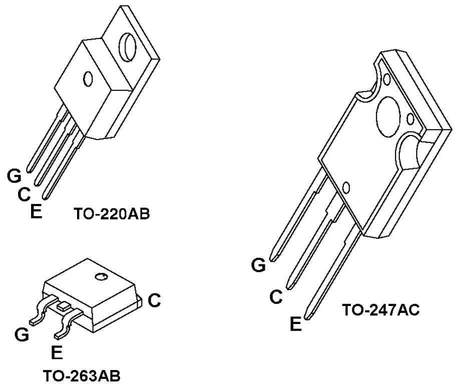
SIEMENS

SGP10N60, SGB10N60, SGW10N60

Fast S-IGBT in NPT-Technology

- 75 % lower E_{off} compared to previous generation combined with low conduction losses
- Short circuit withstand time 10 µs
- Designed for moderate and high frequency applications:
  - SMPS and PFC up to 150 kHz
  - Inverter, Motor controls
- NPT-Technology for 600V applications offers:
  - tighter parameter distribution
  - higher ruggedness, temperature stable behaviour
  - parallel switching capability



Type	V_{CE}	I_C	$V_{CE(sat)}$	T_j	Package	Ordering Code
SGP10N60	600 V	10 A	2.2 V	150 °C	TO-220AB	Q67041-A4710-A2
SGB10N60					TO-263AB	Q67041-A4710-A4
SGW10N60					TO-247AC	Q67040-S4234

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	600	V
DC collector current T_C = 25 °C T_C = 100 °C	I_C	 21 10.9	A
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	42	
Gate-emitter voltage	V_{GE}	±20	V
Avalanche energy, single pulse I_C = 10 A, V_{CC} = 50 V, R_{GE} = 25 Ω, start at T_j = 25 °C	E_{AS}	70	mJ
Short circuit withstand time 1) V_{GE} = 15 V, V_{CC} = 600 V, $T_j \leq$ 150 °C	t_{sc}	10	µs
Power dissipation T_C = 25 °C	P_{tot}	104	W
Operating junction and storage temperature	T_j , T_{stg}	-55...+150	°C
Soldering temperature, 1.6mm from case for 10s	-	260	

1) allowed number of short circuits: <1000; time between short circuits: >1s

Thermal Resistance

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Thermal resistance, junction - case	R_{thJC}	-	-	1.2	K/W
Thermal resistance, junction - ambient	R_{thJA}				
TO-220AB		-	-	62	
TO-247AC		-	-	40	
SMD version, device on PCB: [1] TO-263AB	R_{thJA}	-	-	40	

Electrical Characteristics, at T_j =25 °C, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Collector-emitter breakdown voltage V_{GE} = 0 V, I_C = 500 µA	$V_{(BR)CES}$	600	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$				
V_{GE} = 15 V, I_C = 10 A, T_j = 25 °C		1.6	2	2.5	
V_{GE} = 15 V, I_C = 10 A, T_j = 150 °C		-	2.2	2.7	
Gate-emitter threshold voltage I_C = 300 µA, V_{CE} = V_{GE}	$V_{GE(th)}$	3	4	5	
Zero gate voltage collector current	I_{CES}				µA
V_{CE} = 600 V, V_{GE} = 0 V, T_j = 25 °C		-	-	40	
V_{CE} = 600 V, V_{GE} = 0 V, T_j = 150 °C		-	-	1500	
Gate-emitter leakage current V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	-	-	100	nA

1) Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6cm^2 (one layer, 70 µm thick) copper area for collector connection. PCB is vertical without blown air.

Electrical Characteristics, at T_j =25 °C, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Transconductance V_{CE} = 20 V, I_C = 10 A	g_{fs}	2	6.7	-	S
Input capacitance V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz	C_{iss}	-	580	700	pF
Output capacitance V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz	C_{oss}	-	70	85	
Reverse transfer capacitance V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz	C_{rss}	-	50	60	

Characteristics

Gate charge V_{CC} = 480 V, V_{GE} = 15 V, I_C = 10 A	Q_{Gate}	-	64	84	nC
Internal emitter inductance measured 5mm from case	L_E	-	7	-	nH

Safe Operating Area Characteristics

Short circuit collector current [1)] $V_{CE} \leq$ 600 V, V_{GE} = 15 V, $t_{sc} \leq$ 10 µs, $T_j \leq$ 150 °C	-	-	-	100	A
Turn off safe operating area $V_{CE} \leq$ 600 V, $T_j \leq$ 150 °C	-	-	-	42	

1) allowed number of short circuits: <1000; time between short circuits: >1s

Switching Characteristics, Inductive Load (Diode:BUP400D), at T_j = 25 °C					
Parameter	**Symbol**	**Values**			**Unit**
		min.	**typ.**	**max.**	
Characteristics					
Turn-on delay time V_{CC} = 400 V, V_{GE} = 15 V, I_C = 10 A, R_{Gon} = 25 Ω	$t_{d(on)}$	-	22	27	ns
Rise time V_{CC} = 400 V, V_{GE} = 15 V, I_C = 10 A, R_{Gon} = 25 Ω	t_r	-	26	32	
Turn-off delay time V_{CC} = 400 V, V_{GE} = 0 V, I_C = 10 A, R_{Goff} = 25 Ω	$t_{d(off)}$	-	233	280	
Fall time V_{CC} = 400 V, V_{GE} = 0 V, I_C = 10 A, R_{Goff} = 25 Ω	t_f	-	49	59	
Turn-on energy [1)] V_{CC} = 400 V, V_{GE} = 15 V, I_C = 10 A, R_{Gon} = 25 Ω	E_{on}	-	0.24	0.28	mJ
Turn-off energy V_{CC} = 400 V, V_{GE} = 0 V, I_C = 10 A, R_{Goff} = 25 Ω	E_{off}	-	0.17	0.23	
Total switching energy [1)] V_{CC} = 400 V, V_{GE} = 0/+15 V, I_C = 10 A, R_G = 25 Ω	E_{ts}	-	0.41	0.51	

1) E_{on} and E_{ts} include BUP400D diode commutation losses.

