

Product Summary

$V_{(BR)CES}$	$V_{CE(SAT)TYP}$	$I_C(100^{\circ}C)$
650V	1.6V@15V	20A

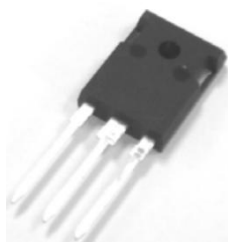
Feature

- High ruggedness performance
- 10 μ s short circuit capability
- Positive $V_{CE(sat)}$ temperature coefficient
- High efficiency for motor control
- Excellent current sharing in parallel operation

Application

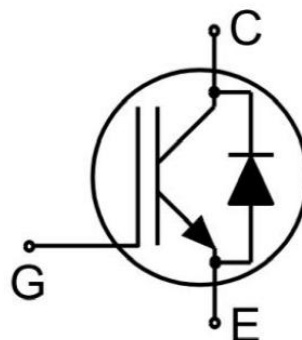
- Home appliances
- Motor drives
- General inverter

Package

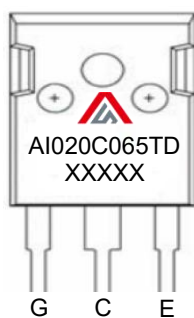


TO-247AB

Circuit diagram



Marking



Absolute maximum ratings ($T_c=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	650	V
Continuous Gate- Emitter Voltage	V_{GE}	± 20	V
Collector Current	I_C	40	A
Collector Current ($T_c=100^{\circ}\text{C}$)	$I_C(100^{\circ}\text{C})$	20	A
Pulsed Collector Current, tp limited by T_{jmax}	I_{CM}	80	A
Diode Continuous Forward Current ($T_c=100^{\circ}\text{C}$)	$I_F(100^{\circ}\text{C})$	20	A
Diode Maximum Current, tp limited by T_{jmax}	I_{FM}	80	A
Short circuit withstand time	t_{sc}	10	μs
Power Dissipation	P_D	187	W
Thermal Resistance, Junction to case for Diode	$R_{\theta JC}$	1.6	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction to case for IGBT	$R_{\theta JC}$	0.8	$^{\circ}\text{C}/\text{W}$
Operating junction temperature range	T_J	$-40 \sim +175$	$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}	$-55 \sim +150$	$^{\circ}\text{C}$

Electrical characteristics of the IGBT ($T_J=25^{\circ}\text{C}$ unless otherwise noted)

