

### Product Summary

$V_{CE}$	1200 V
$I_C$	75A @ $T_C=100^{\circ}\text{C}$
$V_{CE(sat),Typ}$	2.2V @ $I_C=75\text{A}$

### 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
- DC/DC Converters with high Switching frequency

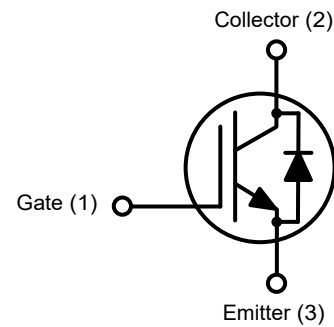
#### Package Pin Definitions

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

#### Package Parameters

Part Number	Marking	Package
BGH75N120HF1	BGH75N120HF1	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 Breakdown Voltage	1200	V	
$V_{GE}$	Continuous Gate-Emitter Voltage	$\pm 20$		
	Transient Gate-Emitter Voltage	$\pm 30$		
$I_C$	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
		$T_C=100^\circ\text{C}$	45	
$I_{C,pulse}$	Pulse Collector Current	$V_{GE}=15\text{V}$ , limited by $T_{jmax}$	200	A
$P_{tot}$	Power Dissipation	$T_C=25^\circ\text{C}$	568	W
$T_j$	Operating Junction Temperature		-40~150	$^\circ\text{C}$
$T_{stg}$	Storage Temperature		-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		0.22		$^\circ\text{C/W}$
$R_{th(j-c)}$	Diode Thermal Resistance-Junction to Case		0.41		$^\circ\text{C/W}$
$R_{th(j-a)}$	Thermal Resistance-Junction to Ambient		31		$^\circ\text{C/W}$

**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	$V_{GE}=15\text{V}$ , $I_C=75\text{A}$	$T_j=25^\circ\text{C}$		2.2	2.65	V
			$T_j=100^\circ\text{C}$		2.6		
			$T_j=150^\circ\text{C}$		3		
$I_{CES}$	Zero Gate Voltage Drain Current	$V_{CE}=1200\text{V}$ , $V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$		4	400	$\mu\text{A}$
			$T_j=150^\circ\text{C}$		85	4000	
		$V_{CE}=960\text{V}$ , $V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$		0.3	90	
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE}=\pm 20\text{V}$ , $V_{CE}=0\text{V}$	$T_j=25^\circ\text{C}$		6	100	nA
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}$ , $I_C=2.6\text{mA}$	$T_j=25^\circ\text{C}$	5	5.7	6.2	V

$g_{fs}$	Transconductance	$V_{CE}=20V, I_C=75A$		97		S
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**Dynamic Characteristics**

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$C_{ies}$	Input Capacitance	$V_{GE}=0V, V_{CE}=25V$ $f=250kHz$		8260		pF
$C_{oes}$	Output Capacitance			575		pF
$C_{res}$	Reverse Transfer Capacitance			134		pF
$Q_G$	Total Gate Charge	$V_{CC}=960V, V_{GE}=15V,$ $I_C=75A$		398		nC

**Switching Characteristics, Inductive Load**

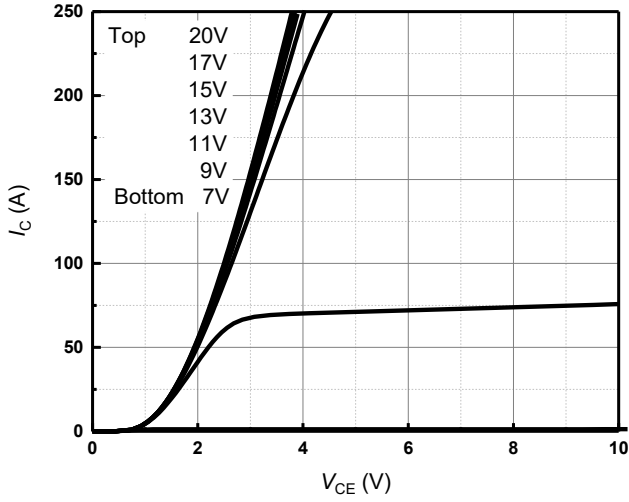
Symbol	Parameter	Test conditions	Value			Unit	
			Min.	Typ.	Max.		
$t_{d(on)}$	Turn-On Delay Time	$T_J=25^\circ C$ $V_{DC}=600V, I_C=37.5A$ $V_{GE}=0/15V, R_{G(ext)}=10\Omega$ $L_\sigma=60nH$		45		ns	
$t_r$	Rise Time			51			
$t_{d(off)}$	Turn-Off Delay Time			355			
$t_f$	Fall Time			59			
$E_{on}$	Turn-On Energy			1.57		mJ	
$E_{off}$	Turn-Off Energy			1.11			
$E_{total}$	Total Switching Energy			2.68			
$t_{d(on)}$	Turn-On Delay Time		$T_J=125^\circ C$ $V_{DC}=600V, I_C=37.5A$ $V_{GE}=0/15V, R_{G(ext)}=10\Omega$ $L_\sigma=60nH$		39		ns
$t_r$	Rise Time				47		
$t_{d(off)}$	Turn-Off Delay Time			403			
$t_f$	Fall Time			93			
$E_{on}$	Turn-On Energy			1.59		mJ	
$E_{off}$	Turn-Off Energy			1.44			
$E_{total}$	Total Switching Energy			3.03			

