ELM99xxxB CMOS Middle current voltage regulator

■General description

ELM99xxxB is CMOS middle current voltage regulator which consists of reference voltage source, error amplifier, low resistance output transistor, short-circuit protection circuit, output voltage setting resistor 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 2.7V, 3.0V, 3.3V, 5.0V; ELM99 series can also be made as semi-custom IC within the range of 1.5V～6.0V by 0.1V step.

■Features

- Output voltage range : 1.5V～6.0V (by 0.1V)
- Max. output current : 300mA
  (Internal current limiter operates when the current exceeds 300mA)
- Stand-by Current consumption : Typ. 0.1μA (ELM99xx3B)
- Input stability : Typ. 0.15%/V (ELM9930xB, Iout=40mA)
- Load stability : Typ. 5mV (1mA≦Iout≦100mA)
- Accuracy of output voltage : ±2.0%
- Input/Output voltage differential : Typ. 140mV (Vout=3.0V, Iout=40mA)
- Short circuit current limiter : Typ. 70mA (Vout=0V)
- Chip enable pin : "L"active ELM99xx2B
  "H"active ELM99xx3B
- Package : SOT-89, SOT-89-5
  (SOT-89-5 ones have chip enable function.)

■Application

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

■Maximum absolute ratings

Parameter	Symbol	Limit	Unit
Input voltage	Vin	12	V
$\overline{CE}$/CE Input voltage	Vce	Vss-0.3～Vin+0.3	V
Output voltage	Vout	Vss-0.3～Vin+0.3	V
Output current	Iout	500	mA
Power dissipation	Pd	300 (SOT-89) 500 (SOT-89-5)	mW
Operationg temperature	Top	-40～+85	℃
Storage temperature	Tstg	-55～+125	℃

* Output current must not exceed power dissipation specified in maximum absolute ratings.

■Selection guide

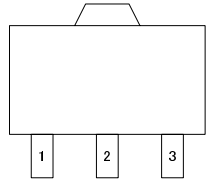
ELM99xxxB-x

Symbol		
a,b	Output voltage	e.g. : 27: Vout=2.7V 30: Vout=3.0V 33: Vout=3.3V 50: Vout=5.0V
c	CE selection	1 : No CE 2: $\overline{CE}$="L" active 3: CE="H" active
d	Product version	B
e	Taping direction	S, N : Refer to PKG file

ELM99 x x x B - x
↑ ↑ ↑ ↑ ↑
a b c d e

■Pin configuration

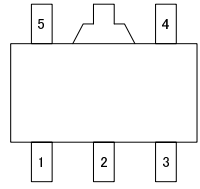
SOT-89 (TOP VIEW)



ELM99xx1B

Pin No.	Pin name
1	VSS
2	VIN
3	VOUT

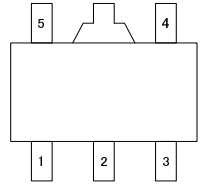
SOT-89-5 (TOP VIEW)



ELM99xx2B

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

SOT-89-5 (TOP VIEW)

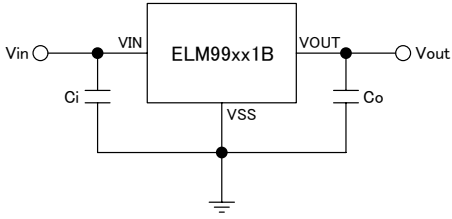


ELM99xx3B

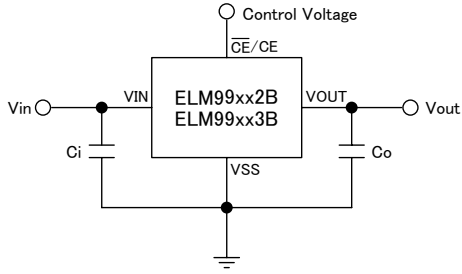
Pin No.	Pin name
1	VSS
2	VIN
3	VOUT
4	NC
5	CE

■Standard circuit

ELM99xx1B

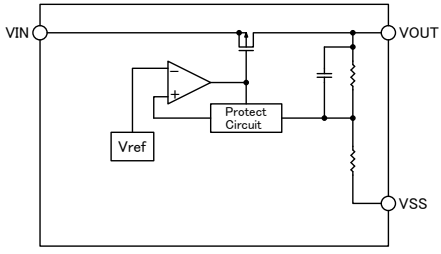


ELM99xx2B:$\overline{CE}$, ELM99xx3B:CE

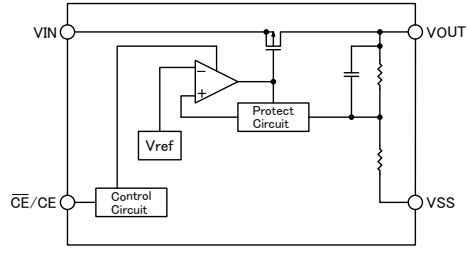


■Block diagram

ELM99xx1B



ELM99xx2B:$\overline{CE}$, ELM99xx3B:CE



■Electrical characteristics (ELM99xx1B)

Vout=2.7V (ELM99271B), No CE pin　　Top=25℃

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=3.7V, Iout=40mA	2.646	2.700	2.754	V
Output current	Iout	Vin=3.7V, Lower by 0.1V than Vout	150	260		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 3.7V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=3.7V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		190	320	mV
Current consumption	Iss	Vin=3.7V, No-load		25	45	μA
Input voltage	Vin				8	V
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=3.7V, Iout=40mA, -40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

