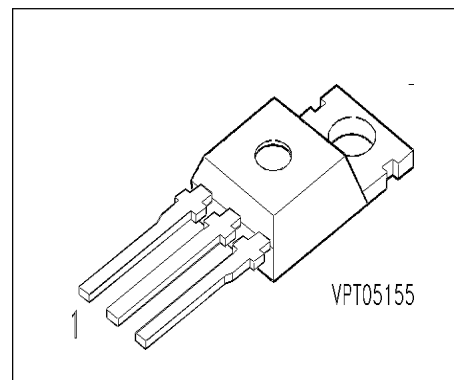


### IGBT

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	$V_{CE}$	$I_C$	Package	Ordering Code
BUP 401	600V	29A	TO-220 AB	C67078-A4404-A2

### Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	$V_{CE}$	600	V
Collector-gate voltage $R_{GE} = 20 \text{ k}\Omega$	$V_{CGR}$	600	
Gate-emitter voltage	$V_{GE}$	$\pm 20$	
DC collector current $T_C = 25 \text{ }^\circ\text{C}$ $T_C = 90 \text{ }^\circ\text{C}$	$I_C$	29 18	A
Pulsed collector current, $t_p = 1 \text{ ms}$ $T_C = 25 \text{ }^\circ\text{C}$ $T_C = 90 \text{ }^\circ\text{C}$	$I_{Cpuls}$	56 34	
Avalanche energy, single pulse $I_C = 15 \text{ A}$ , $V_{CC} = 50 \text{ V}$ , $R_{GE} = 25 \text{ }\Omega$ $L = 200 \text{ }\mu\text{H}$ , $T_j = 25 \text{ }^\circ\text{C}$	$E_{AS}$	24	mJ
Power dissipation $T_C = 25 \text{ }^\circ\text{C}$	$P_{tot}$	125	W
Chip or operating temperature	$T_j$	-55 ... + 150	
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	$R_{thJC}$	$\leq 1$	K/W
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## Electrical Characteristics, at $T_j = 25\text{ }^{\circ}\text{C}$ , 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 $V_{GE} = 15\text{ V}, I_C = 15\text{ A}, T_j = 25\text{ }^{\circ}\text{C}$	$V_{CE(sat)}$	-	2.1	2.7	
$V_{GE} = 15\text{ V}, I_C = 15\text{ A}, T_j = 125\text{ }^{\circ}\text{C}$		-	2.2	2.8	
$V_{GE} = 15\text{ V}, I_C = 30\text{ A}, T_j = 25\text{ }^{\circ}\text{C}$		-	3	-	
$V_{GE} = 15\text{ V}, I_C = 30\text{ A}, T_j = 125\text{ }^{\circ}\text{C}$		-	3.3	-	
Zero gate voltage collector current $V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_j = 25\text{ }^{\circ}\text{C}$	$I_{CES}$	-	-	100	$\mu\text{A}$
Gate-emitter leakage current $V_{GE} = 25\text{ V}, V_{CE} = 0\text{ V}$	$I_{GES}$	-	-	100	nA

## AC Characteristics

Transconductance $V_{CE} = 20\text{ V}, I_C = 15\text{ A}$	$g_{fs}$	3	-	-	S
Input capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{iss}$	-	800	1100	pF
Output capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{oss}$	-	85	130	
Reverse transfer capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{rss}$	-	52	80	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

