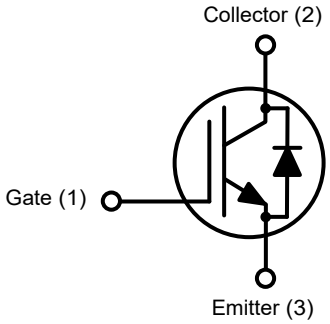
BGH50N65HF1

Hybrid SiC Discrete Devices

Product Summary

V_{CE}	650 V
I_C	50A @T_C=100°C
$V_{CE(sat).Typ}$	1.55V @I_C=50A

Package: TO-247-3



Trench Field Stop IGBT Co-packed with SiC Schottky Barrier Diode

Features

- Low $V_{CE(sat)}$
- Trench FS Technology
- High Speed Switching
- Hybrid SiC Discrete Devices
- Halogen Free, RoHS Complian

Applications

- UPS
- PV Inverter
- Welding Machine
- On-board Charger
- Totem Pole Bridgeless PFC
- High Frequency Motor Drive

Package Pin Definitions

- Pin1 - Gate
- Pin2 - Collector & Backside
- Pin3 - Emitter

Package Parameters

Part Number	Marking	Package
BGH50N65HF1	BGH50N65HF1	TO-247-3

Maximum Ratings(T_C=25°C Unless Otherwise Noted)

Symbol	Parameter		Value	Unit
V_{CE}	Collector-Emitter Voltage ,T_j≥25°C		650	V
V_{GE}	Gate-Emitter Voltage		±20	
	Transient Gate-Emitter Voltage		±30	
I_C	DC Collector Current, limited by T_{jmax}	T_C=25°C	100	A
		T_C=100°C	50	
I_F	Diode Forward Current, limited by T_{jmax}	T_C=25°C	50	A
		T_C=100°C	34	
$I_{C,pulse}$	Pulse Collector Current	V_{GE} =15V, t_p limited by T_{jmax}	200	A
P_{tot}	Power Dissipation	T_C=25°C	357	W
T_j	Operating Junction Temperature		-40~175	°C
T_{stg}	Storage Temperature Range		-55~150	°C
M_d	TO-247 mounting torque	M3 Screw	0.7	Nm

Thermal Resistance

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
$R_{th(j-c)}$	IGBT Thermal Resistance-Junction to Case		0.42		K/W
$R_{th(j-c)}$	Diode Thermal Resistance-Junction to Case		0.81		K/W
$R_{th(j-a)}$	Thermal Resistance-Junction to Ambient		32		K/W

Electrical Characteristics (Defined at T_j=25°C Unless Otherwise Specified)

IGBT Static Characteristics

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=50A	T_j=25°C		1.55	2.1	V
			T_j=100°C		1.75		
			T_j=175°C		2		
I_{CES}	Zero Gate Voltage Drain Current	V_{CE}=650V, V_{GE}=0V	T_j=25°C		2	100	μA
			T_j=175°C		110	2000	
		V_{CE}=480V, V_{GE}=0V	T_j=25°C			80	
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=±20V, V_{CE}=0V	T_j=25°C			100	nA
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE}=V_{CE}, I_C=500μA	T_j=25°C	4.2	5	5.8	V
g_{fs}	Transconductance	V_{CE}=20V, I_C=50A			82		S

Dynamic Characteristics

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
C_{ies}	Input Capacitance	V_{GE}=0V, V_{CE}=25V f=250kHz		5692		pF
C_{oes}	Output Capacitance			339		pF
C_{res}	Reverse Transfer Capacitance			95		pF
Q_G	Internal Gate Resistance	V_{CC}=520V, V_{GE}=15V, I_C=50A		308		nC

