500mA Synchronous Step-Down DC/DC Converters ME3101 Series

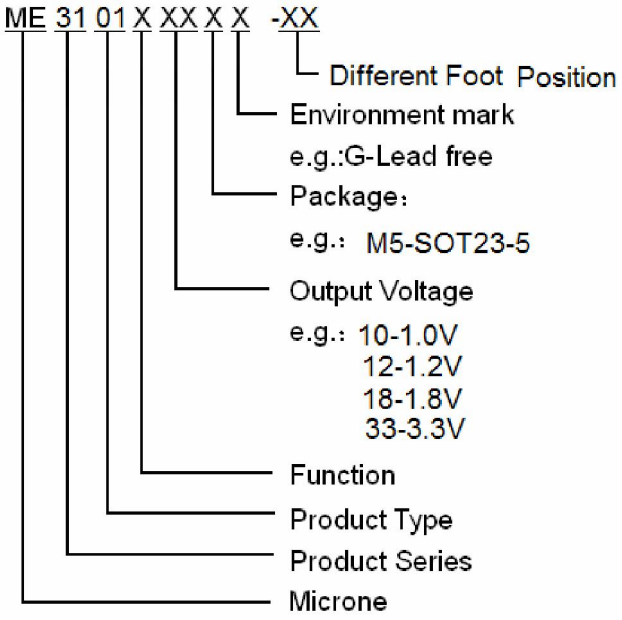
General Description

ME3101 series is a group of synchronous rectification type DC/DC converters with a built-in 0.6Ω P-channel driver transistor and 0.7Ω N-channel switching transistor, designed to allow the use of ceramic capacitors. The ICs enable a high efficiency, stable power supply with an output current of 500mA to be configured using only a coil and two capacitors connected externally.

With the built-in oscillator, oscillation frequency is 1.2MHz.As for operation mode, the ME3101 series can be manually switched with automatic PWM/PFM switching control mode, allowing fast response, low ripple and high efficiency over the full range of load (from light load to high output current conditions).

During standby, all circuits are shutdown to reduce current consumption to as low as 1.0μA or less.

Selection Guide



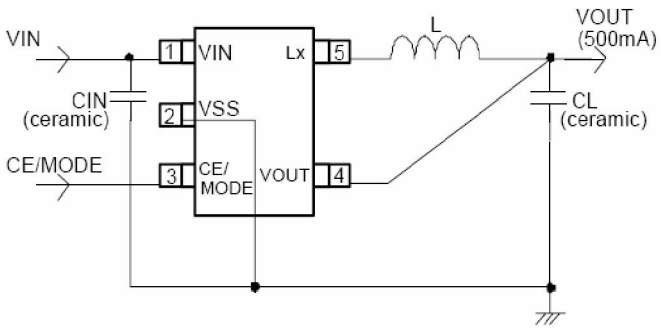
Features

- Synchronous Step-Down DC/DC
- High Efficiency :93%(TYP)
- Low Ripple Voltage :10mV
- Output Current :500mA
- Oscillation Frequency :1.2MHz
- PWM/PFM Automatic Switching Control
- Maximum Duty Ratio :100%
- Ceramic Capacitor Compatible
- Ultra Small Packages :SOT-23-5
- Soft-start ciruit built-in

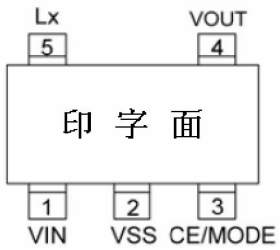
Typical Application

- Mobile phones (PDC, GSM, CDMA, IMT200 etc.)
- Bluetooth equipment
- PDA
- Portable communication modem
- Portable games
- Cameras
- Digital cameras
- Cordless phones
- Notebook computers

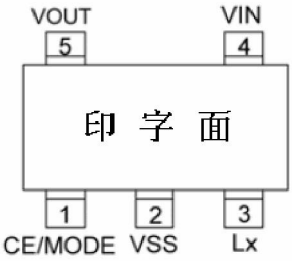
Typical Application Circuit



Pin Configuration



ME3101AXX



ME3101AXX-DS

Pin Assignment

ME3101AXX Pin Number	Pin Name	Function
1	VIN	Power Input
2	VSS	VSS
3	CE/MODE	Chip Enable / Mode Switch
4	VOUT	Output Voltage Sence
5	LX	Switching Output

