JJMICROELECTRONICS

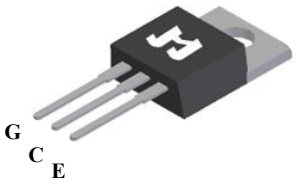
650V 20A Trench and Field Stop IGBT

JJT20N65SY

Key performance:

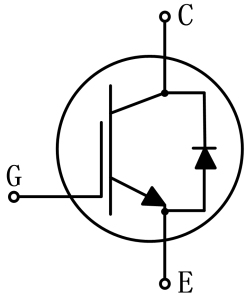
TO-220

- V_{CE}=650V
- I_C=20A@T_C=100℃
- $V_{CE(sat)}$=1.6 V



Features:

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



Applications:

- Home appliances
- Motor drives
- General inverter

Package parameters

Type	Marking	Package	Packaging method
JJT20N65SY	T2065SY	TO-220	Tube

Maximum ratings

Symbol	Parameter	Values	Unit
V_{CES}	Collector-emitter voltage	650	V
V_{GES}	Gate-emitter voltage	±20	V
I_C	Continuous collector current (T_C=25℃)	40	A
	Continuous collector current (T_C=100℃)	20	A
I_{CM}	Pulsed collector current, t_p limited by T_{vjmax}	80	A
I_F	Diode continuous forward current (T_C=100℃)	20	A
I_{FM}	Diode maximum current, t_p limited by T_{vjmax}	80	A
t_{sc}	Short circuit withstand time	10	μs
P_{tot}	Power dissipation (T_C=25℃)	188	W
	Power dissipation (T_C=100℃)	94	W
T_{vj}	Operating junction temperature range	-40 to +175	℃
T_{stg}	Storage temperature range	-55 to +150	℃

Thermal characteristics

Symbol	Parameter	Values		Unit
		Typ.	Max.	
$R_{th(j-c)}$	Thermal resistance, junction to case for IGBT	-	0.8	K/ W
$R_{th(j-c)}$	Thermal resistance, junction to case for Diode	-	1.1	K/ W
$R_{th(j-a)}$	Thermal resistance, junction to ambient	-	60	K/ W

Electrical characteristics of IGBT (T_{vj}=25℃ unless otherwise specified)

Static characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
BV_{CES}	Collector-emitter breakdown voltage	V_{GE}=0V, I_C=250μA	650	-	-	V
I_{CES}	Collector-emitter leakage current	V_{CE}=650V, V_{GE}=0V	-	-	50	μA
I_{GES}	Gate leakage current, forward	V_{GE}=20V, V_{CE}=0V	-	-	100	nA
	Gate leakage current, reverse	V_{GE}=-20V, V_{CE}=0V	-	-	-100	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{GE}=V_{CE}, I_C=1mA	5.2	5.7	6.2	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}=15V, I_C=20A	-	1.6	-	V
		V_{GE}=15V, I_C=20A,T_{vj}=175℃	-	2.0	-	V

Dynamic characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
C_{ies}	Input capacitance	V_{CE}=30V V_{GE}=0V f=1MHz	-	1700	-	pF
C_{oes}	Output capacitance		-	72	-	pF
C_{res}	Reverse transfer capacitance		-	13	-	pF
Q_g	Total gate charge	V_{CC}=520V V_{GE}=15V I_C=20A	-	71	-	nC

Switching characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on delay time	V_{CC}=400V V_{GE}=0/15V I_C=20A R_G=10Ω Inductive load	-	21	-	ns
t_r	Rise time		-	23	-	ns
$t_{d(off)}$	Turn-off delay time		-	120	-	ns
t_f	Fall time		-	63	-	ns
E_{on}	Turn-on energy		-	0.37	-	mJ
E_{off}	Turn-off energy		-	0.46	-	mJ
E_{ts}	Total switching energy		-	0.83	-	mJ
$t_{d(on)}$	Turn-on delay time	V_{CC}=400V V_{GE}=0/15V I_C=20A R_G=10Ω Inductive load T_{vj}=175℃	-	21	-	ns
t_r	Rise time		-	23	-	ns
$t_{d(off)}$	Turn-off delay time		-	141	-	ns
t_f	Fall time		-	108	-	ns
E_{on}	Turn-on energy		-	0.59	-	mJ
E_{off}	Turn-off energy		-	0.67	-	mJ
E_{ts}	Total switching energy		-	1.26	-	mJ

