100V/0.6A, High Efficiency Synchronous Step-Down Converter

DESCRIPTION

ETA1801 is a high-efficiency and high-frequency DC-to-DC step-down switching regulator with up to 100V operation input voltage and up to 105V standoff voltage. It is capable of delivering up to 0.6A output current. ETA1801 adopts an adaptive COT control scheme that enables very fast transient response and provides a very smooth transition when the output varies from light load to heavy load. During light load, ETA1801 goes into a PFM mode that saves switching loss achieving high efficiency. The adaptive COT control also maintains a constant switching frequency across line and load.

ETA1801 is available in ESOP8 package.

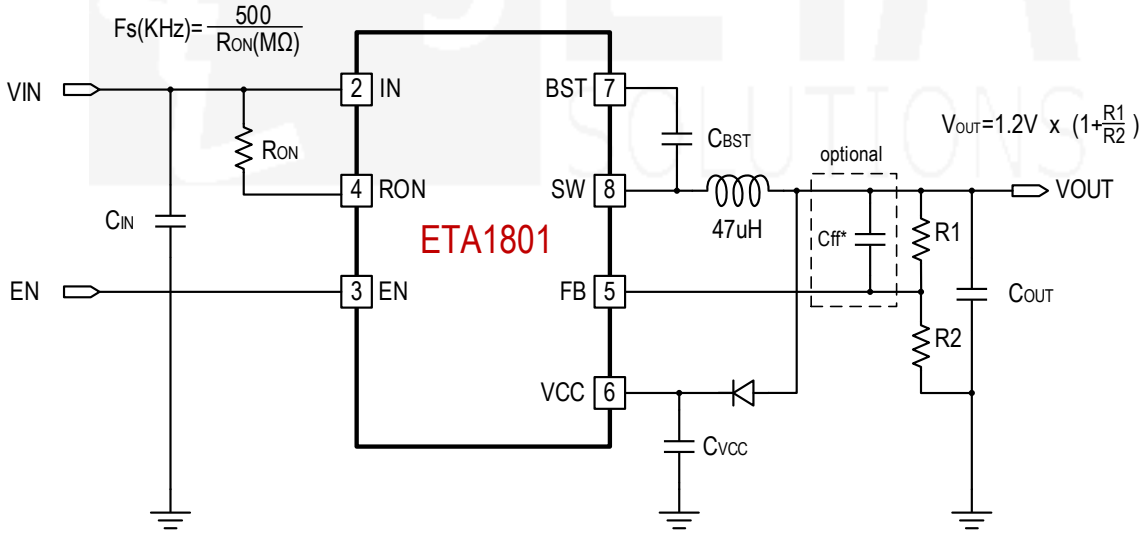
FEATURES

- Wide Input Range: 7V-100V
- 105V Standoff Input Voltage
- Up to 0.6A Output Current
- Adaptive COT Control
- Ultra-fast Load Transient Response
- High Efficiency PFM Mode at Light Load
- Internal Power FETs
- Thermal Shutdown and UVLO
- Available in ESOP8 Package

APPLICATIONS

- Non-Isolated Telecommunication Buck Regulator
- Secondary High Voltage Post Regulator
- Automotive Systems

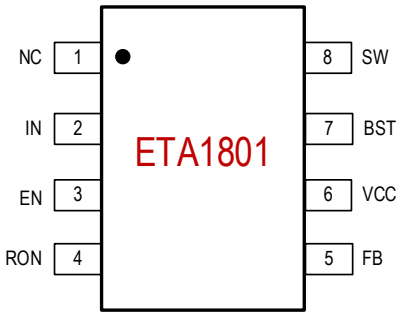
TYPICAL APPLICATION



ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA1801E8A	ESOP8	ETA1801 YWW2L	4000

PIN CONFIGURATION



ESOP8

ABSOLUTE MAXIMUM RATINGS

(Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

IN Voltage 115V
EN,RON,SW Voltage .....VIN+0.3V
BST Voltage .....SW+6V
FB Voltage.....6V
VCC Voltage.....30V
SW to ground current.....Internally limited
Operating Temperature Range .....–40°C to 85°C
Storage Temperature Range .....–55°C to 150°C
Thermal Resistance θ_{JC} θ_{JA}
ESOP8.....10.....30 ..... °C /W
Lead Temperature (Soldering, 10sec) .....260°C

ELECTRICAL CHARACTERISTICS

(V_{IN} = 48V, V_{OUT} = 5V, unless otherwise specified. Typical values are at TA = 25°C.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range		7		100	V
Input UVLO	Rising, Hysteresis = 500mV		6.6	6.99	V
Input Supply Current	V_{FB}=1.3V, no switching		280	400	μA
Input Shutdown Current			7	14	μA
VCC Internal Voltage			4.2		V
FB Voltage		1.176	1.2	1.224	V
FB Input Current			0		μA
Switching Frequency Range	*F_{SW}(KHz) = 500/RON(Mohm)*	0.2		1.0	MHz
Minimum ON time			350		ns
Minimum Off time			350		ns
Short Circuit Hiccup Time	On Time		2		mS
	Off Time		13		mS
FB Hiccup Threshold			0.6		V
High Side Switch On Resistance			400		mΩ
Low Side Switch On Resistance			165		mΩ
High Side Current Limit			1.1		A
Low Side Current Limit			0.7		A
SW Leakage Current	V_{IN} = V_{SW} = 12V, V_{EN} = 0V			10	μA
EN Rising Threshold	Rising		1.2		V

