

Bourns® Rectifier Diodes

Short Form Brochure

Bridge Rectifier Diodes • Schottky Bridge Rectifier Diodes • Fast Response Rectifier Diodes • Standard Rectifier Diodes • Schottky Rectifier Diodes



BOURNS®

Introduction

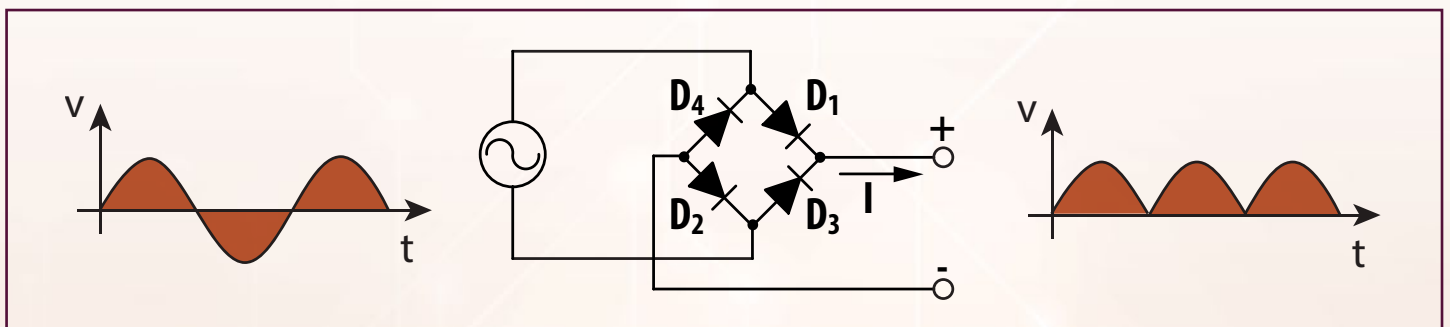
Bourns® Rectifier Diodes

A rectifier is an electrical device used to convert alternating current (AC) which periodically reverses direction, to direct current (DC) which flows in only one direction. Bourns offers a wide variety of rectifier products including bridge rectifiers and discrete rectifiers. Bourns® bridge rectifiers perform with higher forward current and low forward voltages for use in low voltage and high efficiency designs. Fast response rectifier diodes support fast reverse recovery time with high forward current capability for high speed switched-mode power supply applications. Standard rectifier diodes provide high forward current capability with low reverse leakage current, and Schottky rectifier diodes can perform with high forward current and low forward voltage for low heat dissipation. AC to DC and DC to DC converters are common applications of rectifier diodes.

Bourns® Rectifier Diode Product Offering

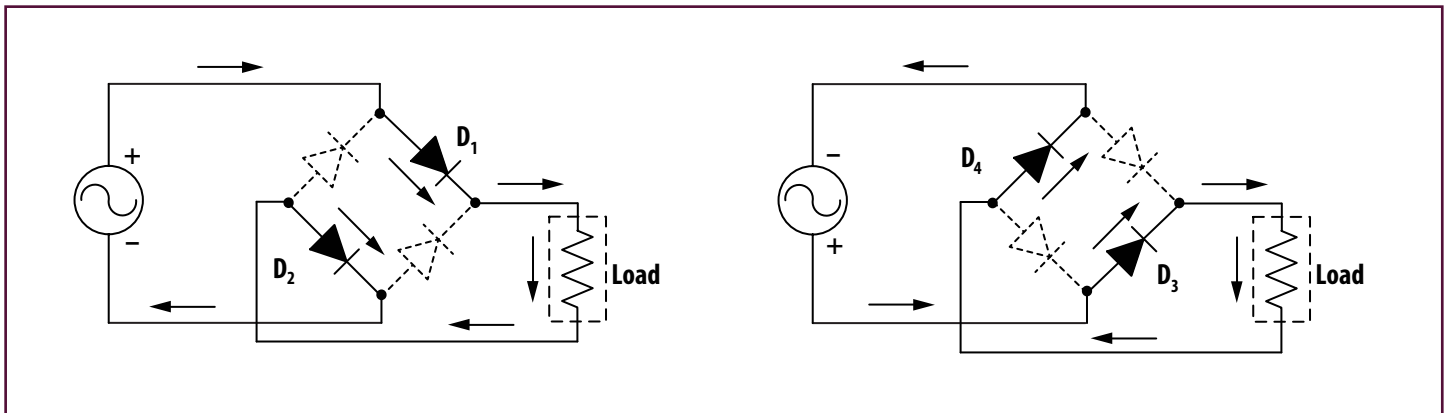
- Bridge Rectifier Diodes
- Schottky Bridge Rectifier Diodes
- Fast Response Rectifier Diodes
- Standard Rectifier Diodes
- Schottky Rectifier Diodes

