

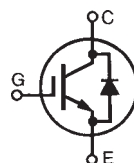
GenX3™ 600V IGBTs with Diode

IXGH60N60C3D1

IXGT60N60C3D1*

*Obsolete Part Number

High Speed PT IGBTs for
40-100kHz switching



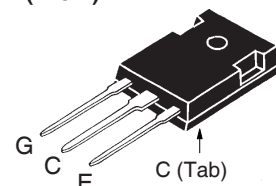
$V_{CES} = 600V$

$I_{C110} = 60A$

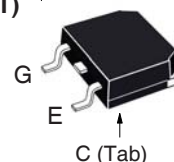
$V_{CE(sat)} \leq 2.5V$

$t_{fi} (typ) = 50ns$

TO-247 (IXGH)



TO-268 (IXGT)



G = Gate
E = Emitter

C = Collector
Tab = Collector

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^{\circ}C$ to $150^{\circ}C$	600	V
V_{CGR}	$T_J = 25^{\circ}C$ to $150^{\circ}C$, $R_{GE} = 1M\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^{\circ}C$, (Limited by Leads)	75	A
I_{C110}	$T_C = 110^{\circ}C$	60	A
I_{F110}	$T_C = 110^{\circ}C$	26	A
I_{CM}	$T_C = 25^{\circ}C$, 1ms	300	A
I_A	$T_C = 25^{\circ}C$	40	A
E_{AS}	$T_C = 25^{\circ}C$	400	mJ
SSOA (RBSOA)	$V_{GE} = 15V$, $T_{VJ} = 125^{\circ}C$, $R_G = 3\Omega$ Clamped Inductive Load	$I_{CM} = 125$ $V_{CE} \leq V_{CES}$	A
P_C	$T_C = 25^{\circ}C$	380	W
T_J		-55 ... +150	$^{\circ}C$
T_{JM}		150	$^{\circ}C$
T_{stg}		-55 ... +150	$^{\circ}C$
T_L	Maximum Lead Temperature for Soldering	300	$^{\circ}C$
T_{SOLD}	1.6 mm (0.062in.) from Case for 10s	260	$^{\circ}C$
M_d	Mounting Torque (TO-247)	1.13/10	Nm/lb.in.
Weight	TO-268	4	g
	TO-247	6	g

Symbol	Test Conditions ($T_J = 25^{\circ}C$, Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$V_{GE(th)}$	$I_C = 250\mu A$, $V_{CE} = V_{GE}$	3.0		5.5 V
I_{CES}	$V_{CE} = V_{CES}$, $V_{GE} = 0V$ $T_J = 125^{\circ}C$			50 μA 1 mA
I_{GES}	$V_{CE} = 0V$, $V_{GE} = \pm 20V$			± 100 nA
$V_{CE(sat)}$	$I_C = 40A$, $V_{GE} = 15V$ $T_J = 125^{\circ}C$	2.2 1.7	2.5	V V

Features

- Optimized for Low Switching Losses
- Square RBSOA
- High Avalanche Capability
- Anti-Parallel Ultra Fast Diode
- International Standard Packages

Advantages

- High Power Density
- Low Gate Drive Requirement

Applications

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

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = 40\text{A}$, $V_{CE} = 10\text{V}$, Note 1	23	38	S
C_{ies}	$V_{CE} = 25\text{V}$, $V_{GE} = 0\text{V}$, $f = 1\text{MHz}$		2810	pF
C_{oes}			210	pF
C_{res}			80	pF
Q_g	$I_C = 40\text{A}$, $V_{GE} = 15\text{V}$, $V_{CE} = 0.5 \cdot V_{CES}$		115	nC
Q_{ge}			22	nC
Q_{gc}			43	nC
$t_{d(on)}$	Inductive Load, $T_J = 125^\circ\text{C}$ $I_C = 40\text{A}$, $V_{GE} = 15\text{V}$ $V_{CE} = 480\text{V}$, $R_G = 3\Omega$ Note 2		21	ns
t_{ri}			33	ns
E_{on}			0.80	mJ
$t_{d(off)}$			70	ns
t_{fi}			50	ns
E_{off}			0.45	mJ
$t_{d(on)}$	Inductive Load, $T_J = 125^\circ\text{C}$ $I_C = 40\text{A}$, $V_{GE} = 15\text{V}$ $V_{CE} = 480\text{V}$, $R_G = 3\Omega$ Note 2		21	ns
t_{ri}			33	ns
E_{on}			1.25	mJ
$t_{d(off)}$			112	ns
t_{fi}			86	ns
E_{off}			0.80	mJ
R_{thJC}				0.33 $^\circ\text{C/W}$
R_{thCK}			0.21	$^\circ\text{C/W}$

Reverse Diode (FRED)

