

17V, 2A High Efficiency Synchronous Step-Down Converter in SOT563

DESCRIPTION

ETA1650 is a wide input range, high-efficiency and high frequency 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. The adaptive COT control also maintains a constant switching frequency across line and load. An OVP function protects the IC itself and its downstream system against input voltage surges. With this OVP function, the IC can stand off input voltage as high as 24V, making it an ideal solution for industrial applications such as LCD TV, Set Top Box, Portable TV, etc.

ETA1650 is available in SOT563 package.

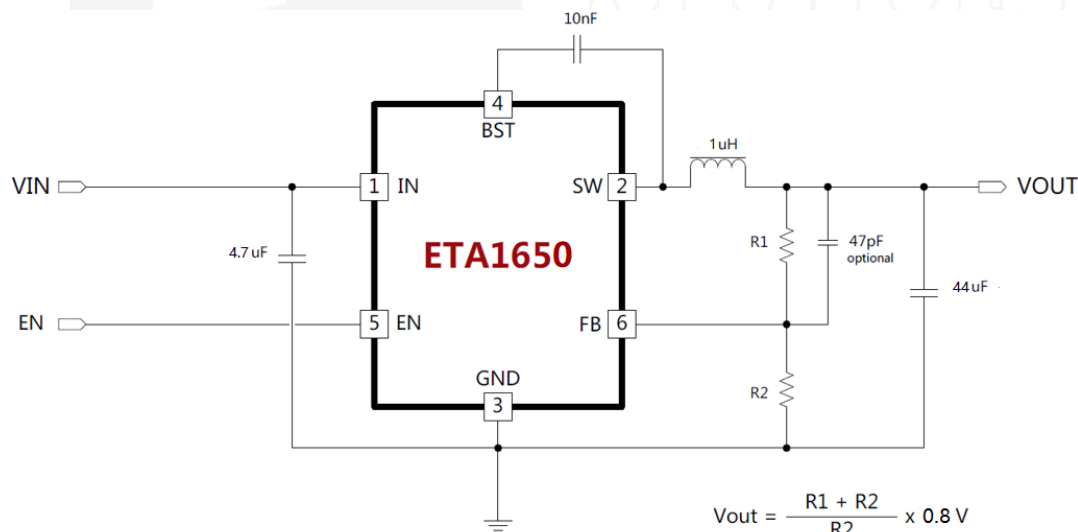
FEATURES

- ◆ Wide Input Range: 4.2V-17V
- ◆ Adaptive COT Control
- ◆ Ultra-fast load transient response
- ◆ Forced PWM mode
- ◆ High Efficiency Synchronous operation
- ◆ Low Rdson Internal power FETs
- ◆ Capable of Delivering 2A
- ◆ No External Compensation Needed
- ◆ Thermal Shutdown and UVLO
- ◆ Available in SOT563 Package

APPLICATIONS

- ◆ LCD TV
- ◆ Set Top Box
- ◆ xDSL Modem

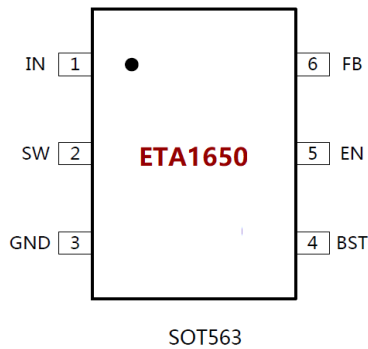
TYPICAL APPLICATION



ORDERING INFORMATION

PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA1650FSG	SOT563	FTYW	5000

PIN CONFIGURATION



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, EN, SW Voltage	-0.3V to 24V
BST Voltage	-0.3V to SW+6V
FB 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}
SOT563.....	120.....50..... °C/W
Lead Temperature (Soldering 10sec)	260°C
ESD HBM (Human Body Mode)	2KV
ESD CDM (Charged Device Mode)	1KV

ELECTRICAL CHARACTERISTICS

($V_{IN} = 12V$, $V_{OUT} = 3.3V$, unless otherwise specified. Typical values are at $T_A = 25^\circ C$.)

