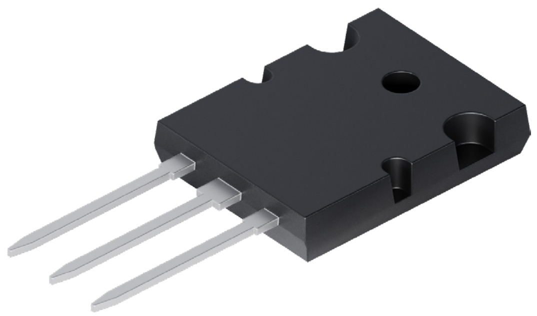
IXYK85N120C4H1

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

High Speed Through IGBT for 20 – 50 kHz Switching



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.

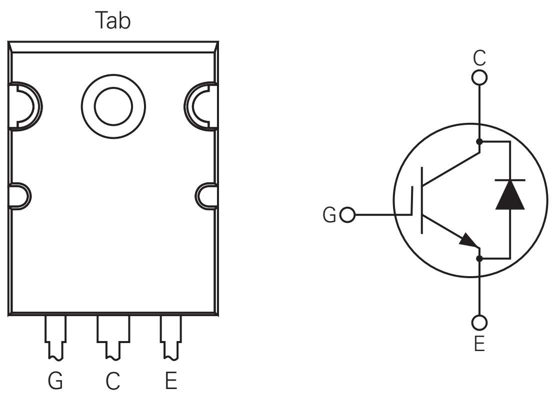
Features & Benefits:

- 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

Pinout Diagram (TO-264)



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

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 °C to 175 °C	1200	V
V_{GES}	Gate-Emitter Voltage	Continuous	±20	V
V_{GEM}	Transient Gate-Emitter Voltage	Transient, < 1 ms	±30	V
I_{C25}	Continuous Collector Current	T_C = 25 °C	220	A
I_{LRMS}	Terminal Current Limit	–	160	A
I_{C110}	Continuous Collector Current	T_C = 110 °C	85	A
I_{F110}	Diode Forward Current	T_C = 110 °C	140	A
I_{CM}	Pulsed Collector Current	T_C = 25 °C, 1 ms	420	A
SSOA (RBSOA)	Switching Safe Operating Area (Reverse Biased Safe Operating Area)	V_{GE} = 15 V, T_{VJ} = 150 °C, R_G = 5 Ω, Clamped Inductive Load, $I_{CM} = V_{CE} \leq 0.8 \times V_{CES}$	170	A
P_C	Collector Power Dissipation	T_C = 25 °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 °C unless otherwise specified)

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

Note 1: Pulse test, t ≤ 300 µs, duty cycle, d ≤ 2%

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

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

Note 1: Pulse test, t ≤ 300 µs, duty cycle, d ≤ 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 °C unless otherwise specified)

