Working Together for
a Greener Society

Future of Power Electronics and the Earth

Selection Guide for xEV

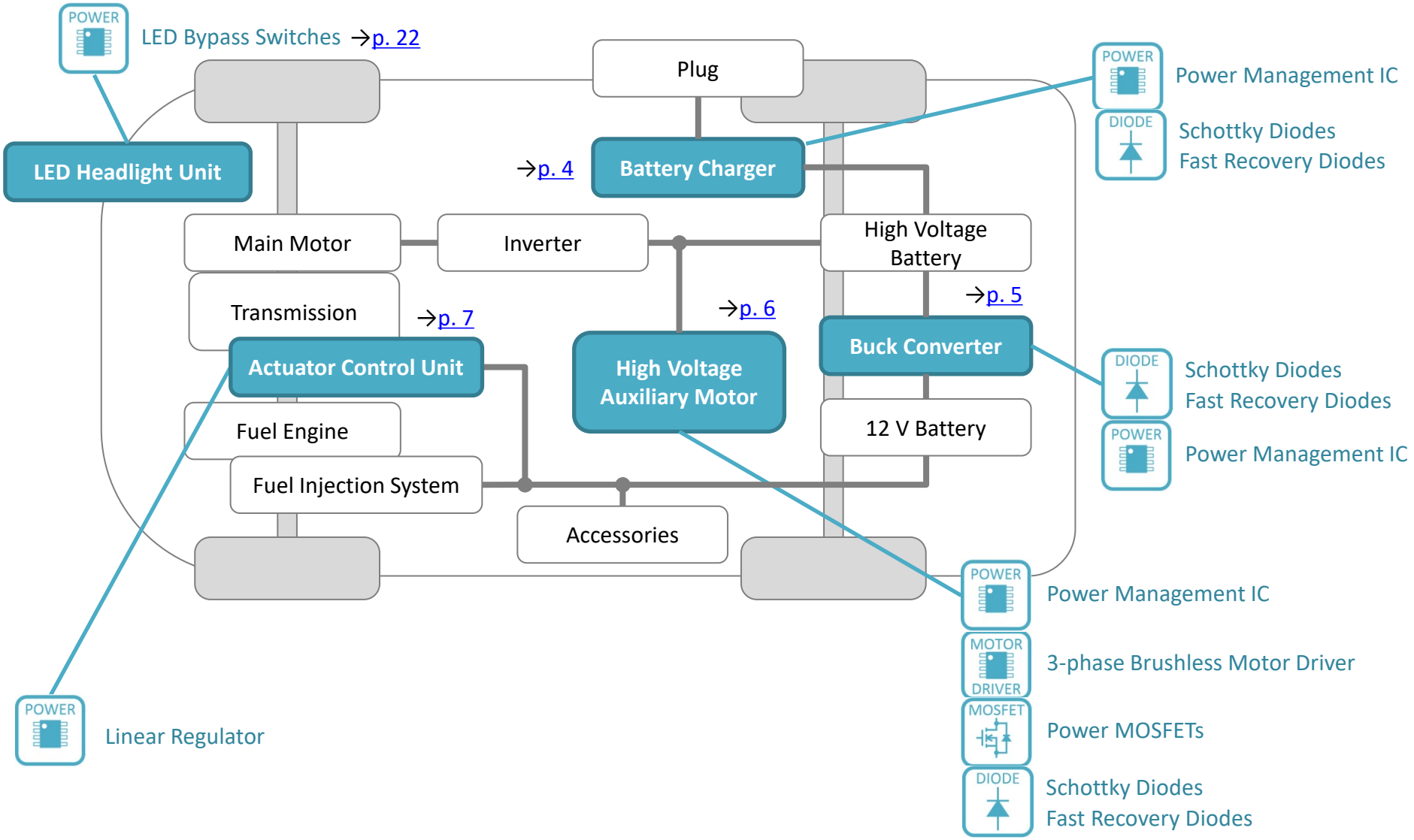
- ICs (For Power Supply, Motor Drive, Linear Solenoid Drive)
- Discrete Devices (Diodes, Power MOSFETs)

All information in this guide is as of the date of publication. Please make sure that you are using the latest version of the guide.
If you need more product information, please refer to our data sheets.
https://www.sanken-ele.co.jp/en

Contents

xEV System

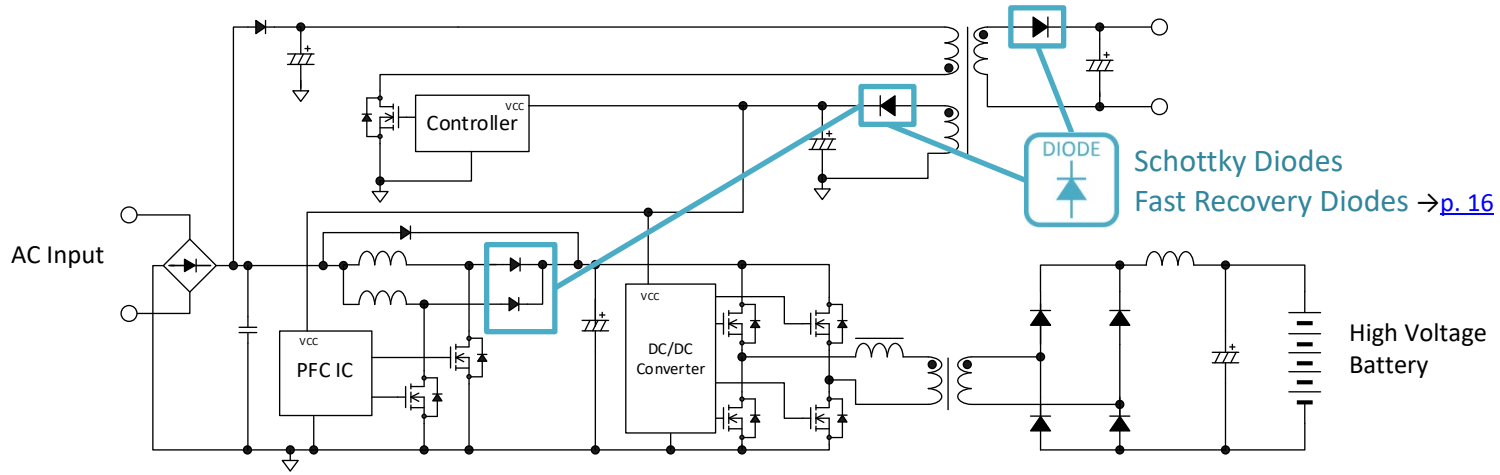
Sanken provides various devices for xEV system that have a high voltage battery.