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
V_F	$I_F = 30\text{A}$, $V_{GE} = 0\text{V}$, Note 1 $T_J = 150^\circ\text{C}$		1.6	2.7 V
I_{RM}	$I_F = 30\text{A}$, $V_{GE} = 0\text{V}$, $di_F/dt = 100\text{ A}/\mu\text{s}$, $T_J = 100^\circ\text{C}$ $V_R = 100\text{V}$, $T_J = 100^\circ\text{C}$ $I_F = 1\text{A}$; $-di/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{V}$			4 A
t_{rr}			100	ns
			25	ns
R_{thJC}				0.9 $^\circ\text{C/W}$

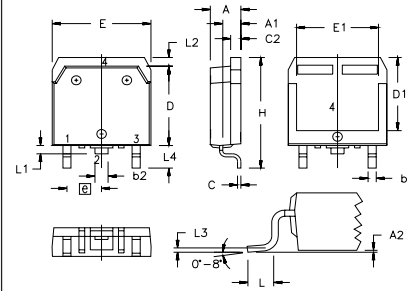
Notes:

1. Pulse test, $t \leq 300\mu\text{s}$, duty cycle, $d \leq 2\%$.
2. Switching times & energy losses may increase for higher $V_{CE}(\text{Clamp})$, T_J or R_G .

IXYS Reserves the Right 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	

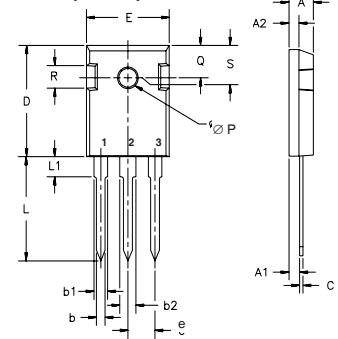
TO-268 (IXGT) Outline



Terminals: 1 - Gate
3 - Emitter
2 - Collector
Tab - Collector

SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.193	.201	4.90	5.10
A1	.106	.114	2.70	2.90
A2	.001	.010	0.02	0.25
b	.045	.057	1.15	1.45
b2	.075	.083	1.90	2.10
C	.016	.026	0.40	0.65
C2	.057	.063	1.45	1.60
D	.543	.551	13.80	14.00
D1	.488	.500	12.40	12.70
E	.624	.632	15.85	16.05
E1	.524	.535	13.30	13.60
e	.215 BSC		5.45 BSC	
H	.736	.752	18.70	19.10
L	.094	.106	2.40	2.70
L1	.047	.055	1.20	1.40
L2	.039	.045	1.00	1.15
L3	.010 BSC		0.25 BSC	
L4	.150	.161	3.80	4.10

TO-247 (IXGH) Outline



Terminals: 1 - Gate
3 - Emitter
2 - Collector
Tab - Collector

Dim.	Millimeter		Inches	
	Min.	Max.	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
ØP	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	

