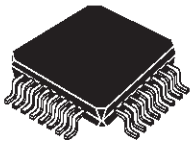
L5994

ADJUSTABLE TRIPLE OUTPUT POWER SUPPLY CONTROLLER

PRODUCT PREVIEW

- DUAL PWM BUCK CONTROLLERS ADJUSTABLE
  1.9V to 5V (Section 1)
  1.66V to 3.5V (Section 2)
- 12V/120mA LINEAR REGULATOR
- DUAL SYNCH RECTIFIERS DRIVERS
- 96% EFFICIENCY ACHIEVABLE
- 50µA (@ 12V) STAND BY CONSUMPTION
- 5.0V TO 25V SUPPLY VOLTAGE
- EXCELLENT LOAD TRANSIENT RESPONSE
- DISABLE PULSE SKIPPING FUNCTION
- OUTPUT UNDERVOLTAGE SHUTDOWN
- POWER MANAGEMENT:
  - UNDER AND OVERVOLTAGE OUTPUT DETECTION
  - POWER GOOD SIGNAL
  - SEPARATED DISABLE
- THERMAL SHUTDOWN
- PACKAGE: TQFP32



TQFP32

ORDERING NUMBER: L5994

APPLICATION

- NOTEBOOK AND SUBNOTEBOOK COMPUTERS
- PEN TOP AND PORTABLE EQUIPMENT
- COMMUNICATING COMPUTERS

DESCRIPTION

The L5994 is a sophisticated dual PWM step-down controller and power monitor intended for Notebook computer and/or battery powered equipment. The device produces regulated 1.8V, 2.5V (both adjustable) and 12V supplies for use in portable and PCMCIA applications.

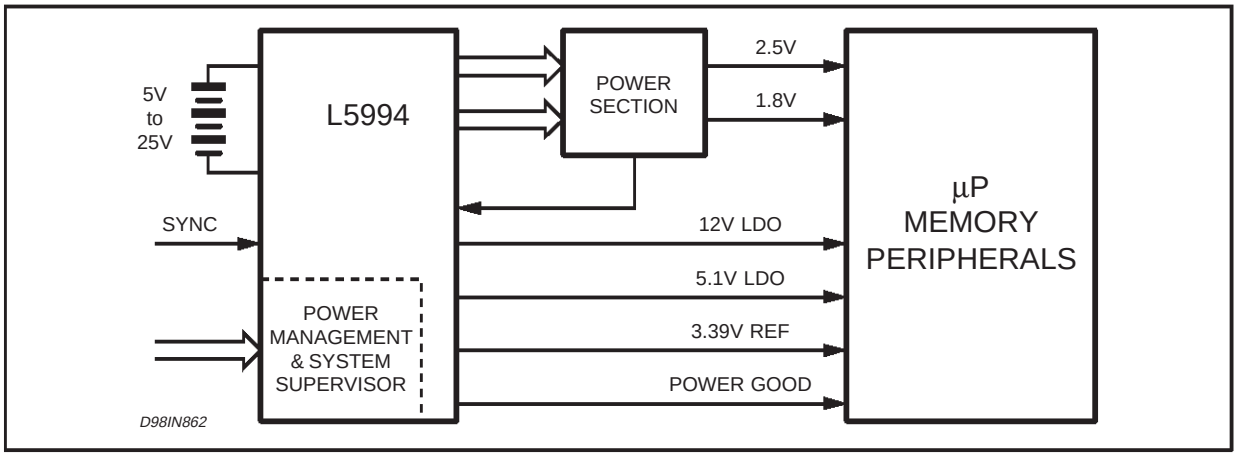
The internal architecture allows to operate with minimum external components count. A very high switching frequency (200/300 KHz or externally synchronizable) optimizes their physical dimensions.

Synchronous rectification and pulse skipping mode for the buck sections optimise the overall efficiency over a wide load current range.

The two high performance PWM controllers for 1.8V and 2.5V lines are monitored for overvoltage, undervoltage and overcurrent conditions. On detection of a fault, a POWER GOOD signal is generated and a specific shutdown procedure takes place to prevent physical damage and data corruption.

