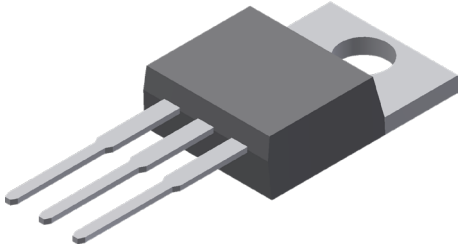


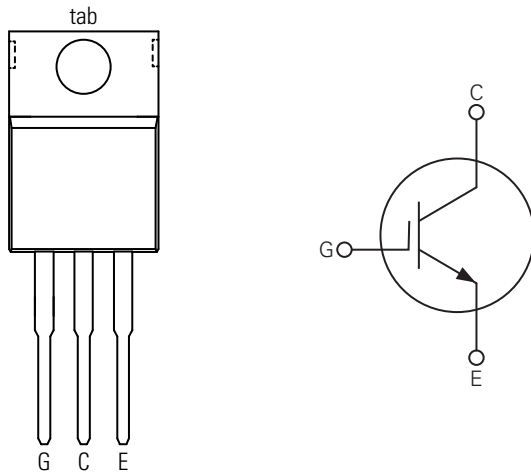
IXYP48N65A5

650 V, 48 A Gen5 XPT™ IGBT

Extreme Light Punch Through IGBT for up to 5 kHz Switching



Pinout Diagram (TO-220-3L)



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 conduction losses, and low gate driver requirements.

Features & Benefits

- Optimized for low conduction losses
- High Surge Current Capability
- Square RBSOA
- International Standard Package
- Low Gate Charge Q_g
- Low Gate Drive Requirement

Applications

- Power Inverters
- UPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts
- Inrush Current Protection Circuits

Product Summary

Characteristic	Value	Unit
V_{CES}	650	V
I_{C110}	48	A
$V_{CE(sat)}$	1.40	V
$t_{fi(typ)}$	137	ns

Maximum Ratings

Symbol	Characteristic	Conditions	Value	Unit
V_{CES}	Collector-Emitter Voltage	$T_J = 25\text{ }^{\circ}\text{C}$ to $175\text{ }^{\circ}\text{C}$	650	V
V_{GES}	Gate-Emitter Voltage	Continuous	± 20	V
V_{GEM}	Transient Gate-Emitter Voltage	Transient, $< 1\text{ ms}$	± 30	V
I_{C25}	Continuous Collector Current	$T_C = 25\text{ }^{\circ}\text{C}$	130	A
I_{C110}	Continuous Collector Current	$T_C = 110\text{ }^{\circ}\text{C}$	48	A
I_{CM}	Pulsed Collector Current	$T_C = 25\text{ }^{\circ}\text{C}$, 1 ms	236	A
SSOA (RBSOA)	Switching Safe Operating Area (Reverse Biased Safe Operating Area)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 150\text{ }^{\circ}\text{C}$, $R_G = 10\text{ }\Omega$, Clamped Inductive Load, $I_{CM} @ V_{CE} \leq V_{CES}$	80	A
P_C	Collector Power Dissipation	$T_C = 25\text{ }^{\circ}\text{C}$	326	W
T_J	Junction Temperature	-	-55 to 175	$^{\circ}\text{C}$
T_{JM}	Maximum Junction Temperature	-	175	$^{\circ}\text{C}$
T_{stg}	Storage Temperature	-	-55 to 175	$^{\circ}\text{C}$
T_L	Lead Temperature for Soldering	1.6 mm (0.062 in.) from Case for 10 s	300	$^{\circ}\text{C}$
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	$^{\circ}\text{C/W}$
$R_{th,CS}$	Thermal Resistance, case-to-sink	-	0.50	-	$^{\circ}\text{C/W}$

