

Product Summary

V_{CE}	650 V
I_C	50A @ $T_c=100^\circ\text{C}$
$V_{CE(sat),Typ}$	1.55V @ $I_C=50\text{A}$

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 Compliant

Applications

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

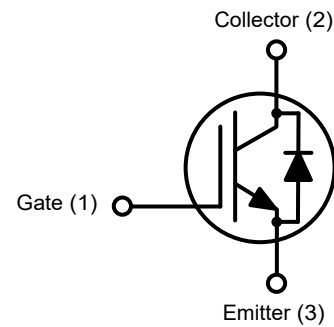
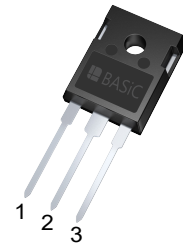
Package Pin Definitions

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

Package Parameters

Part Number	Marking	Package
BGH50N65HF1	BGH50N65HF1	TO-247-3

Package: TO-247-3



Maximum Ratings ($T_c=25\text{ }^\circ\text{C}$ Unless Otherwise Noted)

Symbol	Parameter		Value	Unit
V_{CE}	Collector-Emitter Voltage, $T_j \geq 25\text{ }^\circ\text{C}$		650	V
V_{GE}	Gate-Emitter Voltage		± 20	
	Transient Gate-Emitter Voltage		± 30	
I_C	DC Collector Current, limited by T_{jmax}	$T_c=25\text{ }^\circ\text{C}$	114	A
		$T_c=100\text{ }^\circ\text{C}$	50	
I_F	Diode Forward Current, limited by T_{jmax}	$T_c=25\text{ }^\circ\text{C}$	50	A
		$T_c=100\text{ }^\circ\text{C}$	34	
$I_{C,pulse}$	Pulse Collector Current	$V_{GE}=15\text{V}$, t_p limited by T_{jmax}	200	A
P_{tot}	Power Dissipation	$T_c=25\text{ }^\circ\text{C}$	297	W
T_j	Operating Junction Temperature		-40~150	$^\circ\text{C}$
T_{stg}	Storage Temperature Range		-55~150	$^\circ\text{C}$
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 $T_j=25\text{ }^\circ\text{C}$ Unless Otherwise Specified)
IGBT Static Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15\text{V}$, $I_C=50\text{A}$	$T_j=25\text{ }^\circ\text{C}$		1.55	2.1	V
			$T_j=100\text{ }^\circ\text{C}$		1.75		
			$T_j=150\text{ }^\circ\text{C}$		1.88		
I_{CES}	Zero Gate Voltage Drain Current	$V_{CE}=650\text{V}$, $V_{GE}=0\text{V}$	$T_j=25\text{ }^\circ\text{C}$			100	μA
			$T_j=150\text{ }^\circ\text{C}$			1000	
		$V_{CE}=480\text{V}$, $V_{GE}=0\text{V}$	$T_j=25\text{ }^\circ\text{C}$			80	
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$	$T_j=25\text{ }^\circ\text{C}$			100	nA

$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=500\mu A$	$T_J=25\text{ }^\circ\text{C}$	4.2	5	5.8	V
g_{fs}	Transconductance	$V_{CE}=20V, I_C=40A$			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	$T_J=25\text{ }^\circ\text{C}$ $V_{DC}=400V, I_C=25A$ $V_{GE}=0/15V, R_{G(ext)}=10\Omega$ $L_\sigma=60nH$		23		ns
t_r	Rise Time			27		
$t_{d(off)}$	Turn-Off Delay Time			333		
t_f	Fall Time			42		
E_{on}	Turn-On Energy			357		uJ
E_{off}	Turn-Off Energy			343		
E_{total}	Total Switching Energy			700		

SiC Schottky Barrier Diode Static Characteristics

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
V_F	Diode Forward Voltage	$I_F=20A, V_{GE}=0V$	$T_J=25\text{ }^\circ\text{C}$	1.51		V
			$T_J=100\text{ }^\circ\text{C}$	1.62		
			$T_J=150\text{ }^\circ\text{C}$	1.76		
Q_C	Diode Capacitive Charge	$V_R=400V, T_J=25\text{ }^\circ\text{C}$		46		nC
C	Diode Capacitance	$V_R=1V, f=1MHz$		713		pF
		$V_R=300V, f=1MHz$		79		