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1	CE/MODE	Chip Enable / Mode Switch
2	VSS	VSS
3	LX	Switching Output
4	VIN	Power Input
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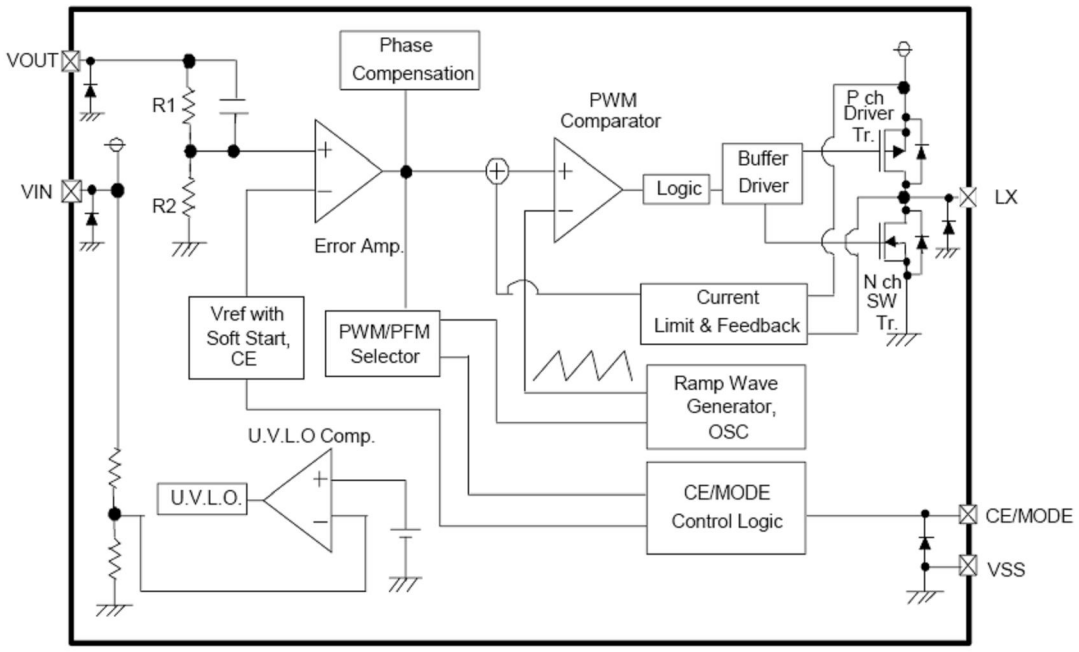
Absolute Maximum Ratings

PARAMETER	SYMBOL	RATINGS	UNITS
VIN Pin Voltage	Vin	-0.3～6.5	V
Lx Pin Voltage	Vlx	-0.3～Vin+0.3	V
VOUT Pin Voltage	Vout	-0.3～6.5	V
CE / MODE Pin Voltage	Vce	-0.3～Vin+0.3	V
Lx Pin Current	Ilx	±1000	mA
Power Dissipation(SOT-23-5L)	Pd	250	mW
Operating Temperature Range	T_{Opr}	-25~+85	℃
Storage Temperature Range	T_{stg}	-40~+125	℃

Block Diagram



Electrical Characteristics

ME3101A10 (Unless Otherwise Stated ,VIN=3.0V，FOSC=1.2MHz, Cin=4.7uF，CL＝10uF，L＝3.3uH，Ta=25℃)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	CIRCUIT
Output Voltage	Vout	Vce＝Vin,Iout＝30mA	0.98	1.0	1.02	V	①
Operating Voltage Range	Vin		2	–	6	V	①
Maximum Output Current	Iout.max		–	500	–	mA	①
U.V.L.O . Voltage	Vuvlo	Vce＝Vin,Vout＝0V, LX Voltage which Lx pin voltage holding "L" level	–	1.2	–	V	②
Supply Current	Idd	Vin＝Vce＝3.0V，Vout＝Vout×1.1	–	55	–	uA	③
Stand-by Current	Istb	Vin＝3.0V，Vce＝0V，Vout＝Vout×1.1	–	0	1	uA	③
Frequency	FOSC	Iout＝100mA	1020	1200	1380	KHz	①
PFM Switch Current	Ipfm	Vce＝Vin，Iout＝1mA	–	180	–	mA	①
Maximum Duty Ratio	Maxdty	Vce＝Vin，Vout＝0	100	–	–	%	④
Minimum Duty Ratio	Mindty	Vce＝Vout＝Vin	–	–	0	%	④
Efficiency	EFFI	Vce＝Vin＝2.5V，Iout＝100mA	–	90	–	%	①
Lx SW “H” ON Resistance	RlxH	Vce＝0.5Vin，Vce＝0V，Ilx＝100mA	–	0.5	1.2	Ω	⑤
Lx SW “L” ON Resistance	RlxL	Vce＝0.5Vin，Ilx＝100mA	–	0.6	1.4	Ω	–
Lx SW “H” Leak Current	IleakH	Vin＝Vout＝5.0V，Vce＝0V，Lx＝0V	–	0.01	1	uA	⑥
Lx SW “L” Leak Current	IleakL	Vin＝Vout＝5.0V，Vce＝0V，Lx＝5V	–	0.01	1	uA	⑥
Current Limit	Ilim	Vin＝Vce＝5.0V，Vout＝0V	–	800	–	mA	⑦
Output Voltage Temperature Characteristics	Vout/ (Vout*⊿topr)	Iout=30mA,-40℃≤Topr≤85℃	–	+100	–	ppm/℃	①
CE “H” Voltage	VceH	Vout＝0V	0.7	–	Vin	V	⑧
CE “L” Voltage	VceL	Vout＝0V	Vss	–	0.6	V	⑧
CE “H” Current	Iceh	Vin＝Vce＝5.5V，Vout＝0V	-0.1	–	0.1	uA	⑧