Electrical Characteristics - Static ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
BV_{CES}	Collector-Emitter Breakdown Voltage	$I_C = 250\text{ }\mu\text{A}$, $V_{GE} = 0\text{ V}$	650	-	-	V
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C = 250\text{ }\mu\text{A}$, $V_{GE} = V_{CE}$	3.7	-	5.8	V
I_{GES}	Gate-Emitter Leakage Current	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$	-	-	± 100	nA
I_{CES}	Zero Gate Voltage Collector Current	$V_{CE} = V_{CES}$, $V_{GE} = 0\text{ V}$	-	-	5	μA
		$V_{CE} = V_{CES}$, $V_{GE} = 0\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	-	250	μA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage ¹	$I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$	-	1.27	1.40	V
		$I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	1.35	-	V

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

Electrical Characteristics - Dynamic ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Symbol	Characteristic	Conditions		Value			Unit	
				Min.	Typ.	Max.		
g_{fs}	Transconductance ¹	$I_C = 30\text{ A}, V_{CE} = 10\text{ V}$		17	28	-	S	
C_{ies}	Input Capacitance	$V_{GE} = 0\text{ V}, V_{CE} = 25\text{ V}, f = 1\text{ MHz}$		-	1500	-	pF	
C_{oes}	Output Capacitance			-	82	-		
C_{res}	Reverse Transfer Capacitance			-	60	-		
$Q_{g(on)}$	Total Gate Charge	$V_{GE} = 15\text{ V}, V_{CE} = 0.5 \times V_{CES},$ $I_C = 30\text{ A}$		-	100	-	nC	
Q_{ge}	Gate-Emitter Charge			-	9	-		
Q_{gc}	Gate-Collector (Miller) Charge			-	50	-		
$t_{d(on)}$	Turn-on Delay Time ²	Inductive Load, $V_{GE} = 15\text{ V},$ $V_{CE} = 400\text{ V},$ $I_C = 30\text{ A},$ $R_{G(ext)} = 5\text{ }\Omega$	$T_J = 25\text{ }^{\circ}\text{C}$	-	20	-	ns	
			$T_J = 150\text{ }^{\circ}\text{C}$	-	15	-		
t_{ri}	Turn-on Rise Time ²		$T_J = 25\text{ }^{\circ}\text{C}$	-	20	-	ns	
			$T_J = 150\text{ }^{\circ}\text{C}$	-	24	-		
E_{on}	Turn-on Energy ²		$T_J = 25\text{ }^{\circ}\text{C}$	-	0.40	-	mJ	
			$T_J = 150\text{ }^{\circ}\text{C}$	-	0.87	-		
$t_{d(off)}$	Turn-off Delay Time ²		$T_J = 25\text{ }^{\circ}\text{C}$	-	205	-	ns	
			$T_J = 150\text{ }^{\circ}\text{C}$	-	235	-		
t_{fi}	Turn-off Fall Time ²		$T_J = 25\text{ }^{\circ}\text{C}$	-	137	-	ns	
			$T_J = 150\text{ }^{\circ}\text{C}$	-	247	-		
E_{off}	Turn-off Energy ²		$T_J = 25\text{ }^{\circ}\text{C}$	-	1.25	-	mJ	
			$T_J = 150\text{ }^{\circ}\text{C}$	-	1.80	-		

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

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 ($T_J = 25\text{ }^{\circ}\text{C}$)

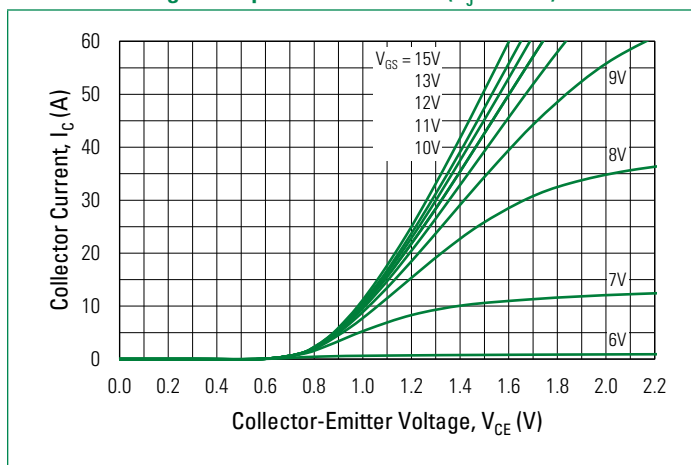


Fig. 2. Extended Output Characteristics ($T_J = 25\text{ }^{\circ}\text{C}$)

