

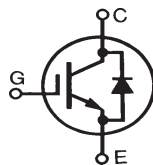
High Speed IGBT with Diode

IXSH 30N60B2D1
IXST 30N60B2D1

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 48 \text{ A} \\ V_{CE(sat)} &= 2.5 \text{ V} \end{aligned}$$

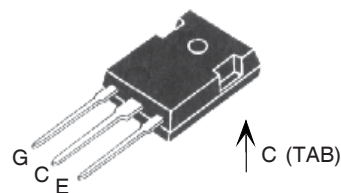
Short Circuit SOA Capability

Preliminary Data Sheet

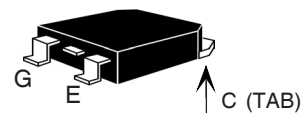


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	48	A
I_{C110}	$T_C = 110^\circ\text{C}$	30	A
$I_{F(110)}$		28	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	90	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_J = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load	$I_{CM} = 48$ @ $0.8 V_{CES}$	A
t_{SC} (SCSOA)	$V_{GE} = 15 \text{ V}, V_{CE} = 360 \text{ V}, T_J = 125^\circ\text{C}$ $R_G = 10 \Omega$, non repetitive	10	μs
P_C	$T_C = 25^\circ\text{C}$	250	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Weight	TO-247	6	g
	TO-268	5	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum tab temperature for soldering for 10s		260	$^\circ\text{C}$

TO-247 (IXSH)



TO-268 (IXST)



G = Gate C = Collector
E = Emitter TAB = Collector

Features

- International standard package
- Guaranteed Short Circuit SOA capability
- Low $V_{CE(sat)}$
 - for low on-state conduction losses
- High current handling capability
- MOS Gate turn-on
 - drive simplicity
- Fast fall time for switching speeds up to 20 kHz

Applications

- AC motor speed control
- Uninterruptible power supplies (UPS)
- Welding

Advantages

- High power density

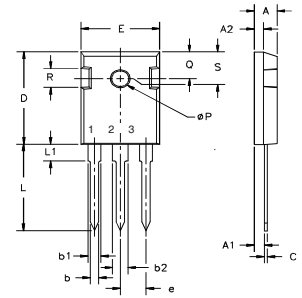
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
$V_{GE(th)}$	$I_C = 750 \mu\text{A}, V_{CE} = V_{GE}$	4.0		7.0 V
I_{CES}	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$			150 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = 24 \text{ A}, V_{GE} = 15 \text{ V}$			2.5 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = 24\text{A}; V_{CE} = 10\text{ V}$, Note 1	7.0	12.0	S
C_{ies}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$ $f = 1\text{ MHz}$ 20N60B2D1		1220	pF
C_{oes}			110	pF
C_{res}			140	pF
Q_g	$I_C = 24\text{A}, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$		42	pF
Q_{ge}			50	nC
Q_{gc}			23	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = 24\text{A}, V_{GE} = 15\text{ V}$ $V_{CE} = 400\text{ V}, R_G = 5\ \Omega$ Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	nC
t_{ri}			30	ns
$t_{d(off)}$			130	ns
t_{fi}			140	ns
E_{off}			0.55	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = 24\text{ A}, V_{GE} = 15\text{ V}$ $V_{CE} = 400\text{ V}, R_G = 5\ \Omega$ Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		30	ns
t_{ri}			50	ns
E_{on}			0.32	mJ
$t_{d(off)}$			0.82	mJ
t_{fi}			202	ns
E_{off}			234	ns
R_{thJC}			1.18	mJ
R_{thCS}			0.21	K/W