CE “L” Current	Icel	Vin=5.5V，Vce=0V，Vout=0V	-0.1	–	0.1	uA	⑧
Soft-Start Time	Tss	Vce=0V～Vin，Iout=1mA	0.5	1.2	3.0	msec	①
Latch Time	Tlat	Vin=Vce=5.0V	1	–	20	msec	⑨

ME3101A12 （Unless Otherwise Stated ,VIN=3.0V，FOSC=1.2MHz, Cin=4.7uF，CL=10uF，L=3.3uH，Ta=25℃）

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	CIRCUIT
Output Voltage	Vout	Vce=Vin,Iout=30mA	1.176	1.2	1.224	V	①
Operating Voltage Range	Vin		2	–	6	V	①
Maximum Output Current	Iout.max	VIN=2.5V	500	–	–	mA	①
U.V.L.O . Voltage	Vuvlo	Vce=Vin,Vout=0V, LX Voltage which Lx pin voltage holding "L" level	1	1.4	1.78	V	②
Supply Current	Idd	Vin=Vce=3.0V，Vout=Vout×1.1	–	60	120	uA	③
Stand-by Current	Istb	Vin=3.0V，Vce=0V，Vout=Vout×1.1	–	0	1	uA	③
Frequency	FOSC	Iout=100mA	1020	1200	1380	KHz	①
PFM Switch Current	Ipfm	Vce=Vin，Iout=1mA	100	140	180	mA	①
Maximum Duty Ratio	Maxdty	Vce=Vin，Vout=0	100	–	–	%	④
Minimum Duty Ratio	Mindty	Vce=Vout=Vin	–	–	0	%	④
Efficiency	EFFI	Vce=Vin=2.5V，Iout=100mA	–	90	–	%	①
Lx SW “H” ON Resistance	RlxH	Vce=0.5Vin，Vce=0V，Ilx=100mA	–	0.5	1.2	Ω	⑤
Lx SW “L” ON Resistance	RlxL	Vce=0.5Vin，Ilx=100mA	–	0.6	1.4	Ω	–
Lx SW “H” Leak Current	IleakH	Vin=Vout=5.0V，Vce=0V，Lx=0V	–	0.01	1	uA	⑥
Lx SW “L” Leak Current	IleakL	Vin=Vout=5.0V，Vce=0V，Lx=5V	–	0.01	1	uA	⑥
Current Limit	Ilim	Vin=Vce=5.0V，Vout=0V	600	700	–	mA	⑦
Output Voltage Temperature Characteristics	Vout/(Vout*⊿topr)	Iout=30mA,-40℃≤Topr≤85℃	–	+100	–	ppm/℃	①

CE “H” Voltage	VceH	Vout=0V	0.9	–	Vin	V	⑧
CE “L” Voltage	VceL	Vout=0V	Vss	–	0.3	V	⑧
CE “H” Current	Iceh	Vin=Vce=5.5V, Vout=0V	-0.1	–	0.1	uA	⑧
CE “L” Current	Icel	Vin=5.5V, Vce=0V, Vout=0V	-0.1	–	0.1	uA	⑧
Soft-Start Time	Tss	Vce=0V～Vin, Iout=1mA	0.5	1.0	3.0	msec	①
Latch Time	Tlat	Vin=Vce=5.0V	1	–	20	msec	⑨

ME3101A18 (Unless Otherwise Stated ,VIN=3.6V, FOSC=1.2MHz, Cin=4.7uF, CL=10uF, L=3.3uH, Ta=25℃)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	CIRCUIT
Output Voltage	Vout	Vce=Vin,Iout=30mA	1.764	1.8	1.836	V	①
Operating Voltage Range	Vin		2	–	6	V	①
Maximum Output Current	Iout.max	VIN=3.0V	500	–	–	mA	①
U.V.L.O . Voltage	Vuvlo	Vce=Vin,Vout=0V, LX Voltage which Lx pin voltage holding "L" level	1	1.4	1.78	V	②
Supply Current	Idd	Vin=Vce=3.6V, Vout=Vout×1.1	–	60	120	uA	③
Stand-by Current	Istb	Vin=3.6V, Vce=0V, Vout=Vout×1.1	–	0	1	uA	③
Frequency	FOSC	Iout=100mA	1020	1200	1380	KHz	①
PFM Switch Current	Ipfm	Vce=Vin, Iout=1mA	100	140	180	mA	①
Maximum Duty Ratio	Maxdty	Vce=Vin, Vout=0	100	–	–	%	④
Minimum Duty Ratio	Mindty	Vce=Vout=Vin	–	–	0	%	④
Efficiency	EFFI	Vce=Vin=3.0V, Iout=100mA	–	90	–	%	①
Lx SW “H” ON Resistance	RlxH	Vce=0.5Vin, Vce=0V, Ilx=100mA	–	0.5	1.2	Ω	⑤
Lx SW “L” ON Resistance	RlxL	Vce=0.5Vin, Ilx=100mA	–	0.6	1.4	Ω	–
Lx SW “H” Leak Current	IleakH	Vin=Vout=5.0V, Vce=0V, Lx=0V	–	0.01	1	uA	⑥
Lx SW “L” Leak Current	IleakL	Vin=Vout=5.0V, Vce=0V, Lx=5V	–	0.01	1	uA	⑥
Current Limit	Ilim	Vin=Vce=5.0V, Vout=0V	600	700	–	mA	⑦
Output Voltage	Vout/	Iout=30mA,-40℃≤Topr≤85℃	–	+100	–	ppm/℃	①

