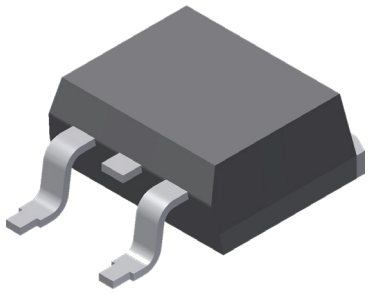
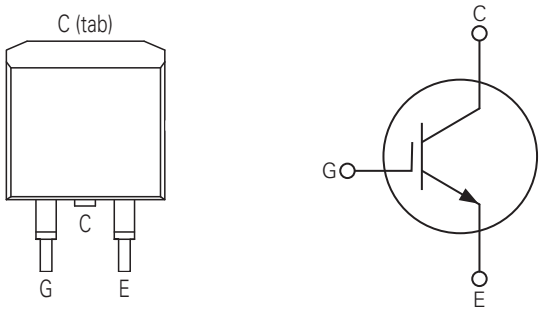
IXYA48N65A5

650 V, 48 A Gen5 XPT™ IGBT

Extreme Light Punch Through IGBT for Up to 5 kHz Switching



Pinout Diagram (TO-263-2L)



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 and optimization for low conduction losses.

Features & Benefits

- High Surge Current Capability
- Square RBSOA
- International Standard Package
- High Power Density
- Low Gate Drive Requirement

Applications

- Power Inverters
- UPS
- Motor Drives
- Battery Chargers
- Welding Machines
- Lamp Ballasts
- Inrush Current Protection Circuits
- Automatic Transfer Switch

Product Summary

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

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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, <1ms	±30	V
I_{C25}	Continuous Collector Current	T_C = 25 °C	130	A
I_{C110}	Continuous Collector Current	T_C = 110 °C	48	A
I_{CM}	Pulsed Collector Current	T_C = 25 °C, 1 ms	236	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} @ $V_{CE} \le V_{CES}$	80	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_{SOLD}	Soldering Temperature	Plastic Body for 10 s	260	°C
W	Weight	-	2.5	g

Thermal Characteristics

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
$R_{th,JC}$	Thermal Resistance, junction-to-case	-	-	0.46	°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_{GE} = V_{CE}	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	-	1.27	1.40	V
		I_C = 30 A, V_{GE} = 15 V, T_J = 150 °C	-	1.35	-	V

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

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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		17	28	-	S
C_{ies}	Input Capacitance	V_{GE} = 0 V, V_{CE} = 25 V, f = 1 MHz		-	1500	-	pF
C_{oes}	Output Capacitance			-	82	-	
C_{res}	Reverse Transfer Capacitance			-	60	-	
$Q_{g(on)}$	Total Gate Charge	V_{GE} = 15 V, V_{CE} = 0.5 × V_{CES}, I_C = 30 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 V, V_{CE} = 400 V, I_C = 30 A, $R_{G(ext)}$ = 5 Ω	T_J = 25 °C	-	20	-	ns
			T_J = 150 °C	-	15	-	
t_{ri}	Turn-on Rise Time [2]		T_J = 25 °C	-	20	-	ns
			T_J = 150 °C	-	24	-	
E_{on}	Turn-on Energy [2]		T_J = 25 °C	-	0.40	-	mJ
			T_J = 150 °C	-	0.87	-	
$t_{d(off)}$	Turn-off Delay Time [2]		T_J = 25 °C	-	205	-	ns
			T_J = 150 °C	-	235	-	
t_{fi}	Turn-off Fall Time [2]		T_J = 25 °C	-	137	-	ns
			T_J = 150 °C	-	247	-	
E_{off}	Turn-off Energy [2]		T_J = 25 °C	-	1.25	-	mJ
			T_J = 150 °C	-	1.80	-	

