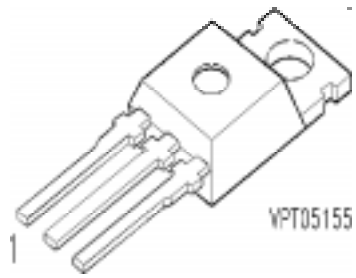
IGBT With Antiparallel Diode

Preliminary data

- Low forward voltage drop
- High switching speed
- Low tail current
- Latch-up free
- Including fast free-wheel diode



Pin 1	Pin 2	Pin 3
G	C	E

Type	V_{CE}	I_C	Package	Ordering Code
BUP 410D	600V	13A	TO-220 AB	Q67040-A4425-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	600	V
Collector-gate voltage R_{GE} = 20 kΩ	V_{CGR}	600	
Gate-emitter voltage	V_{GE}	± 20	
DC collector current T_C = 25 °C T_C = 90 °C	I_C	 13 8	A
Pulsed collector current, t_p = 1 ms T_C = 25 °C T_C = 90 °C	I_{Cpuls}	 26 16	
Diode forward current T_C = 90 °C	I_F	11	
Pulsed diode current, t_p = 1 ms T_C = 25 °C	I_{Fpuls}	72	
Power dissipation T_C = 25 °C	P_{tot}	50	W
Chip or operating temperature	T_j	-55 ... + 150	°C
Storage temperature	T_{stg}	-55 ... + 150	

Maximum Ratings

Parameter	Symbol	Values	Unit
DIN humidity category, DIN 40 040	-	E	-
IEC climatic category, DIN IEC 68-1	-	55 / 150 / 56	

Thermal Resistance

Thermal resistance, chip case	R_{thJC}	≤ 2.5	K/W
Diode thermal resistance, chip case	R_{thJC_D}	3.1	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Gate threshold voltage	$V_{GE(th)}$				V
V_{GE} = V_{CE}, I_C = 0.35 mA, T_j = 25 °C		4.5	5.5	6.5	
Collector-emitter saturation voltage	$V_{CE(sat)}$				
V_{GE} = 15 V, I_C = 6 A, T_j = 25 °C		-	2.1	2.7	
V_{GE} = 15 V, I_C = 6 A, T_j = 125 °C		-	2.2	2.8	
V_{GE} = 15 V, I_C = 12 A, T_j = 25 °C		-	3	-	
V_{GE} = 15 V, I_C = 12 A, T_j = 125 °C		-	3.3	-	
Zero gate voltage collector current	I_{CES}				µA
V_{CE} = 600 V, V_{GE} = 0 V, T_j = 25 °C		-	-	80	
Gate-emitter leakage current	I_{GES}				nA
V_{GE} = 25 V, V_{CE} = 0 V		-	-	100	

AC Characteristics

Transconductance V_{CE} = 20 V, I_C = 6 A	g_{fs}	2	-	-	S
Input capacitance V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz	C_{iss}	-	320	430	pF
Output capacitance V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz	C_{oss}	-	40	60	
Reverse transfer capacitance V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz	C_{rss}	-	25	40	

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

Parameter	**Symbol**	**Values**			**Unit**
		min.	**typ.**	**max.**	

Switching Characteristics, Inductive Load at T_j = 125 °C

Turn-on delay time V_{CC} = 300 V, V_{GE} = 15 V, I_C = 6 A R_{Gon} = 100 Ω	$t_{d(on)}$	-	20	35	ns
Rise time V_{CC} = 300 V, V_{GE} = 15 V, I_C = 6 A R_{Gon} = 100 Ω	t_r	-	60	90	
Turn-off delay time V_{CC} = 300 V, V_{GE} = -15 V, I_C = 6 A R_{Goff} = 100 Ω	$t_{d(off)}$	-	175	240	
Fall time V_{CC} = 300 V, V_{GE} = -15 V, I_C = 6 A R_{Goff} = 100 Ω	t_f	-	160	220	

