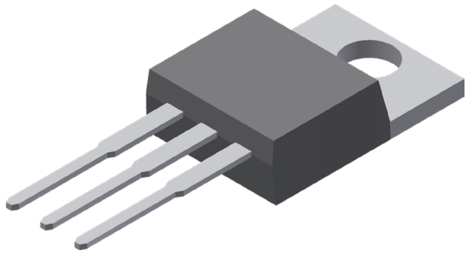
IXYP35N65C5

650 V, 35 A Gen5 XPT™ IGBT

Extreme Light Punch Through IGBT for 20–60 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, and low tail current.

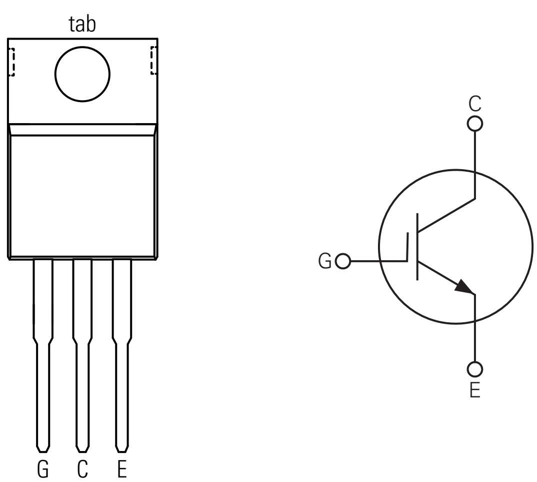
Features & Benefits:

- Optimized for 20–60kHz Switching
- Positive Thermal Coefficient of $V_{CE(sat)}$
- High Surge Current Capability
- Square RBSOA
- International Standard Package
- Low Gate Drive Requirement

Applications:

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

Pinout Diagram (TO-220-3L)



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

Product Summary

Characteristic	Value	Unit
V_{CES}	650	V
I_{C110}	35	A
$V_{CE(sat)}$	2.0	V
$t_{fi(typ)}$	28	ns

Maximum Ratings

Symbol	Characteristic	Conditions	Value	Unit
V_{CES}	Collector-Emitter Voltage	T_J = 25°C to 175°C	650	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	90	A
I_{C110}	Continuous Collector Current	T_C = 110°C	35	A
I_{CM}	Pulsed Collector Current	T_C = 25°C, 1 ms	190	A
SSOA (RBSOA)	Switching Safe Operating Area (Reverse Biased Safe Operating Area)	V_{GE} = 15 V, T_{VJ} = 150°C, R_G = 10 Ω, Clamped Inductive Load, I_{CM} @ $V_{CE} \leq V_{CES}$	60	A
P_C	Collector Power Dissipation	T_C = 25°C	326	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	–	3	g

