EVALUATION KIT MANUALS FOLLOW DATA SHEET

/VI/IXI/VI

Step-Down Controllers with Synchronous Rectifier for CPU Power

General Description

The MAX796–MAX799 high-performance, step-down DC-DC converters with single or dual outputs provide main CPU power in battery-powered systems. These buck controllers achieve 96% efficiency by using synchronous rectification and Maxim's proprietary Idle Mode™ control scheme to extend battery life at full-load (up to 10A) and no-load outputs. Excellent dynamic response corrects output transients caused by the latest dynamic-clock CPUs within five 300kHz clock cycles. Unique bootstrap circuitry drives inexpensive N-channel MOSFETs, reducing system cost and eliminating the crowbar switching currents found in some PMOS/NMOS switch designs.

The MAX796/MAX799 are specially equipped with a secondary feedback input (SECFB) for transformer-based dual-output applications. This secondary feedback path improves cross-regulation of positive (MAX796) or negative (MAX799) auxiliary outputs.

The MAX797/MAX798 have a logic-controlled and synchronizable fixed-frequency pulse-width-modulating (PWM) operating mode, which reduces noise and RF interference in sensitive mobile-communications and pen-entry applications. The SKIP override input allows automatic switchover to idle-mode operation (for high-efficiency pulse skipping) at light loads, or forces fixed-frequency mode for lowest noise at all loads.

The MAX796–MAX799 are all available in 16-pin DIP and narrow SO packages. See the table below to compare these four converters.

PART	MAIN OUTPUT	SPECIAL FEATURE
MAX796	3.3V/5V or adj.	Regulates positive secondary voltage (such as +12V)
MAX797	3.3V/5V or adj.	Logic-controlled low-noise mode
MAX798	2.9V/5V or adj.	Logic-controlled low-noise mode
MAX799	3.3V/5V or adj.	Regulates negative secondary voltage (such as -5V)

Applications

Notebook and Subnotebook Computers

PDAs and Mobile Communicators

Cellular Phones

Typical Operating Circuits appear at end of data sheet.

*U.S. and foreign patents pending.

™ Idle Mode is a trademark of Maxim Integrated Products

Features

♦ 96% Efficiency
♦ 4.5V to 30V Input Range
♦ 2.5V to 6V Adjustable Output
♦ Preset 2.9V, 3.3V, and 5V Outputs (at up to 10A)
♦ Multiple Regulated Outputs
♦ +5V Linear-Regulator Output
♦ Precision 2.505V Reference Output
♦ Automatic Bootstrap Circuit
♦ 150kHz/300kHz Fixed-Frequency PWM Operation
♦ Programmable Soft-Start
♦ 375µA Typ Quiescent Current (V_{IN} = 12V, V_{OUT} = 5V)
♦ 1µA Typ Shutdown Current

Ordering Information

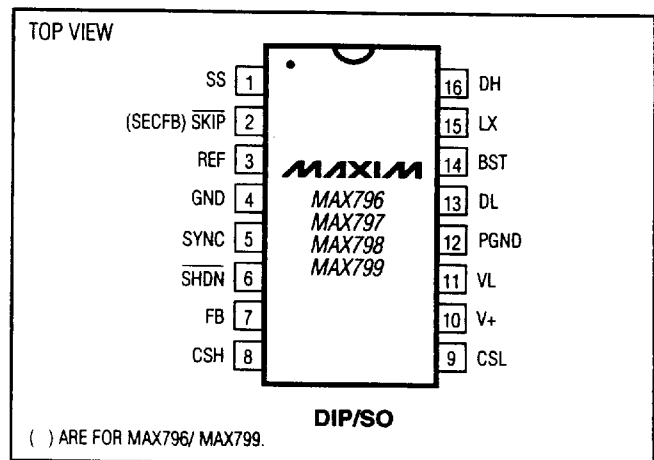| EV KIT	V_{OUT}	BOARD TYPE
MAX796EVKIT-SO	+5V/+15V (dual)	Surface Mount
MAX797EVKIT-SO	+3.3V or Adj.	Surface Mount

PART	TEMP. RANGE	PIN-PACKAGE
MAX796CPE	0°C to +70°C	16 Plastic DIP
MAX796CSE	0°C to +70°C	16 Narrow SO
MAX796C/D	0°C to +70°C	Dice*
MAX796EPE	-40°C to +85°C	16 Plastic DIP
MAX796ESE	-40°C to +85°C	16 Narrow SO
MAX796MJE	-55°C to +125°C	16 CERDIP

Ordering Information continued at end of data sheet.
*Contact factory for dice specifications

Pin Configuration

TOP VIEW

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            ┌───────┐
     SS  1  │●      │ 16  DH
(SECFB) SKIP 2 │      │ 15  LX
    REF  3  │/VI/IXI/VI│ 14  BST
    GND  4  │ MAX796│ 13  DL
   SYNC  5  │ MAX797│ 12  PGND
   SHDN  6  │ MAX798│ 11  VL
    FB   7  │ MAX799│ 10  V+
    CSH  8  │      │  9  CSL
            └───────┘
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DIP/SO

( ) ARE FOR MAX796/ MAX799.

