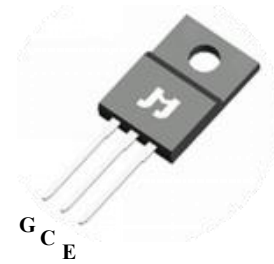


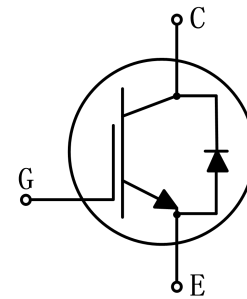
**Key performance:**

- $V_{CE}=650V$
- $I_C=10A@T_C=100^{\circ}C$
- $V_{CE(sat)}=1.8 V$

TO-220F


**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

**Package parameters**

Type	Marking	Package	Packaging method
JJT10N65SS	T1065SS	TO-220F	Tube

## Maximum ratings

Symbol	Parameter	Values	Unit
$V_{CES}$	Collector-emitter voltage	650	V
$V_{GES}$	Gate-emitter voltage	$\pm 20$	V
$I_C$	Continuous collector current ( $T_C=25^\circ\text{C}$ )	20	A
	Continuous collector current ( $T_C=100^\circ\text{C}$ )	10	A
$I_{CM}$	Pulsed collector current, $t_p$ limited by $T_{vjmax}$	40	A
$I_F$	Diode continuous forward current ( $T_C=100^\circ\text{C}$ )	10	A
$I_{FM}$	Diode maximum current, $t_p$ limited by $T_{vjmax}$	40	A
$t_{sc}$	Short circuit withstand time	10	$\mu\text{s}$
$P_{tot}$	Power dissipation ( $T_C=25^\circ\text{C}$ )	35	W
	Power dissipation ( $T_C=100^\circ\text{C}$ )	17	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	-	4.2	K/ W
$R_{th(j-c)}$	Thermal resistance, junction to case for Diode	-	5.6	K/ W
$R_{th(j-a)}$	Thermal resistance, junction to ambient	-	65	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	$V_{GE}=V_{CE}, I_C=250\mu\text{A}$	5.5	5.8	6.2	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE}=15\text{V}, I_C=10\text{A}$	-	1.8	-	V
		$V_{GE}=15\text{V}, I_C=10\text{A}, T_{vj}=150^{\circ}\text{C}$	-	2.1	-	V

**Dynamic characteristics**

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$C_{ies}$	Input capacitance	$V_{CE}=30\text{V}$ $V_{GE}=0\text{V}$ $f=1\text{MHz}$	-	670	-	pF
$C_{oes}$	Output capacitance		-	37	-	pF
$C_{res}$	Reverse transfer capacitance		-	10	-	pF
$Q_g$	Total gate charge	$V_{CC}=520\text{V}$ $V_{GE}=15\text{V}$ $I_C=10\text{A}$	-	28	-	nC

### Switching characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=400V$ $V_{GE}=0/15V$ $I_C=10A$ $R_G=10\Omega$ Inductive load	-	12	-	ns
$t_r$	Rise time		-	11	-	ns
$t_{d(off)}$	Turn-off delay time		-	71	-	ns
$t_f$	Fall time		-	74	-	ns
$E_{on}$	Turn-on energy		-	0.18	-	mJ
$E_{off}$	Turn-off energy		-	0.17	-	mJ
$E_{ts}$	Total switching energy		-	0.35	-	mJ
$t_{d(on)}$	Turn-on delay time	$V_{CC}=400V$ $V_{GE}=0/15V$ $I_C=10A$ $R_G=10\Omega$ Inductive load $T_{vj}=150^\circ C$	-	10	-	ns
$t_r$	Rise time		-	12	-	ns
$t_{d(off)}$	Turn-off delay time		-	86	-	ns
$t_f$	Fall time		-	112	-	ns
$E_{on}$	Turn-on energy		-	0.21	-	mJ
$E_{off}$	Turn-off energy		-	0.25	-	mJ
$E_{ts}$	Total switching energy		-	0.46	-	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	$I_F=10\text{A}$	-	1.4	-	V
		$I_F=10\text{A}, T_{vj}=150^{\circ}\text{C}$	-	1.2	-	V
$t_{rr}$	Diode reverse recovery time	$V_R=400\text{V}$ $I_F=10\text{A}$ $di_F/dt=-750\text{A}/\mu\text{s}$	-	57	-	ns
$I_{rrm}$	Diode peak reverse recovery current		-	12	-	A
$Q_{rr}$	Diode reverse recovery charge		-	411	-	nC
$t_{rr}$	Diode reverse recovery time	$V_R=400\text{V}$ $I_F=10\text{A}$ $di_F/dt=-750\text{A}/\mu\text{s}$ $T_{vj}=150^{\circ}\text{C}$	-	118	-	ns
$I_{rrm}$	Diode peak reverse recovery current		-	13	-	A
$Q_{rr}$	Diode reverse recovery charge		-	728	-	nC

