- **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: ±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: ±2.5%
Maximum oscillator frequency: 100kHz (±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

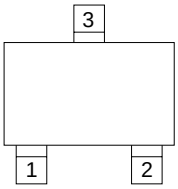
Ta=25℃

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	Pd	150	mW
	SOT-89	Pd	500	mW
Operating Ambient Temperature		Topr	-30 ~ +80	℃
Storage Temperature		Tstg	-40 ~ +125	℃

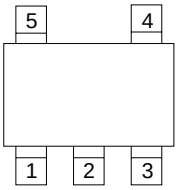
Selection Guide

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.

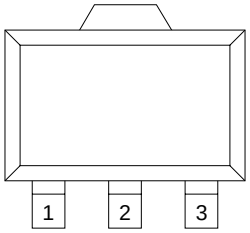
Pin Configuration



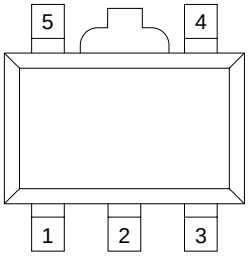
SOT-23
(TOP VIEW)



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	Lx	Switch

XC6385C

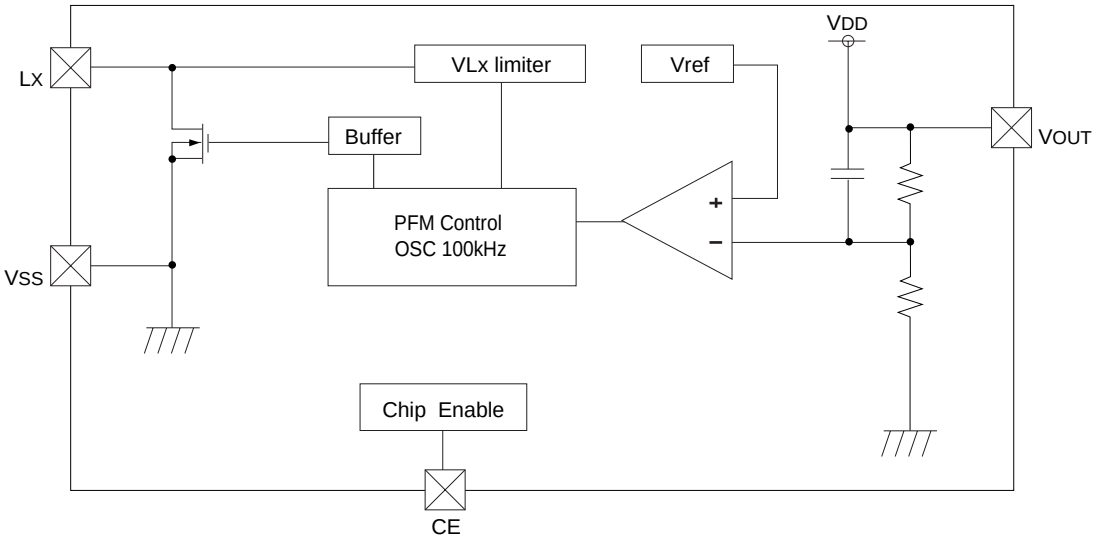
PIN NUMBER		PIN NAME	FUNCTION
SOT-25	SOT-89-5		
4	5	V_{SS}	Ground
2	2	V_{OUT}	Output voltage monitor, IC internal power supply
5	4	Lx	Switch
1	3	CE	Chip enable
3	1	NC	No connection

