

SG40T120DB2

Discrete IGBTs

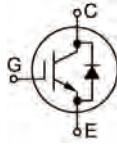
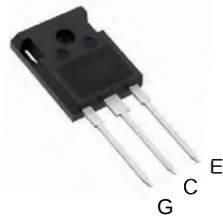
$V_{CES} = 1200V$

$I_{C100} = 40A$

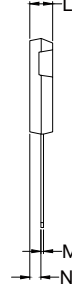
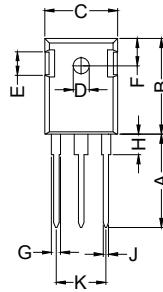
$V_{CESAT} = 1.90V$

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

Dimensions TO-247AD



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



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}	$T_J=25^{\circ}C$ to $150^{\circ}C$ $T_J=25^{\circ}C$ to $150^{\circ}C$; $R_{GE}=1M\Omega$;	1200 1200	V
V_{GES} V_{GEM}	Continuous Transient	± 20 $\pm 3 \pm 30$	V
I_{C25} I_{C100} I_{CM}	$T_C=25^{\circ}C$; limited by leads $T_C=100^{\circ}C$ $T_C=25^{\circ}C$, 1ms	80 40 160	A
SSOA (RBSOA)	$V_{GE}=15V$; $T_{VJ}=125^{\circ}C$; $R_G=5\Omega$ Clamped inductive load	$I_{CM}=120$ @ 0.8 V_{CES}	A
P_C	$T_C=25^{\circ}C$	280	W
T_J T_{JM} T_{stg}		-55...+175 175 -55...+150	$^{\circ}C$
	Maximum lead temperature for soldering 1.6mm(0.062in.) from case for 10s Maximum Tab temperature for soldering SMD devices for 10s	300 260	$^{\circ}C$ $^{\circ}C$
M_d	Mounting torque (M3)	1.13/10	Nm/lb.in.
Weight	Typical	6	g

($T_J=25^{\circ}C$, unless otherwise specified)

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

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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}	V _{CE} =25V; V _{GE} =0V; f=1MHz		3823		pF
C _{oes}			170		
C _{res}			94		
Q _g	I _C =I _{C90} ; V _{GE} =15V; V _{CE} =0.5V _{CES}		230		nC
Q _{ge}			30		
Q _{gc}			147		
t _{d(on)}	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		ns
t _{ri}			54		ns
t _{d(off)}			260		ns
t _{fi}			30		ns
E _{off}			1.4		mJ
t _{d(on)}	Inductive load, T _J =25°C I _C =I _{C100} ; 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		55		ns
t _{ri}			54		ns
E _{on}			3.5		mJ
t _{d(off)}			300		ns
t _{fi}			38		ns
E _{off}			1.85		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 paralleling
- MOS input, voltage controlled
- Ultra fast free wheeling diodes

Application

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

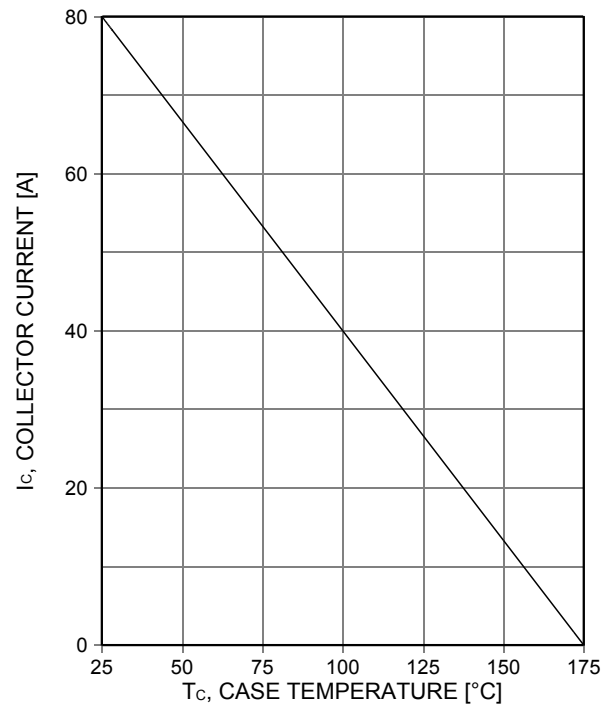
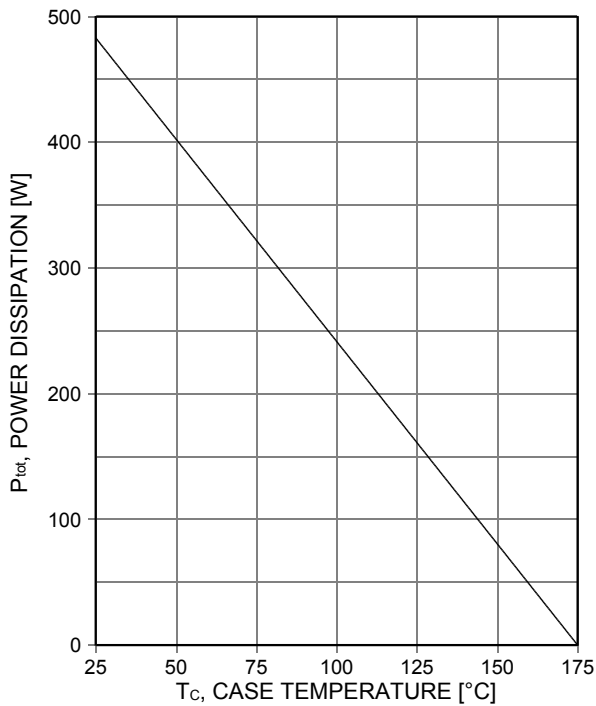
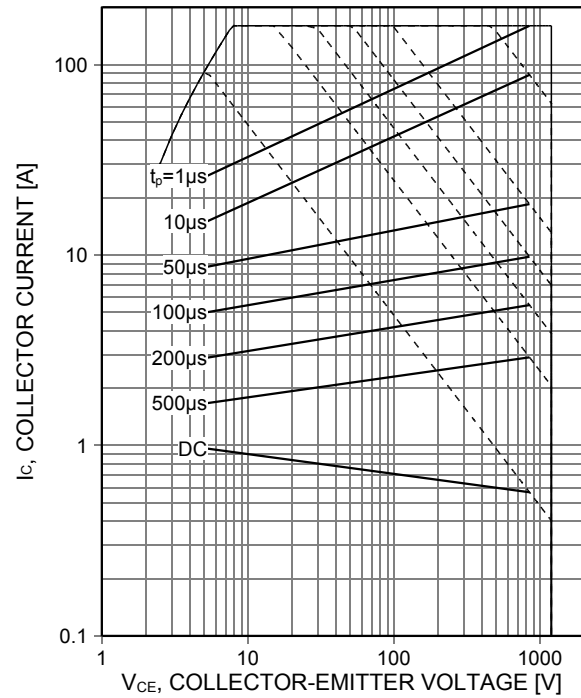
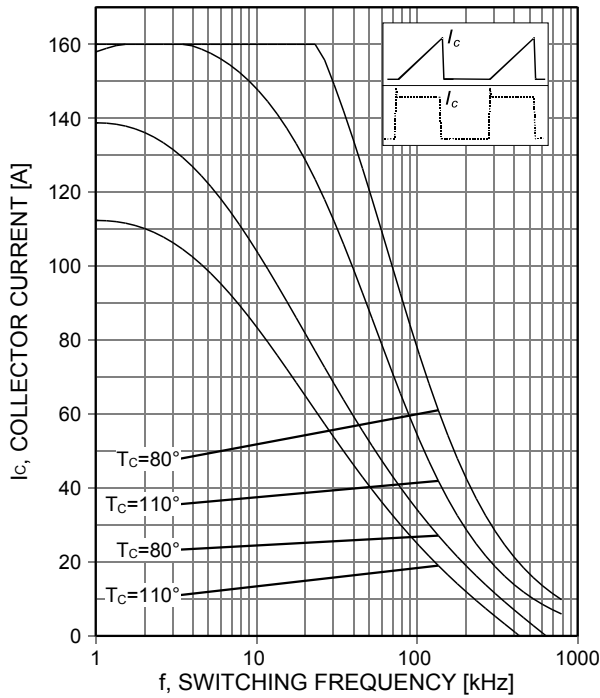
Advantages

