

**Features**

- Including Fast & Soft Recovery anti-Parallel FWD
- Positive Temperature Coefficient
- Maximum junction temperature 175 C
- 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**

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

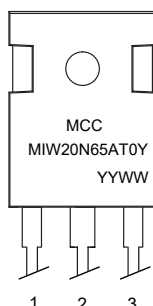
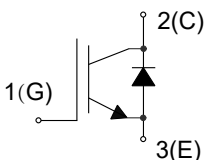
**Maximum Ratings**

Parameter	Symbol	Rating	Unit
Collector-Emitter Voltage	$V_{CE}$	650	V
DC Collector Current (Note 3)	$I_C$	$T_C=25^{\circ}C$	40
		$T_C=100^{\circ}C$	20
Pulsed Collector Current, $V_{GE}=15V$ (Note 4)	$I_{C,pluse}$	60	A
Diode Forward Current (Note 3)	$I_F$	$T_C=25^{\circ}C$	40
		$T_C=100^{\circ}C$	20
Diode Pulsed Current (Note 4)	$I_{F,pluse}$	60	A
Gate-Emitter Voltage	$V_{GE}$	$\pm 20$	V
Transient Gate-Emitter Voltage (Note 5)	$V_{GE}$	$\pm 30$	V
Turn off Safe Operating Area $V_{CE} \leq 650V, T_j \leq 150^{\circ}C$		60	A
pulsed collector current, $V_{GE}=15V, t_p$ limited by $T_{jmax}$	$I_{CM}$	60	A
Power Dissipation	$P_D$	$T_C=25^{\circ}C$	120
		$T_j=175^{\circ}C$	
Short Circuit Withstand Time $V_{GE}=15V, V_{CC}=400V$	$T_{SC}$	5	us

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.  $T_p \leq 10us$ , Duty Cycle < 1%

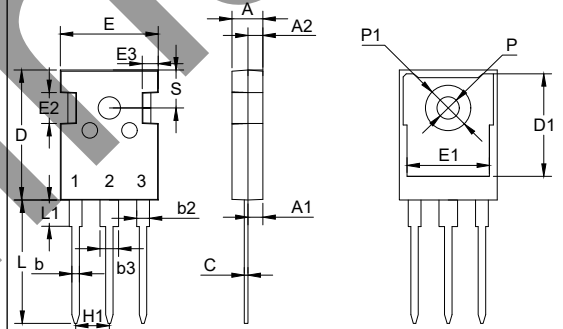
**Internal Structure**



Device Code: MIW20N65AT0Y  
Date Code: YYWW (Year & Week)

**Trench and Field Stop IGBT 650V 20A**

**TO-247AB**



DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	0.189	0.205	4.80	5.20	
A1	0.087	0.103	2.21	2.61	
A2	0.073	0.085	1.85	2.15	
b	0.039	0.055	1.00	1.40	
b2	0.075	0.087	1.91	2.21	
C	0.020	0.028	0.50	0.70	
D	0.815	0.839	20.70	21.30	
D1	0.640	0.663	16.25	16.85	
E	0.610	0.634	15.50	16.10	
E1	0.512	0.535	13.00	13.60	
E2	0.189	0.205	4.80	5.20	
E3	0.091	0.106	2.30	2.70	
L	0.772	0.796	19.62	20.22	
L1	-	0.169	-	4.30	
P	0.134	0.150	3.40	3.80	Φ
P1		0.287	-	7.30	Φ
S	0.242		6.15		TYP
H1	0.214		5.44		TYP
b3	0.110	0.126	2.80	3.20	

