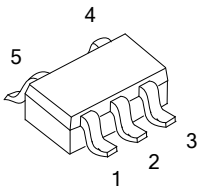
UC3550 **CMOS IC**

PWM CONTROLLED, PWM/PFM SWITCHABLE STEP-UP DC-DC CONTROLLER



SOT-25

■ DESCRIPTION

The UTC **UC3550** series is a compact, high efficiency, step-up DC/DC controllers includes an error amplifier, oscillator, PWM comparator, skip cycle comparator, voltage reference, soft-start, and high speed lower ON-resistance driver for driving external power devices (NMOS or NPN) ,Additionally, a CE (chip enable) function that reduces power consumption during shut-down mode.

That typically operated from a single-or dual-cell battery packs. It have a driver pin ,ext pin, for connecting to an external transistor(NMOS or NPN). a lower ON-resistance external transistor can obtain larger output current. With only external components, this series allow a simple means to accommodate high output current applications.

The UTC **UC3550** series goes automatically into skip switching cycles under light load condition to maintain high efficiency.

■ FEATURES

* Input Voltage Range：0.9~8V
* Output Voltage Range：1.8~6V Programmable in 0.1V with High Accuracy ± 2.5%
* High Efficiency 88% (Typ.)
* Low Start-up Voltage of 0.9V Typical at I_{OUT} = 1.0mA
* Oscillator Frequency: 300kHz.(±20%)
* Chip Enable Pin with Pull-up Current Source
* High Output Current up to 1000mA (V_{IN} = 2.0V, V_{OUT} =3.3V)

■ ORDERING INFORMATION

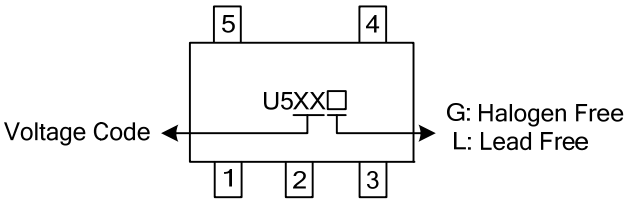
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UC3550L-xx-AF5-R	UC3550G-xx-AF5-R	SOT-25	Tape Reel

UC3550L-xx-AF5-R

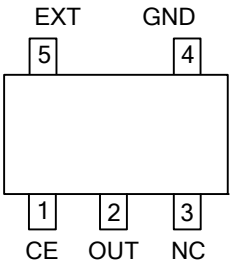
(1)Packing Type	(1) R: Tape Reel
(2)Package Type	(2) AF5: SOT-25
(3)Voltage Code	(3) xx: reference to Marking Information
(4)Lead Free	(4) G: Halogen Free, L: Lead Free

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■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-25	33:3.3V 36:3.6V 37:3.7V 50:5.0V	

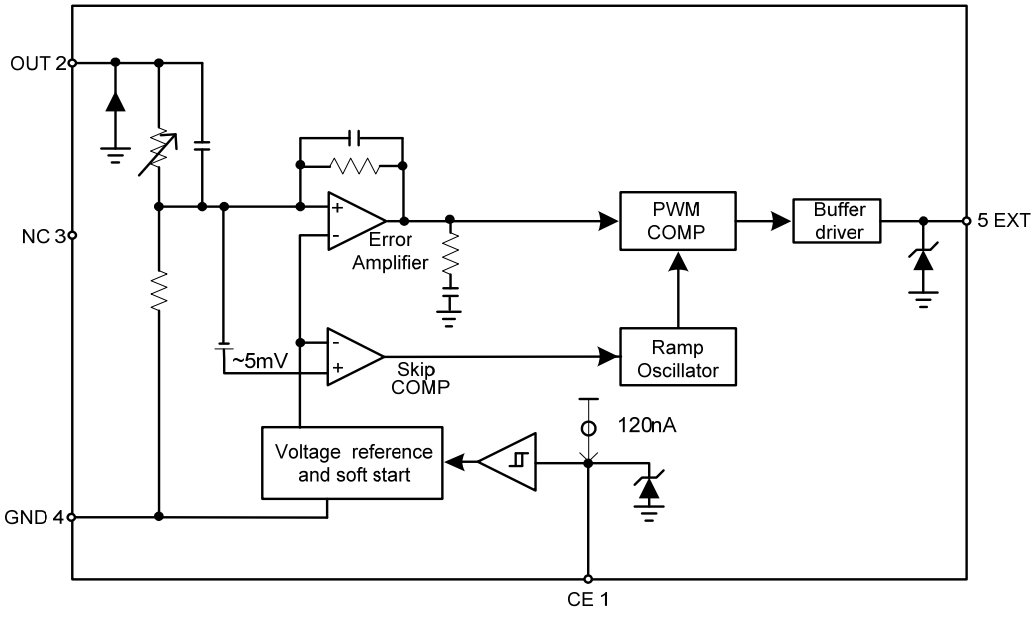
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO	PIN NAME	DESCRIPTION
1	CE	Chip Enable: The chip is enabled if a voltage equal to or greater than 1.0V or left floating is applied. The chip is disabled if a voltage less than 0.3V is applied.
2	OUT	Output voltage monitor, IC internal power supply
3	NC	No connection
4	GND	Ground
5	EXT	External transistor drive

