Features

- High Speed Smooth Switching Device for Hard and Soft Switching
- Maximum Junction Temperature 175℃
- 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)

Trench and Field Stop IGBT 650V 20A

Applications

- Inverter for motor drive
- Air Conditioning
- Uninterruptible power supply

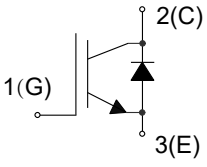
Maximum Ratings

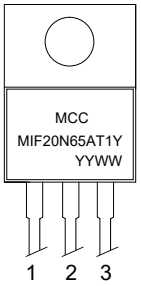
Parameter		Symbol	Rating	Unit
Collector-Emitter Voltage		V_{CE}	650	V
DC Collector Current(3)	T_C=25°C	I_C	40	A
	T_C=100°C		20	
Pulsed Collector Current (4) ,V_{GE}=15V		$I_{C,pluse}$	60	A
Diode Forward Current (3)	T_C=25°C	I_F	40	A
	T_C=100°C		20	
Diode Pulsed Current (4)		$I_{F,pluse}$	60	A
Continuous Gate-Emitter Voltage		V_{GE}	±20	V
Transient Gate-Emitter Voltage(5)			±30	
Turn off Safe Operation Area, T_j≤ 150°C V_{CE}≤650V			60	A
Short Circuit Withstand Time(Note6)		T_{SC}	5.0	us
Power Dissipation,T_C=25℃, T_j=175℃		P_D	55	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≤10us, Duty Cycle<1%
6. V_{GE}=15V,V_{CC}=400V,V_{CEM}≤650V

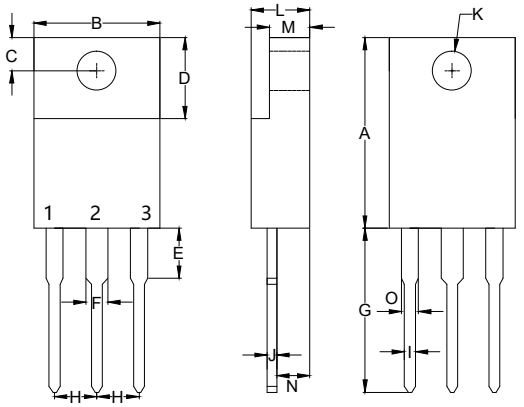
Internal Structure





Device Code: MIF20N65AT1Y
Date Code: YYWW (Year & Week)

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=1mA	650			V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=20A, T_j=25°C		1.6	1.9	V
		V_{GE}=15V, I_C=20A, T_j=125°C		1.8		
		V_{GE}=15V, I_C=20A, T_j=150°C		1.9		
G-E Threshold Voltage	$V_{GE(th)}$	I_C=250uA, V_{CE}=V_{GE}	4.0	5.0	6.5	V
C-E Leakage Current	I_{CES}	V_{CE}=650V, V_{GE}=0V, T_j=25°C			1.0	mA
		V_{CE}=650V, V_{GE}=0V, T_j=150°C			5.0	
G-E Leakage Current	I_{GES}	V_{CE}=0V, V_{GE}=±20V			±200	nA
Dynamic Characteristics						
Input Capacitance	C_{ies}	V_{CE}=25V,V_{GE}=0V,f=1MHz		1.05		nF
Reverse Transfer Capacitance	C_{res}			0.02		
Gate Charge	Q_G	V_{CC}=300V,I_C=20A,V_{GE}=15V		0.09		μC
IGBT Switching Characteristics						
Turn-On Delay Time	$td_{(on)}$	V_{CC}=300V, I_C=20A, V_{GE}=-5V~15V, R_G=20Ω,T_j=25°C		46		ns
Rise Time	t_r			47		
Turn-Off Delay Time	$td_{(off)}$			80		
Fall Time	t_f			74		
Turn-On Energy	E_{on}			0.36		mJ
Turn-Off Energy	E_{off}			0.25		
Turn-On Delay Time	$td_{(on)}$	V_{CC}=300V, I_C=20A V_{GE}=-5V~15V, R_G=20Ω,T_j=125°C		39		ns
Rise Time	t_r			53		
Turn-Off Delay Time	$td_{(off)}$			95		
Fall Time	t_f			131		
Turn-On Energy	E_{on}			0.39		mJ
Turn-Off Energy	E_{off}			0.37		
Turn-On Delay Time	$td_{(on)}$	V_{CC}=300V, I_C=20A V_{GE}=-5V~15V, R_G=20Ω,T_j=150°C		40		ns
Rise Time	t_r			55		
Turn-Off Delay Time	$td_{(off)}$			95		
Fall Time	t_f			138		
Turn-On Energy	E_{on}			0.41		mJ
Turn-Off Energy	E_{off}			0.40		

