

Product Summary

$V_{(BR)CES}$	$V_{CE(SAT)TYP}$	$I_C(100^{\circ}C)$
650V	1.9V@15V	40A

Feature

- Trench and field-stop technology
- Easy parallel switching capability

Application

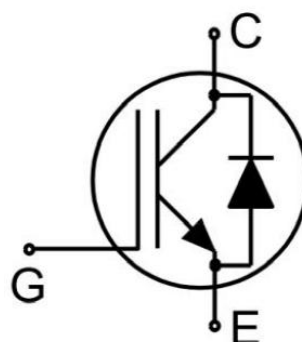
- PFC applications
- Welding machines

Package

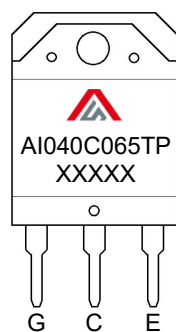


TO-3PF

Circuit diagram



Marking



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

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	650	V
Continuous Gate- Emitter Voltage	V_{GES}	± 20	V
Collector Current	I_C	80	A
Collector Current (T _C =100°C)	$I_C(100^\circ\text{C})$	40	A
Pulsed Collector Current, t _p limited by T _{vjmax}	I_{CM}	160	A
Diode Continuous Forward Current (T _C =100°C)	$I_F(100^\circ\text{C})$	40	A
Diode Maximum Current, t _p limited by T _{vjmax}	I_{FM}	160	A
Power Dissipation	P_D	300	W
Thermal Resistance, Junction to case for Diode	$R_{\theta JC}$	0.9	°C/W
Thermal Resistance, Junction to case for IGBT	$R_{\theta JC}$	0.5	°C/W
Junction Temperature Range	T_{vj}	-40 ~ +175	°C
Storage Temperature Range	T_{STG}	-55 ~ +175	°C

Electrical characteristics of the IGBT (T_{vj}=25°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 _{CE} =250uA	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 _{CE} =V _{GE} ,I _C =1mA	4	5	6	V
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} =15V,I _C =40A		1.9		V
		V _{GE} =15V,I _C =40A,T _{vj} =175℃		2.6		
Dynamic characteristics						
Input Capacitance	C _{ies}	V _{CE} =30V,V _{GE} =0V, f =1MHz		2480		pF
Output Capacitance	C _{oes}			95		
Reverse Transfer Capacitance	C _{res}			21		
Total Gate Charge	Q _g	V _{CC} =520V,V _{GE} =15V,I _C =40A		78		nC
Turn-on delay time	t _{d(on)}	V _{CC} =400V,V _{GE} = 0/15V, I _C =40A,R _G =10Ω, Inductive load		32		nS
Turn-on rise time	t _r			55		
Turn-off delay time	t _{d(off)}			106		
Turn-off fall time	t _f			51		
Turn-on Switching Energy	E _{on}			0.9		mJ
Turn-off Switching Energy	E _{off}			0.5		
Total switching energy	E _{is}			1.4		
Turn-on delay time	t _{d(on)}	V _{CC} =400V,V _{GE} = 0/15V, I _C =40A,R _G =10Ω, Inductive load T _{vj} =175℃		28		nS
Turn-on rise time	t _r			52		
Turn-off delay time	t _{d(off)}			128		
Turn-off fall time	t _f			75		
Turn-on Switching Energy	E _{on}			1.4		mJ
Turn-off Switching Energy	E _{off}			0.7		
Total switching energy	E _{is}			2.1		

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

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	$I_F=40\text{A}$		2.4		V
		$I_F=40\text{A}, T_{vj}=175^{\circ}\text{C}$		1.7		
Reverse Recovery Current	I_{rr}	$I_F=40\text{A}, V_R=400\text{V}, di_F/dt=-950\text{A/us}$		15		A
Reverse Recovery Charge	Q_{rr}			522		nC
Diode reverse recovery time	t_{rr}			68		ns
Reverse Recovery Current	I_{rr}	$I_F=40\text{A}, V_R=400\text{V}, di_F/dt=-950\text{A/us}, T_{vj}=175^{\circ}\text{C}$		24		A
Reverse Recovery Charge	Q_{rr}			1423		nC
Diode reverse recovery time	t_{rr}			106		ns

Typical Characteristics

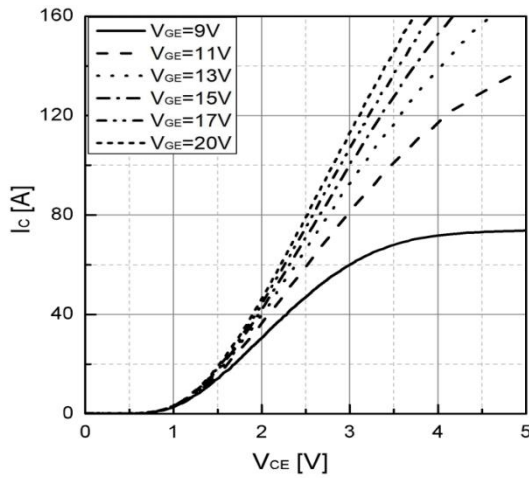


Fig 1. Typical output characteristic ($T_{vj}=25^{\circ}\text{C}$)

