SG40T120DB2

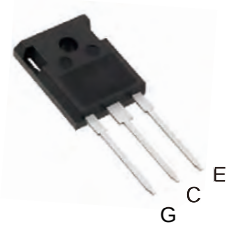
Discrete IGBTs

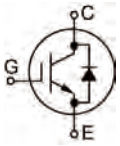
V_{CES} = 1200V

I_{C100} = 40A

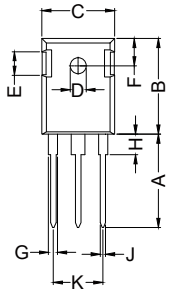
V_{CESAT} = 1.90V

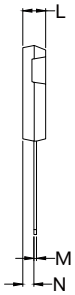
$E_{off(typ)}$ = 1.4mJ





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





Dimensions TO-247AD

Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.620	0.640
ØD	3.15	3.65	0.124	0.144
E	4.32	5.49	0.170	0.216
F	5.40	6.30	0.213	0.248
G	1.65	2.18	0.065	0.086
H	3.80	4.50	0.150	0.177
J	1.00	1.40	0.039	0.055
K	10.80	11.10	0.425	0.437
L	4.70	5.30	0.185	0.209
M	0.40	0.80	0.016	0.031
N	1.50	2.49	0.059	0.098

IGBT

Symbol	Test Conditions	Maximum Ratings	Unit
V_{CES} V_{CGR}	T_J=25°Cto150°C T_J=25°Cto150°C; R_{GE}=1MΩ;	1200 1200	V
V_{GES} V_{GEM}	Continuous Transient	±20 ±3±30	V
I_{C25} I_{C100} I_{CM}	T_C=25°C;limited by leads T_C=100°C T_C=25°C,1ms	80 40 160	A
SSOA (RBSOA)	V_{GE}=15V;T_{VJ}=125°C;R_G=5Ω Clamped inductive load	I_{CM}=120 @ 0.8 V_{CES}	A
P_C	T_C=25°C	280	W
T_J T_{JM} T_{stg}		-55...+175 175 -55...+150	°C
	Maximum lead temperature for soldering 1.6mm(0.062in.)fromcasefor10s Maxium Tab temperature for soldering SMD devicesfor10s	300 260	°C °C
M_d	Mountingtorque(M3)	1.13/10	Nm/lb.in.
Weight	Typical	6	g

(T_J=25°C,unlessotherwisespecified)

Symbol	Test Conditions	Characteristic Values			Unit
		min.	typ.	max.	
BV_{CES}	I_C=1mA;V_{GE}=0V	1200			V
$V_{GE(th)}$	I_C=250uA;V_{CE}=V_{GE}	4.5	5.8	7.0	V
I_{CES}	V_{CE}=V_{CES}; T_J=25°C V_{GE}=0V; T_J=125°C			250 4	uA mA
I_{GES}	V_{CE}=0V;V_{GE}=±20V			±200nA	
$V_{CE(sat)}$	I_C=I_{C100}; V_{GE}=15V		1.90	2.40	V

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Discrete IGBTs

(T_J=25°C, unless otherwise specified)

Symbol	Test Conditions	Characteristic Values			Unit
		min.	typ.	max.	
g_{ts}	I_C=I_{C90}; V_{CE}=10V Pulse test, t ≤ 300us, duty cycle ≤ 2%		33		S
$I_{C(ON)}$	V_{GE}=10V; V_{CE}=10V		140		A
C_{ies} C_{oes} C_{res}	V_{CE}=25V; V_{GE}=0V; f=1MHz		3823 170 94		pF
Q_g Q_{ge} Q_{gc}	I_C=I_{C90}; V_{GE}=15V; V_{CE}=0.5V_{CES}		230 30 147		nC
$t_{d(on)}$ t_{ri} $t_{d(off)}$ t_{fi} E_{off}	Inductive load, T_J=25°C I_C=I_{C90}; V_{GE}=15V; V_{CE}=0.5V_{CES};R_G=R_{off}=10Ω Remarks:Switching times may increase for V_{CE}(Clamp) >0 .8V_{CES} higher T_J or increased R_G		62 54 260 30 1.4		ns ns ns ns mJ
$t_{d(on)}$ t_{ri} E_{on} $t_{d(off)}$ t_{fi} E_{off}	Inductive load, T_J=25°C I_C=I_{C100}; VGE=15V; V_{CE}=0.5V_{CES};R_G=R_{off}=10Ω Remarks:Switching times may increase for V_{CE}(Clamp) >0 .8V_{CES} higher T_J or increased R_G		55 54 3.5 300 38 1.85		ns ns mJ ns ns mJ
$R_{thJC(IGBT)}$				0.45	°C/W
$R_{thJA(IGBT)}$				40	°C/W

Reverse Diode (FRED)

(T_J=25°C, unless otherwise specified)

Symbol	Test Conditions	Characteristic Values			Unit
		min.	typ.	max.	
V_F	I_F=15A; T_{VJ}=25°C I_F= 60A; T_{VJ}=25°C		1.58 2.15	1.70	V
I_{RM}	V_R=100V; I_F=20A; -di$_F$/dt=100A/us L ≤ 0.05uH; T_{VJ}=100°C		5.4		A
t_{rr}	I_F=1A; -di/dt=50A/us; V_R=30V; T_J=25°C		70		ns
R_{thJC}	Diode			0.80	K/W

Features

- Low switching losses
- Switching frequency up to 30KHz
- High short circuit capability
- Positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- Ultra fast free wheeling diodes

Application

- AC and DC motor control
- AC servo and robot drives
- power supplies
- welding inverter

Advantages

- space and weight savings
- reduced protection circuits

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Discrete IGBTs

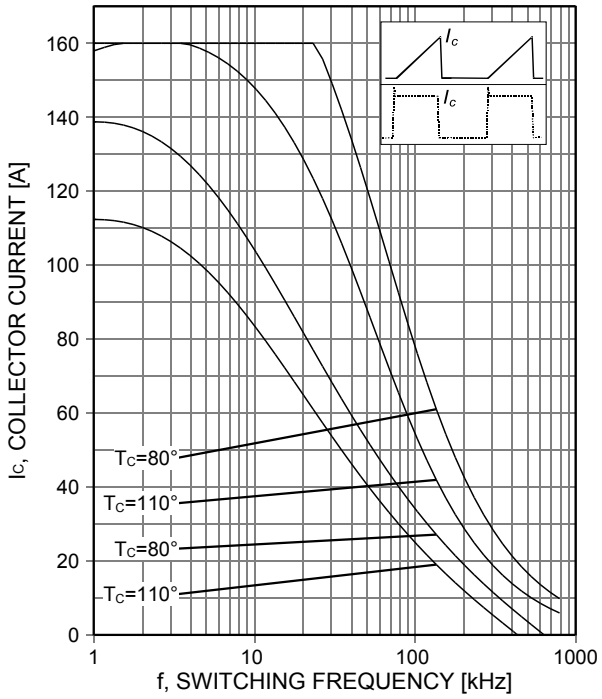

Fig.1 Collector current as a function of switching frequency
(T_j≤175°C,D=0.5,V_{CE}=600V,V_{GE}=15/0V,r_G=12Ω)