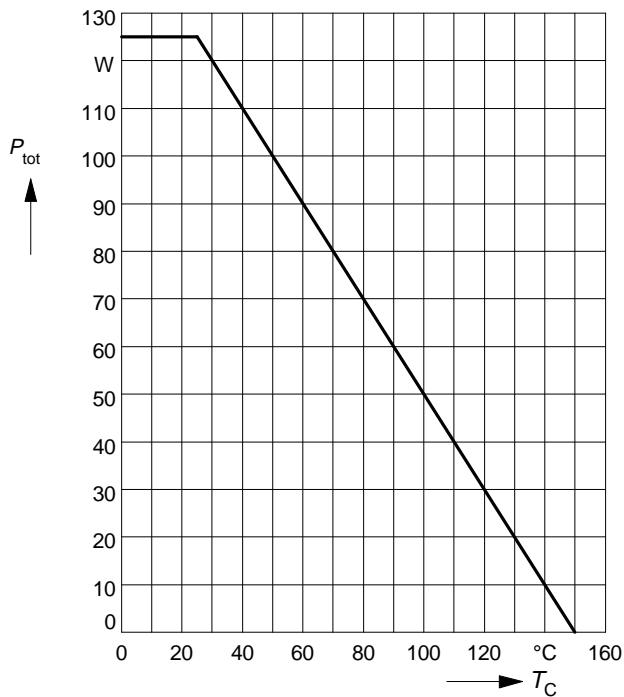
### Switching Characteristics, Inductive Load at $T_j = 125\text{ °C}$

Turn-on delay time $V_{CC} = 300\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 15\text{ A}$ $R_{Gon} = 68\text{ }\Omega$	$t_{d(on)}$	-	40	60	ns
Rise time $V_{CC} = 300\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 15\text{ A}$ $R_{Gon} = 68\text{ }\Omega$	$t_r$	-	60	90	
Turn-off delay time $V_{CC} = 300\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 15\text{ A}$ $R_{Goff} = 68\text{ }\Omega$	$t_{d(off)}$	-	250	470	
Fall time $V_{CC} = 300\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 15\text{ A}$ $R_{Goff} = 68\text{ }\Omega$	$t_f$	-	500	680	

## Power dissipation

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

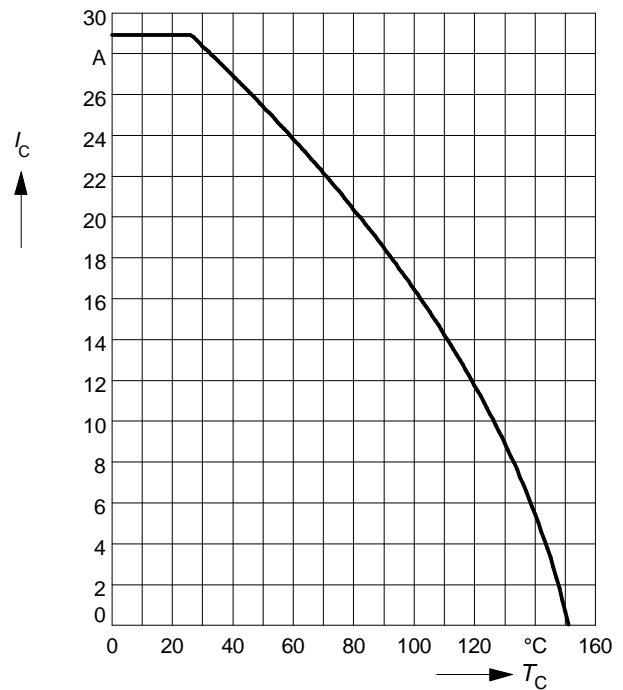
parameter:  $T_j \leq 150^\circ\text{C}$



## Collector current

$$I_C = f(T_C)$$

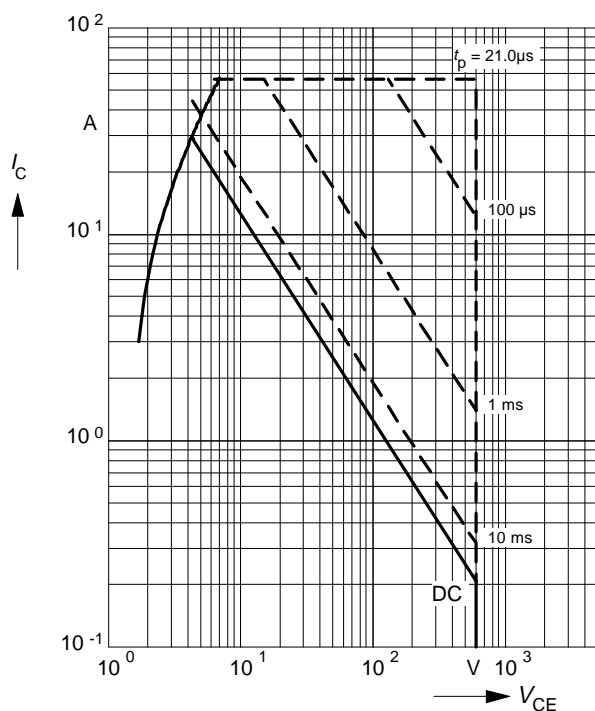
parameter:  $V_{\text{GE}} \geq 15\text{ V}$ ,  $T_j \leq 150^\circ\text{C}$