Fig. 1. Output Characteristics @ $T_J = 25^\circ\text{C}$

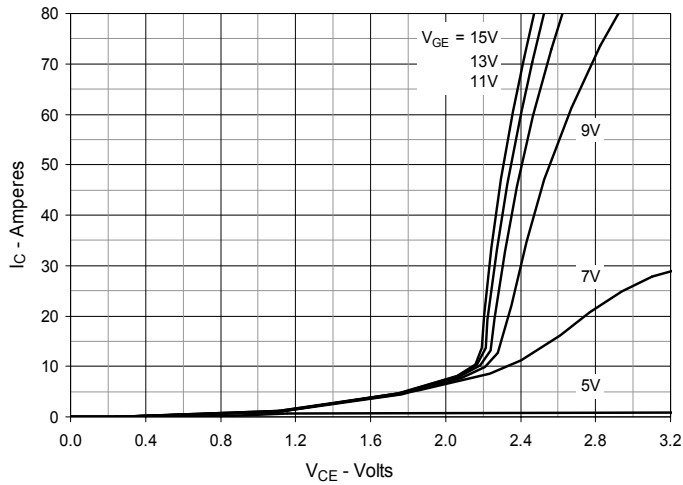


Fig. 2. Extended Output Characteristics @ $T_J = 25^\circ\text{C}$

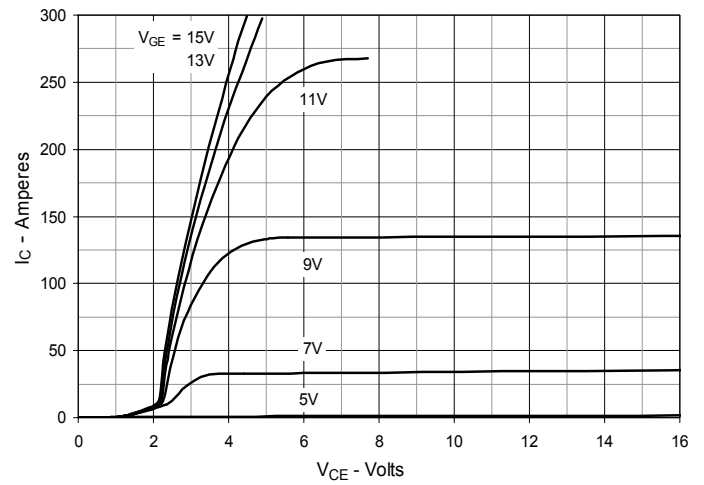


Fig. 3. Output Characteristics @ $T_J = 125^\circ\text{C}$

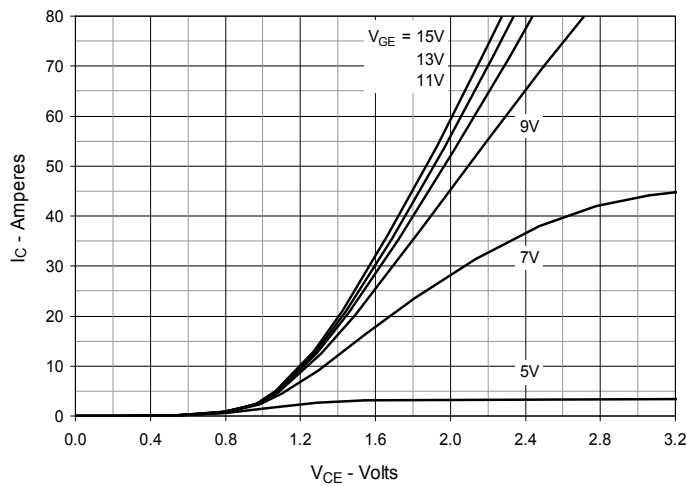


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