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{OUT}	-0.3~8	V
EXT Voltage	V_{EXT}	-0.3 ~ 8	V
EXT Sink/Source Current	I_{EXT}	-150 ~ +150	mA
CE Input Voltage Range	V_{CE}	-0.3 ~ 12.0	V
CE Input Current Range	I_{CE}	-155 ~ 155	mA
Power Dissipation (Ta=25°C)	P_D	500	mW
Junction Temperature	T_J	+150	°C
Operating Temperature	T_{OPR}	-40 ~ +85	°C
Storage Temperature	T_{STG}	-55 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ_{JA}	250	°C/W

■ ELECTRICAL CHARACTERISTICS (T_A=25°C, f_{OSC}=300kHz, unless otherwise specified)

UC3550-3.3V

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OSCILLATOR							
Frequency		f_{OSC}	V_{OUT}=V_{SET}×0.96	240	300	360	kHz
Frequency Temperature Coefficient		△f	T_A=-40°C ~ 85°C		0.10		%/°C
Maximum PWM Duty Cycle		D_{MAX}	V_{OUT}=V_{SET}×0.96	70	80	90	%
Minimum Start-up Voltage		V_{START1}	I_{OUT}=0mA		800	900	mV
Minimum Start-up Voltage		V_{START2}	I_{OUT}=1mA		900	1000	mV
Minimum Start-up Voltage Temperature Coefficient		△V_{START}	T_A=-40°C ~ 85°C		-1.6		mV/°C
Minimum Operation Hold Voltage		V_{OPR}	I_{OUT}=0mA		600	700	mV
Soft-Start Time		t_{SS}	V_{OUT}=V_{SET}		60	250	ms
CE (PIN 1)							
CE Input Voltage :							
High State, Device Enabled		V_{CEH}	V_{OUT}=V_{SET}×0.96	900			mV
Low State, Device Disabled		V_{CEL}				680	mV
CE Input Current :							
High State, Device Enabled		I_{CEH}	V_{OUT}=V_{CE}=5.0V	-0.5	0	0.5	μA
Low State, Device Disabled		I_{CEL}	V_{OUT}=5.0V, V_{CE}=0V	0	0.15	0.5	μA
EXT (PIN 5)							
ON Resistance	EXT “H”	R_{EXTH}	V_{EXT}=V_{OUT}-0.4V		11	15	Ω
	EXT “L”	R_{EXTL}	V_{EXT}=0.4V		8	12	Ω
TOTAL DEVICE							
Output Voltage		V_{OUT}		3.218	3.3	3.383	V
Output Voltage temperature coefficient		△V_{OUT}	T_A=-40 ~ 85°C		150		ppm/°C
Operating Current		I_{DD}	V_{OUT}=V_{CE}=V_{SET}×0.96		103	160	μA
Stand-by Current		I_{STN-BY}	V_{OUT}=V_{CE}=V_{SET}+0.5V		15	38	μA
Off-State Current		I_{OFF}	V_{OUT}=5.0V, V_{CE}=0V, T_A=-40 ~ +85°C		0.6	1.5	μA
Efficiency		η	I_{OUT} = 200mA, V_{IN} = 2.0V	80	88		%

■ ELECTRICAL CHARACTERISTICS (Cont.)

