

- ◆ **Pager Use: Low Noise**
- ◆ **Duty Ratio: 75%**
- ◆ **CMOS Structure: Small Supply Current**
- ◆ **Operating Voltage Range: 0.9~10.0V**
- ◆ **Output Voltage Range: 2.0~7.0V**
- ◆ **Output Voltage Accuracy: $\pm 2.5\%$**

Applications

- Pagers
- Palmtops
- Cameras, Video cameras
- Various portable products

General Description

The XC6385 series is a group of PFM (frequency) controlled step-up DC/DC converters. The XC6385 series employs CMOS process and laser trimming technologies to attain low power and high accuracy.

A common problem among pagers is one of noise, but with the XC6385, high frequency noise that occurs during switching is reduced.

Output voltage is programmable in 0.1V steps between 2.0V ~ 7.0V and maximum frequency is 100kHz (typ.)

With a built-in switching transistor, a step-up circuit can be configured using a coil, diode and capacitor connected externally.

Also available is a CE (chip enable) function that reduces power consumption during shut-down mode, and an independent V_{DD} pin function (separated power supply and voltage detect pins) for fly-back circuits.

SOT-89-5 and SOT-23/25 small packages.

Features

Low noise

Operating voltage range: 0.9V~10V

Output voltage range: 2.0V~7.0V

(programmable in 0.1V steps)

Output voltage accuracy: $\pm 2.5\%$

Maximum oscillator frequency: 100kHz ($\pm 15\%$)

Built-in switching transistor

CE function and/or separated V_{DD}/V_{OUT} types selectable with 5 pin packages

Small package:

SOT-23/25 mini-mold (3pin, 5pin)

SOT-89/89-5 mini-power mold (3 pin, 5 pin)

Absolute Maximum Ratings

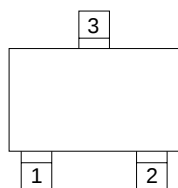
$T_a = 25^\circ\text{C}$

PARAMETER		SYMBOL	RATINGS	UNITS
V _{OUT} Pin Voltage		V _{OUT}	12	V
LX Pin Voltage		V _{LX}	12	V
LX Pin Current		I _{LX}	400	mA
CE Pin Voltage		V _{CE}	V _{SS} -0.3 ~ V _{OUT} +0.3	V
V _{DD} Pin Voltage		V _{DD}	12	V
Continuous Total Power Dissipation	SOT-23	P _d	150	mW
	SOT-89	P _d	500	mW
Operating Ambient Temperature		T _{opr}	-30 ~ +80	°C
Storage Temperature		T _{stg}	-40 ~ +125	°C

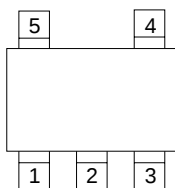
Selection Guide

PARAT TYPE	DUTY RATIO	PACKAGE	SWITCHING TRANSISTOR	CE FUNCTION	V _{DD} PIN	FEATURES
XC6385A	75%	SOT-23 SOT-89-3	Built-in	NO	NO	Duty Ratio 75%
XC6385C	75%	SOT-23 SOT-89-5	Built-in	YES	NO	Stand-by (CE) function During stand-by (CE pin "Low"), Supply current = 0.50μA (max)
XC6385E	75%	SOT-23 SOT-89-5	Built-in	NO	YES	Since the power supply (V _{DD}) pin and the voltage sensor (V _{OUT}) pin are separated, use as a PFM controller is possible.

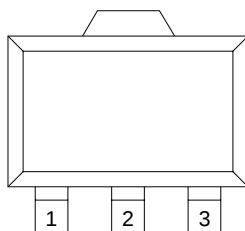
Pin Configuration



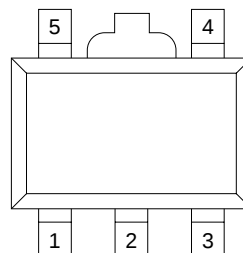
SOT-23
(TOP VIEW)



SOT-25
(TOP VIEW)



SOT-89-3
(TOP VIEW)



SOT-89-5
(TOP VIEW)

Note: The SOT-23/25 and SOT-89 packages shown above are not drawn to scale.