AC to DC Converter

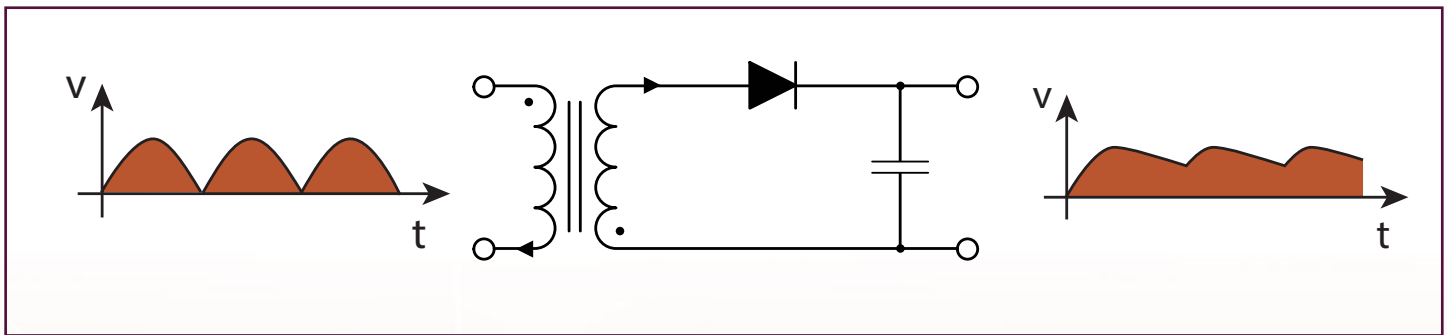


A bridge rectifier diode or four discrete rectifier diodes connected in a closed loop “bridge” configuration provide full-wave rectification from AC input into a DC output. The bridge rectifier diode blocks the current in the reverse direction and allows the current in the forward direction to keep the output current in one direction. During the positive

half cycle of the supply, diodes D_1 and D_2 conduct in series while diodes D_3 and D_4 are reverse biased and the current flows through the load. During the negative half cycle of the supply, diodes D_3 and D_4 conduct in series, but diodes D_1 and D_2 switch “OFF” which are reverse biased. The current flowing through the load.

