Ultra-Low Quiescent 760nA Synchronous Step-Down DC/DC Converter

Description

ME3107 is a high efficiency, easy-to-use, ultra-low quiescent 760nA synchronous step-down DC/DC converter with an input voltage range of 2.06V to 6.0V, the output voltage can be set internally, ranging from 1.0v to 4.0v. And it can drive an output current of 200mA.

With built-in PMOS driver and NMOS rectifier and it only needs two ceramic Capacitors and an inductor outside. PFM control achieves low static current consumption. It is particularly suitable for small, high-efficiency, battery-powered equipment.

With UVLO function and it will not work if the input voltage is less than 2.0V (TYP). When it enters the off state, the system can quickly discharge the charge of the output capacitor through the internal circuit.

Feature

- Output current：200mA
- Efficiency：91%
- Input Voltage：2.06~6.0V
- Output Voltage accuracy:1.8V(±3%); 3.0V(±2.0%), 3.3V(±2.0%)
- Quiescent Current： 760nA(@$V_{OUT(T)}$=1.8V TYP)
- PFM Operation
- PFM current ： 360mA(TYP)
- UVLO and short-circuit protection
- Operation Ambient Temperature：-40~+85℃
- Only need two ceramic Capacitors and an inductor.

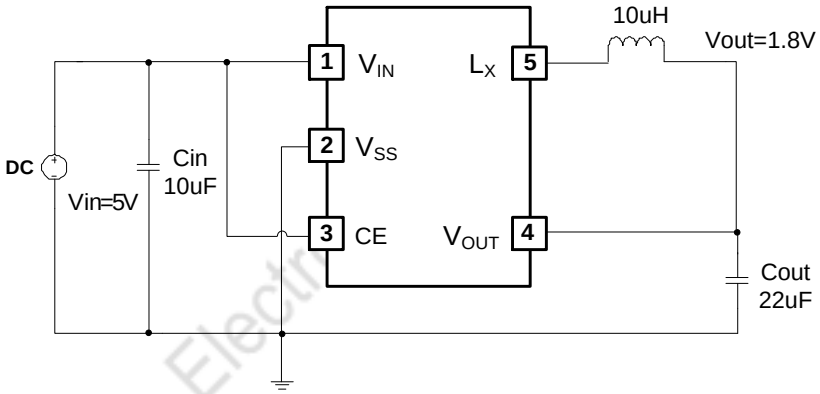
Applications

- Hand-Held Devices, Portable Information
- Battery Powered Equipment
- Wearable Devices
- Smart Watch