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 = 25ºC

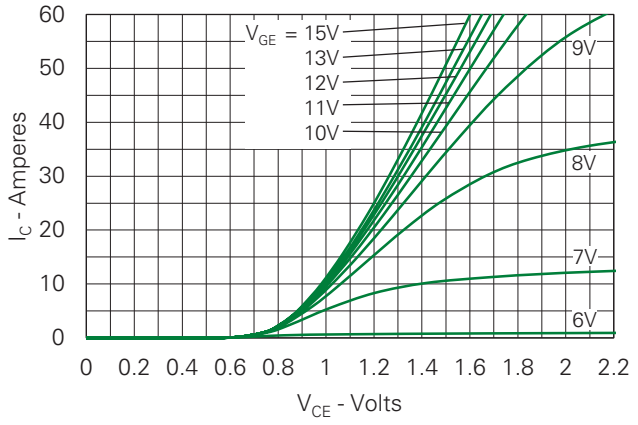

Fig. 2. Extended Output Characteristics @ T_J = 25ºC

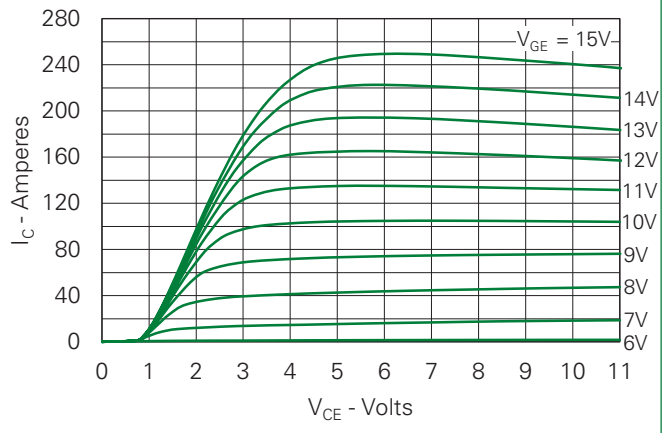

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Fig. 3. Output Characteristics @ T_J = 150ºC

