Designer's™ Data Sheet

Insulated Gate Bipolar Transistor

N−Channel Enhancement−Mode Silicon Gate

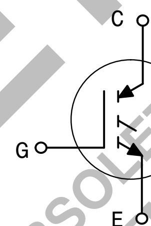
MGW20N120

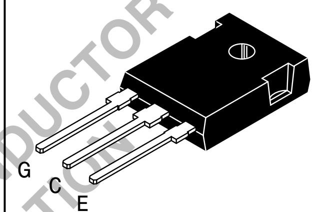
Motorola Preferred Device

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

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 μJ/A typical at 125°C
- High Short Circuit Capability − 10 μs minimum
- Robust High Voltage Termination





CASE 340K−01
STYLE 4
TO−247AE

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Collector−Emitter Voltage	V_{CES}	1200	Vdc
Collector−Gate Voltage (R_{GE} = 1.0 MΩ)	V_{CGR}	1200	Vdc
Gate−Emitter Voltage — Continuous	V_{GE}	±20	Vdc
Collector Current — Continuous @ T_C = 25°C — Continuous @ T_C = 90°C — Repetitive Pulsed Current (1)	I_{C25} I_{C90} I_{CM}	28 20 56	Adc Apk
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	174 1.39	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to 150	°C
Short Circuit Withstand Time (V_{CC} = 720 Vdc, V_{GE} = 15 Vdc, T_J = 125°C, R_G = 20 Ω)	t_{sc}	10	μs
Thermal Resistance — Junction to Case − IGBT — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	0.7 35	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8″ from case for 5 seconds	T_L	260	°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.

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

REV 2

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector−to−Emitter Breakdown Voltage (V_{GE} = 0 Vdc, I_C = 25 µAdc) Temperature Coefficient (Positive)		$V_{(BR)CES}$	 1200 —	 — 870	 — —	Vdc mV/°C
Emitter−to−Collector Breakdown Voltage (V_{GE} = 0 Vdc, I_{EC} = 100 mAdc)		$V_{(BR)ECS}$	25	—	—	Vdc
Zero Gate Voltage Collector Current (V_{CE} = 1200 Vdc, V_{GE} = 0 Vdc) (V_{CE} = 1200 Vdc, V_{GE} = 0 Vdc, T_J = 125°C)		I_{CES}	 — —	 — —	 100 2500	µAdc
Gate−Body Leakage Current (V_{GE} = ± 20 Vdc, V_{CE} = 0 Vdc)		I_{GES}	—	—	250	nAdc
ON CHARACTERISTICS (1)						
Collector−to−Emitter On−State Voltage (V_{GE} = 15 Vdc, I_C = 10 Adc) (V_{GE} = 15 Vdc, I_C = 10 Adc, T_J = 125°C) (V_{GE} = 15 Vdc, I_C = 20 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 mAdc) Threshold Temperature Coefficient (Negative)		$V_{GE(th)}$	 4.0 —	 6.0 10	 8.0 —	Vdc mV/°C
Forward Transconductance (V_{CE} = 10 Vdc, I_C = 20 Adc)		g_{fe}	—	12	—	Mhos
DYNAMIC CHARACTERISTICS						
Input Capacitance	(V_{CE} = 25 Vdc, V_{GE} = 0 Vdc, f = 1.0 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 Vdc, I_C = 20 Adc, V_{GE} = 15 Vdc, L = 300 µH R_G = 20 Ω) 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 Vdc, I_C = 20 Adc, V_{GE} = 15 Vdc, L = 300 µH R_G = 20 Ω, T_J = 125°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 Vdc, I_C = 20 Adc, V_{GE} = 15 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 ≤ 300 µs, Duty Cycle ≤ 2%.