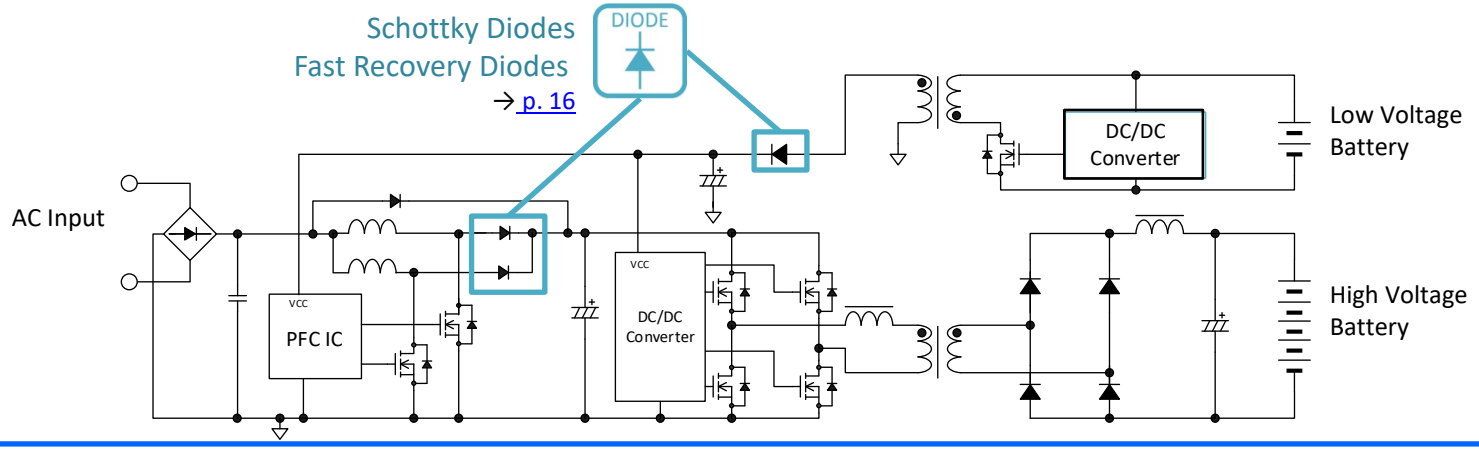
xEV System: Battery Charger System

For the battery charging circuit from a power plug, Sanken provides devices such as auxiliary power supply ICs and rectification diodes.

Auxiliary Power Supply Using AC Input

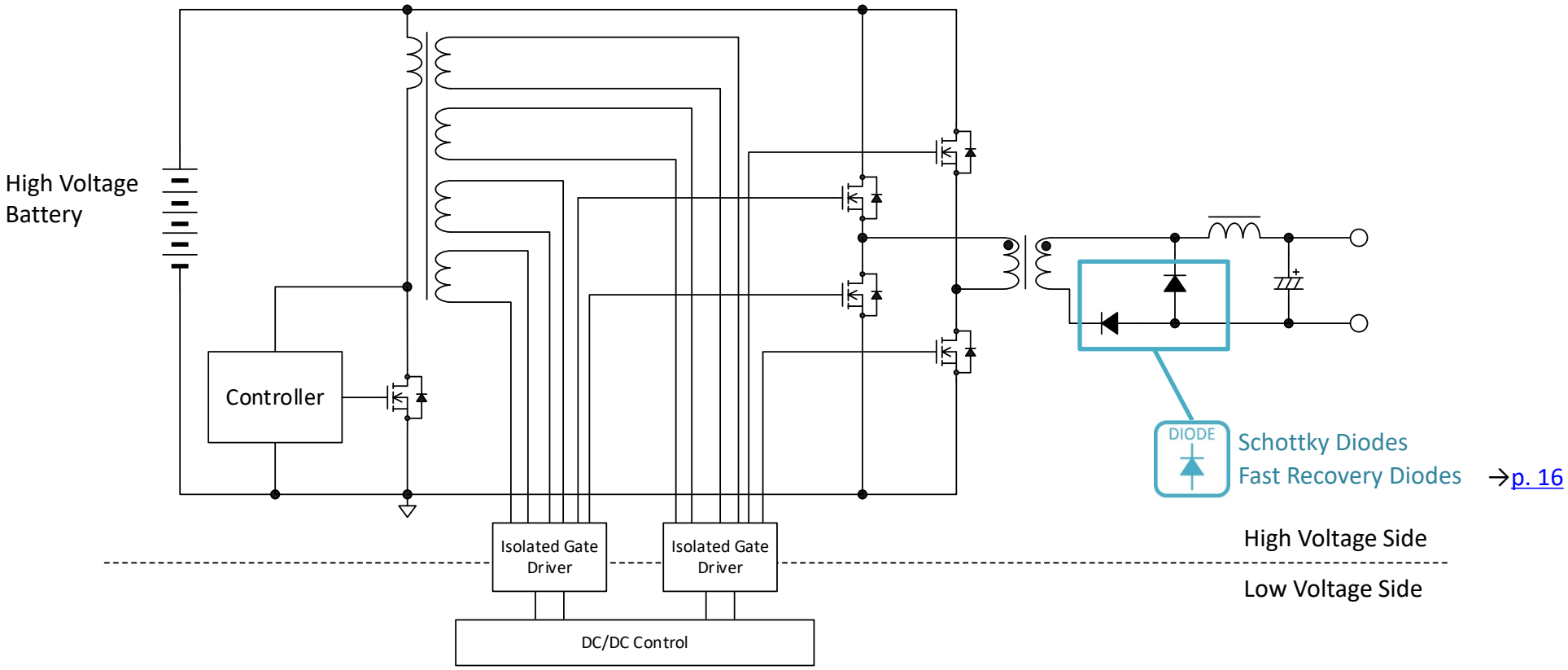


Auxiliary Power Supply Using Battery



xEV System: Buck Converter Circuit

For the buck converter circuit from a high voltage battery, Sanken provides devices such as power management ICs and rectification diodes.



