

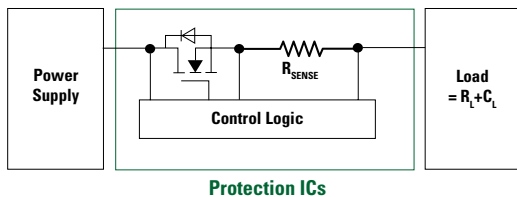
# Protection ICs eFuse Overview

## Overview

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.

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



## 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

Reduces the design-in phase, PC board space requirements, BOM cost, and time-to-market when versus typical discrete solutions (e.g., hot-swap controller + MOSFET)

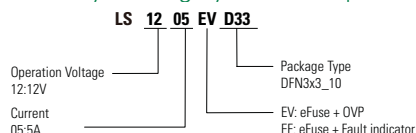
### Maximize Equipment Uptime

Improved 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.

**Figure 2.**  
Easy Naming System Example



## Features

### Over Current Protection

Once the load current reaches the current limit  $I_{LIMIT}$  programmed by  $I_{LIMIT}$  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 TSHDN, 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 TSHDN, after which it will attempt to restart.

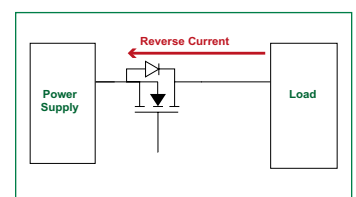
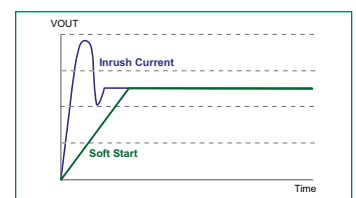
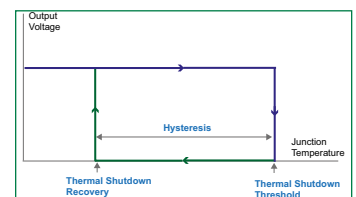
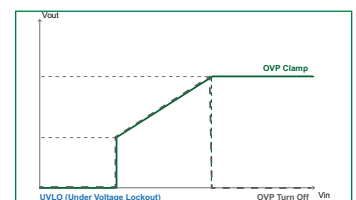
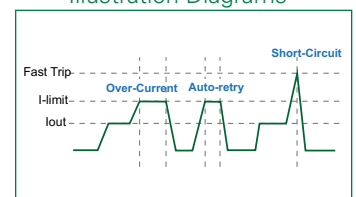
### Soft Start

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 3.**  
Illustration Diagrams



## 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/Datcom
- 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 1.**  
Parts List

Nominal Voltage	Part Number	Operation Voltage Range	V <sub>max</sub>	Continuous Current	R <sub>on</sub>	Over Current Protection	Over Voltage Protection	Over Temperature Protection	Reverse Blocking	Soft Start	Output Discharge	Package	Image
		(V)	(V)	(A)	(mΩ)	(A)	(V)						
5V	<a href="#">LS0505EVD22</a>	2.7 ~ 6	30	5 (Prog*)	50	1 ~ 5 (Prog*)	6.2	Yes	No	Yes	Yes	DFN2x2_8	
	<a href="#">LS0504EVT233</a>	2.7 ~ 6	30	4	50	4	6.2	Yes	No	Yes	Yes	SOT23-3	
	<a href="#">LS0504EDD12</a>	1.8 ~ 5.5	6	4	26	4.5	6.3	Yes	No	Yes	Yes	DFN1.2x1.6_4	
	<a href="#">LS05006VPQ33</a>	0.5 ~ 5	28	0.6	250	No	6 (CC) 4.5 (SBU)	Yes	No	No	No	DFN3x3_20	
	<a href="#">LS0502SCD33</a>	2.5 ~ 5.5	18	2	100	(Prog*)	6	Yes	Yes	No	Yes	DFN3x3_10	
12V	<a href="#">LS1205EVD33</a>	2.7 ~ 18	20	5 (Prog*)	25	1 ~ 5 (Prog*)	3.8/5.7/14.4	Yes	No	(Prog*)	Yes	DFN3x3_10	
	<a href="#">LS1205EFD33</a>	2.7 ~ 18	20	5 (Prog*)	25	1 ~ 5 (Prog*)	14.4	Yes	No	(Prog*)	Yes	DFN3x3_10	
	<a href="#">LS12052BD33</a>	2.7 ~ 18	20	5	25	1 ~ 5	14.4	Yes	Control pin	(Prog*)	Yes	DFN3x3_10	
24V	<a href="#">LS2406ERQ23</a>	3 ~ 24	30	6 (Prog*)	24	1 ~ 6 (Prog*)	(Prog*)	Yes	Yes	(Prog*)	Yes	QFN2.5x3.2_16	
	<a href="#">LS2405IDD23</a>	2.7 ~ 24	28	5	35	-	No	No	Yes	No	No	DFN2x3_8	
	<a href="#">LS24062RQ23</a>	3 ~ 24	30	6	24	1 ~ 6	5~24	Yes	Yes (Bidirectional)	(Prog*)	Yes	QFN2.5x3.2_16	

Note: Prog\* means "Programmable".

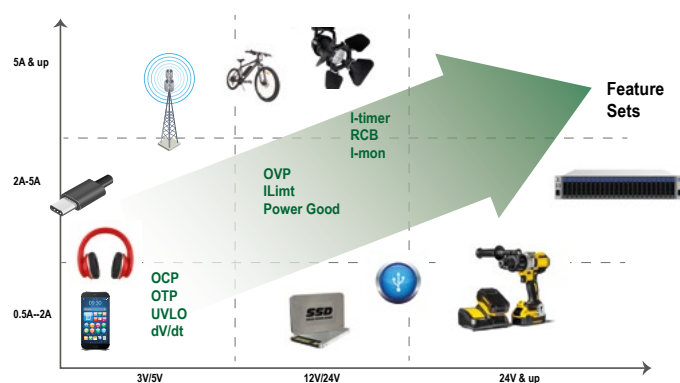
## Evaluation Boards

**Figure 5.**  
[LS0502SCD33 EV. Board](#)



For more details about these Evaluation Boards, please contact your [Littelfuse local sales](#).

**Figure 4.**  
Protection ICs eFuse Feature Sets and Applications



**Table 2.**  
Parts Key Feature Description

Part Number	Key Feature Description	Evaluation Board
LS0505EVD22	30 V Max Rating, Programmable Current Limit	Available
LS0504EVT233	30 V Max Rating, Simple Pin-count	-
LS0504EDD12	Low Ron/Small Package	Available
LS05006VPQ33	Type-C CC/SBU OVP and ESD	-
LS0502SCD33	SuperCap Management and Protection	Available
LS1205EVD33	3.8 V / 5.7 V / 14.4 V OVP, Programmable Current Limit	Available
LS1205EFD33	14.4 V OVP, Programmable Current Limit	-
LS12052BD33	14.4 V OVP, Programmable Current Limit	Available
LS2406ERQ23	Programmable OVP / OCP, Reverse Blocking	Available
LS2405IDD23	Ideal Diode	Available
LS24062RQ23	Programmable OVP / OCP Bi-directional	Available