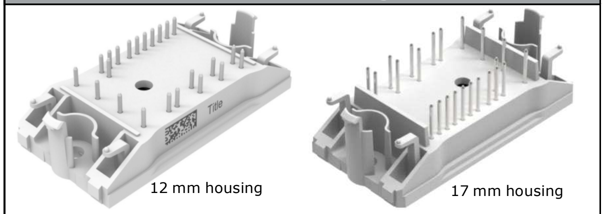
10-FZ12PMA010M7-P849A28
10-F012PMA010M7-P849A29
datasheet

flow PIM 0	1200 V / 10 A

Features

- IGBT M7 with low V_{CEsat} and improved EMC behavior
- Open emitter configuration
- Compact and low inductive design
- Builtin NTC

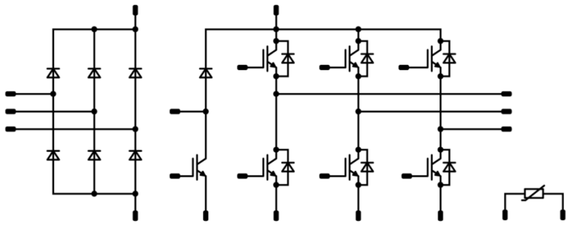
flow 0 housing



Target applications

- Industrial Drives

Schematic



Types

- 10-FZ12PMA010M7-P849A28
- 10-F012PMA010M7-P849A29

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Rectifier Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1600	V
Continuous (direct) forward current	I_F			25	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	200	A
Surge current capability	I^2t			200	A^2s
Total power dissipation	P_{tot}	T_j = T_{jmax}	T_s = 80 °C	44	W
Maximum Junction Temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current	I_C			10	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	55	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F			10	A
Repetitive peak forward current	I_{FRM}	T_j limited by T_{jmax}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	50	W
Maximum junction temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current	I_C			5	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		10	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	41	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
Brake Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F			5	A
Repetitive peak forward current	I_{FRM}	T_j limited by T_{jmax}		10	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	27	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	6000	V
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min. 12,7	mm
Clearance		12 mm housing / 17 mm housing		9,29 / min. 12,7	mm
Comparative Tracking Index	CTI			> 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Rectifier Diode										
Static										
Forward voltage	V_F				30	25 125		1,22 1,21	1,8	V
Reverse leakage current	I_r			1600		25 145			50 1100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,59		K/W

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,001	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 125 150		1,66 1,90 1,96	1,95	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			55	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}		0	10		25		2000		pF
Output capacitance	C_{oes}							86		
Reverse transfer capacitance	C_{res}							23		
Gate charge	Q_g		15	600	10	25		80		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,72		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 32 Ω R_{gon} = 32 Ω	±15	600	10	25 125 150		128 126 123		ns
Rise time	t_r					25 125 150		29 32 34		
Turn-off delay time	$t_{d(off)}$					25 125 150		145 179 182		
Fall time	t_f					25 125 150		98 108 117		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 1,1 µC Q_{rFWD} = 1,7 µC Q_{rFWD} = 1,8 µC				25 125 150		0,883 1,125 1,189		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,656 0,860 0,908		

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_{F} [V]	I_{C} [A] I_{D} [A] I_{F} [A]	T_{j} [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_{F}				10	25 125 150		1,61 1,69 1,69	2,1	V
Reverse leakage current	I_{R}			1200		25			25	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,91		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 278 A/µs di/dt = 270 A/µs di/dt = 272 A/µs	±15	600	10	25 125 150		9 9 9		A
Reverse recovery time	t_{rr}					25 125 150		254 373 409		ns
Recovered charge	Q_{r}					25 125 150		1,088 1,664 1,808		µC
Reverse recovered energy	E_{rec}					25 125 150		0,374 0,620 0,680		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		85 54 49		A/µs

10-FZ12PMA010M7-P849A28
10-F012PMA010M7-P849A29
datasheet

Vincotech

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Brake Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0005	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		5	25 125 150		1,62 1,83 1,89	1,95	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			50	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}		0	10		25		1100		pF
Output capacitance	C_{oes}		0	10		25		57		pF
Reverse transfer capacitance	C_{res}		0	10		25		11		pF
Gate charge	Q_g		15	600	5	25		40		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,30		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 64 Ω R_{gon} = 64 Ω	15/0	600	5	25 125 150		79 73 72		ns
Rise time	t_r	R_{goff} = 64 Ω R_{gon} = 64 Ω	15/0	600	5	25 125 150		45 48 49		ns
Turn-off delay time	$t_{d(off)}$	R_{goff} = 64 Ω R_{gon} = 64 Ω	15/0	600	5	25 125 150		234 262 270		ns
Fall time	t_f	R_{goff} = 64 Ω R_{gon} = 64 Ω	15/0	600	5	25 125 150		101 114 117		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,6 µC Q_{rFWD} = 0,8 µC Q_{rFWD} = 0,9 µC	15/0	600	5	25 125 150		0,480 0,609 0,634		mWs
Turn-off energy (per pulse)	E_{off}		15/0	600	5	25 125 150		0,345 0,454 0,474		mWs

Characteristic Values

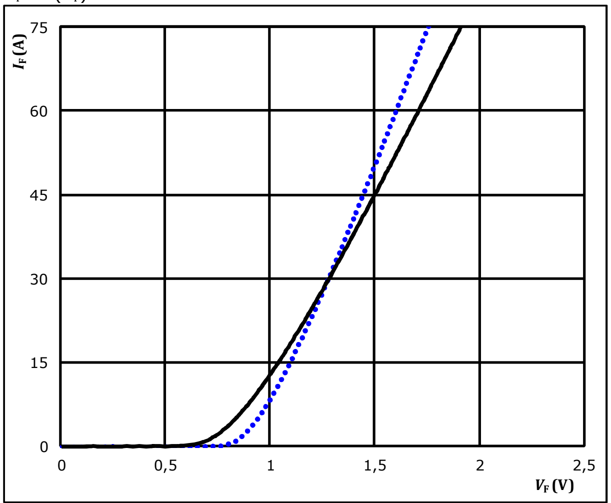
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Brake Diode										
Static										
Forward voltage	V_F				5	25 125 150		1,57 1,65 1,65	2,1	V
Reverse leakage current	I_R			1200		25			20	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						3,50		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 85 A/µs di/dt = 102 A/µs di/dt = 87 A/µs	15/0	600	5	25 125 150		4 4 4		A
Reverse recovery time	t_{rr}					25 125 150		259 386 431		ns
Recovered charge	Q_r					25 125 150		0,558 0,833 0,935		µC
Reverse recovered energy	E_{rec}					25 125 150		0,200 0,314 0,363		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		37 24 20		A/µs
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %				25		4000		K
Vincotech NTC Reference									I	

Rectifier Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



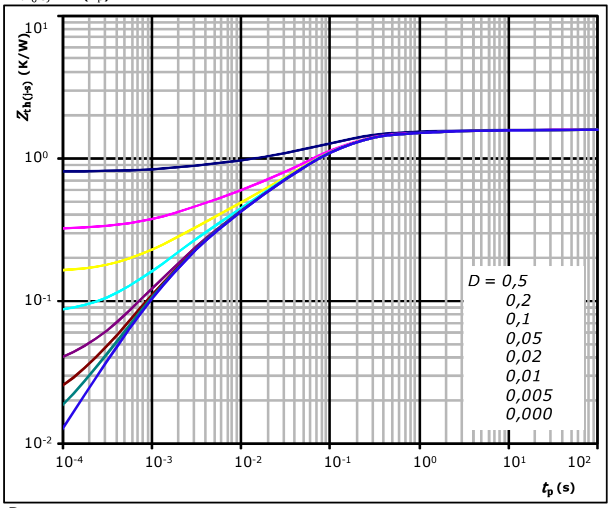
t_p = 250 μs

T_j: 25 °C (dotted), 125 °C (solid)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



D = t_p / T

$R_{th(j-s)}$ = 1,59 K/W

Diode thermal model values

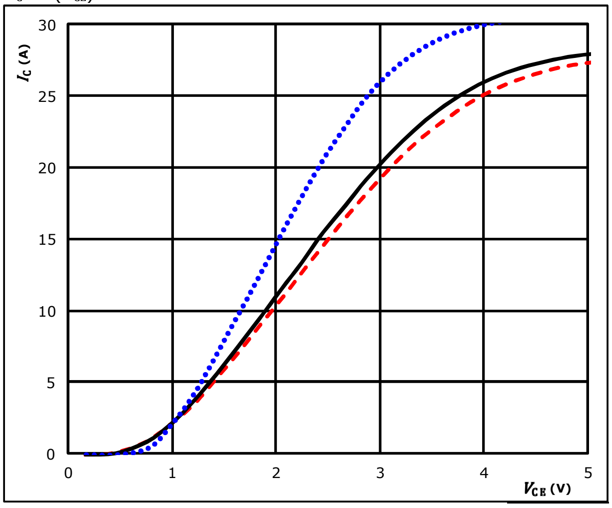
R (K/W)	τ (s)
3,44E-02	9,66E+00
1,12E-01	1,22E+00
5,81E-01	1,45E-01
4,89E-01	5,05E-02
2,38E-01	9,26E-03
1,22E-01	1,79E-03
1,22E-01	1,79E-03