XC6385E

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

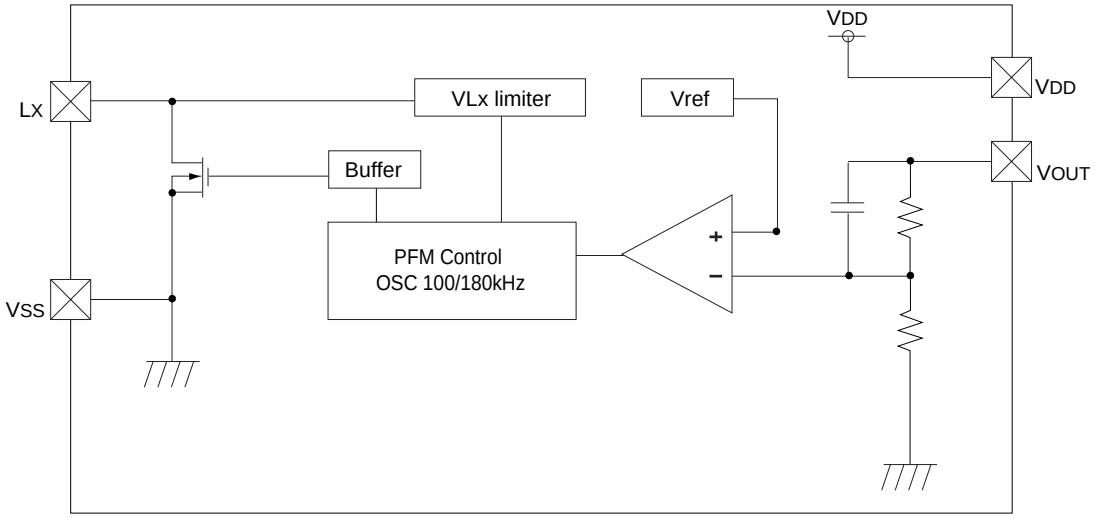
■ Block Diagram

XC6385A~XC6385C (VOUT pin also serves as VDD.)



Note: The CE pin is set up for XC6385C.

XC6383E



Note: The VDD pin is set up for XC6385E.

■ Electrical Characteristics

XC6385A301PR VOUT=3.0V Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	VOUT	External components connected.	2.94	3.000	3.06	V
Maximum Input Voltage	VIN		10			V
Operation Start-up Voltage	VST	External components connected. IOUT=1mA		0.80	0.90	V
Operation Hold Voltage	VHLD	External components connected. IOUT=1mA	0.70			V
No-Load Input Current	IIN	VIN=output voltage x 0.6, IOUT=0mA (Note1)		4.6	9.3	μA
Supply Current 1(Note2)	IDD1	No external components. Apply output voltage x 0.95 to VOUT		19.7	39.4	μA
Supply Current 2	IDD2	No external components. Apply output voltage x 0.95 to VOUT		2.1	4.2	μA
Lx Switch-On Resistance	RSWON	No external components. Apply output voltage x 0.95 to VOUT VLX=0.4V		5.2	7.9	Ω
Lx Leakage Current	ILXL	No external components. VOUT=VLX=10V.			1.0	μA
Duty Ratio	DTY	No external components. Apply output voltage x 0.95 to VOUT LX : 300Ω pull-up to 5V, Measuring of LX waveform.	70	75	80	%
Maximum Oscillation Frequency	MAX FOSC	No external components. Apply output voltage x 0.95 to VOUT LX : 300Ω pull-up to 5V. Duty ratio 75%. Measuring of LX waveform.	85	100	115	kHz
Lx Limit Voltage	VLxLMT	No external components. Apply output voltage x 0.95 to VOUT Apply voltage to Lx. Voltage required to produce FOSC x 2.	0.7		1.1	V
Efficiency (Note3)	EFFI	External components connected		80		%

Measuring conditions: Unless otherwise specified, VIN=VOUT × 0.6, IOUT=4mA. See Typical Application Circuits, Fig.1.

Note: 1. The Schottky diode (SD) must be type MA735, with reverse current (IR) < 1.0μA at reverse voltage (VR)=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. {[Output Voltage] x [Output Current] ÷ [(Input Voltage) x (Input Current)]} x 100.

XC6385C301PR VOUT=3.0V Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	VOUT	External components connected.	2.94	3.000	3.06	V
Maximum Input Voltage	VIN		10			V
Operation Start-up Voltage	VST	External components connected. IOUT=1mA		0.80	0.90	V
Operation Hold Voltage	VHLD	External components connected. IOUT=1mA	0.70			V
No-Load Input Current	IIN	VIN=output voltage x 0.6, IOUT=0mA (Note1)		4.6	9.3	μA
Supply Current 1(Note2)	IDD1	No external components. Apply output voltage x 0.95 to VOUT		19.7	39.4	μA
Supply Current 2	IDD2	No external components. Apply output voltage x 0.95 to VOUT		2.1	4.2	μA
Lx Switch-On Resistance	RSWON	No external components. Apply output voltage x 0.95 to VOUT VLX=0.4V		5.2	7.9	Ω
Lx Leakage Current	ILXL	No external components. VOUT=VLX=10V.			1.0	μA
Duty Ratio	DTY	No external components. Apply output voltage x 0.95 to VOUT LX : 300Ω pull-up to 5V, Measuring of LX waveform.	70	75	80	%
Maximum Oscillation Frequency	MAX FOSC	No external components. Apply output voltage x 0.95 to VOUT LX : 300Ω 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 x 0.95 to VOUT VCE=0V			0.5	μA
CE "High" Voltage	VCEH	No external components. Apply output voltage x 0.95 to VOUT LX : 300Ω pull-up to 5V. Exixtence of LX oxcillation.	0.72			V
CE "Low" Voltage	VCEL	No external components. Apply output voltage x 0.95 to VOUT LX : 300Ω pull-up to 5V. Exixtence of LX oxcillation.			0.20	V
CE "High" Current	ICEH	No external components. Apply output voltage x 0.95 to VOUT LX : 300Ω pull-up to 5V. VCE=output voltage x 0.95			0.25	μA
CE "Low" Current	ICEL	No external components. Apply output voltage x 0.95 to VOUT LX : 300Ω pull-up to 5V. VCE=0V.			-0.25	μA
Lx Limit Voltage	VLxLMT	No external components. Apply output voltage x 0.95 to VOUT Apply voltage to Lx. Voltage required to produce FOSC x 2.	0.7		1.1	V
Efficiency (Note3)	EFFI	External components connected		80		%

