

Features

- High Speed Smooth Switching Device for Hard and Soft Switching
- Maximum Junction Temperature 175 °C
- Positive Temperature Coefficient
- High Ruggedness, Temperature Stable
- Halogen Free. "Green" Device (Note 1)
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant (Note 2) ("P" Suffix Designates RoHS Compliant. See Ordering Information)

Applications

- Soft Switching Applications
- Air Conditioning
- Motor Drive Inverter

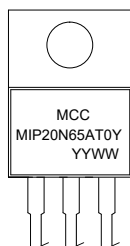
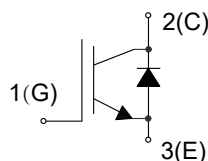
Maximum Ratings

Parameter	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CE}	650	V
DC Collector Current ⁽³⁾	I_C	$T_C=25^{\circ}\text{C}$ 40	A
		$T_C=100^{\circ}\text{C}$ 20	
Pulsed Collector Current ⁽⁴⁾ , $V_{GE}=15\text{V}$	$I_{C,pluse}$	60	A
Diode Forward Current ⁽³⁾	I_F	$T_C=25^{\circ}\text{C}$ 40	A
		$T_C=100^{\circ}\text{C}$ 20	
Diode Pulsed Current ⁽⁴⁾	$I_{F,pluse}$	60	A
Continuous Gate-Emitter Voltage	V_{GE}	± 20	V
Transient Gate-Emitter Voltage ⁽⁵⁾		± 30	
Turn off Safe Operation Area, $V_{CE} \leq 600\text{V}$, $T_J \leq 150^{\circ}\text{C}$		60	A
Short Circuit Withstand Time ⁽⁶⁾	T_{SC}	5	μs
Power Dissipation, $T_C=25^{\circ}\text{C}$, $T_J=175^{\circ}\text{C}$	P_D	120	W

Note:

1. Halogen free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
2. High Temperature Solder Exemptions Applied, see EU Directive Annex 7a.
3. Limited by T_{Jmax} .
4. t_p limited by T_{Jmax} .
5. $t_p \leq 10\mu\text{s}$, Duty Cycle < 1%
6. $V_{GE}=15\text{V}$, $V_{CE} \leq 400\text{V}$

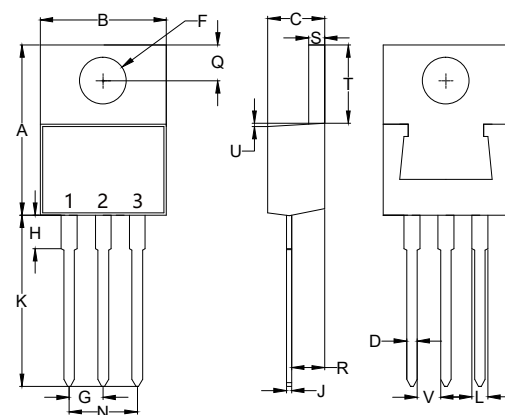
Internal Structure



Device Code: MIP20N65AT0Y
Date Code: YYWW: (Year & Week)

Trench and Field Stop IGBT 650V 20A

TO-220AB



DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	0.560	0.625	14.22	15.88	
B	0.380	0.429	9.65	10.90	
C	0.140	0.201	3.56	5.10	
D	0.020	0.045	0.51	1.14	
F	0.131	0.170	3.34	4.31	Φ
G	0.079	0.121	2.01	3.07	
H	-----	0.250	-----	6.35	
J	0.011	0.025	0.28	0.64	
K	0.500	0.580	12.70	14.73	
L	0.045	0.060	1.14	1.52	
N	0.158	0.242	4.02	6.14	
Q	0.087	0.135	2.22	3.43	
R	0.080	0.126	2.04	3.19	
S	0.045	0.055	1.14	1.39	
T	0.230	0.270	5.84	6.86	
U	-----	0.050	-----	1.27	
V	0.045	-----	1.15	-----	