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

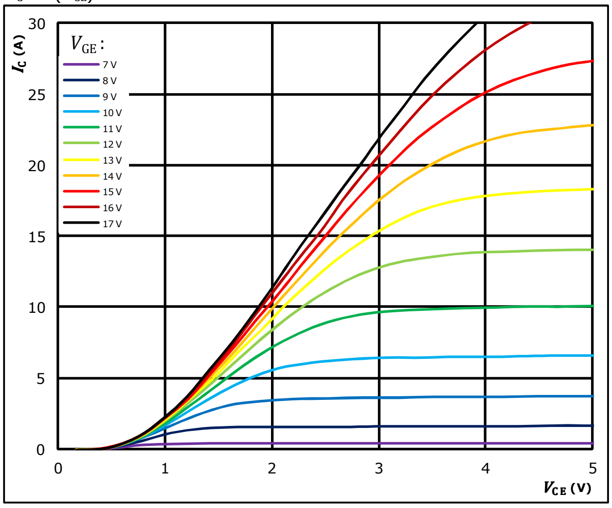
V_{GE} = 15 V

T_j: 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 µs

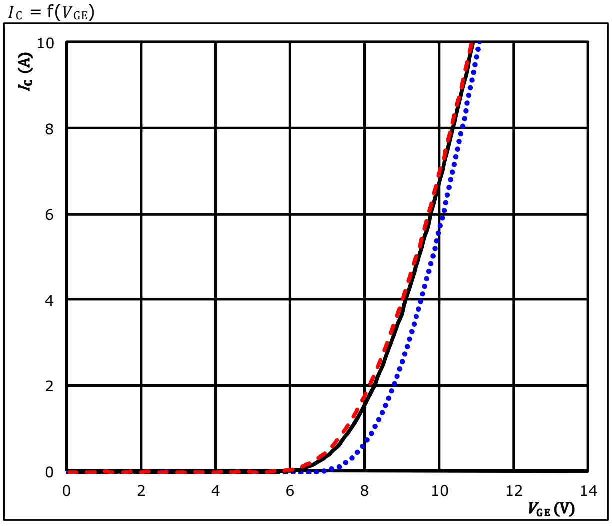
T_j = 150 °C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



t_p = 100 µs

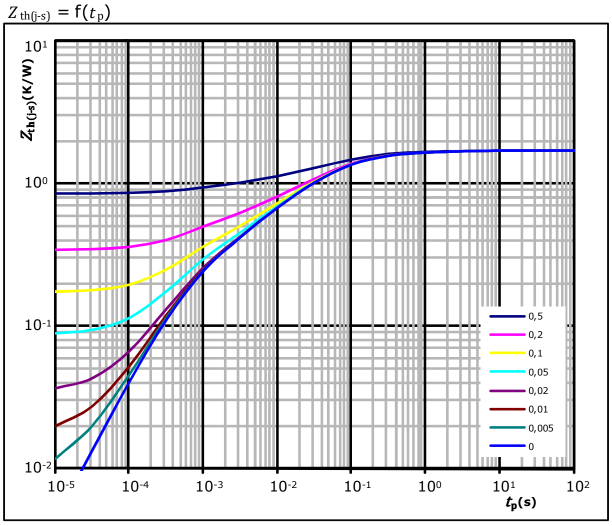
V_{CE} = 10 V

T_j: 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

$Z_{th(j-s)} = f(t_p)$



D = t_p / T

$R_{th(j-s)}$ = 1,72 K/W

IGBT thermal model values

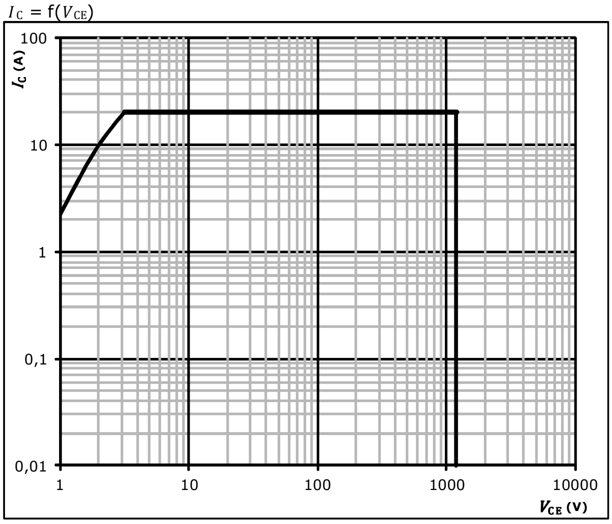
R (K/W)	τ (s)
8,08E-02	2,32E+00
2,21E-01	2,45E-01
6,51E-01	6,03E-02
3,93E-01	1,33E-02
1,95E-01	3,15E-03
1,82E-01	5,45E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



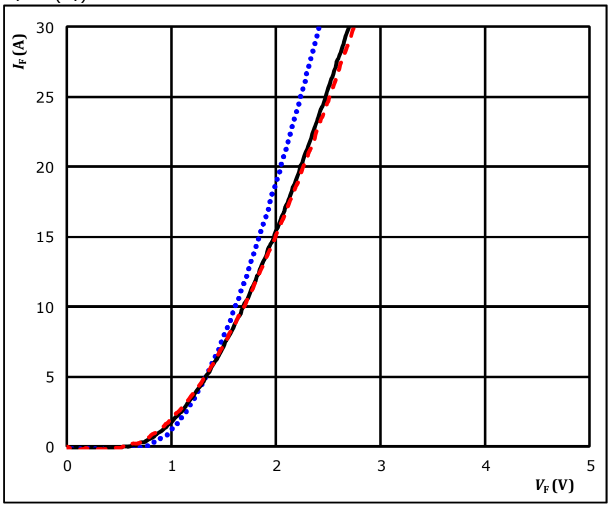
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



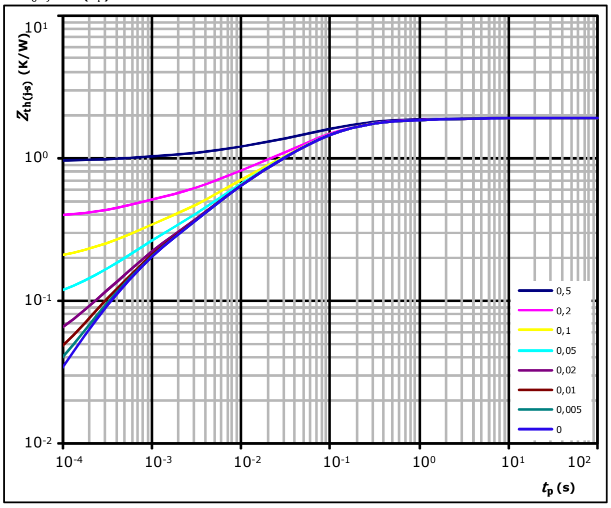
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



$D = t_p / T$

$R_{th(j-s)}$ = 1,91 K/W

FWD thermal model values

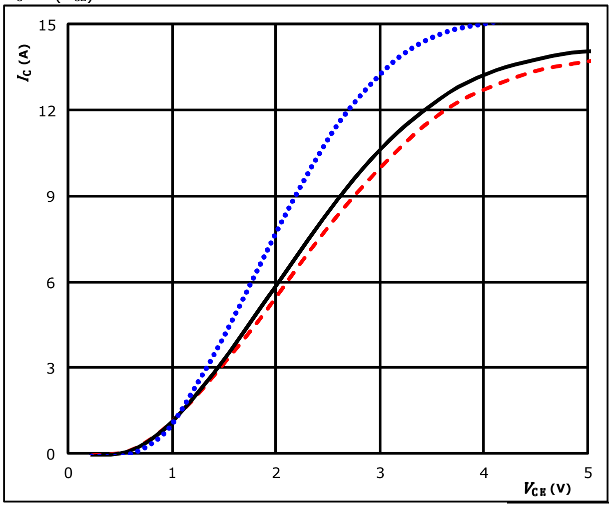
R (K/W)	τ (s)
9,38E-02	2,25E+00
3,43E-01	2,12E-01
8,53E-01	5,82E-02
3,59E-01	9,80E-03
1,37E-01	2,88E-03
1,26E-01	4,78E-04

Brake Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

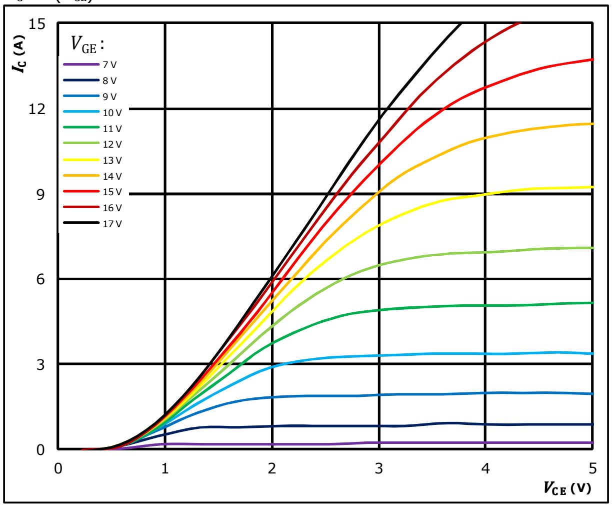


t_p =	250	μs		25 °C	···········
V_{GE} =	15	V	T_j:	125 °C	———
				150 °C	– – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 μs

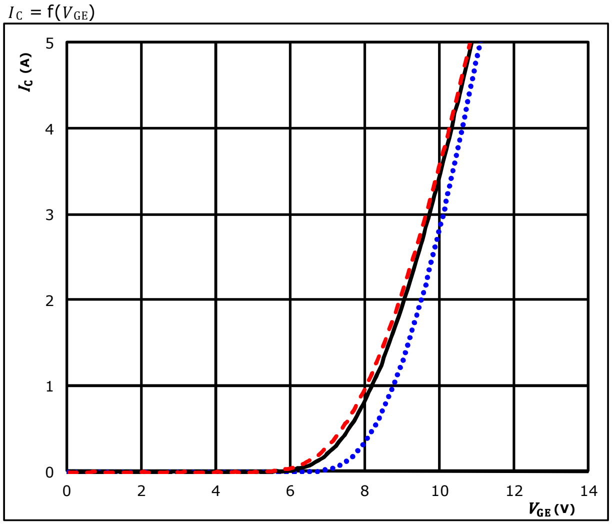
T_j = 150 °C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

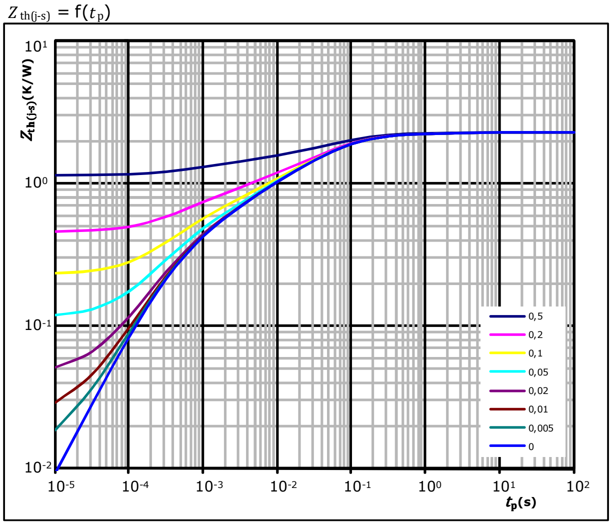


t_p =	100	μs		25 °C	···········
V_{CE} =	10	V	T_j:	125 °C	———
				150 °C	– – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