Typical Performance

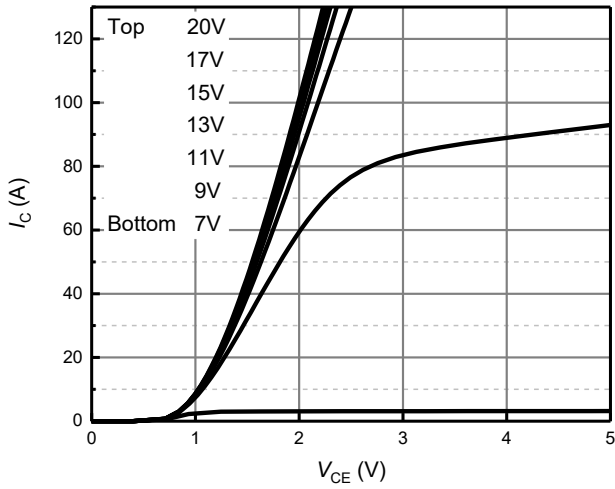


Figure 1 Output Characteristics
($T_j=25^\circ\text{C}$)

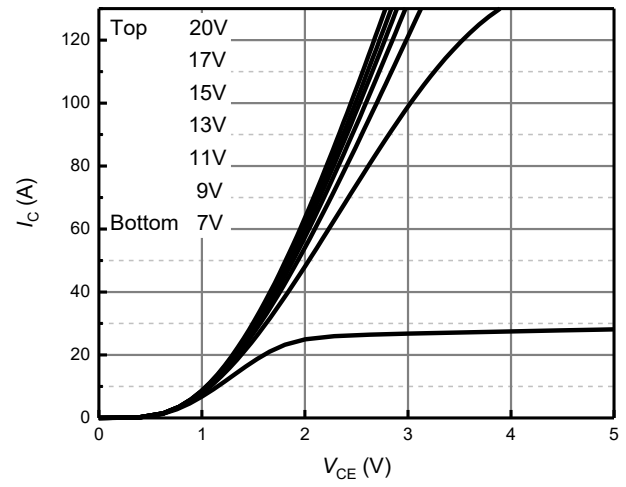


Figure 2 Output Characteristics
($T_j=150^\circ\text{C}$)

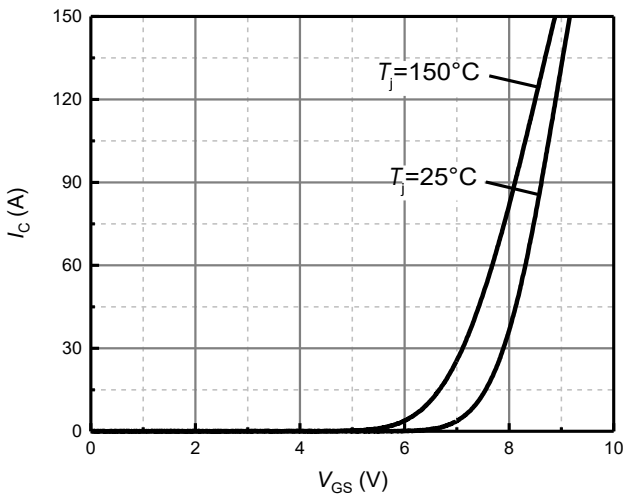


Figure 3 Transfer Characteristics for Various Temperature
($V_{CE}=20\text{V}$)

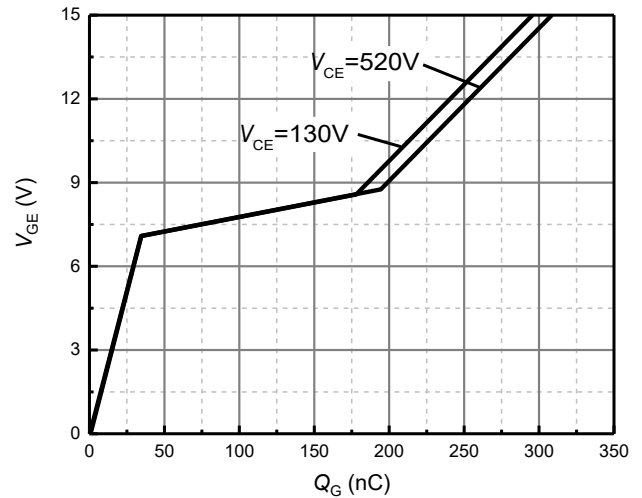


Figure 4 Gate Charge Characteristics
($I_C=50\text{A}$)

