



# Silicon FS Planar IGBT



## BT15N60A9F

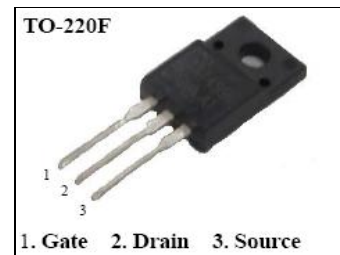
### General Description:

Using HUAJING's proprietary Planar design and advanced FS technology, the 600V FSIGBT offers superior conduction and switching performances, high avalanche ruggedness and easy parallel operation.

$V_{CES}$	600	V
$I_C$	15	A
$P_{tot}$ ( $T_C=25^\circ\text{C}$ )	25	W
$V_{CE(SAT)}$	2.1	V

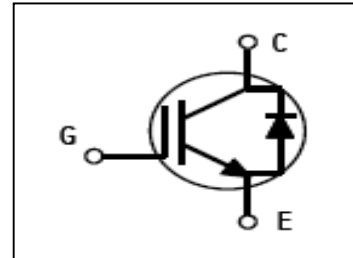
### Features:

- I FS Planar Technology, Positive temperature coefficient
- I Low saturation voltage:  $V_{CE(sat)}$ , typ = 2.1V  
@  $I_C = 15\text{A}$  and  $T_C = 25^\circ\text{C}$
- I Extremely enhanced avalanche capability



### Applications:

Aircondition、Welding、UPS...



### Absolute Maximum Ratings

( $T_C = 25^\circ\text{C}$  unless otherwise specified):

Symbol	Parameter	Rating	Units
$V_{CES}$	Collector-Emitter Voltage	600	V
$V_{GES}$	Gate- Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current	30	A
	Collector Current @TC = 100 °C	15	A
$I_F$	Diode Continuous Forward Current @TC = 100 °C	10	A
$I_{FM}$	Diode Maximum Forward Current	40	A
$P_D$	Power Dissipation @ TC = 25°C	25	W
	Power Dissipation @TC = 100 °C	5	W
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range	-55 to +150	°C

### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction to case for IGBT	--	5	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to case for Diode	--	7	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	--	62.5	$^{\circ}\text{C}/\text{W}$

### Electrical Characteristics of the IGBT ( $T_c = 25^{\circ}\text{C}$ unless otherwise specified):

OFF Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE}=0\text{V}, I_{CE}=250\mu\text{A}$	600	--	--	V
$I_{CES}$	Collector-Emitter Leakage Current	$V_{GE}=0\text{V}, V_{CE}=V_{CES}$	--	--	1.0	mA
$I_{GES(F)}$	Gate to Emitter Forward Leakage	$V_{GE}=+20\text{V}$	--	--	+250	nA
$I_{GES(R)}$	Gate to Source Reverse Leakage	$V_{GE}=-20\text{V}$	--	--	-250	nA

ON Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=15\text{A}, V_{GE}=15\text{V}$	--	2.1	2.6	V
$V_{GE(TH)}$	Gate Threshold Voltage	$I_C=1\text{mA}, V_{CE}=V_{GE}$	3.5	4.8	6.5	V

Pulse width  $t_p \leq 380\mu\text{s}, \delta \leq 2\%$

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}$ $f=1\text{MHz}$	--	630	--	pF
$C_{oes}$	Output Capacitance		--	94	--	
$C_{res}$	Reverse Transfer Capacitance		--	23	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$V_{CE}=390\text{V}, I_C=5\text{A}$ $V_{GE}=15\text{V}, R_g=10\Omega$ Inductive Load ,	--	16	--	ns
$t_r$	Rise Time		--	18	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	113	--	

$t_f$	Fall Time	$T_a=25^\circ\text{C}$	--	36	--	uJ
$E_{on}$	Turn-On Switching Loss		--	116.5	--	
$E_{off}$	Turn-Off Switching Loss		--	22.5	--	
$E_{ts}$	Total Switching Loss		--	139	--	
$Q_g$	Total Gate Charge	$V_{CE}=390\text{V}, I_C=5\text{A}$ $V_{GE}=15\text{V}$	--	38	--	nC
$Q_{ge}$	Gate to Emitter Charge		--	5	--	
$Q_{gc}$	Gate to Collector Charge		--	18	--	

**Electrical Characteristics of the DIODE** ( $T_c=25^\circ\text{C}$  unless otherwise specified):

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$V_{FM}$	Diode Forward Voltage	$I_F=10\text{A}$	--	1.4	2.2	V
$T_{rr}$	Reverse Recovery Time	$I_F=5\text{A}$ $di/dt=100\text{A}/\mu\text{s}$	--	90		ns
$I_{rr}$	Diode Peak Reverse Recovery Current		--	2.4		A
$Q_{rr}$	Reverse Recovery Charge		--	104		nC
Pulse width $t_p \leq 380\mu\text{s}, \delta \leq 2\%$						