## Typical performance characteristics

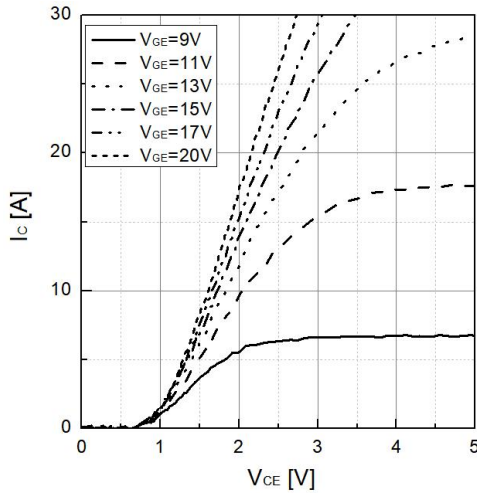


Fig 1. Typical output characteristic ( $T_{vj}=25^{\circ}\text{C}$ )

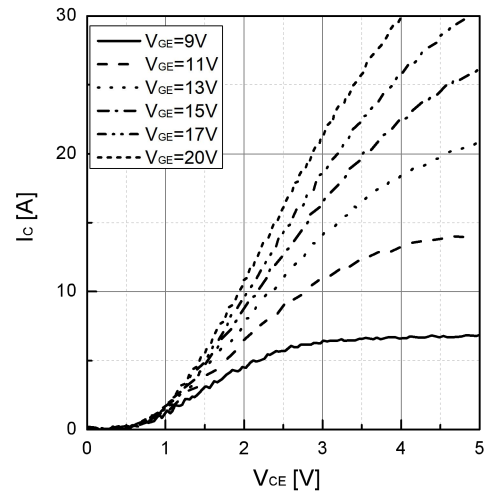


Fig 2. Typical output characteristic ( $T_{vj}=150^{\circ}\text{C}$ )