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-On Delay Time	$T_j=25^\circ\text{C}$ $V_{DC}=600\text{V}, I_C=75\text{A}$ $V_{GE}=0/15\text{V}, R_{G(ext)}=10\Omega$ $L_\sigma=60\text{nH}$		52		ns
$t_r$	Rise Time			101		
$t_{d(off)}$	Turn-Off Delay Time			338		
$t_f$	Fall Time			54		
$E_{on}$	Turn-On Energy			4.49		mJ
$E_{off}$	Turn-Off Energy			2.58		
$E_{total}$	Total Switching Energy			7.07		
$t_{d(on)}$	Turn-On Delay Time	$T_j=125^\circ\text{C}$ $V_{DC}=600\text{V}, I_C=75\text{A}$ $V_{GE}=0/15\text{V}, R_{G(ext)}=10\Omega$ $L_\sigma=60\text{nH}$		47		ns
$t_r$	Rise Time			93		
$t_{d(off)}$	Turn-Off Delay Time			378		
$t_f$	Fall Time			65		
$E_{on}$	Turn-On Energy			4.52		mJ
$E_{off}$	Turn-Off Energy			3.09		
$E_{total}$	Total Switching Energy			7.61		

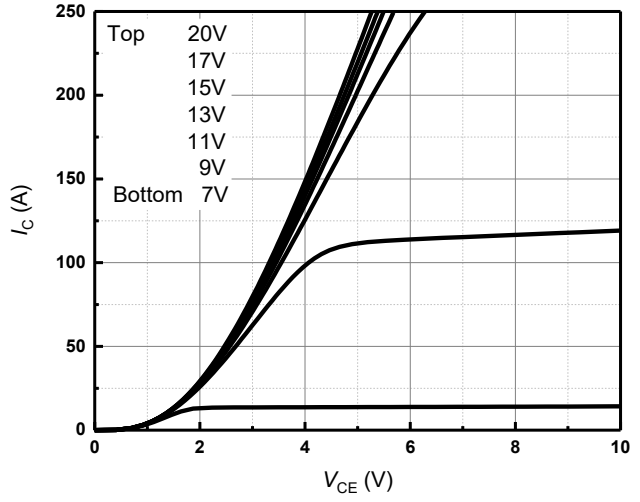
**SiC Schottky Barrier Diode Static Characteristics**

Symbol	Parameter	Test conditions	Value			Unit	
			Min.	Typ.	Max.		
$V_F$	Diode Forward Voltage	$I_F=20\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$		1.3	1.6	V
			$T_j=100^\circ\text{C}$		1.47		
			$T_j=150^\circ\text{C}$		1.65		
$Q_C$	Diode Capacitive Charge	$V_R=800\text{V}, T_j=25^\circ\text{C}$		120		nC	
C	Diode Capacitance	$V_R=1\text{V}, f=1\text{MHz}$		1342		pF	
		$V_R=400\text{V}, f=1\text{MHz}$		112			
		$V_R=800\text{V}, f=1\text{MHz}$		85			

