

### Product Summary

$V_{(BR)CES}$	$V_{CE(SAT)MAX}$	$I_c(100^\circ C)$
650V	1.7V@15V	10A

### Feature

- High speed smooth switching device for hard and soft switching
- Positive temperature coefficient
- High ruggedness, temperature stable

### Application

- Soft switching applications
- Air conditioning
- Motor drive inverter

### Package

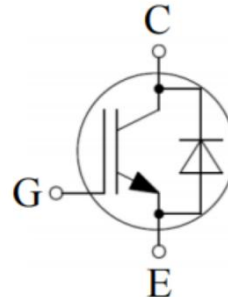


TO-263AB

### Marking



### Circuit diagram



### Absolute maximum ratings (Tc=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V <sub>CEs</sub>	650	V
Continuous Gate- Emitter Voltage	V <sub>GES</sub>	±20	V
Collector Current	I <sub>c</sub>	20	A
Collector Current(T <sub>c</sub> =100°C)	I <sub>c</sub> (100°C)	10	A
Pulsed Collector Current, tp limited by T <sub>jmax</sub> ,V <sub>GE</sub> =15V	I <sub>CM</sub>	40	A
Diode Continuous Forward Current	I <sub>F</sub>	20	A
Diode Continuous Forward Current(T <sub>c</sub> =100°C)	I <sub>F</sub> (100°C)	10	A
Diode Forward Current, tp limited by T <sub>jmax</sub>	I <sub>Fpuls</sub>	40	A
Turn off Safe Operating Area V <sub>CE</sub> ≤ 600V,T <sub>J</sub> ≤150°C	-	40	A
Short circuit withstand time V <sub>GE</sub> =15V, V <sub>CE</sub> ≤400V	T <sub>SC</sub>	5	uS
Power Dissipation(T <sub>J</sub> =175°C)	P <sub>D</sub>	100	W
Thermal Resistance, Junction to case for Diode	R <sub>θJC</sub>	2.0	°C/W
Thermal Resistance, Junction to case for IGBT	R <sub>θJC</sub>	1.5	°C/W
Soldering Temperature,wave soldering 1.6mm(0.063in.) from case for 10s	T <sub>L</sub>	260	°C
Junction Temperature	T <sub>J</sub>	-40 ~ +175	°C
Storage Temperature Range	T <sub>STG</sub>	-55 ~ +150	°C

### Electrical characteristics of the IGBT (T<sub>J</sub>=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
Collector-Emitter Breakdown Voltage	V <sub>(BR)CES</sub>	V <sub>GE</sub> = 0V, I <sub>c</sub> =250uA	650			V
Collector-Emitter Leakage Current	I <sub>CES</sub>	V <sub>GE</sub> = 0V, V <sub>CE</sub> =650V			0.25	mA
		V <sub>GE</sub> = 0V, V <sub>CE</sub> =650V, T <sub>J</sub> =150°C			1	
Gate to Emitter Leakage Current	I <sub>GES</sub>	V <sub>GE</sub> =±20V, V <sub>CE</sub> = 0V			200	nA
Collector-Emitter Saturation Voltage	V <sub>CE(sat)</sub>	V <sub>GE</sub> =15V, I <sub>c</sub> =10A,		1.4	1.7	V
		V <sub>GE</sub> =15V, I <sub>c</sub> =10A, T <sub>J</sub> =125°C		1.55		
		V <sub>GE</sub> =15V, I <sub>c</sub> =10A, T <sub>J</sub> =150°C		1.6		
Gate Threshold Voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> =V <sub>GE</sub> , I <sub>c</sub> =1mA	4.4	5.2	6.0	V
<b>Dynamic characteristics</b>						
Input Capacitance	C <sub>ies</sub>	V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f =1MHz		0.89		nF
Output Capacitance	C <sub>oes</sub>			0.04		
Reverse Transfer Capacitance	C <sub>res</sub>			0.01		
Total Gate Charge	Q <sub>g</sub>	V <sub>CC</sub> =300V, V <sub>GE</sub> =15V, I <sub>c</sub> =10A		0.059		uC
Short Circuit Collector Current	I <sub>C(SC)</sub>	V <sub>CC</sub> =400V, V <sub>GE</sub> =15V, t <sub>SC</sub> ≤5us, T <sub>J(start)</sub> =25°C		110		A
Turn-on delay time	t <sub>d(on)</sub>	V <sub>CC</sub> =300V, V <sub>GE</sub> =-5V~15V, I <sub>c</sub> =10A, R <sub>G</sub> =51Ω		10		nS
Turn-on rise time	t <sub>r</sub>			26		
Turn-off delay time	t <sub>d(off)</sub>			68		
Turn-off fall time	t <sub>f</sub>			135		
Turn-on Switching Energy	E <sub>on</sub>			0.36		
Turn-off Switching Energy	E <sub>off</sub>		0.17			
Turn-on delay time	t <sub>d(on)</sub>	V <sub>CC</sub> =300V, V <sub>GE</sub> =-5V~15V, I <sub>c</sub> =10A, R <sub>G</sub> =51Ω, T <sub>J</sub> =125°C		14		nS
Turn-on rise time	t <sub>r</sub>			35		
Turn-off delay time	t <sub>d(off)</sub>			68		
Turn-off fall time	t <sub>f</sub>			162		
Turn-on Switching Energy	E <sub>on</sub>			0.42		
Turn-off Switching Energy	E <sub>off</sub>		0.29			
Turn-on delay time	t <sub>d(on)</sub>	V <sub>CC</sub> =300V, V <sub>GE</sub> =-5V~15V, I <sub>c</sub> =10A, R <sub>G</sub> =51Ω, T <sub>J</sub> =150°C		16		nS
Turn-on rise time	t <sub>r</sub>			41		
Turn-off delay time	t <sub>d(off)</sub>			69		
Turn-off fall time	t <sub>f</sub>			181		
Turn-on Switching Energy	E <sub>on</sub>			0.46		
Turn-off Switching Energy	E <sub>off</sub>		0.33			

