5V 3A Ultralow Dropout Linear Regulator

General Description

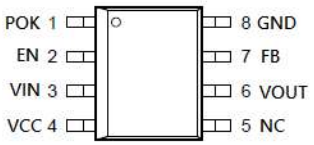
The ZCC9059 is a 3A low dropout linear regulator designed for low dropout and high current applications. This device works with dual supplies, a control input for the control circuitry and a power input as low as 0.9V for providing current to output. It features 3A output current and ultra-low-drop output voltage as well as full protection functions. VOUT can be as low as 0.792V.

The other features include soft start, under voltage protection, current limit protection, Power-On-Reset function, and over temperature protection. The ZCC9059 is available in ESOP8 packages.

Applications

- Notebook, Netbook, Graphic Cards
- Low Voltage Logic Supplies
- Chipset Supplies
- Server System
- SMPS Post Regulators

Pin Configuration



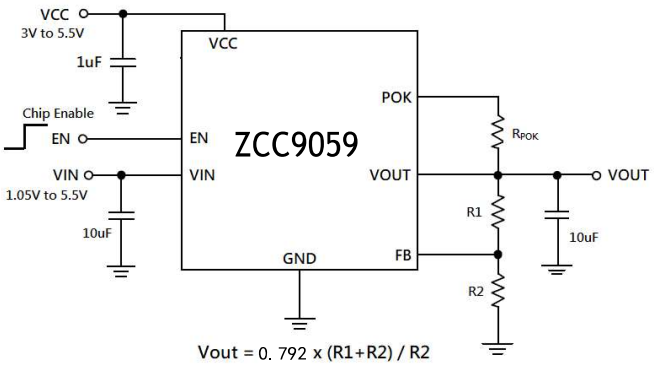
Ordering Information

Part Number	Package	Body Size
ZCC9059	ESOP8	ZCC9059
		X-XX-XX

Features

- VIN Range 0.9V to 5.5V
- VOUT is Adjustable (0.8V to 4.0V)
- Excellent Line Regulation (0.01%/V typ.)
- Excellent Load Regulation(0.1%/A typ.)
- Dropout Voltage Typically 350 mV at IOUT = 3A
- Internal Thermal Overload Protection
- Internal Short-Circuit Current Limit
- VOUT Under Voltage Protection
- Ceramic Capacitor Stable

