



GOSTONE



GA60F06K1BK

650V, 60A IGBT with soft and fast recovery anti-parallel diode

Product Summary

Parameter	Value
V_{CE}	650V
$I_C(T_C=100^{\circ}\text{C})$	60A
$V_{CE(sat)}(T_J=25^{\circ}\text{C})$	1.9V

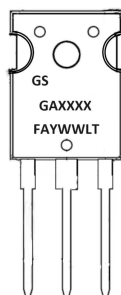
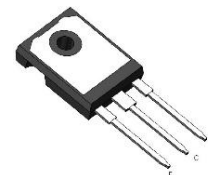
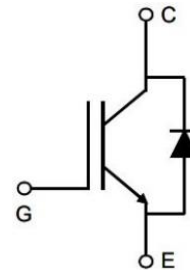
Features

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

Application

- ✓ PFC applications
- ✓ Uninterruptible power supplies
- ✓ Solar inverters

Equivalent circuit



TO247

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

Note : This Gostone product is Consumer grade product and applicable for Solar Inverters and other similar end devices. Please also read Important Notice at the end of this document.

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 ($T_C=25^\circ\text{C}$)	120	A
	Continuous collector current ($T_C=100^\circ\text{C}$)	60	A
I_{CM}	Pulsed collector current, t_p limited by T_{vjmax}	240	A
I_F	Diode continuous forward current ($T_C=100^\circ\text{C}$)	60	A
I_{FM}	Diode maximum current, t_p limited by T_{vjmax}	240	A
P_{tot}	Power dissipation ($T_C=25^\circ\text{C}$)	394	W
	Power dissipation ($T_C=100^\circ\text{C}$)	197	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	-	0.38	K/ W
$R_{th(j-c)}$	Thermal resistance, junction to case for Diode	-	0.5	K/ W
$R_{th(j-a)}$	Thermal resistance, junction to ambient	-	40	K/ W

Electrical characteristics of IGBT (Tvj=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	$V_{GE}=V_{CE}, I_C=1mA$	5.2	5.4	5.7	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE}=15V, I_C=60A$	-	1.9	-	V
		$V_{GE}=15V, I_C=60A, T_{vj}=175^\circ C$	-	2.5	-	V

Dynamic characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
C_{ies}	Input capacitance	$V_{CE}=30V$ $V_{GE}=0V$ $f=1MHz$	-	3860	-	pF
C_{oes}	Output capacitance		-	170	-	pF
C_{res}	Reverse transfer capacitance		-	30	-	pF
Q_g	Total gate charge	$V_{CC}=520V$ $V_{GE}=15V$ $I_C=60A$	-	120	-	nC

Switching characteristicsElectrical

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=400V$ $V_{GE}=0/15V$ $I_C=60A$ $R_G=10\Omega$ Inductive load	-	44	-	ns
t_r	Rise time		-	100	-	ns
$t_{d(off)}$	Turn-off delay time		-	166	-	ns
t_f	Fall time		-	75	-	ns
E_{on}	Turn-on energy		-	2.3	-	mJ
E_{off}	Turn-off energy		-	1.3	-	mJ
E_{ts}	Total switching energy		-	3.6	-	mJ
$t_{d(on)}$	Turn-on delay time	$V_{CC}=400V$ $V_{GE}=0/15V$ $I_C=60A$ $R_G=10\Omega$ Inductive load $T_{vj}=175^{\circ}C$	-	45	-	ns
t_r	Rise time		-	105	-	ns
$t_{d(off)}$	Turn-off delay time		-	180	-	ns
t_f	Fall time		-	76	-	ns
E_{on}	Turn-on energy		-	3.6	-	mJ
E_{off}	Turn-off energy		-	1.6	-	mJ
E_{ts}	Total switching energy		-	5.2	-	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	$I_F=30\text{A}$	-	1.7	-	V
		$I_F=30\text{A}, T_{vj}=175^{\circ}\text{C}$	-	1.4	-	V
t_{rr}	Diode reverse recovery time	$V_R=400\text{V}$ $I_F=30\text{A}$ $di_F/dt=-450\text{A}/\mu\text{s}$	-	78	-	ns
I_{rrm}	Diode peak reverse recovery current		-	14	-	A
Q_{rr}	Diode reverse recovery charge		-	600	-	nC
t_{rr}	Diode reverse recovery time	$V_R=400\text{V}$ $I_F=30\text{A}$ $di_F/dt=-450\text{A}/\mu\text{s}$ $T_{vj}=175^{\circ}\text{C}$	-	155	-	ns
I_{rrm}	Diode peak reverse recovery current		-	25	-	A
Q_{rr}	Diode reverse recovery charge		-	2300	-	nC

