

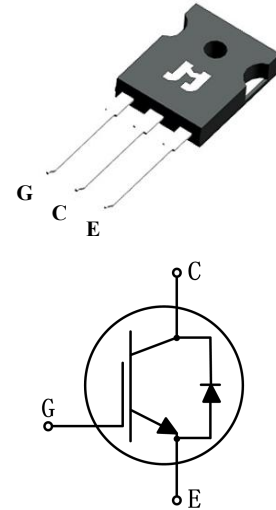
**Key performance:**

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

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
- PFC applications

**Package parameters**

Type	Marking	Package	Packaging Method
JJT40N120UE	T40120UE	TO-247	Tube

## Maximum ratings

Symbol	Parameter	Values	Unit
$V_{CES}$	Collector-emitter voltage	1200	V
$V_{GES}$	Gate-emitter voltage	$\pm 20$	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 ( $T_C=25^\circ\text{C}$ )	625	W
	Power dissipation ( $T_C=100^\circ\text{C}$ )	312	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	-	0.24	K/ W
$R_{th(j-c)}$	Thermal resistance, junction to case for Diode	-	0.67	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	$\mu\text{A}$
$I_{GES}$	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
		$V_{GE}=15\text{V}, I_C=40\text{A}, T_{vj}=175^{\circ}\text{C}$	-	2.3	-	V

**Dynamic characteristics**

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$C_{ies}$	Input capacitance	$V_{CE}=30\text{V}$ $V_{GE}=0\text{V}$ $f=1\text{MHz}$	-	9780	-	pF
$C_{oes}$	Output capacitance		-	140	-	pF
$C_{res}$	Reverse transfer capacitance		-	42	-	pF
$Q_g$	Total gate charge	$V_{CC}=960\text{V}$ $V_{GE}=15\text{V}$ $I_C=40\text{A}$	-	269	-	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	-	80	-	ns
$t_r$	Rise time		-	77	-	ns
$t_{d(off)}$	Turn-off delay time		-	308	-	ns
$t_f$	Fall time		-	67	-	ns
$E_{on}$	Turn-on energy		-	2.1	-	mJ
$E_{off}$	Turn-off energy		-	1.4	-	mJ
$E_{ts}$	Total switching energy		-	3.5	-	mJ
$t_{d(on)}$	Turn-on delay time		$V_{CC}=600V$ $V_{GE}=0/15V$ $I_C=40A$ $R_G=10\Omega$ Inductive load $T_{vj}=175^\circ C$	-	70	-
$t_r$	Rise time	-		75	-	ns
$t_{d(off)}$	Turn-off delay time	-		352	-	ns
$t_f$	Fall time	-		132	-	ns
$E_{on}$	Turn-on energy	-		2.5	-	mJ
$E_{off}$	Turn-off energy	-		2.4	-	mJ
$E_{ts}$	Total switching energy	-		4.9	-	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	$I_F=40\text{A}$	-	3.1	-	V
		$I_F=40\text{A}, T_{vj}=175^{\circ}\text{C}$	-	2.3	-	V
$t_{rr}$	Diode reverse recovery time	$V_R=600\text{V}$ $I_F=40\text{A}$ $di_F/dt=-750\text{A}/\mu\text{s}$	-	170	-	ns
$I_{rrm}$	Diode peak reverse recovery current		-	17	-	A
$Q_{rr}$	Diode reverse recovery charge		-	1100	-	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		-	28	-	A
$Q_{rr}$	Diode reverse recovery charge		-	3300	-	nC

