

## Zero Recovery Silicon Carbide Schottky Diode

#### **Product Overview**

The silicon carbide (SiC) power Schottky barrier diode (SBD) product line from Microchip increases the performance over silicon diode solutions while lowering the total cost of ownership for high-voltage applications. The MSC010SDA070K device is a 700 V, 10 A SiC SBD in a two-lead TO-220 package.



#### Features

The following are key features of the MSC010SDA070K device:

- No reverse recovery
- Low forward voltage
- Low leakage current
- Avalanche-energy rated
- RoHS compliant

#### Benefits

The following are benefits of the MSC010SDA070K device:

- High switching frequency
- Low switching losses
- · Low noise (EMI) switching
- · Higher reliability systems
- · Increased system power density

#### Applications

The MSC010SDA070K device is designed for the following applications:

- Power factor correction (PFC)
- Anti-parallel diode
  - Switch-mode power supply
  - Inverters/converters
  - Motor controllers
- Freewheeling diode
  - Switch-mode power supply
  - Inverters/converters
- Snubber/clamp diode

#### 1. Device Specifications

This section shows the specifications of the MSC010SDA070K device.

#### 1.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the MSC010SDA070K device.  $T_C = 25$  °C unless otherwise specified.

Symbol	Parameter			Unit
V <sub>R</sub>	Maximum DC reverse voltage		700	V
V <sub>RRM</sub>	Maximum peak repetitive reverse voltage			
V <sub>RWM</sub>	Maximum working peak reverse voltage			
l <sub>F</sub>	Maximum DC forward current	T <sub>C</sub> = 25 °C	24	A
		T <sub>C</sub> = 135 °C	10	
		T <sub>C</sub> = 145 °C	8	
I <sub>FRM</sub>	Repetitive peak forward surge current (T <sub>C</sub> = 25 °C, tp = 8.3 ms, half sine wave)			
I <sub>FSM</sub>	Non-repetitive forward surge current (T <sub>C</sub> = 25 °C, tp = 8.3 ms, half sine wave)			
P <sub>TOT</sub>	Total power dissipation	T <sub>C</sub> = 25 °C	83	W
		T <sub>C</sub> = 110 °C	36	
E <sub>AS</sub>	Single-pulse avalanche energy (starting $T_J$ = 25 °C, peak I <sub>L</sub> = 10 A)	100		mJ

 Table 1-1. Absolute Maximum Ratings

The following table shows the thermal and mechanical characteristics of the MSC010SDA070K device.

 Table 1-2. Thermal and Mechanical Characteristics

Symbol	Characteristic/Test Conditions	Min	Тур	Мах	Unit
$R_{\theta JC}$	Junction-to-case thermal resistance		1.30	1.80	°C/W
T <sub>J</sub> , T <sub>STG</sub>	Operating junction and storage temperature range	-55		175	°C
TL	Lead temperature for 10 seconds			300	
Wt Package weight			0.07		oz
			1.9		g
	Mounting torque, 6-32 or M3 screw			10	lbf-in
				1.1	N-m

#### 1.2 Electrical Performance

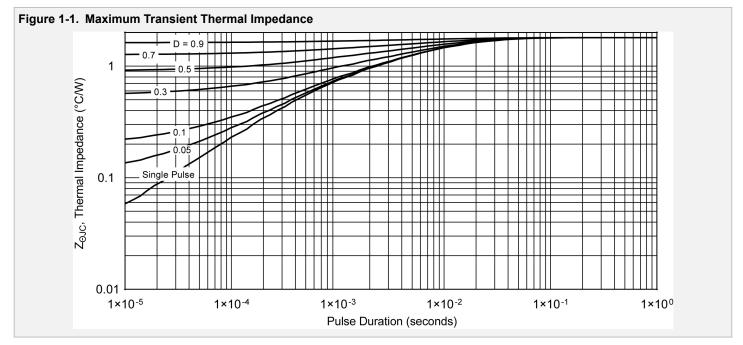
The following table shows the static characteristics of the MSC010SDA070K device. T<sub>J</sub> = 25  $^{\circ}$ C unless otherwise specified.