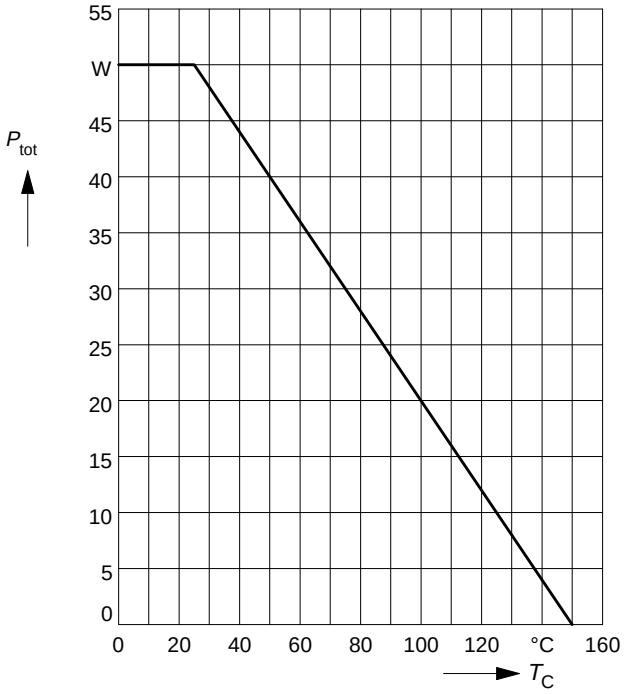
Free-Wheel Diode

Diode forward voltage I_F = 10 A, V_{GE} = 0 V, T_j = 25 °C	V_F	-	1.65	-	V
Reverse recovery time I_F = 10 A, V_R = -300 V, V_{GE} = 0 V di_F/dt = -100 A/µs T_j = 25 °C T_j = 125 °C	t_{rr}	- - -	- 60 100	- 100 150	ns
Reverse recovery charge I_F = 10 A, V_R = -300 V, V_{GE} = 0 V di_F/dt = -100 A/µs T_j = 25 °C T_j = 125 °C	Q_{rr}	- -	0.2 0.4	0.37 0.74	µC