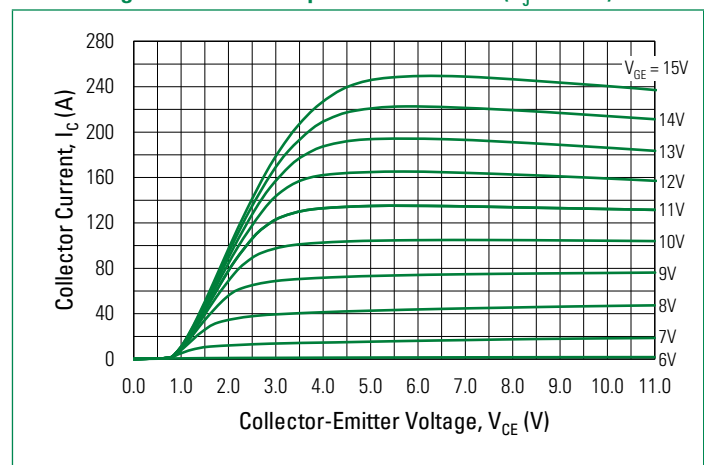


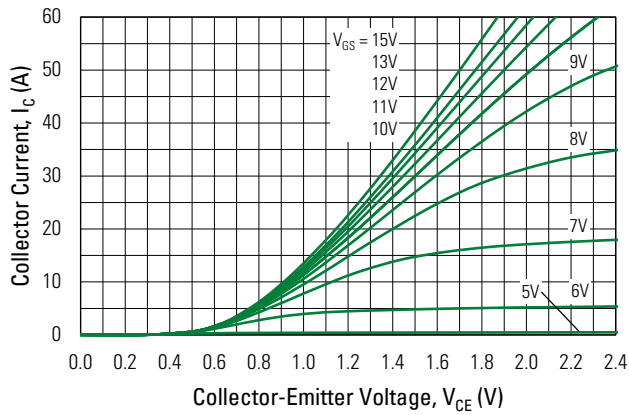
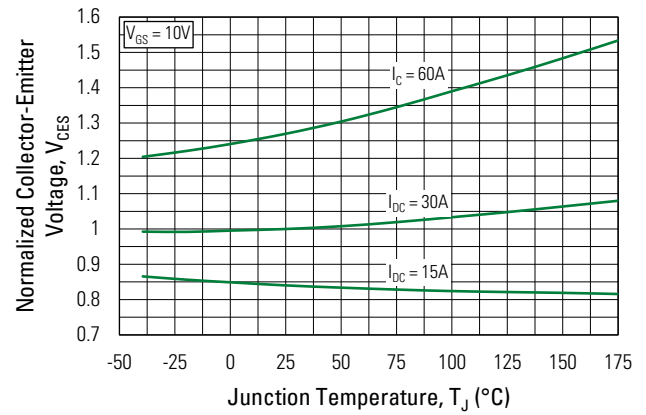
Fig. 3. Output Characteristics ($T_J = 150^\circ\text{C}$)Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