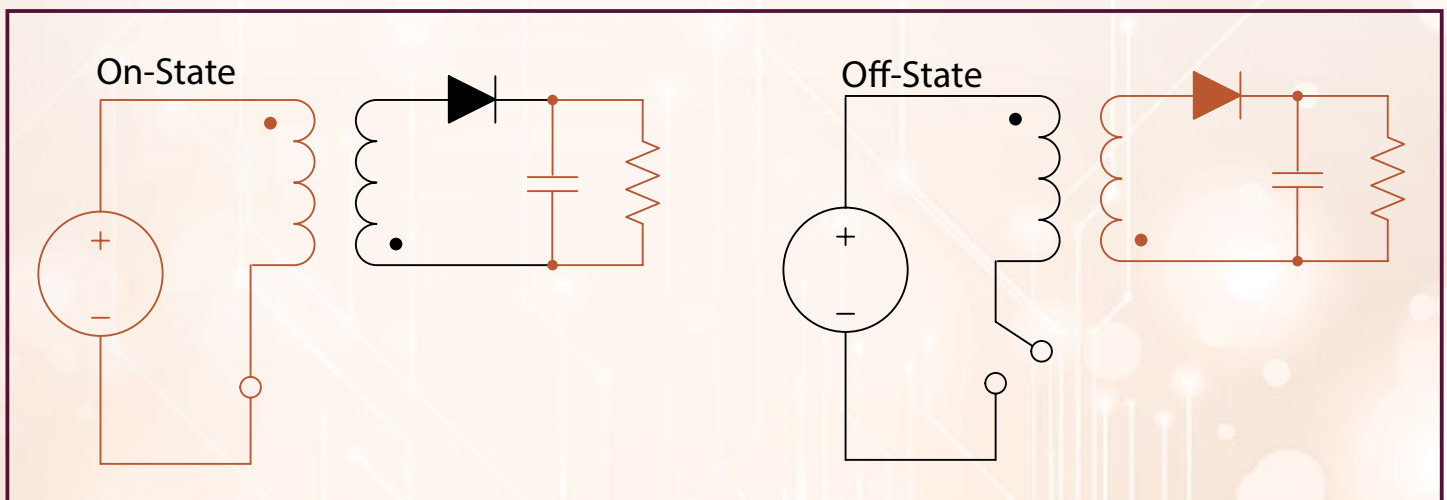


DC to DC Converter



Switched-mode DC to DC converters transform one DC voltage level to another, which may be higher (boost) or lower (buck), by storing the input energy temporarily and then releasing that energy to the output at a different voltage. When the switch is in the on-state, the rectifier diode blocks the reverse current and the

energy is transferred from the input voltage source to the transformer and the output capacitor supplies energy to the output load. When the switch is in the off-state, the energy is transferred from the transformer to the output load and the output capacitor.



Product Selection

General Rectifier Diode Parameters

Maximum Repetitive Peak Reverse Voltage (V_{RRM}) is the maximum voltage a rectifier diode can withstand in the reverse direction without breaking down or avalanching, and rectifier diodes must have a peak inverse voltage rating higher than the maximum voltage being applied to them in the application.

Maximum Average Forward Rectified Current (I_F) is the maximum allowable average forward current in the normal operating temperature range.

Maximum Peak Forward Surge Current (I_{FSM}) is the maximum allowable non-repetitive half-sine wave surge current with a pulse width of 8.3 milliseconds.

Forward Voltage (V_F) is the rectifier diode's forward voltage and low V_F rectifier diodes have less power dissipation in the forward direction to save energy.

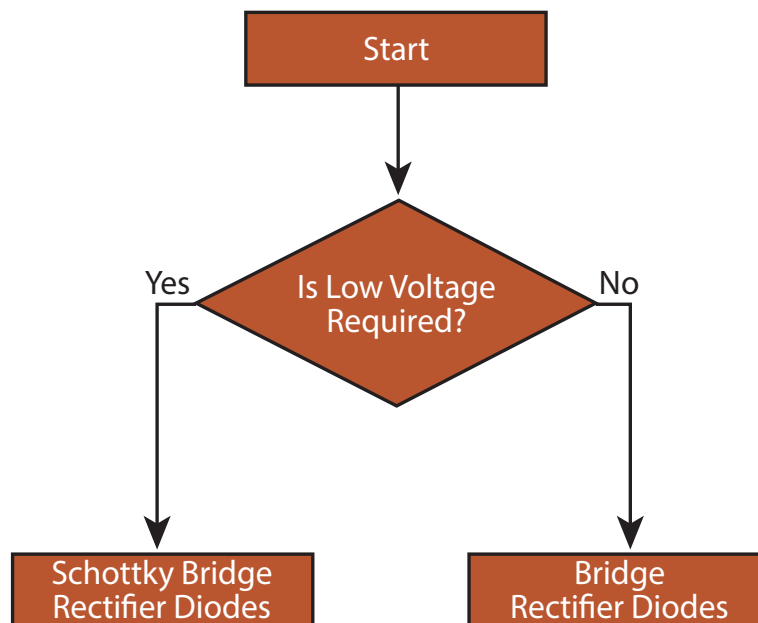
Reverse Leakage Current (I_R) is the diode's reverse leakage current, and low I_R rectifier diodes have less power dissipation in the reverse direction for power reduction.

