Features

- Low switching losses
- Maximum junction temperature 175°C
- Positive temperature coefficient
- High ruggedness, temperature stable
- High short circuit capability(5μs)
- Halogen Free. “Green” Device (Note 1)
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant ("P" Suffix Designates RoHS Compliant. See Ordering Information)

Applications

- High frequency switching application
- Medical applications
- Uninterruptible power supply
- Motion/servo control

Maximum Ratings

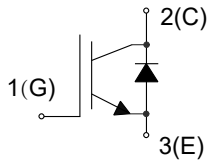
- Operating Junction Temperature Range : -40°C to +175°C
- Storage Temperature Range: -55°C to +150°C
- IGBT Thermal Resistance: 0.49°C/W Junction to Case
- Diode Thermal Resistance: 1.05°C/W Junction to Case
- Thermal Resistance: 40°C/W Junction to Ambient

Parameter		Symbol	Rating	Unit
Collector-Emitter Voltage		V_{CE}	650	V
DC Collector Current (2)	T_C=25°C	I_C	80	A
	T_C=100°C		40	
Pulsed Collector Current (3) V_{GE}=15V		I_{CM}	160	A
Diode Forward Current (2)	T_C=25°C	I_F	60	A
	T_C=100°C		30	
Diode Pulsed Current (3)		$I_{F,pulse}$	120	A
Gate-Emitter Voltage		V_{GE}	±20	V
Transient Gate-Emitter Voltage			±30	
Short Circuit Withstand Time V_{GE}=15V, V_{CC}=400V, V_{CEM}≤650V		t_{SC}	5	μs
Power Dissipation	T_j=25°C	P_D	306	W

Note:

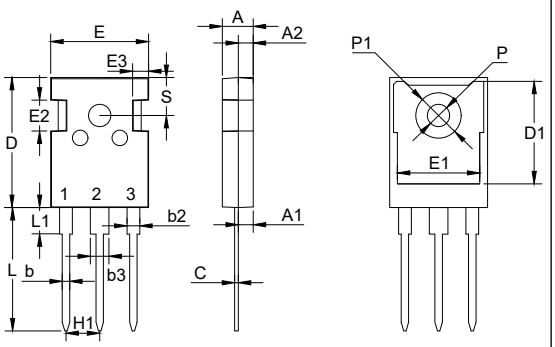
1. Halogen free "Green” products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
2. Limited by T_{Jmax}.
3. T_p limited by T_{Jmax}.

Internal Structure



Trench and Field Stop IGBT 650V 40A

TO-247AB



DIMENSIONS					
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 @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Static Characteristics						
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=250μA	650			V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=40A, T_J=25℃		1.95	2.40	V
		V_{GE}=15V, I_C=40A, T_J=125℃		2.30		
		V_{GE}=15V, I_C=40A, T_J=150℃		2.40		
G-E Threshold Voltage	$V_{GE(th)}$	I_C=430μA, V_{GE}=V_{CE}	4.1	5.1	6.1	V
C-E Leakage Current	I_{CES}	V_{CE}=650V, V_{GE}=0V, T_J=25℃			0.25	mA
		V_{CE}=650V, V_{GE}=0V, T_J=150℃			4.00	
G-E Leakage Current	I_{GES}	V_{CE}=0V, V_{GE}=±20V			100	nA
Dynamic Characteristics						
Input Capacitance	C_{ies}	V_{CE}=25V,V_{GE}=0V,f=1MHz		1.56		nF
Reverse Transfer Capacitance	C_{res}			0.06		
Gate Charge	Q_g	V_{CC}=300V,I_C=40A,V_{GE}=15V		0.16		μC
Short Circuit Collector Current	Isc	V_{GE}=15V, tsc≤5μs, V_{cc}=300V,T_J≤150°C		200		A
IGBT Switching Characteristics						
Turn-On Delay Time	$td_{(on)}$	V_{CC}=400V, I_C=40A, V_{GE}=0~15V, R_G=10Ω, Ls=60nH, T_J=25℃		12		ns
Rise Time	t_r			31		
Turn-Off Delay Time	$td_{(off)}$			124		
Fall Time	t_f			54		
Turn-On Energy	E_{on}			1.55		mJ
Turn-Off Energy	E_{off}			0.59		
Turn-On Delay Time	$td_{(on)}$	V_{CC}=400V, I_C=40A, V_{GE}=0~15V, R_G=10Ω, Ls=60nH, T_J=125℃		11		ns
Rise Time	t_r			30		
Turn-Off Delay Time	$td_{(off)}$			132		
Fall Time	t_f			84		
Turn-On Energy	E_{on}			1.57		mJ
Turn-Off Energy	E_{off}			0.83		
Turn-On Delay Time	$td_{(on)}$	V_{CC}=400V, I_C=40A, V_{GE}=0~15V, R_G=10Ω, Ls=60nH, T_J=150℃		11		ns
Rise Time	t_r			30		
Turn-Off Delay Time	$td_{(off)}$			137		
Fall Time	t_f			102		
Turn-On Energy	E_{on}			1.6		mJ
Turn-Off Energy	E_{off}			0.88		