Typical Performance

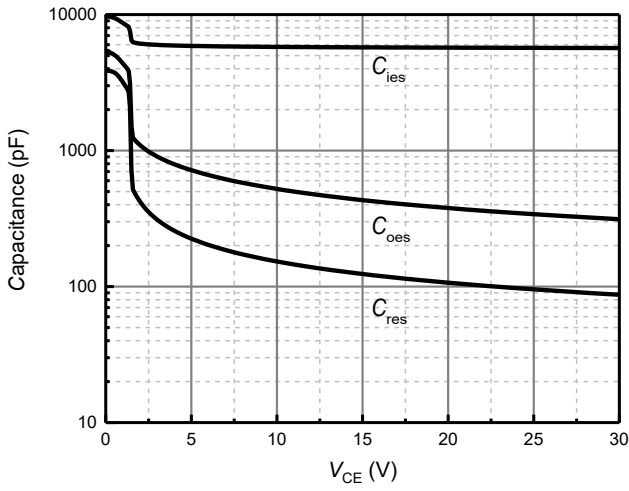


Figure 5 Capacitance Characteristics
($V_{GE}=0V$, $f=250kHz$)

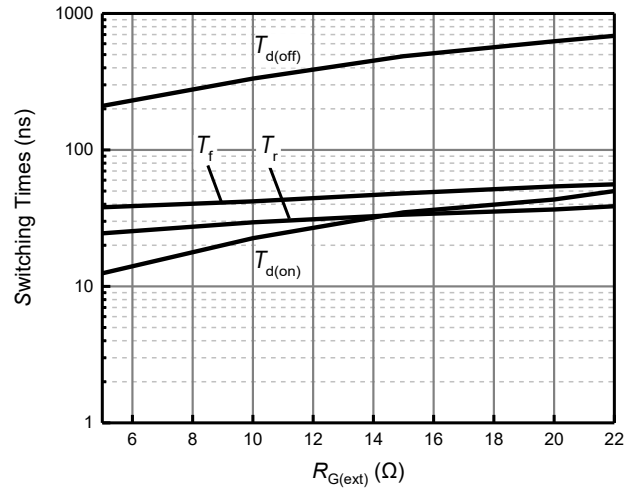


Figure 6 Switching Times vs. Gate Resistor
($V_{DC}=400V$, $V_{GE}=0/15V$, $I_C=25A$, $T_j=25^\circ C$)

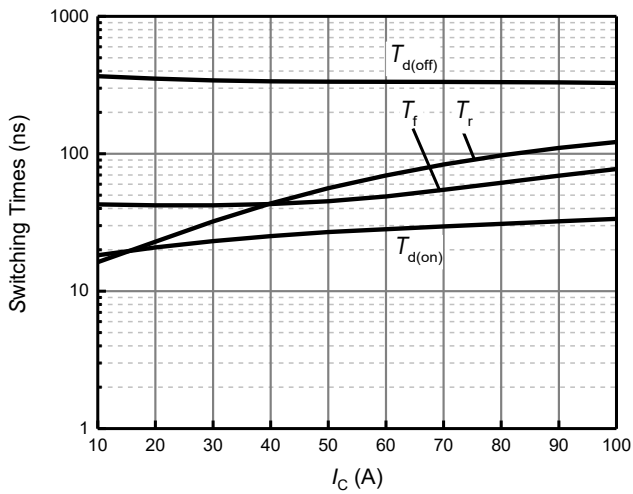


Figure 7 Switching Times vs. Collector Current
($V_{DC}=400V$, $V_{GE}=0/15V$, $R_{G(ext)}=10\Omega$, $T_j=25^\circ C$)