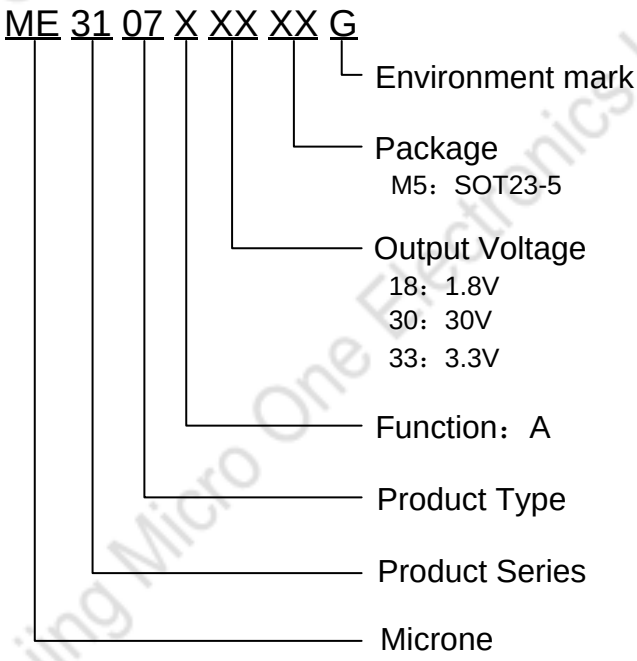
Package

- 5-pin SOT23-5

Typical Application Circuit

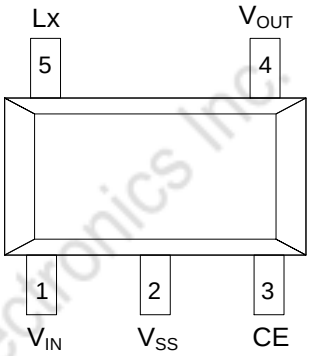


Selection Guide



product serise	product description
ME3107A18M5G	V_{OUT}=1.8V, built-in MOSFET, Package: SOT23-5
ME3107A30M5G	V_{OUT}=3.0V, built-in MOSFET, Package: SOT23-5
ME3107A33M5G	V_{OUT}=3.3V, built-in MOSFET, Package: SOT23-5

Pin Configuration

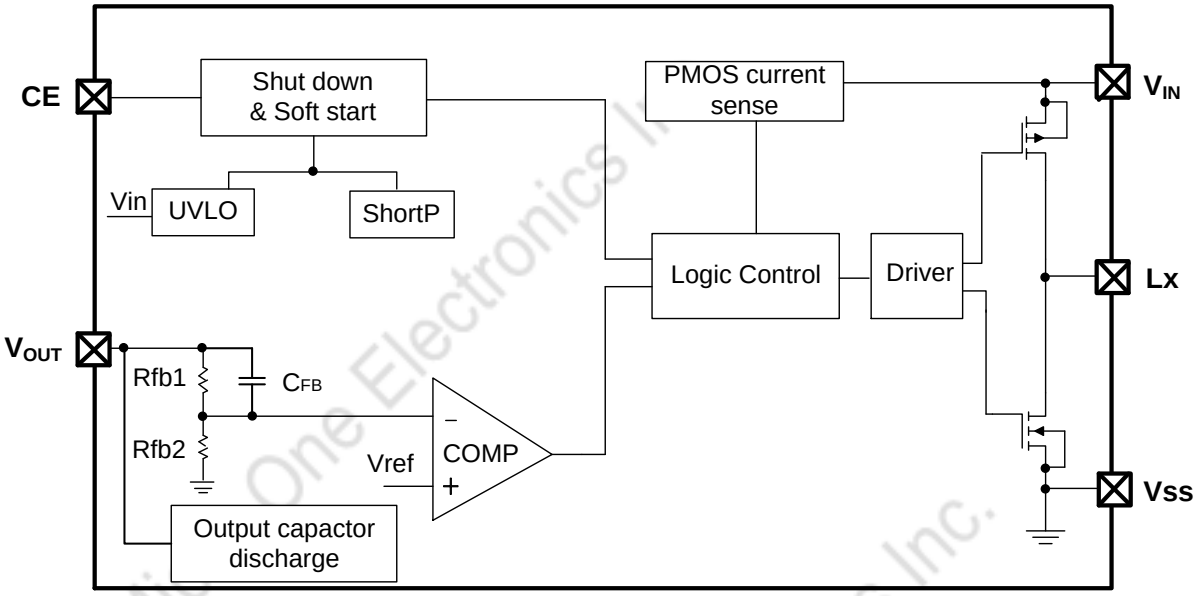


SOT23-5

Pin Assignment

PIN Number	symbol	Function
1	V_{IN}	Input
2	Vss	Ground
3	CE	Enable
4	V_{OUT}	Output
5	Lx	Switch

Block Diagram



Absolute Maximum Ratings

Parameter	Symbol	Ratings	Units
Input Voltage	V_{IN}	-0.3~6.5	V
Lx Pin Voltage	V_{Lx}	-0.3~6.5	V
CE Pin Voltage	V_{CE}	-0.3~6.5	V
V_{OUT} Voltage	V_{OUT}	-0.3~6.5	V
Internal Power Dissipation (SOT23-5)	Pd	600	mW
Thermal resistance (Junction to air) (SOT23-5)	θ_{JA}	210	℃/W
Operating Ambient Temperature Range	T_{Opr}	-40~+85	℃
Storage Temperature Range	T_{stg}	-55~+150	℃
Maximum junction temperature	T_J	-40~+150	℃

Electrical Characteristic

ME3107 test conditions：V_{IN}=3.6V, Topt=25℃ $V_{OUT(T)}$=Set values。 unless otherwise noted.

