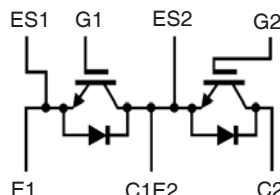


Low Gain IGBT w/ Diode

MMIX2S50N60B4D1

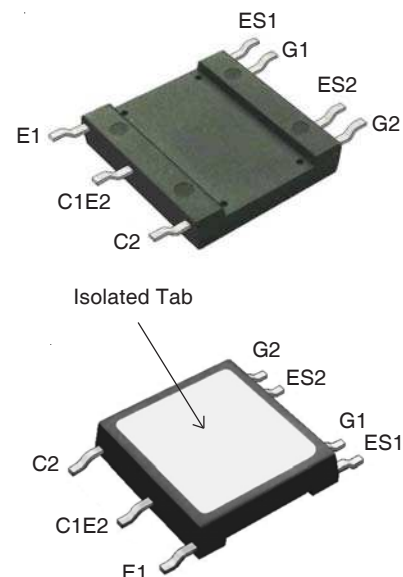
(Electrically Isolated Tab)



Short Circuit SOA Capability

$$\begin{aligned} V_{CES} &= 600V \\ I_{C90} &= 30A \\ V_{CE(sat)} &\leq 2.0V \\ t_{fi(typ)} &= 50ns \end{aligned}$$

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C , $R_{GE} = 1M\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	50	A
I_{C90}	$T_C = 90^\circ\text{C}$	30	A
I_{F110}	$T_C = 110^\circ\text{C}$	27	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1ms	220	A
SSOA (RBSOA)	$V_{GE} = 15V$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 5\Omega$ Clamped Inductive Load	$I_{CM} = 60$ $@ V_{CE} \leq V_{CES}$	A
t_{sc} (SCSOA)	$V_{GE} = 15V$, $V_{CE} = 360V$, $T_J = 125^\circ\text{C}$ $R_G = 82\Omega$, Non Repetitive	8	μs
P_C	$T_C = 25^\circ\text{C}$	110	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
T_L	1.6mm (0.062 in.) from Case for 10s	300	$^\circ\text{C}$
T_{SOLD}	Plastic Body for 10 seconds	260	$^\circ\text{C}$
F_C	Mounting Force	20..120 / 4.5..27	N/lb.
V_{ISOL}	50/60 Hz, RM, $t = 1\text{min}$	2500	V~
Weight		4.0	g



G = Gate E = Emitter
C = Collector S = Kelvin Emitter

Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface
- 2500V~ Electrical Isolation
- Anti-Parallel Ultra Fast Diode
- Short Circuit Capability

Advantages

- High Power Density
- Low Gate Drive Requirement

Applications

- 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}	$I_C = 250\mu\text{A}$, $V_{GE} = 0V$	600		V
$V_{GE(th)}$	$I_C = 250\mu\text{A}$, $V_{CE} = V_{GE}$	4.5		7.0 V
I_{CES}	$V_{CE} = V_{CES}$, $V_{GE} = 0V$ Note 2, $T_J = 125^\circ\text{C}$			25 μA 1 mA
I_{GES}	$V_{CE} = 0V$, $V_{GE} = \pm 20V$			± 100 nA
$V_{CE(sat)}$	$I_C = 30A$, $V_{GE} = 15V$, Note 1 $T_J = 125^\circ\text{C}$		1.7 1.4	2.0 V V

Symbol Test Conditions ($T_J = 25^\circ\text{C}$ Unless Otherwise Specified)		Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = 15\text{A}, V_{CE} = 10\text{V}$, Note 1	13	21	S
$I_{C(on)}$	$V_{GE} = 15\text{V}, V_{CE} = 10\text{V}$		210	A
C_{ies}	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		1940	pF
C_{oes}			176	pF
C_{res}			65	pF
$Q_{g(on)}$	$I_C = 30\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		93	nC
Q_{ge}			19	nC
Q_{gc}			36	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = 30\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 5\Omega$ Note 3		30	ns
t_{ri}			55	ns
E_{on}			0.85	mJ
$t_{d(off)}$			123	ns
t_{fi}			50	ns
E_{off}			0.33	0.55 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = 30\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 5\Omega$ Note 3		28	ns
t_{ri}			30	ns
E_{on}			1.00	mJ
$t_{d(off)}$			185	ns
t_{fi}			120	ns
E_{off}			0.86	mJ
R_{thJC}				1.13 $^\circ\text{C/W}$
R_{thCS}			0.15	$^\circ\text{C/W}$

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	$T_J = 25^\circ\text{C}$		2.7 V
I_{RM}	$I_F = 30\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 100\text{A}/\mu\text{s}$	$T_J = 100^\circ\text{C}$		4 A
t_{rr}	$V_R = 100\text{V}$	$T_J = 100^\circ\text{C}$	100	ns
	$I_F = 1\text{A}, -di/dt = 100\text{A}/\mu\text{s}, V_R = 30\text{V}$		25	ns
R_{thJC}				1.5 $^\circ\text{C/W}$

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 .

