Keywords: AMD K8, motherboard power, dual phase

APPLICATION NOTE 3499

Compact-Footprint, 60A, Two-Phase Power Supply for AMD K8 Motherboards

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Abstract: This application note describes a compact-footprint, low-cost, 60A, two-phase solution for desktop motherboard applications using AMD K8 CPUs. Test data, schematics, and bill of materials are included. The regulator operates from a 12V input and delivers a peak efficiency of 90% with a four-layer, 1oz. copper PC board typically employed in desktop designs. It features a 5in x 1.3in regulator area footprint, and uses low-cost components. Adequate airflow is necessary to ensure that the board/component temperature rise is within acceptable limits for the required operating ambient-temperature range.

The power supply is implemented using the MAX1937 Quick-PWM™ controller. The Quick-PWM architecture regulates the output voltage by driving the output inductor with a constant on-time pulse whenever the output-voltage ripple waveform falls below a reference voltage (**Figure 1**). The next pulse is applied to the inductor after a fixed minimum off-time, if the output voltage has fallen below the reference. Unlike fixed-frequency controllers that have to wait for the next clock pulse to service load transients, the Quick-PWM control architecture responds after the minimum off-time (350ns for the MAX1937) has elapsed. This ensures fast response under load-transient conditions. The steady-state switching frequency can still be low (180kHz in this design) to maximize efficiency.

Load-transient response (**Figure 2**) and efficiency data (**Figure 3**) are shown, along with a bill of materials (**Table 1**) and schematics of a two-phase power supply for AMD K8 motherboards (**Figures 4a and 4b**).

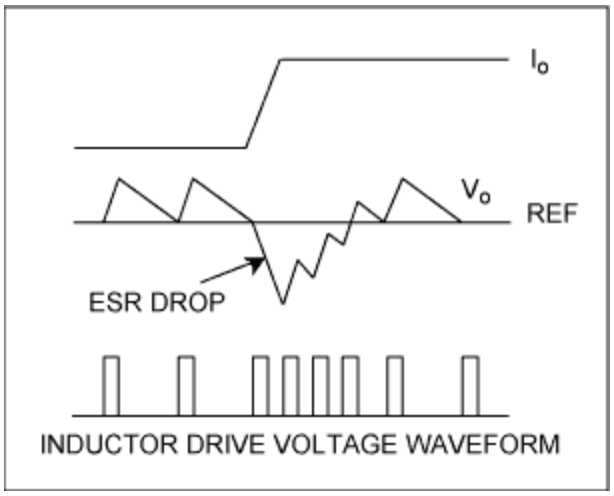

Figure 1. Quick-PWM operation.

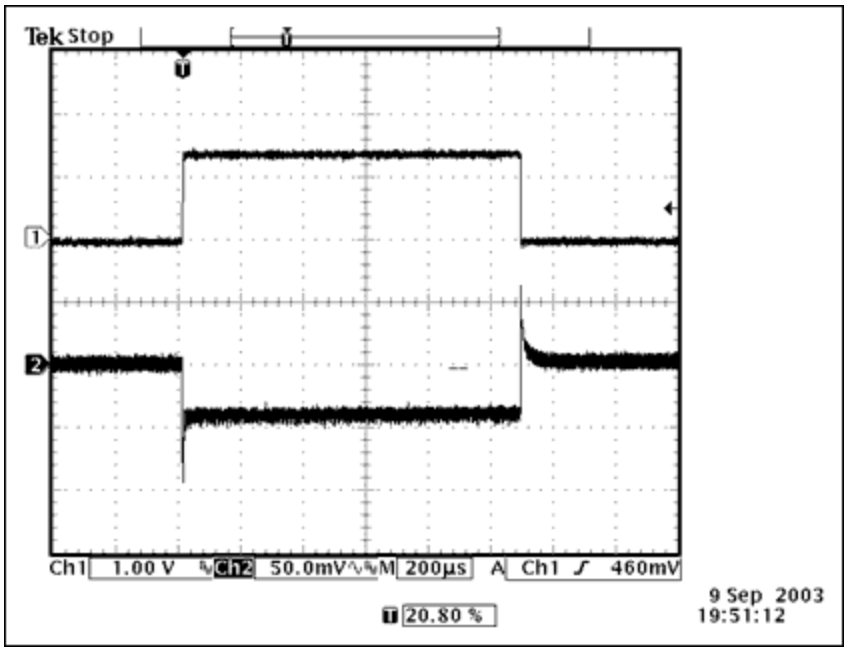

Figure 2. Load-transient response.

