

Features

- High speed smooth switching device for hard & 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

- Energy storage inverter
- Uninterruptible power supplies
- Solar inverters

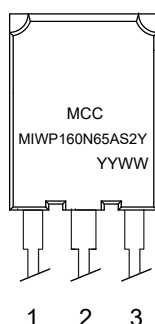
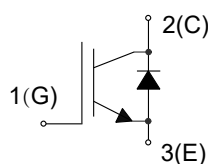
Maximum Ratings

Parameter	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CE}	650	V
DC Collector Current ⁽³⁾	I_C	$T_C=25^{\circ}\text{C}^{(6)}$ 180	A
		$T_C=100^{\circ}\text{C}$ 160	
Pulsed Collector Current ⁽⁴⁾ , $V_{GE}=15\text{V}$	$I_{C,pluse}$	320	A
Diode Forward Current ⁽³⁾	I_F	$T_C=25^{\circ}\text{C}^{(6)}$ 180	A
		$T_C=100^{\circ}\text{C}$ 160	
Diode Pulsed Current ⁽⁴⁾	$I_{F,pluse}$	320	A
Continuous Gate-Emitter Voltage	V_{GE}	±20	V
Transient Gate-Emitter Voltage ⁽⁵⁾		±30	
Turn off Safe Operation Area $V_{CE} \leq 650\text{V}$, $T_j \leq 150^{\circ}\text{C}$		320	A
Power Dissipation, $T_C=25^{\circ}\text{C}$, $T_j=175^{\circ}\text{C}$	P_D	714	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. Value limited by bondwire

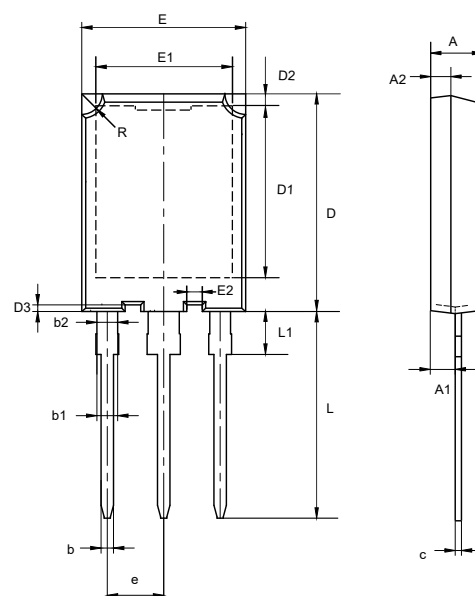
Internal Structure



Device Code: MIWP160N65AS2Y
Date Code: YYWW (Year & Week)

Trench and Field Stop IGBT 650V 160A

TO-247Plus



DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	0.192	0.201	4.90	5.10	
A1	0.090	0.099	2.31	2.51	
A2	0.074	0.083	1.90	2.10	
b	0.044	0.050	1.14	1.26	
b1	0.073	0.085	1.86	2.16	
b2	0.077	0.081	1.96	2.06	
c	0.022	0.026	0.58	0.64	
D	0.822	0.831	20.90	21.10	
D1	0.639	0.664	16.25	16.85	
D2	0.041	0.054	1.05	1.35	
D3	0.022	0.031	0.58	0.78	
E	0.618	0.626	15.70	15.90	
E1	0.515	0.532	13.10	13.50	
E2	0.053	0.061	1.35	1.55	
e	0.214(BSC)		5.44(BSC)		
L	0.778	0.791	19.78	20.08	
L1	0.158	0.167	4.03	4.23	
R	0.074	0.083	1.90	2.10	