**Electrical Characteristics of the IGBT @ 25°C (Unless Otherwise Specified)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>IGBT Static Characteristics</b>						
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=250\mu A$	650			V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=20A, T_J=25^\circ C$		1.60	1.95	V
		$V_{GE}=15V, I_C=20A, T_J=125^\circ C$		1.75		
		$V_{GE}=15V, I_C=20A, T_J=150^\circ C$		1.80		
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
		$V_{CE}=650V, V_{GE}=0V, T_J=150^\circ C$			1.00	
G-E Leakage Current	$I_{GES}$	$V_{CE}=0V, V_{GE}=\pm 20V$			$\pm 200$	nA
<b>Dynamic Characteristics</b>						
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		$\mu C$
<b>IGBT Switching Characteristics</b>						
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	$E_{on}$	$V_{CC}=300V, I_C=20A, V_{GE}=-5V\sim 15V, R_G=51\Omega, T_J=25^\circ C$		0.41		mJ
Turn-Off Energy	$E_{off}$			0.22		
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=300V, I_C=20A, V_{GE}=-5V\sim 15V, R_G=51\Omega, T_J=125^\circ C$		16		ns
Rise Time	$t_r$			41		
Turn-Off Delay Time	$t_{d(off)}$			74		
Fall Time	$t_f$			154		
Turn-On Energy	$E_{on}$	$V_{CC}=300V, I_C=20A, V_{GE}=-5V\sim 15V, R_G=51\Omega, T_J=125^\circ C$		0.48		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		