Typical Application Circuit

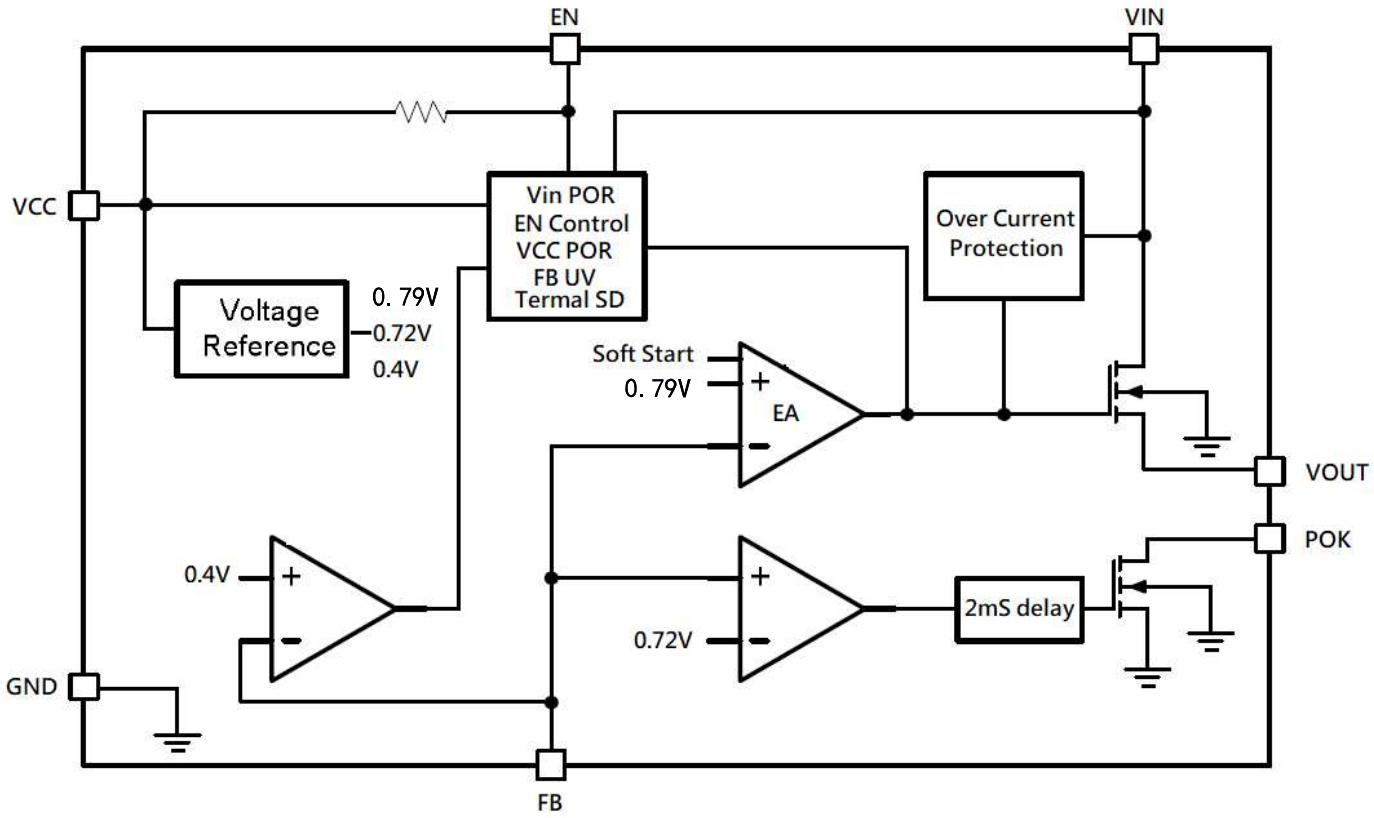


Ceramic Capacitor Stable

Pin Assignment

Pin Name	Pin No. ESOP8	Pin Function
POK	1	Power OK indication, open drain output.
FB	7	Feedback
VOUT	6	Output Voltage pin, the Source of power device.
VIN	3	Input Voltage pin, the Drain of power device.
EN	2	Enable pin. Internal pull high to VCC
VCC	4	Supply input of control circuit.
GND	2&(Exposed PAD)	Ground
NC	5	Non connect

Function Block Diagram



Absolute Maximum Ratings (Note1)

- VIN ---------- -0.3V to +6.0V
- VCC ---------- -0.3V to +6.0V
- Other pins ---------- -0.3V to (VCC+0.3V)
- Junction Temperature---------- 125°C
- Lead Temperature (Soldering, 10 sec.)---------- 300°C
- Storage Temperature ---------- –65°C to 150°C

Recommended Operating Conditions

- VIN ---------- +1.05V to VCC
- VCC ---------- +3.0V to +5.5V
- Junction Temperature ---------- 0°C to 125°C