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	$V_{CE(sat)}$	$V_{GE}=15V, I_C=160A, T_J=25^\circ C$		1.55	1.85	V
		$V_{GE}=15V, I_C=160A, T_J=125^\circ C$		1.75		
		$V_{GE}=15V, I_C=160A, T_J=150^\circ C$		1.85		
G-E Threshold Voltage	$V_{GE(th)}$	$I_C=1mA, V_{CE}=V_{GE}$	3.2	4.0	4.8	V
C-E Leakage Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V, T_J=25^\circ C$			0.25	mA
		$V_{CE}=650V, V_{GE}=0V, T_J=150^\circ C$			3.00	
G-E Leakage Current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$			100	nA
Dynamic Characteristics						
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		6.93		nF
Reverse Transfer Capacitance	C_{res}			0.07		
Gate Charge	Q_G	$V_{CC}=400V, I_C=160A, V_{GE}=-5\sim 15V$		0.35		μC
IGBT Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=400V,$ $I_C=160A, V_{GE}=-5V\sim 15V,$ $R_G=10\Omega, \text{Inductive Load}$ $T_J=25^\circ C$		47		ns
Rise Time	t_r			103		
Turn-Off Delay Time	$t_{d(off)}$			210		
Fall Time	t_f			74		
Turn-On Energy	E_{on}	$V_{CC}=400V,$ $I_C=160A, V_{GE}=-5V\sim 15V,$ $R_G=10\Omega, \text{Inductive Load}$ $T_J=25^\circ C$		5.75		mJ
Turn-Off Energy	E_{off}			3.69		
Turn-On Delay Time	$t_{d(on)}$			42		ns
Rise Time	t_r			109		
Turn-Off Delay Time	$t_{d(off)}$			214		
Fall Time	t_f			75		
Turn-On Energy	E_{on}	$V_{CC}=400V,$ $I_C=160A, V_{GE}=-5V\sim 15V,$ $R_G=10\Omega, \text{Inductive Load}$ $T_J=125^\circ C$		8.36		mJ
Turn-Off Energy	E_{off}			4.42		
Turn-On Delay Time	$t_{d(on)}$			41		ns
Rise Time	t_r			113		
Turn-Off Delay Time	$t_{d(off)}$			217		
Fall Time	t_f			76		
Turn-On Energy	E_{on}	$V_{CC}=400V,$ $I_C=160A, V_{GE}=-5V\sim 15V,$ $R_G=10\Omega, \text{Inductive Load}$ $T_J=150^\circ C$		9.08		mJ
Total switching energy	E_{off}			4.67		

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Characteristics						
Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=160A, T_J=25^{\circ}C$		2.10	2.60	V
		$V_{GE}=0V, I_F=160A, T_J=125^{\circ}C$		1.95		
		$V_{GE}=0V, I_F=160A, T_J=150^{\circ}C$		1.90		
Reverse Recovery Current	I_{RR}	$V_R=400V, I_F=160A,$ $di/dt=-1200A/\mu s,$ $T_J=25^{\circ}C$		30		A
Diode Reverse Recovery Time	t_{RR}			55		ns
Reverse Recovery Charge	Q_{RR}			1.05		μC
Reverse Recovery Energy	E_{rec}			0.15		mJ
Reverse Recovery Current	I_{RR}	$V_R=400V, I_F=160A,$ $di/dt=-1200A/\mu s,$ $T_J=125^{\circ}C$		69		A
Diode Reverse Recovery Time	t_{RR}			104		ns
Reverse Recovery Charge	Q_{RR}			4.97		μC
Reverse Recovery Energy	E_{rec}			0.88		mJ
Reverse Recovery Current	I_{RR}	$V_R=400V, I_F=160A,$ $di/dt=-1200A/\mu s,$ $T_J=150^{\circ}C$		89		A
Diode Reverse Recovery Time	t_{RR}			131		ns
Reverse Recovery Charge	Q_{RR}			6.93		μC
Reverse Recovery Energy	E_{rec}			1.27		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)	$R_{th_{J-C}}$			0.21	$^{\circ}C/W$
Thermal Resistance from Junction to Case (Diode)	$R_{th_{J-C}}$			0.25	$^{\circ}C/W$
Thermal Resistance from Junction to Ambient	$R_{th_{J-A}}$			40	$^{\circ}C/W$

Curve Characteristics

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

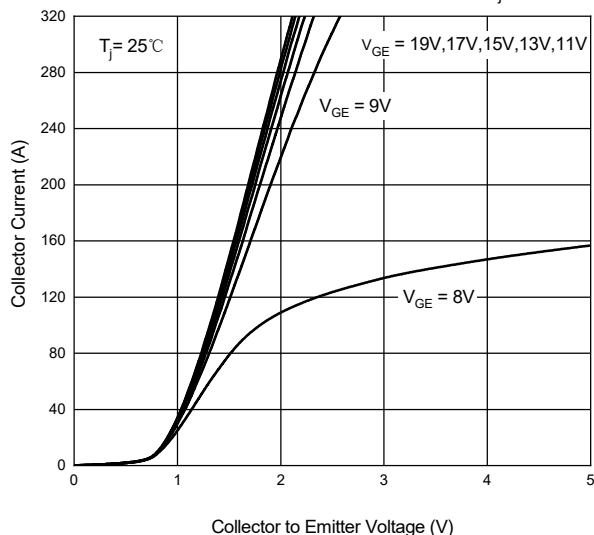


Fig. 2 - Typical Output Characteristic ($T_j=150^\circ\text{C}$)