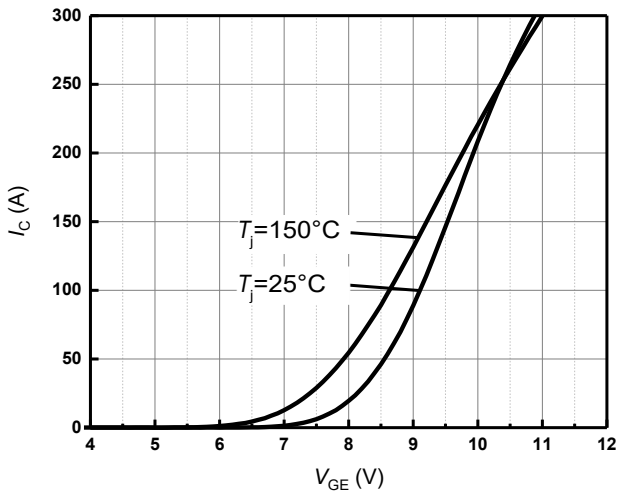
**Typical Performance**



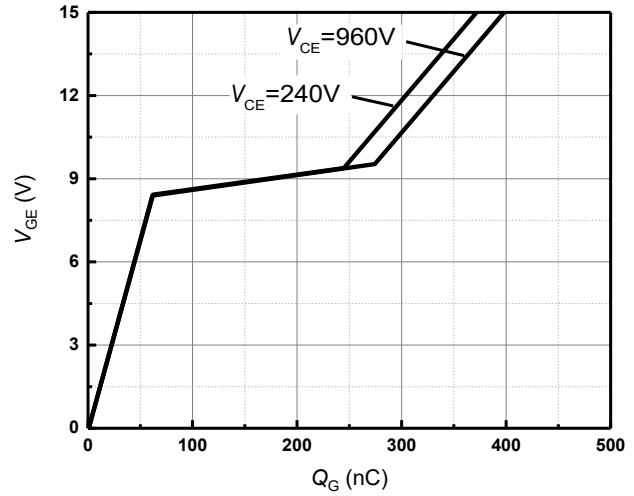
**Figure 1 Output Characteristics**  
( $T_j=25^\circ\text{C}$ )



