16V, 3A, 600KHz
Synchronous Buck Converter

EA8273

Datasheet

General Description

The EA8273 is a 3A buck regulator, designed to operate from 4.5V to 16V input voltage range. Built-in low $R_{DS(ON)}$ high/low side Power-MOSFETS not only reduce external components and has highly efficiency, ideal for3A output current applications. The EA8273 applies Constant On-Time control architecture and can provide fast transient response. The EA8273 has complete protection functions, including short circuit protection, OCP, OTP and UVLO protection. The EA8273 is available in the SOT-563 package and easy to use.

Features

- Built-in Low $R_{DS(ON)}$ Power-MOSFETS
- 4.5V to 16V Input Voltage Range
- 3A Continuous Load Current
- Quiescent Current Lower to 350uA
- Output Adjustable Down to 0.8V
- 600KHz Switching Frequency
- Fast Transient Response
- Internal Sost-Start
- Over-Current Protection
- Auto Recovery Hiccup Mode Short Circuit Protection
- Input UVLO Protection
- Auto Recovery OTP Protection
- Available in SOT-563 Package

Applications

- Distributed Power Systems
- Netcom Products
- LCD TVs and Flat TVs
- Notebooks

Pin Configurations

(TOP VIEW)

SOT-563

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Pin Description

Pin Name	Function Description	Pin No.
PWR	The EA8273 power input pin. Recommended to use two 10uF MLCC capacitors between PWR pin and GND pin.	1
SWITCH	Internal MOSFET switching output. Connect SWITCH pin with a low pass filter circuit to obtain a stable DC output voltage.	2
GND	Ground pin.	3
BOOT	The power input of the internal high side N-MOSFET gate driver. Connect a 33nF ceramic capacitor from BOOT pin to SWITCH pin.	4
RUN	The device turns on/turns off control input. The EA8273 on/off state can be controlled by RUN pin voltage level. Connect RUN pin to PWR pin with a 150KΩ pull up resistor for automatic startup. Don't short PWR pin to RUN pin directly.	5
FBK	Feedback input. Connect FBK pin and GND pin with voltage dividing resistors to set the output voltage.	6

