

## Features

- High Speed Smooth Switching Device for Hard and Soft Switching
- $V_{ce(sat)}$  with Positive Temperature Coefficient
- High Ruggedness, Good Thermal Stability
- Very Tight Parameter Distribution
- 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)

## Maximum Ratings

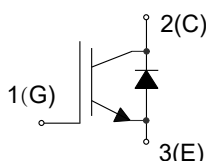
- Operating Junction Temperature Range :  $-40^{\circ}\text{C}$  to  $+175^{\circ}\text{C}$
- Storage Temperature Range:  $-55^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$
- IGBT Thermal Resistance:  $0.46^{\circ}\text{C/W}$  Junction to Case
- Diode Thermal Resistance:  $0.51^{\circ}\text{C/W}$  Junction to Case
- Thermal Resistance:  $40^{\circ}\text{C/W}$  Junction to Ambient

Parameter	Symbol	Rating	Unit
Collector-Emitter Voltage	$V_{CE}$	650	V
DC Collector Current <sup>(2)</sup>	$I_C$	$T_C=25^{\circ}\text{C}$	85
		$T_C=100^{\circ}\text{C}$	60
Pulsed Collector Current <sup>(3)</sup>	$I_{C,pluse}$	200	A
Diode Forward Current <sup>(2)</sup>	$I_F$	$T_C=25^{\circ}\text{C}$	85
		$T_C=100^{\circ}\text{C}$	60
Diode Pulsed Current <sup>(3)</sup>	$I_{F,pluse}$	200	A
Gate-Emitter Voltage	$V_{GE}$	$\pm 20$	V
Transient Gate-Emitter Voltage <sup>(4)</sup>		$\pm 30$	
Power Dissipation	$P_D$	$T_C=25^{\circ}\text{C}$	326
		$T_C=100^{\circ}\text{C}$	163

Note:

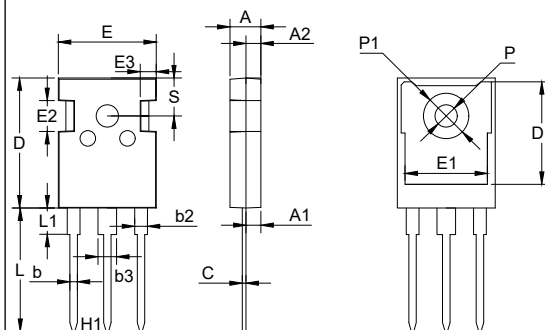
1. Halogen free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
2. Limited by  $T_{Jmax}$ .
3.  $T_p$  limited by  $T_{Jmax}$ .
4.  $T_p \leq 10\mu\text{s}$ , Duty Cycle < 1%
5. Allowed number of short circuits: < 1000; time between short circuits: > 1s.