## Typical performance characteristics

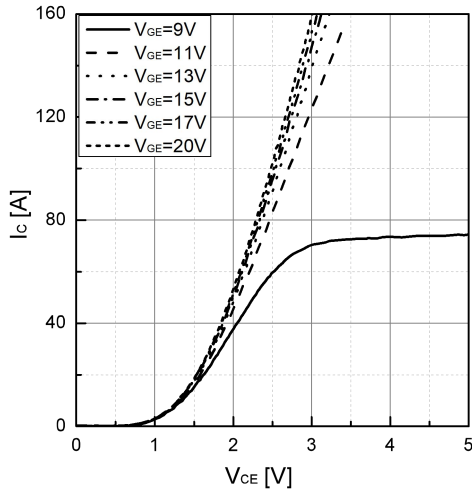


Fig 1. Typical output characteristic ( $T_{vj}=25^{\circ}\text{C}$ )

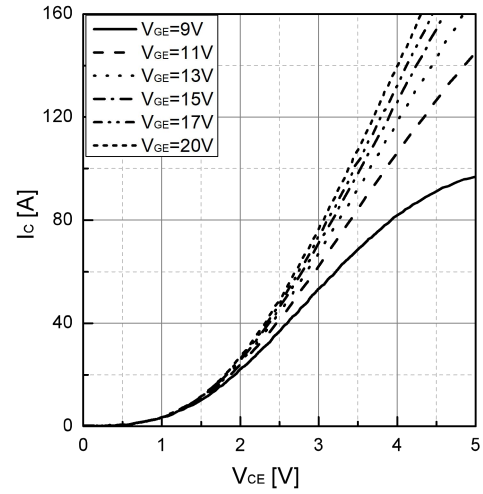


Fig 2. Typical output characteristic ( $T_{vj}=175^{\circ}\text{C}$ )

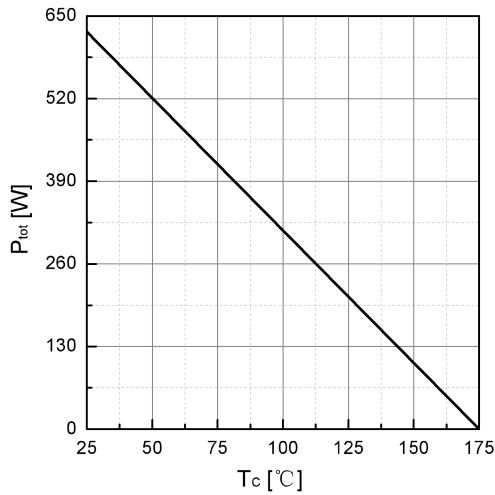


Fig 3. Power dissipation as a function of  $T_c$

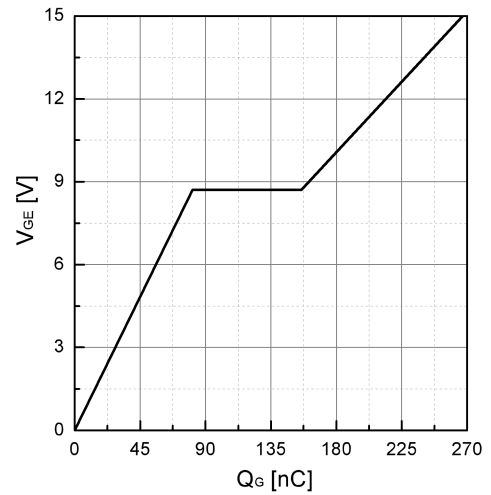


Fig 4. Typical Gate charge

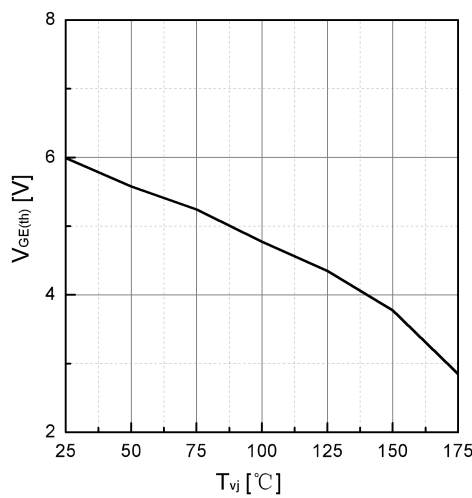


Fig 5. Typical  $V_{GE(th)}$  as a function of  $T_{vj}$   
( $I_C=1\text{mA}$ )