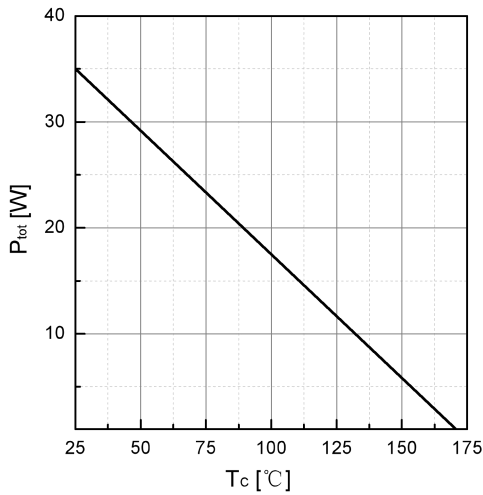


Fig 3. Power dissipation as a function of  $T_c$

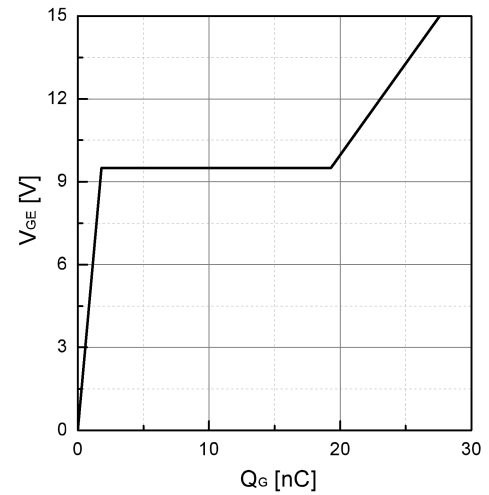


Fig 4. Typical Gate charge

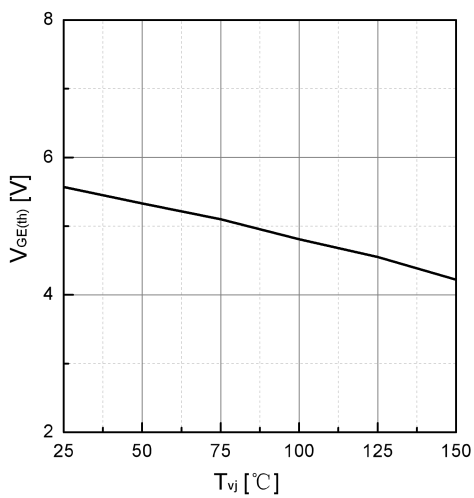


Fig 5. Typical  $V_{GE(th)}$  as a function of  $T_{vj}$   
( $I_C=1\text{mA}$ )

