Wide input Range with High Efficiency Power and Surge protection Design

Galant Chen
Field Application Manager
Linear Technology Corporation
Agenda

- How Buck-Boost converter work with high efficiency
- Wide input with High Efficiency Buck-Boost converter
  - Monolithic, Controller, uModule solution
- What kind of application need Buck-Boost converter
- Application example of Buck-Boost Converter

Board level protection
  - Surge protection
How Buck-Boost converter work with high efficiency

Figure 5. Buck Region ($V_{IN} >> V_{OUT}$)

Figure 6. Buck-Boost Region ($V_{IN} \leq V_{OUT}$)

Figure 7. Boost Region ($V_{IN} << V_{OUT}$)
Wide input High Efficiency Buck-Boost converter

- **Wide input range operation**
  - Star operation range from 2.8V to 80V
  - 4 Switch one Inductor operation.
  - Can regulate Vout, Vin, Iout, and Iin

- **What applications or markets are targeted?**
  - General Purpose Battery type source
  - Telecom 48V Stabilizers.
  - Automotive Battery Stabilizers.
  - Industrial Wide Input Purpose Buck-Boost Apps.
  - Solar, Bi-Directional, Battery Charging…
Monolithic Buck-Boost Converters
Monolithic Buck-Boost Converters

- **Input Voltage Range**
  - 1.8V
  - 2.5V
  - 5V
  - 7V
  - 15V
  - 40V

- **Max Output Current**
  - 1A
  - 2A
  - 3A
  - 4A

- **New!**
  - LTC3129 (non-synchronous)
  - LTC3433
  - LTC3534
  - LTC3530
  - LTC3532
  - LTC3533
  - LTC3538
  - LTC3112
  - LTC3114-1
  - LTC3115
  - LTC3118
  - LT3433 (non-synchronous)
  - LTC3113
Monolithic Buck-Boost Converters < 3A

- **LTC3113**
- **LTC3112/5/8**
- **LTC3533**
- **LTC3441/2/3**

Output Current

- Vin **1.8V** to 5.5V
- Vin **2.5V** to 5.5V
- Vin **2.4V** to **>7V**

DFN-8
DFN-10
DFN-12, TSSOP-16
DFN-10
DFN-8
DFN-10, MS-12
DFN-12
DFN-14
Wide Vin Synchronous Monolithic Buck-Boost

<table>
<thead>
<tr>
<th></th>
<th>LTC3114-1</th>
<th>LTC3111</th>
<th>LTC3115</th>
<th>LTC3118</th>
<th>LTC3112</th>
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<tbody>
<tr>
<td>Vin (V)</td>
<td>2.7 – 40</td>
<td>2.5 – 15</td>
<td>2.7 – 40</td>
<td>2.35 – 18</td>
<td>2.7 – 15</td>
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<tr>
<td>Iout</td>
<td>1A</td>
<td>1.4A</td>
<td>2A</td>
<td>2A</td>
<td>2.5A</td>
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<tr>
<td>Iq</td>
<td>30µA</td>
<td>49µA</td>
<td>50µA</td>
<td>50µA</td>
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<tr>
<td>Freq</td>
<td>1.2MHz</td>
<td>1.5MHz</td>
<td>2MHz</td>
<td>1.2MHz</td>
<td>750kHz</td>
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<td>Notes</td>
<td>Low Noise</td>
<td>Low Noise</td>
<td>Low Noise</td>
<td>Low Noise</td>
<td>Low Noise</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>-2 Optimized for fast voltage transients</td>
<td>Dual Input!</td>
<td></td>
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<tr>
<td>Pack</td>
<td>3x5 DFN-16, TSSOP-16</td>
<td>3x4 DFN-16, MS-16</td>
<td>TSSOP-20 5x4 DFN-16</td>
<td>4x5 QFN-24, TSSOP-28</td>
<td>TSSOP-20 5x4 DFN-16</td>
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</tbody>
</table>
# Synchronous Buck-Boost Controllers