Thermal Characteristics

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
$R_{th, JC}$	Thermal Resistance, junction-to-case	–	–	0.46	°C/W
$R_{th, CS}$	Thermal Resistance, case-to-heat sink	–	0.50	–	°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	650	–	–	V
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C = 250 µA, V_{CE} = V_{GE}	3.7	–	5.8	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	–	–	5	µA
		V_{CE} = V_{CES}, V_{GE} = 0 V, T_J = 150°C	–	–	250	µA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage[1]	I_C = 30 A, V_{GE} = 15 V	–	1.70	2.00	V
		I_C = 30 A, V_{GE} = 15 V, T_J = 150°C	–	1.96	–	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 = 30 A, V_{CE} = 10 V		16	27	–	S
C_{ies}	Input Capacitance	V_{GE} = 0 V, V_{CE} = 25 V, f = 1MHz		–	1660	–	pF
C_{oes}	Output Capacitance			–	78	–	
C_{res}	Reverse Transfer Capacitance			–	53	–	
$Q_{g(on)}$	Total Gate Charge	V_{GE} = 15 V, V_{CE} = 0.5 x $V_{CES,}$ I_C = 30 A		–	96	–	nC
Q_{ge}	Gate-Emitter Charge			–	10	–	
Q_{gc}	Gate-Collector Charge			–	48	–	
$t_{d(on)}$	Turn-on Delay Time[2]	Inductive Load, V_{GE} = 15 V, V_{CE} = 300 V, I_C = 20 A, $R_{G(ext)}$ = 5 Ω	T_J = 25°C	–	21	–	ns
			T_J = 150°C	–	15	–	
t_{ri}	Turn-on Rise Time[2]		T_J = 25°C	–	25	–	ns
			T_J = 150°C	–	18	–	
E_{on}	Turn-on Energy[2]		T_J = 25°C	–	0.23	–	mJ
			T_J = 150°C	–	0.46	–	
$t_{d(off)}$	Turn-off Delay Time[2]		T_J = 25°C	–	122	–	ns
			T_J = 150°C	–	124	–	
t_{fi}	Turn-off Fall Time[2]		T_J = 25°C	–	28	–	ns
			T_J = 150°C	–	30	–	
E_{off}	Turn-off Energy[2]		T_J = 25°C	–	0.18	–	mJ
			T_J = 150°C	–	0.27	–	

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.

