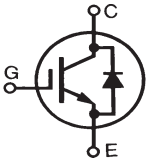
IXYS

GenX3™ 600V IGBT w/ Diode

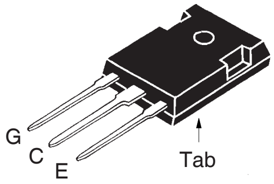
IXGH56N60B3D1

V_{CES} = 600V
I_{C110} = 56A
$V_{CE(sat)}$ ≤ 1.80V

Medium-Speed-Low-Vsat PT
IGBT 5-40kHz Switching



TO-247



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

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 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	56	A
I_{CM}	T_C = 25°C, 1ms	350	A
SSOA **(RBSOA)**	V_{GE} = 15V, T_{VJ} = 125°C, R_G = 5Ω Clamped Inductive Load	I_{CM} = 150 @$V_{CE} \leq V_{CES}$	A
P_C	T_C = 25°C	330	W
T_J		-55 ... +150	°C
T_{JM}		150	°C
T_{stg}		-55 ... +150	°C
T_L	Maximum Lead Temperature for Soldering	300	°C
T_{SOLD}	1.6 mm (0.062in.) from Case for 10s	260	°C
M_d	Mounting Torque	1.13/10	Nm/lb.in.
Weight		6	g

Features

- Optimized for Low Conduction and Switching losses
- Square RBSOA
- Anti-Parallel Ultra Fast Diode
- International Standard Package

Advantages

- High Power Density
- Low Gate Drive Requirement

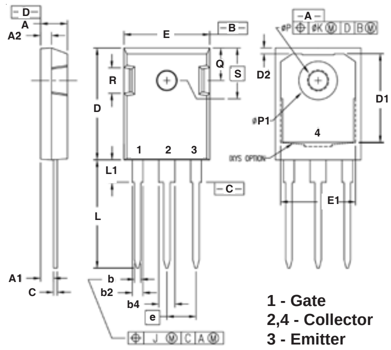
Applications

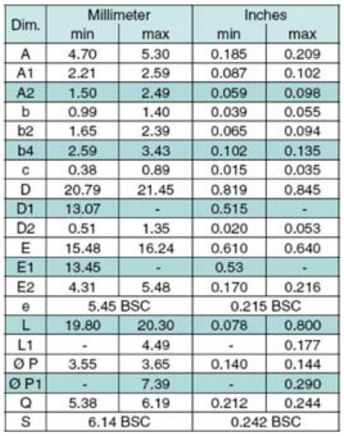
- Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts

Symbol	Test Conditions	Characteristic Values			
	(T_J = 25°C, Unless Otherwise Specified)	Min.	Typ.	Max.	
$V_{GE(th)}$	I_C = 250μA, V_{CE} = V_{GE}	3.0		5.0	V
I_{CES}	V_{CE} = V_{CES}, V_{GE} = 0V			300	μA
	T_J = 125°C			2	mA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±100	nA
$V_{CE(sat)}$	I_C = 44A, V_{GE} = 15V, Note 1		1.49	1.80	V
	T_J = 125°C		1.47		V

Symbol	Test Conditions (T_J = 25°C Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
g_{fs}	I_C = 44A, V_{CE} = 10V, Note 1	36	60		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		3950		pF
C_{oes}			220		pF
C_{res}			56		pF
$Q_{g(on)}$	I_C = 40A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		138		nC
Q_{ge}			25		nC
Q_{gc}			47		nC
$t_{d(on)}$	**Inductive Load, T_J = 25°C** I_C = 44A, V_{GE} = 15V V_{CE} = 480V, R_G = 5Ω Note 2		26		ns
t_{ri}			41		ns
E_{on}			1.30		mJ
$t_{d(off)}$			155	335	ns
t_{fi}			95	165	ns
E_{off}			1.05	2.0	mJ
$t_{d(on)}$	**Inductive Load, T_J = 125°C** I_C = 44A, V_{GE} = 15V V_{CE} = 480V, R_G = 5Ω Note 2		26		ns
t_{ri}			37		ns
E_{on}			2.34		mJ
$t_{d(off)}$			220		ns
t_{fi}			165		ns
E_{off}			2.20		mJ
R_{thJC}				0.375	°C/W
R_{thCS}			0.21		°C/W