- space and weight savings
- reduced protection circuits

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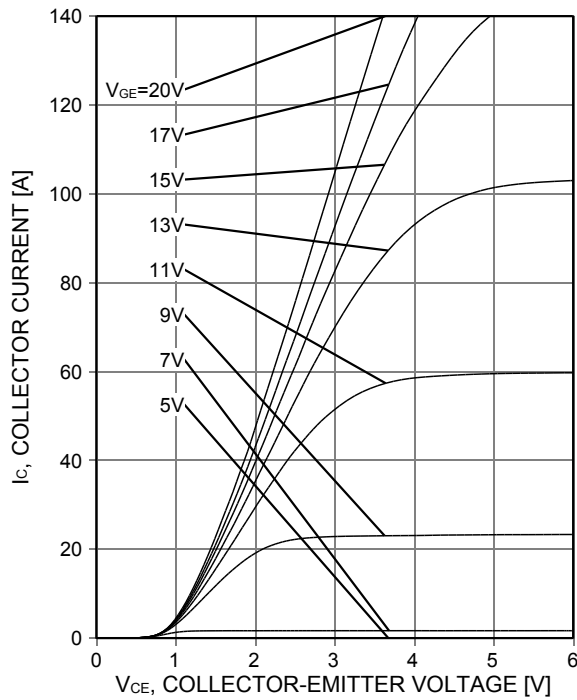


Fig.5 Typical output characteristic ($T_j = 25^\circ\text{C}$)

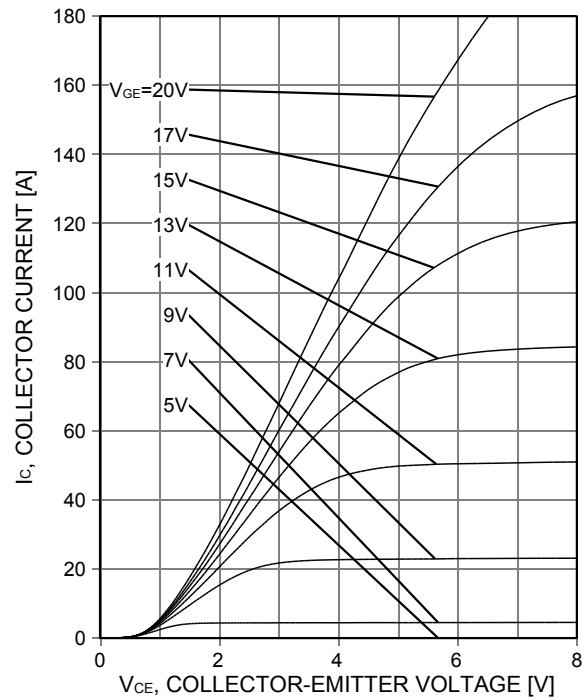


Fig.6 Typical output characteristic ($T_j = 175^\circ\text{C}$)

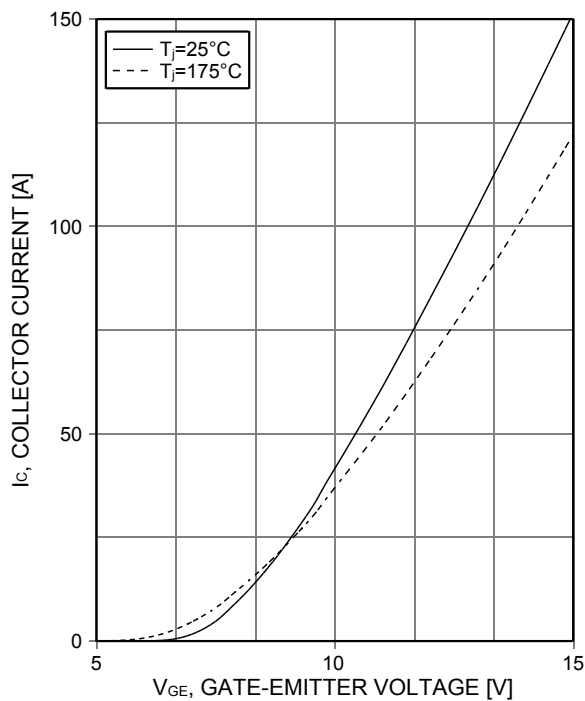


Fig.7 Typical transfer characteristic ($V_{CE} = 20\text{V}$)

