

### Product Summary

$V_{CE}$	650V
$I_C$	75A @ $T_C=100^{\circ}\text{C}$
$V_{CE(sat),Typ}$	1.6V @ $I_C=75\text{A}$

### 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 Device
- Halogen Free, RoHS Compliant

#### Applications

- UPS
- PV Inverter
- Welding Machine
- On-board Charger
- Totem Pole Bridgeless PFC

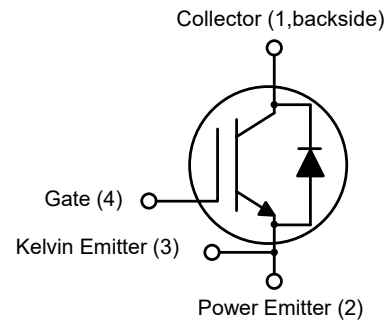
#### Package Pin Definitions

- Pin1 and backside - Collector
- Pin2 - Power Emitter
- Pin3 - Kelvin Emitter
- Pin4 - Gate

#### Package Parameters

Part Number	Marking	Package
BGH75N65ZF1	BGH75N65ZF1	TO-247-4

### Package: TO-247-4



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

Symbol	Parameter		Value	Unit
$V_{CE}$	Collector-Emitter Breakdown Voltage, $T_j \geq 25^\circ\text{C}$		650	V
$V_{GE}$	Continuous Gate-Emitter Voltage		$\pm 20$	
	Transient Gate-Emitter Voltage		$\pm 30$	
$I_C$	DC Collector Current, limited by $T_{jmax}$	$T_c=25^\circ\text{C}$	135	A
		$T_c=100^\circ\text{C}$	75	
$I_F$	Diode Forward Current, limited by $T_{jmax}$	$T_c=25^\circ\text{C}$	70	A
		$T_c=100^\circ\text{C}$	41	
$I_{C,pulse}$	Pulse Collector Current	$V_{GE}=15\text{V}$ , limited by $T_{jmax}$	300	A
$P_{tot}$	Power Dissipation	$T_c=25^\circ\text{C}$	338	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	N*m

**Thermal Characteristics**

Symbol	Parameter	Value	Unit
$R_{th(j-c)}$	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	$V_{GE}=15\text{V}$ , $I_C=75\text{A}$	$T_j=25^\circ\text{C}$	1.6	2.1	V	
			$T_j=100^\circ\text{C}$	1.79			
			$T_j=150^\circ\text{C}$	1.94			
$I_{CES}$	Zero Gate Voltage Collector Current	$V_{CE}=650\text{V}$ , $V_{GE}=0\text{A}$	$T_j=25^\circ\text{C}$		500	$\mu\text{A}$	
			$T_j=150^\circ\text{C}$		2000		
		$V_{CE}=480\text{V}$ , $V_{GE}=0\text{A}$	$T_j=25^\circ\text{C}$		90		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}$ , $I_C=750\mu\text{A}$	$T_j=25^\circ\text{C}$	4.2	5	5.8	V
$I_{GES}$	Gate-Emitter Leakage Current	$V_{CE}=0\text{V}$ , $V_{GE}=\pm 20\text{V}$	$T_j=25^\circ\text{C}$			100	nA

$g_{fs}$	Transconductance	$V_{CE}=20V, I_C=75A$		94		S
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**Dynamic Characteristics**