## Safe operating area

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

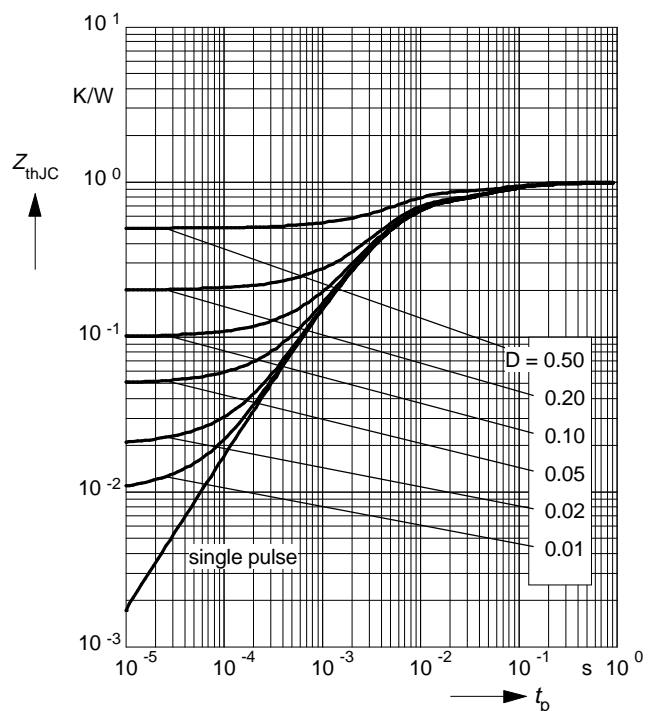
parameter:  $D = 0$ ,  $T_C = 25^\circ\text{C}$ ,  $T_j \leq 150^\circ\text{C}$