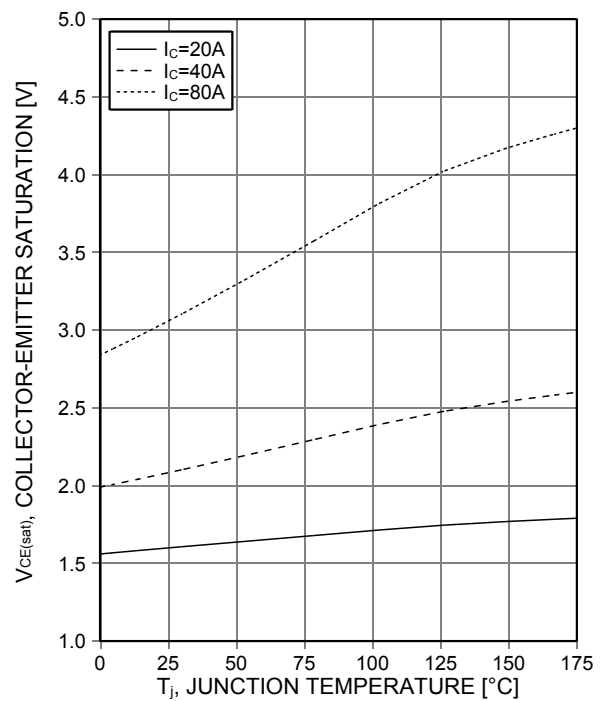


Fig.8 Typical collector-emitter saturation voltage as a function of junction temperature ($V_{GE} = 15\text{V}$)

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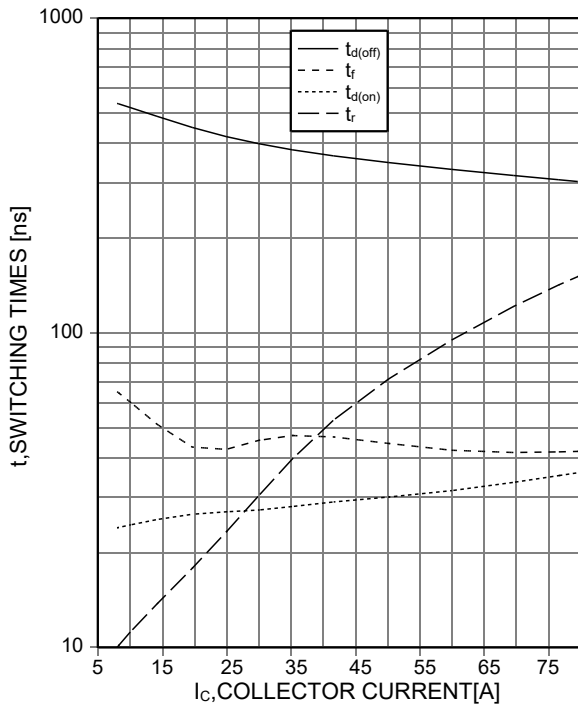


Fig.9 Typical switching times as a function of collector current (ind.load, $T_j=175^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $r_G=12\Omega$, test circuit in Fig.E)

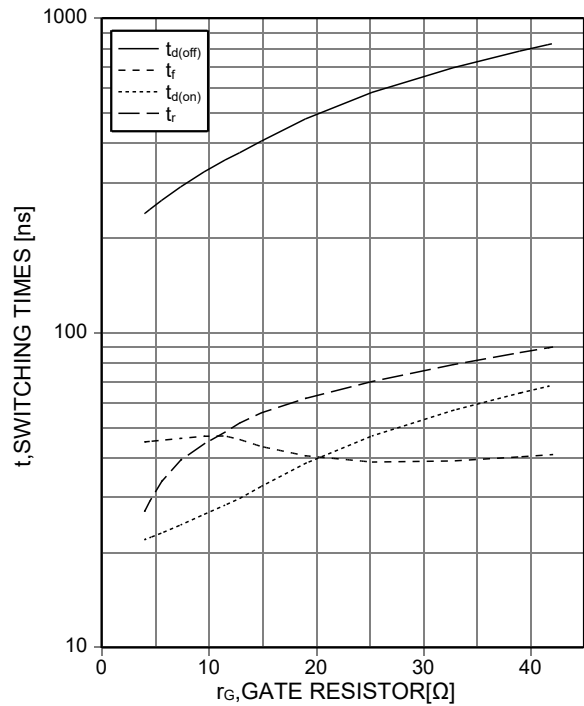


Fig.10 Typical switching times as a function of gate resistor (ind.load, $T_j=175^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$, test circuit in Fig.E)

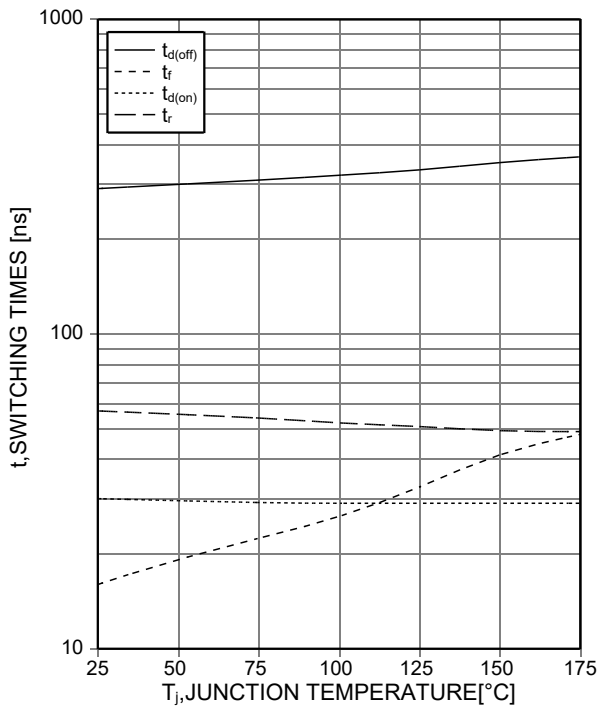


Fig.11 Typical switching times as a function of junction temperature (ind.load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$, $r_G=12\Omega$, test circuit in Fig.E)

