JJMICROELECTRONICS

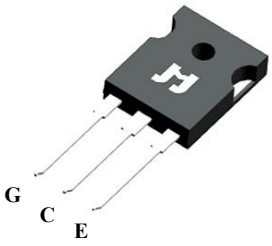
650V 40A Trench and Field Stop IGBT

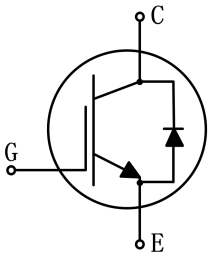
JJT40N65SE

Key performance:

- V_{CE}=650V
- I_C=40A@T_C=100℃
- $V_{CE(sat)}$=1.7V

TO-247





Features:

- Trench field-stop IGBT technology.
- Positive $V_{CE\ (sat)}$ temperature coefficient.
- Fast switching and short tail current.
- 8μs short circuit capability.

Benefits:

- High efficiency for Motor drives.
- High ruggedness performance.
- RoHS compliant.

Applications:

- Motor drives

Package parameters

Type	Marking	Package	Packaging Method
JJT40N65SE	T4065SE	TO-247	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℃)	80	A
	Continuous collector current (T_C=100℃)	40	A
I_{CM}	Pulsed collector current, t_p limited by T_{vjmax}	160	A
I_F	Diode continuous forward current (T_C=100℃)	40	A
I_{FM}	Diode maximum current, t_p limited by T_{vjmax}	160	A
t_{sc}	Short circuit withstand time	8	μs
P_{tot}	Power dissipation (T_C=25℃)	300	W
	Power dissipation (T_C=100℃)	150	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	-	0.5	K/ W
$R_{th(j-c)}$	Thermal resistance, junction to case for Diode	-	0.9	K/ W
$R_{th(j-a)}$	Thermal resistance, junction to ambient	-	40	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}=15 V, I_C=40A	-	1.7	-	V
		V_{GE}=15V, I_C=40A, T_{vj}=175℃	-	2.2	-	V

Dynamic characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
C_{ies}	Input capacitance	V_{CE}=30V V_{GE}=0V f=1MHz	-	1844	-	pF
C_{oes}	Output capacitance		-	100	-	pF
C_{res}	Reverse transfer capacitance		-	27	-	pF
Q_g	Total gate charge	V_{CC}=520V V_{GE}=15V I_C=40A	-	125	-	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=40A R_G=10Ω Inductive load	-	25	-	ns
t_r	Rise time		-	77	-	ns
$t_{d(off)}$	Turn-off delay time		-	162	-	ns
t_f	Fall time		-	64	-	ns
E_{on}	Turn-on energy		-	1.8	-	mJ
E_{off}	Turn-off energy		-	0.9	-	mJ
E_{ts}	Total switching energy		-	2.7	-	mJ
$t_{d(on)}$	Turn-on delay time	V_{CC}=400V V_{GE}=0/15V I_C=40A R_G=10Ω Inductive load T_{vj}=175℃	-	25	-	ns
t_r	Rise time		-	79	-	ns
$t_{d(off)}$	Turn-off delay time		-	187	-	ns
t_f	Fall time		-	107	-	ns
E_{on}	Turn-on energy		-	1.9	-	mJ
E_{off}	Turn-off energy		-	1.2	-	mJ
E_{ts}	Total switching energy		-	3.1	-	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=40A	-	1.65	-	V
		I_F=40A,T_{vj}=175℃	-	1.4	-	V
t_{rr}	Diode reverse recovery time	V_R=400V I_F=40A di_F/dt=-400A/μs	-	120	-	ns
I_{rrm}	Diode peak reverse recovery current		-	9	-	A
Q_{rr}	Diode reverse recovery charge		-	600	-	nC
t_{rr}	Diode reverse recovery time	V_R=400V I_F=40A di_F/dt=-400A/μs T_{vj}=175℃	-	190	-	ns
I_{rrm}	Diode peak reverse recovery current		-	19	-	A
Q_{rr}	Diode reverse recovery charge		-	2000	-	nC

