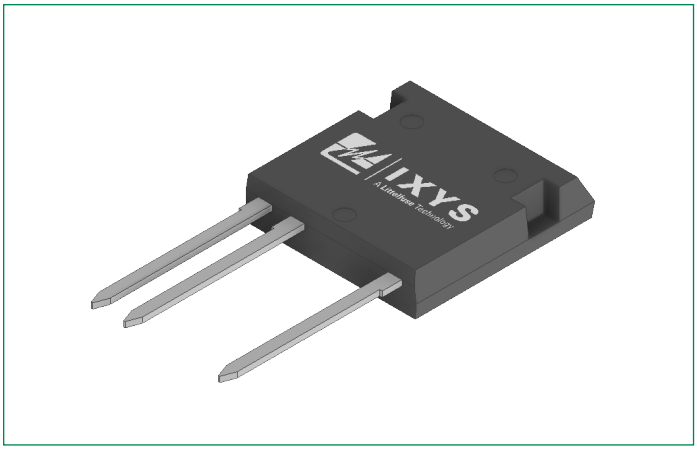
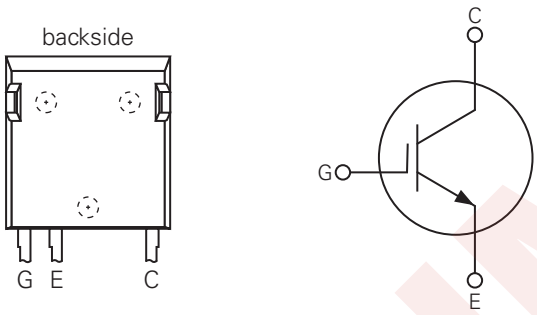
IXYF20N400C

4000 V, 13 A High Voltage XPT™ IGBT



Pinout Diagram (ISOPLUS i4-Pak™)



G: Gate; **C:** Collector; **E:** Emitter; **backside:** Isolated

Description:

Designed using the proprietary XPT™ technology and state-of-the-art IGBT process, these devices feature high blocking voltage, switching robustness, and low energy loss.

Features & Benefits:

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface
- 4000V~ Electrical Isolation
- High Peak Current Capability
- Fast Switching
- Low Gate Drive Requirement
- High Power Density

Applications:

- Switch-Mode and Resonant-Mode Power Supplies
- Uninterruptible Power Supplies (UPS)
- Laser Generators
- Capacitor Discharge Circuits
- AC Switches

Product Summary

Characteristic	Value	Unit
V_{CES}	4000	V
I_{C110}	13	A
$V_{CE(sat)}$	3.2	V

Revised: XZ 01/24/2023

Maximum Ratings

Symbol	Characteristic	Conditions	Value	Unit
V_{CES}	Collector-Emitter Voltage	T_J = 25°C to 150°C	4000	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	29	A
I_{C110}	Continuous Collector Current	T_C = 110°C	13	A
I_{CM}	Pulsed Collector Current	T_C = 25°C, 1 ms	174	A
SSOA (RBSOA)	Switching Safe Operating Area (Reverse Biased Safe Operating Area)	V_{GE} = 15 V, T_{VJ} = 125°C, R_G = 10 Ω, $I_{CM} = V_{CE} \leq 0.8 \times V_{CES}$	40	A
P_C	Collector Power Dissipation	T_C = 25°C	190	W
T_J	Junction Temperature	–	-55 to 150	°C
T_{JM}	Maximum Junction Temperature	–	150	°C
T_{stg}	Storage Temperature	–	-55 to 150	°C
V_{ISOL}	Isolation Voltage	50/60 Hz, 1 min	4000	V~
T_L	Lead Temperature for Soldering	1.6 mm (0.062 in.) from Case for 10 s	300	°C
F_C	Mounting Force	–	20..120/4.5..27	Nm/lb.in
W	Weight	–	5	g