Switching Characteristics, Inductive Load

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-On Delay Time	T_j=25°C V_{DC}=400V, I_C=25A V_{GE}=0/15V, $R_{G(ext)}$=3.3Ω L_σ=60nH		17		ns
t_r	Rise Time			16		
$t_{d(off)}$	Turn-Off Delay Time			177		
t_f	Fall Time			31		
E_{on}	Turn-On Energy			278		uJ
E_{off}	Turn-Off Energy			324		
E_{total}	Total Switiching Energy			602		
$t_{d(on)}$	Turn-On Delay Time	T_j=150°C V_{DC}=400V, I_C=25A V_{GE}=0/15V, $R_{G(ext)}$=3.3Ω L_σ=60nH		14		ns
t_r	Rise Time			17		
$t_{d(off)}$	Turn-Off Delay Time			217		
t_f	Fall Time			68		
E_{on}	Turn-On Energy			296		uJ
E_{off}	Turn-Off Energy			480		
E_{total}	Total Switiching Energy			776		
$t_{d(on)}$	Turn-On Delay Time	T_j=25°C V_{DC}=400V, I_C=50A V_{GE}=0/15V, $R_{G(ext)}$=3.3Ω L_σ=60nH		20		ns
t_r	Rise Time			40		
$t_{d(off)}$	Turn-Off Delay Time			159		
t_f	Fall Time			35		
E_{on}	Turn-On Energy			818		uJ
E_{off}	Turn-Off Energy			590		
E_{total}	Total Switiching Energy			1408		

$t_{d(on)}$	Turn-On Delay Time	T_j=150°C V_{DC}=400V, I_C=50A V_{GE}=0/15V, $R_{G(ext)}$=3.3Ω L_σ=60nH		18		ns
t_r	Rise Time			36		
$t_{d(off)}$	Turn-Off Delay Time			190		
t_f	Fall Time			66		
E_{on}	Turn-On Energy			860		uJ
E_{off}	Turn-Off Energy			838		
E_{total}	Total Switiching Energy			1698		

SiC Schottky Barrier Diode Static Characteristics

Symbol	Parameter	Test conditions		Value			Unit
				Min.	Typ.	Max.	
V_F	Diode Forward Voltage	I_F=15A, V_{GE}=0V	T_j=25°C		1.39	1.7	V
			T_j=100°C		1.43		
			T_j=175°C		1.65		
Q_C	Diode Capacitive Charge	V_R=400V, T_j=25°C			46		nC
C	Diode Capacitance	V_R=1V, f=1MHz			713		pF
		V_R=300V, f=1MHz			79		

Typical Performance

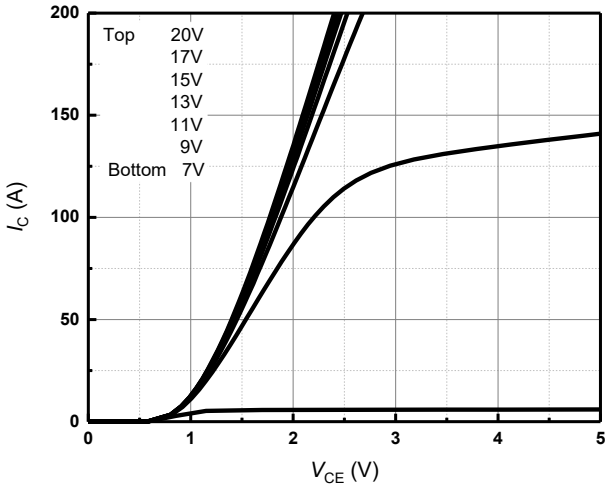


Figure 1 Output Characteristics (T_j=25°C)

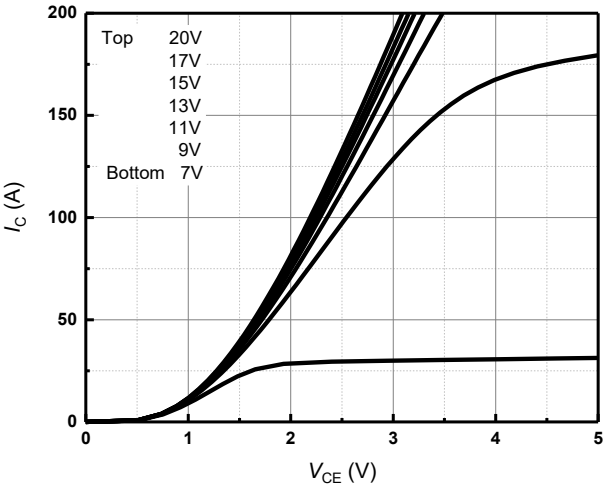


Figure 2 Output Characteristics (T_j=150°C)

