

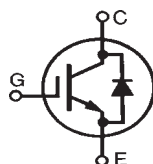
High Speed IGBT with Diode

IXSH 30N60B2D1
IXST 30N60B2D1

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

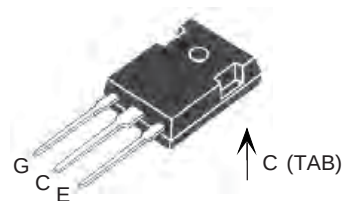
Short Circuit SOA Capability

Preliminary Data Sheet

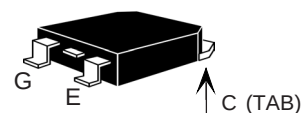


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	48	A
I_{C110}	$T_C = 110^\circ\text{C}$	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

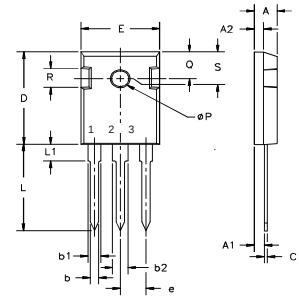
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
$V_{GE(th)}$	$I_C = 750 \mu\text{A}, V_{CE} = V_{GE}$	4.0		7.0 V
I_{CES}	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$			150 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = 24 \text{ A}, V_{GE} = 15 \text{ V}$			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
			140	pF
C_{res}			42	pF
Q_g	$I_C = 24\text{A}, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$		50	nC
Q_{ge}			23	nC
Q_{gc}			15	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		30	ns
t_{ri}			30	ns
$t_{d(off)}$			130	280 ns
t_{fi}			140	300 ns
E_{off}			0.55	1.0 mJ
$t_{d(on)}$			30	ns
t_{ri}	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		50	ns
E_{on}			0.32	mJ
			0.82	mJ
$t_{d(off)}$			202	ns
t_{fi}			234	ns
E_{off}			1.18	mJ
R_{thJC}				0.50 K/W
R_{thCS}			0.21	K/W

Reverse Diode (FRED)		Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
Symbol	Test Conditions	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 $d \leq 2\%$

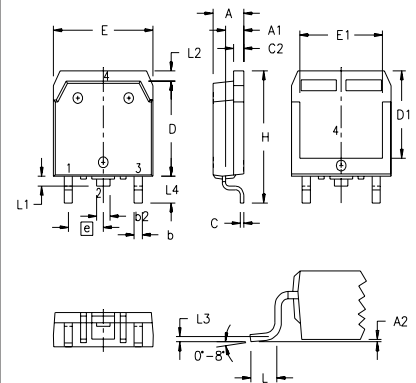
TO-247 (IXSH) Outline



Terminals: 1 - Gate 2 - Drain

Dim.	Millimeter	Inches
	Min. Max.	Min. Max.
A	4.7 5.3	.185 .209
A ₁	2.2 2.54	.087 .102
A ₂	2.2 2.6	.059 .098
b	1.0 1.4	.040 .055
b ₁	1.65 2.13	.065 .084
b ₂	2.87 3.12	.113 .123
C	.4 .8	.016 .031
D	20.80 21.46	.819 .845
E	15.75 16.26	.610 .640
e	5.20 5.72	0.205 0.225
L	19.81 20.32	.780 .800
L ₁	4.50	.177
ØP	3.55 3.65	.140 .144
Q	5.89 6.40	0.232 0.252

TO-268 (IXST) Outline



SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.193	.201	4.90	5.10
A ₁	.106	.114	2.70	2.90
A ₂	.001	.010	0.02	0.25
b	.045	.057	1.15	1.45
b ₂	.075	.083	1.90	2.10
C	.016	.026	0.40	0.65
C ₂	.057	.063	1.45	1.60
D	.543	.551	13.80	14.00
D ₁	.488	.500	12.40	12.70
E	.624	.632	15.85	16.05
E ₁	.524	.535	13.30	13.60
e	.215 BSC		5.45 BSC	
H	.736	.752	18.70	19.10
L	.094	.106	2.40	2.70
L ₁	.047	.055	1.20	1.40
L ₂	.039	.045	1.00	1.15
L ₃	.010 BSC		0.25 BSC	
L ₄	.150	.161	3.80	4.10