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

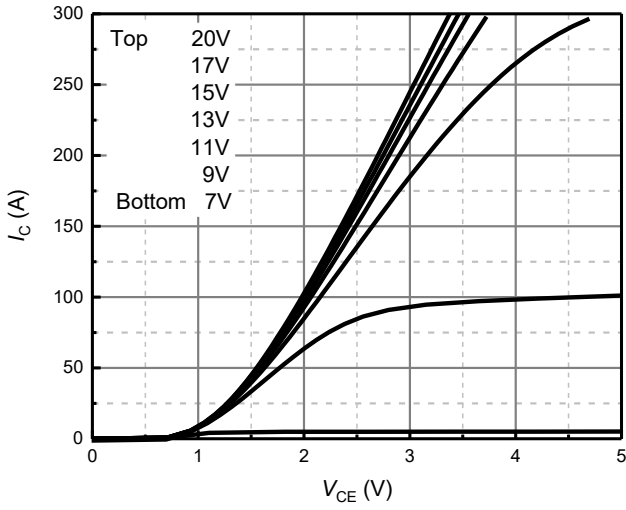
**Switching Characteristics, Inductive Load**

Symbol	Parameter	Test conditions	Value			Unit	
			Min.	Typ.	Max.		
$t_{d(on)}$	Turn-On Delay Time	$T_j=25^\circ C$ $V_{DC}=400V, I_C=37.5A$ $V_{GE}=0/15V, R_{G(ext)}=10\Omega$ $L_\sigma=60nH$		38		ns	
$t_r$	Rise Time			26			
$t_{d(off)}$	Turn-Off Delay Time			481			
$t_f$	Fall Time			37			
$E_{on}$	Turn-On Energy			440		uJ	
$E_{off}$	Turn-Off Energy			600			
$E_{total}$	Total Switching Energy			1040			
$t_{d(on)}$	Turn-On Delay Time		$T_j=25^\circ C$ $V_{DC}=400V, I_C=75A$ $V_{GE}=0/15V, R_{G(ext)}=10\Omega$ $L_\sigma=60nH$		40		ns
$t_r$	Rise Time				47		
$t_{d(off)}$	Turn-Off Delay Time			429			
$t_f$	Fall Time			32			
$E_{on}$	Turn-On Energy			1210		uJ	
$E_{off}$	Turn-Off Energy			1305			
$E_{total}$	Total Switching Energy			2515			

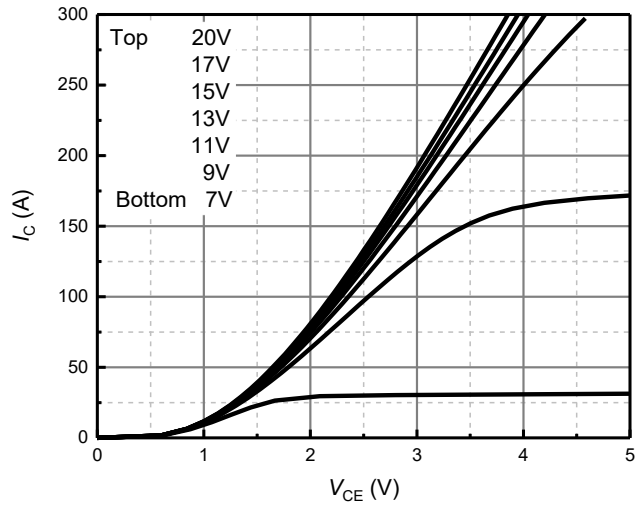
**SiC Schottky Barrier Diode Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_F$	Diode Forward Voltage	$V_{GE}=0V,$ $I_F=30A$	$T_j=25^\circ C$		1.5		V
			$T_j=100^\circ C$		1.63		
			$T_j=150^\circ C$		1.81		
$Q_C$	Diode Capacitive Charge	$V_R=400V, T_j=25^\circ C$		64		nC	
C	Diode Capacitance	$V_R=1V, f=1MHz$		998		pF	
		$V_R=300V, f=1MHz$		110			