Temperature Characteristics	(Vout*⊿topr)						
CE “H” Voltage	VceH	Vout=0V	0.9	–	Vin	V	⑧
CE “L” Voltage	VceL	Vout=0V	Vss	–	0.3	V	⑧
CE “H” Current	Iceh	Vin=Vce=5.5V，Vout=0V	-0.1	–	0.1	uA	⑧
CE “L” Current	Icel	Vin=5.5V，Vce=0V，Vout=0V	-0.1	–	0.1	uA	⑧
Soft-Start Time	Tss	Vce=0V～Vin，Iout=1mA	0.5	1.0	3.0	msec	①
Latch Time	Tlat	Vin=Vce=5.0V	1	–	20	msec	⑨

ME3101A33 （Unless Otherwise Stated ,VIN=5V，FOSC=1.2MHz, Cin=4.7uF，CL=10uF，L=3.3uH，Ta=25℃）

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	CIRCUIT
Output Voltage	Vout	Vce=Vin,Iout=30mA	3.234	3.3	3.366	V	①
Operating Voltage Range	Vin		2	–	6	V	①
Maximum Output Current	Iout.max	VIN=4.5V	500	–	–	mA	①
U.V.L.O . Voltage	Vuvlo	Vce=Vin,Vout=0V, LX Voltage which Lx pin voltage holding "L" level	1	1.4	1.78	V	②
Supply Current	Idd	Vin=Vce=5V，Vout=Vout×1.1	–	60	120	uA	③
Stand-by Current	Istb	Vin=5V，Vce=0V，Vout=Vout×1.1	–	0	1	uA	③
Frequency	FOSC	Iout=100mA	1020	1200	1380	KHz	①
PFM Switch Current	Ipfm	Vce=Vin，Iout=1mA	100	140	180	mA	①
Maximum Duty Ratio	Maxdty	Vce=Vin，Vout=0	100	–	–	%	④
Minimum Duty Ratio	Mindty	Vce=Vout=Vin	–	–	0	%	④
Efficiency	EFFI	Vce=Vin=4.5V，Iout=100mA	–	93	–	%	①
Lx SW “H” ON Resistance	RlxH	Vce=0.5Vin，Vce=0V，Ilx=100mA	–	0.5	1.2	Ω	⑤
Lx SW “L” ON Resistance	RlxL	Vce=0.5Vin，Ilx=100mA	–	0.6	1.4	Ω	–
Lx SW “H” Leak Current	IleakH	Vin=Vout=5.0V，Vce=0V，Lx=0V	–	0.01	1	uA	⑥
Lx SW “L” Leak Current	IleakL	Vin=Vout=5.0V，Vce=0V，Lx=5V	–	0.01	1	uA	⑥
Current Limit	Ilim	Vin=Vce=5.0V，Vout=0V	600	700	–	mA	⑦
Output Voltage	Vout/	Iout=30mA,-40℃≤Topr≤85℃	–	±100	–	ppm/℃	①

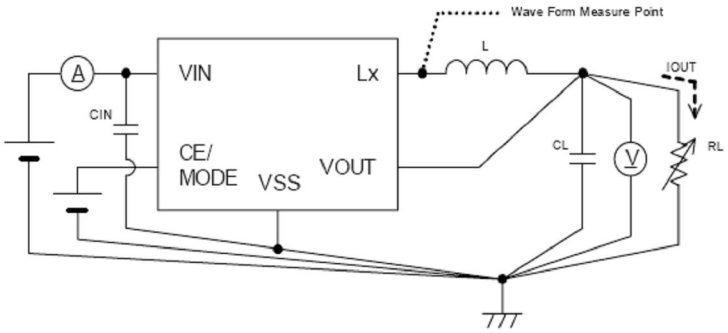
Temperature Characteristics	(Vout*⊿topr)						
CE “H” Voltage	VceH	Vout=0V	1.1	–	Vin	V	⑧
CE “L” Voltage	VceL	Vout=0V	Vss	–	0.3	V	⑧
CE “H” Current	Iceh	Vin=Vce=5.5V，Vout=0V	-0.1	–	0.1	uA	⑧
CE “L” Current	Icel	Vin=5.5V，Vce=0V，Vout=0V	-0.1	–	0.1	uA	⑧
Soft-Start Time	Tss	Vce=0V～Vin，Iout=1mA	0.5	1.0	3.0	msec	①
Latch Time	Tlat	Vin=Vce=5.0V	1	–	20	msec	⑨