A disable function allows to manage the output power sections separately, optimising the quiescent consumption of the IC in stand-by conditions.

SYSTEM BLOCK DIAGRAM



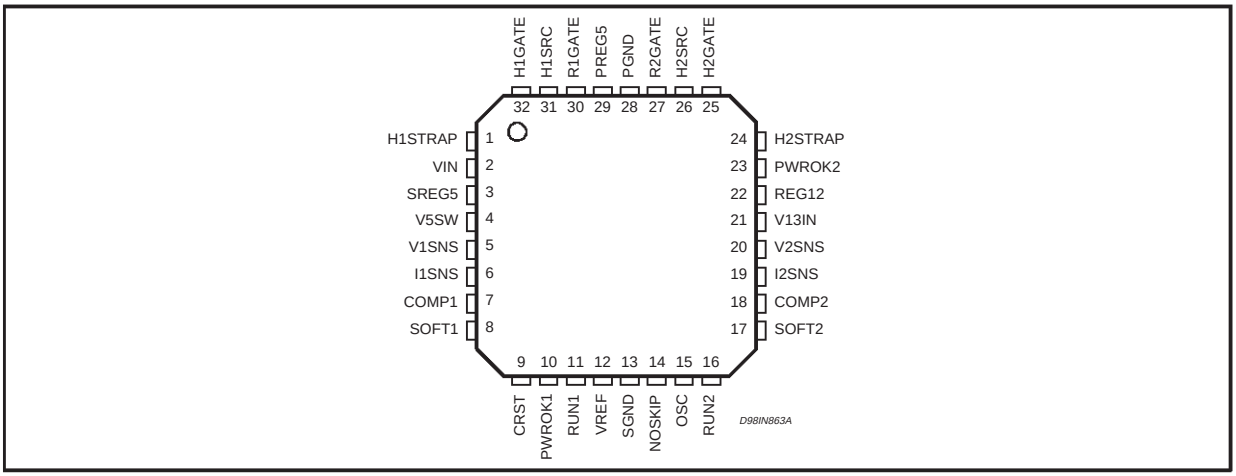
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{IN}	Power Supply Voltage on V_{IN}	0 to 25	V
V_I	Maximum Pin Voltage to Pins 1, 24, 25, 32	-0.5 to (V_{IN} +5)	V
I_{IN}	Input Current Except V13IN and V_{IN}	-1 to +1	mA
I_{OUT}	Output Current Digital Output	-15 to +15	mA
T_J	Junction Temperature	-55 to 150	°C

