

**XPT™ 600V IGBT  
GenX3™ w/Diode**
**MMIX1X200N60B3H1**

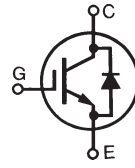
$$V_{CES} = 600V$$

$$I_{C110} = 72A$$

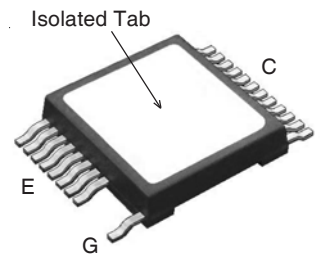
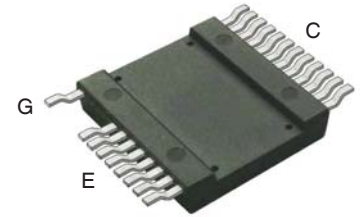
$$V_{CE(sat)} \leq 1.7V$$

$$t_{fi(typ)} = 110ns$$

(Electrically Isolated Tab)


 Extreme Light Punch Through  
IGBT for 10-30kHz Switching

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	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ C$ (Chip Capability)	175	A
$I_{C110}$	$T_C = 110^\circ C$	72	A
$I_{F110}$	$T_C = 110^\circ C$	28	A
$I_{CM}$	$T_C = 25^\circ C$ , 1ms	1000	A
$I_A$	$T_C = 25^\circ C$	100	A
$E_{AS}$	$T_C = 25^\circ C$	1	J
<b>SSOA</b>	$V_{GE} = 15V$ , $T_{VJ} = 150^\circ C$ , $R_G = 1\Omega$	$I_{CM} = 400$	A
<b>(RBSOA)</b>	Clamped Inductive Load	@ $V_{CE} \leq V_{CES}$	
$t_{sc}$	$V_{GE} = 15V$ , $V_{CE} = 360V$ , $T_J = 150^\circ C$	10	$\mu s$
<b>(SCSOA)</b>	$R_G = 10\Omega$ , Non Repetitive		
$P_C$	$T_C = 25^\circ C$	520	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 (0.062 in.) from Case for 10	260	$^\circ C$
$V_{ISOL}$	50/60Hz, 1 minute	2500	V~
$F_C$	Mounting Force	50..200/11..45	N/lb.
<b>Weight</b>		8	g


 G = Gate                      E = Emitter  
 C = Collector

**Features**

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface
- 2500V~ Electrical Isolation
- Optimized for Low Conduction and Switching Losses
- Avalanche Rated
- Short Circuit Capability
- Very High Current Capability
- Square RBSOA

**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 ( $T_J = 25^\circ C$ , Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$BV_{CES}$	$I_C = 250\mu A$ , $V_{GE} = 0V$	600		V
$V_{GE(th)}$	$I_C = 250\mu A$ , $V_{CE} = V_{GE}$	3.5		6.0 V
$I_{CES}$	$V_{CE} = V_{CES}$ , $V_{GE} = 0V$ Note 2, $T_J = 150^\circ C$			50 $\mu A$ 3 mA
$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = \pm 20V$			$\pm 200$ nA
$V_{CE(sat)}$	$I_C = 100A$ , $V_{GE} = 15V$ , Note 1 $T_J = 150^\circ C$		1.40 1.58	V V

Symbol Test Conditions ( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)		Characteristic Values		
		Min.	Typ.	Max.
$g_{fs}$	$I_C = 60\text{A}, V_{CE} = 10\text{V}$ , Note 1	27	45	S
$C_{ies}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		9970	pF
$C_{oes}$			570	pF
$C_{res}$			183	pF
$Q_{g(on)}$	$I_C = 200\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		315	nC
$Q_{ge}$			98	nC
$Q_{gc}$			130	nC
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 100\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 360\text{V}, R_G = 1\Omega$ Note 3		48	ns
$t_{ri}$			100	ns
$E_{on}$			2.85	mJ
$t_{d(off)}$			160	ns
$t_{fi}$			110	ns
$E_{off}$			2.90	4.40 mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 150^\circ\text{C}</math></b> $I_C = 100\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 360\text{V}, R_G = 1\Omega$ Note 3		46	ns
$t_{ri}$			94	ns
$E_{on}$			4.40	mJ
$t_{d(off)}$			180	ns
$t_{fi}$			215	ns
$E_{off}$			3.45	mJ
$R_{thJC}$				0.24 $^\circ\text{C/W}$
$R_{thCS}$		0.05		$^\circ\text{C/W}$

**Reverse Diode (FRED)**

Symbol Test Conditions ( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)		Characteristic Values		
		Min.	Typ.	Max.
$V_F$	$I_F = 100\text{A}, V_{GE} = 0\text{V}$ , Note 1 $T_J = 150^\circ\text{C}$		2.3	2.5 V
$I_{RM}$	$I_F = 100\text{A}, V_{GE} = 0\text{V}, T_J = 150^\circ\text{C}$ $-di_F/dt = 1500\text{A}/\mu\text{s}, V_R = 300\text{V}$		95	A
$t_{rr}$			100	ns
$R_{thJC}$				0.83 $^\circ\text{C/W}$