ADVANCE 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.

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	

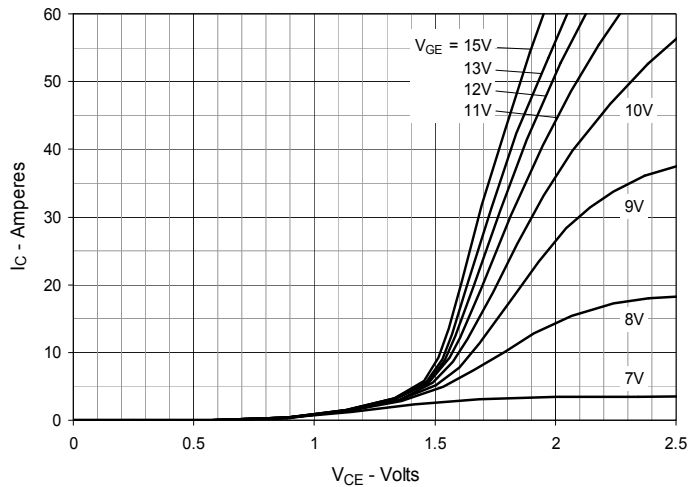
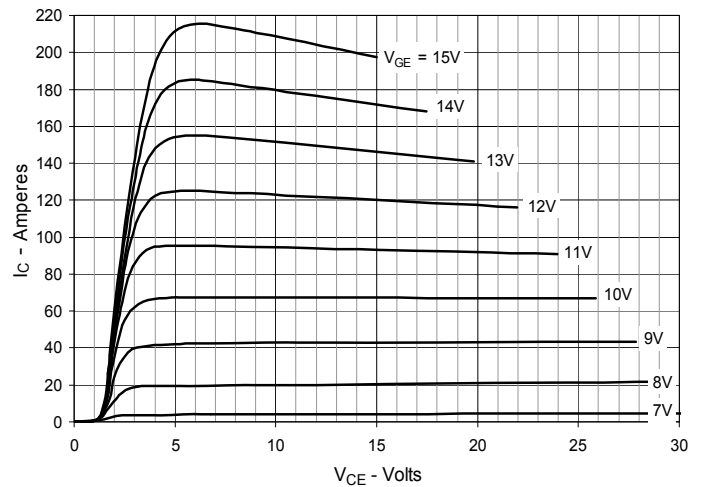
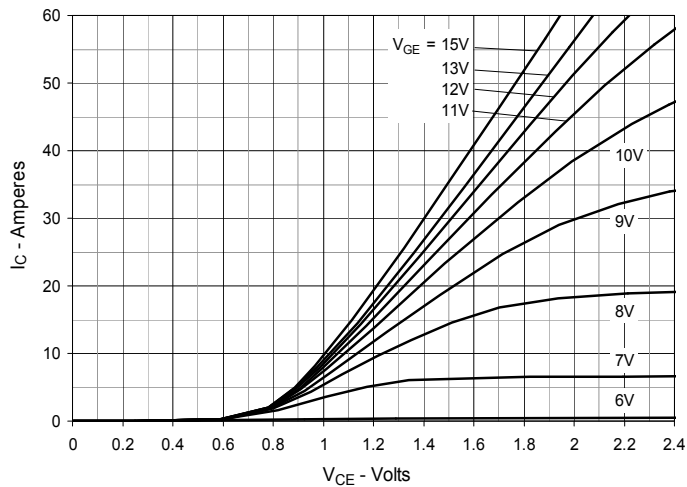
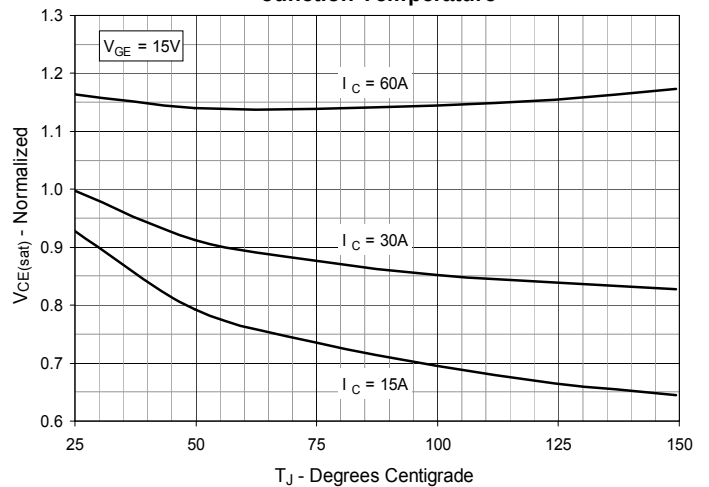
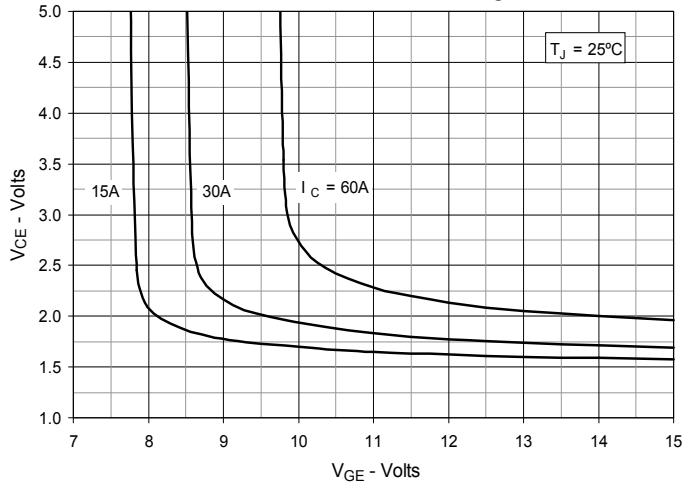
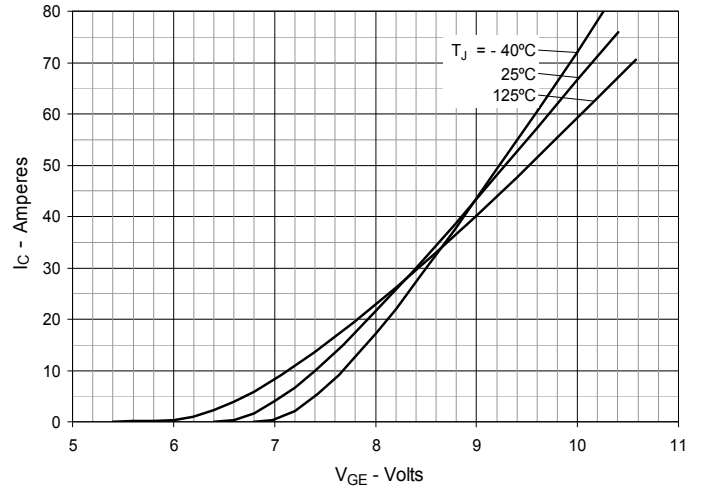
Fig. 1. Output Characteristics @ $T_J = 25^\circ\text{C}$

