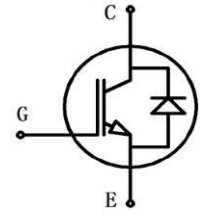
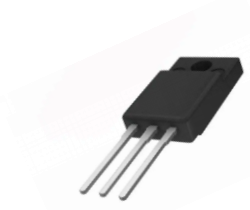


$$V_{CES} = 650V, I_C = 15A, V_{CE(sat)} = 1.6V$$

Features:

- High ruggedness performance
- 10 us short circuit capability
- Positive $V_{CE(sat)}$ temperature coefficient
- High efficiency for motor control
- Excellent current sharing in parallel operation
- RoHS compliant



TO-220F

Applications:

- Home appliances
- Motor drives
- General inverter

Absolute Maximum Ratings of IGBT ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Value	Unit
V_{CES}	Collector to Emitter Voltage		650	V
V_{GES}	Continuous Gate to Emitter Voltage		± 20	V
I_C	Continuous Collector Current	$T_C = 100^\circ\text{C}$	15	A
		$T_C = 25^\circ\text{C}$	30	A
I_{CM}	Pulse Collector Current	$t_p = 1\text{ms}$	60	A
P_D	Maximum Power Dissipation (IGBT)	$T_C = 25^\circ\text{C}, T_J = 175^\circ\text{C}$	150	W
t_{sc}	Short Circuit Withstand Time	$V_{CC} = 400V, V_{GE} \leq 15V$	10	μs

Absolute Maximum Ratings of Diode ($T_J = 25^\circ\text{C}$ unless otherwise noted)

V_{RRM}	Repetitive peak reverse voltage	$T_C = 25^\circ\text{C}$	650	V
I_F	Diode Continuous Forward Current	$T_C = 100^\circ\text{C}$	15	A
I_{FM}	Peak FWD Current Repetitive	$t_p = 1\text{ms}$	60	A

Electrical Characteristics of IGBT ($T_J = 25^\circ\text{C}$ unless otherwise noted)
Static characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C = 1\text{mA}, V_{CE} = V_{GE}, T_J = 25^\circ\text{C}$	5.4	5.6	5.9	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 15A, V_{GE} = 15V, T_J = 25^\circ\text{C}$	-	1.6	-	V
		$T_J = 175^\circ\text{C}$		1.9		
I_{CES}	Collector-Emitter Leakage Current	$V_{GE} = 0V, V_{CE} = V_{CES}, T_J = 25^\circ\text{C}$	-	-	0.1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE} = \pm 20V, V_{CE} = 0V, T_J = 25^\circ\text{C}$	-100	-	100	nA

C_{iss}	Input capacitance	$V_{CE}=30V,$ $V_{GE}=0V,$ $f=1MHz$	-	1055	-	pF
C_{oss}	Output capacitance		-	57	-	
C_{rss}	Reverse transfer capacitance		-	15	-	
Q_g	Total gate charge	$V_{CC}=520V$ $V_{GE}=15V$ $I_C=15A$	-	55	-	nC

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=400V,$ $I_C=15A,$ $V_{GE}=\pm 15V,$ $L=525\mu H,$ $R_G=10\Omega$	$T_J = 25^{\circ}C$		17		ns
			$T_J = 175^{\circ}C$		16		
t_r	Rise Time		$T_J = 25^{\circ}C$		14		ns
			$T_J = 175^{\circ}C$		15		
$t_{d(off)}$	Turn-off Delay Time		$T_J = 25^{\circ}C$		104		ns
			$T_J = 175^{\circ}C$		119		
t_f	Fall Time		$T_J = 25^{\circ}C$		46		ns
			$T_J = 175^{\circ}C$		81		
E_{on}	Turn-on Switching Loss		$T_J = 25^{\circ}C$		0.3		mJ
			$T_J = 175^{\circ}C$		0.38		
E_{off}	Turn-off Switching Loss		$T_J = 25^{\circ}C$		0.27		mJ
			$T_J = 175^{\circ}C$		0.4		
$R_{\theta JC}$	Junction-To-Case (IGBT)					1.0	K/W

Electrical Characteristics of Diode ($T_J = 25^\circ C$ unless otherwise noted)
Static characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{FM}	Forward Voltage	$I_F=15A, V_{GE}=0V$	$T_J = 25^\circ C$		1.4		V
			$T_J = 150^\circ C$		1.2		