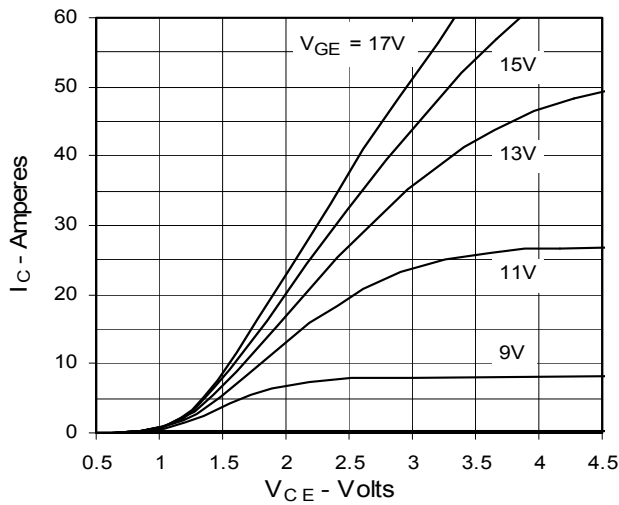
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = 30\text{A}, V_{GE} = 0\text{ V}$ $T_J = 150^\circ\text{C}$			1.6 V 2.5 V
I_{RM}	$I_F = 50\text{A}, V_{GE} = 0\text{ V}, -di_F/dt = 100\text{ A}/\mu\text{s}$ $T_J = 100^\circ\text{C}$		2.0	2.5 A
t_{rr}	$V_R = 100\text{ V}$ $T_J = 100^\circ\text{C}$		150	ns
t_{rr}	$I_F = 1\text{ A}; -di/dt = 100\text{ A}/\mu\text{s}; V_R = 30\text{ V}$		30	ns
R_{thJC}				0.9 K/W

Note 1: Pulse test, $t \leq 300\ \mu\text{s}$, duty cycle $d \leq 2\%$

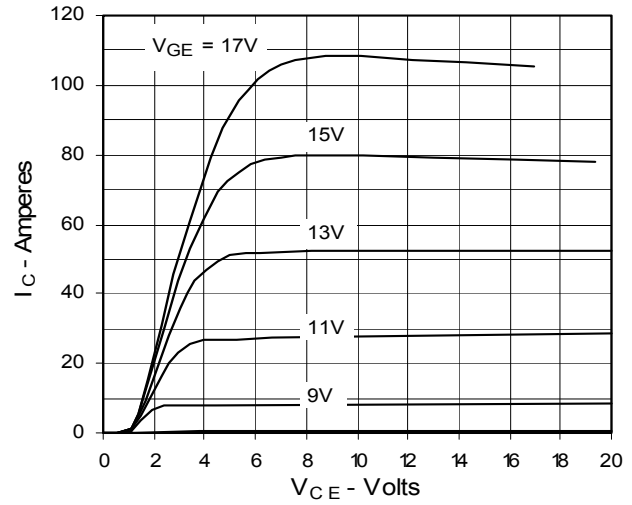
TO-247 (IXSH) Outline



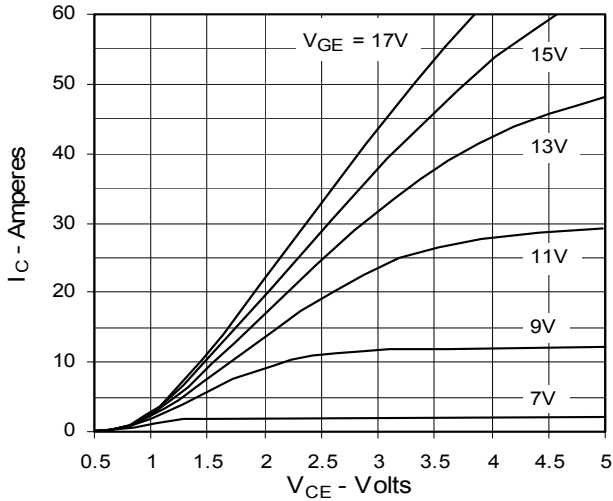
**Fig. 1. Output Characteristics
@ 25 °C**



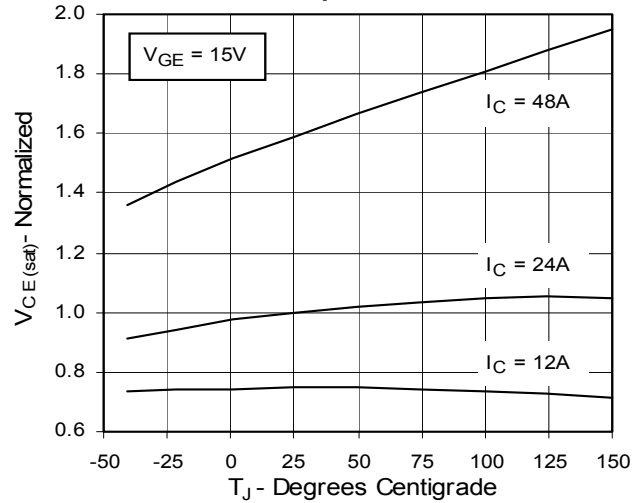
**Fig. 2. Extended Output Characteristics
@ 25 °C**