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

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

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

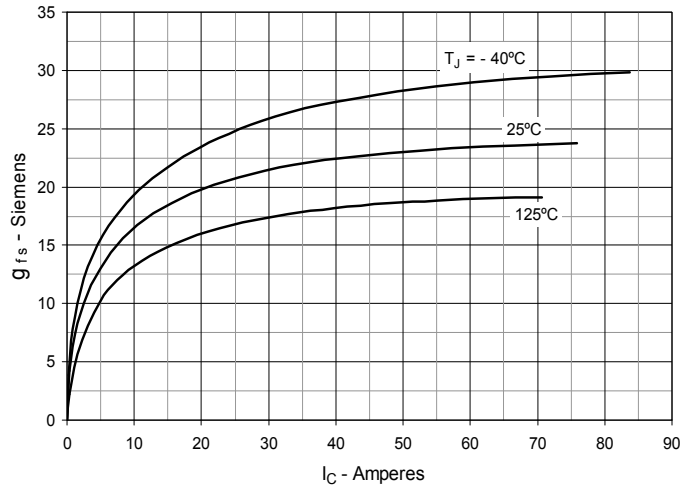


Fig. 8. Gate Charge

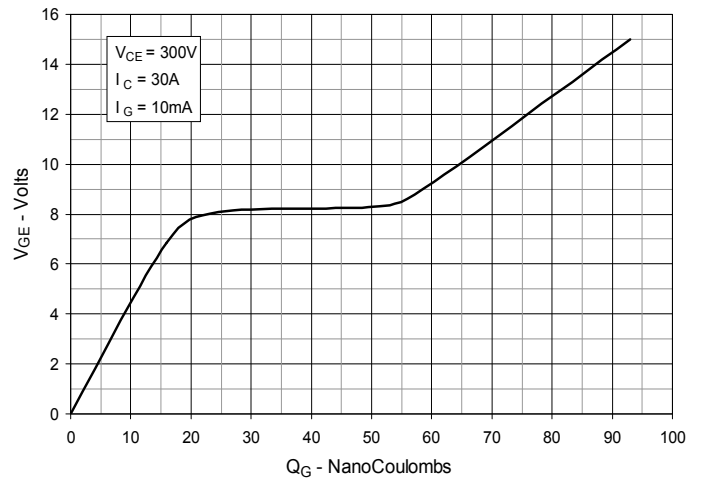