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°C		1.75	2.3	V
		V_{GE}=0V, I_F=20A, T_j=125°C		1.65		
		V_{GE}=0V, I_F=20A, T_j=150°C		1.6		
Reverse Recovery Current	I_{rr}	V_R=300V, I_F=20A, di_F/dt=-360A/μs, T_j=25°C		6.0		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/μs, T_j=125°C		8.0		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/μs, T_j=150°C		9.0		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	°C
Storage Temperature Range	T_{stg}	-55		150	°C
Thermal Resistance from Junction to Case (IGBT)	Rth_{J-C}			2.7	°C/W
Thermal Resistance from Junction to Case (Diode)	Rth_{J-C}			4.8	°C/W
Thermal Resistance from Junction to Ambient	Rth_{J-A}			40	°C/W

Curve Characteristics

Fig. 1 - Typical Output Characteristic(T_j=25°C)

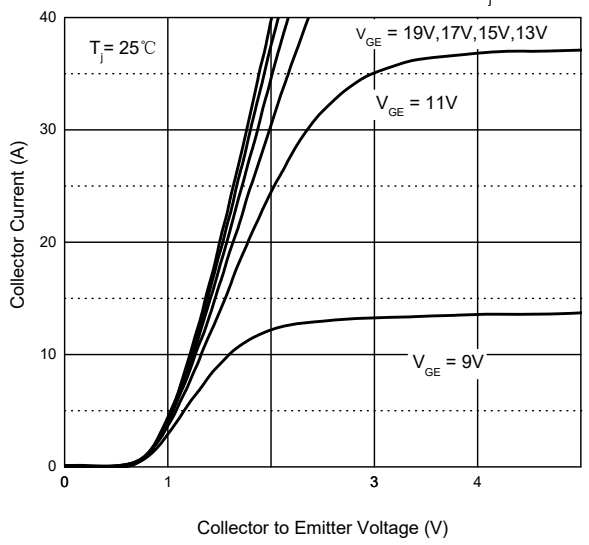


Fig. 2 - Typical Output Characteristic (T_j=150°C)

