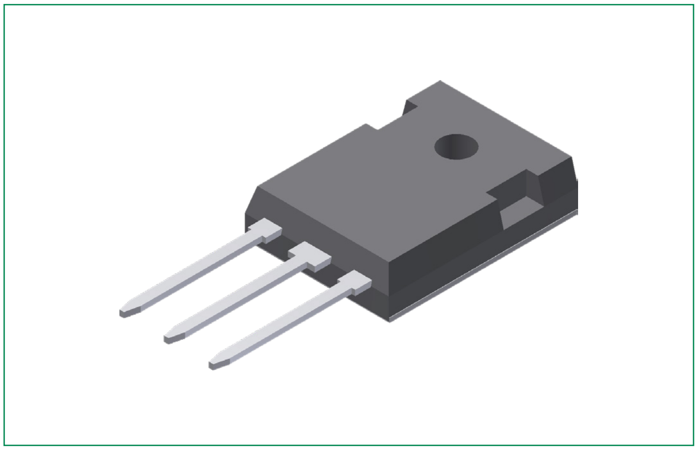
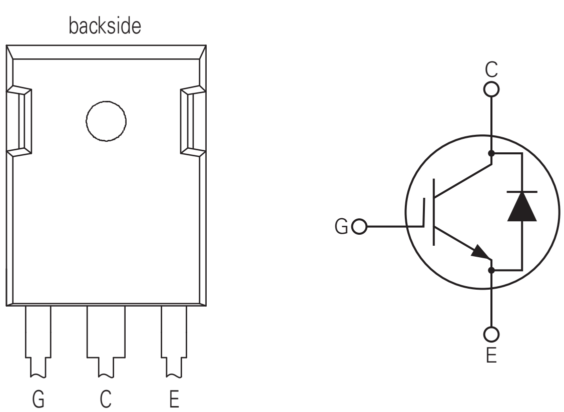
IXYH55N120B4H1

1200 V, 55 A XPT™ Gen4 IGBT with Sonic Diode

Extreme Light Punch Through IGBT for 5–30 kHz Switching



Pinout Diagram (TO-247-3L)



G: Gate; **C:** Collector; **E:** Emitter; **backside:** 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 5–30 kHz Switching
- Positive Thermal Coefficient of $V_{CE(sat)}$
- International Standard Package
- High Current Handling Capability
- 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}	55	A
$V_{CE(sat)}$	2.1	V
$t_{fi(typ)}$	146	nsv

Revised: XZ 04/19/2023

Maximum Ratings

Symbol	Characteristic	Conditions	Value	Unit
V_{CES}	Collector-Emitter Voltage	T_J = 25°C to 175°C	1200	V
V_{GES}	Gate-Emitter Voltage	Continuous	±20	V
V_{GEM}	Transient Gate-Emitter Voltage	Transient	±30	V
I_{C25}	Continuous Collector Current	T_C = 25°C	138	A
I_{C110}	Continuous Collector Current	T_C = 110°C	55	A
I_{F110}	Diode Forward Current	T_C = 110°C	32	A
I_{CM}	Pulsed Collector Current	T_C = 25°C, 1 ms	310	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} = $V_{CE} \leq 0.8 \times V_{CES}$	110	A
P_C	Collector Power Dissipation	T_C = 25°C	650	W
T_J	Junction Temperature	–	-55 to 175	°C
T_{JM}	Maximum Junction Temperature	–	175	°C
T_{stg}	Storage Temperature	–	-55 to 175	°C
T_L	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	–	6	g

Thermal Characteristics

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
$R_{th, JC}$	Thermal Resistance, junction-to-case	–	–	0.23	°C/W
$R_{th, CS}$	Thermal Resistance, case-to-heat sink	–	0.21	–	°C/W

Electrical Characteristics – Static (T_J = 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	–	–	50	µA
		V_{CE} = V_{CES}, V_{GE} = 0 V, T_J = 125°C	–	–	5	mA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage[1]	I_C = 55 A, V_{GE} = 15 V	–	1.8	2.1	V
		I_C = 55 A, V_{GE} = 15 V, T_J = 150°C	–	2.2	–	V

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

Electrical Characteristics – Dynamic (T_J = 25°C unless otherwise specified)

