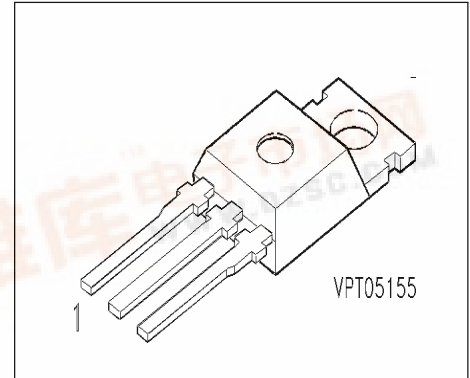


### IGBT

Preliminary data

- Low forward voltage drop
- High switching speed
- Low tail current
- Latch-up free
- Avalanche rated



Pin 1	Pin 2	Pin 3
G	C	E

Type	V <sub>CE</sub>	I <sub>C</sub>	Package	Ordering Code
BUP 400	600V	22A	TO-220 AB	C67078-A4403-A2

### Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V <sub>CE</sub>	600	V
Collector-gate voltage	V <sub>CGR</sub>	600	V
R <sub>GE</sub> = 20 kΩ			
Gate-emitter voltage	V <sub>GE</sub>	± 20	
DC collector current	I <sub>C</sub>		A
T <sub>C</sub> = 25 °C		22	
T <sub>C</sub> = 90 °C		14	
Pulsed collector current, t <sub>p</sub> = 1 ms	I <sub>Cpuls</sub>		
T <sub>C</sub> = 25 °C		44	
T <sub>C</sub> = 90 °C		28	
Avalanche energy, single pulse	E <sub>AS</sub>		mJ
I <sub>C</sub> = 10 A, V <sub>CC</sub> = 50 V, R <sub>GE</sub> = 25 Ω			
L = 350 μH, T <sub>j</sub> = 25 °C		18	
Power dissipation	P <sub>tot</sub>		W
T <sub>C</sub> = 25 °C		100	
Chip or operating temperature	T <sub>j</sub>	-55 ... + 150	°C
Storage temperature	T <sub>stg</sub>	-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	$R_{thJC}$	$\leq 1.25$	K/W
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## Electrical Characteristics, at $T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

## Static Characteristics

Gate threshold voltage $V_{GE} = V_{CE}, I_C = 0.35\text{ mA}$	$V_{GE(th)}$	4.5	5.5	6.5	V
Collector-emitter saturation voltage $V_{GE} = 15\text{ V}, I_C = 10\text{ A}, T_j = 25\text{ °C}$	$V_{CE(sat)}$	-	2.1	2.7	
$V_{GE} = 15\text{ V}, I_C = 10\text{ A}, T_j = 125\text{ °C}$		-	2.2	2.8	
$V_{GE} = 15\text{ V}, I_C = 20\text{ A}, T_j = 25\text{ °C}$		-	3	-	
$V_{GE} = 15\text{ V}, I_C = 20\text{ A}, T_j = 125\text{ °C}$		-	3.3	-	
Zero gate voltage collector current $V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_j = 25\text{ °C}$	$I_{CES}$	-	-	40	$\mu\text{A}$
Gate-emitter leakage current $V_{GE} = 25\text{ V}, V_{CE} = 0\text{ V}$	$I_{GES}$	-	-	100	nA

## AC Characteristics

Transconductance $V_{CE} = 20\text{ V}, I_C = 10\text{ A}$	$g_{fs}$	2	-	-	S
Input capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{iss}$	-	570	760	pF
Output capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{oss}$	-	80	120	
Reverse transfer capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{rss}$	-	50	75	

