Dual 18V, 2A, High Efficiency Synchronous Step-Down Converter

DESCRIPTION

ETA8291 is a Power Management Unit(PMU) with 2 channels of wide input range, high efficiency DC-to-DC step-down switching regulators. Each channel is capable of delivering up to 2A of output current. It 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, ETA8291 goes into a PFM mode that saves switching loss to achieve high efficiency. The adaptive COT control also maintains a constant switching frequency across line and load.

ETA8291 is available in DFN3x3-10 package.

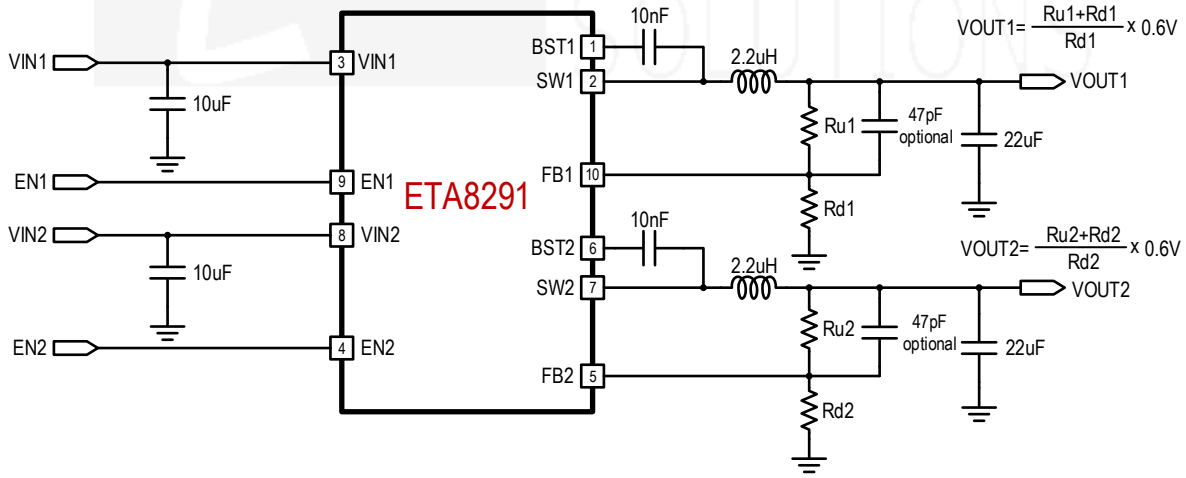
FEATURES

- Wide Input Range: 3.5V-18V
- Dual 2A Max Output Current
- Adaptive COT Control
- Ultra-fast Load Transient Response
- High Efficiency PFM mode at Light Load
- High Efficiency Synchronous Operation
- Low Rdson Internal Power FETs
- No External Compensation Needed
- Thermal Shutdown and UVLO
- RoHS Compliant

APPLICATIONS

- Set Top Box
- xDSL Modem
- LCD TV

TYPICAL APPLICATION



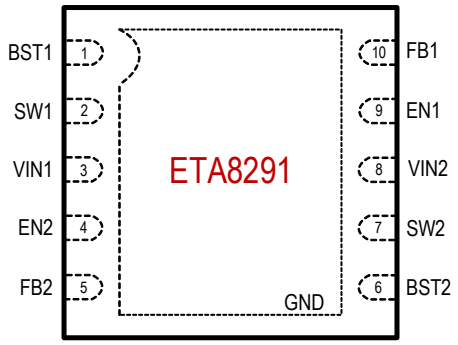
*Resistors Rd1 and Rd2 have to be between 1KOhm to 70KOhm

ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA8291D3K	DFN3x3-10	ETA8291 YWW2L	5000

PIN CONFIGURATION

Top View



DFN3x3-10

ABSOLUTE MAXIMUM RATINGS

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

VIN1, VIN2, EN1, EN2 Voltage .....–0.3V to 24V
SW1 Voltage..–0.3V (-5V for <10nS) to 19V (23V for <10nS)
SW2 Voltage..–0.3V (-5V for <10nS) to 19V (23V for <10nS)
BST1, BST2 Voltage .....–0.3V to SW+6V
FB1, FB2 Voltage .....–0.3V to 6V
Operating Temperature Range .....–40°C to 85°C
Storage Temperature Range .....–55°C to 150°C

