



GOSTONE



GA20F06K2BH

**650V, 20A IGBT with soft and fast recovery
anti-parallel diode**

Product Summary

Parameter	Value
V_{CE}	650V
$I_C(T_C=100^{\circ}\text{C})$	20A
$V_{CE(sat)}(T_J=25^{\circ}\text{C})$	1.6V

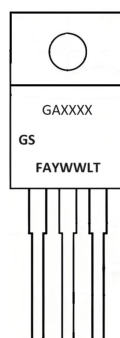
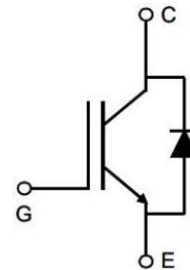
Features

- ✓ Trench and field-stop technology.
- ✓ Easy parallel switching capability.
- ✓ High efficiency for inverters.
- ✓ High ruggedness performance.
- ✓ RoHS compliant.

Application

- ✓ Home appliances
- ✓ Motor drives
- ✓ General inverter

Equivalent circuit



TO-220F

NOTE:
LOGO - GS
GAXXXX - Part number code
F - Fab location code
A - Assembly location code
Y - Year code
WW - Week code
L&T - Assembly lot code

Absolute Maximum ratings Ta = 25°C

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
P_{tot}	Power dissipation ($T_C=25^\circ\text{C}$)	53	W
	Power dissipation ($T_C=100^\circ\text{C}$)	26	W
T_{vj}	Operating junction temperature range	-40 to +175	°C
T_{stg}	Storage temperature range	-55 to +150	°C

Thermal Characteristic

Symbol	Parameter	Values		Unit
		Typ.	Max.	
$R_{th(j-c)}$	Thermal resistance, junction to case for IGBT	-	2.7	K/ W
$R_{th(j-c)}$	Thermal resistance, junction to case for Diode	-	4.1	K/ W
$R_{th(j-a)}$	Thermal resistance, junction to ambient	-	50	K/ W

Electrical characteristics of IGBT (T_{vj}=25℃ unless otherwise specified)
Static characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
BV_{CES}	Collector-emitter breakdown voltage	$V_{GE}=0V, I_C=250\mu A$	650	-	-	V
I_{CES}	Collector-emitter leakage current	$V_{CE}=650V, V_{GE}=0V$	-	-	50	μA
I_{GES}	Gate leakage current, forward	$V_{GE}=20V, V_{CE}=0V$	-	-	100	nA
	Gate leakage current, reverse	$V_{GE}=-20V, V_{CE}=0V$	-	-	-100	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	$V_{GE}=V_{CE}, I_C=1mA$	5.3	5.6	5.9	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE}=15V, I_C=20A$	-	1.6	-	V
		$V_{GE}=15V, I_C=20A, T_{vj}=175^\circ C$	-	2.0	-	V

Dynamic characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
C_{ies}	Input capacitance	$V_{CE}=30V$ $V_{GE}=0V$ $f=1MHz$	-	1700	-	pF
C_{oes}	Output capacitance		-	75	-	pF
C_{res}	Reverse transfer capacitance		-	12	-	pF
Q_g	Total gate charge	$V_{CC}=520V$ $V_{GE}=15V$ $I_C=20A$	-	70	-	nC

Switching characteristicsElectrical

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	-	22	-	ns
t_r	Rise time		-	23	-	ns
$t_{d(off)}$	Turn-off delay time		-	120	-	ns
t_f	Fall time		-	62	-	ns
E_{on}	Turn-on energy		-	0.38	-	mJ
E_{off}	Turn-off energy		-	0.46	-	mJ
E_{ts}	Total switching energy		-	0.84	-	mJ
$t_{d(on)}$	Turn-on delay time	$V_{CC}=400V$ $V_{GE}=0/15V$ $I_C=20A$ $R_G=10\Omega$ Inductive load $T_{vj}=175^{\circ}C$	-	22	-	ns
t_r	Rise time		-	23	-	ns
$t_{d(off)}$	Turn-off delay time		-	142	-	ns
t_f	Fall time		-	105	-	ns
E_{on}	Turn-on energy		-	0.6	-	mJ
E_{off}	Turn-off energy		-	0.69	-	mJ
E_{ts}	Total switching energy		-	1.28	-	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		-	432	-	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		-	1120	-	nC