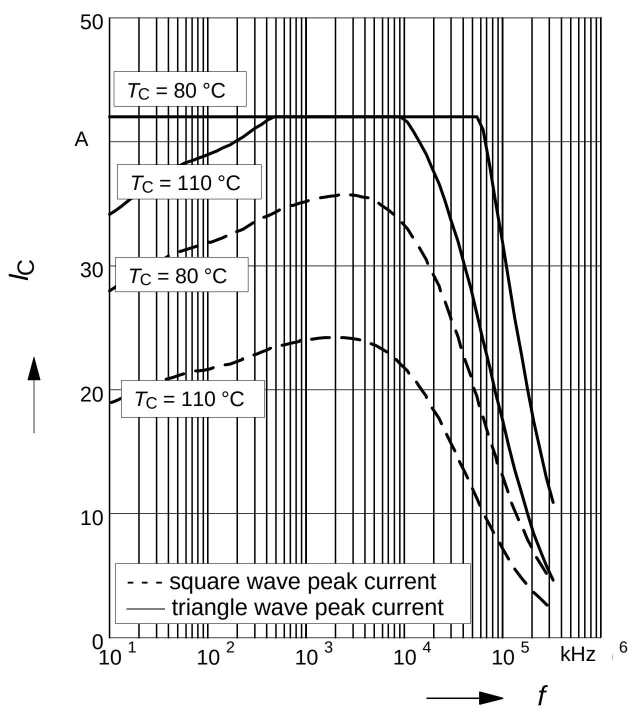
Switching Characteristics, Inductive Load (Diode: BUP400D), at $T_j = 150$ °C					
Parameter	**Symbol**	**Values**			**Unit**
		min.	**typ.**	**max.**	
Characteristics					
Turn-on delay time $V_{CC} = 400$ V, $V_{GE} = 15$ V, $I_C = 10$ A, $R_{Gon} = 25\ \Omega$	$t_{d(on)}$	-	20	24	ns
Rise time $V_{CC} = 400$ V, $V_{GE} = 15$ V, $I_C = 10$ A, $R_{Gon} = 25\ \Omega$	t_r	-	26	32	
Turn-off delay time $V_{CC} = 400$ V, $V_{GE} = 0$ V, $I_C = 10$ A, $R_{Goff} = 25\ \Omega$	$t_{d(off)}$	-	266	320	
Fall time $V_{CC} = 400$ V, $V_{GE} = 0$ V, $I_C = 10$ A, $R_{Goff} = 25\ \Omega$	t_f	-	63	76	
Turn-on energy [1)] $V_{CC} = 400$ V, $V_{GE} = 15$ V, $I_C = 10$ A, $R_{Gon} = 25\ \Omega$	E_{on}	-	0.34	0.39	mJ
Turn-off energy $V_{CC} = 400$ V, $V_{GE} = 0$ V, $I_C = 10$ A, $R_{Goff} = 25\ \Omega$	E_{off}	-	0.28	0.37	
Total switching energy [1)] $V_{CC} = 400$ V, $V_{GE} = 0/+15$ V, $I_C = 10$ A, $R_G = 25\ \Omega$	E_{ts}	-	0.62	0.76	

1) E_{on} and E_{ts} include BUP400D diode commutation losses.