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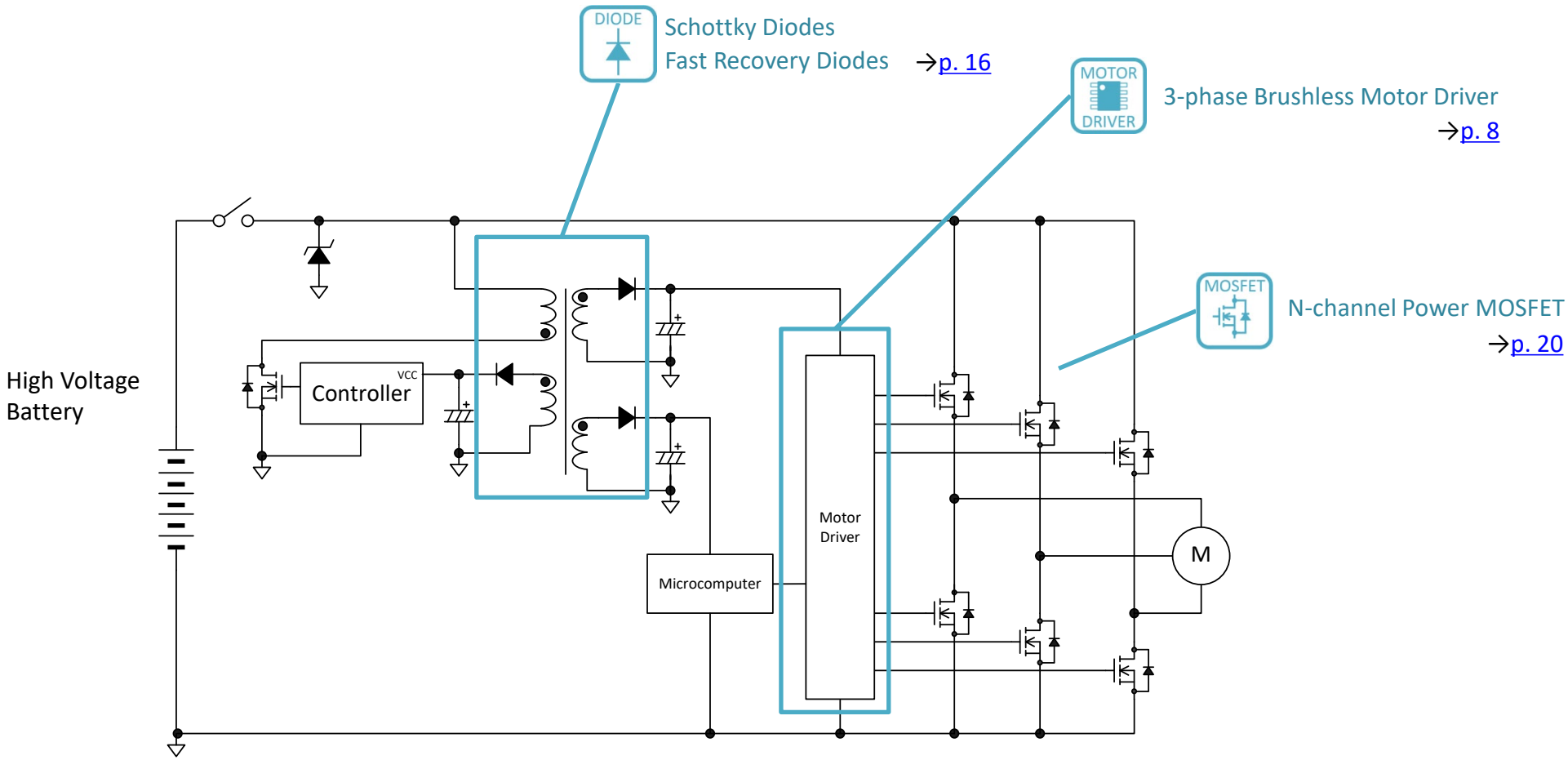
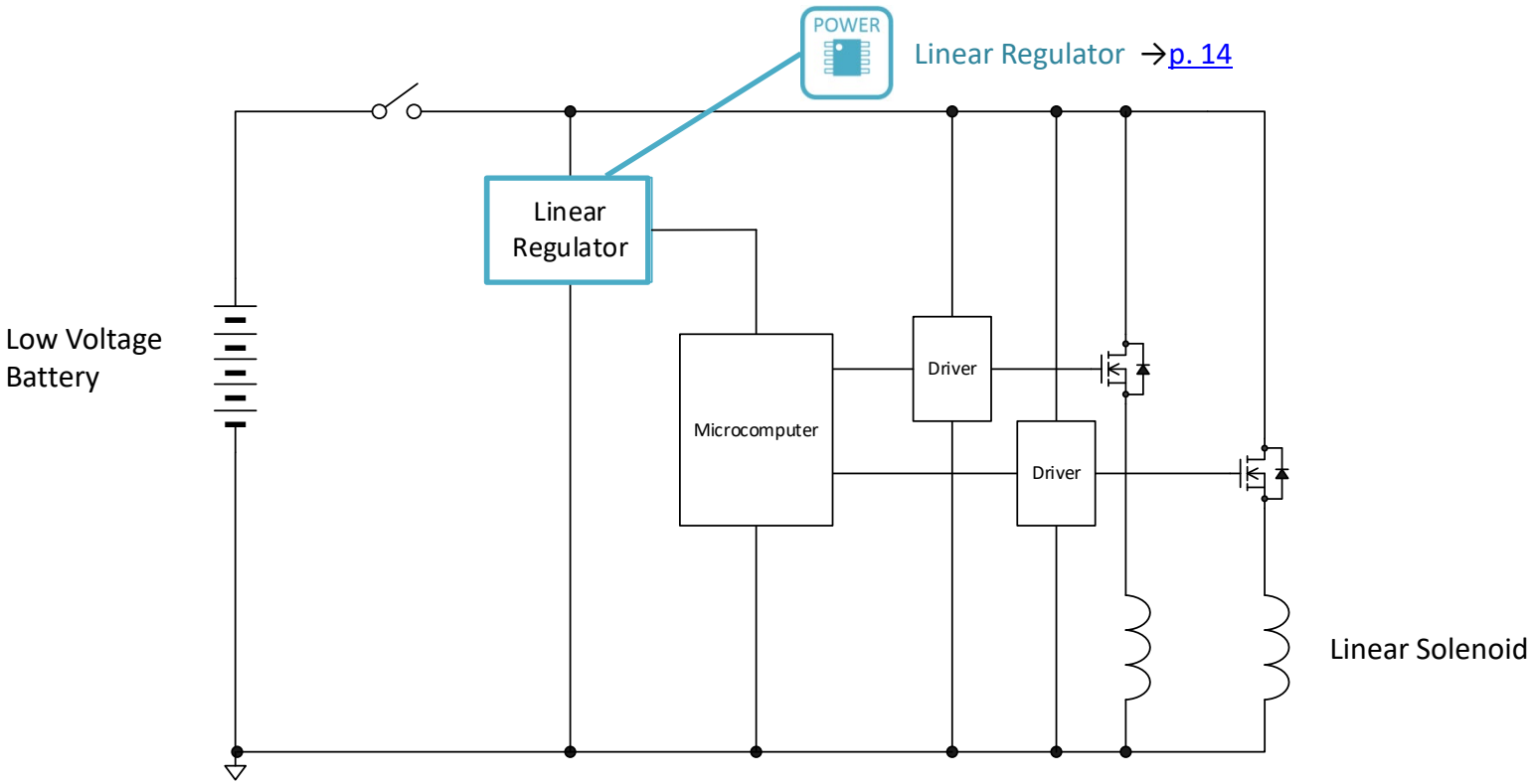
xEV System: High Voltage Auxiliary Motor