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

Note 1: Pulse test, t ≤ 300 µs, duty cycle, d ≤ 2%

Characteristic Curves

Fig. 1. Output Characteristics @ T_{VJ} = 25 °C

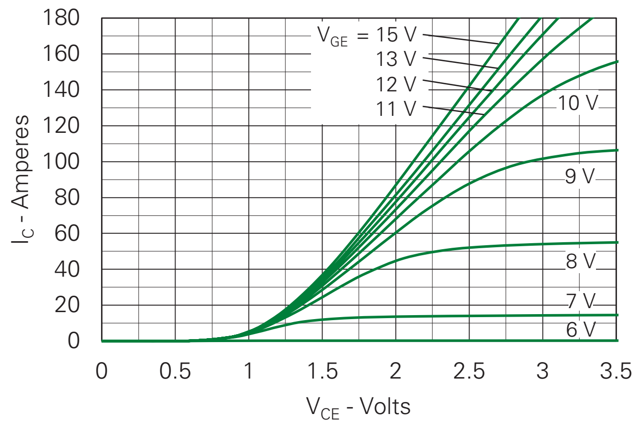


Fig. 2. Extended Output Characteristics @ T_{VJ} = 25 °C

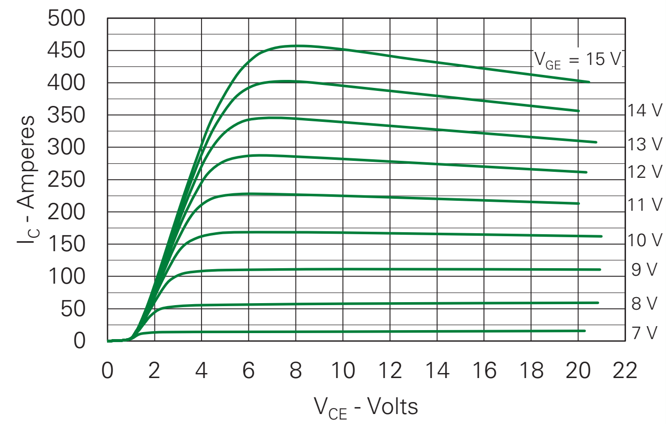


Fig. 3. Output Characteristics @ T_{VJ} = 150 °C

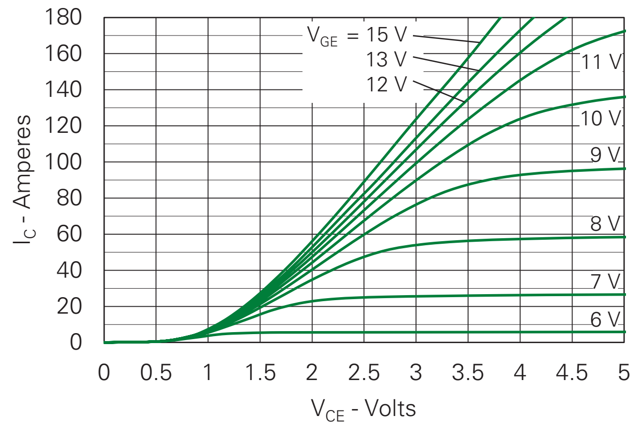


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

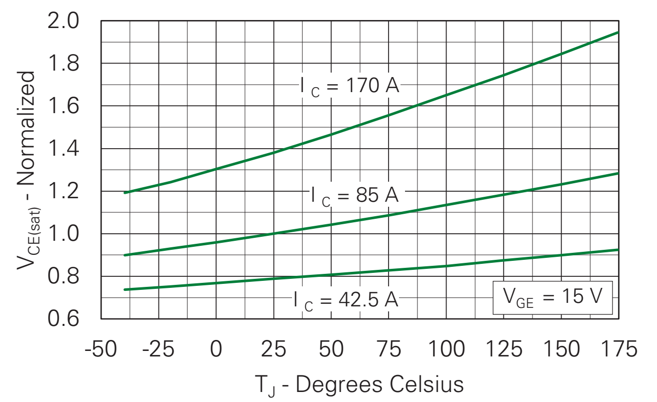


