

Features

- High Speed Smooth Switching Device for Hard and Soft Switching
- Positive Temperature Coefficient
- High Ruggedness, Good Thermal Stability
- 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

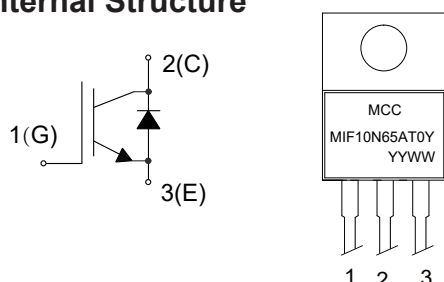
Maximum Ratings

Parameter	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CE}	650	V
DC Collector Current ^(Note 3)	I_C	$T_C=25^{\circ}C$ 15	A
		$T_C=100^{\circ}C$ 8	
Pulsed Collector Current, $V_{GE}=15V$ ^(Note 4)	$I_{C,pluse}$	40	A
Diode Forward Current ^(Note 3)	I_F	$T_C=25^{\circ}C$ 15	A
		$T_C=100^{\circ}C$ 8	
Diode Pulsed Current ^(Note 4)	$I_{F,pluse}$	40	A
Gate-Emitter Voltage	V_{GE}	± 20	V
Transient Gate-Emitter Voltage ^(Note 5)		± 30	
Short Circuit Withstand Time ^(Note 6)	t_{SC}	5	μs
Power Dissipation, $T_C=25^{\circ}C$, $T_J=175^{\circ}C$	P_D	31	W

Notes:

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. $T_p \leq 10\mu s$, Duty Cycle < 1%
6. $V_{GE}=15V$, $V_{CE} \leq 400V$

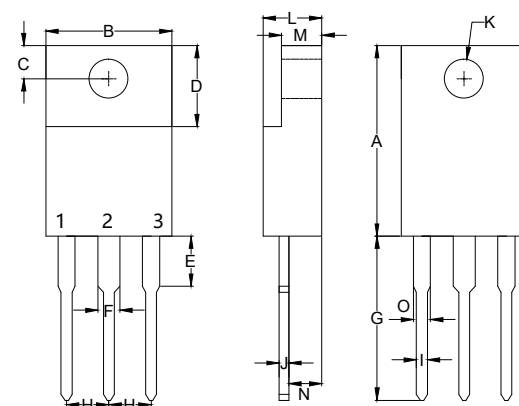
Internal Structure



Device Code: MIF10N65AT0Y
Date Code: YYWW: (Year & Week)

Trench and Field Stop IGBT 650V 10A

ITO-220AB



DIMENSIONS					
DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	0.567	0.642	14.40	16.30	
B	-----	0.421	-----	10.70	
C	0.085	0.128	2.15	3.25	
D	0.248	0.272	6.30	6.90	
E	-----	0.177	-----	4.50	
F	-----	0.071	-----	1.80	
G	0.500	0.539	12.70	14.20	
H	0.100		2.55		
I	-----	0.035	-----	0.90	
J	-----	0.032	-----	0.80	
K	0.102	0.150	2.60	3.80	Φ
L	-----	0.201	-----	5.10	
M	-----	0.140	-----	3.56	
N	0.083	0.126	2.10	3.20	
O	-----	0.071	-----	1.80	

