

### The World's Most Versatile Synchronous Buck Converter

Micrel's MIC2182 synchronous buck regulator offers high efficiency dc/dc conversion suitable for multitude of applications. With its all n-channel synchronous architecture, the MIC2182 is capable of delivering up to 15A without the need of external MOSFET drivers. At the same time, the MIC2182 is capable of transitioning to "skip" mode, if needed, to improve efficiency at lower power levels.

Though the MIC2182 is rated for operation from a 4.5V to 32V input voltage range, the device can convert lower voltage supply lines, like 3.3V or 2.5V, provided that at least a 5V bias is applied to the V<sub>IN</sub> pin. The MIC2182 can be programmed for output voltages down to 1.25V (or lower with a few extra components) so it is capable of meeting the ever-decreasing voltage levels of the latest high performance DSPs and CPUs.

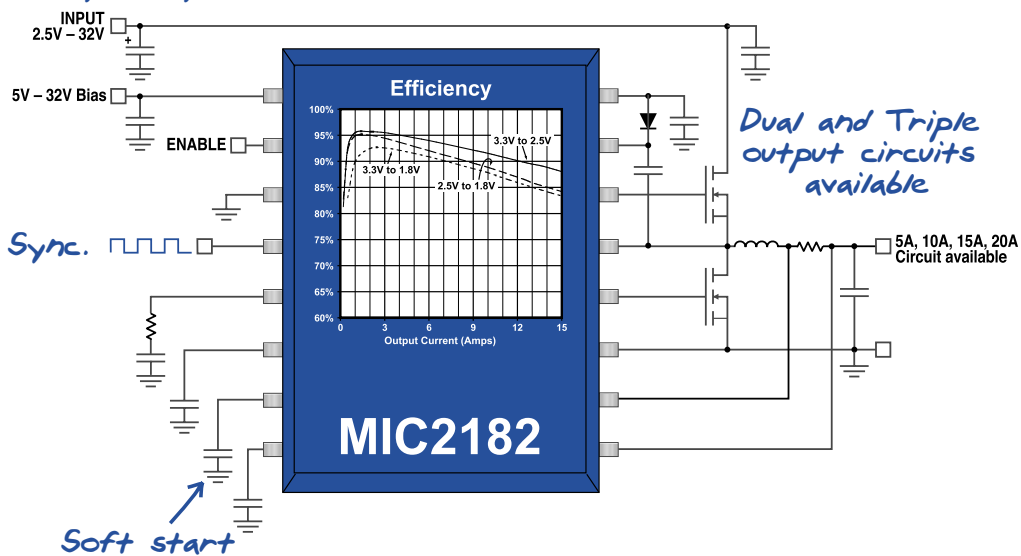
#### Features

- ◆ 96% efficiency
- ◆ Up to 15A output current without external drivers
- ◆ Up to 32V input
- ◆ Frequency foldback short circuit protection
- ◆ Cycle-by-cycle current limit
- ◆ Shutdown current <0.1µA
- ◆ 300KHz operation
- ◆ Sync to 600KHz
- ◆ 0.6% total regulation
- ◆ Adjustable UVLO
- ◆ Available in SOP-16 and SSOP-16

#### Applications

- ◆ DC power distribution systems
- ◆ Notebook and subnotebook computers
- ◆ Termination circuits

#### 2.5V input capability



### Applications

Low Input Voltage Circuit (V <sub>IN</sub> down to 2.5V) .....	2	Current-Sharing Circuit .....	15
Dual Output Circuit .....	4	4A Circuit .....	17
5-Bit V <sub>ID</sub> Circuit .....	6	10A Circuit .....	19
Low Output Voltage Circuit (<1.2V) .....	9	12A Circuit .....	21
High Input Voltage Circuit (55V) .....	11	20A Circuit .....	23
Efficient 10A SSTL Switching Regulator .....	13	Available Evaluation Boards .....	24

# 96% Efficient Low Input Voltage Circuit ( $V_{IN}$ down to 2.5V)

Though the MIC2182 is rated for operation between 4.5V to 32V input, it can convert input voltages as low as 2.5V as long as a  $\geq 5V$  bias is applied to the  $V_{IN}$  pin (10). If a  $\geq 5V$  bias is not available in your application, a charge pump can be used to provide the voltage. See figure 3 and figure 4 for charge-pump ideas.

The circuit below shows a 3.3  $V_{IN}$  to 2.5  $V_{OUT}$  converter. By changing only the feedback resistor ratio, the same basic circuit could be configured for the following applications:

$V_{IN}$	$V_{OUT}$	$R4(\Omega)$	$R13(\Omega)$	$I_{OUT}$
3.3V	2.5V	10k	10k	15A
3.3V	1.8V	10k	22.6k	15A
2.5V	1.8V	10k	22.6k	15A

Table 1. Applications

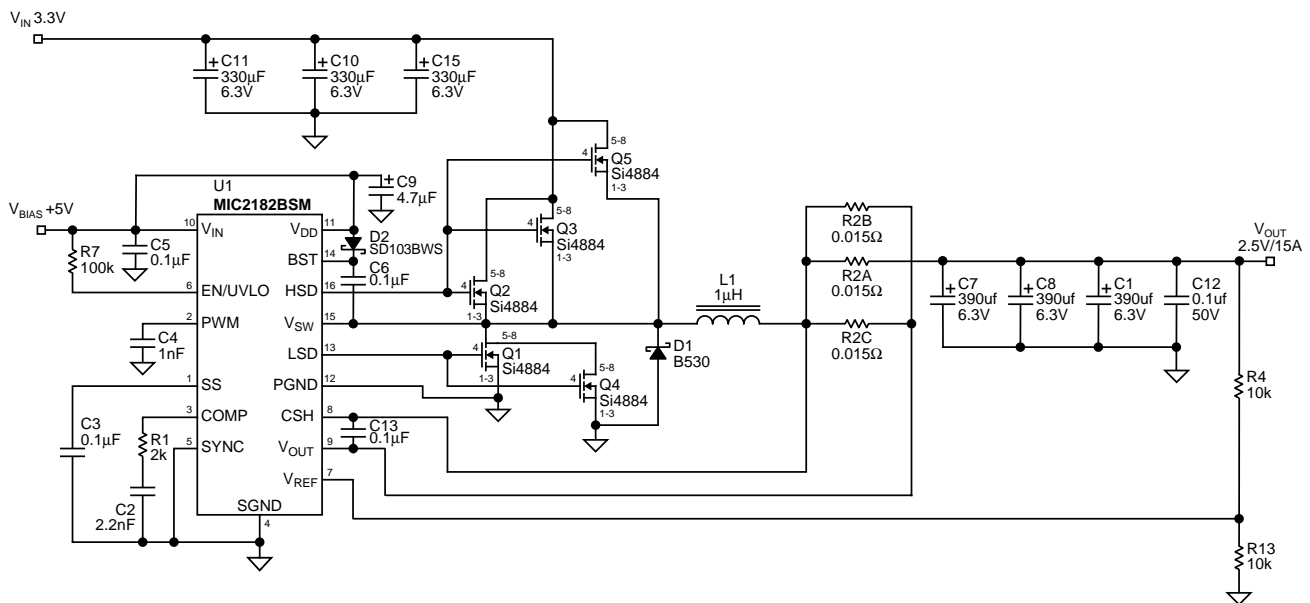
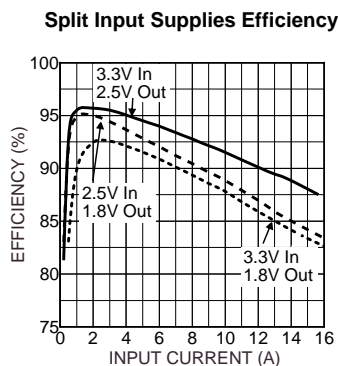