Electrical Characteristics

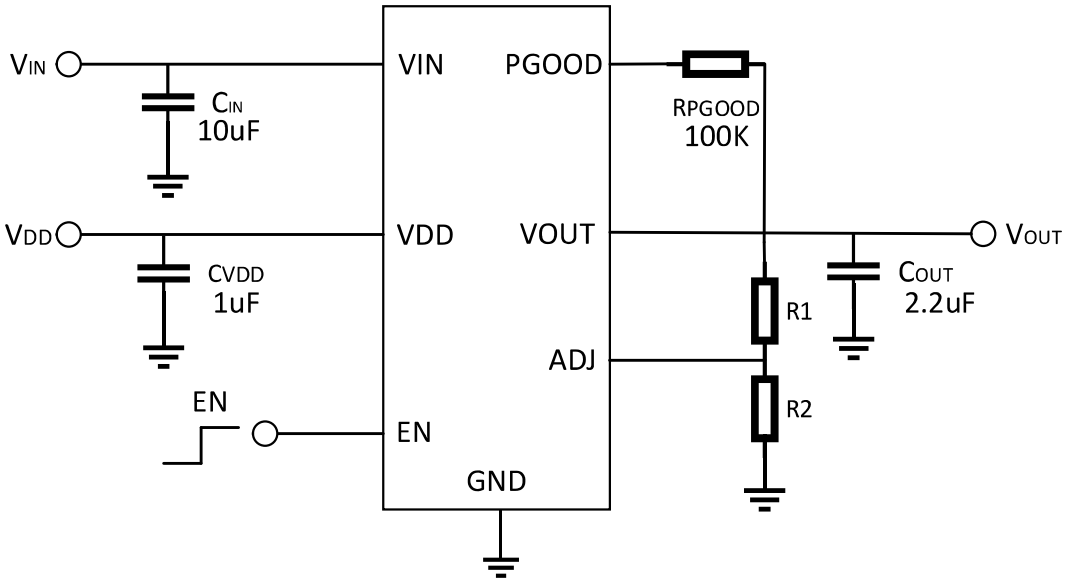
VCC=5V, T_J=25℃, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Control Input Voltage VCC	VCC	VOUT= VREF	2.7	--	5.5	V
VCC POR Threshold	VCCPOR		2.0	--	2.5	V
VCC POR Hysteresis	VCCHY		--	0.2	--	V
Power Input Voltage VIN	VIN	VOUT= VREF	0.9	--	VCC-1.5	V
VIN POR Threshold	VINPOR		0.69	0.79	0.89	V
VIN POR Hysteresis	VINHY		0.07	0.1	0.13	V
VIN POR Deglitch Time	TDEG		--	100	--	uS
Control Input Current in Shutdown	IVCCSD	VIN=VCC=5V, VEN=0V	--	0.3	0.8	uA
Quiescent Current	IQ	VIN=VCC= VEN =5V, IOUT=0A	--	0.02	0.039	mA
Reference Voltage	VREF	VIN=VCC= VEN =5V, IOUT=0A, VOUT=VREF	0.788	0.800	0.812	V
VIN Line Regulation	VREFLINE	1.05V<VIN<5V, VCC= VEN =5V	--	0.01	0.1	%/V
Load Regulation	VREFLOAD	0A<IOUT<3A, VCC= VEN =5V	--	0.1	0.5	%/A
Dropout Voltage	VDROP	IOUT=3A, VCC=5V, VOUT=1.2V	--	350	450	mV
VOUT Pull Low Resistance	RPULL	VCC= 5V, VEN =0V, Sink =5mA	--	--	150	ohm
Enable High Level	VEN		0.9	--	--	V
Disable Low Level	VSD		--	--	0.4	V
Enable Source Current	IEN	VCC= 5V, VEN =0V	--	0.15	--	uA
Enable pull high resistor	REN		500K	--	--	ohm
Output Voltage Ramp Up Time	TSS		0.4	1	2	mS

POK Threshold	VPOKH	VFB Rising	--	90	--	%
	VPOKL	VFB falling	--	10	--	%
POK Sink Voltage	VPOK	Sinking Current = 5mA	--	--	0.4	V
POK Delay Time	TPOKDE	From VOUT>92% to POK rising	--	1.1	--	mS
OCP Threshold Level	IOCP		3.2	4.5	--	A
Under Voltage Threshold	VUVP	VFB Falling	--	0.4	--	V
Thermal Shutdown Temperature	TSD		--	165	--	°C
Thermal Shutdown Hysteresis	TSDHY		--	30	--	°C
Power Supply Rejection Ratio	PSRR at VIN	PSRR-1Khz,Vin=Vout+0.3V,Iout=3A	--	60	--	DB
		PSRR-10Khz,Vin=Vout+0.3V,Iout=3A	--	40	--	
	PSRR at VCC	PSRR-1Khz,VCC=3~5.5V,Iout=3A	--	58	--	
		PSRR-10Khz,VCC=3~5.5V,Iout=3A	--	58	--	
VOUT Noise	Noise	IOUT=3A	--	57.6	--	uVrms
LOAD TRANSIENT	Vout-DIP	1mA- ＜3A in 1uS	--	80	--	mV
		1mA- ＜3A in 10uS	--	55	--	mV
	Vout-OV	3A- ＞1mA in 1uS	--	50	--	mV
		3A- ＞1mA in 10uS	--	30	--	mV

