The semiconductor-based Protection ICs eFuse provide highly integrated functionality in compact-size packages. They offer protection against overcurrent, overvoltage, undervoltage, overtemperature, reverse current as well as inrush protection in Hot-swap and Hot-plug events.

**Benefits**

*Accuracy and Integration*
Provides highly accurate current limiting, faster response time, and more integrated protection, sensing and control features than traditional fuses and PTCs

*Programmable and Customized Designed to Your Request*
Incorporates more flexibility such as adjustable overvoltage threshold, current limiting, and inrush current, along with true reverse current blocking compared to conventional power switches

*Speed Up Time to Market*
Improves product reliability, increased battery life, lower repair costs, and lengthened overall product lifetime.

*Easy System for Quick Understanding*
Easy naming rules for understanding products specification such as operation voltage, current, package type and key functions.

**Overview**

**Figure 1.** Protection ICs eFuse Function Block Diagram

- **Power Supply**
- **Control Logic**
- **Load + R_L**

**Features**

**Over Current Protection**
Once the load current reaches the current limit \( I_{\text{LIMT}} \) programmed by \( I_{\text{LIMT}} \) pin, input current will be automatically reduced to the programmed level to satisfy the limited input power.

**Over Voltage Protection**
Protects the system from being stressed by excessive high voltage. Once it detects input voltage is higher than the built-in over-voltage threshold, it will immediately turn off and clamp the voltage.

**Under Voltage Lockout (UVLO)**
UVLO feature disconnects the load from the supply if the input voltage is lower than the threshold to avoid issues caused by an insufficient supply voltage.

**Over Temperature Protection**
When the device temperature \( T_J \) exceeds \( T_{SHDN} \), the thermal shutdown circuitry shuts down the internal MOSFET, thereby disconnecting the load from the supply. The Protection IC will remain off during a cooling period until the device temperature falls below \( T_{SHDN} \), after which it will attempt to restart.

**Soft Start**
Provides the output voltage slew rate control that can limit the inrush current, and an external capacitor can configure the soft start duration.

**Reverse Current Blocking**
Detects when there is a higher system output voltage than the system input voltage, blocking backward current flow through the system.

**Figure 2.** Easy Naming System Example

- **Part Numbering**
- **Operation Voltage**
- **Current**
- **Package Type**
- **EF: eFuse + OVP**
- **EV: eFuse + OVP + Fault indicator**

**Figure 3.** Illustration Diagrams

- **Fast Trip**
- **Over Completion**
- **Auto-retry**
- **Thermal Shutdown**
- **Thermal Shutdown Recovery**
- **Inrush Current**
- **Soft Start**
- **Reverse Current**
## Applications

The Protection ICs eFuse are ideal for Power Line Protection, Hot-swap, and hot-plug protection as well as protecting current limiter and circuit breaker.

Below is a list of the end equipment’s examples.
- Type-C Adapter
- Networking/Datacom
- Notebook/PC Desktop
- TV/Monitor
- Set Top Box
- Smart Phone
- Industry
- Solid-state Drive (SSD) / Hard Disk Drive (HDD)
- Enterprise Server
- Programmable Logic Control (PLC)
- Battery System
- Telecom
- Appliance
- Tablets

