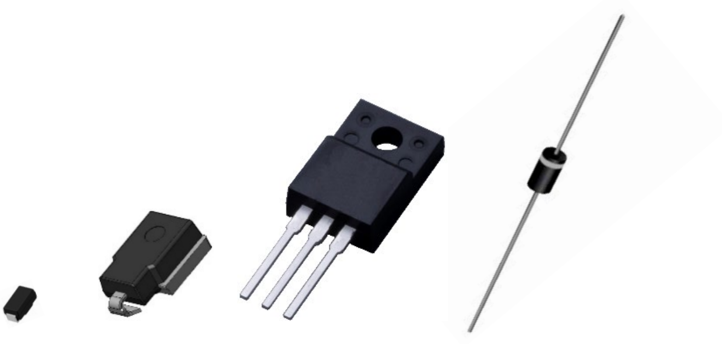
Working Together for
a Greener Society

Future of Power Electronics and the Earth

Diode Selection Guide

Outline

- ■ **Off-line Non-isolated Circuit（Buck/Buck-boost)**
  - ✓ Freewheeling Diode
- ■ **Off-line Isolated Circuit (Flyback)**
  - ✓ Secondary-side Rectifier Diode
  - ✓ Auxiliary Switch Diode for Snubber (SARS Series)
- ■ **Current Resonant Circuit**
  - ✓ Bootstrap Diode
  - ✓ Secondary-side Rectifier Diode
- ■ **PFC Circuit**
  - ✓ Bypass Diode
  - ✓ Boost Diode



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

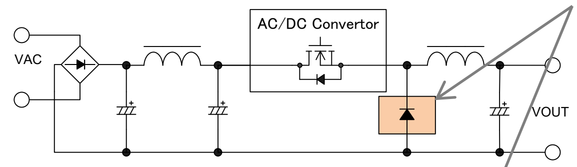
Diodes by Application

This guide introduces Sanken's diodes used for peripheral power supply circuits.
Please visit our website to learn more about our diode products.

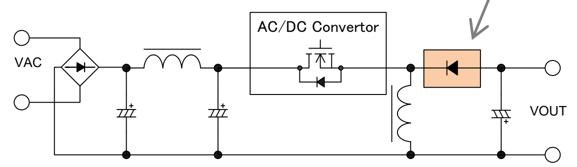
Off-line Non-isolated Circuit (Buck/Buck-boost)

- Low Power Application
- Motor Control Power Supply
- Auxiliary Power Supply
- LED Lighting, etc.

Off-line Buck Converter



Off-line Buck-boost Converter

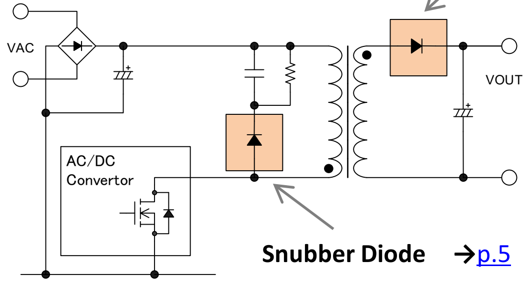


Freewheeling Diode

- Fast recovery diode
  →p.4

Off-line Isolated Circuit (Flyback)

- Low to Middle Power Application
- Adapter
- Auxiliary Power Supply
- LED Lighting, etc.



Secondary-side Rectifier Diode

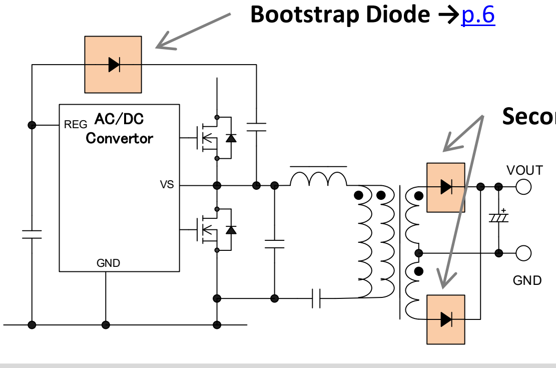
- Schottky diode
  →p.3
- Fast recovery diode
  →p.4

Snubber Diode →p.5

Current Resonant Circuit

- High Power Application
- Office Automation and Audiovisual Equipment
- Industrial Equipment
- LED Street Light, etc.