Thermal Characteristics

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
$R_{th, JC}$	Thermal Resistance, junction-to-case	–	–	0.66	°C/W
$R_{th, CS}$	Thermal Resistance, case-to-heat sink	–	0.15	–	°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	4000	–	–	V
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C = 1 mA, $V_{CE} = V_{GE}$	3.0	–	5.0	V
I_{GES}	Gate-Emitter Leakage Current	V_{CE} = 0 V, V_{GE} = ±20 V	–	–	±200	nA
I_{CES}	Zero Gate Voltage Collector Current[2]	V_{CE} = 0.8 x V_{CES}, V_{GE} = 0 V	–	–	50	µA
		V_{CE} = 0.8 x V_{CES}, V_{GE} = 0 V, T_J = 125°C	–	–	5	mA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage[1]	I_C = 20 A, V_{GE} = 15 V	–	3.2	4.2	V
		I_C = 20 A, V_{GE} = 15 V, T_J = 125°C	–	3.7	–	V

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.

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

Symbol	Characteristic	Conditions		Value			Unit
				Min.	Typ.	Max.	
g_{fs}	Transconductance[1]	I_C = 20 A, V_{CE} = 10 V		18	30	–	S
C_{ies}	Input Capacitance	V_{GE} = 0 V, V_{CE} = 25 V, f = 1 MHz		–	2760	–	pF
C_{oes}	Output Capacitance			–	87	–	
C_{res}	Reverse Transfer Capacitance			–	30	–	
$Q_{g(on)}$	Total Gate Charge	V_{GE} = 15 V, V_{CE} = 2000 V, I_C = 20 A		–	136	–	nC
Q_{ge}	Gate-Emitter Charge			–	16	–	
Q_{gc}	Gate-Collector Charge			–	62	–	
$t_{d(on)}$	Turn-on Delay Time[2]	Inductive Load, V_{GE} = 15 V, V_{CE} = 1200 V, I_C = 20 A, $R_{G(ext)}$ = 5 Ω	T_J = 25°C	–	13	–	ns
			T_J = 125°C	–	14	–	
t_{ri}	Turn-on Rise Time[2]		T_J = 25°C	–	15	–	ns
			T_J = 125°C	–	19	–	
E_{on}	Turn-on Energy[2]		T_J = 25°C	–	5.2	–	mJ
			T_J = 125°C	–	6.0	–	
$t_{d(off)}$	Turn-off Delay Time[2]		T_J = 25°C	–	165	–	ns
			T_J = 125°C	–	180	–	
t_{fi}	Turn-off Fall Time[2]		T_J = 25°C	–	190	–	ns
			T_J = 125°C	–	140	–	
E_{off}	Turn-off Energy[2]		T_J = 25°C	–	2.5	–	mJ
			T_J = 125°C	–	2.4	–	