**Fig. 3. Output Characteristics
@ 125 °C**



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



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

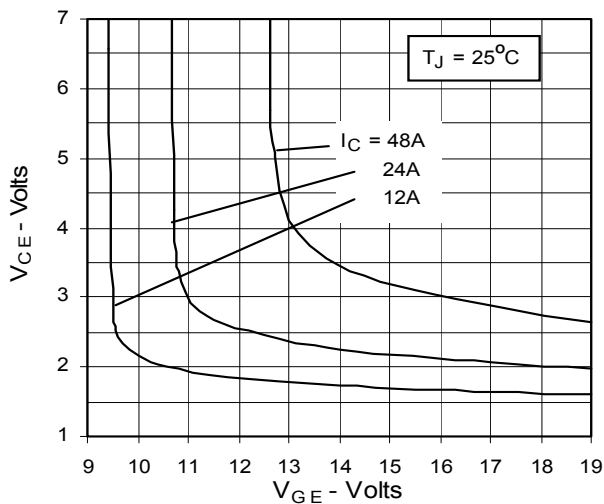


Fig. 6. Input Admittance

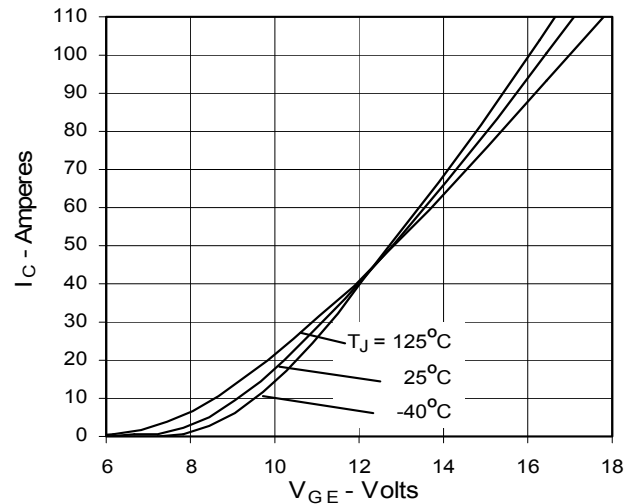


Fig. 7. Transconductance