### Electrical characteristics of the Diode ( $T_j=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	$V_F$	$I_F=10\text{A}$		1.7	2.2	V
		$I_F=10\text{A}, T_j=125^\circ\text{C}$		1.5		
		$I_F=10\text{A}, T_j=150^\circ\text{C}$		1.4		
Reverse Recovery Current	$I_{rr}$	$I_F=10\text{A}, V_R=300\text{V}, -di/dt=365\text{A}/\mu\text{s}$		6		A
Reverse Recovery Charge	$Q_{rr}$			0.12		$\mu\text{C}$
Diode Reverse Recovery Time	$t_{rr}$			176		ns
Reverse Recovery Energy	$E_{rec}$			0.05		mJ
Reverse Recovery Current	$I_{rr}$	$I_F=10\text{A}, V_R=300\text{V}, -di/dt=365\text{A}/\mu\text{s}, T_j=125^\circ\text{C}$		7		A
Reverse Recovery Charge	$Q_{rr}$			0.48		$\mu\text{C}$
Diode Reverse Recovery Time	$t_{rr}$			189		ns
Reverse Recovery Energy	$E_{rec}$			0.09		mJ
Reverse Recovery Current	$I_{rr}$	$I_F=10\text{A}, V_R=300\text{V}, -di/dt=365\text{A}/\mu\text{s}, T_j=150^\circ\text{C}$		8		A
Reverse Recovery Charge	$Q_{rr}$			0.62		$\mu\text{C}$
Diode Reverse Recovery Time	$t_{rr}$			195		ns
Reverse Recovery Energy	$E_{rec}$			0.11		mJ

## Typical Characteristics

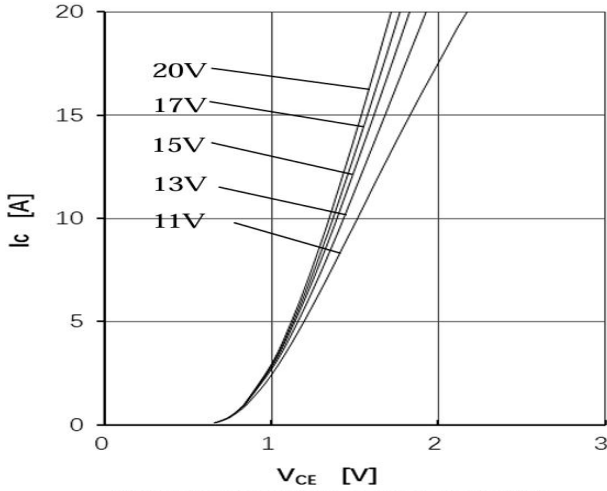


Fig1.IGBT Output Characteristics(25°C)