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Static Characteristics						
Diode Forward Voltage	V_F	I_F=30A, T_J=25℃		2.00	2.50	V
		I_F=30A, T_J=125℃		1.95		
		I_F=30A, T_J=150℃		1.95		
Diode Dynamic Characteristics						
Reverse Recovery Current	I_{rr}	V_R=400V, I_F=40A, di/dt=-410A/μs, T_J=25℃		9		A
Reverse Recovery Charge	Q_{rr}			0.155		μC
Diode Reverse Recovery Time	t_{rr}			29		ns
Reverse Recovery Energy	E_{rec}			0.09		mJ
Reverse Recovery Current	I_{rr}	V_R=400V, I_F=40A, di/dt=-410A/μs, T_J=125℃		13		A
Reverse Recovery Charge	Q_{rr}			0.824		μC
Diode Reverse Recovery Time	t_{rr}			112		ns
Reverse Recovery Energy	E_{rec}			0.15		mJ
Reverse Recovery Current	I_{rr}	V_R=400V, I_F=40A, di/dt=-410A/μs, T_J=150℃		13		A
Reverse Recovery Charge	Q_{rr}			1.16		μC
Diode Reverse Recovery Time	t_{rr}			140		ns
Reverse Recovery Energy	E_{rec}			0.23		mJ

Curve Characteristics

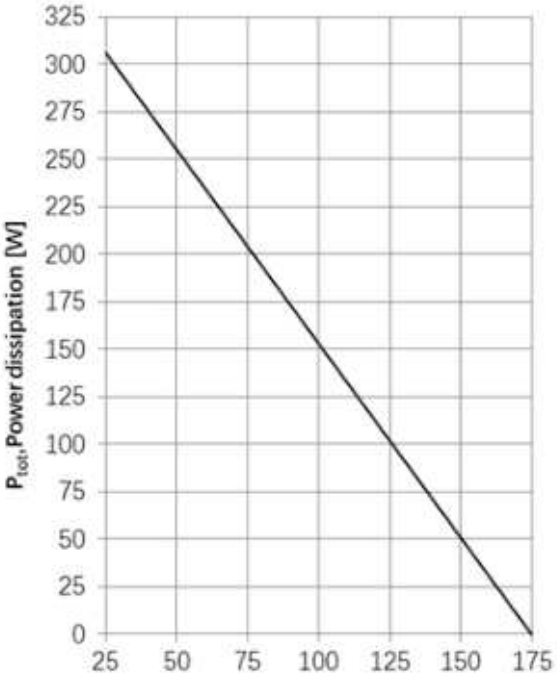


Fig1. Power dissipation as a function of case temperature (Tj≤175℃)

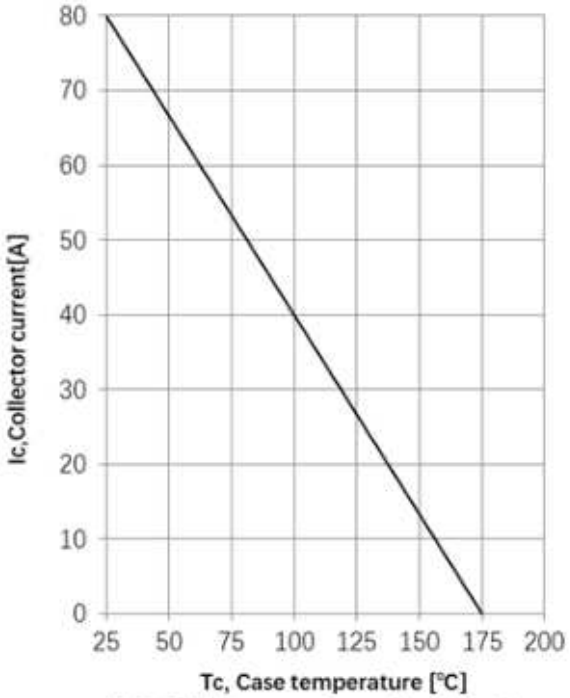


Fig2. Collector current as a function of case temperature(Vge≥15V, Tj≤175℃)