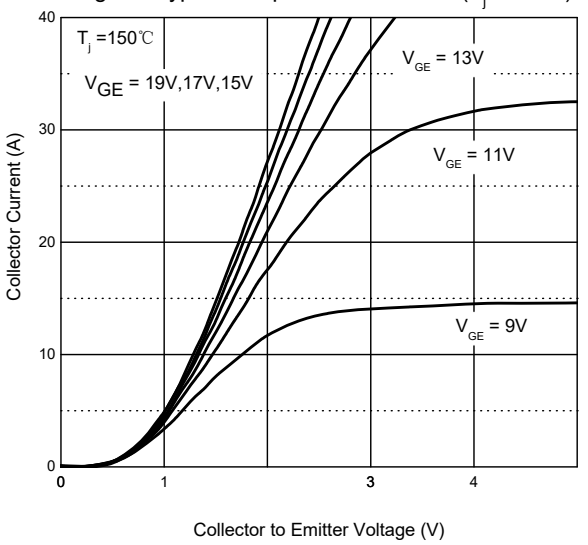


Fig. 3 - Typical Transfer Characteristic

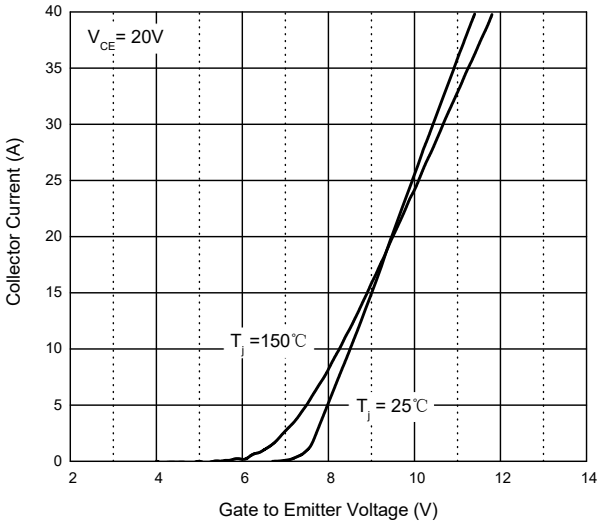


Fig. 4 - Diode Forward Current vs. Forward Voltage

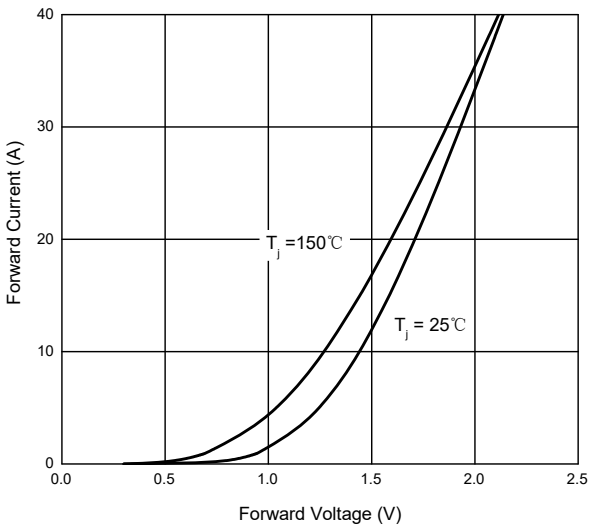


Fig. 5 - Diode VF vs. Junction Temperature

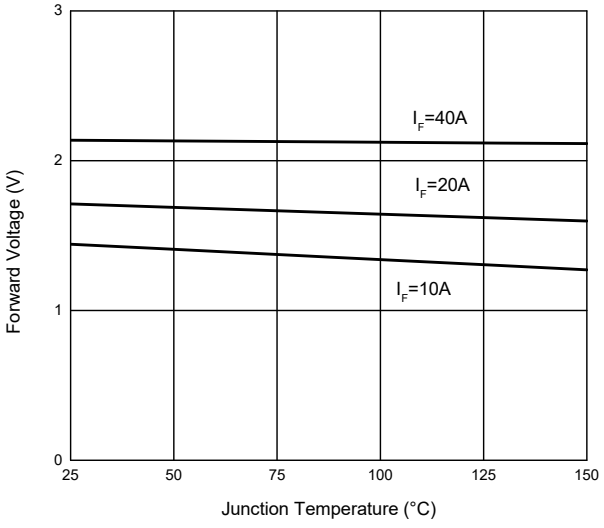
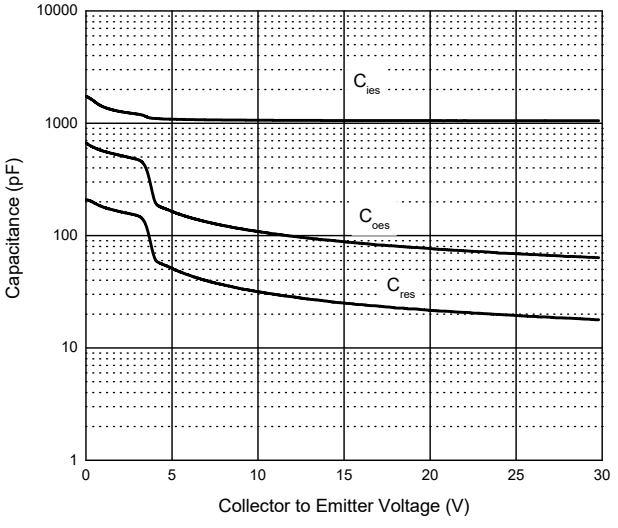


