

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

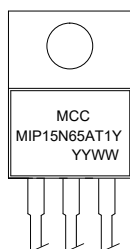
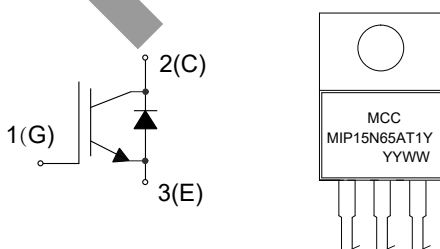
Maximum Ratings

Parameter	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CE}	650	V
DC Collector Current ⁽³⁾	I_C	$T_C=25^\circ\text{C}$	30
		$T_C=100^\circ\text{C}$	15
Pulsed Collector Current ⁽⁴⁾ , $V_{GE}=15\text{V}$	$I_{C,pluse}$	45	A
Diode Forward Current ⁽³⁾	I_F	$T_C=25^\circ\text{C}$	30
		$T_C=100^\circ\text{C}$	15
Diode Pulsed Current ⁽⁴⁾	$I_{F,pluse}$	45	A
Continuous Gate-Emitter Voltage	V_{GE}	± 20	V
Transient Gate-Emitter Voltage ⁽⁵⁾		± 30	V
Turn off Safe Operation Area $V_{CE} \leq 650\text{V}$, $T_j \leq 150^\circ\text{C}$		45	A
Short Circuit Withstand Time, $V_{GE} = 15\text{V}$, $V_{CC} = 400\text{V}$, $V_{CEM} \leq 650\text{V}$	T_{SC}	5	us
Power Dissipation	P_D	$T_C=25^\circ\text{C}$	150
		$T_j=175^\circ\text{C}$	

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. $T_p \leq 10\mu\text{s}$, Duty Cycle < 1%

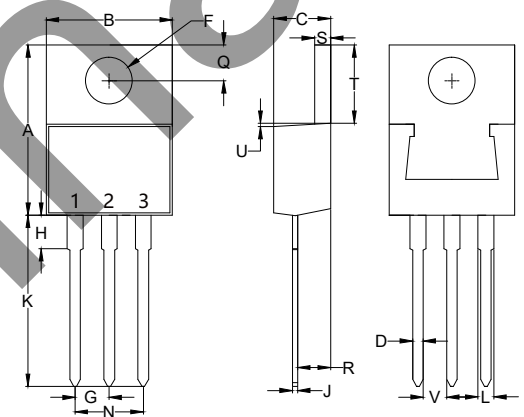
Internal Structure



Device Code: MIP15N65AT1Y
Date Code: YYWW: (Year & Week)

Trench and Field Stop IGBT 650V 15A

TO-220AB



DIMENSIONS

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	$V_{(BR)CES}$	$V_{GE}=0V, I_C=1mA$	650			V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=15A, T_J=25^\circ C$		1.65	2.15	V
		$V_{GE}=15V, I_C=15A, T_J=125^\circ C$		1.80		
		$V_{GE}=15V, I_C=15A, T_J=150^\circ C$		1.85		
G-E Threshold Voltage	$V_{GE(th)}$	$I_C=250\mu A, V_{CE}=V_{GE}$	4.0	5.5	6.5	V
C-E Leakage Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V, T_J=25^\circ C$			0.25	mA
		$V_{CE}=650V, V_{GE}=0V, T_J=150^\circ C$			5	
G-E Leakage Current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$			± 200	nA
Dynamic Characteristics						
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		0.74		nF
Reverse Transfer Capacitance	C_{res}				0.02	
Gate Charge	Q_g	$V_{CC}=400V, I_C=15A, V_{GE}=15V$		0.08		μC
IGBT Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=400V, I_C=15A, V_{GE}=-5\sim 15V, R_G=10\Omega, T_J=25^\circ C$		10		ns
Rise Time	t_r			27		
Turn-Off Delay Time	$t_{d(off)}$			58		
Fall Time	t_f			64		
Turn-On Energy	E_{on}	$V_{CC}=400V, I_C=15A, V_{GE}=-5\sim 15V, R_G=10\Omega, T_J=25^\circ C$		0.33		mJ
Turn-Off Energy	E_{off}			0.22		
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=400V, I_C=15A, V_{GE}=-5\sim 15V, R_G=10\Omega, T_J=125^\circ C$		10		ns
Rise Time	t_r			27		
Turn-Off Delay Time	$t_{d(off)}$			74		
Fall Time	t_f			105		
Turn-On Energy	E_{on}	$V_{CC}=400V, I_C=15A, V_{GE}=-5\sim 15V, R_G=10\Omega, T_J=125^\circ C$		0.35		mJ
Turn-Off Energy	E_{off}			0.35		
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=400V, I_C=15A, V_{GE}=-5\sim 15V, R_G=10\Omega, T_J=150^\circ C$		9		ns
Rise Time	t_r			27		
Turn-Off Delay Time	$t_{d(off)}$			81		
Fall Time	t_f			122		
Turn-On Energy	E_{on}	$V_{CC}=400V, I_C=15A, V_{GE}=-5\sim 15V, R_G=10\Omega, T_J=150^\circ C$		0.36		mJ
Turn-Off Energy	E_{off}			0.41		

