

Product Summary

V_{CE}	650 V
I_C	75A @ $T_c=100^{\circ}\text{C}$
$V_{CE(sat),Typ}$	1.64V @ $I_c=75\text{A}$

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

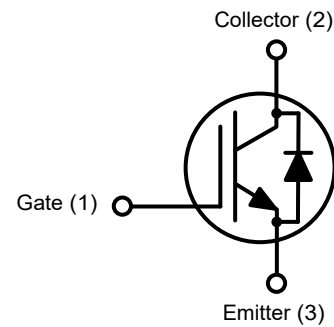
Package Pin Definitions

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

Package Parameters

Part Number	Marking	Package
BGH75N65HF1	BGH75N65HF1	TO-247-3

Package: TO-247-3



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

Symbol	Parameter		Value	Unit
V_{CE}	Collector-Emitter Voltage, $T_j \geq 25^\circ\text{C}$		650	V
V_{GE}	Gate-Emitter Voltage		± 20	
	Transient Gate-Emitter Voltage		± 30	
I_C	DC Collector Current, limited by T_{jmax}	$T_c=25^\circ\text{C}$	150	A
		$T_c=100^\circ\text{C}$	75	
I_F	Diode Forward Current, limited by T_{jmax}	$T_c=25^\circ\text{C}$	76	A
		$T_c=100^\circ\text{C}$	51	
$I_{C,pulse}$	Pulse Collector Current	$V_{GE}=15\text{V}$, t_p limited by T_{jmax}	300	A
P_{tot}	Power Dissipation	$T_c=25^\circ\text{C}$	405	W
T_j	Operating Junction Temperature		-40~175	$^\circ\text{C}$
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		0.37		K/W
$R_{th(j-c)}$	Diode Thermal Resistance-Junction to Case		0.57		K/W
$R_{th(j-a)}$	Thermal Resistance-Junction to Ambient		30		K/W

Electrical Characteristics (Defined at $T_j=25^\circ\text{C}$ Unless Otherwise Specified)
IGBT Static Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15\text{V}$, $I_C=75\text{A}$	$T_j=25^\circ\text{C}$		1.64	2.1	V
			$T_j=100^\circ\text{C}$		1.95		
			$T_j=175^\circ\text{C}$		2.22		
I_{CES}	Zero Gate Voltage Drain Current	$V_{CE}=650\text{V}$, $V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$		5	500	μA
			$T_j=175^\circ\text{C}$		500	5000	
		$V_{CE}=480\text{V}$, $V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$			200	
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$	$T_j=25^\circ\text{C}$			100	nA

$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=750\mu A$	$T_J=25^\circ C$	4.2	5	5.8	V
g_{fs}	Transconductance	$V_{CE}=20V, I_C=75A$			94		S

Dynamic Characteristics

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
C_{ies}	Input Capacitance	$V_{GE}=0V, V_{CE}=25V$ $f=250kHz$		8164		pF
C_{oes}	Output Capacitance			468		pF
C_{res}	Reverse Transfer Capacitance			137		pF
Q_G	Gate Charge	$V_{CC}=520V, V_{GE}=15V, I_C=75A$		444		nC

Switching Characteristics, Inductive Load

Symbol	Parameter	Test conditions	Value			Unit	
			Min.	Typ.	Max.		
$t_{d(on)}$	Turn-On Delay Time	$T_J=25^\circ C$ $V_{DC}=400V, I_C=37.5A$ $V_{GE}=0/15V, R_{G(ext)}=4.7\Omega$ $L_\sigma=60nH$		30		ns	
t_r	Rise Time			35			
$t_{d(off)}$	Turn-Off Delay Time			288			
t_f	Fall Time			29		uJ	
E_{on}	Turn-On Energy			721			
E_{off}	Turn-Off Energy			460			
E_{total}	Total Switching Energy			1181			
$t_{d(on)}$	Turn-On Delay Time		$T_J=150^\circ C$ $V_{DC}=400V, I_C=37.5A$ $V_{GE}=0/15V, R_{G(ext)}=4.7\Omega$ $L_\sigma=60nH$		27		ns
t_r	Rise Time				33		
$t_{d(off)}$	Turn-Off Delay Time			332			
t_f	Fall Time			49		uJ	
E_{on}	Turn-On Energy			712			
E_{off}	Turn-Off Energy			611			
E_{total}	Total Switching Energy			1323			

