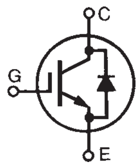
GenX3™ 600V IGBTs with Diode

IXGH60N60C3D1
IXGT60N60C3D1*

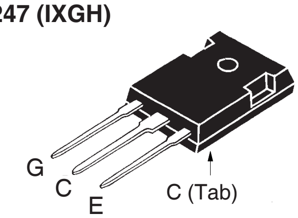
*Obsolete Part Number

V_{CES}	=	600V
I_{C110}	=	60A
$V_{CE(sat)}$	≤	2.5V
$t_{fi\ (typ)}$	=	50ns

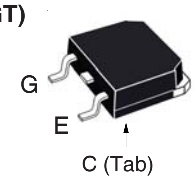
High Speed PT IGBTs for 40-100kHz switching



TO-247 (IXGH)



TO-268 (IXGT)



G = Gate　　C = Collector
E = Emitter　　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_{C25}	T_C = 25°C, (Limited by Leads)	75	A
I_{C110}	T_C = 110°C	60	A
I_{F110}	T_C = 110°C	26	A
I_{CM}	T_C = 25°C, 1ms	300	A
I_A	T_C = 25°C	40	A
E_{AS}	T_C = 25°C	400	mJ
SSOA (RBSOA)	V_{GE}= 15V, T_{VJ} = 125°C, R_G = 3Ω Clamped Inductive Load	I_{CM} = 125 $V_{CE} \leq V_{CES}$	A
P_C	T_C = 25°C	380	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 (TO-247)	1.13/10	Nm/lb.in.
Weight	TO-268	4	g
	TO-247	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} = V_{CES}, V_{GE}= 0V			50	μA
	T_J = 125°C			1	mA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±100	nA
$V_{CE(sat)}$	I_C = 40A, V_{GE} = 15V		2.2	2.5	V
	T_J = 125°C		1.7		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

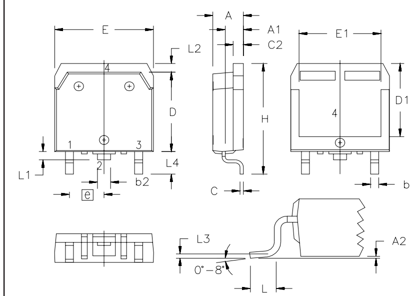
Symbol	Test Conditions (T_J = 25°C, Unless Otherwise Specified)	Min.	Typ.	Max.	
g_{fs}	I_C = 40A, V_{CE} = 10V, Note 1	23	38		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		2810		pF
C_{oes}			210		pF
C_{res}			80		pF
Q_g	I_C = 40A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		115		nC
Q_{ge}			22		nC
Q_{gc}			43		nC
$t_{d(on)}$	**Inductive Load, T_J = 125°C**		21		ns
t_{ri}	I_C = 40A, V_{GE} = 15V		33		ns
E_{on}	V_{CE} = 480V, R_G = 3Ω		0.80		mJ
$t_{d(off)}$	Note 2		70	110	ns
t_{fi}			50		ns
E_{off}			0.45	0.80	mJ
$t_{d(on)}$	**Inductive Load, T_J = 125°C**		21		ns
t_{ri}	I_C = 40A, V_{GE} = 15V		33		ns
E_{on}	V_{CE} = 480V, R_G = 3Ω		1.25		mJ
$t_{d(off)}$	Note 2		112		ns
t_{fi}			86		ns
E_{off}			0.80		mJ
R_{thJC}				0.33	°C/W
R_{thCK}			0.21		°C/W

Reverse Diode (FRED)

Symbol	Test Conditions (T_J = 25°C, Unless Otherwise Specified)	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 =100 A/μs, T_J = 100°C			4	A
t_{rr}	V_R = 100V, T_J =100°C		100		ns
	I_F = 1A; -di/dt = 100 A/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.

