

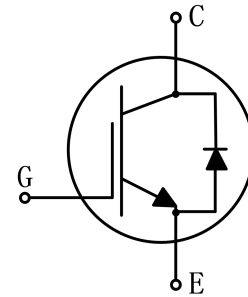
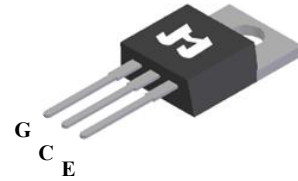
**Key performance:**

- $V_{CE}=650V$
- $I_C=20A@T_C=100^{\circ}C$
- $V_{CE(sat)}=1.6V$

TO-220

**Features:**

- High ruggedness performance.
- 10 $\mu$ s 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 ( $T_C=25^\circ\text{C}$ )	40	A
	Continuous collector current ( $T_C=100^\circ\text{C}$ )	20	A
$I_{CM}$	Pulsed collector current, $t_p$ limited by $T_{vjmax}$	80	A
$I_F$	Diode continuous forward current ( $T_C=100^\circ\text{C}$ )	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 ( $T_C=25^\circ\text{C}$ )	188	W
	Power dissipation ( $T_C=100^\circ\text{C}$ )	94	W
$T_{vj}$	Operating junction temperature range	-40 to +175	°C
$T_{stg}$	Storage temperature range	-55 to +150	°C

## 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** ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise specified)

**Static characteristics**

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$BV_{CES}$	Collector-emitter breakdown voltage	$V_{GE}=0\text{V}, I_C=250\mu\text{A}$	650	-	-	V
$I_{CES}$	Collector-emitter leakage current	$V_{CE}=650\text{V}, V_{GE}=0\text{V}$	-	-	50	$\mu\text{A}$
$I_{GES}$	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	$V_{GE}=V_{CE}, I_C=1\text{mA}$	5.2	5.7	6.2	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE}=15\text{V}, I_C=20\text{A}$	-	1.6	-	V
		$V_{GE}=15\text{V}, I_C=20\text{A}, T_{vj}=175^{\circ}\text{C}$	-	2.0	-	V

**Dynamic characteristics**

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

### Switching characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=400V$ $V_{GE}=0/15V$ $I_C=20A$ $R_G=10\Omega$ 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	$V_{CC}=400V$ $V_{GE}=0/15V$ $I_C=20A$ $R_G=10\Omega$ Inductive load $T_{vj}=175^\circ C$	-	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** ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise specified)

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$V_F$	Diode forward voltage	$I_F=20\text{A}$	-	1.6	-	V
		$I_F=20\text{A}, T_{vj}=175^{\circ}\text{C}$	-	1.2	-	V
$t_{rr}$	Diode reverse recovery time	$V_R=400\text{V}$ $I_F=20\text{A}$ $di_F/dt=-500\text{A}/\mu\text{s}$	-	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	$V_R=400\text{V}$ $I_F=20\text{A}$ $di_F/dt=-500\text{A}/\mu\text{s}$ $T_{vj}=175^{\circ}\text{C}$	-	90	-	ns
$I_{rrm}$	Diode peak reverse recovery current		-	19	-	A
$Q_{rr}$	Diode reverse recovery charge		-	1130	-	nC

## Typical performance characteristics

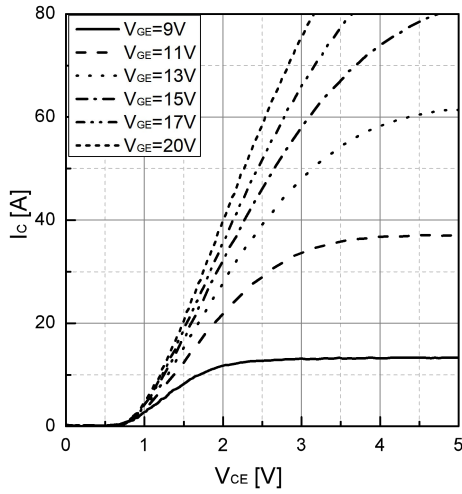


Fig 1. Typical output characteristic ( $T_{vj}=25^{\circ}\text{C}$ )