**Electrical Characteristics**, at  $T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

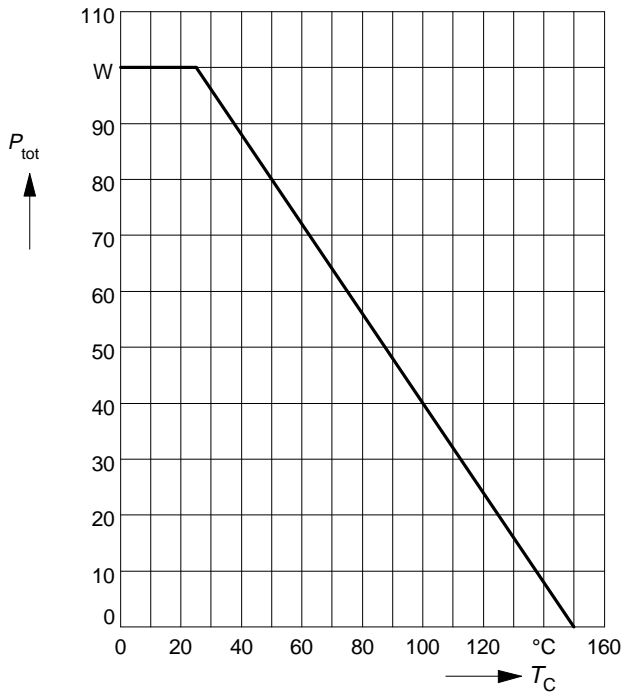
**Switching Characteristics, Inductive Load at  $T_j = 125\text{ °C}$**

Turn-on delay time $V_{CC} = 300\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 10\text{ A}$ $R_{Gon} = 100\ \Omega$	$t_{d(on)}$	-	45	70	ns
Rise time $V_{CC} = 300\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 10\text{ A}$ $R_{Gon} = 100\ \Omega$	$t_r$	-	60	90	
Turn-off delay time $V_{CC} = 300\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 10\text{ A}$ $R_{Goff} = 100\ \Omega$	$t_{d(off)}$	-	250	340	
Fall time $V_{CC} = 300\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 10\text{ A}$ $R_{Goff} = 100\ \Omega$	$t_f$	-	500	680	

### Power dissipation

$$P_{\text{tot}} = f(T_C)$$

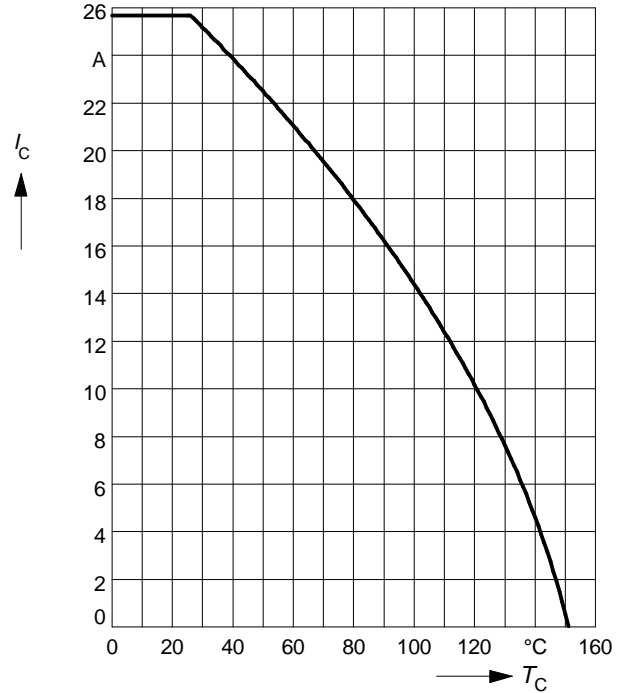
parameter:  $T_j \leq 150^\circ\text{C}$



### Collector current

$$I_C = f(T_C)$$

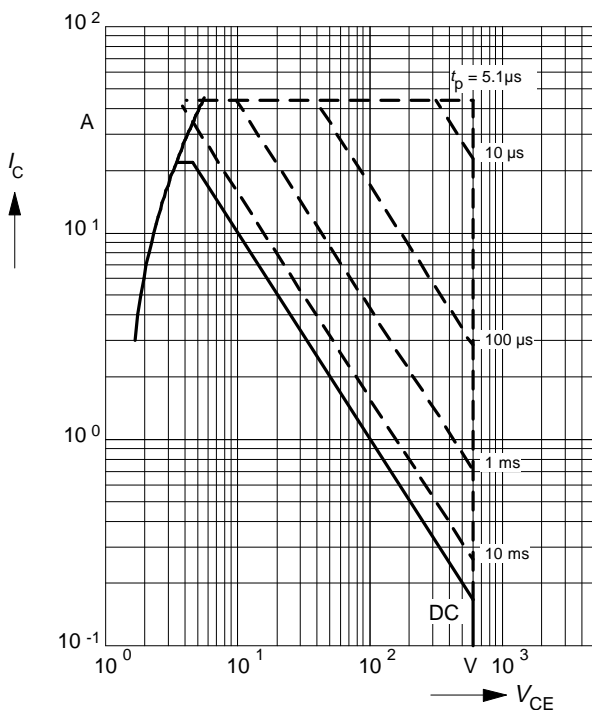
parameter:  $V_{\text{GE}} \geq 15\text{ V}$ ,  $T_j \leq 150^\circ\text{C}$