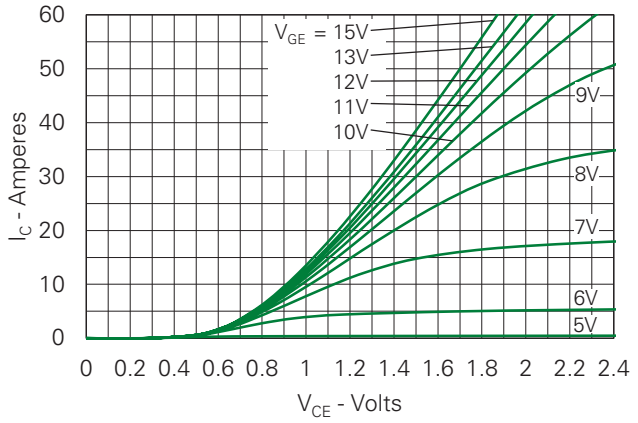

Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

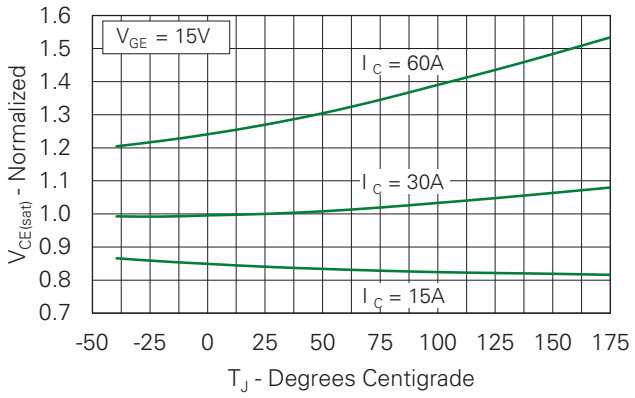

Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

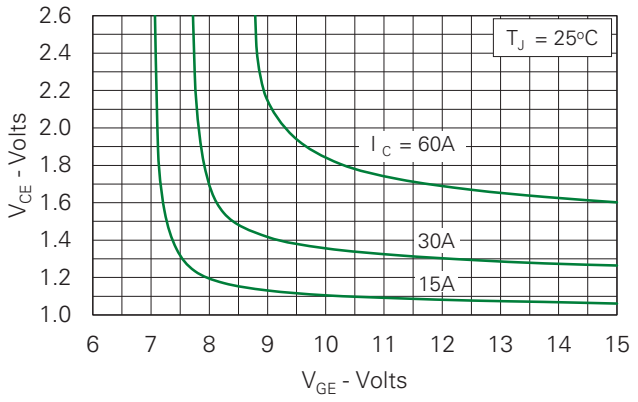

Fig. 6. Input Admittance

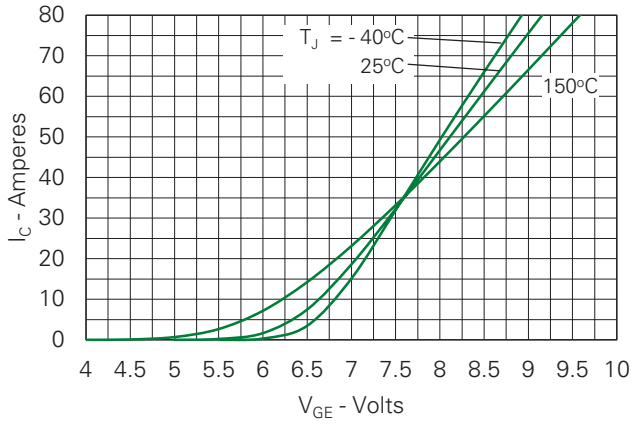

Fig. 7. Transconductance

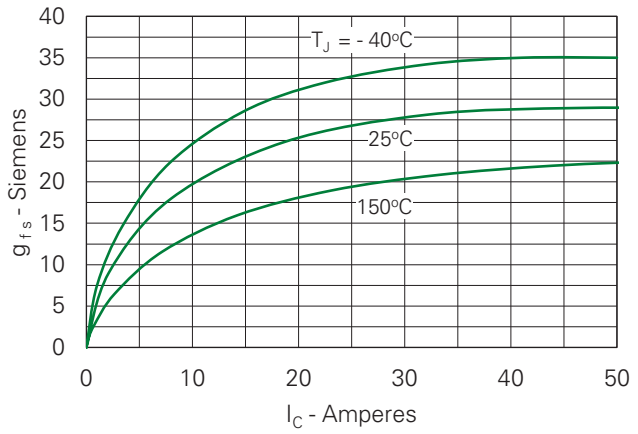

Fig. 8. Gate Charge

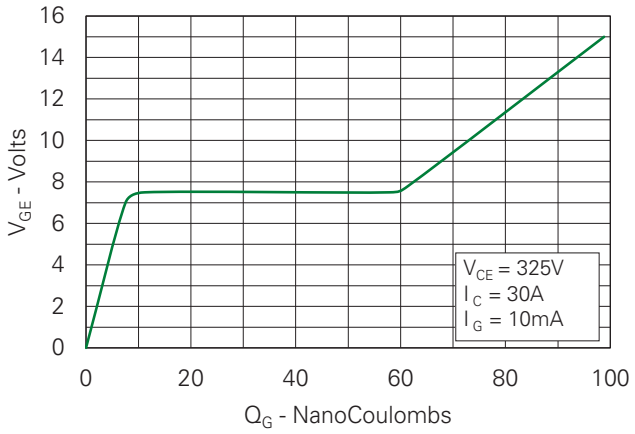

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Fig. 9. Capacitance

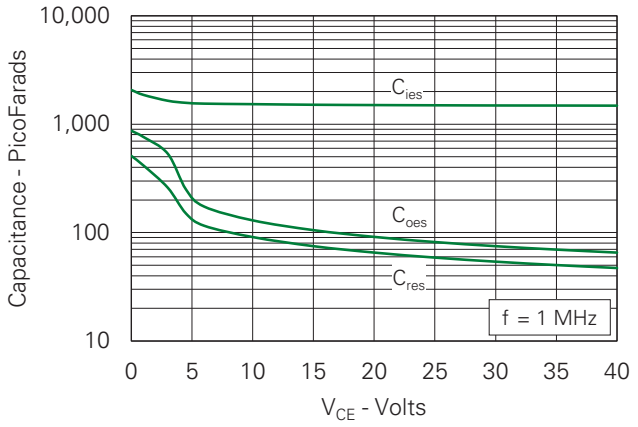