Fig. 9. Capacitance

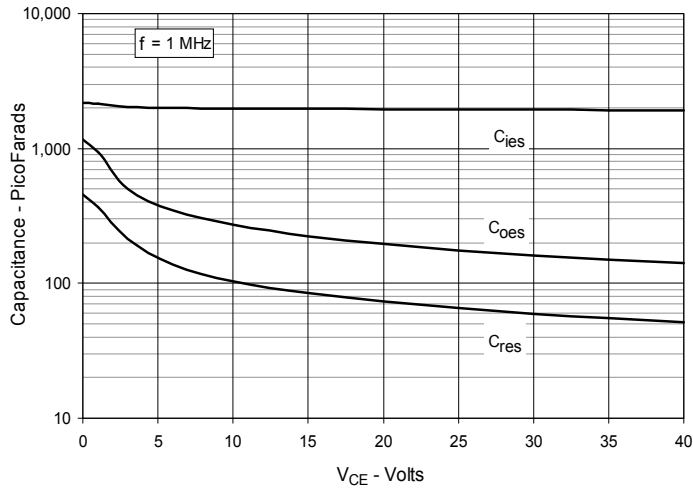


Fig. 10. Reverse-Bias Safe Operating Area

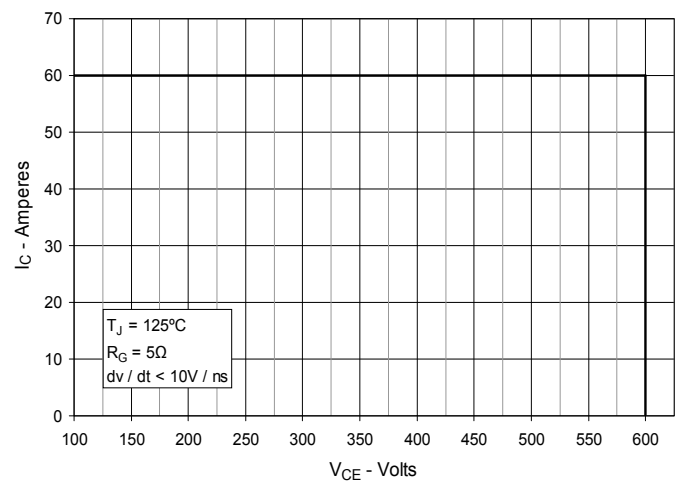
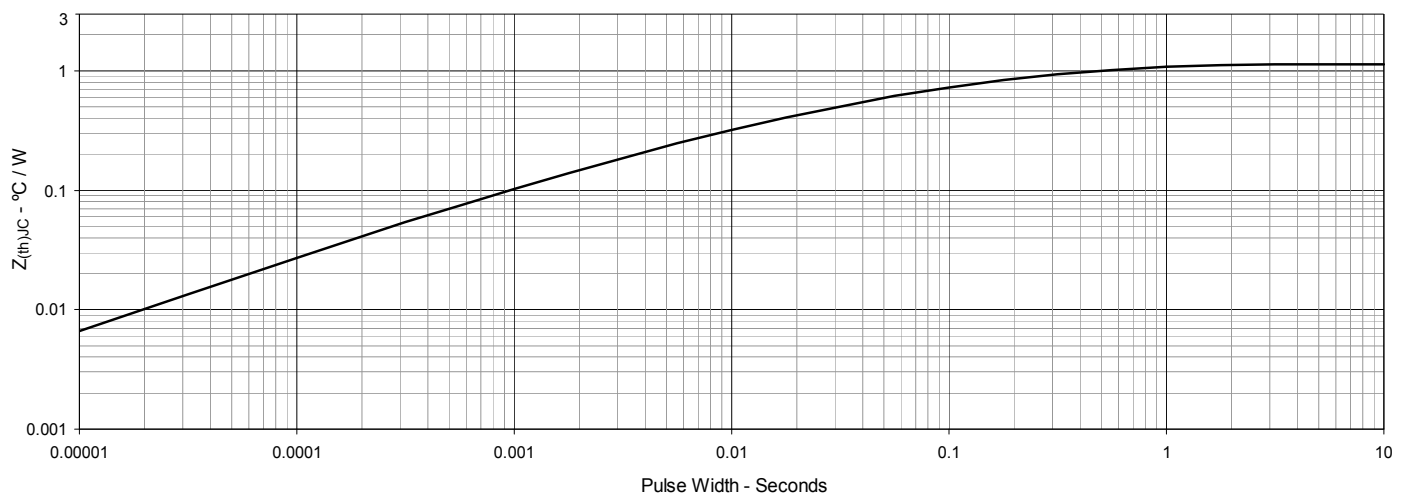
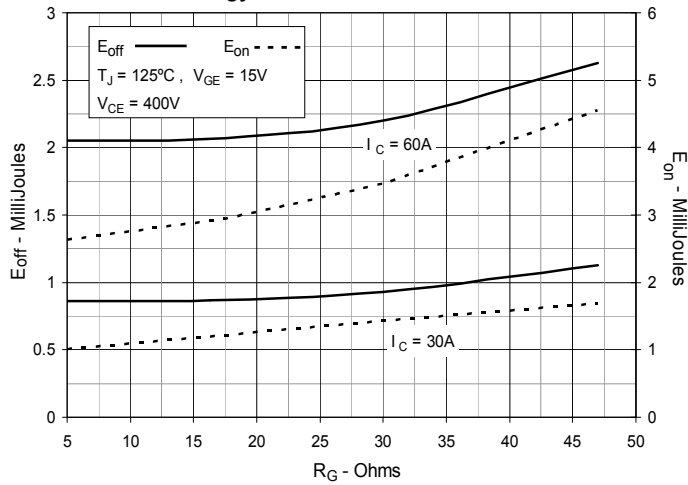