$Z_{th(j\text{-}s)} = f(t_p)$



D = t_p / T

$R_{th(j\text{-}s)}$ = 2,30 K/W

IGBT thermal model values

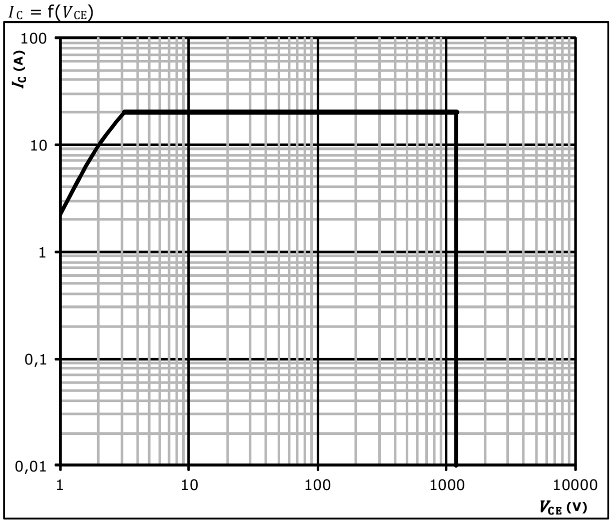
R (K/W)	τ (s)
6,25E-02	3,48E+00
1,37E-01	5,00E-01
7,38E-01	8,11E-02
5,28E-01	2,49E-02
3,84E-01	5,54E-03
2,39E-01	1,24E-03
2,13E-01	3,29E-04

Brake Switch Characteristics

figure 5.	IGBT

Safe operating area

$I_C = f(V_{CE})$



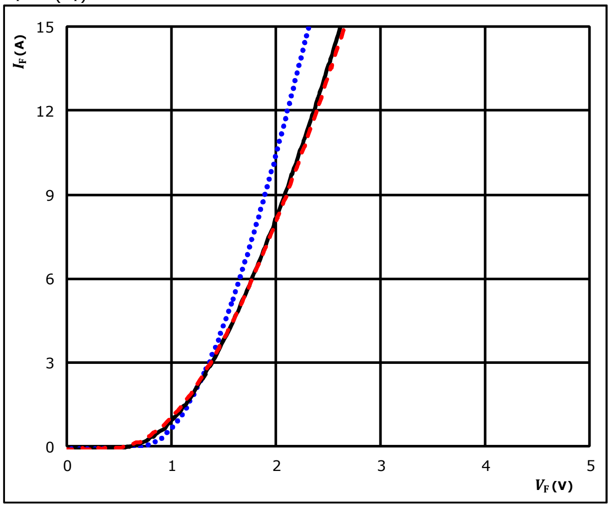
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Brake Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



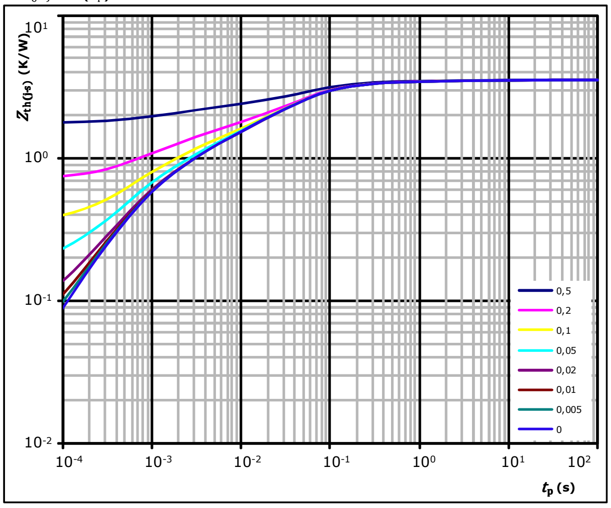
t_p = 250 µs

T_j:	
25 °C	dotted blue
125 °C	solid black
150 °C	dashed red

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

$Z_{th(j\text{-}s)} = f(t_p)$



$D = t_p / T$

$R_{th(j\text{-}s)}$ = 3,50 K/W

FWD thermal model values

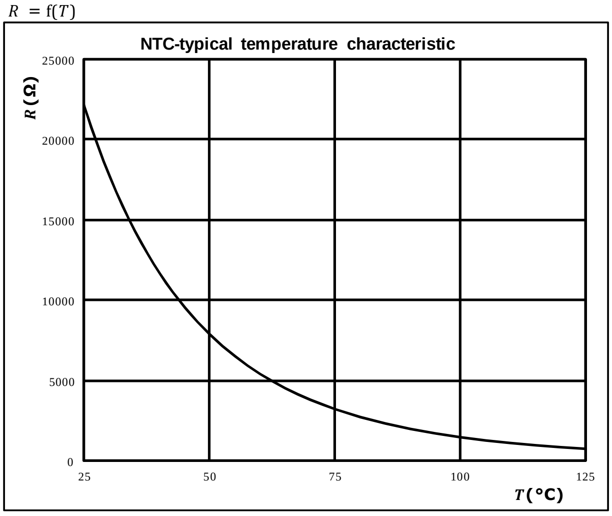
R (K/W)	τ (s)
8,03E-02	7,23E+00
2,34E-01	4,70E-01
1,33E+00	6,36E-02
7,92E-01	2,24E-02
5,71E-01	3,34E-03
4,85E-01	7,05E-04

NTC Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

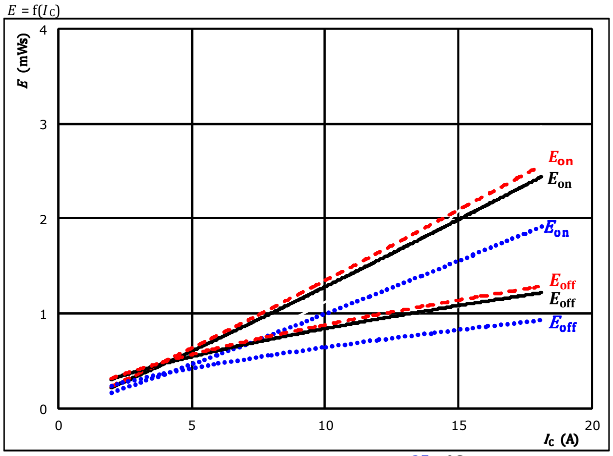


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



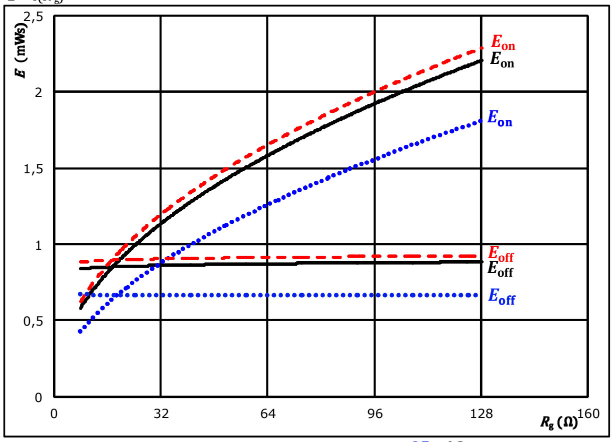
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted (blue)
V_{GE} =	±15	V		125 °C	solid (black)
R_{gon} =	32	Ω		150 °C	dashed (red)
R_{goff} =	32	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



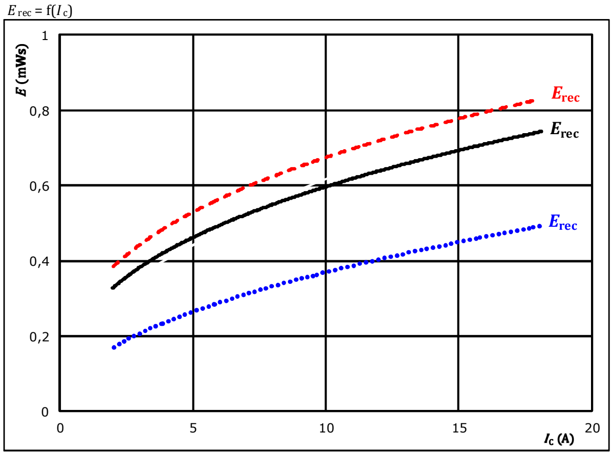
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted (blue)
V_{GE} =	±15	V		125 °C	solid (black)
I_C =	10	A		150 °C	dashed (red)

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



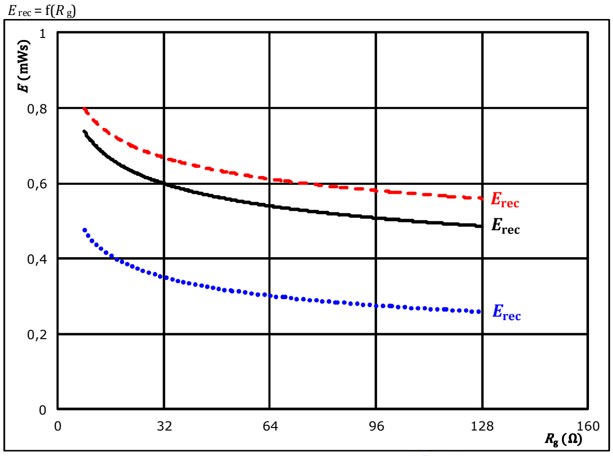
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted (blue)
V_{GE} =	±15	V		125 °C	solid (black)
R_{gon} =	32	Ω		150 °C	dashed (red)

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

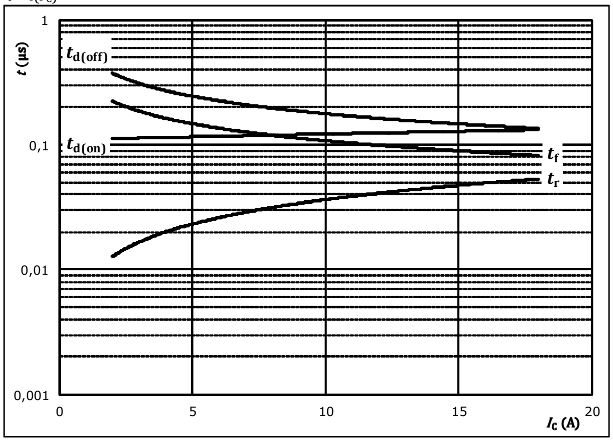
V_{CE} =	600	V	T_j:	25 °C	dotted (blue)
V_{GE} =	±15	V		125 °C	solid (black)
I_C =	10	A		150 °C	dashed (red)