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
IGBT Static Characteristics						
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=250\mu A$	650			V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=20A, T_J=25^\circ C$		1.6	1.95	V
		$V_{GE}=15V, I_C=20A, T_J=125^\circ C$		1.75		
		$V_{GE}=15V, I_C=20A, T_J=150^\circ C$		1.8		
G-E Threshold Voltage	$V_{GE(th)}$	$I_C=1mA, V_{CE}=V_{GE}$	5.0	5.8	6.5	V
C-E Leakage Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V, T_J=25^\circ C$			0.25	mA
		$V_{CE}=650V, V_{GE}=0V, T_J=150^\circ C$			1	
G-E Leakage Current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$			± 200	nA
Dynamic Characteristics						
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		0.90		nF
Output Capacitance	C_{oes}			0.04		
Reverse Transfer Capacitance	C_{res}			0.01		
Gate Charge	Q_G	$V_{CC}=300V, I_C=20A, V_{GE}=15V$		0.085		μC
IGBT Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=300V, I_C=20A,$ $V_{GE}=-5V\sim 15V,$ $R_G=51\Omega, T_J=25^\circ C$		12		ns
Rise Time	t_r			33		
Turn-Off Delay Time	$t_{d(off)}$			68		
Fall Time	t_f			129		
Turn-On Energy	E_{on}	$V_{CC}=300V, I_C=20A$ $V_{GE}=-5V\sim 15V,$ $R_G=51\Omega, T_J=125^\circ C$		0.41		mJ
Turn-Off Energy	E_{off}			0.22		
Turn-On Delay Time	$t_{d(on)}$			16		ns
Rise Time	t_r			41		
Turn-Off Delay Time	$t_{d(off)}$	$V_{CC}=300V, I_C=20A$ $V_{GE}=-5V\sim 15V,$ $R_G=51\Omega, T_J=150^\circ C$		69		
Fall Time	t_f			154		
Turn-On Energy	E_{on}			0.48		mJ
Turn-Off Energy	E_{off}			0.35		
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=300V, I_C=20A$ $V_{GE}=-5V\sim 15V,$ $R_G=51\Omega, T_J=150^\circ C$		18		ns
Rise Time	t_r			49		
Turn-Off Delay Time	$t_{d(off)}$			69		
Fall Time	t_f			173		
Turn-On Energy	E_{on}	$V_{CC}=300V, I_C=20A$ $V_{GE}=-5V\sim 15V,$ $R_G=51\Omega, T_J=150^\circ C$		0.52		mJ
Turn-Off Energy	E_{off}			0.38		
Short Circuit Collector Current	$I_{C(SC)}$	$V_{GE}=15V, t_{SC}\leq 5\mu s, V_{CC}=400V, T_{J,start}=25^\circ C$		115		A

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Characteristics						
Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=20A, T_j=25^{\circ}C$		2	2.5	V
		$V_{GE}=0V, I_F=20A, T_j=125^{\circ}C$		1.8		
		$V_{GE}=0V, I_F=20A, T_j=150^{\circ}C$		1.7		
Reverse Recovery Current	I_{rr}	$V_R=300V, I_F=20A,$ $di_F/dt=-360A/\mu s, T_j=25^{\circ}C$		6		A
Diode Reverse Recovery Time	t_{rr}			200		ns
Reverse Recovery Charge	Q_{rr}			0.25		μC
Reverse Recovery Energy	E_{rec}			0.07		mJ
Reverse Recovery Current	I_{rr}	$V_R=300V, I_F=20A,$ $di_F/dt=-360A/\mu s, T_j=125^{\circ}C$		8		A
Diode Reverse Recovery Time	t_{rr}			218		ns
Reverse Recovery Charge	Q_{rr}			0.59		μC
Reverse Recovery Energy	E_{rec}			0.13		mJ
Reverse Recovery Current	I_{rr}	$V_R=300V, I_F=20A,$ $di_F/dt=-360A/\mu s, T_j=150^{\circ}C$		9		A
Diode Reverse Recovery Time	t_{rr}			227		ns
Reverse Recovery Charge	Q_{rr}			0.78		μC
Reverse Recovery Energy	E_{rec}			0.16		mJ

