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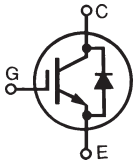
IXYS

GenX3™ 600V IGBT w/Diode

IXGH48N60A3D1

V_{CES} = 600V
I_{C110} = 48A
$V_{CE(sat)}$ ≤ 1.35V

Ultra Low Vsat PT IGBT for up to 5kHz switching



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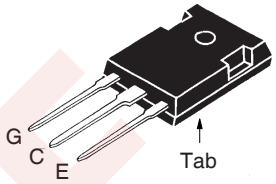

G = Gate C = Collector
E = Emitter Tab = Collector

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_C = 25°C to 150°C	600	V
V_{CGR}	T_J = 25°C to 150°C, R_{GE} = 1MΩ	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C110}	T_C = 110°C	48	A
I_{CM}	T_C = 25°C, 1ms	300	A
SSOA (RBSOA)	V_{GE} = 15V, T_{VJ} = 125°C, R_G = 5Ω Clamped inductive load	I_{CM} = 96 @ ≤ V_{CES}	A
P_C	T_C = 25°C	300	W
T_J		-55 ... +150	°C
T_{JM}		150	°C
T_{stg}		-55 ... +150	°C
T_L	1.6mm (0.062in.) from case for 10s	300	°C
T_{SOLD}	Plastic body for 10 seconds	260	°C
M_d	Mounting torque	1.13/10	Nm/lb.in.
Weight		6	g

Symbol	Test Conditions (T_J = 25°C unless otherwise specified)	Characteristic Values Min.	Typ.	Max.	
$V_{GE(th)}$	I_C = 250μA, V_{CE} = V_{GE}	3.0		5.5	V
I_{CES}	V_{CE} = 0.8 • V_{CES}, V_{GE} = 0V			300	μA
	T_J = 125°C			1.75	mA
I_{GES}	V_{CE} = 0V, V_{GE} = ± 20V			±100	nA
$V_{CE(sat)}$	I_C = 32A, V_{GE} = 15V, Note 1		1.18	1.35	V

Features

- Optimized for Low Conduction Losses
- Square RBSOA
- Anti-Parallel Ultra Fast Diode
- High Current Handling Capability
- International Standard Package

Advantages

- High Power Density
- Low Gate Drive Requirement

Applications

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

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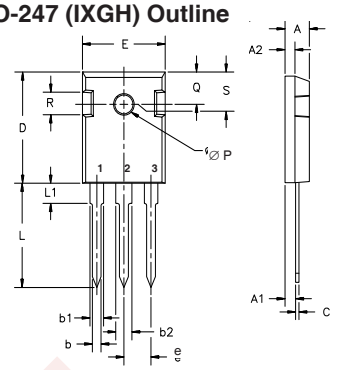
Symbol	Test Conditions (T_J = 25°C unless otherwise specified)	Characteristic Values Min.	Typ.	Max.	
g_{fs}	I_C = 32A, V_{CE} = 10V, Note 1	30	48		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		3190		pF
C_{oes}			175		pF
C_{res}			43		pF
Q_g	I_C = 32A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		110		nC
Q_{ge}			21		nC
Q_{gc}			42		nC
$t_{d(on)}$	**Inductive Load, T_J = 25°C**		25		ns
t_{ri}	I_C = 32A, V_{GE} = 15V		30		ns
E_{on}	V_{CE} = 480V, R_G = 5Ω		0.95		mJ
$t_{d(off)}$	Note 2		334		ns
t_{fi}			224		ns
E_{off}			2.9		mJ
$t_{d(on)}$	**Inductive Load, T_J = 125°C**		24		ns
t_{ri}	I_C = 32A, V_{GE} = 15V		30		ns
E_{on}	V_{CE} = 480V, R_G = 5Ω		1.97		mJ
$t_{d(off)}$	Note 2		545		ns
t_{fi}			380		ns
E_{off}			5.6		mJ
R_{thJC}				0.42	°C/W
R_{thCS}			0.21		°C/W

TO-247 (IXGH) Outline



Terminals: 1 - Gate 2 - Collector
3 - Emitter

Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	4.7	5.3	.185	.209
A_1	2.2	2.54	.087	.102
A_2	2.2	2.6	.059	.098
b	1.0	1.4	.040	.055
b_1	1.65	2.13	.065	.084
b_2	2.87	3.12	.113	.123
C	.4	.8	.016	.031
D	20.80	21.46	.819	.845
E	15.75	16.26	.610	.640
e	5.20	5.72	0.205	0.225
L	19.81	20.32	.780	.800
L1		4.50		.177
∅P	3.55	3.65	.140	.144
Q	5.89	6.40	0.232	0.252
R	4.32	5.49	.170	.216
S	6.15 BSC		242 BSC	