Thermal Resistance	θ_{JA}	θ_{JC}	
DFN3x3-10	50	12	°C/W

Lead Temperature (Soldering 10sec) .....260°C

ELECTRICAL CHARACTERISTICS

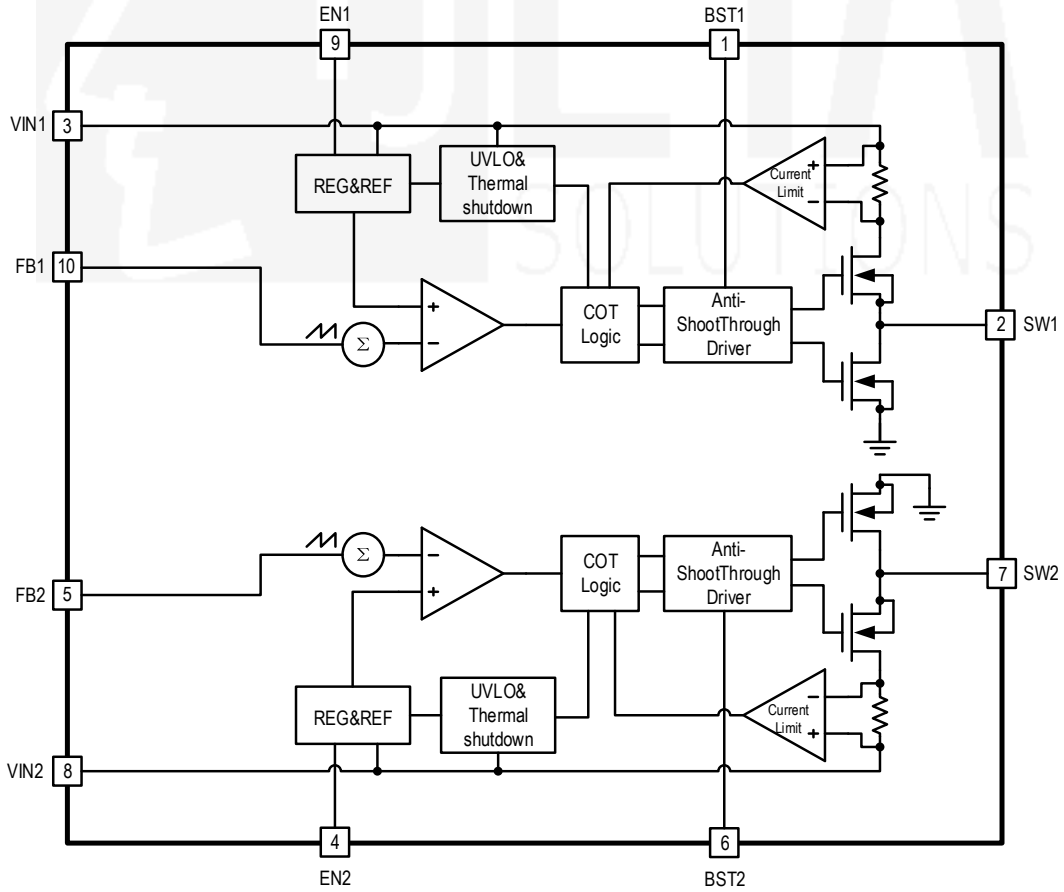
(For each channel, V_{IN1}=V_{IN2}=12V, unless otherwise specified. Typical values are at T_A = 25°C.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range		3.5		18	V
Input UVLO	Rising, Hysteresis =200mV		3.5		V
Input Supply Current	No Switching		210		μA
Input Shutdown Current			7	14	μA
FB Voltage		0.588	0.6	0.612	V
FB Input Current			0	0.05	μA
Switching Frequency			600		KHz
Maximum Duty Cycle			90		%
Short Circuit Hiccup Time	On Time		1		mS
Short Circuit Hiccup Time	Off Time		7		mS
FB Hiccup Threshold			0.2		V
High Side Switch On Resistance			160		mΩ
Low Side Switch On Resistance			95		mΩ
High Side Current Limit			4.2		A
SW Leakage Current	V_{IN}=V_{SW}=12V			10	μA
EN Rising Threshold	Rising	1	1.2	1.4	V
EN Falling Threshold	Falling	0.9	1.1	1.3	V
EN Input Current	V_{EN}=2V		1		uA
Thermal Shutdown	Rising, Hysteresis=36°C		150		°C