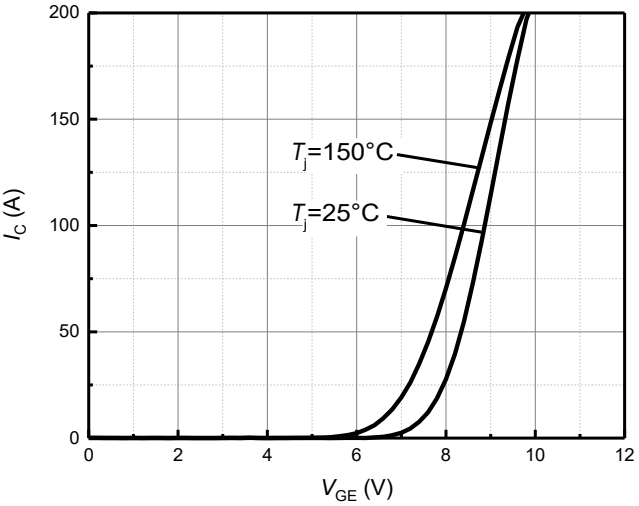


Figure 3 Transfer Characteristics for Various Temperature (V_{CE}=20V)

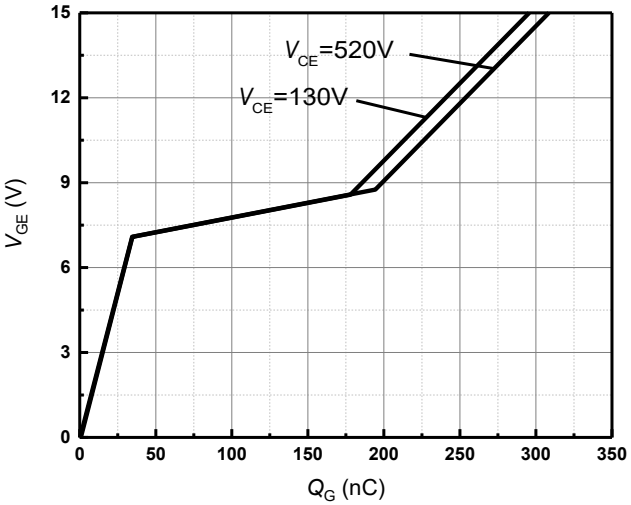


Figure 4 Gate Charge Characteristics (I_C=50A)

Typical Performance

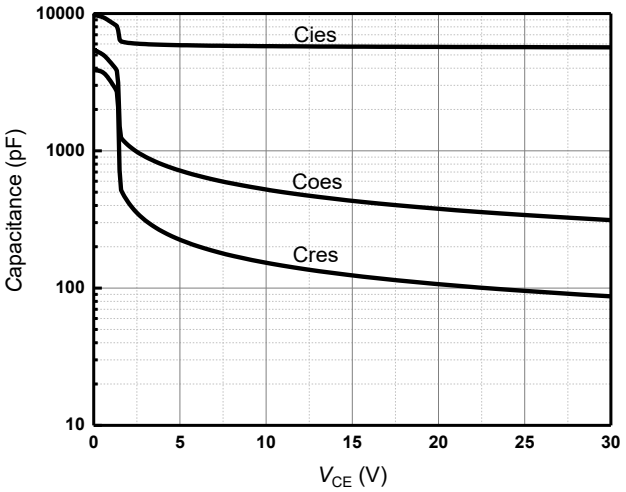


Figure 5 Capacitance Characteristics (V_{GE}=0V, f=250kHZ)

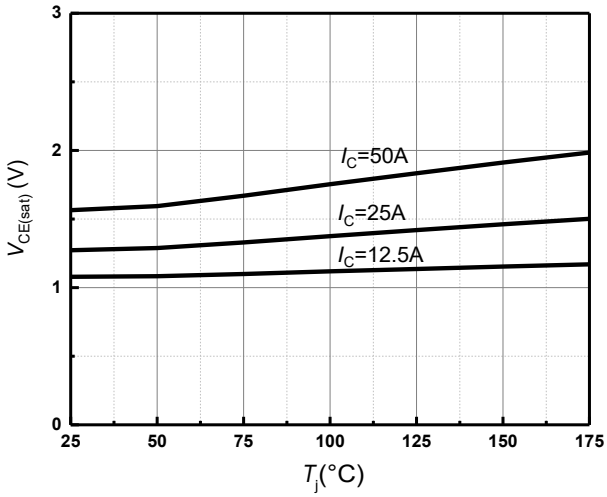


Figure 6 Collector-Emitter Saturation Voltage vs. Junction Temperature for Various Collector Current (V_{GE}=15V)