Characteristic Curves

Fig. 1. Output Characteristics @ $T_J = 25^oC$

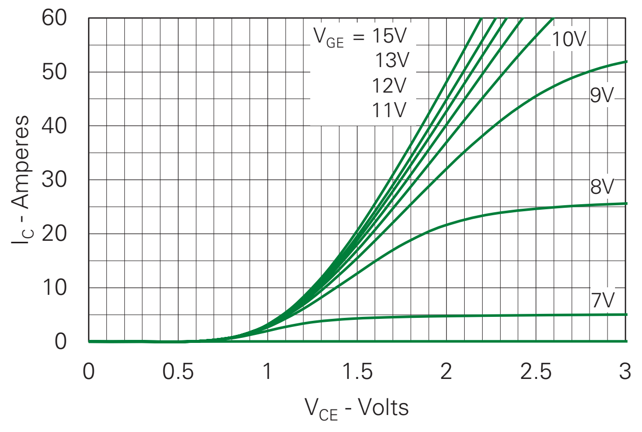


Fig. 2. Extended Output Characteristics @ $T_J = 25^oC$

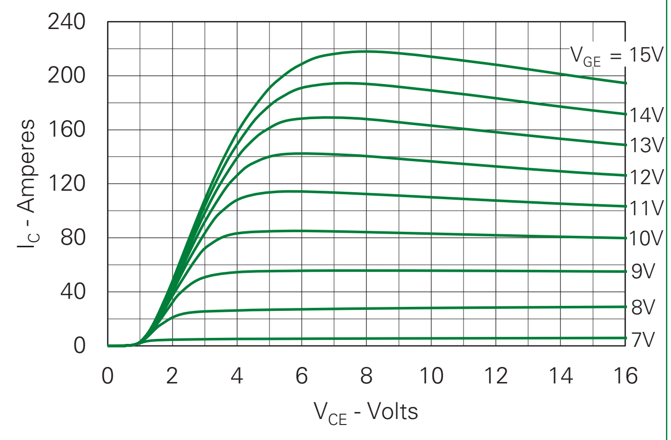


Fig. 3. Output Characteristics @ $T_J = 150^oC$

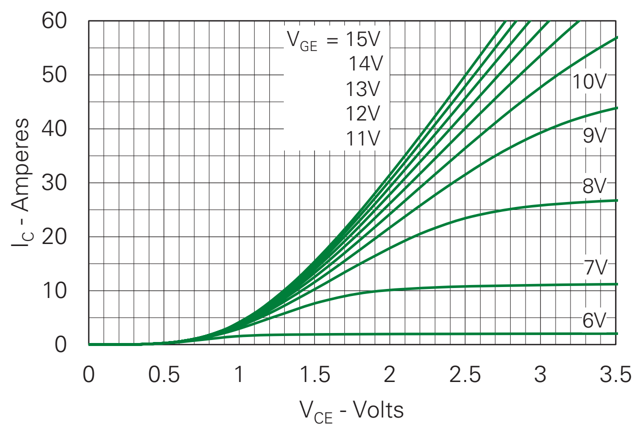


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

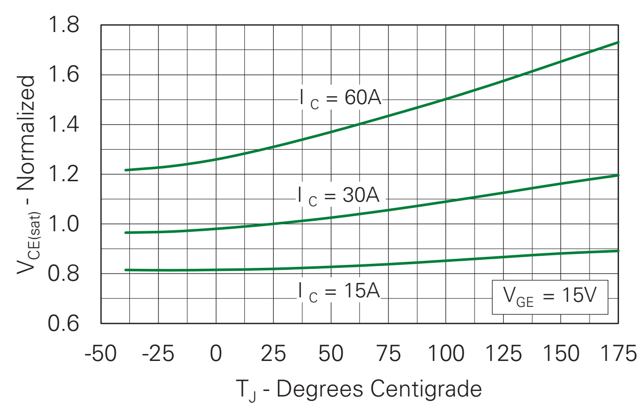


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

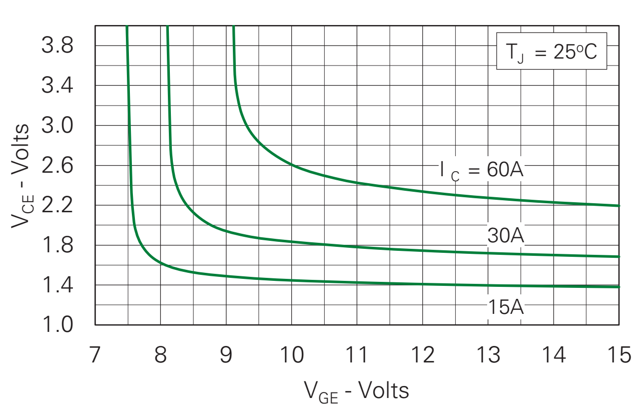