Thermal characteristics

Parameter	Symbol	Min	Typ	Max	Units
Operating Junction Temperature Range	T_j	-40		175	$^{\circ}C$
Storage Temperature Range	T_{stg}	-55		150	$^{\circ}C$
Thermal Resistance from Junction to Case (IGBT)	$R_{th_{J-C}}$			1.25	$^{\circ}C/W$
Thermal Resistance from Junction to Case (Diode)	$R_{th_{J-C}}$			1.5	$^{\circ}C/W$
Thermal Resistance from Junction to Ambient	$R_{th_{J-A}}$			60	$^{\circ}C/W$

Curve Characteristics

Fig. 1 - Typical Output Characteristic($T_J=25^\circ\text{C}$)

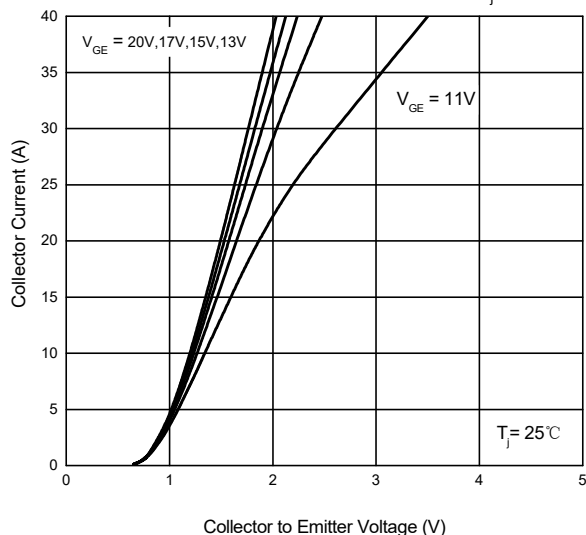


Fig. 2 - Typical Output Characteristic ($T_J=150^\circ\text{C}$)