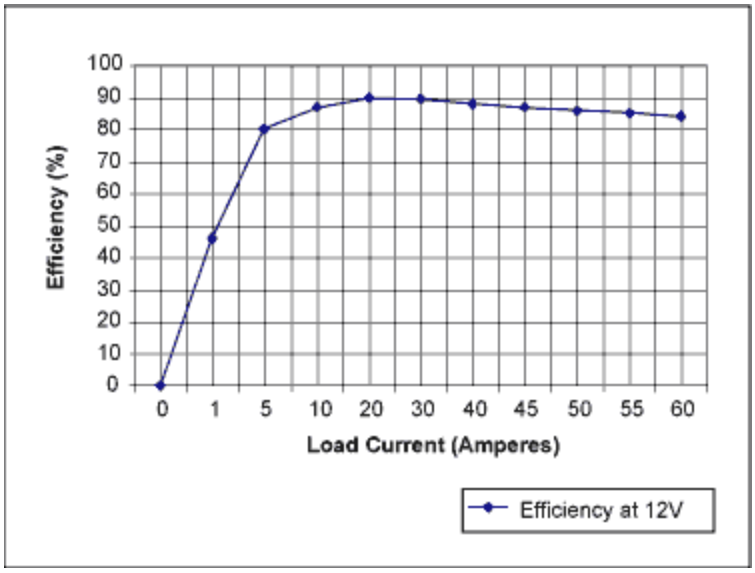

Figure 3. Efficiency (V_{IN} = 12V, V_{OUT} = 1.5V).

Table 1. Bill of Materials

DESIGNATION	QTY	DESCRIPTION
C1, C2, C20, C64	4	1500µF, 16V capacitors Rubycon 16VMBZ1500
C3, C9	2	10µF, 16V capacitors (1210) Taiyo Yuden CE EMK325 BJ106MN-T
C4, C6	2	0.22µF, 10V X7R capacitors (0603)

		Taiyo Yuden CE LMK107 BJ334KA-T
C5, C7	2	1000pF, 6.3V X7R capacitors (0603) Murata GRM39X7R102K
C8	1	2.2µF, 6.3V capacitor (0603) Taiyo Yuden CE JMK107 BJ105MA-T
C10	1	820pF, C0G capacitor (0603) Murata GRM39C0G821J050
C11, C14	1	0.22µF, 10V X7R capacitors (0603) Taiyo Yuden CE LMK107 BJ224KA-T
C12, C13	2	2200pF, 6.3V X7R capacitors (0603) Murata GRM39X7R222K
C15	1	47pF, 50V C0G capacitors (0603) Murata GRM39C0G470J050AD
C16	1	Not used
C17	1	0.47µF, 10V X5R capacitor (0603) Taiyo Yuden CE LMK107 BJ474KA-T
C18, C19	2	0.0022µF, 50V capacitors (0805) Murata GRM39X7R222K50
C21	1	0.1µF, 25V X7R capacitor (0603) Murata GRM188R71E104KA01B
C22-C27	6	3300µF, 6.3V capacitors Rubycon 6.3VMBZ3300, 12ΩWMAX ESR
C28-C33, C34-C39	12	10µF capacitors (1206) Taiyo Yuden CE JMK316 BJ106ML-T
C40-C47, C48-C61	22	2.2µF capacitors (0603) Taiyo Yuden JMK107BJ225MA
C62-C63, C67-C70	6	22µF X5R capacitors (1206) Taiyo Yuden JMK316BJ226ML
R1	1	10Ω ±5% resistor (0603)
R2, R5	2	3.3Ω ±5% resistors (0603)
R3	1	10kΩ ±5% resistor (0603)
R4, R7, R8, R9	4	200Ω ±5% resistors (0603)
R6	2	20kΩ ±1% resistor (0603)
R16, R17	2	68.1kΩ ±5% resistors (0603)
R8, R9	2	200Ω ±5% resistors (0603)
R10	1	100kΩ ±1% resistor (0603)
R11	1	2kΩ ±5% resistor (0603)
R12	1	120kΩ ±1% resistor (0603)
R13	1	80.6kΩ ±1% resistor (0603)
R14, R15	2	200kΩ ±1% resistors (0603)
R18, R19	2	3.3Ω ±5% resistors (1206)
R20	1	Open (0603)

R21	1	390Ω ±1% resistor (0603)
R22	1	1.5kΩ ±1% resistor (0603)
R29	1	2.2Ω ±5% resistor (0603)
L1, L2	1	1.2µH, 30A toroidal inductors BI Technologies HM00-3583
L3	1	0.33µH, 10A toroidal inductor BI Technologies HM00-3661
D1	1	Dual Schottky diodes (SOT23) Central CMSSH-3A
D2, D3	2	Diodes (SOT23) Central Semiconductor CMPD2836
J1-J6, J9	7	2-pin headers
Q3, Q4, Q7, Q8	4	N-channel MOSFETs (D2-Pak) International Rectifier IRLR7833S
Q1, Q2, Q5, Q6	4	N-channel MOSFETs (D-Pak), International Rectifier IRLR7821
Q9, Q10	2	N-channel MOSFETs (SOT23) Vishay 2N7002
U1	1	Maxim MAX1937EEI controller (QSOP)
U2	1	National LM317 regulator (D-Pak)
J7	1	4-pin ATX Molex connector
J8	1	PGA socket 754 Foxconn PZ75403-2948-01
PC board	1	Maxim MAX1937 K8 evaluation kit, 8/03, compact footprint