Fig. 6. Input Admittance

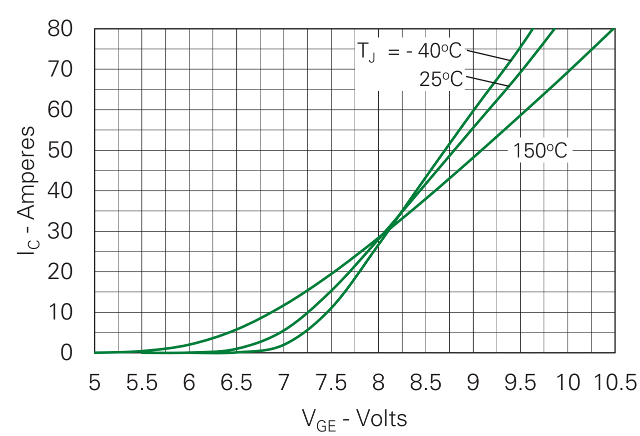


Fig. 7. Transconductance

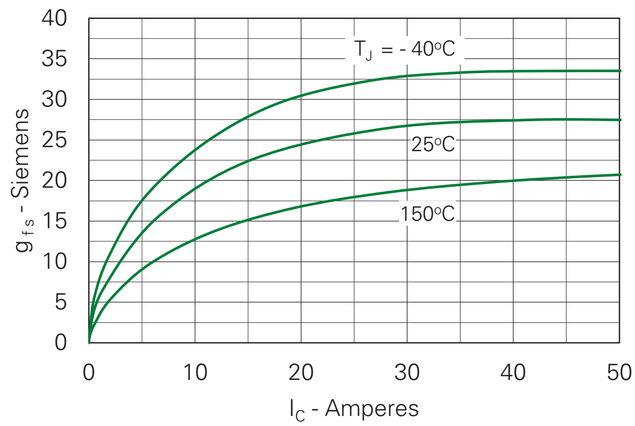


Fig. 8. Gate Charge

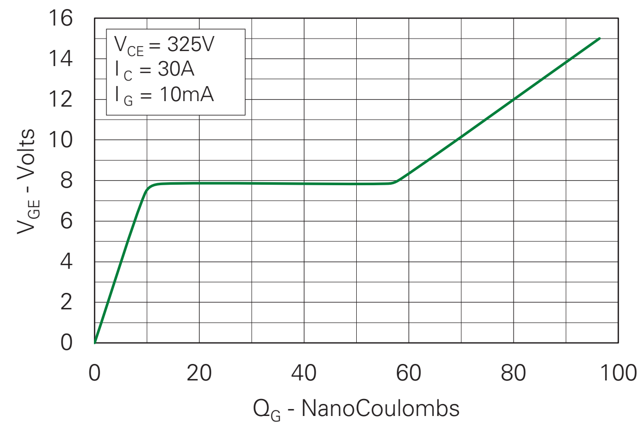


Fig. 9. Capacitance

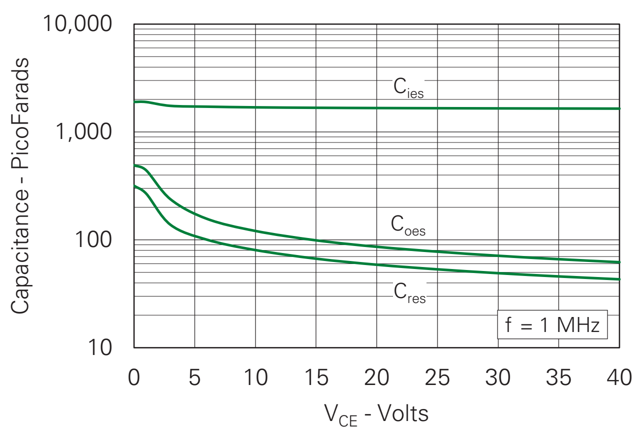


Fig. 10. Reverse-Bias Safe Operating Area

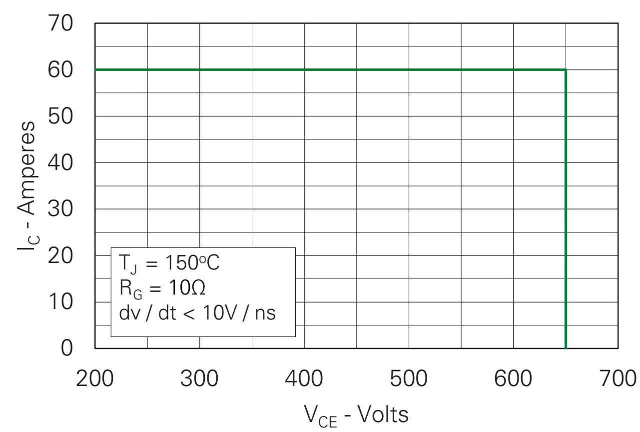


Fig. 11. Maximum Transient Thermal Impedance

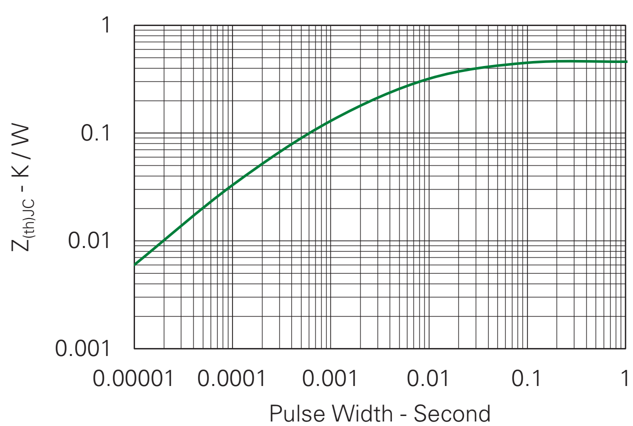


Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

