## IGBT With Antiparallel Diode

Preliminary data

- Low forward voltage drop
- High switching speed
- Low tail current
- Latch-up free
- Including fast free-wheel diode
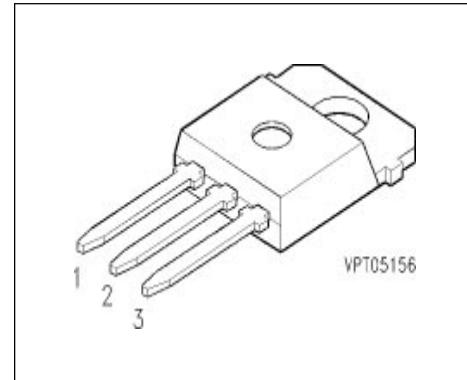
Pin 1	Pin 2	Pin 3
G	C	E

Type	V_{CE}	I_C	Package	Ordering Code
BUP 305 D	1200V	12A	TO-218 AB	Q67040-A4225-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1200	V
Collector-gate voltage $R_{GE} = 20 \text{ k}\Omega$	V_{CGR}	1200	
Gate-emitter voltage	V_{GE}	± 20	
DC collector current $T_C = 25 \degree C$ $T_C = 90 \degree C$	I_C	12 8	A
Pulsed collector current, $t_p = 1$ ms $T_C = 25 \degree C$ $T_C = 90 \degree C$	I_{Cpuls}	24 16	
Diode forward current $T_C = 90 \degree C$	I_F	8	
Pulsed diode current, $t_p = 1$ ms $T_C = 25 \degree C$	I_{Fpuls}	48	
Power dissipation $T_C = 25 \degree C$	P_{tot}	100	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}	1	K/W
Diode thermal resistance, chip case	R_{thJCD}	3.1	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

Static Characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Gate threshold voltage	$V_{GE(th)}$				V
$V_{GE} = V_{CE}$, I_C = 0.3 mA, T_j = 25 °C		4.5	5.5	6.5	
Collector-emitter saturation voltage	$V_{CE(sat)}$				
V_{GE} = 15 V, I_C = 5 A, T_j = 25 °C		-	2.8	3.3	
V_{GE} = 15 V, I_C = 5 A, T_j = 125 °C		-	3.8	4.3	
Zero gate voltage collector current	I_{CES}				mA
V_{CE} = 1200 V, V_{GE} = 0 V, T_j = 25 °C		-	-	0.35	
Gate-emitter leakage current	I_{GES}				nA
V_{GE} = 20 V, V_{CE} = 0 V		-	-	100	

AC Characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Transconductance	g_{fs}				S
V_{CE} = 20 V, I_C = 5 A		1.7	2.5	-	
Input capacitance	C_{iss}				pF
V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz		-	650	800	
Output capacitance	C_{oss}				
V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz		-	50	80	
Reverse transfer capacitance	C_{rss}				
V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz		-	20	30	

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} = 600 V, V_{GE} = 15 V, I_C = 5 A R_{Gon} = 68 Ω	$t_{d(on)}$	-	30	50	ns
Rise time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 5 A R_{Gon} = 68 Ω	t_r	-	20	30	nS
Turn-off delay time V_{CC} = 600 V, V_{GE} = -15 V, I_C = 5 A R_{Goff} = 68 Ω	$t_{d(off)}$	-	180	270	ns
Fall time V_{CC} = 600 V, V_{GE} = -15 V, I_C = 5 A R_{Goff} = 68 Ω	t_f	-	15	25	
Total turn-off loss energy V_{CC} = 600 V, V_{GE} = -15 V, I_C = 5 A R_{Goff} = 68 Ω, T_j = 25 °C	E_{off}	-	0.7	-	mWs
Free-Wheel Diode					
Diode forward voltage I_F = 4 A, V_{GE} = 0 V, T_j = 25 °C	V_F	-	2.3	3	V
I_F = 4 A, V_{GE} = 0 V, T_j = 125 °C		-	1.9	-	
Reverse recovery time I_F = 4 A, V_R = -300 V, V_{GE} = 0 V di_F/dt = -800 A/µs T_j = 25 °C	t_{rr}	-	-	-	ns
T_j = 125 °C		-	60	100	
Reverse recovery charge I_F = 4 A, V_R = -300 V, V_{GE} = 0 V di_F/dt = -800 A/µs T_j = 25 °C	Q_{rr}	-	-	-	µC
T_j = 125 °C		-	1	1.8	

