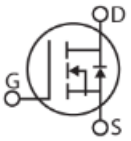
MSC035SMA170S Silicon Carbide N-Channel Power MOSFET

Product Overview

The silicon carbide (SiC) power MOSFET product line from Microsemi increases the performance over silicon MOSFET and silicon IGBT solutions while lowering the total cost of ownership for high-voltage applications. The MSC035SMA170S device is a 1700 V, 35 mΩ SiC MOSFET in a TO-268 (D3PAK) package.



1—Gate
2—Drain
3—Source
Backside—Drain



Features

The following are key features of the MSC035SMA170S device:

- Low capacitances and low gate charge
- Fast switching speed due to low internal gate resistance (ESR)
- Stable operation at high junction temperature, $T_{J(max)}$ = 175 °C
- Fast and reliable body diode
- Superior avalanche ruggedness
- RoHS compliant

Benefits

The following are benefits of the MSC035SMA170S device:

- High efficiency to enable lighter, more compact system
- Simple to drive and easy to parallel
- Improved thermal capabilities and lower switching losses
- Eliminates the need for external freewheeling diode
- Lower system cost of ownership

Applications

The MSC035SMA170S device is designed for the following applications:

- PV inverter, converter, and industrial motor drives
- Smart grid transmission and distribution
- Induction heating and welding
- H/EV powertrain and EV charger
- Power supply and distribution

Device Specifications

This section shows the specifications of the MSC035SMA170S device.

Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the MSC035SMA170S device.

Table 1 • Absolute Maximum Ratings

Symbol	Characteristic	Ratings	Unit
V_{DSS}	Drain source voltage	1700	V
I_D	Continuous drain current at T_C = 25 °C	59	A
	Continuous drain current at T_C = 100 °C	42	
I_{DM}	Pulsed drain current [1]	200	
V_{GS}	Gate-source voltage	23 to –10	V
P_D	Total power dissipation at T_C = 25 °C	278	W
	Linear derating factor	1.85	W/°C

Note:

1. Repetitive rating: pulse width and case temperature limited by maximum junction temperature.

The following table shows the thermal and mechanical characteristics of the MSC035SMA170S device.

Table 2 • Thermal and Mechanical Characteristics

Sym-bol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal resistance		0.36	0.54	°C/W
T_J	Operating junction temperature	–55		175	°C
T_{STG}	Storage temperature	–55		150	
T_L	Soldering temperature for 10 seconds (1.6 mm from case)			260	
Wt	Package weight		0.14		oz
			3.9		g

Electrical Performance

The following table shows the static characteristics of the MSC035SMA170S device. T_J = 25 °C unless otherwise specified.

Table 3 • Static Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$V_{(BR)\ DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 100 µA	1700			V
$R_{DS(on)}$	Drain-source on resistance[1]	V_{GS} = 20 V, I_D = 30 A		35	45	mΩ
$V_{GS(th)}$	Gate-source threshold voltage	V_{GS} = V_{DS}, I_D = 2.5 mA	1.8	3.25		V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold voltage coefficient	V_{GS} = V_{DS}, I_D = 2.5 mA		–5.1		mV/°C
I_{DSS}	Zero gate voltage drain current	V_{DS} = 1700 V, V_{GS} = 0 V			100	µA
		V_{DS} = 1700 V, V_{GS} = 0 V T_J = 125 °C			500	
I_{GSS}	Gate-source leakage current	V_{GS} = 20 V/–10 V			±100	nA

Note:

1. Pulse test: pulse width < 380 µs, duty cycle < 2%.

The following table shows the dynamic characteristics of the MSC035SMA170S device. T_J = 25 °C unless otherwise specified.