For the high voltage auxiliary motor circuit, Sanken provides devices such as power management ICs, motor drive ICs, and discrete devices.



xEV System: Actuator Control Unit (ACU)

For the Actuator Control Unit (ACU) of a linear solenoid valve in the transmission, Sanken provides linear regulators.

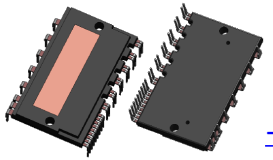


3-phase Brushless Motor Drivers

Sanken's motor drivers for automotive applications are AEC-Q100 or AQG-324 qualified high-quality ICs.
Sanken provides the optimal ICs according to the application and system of the DC motors.

SAM2 Series (Built-in Power MOSFETs)

DIP30（LF2540 / LF2541）



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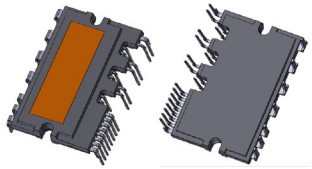
- Built-in IGBTs (650 V, 30 A to 50 A)
- Isolation Voltage: 2500 V (for 1 min)
- Built-in Thermistor
- Built-in Bootstrap Diodes

Applications:
High Voltage Auxiliary Circuit (Compressor, etc.)

SAM4 Series (Built-in Power MOSFETs)

DIP27（LF4550）



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- Built-in IGBTs (700 V, 30 A to 50 A)
- Isolation Voltage: 2500 V (for 1 min)
- Direct Bonding Copper (DBC) Structure with Excellent Heat Dissipation
- Built-in Thermistor
- Built-in Bootstrap Diodes

Applications:
High Voltage Auxiliary Circuit (Compressor, etc.)

SPF6102/SPF6001 (External Power MOSFETs)

SPF6102
HSOP48

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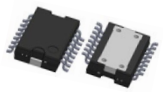
SPF6001
HSOP16



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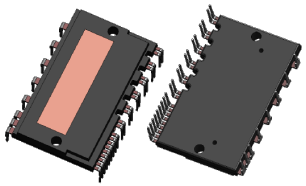
- 3-phase type (SPF6102) and single-phase (SPF6001) are available
- Built-in Bootstrap Diodes
- Built-in Auxiliary Power Supply
- Enable Function

Applications:
Electronic Power Steering (EPS)
Integrated Starter Generator (ISG) Hybrid System
Radiator Pump
Fan for Air Conditioner

SAM265Mx0AA1/AS3 Series

Package



DIP30
- LF2540 (Long Lead Type)
- LF2541 (Short Lead Type)

Features

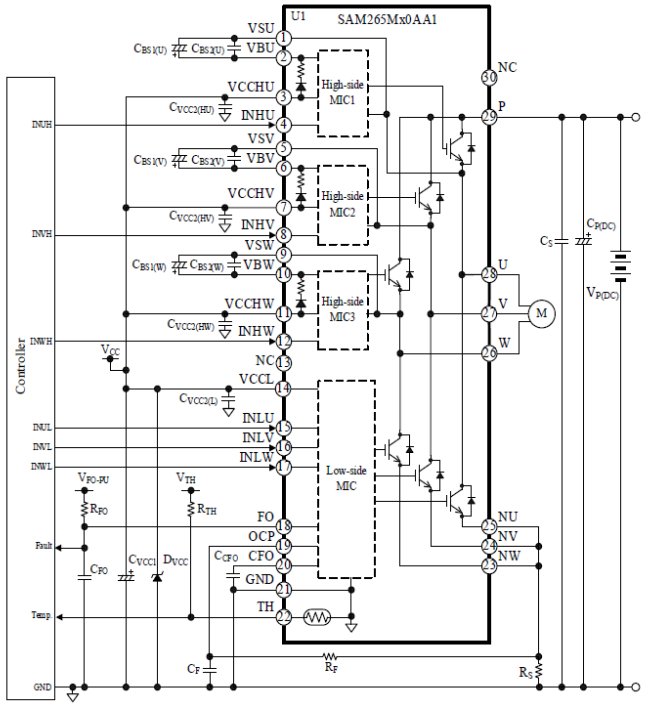
- AEC-Q100 Qualified
- Pb-free (RoHS Compliant)
- Isolation Voltage: 2500 V (for 1 min)
- Built-in Thermistor
- Built-in Bootstrap Diodes
- CMOS-compatible Input (3.3 V or 5 V)
- Fault Signal Output at Protection Activation
- Shutdown Signal Input
- Adjustable OCP Hold Time
- Protection Functions

  Undervoltage Lockout for Power Supply

  - VBx Pin (UVLO_VBx): Auto-restart
  - VCCL Pin (UVLO_VCCL): Auto-restart

  Overcurrent Protection (OCP): Auto-restart

Typical Application



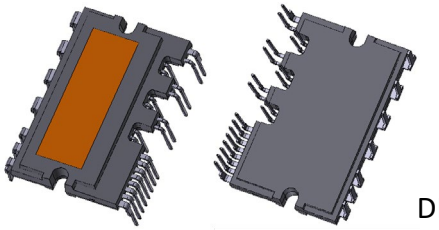
Selection Guide

Part Number	V_{CES}	I_C	$V_{CE(SAT)}$ (Typ.)
SAM265M30AA1	650 V	30 A	1.7 V
SAM265M50AA1	650 V	50 A	1.7 V
SAM265M50AS3*	650 V	50 A	1.8 V