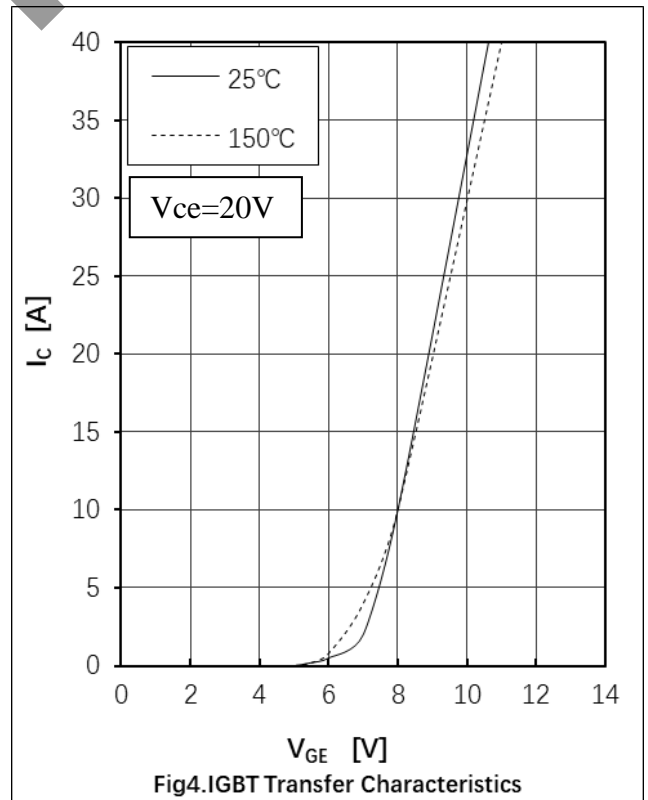
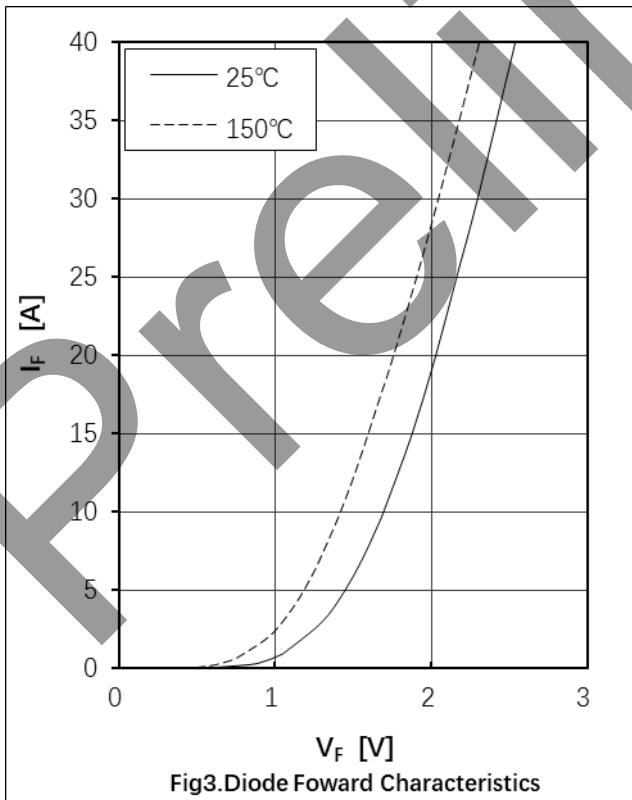
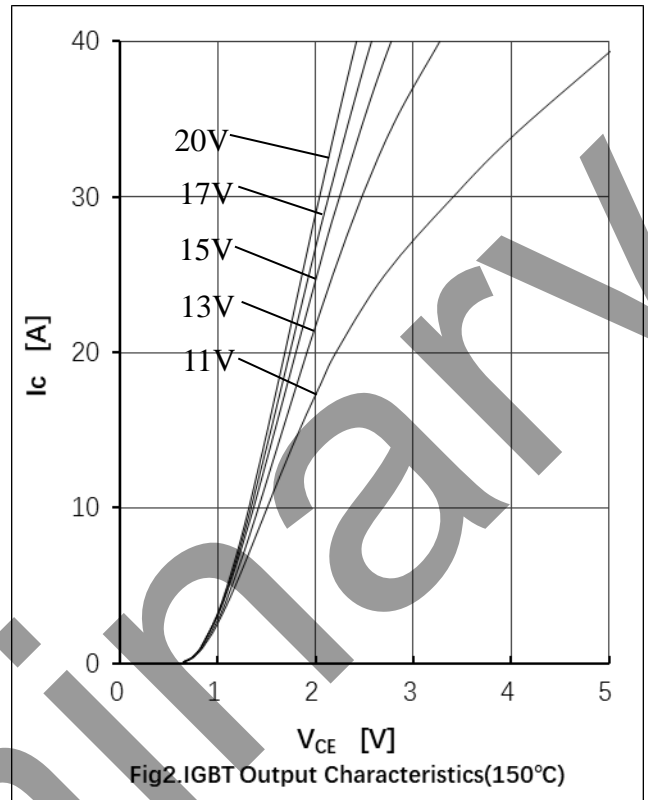
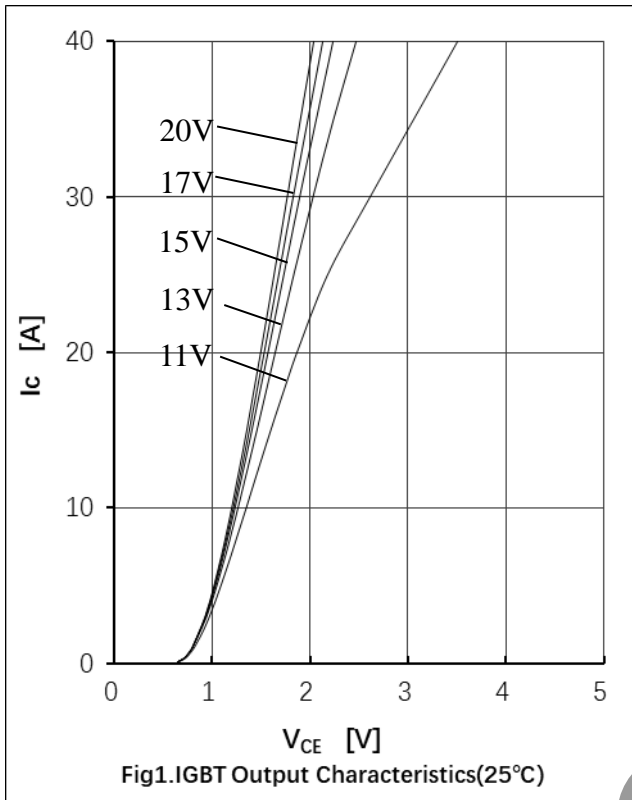
**Electrical Characteristics of the Diode @ 25°C (Unless Otherwise Specified)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Diode Characteristics</b>						
Diode Forward Voltage	$V_F$	$V_{GE}=0V, I_F=20A, T_J=25^\circ C$		2.00	2.50	V
		$V_{GE}=0V, I_F=20A, T_J=125^\circ C$		1.80		
		$V_{GE}=0V, I_F=20A, T_J=150^\circ C$		1.70		
Reverse Recovery Current	$I_{rr}$	$V_R=300V, I_F=20A,$ $di_F/dt=-500A/\mu s,$ $T_J=25^\circ C$		11		A
Reverse Recovery Charge	$Q_{rr}$			0.20		$\mu C$
Reverse Recovery Energy	$E_{rec}$			0.07		mJ
Reverse Recovery Current	$I_{rr}$	$V_R=300V, I_F=20A,$ $di_F/dt=-500A/\mu s,$ $T_J=125^\circ C$		14		A
Reverse Recovery Charge	$Q_{rr}$			0.75		$\mu C$
Reverse Recovery Energy	$E_{rec}$			0.20		mJ
Reverse Recovery Current	$I_{rr}$	$V_R=300V, I_F=20A,$ $di_F/dt=-500A/\mu s,$ $T_J=150^\circ C$		16		A
Reverse Recovery Charge	$Q_{rr}$			0.86		$\mu C$
Reverse Recovery Energy	$E_{rec}$			0.25		mJ

