

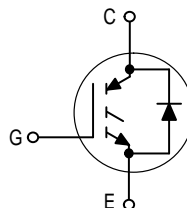
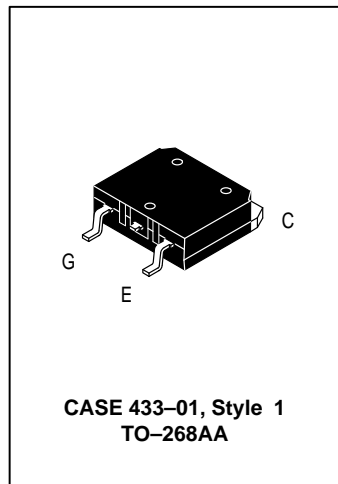
*Product Preview Data Sheet*  
**Insulated Gate Bipolar Transistor  
with Anti-Parallel Diode**  
**N-Channel Enhancement Mode Silicon Gate**

**MGV12N120D**

**IGBT & DIODE IN D3PAK**  
**12 A @ 90°C**  
**20 A @ 25°C**  
**1200 VOLTS**  
**SHORT CIRCUIT RATED**

This Insulated Gate Bipolar Transistor (IGBT) is co-packaged with a soft recovery ultra-fast rectifier and uses an advanced termination scheme to provide an enhanced and reliable high voltage blocking capability. Short circuit rated IGBTs are specifically suited for applications requiring a guaranteed short circuit withstand time. Fast switching characteristics result in efficient operations at high frequencies. Co-packaged IGBTs save space, reduce assembly time and cost.

- High Power Surface Mount D3PAK Package
- High Speed  $E_{off}$ : 160  $\mu$ J/A typical at 125°C
- High Short Circuit Capability – 10  $\mu$ s minimum
- Soft Recovery Free Wheeling Diode is included in the package
- Robust High Voltage Termination



**MAXIMUM RATINGS** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CES}$	1200	Vdc
Collector-Gate Voltage ( $R_{GE} = 1.0 \text{ M}\Omega$ )	$V_{CGR}$	1200	Vdc
Gate-Emitter Voltage — Continuous	$V_{GE}$	$\pm 20$	Vdc
Collector Current — Continuous @ $T_C = 25^\circ\text{C}$	$I_{C25}$	20	Adc
— Continuous @ $T_C = 90^\circ\text{C}$	$I_{C90}$	12	
— Repetitive Pulsed Current (1)	$I_{CM}$	40	Apk
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	$P_D$	123 0.98	Watts W/°C
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to 150	°C
Short Circuit Withstand Time ( $V_{CC} = 720 \text{ Vdc}, V_{GE} = 15 \text{ Vdc}, T_J = 125^\circ\text{C}, R_G = 20 \Omega$ )	$t_{sc}$	10	$\mu$ s
Thermal Resistance — Junction to Case – IGBT	$R_{\theta JC}$	1.02	°C/W
— Junction to Case – Diode	$R_{\theta JC}$	1.41	
— Junction to Ambient	$R_{\theta JA}$	45	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	$T_L$	260	°C

(1) Pulse width is limited by maximum junction temperature.

This document contains information on a new product. Specifications and information are subject to change without notice.

# MGV12N120D

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector-to-Emitter Breakdown Voltage (V <sub>GE</sub> = 0 Vdc, I <sub>C</sub> = 250 μAdc) Temperature Coefficient (Positive)	B <sub>V</sub> CES	1200 —	— 870	— —	Vdc mV/°C
Zero Gate Voltage Collector Current (V <sub>CE</sub> = 1200 Vdc, V <sub>GE</sub> = 0 Vdc) (V <sub>CE</sub> = 1200 Vdc, V <sub>GE</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	I <sub>C</sub> ES	— —	— —	100 2500	μAdc
Gate-Body Leakage Current (V <sub>GE</sub> = ± 20 Vdc, V <sub>CE</sub> = 0 Vdc)	I <sub>G</sub> ES	—	—	250	nAdc