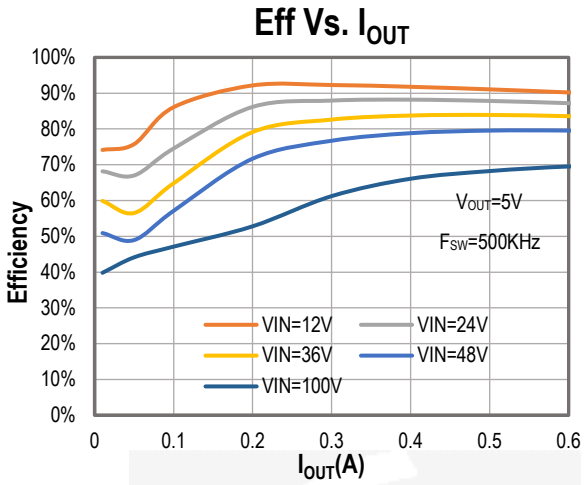
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
EN Falling Threshold	Falling	0.8			V
EN Input Current	V_{EN} = 2V			15	uA
Thermal Shutdown	Rising, Hysteresis = 35°C		150		°C

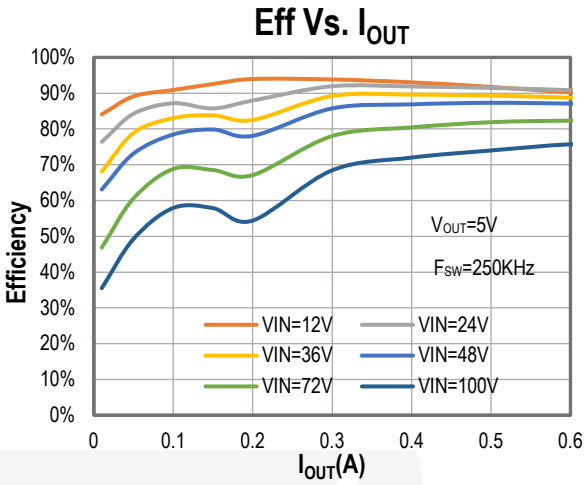
PIN DESCRIPTION

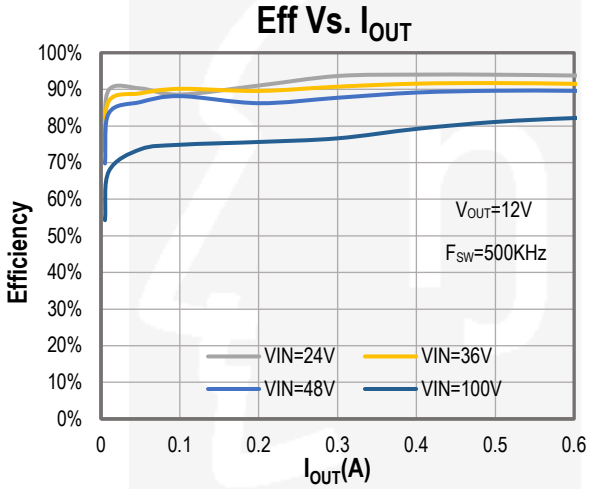
PIN #	NAME	DESCRIPTION
1	NC	No connection
2	IN	Input power pin. Bypass to GND with a minimum 1uF capacitor.
3	EN	Enable pin. Pull high to enable, pull low to disable. It has an accurate threshold for seting UVLO externally.
4	RON	On Time programming pin. Connnect a resistor from this pin to IN to set the on time or frequency.
5	FB	Feedback Input. Connect an external resistor divider from the output to FB and GND to set V_{OUT}
6	VCC	Power supply pin for internal circuit. Bypass with a 100nF capacitor.
7	BST	Bootstrap pin . Connect a 100nF capacitor from this pin to SW
8	SW	Inductor Connection for output . Connect an inductor Between SW and the regulator output.
Exposed Pad	GND	Ground pin

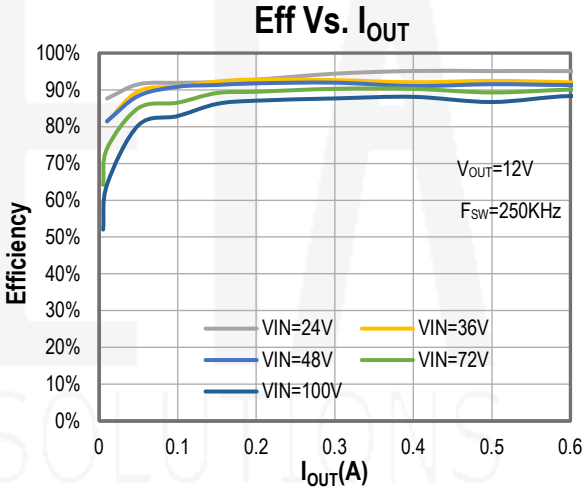
TYPICAL CHARACTERISTICS

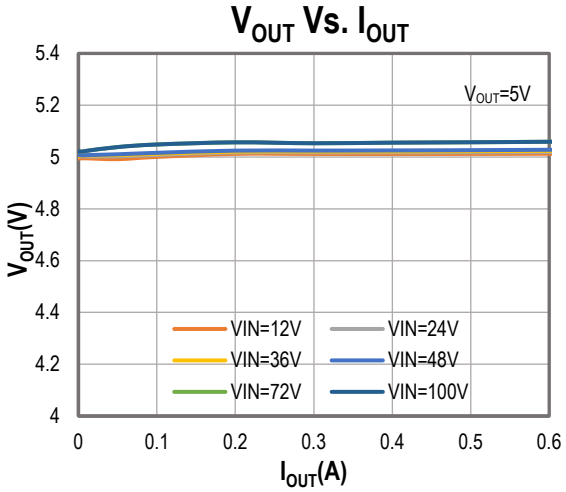
(Typical values are at T_A = 25°C unless otherwise specified.)