UC3550-3.6V

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OSCILLATOR							
Frequency		f_{OSC}	$V_{OUT}=V_{SET}\times0.96$	240	300	360	kHz
Frequency Temperature Coefficient		$\triangle f$	T_A=-40°C ~ 85°C		0.10		%/°C
Maximum PWM Duty Cycle		D_{MAX}	$V_{OUT}=V_{SET}\times0.96$	70	80	90	%
Minimum Start-up Voltage		V_{START1}	I_{OUT}=0mA		800	900	mV
Minimum Start-up Voltage		V_{START2}	I_{OUT}=1mA		900	1000	mV
Minimum Start-up Voltage Temperature Coefficient		$\triangle V_{START}$	T_A=-40°C ~ 85°C		-1.6		mV/°C
Minimum Operation Hold Voltage		V_{OPR}	I_{OUT}=0mA		600	700	mV
Soft-Start Time		t_{SS}	$V_{OUT}=V_{SET}$		60	250	ms
CE (PIN 1)							
CE Input Voltage :							
High State, Device Enabled		V_{CEH}	$V_{OUT}=V_{SET}\times0.96$	900			mV
Low State, Device Disabled		V_{CEL}				680	mV
CE Input Current :							
High State, Device Enabled		I_{CEH}	$V_{OUT}=V_{CE}$=5.0V	-0.5	0	0.5	μA
Low State, Device Disabled		I_{CEL}	V_{OUT}=5.0V, V_{CE}=0V	0	0.15	0.5	μA
EXT (PIN 5)							
ON Resistance	EXT “H”	R_{EXTH}	$V_{EXT}=V_{OUT}$-0.4V		11	15	Ω
	EXT “L”	R_{EXTL}	V_{EXT}=0.4V		8	12	Ω
TOTAL DEVICE							
Output Voltage		V_{OUT}		3.51	3.6	3.69	V
Output Voltage temperature coefficient		$\triangle V_{OUT}$	T_A=-40 ~ 85°C		150		ppm/°C
Operating Current		I_{DD}	$V_{OUT}=V_{CE}=V_{SET}\times0.96$		103	160	μA
Stand-by Current		I_{STN-BY}	$V_{OUT}=V_{CE}=V_{SET}$+0.5V		15	38	μA
Off-State Current		I_{OFF}	V_{OUT}=5.0V, V_{CE}=0V, T_A=-40 ~ +85°C		0.6	1.5	μA
Efficiency		η	I_{OUT} = 200mA, V_{IN} = 2.0V	80	88		%

■ ELECTRICAL CHARACTERISTICS (Cont.)