## Internal Structure



# Trench and Field Stop IGBT 650V 50A

## 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	

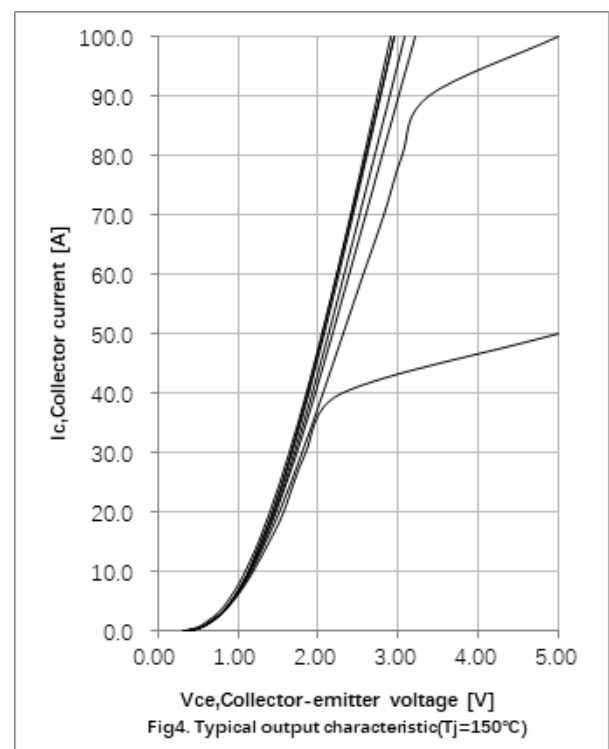
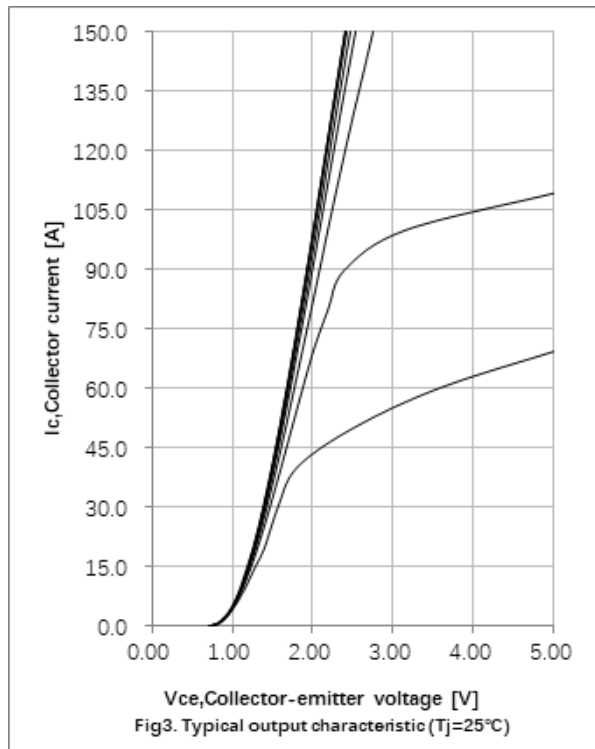
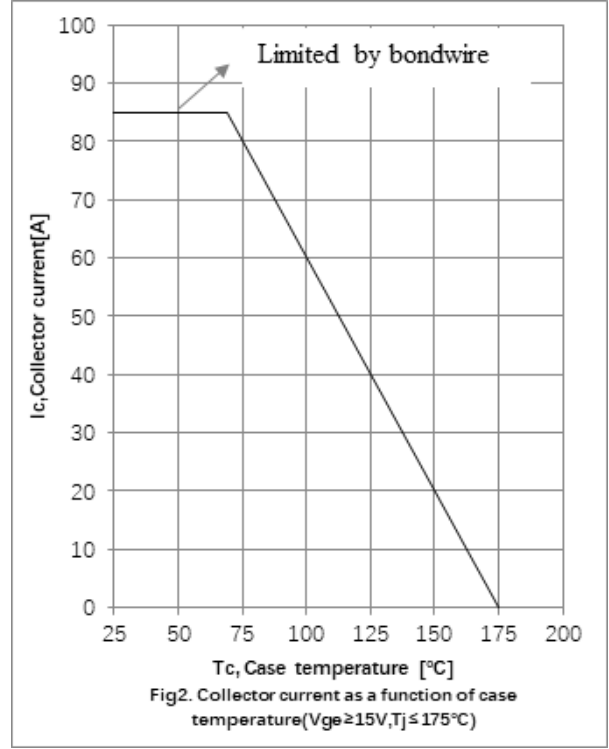
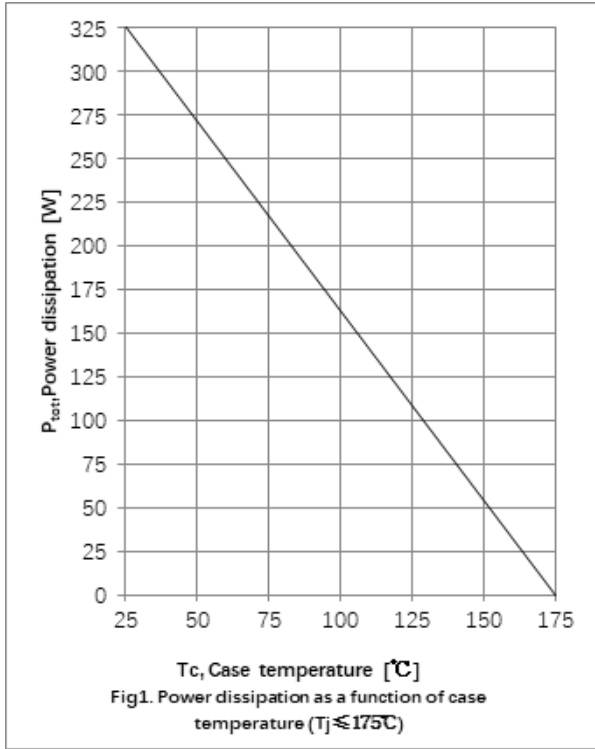
**Electrical Characteristics @ 25°C (Unless Otherwise Specified)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=250\mu A$	650			V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=50A, T_J=25^\circ C$		1.60	1.95	V
		$V_{GE}=15V, I_C=50A, T_J=125^\circ C$		1.95		
		$V_{GE}=15V, I_C=50A, T_J=150^\circ C$		2.05		
G-E Threshold Voltage	$V_{GE(th)}$	$I_C=0.75mA, V_{CE}=V_{GE}$	4.25	5.05	5.85	V
C-E Leakage Current	$I_{CES}$	$V_{CE}=650V, V_{GE}=0V$			0.25	mA
G-E Leakage Current	$I_{GES}$	$V_{CE}=0V, V_{GE}=\pm 20V$			200	nA
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		5.92		nF
Reverse Transfer Capacitance	$C_{res}$			0.23		