Bootstrap Diode →p.6



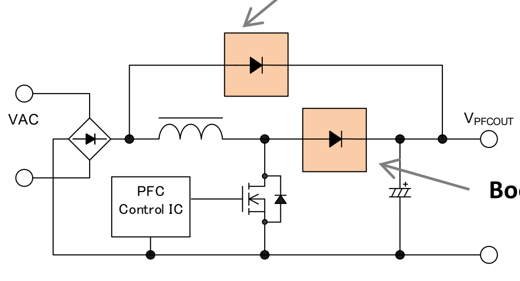
Secondary-side Rectifier Diode

- Schottky diode
  →p.3
- Fast recovery diode
  →p.4

Power Factor Correction (PFC)

- Application of ≥75 W
- Industrial Equipment
- LED Lighting, etc.

Bypass Diode → p.7



Boost Diode →p.8

Sanken

Schottky Diodes

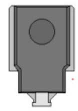
Features

- V_{RM} = 60 V to 150 V
- I_F = 1 A to 45 A
- $V_F \leq$ 1.1 V

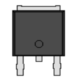
Packages

SJP

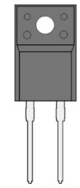
SZ-E10



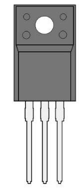
TO252-2L



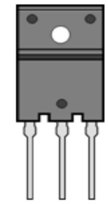
TO220F-2L



TO220F-3L



TO3PF-3L



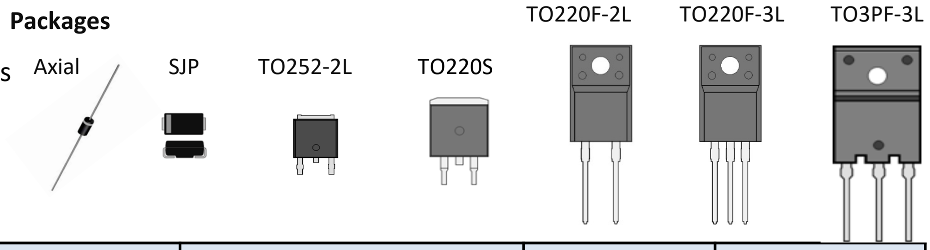
V_{RM}	$I_{F(AV)}$	Part Number	Package	V_F (max.)	I_R	H・I_R
40 V	1 A	**SJPB-D4**	SJP	0.55 V	0.1 mA	35 mA
	2 A	**SJPB-H4**		0.55 V	0.2 mA	70 mA
	3 A	**SJPB-L4**		0.55 V	0.3 mA	100 mA
60 V	1 A	**SJPB-D6**	SJP	0.68 V	0.1 mA	30 mA
	2 A	**SJPB-H6**		0.69 V	0.2 mA	55 mA
	3 A	**SJPB-L6**		0.70 V	0.3 mA	70 mA
	6 A	**FMB-G16L**	TO220F-2L	0.72 V	5.0 mA	200 mA
	15 A	**FMW-2156**	TO220F-3L	0.70 V	5.0 mA	175 mA
	30 A	**FMB-2306**		0.70 V	8.0 mA	400 mA
		FMW-4306	TO3PF-3L	0.70 V	3.0 mA	350 mA
80 V	20 A	**FMEN-2208**	TO220F-3L	0.76 V	0.2 mA	100 mA
	30 A	**FMEN-2308**		0.765 V	0.3 mA	150 mA
	45 A	**SZ-10EF**	SZ-10	0.82 V	0.05 mA	50 mA
90 V	1 A	**SJPB-D9**	SJP	0.85 V	0.1 mA	30 mA
	2 A	**SJPB-H9**		0.85 V	0.2 mA	55 mA
100 V	10 A	**FMES-21010**	TO220F-3L	0.85 V	0.035 mA	18 mA
	20 A	**FMES-22010**		0.85 V	0.07 mA	35 mA
	30 A	**FMES-23010**	TO220F-3L	0.85 V	0.10 mA	50 mA
		FMEN-430A	TO3PF-3L	0.85 V	0.3 mA	150 mA
	40 A	**FMES-24010**	TO220F-3L	0.85 V	0.15 mA	75 mA
150 V	3 A	**SJPE-L15**	SJP	0.95 V	0.06 mA	15 mA
	5 A	**SJPE-T15**		0.95 V	0.1 mA	25 mA
	10 A	**FMEN-210B**	TO220F-3L	0.92 V	0.1 mA	25 mA
		SPET-21015	TO252-2L	0.98 V	0.05 mA	25 mA
	15 A	**SPET-21515**		0.98 V	0.07 mA	35 mA
	20 A	**FMEN-220B**	TO220F-3L	0.95 V	0.2 mA	50 mA
	30 A	**FME-230B**		0.95 V	0.3 mA	75 mA