Function Block Diagram

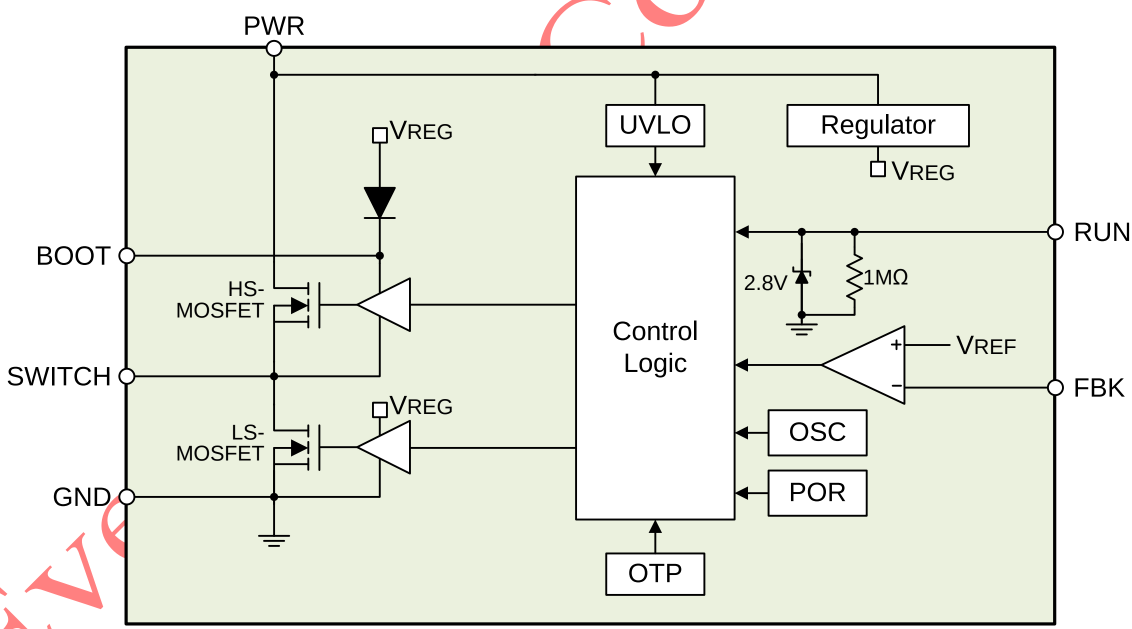

Figure 1. EA8273 internal function block diagram

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Absolute Maximum Ratings

Parameter	Value
Input Voltage (V_{PWR})	-0.3V to +17V
RUN Pin Input Voltage (V_{RUN})	-0.3V to +6.3V
BOOT Pin Voltage (V_{BOOT})	V_{SWITCH}-0.3V to V_{SWITCH}+5V
SWITCH Pin Voltage (V_{SWITCH})	-1V to +17.5V
FBK Pin Voltage (V_{FBK})	-0.3V to +6.3V
Ambient Temperature operating Range (T_A)	-40°C to +85°C
Maximum Junction Temperature (T_{Jmax})	+150°C
Lead Temperature (Soldering, 10 sec)	+260°C
Storage Temperature Range (T_S)	-65°C to +150°C

Note (1):Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. Exposure to "Absolute Maximum Ratings" conditions for extended periods may affect device reliability and lifetime.

Package Thermal Characteristics

Parameter	Value
SOT-563 Thermal Resistance (θ_{JC})	60°C/W
SOT-563 Thermal Resistance (θ_{JA})	130°C/W
SOT-563 Power Dissipation at T_A=25°C (P_{Dmax})	1W

Note (1): P_{Dmax} is calculated according to the formula: $P_{DMAX}=(T_{JMAX}-T_A)/\ \theta_{JA}$.

Recommended Operating Conditions

Parameter	Value
Input Voltage (V_{PWR})	+4.5V to +16V
RUN Pin Input Voltage (V_{RUN})	-0.3V to +16V
Output Voltage (V_{OUT})	+0.6V to +9V
Junction Temperature Range (T_J)	-40°C to +125°C

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Electrical Characteristics

V_{PWR}=12V, T_A=25°C, unless otherwise noted

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage	V_{PWR}		4.5		16	V
Shutdown Supply Current	I_{SD}	V_{RUN} = 0V		3.6	10	uA
Quiescent Current	I_Q	V_{RUN} = 2V, V_{FBK} = 1V		350	600	uA
UVLO Threshold	V_{UVLO}	V_{PWR} Rising		3.55		V
UVLO Hysteresis	$V_{UV\text{-}HYST}$			200		mV
Output Load Current	I_{LOAD}				3	A
Reference Voltage	V_{REF}	4. 5V ≤ V_{PWR} ≤ 16V	0.791	0.807	0.823	V
Switching Frequency	F_{SW}		400	600	800	KHz
Input OVP Voltage	V_{OVP}			19		V
High Side MOSFET On-Resistance	$R_{DS(ON)\text{-}HM}$			110		mΩ
Low Side MOSFET On-Resistance	$R_{DS(ON)\text{-}LM}$			60		mΩ
High Side MOSFET Current Limit	$I_{LIM\text{-}HM}$		3.5	4		A
High Side MOSFET Leakage Current	$I_{LEAK\text{-}HM}$	V_{RUN} = 0V, V_{SWITCH} = 0V		1	10	uA
RUN Pin Rising Threshold Voltage	$V_{RUN\text{-}th}$				0.4	V
RUN Pin Input High Voltage	$V_{RUN\text{-}H}$		1.1	1.2	1.3	V
RUN Pin Hysteresis	$V_{RUN\text{-}HYST}$			100		mV
FBK UV Threshold (H to L)	$V_{FBK\text{-}UV}$			75%		V_{REF}
Hiccup Duty Cycle	D_{HICCUP}			25		%
Minimum On Time	T_{ONMIN}			45		ns
Minimum Off Time	T_{OFFMIN}			140		ns
Internal Soft-Start Time	t_{SS}			2		ms
Thermal Shutdown Threshold	T_{OTP}			150		°C
Thermal Shutdown Hysteresis	T_{HYST}			20		°C

Note (1): MOSFET on-resistance specifications are guaranteed by correlation to wafer level measurements.
(2): Thermal shutdown specifications are guaranteed by correlation to the design and characteristics analysis.