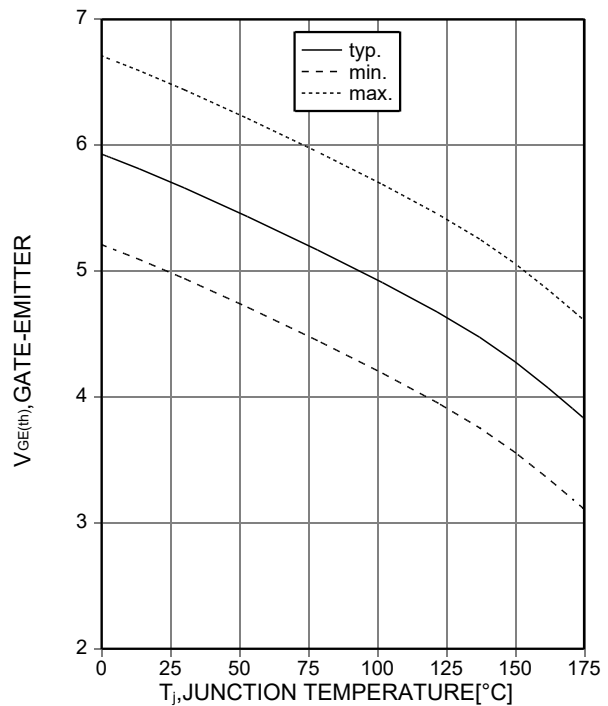


Fig.12 Gate-emitter threshold voltage as a function of junction temperature ($I_C=1\text{mA}$)

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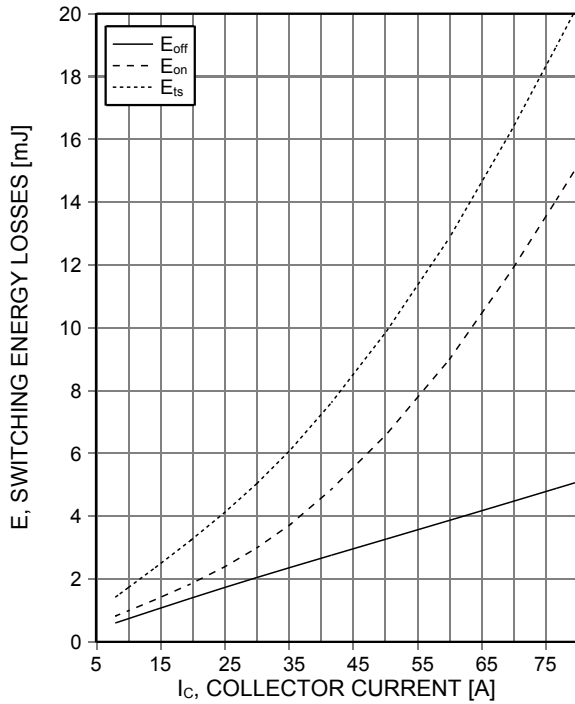


Fig.13 Typical switching energy losses as a function of collector current
(ind.load, $T_j=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $r_G=12\Omega$, test circuit in Fig.E)

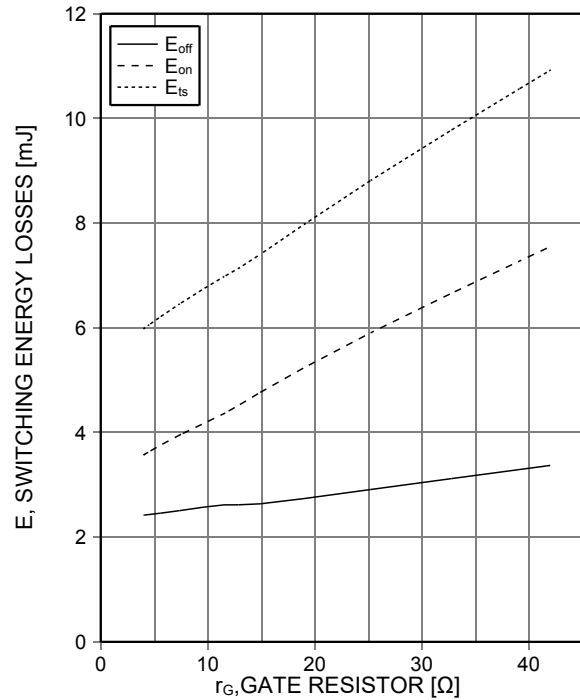


Fig.14 Typical switching energy losses as a function of gate resistor
(ind.load, $T_j=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$, test circuit in Fig.E)

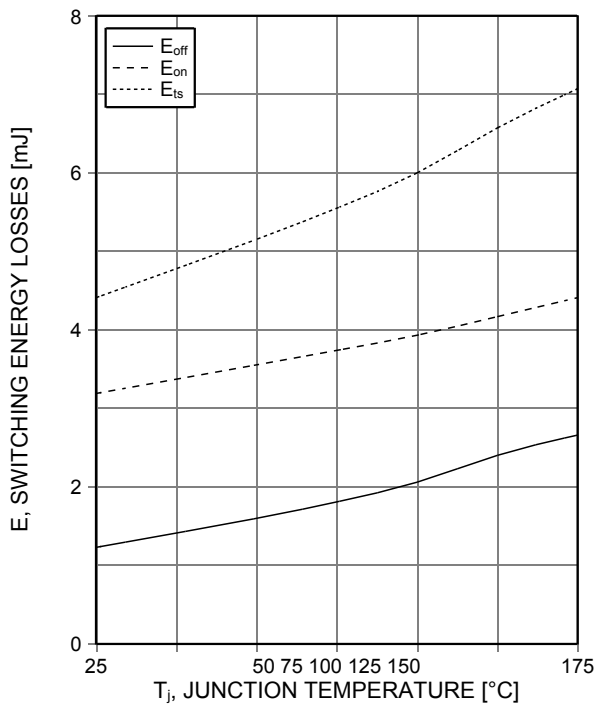


Fig.15 Typical switching energy losses as a function of junction temperature
(ind load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$, $r_G=12\Omega$, test circuit in Fig.E)