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-On Delay Time	$T_j=25^\circ\text{C}$ $V_{DC}=400\text{V}, I_C=75\text{A}$ $V_{GE}=0/15\text{V}, R_{G(ext)}=4.7\Omega$ $L_\sigma=60\text{nH}$		35		ns
t_r	Rise Time			77		
$t_{d(off)}$	Turn-Off Delay Time			277		
t_f	Fall Time			53		
E_{on}	Turn-On Energy			2119		uJ
E_{off}	Turn-Off Energy			1313		
E_{total}	Total Switching Energy			3432		
$t_{d(on)}$	Turn-On Delay Time	$T_j=150^\circ\text{C}$ $V_{DC}=400\text{V}, I_C=75\text{A}$ $V_{GE}=0/15\text{V}, R_{G(ext)}=4.7\Omega$ $L_\sigma=60\text{nH}$		32		ns
t_r	Rise Time			72		
$t_{d(off)}$	Turn-Off Delay Time			313		
t_f	Fall Time			63		
E_{on}	Turn-On Energy			2132		uJ
E_{off}	Turn-Off Energy			1531		
E_{total}	Total Switching Energy			3663		

SiC Schottky Barrier Diode Static Characteristics

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
V_F	Diode Forward Voltage	$I_F=20\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	1.30	1.70	V
			$T_j=100^\circ\text{C}$	1.36		
			$T_j=175^\circ\text{C}$	1.60		
Q_C	Diode Capacitive Charge	$V_R=400\text{V}, T_j=25^\circ\text{C}$		64		nC
C	Diode Capacitance	$V_R=1\text{V}, f=1\text{MHz}$		998		pF
		$V_R=300\text{V}, f=1\text{MHz}$		110		

Typical Performance

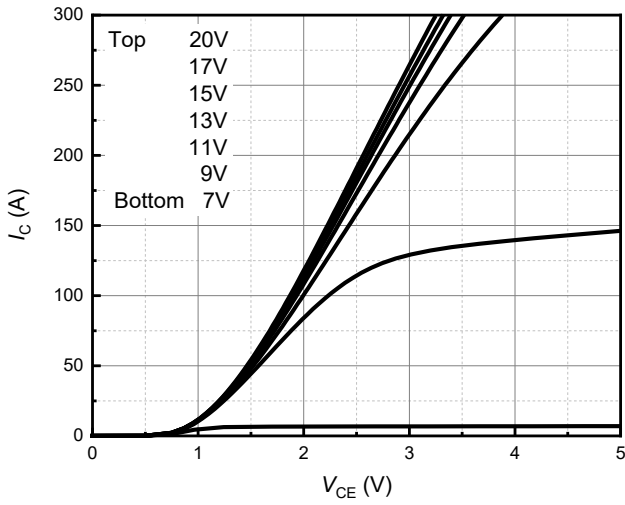


Figure 1 Output Characteristics
($T_j = 25^\circ\text{C}$)

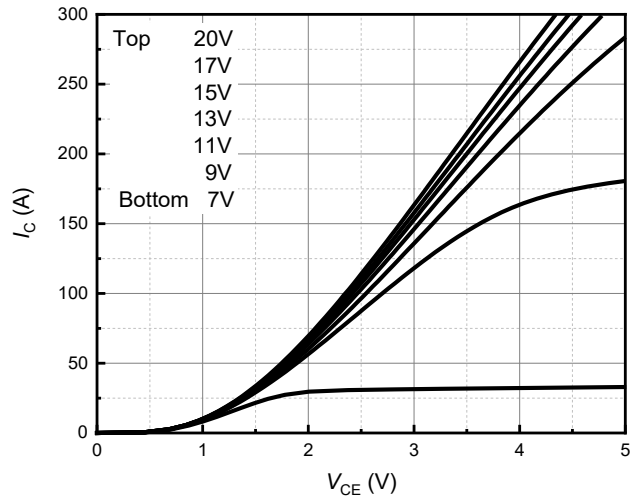


Figure 2 Output Characteristics
($T_j = 150^\circ\text{C}$)