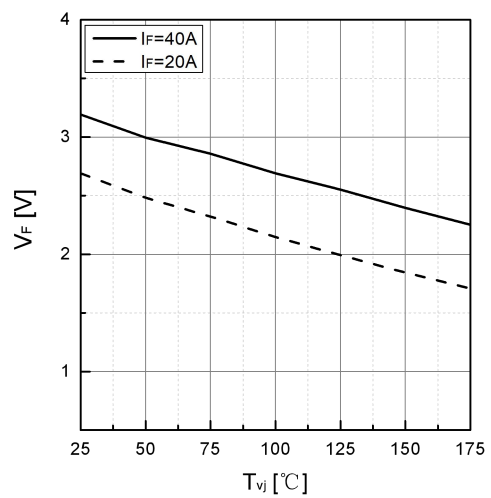


Fig 6. Typical  $V_F$  as a function of  $T_{vj}$

## Typical performance characteristics

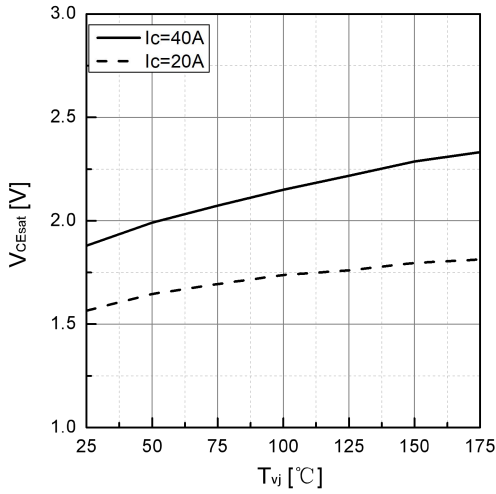


Fig 7. Typical  $V_{CEsat}$  as a function of  $T_{vj}$

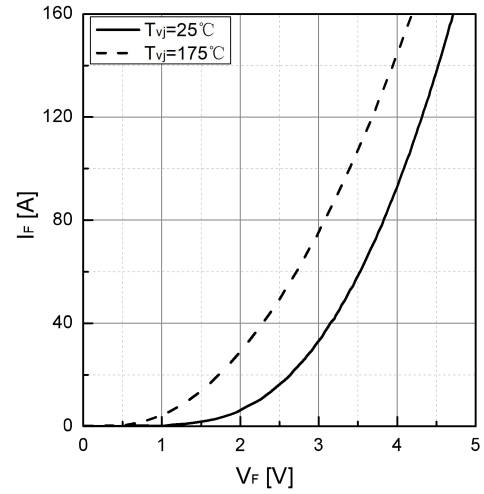


Fig 8. Typical  $I_F$  as a function of  $V_F$

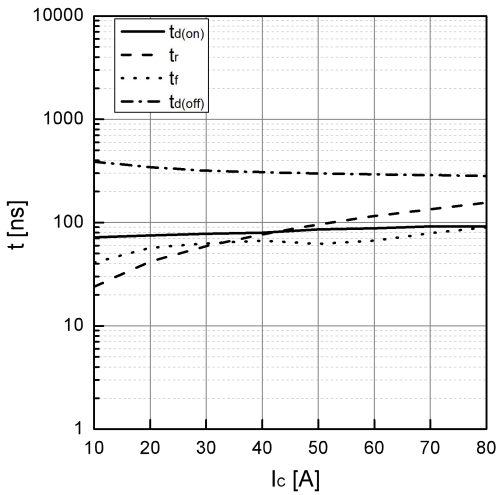


Fig 9. Typical switching time as a function of  $I_c$

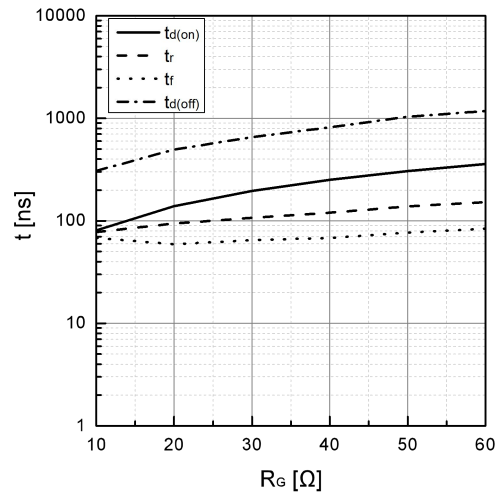