Switching Characteristics

I _{RM}	Peak Reverse Recovery Current	I _F =15A, V _{CC} =400V, V _{GE} =-15V, L=525uH, R _G =10Ω	T _J = 25°C		9.5		A	
			T _J = 175°C		15			
Q _{rr}	Reverse Recovery Charge			T _J = 25°C		220		nC
				T _J = 175°C		450		
t _{rr}	Reverse Recovery Energy			T _J = 25°C		55		ns
				T _J = 175°C		75		
R _{θJC}	Junction-To-Case (Diode)					1.5	K/W	

Module Characteristics

T_J	Maximum Junction Temperature			175	$^\circ C$
T_{JOP}	Maximum Operating Junction Temperature Range	-40		+175	$^\circ C$
T_{stg}	Storage Temperature	-55		+150	$^\circ C$

Typical performance characteristics

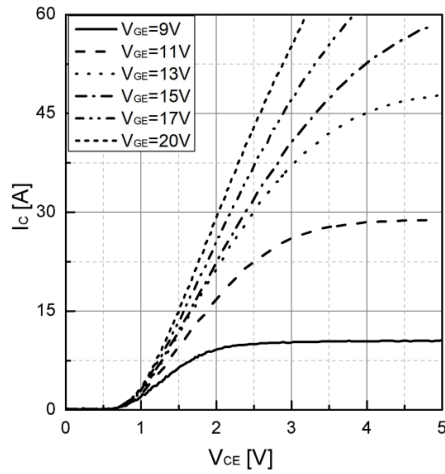


Fig 1. Typical output characteristic ($T_{vj}=25^{\circ}\text{C}$)

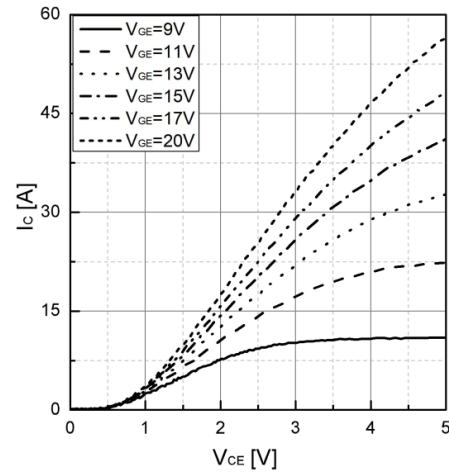


Fig 2. Typical output characteristic ($T_{vj}=175^{\circ}\text{C}$)

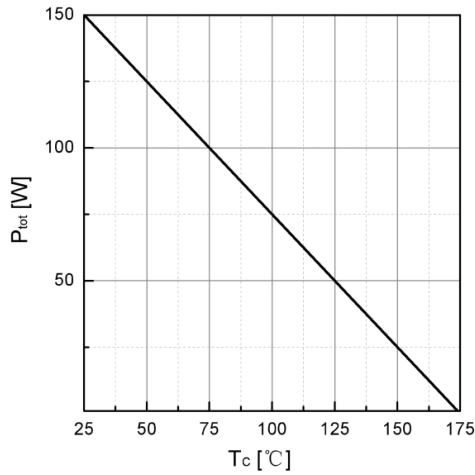


Fig 3. Power dissipation as a function of T_c

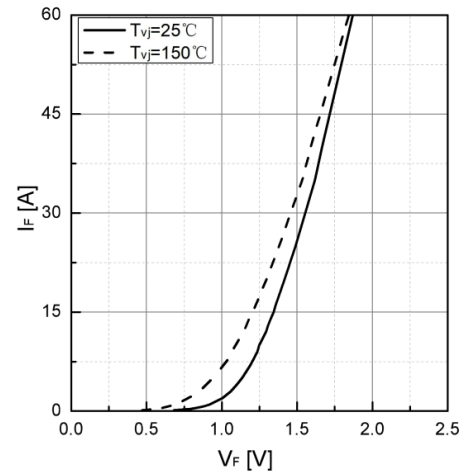


Fig 4. Typical I_F as a function of V_F

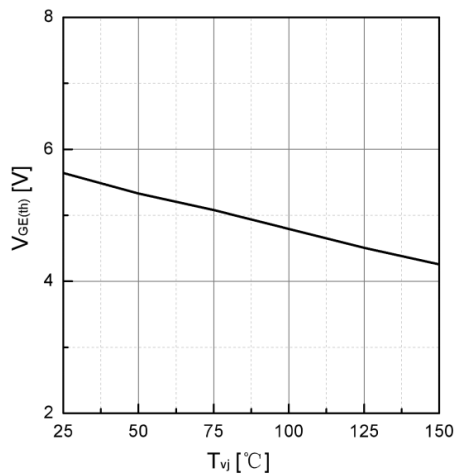


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj}
($I_C=1\text{mA}$)