UC3550-3.7V

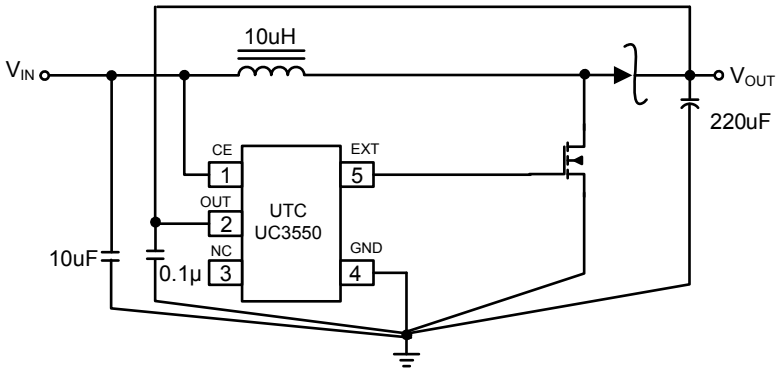
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OSCILLATOR							
Frequency		f_{OSC}	$V_{OUT}=V_{SET}\times0.96$	240	300	360	kHz
Frequency Temperature Coefficient		$\triangle f$	T_A=-40°C ~ 85°C		0.10		%/°C
Maximum PWM Duty Cycle		D_{MAX}	$V_{OUT}=V_{SET}\times0.96$	70	80	90	%
Minimum Start-up Voltage		V_{START1}	I_{OUT}=0mA		800	900	mV
Minimum Start-up Voltage		V_{START2}	I_{OUT}=1mA		900	1000	mV
Minimum Start-up Voltage Temperature Coefficient		$\triangle V_{START}$	T_A=-40°C ~ 85°C		-1.6		mV/°C
Minimum Operation Hold Voltage		V_{OPR}	I_{OUT}=0mA		600	700	mV
Soft-Start Time		t_{SS}	$V_{OUT}=V_{SET}$		60	250	ms
CE (PIN 1)							
CE Input Voltage :							
High State, Device Enabled		V_{CEH}	$V_{OUT}=V_{SET}\times0.96$	900			mV
Low State, Device Disabled		V_{CEL}				680	mV
CE Input Current :							
High State, Device Enabled		I_{CEH}	$V_{OUT}=V_{CE}$=5.0V	-0.5	0	0.5	μA
Low State, Device Disabled		I_{CEL}	V_{OUT}=5.0V, V_{CE}=0V	0	0.15	0.5	μA
EXT (PIN 5)							
ON Resistance	EXT “H”	R_{EXTH}	$V_{EXT}=V_{OUT}$-0.4V		11	15	Ω
	EXT “L”	R_{EXTL}	V_{EXT}=0.4V		8	12	Ω
TOTAL DEVICE							
Output Voltage		V_{OUT}		3.608	3.7	3.793	V
Output Voltage temperature coefficient		$\triangle V_{OUT}$	T_A=-40 ~ 85°C		150		ppm/°C
Operating Current		I_{DD}	$V_{OUT}=V_{CE}=V_{SET}\times0.96$		103	160	μA
Stand-by Current		I_{STN-BY}	$V_{OUT}=V_{CE}=V_{SET}$+0.5V		15	38	μA
Off-State Current		I_{OFF}	V_{OUT}=5.0V, V_{CE}=0V, T_A=-40 ~ +85°C		0.6	1.5	μA
Efficiency		η	I_{OUT} = 200mA, V_{IN} = 2.0V	80	88		%

■ ELECTRICAL CHARACTERISTICS (Cont.)