Note On Use：

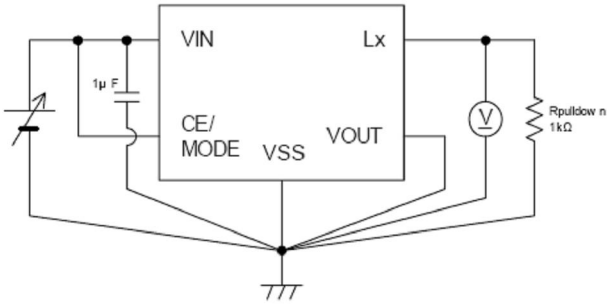
1. Use Ceramic Capacitor will achieve low ripple and high efficiency.
2. When the difference between VIN and VOUT is large in PWM control, very narrow pulses will be outputted, and there is the possibility that some cycles may be skipped completely.
3. When the difference between VIN and VOUT is small, and the load current is heavy, very wide pulses will be outputted and there is the possibility that some cycles may be skipped completely: in this case, the Lx pin may not go low at all.
4. With the IC, the peak current of the coil is controlled by the current limit circuit. Since the peak current increases when dropout voltage or load current is high, current limit starts operating, and this can lead to instability. When peak current becomes high, please adjust the coil inductance value and fully check the circuit operation. In addition, please calculate the peak current according to the following formula:
   Ipk = (VIN-VOUT) * On Duty / (2* L* FOSC) + IOUT
   L: Coil Inductance Value
   FOSC: Oscillation Frequency
5. When VIN is less than 2.4V, limit current may not be reached because voltage falls caused by ON resistance.
6. Care must be taken when laying out the PC Board, in order to prevent misoperation of the current limit mode. Depending on the state of the PC Board, latch time may become longer and latch operation may not work. In order to avoid the effect of noise, the board should be laid out so that capacitors are placed as close to the chip as possible.
7. Use of the IC at voltages below the recommended voltage range may lead to instability.
8. When the IC is used in high temperature, output voltage may increase up to input voltage level at no load because of the leak current of the driver transistor.