Pin Assignment

XC6385A

PIN NUMBER		PIN NAME	FUNCTION
SOT-23	SOT-89-3		
1	1	V _{SS}	Ground
3	2	V _{OUT}	Output voltage monitor, IC internal power supply
2	3	L _x	Switch

XC6385C

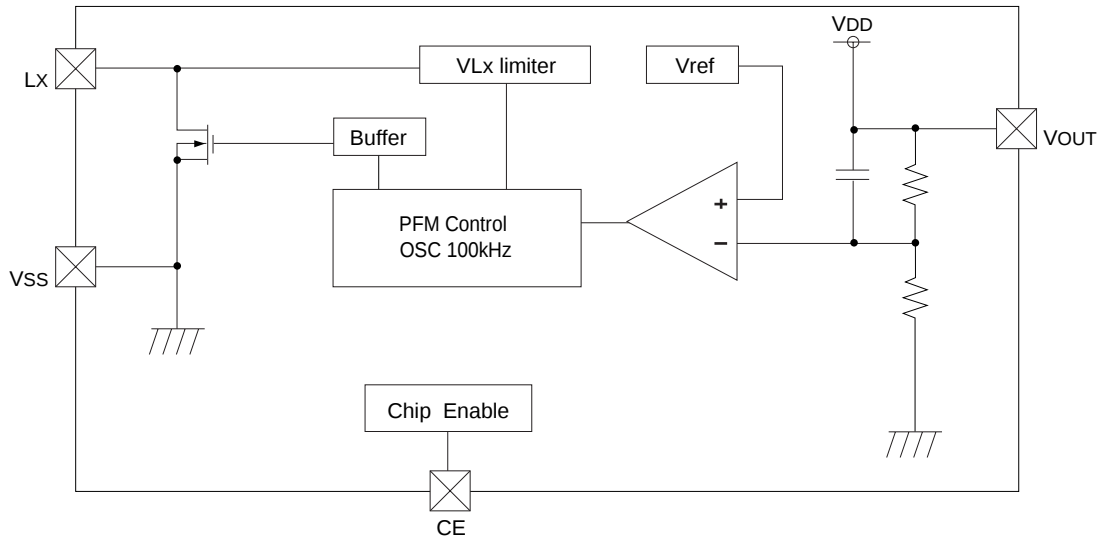
PIN NUMBER		PIN NAME	FUNCTION
SOT-25	SOT-89-5		
4	5	V _{SS}	Ground
2	2	V _{OUT}	Output voltage monitor, IC internal power supply
5	4	L _x	Switch
1	3	CE	Chip enable
3	1	NC	No connection

XC6385E

PIN NUMBER		PIN NAME	FUNCTION
SOT-25	SOT-89-5		
4	5	V _{SS}	Ground
2	2	V _{DD}	IC internal power supply

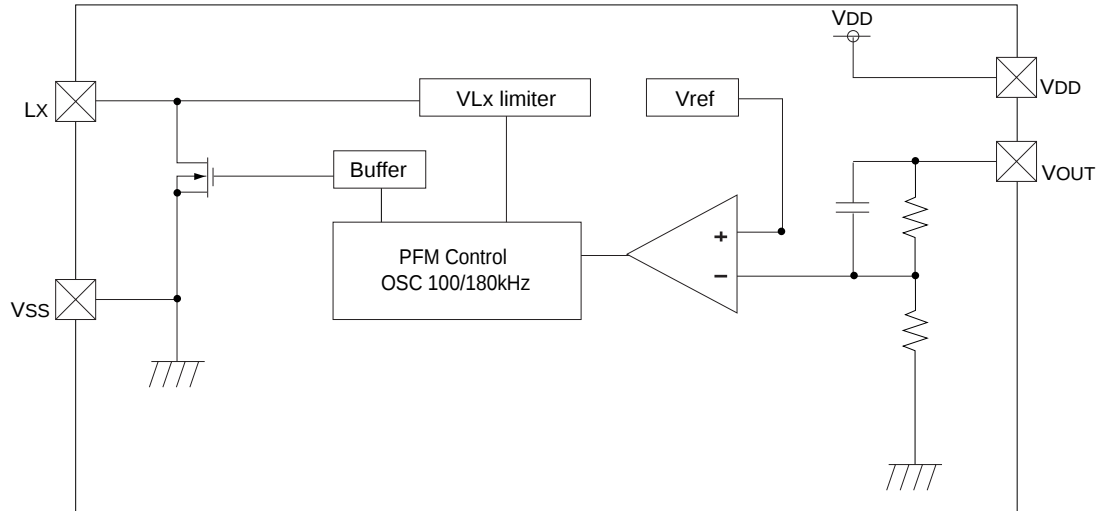
■ Block Diagram

XC6385A~XC6385C (V_{OUT} pin also serves as V_{DD} .)