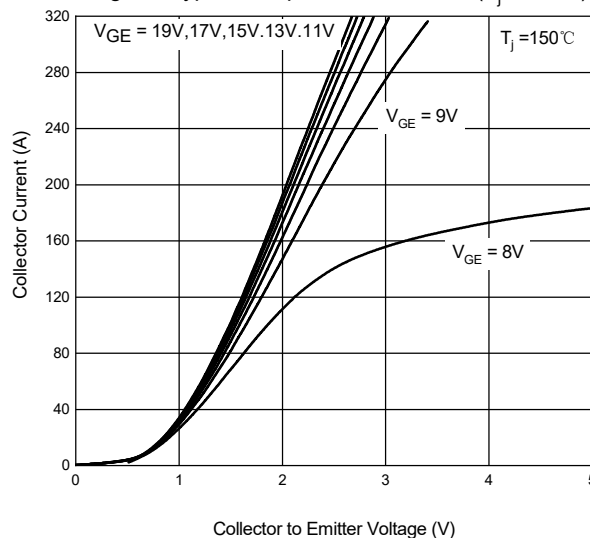


Fig. 3 - Typical Transfer Characteristic

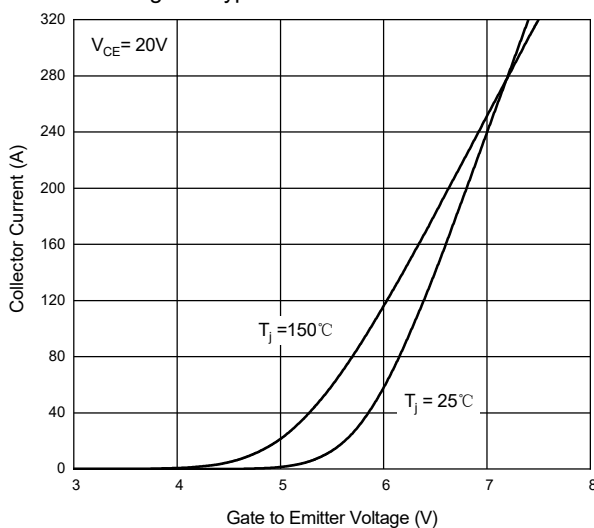


Fig. 4 - Diode Forward Current vs. Forward Voltage

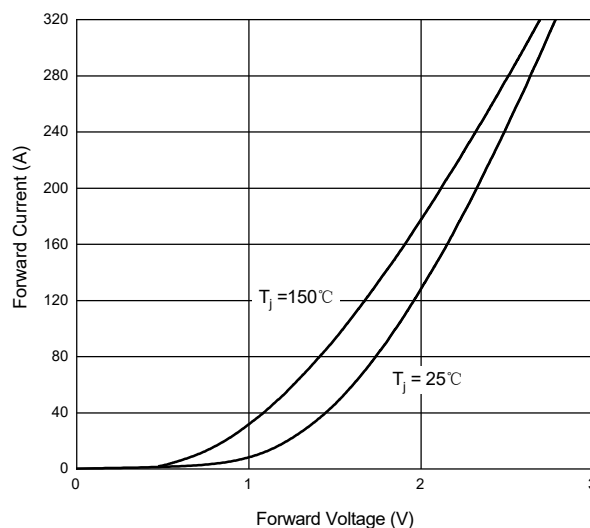


Fig. 5 - Diode V_F vs. Junction Temperature

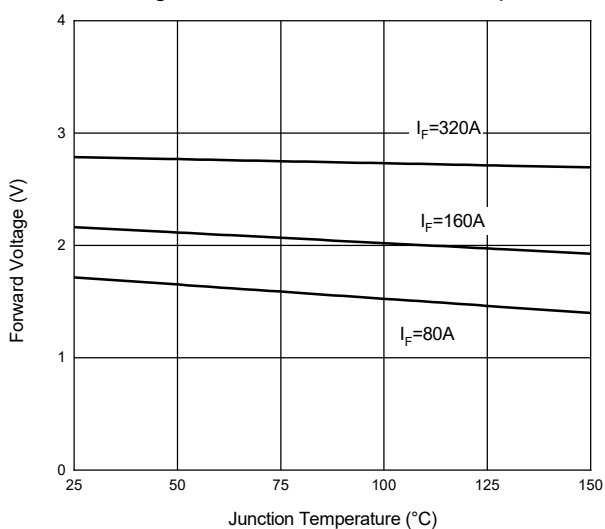
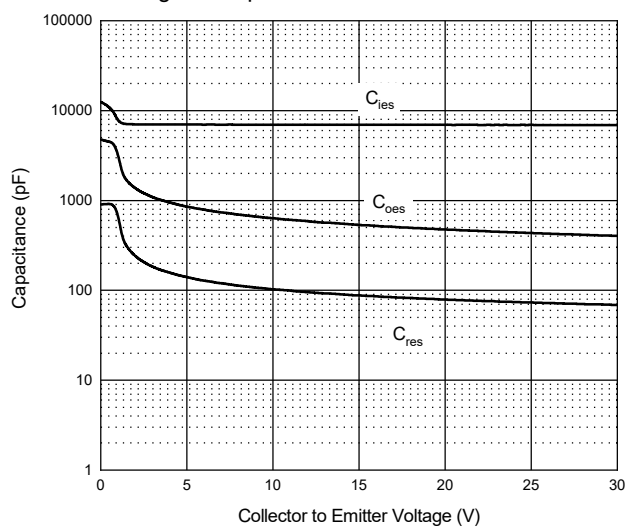