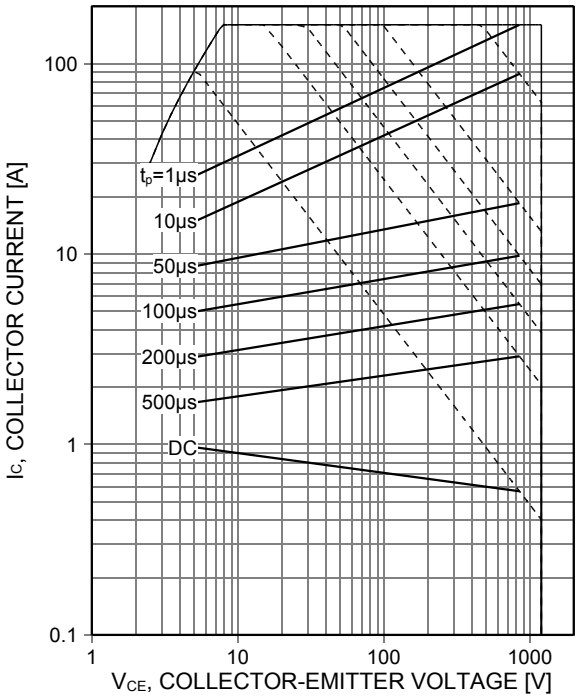

Fig.2 Forward bias safe operating area
(D=0,T_C=25°C,T_j≤175°C;V_{GE}=15V)

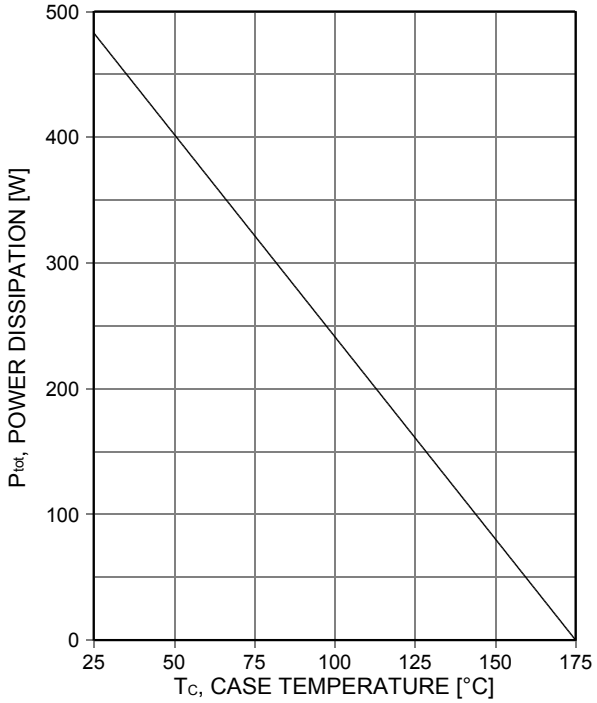

Fig.3 Power dissipation as a function of case temperature (T_j≤175°C)

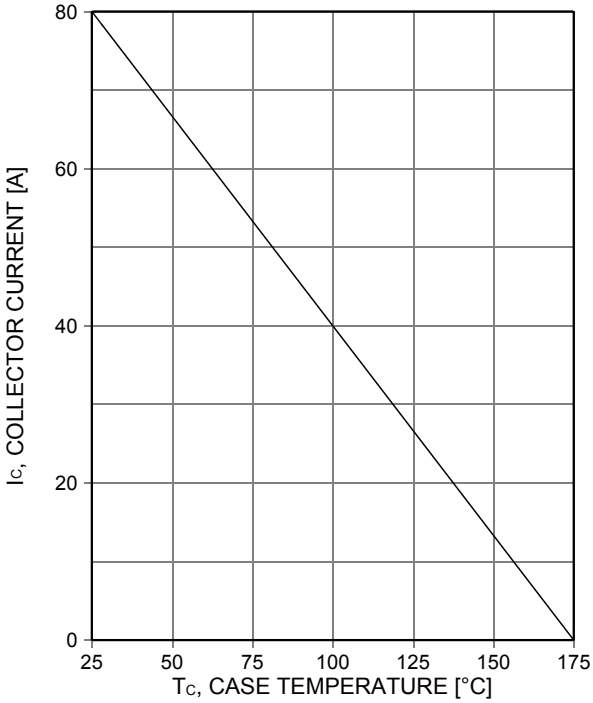

Fig.4 Collector current as a function of case temperature
(V_{GE}≥15V,T_j≤175°C)

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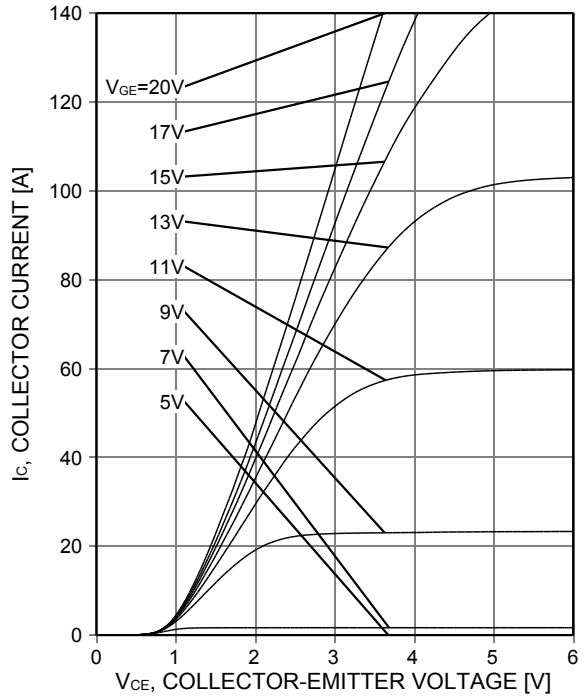

Fig.5 Typical output characteristic (T_j=25°C)