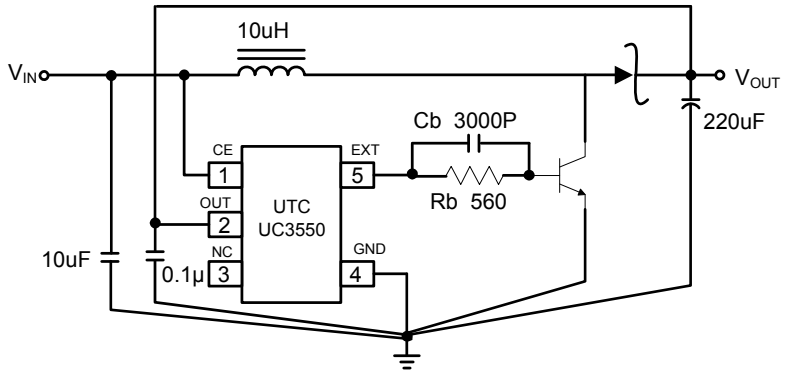
UC3550-5.0V

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OSCILLATOR							
Frequency		f_{OSC}	$V_{OUT}=V_{SET}\times0.96$	240	300	360	kHz
Frequency Temperature Coefficient		$\triangle f$	T_A=-40°C ~ 85°C		0.1		%/°C
Maximum PWM Duty Cycle		D_{MAX}	$V_{OUT}=V_{SET}\times0.96$	70	80	90	%
Minimum Start-up Voltage		V_{START1}	I_{OUT}=0mA		800	900	mV
Minimum Start-up Voltage		V_{START2}	I_{OUT}=1mA		900	1000	mV
Minimum Start-up Voltage Temperature Coefficient		$\triangle V_{START}$	T_A=-40°C ~ 85°C		-1.6		mV/°C
Minimum Operation Hold Voltage		V_{OPR}	I_{OUT}=0mA		600	700	mV
Soft-Start Time		t_{SS}	$V_{OUT}=V_{SET}$		60	200	ms
CE (PIN 1)							
CE Input Voltage :							
High State, Device Enabled		V_{CEH}	$V_{OUT}=V_{SET}\times0.96$	900			mV
Low State, Device Disabled		V_{CEL}				680	mV
CE Input Current :							
High State, Device Enabled		I_{CEH}	$V_{OUT}=V_{CE}$=5.0V	-0.5	0	0.5	μA
Low State, Device Disabled		I_{CEL}	V_{OUT}=5.0V, V_{CE}=0V	0	0.15	0.5	μA
EXT (PIN 5)							
ON Resistance	EXT “H”	R_{EXTH}	$V_{EXT}=V_{OUT}$-0.4V		6	10	Ω
	EXT “L”	R_{EXTL}	V_{EXT}=0.4V		6	10	Ω
TOTAL DEVICE							
Output Voltage		V_{OUT}		4.875	5	5.125	V
Output Voltage temperature coefficient		$\triangle V_{OUT}$	T_A=-40 ~ 85°C		150		ppm/°C
Operating Current		I_{DD}	$V_{OUT}=V_{CE}=V_{SET}\times0.96$		136	220	μA
Stand-by Current		I_{STN-BY}	$V_{OUT}=V_{CE}=V_{SET}$+0.5V		15	38	μA
Off-State Current		I_{OFF}	V_{OUT}=5.0V, V_{CE}=0V, T_A=-40 ~ +85°C		0.6	1.5	μA
Efficiency		η	I_{OUT} = 200mA, V_{IN} = 3.0V	80	88		%

■ TYPICAL STEP-UP CONVERTER APPLICATION



Step-up Converter using external MOSFET



Step-up Converter using external NPN

Recommended components

Nmos t_R ： XP161A0390PR/ (Torex) or NTGS3446T1(ON SEMI)
L ： 10Uh(Sunida CD54 f_{OSC}＝300kHz)
SD ： MA737, or MBRM110L
C_{IN} ： 10V 10uF (tantalum)
C_L ： 16V220uF (tantalum)

NPN t_R type
t_R ： 2SD1628(Sanyo)，MMJT9410
R_B ： 500～1000Ω(Adjust according to load and Tr. h_{FE} levels)
C_B ： 3000p(ceramic type)

■ EXTERNAL COMPONENT SELECTION

Inductor Selection

An inductor value of 10uH performs well in most application. The UC3550 series also work with inductors in the 4.7uH to 12uH range. An inductor with higher peak inductor current tends a higher output voltage ripple(I_{PEAK} x output filter capacitor ESR). The inductor's DC resistance significantly affects efficiency.

Output Capacitor Selection

The output ripple voltage(I_{PEAK} x output filter capacitor ESR)is the product of the peak inductor current and the output capacitor Equivalent Series Resistance (ESR). Best performances are obtained with good high frequency characteristics capacitors and low ESR. The best compromise for the value of the Output Capacitance is 220F Tantalum Capacitor. The output capacitor as close as possible to the device pins.

Input Capacitor Selection

The Input Capacitor is required to compensate, if present, the series impedance between the Supply Voltage Source and the Input Voltage of the Application. A value of 10 F is enough to guarantee stability for distances less than 2". In any case we suggest to connect both capacitors, The input capacitor as close as possible to the device pins.

Diode Selection

The Schottky diode with an high switching speed and a very low Forward Voltage (VF) is needed. Higher VF may cause lost power as heat in the diode, with a decrease of the Efficiency. Moreover, since the Output Voltage pin is also used as the device Supply Voltage, the Start-up Voltage (see related plots) is strictly due to the diode Forward Voltage at the rated Forward Current.

External Component Selection

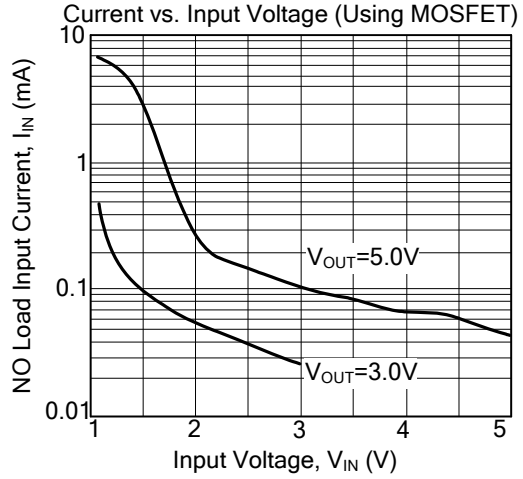
An enhancement N-channel MOSFET or a bipolar NPN transistor can be used as the external switch transistor. since enhancement N-channel MOSFET is a voltage driven device, it is a more efficient switch than a BJT transistor. However, he MOSFET requires a higher voltage to turn on as compared with BJT transistor

For enhancement N-channel MOSFET (it is especially importance for $R_{DS(ON)}$,typically<0.1Ω, threshold voltage, $V_{GS(TH)}$ must be<V_{OUT}, typically<1.5V.