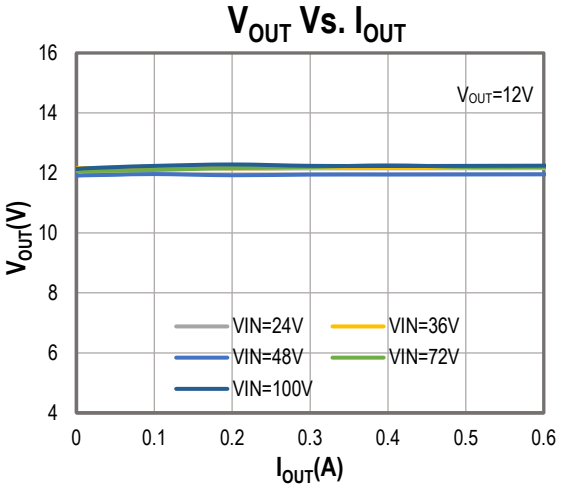










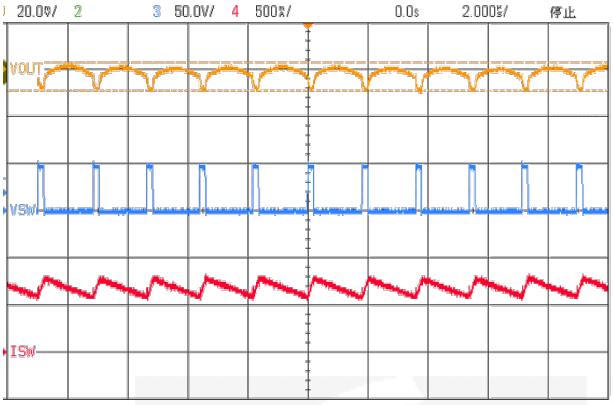


TYPICAL CHARACTERISTICS cont'd

(Typical values are at T_A = 25°C unless otherwise specified.)