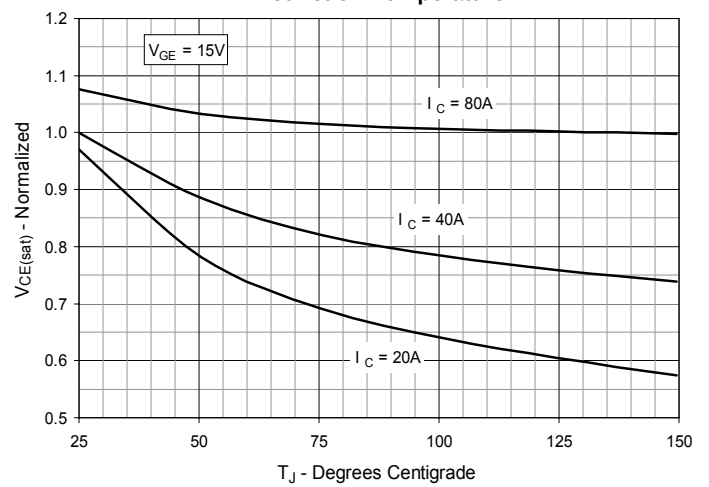


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

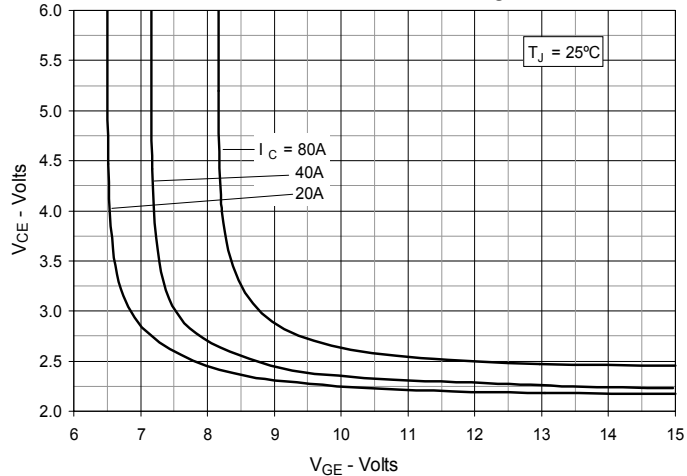


Fig. 6. Input Admittance

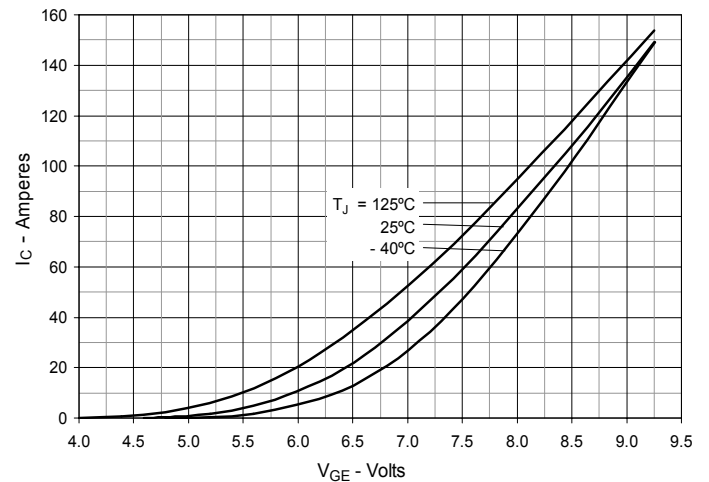


Fig. 7. Transconductance

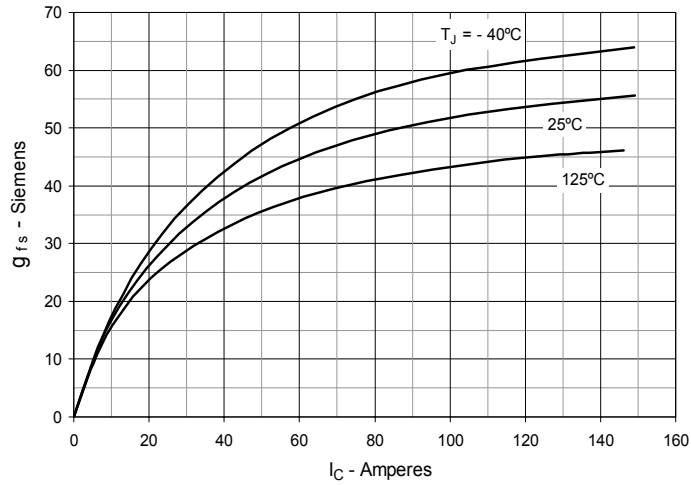


Fig. 8. Gate Charge

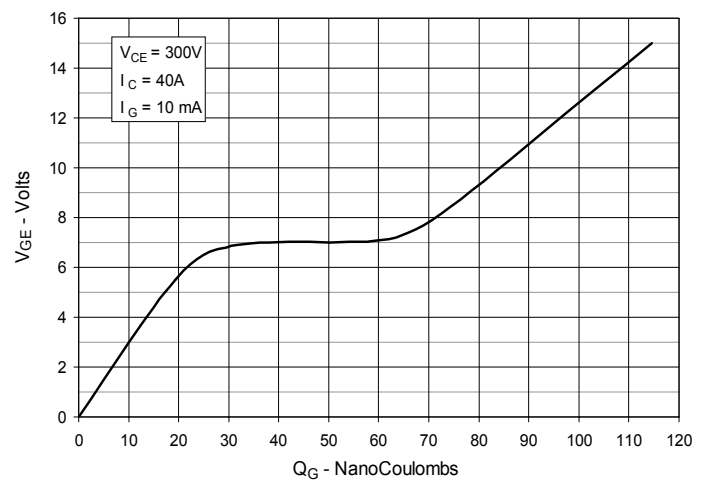