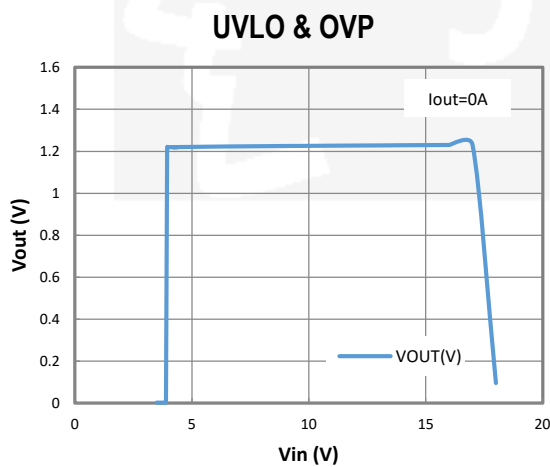
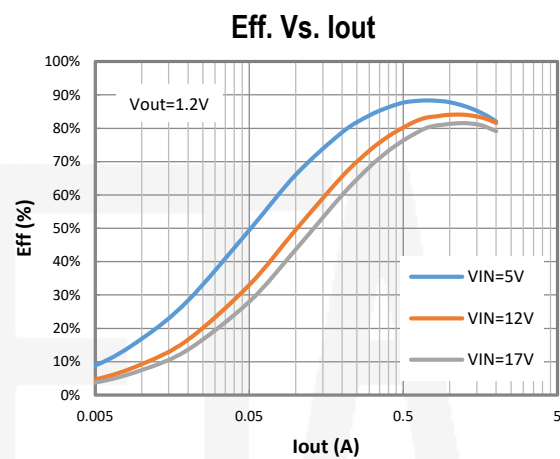
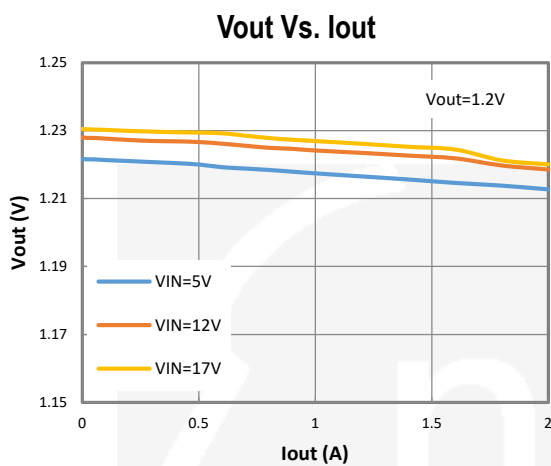
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range		4.2		17	V
Input UVLO	Rising, Hysteresis=450mV		3.85		V
Input OVP	Rising, Hysteresis=0.9V		18.4		V
Input Supply Current	$V_{FB}=0.85V$		200		μA
Input Shutdown Current			7	14	μA
FB Voltage		0.788	0.8	0.812	V
FB Input Current			0	0.1	μA
Switching Frequency		520	650	780	kHz
Maximum Duty Cycle			87		%
Short Circuit Hiccup Time	On Time		1.4		mS
	Off Time		4.2		mS
FB Hiccup Threshold			0.3		V
High Side Switch On Resistance			130		m Ω
Low Side Switch On Resistance			65		m Ω
High Side Current Limit			3.5		A
SW Leakage Current	$IN=SW=12V$			10	μA
EN Rising Threshold	$HYS=0.1V$	1.14	1.2	1.26	V
EN Input Current	$V_{EN}=2V$		2	6	μA
Thermal Shutdown	Rising, Hysteresis =36°C		150		°C

PIN DESCRIPTION

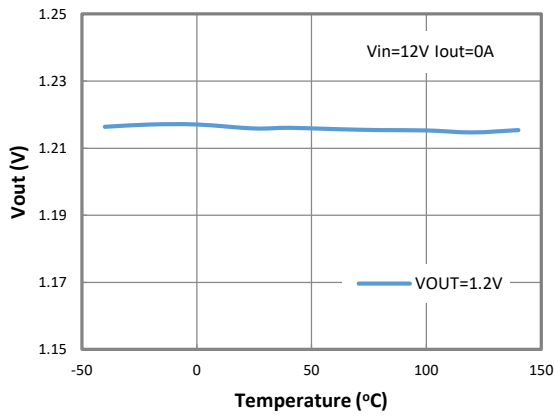
PIN #	NAME	DESCRIPTION
1	IN	Supply Voltage. Bypass with a 4.7 μ F ceramic capacitor to GND
2	SW	Inductor Connection. Connect an inductor Between SW and the regulator output.
3	GND	Ground
4	BST	Bootstrap pin. Connect a 10nF capacitor from this pin to SW
5	EN	Enable pin for the IC. Drive this pin high to enable the part, low or floating to disable.
6	FB	Feedback Input. Connect an external resistor divider from the output to FB and GND to set V_{OUT}