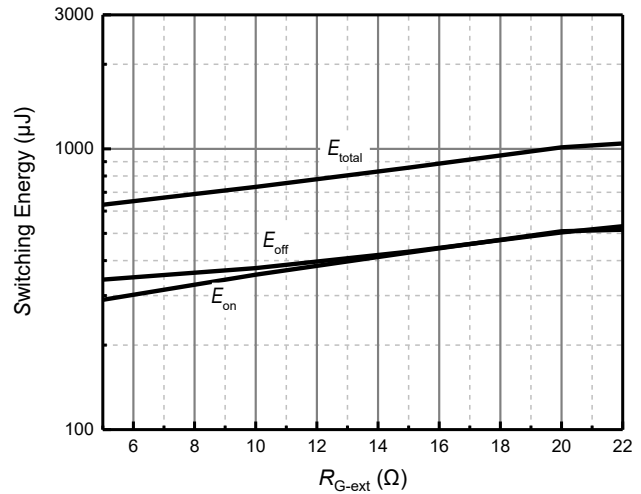


Figure 8 Switching Loss vs. Gate Resistor
($V_{DC}=400V$, $V_{GE}=0/15V$, $I_C=25A$, $T_j=25^\circ C$)

Typical Performance

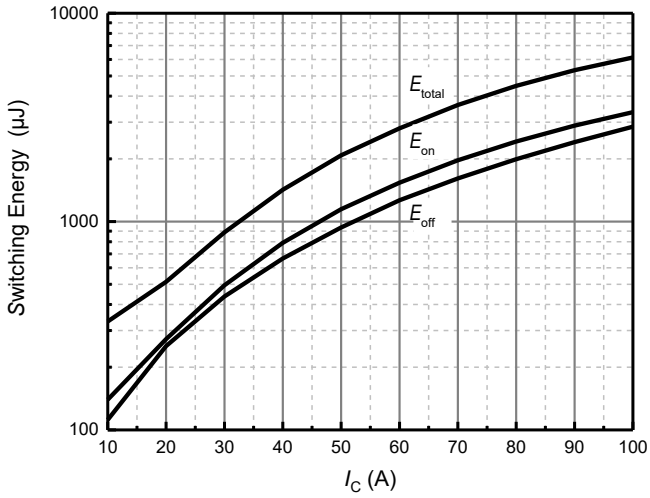


Figure 9 Switching Loss vs. Collector current ($V_{DC}=400V$, $V_{GE}=0/15V$, $R_{G(ext)}=10\Omega$, $T_j=25^\circ C$)

