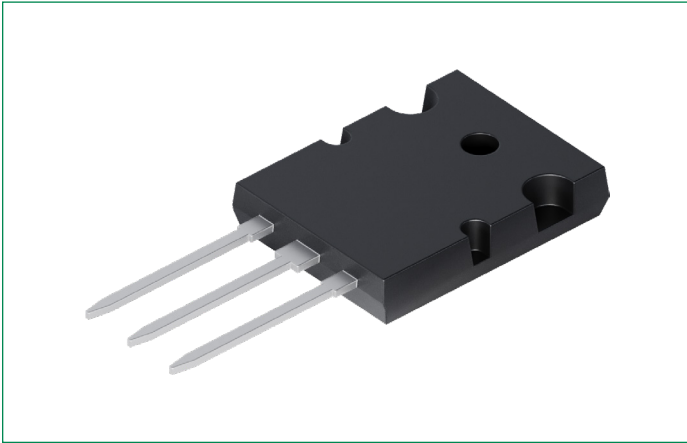


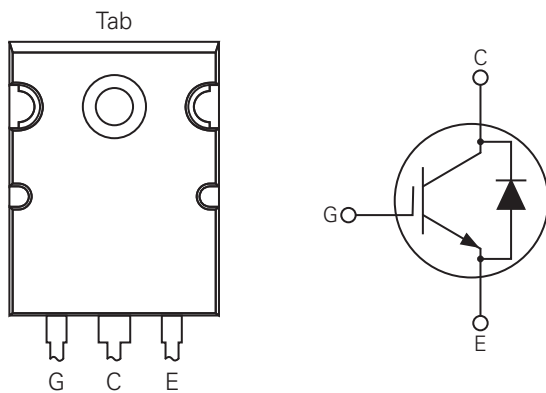
# IXYK85N120C4H1

## 1200 V, 85 A XPT™ Gen4 IGBT with Sonic Diode

### High Speed Through IGBT for 20–50 kHz Switching



### Pinout Diagram (TO-264)



**G:** Gate; **C:** Collector; **E:** Emitter; **Tab:** Collector

### Description:

Developed using our proprietary XPT™ thin-wafer technology and state-of-the-art Trench IGBT process, these devices feature reduced thermal resistance, low energy losses, fast switching, low tail current, and high current densities.

### Features & Benefits:

- Optimized for Low Switching Losses
- Positive Thermal Coefficient of  $V_{CE(sat)}$
- International Standard Package
- High Power Density
- Low Gate Drive Requirement
- Anti-Parallel Sonic Diode

### Applications:

- Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines

### Product Summary

Characteristic	Value	Unit
$V_{CES}$	1200	V
$I_{C110}$	85	A
$V_{CE(sat)}$	2.50	V
$t_{fi(typ)}$	37	ns

## Maximum Ratings

Symbol	Characteristic	Conditions	Value	Unit
$V_{CES}$	Collector-Emitter Voltage	$T_{VJ} = 25\text{ °C to }175\text{ °C}$	1200	V
$V_{GES}$	Gate-Emitter Voltage	Continuous	$\pm 20$	V
$V_{GEM}$	Transient Gate-Emitter Voltage	Transient, < 1 ms	$\pm 30$	V
$I_{C25}$	Continuous Collector Current	$T_C = 25\text{ °C}$	220	A
$I_{LRMS}$	Terminal Current Limit	–	160	A
$I_{C110}$	Continuous Collector Current	$T_C = 110\text{ °C}$	85	A
$I_{F110}$	Diode Forward Current	$T_C = 110\text{ °C}$	140	A
$I_{CM}$	Pulsed Collector Current	$T_C = 25\text{ °C}, 1\text{ ms}$	420	A
SSOA (RBSOA)	Switching Safe Operating Area (Reverse Biased Safe Operating Area)	$V_{GE} = 15\text{ V}, T_{VJ} = 150\text{ °C}, R_G = 5\ \Omega,$ Clamped Inductive Load, $I_{CM} = V_{CE} \leq 0.8 \times V_{CES}$	170	A
$P_C$	Collector Power Dissipation	$T_C = 25\text{ °C}$	1150	W
$T_{VJ}$	Virtual Junction Temperature	–	–55 to 175	°C
$T_{stg}$	Storage Temperature	–	–55 to 175	
$T_L$	Maximum Lead Temperature for Soldering	1.6 mm (0.062 in.) from Case for 10 s	300	°C
$M_d$	Mounting Torque	–	1.13 / 10	Nm/lb.in
W	Weight	–	10	g

## Thermal Characteristics

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
$R_{th, JC}$	Thermal Resistance, junction-to-case, IGBT	–	–	–	0.13	K/W
$R_{th, CS}$	Thermal Resistance, case-to-heat sink	–	–	0.15	–	K/W