Typical performance characteristics

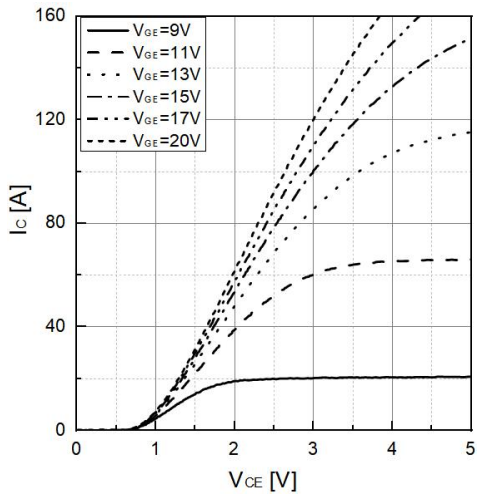


Fig 1. Typical output characteristic (T_{vj}=25℃)

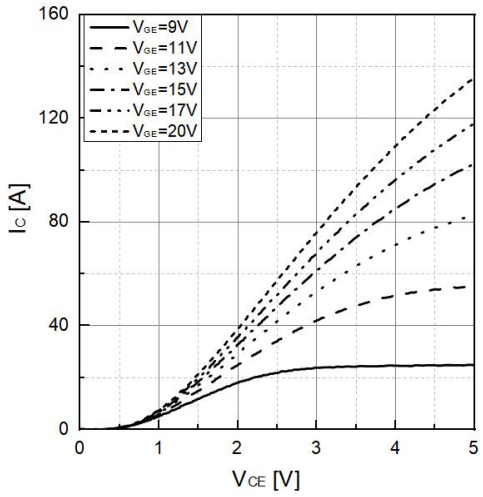


Fig 2. Typical output characteristic(T_{vj}=175℃)

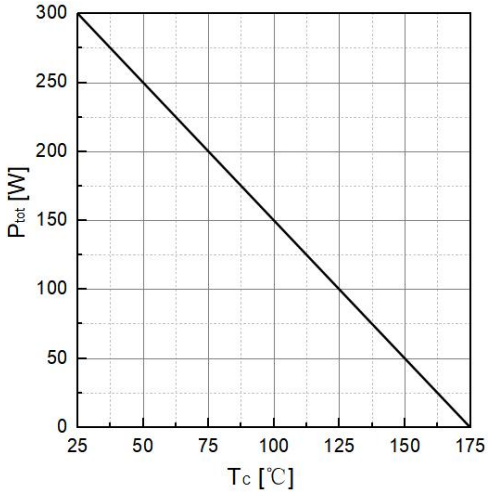


Fig 3. Power dissipation as a function of T_C

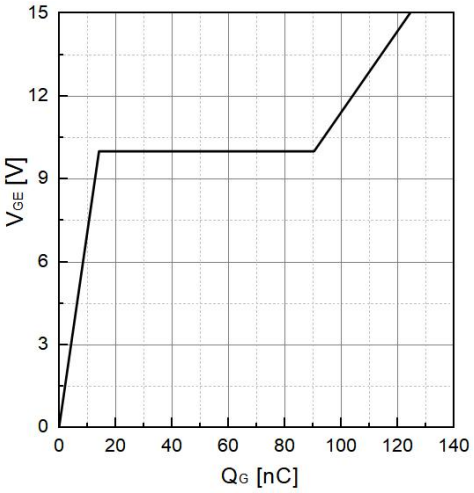


Fig 4. Typical Gate charge

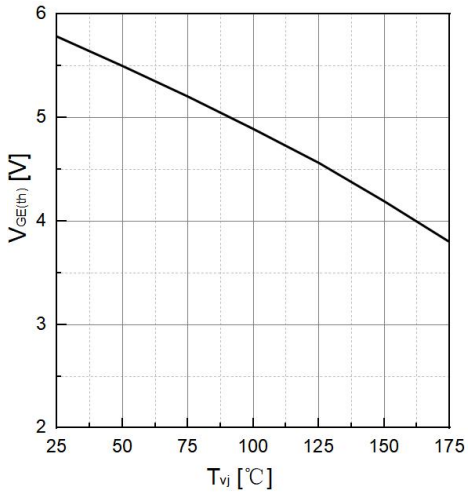


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj} (I_C=1mA)