Table 4 • Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input capacitance	V_{GS} = 0 V, V_{DD} = 1000 V V_{AC} = 25 mV, ƒ = 1 MHz		3300		pF
C_{rss}	Reverse transfer capacitance			10		
C_{oss}	Output capacitance			150		
Q_g	Total gate charge	V_{GS} = –5 V/20 V, V_{DD} = 850 V I_D = 30 A		178		nC
Q_{gs}	Gate-source charge			49		
Q_{gd}	Gate-drain charge			27		
$t_{d(on)}$	Turn-on delay time	V_{DD} = 1200 V, V_{GS} = –5 V/20 V I_D = 50 A, $R_{G(ext)}$ = 4 Ω[1], Freewheeling diode = MSC035SMA170S (Vg = –5 V)		38		ns
t_f	Voltage fall time			20		

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$t_{d(off)}$	Turn-off delay time			26		
t_r	Voltage rise time			10		
E_{on}	Turn-on switching energy [2]			2743		µJ
E_{off}	Turn-off switching energy			368		
$t_{d(on)}$	Turn-on delay time	V_{DD} = 1200 V, V_{GS} = –5 V/20 V I_D = 50 A, $R_{G(ext)}$ = 4 Ω[1], Freewheeling diode = MSC050SDA170B		38		ns
t_f	Voltage fall time			20		
$t_{d(off)}$	Turn-off delay time			26		
t_r	Voltage rise time			10		
E_{on}	Turn-on switching energy [2]			2820		µJ
E_{off}	Turn-off switching energy			368		
ESR	Equivalent series resistance	f = 1 MHz, 25 mV, drain short		0.85		Ω
SCWT	Short circuit withstand time	V_{DS} = 1200 V, V_{GS} = 20 V		3		µs
E_{AS}	Avalanche energy, single pulse	V_{DS} = 150 V, V_{GS} = 20 V, I_D = 30 A		4000		mJ

Notes:

1. R_G is total gate resistance excluding internal gate driver impedance.
2. E_{on} includes energy of the freewheeling diode.

The following table shows the body diode characteristics of the MSC035SMA170S device. T_J = 25 °C unless otherwise specified.

Table 5 • Body Diode Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode forward voltage	I_{SD} = 30 A, V_{GS} = 0 V		3.7		V
		I_{SD} = 30 A, V_{GS} = –5 V		3.9		V
t_{rr}	Reverse recovery time	I_{SD} = 50 A, V_{GS} = –5 V, V_{DD} = 1200 V, dI/dt = –1900 A/µs		42		ns
Q_{rr}	Reverse recovery charge			510		nC
I_{RRM}	Reverse recovery current			18		A

Typical Performance Curves

This section shows the typical performance curves of the MSC035SMA170S device.