TO-247 (IXGH) Outline





Dim.	Millimeter min	max	Inches min	max
A	4.70	5.30	0.185	0.209
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b2	1.65	2.39	0.065	0.094
b4	2.59	3.43	0.102	0.135
c	0.38	0.89	0.015	0.035
D	20.79	21.45	0.819	0.845
D1	13.07	-	0.515	-
D2	0.51	1.35	0.020	0.053
E	15.48	16.24	0.610	0.640
E1	13.45	-	0.53	-
E2	4.31	5.48	0.170	0.216
e	5.45 BSC		0.215 BSC	
L	19.80	20.30	0.078	0.800
L1	-	4.49	-	0.177
Ø P	3.55	3.65	0.140	0.144
Ø P1	-	7.39	-	0.290
Q	5.38	6.19	0.212	0.244
S	6.14 BSC		0.242 BSC	

Reverse Diode (FRED)

Symbol	Test Conditions (T_J = 25°C Unless Otherwise Specified)		Characteristic Values Min.	Typ.	Max.	
V_F	I_F = 30A, V_{GE} = 0V, Note 1				2.7	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 = 100V	T_J = 100°C		100		ns
	I_F = 1A, V_{GE} = 0V, -di_F/dt = 100A/μs, V_R = 30V			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.

Fig. 1. Output Characteristics @ 25ºC

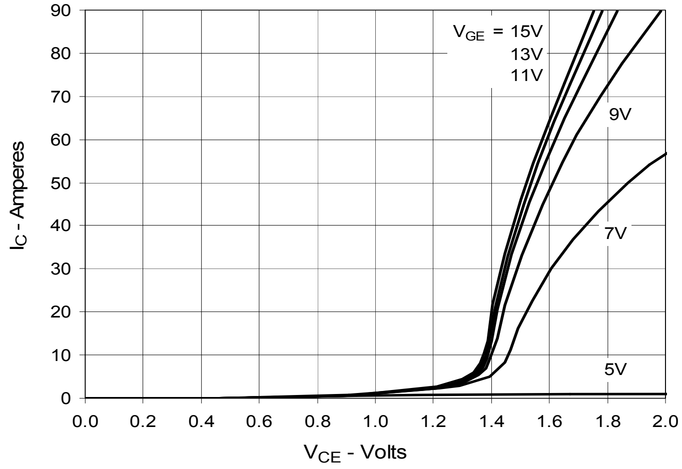


Fig. 2. Extended Output Characteristics @ 25ºC

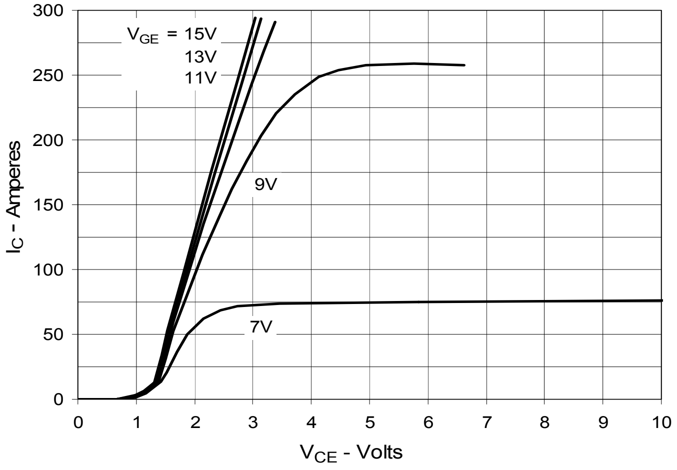


Fig. 3. Output Characteristics @ 125ºC

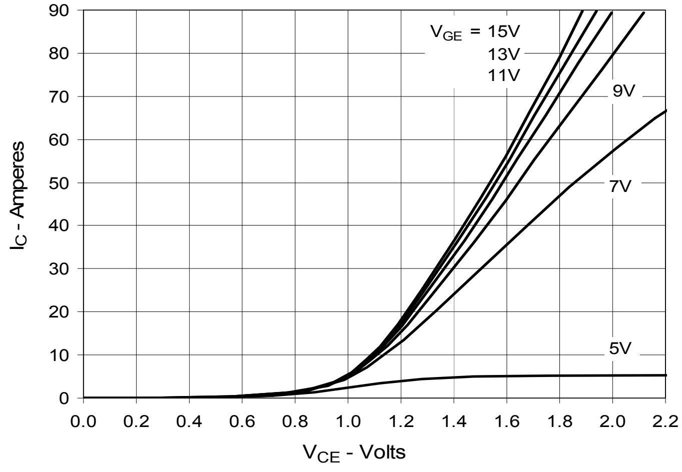


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

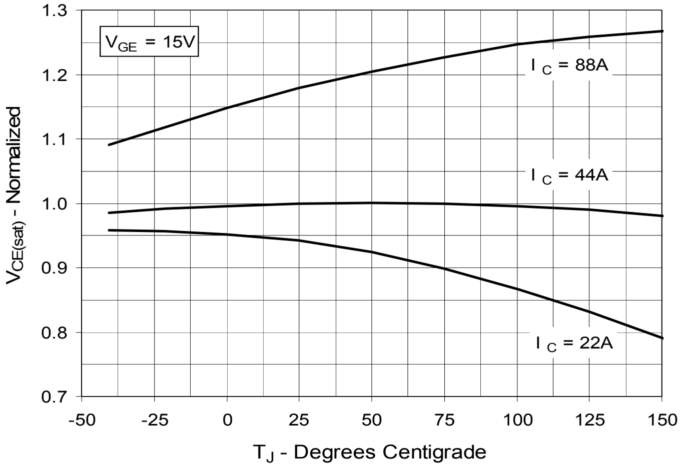


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

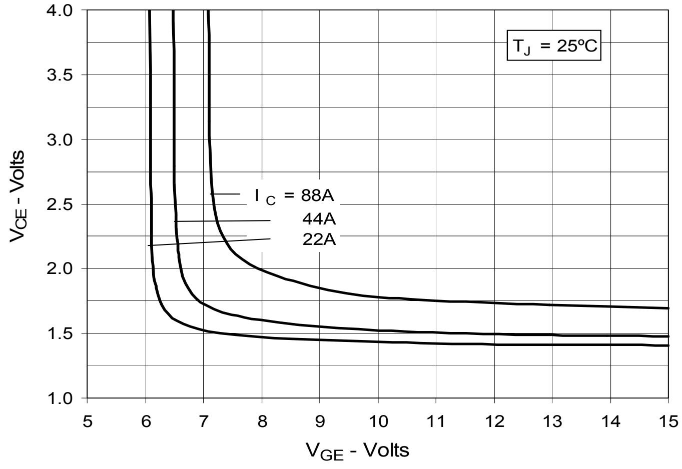
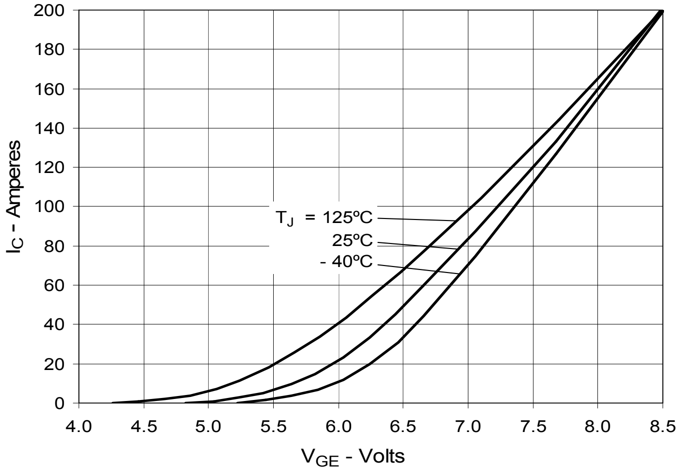