### Safe operating area

$$I_C = f(V_{\text{CE}})$$

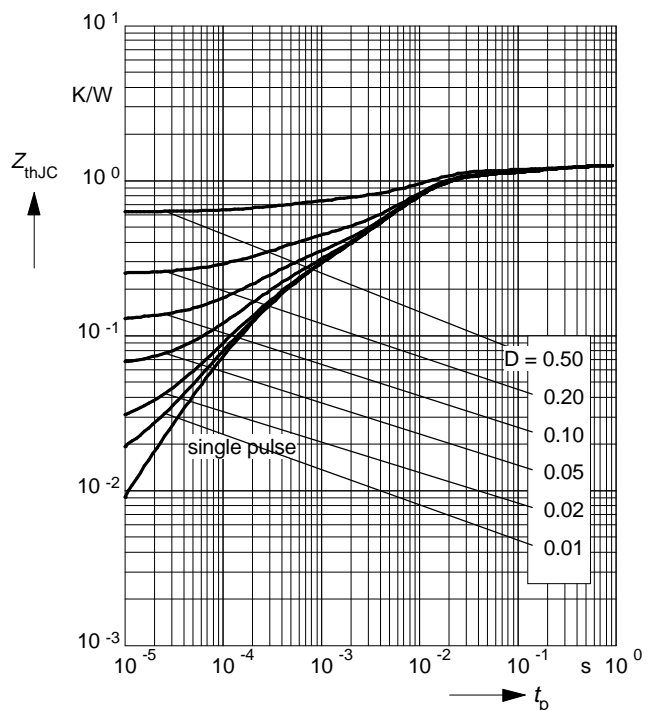
parameter:  $D = 0$ ,  $T_C = 25^\circ\text{C}$ ,  $T_j \leq 150^\circ\text{C}$



