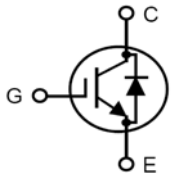
IXYS

XPT™ 650V IGBT GenX3™ w/Diode

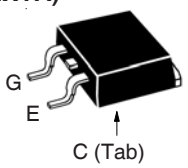
IXYA20N65C3D1
IXYP20N65C3D1

V_{CES} = 650V
I_{C110} = 20A
$V_{CE(sat)}$ ≤ 2.50V
$t_{fi(typ)}$ = 28ns

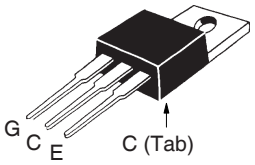
Extreme Light Punch Through
IGBT for 20-60kHz Switching



TO-263 AA (IXYA)



TO-220AB (IXYP)



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

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 175°C	650	V
V_{CGR}	T_J = 25°C to 175°C, R_{GE} = 1MΩ	650	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	50	A
I_{C110}	T_C = 110°C	20	A
I_{F110}	T_C = 110°C	18	A
I_{CM}	T_C = 25°C, 1ms	105	A
I_A	T_C = 25°C	10	A
E_{AS}	T_C = 25°C	200	mJ
SSOA (RBSOA)	V_{GE} = 15V, T_{VJ} = 150°C, R_G = 20Ω Clamped Inductive Load	I_{CM} = 40 $V_{CE} \leq V_{CES}$	A
t_{sc} (SCSOA)	V_{GE} = 15V, V_{CE} = 360V, T_J = 150°C R_G = 82Ω, Non Repetitive	10	μs
P_C	T_C = 25°C	200	W
T_J		-55 ... +175	°C
T_{JM}		175	°C
T_{stg}		-55 ... +175	°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-220)	1.13/10	Nm/lb.in
F_C	Mounting Force (TO-263)	10..65 / 2.2..14.6	N/lb
Weight	TO-263	2.5	g
	TO-220	3.0	g

Symbol	Test Conditions (T_J = 25°C, Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
BV_{CES}	I_C = 250μA, V_{GE} = 0V	650			V
$V_{GE(th)}$	I_C = 250μA, V_{CE} = V_{GE}	3.5		6.0	V
I_{CES}	V_{CE} = V_{CES}, V_{GE} = 0V			10	μA
	T_J = 150°C			400	μA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±100	nA
$V_{CE(sat)}$	I_C = 20A, V_{GE} = 15V, Note 1		2.27	2.50	V
	T_J = 150°C		2.44		V

Features

- Optimized for 20-60kHz Switching
- Square RBSOA
- Avalanche Rated
- Anti-Parallel Fast Diode
- Short Circuit Capability
- International Standard Packages

Advantages

- High Power Density
- Extremely Rugged
- Low Gate Drive Requirement

Applications

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

Symbol	Test Conditions (T_J = 25°C Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
g_{fs}	I_C = 20A, V_{CE} = 10V, Note 1	7	12		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		822		pF
C_{oes}			67		pF
C_{res}			19		pF
$Q_{g(on)}$	I_C = 20A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		30		nC
Q_{ge}			6		nC
Q_{gc}			15		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		19		ns
t_{ri}	I_C = 20A, V_{GE} = 15V		34		ns
E_{on}	V_{CE} = 400V, R_G = 20Ω		0.43		mJ
$t_{d(off)}$	Note 2		80		ns
t_{fi}			28		ns
E_{off}			0.35	0.65	mJ
$t_{d(on)}$	**Inductive load, T_J = 150°C**		18		ns
t_{ri}	I_C = 20A, V_{GE} = 15V		33		ns
E_{on}	V_{CE} = 400V, R_G = 20Ω		0.70		mJ
$t_{d(off)}$	Note 2		96		ns
t_{fi}			36		ns
E_{off}			0.40		mJ
R_{thJC}				0.65	°C/W
R_{thCS}	TO-220		0.50		°C/W

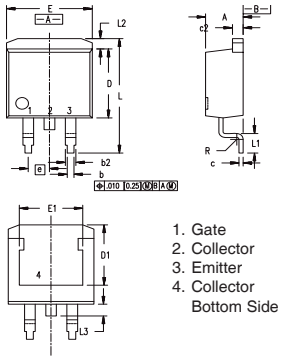
Reverse Diode (FRED)

Symbol	Test Conditions (T_J = 25°C, Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
V_F	I_F = 20A, V_{GE} = 0V, Note 1			2.5	V
	T_J = 150°C		1.5		V
I_{RM}	I_F = 20A, V_{GE} = 0V,		11		A
t_{rr}	$-di_F/dt$ = 300A/μs, V_R = 400V, T_J = 150°C		135		ns
R_{thJC}				1.85	°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.