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

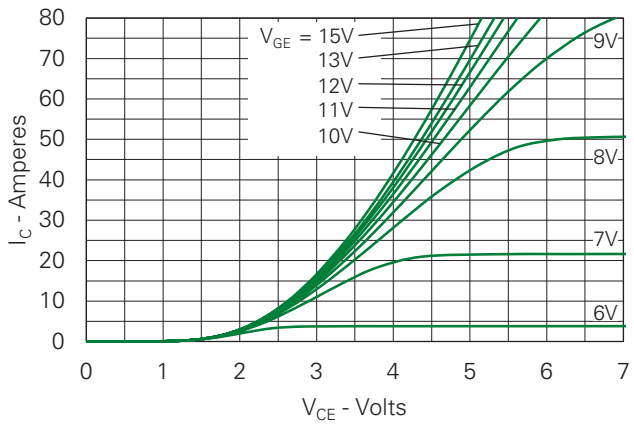


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

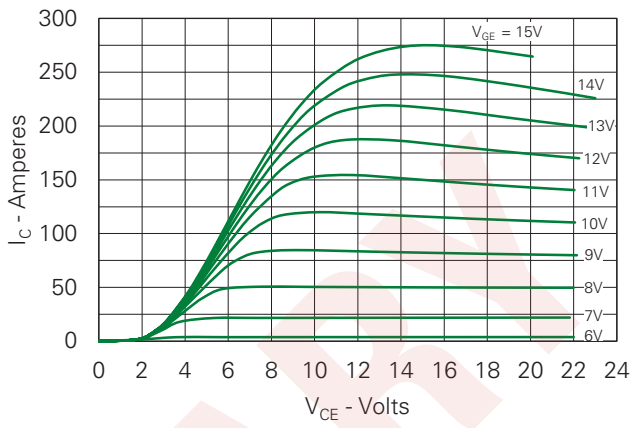


Fig. 3. Output Characteristics @ T_J = 125ºC

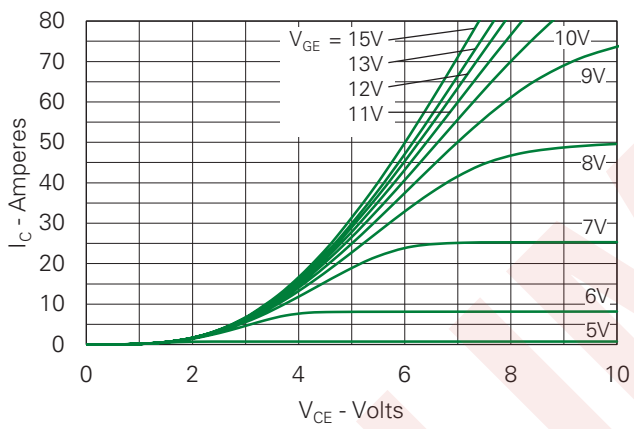


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

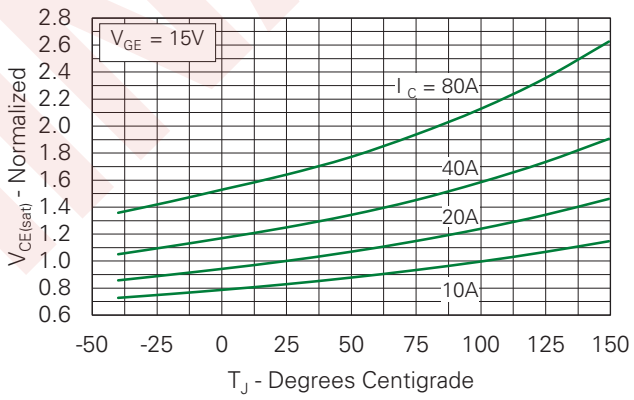


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

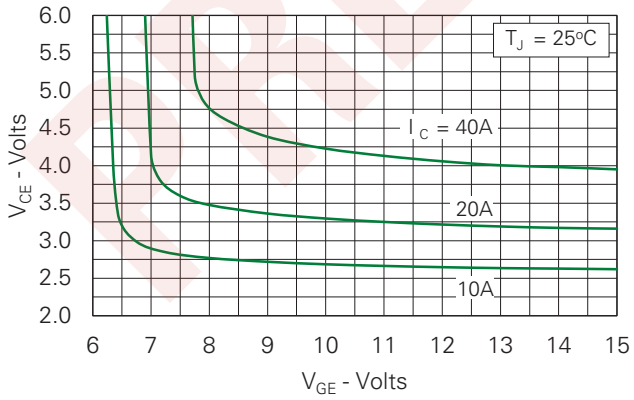