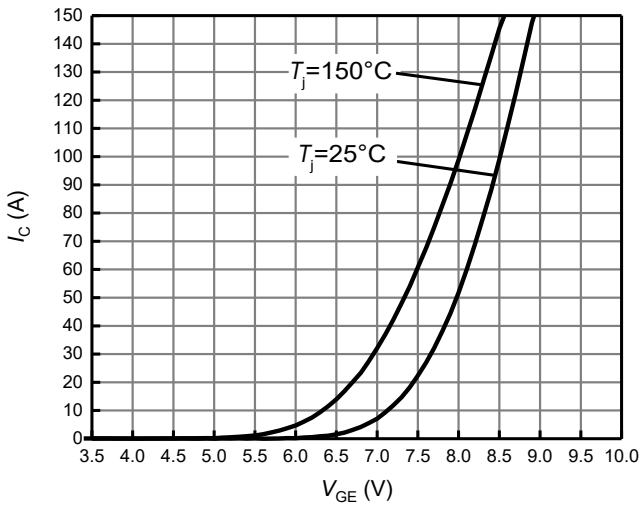
**Typical Performance**



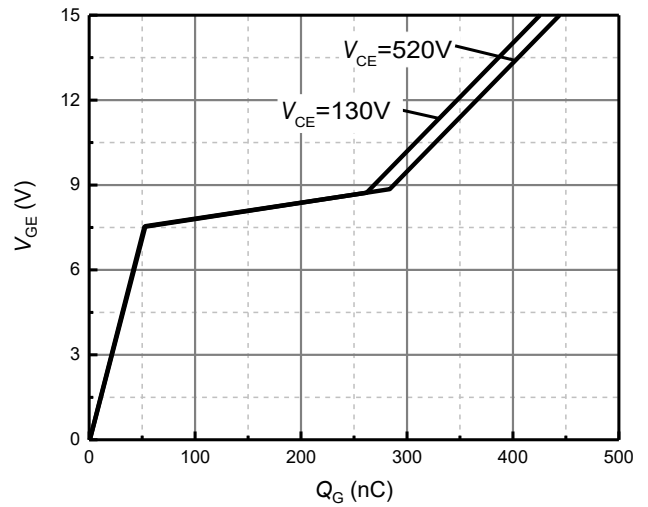
**Figure 1 Output Characteristics**  
( $T_j=25^\circ\text{C}$ )