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

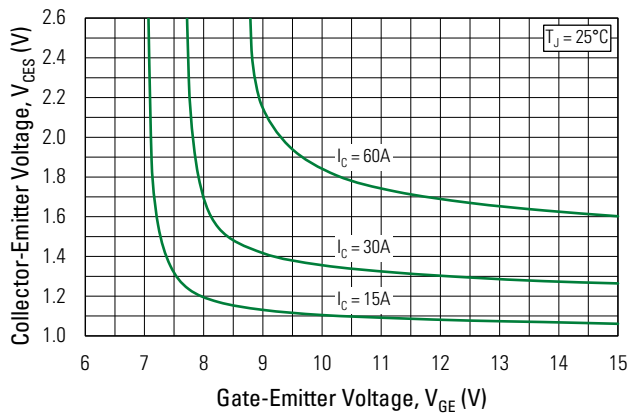


Fig. 6. Input Admittance

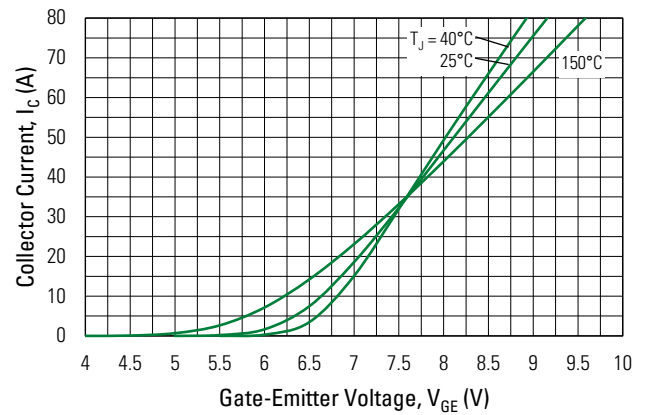


Fig. 7. Transconductance

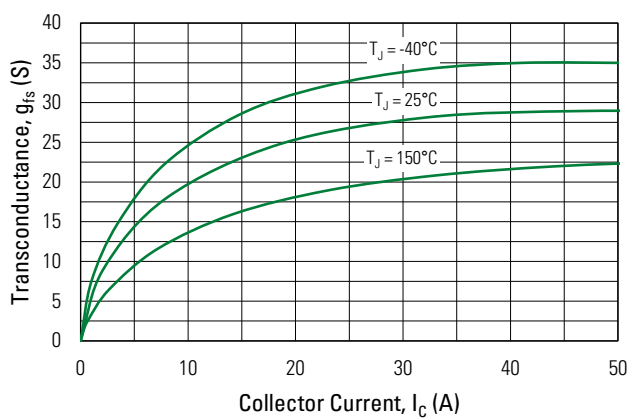


Fig. 8. Gate Charge

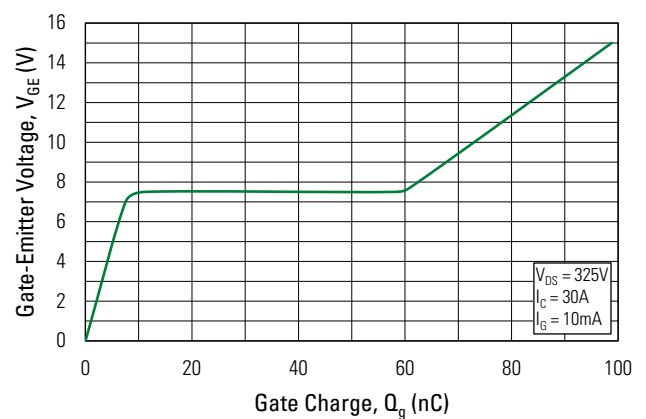


Fig. 9. Capacitance

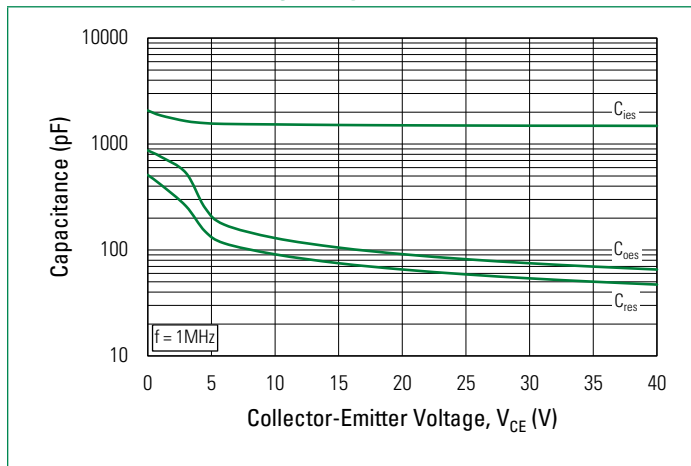


Fig. 10. Reverse-Bias Safe Operating Area