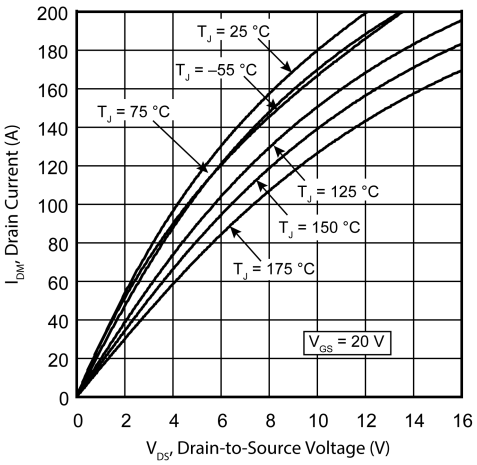


Figure 1 • Drain Current vs. V_{DS}

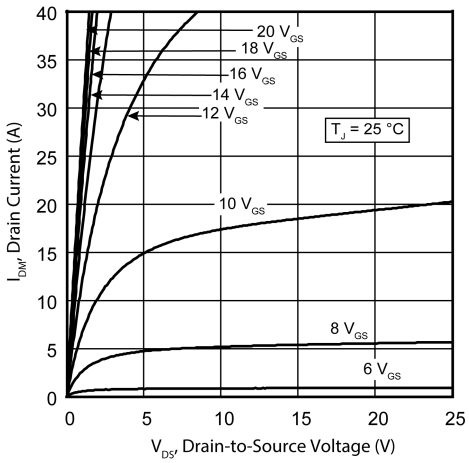


Figure 2 • Drain Current vs. V_{DS}

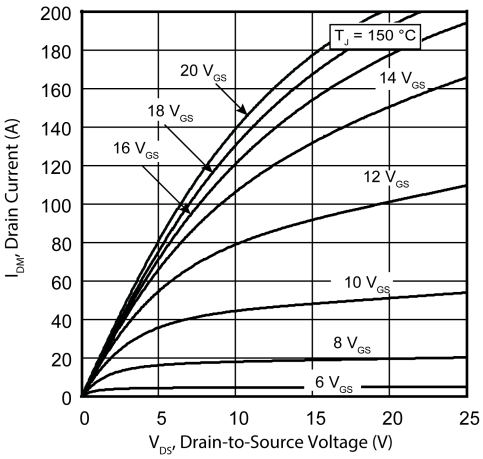


Figure 3 • Drain Current vs. V_{DS}

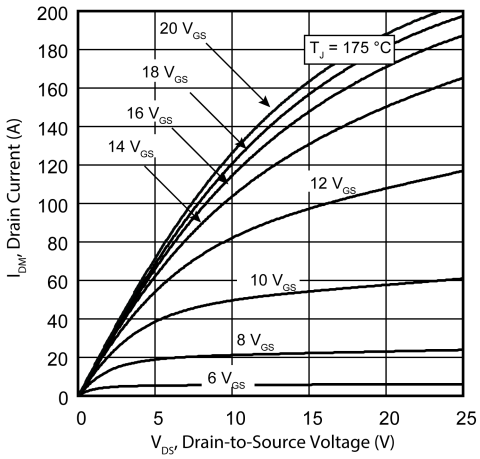


Figure 4 • Drain Current vs. V_{DS}

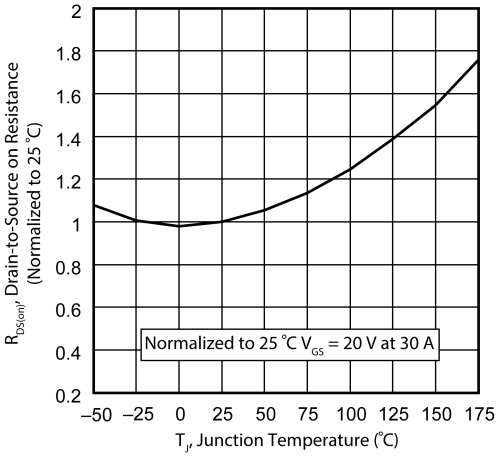


Figure 5 • RDS(on) vs. Junction Temperature

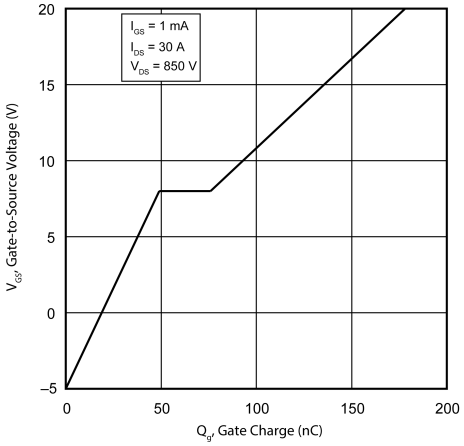


Figure 6 • Gate Charge Characteristics