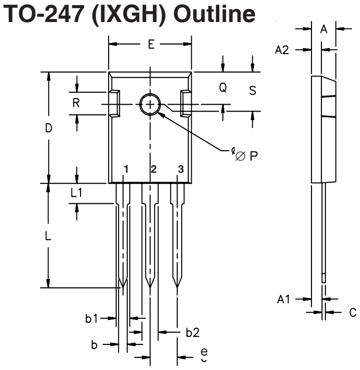
TO-268 (IXGT) Outline



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

SYM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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 2 - Collector
3 - Emitter Tab - Collector

Dim.	Millimeter Min.	Millimeter Max.	Inches Min.	Inches 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	

Fig. 1. Output Characteristics @ T_J = 25ºC

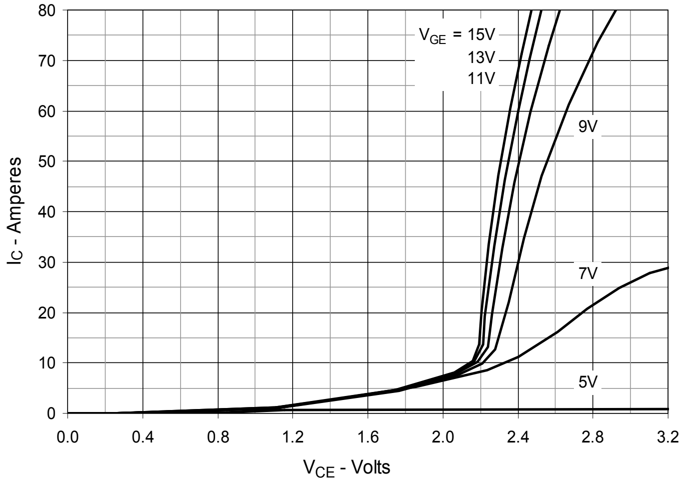


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

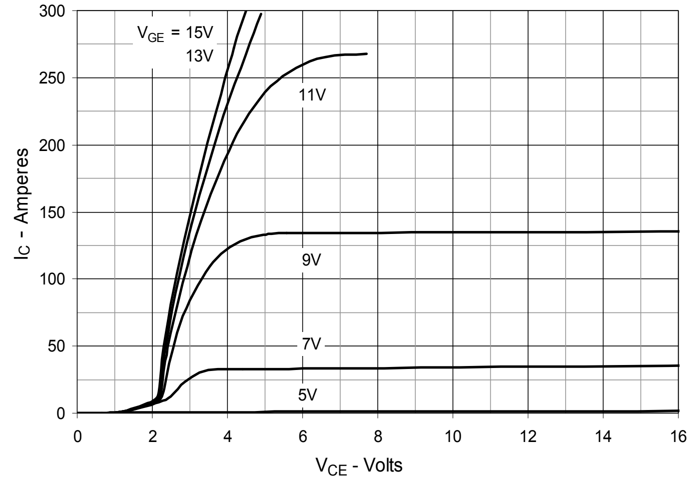


Fig. 3. Output Characteristics @ T_J = 125ºC

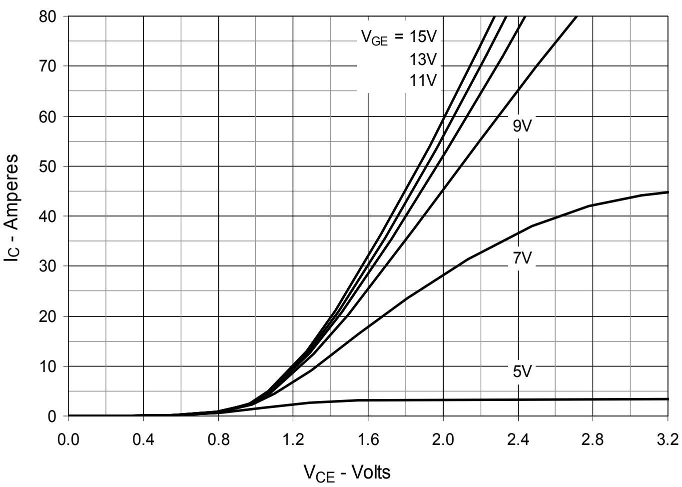


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