Electrical characteristics of Diode (T_{vj}=25℃ unless otherwise specified)

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
V_F	Diode forward voltage	I_F=20A	-	1.6	-	V
		I_F=20A,T_{vj}=175℃	-	1.2	-	V
t_{rr}	Diode reverse recovery time	V_R=400V I_F=20A di_F/dt=-500A/μs	-	62	-	ns
I_{rrm}	Diode peak reverse recovery current		-	12	-	A
Q_{rr}	Diode reverse recovery charge		-	472	-	nC
t_{rr}	Diode reverse recovery time	V_R=400V I_F=20A di_F/dt=-500A/μs T_{vj}=175℃	-	90	-	ns
I_{rrm}	Diode peak reverse recovery current		-	19	-	A
Q_{rr}	Diode reverse recovery charge		-	1130	-	nC

Typical performance characteristics

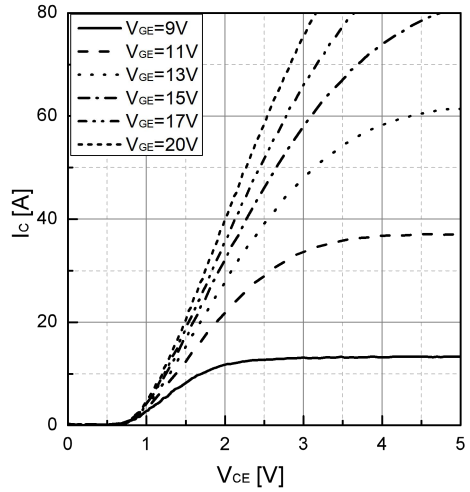


Fig 1. Typical output characteristic (T_{vj}=25℃)

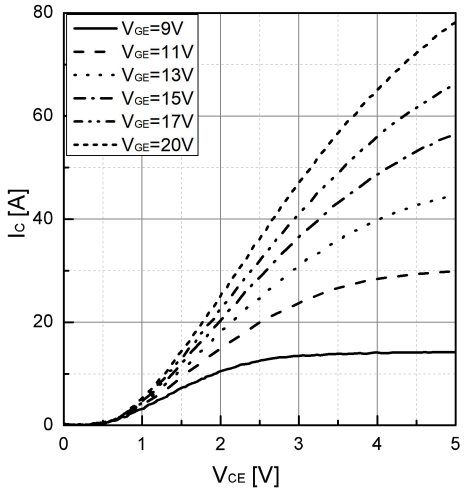


Fig 2. Typical output characteristic(T_{vj}=175℃)