Note: The CE pin is set up for XC6385C.

XC6383E



Note: The V_{DD} pin is set up for XC6385E.

Electrical Characteristics

XC6385A301PR $V_{OUT}=3.0V$

$T_a=25^{\circ}C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	V_{OUT}	External components connected.	2.94	3.000	3.06	V
Maximum Input Voltage	V_{IN}		10			V
Operation Start-up Voltage	V_{ST}	External components connected. $I_{OUT}=1mA$		0.80	0.90	V
Operation Hold Voltage	V_{HLD}	External components connected. $I_{OUT}=1mA$	0.70			V
No-Load Input Current	I_{IN}	$V_{IN}=\text{output voltage} \times 0.6$, $I_{OUT}=0mA$ (Note1)		4.6	9.3	μA
Supply Current 1(Note2)	I_{DD1}	No external components. Apply output voltage $\times 0.95$ to V_{OUT}		19.7	39.4	μA
Supply Current 2	I_{DD2}	No external components. Apply output voltage $\times 0.95$ to V_{OUT}		2.1	4.2	μA
Lx Switch-On Resistance	R_{SWON}	No external components. Apply output voltage $\times 0.95$ to V_{OUT} $V_{LX}=0.4V$		5.2	7.9	Ω
Lx Leakage Current	I_{LXL}	No external components. $V_{OUT}=V_{LX}=10V$.			1.0	μA
Duty Ratio	DTY	No external components. Apply output voltage $\times 0.95$ to V_{OUT} LX : 300 Ω pull-up to 5V, Measuring of LX waveform.	70	75	80	%
Maximum Oscillation Frequency	MAX Fosc	No external components. Apply output voltage $\times 0.95$ to V_{OUT} LX : 300 Ω pull-up to 5V. Duty ratio 75%. Measuring of LX waveform.	85	100	115	kHz
Lx Limit Voltage	V_{LXLMT}	No external components. Apply output voltage $\times 0.95$ to V_{OUT} Apply voltage to LX. Voltage required to produce Fosc $\times 2$.	0.7		1.1	V
Efficiency (Note3)	EFFI	External components connected		80		%

Measuring conditions: Unless otherwise specified, $V_{IN}=V_{OUT} \times 0.6$, $I_{OUT}=4mA$. See Typical Application Circuits, Fig.1.

- Note: 1. The Schottky diode (SD) must be type MA735, with reverse current (I_R) $< 1.0\mu A$ at reverse voltage (V_R)=10.0V
 2. "Supply Current 1" is the supply current while the oscillator is continuously oscillating. In actual operation the oscillator periodically operates which results in less average power consumption.
 3. $\{[\text{Output Voltage}] \times [\text{Output Current}] \div [(\text{Input Voltage}) \times (\text{Input Current})]\} \times 100$.

