## Single Synchronous Buck Pulse-Width Modulation (PWM) Controller

The ISL6520 makes simple work out of implementing a complete control and protection scheme for a DC/DC stepdown converter. Designed to drive N-Channel MOSFETs in a synchronous buck topology, the ISL6520 integrates the control, output adjustment, monitoring and protection functions into a single 8 Lead package.

The ISL6520 provides simple, single feedback loop, voltage-mode control with fast transient response. The output voltage can be precisely regulated to as low as 0.8V, with a maximum tolerance of ±1.5% over-temperature and line voltage variations. A fixed frequency oscillator reduces design complexity, while balancing typical application cost and efficiency.

The error amplifier features a 15MHz gain-bandwidth product and 8V/μs slew rate which enables high converter bandwidth for fast transient performance. The resulting PWM duty cycles range from 0% to 100%.

Protection from over-current conditions is provided by monitoring the $r_{DS(ON)}$ of the upper MOSFET to inhibit PWM operation appropriately. This approach simplifies the implementation and improves efficiency by eliminating the need for a current sense resistor.

## Ordering Information

| PART NUMBER | PART MARKING | TEMP. RANGE (°C) | PACKAGE | PKG. DWG. # |
|---|---|---|---|---|
| ISL6520CB* | 6520CB | 0 to 70 | 8 Ld SOIC | M8.15 |
| ISL6520CBZ* (Note) | 6520 CBZ | 0 to 70 | 8 Ld SOIC (Pb-free) | M8.15 |
| ISL6520IB* | 6520IB | -40 to 85 | 8 Ld SOIC | M8.15 |
| ISL6520IBZ* (Note) | 6520 IBZ | -40 to 85 | 8 Ld SOIC (Pb-free) | M8.15 |
| ISL6520CR* | ISL 6520CR | 0 to 70 | 16 Ld 4x4mm QFN | L16.4x4 |
| ISL6520CRZ* (Note) | 65 20CRZ | 0 to 70 | 16 Ld 4x4mm QFN (Pb-free) | L16.4x4 |
| ISL6520IR* | ISL 6520IR | -40 to 85 | 16 Ld 4x4mm QFN | L16.4x4 |
| ISL6520IRZ* (Note) | 65 20IRZ | -40 to 85 | 16 Ld 4x4mm QFN (Pb-free) | L16.4x4 |
| ISL6520EVAL1 | | Evaluation Board | | |

* Add “-T” suffix for tape and reel.

NOTE: Intersil Pb-free plus anneal 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.

## Features

- Operates from +5V Input
- 0.8V to $V_{IN}$ Output Range
  - 0.8V Internal Reference
  - ±1.5% Over Line Voltage and Temperature
- Drives N-Channel MOSFETs
- Simple Single-Loop Control Design
  - Voltage-Mode PWM Control
- Fast Transient Response
  - High-Bandwidth Error Amplifier
  - Full 0% to 100% Duty Cycle
- Lossless, Programmable Over-Current Protection
  - Uses Upper MOSFET’s $r_{DS(on)}$
- Small Converter Size
  - 300kHz Fixed Frequency Oscillator
  - Internal Soft Start
  - 8 Ld SOIC or 16Ld 4mmx4mm QFN
- QFN Package:
  - Compliant to JEDEC PUB95 MO-220 QFN - Quad Flat No Leads - Package Outline
  - Near Chip Scale Package footprint, which improves PCB efficiency and has a thinner profile
- Pb-Free Plus Anneal Available (RoHS Compliant)

## Applications

- Power Supplies for Microprocessors
  - PCs
  - Embedded Controllers
- Subsystem Power Supplies
  - PCI/AGP/GTL+ Buses
  - ACPI Power Control
- Cable Modems, Set Top Boxes, and DSL Modems
- DSP and Core Communications Processor Supplies
- Memory Supplies
- Personal Computer Peripherals
- Industrial Power Supplies
- 5V-Input DC/DC Regulators
- Low-Voltage Distributed Power Supplies

## Absolute Maximum Ratings

Supply Voltage, $V_{CC}$ . . . . . +6.0V
Absolute Boot Voltage, $V_{BOOT}$ . . . . . +15.0V
Upper Driver Supply Voltage, $V_{BOOT}$ - $V_{PHASE}$ . . . . . 7.0V (DC)
8.0V (<10ns Pulse Width, 10µJ)
Input, Output or I/O Voltage . . . . . GND -0.3V to VCC +0.3V
ESD Classification . . . . . Class 2

## Recommended Operating Conditions

Supply Voltage, VCC . . . . . +5V ±10%
Ambient Temperature Range - ISL6520C . . . . . 0°C to +70°C
Ambient Temperature Range - ISL6520I . . . . . -40°C to +85°C
Junction Temperature Range. . . . . -40°C to +125°C