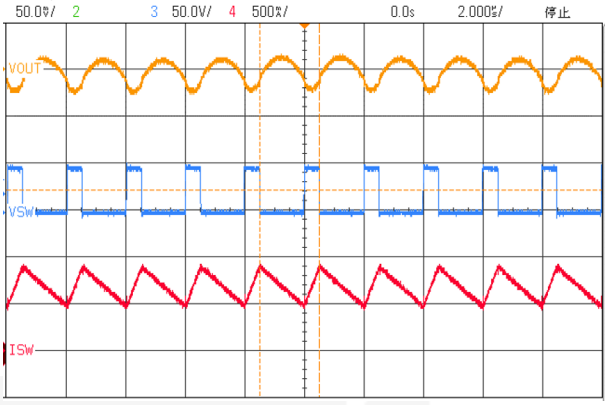
Output Waveform

V_{IN}=48V, V_{OUT}=5V, I_{OUT}=0.6A



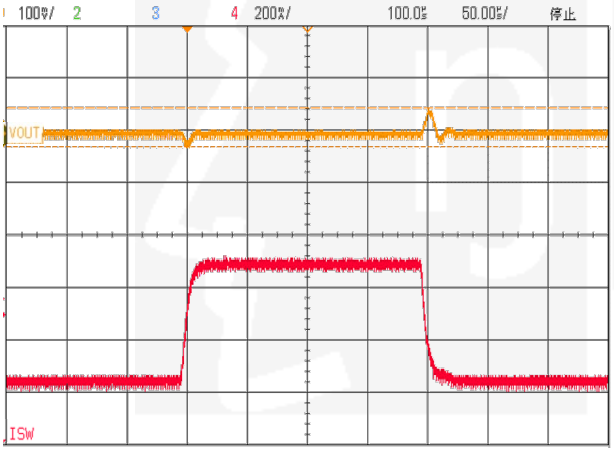
Output Waveform

V_{IN}=48V, V_{OUT}=12V, I_{OUT}=0.6A



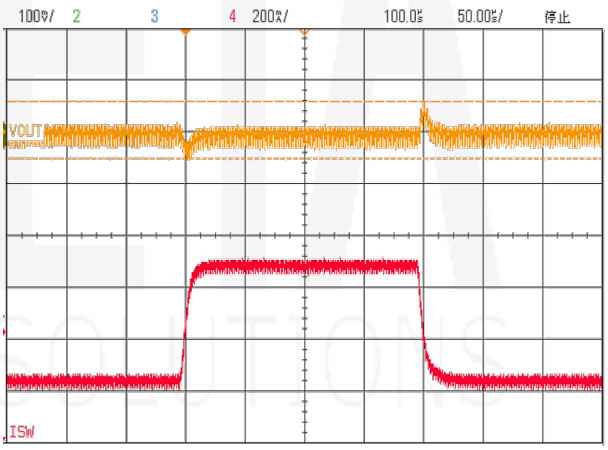
Load Transient

V_{IN}=48V, V_{OUT}=5V, I_{OUT}=0.25A-0.6A-0.25A



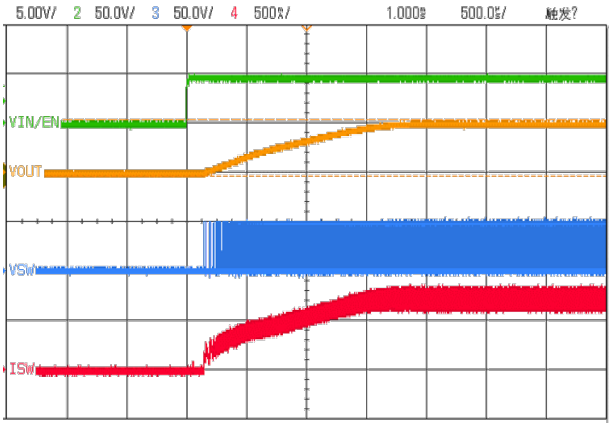
Load Transient

V_{IN}=48V, V_{OUT}=12V, I_{OUT}=0.25A-0.6A-0.25A



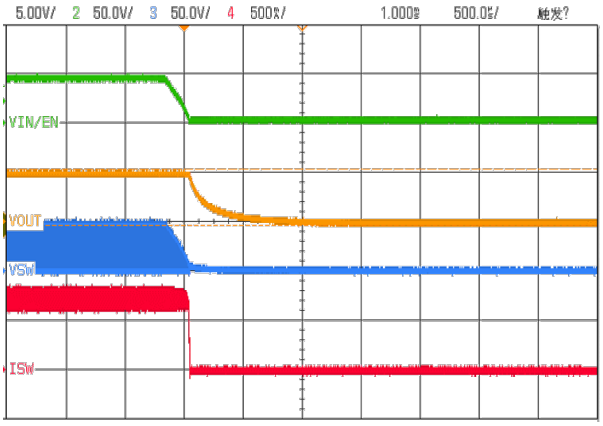
Startup from VIN

V_{IN}=48V, V_{OUT}=5V, I_{OUT}=0.6A



Shutdown from VIN

V_{IN}=48V, V_{OUT}=5V, I_{OUT}=0.6A

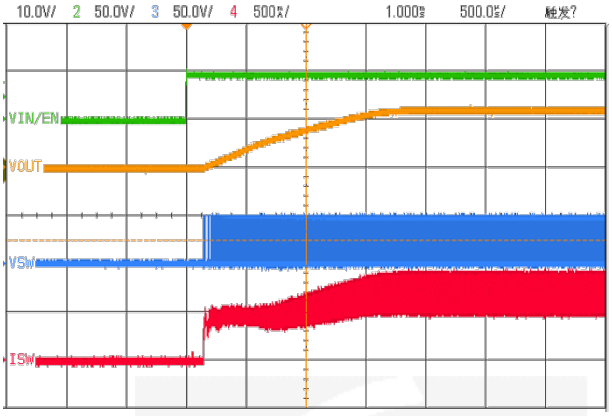


TYPICAL CHARACTERISTICS cont'd

(Typical values are at T_A = 25°C unless otherwise specified.)