## Electrical Characteristics – Static ( $T_{VJ} = 25\text{ °C}$ unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$I_C = 250\ \mu\text{A}, V_{GE} = 0\text{ V}$	1200	–	–	V
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C = 250\ \mu\text{A}, V_{CE} = V_{GE}$	4.0	–	6.5	V
$I_{GES}$	Gate-Emitter Leakage Current	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$	–	–	$\pm 100$	nA
$I_{CES}$	Zero Gate Voltage Collector Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$	–	–	25	$\mu\text{A}$
		$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}, T_{VJ} = 150\text{ °C}$	–	–	5	mA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage <sup>1</sup>	$I_C = 85\text{ A}, V_{GE} = 15\text{ V}$	–	2.00	2.50	V
		$I_C = 85\text{ A}, V_{GE} = 15\text{ V}, T_{VJ} = 150\text{ °C}$	–	2.45	–	V

**Note 1:** Pulse test,  $t \leq 300\ \mu\text{s}$ , duty cycle,  $d \leq 2\%$

**Electrical Characteristics – Dynamic** ( $T_{VJ} = 25\text{ °C}$  unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit	
			Min.	Typ.	Max.		
$g_{fs}$	Transconductance <sup>1</sup>	$I_C = 60\text{ A}, V_{CE} = 10\text{ V}$	30	50	–	S	
$C_{ies}$	Input Capacitance	$V_{GE} = 0\text{ V}, V_{CE} = 25\text{ V}, f = 1\text{ MHz}$	–	4030	–	pF	
$C_{oes}$	Output Capacitance		–	355	–		
$C_{res}$	Reverse Transfer Capacitance		–	135	–		
$Q_{g(on)}$	Total Gate Charge	$V_{GE} = 15\text{ V}, V_{CE} = 0.5 \times V_{CES},$ $I_C = 85\text{ A}$	–	192	–	nC	
$Q_{ge}$	Gate-Emitter Charge		–	34	–		
$Q_{gc}$	Gate-Collector Charge		–	72	–		
$t_{d(on)}$	Turn-on Delay Time <sup>2</sup>	Inductive Load, $V_{GE} = 15\text{ V},$ $V_{CE} = 0.5 \times V_{CES},$ $I_C = 50\text{ A},$ $R_{G(ext)} = 5\ \Omega$	$T_{VJ} = 25\text{ °C}$	–	35	–	ns
			$T_{VJ} = 150\text{ °C}$	–	27	–	
$t_{ri}$	Turn-on Rise Time <sup>2</sup>		$T_{VJ} = 25\text{ °C}$	–	60	–	ns
			$T_{VJ} = 150\text{ °C}$	–	45	–	
$E_{on}$	Turn-on Energy <sup>2</sup>		$T_{VJ} = 25\text{ °C}$	–	4.30	–	mJ
			$T_{VJ} = 150\text{ °C}$	–	6.15	–	
$t_{d(off)}$	Turn-off Delay Time <sup>2</sup>		$T_{VJ} = 25\text{ °C}$	–	280	–	ns
			$T_{VJ} = 150\text{ °C}$	–	260	–	
$t_{fi}$	Turn-off Fall Time <sup>2</sup>		$T_{VJ} = 25\text{ °C}$	–	37	–	ns
			$T_{VJ} = 150\text{ °C}$	–	110	–	
$E_{off}$	Turn-off Energy <sup>2</sup>	$T_{VJ} = 25\text{ °C}$	–	2.00	–	mJ	
		$T_{VJ} = 150\text{ °C}$	–	3.30	–		

**Note 1:** Pulse test,  $t \leq 300\ \mu\text{s}$ , duty cycle,  $d \leq 2\%$

**Note 2:** Switching times and energy losses may increase for higher  $V_{CE(clamp)}$ ,  $T_{VJ}$ , or  $R_G$ .

**Reverse Sonic Diode (FRD)** ( $T_{VJ} = 25\text{ °C}$  unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
$V_F$	Diode Forward Voltage <sup>1</sup>	$I_F = 60\text{ A}, V_{GE} = 0\text{ V}$	–	1.80	2.40	V
		$I_F = 60\text{ A}, V_{GE} = 0\text{ V}, T_{VJ} = 150\text{ °C}$	–	1.65	–	
$I_{RM}$	Reverse Recovery Current	$I_F = 50\text{ A}, V_{GE} = 0\text{ V}, T_{VJ} = 150\text{ °C}$	–	42	–	A
$t_{rr}$	Reverse Recovery Time	$-di_F/dt = 750\text{ A}/\mu\text{s}, V_R = 600\text{ V}$	–	265	–	ns
$R_{th, JC}$	Thermal Resistance, junction-to-case	–	–	–	0.16	K/W