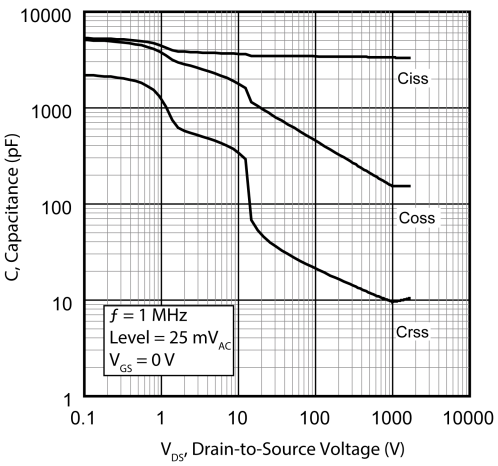


Figure 7 • Capacitance vs. Drain-to-Source Voltage

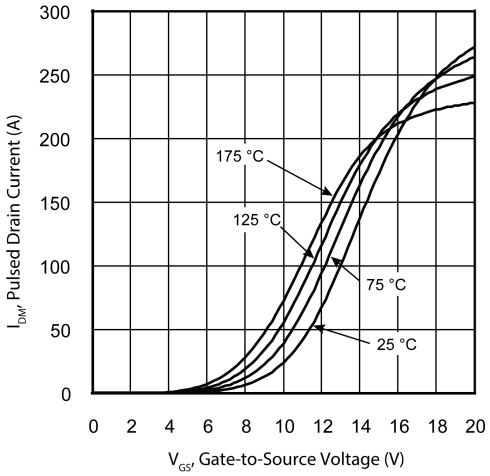


Figure 8 • IDM vs. Gate-to-Source Voltage

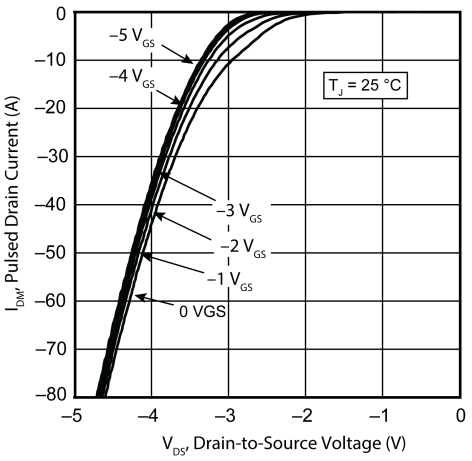


Figure 9 • I_{DM} vs. V_{DS} 3rd Quadrant Conduction

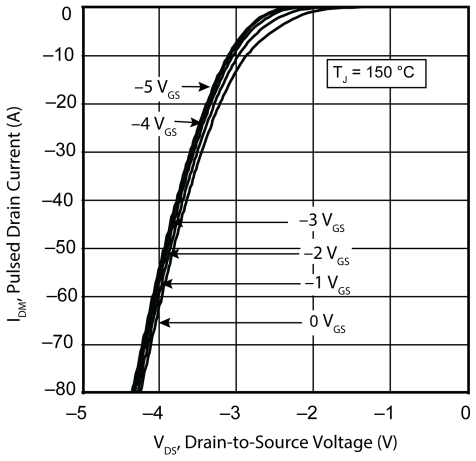


Figure 10 • I_{DM} vs. V_{DS} 3rd Quadrant Conduction

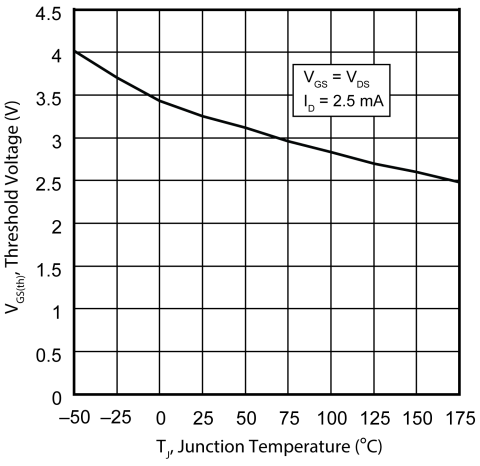


Figure 11 • Threshold Voltage vs. Junction Temp.