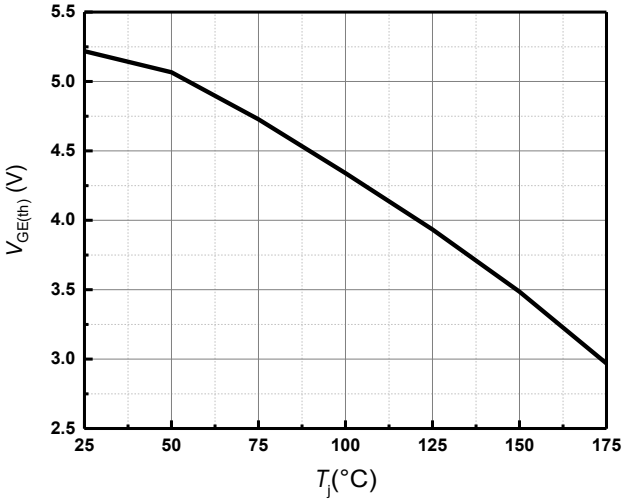


Figure 7 Gate-Emitter threshold Voltage vs. Junction Temperature (I_C=0.5mA)

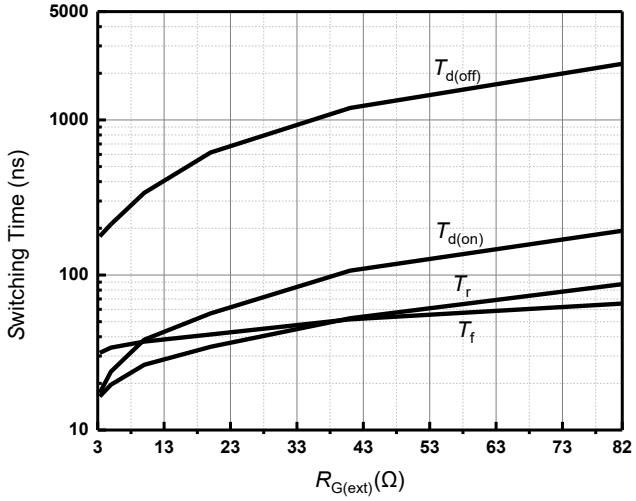


Figure 8 Switching Times vs. Gate Resistor (V_{DC}=400V , V_{GE}=0/15V, I_C=25A, T_j=25°C)

Typical Performance

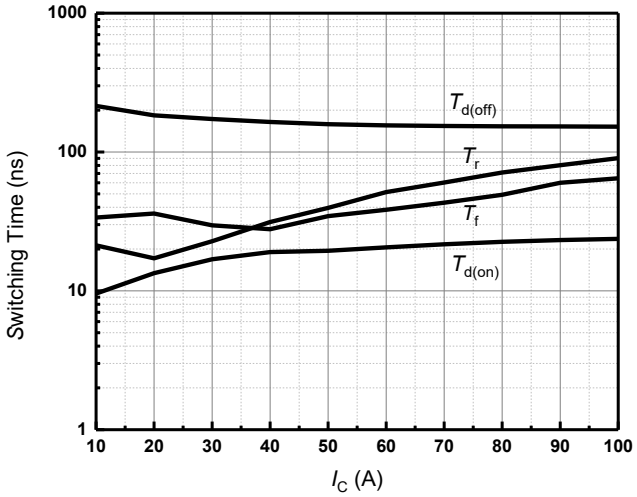


Figure 9 Switching Times vs. Collector Current (V_{DC}=400V, V_{GE}=0/15V, $R_{G(ext)}$=3.3Ω, T_j=25°C)

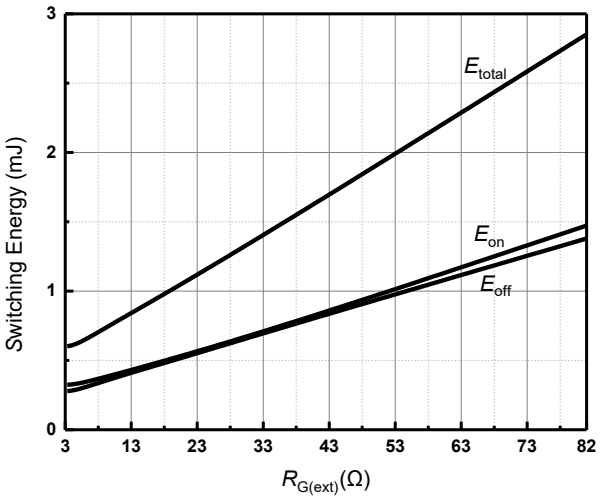


Figure 10 Switching Loss vs. Gate Resistor (V_{DC}=400V, V_{GE}=0/15V, I_C=25A, T_j=25°C)