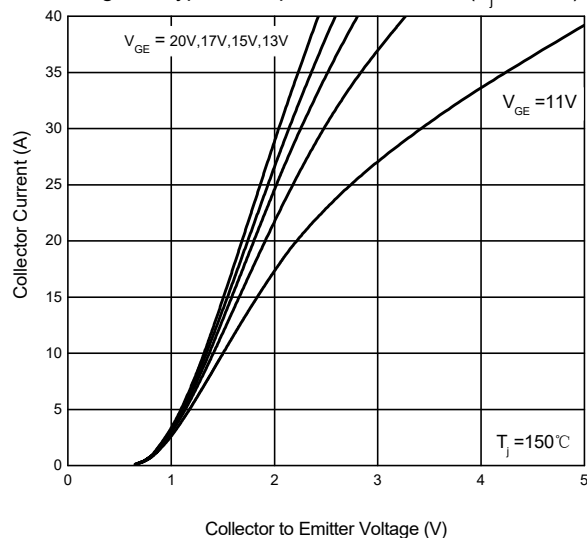


Fig. 3 - Typical Transfer Characteristic

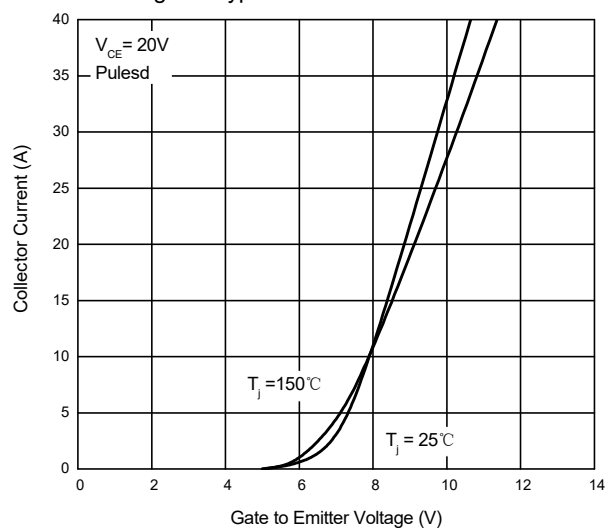


Fig. 4 - Diode Forward Current vs V_F

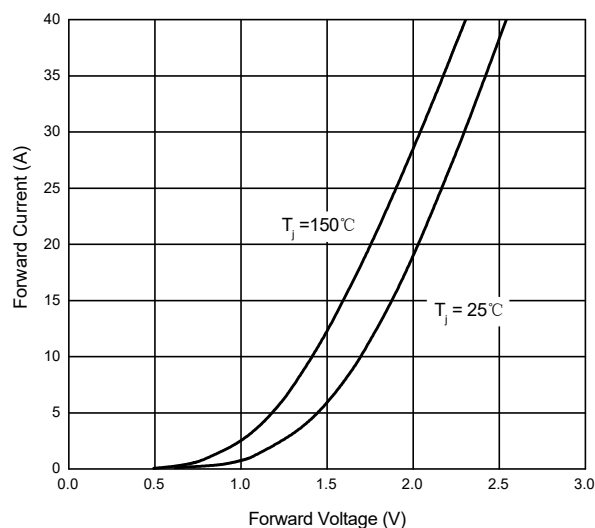


Fig. 5 - IGBT Switching Loss vs. I_C

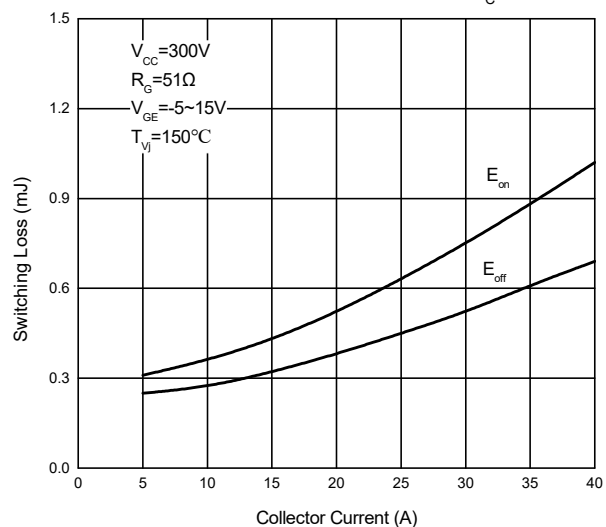
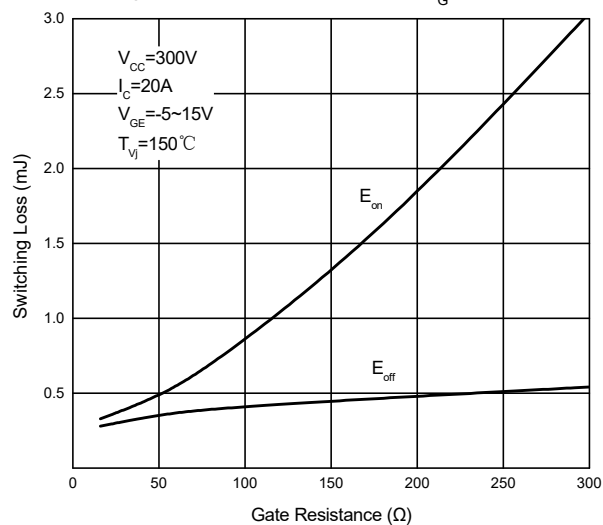