Reverse Diode (FRED)

Symbol	Test Conditions (T_J = 25°C, Unless Otherwise Specified)	Characteristic Value Min.	Typ.	Max.	
V_F	I_F = 30A, V_{GE} = 0V, Note 1			3.0	V
	T_J = 150°C		1.6		V
I_{RM}	I_F = 30A, V_{GE} = 0V, $-di_F/dt$ = 100A/μs, T_J = 100°C			4	A
t_{rr}	V_R = 300V, T_J = 100°C		100		ns
	I_F = 1A, V_R = 30V, $-di_F/dt$ = 100A/μs		25		ns
R_{thJC}				0.9	°C/W

Notes:

1. Pulse test, t ≤ 300μs, duty cycle, d ≤ 2%.
2. Switching times & energy losses may increase for higher V_{CE}(clamp), T_J or R_G.

IXYS Reserves the Rght to Change Limits, Test Conditions and Dimensions.

IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents: 4,835,592 4,931,844 5,049,961 5,237,481 6,162,665 6,404,065 B1 6,683,344 6,727,585 7,005,734 B2 7,157,338B2 4,850,072 5,017,508 5,063,307 5,381,025 6,259,123 B1 6,534,343 6,710,405 B2 6,759,692 7,063,975 B2 4,881,106 5,034,796 5,187,117 5,486,715 6,306,728 B1 6,583,505 6,710,463 6,771,478 B2 7,071,537