Symbol	Characteristic	Conditions		Value			Unit
				Min.	Typ.	Max.	
g_{fs}	Transconductance[1]	I_C = 55 A, V_{CE} = 10 V		18	30	–	S
C_{ies}	Input Capacitance	V_{GE} = 0 V, V_{CE} = 25 V, f = 1 MHz		–	2290	–	pF
C_{oes}	Output Capacitance			–	190	–	
C_{res}	Reverse Transfer Capacitance			–	76	–	
$Q_{g(on)}$	Total Gate Charge	V_{GE} = 15 V, V_{CE} = 0.5 x V_{CES}, I_C = 55 A		–	120	–	nC
Q_{ge}	Gate-Emitter Charge			–	18	–	
Q_{gc}	Gate-Collector Charge			–	47	–	
$t_{d(on)}$	Turn-on Delay Time[2]	Inductive Load, V_{GE} = 15 V, V_{CE} = 0.5 x V_{CES}, I_C = 40 A, $R_{G(ext)}$ = 5 Ω	T_J = 25°C	–	27	–	ns
			T_J = 150°C	–	20	–	
t_{ri}	Turn-on Rise Time[2]		T_J = 25°C	–	43	–	ns
			T_J = 150°C	–	34	–	
E_{on}	Turn-on Energy[2]		T_J = 25°C	–	3.40	–	mJ
			T_J = 150°C	–	4.80	–	
$t_{d(off)}$	Turn-off Delay Time[2]		T_J = 25°C	–	215	–	ns
			T_J = 150°C	–	220	–	
t_{fi}	Turn-off Fall Time[2]		T_J = 25°C	–	146	–	ns
			T_J = 150°C	–	340	–	
E_{off}	Turn-off Energy[2]		T_J = 25°C	–	2.75	–	mJ
			T_J = 150°C	–	4.50	–	

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_J, or R_G.

Reverse Sonic Diode (FRD) (T_J = 25°C unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
V_F	Diode Forward Voltage[1]	I_F = 40 A, V_{GE} = 0 V	–	2.4	2.8	V
		I_F = 40 A, V_{GE} = 0 V, T_J = 125°C	–	3.0	–	
I_{RM}	Reverse Recovery Current	I_F = 40 A, V_{GE} = 0 V, T_J = 125°C, $-di_F/dt$= 500 A/μs, V_R = 600 V	–	28	–	A
t_{rr}	Reverse Recovery Time		–	420	–	ns
$R_{th, JC}$	Thermal Resistance, junction-to-case	–	–	–	0.35	°C/W