### Transient thermal impedance IGBT

$$Z_{\text{thJC}} = f(t_p)$$

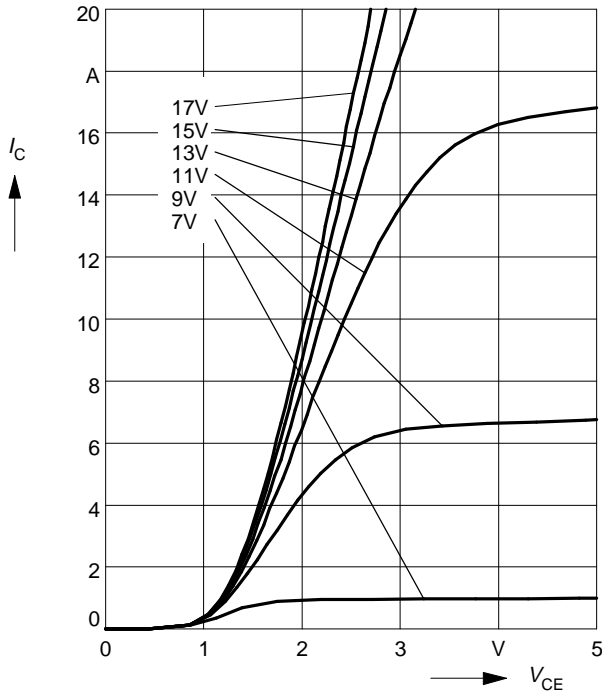
parameter:  $D = t_p / T$



### Typ. output characteristics

$$I_C = f(V_{CE})$$

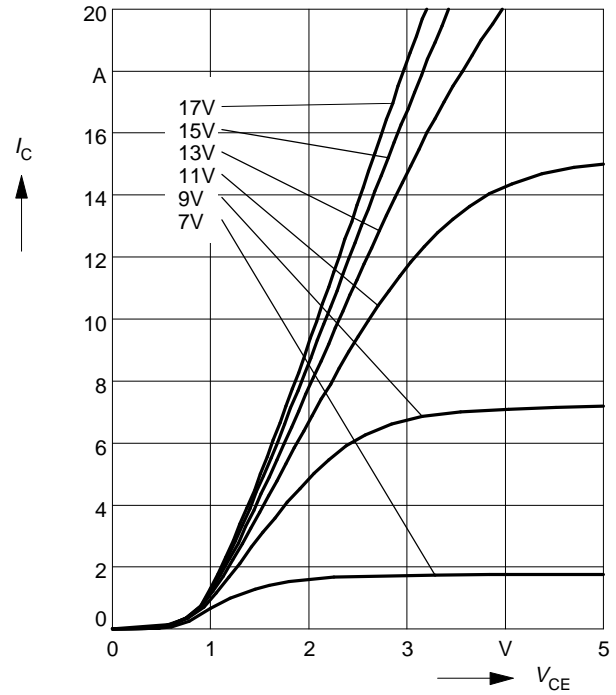
parameter:  $t_p = 80 \mu s, T_j = 25 \text{ }^\circ\text{C}$



### Typ. output characteristics

$$I_C = f(V_{CE})$$

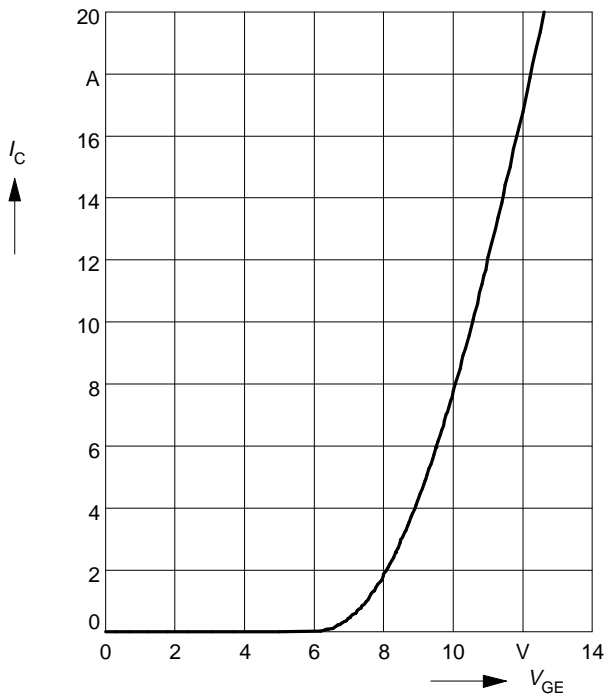
parameter:  $t_p = 80 \mu s, T_j = 125 \text{ }^\circ\text{C}$



