3A,2.3V-6V Input,1.5MHz Synchronous Step-Down Converter

FEATURES

- High Efficiency: Up to 95%
- 1.5MHz Constant Frequency Operation
- 3A Output Current
- No Schottky Diode Required
- 2.3V to 6V Input Voltage Range
- Output Voltage as Low as 0.6V
- PFM Mode for High Efficiency in Light Load
- Slope Compensated Current Mode Control for Excellent Line and Load Transient Response
- 100% Duty Cycle in Dropout Operation
- Low Quiescent Current: 40μA
- Short Circuit Protection
- Thermal Fault Protection
- Inrush Current Limit and Soft Start
- <1μA Shutdown Current
- ESOP8 package

APPLICATIONS

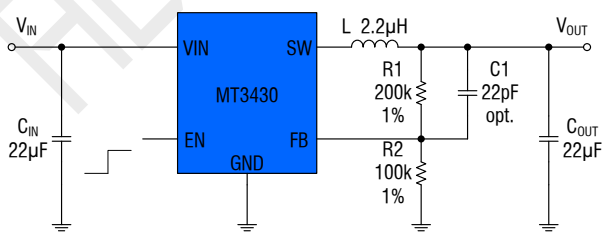
- Wireless and DSL Modems
- Computer Peripherals
- Network Cards
- Set-Top Boxes
- Portable Instruments

GENERAL DESCRIPTION

The MT3430 is a constant frequency, current mode step-down converter. The device integrates a main switch and a synchronous rectifier for high efficiency without an external Schottky diode. It is ideal for powering portable equipment that runs from a single cell Lithium-Ion (Li+) battery. The MT3430 can supply up to 3A output load current from a 2.3V to 6V input voltage and the output voltage can be regulated as low as 0.6V. The MT3430 can also run at 100% duty cycle for low dropout operation, extending battery life in portable systems while light load operation provides very low output ripple for noise sensitive applications. The internal slope compensation setting allows the device to operate with smaller inductor values to optimize size and provide efficient operation. The MT3430 is available in adjustable (0.6V to V_{IN}) output voltage.

This device offers two operation modes, PWM control and PFM Mode switching control, which allows a high efficiency over the wider range of the load.

TYPICAL APPLICATION



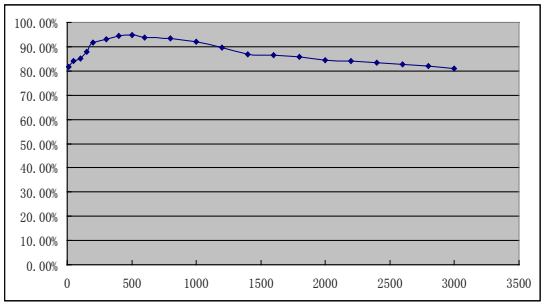
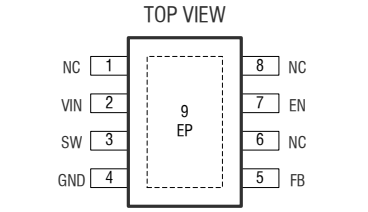


Figure 1. Basic Application Circuit

ABSOLUTE MAXIMUM RATINGS (Note 1)

Input Supply Voltage……-0.3V to 6.5V
EN,FB Voltages……..-0.3V to (V_{IN}+0.3V)
SW Voltage……..-0.3V to (V_{IN}+0.3V)
Power Dissipation……....2W
Thermal Resistance θ_{JC}……10°C/W
Thermal Resistance θ_{JA}……50°C/W
Junction Temperature(Note2)…….....150°C
Operating Temperature Range…….-40°C to 85°C
Lead Temperature(Soldering,10s)……...300°C
Storage Temperature Range……..-65°C to 150°C
ESD HBM(Human Body Mode)……...2kV
ESD MM(Machine Mode)……200V