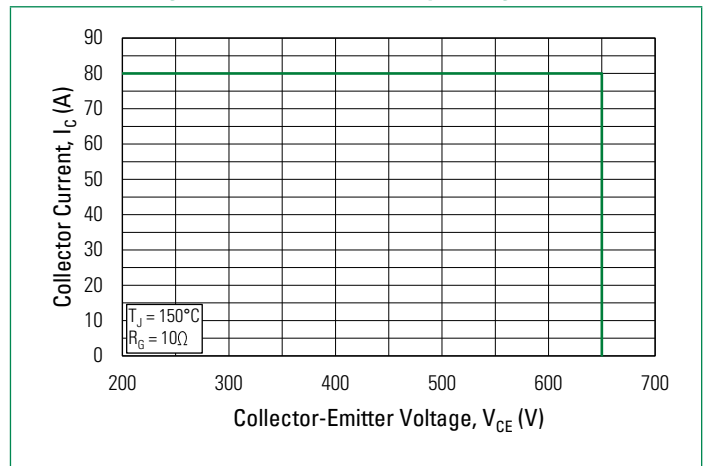


Fig. 11. Maximum Transient Thermal Impedance

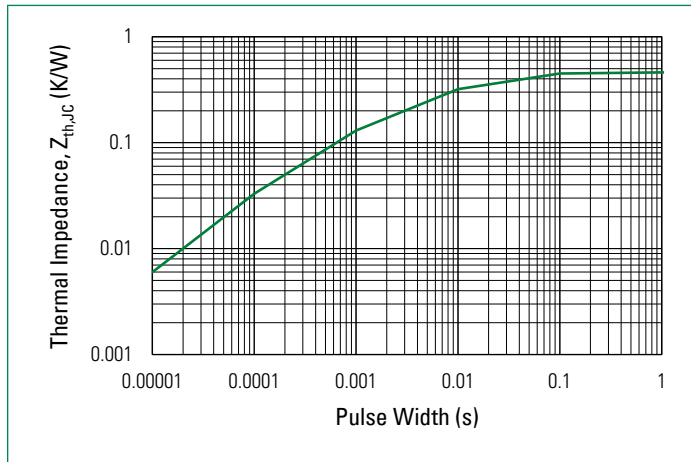


Fig. 12. Inductive Switching Energy Loss vs. Collector Current

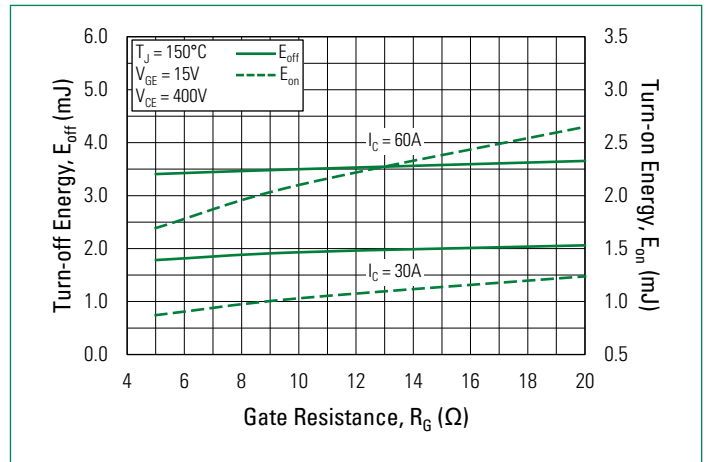


Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance

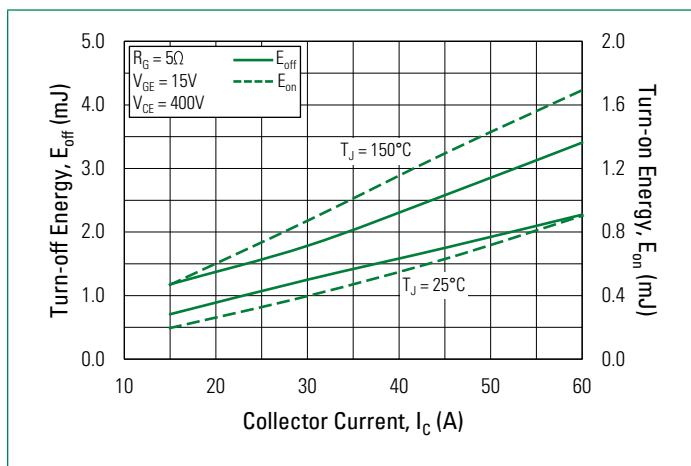


Fig. 14. Inductive Switching Energy vs. Junction Temperature