Inverter Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



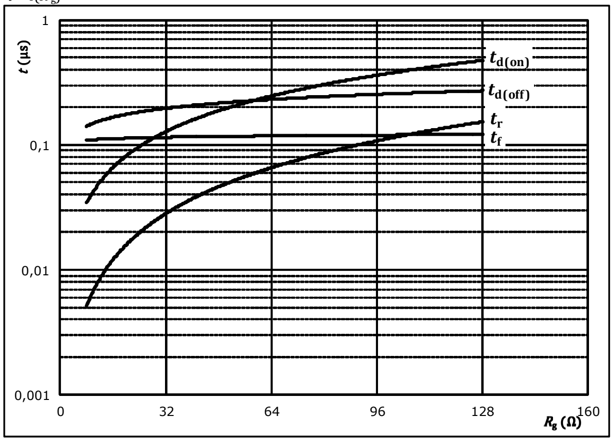
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



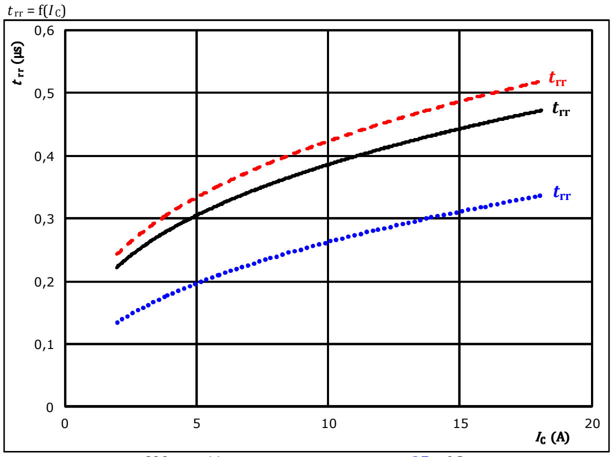
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	10	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

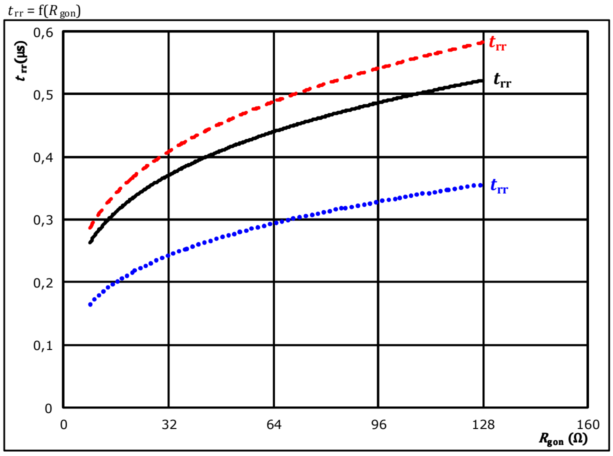


At					
V_{CE} =	600	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
R_{gon} =	32	Ω		150	°C

figure 8. **FWD**

Typical reverse recovery time as a function of IGBT turn on gate resistor

$t_{rr} = f(R_{gon})$



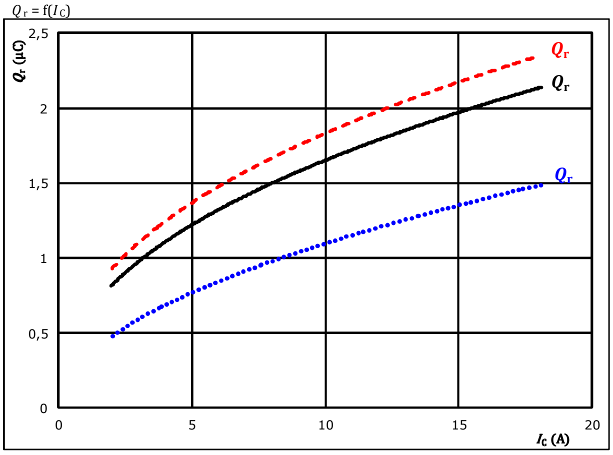
At					
V_{CE} =	600	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
I_C =	10	A		150	°C

Inverter Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

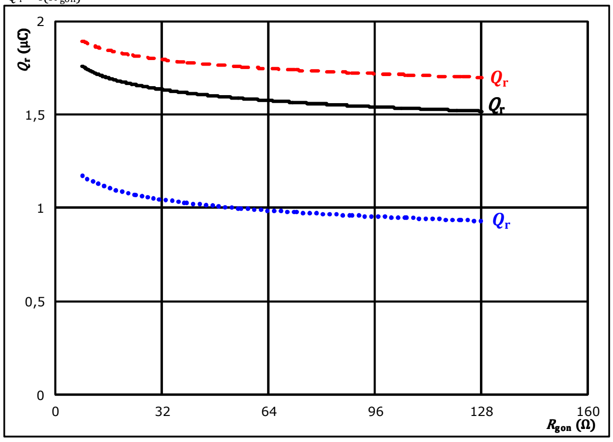


At					
V_{CE} =	600	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
R_{gon} =	32	Ω		150 °C	dashed

figure 10. **FWD**

Typical recovered charge as a function of IGBT turn on gate resistor

$Q_r = f(R_{gon})$

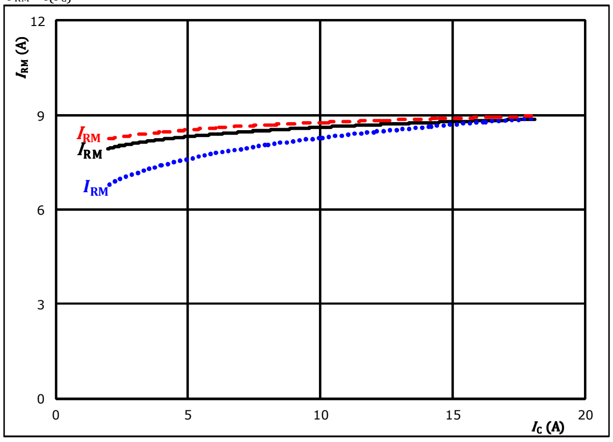


At					
V_{CE} =	600	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
I_C =	10	A		150 °C	dashed

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

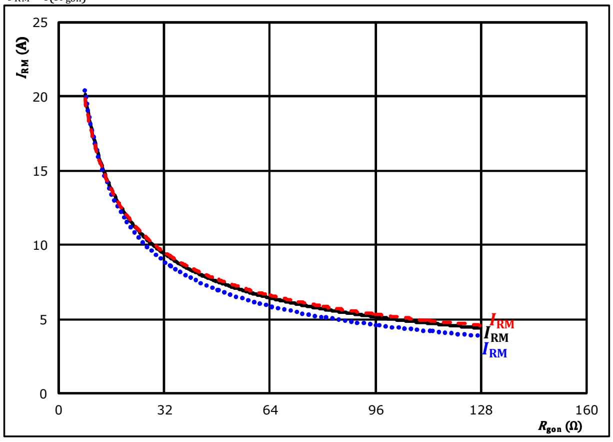


At					
V_{CE} =	600	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
R_{gon} =	32	Ω		150 °C	dashed

figure 12. **FWD**

Typical peak reverse recovery current as a function of IGBT turn on gate resistor

$I_{RM} = f(R_{gon})$



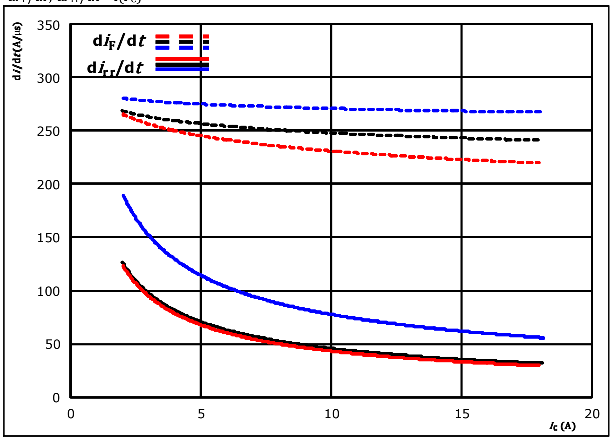
At					
V_{CE} =	600	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
I_C =	10	A		150 °C	dashed

Inverter Switching Characteristics

figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

di_F/dt, $di_{rr}/dt = f(I_C)$



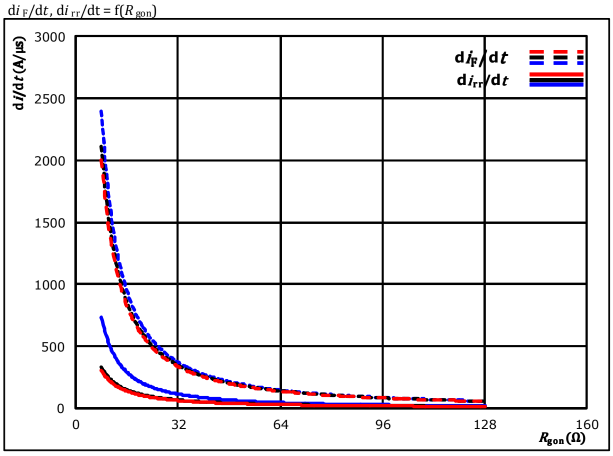
At

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	32	Ω		150 °C	dashed

figure 14. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

di_F/dt, $di_{rr}/dt = f(R_{gon})$



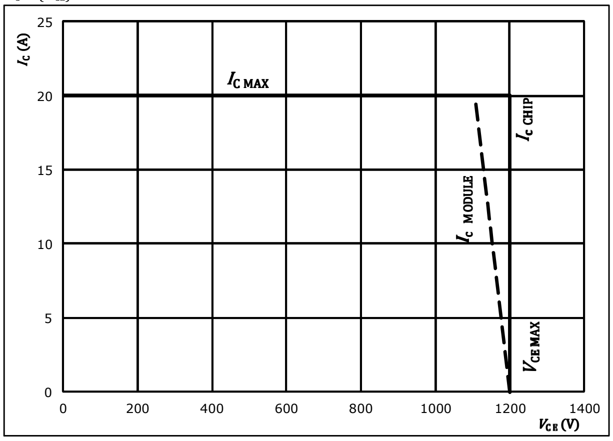
At

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	10	A		150 °C	dashed

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C
R_{gon} =	32	Ω
R_{goff} =	32	Ω