PACKAGE/ORDER INFORMATION



8-LEAD PLASTIC SOP WITH EXPOSED PAD ON BACKSIDE
T_{JMAX} = 150°C, θ_{JA} = 50°C/ W, θ_{JC} = 10°C/W

Order Part Number	Package	Top Marking
MT3430	ESOP8	3430

PIN DESCRIPTION

Pin Name	Pin Number	Description
NC	1,6,8	No Connect.
VIN	2	Power Supply Input. Must be closely decoupled to GND with a 22μF or greater ceramic capacitor.
SW	3	Power Switch Output. It is the switch node connection to Inductor. This pin connects to the drains of the internal P-ch and N-ch MOSFET switches.
GND	4	Ground pin.
FB	5	Output Voltage Feedback Pin. An internal resistive divider divides the output voltage down for comparison to the internal reference voltage.
EN	7	Chip Enable Pin. Drive EN above 1.5V to turn on the part. Drive EN below 0.4V to turn it off. Do not leave EN floating.
EP	9	Power Ground exposed pad, Must be connected to bare copper ground plane.

ELECTRICAL CHARACTERISTICS (Note 3)

(V_{IN}=V_{EN}=3.6V, V_{OUT}=1.8V, T_A = 25°C, unless otherwise noted.)

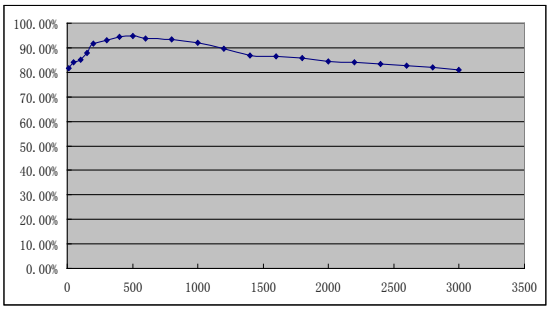
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range		2.3		6	V
UVLO Threshold		1.7	1.8	1.9	V
Input DC Supply Current	(Note 4)				μA
PWM Mode	V_{OUT} = 90%, I_{LOAD}=0mA		160	240	μA
PFM Mode	V_{OUT} = 105%, I_{LOAD} =0mA		40	75	μA
Shutdown Mode	V_{EN} = 0V, V_{IN}=4.2V		0.1	1.0	μA
Regulated Feedback Voltage V_{FB}	T_A = 25°C	0.588	0.600	0.612	V
	T_A = 0°C ≤T_A ≤ 85°C	0.586	0.600	0.613	V
	T_A = -40°C ≤T_A ≤ 85°C	0.585	0.600	0.615	V
Reference Voltage Line Regulation	V_{IN}=2.7V to 5.5V		0.04	0.40	%/V
Output Voltage Line Regulation	V_{IN} = 2.7V to 5.5V		0.04	0.4	%
Output Voltage Load Regulation	I_{OUT}=10mA to 2000mA		0.5		%/A
Oscillation Frequency	V_{OUT} =100%		1.5		MHz
	V_{OUT} =0V		300		kHz
On Resistance of PMOS	I_{SW}=100mA		90	150	mΩ
On Resistance of NMOS	I_{SW}=-100mA		80	150	mΩ
Peak Current Limit	V_{IN}= 3V, V_{OUT} =90%		4		A
EN Threshold		0.40	1.0	1.50	V
EN Leakage Current			±0.01	±1.0	μA
SW Leakage Current	V_{EN}=0V,V_{IN}=V_{SW}=3.6V		±0.01	±1.0	μA

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.
Note 2: T_J is calculated from the ambient temperature T_A and power dissipation P_D according to the following formula: T_J = T_A + (P_D) x (50°C/W).
Note 3: 100% production test at +25°C. Specifications over the temperature range are guaranteed by design and characterization.
Note 4: Dynamic supply current is higher due to the gate charge being delivered at the switching frequency.