Fig. 6. Input Admittance



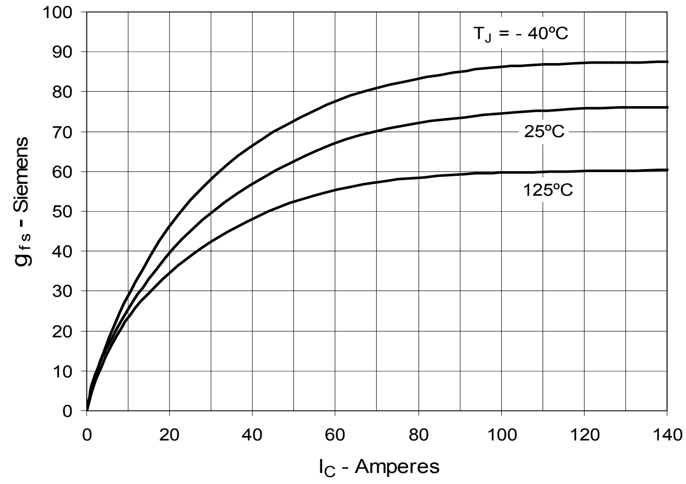


Fig. 7. Transconductance

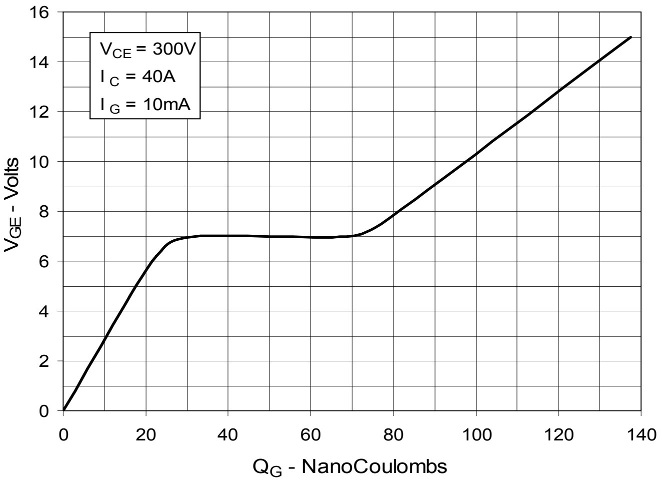


Fig. 8. Gate Charge

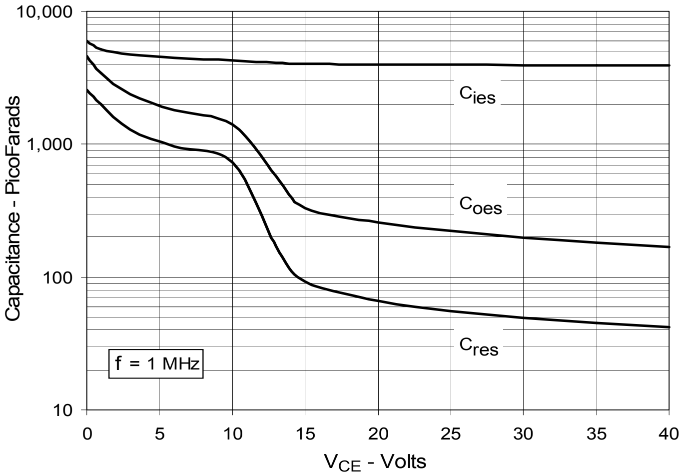


Fig. 9. Capacitance

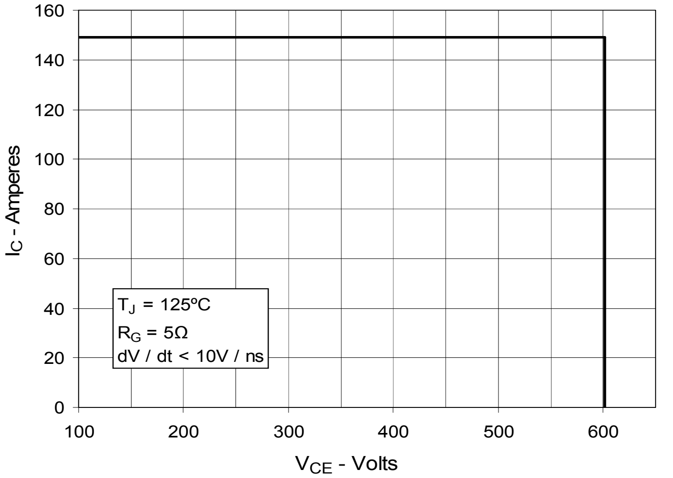


Fig. 10. Reverse-Bias Safe Operating Area

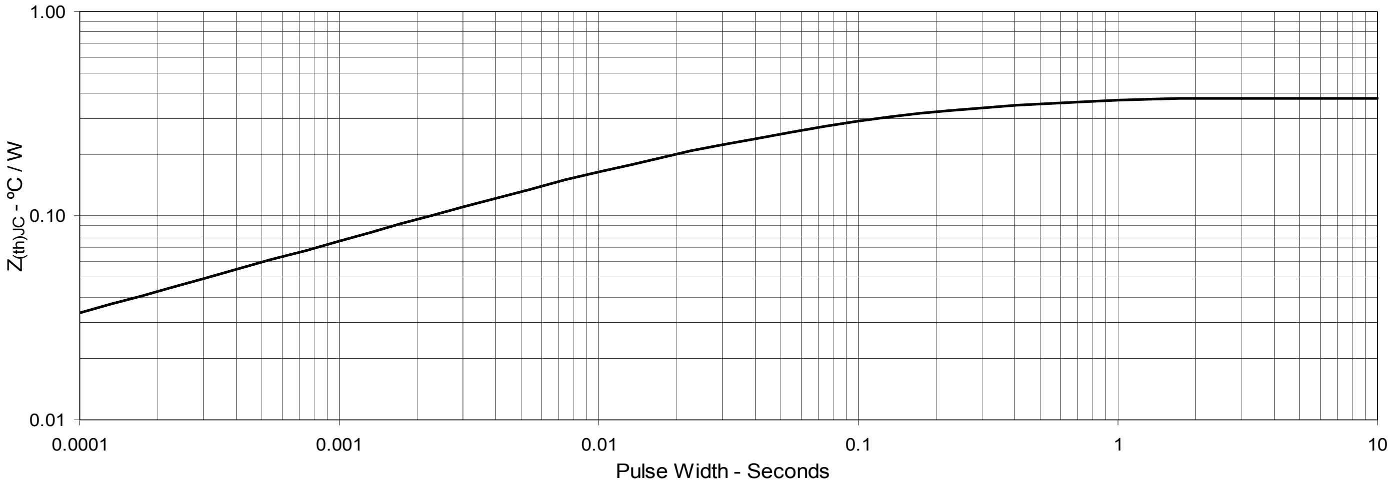