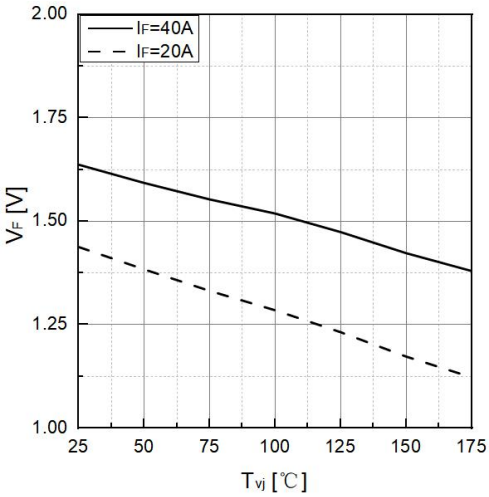


Fig 6. Typical V_F as a function of T_{vj}

Typical performance characteristics

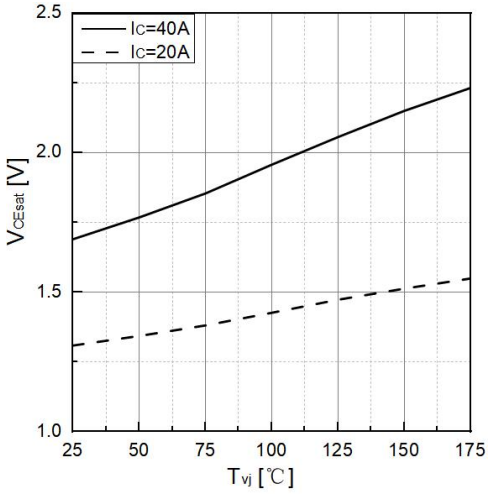


Fig 7. Typical V_{CEsat} as a function of T_{vj}

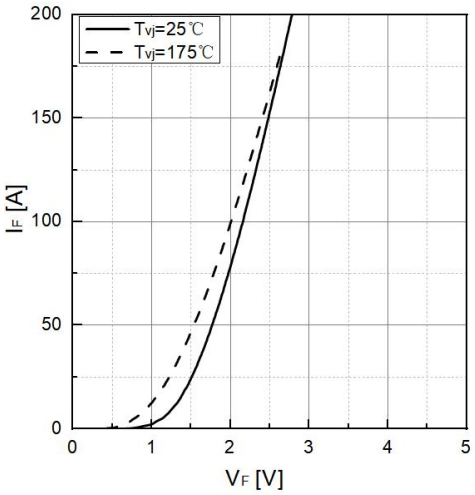


Fig 8. Typical I_F as a function of V_F

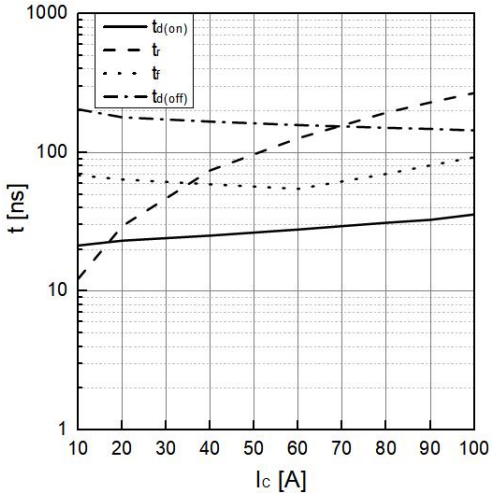


Fig 9. Typical switching time as a function of I_C

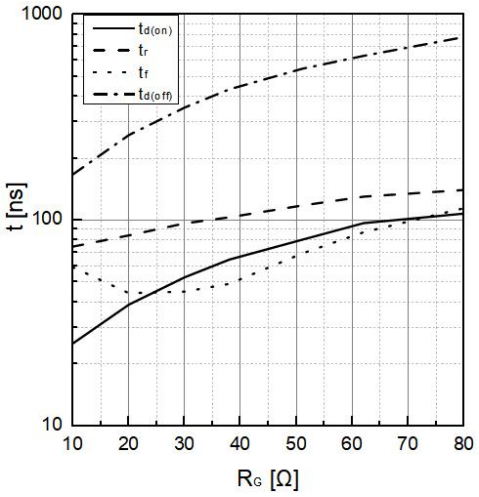


Fig 10. Typical switching time as a function of R_G

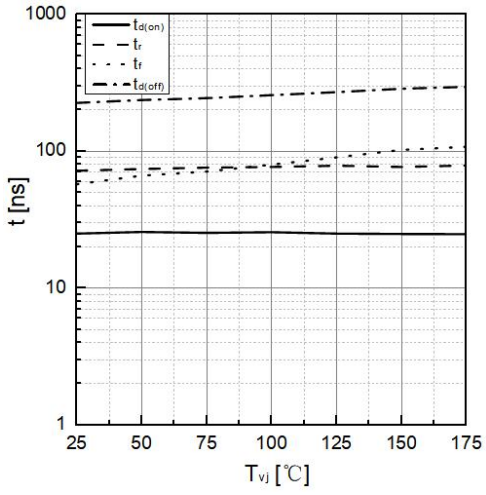


Fig 11. Typical switching time as a function of T_{vj}

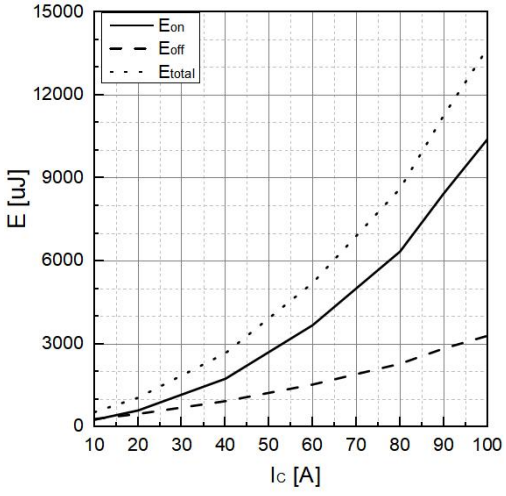