Fig. 6. Input Admittance

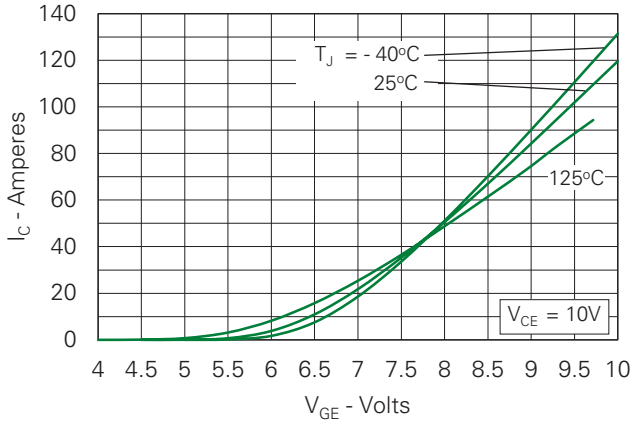


Fig. 7. Transconductance

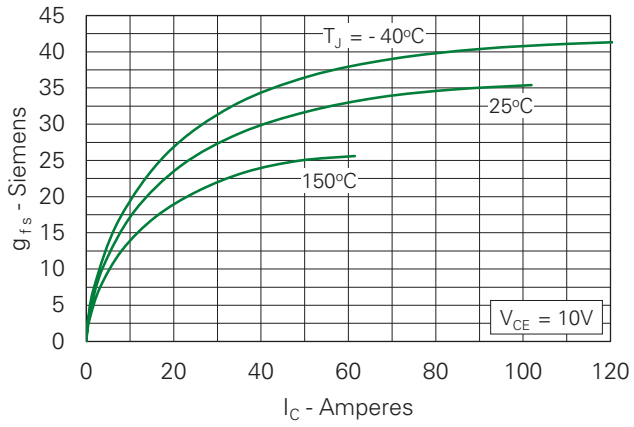


Fig. 8. Gate Charge

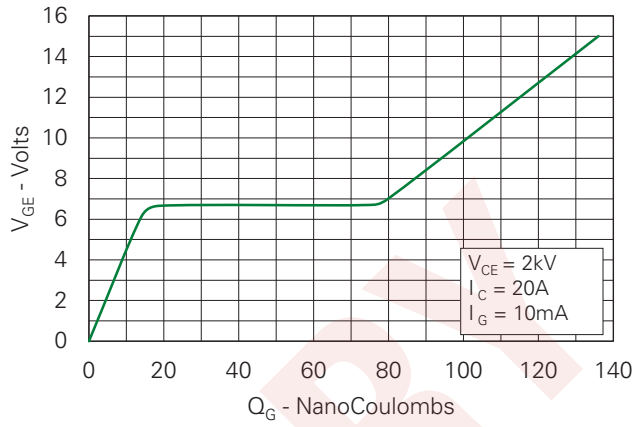


Fig. 9. Capacitance

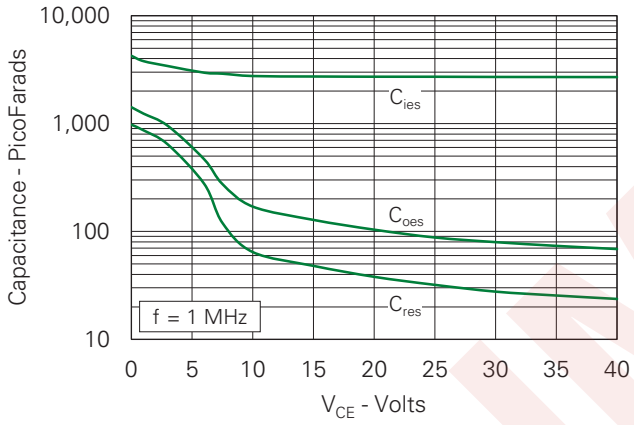


Fig. 10. Reverse-Bias Safe Operating Area

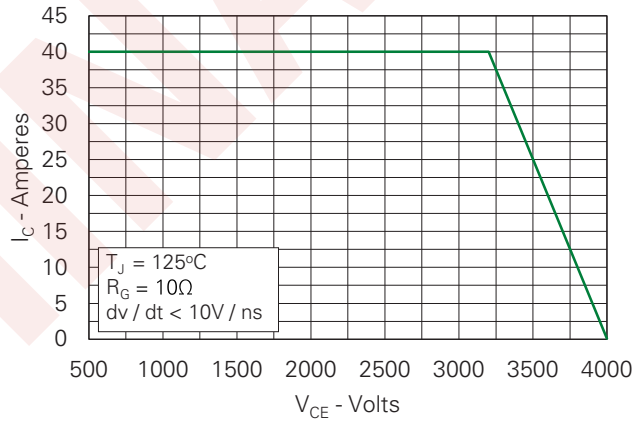


Fig. 11. Maximum Transient Thermal Impedance

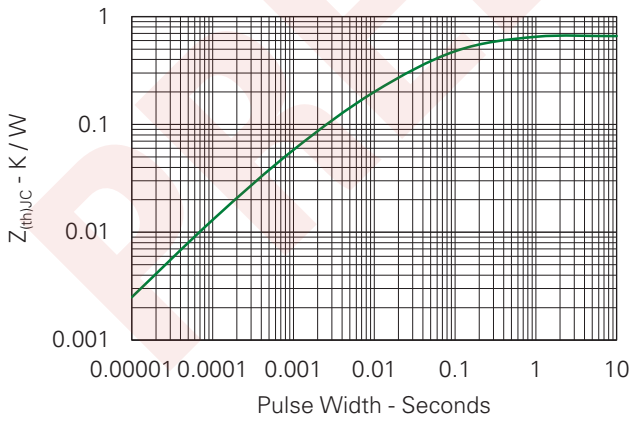


Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