Fig. 1. Output Characteristics
@ 25 °C

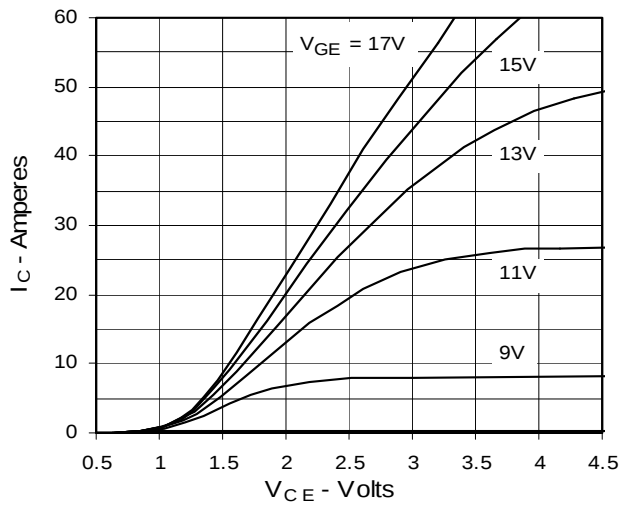


Fig. 2. Extended Output Characteristics
@ 25 °C

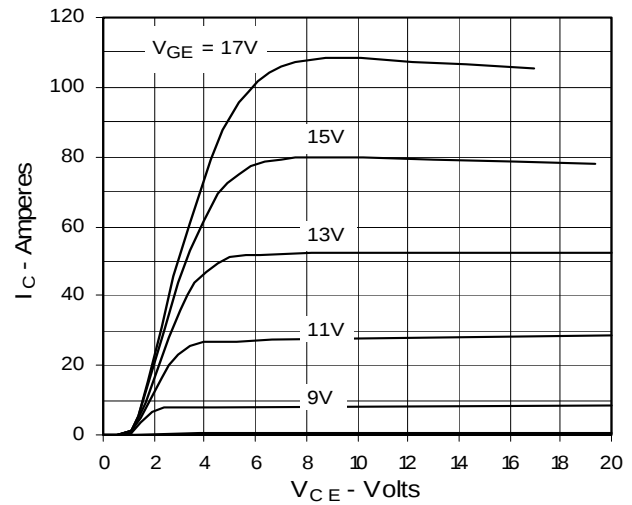


Fig. 3. Output Characteristics
@ 125 °C

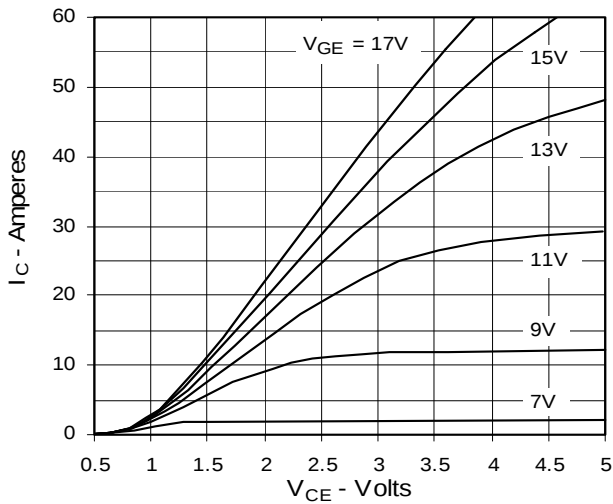


Fig. 4. Dependence of $V_{CE(sat)}$ on Temperature