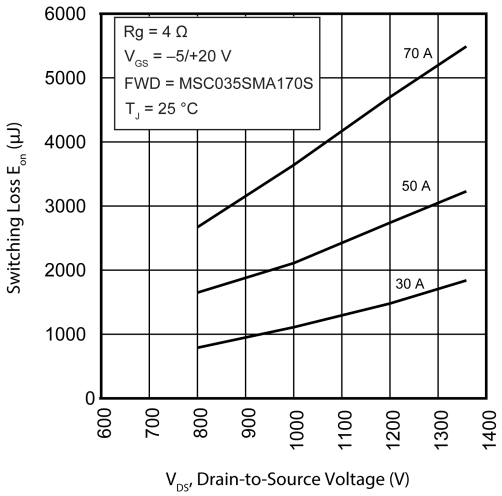


Figure 12 • Switching Energy Eon vs. V_{DS} and I_D

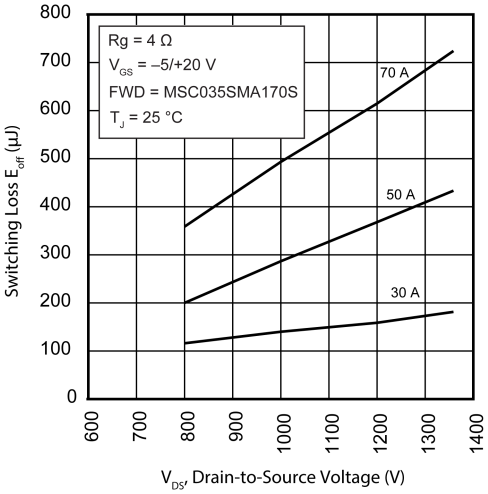


Figure 13 • Switching Energy Eoff vs. V_{DS} & I_D

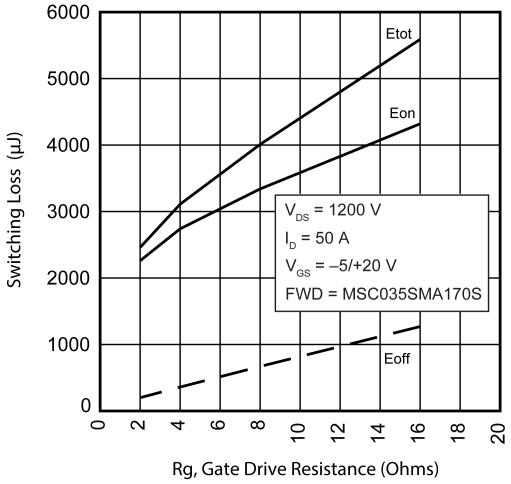


Figure 14 • Switching Energy vs. Rg

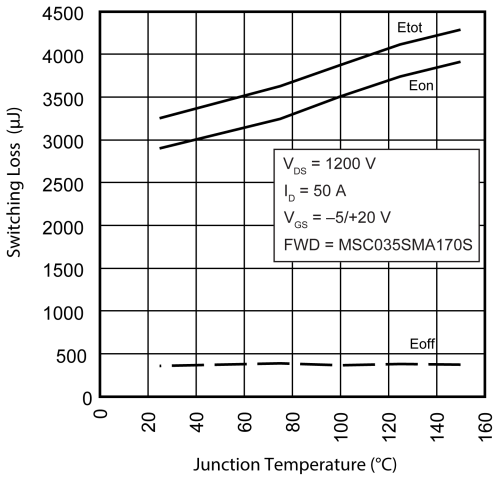


Figure 15 • Switching Energy vs. T_J

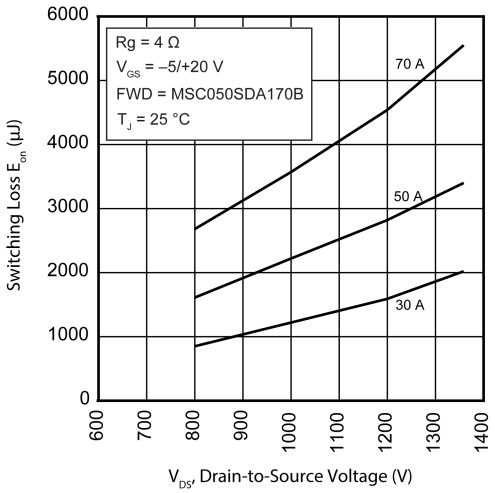


Figure 16 • Switching Energy Eon vs. V_{DS} and I_D

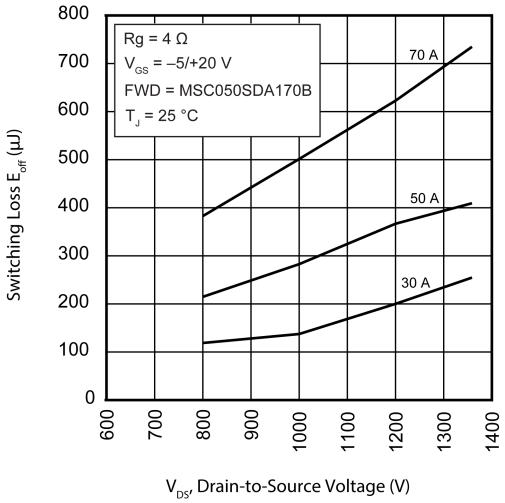


Figure 17 • Switching Energy Eoff vs. V_{DS} and I_D