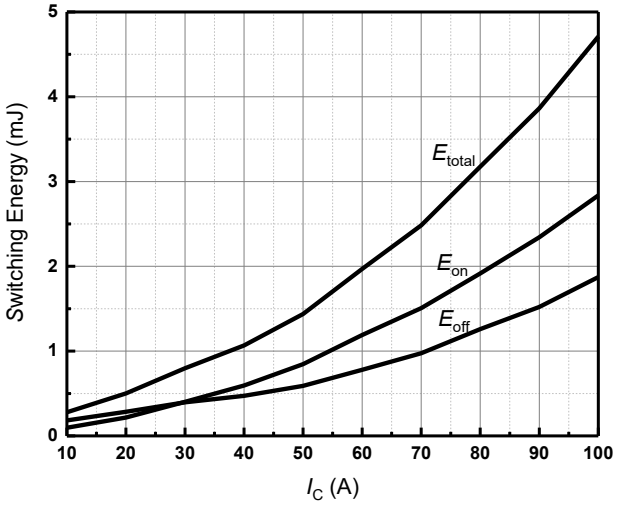


Figure 11 Switching Loss vs. Collector Current (V_{DC}=400V, V_{GE}=0/15V, $R_{G(ext)}$=3.3Ω, T_j=25°C)

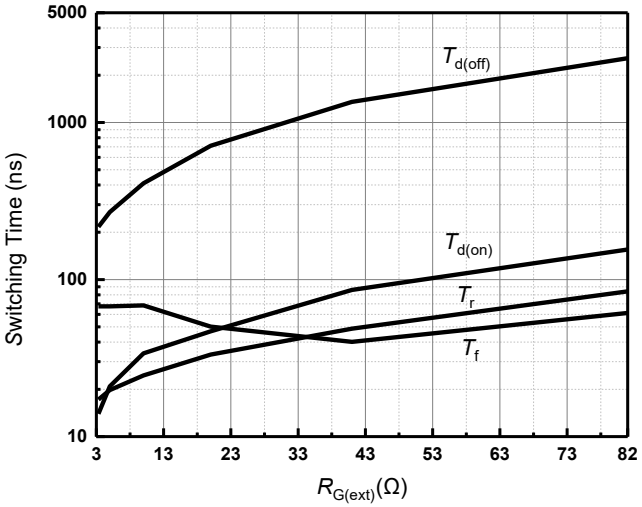


Figure 12 Switching Times vs. Gate Resistor (V_{DC}=400V, V_{GE}=0/15V, I_C=25A, T_j=150°C)

Typical Performance

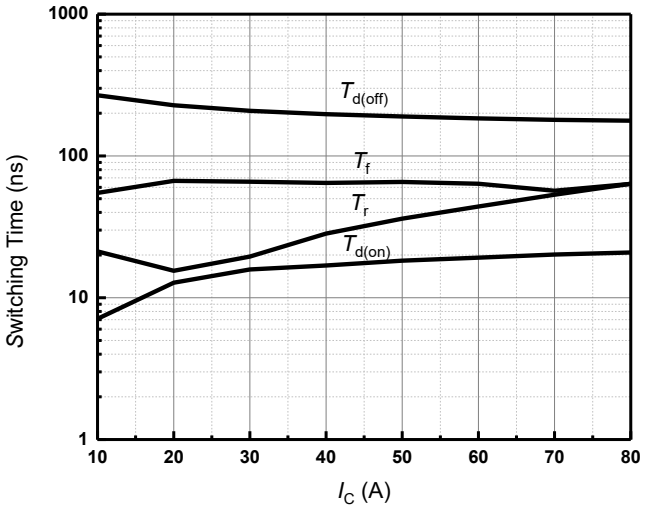


Figure 13 Switching Times vs. Collector Current (V_{DC}=400V, V_{GE}=0/15V, $R_{G(ext)}$=3.3Ω, T_j=150°C)