Figure 1. 3.3 $V_{IN}$  to 2.5 $V_{OUT}$  Converter



Graph 1. Efficiency Results

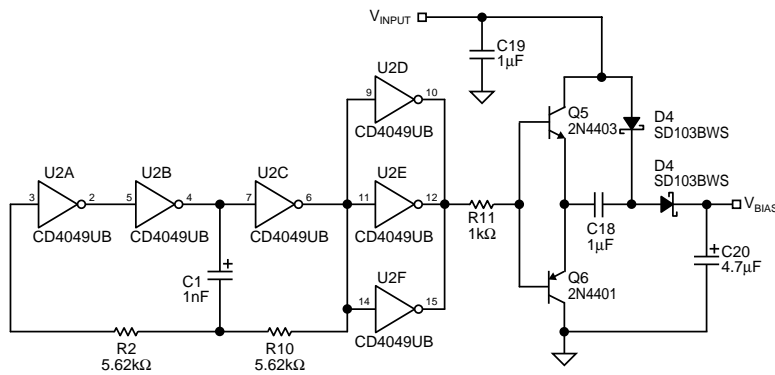


Figure 2. Charge Pump Circuit 1

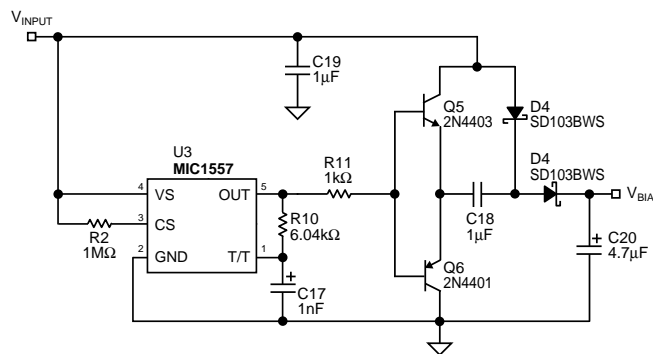


Figure 3. Charge Pump Circuit 2

## Low Input Voltage Circuit Bill of Material

Reference	Part Number	Manufacturer	Description	Qty
C1, C7, C8, C10, C11, C15	594D397X06R3R2T	Vishay/Sprague <sup>(1)</sup>	390μF, 6.3V, tantalum	6
C2	YJ0805Y222MXAAT	Vishay/Sprague <sup>(1)</sup>	2.2nF, 50V, X7R ceramic cap	1
C3, C5, C6, C12, C13	YJ0805Y104MXAAT	Vishay/Sprague <sup>(1)</sup>	0.1μF, 50V, X7R ceramic cap	5
C9	293D475X0016A2	Vishay/Sprague <sup>(1)</sup>	4.7μF, 16V, tantalum	1
D1	B530	Vishay/Lite-On <sup>(2)</sup>	5A, 30V, Schottky diode	1
D2	SD103BWS CDSH2-3	Vishay/Lite-On Central Semiconductor <sup>(3)</sup>	100mA, 30V, Schottky diode	1
L1	UP4B-1R0	Coiltronics <sup>(4)</sup>	1μH, 10A inductor	1
Q1, Q2, Q3 Q4, Q5	Si4884DY	Vishay/Siliconix <sup>(5)</sup>	MOSFET	5
R1	CRCW08052001FRT1	Vishay-Dale <sup>(6)</sup>	2k 1/10W ±1%, size 0805	1
R2a, R2b, R2c	WSL-2512-R015-F	Vishay-Dale	0.015Ω ±1%, size 2512	3
R4, R13	CRCW08051002FRT1	Vishay-Dale	10k 1/10W ±1%, size 0805	2
R7	CRCW08051003FRT1	Vishay-Dale	100k 1/10W ±1%, size 0805	1
U1	<b>MIC2182BM</b>	<b>Micrel</b>	High-Efficiency Synchronous Buck Controller	1

Note 1: Vishay/Sprague (603) 224-1961.

Note 2: Vishay/Lite-On (805) 446-4800.

Note 3: Central Semiconductor (516) 435-1110.

Note 4: Coiltronics (561) 241-7876.

Note 5: Vishay/Siliconix (408) 988-8000.

Note 6: Vishay-Dale (402) 644-4218.

## Dual Output Circuit

The circuit shows a low cost way to generate two outputs from the MIC2182 synchronous buck controller. A second winding on the output inductor produces a second voltage. This secondary voltage has good line regulation and fair output load regulation. A linear regulator (LDO) in the secondary output improves line/load regulation and reduces output ripple. The efficiency, including the LDO power losses is shown in graph 4. Evaluation boards are available for this application.

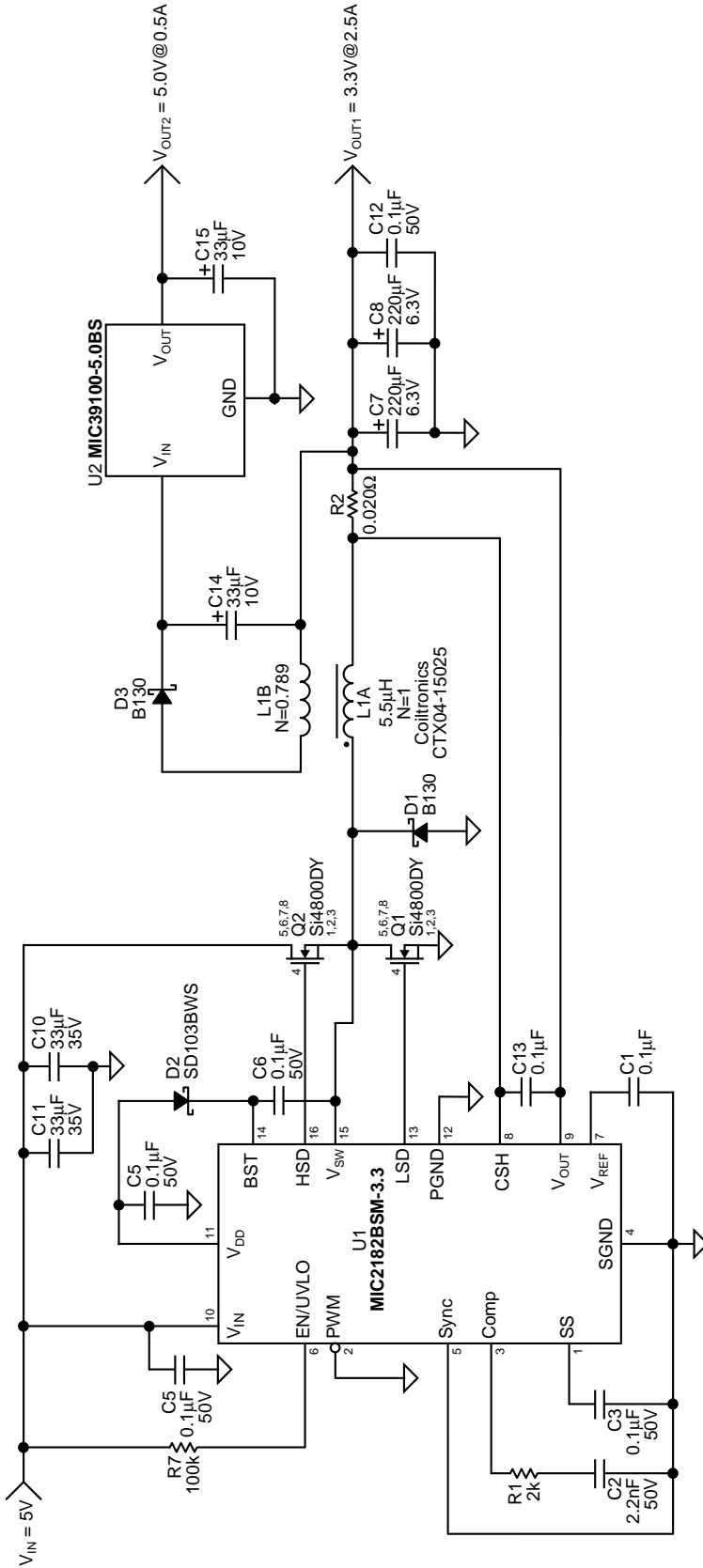
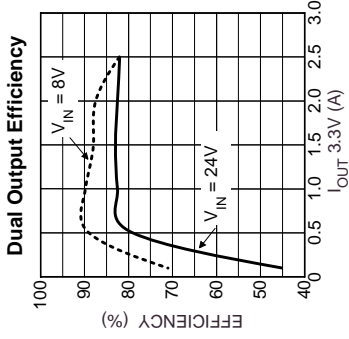


Figure 4. Dual Output 8-24V<sub>IN</sub> 3.3V<sub>OUT</sub> at 2.5V and 5V<sub>OUT</sub> at 0.5A