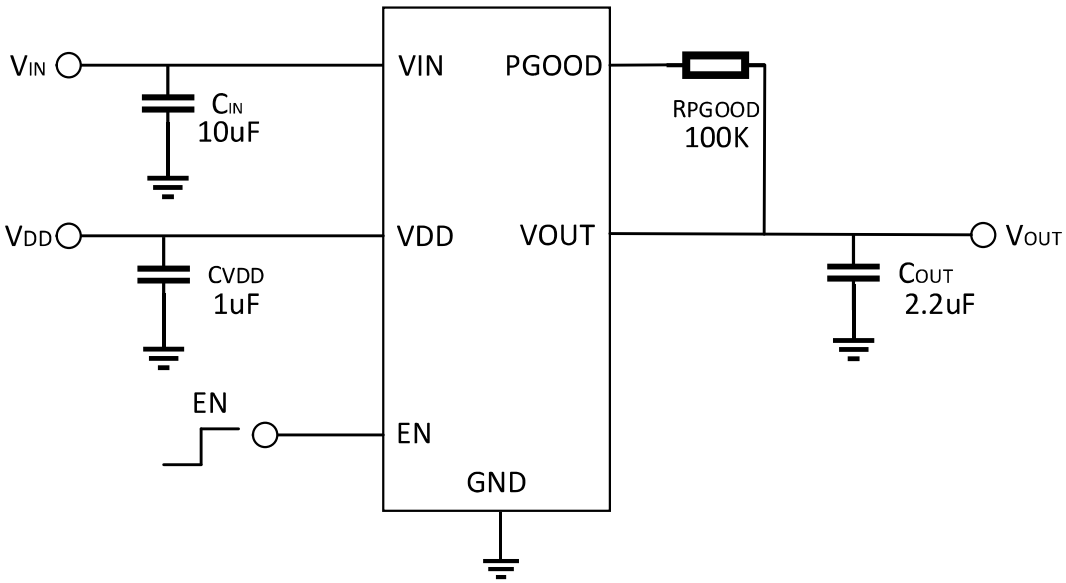
TYPICAL APPLICATION CIRCUIT

Adjusted VOUT Application



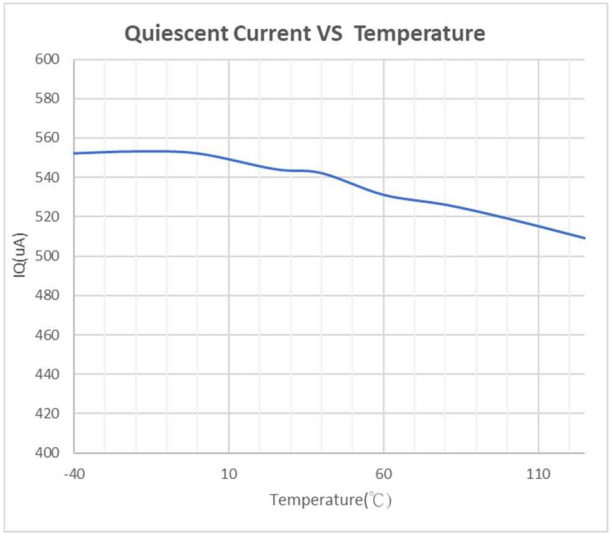
VOUT = 0.8 x (R1+R2)/R2

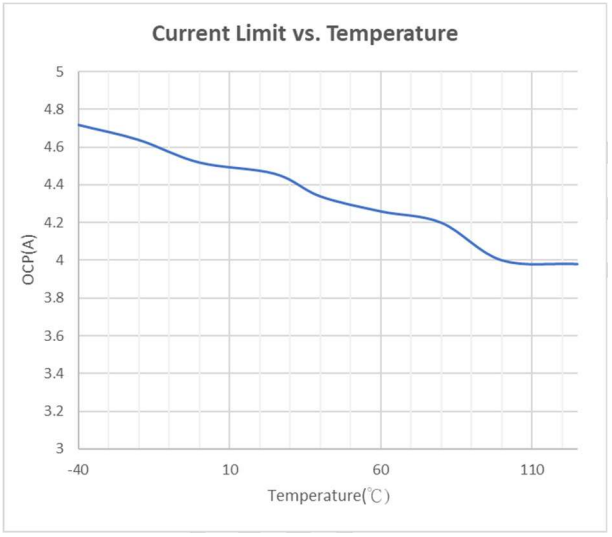
Fixed VOUT Application

