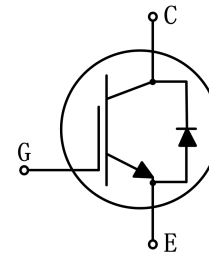
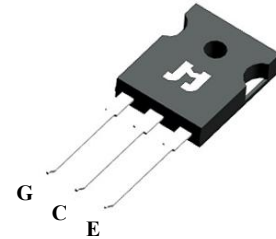


Key performance:

- $V_{CE}=1200V$
- $I_C=40A@T_C=100^{\circ}C$
- $V_{CE(sat)}=1.9V$

TO-247


Features:

- Trench and field-stop technology
- High speed switching
- Low collector to emitter saturation voltage
- Easy parallel switching capability
- High ruggedness performance
- RoHS compliant

Applications:

- Welding machines
- UPS
- Solar inverters

Package parameters

Type	Marking	Package	Packaging Method
JJT40N120HE	T40120HE	TO-247	Tube

Maximum ratings

Symbol	Parameter	Values	Unit
V_{CES}	Collector-emitter voltage	1200	V
V_{GES}	Gate-emitter voltage	± 20	V
I_C	Continuous collector current ($T_C=25^\circ\text{C}$)	80	A
	Continuous collector current ($T_C=100^\circ\text{C}$)	40	A
I_{CM}	Pulsed collector current, t_p limited by T_{vjmax}	160	A
I_F	Diode continuous forward current ($T_C=100^\circ\text{C}$)	40	A
I_{FM}	Diode maximum current, t_p limited by T_{vjmax}	160	A
P_{tot}	Power dissipation ($T_C=25^\circ\text{C}$)	681	W
	Power dissipation ($T_C=100^\circ\text{C}$)	340	W
T_{vj}	Operating junction temperature range	-40 to +175	$^\circ\text{C}$
T_{stg}	Storage temperature range	-55 to +150	$^\circ\text{C}$

Thermal characteristics

Symbol	Parameter	Values		Unit
		Typ.	Max.	
$R_{th(j-c)}$	Thermal resistance, junction to case for IGBT	-	0.22	K/ W
$R_{th(j-c)}$	Thermal resistance, junction to case for Diode	-	0.48	K/ W
$R_{th(j-a)}$	Thermal resistance, junction to ambient	-	40	K/ W

Electrical characteristics of IGBT ($T_{vj}=25^{\circ}\text{C}$ unless otherwise specified)

Static characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
BV_{CES}	Collector-emitter breakdown voltage	$V_{GE}=0\text{V}, I_C=250\mu\text{A}$	1200	-	-	V
I_{CES}	Collector-emitter leakage current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$	-	-	100	μA
I_{GES}	Gate leakage current, forward	$V_{GE}=20\text{V}, V_{CE}=0\text{V}$	-	-	100	nA
	Gate leakage current, reverse	$V_{GE}=-20\text{V}, V_{CE}=0\text{V}$	-	-	-100	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	$V_{GE}=V_{CE}, I_C=1\text{mA}$	5.0	6.0	7.0	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE}=15\text{V}, I_C=40\text{A}$	-	1.9	-	V
		$V_{GE}=15\text{V}, I_C=40\text{A}, T_{vj}=175^{\circ}\text{C}$	-	2.2	-	V

Dynamic characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
C_{ies}	Input capacitance	$V_{CE}=30\text{V}$ $V_{GE}=0\text{V}$ $f=1\text{MHz}$	-	9900	-	pF
C_{oes}	Output capacitance		-	189	-	pF
C_{res}	Reverse transfer capacitance		-	40	-	pF
Q_g	Total gate charge	$V_{CC}=960\text{V}$ $V_{GE}=15\text{V}$ $I_C=40\text{A}$	-	263	-	nC