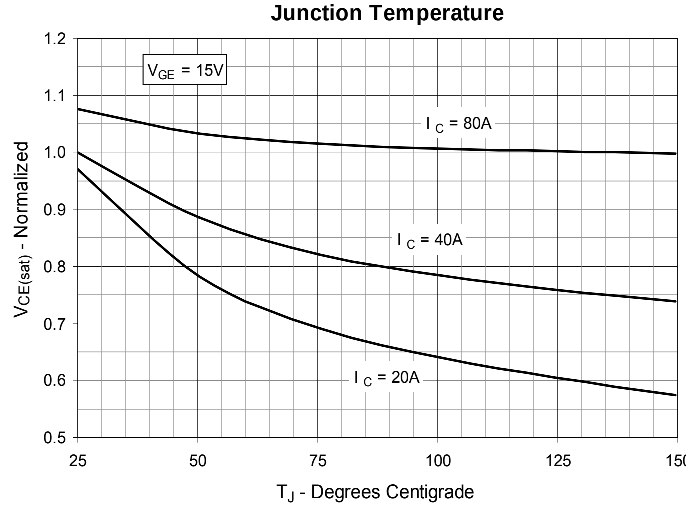


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

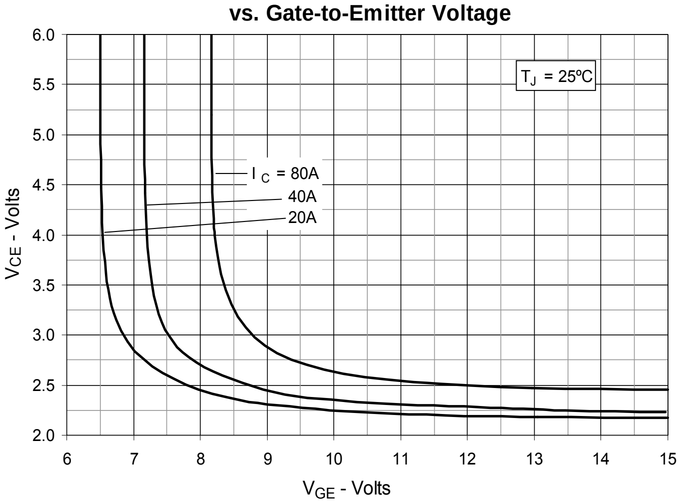


Fig. 6. Input Admittance

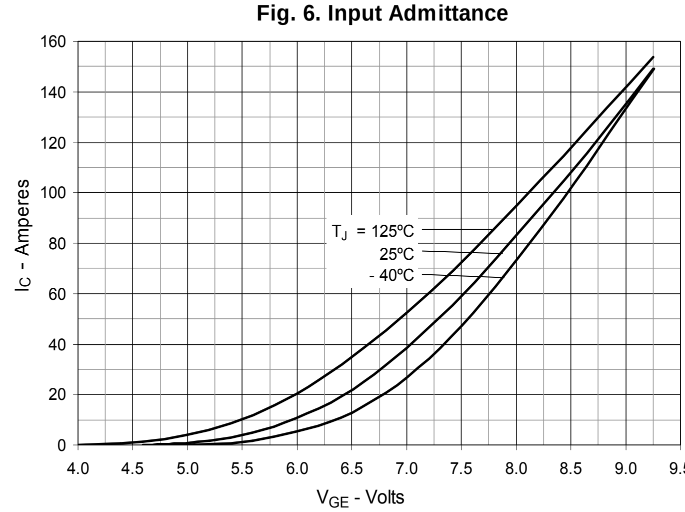


Fig. 7. Transconductance

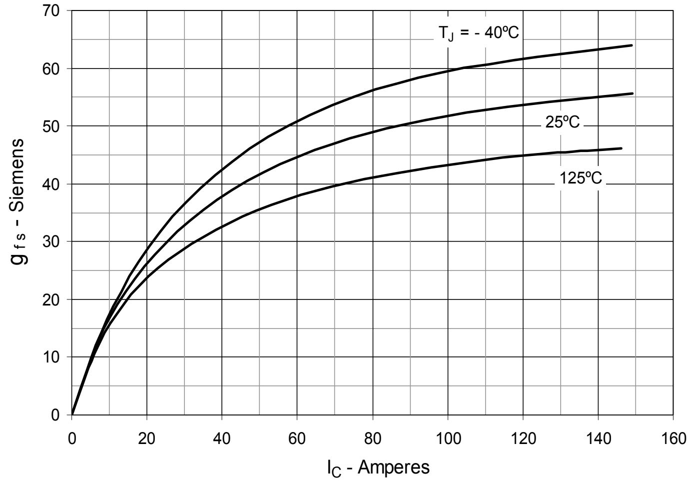


Fig. 8. Gate Charge

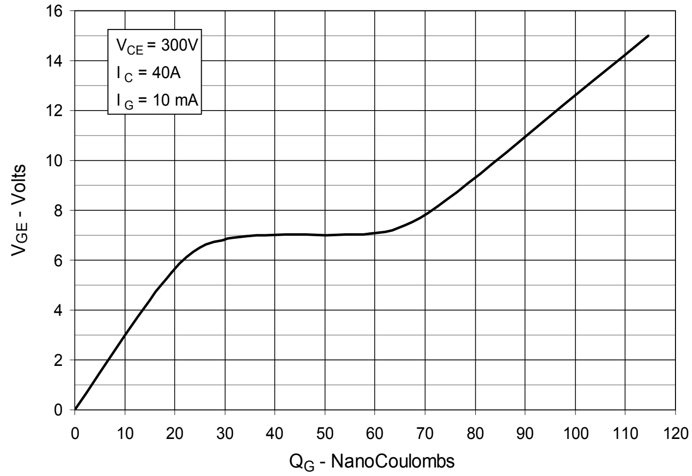