Fig. 9. Capacitance

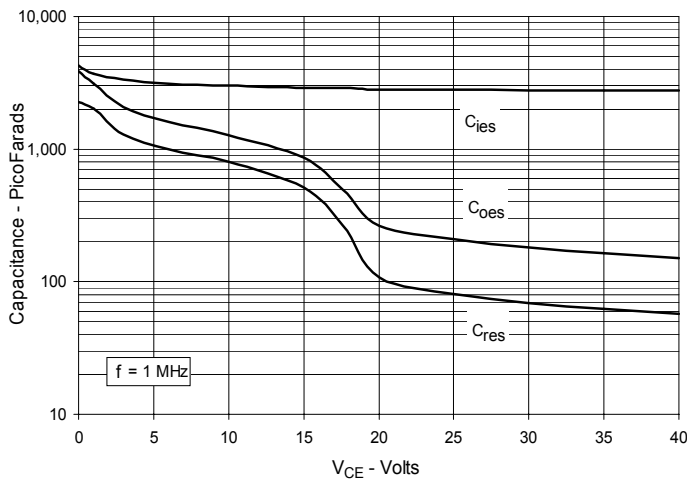


Fig. 10. Reverse-Bias Safe Operating Area

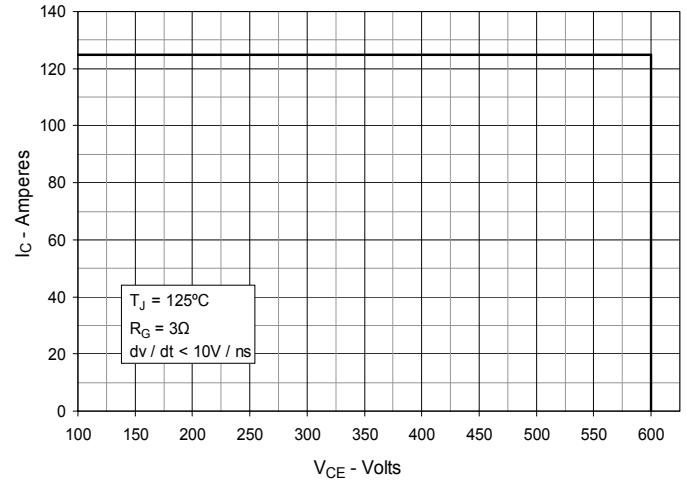


Fig. 11. Maximum Transient Thermal Impedance

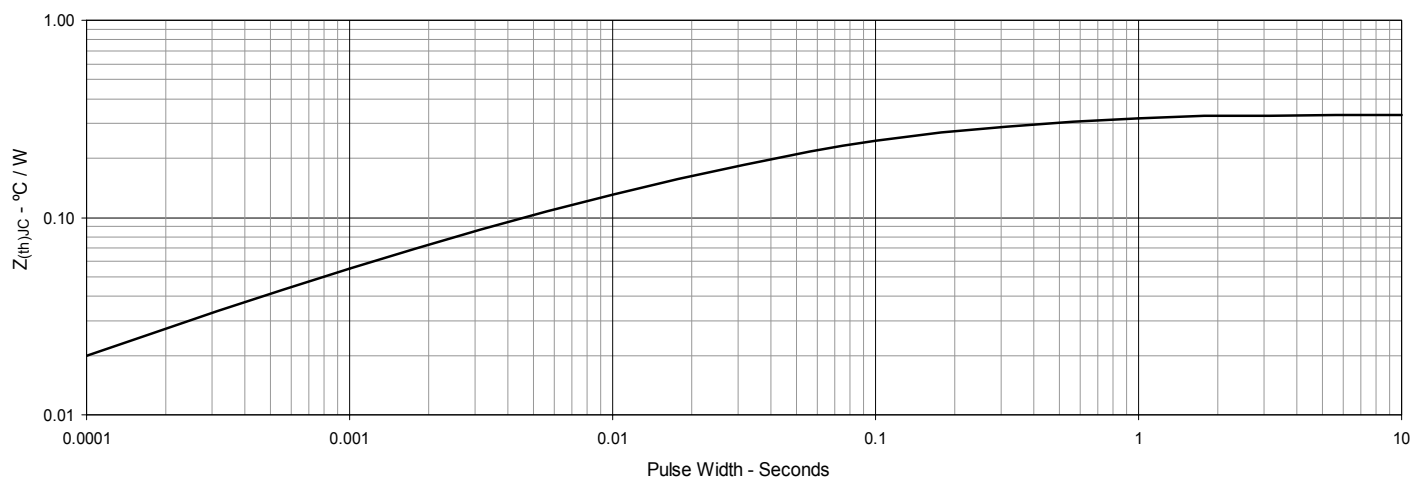


Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

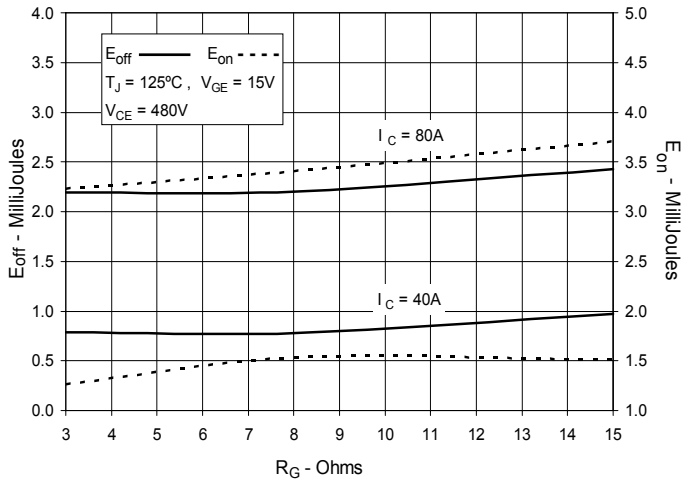