## Thermal Information

| Thermal Resistance | $\theta_{JA}$ (°C/W) | $\theta_{JC}$ (°C/W) |
|---|---|---|
| SOIC Package (Note 1) . . . . . | 95 | N/A |
| QFN Package (Notes 2, 3). . . . . | 45 | 7 |

Maximum Junction Temperature
(Plastic Package) . . . . . +150°C
Maximum Storage Temperature Range. . . . . -65°C to +150°C
Maximum Lead Temperature
(Soldering 10s) . . . . . +300°C
(SOIC - 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.*

NOTES:

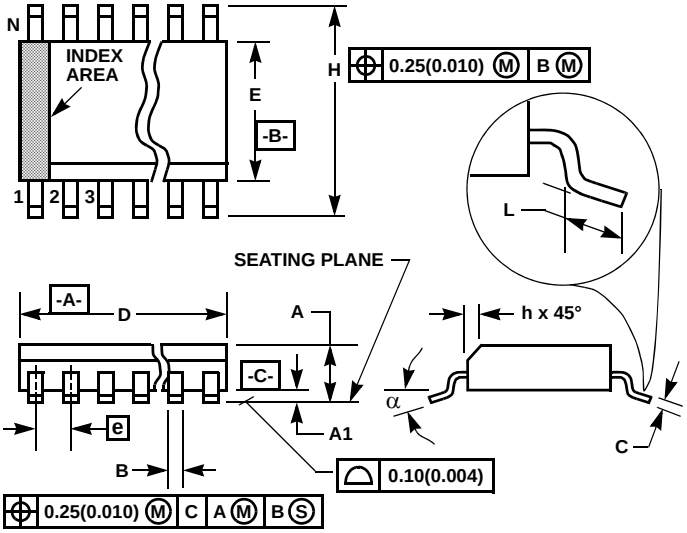
1. $\theta_{JA}$ is measured with the component mounted on a high effective thermal conductivity test board in free air. See Tech Brief TB379 for details.
2. $\theta_{JA}$ is measured in free air with the component mounted on a high effective thermal conductivity test board with "direct attach" features. See Tech Brief TB379.
3. For $\theta_{JC}$, the "case temp" location is the center of the exposed metal pad on the package underside.

## Electrical Specifications

Recommended Operating Conditions, Unless Otherwise Noted.

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| **VCC SUPPLY CURRENT** | | | | | | |
| Nominal Supply | $I_{VCC}$ | UGATE and LGATE Open | 2.6 | 3.2 | 3.8 | mA |
| **POWER-ON RESET** | | | | | | |
| Rising VCC POR Threshold | POR | | 4.19 | 4.30 | 4.5 | V |
| VCC POR Threshold Hysteresis | | | - | 0.25 | - | V |
| **OSCILLATOR** | | | | | | |
| Frequency | $f_{OSC}$ | ISL6520C, $V_{CC}$ = 5V | 250 | 300 | 340 | kHz |
| | | ISL6520I, $V_{CC}$ = 5V | 230 | 300 | 340 | kHz |
| Ramp Amplitude | $\Delta V_{OSC}$ | | - | 1.5 | - | $V_{P-P}$ |
| **REFERENCE** | | | | | | |
| Reference Voltage Tolerance | | ISL6520C | -1.5 | - | +1.5 | % |
| | | ISL6520I | -2.5 | | +2.5 | % |
| Nominal Reference Voltage | $V_{REF}$ | | - | 0.800 | - | V |
| **ERROR AMPLIFIER** | | | | | | |
| DC Gain | | Guaranteed By Design | - | 88 | - | dB |
| Gain-Bandwidth Product | GBWP | | - | 15 | - | MHz |
| Slew Rate | SR | | - | 8 | - | V/µs |
| **GATE DRIVERS** | | | | | | |
| Upper Gate Source Current | $I_{UGATE-SRC}$ | | - | -1 | - | A |
| Upper Gate Sink Current | $I_{UGATE-SNK}$ | | - | 1 | - | A |
| Lower Gate Source Current | $I_{LGATE-SRC}$ | | - | -1 | - | A |
| Lower Gate Sink Current | $I_{LGATE-SNK}$ | | - | 2 | - | A |
| **PROTECTION / DISABLE** | | | | | | |
| OCSET Current Source | $I_{OCSET}$ | ISL6520C | 17 | 20 | 22 | µA |
| | | ISL6520I | 14 | 20 | 24 | µA |
| Disable Threshold | $V_{DISABLE}$ | | - | 0.8 | - | V |

## Small Outline Plastic Packages (SOIC)




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.

**M8.15 (JEDEC MS-012-AA ISSUE C)**
**8 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 | 0.1890 | 0.1968 | 4.80 | 5.00 | 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 | 8 | | 8 | | 7 |
| α | 0° | 8° | 0° | 8° | - |