**Notes:**

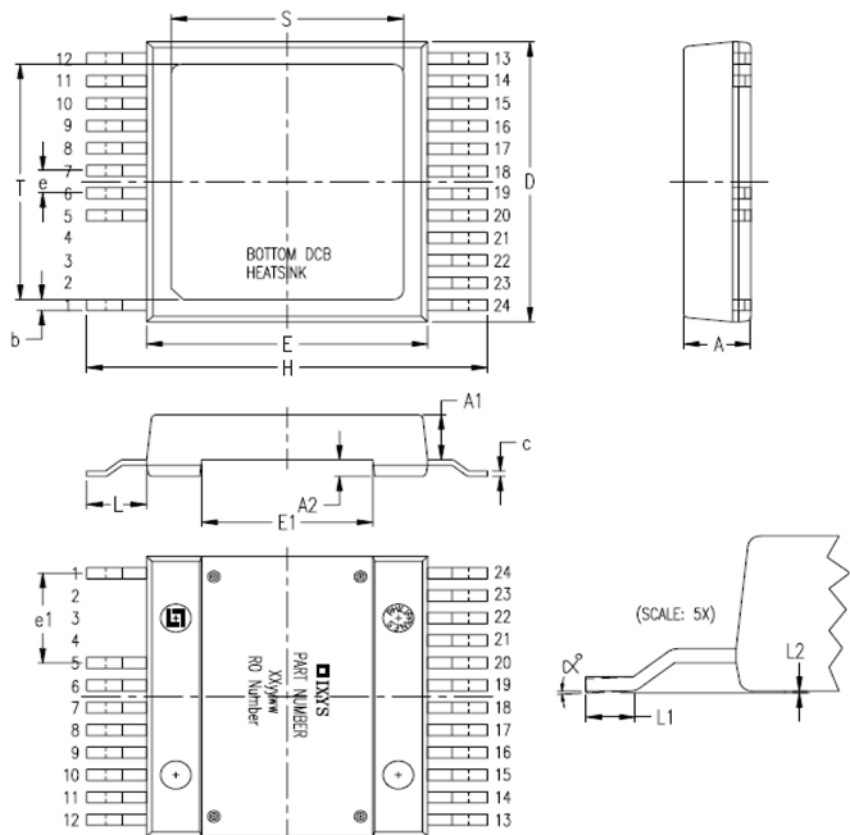
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Part must be heatsunk for high-temp  $I_{CES}$  measurement.
3. Switching times & energy losses may increase for higher  $V_{CE}(\text{Clamp})$ ,  $T_J$  or  $R_G$ .

**PRELIMINARY TECHNICAL INFORMATION**

The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

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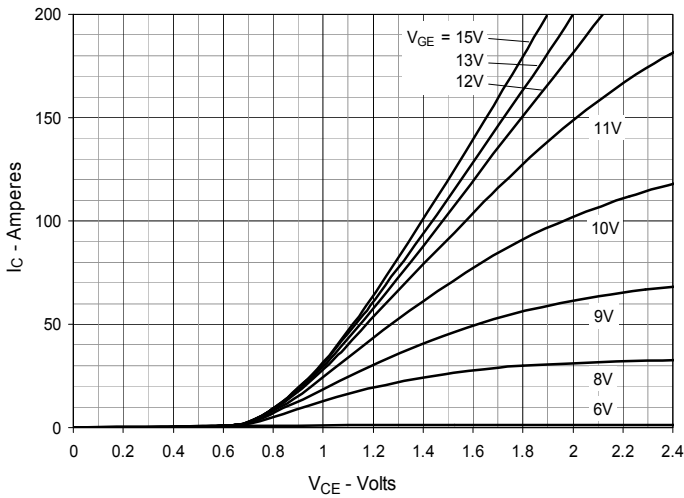
IXYS MOSFETs and IGBTs are covered	4,835,592	4,931,844	5,049,961	5,237,481	6,162,665	6,404,065 B1	6,683,344	6,727,585	7,005,734 B2	7,157,338B2
by one or more of the following U.S. patents:	4,860,072	5,017,508	5,063,307	5,381,025	6,259,123 B1	6,534,343	6,710,405 B2	6,759,692	7,063,975 B2	
	4,881,106	5,034,796	5,187,117	5,486,715	6,306,728 B1	6,583,505	6,710,463	6,771,478 B2	7,071,537	