Fast Recovery Diodes

Features

- Fast Recovery Characteristics
  $t_{rr} \leq 100$ ns
- V_{RM} = 200 V to 600 V
- I_F = 0.5 A to 20 A

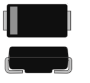
Packages



V_{RM}	$I_{F(AVG)}$	Part Number	Package	V_F	t_{rr} (I_F : I_R=1 : 1)
200 V	1 A	**SJPL-D2**	SJP	0.98 V	50 ns
	1.5 A	**SJPX-F2**	SJP	0.98 V	30 ns
	2 A	**SJPL-H2**	SJP	0.98 V	50 ns
	3 A	**SJPL-L2**	SJP	0.98 V	50 ns
	5.0 A	**FML-G12S**	TO220F-2L	0.98 V	40 ns
		FMX-12S	TO220F-3L	0.98 V	30 ns
	10 A	**MPL-102S**	TO220S	0.98 V	40 ns
		SPXS-2102S	TO252	1.25 V	30 ns
		FMX-22S	TO220F-3L	0.98 V	30 ns
		FMX-12SL	TO220F-3L	1.25 V	30 ns
		FMX-G22S	TO220F-2L	0.98 V	30 ns
	15 A	**FMX-22SL**	TO220F-3L	0.98 V	30 ns
	20 A	**FMX-4202S**	TO3PF-3L	0.98 V	30 ns
		FMXA-2202S	TO220F-3L	1.20 V	25 ns
		MP2-202S	TO220S-2L	0.90 V	50 ns
300 V	2 A	**SJPX-H3**	SJP	1.30 V	30 ns
	5 A	**FML-G13S**	TO220F-2L	1.30 V	50 ns
	10 A	**FMX-23S**	TO220F-3L	1.30 V	30 ns
	20 A	**FMXA-2203S**	TO220F-3L	1.30 V	25 ns
		FMXA-4203S	TO3PF-3L	1.30 V	25 ns
		FMX-4203S	TO3PF-3L	1.30 V	30 ns
400 V	0.7 A	**AG01**	Axial (ϕ2.4×2.9L/ϕ0.57)	1.80 V	100 ns
		EG01	Axial (ϕ2.7×5.0L/ϕ0.6)	2.00 V	100 ns
	0.8 A	**EG1**	Axial (ϕ2.7×5.0L/ϕ0.78)	1.80 V	100 ns
	1.5 A	**SJPL-F4**	SJP	1.30 V	50 ns
	3 A	**SJPL-L4**	SJP	1.30 V	50 ns
	10 A	**FMXA-1104S**	TO220F-2L	1.50 V	25 ns
	20 A	**FMD-4204S**	TO3PF-3L	1.40 V	50 ns
500 V	1 A	**SJPD-D5**	SJP	1.40 V	40 ns
	3 A	**SJPD-L5**	SJP	1.40 V	50 ns
600 V	0.5 A	**AG01A**	Axial (ϕ2.4×2.9L/ϕ0.57)	1.80 V	100 ns
		EG01A	Axial (ϕ2.7×5.0L/ϕ0.6)	2.00 V	100 ns
	0.6 A	**EG1A**	Axial (ϕ2.7×5.0L/ϕ0.78)	2.00 V	100 ns
	2 A	**SJPL-H6**	SJP	1.50 V	50 ns
		SJPX-H6	SJP	1.50 V	30 ns
	10 A	**SPNS-1106S**	TO252-2L	1.30 V	100 ns
		FMNS-1106S	TO220F-2L	1.30 V	100 ns
		FMX-1106S	TO220F-2L	1.60 V	30 ns
		FMXA-1106S	TO220F-2L	1.98 V	28 ns

