# 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
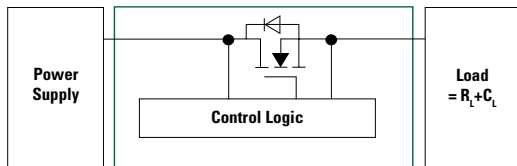
Benefits

Accuracy and Integration
Provides highly accurate current limiting, faster response time, and more integrated protection, sensing and control features.

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 versus typical discrete solutions (e.g., hot-swap controller + MOSFET).
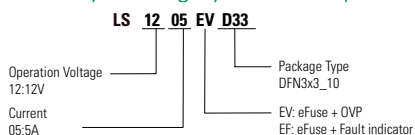
Maximize Equipment Uptime
Improved product reliability, increased battery life, lower repair costs, and lengthened overall product lifetime.

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

Figure 2.
Easy Naming System Example

LS 12 05 EV D33

Operation Voltage
12:12V

Current
05:5A

Package Type
DFN3x3_10

EV: eFuse + OVP
EF: eFuse + Fault indicator

Features

Over Current Protection
Once the load current reaches the current limit I_{LIMT} programmed by I_{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 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.
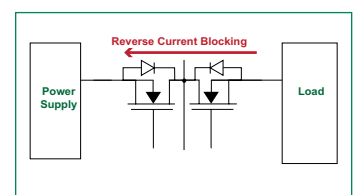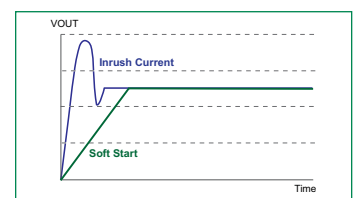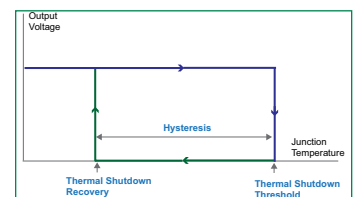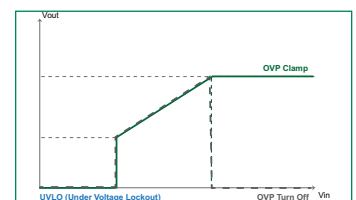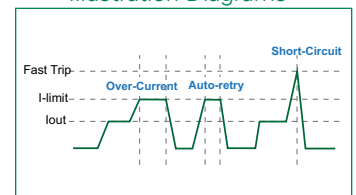
Soft Start
Provides the output voltage slew rate control that can limit the inrush current, and an external capacitor can configure the soft start duration.

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/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

Figure 4.
Protection ICs eFuse Feature Sets and Applications
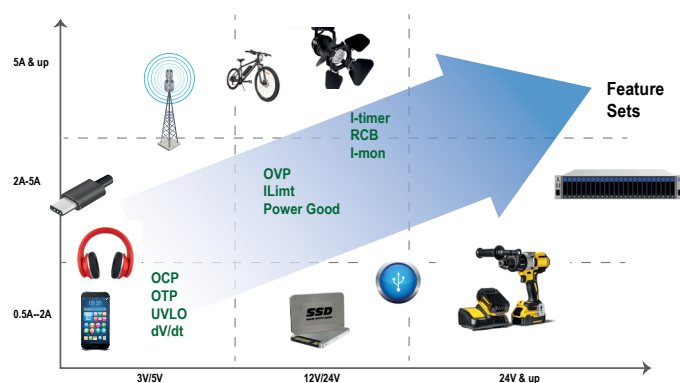
Available Parts

Table 1. Parts List

Nominal Voltage	Part Number	Operation Voltage Range (V)	Vmax (V)	Continuous Current (A)	Ron (mΩ)	Over Current Protection (A)	Over Voltage Protection (V)	Over Temperature Protection	Reverse Blocking	Soft Start	Output Discharge	Package	Image
5V	LS0503EVD22L	2.7 ~ 6	30	3 (Prog*)	100	1~ 3 (Prog*)	5.7	Yes	No	Yes	Yes	DFN2x2_6	
	LS0505EVD22L	2.7 ~ 6	30	5 (Prog*)	50	1~ 5 (Prog*)	5.7	Yes	No	Yes	Yes	DFN2x2_8	
	LS0505EVD22	2.7 ~ 6	30	5 (Prog*)	50	1~ 5 (Prog*)	6.2	Yes	No	Yes	Yes	DFN2x2_8	
	LS0504EVT233	2.7 ~ 6	30	4	50	4	6.2	Yes	No	Yes	Yes	SOT23-3	
	LS0504EDD12	1.8 ~ 5.5	6	4	26	4.5	6.3	Yes	No	Yes	Yes	DFN1.2x1.6_4	
	LS05006VPQ33	0.5 ~ 5	28	0.6	250	No	6 (CC) 4.5 (SBU)	Yes	No	No	No	DFN3x3_20	
	LS0502SCD33	3.3 ~ 5.5	18	2	100	(Prog*)	6	Yes	Yes	No	Yes	DFN3x3_10	
	LS0502SCD33S **	3.3 ~ 5.5	18	2	100	(Prog*)	6	Yes	Yes	No	Yes	DFN3x3_10	
12V	LS1205EVD33	2.7 ~ 18	20	5 (Prog*)	25	1 ~ 5 (Prog*)	3.8/5.7/14.4	Yes	No	(Prog*)	Yes	DFN3x3_10	
	LS1205EFD33	2.7 ~ 18	20	5 (Prog*)	25	1 ~ 5 (Prog*)	14.4	Yes	No	(Prog*)	Yes	DFN3x3_10	
	LS12052BD33	2.7 ~ 18	20	5	25	1 ~ 5	14.4	Yes	Control pin	(Prog*)	Yes	DFN3x3_10	
24V	LS2406ERQ23	3 ~ 24	30	6 (Prog*)	24	1 ~ 6 (Prog*)	(Prog*)	Yes	Yes	(Prog*)	Yes	QFN2.5x3.2_16	
	LS2405IDD23	2.7 ~24	28	5	35	-	No	No	Yes	No	No	DFN2x3_8	
	LS24062RQ23	3 ~ 24	30	6	24	1 ~ 6	5~24	Yes	Yes (Bidirectional)	(Prog*)	Yes	QFN2.5x3.2_16	

Note: Prog* stands for "Programmable". LS0502SCD33S** is for single channel without active balancing.

Evaluation Boards

Figure 5.
LS0502SCD33 EV. Board

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

Table 2. EV. Boards Availability Status

Part Number	Key Feature Description	Evaluation Board
LS0503EVD22L	30 V Max Rating, 3 A, Programmable Current Limit	Available
LS0505EVD22L	30 V Max Rating, 5 A, 5.7 V Programmable Current Limit	Available
LS0505EVD22	30 V Max Rating, 5 A, 6.2 VProgrammable Current Limit	Available
LS0504EVT233	30 V Max Rating, Simple Pin-count	-
LS0504EDD12	Low RonSmall Package	Available
LS05006VPQ33	Type-C CC/SBU OVP and ESD	-
LS0502SCD33	SuperCap Management and Dual Channel Protection	Available
LS0502SCD33S	SuperCap Management and Single Channel 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-driectionl	Available