Fig. 6 - IGBT Switch Loss VS R_G



Curve Characteristics

Fig. 7 - Diode Switching Loss vs I_F

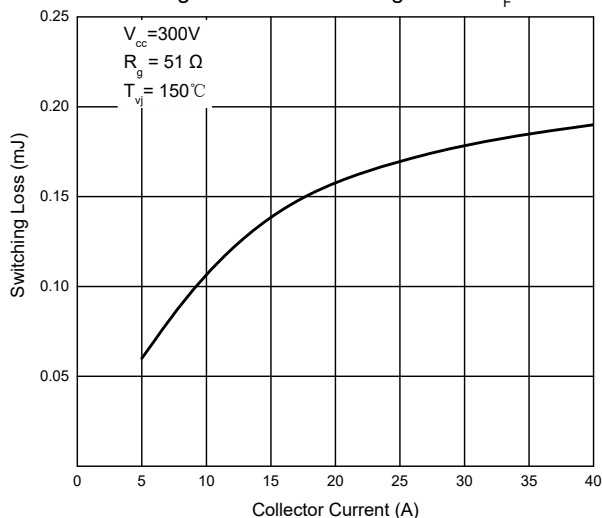


Fig. 8 - Diode Switching Loss vs R_G

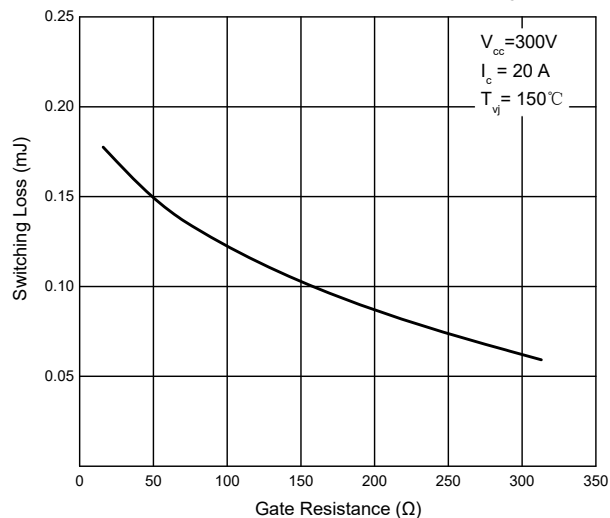


Fig. 9 - IGBT Transient Thermal Impedance

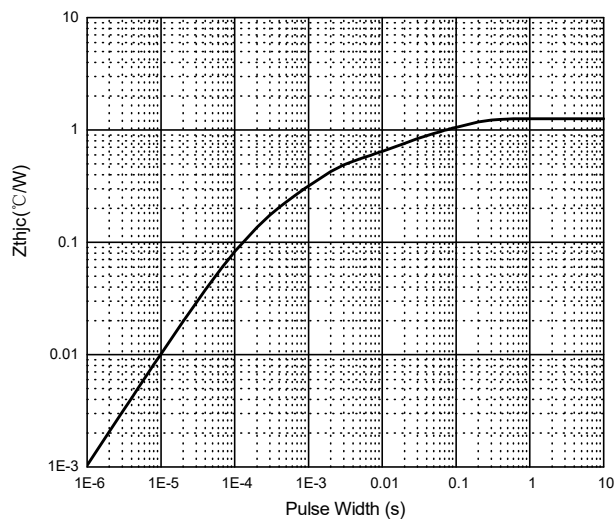


Fig. 10 - Diode Transient Thermal Impedance

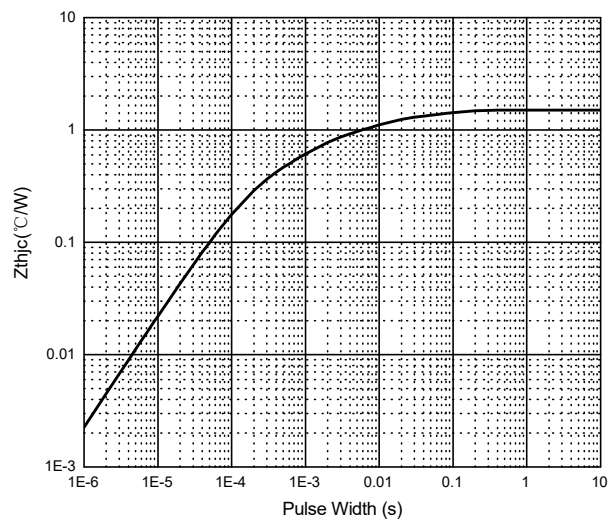


Fig. 11 - Collector Current vs Case Temperature

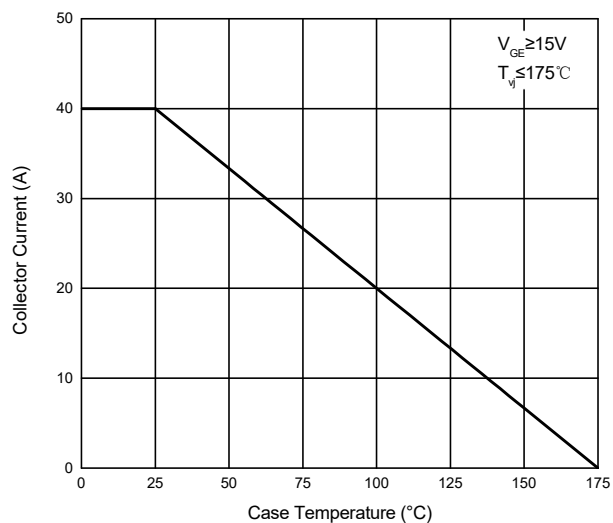
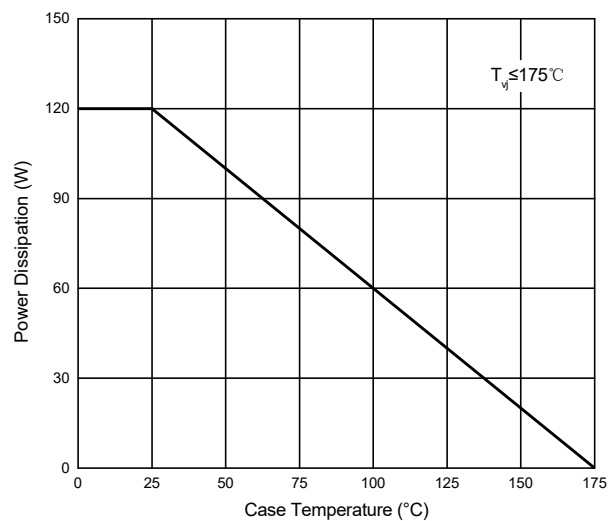


Fig. 12 - Power Derating



Ordering Information

Device	Packing
Part Number-BP	Bulk:50pcs/Tube,1Kpcs/Box,5Kpcs/Carton

IMPORTANT NOTICE

Micro Commercial Components Corp. reserves the right to make changes without further notice to any product herein to make corrections, modifications , enhancements , improvements , or other changes . **Micro Commercial Components Corp** . does not assume any liability arising out of the application or use of any product described herein; neither does it convey any license under its patent rights ,nor the rights of others . The user of products in such applications shall assume all risks of such use and will agree to hold **Micro Commercial Components Corp** . and all the companies whose products are represented on our website, harmless against all damages. **Micro Commercial Components Corp.** products are sold subject to the general terms and conditions of commercial sale, as published at <https://www.mccsemi.com/Home/TermsAndConditions>.

LIFE SUPPORT

MCC's products are not authorized for use as critical components in life support devices or systems without the express written approval of Micro Commercial Components Corporation.

CUSTOMER AWARENESS

Counterfeiting of semiconductor parts is a growing problem in the industry. Micro Commercial Components (MCC) is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. MCC strongly encourages customers to purchase MCC parts either directly from MCC or from Authorized MCC Distributors who are listed by country on our web page cited below. Products customers buy either from MCC directly or from Authorized MCC Distributors are genuine parts, have full traceability, meet MCC's quality standards for handling and storage. **MCC will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources.** MCC is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.