Diodes for Snubber Circuit (SARS Series)

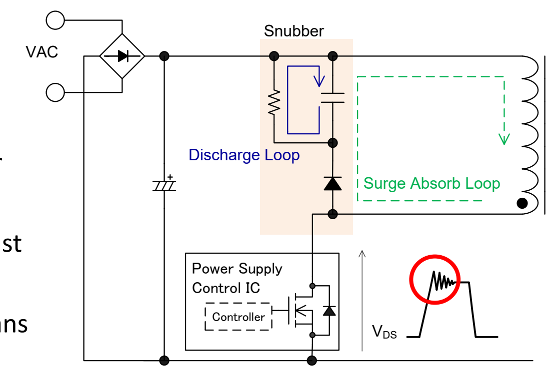
The SARS series are snubber diodes that allow your application to have lower noise and higher circuit efficiency.

Part Number	V_{RM}	$I_{F\,(AVG)}$	I_{FSM} 50 Hz Half Wave	V_F		t_{rr} $I_F : I_R = 1 : 1$	Package
				V_F (max.)	I_F		
SARS01	800 V	1.2 A	110 A	0.92 V	1.2 A	2 µs to 18 µs	Axial (ϕ2.7×5.0L/ϕ0.6)
SARS05	800 V	1.0 A	30 A	1.05 V	1.0 A	2 µs to 19 µs	SJP 

The following comparisons explain how flyback circuit operations differ when the snubber circuit uses a fast recovery diode or a SARS series device.

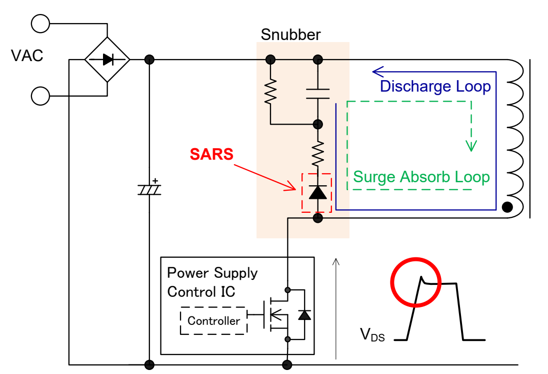
FRD

When the power MOSFET turns off, a surge current flows through the surge absorb loop and is then absorbed by the capacitor. The discharge loop discharges an electrical charge stored in the capacitor. This discharged energy is not transferred to the secondary side and thus turned into power dissipation. During the capacitor discharge, the recovery current of the diode flows into the power MOSFET. Using a fast recovery diode with a short t_{rr} is necessary to prevent the power MOSFET from any damage. However, a shorter t_{rr} means a shorter diode conduction period. To suppress ringing noise, enhanced input filtering must be implemented for FRD snubber circuits.