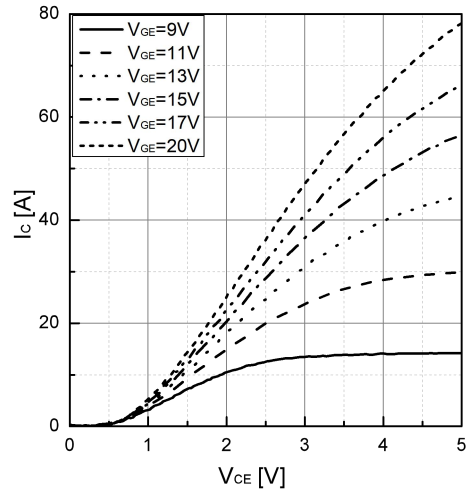


Fig 2. Typical output characteristic ( $T_{vj}=175^{\circ}\text{C}$ )

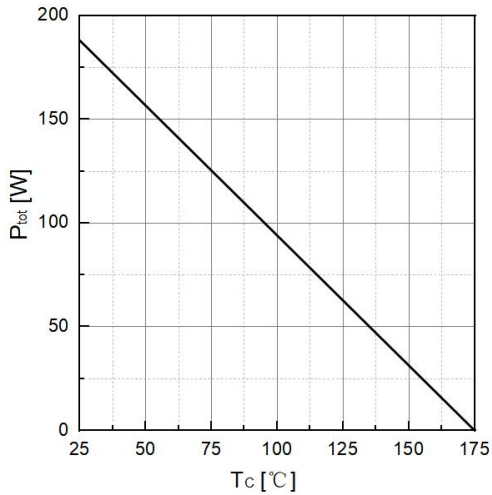


Fig 3. Power dissipation as a function of  $T_c$

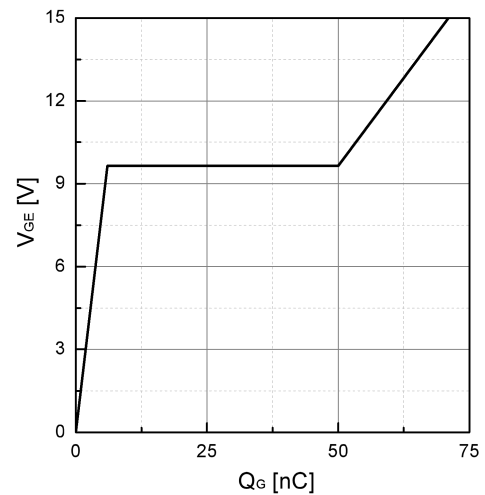


Fig 4. Typical Gate charge

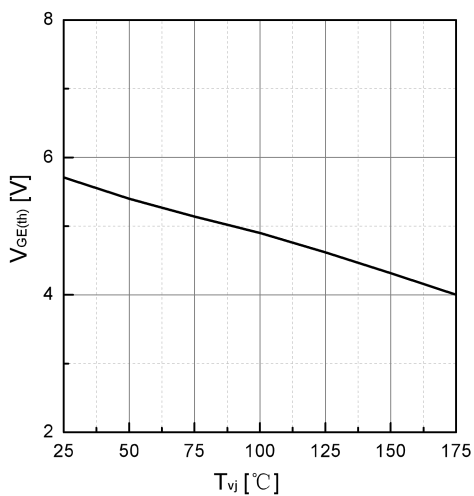


Fig 5. Typical  $V_{GE(th)}$  as a function of  $T_{vj}$   
( $I_C=1\text{mA}$ )