Power dissipation

$P_{tot} = f(T_C)$

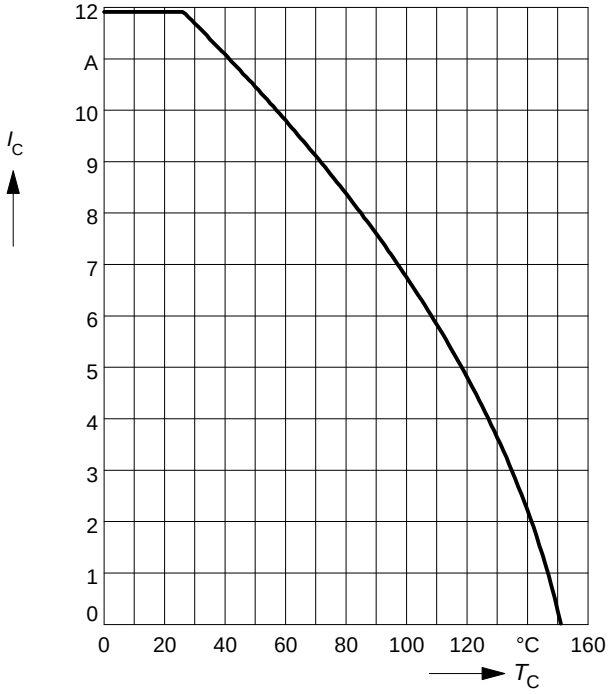
parameter: $T_j \leq 150$ °C



Collector current

$I_C = f(T_C)$

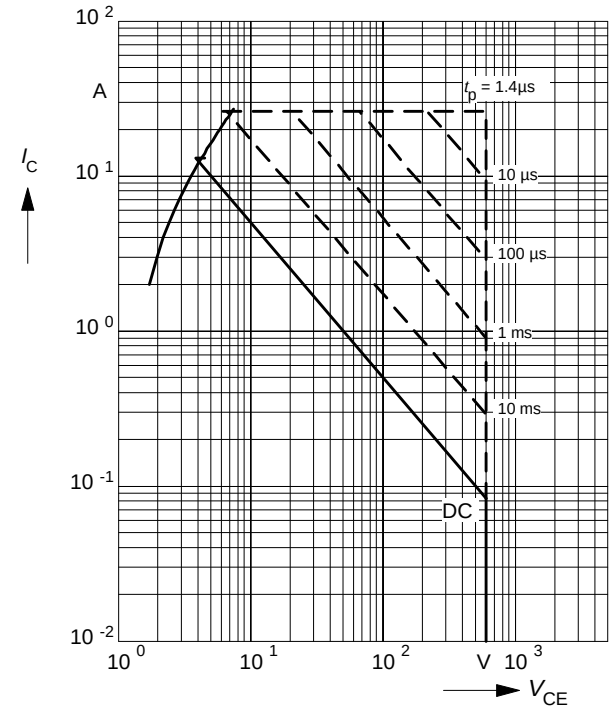
parameter: $V_{GE} \geq 15$ V , $T_j \leq 150$ °C



Safe operating area

$I_C = f(V_{CE})$

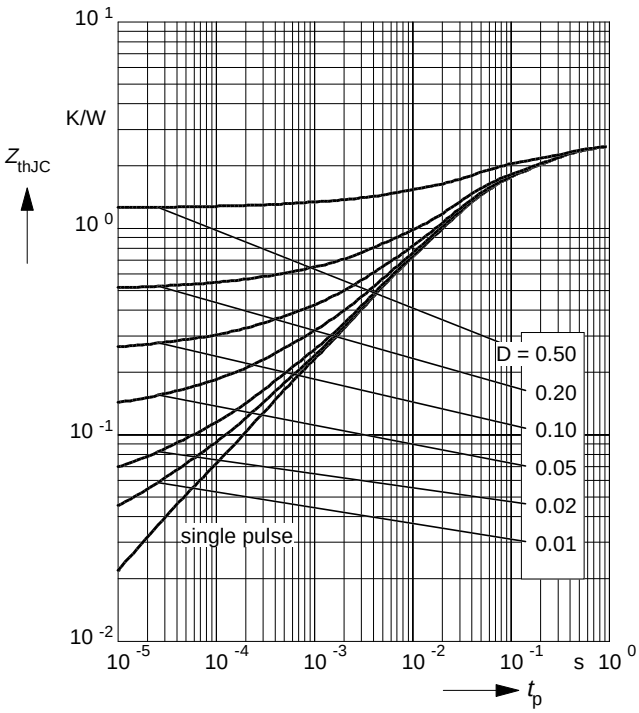
parameter: $D = 0$, $T_C = 25$°C , $T_j \leq 150$ °C