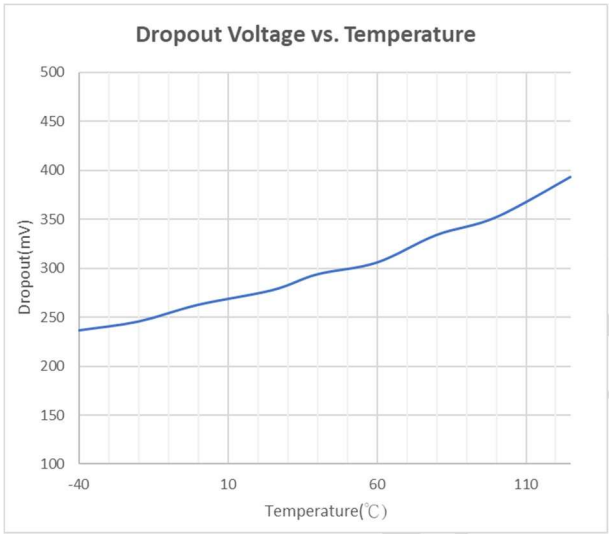


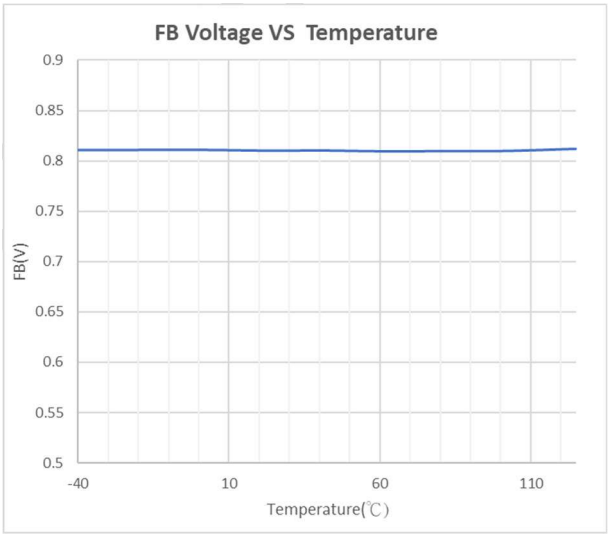
Typical Characteristics

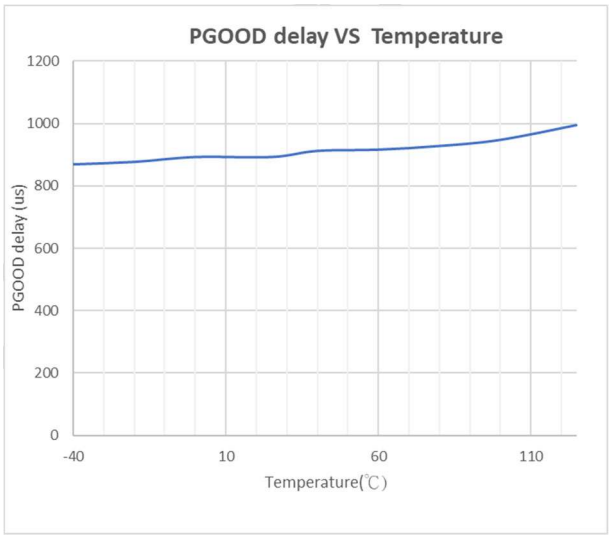
VIN=5V, VCC=5V, V_{OUT}=0.8V, C_{IN}=10uF, C_{OUT}=10uF, T_J=25℃, unless otherwise specified

