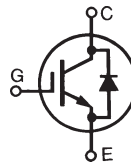


# High Voltage IGBT with Diode

**IXGH 20N120BD1**  
**IXGT 20N120BD1**

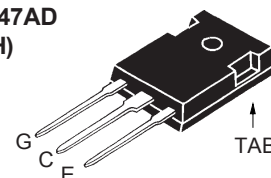
Preliminary Data Sheet



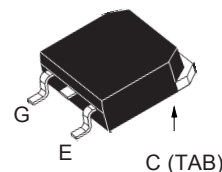
$V_{CES} = 1200 \text{ V}$   
 $I_{C25} = 40 \text{ A}$   
 $V_{CE(sat)} = 3.4 \text{ V}$   
 $t_{fi(typ)} = 160 \text{ ns}$

Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1200	V
$V_{CGR}$	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	1200	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ\text{C}$	40	A
$I_{C110}$	$T_C = 110^\circ\text{C}$	20	A
$I_{CM}$	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	100	A
<b>SSOA</b> <b>(RBSOA)</b>	$V_{GE} = 15 \text{ V}, T_J = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load	$I_{CM} = 80$ @ $0.8 V_{CES}$	A
$P_C$	$T_C = 25^\circ\text{C}$	190	W
$T_J$		-55 ... +150	$^\circ\text{C}$
$T_{JM}$		150	$^\circ\text{C}$
$T_{stg}$		-55 ... +150	$^\circ\text{C}$
$M_d$	Mounting torque (TO-247)	1.13/10	Nm/lb.in.
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum tab temperature soldering SMD devices for 10s		260	$^\circ\text{C}$
<b>Weight</b>	TO-247AD/TO-268	6/4	g

**TO-247AD**  
**(IXGH)**



**TO-268**  
**(IXGT)**



G = Gate      C = Collector  
E = Emitter    TAB = Collector

## Features

- International standard packages: JEDEC TO-247AD & TO-268
- IGBT and anti-parallel FRED for resonant power supplies
  - Induction heating
  - Rice cookers
- MOS Gate turn-on
  - drive simplicity
- Fast Recovery Expitaxial Diode (FRED)
  - soft recovery with low  $I_{RM}$

## Advantages

- Saves space (two devices in one package)
- Easy to mount with 1 screw (isolated mounting screw hole)
- Reduces assembly time and cost

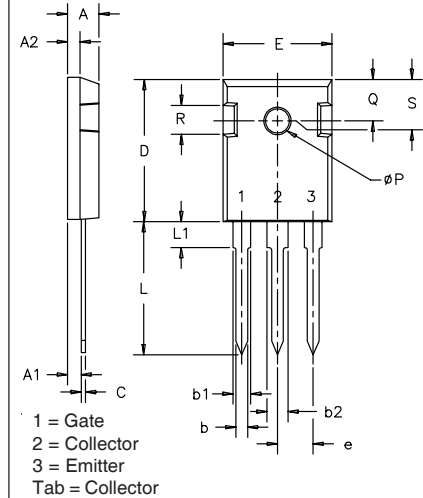
Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$BV_{CES}$	$I_C = 1 \mu\text{A}, V_{GE} = 0 \text{ V}$	1200		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.0 V
$I_{CES}$	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$		$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$	150 $\mu\text{A}$ 50 $\mu\text{A}$
$I_{GES}$	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = 20 \text{ A}, V_{GE} = 15 \text{ V}$ Note 2		$T_J = 125^\circ\text{C}$	2.9 V 2.8 V