<table>
<thead>
<tr>
<th></th>
<th>LTC3785</th>
<th>LTC3780</th>
<th>LTC3789</th>
<th>LT3790</th>
<th>LT8705</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vin (V)</strong></td>
<td>2.7 – 10</td>
<td>4 – 36</td>
<td>4 – 38</td>
<td>4.7 – 60</td>
<td>2.8 – 80</td>
</tr>
<tr>
<td><strong>Vout (V)</strong></td>
<td>2.7 – 10</td>
<td>0.8 – 30</td>
<td>0.8 – 38</td>
<td>1.2 – 60</td>
<td>1.3 – 80</td>
</tr>
<tr>
<td><strong>Iout (Max)</strong></td>
<td>10A</td>
<td>20A</td>
<td>20A</td>
<td>20A+</td>
<td>20A+</td>
</tr>
<tr>
<td><strong>Synch?</strong></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Features</strong></td>
<td>In/Out Current Regulation</td>
<td>In/Out Current Regulation</td>
<td>In/Out Current Regulation</td>
<td>In/Out Current Regulation</td>
<td>In/Out Current Regulation</td>
</tr>
<tr>
<td><strong>Package</strong></td>
<td>4x4 QFN-24</td>
<td>5x5 QFN-32, SSOP-24</td>
<td>4x5 QFN-28, SSOP-28</td>
<td>TSSOP-38</td>
<td>5x7 QFN-38, TSSOP-38</td>
</tr>
</tbody>
</table>
Buck-Boost µModule Features

- Inductor Inside
- Power stage FETs and sense resistor inside
- High Efficiency
- Input current regulation
- Output current regulation
- SVIN for low dropout
- CTL for output current scaling (i.e., fans and LEDs)
LTM8055/LTM8056 Load Sharing

- LTM8055/LTM8056 Load Share via master/slave
- IOUTMON commands slaves vis CTL
- Needs buffer between master and slave
- CLKOUT drives slave 180° out of phase
# LTM8055/LTM8056 Comparison

<table>
<thead>
<tr>
<th></th>
<th>LTM8055</th>
<th>LTM8056</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vin</strong></td>
<td>36VDC</td>
<td>58VDC</td>
</tr>
<tr>
<td><strong>Vout</strong></td>
<td>36VDC</td>
<td>48VDC</td>
</tr>
<tr>
<td><strong>Power Stage Current Limit</strong></td>
<td>10A</td>
<td>5A</td>
</tr>
<tr>
<td><strong>Maximum Output Current</strong></td>
<td>12Vout:</td>
<td>24Vout:</td>
</tr>
<tr>
<td></td>
<td>3A from 6Vin</td>
<td>1A from 7Vin</td>
</tr>
<tr>
<td></td>
<td>6A from 12Vin</td>
<td>4.1A from 24Vin</td>
</tr>
<tr>
<td></td>
<td>8.5A from 24Vin</td>
<td>4.7A from 48Vin</td>
</tr>
</tbody>
</table>
Wide operation range Buck-Boost - LT8705
Sense & Regulate $V_{IN}, V_{OUT}, I_{IN}$ & $I_{OUT}$

$V_{IN}$ Sense & Regulation

$I_{IN}$ Sense

$L_{IN}$ & $I_{OUT}$ Monitor, Regulation, Limit

$V_{OUT}$ Sense & Regulation

$I_{OUT}$ Sense
LT8705 Additional Features

- Master Shutdown
  - Can be wired as UVLO

- Switcher Enable
  - No Effect on LDO
  - Useful for μC interface

- 3.3V/10mA LDO
  - To Power External Devices (i.e. μC)

- MODE Pin
  - FCM, Burst, DCM

- Input Clock Synchronization

- Output Clock
  - -180° Phase Shift
  - Die Temp Info

- SRVO Pins
  - Indicate When Loops Are Active
LT8705 Additional Features (continued…)

- **$V_{IN}$** Range: 2.8V (Need $EXTV_{CC} > 6.4V$) to 80V
- **$V_{OUT}$** Range: 1.3V to 80V
- 100kHz to 400kHz Oscillator set by RT pin
- No “Gate Refresh” Noise. New scheme utilized.
- Programmable Soft-Start
- Modified FE38 Package (with Skipped Leads) for High Voltage Operation but will have reduced feature set
- Can run in two switch Buck Mode (M3 and M4 not inserted, FCM Mode only).
- 5mm x 7mm QFN with 38 Leads is Full Featured
Application #1 – 36V to 80V Input; 48V, 5A Output

Fosc = 200kHz
Application #1 – 36V to 80V Input; 48V, 5A Output

![Graph showing efficiency vs. output current for different input voltages (36V, 48V, 80V).](image-url)
Application #1 – 36V to 80V Input; 48V, 5A Output
LT8705 DC1924A - Medium Power Demo – 250W

- $V_{IN}=36V-80V$, $V_{OUT}=48V/5.2A$
- 6 Fairchild MOSFETs for increased current handling
- No heatsink required
Application #2 – Bidirectional SuperCap Backup

Fosc = 350kHz
When 12V Input is present, 12V loads are powered and SuperCaps are charged. PCI Current is limited by input current loop.

