

ON Semiconductor

Is Now



To learn more about onsemi™, please visit our website at
www.onsemi.com

onsemi and onsemi. and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries. onsemi owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of onsemi product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. onsemi reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and onsemi makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does onsemi 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 special, consequential or incidental damages. Buyer is responsible for its products and applications using onsemi products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by onsemi. "Typical" parameters which may be provided in onsemi data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. onsemi does not convey any license under any of its intellectual property rights nor the rights of others. onsemi products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use onsemi products for any such unintended or unauthorized application, Buyer shall indemnify and hold onsemi 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 onsemi was negligent regarding the design or manufacture of the part. onsemi is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.

Designer's™ Data Sheet

Insulated Gate Bipolar Transistor

N-Channel Enhancement-Mode Silicon Gate

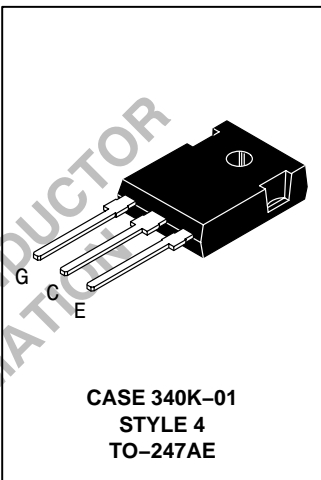
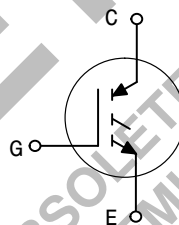
MGW20N120

Motorola Preferred Device

This Insulated Gate Bipolar Transistor (IGBT) uses an advanced termination scheme to provide an enhanced and reliable high voltage-blocking capability. Short circuit rated IGBT's are specifically suited for applications requiring a guaranteed short circuit withstand time. Fast switching characteristics result in efficient operation at high frequencies.

- Industry Standard High Power TO-247 Package with Isolated Mounting Hole
- High Speed E_{off} : 160 μ J/A typical at 125°C
- High Short Circuit Capability – 10 μ s minimum
- Robust High Voltage Termination

IGBT IN TO-247
20 A @ 90°C
28 A @ 25°C
1200 VOLTS
SHORT CIRCUIT RATED



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}	± 20	Vdc
Collector Current — Continuous @ $T_C = 25^\circ\text{C}$ — Continuous @ $T_C = 90^\circ\text{C}$ — Repetitive Pulsed Current (1)	I_{C25} I_{C90} I_{CM}	28 20 56	Adc Apk
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	174 1.39	Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-55 to 150	$^\circ\text{C}$
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	μs
Thermal Resistance — Junction to Case – IGBT — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	0.7 35	$^\circ\text{C/W}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T_L	260	$^\circ\text{C}$
Mounting Torque, 6-32 or M3 screw	10 lbf•in (1.13 N•m)		

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

Designer's Data for "Worst Case" Conditions — The Designer's Data Sheet permits the design of most circuits entirely from the information presented. SOA Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

Designer's is a trademark of Motorola, Inc.

Preferred devices are Motorola recommended choices for future use and best overall value.

REV 2



MGW20N120

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

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

OFF CHARACTERISTICS

Collector-to-Emitter Breakdown Voltage ($V_{GE} = 0\text{ Vdc}$, $I_C = 25\text{ }\mu\text{Adc}$) Temperature Coefficient (Positive)	$V_{(BR)CES}$	1200 —	— 870	— —	Vdc mV/ $^\circ\text{C}$
Emitter-to-Collector Breakdown Voltage ($V_{GE} = 0\text{ Vdc}$, $I_{EC} = 100\text{ mAdc}$)	$V_{(BR)ECS}$	25	—	—	Vdc
Zero Gate Voltage Collector Current ($V_{CE} = 1200\text{ Vdc}$, $V_{GE} = 0\text{ Vdc}$) ($V_{CE} = 1200\text{ Vdc}$, $V_{GE} = 0\text{ Vdc}$, $T_J = 125^\circ\text{C}$)	I_{CES}	— —	— —	100 2500	μAdc
Gate-Body Leakage Current ($V_{GE} = \pm 20\text{ Vdc}$, $V_{CE} = 0\text{ Vdc}$)	I_{GES}	—	—	250	nAdc