* Under development

SAM470Mx0AF1 Series

Package

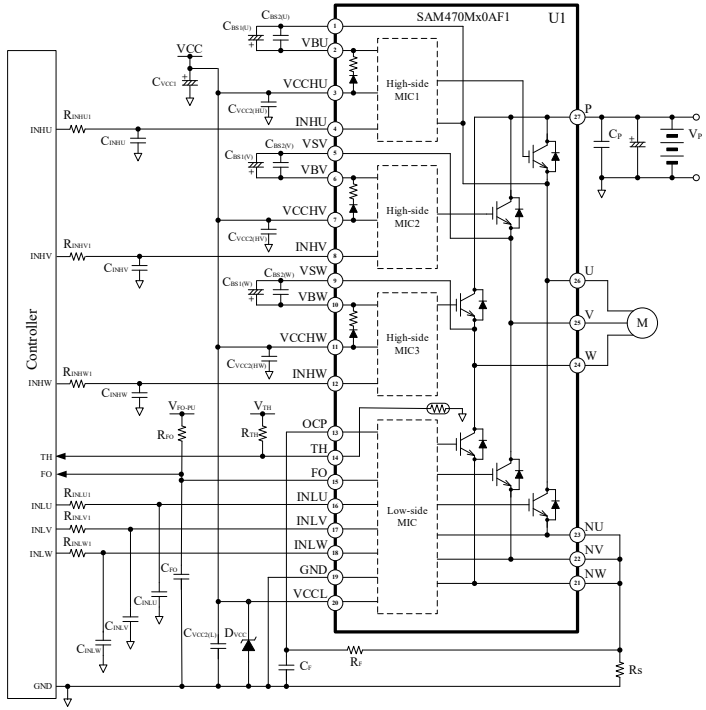


DIP27 (LF4550)

Features

- AQG-324 Qualified
- Pb-free (RoHS Compliant)
- Isolation Voltage: 2500 V (for 1 min)
- Direct Bonding Copper (DBC) Structure with Excellent Heat Dissipation
- Built-in Thermistor
- Built-in Bootstrap Diodes
- CMOS-compatible Input (3.3 V or 5 V)
- Fault Signal Output at Protection Activation
- Protection Functions
  Undervoltage Lockout for Power Supply
  - VBx Pin (UVLO_VBx): Auto-restart
  - VCCL Pin (UVLO_VCCL): Auto-restart
  Overcurrent Protection (OCP): Auto-restart

Typical Application



Selection Guide

Part Number	V_{CES}	I_C	$V_{CE(SAT)}$ (Typ.)
SAM470M30AF1	700 V	30 A	1.55 V
SAM470M50AF1*	700 V	50 A	1.70 V

* Under development

SPF6102

Package

HSOP48

Features

- AEC-Q100 Qualified
- Pb-free (RoHS Compliant)
- Built-in Bootstrap Diodes
- Built-in Auxiliary Power Supply (VREGx)
- Enable Function (All Phases Shutdown with EN = Logic Low)
- Fault Signal Output at Protect Circuit Activated
- Protections

  Simultaneous On-state Prevention

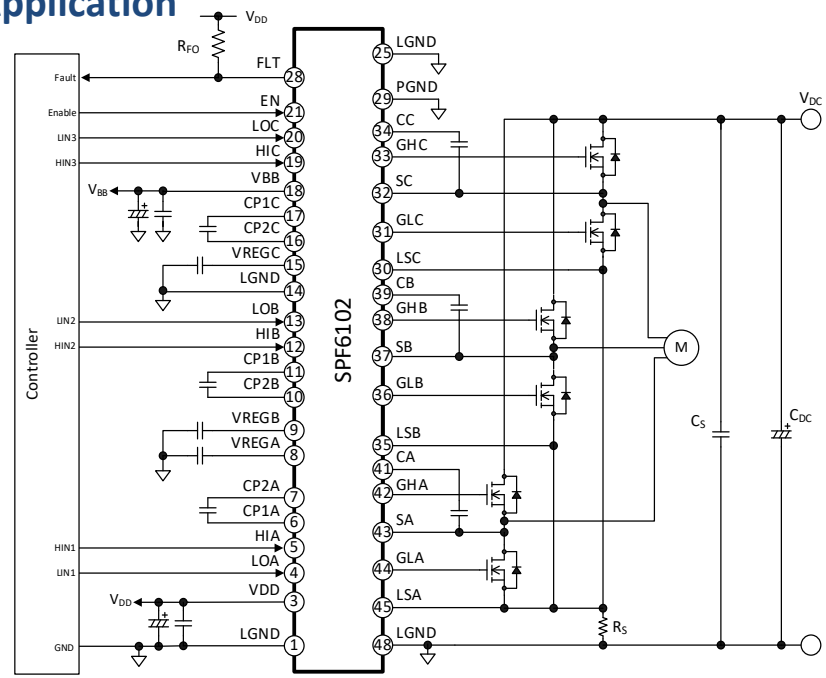
  VBB Pin Overvoltage Protection (VBB_OVP)

  Under Voltage Protection

  - VBB Pin (VBB_UVLO)
  - VDD Pin (VDD_UVLO)
  - VREGx Pin (VREGx_UVLO)

  Thermal Shutdown (TSD)

Typical Application



Specifications

Part Number	V_{DC}	V_{BB}	On-resistance of Internal Driver
SPF6102	150 V	35 V	Sink: 4 Ω (typ.) Source: 5 Ω (typ.)

SPF6001

Package

HSOP16

Features

- AEC-Q100 Qualified
- Pb-free (RoHS Compliant)
- Built-in Bootstrap Diodes
- Built-in Auxiliary Power Supply (VREG)
- Enable Function (All Phases Shutdown with EN = Logic Low)
- Fault Signal Output at Protect Circuit Activated
- Protections

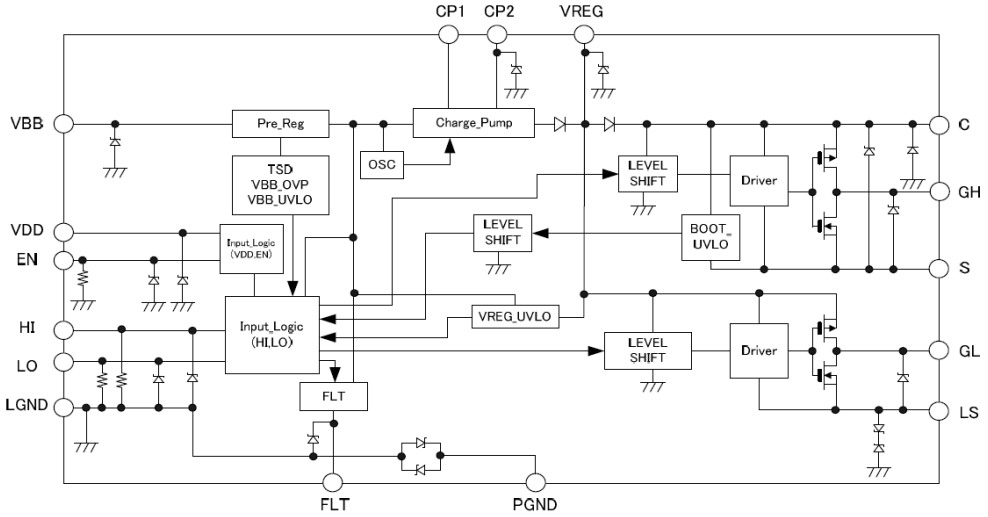
  VBB Pin Overvoltage Protection (VBB_OVP)