Transient thermal impedance IGBT

$Z_{th\,JC} = f(t_p)$

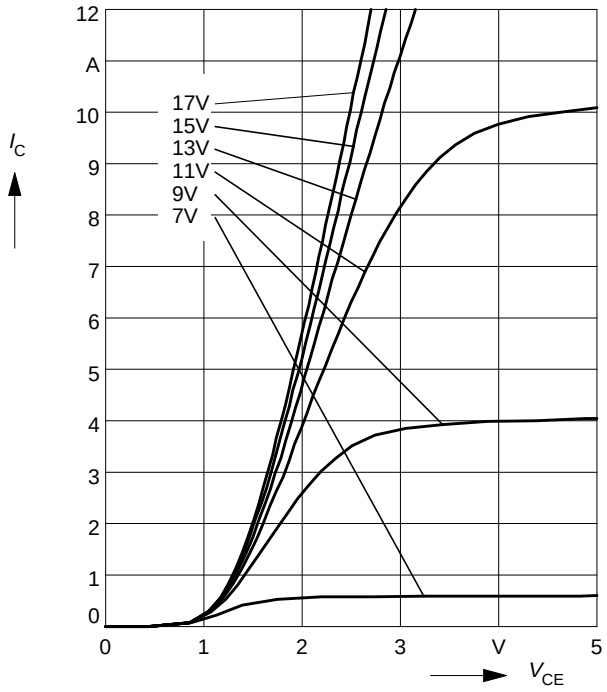
parameter: $D = t_p / T$



Typ. output characteristics

$I_C = f(V_{CE})$

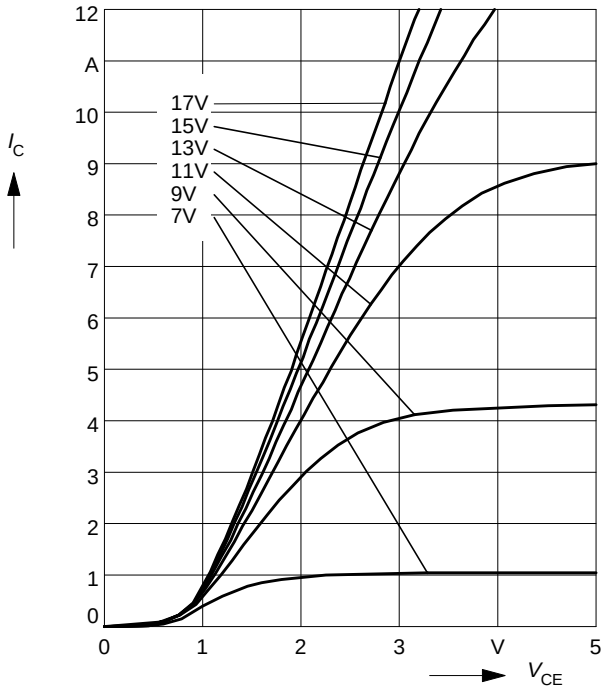
parameter: t_p = 80 µs, T_j = 25 °C



Typ. output characteristics

$I_C = f(V_{CE})$

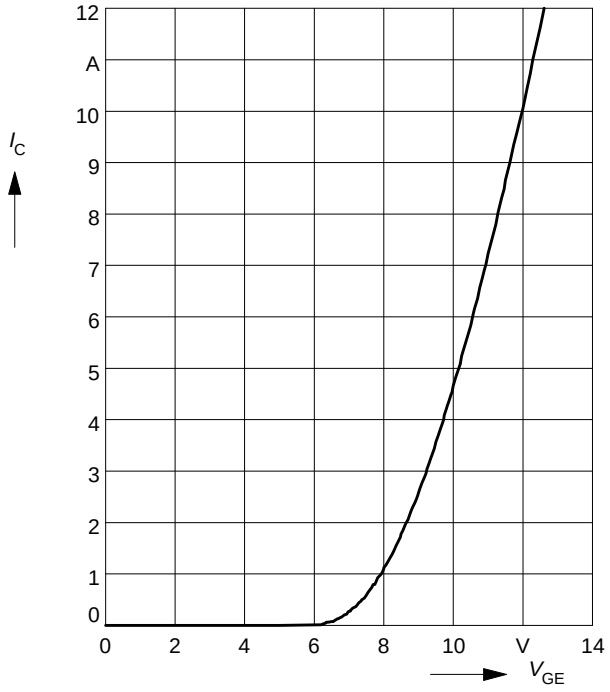
parameter: t_p = 80 µs, T_j = 125 °C



Typ. transfer characteristics