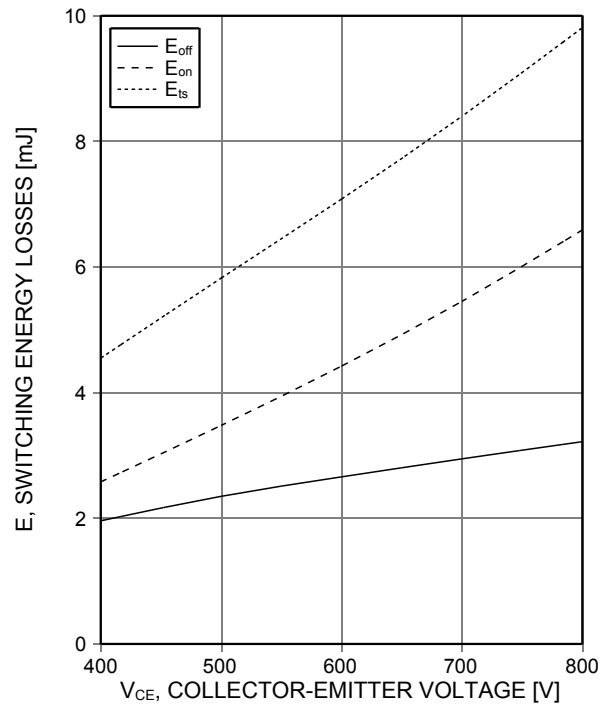


Fig.16 Typical switching energy losses as a function of collector emitter voltage
(ind load, $T_j=175^\circ\text{C}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$, $r_G=12\Omega$, test circuit in Fig.E)

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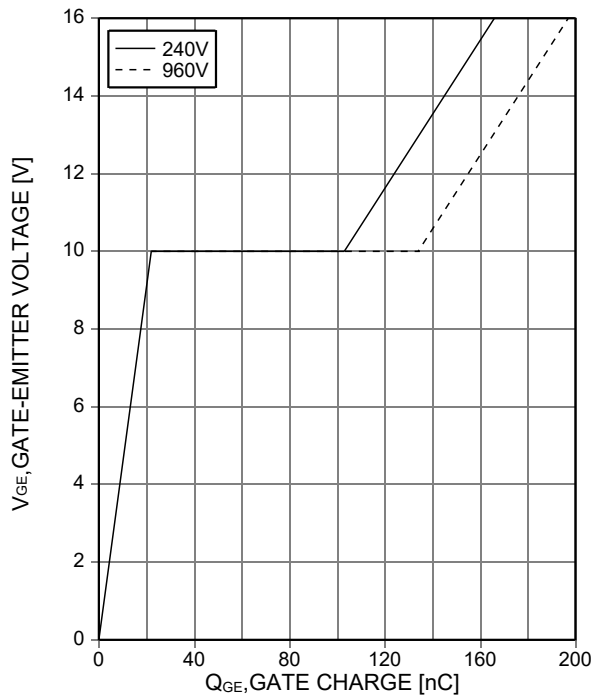


Fig.17 Typical gate charge ($I_C=40A$)

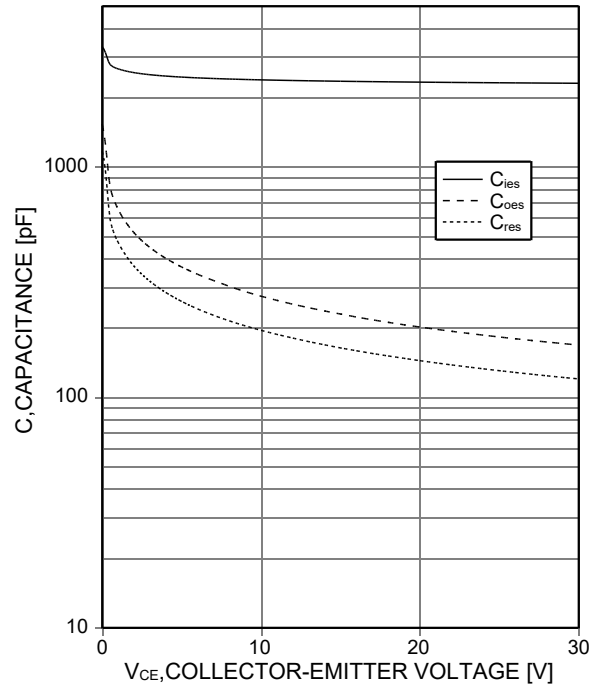


Fig.18 Typical capacitance as a function of collector-emitter voltage ($V_{GE}=0V, f=1MHz$)

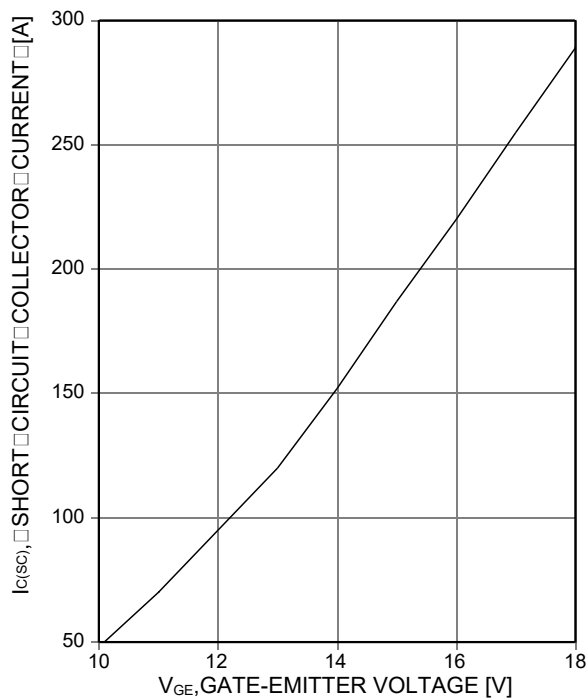


Fig.19 Typical short circuit collector current as a function of gate-emitter voltage ($V_{CE} \leq 600V$, start at $T_j = 25^\circ C$)