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

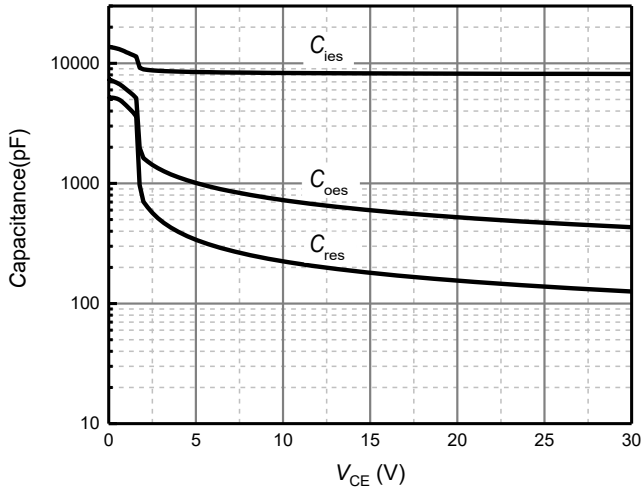


**Figure 3 Transfer Characteristics for Various Temperature**  
( $V_{CE}=20\text{V}$ )

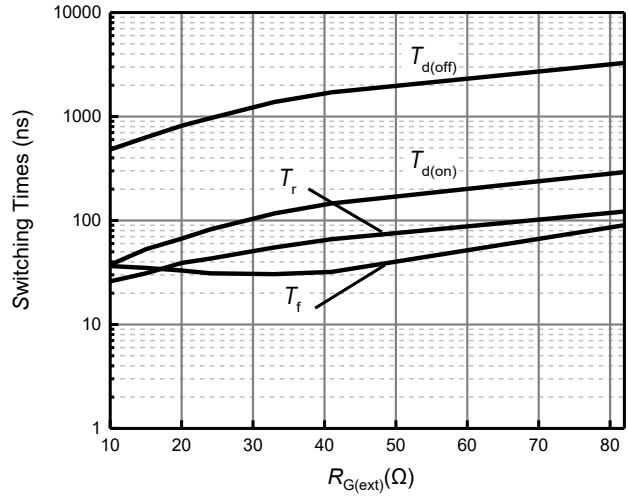


**Figure 4 Gate Charge Characteristics**  
( $I_c=75\text{A}$ )

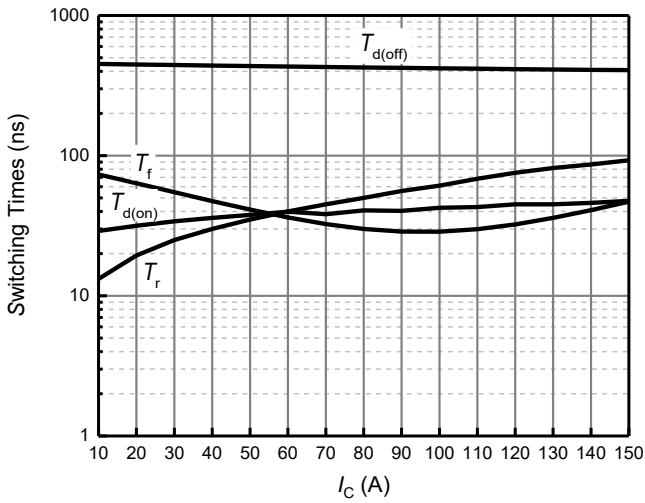
**Typical Performance**



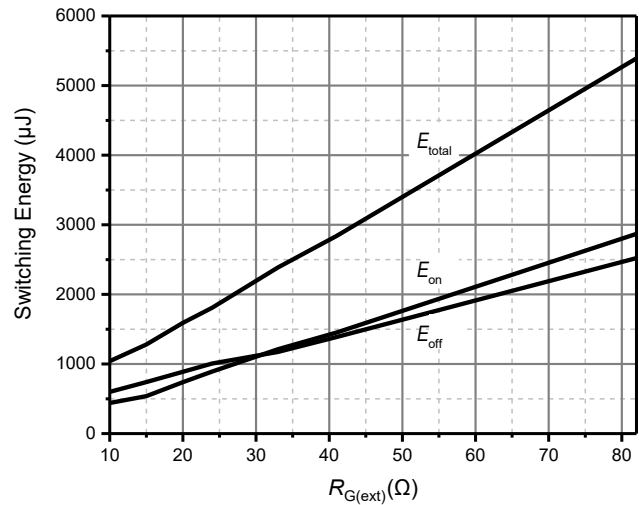
**Figure 5** Capacitance Characteristics  
( $V_{GE}=0V$ ,  $f=250kHz$ )



**Figure 6** Switching Times vs. Gate Resistor  
( $V_{DC}=400V$ ,  $V_{GE}=0/15V$ ,  $I_C=37.5A$ ,  $T_j=25^\circ C$ )

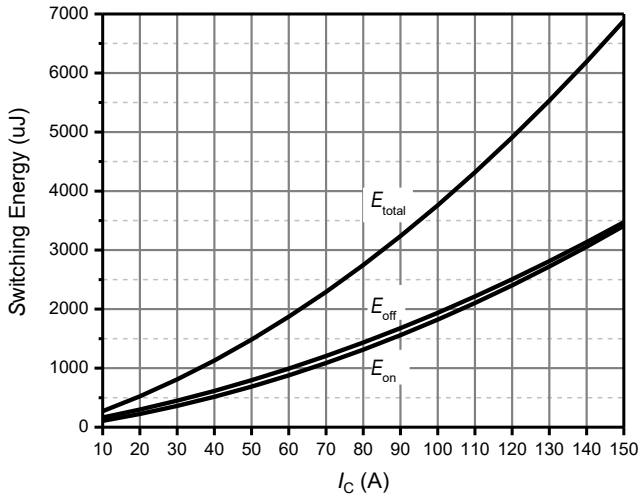


**Figure 7** Switching Times vs. Collector Current  
( $V_{DC}=400V$ ,  $V_{GE}=0/15V$ ,  $R_{G(ext)}=10\Omega$ ,  $T_j=25^\circ C$ )