## Transient thermal impedance IGBT

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

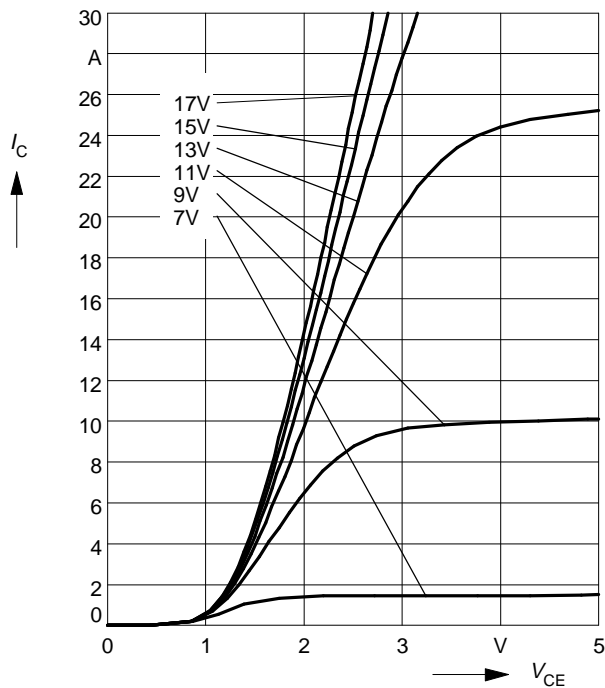
parameter:  $D = t_p / T$



## Typ. output characteristics

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

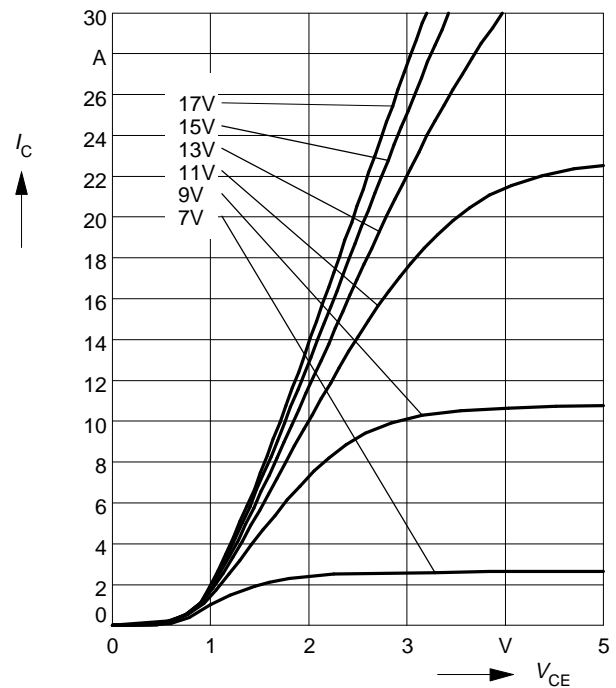
parameter:  $t_p = 80 \mu s$ ,  $T_j = 25^\circ C$



## Typ. output characteristics

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

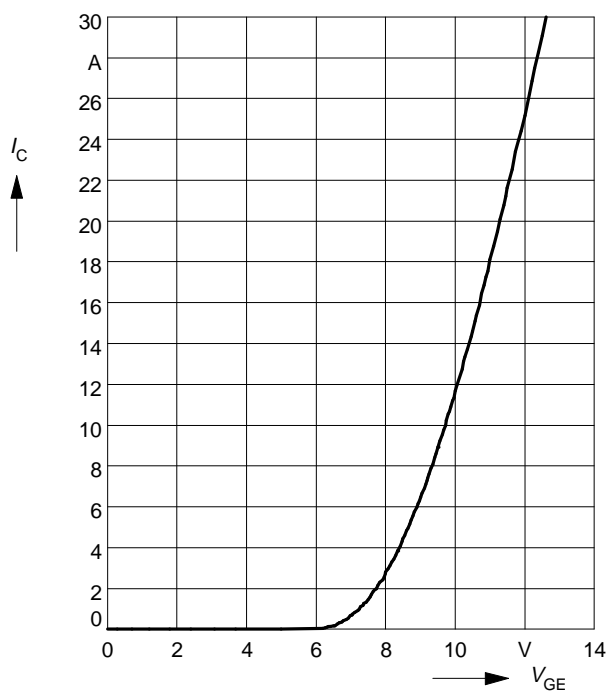
parameter:  $t_p = 80 \mu s$ ,  $T_j = 125^\circ C$