Gate Charge	$Q_g$	$V_{CC}=300V, I_C=50A, V_{GE}=15V$		0.45		uC
<b>IGBT Switching Characteristics</b>						
Turn-On Delay Time	$td_{(on)}$	$V_{CC}=300V, I_C=50A, V_{GE}=0/15V, R_G=10\Omega, L_S=60nH, T_J=25^\circ C$		55		ns
Rise Time	$t_r$			56		
Turn-Off Delay Time	$td_{(off)}$			319		
Fall Time	$t_f$			24		
Turn-On Energy	$E_{on}$			1.27		mJ
Turn-Off Energy	$E_{off}$			0.65		
Turn-On Delay Time	$td_{(on)}$	$V_{CC}=300V, I_C=50A, V_{GE}=0/15V, R_G=10\Omega, L_S=60nH, T_J=125^\circ C$		53		ns
Rise Time	$t_r$			61		
Turn-Off Delay Time	$td_{(off)}$			351		
Fall Time	$t_f$			59		
Turn-On Energy	$E_{on}$			1.51		mJ
Turn-Off Energy	$E_{off}$			0.8		
Turn-On Delay Time	$td_{(on)}$	$V_{CC}=300V, I_C=50A, V_{GE}=0/15V, R_G=10\Omega, L_S=60nH, T_J=150^\circ C$		52		ns
Rise Time	$t_r$			60		
Turn-Off Delay Time	$td_{(off)}$			361		
Fall Time	$t_f$			71		
Turn-On Energy	$E_{on}$			1.62		mJ
Turn-Off Energy	$E_{off}$			0.85		