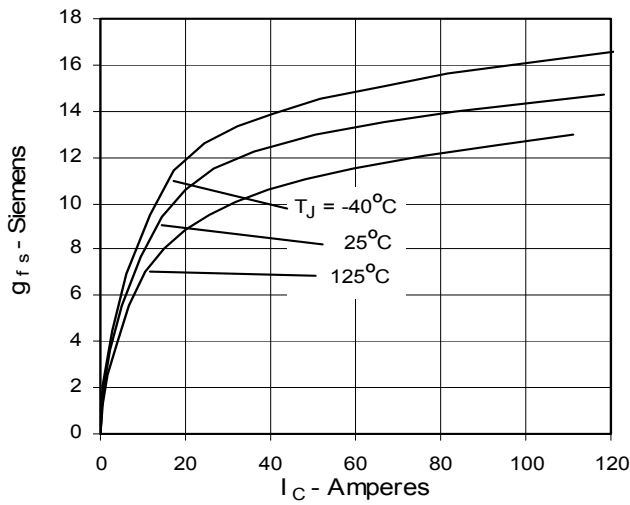


Fig. 8. Dependence of Turn-off Energy Loss on R_G

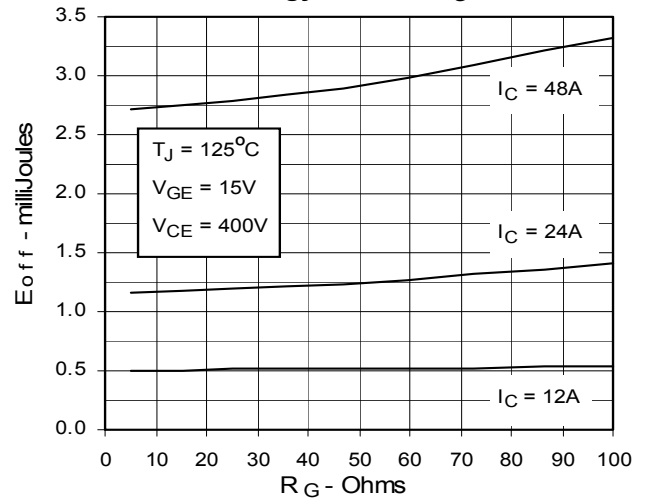


Fig. 9. Dependence of Turn-Off Energy Loss on I_C

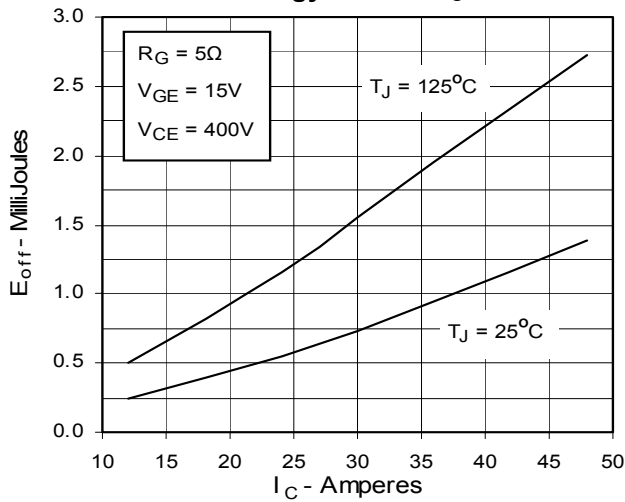


Fig. 10. Dependence of Turn-off Energy Loss on Temperature