Typical performance characteristics

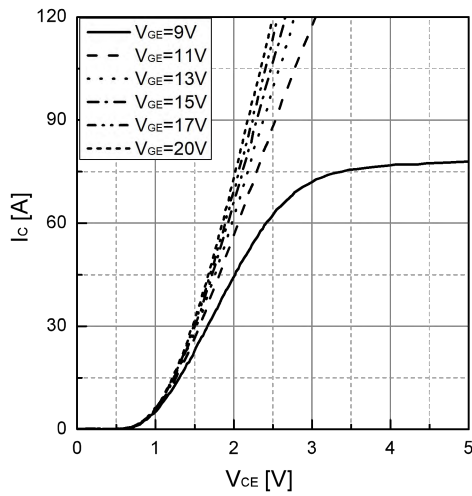


Fig 1. Typical output characteristic ($T_{vj}=25^\circ\text{C}$)

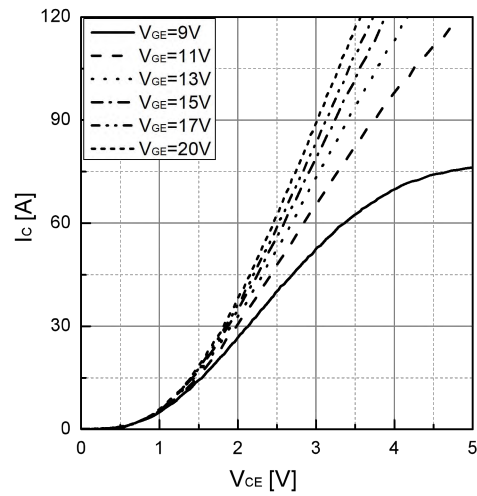


Fig 2. Typical output characteristic ($T_{vj}=175^\circ\text{C}$)

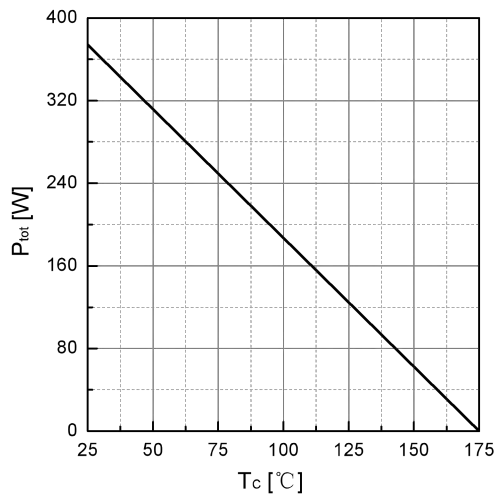


Fig 3. Power dissipation as a function of T_c

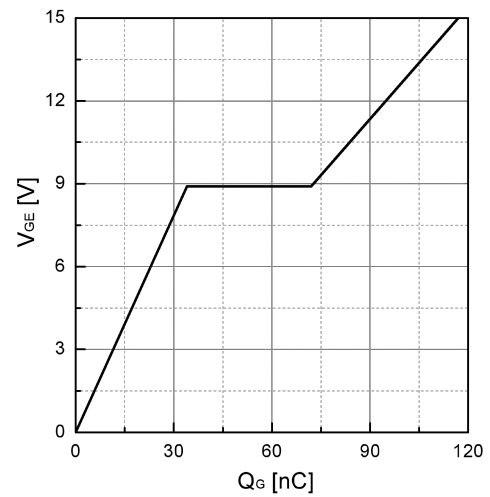


Fig 4. Typical Gate charge

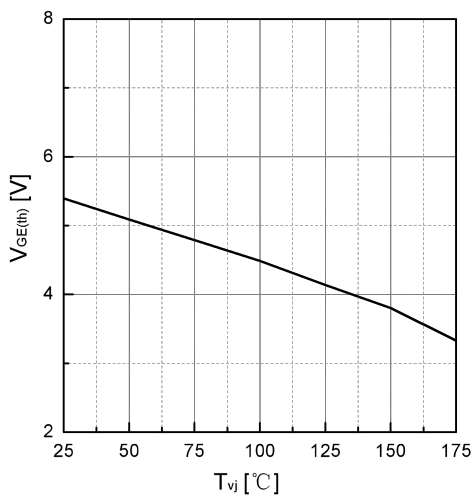


Fig 5. Typical $V_{GE(th)}$ as a function of T_{vj}
($I_C=1\text{mA}$)