$I_C = f(V_{GE})$

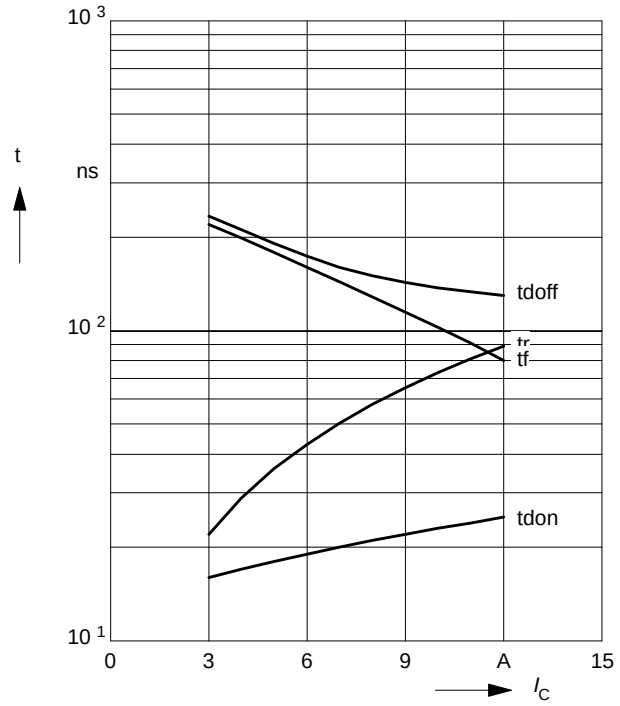
parameter: t_p = 80 µs, V_{CE} = 20 V



Typ. switching time

$t = f(I_C)$, inductive load , T_j = 125°C

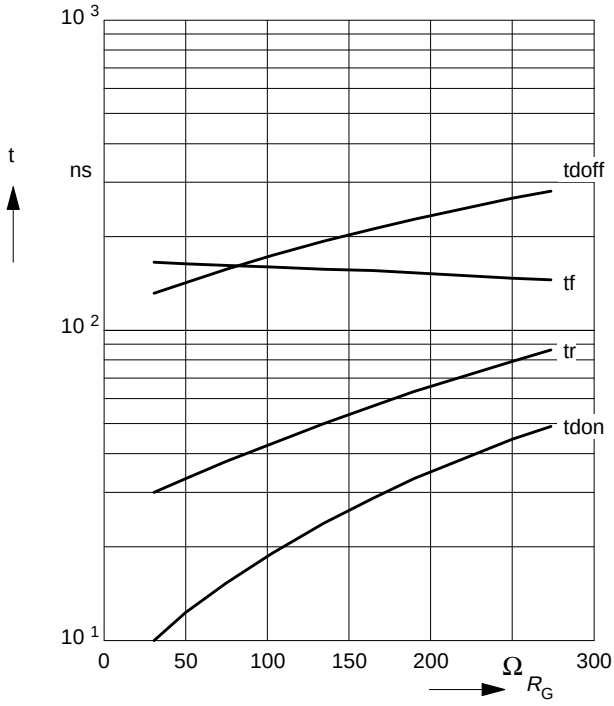
par.: V_{CE} = 300 V, V_{GE} = ± 15 V, R_G = 100 Ω



Typ. switching time

$t = f(R_G)$, inductive load , T_j = 125°C

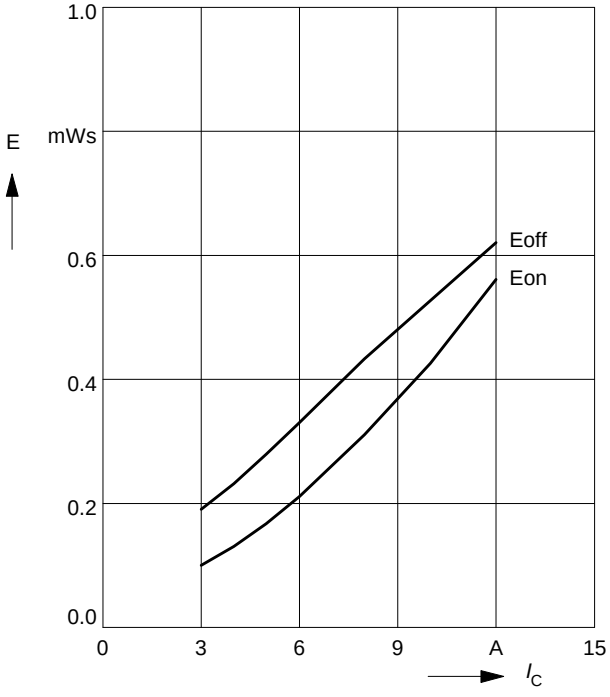
par.: V_{CE} = 300 V, V_{GE} = ± 15 V, I_C = 6 A