When 12V Input goes away, LT8705 runs “backwards” and holds up $V_{IN}$ to 8V. Up to 6A of load can be pulled from $V_{IN}$ during this mode.

For Bidirectional Apps, you must tie MODE pin to GND (FCM Mode).
Application #3 – Four-Phase High Power Application

- >900 Watt Output Power!
- Take four App #1 Circuits and run them in parallel.
- Use IMON_OUT function to make each channel have a higher output impedance (much like AVP).
- Use one of Linear’s clock chips (LTC6902) to clock all 4 LT8705 out of phase.
- Excellent Current sharing at DC and during Transients.
Application #4 – Four-Phase Application

![Graph showing efficiency vs. current for different input voltages.]

- Efficiency (%) vs. Iout (A)
- Lines represent different input voltages:
  - Blue line: Vin = 36V
  - Red line: Vin = 48V
  - Yellow line: Vin = 80V
LT8705 Multiphase Board – 1kW Max!!!

- $V_{\text{IN}} = 36V-80V$
- $V_{\text{OUT}} = 48V/20.8A$

- “Interface” board
  - Input and output caps
  - LT6902 clock generator

- 1-4 “Converter” boards
  - 1 Phase each
  - 1 LT8705 each
  - 250W max each

- Uses one LT6902 clock generator
LTC3895: 150V*, Low I_Q, Synchronous Buck Controller

- Optional External NMOS pass device w/ built in charge pump (even works at low V_IN!) for DRVCC LDO or use internal PMOS pass device for lower power apps and/or startup
- Optional VIN OVLO
- V_IN down to ~4V with lower DRVUV setting (for logic level FETs)
- 5-10V Adjustable Gate Drive for logic-level or standard threshold MOSFETs
- Integrated Bootstrap Diode and built in charge pump for optional 100% duty cycle!
- Constant Frequency Peak Current Mode Control (<100ns minimum on-time)
- V_OUT up to 60V
- V_IN 12.5V to 140V
- V_OUT 12V/5A
- V_IN 150µF
- V_OUT up to 60V
- Optional VIN OVLO
- 5-10V Adjustable Gate Drive for logic-level or standard threshold MOSFETs
- Constant Frequency Peak Current Mode Control (<100ns minimum on-time)
- Integrated Bootstrap Diode and built in charge pump for optional 100% duty cycle!
LTC3895 Key Features

- Wide Input Voltage Range: 4V to 150V* (Abs Max)
- Constant Frequency Peak Current Mode Control
  - 75kHz to 850kHz; CLKOUT for multiphase
- Output Voltage Range: 0.8V to 60V
- Integrated bootstrap diode w/ internal charge pump for BOOST pin
- 100% Duty cycle operation
- Low $I_Q$: No-load in Burst Mode: 50uA; Shutdown: 8uA
- 5-10V Adjustable Gate Drive (DRVCC) for logic-level or standard threshold MOSFETs
- FE38(31) package with high voltage pin spacing, or 4x5 QFN
LTC3895 Switching waveforms $140V_{IN}$ to $12V_{OUT}/5A$

- 150kHz switching frequency to limit transition losses in top MOSFET at $140V_{IN}$ and full load.
- If maximum $V_{IN}$ and/or $I_{LOAD}$ were lower (e.g., 100V), then frequency could be higher.
- Also, depends on board/heatsinking/airflow, etc.
LTC3895 Efficiency 12Vout/5A

Efficiency, $V_{OUT} = 12V$, Burst Mode

Efficiency, $V_{OUT} = 12V$, FC Mode

Efficiency, $V_{OUT} = 12V$, $V_{IN} = 48V$
Surge Stoppers

Protect Circuits from Voltage & Current Surges
Voltage / Current Protection

- Overcurrent
- Undervoltage
- Overvoltage
- Reverse Voltage
- Reverse Current
- Reverse Voltage, Reverse Current
- Normal Operating Range
Protection Portfolio

**Normal Operating Range**

- **Overcurrent**
  - Hot Swap Controllers (HSC)
  - Surge Stoppers (SS)