Table 1-3. Static Characteristics

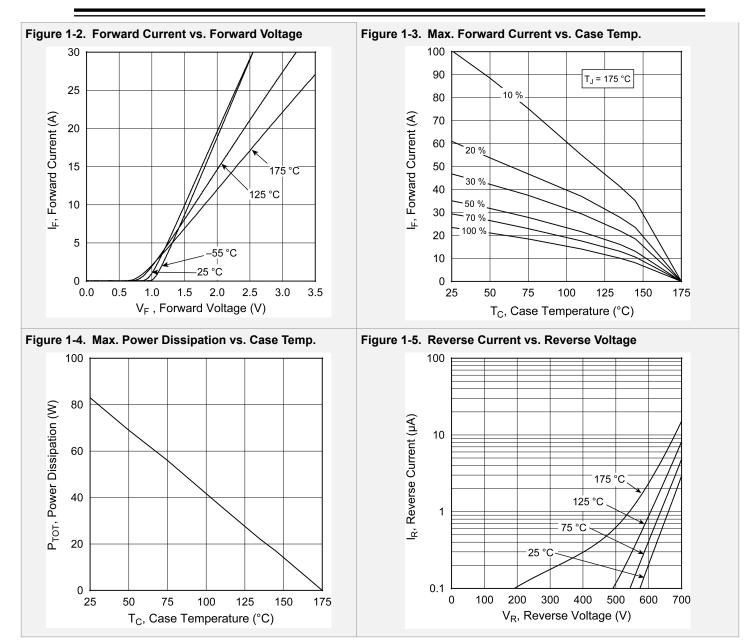
Symbol	Characteristic	Test Conditions	Min	Тур	Max	Unit
V <sub>F</sub>	Forward voltage	I <sub>F</sub> = 10 A, T <sub>J</sub> = 25 °C		1.5	1.8	V
		I <sub>F</sub> = 10 A, T <sub>J</sub> = 175 °C		1.8		
I <sub>RM</sub>	Reverse leakage current	V <sub>R</sub> = 700 V, T <sub>J</sub> = 25 °C		3	200	μA
		V <sub>R</sub> = 700 V, T <sub>J</sub> = 175 °C		15		-
Q <sub>C</sub>	Total capacitive charge	V <sub>R</sub> = 400 V		27		nC
CJ	Junction capacitance	V <sub>R</sub> = 1 V, f = 1 MHz		353		pF
		V <sub>R</sub> = 200 V, f = 1 MHz		54		
		V <sub>R</sub> = 400 V, f = 1 MHz		46		

#### 1.3 Typical Performance Curves

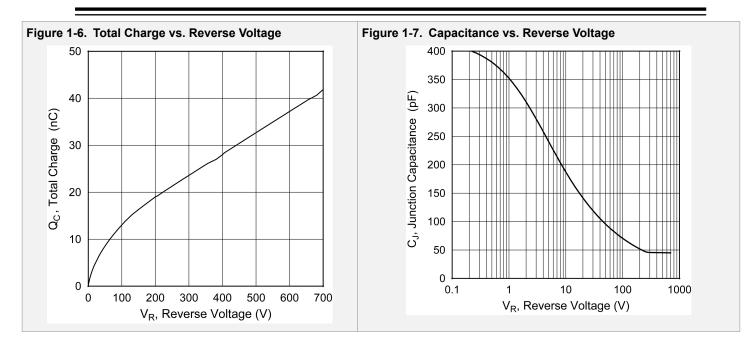
This section shows the typical performance curves of the MSC010SDA070K device.



**Device Specifications** 



**Device Specifications** 

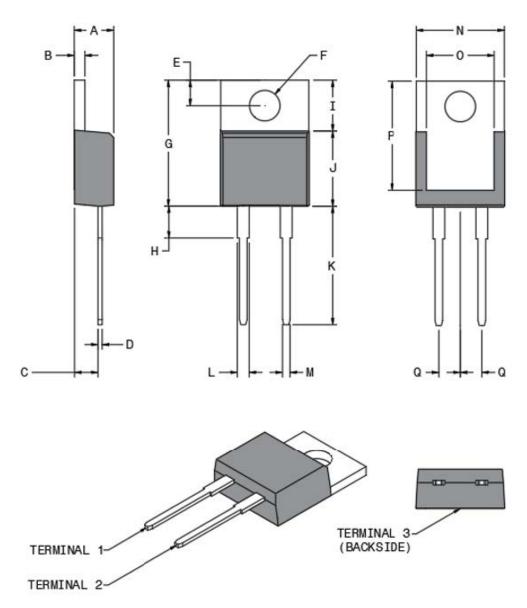


#### 2. Package Specification

This section shows the package specification of the MSC010SDA070K device.

#### 2.1 Package Outline Drawing

The following figure illustrates the TO-220 package outline of the MSC010SDA070K device. **Figure 2-1. Package Outline Drawing** 



The following table shows the TO-220 dimensions and should be used in conjunction with the package outline drawing.