Vout=3.0V (ELM99301B), No CE pin

Top=25℃

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=4.0V, Iout=40mA	2.940	3.000	3.060	V
Output current	Iout	Vin=4.0V, Lower by 0.1V than Vout	160	290		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 4.0V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=4.0V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		170	275	mV
Current consumption	Iss	Vin=4.0V, No-load		25	45	μA
Input voltage	Vin				8	V
Output voltage temperature coefficient	ΔVout/Top	Vin=4.0V, Iout=40mA, -40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

Vout=3.3V (ELM99331B), No CE pin

Top=25℃

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, Lower by 0.1V than Vout	170	300		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 4.3V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=4.3V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		150	265	mV
Current consumption	Iss	Vin=4.3V, No-load		25	45	μA
Input voltage	Vin				8	V
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=4.3V, Iout=40mA, -40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

Vout=5.0V (ELM99501B), No CE pin

Top=25℃

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, Lower by 0.1V than Vout	200	330		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 6.0V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=6.0V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		125	220	mV
Current consumption	Iss	Vin=6.0V, No-load		30	55	μA
Input voltage	Vin				8	V
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=6.0V, Iout=40mA, -40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

■Electrical characteristics (ELM99xx2B)

Vout=2.7V (ELM99272B), $\overline{CE}$="L"active Top=25℃

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=3.7V, Iout=40mA	2.646	2.700	2.754	V
Output current	Iout	Vin=3.7V, Lower by 0.1V than Vout	150	260		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 3.7V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=3.7V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		190	320	mV
Current consumption	Iss	Vin=3.7V		25	45	μA
Stand-by current consumption	Istandby	Vin=Vce=3.7V		0.005	0.100	μA
Input voltage	Vin				8	V
$\overline{CE}$ Input voltage High	Vceh	Vin=8.0V	1.80		Vin	V
$\overline{CE}$ Input voltage Low	Vcel	Vin=2.0V	0.00		0.25	
$\overline{CE}$ Input current High	Iceh	Vce=Vin		0.0	0.2	μA
$\overline{CE}$ Input current Low	Icel	Vce=Vss	−1.5	−0.4		
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=3.7V, Iout=40mA, −40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

Vout=3.0V (ELM99302B), $\overline{CE}$="L"active Top=25℃

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=4.0V, Iout=40mA	2.940	3.000	3.060	V
Output current	Iout	Vin=4.0V, Lower by 0.1V than Vout	160	290		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 4.0V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=4.0V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		170	275	mV
Current consumption	Iss	Vin=4.0V		25	45	μA
Stand-by current consumption	Istandby	Vin=Vce=4.0V		0.005	0.100	μA
Input voltage	Vin				8	V
$\overline{CE}$ Input voltage High	Vceh	Vin=8.0V	1.80		Vin	V
$\overline{CE}$ Input voltage Low	Vcel	Vin=2.0V	0.00		0.25	
$\overline{CE}$ Input current High	Iceh	Vce=Vin		0.0	0.2	μA
$\overline{CE}$ Input current Low	Icel	Vce=Vss	−1.5	−0.4		
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=4.0V, Iout=40mA, −40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

Vout=3.3V (ELM99332B), $\overline{CE}$="L"active Top=25℃

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, Lower by 0.1V than Vout	170	300		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 4.3V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=4.3V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		150	265	mV
Current consumption	Iss	Vin=4.3V		25	45	μA
Stand-by current consumption	Istandby	Vin=Vce=4.3V		0.005	0.100	μA
Input voltage	Vin				8	V
$\overline{CE}$ Input voltage High	Vceh	Vin=8.0V	1.80		Vin	V
$\overline{CE}$ Input voltage Low	Vcel	Vin=2.0V	0.00		0.25	
$\overline{CE}$ Input current High	Iceh	Vce=Vin		0.0	0.2	μA
$\overline{CE}$ Input current Low	Icel	Vce=Vss	−1.5	−0.4		
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=4.3V, Iout=40mA, −40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

Vout=5.0V (ELM99502B), $\overline{CE}$="L"active Top=25℃

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, Lower by 0.1V than Vout	200	330		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 6.0V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=6.0V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		125	220	mV
Current consumption	Iss	Vin=6.0V		30	55	μA
Stand-by current consumption	Istandby	Vin=Vce=6.0V		0.005	0.100	μA
Input voltage	Vin				8	V
$\overline{CE}$ Input voltage High	Vceh	Vin=8.0V	1.80		Vin	V
$\overline{CE}$ Input voltage Low	Vcel	Vin=2.0V	0.00		0.25	
$\overline{CE}$ Input current High	Iceh	Vce=Vin		0.0	0.2	μA
$\overline{CE}$ Input current Low	Icel	Vce=Vss	−1.5	−0.4		
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=6.0V, Iout=40mA, −40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

■Electrical characteristics (ELM99xx3B)

Vout=2.7V (ELM99273B), CE="H"active Top=25℃

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=3.7V, Iout=40mA	2.646	2.700	2.754	V
Output current	Iout	Vin=3.7V, Lower by 0.1V than Vout	150	260		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 3.7V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=3.7V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		190	320	mV
Current consumption	Iss	Vin=3.7V		25	45	μA
Stand-by current consumption	Istandby	Vin=3.7V, Vce=Vss		0.1	0.5	μA
Input voltage	Vin				8	V
CE Input voltage High	Vceh	Vin=8.0V	1.80		Vin	V
CE Input voltage Low	Vcel	Vin=2.0V	0.00		0.25	
CE Input current High	Iceh	Vce=Vin		0.4	1.5	μA
CE Input current Low	Icel	Vce=Vss	-0.2	0.0		
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=3.7V, Iout=40mA, -40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