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

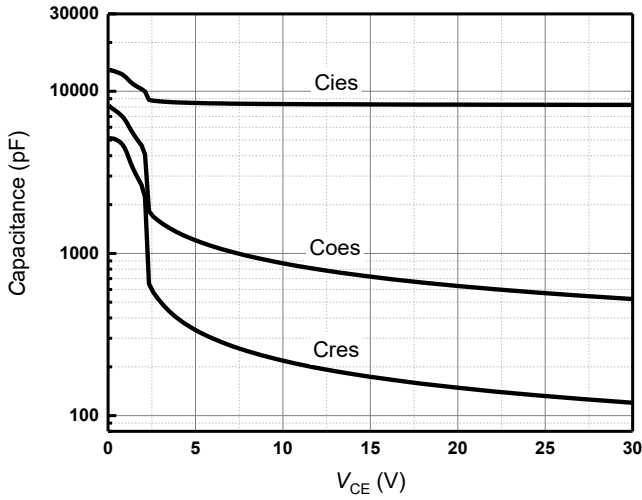


**Figure 3 Transfer Characteristics for Various Temperature**  
( $V_{CE}=20\text{V}$ )

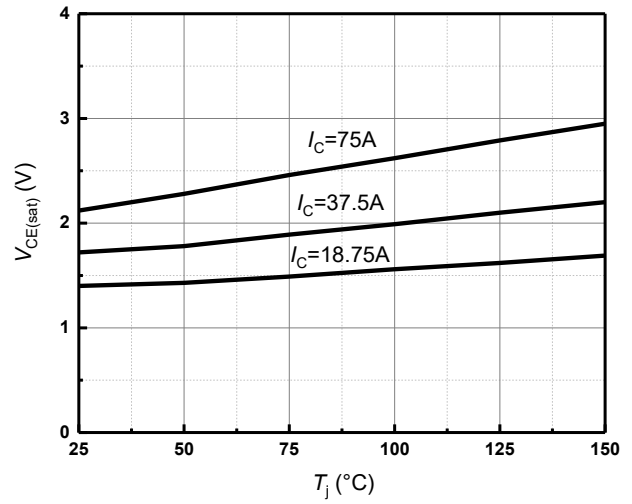


**Figure 4 Gate Charge Characteristics**  
( $I_C=75\text{A}$ )

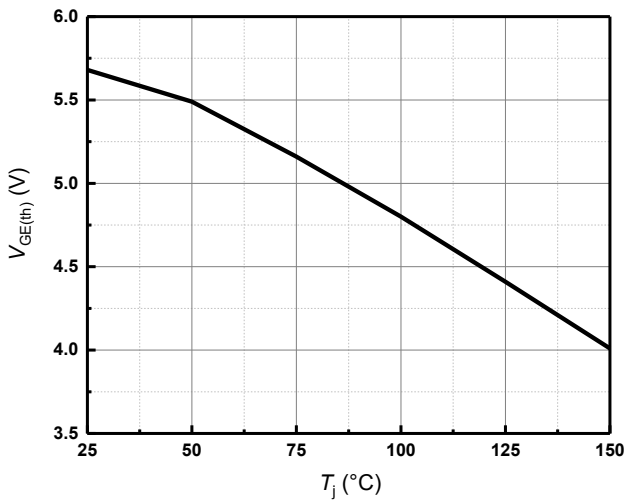
**Typical Performance**



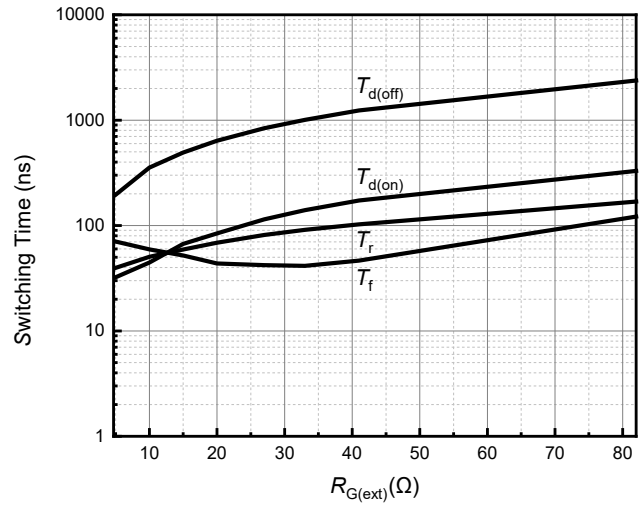
**Figure 5** Capacitance Characteristics ( $V_{GE}=0V$ ,  $f=250kHz$ )