Fig. 6 - Capacitance Characteristics



Curve Characteristics

Fig. 7 - IGBT Switching Loss vs. I_c

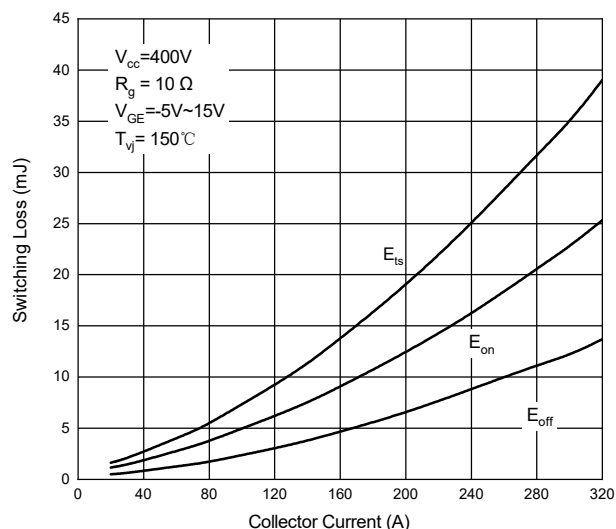


Fig. 8- IGBT Switching Loss vs. R_g

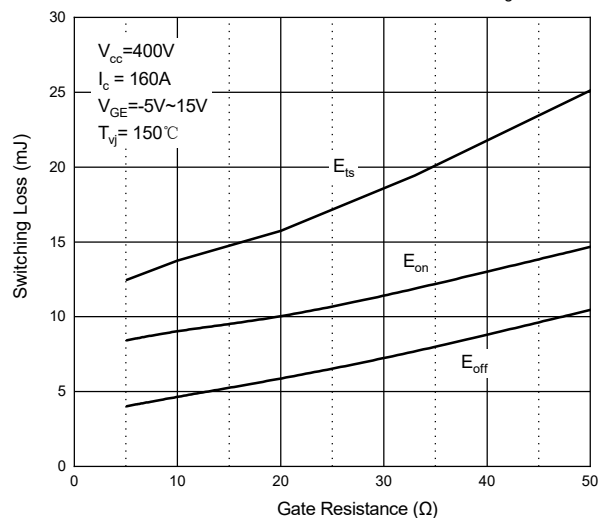


Fig. 9 -IGBT Switching Loss vs. Junction Temperature