SARS Series

When the power MOSFET turns off, a surge current flows through the surge absorb loop and is then absorbed by the capacitor. The discharge loop discharges an electrical charge stored in the capacitor within a recovery time of the SARS series. This discharged energy is transferred to the secondary side, resulting in circuit efficiency improvement.
During the capacitor discharge, the recovery current of the SARS series instantaneously flows into the power MOSFET. Adding a resistor in series with the SARS series is necessary to prevent the power MOSFET from any damage. Having a longer t_{rr}, the SARS series can suppress ringing noise. This enables not only avoiding power MOSFET damage but also simplifying input filtering (patented).



Check our SARS series video on YouTube!
https://youtu.be/gRUQcjVdLag

Bootstrap Diodes

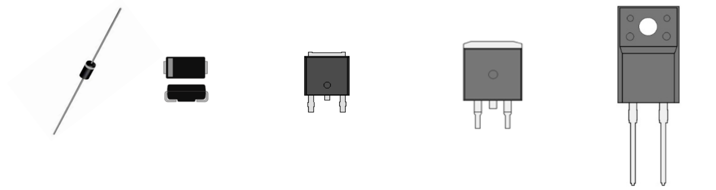
A bootstrap diode is generally used for a high-side driver circuit.
Since a recovery current flows into the diode used according to the switching frequency of the driver IC, use a diode with fast recovery characteristics (t_{rr}) as a bootstrap diode. For bootstrap diodes, therefore, select a fast recovery diode designed with considerations in the voltage applied to a power MOSFET and the high-side sink current.

Features

- Fast Recovery Characteristics
  $t_{rr} \leq 100$ ns
- V_{RM} = 600 V to 1000 V
- I_F = 0.5 A to 10 A

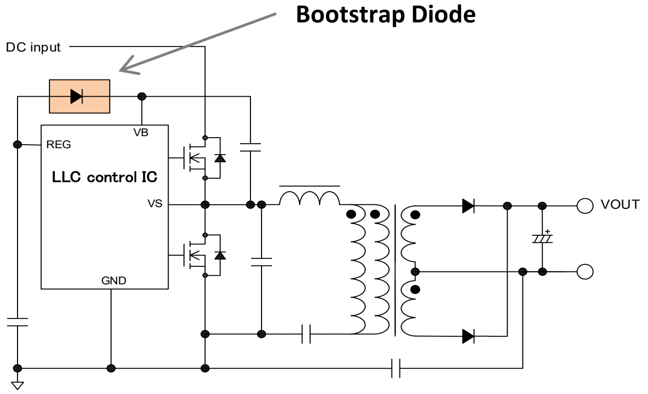
Packages

Axial SJP TO252-2L TO220S TO220F-2L



V_{RM}	$I_{F(AVG)}$	Part Number	Package	V_F	t_{rr} (I_F : I_R=1 : 1)
600 V	0.5 A	**AG01A**	Axial (ϕ2.4×2.9L/ϕ0.57)	1.8 V	100 ns
		EG01A	Axial (ϕ2.7×5.0L/ϕ0.6)	2.0 V	100 ns
	0.6 A	**EG1A**	Axial (ϕ2.7×5.0L/ϕ0.78)	2.0 V	100 ns
	2 A	**SJPL-H6**	SJP	1.5 V	50 ns
		SJPX-H6	SJP	1.5 V	30 ns
	10 A	**SPNS-1106S**	TO252-2L	1.3 V	100 ns
		FMNS-1106S	TO220F-2L	1.3 V	100 ns
		FMX-1106S	TO220F-2L	1.6 V	30 ns
		FMXA-1106S	TO220F-2L	1.98 V	28 ns
1000 V	0.5 A	**EG01C**	Axial (ϕ2.7×5.0L/ϕ0.6)	3.3 V	100 ns

Bootstrap Diode



Bypass Diodes

For bypass diodes used in PFC circuits, select a diode that can withstand an instantaneous large current and has a forward voltage lower than that of a boost diode.