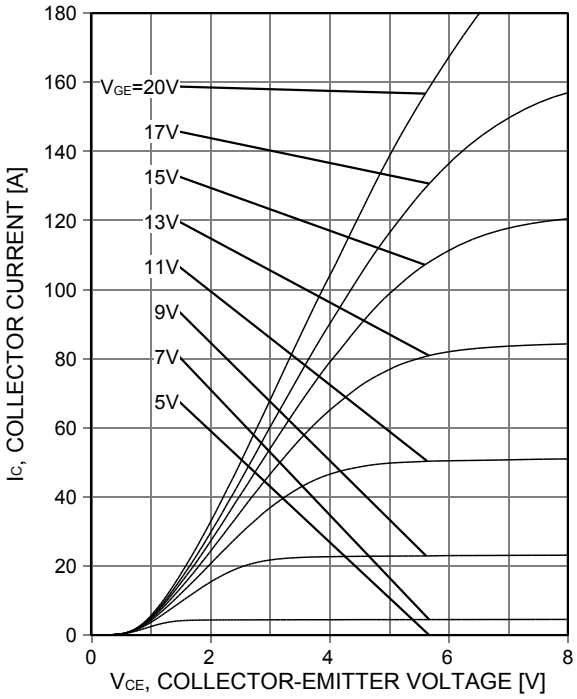

Fig.6 Typical output characteristic (T_j=175°C)

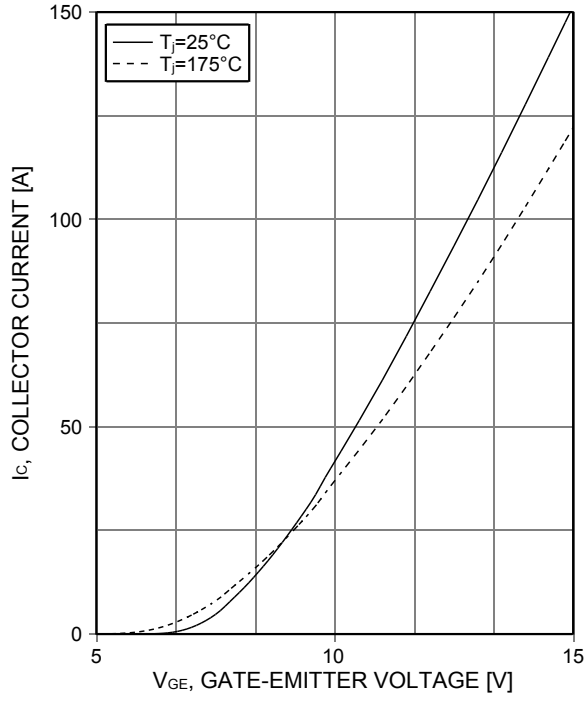

Fig.7 Typical transfer characteristic (V_{CE}=20V)

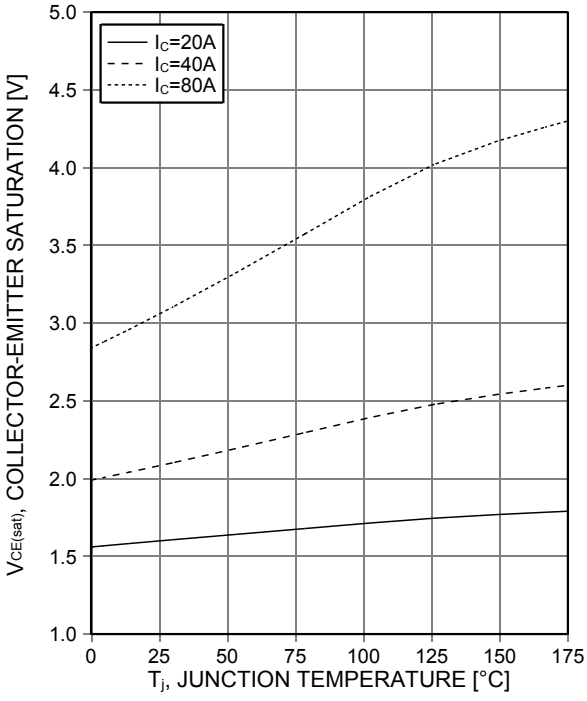

Fig.8 Typical collector-emitter saturation voltage as a function of junction temperature (V_{GE}=15V)

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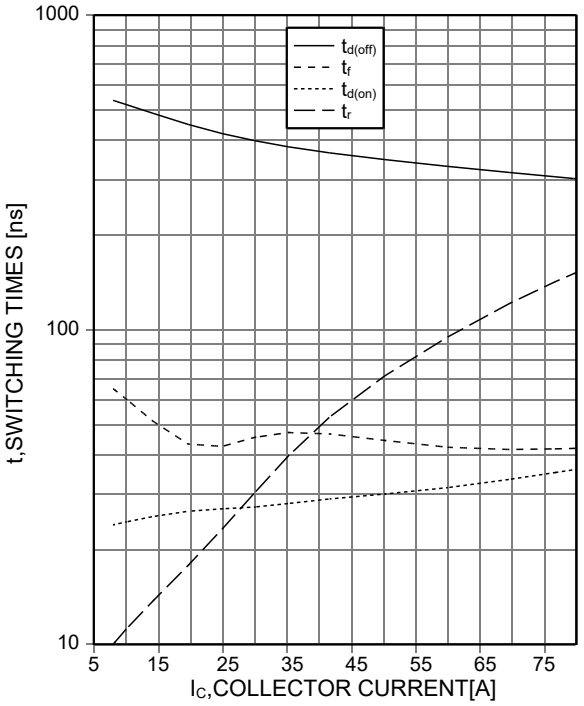

Fig.9 Typical switching times as a function of collector current (ind.load,T_j=175°C,V_{CE}=600V,V_{GE}=15/0V r_G=12Ω,test circuit in Fig.E)

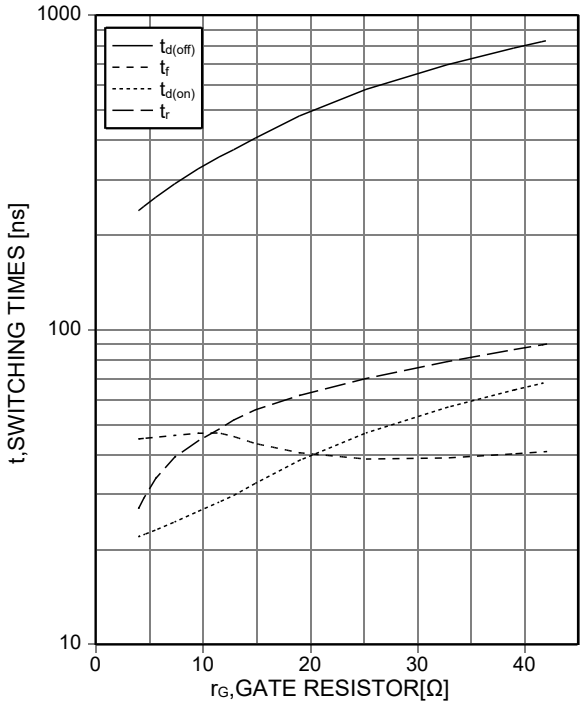

Fig.10 Typical switching times as a function of gate resistor (ind.load,T_j=175°C,V_{CE}=600V,V_{GE}=15/0V, I_C=40A,test circuit in Fig.E)