Graph 2. Efficiency Results

## Dual Output Circuit Bill of Material

Reference	Part Number	Manufacturer	Description	Qty.
C1, C3, C5, C6, C12, C13	YJ0805Y104MXAAT	Vishay/Sprague	0.1 $\mu$ F 50V, X7R ceramic	6
C2	YJ0805Y222MXAAT	Vishay/Sprague	2.2nF 50V, X7R ceramic	1
C7, C8	594D227X06R3C2T	Vishay/Sprague	220 $\mu$ F 6.3V, tantalum	2
C14, C15	593D336X0010C2	Vishay/Sprague	33 $\mu$ F 20V, tantalum	2
C9	293D475X0016A2	Vishay/Sprague	4.7 $\mu$ F 16V, tantalum	1
C10, C11	594D336X035R2	Vishay/Sprague	22 $\mu$ F 35V, tantalum	2
D1, D3	B130	Vishay/Lite-On	1A 30V, Schottky diode	2
D2	SD103BWS CMD5H2-3	Vishay/Lite-On Central Semiconductor	100mA 30V, Schottky diode	1
L1	CTX04-15025	Coiltronics	2 winding inductor	1
Q1, Q2	Si4800DY	Siliconix	MOSFET	2
R1	CRCW08052001FRT1	Vishay/Dale	2k $\pm$ 1%	1
R2	WSL-2010-R020-F	Vishay/Dale	0.020 $\Omega$ $\pm$ 1% (2010 size)	1
R7	CRCW08051003FRT1	Vishay/Dale	100k $\pm$ 1%	1
U1	<b>MIC2182BSM-3.3</b>	<b>Micrel</b>	Buck Controller	1
U2	<b>MIC39100-5.0BS</b>	<b>Micrel</b>	LDO	1

Vendor	Telephone Number
Vishay/Lite-On	(805) 446-4800
Vishay/Dale	(402) 644-4218
Vishay/Siliconix	(408) 988-8000
Central Semiconductor	(516) 435-1110
Coiltronics	(561) 241-7876

Table 2. Component Vendors

## 5-Bit $V_{ID}$ Circuit

The following circuit shows a low cost way to control the MIC2182 from a 5-bit  $V_{ID}$  input. Table 3 shows the 5-bit code and the resulting output voltages. Signal  $V_{ID4}$  switches R2 in and out, which changes the voltage step size (50mV per step for  $V_{ID4}$  low vs. 100mV per step for  $V_{ID4}$  high).  $V_{ID4}$  also switches R18 in and out, which

changes the DC starting voltage (1.3V minimum for  $V_{ID4}$  low and 2.0V minimum for  $V_{ID4}$  high). Any low cost MOSFET, such as the 2N7002, can be used as the switch. The optional power OK circuit (POK), with a separate reference, monitors the feedback voltage to insure proper operation of the converter.

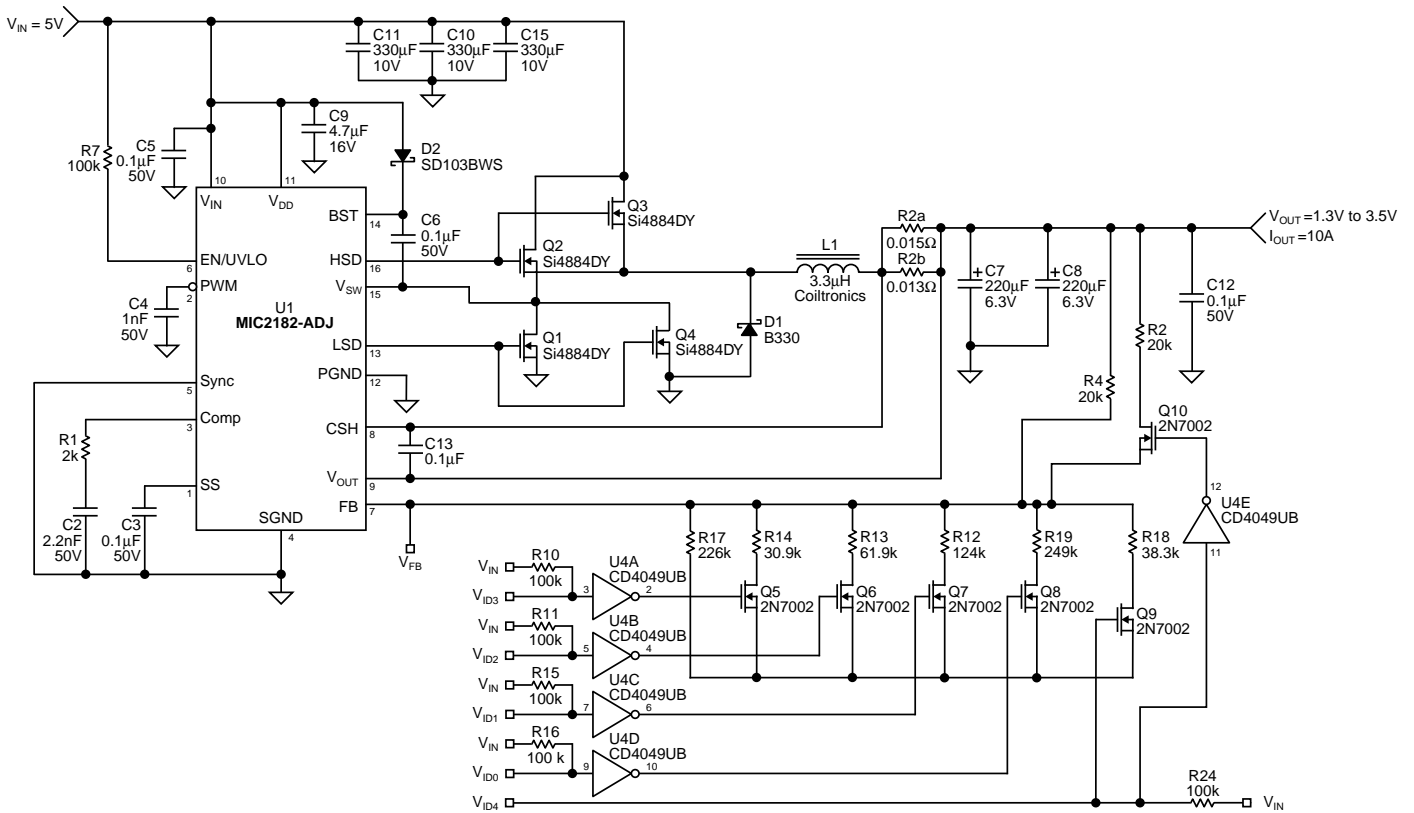


Figure 5. MIC2182, 10A, Synchronous Buck  $V_{ID}$  Circuit

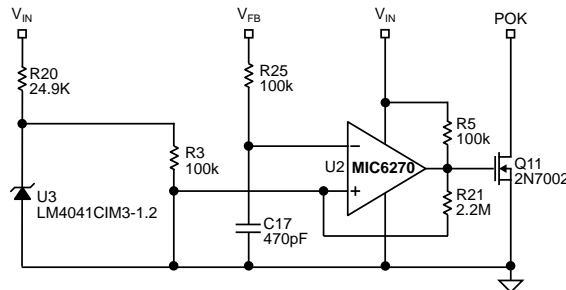


Figure 6. Power Good Circuit

V <sub>ID4</sub>	V <sub>ID3</sub>	V <sub>ID2</sub>	V <sub>ID1</sub>	V <sub>ID0</sub>	V <sub>OUT</sub>
0	1	1	1	1	1.30
0	1	1	1	0	1.35
0	1	1	0	1	1.40
0	1	1	0	0	1.45
0	1	0	1	1	1.50
0	1	0	1	0	1.55
0	1	0	0	1	1.60
0	1	0	0	0	1.65
0	0	1	1	1	1.70
0	0	1	1	0	1.75
0	0	1	0	1	1.80
0	0	1	0	0	1.85
0	0	0	1	1	1.90
0	0	0	1	0	1.95
0	0	0	0	1	2.00
0	0	0	0	0	2.05
1	1	1	1	1	2.0
1	1	1	1	0	2.1
1	1	1	0	1	2.2
1	1	1	0	0	2.3
1	1	0	1	1	2.4
1	1	0	1	0	2.5
1	1	0	0	1	2.6
1	1	0	0	0	2.7
1	0	1	1	1	2.8
1	0	1	1	0	2.9
1	0	1	0	1	3.0
1	0	1	0	0	3.1
1	0	0	1	1	3.2
1	0	0	1	0	3.3
1	0	0	0	1	3.4
1	0	0	0	0	3.5