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

Revised: XZ 04/19/2023

Characteristic Curves

Fig. 1. Output Characteristics @ T_J = 25°C

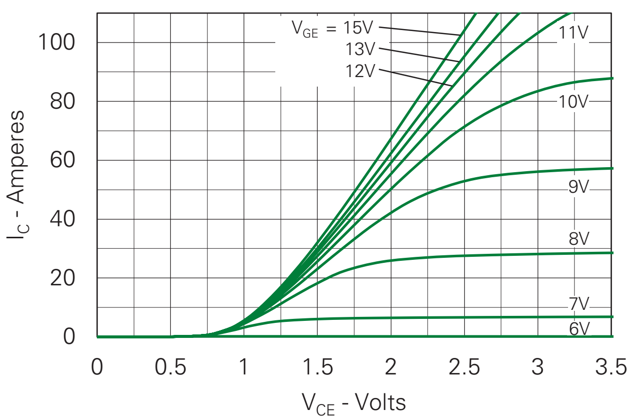


Fig. 2. Extended Output Characteristics @ T_J = 25°C

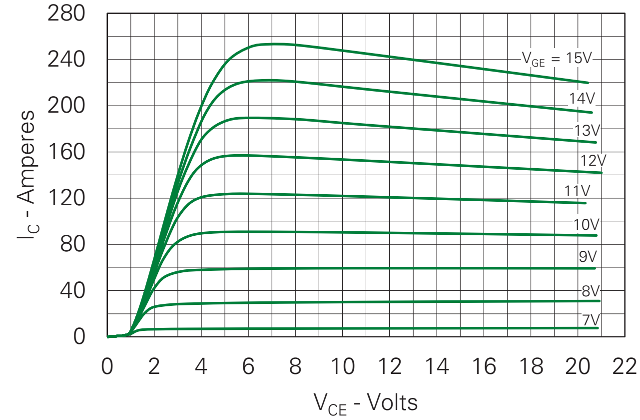


Fig. 3. Output Characteristics @ T_J = 150°C

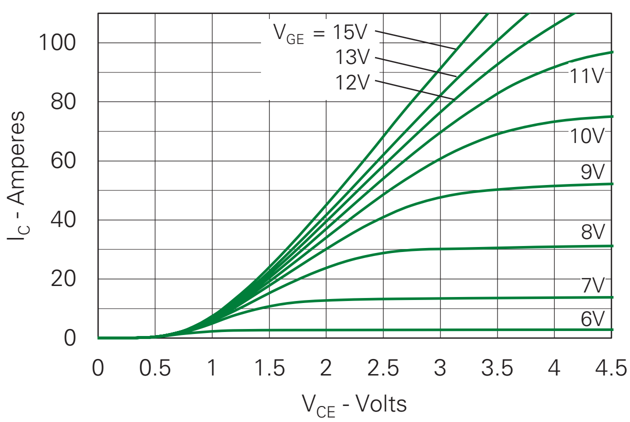


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

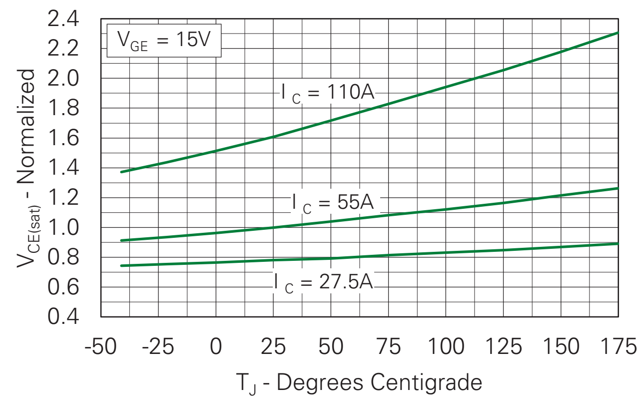