Symbol	Test Conditions	Characteristic Values		
		$(T_J = 25^\circ\text{C}, \text{ unless otherwise specified})$		
		min.	typ.	max.
$g_{fs}$	$I_C = 20\text{A}; V_{CE} = 10\text{V}$ , Note 2.	12	18	S
$C_{ies}$	$V_{CE} = 25\text{V}; V_{GE} = 0\text{V}; f = 1\text{MHz}$		1700	pF
$C_{oes}$		105	pF	
$C_{res}$		39	pF	
$Q_g$	$I_C = 20\text{A}; V_{GE} = 15\text{V}; V_{CE} = 0.5 V_{CES}$		72	nC
$Q_{ge}$		12	nC	
$Q_{gc}$		27	nC	
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b>		25	ns
$t_{ri}$	$I_C = 20\text{A}; V_{GE} = 15\text{V}$		15	ns
$t_{d(off)}$	$V_{CE} = 0.8 V_{CES}; R_G = R_{off} = 10\ \Omega$		150	280
$t_{fi}$	Note 1.		160	320
$E_{off}$		2.1	3.5	mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b>		25	ns
$t_{ri}$	$I_C = 20\text{A}; V_{GE} = 15\text{V}$		18	ns
$E_{on}$	$V_{CE} = 0.8 V_{CES}; R_G = R_{off} = 10\ \Omega$		1.9	mJ
$t_{d(off)}$	Note 1		270	ns
$t_{fi}$			360	ns
$E_{off}$		3.5	mJ	
$R_{thJC}$	(TO-247)			0.65
$R_{thCK}$		0.25	K/W	

Symbol	Test Conditions	Characteristic Values		
		$(T_J = 25^\circ\text{C}, \text{ unless otherwise specified})$		
		min.	typ.	max.
$V_F$	$I_F = 10\text{A}; V_{GE} = 0\text{V}$			3.3
$I_F$	$T_C = 90^\circ\text{C}$			10
$I_{RM}$	$I_F = 10\text{A}; -di_F/dt = 400\text{A}/\mu\text{s}; V_R = 600\text{V}$ $V_{GE} = 0\text{V}; T_J = 125^\circ\text{C}$		14	A
$t_{rr}$		120	ns	
$t_{rr}$	$I_F = 1\text{A}; -di_F/dt = 100\text{A}/\mu\text{s}; V_R = 30\text{V}; V_{GE} = 0\text{V}$		40	ns
$R_{thJC}$				2.5

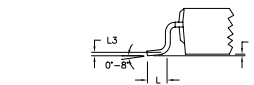
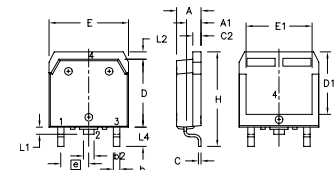
- Notes:
- Switching times may increase for  $V_{CE} \text{ (Clamp)} > 0.8 \cdot V_{CES}$ , higher  $T_J$  or increased  $R_G$ .
  - Pulse test,  $t \leq 300\ \mu\text{s}$ , duty cycle  $d \leq 2\%$

### TO-247 AD Outline



SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.185	.209	4.7	5.3
A1	.087	.102	2.2	2.54
A2	.059	.098	2.2	2.6
b	.040	.055	1.0	1.4
b1	.065	.084	1.65	2.13
b2	.113	.123	2.87	3.12
C	.016	.031	.4	.8
D	.819	.845	20.80	21.46
E	.610	.640	15.75	16.26
e	.215 BSC		5.45 BSC	
L	.780	.800	19.81	20.32
L1		.177		4.50
$\phi P$	.140	.144	3.55	3.65
Q	.212	.244	5.4	6.2
R	.170	.216	4.32	5.49
S	.242 BSC		6.15 BSC	

