Application Hint 71

MIC2182 All Ceramic Capacitor Synchronous Buck Converter Application Circuit

By Steven Chenetz

General Description

The MIC2182 controller is used in a Synchronous Buck converter using ceramic capacitors on both the input and output. The controller operates at 300kHz, allowing the use of a small 5uH inductor and 22uF input and output capacitors. The output voltage is set at 1.8V. A dual MOSFET with Schottky diode is used to minimize board space and external component count.

Compensation issues

The capacitance and ESR values of Tantalum and Al. El. Capacitors are large enough to add a “zero” within the bandwidth of the control loop. The ceramic capacitor in the output has a much lower ESR and capacitance value and the compensating “zero” is at higher frequency (outside the bandwidth of the control loop). Components R10, R11, C9 and C10 form an RC feedforward network which helps compensate the control loop. C11 also helps add some feedforward to improve phase margin.

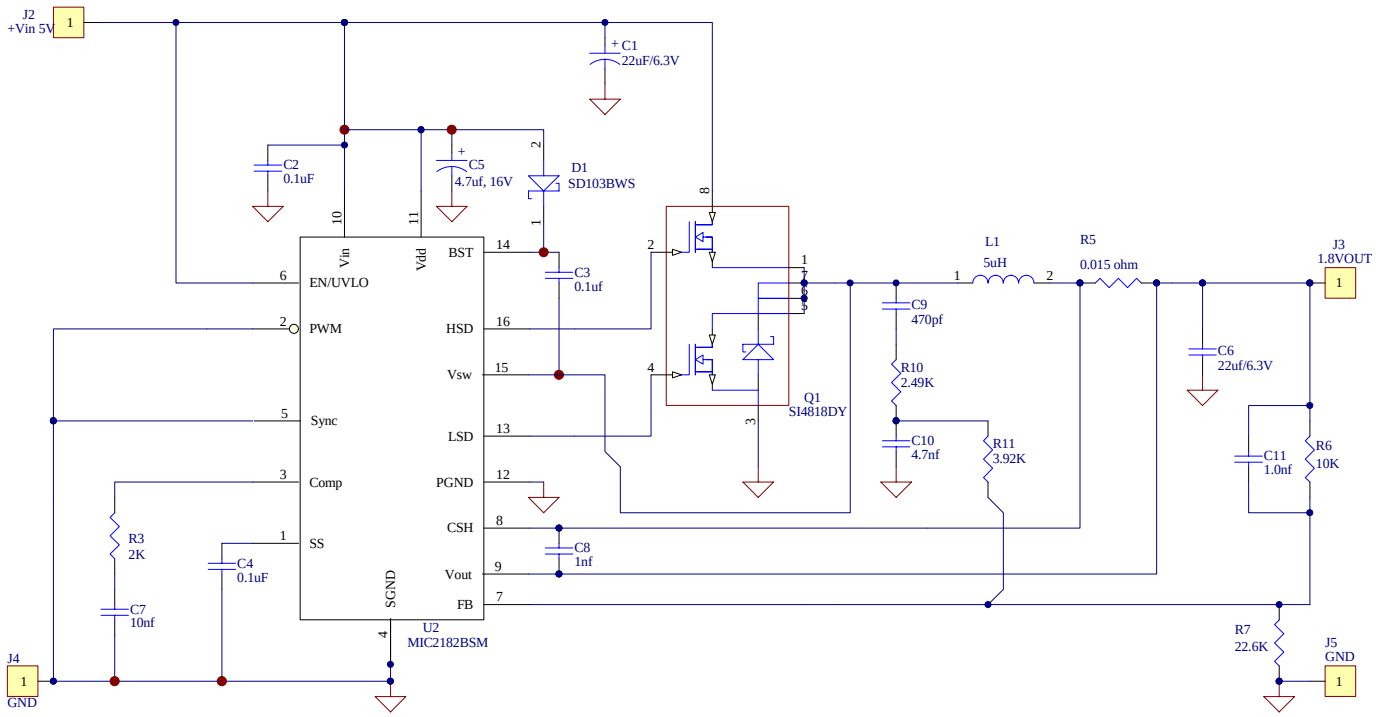

Figure 1

Bill of Materials

Quant	Part Description	Ref Des	Vendor	Vendor P/N
1	Buck controller	U2	Micrel	MIC2182BSM
1	MOSFET/Diode combo	Q1	Vishay Silliconix	Si4818DY
1	100mA, 30V schottky	D1	Diodes Inc.	SD103BWS
			Central Semi	CDSH2-3-MI1
1	5uH, 2.6A inductor	L1	Sumida	CDRH6D38-5R0