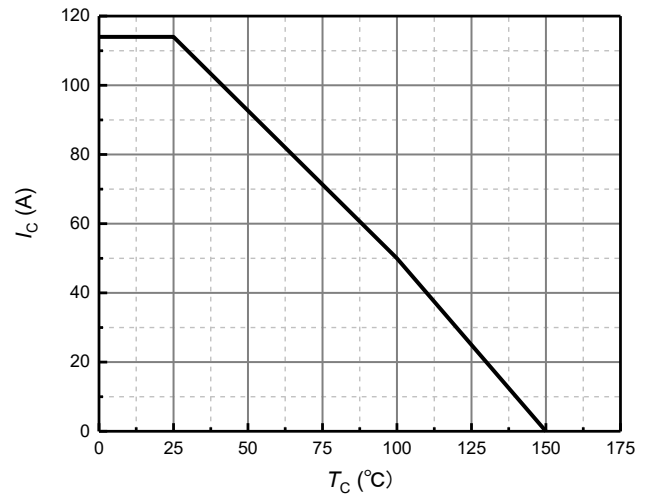


Figure 10 Collector current vs. Case Temperature

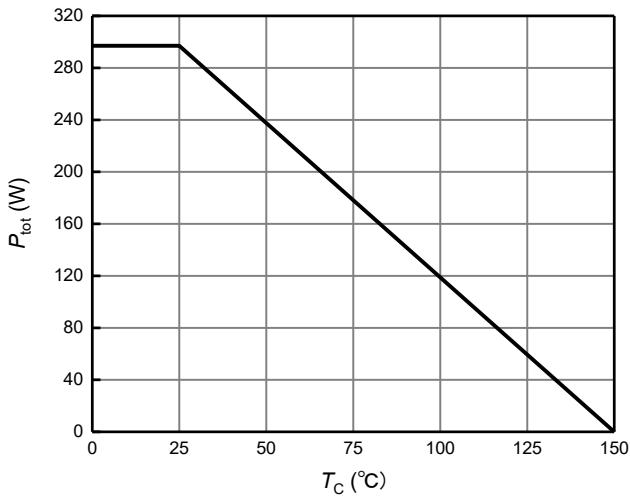


Figure 11 Power Dissipation vs. Case Temperature

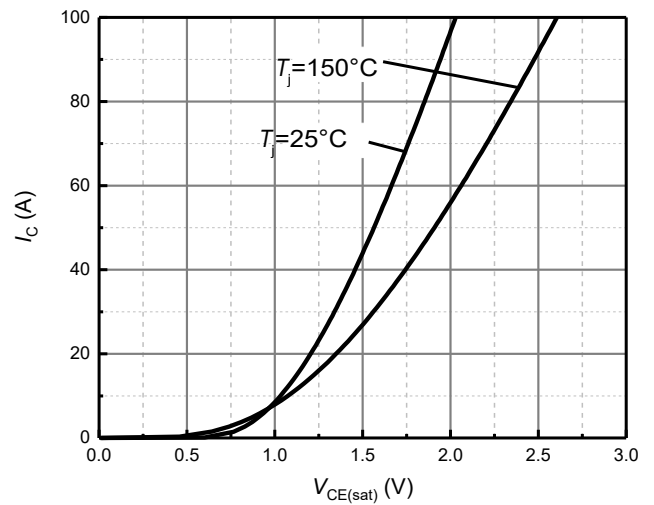


Figure 12 Collector-emitter saturation voltage for Various Temperature ($V_{GE}=15V$)

