MPQ3426

6A, 45V, Boost Converter with Configurable Switching Frequency and UVLO AEC-Q100 Qualified

The Future of Analog IC Technology

DESCRIPTION

The MPQ3426 is a current-mode step-up converter with a 6A, 90mΩ, 45V internal switch that provides a highly efficient regulator with a fast response.

The MPQ3426 features a configurable switching frequency (f_{SW}) of up to 2MHz that allows for simple filtering and reduces noise. An external compensation pin gives the user flexibility in setting loop dynamics, and allows the user to use small, low-ESR, ceramic output capacitors.

Soft start leads to a small inrush current that can be configured with an external capacitor. The MPQ3426 operates from a biased supply voltage as low as 3.2V, and can generate an output voltage (V_{OUT}) up to 35V.

The MPQ3426's features include under-voltage lockout (UVLO), current limiting, and thermal overload protection.

The MPQ3426 is available in a low-profile QFN-14 (3mmx4mm) package and a QFN-14 (4mmx4mm) package with wettable flanks and an exposed pad.

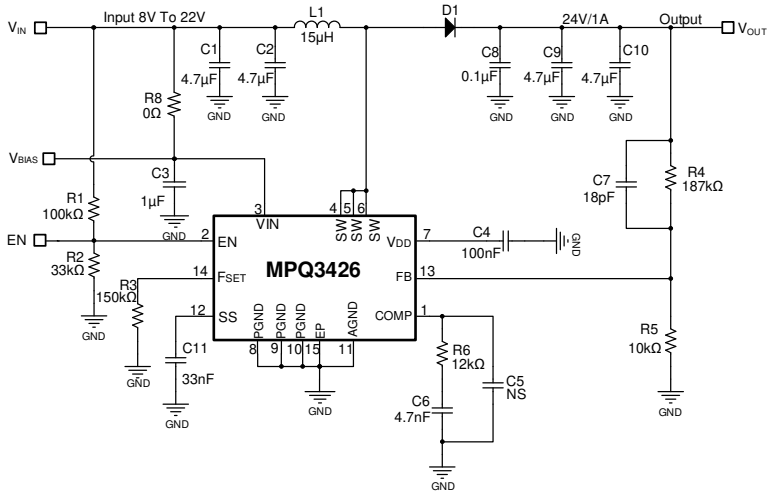
FEATURES

- 6A, 90mΩ, 45V Power MOSFET Supports Battery Range up to 45V (Load Dump)
- Wide Input Voltage (V_{IN}) Biased Supply Range: 3.2V to 22V
- Ideal for Automotive Pre-Boost Applications
- Output Voltage (V_{OUT}) as High as 35V
- Configurable 300kHz to 2MHz Switching Frequency (f_{SW})
- Micro-Power Shutdown <1μA
- Thermal Shutdown at 160°C
- Available in a QFN-14 (3mmx4mm) Package
- Available in a QFN-14 (4mmx4mm) Package with Wettable Flanks
- Available in AEC-Q100 Grade 1

APPLICATIONS

- Automotive Cold-Crank, Pre-Boost, and SEPIC
- Audio Microphones and Tuner Bias
- OLED Biased Supplies

TYPICAL APPLICATION



ORDERING INFORMATION

Part Number*	Package	Top Marking	MLS Rating**
MPQ3426DL	QFN-14 (3mmx4mm)	*See Below*	Level 1
MPQ3426DL-AEC1	QFN-14 (3mmx4mm)		Level 1
MPQ3426GRE-AEC1***	QFN-14 (4mmx4mm)	*See Below*	Level 1

* For Tape & Reel, add suffix -Z (e.g. MPQ3426DL-AEC1-Z).
For RoHS Compliant Packaging, add suffix -LF (e.g. MPQ3426DL-AEC1-LF-Z).
** Moisture Sensitivity Level Rating
*** Wettable Flank

TOP MARKING (MPQ3426DL)

MPYW
3426
LLL

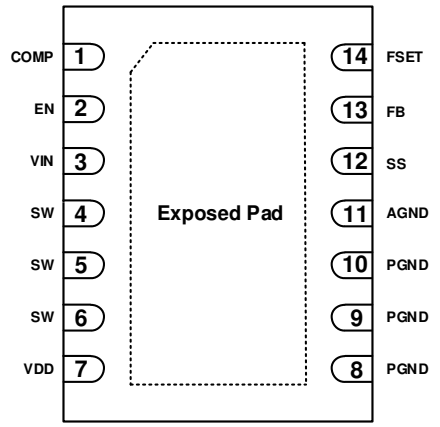
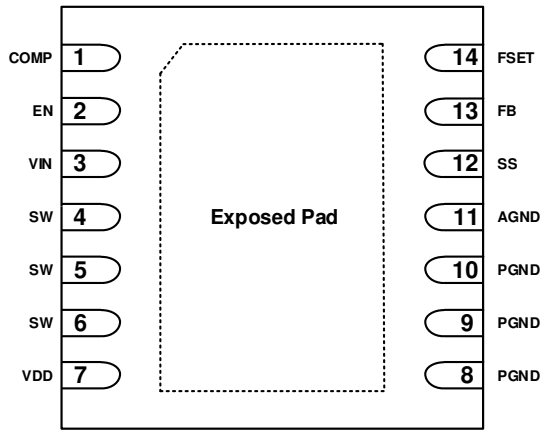
MP: MPS prefix
Y: Year code
W: Week code
3426: First four digits of the part number
LLL: Lot number

TOP MARKING (MPQ3426GRE)

MPSYWW
MP3426
LLLLLL
E

MPS: MPS prefix
Y: Year code
WW: Week code
MP3426: Part number
LLLLLL: Lot number
E: Wettable Flank

PACKAGE REFERENCE

TOP VIEW	TOP VIEW
	
QFN-14 (3mmx4mm)	QFN-14 (4mmx4mm)

ABSOLUTE MAXIMUM RATINGS (1)

SW .....-0.5V to +45V
VIN .....-0.5V to +24V
All other pins .....-0.3V to +6.5V
Continuous power dissipation (T_A = 25°C) (2)
QFN-14 (3mmx4mm) 2.5W
QFN-14 (4mmx4mm) 2.6W
Junction temperature .....150°C
Lead temperature .....260°C
Storage temperature..... -65°C to +150°C

ESD Ratings

Human body model (HBM) ..... ±2000V
Charged device model (CDM) ..... ±750V

Recommended Operating Conditions (3)

Supply voltage (V_{IN}) .....3.2V to 22V
Output voltage (V_{OUT}).....3.2V to 35V
Operating junction temp (T_J)... - 40°C to +125°C

Thermal Resistance (4) θ_{JA} θ_{JC}

QFN-14 (3mmx4mm)	50	12 °C/W
QFN-14 (4mmx4mm)	47.2	4.8 °C/W

Notes:

1) Absolute maximum are rated under room temperature unless otherwise noted. Exceeding these ratings may damage the device.
2) The maximum allowable power dissipation is a function of the maximum junction temperature, T_J (MAX), the junction-to-ambient thermal resistance, θ_{JA}, and the ambient temperature, T_A. The maximum allowable continuous power dissipation at any ambient temperature is calculated by P_D (MAX) = (T_J (MAX) - T_A) / θ_{JA}. Exceeding the maximum allowable power dissipation can cause excessive die temperature, and the regulator may go into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage.
3) The device is not guaranteed to function outside of its operating conditions.
4) Measured on JESD51-7, 4-layer PCB.

ELECTRICAL CHARACTERISTICS

V_{IN} = 12V, V_{EN} = 5V, T_J = -40°C to +125°C Typical values are at T_J = +25°C, unless otherwise noted.

Parameter	Symbol	Condition		Min	Typ	Max	Units
Operating VIN Bias Voltage	V_{IN}			3.2		22	V
Under-Voltage Lockout		V_{BIAS} rising	T_J=25˚C	2.8		3.1	V
				2.75		3.15	
Under-Voltage Lockout Hysteresis					250		mV
VDD Voltage Gate Drive Voltage Supply	V_{DD}	C = 10nF			4.6	5.9	V
Supply Current (Shutdown)		V_{EN} = 0V				1	µA
Supply Current (Quiescent)		V_{FB} = 1.35V	T_J=25˚C		650	900	µA
						950	
Switching Frequency		R_{FSET} = 84.5kΩ		450	540	630	kHz
Minimum OFF Time		V_{FB} = 0V			80	150	ns
Minimum ON Time(5)		V_{FB} = 1.35V			100		ns
EN Turn-On Threshold(6)		V_{EN} Rising (switching)	T_J=25˚C	1.45	1.5	1.55	V
				1.4		1.6	
EN High Threshold (Micro power)		V_{EN} Rising				1.0	V
EN Low Threshold (Micro power)		V_{EN} Falling	T_J=25˚C	0.5			V
				0.45			
EN Input Bias Current		V_{EN} = 0V, 5V			0.1	1	µA
UVLO Hysteresis Current to EN(6)		1.0 < EN < 1.4			4		µA
Soft-Start Current				4	6	8	µA
FB Voltage			T_J=25˚C	1.200	1.225	1.250	V
				1.19		1.26	
FB Input Bias Current				-200	-100		nA
Error Amp. Voltage Gain(5)	A_{VEA}				300		V/V
Error Amp. Transconductance ($\frac{\mu A}{V}$)(5)	G_{EA}				160		µA/V
Error Amp. Output Current(5)					15		µA
GCS : I_{SW}/V_{COMP} (5)	G_{CS}				18		A/V
SW ON Resistance	R_{ON}	I_{SW} = 100mA			90		mΩ
SW Current Limit		Duty Cycle = 0%	T_J=25˚C	6.8	8.5		A
				6.2			
Thermal Shutdown(5)					160		°C

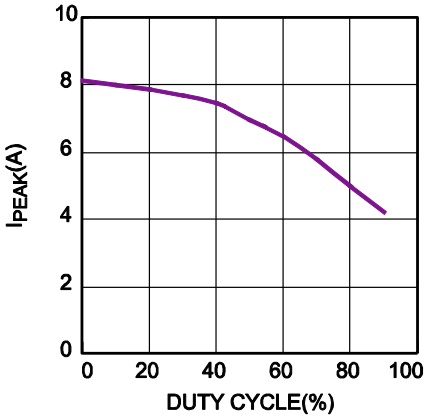
Notes:

5) Guaranteed by design, not tested.
6) Refer to the “APPLICATION INFORMATION-EN UVLO Hysteresis”.

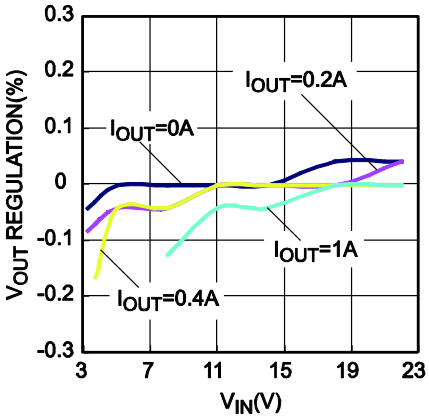
TYPICAL PERFORMANCE CHARACTERISTICS

V_{IN}=12V, V_{OUT}=24V, L=15µH, C_{OUT}=4.7µF×2, f_{SW}=300kHz, T_A=+25°C, unless otherwise noted.

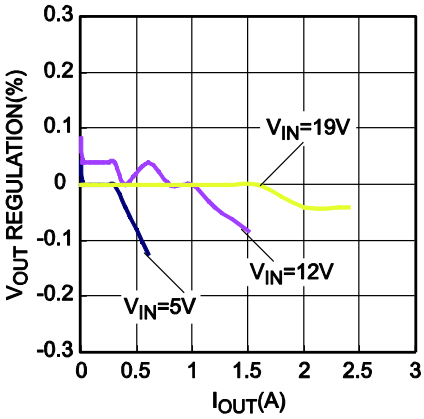
I_{LIMIT} vs. Duty Cycle



Line Regulation

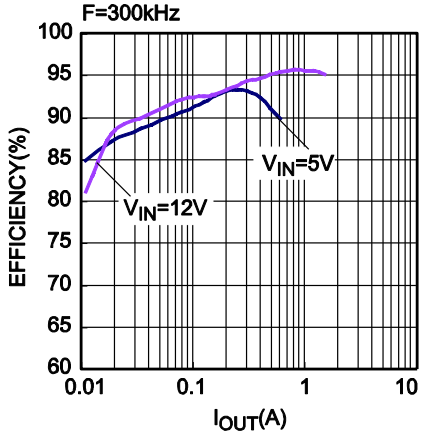


Load Regulation



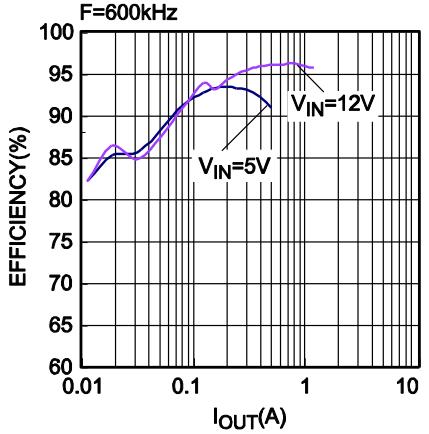
Efficiency

F=300kHz



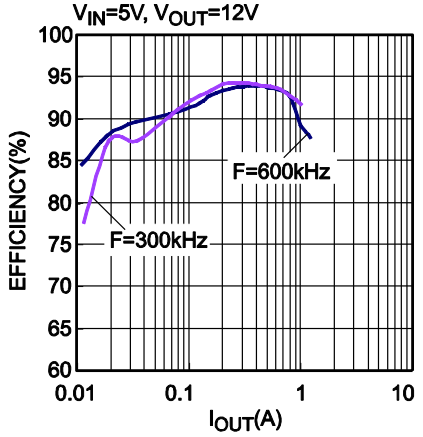
Efficiency

F=600kHz



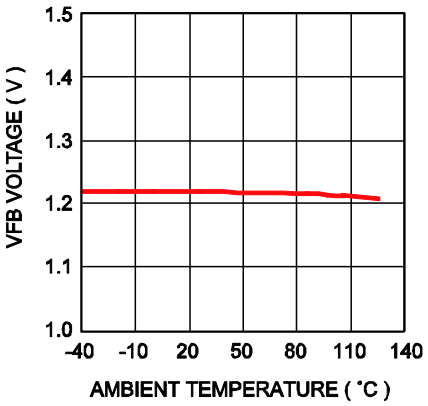
Efficiency

V_{IN}=5V, V_{OUT}=12V

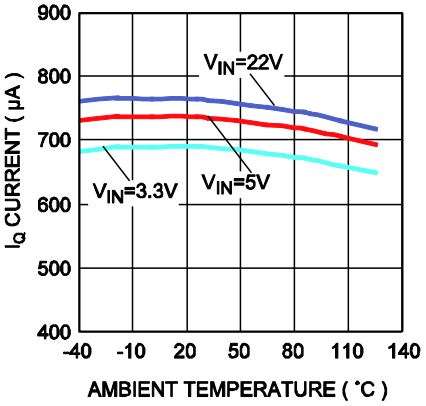


TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

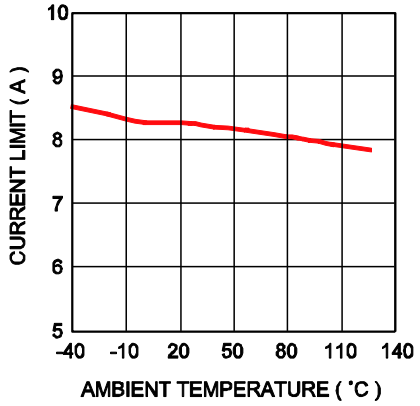
V_{FB} Voltage vs. T_A



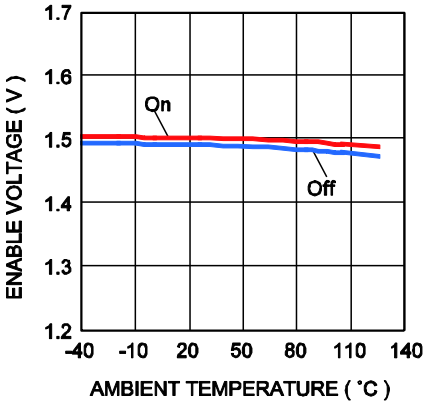
I_Q Current vs. T_A



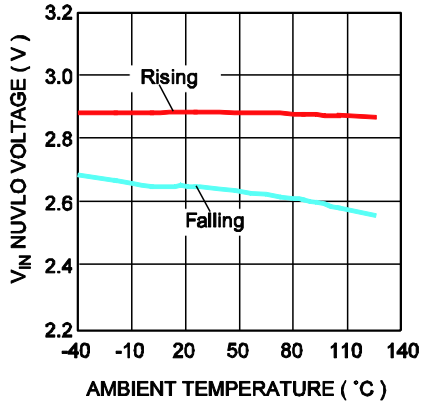
Current Limit vs. T_A



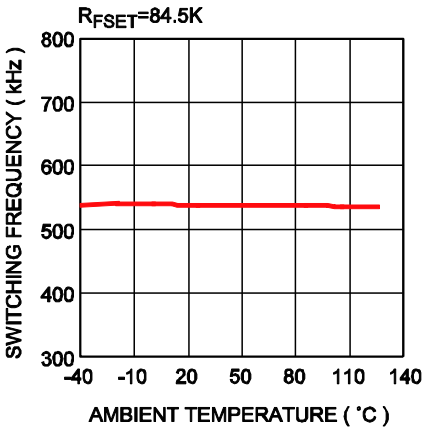
Enable Voltage vs. T_A



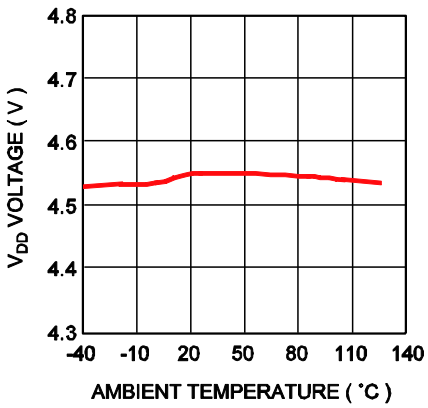
V_{IN} UVLO Voltage vs. T_A



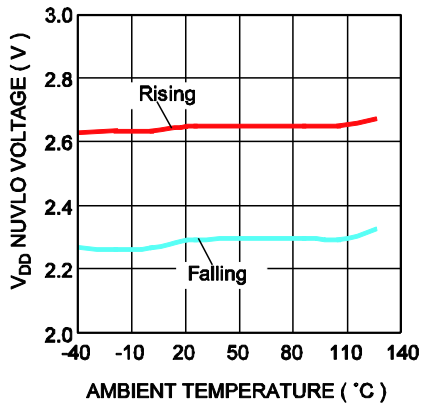
F_{SW} Frequency vs. T_A



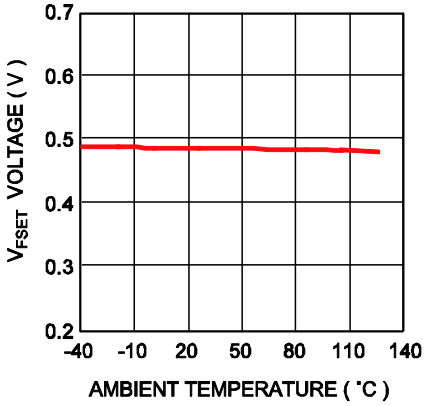
V_{DD} Regulation vs. T_A



V_{DD} UVLO Voltage vs. T_A



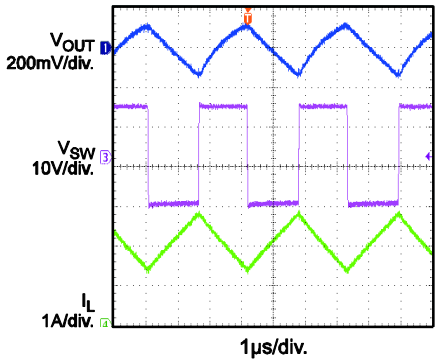
FSET Voltage vs. T_A



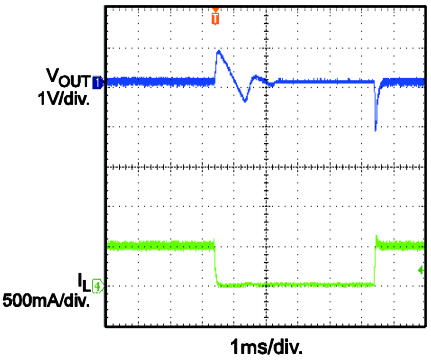
TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

V_{IN}=12V, V_{OUT}=24V, L=15µH, C_{OUT}=4.7µF×2, f_{SW}=300kHz, T_A=+25°C, unless otherwise noted.

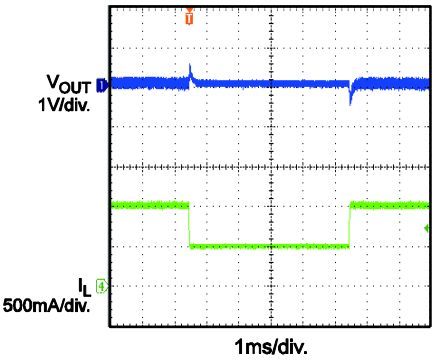
VOUT Ripple
I_{OUT}=1A



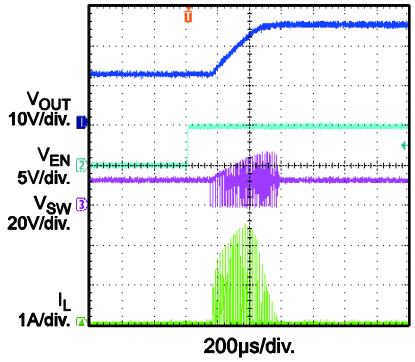
Load Transient Response
I_{OUT}=0->0.5A, 0.1A/µs



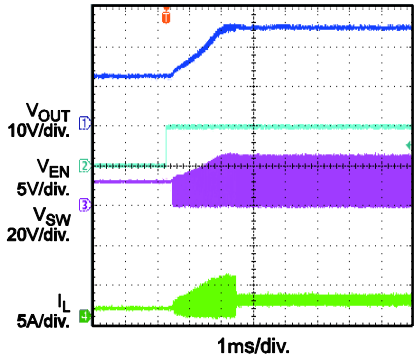
Load Transient Response
I_{OUT}=0.5A->1A, 0.1A/µs



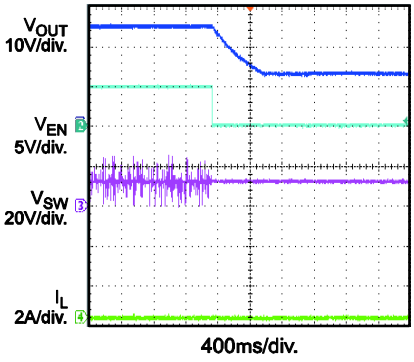
EN Startup
I_{OUT}=0A



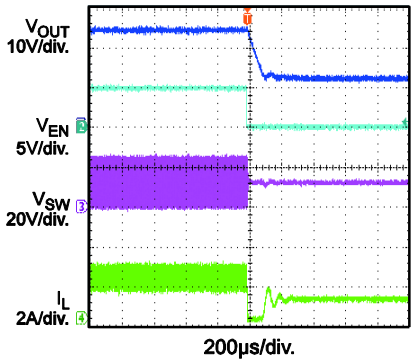
EN Startup
I_{OUT}=1A



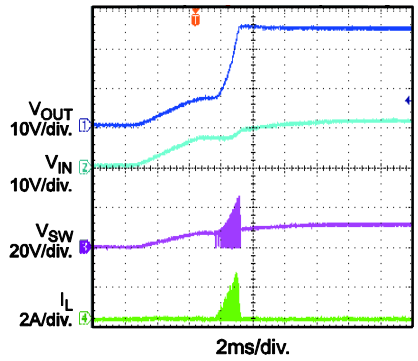
EN Shutodwn
I_{OUT}=0A



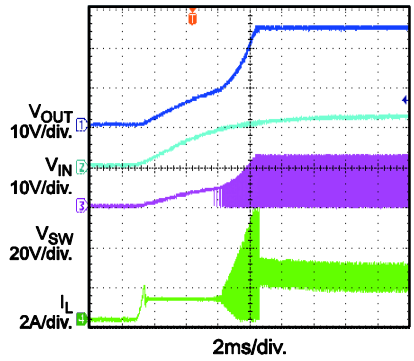
EN Shutdown
I_{OUT}=1A



VIN Startup
I_{OUT}=0A



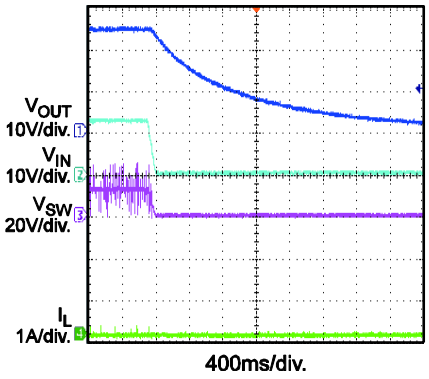
VIN Startup
I_{OUT}=1A



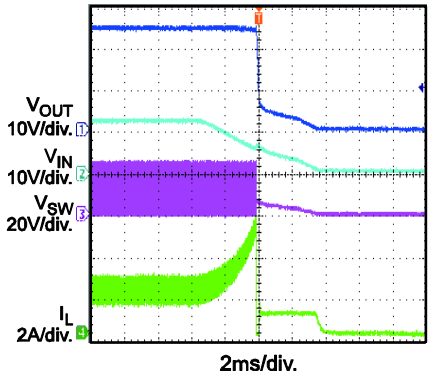
TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

V_{IN}=12V, V_{OUT}=24V, L=15µH, C_{OUT}=4.7µF×2, f_{SW}=300kHz, T_A=+25°C, unless otherwise noted.

VIN SHUTDOWN
I_{OUT}=0A



VIN SHUTDOWN
I_{OUT}=1A



PIN FUNCTIONS

Pin #	Name	Description
1	COMP	Compensation. Connect a capacitor and resistor in series to Analog ground for loop stability.
2	EN	Regulator on/off control input. A high input at EN turns on the converter, and a low input turns it off. When not used, connect EN to the input source (through a 100kΩ pull-up resistor if V_{IN} > 6V) for automatic startup. EN pin can also be used to program VIN UVLO. Do not leave EN floating.
3	VIN	Internal LDO bias supply. VIN must be locally bypassed. To extend the device's operating range, VIN can be connected to a different potential instead of the boost system's supply.
4, 5, 6	SW	Power Switch Output. SW is the drain of the internal MOSFET switch. Connect to the power inductor and output rectifier.
7	VDD	LDO output. VDD can be connected directly to BIAS when V_{DD} < 5.9V to improve efficiency and extend the low input operating range.
8, 9, 10	PGND	Power ground.
11	AGND	Analog ground. Connect to the exposed pad at a single point.
12	SS	Soft-Start. Connect a soft-start capacitor to this pin. The soft-start capacitor charges from a 6μA constant current. Leave disconnected if the soft-start is not used.
13	FB	Feedback Input. Reference voltage is 1.25V. Connect a resistor divider to this pin.
14	FSET	Frequency Set. Connect a resistor from this pin to AGND. FSET pin voltage is internally regulated to 0.5V. The current flowing out of this pin linearly sets the operating frequency.
15	EP	Exposed Pad. The bottom exposed pad is the power ground. For best thermal dissipation, solder the exposed pad to the underlying cooper backplane.

FUNCTIONAL BLOCK DIAGRAM

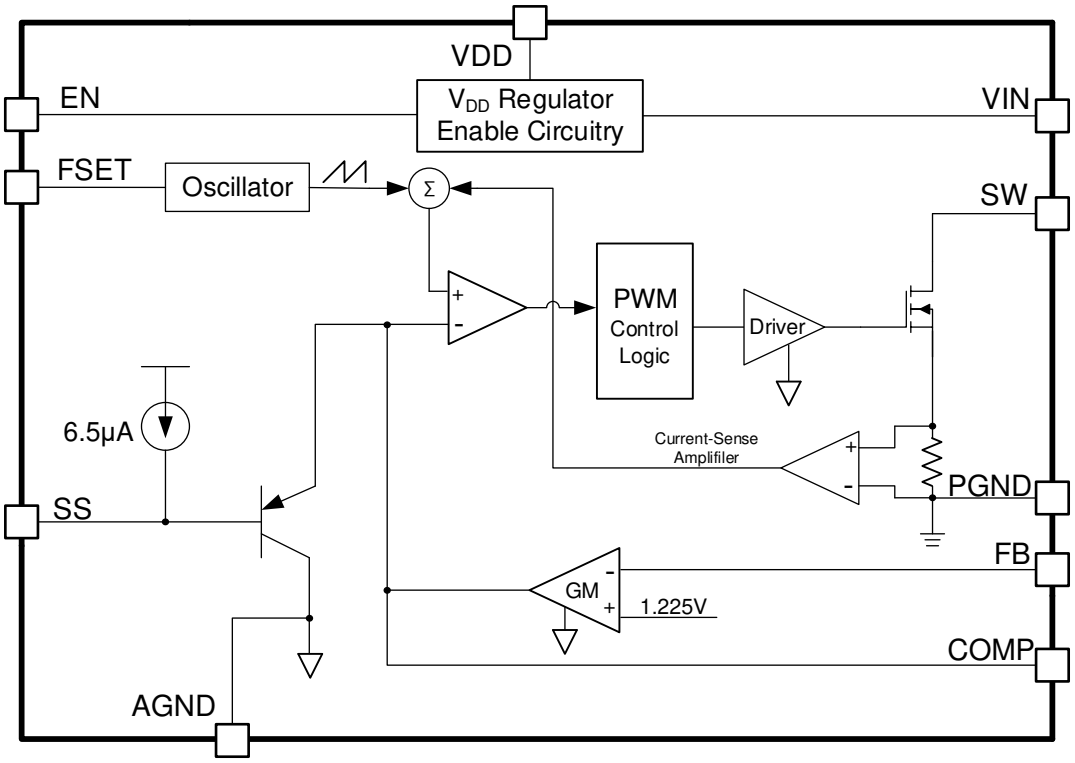


Figure 1: Functional Block Diagram

APPLICATION INFORMATION

Components referenced below apply to the Typical Application Circuit on both page 1 and Figure 5 on page 17.

Theory of Operation

The MPQ3426 uses a constant-frequency, peak-current–mode, boost regulator architecture to regulate the feedback voltage. Refer to the functional block diagram for the MPQ3426's operating principles.

At the beginning of each cycle, the N-Channel MOSFET switch turns on, causing the inductor current to rise. The current-sense amplifier (CSA) at the switch's source internally converts the switch current to a voltage. This voltage goes to a comparator that compares it to the COMP voltage. The COMP voltage is the output of the error amplifier, which is an amplified version of the difference between the 1.225V reference voltage and V_{FB}.

When V_{CSA} and V_{COMP} are equal, the PWM comparator turns off the switch to force the inductor current through the external rectifier to the output capacitor. This decreases the inductor current. V_{COMP} controls the peak inductor current, which is controlled by the output voltage. The output voltage is regulated by the inductor current to satisfy the load. Current-mode regulation improves the transient response and control-loop stability.

Selecting the Switching Frequency

The switching frequency is set by the FSET resistor (R_{FSET}), where:

$$f_{FSET} = 23 \times (R_{FSET}^{-0.86})$$

Where R5 is in kΩ

EN UVLO Hysteresis

The MPQ3426 features a programmable UVLO hysteresis. Upon power up a 4μA current sink (I_{SINK}) is applied to the EN pin, requiring a higher V_{IN} to overcome the current sink. That extra voltage on VIN equals

$$(I_{SINK} + I_{R\_BOTTOM}) \times R_{TOP}$$

Once the EN pin reaches about 1.5V (the EN turn-on threshold), the MPQ3426 starts and the current sink turns off to create the reverse hysteresis for V_{IN} falling. This hysteresis is determined by:

$$UVLOHysteresis = 4\mu A \times R_{TOP}$$

At the same time, the V_{BIAS} start-up threshold is determined by its UVLO value or:

$$V_{IN}=1.5 \times \frac{R_{TOP} + R_{BOTTOM}}{R_{BOTTOM}} + UVLOHysteresis$$

Depending on whichever value is greater. V_{BIAS} is in V, and R_{TOP}/R_{BOTTOM} are in MΩ.

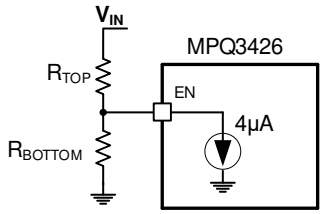


Figure 2: EN Resistor Divider

Table 1: Switching Frequency vs. FSET Resistor Values

R_{FSET} (kΩ)	Freq (MHz)
180	0.26
160	0.29
150	0.31
143	0.32
66.5	0.62
35.7	1.06
25	1.44
18	1.91
16	2.12

Selecting the Soft-Start Capacitor

The MPQ3426 includes a soft-start timer that limits the COMP voltage during startup to prevent excessive input current. This prevents premature source voltage termination at startup due to input-current overshoot. When power is applied to the MPQ3426, and EN goes HIGH, a 6μA internal current source charges the external SS capacitor. As the SS capacitor charges, the SS

voltage rises. When the SS voltage reaches 250mV, the MPQ3426 starts switching at 1/5 the programmed frequency (frequency fold-back mode). At 800mV the switching frequency rises to the programmed value. The soft-start ends when the SS voltage reaches 2.5V. This limits the inductor current at start-up, forcing the input current to rise slowly to the required current to regulate the output voltage.

The soft-start period is determined by the equation:

$$t_{SS} = \frac{C_{SS} \times 10^{-9} \times 2.5V}{6\mu A}$$

Where C_{SS} (nF) is the soft-start capacitor from SS to GND, and t_{SS} is the soft-start period.

Setting the Output Voltage

V_{OUT} connects to the top of a resistor divider (R2 and R3); the resistor divider's tap connects to the FB pin. The feedback voltage is typically 1.225V. The output voltage is then:

$$V_{OUT} = V_{FB} \times \left(1 + \frac{R2}{R3}\right)$$

Where:

R2 is the top feedback resistor
R3 is the bottom feedback resistor
V_{FB} is the feedback reference voltage (typically 1.225V)

To increase efficiency, use ≥10kΩ feedback resistors.

Selecting the Input Capacitor

The input requires a capacitor to supply the AC ripple current to the inductor, while limiting noise at the input source. Use a low-ESR capacitor with a value >4.7µF to minimize the IC noise. Ceramic capacitors are preferred, but tantalum or low-ESR electrolytic capacitors can also suffice. However since it absorbs the input switching current it requires an adequate ripple current rating. Use a capacitor with an RMS current rating greater than the inductor ripple current.

To ensure stable operation, place the input bias capacitor as close to the IC as possible. As an alternative, place a small, high-quality ceramic 0.1µF capacitor close to the IC and place the larger capacitor further away. If using the latter technique, use either tantalum- or electrolytic-type capacitors for the larger capacitor. Place all ceramic capacitors close to the MPQ3426.

Selecting the Output Capacitor

The output capacitor maintains the DC output voltage. For best results, use low-ESR capacitors to minimize the output voltage ripple. The output capacitor's characteristics also affect regulatory control system's stability. For best results, use ceramic, tantalum, or low-ESR electrolytic capacitors. For ceramic capacitors, the capacitance dominates the impedance at the switching frequency, and so the output voltage ripple is mostly independent of the ESR. The output voltage ripple is estimated as

$$V_{RIPPLE} \cong I_{LOAD} \times \frac{1 - \frac{V_{IN}}{V_{OUT}}}{C_{OUT} \times f_{SW}} :$$

Where V_{RIPPLE} is the output ripple voltage, V_{IN} and V_{OUT} are the DC input and output voltages, respectively, I_{LOAD} is the load current, f_{SW} is the switching frequency, and C_{OUT} is the value of the output capacitor.

For tantalum or low-ESR electrolytic capacitors, the ESR dominates the impedance at the switching frequency, and so the output ripple is:

$$V_{RIPPLE} \cong I_{LOAD} \times \frac{1 - \frac{V_{IN}}{V_{OUT}}}{C_{OUT} \times f_{SW}} + \frac{I_{LOAD} \times R_{ESR} \times V_{OUT}}{V_{IN}}$$

Where R_{ESR} is the equivalent series resistance of the output capacitors.

Choose an output capacitor that satisfies the output ripple and load transient requirements of the design. A 4.7µF-to-22µF ceramic capacitor is suitable for most applications.

Selecting the Inductor

The inductor forces the output voltage higher than the input voltage. A larger inductor value results in less ripple current and reduces the peak inductor current; this reduces the stress on the internal N-channel switch. However, a larger-value inductor is physically larger, has a higher series resistance, and/or lower saturation current.

A good rule of thumb is to allow the peak-to-peak ripple current to equal 30% to 50% of the maximum input current. Make sure that the peak inductor current is less than 75% of the current limit during duty-cycle operation to prevent regulator losses due to the current limit. Also make sure that the inductor does not saturate under the worst-case load transient and startup conditions. Calculate the required inductance value using the following equations:

$$L = \frac{V_{IN} \times (V_{OUT} - V_{IN})}{V_{OUT} \times f_{SW} \times \Delta I}$$

$$I_{IN(max)} = \frac{V_{OUT} \times I_{LOAD(MAX)}}{V_{IN} \times \eta}$$

Where:

I_{LOAD}(max) = maximum load current
ΔI = peak-to-peak inductor ripple current
ΔI = (30% to 50%) × $I_{LOAD\ (MAX)}$
η = efficiency.

Selecting the Diode

The output rectifier diode supplies current to the inductor when the internal MOSFET is off. Use a Schottky diode to reduce losses due to the diode forward voltage and recovery time. The diode should be rated for a reverse voltage equal to or greater than the expected output voltage. The average current rating must exceed the maximum expected load current, and the peak current rating must exceed the peak inductor current.

Compensation

The output of the transconductance error amplifier (COMP) compensates the regulation control system. The system uses two poles and one zero to stabilize the control loop. The poles are f_{P1} (set by the output capacitor C_{OUT} and the load resistance) and f_{P2} (set by the compensation capacitor C_{COMP} and the compensation resistor R_{COMP}). These are determined by the equations:

$$f_{P1} = \frac{1}{2 \times \Pi \times R_{LOAD} \times C_{OUT}} (Hz)$$

$$f_{P2} = \frac{G_{EA}}{2 \times \Pi \times A_{VEA} \times C_{COMP}} (Hz)$$

$$f_{Z1} = \frac{1}{2 \times \Pi \times R_{COMP} \times C_{COMP}} (Hz)$$

Where R_{LOAD} is the load resistance, G_{EA} is the error amplifier transconductance, and A_{VEA} is the error amplifier voltage gain.

The DC loop gain is

$$A_{VDC} = \frac{A_{VEA} \times V_{IN} \times R_{LOAD} \times V_{FB} \times G_{CS}}{0.5 \times V_{OUT}^2} (V/V)$$

Where G_{CS} is the compensation voltage/inductor current gain, and the V_{FB} is the feedback regulation threshold.

There is also a right-half-plane zero (f_{RHPZ}) that exists in continuous conduction mode (the inductor current does not drop to zero for each cycle). The f_{RHPZ} is:

$$f_{RHPZ} = \frac{R_{LOAD}}{2 \times \Pi \times L} \times \left(\frac{V_{IN}}{V_{OUT}} \right)^2 (Hz)$$

Table 2 lists a few compensation component combinations for different input voltages, output voltages and capacitances for the most-frequently–used output ceramic capacitors. Ceramic capacitors generally have extremely low ESR, and therefore do not require the second compensation capacitor (from COMP to GND).

For faster control loop and better transient response, select C_{COMP} (C7) from Table 2: Recommended Component Values. Then gradually increase the R_{COMP} (R6) value and check the load step response to find a value that minimizes any output voltage ringing or overshoot at the load step edge. Finally, check the compensator design by calculating the DC loop gain and the crossover frequency. The crossover frequency where the loop gain drops to 0dB (a gain of 1) can be obtained visually by placing a -20dB/decade slope at each pole, and a +20dB/decade slope at each zero. The crossover frequency should be at least one decade below the f_{RHPZ} at the maximum output load current to obtain a high-enough phase margin for stability.

Table 2: Recommended Component Values

V_{IN} (V)	V_{OUT} (V)	C_{OUT} (µF)	R_{COMP} (kΩ)	C_{COMP} (nF)	Switching Frequency (kHz)	Inductor (µH)
3.2	12	4.7	10	6.8	600	8.2
3.2	12	10	15	6.8	600	8.2
3.2	12	22	30	6.8	600	8.2
5	12	10	12	4.9	600	6.8
5	12	22	25	4.9	600	6.8
5	18	4.7	12	4.9	600	10
5	18	10	25	4.9	600	10
5	18	22	50	4.9	600	10
12	24	4.7	10	6.8	600	10
12	24	10	20	6.8	600	10
12	24	22	40	6.8	600	10

Layout Considerations

High-frequency switching regulators require a very careful layout for stable operation and low noise. Place all components as close to the IC as possible. Keep the path between L1, D1, and C_{OUT} extremely short to minimize noise and ringing. Place C_{BIAS} close to the VIN pin to maximize decoupling. Keep all feedback components close to the FB pin to prevent noise injection on the FB pin trace. Tie the C_{IN} and C_{OUT} ground returns close to the GND pin. Figure 3 shows the recommended component placement for the MPQ3426.

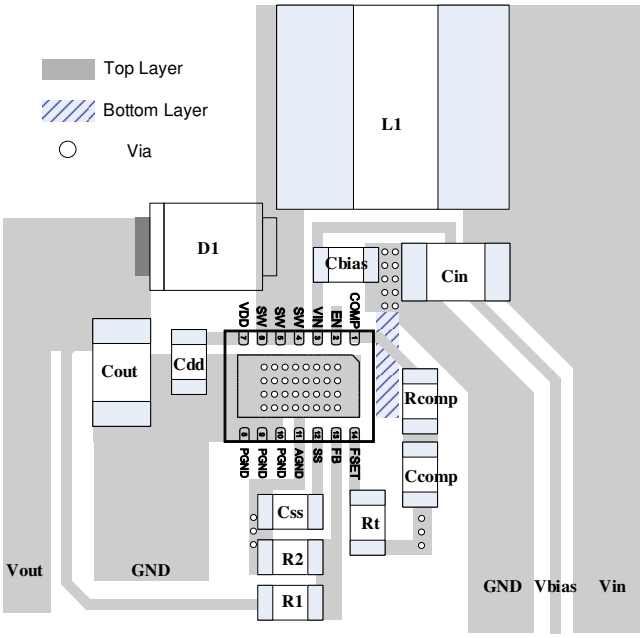


Figure 3: Recommended PCB Layout

Design example

Below is a design example following the application guidelines for the following specifications:

Table 3: Design Example

V_{IN}	8V-22V
V_{OUT}	24V
f_{SW}	300kHz

The typical application circuit for VOUT = 24V on page 1 shows the detailed application schematic, and is the basis for the typical performance and circuit waveforms. For more detailed device applications, please refer to the schematic on page 1.

TYPICAL APPLICATION CIRCUITS

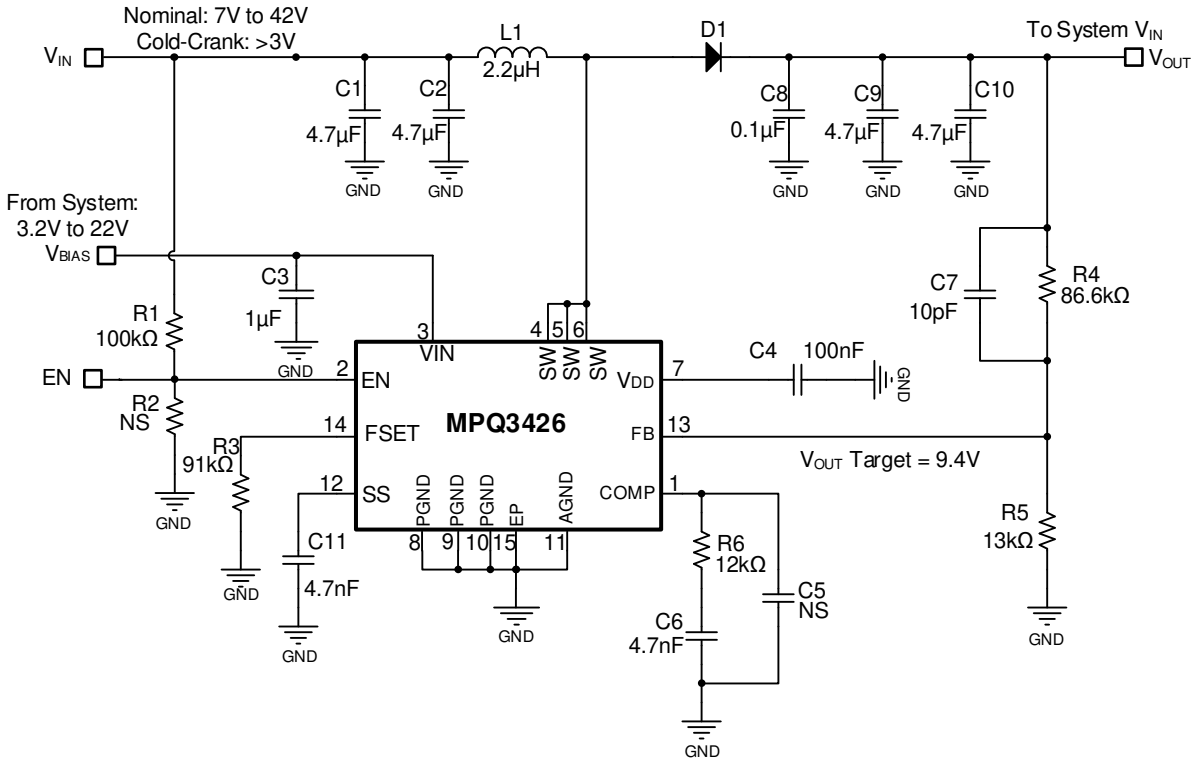


Figure 4: Pre-Boost Typical Application Schematic

Table 4: Pre-Boost Maximum Output Power vs. V_{IN} ($V_{PREBOOST}$ = 9.4V)

V_{IN} (V)	Max Output Power (W)
1.5	4.5
2.0	6
2.5	8
3.0	10.5
3.5	14
4.0	16.5
4.2	17.5

TYPICAL APPLICATION CIRCUITS *(continued)*

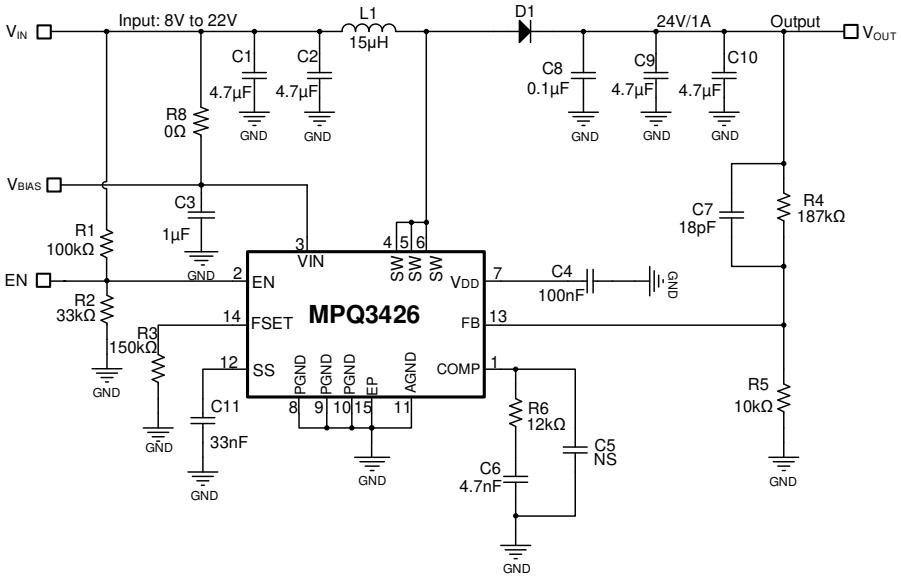


Figure 5: Typical Application Schematic (24V Output)

TYPICAL APPLICATION CIRCUITS *(continued)*

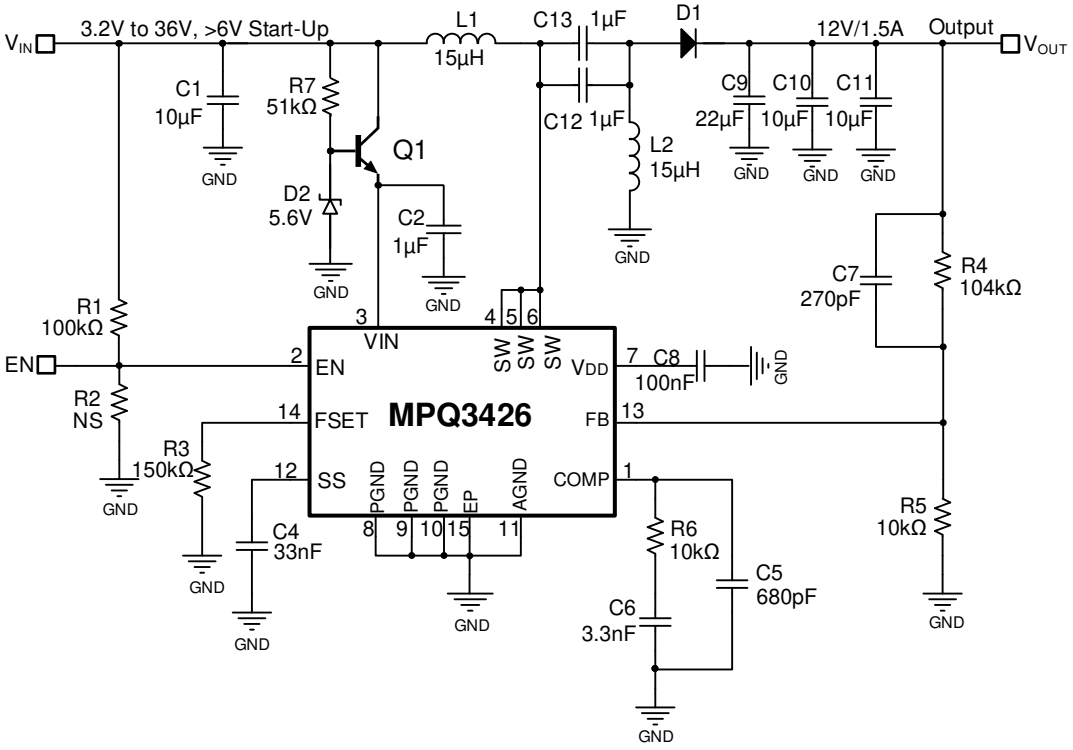


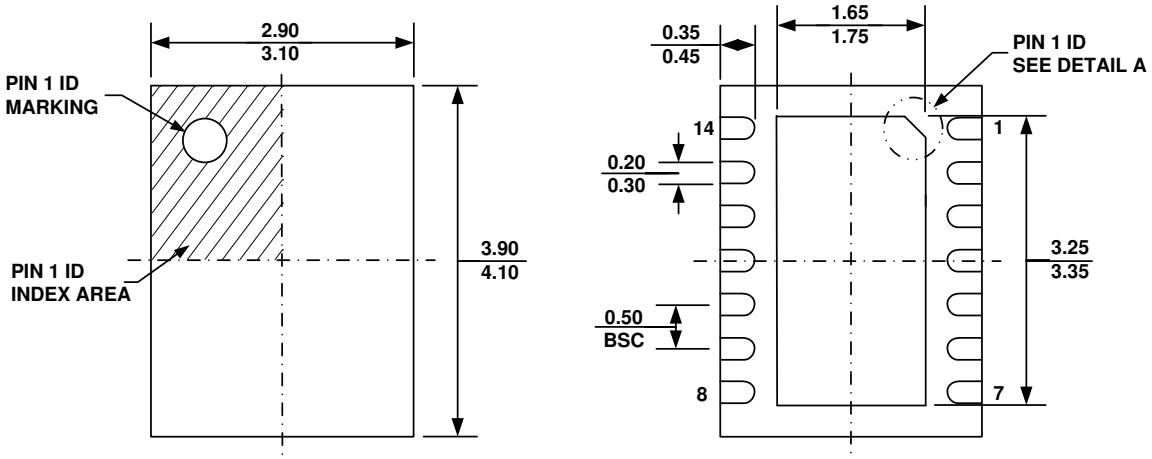
Figure 6: SEPIC Application Schematic (12V Output)

Table 5: V_{IN} Biased Supply Current vs. Switching Frequency

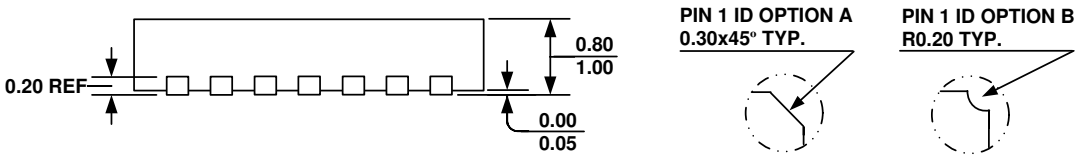
f_{SW}	V_{IN} Bias Supply Current
500kHz	3mA
1000kHz	4mA
2000kHz	7mA

PACKAGE INFORMATION

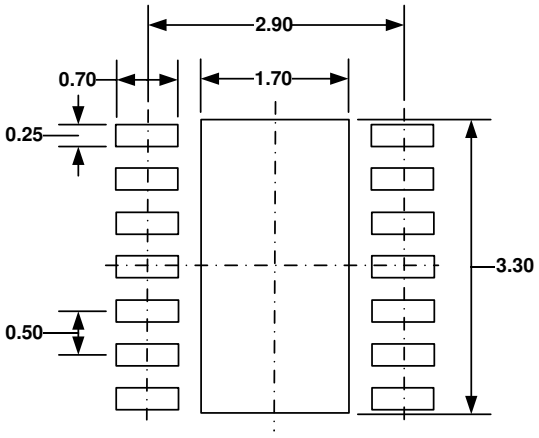
QFN-14 (3mmx4mm)



TOP VIEW **BOTTOM VIEW**



SIDE VIEW **DETAIL A**



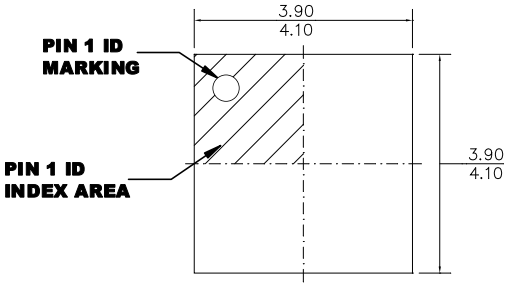
RECOMMENDED LAND PATTERN

NOTE:

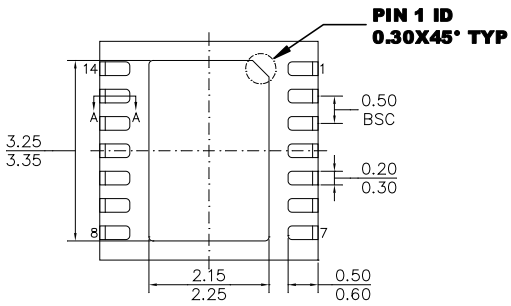
1) ALL DIMENSIONS ARE IN MILLIMETERS.
2) EXPOSED PADDLE SIZE DOES NOT INCLUDE MOLD FLASH.
3) LEAD COPLANARITY SHALL BE 0.10 MILLIMETER MAX.
4) DRAWING CONFORMS TO JEDEC MO-229, VARIATION VEED-5.
5) DRAWING IS NOT TO SCALE.

PACKAGE INFORMATION *(continued)*

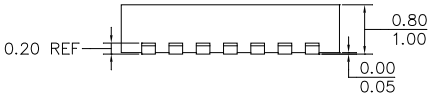
QFN-14 (4mmx4mm)
Wettable Flank



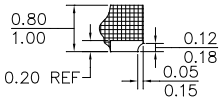
TOP VIEW



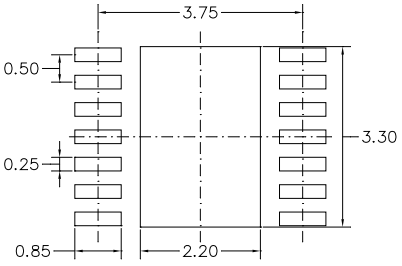
BOTTOM VIEW



SIDE VIEW



SECTION A-A

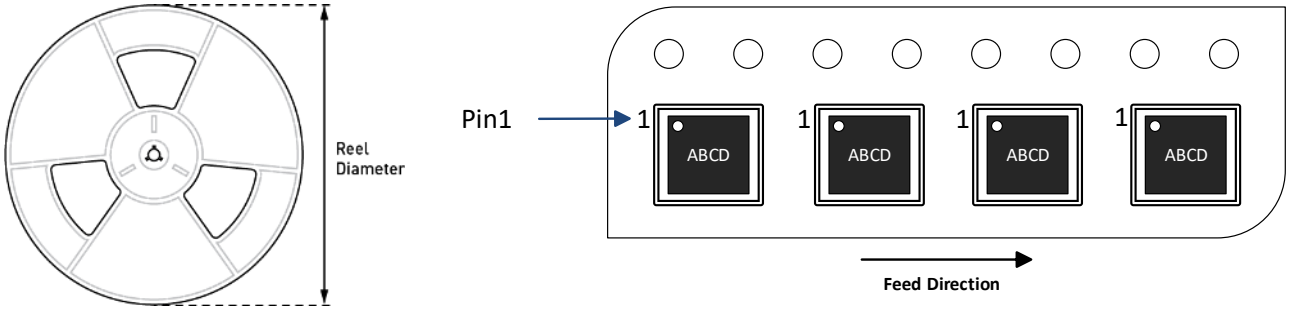


RECOMMENDED LAND PATTERN

NOTE:

1) THE LEAD SIDE IS WETTABLE.
2) ALL DIMENSIONS ARE IN MILLIMETERS.
3) EXPOSED PADDLE SIZE DOES NOT INCLUDE MOLD FLASH.
4) LEAD COPLANARITY SHALL BE 0.08 MILLIMETERS MAX.
5) JEDEC REFERENCE IS MO-220.
6) DRAWING IS NOT TO SCALE.

CARRIER INFORMATION



Part Number	Package Description	Quantity/ Reel	Quantity/ Tube	Quantity/ Tray	Reel Diameter	Carrier Tape Width	Carrier Tape Pitch
MPQ3426DL-AEC1-Z	QFN-14 (3mmx4mm)	5000	N/A	N/A	13in	12mm	8mm
MPQ3426GRE-AEC1-Z	QFN-14 (4mmx4mm)	5000	N/A	N/A	13in	12mm	8mm

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	9/10/2014	Initial Release	-
1.01	7/13/2017	Added package	17
1.1	2/21/2023	Updated product description to reflect 45V operation in typical use cases	All
		Modified Description and Features to clarify the IC use cases; Updated input voltage ranges to reflect typical IC applications; Updated Applications section with additional applications; Added information about the 4mmx4mm package; Removed long descriptions from the features section; Updated typical application diagram; Updated boilerplate message	1
		Update Ordering information and Top Marking to include the MPQ3426GRE-AEC1	2
		Removed erroneous DLE package; Updated Package Reference, adding (4mmx4mm) with WF	3
		Corrected VIN pin name in Absolute Maximum Ratings; Added new package to thermal resistance table (page 4); Added ESD Ratings; Minor copyedits to note 2	4
		Fixed subscript on VEN and removed extraneous comma in Electrical Characteristics table conditions; Updated VIN operating voltage parameter name; Changed UVLO condition signal name to V_{BIAS}; Updated V_{VDD} symbol to V_{DD}	5
		Updated pin description for VIN and VDD pins	10
		Updated Functional Block Diagram	11
		Updated Figure 4 reference; Updated UVLO description to refer to VBIAS connecting to the VIN pin; Updated Figure 2 with higher-resolution drawing	12
		Updated input capacitor recommendation to refer to VBIAS	13
		Update the recommended layout and description to separate system VIN from IC VIN bias pin 3	15
		Updated Typical Application Circuits section to reflect multiple circuit drawings; Added typical application for pre-boost; Added Table 4	16
		Updated 24V typical application with improved schematics	17
		Added Table 5; Added typical application for SEPIC	18
		Removed specific part number from Package Information header	19
		Added the POD for the new package	20
		Added Carrier Information	21
		Updated footer	22
1.2	5/25/2023	Updated the Top Marking for the MPQ3426GRE SKU	2
		Updated the QFN-14 (4mmx4mm) package values from “48” and “9” to “47.2” and “4.8” in the Thermal Resistance section	4
		Updated the L1 value from “15µH” to “2.2µH” in Figure 5	16