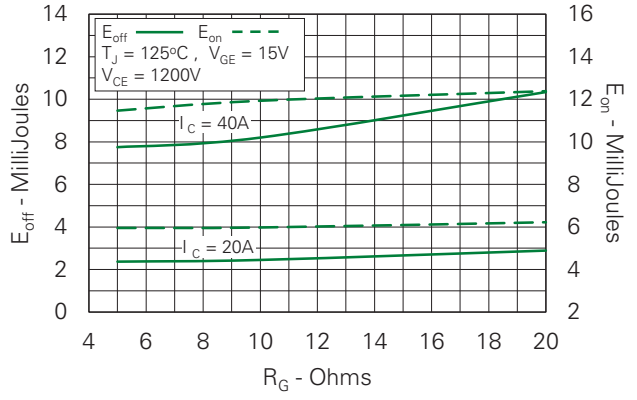


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

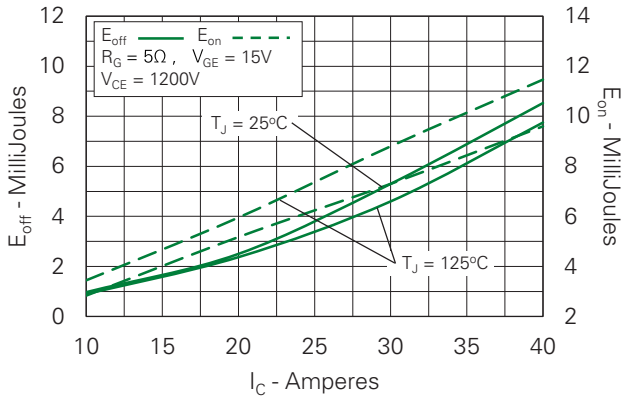


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

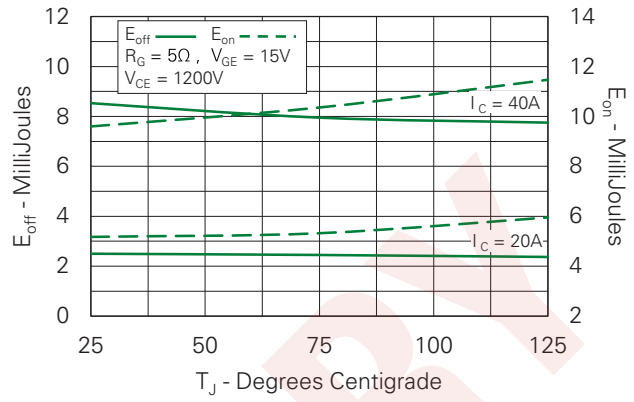


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

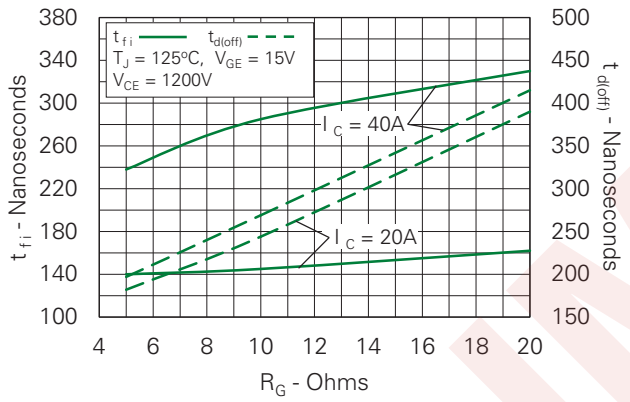


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

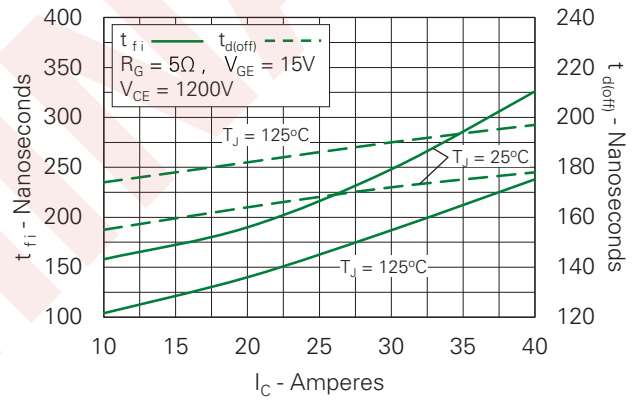


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