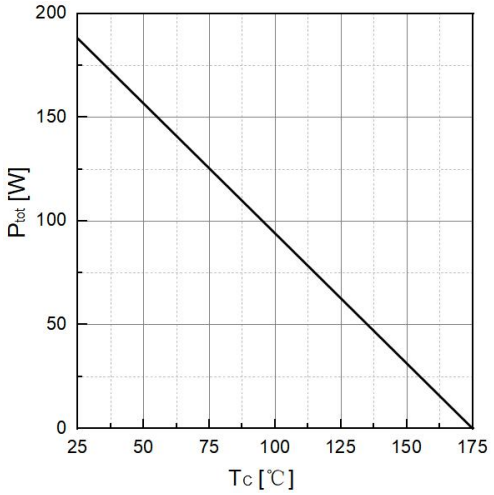


Fig 3. Power dissipation as a function of T_C

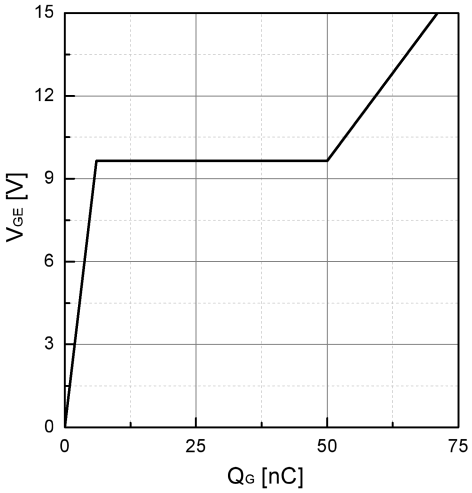


Fig 4. Typical Gate charge

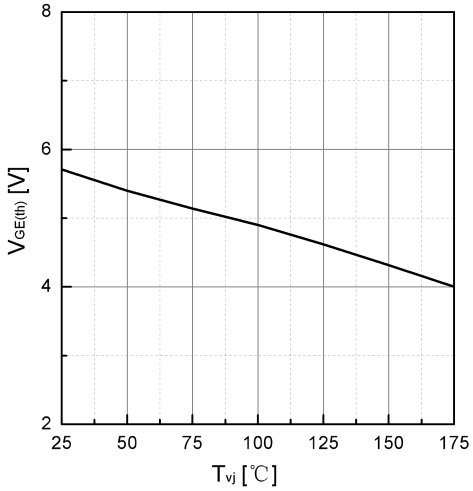


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj} (I_C=1mA)