Typical performance characteristics

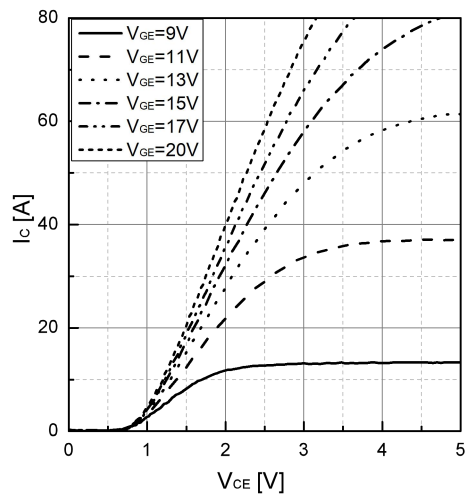


Fig 1. Typical output characteristic ($T_{vj}=25^{\circ}\text{C}$)

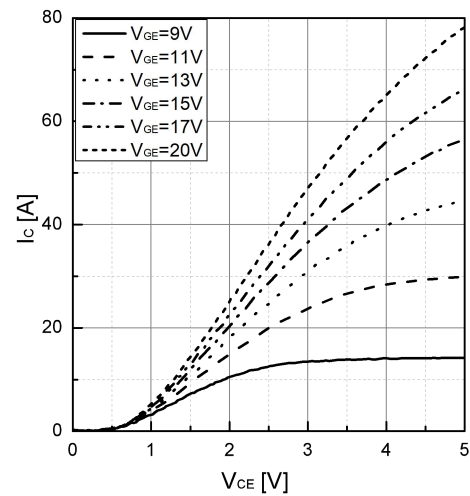


Fig 2. Typical output characteristic ($T_{vj}=175^{\circ}\text{C}$)

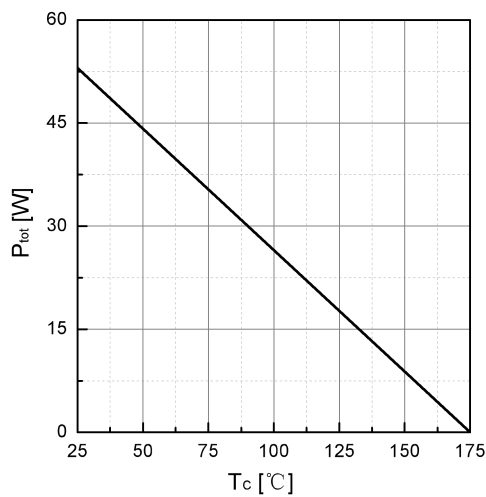


Fig 3. Power dissipation as a function of T_C

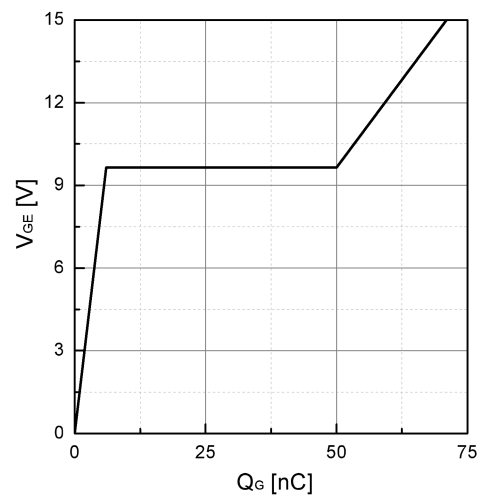


Fig 4. Typical Gate charge

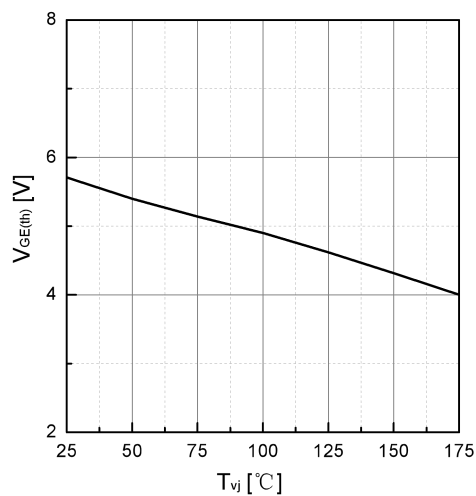


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj}
($I_C=1\text{mA}$)