Power dissipation

$P_{tot} = f(T_C)$
parameter: $T_j \leq 150\ °C$
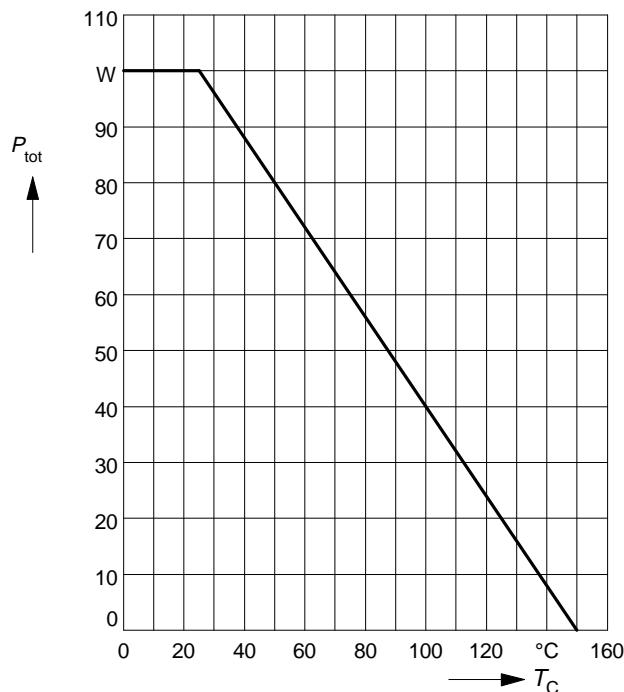
Collector current

$I_C = f(T_C)$
parameter: $V_{GE} \geq 15\ V$, $T_j \leq 150\ °C$
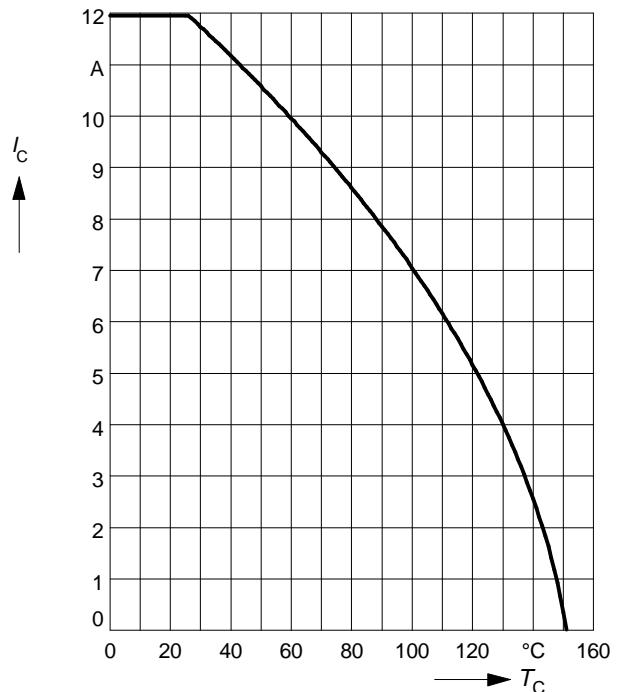
Safe operating area

$I_C = f(V_{CE})$
parameter: $D = 0$, $T_C = 25°C$, $T_j \leq 150\ °C$
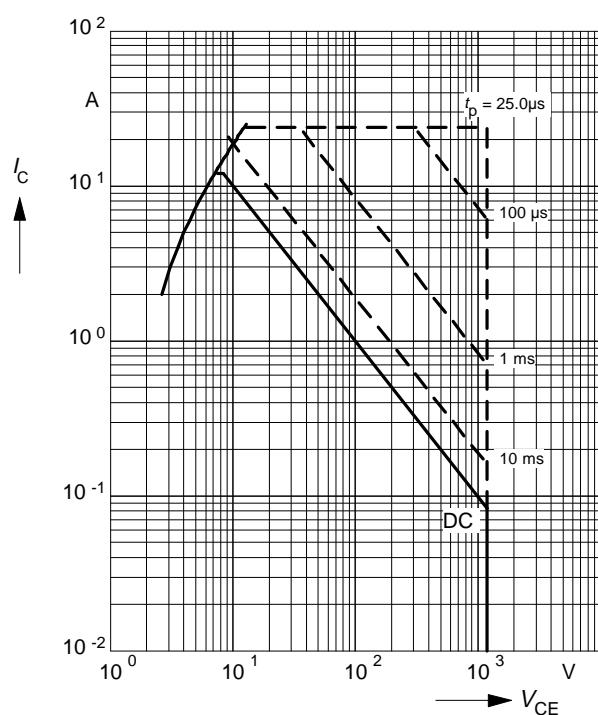