Vout=3.0V (ELM99303B), CE="H"active Top=25℃

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Output voltage	Vout	Vin=4.0V, Iout=40mA	2.940	3.000	3.060	V
Output current	Iout	Vin=4.0V, Lower by 0.1V than Vout	160	290		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 4.0V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=4.0V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		170	275	mV
Current consumption	Iss	Vin=4.0V		25	45	μA
Stand-by current consumption	Istandby	Vin=4.0V, Vce=Vss		0.1	0.5	μA
Input voltage	Vin				8	V
CE Input voltage High	Vceh	Vin=8.0V	1.80		Vin	V
CE Input voltage Low	Vcel	Vin=2.0V	0.00		0.25	
CE Input current High	Iceh	Vce=Vin		0.4	1.5	μA
CE Input current Low	Icel	Vce=Vss	-0.2	0.0		
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=4.0V, Iout=40mA, -40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

Vout=3.3V (ELM99333B), CE="H"active Top=25℃

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, Lower by 0.1V than Vout	170	300		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 4.3V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=4.3V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		150	265	mV
Current consumption	Iss	Vin=4.3V		25	45	μA
Stand-by current consumption	Istandby	Vin=4.3V, Vce=Vss		0.1	0.5	μA
Input voltage	Vin				8	V
CE Input voltage High	Vceh	Vin=8.0V	1.80		Vin	V
CE Input voltage Low	Vcel	Vin=2.0V	0.00		0.25	
CE Input current High	Iceh	Vce=Vin		0.4	1.5	μA
CE Input current Low	Icel	Vce=Vss	-0.2	0.0		
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=4.3V, Iout=40mA, -40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

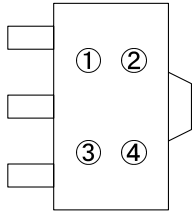
Vout=5.0V (ELM99503B), CE="H"active Top=25℃

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, Lower by 0.1V than Vout	200	330		mA
Input stability	ΔVout/ΔVin	Iout=40mA, 6.0V≦Vin≦8.0V		0.15	0.30	%/V
Load stability	ΔVout/ΔIout	1mA≦Iout≦100mA, Vin=6.0V		5	15	mV
Input/output voltage differential	Vdif	Iout=40mA		125	220	mV
Current consumption	Iss	Vin=6.0V		30	55	μA
Stand-by current consumption	Istandby	Vin=6.0V, Vce=Vss		0.1	0.5	μA
Input voltage	Vin				8	V
CE Input voltage High	Vceh	Vin=8.0V	1.80		Vin	V
CE Input voltage Low	Vcel	Vin=2.0V	0.00		0.25	
CE Input current High	Iceh	Vce=Vin		0.4	1.5	μA
CE Input current Low	Icel	Vce=Vss	-0.2	0.0		
Output voltage temperature coefficient	ΔVout/ΔTop	Vin=6.0V, Iout=40mA, -40℃≦Top≦+85℃		±100		ppm/℃
Short circuit current	Ilim	Vout=0V		70		mA

■Marking

・SOT-89 package : ELM99xx1B

SOT-89



No. ① : the integer digit of the output voltage

Mark	Vout	Mark	Vout
A	2.*V	D	5.*V
B	3.*V	E	6.*V
C	4.*V	F	1.*V

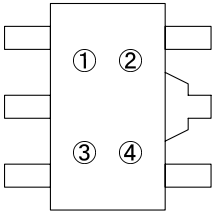
No. ② : the decimal digit of the output voltage

Mark	Vout	Mark	Vout
A	*.0V	F	*.5V
B	*.1V	G	*.6V
C	*.2V	H	*.7V
D	*.3V	J	*.8V
E	*.4V	K	*.9V

No. ③ : Assembly lot No.
A～Z (I, O, X excepted)
No. ④ : Assembly lot No.
0～9

・SOT-89-5 package : ELM99xx2B, ELM99xx3B with CE

SOT-89-5



No. ① : the integer digit of the output voltage

ELM99xx2B

Mark	Vout	Mark	Vout
F	2.*V	J	5.*V
G	3.*V	K	6.*V
H	4.*V	S	1.*V

ELM99xx3B

Mark	Vout	Mark	Vout
L	2.*V	P	5.*V
M	3.*V	Q	6.*V
N	4.*V	T	1.*V

No. ② : the decimal digit of the output voltage

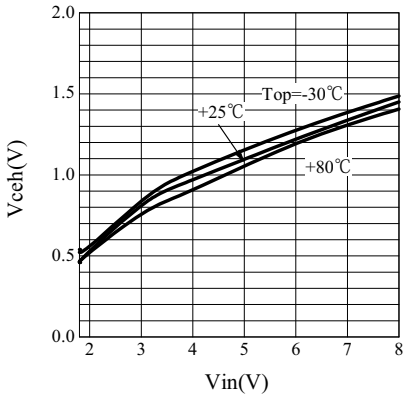
ELM99xx2B, ELM99xx3B

Mark	Vout	Mark	Vout
A	*.0V	F	*.5V
B	*.1V	G	*.6V
C	*.2V	H	*.7V
D	*.3V	J	*.8V
E	*.4V	K	*.9V