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

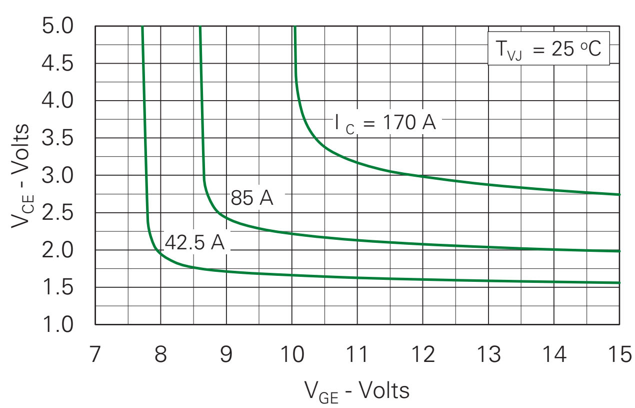


Fig. 6. Input Admittance

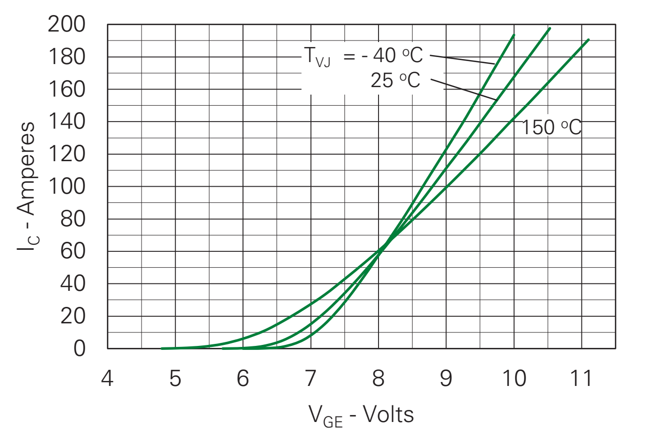


Fig. 7. Transconductance

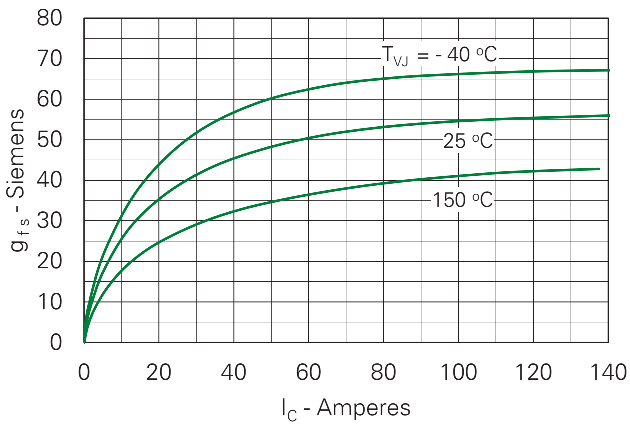


Fig. 8. Gate Charge

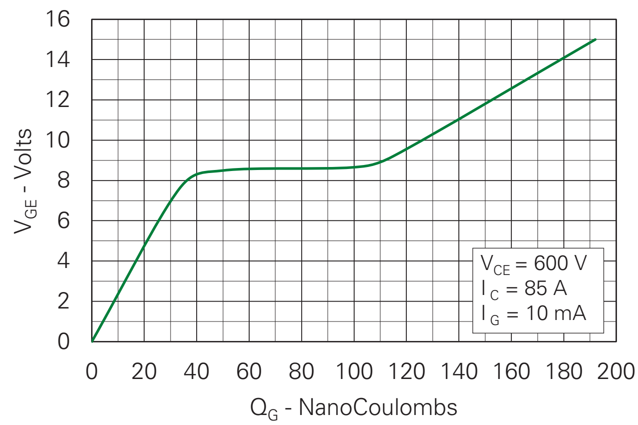


Fig. 9. Capacitance

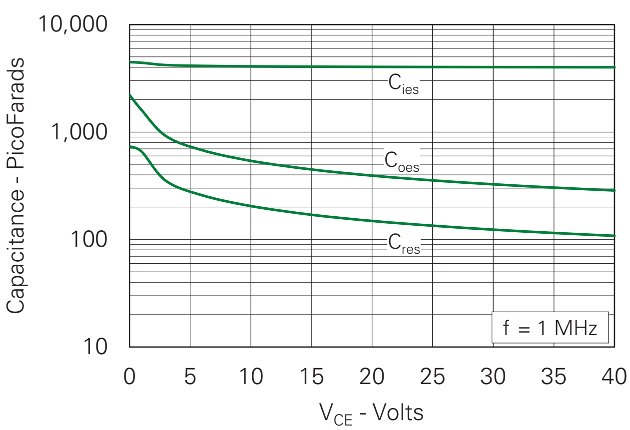


Fig. 10. Reverse-Bias Safe Operating Area

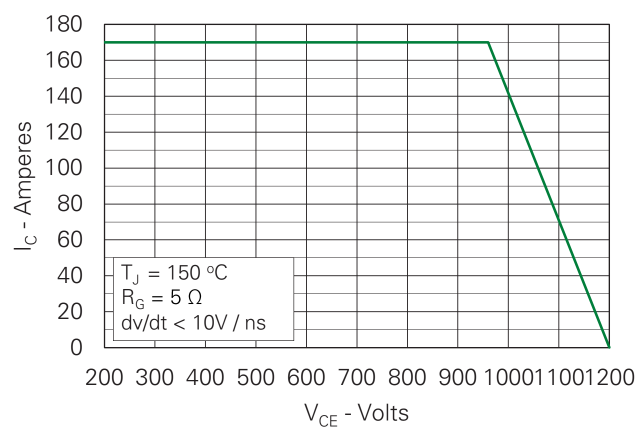


Fig. 11. Maximum Transient Thermal Impedance (IGBT)