**Table 3. Output Voltage Identification Codes**

## 5-Bit V<sub>D</sub> Circuit Bill of Material

Reference	Part Number	Manufacturer	Description	Qty.
C2			2.2nF 50V, X7R ceramic	1
C3, C5, C6, C12, C13			0.1µF X7R, ceramic	5
C4			1nF, X7R ceramic	1
C7, C8	594D227X06R3D2T	Vishay/Sprague	220µF 6.3V, tantalum	2
C9	293D475X0016A2	Vishay/Sprague	4.7µF 16V, tantalum	1
C10, C11, C15	594D337X0010R2T	Vishay/Sprague	330µF 10V, tantalum	3
C17		Vishay/Sprague	470pF, X7R ceramic	1
D1	B330	Vishay/Lite-On	3A 30V, Schottky diode	1
D2	SD103BWS CMD5H2-3	Vishay/Lite-On Central Semiconductor	100mA 30V, Schottky diode	1
L1	UP4B-3R3	Coiltronics	3.3µH, 10A inductor	1
Q1, Q2, Q3, Q4	Si4884DY	Siliconix	MOSFET	4
Q5, Q6, Q7, Q8, Q9, Q10, Q11	2N7002	General Semiconductor	MOSFET	7
R1	CRCW08052001FRT1	Vishay/Dale	2k ±1%	1
R2a	WSL-2010-R015-F	Vishay/Dale	0.015Ω ±1% (2010 size)	1
R2b	WSL-2010-R013-F	Vishay/Dale	0.013Ω ±1% (2010 size)	1
R2, R4		Vishay/Dale	20K ±1%	2
R3, R5, R7, R10, R11, R15, R16, R23, R24, R25		Vishay/Dale	100k ±1%	10
R12		Vishay/Dale	124K ±1%	1
R13		Vishay/Dale	61.9K ±1%	1
R14		Vishay/Dale	30.9K ±1%	1
R17		Vishay/Dale	226K ±1%	1
R18		Vishay/Dale	38.3K ±1%	1
R19		Vishay/Dale	249K ±1%	1
R20		Vishay/Dale	24.9K ±1%	1
R21		Vishay/Dale	2.2M ±5%	1
U1	<b>MIC2182BM</b>	<b>Micrel</b>	Buck Controller	1
U2	<b>MIC6270BM5</b>	<b>Micrel</b>	Comparator	1
U3	<b>LM4040CIM3-1.2</b>	<b>Micrel</b>	Reference	1
U4	<b>CD4049UB</b>	Any Vendor	Inverter	1

Vendor	Telephone Number
Vishay/Lite-On	(805) 446-4800
Vishay/Dale	(402) 644-4218
Vishay/Siliconix	(408) 988-8000
Vishay/Sprague	(603) 224-1961
Central Semiconductor	(516) 435-1110
Coiltronics	(561) 241-7876

Table 4. Component Vendors

## Low Output Voltage Circuit (< 1.2V)

This circuit allows output voltages below the internal 1.245V reference. The external 1.225V reference, U2, reduces the voltage to the resistor divider (R4, R13) by 1.225V. The output voltage can be set by the following formula:

$$V_{OUT} = 1.245 \times \left( 1 + \frac{R4}{R13} \right) - 1.225$$

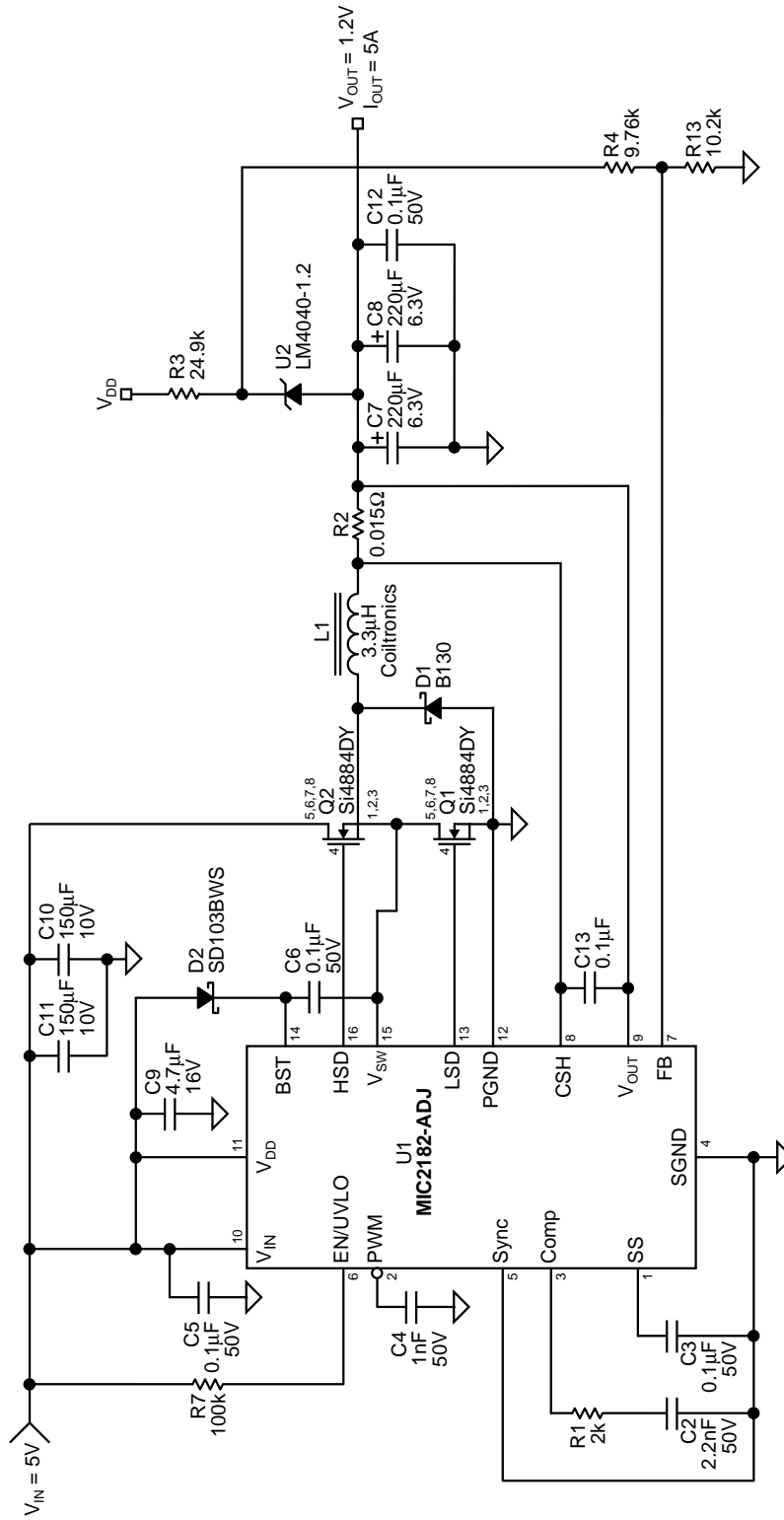


Figure 7. Low Output Voltage Circuit

## Low Output Voltage Circuit (< 1.2V) Bill of Material

Reference	Part Number	Manufacturer	Description	Qty.
C2			2.2nF 50V, X7R ceramic	1
C4			1nF X7R, ceramic	1
C3, C5, C6, C12, C13			0.1μF 50V X7R, ceramic	5
C7, C8	594D227X06R3D2T	Vishay/Sprague	220μF 6.3V, tantalum	2
C9	293D475X0016A2	Vishay/Sprague	4.7μF 16V, tantalum	1
C10, C11	594D157X0010D2T	Vishay/Sprague	150μF 10V, tantalum	2
D1	B130	Vishay/Lite-On	1A 30V, Schottky diode	1
D2	SD103BWS CDSH2-3	Vishay/Lite-On Central Semiconductor	100mA 30V, Schottky diode	1
L1	UP2B-3R3	Coiltronics	3.3μH, 6A inductor	1
Q1, Q2	Si4884DY	Siliconix	MOSFET	2
R1	CRCW08052001FRT1	Vishay/Dale	2k ±1%	1
R2	WSL-2512-R015-F	Vishay/Dale	0.015Ω ±1% (2512 size)	1
R3		Any Vendor	24.9K ±1%	1
R4		Any Vendor	9.76K ±1%	1
R7		Any Vendor	100K ±1%	1
R13		Any Vendor	10.2K ±1%	1
U1	<b>MIC2182BM</b>	<b>Micrel</b>	Buck Controller	1
U2	<b>LM4040CIM3-1.2</b>	<b>Micrel</b>	1.2V Reference	1

Vendor	Telephone Number
Vishay/Lite-On	(805) 446-4800
Vishay/Dale	(402) 644-4218
Vishay/Siliconix	(408) 988-8000
Vishay/Sprague	(603) 224-1961
Central Semiconductor	(516) 435-1110
Coiltronics	(561) 241-7876

**Table 5. Component Vendors**

## High Input Voltage Circuit (55V)

This circuit allows the MIC2182 to operate with an input voltage greater than 32V. Q6 and DZ1 regulate the MIC2182 supply voltage to approximately 15V. Transistors Q3, Q4 and Q5 form a cascade driver,

buffering the MIC2182 from the high input voltage. Capacitor C4 supplies the voltage for the high side MOSFET gate drive. It charges to approximately 15V when the low side MOSFET turns on and it flies up to  $V_{IN}$  when the high side MOSFET turns on.