TYPICAL PERFORMANCE CHARACTERISTICS

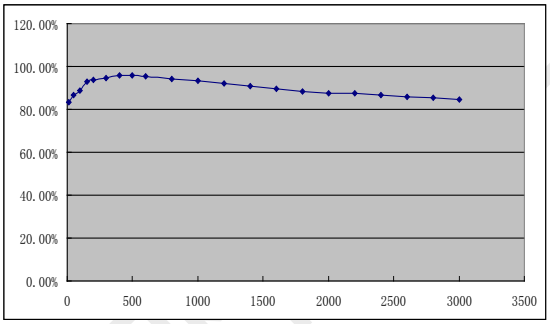
Efficiency vs. Load Current

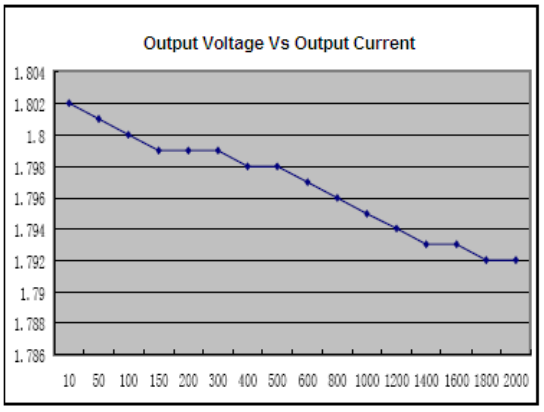
V_{IN}=5V,V_{OUT}=1.8V



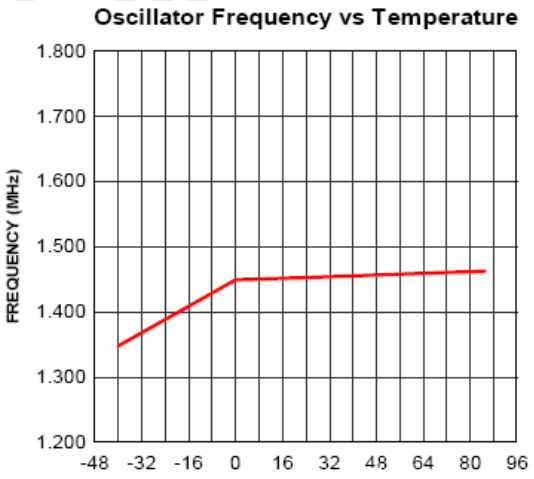
Efficiency vs. Load Current

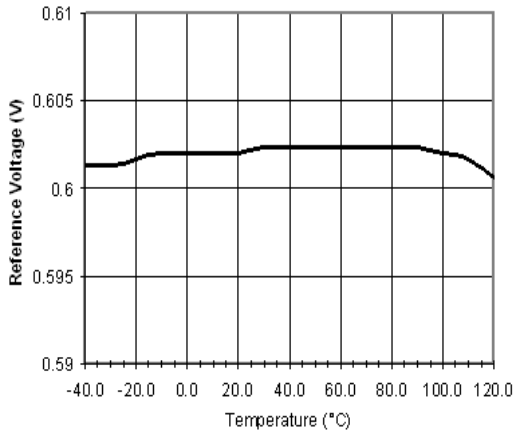
V_{IN}=5V,V_{OUT}=3.3V



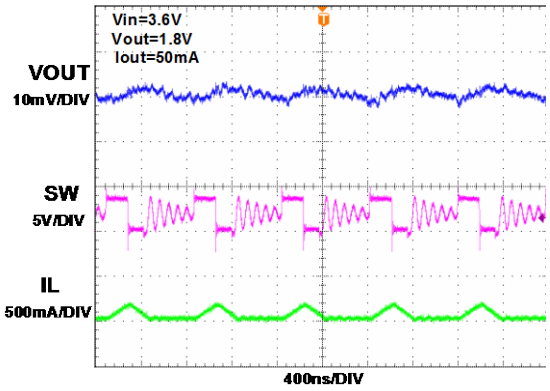


Vin=3.6V,Vout=1.8V

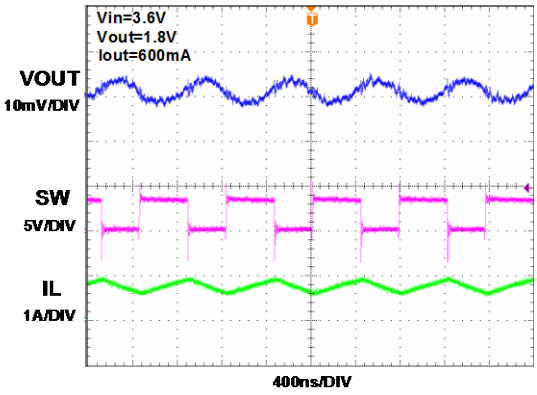




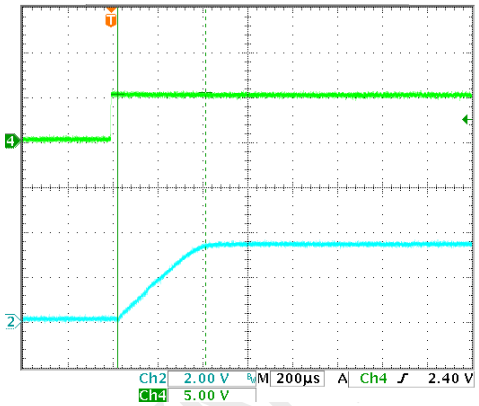
PFM MODE



PWM MODE



Start Up Response



FUNCTIONAL BLOCK DIAGRAM

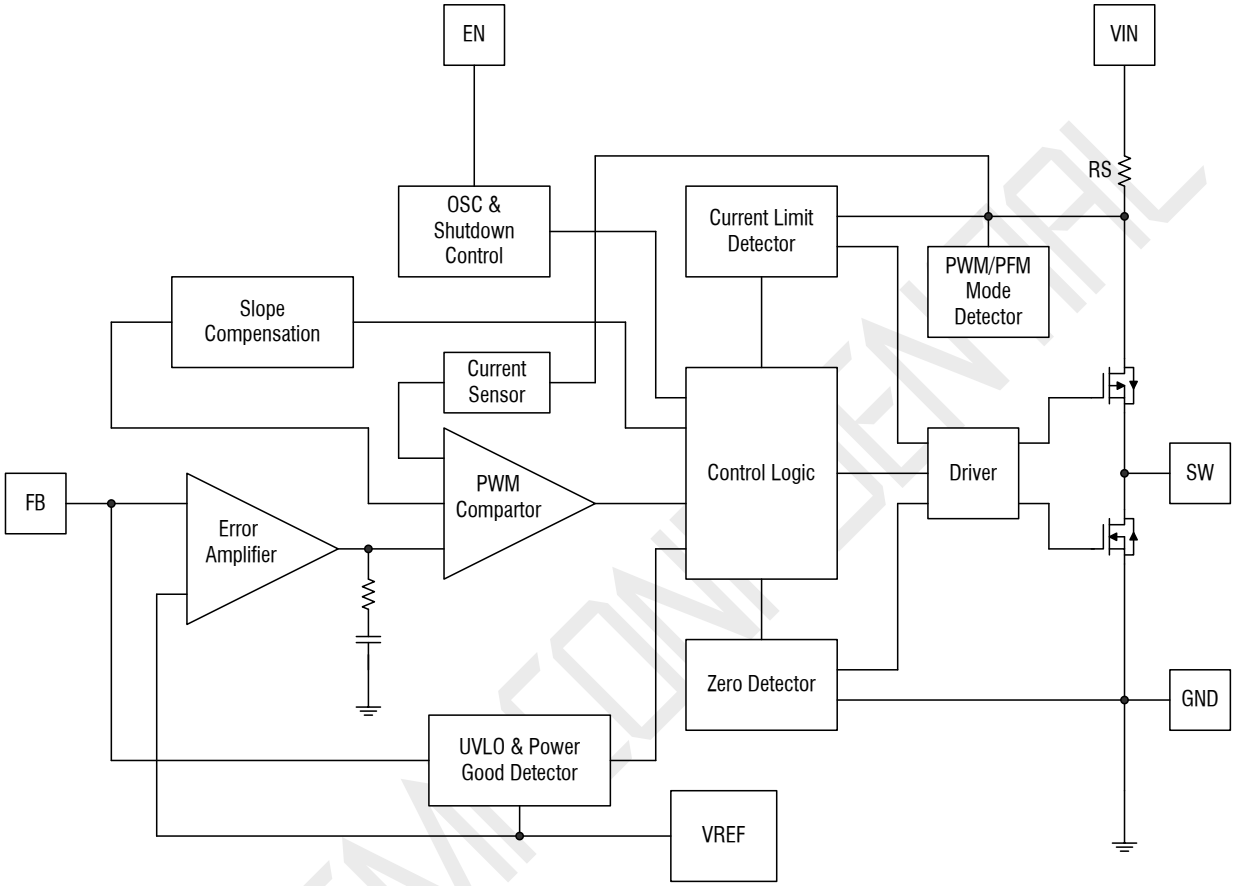


Figure 2. MT3430 Block Diagram

FUNCTIONAL DESCRIPTION

The MT3430 is a high performance 3A 1.5MHz monolithic step-down converter. The MT3430 requires only three external power components (C_{IN}, C_{OUT} and L). The adjustable V_{OUT} can be programmed with external feedback to any voltage, ranging from 0.6V to the input voltage.

At dropout operation, the converter duty cycle increases to 100% and the output voltage tracks the input voltage minus the $R_{DS(ON)}$ drop of the high-side MOSFET.

The internal error amplifier and compensation provides excellent transient response, load, and line regulation. Soft start function prevents input inrush current and output overshoot during start up.

APPLICATIONS INFORMATION

Setting the Output Voltage