Features

- $V_F \leq 1.05$ V
- V_{RM} = 600 V to 1000 V
- I_{FSM} = 35 A to 80 A

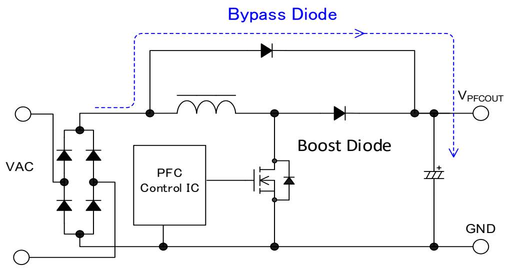
Package

Axial

V_{RM}	$I_{F(AVG)}$	Part Number	Package	V_F (max.)	I_{FSM} 50 Hz Half Wave
600 V	1 A	**AM01A**	Axial (ϕ2.4×2.9L/ϕ0.57)	0.98 V	35 A
	1 A	**EM01A**	Axial (ϕ2.7×5.0L/ϕ0.6)	0.97 V	45 A
	1 A	**EM1A**	Axial (ϕ2.7×5.0L/ϕ0.78)	0.97 V	45 A
	1.2 A	**EM2A**	Axial (ϕ2.7×5.0L/ϕ0.78)	0.92 V	80 A
800 V	1 A	**EM1B**	Axial (ϕ2.7×5.0L/ϕ0.78)	1.05 V	35 A
	1.2 A	**EM2B**	Axial (ϕ2.7×5.0L/ϕ0.78)	0.92 V	80 A
1000 V	1 A	**EM01C**	Axial (ϕ2.7×5.0L/ϕ0.6)	1.05 V	35 A
	1 A	**EM1C**	Axial (ϕ2.7×5.0L/ϕ0.78)	1.05 V	35 A

◆Bypass Diode Functions

A bypass diode has two major functions.



- **Protect Power MOSFETs and Rectifier Diodes from Inrush Current**
  If the reactor (inductance) becomes saturated due to an inrush current, a large current flows into the rectifier diode used and may thus destroy it. If the power MOSFET turns on during the inductance saturation, it may also be destroyed. To protect the power MOSFET and rectifier diode, bypass inrush currents to a bypass diode so that the inductance saturation can be suppressed.

- **Protect Bridge Diodes from Lightning Surge**
  In case of a lightning surge applied to the PFC circuit, the bridge diode used may cause dielectric breakdown. To prevent such event, a bypass diode is commonly used to bypass the lightning surge energy to an electrolytic capacitor.

◆Bypass Diode Electrical Characteristics

To have inrush currents or lightning surge currents flow through a bypass diode, the forward voltage of the bypass diode must be lower than that of a boost diode.
In addition, in a state where a PFC output voltage is higher than an input voltage, the bypass diode remains turned off. This requires no consideration of t_{rr}.

Boost Diodes

A fast recovery diode is commonly used as a boost diode in a PFC circuit. You can reduce loss in your application by selecting a fast recovery diode suitable for each PFC operation mode.

◆PFC Operation Modes

	Discontinuous Conduction Mode (DCM)	Critical Conduction Mode (CRM)	Continuous Conduction Mode (CCM)
Advantages	■ Low switching noise ■ No recovery loss in a boost diode		■ Low peak current of a power MOSFET ■ Low input current ripple ■ Low noise in normal mode
Disadvantages	■ High peak current of a power MOSFET ■ High input current ripple ■ High noise in normal mode		■ High switching noise ■ High recovery loss in a boost diode

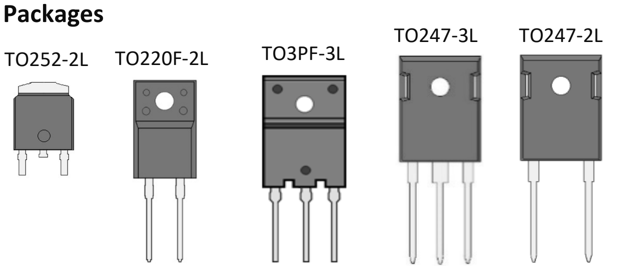
◆Fast Recovery Diodes for DCM, CRM

In these modes, almost no recovery current flows into a boost diode at power MOSFET turn-on because there is zero current through the boost diode. This allows you to put forward voltages before recovery characteristics in diode selection.
Therefore, select a diode with a low forward voltage.