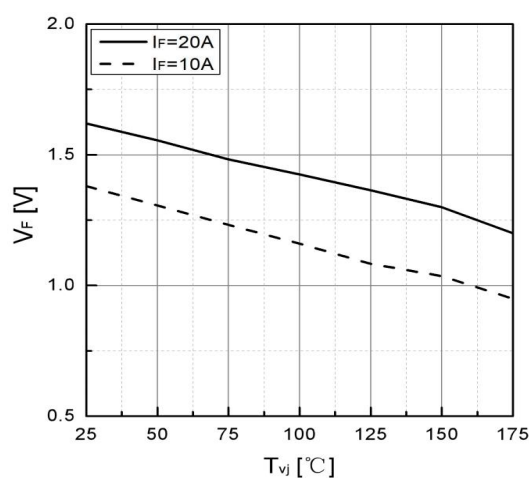
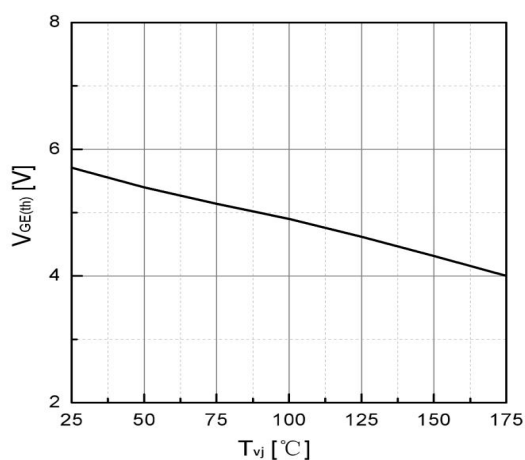
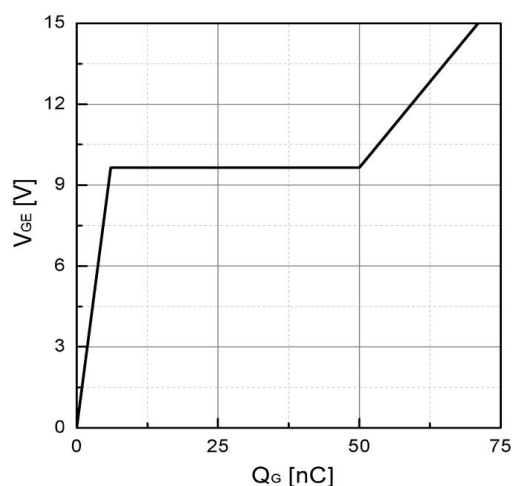
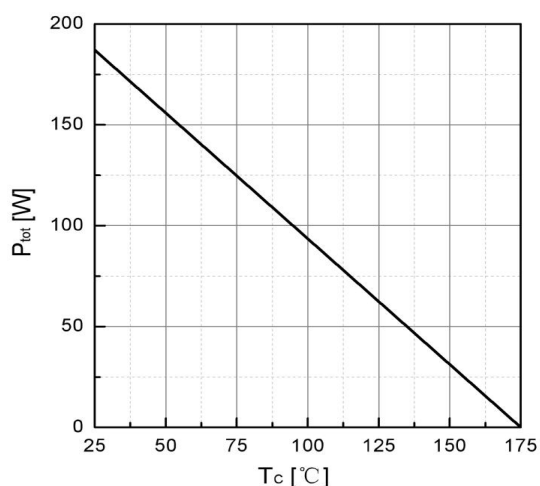
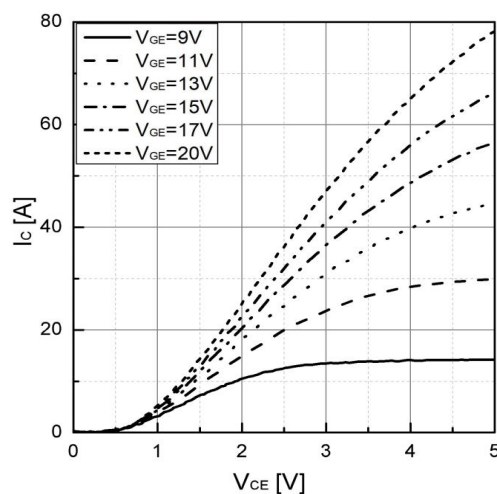
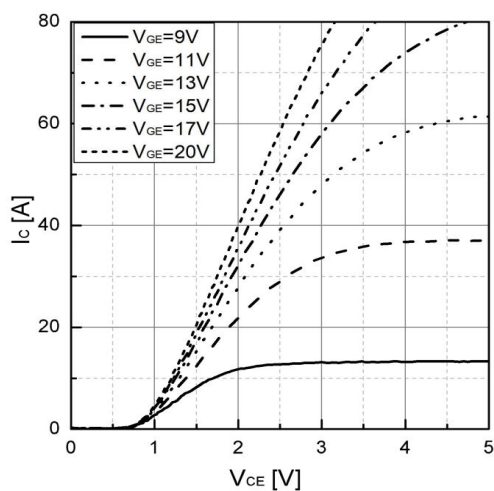
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
Collector-Emitter Breakdown Voltage	V _{(BR)CES}	V _{GE} =0V, I _C =250μA	650			V
Collector-Emitter Leakage Current	I _{CES}	V _{GE} =0V, V _{CE} =650V			50	μA
Gate to Emitter Leakage Current	I _{GES}	V _{GE} =±20V, V _{CE} =0V			±100	nA
Gate Threshold Voltage	V _{GE(th)}	V _{GE} =V _{CE} , I _C =1mA	5.2	5.7	6.2	V
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} =15V, I _C =20A		1.6		V
		V _{GE} =15V, I _C =20A, T _J =175°C		2		
Dynamic characteristics						
Input Capacitance	C _{ies}	V _{CE} =30V, V _{GE} =0V, f =1MHz		1700		pF
Output capacitance	C _{oes}			72		
Reverse Transfer Capacitance	C _{res}			13		
Total Gate Charge	Q _g	V _{CC} =520V, V _{GE} =15V, I _C =20A		71		nC
Turn-on delay time	t _{d(on)}	V _{CC} =400V, V _{GE} =0V/15V I _C =20A, R _G =10Ω Inductive load		21		nS
Turn-on rise time	t _r			23		
Turn-off delay time	t _{d(off)}			120		
Turn-off fall time	t _f			63		
Turn-On Switching Loss	E _{on}			0.37		mJ
Turn-Off Switching Loss	E _{off}			0.46		
Total Switching Energy	E _{ts}			0.83		