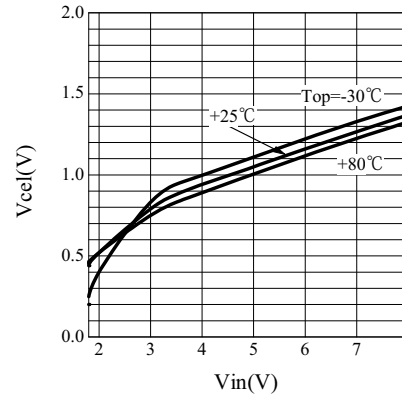
No. ③ : Assembly lot No.
A～Z (I, O, X excepted)
No. ④ : Assembly lot No.
0～9

■Typical characteristics

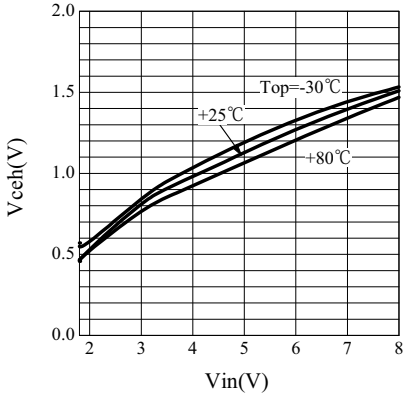
ELM99xx2x Vceh - Vin



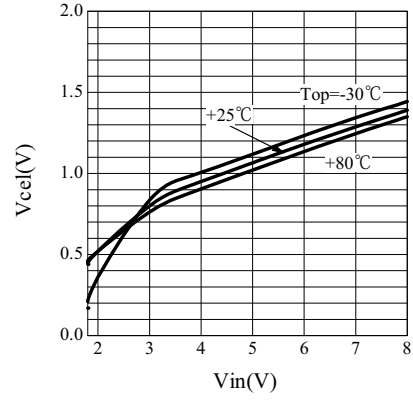
ELM99xx2x Vcel - Vin



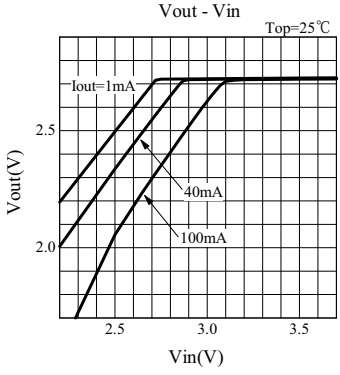
ELM99xx3x Vceh - Vin

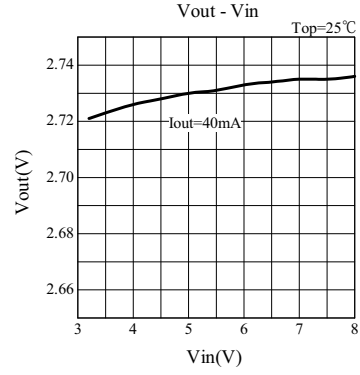


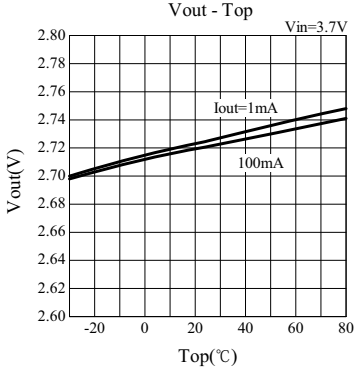
ELM99xx3x Vcel - Vin

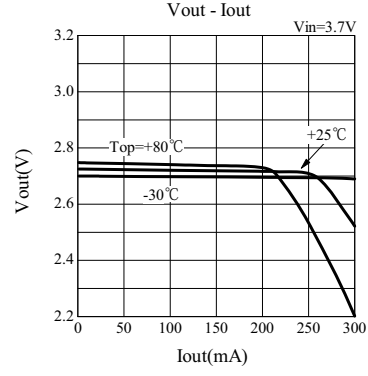


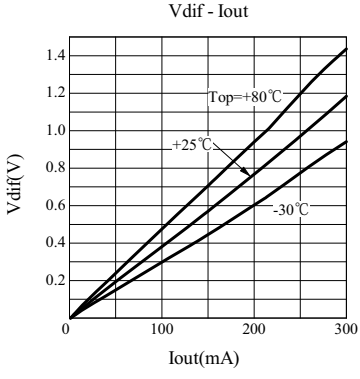
・Vout=2.7V (ELM9927xB)