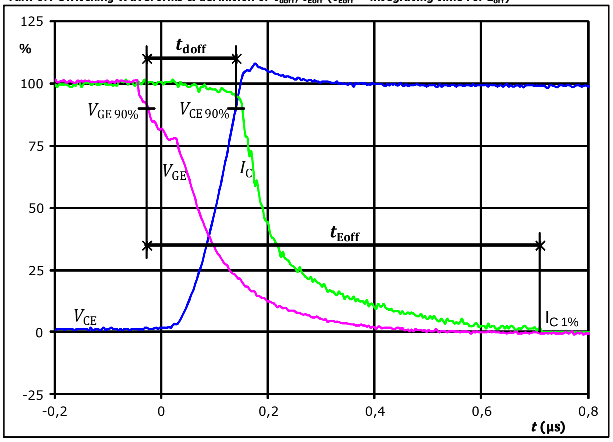
Inverter Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

figure 1. IGBT

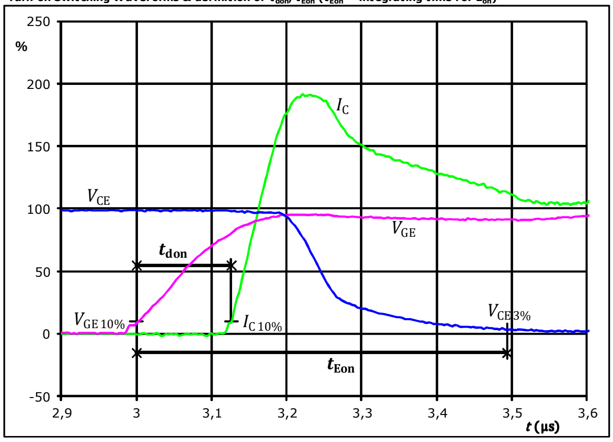
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	10	A
t_{doff} =	0,179	µs
t_{Eoff} =	0,737	µs

figure 2. IGBT

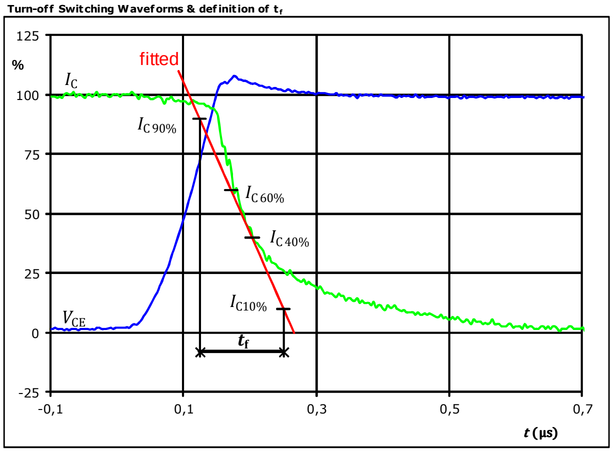
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	10	A
t_{don} =	0,126	µs
t_{Eon} =	0,493	µs

figure 3. IGBT

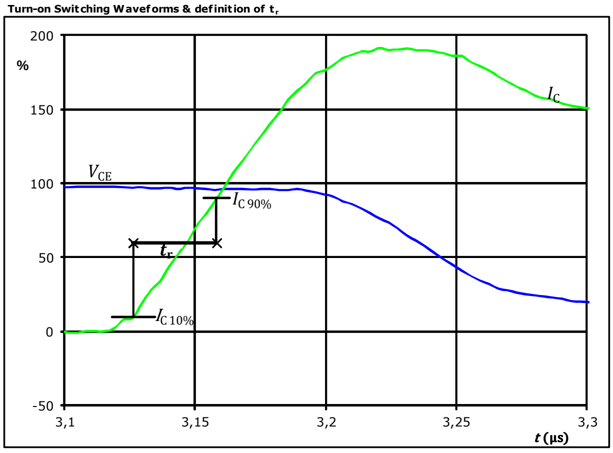
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	10	A
t_f =	0,108	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

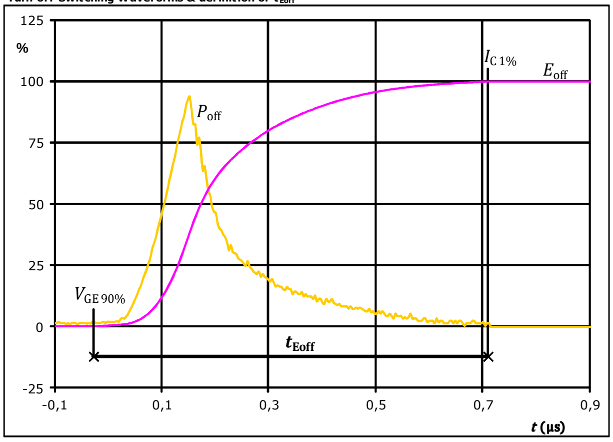


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	10	A
t_r =	0,032	µs

Inverter Switching Characteristics

figure 5. **IGBT**

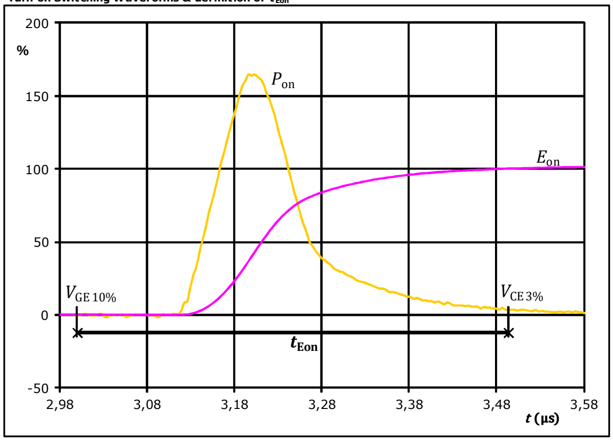
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	6,02	kW
E_{off} (100%) =	0,86	mJ
t_{Eoff} =	0,74	µs

figure 6. **IGBT**

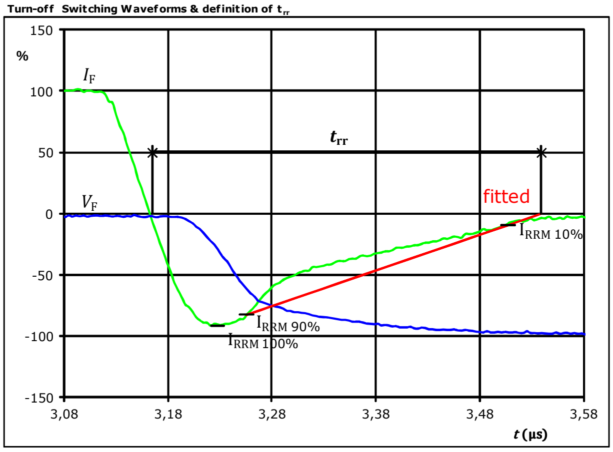
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	6,02	kW
E_{on} (100%) =	1,13	mJ
t_{Eon} =	0,49	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of t_{rr}

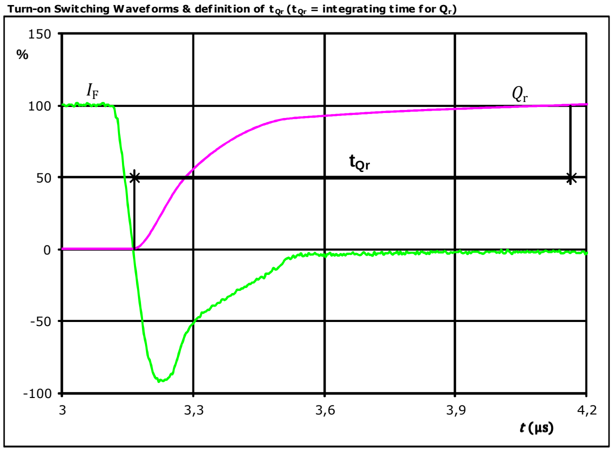


V_F (100%) =	600	V
I_F (100%) =	10	A
I_{RRM} (100%) =	-9	A
t_{rr} =	0,373	µs

Inverter Switching Characteristics

figure 8. **FWD**

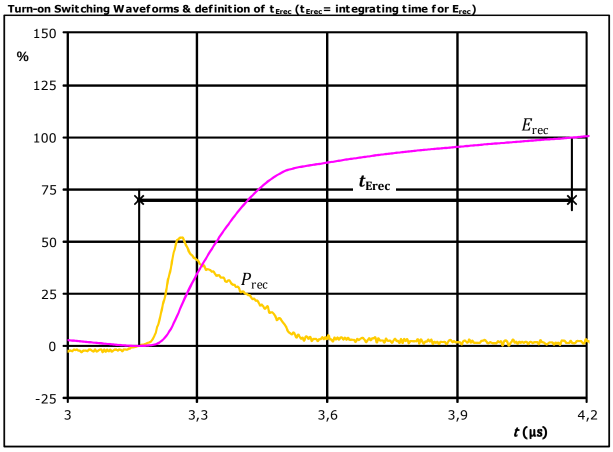
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	10	A
Q_r (100%) =	1,66	µC
t_{Qr} =	1,00	µs

figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec}= integrating time for E_{rec})



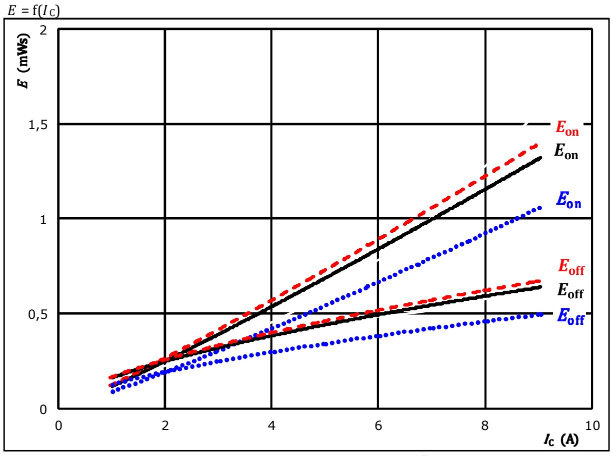
P_{rec} (100%) =	6,02	kW
E_{rec} (100%) =	0,62	mJ
t_{Erec} =	1,00	µs