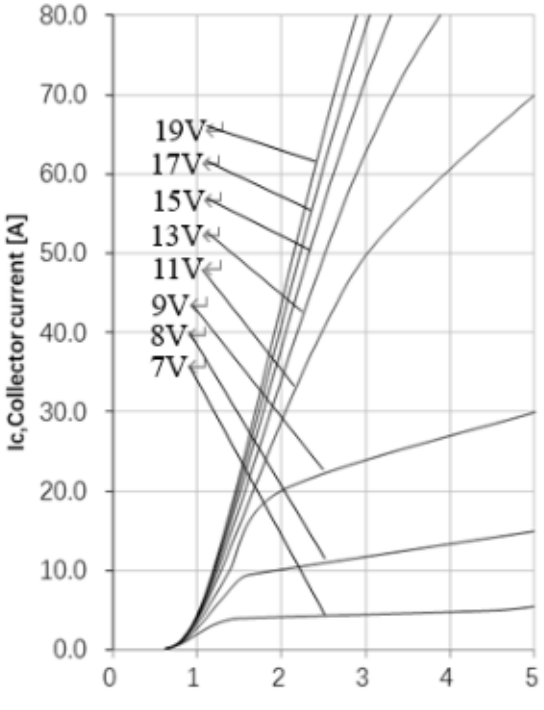


Fig3. Typical output characteristic (Tj=25℃)

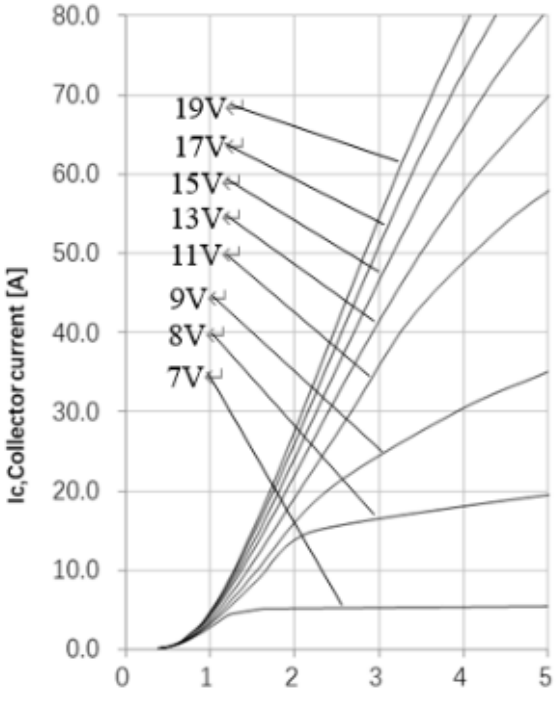


Fig4. Typical output characteristic (Tj=150℃)

Curve Characteristics

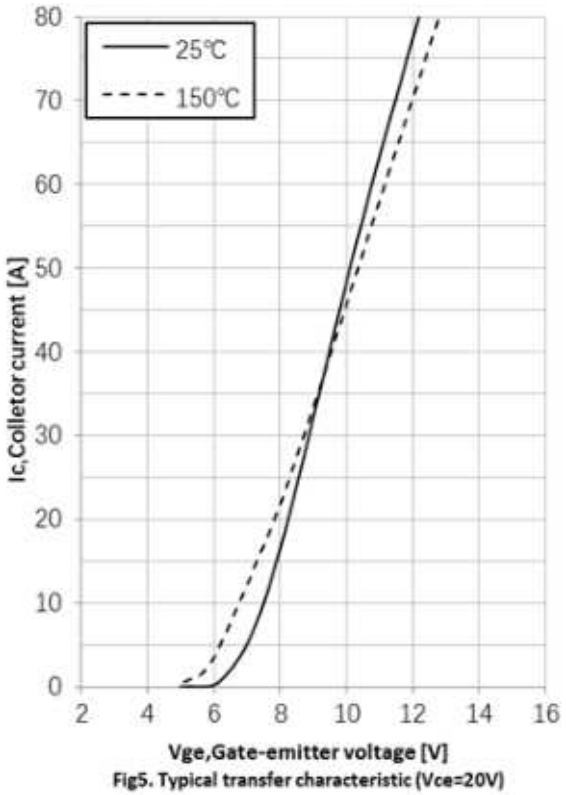


Fig5. Typical transfer characteristic (Vce=20V)