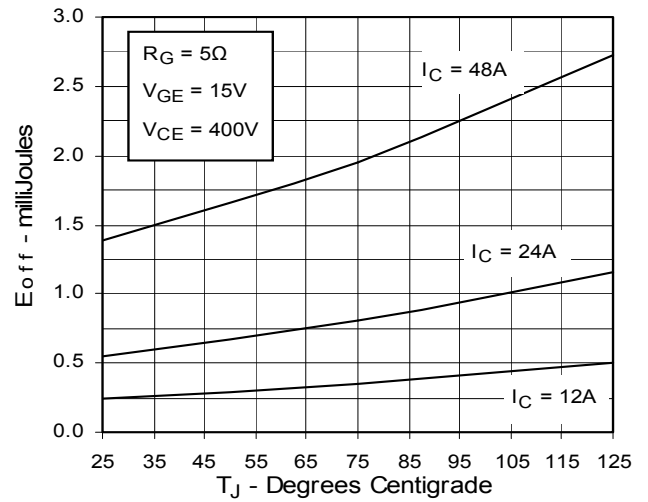


Fig. 11. Dependence of Turn-off Switching Time on R_G

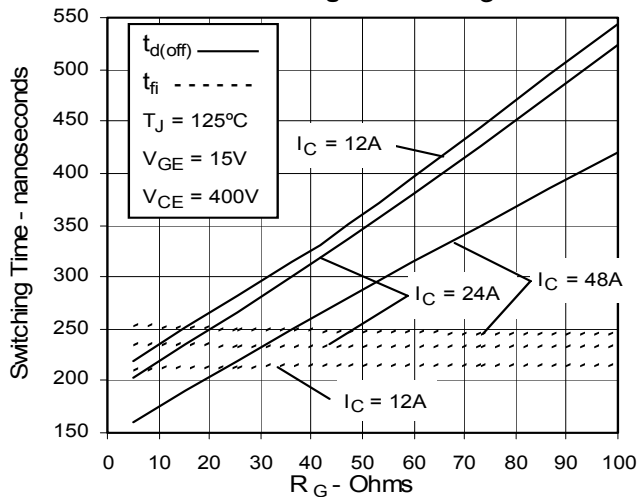


Fig. 12. Dependence of Turn-off Switching Time on I_C

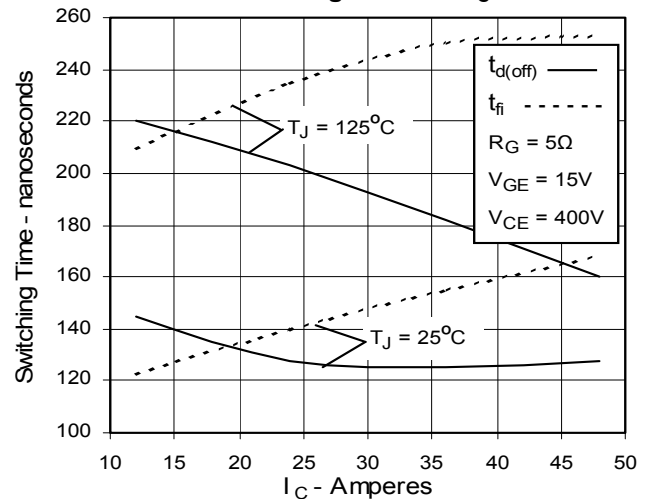


Fig. 13. Dependence of Turn-off Switching Time on Temperature

