Buck and Synchronous-Rectifier Pulse-Width Modulator (PWM) Controller
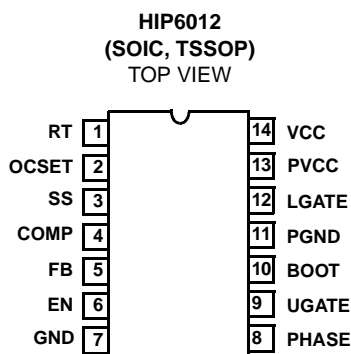
The HIP6012 provides complete control and protection for a DC-DC converter optimized for high-performance microprocessor applications. It is designed to drive two N-Channel MOSFETs in a synchronous-rectified buck topology. The HIP6012 integrates all of the control, output adjustment, monitoring and protection functions into a single package.

The output voltage of the converter can be precisely regulated to as low as 1.27V, with a maximum tolerance of $\pm1.5\%$ over temperature and line voltage variations.

The HIP6012 provides simple, single feedback loop, voltage-mode control with fast transient response. It includes a 200kHz free-running triangle-wave oscillator that is adjustable from below 50kHz to over 1MHz. The error amplifier features a 15MHz gain-bandwidth product and $6V/\mu s$ slew rate which enables high converter bandwidth for fast transient performance. The resulting PWM duty ratio ranges from 0% to 100%.

The HIP6012 protects against overcurrent conditions by inhibiting PWM operation. The HIP6012 monitors the current by using the $r_{DS(ON)}$ of the upper MOSFET which eliminates the need for a current sensing resistor.

Pinout

**HIP6012
(SOIC, TSSOP)
TOP VIEW**

RT	1		14	VCC
OCSET	2		13	PVCC
SS	3		12	LGATE
COMP	4		11	PGND
FB	5		10	BOOT
EN	6		9	UGATE
GND	7		8	PHASE

Features

- Drives Two N-Channel MOSFETs

- Operates From +5V or +12V Input

- Simple Single-Loop Control Design
  - Voltage-Mode PWM Control

- Fast Transient Response
  - High-Bandwidth Error Amplifier
  - Full 0% to 100%   ty Ratio

- Excellent Output Voltage Regulation
  - 1.27V Internal Reference
  - $\pm1.5\%$ Over Line Voltage and Temperature

- Overcurrent Fault Monitor
  - Does Not Require Extra Current Sensing Element
  - Uses MOSFETs $r_{DS(ON)}$

- Small Converter Size
  - Constant Frequency Operation
  - 200kHz Free-Running Oscillator Programmable from 50kHz to Over 1MHz

- 14 Pin, SOIC and TSSOP Packages

- Pb-Free Available (RoHS Compliant)

Applications

- Power Supply for Pentium®, Pentium Pro, PowerPC™ and Alpha™ Microprocessors

- High-Power 5V to 3.xV DC-DC Regulators

- Low-Voltage Distributed Power Supplies

Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
HIP6012CB	0 to 70	14 Ld SOIC	M14.15
HIP6012CBZ (See Note)	0 to 70	14 Ld SOIC (Pb-free)	M14.15
HIP6012CV	0 to 70	14 Ld TSSOP	M14.173
HIP6012CVZ (See Note)	0 to 70	14 Ld TSSOP (Pb-free)	M14.173

Add "-T" suffix for tape and reel.

NOTE: Intersil Pb-free products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate termination finish, which are RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.

Absolute Maximum Ratings

Supply Voltage, V_{CC} . . . . +15.0V
Boot Voltage, V_{BOOT} - V_{PHASE} . . . . +15.0V
Input, Output or I/O Voltage . . . . .GND -0.3V to V_{CC} +0.3V
ESD Classification . . . . .Class 2

Operating Conditions

Supply Voltage, V_{CC} . . . . +12V ±10%
Ambient Temperature Range. 0°C to 70°C
Junction Temperature Range. . . . . 0°C to 125°C