Fig 10. Typical switching times as a function of  $R_G$

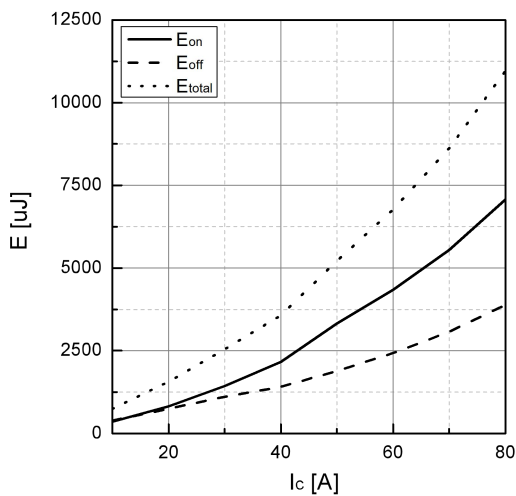


Fig 11. Typical switching energy losses as a function of  $I_c$

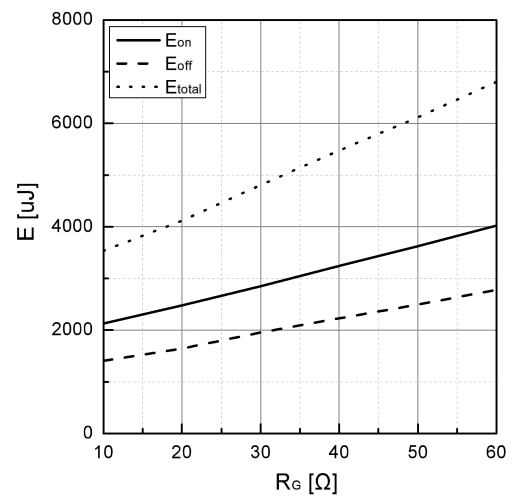


Fig 12. Typical switching energy losses as a function of  $R_G$

## Typical performance characteristics

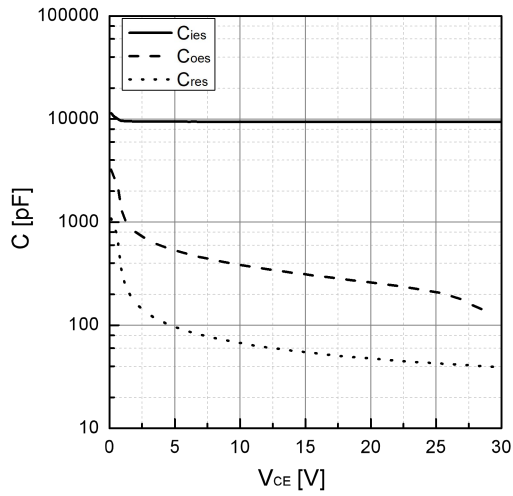


Fig 13. Typical capacitance as a function of  $V_{CE}$   
( $f=1\text{MHz}$ ,  $V_{GE}=0\text{V}$ )