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Dynamic characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 400V, V_{GE} = 0V/15V$ $I_C = 20A, R_G = 10\Omega$ Inductive load $T_J = 175^\circ C$		21		nS
Turn-on rise time	t_r			23		
Turn-off delay time	$t_{d(off)}$			141		
Turn-off fall time	t_f			108		
Turn-On Switching Loss	E_{on}			0.59		mJ
Turn-Off Switching Loss	E_{off}			0.67		
Total Switching Energy	E_{ts}			1.26		

Electrical characteristics of the Diode ($T_J = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	$I_F = 20A$		1.6		V
		$I_F = 20A, T_J = 175^\circ C$		1.2		
Reverse Recovery Current	I_{rrm}	$V_R = 400V, I_F = 20A$ $di/dt = -500A/\mu s$		12		A
Reverse Recovery Charge	Q_{rr}			472		nC
Reverse Recovery Time	T_{rr}			62		nS
Reverse Recovery Current	I_{rrm}	$V_R = 400V, I_F = 20A$ $di/dt = -500A/\mu s$ $T_J = 175^\circ C$		19		A
Reverse Recovery Charge	Q_{rr}			1130		nC
Reverse Recovery Time	T_{rr}			90		nS

Typical Characteristics



Typical Characteristics

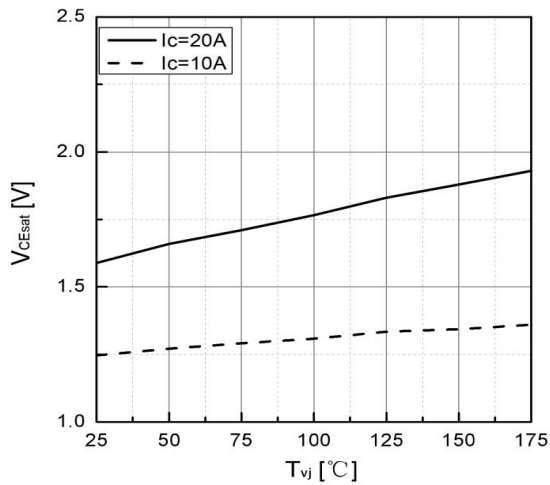


Fig 7. Typical V_{CEsat} as a function of T_{vj}

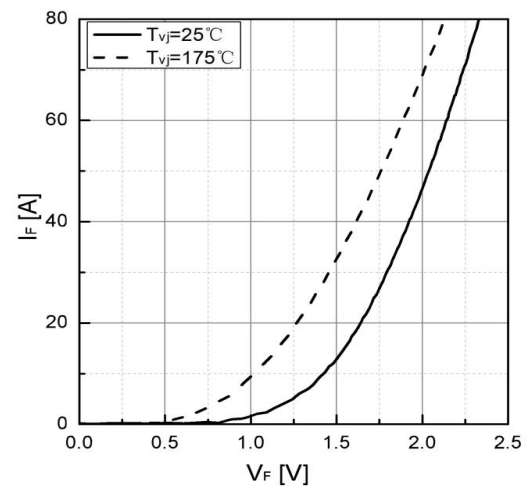


Fig 8. Typical I_F as a function of V_F

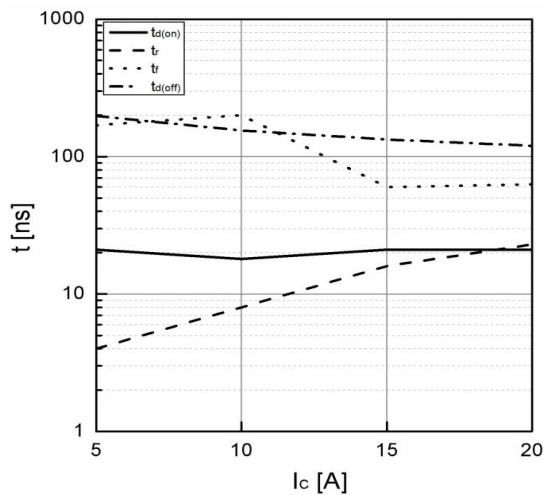


Fig 9. Typical switching time as a function of I_c

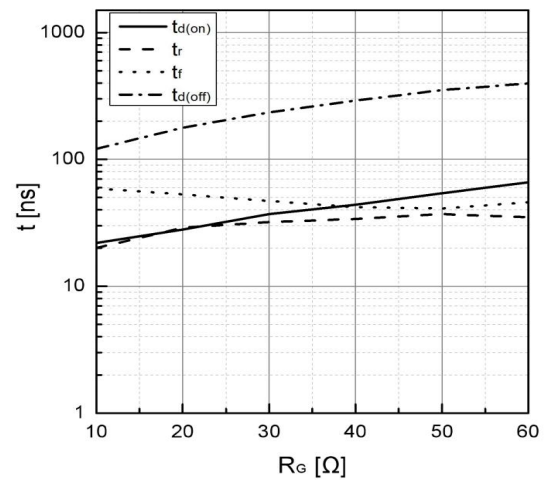


Fig 10. Typical switching times as a function of R_G

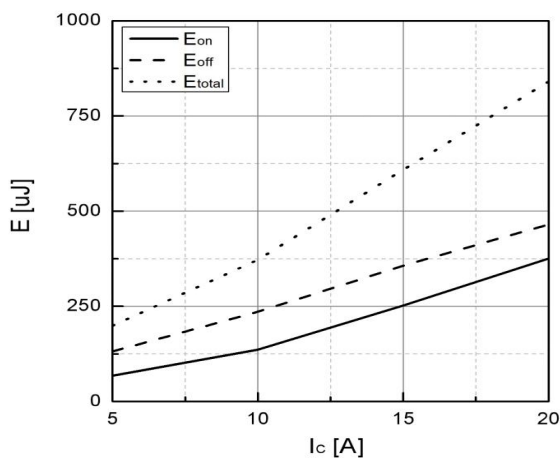


Fig 11. Typical switching energy losses as a function of I_c