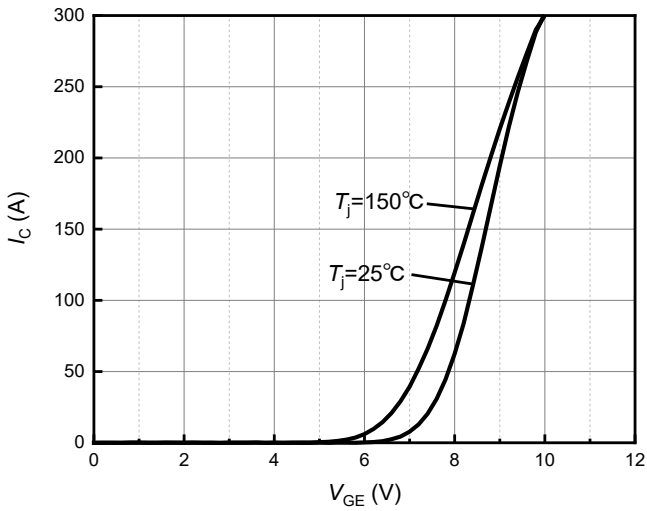


Figure 3 Transfer Characteristics for Various Temperature
($V_{CE} = 20\text{V}$)

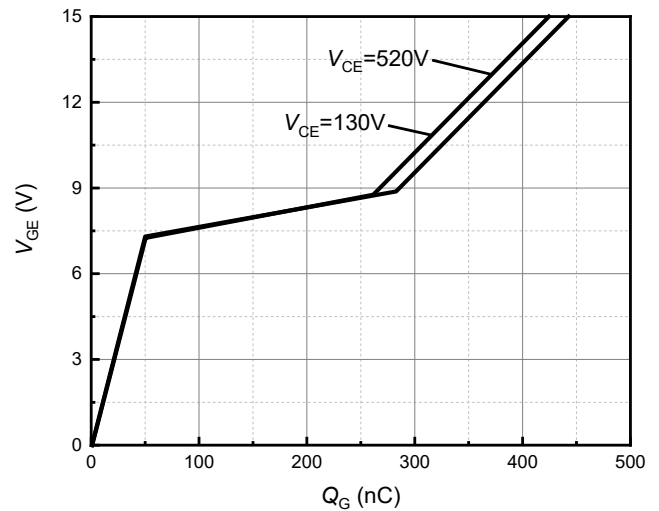


Figure 4 Gate Charge Characteristics
($I_c = 75\text{A}$)

Typical Performance

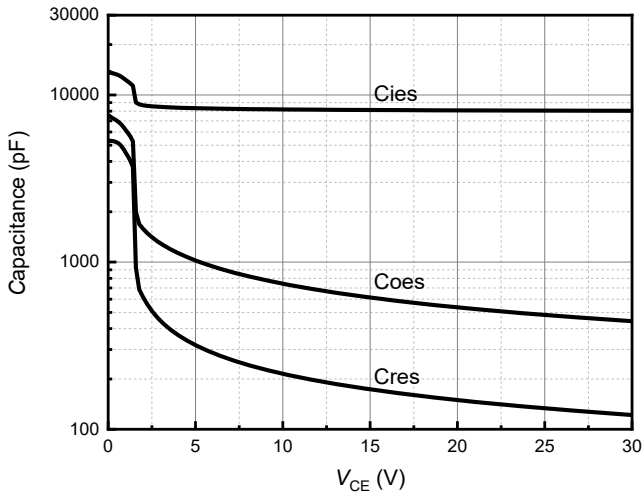


Figure 5 Capacitance Characteristics
($V_{GE}=0V$, $f=250kHz$)

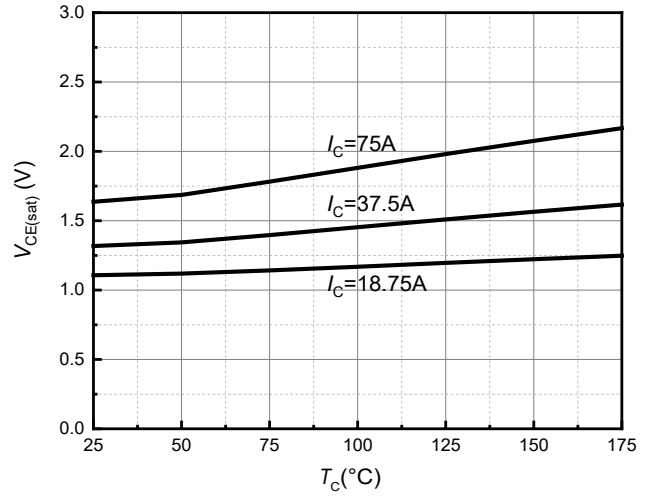


Figure 6 Collector-Emitter Saturation Voltage vs. Junction Temperature for Various Collector Current
($V_{GE}=15V$)