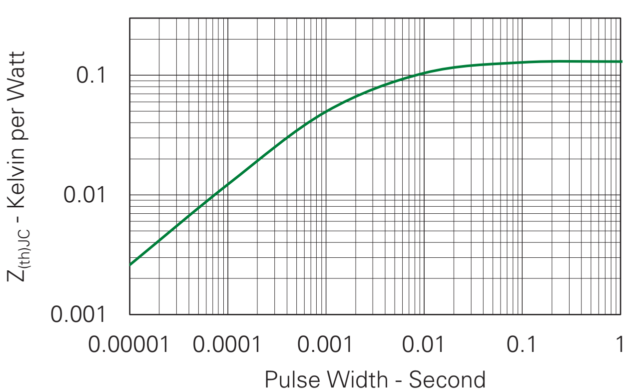


Fig. 12. Inductive Switching Energy Loss vs. Collector Current

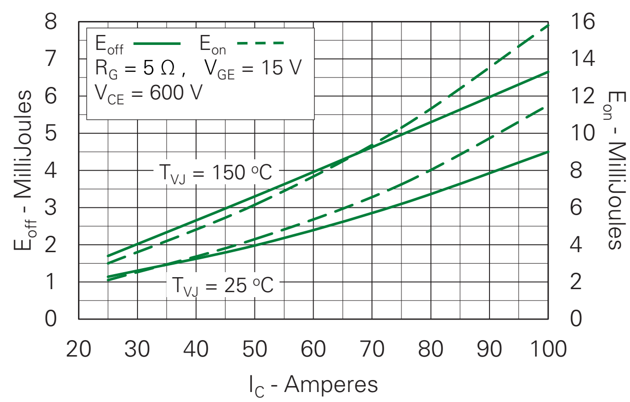


Fig. 13. Inductive Switching Energy Loss vs. Collector-Emitter Voltage

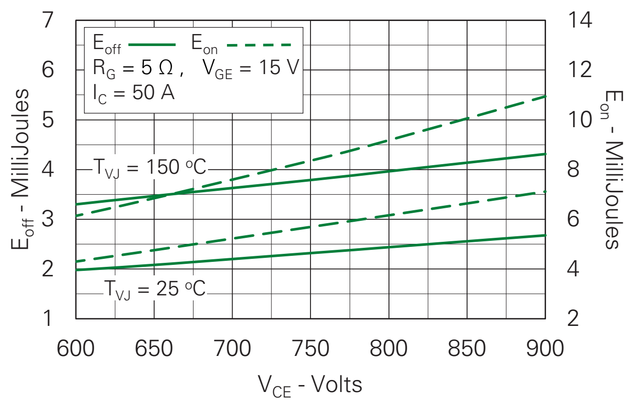


Fig. 14. Inductive Switching Energy Loss vs. Gate Resistance

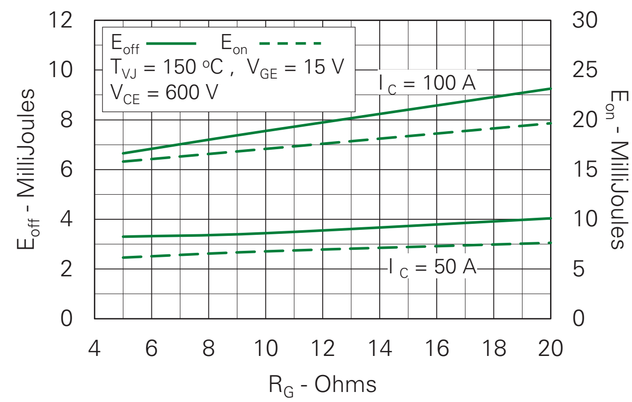


Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature

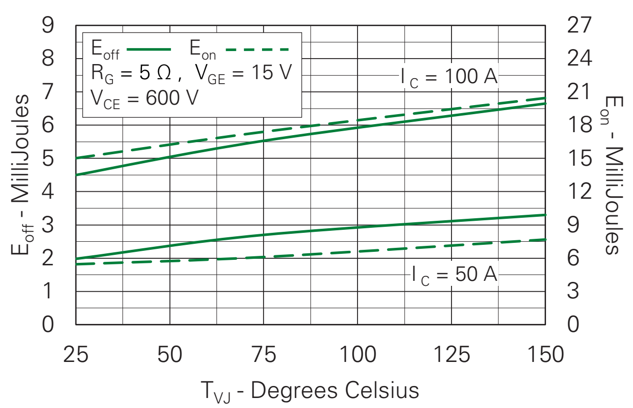


Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance

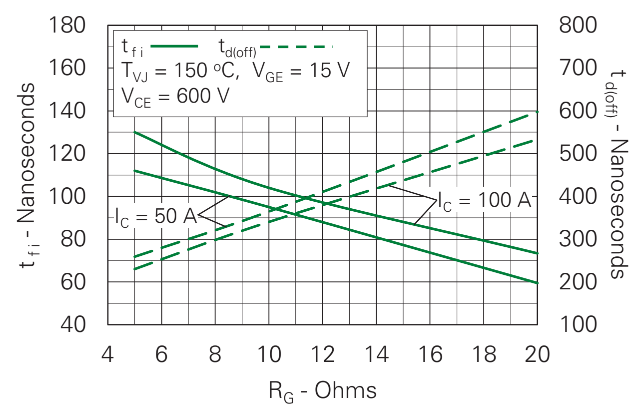


Fig. 17. Inductive Turn-off Switching Times vs. Collector Current

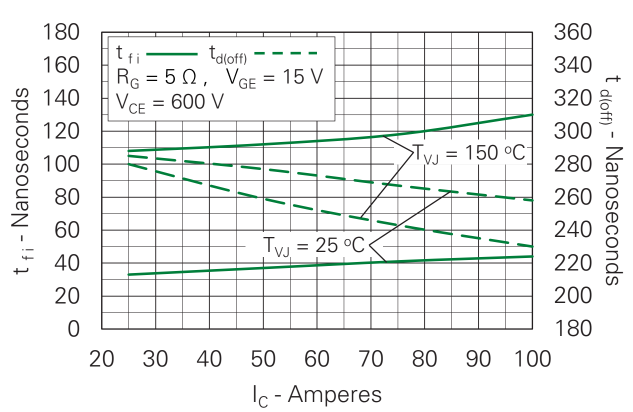


Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature

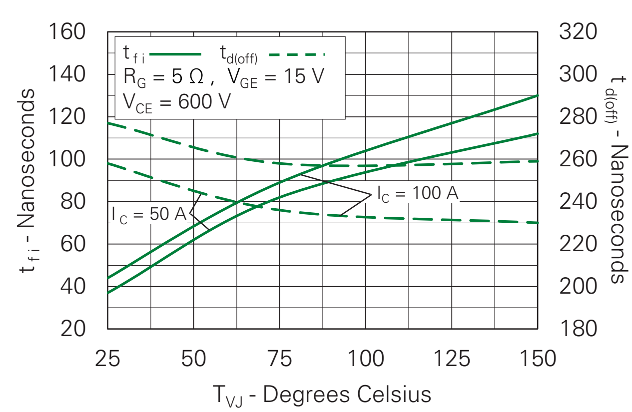


Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance

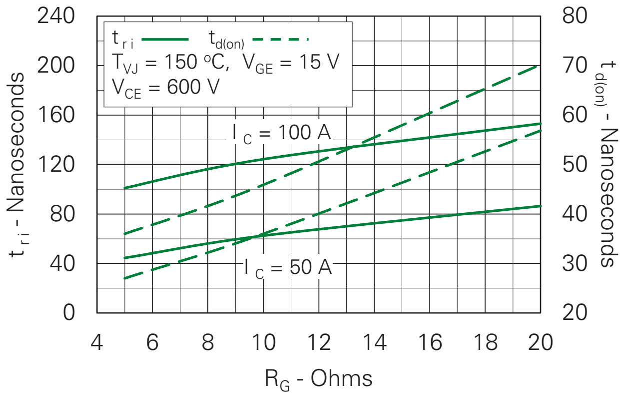


Fig. 20. Inductive Turn-on Switching Times vs. Collector Current

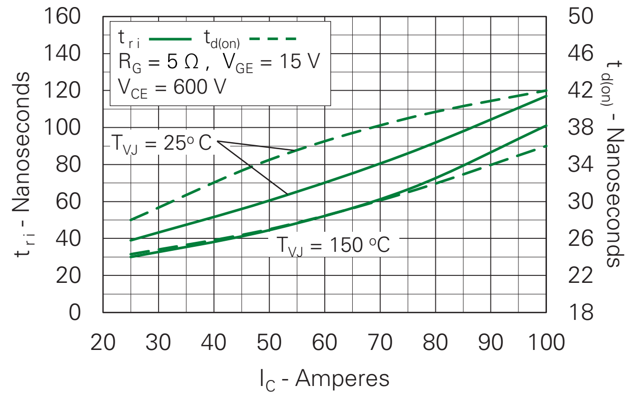


Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature

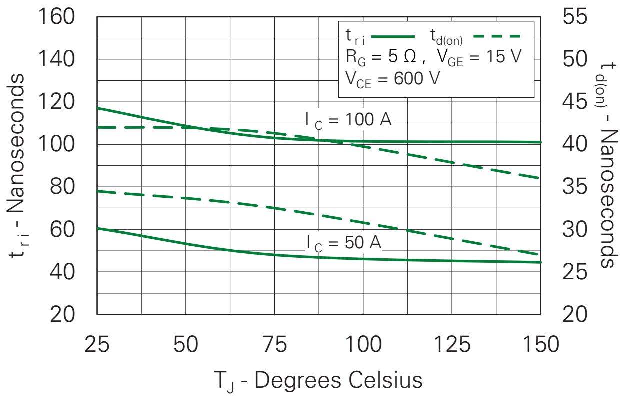