## Typ. transfer characteristics

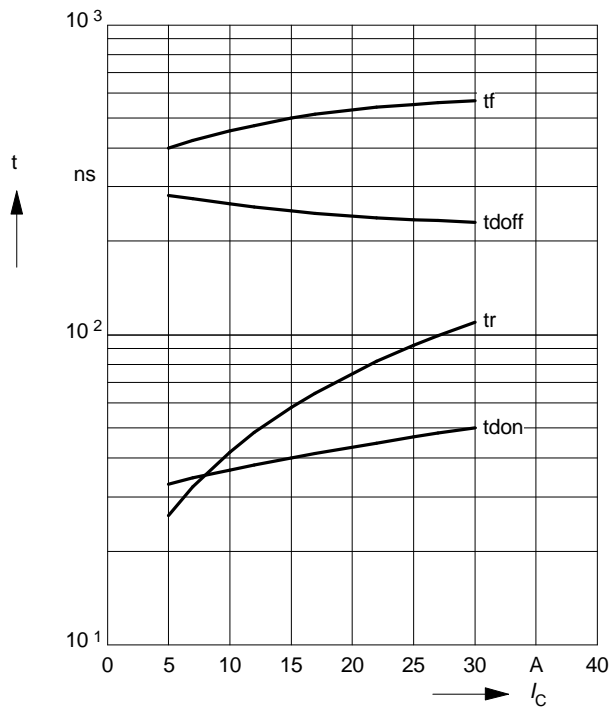
$$I_C = f(V_{GE})$$

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



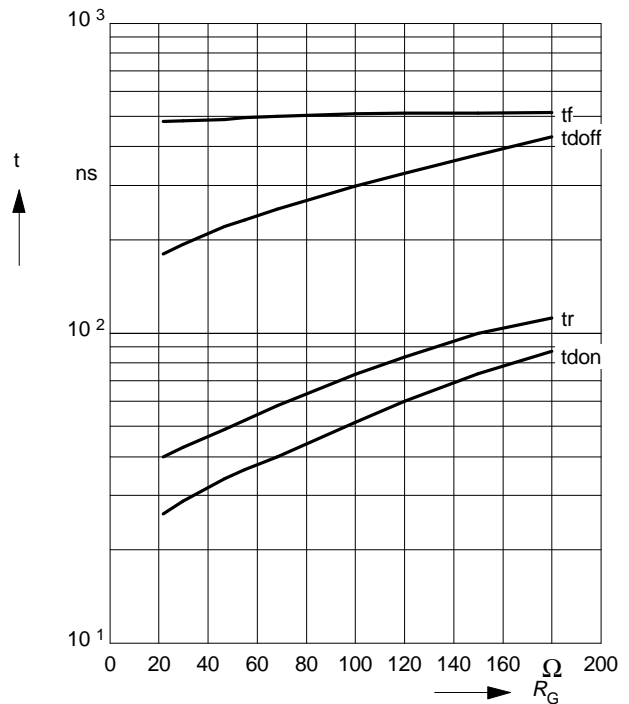
## Typ. switching time

$I = f(I_C)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 68\ \Omega$



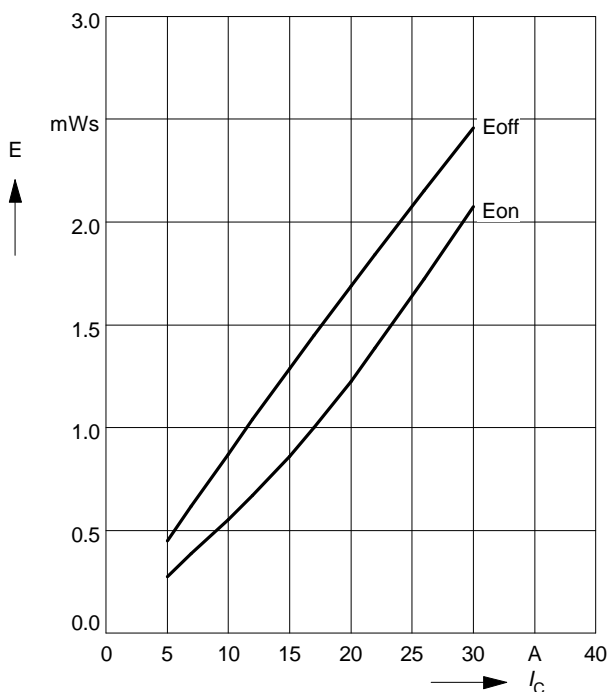