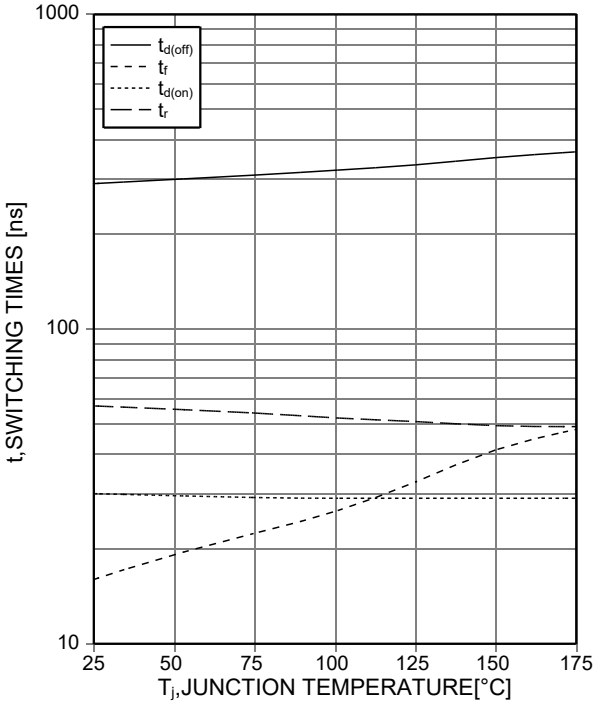

Fig.11 Typical switching times as a function of junction temperature (ind.load,V_{CE}=600V,V_{GE}=15/0V,I_C=40A, r_G=12Ω,test circuit in Fig.E)

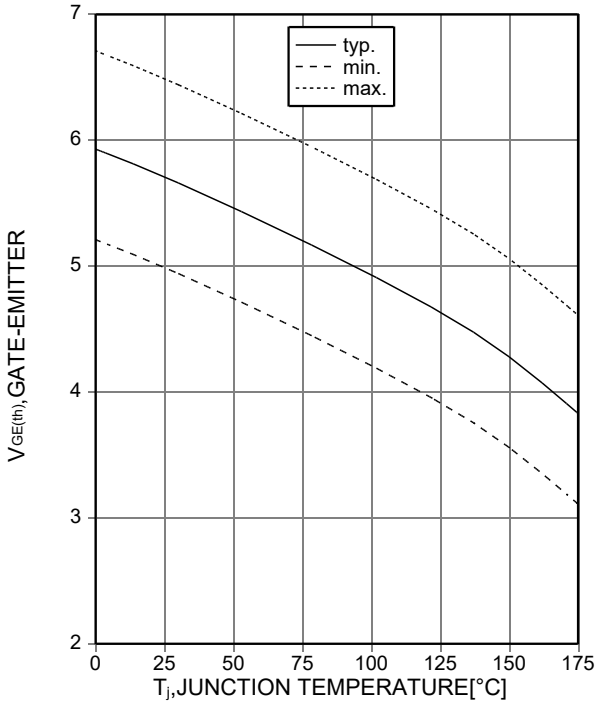

Fig.12 Gate-emitter threshold voltage as a function of junction temperature (I_C=1mA)

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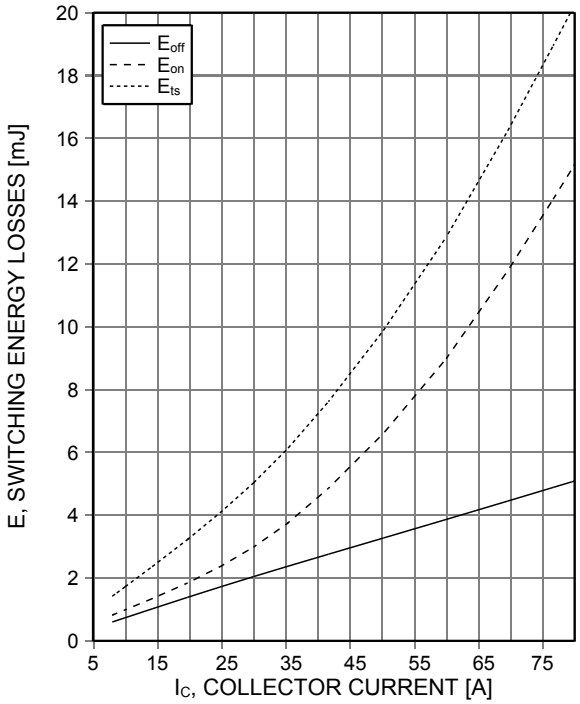

Fig.13 Typical switching energy losses as a function of collector current (ind.load,T_j=175°C,V_{CE}=600V,V_{GE}=15/0V, r_G=12Ω,test circuit in Fig.E)

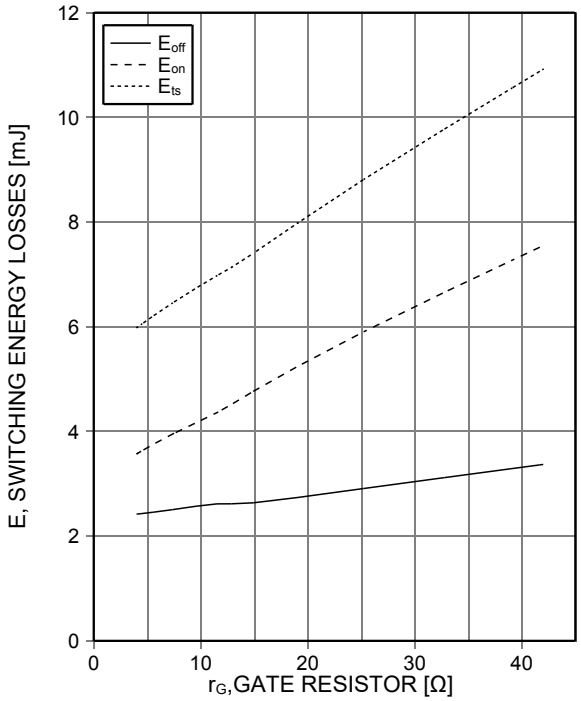

Fig.14 Typical switching energy losses as a function of gate resistor (ind.load,Tj=175°C,V_{CE}=600V,V_{GE}=15/0V, I_C=40A, test circuit in Fig.E)

