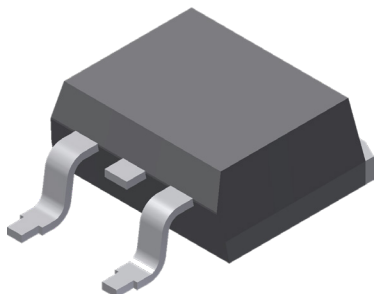


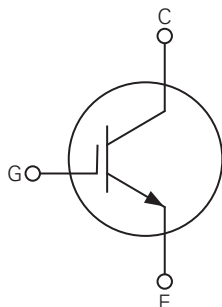
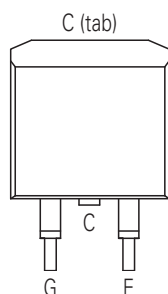
IXYA50N65C5

650 V, 50 A XPT™ Gen5 IGBT

Extreme Light Punch Through IGBT for 20–60 kHz Switching



Pinout Diagram (TO-263AB)

**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 energy losses, fast switching, low tail current, and high current densities.

Features & Benefits:

- Optimized for 20–60kHz Switching
- High Surge Current Capability
- Square RBSOA
- International Standard Package
- High Power Density
- Extremely Rugged
- Low Gate Drive Requirement

Applications:

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

Product Summary

Characteristic	Value	Unit
V_{CES}	650	V
I_{C110}	50	A
$V_{CE(sat)}$	2.0	V
$t_{fi(typ)}$	28	ns

Maximum Ratings

Symbol	Characteristic	Conditions	Value	Unit
V_{CES}	Collector-Emitter Voltage	$T_J = 25^{\circ}\text{C}$ 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	$T_C = 25^{\circ}\text{C}$	110	A
I_{C110}	Continuous Collector Current	$T_C = 110^{\circ}\text{C}$	50	A
I_{CM}	Pulsed Collector Current	$T_C = 25^{\circ}\text{C}$, 1 ms	240	A
SSOA (RBSOA)	Switching Safe Operating Area (Reverse Biased Safe Operating Area)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 150^{\circ}\text{C}$, $R_G = 5\ \Omega$, Clamped Inductive Load, I_{CM} @ $V_{CE} \leq V_{CES}$	100	A
P_C	Collector Power Dissipation	$T_C = 25^{\circ}\text{C}$	650	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_{SOLD}	Soldering Temperature	Plastic Body for 10 s	260	$^{\circ}\text{C}$
W	Weight	–	2.5	g

Thermal Characteristics

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
$R_{th, JC}$	Thermal Resistance, junction-to-case	–	–	0.38	$^{\circ}\text{C}/\text{W}$
$R_{th, CS}$	Thermal Resistance, case-to-heat sink	–	0.21	–	$^{\circ}\text{C}/\text{W}$

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

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
BV_{CES}	Collector-Emitter Breakdown Voltage	$I_C = 250\ \mu\text{A}$, $V_{GE} = 0\text{ V}$	650	–	–	V
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C = 250\ \mu\text{A}$, $V_{CE} = V_{GE}$	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
		$V_{CE} = V_{CES}$, $V_{GE} = 0\text{ V}$, $T_J = 150^{\circ}\text{C}$	–	–	750	μA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage ¹	$I_C = 36\text{ A}$, $V_{GE} = 15\text{ V}$	–	1.67	2.00	V
		$I_C = 36\text{ A}$, $V_{GE} = 15\text{ V}$, $T_J = 150^{\circ}\text{C}$	–	1.93	–	V