- **Overvoltage**
  - Surge Stoppers
  - Hot Swap Controllers

- **Undervoltage**
  - HSC
  - SS

**Reverse Voltage**
- LTC4365, LTC4367, LTC4359, LTC4364

**Reverse Voltage & Reverse Current**
- LTC4359, LTC4364

**Reverse Current**
- Ideal Diode Controllers
Automotive Transients

FIGURE 1. TYPICAL AUTOMOTIVE TRANSIENTS
Traditional Solution

- Consists of:
  - Transient voltage suppressor (TVS) for overvoltage protection
  - Inline fuse for overcurrent protection
  - Capacitors, inductors for filtering low energy spikes
  - Series diode for reverse battery protection

- Cons:
  - Large size to absorb load dump energy
  - Sloppy, e.g., select SMBJ28A to be above dual-battery jump-start of 26V
    - This TVS breaks at 33V but clamps 13A at 45V, so need 45V downstream circuits
  - Sustained or DC transients can blow fuse or TVS, requiring repairs
  - Reverse protection diode drops voltage, dissipates power
LT4363: Surge Stopper with Current Limit

- Withstands >100V Transients with Input Clamp
- Overcurrent Protection
- 4V to 80V Operating Range
- Adjustable Output Clamp Voltage
- OV/UV Monitoring
- Adjustable Fault Timer
- Reverse Input Protection to −60V

No More Bulky Components!
LTC4366: Floating Surge Stopper

- Rugged Floating Topology
- 9V to >500V Operating Range
- Adjustable Output Clamp Voltage
- 9sec Cool Down Timer
- Adjustable Fault Timer
- 8-Pin TSOT and 3x2 DFN
LTC4366: 160V Application, 800V Surge

**Figure 7. Rectified 110V AC Supply Protected from 220V AC**

**DANGER! Lethal Voltages Present**
LTC4380: Low Quiescent Current Surge Stopper

- 8µA $I_Q$
- 6µA $I_{SHDN}$
- 50mV ± 11% Current Limit
- 12V/1A Clamps @ 27V
- Allows >100V Surges
- Pin-Select (-1/-2 Options) or Adj (-3/-4) Clamp Voltage
- Timer Current Proportional to MOSFET Power

High Value Resistor Allows Small $V_{CC}$ Clamp
No Output Divider Current
Sets Timer Current
Allows >100V Surges
LTC4364: Surge Stopper with Ideal Diode

- Reverse Input Protection to -40V
- >80V Surge Protection
- Ideal Diode for Output Hold-Up and Reverse Protection
- Overcurrent Protection
- Output Port Protection to -20V

V_{IN} 4V to 80V

10\mu A Shutdown Current

V_{OUT}

Adjustable Output Clamp

SHDN

UV

OV

FB

ENABLE

FAULT

TIMER

LTC4364

LINEAR TECHNOLOGY
LT4356: Surge Stopper

- 4V to 80V Operation Range
- Adjustable Output Clamp Voltage
- Overcurrent Protection, Inrush Limiting
- Adjustable Fault Timer
- Reverse Input Protection up to −60V
- Guaranteed Operation −55°C to 125°C (MP Grade)
**LT4356 Options**

<table>
<thead>
<tr>
<th></th>
<th>LT4356-1</th>
<th>LT4356-2</th>
<th>LT4356-3</th>
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<tbody>
<tr>
<td><strong>Shutdown Current</strong></td>
<td>7μA</td>
<td>60μA</td>
<td>7μA</td>
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<tr>
<td><strong>Aux. Amp in Shutdown</strong></td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td><strong>Fault Retry</strong></td>
<td>Retry</td>
<td>Retry</td>
<td>Latchoff</td>
</tr>
<tr>
<td><strong>Temperature Grades</strong></td>
<td>C, I, H, MP</td>
<td>C, I, H, MP</td>
<td>C, I, H</td>
</tr>
<tr>
<td><strong>Packages</strong></td>
<td>4 × 3 DFN-12 MSOP-10 SO-16</td>
<td>4 × 3 DFN-12 SO-16</td>
<td>4 × 3 DFN-12 MSOP-10 SO-16</td>
</tr>
</tbody>
</table>
LTC7860: High Efficiency Switching Surge Stopper

- For High Power (> 5A) Surges
- Normal: 100% Duty Cycle, PFET On
- Input Surge: Switcher w/ Timeout
- Current Limit