◆Fast Recovery Diodes for CCM

In this mode, a recovery current flows into a boost diode at power MOSFET turn-on. Therefore, select a diode with a short t_{rr}.

Packages



V_{RM}	$I_{F(AVG)}$	Part Number	Package	V_F	t_{rr} (I_F : I_R=1 : 1)
600 V	10 A	**SPNS-1106S**	TO252-2L	1.3 V	100 ns
		FMNS-1106S	TO220F-2L	1.3 V	100 ns
		FMX-1106S	TO220F-2L	1.6 V	30 ns
		FMXA-1106S	TO220F-2L	1.98 V	28 ns
	15 A	**FMN-1156S**	TO220F-2L	1.3 V	100 ns
	20 A	**FMD-4206S**	TO3PF-3L	1.7 V	50 ns
		FMLD-4206S	TO3PF-3L	1.7 V	50 ns
		FMXR-1206S	TO220F-2L	2.5 V	60 ns
	30 A	**CTNS-6306S**	TO247-3L	1.3 V	100 ns
		FMN-4306S	TO3PF-3L	1.3 V	100 ns
		CTXS-5306S	TO247-2L	1.7 V	35 ns
		CTXR-5306S	TO247-2L	2.5 V	70 ns
	40 A	**CTXR-5406S**	TO247-2L	2.5 V	75 ns
	60 A	**CTNS-6606S**	TO247-3L	1.3 V	150 ns
		CTXS-6606S	TO247-3L	1.7 V	35 ns
		CTXS-5606S	TO247-2L	1.7 V	50 ns
		CTXR-5606S	TO247-2L	2.5 V	80 ns

Introduction to SPICE Modes

We have SPICE models for LTspice® or OrCAD®PSpice® available.

30 件表示 « < 1 > » (1～27 件表示／27 件中) ダウンロード(Excel)

フィルタ 絞り込みたい値を入力 ? 列 表示/非表示

PSpice	LTspice	品名	ステイタス	内容	製品概要
ZIP	ZIP	FMEN-210A 在庫	量産中	ショットキダイオード	100V/10A
ZIP	ZIP	FMES-21010 在庫	量産中	ショットキダイオード	100V/10A
ZIP	ZIP	FMES-22010 在庫	量産中	ショットキダイオード	100V/20A
ZIP	ZIP	FMES-23010 在庫	量産中	ショットキダイオード	100V/30A
ZIP	ZIP	FMES-24010 在庫	量産中	ショットキダイオード	100V/40A
ZIP	—	SJPA-D3 在庫	量産中	ショットキダイオード	30V/1A
ZIP	—	SJPA-L3 在庫	量産中	ショットキダイオード	30V/3A
ZIP	—	SJPB-D4 在庫	量産中	ショットキダイオード	40V/1A
ZIP	—	SJPB-D6 在庫	量産中	ショットキダイオード	1A, 60V
ZIP	—	SJPB-D9 在庫	量産中	ショットキダイオード	1A, 90V
ZIP	—	SJPB-H4 在庫	量産中	ショットキダイオード	2A, 40V
ZIP	—	SJPB-H6 在庫	量産中	ショットキダイオード	2A, 60V
ZIP	—	SJPB-H9 在庫	量産中	ショットキダイオード	2A, 90V
ZIP	—	SJPB-L4 在庫	量産中	ショットキダイオード	3A, 40V
ZIP	—	SJPB-L6 在庫	量産中	ショットキダイオード	3A, 60V

SPICE Model Downloads Page

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