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	$V_{CE(sat)}$	$V_{GE}=15V, I_C=10A, T_J=25^\circ C$		1.40	1.70	V
		$V_{GE}=15V, I_C=10A, T_J=125^\circ C$		1.55		
		$V_{GE}=15V, I_C=10A, T_J=150^\circ C$		1.60		
G-E Threshold Voltage	$V_{GE(th)}$	$I_C=1mA, V_{CE}=V_{GE}$	4.4	5.2	6.0	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}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		0.89		nF
Reverse Transfer Capacitance	C_{oes}			0.04		
Reverse Transfer Capacitance	C_{res}			0.01		
Gate Charge	Q_g	$V_{CC}=300V, I_C=10A, V_{GE}=15V$		0.059		μC
IGBT Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=300V, I_C=10A,$ $V_{GE}=-5\sim 15V, R_G=51\Omega,$ $T_J=25^\circ C$		10		ns
Rise Time	t_r			26		
Turn-Off Delay Time	$t_{d(off)}$			68		
Fall Time	t_f			135		
Turn-On Energy	E_{on}	$V_{CC}=300V, I_C=10A,$ $V_{GE}=-5\sim 15V, R_G=51\Omega,$ $T_J=25^\circ C$		0.36		mJ
Turn-Off Energy	E_{off}			0.17		
Turn-On Delay Time	$t_{d(on)}$			14		ns
Rise Time	t_r			35		
Turn-Off Delay Time	$t_{d(off)}$			68		
Fall Time	t_f			162		
Turn-On Energy	E_{on}	$V_{CC}=300V, I_C=10A,$ $V_{GE}=-5\sim 15V, R_G=51\Omega,$ $T_J=125^\circ C$		0.42		mJ
Turn-Off Energy	E_{off}			0.29		
Turn-On Delay Time	$t_{d(on)}$			16		ns
Rise Time	t_r			41		
Turn-Off Delay Time	$t_{d(off)}$			69		
Fall Time	t_f			181		
Turn-On Energy	E_{on}	$V_{CC}=300V, I_C=10A,$ $V_{GE}=-5\sim 15V, R_G=51\Omega,$ $T_J=150^\circ C$		0.46		mJ
Turn-Off Energy	E_{off}			0.33		
Short Circuit Collector Current	$I_{C(SC)}$	$V_{CC}=400V, V_{GE}=15V, T_{sc}\leq 5\mu s, T_{j,start}=25^\circ C$		110		A

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Characteristics						
Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=10A, T_J=25^{\circ}C$		1.70	2.20	V
		$V_{GE}=0V, I_F=10A, T_J=125^{\circ}C$		1.50		
		$V_{GE}=0V, I_F=10A, T_J=150^{\circ}C$		1.40		
Reverse Recovery Current	I_{rr}	$V_R=300V, I_F=10A,$ $di_F/dt=-365A/\mu s, T_J=25^{\circ}C$		6		A
Reverse Recovery time	t_{rr}			176		ns
Reverse Recovery Charge	Q_{rr}			0.12		μC
Reverse Recovery Energy	E_{rec}			0.05		mJ
Reverse Recovery Current	I_{rr}	$V_R=300V, I_F=10A,$ $di_F/dt=-365A/\mu s, T_J=125^{\circ}C$		7		A
Reverse Recovery time	t_{rr}			189		ns
Reverse Recovery Charge	Q_{rr}			0.48		μC
Reverse Recovery Energy	E_{rec}			0.09		mJ
Reverse Recovery Current	I_{rr}	$V_R=300V, I_F=10A,$ $di_F/dt=-365A/\mu s, T_J=150^{\circ}C$		8		A
Reverse Recovery time	t_{rr}			195		ns
Reverse Recovery Charge	Q_{rr}			0.62		μC
Reverse Recovery Energy	E_{rec}			0.11		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)	$R_{th_{J-C}}$			4.8	$^{\circ}C/W$
Thermal Resistance from Junction to Case (Diode)	$R_{th_{J-C}}$			6.0	$^{\circ}C/W$
Thermal Resistance from Junction to Ambient	$R_{th_{J-A}}$			60	$^{\circ}C/W$