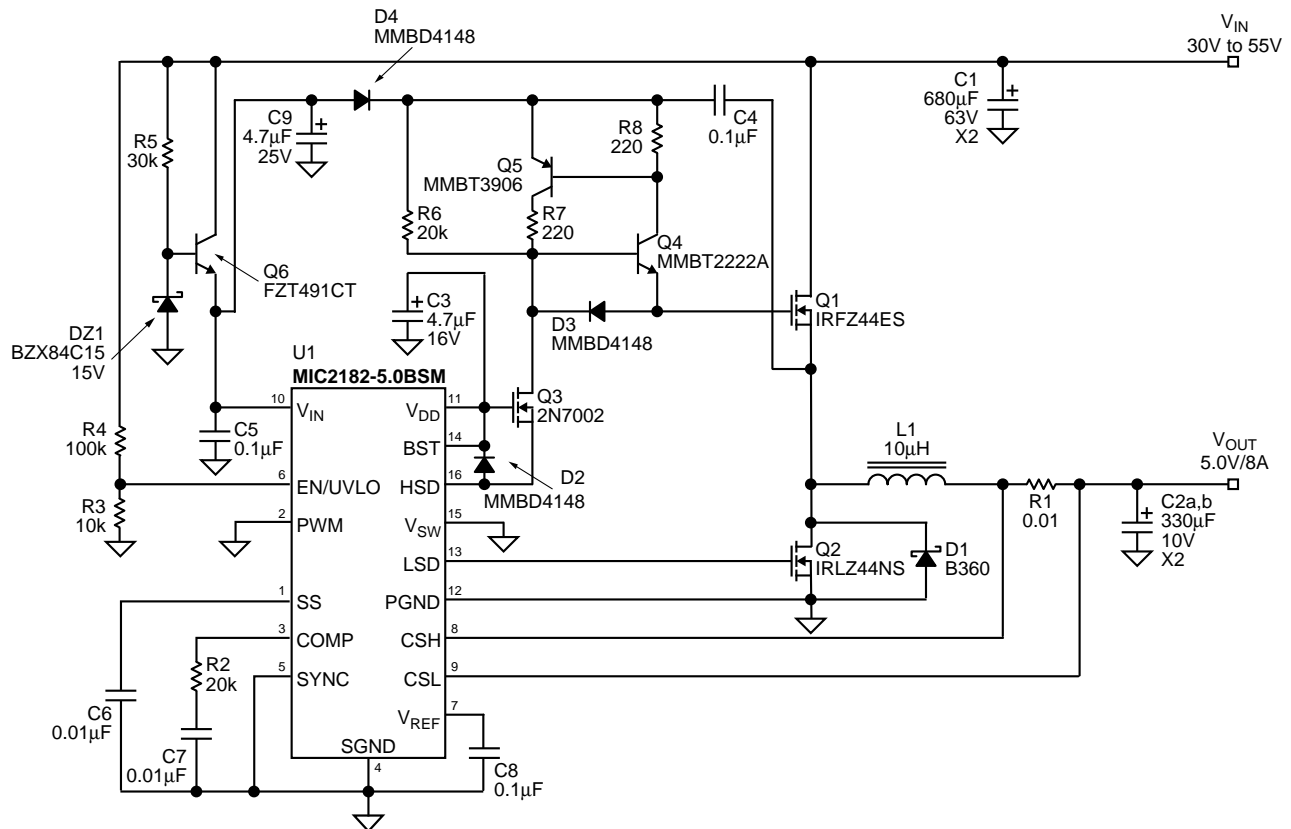


Figure 8. High-Voltage Circuit

## High Input Voltage Circuit (55V) Bill of Material

Reference	Part Number	Manufacturer	Description	Qty.
C1a, b	63MV680GX	Sanyo	680 $\mu$ F, 63V, AL. EL.	2
C2a, b	TPSV337M010R0060	AVX	ESR 0.06, tantalum	2
C3	293D475X0016A2	Vishay/Sprague	4.7 $\mu$ F, 16V, tantalum	1
C4, C5, C8			0.1 $\mu$ F, X7R ceramic	3
C6, C7			0.01 $\mu$ F, X7R ceramic	2
C9	293D475X0025C2	Vishay/Sprague	4.7 $\mu$ F, 25V, tantalum	1
D1	B360	Vishay/Lite-On	3A 60V, Schottky diode	1
D2, D3, D4	MMBD4148	Vishay/Lite-On	75V, Schottky diode	3
DZ1	BZX84C15		15V	1
L1	HM77-22006	Beckman Industries	12A	1
Q1	IR-IRFZ44ES		60V, 0.023 $\Omega$	1
Q2	IR-IRLZ44NS		55V, 0.022 $\Omega$	1
Q3	2N7002	Vishay/Lite-On	N-Channel MOSFET, 60V	1
Q4	MMBT2222A	Vishay/Lite-On	NPN transistor, 40V	1
Q5	MMBT3906	Vishay/Lite-On	PNP transistor, 40V	1
Q6	FZT491CT	Zetex	NPN transistor, 60V	1
R1	WSL-2512-R010-F	Vishay/Dale	0.01 $\Omega$ , $\pm$ 1%, size 2512	1
R2, R6			20k, $\pm$ 1%	2
R3			10k, $\pm$ 1%	1
R4			100k, $\pm$ 1%	1
R5			30.1k, $\pm$ 1%	1
R7, R8			221 $\Omega$ , $\pm$ 1%	2
U1	<b>MIC2182BSM</b>	<b>Micrel</b>	Buck Controller	1

Vendor	Telephone Number
Vishay/Lite-On	(805) 446-4800
Vishay/Dale	(402) 644-4218
Vishay/Siliconix	(408) 988-8000
Vishay/Sprague	(603) 224-1961
Central Semiconductor	(516) 435-1110
Coiltronics	(561) 241-7876

Table 6. Component Vendors



## Efficiency 10A SSTL Switching Regulator Bill of Material

Reference	Part Number	Manufacturer	Description	Qty.
C1, C5		AVX	1nF, X7R ceramic	2
C2, C3, C4		AVX	0.1μF 50V, X7R ceramic	3
C6	293D475X0016A2	Vishay/Sprague	4.7μF 16V, tantalum	1
C7, C8	594D397X06R3R2T	Vishay/Sprague	390μF 6.3V, tantalum	2
C9			0.01μF X7R ceramic	1
C10	UUR1C221MNRIGS	Nichicon	220μF 16V, AL. EL	1
C11, C12	594D227X06R3D2T	Vishay/Sprague	220μF 6.3V, tantalum	2
D1	B330	Vishay/Lite-On	3A 40V, Schottky diode	1
D2	SD103BWS CDSH2-3	Vishay/Lite-On Central Semiconductor	100mA 30V, Schottky diode	1
L1	UP4B-3R3	Coiltronics	3.3μH, 11A inductor	1
Q1a, b Q2a, b	Si4884DY	Vishay/Siliconix	MOSFET	4
R1, R2, R3	CRCW08052001FRT1	Vishay/Dale	10k ±1%	3
R4	CRCW08052001FRT1	Vishay/Dale	100k ±1%	1
R7	CRCW08051003FRT1	Vishay/Dale	3.32k ±1%	1
U1	<b>MIC2182BM</b>	<b>Micrel</b>	High-efficiency Sync. Buck Controller	1
U2	<b>MIC7300BM5</b>	<b>Micrel</b>	Op Amp	1

Vendor	Telephone Number
Vishay/Lite-On	(805) 446-4800
Vishay/Dale	(402) 644-4218
Vishay/Siliconix	(408) 988-8000
Vishay/Sprague	(603) 224-1961
Central Semiconductor	(516) 435-1110
Coiltronics	(561) 241-7876
Nichicon	(847) 843-7500

**Table 7. Component Vendors**

# Current-Sharing Circuit

The circuit below shows how to connect the MIC2182 in parallel. This is a useful configuration if the total output current is more than a single supply can handle. The primary regulator operates as a normal MIC2182 controller. The secondary regulator uses an external

operational amplifier to sense the voltage across the primary regulator's current sense resistor and force the secondary regulator to match the output current. The two regulators may share the same input voltage source or may operate from different inputs as long as the input voltages are similar (within 20% of each other).