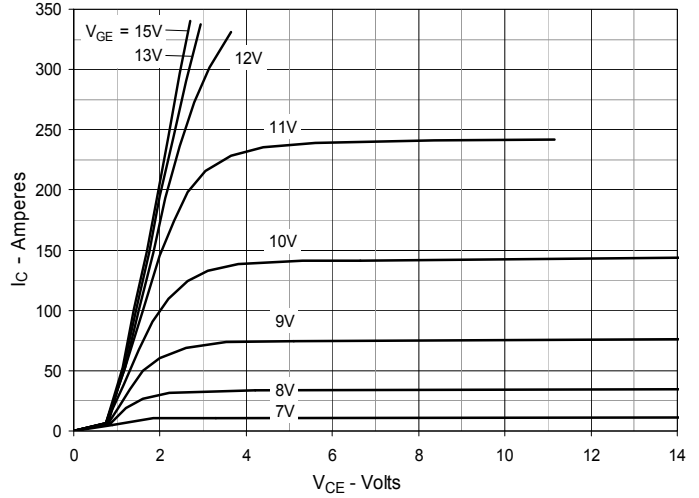
SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.209	.224	5.30	5.70
A1	.154	.161	3.90	4.10
A2	.055	.063	1.40	1.60
b	.035	.045	0.90	1.15
c	.018	.026	0.45	0.65
D	.976	.994	24.80	25.25
E	.898	.915	22.80	23.25
E1	.543	.559	13.80	14.20
e	.079 BSC		2.00 BSC	
e1	.315 BSC		8.00 BSC	
H	1.272	1.311	32.30	33.30
L	.181	.209	4.60	5.30
L1	.051	.067	1.30	1.70
L2	.000	.006	0.00	0.15
S	.736	.760	18.70	19.30
T	.815	.839	20.70	21.30
α	0	4°	0	4°

**PIN: 1 = Gate**  
**5-12 = Emitter**  
**13-24 = Collector**

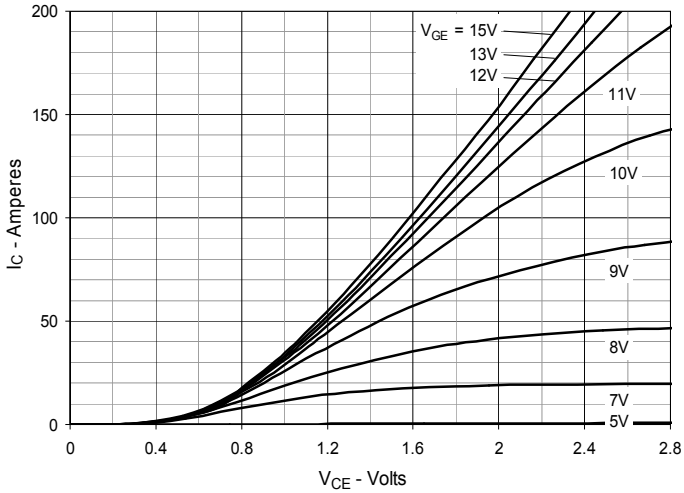
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$**



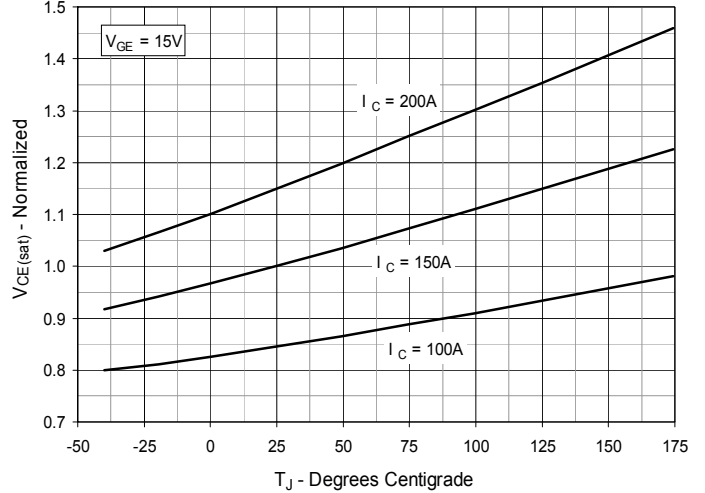
**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$**



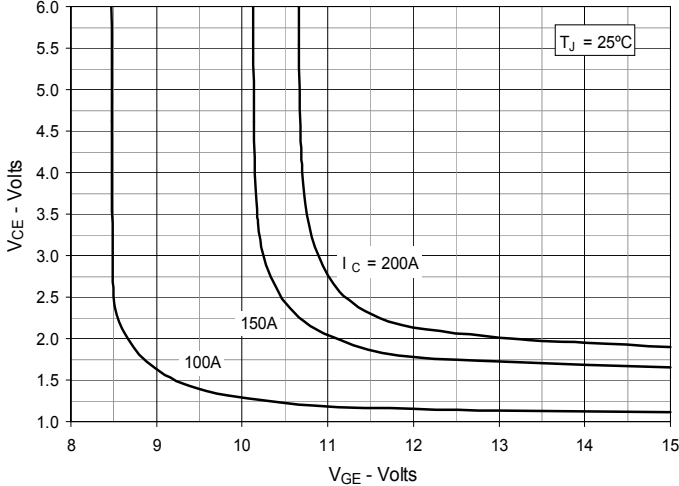
**Fig. 3. Output Characteristics @  $T_J = 150^\circ\text{C}$**