**Note 1:** Pulse test,  $t \leq 300\ \mu\text{s}$ , duty cycle,  $d \leq 2\%$

Characteristic Curves

Fig. 1. Output Characteristics @  $T_{VJ} = 25\text{ }^{\circ}\text{C}$

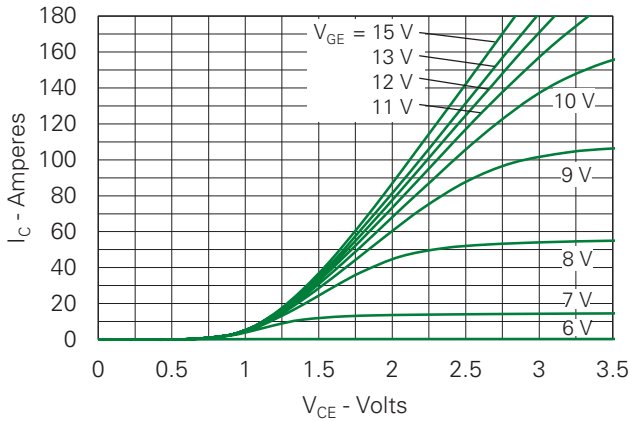


Fig. 2. Extended Output Characteristics @  $T_{VJ} = 25\text{ }^{\circ}\text{C}$

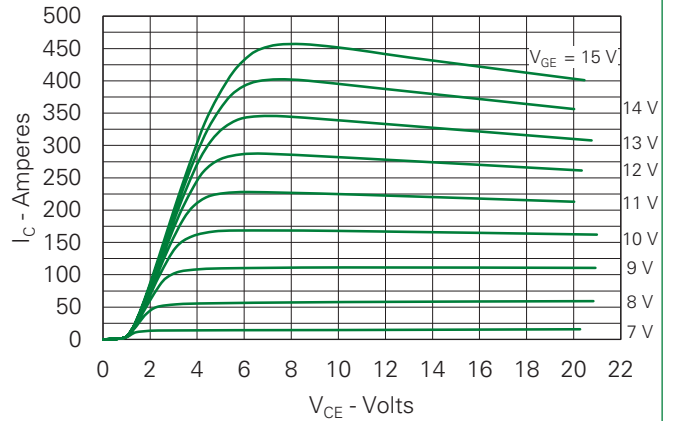


Fig. 3. Output Characteristics @  $T_{VJ} = 150\text{ }^{\circ}\text{C}$

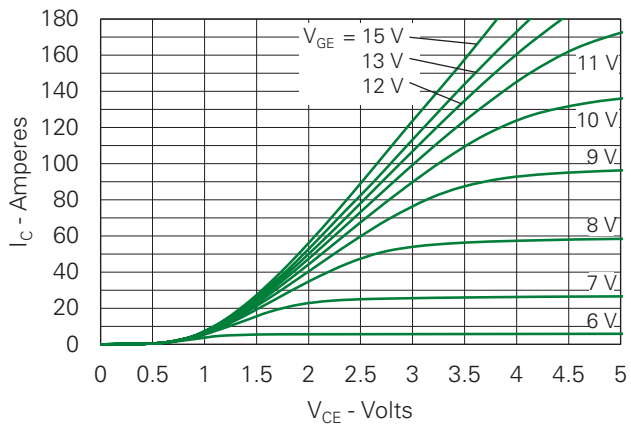


Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature

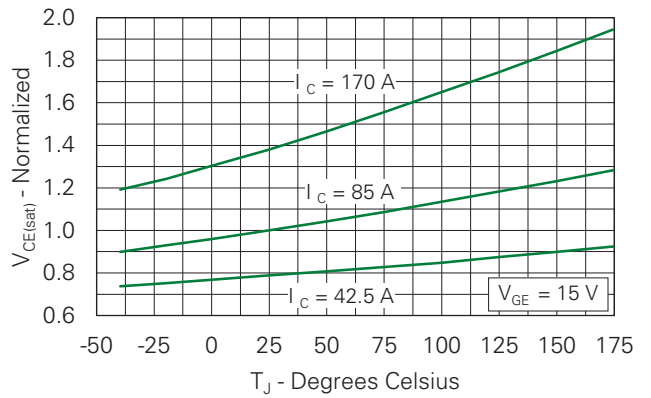


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

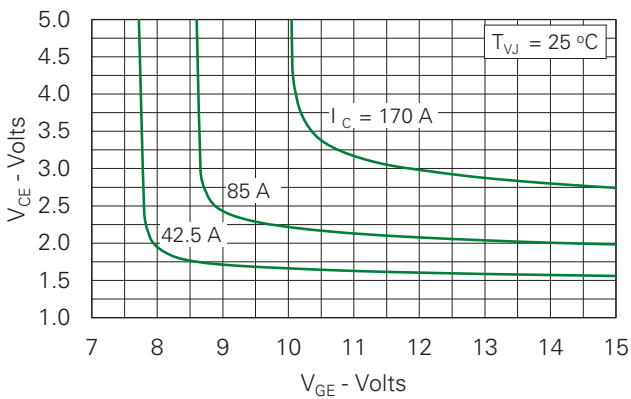
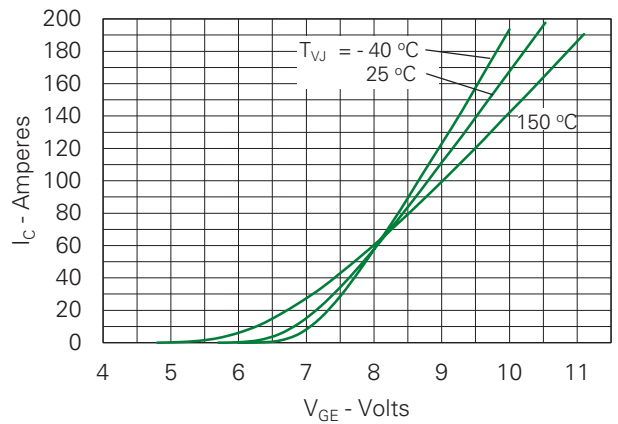
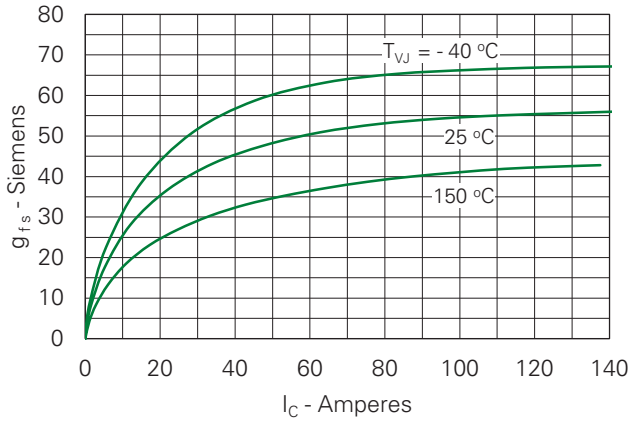