Junction Capacitance (C_J) is the junction capacitance, and Reverse Recovery Time (T_{rr}) is the turn-off delay from the forward direction to the reverse direction. Low junction capacitance and fast reverse recovery time rectifier diodes are used for high-speed switching converter applications.

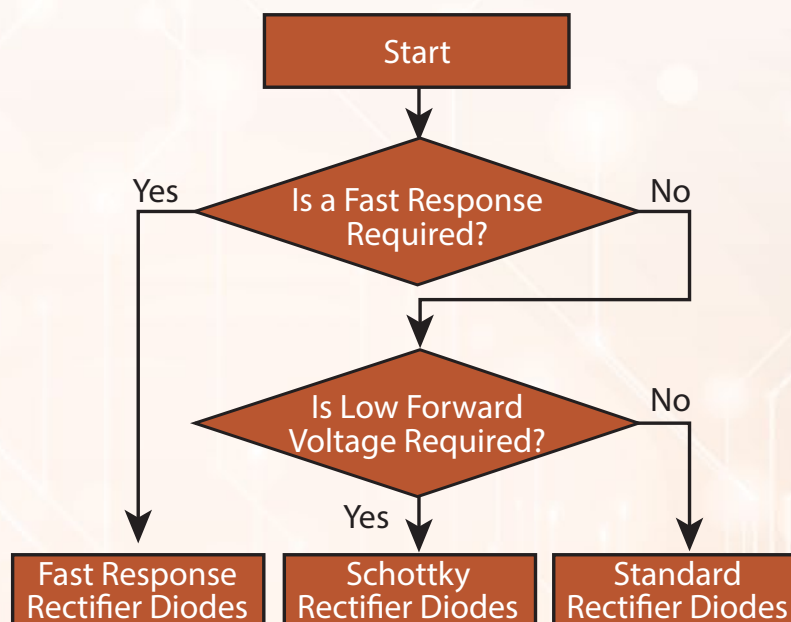
Thermal Resistance to Air ($R_{\theta JA}$) is the resistance to heat flow. Low thermal resistance rectifier diodes generate less heat, making them a good quality insulator.

Symbol	Parameter	Unit	Description
V_{RRM}	Maximum Repetitive Peak Reverse Voltage	V	Maximum allowable repetitive instantaneous value of the diode's reverse voltage
I_F	Maximum Average Forward Rectified Current	A	Maximum allowable average forward current
I_{FSM}	Maximum Peak Forward Surge Current	A	Maximum allowable non-repetitive half-sine wave surge current
V_F	Forward Voltage	V	Voltage of the diode at I_F
I_R	Reverse Leakage Current	μA	Reverse leakage current at V_{RRM}
C_J	Junction Capacitance	pF	Junction capacitance of the diode
T_{rr}	Reverse Recovery Time	ns	Duration of time for diode to "turn off" when alternating current is from forward-bias to reverse-bias polarity
$R_{\theta JA}$	Thermal Resistance to Air	$^{\circ}C/W$	Temperature difference between junction and outside air per watt

