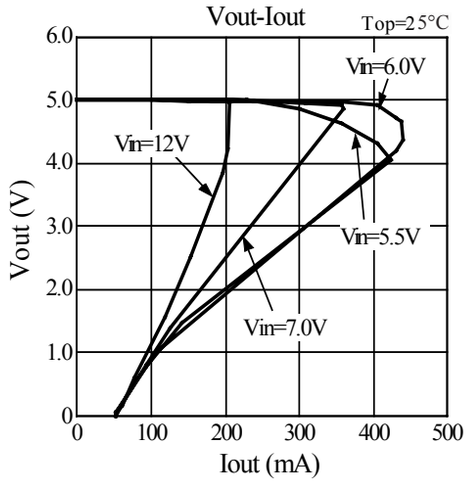

Load Transient Response
Vin=4.3V, Co=2.2μF
Vout
Output Current
40mA
1mA
Vout (V)
Time (μs)

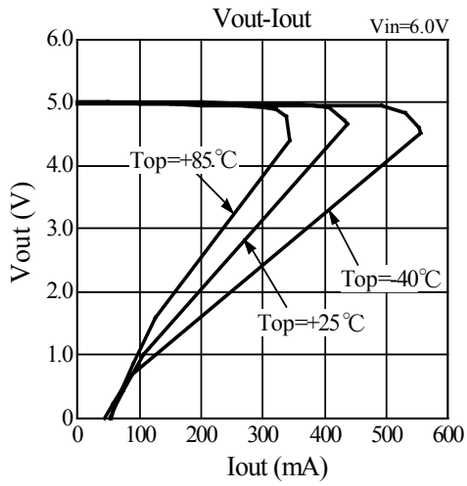

Load Transient Response
Vin=4.3V, Co=2.2μF
Vout
Output Current
100mA
10mA
Vout (V)
Time (μs)

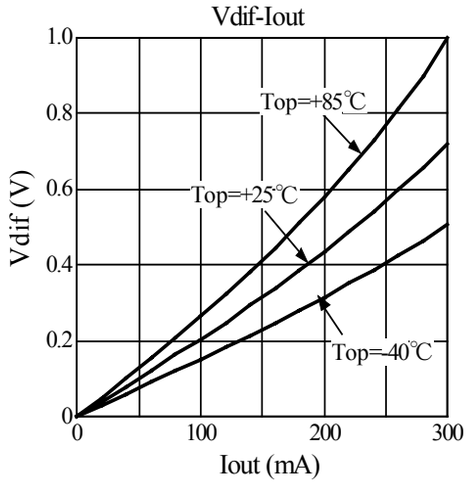
• Vout=5.0V(ELM99050xxC)