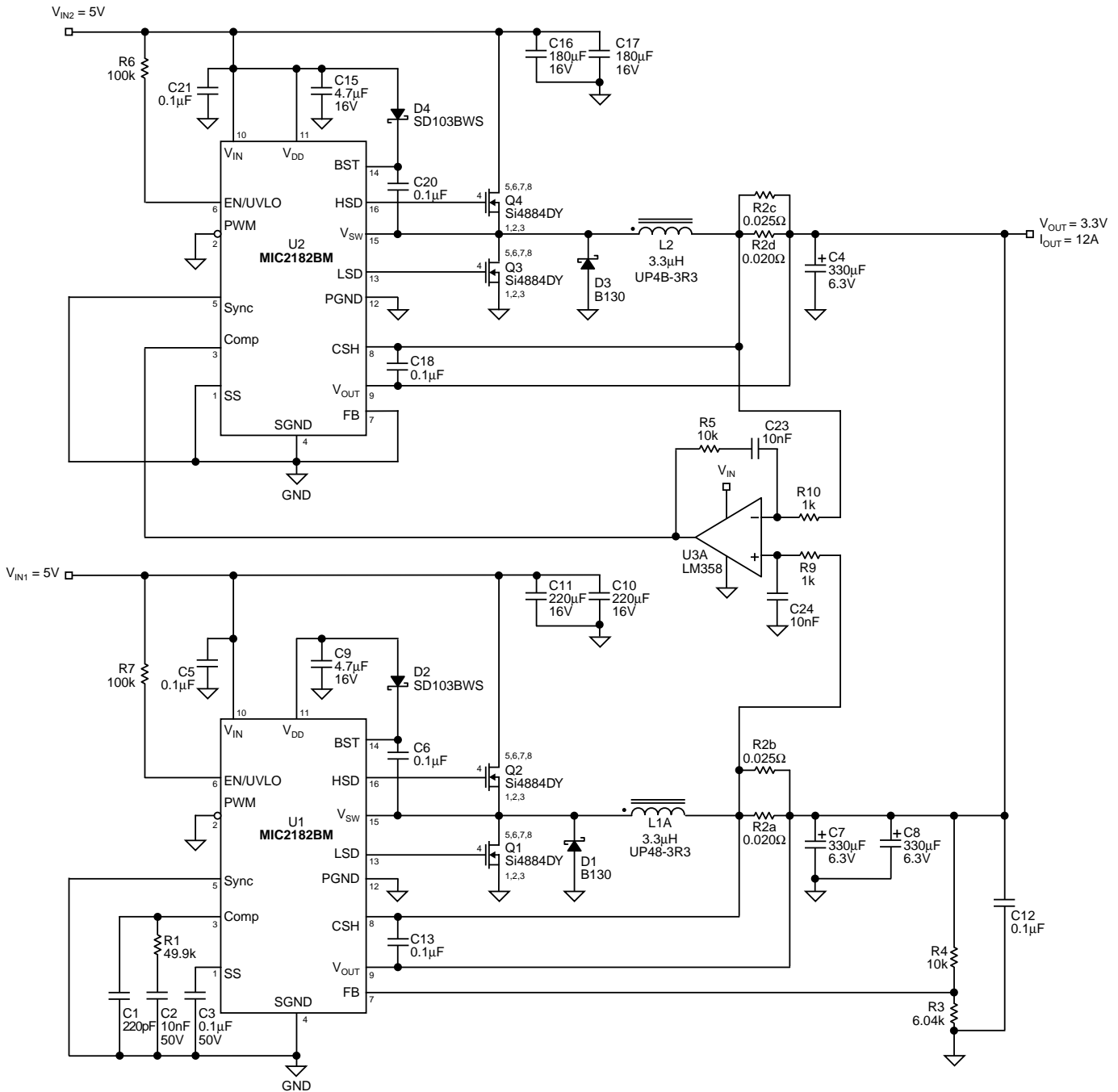


Figure 10. Parallel Converter

## Current-Sharing Parallel Converters Bill of Material

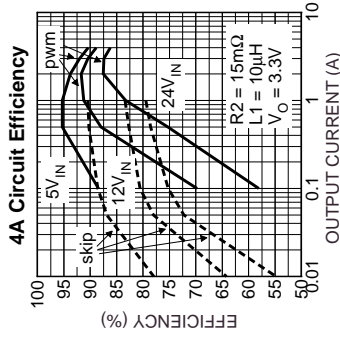
Reference	Part Number	Manufacturer	Description	Qty.
C1		Any	220pF 50V, X7R ceramic	1
C2, C23, C24		Any	10nF X7R, ceramic	3
C3, C5, C6, C12, C13, C18, C20, C21		Any	0.1μF 50V X7R, ceramic	8
C4, C7, C8	594D337X06R3D2T	Vishay/Sprague	330μF, 6.3V, tantalum	3
C10, C11, C16, C17	594D187X0016R2T	Vishay/Sprague	220μF 16V, tantalum	4
C9, C15	293D475X0016A2	Vishay/Sprague	4.7μF 16V, tantalum	2
D1, D3	B130	Vishay/Lite-On	1A 30V, Schottky diode	2
D2, D4	SD103BWS CMD5H2-3	Vishay Central Semiconductor	100mA 30V, Schottky diode	2
L1, L2	UP4B-3R3	Coiltronics	3.3μH, 11A inductor	2
Q1, Q2, Q3, Q4	Si4884DY	Vishay/Siliconix	MOSFET	4
R1		Any	49.9k ±1%	1
R2a, R2d	LR2010-01-R020-F WSL-2010-R020-F	IRC Vishay	0.020Ω ±1% (2010 size)	2
R2b, R2c	LR2010-01-R025-F WSL-2010-R025-F	IRC Vishay	0.025Ω ±1% (2010 size)	2
R3		Any	6.04k, ±1%	1
R4, R5		Any	10k ±1%	2
R6, R7		Any	100k ±1%	2
R9, R10		Any	1k, ±1%	2
U1, U2	<b>MIC2182BM</b>	<b>Micrel</b>	Buck Controller	2
U3a	LM358	Any	LM358 Op Amp	1

Vendor	Telephone Number
Vishay/Lite-On	(805) 446-4800
Vishay/Dale	(402) 644-4218
Vishay/Siliconix	(408) 988-8000
Vishay/Sprague	(603) 224-1961
Central Semiconductor	(516) 435-1110
Coiltronics	(561) 241-7876

Table 8. Component Vendors

## 4A Circuit

The following circuit is of the 4A MIC2182BSM evaluation board. The input voltage range is between 4.5V to 28V. Output voltages of 1.8V, 2.5V, 3.3V or 5V can be selected with the proper jumper connection. Full load efficiency is over 90%.