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

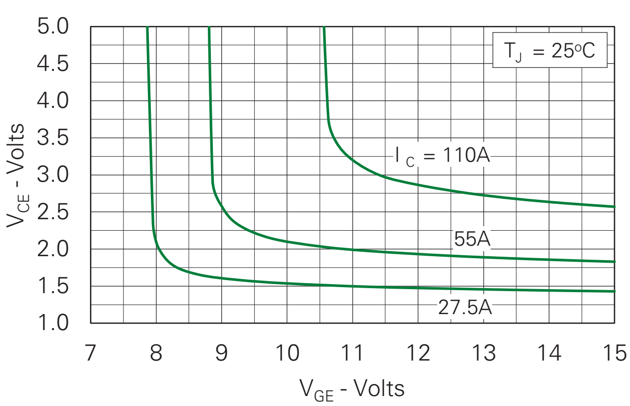


Fig. 6. Input Admittance

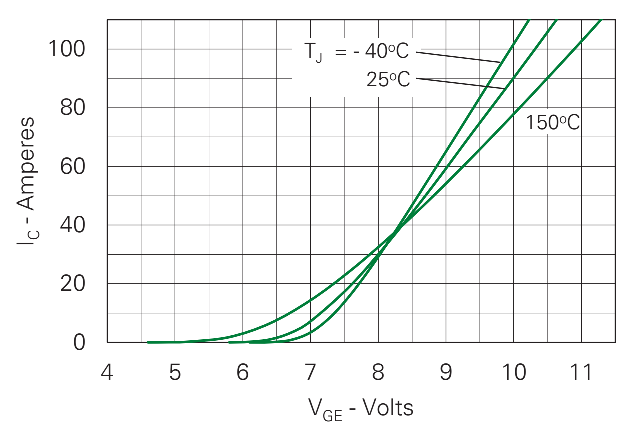


Fig. 7. Transconductance

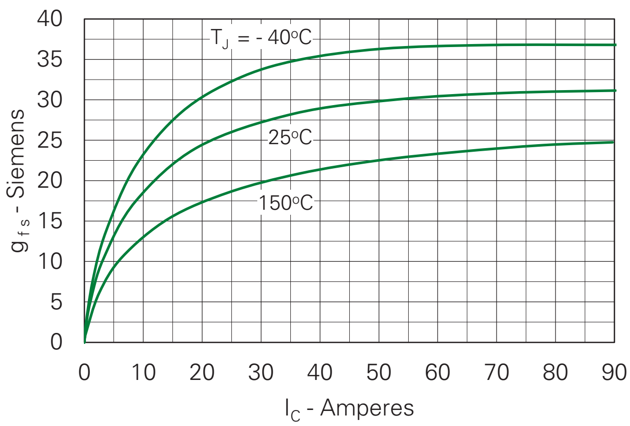


Fig. 8. Gate Charge

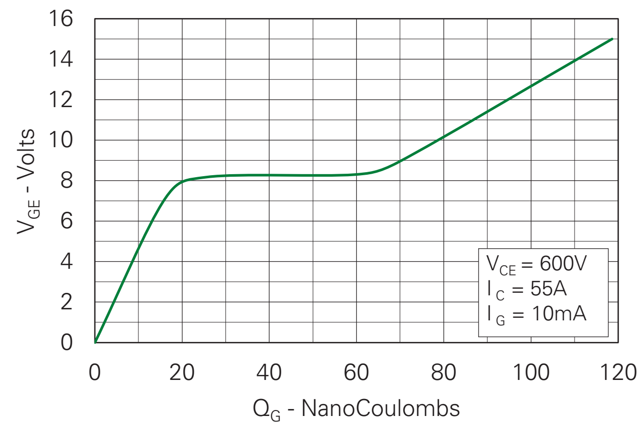


Fig. 9. Capacitance

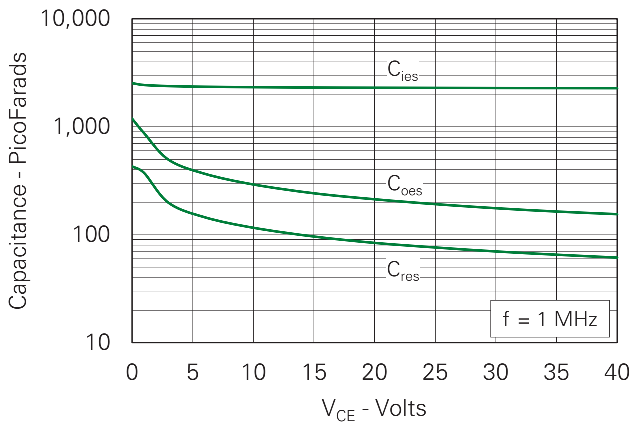


Fig. 10. Reverse-Bias Safe Operating Area

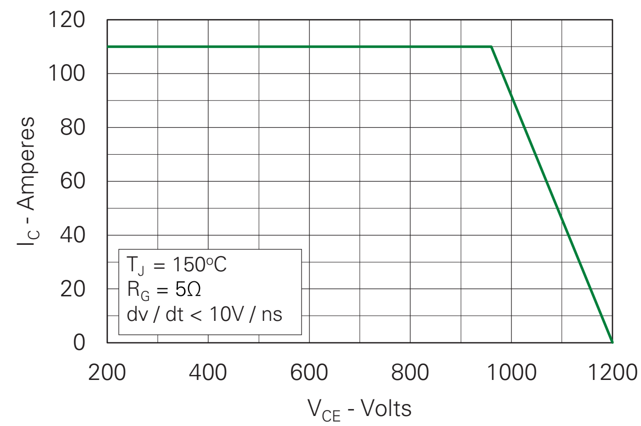


Fig. 11. Maximum Transient Thermal Impedance (IGBT)