PIN DESCRIPTION

PIN #	NAME	DESCRIPTION
1	BST1	Bootstrap pin of the channel 1. Connect a 10nF capacitor from this pin to SW1.
2	SW1	Inductor connection of the channel 1. Connect an inductor between SW1 and VOUT1.
3	VIN1	Input supply of the channel 1. Bypass with a 10μF ceramic capacitor to GND.
4	EN2	Channel 2 enable. Drive this pin high to enable the part, low or floating to disable.
5	FB2	Feedback input of the channel 2. Connect an external resistor divider from the output to FB2 and GND to set VOUT2.
6	BST2	Bootstrap pin of the channel 2. Connect a 10nF capacitor from this pin to SW2.
7	SW2	Inductor connection of the channel 2. Connect an inductor between SW2 and VOUT2.
8	VIN2	Input supply of the channel 2. Bypass with a 10μF ceramic capacitor to GND.
9	EN1	Channel 1 enable. Drive this pin high to enable the part, low or floating to disable.
10	FB1	Feedback input of the channel 1. Connect an external resistor divider from the output to FB1 and GND to set VOUT1.

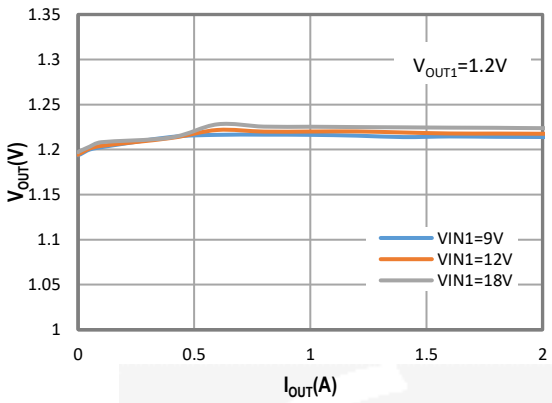
FUNCTIONAL BLOCK DIAGRAM



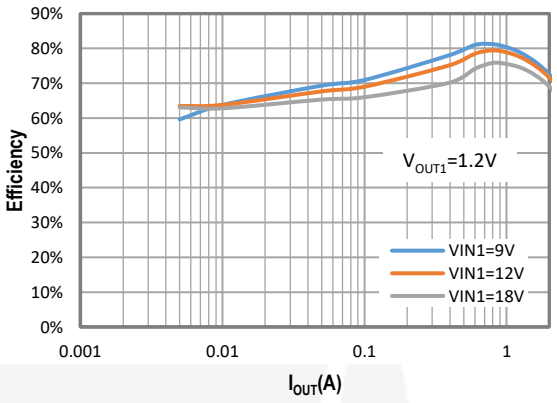
TYPICAL CHARACTERISTICS

(For each channel, typical values are with Cff=47pF, at T_A = 25°C unless otherwise specified.)