Transient thermal impedance   IGBT

$Z_{th\ JC} = f(t_p)$
parameter: $D = t_p\ /\ T$
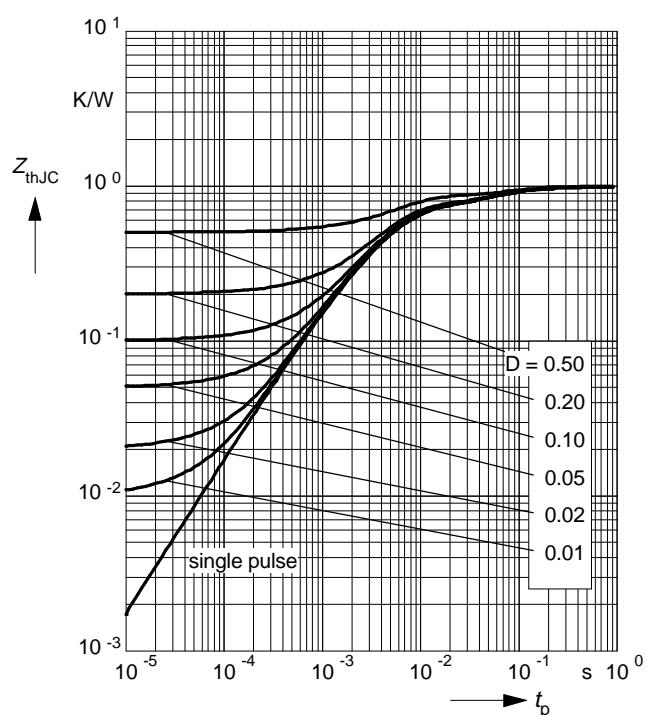
Typ. output characteristics

$I_C = f(V_{CE})$

parameter: $t_p = 80\ \mu s$, $T_j = 125\ °C$
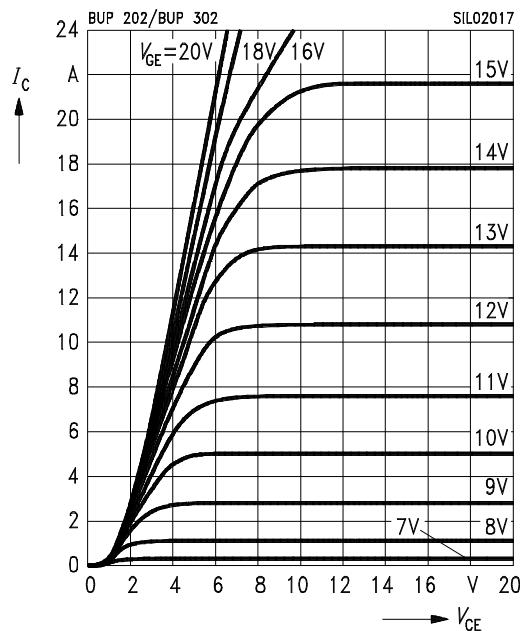
Typ. transfer characteristics

$I_C = f(V_{GE})$

parameter: $t_P = 80\ \mu s$, $V_{CE} = 20\ V$, $T_j = 25\ °C$
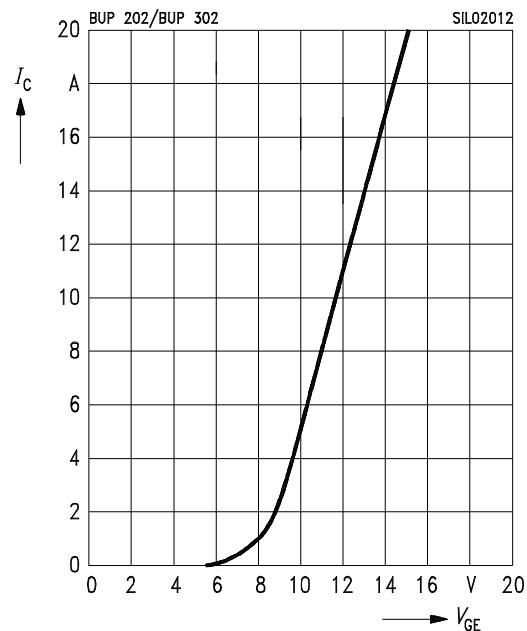
Typ. saturation characteristics