Brake Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



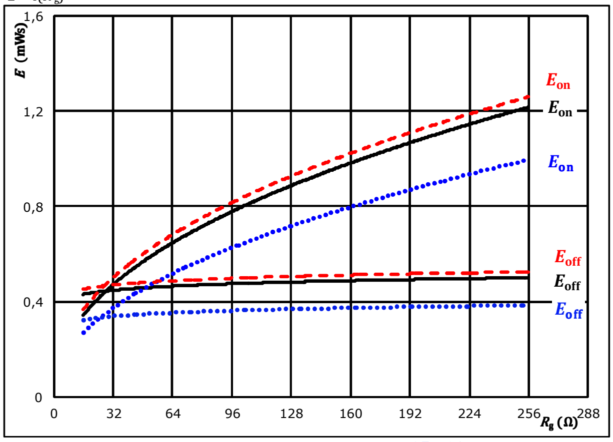
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
R_{gon} =	64	Ω		150 °C	dashed
R_{goff} =	64	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



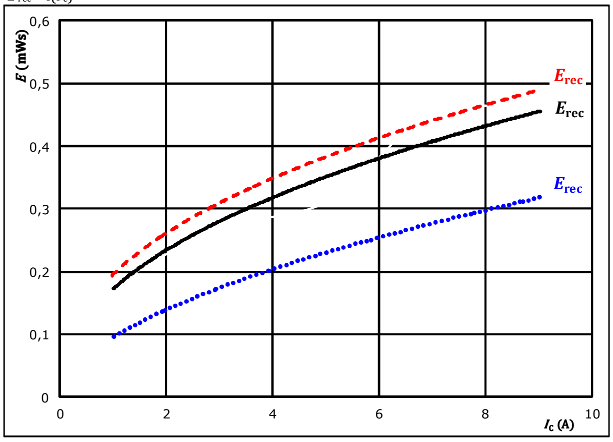
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
I_C =	5	A		150 °C	dashed

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



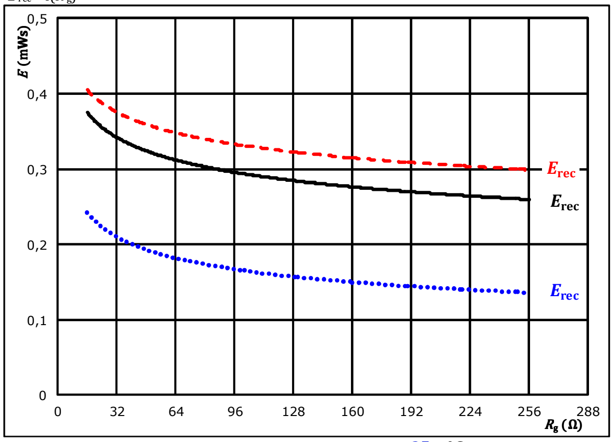
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
R_{gon} =	64	Ω		150 °C	dashed

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

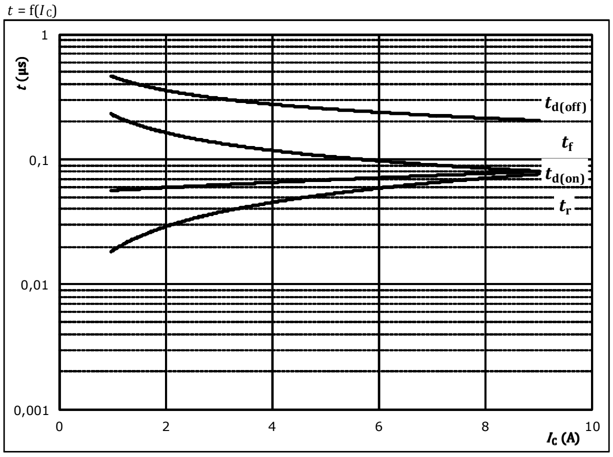
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
I_C =	5	A		150 °C	dashed

Brake Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



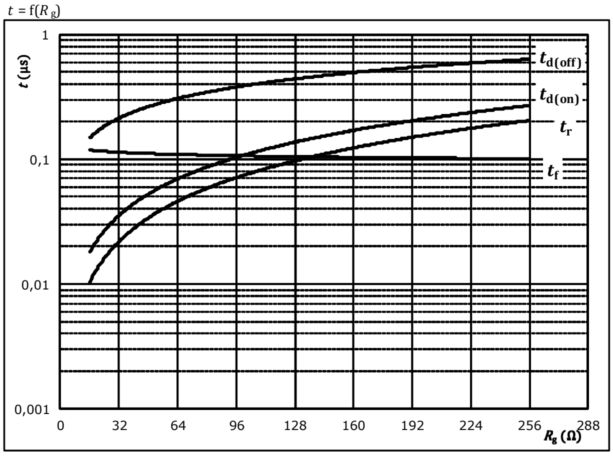
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	15/0	V
R_{gon} =	64	Ω
R_{goff} =	64	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



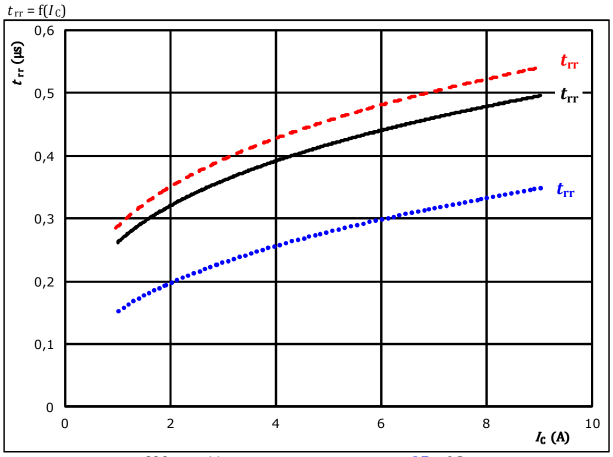
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	15/0	V
I_C =	5	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

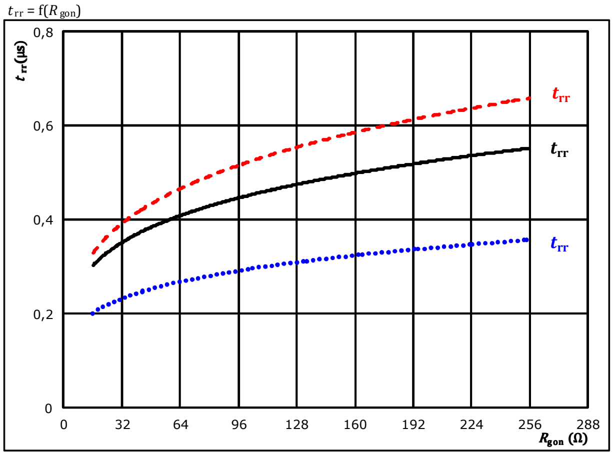


At V_{CE} =	600	V		25 °C	············
V_{GE} =	15/0	V	T_j:	125 °C	———
R_{gon} =	64	Ω		150 °C	– – –

figure 8. **FWD**

Typical reverse recovery time as a function of IGBT turn on gate resistor

$t_{rr} = f(R_{gon})$



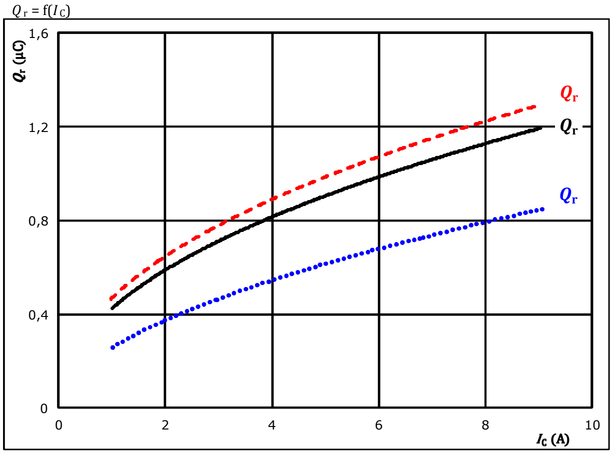
At V_{CE} =	600	V		25 °C	············
V_{GE} =	15/0	V	T_j:	125 °C	———
I_C =	5	A		150 °C	– – –

Brake Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

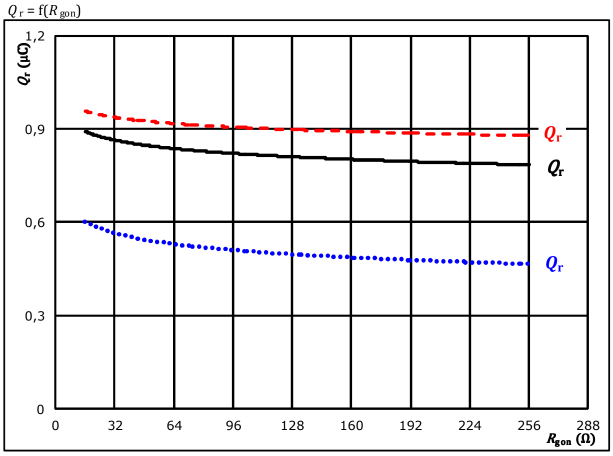


At	V_{CE} =	600	V		25 °C	···········
	V_{GE} =	15/0	V	T_j:	125 °C	———
	R_{gon} =	64	Ω		150 °C	– – –

figure 10. **FWD**

Typical recovered charge as a function of IGBT turn on gate resistor

$Q_r = f(R_{gon})$

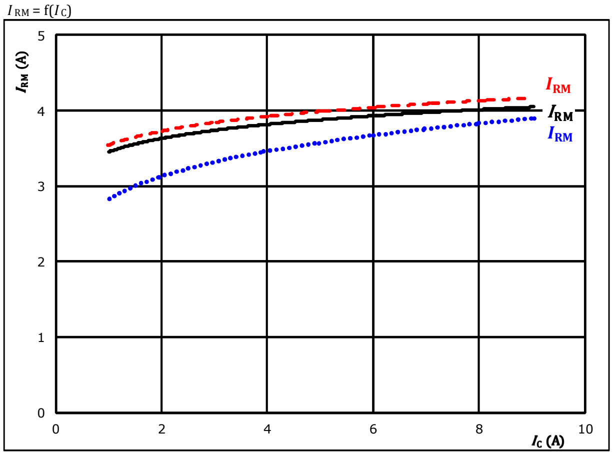


At	V_{CE}=	600	V		25 °C	···········
	V_{GE} =	15/0	V	T_j:	125 °C	———
	I_C=	5	A		150 °C	– – –

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

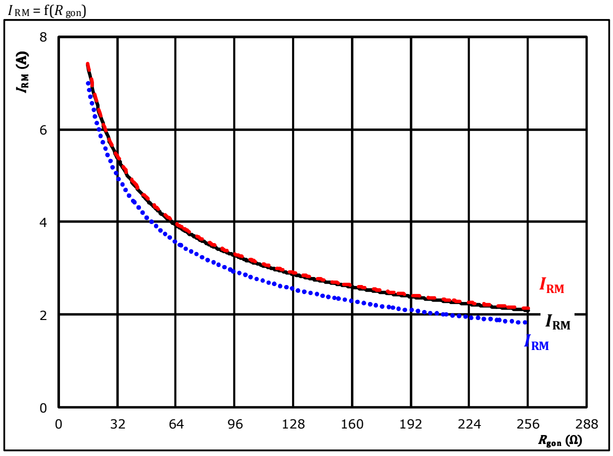


At	V_{CE}:	600	V		25 °C	···········
	V_{GE} =	15/0	V	T_j:	125 °C	———
	R_{gon} =	64	Ω		150 °C	– – –

figure 12. **FWD**

Typical peak reverse recovery current as a function of IGBT turn on gate resistor