Typ. collector current

$I_C = f(f)$

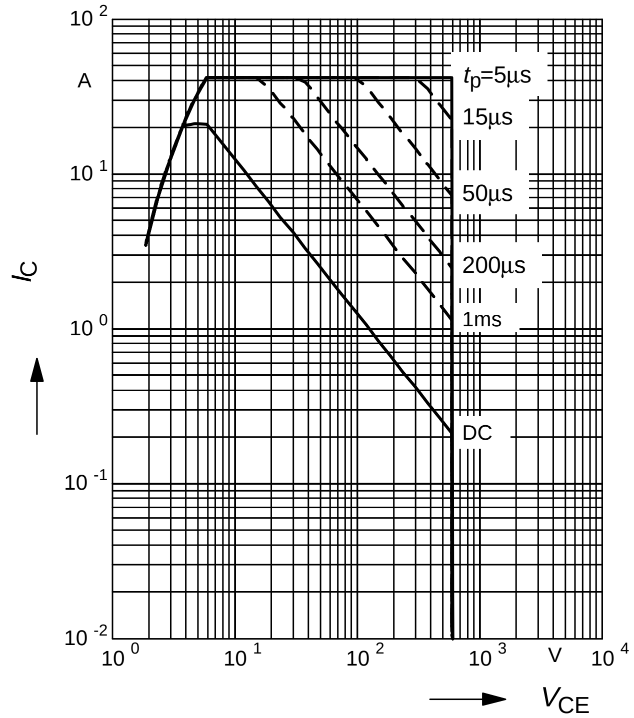
parameter: $D = 0.5$, $T_j \leq 150$ °C



Safe operating area

$I_C = f(V_{CE})$

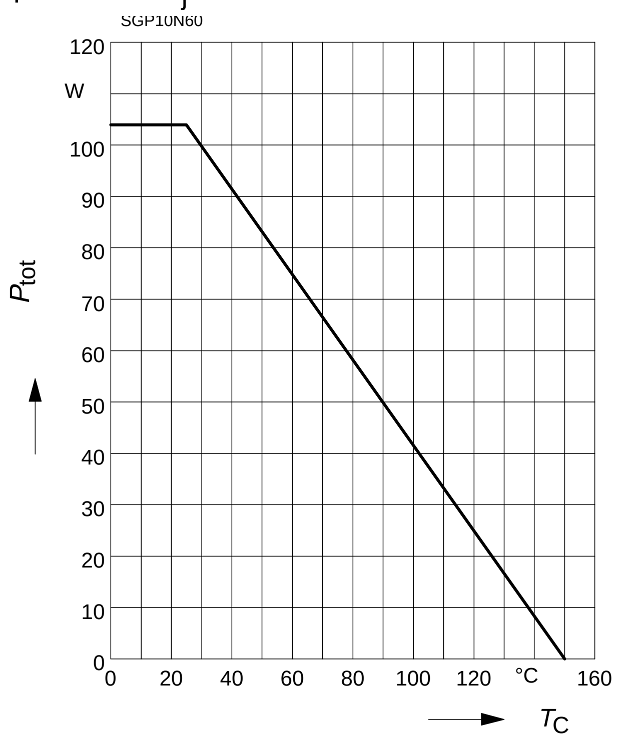
parameter: $D = 0$, $T_C = 25$°C, $T_j \leq 150$°C



Power dissipation

$P_{tot} = f(T_C)$

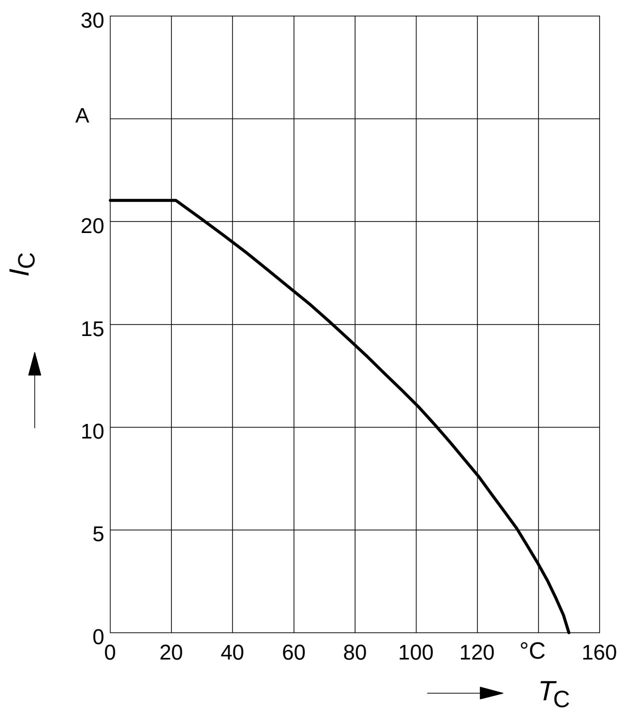
parameter: $T_j \leq 150$ °C



Collector current

$I_C = f(T_C)$

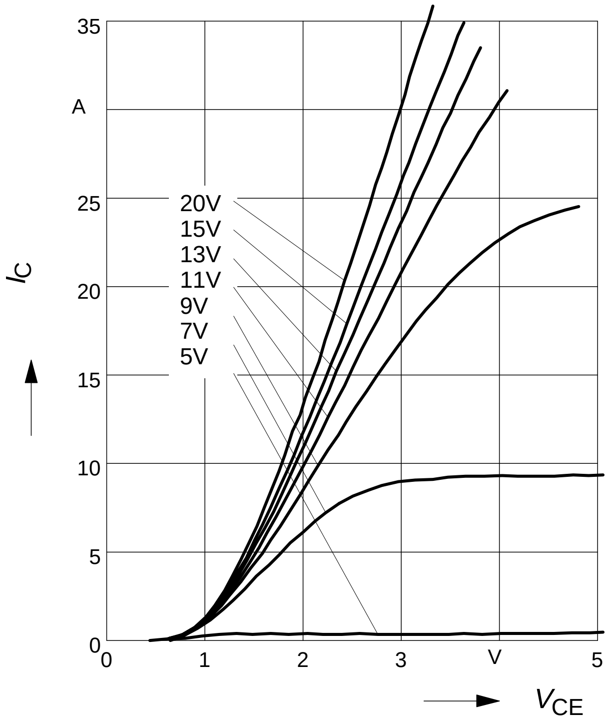
parameter: $V_{GE} \geq 15$ V , $T_j \leq 150$ °C



