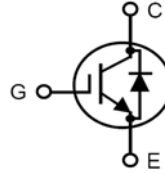


XPT™ 650V IGBT GenX3™ w/Diode

IXYA20N65C3D1 IXYP20N65C3D1

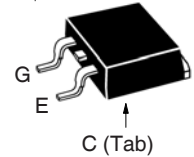
Extreme Light Punch Through
IGBT for 20-60kHz Switching



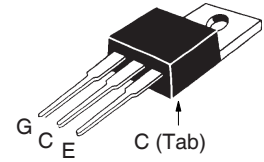
$$\begin{aligned} V_{CES} &= 650V \\ I_{C110} &= 20A \\ V_{CE(sat)} &\leq 2.50V \\ t_{fi(typ)} &= 28ns \end{aligned}$$

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 175^\circ\text{C}$	650	V
V_{CGR}	$T_J = 25^\circ\text{C to } 175^\circ\text{C}, R_{GE} = 1M\Omega$	650	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	50	A
I_{C110}	$T_C = 110^\circ\text{C}$	20	A
I_{F110}	$T_C = 110^\circ\text{C}$	18	A
I_{CM}	$T_C = 25^\circ\text{C}, 1\text{ms}$	105	A
I_A	$T_C = 25^\circ\text{C}$	10	A
E_{AS}	$T_C = 25^\circ\text{C}$	200	mJ
SSOA (RBSOA)	$V_{GE} = 15V, T_{VJ} = 150^\circ\text{C}, R_G = 20\Omega$ Clamped Inductive Load	$I_{CM} = 40$ $V_{CE} \leq V_{CES}$	A
t_{sc} (SCSOA)	$V_{GE} = 15V, V_{CE} = 360V, T_J = 150^\circ\text{C}$ $R_G = 82\Omega, \text{Non Repetitive}$	10	μs
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +175	$^\circ\text{C}$
T_{JM}		175	$^\circ\text{C}$
T_{stg}		-55 ... +175	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering	300	$^\circ\text{C}$
T_{SOLD}	1.6 mm (0.062in.) from Case for 10s	260	$^\circ\text{C}$
M_d F_c	Mounting Torque (TO-220) Mounting Force (TO-263)	1.13/10 10..65 / 2.2..14.6	Nm/lb.in N/lb
Weight	TO-263 TO-220	2.5 3.0	g g

TO-263 AA (IXYA)



TO-220AB (IXYP)



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

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

Symbol Test Conditions
 $(T_J = 25^\circ\text{C Unless Otherwise Specified})$
Characteristic Values
Min. Typ. Max.

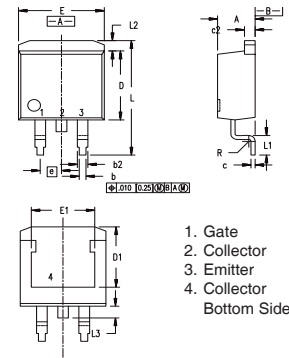
g_{fs}	$I_C = 20\text{A}, V_{CE} = 10\text{V}, \text{Note 1}$	7	12	S
C_{ies}	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		822	pF
C_{oes}			67	pF
C_{res}			19	pF
$Q_{g(on)}$	$I_C = 20\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		30	nC
Q_{ge}			6	nC
Q_{gc}			15	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = 20\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 20\Omega$ Note 2		19	ns
t_{ri}			34	ns
E_{on}			0.43	mJ
$t_{d(off)}$			80	ns
t_{fi}			28	ns
E_{off}			0.35	mJ
$t_{d(on)}$	Inductive load, $T_J = 150^\circ\text{C}$ $I_C = 20\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 20\Omega$ Note 2		18	ns
t_{ri}			33	ns
E_{on}			0.70	mJ
$t_{d(off)}$			96	ns
t_{fi}			36	ns
E_{off}			0.40	mJ
R_{thJC}	TO-220		0.65	$^\circ\text{C/W}$
R_{thCS}				$^\circ\text{C/W}$

Reverse Diode (FRED)
Symbol Test Conditions
 $(T_J = 25^\circ\text{C, Unless Otherwise Specified})$
Characteristic Values
Min. Typ. Max.

V_F	$I_F = 20\text{A}, V_{GE} = 0\text{V}, \text{Note 1}$	$T_J = 150^\circ\text{C}$	1.5	2.5	V
					V
I_{RM}	$I_F = 20\text{A}, V_{GE} = 0\text{V},$ $-di_F/dt = 300\text{A}/\mu\text{s}, V_R = 400\text{V}, T_J = 150^\circ\text{C}$		11		A
t_{rr}				135	ns
R_{thJC}				1.85	$^\circ\text{C/W}$

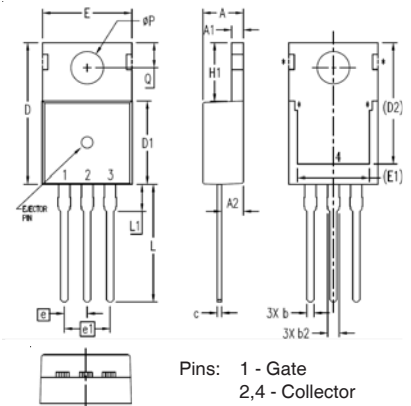
Notes:

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} (clamp), T_J or R_G .