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

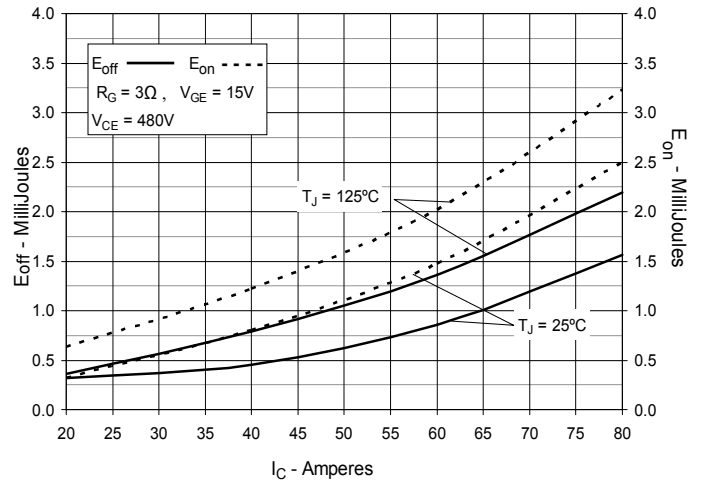


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

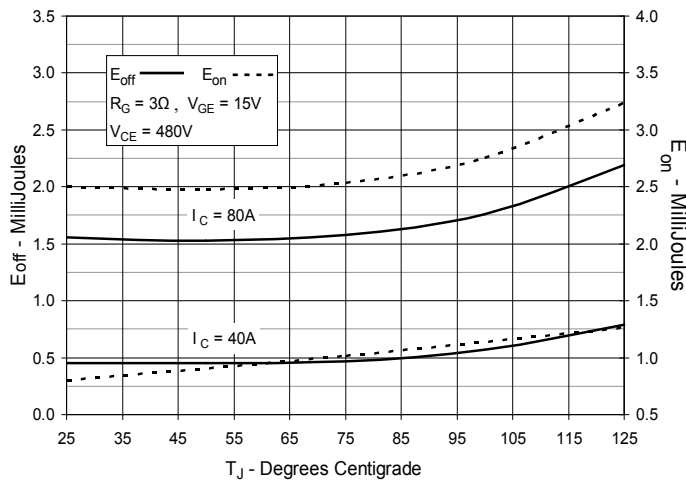


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

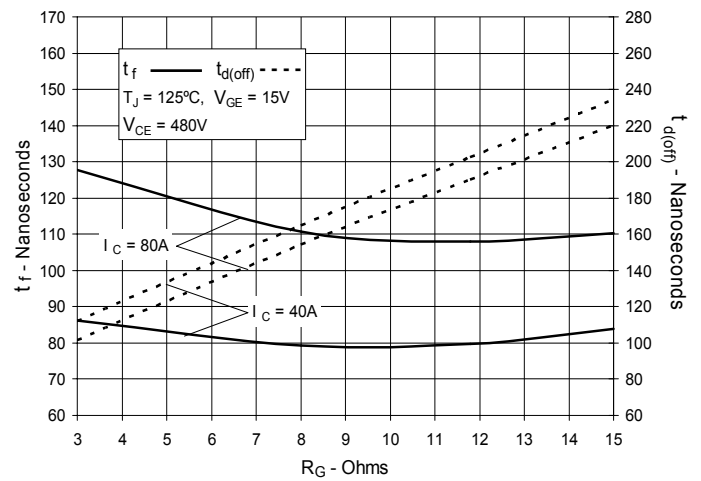


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

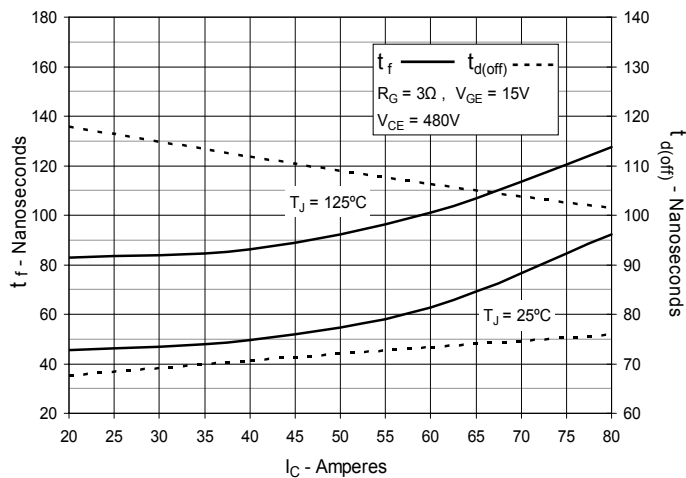