Typ. output characteristics

$I_C = f(V_{CE})$

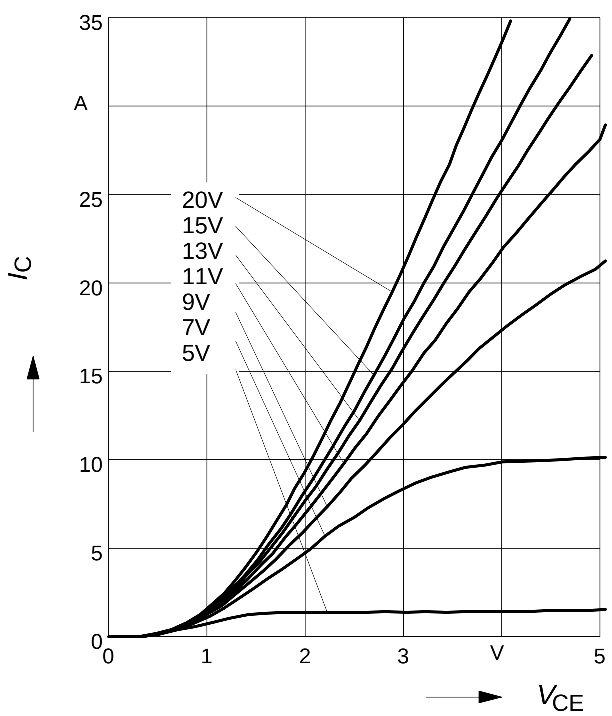
parameter: t_p = 80 µs, T_j = 25 °C



Typ. output characteristics

$I_C = f(V_{CE})$

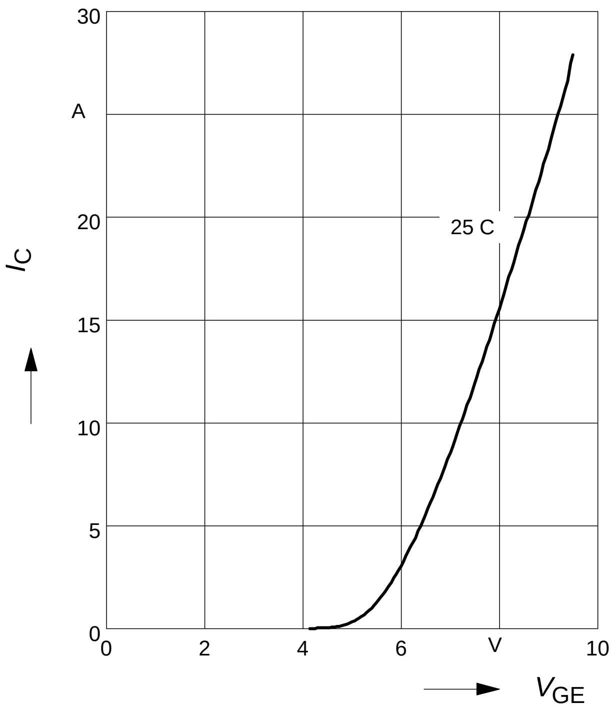
parameter: t_p = 80 µs, T_j = 150 °C



Typ. transfer characteristics

$I_C = f(V_{GE})$

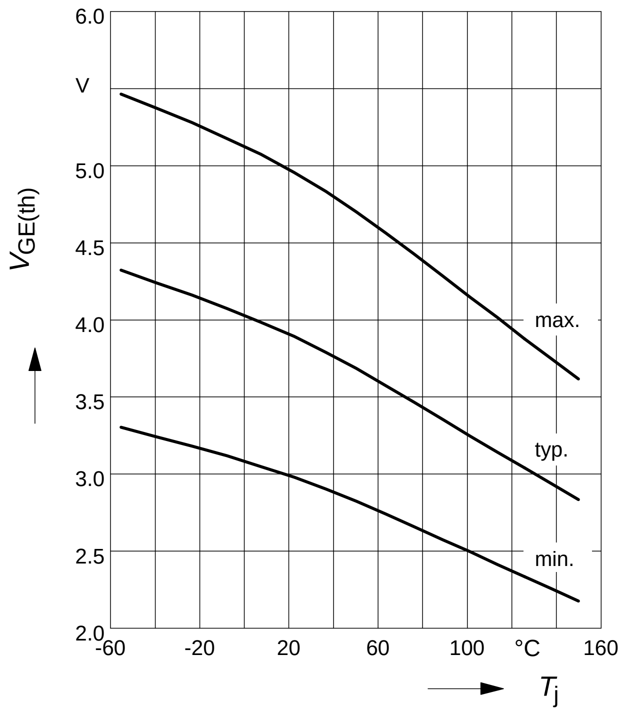
parameter: t_p = 80 µs, V_{CE} = 10 V



Gate-emitter threshold voltage

$V_{GE(th)} = f(T_j)$

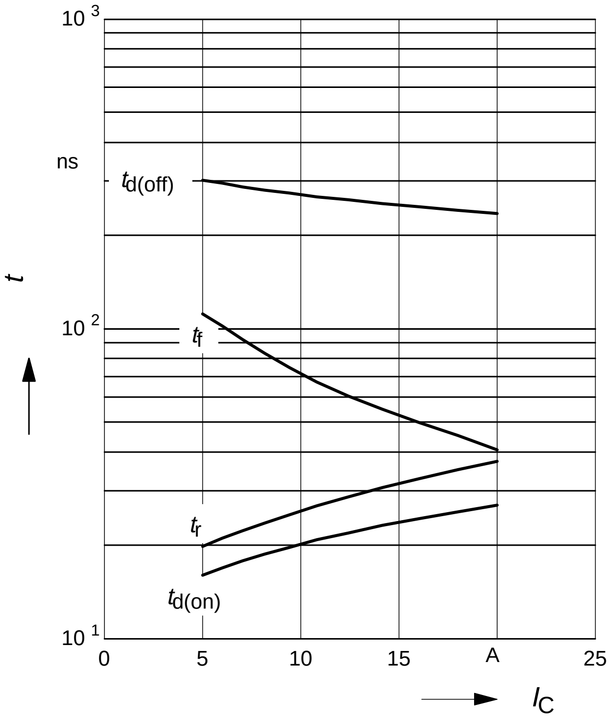
