

Product Summary

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

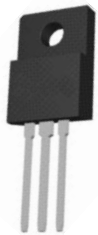
Feature

- 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

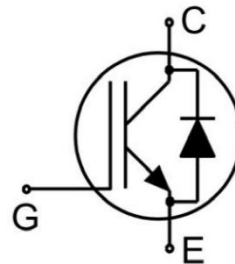
- Home appliances
- Motor drives
- General inverter

Package



ITO-220AB

Circuit diagram



Marking



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

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	650	V
Gate-Emitter Voltage	V_{GE}	±20	V
Continuous Collector Current	I_C	40	A
Continuous Collector Current (T _C =100°C)	$I_C(100^\circ\text{C})$	20	A
Pulsed Collector Current, tp limited by T _{vjmax}	I_{CM}	80	A
Diode Continuous Forward Current (T _C =100°C)	$I_F(100^\circ\text{C})$	20	A
Diode Maximum Current, t _p limited by T _{vjmax}	I_{FM}	80	A
Short Circuit Withstand Time	T_{SC}	10	µs
Power Dissipation	P_{tot}	53	W
Thermal Resistance, Junction to case for Diode	$R_{\theta JC}$	4.1	°C/W
Thermal Resistance, Junction to case for IGBT	$R_{\theta JC}$	2.8	°C/W
Junction Temperature	T_{vj}	-40 ~ +175	°C
Storage Temperature Range	T_{STG}	-55 ~ +150	°C

Electrical characteristics (T_{vj}=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Static Characteristics							
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	$V_{GE} = 0V, I_C = 250\mu A$	650			V	
Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 1mA$	5.2	5.7	6.2	V	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C = 20A$		1.6		V	
		$V_{GE} = 15V, I_C = 20A, T_{vj} = 175^\circ\text{C}$		1.9			
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 650V, V_{GE} = 0V$			50	µA	
Gate to Emitter Leakage Current	I_{GES}	$V_{CE} = 0V, V_{GE} = \pm 20V$			±100	nA	
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			
Gate Charge	Q_g	$V_{CC} = 520V, V_{GE} = 15V, I_C = 20A$		71		nC	
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 400V, V_{GE} = 0V/15V, I_C = 20A, R_G = 10\Omega, \text{Inductive load}$		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 Energy	E_{on}				0.37		mJ
Turn-off Switching Energy	E_{off}				0.46		
Total Switching Energy	E_{ts}				0.83		
Turn-on delay time	$t_{d(on)}$		$V_{CC} = 400V, V_{GE} = 0V/15V, I_C = 20A, R_G = 10\Omega, \text{Inductive load}, T_{vj} = 175^\circ\text{C}$		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 Energy	E_{on}				0.59		mJ
Turn-off Switching Energy	E_{off}				0.67		
Total Switching Energy	E_{ts}				1.26		

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	$I_F=20\text{A}$		1.5		V
		$I_F=20\text{A}, T_{vj}=175^{\circ}\text{C}$		1.2		
Peak Reverse Recovery Current	I_{rrm}	$I_F=20\text{A}, V_R=400\text{V}, dI_F/dt= -500\text{A}/\mu\text{s}$		12		A
Diode reverse recovery Time	t_{rr}			62		nS
Reverse Recovery Charge	Q_{rr}			472		nC
Peak Reverse Recovery Current	I_{rrm}	$I_F=20\text{A}, V_R=400\text{V}, dI_F/dt= -500\text{A}/\mu\text{s}, T_{vj}=175^{\circ}\text{C}$		19		A
Diode reverse recovery Time	t_{rr}			90		nS
Reverse Recovery Charge	Q_{rr}			1130		nC

Typical Characteristics

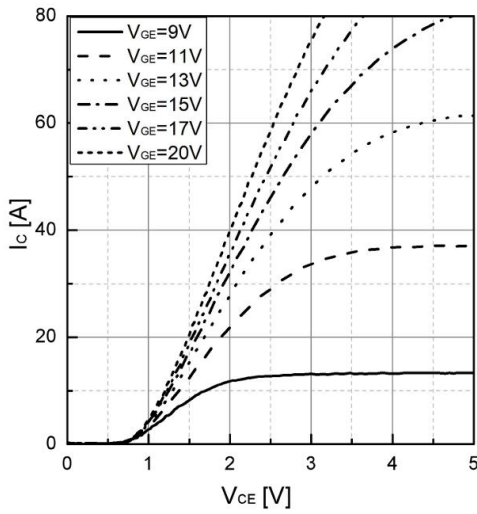


Fig 1. Typical output characteristic ($T_{vj}=25^{\circ}\text{C}$)