Bridge Rectifier Selection

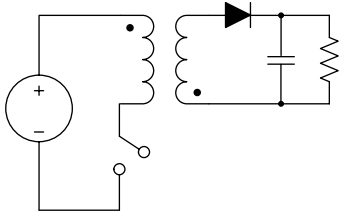


Discrete Rectifier Selection



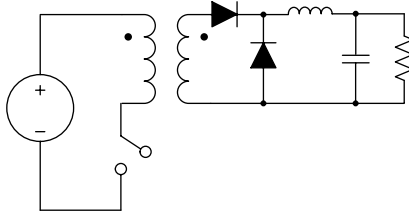
Rectifier Diode Applications

Flyback Converter Topology



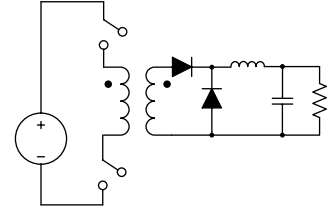
Isolation	Yes
Max. Power (W)	100
Strengths	Ground referenced switch, multiple outputs, fewer components
Weaknesses	Limited to 10 A output, high stress on diode, inefficient (use of ZVS converters improves losses)
Applications	AC/DC and DC/DC appliances, solar inverters, LED lighting, AC adaptors, E-meters, battery chargers, automotive, circuit breakers, TVs, STBs, PoE

Forward Topology



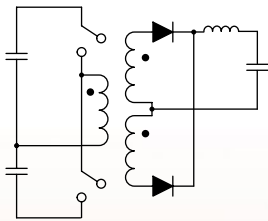
Isolation	Yes
Max. Power (W)	200
Strengths	Large step-down ratio
Weaknesses	High voltage on-switch increases power lost
Applications	AC/DC, DC/DC industrial controls

Two-Switch Forward Topology



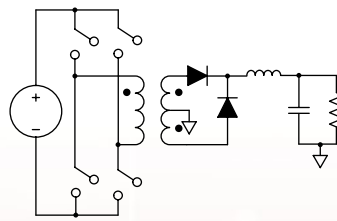
Isolation	Yes
Max. Power (W)	1000
Strengths	Very rugged circuit
Weaknesses	Noisy input
Applications	AC/DC, DC/DC industrial controls

Half Bridge Forward Topology



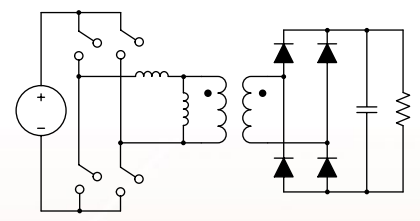
Isolation	Yes
Max. Power (W)	500
Strengths	Reduced core loss
Weaknesses	Does not work well with current mode, making it less than ideal for off-line power supplies
Applications	DC/DC industrial controls, telecom, data processing

Full Bridge Forward Topology



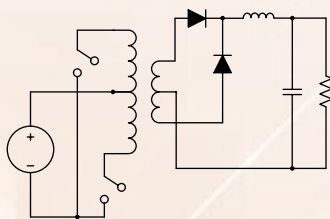
Isolation	Yes
Max. Power (W)	5000
Strengths	Clamped primary switch and minimal switching losses
Weaknesses	Requires experience to get functioning properly
Applications	AC/DC and DC/DC industrial controls, telecom, data processing, automotive HEV / EV

Full Bridge Resonant Topology



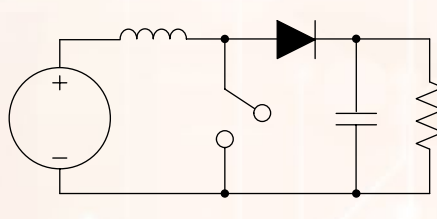
Isolation	Yes
Max. Power (W)	5000
Strengths	Soft switching
Weaknesses	Narrow input range
Applications	Lighting

Push Pull Converter Topology



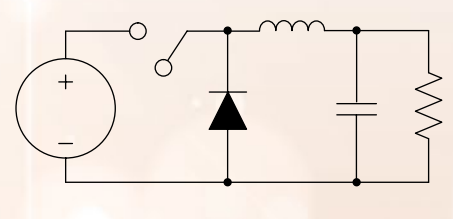
Isolation	Yes
Max. Power (W)	500
Strengths	Ground referenced switches
Weaknesses	Limited to low input voltages
Applications	DC/DC battery chargers, servers