Typ. switching losses

$E = f(I_C)$, inductive load , T_j = 125°C

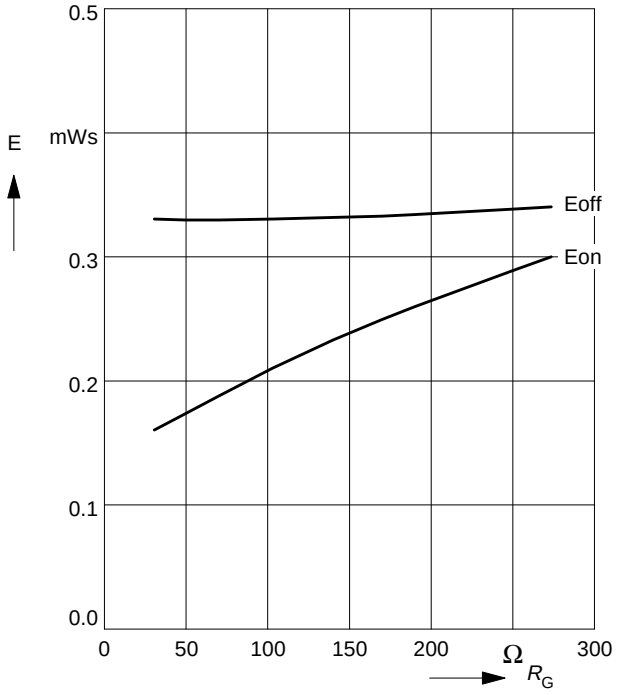
par.: V_{CE} = 300 V, V_{GE} = ± 15 V, R_G = 100 Ω



Typ. switching losses

$E = f(R_G)$, inductive load , T_j = 125°C

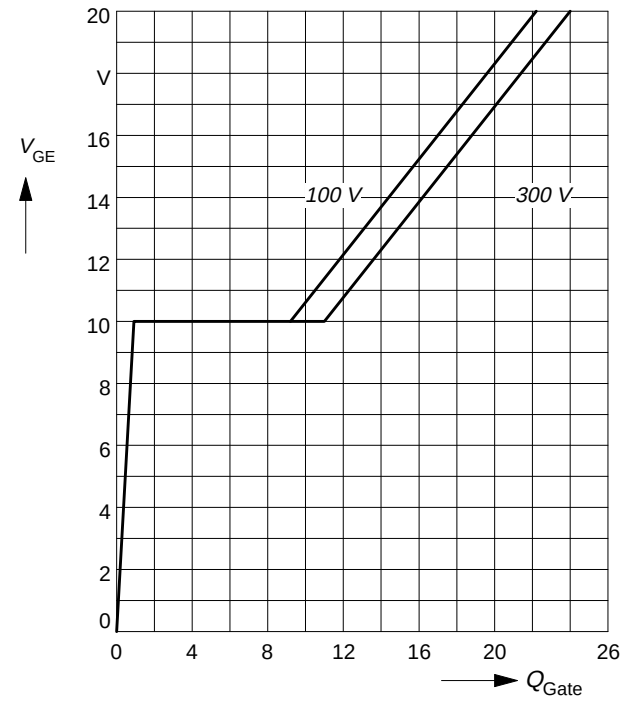
par.: V_{CE} = 300V, V_{GE} = ± 15 V, I_C = 6 A