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

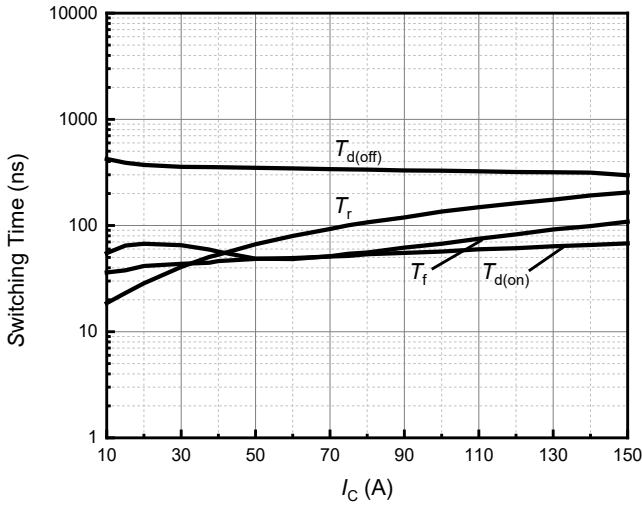


**Figure 7** Gate-Emitter threshold Voltage vs. Junction Temperature ( $I_C=2.6mA$ )

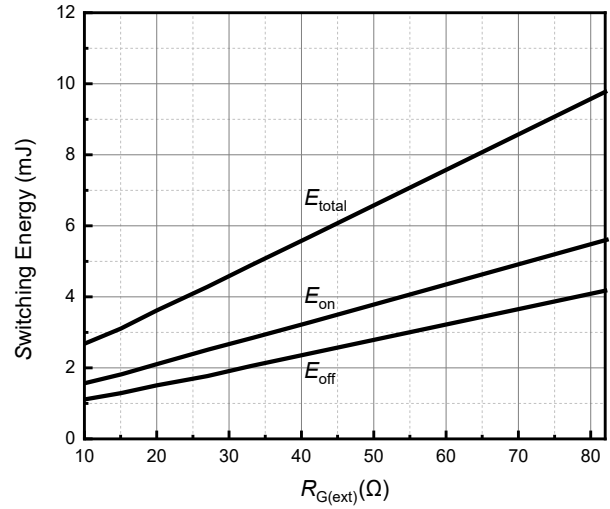


**Figure 8** Switching Times vs. Gate Resistor ( $V_{CC}=600V$ ,  $V_{GE}=15V$ ,  $I_C=75A$ ,  $T_j=25°C$ )

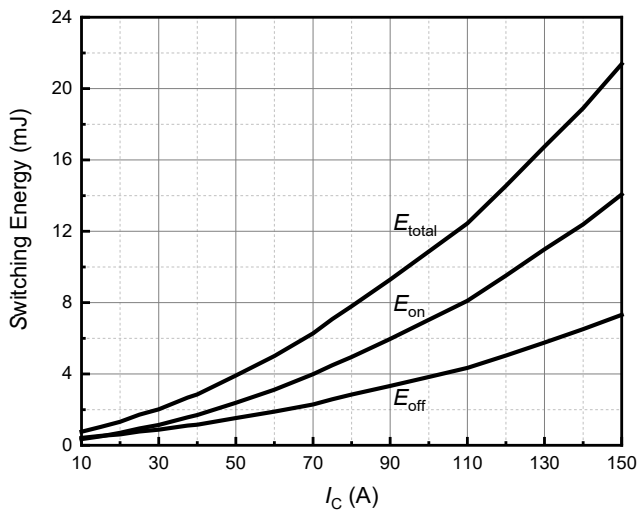
**Typical Performance**



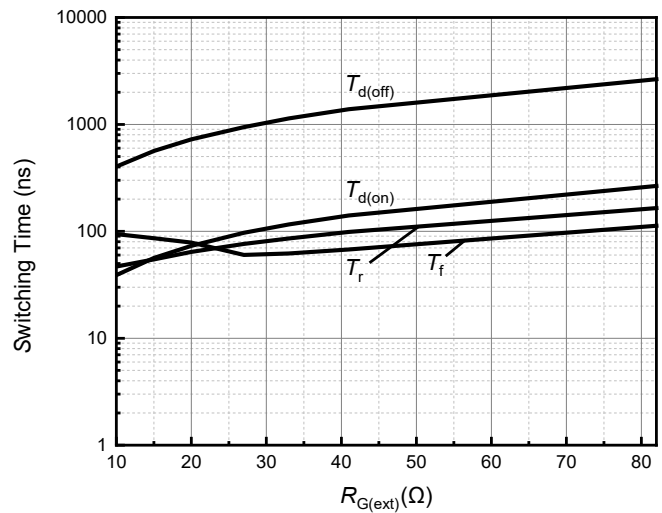
**Figure 9** Switching Times vs. Collector Current ( $V_{CC}=600V$ ,  $V_{GE}=15V$ ,  $R_{G(ext)}=10\Omega$ ,  $T_j=25^\circ C$ )



**Figure 10** Switching Loss vs. Gate Resistor ( $V_{CC}=600V$ ,  $V_{GE}=15V$ ,  $I_C=75A$ ,  $T_j=25^\circ C$ )

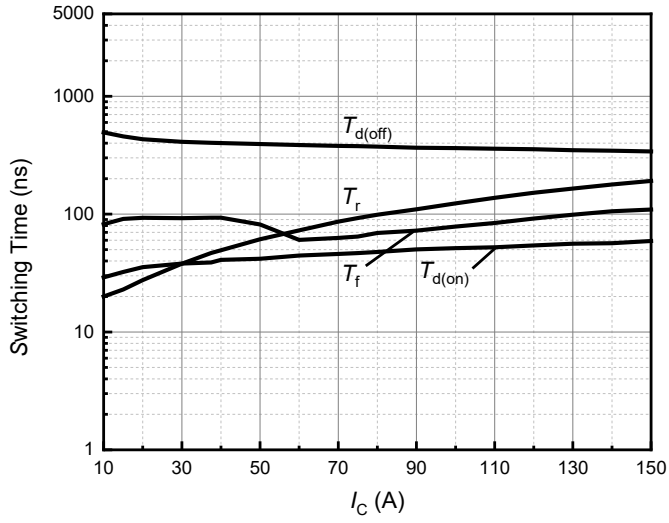


**Figure 11** Switching Loss vs. Collector Current ( $V_{CC}=600V$ ,  $V_{GE}=15V$ ,  $R_{G(ext)}=10\Omega$ ,  $T_j=25^\circ C$ )