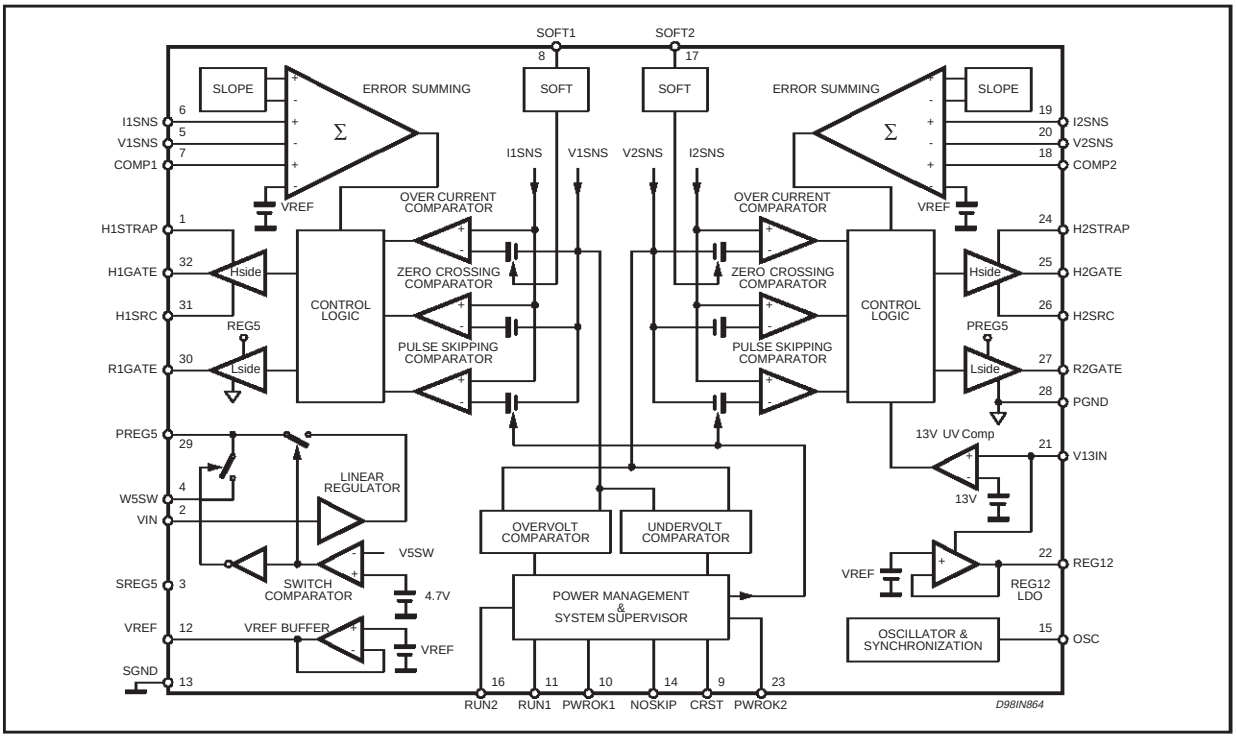
THERMAL DATA

Symbol	Parameter	Value	Unit
$R_{TH\ J\text{-}amb}$	Thermal Resistance Junction -Ambient	60	°C/W

PIN CONNECTION (Top view)



BLOCK DIAGRAM



PIN FUNCTIONS

N.	Name	Description
1	H1STRAP	Section 1 section bootstrap capacitor connection
2	V_{IN}	Device supply voltage. From 5.0 to 25V
3	SREG5	Signal 5V. It should be connected to PREG5 pin.
4	V1SW	Alternative device supply voltage.
5	V1SNS	This pin connects to the (-) input of the section 1 internal current sense comparator
6	I1SNS	This pin connects to the (+) input of the section 1 internal current sense comparator
7	COMP1	Feedback input for the section 1.
8	SOFT1	Soft-start input of the section 1. The soft-start time is programmed by an external capacitor connected between this pin and SGND. Approximately, 1ms/nF @ full load.
9	CRST	Input used for start-up and shut-down timing. A capacitor defines a time of 2ms/nF.
10	PWROK1	Power-good diagnostic signal. This output is driven high when section 1 is enabled and running properly, after a delay defined by the CRST capacitor.
11	RUN1	Control input to enable/disable the section 1. A high level (>2.4V) enables this section, a low level (<0.8V) shuts it down
12	VREF	Internal +2.5V high accuracy voltage generator. It can source 5mA to external load. Bypass to ground with a 4.7µF capacitor to reduce noise.
13	SGND	Signal ground. Reference for internal logic circuitry. It must be routed separately from high current returns.
14	NOSKIP	Pulse skipping mode control. A high level (>2.4V) disables pulse skipping at low load current, a low level (<0.8V) enables it.
15	OSC	Oscillator frequency control: connect to 2.5V to select 300KHz operation, to ground or to 5V for 200KHz operation. A proper external signal can synchronize the oscillator
16	RUN2	Control input to enable/disable the section 2. A high level (>2.4V) enables this section, a low level (>0.8V) shuts it down.
17	SOFT2	Soft-start input for the section 2. The soft-start time is programmed by an external capacitor connected between this pin and GND. Approximately, 1ms/nF @full load.
18	COMP2	Feedback input for the section 2.
19	I2SNS	This pin connects to the (+) input of the section 2 internal current sense comparator
20	V2SNS	This pin connects to the (-) input of the section 2 internal current sense comparator
21	V13IN	12V regulator input supply voltage, included between 13 and 20V. This voltage can be supplied by a flyback winding.
22	REG12	12V regulator output voltage. It can source up to 150mA to an external load
23	PWROK2	Power good diagnostic signal. This output is driven high when section 2 is enabled and running properly, after a delay defined by CRST capacitor
24	H2STRAP	Section 2 bootstrap capacitor connection
25	H2GATE	Gate- driver output for the section 2 high-side N-MOS
26	H2SRC	Section 2 high-side N-MOS source connection
27	R2GATE	Gate- driver output for the section 2 low- side N-MOS (synchronous rectifier).
28	PGND	Current return for drivers
29	PREG5	+5V regulator supply. Used mainly for bootstrap capacitors. It should be bypassed to ground.
30	R1GATE	Gate-driver output for the section 1 low-side N-MOS (synchronous rectifier).
31	H1SRC	Section 1 high-side N-MOS source connection
32	H1GATE	Gate-driver output for the section 1 high-side N-MOS