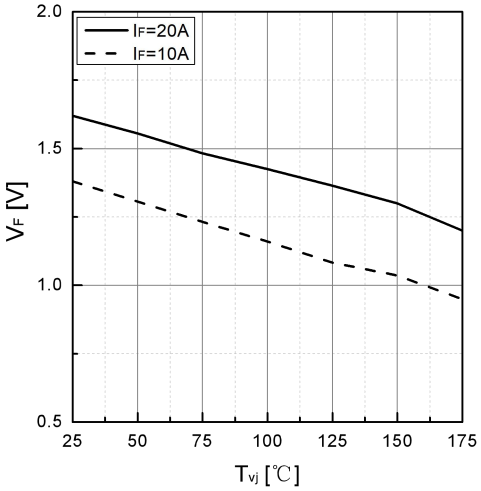


Fig 6. Typical V_F as a function of T_{vj}

Typical performance characteristics

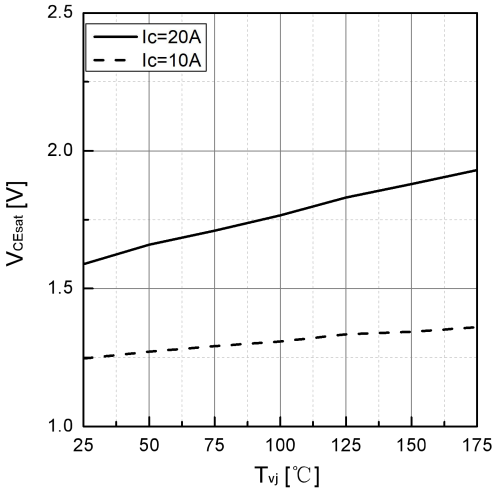


Fig 7. Typical V_{CEsat} as a function of T_{vj}

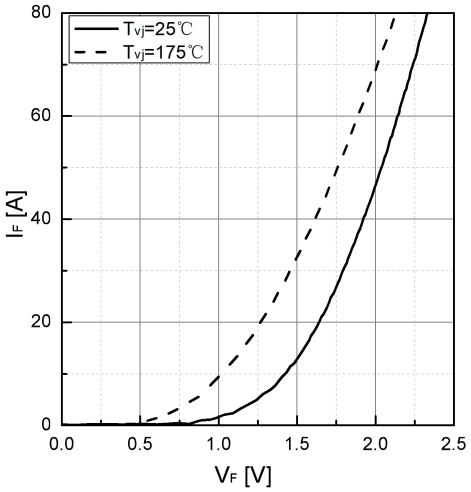


Fig 8. Typical I_F as a function of V_F

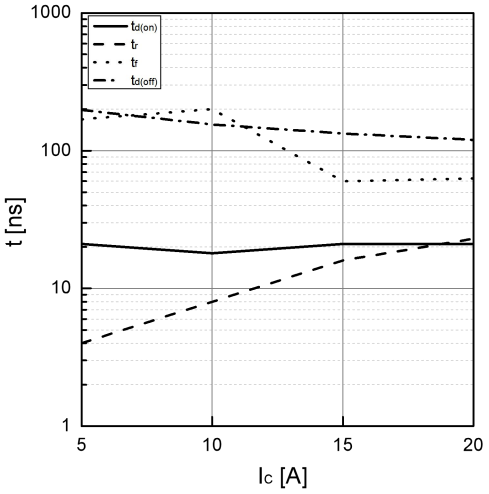


Fig 9. Typical switching time as a function of I_C

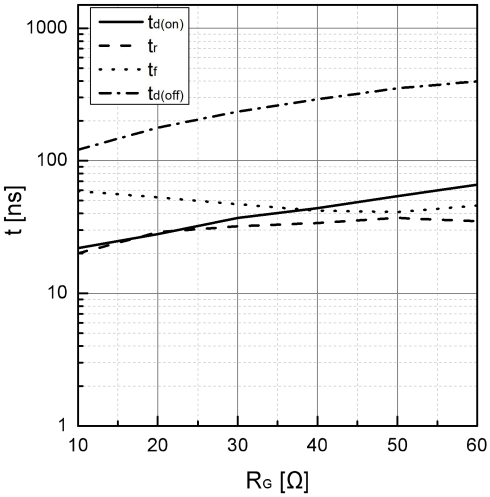


Fig 10. Typical switching times as a function of R_G

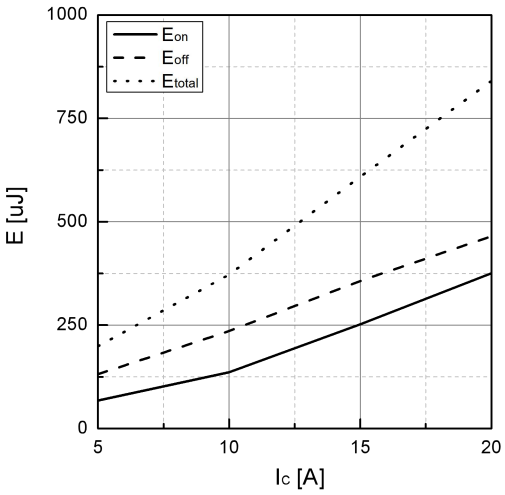


Fig 11. Typical switching energy losses as a function of I_C

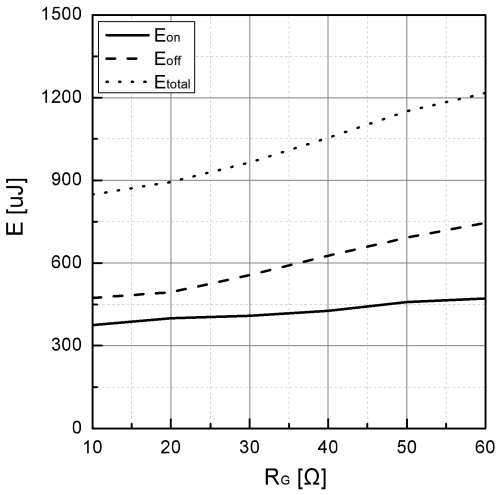


Fig 12. Typical switching energy losses as a function of R_G

Typical performance characteristics

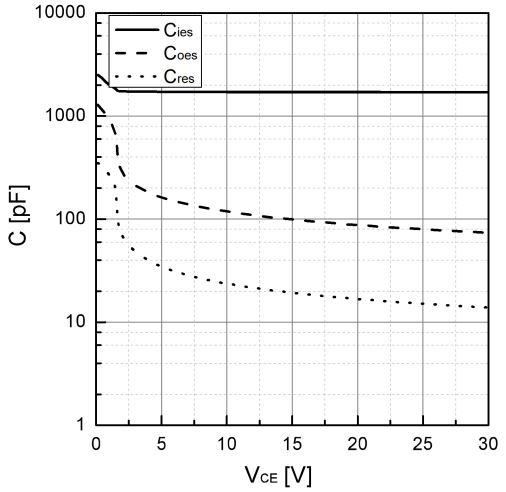