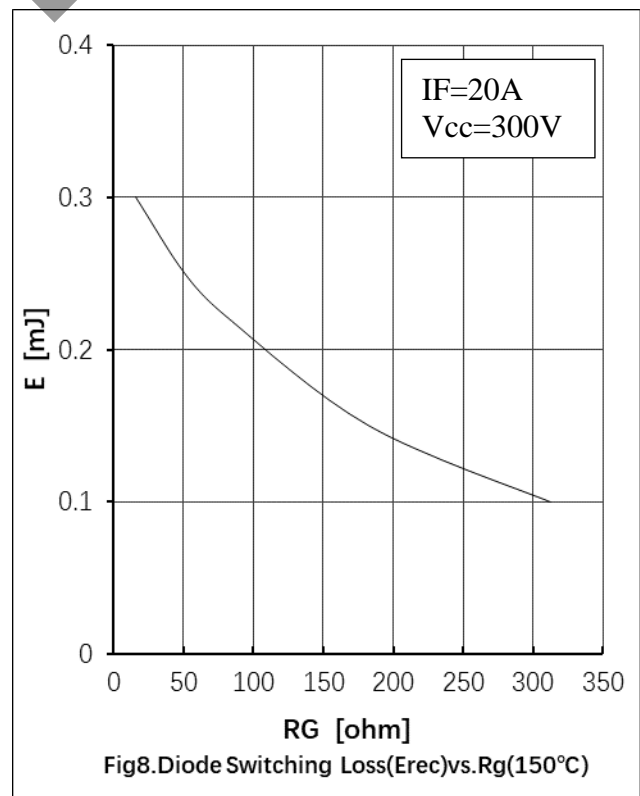
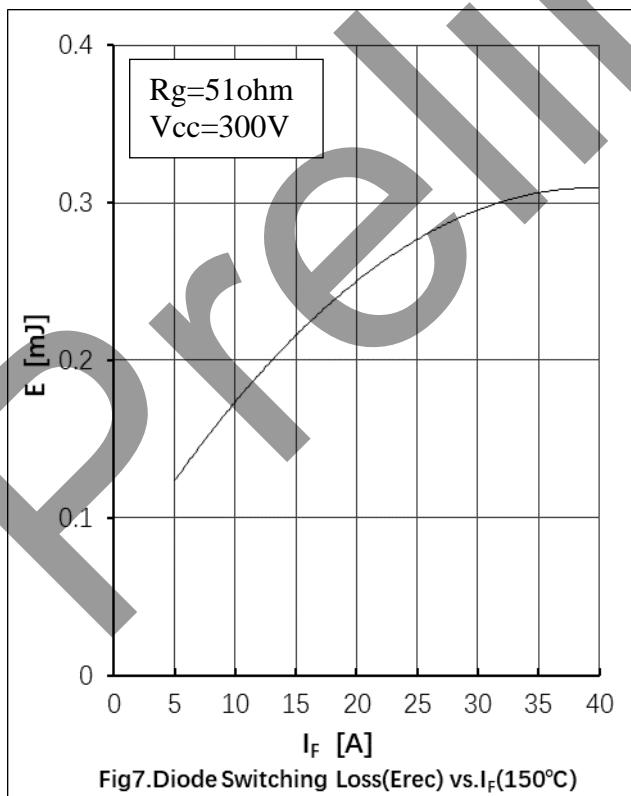
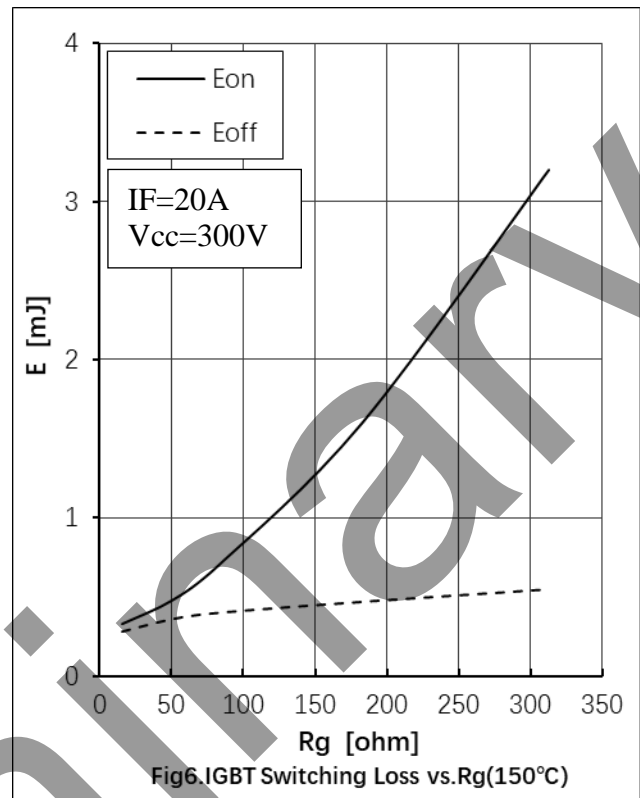
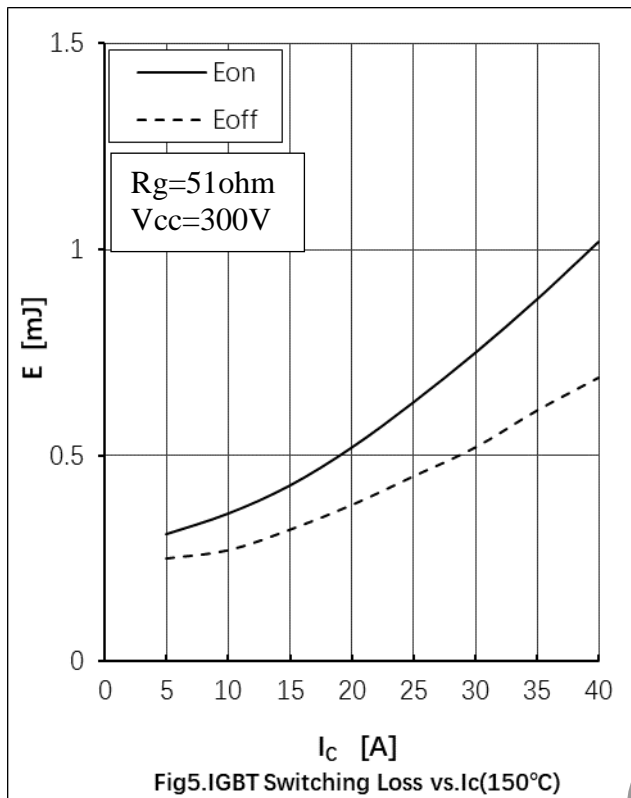
**Thermal characteristics**