Fig. 1. Output Characteristics @ T_J = 25ºC

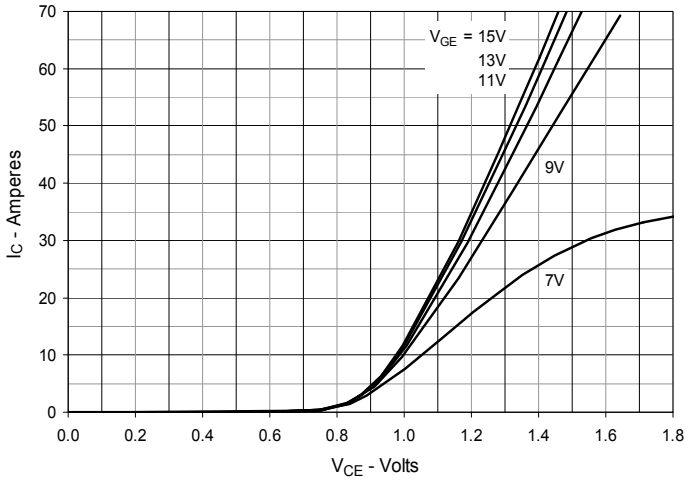


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

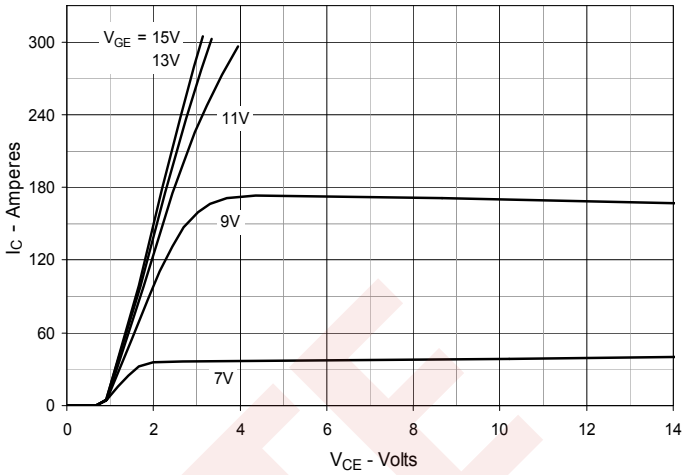


Fig. 3. Output Characteristics @ T_J = 125ºC

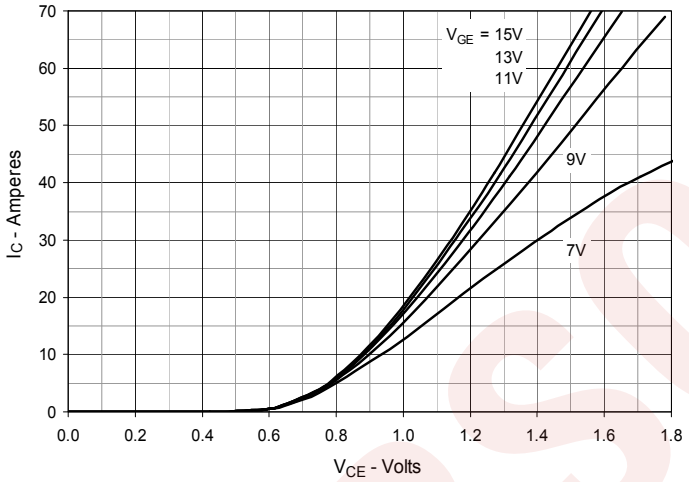


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

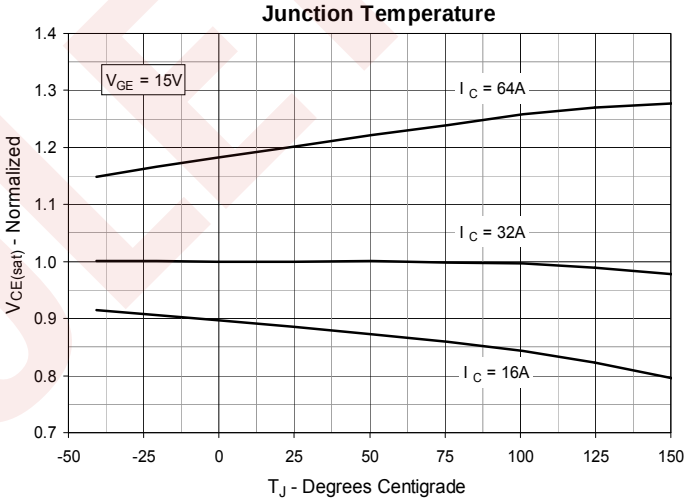