Fig. 9. Capacitance

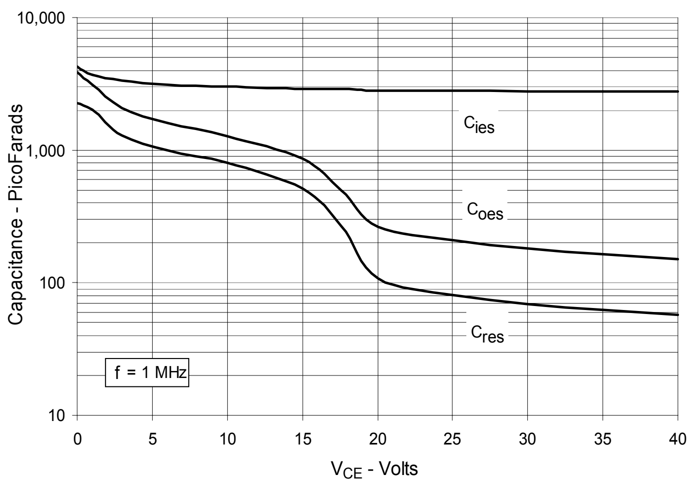


Fig. 10. Reverse-Bias Safe Operating Area

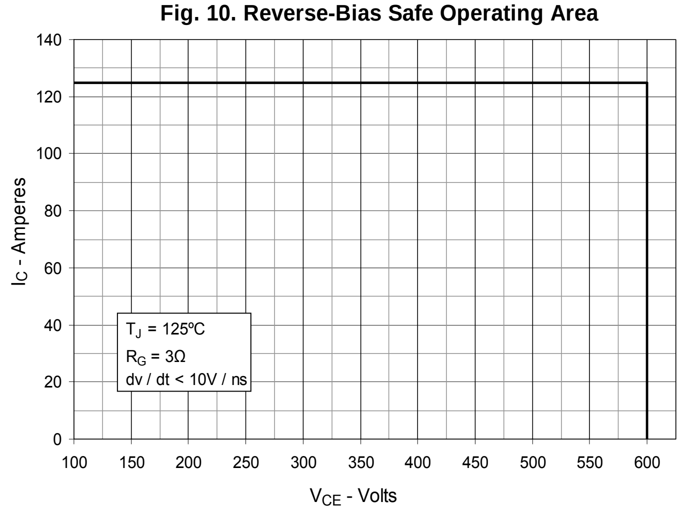


Fig. 11. Maximum Transient Thermal Impedance

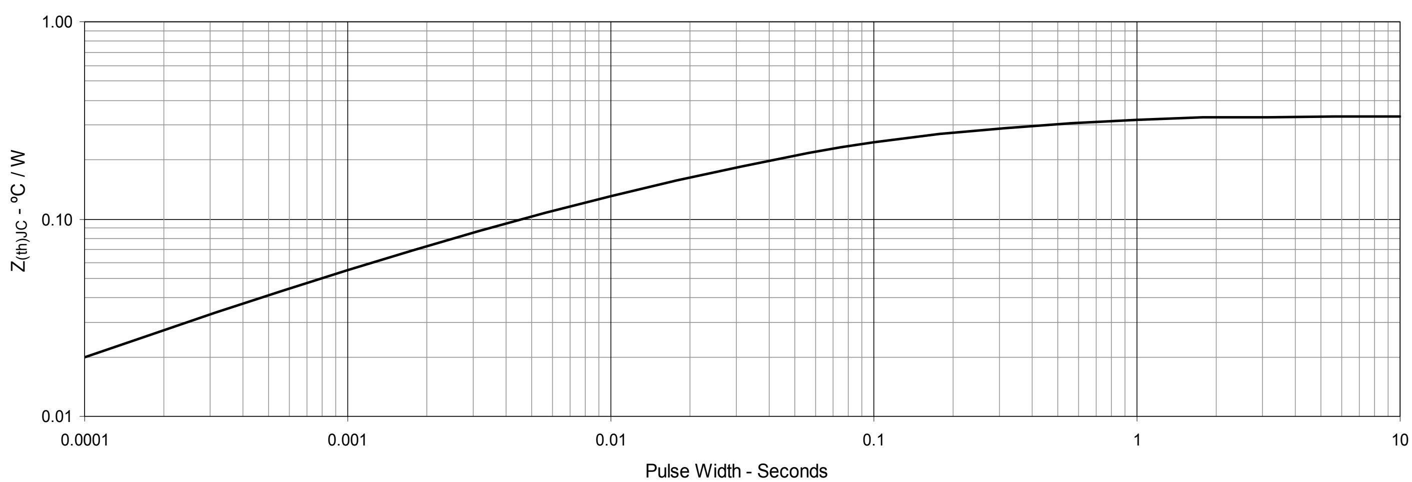


Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

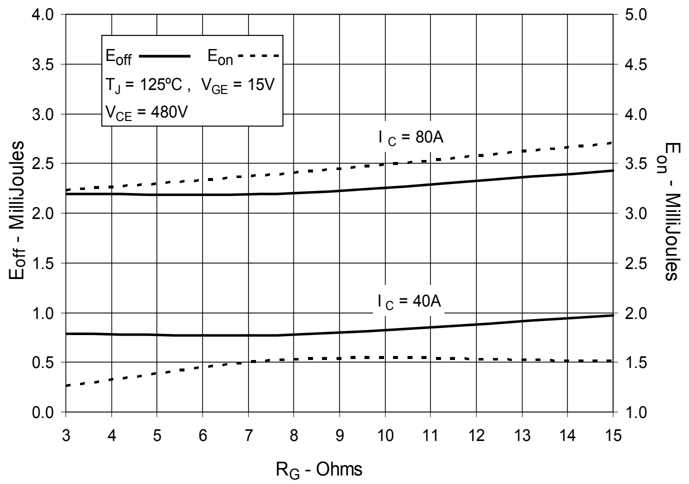