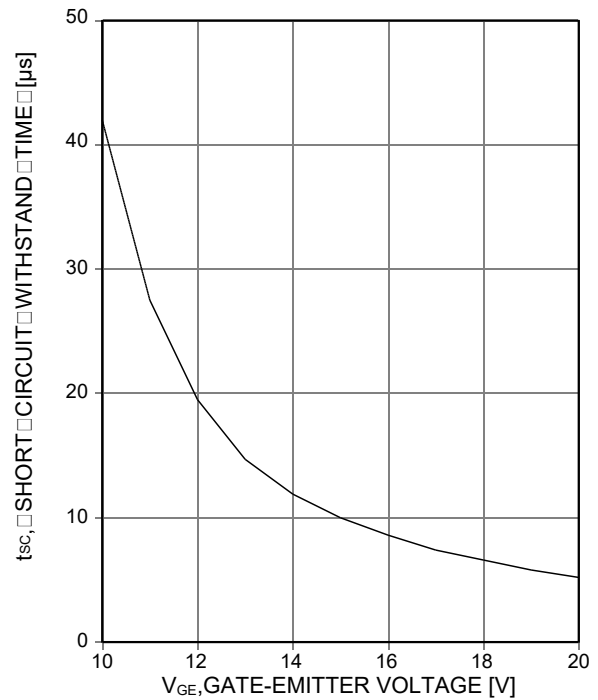


Fig.20 Short circuit with stand time as a function of gate-emitter voltage ($V_{CE} \leq 600V$, start at $T_j \leq 150^\circ C$)

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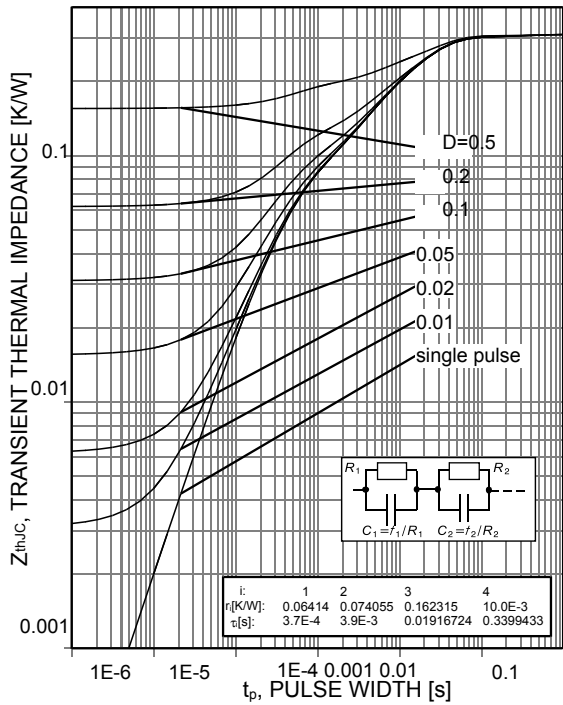


Fig.21 IGBT transient thermal impedance ($D=t_p/T$)

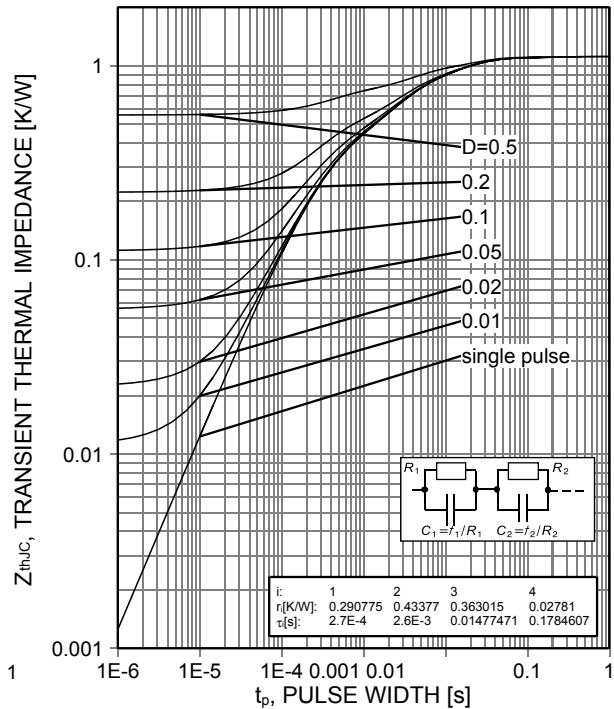


Fig.22 Diode transient thermal impedance as a function of pulse width ($D=t_p/T$)

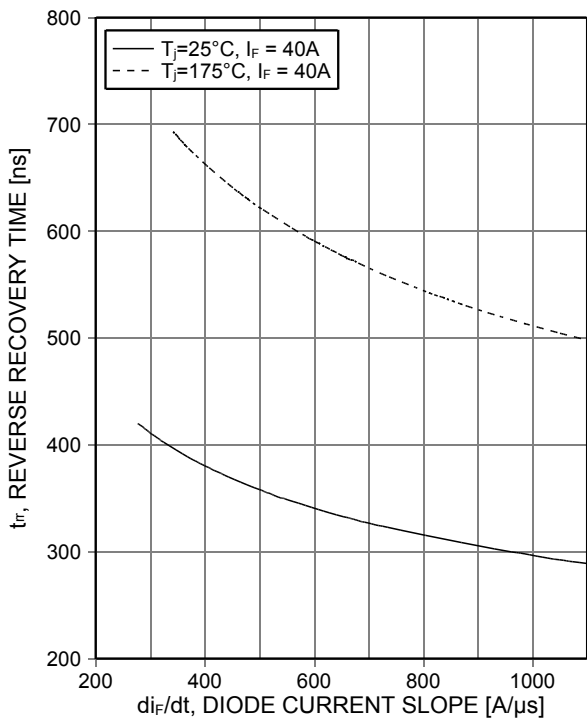


Fig.23 Typical reverse recovery time as a function of diode current slope ($V_R=600\text{V}$)