## ON CHARACTERISTICS (1)

Collector-to-Emitter On-State Voltage (V <sub>GE</sub> = 15 Vdc, I <sub>C</sub> = 5 Adc) (V <sub>GE</sub> = 15 Vdc, I <sub>C</sub> = 10 Adc, T <sub>J</sub> = 125°C) (V <sub>GE</sub> = 15 Vdc, I <sub>C</sub> = 10 Adc)	V <sub>CE(on)</sub>	— — —	2.51 2.36 3.21	3.37 — 4.42	Vdc
Gate Threshold Voltage (V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 1 mAdc) Threshold Temperature Coefficient (Negative)	V <sub>GE(th)</sub>	4.0 —	6.0 10	8.0 —	Vdc mV/°C
Forward Transconductance (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 10 Adc)	g <sub>fe</sub>	—	12	—	Mhos

## DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>CE</sub> = 25 Vdc, V <sub>GE</sub> = 0 Vdc, f = 1.0 MHz)	C <sub>ies</sub>	—	930	—	pF
Output Capacitance		C <sub>oes</sub>	—	126	—	
Transfer Capacitance		C <sub>res</sub>	—	16	—	

## SWITCHING CHARACTERISTICS (1)

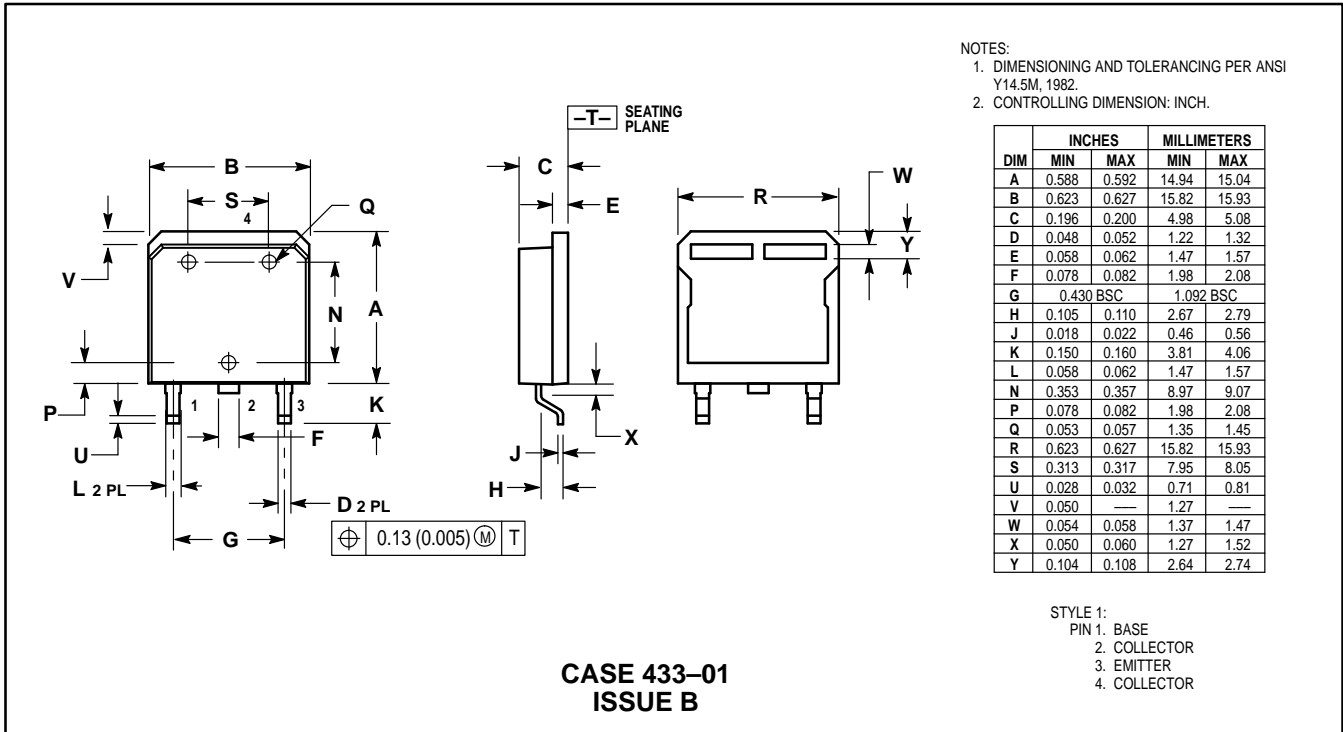
Turn-On Delay Time	(V <sub>CC</sub> = 720 Vdc, I <sub>C</sub> = 10 Adc, V <sub>GE</sub> = 15 Vdc, L = 300 μH R <sub>G</sub> = 20 Ω, T <sub>J</sub> = 25°C) Energy losses include "tail"	t <sub>d(on)</sub>	—	80	—	ns
Rise Time		t <sub>r</sub>	—	114	—	
Turn-Off Delay Time		t <sub>d(off)</sub>	—	66	—	
Fall Time		t <sub>f</sub>	—	232	—	
Turn-Off Switching Loss		E <sub>off</sub>	—	0.57	1.33	mJ
Turn-On Switching Loss		E <sub>on</sub>	—	1.12	1.88	
Total Switching Loss		E <sub>ts</sub>	—	1.69	3.21	
Turn-On Delay Time	(V <sub>CC</sub> = 720 Vdc, I <sub>C</sub> = 10 Adc, V <sub>GE</sub> = 15 Vdc, L = 300 μH R <sub>G</sub> = 20 Ω, T <sub>J</sub> = 125°C) Energy losses include "tail"	t <sub>d(on)</sub>	—	74	—	ns
Rise Time		t <sub>r</sub>	—	110	—	
Turn-Off Delay Time		t <sub>d(off)</sub>	—	80	—	
Fall Time		t <sub>f</sub>	—	616	—	
Turn-Off Switching Loss		E <sub>off</sub>	—	1.60	—	mJ
Turn-On Switching Loss		E <sub>on</sub>	—	2.30	—	
Total Switching Loss		E <sub>ts</sub>	—	3.90	—	
Gate Charge	(V <sub>CC</sub> = 720 Vdc, I <sub>C</sub> = 10 Adc, V <sub>GE</sub> = 15 Vdc)	Q <sub>T</sub>	—	31	—	nC
		Q <sub>1</sub>	—	13	—	
		Q <sub>2</sub>	—	14	—	