Curve Characteristics

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

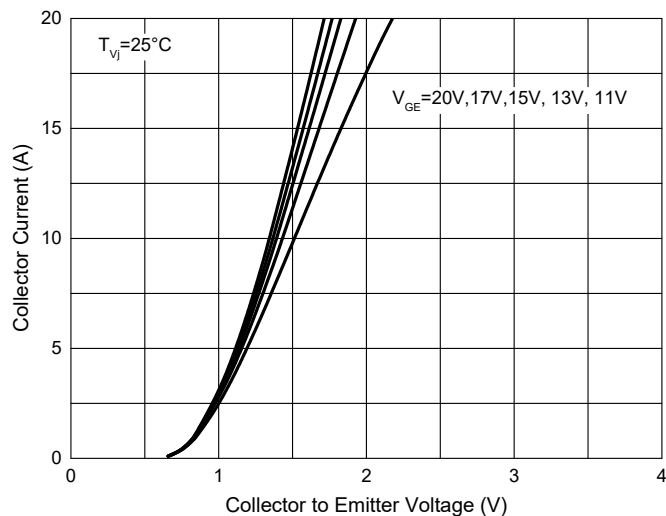


Fig. 2 - Typical Output Characteristic ($T_J=150^\circ\text{C}$)

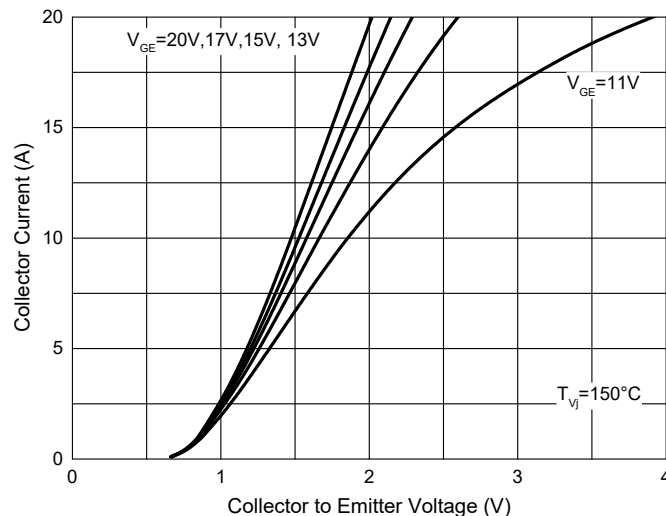


Fig. 3 - Typical Transfer Characteristic