TYPICAL ELECTRICAL CHARACTERISTICS

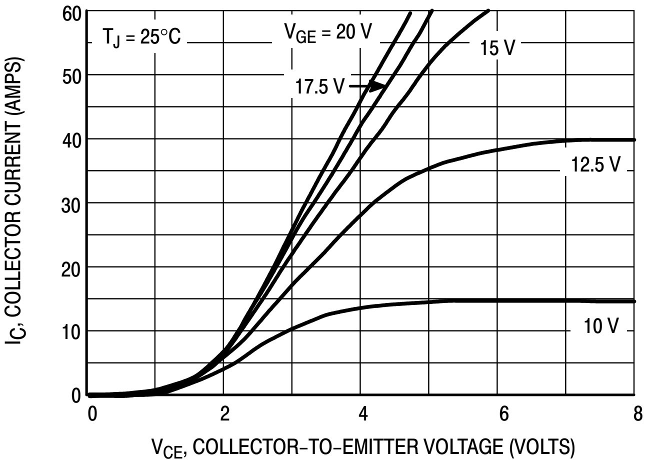


Figure 1. Output Characteristics

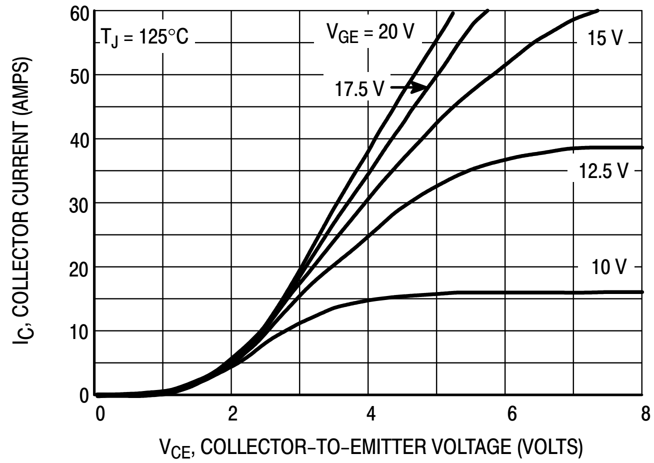


Figure 2. Output Characteristics

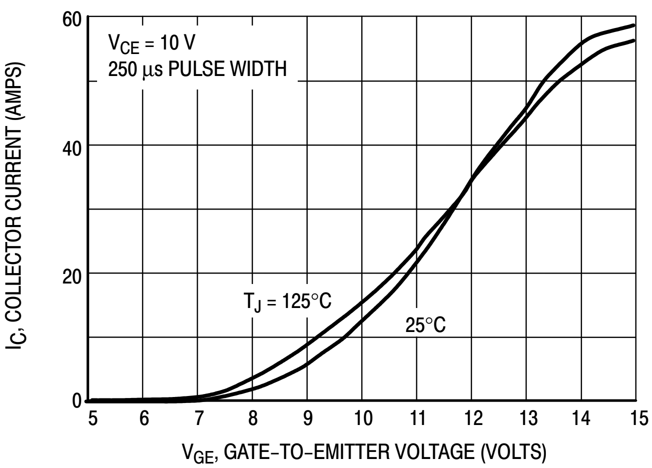


Figure 3. Transfer Characteristics

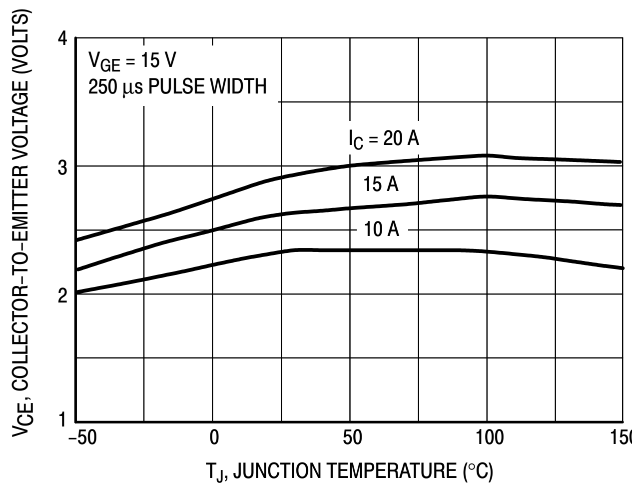


Figure 4. Collector−to−Emitter Saturation Voltage versus Junction Temperature

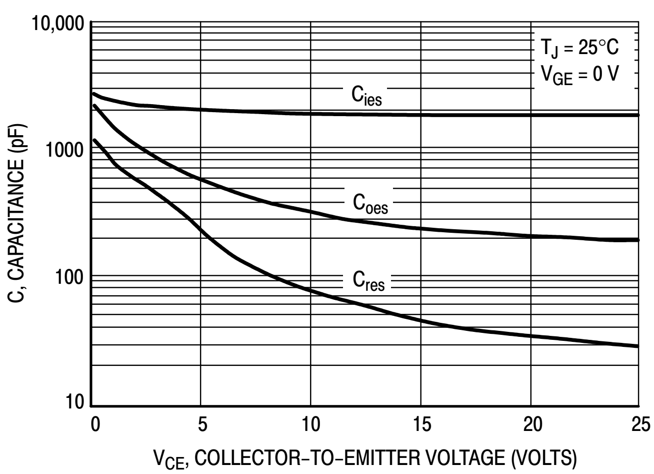


Figure 5. Capacitance Variation

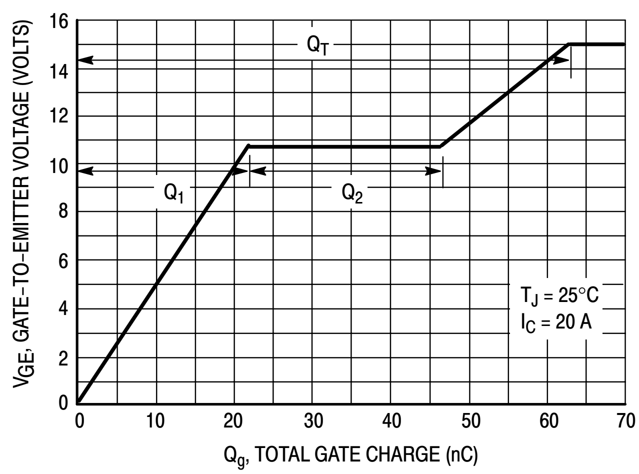


Figure 6. Gate−to−Emitter Voltage versus Total Charge