Fig. 10. Reverse-Bias Safe Operating Area

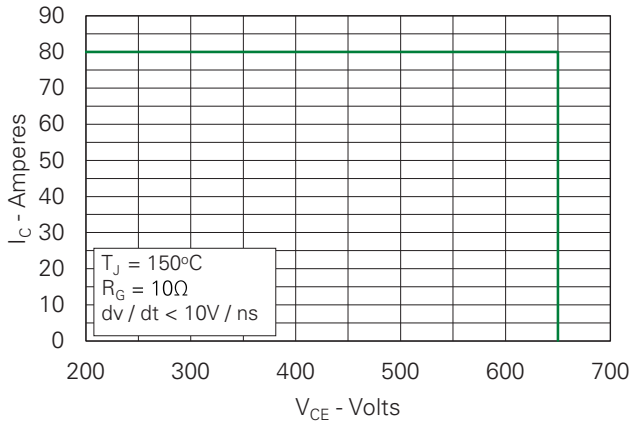

Fig. 11. Maximum Transient Thermal Impedance

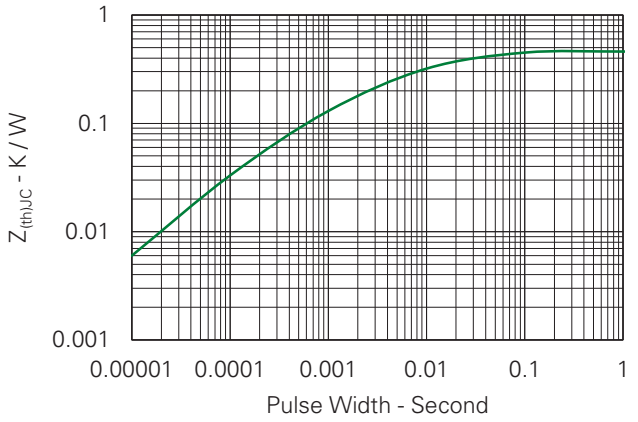

Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

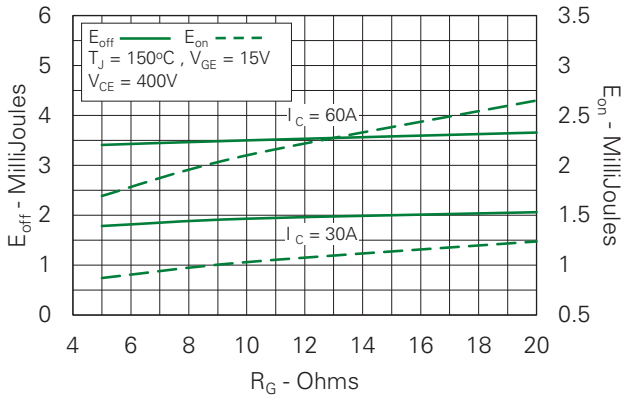

Fig. 13. Inductive Switching Energy Loss vs. Collector Current

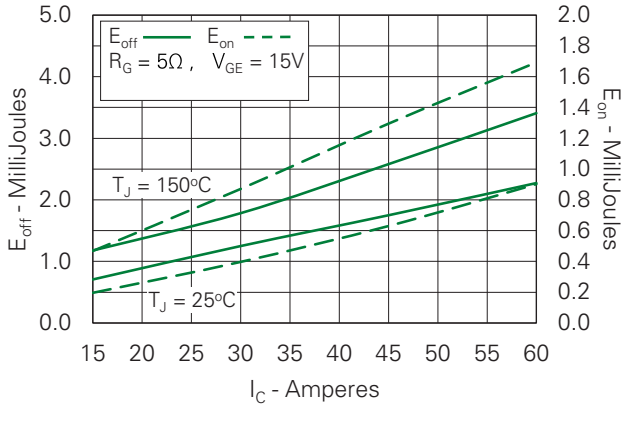

Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

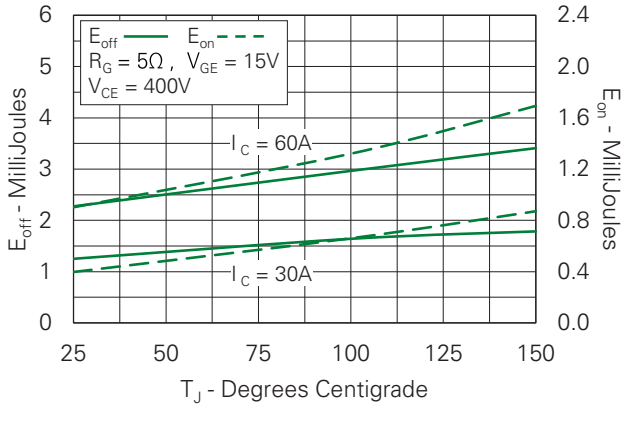

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Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