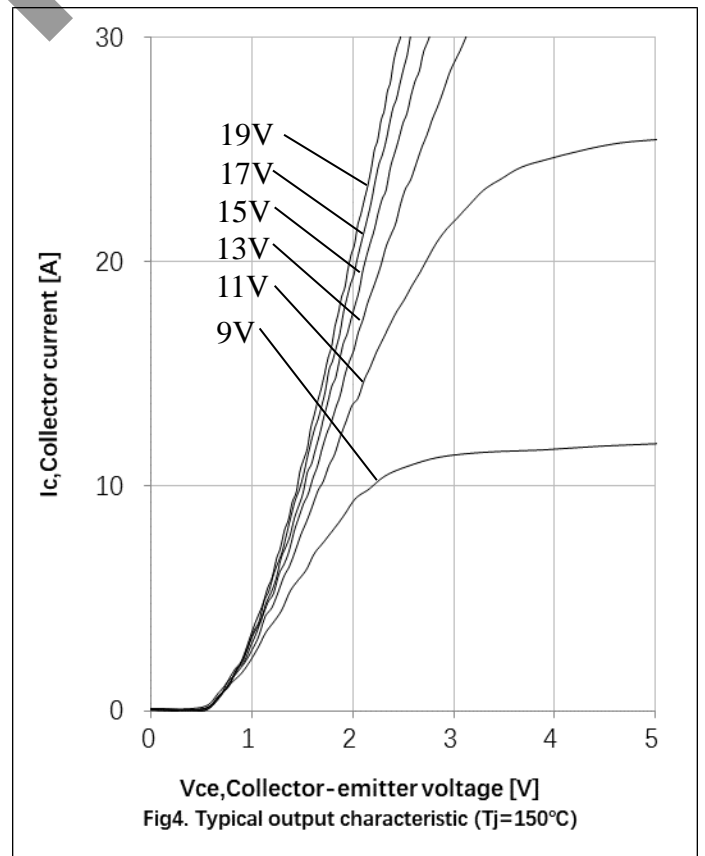
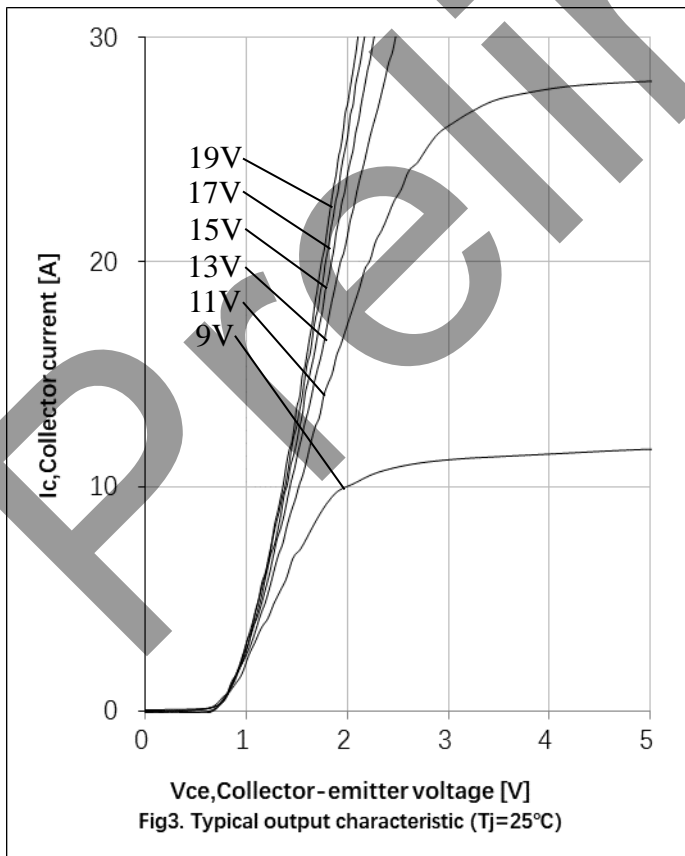
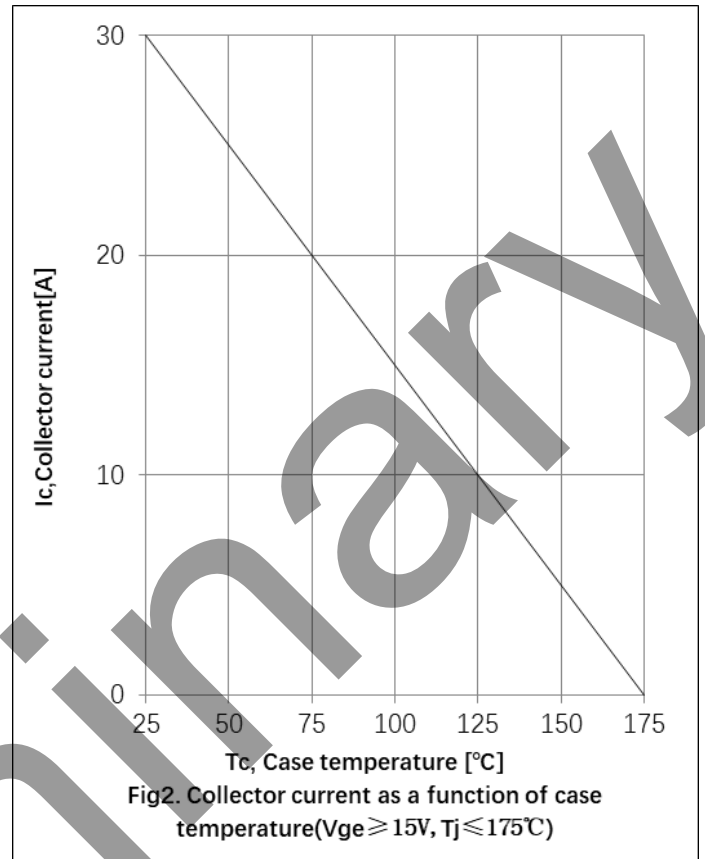
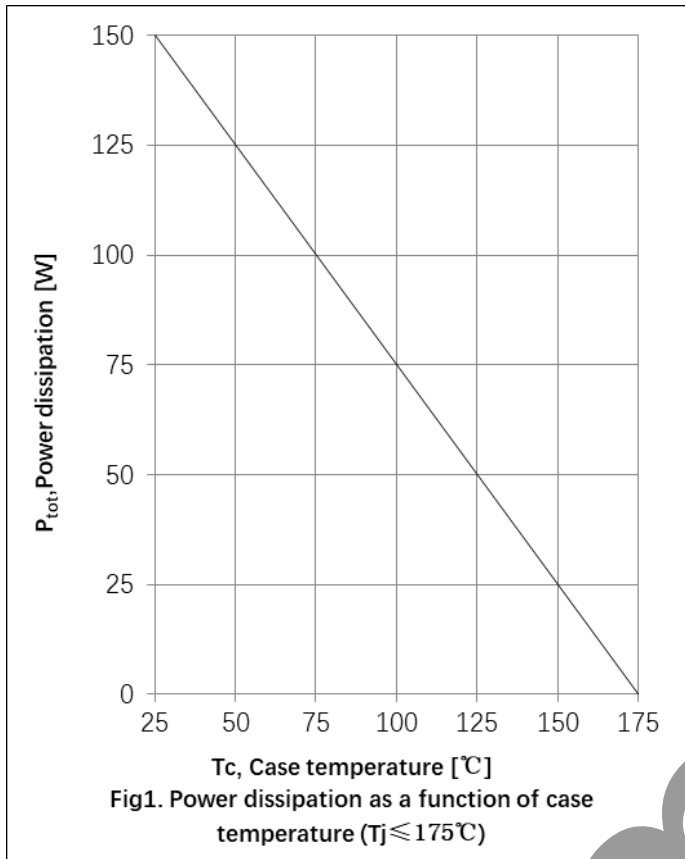
Electrical Characteristics @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Characteristics						
Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=15A, T_J=25^\circ C$		1.60	2.10	V
		$V_{GE}=0V, I_F=15A, T_J=125^\circ C$		1.50		
		$V_{GE}=0V, I_F=15A, T_J=150^\circ C$		1.45		
Reverse Recovery Current	I_{rr}	$V_R=400V, I_F=15A,$ $di_F/dt=-450A/\mu s, T_J=25^\circ C$		8		A
Diode Recovery Current	t_{rr}			78		ns
Reverse Recovery Charge	Q_{rr}			0.36		μC
Reverse Recovery Energy	E_{rec}			0.08		mJ
Reverse Recovery Current	I_{rr}	$V_R=400V, I_F=15A,$ $di_F/dt=-450A/\mu s, T_J=125^\circ C$		12		A
Diode Recovery Current	t_{rr}			126		ns
Reverse Recovery Charge	Q_{rr}			0.77		μC
Reverse Recovery Energy	E_{rec}			0.20		mJ
Reverse Recovery Current	I_{rr}	$V_R=400V, I_F=15A,$ $di_F/dt=-450A/\mu s, T_J=150^\circ C$		14		A
Diode Recovery Current	t_{rr}			146		ns
Reverse Recovery Charge	Q_{rr}			0.94		μC
Reverse Recovery Energy	E_{rec}			0.25		mJ