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Application Circuit Diagram

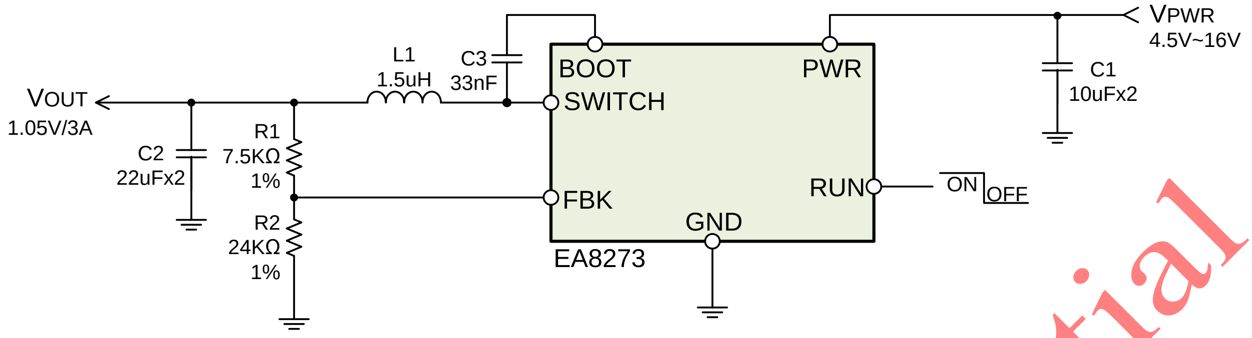

Figure 2. Typical application circuit diagram

Ordering Information

Part Number	Package Type	Packing Information
EA8273T7R	SOT-563	Tape & Reel / 3000

Note (1):“T7”: Package type code.
(2):“R”: Tape & Reel.

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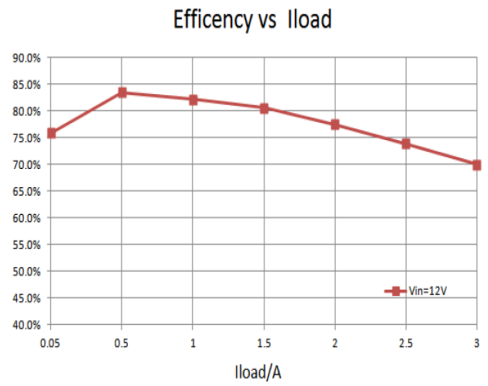
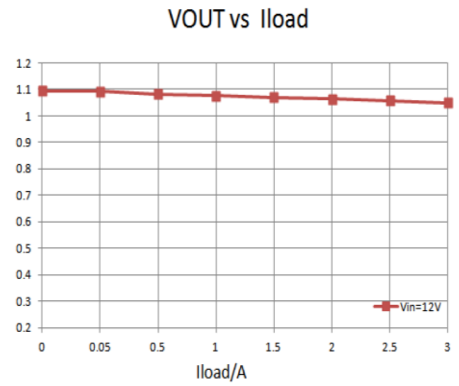
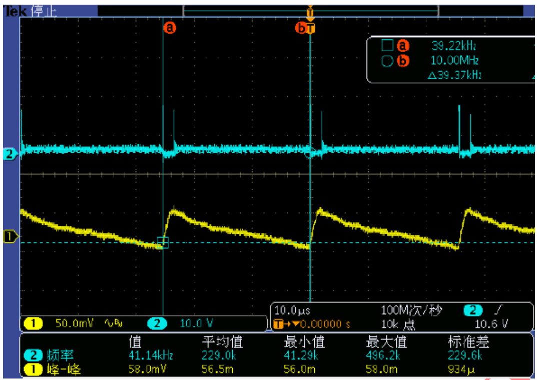
Typical Operating Characteristics

V_{PWR}=12V, V_{OUT}=1.05V, L1=1.5uH, C1=10Fx2, C2=22uFx2, T_A=25°C, unless otherwise noted