Fig 13. Typical capacitance as a function of V_{CE} (f=1Mhz, V_{GE}=0V)

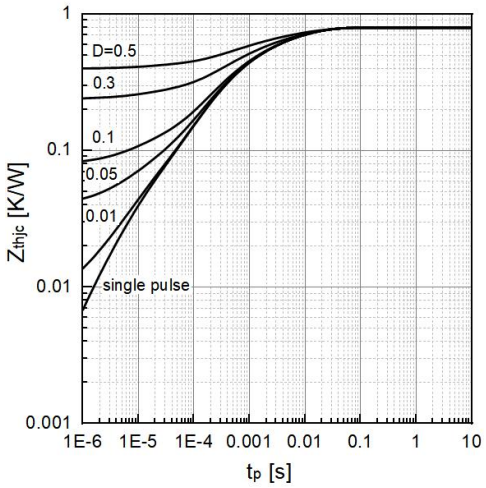
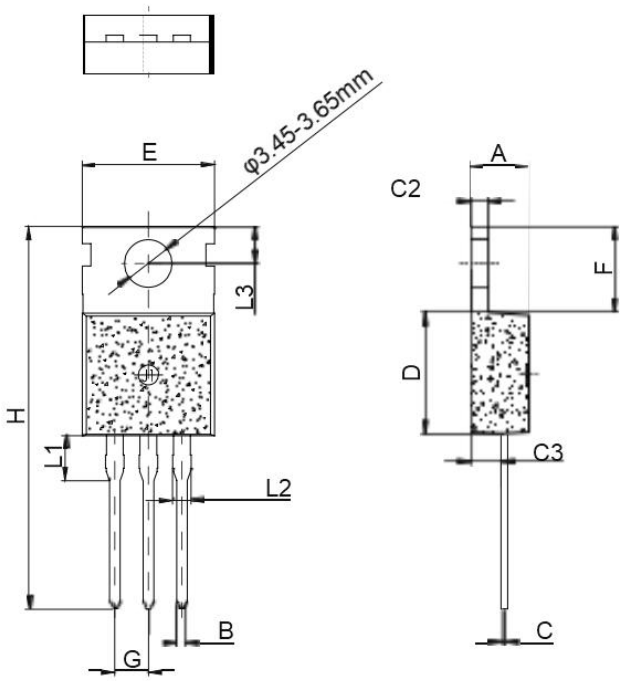


Fig 14. Transient thermal impedance, IGBT

Package dimension

TO-220



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40	-	4.60	0.173	-	0.181
B	0.70		0.90	0.028		0.035
C	0.45		0.60	0.018		0.024
C2	1.23		1.32	0.048		0.052
C3	2.20		2.60	0.087		0.102
D	8.90		9.90	0.350		0.390
E	9.90		10.3	0.390		0.406
F	6.30		6.90	0.248		0.272
G		2.54			0.100	
H	28.0		29.8	1.102		1.173
L1		3.39			0.133	
L2	1.14		1.70	0.045		0.067
L3	2.65		2.95	0.104		0.116

Revision history

Date	Revision	Changes
2023-12-05	Rev 1.0	Release of the datasheet.
2024-05-20	Rev 1.1	Update
2025-03-06	Rev 1.2	Character update
2026-06-24	Rev 1.3	Update thermal

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