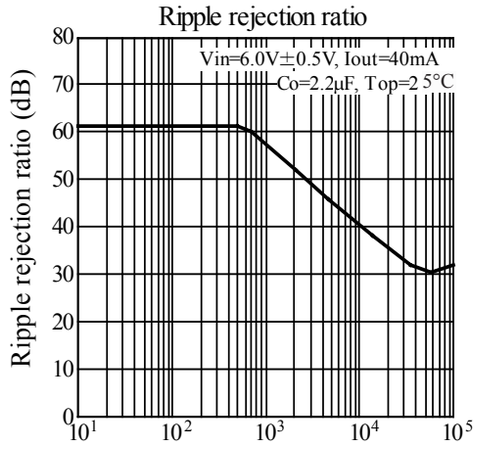


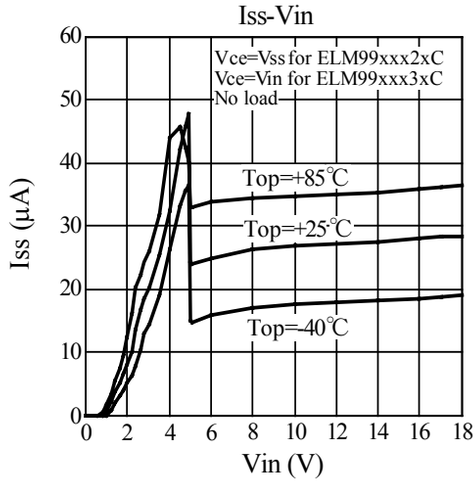


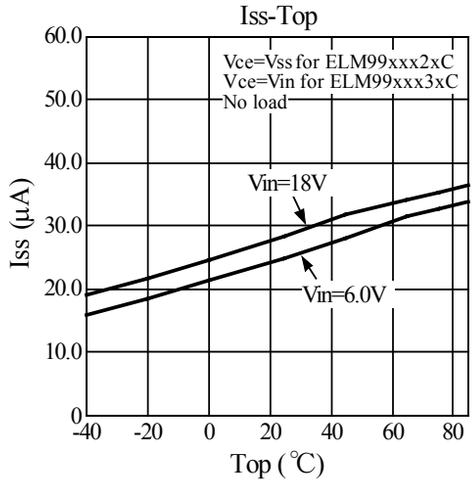


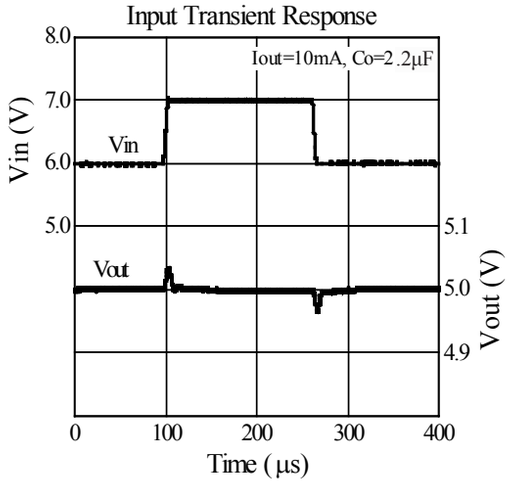


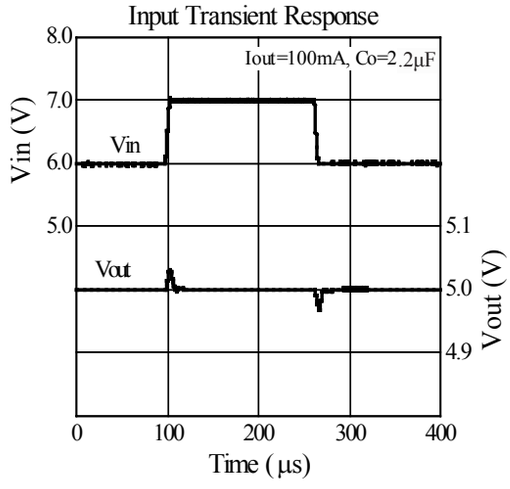


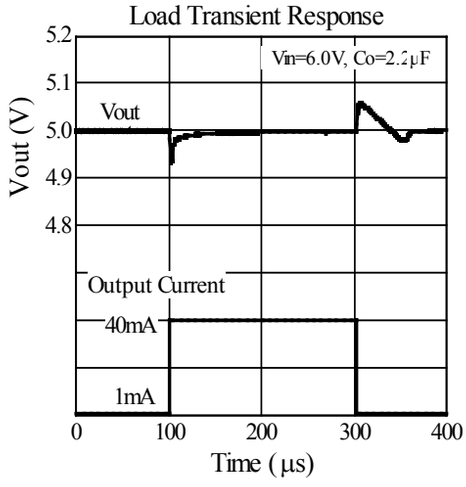


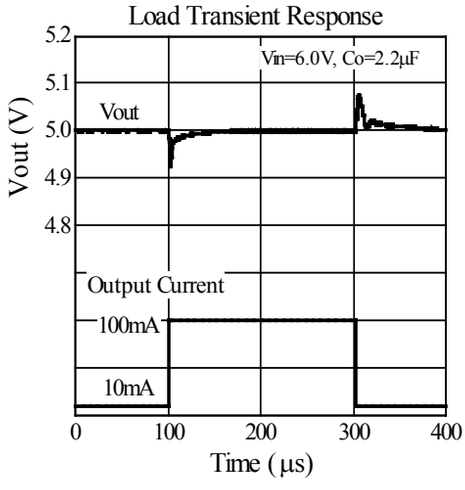

Iss-Vin
Vce=Vss for ELM99xxx2xC
Vce=Vin for ELM99xxx3xC
No load
Top=+85℃
Top=+25℃
Top=-40℃
Iss (μA)
Vin (V)


Iss-Top
Vce=Vss for ELM99xxx2xC
Vce=Vin for ELM99xxx3xC
No load
Vin=18V
Vin=6.0V
Iss (μA)
Top (℃)


Input Transient Response
Iout=10mA, Co=2.2μF
Vin
Vout
Vin (V)
Vout (V)
Time (μs)


Input Transient Response
Iout=100mA, Co=2.2μF
Vin
Vout
Vin (V)
Vout (V)
Time (μs)


Load Transient Response
Vin=6.0V, Co=2.2μF
Vout
Output Current
40mA
1mA
Vout (V)
Time (μs)


Load Transient Response
Vin=6.0V, Co=2.2μF
Vout
Output Current
100mA
10mA
Vout (V)
Time (μs)