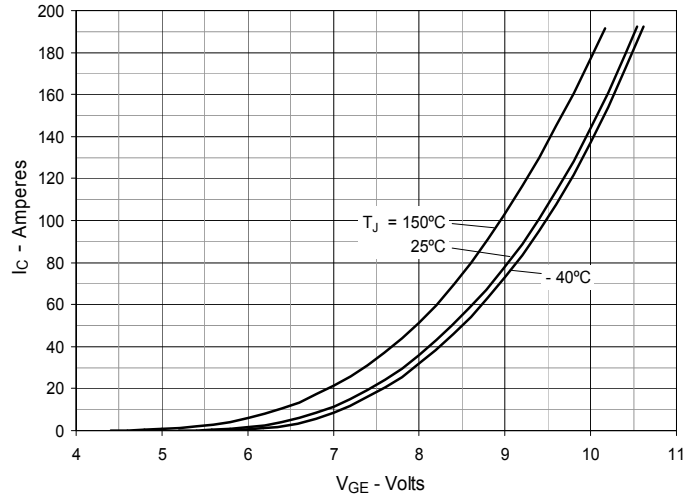
**Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature**



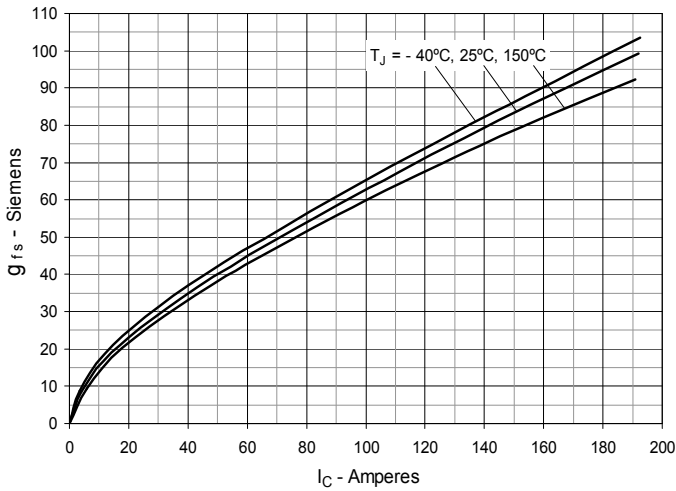
**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**