ON CHARACTERISTICS (1)

Collector-to-Emitter On-State Voltage ($V_{GE} = 15\text{ Vdc}$, $I_C = 10\text{ Adc}$) ($V_{GE} = 15\text{ Vdc}$, $I_C = 10\text{ Adc}$, $T_J = 125^\circ\text{C}$) ($V_{GE} = 15\text{ Vdc}$, $I_C = 20\text{ Adc}$)	$V_{CE(on)}$	— — —	2.42 2.36 2.90	3.54 — 4.99	Vdc
Gate Threshold Voltage ($V_{CE} = V_{GE}$, $I_C = 1.0\text{ mAdc}$) Threshold Temperature Coefficient (Negative)	$V_{GE(th)}$	4.0 —	6.0 10	8.0 —	Vdc mV/ $^\circ\text{C}$
Forward Transconductance ($V_{CE} = 10\text{ Vdc}$, $I_C = 20\text{ Adc}$)	g_{fe}	—	12	—	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	$(V_{CE} = 25\text{ Vdc}$, $V_{GE} = 0\text{ Vdc}$, $f = 1.0\text{ MHz}$)	C_{ies}	—	1860	—	pF
Output Capacitance		C_{oes}	—	122	—	
Transfer Capacitance		C_{res}	—	29	—	

SWITCHING CHARACTERISTICS (1)

Turn-On Delay Time	$(V_{CC} = 720\text{ Vdc}$, $I_C = 20\text{ Adc}$, $V_{GE} = 15\text{ Vdc}$, $L = 300\text{ }\mu\text{H}$ $R_G = 20\text{ }\Omega$) Energy losses include "tail"	$t_{d(on)}$	—	88	—	ns
Rise Time		t_r	—	103	—	
Turn-Off Delay Time		$t_{d(off)}$	—	190	—	
Fall Time		t_f	—	284	—	
Turn-Off Switching Loss		E_{off}	—	1.65	2.75	mJ
Turn-On Delay Time	$(V_{CC} = 720\text{ Vdc}$, $I_C = 20\text{ Adc}$, $V_{GE} = 15\text{ Vdc}$, $L = 300\text{ }\mu\text{H}$ $R_G = 20\text{ }\Omega$, $T_J = 125^\circ\text{C}$) Energy losses include "tail"	$t_{d(on)}$	—	83	—	ns
Rise Time		t_r	—	107	—	
Turn-Off Delay Time		$t_{d(off)}$	—	216	—	
Fall Time		t_f	—	494	—	
Turn-Off Switching Loss		E_{off}	—	3.19	—	mJ
Gate Charge	$(V_{CC} = 720\text{ Vdc}$, $I_C = 20\text{ Adc}$, $V_{GE} = 15\text{ Vdc}$)	Q_T	—	62	—	nC
		Q_1	—	21	—	
		Q_2	—	25	—	

INTERNAL PACKAGE INDUCTANCE

Internal Emitter Inductance (Measured from the emitter lead 0.25" from package to emitter bond pad)	L_E	—	13	—	nH
--	-------	---	----	---	----