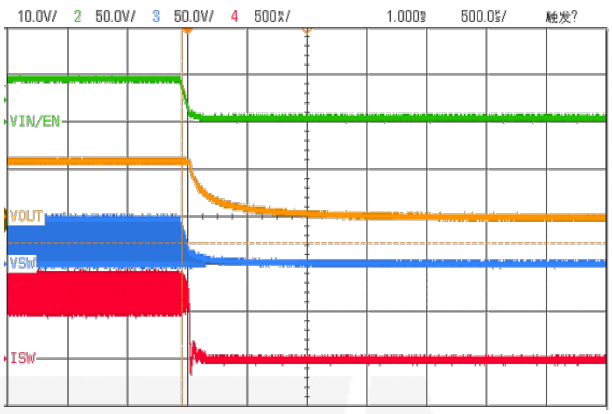
Startup from VIN

V_{IN}=48V, V_{OUT}=12V, I_{OUT}=0.6A



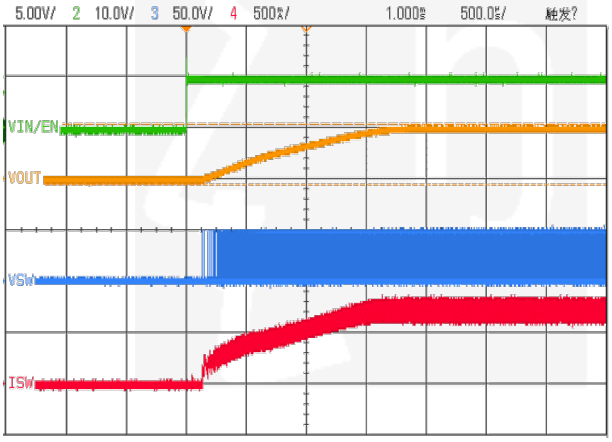
Shutdown from VIN

V_{IN}=48V, V_{OUT}=12V, I_{OUT}=0.6A



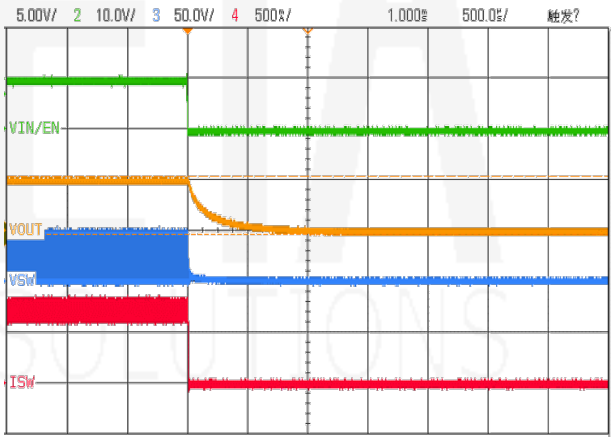
Startup from EN

V_{IN}=48V,V_{EN}=10V, V_{OUT}=5V, I_{OUT}=0.6A



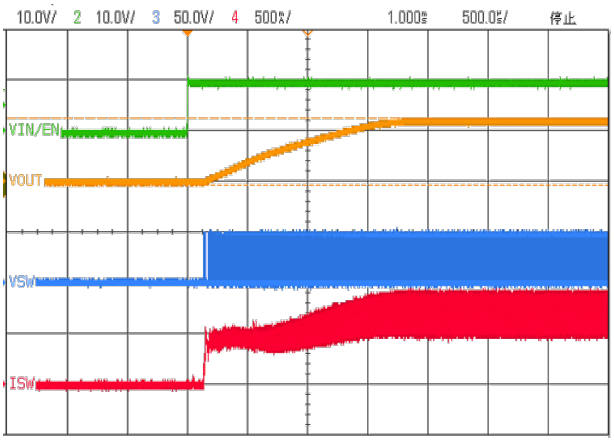
Shutdown from EN

V_{IN}=48V,V_{EN}=10V, V_{OUT}=5V, I_{OUT}=0.6A



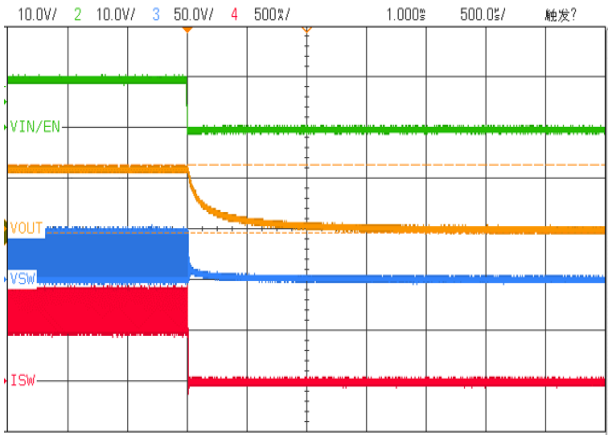
Startup from EN

V_{IN}=48V,V_{EN}=10V, V_{OUT}=12V, I_{OUT}=0.6A



Shutdown from EN

V_{IN}=48V,V_{EN}=10V, V_{OUT}=12V, I_{OUT}=0.6A

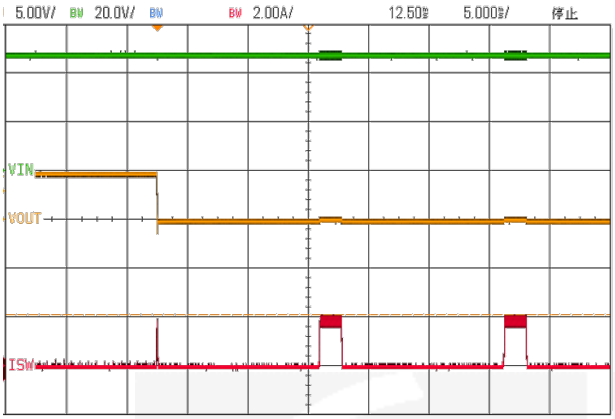


TYPICAL CHARACTERISTICS cont'd

(Typical values are at T_A = 25°C unless otherwise specified.)