Measuring conditions: Unless otherwise specified, VIN=VOUT × 0.6, IOUT=4mA. See Typical Application Circuits, Fig.2.

Note: 1. The Schottky diode (SD) must be type MA735, with reverse current (IR) < 1.0μA at reverse voltage (VR)=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. {[Output Voltage] x [Output Current] ÷ [(Input Voltage) x (Input Current)]} x 100.

■ Electrical Characteristics

XC6385E301PR V_{OUT}=3.0V Ta=25℃

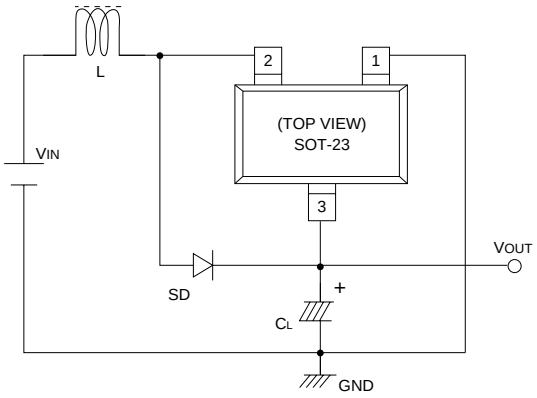
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	V_{OUT}	External components connected.	2.94	3.000	3.06	V
Maximum Input Voltage	V_{IN}		10			V
Operation Start-up Voltage	V_{ST}	External components connected. I_{OUT}=1mA		0.80	0.90	V
Operation Hold Voltage	V_{HLD}	External components connected.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

Measuring conditions: Unless otherwise specified, V_{IN}=V_{OUT} × 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) < 1.0μA 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. {[Output Voltage] x [Output Current] ÷ [(Input Voltage) x (Input Current)]} x 100.

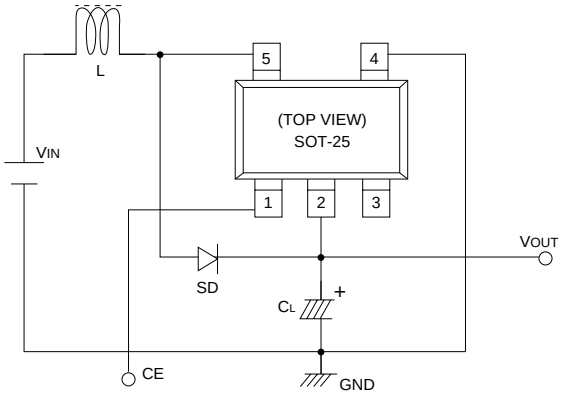
When the V_{DD} and V_{OUT} pins are independently used, the voltage range at the V_{DD} pin should be 2.2V to 10V.
The IC operates from V_{DD}=0.8V. However, output voltage and oscillator frequency are properly stabilized when V_{DD}=2.2V or higher.

■ Typical Application Circuits



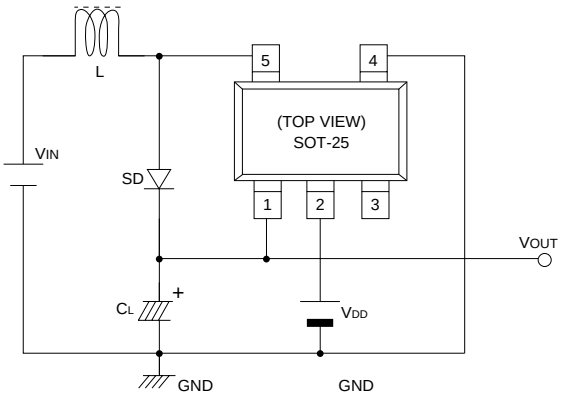
L: 220µH (SUMIDA, CD54)
SD: MA735 (Schottky diode; MATSUSHITA)
CL: 16V 47µF (Tantalum capacitor, NICHICON, F93)