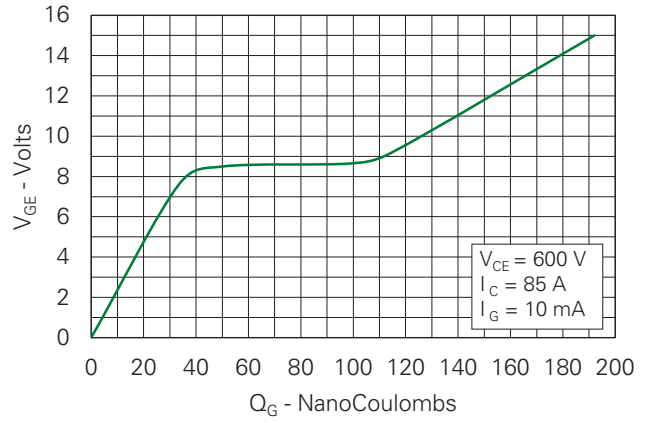
Fig. 6. Input Admittance



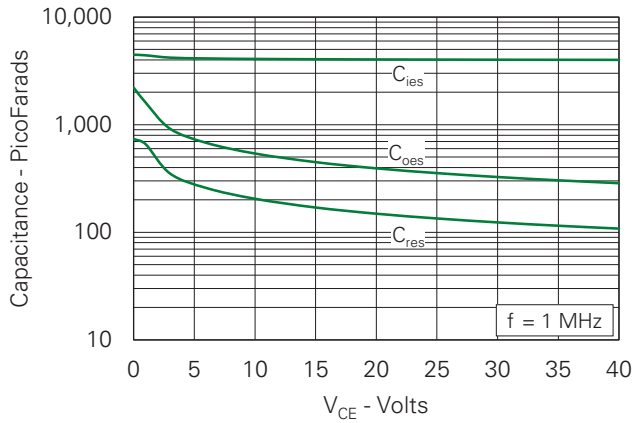
**Fig. 7. Transconductance**



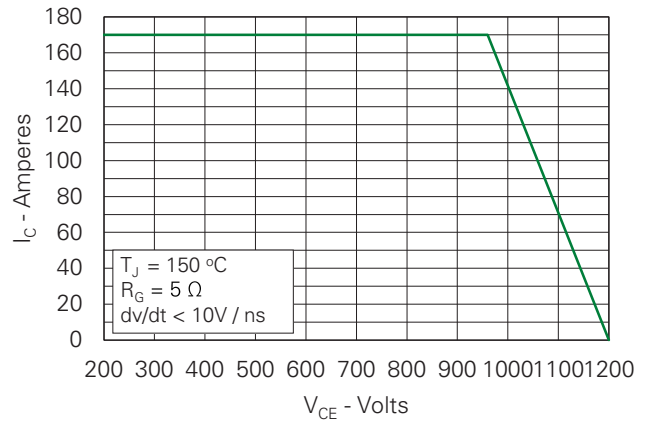
**Fig. 8. Gate Charge**



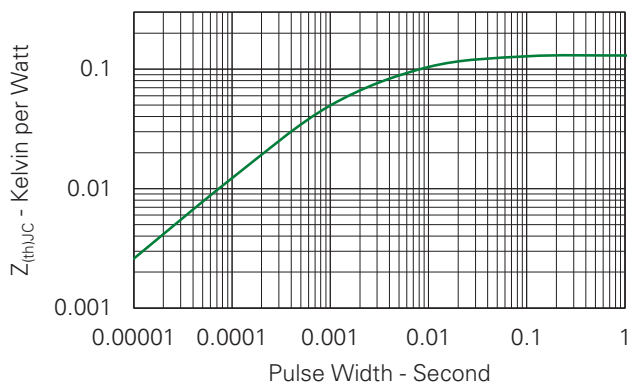
**Fig. 9. Capacitance**



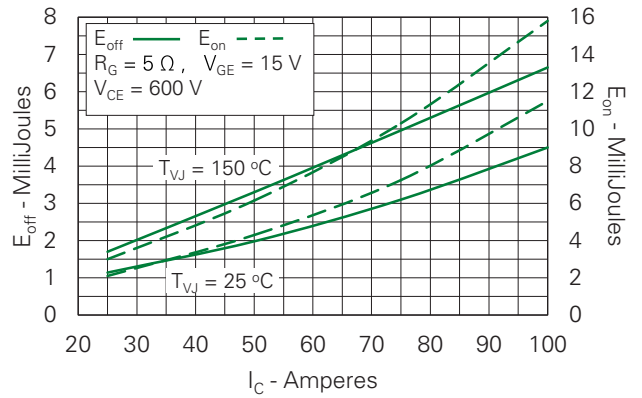
**Fig. 10. Reverse-Bias Safe Operating Area**



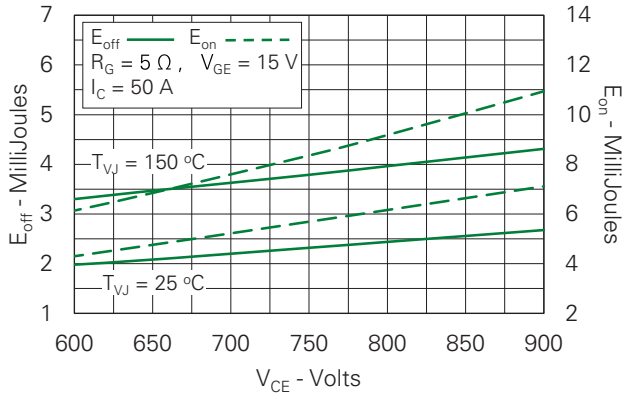