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Step-Down Controllers with Synchronous Rectifier for CPU Power

ABSOLUTE MAXIMUM RATINGS

V+ to GND	-0.3V, +36V
GND to PGND	±2V
VL to GND	-0.3V, +7V
BST to GND	-0.3V, +36V
DH to LX	-0.3V, BST + 0.3V
LX to BST	-7V, +0.3V
SHDN to GND	-7V, +0.3V
SYNC, SS, REF, SECFB, SKIP, DL to GND	-0.3V, VL + 0.3V
CSH, CSL to GND	-0.3V, +7V
VL Short Circuit to GND	Momentary
REF Short Circuit to GND	Continuous

VL Output Current	50mA
Continuous Power Dissipation (T$_A$ = +70°C)	
SO (derate 8.70mW/°C above +70°C)	696mW
Plastic DIP (derate 10.53mW/°C above +70°C)	842mW
CERDIP (derate 10.00mW/°C above +70°C)	800mW
Operating Temperature Ranges	
MAX79_C_ _	0°C to +70°C
MAX79_E_ _	-40°C to +85°C
MAX79_MJE	-55°C to +125°C
Storage Temperature Range	-65°C to +160°C
Lead Temperature (soldering, 10sec)	+300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V+ = 15V, GND = PGND = 0V, I$_{VL}$ = I$_{REF}$ = 0A, T$_A$ = T$_{MIN}$ to T$_{MAX}$, unless otherwise noted.)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
+2.9V/+3.3V AND +5V STEP-DOWN CONTROLLERS						
Input Supply Range	(Note 1)	MAX79_C	4.5		30	V
		MAX79_E/M	5.0		30	
5V Output Voltage (CSL)	0mV < (CSH-CSL) < 80mV, FB = VL, 6V < V+ < 30V, includes line and load regulation		4.85	5.10	5.25	V
3.3V Output Voltage (CSL)	0mV < (CSH-CSL) < 80mV, FB = 0V, 4.5V < V+ < 30V, includes line and load regulation (MAX796/7/9)		3.20	3.35	3.46	V
2.9V Output Voltage (CSL)	0mV < (CSH-CSL) < 80mV, FB = 0V, 4.5V < V+ < 30V, includes line and load regulation (MAX798)		2.78	2.94	3.02	V
Nominal Adjustable Output Voltage Range	External resistor divider		REF		6	V
Feedback Voltage	(CSH-CSL) = 0V		2.43	2.505	2.57	V
Load Regulation	0mV < (CSH-CSL) < 80mV			2.5		%
	25mV < (CSH-CSL) < 80mV			1.5		
Line Regulation	6V < V+ < 30V			0.04	0.06	%/V
Current-Limit Voltage	CSH-CSL, positive		80	100	120	mV
	CSH-CSL, negative		-50	-100	-160	
SS Source Current			2.5	4.0	6.5	µA
SS Fault Sink Current			2.0			mA
FLYBACK/PWM CONTROLLER						
SECFB Regulation Setpoint	Falling edge, hysteresis = 15mV (MAX796)		2.45	2.505	2.55	V
	Falling edge, hysteresis = 20mV (MAX799)		-0.05	0	0.05	
INTERNAL REGULATOR AND REFERENCE						
VL Output Voltage	SHDN = 2V, 0mA < I$_{VL}$ < 25mA, 5.5V < V+ < 30V		4.7		5.3	V
VL Fault Lockout Voltage	Rising edge, hysteresis = 15mV		3.8		4.0	V
VL/CSL Switchover Voltage	Rising edge, hysteresis = 25mV		4.2		4.7	V

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ELECTRICAL CHARACTERISTICS (continued)

(V+ = 15V, GND = PGND = 0V, I_{VL} = I_{REF} = 0A, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Reference Output Voltage	No external load (Note 2)	MAX79_C	2.46	2.505	2.54	V
		MAX79_E/M	2.45		2.55	
Reference Fault Lockout Voltage	Falling edge		1.8		2.3	V
Reference Load Regulation	0µA < I_{REF} < 100µA				50	mV
CSL Shutdown Leakage Current	$\overline{SHDN}$ = 0V, CSL = 6V, V+ = 0V or 30V, VL = 0V			0.1	1	µA
V+ Shutdown Current	$\overline{SHDN}$ = 0V, V+ = 30V, CSL = 0V or 6V	MAX79_C		1	3	µA
		MAX79_E/M		1	5	
V+ Off-State Leakage Current	FB = CSH = CSL = 6V, VL switched over to CSL	MAX79_C		1	3	µA
		MAX79_E/M		1	5	
Dropout Power Consumption	V+ = 4V, CSL = 0V			4	8	mW
Quiescent Power Consumption	CSH = CSL = 6V			4.8	6.6	mW
OSCILLATOR AND INPUTS/OUTPUTS						
Oscillator Frequency	SYNC = REF		270	300	330	kHz
	SYNC = 0V or 5V		125	150	175	
SYNC High Pulse Width			200			ns
SYNC Low Pulse Width			200			ns
SYNC Rise/Fall Time	Guaranteed by design				200	ns
Oscillator Sync Range			190		340	kHz
Maximum Duty Cycle	SYNC = REF		89	91		%
	SYNC = 0V or 5V		93	96		
Input High Voltage	SYNC		VL - 0.5			V
	$\overline{SHDN}$, $\overline{SKIP}$		2.0			
Input Low Voltage	SYNC				0.8	V
	$\overline{SHDN}$, SKIP				0.5	
Input Current	$\overline{SHDN}$, 0V or 30V				2.0	µA
	SECFB, 0V or 4V				0.1	
	SYNC, $\overline{SKIP}$				1.0	
	CSH, CSL, CSH = CSL = 6V, device not shut down				50	
	FB, FB = REF				±100	nA
DL Sink/Source Current	DL forced to 2V			1		A
DH Sink/Source Current	DH forced to 2V, BST-LX = 4.5V			1		A
DL On-Resistance	High or low				7	Ω
DH On-Resistance	High or low, BST-LX = 4.5V				7	Ω

Note 1: When V+ drops to VL output voltage, the regulator will operate as a low-dropout regulator, so there is an increase in quiescent current due to PNP base current. See *Typical Operating Characteristics*.

Note 2: Since the reference uses VL as its supply, V+ line-regulation error is insignificant.

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