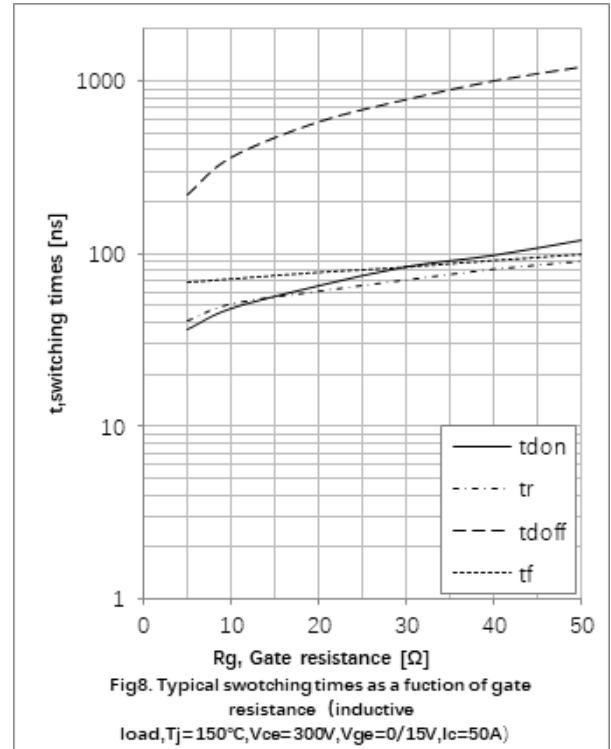
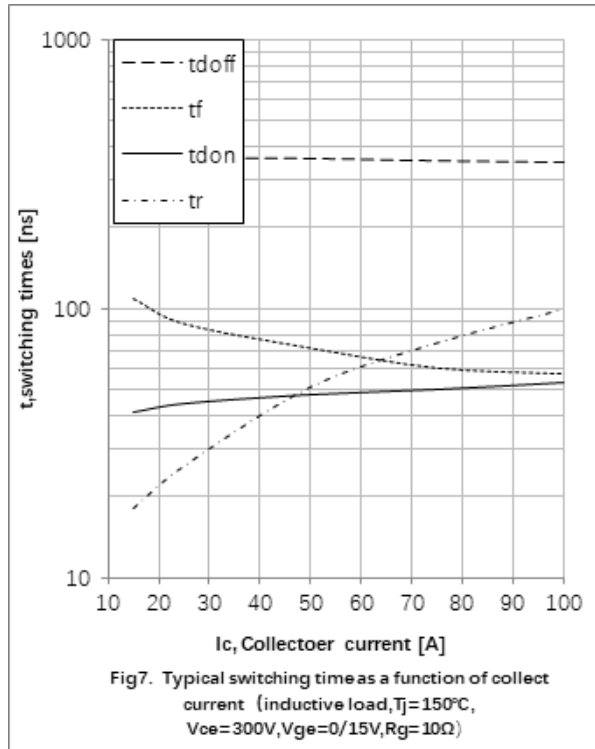
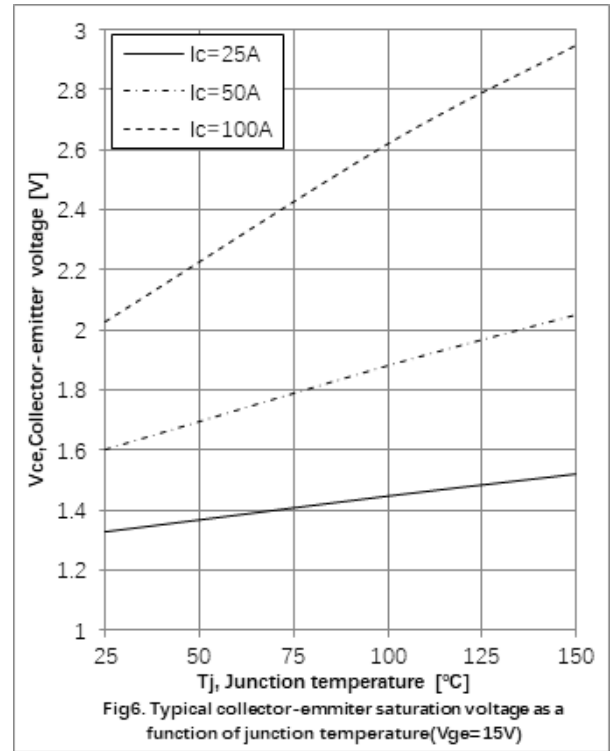
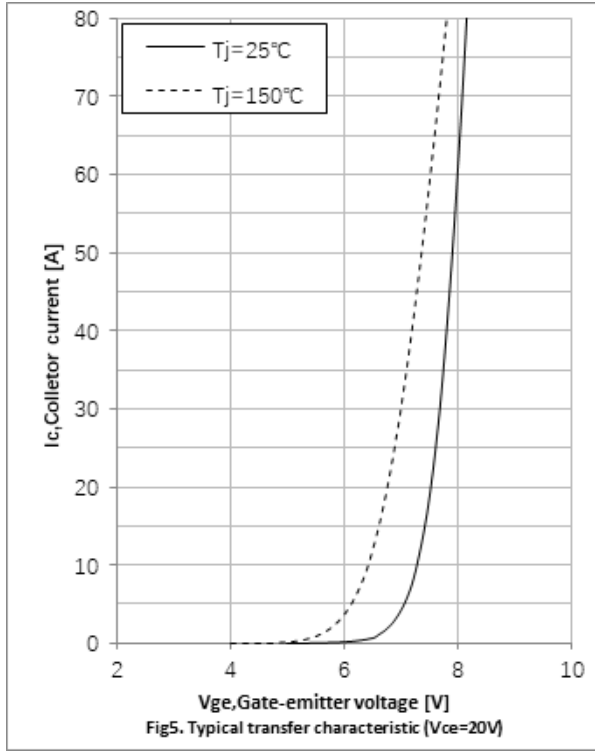
**Electrical Characteristics @ 25°C (Unless Otherwise Specified)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Diode Characteristics</b>						
Diode Forward Voltage	$V_F$	$V_{GE}=0V, I_F=50A, T_J=25^\circ C$		1.45	1.80	V
		$V_{GE}=0V, I_F=50A, T_J=125^\circ C$		1.29		
		$V_{GE}=0V, I_F=50A, T_J=150^\circ C$		1.23		
Reverse Recovery Current	$I_{rr}$	$V_R=300V, I_F=50A,$ $di_F/dt=-610A/\mu s, T_J=25^\circ C$		13		A
Reverse Recovery Charge	$Q_{rr}$			0.78		$\mu C$
Reverse Recovery Energy	$E_{rec}$			0.1		mJ
Reverse Recovery Current	$I_{rr}$	$V_R=300V, I_F=50A,$ $di_F/dt=-610A/\mu s, T_J=125^\circ C$		35		A
Reverse Recovery Charge	$Q_{rr}$			2.8		$\mu C$
Reverse Recovery Energy	$E_{rec}$			0.38		mJ
Reverse Recovery Current	$I_{rr}$	$V_R=300V, I_F=50A,$ $di_F/dt=-610A/\mu s, T_J=150^\circ C$		40		A
Reverse Recovery Charge	$Q_{rr}$			3.22		$\mu C$
Reverse Recovery Energy	$E_{rec}$			0.43		mJ