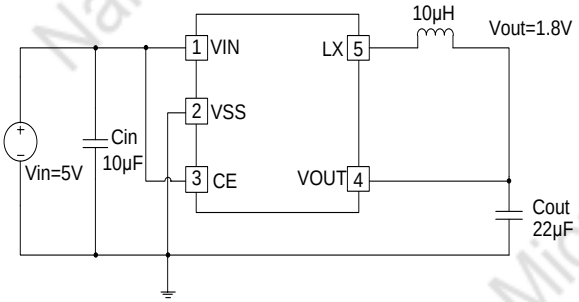
Parameter	Symbol	Condition		Min	Typ	Max	Unit	Circuit
Input Voltage Range	V_{IN}			2.7	-	6	V	
Output Voltage	V_{OUT}	I_{OUT}=10mA，V_{IN}=V_{CE}=3.6V	ME3107A18	1.746	1.8	1.854	V	1
		I_{OUT}=10mA V_{IN}=V_{CE}=5.0V	ME3107A30	2.94	3.0	3.06	V	1
			ME3107A33	3.234	3.3	3.366	V	1
UVLO Voltage	V_{UVLO}	V_{CE}=2V, I_{OUT}=20mA V_{IN}= 1.98V⟶ 2.1V，Scanning upward, the VIN voltage value when the VOUT terminal voltage changes from low to high		2.0	2.03	2.06	V	1
UVLO Hysteresis Voltage	$V_{UVLOHYS}$	V_{CE}=2V, I_{OUT}=20mA V_{IN}= 2.1V⟶ **1.95**V Scan down, the VIN voltage value when the VOUT terminal voltage changes from high to low, and then make the difference with VUVLO+ value		0.005	0.03	0.075	V	1
DC Bias Current	I_q	V_{IN}=V_{CE}=V_{OUT}=2.3V	ME3107A18	0.5	0.76	1.0	μA	3
		V_{IN}=V_{CE}=V_{OUT}=3.5V	ME3107A30	0.6	0.80	1.5	μA	3
		V_{IN}=V_{CE}=V_{OUT}=3.8V	ME3107A33	0.6	0.85	1.5	μA	3
Standby current	I_{SBY}	V_{CE}=0V		-	0.1	1.0	μA	3
Switch ON Resistance, High	R_{PMOS}	V_{IN}=V_{CE}=5V，V_{OUT}=0V，I_{OUT}=100mA		-	0.4	0.6	Ω	4
Switch ON Resistance, Low(*1)	R_{NMOS}			-	0.4	-	Ω	
Switching Leakage Current	I_{LeakH}	V_{IN}=5V，V_{CE}=V_{OUT}=0V，LX=0V		-	0.1	1.0	μA	3
	I_{LeakL}	V_{IN}=5V，V_{CE}=V_{OUT}=0V，LX=5V		-	0.1	1.0	μA	3
PFM Current Limit	I_{PFM}	V_{IN}=V_{CE}=3.6V，I_{OUT}=1mA		280	360	410	mA	1
Enable Input Voltage	V_{CEH}	V_{OUT}=0V，LX conncts100Ω to GND, V_{CE}=0.5V—>1.2V, when LX changes to Vin		1.2	-	6.0	V	2
	V_{CEL}	V_{OUT}=0V，LX conncts100Ω to GND, V_{CE}=1.5V—>0.4V, when LX changes to” Vss”		Vss	-	0.3	V	2
Short Protection Threshold Voltage	V_{SHORT}	LX connects register to GND, V_{IN}=V_{CE}=5V, when LX changes “V_{IN}” to “Vss” V_{OUT}=V_{OUT}(T)+0.1V→0V		0.55	0.68	0. 9	V	2