**Fig. 11. Maximum Transient Thermal Impedance (IGBT)**



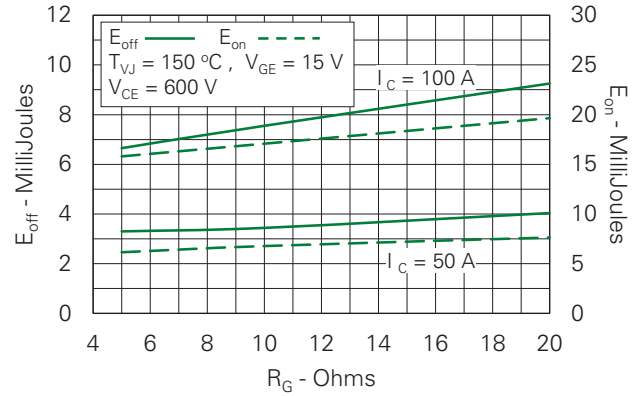
**Fig. 12. Inductive Switching Energy Loss vs. Collector Current**



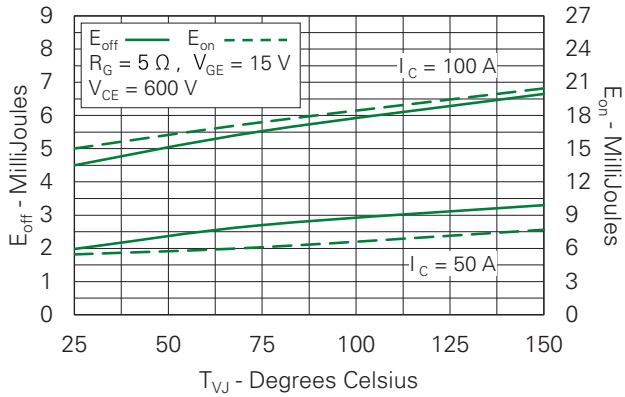
**Fig. 13. Inductive Switching Energy Loss vs. Collector-Emitter Voltage**



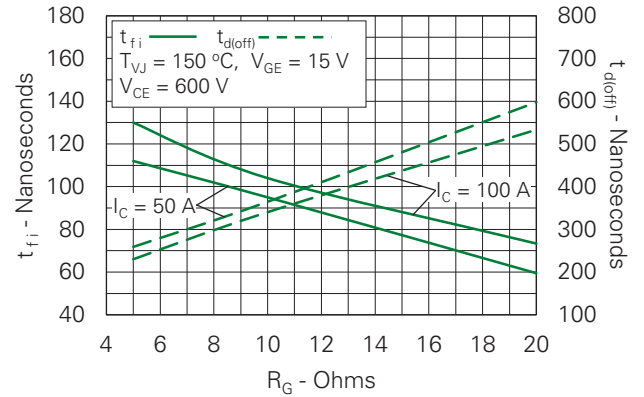
**Fig. 14. Inductive Switching Energy Loss vs. Gate Resistance**