parameter: I_C = 0.3 mA



Typ. switching time

$t = f(I_C)$, inductive load, T_j = 150°C

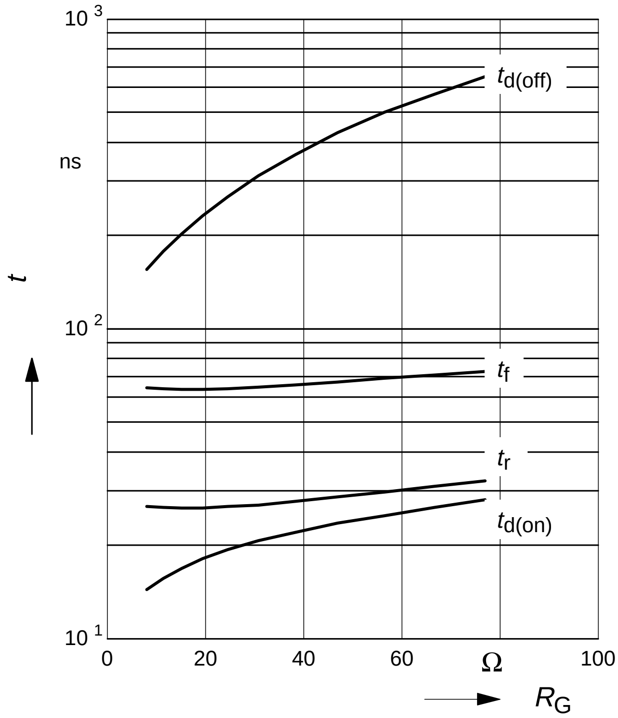
par.: V_{CE} = 400 V, V_{GE} = 0/+15 V, R_G = 25 Ω



Typ. switching time

$t = f(R_G)$, inductive load, T_j = 150°C

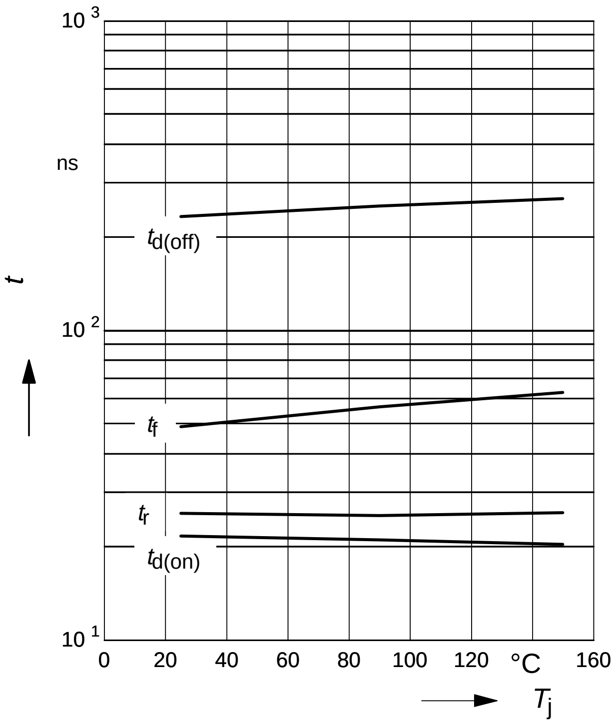
par.: V_{CE} = 400 V, V_{GE} = 0/+15 V, I_C = 10 A



Typ. switching time

$t = f(T_j)$, inductive load, V_{CE} = 400 V,

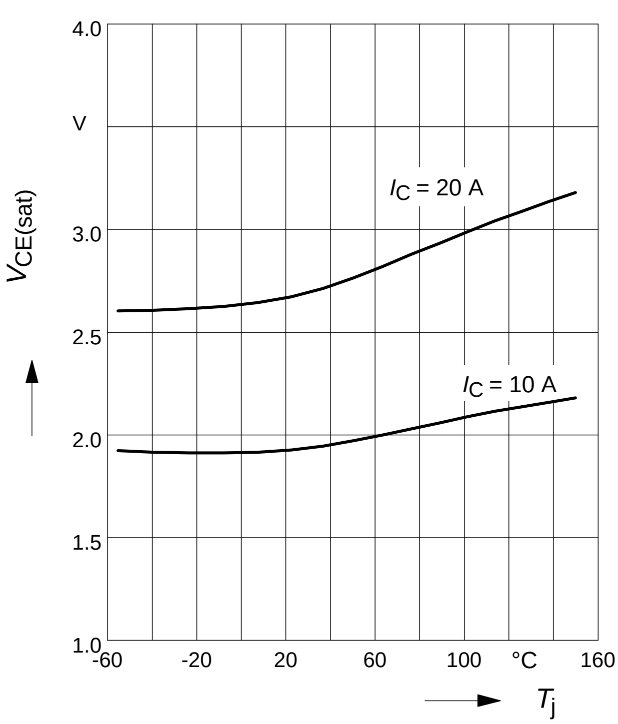
V_{GE} = 0/+15 V, I_C = 10 A, R_G = 25 Ω