Typical Performance

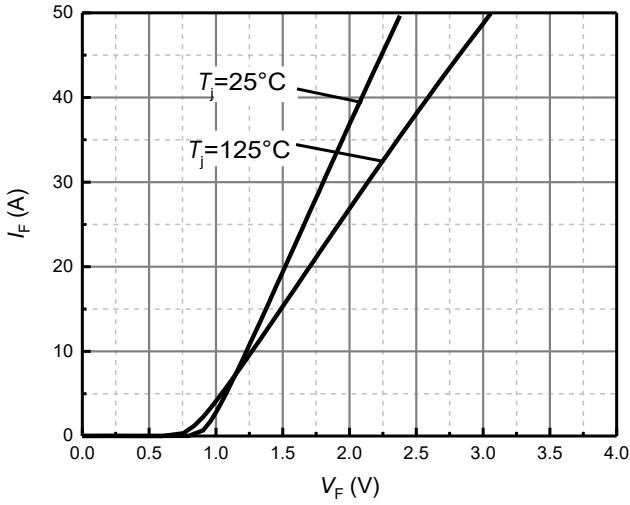


Figure 13 Forward characteristic of Diode

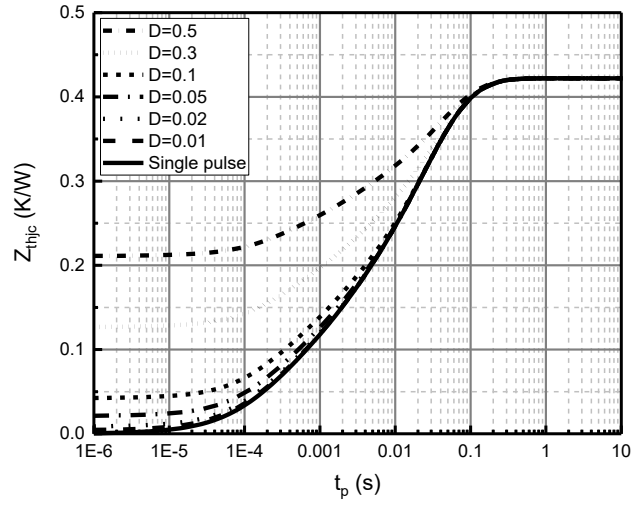


Figure 14 IGBT Transient Thermal Response Curve

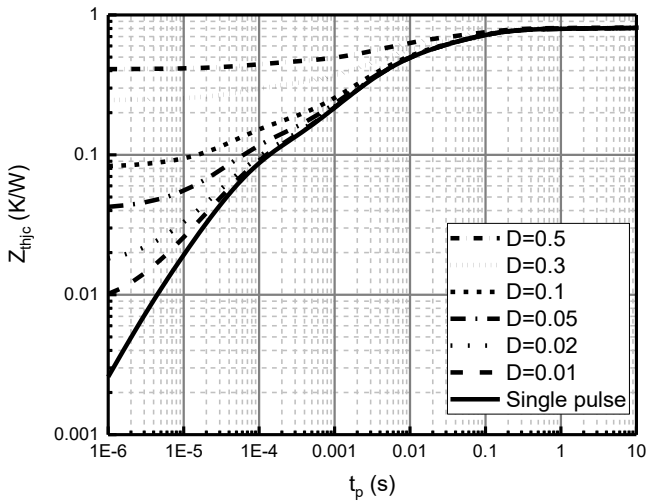


Figure 15 Diode Transient Thermal Response Curve

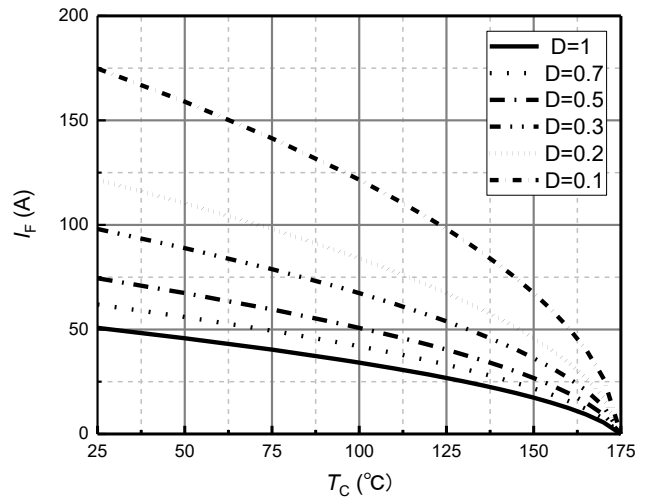
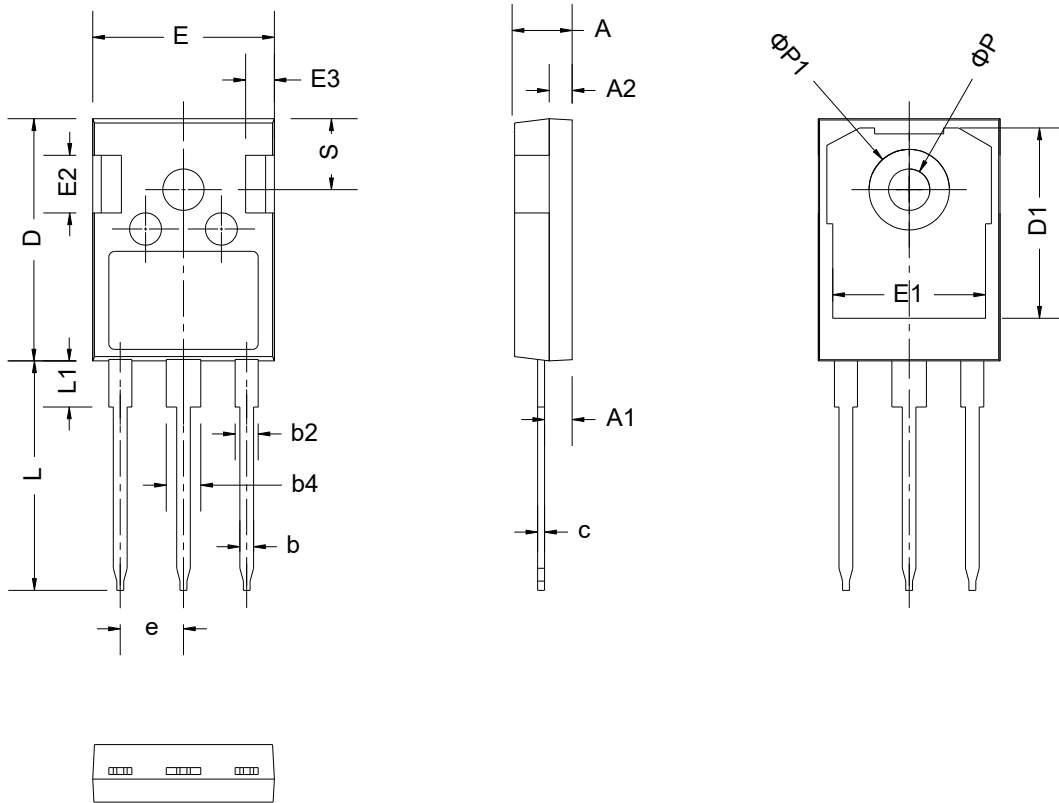


Figure 16 Diode forward current as function of temperature, D=duty cycle

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
$\phi P1$	-	-	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.

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