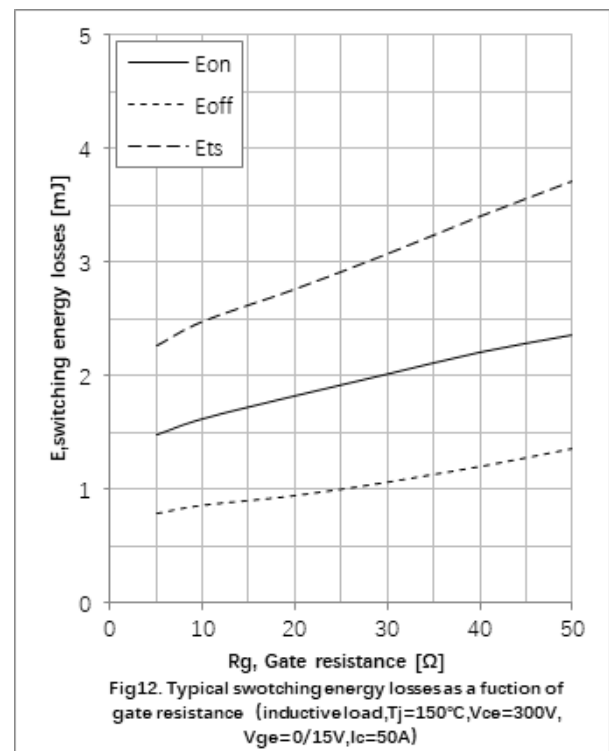
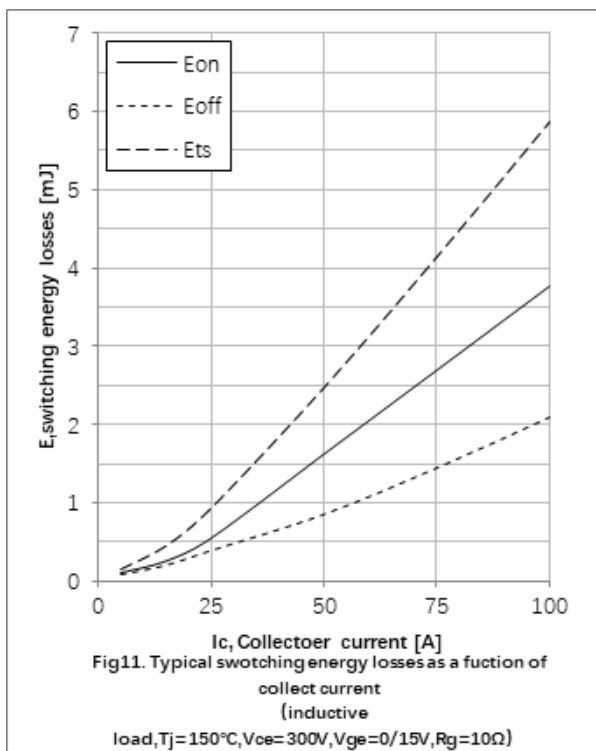
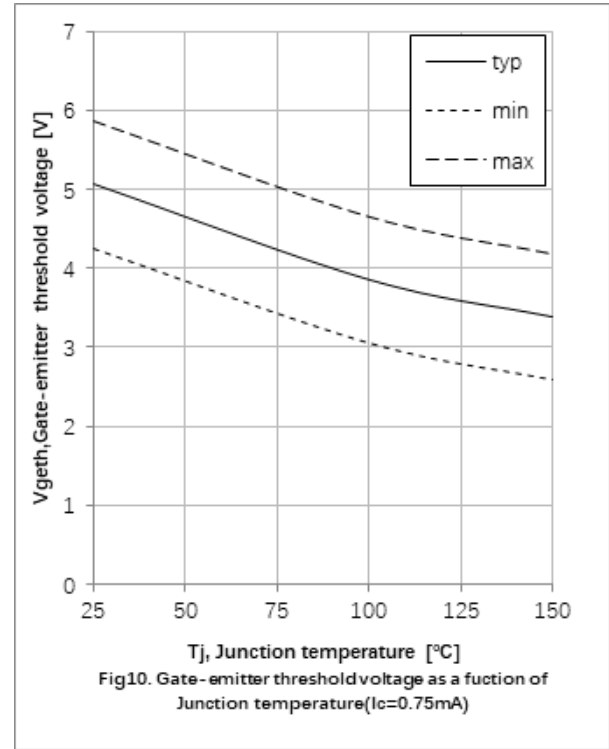
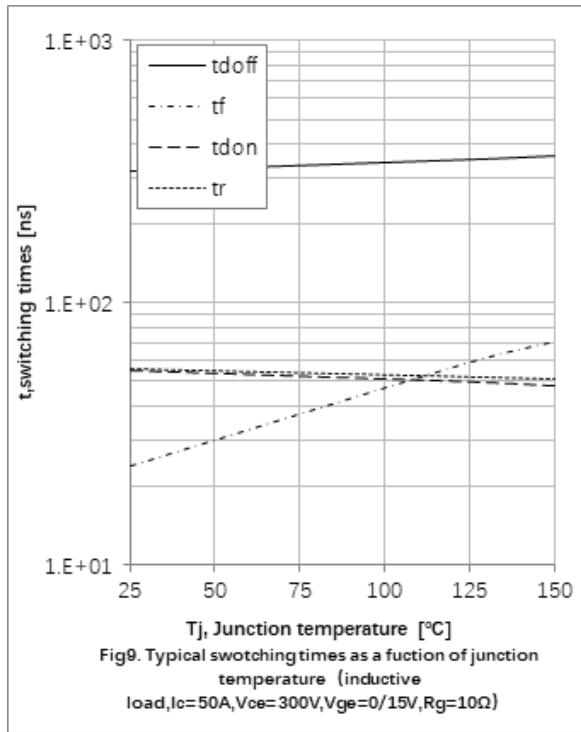
Curve Characteristics