TYPICAL CHARACTERISTICS

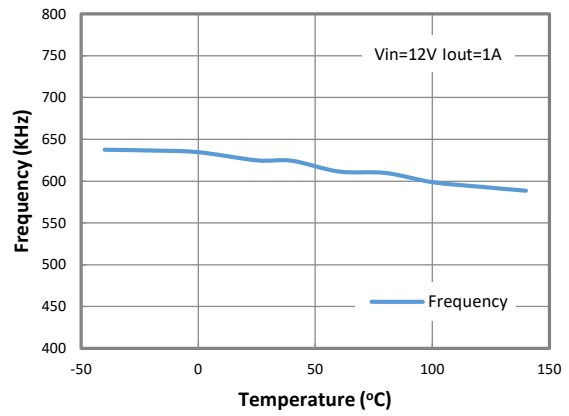
(Typical values are at $V_{IN}=12V$ $T_A = 25^{\circ}C$ unless otherwise specified.)



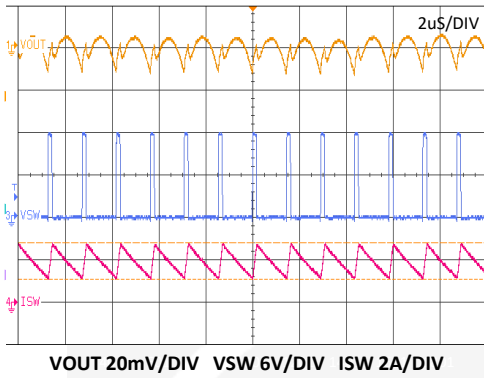
Vout Vs. Temp



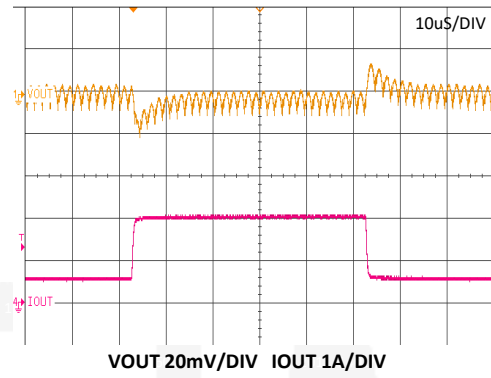
Freq Vs. Temp



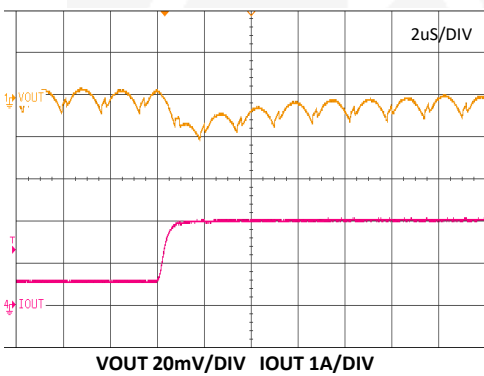
Waveform 1.2V/2A Vin=12V



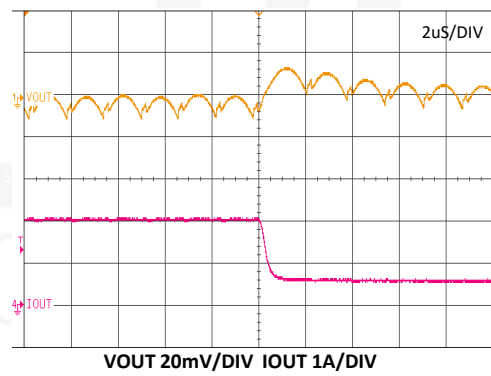
1.2V Load Step 0.3A-2A-0.3A 3A/1uS



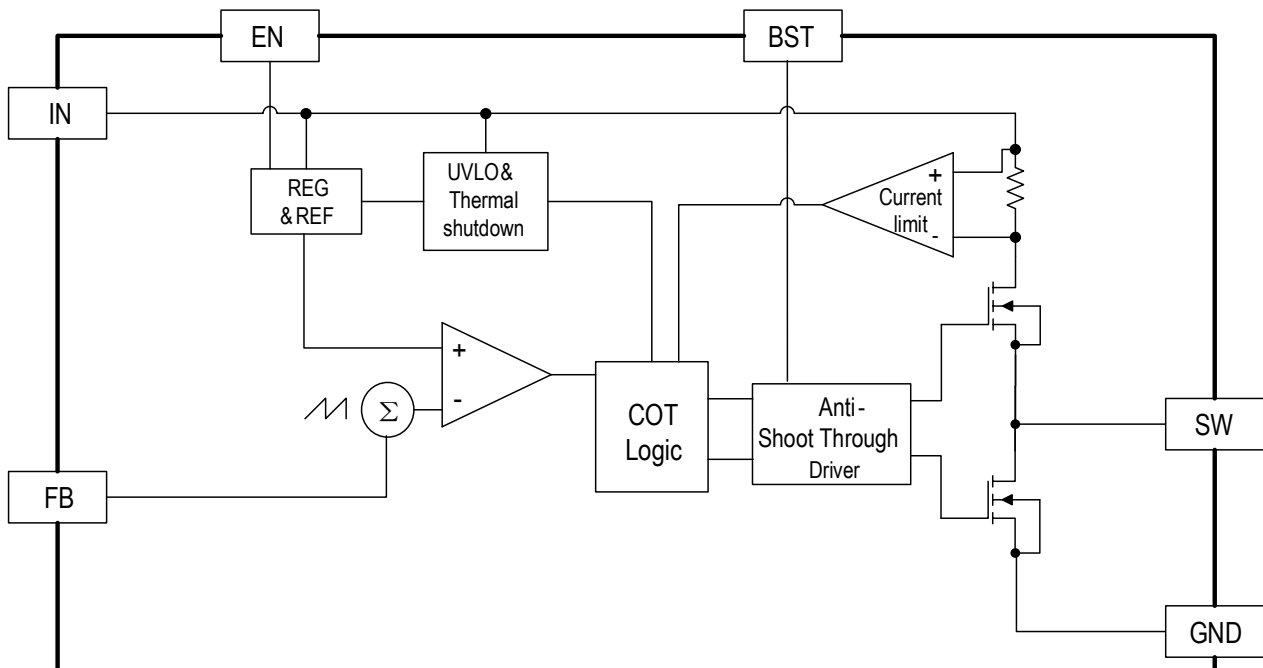
1.2V Load Step Rising 0.3-2A 3A/1uS



1.2V Load Step Falling 2-0.3A 3A/1uS



FUNCTIONAL BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

The ETA1650 is a synchronous buck regulator ICs that integrates the adaptive COT control, top and bottom switches on the same die to minimize the switching transition loss and conduction loss.

ETA1650 is a wide input range, high-efficiency and high frequency 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.

Forced PWM Operation

A forced PWM DC-DC regulator always switches at a fixed frequency when the output heavy load or light load. This is to ensure a minimum output voltage ripple over the full load range.

Enable

EN is a digital control pin that turns the ETA1650 on and off. Drive EN High to turn on the regulator, drive it Low to turn it off. An internal 1M Ω 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 IN will automatically turn on the chip whenever plug in IN.

Over Current Protection and Hiccup

ETA1650 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 (0.3V), the ETA1650 will enter hiccup mode. It will turn off the chip immediately for 4.2mS. After that, it will try to re-starts as

normal for 1.4mS. After 1.4mS, 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