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

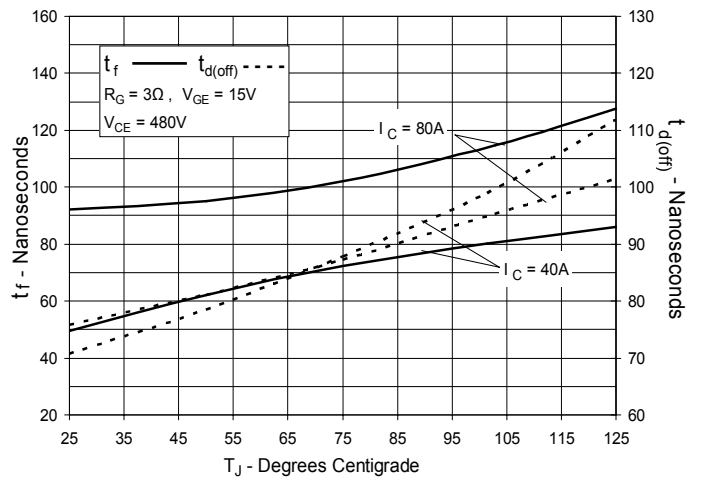


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

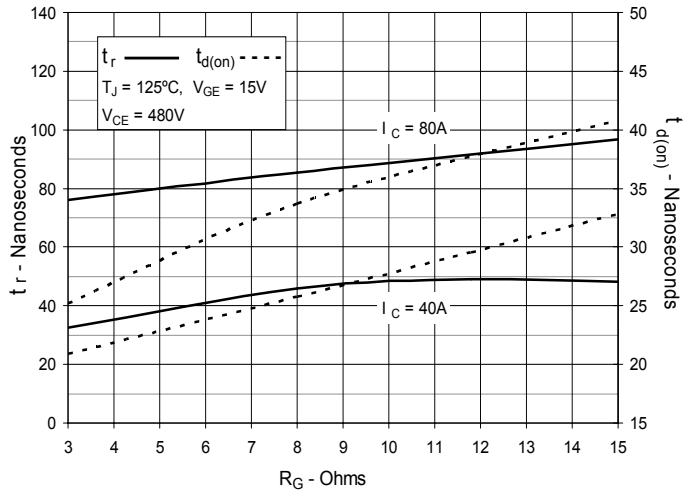


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

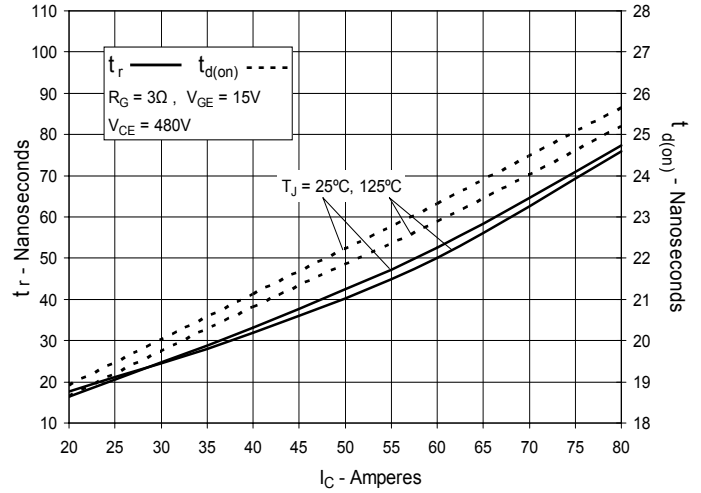
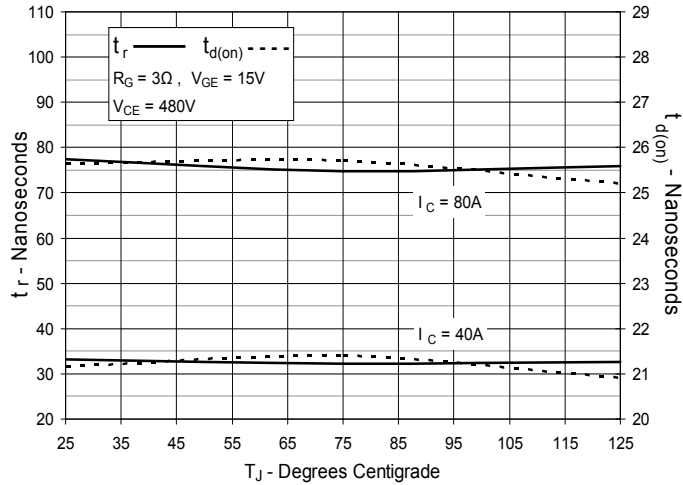