Boost Converter Topology



Isolation	No
Max. Power (W)	1000
Strengths	Low noise input
Weaknesses	Requires current mode control and has no isolation
Applications	AC/DC and DC/DC power factor correction circuits, automotive electric vehicles, motor drives (appliances)

Buck Converter Topology



Isolation	No
Max. Power (W)	1000
Strengths	Low noise output
Weaknesses	Optimum input/output ratio must be less than 10; no isolation
Applications	AC/DC and DC/DC notebooks, servers, graphic processors, automotive

Bridge Rectifier Diodes



Features

High current capability
Low profile package

Applications

Switch Mode Power Supplies (SMPS)

Part Number	V _{RRM} (V)	I _F (A)	I _{FSM} (A)	V _F @ I _F (V)	I _R (μA)	Capacitance (pF)	Compliant Package	Length (mm)	Width (mm)	R _{θJA} (°C/W)						
CD-DF410SL	1000	4	150		5	45	DFS-4	10.6	8.2	35						
CD-DF408SL	800			0.9												
CD-DF406SL	600															
CD-DF410S	1000															
CD-DF408S	800			0.95												
CD-DF406S	600															
CD-MBL210SL	1000	2	60		5	35										
CD-MBL208SL	800			0.96												
CD-MBL206SL	600															
CD-MBL210S	1000															
CD-MBL208S	800															
CD-MBL206S	600		50	1		25										
CD-MBL110SL	1000	1	45		5	25	2320	5.9	5.4	95						
CD-MBL108SL	800			0.95												
CD-MBL106SL	600															
CD-MBL110S	1000															
CD-MBL108S	800		30								1					
CD-MBL106S	600															
CD-MBL104S	400															
CD-MBL102S	200															
CD2320-B11000	1000	1	30		5	25	2320	5.9	5.4	95						
CD2320-B1800	800			1												
CD2320-B1600	600															
CD2320-B1400	400															
CD2320-B1200	200															
CDBNS04-B08800	800	0.8	30		5	26	NBS04	7	4.9	50						
CDBNS04-B08600	600			1.15												
CDBNS04-B08400	400															
CDBNS04-B08200	200															

Schottky Bridge Rectifier Diodes




Features

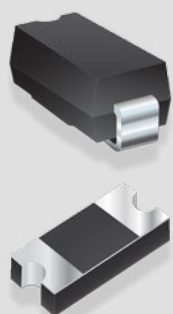
- High current capability
- Low forward voltage
- Low profile package

Applications

- Switch Mode Power Supplies (SMPS)
- Power Supplies

Part Number	V _{RRM} (V)	I _F (A)	I _{FSM} (A)	V _F @ I _F (V)	I _R (μA)	Capacitance (pF)	Compliant Package	Length (mm)	Width (mm)	R _{θJA} (°C/W)
CD-HD201L	100	2	60	0.8	100	250	TO-269AA	6.25	4.85	145
CD-HD2006L	60		50	0.55	200					110
CD-HD2004	40			0.5						
CD-HD201	100			0.85						
CD-HD2006	60	1	30	0.7		200	250	TO-269AA	6.25	
CD-HD01	100			0.85						
CD-HD006	60			0.7						
CD-HD004	40			0.5						

Fast Response Rectifier Diodes



Features

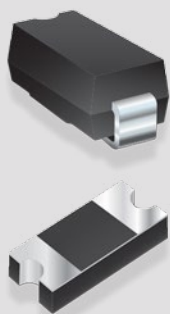
High current capability
Fast reverse recovery time