## Available Parts

<table>
<thead>
<tr>
<th>Nominal Voltage</th>
<th>Part Number</th>
<th>Operation Voltage Range</th>
<th>Vmax</th>
<th>Continuous Current</th>
<th>Ron (mΩ)</th>
<th>Over Current Protection</th>
<th>Over Voltage Protection</th>
<th>Over Temperature Protection</th>
<th>Reverse Blocking</th>
<th>Soft Start</th>
<th>Output Discharge</th>
<th>Package</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>5V</td>
<td>LS0505EVD22</td>
<td>2.7 ~ 6</td>
<td>30</td>
<td>5 (Prog*)</td>
<td>50</td>
<td>1 – 5 (Prog*)</td>
<td>6.2</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>DFN2x2_8</td>
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<tr>
<td></td>
<td>LS0504EVT233</td>
<td>2.7 ~ 6</td>
<td>30</td>
<td>4</td>
<td>50</td>
<td>4</td>
<td>6.3</td>
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<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>SOT23-3</td>
<td><img src="image2.png" alt="Image" /></td>
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<tr>
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<td>LS0504EDD12</td>
<td>1.8 ~ 5.5</td>
<td>6</td>
<td>4</td>
<td>26</td>
<td>4.5</td>
<td>6.3</td>
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<td>Yes</td>
<td>Yes</td>
<td>DFN1.2x1.6_4</td>
<td><img src="image3.png" alt="Image" /></td>
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<tr>
<td></td>
<td>LS05006VPQ33</td>
<td>0.5 ~ 5.5</td>
<td>28</td>
<td>0.6</td>
<td>250</td>
<td>No</td>
<td>6 (ICC) 4.5 (SBU)</td>
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<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>QFN3x3_20</td>
<td><img src="image4.png" alt="Image" /></td>
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<td>2.5 ~ 5.5</td>
<td>18</td>
<td>2</td>
<td>100</td>
<td>(Prog*)</td>
<td>6</td>
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<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>DFN3x3_10</td>
<td><img src="image5.png" alt="Image" /></td>
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<tr>
<td>12V</td>
<td>LS1205EVD33</td>
<td>2.7 ~ 18</td>
<td>20</td>
<td>5 (Prog*)</td>
<td>25</td>
<td>1 – 5 (Prog*)</td>
<td>3.8/5.7/14.4</td>
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<td>No</td>
<td>Yes</td>
<td>(Prog*)</td>
<td>DFN3x3_10</td>
<td><img src="image6.png" alt="Image" /></td>
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<td>LS1205EDD33</td>
<td>2.7 ~ 18</td>
<td>20</td>
<td>5 (Prog*)</td>
<td>25</td>
<td>1 – 5 (Prog*)</td>
<td>14.4</td>
<td>Yes</td>
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<td>(Prog*)</td>
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<td>LS12052BD33</td>
<td>2.7 ~ 18</td>
<td>20</td>
<td>5</td>
<td>25</td>
<td>1 – 5</td>
<td>14.4</td>
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<td>Yes</td>
<td>Control pin</td>
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<td>LS2406ERQ23</td>
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<td>30</td>
<td>6 (Prog*)</td>
<td>24</td>
<td>1 – 6 (Prog*)</td>
<td>(Prog*)</td>
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<td>Yes</td>
<td>(Prog*)</td>
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<td>QFN2.5x3.2_16</td>
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<td>LS2406IDD23</td>
<td>2.7 ~ 24</td>
<td>28</td>
<td>5</td>
<td>35</td>
<td>-</td>
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<td>No</td>
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<td>30</td>
<td>6</td>
<td>24</td>
<td>1 – 6</td>
<td>5~24</td>
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<td>(Prog*)</td>
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<td>QFN2.5x3.2_16</td>
<td><img src="image11.png" alt="Image" /></td>
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</tbody>
</table>

**Note:** Prog* means “Programmable”.

## Table 1. Parts List

**Table 2. Parts Key Feature Description**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Key Feature Description</th>
<th>Evaluation Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS0505EVD22</td>
<td>30 V Max Rating, Programmable Current Limit</td>
<td>Available</td>
</tr>
<tr>
<td>LS0504EVT233</td>
<td>30 V Max Rating, Simple Pin-count</td>
<td>-</td>
</tr>
<tr>
<td>LS0504EDD12</td>
<td>Low Ron Small Package</td>
<td>Available</td>
</tr>
<tr>
<td>LS05006VPQ33</td>
<td>Type-C CC/SBU OVP and ESD</td>
<td>-</td>
</tr>
<tr>
<td>LS0502SCD33</td>
<td>SuperCap Management and Protection</td>
<td>Available</td>
</tr>
<tr>
<td>LS1205EVD33</td>
<td>3.8 V / 5.7 V / 14.4 V OVP Programmable Current Limit</td>
<td>Available</td>
</tr>
<tr>
<td>LS1205EDD33</td>
<td>14.4 V OVP Programmable Current Limit</td>
<td>-</td>
</tr>
<tr>
<td>LS12052BD33</td>
<td>14.4 V OVP Programmable Current Limit</td>
<td>Available</td>
</tr>
<tr>
<td>LS2406ERQ23</td>
<td>Programmable OVP / OCP, Reverse Blocking</td>
<td>Available</td>
</tr>
<tr>
<td>LS2406IDD23</td>
<td>Ideal Diode</td>
<td>Available</td>
</tr>
<tr>
<td>LS24062RQ23</td>
<td>Programmable OVP / OCP Bi-directional</td>
<td>Available</td>
</tr>
</tbody>
</table>

### Figure 4.

Protection ICs eFuse Feature Sets and Applications

### Figure 5.

LS0502SCD33 EV Board

For more details about these Evaluation Boards, please contact your Littelfuse local sales.