## Typ. switching time

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



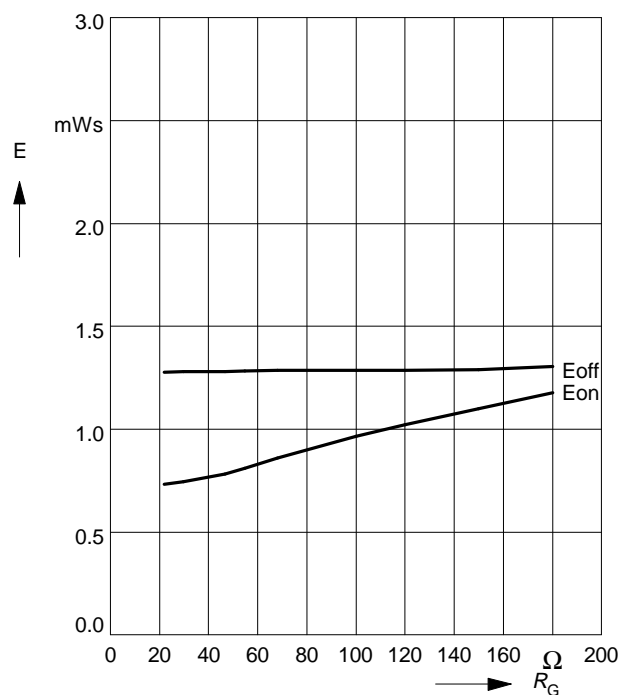
## Typ. switching losses

$E = f(I_C)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 68\ \Omega$



## Typ. switching losses

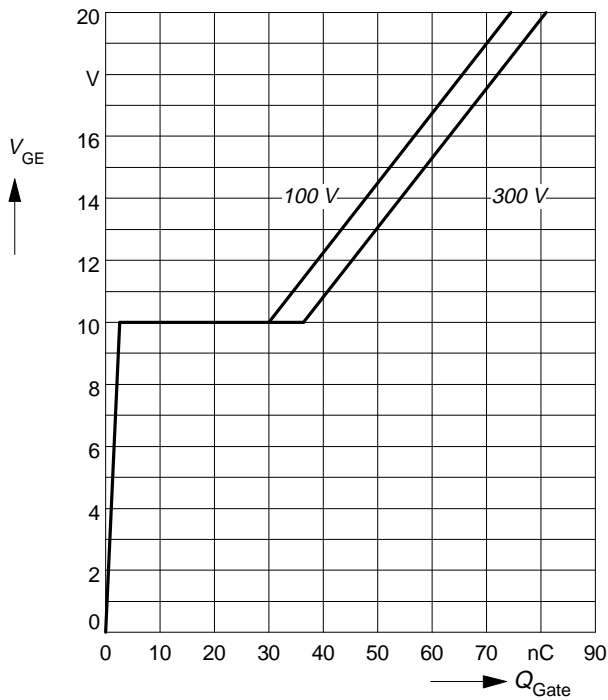
$E = f(R_G)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 15\text{ A}$