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

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

Symbol	Characteristic	Conditions		Value			Unit	
				Min.	Typ.	Max.		
g_{fs}	Transconductance ¹	$I_C = 36\text{ A}, V_{CE} = 10\text{ V}$		20	34	–	S	
C_{ies}	Input Capacitance	$V_{GE} = 0\text{ V}, V_{CE} = 25\text{ V}, f = 1\text{ MHz}$		–	2060	–	pF	
C_{oes}	Output Capacitance			–	100	–		
C_{res}	Reverse Transfer Capacitance			–	70	–		
$Q_{g(on)}$	Total Gate Charge	$V_{GE} = 15\text{ V}, V_{CE} = 0.5 \times V_{CES},$ $I_C = 50\text{ A}$		–	117	–	nC	
Q_{ge}	Gate-Emitter Charge			–	16	–		
Q_{gc}	Gate-Collector Charge			–	55	–		
$t_{d(on)}$	Turn-on Delay Time ²	Inductive Load, $V_{GE} = 15\text{ V},$ $V_{CE} = 300\text{ V},$ $I_C = 25\text{ A},$ $R_{G(ext)} = 5\ \Omega$	$T_J = 25^\circ\text{C}$	–	25	–	ns	
			$T_J = 150^\circ\text{C}$	–	19	–		
t_{ri}	Turn-on Rise Time ²		$T_J = 25^\circ\text{C}$	–	37	–	ns	
			$T_J = 150^\circ\text{C}$	–	27	–		