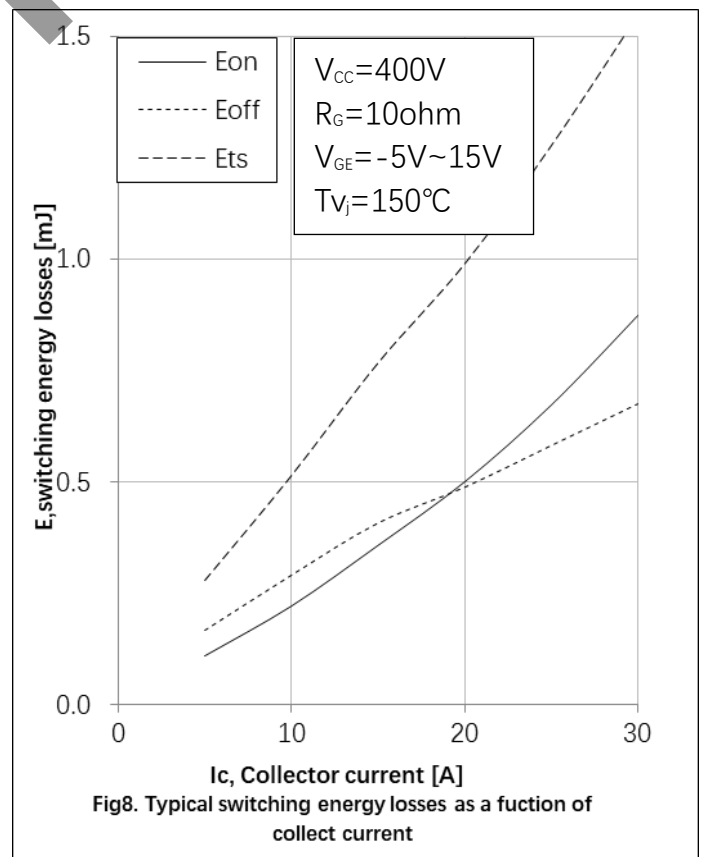
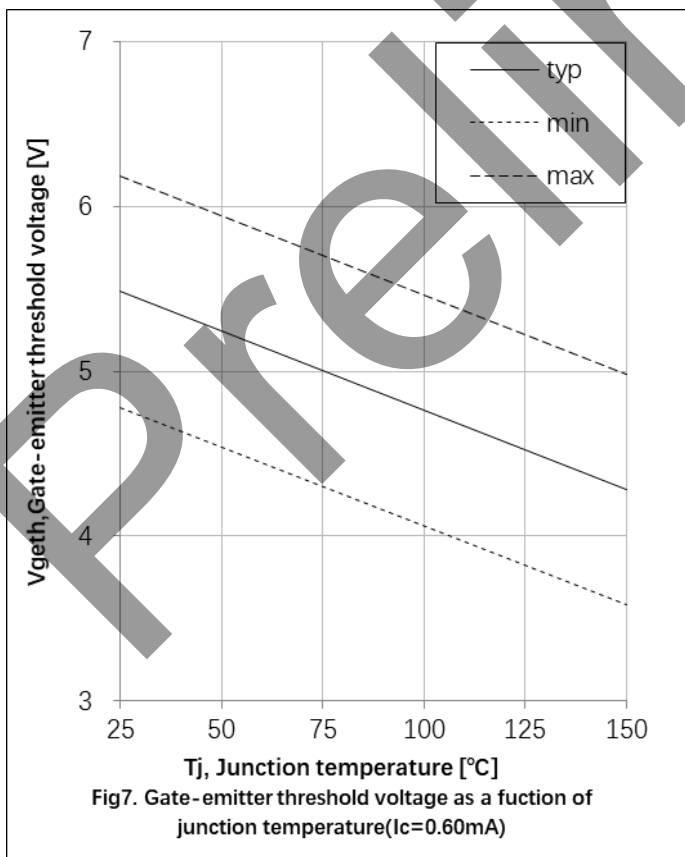
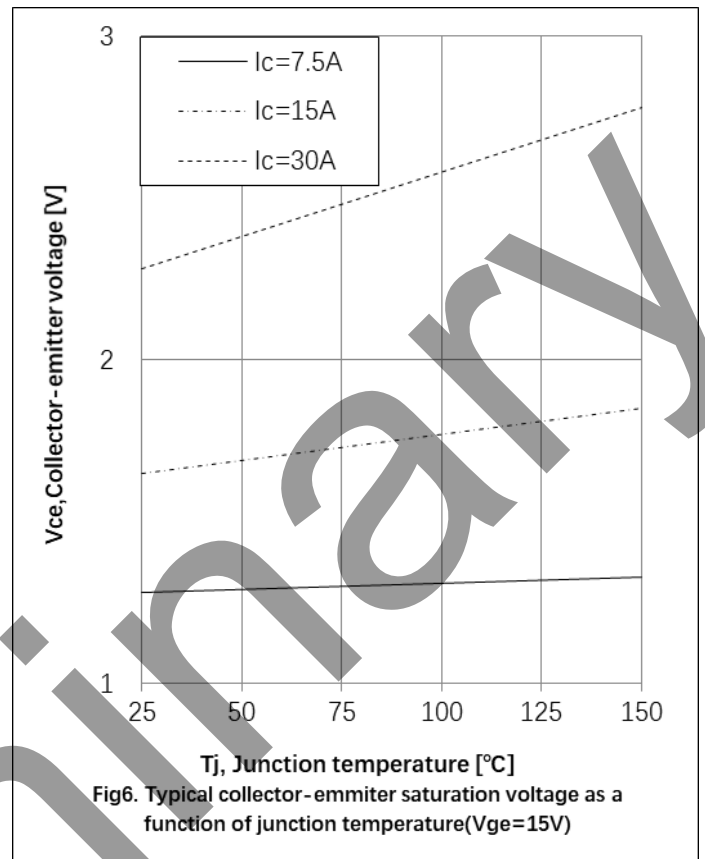
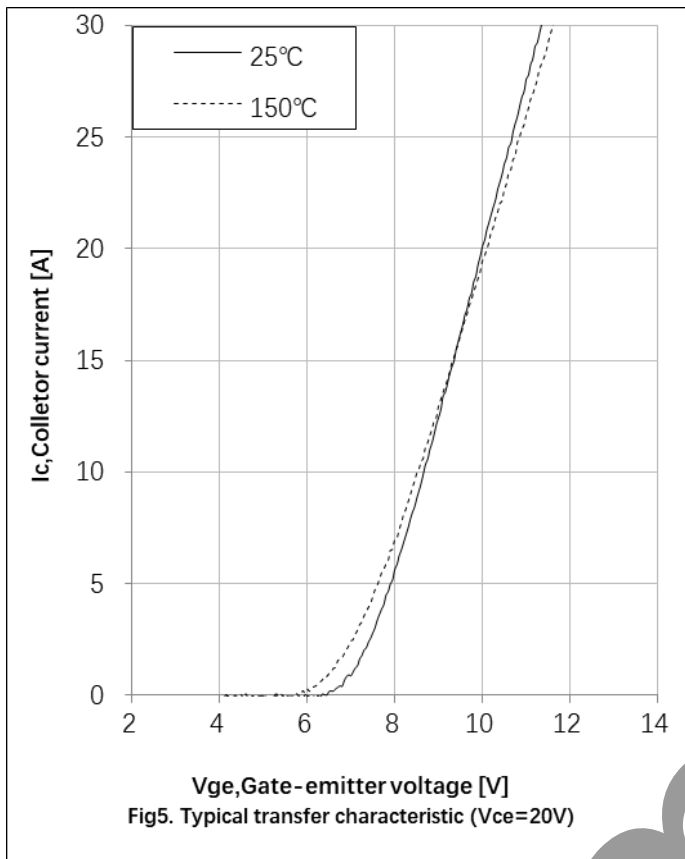
Thermal characteristics