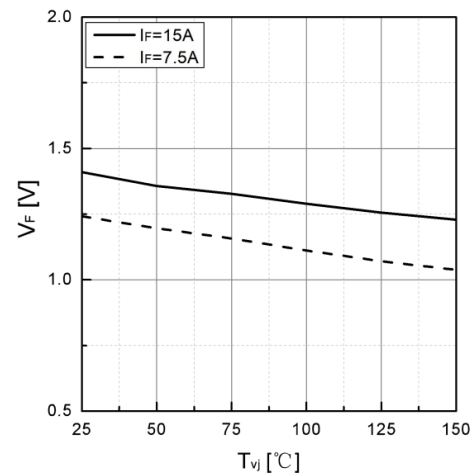


Fig 6. Typical V_F as a function of T_{vj}

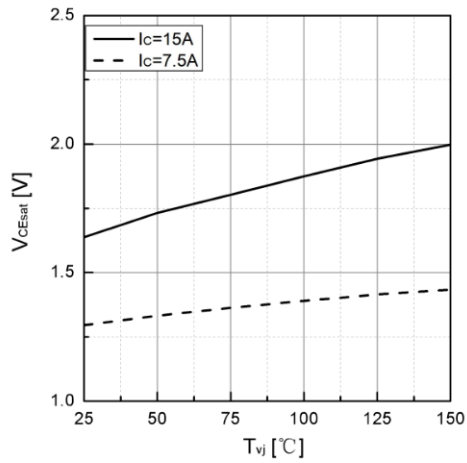


Fig 7. Typical V_{CEsat} as a function of T_{vj}

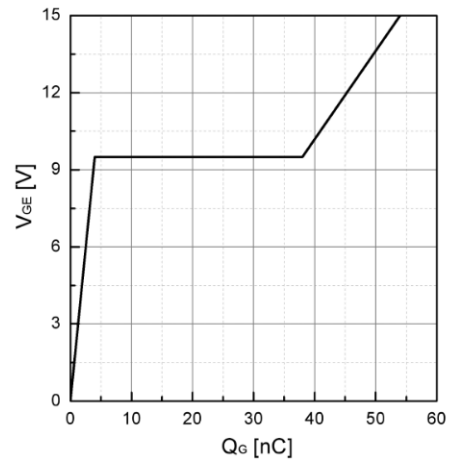


Fig 8. Typical Gate charge

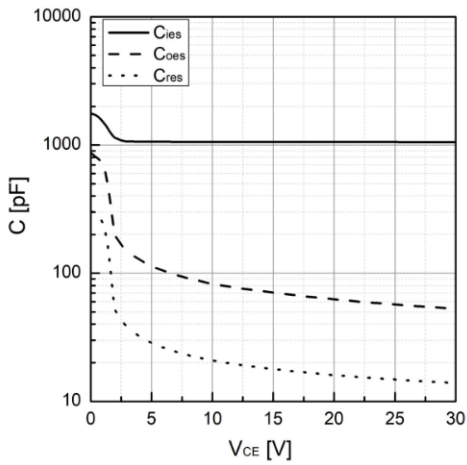


Fig 9. Typical capacitance as a function of V_{CE}
($f=1\text{MHz}$, $V_{GE}=0\text{V}$)