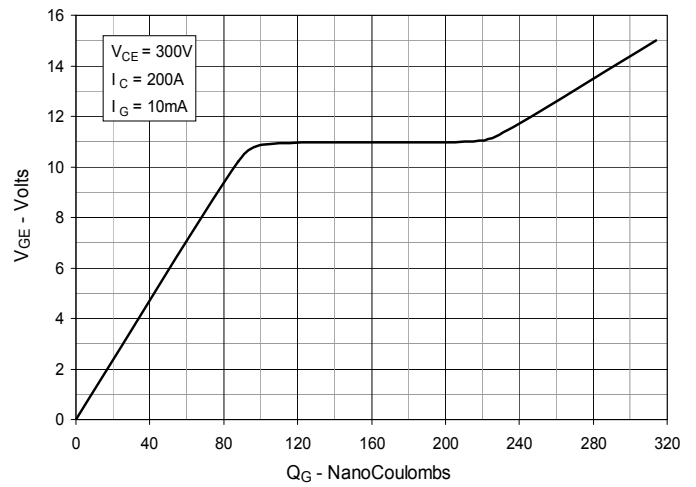
**Fig. 6. Input Admittance**



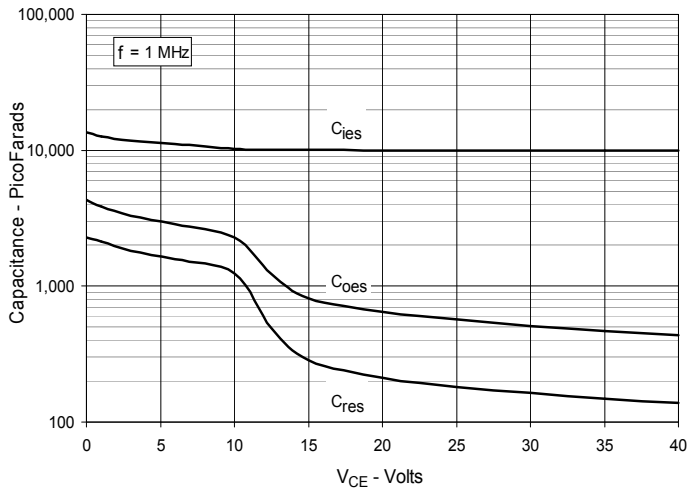
**Fig. 7. Transconductance**



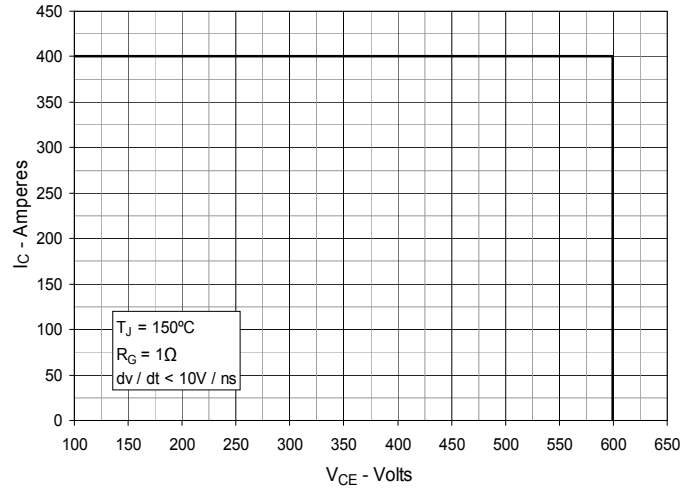
**Fig. 8. Gate Charge**



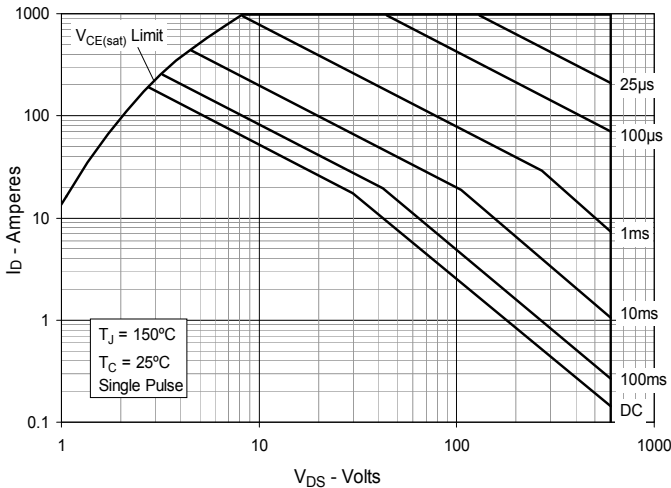
**Fig. 9. Capacitance**



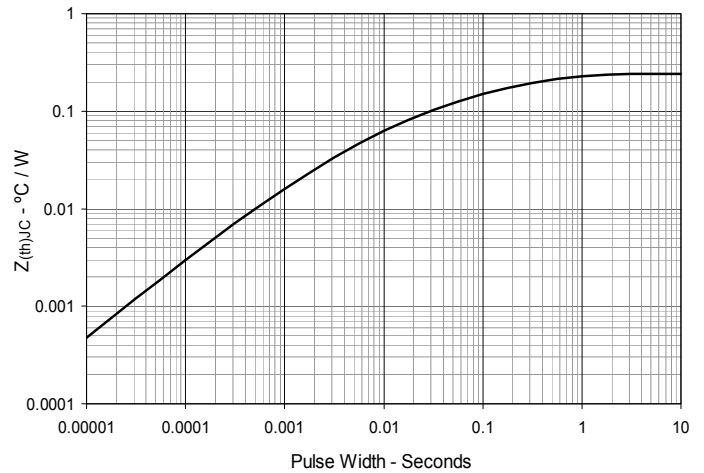
**Fig. 10. Reverse-Bias Safe Operating Area**



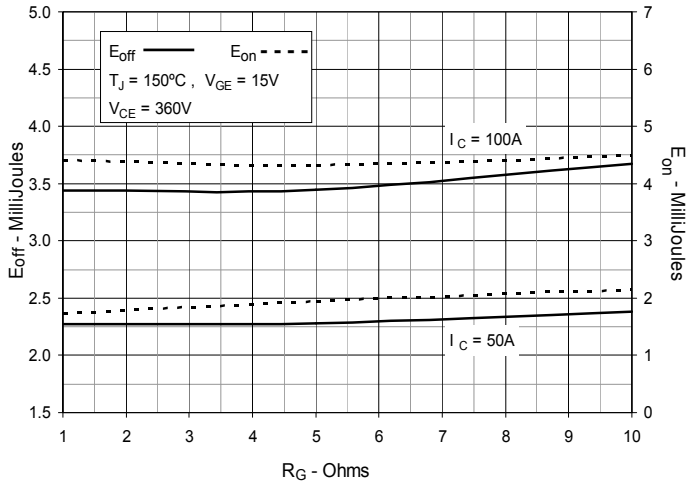
**Fig. 11. Forward-Bias Safe Operating Area**



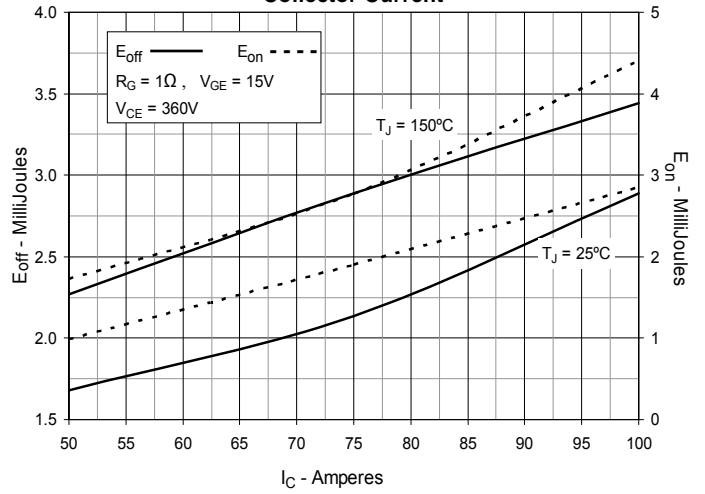
**Fig. 12. Maximum Transient Thermal Impedance**