Switching characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=600V$ $V_{GE}=0/15V$ $I_C=40A$ $R_G=10\Omega$ Inductive load	-	85	-	ns
t_r	Rise time		-	76	-	ns
$t_{d(off)}$	Turn-off delay time		-	307	-	ns
t_f	Fall time		-	69	-	ns
E_{on}	Turn-on energy		-	2.5	-	mJ
E_{off}	Turn-off energy		-	1.4	-	mJ
E_{ts}	Total switching energy		-	3.9	-	mJ
$t_{d(on)}$	Turn-on delay time		$V_{CC}=600V$ $V_{GE}=0/15V$ $I_C=40A$ $R_G=10\Omega$ Inductive load $T_{vj}=175^\circ C$	-	76	-
t_r	Rise time	-		75	-	ns
$t_{d(off)}$	Turn-off delay time	-		360	-	ns
t_f	Fall time	-		149	-	ns
E_{on}	Turn-on energy	-		2.9	-	mJ
E_{off}	Turn-off energy	-		2.6	-	mJ
E_{ts}	Total switching energy	-		5.5	-	mJ

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

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
V_F	Diode forward voltage	$I_F=40\text{A}$	-	2.0	-	V
		$I_F=40\text{A}, T_{vj}=175^{\circ}\text{C}$	-	1.6	-	V
t_{rr}	Diode reverse recovery time	$V_R=600\text{V}$ $I_F=40\text{A}$ $di_F/dt=-750\text{A}/\mu\text{s}$	-	175	-	ns
I_{rrm}	Diode peak reverse recovery current		-	24	-	A
Q_{rr}	Diode reverse recovery charge		-	2000	-	nC
t_{rr}	Diode reverse recovery time	$V_R=600\text{V}$ $I_F=40\text{A}$ $di_F/dt=-750\text{A}/\mu\text{s}$ $T_{vj}=175^{\circ}\text{C}$	-	285	-	ns
I_{rrm}	Diode peak reverse recovery current		-	37	-	A
Q_{rr}	Diode reverse recovery charge		-	5500	-	nC

Typical performance characteristics

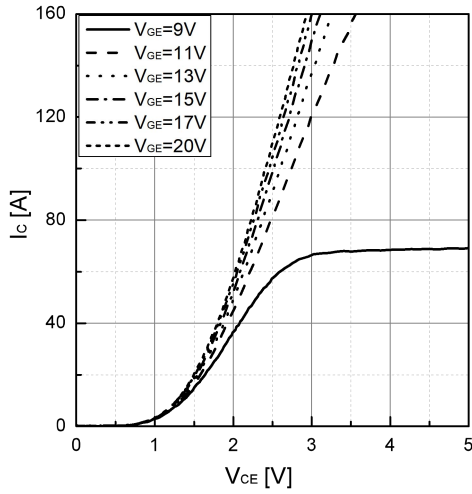


Fig 1. Typical output characteristic ($T_{vj}=25^{\circ}\text{C}$)

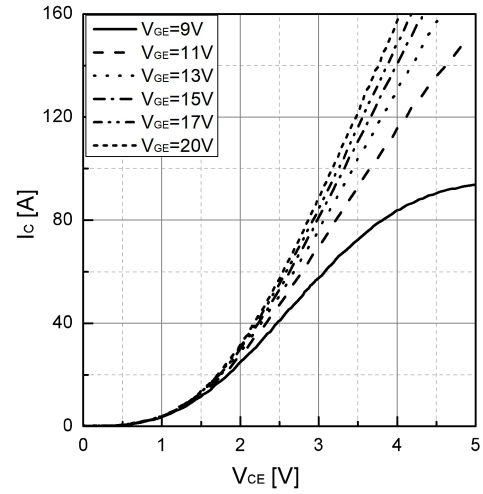


Fig 2. Typical output characteristic ($T_{vj}=175^{\circ}\text{C}$)