### Typ. transfer characteristics

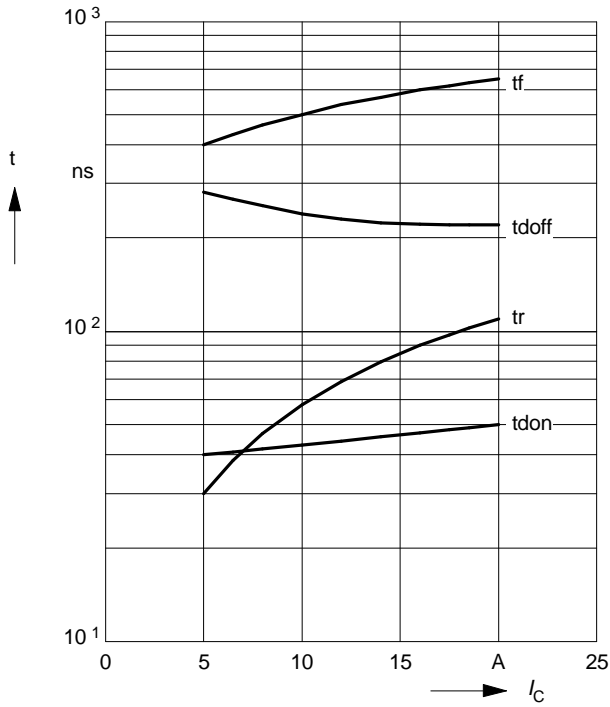
$$I_C = f(V_{GE})$$

parameter:  $t_p = 80 \mu s, V_{CE} = 20 \text{ V}$



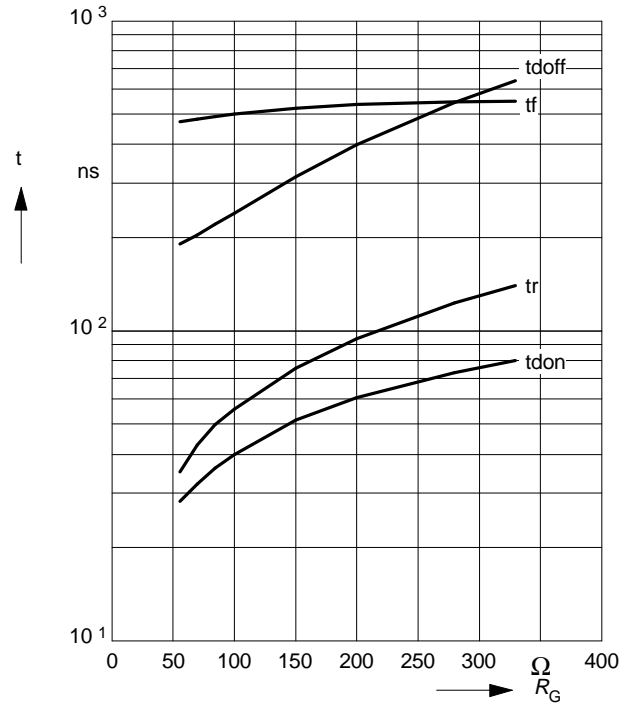
### Typ. switching time

$t = f(I_C)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 100\ \Omega$



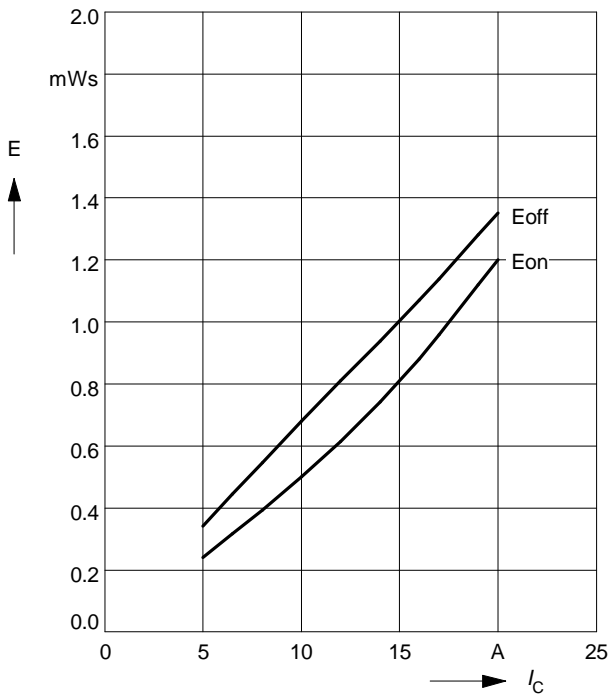
### Typ. switching time

$t = f(R_G)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 10\text{ A}$



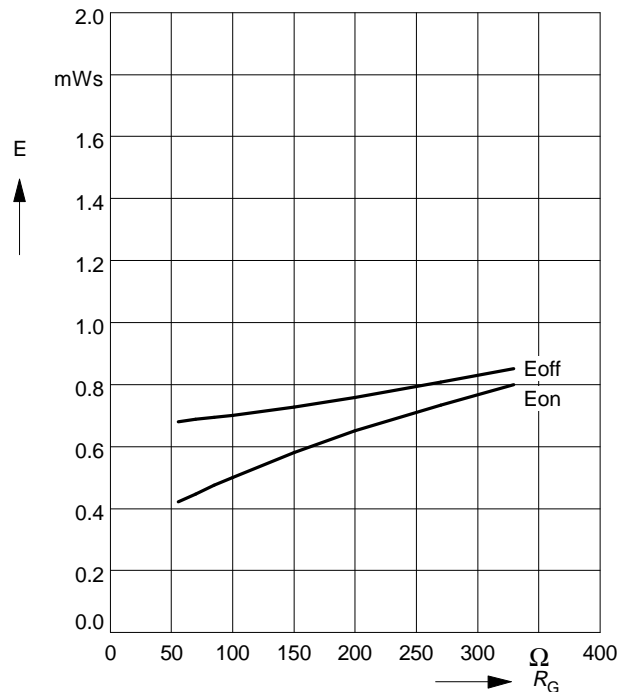