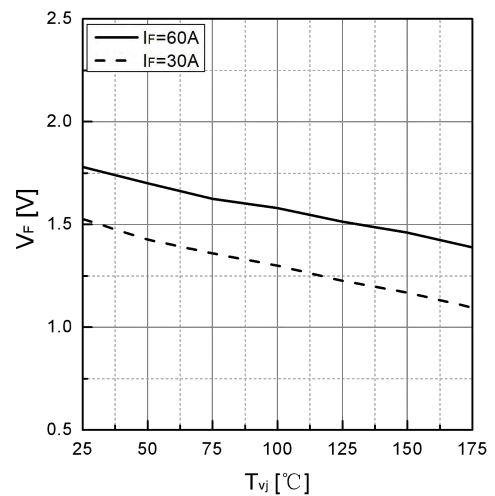


Fig 6. Typical V_F as a function of T_{vj}

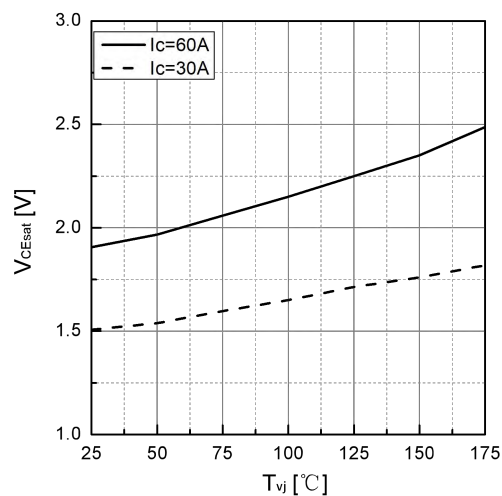


Fig 7. Typical V_{CEsat} as a function of T_{vj}

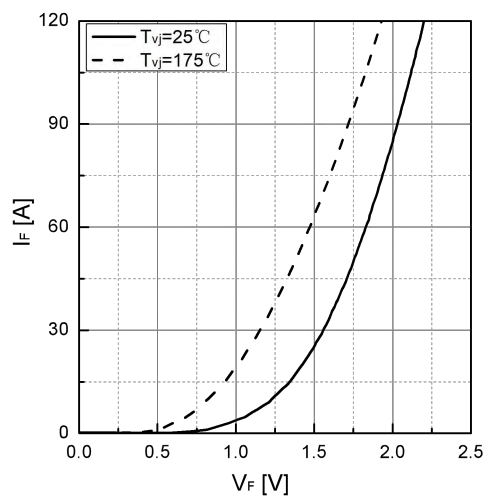


Fig 8. Typical I_F as a function of V_F

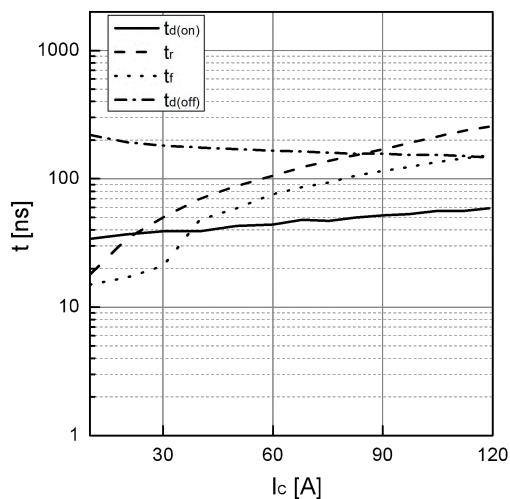


Fig 9. Typical switching time as a function of I_c

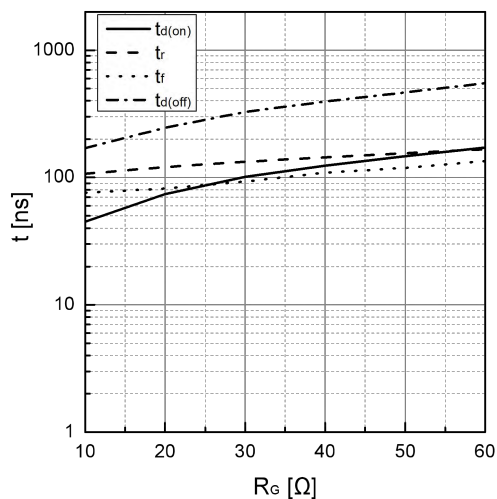


