

### Introduction

MIC2196 is a high-efficiency PWM boost control IC housed in a SO-8 package. The MIC2196 is optimized for low input voltage applications. With its wide input voltage range of 2.9V to 14V, the MIC2196 can be used in boost, SEPIC (single ended primary inductive coupled), CUK and flyback topologies to efficiently generate positive and negative voltages. This evaluation board addresses the CUK topology where input voltage range of 4V to 6V is used to generate  $-5V$ .

The MIC2196 is ideal for space sensitive applications. The device is housed in the space saving SO-8 package, whose low pin-count minimizes external components. Its fixed 400kHz PWM operation allows the use of small inductor and small output capacitors and is ideal for noise-sensitive telecommunication applications. Efficiencies over 80% are achievable over a wide range of load conditions for a CUK topology.

### MIC2196 Evaluation Board Input/Output Voltages and Load Current

The MIC2196 CUK evaluation board is designed for input voltage 4V to 6V and output voltage of  $-5V$  at 2A. The evaluation board can be programmed to a different output voltage and load current by merely replacing a few components. Please consult factory or your local Micrel Field Application Engineer to implement this change.

### Quick-Start Guide

Refer to Figure 1 for the following:

1. Connect the positive terminal from the power supply to  $V_{IN}$  post (J1) on the MIC2196 CUK evaluation board.
2. Connect the GND terminal of the input power supply to GND (J2).
3. Connect a digital voltmeter across  $V_{OUT}$  (J3) and GND (J4) to measure output voltage.
4. After turning the input supply on, the output voltage should read approximately  $-5V$ .

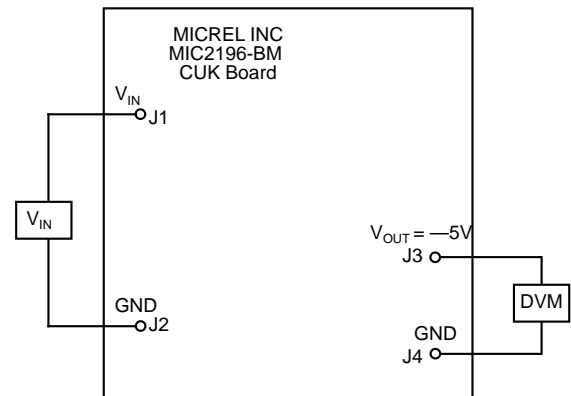
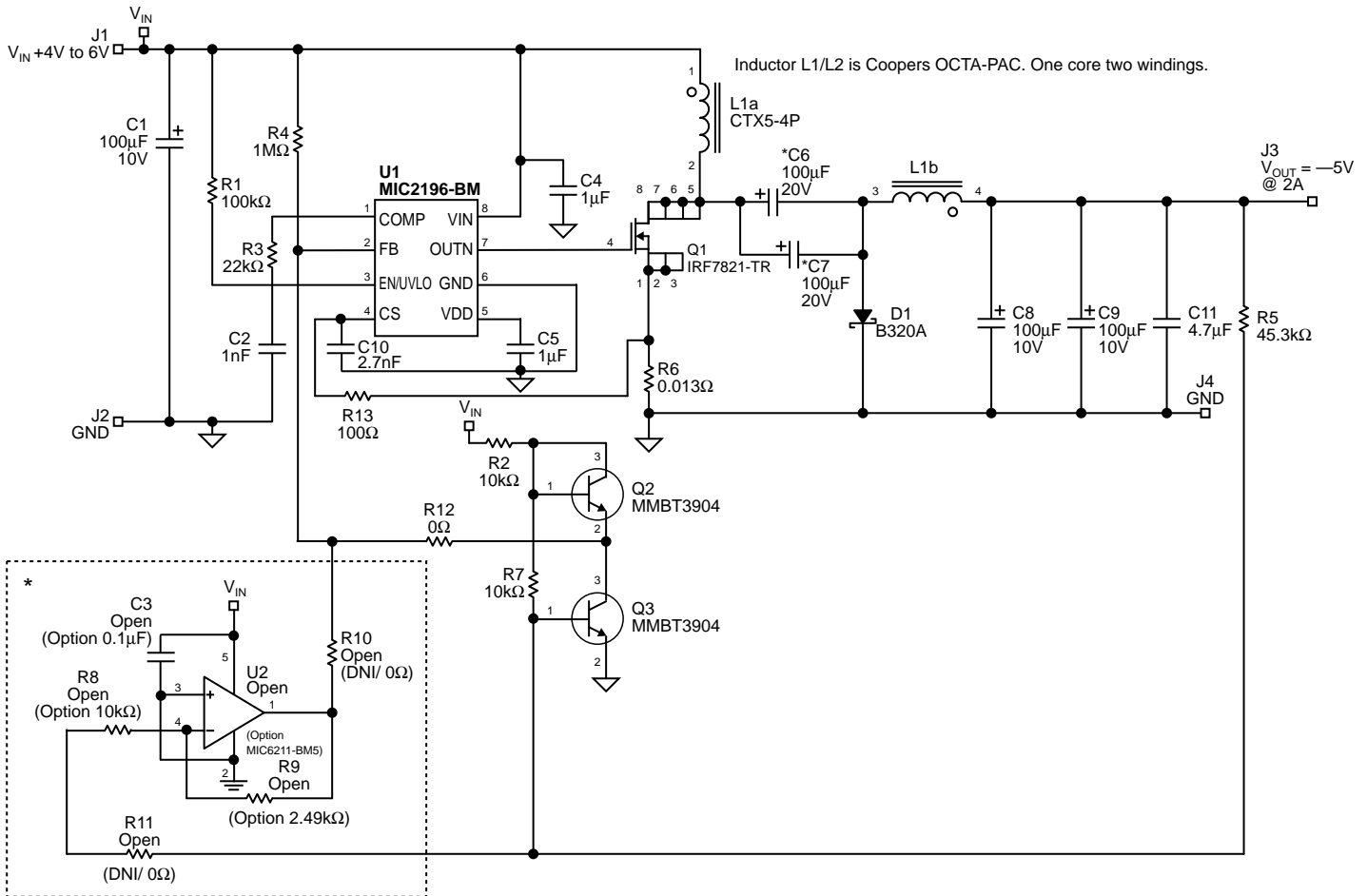


Figure 1. MIC2196 CUK Evaluation Board Hook-up

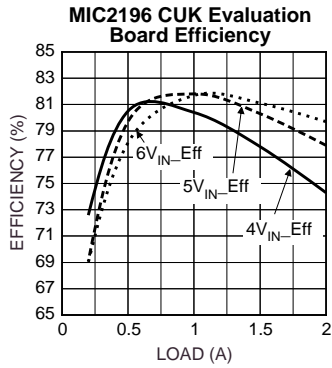
# Evaluation Board Schematic



\* This circuit can be used instead of Q2 and Q3 to generate negative feedback voltage for the CUK topology.

**Evaluation Board Efficiency**

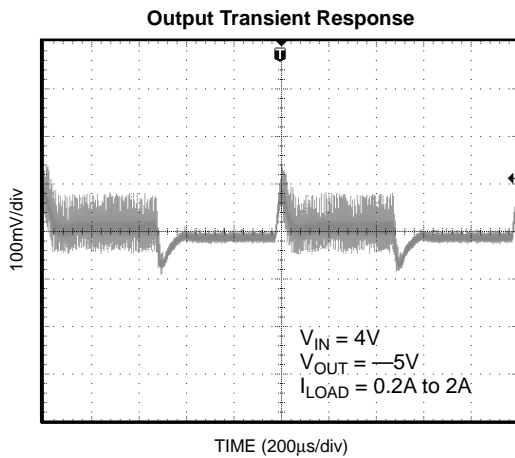
Figure 2 shows the MIC2196 efficiency for input voltage between 4V and 6V to produce a constant -5V output for up to 2A of load current.



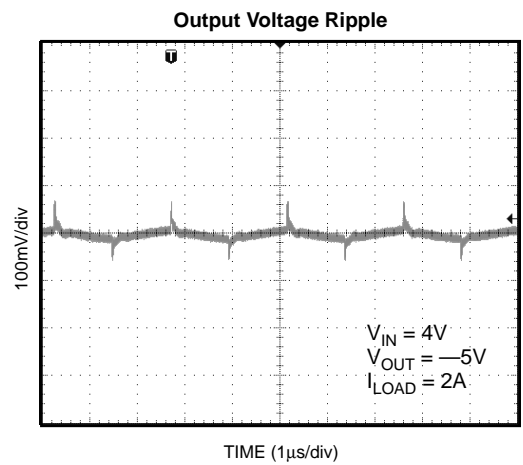
**Figure 2. MIC2196 CUK Evaluation Board Efficiency for  $V_{IN} = 4V$  to  $6V$  and  $V_{OUT} = -5V$**

**Transient Response**

Figures 3 and 4 show the transient response and output voltage ripple for  $V_{IN} = 6V$  for the MIC2196 CUK evaluation board.



**Figure 3. Transient Response for  $V_{IN} = 4V$ ,  $V_{OUT} = -5V$ ,  $I_{LOAD} = 0.2A$  to  $2A$**



**Figure 4. Output Voltage Ripple for  $V_{IN} = 4V$ ,  $V_{OUT} = -5V$ ,  $I_{LOAD} = 2A$**

**Bill of Materials**

Item	Part Number	Manufacturer	Description	Qty.
C1, C8, C9	594D107X0010D2T TPSD107K010R0065	Vishay Sprague AVX	100 $\mu$ F, 10V, tantalum capacitor	3 OR
C2	VJ0805Y102KXXMT	Vishay Vitramon	1000pF, 25V	1
C3 C3	VJ0805Y104KXXAT	Vishay Vitramon	OPEN 0.1 $\mu$ F, 25V ceramic capacitor	0 0
C4, C5	GRM21BR71C105KA01L VJ0805S105KXXAT	Murata Vishay Vitramon	1 $\mu$ F, 16V, ceramic capacitors	2 OR
C6, C7 C6, C7 C6, C7	TPSD68K020R0070 594D687X0020D2T GRM31CR61E106K***L	AVX Vishay Sprague Murata	68 $\mu$ F, 20V 10 $\mu$ F, 25V, ceramic capacitors	2 OR OR
C10	VJ0805272KXXAT	Vishay Vitramon	2.7nF, 25V, ceramic capacitor	1
C11	GRM21BR61A475KA73L	Murata	4.7 $\mu$ F, 10V, ceramic capacitor	1
D1	B320A (SMA Package) SK32 SMA	Diodes, Inc. Micro Commercial Components	3A, 20V schottky diode OR	1
J1-J4	2551-2-00-01-00-00-07-0	MilMax	Turret Pins	4
L1	CTX5-4P	Cooper Electronics	Econo-Pac	1
Q1	IFR7821-TR Si4888DY	IR Siliconix Corp.	MOSFET	1 OR
Q2, Q3	MMBT3904	Vishay Dale	NPN transistor	2
R1	CRCW08051003FRT1	Vishay Dale	100k $\Omega$ , size 0805, 1%	1
R3	CRCW08052212FRT1	Vishay Dale	22.1k $\Omega$ , size 0805, 1%	1
R4	CRCW08051004FRT1	Vishay Dale	1M $\Omega$ , size 0805, 1%	1
R5	CRCW08054532FRT1	Vishay Dale	45.3k $\Omega$ , size 0805, 1%	1
R6	WSL-2010-R013-F	Vishay Dale	0.013 $\Omega$ size 2010, 1%	1
R2, R7	CRCW08051002FRT1	Vishay Dale	10k $\Omega$ , size 0805, 1%	2
R8, R9, R10, R11			OPEN Option for use with U2=MIC6211-BM5, R8=10k $\Omega$ , R9=2.49k $\Omega$ , R10,R11=DNI/0 $\Omega$	0
R12	CRCW08050000FRT1	Vishay Dale	0 $\Omega$ , size 0805, 1%	1
R13	CRCW08051000FRT1	Vishay Dale	100 $\Omega$ , size 0805, 1%	1
U1	MIC2196-BM	Micrel Semiconductor	Boost controller	1
U2	MIC6211-BM5	Micrel Semiconductor	OPEN	0

**Vendor Phone Numbers:**

1. Vishay Corp. tel: 206-452-5664
2. AVX tel: 843-448-9411
3. Murata tel: 800-831-9172
4. Diodes, Inc. tel: 805-446-4800
5. Micro Commercial Components tel: 800-346-3371
6. Cooper Electronics tel: 561-752-5000
7. International Rectifier tel: 310-322-3331
8. Siliconix tel: 408-980-8000
9. **Micrel Semiconductor** tel: 408-944-0800

Shaded items not being used by evaluation board.

# Printed Circuit Board Layouts

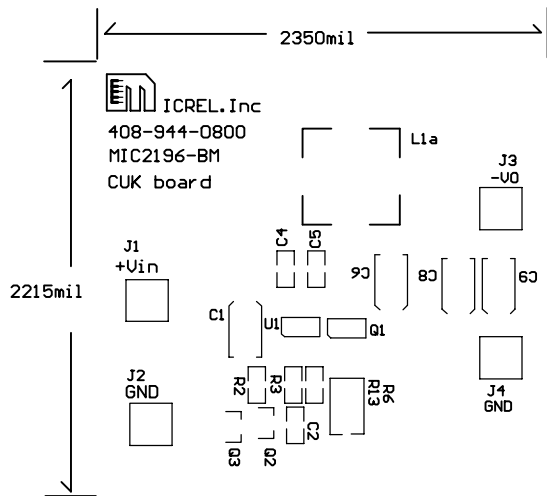


Figure 5a. Top Silkscreen

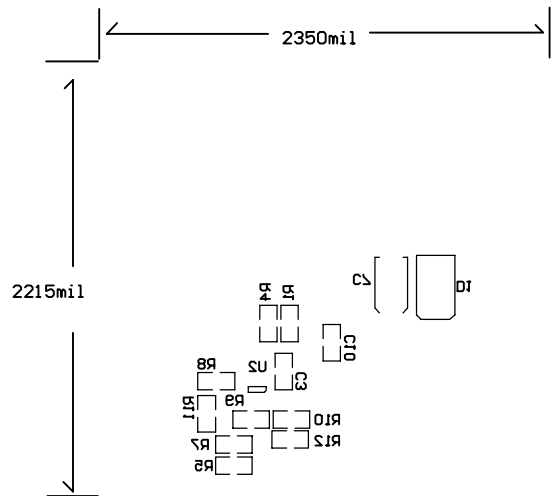


Figure 5c. Bottom Silkscreen

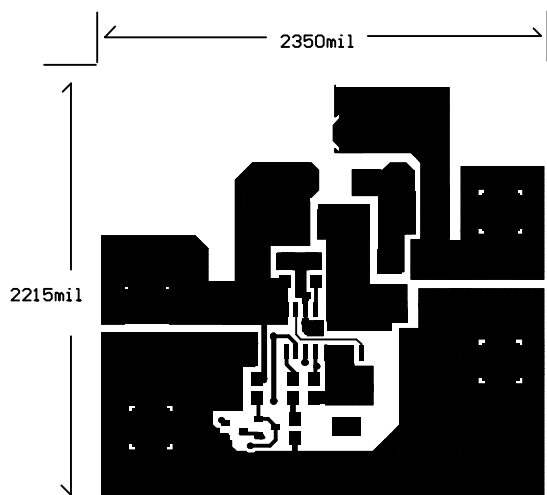


Figure 5b. Top Layer

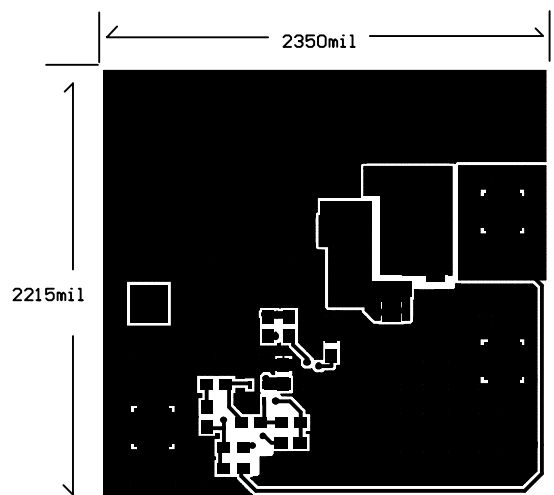


Figure 5d. Bottom Layer

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