Applications

High Frequency
Switch Mode Power Supplies
Inverters

Part Number	V _{RRM} (V)	I _F (A)	T _{rr} (ns)	I _{FSM} (A)	V _F @ I _F (V)	I _R (μA)	Capacitance (pF)	Compliant Package	Length (mm)	Width (mm)	R _{ΘJA} (°C/W)							
CD214C-F3600	600	3	35	100	1.3	10	45	DO-214AB/SMC	6.9	5.9	15							
CD214C-F3400	400		1.25		10													
CD214C-F3200	200		0.92															
CD214C-F3100	100		0.92															
CD214C-F350	50		0.92		5						10	DO-214AA/SMB	4.3	3.6	34			
CD214B-F3600	600	1.7																
CD214B-F3400	400	1.25																
CD214B-F3200	200	0.95																
CD214B-F3150	150	0.95																
CD214B-F3100	100	3	35	100	0.95	5	10	DO-214AA/SMB	4.3	3.6	34							
CD214B-F350	50				0.95													
CD214B-F2600	600				35							1.3	5	200	DO-214AA/SMB	4.3	3.6	15
CD214B-F2400	400				1.25													
CD214B-F2200	200				0.92													
CD214B-F2150	150	0.92																
CD214B-F2100	100	0.92																
CD214B-F250	50	0.92	2	25	50	5	200	DO-214AA/SMB	4.3	3.6	15							
CD214A-F1600	600	30										25	1.7					
CD214A-F1400	400	20										30	1.25					
CD214A-F1200	200											30	0.95					
CD214A-F1150	150											30	0.95					
CD214A-F1100	100		30	0.95														
CD214A-F150	50		30	0.95	5	10	DO-214AC/SMA	4.3	2.6	34								
CD1408-FU1800	800	1	25	2.5							50	10	SOD-87 /SOD-123	3.4	1.9	80		
CD1408-FU1600	600		30	1.25														
CD1408-FU1400	400		30	1.05														
CD1408-FU1200	200		30	0.93														
CD1408-FF11500	1500		50	15	6	5	10	SOD-87 /SOD-123	3.4	1.9							95	
CD1408-FF11000	1000	75	25	1.7	5	10												
CD1408-FF1800	800	50	30															
CD1408-FF1600	600																	
CD1408-FF1400	400																	
CD1408-FF1200	200																	
CD1408-F11000	1000			1	300	30	1.3	5	15	SOD-87 /SOD-123	3.4	1.9	80					
CD1408-F1800	800																	
CD1408-F1600	600																	
CD1408-F1400	400																	
CD1408-F1200	200																	

Standard Rectifier Diodes



Features

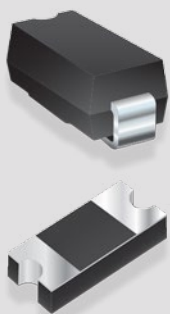
High current capability
Low reverse leakage current

Applications

Switch Mode Power Supplies (SMPS)

Part Number	V _{RRM} (V)	I _F (A)	I _{FSM} (A)	V _F @ I _F (V)	I _R (μA)	Capacitance (pF)	Compliant Package	Length (mm)	Width (mm)	R _{θJA} (°C/W)
CD214C-R31000	1000	3	100	1.15	10	40	DO-214AB/SMC	6.9	5.9	10
CD214C-R3800	800									
CD214C-R3600	600									
CD214C-R3400	400									
CD214C-R3200	200									
CD214C-R3100	100									
CD214C-R350	50	3	115	1	5	40	DO-214AA/SMB	4.3	3.6	47
CD214B-R31000	1000									
CD214B-R3800	800									
CD214B-R3600	600									
CD214B-R3400	400									
CD214B-R3200	200									
CD214B-R3100	100	2	65	1	5	25	DO-214AA/SMB	4.3	3.6	53
CD214B-R350	50									
CD214B-R21000	1000									
CD214B-R2800	800									
CD214B-R2600	600									
CD214B-R2400	400									
CD214B-R2200	200	1	25	2	12	DO-214AC/SMA	4.3	2.6	75	
CD214B-R2100	100									
CD214B-R250	50									
CD214A-R12000	2000									
CD214A-R11600	1600		30	1	5	12	DO-214AC/SMA	4.3	2.6	75
CD214A-R11200	1200									
CD214A-R11100	1100									
CD214A-R11000	1000									
CD214A-R1800	800	1	30	1	5	12	DO-214AC/SMA	4.3	2.6	75
CD214A-R1600	600									
CD214A-R1400	400									
CD214A-R1200	200									
CD214A-R1100	100									
CD214A-R150	50									
CD1408-R11000	1000	1	30	1	1	12	SOD-87 /SOD-123	3.4	1.9	80
CD1408-R1800	800									
CD1408-R1600	600									
CD1408-R1400	400									
CD1408-R1200	200									