Fig. 22. Maximum Peak Load Current vs. Frequency

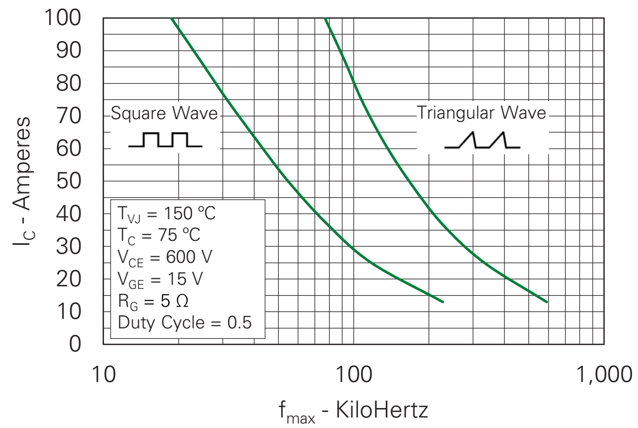


Fig. 23. Diode Forward Characteristics

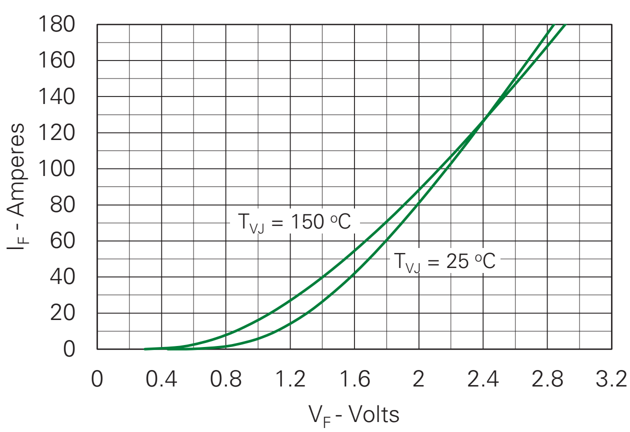


Fig. 24. Reverse Recovery Charge vs. -di$_F$/dt

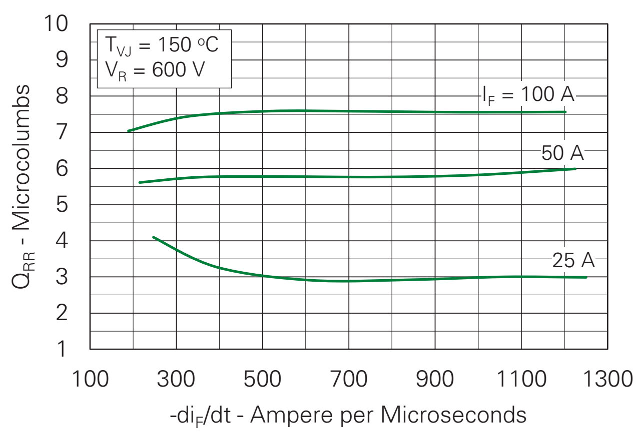


Fig. 25 Reverse Recovery Current vs. -di_F/dt

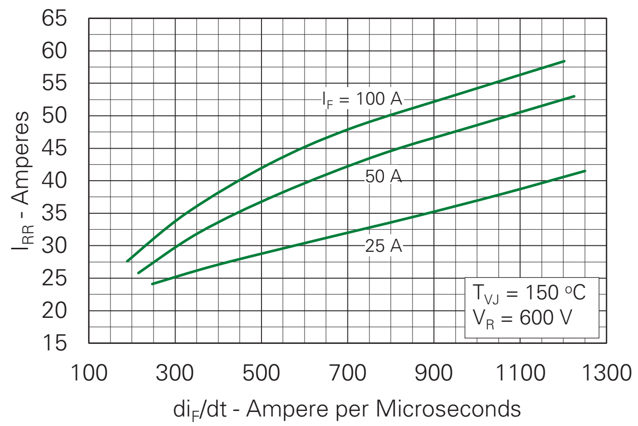