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

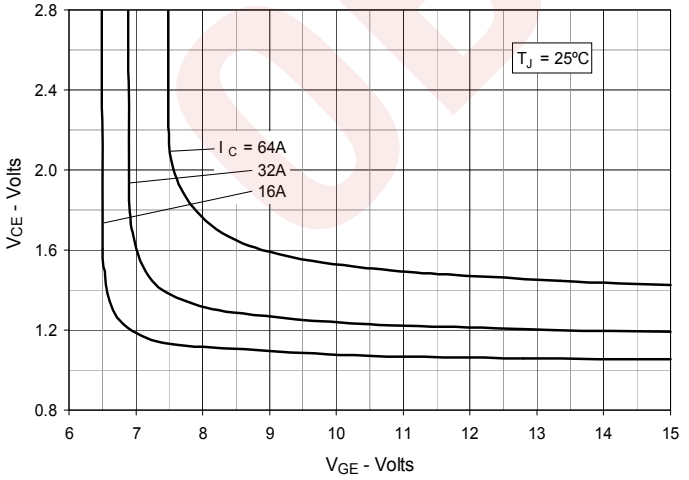


Fig. 6. Input Admittance

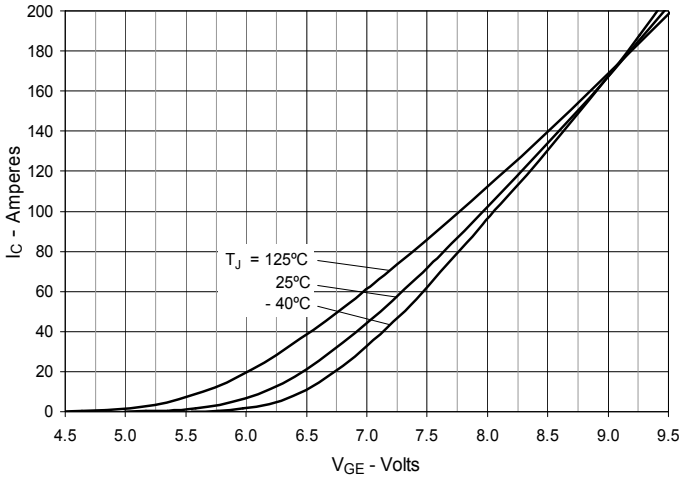


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Fig. 7. Transconductance

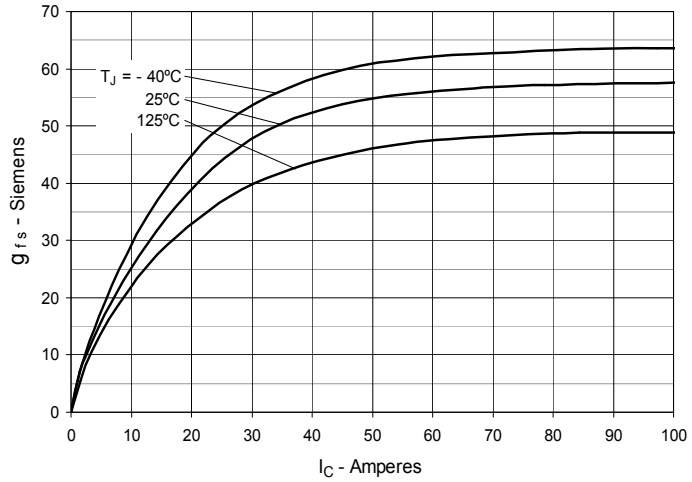

Fig. 8. Gate Charge

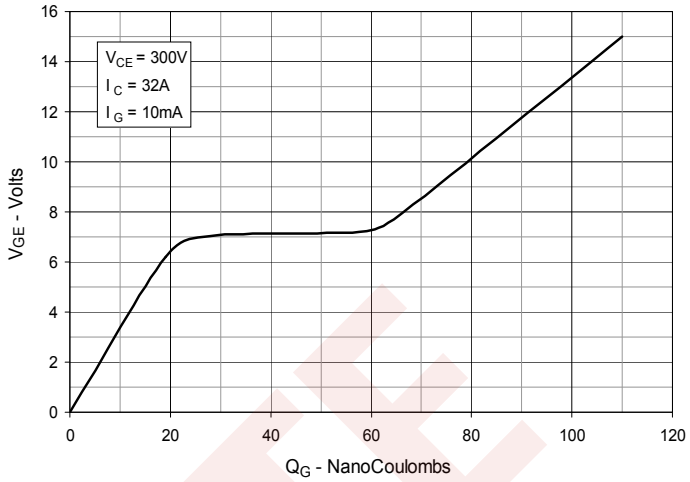