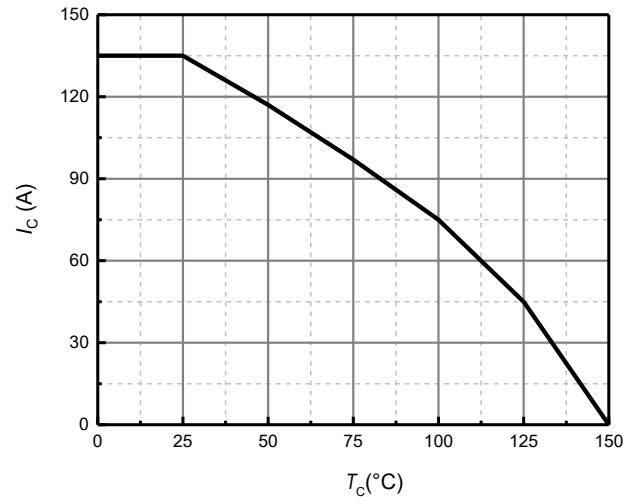


**Figure 8** Switching Loss vs. Gate Resistor  
( $V_{DC}=400V$ ,  $V_{GE}=0/15V$ ,  $I_C=37.5A$ ,  $T_j=25^\circ C$ )

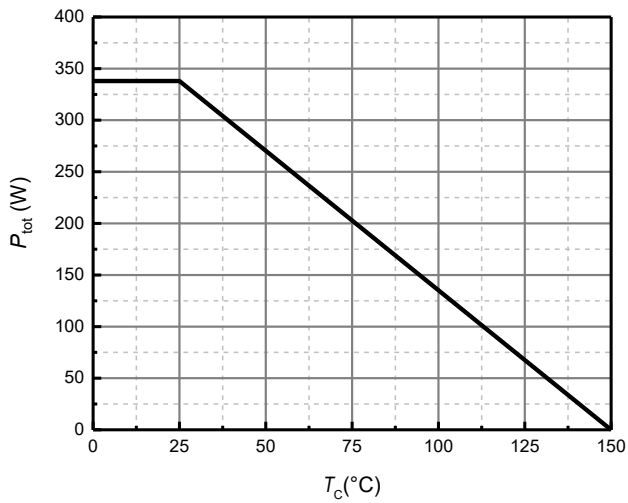
**Typical Performance**



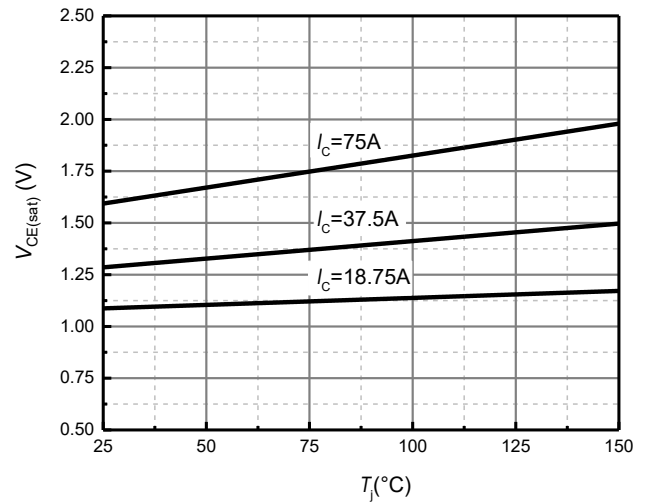
**Figure 9** Switching Loss vs. Collector Current ( $V_{DC}=400V$ ,  $V_{GE}=0/15V$ ,  $R_{G(ext)}=10\Omega$ ,  $T_j=25^\circ C$ )