$V_{CE(sat)} = f(V_{GE})$

parameter: $T_j = 25\ °C$
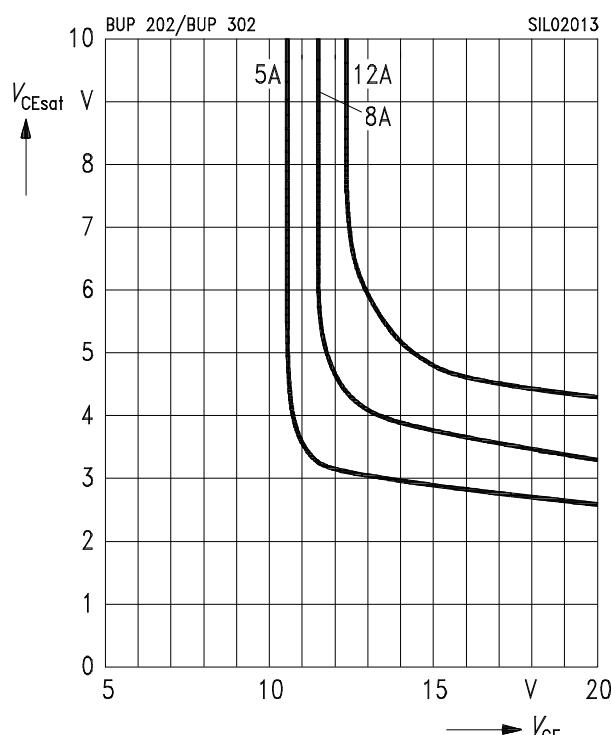
Typ. saturation characteristics

$V_{CE(sat)} = f(V_{GE})$

parameter: $T_j = 125\ °C$
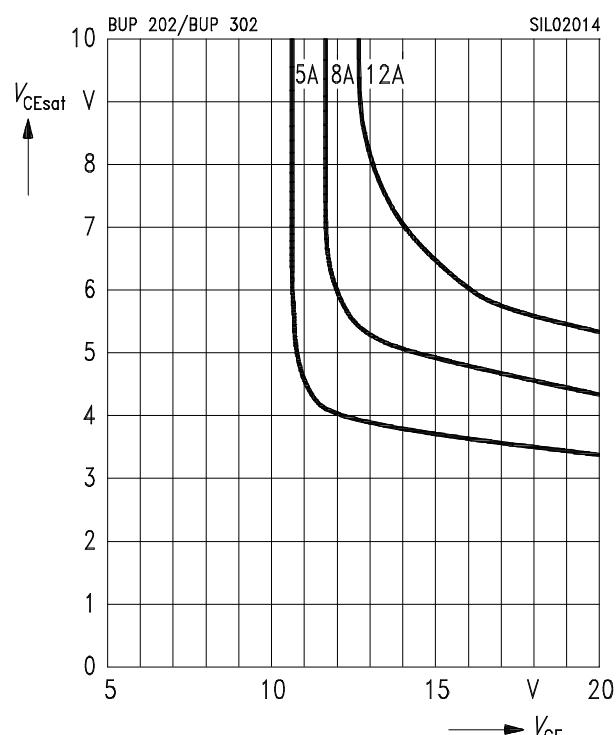
Typ. gate charge