  Under Voltage Protection

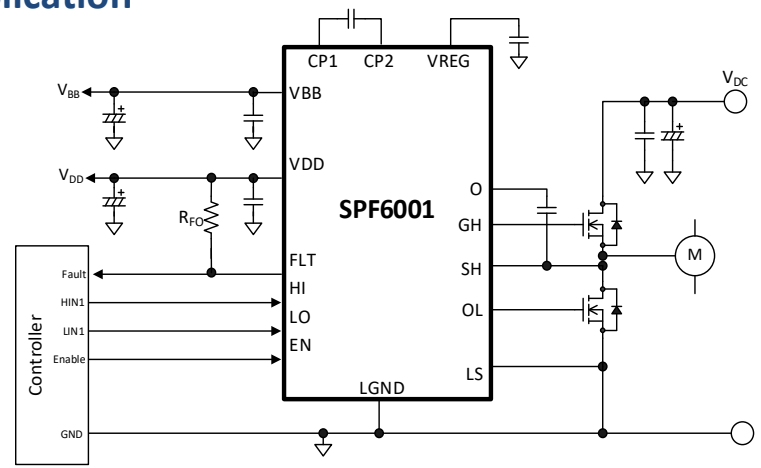
  - VBB Pin (VBB_UVLO)
  - VDD Pin (VDD_UVLO)
  - VREG Pin (VREG_UVLO)

  Thermal Shutdown (TSD)

Block Diagram



Typical Application



Power Management ICs

Sanken's power management ICs for automotive applications are AEC-Q100 qualified high-quality ICs.
Sanken provides the optimal ICs according to the application and system of a power supply.

Two Outputs Linear Regulator

◆SPF3000 Series

- One Input, Two Outputs Linear Regulator
- Built-in Power MOSFET
  I_O = 0.2 A to 0.4 A
  V_{IN} = 35 V

HSOP16

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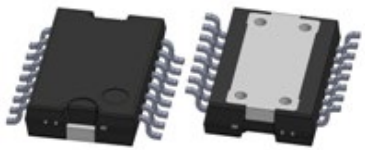
For the buck converters used in:
- Inverter
- On Board Charger (OBC)
- Battery Management System (BMS)

SPF3000 Series

Package

SOP16



Applications

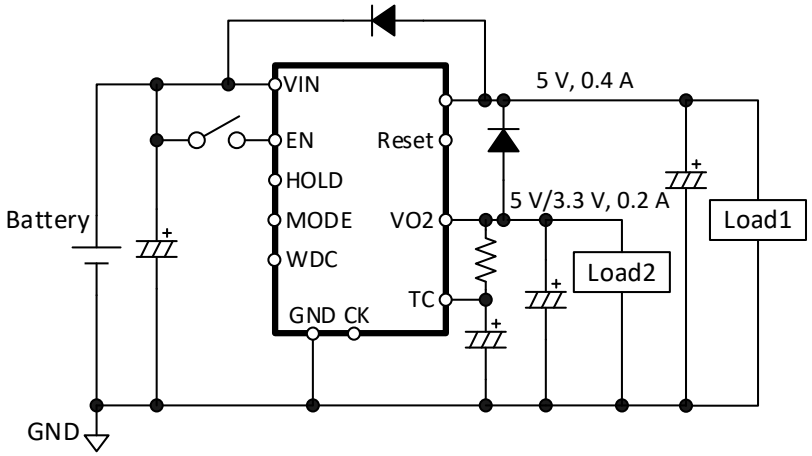
For the buck converters used in:

- Inverter
- On Board Charger (OBC)
- Battery Management System (BMS)

Features

- One Input, Two Outputs Linear Regulator
- AEC-Q100 Qualified
- Pb-free (RoHS Compliant)
- High Accuracy Output Voltage (Output 1: ±2%)
- Power-on Reset Function
- Built-in Watchdog Timer
- Enable Function
- Protections
  Overcurrent Protection: Drooping
  Thermal Shutdown (Output 1)

Typical Application



Selection Guide

Part Number	Output 1		Output 2		V_{IN} (max.)	P_D
	I_O	V_O	I_O	V_O		
SPF3006	0.4 A	5.0 V	0.2 A	5.0 V	35 V	3 W
SPF3009	0.4 A	5.0 V	0.2 A	3.3 V		

Diodes

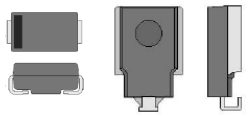
Sanken provides the optimal diodes according to the automotive application.
The TVS diodes have high surge capability, and protect automotive electronic units, especially from the surge generated during load dump conditions and voltage transients induced by inductive loads. These are provided in high thermal dissipation package.
The various diodes for high speed switching such as switching power supply are provided.

Features

- AEC-Q101 Qualified
- T_J = 175 °C Capability Suitable for High Reliability and Automotive Requirement
- Flammability UL94V-0 (Equivalent)
- Bare Lead Frame: Pb-free (RoHS Compliant)

TVS Diodes

- P_D = 1 W to 6 W
- For Circuit using 12 V or 24 V Battery
- Meets the Surge Protection Requirements in ISO7637-2



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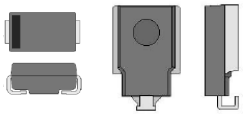
Schottky Diodes