TO-263 Outline


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

Dim.	Millimeter		Inches	
	Min.	Max.	Min.	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		MILLIMETERS	
	MIN	MAX	MIN	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

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
	4,860,072	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 @ $T_J = 25^\circ\text{C}$

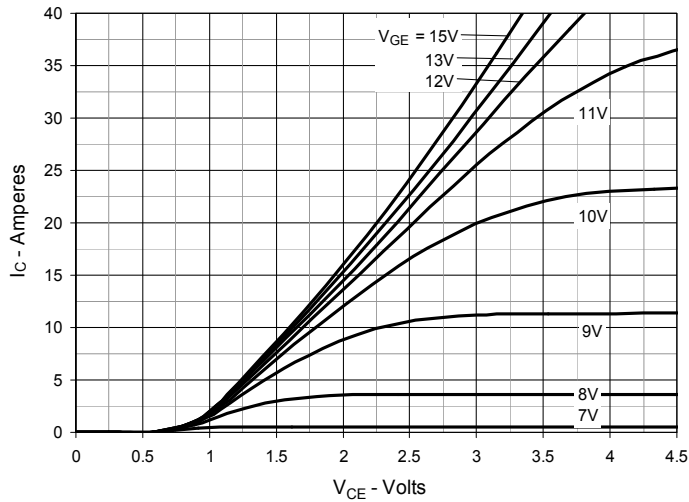