Typical Applications

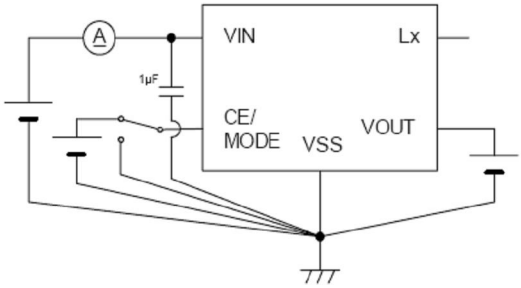
Circuit ①



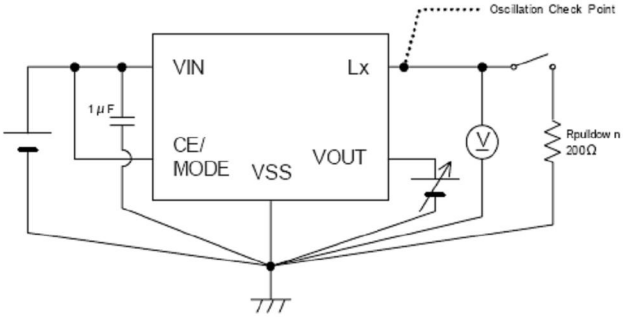
Circuit ②



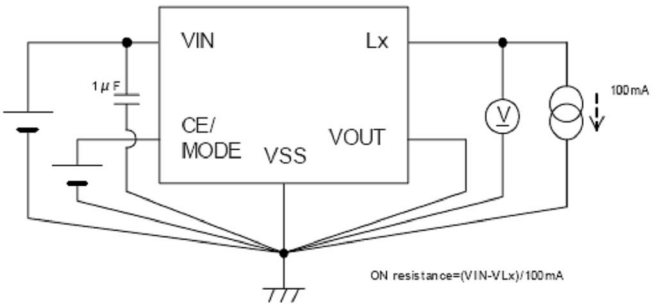
Circuit ③



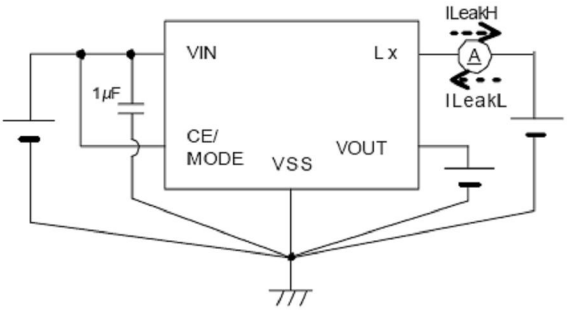
Circuit ④



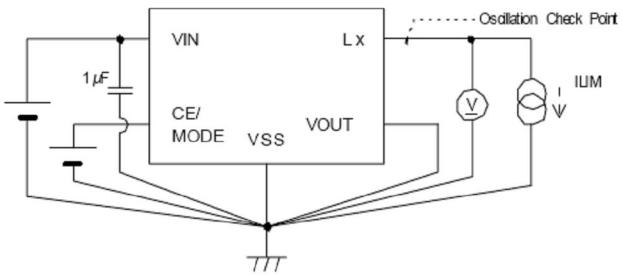
Circuit ⑤



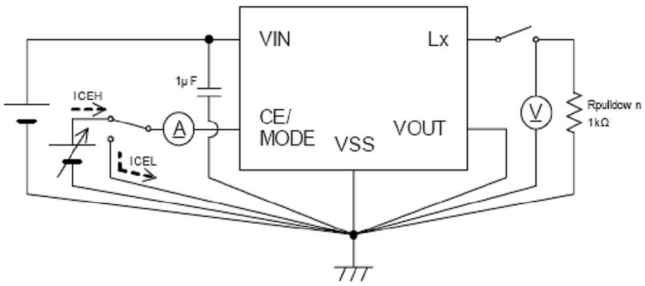
Circuit ⑥



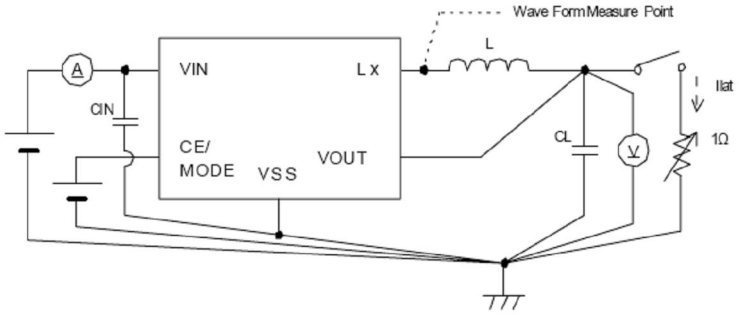
Circuit ⑦



Circuit ⑧

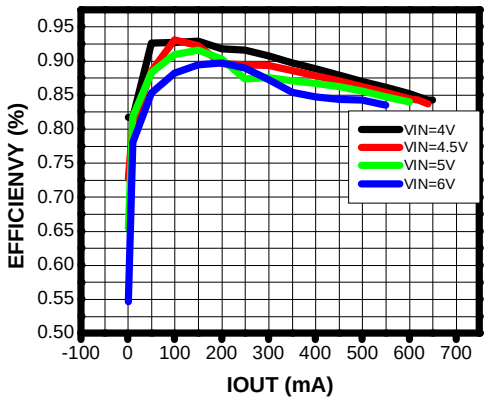


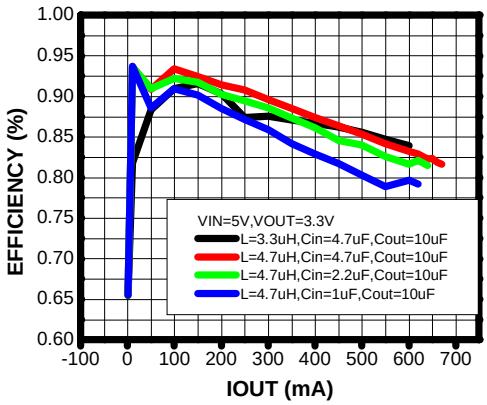
Circuit ⑨