ELECTRICAL CHARACTERISTICS (V_{IN} = 12V; T_J = 25°C; V_{OSC} = GND; unless otherwise specified.)

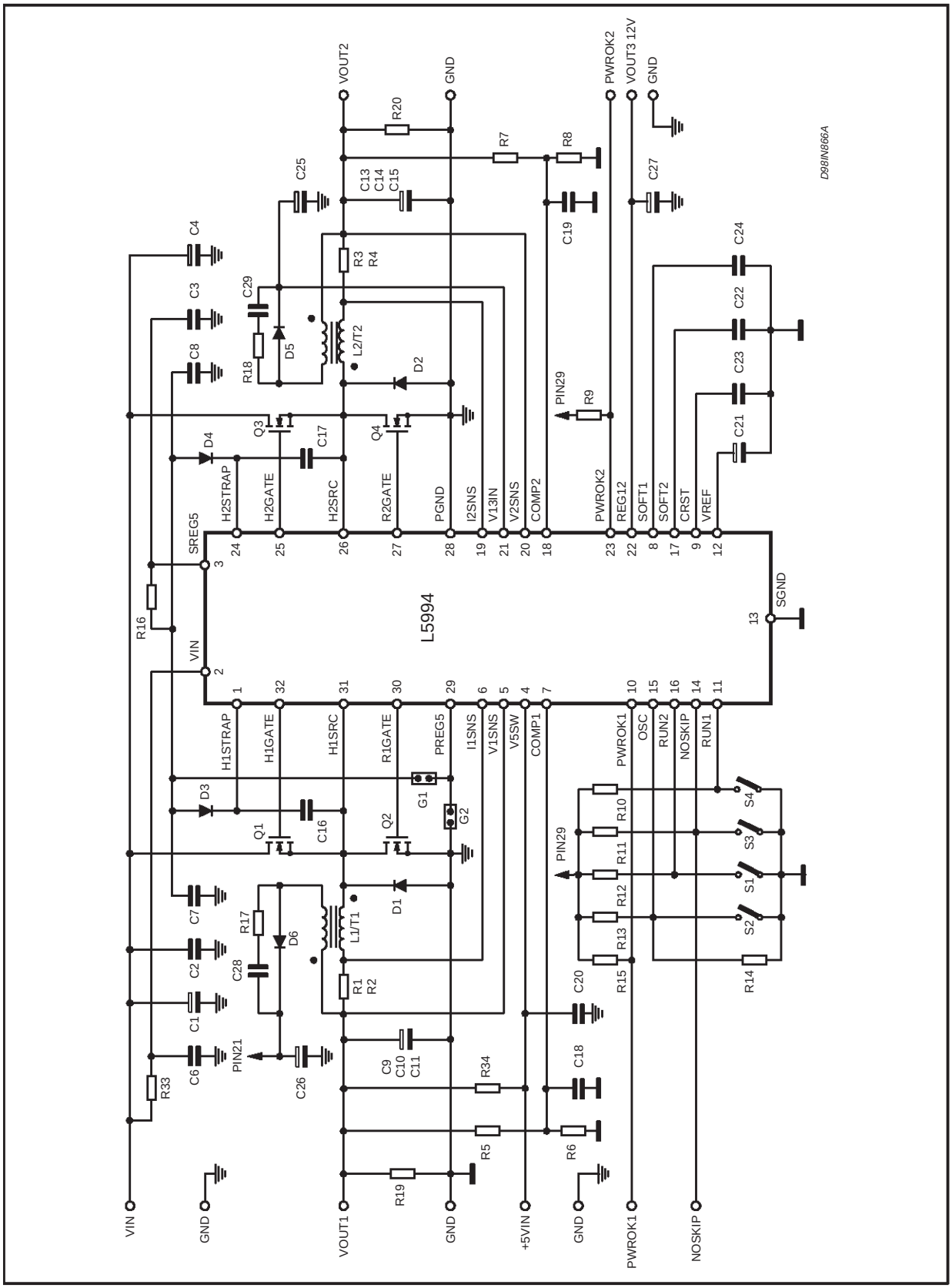
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
DC CHARACTERISTICS						
V_{IN}	Input Supply Voltage		5.0		25	V
I_2	Operating Quiescent Current	R1GATE = R2GATE = OPEN H1GATE = H2GATE = OPEN RUN2 = RUN1 = SREG5 (DRIVERS OFF)			1.35	mA
I_2	Stand-By Current	RUN2= RUN1 = GND V_{IN} = 12V V_{IN} = 20V		50 60	100 120	µA
SECTION 1 PWM CONTROLLER						
V_{1OUT} (*)	V1SNS Feedback Voltage	V_{IN} = 5.0 to 20V; V_{I1SNS} - V_{V1SNS} = 0 to 40mV	1.843	1.9	1.957	V
V_6 - V_5	Over-Current Threshold Voltage	VSOFT1 = 4V		50		mV
V_6 - V_5	Pulse Skipping Mode Thereshold Voltage	V_{IN} > 6.8V		13		mV
		V_{IN} < 5.8V		6.5		mV
V_5	Over Voltage Threshold ON V1SNS		1.99	2.052	2.11	V
	Under Voltage Threshold ON V1SNS		1.695	1.748	1.80	V
SECTION 2 PWM CONTROLLER						