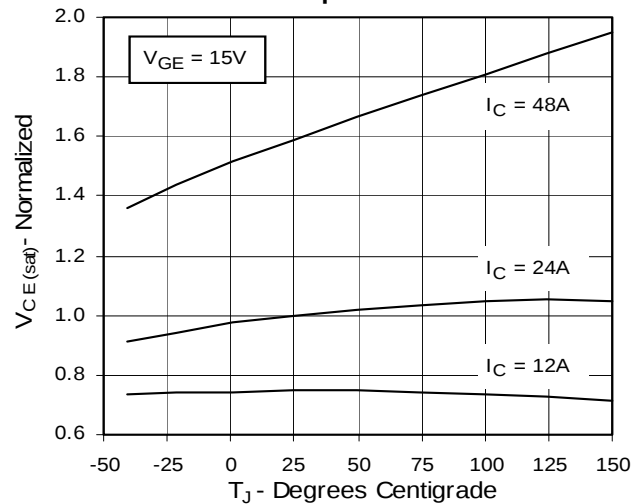


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage

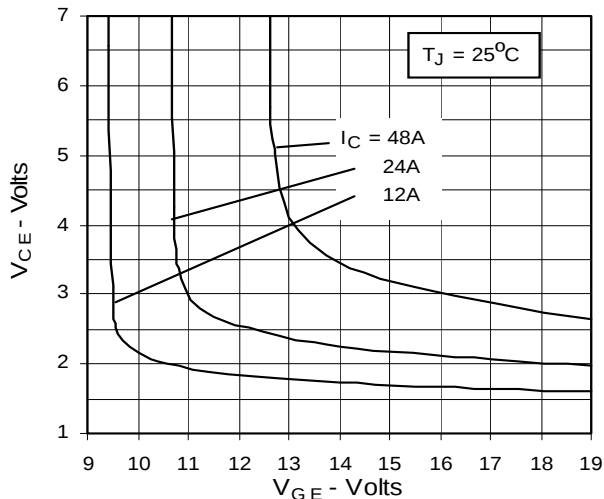


Fig. 6. Input Admittance

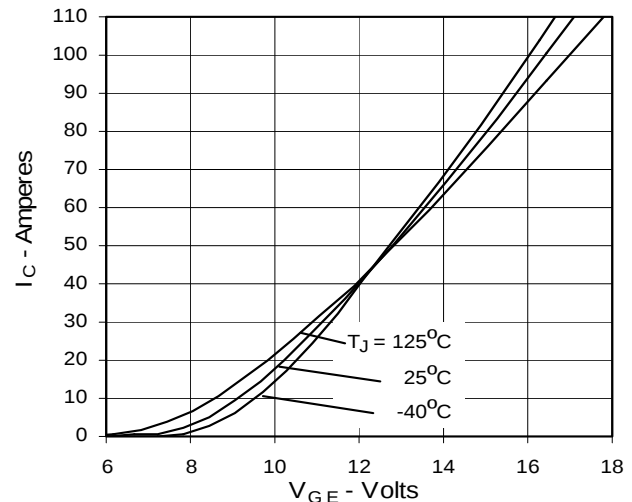


Fig. 7. Transconductance

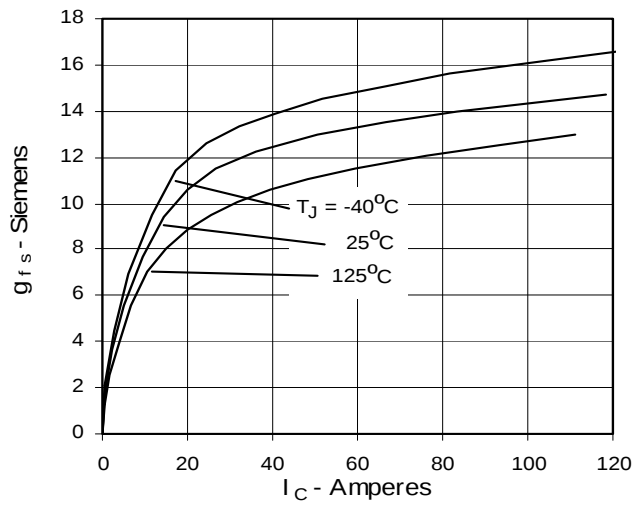