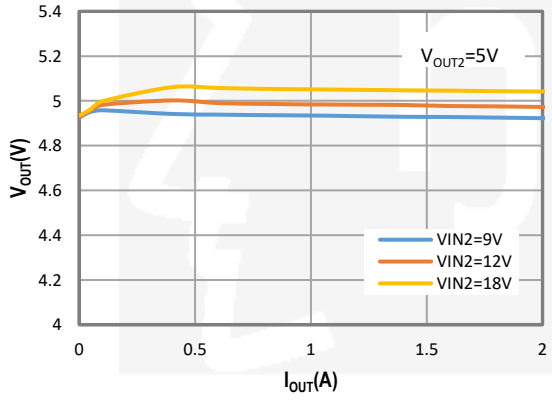
V_{OUT} Vs. I_{OUT}



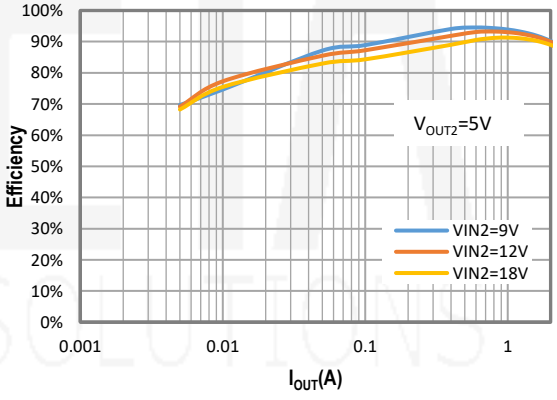
Eff. Vs. I_{OUT}



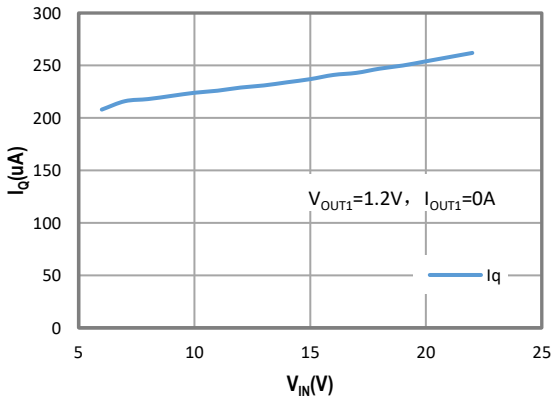
V_{OUT} Vs. I_{OUT}



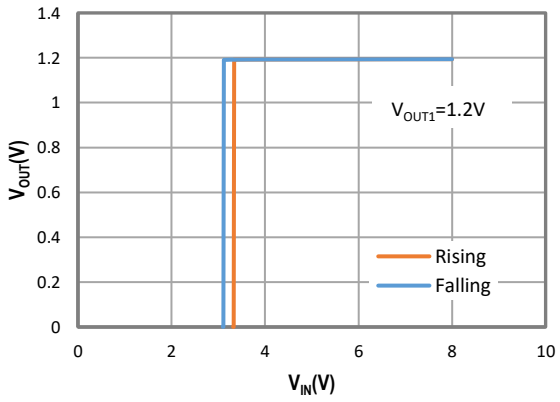
Eff. Vs. I_{OUT}



I_Q Vs. V_{IN}



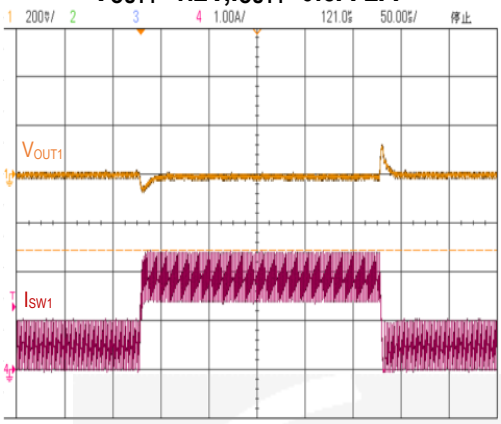
UVLO



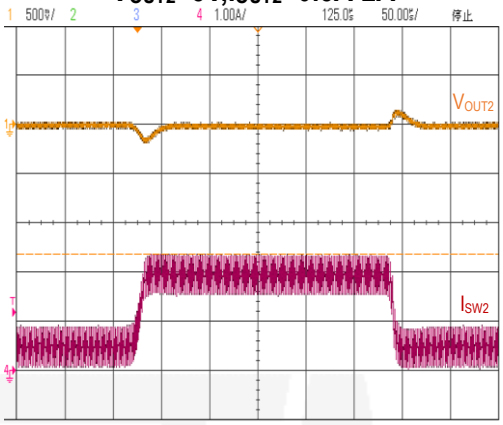
TYPICAL CHARACTERISTICS (cont'd)

(V_{IN1}=V_{IN2}=12V,For each channel, typical values are with Cff=47pF, at T_A = 25°C unless otherwise specified.)

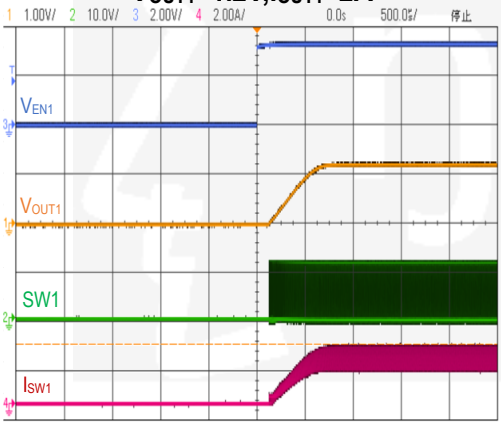
Load Transient
V_{OUT1}=1.2V,I_{OUT1}=0.5A-2A