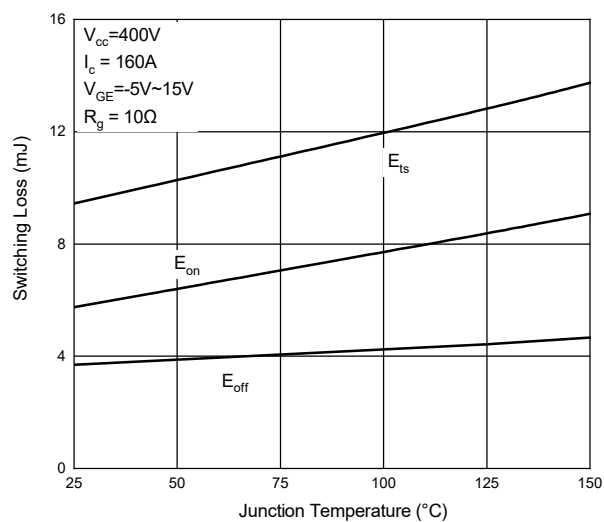


Fig. 10 - Switching Loss vs. V_{CE}

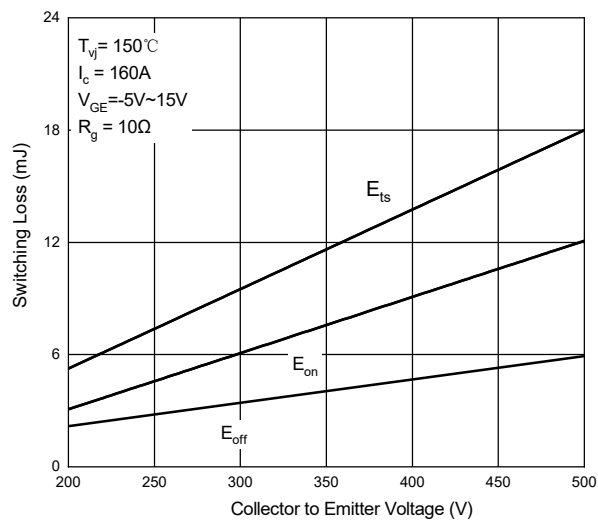


Fig. 11 - $V_{CE(sat)}$ vs. Junction Temperature

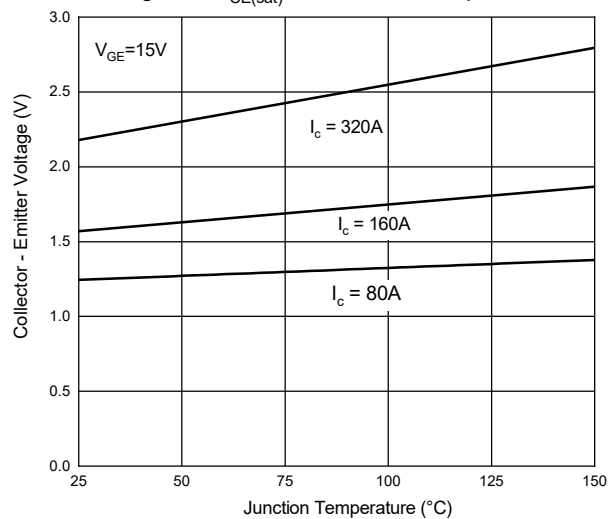
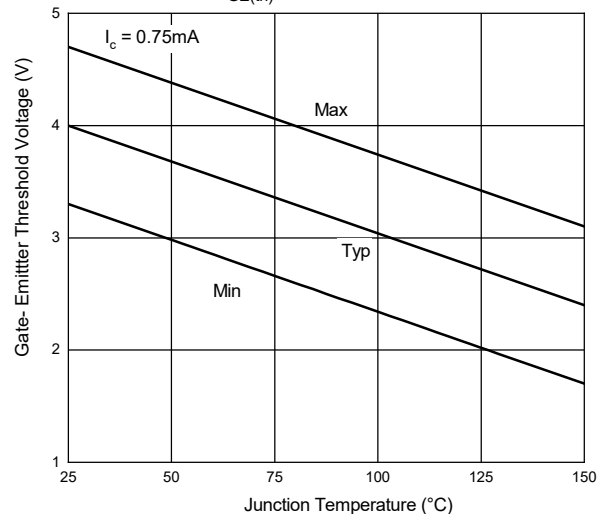