XC6385C301PR $V_{OUT}=3.0V$

$T_a=25^{\circ}C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	V_{OUT}	External components connected.	2.94	3.000	3.06	V
Maximum Input Voltage	V_{IN}		10			V
Operation Start-up Voltage	V_{ST}	External components connected. $I_{OUT}=1mA$		0.80	0.90	V
Operation Hold Voltage	V_{HLD}	External components connected. $I_{OUT}=1mA$	0.70			V
No-Load Input Current	I_{IN}	$V_{IN}=\text{output voltage} \times 0.6$, $I_{OUT}=0mA$ (Note1)		4.6	9.3	μA
Supply Current 1(Note2)	I_{DD1}	No external components. Apply output voltage $\times 0.95$ to V_{OUT}		19.7	39.4	μA
Supply Current 2	I_{DD2}	No external components. Apply output voltage $\times 0.95$ to V_{OUT}		2.1	4.2	μA
Lx Switch-On Resistance	R_{SWON}	No external components. Apply output voltage $\times 0.95$ to V_{OUT} $V_{LX}=0.4V$		5.2	7.9	Ω
Lx Leakage Current	I_{LXL}	No external components. $V_{OUT}=V_{LX}=10V$.			1.0	μA
Duty Ratio	DTY	No external components. Apply output voltage $\times 0.95$ to V_{OUT} LX : 300 Ω pull-up to 5V, Measuring of LX waveform.	70	75	80	%
Maximum Oscillation Frequency	MAX Fosc	No external components. Apply output voltage $\times 0.95$ to V_{OUT} LX : 300 Ω pull-up to 5V. Duty ratio 75%. Measuring of LX waveform.	85	100	115	kHz
Stand-by Current	ISTB	No external components. Apply output voltage $\times 0.95$ to V_{OUT} $V_{CE}=0V$			0.5	μA
CE "High" Voltage	V_{CEH}	No external components. Apply output voltage $\times 0.95$ to V_{OUT} LX : 300 Ω pull-up to 5V. Existence of LX oscillation.	0.72			V
CE "Low" Voltage	V_{CEL}	No external components. Apply output voltage $\times 0.95$ to V_{OUT} LX : 300 Ω pull-up to 5V. Existence of LX oscillation.			0.20	V
CE "High" Current	I_{CEH}	No external components. Apply output voltage $\times 0.95$ to V_{OUT} LX : 300 Ω pull-up to 5V. $V_{CE}=\text{output voltage} \times 0.95$			0.25	μA
CE "Low" Current	I_{CEL}	No external components. Apply output voltage $\times 0.95$ to V_{OUT} LX : 300 Ω pull-up to 5V. $V_{CE}=0V$.			-0.25	μA
Lx Limit Voltage	V_{LXLMT}	No external components. Apply output voltage $\times 0.95$ to V_{OUT} Apply voltage to LX. Voltage required to produce Fosc $\times 2$.	0.7		1.1	V
Efficiency (Note3)	EFFI	External components connected		80		%

Measuring conditions: Unless otherwise specified, $V_{IN}=V_{OUT} \times 0.6$, $I_{OUT}=4mA$. See Typical Application Circuits, Fig.2.

- Note: 1. The Schottky diode (SD) must be type MA735, with reverse current (I_R) $< 1.0\mu A$ at reverse voltage (V_R)=10.0V
 2. "Supply Current 1" is the supply current while the oscillator is continuously oscillating. In actual operation the oscillator periodically operates which results in less average power consumption.
 3. $\{[\text{Output Voltage}] \times [\text{Output Current}] \div [(\text{Input Voltage}) \times (\text{Input Current})]\} \times 100$.

Electrical Characteristics

XC6385E301PR $V_{OUT}=3.0V$

$T_a=25^{\circ}C$

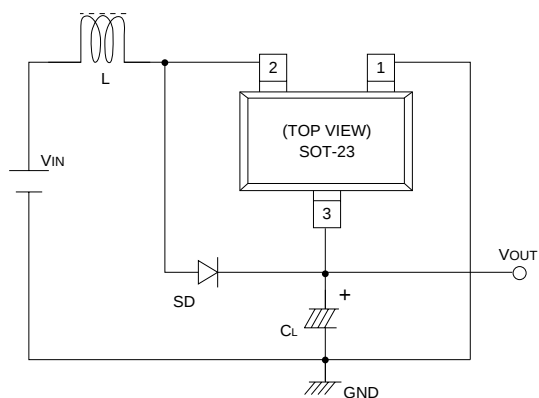
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	V_{OUT}	External components connected.	2.94	3.000	3.06	V
Maximum Input Voltage	V_{IN}		10			V
Operation Start-up Voltage	V_{ST}	External components connected. $I_{OUT}=1mA$		0.80	0.90	V
Operation Hold Voltage	V_{HLD}	External components connected. $I_{OUT}=1mA$	0.70			V
No-Load Input Current	I_{IN}	$V_{IN}=\text{output voltage} \times 0.6$, $I_{OUT}=0mA$ (Note1)		4.6	9.3	μA
Supply Current 1(Note2)	I_{DD1}	No external components. Apply output voltage $\times 0.95$ to V_{OUT}		19.7	39.4	μA
Supply Current 2	I_{DD2}	No external components. Apply output voltage $\times 0.95$ to V_{OUT}		2.1	4.2	μA
Lx Switch-On Resistance	R_{SWON}	No external components. Apply output voltage $\times 0.95$ to V_{OUT} $V_{LX}=0.4V$		5.2	7.9	Ω
Lx Leakage Current	I_{LXL}	No external components. $V_{OUT}=V_{LX}=10V$.			1.0	μA
Duty Ratio	DTY	No external components. Apply output voltage $\times 0.95$ to V_{OUT} LX : 300 Ω pull-up to 5V, Measuring of LX waveform.	70	75	80	%
Maximum Oscillation Frequency	MAX Fosc	No external components. Apply output voltage $\times 0.95$ to V_{OUT} LX : 300 Ω pull-up to 5V. Duty ratio 75%. Measuring of LX waveform.	85	100	115	kHz
Lx Limit Voltage	V_{LXLMT}	No external components. Apply output voltage $\times 0.95$ to V_{OUT} Apply voltage to LX. Voltage required to produce Fosc $\times 2$.	0.7		1.1	V
Efficiency (Note3)	EFFI	External components connected		80		%