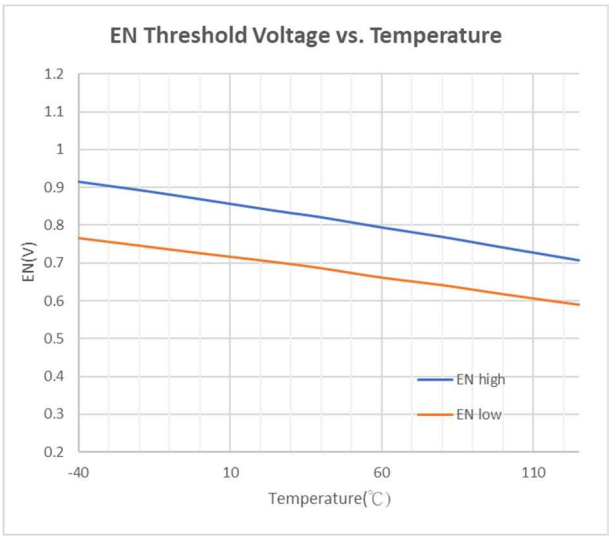


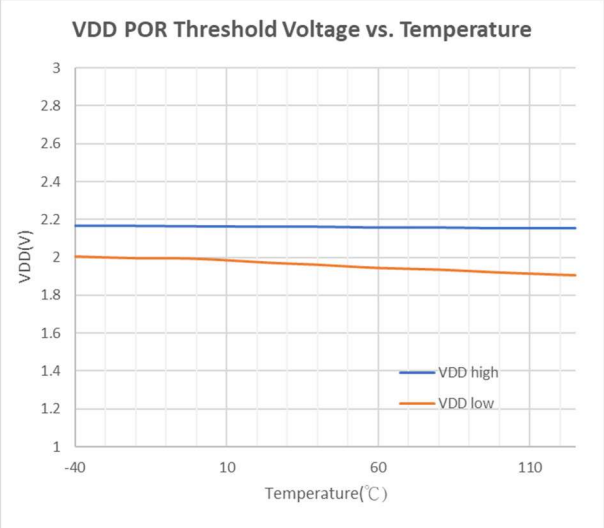


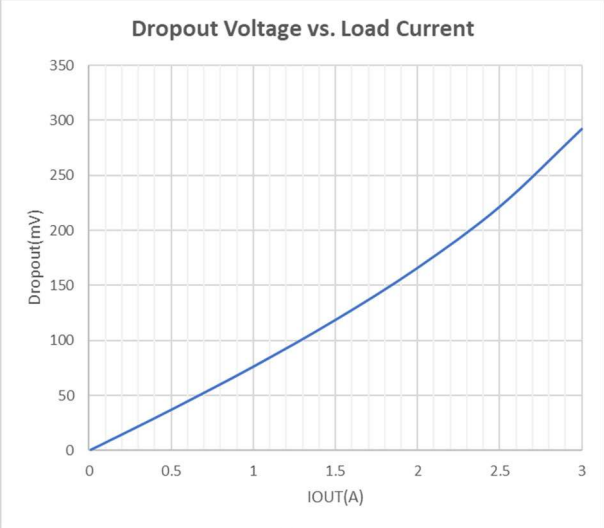








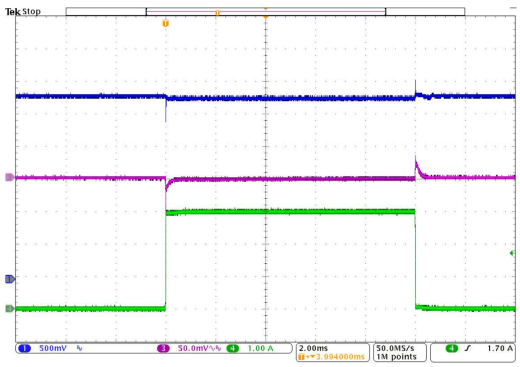




Load Transient Response

VIN=2.8V, VOUT=1.8V, IOUT=0 to 3A

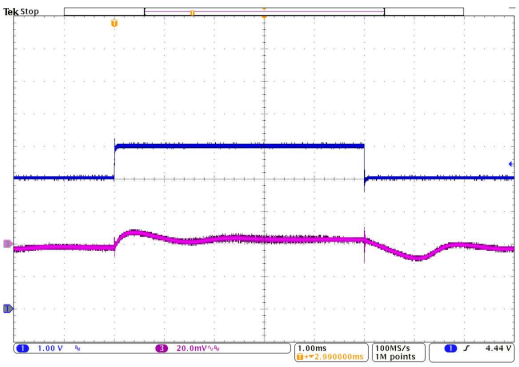
Ch1:VIN Ch3:VOUT Ch4:IOUT



Line Transient Response

VIN=4V to 5V, VDD=5V, IOUT=1mA

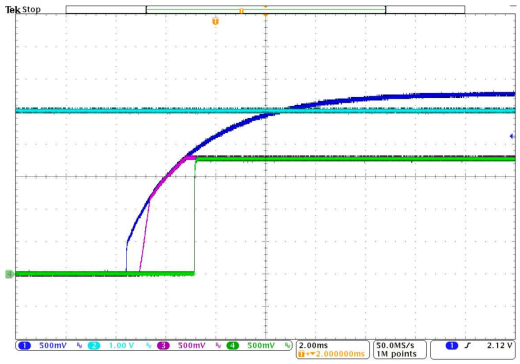
Ch1:VIN Ch3:VOUT



VIN power on

VOUT=1.8V, RL=NC

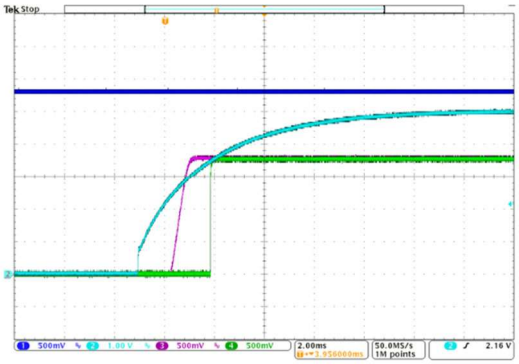
Ch1:VIN Ch2:VDD Ch3:VOUT Ch4:PGOOD



VDD power on

VOUT=1.8V, RL=NC

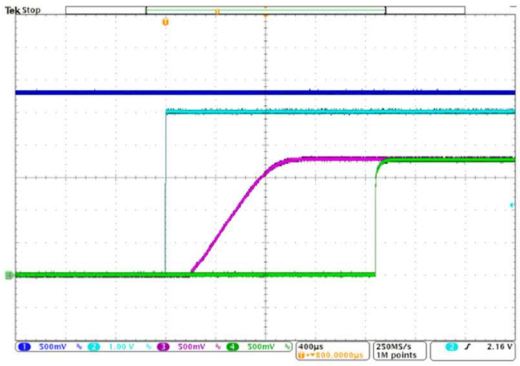