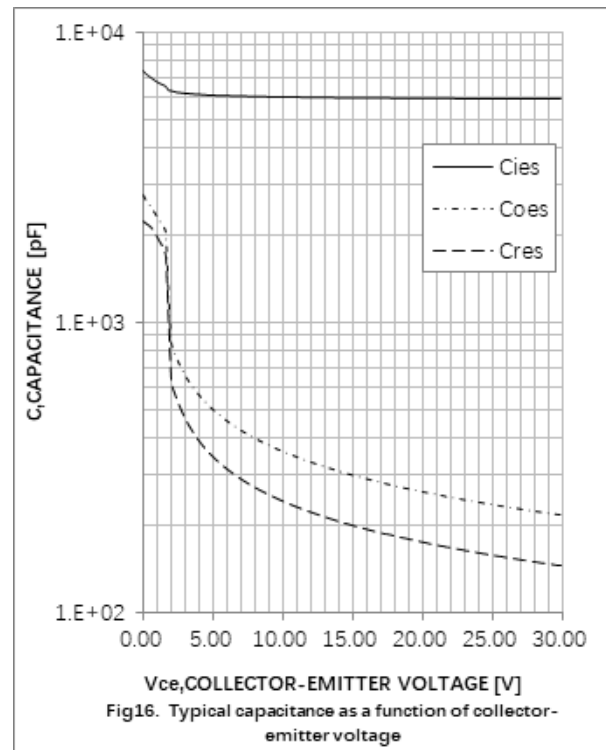
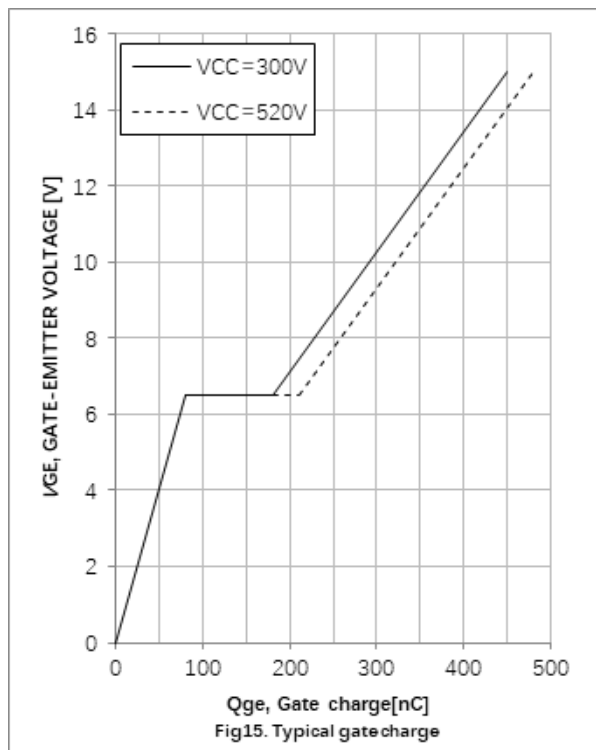
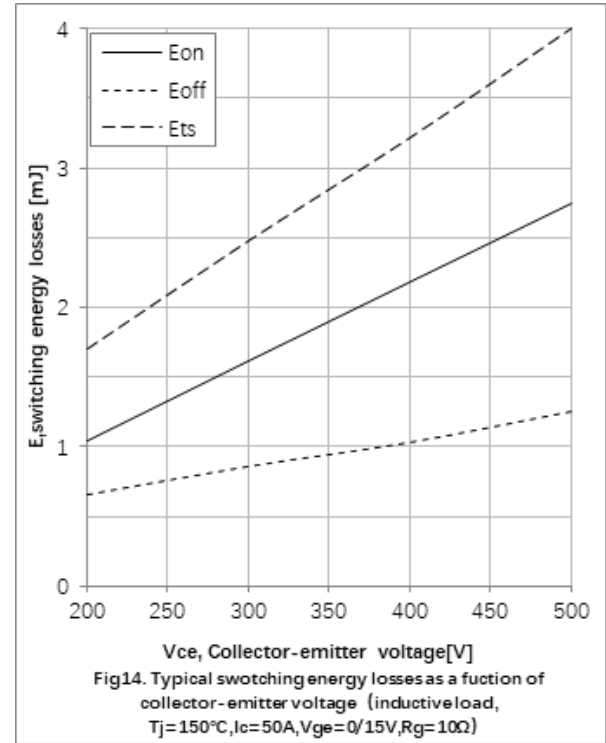
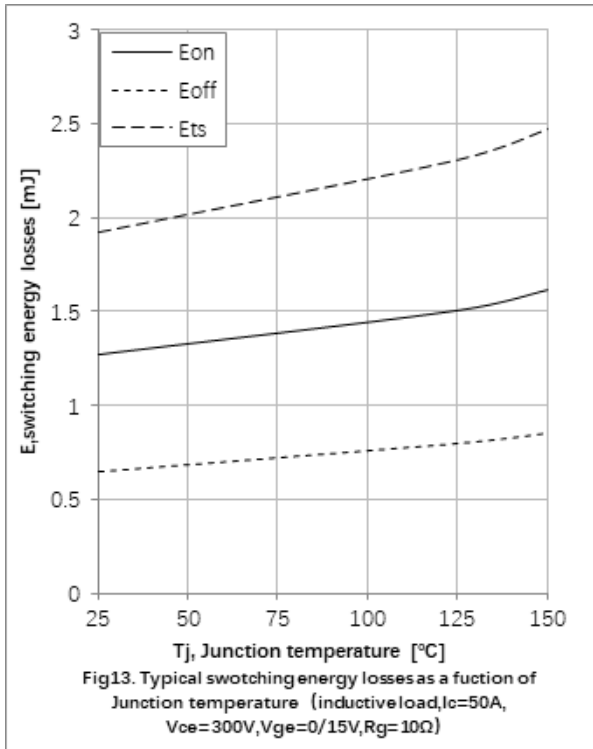
Curve Characteristics