Comparator on voltage	V_{ON}	VIN=VCE=2.5V, VOUT=2.0V —> 1.720V，Scan downward to test the voltage at LX terminal. When the voltage at LX terminal is greater than or equal to 2.48 V, the VOUT is V_{ON}		1.736	1.780	1.836	V	5
Efficiency	η	Vin=3.6V, I_{OUT}=1mA~200mA	ME3107A18	89	91	93	%	1
		Vin=4.2V, I_{OUT}=1mA~200mA	ME3107A30	90	94	96	%	1
		Vin=5.0V, I_{OUT}=1mA~200mA	ME3107A33	90	95	96	%	1
Cout Discharge	R_{DCHG}	V_{IN}=V_{OUT}=5V,V_{CE}=0V, L_X=OPEN		65	80	105	Ω	3

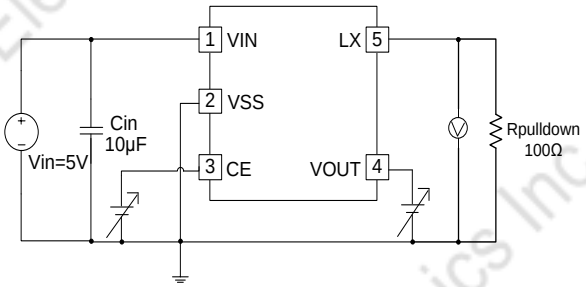
NOTES：(*1) Design value for the ME3107 series.

Test Circuits

Circuit No.1



Circuit No.2



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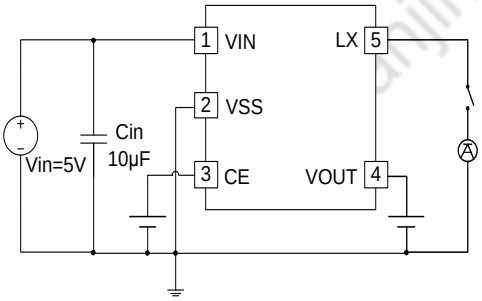
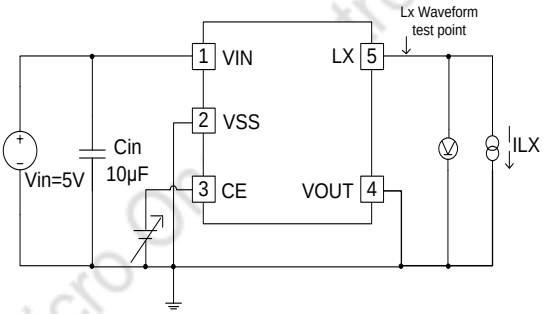
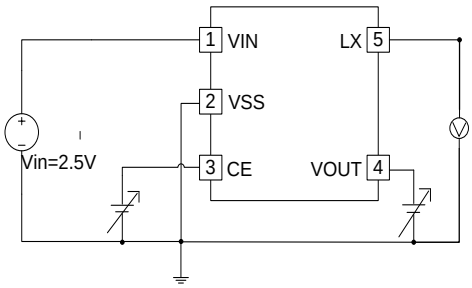