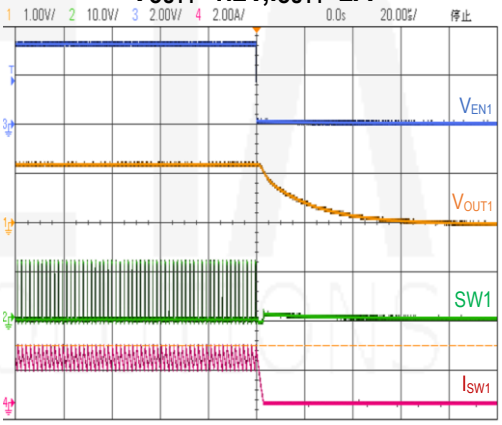
Load Transient
V_{OUT2}=5V,I_{OUT2}=0.5A-2A



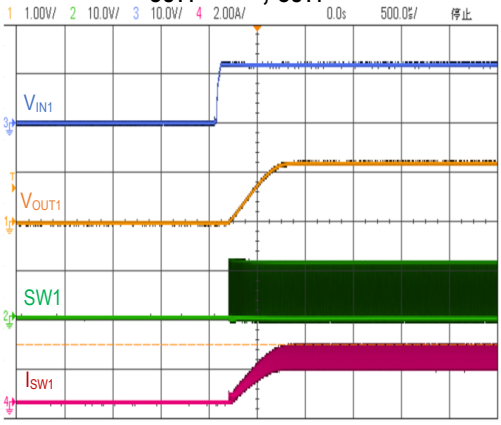
Start Up from EN1
V_{OUT1}=1.2V,I_{OUT1}=2A



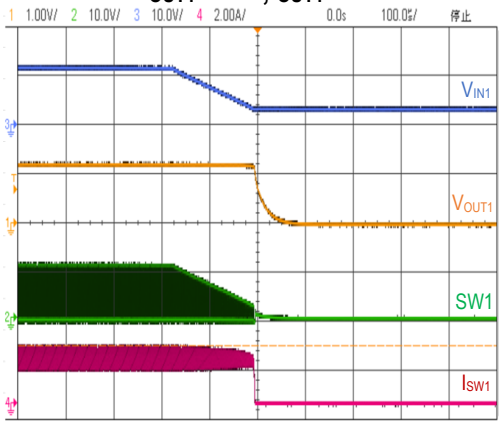
Shut Down from EN1
V_{OUT1}=1.2V,I_{OUT1}=2A



Start Up from VIN1
V_{OUT1}=1.2V,I_{OUT1}=2A



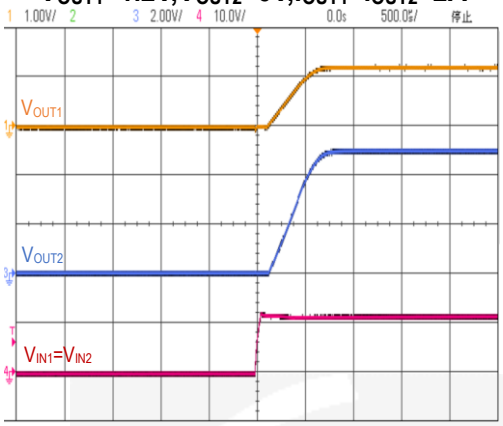
Shut Down from VIN1
V_{OUT1}=1.2V,I_{OUT1}=2A



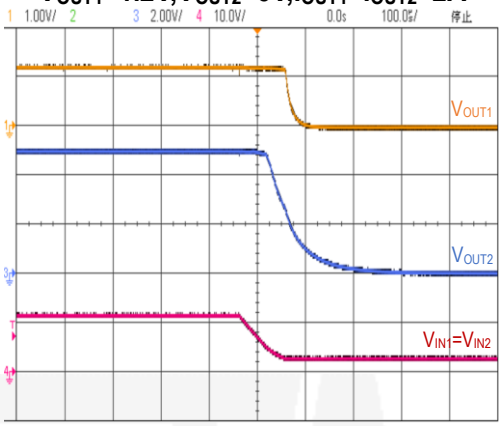
TYPICAL CHARACTERISTICS (cont'd)

(V_{IN1}=V_{IN2}=12V ,For each channel, typical values are with Cff=47pF, at T_A = 25°C unless otherwise specified.)