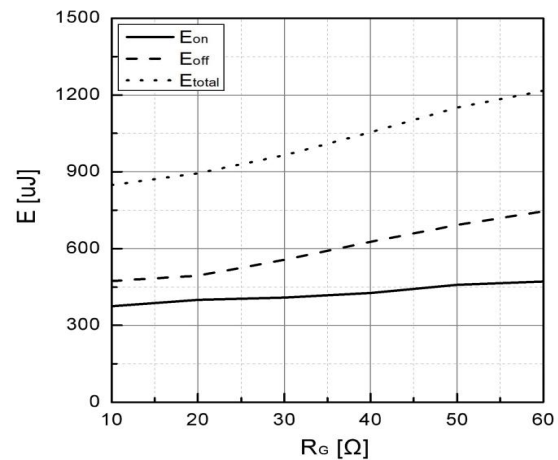


Fig 12. Typical switching energy losses as a function of R_G

Typical Characteristics

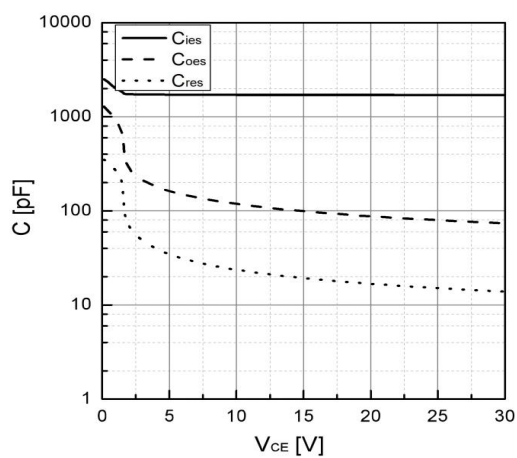
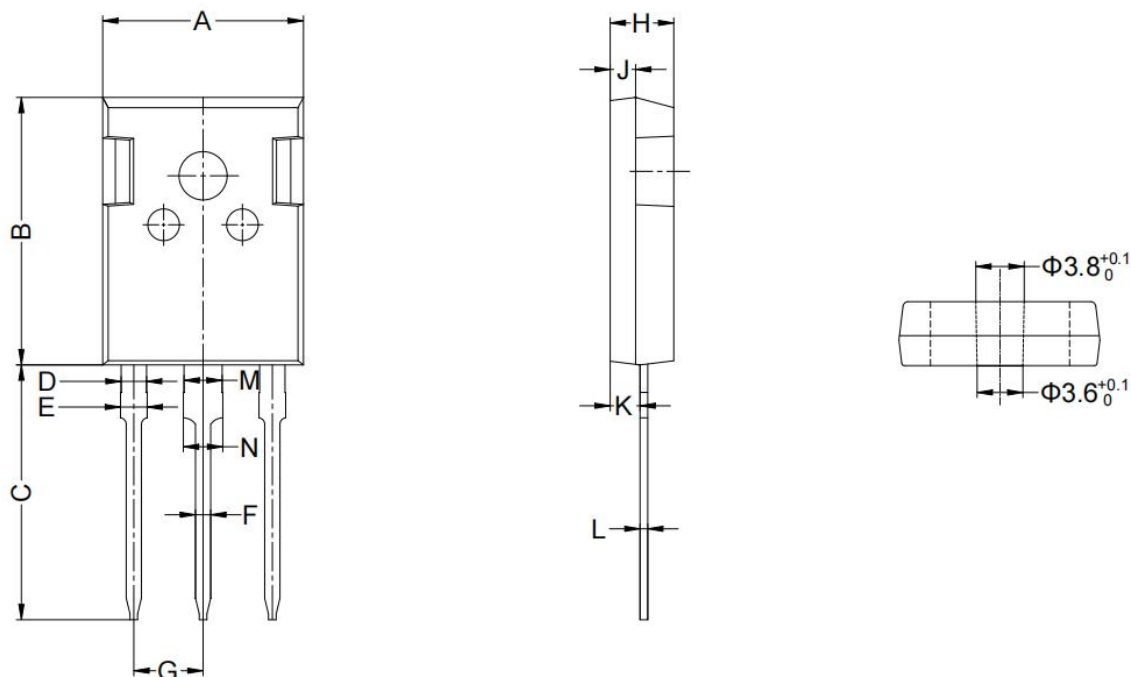


Fig 13. Typical capacitance as a function of V_{CE}
($f=1\text{Mhz}$, $V_{GE}=0\text{V}$)

TO-247AB Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	15.500	16.100	0.610	0.634
B	20.800	21.200	0.819	0.835
C	19.700	20.300	0.776	0.799
D	1.800	2.200	0.071	0.087
E	1.900	2.300	0.075	0.091
F	1.000	1.400	0.039	0.055
G	5.250	5.650	0.207	0.222
H	4.800	5.200	0.189	0.205
J	1.900	2.100	0.075	0.083
K	2.200	2.500	0.087	0.098
L	0.410	0.790	0.016	0.031
M	2.800	3.200	0.110	0.126
N	2.900	3.300	0.114	0.130