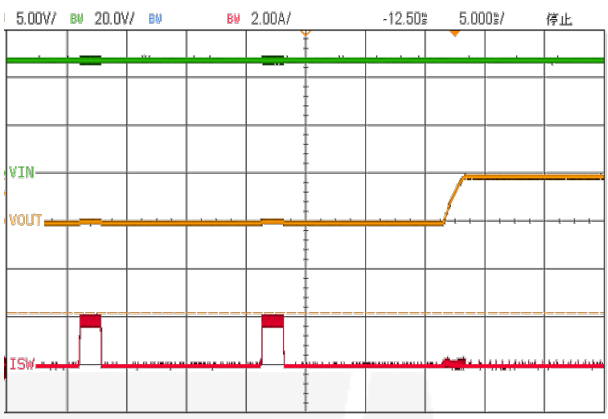
Short Circuit

V_{IN}=48V, V_{OUT}=5V, No load



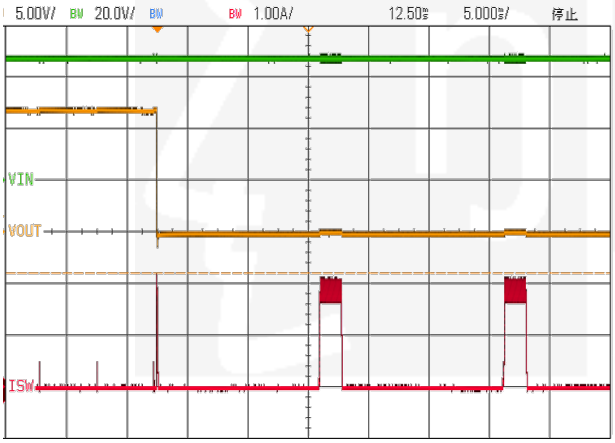
Short Circuit Recovery

V_{IN}=48V, V_{OUT}=5V, No load



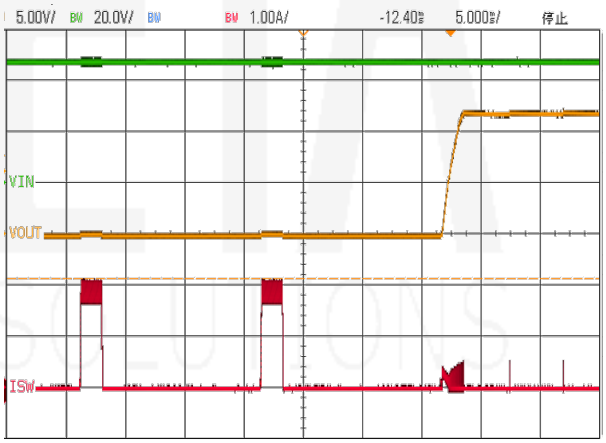
Short Circuit

V_{IN}=48V, V_{OUT}=12V, No load



Short Circuit Recovery

V_{IN}=48V, V_{OUT}=12V, No load



FUNCTIONAL DESCRIPTION

ETA1801 is a high efficiency and high frequency DC-to-DC step-down switching regulator with operation input voltage up to 100V and standoff voltage up to 105V. It is capable of delivering up to 0.6A output current and adopts an adaptive COT control scheme.

Light Load Operation

Traditionally, a fixed constant frequency PWM DC-DC regulator always switches even when the output load is small. When energy is shuffling back and forth through the power MOSFET, power is lost due to the finite R_{DSON} of the MOSFET and parasitic capacitances. At light load, switching loss is prominent and efficiency is therefore very low. ETA1801 goes into a power save mode during light load, thereby extending the range of high efficiency operation.

Enable

EN is a digital control pin that turns the ETA1801 on and off. Driving EN High to turn on the regulator, Low to turn it off. Connecting the EN pin through a pull up resistor or shorting EN to IN will automatically turn on the chip whenever plug in IN.

Over Current Protection and Hiccup

ETA1801 has a cycle-by-cycle over current limit for when the inductor current peak value is over the set current limit threshold. When the output voltage drop until FB falls below UV threshold (0.6V), the ETA1801 will enter hiccup mode. It will turn off the chip immediately for 13mS. After that, it will try to re-start as normal for 2mS. After 2mS, if FB is still below UV threshold, then the chip enters hiccup mode again. If FB is higher than UV threshold, it will enter the normal mode.

Over-Temperature Protection

Thermal protection disables the output when the junction temperature rises to approximately 150°C, allowing the device to cool down. When the junction temperature cools to approximately 115°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the device from damage as a result of overheating.

External Output Voltage Setting

In external Output Voltage Setting Version selected, the ETA1801 regulator is programmed using an external resistor divider. The output voltage is calculated using below equation.

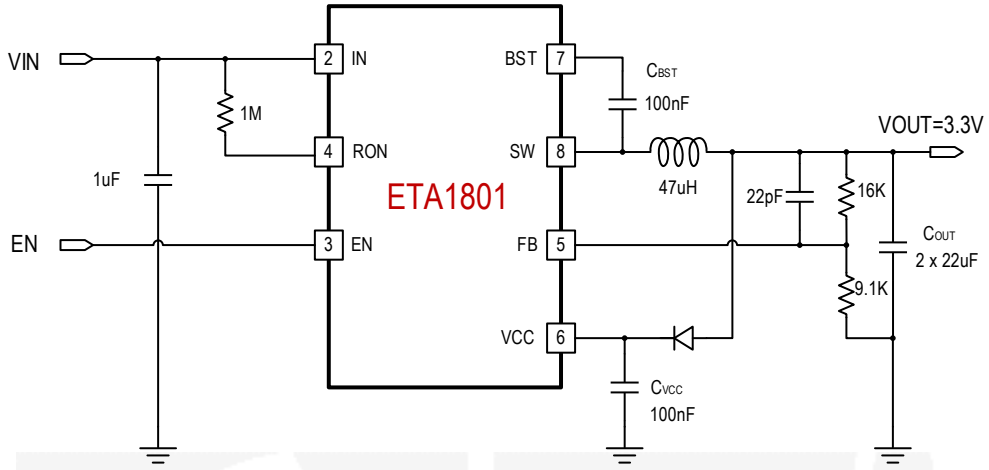
$$V_{OUT} = V_{REF} \times (1 + \frac{R_1}{R_2})$$

Where: V_{REF} =1.2V typically (the internal reference voltage)

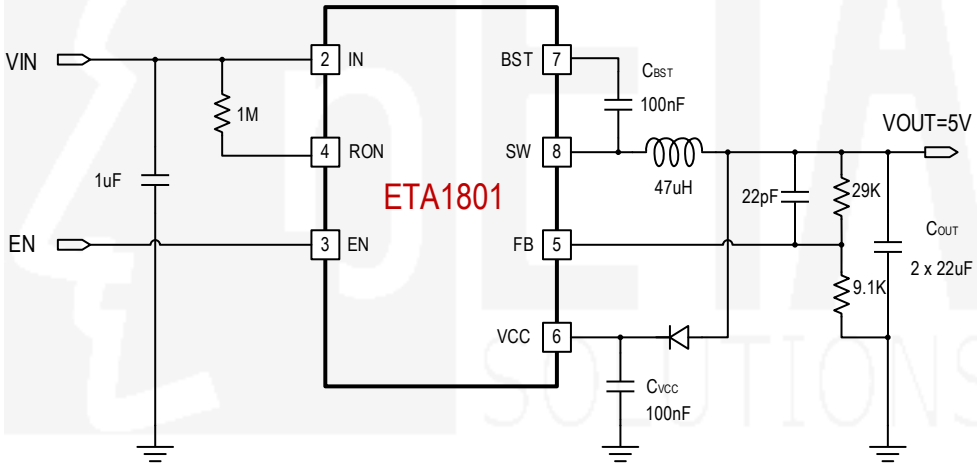
Resistors R2 has to be between 1Kohm to 20Kohm and thus R1 is calculated by following equation.

