The power to be flexible

ST has developed a complete family of step-down monolithic synchronous DC-DC converters, which have the power to offer a complete and flexible solution for all application needs. The L/A698x family is a new generation of switching regulators that provide a continuous output current up to 2 A and a wide range of flavors to help overcome today's IoT challenges.

Benefits of using synchronous topology:

1. Offers superior efficiency in the wide load and conversion ratio range of applications
2. Ensures higher integration and reduces need for external components

Key features of new generation:

- Adjustable switching frequency up to 2 MHz
- PMOS high-side for 100% duty cycle
- Low minimum on time (t_{ON}) (80 ns)
- Operating quiescent current as low as 30 µA in low consumption mode
- Switchover capability to further improve efficiency

You can enhance the compactness by reducing the external BOM, by avoiding any boot capacitor and reducing the external coil size, you can widen the conversion ratio range and enjoy the best power-savings either in light load or at full operating conditions.

A comprehensive set of smart features is also embedded:

- Synchronization capability
- Dynamically adjustable skip current level in low consumption mode (LCM)(L/A6985F/6F/6H)
- Power Good function with adjustable delay
- Adjustable soft-start

The A698x family lets you set the switching frequency to obtain the best trade-off for your application, by negotiating between BOM cost, space-saving and system tolerance. You can also synchronize more than one product using a master/slave approach to avoid beating frequencies, or even use your own system clock.

Developers will also like the fact that they can then configure system behavior in terms of light load management and by defining the time to reset the MCU or even sizing the in-rush current condition at system start-up.

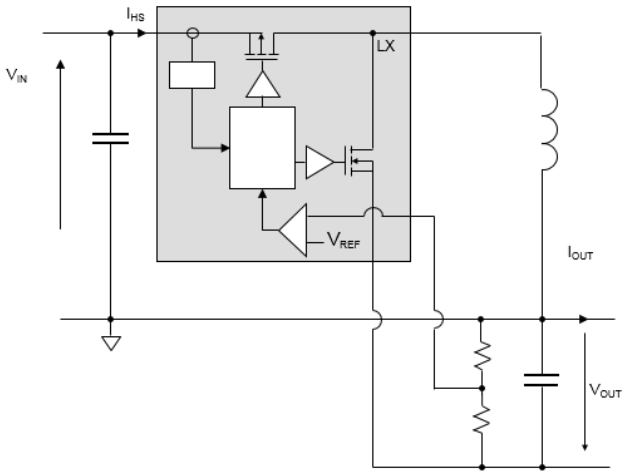
We believe that flexibility is a plus to adjust the same product to different working conditions and ensure the best performance. But when talking of flexibility, let's go one step further and learn how to reuse these flexible switching regulators in different topologies.

Same product in different architectures

Do you need to implement a power conversion in different topology? Apply your knowledge and experience to design a different operating mode. You can use your native buck converter architecture in one of the following topologies:

- Floating boost
- Inverting or positive buck-boost
- Isolated Buck

INVERTING BUCK-BOOST



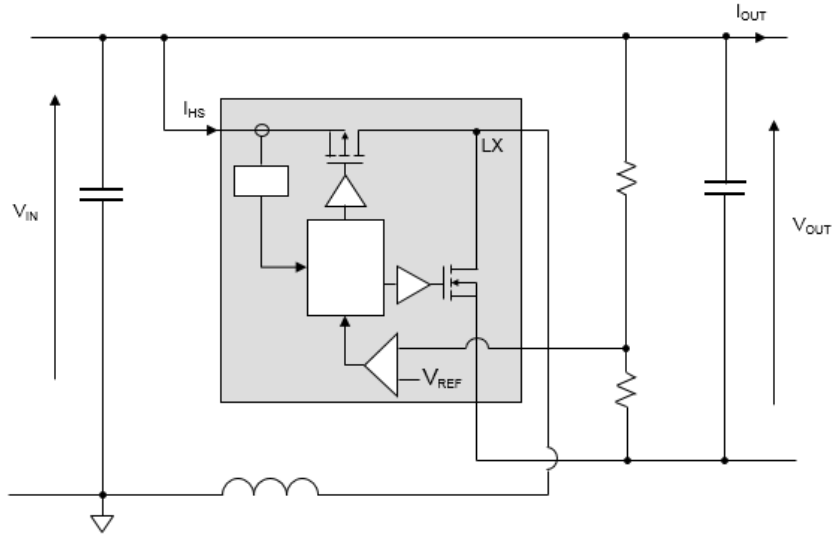
$$D_{IDEAL} = \frac{|V_{OUT}|}{V_{IN} + |V_{OUT}|}$$