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

TYPICAL ELECTRICAL CHARACTERISTICS

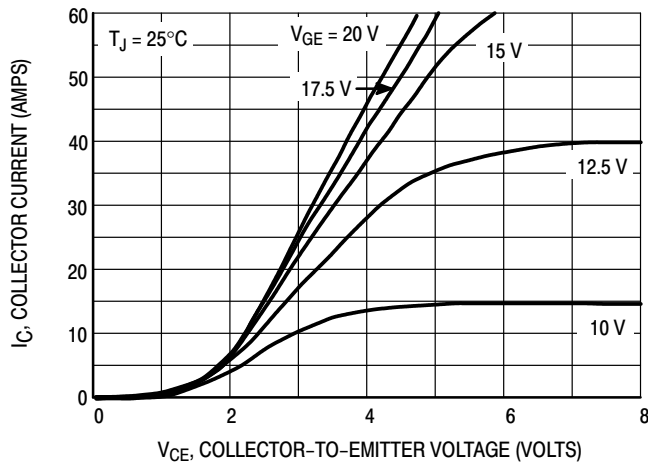


Figure 1. Output Characteristics

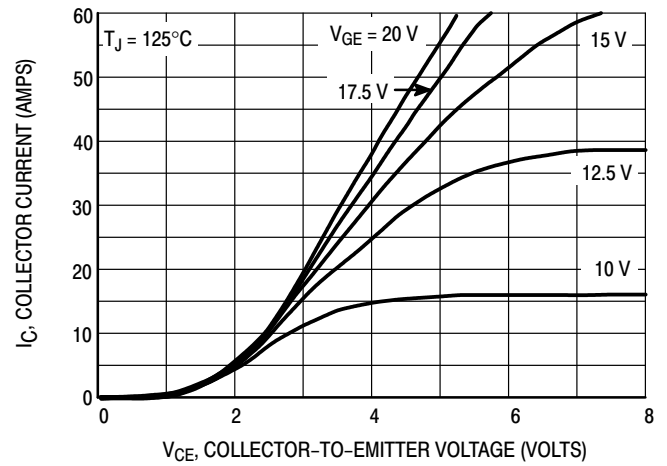


Figure 2. Output Characteristics

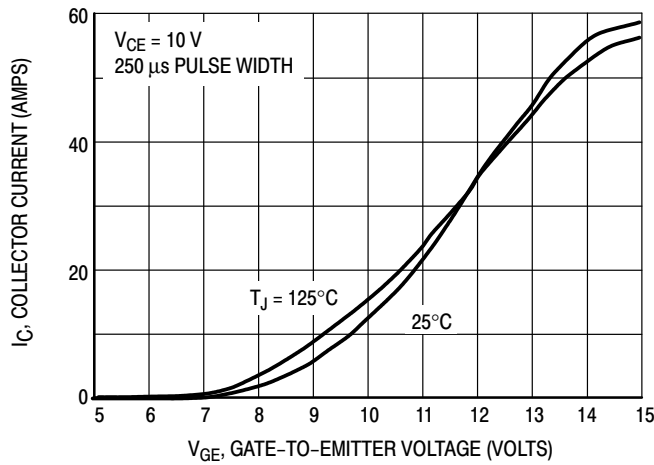


Figure 3. Transfer Characteristics

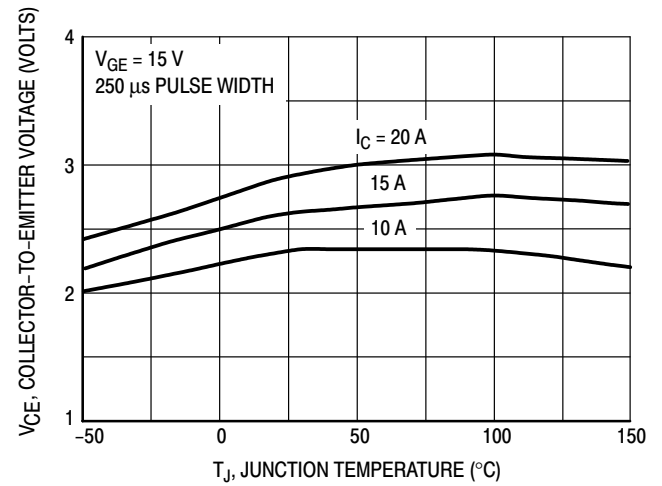


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

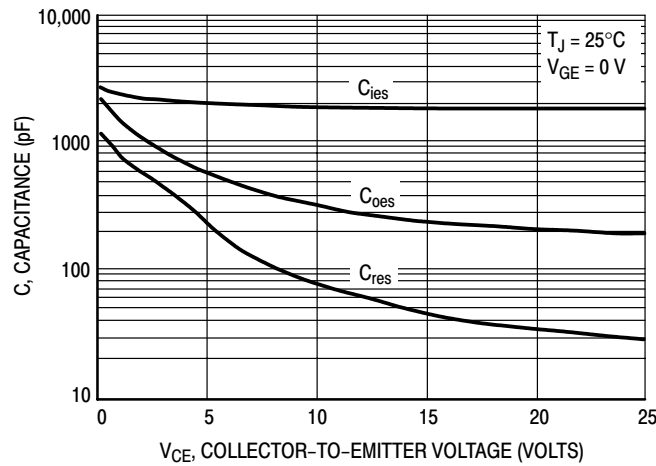


Figure 5. Capacitance Variation

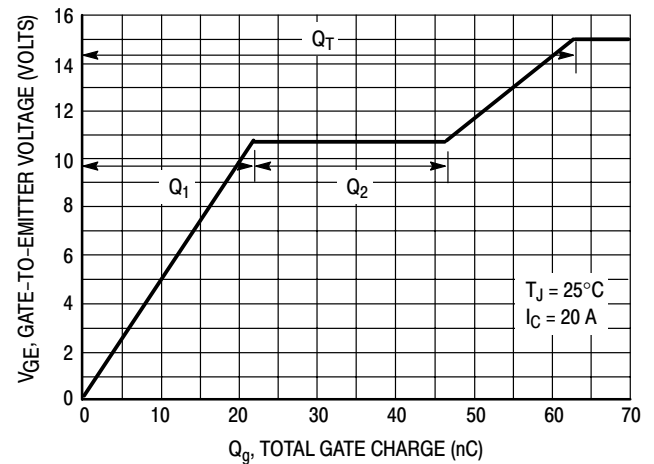


Figure 6. Gate-to-Emitter Voltage versus Total Charge

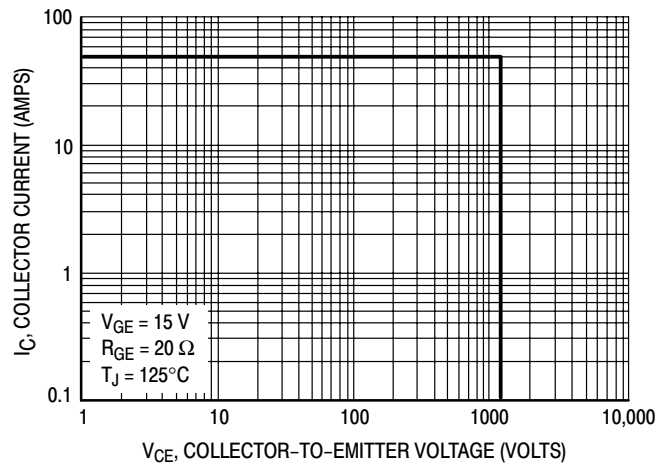


Figure 7. Reverse Biased Safe Operating Area