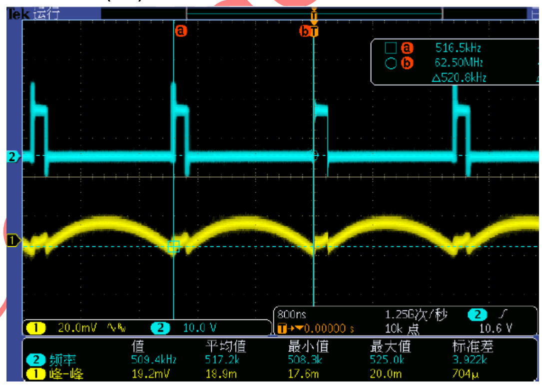


CH1: $V_{OUT\ (AC)}$ CH2: V_{SW}



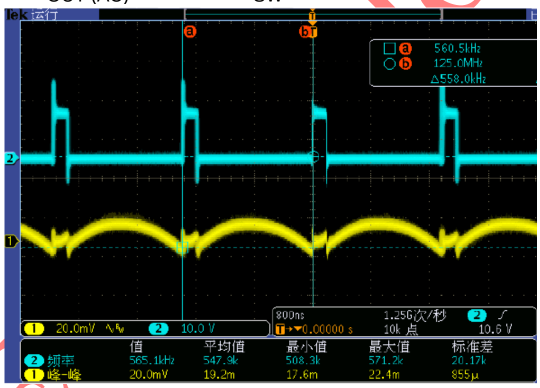
ILOAD = 50mA Switching Waveform

CH1: $V_{OUT\ (AC)}$ CH2: V_{SW}



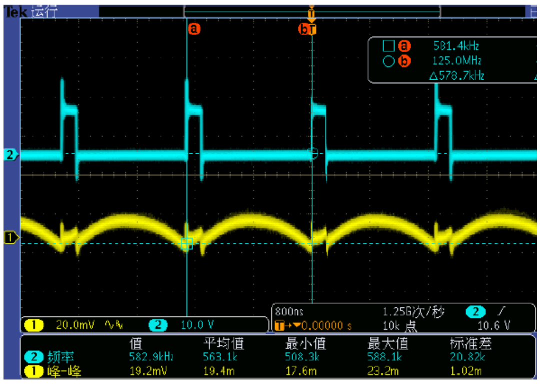
ILOAD = 1A Switching Waveform

CH1: $V_{OUT\ (AC)}$ CH2: V_{SW}



ILOAD = 2A Switching Waveform

CH1: $V_{OUT\ (AC)}$ CH2: V_{SW}



ILOAD = 3A Switching Waveform

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Application Information

Enable Control

The EA8273 use RUN pin to control the regulator turns on / turns off. When the RUN pin input voltage is higher than 1.2V(typ.), the EA8273 enters the operating mode. Drive the RUN pin input voltage lower than 0.4V to ensure the EA8273 into shutdown mode, as shown in Figure3. When the device works in the shutdown mode, the shutdown supply current is less than 10uA. The EA8273 also provides automatic startup function as shown in Figure 4. Connect RUN pin and PWR pin with a 150KΩ resistor, when the PWR supply input voltage increasing and higher than RUN pin threshold voltage, the EA8273 will enter operating mode automatically. Do not short PWR pin to RUN pin directly or it will damage the internal zener diode.

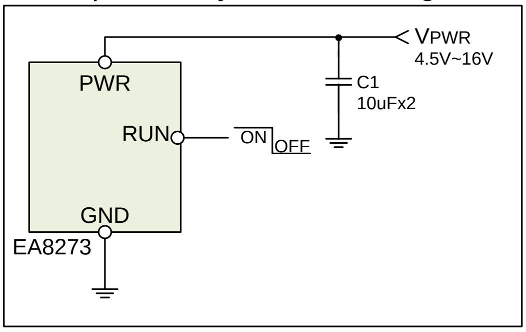

Figure 3. Enable control by RUN pin voltage

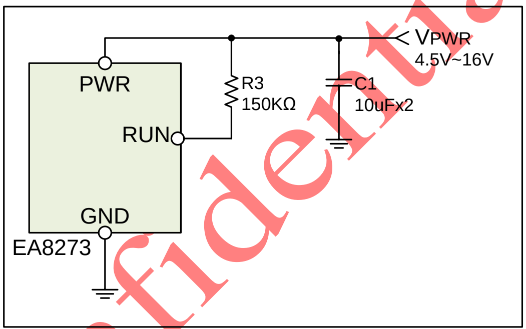

Figure 4. Automatic startup application circuit

Output Voltage Setting

The EA8273 output voltage can be set via a resistor divider (R1, R2). The output voltage is calculated by following equation:

$$V_{OUT} = 0.8 \times \frac{R1}{R2} + 0.8\ V$$

The following table lists common output voltage and the corresponding R1, R2 resistance value for reference.

Output Voltage	R1 Resistance	R2 Resistance	Tolerance
5V	43KΩ	8.2KΩ	1%
3.3V	47KΩ	15KΩ	1%
1.8V	20KΩ	15KΩ	1%
1.2V	15KΩ	30KΩ	1%
1V	7.5 KΩ	30 KΩ	1%

Input / Output Capacitors Selection

The input capacitors are used to suppress the noise amplitude of the input voltage and provide a stable and clean DC input to the device. Because the ceramic capacitor has low ESR characteristic, so it is suitable for input capacitor use. It is recommended to use X5R or X7R MLCC capacitors in order to have better temperature performance and smaller capacitance tolerance. In order to suppress the output voltage ripple, the MLCC capacitor is also the best choice. The suggested part numbers of input / output capacitors are as follows:

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Vendor	Part Number	Capacitance	Edc	Parameter	Size
TDK	C2012X5R1C106K	10uF	16V	X5R	0805
TDK	C3216X5R1E106K	10uF	25V	X5R	1206
TDK	C2012X5R0J226K	22uF	6.3V	X5R	0805
TDK	C3216X5R1A226M	22uF	10V	X5R	1206

Output Inductor Selection

The output inductor selection mainly depends on the amount of ripple current through the inductor ΔI_L. Large ΔI_L will cause larger output voltage ripple and loss, but the user can use a smaller inductor to save cost and space. On the contrary, the larger inductance can get smaller ΔI_L and thus the smaller output voltage ripple and loss. But it will increase the space and the cost. The inductor value can be calculated as:

$$L = \frac{V_{PWR} - V_{OUT}}{\Delta I_L \times F_{SW}} \times \frac{V_{OUT}}{V_{PWR}}$$

The following table lists common output voltage and the corresponding L inductance value for reference.

Output Voltage	L Inductance Value
5V	3.3uH
3.3V	2.2uH
1.8V	1.5uH
1.2V	1.0uH ~ 1.5uH
1V	1.0uH ~ 1.5uH

PCB Layout Recommendations

For EA8273 PCB layout considerations, please refer to the following suggestions in order to get good performance.

- High current path traces (shown as Figure 5.) need to be widened.
- Place the input capacitors as close as possible to the PWR pin to reduce noise interference.
- Keep the feedback path (from V_{OUT} to FBK) away from the noise node (ex. SWITCH).
- SWITCH is a high current noise node. Complete the layout by using short and wide traces.

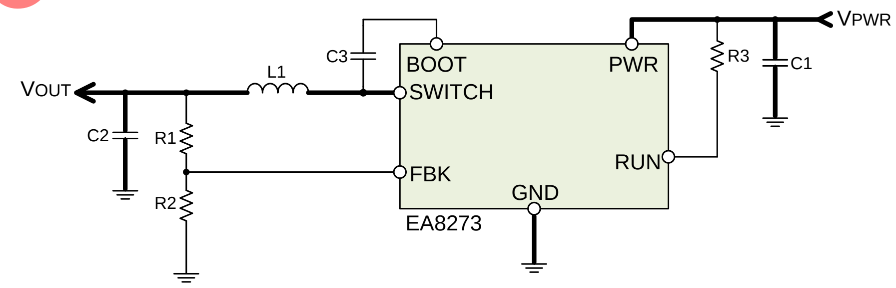

Figure 5. Recommended high current traces layout guide

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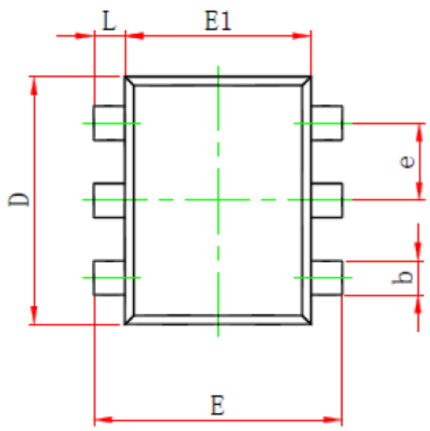
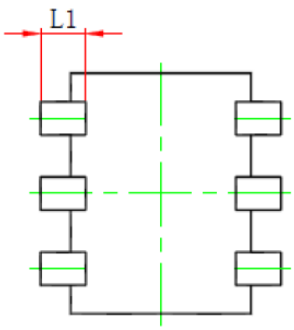
Package Information

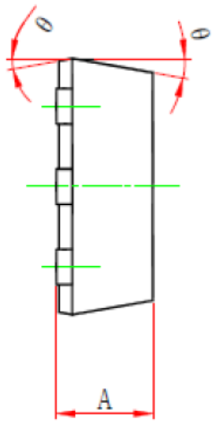
SOT-563 Package



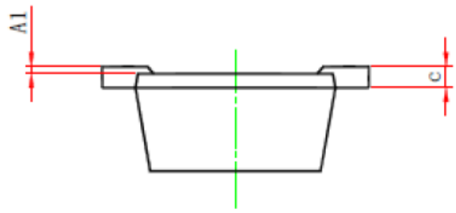
Top View



Bottom View



Side View



Front View

Unit: mm

Symbol	Dimension Min	Max
A	0.525	0.600
A1	0.000	0.050
e	0.450	0.550
c	0.090	0.180
D	1.500	1.700
b	0.170	0.270
E1	1.100	1.300
E	1.500	1.700
L	0.100	0.300
L1	0.200	0.400
θ	9°REF	

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