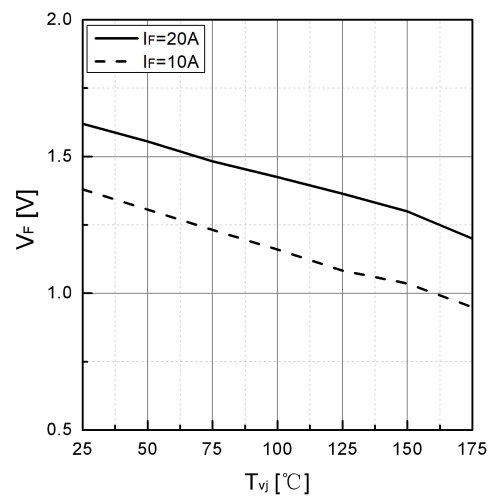


Fig 6. Typical V_F as a function of T_{vj}

Typical performance characteristics

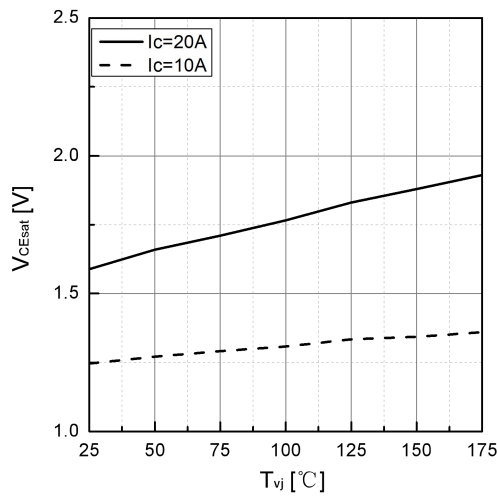


Fig 7. Typical V_{CEsat} as a function of T_{vj}

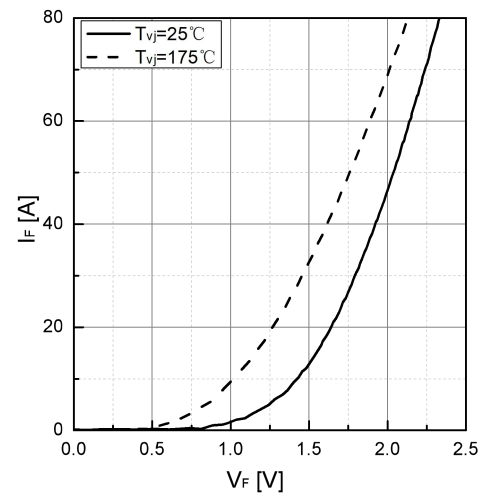


Fig 8. Typical I_F as a function of V_F

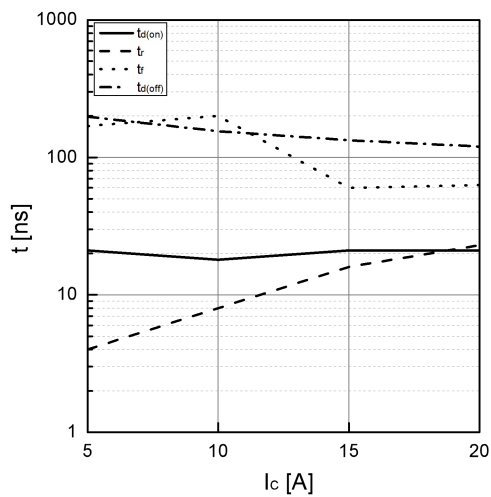


Fig 9. Typical switching time as a function of I_C

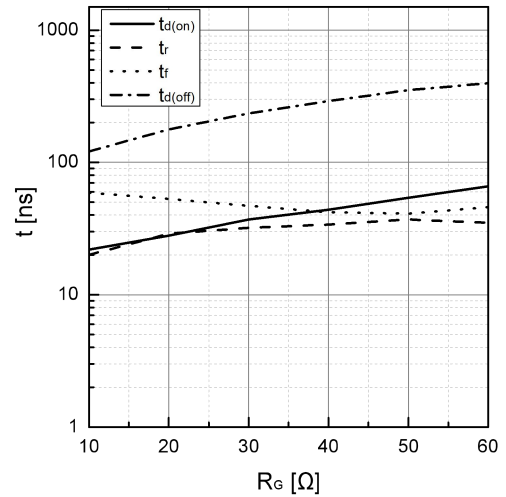


Fig 10. Typical switching times as a function of R_G

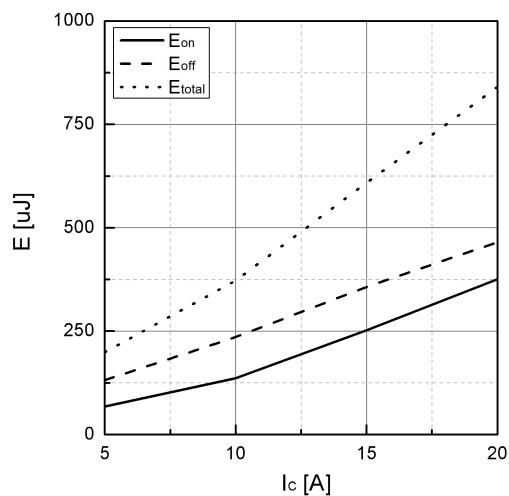