Fig 12. Typical switching energy losses as a function of I_C

Typical performance characteristics

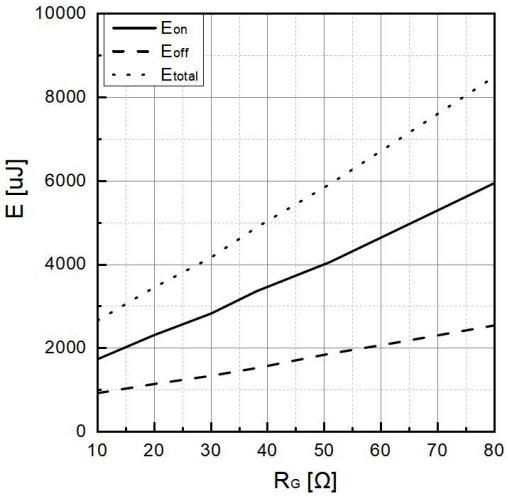


Fig 13. Typical switching energy losses as a function of R_G

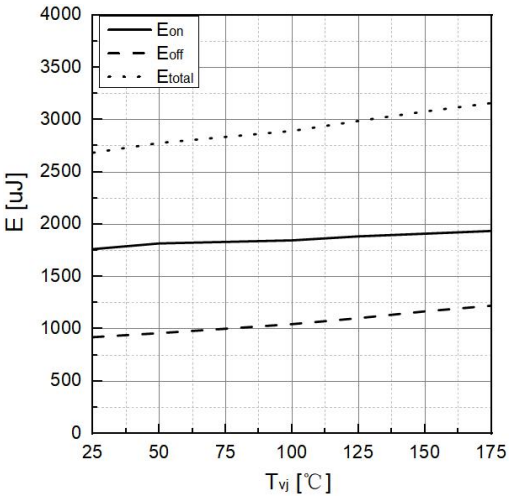


Fig 14. Typical switching energy losses as a function of T_{vj}

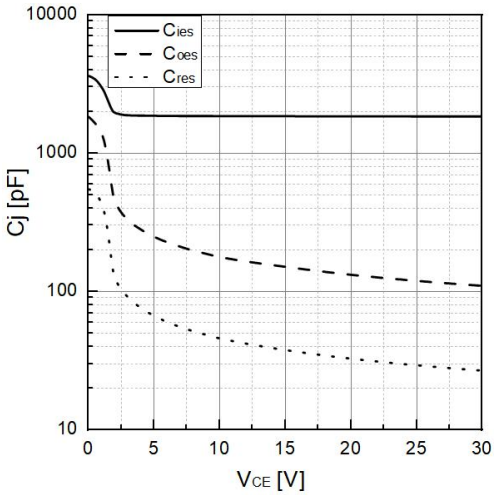


Fig 15. Typical capacitance as a function of V_{CE} (f=1Mhz, V_{GE}=0V)

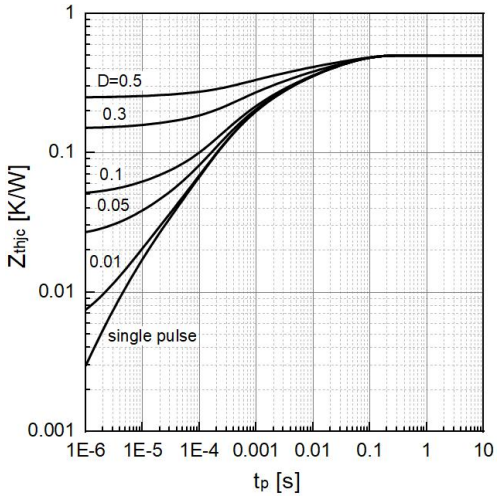


Fig 16. Transient thermal impedance of IGBT

Package dimension

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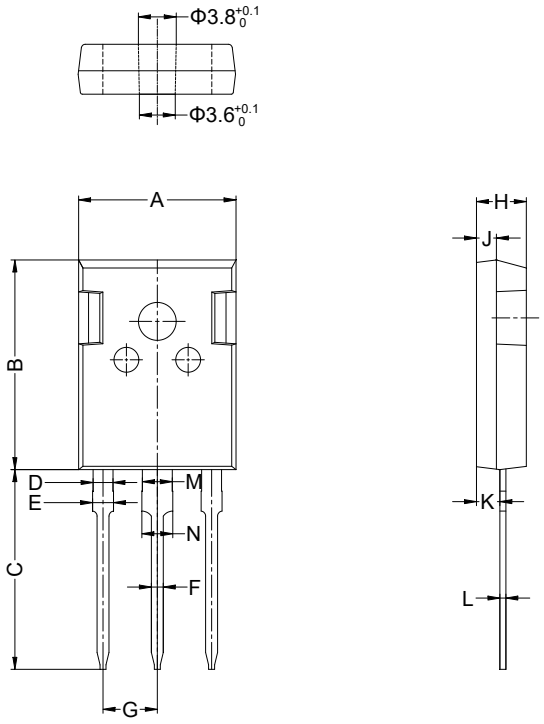

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.50	15.80	16.10	0.610	0.622	0.634
B	20.80	21.00	21.20	0.819	0.827	0.835
C	19.70	20.00	20.30	0.776	0.787	0.799
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.90	2.10	2.30	0.075	0.083	0.091
F	1.00	1.20	1.40	0.039	0.047	0.055
G	5.25	-	5.65	0.207	-	0.222
H	4.80	5.00	5.20	0.189	0.197	0.205
J	1.90	2.00	2.10	0.075	0.079	0.083
K	2.20	2.35	2.50	0.087	0.093	0.098
L	0.41	0.60	0.79	0.016	0.024	0.031
M	2.80	3.00	3.20	0.110	0.118	0.126
N	2.90	3.10	3.30	0.114	0.122	0.130

Revision history

Date	Revision	Changes
2025-05-05	Rev 1.0	Preliminary Release of the datasheet
2025-11-30	Rev 1.1	Release of the Characterization
2026-06-25	Rev 1.2	Update thermal

Disclaimer