Fig. 8. Dependence of Turn-off Energy Loss on R_G

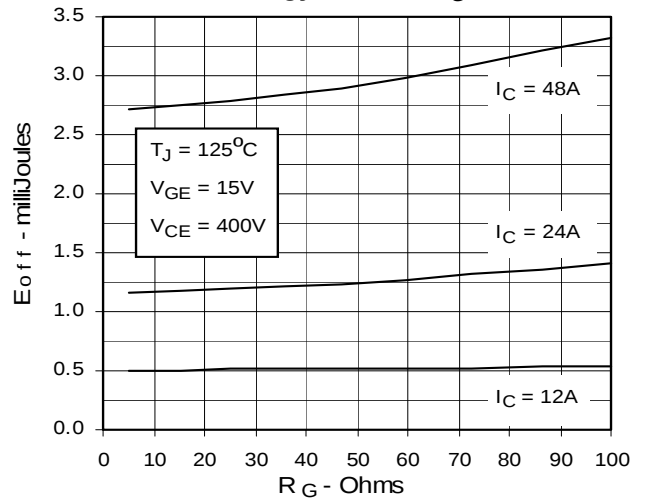


Fig. 9. Dependence of Turn-Off Energy Loss on I_C

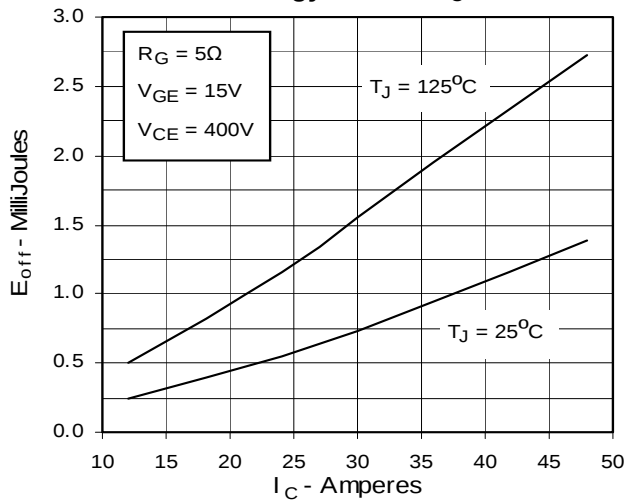


Fig. 10. Dependence of Turn-off Energy Loss on Temperature

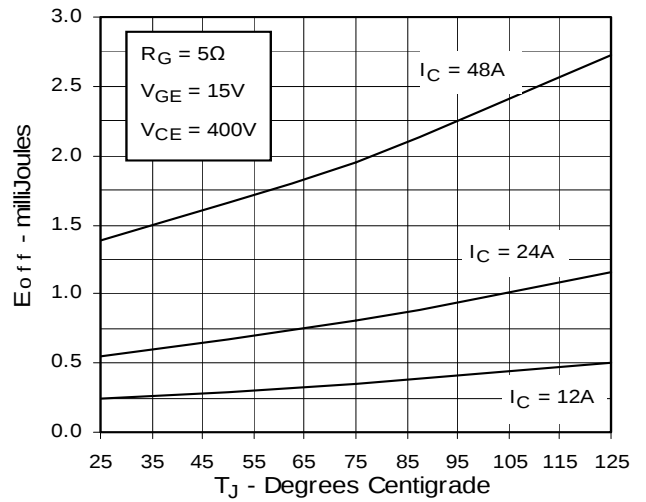