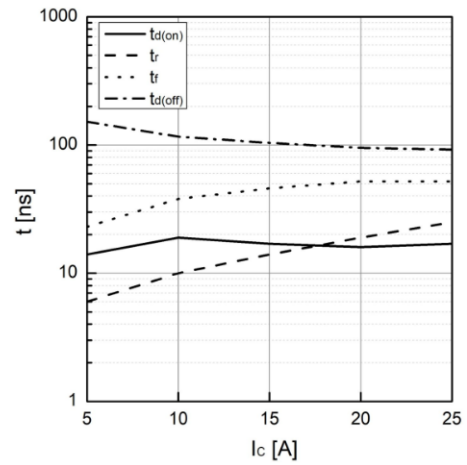


Fig 10. Typical switching times as a function of I_C

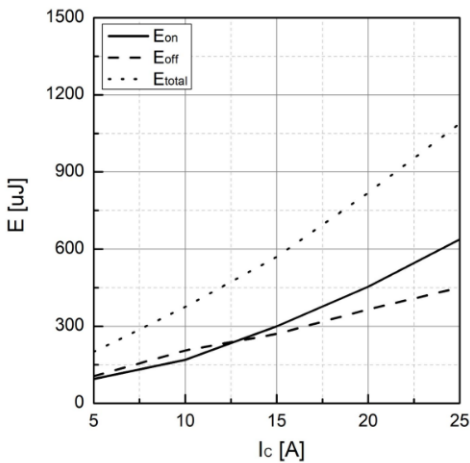


Fig 11. Typical switching energy losses as a function of I_C

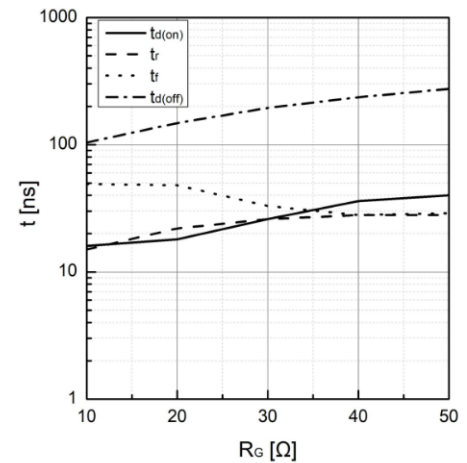


Fig 12. Typical switching times as a function of R_G

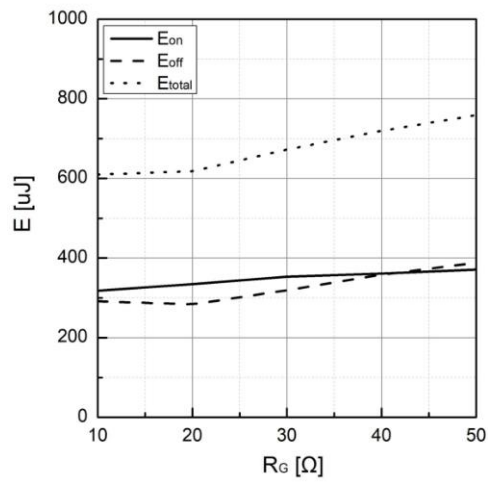


Fig 13. Typical switching energy losses as a function of R_G

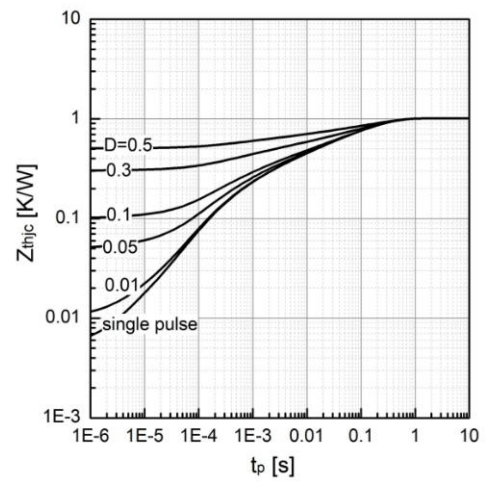
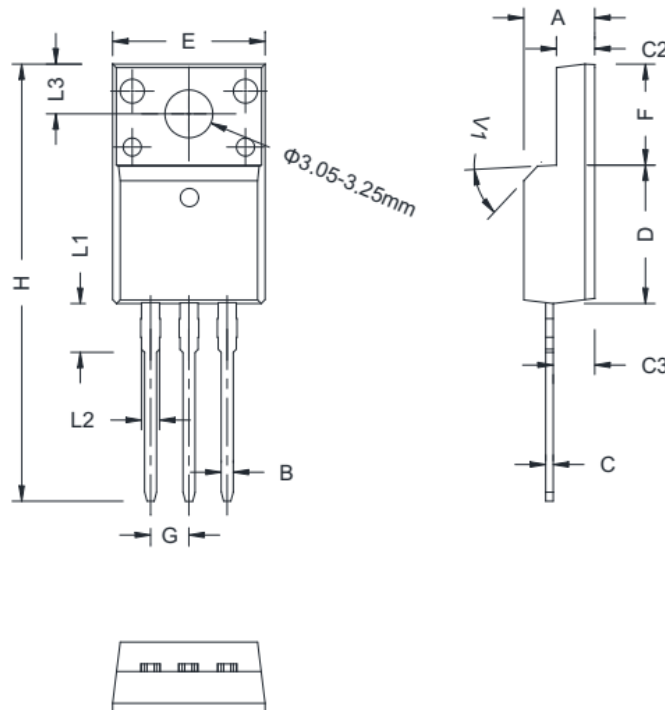


Fig 14. Transient thermal impedance, IGBT

Package Outline:

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°	-

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