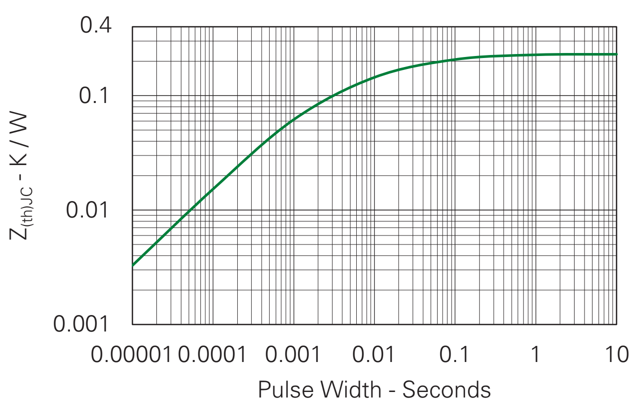


Fig. 12. Inductive Switching Energy Loss vs. Collector Current

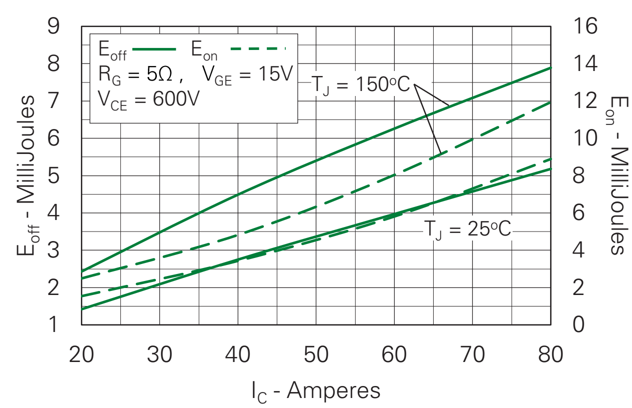


Fig. 13. Inductive Switching Energy Loss vs. Collector-Emitter Voltage

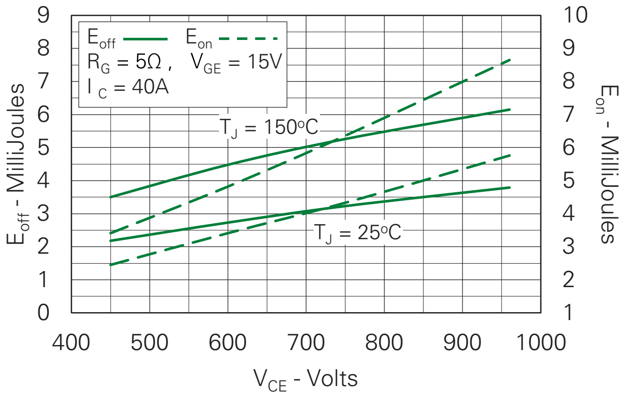


Fig. 14. Inductive Switching Energy Loss vs. Gate Resistance

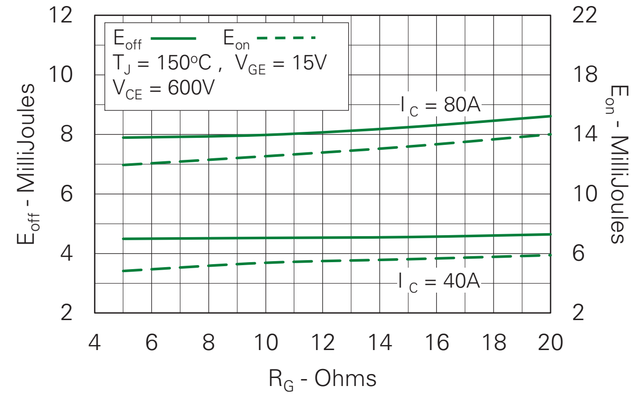


Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature

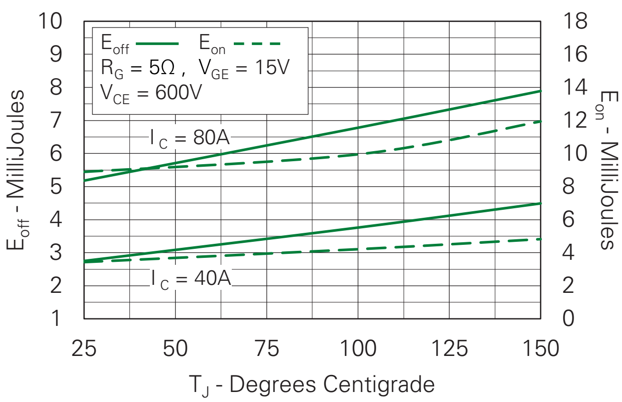


Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance

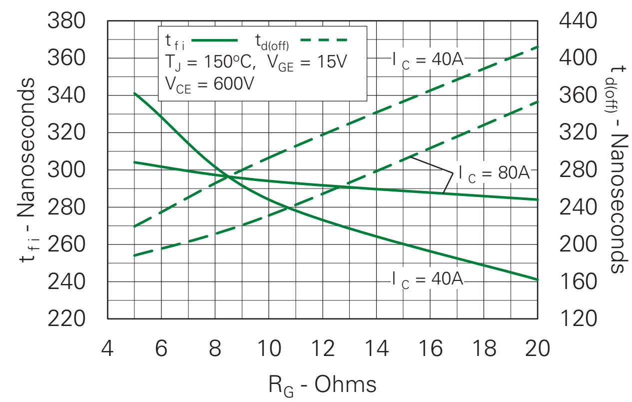


Fig. 17. Inductive Turn-off Switching Times vs. Collector Current