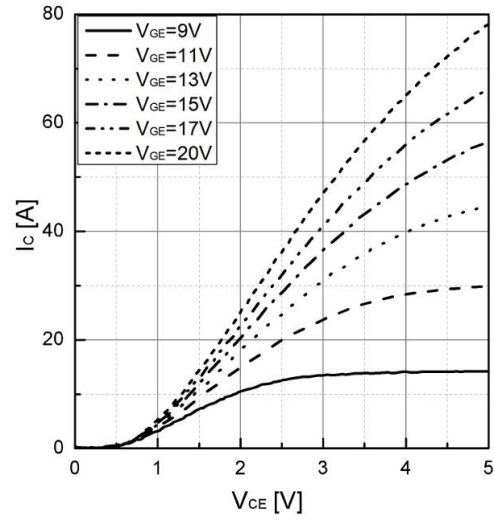


Fig 2. Typical output characteristic ($T_{vj}=175^{\circ}\text{C}$)

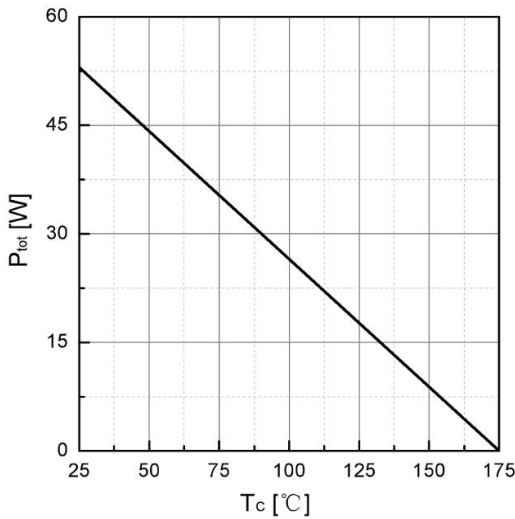


Fig 3. Power dissipation as a function of T_c

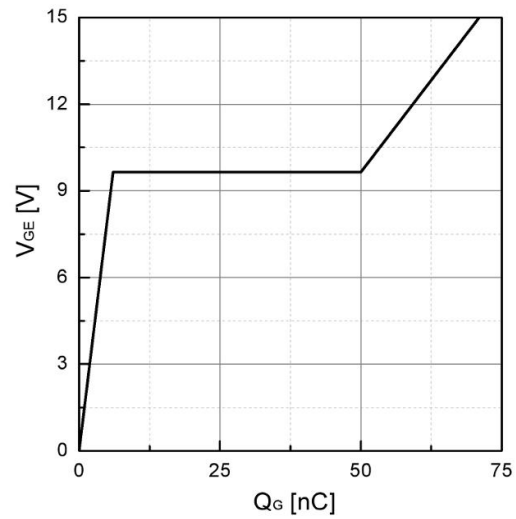


Fig 4. Typical Gate charge

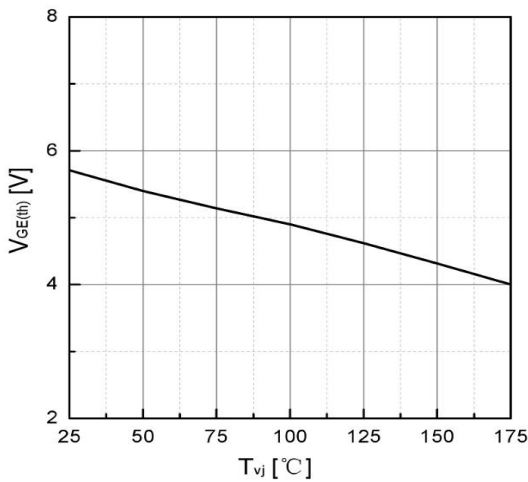


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj}
($I_C=1\text{mA}$)