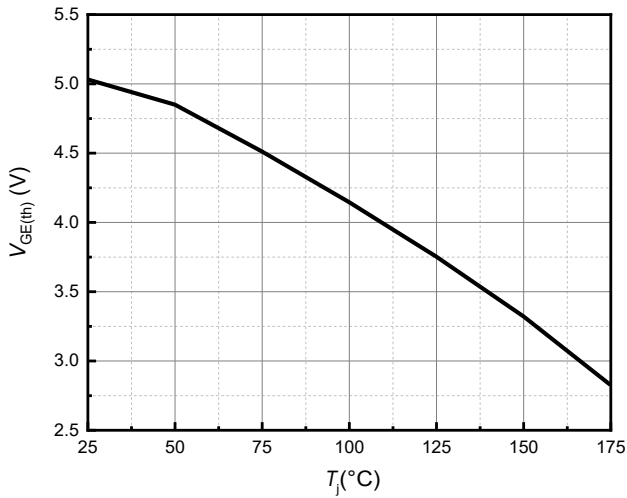


Figure 7 Gate-Emitter threshold Voltage vs. Junction Temperature
($I_C=0.75mA$)

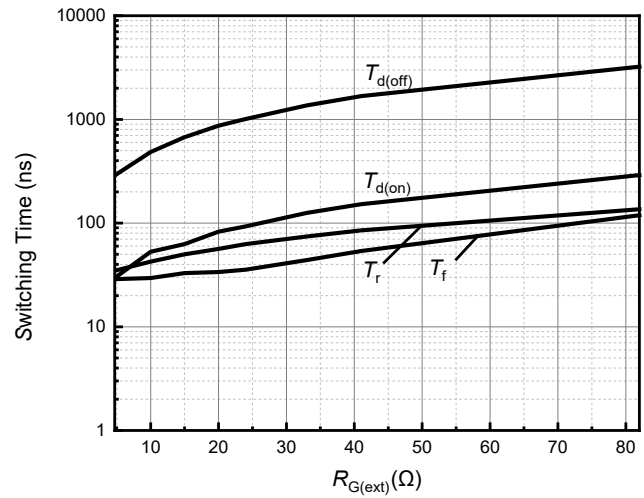


Figure 8 Switching Times vs. Gate Resistor
($V_{DC}=400V$, $V_{GE}=0/15V$, $I_C=37.5A$, $T_j=25°C$)

Typical Performance

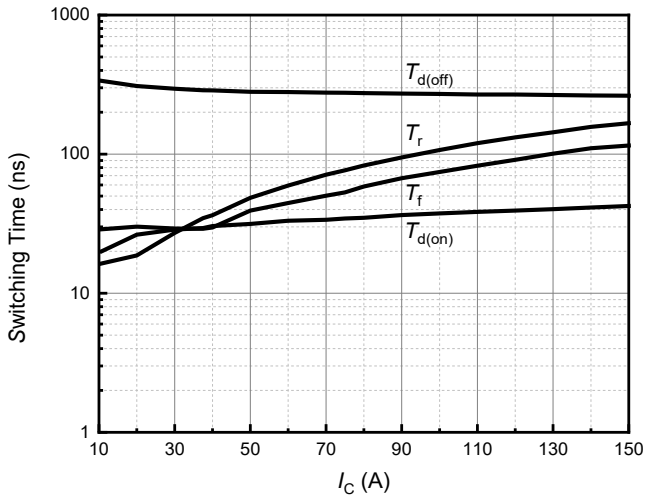


Figure 9 Switching Times vs. Collector Current ($V_{DC}=400V$, $V_{GE}=0/15V$, $R_{G(ext)}=4.7\Omega$, $T_j=25^\circ C$)