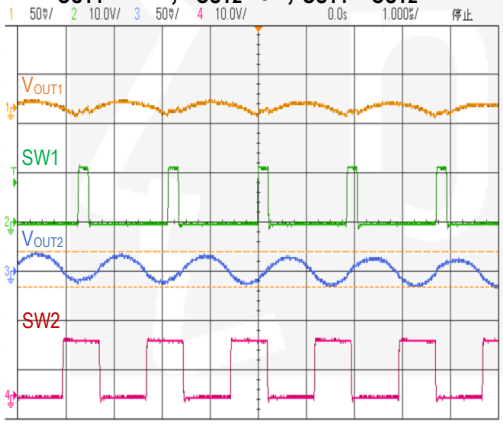
Start Up from VIN
V_{OUT1}=1.2V,V_{OUT2}=5V,I_{OUT1}=I_{OUT2}=2A



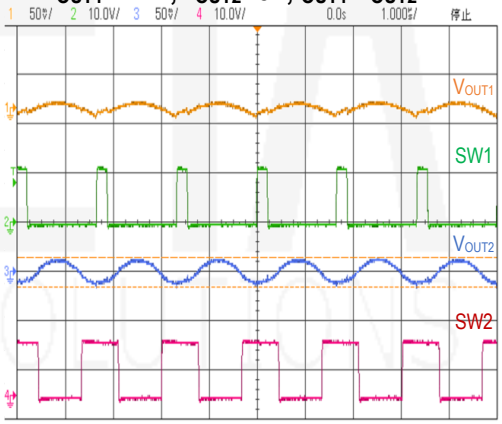
Shut Down from VIN
V_{OUT1}=1.2V,V_{OUT2}=5V,I_{OUT1}=I_{OUT2}=2A



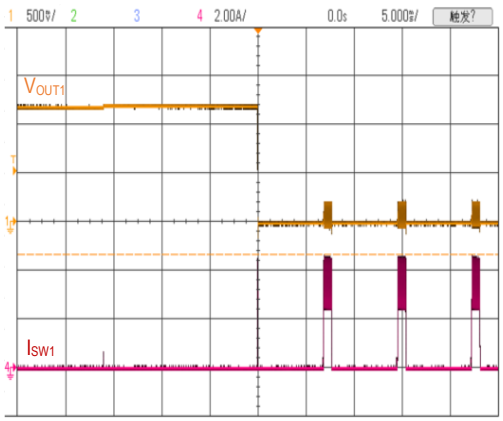
Output Ripple
V_{OUT1}=1.2V,V_{OUT2}=5V,I_{OUT1}=I_{OUT2}=1A



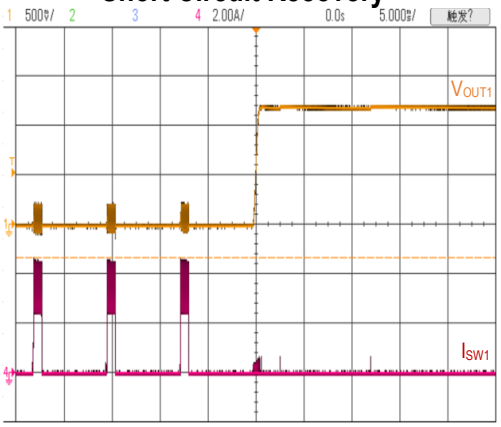
Output Ripple
V_{OUT1}=1.2V,V_{OUT2}=5V,I_{OUT1}=I_{OUT2}=2A



Short Circuit Protection



Short Circuit Recovery



FUNCTIONAL DESCRIPTION

ETA8291 is a fully-integrated, dual-channel, synchronous step-down regulator. For each channel, it is a wide input range, high efficiency DC-to-DC step-down switching regulator, capable of delivering up to 2A of output current. It 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. It compares the sum of the FB voltage and a ripple voltage that mimics the voltage due to the output ESR and capacitance. The constant-on-time timer varies with line to achieve relative constant switching frequency across line.

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 Rdson of the MOSFET and parasitic capacitances. At light load, this loss is prominent and efficiency is therefore very low. ETA8291 goes into a power save mode during light load, thereby extending the range of high efficiency operation.