Figure 1 shows the basic application circuit for the MT3430. The MT3430 can be externally programmed. Resistors R1 and R2 in Figure 1 program the output to regulate at a voltage higher than 0.6V. To limit the bias current required for the external feedback resistor string while maintaining good noise immunity, the minimum suggested value for R2 is 59kΩ. Although a larger value will further reduce quiescent current, it will also increase the impedance of the feedback node, making it more sensitive to external noise and interference. Table 1 summarizes the resistor values for various output voltages with R2 set to either 59kΩ for good noise immunity or 316kΩ for reduced no load input current.

The external resistor sets the output voltage according to the following equation:

$$V_{OUT} = 0.6 \times \left(1 + \frac{R1}{R2}\right)$$

$$R1 = \left(\frac{V_{OUT}}{0.6} - 1\right) \times R2$$

Inductor Selection

For most designs, the MT3430 operates with inductors of 1μH to 4.7μH. Low inductance values are physically smaller but require faster switching, which results in some efficiency loss. The inductor value can be derived from the following equation:

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

Where ΔI_L is inductor Ripple Current. Large value inductors result in lower ripple current and small value inductors result in high ripple current. For optimum voltage-positioning load transients, choose an inductor with DC series resistance in the 20mΩ to 100mΩ range.

Input Capacitor Selection