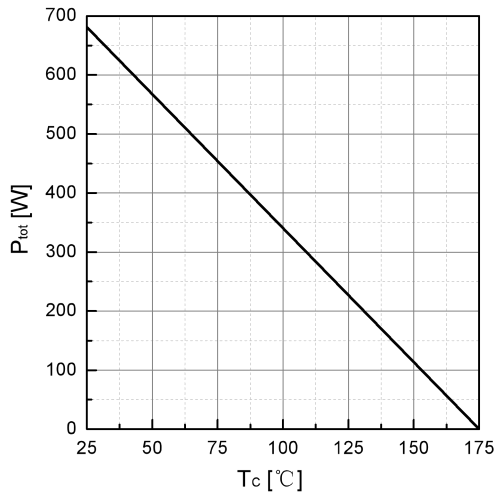


Fig 3. Power dissipation as a function of T_c

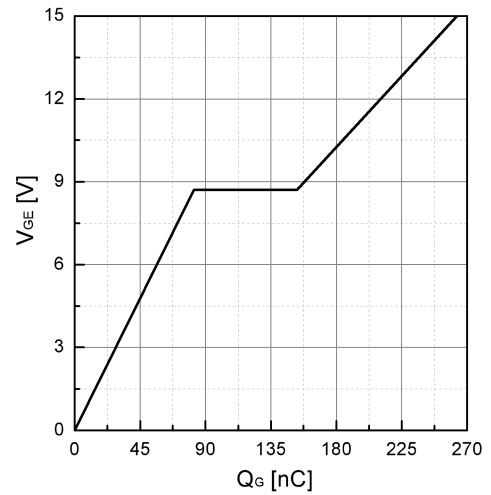


Fig 4. Typical Gate charge

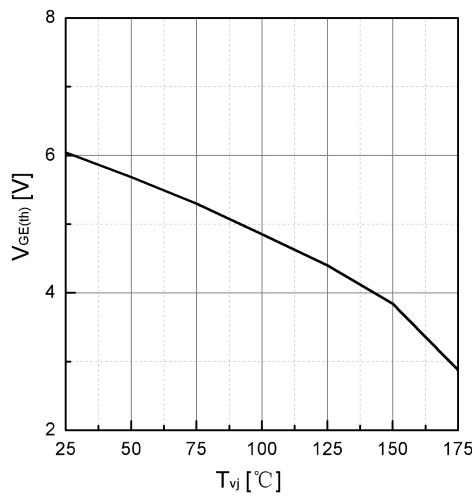


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj}
($I_C=1\text{mA}$)