$I_{RM} = f(R_{gon})$



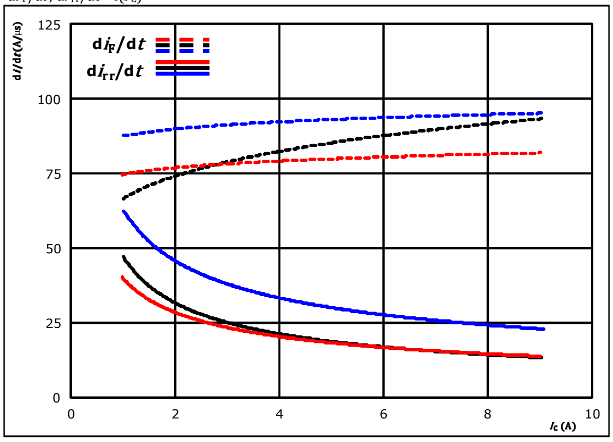
At	V_{CE} =	600	V		25 °C	···········
	V_{GE} =	15/0	V	T_j:	125 °C	———
	I_C =	5	A		150 °C	– – –

Brake Switching Characteristics

figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

di_F/dt, di_{rr}/dt = f(I_C)



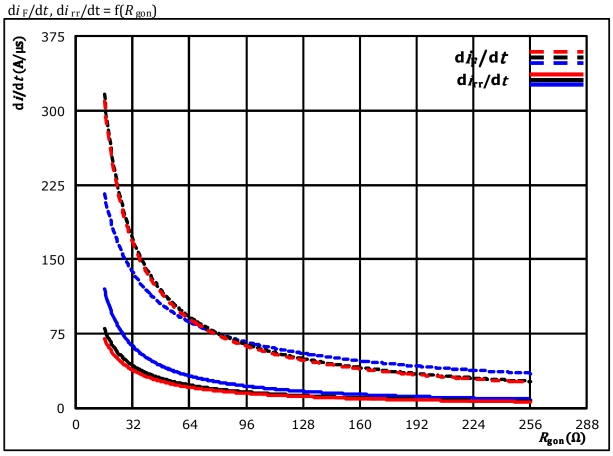
At

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
R_{gon} =	64	Ω		150 °C	dashed

figure 14. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

di_F/dt, di_{rr}/dt = f(R_{gon})



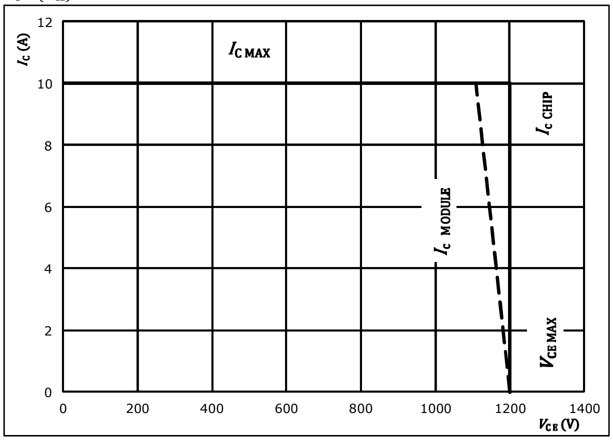
At

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
I_C=	5	A		150 °C	dashed

figure 15. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At

T_j =	175	°C
R_{gon} =	64	Ω
R_{goff} =	64	Ω

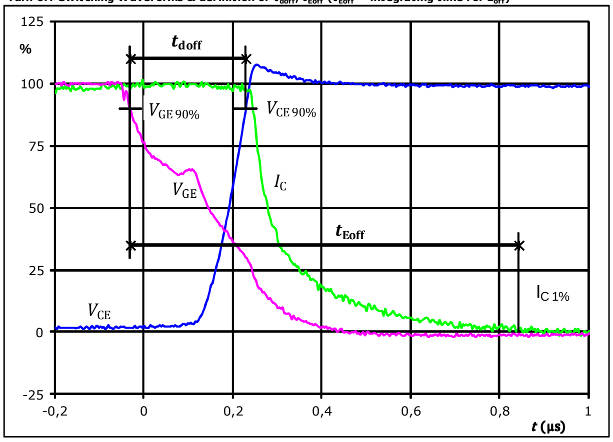
Brake Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	64 Ω
R_{goff}	=	64 Ω

figure 1. IGBT

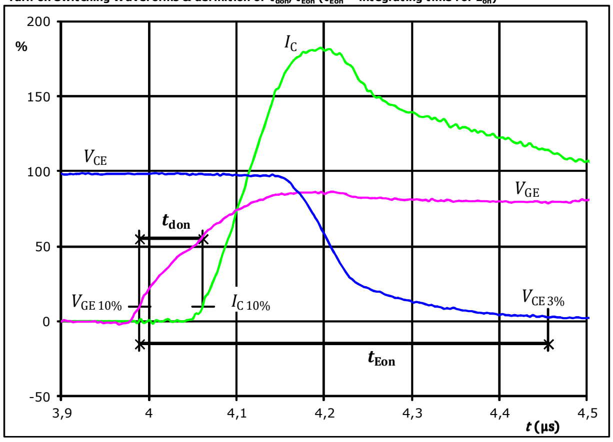
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	5	A
t_{doff} =	0,262	µs
t_{Eoff} =	0,874	µs

figure 2. IGBT

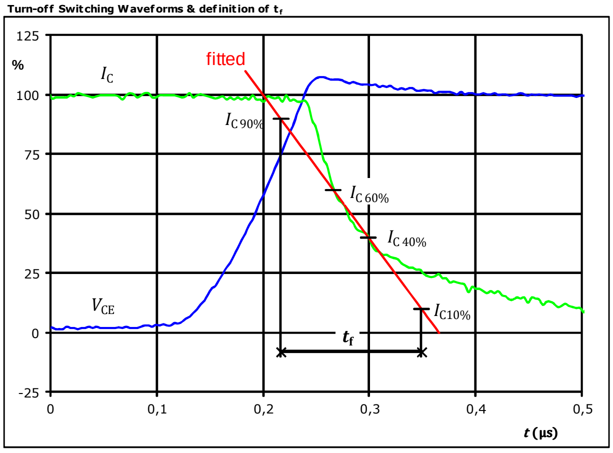
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	5	A
t_{don} =	0,073	µs
t_{Eon} =	0,467	µs

figure 3. IGBT

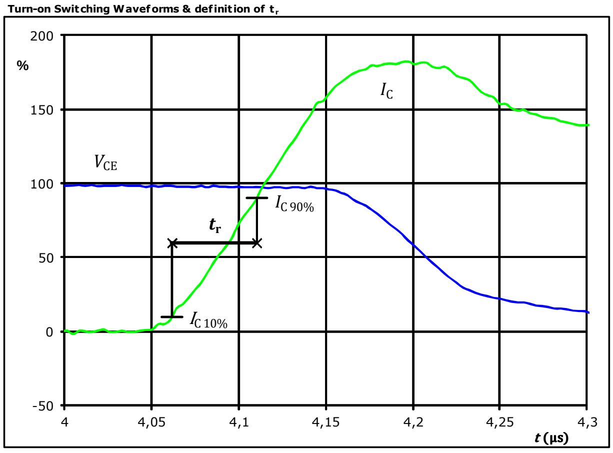
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	5	A
t_f =	0,114	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

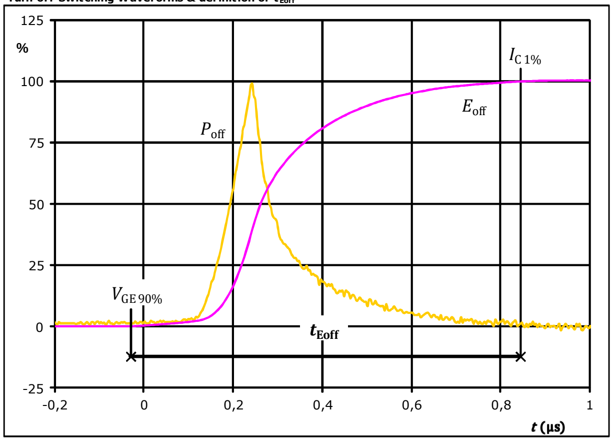


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	5	A
t_r =	0,048	µs

Brake Switching Characteristics

figure 5. **IGBT**

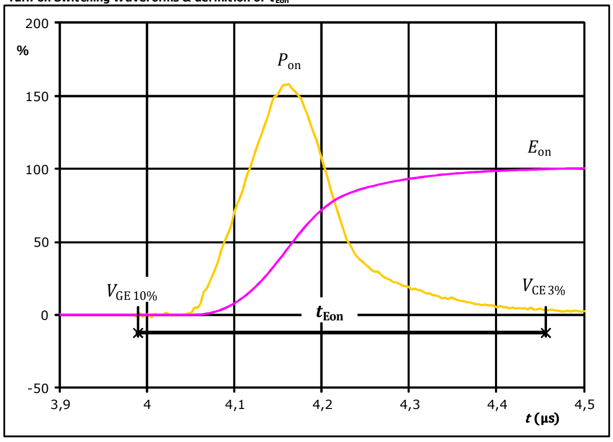
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	3,03	kW
E_{off} (100%) =	0,45	mJ
t_{Eoff} =	0,87	µs

figure 6. **IGBT**

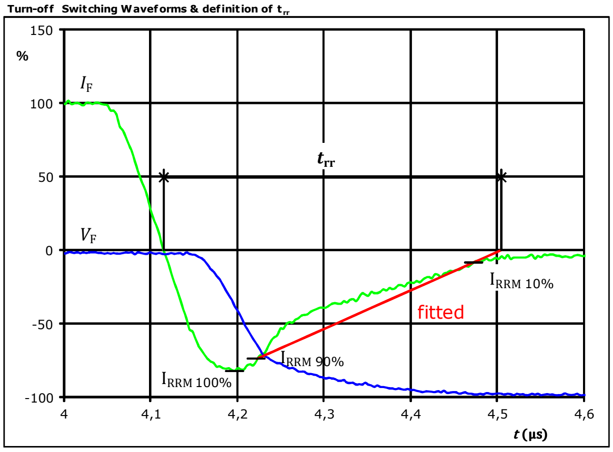
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	3,03	kW
E_{on} (100%) =	0,61	mJ
t_{Eon} =	0,47	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of t_{rr}

