

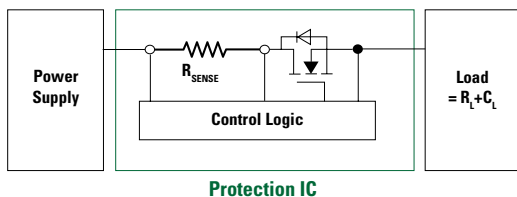
# Protection IC Overview

## Overview

The semiconductor-based Protection IC (eFuse) provides highly integrated functionality in compact-size packages in addition to existing passive overcurrent protection such as fuses and PTCs etc.

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 IC 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.

## 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, typically  $140^{\circ}\text{C}$ , 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  $-20^{\circ}\text{C}$ , after which it will attempt to restart.

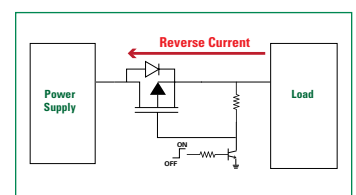
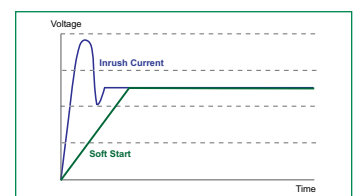
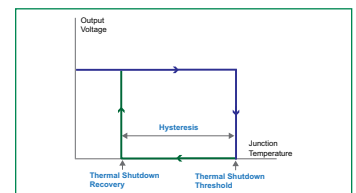
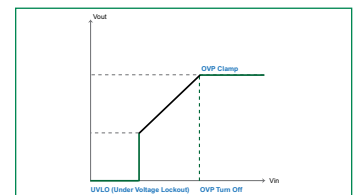
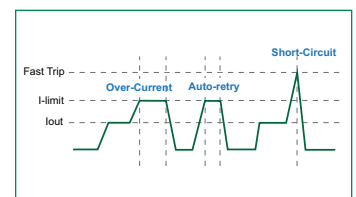
### Soft Start

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.**  
Illustration Diagrams



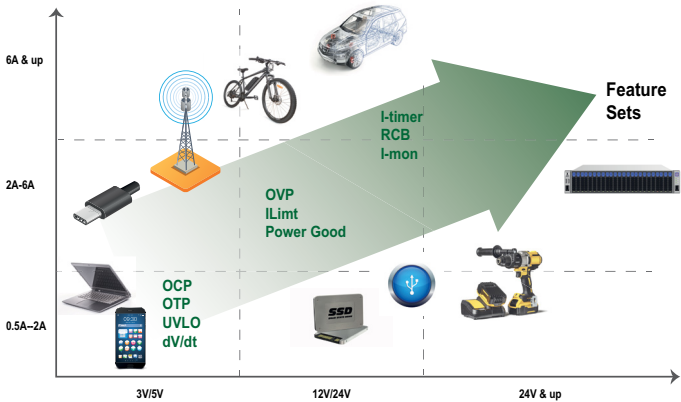
## Applications

The Protection IC 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
- SSD/HDD
- Enterprise Server
- Programmable Logic Control (PLC)
- Battery System
- Telecom
- Appliance
- Tablets

**Figure 3.**  
Protection IC Feature Sets and Applications



## Available Parts

**Table 1.**  
Parts List Table

Nominal Voltage	Part Number	Operation Voltage Range	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
		(V)				(A)	(V)						
5V	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	
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	28	6 (Prog*)	24	1 ~ 6 (Prog*)	(Prog*)	Yes	Yes	(Prog*)	Yes	QFN2.5x3.2_16	
	LS24051DD23**	2.7 ~ 24	28	5	35	-	No	No	Yes	No	No	DFN2x3_8	
	LS24062RQ23**	3 ~ 24	28	6	24	1 ~ 6	5~24	Yes	Yes (Bidirectional)	(Prog*)	Yes	QFN2.5x3.2_16	

Note:  
 1. Prog\* means "Programmable".  
 2. The parts with \*\* are planned to be released by Q4, 2022

## Evaluation Boards

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

**Figure 4.**  
LS0505EVD22 EV. Board  
5V, 5A with 30Vmax & OVP / OCP



**Figure 5.**  
LS1205EVD33 EV. Board  
12V/5V/3.3V with Programmable OCP / OVP



**Figure 6.**  
LS2406ERQ23 EV. Board  
28V, 6A with Reverse Current Blocking