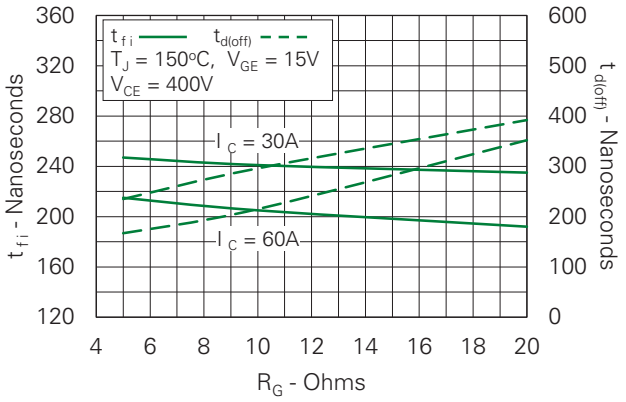

Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

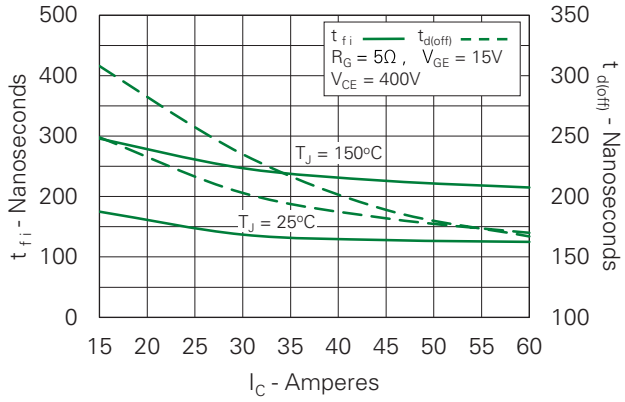

Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

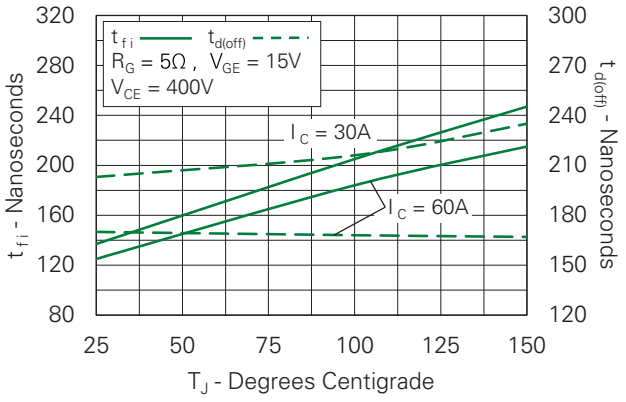

Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

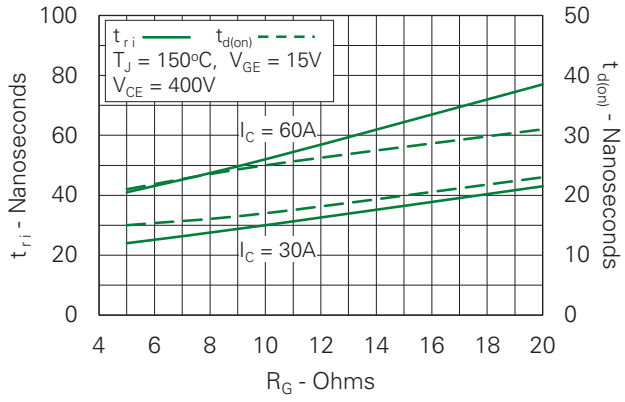

Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

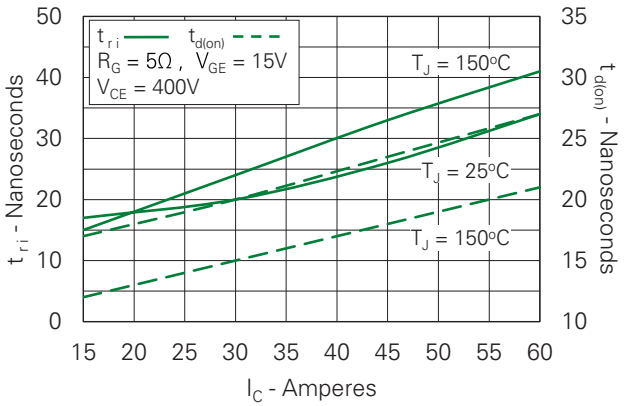

Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature

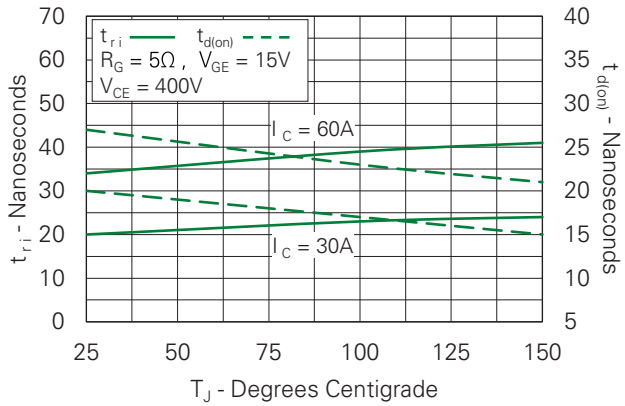

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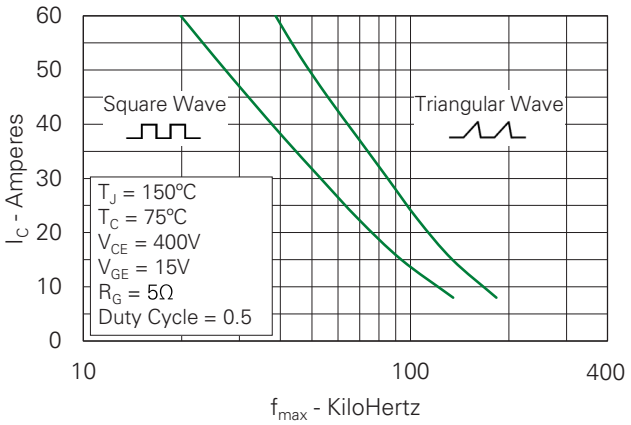