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

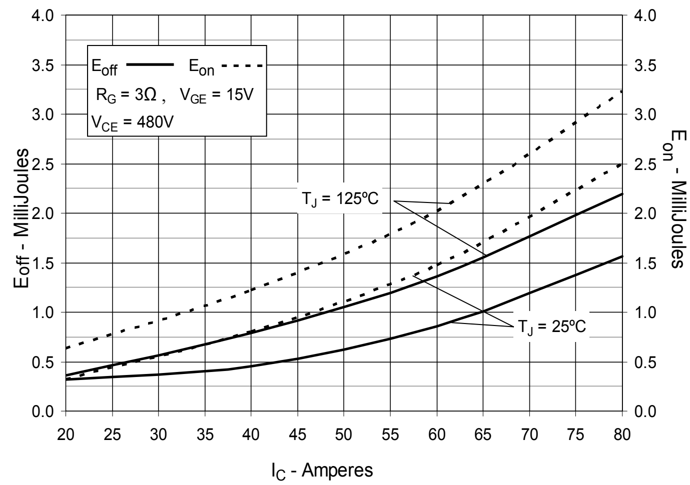


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

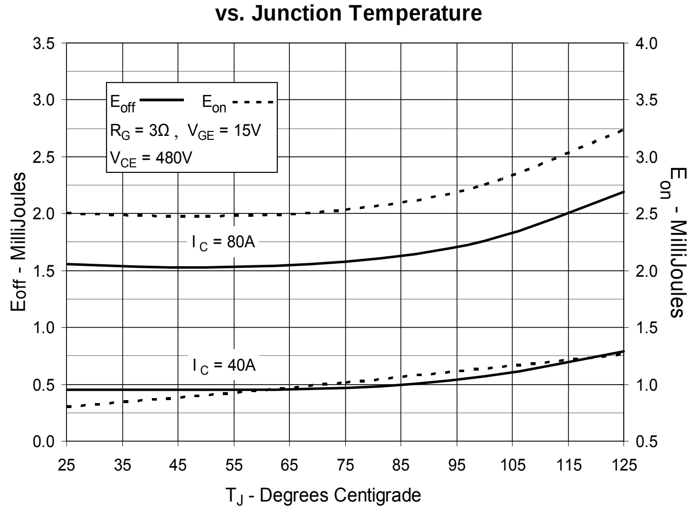


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

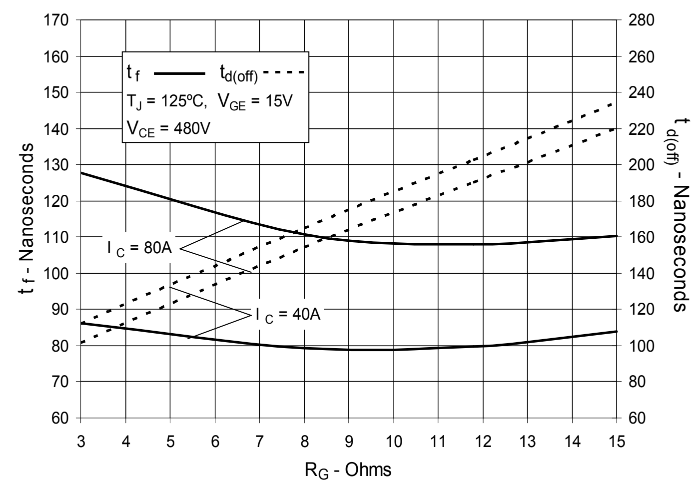


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

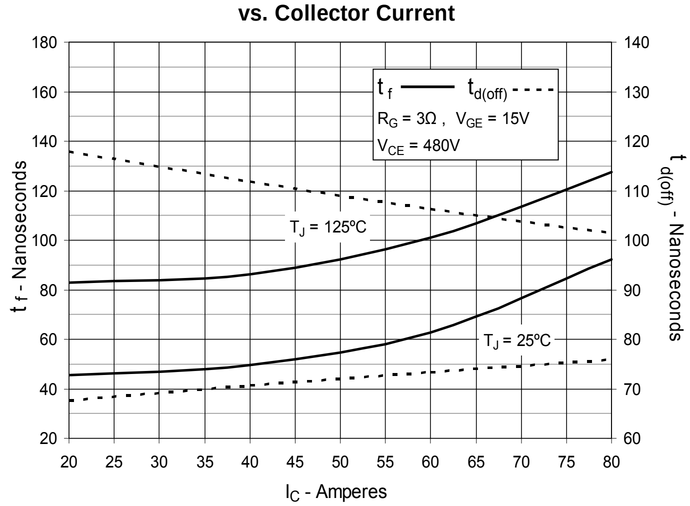