Fig. 11. Maximum Transient Thermal Impedance

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

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

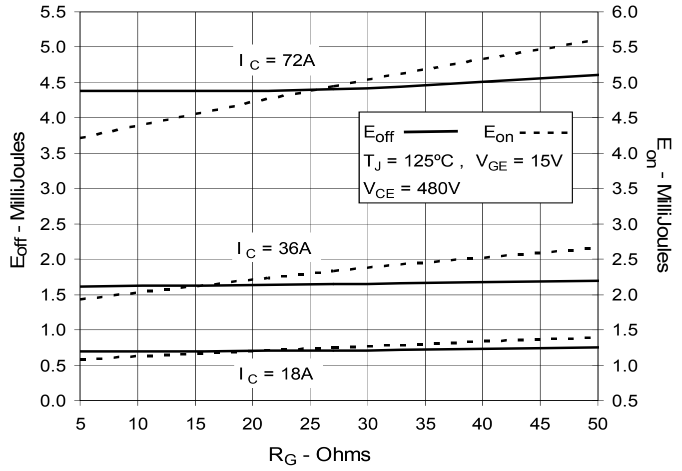


Fig. 13. Inductive Swiching Energy Loss vs. Collector Current

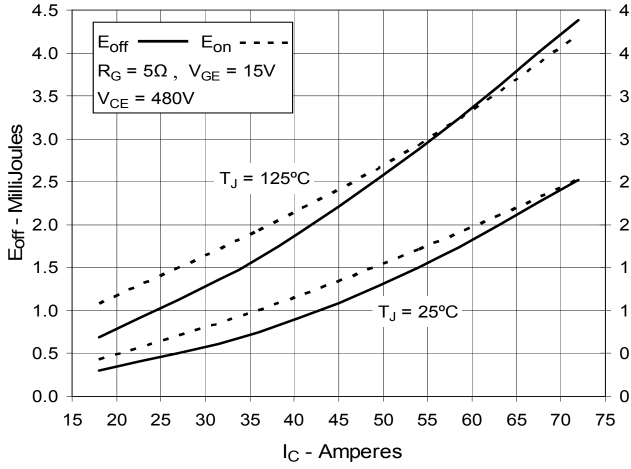


Fig. 14. Inductive Swiching Energy Loss vs. Junction Temperature