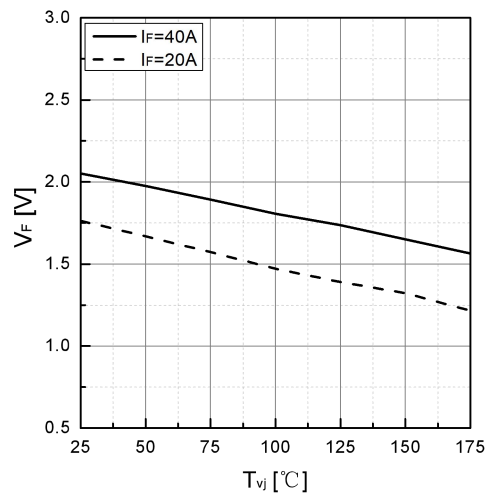


Fig 6. Typical V_F as a function of T_{vj}

Typical performance characteristics

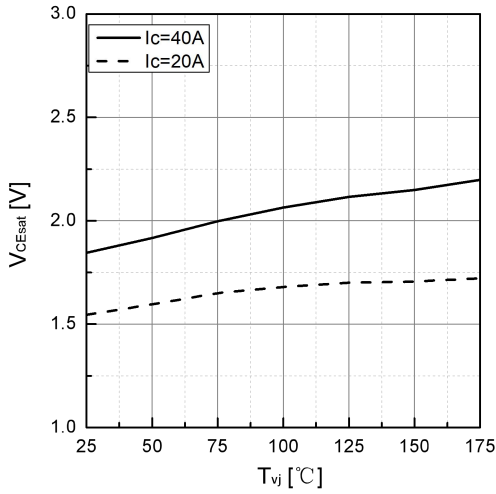


Fig 7. Typical V_{CEsat} as a function of T_{vj}

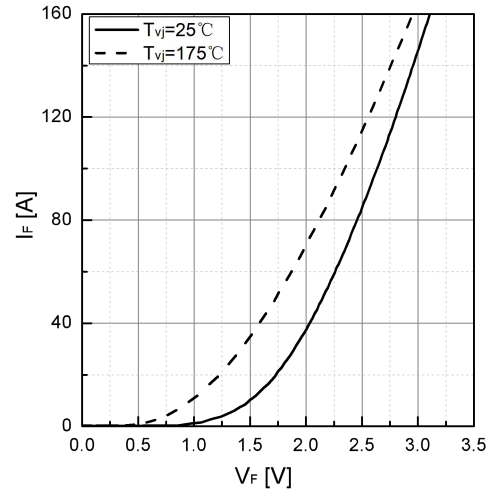


Fig 8. Typical I_F as a function of V_F

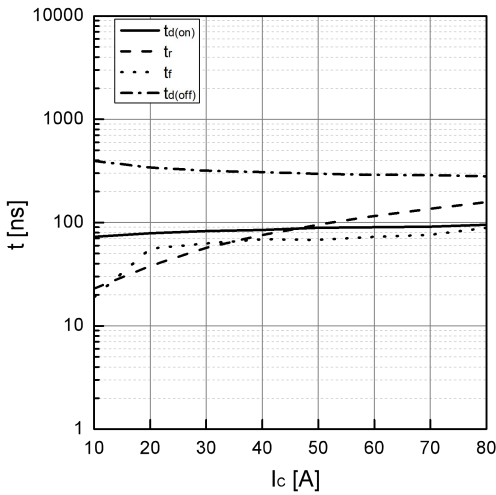


Fig 9. Typical switching time as a function of I_c

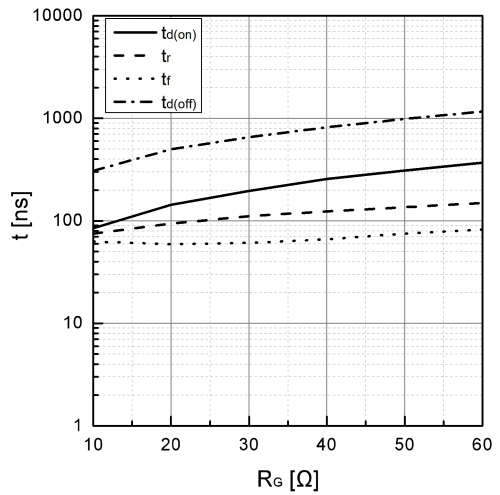


Fig 10. Typical switching times as a function of R_G

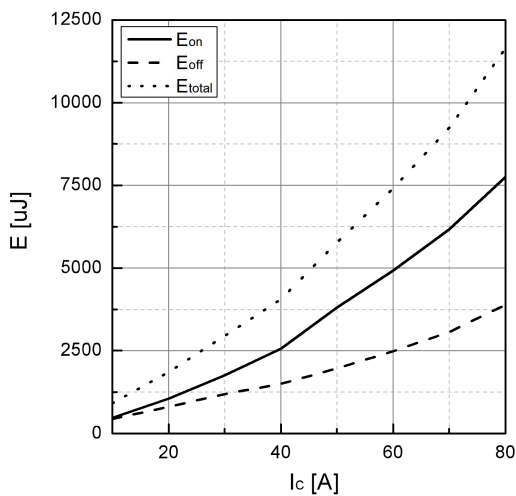


Fig 11. Typical switching energy losses as a function of I_c

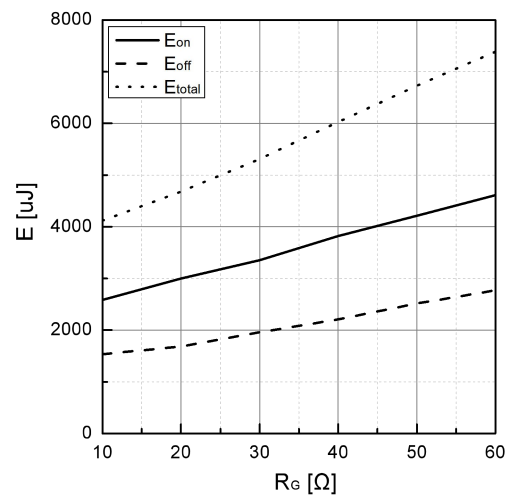