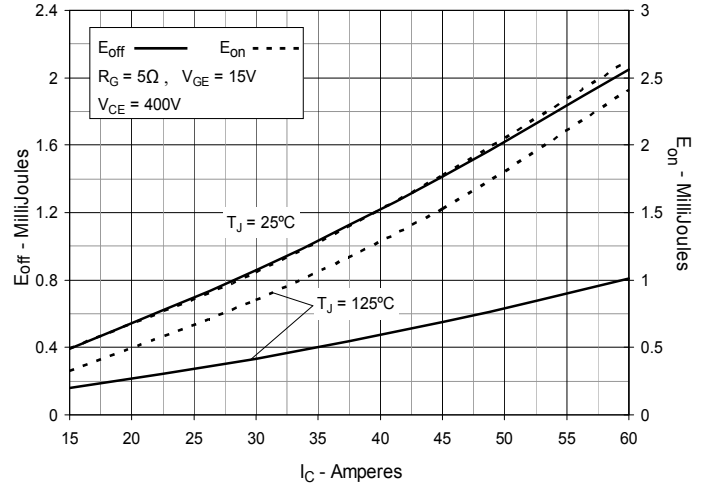
Fig. 11. Maximum Transient Thermal Impedance



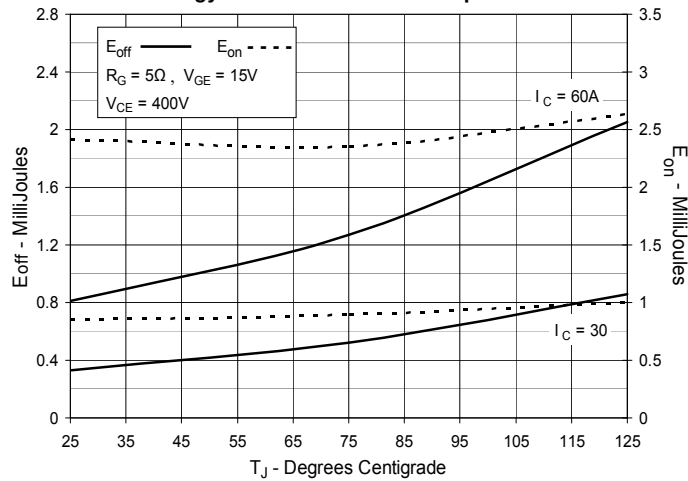
**Fig. 12. Inductive Switching
Energy Loss vs. Gate Resistance**



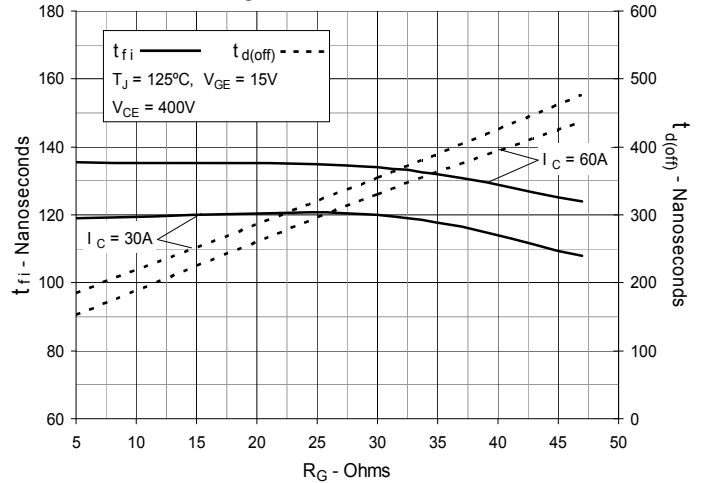
**Fig. 13. Inductive Switching
Energy Loss vs. Collector Current**



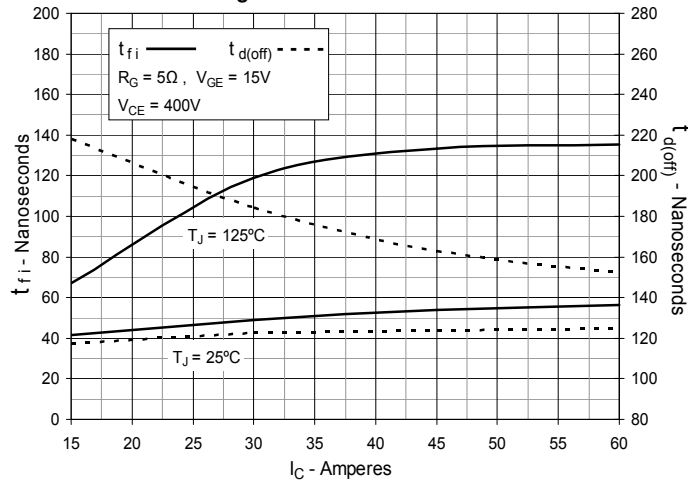
**Fig. 14. Inductive Switching
Energy Loss vs. Junction Temperature**