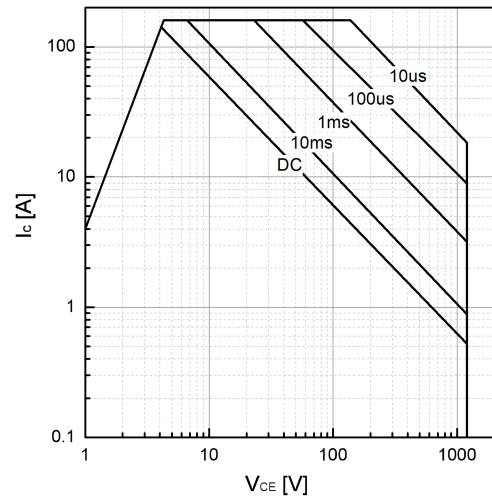


Fig 14. Safe operating area

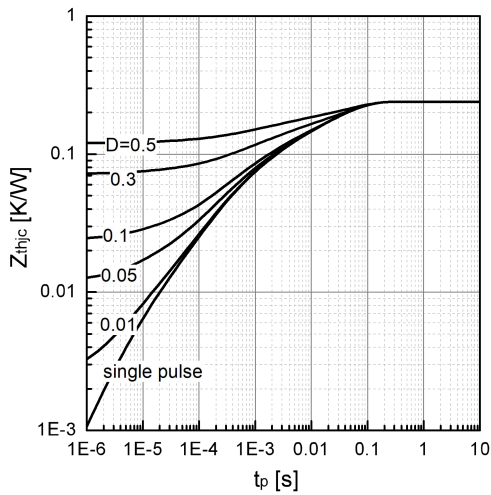
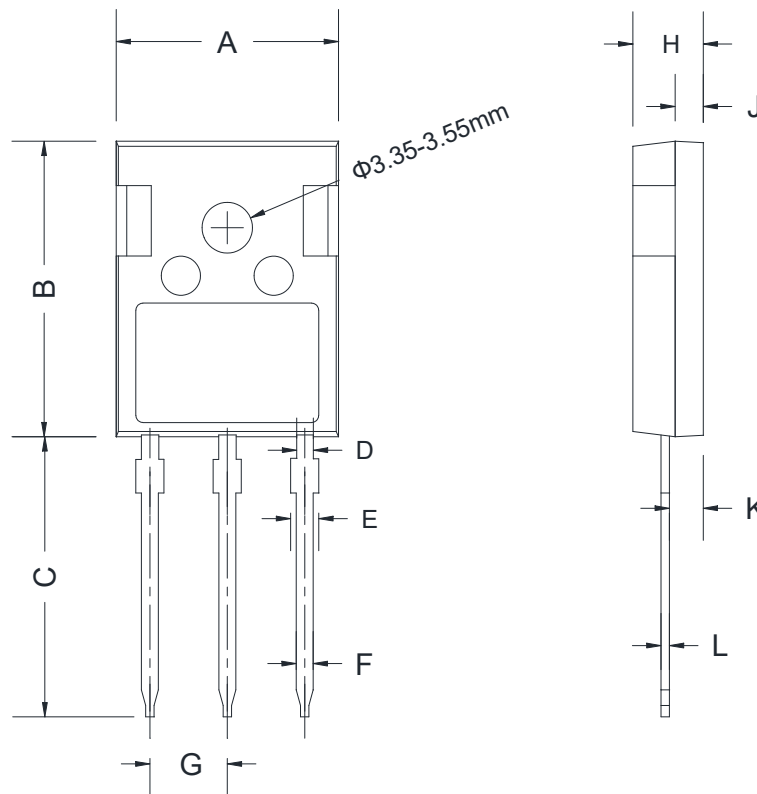


Fig 15. Transient thermal impedance of IGBT



**Package dimension**

TO-247



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	22.20	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	-	5.44	-	-	0.214	-
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

## Revision history

Date	Revision	Changes
2023-12-12	Rev. 1.0	Release of the datasheet.
2024-04-03	Rev. 1.1	Update

## Disclaimer

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