Fig. 11. Dependence of Turn-off Switching Time on R_G

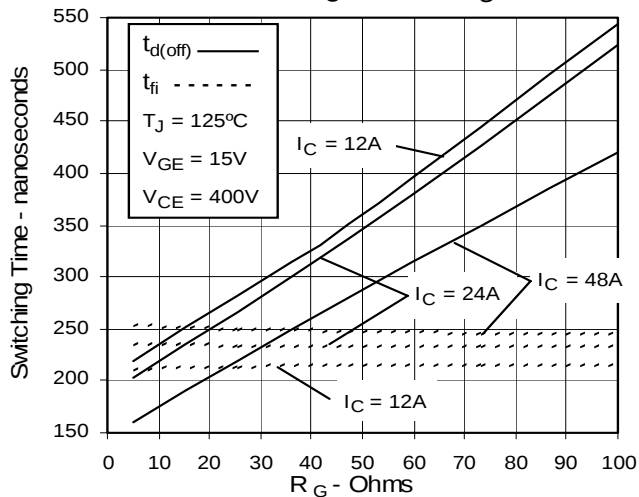


Fig. 12. Dependence of Turn-off Switching Time on I_C

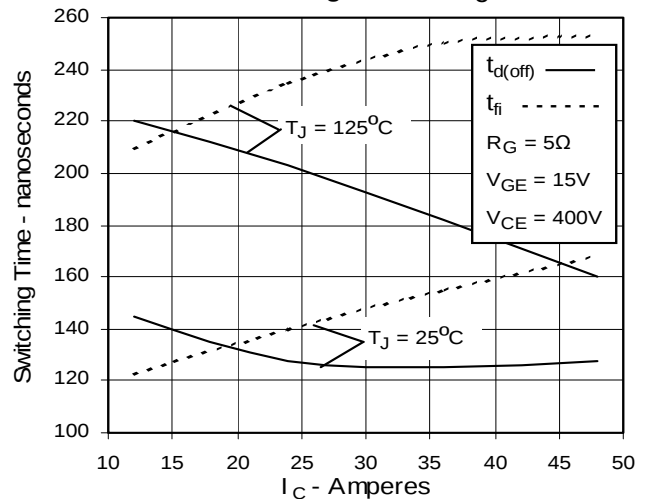


Fig. 13. Dependence of Turn-off Switching Time on Temperature