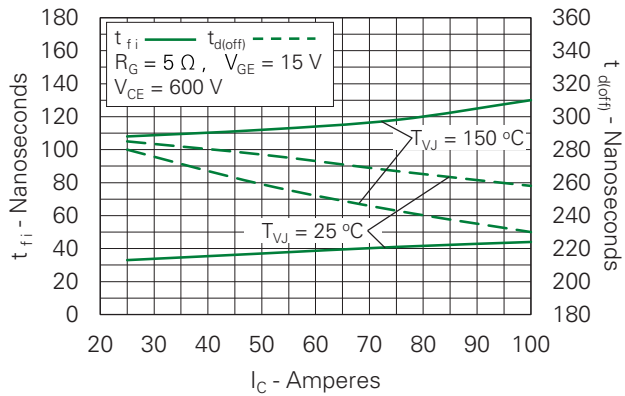
**Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature**



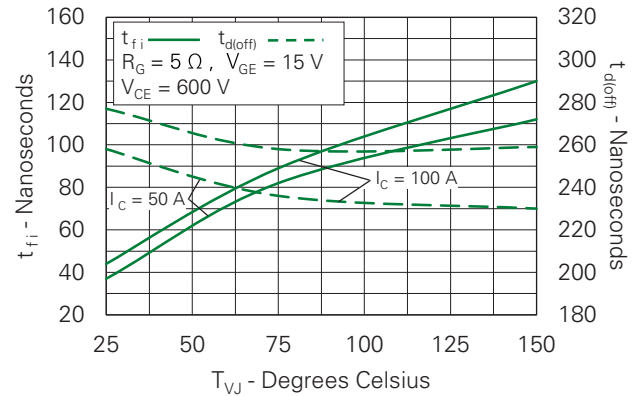
**Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance**



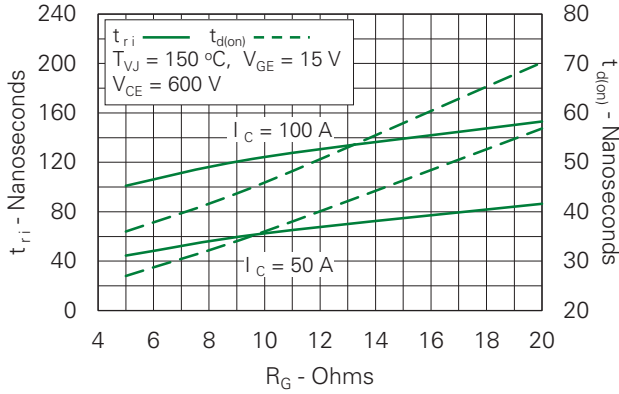
**Fig. 17. Inductive Turn-off Switching Times vs. Collector Current**



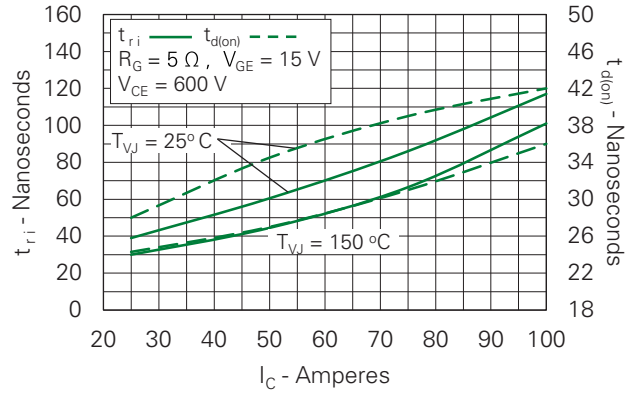
**Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature**



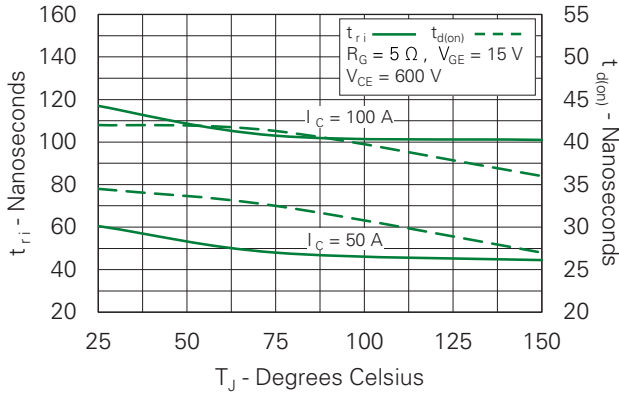
**Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance**



