

Keywords: high voltage, buck converter, step down, power supply, buck controller

REFERENCE DESIGN 4376 INCLUDES: ✓Tested Circuit ✓Schematic ✓BOM ✓Board Available ✓Test Data

Reference Design for a High-Input-Voltage, High-Output-Current Buck Controller Using the MAX15046

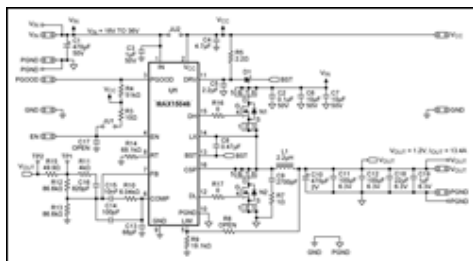
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 Nov 04, 2009

Abstract: This reference design presents a circuit for using the MAX15046 step-down power-supply controller for high-input-voltage, low-output-voltage applications that require high output current.

The reference design presents a schematic (**Figure 1**), bill of materials (**Table 1**), and performance characteristics (**Figures 2–7**). Key specifications of the [MAX15046](#) are listed below.

Design Specifications and Setup

- Input Voltage: 18V to 36V
- Output Voltage: 1.2V
- Output Current: 13.4A
- Output-Voltage Ripple: 12mV_{P-P}
- Input-Voltage Ripple: 180mV_{P-P}
- Switching Frequency: 250kHz
- Efficiency: 82% with $V_{IN} = 18V$ at 13.4A, 74% with $V_{IN} = 36V$ at 13.4A.



[More detailed image](#) (PDF, 256kB)

Figure 1. Schematic of the MAX15046 buck power supply at $F_{SW} = 250kHz$.

Table 1. Bill of Materials

Designator	Value	Description	Part Number	Manufacturer	Package	Quantity
C1	470μF/50V	Capacitor	EEVFK1H471M	Panasonic	Electrolytic	1
C2	0.1μF/50V	Capacitor	GRM188R71H104K	Murata	603	1
C3	1μF/50V	Capacitor	GRM21BR71H105K	Murata	805	1
C4	4.7μF/6.3V	Capacitor	GRM188R60J475K	Murata	603	1
C5	2.2μF	Capacitor	GRM188R60J225K	Murata	603	1
C6, C7,						

C7X	10µF/50V	Capacitor	GRM55DR70H106K	Murata	2220	3
C8	0.47µF/16V	Capacitor	GRM188R71C474K	Murata	603	1
C9	2700pF/50V	Capacitor	GRM2165C1H272JA	Murata	805	1
C10	470µF/6.3V	Capacitor	EEFSX0D471E4	Panasonic	7.3mm x 4.3mm x 1.9mm	1
C11	100µF/6.3V	Capacitor	GRM32ER60J107ME20L	Murata	1210	1
C12	100µF/6.3V	Capacitor	GRM32ER60J107ME20L	Murata	1210	1
C13	68pF/50V	Capacitor	GRM1885C1H680J	Murata	603	1
C14	100pF/50V	Capacitor	GRM39COG101J50D500	Murata	603	1
C15	10nF/50V	Capacitor	GRM188R71H103KA01D	Murata	603	1
C16	820pF/50V	Capacitor	GRM39COG821J50D500	Murata	603	1
C17	Open	Capacitor				
C18	22µF/6.3V	Capacitor	GRM31CR70J226KE19L	Murata	1206	1
C19	1µF/6.3V	Capacitor	GRM188R70J105KA01D	Murata	603	1
R3	10Ω	Resistor	Resistor	Multisource	603	1
R4	51kΩ	Resistor	Resistor	Multisource	603	1
R5	2.2Ω	Resistor	Resistor	Multisource	603	1
R7	1Ω	Resistor	Resistor	Multisource	603	1
R8	Open	Resistor				
R9	19.1kΩ	Resistor	Resistor	Multisource	603	1
R10	6.04kΩ	Resistor	Resistor	Multisource	603	1
R11	4kΩ	Resistor	Resistor	Multisource	603	1
R12	86.6kΩ	Resistor	Resistor	Multisource	603	1
R13	86.6kΩ	Resistor	Resistor	Multisource	603	1
R14	68.1kΩ	Resistor	Resistor	Multisource	603	1
R15	49.9Ω	Resistor	Resistor	Multisource	603	1
R16	0	Resistor	Resistor	Multisource	603	1
R17	0	Resistor	Resistor	Multisource	603	1
L1	2.2µH/20A	Inductor	IHLP5050EZER2R2M01	Vishay	13.20mm x 12.90mm x 5.00mm	1
N1	60V, 6.2A	n-Channel MOSFET	SI7850DP	Vishay	PowerPAK® SO-8	1
N2	60V, 18.5A	n-Channel MOSFET	SI7478DP	Vishay	PowerPAK SO-8	1
D1	0.5A, 60V	Schottky diode	ZHCS506TA	Zetex	SOT23	1
U1	MAX15046	PWM Controller	MAX15046	Maxim	16 PIN TQFN	1

Performance Characteristics

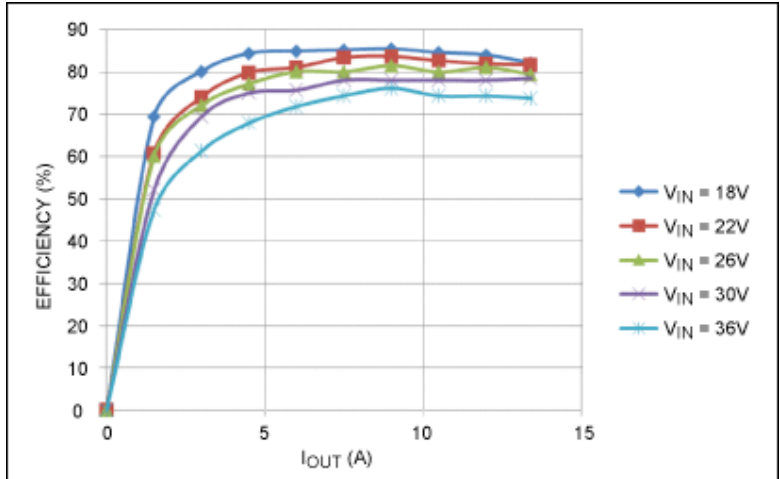


Figure 2. Total system efficiency versus load current relative to different input voltages.

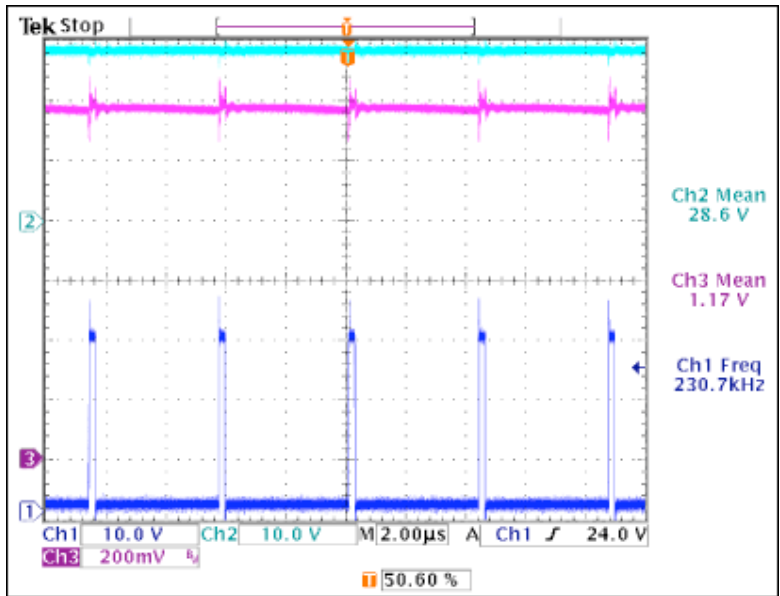


Figure 3. Steady-state input voltage, output voltage, and gate signal.
 Ch1: Switching-Node Voltage
 Ch2: Input Voltage
 Ch3: Output Voltage

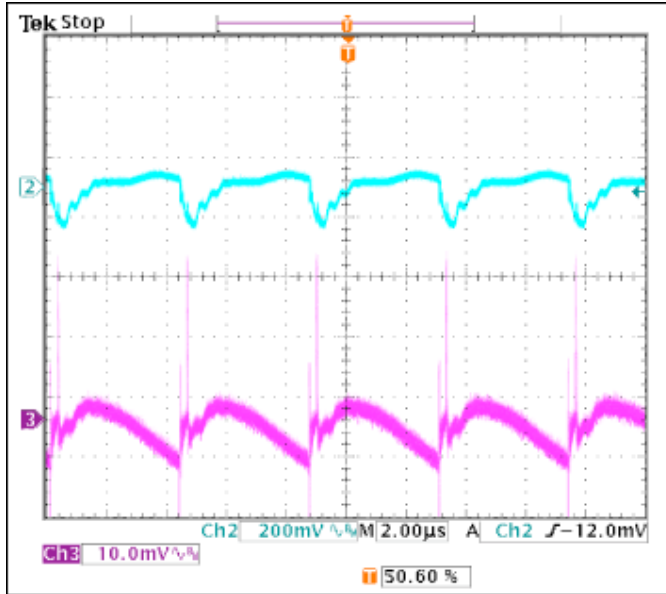


Figure 4. Steady-state peak-to-peak input ripple and peak-to-peak output ripple.
 Ch2: Input-Voltage Ripple
 Ch3: Output-Voltage Ripple

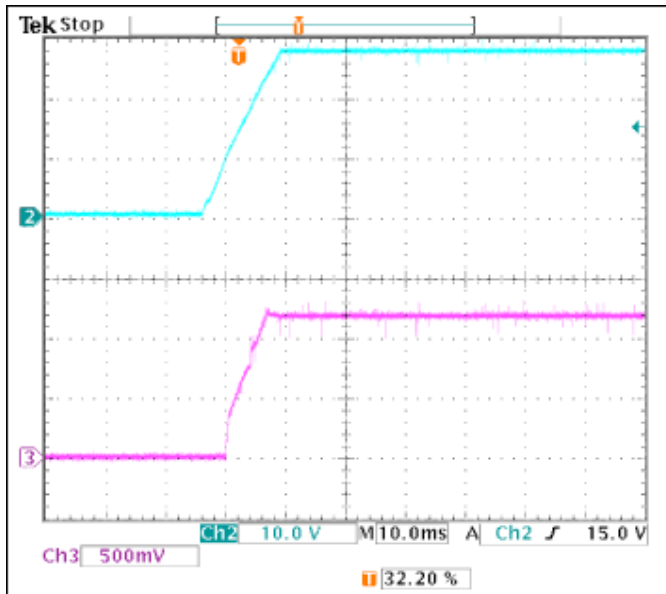


Figure 5. Soft-start when $V_{IN} = 28V$ is applied with a 13.4A load.
 Ch2: Input Voltage
 Ch3: Output Voltage

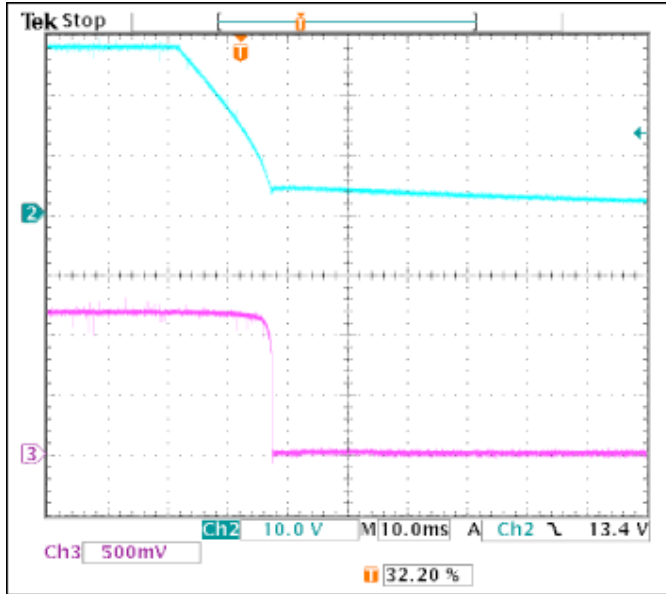


Figure 6. Soft-stop when input power is off.
 Ch2: Input Voltage
 Ch3: Output Voltage

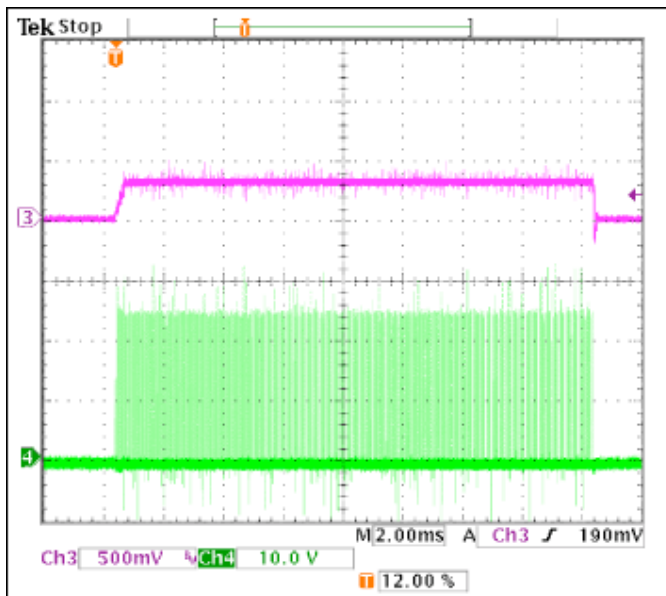
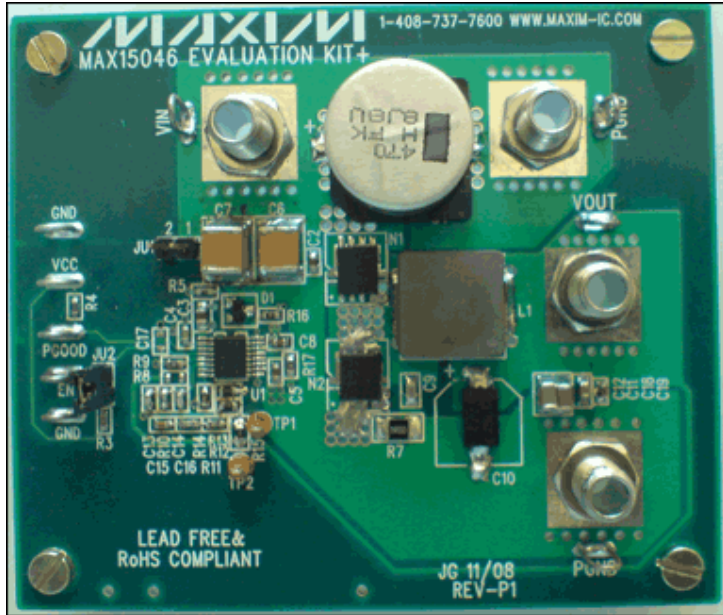


Figure 7. Output voltage and gate signal when the load is short circuited.
 Ch3: Output Voltage
 Ch4: Gate Signal of High-Side Switch

Board Layout



[More detailed image \(PDF, 4.7MB\)](#)

Figure 8. Two-layer layout of the reference design using the MAX15046 step-down power supply.

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Related Parts

[MAX15046](#)

40V, High-Performance, Synchronous Buck Controller

[Free Samples](#)

More Information

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Application Note 4376: <http://www.maximintegrated.com/an4376>

REFERENCE DESIGN 4376, AN4376, AN 4376, APP4376, Appnote4376, Appnote 4376

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