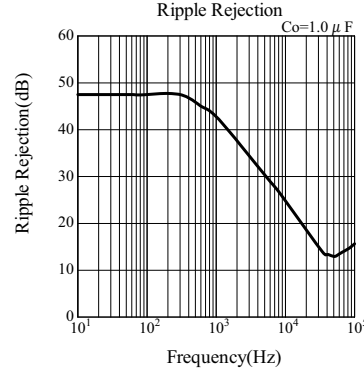


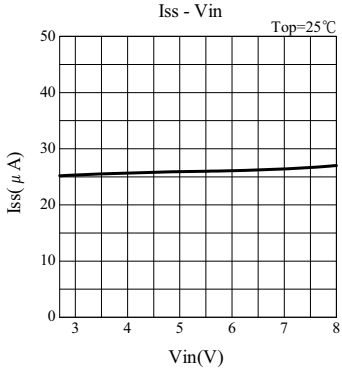


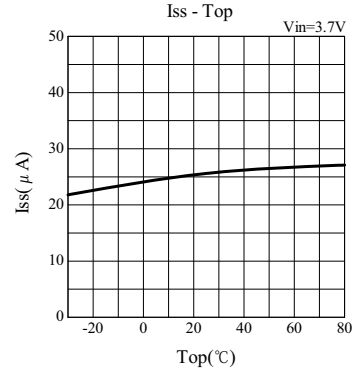


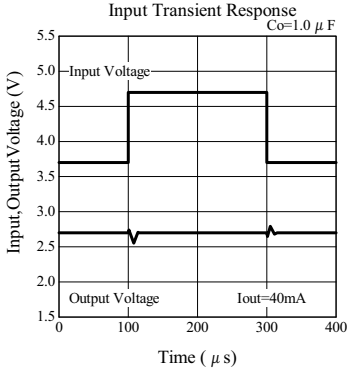


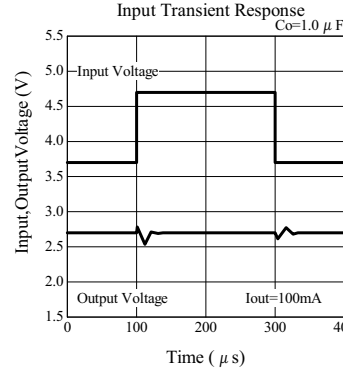


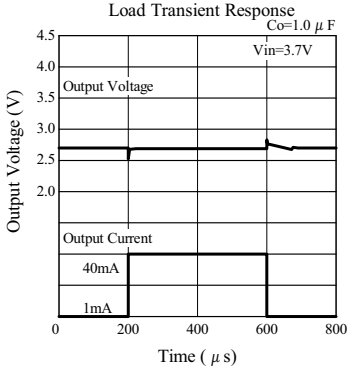


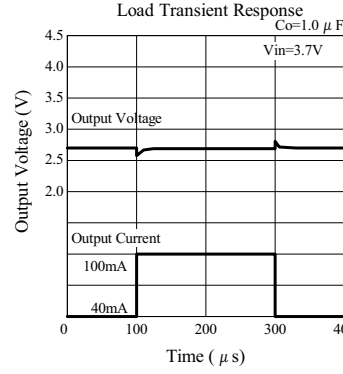

Iss - Vin
Top=25℃
Iss(μA)
Vin(V)


Iss - Top
Vin=3.7V
Iss(μA)
Top(℃)

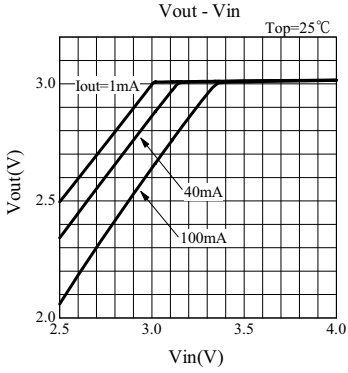

Input Transient Response
Co=1.0μF
Input Voltage
Input,OutputVoltage (V)
Output Voltage
Iout=40mA
Time (μs)

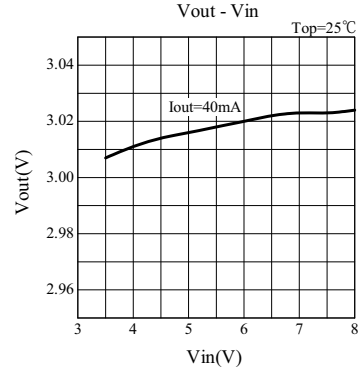

Input Transient Response
Co=1.0μF
Input Voltage
Input,OutputVoltage (V)
Output Voltage
Iout=100mA
Time (μs)

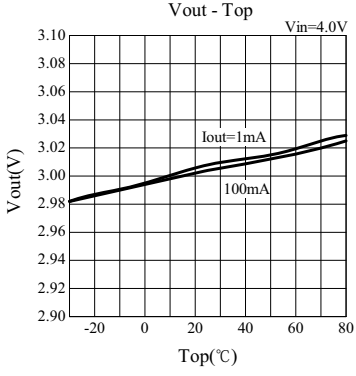

Load Transient Response
Co=1.0μF
Vin=3.7V
Output Voltage
Output Voltage (V)
Output Current
40mA
1mA
Time (μs)

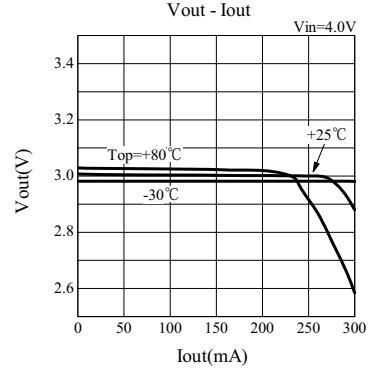

Load Transient Response
Co=1.0μF
Vin=3.7V
Output Voltage
Output Voltage (V)
Output Current
100mA
40mA
Time (μs)

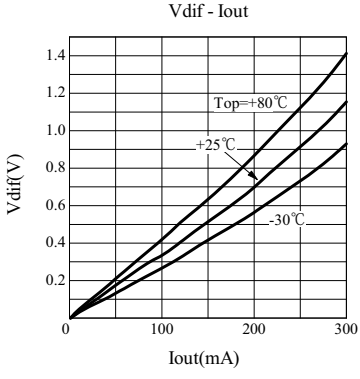
・Vout=3.0V (ELM9930xB)