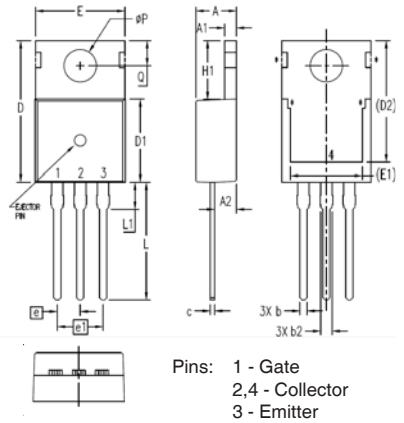
TO-263 Outline



1. Gate
2. Collector
3. Emitter
4. Collector
   Bottom Side

Dim.	Millimeter Min.	Millimeter Max.	Inches Min.	Inches Max.
A	4.06	4.83	.160	.190
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.40	0.74	.016	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	8.00	8.89	.280	.320
E	9.65	10.41	.380	.405
E1	6.22	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.13	0	.005

TO-220 Outline



Pins: 1 - Gate
2,4 - Collector
3 - Emitter

SYM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	.169	.185	4.30	4.70
A1	.047	.055	1.20	1.40
A2	.079	.106	2.00	2.70
b	.024	.039	0.60	1.00
b2	.045	.057	1.15	1.45
c	.014	.026	0.35	0.65
D	.587	.626	14.90	15.90
D1	.335	.370	8.50	9.40
(D2)	.500	.531	12.70	13.50
E	.382	.406	9.70	10.30
(E1)	.283	.323	7.20	8.20
e	.100 BSC		2.54 BSC	
e1	.200 BSC		5.08 BSC	
H1	.244	.268	6.20	6.80
L	.492	.547	12.50	13.90
L1	.110	.154	2.80	3.90
ØP	.134	.150	3.40	3.80
Q	.106	.126	2.70	3.20