E_{on}	Turn-on Energy ²		$T_J = 25^\circ\text{C}$	–	0.36	–	mJ	
			$T_J = 150^\circ\text{C}$	–	0.66	–		
$t_{d(off)}$	Turn-off Delay Time ²		$T_J = 25^\circ\text{C}$	–	170	–	ns	
			$T_J = 150^\circ\text{C}$	–	146	–		
t_{fi}	Turn-off Fall Time ²		$T_J = 25^\circ\text{C}$	–	28	–	ns	
			$T_J = 150^\circ\text{C}$	–	26	–		
E_{off}	Turn-off Energy ²		$T_J = 25^\circ\text{C}$	–	0.26	–	mJ	
			$T_J = 150^\circ\text{C}$	–	0.30	–		

Note 1: Pulse test, $t \leq 300\ \mu\text{s}$, 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

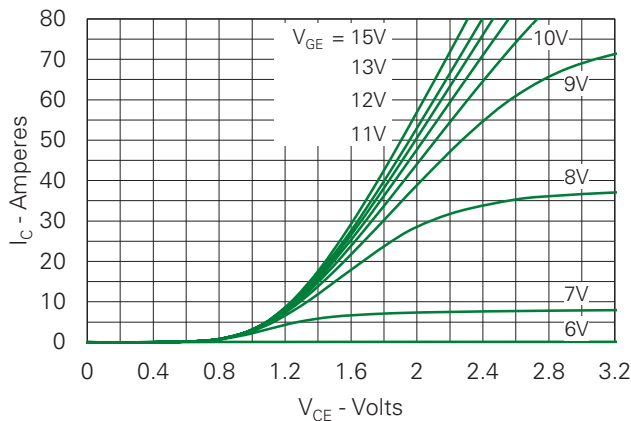
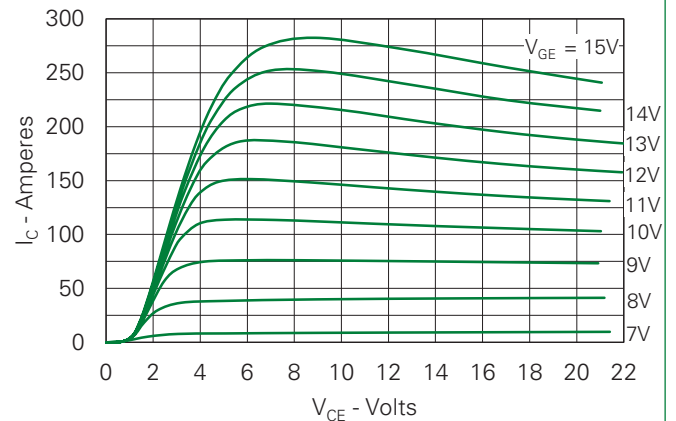
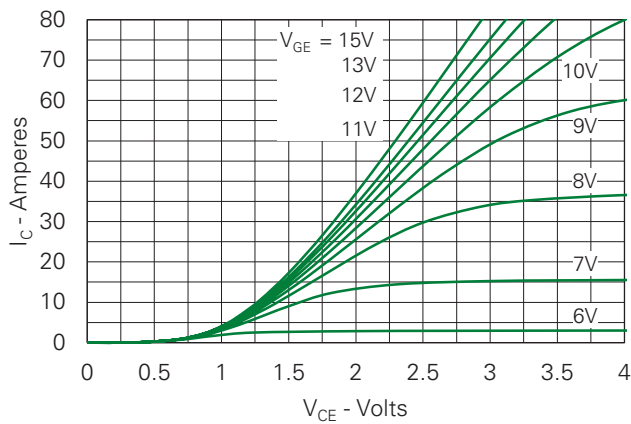
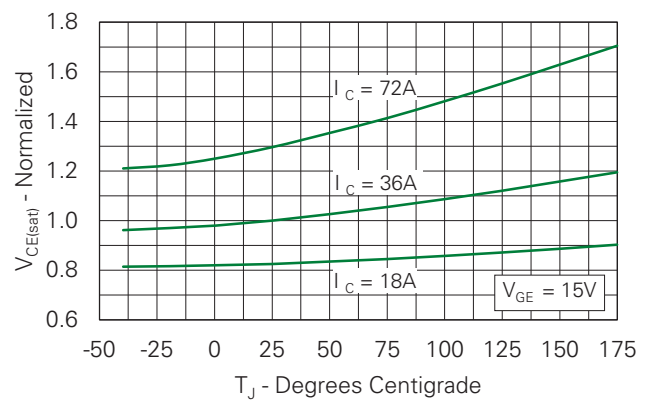
Fig. 1. Output Characteristics @ $T_J = 25^\circ\text{C}$ Fig. 2. Extended Output Characteristics @ $T_J = 25^\circ\text{C}$ Fig. 3. Output Characteristics @ $T_J = 150^\circ\text{C}$ Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