## Typ. gate charge

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

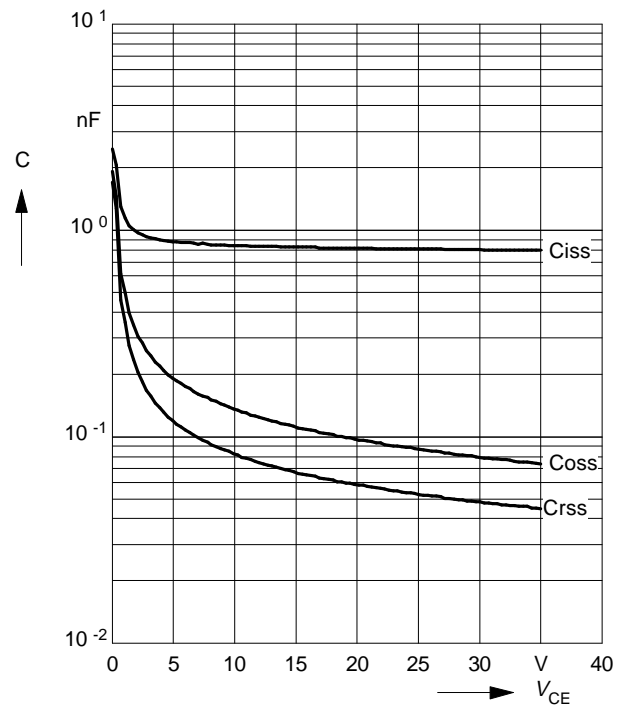
parameter:  $I_{C\ puls} = 15\ A$



## Typ. capacitances

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

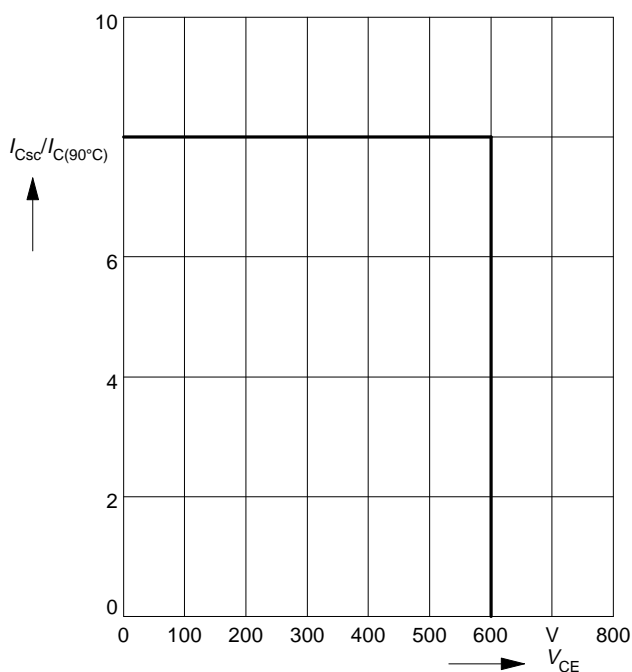
parameter:  $V_{GE} = 0\ V, f = 1\ MHz$



## Short circuit safe operating area

$$I_{Csc} = f(V_{CE}), T_j = 150^\circ C$$

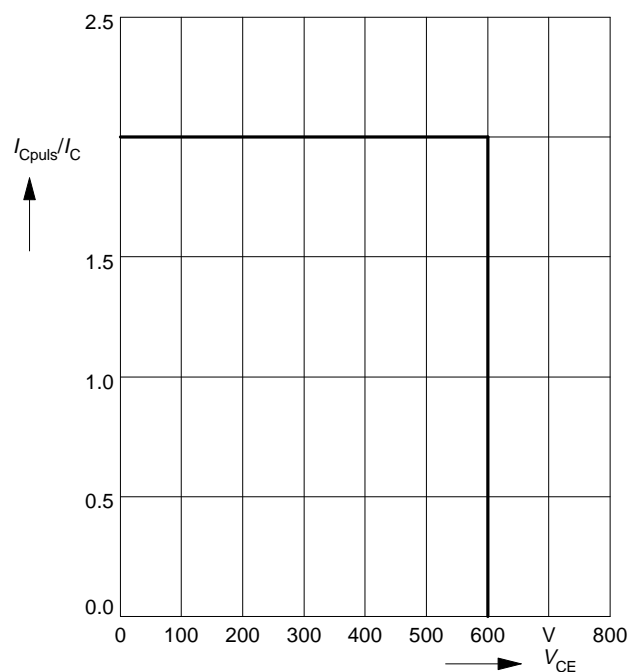
parameter:  $V_{GE} = \pm 15\ V, t_{sc} \leq 10\ \mu s, L < 50\ nH$



## Reverse biased safe operating area

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

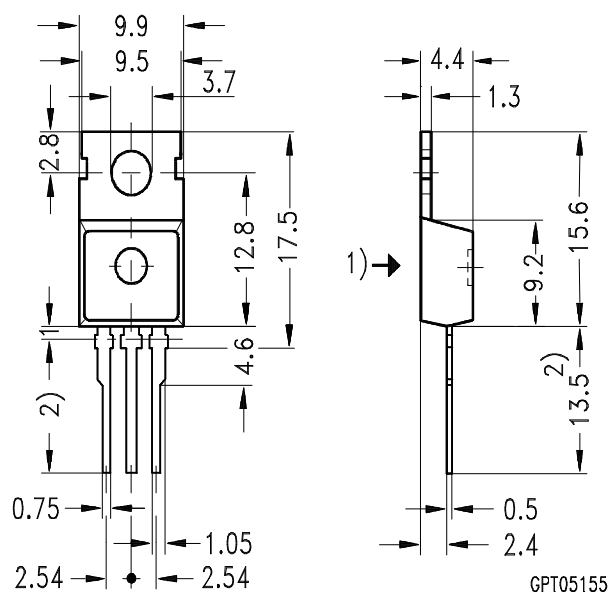
parameter:  $V_{GE} = 15\ V$



## 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