Fig. 2. Extended Output Characteristics @ $T_J = 25^\circ\text{C}$

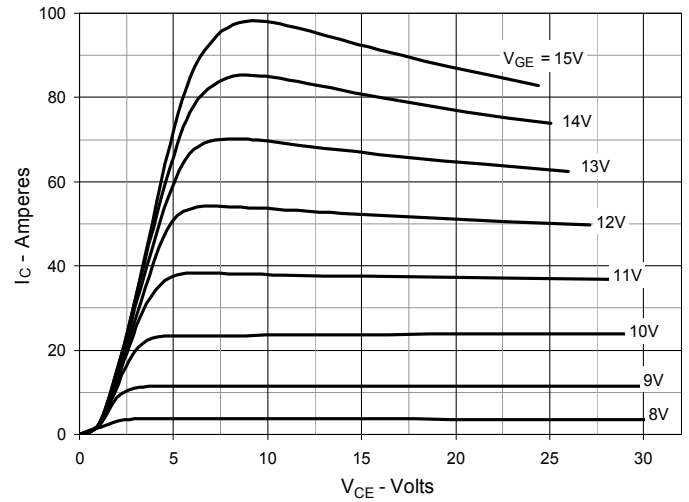


Fig. 3. Output Characteristics @ $T_J = 150^\circ\text{C}$

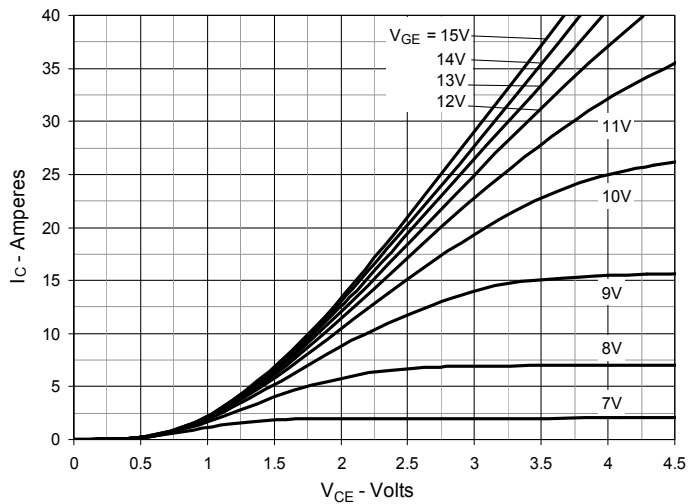


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

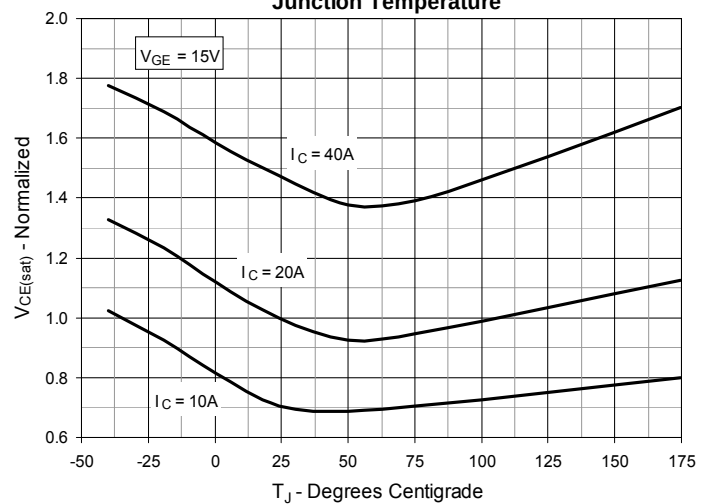


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

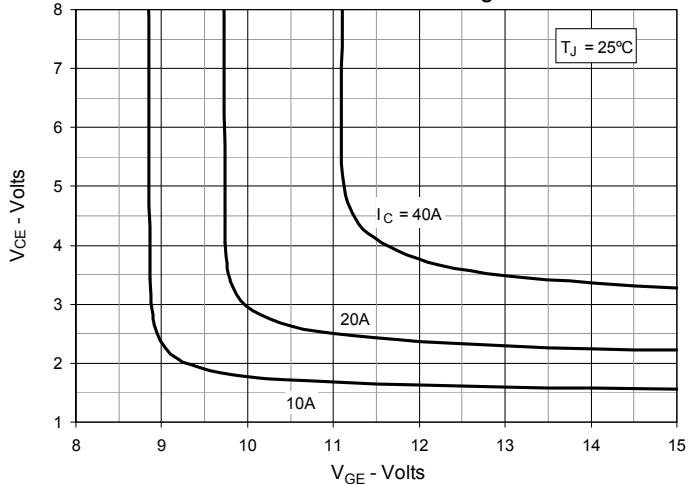


Fig. 6. Input Admittance