Package Specification

Symbol	Min (mm)	Max (mm)	Min (in.)	Max (in.)
A	4.32	4.57	0.170	0.180
В	1.14	1.40	0.045	0.055
С	2.50	2.74	0.098	0.108
D	0.36	0.53	0.014	0.021
E	2.65	3.05	0.104	0.120
F	3.60	3.96	0.142	0.156
G	14.50	15.60	0.571	0.614
н	2.39	3.65	0.094	0.144
I	6.00	6.80	0.236	0.268
J	8.40	9.00	0.331	0.354
К	13.00	14.00	0.512	0.051
L	1.23	1.39	0.048	0.055
М	0.69	0.88	0.027	0.035
N	10.00	10.36	0.394	0.408
0	7.57	7.90	0.298	0.311
Р	12.20	13.10	0.480	0.516
Q	2.54 BSC (nom.)		0.100 BSC (non	n.)
Terminal 1	Cathode			
Terminal 2	Anode			
Terminal 3	Cathode	Cathode		

#### Table 2-1. TO-220 Dimensions

### 3. Revision History

Table 3-1. Revision History

Revision	Date	Description
A	03/2021	Document migrated from Microsemi template to Microchip template; Assigned Microchip literature number DS-00003907A,which replaces the previous Microsemi literature number 053-4083.
Initial release (Microsemi Revision A)	12/2017	Document created.

### The Microchip Website

Microchip provides online support via our website at www.microchip.com/. This website is used to make files and information easily available to customers. Some of the content available includes:

- **Product Support** Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- General Technical Support Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip design partner program member listing
- **Business of Microchip** Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

### Product Change Notification Service

Microchip's product change notification service helps keep customers current on Microchip products. Subscribers will receive email notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, go to www.microchip.com/pcn and follow the registration instructions.

### Customer Support

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Embedded Solutions Engineer (ESE)
- · Technical Support

Customers should contact their distributor, representative or ESE for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in this document.

Technical support is available through the website at: www.microchip.com/support

### **Microchip Devices Code Protection Feature**

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods being used in attempts to breach the code protection features of the Microchip devices. We believe that these methods require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Attempts to breach these code protection features, most likely, cannot be accomplished without violating Microchip's intellectual property rights.
- · Microchip is willing to work with any customer who is concerned about the integrity of its code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code
  protection does not mean that we are guaranteeing the product is "unbreakable." Code protection is constantly
  evolving. We at Microchip are committed to continuously improving the code protection features of our products.
  Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act.
  If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue
  for relief under that Act.

### Legal Notice

Information contained in this publication is provided for the sole purpose of designing with and using Microchip products. Information regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications.

THIS INFORMATION IS PROVIDED BY MICROCHIP "AS IS". MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL OR CONSEQUENTIAL LOSS, DAMAGE, COST OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

### Trademarks

The Microchip name and logo, the Microchip logo, Adaptec, AnyRate, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, chipKIT, chipKIT logo, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Kleer, LANCheck, LinkMD, maXStylus, maXTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, PackeTime, PIC, picoPower, PICSTART, PIC32 logo, PolarFire, Prochip Designer, QTouch, SAM-BA, SenGenuity, SpyNIC, SST, SST Logo, SuperFlash, Symmetricom, SyncServer, Tachyon, TimeSource, tinyAVR, UNI/O, Vectron, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

AgileSwitch, APT, ClockWorks, The Embedded Control Solutions Company, EtherSynch, FlashTec, Hyper Speed Control, HyperLight Load, IntelliMOS, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, Quiet-Wire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, WinPath, and ZL are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, Augmented Switching, BlueSky, BodyCom, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, Espresso T1S, EtherGREEN, IdealBridge, In-Circuit Serial Programming, ICSP, INICnet, Intelligent Paralleling, Inter-Chip Connectivity, JitterBlocker, maxCrypto, maxView, memBrain, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PowerSmart, PureSilicon, QMatrix, REAL ICE, Ripple Blocker, RTAX, RTG4, SAM-ICE, Serial Quad I/O, simpleMAP, SimpliPHY, SmartBuffer, SMART-I.S., storClad, SQI, SuperSwitcher, SuperSwitcher II, Switchtec, SynchroPHY, Total Endurance, TSHARC, USBCheck, VariSense, VectorBlox, VeriPHY, ViewSpan, WiperLock, XpressConnect, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

The Adaptec logo, Frequency on Demand, Silicon Storage Technology, and Symmcom are registered trademarks of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2021, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-5224-7905-5

### Quality Management System

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.