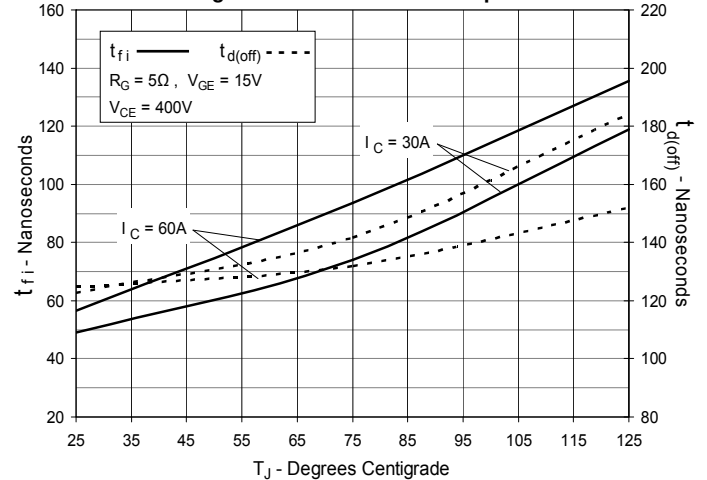
**Fig. 15. Inductive Turn-off
Switching Times vs. Gate Resistance**



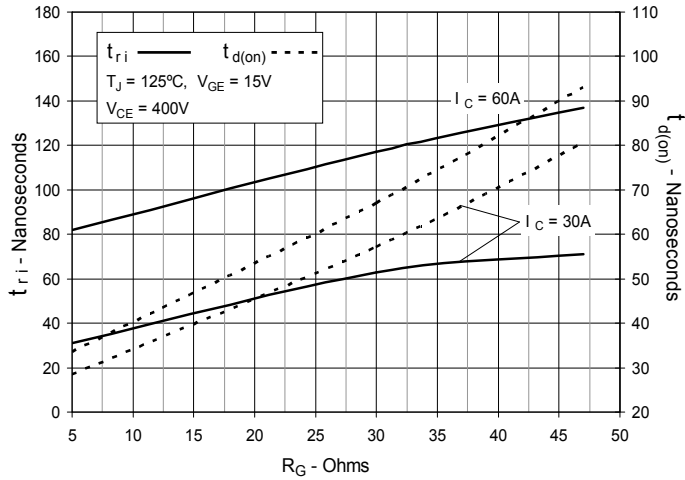
**Fig. 16. Inductive Turn-off
Switching Times vs. Collector Current**



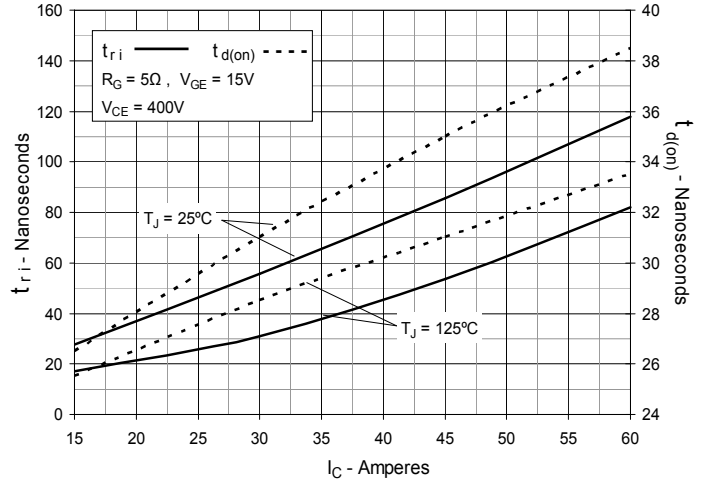
**Fig. 17. Inductive Turn-off
Switching Times vs. Junction Temperature**