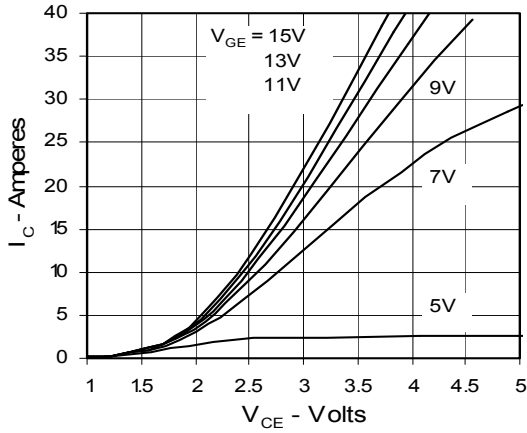
### TO-268 Outline



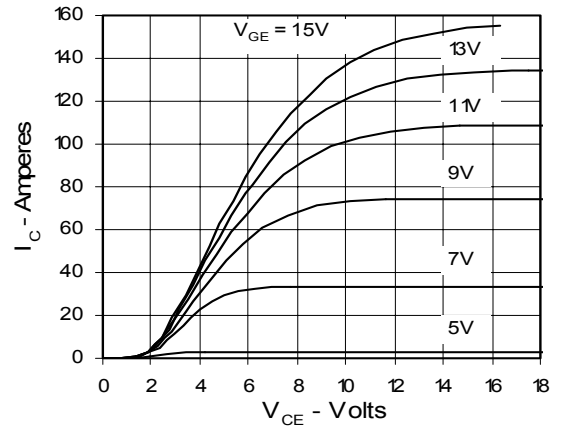
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A1	2.7	2.9	.106	.114
A2	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b2	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E1	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L1	1.20	1.40	.047	.055
L2	1.00	1.15	.039	.045
L3	0.25 BSC		.010 BSC	
L4	3.80	4.10	.150	.161

IXYS reserves the right to change limits, test conditions, and dimensions.

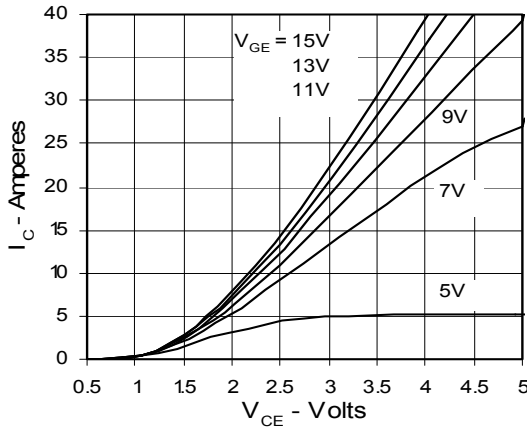
**Fig. 1. Output Characteristics**  
@ 25 Deg. C



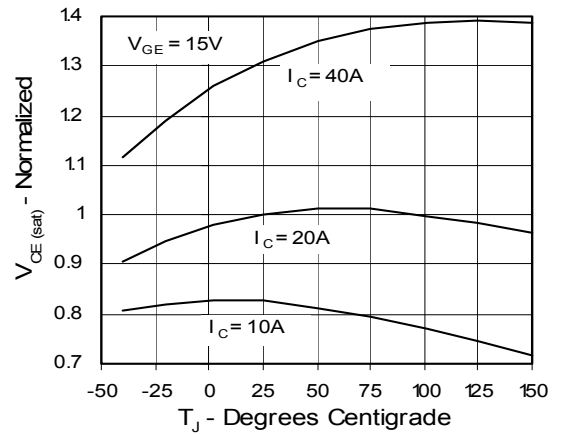
**Fig. 2. Extended Output Characteristics**  
@ 25 deg. C



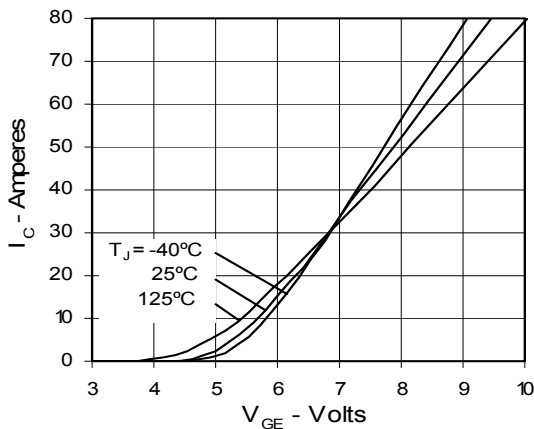
**Fig. 3. Output Characteristics**  
@ 125 Deg. C