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

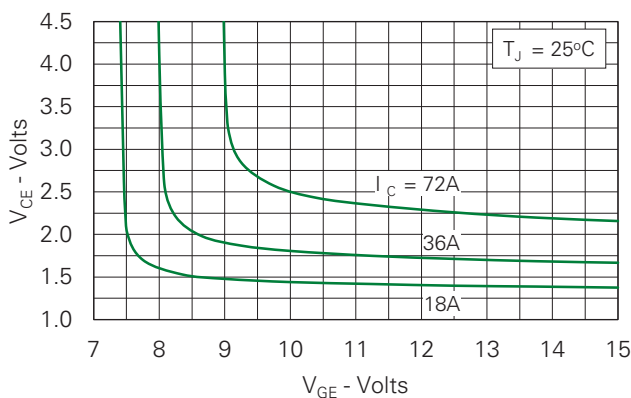


Fig. 6. Input Admittance

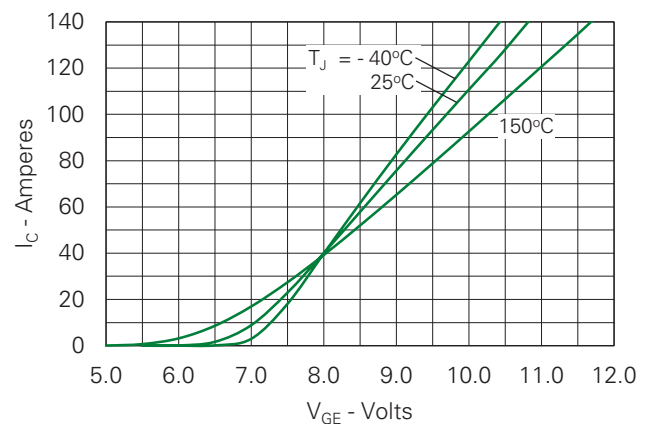


Fig. 7. Transconductance

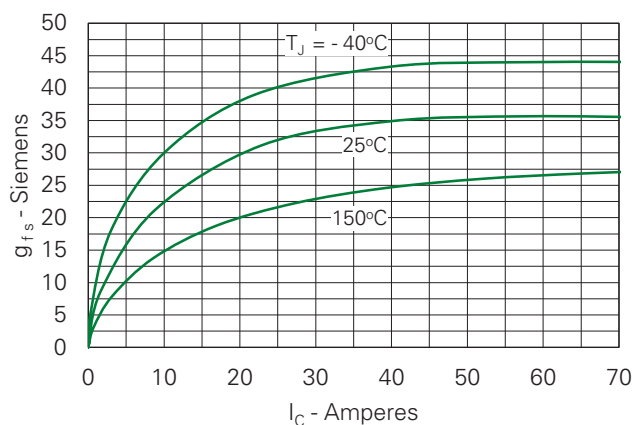


Fig. 8. Gate Charge

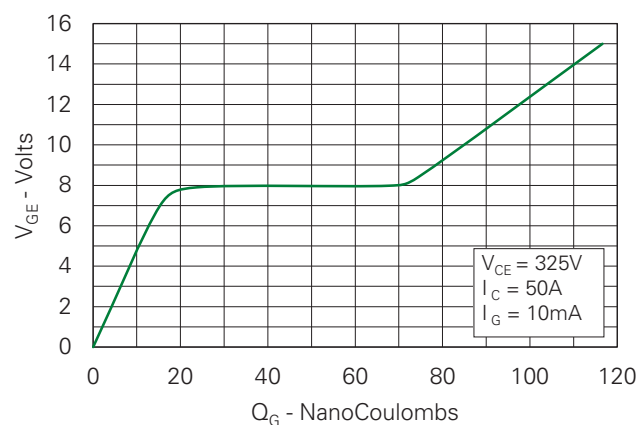


Fig. 9. Capacitance

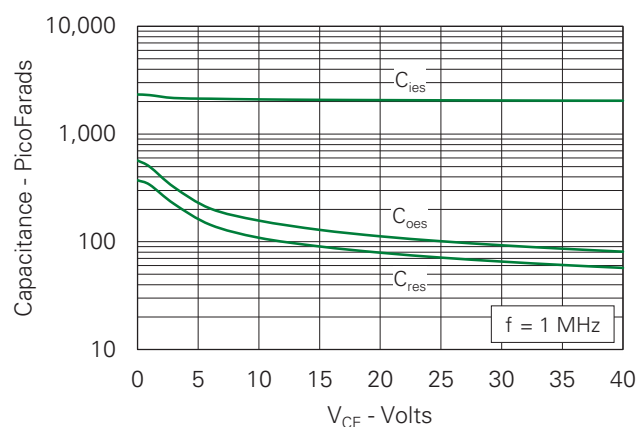


Fig. 10. Reverse-Bias Safe Operating Area