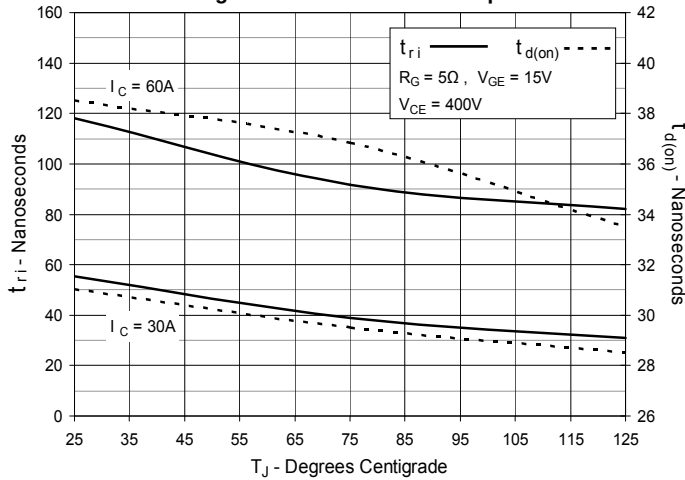
**Fig. 18. Inductive Turn-on
Switching Times vs. Gate Resistance**



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



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



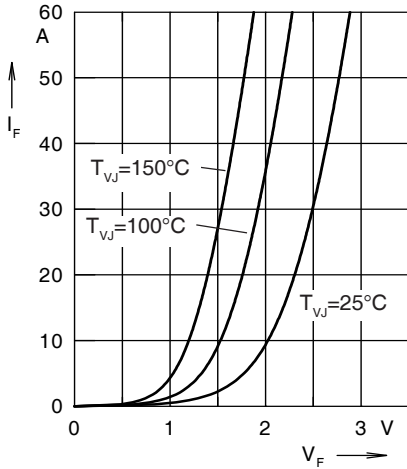


Fig. 21. Forward current I_F versus V_F

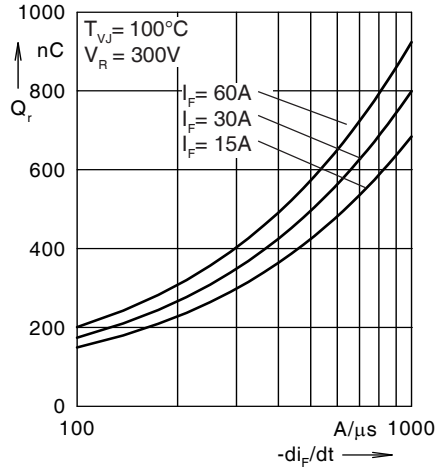


Fig. 22. Reverse recovery charge Q_r versus $-di_F/dt$

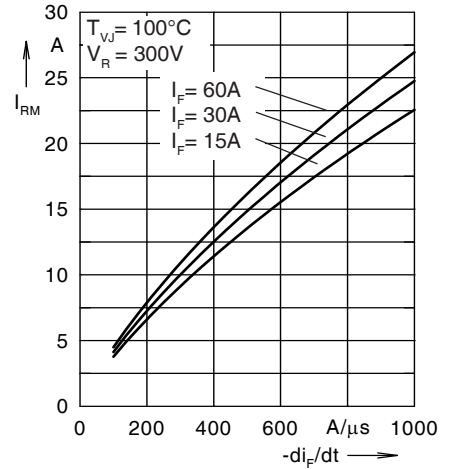


Fig. 23. Peak reverse current I_{RM} versus $-di_F/dt$

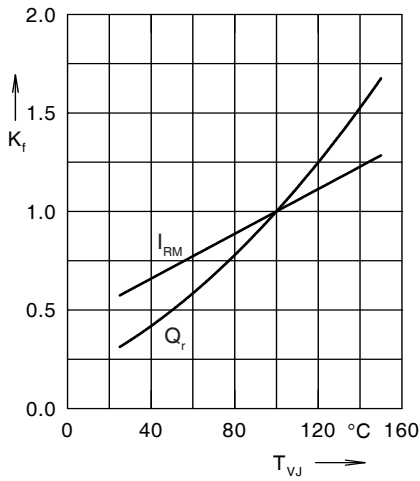


Fig. 24. Dynamic parameters Q_r , I_{RM} versus T_{VJ}

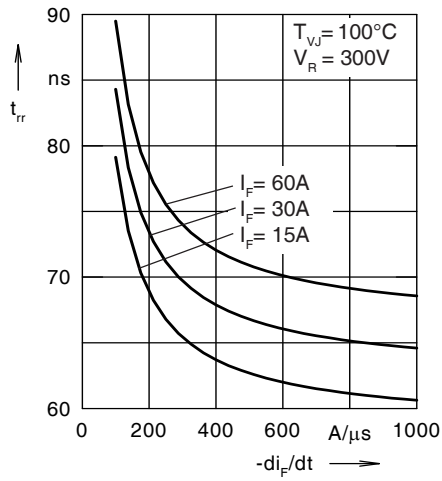