Typ. gate charge

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

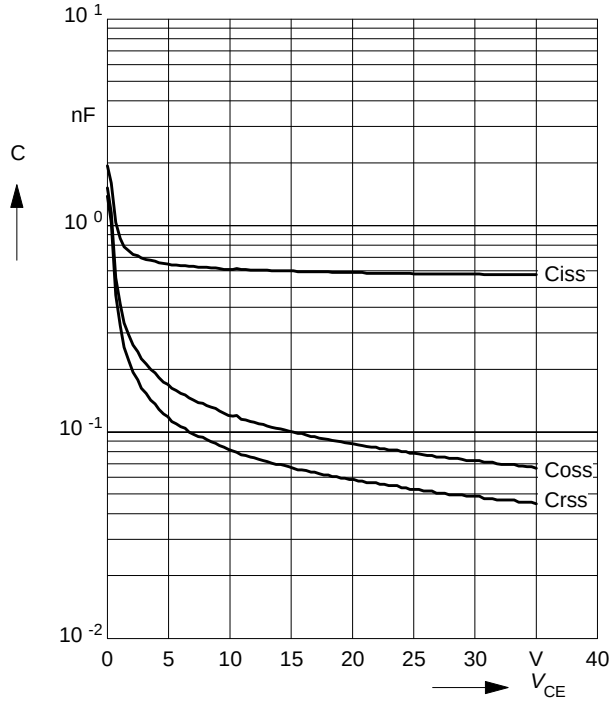
parameter: $I_{C\ puls}$ = 6 A



Typ. capacitances

$C = f(V_{CE})$

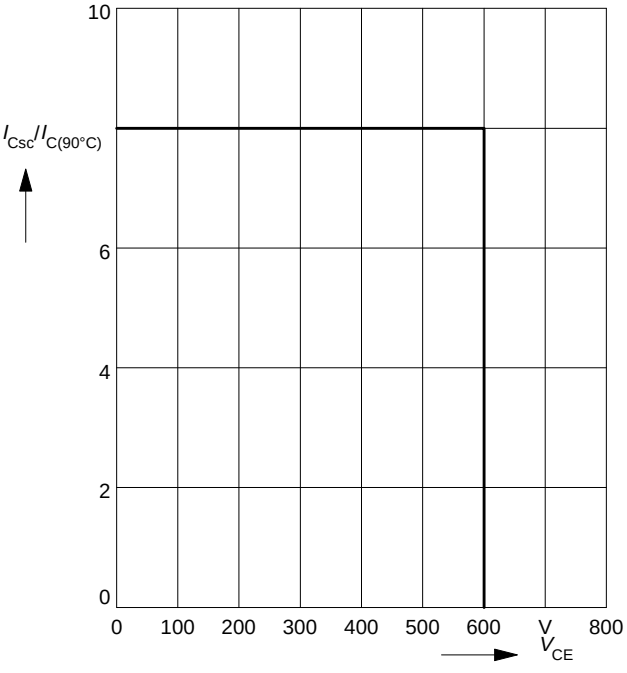
parameter: V_{GE} = 0 V, f = 1 MHz



Short circuit safe operating area

$I_{Csc} = f(V_{CE})$, T_j = 150°C

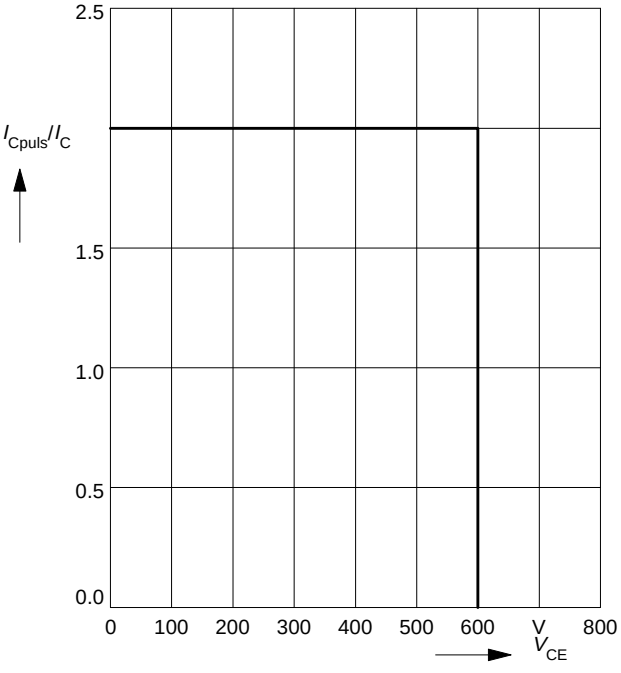
parameter: V_{GE} = ± 15 V, $t_{sc} \leq$ 10 µs, L < 50 nH