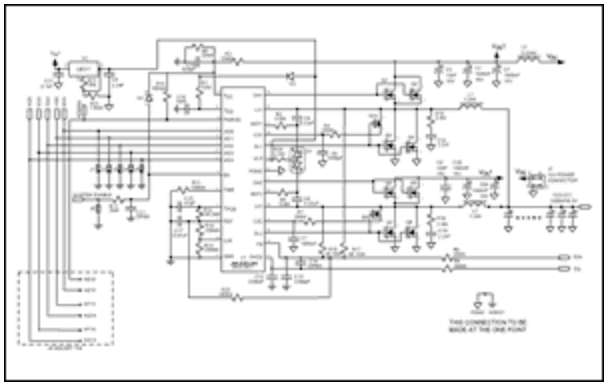

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Figure 4a. 60A, Two-Phase Power Supply for AMD K8 Motherboards (V_{IN} = 12V, V_{OUT} = 1.5V at 60A)

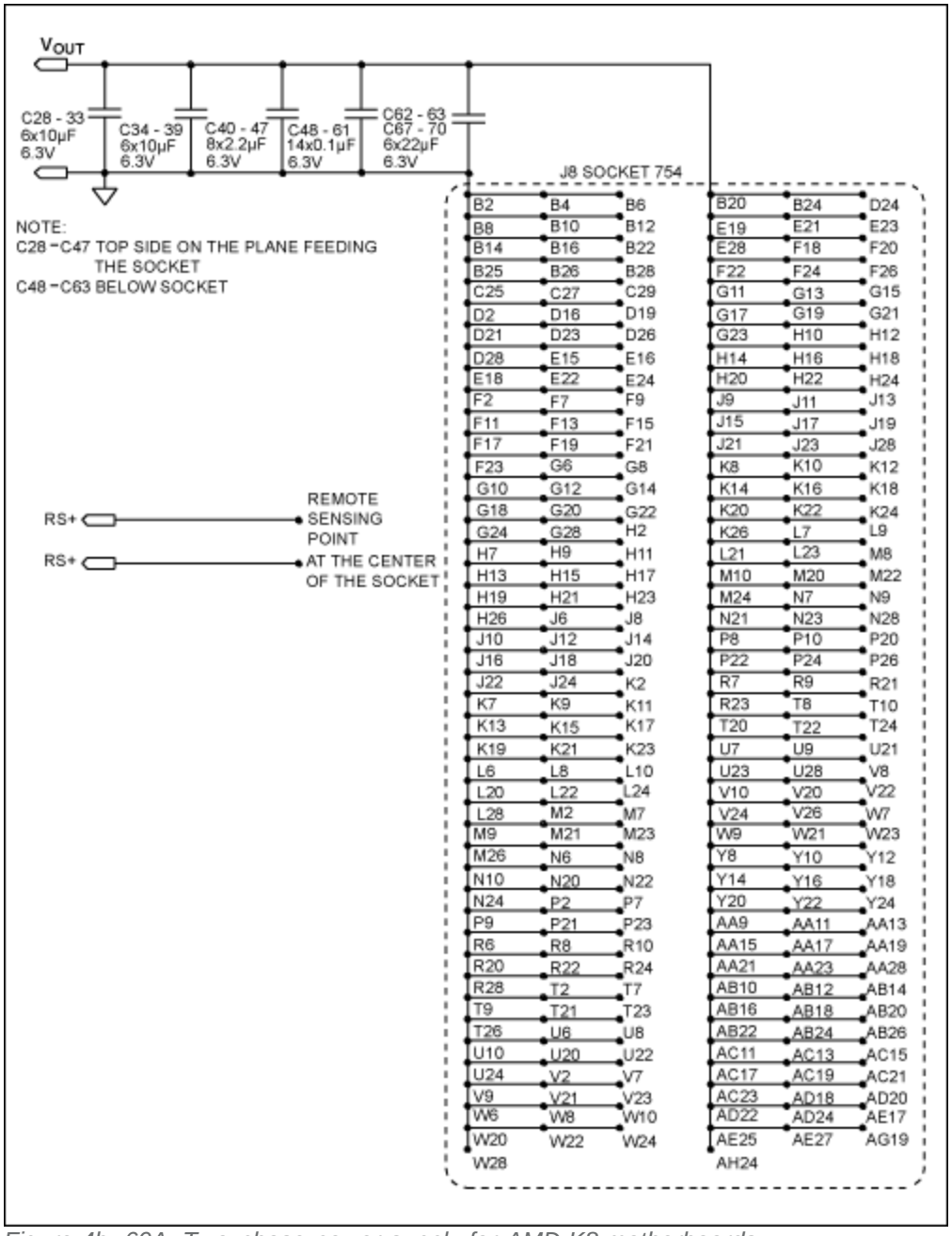

Figure 4b. 60A, Two-phase power supply for AMD K8 motherboards.

Related Parts		
MAX1937	Two-Phase Desktop CPU Core Supply Controllers with Controlled VID Change	Free Samples

More Information
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