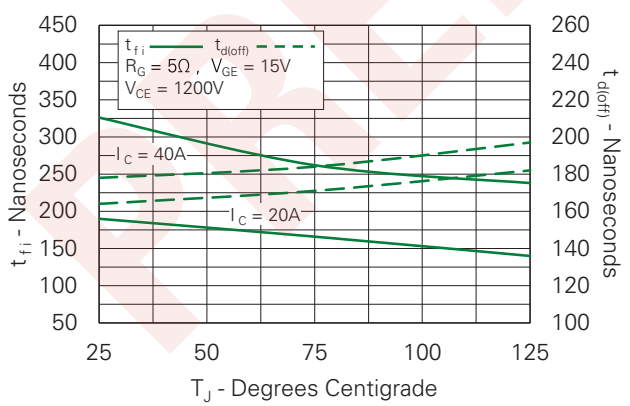


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

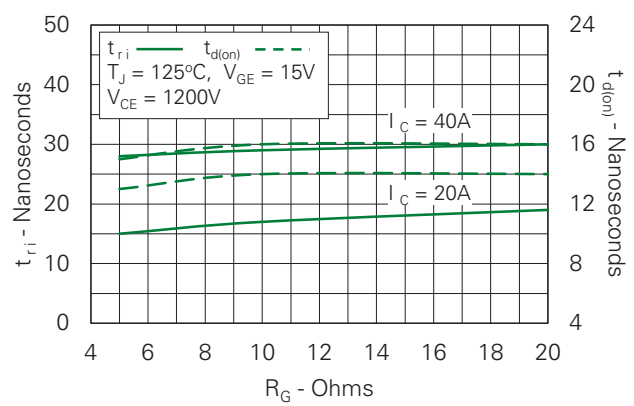


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

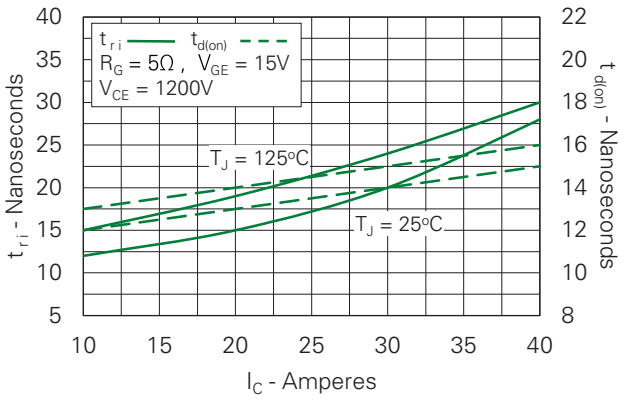
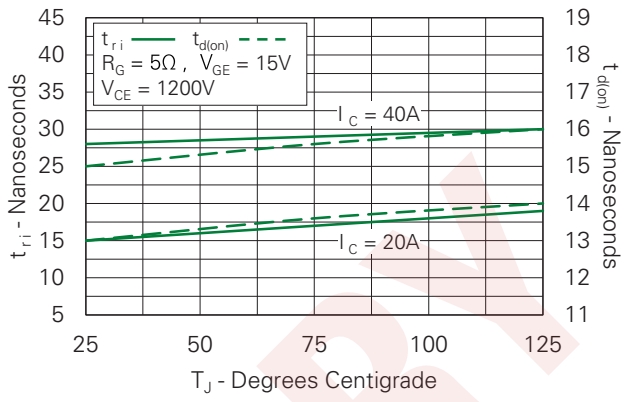
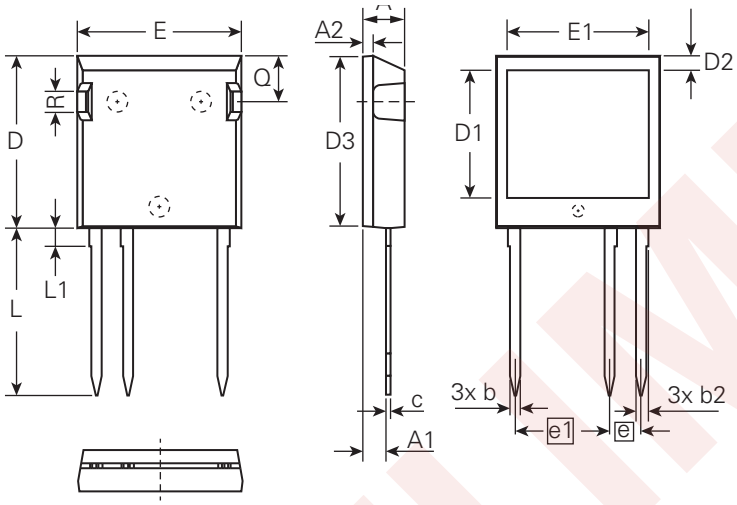


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature



Part Outline Drawing (ISOPLUS i4-Pak™)



Symbol	Inches			Millimeters		
	Min.	Typical	Max.	Min.	Typical	Max
A	0.190	–	0.205	4.83	–	5.21
A1	0.102	–	0.118	2.59	–	3.00
A2	0.046	–	0.085	1.17	–	2.16
b	0.045	–	0.055	1.14	–	1.40
b2	0.058	–	0.068	1.47	–	1.73
c	0.020	–	0.029	0.51	–	0.74
D	0.819	–	0.840	20.80	–	21.34
D1	0.590	–	0.620	14.99	–	15.75
D2	0.065	–	0.080	1.65	–	2.03
E	0.770	–	0.799	19.56	–	20.29
E1	0.660	–	0.690	16.76	–	17.53
e	0.150 BSC			3.81 BSC		
e1	0.450 BSC			11.43 BSC		
L	0.780	–	0.840	19.81	–	21.34
L1	0.083	–	0.102	2.11	–	2.59
Q	0.210	–	0.244	5.33	–	6.20
R	0.100	–	0.180	2.54	–	4.57