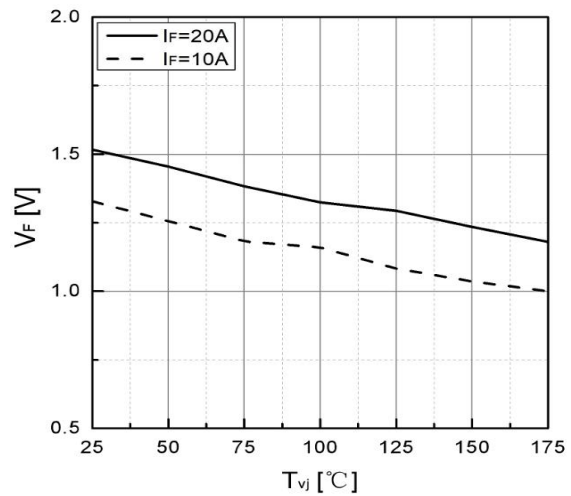


Fig 6. Typical V_F as a function of T_{vj}

Typical Characteristics

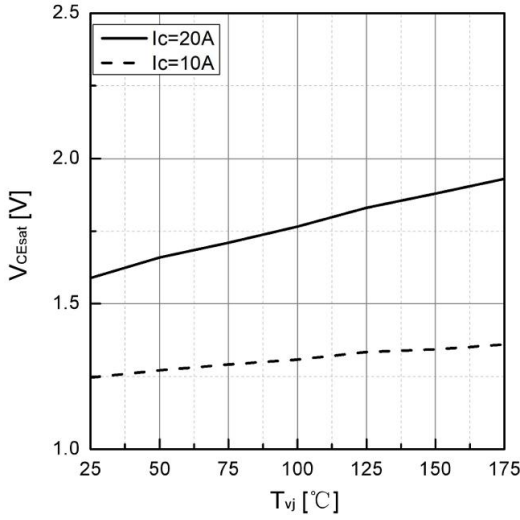


Fig 7. Typical V_{CEsat} as a function of T_{vj}

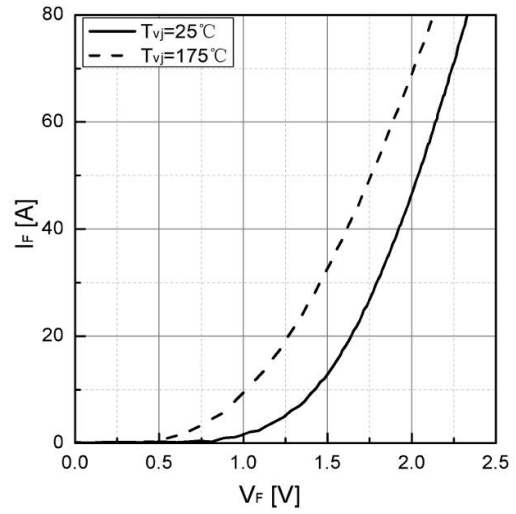


Fig 8. Typical I_F as a function of V_F

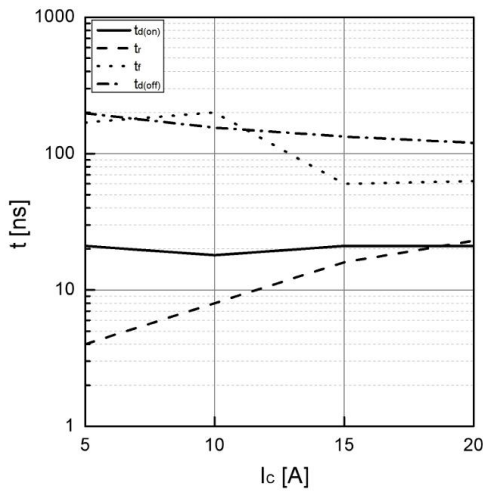


Fig 9. Typical switching time as a function of I_c

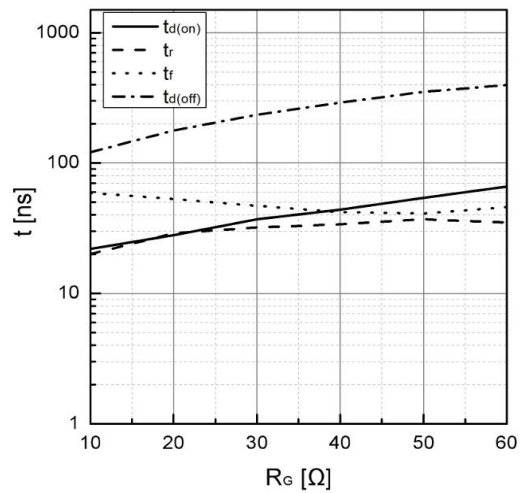


Fig 10. Typical switching times as a function of R_G

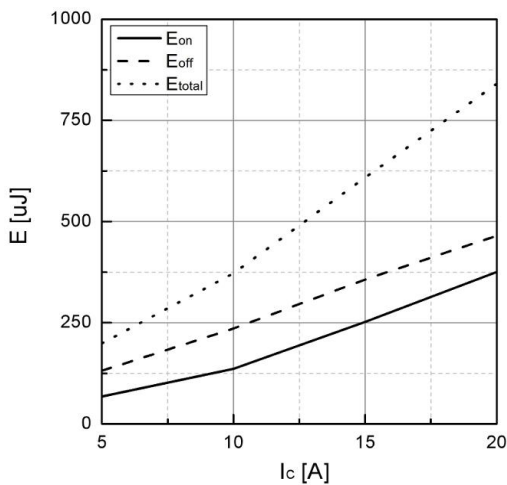


Fig 11. Typical switching energy losses as a function of I_c

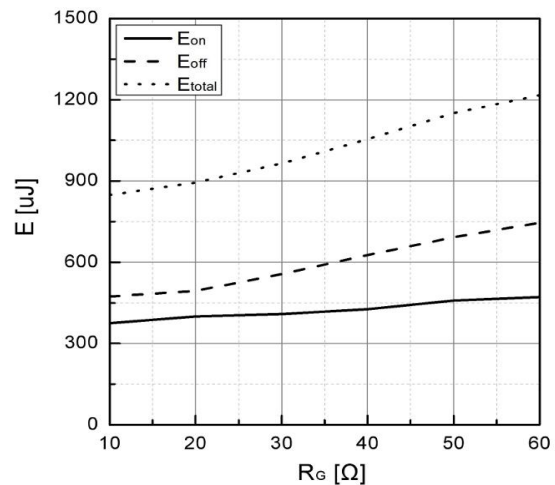