**Fig. 4. Temperature Dependence of  $V_{CE(sat)}$**



**Fig. 5. Input Admittance**



**Fig. 6. Transconductance**

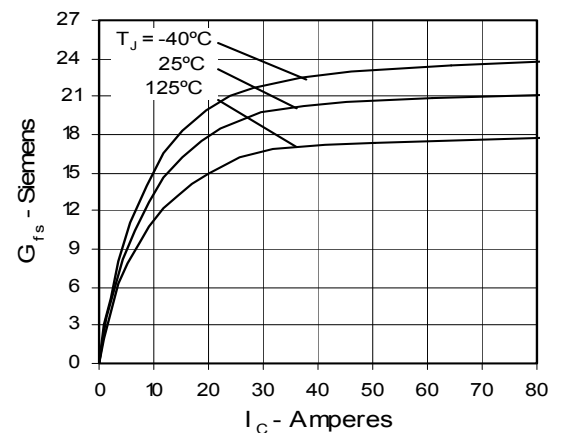


Fig. 7. Dependence of  $E_{off}$  on  $R_G$

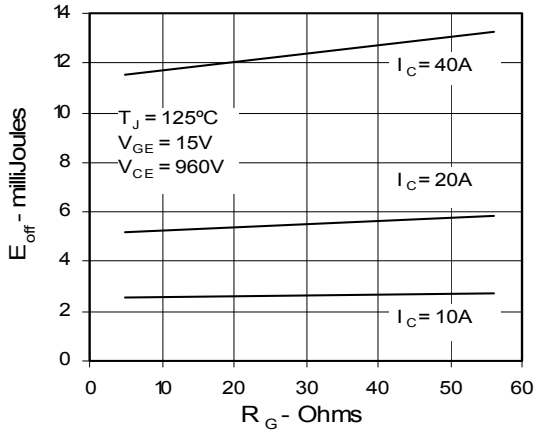


Fig. 8. Dependence of  $E_{off}$  on  $I_C$

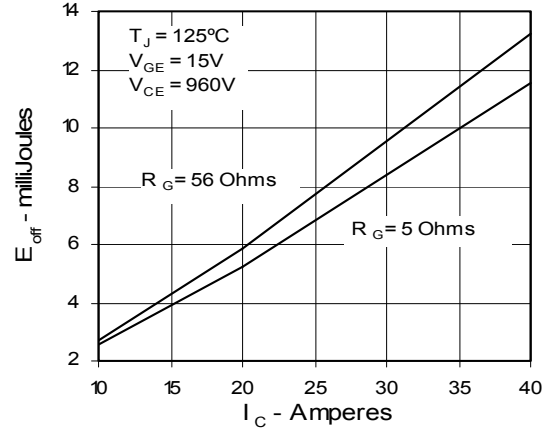


Fig. 9. Dependence of  $E_{off}$  on Temperature

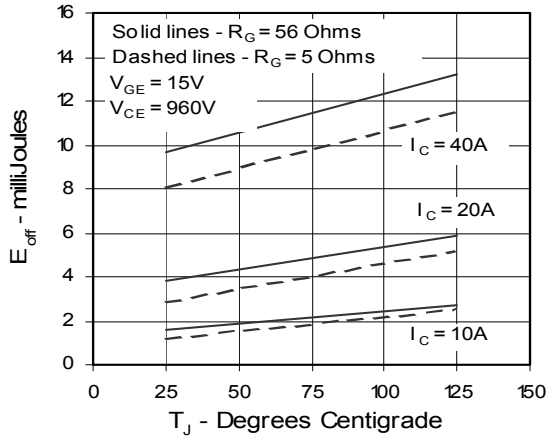


Fig. 10. Gate Charge

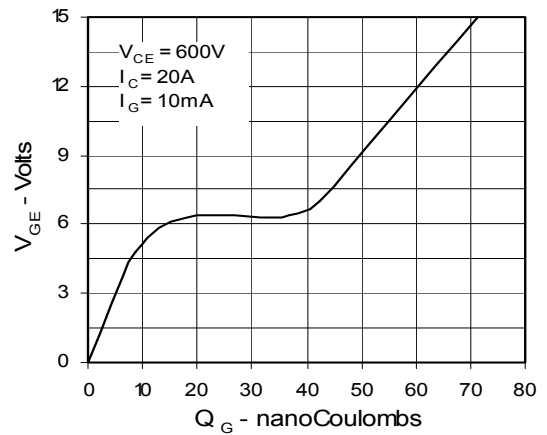