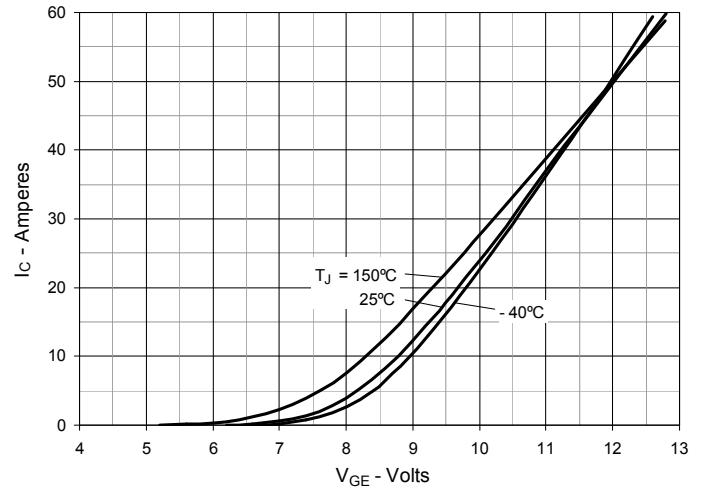


Fig. 7. Transconductance

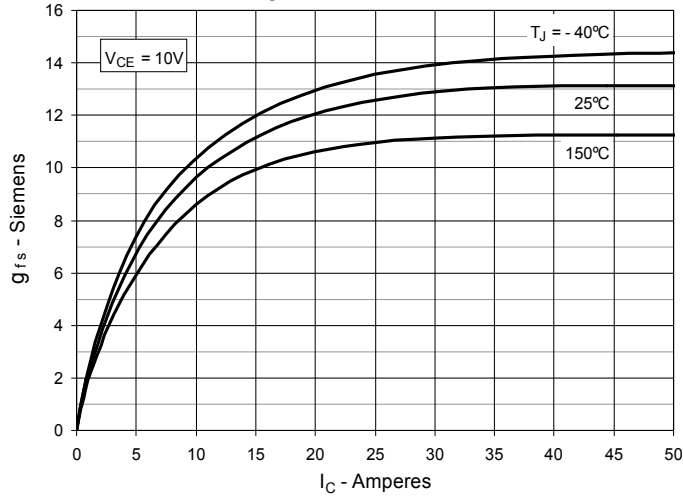


Fig. 8. Gate Charge

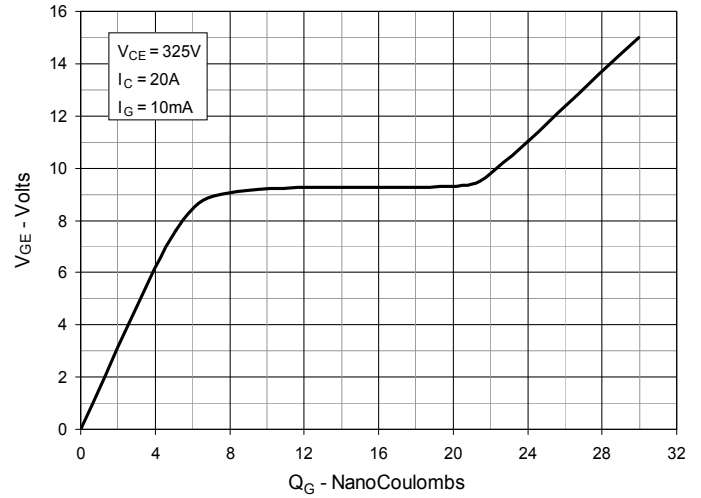


Fig. 9. Capacitance

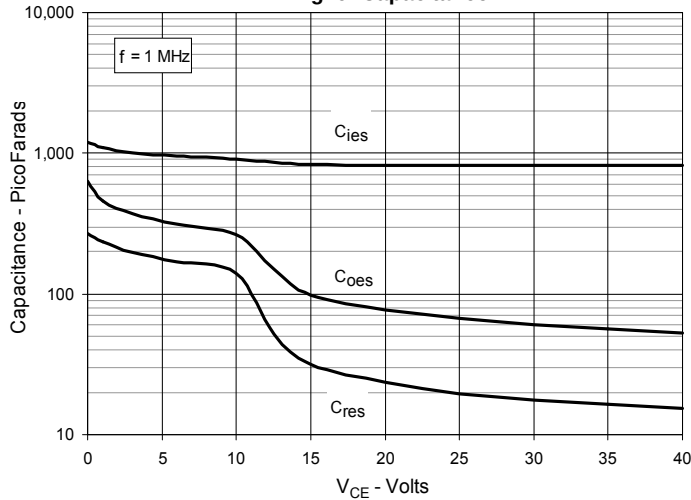


Fig. 10. Reverse-Bias Safe Operating Area

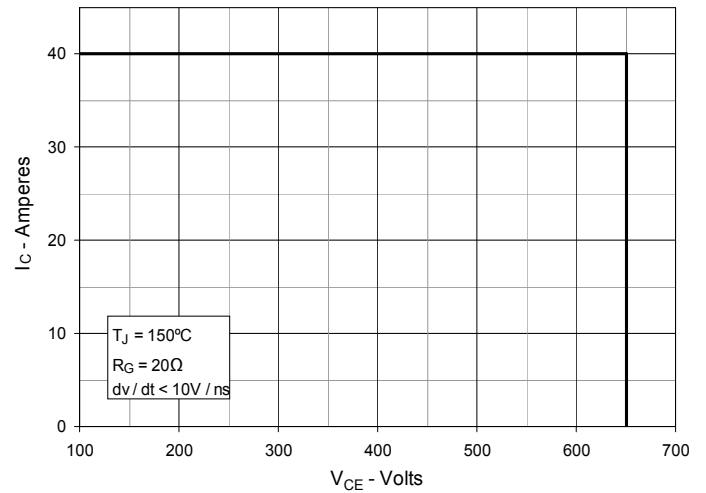


Fig. 11. Forward-Bias Safe Operating Area

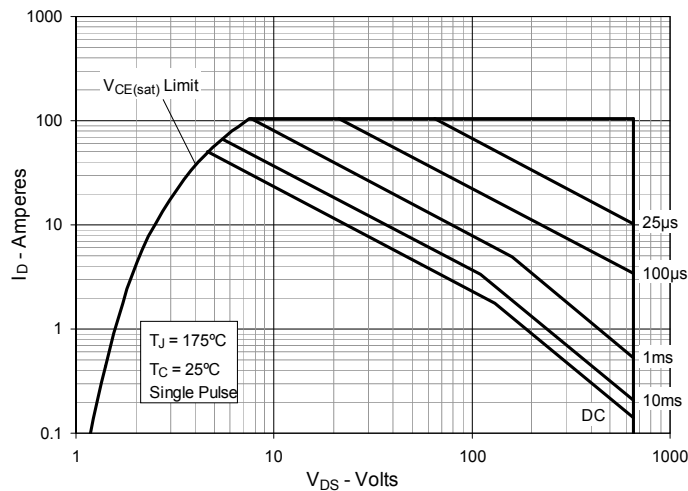


Fig. 12. Maximum Transient Thermal Impedance (IGBT)