Graph 3. Efficiency Results

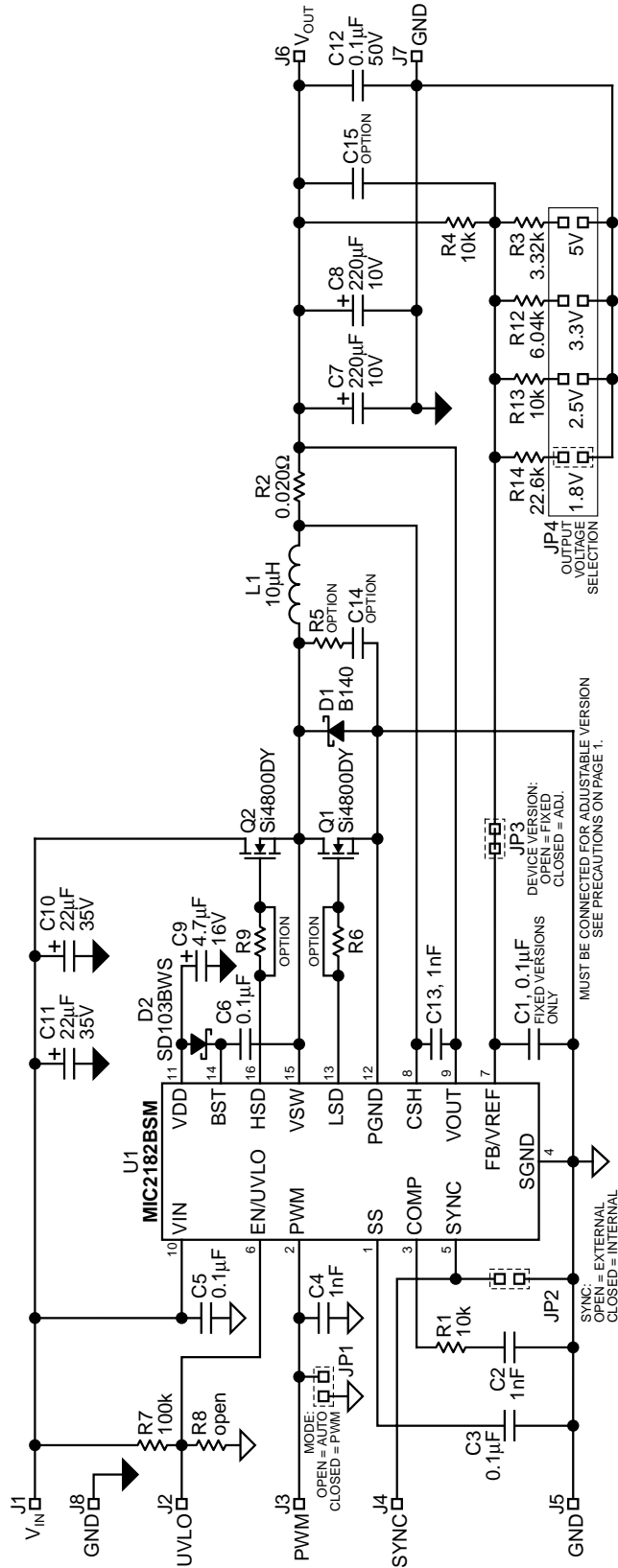


Figure 11. Evaluation Board Schematic

## 4A Circuit Bill of Material

Reference	Part Number	Manufacturer	Description	Qty.
C1*		AVX	0.1 $\mu$ F 25V, X7R ceramic	0
C2, C4, C13	08055C102MAT2A	AVX	1nF 50V, X7R ceramic	3
C3, C5, C6, C12	08055C104MAT2A	AVX	0.1 $\mu$ F 25V, X7R ceramic	4
C7, C8	TPSE227M010R0100	AVX	220 $\mu$ F 10V, tantalum	2
C9	TAJA475M016R	AVX	4.7 $\mu$ F 16V, tantalum	1
C10, C11	TPSE226M035R0300	AVX	22 $\mu$ F 35V, tantalum	2
C14, C15		AVX	open (0805 size)	2
D1	B140	Vishay/Lite-On	1A 40V, Schottky	1
D2	SD103BWS CMDSH2-3	Vishay/Lite-On Central Semiconductor	100mA 30V, Schottky diode	1
L1	CDRH127-100	Sumida	10 $\mu$ H 5A	1
R1, R4, R13	CRCW08051002FRT1	Vishay/Dale	10k $\pm$ 1%	3
R2	WSL-2010-R020-F LR2010-01-R020-F	Vishay/Dale IRC	0.020 $\Omega$ $\pm$ 1% (2010 size)	1
R3	CRCW08053321FRT1	Vishay/Dale	3.32k $\pm$ 1%	1
R5, R6, R8, R9			open	4
R7	CRCW08051003FRT1	Vishay/Dale	100k $\pm$ 1%	1
R12	CRCW08056041FRT1	Vishay/Dale	6.04k $\pm$ 1%	1
R14	CRCW08052262FRT1	Vishay/Dale	22.6k $\pm$ 1%	1
Q1, Q2	Si4800DY	Vishay/Siliconix	MOSFET	2
U1	<b>MIC2182BSM</b>	<b>Micrel</b>	High-Efficiency Synchronous Buck Controller	1

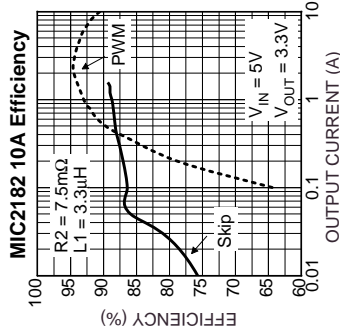
\* Used with MIC2182-x.xBSM (fixed) applications only.

Vendor	Telephone Number
Vishay/Lite-On	(805) 446-4800
Vishay/Dale	(402) 644-4218
Vishay/Siliconix	(408) 988-8000
Central Semiconductor	(516) 435-1110
Sumida	(847) 956-0666
AVX	(803) 448-9411

Table 9. Component Vendors

# 10A Circuit

The following circuit is of the 10A MIC2182BM evaluation board. The input voltage range is between 5V to 10V. Output voltages of 1.8V, 2.5V or 3.3V can be selected with the proper jumper connection. Full load offering is over 90%.



Graph 4. Efficiency Results

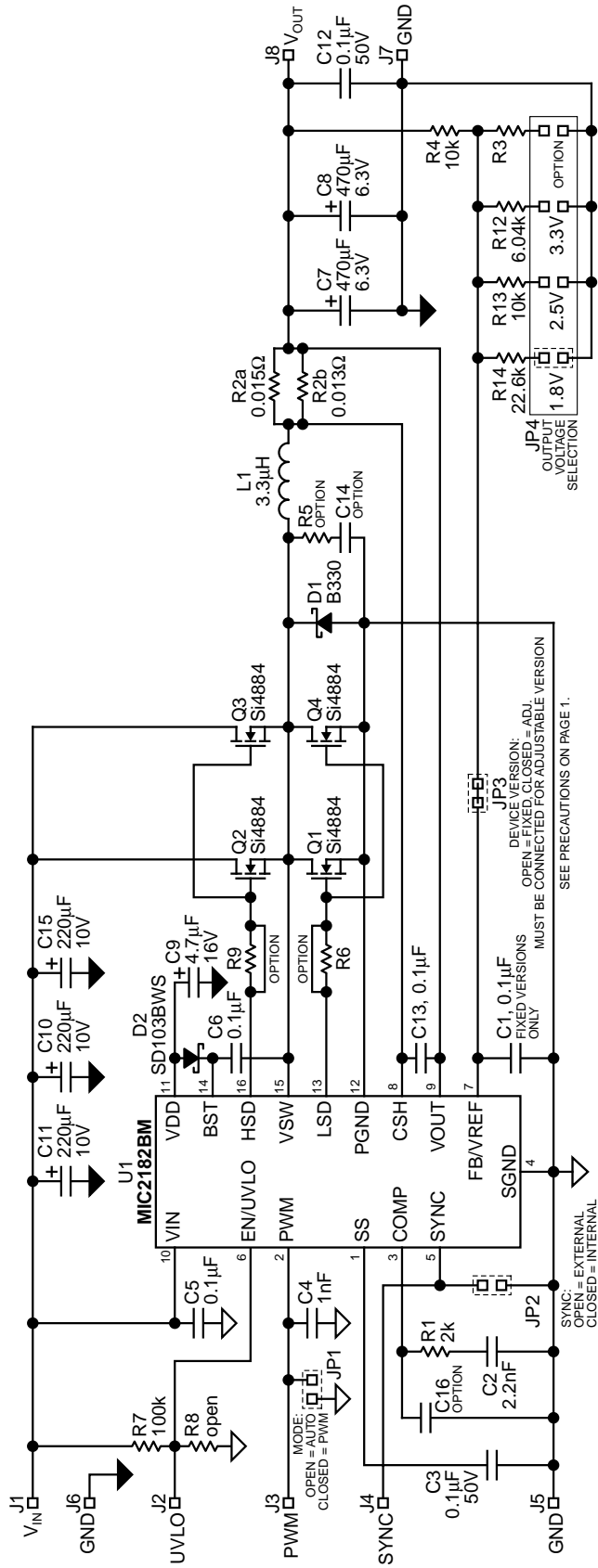


Figure 12. Evaluation Board Schematic

## 10A Circuit Bill of Material

Reference	Part Number	Manufacturer	Description	Qty.
C1, C14, C16		AVX	open (0805 size)	3
C2		AVX	2.2nF 50V, X7R ceramic	1
C3, C5, C6, C12, C13		AVX	0.1μF 50V, X7R ceramic	5
C4		AVX	1nF 50V, X7R ceramic	1
C7, C8	TPSV477M006R0055	AVX	470μF 6.3V, tantalum	2
C9	TAJA475M016R	AVX	4.7μF 16V, tantalum	1
C10, C11, C15	TPSV227M010R0060	AVX	220μF 10V, tantalum	3
D1	B330	Vishay/Lite-On	3A 30V, Schottky diode	1
D2	SD103BWS CMD5H2-3	Vishay/Lite-On Central Semiconductor	100mA 30V, Schottky diode	1
L1	UP4B-3R3	Coiltronics	3.3μH 10A	1
Q1, Q2, Q3, Q4	Si4884DY	Vishay/Siliconix	MOSFET	4
R1	CRCW08052001FRT1	Vishay/Dale	2k ±1%	1
R2a	WSL-2010-R015-F	Vishay/Dale	0.015Ω ±1% (2010 size)	1
R2b	WSL-2010-R013-F	Vishay/Dale	0.013Ω ±1% (2010 size)	1
R3, R5, R6, R8, R9			open	5
R4, R13	CRCW08051002FRT1	Vishay/Dale	10k ±1%	2
R7	CRCW08051003FRT1	Vishay/Dale	100k ±1%	1
U1	<b>MIC2182BM</b>	<b>Micrel</b>	High-Efficiency Synchronous Buck Controller	1