- V_{RM} = 40 V to 150 V
- $I_{F(AVG)}$ = 1 A to 3 A, and 45 A to 65 A



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Fast Recovery Diodes

- V_{RM} = 200 V to 600 V
- 1 A to 3 A

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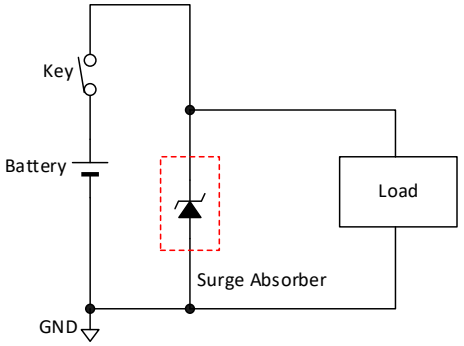
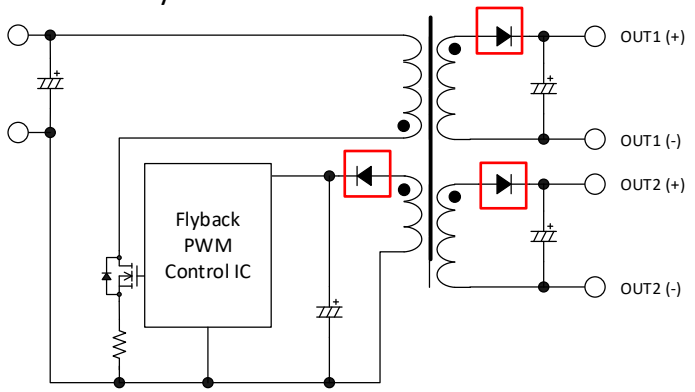
Typical Application

◆TVS Diodes



◆Schottky Diodes
◆Fast Recovery Diodes



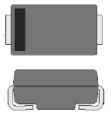
TVS Diodes

Features

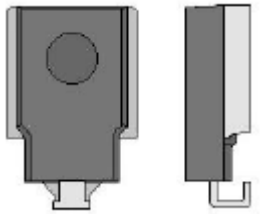
- AEC-Q101 Qualified
- Meets the Surge Protection Requirements in ISO7637-2
- for High Reliability and Automotive Requirement
- SZ-10 Series: T_J = 175 °C Capability Suitable
- Flammability UL94V-0 (Equivalent)
- Bare Lead Frame: Pb-free (RoHS Compliant)

Packages

SJP



SZ-10



Selection Guide

P_D	Part Number	V_Z (min.)	V_Z (max.)	I_{RSM}	I_R	Package	ISO7637-2
1 W	SJPZ-K20	18.8 V	21.2 V	—	10 µA	SJP	Pulse 1 to 3
	SJPZ-K28	25.0 V	31.0 V	2 A	10 µA		
2 W	SJPZ-N18	16.8 V	19.1 V	—	1 µA		
	SJPZ-N27	25.1 V	28.9 V	—	1 µA		
	SJPZ-N33	31.0 V	35.0 V	—	1 µA		
5 W	SZ-10N27	24.0 V	30.0 V	70 A	10 µA	SZ-10	Pulse 5a
6 W	SZ-10NN27	24.0 V	30.0 V	90 A	10 µA		
	SZ-10NN40	36.0 V	44.0 V	70 A	10 µA		

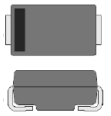
Schottky Diodes

Features

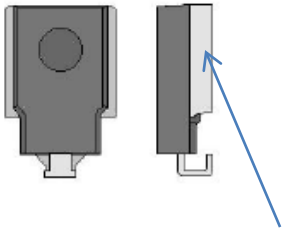
- AEC-Q101 Qualified
- Guaranteed Avalanche Energy for SZ-10EF
- Flammability UL94V-0 (Equivalent)
- Bare Lead Frame: Pb-free (RoHS Compliant)

Packages

SJP



SZ-10



Selection Guide

Package	V_{RM}	$I_{F(AVG)}$	Part Number	I_{FSM} (50 Hz Half-wave)	V_F	
					V_F (max.)	I_F Condition
SJP	40 V	1 A	SJPB-D4	30 A	0.55 V	1 A
		2 A	SJPE-H4	40 A	0.60 V	2 A
		2 A	SJPB-H4	50 A	0.55 V	2 A
		3 A	SJPB-L4	60 A	0.55 V	3 A
	60 V	1 A	SJPB-D6	20 A	0.68 V	1 A
		2 A	SJPB-H6	40 A	0.69 V	2 A
		3 A	SJPB-L6	50 A	0.70 V	3 A
	90 V	1 A	SJPB-D9	20 A	0.85 V	1 A
		2 A	SJPB-H9	40 A	0.85 V	2 A
	150 V	3 A	SJPE-L15	40 A	0.95 V	3 A
		5 A	SJPE-T15	75 A	0.95 V	5 A
SZ-10	80 V	45 A	SZ-10EF	300 A	0.82 V	45 A

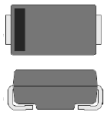
Fast Recovery Diodes

Features

- AEC-Q101 Qualified
- Flammability UL94V-0 (Equivalent)
- Bare Lead Frame: Pb-free (RoHS Compliant)

Package

SJP



Selection Guide

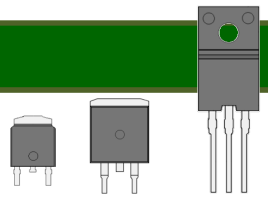
V_{RM}	$I_{F(AVG)}$	Part Number	I_{FSM} (50 Hz Half-wave)	V_F		t_{rr} $I_F : I_R = 1 : 1$
				V_F (max.)	I_F Condition	
200 V	1.0 A	SJPL-D2	25 A	0.98 V	1.0 A	50 ns
	1.5 A	SJPX-F2	30 A	0.98 V	1.5 A	30 ns
	2.0 A	SJPL-H2	25 A	0.98 V	2.0 A	50 ns
	3.0 A	SJPL-L2	60 A	0.98 V	3.0 A	50 ns
300 V	2.0 A	SJPX-H3	20 A	1.3 V	2.0 A	30 ns
400 V	1.5 A	SJPL-F4	25 A	1.3 V	1.5 A	50 ns
	3.0 A	SJPL-L4	30 A	1.3 V	3.0 A	50 ns
500 V	1.0 A	SJPD-D5	20 A	1.4 V	1.0 A	40 ns
	3.0 A	SJPD-L5	50 A	1.4 V	3.0 A	50 ns
600 V	2.0 A	SJPL-H6	30 A	1.5 V	2.0 A	50 ns
	2.0 A	SJPX-H6	20 A	1.5 V	2.0 A	30 ns

Power MOSFETs

Sanken provides various power MOSFETs according to the automotive application.
The high-quality power MOSFETs have low on-resistance, and are optimal for the automotive applications including inverters and switch.