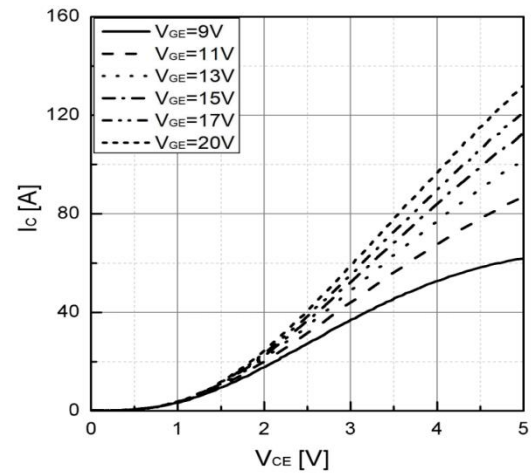


Fig 2. Typical output characteristic ($T_{vj}=175^{\circ}\text{C}$)

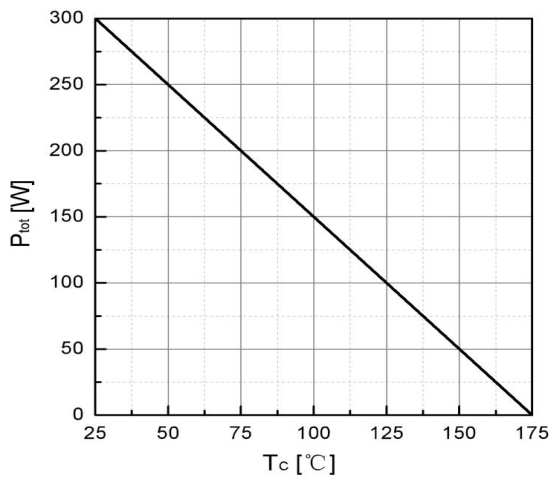


Fig 3. Power dissipation as a function of T_c

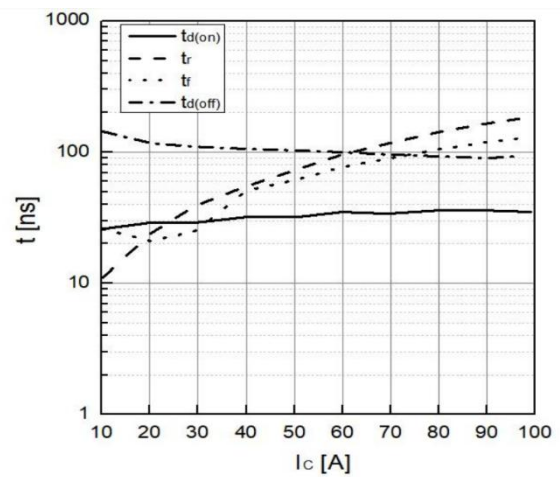


Fig 4. Typical switching time as a function of I_c

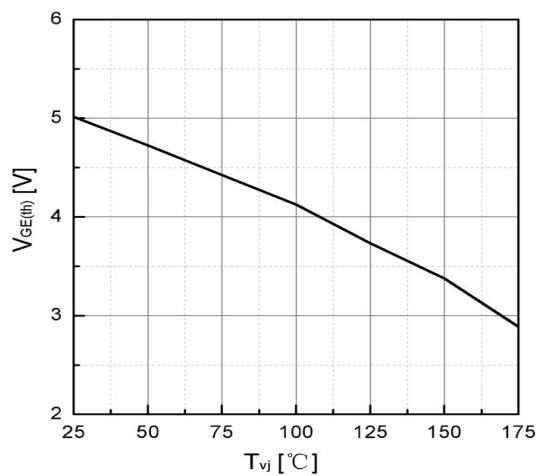


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj}

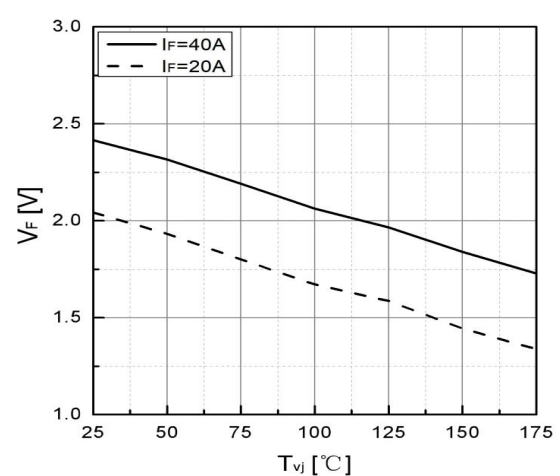


Fig 6. Typical V_F as a function of T_{vj}

Typical Characteristics

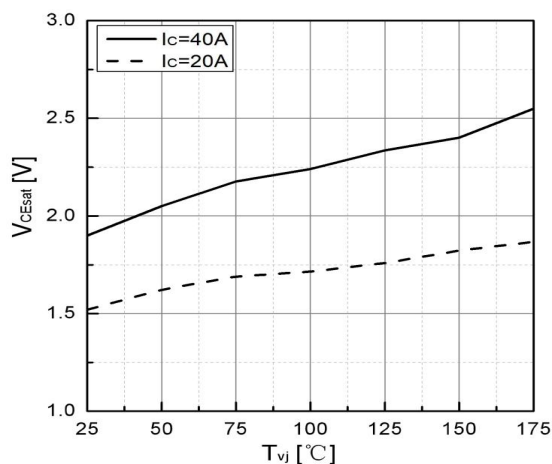


Fig 7. Typical V_{CEsat} as a function of T_{vj}