1	10nf, 50V, X7R ceramic cap	C7	Vishay	VJ0603Y103KXAAT
1	470pf, 50V, X7R ceramic cap	C9	Vishay	VJ0603Y471KXAAT
1	4.7nf, 50V, X7R ceramic cap	C10	Vishay	VJ0603Y472KXAAT
2	1nf, 50V, X7R ceramic cap	C8, C11	Vishay	VJ0603Y102KXAAT
3	0.1uf, 50V,X7R ceramic cap	C2,C3, C4	Vishay	VJ0806Y104KXAAT
2	22UF, 6.3v X5R, ceramic	C1, C6	Murata	GRM42-2 X5R 226K 6.3
			TDK	C3225X5R0J226M
1	4.7uf, 16V, tantalum	C5	Vishay- Sprague	293D475X0016A2
1	2K , 1%	R3	Vishay dale	CRCW06032001FRT1
1	0.015 ohms (2010 size), 1%	R5	Vishay-Dale	WSL-2010-R015-F
1	10K , 1%, MF	R6	Vishay dale	CRCW06031002FRT1
1	22.6K, 1%, MF	R7	Vishay dale	CRCW06032262FRT1
1	2K, 1%, MF	R3	Vishay dale	CRCW06032001FRT1
1	2.49K, 1%, MF	R10	Vishay dale	CRCW06032491FRT1
1	3.92k, 1%, MF	R11	Vishay dale	CRCW06033921FRT1

Notes:

1. Micrel Semiconductor Tel: 408-944-0800
2. Sumida Tel: 408-982-9660
3. Murata Tel: 949-916-4000
4. Vishay Tel: 402-644-4218
5. Diodes Inc. Tel: 805-446-4800
6. TDK Tel: 847-803-6100
7: Central Semiconductor Tel:631-435-1110

The efficiency at 5Vin is shown in Figure 3.

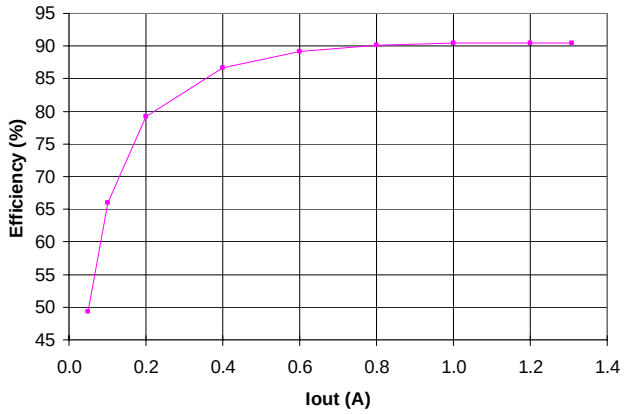

Figure 3

The Bode plot at 5Vin and 1.8V out is shown in Figure 4. Bandwidth is 23kHz with a 69 degree phase margin.

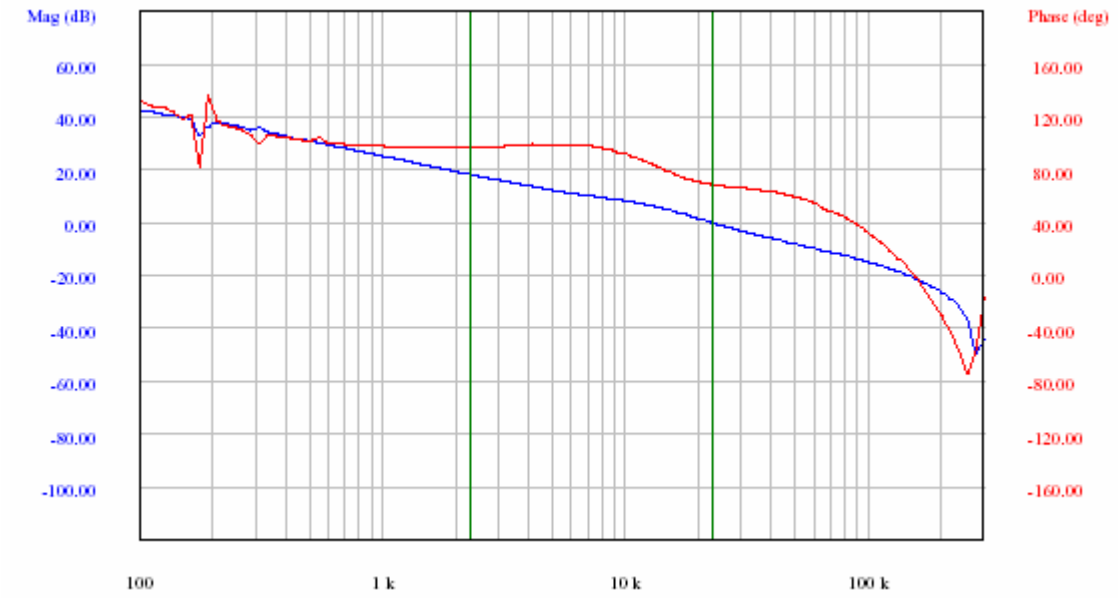

Figure 4

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