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

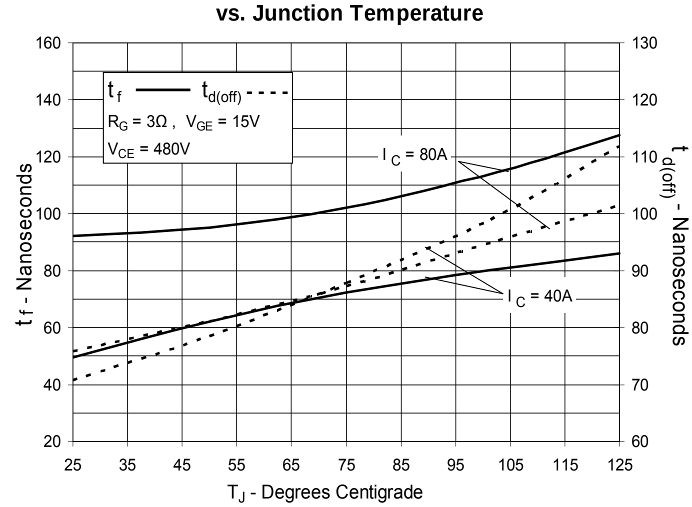


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

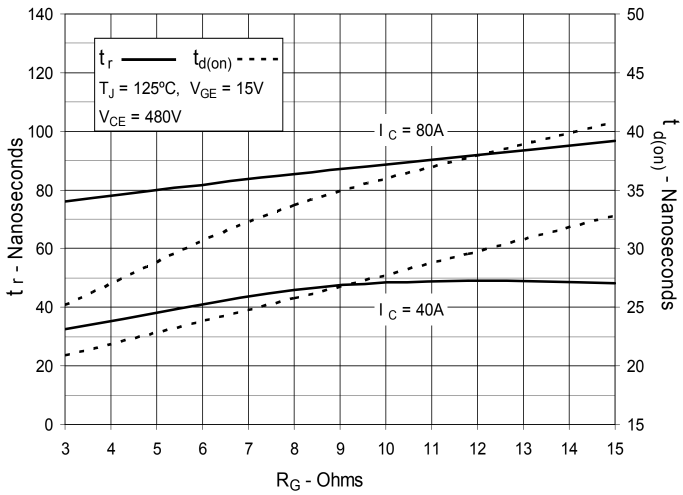


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

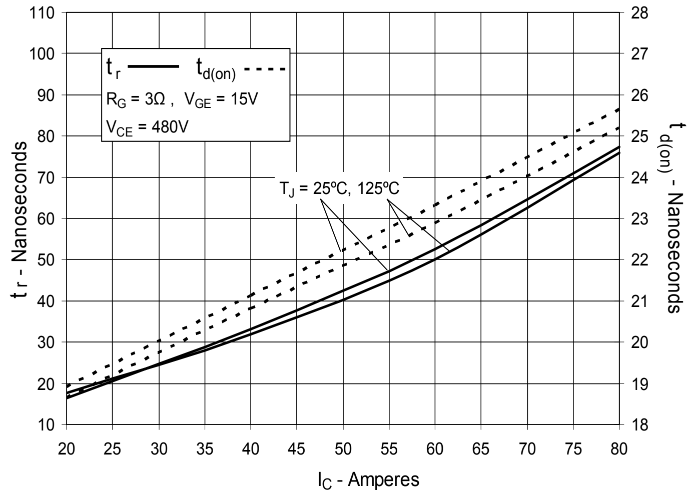
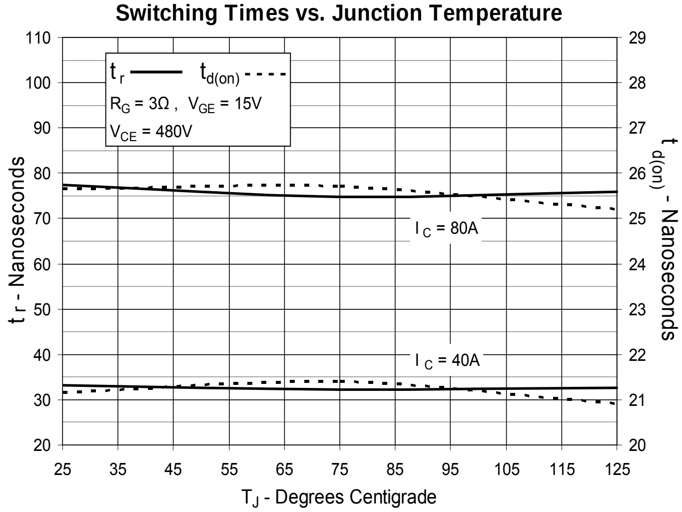