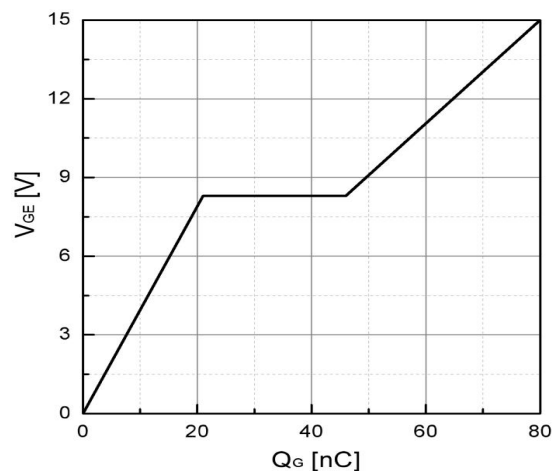


Fig 8. Typical Gate charge

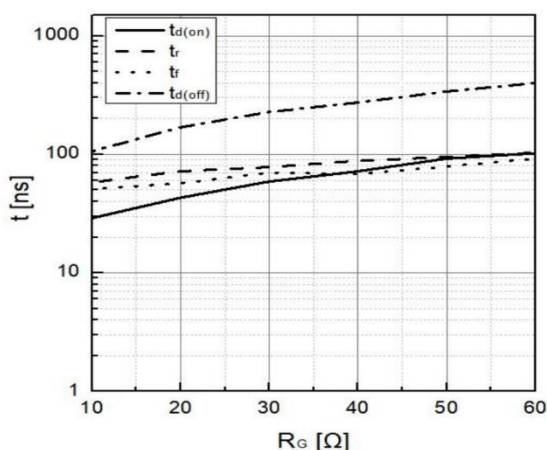


Fig 9. Typical switching times as a function of R_G

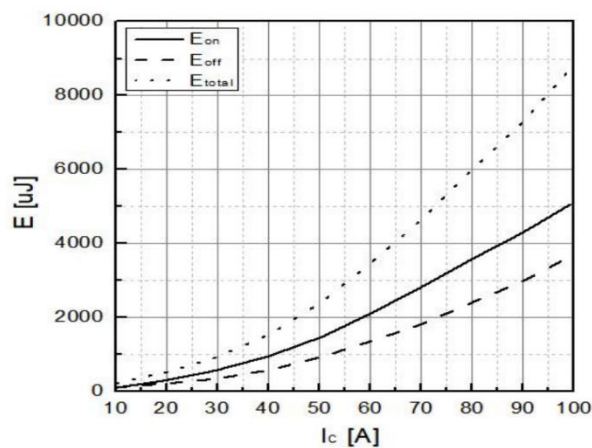


Fig 10. Typical switching energy losses as a function of I_C

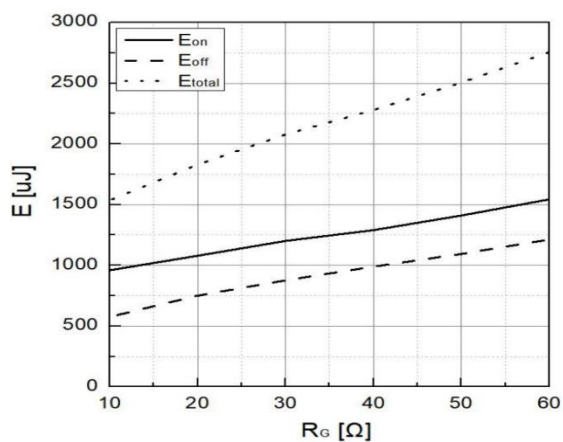


Fig 11. Typical switching energy losses as a function of R_G

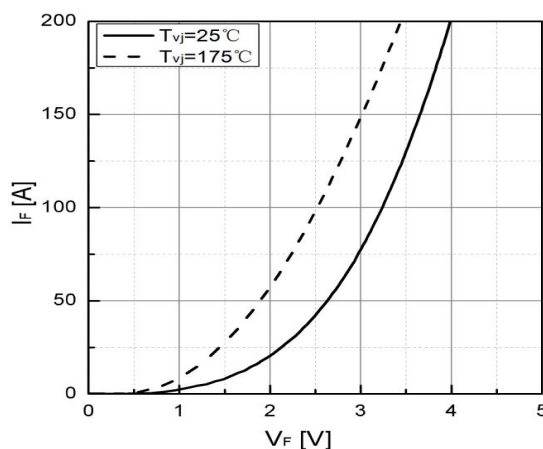


Fig 12. Typical I_F as a function of V_F

Typical Characteristics

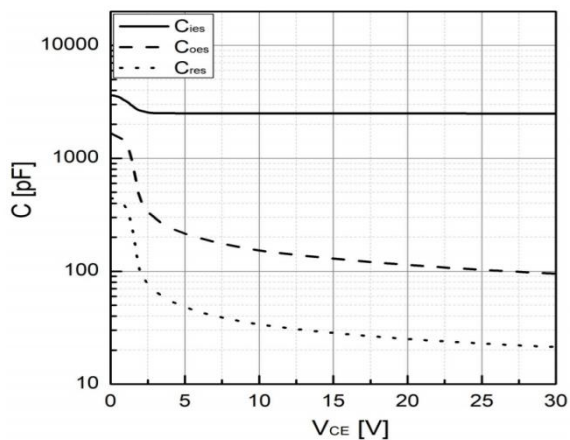


Fig 13. Typical capacitance as a function of V_{CE}