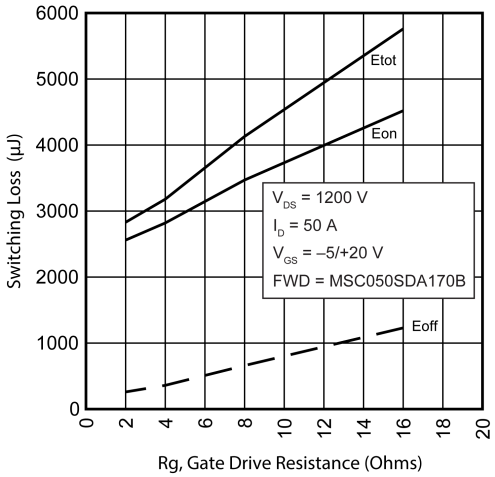


Figure 18 • Switching Energy vs. Rg

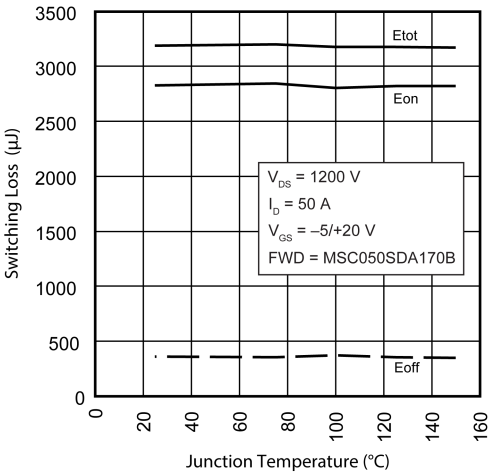


Figure 19 • Switching Energy vs. T_J

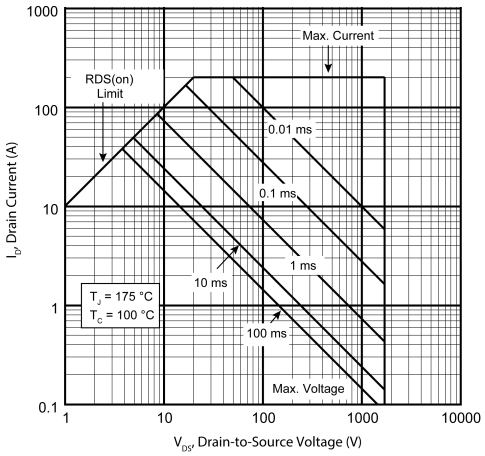


Figure 20 • Forward Safe Operating Area

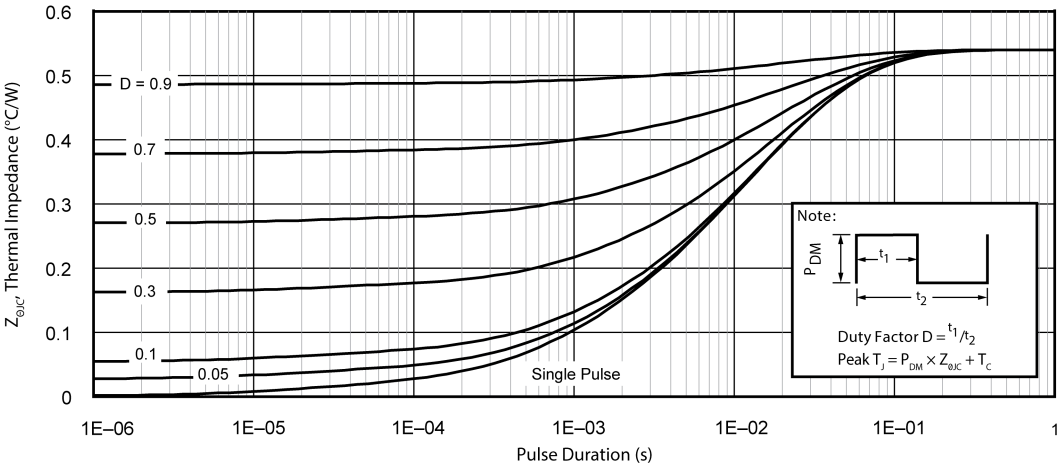


Figure 21 • Maximum Transient Thermal Impedance

Package Specification

This section shows the package specification of the MSC035SMA170S device.

Package Outline Drawing