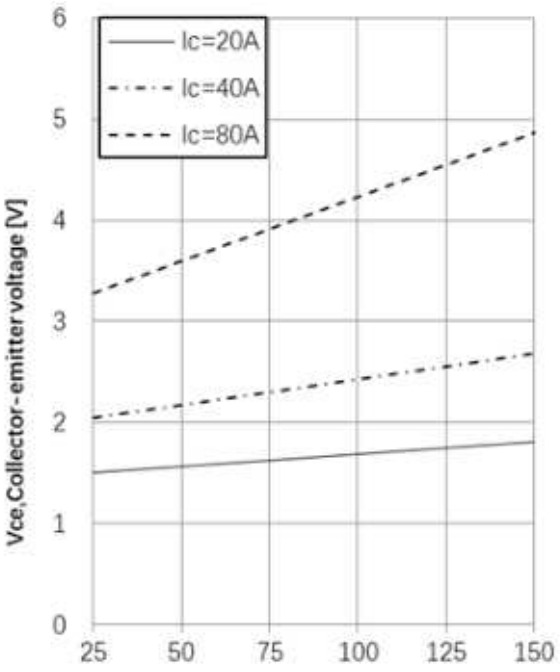


Fig6. Typical collector-emmiter saturation voltage as a function of junction temperature(Vge=15V)

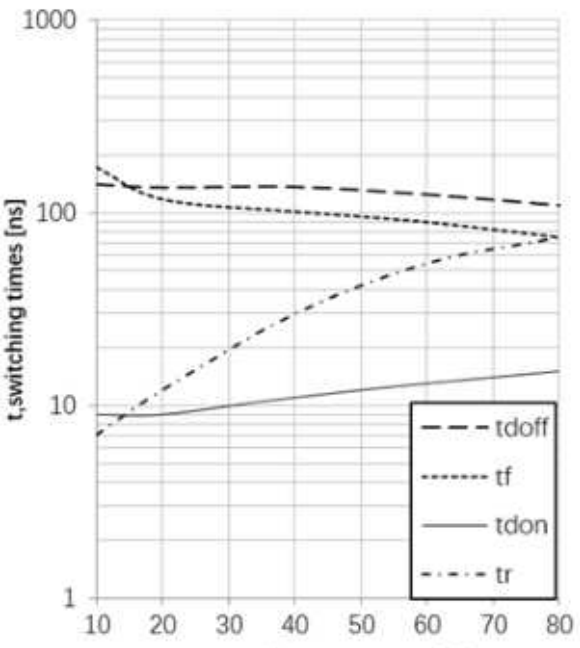


Fig7. Typical switching time as a function of collectcurrent (inductive load,Tvj=150°C,Vce=400V,Vge=0/15V,Rg=10Ω)

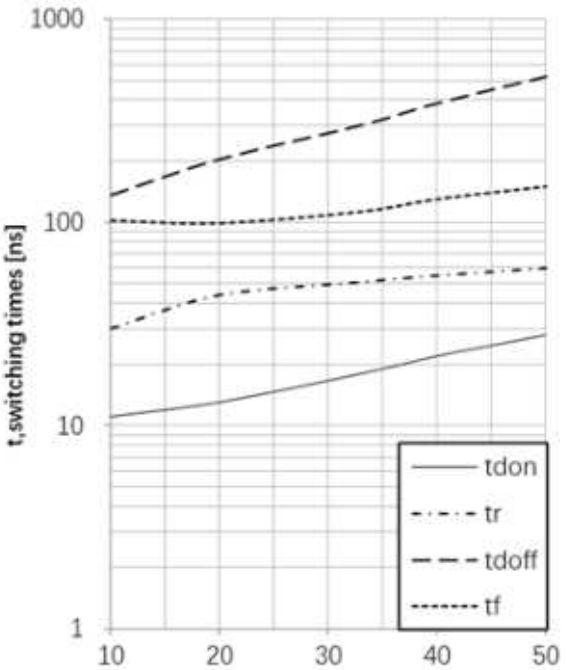


Fig8. Typical swotching times as a fuction of gate resistance (inductive load,Tvj=150°C,Vce=400V,Vge=0/15V,Ic=40A)

Curve Characteristics

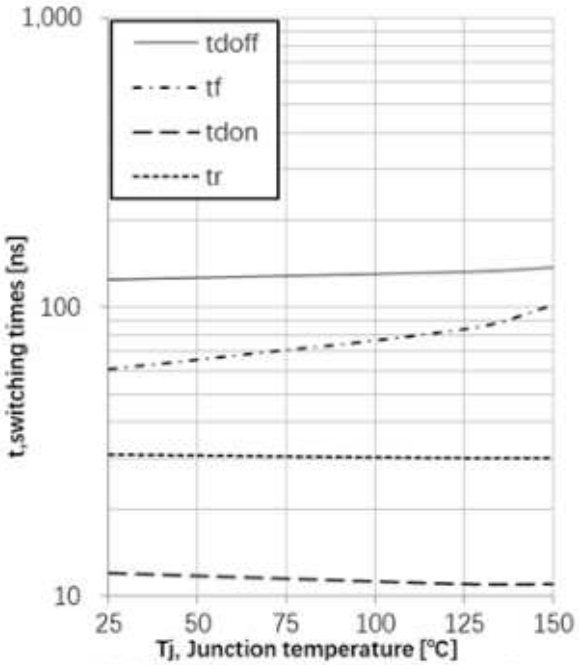


Fig9. Typical swotching times as a fuction of junction temperature (inductive load,Ic=40A,Vce=400V,Vge=0/15V,Rg=10Ω)