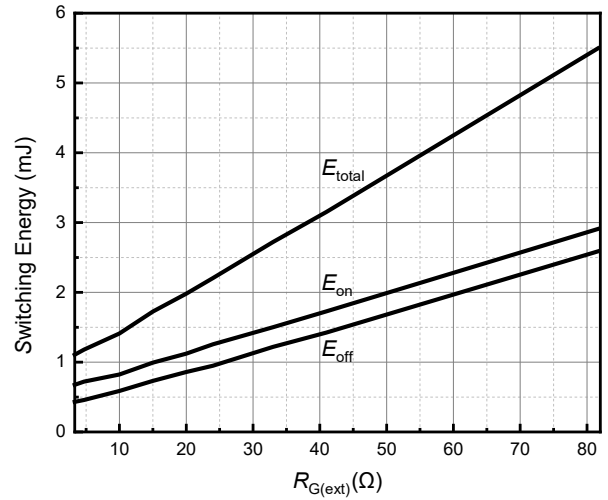


Figure 10 Switching Loss vs. Gate Resistor ($V_{DC}=400V$, $V_{GE}=0/15V$, $I_C=37.5A$, $T_j=25^\circ C$)

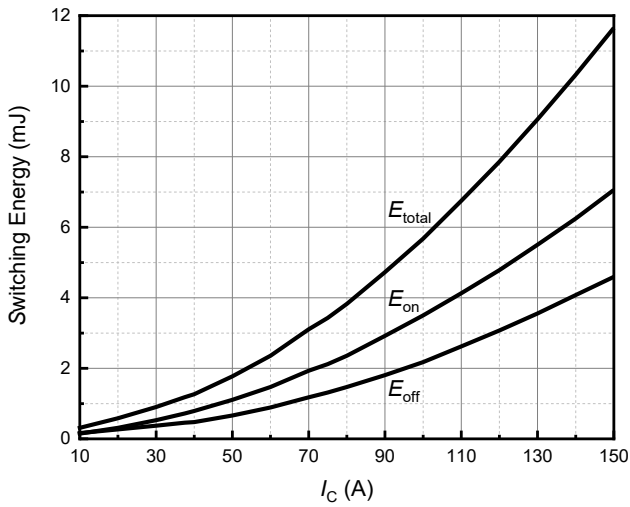


Figure 11 Switching Loss vs. Collector Current ($V_{DC}=400V$, $V_{GE}=0/15V$, $R_{G(ext)}=4.7\Omega$, $T_j=25^\circ C$)

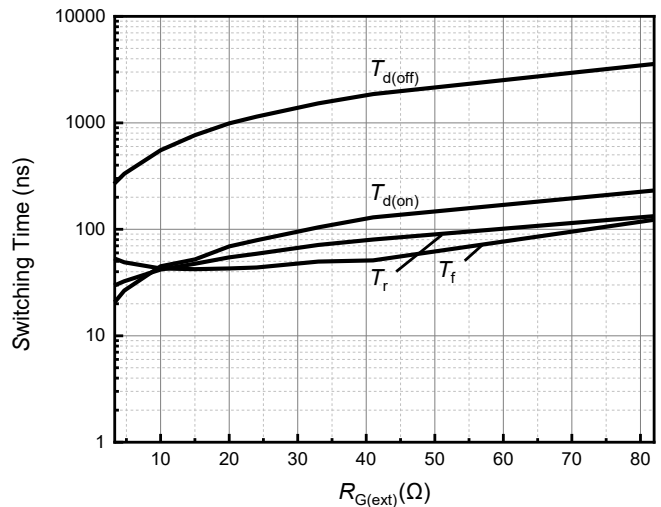


Figure 12 Switching Times vs. Gate Resistor ($V_{DC}=400V$, $V_{GE}=0/15V$, $I_C=37.5A$, $T_j=150^\circ C$)

Typical Performance

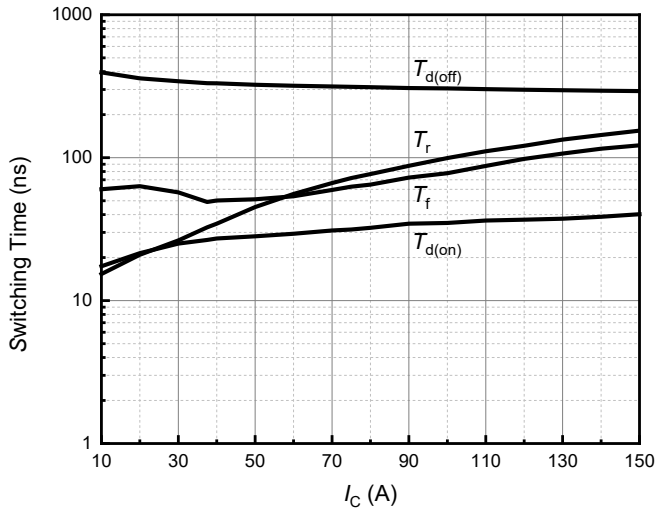


Figure 13 Switching Times vs. Collector Current ($V_{DC}=400V$, $V_{GE}=0/15V$, $R_{G(ext)}=4.7\Omega$, $T_j=150^\circ C$)