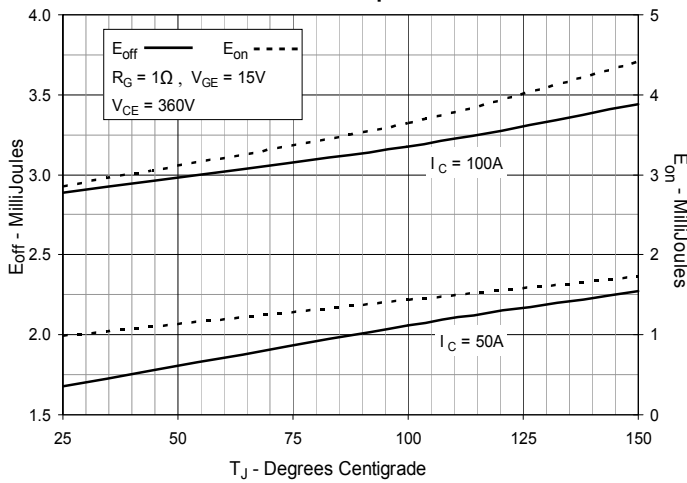
**Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance**



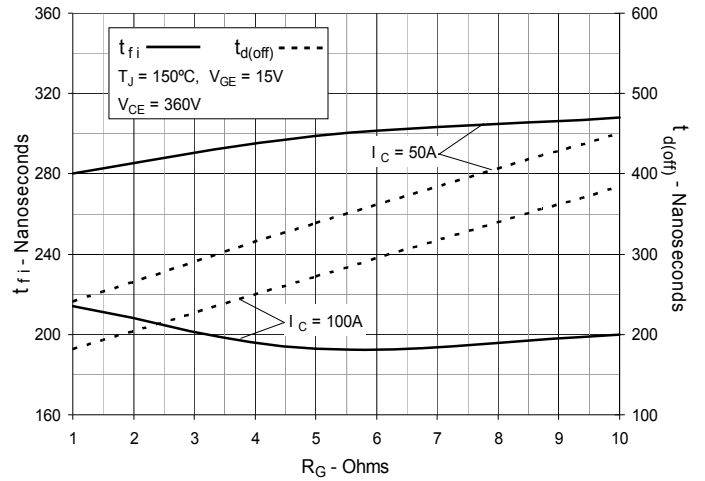
**Fig. 14. Inductive Switching Energy Loss vs. Collector Current**



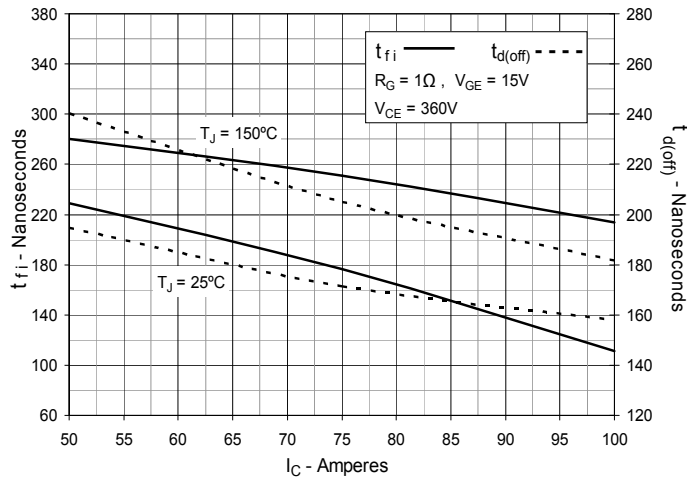
**Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature**



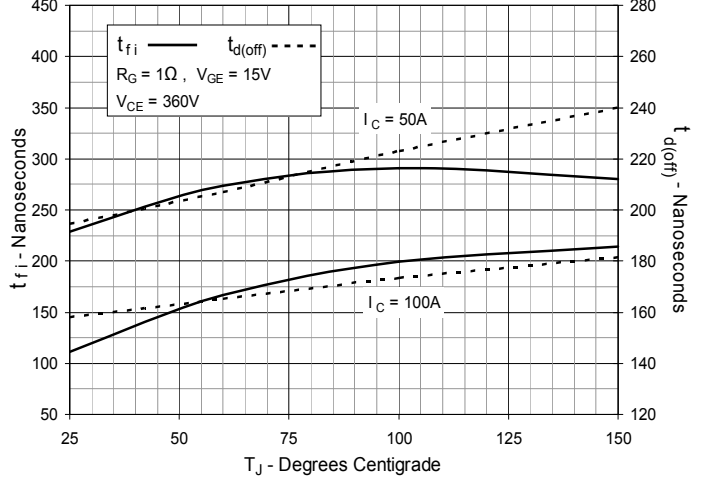
**Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance**