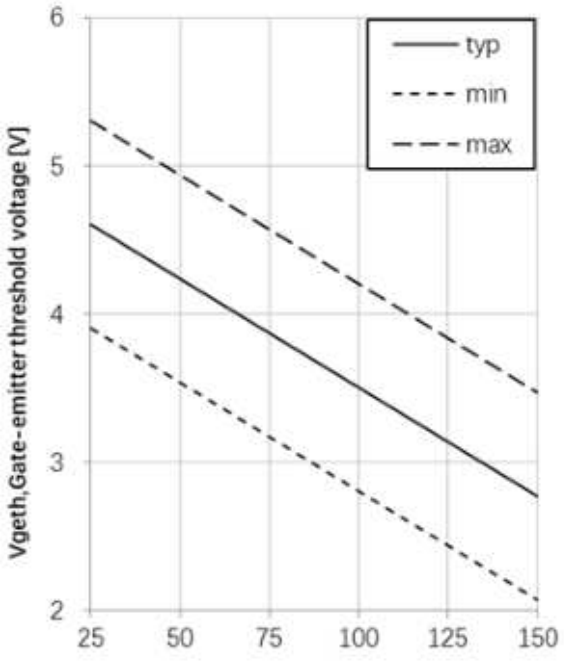


Fig10. Gate-emitter threshold voltage as a fuction of Junction temperature(Ic=0.75mA)

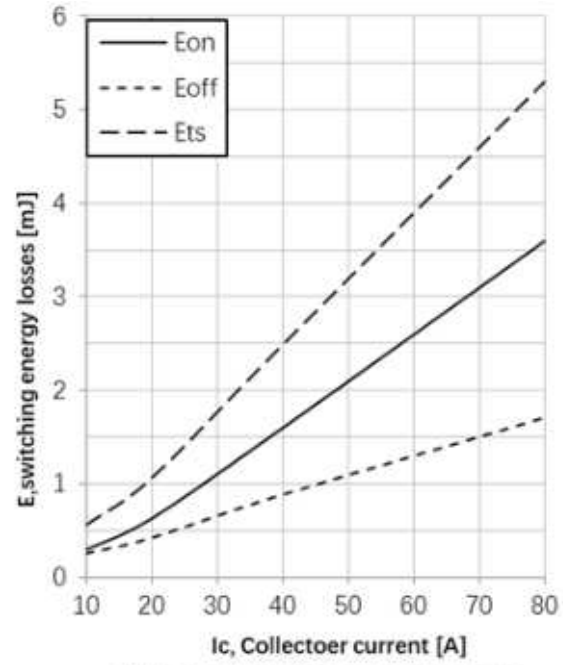


Fig11. Typical swotching energy losses as a fuction of collect current (inductive load,Tvj=150℃,Vce=400V,Vge=0/15V,Rg=10Ω)

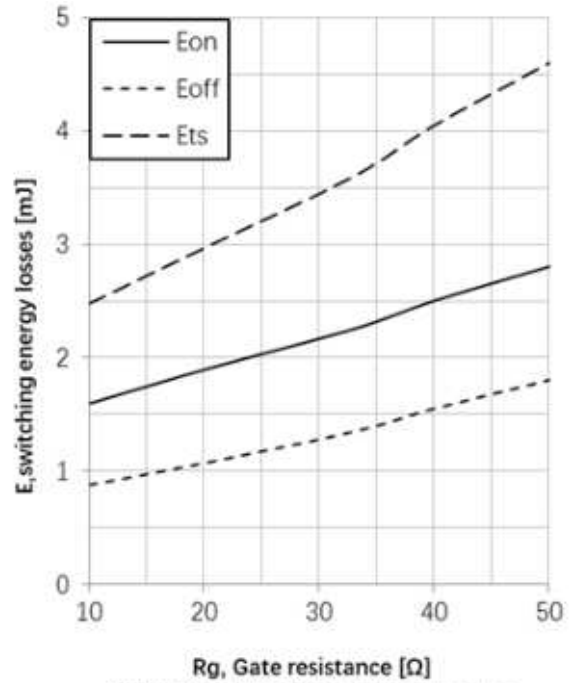


Fig12. Typical swotching energy losses as a fuction of gate resistance (inductive load,Tvj=150℃,Vce=400V,Vge=0/15V,Ic=40A)