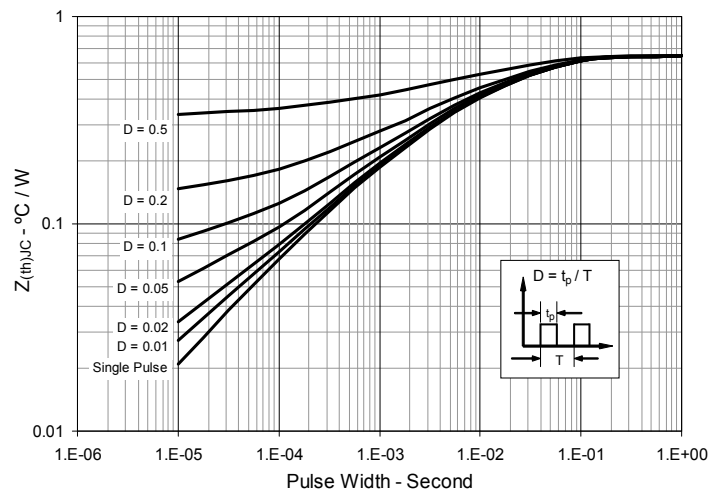


Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance

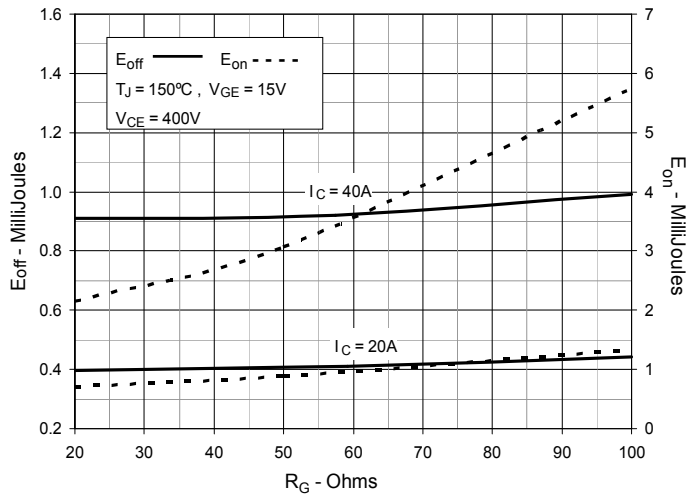


Fig. 14. Inductive Switching Energy Loss vs. Collector Current

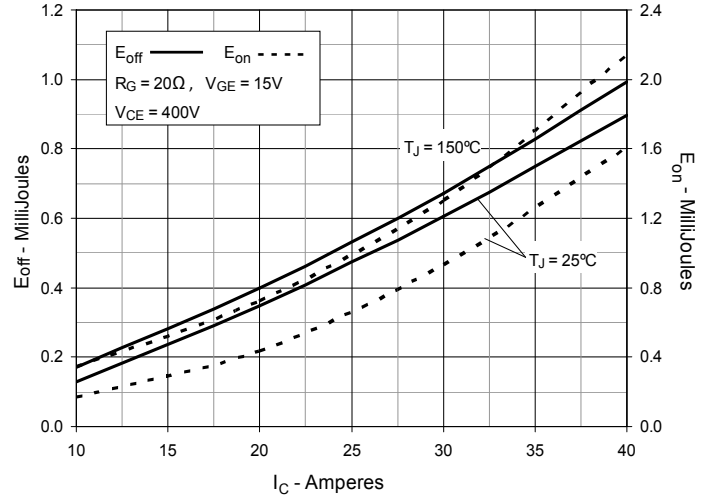


Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature

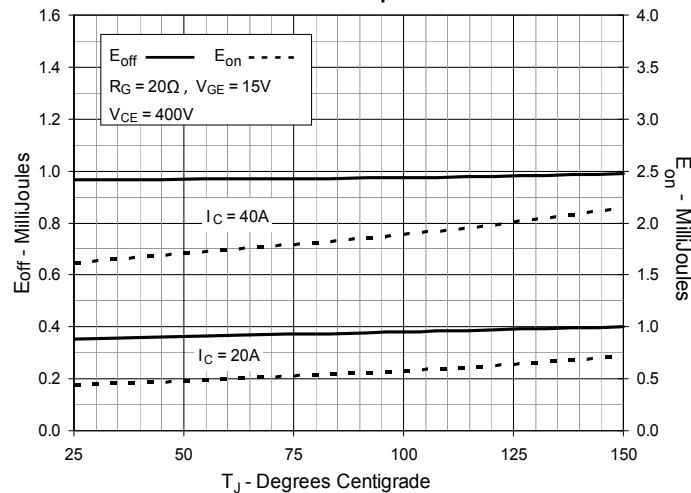


Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance

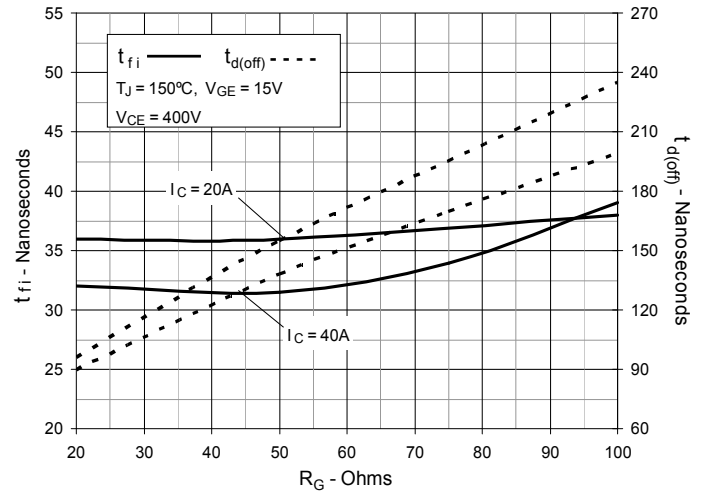


Fig. 17. Inductive Turn-off Switching Times vs. Collector Current

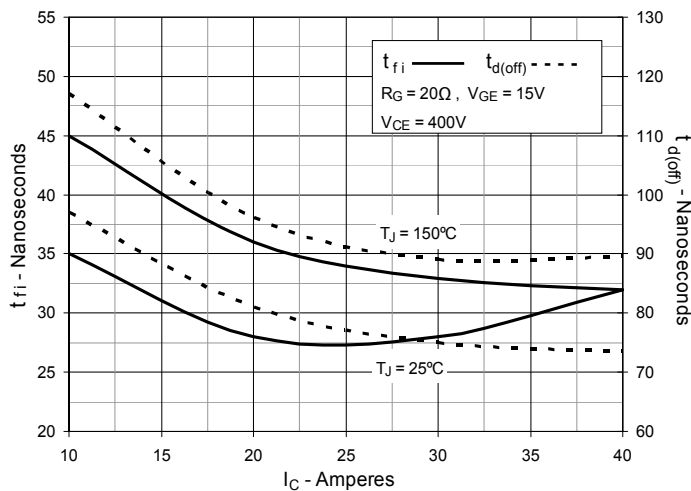


Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature

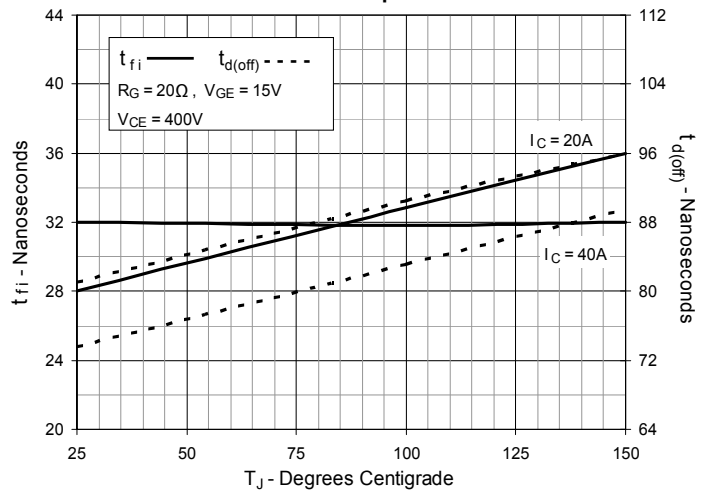


Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance

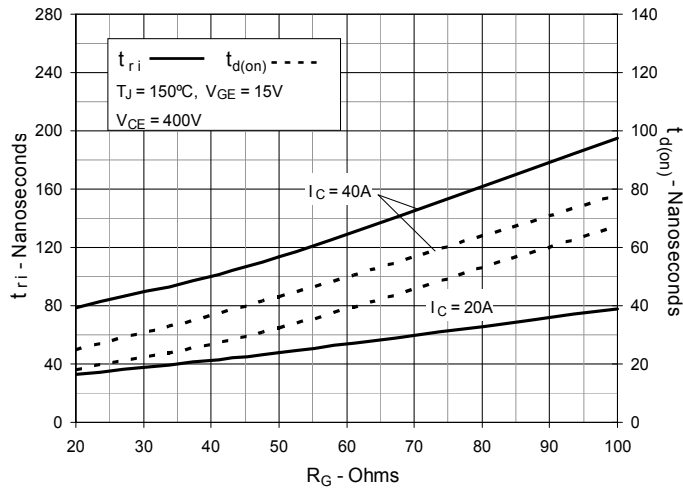


Fig. 20. Inductive Turn-on Switching Times vs. Collector Current

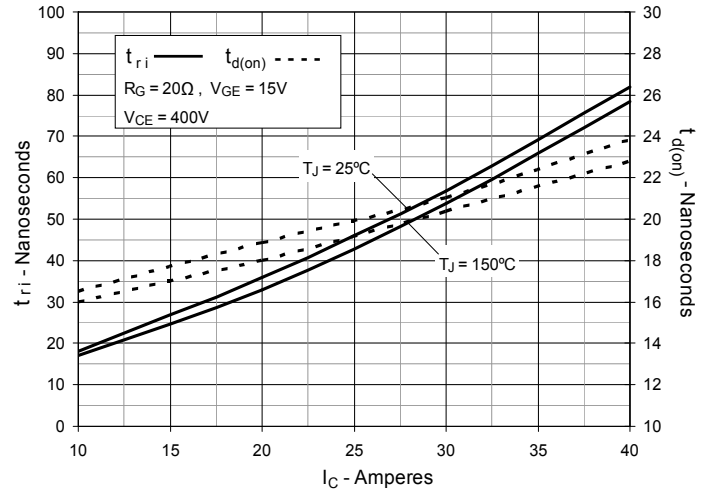


Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature

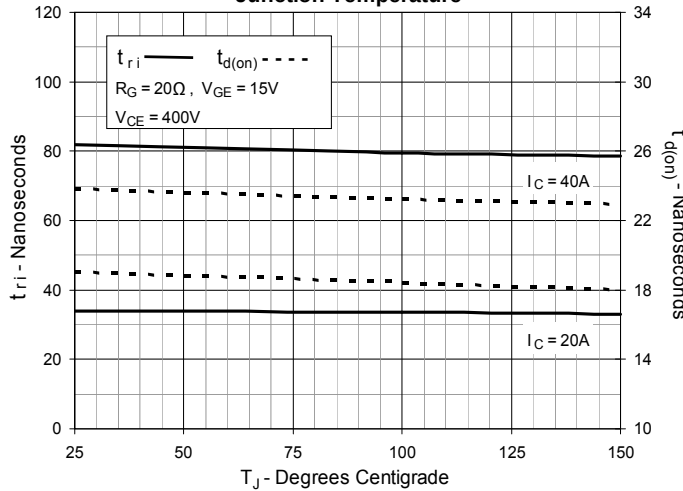


Fig. 22. Diode Forward Characteristics

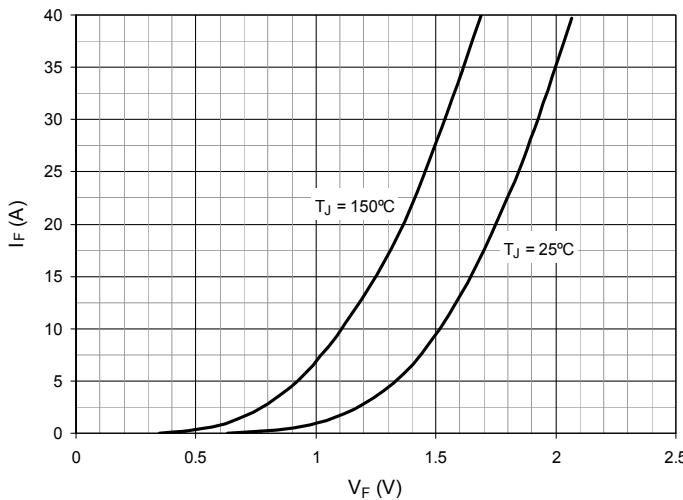


Fig. 23. Reverse Recovery Charge vs. $-di_F/dt$

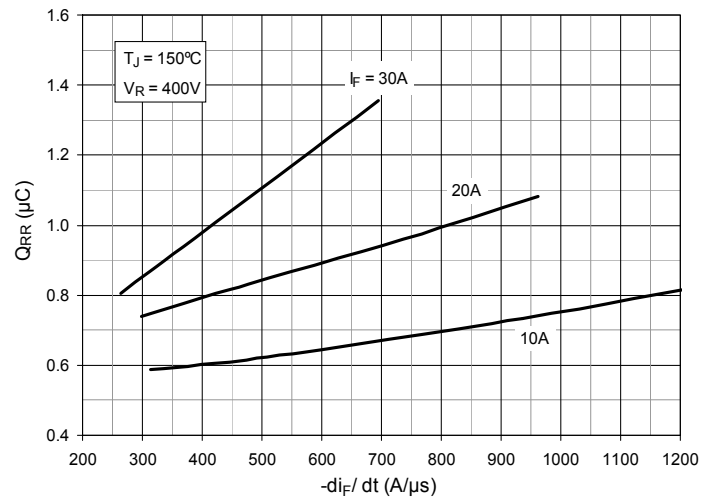


Fig. 24 Reverse Recovery Current vs. $-di_F/dt$

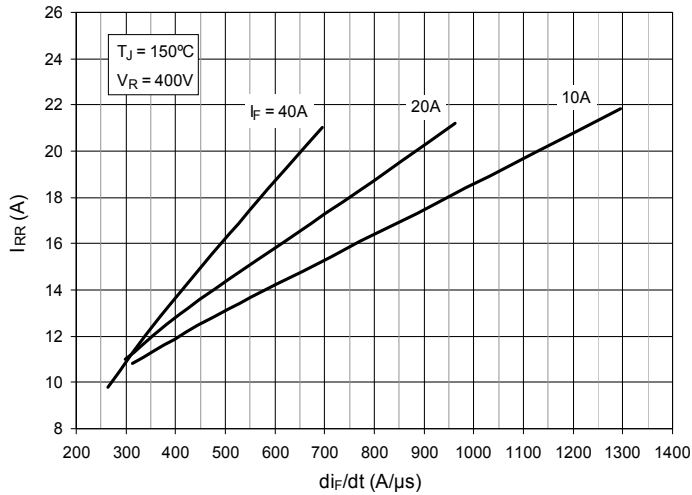


Fig. 25. Reverse Recovery Time vs. $-di_F/dt$