**ELECTRICAL CHARACTERISTICS — continued** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
<b>DIODE CHARACTERISTICS</b>						
Diode Forward Voltage Drop ( $I_{EC} = 5 \text{ Adc}$ ) ( $I_{EC} = 5 \text{ Adc}, T_J = 125^\circ\text{C}$ ) ( $I_{EC} = 10 \text{ Adc}$ )		$V_{FEC}$	— — —	2.75 2.50 3.50	3.22 — 4.18	Vdc
Reverse Recovery Time	( $I_F = 10 \text{ Adc}, V_R = 720 \text{ Vdc},$ $di_F/dt = 200 \text{ A}/\mu\text{s}$ )	$t_{rr}$	—	54	—	ns
		$t_a$	—	30	—	
		$t_b$	—	24	—	
Reverse Recovery Stored Charge		$Q_{RR}$	—	61	—	$\mu\text{C}$
Reverse Recovery Time	( $I_F = 10 \text{ Adc}, V_R = 720 \text{ Vdc},$ $di_F/dt = 200 \text{ A}/\mu\text{s}, T_J = 125^\circ\text{C}$ )	$t_{rr}$	—	150	—	ns
		$t_a$	—	102	—	
		$t_b$	—	48	—	
Reverse Recovery Stored Charge		$Q_{RR}$	—	653	—	$\mu\text{C}$

(1) Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

PACKAGE DIMENSIONS



Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters can and do vary in different applications. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

**How to reach us:**  
**USA / EUROPE:** Motorola Literature Distribution;  
 P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, Toshikatsu Otsuki,  
 6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-3521-8315

**MFAX:** RMFAX0@email.sps.mot.com - TOUCHTONE (602) 244-6609  
**INTERNET:** http://Design-NET.com

**HONG KONG:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,  
 51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