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)	$R_{th_{J-C}}$			1.0	$^\circ C/W$
Thermal Resistance from Junction to Case (Diode)	$R_{th_{J-C}}$			1.5	$^\circ C/W$
Thermal Resistance from Junction to Ambient	$R_{th_{J-A}}$			40	$^\circ C/W$

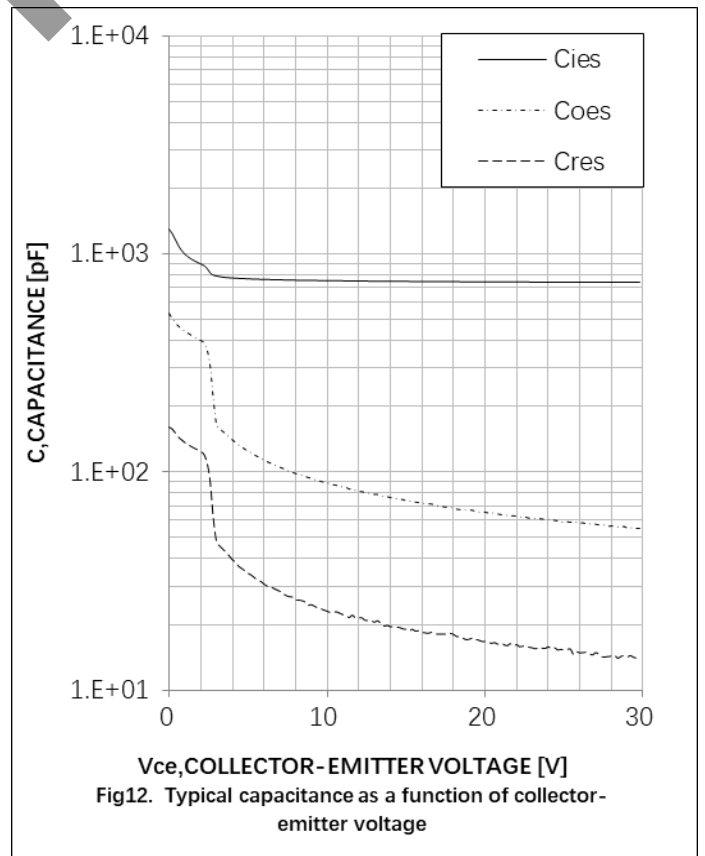
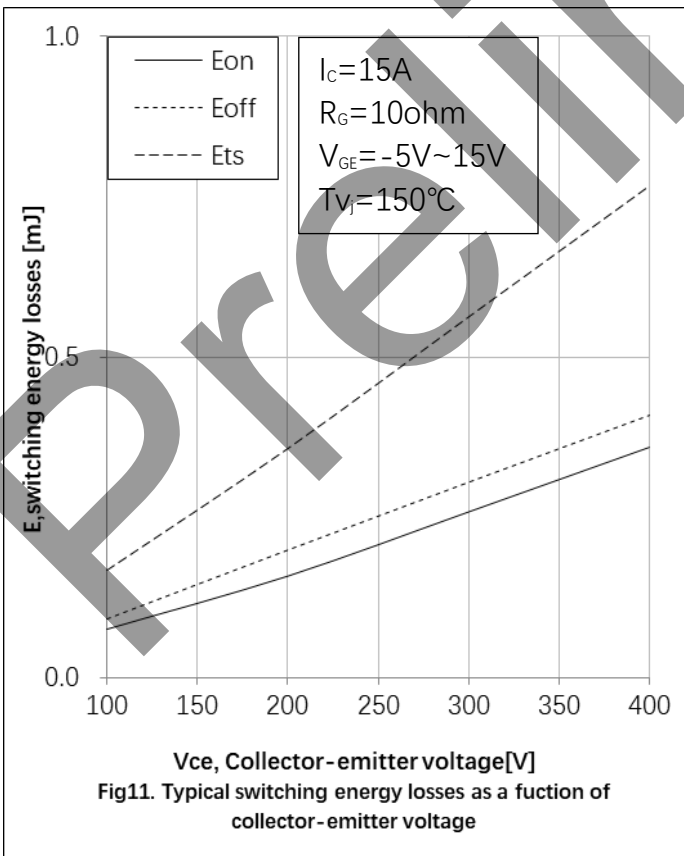
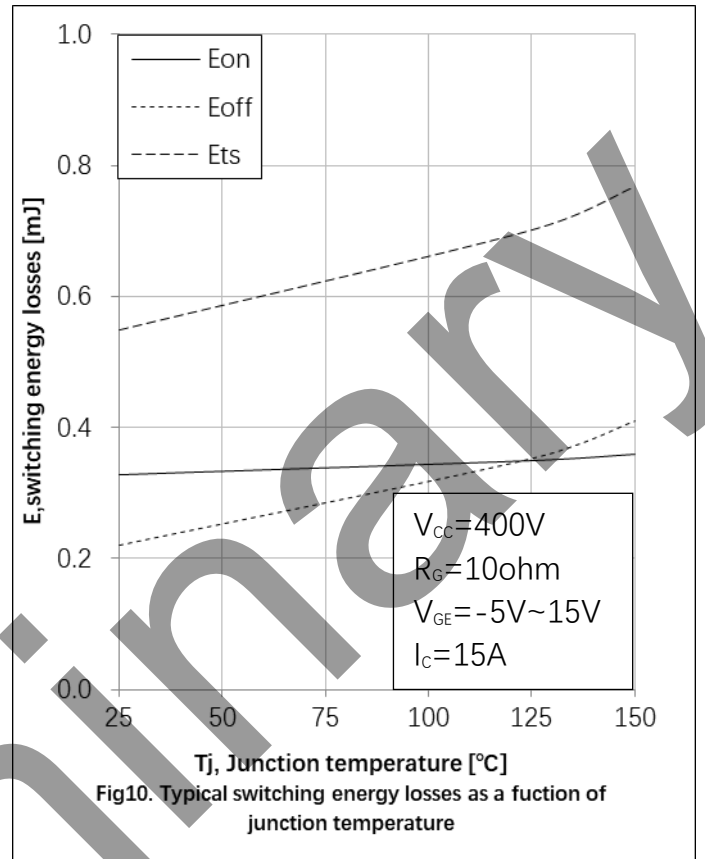
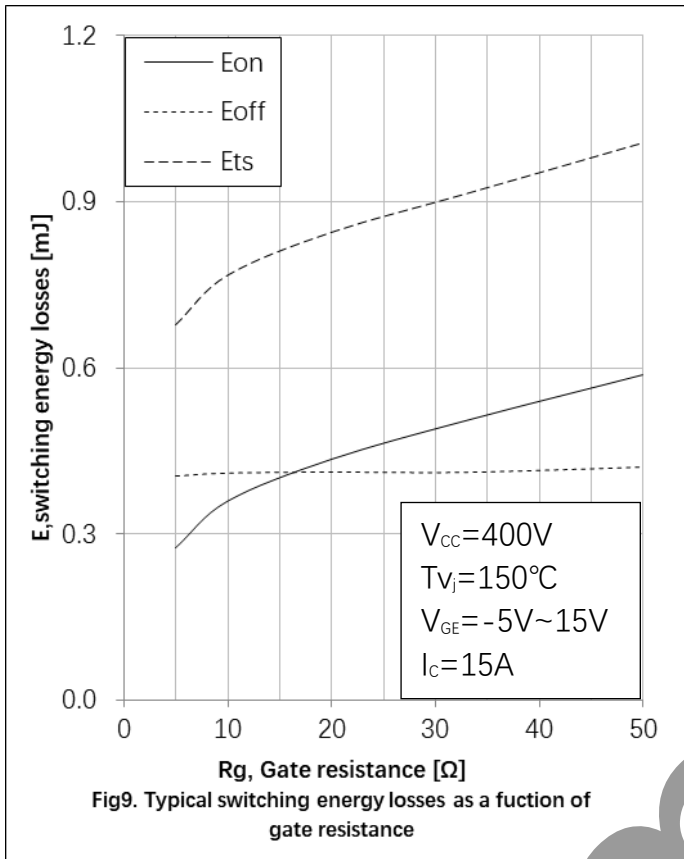
Curve Characteristics