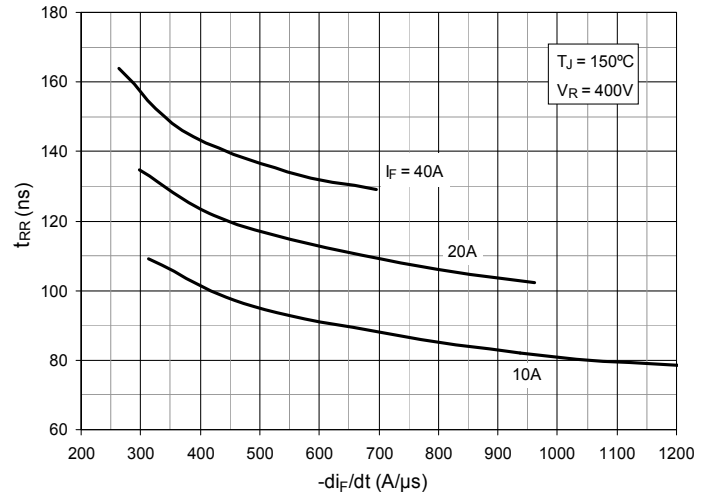


Fig. 26. Dynamic Parameters Q_{RR} , I_{RR} vs. Junction Temperature

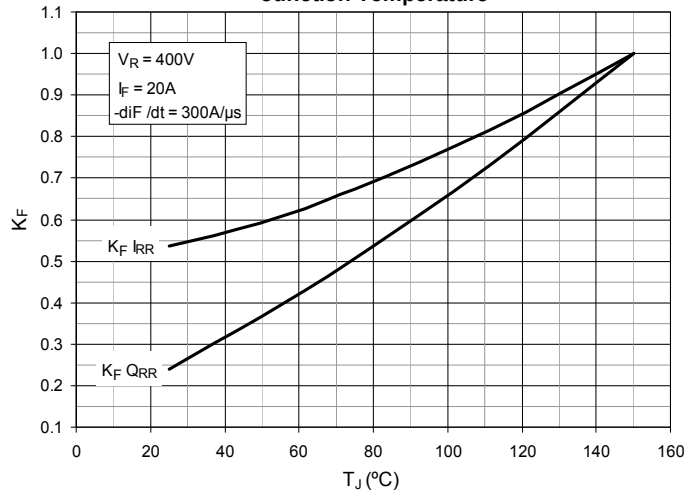


Fig. 27. Maximum Transient Thermal Impedance (Diode)

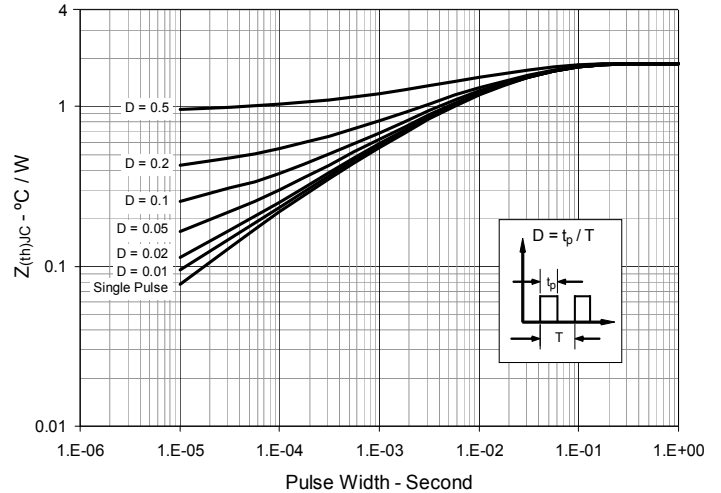
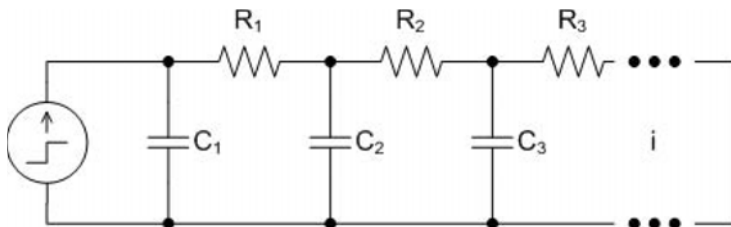


Fig. 28. Cauer Thermal Network



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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