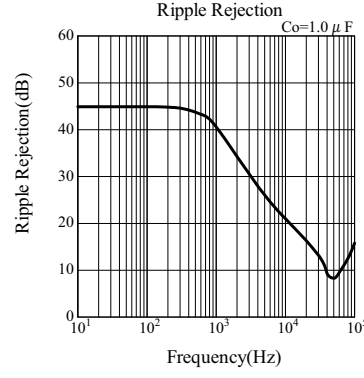


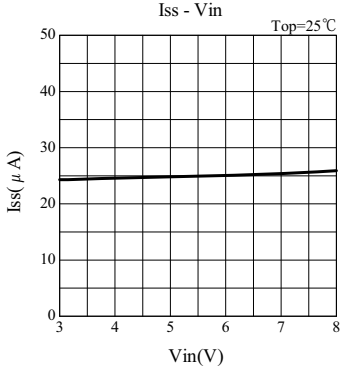


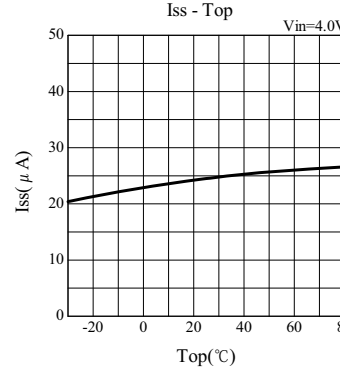


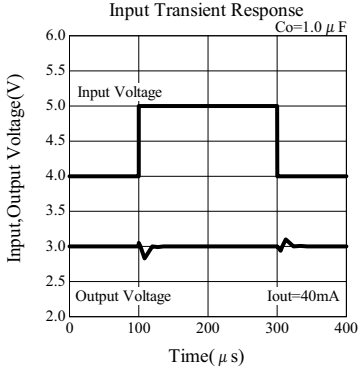


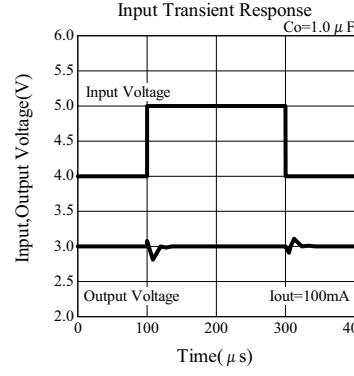


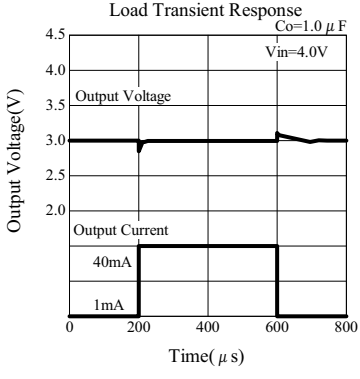


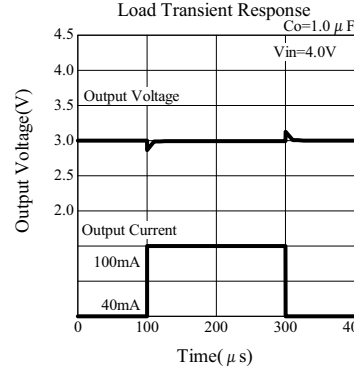

Iss - Vin
Top=25℃
Iss(μA)
Vin(V)


Iss - Top
Vin=4.0V
Iss(μA)
Top(℃)

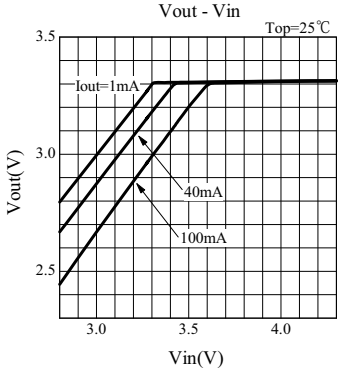

Input Transient Response
Co=1.0μF
Input Voltage
Output Voltage
Iout=40mA
Input,Output Voltage(V)
Time(μs)

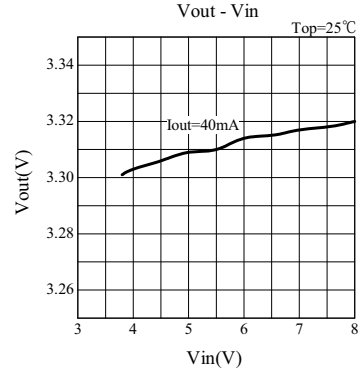

Input Transient Response
Co=1.0μF
Input Voltage
Output Voltage
Iout=100mA
Input,Output Voltage(V)
Time(μs)

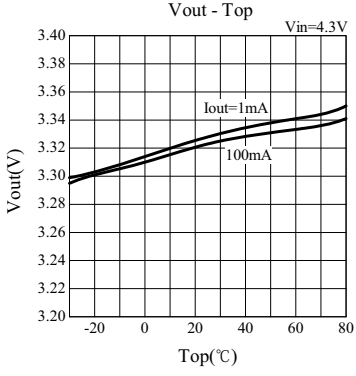

Load Transient Response
Co=1.0μF
Vin=4.0V
Output Voltage
Output Current
40mA
1mA
Output Voltage(V)
Time(μs)

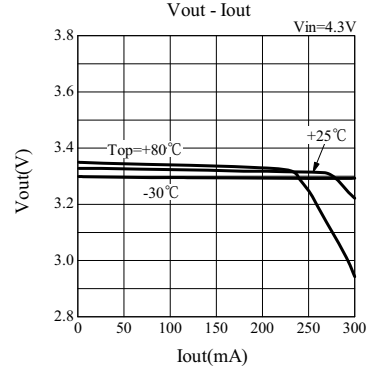

Load Transient Response
Co=1.0μF
Vin=4.0V
Output Voltage
Output Current
100mA
40mA
Output Voltage(V)
Time(μs)