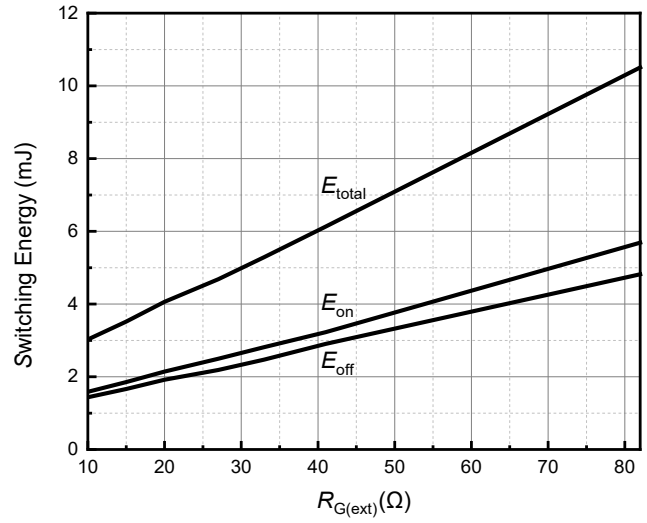


**Figure 12** Switching Times vs. Gate Resistor ( $V_{CC}=600V$ ,  $V_{GE}=15V$ ,  $I_C=75A$ ,  $T_j=125^\circ C$ )

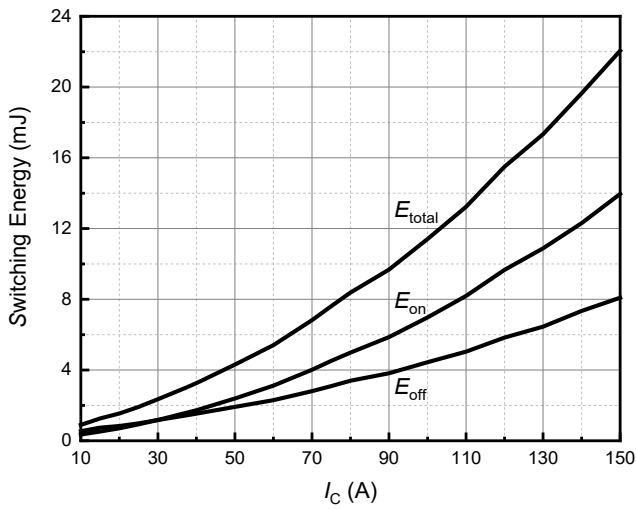
**Typical Performance**



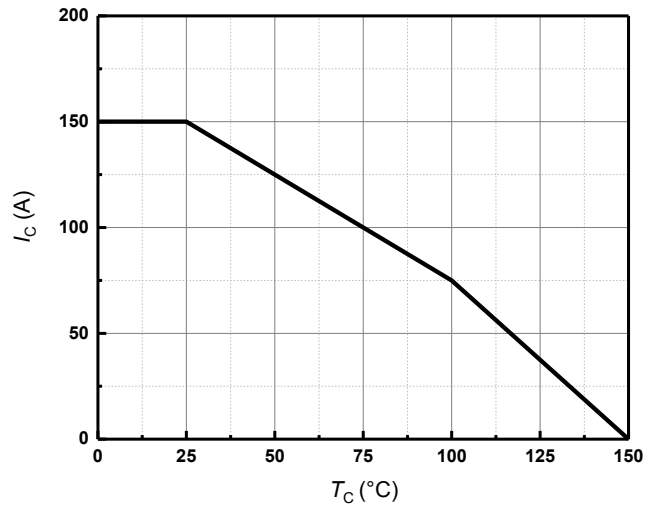
**Figure 13** Switching Times vs. Collector Current ( $V_{CC}=600V$ ,  $V_{GE}=15V$ ,  $R_{G(ext)}=10\Omega$ ,  $T_j=125^\circ C$ )