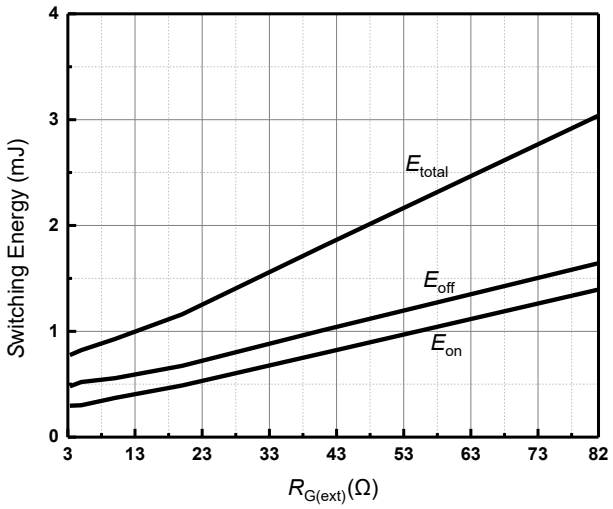


Figure 14 Switching Loss vs. Gate Resistor (V_{DC}=400V, V_{GE}=0/15V, I_C=25A, T_j=150°C)

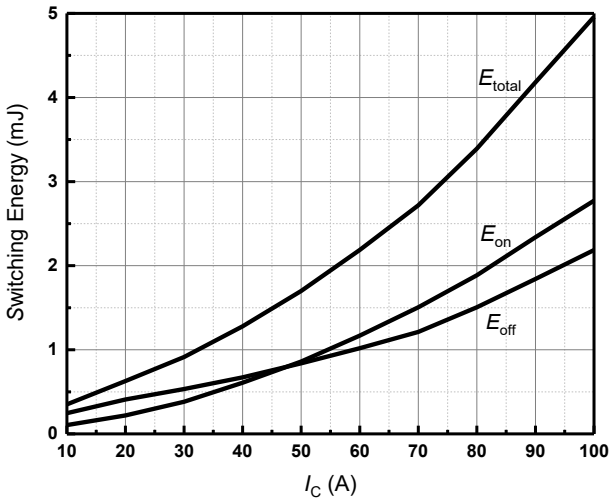


Figure 15 Switching Loss vs. Collector Current (V_{DC}=400V, V_{GE}=0/15V, $R_{G(ext)}$=3.3Ω, T_j=150°C)