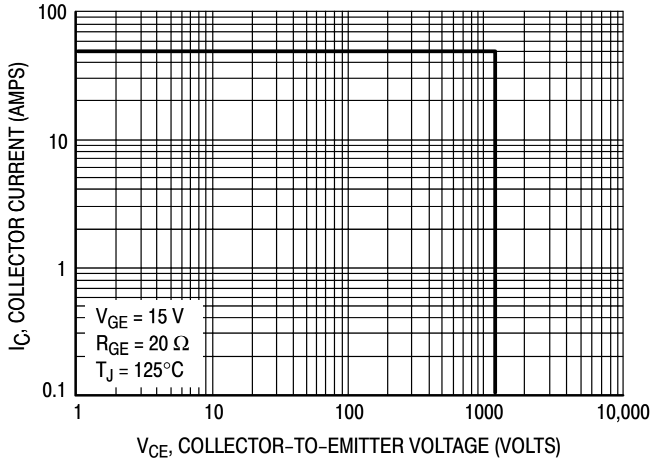


Figure 7. Reverse Biased Safe Operating Area

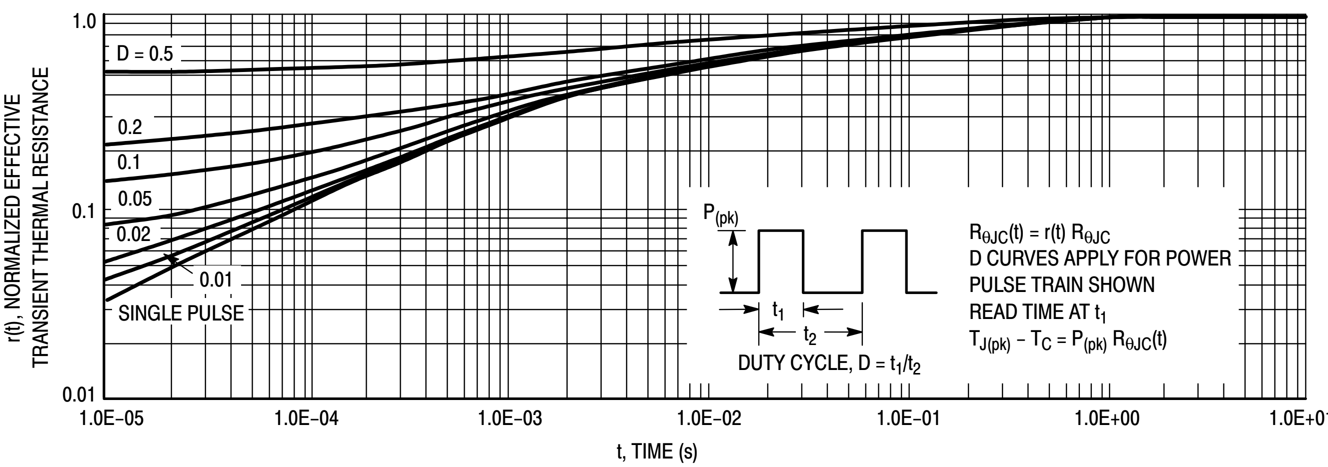
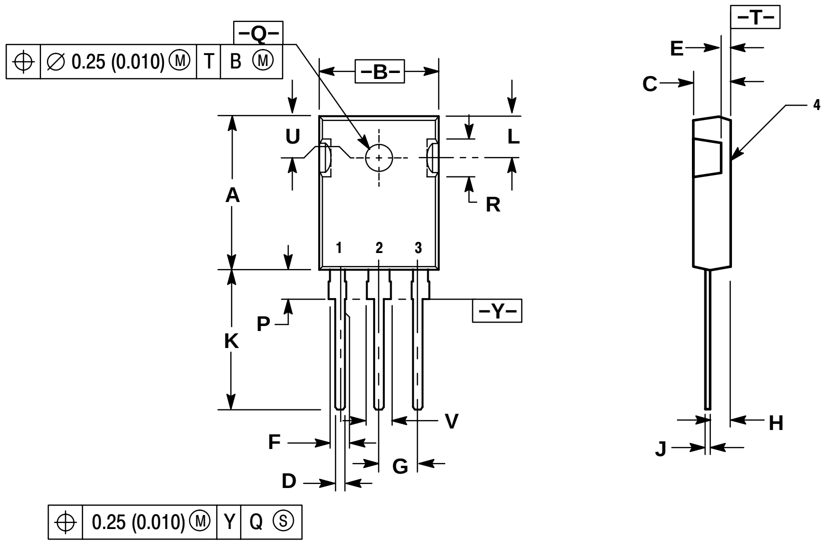


Figure 8. Thermal Response

PACKAGE DIMENSIONS



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

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES 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

STYLE 4:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

CASE 340K−01
TO−247AE
ISSUE A

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