Curve Characteristics



Curve Characteristics



Curve Characteristics

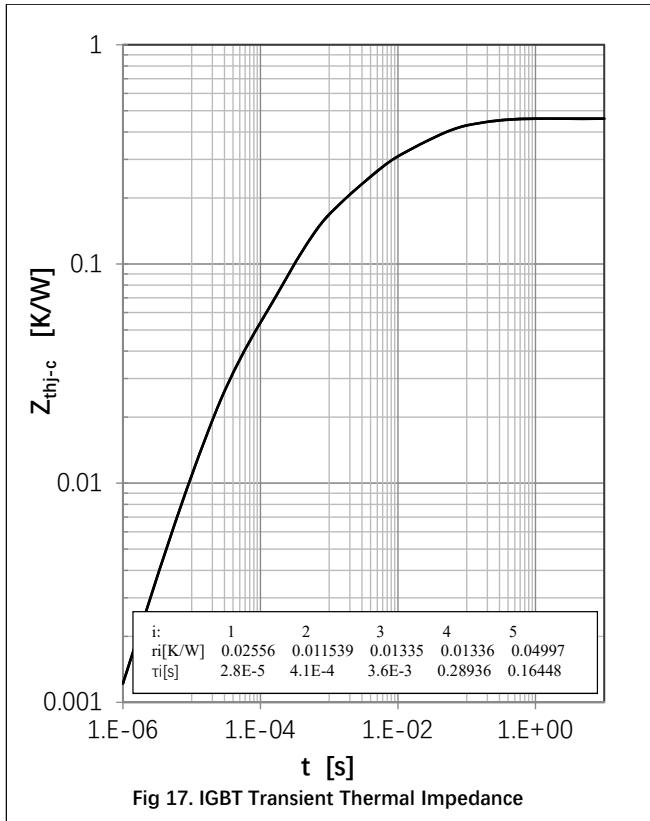


Fig 17. IGBT Transient Thermal Impedance

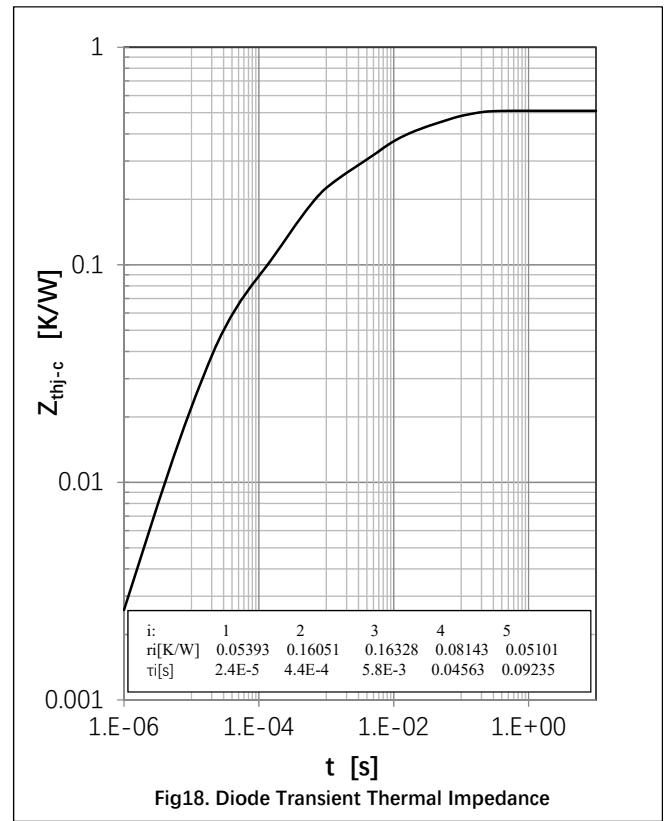


Fig 18. Diode Transient Thermal Impedance

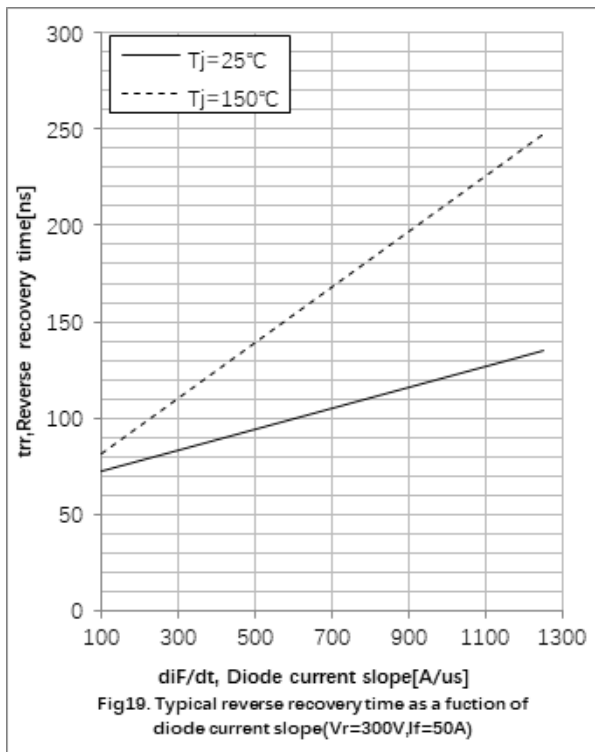


Fig 19. Typical reverse recovery time as a function of diode current slope (Vr=300V, If=50A)