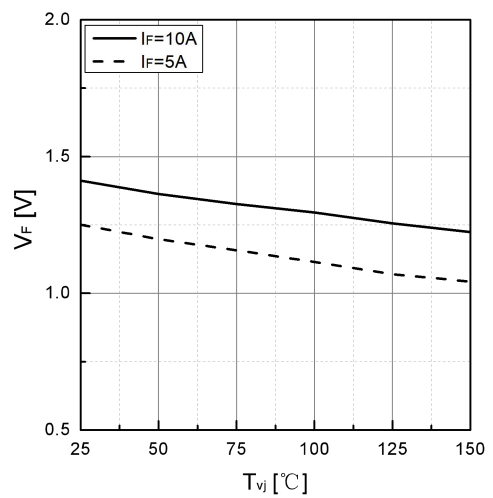


Fig 6. Typical  $V_F$  as a function of  $T_{vj}$

## Typical performance characteristics

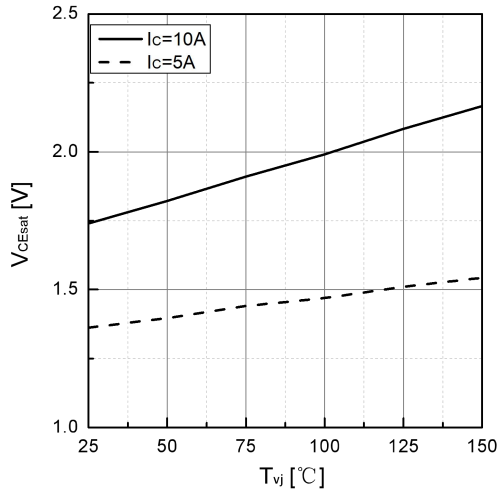


Fig 7. Typical  $V_{CEsat}$  as a function of  $T_{vj}$

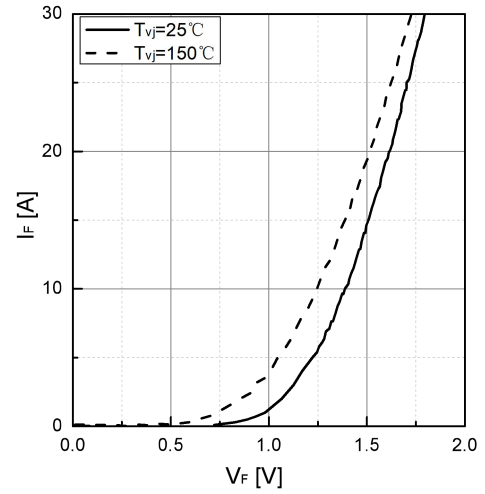


Fig 8. Typical  $I_F$  as a function of  $V_F$

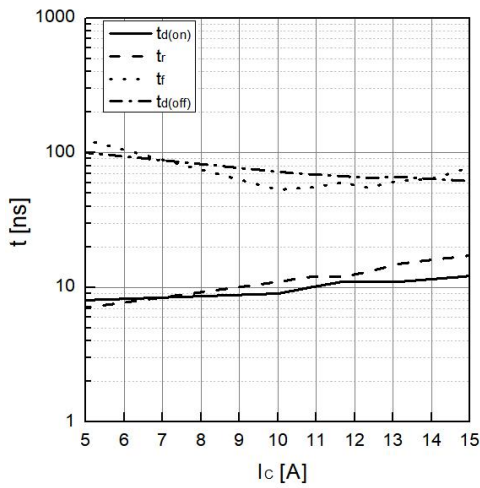


Fig 9. Typical switching time as a function of  $I_c$

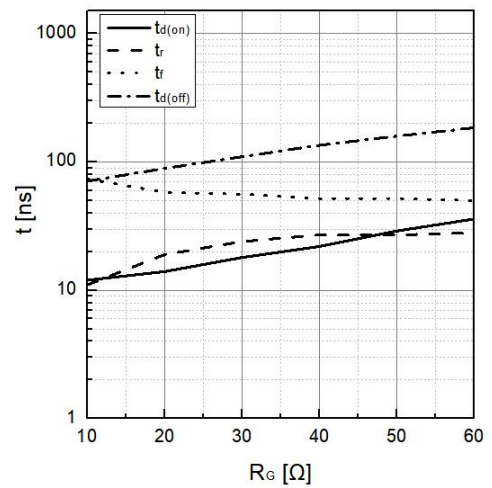


Fig 10. Typical switching times as a function of  $R_G$

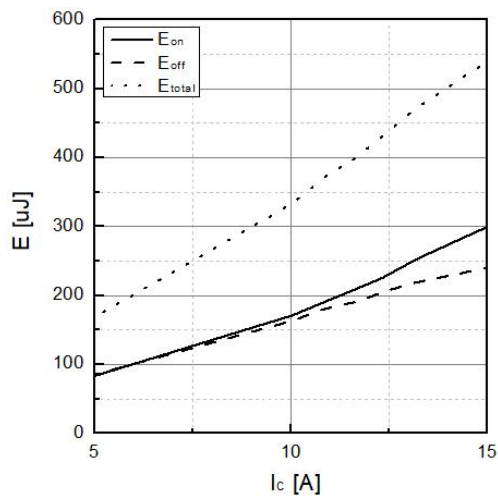


Fig 11. Typical switching energy losses as a function of  $I_c$

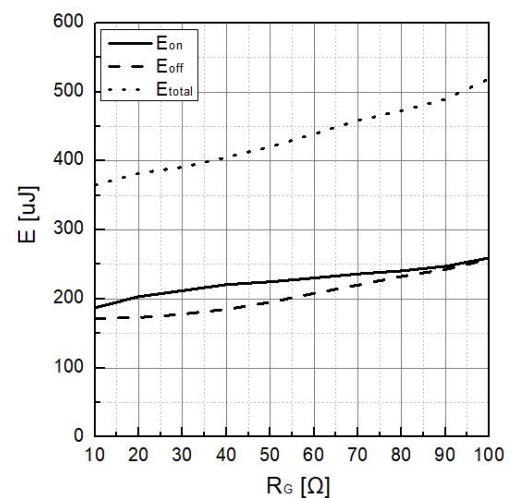


Fig 12. Typical switching energy losses as a function of  $R_G$

## Typical performance characteristics

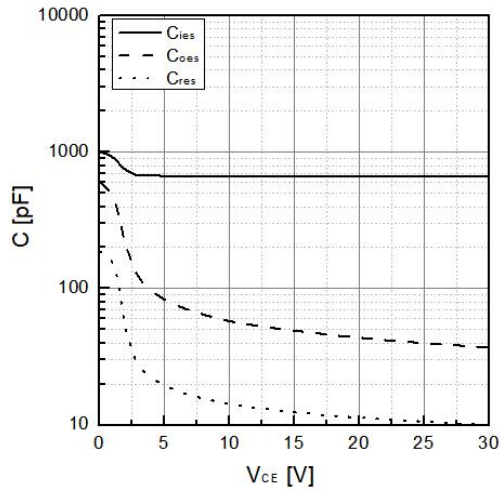