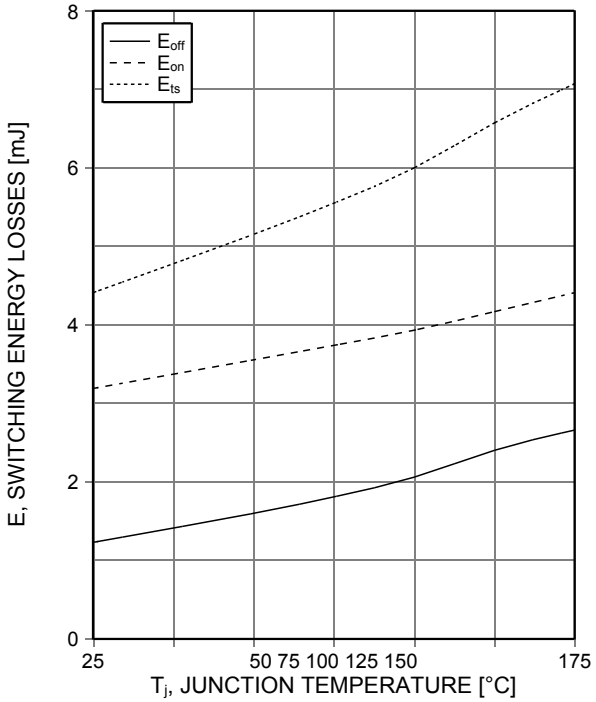

Fig.15 Typical switching energy losses as a function of junction temperature (ind load,V_{CE}=600V,V_{GE}=15/0V,I_C=40A, r_G=12Ω, test circuit in Fig.E)

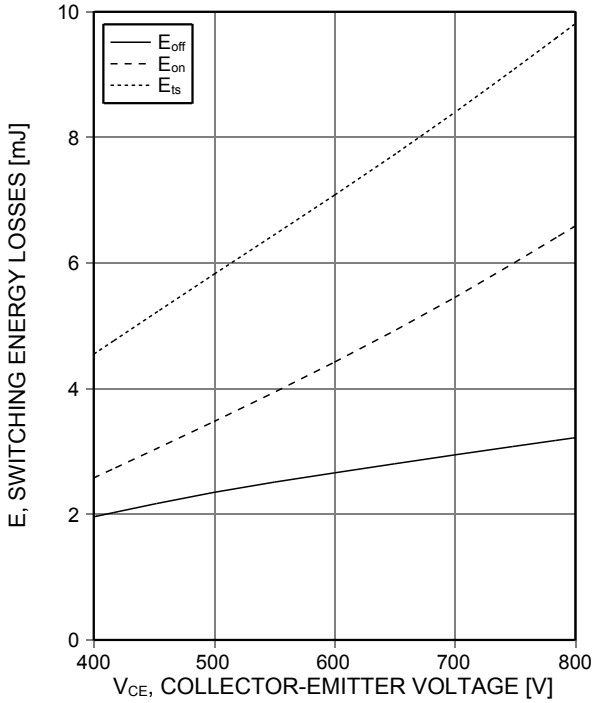

Fig.16 Typical switching energy losses as a function of collector emitter voltage (ind load,T_j=175°C,V_{GE}=15/0V,I_C=40A, r_G=12Ω,test circuit in Fig.E)

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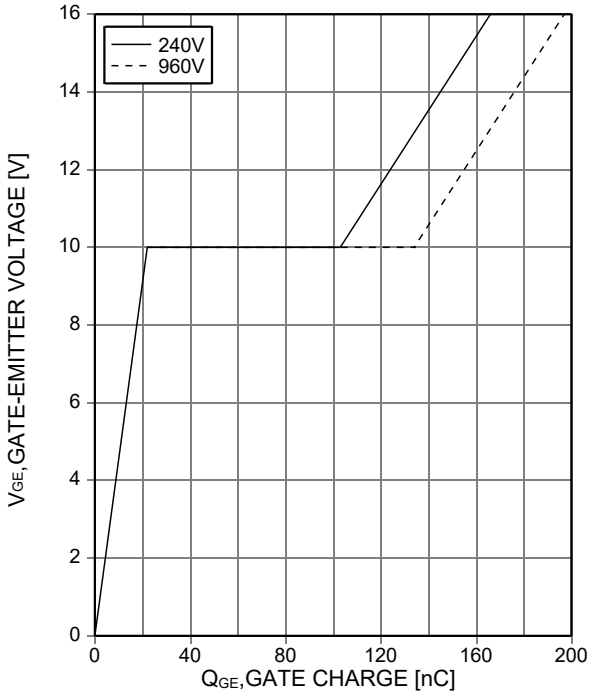

Fig.17 Typical gate charge (I_C=40A)

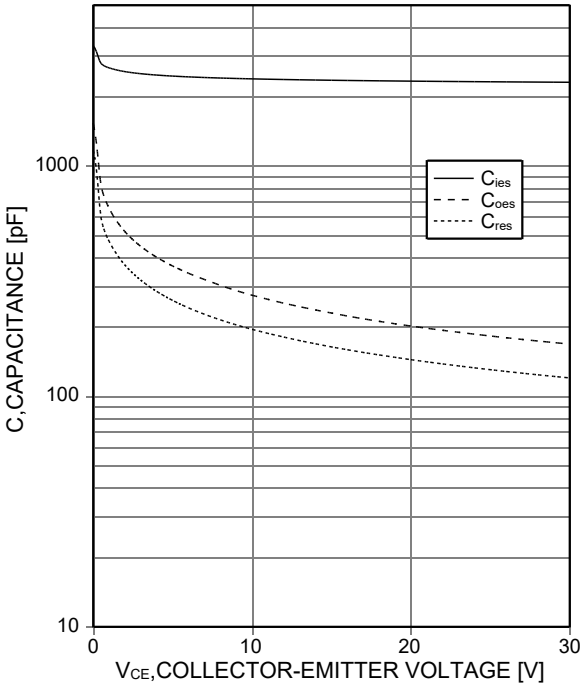

Fig.18 Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V,f=1MHz)