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)	$R_{thJ-C}$			1.25	$^\circ C/W$
Thermal Resistance from Junction to Case (Diode)	$R_{thJ-C}$			1.50	$^\circ C/W$
Thermal Resistance from Junction to Ambient	$R_{thJ-A}$			60	$^\circ C/W$

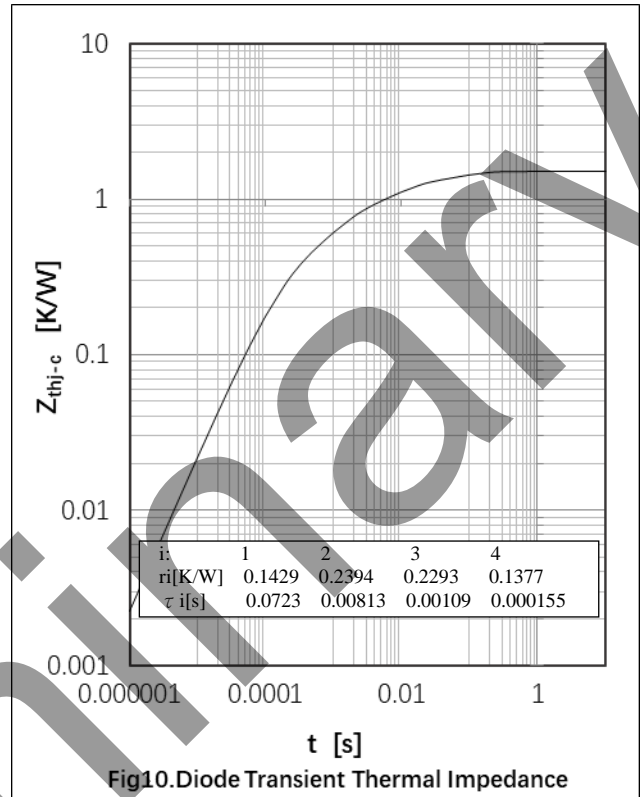
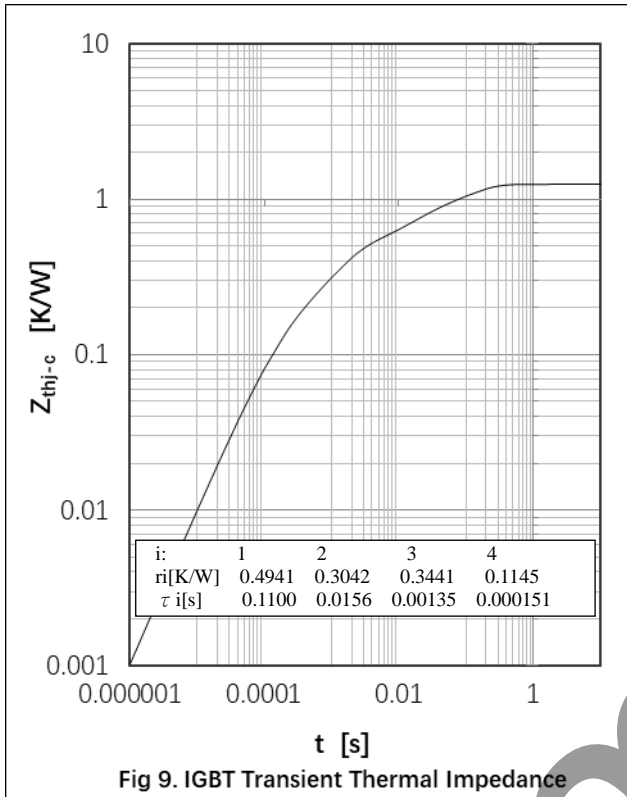
**Curve Characteristics**



**Curve Characteristics**



Curve Characteristics



## Ordering Information

Device	Packing
Part Number-BP	Tube: 30pcs/Tube, 360pcs/Box, 1800pcs/Ctn

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