Circuit No.4

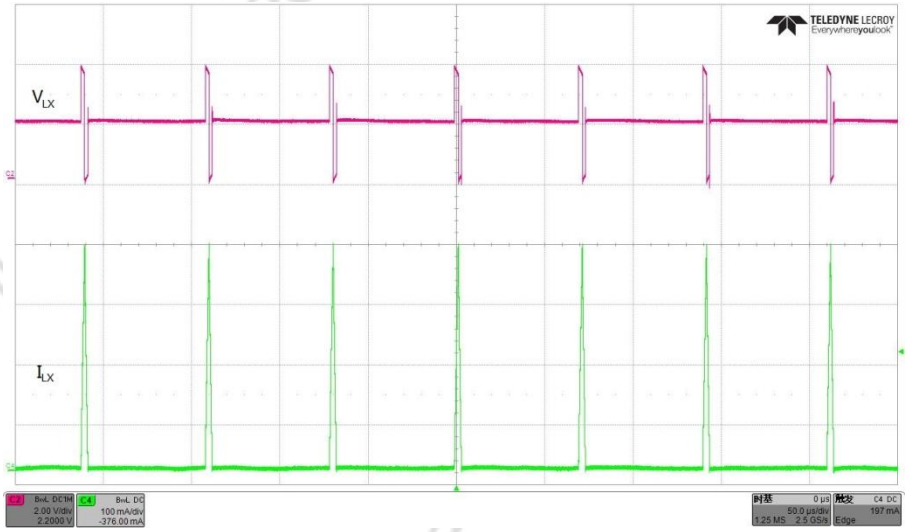


Circuit No.5

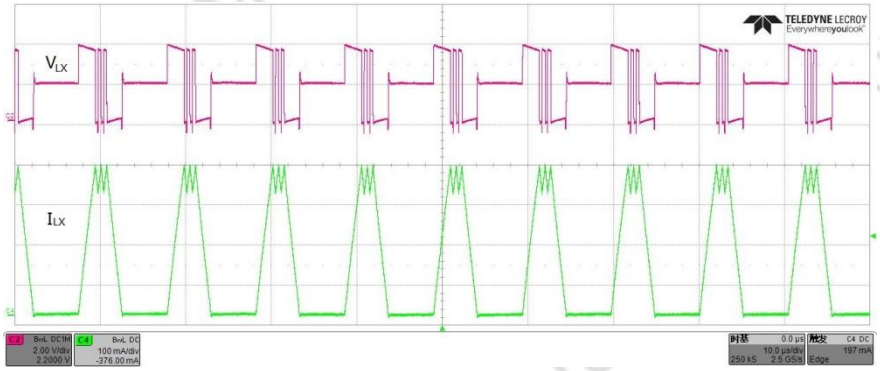


Operation Principles

The ME3107 is a synchronous low voltage step-down DC/DC converter that can support the input voltage range of 2.0V to 6.0V and the output current can be up to 200mA(TYP) and with ultra-low quiescent 760nA(TYP). The output voltage is 1.8V,under no-load conditions, the operating current does not exceed 3uA. Under light load conditions, the driver PMOS is opened by the comparator and the current flowing through the inductor is sampled. When the current limit is reached at 360 mA (TYP), the PMOS is turned off and the rectifier is turned on. After the inductor current is discharged, the zero-crossing detection circuit will turn off the rectifier and short-circuit the LX terminal to V_{OUT}. See the Fig below.



If the load is heavy, after one cycle of charging, and reaching the current limit point, FB is still lower than the reference voltage and then after a fixed discharge time, turns on the driver PMOS again, charge the inductor, reach the current limit point, discharge again, and so on. Until the FB voltage is greater than the reference voltage. See the Fig below.



Start mode

In order to prevent overshoot of the output voltage, the startup mode is entered when the chip is just powered up. The startup mode will shield the chip's short-circuit protection until V_{FB} is greater than 0.8 times V_{REF}. The chip will exit the start mode. In start mode, the inductor current is still limited by I_{PFM}, and the time of a fixed discharge. The rectifier is now closed until the end of the startup mode

Enable

A logic-high enables the converter; a logic-low forces the device into shutdown mode. When enable the chip, it

will work after 160us delay.

UVLO

If the V_{IN} lower than threshold voltage 2.0V (TYP), the UV comparator's output will go high and the switch controller will turn off the high side MOSFET. If the V_{IN} higher than2.03V (typical value), the controller will resume the working state.

Short-circuit protection function

The ME3107 has short-circuit protection function. When the load is shorted or the load current is huge making the output voltage below 0.68V (TYP), it enters into shutdown mode and couldn't work again except restart the CE pin or the V_{IN} pin.

Switching Current limit (I_{PFM})

The internal current limiting circuit of ME3107 detects the inductor current. Once the current flowing through the PMOS reaches the current limit value, the peak current reaches 360mA (typ.), and the current limiting circuit immediately turns off the PMOS transistor to end the charging cycle of the inductor current.