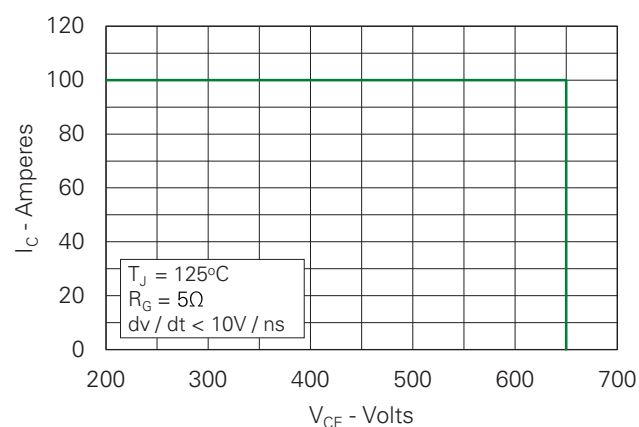


Fig. 11. Maximum Transient Thermal Impedance

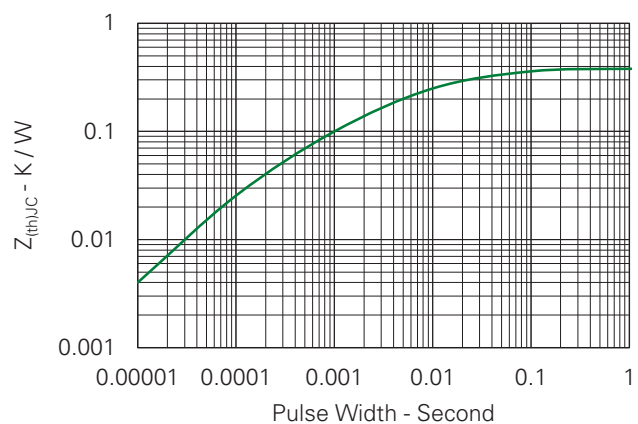


Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

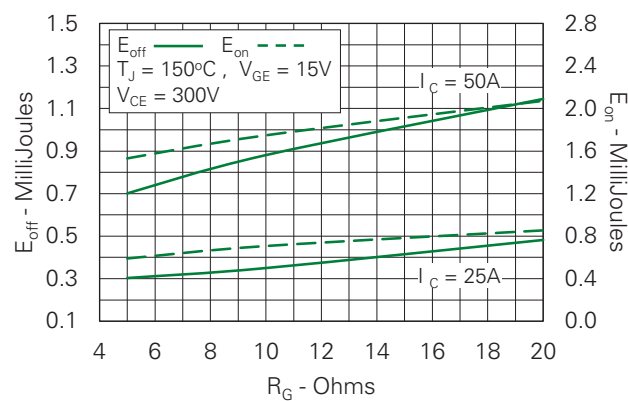


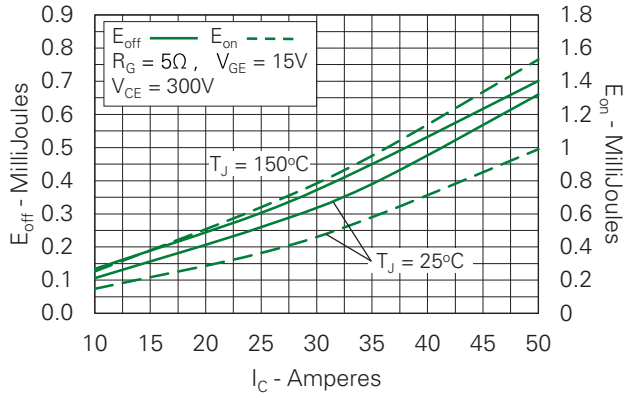
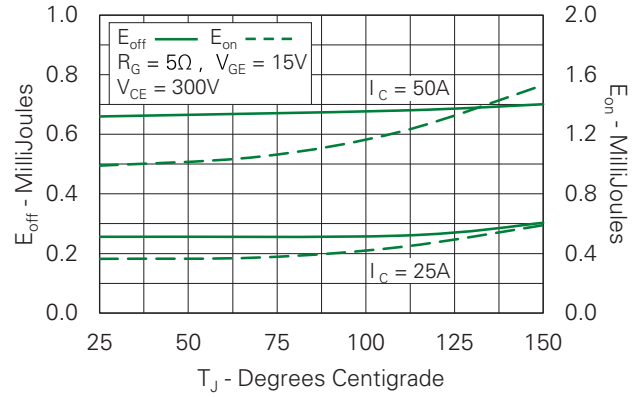
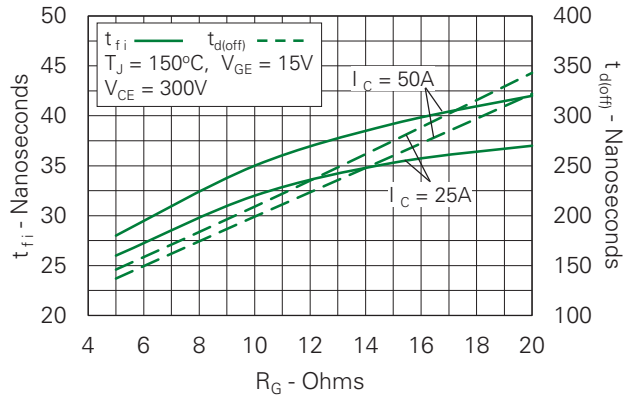
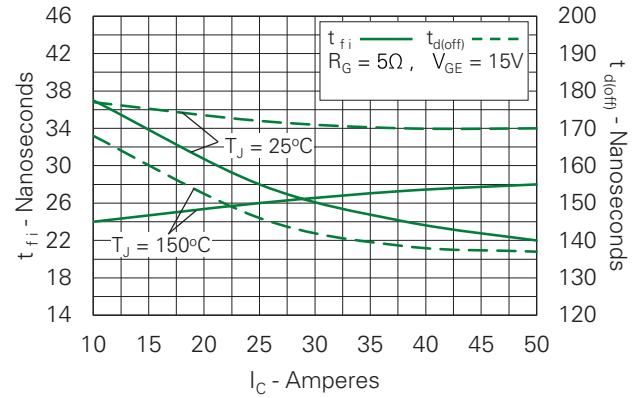
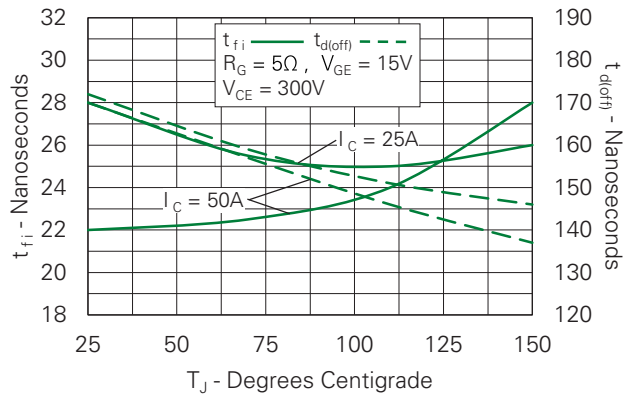
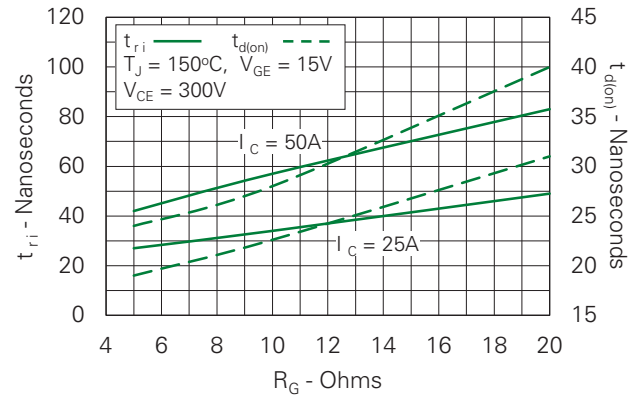
Fig. 13. Inductive Switching Energy Loss vs. Collector Current**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature****Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance****Fig. 16. Inductive Turn-off Switching Times vs. Collector Current****Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature****Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**