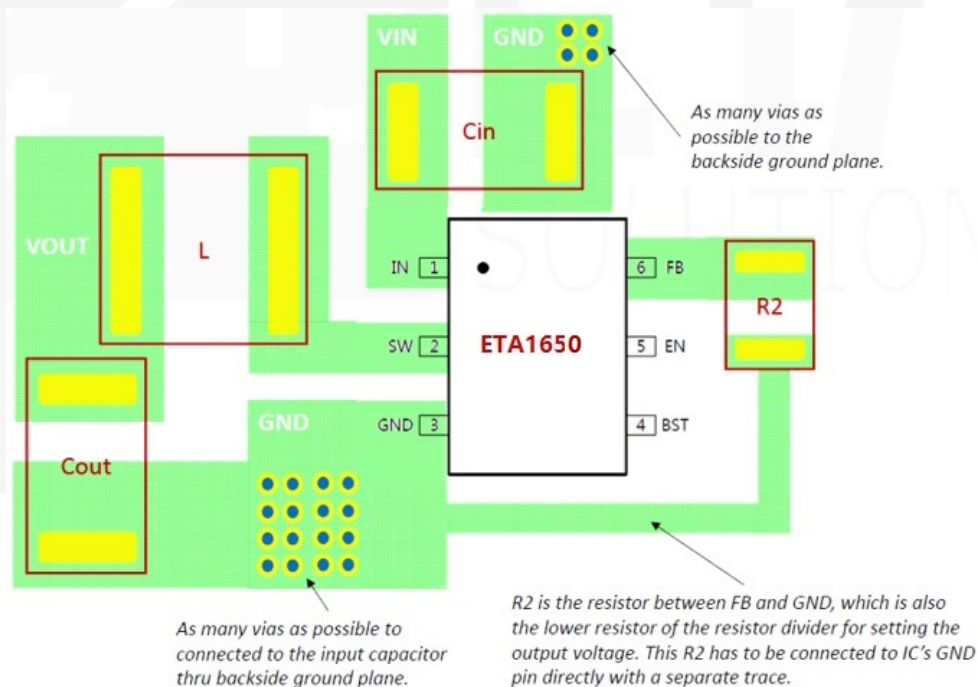
External Output Voltage Setting

In external Output Voltage Setting Version selected, the ETA1650 regulator is programmed using an external resistor divider. The output voltage is calculated using below equation.

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

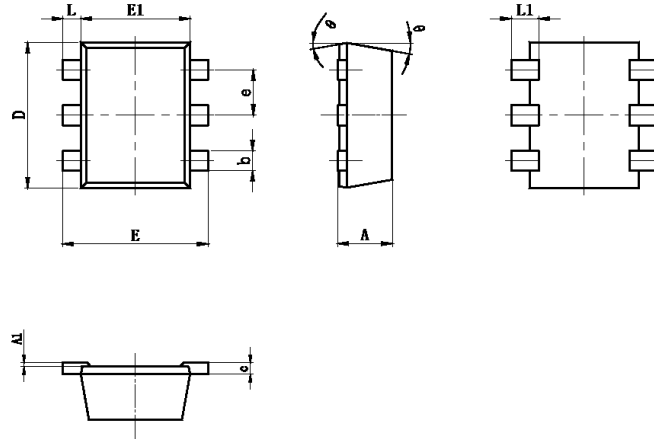
Where: VREF =0.8V typically (the internal reference voltage)

PCB LAYOUT GUIDE



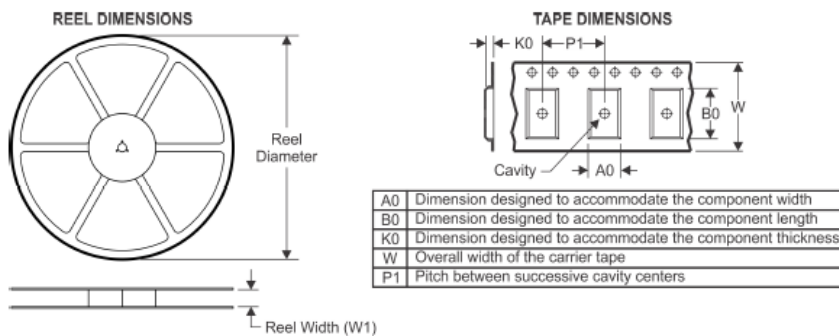
PACKAGE OUTLINE

Package: SOT563

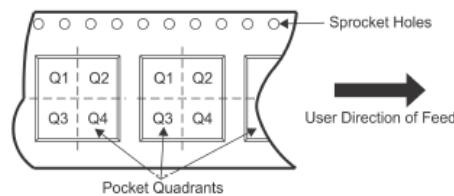


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.525	0.600	0.021	0.024
A1	0.000	0.050	0.000	0.002
e	0.450	0.550	0.018	0.022
c	0.090	0.180	0.004	0.007
D	1.500	1.700	0.059	0.067
b	0.170	0.270	0.007	0.011
E1	1.100	1.300	0.043	0.051
E	1.500	1.700	0.059	0.067
L	0.100	0.300	0.004	0.012
L1	0.200	0.400	0.008	0.016
θ	9° REF.		9° REF.	

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ETA1650FSG	FC50T563	6	5000	178	9.5	1.78	1.78	0.69	4	8	Q3