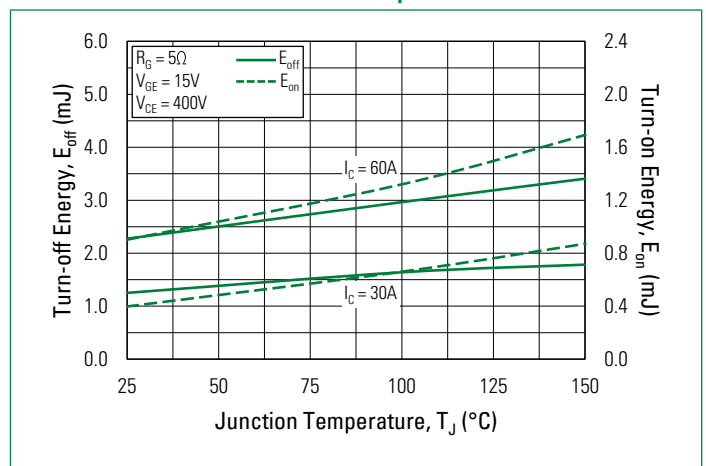


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

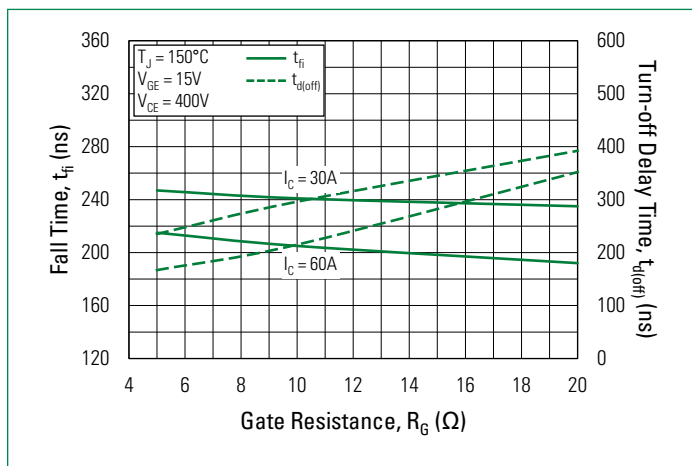


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

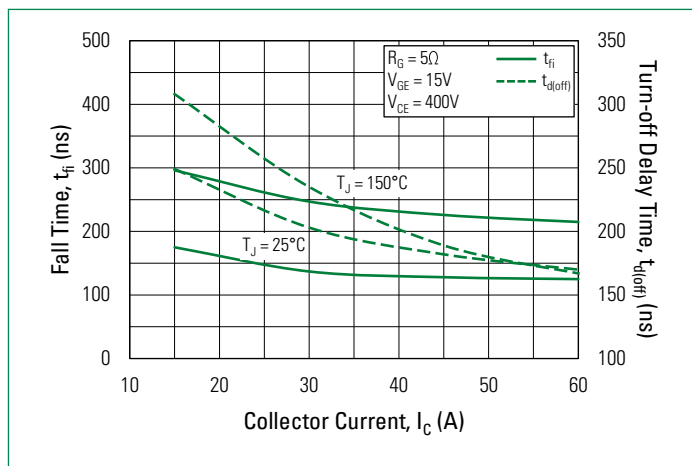


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

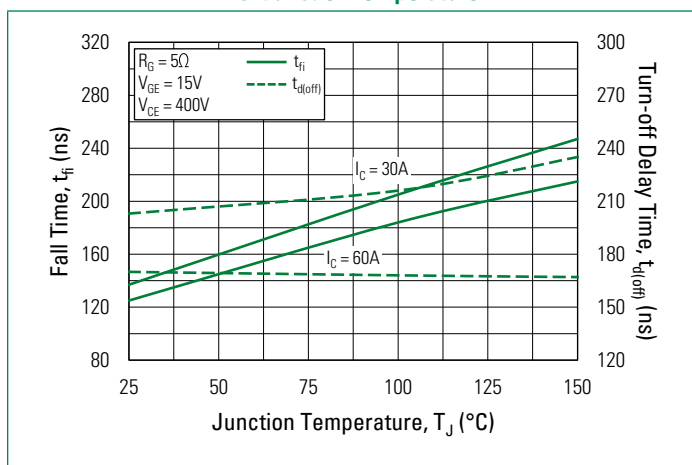


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

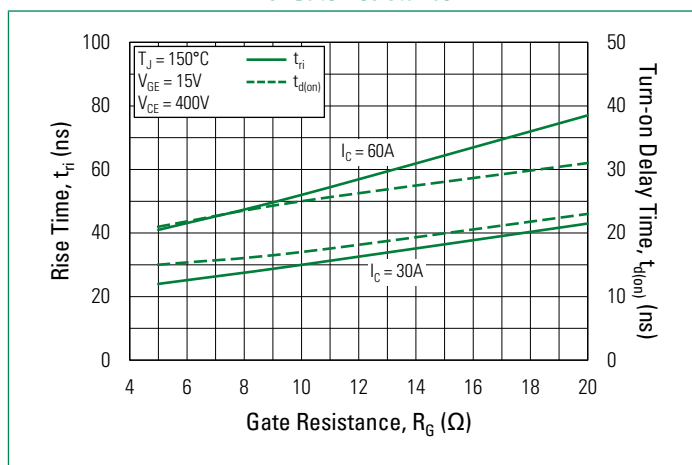