- Extendable to 200V+ Input
- Inherent EMI LC Filter
- 4.5% Retry Duty Cycle
- MSOP-12 Exposed Package
LTC7860: Typical Application
# Surge Stopper Selection

<table>
<thead>
<tr>
<th></th>
<th>LT4356</th>
<th>LT4363</th>
<th>LTC4380</th>
<th>LTC4364</th>
<th>LTC4366</th>
<th>LTC7860</th>
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<tbody>
<tr>
<td><strong>Method</strong></td>
<td>Linear</td>
<td>Linear</td>
<td>Gate Clamp</td>
<td>Linear</td>
<td>Linear</td>
<td><strong>Switching</strong></td>
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<td><strong>MOSFET</strong></td>
<td>N-Ch</td>
<td>N-Ch</td>
<td>N-Ch</td>
<td>N-Ch</td>
<td>N-Ch</td>
<td>P-Ch</td>
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<tr>
<td><strong>Operates</strong></td>
<td>4V to 80V</td>
<td>4V to 80V</td>
<td>4V to 72V</td>
<td>4V to 80V</td>
<td>9V to <strong>500V</strong></td>
<td>3.5V to 60V</td>
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<tr>
<td><strong>Protects</strong></td>
<td>100V</td>
<td>100V+</td>
<td>100V+</td>
<td>100V+</td>
<td>500V+</td>
<td>100V+</td>
</tr>
<tr>
<td>$I_{CC} / I_{SHDN}$</td>
<td>1mA/7µA</td>
<td>700µA/7µA</td>
<td><strong>8µA/6µA</strong></td>
<td>370µA/10µA</td>
<td>159µA/5µA</td>
<td>770µA/7µA</td>
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<tr>
<td><strong>$I_{LIM}$</strong></td>
<td>50mV±10%</td>
<td>50mV±10%</td>
<td>50mV±11%</td>
<td>50mV±10%</td>
<td>None</td>
<td>94mV±9.6%</td>
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<tr>
<td><strong>Rev $V_{IN}$</strong></td>
<td>-60V Ext</td>
<td>-60V Ext</td>
<td>-60V Ext</td>
<td>-40V</td>
<td>Externals</td>
<td>Ext PFET</td>
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<tr>
<td><strong>Rev $V_{OUT}$</strong></td>
<td></td>
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<td>-20V</td>
<td></td>
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<tr>
<td><strong>OVP Acc</strong></td>
<td>2%</td>
<td>2%</td>
<td>~10%</td>
<td>2.4%</td>
<td>3%</td>
<td>1.1%</td>
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<tr>
<td><strong>$I_{TMR}$ Vary</strong></td>
<td>FET $V_{DS}$</td>
<td>FET $V_{DS}$</td>
<td>FET Power</td>
<td>FET $V_{DS}$</td>
<td>Fixed</td>
<td>Fixed</td>
</tr>
<tr>
<td><strong>Retry</strong></td>
<td>7%</td>
<td>1%</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.3% (9sec)</td>
<td>4.5%</td>
</tr>
<tr>
<td><strong>Package</strong></td>
<td>MSOP-10, 4x3 DFN-12, SO-16</td>
<td>MSOP-12, 4x3 DFN-12, SO-16</td>
<td>MSOP-10, 3x3 DFN-10</td>
<td>MSOP-16, 4x3 DFN-14, SO-16</td>
<td>3x2 DFN-8, TSOT-8</td>
<td>MSOPE-12</td>
</tr>
</tbody>
</table>
LTC4365: 60V UV, OV & Reverse Input Protection

- 2.5V to 34V Operation
- -40V to 60V Protection
- 125µA $I_Q$, 10µA $I_{SHDN}$
- 36ms or 1ms On Delay Options
- -40°C to 125°C Temp Range
- 8-Pin TSOT-23 & 3x2 DFN
LTC4367: 100V UV, OV & Reverse Input Protection

- 2.5V to 60V Operation
- −40V to 100V Protection
- 70µA $I_Q$, 5µA $I_{SHDN}$
- 32ms or 0.5ms On Delay Options
- −40°C to 125°C Temp Range
- 8-Pin MSOP & 3x3 DFN
LTC4368^{NR}: UV, OV, OC & Reverse Input Protection

- **LTC4367 + Bi-Directional ECB**
- **50mV, 8µs Forward ECB**
- **−50mV/−3mV, 8µs Reverse ECB**
- **Pin-Selectable Latchoff/Retry**
- **80µA I\textsubscript{Q}, 32ms On Delay**
- **10-Pin MSOP & 3x3 DFN**
# Overvoltage Protection Controllers