Curve Characteristics

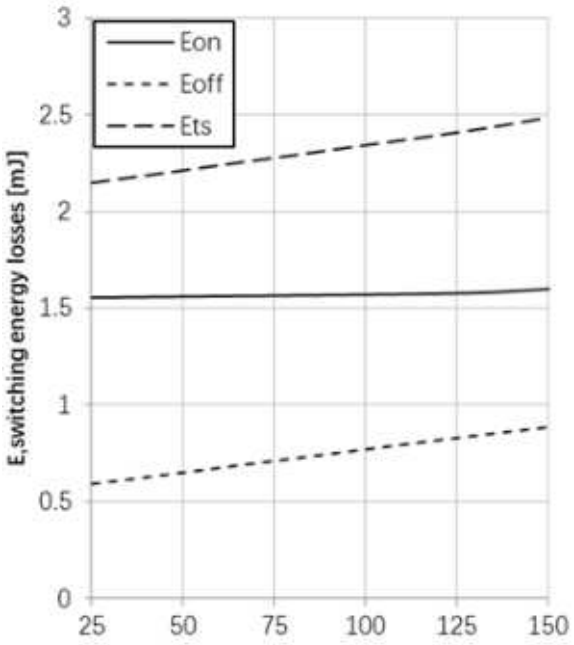


Fig13. Typical swotching energy losses as a fuction of Junction temperature (inductive load,Ic=40A,Vce=400V,Vge=0/15V,Rg=10Ω)

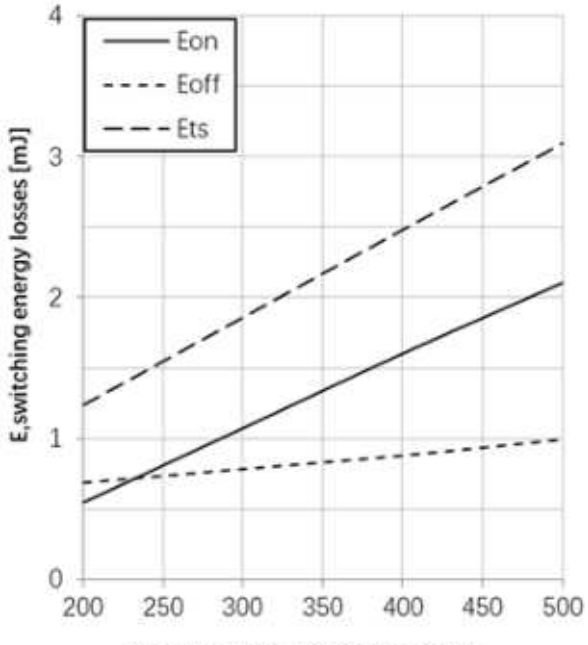


Fig14. Typical swotching energy losses as a fuction of collector-emitter voltage (inductive load,Tvj=150℃,Ic=40A,Vge=0/15V,Rg=10Ω)

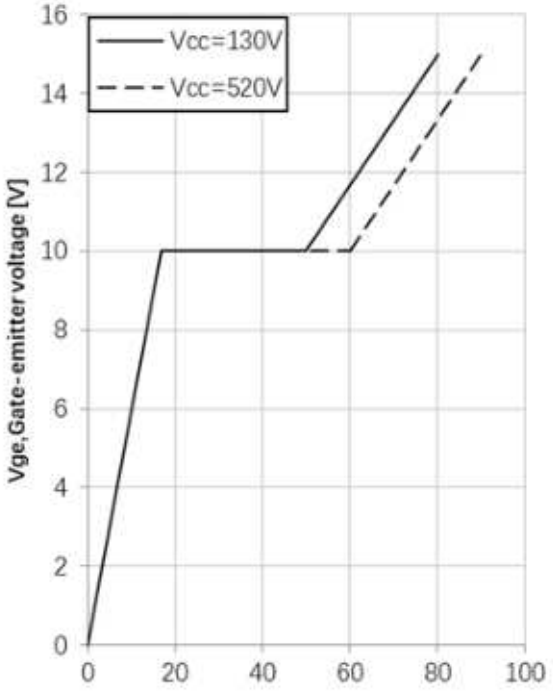


Fig15. Typical gate charge(Ic=40A)