Enable

ETA8291 has an independent on/off control for each channel. Drive EN High to turn on each channel, drive it Low to turn it off. An internal 1MΩ resistor from EN pin to GND allows EN to float to shut down the chip. Connecting the EN pin through a pull up resistor or shorted EN to VIN will automatically turn on the chip whenever plug in VIN.

Over Current Protection and Hiccup

Each channel of ETA8291 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 (0.2V), the ETA8291 will enter hiccup mode. It will turn off the chip immediately for 7mS. After that, it will try to re-starts as normal for 1mS. After 1mS, 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 114°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.

APPLICATION INFORMATION

External Output Voltage Setting

The output voltage of ETA8291 regulator is programmed by using an external resistor divider. The output voltage is calculated by using the below equations.

$$V_{OUT1}=V_{REF1}\times(1+\frac{R_{u1}}{R_{d1}})$$

$$V_{OUT2}=V_{REF2}\times(1+\frac{R_{u2}}{R_{d2}})$$

Where: $V_{REF1}=V_{REF2}=0.6V$ typically (the internal reference voltage)

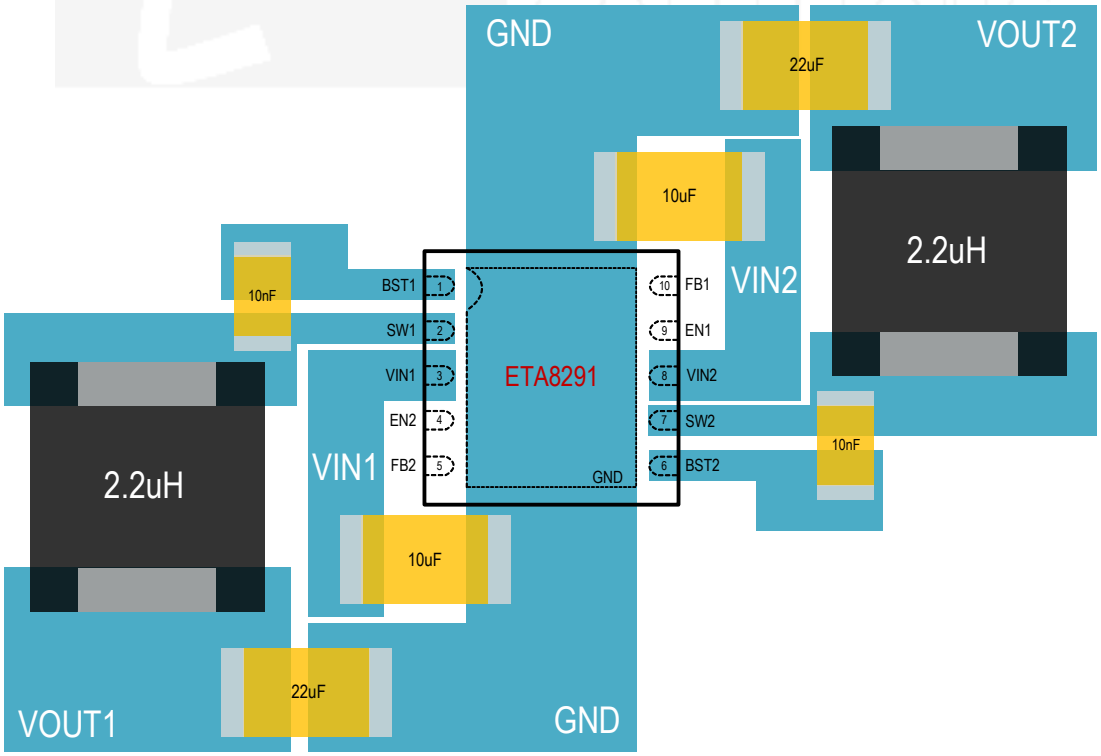
Resistors Rd1 and Rd2 have to be between 1KOhm to 70KOhm and thus Ru1 and Ru2 are calculated by the following equations.

$$R_{u1}=\left(\frac{V_{OUT1}}{V_{REF1}}-1\right)\times R_{d1}$$

$$R_{u2}=\left(\frac{V_{OUT2}}{V_{REF2}}-1\right)\times R_{d2}$$

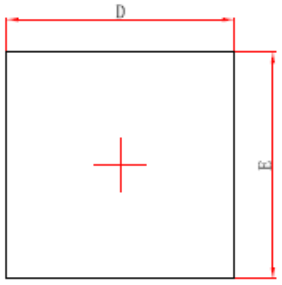
PCB LAYOUT GUIDE

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.