### Typ. switching losses

$E = f(I_C)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 100\ \Omega$



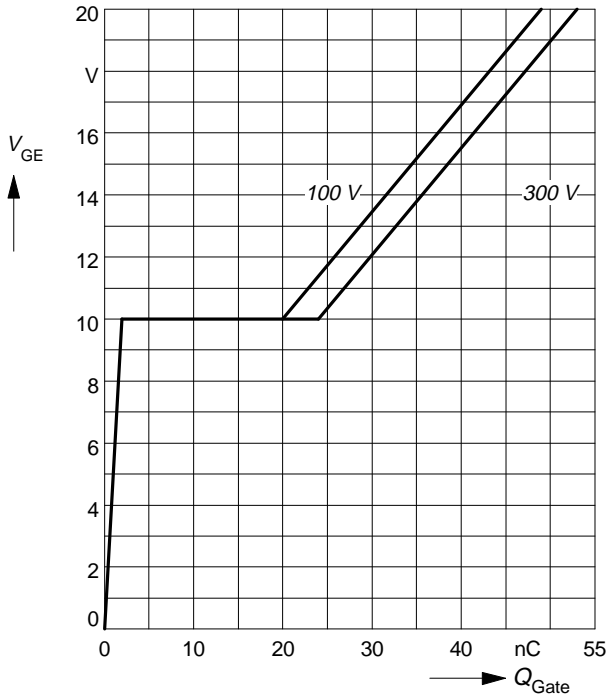
### Typ. switching losses

$E = f(R_G)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 10\text{ A}$



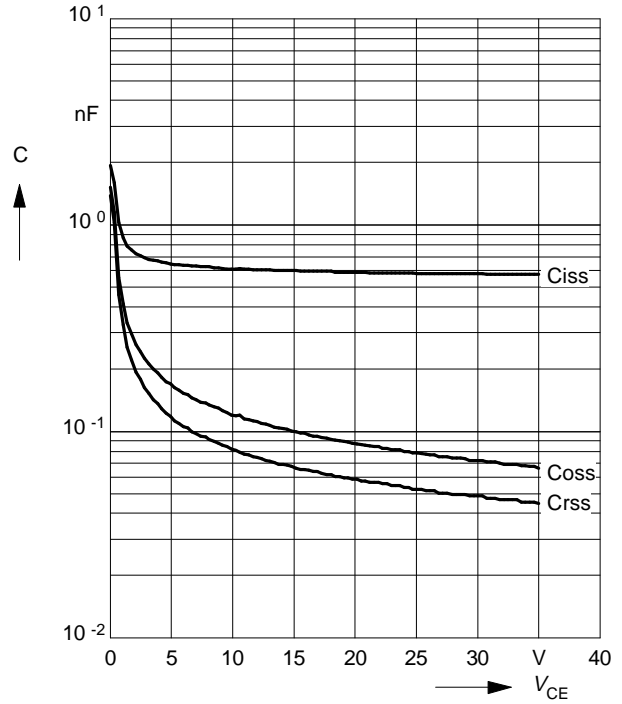
### Typ. gate charge

$V_{GE} = f(Q_{Gate})$   
parameter:  $I_{C\ puls} = 10\ A$



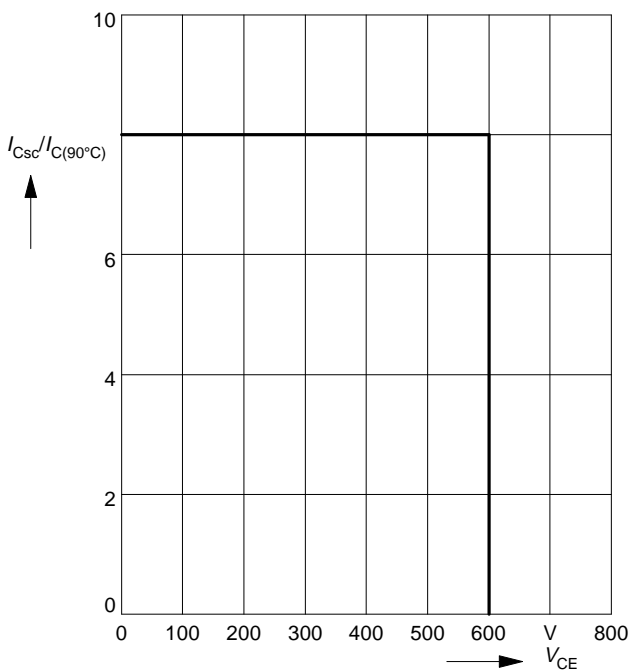
### Typ. capacitances

$C = f(V_{CE})$   
parameter:  $V_{GE} = 0\ V, f = 1\ MHz$