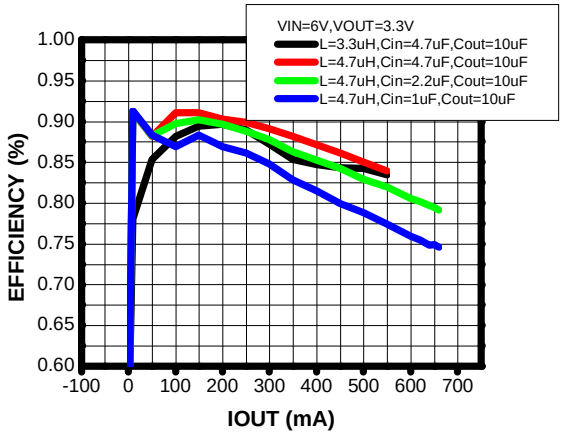


Type Characteristics

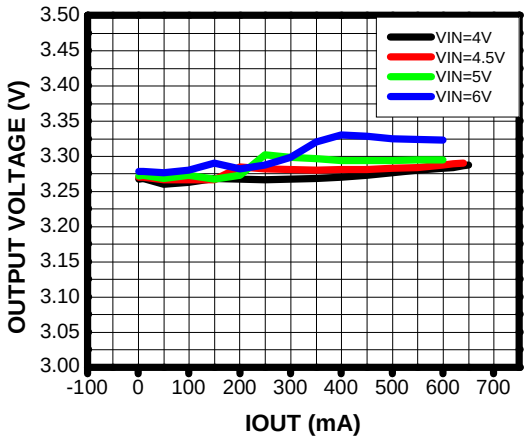
(1) Efficiency vs. Output Current



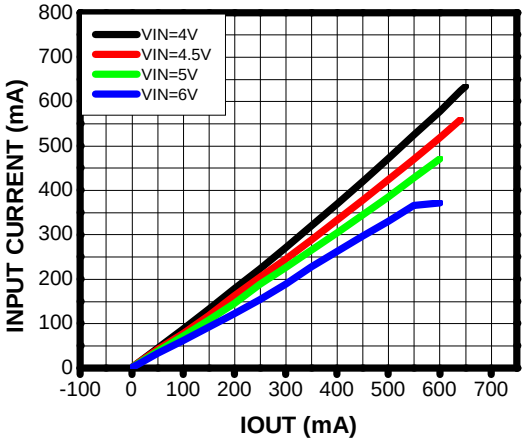




(2) Output Voltage vs. Output Current

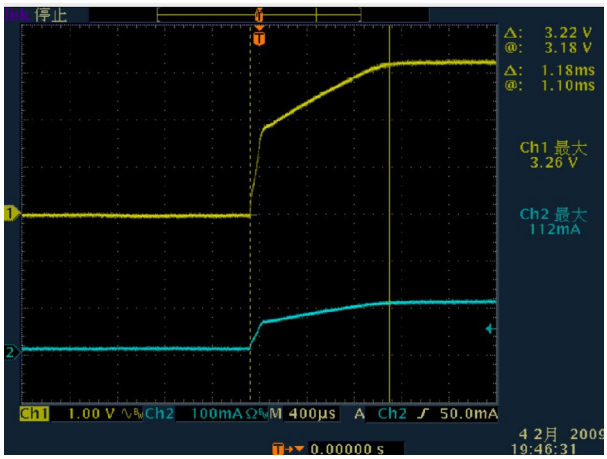


(3) Input Current vs. Output Current

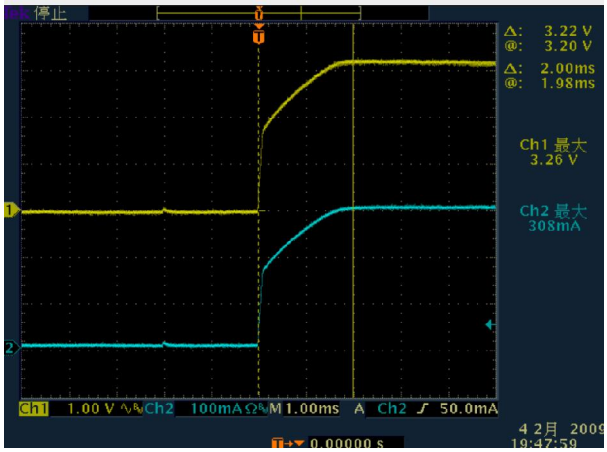


(4) Linear Transient Response Time

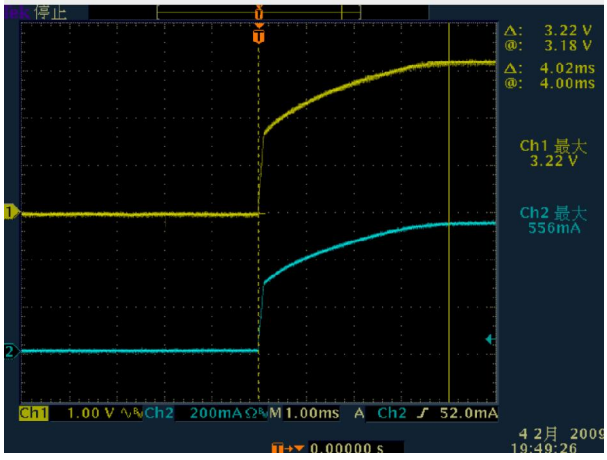
R=33Ω,IOUT=100mA，VIN=0~5V



R=11Ω,IOUT=300mA，VIN=0~5V

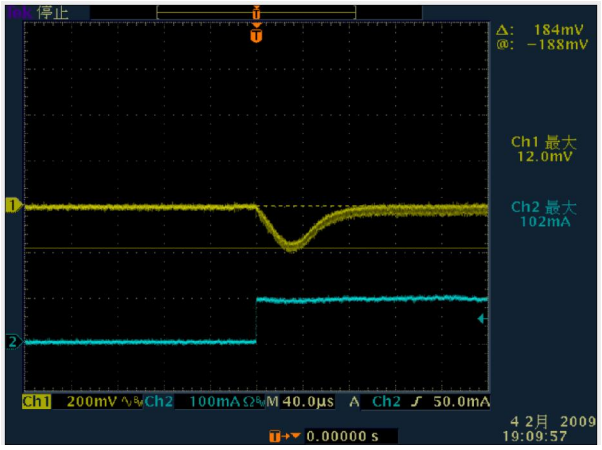