Typ. collector-emitter saturation voltage

$V_{CEsat} = f(T_j)$

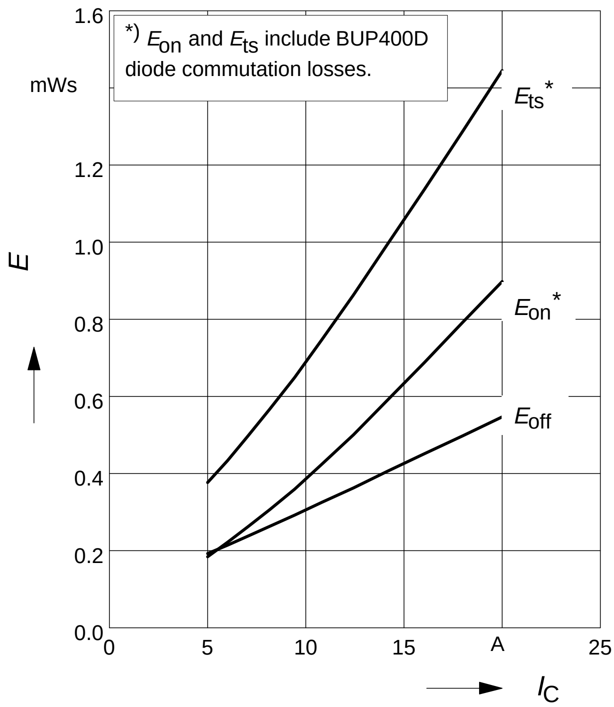
parameter: V_{GE} = 15 V



Typ. switching losses

$E = f(I_C)$, inductive load, T_j = 150°C

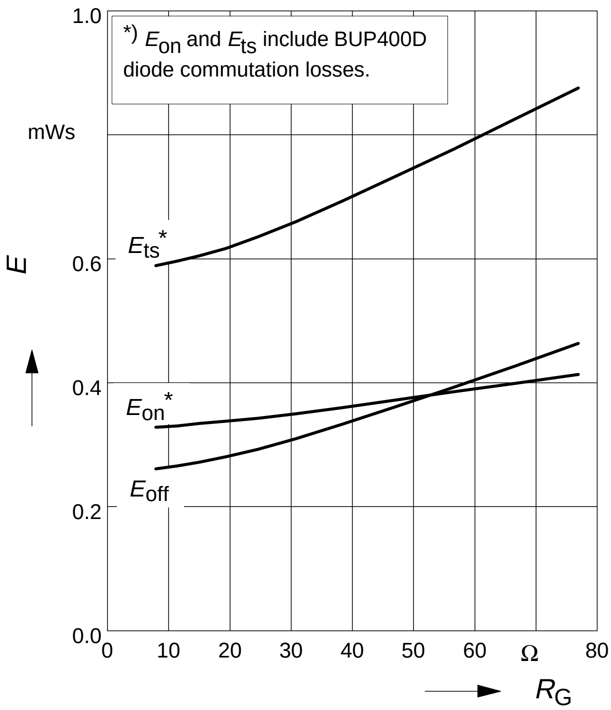
par.: V_{CE} = 400 V, V_{GE} = 0/+15V, R_G = 25 Ω



Typ. switching losses

$E = f(R_G)$, inductive load, T_j = 150°C

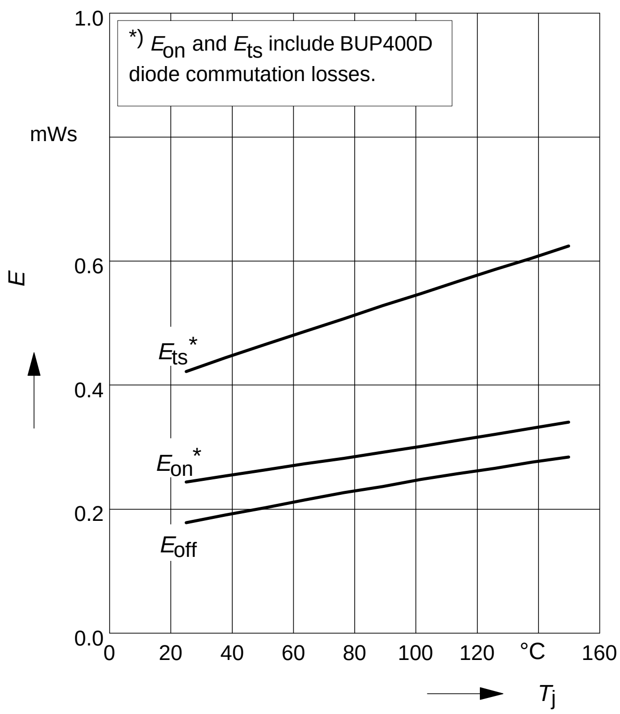
par.: V_{CE} = 400 V, V_{GE} = 0/+15 V, I_C = 10 A



Typ. switching losses

$E = f(T_j)$, inductive load, V_{CE} = 400 V,

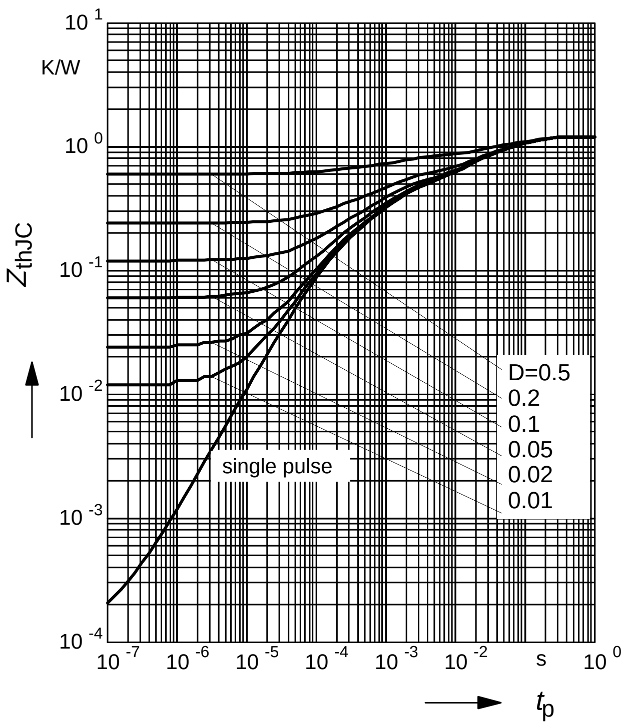
V_{GE} = 0/+15 V, I_C = 10 A, R_G = 25 Ω