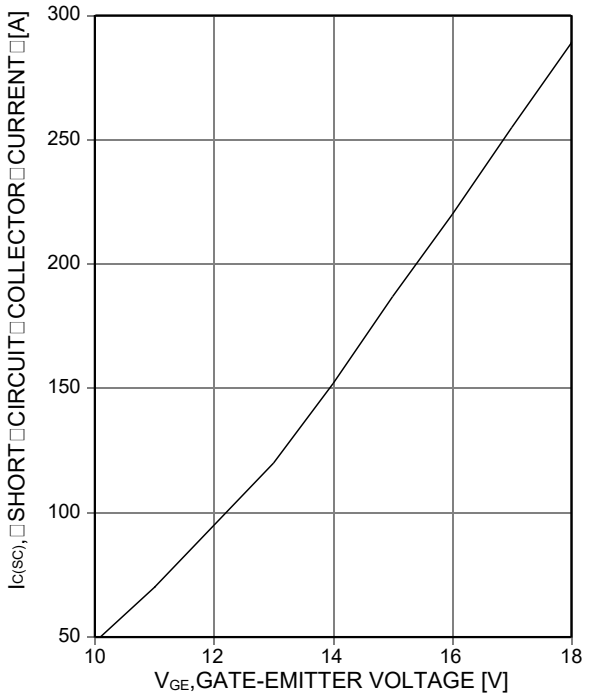

Fig.19 Typical short circuit collector current as a function of gate-emitter voltage
(V_{CE}≤600V,start at T_j=25°C)

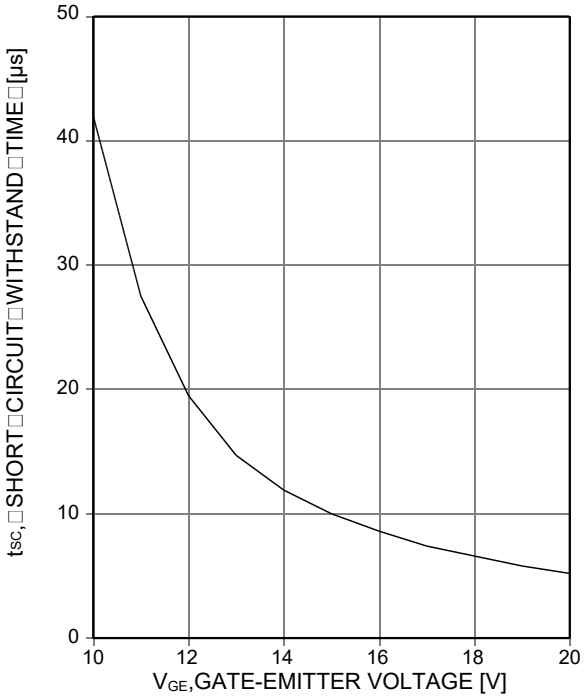

Fig.20 Short circuit with stand time as a function of gate-emitter voltage
(V_{CE}≤600V,start at T_j≤150°C)

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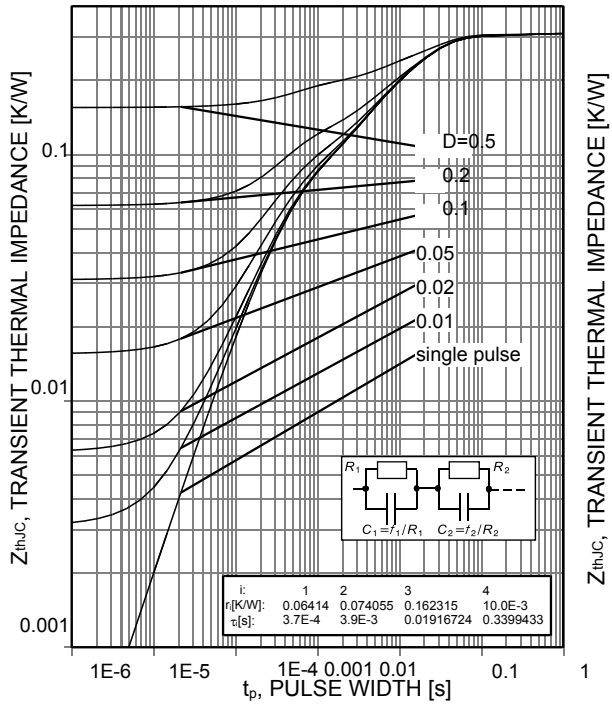

Fig.21 IGBT transient thermal impedance ($D=t_p/T$)

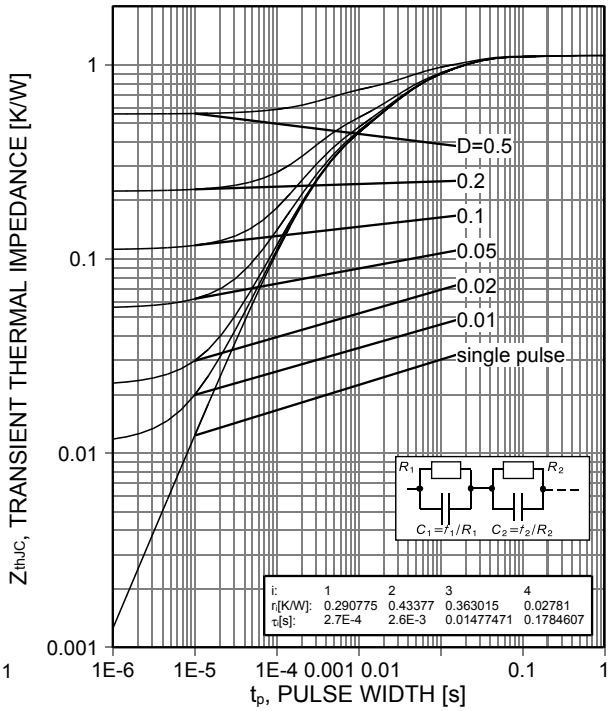

Fig.22 Diode transient thermal impedance as a function of pulse width ($D=t_p/T$)

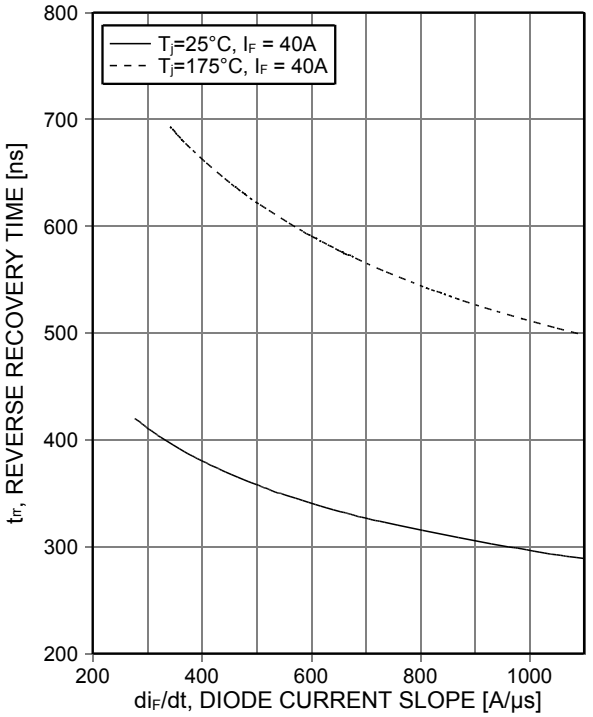

Fig.23 Typical reverse recovery time as a function of diode current slope (V_R=600V)