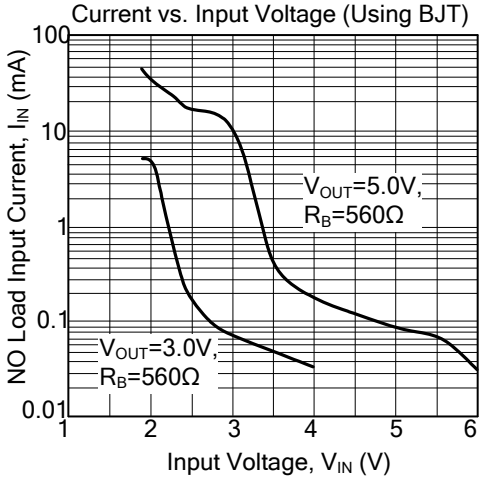
For bipolar NPN transistor, continuous collector current typically 1A to 4A and $V_{CE(SAT)}$<0.2V. the driving capability is determined by the DC current gain, H_{FE}, of the transistor and the base resistor, R_B. Moreover, a speed-up capacitor, C_B should be connected in paralled with R_B to reduce switch loss and improve efficiency.

■ TYPICAL CHARACTERISTICS

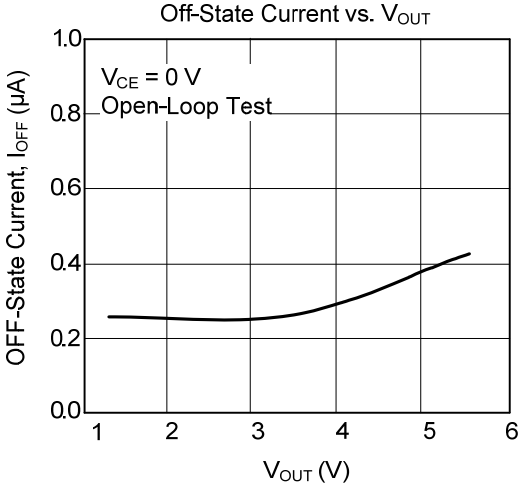
No Load Input
Current vs. Input Voltage (Using MOSFET)



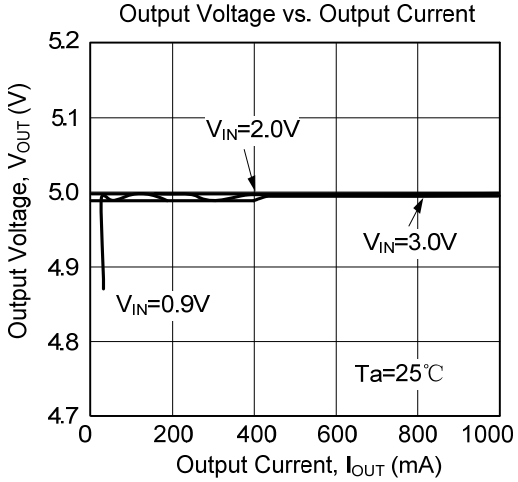
No Load Input
Current vs. Input Voltage (Using BJT)