Fig. 26. Reverse Recovery Time vs. -di_F/dt

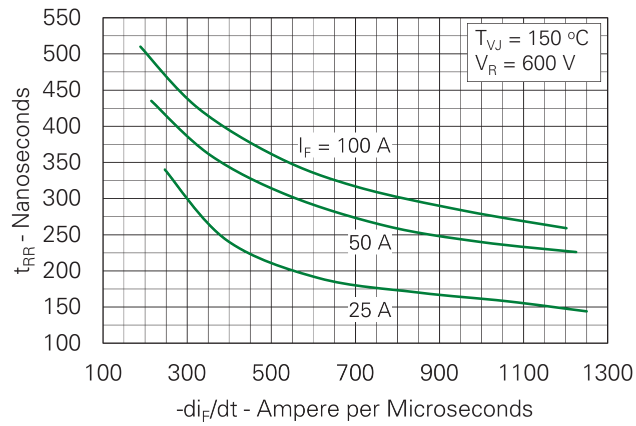


Fig. 27. Dynamic Parameters Q_{RR}, I_{RR} vs. Junction Temperature

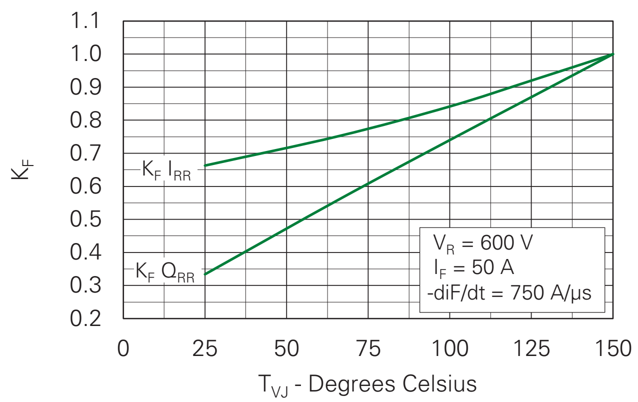
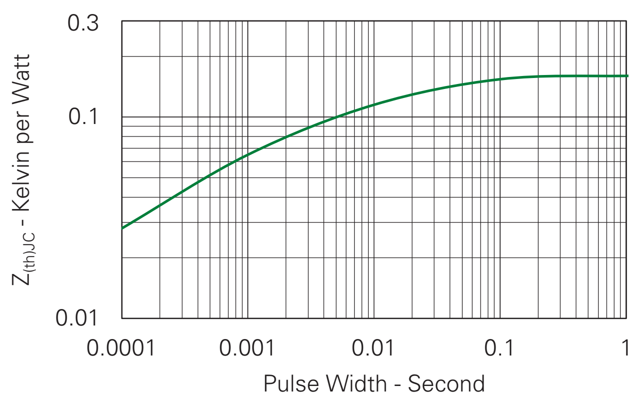
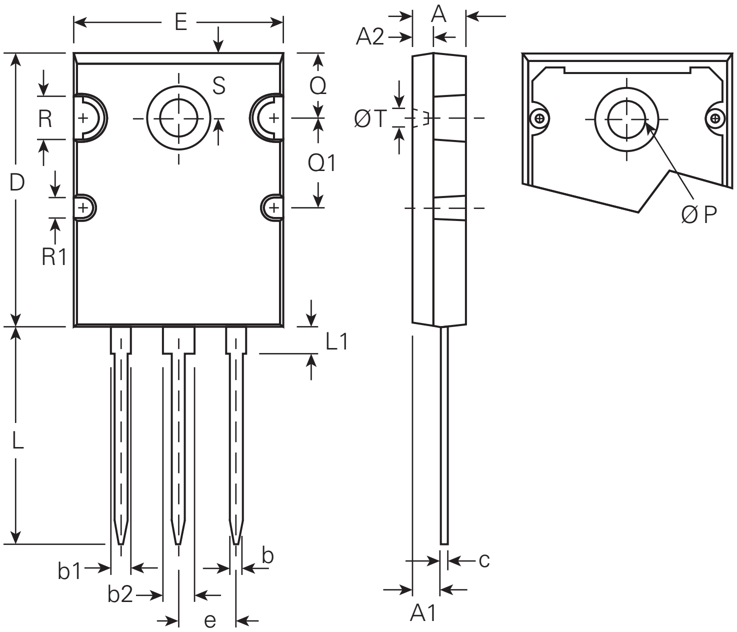


Fig. 28. Maximum Transient Thermal Impedance (Diode)



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