Transient thermal impedance

$Z_{thJC} = f(t_p)$

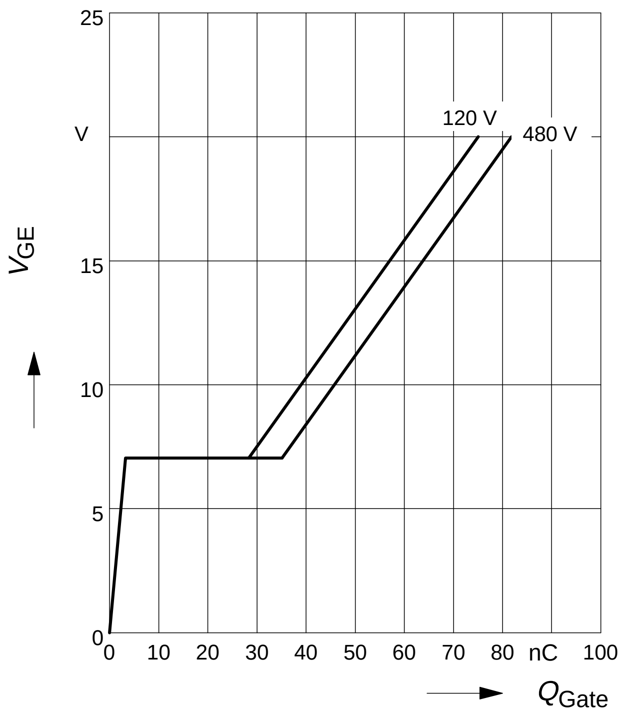
parameter: $D = t_p / T$



Typ. gate charge

$V_{GE} = f(Q_{Gate})$

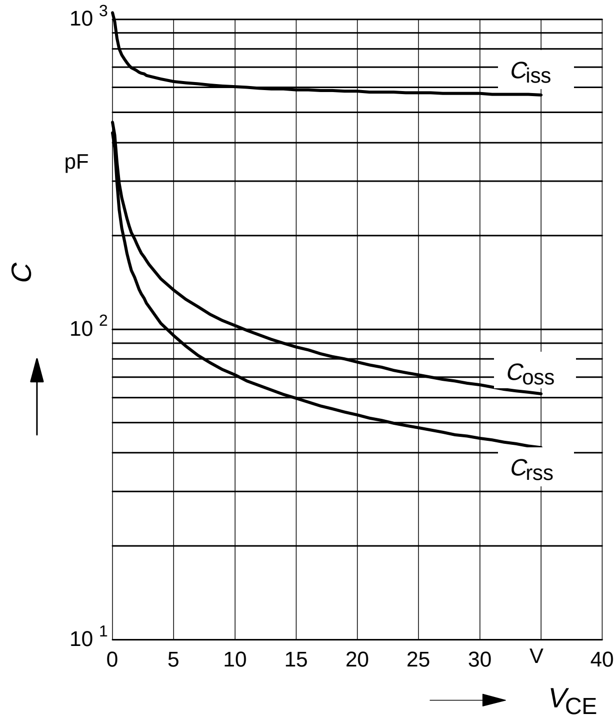
parameter: I_C = 10 A



Typ. capacitances

$C = f(V_{CE})$

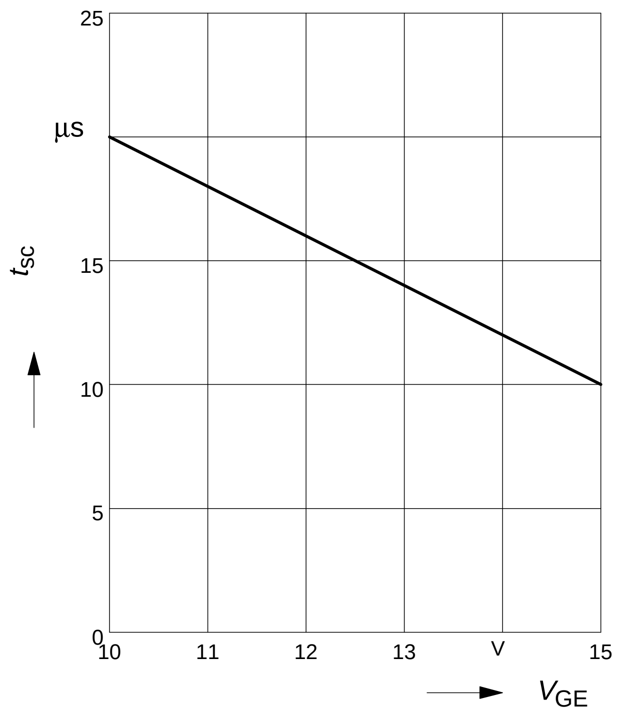
parameter: V_{GE} = 0 V, f = 1 MHz



Short circuit withstand time

$t_{sc} = f(V_{GE})$

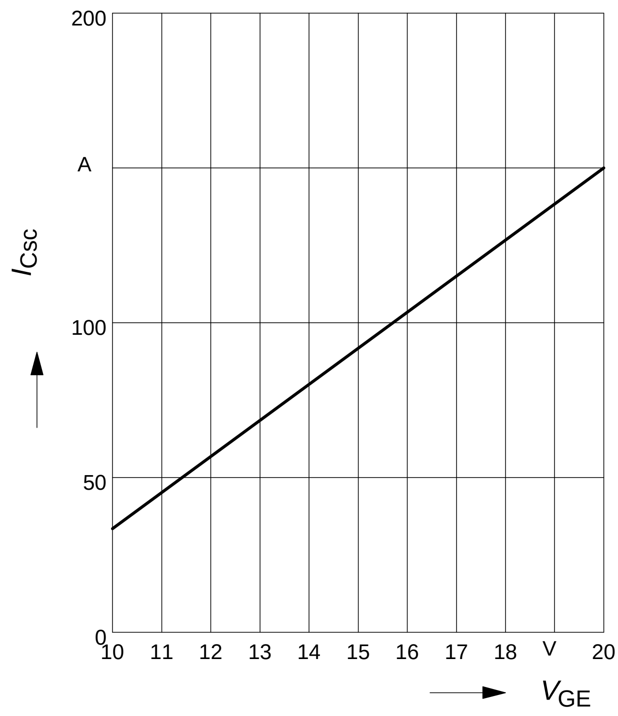
par.: V_{CE} = 600 V, start at T_j = 25 °C



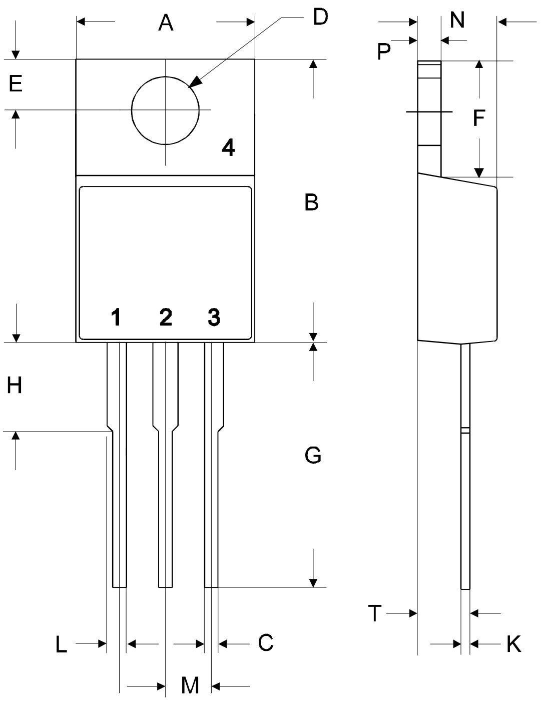
Typ. short circuit current

$I_{Csc} = f(V_{GE})$

par.: $V_{CE} \leq 600$ V, T_C = 25 °C, $T_j \leq 150$ °C

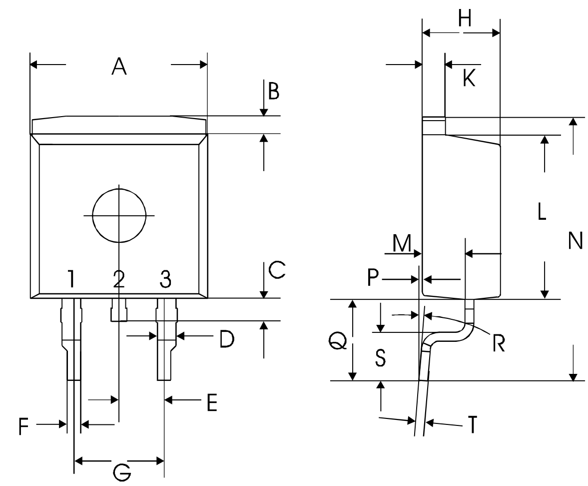