$$R_1 = \left(\frac{V_{OUT}}{V_{REF}} - 1\right) \times R_2$$

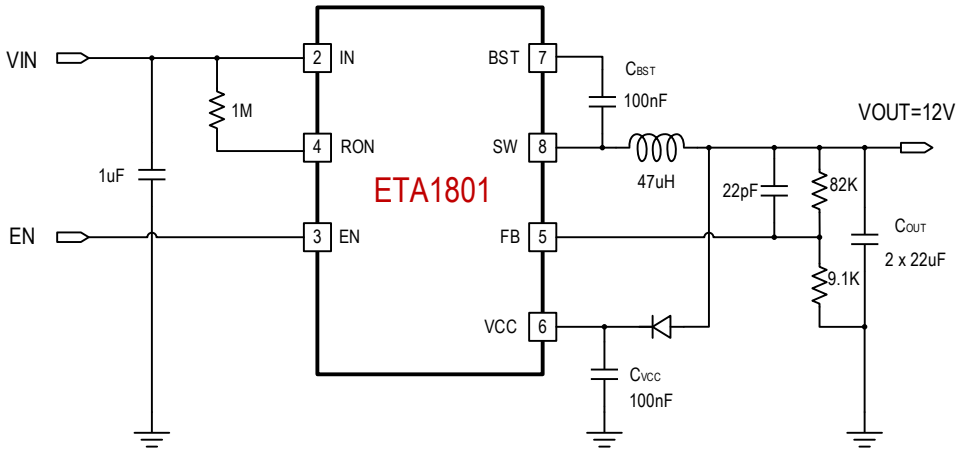
Typical Application Circuit



V_{IN}=48V, V_{OUT}=3.3V, F_{SW}=500KHz, I_{OUT}=0.6A



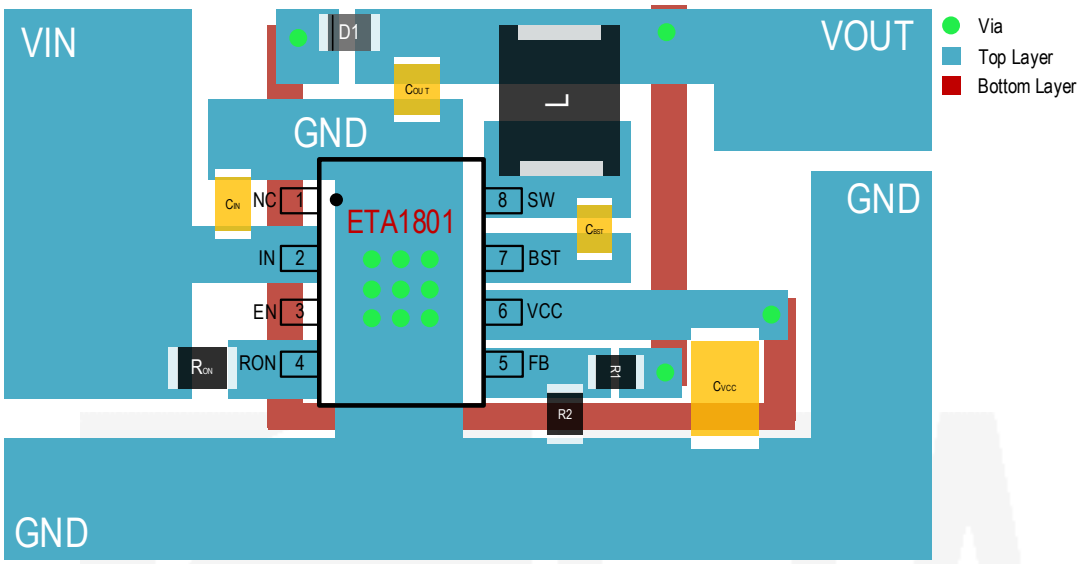
V_{IN}=48V, V_{OUT}=5V, F_{SW}=500KHz, I_{OUT}=0.6A



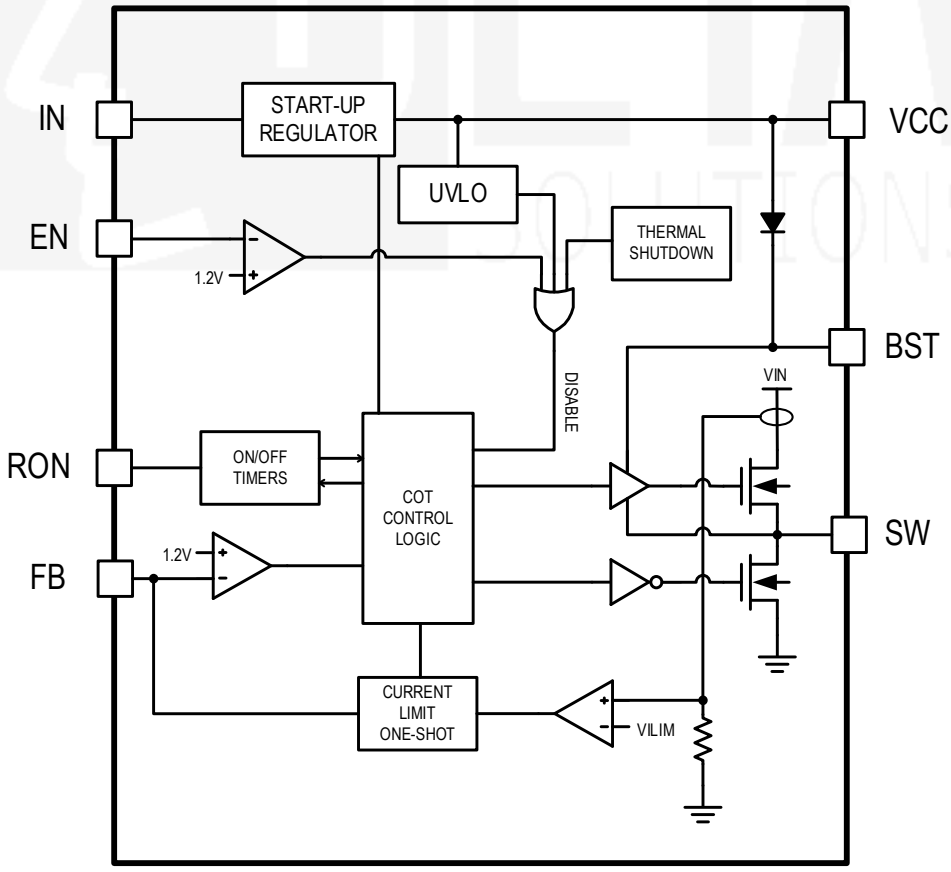
V_{IN}=48V, V_{OUT}=12V, F_{SW}=500KHz, I_{OUT}=0.6A