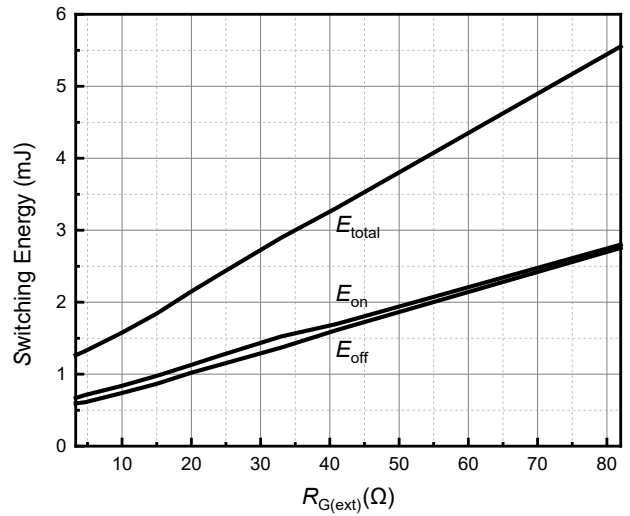


Figure 14 Switching Loss vs. Gate Resistor ($V_{DC}=400V$, $V_{GE}=0/15V$, $I_C=37.5A$, $T_j=150^\circ C$)

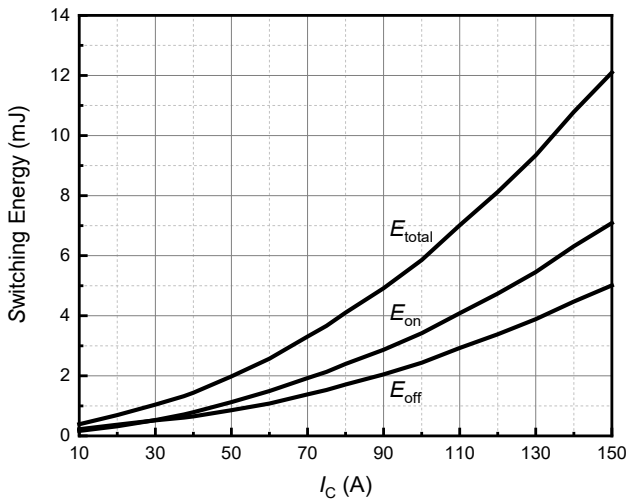


Figure 15 Switching Loss vs. Collector Current ($V_{DC}=400V$, $V_{GE}=0/15V$, $R_{G(ext)}=4.7\Omega$, $T_j=150^\circ C$)