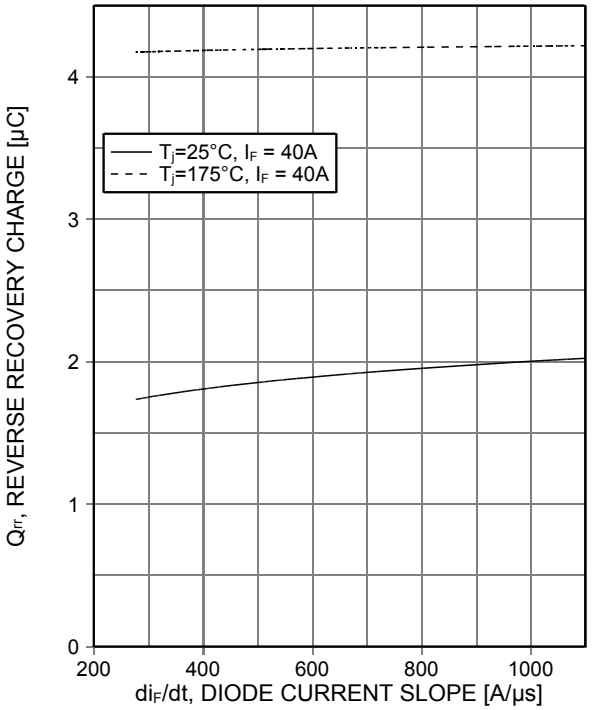

Fig.24 Typical reverse recovery charge as a function of diode current slope (V_R=600V)

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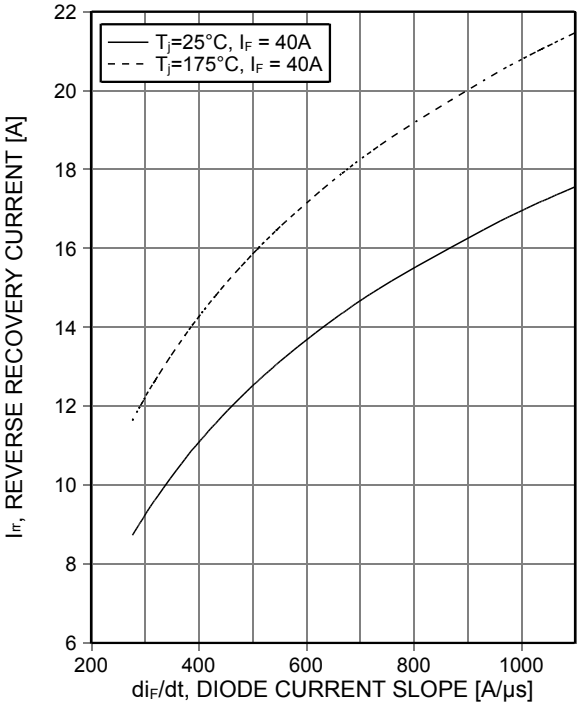

Fig.25 Typical reverse recovery current as a function of diode current slope (V_R=600V)

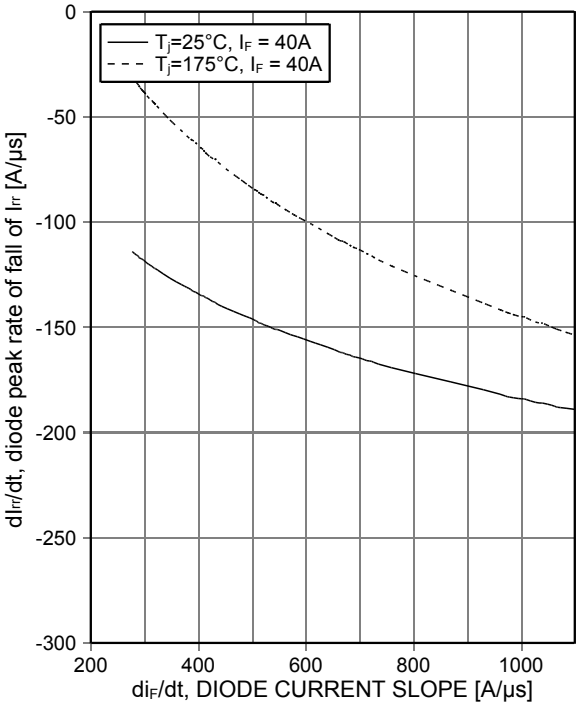

Fig.26 Typical diode peak rate of fall of reverse recovery current as a function of diode current slope(V_R=600V)