Fig 10. Typical switching times as a function of R_G

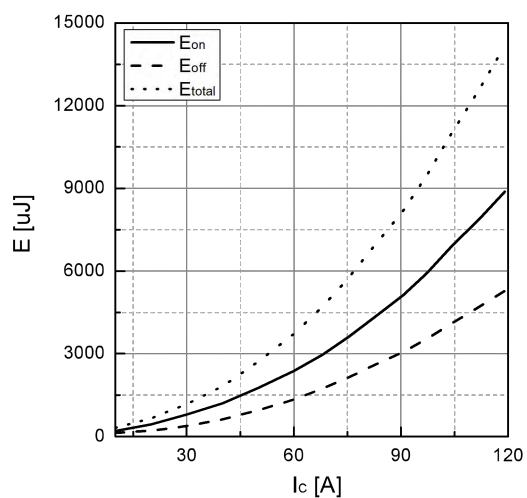


Fig 11. Typical switching energy losses as a function of I_c

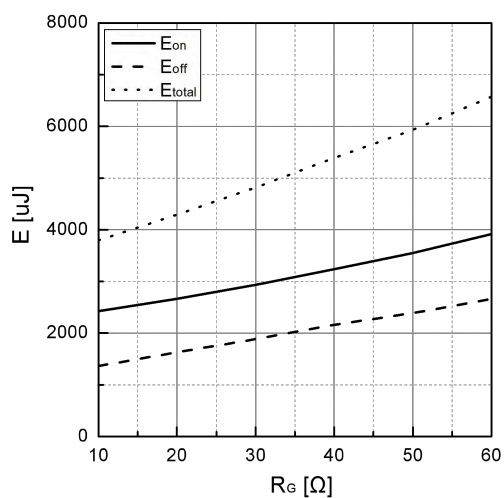


Fig 12. Typical switching energy losses as a function of R_G

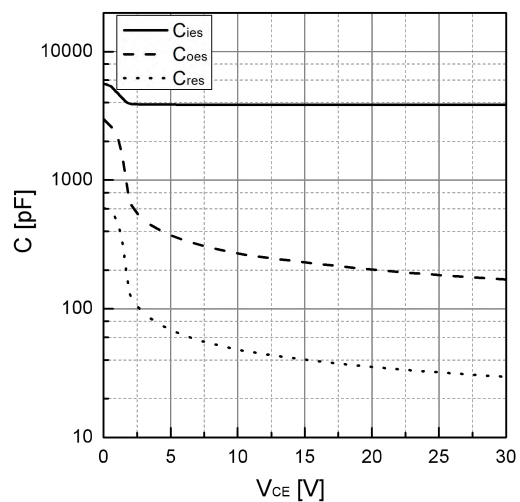


Fig 13. Typical capacitance as a function of V_{CE}
($f=1\text{MHz}$, $V_{GE}=0\text{V}$)