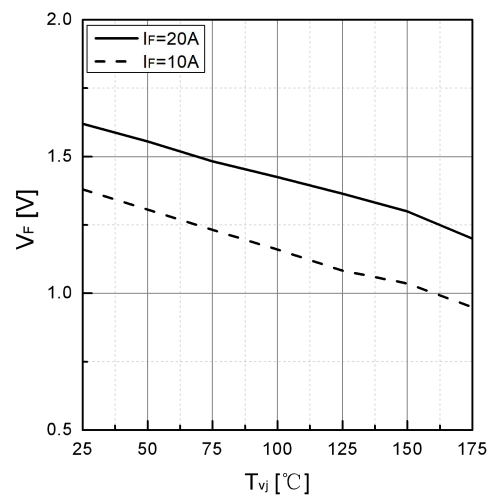


Fig 6. Typical  $V_F$  as a function of  $T_{vj}$

## Typical performance characteristics

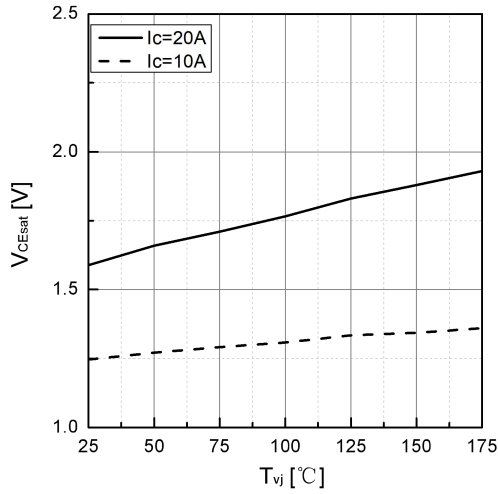


Fig 7. Typical  $V_{CEsat}$  as a function of  $T_{vj}$

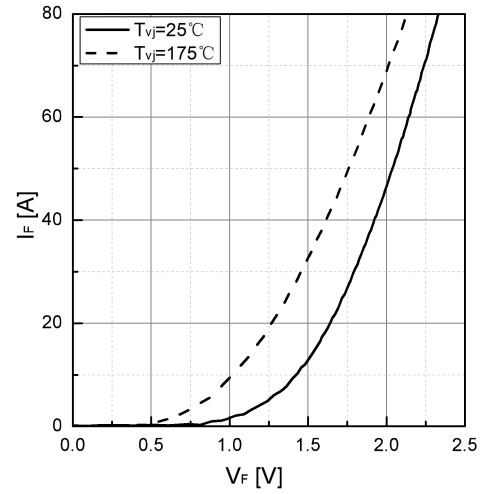


Fig 8. Typical  $I_F$  as a function of  $V_F$

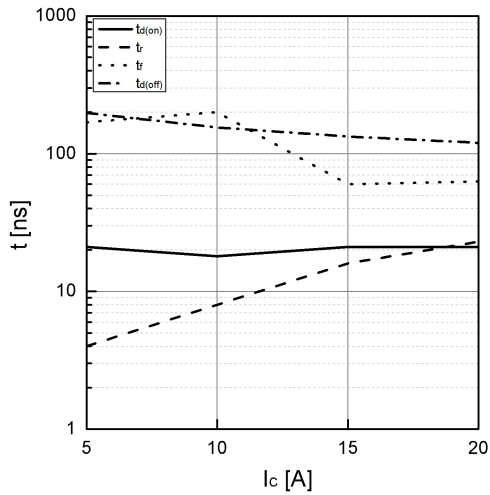


Fig 9. Typical switching time as a function of  $I_c$

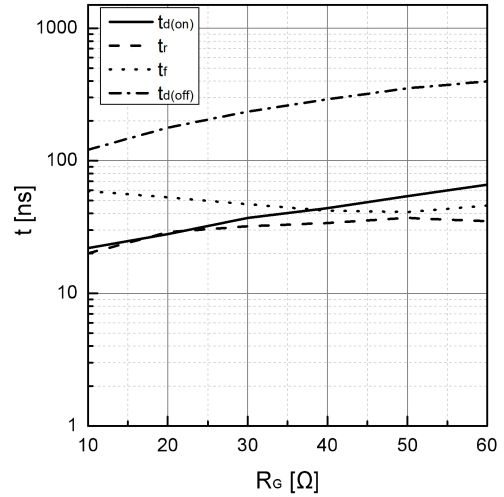


Fig 10. Typical switching times as a function of  $R_G$

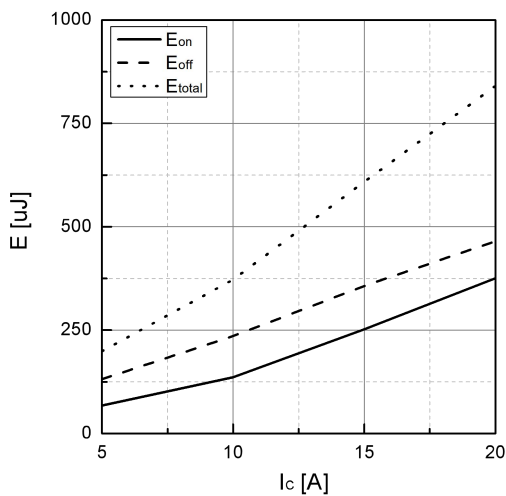