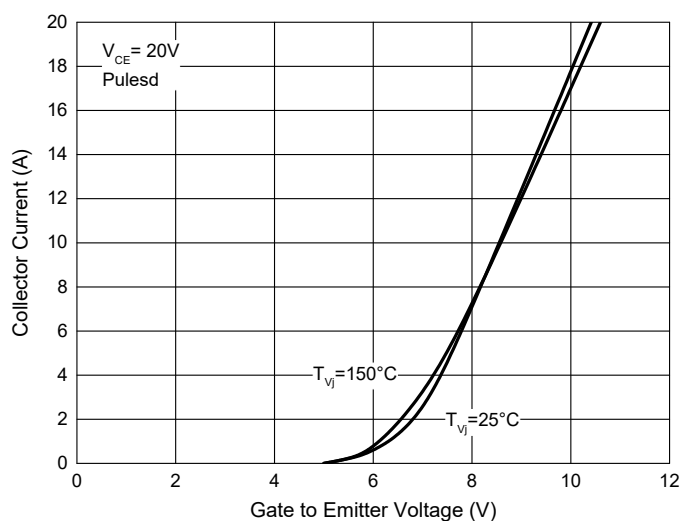


Fig. 4 - Diode Forward Current Characteristics

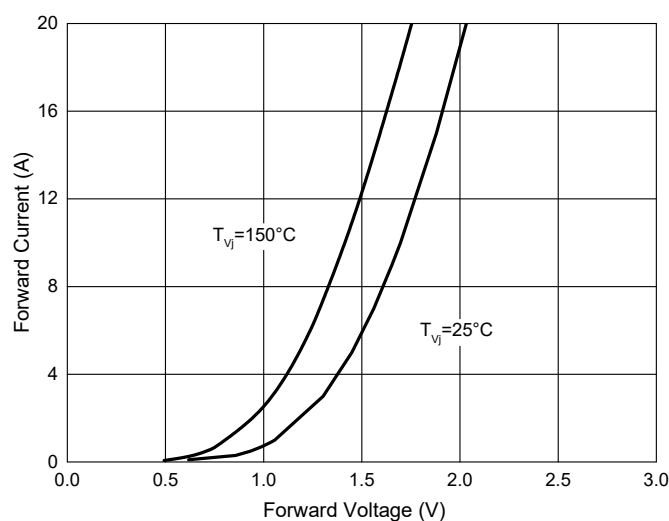


Fig. 5 - IGBT Switching Loss vs I_C

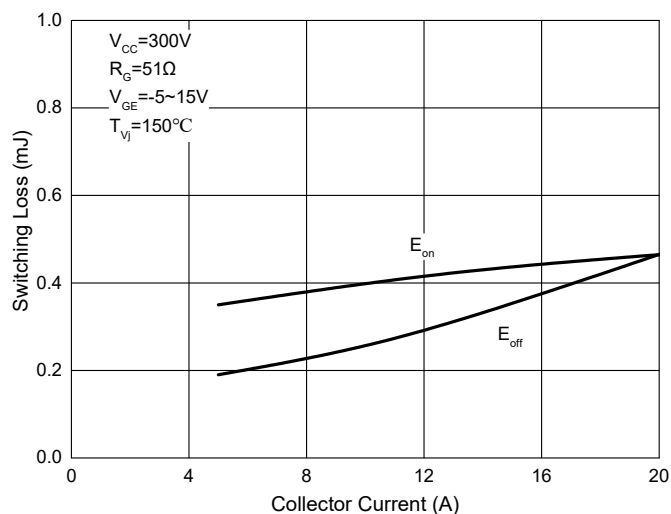
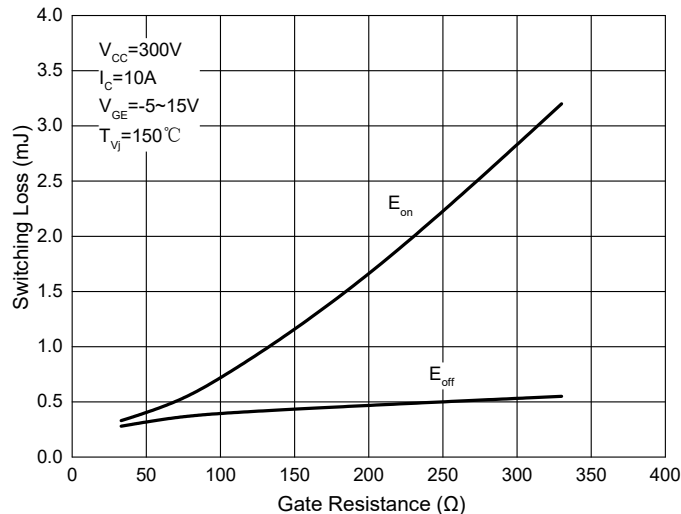