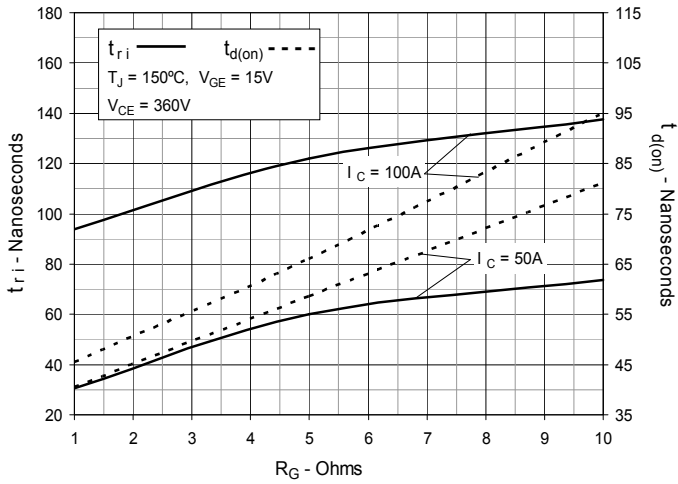
**Fig. 17. Inductive Turn-off Switching Times vs. Collector Current**



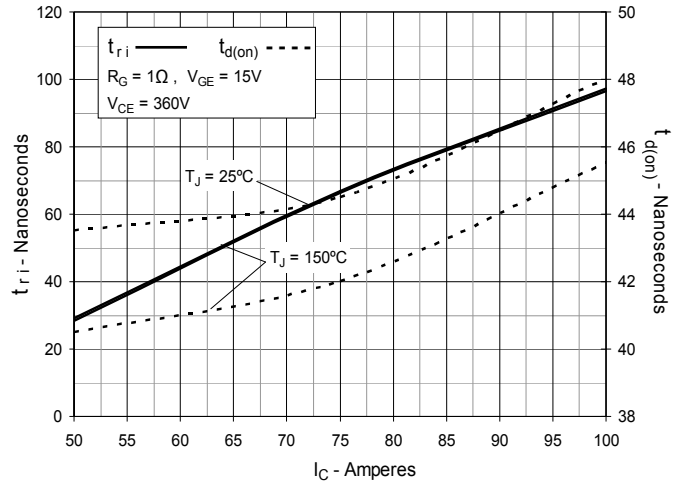
**Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature**



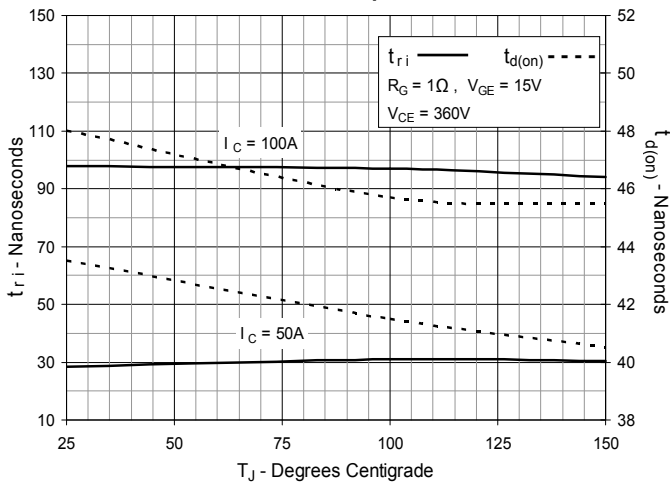
**Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance**



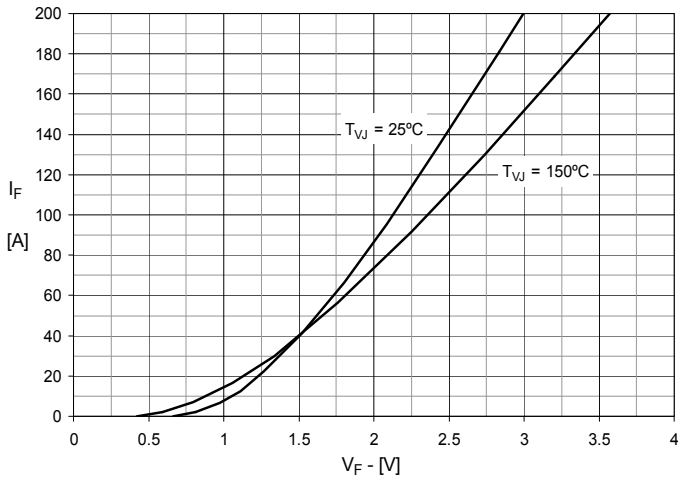
**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**