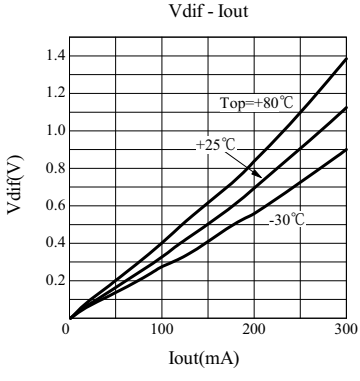
・Vout=3.3V (ELM9933xB)

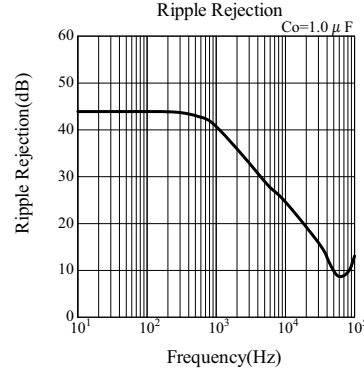


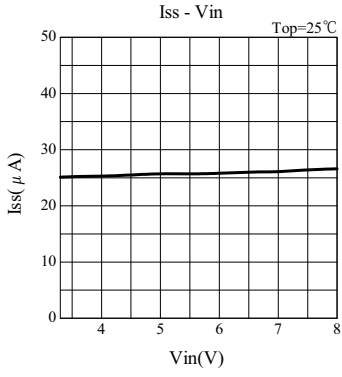


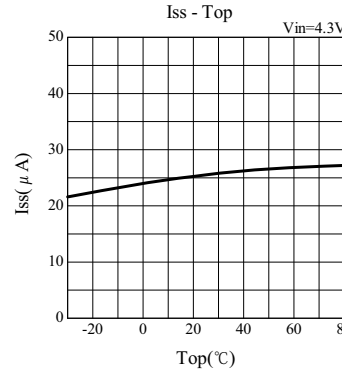


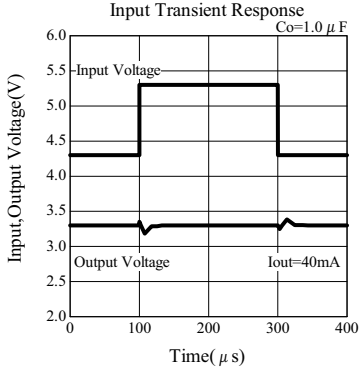


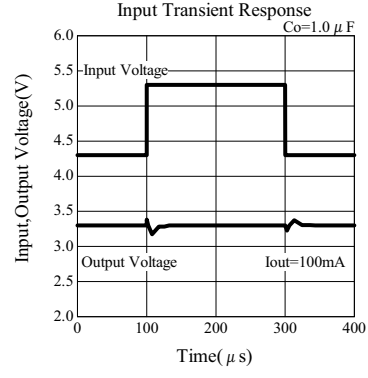


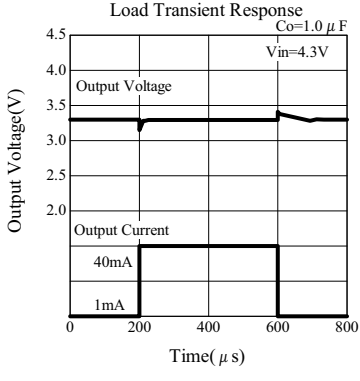


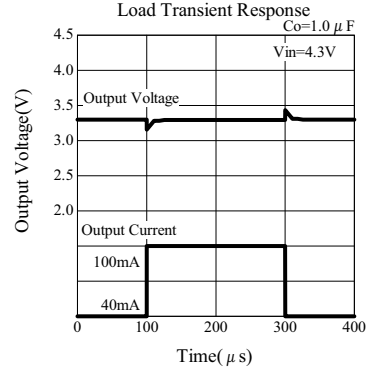

Iss - Vin
Top=25℃
Iss(μA)
Vin(V)


Iss - Top
Vin=4.3V
Iss(μA)
Top(℃)

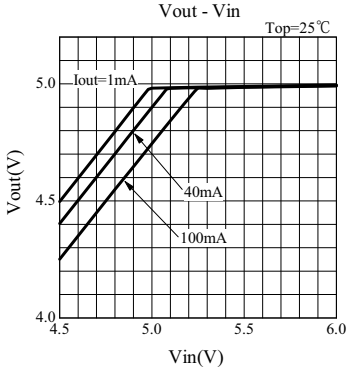

Input Transient Response
Co=1.0μF
Input Voltage
Output Voltage
Iout=40mA
Input,Output Voltage(V)
Time(μs)

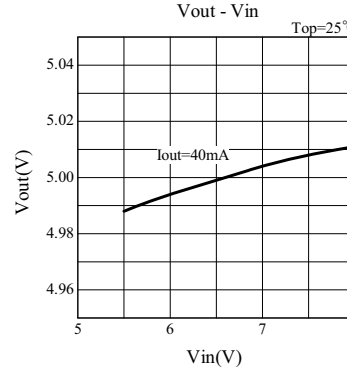

Input Transient Response
Co=1.0μF
Input Voltage
Output Voltage
Iout=100mA
Input,Output Voltage(V)
Time(μs)