**Figure 14** Switching Loss vs. Gate Resistor ( $V_{CC}=600V$ ,  $V_{GE}=15V$ ,  $I_C=75A$ ,  $T_j=125^\circ C$ )



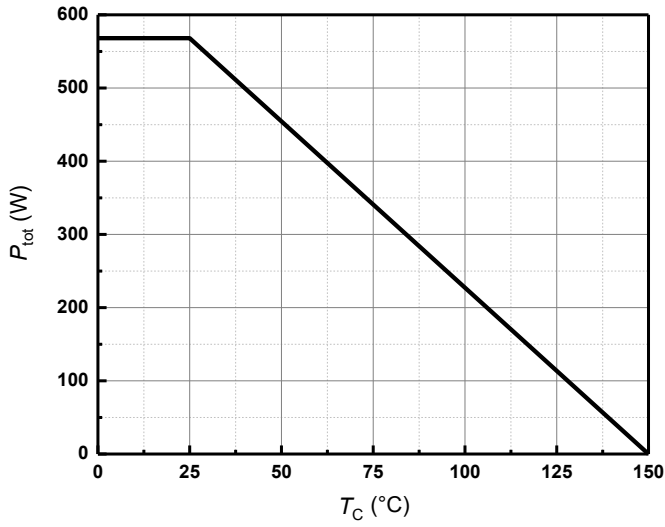
**Figure 15** Switching Loss vs. Collector Current ( $V_{CC}=600V$ ,  $V_{GE}=15V$ ,  $R_{G(ext)}=10\Omega$ ,  $T_j=125^\circ C$ )



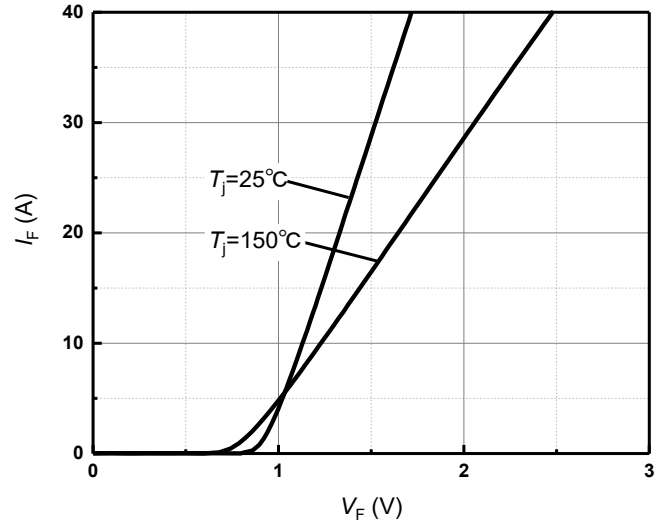
**Figure 16** Maximum Collector current vs. Case Temperature



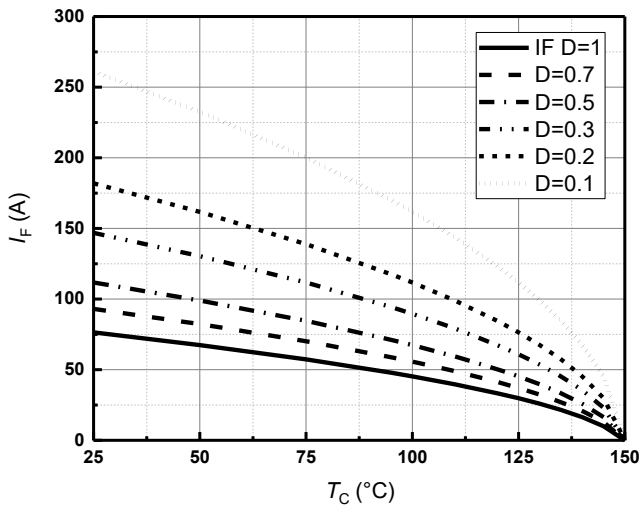
**Typical Performance**



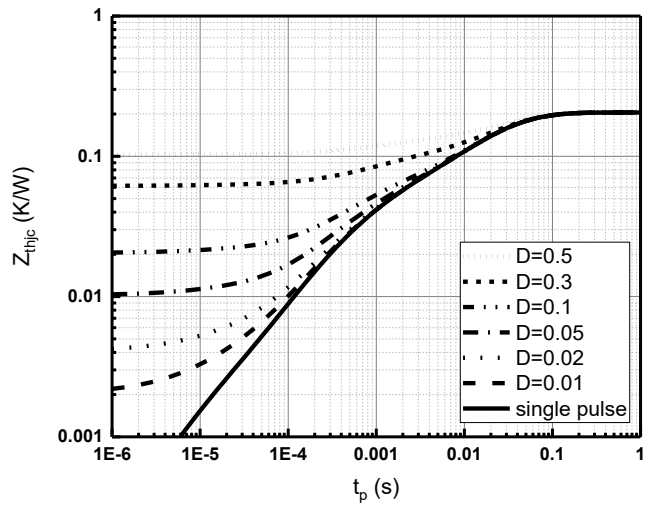
**Figure 17 Power Dissipation as a Function of  $T_c$**



