



Taking DCDC Conversion to the Next Level



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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 of up to 2 A and a wide range of flavours to help to 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 μ A 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 L/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 behaviour 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.

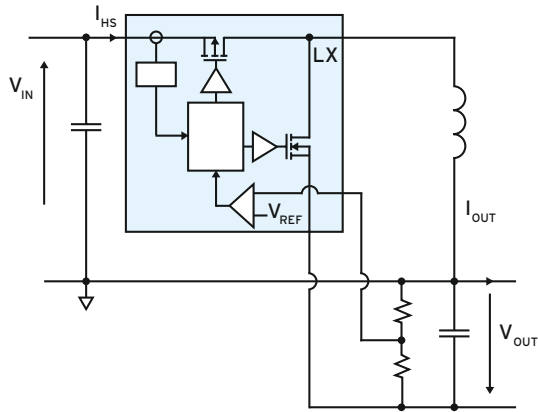
We believe that flexibility is a plus to adjust the same product to different working conditions and ensure the best performance. But when talking of flexibility, let's go one step further and learn how to reuse these flexible switching regulators in different topologies.

SAME PRODUCT IN DIFFERENT ARCHITECTURES

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

- Inverting buck-boost
- Floating boost
- Positive buck-boost
- Isolated Buck

INVERTING BUCK-BOOST



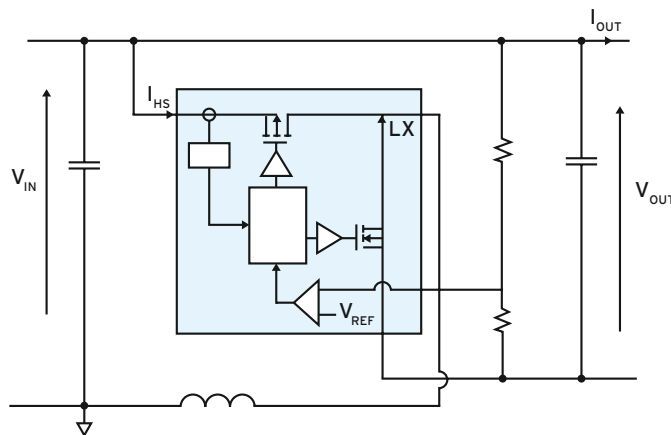
$$D_{\text{IDEAL}} = \frac{|V_{\text{OUT}}|}{V_{\text{IN}} + |V_{\text{OUT}}|}$$

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

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

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

FLOATING BOOST



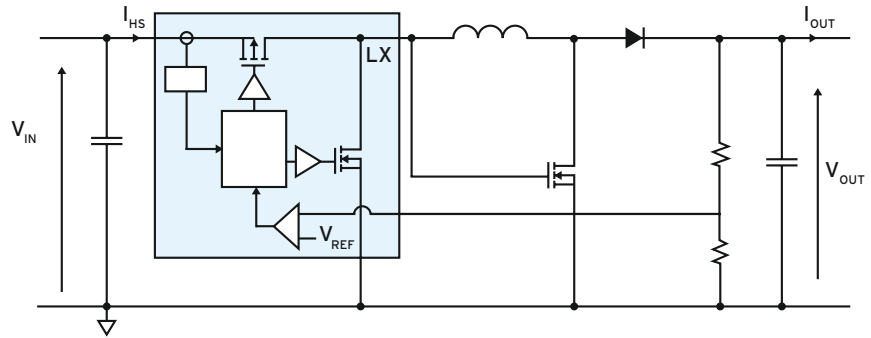
$$V_{\text{OUT}} = \frac{1}{1 - D_{\text{IDEAL}}} \cdot V_{\text{IN}}$$

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

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

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

POSITIVE BUCK-BOOST



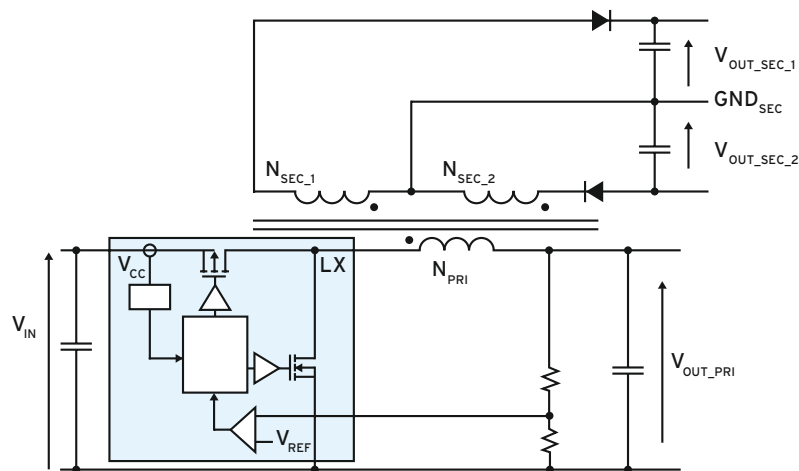
$$V_{OUT} = \frac{D_{IDEAL}}{1-D_{IDEAL}} \cdot V_{IN}$$

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

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

- 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 & EBV help you to move into the future.

VIN (V)	Grade	V _{OUT} (V)	I _{OUT} (A)	Frequency	I _q	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	Industrial	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	

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