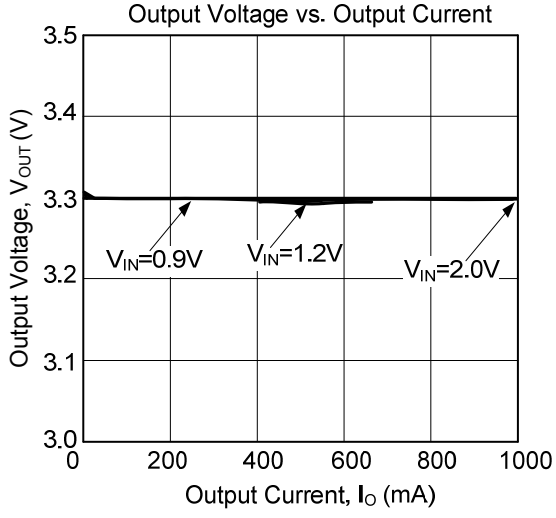
Off-State Current vs. V_{OUT}



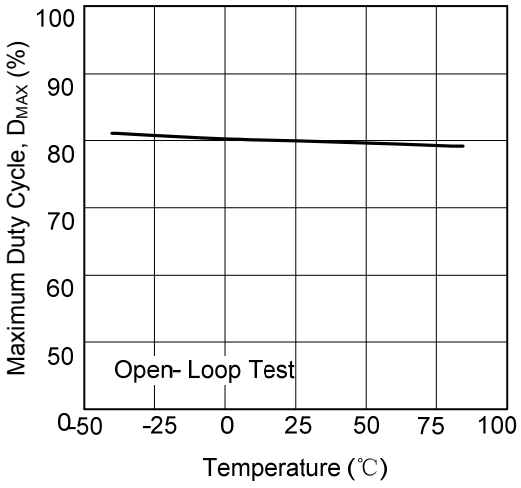
Output Voltage vs. Output Current



Output Voltage vs. Output Current

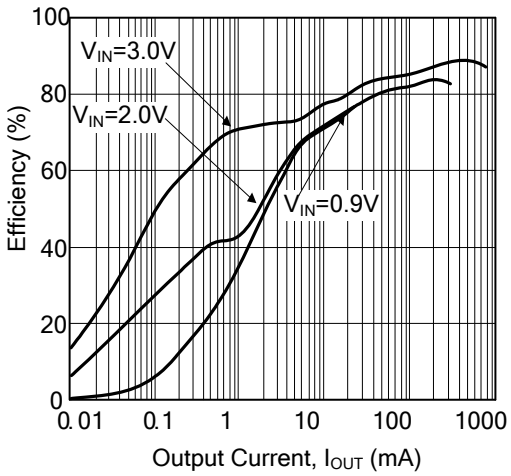


Maximum Duty Cycle vs. Temperature

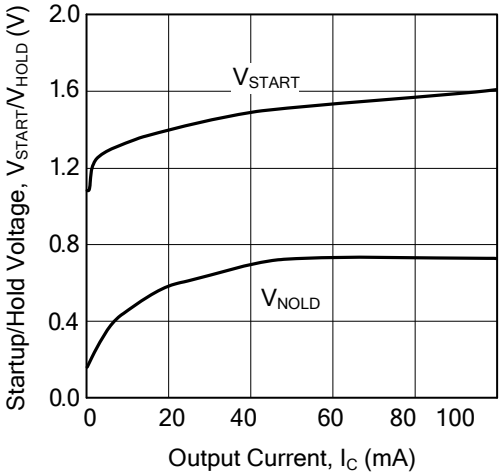


■ TYPICAL CHARACTERISTICS(Cont.)

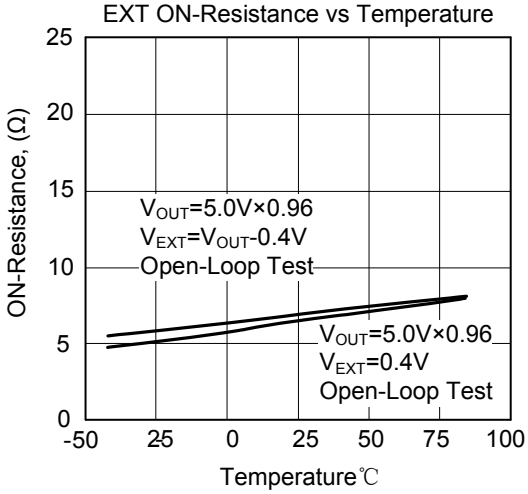
Efficiency vs Output Current (5.0V)