Ch1:VIN Ch2:VDD Ch3:VOUT Ch4:PGOOD



EN turn on

VOUT=1.8V, RL=NC

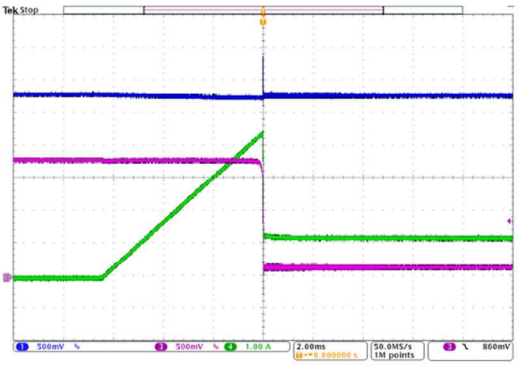
Ch1:VIN Ch2:EN Ch3:VOUT Ch4:PGOOD



Over Current Protect

VIN=2.8V, VOUT=1.8V

Ch1:VIN Ch3:VOUT Ch4:IOUT



APPLICATIONS INFORMATION

Enable

ZCC9059 has a dedicated enable pin (EN). When the EN pin is at logic low voltage (EN<0.4V), the regulator will be turned off, VOUT discharger initiates to release the output voltage, reducing the supply current to 0.8uA. When the EN pin is at a logic high voltage (EN>0.9V), after an EN delay time, the regulator will turn on. This pin cannot be left floating.