The input capacitor reduces the surge current drawn from the input and switching noise from the device. The input capacitor impedance at the switching frequency should be less than input source impedance to prevent high frequency switching current passing to the input. A low ESR input capacitor sized for maximum RMS current must be used. Ceramic capacitors with X5R or X7R dielectrics are highly recommended because of their low ESR and small temperature coefficients. A 22μF ceramic capacitor for most applications is sufficient. A large value may be used for improved input voltage filtering.

Output Capacitor Selection

The output capacitor is required to keep the output voltage ripple small and to ensure regulation loop stability. The output capacitor must have low impedance at the switching frequency. Ceramic capacitors with X5R or X7R dielectrics are recommended due to their low ESR and high ripple current ratings. The output ripple ΔV_{OUT} is determined by:

$$\Delta V_{OUT} \le \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} \times f_{OSC} \times L} \times \left(ESR + \frac{1}{8 \times f_{OSC} \times C_{OUT}}\right)$$

A 22μF ceramic can satisfy most applications.

100% Duty Cycle Operation

As the input voltage approaches the output voltage, the converter turns the P-channel transistor continuously on. In this mode the output voltage is equal to the input voltage minus the voltage drop across the P- channel transistor:

$$V_{OUT} = V_{IN} - I_{LOAD} \times (R_{DS(ON)} + R_{DCR})$$

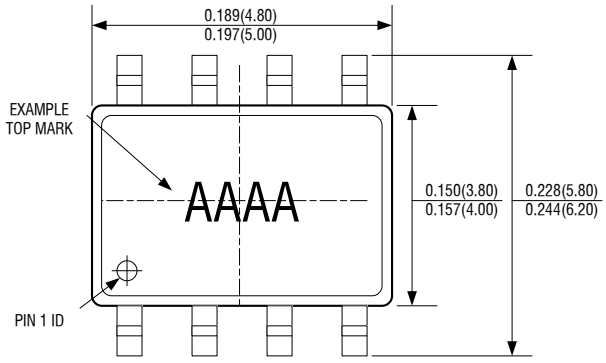
PCB Layout Recommendations

When laying out the printed circuit board, the following checking should be used to ensure proper operation of the MT3430. Check the following in your layout:

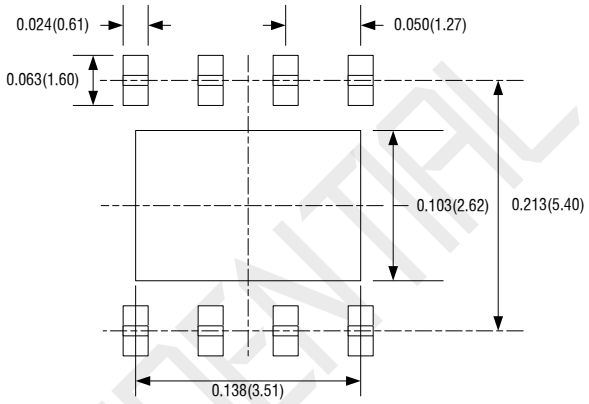
- The power traces, consisting of the GND trace, the SW trace and the VIN trace should be kept short, direct and wide
- Does the (+) plates of C_{IN} connect to VIN as closely as possible. This capacitor provides the AC current to the internal power MOSFETs.
- Keep the switching node, SW, away from the sensitive V_{OUT} node.
- Keep the (-) plates of C_{IN} and C_{OUT} as close as possible

PACKAGE DESCRIPTION

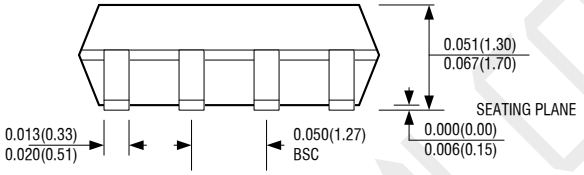
SOP8(EXPOSED PAD)



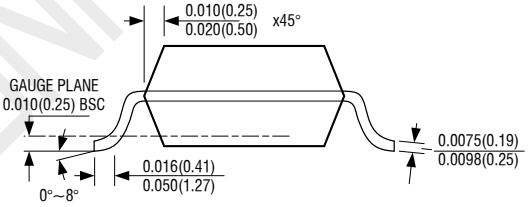
TOP VIEW



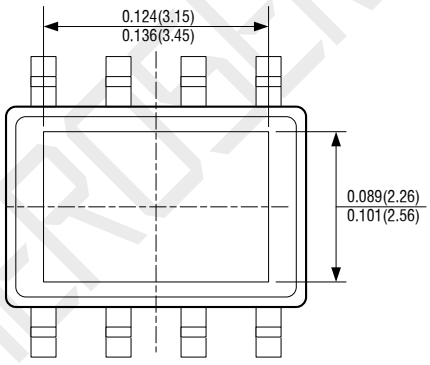
RECOMMENDED SOLDER PAD LAYOUT



FRONT VIEW



SIDE VIEW



BOTTOM VIEW

NOTE:
1) CONTROL DIMENSION IS IN INCHES. DIMENSION IN BRACKET IS IN MILLIMETERS.
2) PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
3) PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.
4) LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.004" INCHES MAX.
5) DRAWING CONFORMS TO JEDEC MS-012, VARIATION BA.
6) DRAWING IS NOT TO SCALE.

IMPORTANT NOTICE

Xi'an Aerosemi Technology Co.,Ltd reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services.

Xi'an Aerosemi Technology Co.,Ltd is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Xi'an Aerosemi Technology Co.,Ltd does not assume any responsibility for use of any its products for any particular purpose, nor does Xi'an Aerosemi Technology Co.,Ltd assume any liability arising out of the application or use of any its products or circuits.

Tel: 0755-82879616 021-50871055 029-88868021

Http://www.aerosemi.com

E-Mail: sales@aerosemi.com