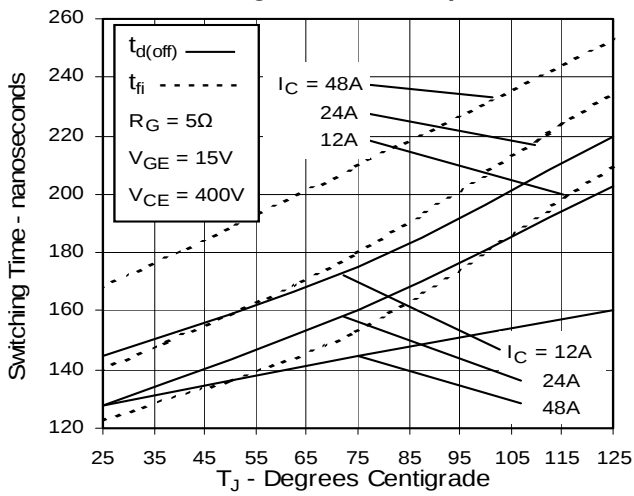


Fig. 14. Gate Charge

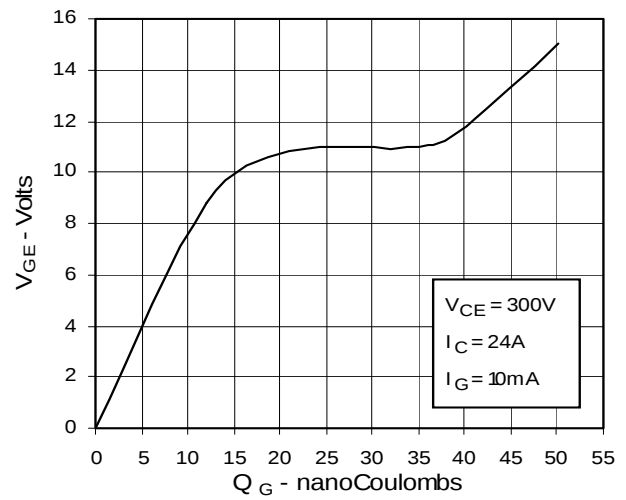


Fig. 15. Capacitance

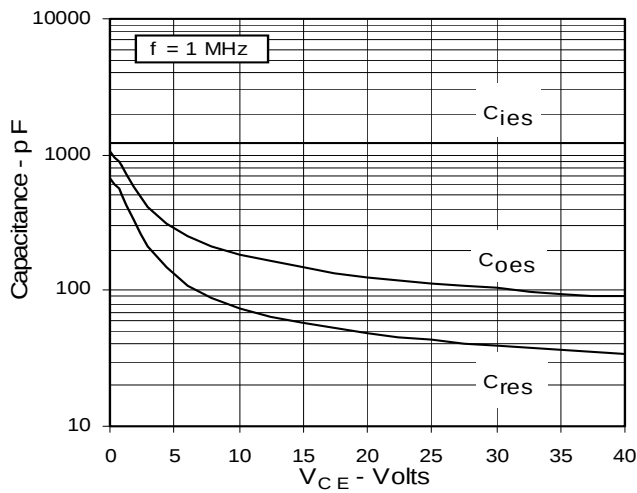


Fig. 16. Reverse-Bias Safe Operating Area

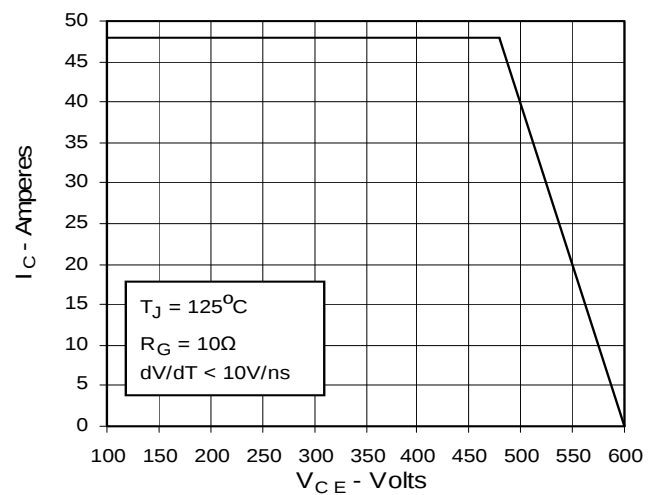
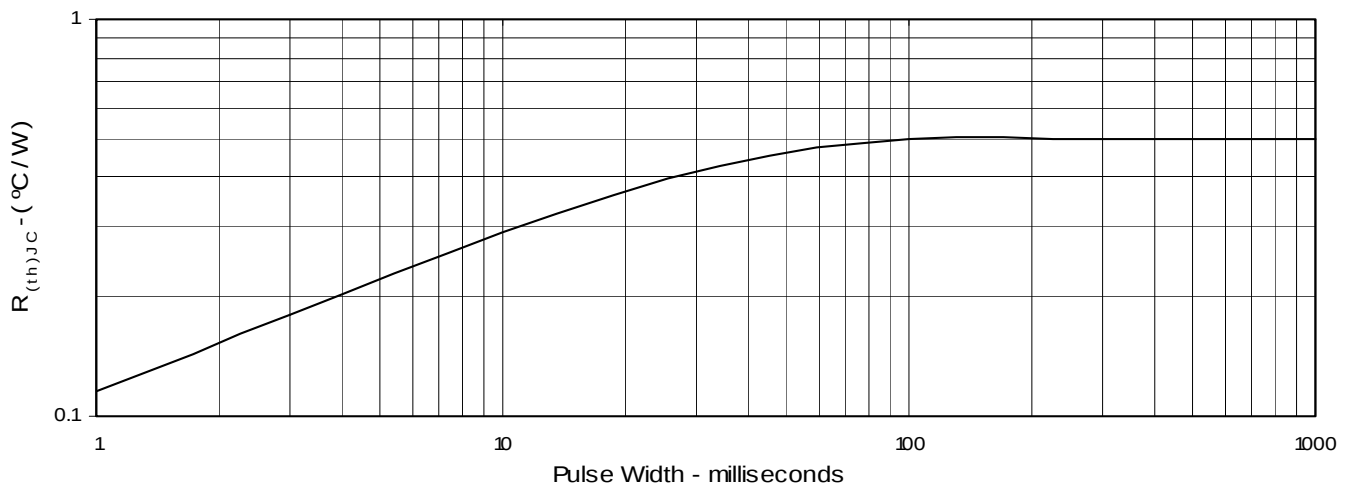