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

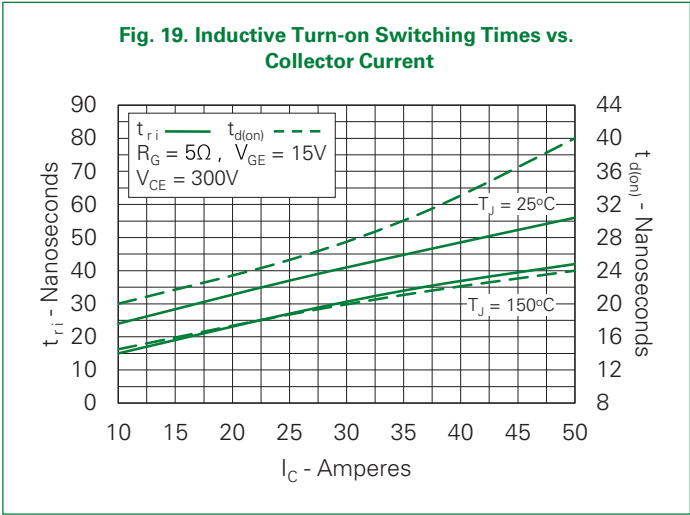


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature

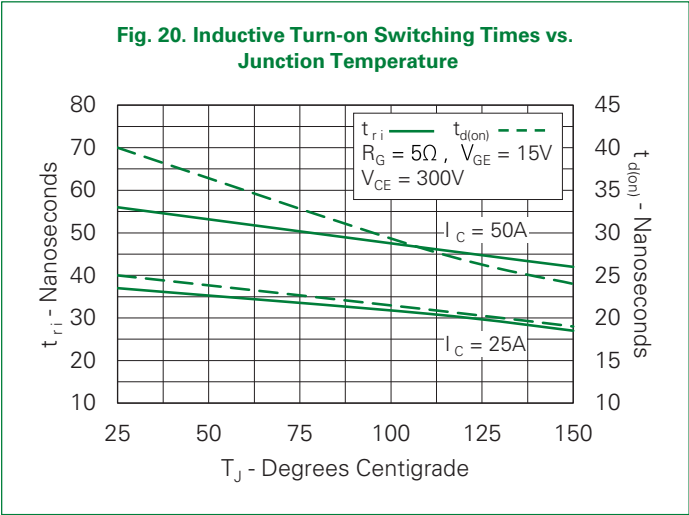
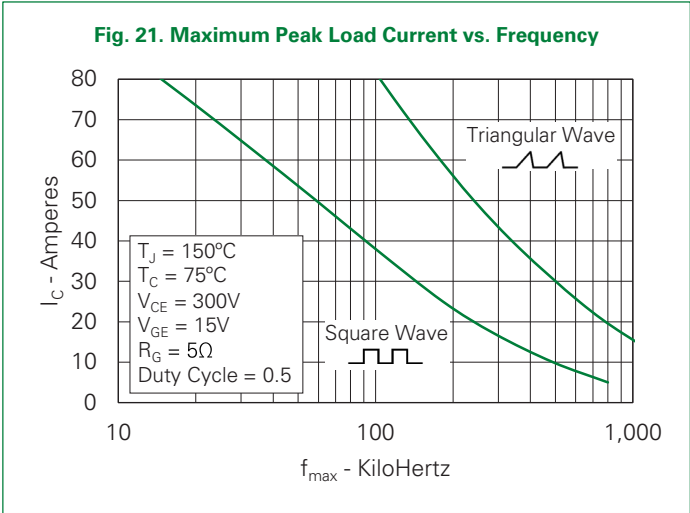
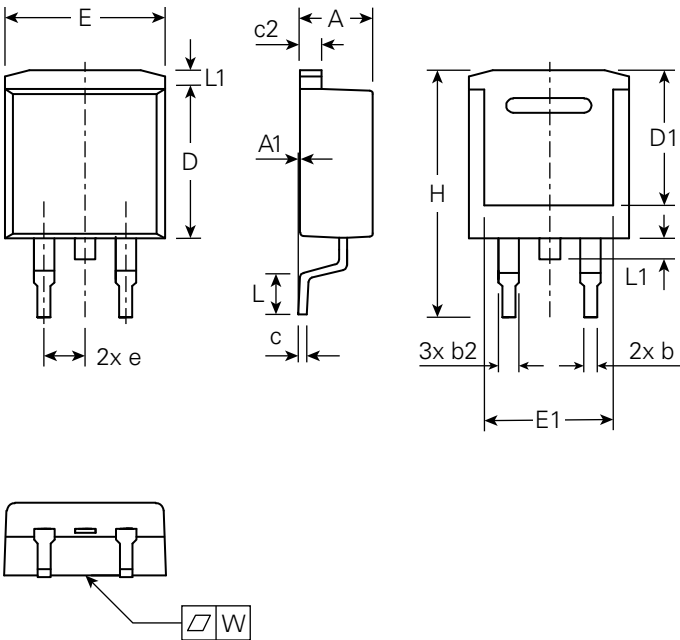


Fig. 21. Maximum Peak Load Current vs. Frequency



Part Outline Drawing (TO-263AB)



Symbol	Inches			Millimeters		
	Min.	Typical	Max.	Min.	Typical	Max
A	0.160	–	0.190	4.06	–	4.83
A1	–	0.004	–	–	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 BSC			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	–	0.0008	0.002	–	0.02	0.04

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