Reverse biased safe operating area

$I_{Cpuls} = f(V_{CE})$, T_j = 150°C

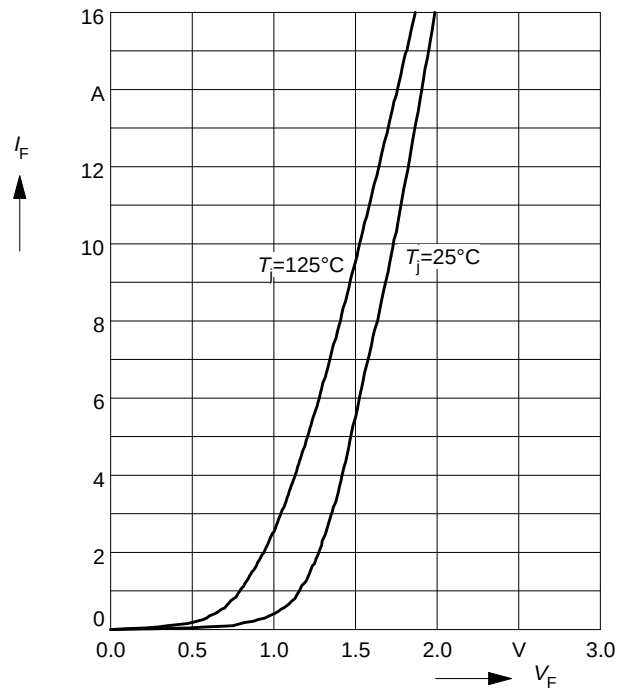
parameter: V_{GE} = 15 V



Typ. forward characteristics

$I_F = f(V_F)$

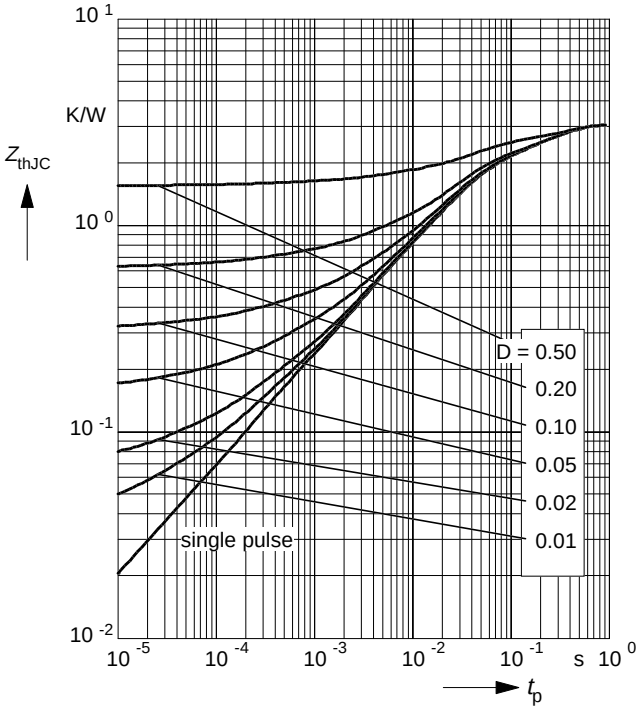
parameter: T_j



Transient thermal impedance Diode

$Z_{th\ JC} = f(t_p)$

parameter: $D = t_p / T$



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