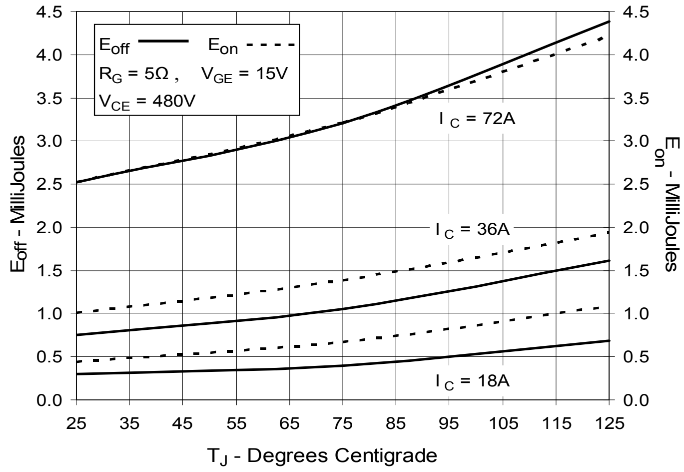


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

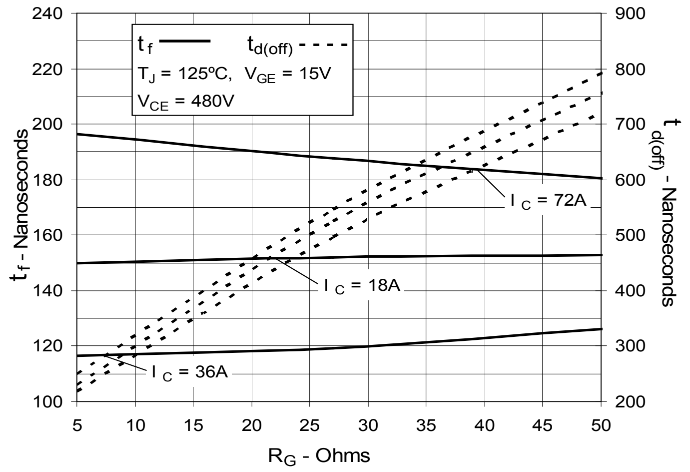


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

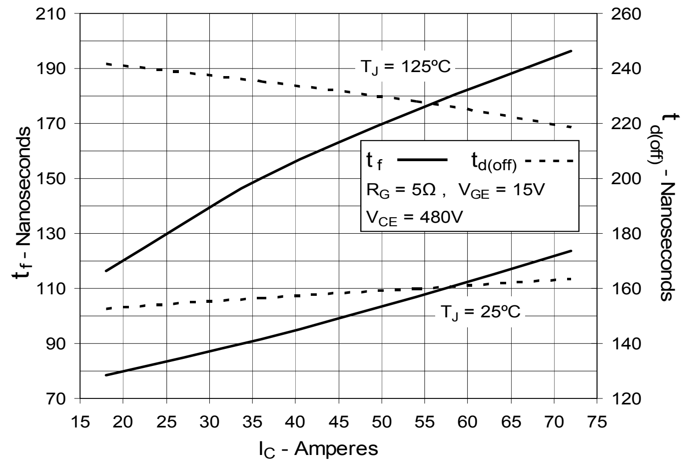


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

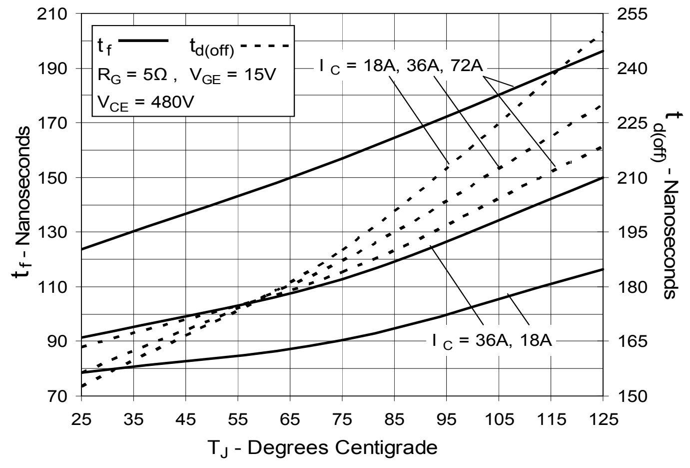


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