Vendor	Telephone Number
Vishay/Lite-On	(805) 446-4800
Vishay/Dale	(402) 644-4218
Vishay/Siliconix	(408) 988-8000
Central Semiconductor	(516) 435-1110
Sumida	(847) 956-0666
AVX	(803) 448-9411

Table 10. Component Vendors



## 12V<sub>IN</sub>, 2.5V<sub>OUT</sub> at 12A Circuit Bill of Material

Reference	Part Number	Manufacturer	Description	Qty.
C1		AVX	1μF, 25V X7R ceramic	1
C2		AVX	2.2nF 50V, X7R ceramic	1
C4		AVX	1nF X7R, ceramic	1
C3, C5, C6, C12, C13		AVX	0.1μF 50V X7R, ceramic	5
C7, C8	TPSV477M006R0055	AVX	470μF 6.3V, tantalum	2
C9	TAJA475M016R	AVX	4.7μF 16V, tantalum	1
C10, C11, C13	TPSV107M020R0085	AVX	100μF 20V, tantalum	3
D1	B530	Vishay/Lite-On	5A 30V, Schottky diode	1
D2	SD103BWS CMD5H2-3	Vishay/Lite-On Central Semiconductor	100mA 30V, Schottky diode	1
D3	B130	Vishay/Lite-On	1A 30V, Schottky diode	1
L1	UP4B-2R2	Coiltronics	2.2μH, 12A inductor	1
Q1, Q2	SUD50N03-07	Vishay/Siliconix	MOSFET	2
R1	CRCW08052001FRT1	Vishay/Dale	2k ±1%	1
R2a	WSL-2010-R010-F	Vishay/Dale	0.010Ω ±1% (2010 size)	1
R2b	WSL-2010-R015-F	Vishay/Dale	0.015Ω ±1% (2010 size)	1
R4, R13	CRCW08051002FRT1	Vishay/Dale	10k ±1%	2
R7	CRCW08051003FRT1	Vishay/Dale	100k ±1%	1
U1	<b>MIC2182BM</b>	<b>Micrel</b>	High-efficiency Sync. Buck Controller	1
U2, U3	<b>MIC4452BM</b>	<b>Micrel</b>	MOSFET Driver	2

Vendor	Telephone Number
Vishay/Lite-On	(805) 446-4800
Vishay/Dale	(402) 644-4218
Vishay/Siliconix	(408) 988-8000
Central Semiconductor	(516) 435-1110
Coiltronics	(561) 241-7876

Table 11. Component Vendors

## 20A Circuit

Shown below is a 20A MIC2182BM circuit. The input voltage range is between 5V to 10V. Since larger MOSFETs are needed to provide 20A, MIC4452 MOSFET drivers are used to provide the needed gate drive.

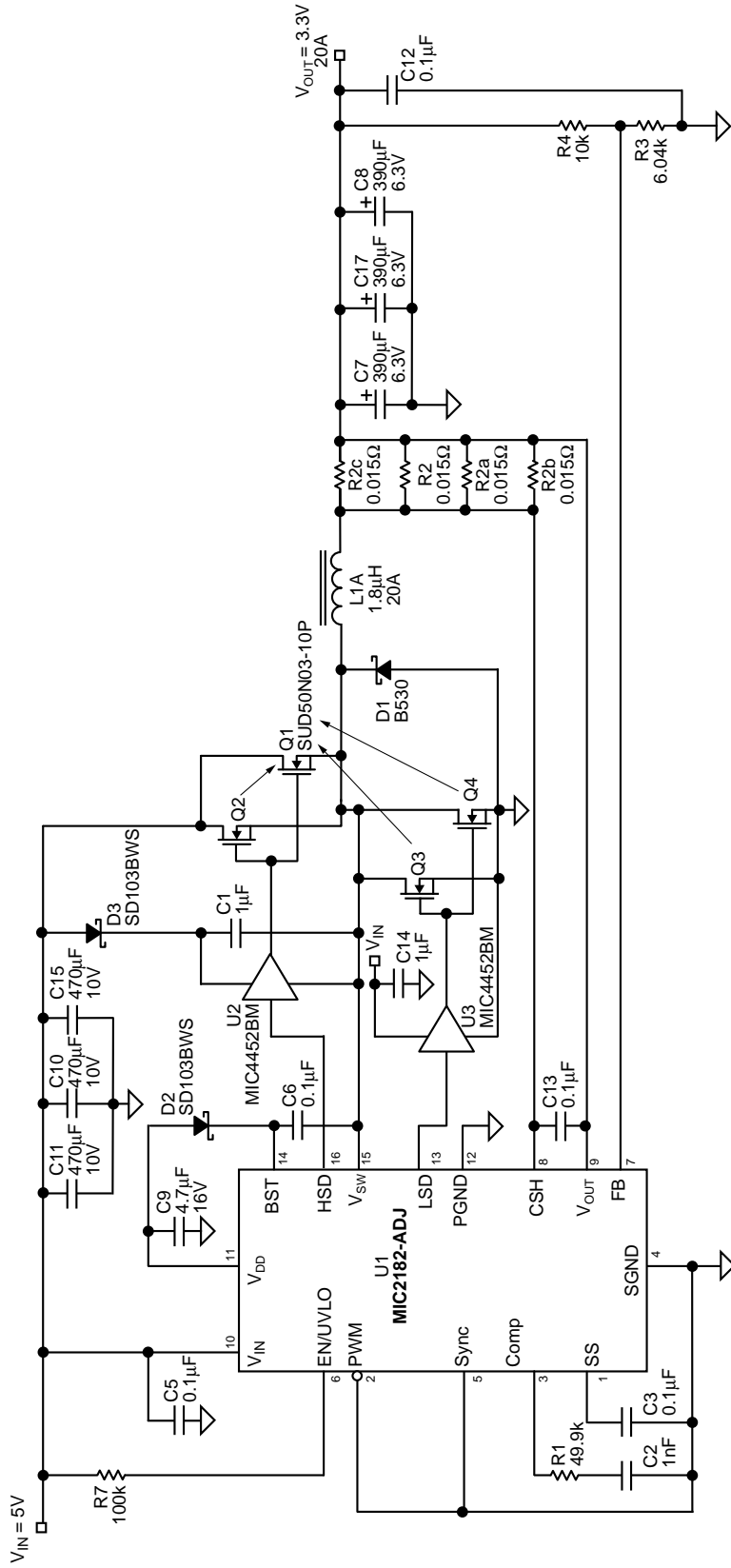


Figure 14. 20A Synchronous Buck Evaluation Board

## 20A Synchronous Buck Converter Bill of Material

Reference	Part Number	Manufacturer	Description	Qty.
C1, C14		AVX	1 $\mu$ F 50V, X7R ceramic	2
C2		AVX	1nF X7R, ceramic	1
C3, C5, C6 C12, C13		AVX	0.1 $\mu$ F 50V X7R, ceramic	5
C7, C8, C17	594D397X06R3R2T	Vishay/Sprague	390 $\mu$ F, 6.3V, ESR = 0.045 $\Omega$	3
C9	TAJA475M016R	AVX	4.7 $\mu$ F 16V, tantalum	1
C10, C11, C15	94SV477X06R3F	Vishay/Sprague	470 $\mu$ F 10V, OS-CON	3
D1	B530C	Vishay/Lite-On	5A 30V, Schottky diode	1
D2, D3	SD103BWS	Vishay/Lite-On	100mA 30V, Schottky diode	2
L1	CDEP149-1R8MC	Sumida	1.8 $\mu$ H, 20A inductor	1
Q1, Q2, Q3, Q4	SUD50N03-10P	Siliconix	MOSFET	4
R1			49.9k $\pm$ 1%	1
R2, R2a, R2b, R2c	WSL-2512-R015-F	Dale	0.015 $\Omega$ $\pm$ 1% (2512 size)	4
R3			6.04k, $\pm$ 1%	1
R4			10k $\pm$ 1%	1
R7			100k $\pm$ 1%	1
U1	<b>MIC2182BM</b>	<b>Micrel</b>	High-efficiency Sync. Buck Controller	1
U2, U3	<b>MIC4452BM</b>	<b>Micrel</b>	MOSFET Driver	2

Vendor	Telephone Number
Vishay/Lite-On	(805) 446-4800
Vishay/Dale	(402) 644-4218
Vishay/Siliconix	(408) 988-8000
Vishay/Sprague	(603) 224-1961
Central Semiconductor	(516) 435-1110
Coiltronics	(561) 241-7876

Table 12. Component Vendors

## Evaluation Boards

The following evaluation boards are available through your local Micrel Sales Representatives:

- 4A Evaluation Board
- 10A Evaluation Board
- Dual/Triple Output Evaluation Board