Fig. 25. Recovery time t_{rr} versus $-di_F/dt$

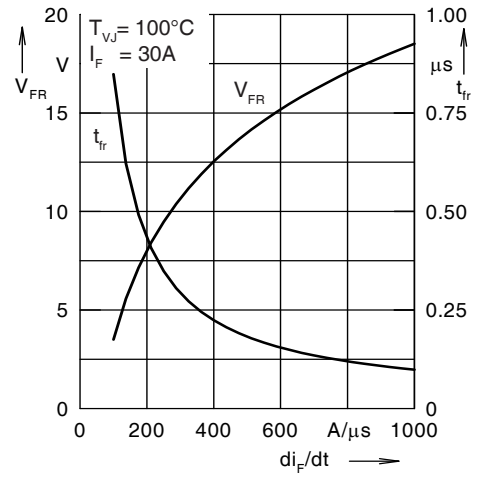


Fig. 26. Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

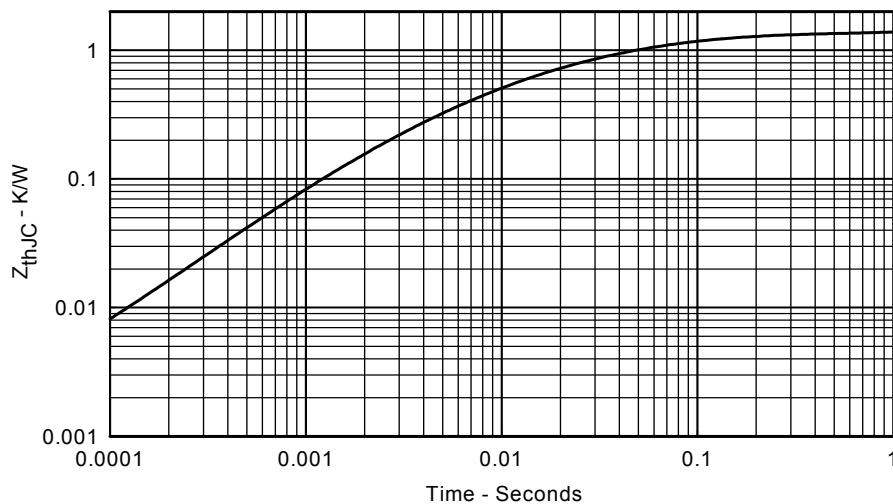
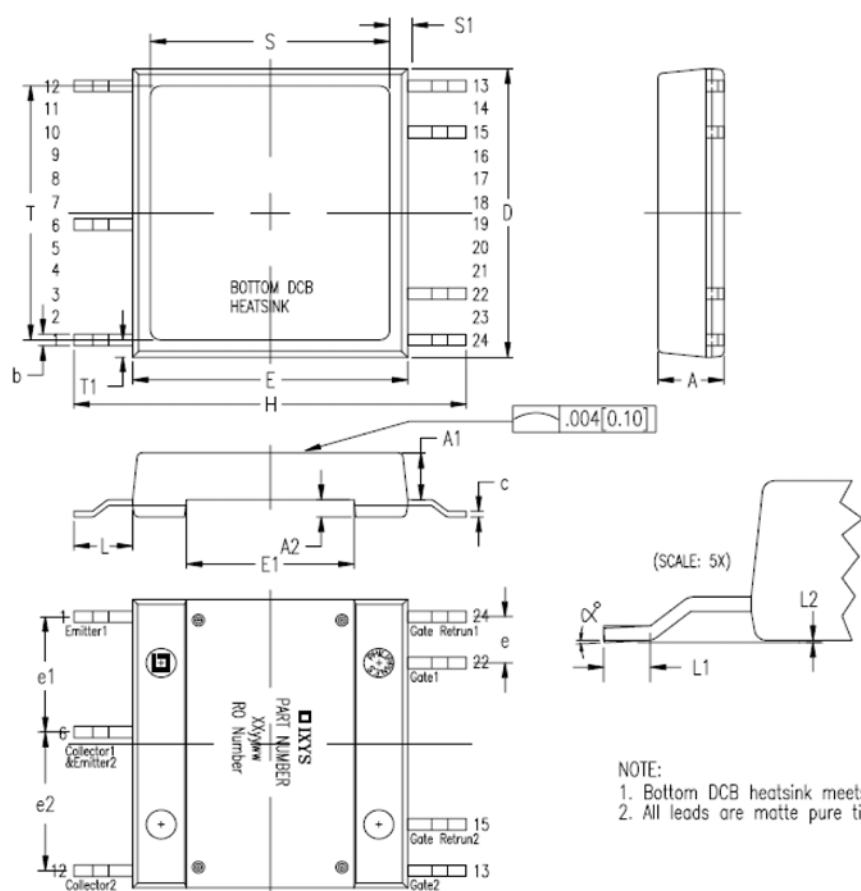


Fig. 27. Transient thermal resistance junction to case



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	.157 BSC		4.00 BSC	
e1	.394 BSC		10.00 BSC	
e2	.472 BSC		12.00 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	.748	.807	19.00	20.50
S1	.039	.079	1.00	2.00
T	.826	.886	21.00	22.50
T1	.039	.079	1.00	2.00
α	0	4°	0	4°

NOTE:

1. Bottom DCB heatsink meets 2.6KV AC, 2 Sec isolation to the other pins.
2. All leads are matte pure tin plated.