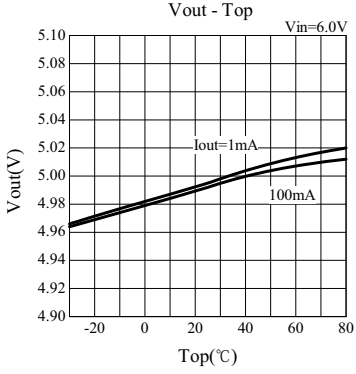

Load Transient Response
Co=1.0μF
Vin=4.3V
Output Voltage
Output Current
40mA
1mA
Output Voltage(V)
Time(μs)

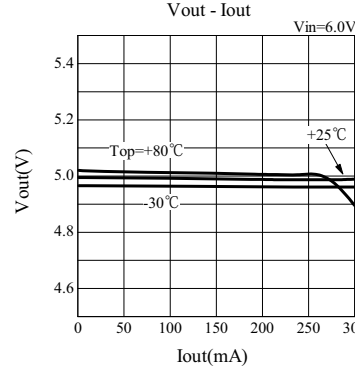

Load Transient Response
Co=1.0μF
Vin=4.3V
Output Voltage
Output Current
100mA
40mA
Output Voltage(V)
Time(μs)

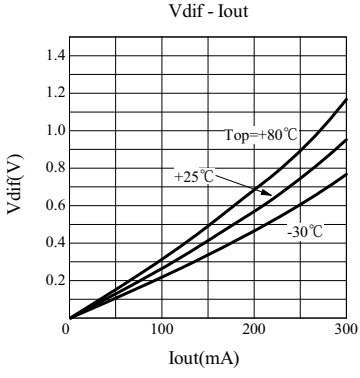
・Vout=5.0V (ELM9950xB)

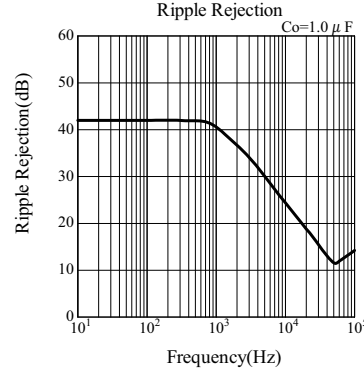


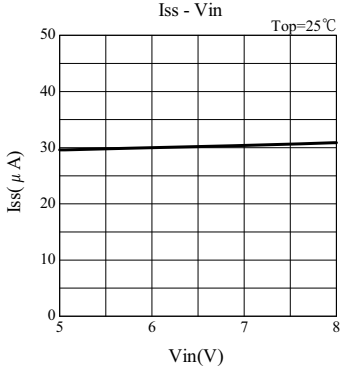


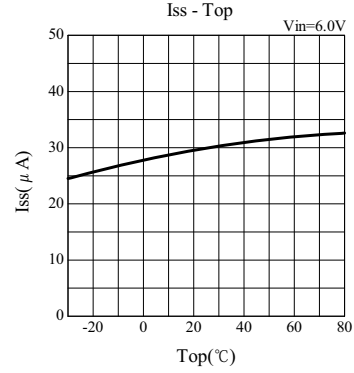


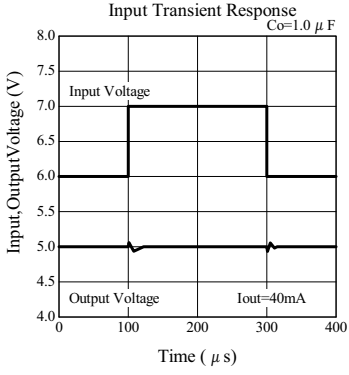


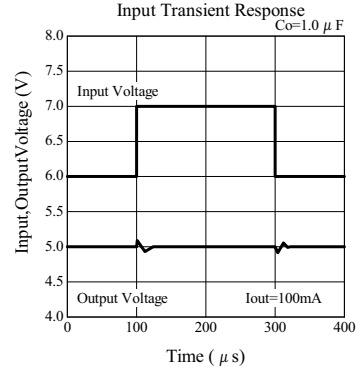


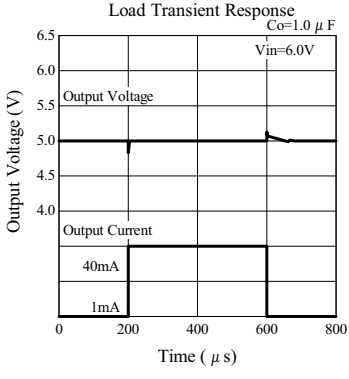


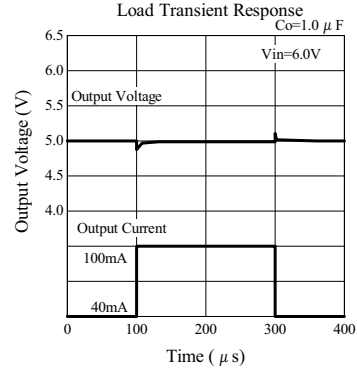

Iss - Vin
Top=25℃
Iss(μA)
Vin(V)


Iss - Top
Vin=6.0V
Iss(μA)
Top(℃)


Input Transient Response
Co=1.0μF
Input Voltage
Output Voltage
Iout=40mA
Input,OutputVoltage (V)
Time (μs)


Input Transient Response
Co=1.0μF
Input Voltage
Output Voltage
Iout=100mA
Input,OutputVoltage (V)
Time (μs)


Load Transient Response
Co=1.0μF
Vin=6.0V
Output Voltage
Output Current
40mA
1mA
Output Voltage (V)
Time (μs)


Load Transient Response
Co=1.0μF
Vin=6.0V
Output Voltage
Output Current
100mA
40mA
Output Voltage (V)
Time (μs)