PCB GUIDELINES

Keep the power devices as close to the chip as possible to achieve the smallest power loop area, which leads to the best EMI performance; Cin is always placed nearest to Vin and GND

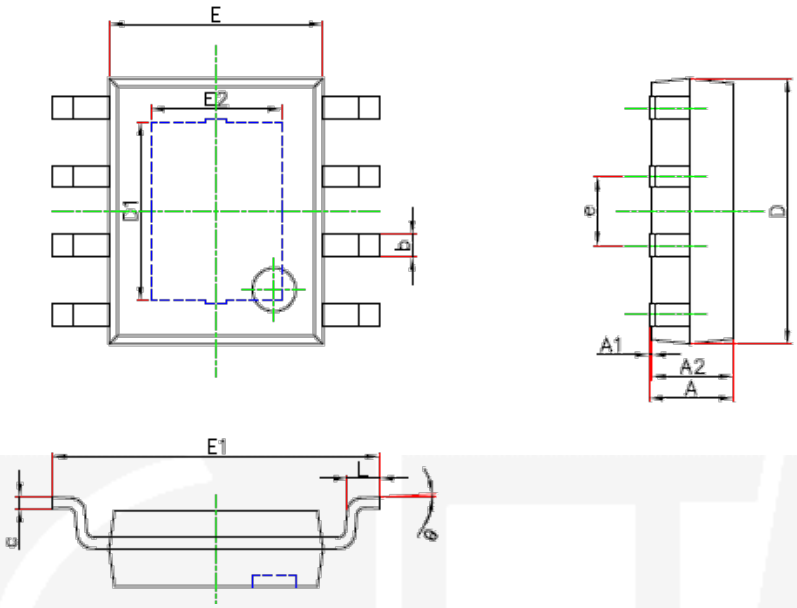


BLOCK DIAGRAM



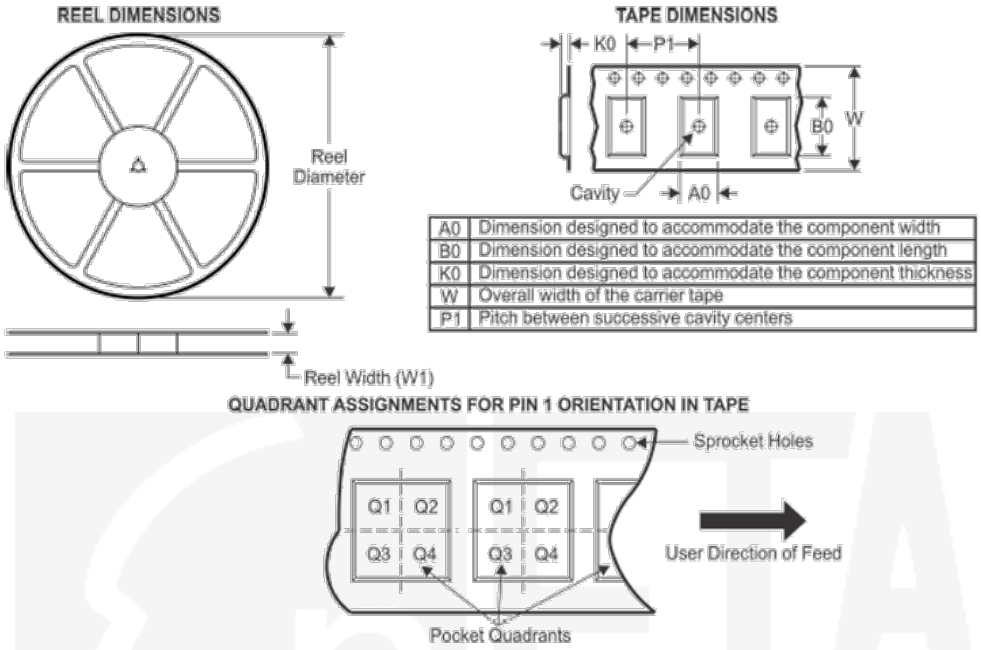
PACKAGE OUTLINE

Package: ESOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.300	1.700	0.051	0.067
A1	0.000	0.100	0.000	0.004
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION



Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ETA1801E8A	ESOP8	8	4000	330	12.7	6.6	5.4	2.05	8	12	Q1