Fig. 1. Output Characteristics @ T_J = 25ºC

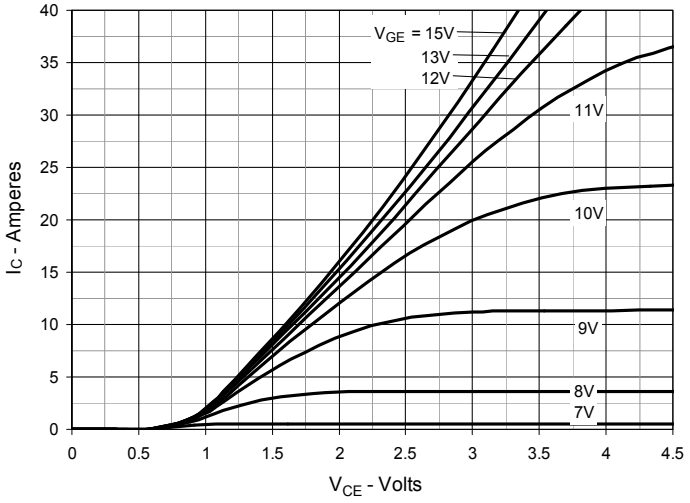


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

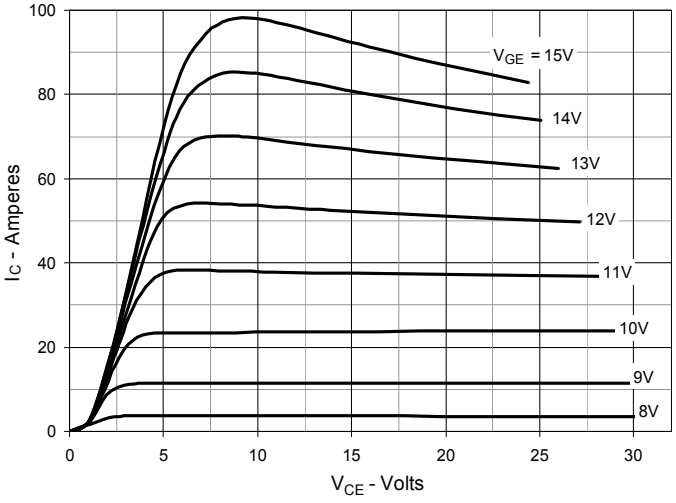


Fig. 3. Output Characteristics @ T_J = 150ºC

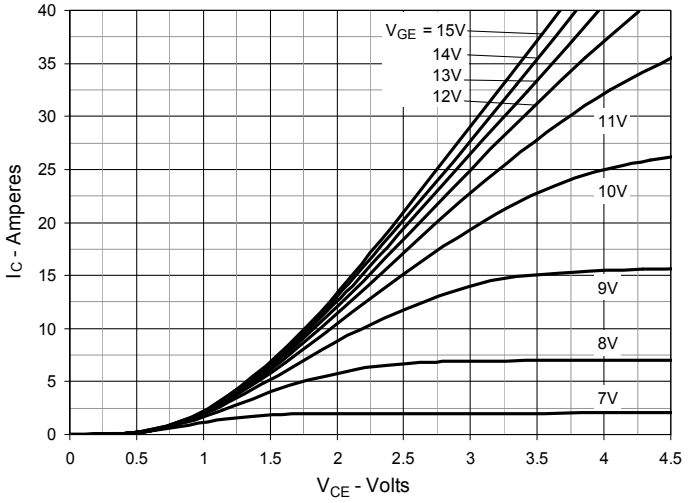


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

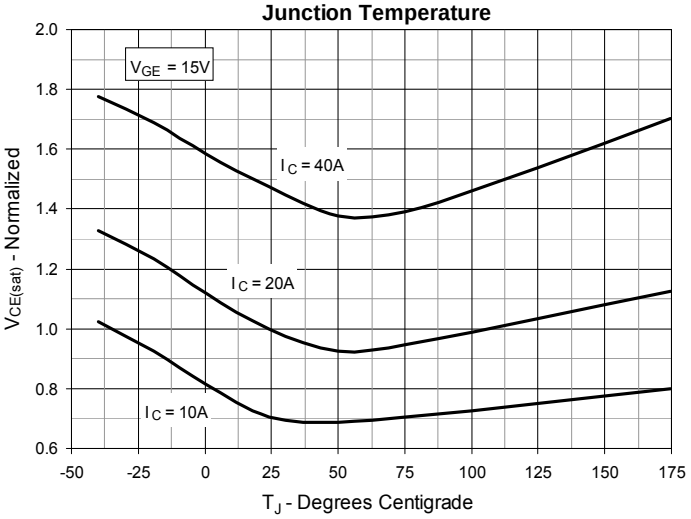


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

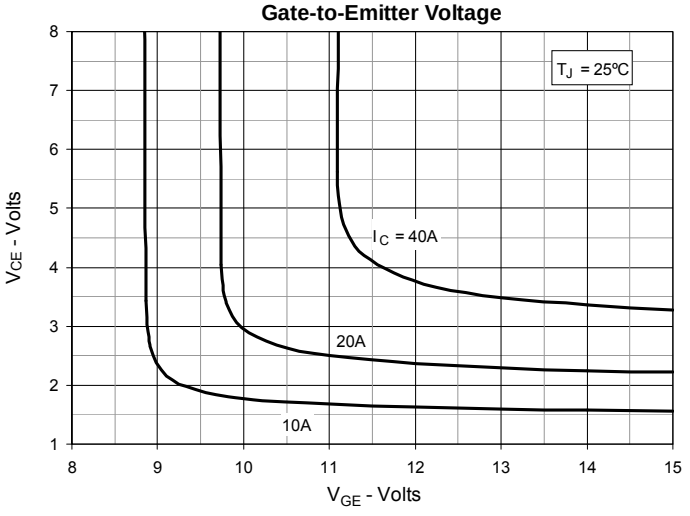