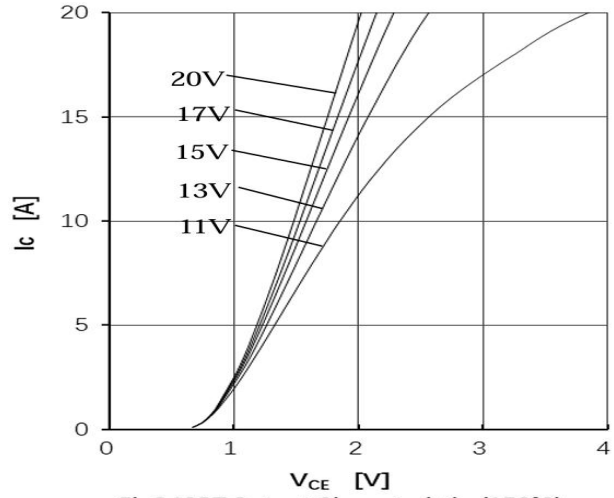


Fig2.IGBT Output Characteristics(150°C)

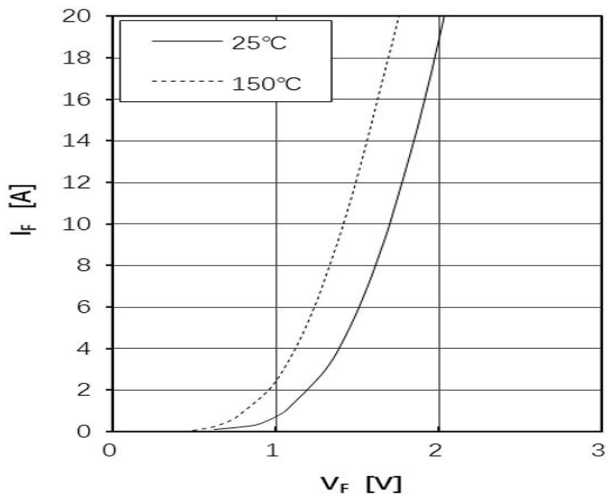


Fig3.Diode Foward Characteristics

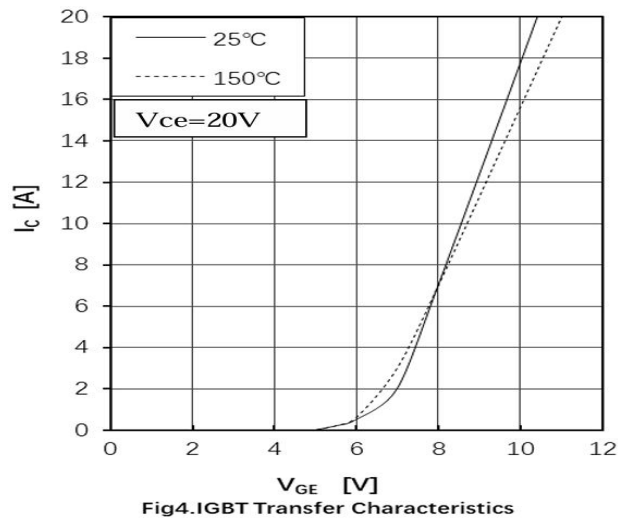


Fig4.IGBT Transfer Characteristics

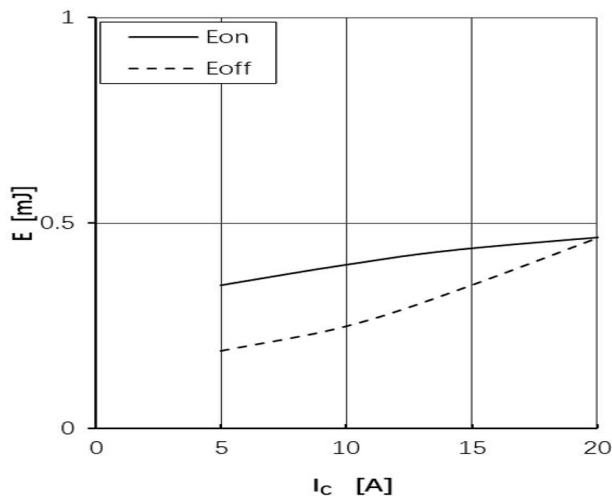


Fig5.IGBT Switching Loss vs. $I_c$ (150°C)