Fig. 11. Reverse-Bias Safe Operating Area

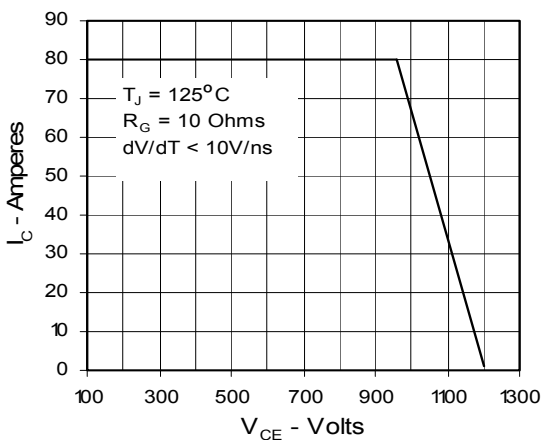
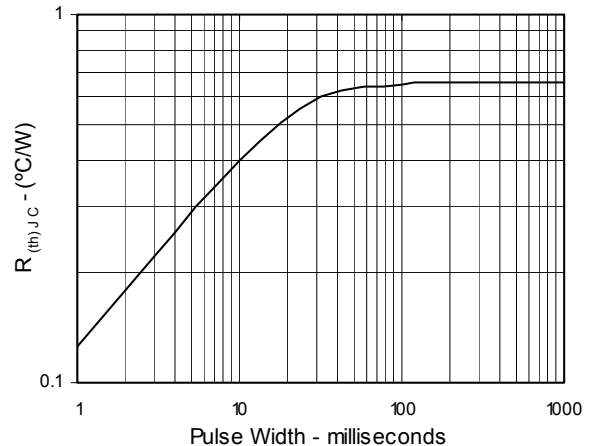


Fig. 12. Maximum Transient Thermal Resistance



IXYS reserves the right to change limits, test conditions, and dimensions.

IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

4,835,592 4,881,106 5,017,508 5,049,961 5,187,117 5,486,715 6,306,728B1 6,259,123B1 6,306,728B1  
4,850,072 4,931,844 5,034,796 5,063,307 5,237,481 5,381,025 6,404,065B1 6,162,665 6,534,343