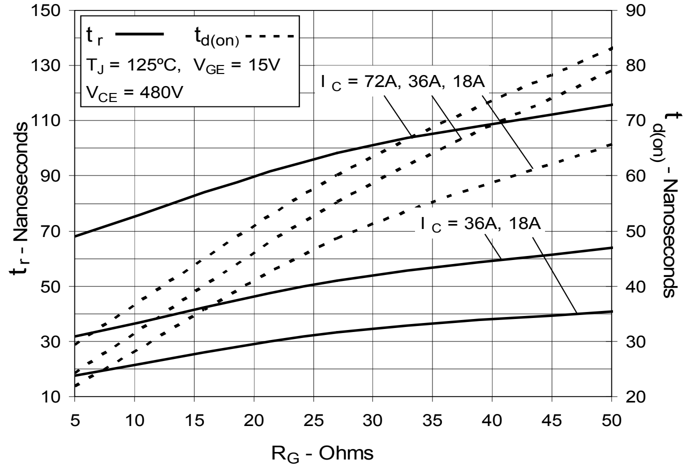


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

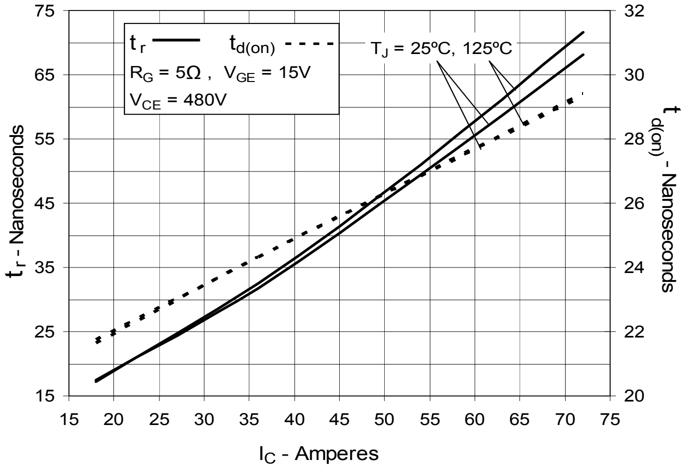
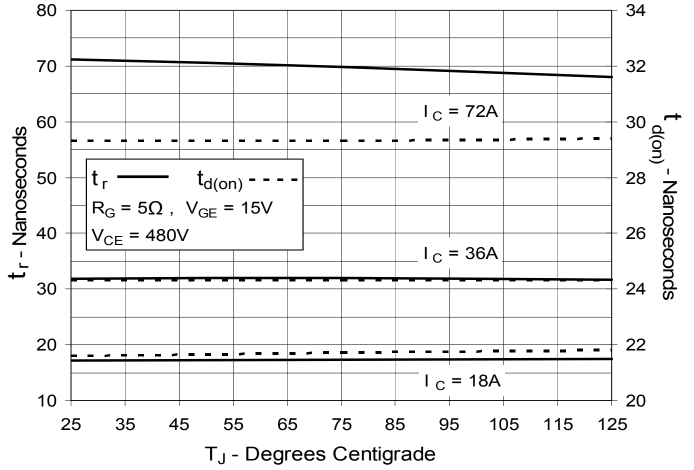


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature



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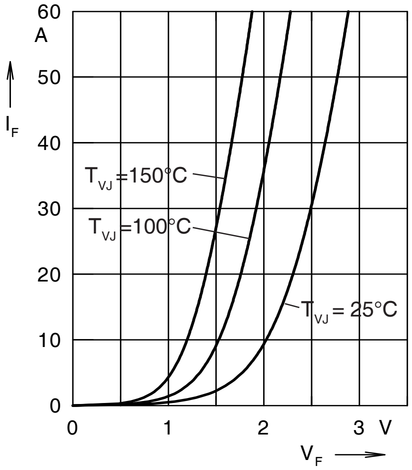