**Figure 10** Collector current vs. Case Temperature

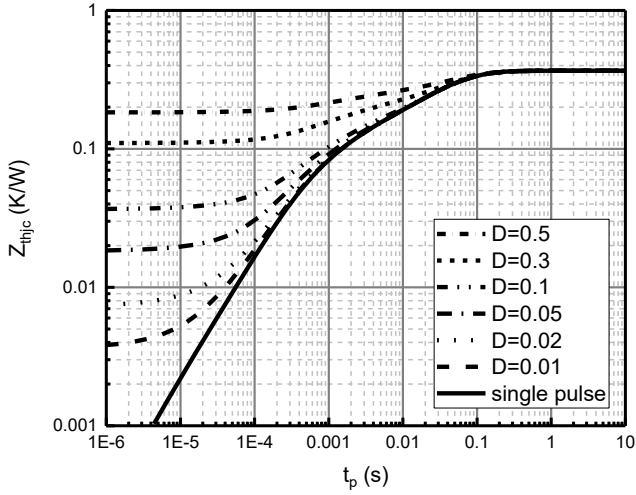


**Figure 11** Power Dissipation vs. Case Temperature

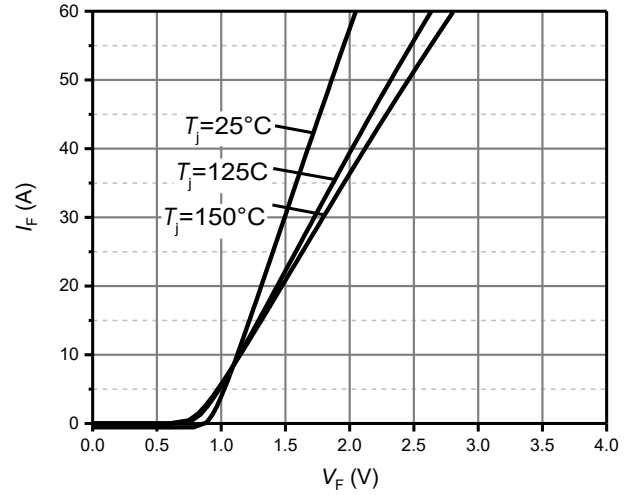


**Figure 12** Collector-Emitter Saturation Voltage vs. Junction Temperature ( $V_{GE}=15V$ )

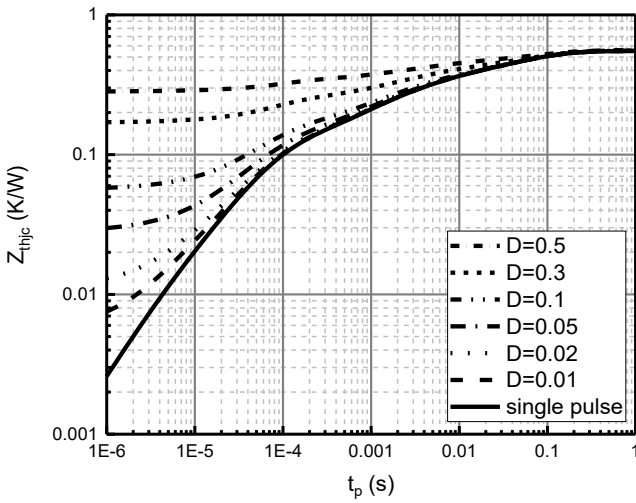
**Typical Performance**



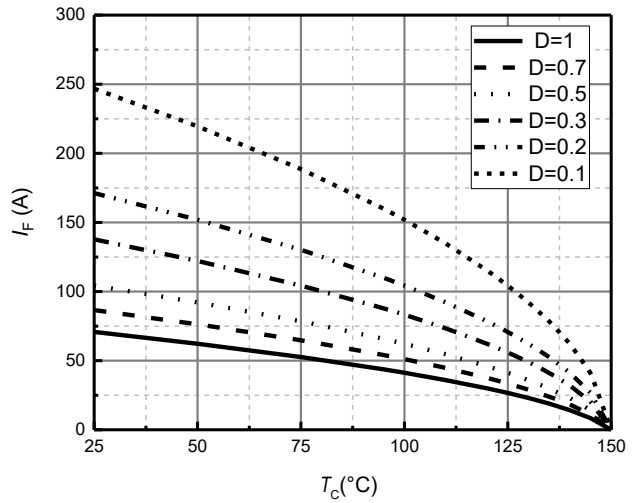
**Figure 13 IGBT Transient Thermal Response Curve**



**Figure 14 Forward characteristic of Diode**

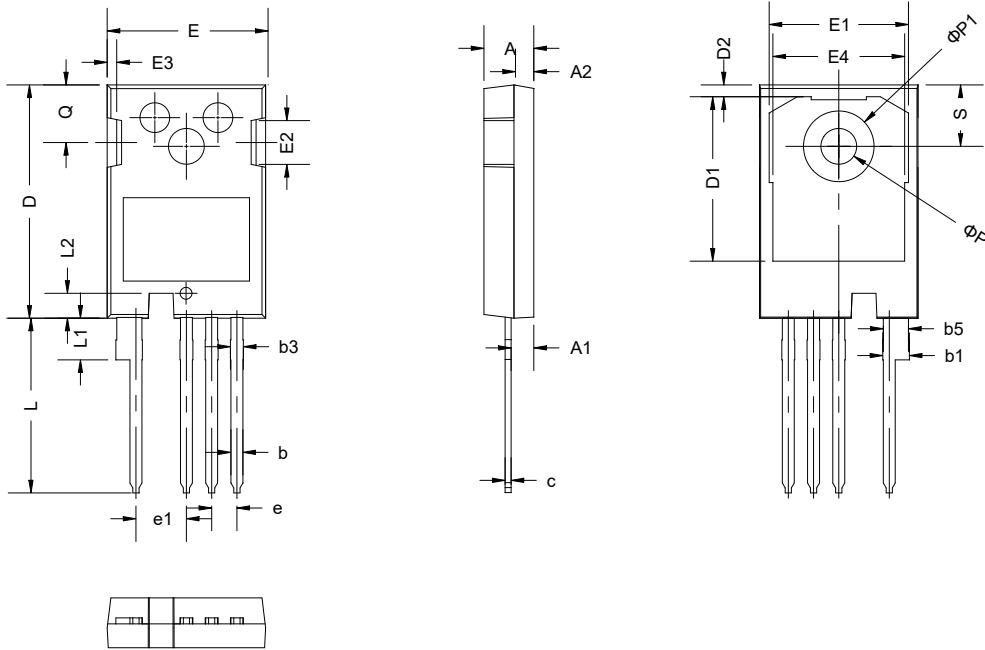


**Figure 15 Diode Transient Thermal Response Curve**



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



**Package Dimensions**


SYMBOL	mm		
	MIN	NOM	MAX
A	4.83	5.02	5.21
A1	2.29	2.41	2.54
A2	1.91	2.00	2.16
b	1.07	1.20	1.33
b1	2.39	2.67	2.84
b3	1.07	1.30	1.60
b5	2.39	2.53	2.69
c	0.55	0.60	0.68
D	23.30	23.45	23.60
D1	16.25	16.55	17.65
D2	0.95	1.19	1.25
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.68	4.40	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
e	2.54 BSC		
e1	5.08 BSC		
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
φ P	3.51	3.61	3.65
φ P1	7.19 REF		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30

**Revision History**

<b>Document Version</b>	<b>Date of Release</b>	<b>Description of Changes</b>
Rev. 0.0	2022-10-11	Draft datasheet created.

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