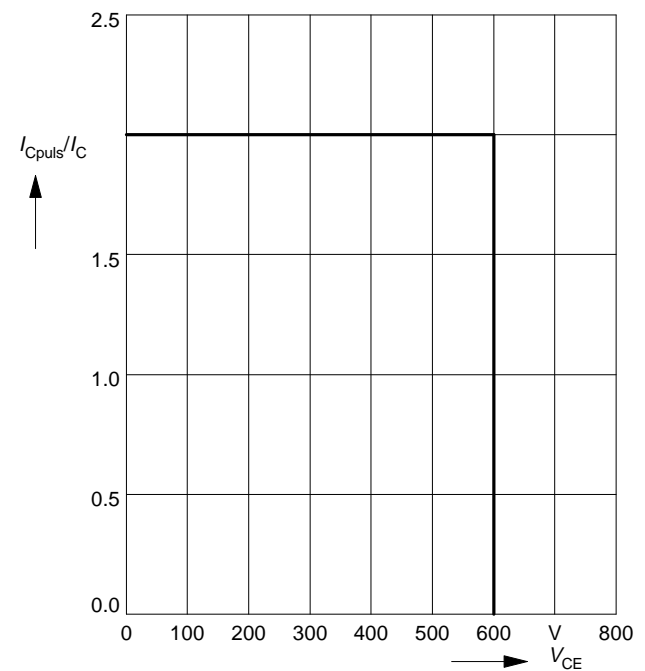
### Short circuit safe operating area

$I_{Csc} = f(V_{CE}), T_j = 150^\circ C$   
parameter:  $V_{GE} = \pm 15\ V, t_{sc} \leq 10\ \mu s, L < 50\ nH$



### Reverse biased safe operating area

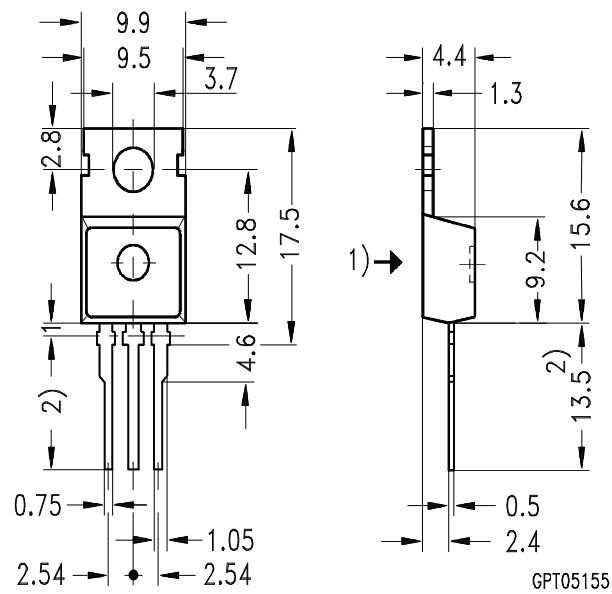
$I_{Cpuls}/I_C = f(V_{CE}), T_j = 150^\circ C$   
parameter:  $V_{GE} = 15\ V$



## Package Outlines

Dimensions in mm

Weight:



1) punch direction, burr max. 0.04

2) dip tinning

3) max. 14.5 by dip tinning press burr max. 0.05