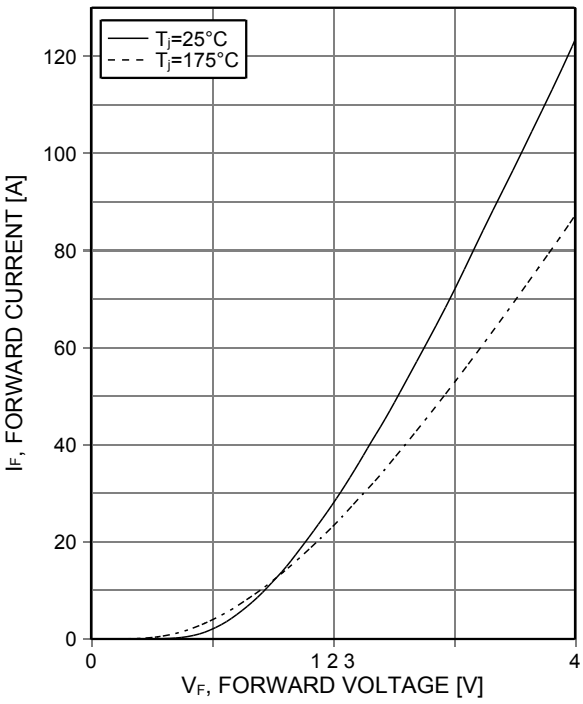

Fig.27 Typical diode forward current as a function of forward voltage

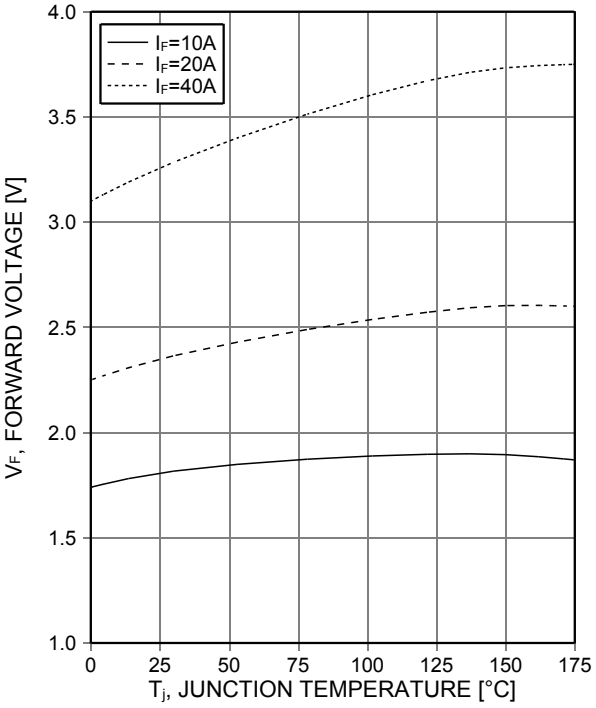

Fig.28 Typical diode forward voltage as a function of junction temperature

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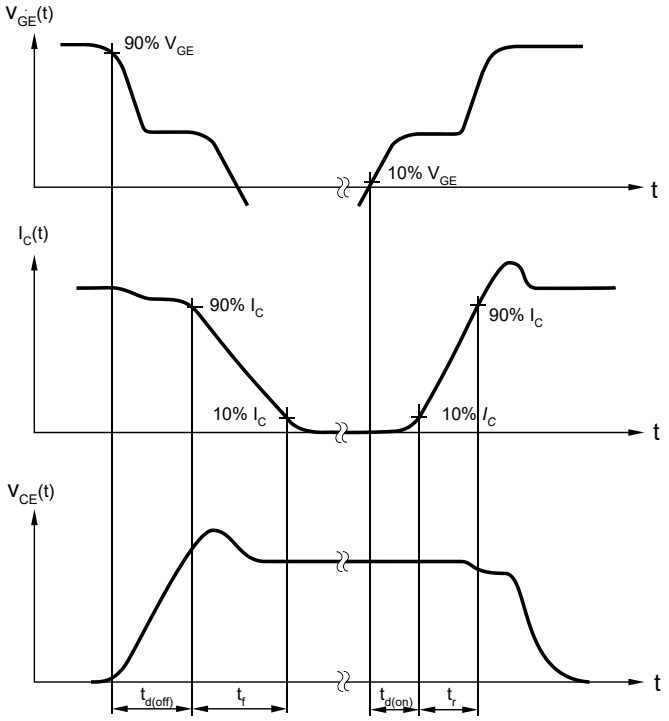

Fig.A Definition of switching times

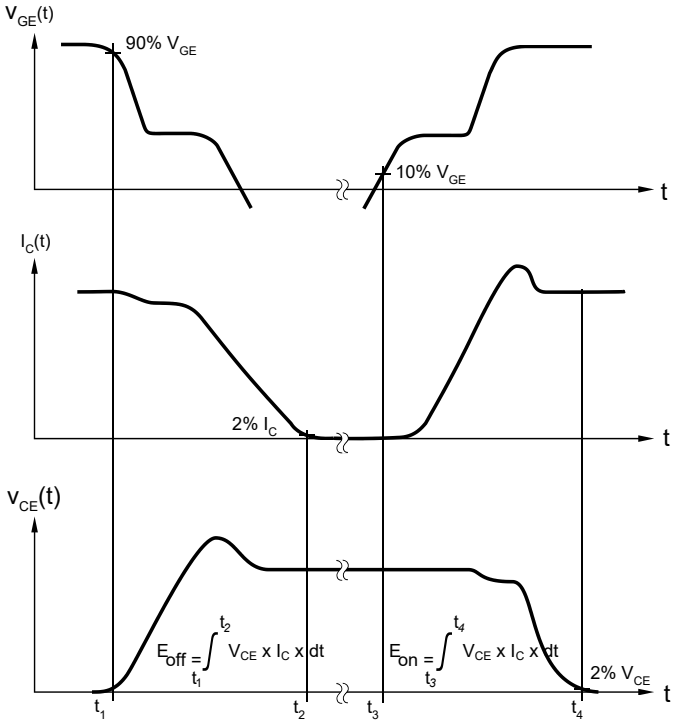

Fig.B Definition of switching losses

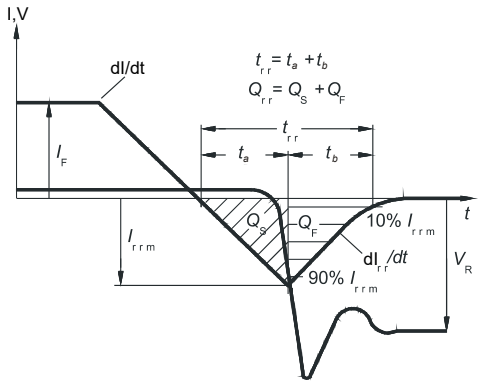

Fig.C Definition of diodes switching characteristics

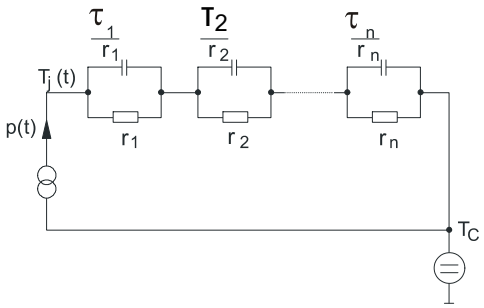

Fig.D Thermal equivalent circuit

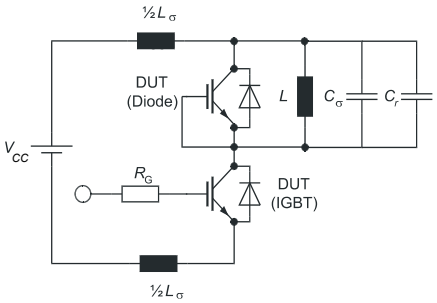

Fig.E Dynamic test circuit
Parasitic inductance L_σ
Parasitic capacitor C_σ
Relief capacitor C_r
(only for ZVT switching)

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