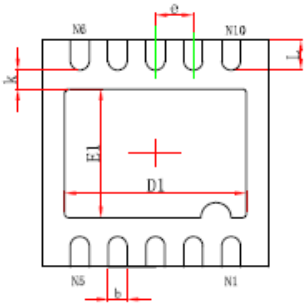


PACKAGE OUTLINE

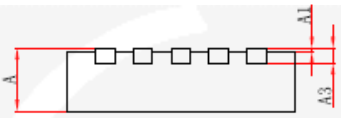
Package: DFN3x3-10



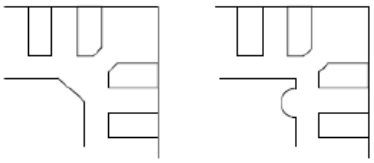
Top View



Bottom View

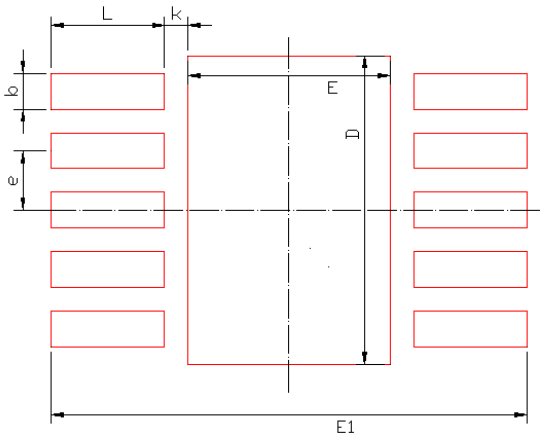


Side View



Detail A
Pin1 Identifier: two options

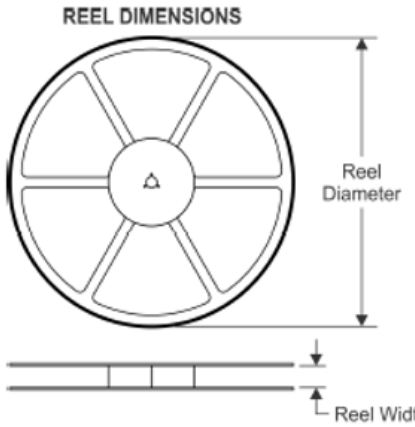
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	2.924	3.076	0.115	0.121
E	2.924	3.076	0.115	0.121
D1	2.300	2.500	0.091	0.098
E1	1.600	1.800	0.063	0.071
k	0.200MIN.		0.008MIN.	
b	0.200	0.300	0.008	0.012
e	0.500TYP.		0.020TYP.	
L	0.324	0.476	0.013	0.019

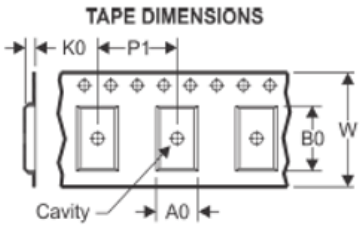


RECOMMENDED LAND PATTERN

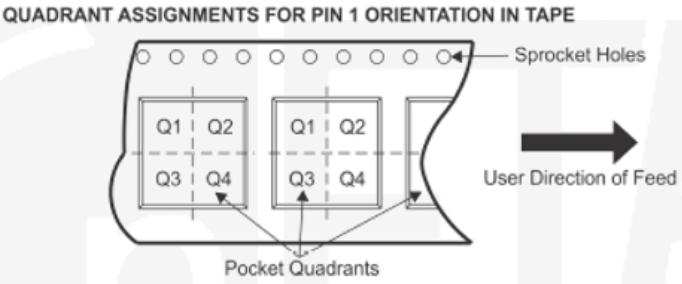
Dimensions	Value (in mm)
D	2.6
E	1.7
E1	4
e	0.5
b	0.3
L	0.95
k	0.2

TAPE AND REEL INFORMATION





A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers



Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ETA8291D3K	DFN3x3-10	10	5000	330	12.4	3.35	3.35	1.13	8	12	Q1