TO-220AB

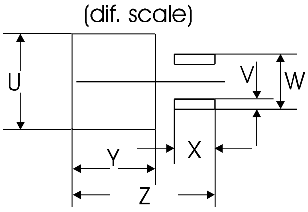


	dimensions	
	[mm]	
symbol	min	max
A	9.70	10.30
B	14.88	15.95
C	0.65	0.86
D	3.55	3.89
E	2.60	3.00
F	6.00	6.80
G	13.00	14.00
H	4.35	4.75
K	0.38	0.65
L	0.95	1.32
M	2.54 typ.	
N	4.30	4.50
P	1.17	1.40
T	2.30	2.72

TO-263AB



Footprint
(dif. scale)



	dimensions	
	[mm]	
symbol	min	max
A	9.80	10.20
B	0.70	1.30
C	1.00	1.60
D	1.03	1.07
E	2.54 typ.	
F	0.65	0.85
G	5.08 typ.	
H	4.30	4.50
K	1.17	1.37
L	9.05	9.45
M	2.30	2.50
N	15 typ.	
P	0.00	0.20
Q	4.20	5.20
R	8° max	
S	2.40	3.00
T	0.40	0.60
U	10.80	
V	1.15	
W	6.23	
X	4.60	
Y	9.40	
Z	16.15	

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