$$V_{OUT} = -\frac{D_{IDEAL}}{1 - D_{IDEAL}} \cdot V_{IN}$$

$$I_{HS,PEAK} = \frac{1}{1 - D_{REAL}} \cdot I_{OUT} + \frac{\Delta I_L}{2}$$

- The topology is able to work with V_{IN} lower or higher than $|V_{OUT}|$
- V_{OUT} negative with respect to input ground
- Minimal added external BOM

FLOATING BOOST



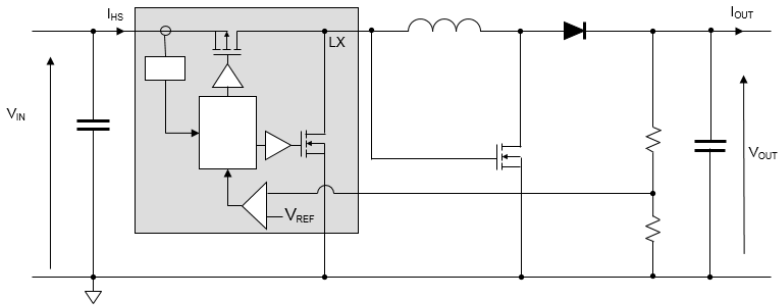
$$V_{OUT} = \frac{1}{1 - D_{IDEAL}} \cdot V_{IN}$$

$$D_{IDEAL} = \frac{V_{OUT} - V_{IN}}{V_{OUT}}$$

$$I_{HS,PEAK} = \frac{1}{1 - D_{REAL}} \cdot I_{OUT} + \frac{\Delta I_L}{2}$$

- The topology is able to work with V_{IN} lower than V_{OUT}
- V_{OUT} floating since referred to VIN instead of ground net
- Minimal added external BOM

POSITIVE BUCK-BOOST



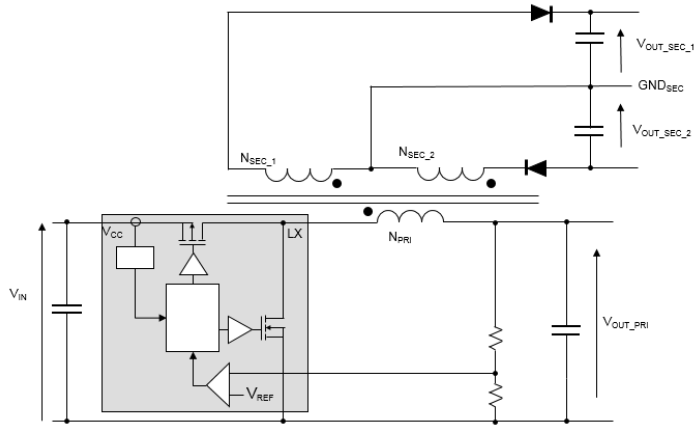
$$V_{OUT} = \frac{D_{IDEAL}}{1 - D_{IDEAL}} \cdot V_{IN}$$

$$D_{IDEAL} = \frac{V_{OUT}}{V_{IN} + V_{OUT}}$$

$$I_{HS,PEAK} = \frac{1}{1 - D_{REAL}} \cdot I_{OUT} + \frac{\Delta I_L}{2}$$

- V_{IN} and V_{OUT} are referred to the same ground net
- Minor efficiency with respect to Inverting solution
- Added external BOM (additional power MOS and diode)