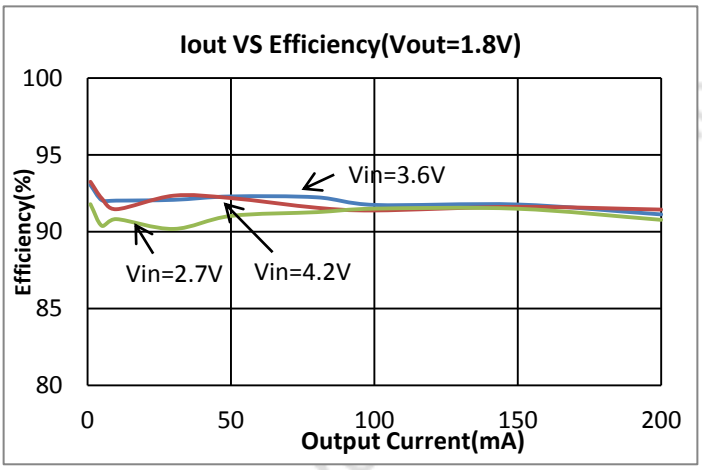
Output Capacitor Discharge

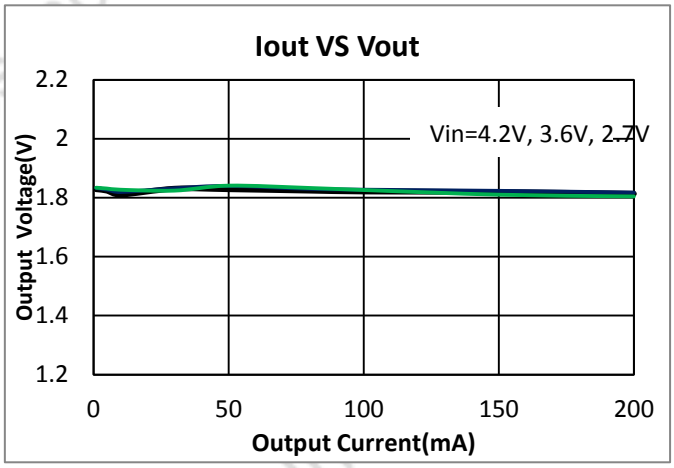
The ME3107 integrates output voltage high speed discharge function. When the ME3107 is shutdown, the output voltage will be discharged via the device internal.