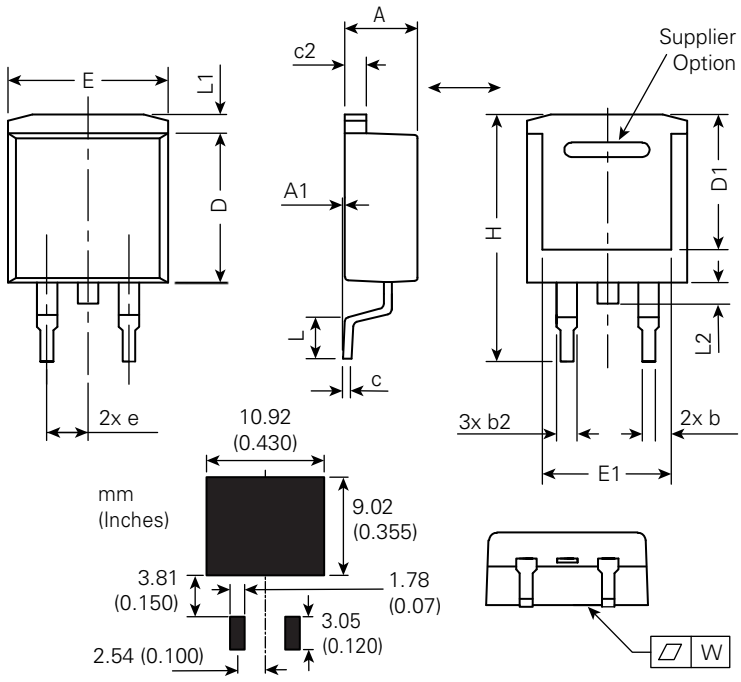
Fig. 21. Maximum Peak Load Current vs. Frequency



Part Outline Drawing (TO-263-2L)



Symbol	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	0.160	0.190	4.06	4.83
A1	Typ. 0.004		Typ. 0.10	
b	0.020	0.039	0.51	0.99
b2	0.045	0.055	1.14	1.40
c	0.016	0.029	0.40	0.74
c2	0.045	0.055	1.14	1.40
D	0.330	0.370	8.38	9.40
D1	0.315	0.350	8.00	8.89
E	0.380	0.410	9.65	10.41
E1	0.245	0.320	6.22	8.13
e	0.100		2.54 BSC	
H	0.575	0.625	14.61	15.88
L	0.070	0.110	1.78	2.79
L1	0.040	0.066	1.02	1.68
W	Typ. 8.0e-4	0.002	Typ. 0.02	0.040

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