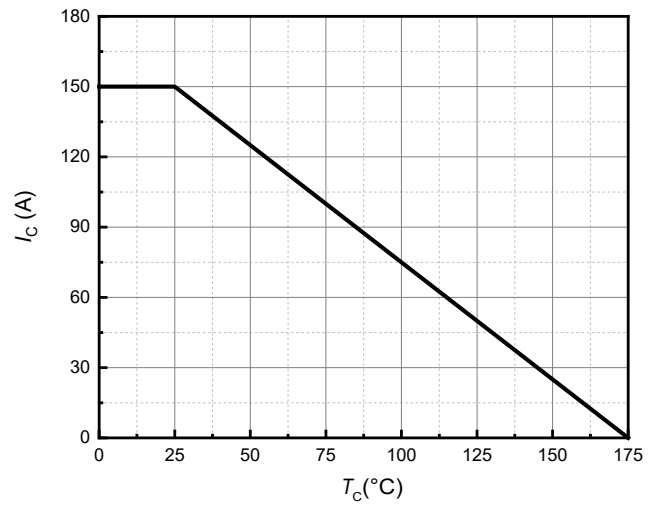


Figure 16 Maximum Collector current vs. Case Temperature

Typical Performance

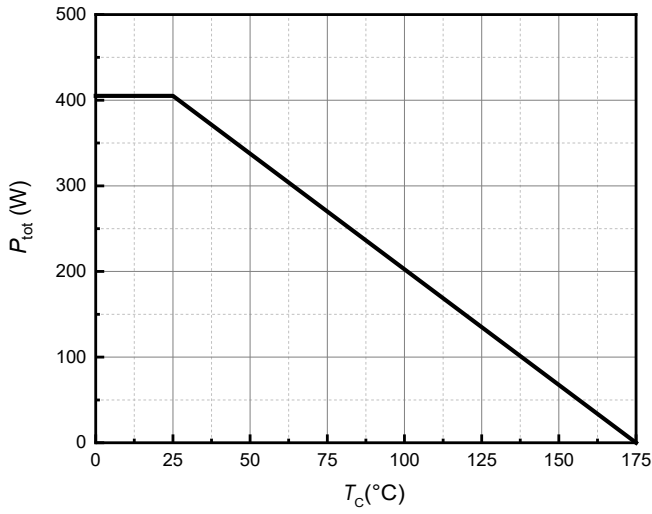


Figure 17 Power Dissipation as a Function of T_c

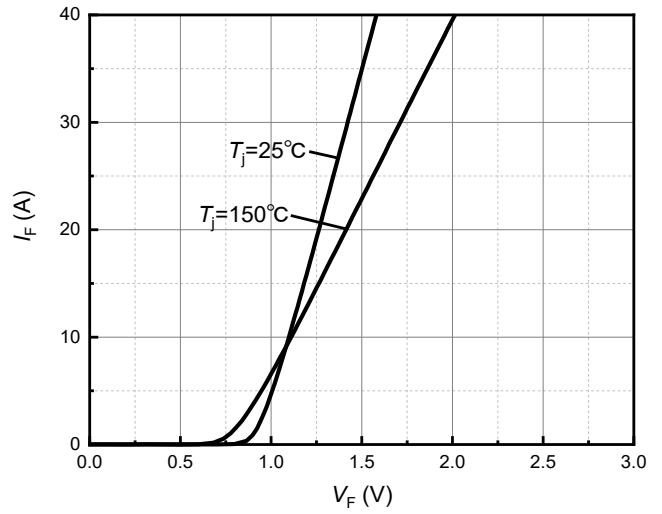


Figure 18 Forward characteristic of Diode

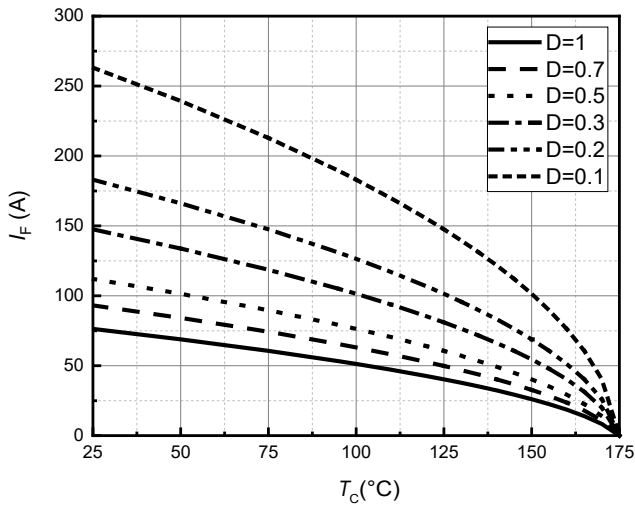


Figure 19 Diode forward current as function of temperature, D=duty cycle

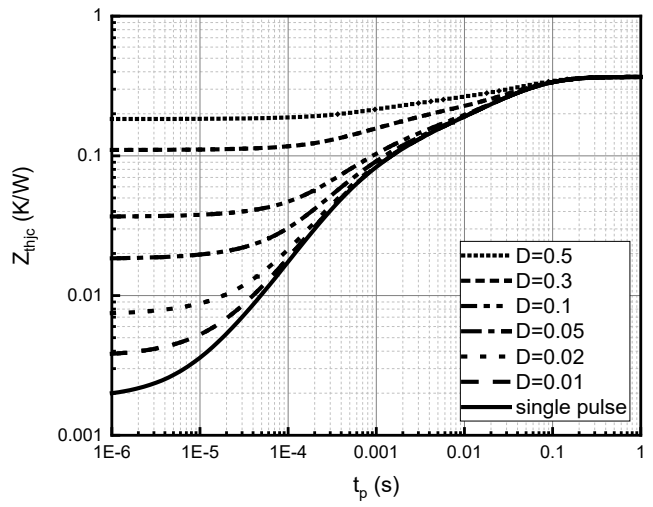


Figure 20 IGBT Transient Thermal Response Curve