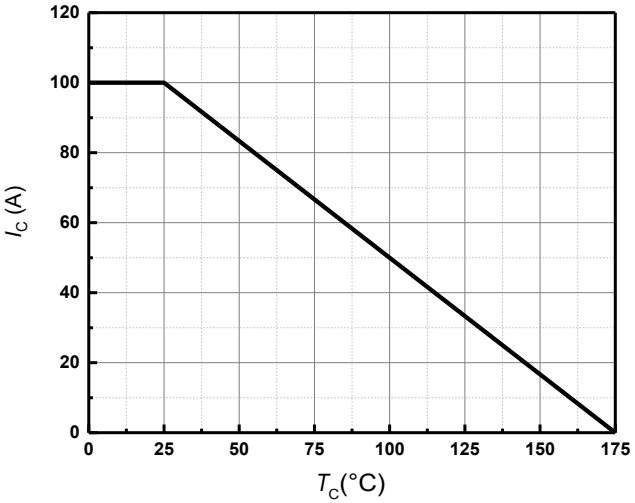


Figure 16 Maximum Collector current vs. Case Temperature

Typical Performance

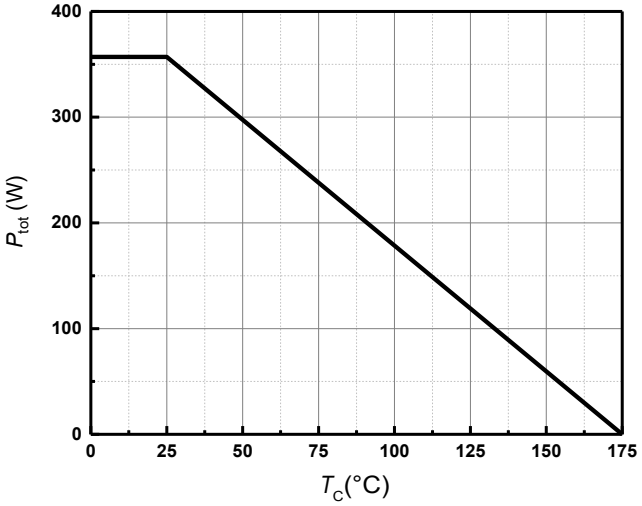


Figure 17 Power Dissipation as a Funcation of T_c

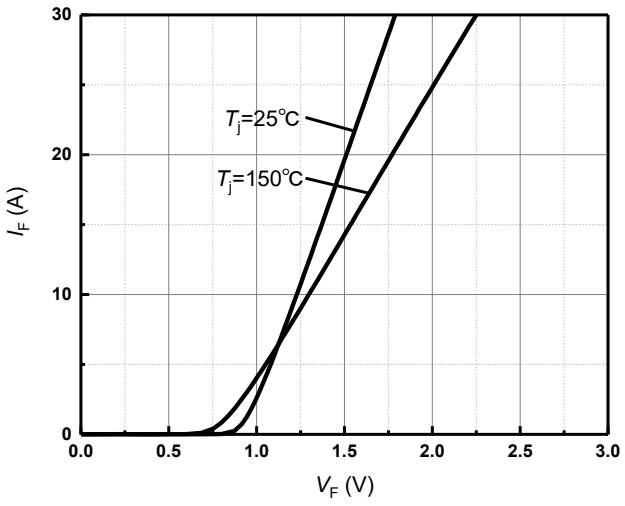


Figure 18 Forward characteristic of Diode

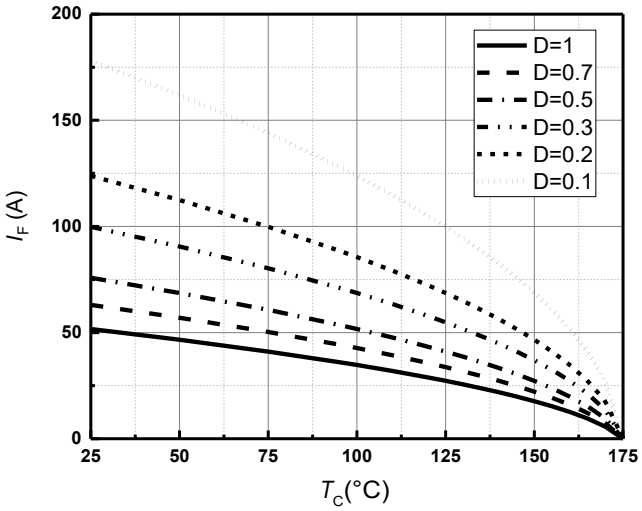


Figure 19 Diode forward current as function of temperature, D=duty cycle

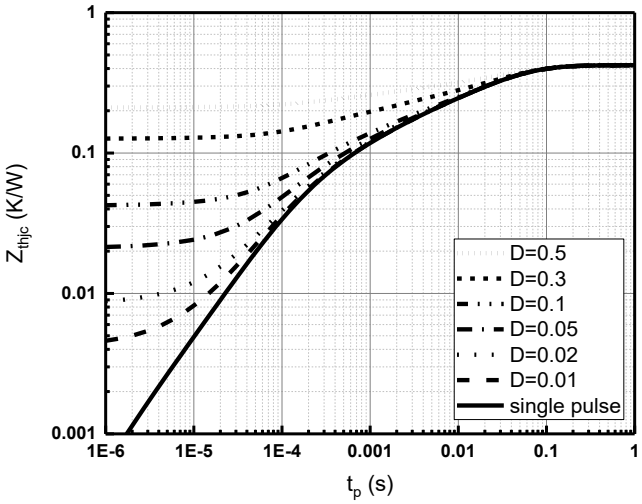


Figure 20 IGBT Transient Thermal Response Curve

Typical Performance

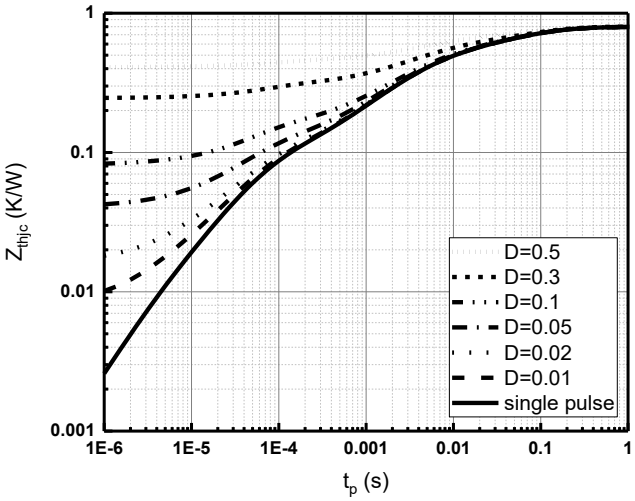
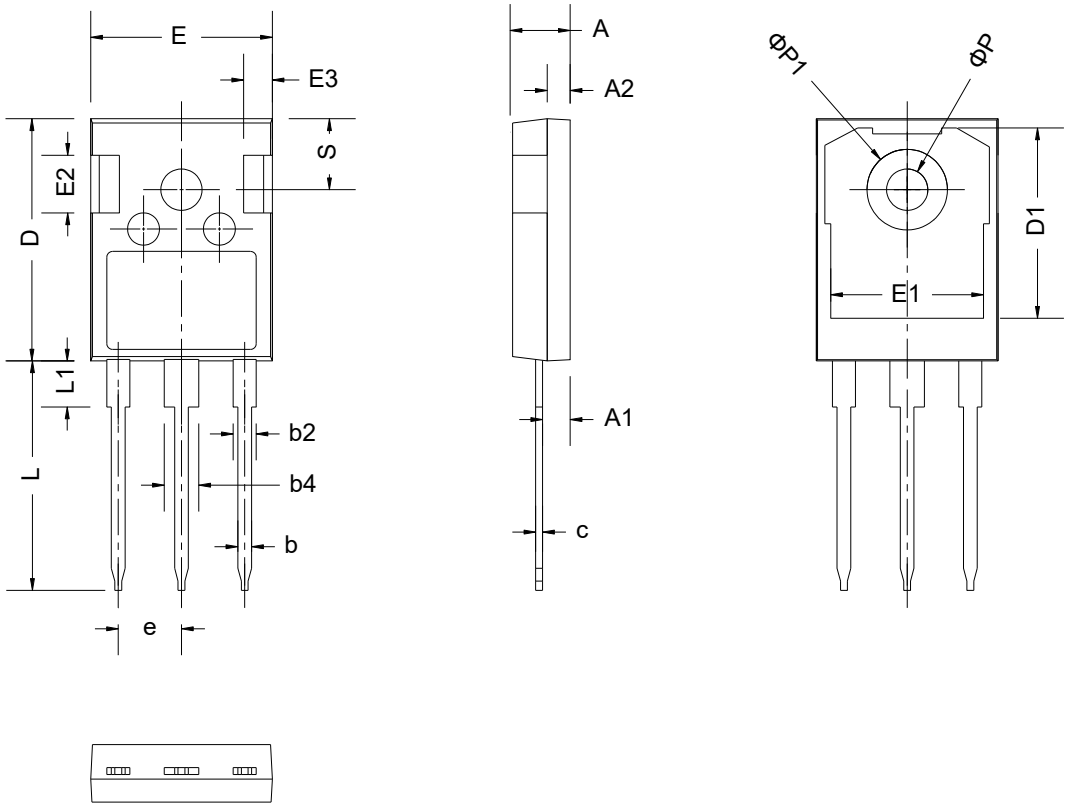


Figure 21 Diode Transient Thermal Response Curve

Package Dimensions



Items	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.80	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.8	5.00	5.20
E3	2.3	2.50	2.70
e	5.44 BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.16 BSC		

Revision History

Document Version	Date of Release	Description of Changes
Rev. 0.0	2022-05-16	Draft datasheet created.
Rev. 0.1	2023-05-04	Update features.

BASiC Semiconductor Ltd.
Shenzhen, China

Information

For further information on technology, delivery terms and conditions and prices, please contact the nearest BASiC Semiconductor Office

Disclaimer

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, BASiC semiconductor Ltd. hereby disclaims any and all warranties and liabilities of any kind, including without limitation, warranties of non-infringement of intellectual property rights of any third party.