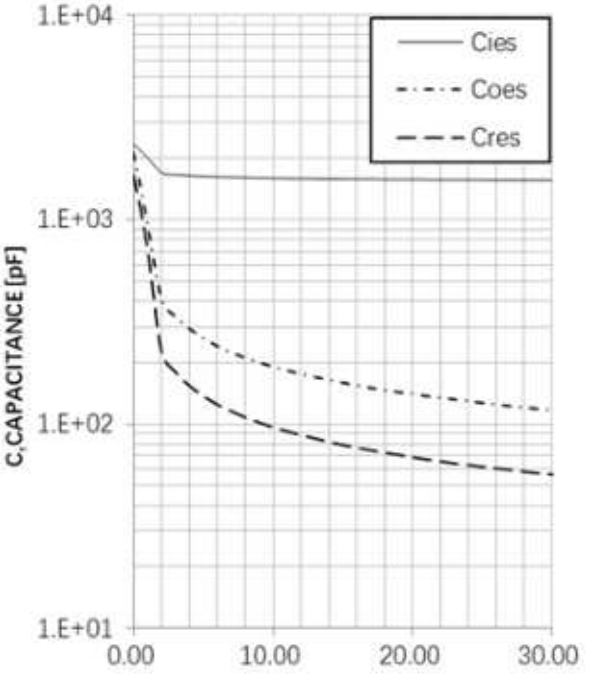


Fig16. Typical capacitance as a function of collector-emitter voltage

Curve Characteristics

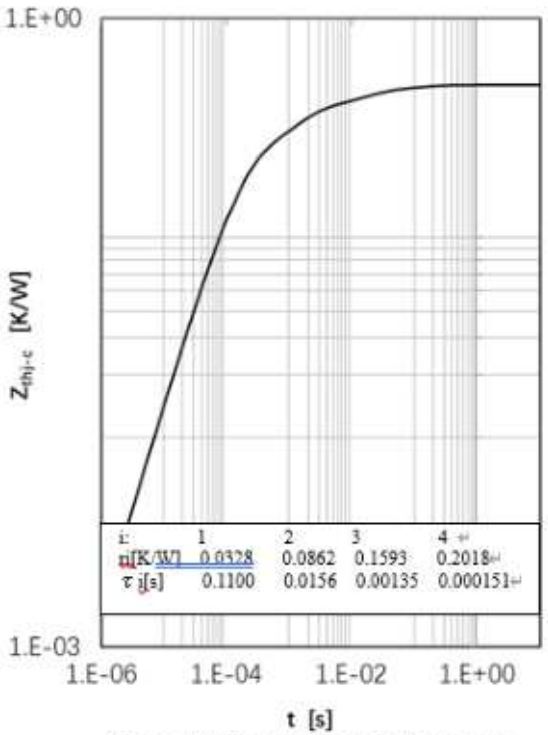


Fig 17. IGBT Transient Thermal Impedance

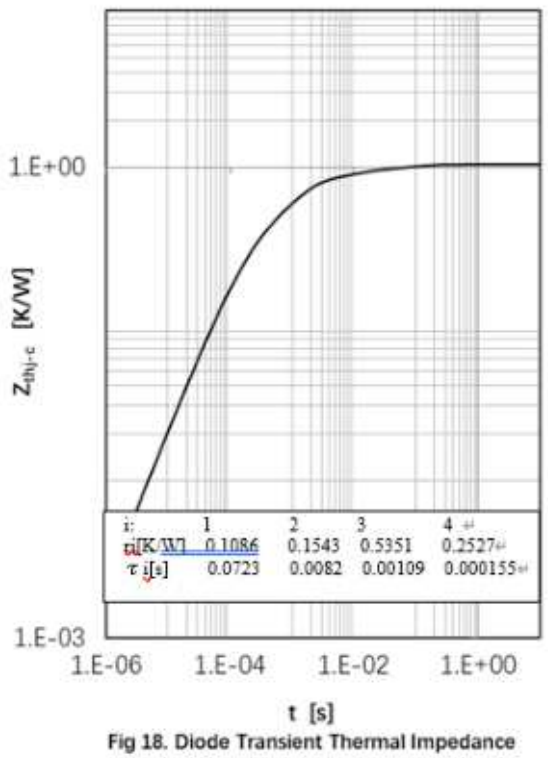


Fig 18. Diode Transient Thermal Impedance

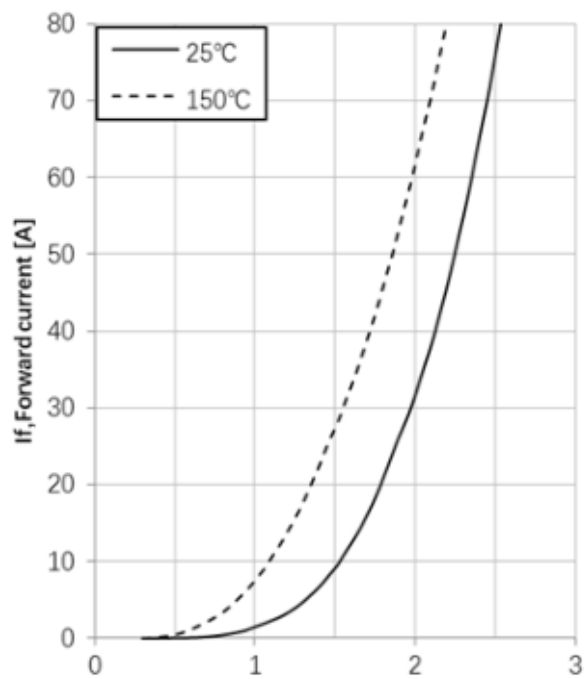


Fig19. Diode forawrd current as a function of foraward voltage

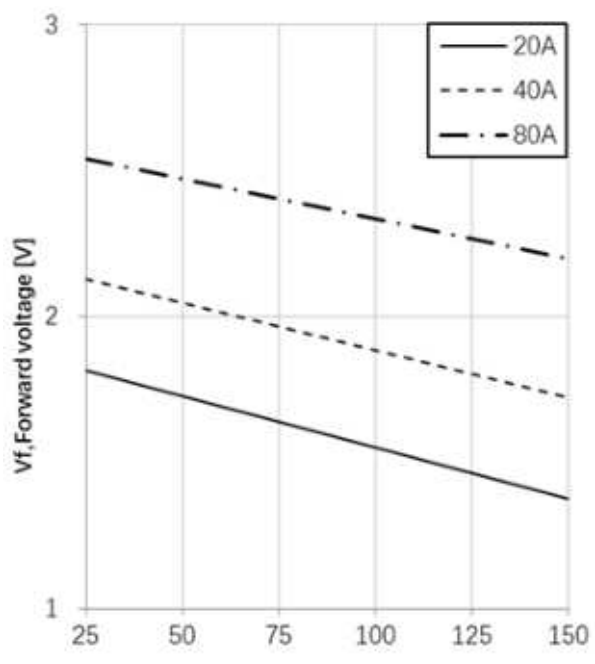


Fig20. Typical diode foraward voltageas a function of Junction temperature