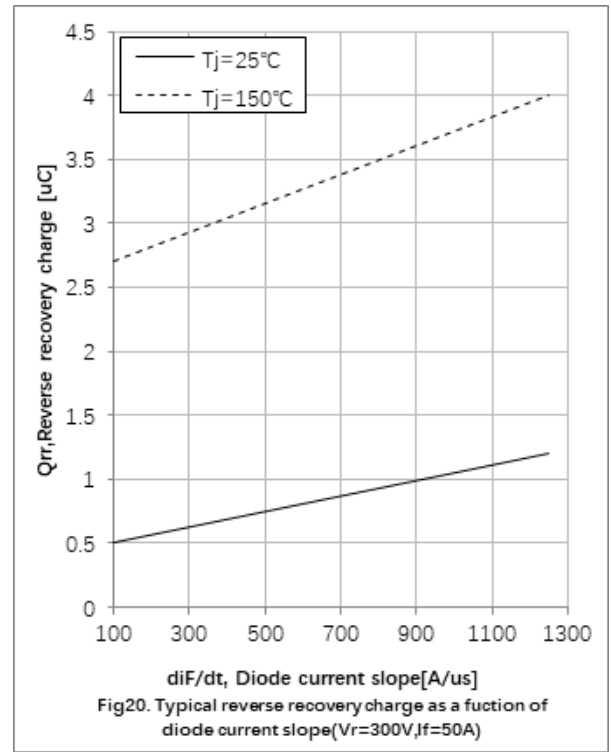
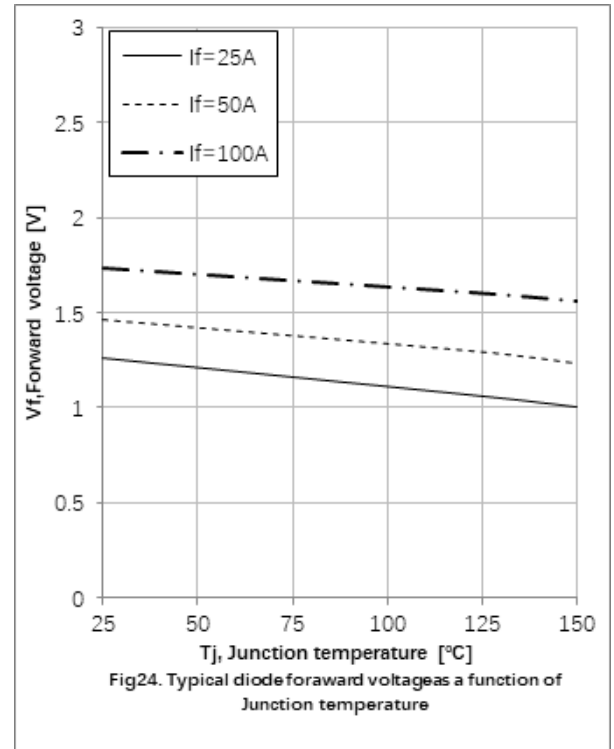
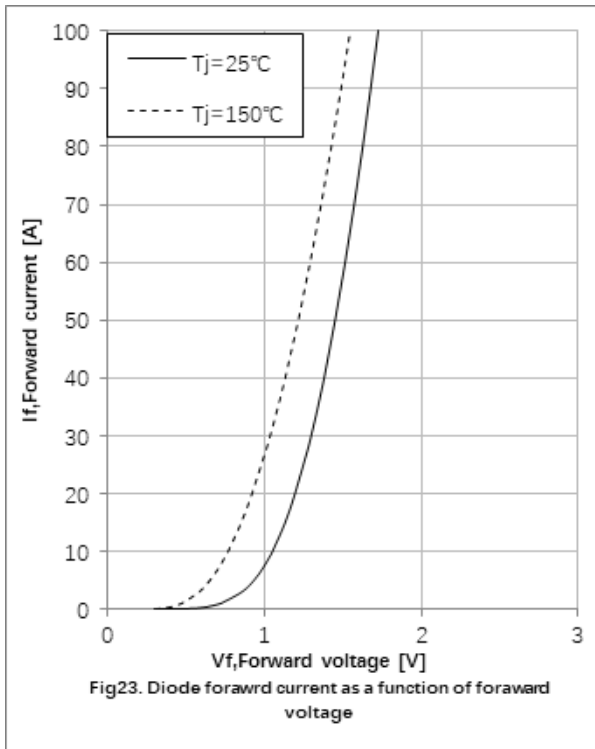
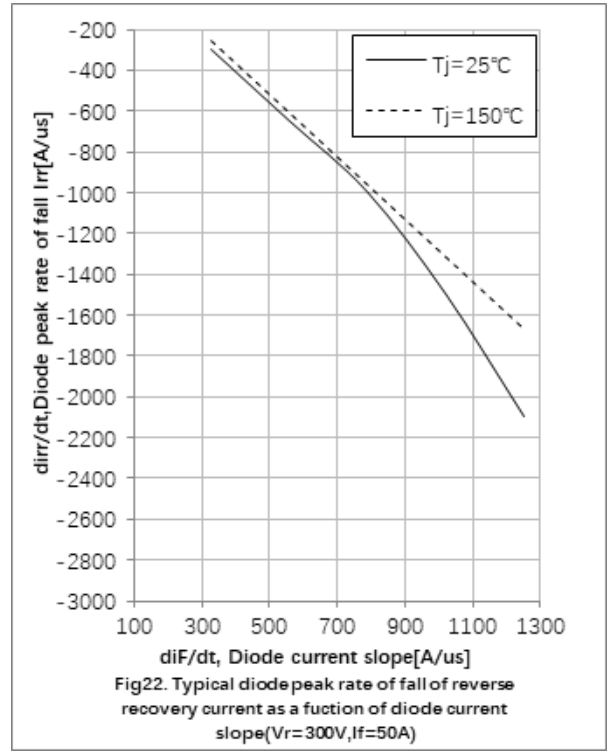
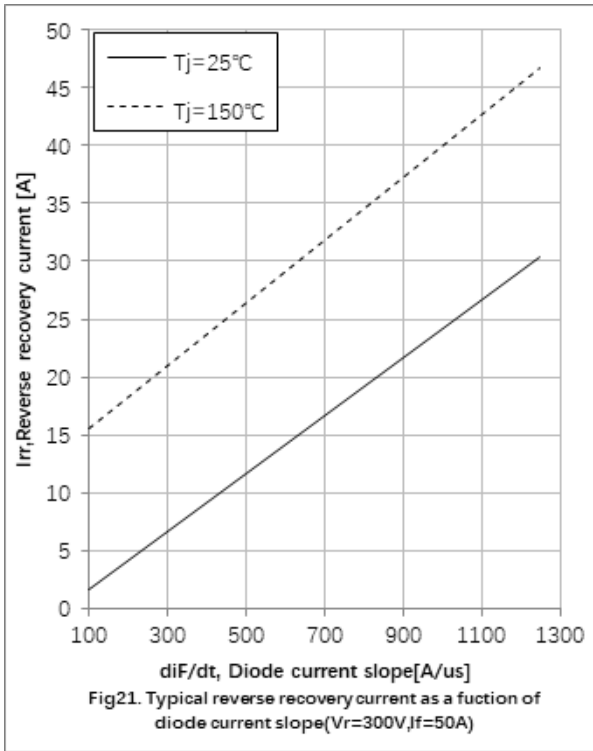


Fig 20. Typical reverse recovery charge as a function of diode current slope (Vr=300V, If=50A)



Curve Characteristics



## Ordering Information

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

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