Measuring conditions: Unless otherwise specified, $V_{IN}=V_{OUT} \times 0.6$, $I_{OUT}=4mA$. See Typical Application Circuits, Fig.3.

- Note:
1. The Schottky diode (SD) must be type MA735, with reverse current (I_R) $< 1.0\mu A$ at reverse voltage (V_R)=10.0V
 2. "Supply Current 1" is the supply current while the oscillator is continuously oscillating. In actual operation the oscillator periodically operates which results in less average power consumption.
 3. $\{[\text{Output Voltage}] \times [\text{Output Current}] \div [(\text{Input Voltage}) \times (\text{Input Current})]\} \times 100$.

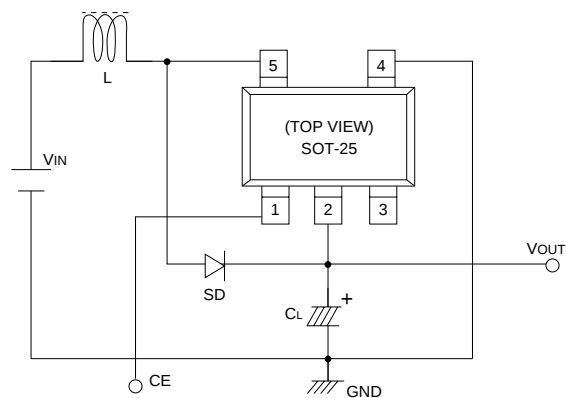
When the V_{DD} and V_{OUT} pins are independently used, the voltage range at the V_{DD} pin should be 2.2V to 10V.
The IC operates from $V_{DD}=0.8V$. However, output voltage and oscillator frequency are properly stabilized when $V_{DD}=2.2V$ or higher.

Typical Application Circuits



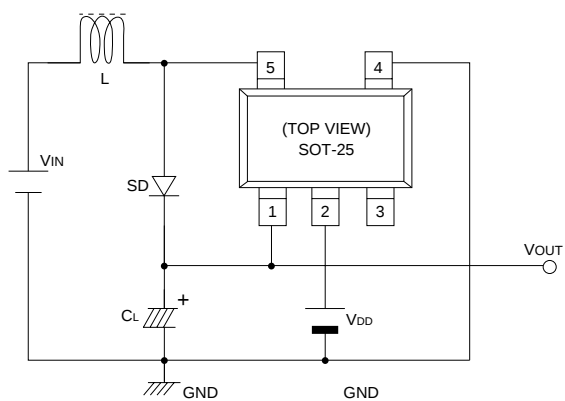
L: 220 μ H (SUMIDA, CD54)
SD: MA735 (Schottky diode; MATSUSHITA)
CL: 16V 47 μ F (Tantalum capacitor, NICHICON, F93)

Fig.1 XC6385A Application



L: 220 μ H (SUMIDA, CD-54)
SD: MA735 (Schottky diode; MATSUSHITA)
CL: 16V 47 μ F (Tantalum capacitor, NICHICON, F93)