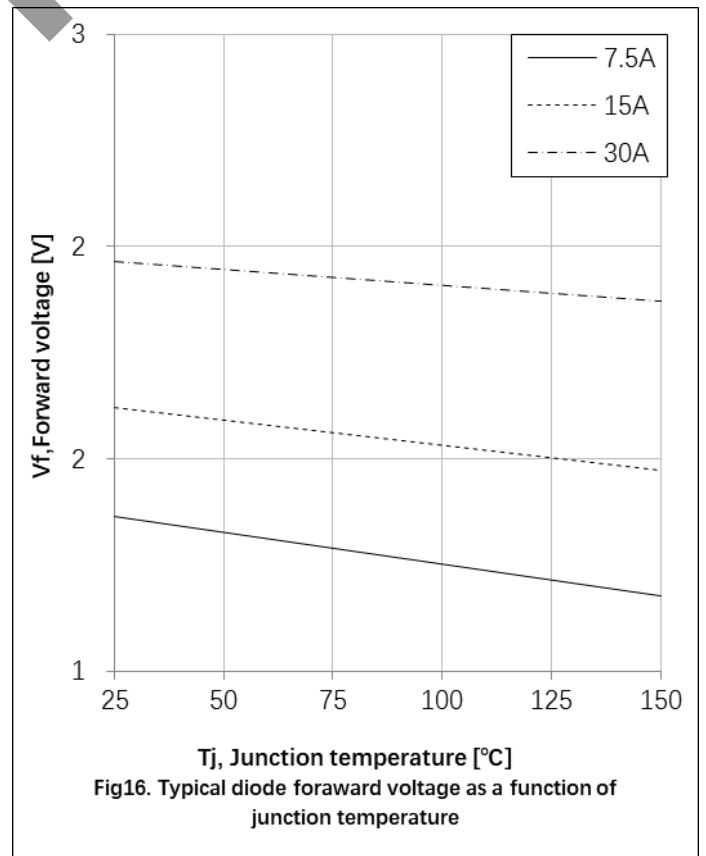
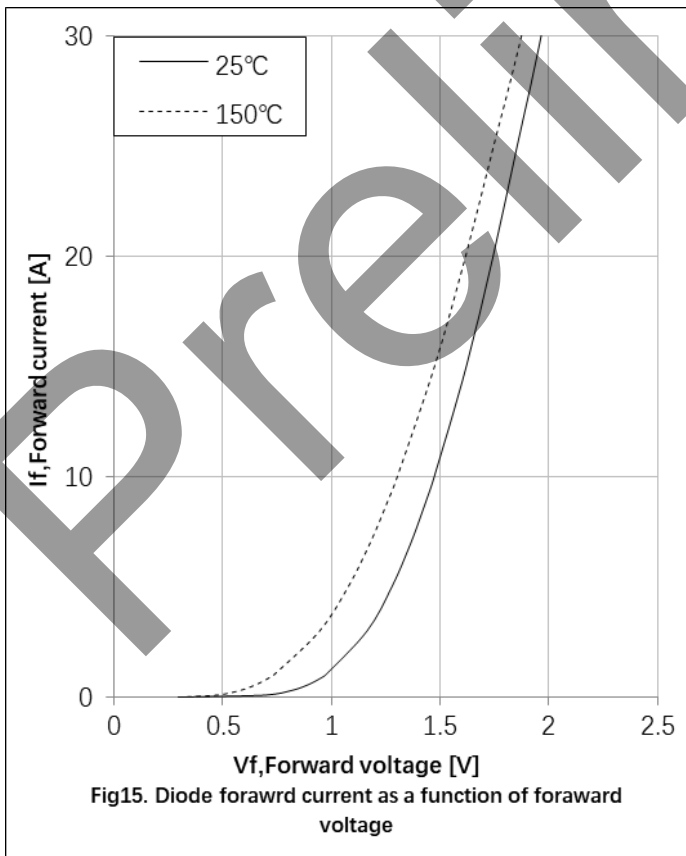
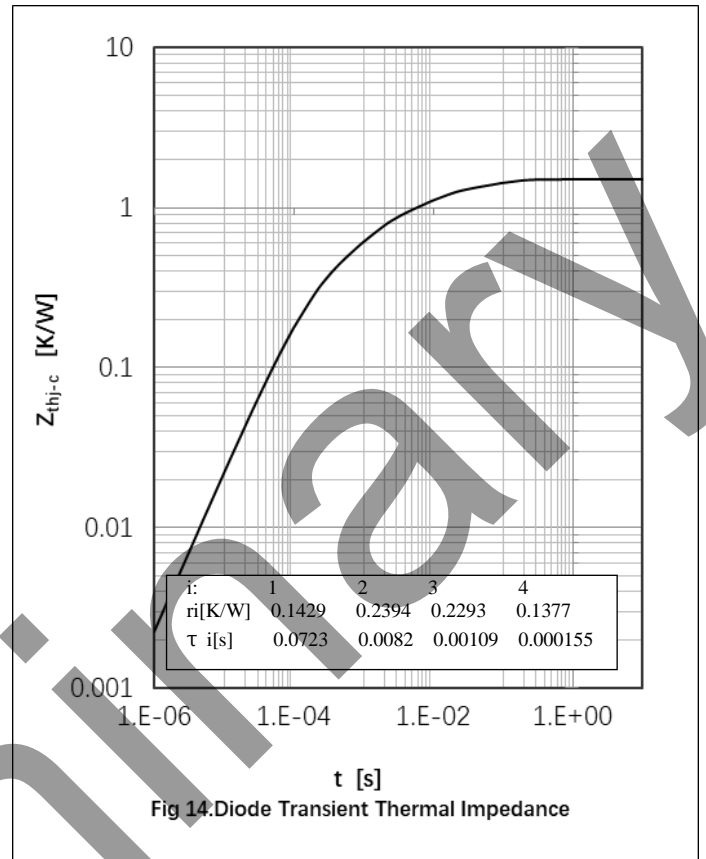
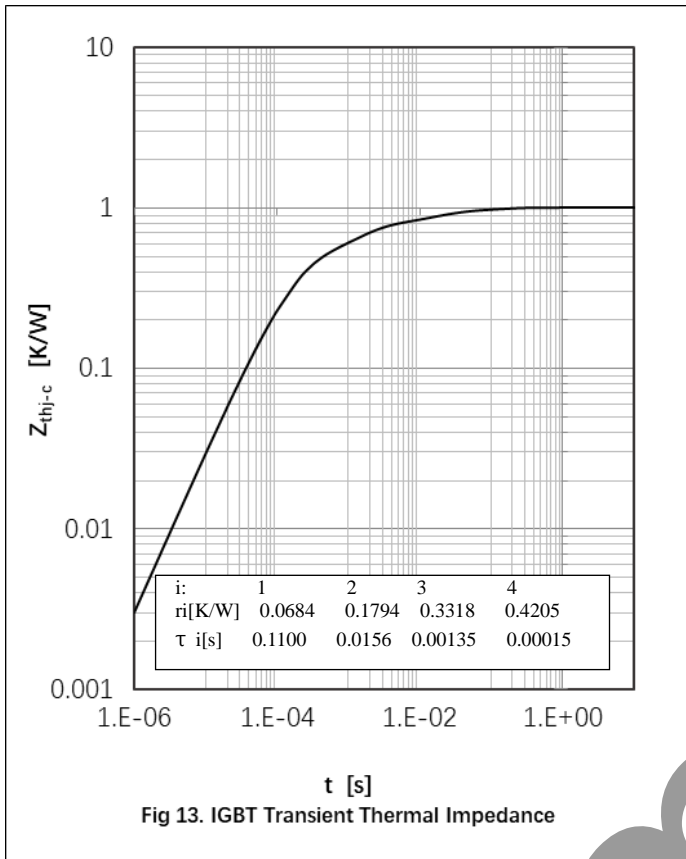
Curve Characteristics



Curve Characteristics



Curve Characteristics



Ordering Information

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

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