Fig. 12 - $V_{GE(th)}$ vs. Junction Temperature



Curve Characteristics

Fig. 13 - Switching Time vs. Collect Current

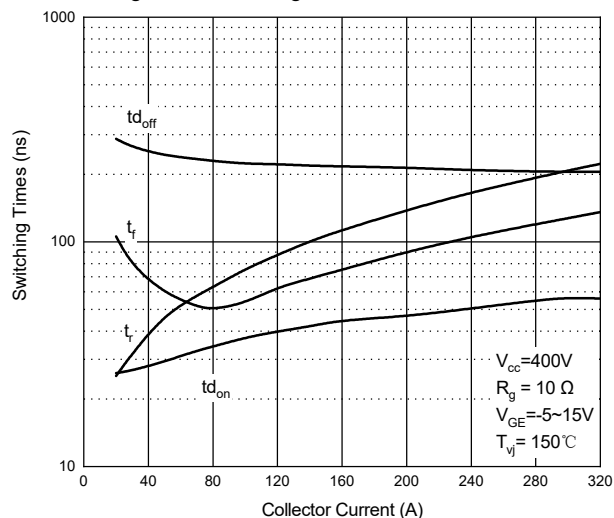


Fig. 14 - Switching Time vs. Gate Resistance

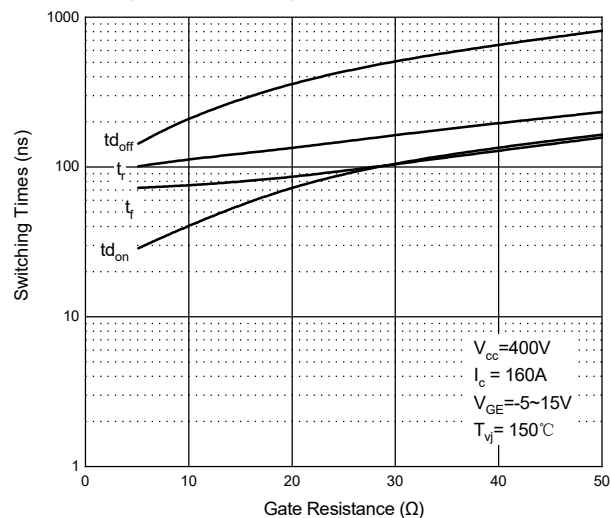


Fig. 15 - Switching Time vs. Juction temperature

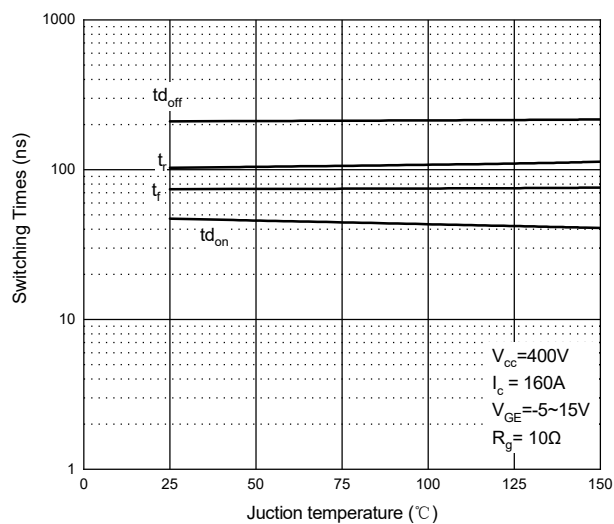


Fig. 16 - IGBT Transient Thermal Impedance

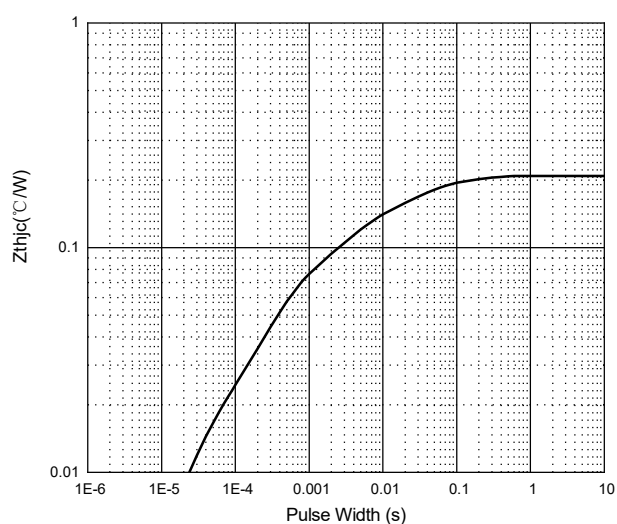