<table>
<thead>
<tr>
<th></th>
<th>LTC4365</th>
<th>LTC4367</th>
<th>LTC4368&lt;sup&gt;NR&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating Range</strong></td>
<td>2.5V to 34V</td>
<td>2.5V to 60V</td>
<td>2.5V to 60V</td>
</tr>
<tr>
<td><strong>Abs Max Voltage</strong></td>
<td>−40V to 60V</td>
<td>−40V to 100V</td>
<td>−40V to 100V</td>
</tr>
<tr>
<td><strong>I&lt;sub&gt;Q&lt;/sub&gt;, I&lt;sub&gt;SHDN&lt;/sub&gt;</strong></td>
<td>125µA, 10µA</td>
<td>70µA, 5µA</td>
<td>80µA, 5µA</td>
</tr>
<tr>
<td><strong>UV, OV Accuracy</strong></td>
<td>1.5%</td>
<td>1.5%</td>
<td>1.5%</td>
</tr>
<tr>
<td><strong>Forward ECB</strong></td>
<td></td>
<td></td>
<td>50mV</td>
</tr>
<tr>
<td><strong>Reverse ECB</strong></td>
<td></td>
<td></td>
<td>−50mV / −3mV</td>
</tr>
<tr>
<td><strong>Gate Voltage Min</strong></td>
<td>7.4V</td>
<td>10V</td>
<td>10V</td>
</tr>
<tr>
<td><strong>Gate Off Current</strong></td>
<td>50mA</td>
<td>60mA</td>
<td>60mA</td>
</tr>
<tr>
<td><strong>On Delay</strong></td>
<td>36ms / 1ms</td>
<td>32ms / 0.5ms</td>
<td>32ms</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>FAULT#</td>
<td>FAULT#</td>
<td>FAULT#</td>
</tr>
<tr>
<td><strong>Temp Grades</strong></td>
<td>C, I, H</td>
<td>C, I, H</td>
<td>C, I, H</td>
</tr>
<tr>
<td><strong>Package</strong></td>
<td>TSOT23-8, 3x2 DFN-8</td>
<td>MSOP-8, 3x3 DFN-8</td>
<td>MSOP-10, 3x3 DFN-10</td>
</tr>
</tbody>
</table>
LTC4361: 5.8V Overvoltage, Overcurrent Protection

- 2.5V to 5.5V Operation
- Overvoltage Protection Up to 80V
- No Input Capacitor or TVS Required for Most Applications
- 5.8V ± 2%, 1µs Overvoltage Threshold
- 50mV ± 10% Circuit Breaker
- Reverse Voltage Protection Driver
# LTC4360/1/2: 5.8V Overvoltage Protection

<table>
<thead>
<tr>
<th></th>
<th>LTC4360-1 Overvoltage Protection Controller</th>
<th>LTC4360-2 Overvoltage Protection Controller</th>
<th>LTC4361-1/2 Overvoltage/Overcurrent Protection Controller</th>
<th>LTC4362-1/2 Overvoltage/Overcurrent Protector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Range</td>
<td>2.5V to 80V</td>
<td>2.5V to 80V</td>
<td>2.5V to 80V</td>
<td>2.5V to 28V</td>
</tr>
<tr>
<td>Overvoltage Trip Level</td>
<td>5.8V</td>
<td>5.8V</td>
<td>5.8V</td>
<td>5.8V</td>
</tr>
<tr>
<td>N-Channel MOSFET</td>
<td>External</td>
<td>External</td>
<td>External</td>
<td>Internal, 40mΩ Switch</td>
</tr>
<tr>
<td>Reverse Voltage Protection</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Overcurrent Protection</td>
<td>No</td>
<td>No</td>
<td>Yes, Adjustable</td>
<td>Yes, 1.5A</td>
</tr>
<tr>
<td>Overcurrent Fault Retry</td>
<td>−</td>
<td>−</td>
<td>Latchoff/Auto-Retry</td>
<td>Latchoff/Auto-Retry</td>
</tr>
<tr>
<td>Low Current Shutdown</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Power Good Output</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Packages</td>
<td>SC70-8</td>
<td>SC70-8</td>
<td>TSOT-8 2×2 DFN-8</td>
<td>2×3 DFN-8</td>
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</tbody>
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