The following figure illustrates the TO-268 package drawing for the MSC035SMA170S device. The dimensions in the figure below are in millimeters and (inches).

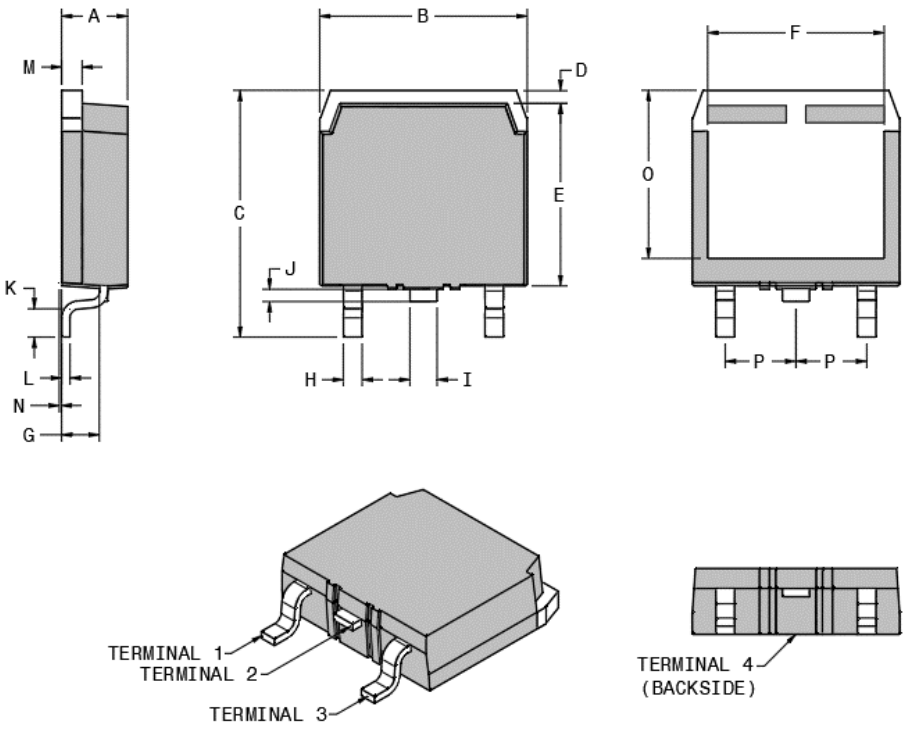


Figure 22 • Package Outline Drawing

The following table shows the TO-268 dimensions and should be used in conjunction with the package outline drawing.

Table 6 • TO-268 Dimensions

Symbol	Min (mm)	Max (mm)	Min (in.)	Max (in.)
A	4.90	5.10	0.193	0.201
B	15.85	16.20	0.624	0.638
C	18.70	19.10	0.736	0.752
D	1.00	1.25	0.039	0.049
E	13.80	14.00	0.543	0.551
F	13.30	13.60	0.524	0.535