Fig. 17- Diode Transient Thermal Impedance

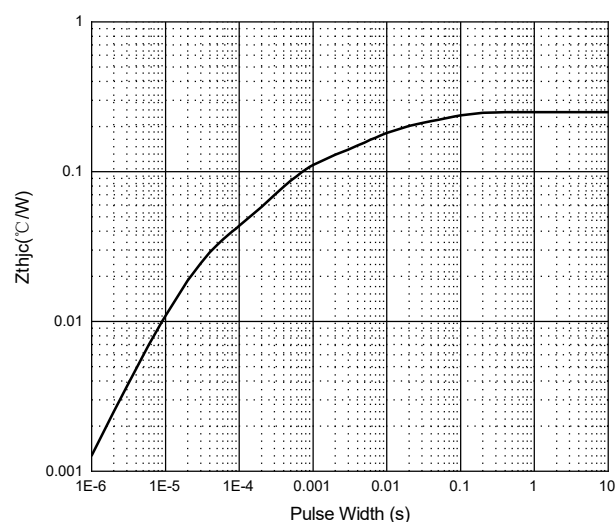
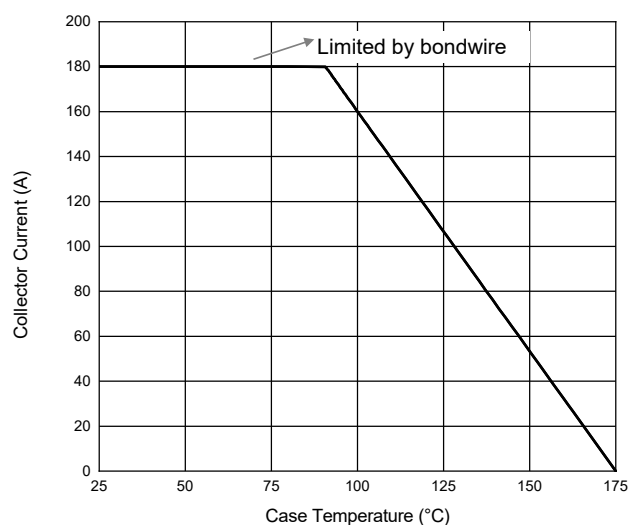


Fig. 18 - Collector Current vs. Case Temperature



Curve Characteristics

Fig. 19 - Power Derating

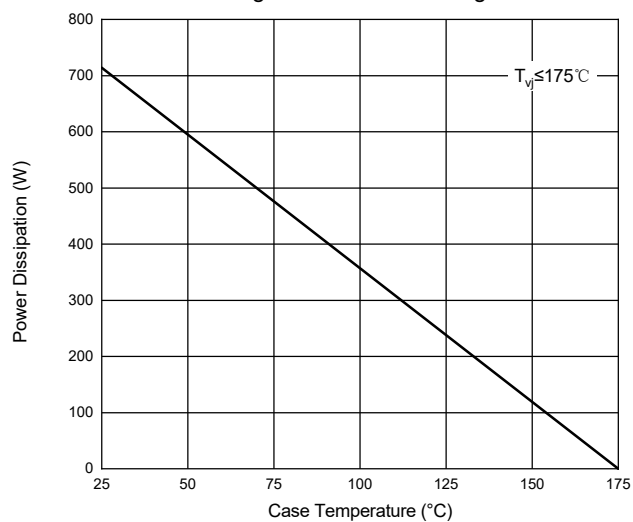
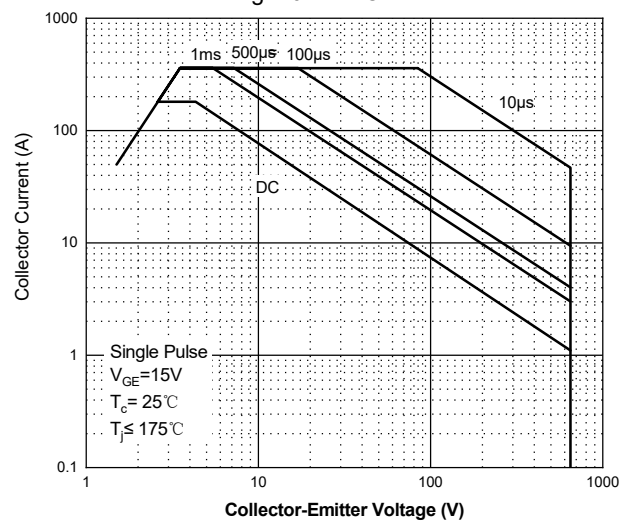


Fig. 20 - FBSOA



Ordering Information

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

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