## **Worldwide Sales and Service**

MERICAS	ASIA/PACIFIC	ASIA/PACIFIC	EUROPE
Corporate Office 355 West Chandler Blvd.	Australia - Sydney Tel: 61-2-9868-6733	India - Bangalore Tel: 91-80-3090-4444	Austria - Wels Tel: 43-7242-2244-39
	China - Beijing	India - New Delhi	Fax: 43-7242-2244-39
handler, AZ 85224-6199	Tel: 86-10-8569-7000	Tel: 91-11-4160-8631	
el: 480-792-7200			Denmark - Copenhager
ax: 480-792-7277	China - Chengdu	India - Pune	Tel: 45-4485-5910
echnical Support:	Tel: 86-28-8665-5511	Tel: 91-20-4121-0141	Fax: 45-4485-2829
ww.microchip.com/support	China - Chongqing	Japan - Osaka Tel: 81-6-6152-7160	Finland - Espoo
Veb Address:	Tel: 86-23-8980-9588		Tel: 358-9-4520-820
ww.microchip.com	China - Dongguan	Japan - Tokyo	France - Paris
tlanta	Tel: 86-769-8702-9880	Tel: 81-3-6880- 3770	Tel: 33-1-69-53-63-20
uluth, GA	China - Guangzhou	Korea - Daegu	Fax: 33-1-69-30-90-79
el: 678-957-9614	Tel: 86-20-8755-8029	Tel: 82-53-744-4301	Germany - Garching
ax: 678-957-1455	China - Hangzhou	Korea - Seoul	Tel: 49-8931-9700
ustin, TX	Tel: 86-571-8792-8115	Tel: 82-2-554-7200	Germany - Haan
el: 512-257-3370	China - Hong Kong SAR	Malaysia - Kuala Lumpur	Tel: 49-2129-3766400
oston	Tel: 852-2943-5100	Tel: 60-3-7651-7906	Germany - Heilbronn
/estborough, MA	China - Nanjing	Malaysia - Penang	Tel: 49-7131-72400
el: 774-760-0087	Tel: 86-25-8473-2460	Tel: 60-4-227-8870	Germany - Karlsruhe
ax: 774-760-0088	China - Qingdao	Philippines - Manila	Tel: 49-721-625370
hicago	Tel: 86-532-8502-7355	Tel: 63-2-634-9065	Germany - Munich
asca, IL	China - Shanghai	Singapore	Tel: 49-89-627-144-0
el: 630-285-0071	Tel: 86-21-3326-8000	Tel: 65-6334-8870	Fax: 49-89-627-144-44
ax: 630-285-0075	China - Shenyang	Taiwan - Hsin Chu	Germany - Rosenheim
allas	Tel: 86-24-2334-2829	Tel: 886-3-577-8366	Tel: 49-8031-354-560
ddison, TX	China - Shenzhen	Taiwan - Kaohsiung	Israel - Ra'anana
el: 972-818-7423	Tel: 86-755-8864-2200	Tel: 886-7-213-7830	Tel: 972-9-744-7705
ax: 972-818-2924	China - Suzhou	Taiwan - Taipei	Italy - Milan
etroit	Tel: 86-186-6233-1526	Tel: 886-2-2508-8600	Tel: 39-0331-742611
ovi, MI	China - Wuhan	Thailand - Bangkok	Fax: 39-0331-466781
el: 248-848-4000	Tel: 86-27-5980-5300	Tel: 66-2-694-1351	Italy - Padova
ouston, TX	China - Xian	Vietnam - Ho Chi Minh	Tel: 39-049-7625286
el: 281-894-5983	Tel: 86-29-8833-7252	Tel: 84-28-5448-2100	Netherlands - Drunen
Idianapolis	China - Xiamen		Tel: 31-416-690399
oblesville, IN	Tel: 86-592-2388138		Fax: 31-416-690340
el: 317-773-8323	China - Zhuhai		Norway - Trondheim
ax: 317-773-5453	Tel: 86-756-3210040		Tel: 47-72884388
el: 317-536-2380			Poland - Warsaw
os Angeles			Tel: 48-22-3325737
lission Viejo, CA			Romania - Bucharest
el: 949-462-9523			Tel: 40-21-407-87-50
ax: 949-462-9608			Spain - Madrid
el: 951-273-7800			Tel: 34-91-708-08-90
aleigh, NC			Fax: 34-91-708-08-91
el: 919-844-7510			Sweden - Gothenberg
ew York, NY			Tel: 46-31-704-60-40
el: 631-435-6000			Sweden - Stockholm
an Jose, CA			Tel: 46-8-5090-4654
el: 408-735-9110			UK - Wokingham
el: 408-436-4270			Tel: 44-118-921-5800
anada - Toronto			Fax: 44-118-921-5820
el: 905-695-1980			1 a. ++-110-321-3020
ax: 905-695-2078			