$V_{GE} = f(Q_{Gate})$
parameter: $I_{C\,puls} = 6$ A
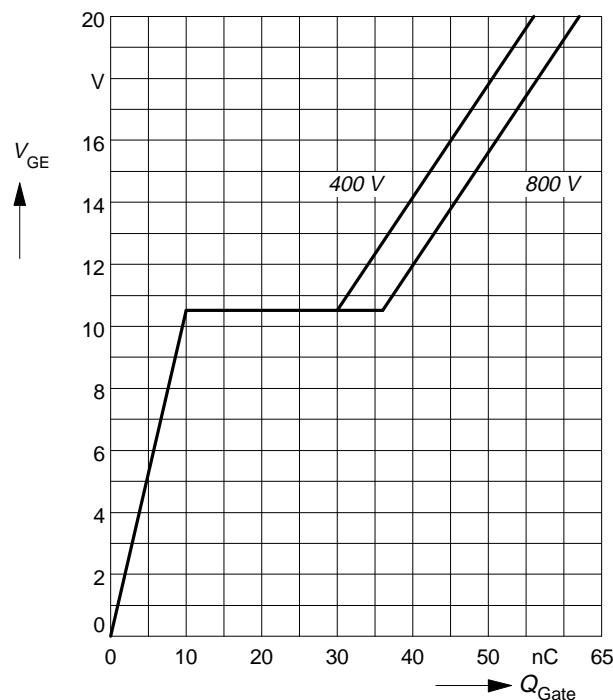
Typ. capacitances

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

BUP 202/BUP 302   SIL02011
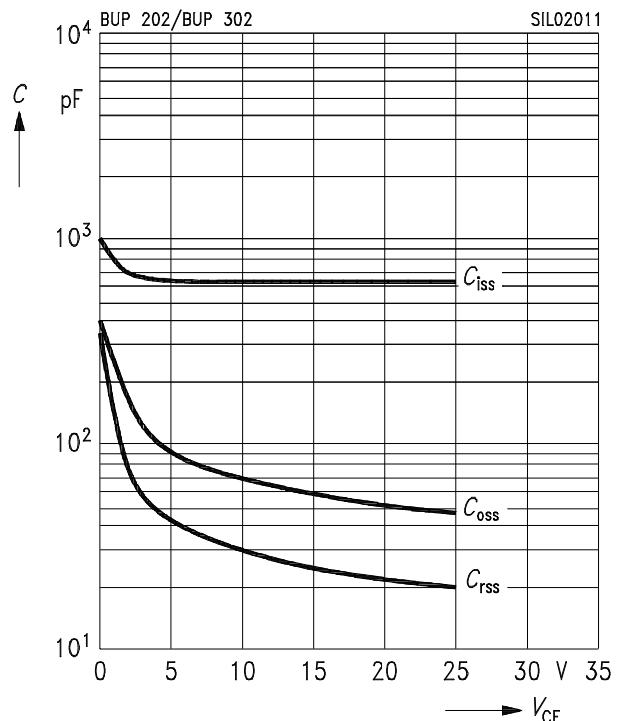
## Short circuit safe operating area

$I_{Csc} = f(V_{CE})$, $T_j = 150°C$
parameter: $V_{GE} = \pm 15$ V, $t_{sc} \le 10$ µs, L < 25 nH
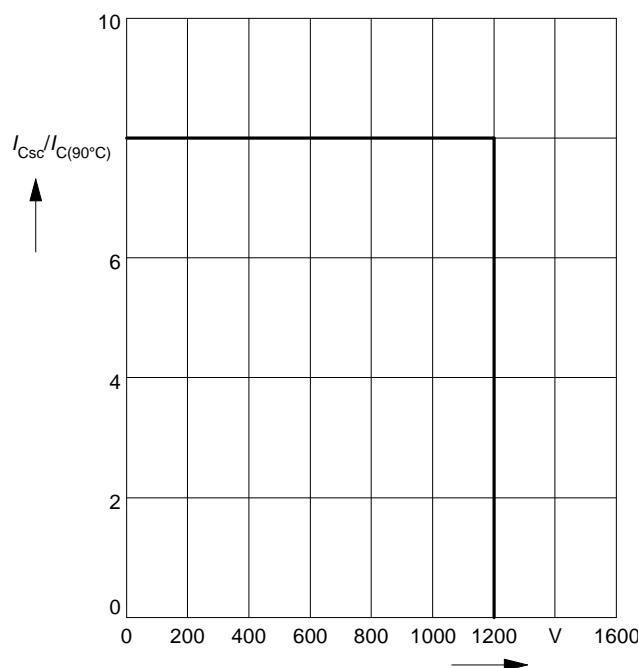
Reverse biased safe operating area