Fig. 9. Capacitance

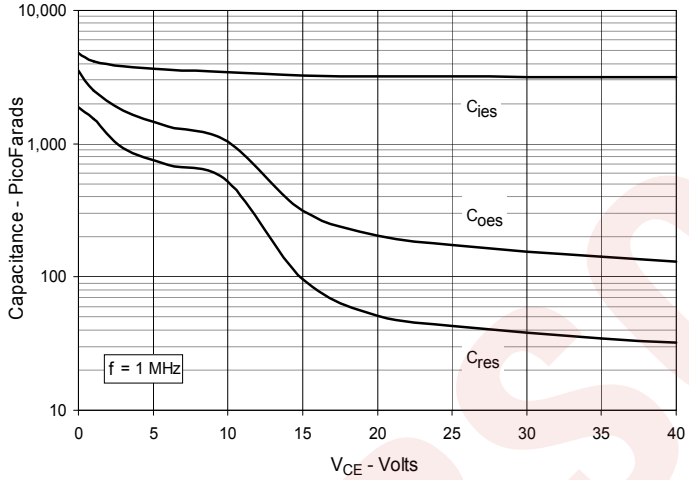

Fig. 10. Reverse-Bias Safe Operating Area

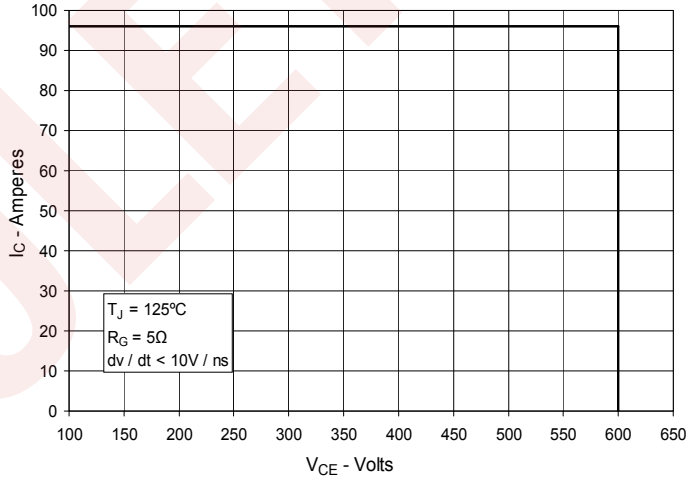

Fig. 11. Maximum Transient Thermal Impedance

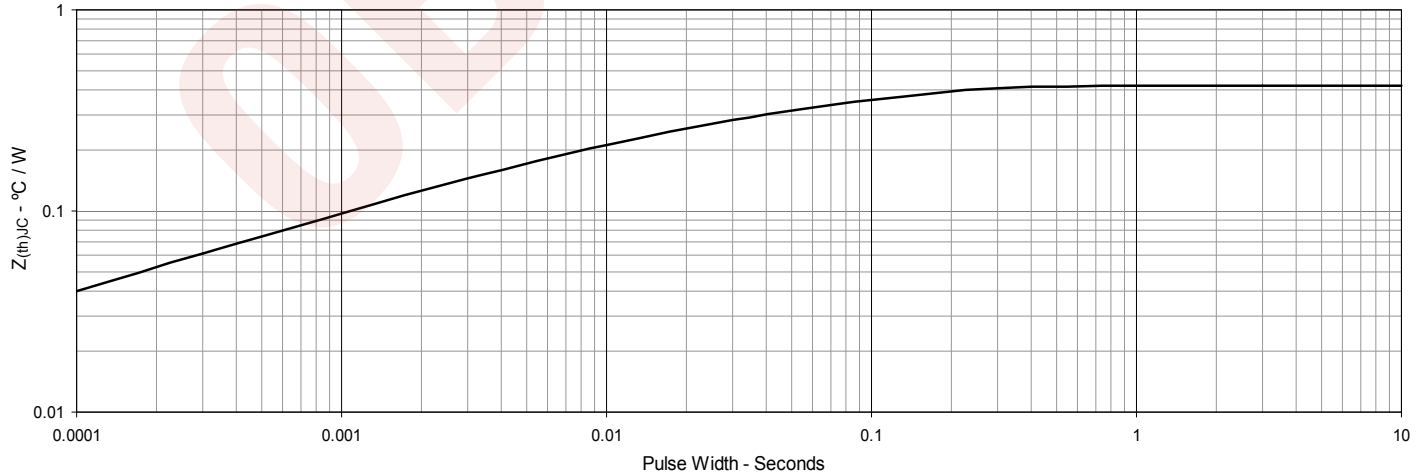

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Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