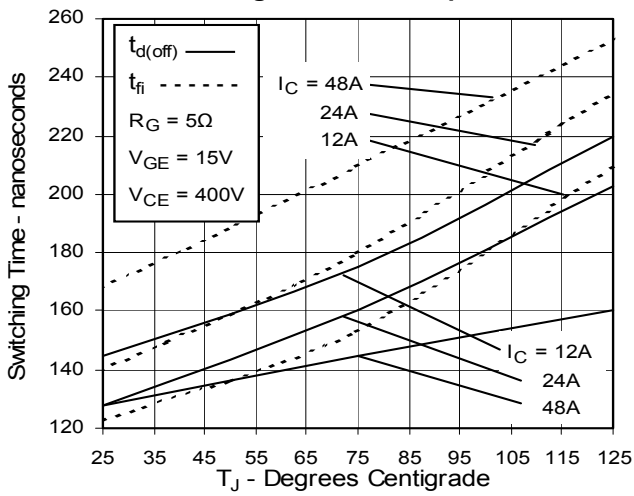


Fig. 14. Gate Charge

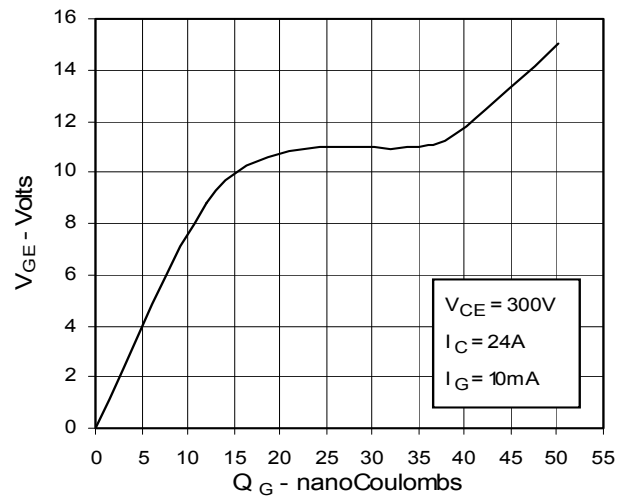


Fig. 15. Capacitance

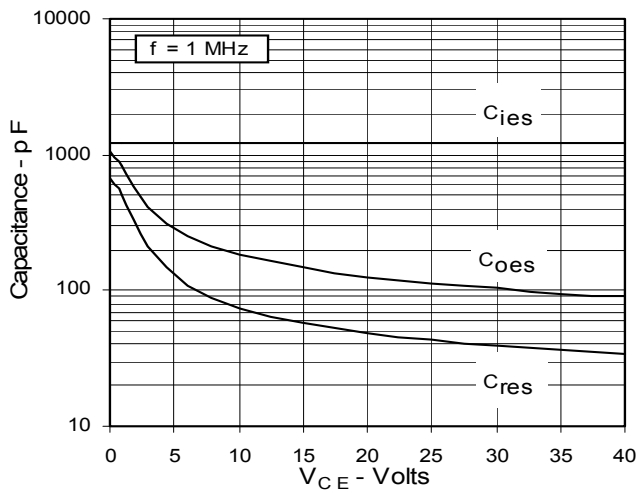


Fig. 16. Reverse-Bias Safe Operating Area

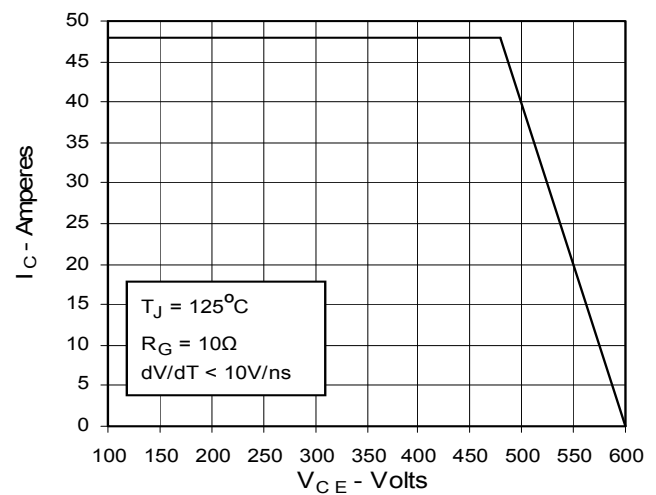
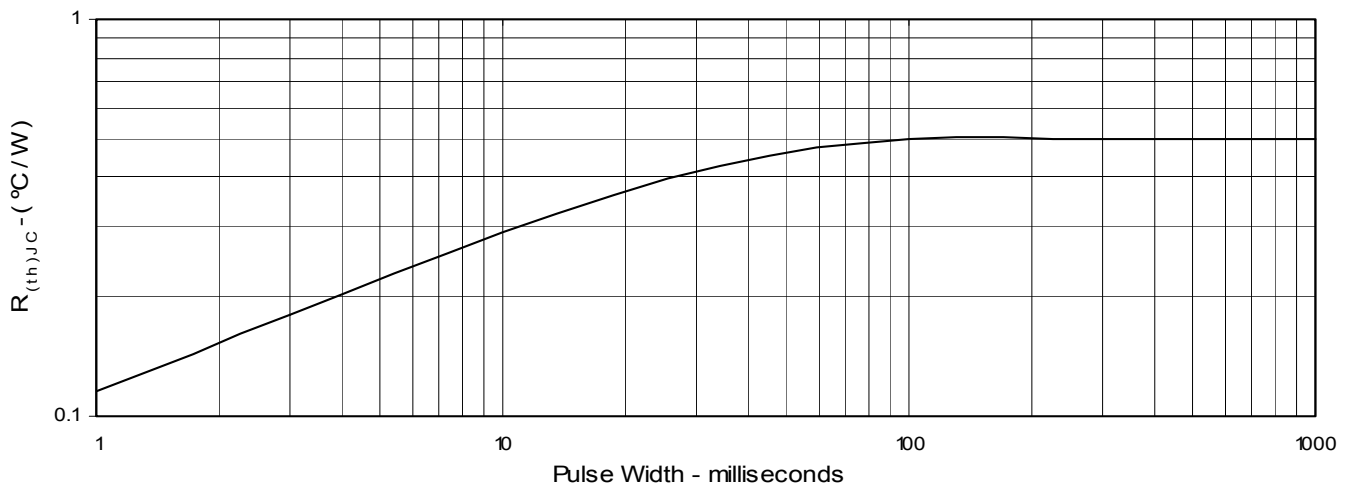