Fig. 6. Input Admittance

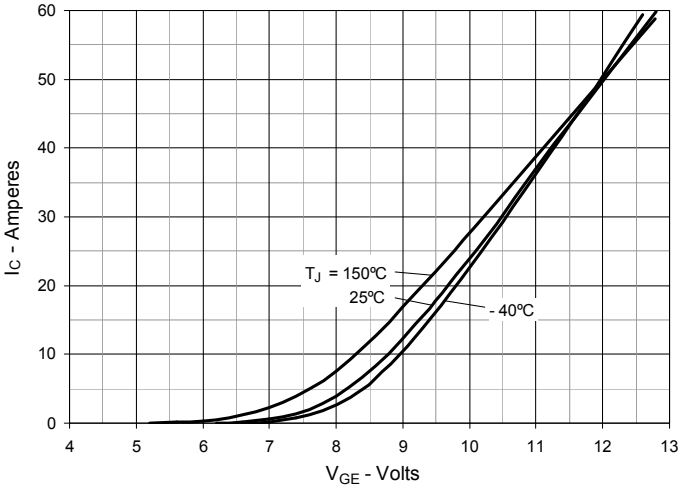


Fig. 7. Transconductance

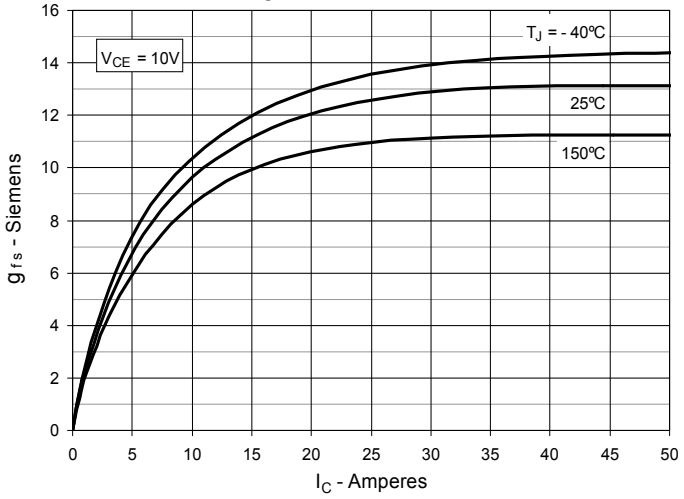


Fig. 8. Gate Charge

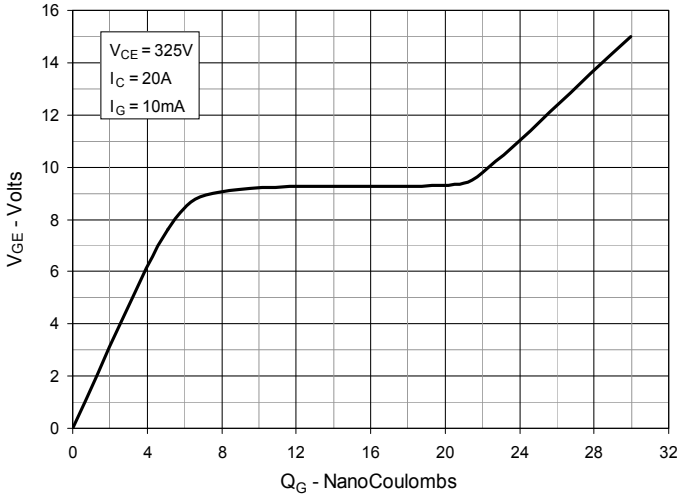


Fig. 9. Capacitance

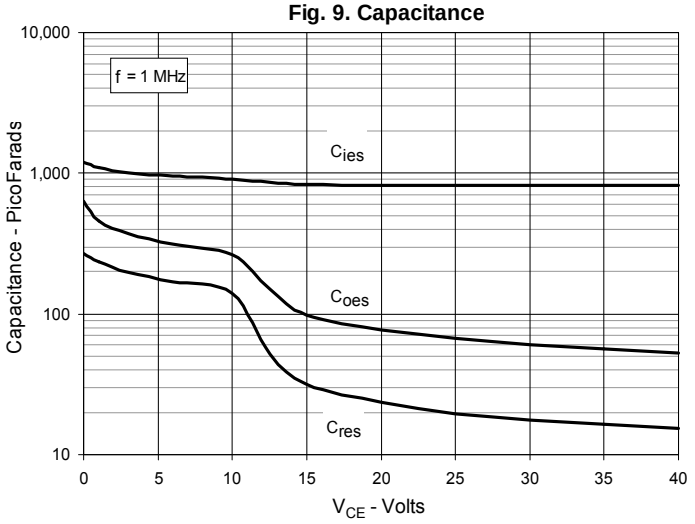


Fig. 10. Reverse-Bias Safe Operating Area

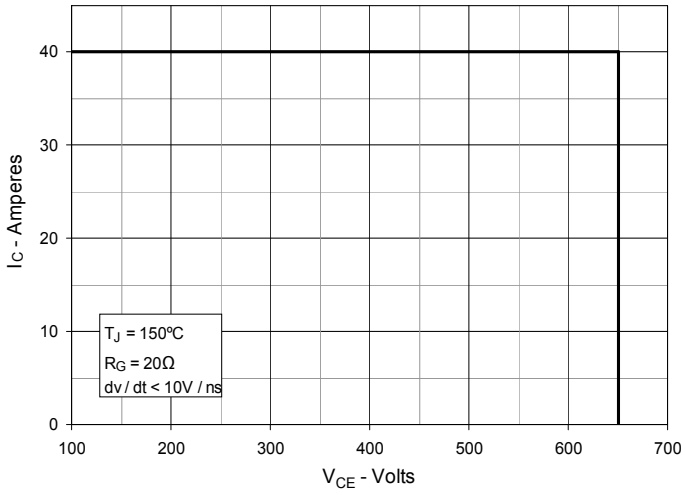


Fig. 11. Forward-Bias Safe Operating Area

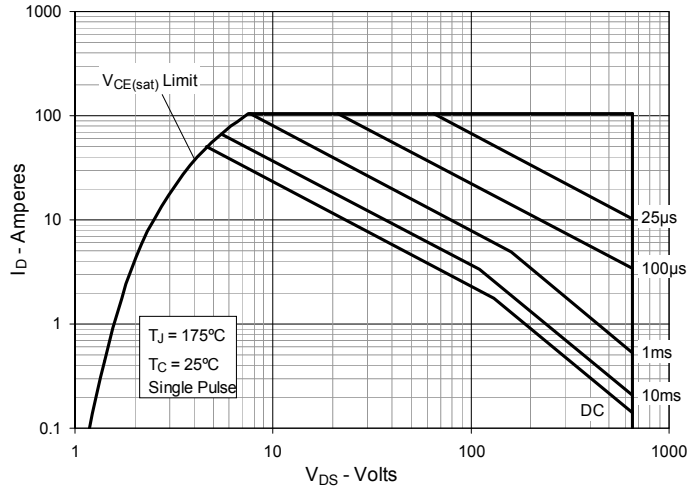


Fig. 12. Maximum Transient Thermal Impedance (IGBT)