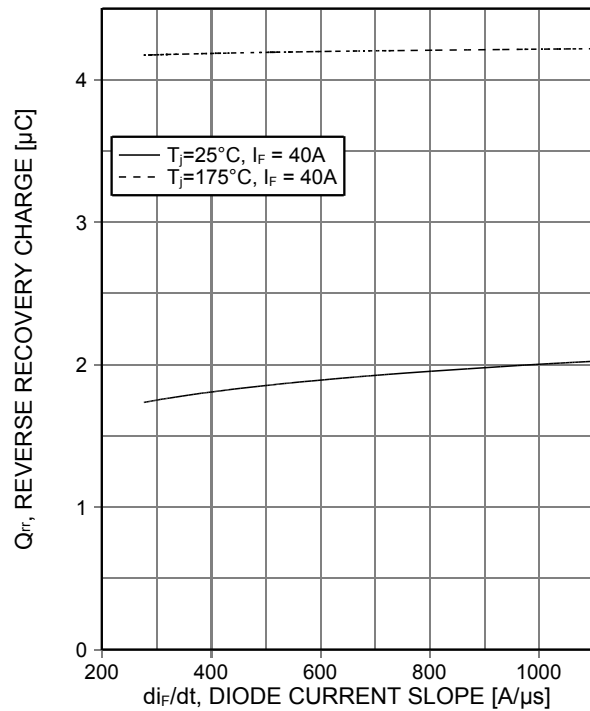


Fig.24 Typical reverse recovery charge as a function of diode current slope ($V_R=600\text{V}$)

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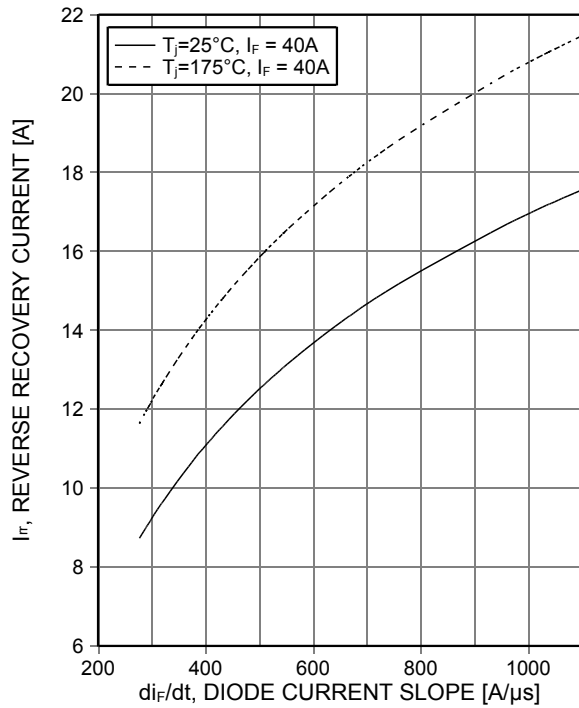


Fig.25 Typical reverse recovery current as a function of diode current slope ($V_R=600\text{V}$)

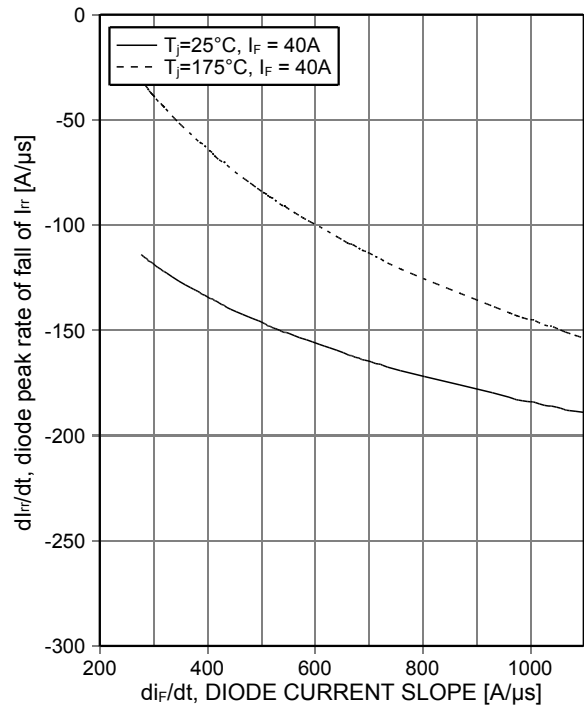


Fig.26 Typical diode peak rate of fall of reverse recovery current as a function of diode current slope ($V_R=600\text{V}$)