ISO-BUCK



$$D_{IDEAL} = \frac{V_{OUT\_PRI}}{V_{IN}}$$

$$V_{OUT\_PRI} = D_{IDEAL} \cdot V_{IN}$$

$$V_{OUT\_SEC\_1} = \frac{N_{OUT\_SEC\_1}}{N_{PRI}} V_{OUT\_PRI} - V_D$$

$$V_{OUT\_SEC\_2} = \frac{N_{OUT\_SEC\_2}}{N_{PRI}} V_{OUT\_PRI} - V_D$$

- One non-isolated highly regulated output voltage
- Multiple isolated outputs with just one regulator
- Possible to have symmetrical rails
- Limited external BOM increase (one diode and one capacitor for each isolated rail)

For all the proposed topologies the closed loop operation compensates for conversion losses enlarging the real duty cycle ($D_{REAL} > D_{IDEAL}$)

CONCLUSION

A universal switching regulator does not exist and each application requires its own converter correctly tailored to best fit its specific needs.

The first step when selecting a switching regulator is to choose between asynchronous or synchronous conversion. Then, you have to decide the trade-offs in regards to key parameters especially size, efficiency, cost, temperature, accuracy, and transient response vs overall noise conflicts.

Suitable for a wide range of applications, the new L/A698x switching regulators offer important smart features and high performance as well as the flexibility required for application scalability and future needs.

This new generation of synchronous DC-DC converters offers various performance levels, while ensuring a low time to market, so that you can grow and maintain your business.

ST helps you move into the future.

Selection table

V_{IN} (V)	Grade	V_{OUT} (V)	I_{OUT} (A)	Frequency	Iq	Package	P/N	Other feat.	Availability
4-38	Industrial	0.85 to V_{IN}	2	250 kHz → 2 MHz	30 µA	HTSSOP 16	**L6986**	Sync, adj. fsw, adj. SS, adj. PGOOD, LNM/LCM	In production
		0.85 to V_{IN}	1.5	250 kHz → 2 MHz	30 µA	HTSSOP 16	**L6986F**	Sync, adj. fsw, adj. SS, adj. PGOOD, LNM/LCM, adj ISKIP	In production
		0.85 to V_{IN}	0.5	250 kHz → 2 MHz	30 µA	HTSSOP 16	**L6985F**	Sync, adj. fsw, adj. SS, adj. PGOOD, LNM/LCM, adj ISKIP	In production
	Automotive AEC-Q100	0.85 to VIN	2	250 kHz → 2 MHz	30 µA	HTSSOP 16	**A6986**	Sync, adj. fsw, adj. SS, adj. PGOOD, LNM/LCM	In production
		0.85 to VIN	1.5	250 kHz → 2 MHz	30 µA	HTSSOP 16	**A6986F**	Sync, adj. fsw, adj. SS, adj. PGOOD, LNM/LCM, adj ISKIP	In production
		3.3	1.5	250 kHz → 2 MHz	30 µA	HTSSOP 16	**A6986F3V3**	Sync, adj. fsw, adj. SS, adj. PGOOD, LNM/LCM, adj ISKIP	In production
		5	1.5	250 kHz → 2 MHz	30 µA	HTSSOP 16	**A6986F5V**	Sync, adj. fsw, adj. SS, adj. PGOOD, LNM/LCM, adj ISKIP	In production
		0.85 to VIN	0.5	250 kHz → 2 MHz	30 µA	HTSSOP 16	**A6985F**	Sync, adj. fsw, adj. SS, adj. PGOOD, LNM/LCM, adj ISKIP	In production
		3.3	0.5	250 kHz → 2 MHz	30 µA	HTSSOP 16	**A6985F3V3**	Sync, adj. fsw, adj. SS, adj. PGOOD, LNM/LCM, adj ISKIP	In production
		5	0.5	250 kHz → 2 MHz	30 µA	HTSSOP 16	**A6985F5V**	Sync, adj. fsw, adj. SS, adj. PGOOD, LNM/LCM, adj ISKIP	In production
4.5-36	Industrial	0.9 to VIN	0.4	250 → 600 kHz	80 µA	QFN10 4x4	**L6984**	Adj. fsw, SS, PGOOD, LNM/LCM	In production
	Automotive AEC-Q100	0.9 to VIN	0.4	250 → 600 kHz	80 µA	QFN10 4x4 WF	**A6984**	Adj. fsw, SS, PGOOD, LNM/LCM	In production