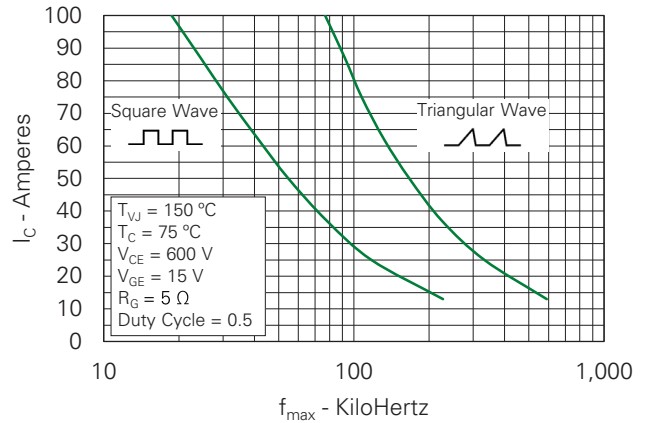
**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**



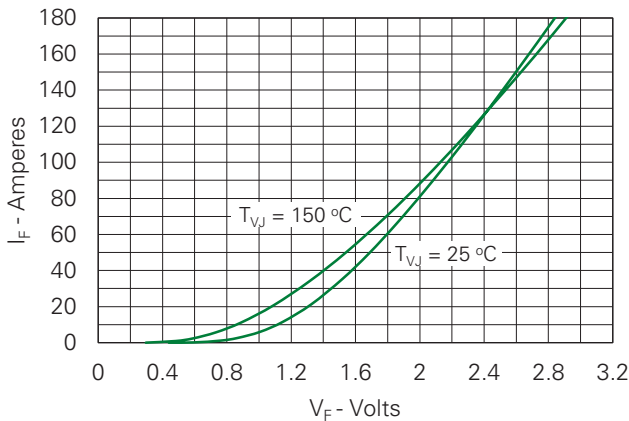
**Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature**