Fig 12. Typical switching energy losses as a function of R_G

Typical Characteristics

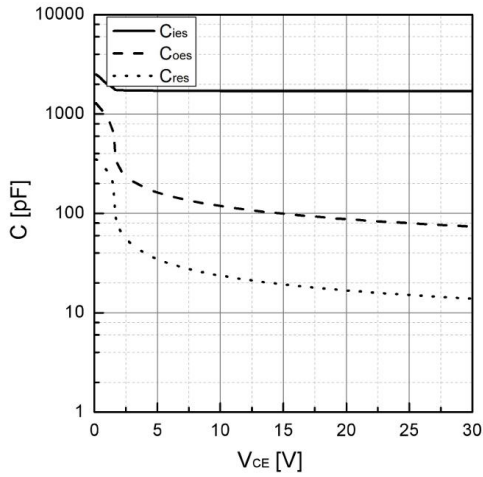
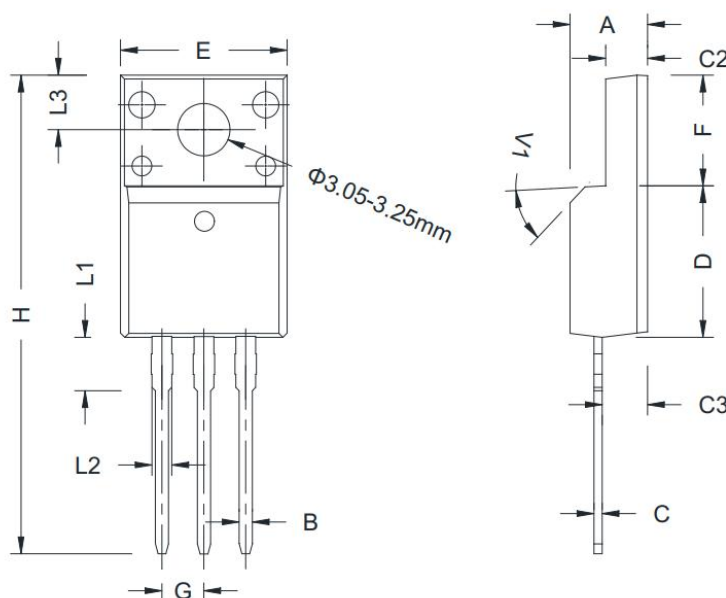


Fig 13. Typical capacitance as a function of V_{CE}
($f=1\text{Mhz}$, $V_{GE}=0\text{V}$)

ITO-220AB Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.500	4.900	0.177	0.193
B	0.740	0.830	0.029	0.033
C	0.470	0.660	0.019	0.026
C2	2.450	2.750	0.096	0.108
C3	2.600	3.000	0.102	0.118
D	8.800	9.300	0.346	0.366
E	9.800	10.400	0.386	0.410
F	6.400	6.800	0.252	0.268
G	2.400	2.700	0.094	0.106
H	28.000	29.800	1.102	1.173
L1	3.630 REF.		0.143 REF.	
L2	1.140	1.700	0.045	0.067
L3	3.300 REF.		0.130 REF.	
V1	45°		45°	