Fig 12. Typical switching energy losses as a function of R_G

Typical performance characteristics

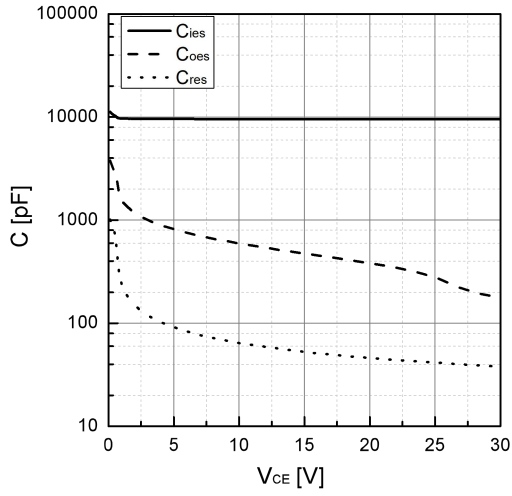


Fig 13. Typical capacitance as a function of V_{CE}
($f=1\text{MHz}$, $V_{GE}=0\text{V}$)

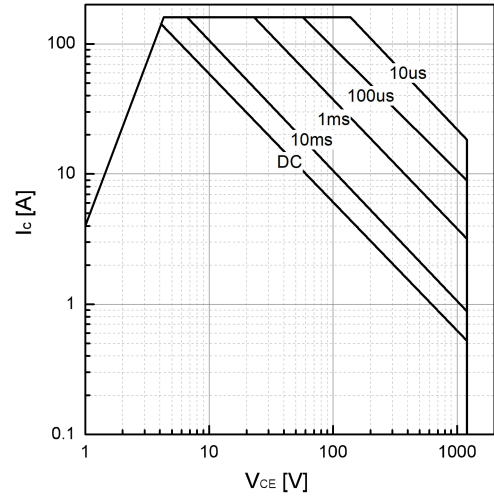


Fig 14. Safe operating area

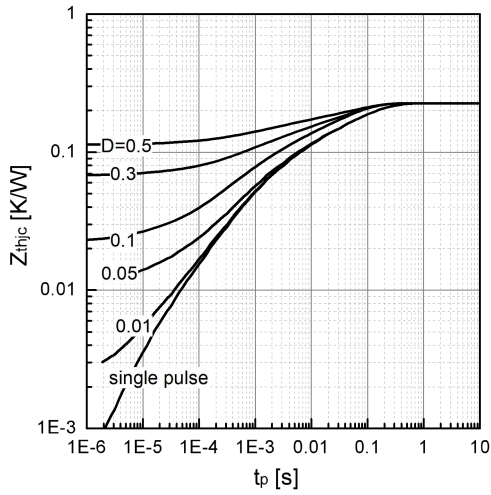
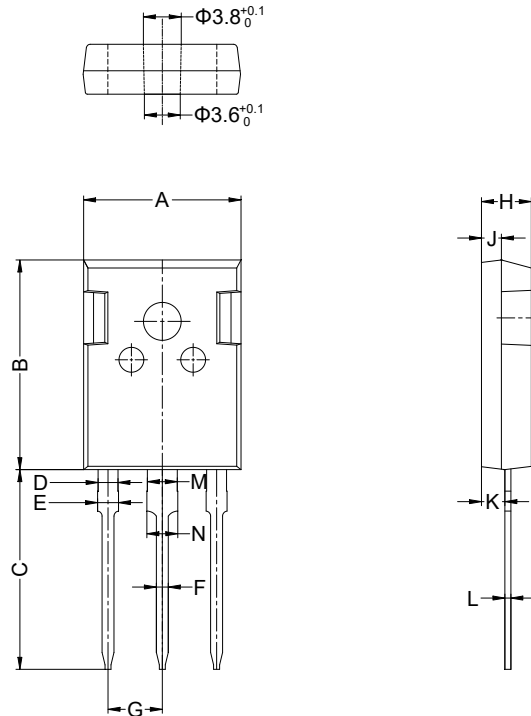


Fig 15. Transient thermal impedance of IGBT

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
2023-12-12	Rev. 1.0	Release of the datasheet.
2024-04-03	Rev. 1.1	Update
2024-05-17	Rev. 1.2	Update

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