Typical Performance Characteristics

ME3107A18M5G

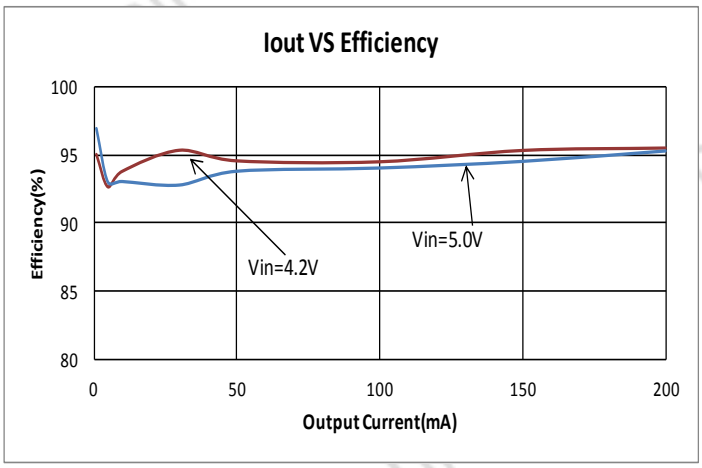
L=10μH, Cin=10uF, Cout=22uF

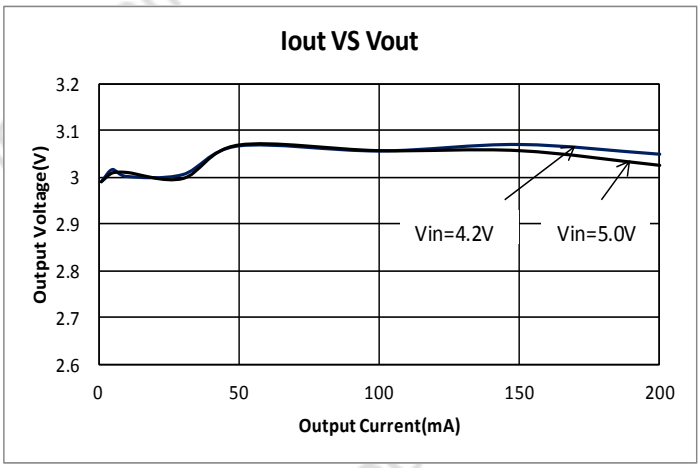




ME3107A30M5G

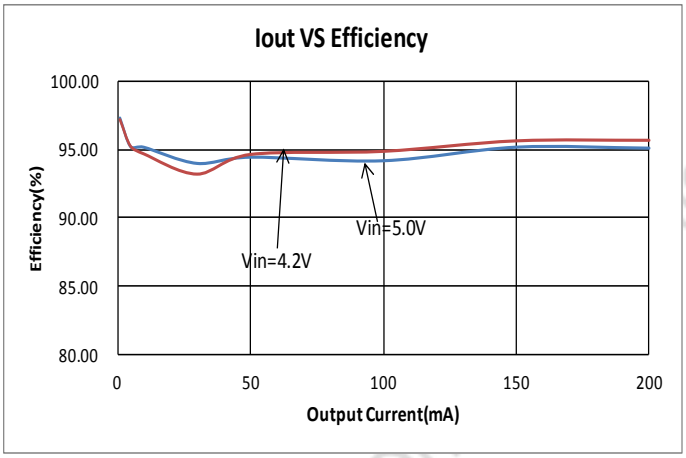
L=10μH, Cin=10uF, Cout=22uF

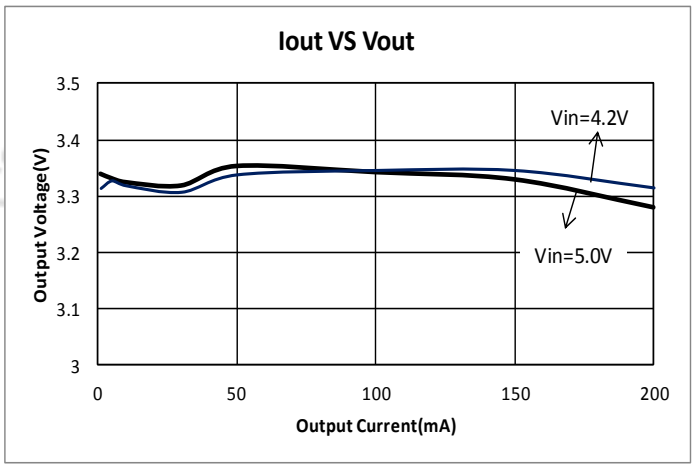




ME3107A33M5G

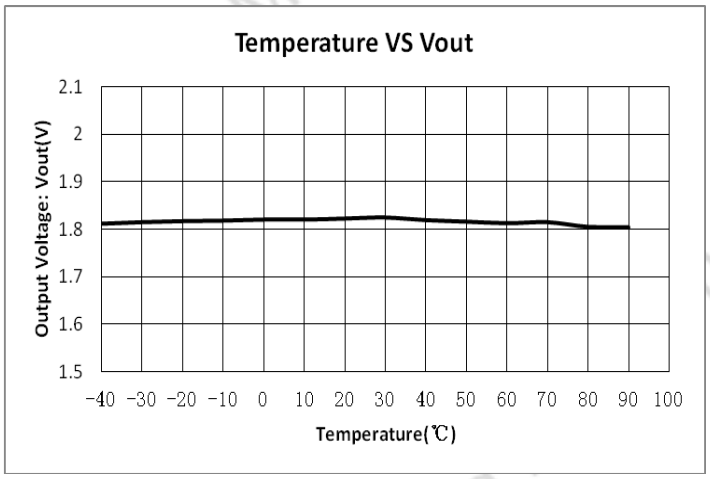
L=10μH, Cin=10uF, Cout=22uF





ME3107A18M5G

L=10μH, Cin=10uF, Cout=22uF

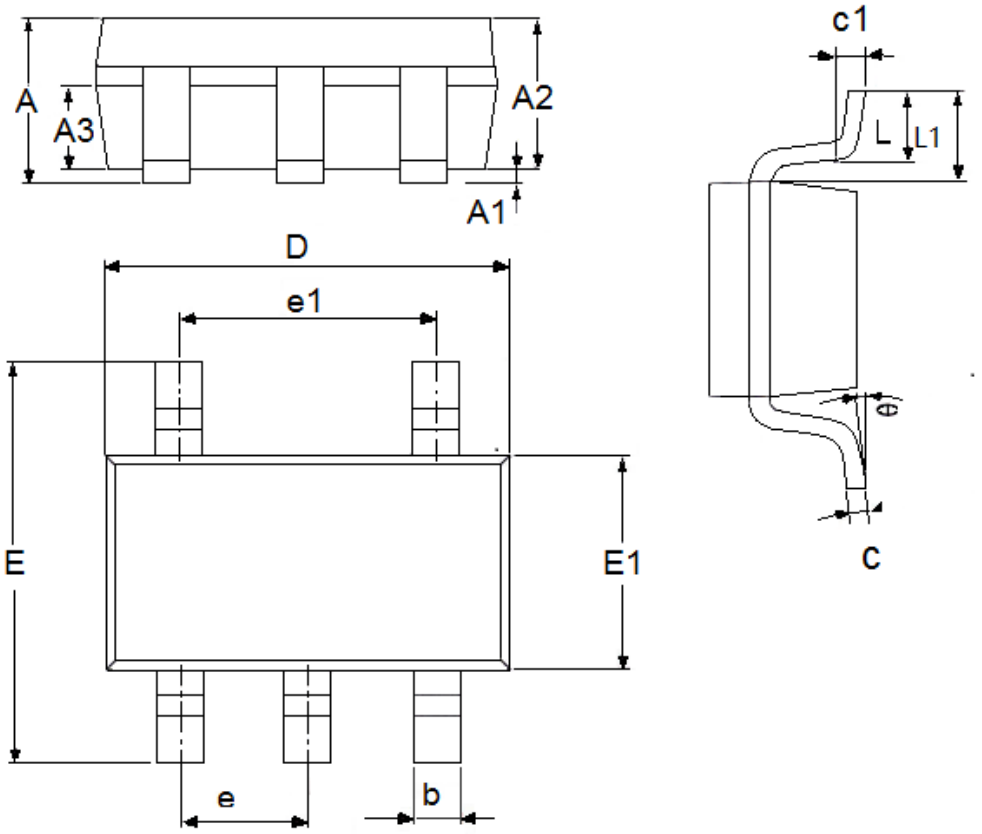


Package Quantity

Package Type	Minimum Packing QTY	UNITS	Small Box	Large BOX
SOT23-5	3000	Tape & Reel	30K	120K

Packaging Information

- **Packaging Type: SOT23-5**



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.05	1.45	0.0413	0.0571
A1	0	0.15	0.0000	0.0059
A2	0.9	1.3	0.0354	0.0512
A3	0.6	0.7	0.0236	0.0276
b	0.25	0.5	0.0098	0.0197
c	0.1	0.23	0.0039	0.0091
D	2.82	3.05	0.1110	0.1201
e1	1.9(TYP)		0.0748(TYP)	
E	2.6	3.05	0.1024	0.1201
E1	1.5	1.75	0.0512	0.0689
e	0.95(TYP)		0.0374(TYP)	
L	0.3	0.6	0.0118	0.0236
L1	0.59(TYP)		0.0232(TYP)	
θ	0	8°	0.0000	8°
c1	0.2(TYP)		0.0079(TYP)	

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