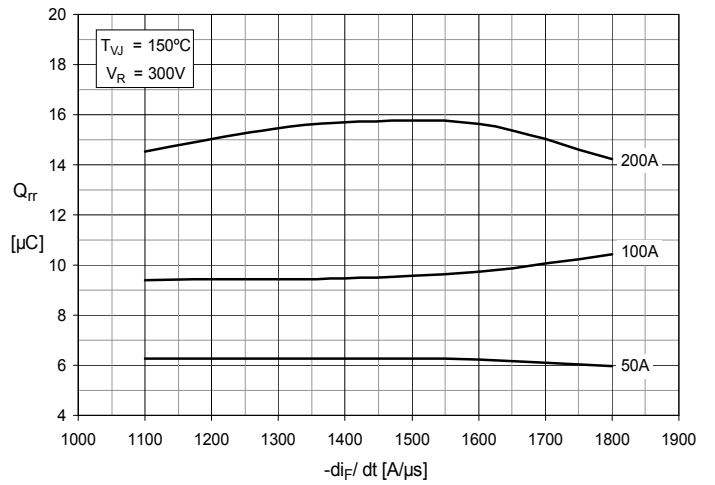
**Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature**



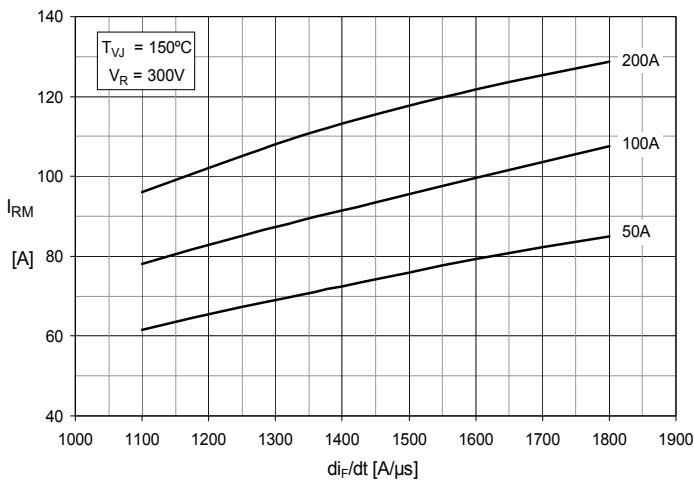
**Fig. 22. Typ. Forward characteristics**



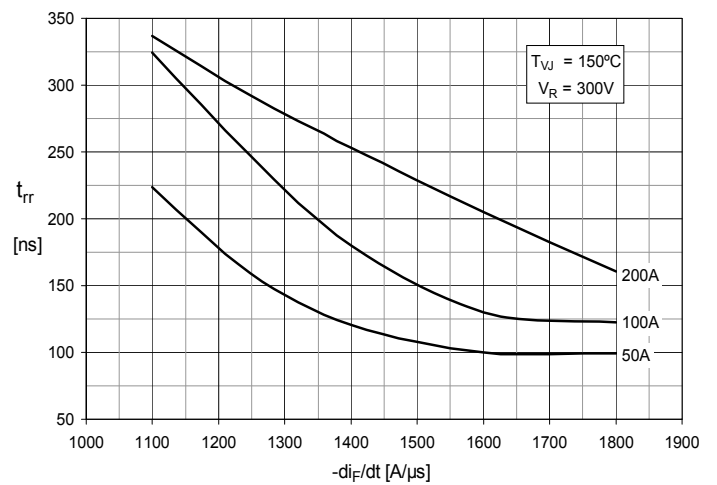
**Fig. 23. Typ. Reverse Recovery Charge  $Q_{rr}$  vs.  $-di_F/dt$**



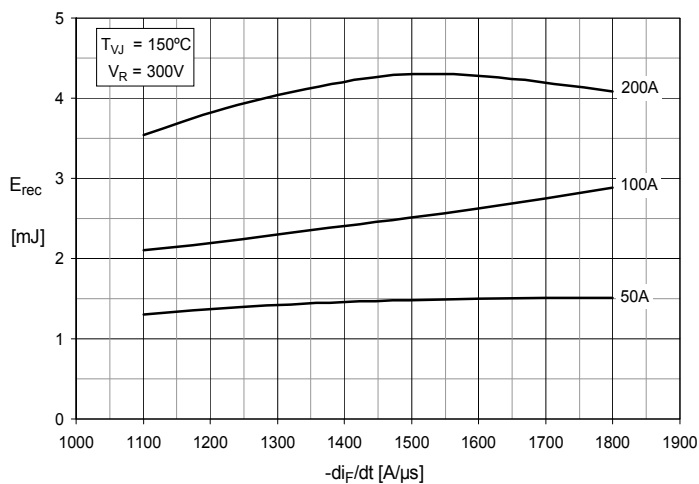
**Fig. 24. Typ. Peak Reverse Current  $I_{RM}$  vs.  $-di_F/dt$**



**Fig. 25. Typ. Recovery Time  $t_{rr}$  vs.  $-di_F/dt$**



**Fig. 26. Typ. Recovery Energy  $E_{rec}$  vs.  $-di_F/dt$**







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