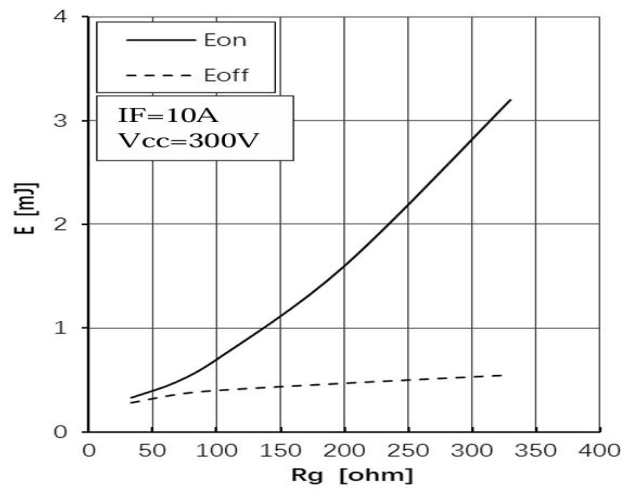
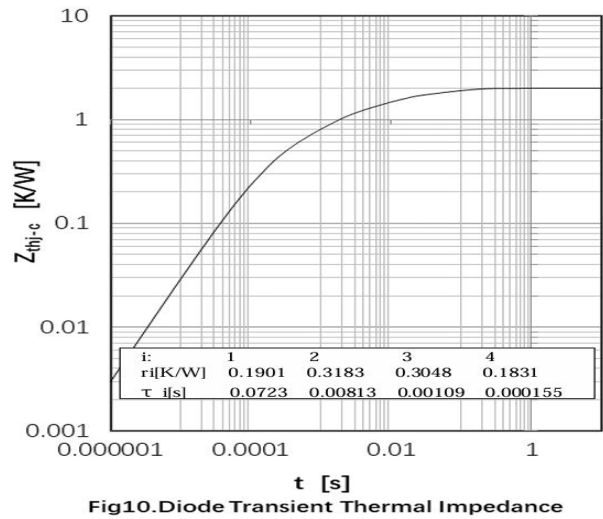
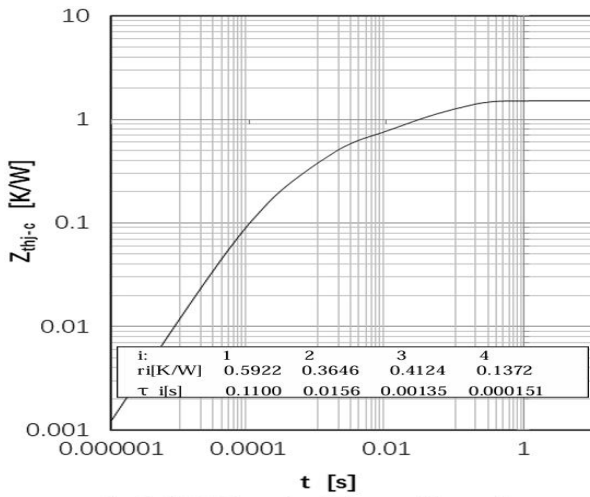
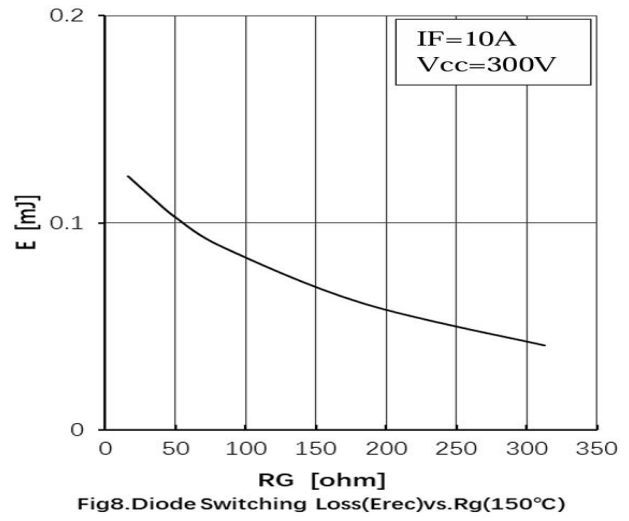
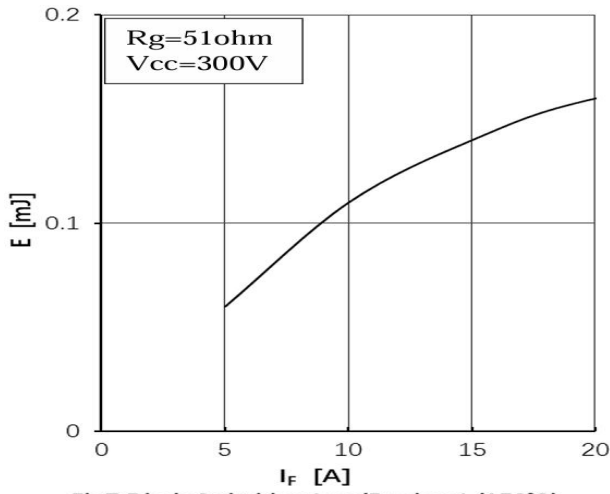
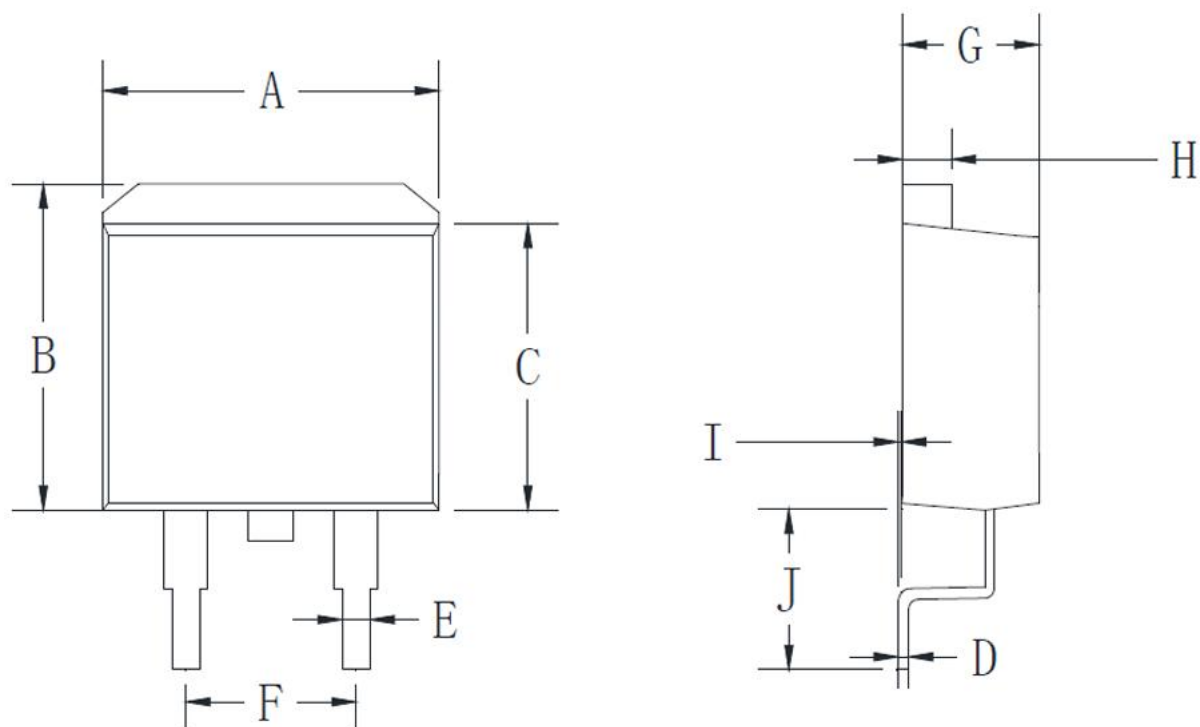


Fig6.IGBT Switching Loss vs. $R_g$ (150°C)

## Typical Characteristics



### TO-263AB Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	9.500	11.500	0.374	0.453
B	9.700	10.500	0.382	0.413
C	8.400	9.000	0.331	0.354
D	0.280	0.640	0.011	0.025
E	0.680	0.940	0.027	0.037
F	4.550	5.600	0.179	0.220
G	4.040	5.100	0.159	0.201
H	1.140	1.400	0.045	0.055
I	0.000	0.200	0.000	0.008
J	4.900	6.050	0.193	0.238