V_{2OUT} (*)	V2SNS Feedback Voltage	V_{IN} = 5.0 to 20V; V_{I2SNS} - V_{V2SNS} = 0 to 40mV	1.610	1.66	1.709	V
V_{19} - V_{20}	Over Current Threshold Voltage	VSOFT2 = 4V		50		mV
V_{19} - V_{20}	Pulse Skipping Mode Threshold Voltage	V_{IN} = 5.0 to 20V;		13		mV
V_{20}	Over Voltage Threshold ON V2SNS		1.738	1.792	1.845	V
	Under Voltage Threshold ON V2SNS		1.48	1.527	1.572	V
PWM CONTROLLERS CHARACTERISTICS (BOTH SECTIONS)						
F_{OSC}	Switching Frequency Accuracy	OSC = SREG5/2	255	300	345	kHz
		OSC = 0 or SREG5	170	200	230	kHz
V_{15}	Voltage Range for 300kHz Operation		2.4		2.6	V
T_{OFF}	Dead Time		300	375	450	ns
T_{OV}	Overvoltage Propagation Time	V1SNS to PWROK or V2SNS to PWROK			1.25	µs
T_{UV}	Undervoltage Propagation Time	V1SNS to PWROK or V2SNS to PWROK			1.5	µs
V_5, V_{20}	Output UVLO Threshold	Respect output voltage		70		%
I_8, I_{17}	Soft Start Charge Current		3.2	4	4.8	µA
V_8, V_{17}	Soft Start Clamp Voltage			4		V