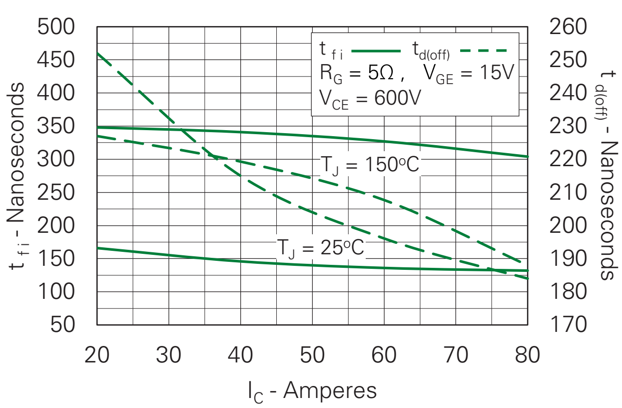


Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature

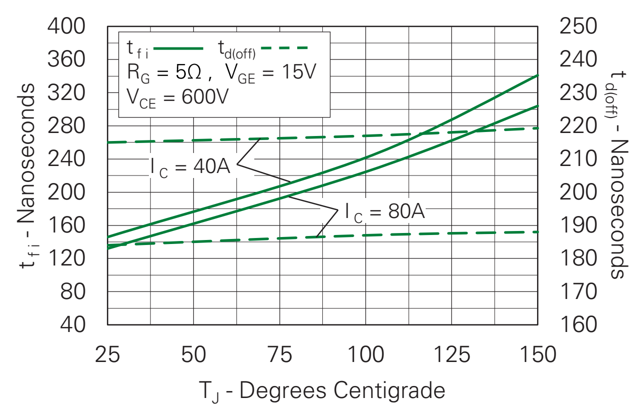


Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance

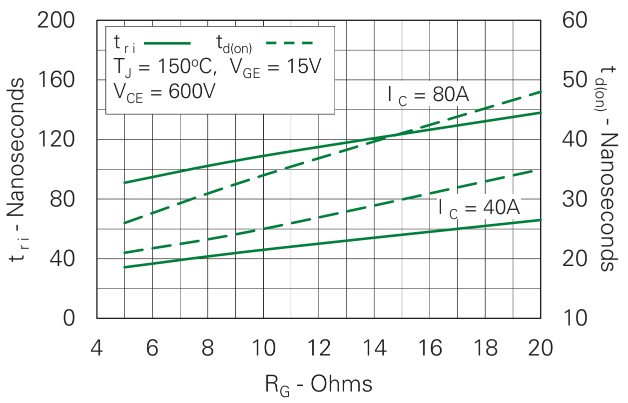


Fig. 20. Inductive Turn-on Switching Times vs. Collector Current

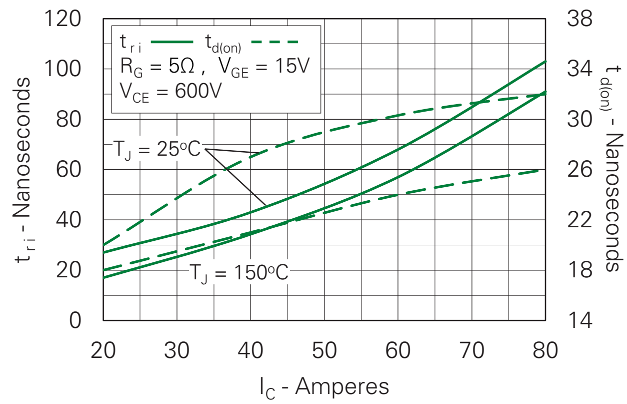


Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature

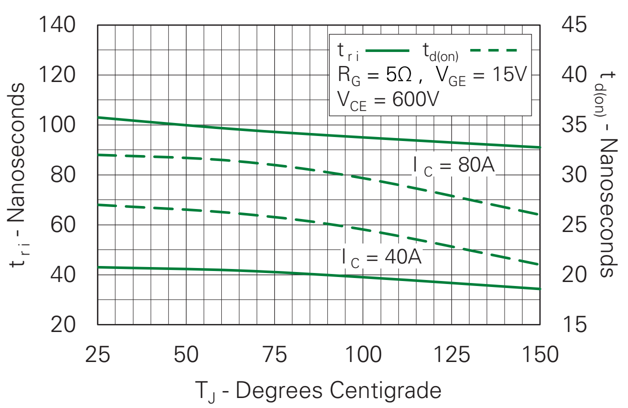
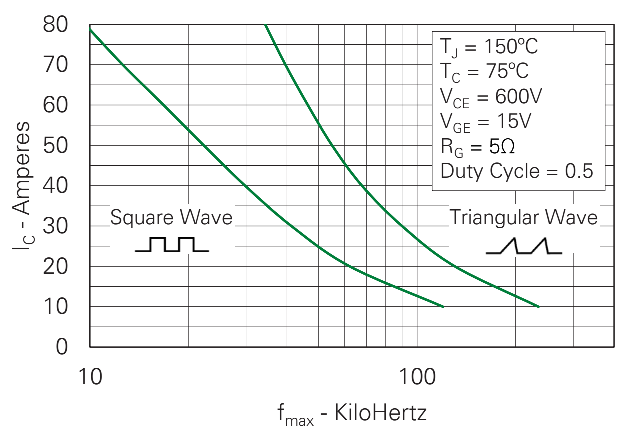
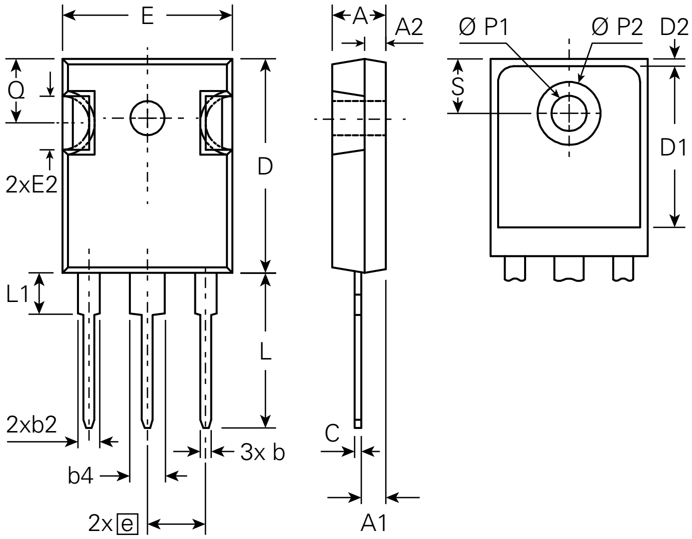


Fig. 22. Maximum Peak Load Current vs. Frequency



Part Outline Drawing (TO-247-3L)



Symbol	Inches			Millimeters		
	Min.	Typical	Max.	Min.	Typical	Max
A	0.185	–	0.209	4.70	–	5.30
A1	0.087	–	0.102	2.21	–	2.59
A2	0.059	–	0.098	1.50	–	2.49
b	0.039	–	0.055	0.99	–	1.40
b2	0.065	–	0.094	1.65	–	2.39
b4	0.102	–	0.135	2.59	–	3.43
c	0.015	–	0.035	0.38	–	0.89
D	0.819	–	0.844	20.79	–	21.45
D1	0.515	–	–	13.07	–	–
D2	0.020	–	0.053	0.51	–	1.35
E	0.609	–	0.639	15.48	–	16.24
E1	0.530	–	–	13.45	–	–
E2	0.170	–	0.216	4.31	–	5.48
e	0.215 BSC			5.45 BSC		
L	0.780	–	0.799	19.80	–	20.30
L1	–	–	0.177	–	–	4.49
Ø P1	0.140	–	0.144	3.55	–	3.65
Ø P2	–	–	0.291	-	–	7.39
Q	0.212	–	0.244	5.38	–	6.19
S	0.242 BSC			6.14 BSC		

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