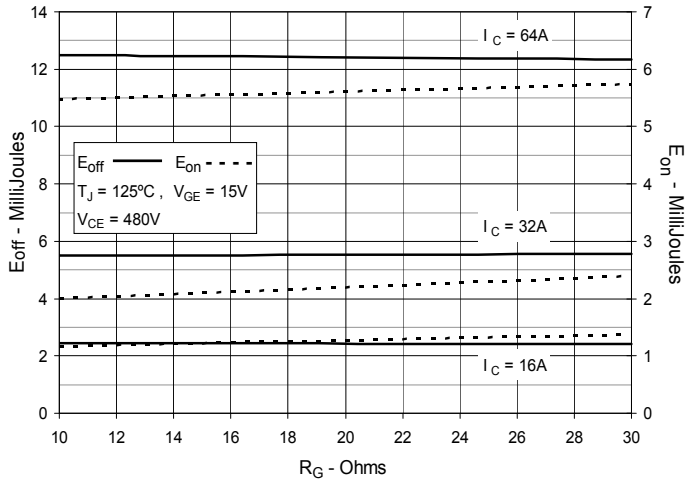

Fig. 13. Inductive Switching Energy Loss vs. Collector Current

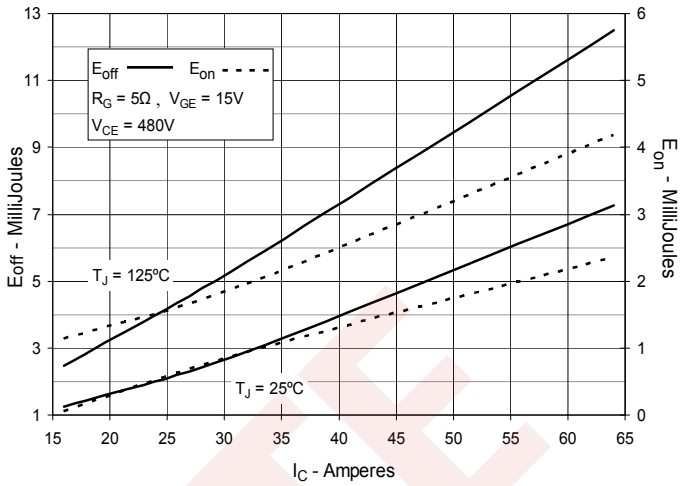

Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

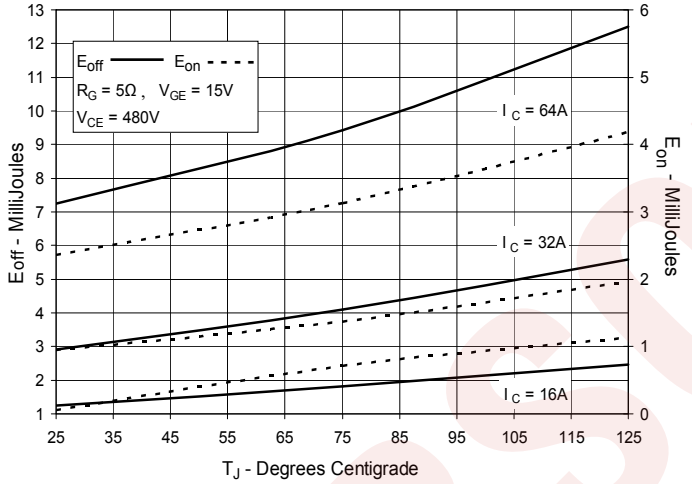

Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

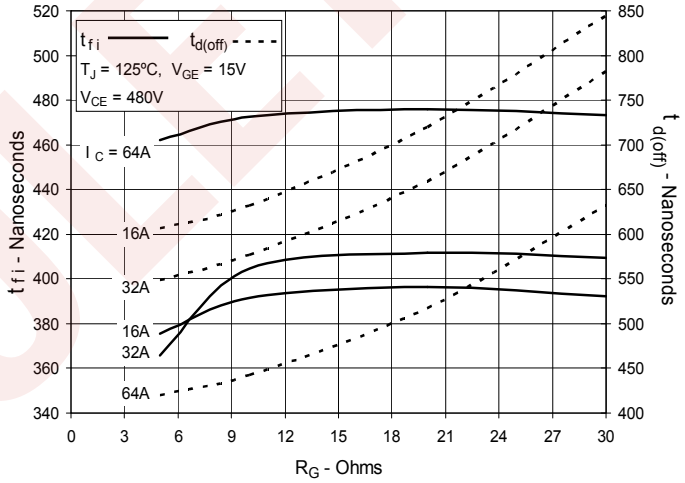

Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

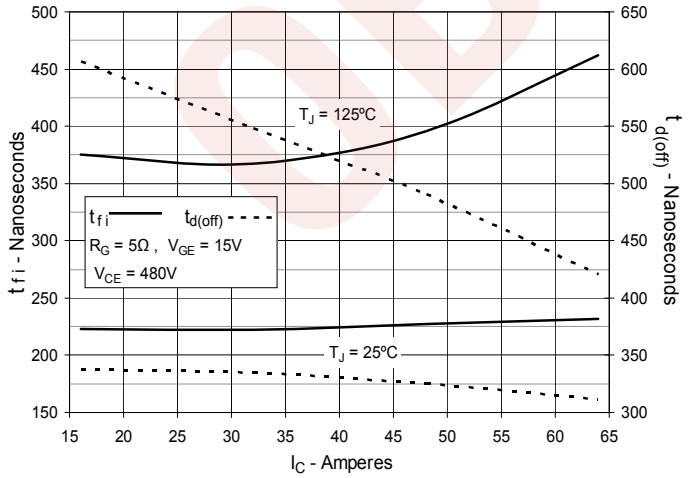

Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

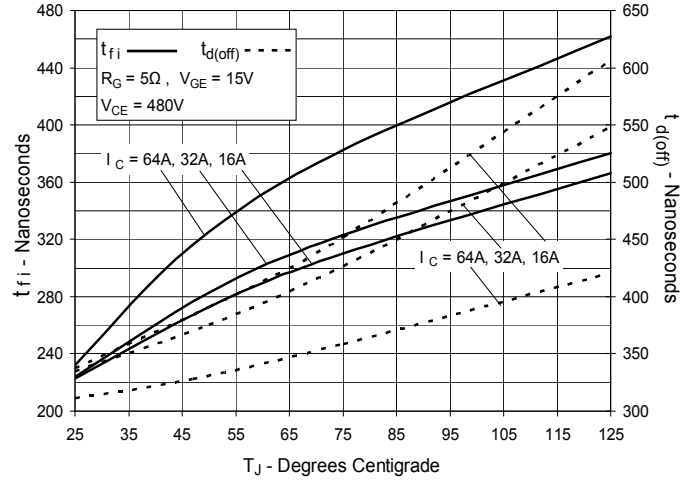

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Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