Fig. 6 - Capacitance Characteristics



Curve Characteristics

Fig. 7 - IGBT Switching Loss vs. I_C

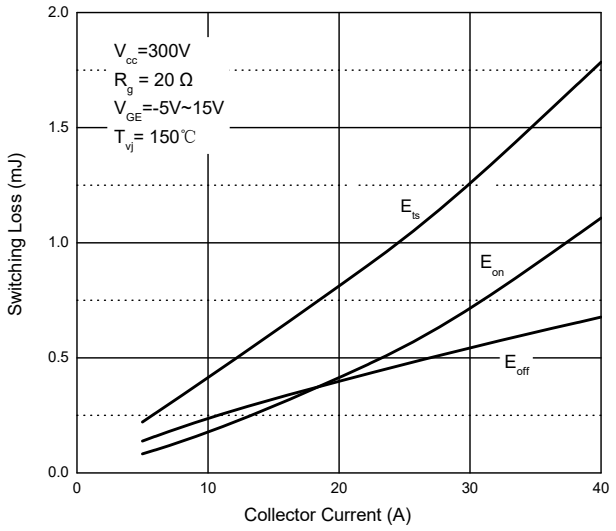


Fig. 8- IGBT Switching Loss vs. R_g

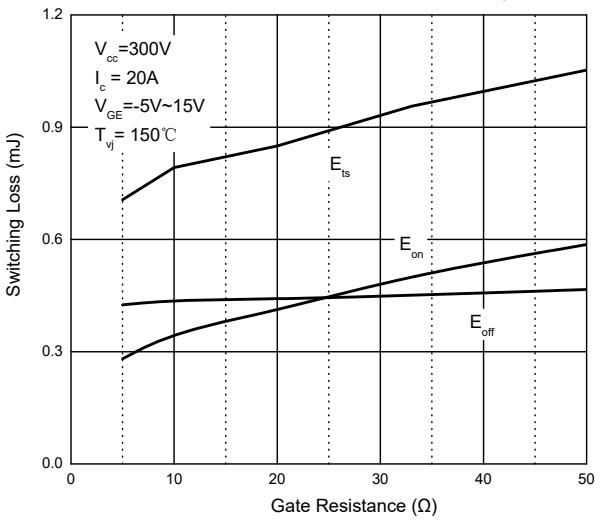


Fig. 9 -IGBT Switching Loss vs. Junction Temperature