($f=1\text{MHz}$, $V_{GE}=0\text{V}$)

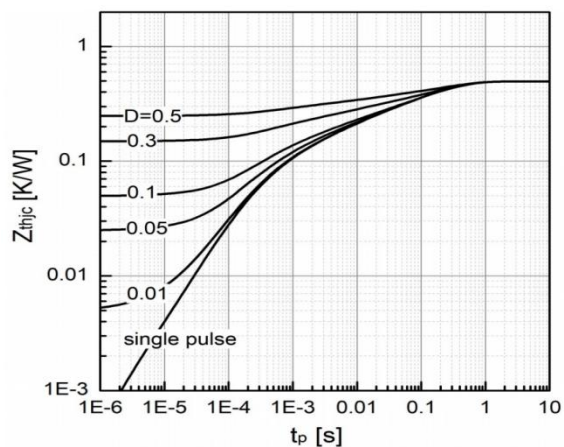
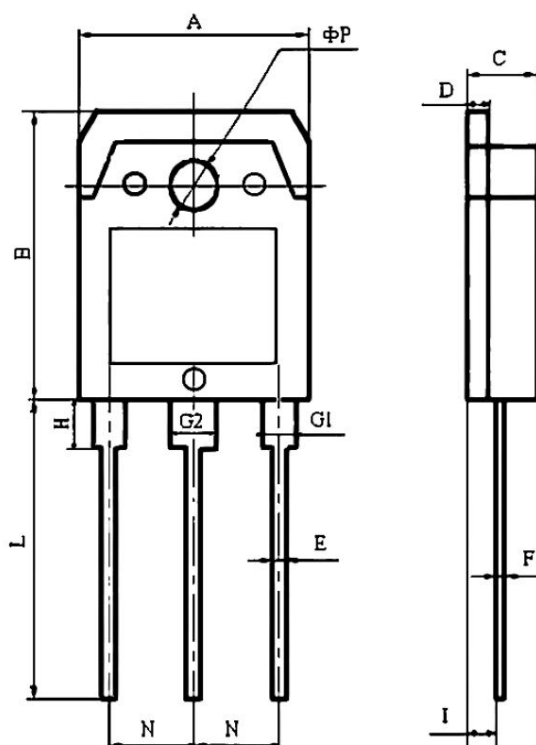


Fig 14. Transient thermal impedance of IGBT

TO-3PF Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	15.000	16.000	0.591	0.630
B	19.200	20.600	0.756	0.811
C	4.600	5.000	0.181	0.197
D	1.400	1.600	0.055	0.063
E	0.900	1.100	0.035	0.043
F	0.500	0.700	0.020	0.028
G1	2.000	2.200	0.079	0.087
G2	3.000	3.200	0.118	0.126
H	3.000	3.700	0.118	0.146
I	2.300	2.500	0.091	0.098
L	19.000	21.000	0.748	0.827
N	5.250	5.650	0.207	0.222
φ P	3.100	3.300	0.122	0.130