Symbol	Min (mm)	Max (mm)	Min (in.)	Max (in.)
G	2.70	2.90	0.106	0.114
H	1.15	1.45	0.045	0.057
I	1.95	2.21	0.077	0.087
J	0.94	1.40	0.037	0.055
K	2.40	2.70	0.094	0.106
L	0.40	0.60	0.016	0.024
M	1.45	1.60	0.057	0.063
N	0.00	0.18	0.000	0.007
O	12.40	12.70	0.488	0.500
P	5.45 BSC (nom.)		0.215 BSC (nom.)	
Terminal 1	Gate			
Terminal 2	Drain			
Terminal 3	Source			
Terminal 4	Drain			





Microsemi
2355 W. Chandler Blvd.
Chandler, AZ 85224 USA

Within the USA: +1 (480) 792-7200
Fax: +1 (480) 792-7277

www.microsemi.com © 2020 Microsemi and its corporate affiliates. All rights reserved. Microsemi and the Microsemi logo are trademarks of Microsemi Corporation and its corporate affiliates. All other trademarks and service marks are the property of their respective owners.

Microsemi's product warranty is set forth in Microsemi's Sales Order Terms and Conditions. Information contained in this publication is provided for the sole purpose of designing with and using Microsemi products. Information regarding device applications and the like is provided only for your convenience and may be superseded by updates. Buyer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is your responsibility to ensure that your application meets with your specifications. THIS INFORMATION IS PROVIDED "AS IS." MICROSEMI 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 ITS CONDITION, QUALITY, PERFORMANCE, NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT WILL MICROSEMI BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL OR CONSEQUENTIAL LOSS, DAMAGE, COST OR EXPENSE WHATSOEVER RELATED TO THIS INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROSEMI HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROSEMI'S TOTAL LIABILITY ON ALL CLAIMS IN RELATED TO THIS INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, YOU PAID DIRECTLY TO MICROSEMI FOR THIS INFORMATION. Use of Microsemi devices in life support, mission-critical equipment or applications, and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend and indemnify Microsemi from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microsemi intellectual property rights unless otherwise stated.

Microsemi Corporation, a subsidiary of Microchip Technology Inc. (Nasdaq: MCHP), and its corporate affiliates are leading providers of smart, connected and secure embedded control solutions. Their easy-to-use development tools and comprehensive product portfolio enable customers to create optimal designs which reduce risk while lowering total system cost and time to market. These solutions serve more than 120,000 customers across the industrial, automotive, consumer, aerospace and defense, communications and computing markets. Headquartered in Chandler, Arizona, the company offers outstanding technical support along with dependable delivery and quality. Learn more at **www.microsemi.com**.

050-7771 | April 2020 | Released

ENTEGRECİ

Bu belge www.entegreci.com üzerinden sunulmaktadır.

Elektronik komponent tedarikinde Entegreci

Entegreci, Eskişehir merkezli, Türkiye geneline satış yapan bir elektronik komponent mağazasıdır. Entegreler (IC), mikrodenetleyiciler, transistörler, diyotlar, pasif elemanlar, konnektörler, modüller ve geliştirme kartları tek adetten seri üretim adetlerine kadar satılır. Ürün sayfalarında güncel stok durumunu, fiyatı ve datasheet bağlantısını bulabilirsiniz.

Parça koduyla arama

Üretici parça numarasını yazın; stok ve fiyatı hemen görün.

www.entegreci.com

Ürün kategorileri

Entegreden kapasitöre tüm elektronik komponent kategorileri.

Kategorilere göz atın

Üreticiler

Aradığınız üreticinin ürünlerini tek sayfada inceleyin.

Üreticileri görün

Toplu alım ve teklif

Listede olmayan ya da yüksek adetli parçalar için teklif isteyin.

Teklif isteyin

www.entegreci.com | **destek@entegreci.com** | **0850 305 90 34**

Entegreci is an online electronic components store based in Türkiye. Search by manufacturer part number to see stock, prices and datasheets for integrated circuits, microcontrollers, transistors, passive components and connectors, or request a quote for parts that are not listed.

Bu sayfa Entegreci tarafından eklenmiştir. Belgenin önceki sayfaları asıl yayıncısına aittir ve içeriği değiştirilmemiştir; en güncel sürüm için belgenin yayıncısına başvurun.