**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

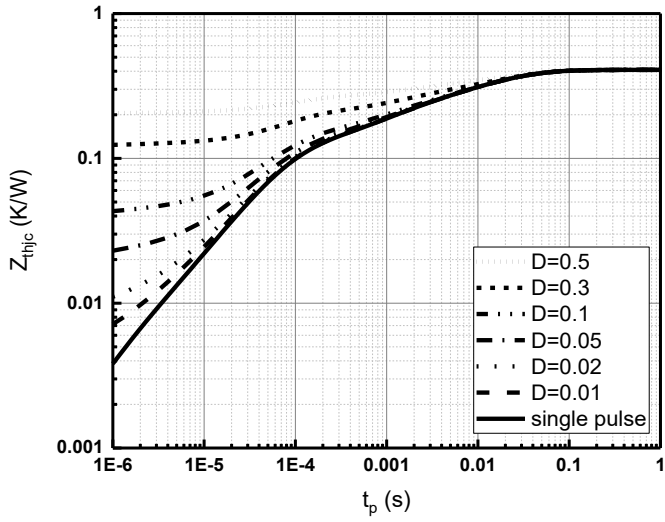
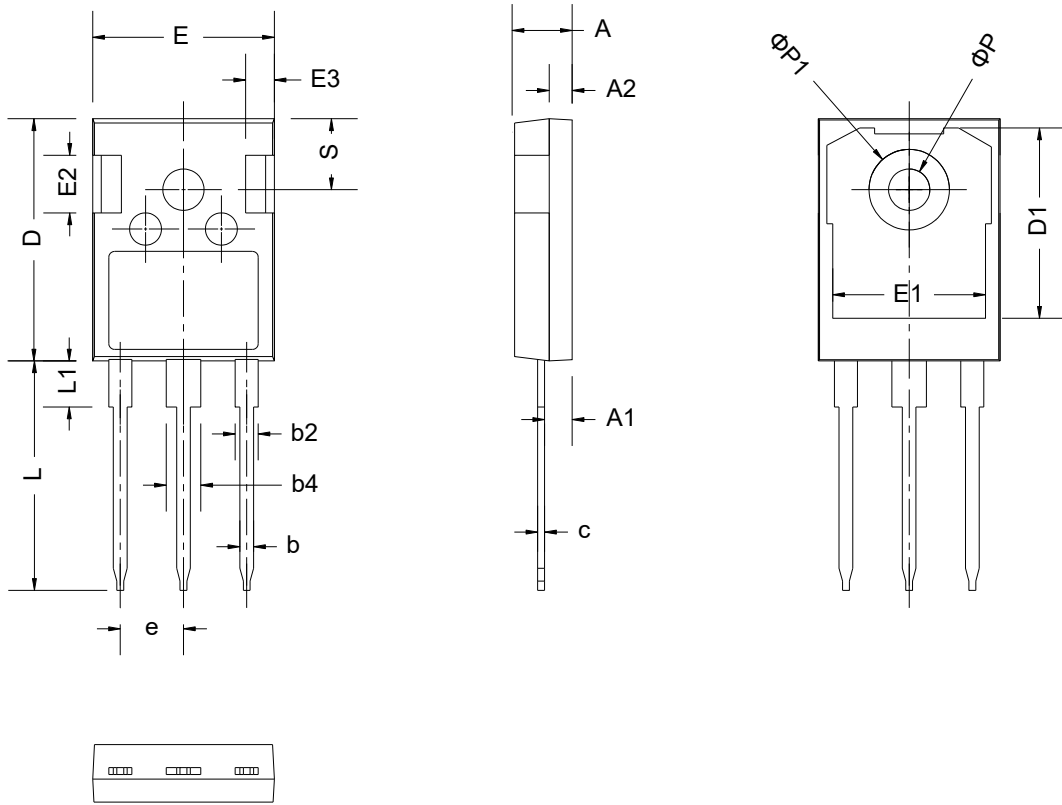


Figure 21 Diode Transient Thermal Response Curve

**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**

<b>Document Version</b>	<b>Date of Release</b>	<b>Description of Changes</b>
Rev. 0.0	2023-03-22	Draft datasheet created.
Rev. 0.1	2023-05-05	Update features.

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