Fig. 17. Maximum Transient Thermal Resistance



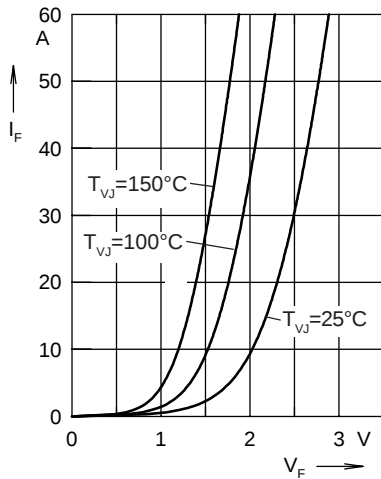


Fig. 18. Forward current I_F versus V_F

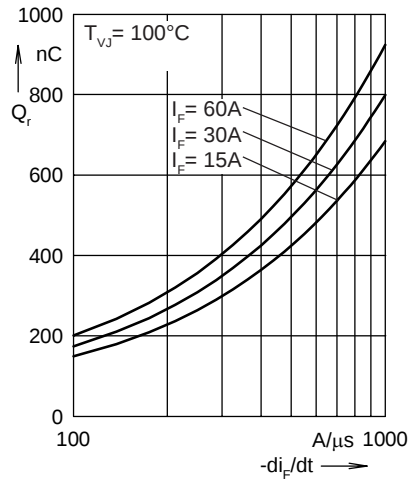


Fig. 19. Reverse recovery charge

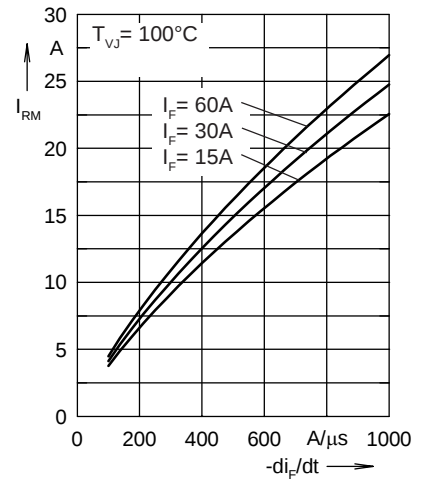


Fig. 20. Peak reverse current I_{RM}

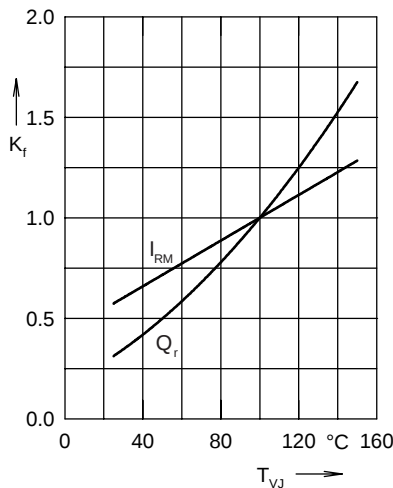


Fig. 21. Dynamic parameters Q_r , I_{RM}

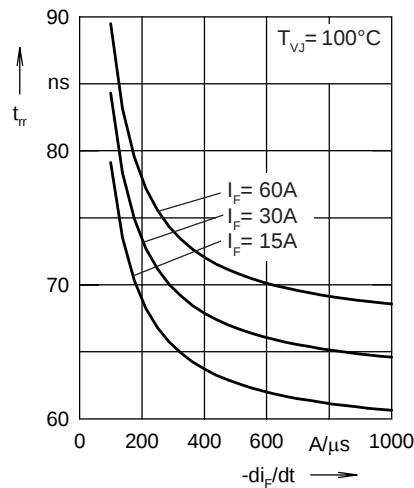


Fig. 22. Recovery time t_{rr} versus

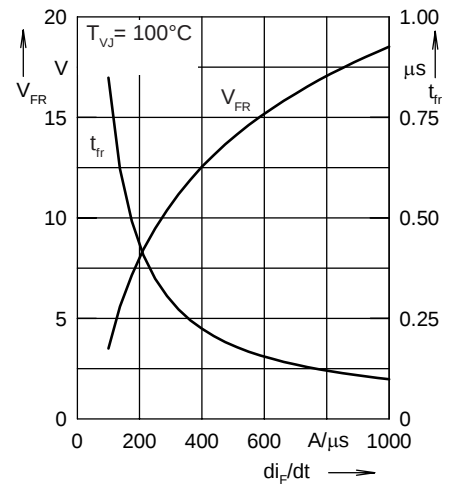


Fig. 23. Peak forward voltage V_{FR}

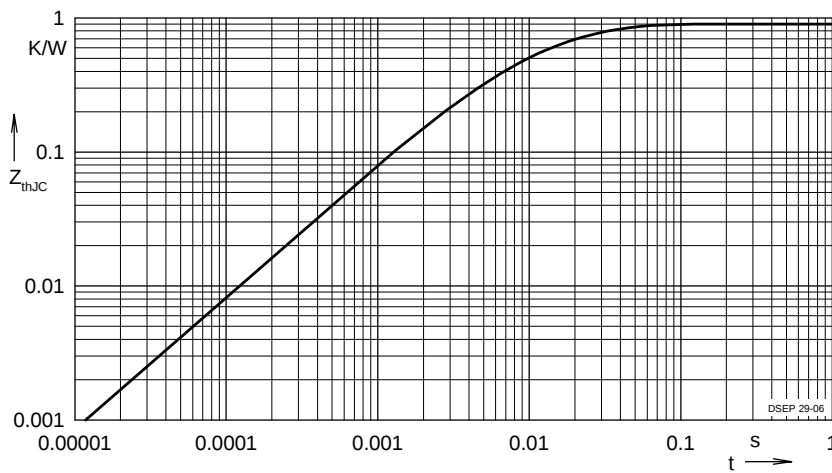


Fig. 24. Transient thermal resistance junction to case

Constants for Z_{thJC} calculation:

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



Disclaimer Notice - Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at www.littelfuse.com/disclaimer-electronics.