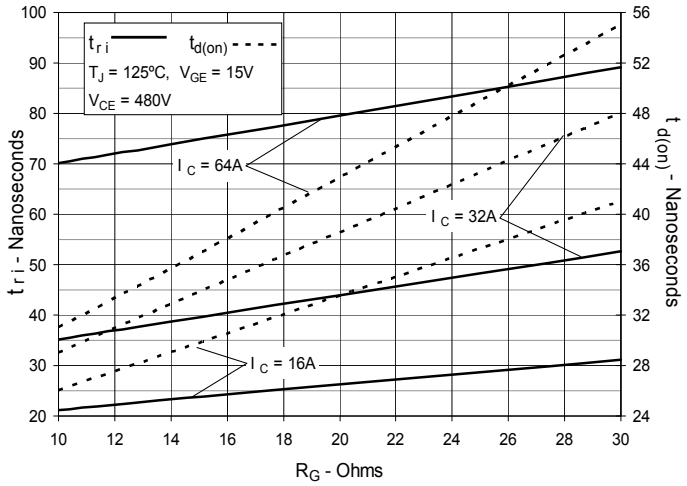


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

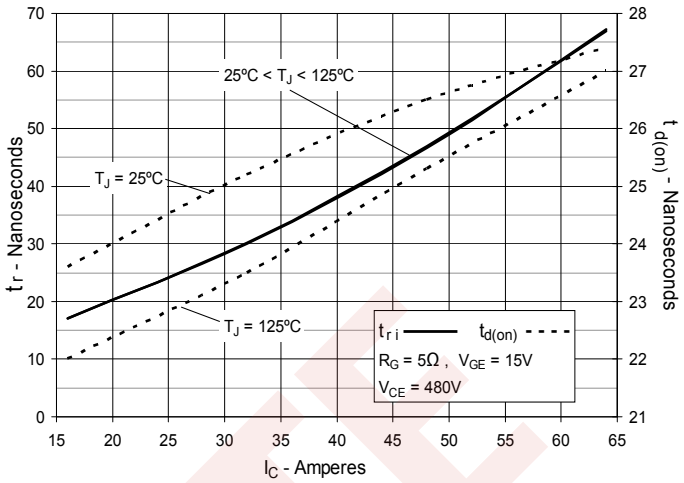
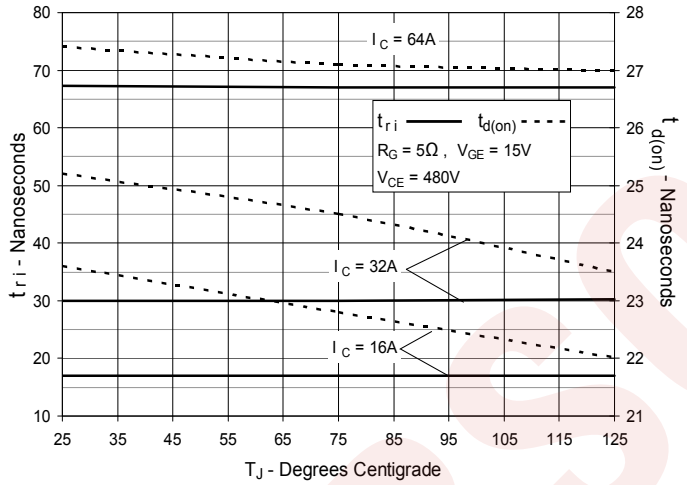


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature



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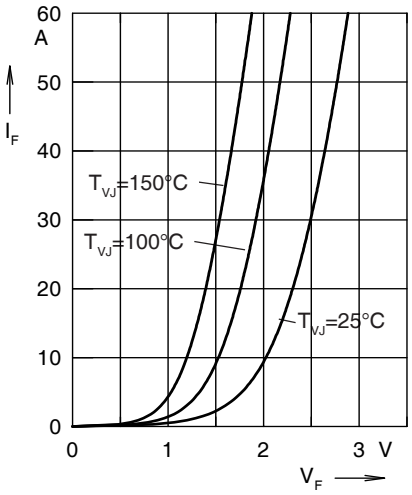