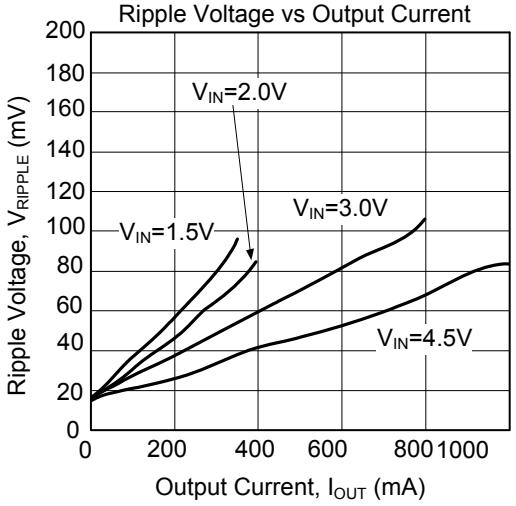
Startup/Hold Voltage vs Output Current (Using MOSFET) Output Current (3.3V)



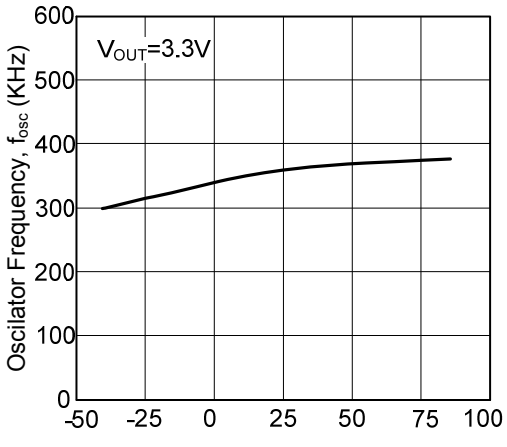
EXT ON-Resistance vs Temperature



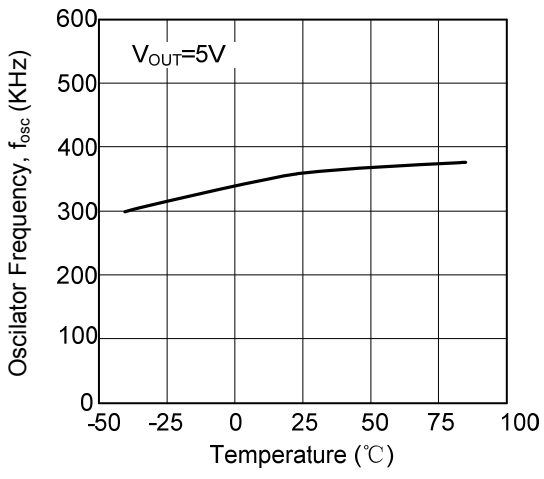
Ripple Voltage vs Output Current



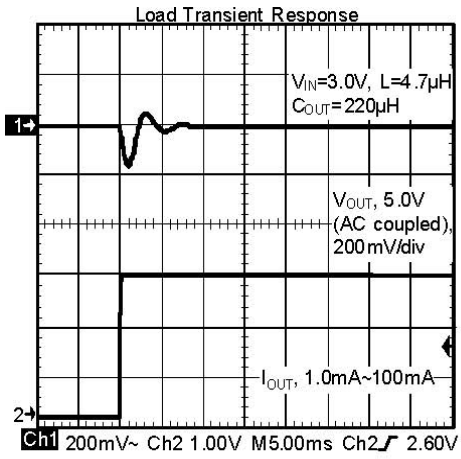
Oscillator Frequency vs. Temperature

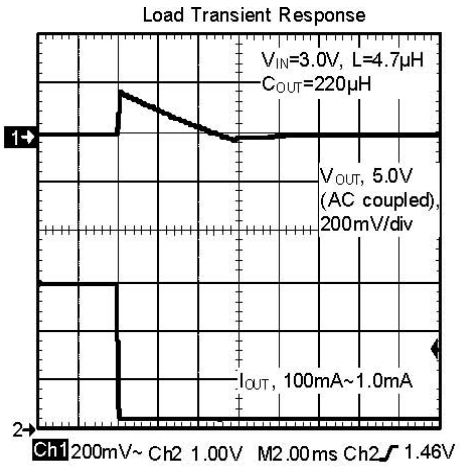


Oscillator Frequency vs. Temperature



■ TYPICAL CHARACTERISTICS(Cont.)





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