(*) Guaranteed by design, not tested in production

ELECTRICAL CHARACTERISTICS (Continued)

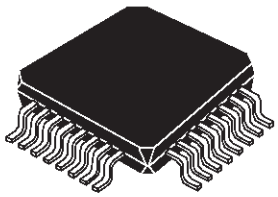
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
HIGH AND LOW SIDE GATE DRIVER (BOTH SECTIONS)						
I_{25}, I_{27}, I_{32}, I_{30}	Source Output Peak Current	C_{LOAD} = 1nF	0.2	0.5		A
	Sink Output Peak Current	C_{LOAD} = 1nF	0.2	0.5		A
R_H	R_{DSON} Resistance (or Impedance)	Driver OUT HIGH			7	Ω
R_L	R_{DSON} resistance (or Impedance)	Driver OUT LOW			5	Ω
V_{OH}	Output High Voltage	HSTRAP = PREG5 I_{SOURCE} = 10mA; HSRC = GND	4.40	5.3	5.61	V
V_{OL}	Output Low Voltage	HSTRAP = PREG5 I_{SINK} = 10mA HSRC = GND			0.5	V
T_{CC}	Cross-Conduction Delay		30	75	130	ns
12V LINEAR REGULATOR SECTION						
V_{21}	Input Voltage Range		13		20	V
V_{22}	Output Voltage	I_{22} = 0 to 120mA	11.54	12.0	12.48	V
I_{22}	Current Limiting	V_{REG12} = 12V	120			mA
	Short Circuit Current	V_{REG12} = 0V	150			mA
V_{CP}	Input Voltage Clamp	I_{CLAMP} = 100µA	16			V
	”One Shot” Activation Threshold	V_{13IN} Falling	12.88	13.7	14.52	V
	”One Shot” Pulse				1.5	µs
INTERNAL REGULATOR (VPREG5) AND REFERENCE VOLTAGE						
V_{29}	VREG5 Output Voltage	V_{IN} = 5.0 to 20V I_{LOAD} = 0 to 5mA	5.0	5.3	5.61	V
I_{29}	Total Current Capability	VPREG5 = 5.3V V_{REG5} = 6V	25 70			mA
	Switch-Over Threshold Voltage		4.3	4.53	4.7	V
V_{12}	Reference Voltage			2.5		V
		V_{IN} = 5.0 to 20V I_{LOAD} = 1 to 5mA		2.5		V
I_{12}	Source Current at Reference Voltage		5			mA
POWER GOOD AND ENABLE FUNCTION						
V_{16}, V_{11}	RUN2, RUN1, Enable Voltage	HIGH LEVEL	2.4			V
V_{16}, V_{11}	RUN2, RUN1, Disable Voltage	LOW LEVEL			0.8	V
T_{10}	Power Good Delay	C_{CRST} = 100nF	160	200	240	ms
T_{27}, T_{30}	Shutdown Delay Time before Low Side Activation (Except Over-Voltage Fault)	C_{CRST} = 100nF,	160	200	240	ms
	CRST Timing Rate			2		ms/nF
	Power Good High Level	I_{PWROK} = 40µA	4.1			V
	Power Good LowLevel	I_{PWROK} = 320µA			0.4	V
SYNCHRONIZATION						
	Synchronisation Pulse Width		400			ns
	Synchronisation Input Voltage (Falling Edge Transition)		5			V

APPLICATION CIRCUIT



DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.60			0.063
A1	0.05		0.15	0.002		0.006
A2	1.35	1.40	1.45	0.053	0.055	0.057
B	0.30	0.37	0.45	0.012	0.015	0.018
C	0.09		0.20	0.004		0.008
D		9.00			0.354	
D1		7.00			0.276	
D3		5.60			0.220	
e		0.80			0.031	
E		9.00			0.354	
E1		7.00			0.276	
E3		5.60			0.220	
L	0.45	0.60	0.75	0.018	0.024	0.030
L1		1.00			0.039	
K	0°(min.), 7°(max.)					

OUTLINE AND MECHANICAL DATA



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