Fig.2 XC6385C Application

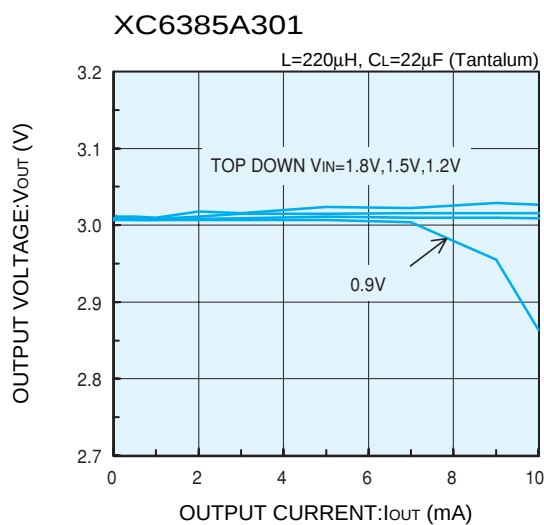


L: 220 μ H (SUMIDA, CD-54)
SD: MA735 (Schottky diode; MATSUSHITA)
CL: 16V 47 μ F (Tantalum capacitor, NICHICON, F93)

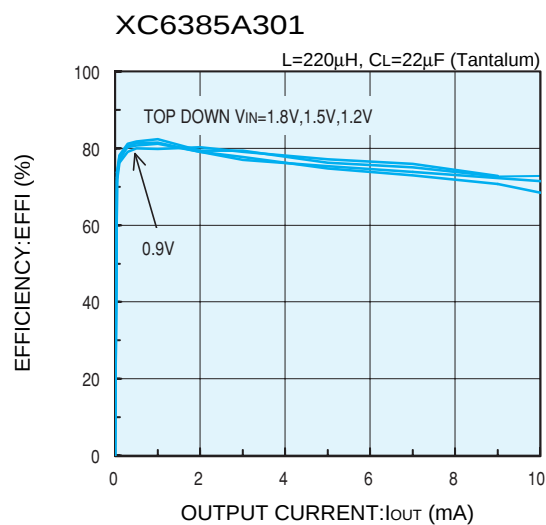
Fig.3 XC6385E Application

XC6385A301 Characteristics (Output Voltage = 3.0V)

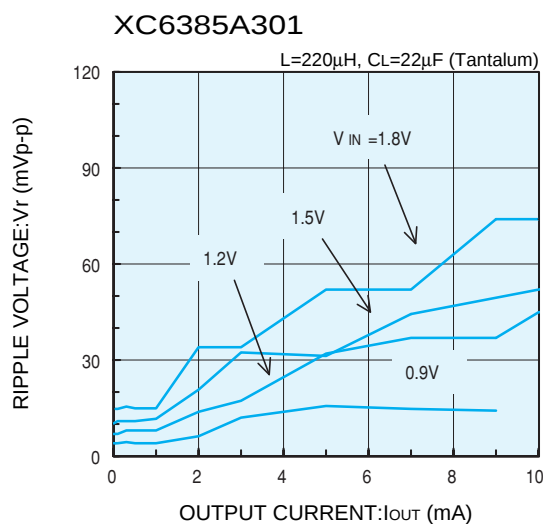
(1) OUTPUT VOLTAGE vs. OUTPUT CURRENT



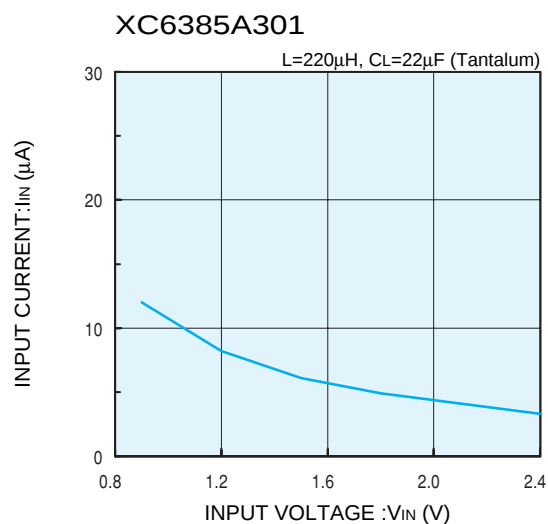
(2) EFFICIENCY vs. OUTPUT CURRENT



(3) RIPPLE VOLTAGE vs. OUTPUT CURRENT



(4) NO LOAD INPUT CURRENT vs. INPUT VOLTAGE



< Recommended external components >

L : 220 μ H (Sumida CD54)
 CL : 22 μ F (Tantalum)
 SD : MA729 (Matsushita)