Fig 11. Typical switching energy losses as a function of  $I_c$

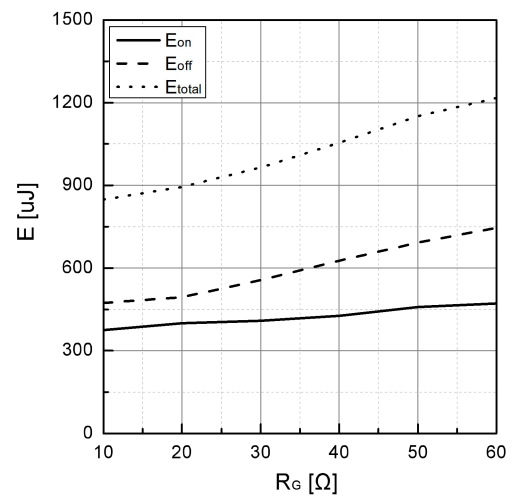


Fig 12. Typical switching energy losses as a function of  $R_G$

### Typical performance characteristics

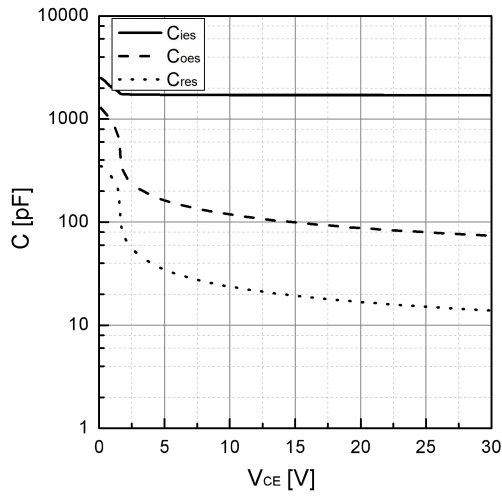


Fig 13. Typical capacitance as a function of  $V_{CE}$   
( $f=1\text{MHz}$ ,  $V_{GE}=0\text{V}$ )

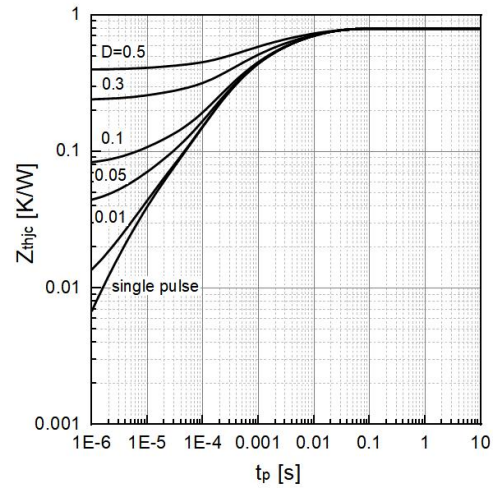
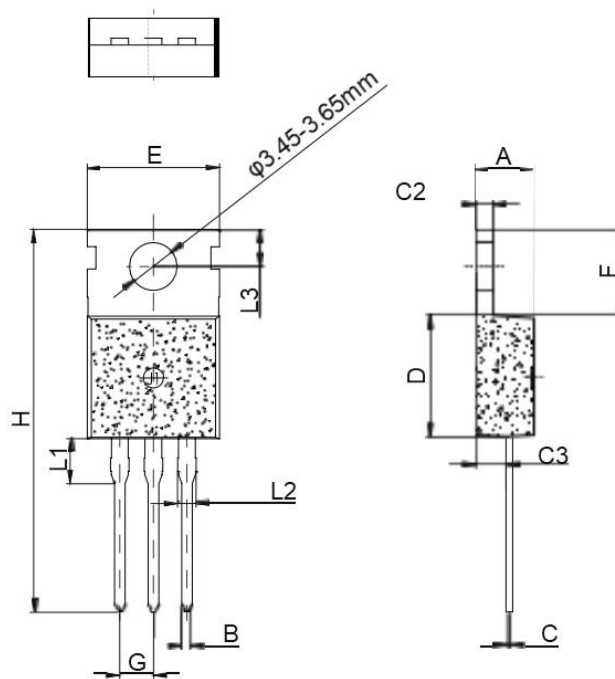


Fig 14. Transient thermal impedance, IGBT

**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

## Disclaimer

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