Fig. 6 - IGBT Switch Loss vs R_G



Curve Characteristics

Fig. 7 - Diode Switching Loss vs I_F

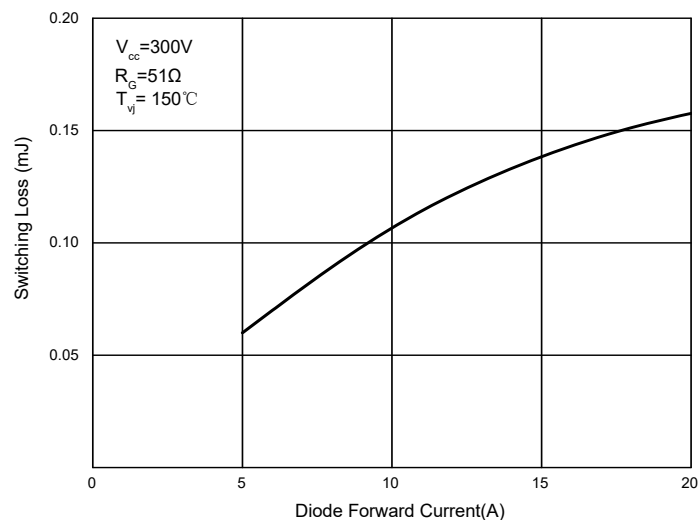


Fig. 8- Capacitance Characteristics

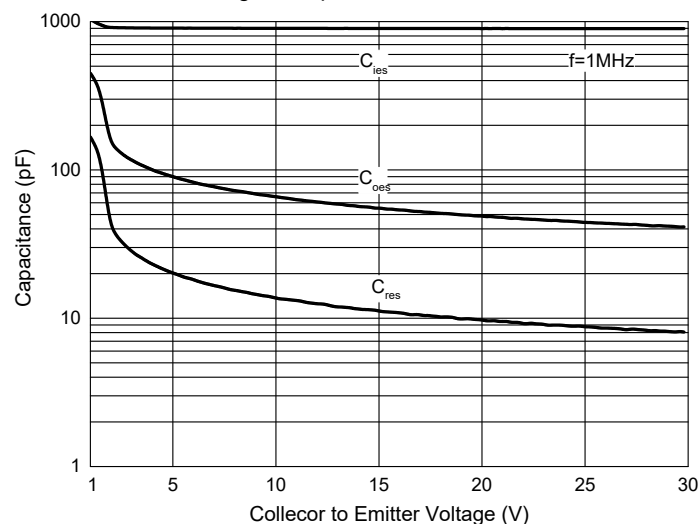


Fig. 9 - IGBT Transient Thermal Impedance

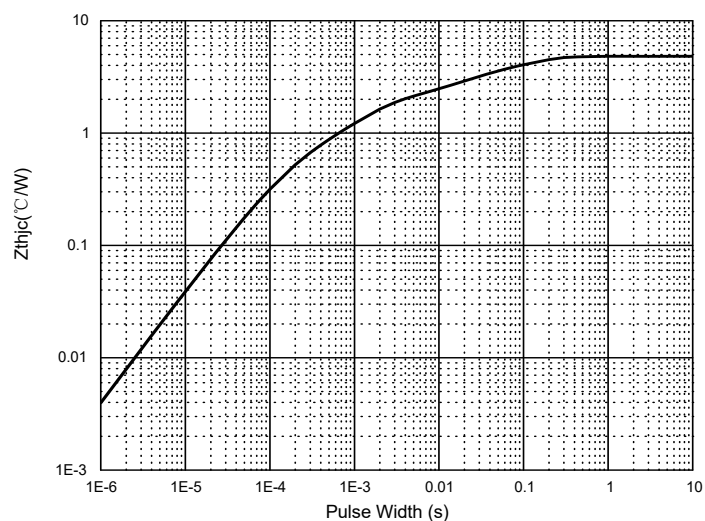
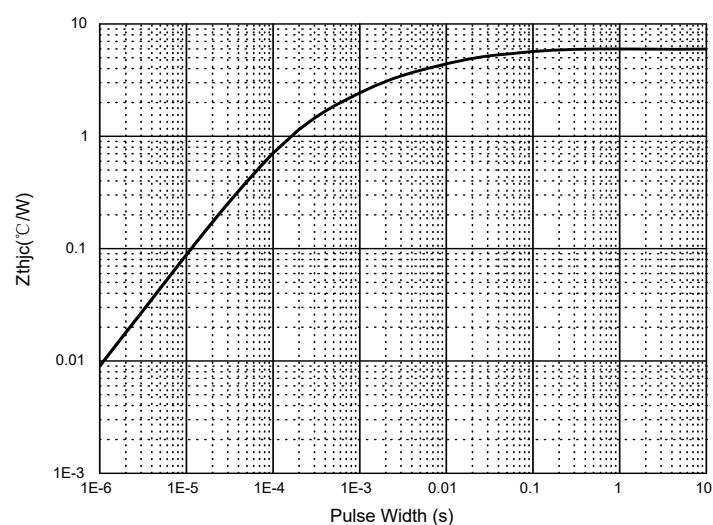


Fig. 10 - Diode Transient Thermal Impedance



Ordering Information

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

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