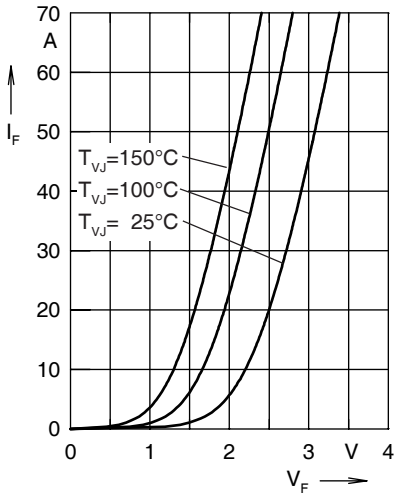


Fig. 13. Forward current  $I_F$  versus  $V_F$

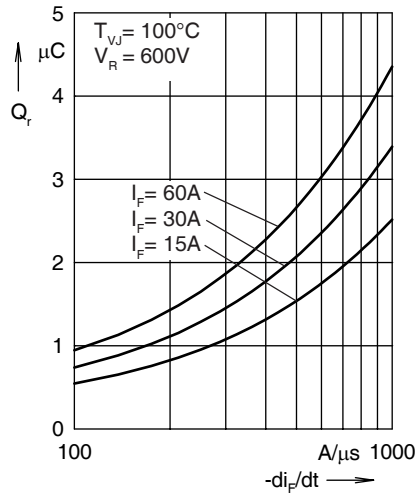


Fig. 14. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

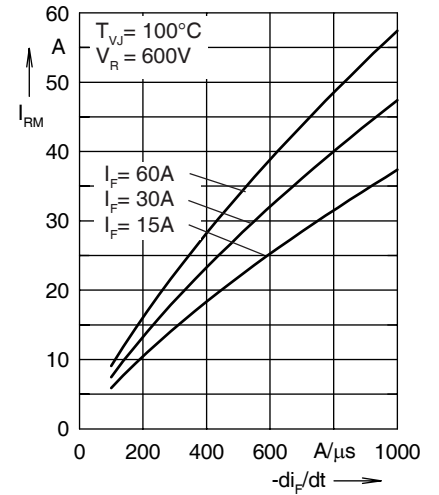


Fig. 15. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

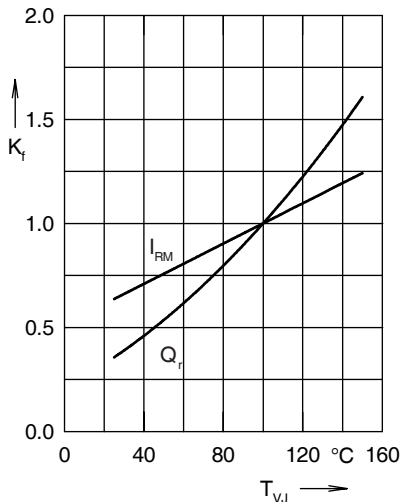


Fig. 16. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

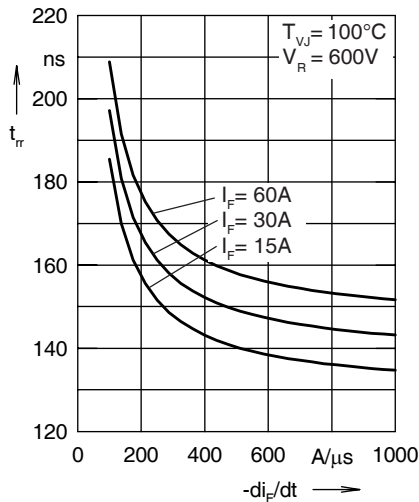


Fig. 17. Recovery time  $t_{rr}$  versus  $-di_F/dt$

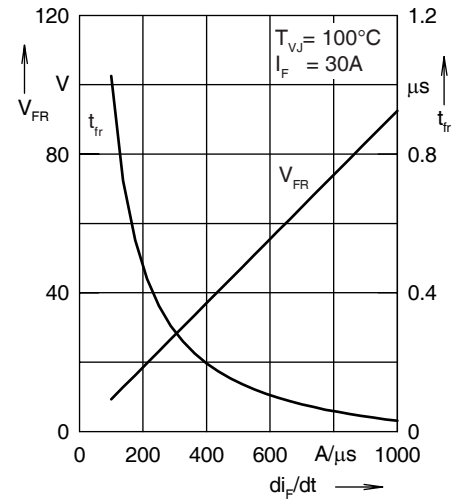


Fig. 18. Peak forward voltage  $V_{FR}$  and  $t_{fr}$  versus  $di_F/dt$

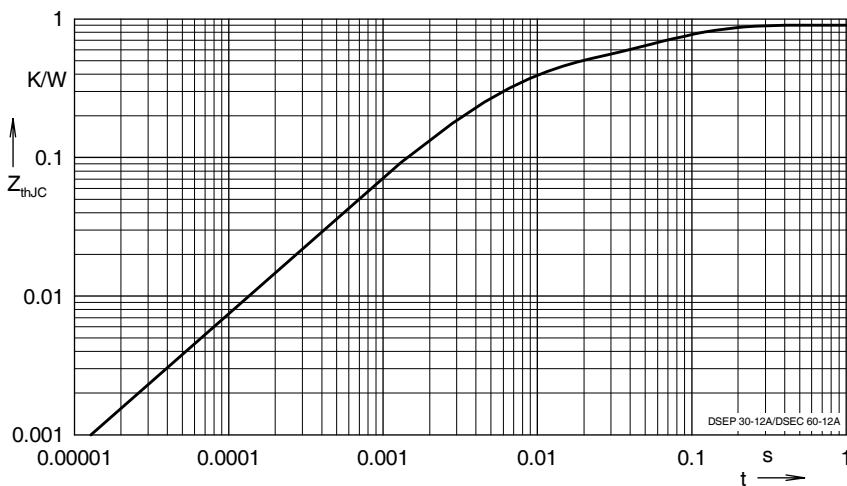


Fig. 19. Transient thermal resistance junction to case

Constants for  $Z_{thJC}$  calculation:

i	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.465	0.0052
2	0.179	0.0003
3	0.256	0.0397