Fig 11. Typical switching energy losses as a function of I_C

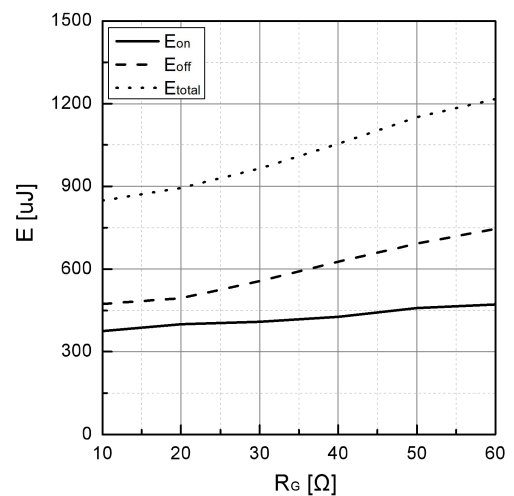


Fig 12. Typical switching energy losses as a function of R_G

Typical performance characteristics

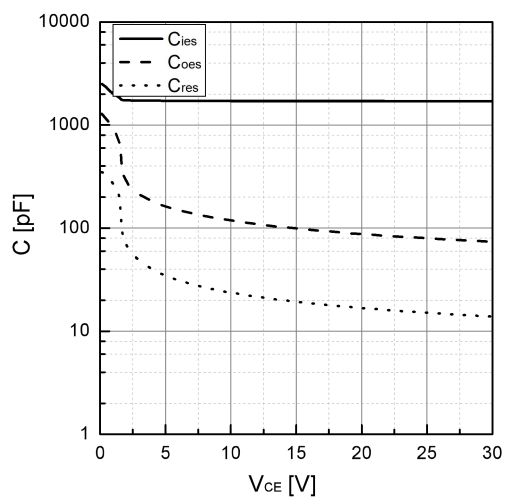
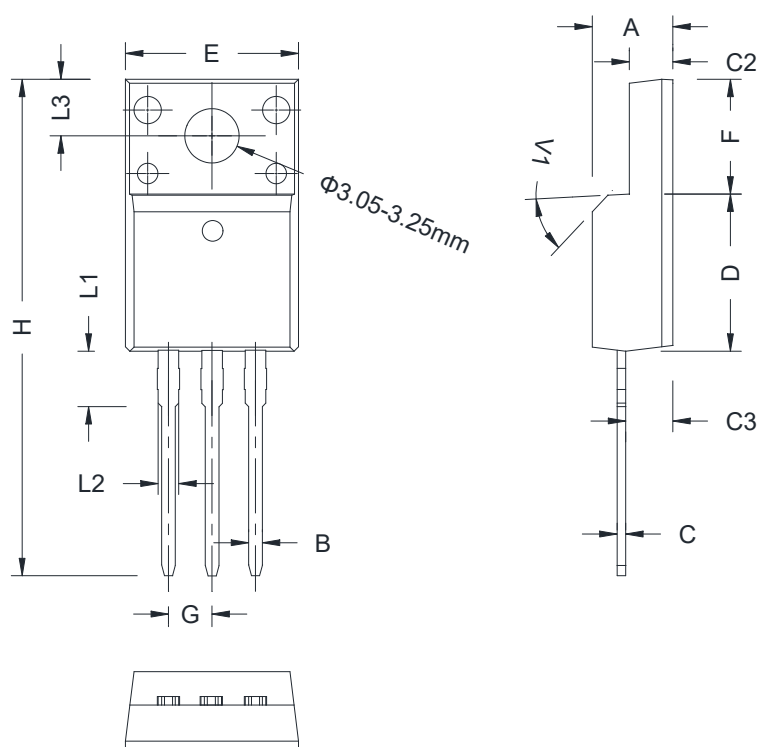


Fig 13. Typical capacitance as a function of V_{CE}
($f=1\text{MHz}$, $V_{GE}=0\text{V}$)

Package Drawing 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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