<sup>a1</sup>: Repetitive rating; pulse width limited by maximum junction temperature

Figure1. Output characteristics

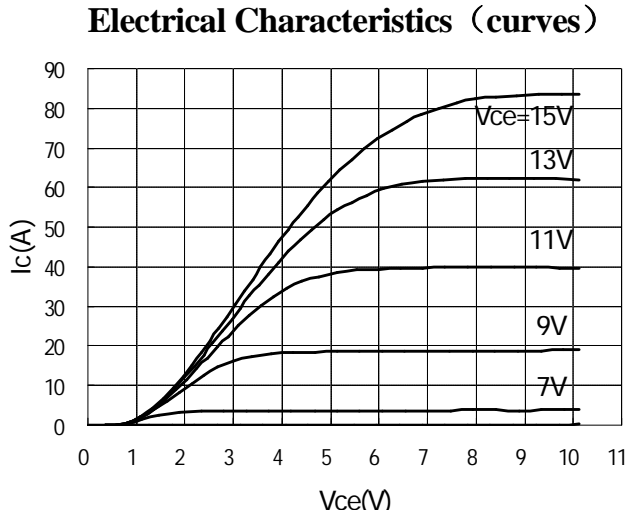


Figure2. Transfer characteristics

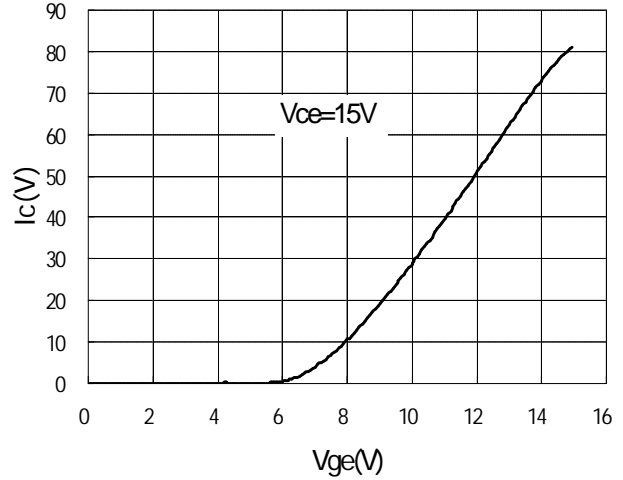


Figure3. Transconductance

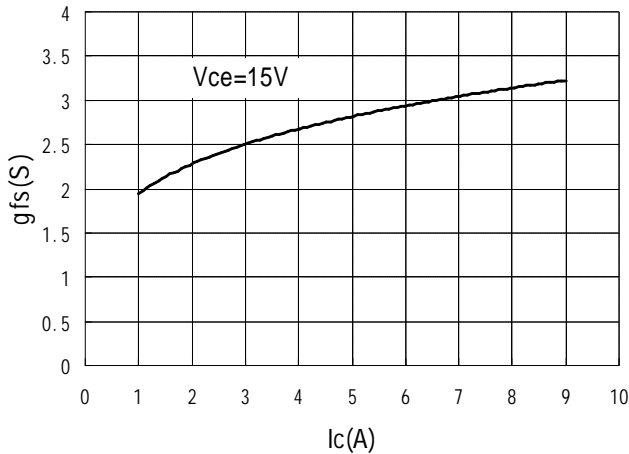


Figure4. Gate charge vs G-S voltage

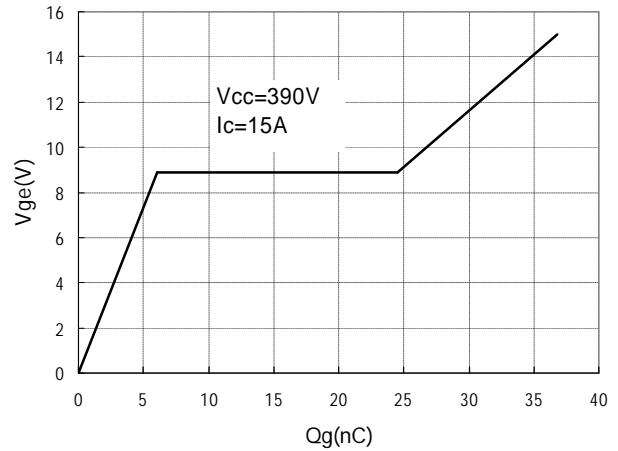


Figure5. Capacitance variations

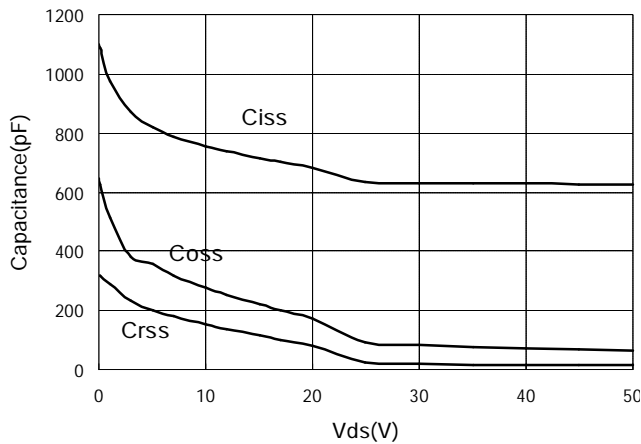
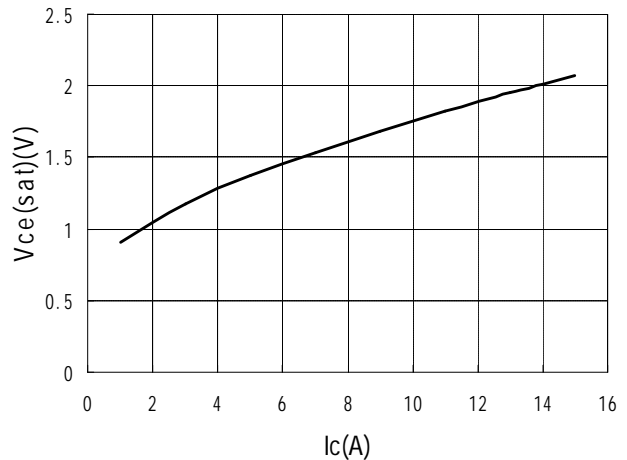
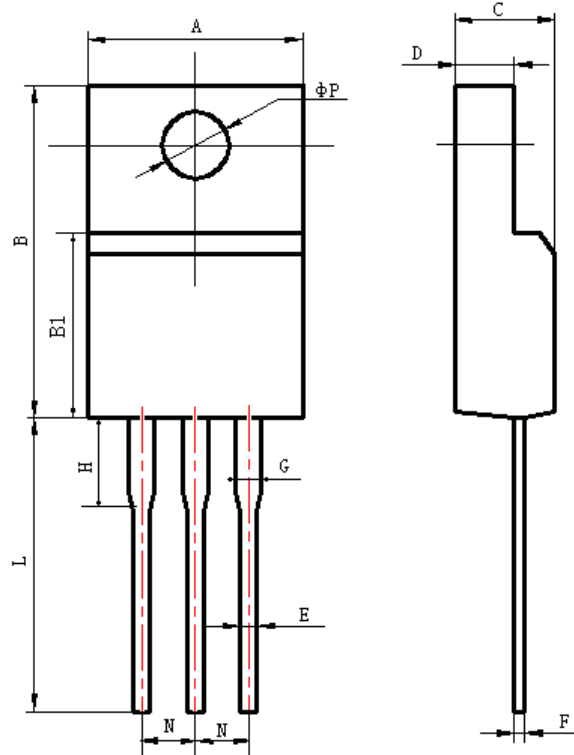


Figure6. C-E voltage vs Collector current



**Package Information:**


Items	Values(mm)	
	MIN	MAX
A	9.60	10.40
B	15.40	16.20
B1	8.25	8.65
C	4.40	4.80
D	2.50	2.90
E	0.70	0.90
F	0.30	0.60
G	1.12	1.42
H	3.40	3.80
L	12.0	14.0
N	2.34	2.74
$\Phi P$	3.00	3.30

TO-220F Package

**The name and content of poisonous and harmful material in products**

Part's Name	Hazardous Substance					
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE
Limit	≤0.1%	≤0.1%	≤0.01%	≤0.1%	≤0.1%	≤0.1%
Lead Frame	○	○	○	○	○	○
Molding Compound	○	○	○	○	○	○
Chip	○	○	○	○	○	○
Wire Bonding	○	○	○	○	○	○
Solder	×	○	○	○	○	○
Note	Means the hazardous material is under the criterion of SJ/T11363-2006. Means the hazardous material exceeds the criterion of SJ/T11363-2006. The plumbum element of solder exist in products presently, but within the allowed range of Eurogroup's RoHS.					

**Warnings**

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. It is suggested to be used under 80 percent of the maximum ratings of the device.
2. When installing the heatsink, please pay attention to the torsional moment and the smoothness of the heatsink.
3. IGBTs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. This publication is made by Huajing Microelectronics and subject to regular change without notice.

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