Fig.1 XC6385A Application



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

Fig.2 XC6385C Application

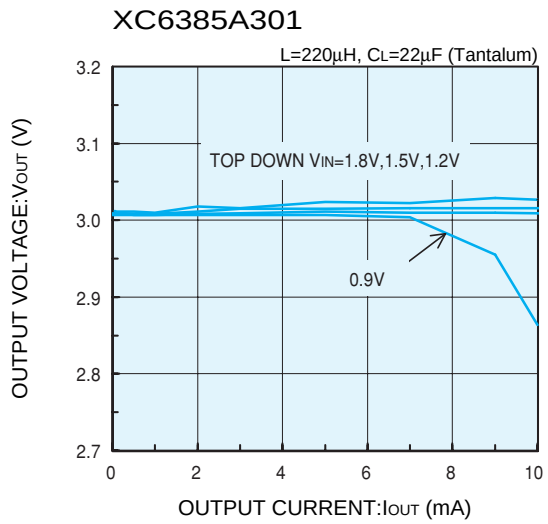


L: 220µH (SUMIDA, CD-54)
SD: MA735 (Schottky diode; MATSUSHITA)
CL: 16V 47µF (Tantalum capacitor, NICHICON, F93)

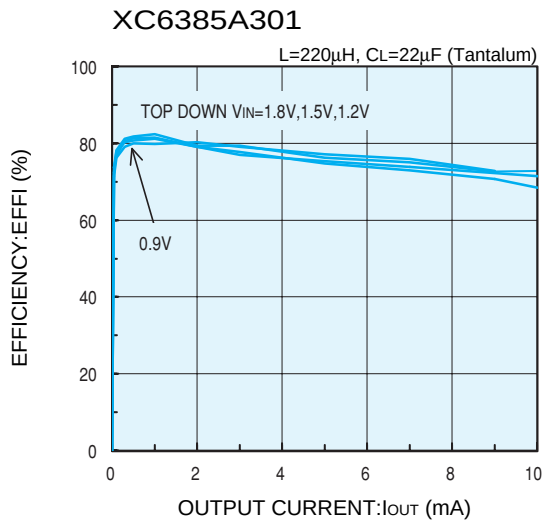
Fig.3 XC6385E Application

■ XC6385A301 Characteristics (Output Voltage = 3.0V)

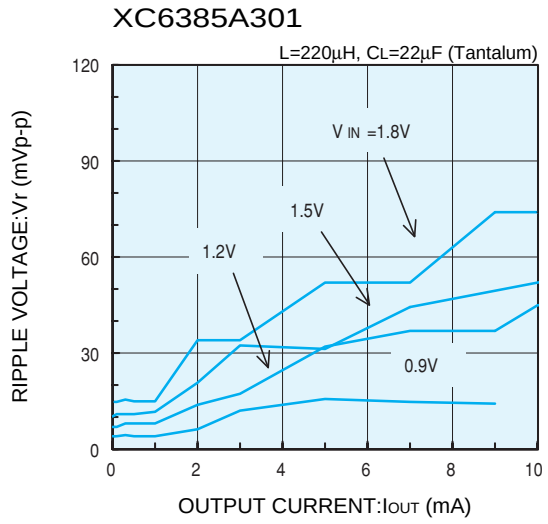
(1) OUTPUT VOLTAGE vs. OUTPUT CURRENT



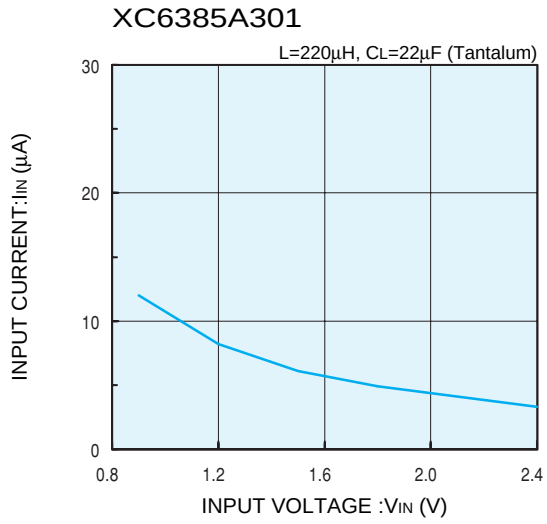
(2) EFFICIENCY vs. OUTPUT CURRENT



(3) RIPPLE VOLTAGE vs. OUTPUT CURRENT



(4) NO LOAD INPUT CURRENT vs. INPUT VOLTAGE



< Recommended external components >

L : 220µH (Sumida CD54)
CL : 22µF (Tantalum)
SD : MA729 (Matsushita)