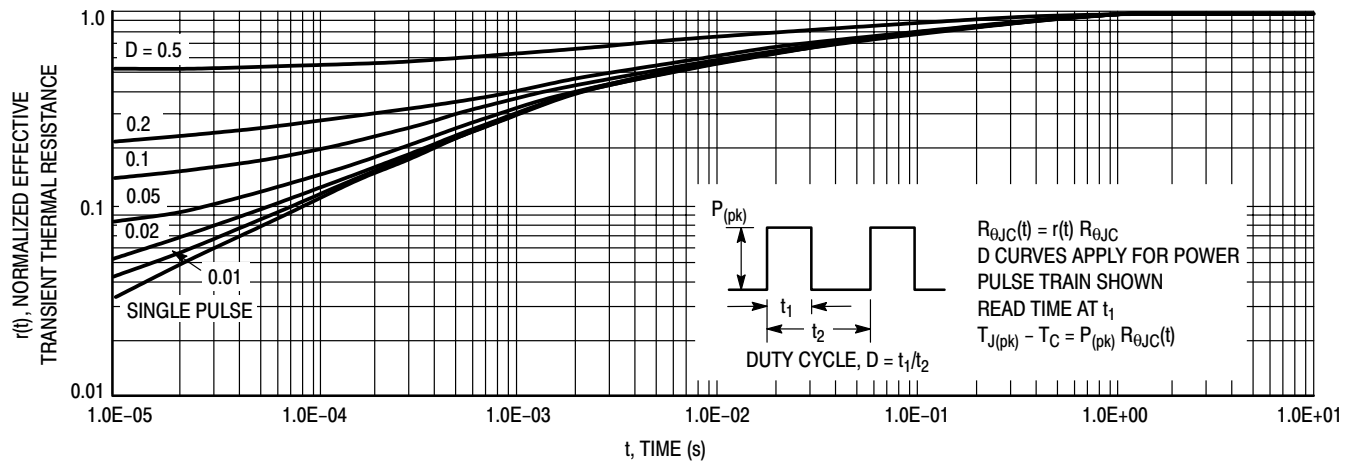
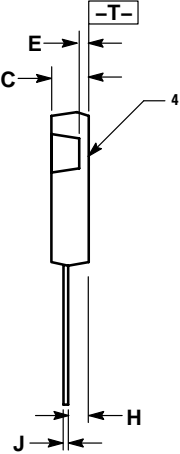
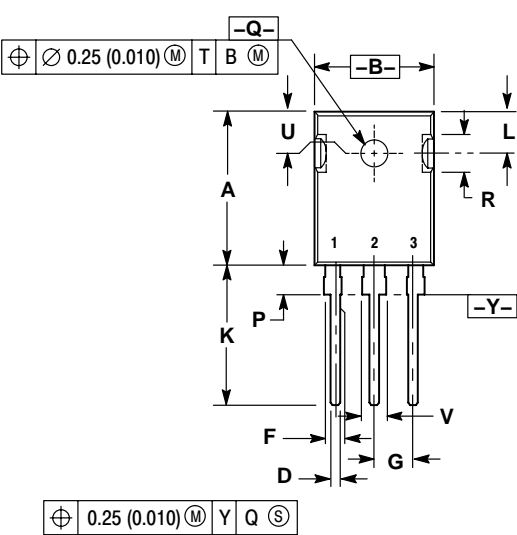


Figure 8. Thermal Response

PACKAGE DIMENSIONS




- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	19.7	20.3	0.776	0.799
B	15.3	15.9	0.602	0.626
C	4.7	5.3	0.185	0.209
D	1.0	1.4	0.039	0.055
E	1.27 REF		0.050 REF	
F	2.0	2.4	0.079	0.094
G	5.5 BSC		0.216 BSC	
H	2.2	2.6	0.087	0.102
J	0.4	0.8	0.016	0.031
K	14.2	14.8	0.559	0.583
L	5.5 NOM		0.217 NOM	
P	3.7	4.3	0.146	0.169
Q	3.55	3.65	0.140	0.144
R	5.0 NOM		0.197 NOM	
U	5.5 BSC		0.217 BSC	
V	3.0	3.4	0.118	0.134

CASE 340K-01
TO-247AE
ISSUE A

- STYLE 4:
- PIN 1. GATE
 - COLLECTOR
 - EMITTER
 - COLLECTOR

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 which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. 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.

Mfax is a trademark of Motorola, Inc.

How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 1-303-675-2140 or 1-800-441-2447

JAPAN: Nippon Motorola Ltd.: SPD, Strategic Planning Office, 141,
4-32-1 Nishi-Gotanda, Shagawa-ku, Tokyo, Japan. 03-5487-8488

Customer Focus Center: 1-800-521-6274

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 1-602-244-6609
Motorola Fax Back System – US & Canada ONLY 1-800-774-1848
– <http://sps.motorola.com/mfax/>

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

HOME PAGE: <http://motorola.com/sps/>

**MOTOROLA**