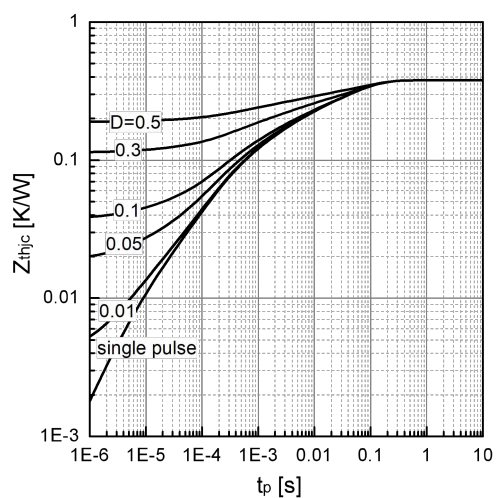
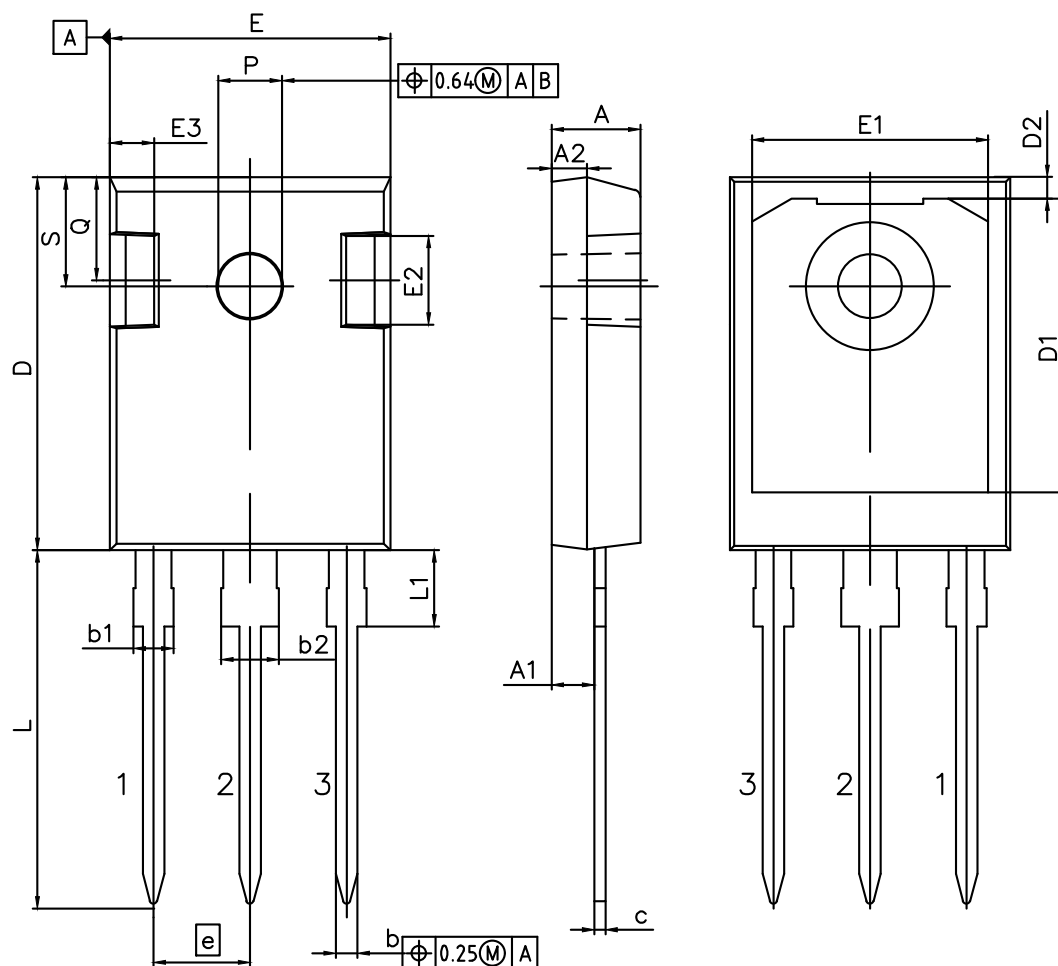


Fig 14. Transient thermal impedance of IGBT

Package Drawing TO-247


DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.70	5.30
A1	2.20	2.60
A2	1.50	2.50
b	1.00	1.40
b1	1.60	2.41
b2	2.57	3.43
c	0.38	0.89
D	20.70	21.50
D1	13.08	17.65
D2	0.51	1.35
E	15.50	16.30
E1	12.38	14.15
E2	3.40	5.10
E3	1.00	2.60
e	5.44	
L	19.80	20.40
L1	3.85	4.50
P	3.50	3.70
Q	5.35	6.25
S	6.04	6.30

Important Notice

The information given in this document shall be for illustrative purposes only and shall in no event be regarded as a guarantee of conditions or characteristics. Gostone reserves the right to change any information herein. With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Gostone or its affiliates hereby make no representation or warranty of any kind, expressed or implied, as to any information provided hereunder, including without limitation as to the accuracy, completeness or non-infringement of intellectual property rights of any third party, and they assume no liability for the consequences of use of such information. In addition, any information given in this document is subject to customer's compliance with its obligations stated herein and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Gostone in customer's applications. The information contained herein is exclusively intended for technically trained staff. No license is granted by implication under any patent right, copyright, mask work right, or other intellectual property right. It is customer's sole responsibility to evaluate the suitability of the product for the intended application and the completeness of the product information given herein with respect to such application. In no event shall Gostone or its affiliates be liable to any party for any direct, indirect, special, punitive, incidental or consequential damages of any nature whatsoever, including but not limited to loss of profits and loss of goodwill, whether or not such damages are based on tort or negligence, warranty, breach of contract or any other legal theory. In addition, any recipient of this document and the relevant products samples may not alter, decompile, disassemble, reverse engineer, or otherwise modify any information/samples received hereunder. Any intellectual property rights arising from the reverse engineering of Gostone's products shall belong to Gostone.