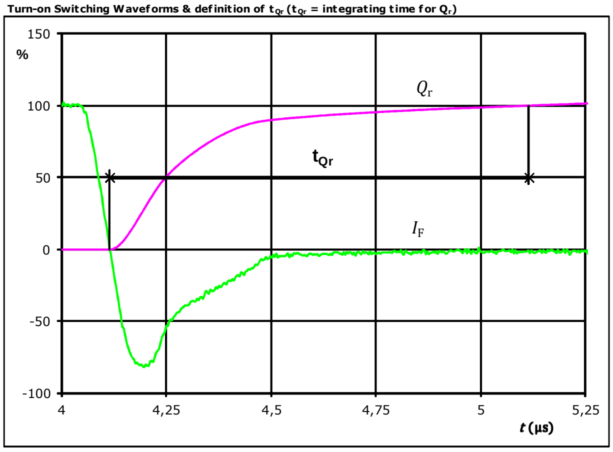


V_F (100%) =	600	V
I_F (100%) =	5	A
I_{RRM} (100%) =	-4	A
t_{rr} =	0,386	µs

Brake Switching Characteristics

figure 8. **FWD**

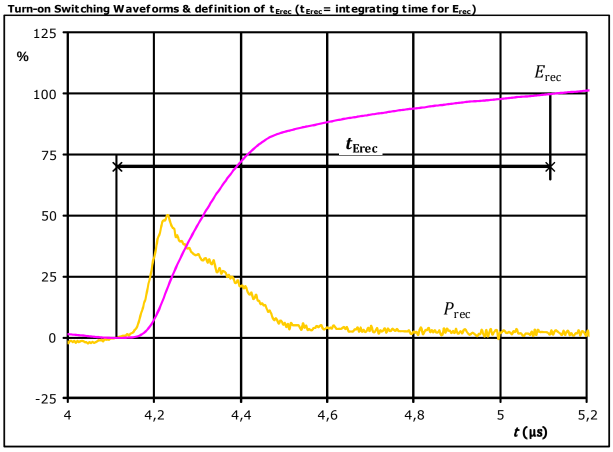
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	5	A
Q_r (100%) =	0,83	µC
t_{Qr} =	1,00	µs

figure 9. **FWD**

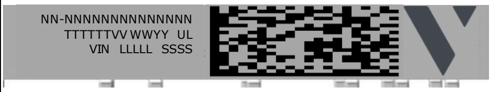
Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



P_{rec} (100%) =	3,03	kW
E_{rec} (100%) =	0,31	mJ
t_{Erec} =	1,00	µs

Ordering Code & Marking

Version	Ordering Code
without thermal paste 12 mm housing with solder pins	10-FZ12PMA010M7-P849A28
without thermal paste 17 mm housing with solder pins	10-F012PMA010M7-P849A29

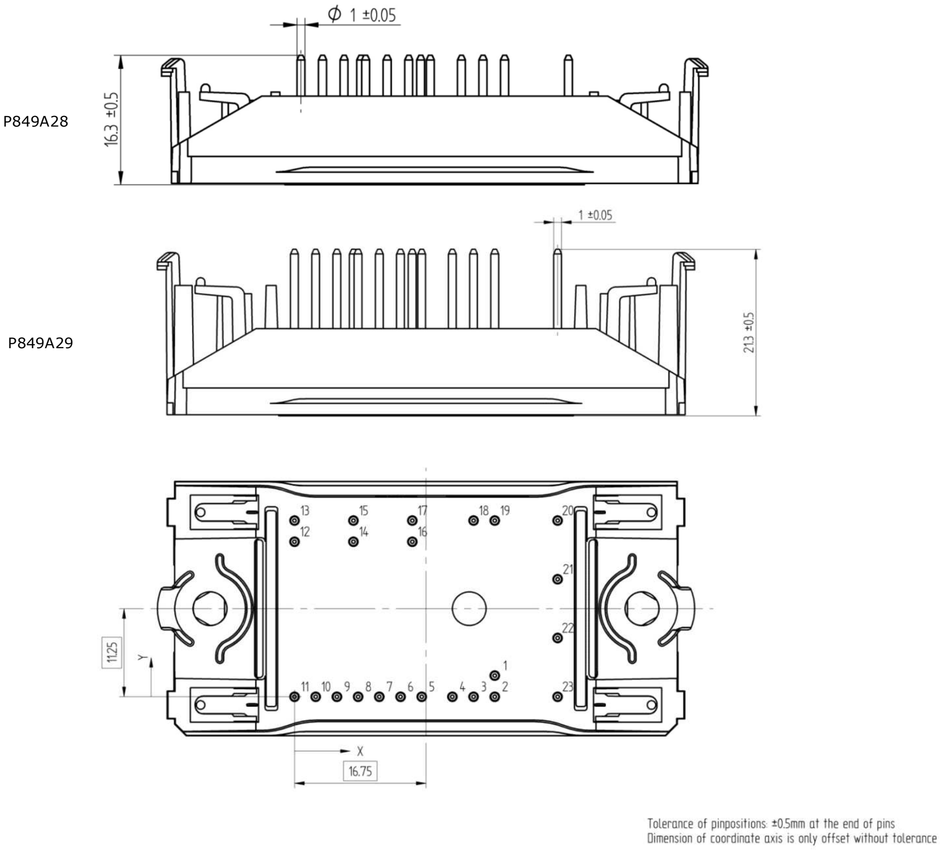


Text	**Name**		**Date code**	**UL & VIN**	**Lot**	**Serial**
	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

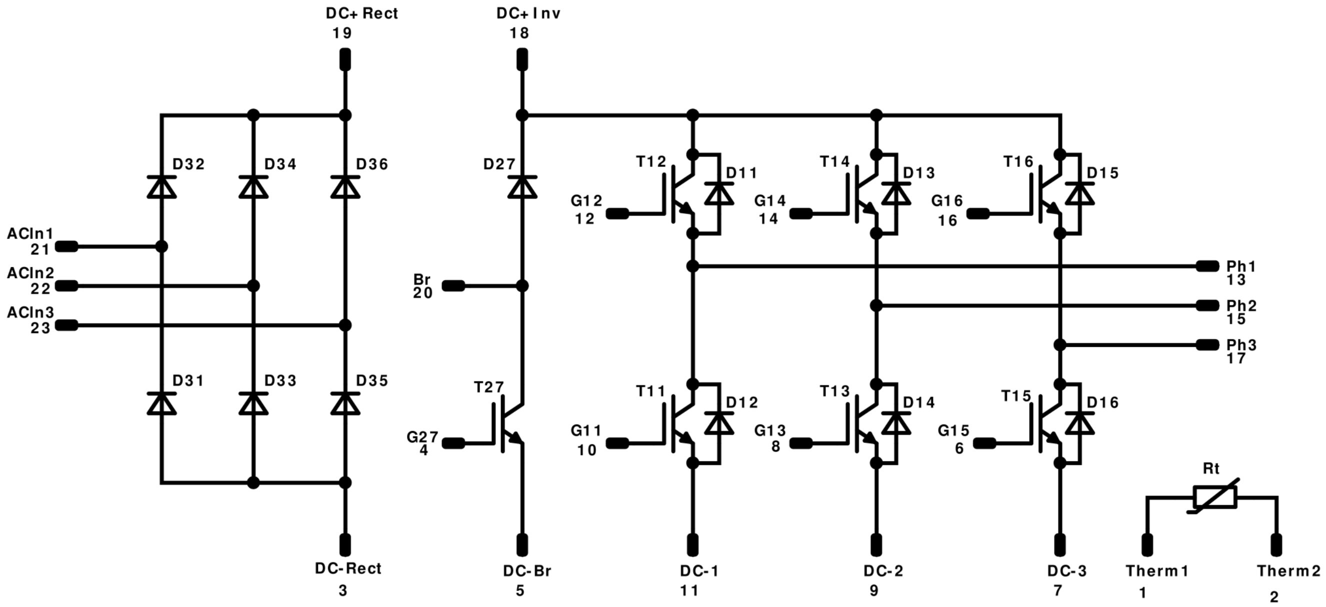
Outline

Pin table

Pin	X	Y	Function
1	25,5	2,7	Therm1
2	25,5	0	Therm2
3	22,8	0	DC-Rect
4	20,1	0	G27
5	16,2	0	DC-Br
6	13,5	0	G15
7	10,8	0	DC-3
8	8,1	0	G13
9	5,4	0	DC-2
10	2,7	0	G11
11	0	0	DC-1
12	0	19,8	G12
13	0	22,5	Ph1
14	7,5	19,8	G14
15	7,5	22,5	Ph2
16	15	19,8	G16
17	15	22,5	Ph3
18	22,8	22,5	DC+Inv
19	25,5	22,5	DC+Rect
20	33,5	22,5	Br
21	33,5	15	ACIn1
22	33,5	7,5	ACIn2
23	33,5	0	ACIn3



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	25 A	Rectifier Diode	
T11, T12, T13, T14, T15, T16	IGBT	1200 V	10 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	10 A	Inverter Diode	
T27	IGBT	1200 V	5 A	Brake Switch	
D27	FWD	1200 V	5 A	Brake Diode	
Rt	NTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 135	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

Package data
Package data for *flow* 0 packages see vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-Fx12PMA010M7-P849A2x-D1-14	17 Nov. 2017		