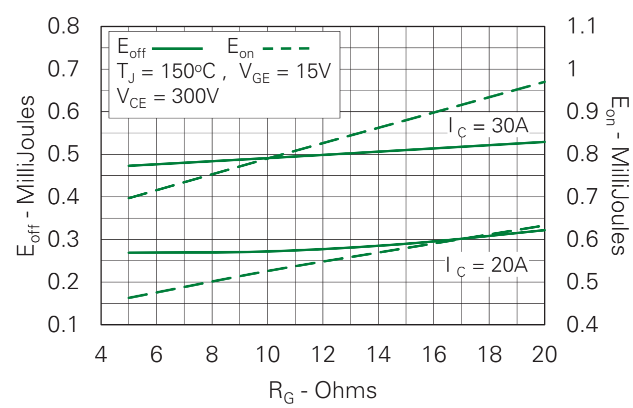


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

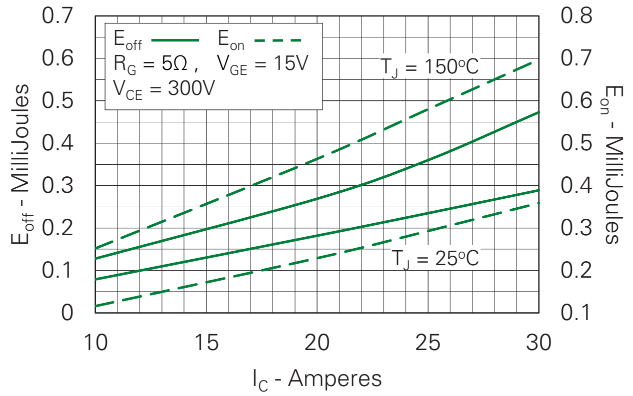


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

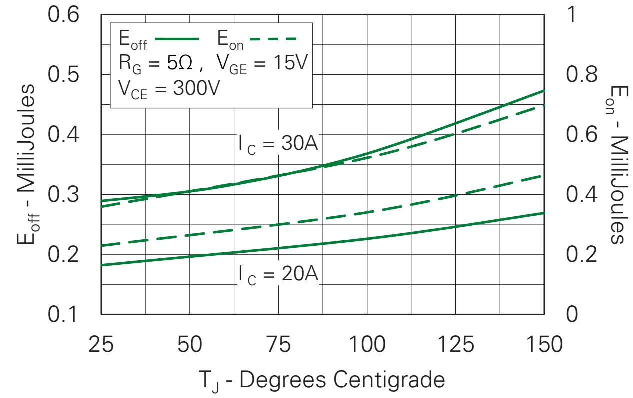


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

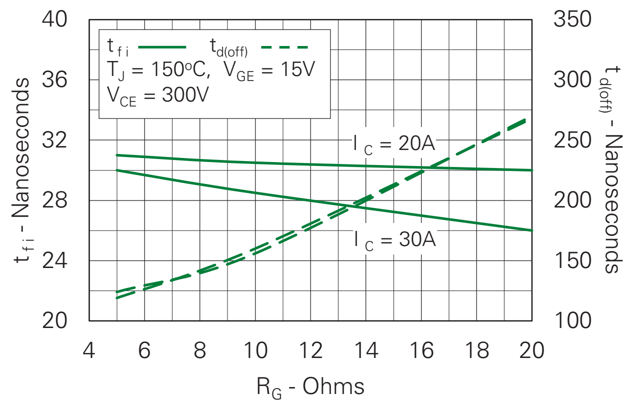


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

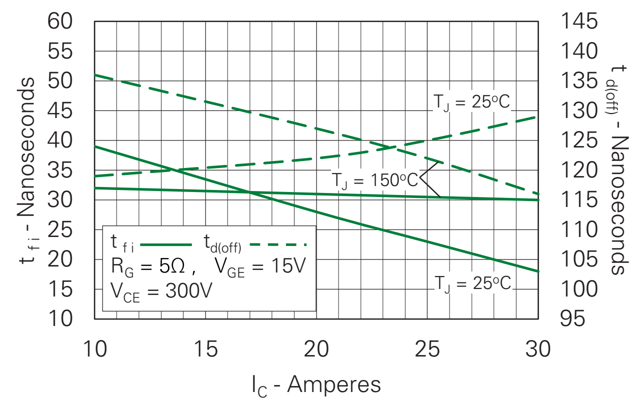


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