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

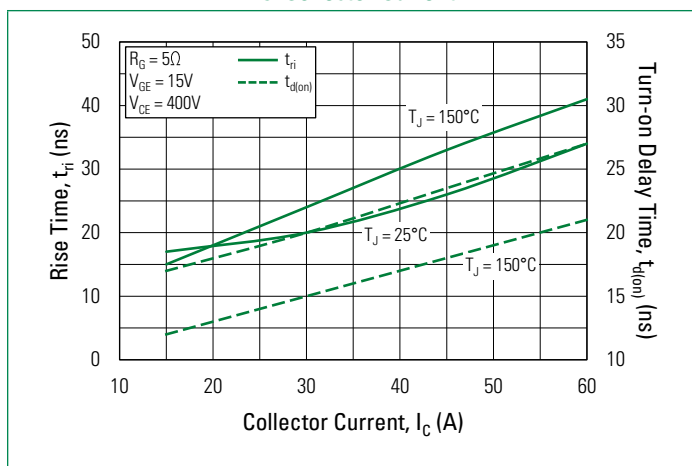


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature

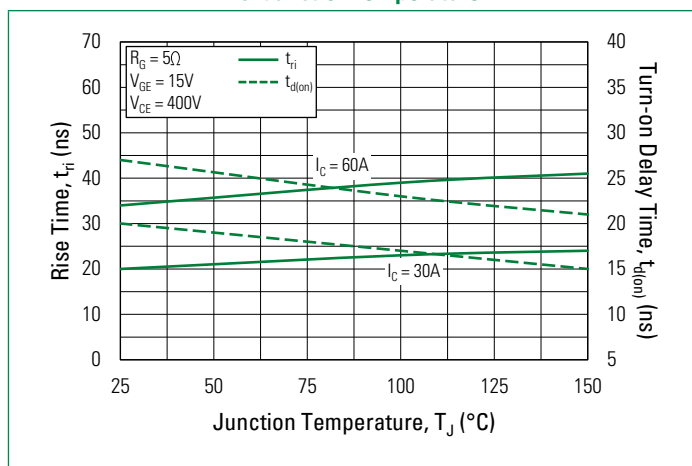
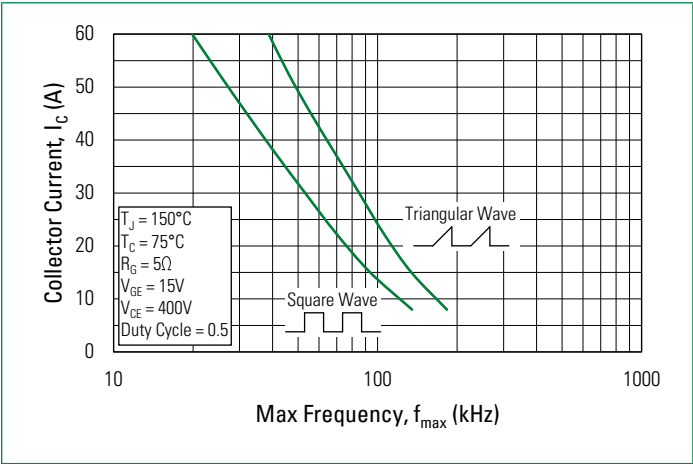
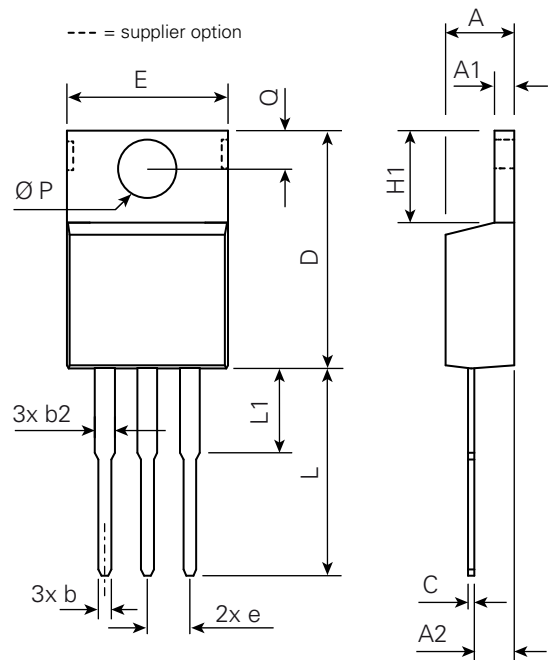


Fig. 21. Maximum Peak Load Current vs. Frequency



Part Outline Drawing (TO-220-3L)



Symbol	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	0.170	0.190	4.32	4.82
A1	0.045	0.055	1.14	1.39
A2	0.090	0.110	2.29	2.79
b	0.025	0.040	0.64	1.01
b2	0.045	0.065	1.15	1.65
C	0.014	0.022	0.35	0.56
D	0.580	0.630	14.73	16.00
E	0.390	0.420	9.91	10.66
e	0.100 BSC		2.54 BSC	
H1	0.230	0.270	5.85	6.85
L	0.500	0.550	12.70	13.97
L1	0.110	0.230	2.79	5.84
Ø P	0.139	0.161	3.54	4.08
Q	0.100	0.125	2.54	3.18

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