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature



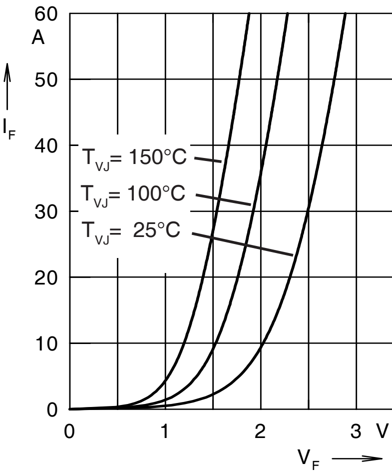


Fig. 21 Forward current I_F versus V_F

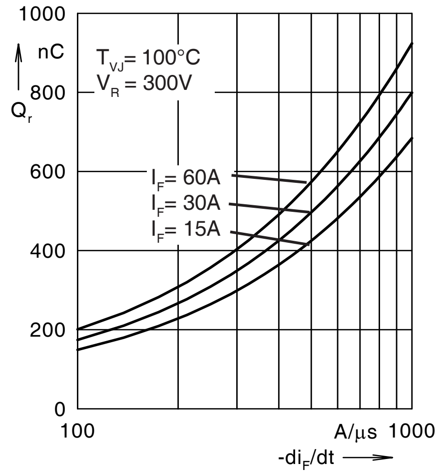


Fig. 22 Reverse recovery charge Q_r versus $-di_F/dt$

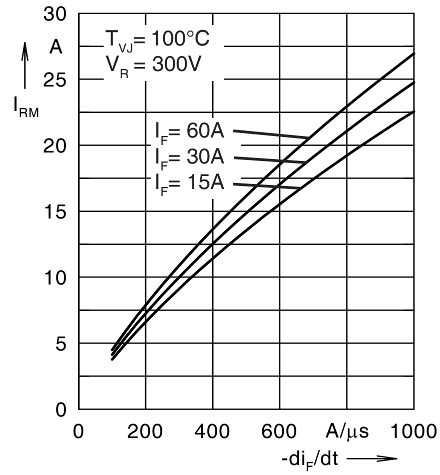


Fig. 23 Peak reverse current I_{RM} versus $-di_F/dt$

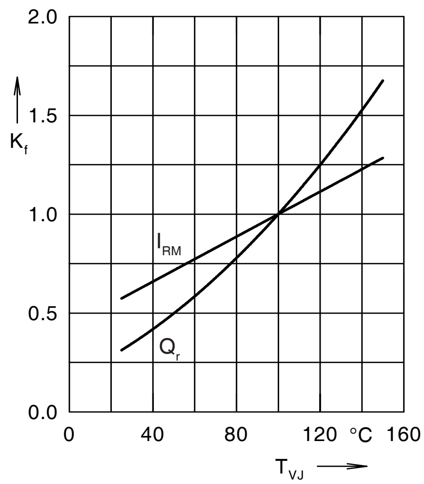


Fig. 24 Dynamic parameters Q_r, I_{RM} versus T_{VJ}

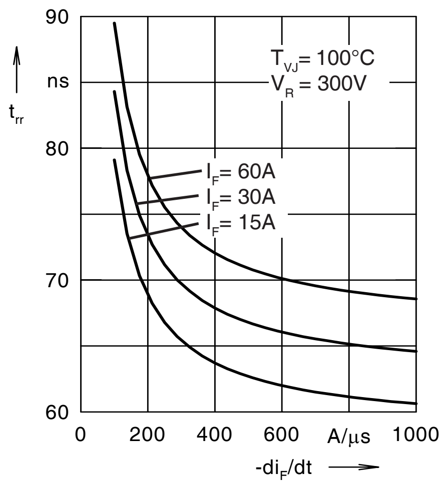


Fig. 25 Recovery time t_{rr} versus $-di_F/dt$

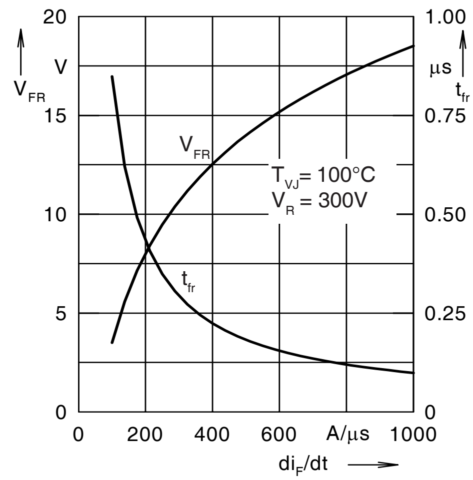


Fig. 26 Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

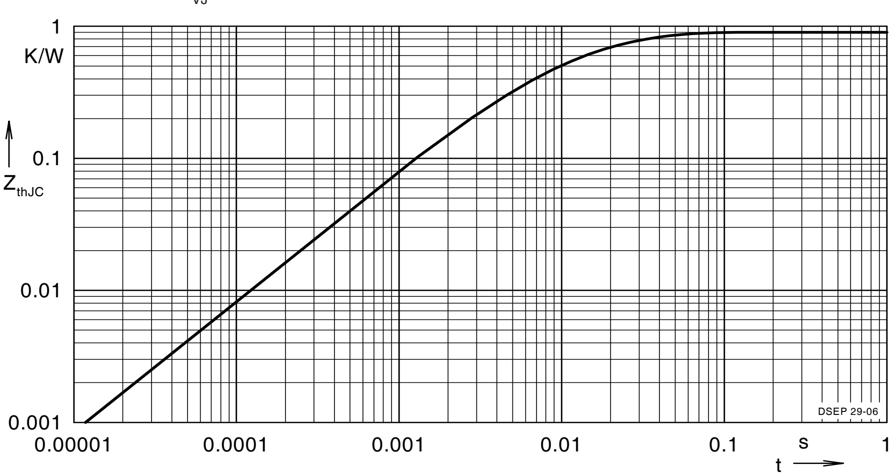


Fig. 27 Transient thermal resistance junction to case

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