Fig. 17. Maximum Transient Thermal Resistance



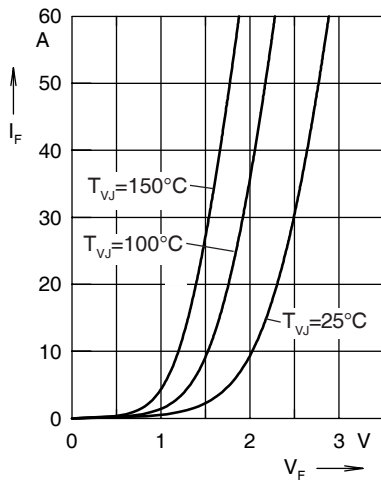


Fig. 18. Forward current I_F versus V_F

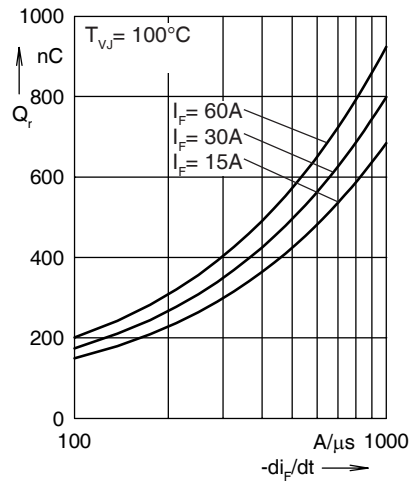


Fig. 19. Reverse recovery charge

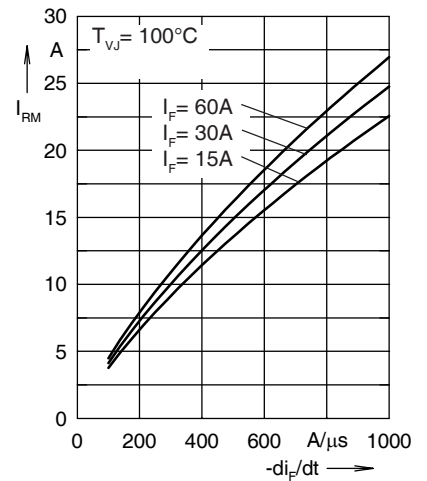


Fig. 20. Peak reverse current I_{RM}

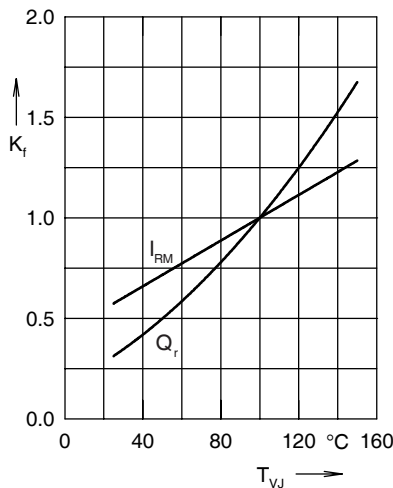


Fig. 21. Dynamic parameters Q_r , I_{RM}

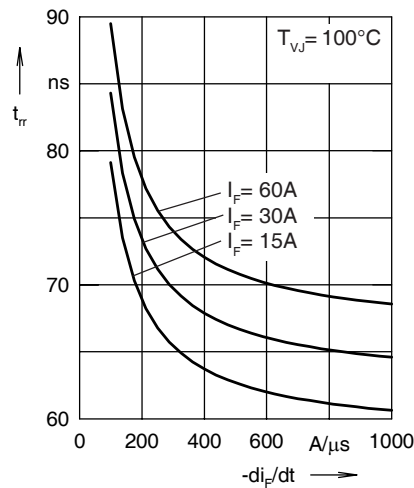


Fig. 22. Recovery time t_{rr} versus

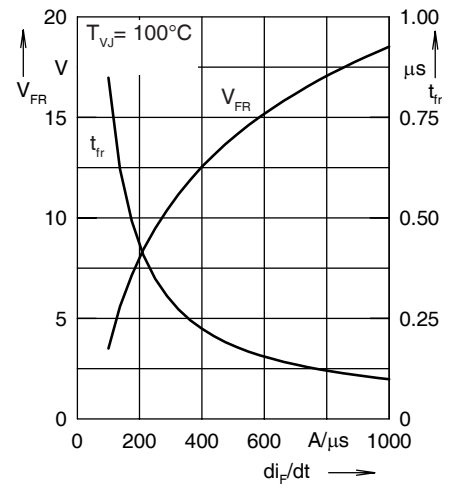


Fig. 23. Peak forward voltage V_{FR}

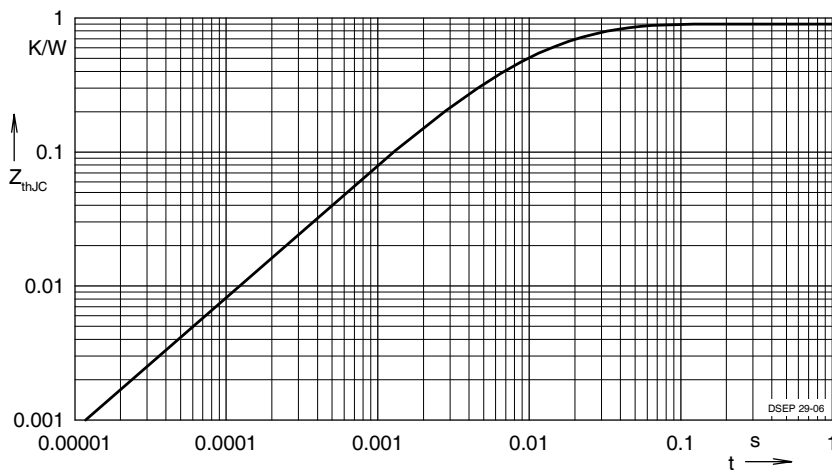


Fig. 24. Transient thermal resistance junction to case

Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.502	0.0052
2	0.193	0.0003