**Fig. 22. Maximum Peak Load Current vs. Frequency**



**Fig. 23. Diode Forward Characteristics**



**Fig. 24. Reverse Recovery Charge vs. -di\_F/dt**

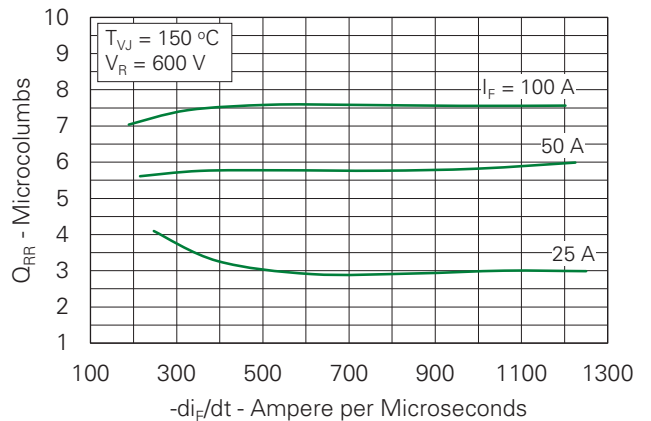


Fig. 25 Reverse Recovery Current vs.  $-di_F/dt$

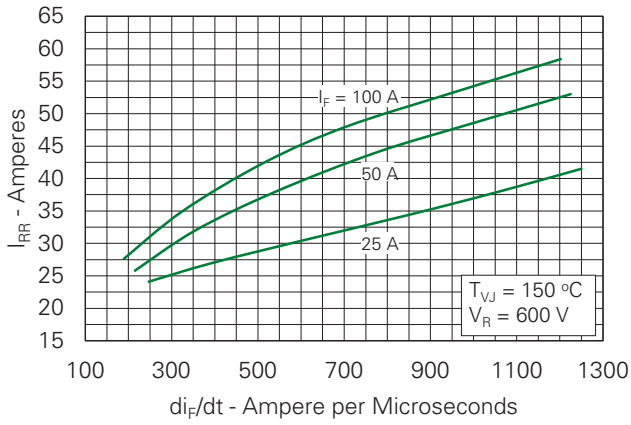


Fig. 26. Reverse Recovery Time vs.  $-di_F/dt$

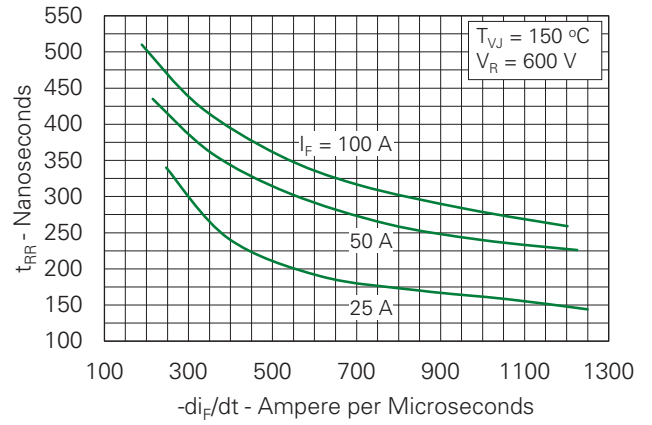


Fig. 27. Dynamic Parameters  $Q_{RR}$ ,  $I_{RR}$  vs. Junction Temperature

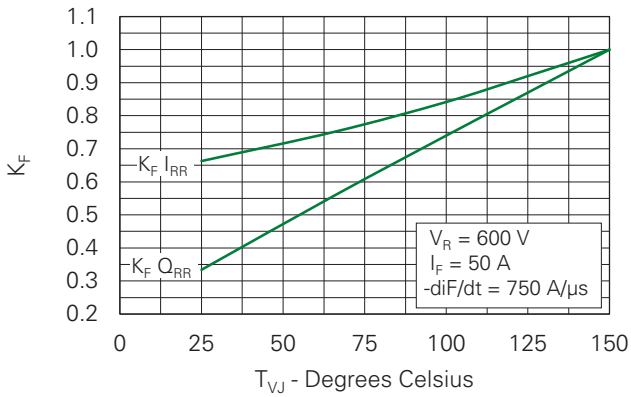
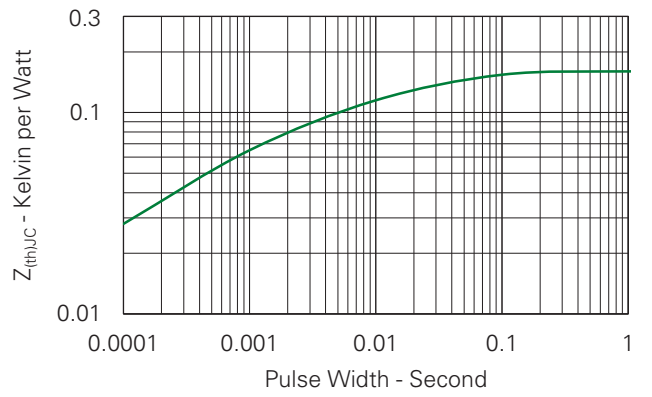
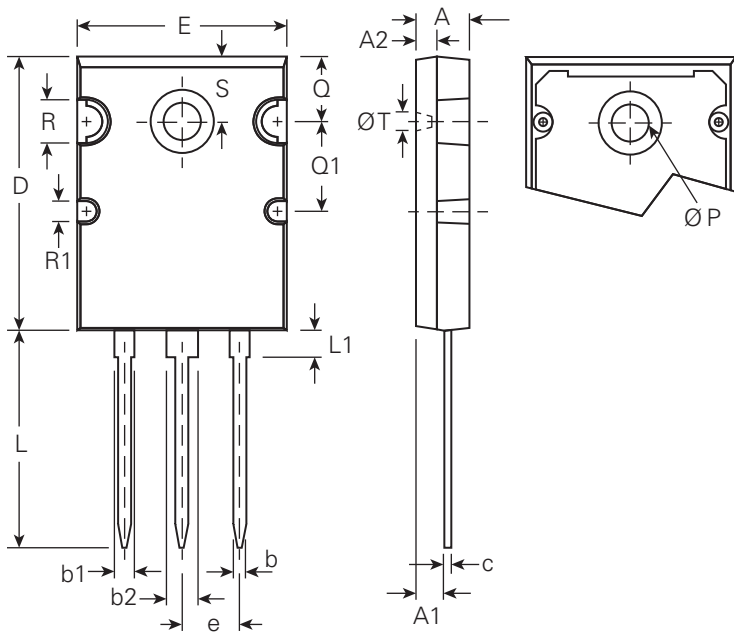


Fig. 28. Maximum Transient Thermal Impedance (Diode)





## Part Outline Drawing (TO-264)



Symbol	Inches			Millimeters		
	Min.	Typical	Max.	Min.	Typical	Max.
A	0.190	–	0.202	4.82	–	5.13
A1	0.100	–	0.114	2.54	–	2.89
A2	0.079	–	0.083	2.00	–	2.10
b	0.044	–	0.056	1.12	–	1.42
b2	0.114	–	0.122	2.90	–	3.09
C	0.021	–	0.033	0.53	–	0.83
D	1.020	–	1.030	25.91	–	26.16
E	0.780	–	0.786	19.81	–	19.96
e	0.215 BSC			5.45 BSC		
J	0.000	–	0.010	0.00	–	0.25
K	0.000	–	0.010	0.00	–	0.25
L	0.800	–	0.820	20.32	–	20.83
L1	0.090	–	0.102	2.29	–	2.59
Ø P	0.125	–	0.105	3.17	–	2.66
Q	0.239	–	0.247	6.07	–	6.27
Q1	0.330	–	0.342	8.38	–	8.69
R	0.150	–	0.170	3.81	–	4.32
R1	0.070	–	0.090	1.78	–	2.29
S	0.238	–	0.248	6.04	–	6.30
Ø T	0.062	–	0.072	1.57	–	1.83

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