Fig. 21. Forward Current I_F Versus V_F

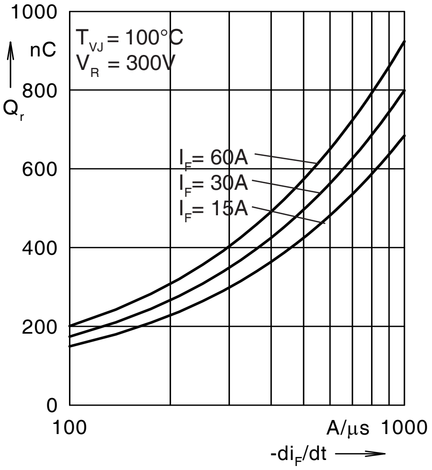

Fig. 22. Reverse Recovery Charge Q_r Versus $-di_F/dt$

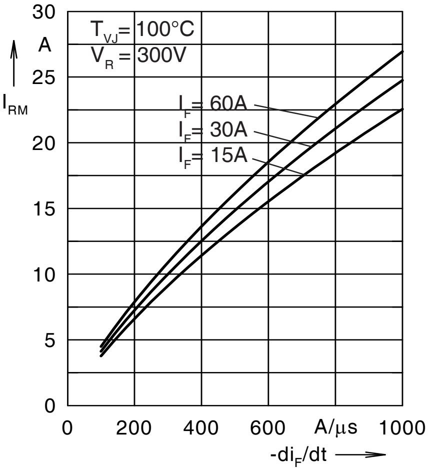

Fig. 23. Peak Reverse Current I_{RM} Versus $-di_F/dt$

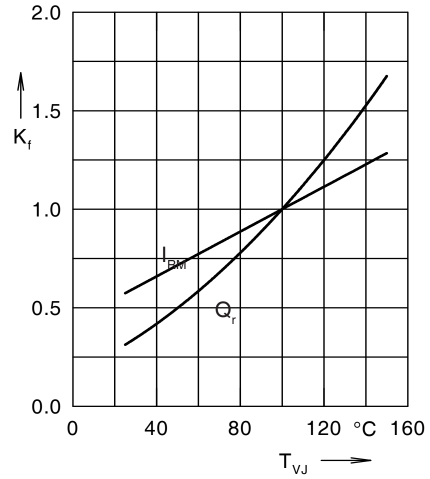

Fig. 24. Dynamic Parameters Q_r, I_{RM} Versus T_{VJ}

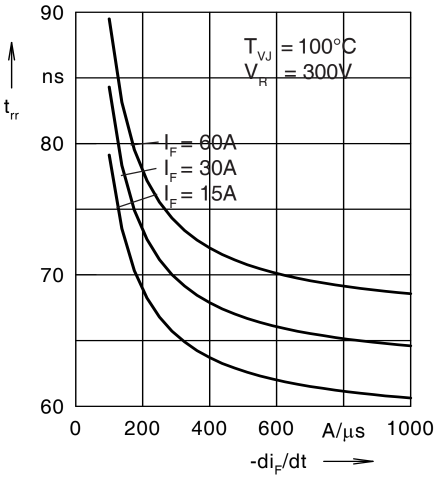

Fig. 25. Recovery Time t_{rr} Versus $-di_F/dt$

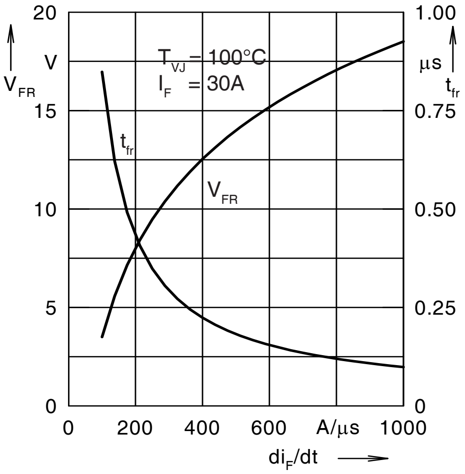

Fig. 26. Peak Forward Voltage V_{FR} and t_{fr} Versus di_F/dt

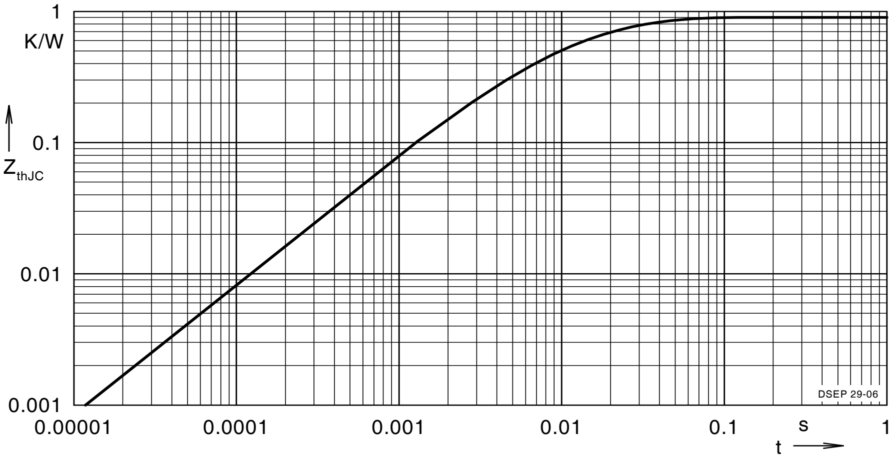

Fig. 27. Transient Thermal Resistance Junction to Case

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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