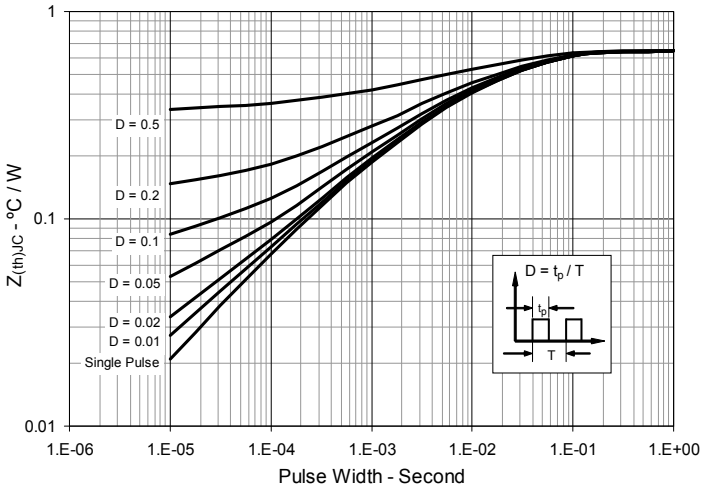


Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance

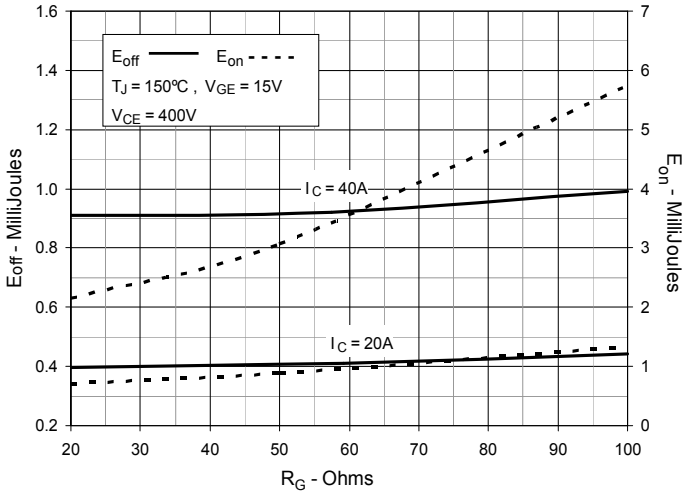


Fig. 14. Inductive Switching Energy Loss vs. Collector Current

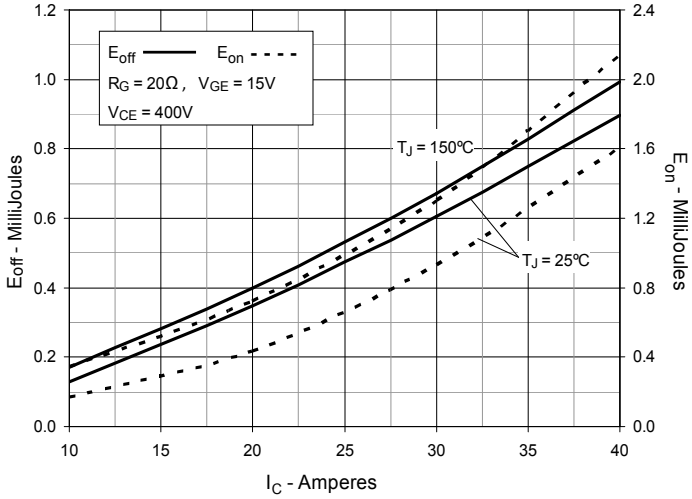


Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature

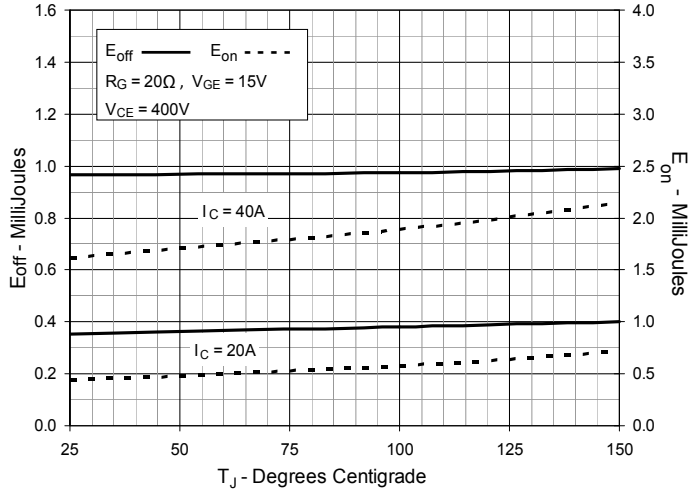


Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance

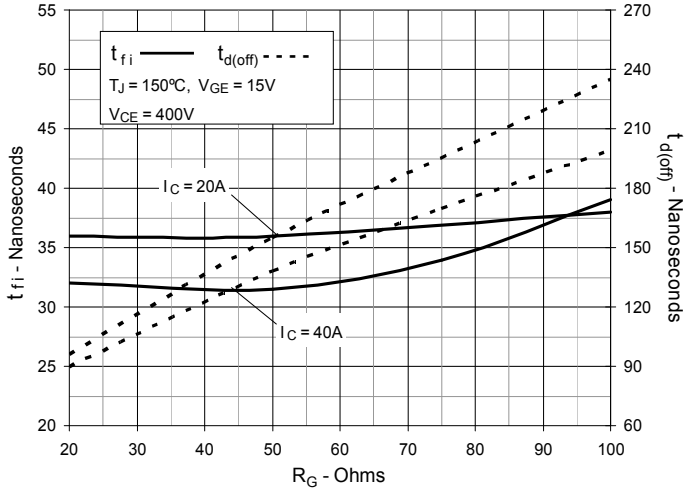