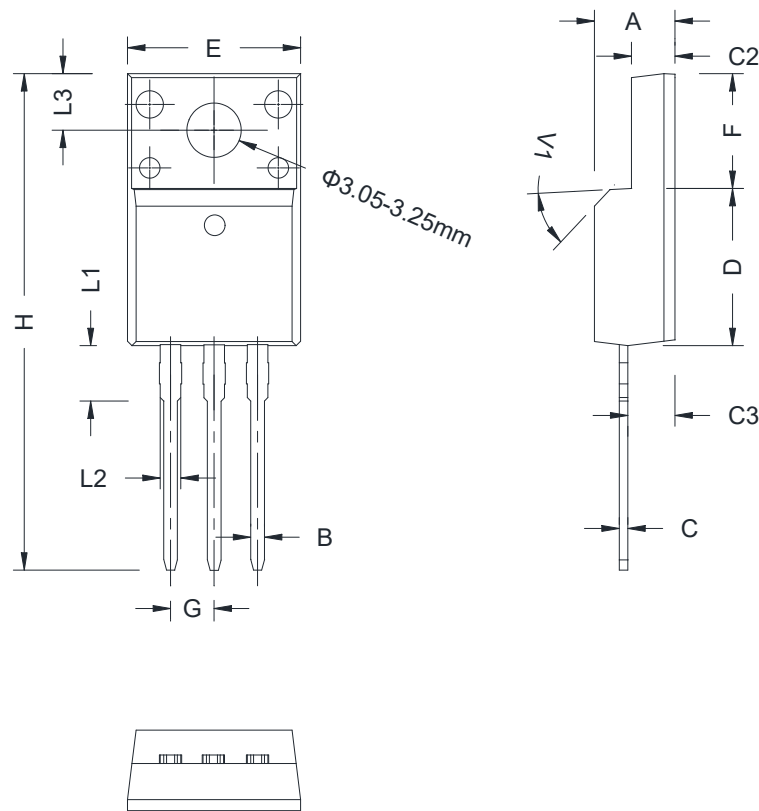


Fig 13. Typical capacitance as a function of  $V_{CE}$   
( $f=1\text{MHz}$ ,  $V_{GE}=0\text{V}$ )



**Package dimension**

TO-220F



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.50	-	4.90	0.177	-	0.193
B	0.74	0.80	0.83	0.029	0.031	0.033
C	0.47	-	0.66	0.019	-	0.026
C2	2.45	-	2.75	0.096	-	0.108
C3	2.60	-	3.00	0.102	-	0.118
D	8.80	-	9.30	0.346	-	0.366
E	9.80	-	10.40	0.386	-	0.410
F	6.40	-	6.80	0.252	-	0.268
G	2.40	-	2.70	0.094	-	0.106
H	28.0	-	29.80	1.102	-	1.173
L1	-	3.63	-	-	0.143	-
L2	1.14	-	1.70	0.045	-	0.067
L3	-	3.30	-	-	0.130	-
V1	-	45°	-	-	45°	-

## Revision history

Date	Revision	Changes
2023-12-23	Rev 1.0	Release of the datasheet

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