$I_{Cpuls} = f(V_{CE})$, $T_j = 150°C$
parameter: $V_{GE} = 15$ V
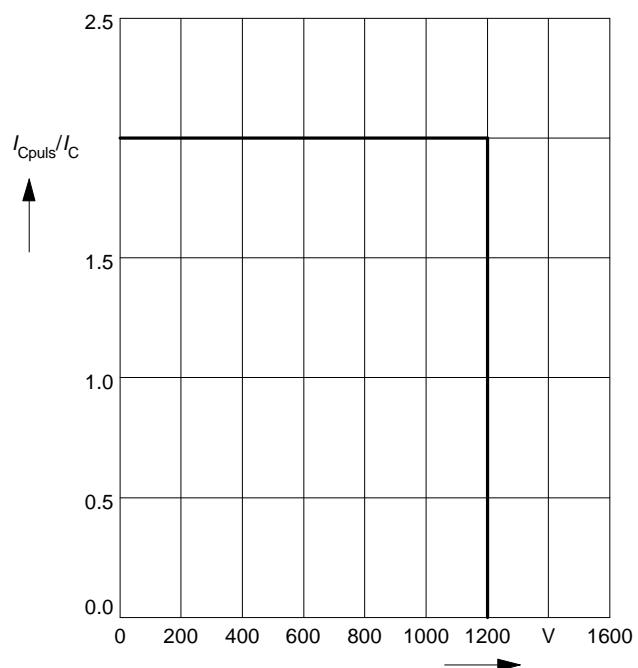
**Typ. switching time**

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

parameter: $V_{CE} = 600\ V$, $V_{GE} = \pm 15\ V$, $I_C = 5\ A$
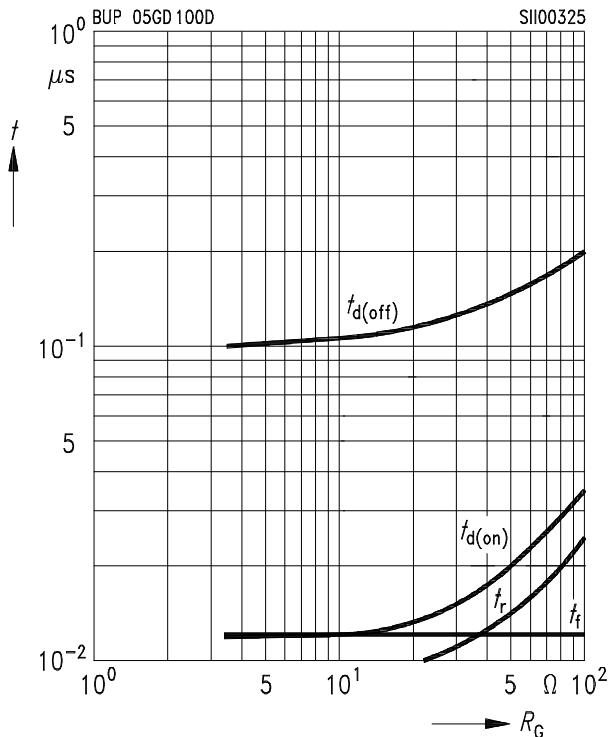
Typ. forward characteristics

$I_F = f(V_F)$

parameter: T_j
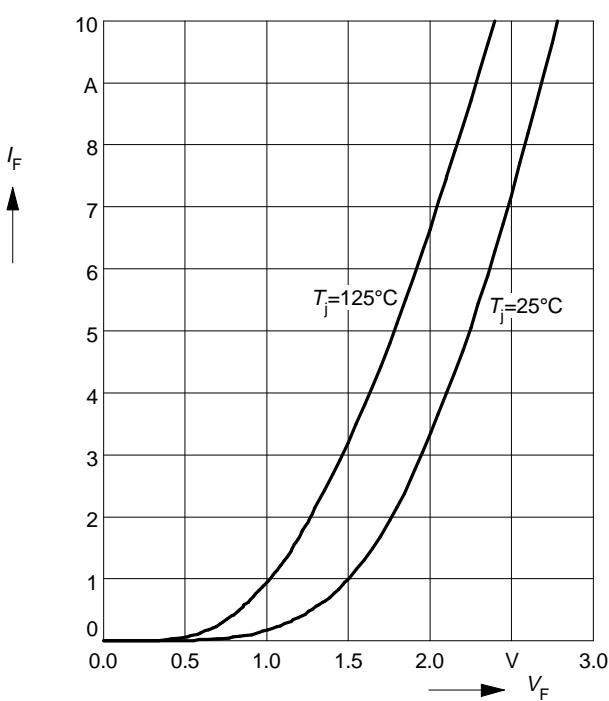
Transient thermal impedance   Diode

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

parameter: $D = t_p / T$