Fig. 17. Inductive Turn-off Switching Times vs. Collector Current

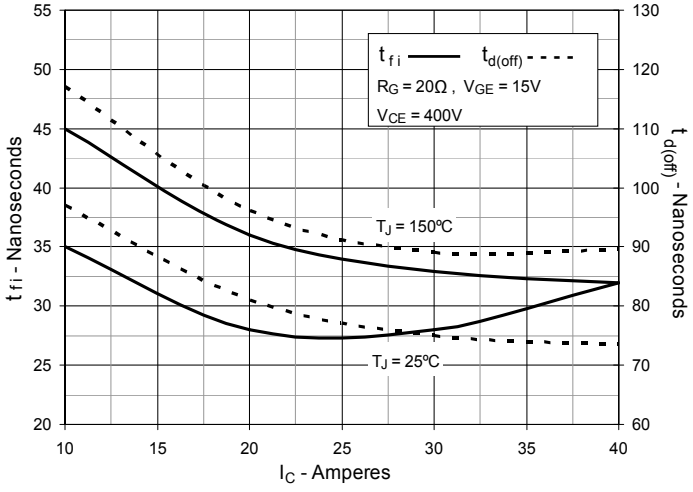


Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature

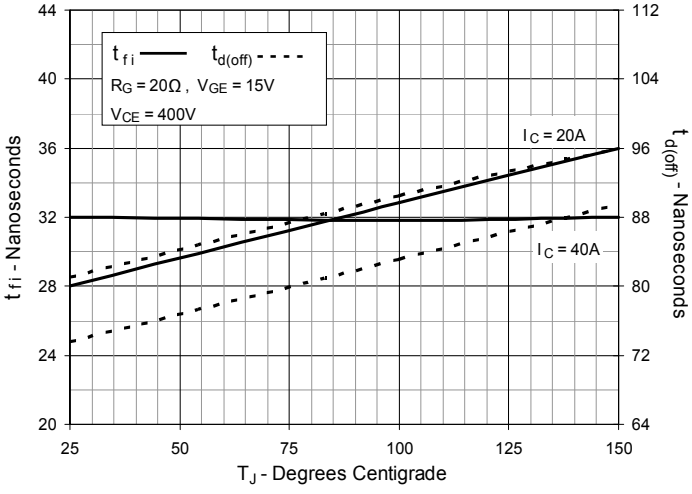


Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance

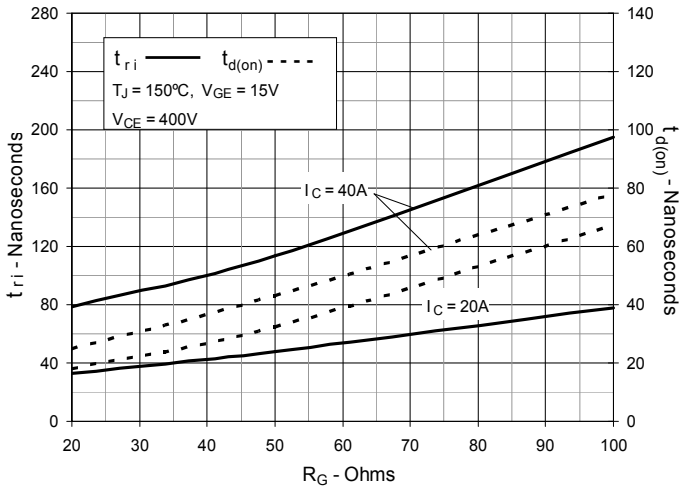


Fig. 20. Inductive Turn-on Switching Times vs. Collector Current

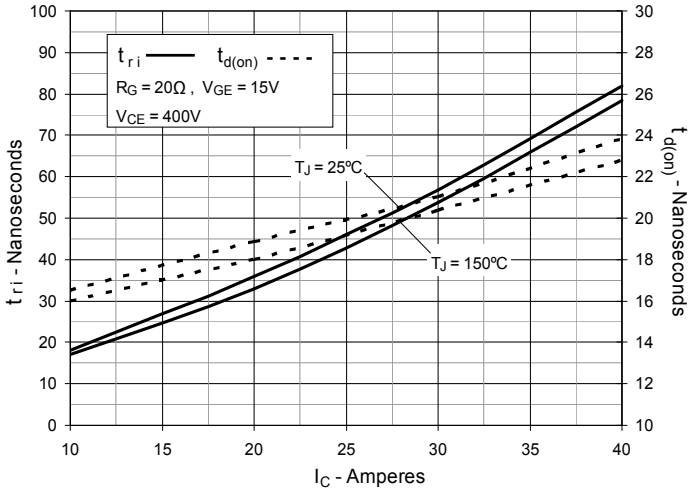


Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature

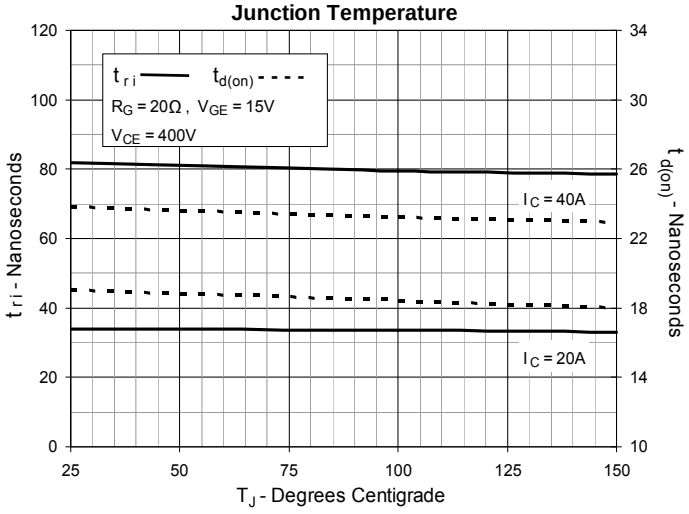


Fig. 22. Diode Forward Characteristics

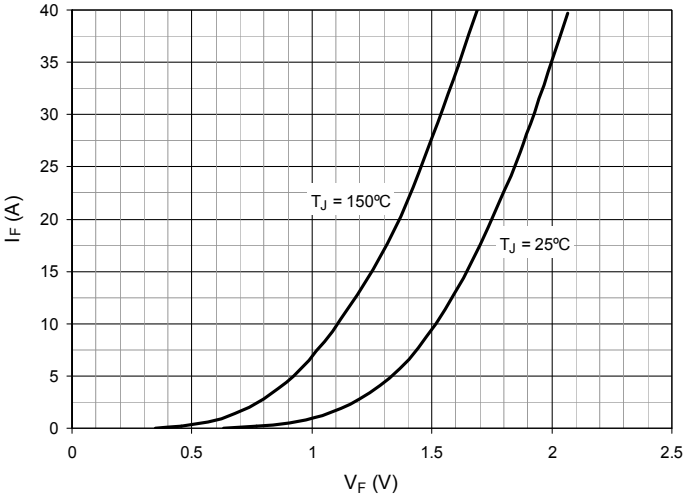


Fig. 23. Reverse Recovery Charge vs. -di$_F$/dt

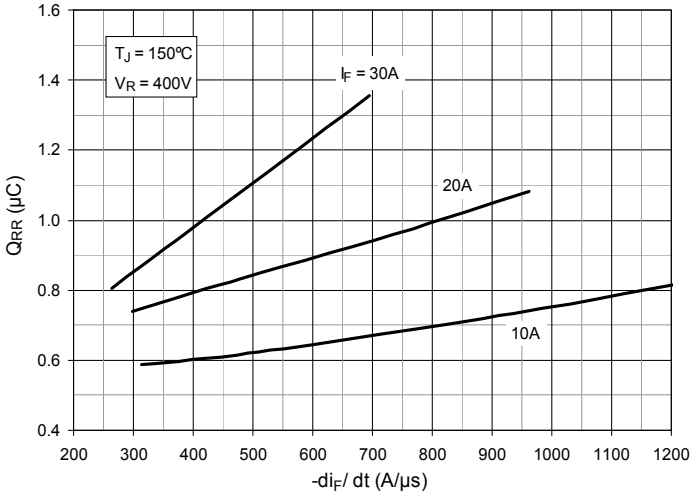


Fig. 24 Reverse Recovery Current vs. -di$_F$/dt

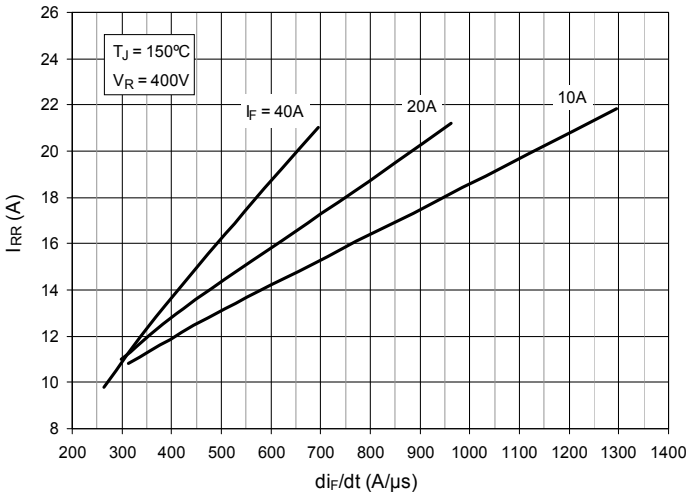


Fig. 25. Reverse Recovery Time vs. -di$_F$/dt

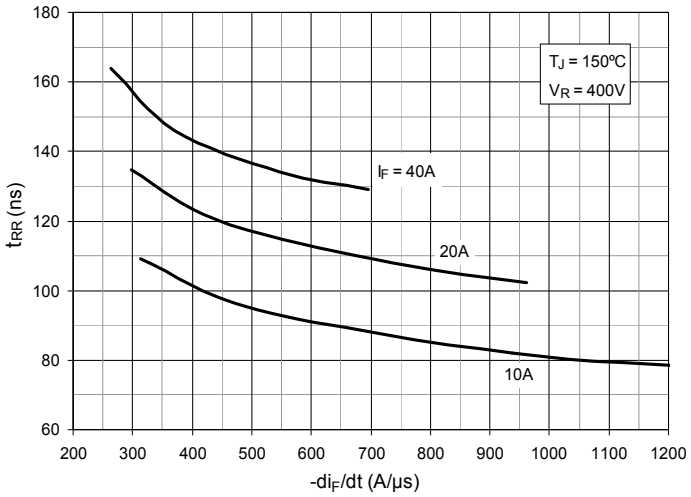


Fig. 26. Dynamic Parameters Q_{RR}, I_{RR} vs. Junction Temperature