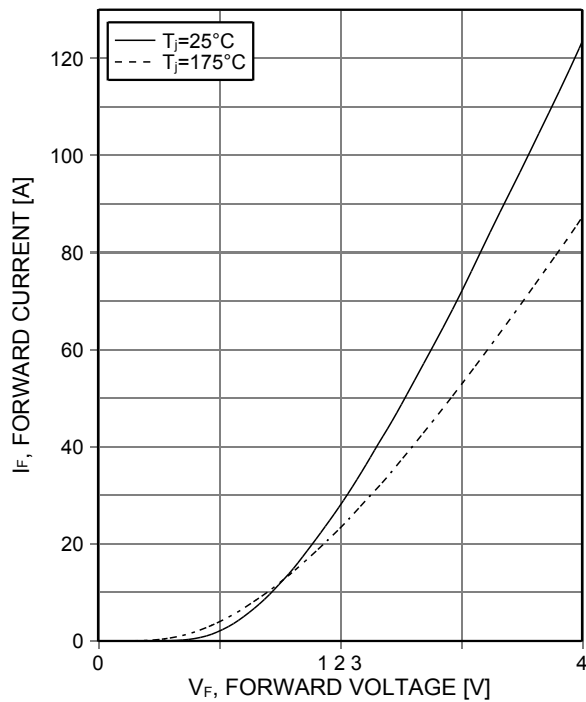


Fig.27 Typical diode forward current as a function of forward voltage

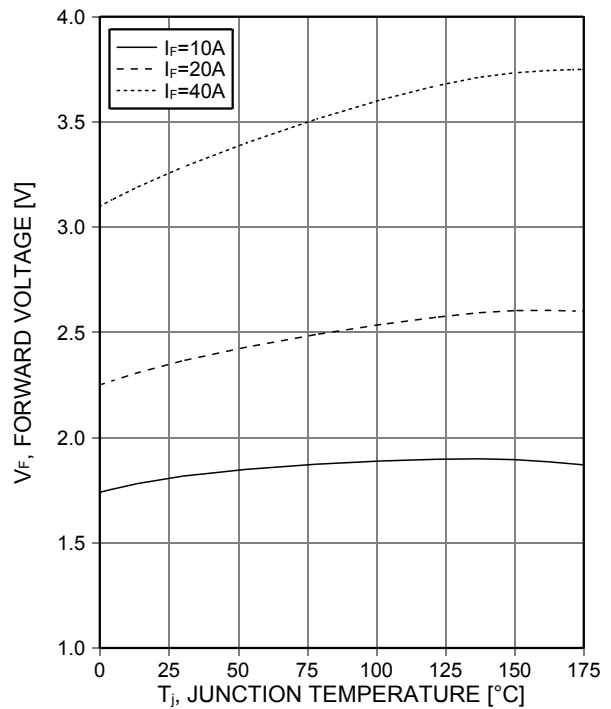


Fig.28 Typical diode forward voltage as a function of junction temperature

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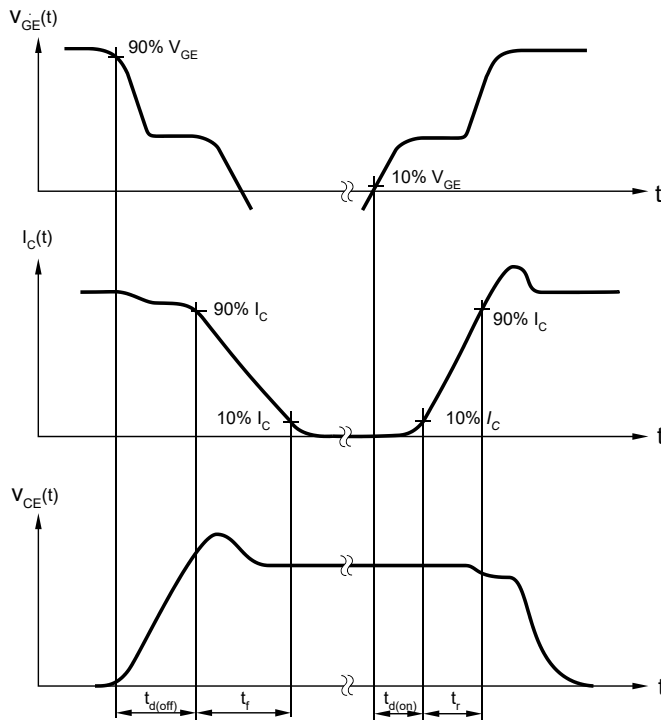


Fig.A Definition of switching times

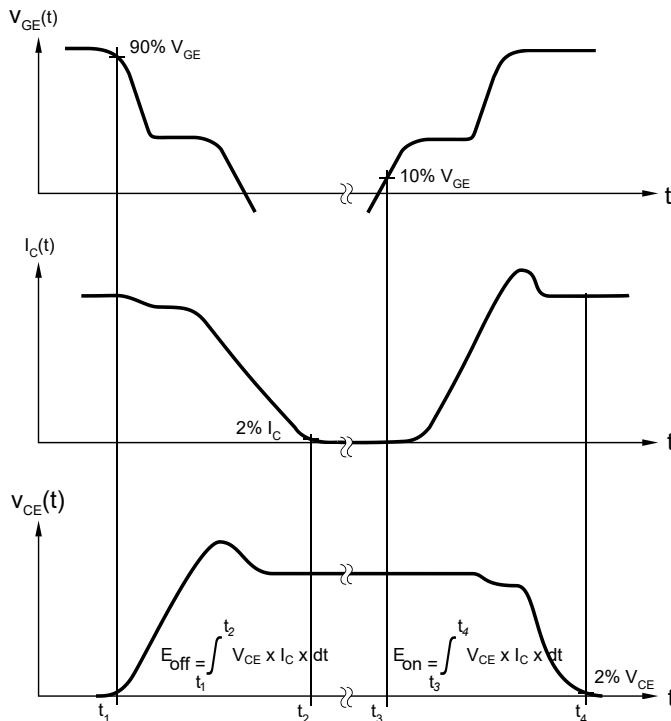


Fig.B Definition of switching losses

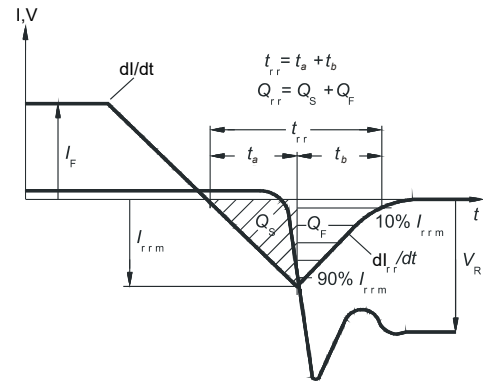


Fig.C Definition of diodes switching characteristics

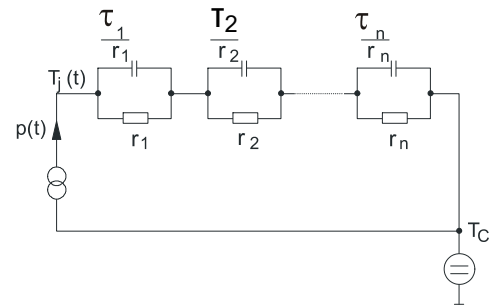


Fig.D Thermal equivalent circuit

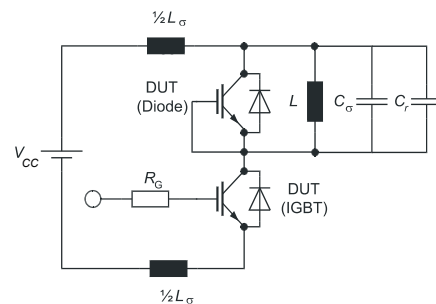


Fig.E Dynamic test circuit
Parasitic inductance L_σ
Parasitic capacitor C_σ
Relief capacitor C_r
(only for ZVT switching)