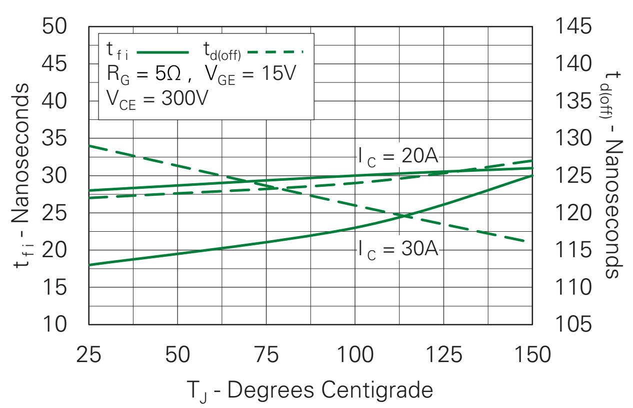


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

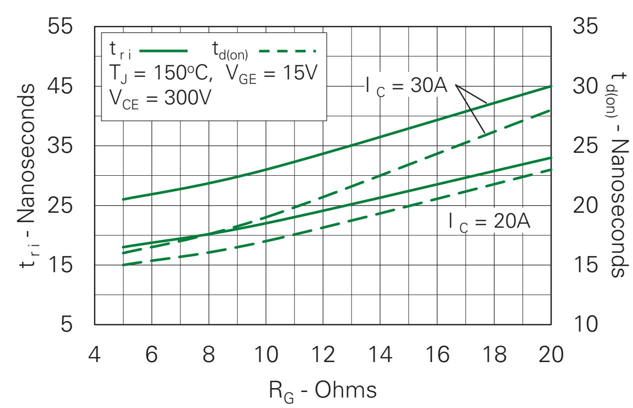


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

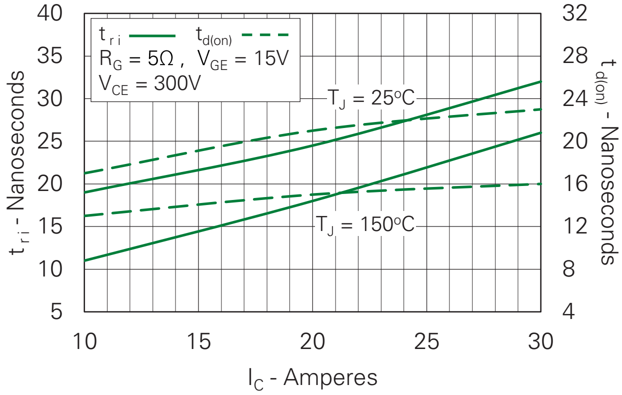


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature

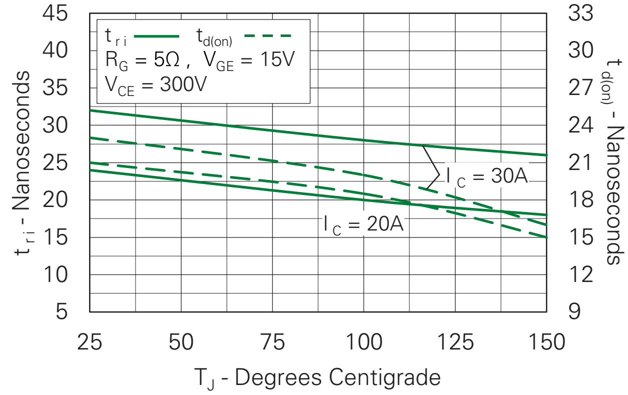
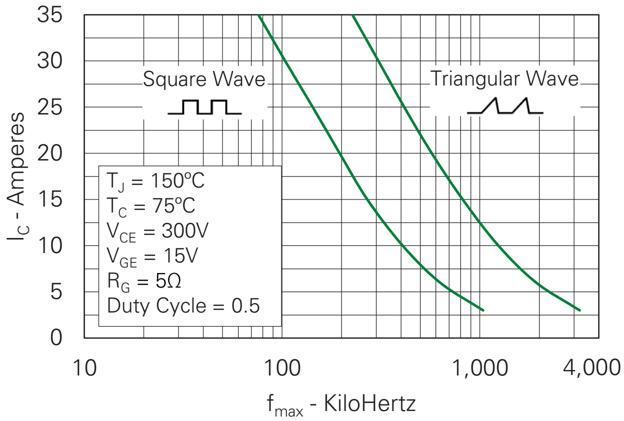
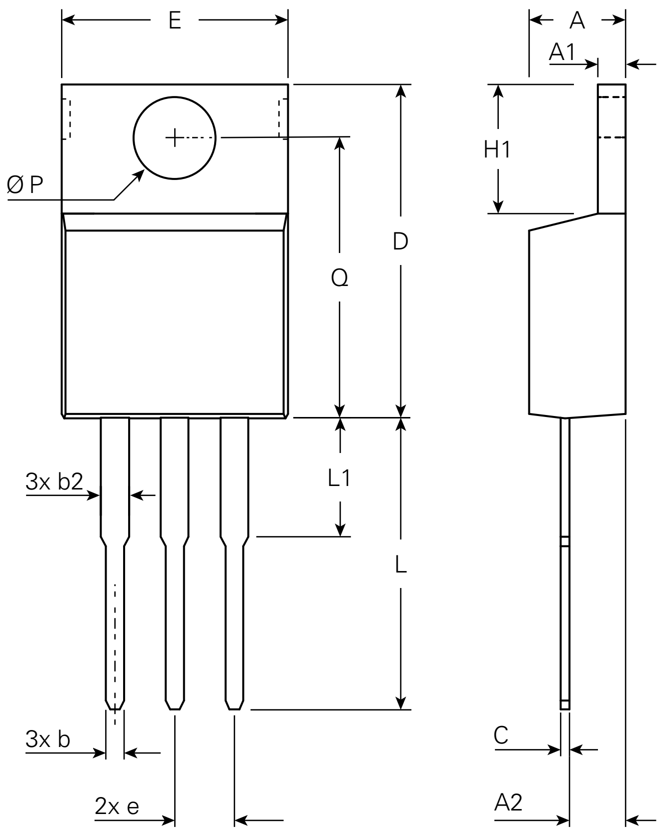


Fig. 21. Maximum Peak Load Current vs. Frequency



Part Outline Drawing (TO-220-3L)



Symbol	Inches			Millimeters		
	Min.	Typical	Max.	Min.	Typical	Max
A	0.140	–	0.190	3.56	–	4.83
A1	0.020	–	0.055	0.51	–	1.40
A2	0.080	–	0.110	2.03	–	2.92
b	0.015	–	0.040	0.38	–	1.02
b2	0.045	–	0.065	1.15	–	1.65
C	0.012	–	0.022	0.31	–	0.61
D	0.560	–	0.630	14.22	–	16.51
E	0.380	–	0.420	9.65	–	10.67
e	0.100 BSC			2.54 BSC		
H1	0.230	–	0.270	5.85	–	6.86
L	0.500	–	0.580	12.70	–	14.73
L1	–	–	0.250	–	–	6.35
Ø P	–	0.140	–	–	3.56	–
Q	0.100	–	0.135	2.54	–	3.43