Typical Performance

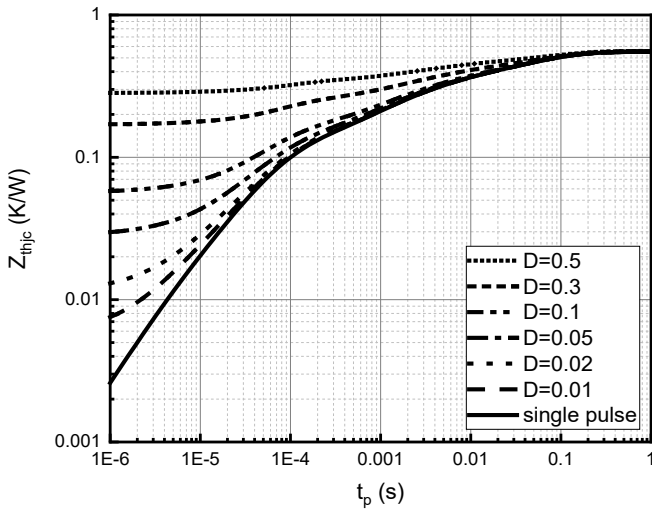
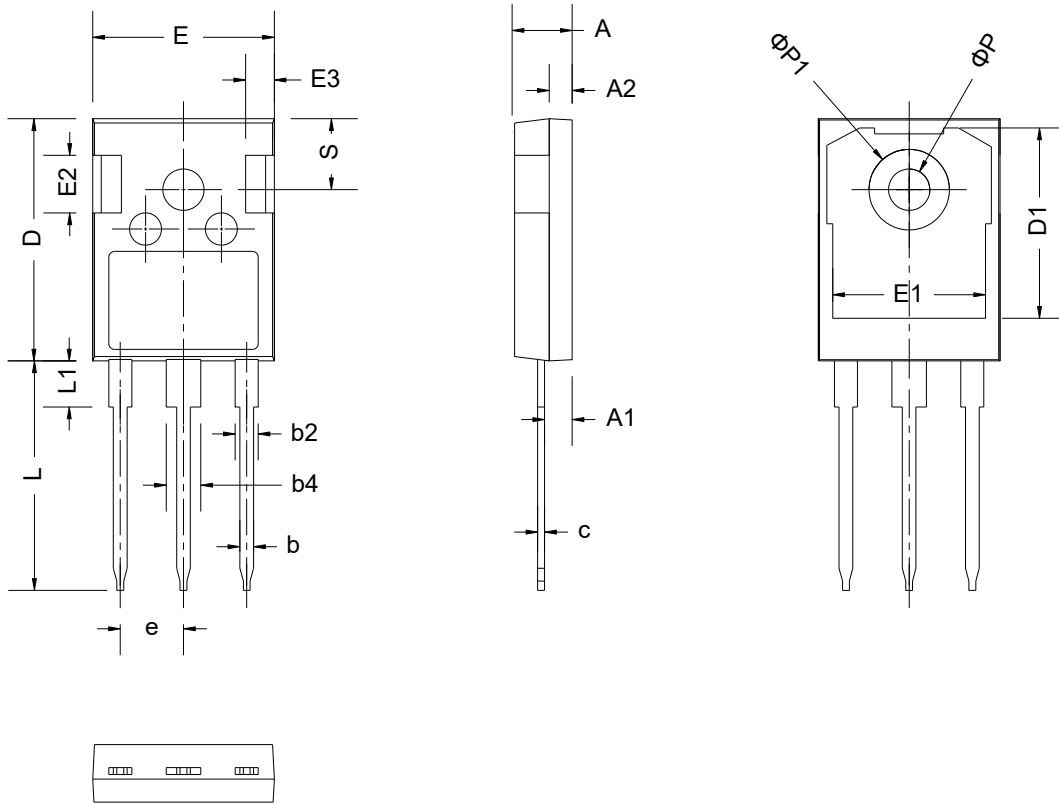


Figure 21 Diode Transient Thermal Response Curve

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
φ P	3.40	3.60	3.80
φ P1	-	-	7.30
S	6.16 BSC		

Revision History

Document Version	Date of Release	Description of Changes
Rev. 0.0	2022-06-08	Draft datasheet created.
Rev. 0.1	2023-05-05	Update features.

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