Curve Characteristics

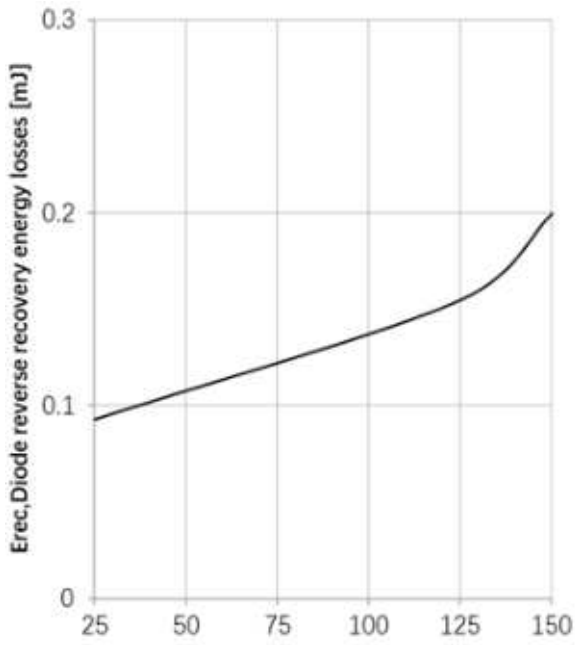


Fig21. Typical diode reverse recovery energy losses as a fuction of Junction temperature (inductive load,If=40A,Vrr=400V)

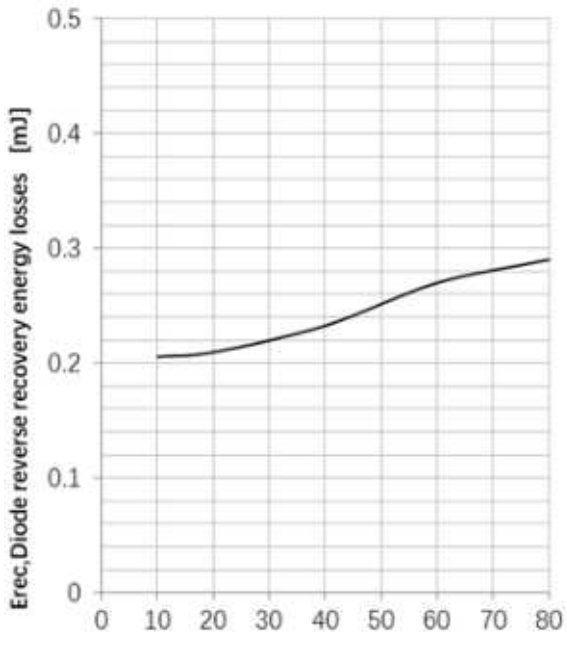


Fig22. Typical diode reverse recovery energy losses as a fuction of collect current (inductive load,Tvj=150℃,Vrr=400V)

Ordering Information

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

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