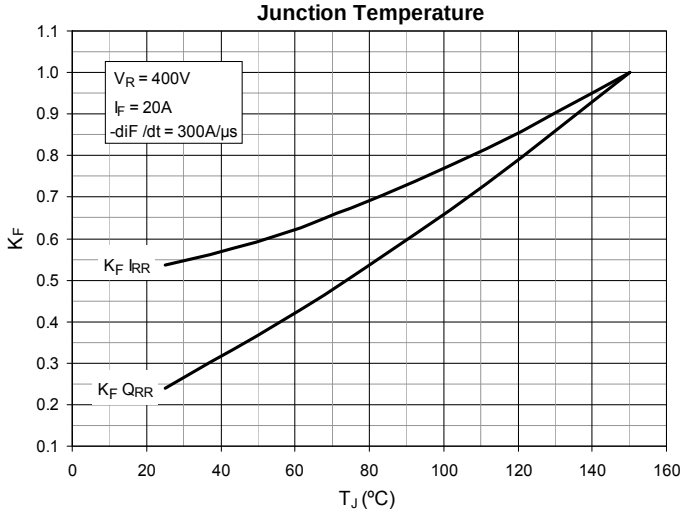


Fig. 27. Maximum Transient Thermal Impedance (Diode)

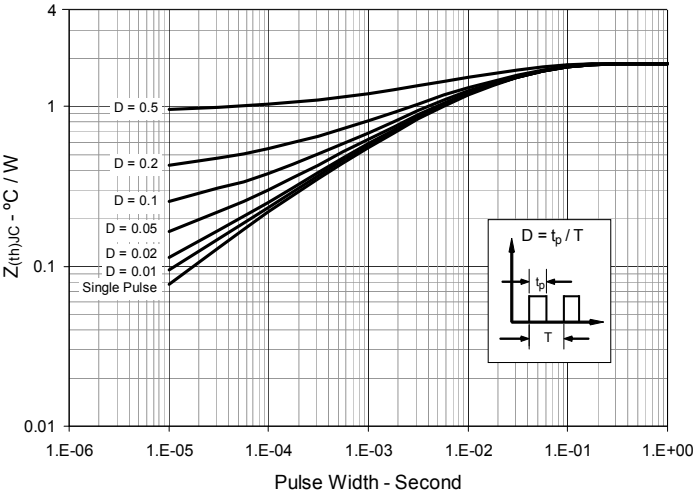
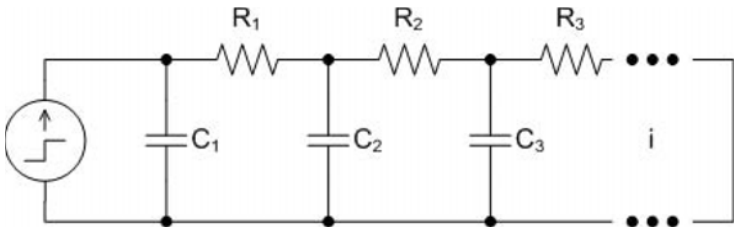


Fig. 28. Cauer Thermal Network



IGBT

i	Ri (°C/W)	Ci (J/°C)
1	0.170320	0.0017715
2	0.136990	0.0166820
3	0.090011	0.0391660

DIODE

i	Ri (°C/W)	Ci (J/°C)
1	0.331730	0.0002858
2	0.768860	0.0037423
3	0.285550	0.0432130

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