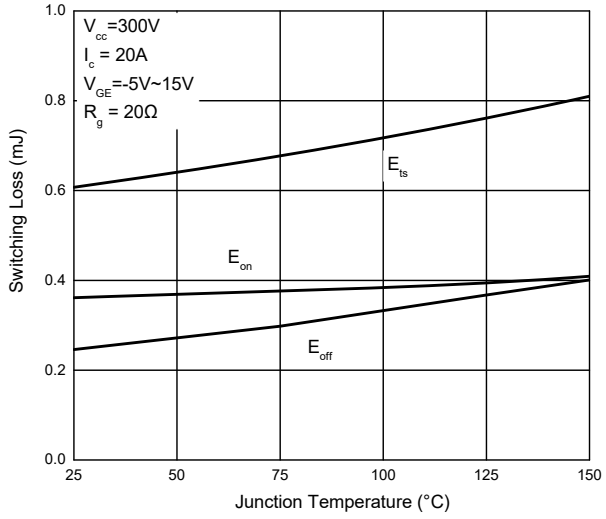


Fig. 10 - Switching Loss vs. V_{CE}

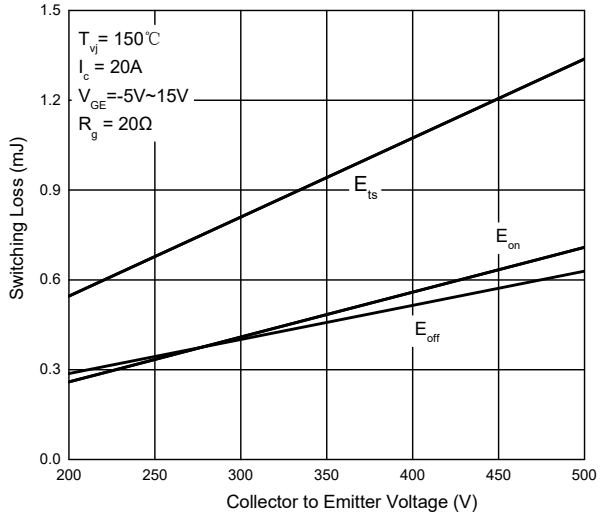


Fig. 11 - $V_{CE(sat)}$ vs. Junction Temperature

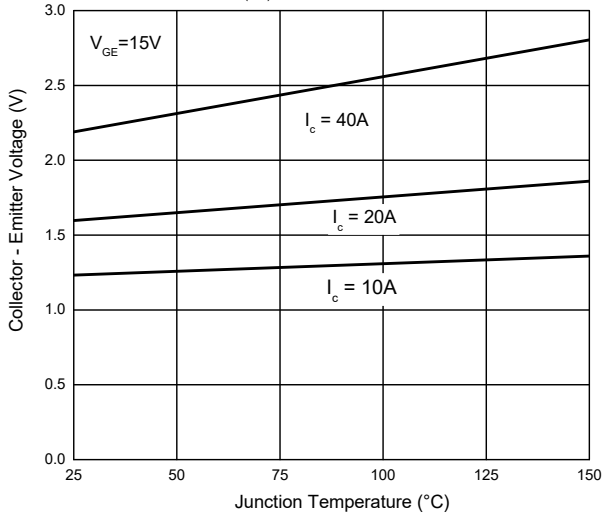
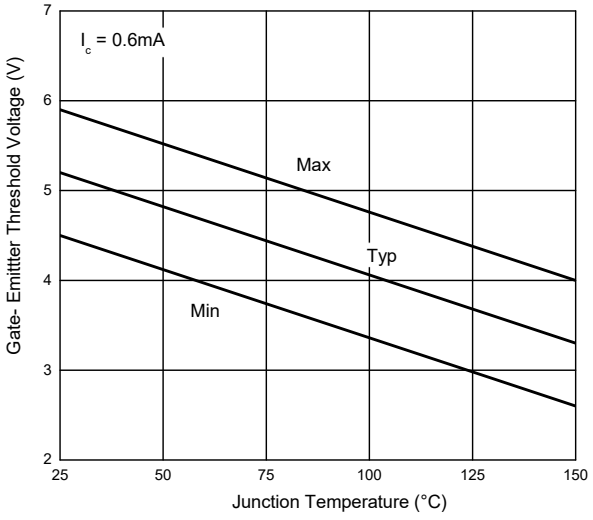


Fig. 12 $V_{GE(th)}$ vs. Junction Temperature



Curve Characteristics

Fig. 13 - IGBT Transient Thermal Impedance

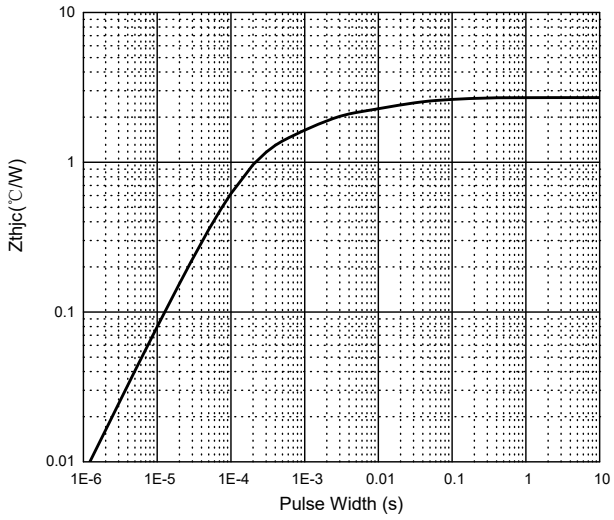


Fig. 14 - Diode Transient Thermal Impedance

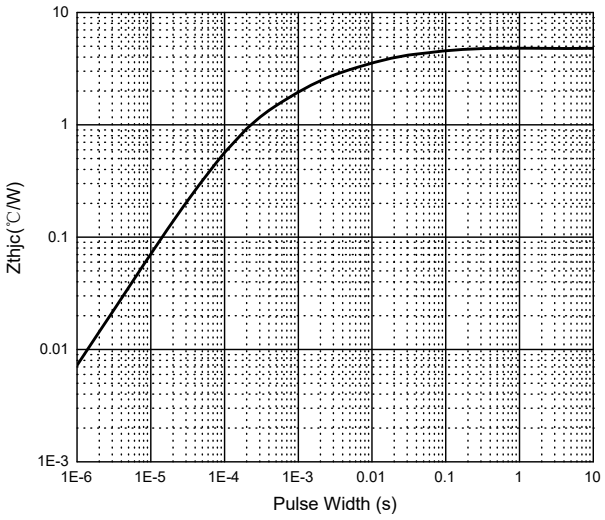


Fig. 15 - Collector Current vs. Case Temperature

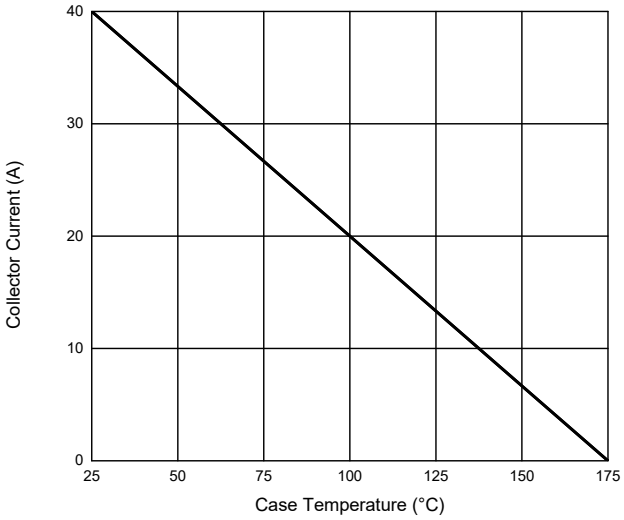
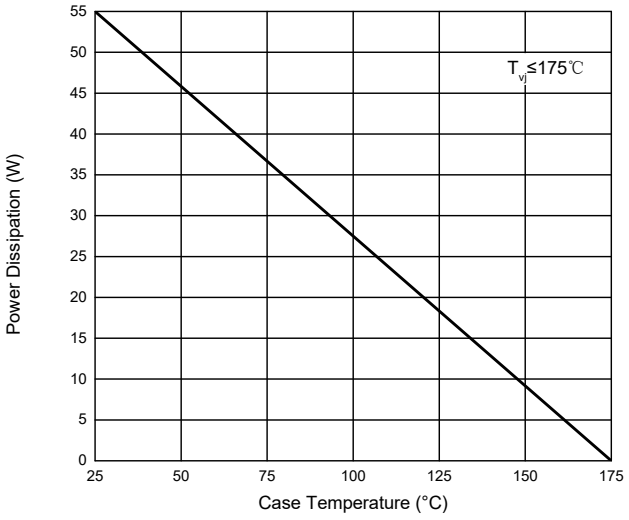


Fig. 16 - Power Derating



Ordering Information

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