N-channel Power MOSFETs

- V_{DSS} = 40 V to 300 V
- I_D = ±20 A to ±100 A



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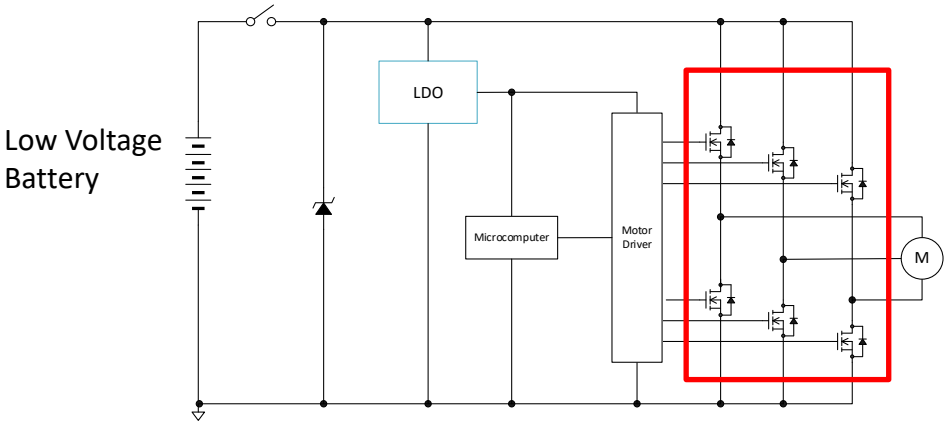
Features

- AEC-Q101 Qualified
- Bare Lead Frame: Pb-free (RoHS Compliant)
- Guaranteed Avalanche Energy

Applications

- Motor Drive
- Injection Switch
- Power Management Circuit

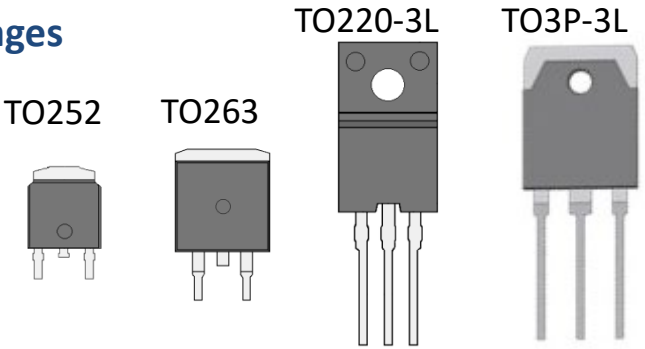


N-channel Power MOSFETs

Features

- V_{DSS} = 40 V to 300 V
- Low On-resistance
- AEC-Q101 Qualified
- Bare Lead Frame: Pb-free (RoHS Compliant)
- Guaranteed Avalanche Energy

Packages



Selection Guide

V_{DSS}	I_D	Part Number	Package	P_D	V_{GSS}	V_{TH} (max.)	C_{iss} (V_{DS} = 10 V, V_{GS} = 0 V)	C_{rss} (V_{DS} = 10 V, V_{GS} = 0 V)	$R_{DS(ON)}$ (max.)
40 V	±70 A	2SK3801	TO3P-3L	100 W	±20 V	4.0 V	5100 pF	860 pF	6 mΩ
		FLD470	TO220F-3L	35 W					
60 V	±70 A	2SK3711	TO3P-3L	130 W	±20 V	4.0 V	8000 pF	1000 pF	6 mΩ
	±100 A	2SK4161D	TO3P-3L	132 W	±20 V	4.0 V	10000 pF	1000 pF	4.8 mΩ
100 V	±20 A	DKG1020	TO252	40 W	±20 V	2.5 V	2200 pF	110 pF	52 mΩ
300 V	±15 A	SUK3015	TO263	89 W	±20 V	2.5 V	1800 pF	85 pF	150 mΩ

Other Devices

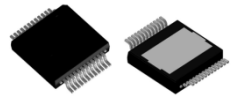
LED Headlight Driver

Sanken's LED headlight driver is a bypass switch for the highbrightness matrix LEDs used in applications such as automotive headlights. Each LED has open and short detections that can send fault flags to the CPU.

◆SPF5047

- 4 Series LED Bypass Switches
- V_{POS} = −65 V, $R_{DS(ON)}$ = 120 mΩ
- LED Open / Short Detection

HSOP24



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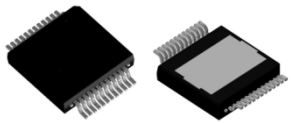
SPF5047

Package

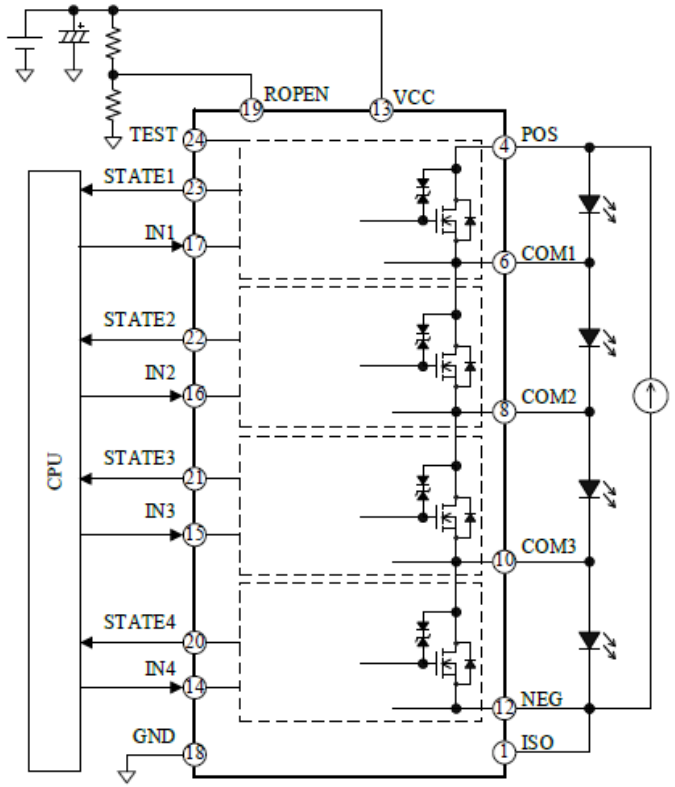
HSOP24



Features

- Four Series LED Bypass Switches
- Drives Up to 16 LEDs in Series
  (with 4 ICs; at VF of an LED is approx. 3 V)
- Low Noise:
  No charge-current-induced noise occurs as each gate driver uses a negative power source which requires no charge-pump circuit.
- High Efficiency:
  Optimized trade-offs between switching loss and switching noise allow highly-accurate control in tr and tf.
- Fault Flag Reporting
- LED Open Detection
- LED Short Detection

Typical Application



Specifications

Part Number	V_{POS}	I_{OUT}	$R_{DS(ON)}$
SPF5047	−65 V (max.)	2 A (max.)	120 mΩ (typ.)

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