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature



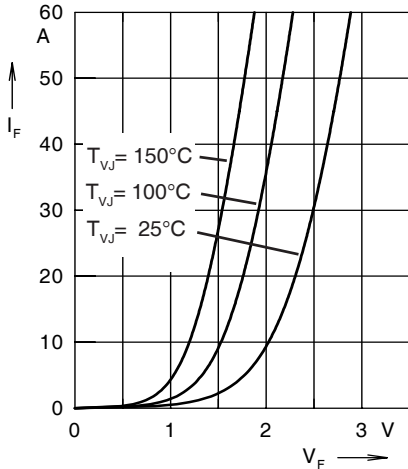


Fig. 21 Forward current I_F versus V_F

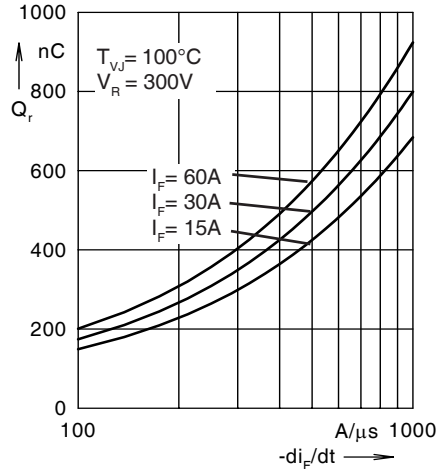


Fig. 22 Reverse recovery charge Q_r versus $-di_F/dt$

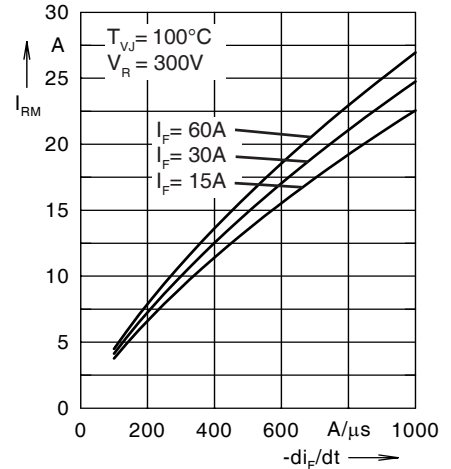


Fig. 23 Peak reverse current I_{RM} versus $-di_F/dt$

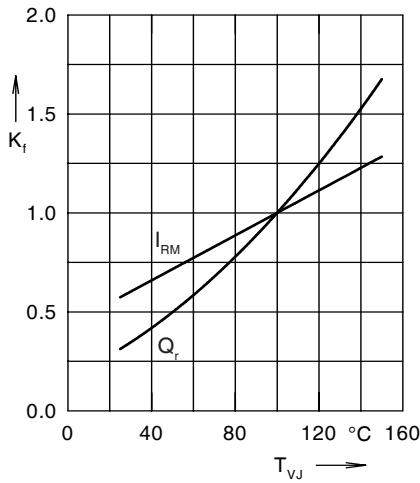


Fig. 24 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

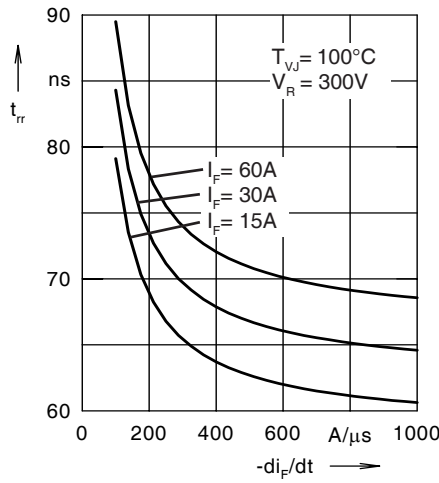


Fig. 25 Recovery time t_{rr} versus $-di_F/dt$

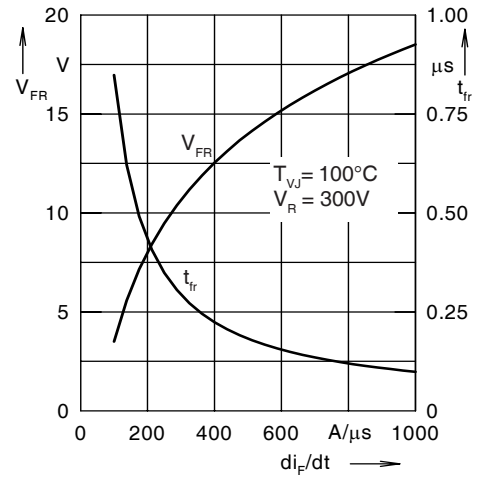


Fig. 26 Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

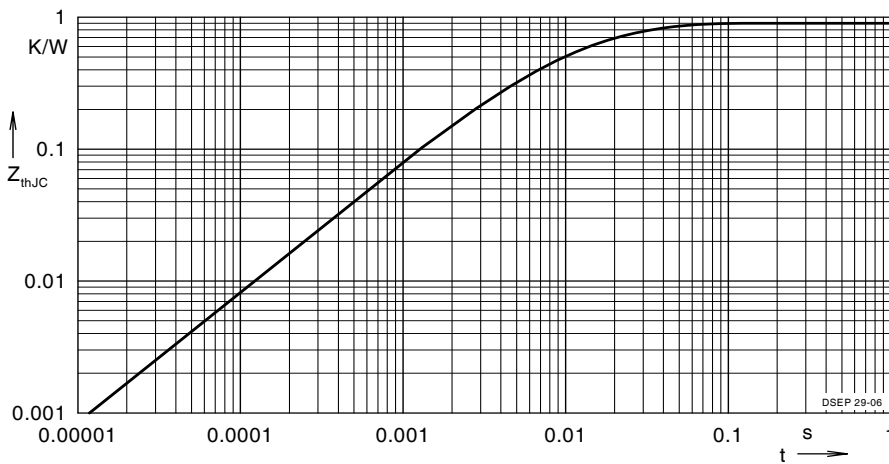


Fig. 27 Transient thermal resistance junction to case

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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