Fig. 21. Forward current I_F versus V_F

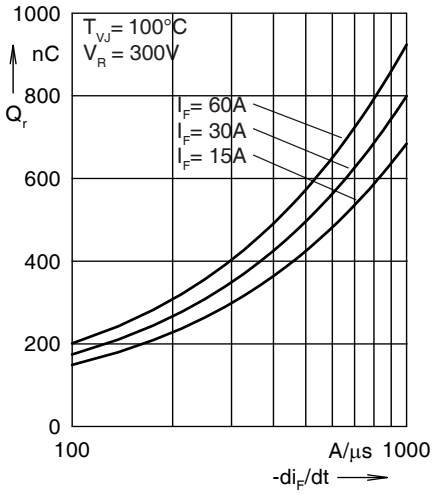

Fig. 22. Reverse recovery charge Q_r versus $-di_F/dt$

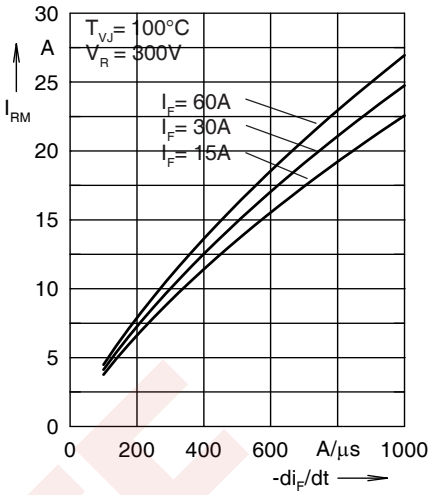

Fig. 23. Peak reverse current I_{RM} versus $-di_F/dt$

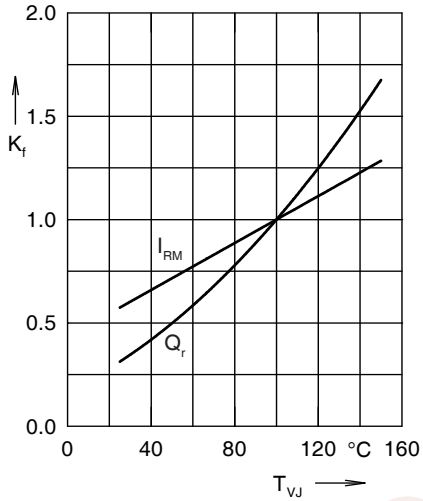

Fig. 24. Dynamic parameters Q_r, I_{RM} versus T_{VJ}

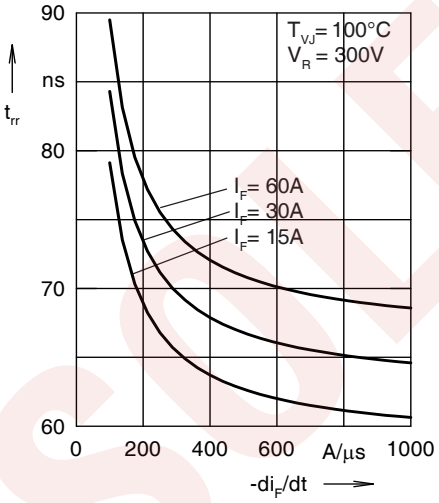

Fig. 25. Recovery time t_{rr} versus $-di_F/dt$

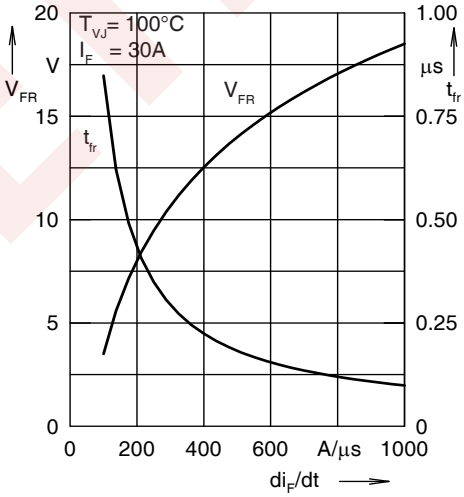

Fig. 26. Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

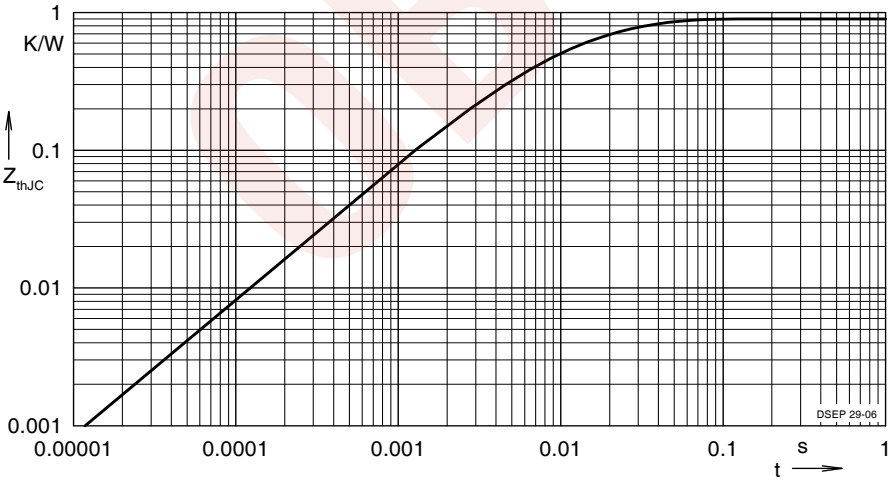

Fig. 27. Transient thermal resistance junction to case

Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.502	0.0052
2	0.193	0.0003
3	0.205	0.0162

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