Thermal Information

Thermal Resistance (Typical, Note 1) θ_{JA} (°C/W)
   SOIC Package   85
   TSSOP Package   95
Maximum Junction Temperature . . . . 150°C
Maximum Storage Temperature Range. . . . . -65°C to 150°C
Maximum Lead Temperature (Soldering 10s) . . . . 300°C
   (Lead tips only)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.
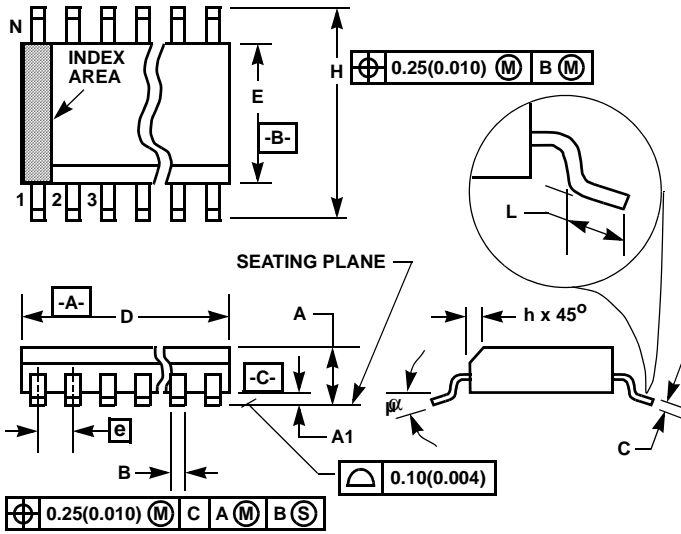
NOTE:

1. θ_{JA} is measured with the component mounted on a high effective thermal conductivity test board in free air. See Tech Brief TB379 for details.

Electrical Specifications   Recommended Operating Conditions, Unless Otherwise Noted

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
VCC SUPPLY CURRENT						
Nominal Supply	I_{CC}	EN = V_{CC}; UGATE and LGATE Open	-	5	-	mA
Shutdown Supply		EN = 0V	-	50	100	μA
POWER-ON RESET						
Rising V_{CC} Threshold		V_{OCSET} = 4.5VDC	-	-	10.4	V
Falling V_{CC} Threshold		V_{OCSET} = 4.5VDC	8.8	-	-	V
Enable - Input threshold Voltage		V_{OCSET} = 4.5VDC	0.8	-	2.0	V
Rising V_{OCSET} Threshold			-	1.27	-	V
OSCILLATOR						
Free Running Frequency		R_T = OPEN, V_{CC} = 12	180	200	220	kHz
Total Variation		6kΩ < R_T to GND < 200kΩ	-20	-	+20	%
Ramp Amplitude	ΔV_{OSC}	R_T = OPEN	-	1.9	-	V_{P-P}
REFERENCE						
Reference Voltage			1.251	1.270	1.289	V
ERROR AMPLIFIER						
DC Gain			-	88	-	dB
Gain-Bandwidth Product	GBW		-	15	-	MHz
Slew Rate	SR	COMP = 10pF	-	6	-	V/μs
GATE DRIVERS						
Upper Gate Source	I_{UGATE}	V_{BOOT} - V_{PHASE} = 12V, V_{UGATE} = 6V	350	500	-	mA
Upper Gate Sink	R_{UGATE}	I_{LGATE} = 0.3A	-	5.5	10	W
Lower Gate Source	I_{LGATE}	V_{CC} = 12V, V_{LGATE} = 6V	300	450	-	mA
Lower Gate Sink	R_{LGATE}	I_{LGATE} = 0.3A	-	3.5	6.5	W
PROTECTION						
OCSET Current Source	I_{OCSET}	V_{OCSET} = 4.5VDC	170	200	230	μA
Soft Start Current	I_{SS}		-	10	-	μA

Small Outline Plastic Packages (SOIC)

M14.15 (JEDEC MS-012-AB ISSUE C)
14 LEAD NARROW BODY SMALL OUTLINE PLASTIC PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.0532	0.0688	1.35	1.75	-
A1	0.0040	0.0098	0.10	0.25	-
B	0.013	0.020	0.33	0.51	9
C	0.0075	0.0098	0.19	0.25	-
D	0.3367	0.3444	8.55	8.75	3
E	0.1497	0.1574	3.80	4.00	4
e	0.050 BSC		1.27 BSC		-
H	0.2284	0.2440	5.80	6.20	-
h	0.0099	0.0196	0.25	0.50	5
L	0.016	0.050	0.40	1.27	6
N	14		14		7
α	0°	8°	0°	8°	-

NOTES:

1. Symbols are defined in the "MO Series Symbol List" in Section 2.2 of Publication Number 95.

2. Dimensioning and tolerancing per ANSI Y14.5M-1982.

3. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion and gate burrs shall not exceed 0.15mm (0.006 inch) per side.

4. Dimension "E" does not include interlead flash or protrusions. Interlead flash and protrusions shall not exceed 0.25mm (0.010 inch) per side.

5. The chamfer on the body is optional. If it is not present, a visual index feature must be located within the crosshatched area.

6. "L" is the length of terminal for soldering to a substrate.

7. "N" is the number of terminal positions.

8. Terminal numbers are shown for reference only.

9. The lead width "B", as measured 0.36mm (0.014 inch) or greater above the seating plane, shall not exceed a maximum value of 0.61mm (0.024 inch).

10. Controlling dimension: MILLIMETER. Converted inch dimensions are not necessarily exact.