Schottky Rectifier Diodes



Features

High current capability
Low forward voltage

Applications

Switch Mode Power Supplies (SMPS)
Inverters

Part Number	V _{RRM} (V)	I _F (A)	I _{FSM} (A)	V _F @ I _F (V)	I _R (μA)	Capacitance (pF)	Compliant Package	Length (mm)	Width (mm)	R _{θJA} (°C/W)	
CD214C-B360LF	60	3	100	0.7	500	250	DO-214AB/SMC	6.9	5.9	60	
CD214C-B350LF	50			0.7							
CD214C-B340LF	40			0.5							
CD214C-B330LF	30			0.5							
CD214C-B320LF	20			0.5							
CD214B-B360LF	60	3	100	0.7	500	250	DO-214AA/SMB	4.3	3.6	95	
CD214B-B350LF	50			0.7							
CD214B-B340LF	40			0.5							
CD214B-B330LF	30			0.5							
CD214B-B320LF	20			0.5							
CD214A-B360LF	60	3	100	0.7	500	250	DO-214AC/SMA	4.3	2.6	100	
CD214A-B350LF	50			0.7							
CD214A-B340LF	40			0.5							
CD214A-B340LLF	40		70	0.45							
CD214A-B330LF	30		100	0.5							
CD214A-B320LF	20			0.5							
CD214B-B260LF	60	2	50	0.7	500	200	DO-214AA/SMB	4.3	3.6	60	
CD214B-B250LF	50			0.7							
CD214B-B240LF	40			0.5						500	
CD214B-B230LF	30			0.5						500	
CD214B-B220LF	20			0.5						500	
CD214A-B260LF	60	2	50	0.7	500	200	DO-214AC/SMA	4.3	2.6	65	
CD214A-B250LF	50			0.7						500	
CD214A-B240LF	40			0.5						500	
CD214A-B240LLF	40			0.43						200	
CD214A-B230LF	30			0.5						500	
CD214A-B220LF	20			0.5						500	
CD1206-B2100	100	2	40	0.85	500	200	SOD-87 /SOD-123	3.4	1.9	75	
CD1206-B260	60			0.7	500						
CD1206-B240	40			0.5	500						
CD1206-B220	20			0.5	500						
CD214B-B160LF	60	1	30	0.7	500	110	DO-214AA/SMB	4.3	3.6	22	
CD214B-B150LF	50			0.7	500						
CD214B-B140LF	40			0.5	500						
CD214B-B130LF	30			0.5	500						
CD214B-B120LF	20			0.5	500						
CD214A-B1100LF	100	1	30	0.79	500	30	DO-214AC/SMA	4.3	2.6	50	
CD214A-B190LF	90			0.79	500						
CD214A-B180LF	80			0.79	500						
CD214A-B170LF	70			0.79	500						
CD214A-B160LF	60			0.7	500						110
CD214A-B150LF	50			0.7	500						100
CD214A-B140LF	40			0.5	500						110
CD214A-B130LF	30			0.5	500						110
CD214A-B130LLF	30			25	0.41						1000
CD214A-B120LF	20		30	0.5	500	110					
CD214A-B120LLF	20		25	0.41	1000	100					
CD2010-B160	60		1	50	0.52	500				300	SOD-106
CD2010-B140	40	70		0.45	100	300					
CD216A-B140LF	40	1	40	0.55	500	60	DO-216AA	3.95	2.05	250	
CD216A-B130LLF	30		50	0.38	410	70					
CD216A-B120LLF	20			0.45	400	90					
CD216A-B120RLF	20			0.53	10	75					

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