Power On Reset

The ZCC9059 features power-on-reset control, which prevents accidental operations by monitoring the VIN and VDD voltages. The regulator will only activate after both power supply voltages have exceeded their rising POR threshold voltages.

Output Voltage

The output voltage of ZCC9059 can be adjusted between 0.8V and VIN using an external voltage divider resistor. The output voltage can be calculated using the following equation:

$$VOUT = VREF \times \left(1 + \frac{R1}{R2}\right)$$

Soft Start

The internal soft-start feature controls the rise rate of the output voltage to limit the inrush current during startup. The typical soft-start interval is approximately 1ms. During startup, the ZCC9059 limits the current to half load and does not support full-load startup to prevent current overshoot.

Power Good

The PGOOD pin function is an open-drain output. It can be connected to VOUT or other power rails through an external pull-up resistor. When the output voltage reaches 90% of the normal output voltage, the internal delay function begins its delay time, and the PGOOD pin goes high to indicate normal output voltage. If the output voltage falls below the normal power-down threshold or if one of the power supply voltages falls below its power-on reset (POR) threshold, the PGOOD pin will output low.

Current Limit

It features a foldback current protection function that limits the output current to a maximum value, typically set to exceed 4.4A. If the output voltage drops below 0.25V, short-circuit protection will activate, limiting the load current to 1A. The output can be shorted to ground without damaging the device.

Thermal Shutdown Protection

The thermal protection will be activated when the power dissipation exceeds a certain threshold. If the die temperature exceeds 160℃, the regulator will shut down until the temperature drops to 130 ℃ Recovery, after which the regulator will restart operation.

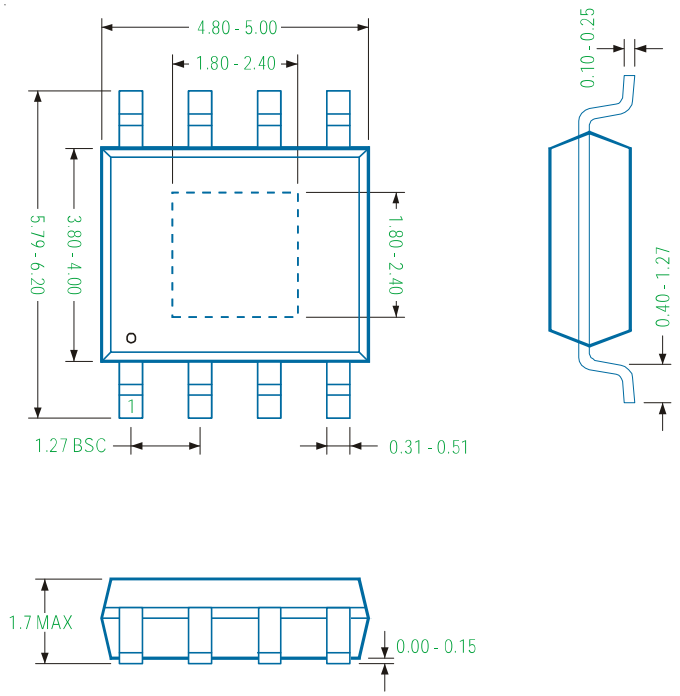
Input Capacitor

It is recommended to use a 10uF capacitor to bypass VIN to ground. In most applications, a 1uF capacitor is used to bypass VDD to ground for normal operation. Place the capacitors as close as possible to the device using wide and direct PCB traces.

Output Capacitor

The output capacitor is recommended to use a 10uF capacitor to ensure stability. Using larger capacitance capacitors at the output can help reduce noise and improve load transient response, stability, and PSRR. Place the capacitors as close as possible to the device using wide and direct PCB traces.

ESOP-8L Package



Note

1. Package Outline Unit Description:
   BSC: Basic. Represents theoretical exact dimension or dimension target
   MIN: Minimum dimension specified.
   MAX: Maximum dimension specified.
   REF: Reference. Represents dimension for reference use only. This value is not a device specification.
   TYP. Typical. Provided as a general value. This value is not a device specification.
2. Dimensions in Millimeters.
3. Drawing not to scale.
4. These dimensions do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm.