Keywords: Dual Converter, Switcher, DC/DC converter, Integrated MOSFET, High Switching Frequency, Nov 19, 2007

APPLICATION NOTE 4152

Reference Design for the MAX5073 Dual Buck Converter Operating at a Switching Frequency of 2MHz

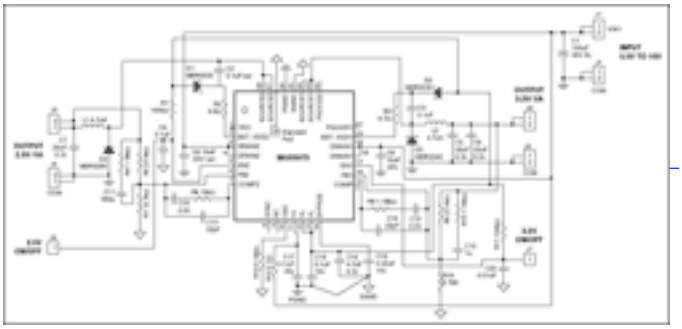
Abstract: The MAX5073 is a dual converter capable of operating as a buck or boost converter. As a dual buck converter, this device can deliver up to 2A and 1A of output current. The reference design focuses on the MAX5073 operating as a buck converter with a switching frequency of 2MHz, which allows the use of smaller passive components and keeps it out of the AM band for automotive applications.

This article shows a detailed reference design using the MAX5073 as a dual buck converter with a switching frequency of 2MHz. This design can be used in applications that are space limited, because the higher switching frequency allows smaller passive components to be used on the board. In addition, this power solution can be used (in conjunction with load-dump protection) for automotive applications that require a switching frequency outside of the AM radio band, such as those found in automotive instrument clusters and infotainment systems.

Key specifications for this reference design are listed below, along with a detailed schematic (**Figure 1**) and the bill of materials (**Table 1**) needed for this application.

Specifications

- Input Voltage: 5.5V to 16V
- Converter 1 Output Voltage = 3.3V/2A (max)
- Converter 2 Output Voltage = 2.5V/1A (max)
- Switching Frequency (f_{SW}) of Each Converter = 2MHz
- Temperature with Airflow (TA) = -40°C to +85°C



More detailed image (PDF)

Figure 1. MAX5073 reference design.

Table 1. Bill of Materials

Designator	Value	Description	Part	Footprint	Manufacturer	Quantity
C1	100µF/35V	Capacitor	EEVFK1V101P	8mm x 10.2mm	Panasonic	1
C2, C3, C4, C17, C18	0.1µF/25V	Capacitors	GRM188R71E104KA01D	603	Murata	5
C5, C6, C7	22µF/6.3V	Capacitors	GRM31CR60J226KE19	1206	Murata	2
C8, C9	10µF/25V	Capacitors	GRM31CR61E106KA12	1206	Murata	1
C10, C12	2.2nF	Capacitors	GRM188R71H222JA01	603	Murata	2
C11	560pF	Capacitor	GRM188R71H561KA01	603	Murata	1
C13, C14	22pF	Capacitors	GRM1885C1H220JA01	603	Murata	2
C15	1nF	Capacitor	GRM18871H102KA01	603	Murata	1
C16	4.7µF/6.3V	Capacitor	GRM188R60J475KE19B	603	Murata	1
C19	0.22µF/10V	Capacitor	GRM188R71A224KA01	603	Murata	1
C20	0.01µF	Capacitor	GRM188R71H103KA01J	603	Murata	1
D1, D2	30V, 500mA	Schottky diodes	MBR0530	SOD123	ON Semiconductor	2
D3	40V, 3A	Schottky diode	MBRS340	SMC	ON Semiconductor	1
D4	40V, 2A	Schottky diode	MBRS240	SMB	ON Semiconductor	1
L1, L2	4.7µH	Inductors	IHLP2525-CZ	6.86mm x 6.47mm x 3.18mm	Vishay	1
R1, R11	100kΩ	Resistors	SMD, 1%, 0.125W	603	Vishay	2
R2	6.8Ω	Resistor	SMD, 1%, 0.125W	603	Vishay	1
R3	4.7Ω	Resistor	SMD, 1%, 0.125W	603	Vishay	1
R4, R8, R10	1.18kΩ	Resistors	SMD, 1%, 0.125W	603	Vishay	3
R5, R9	27.4kΩ	Resistors	SMD, 1%, 0.125W	603	Vishay	2
R6	10kΩ	Resistor	SMD, 1%, 0.125W	603	Vishay	1
R7	12.7kΩ	Resistor	SMD, 1%, 0.125W	603	Vishay	1
R12	2.2Ω	Resistor	SMD, 1%, 0.125W	603	Vishay	1
R13	6.19kΩ	Resistor	SMD, 1%, 0.125W	603	Vishay	1
R14	8.76kΩ	Resistor	SMD, 1%, 0.125W	603	Vishay	1
U1	**MAX5073**	**Dual buck converter**	**MAX5073ETI+**	**32-TQFN_EP (5mm x 5mm)**	**Maxim**	**1**

Actual measurements taken from the board showing the efficiency performance are shown in **Tables 2** and **3**.

Table 2. Efficiency Data for V_{OUT2} Disabled

f_{SW} = 2MHz, L_{OUT} = 4.7µH, C_{OUT} = 22µF/6.3V (ceramic)

V_{IN} (V)	I_{IN} (A)	V_{OUT1} (V)	I_{OUT1} (A)	Efficiency (%)
14.007	0.065732	3.3371	0.1018	36.8973371
14.010	0.183690	3.3339	0.5122	66.3542117
14.005	0.267750	3.3321	0.8032	71.3722082
14.007	0.329490	3.3309	1.0112	72.9812485
14.005	0.449290	3.3298	1.4007	74.1230723
14.002	0.584520	3.3281	1.8203	74.0201375
14.001	0.650260	3.3267	2.0150	73.6279304

Table 3. Efficiency Data for V_{OUT1} Disabled

f_{SW} = 2MHz, L_{OUT} = 4.7µH, C_{OUT} = 22µF/6.3V (ceramic)

V_{IN} (V)	I_{IN} (A)	V_{OUT2} (V)	I_{OUT2} (A)	Efficiency (%)
14.008	0.044533	2.5350	0.1075	43.6845979
14.008	0.067144	2.5337	0.2049	55.1967881
14.003	0.087638	2.5337	0.3010	62.1452787
14.004	0.109076	2.5337	0.4003	66.3986847
14.005	0.133680	2.5337	0.5122	69.3178710
14.005	0.155350	2.5338	0.6097	71.0058542
14.008	0.255976	2.5334	1.0001	70.6597037

In terms of stability, bode plots for each output are shown in **Figures 2** and **3**, detailing the gain and phase of each output.

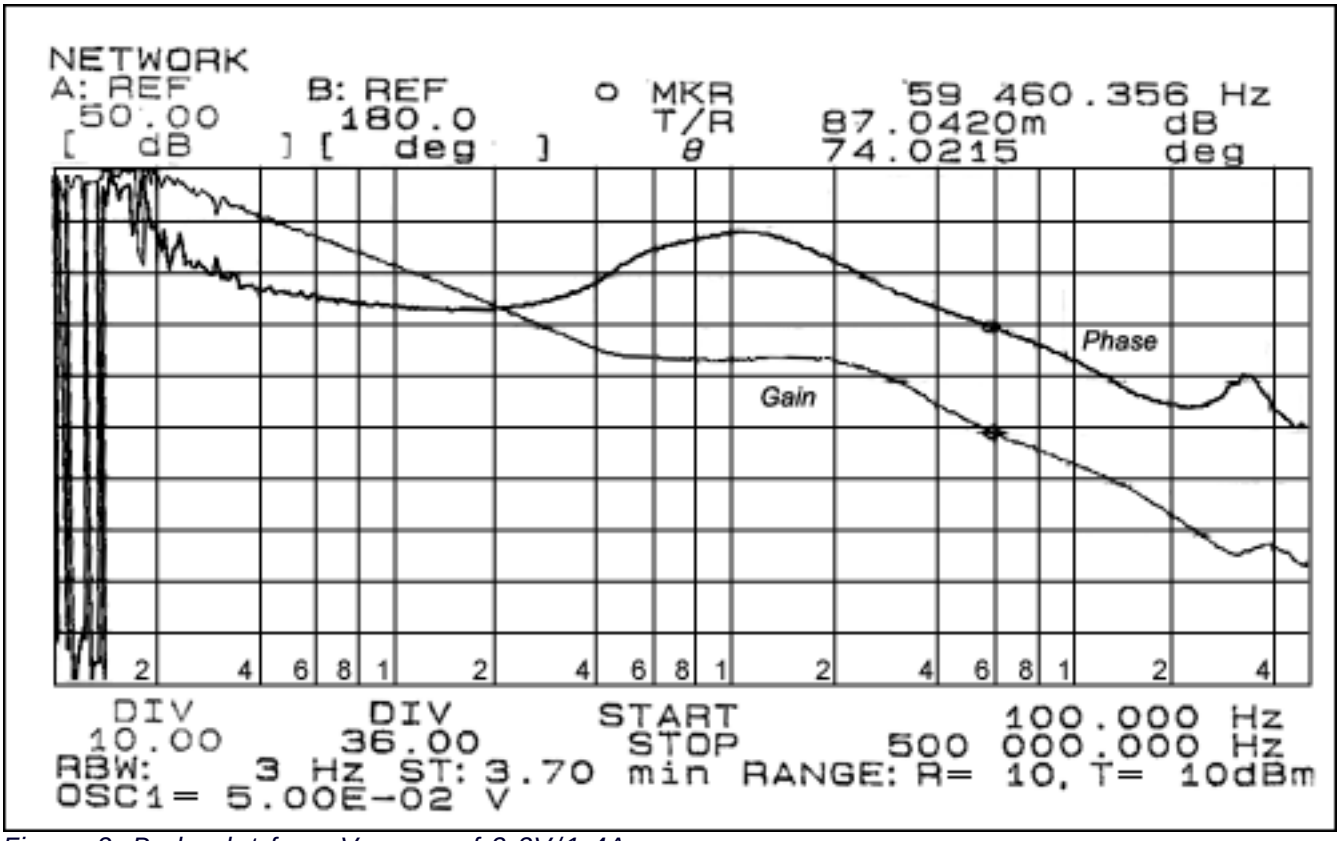


Figure 2. Bode plot for a V_{OUTPUT} of 3.3V/1.4A.

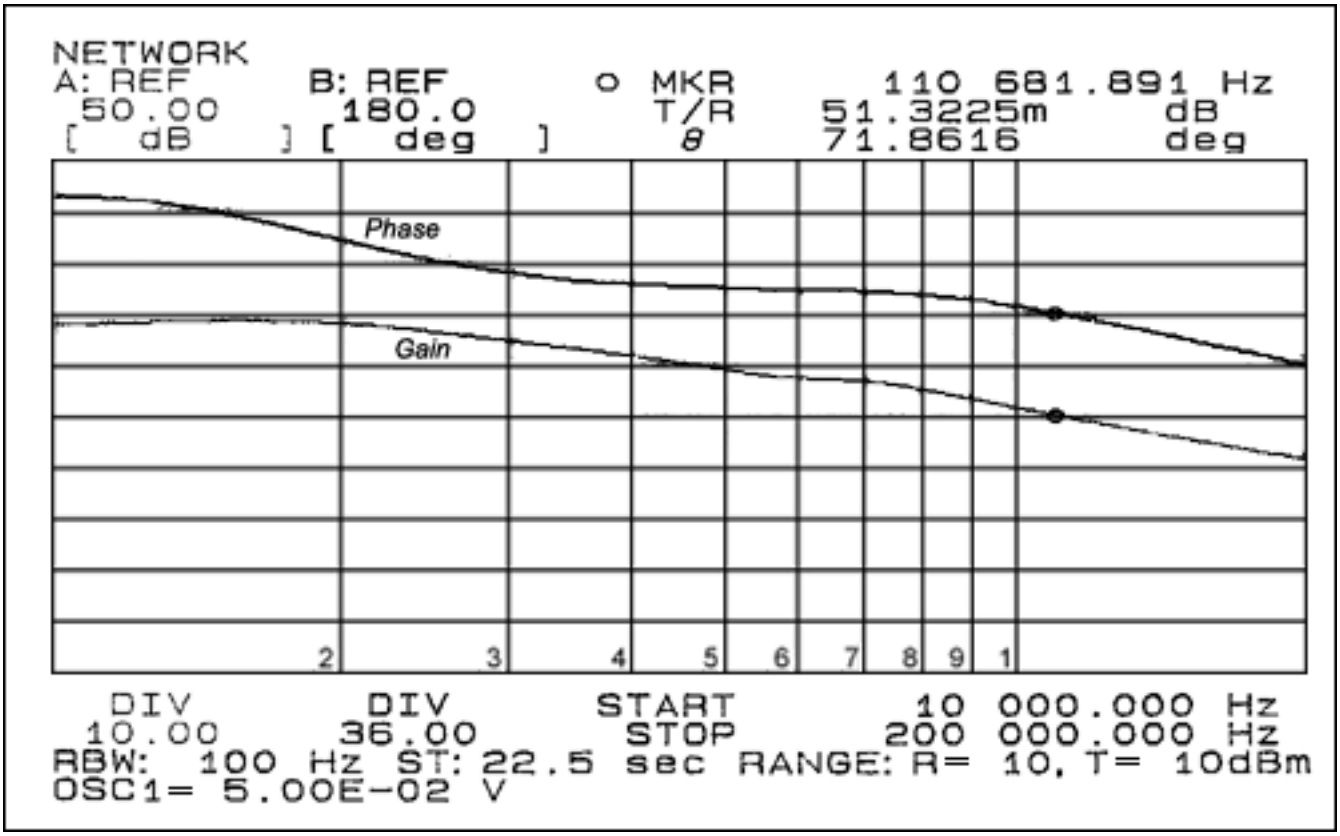


Figure 3. Bode plot for a V_{OUTPUT} of 2.5V/0.6A.

Application Note 4152: www.maxim-ic.com/an4152

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