R=6Ω,IOUT=550mA，VIN=0~5V

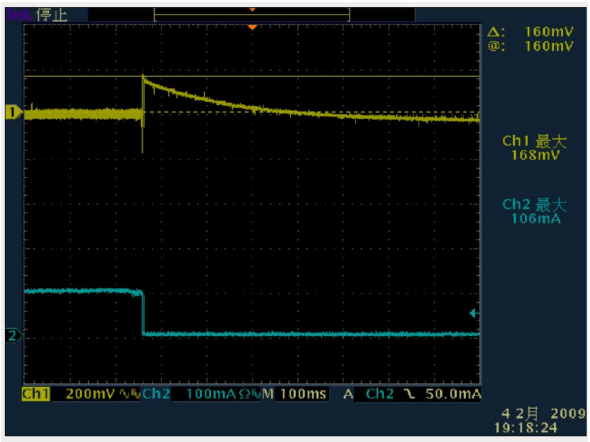


(5) Load Response

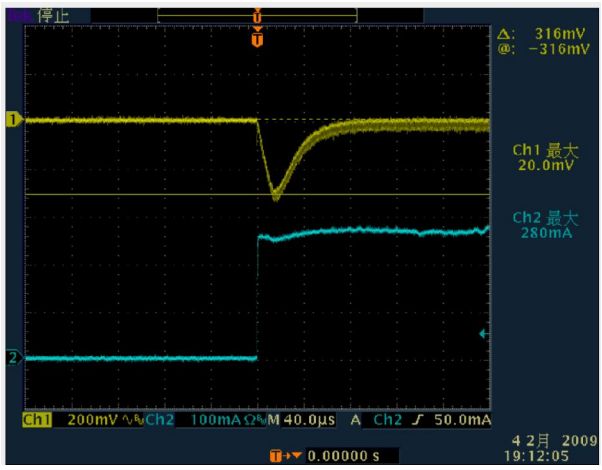
VIN=5V,IOUT=0~100mA



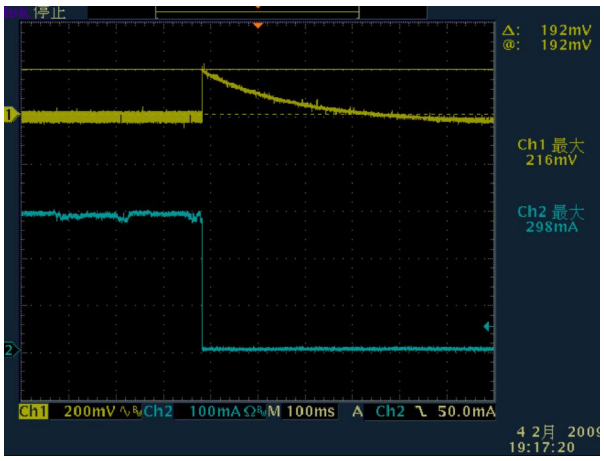
VIN=5V,IOUT=100~0mA



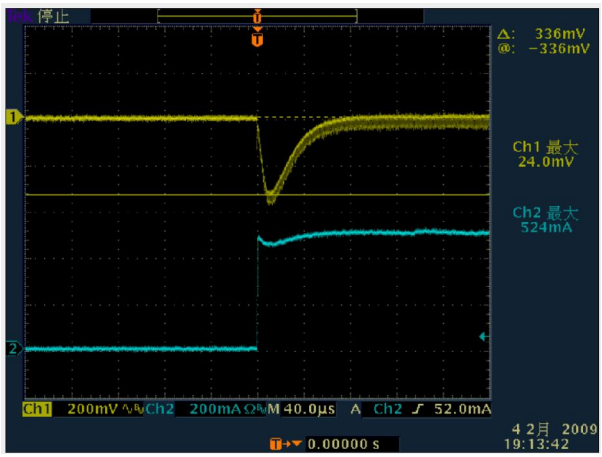
VIN=5V,IOUT=0~300mA



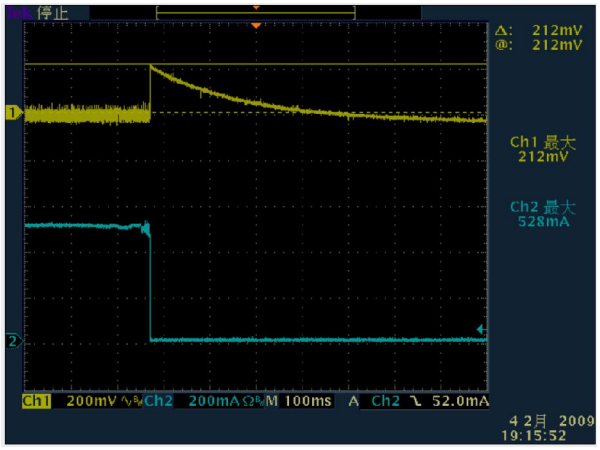
VIN=5V,IOUT=300~0mA



VIN=5V,IOUT=0~550mA

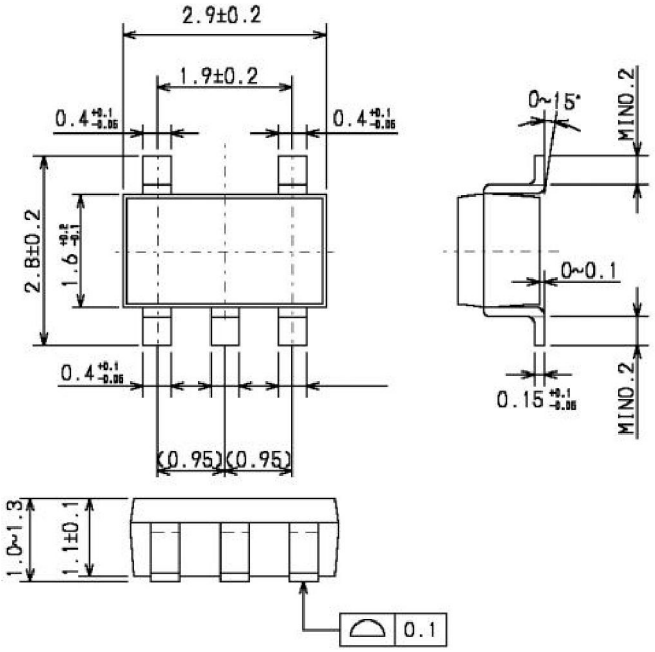


VIN=5V,IOUT=550~0mA



Packaging Information

SOT23-5



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