



Vincotech

<i>flow</i> PIM 0 3 rd gen	1200 V / 15 A
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Features</div> <ul style="list-style-type: none"> 2 Clips housing in 12 and 17mm height Trench Fieldstop Technology IGBT4 Optional w/o BRC 	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">flow 0 housing</div> <div style="display: flex; justify-content: space-around;"> </div> <p style="font-size: small; margin-top: 5px;">12mm housing 17mm housing</p>
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Target Applications</div> <ul style="list-style-type: none"> Industrial Drives Embedded Generation 	<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Schematic</div>
<div style="background-color: #eee; padding: 2px; margin-bottom: 5px;">Types</div> <ul style="list-style-type: none"> V23990-P840-A48-PM V23990-P840-A49-PM V23990-P840-C48-PM V23990-P840-C49-PM 	

Maximum Ratings

$T_j = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit	
Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}		1600	V	
DC forward current	I_{FAV}	$T_j = T_{jmax}$	$T_s = 80^\circ\text{C}$ $T_c = 80^\circ\text{C}$	27 30	A
Surge forward current	I_{FSM}	$t_p = 10 \text{ ms}$	220	A	
I^2t -value	I^2t		200	A^2s	
Power dissipation	P_{tot}	$T_j = T_{jmax}$	$T_s = 80^\circ\text{C}$ $T_c = 80^\circ\text{C}$	33 50	W
Maximum Junction Temperature	T_{jmax}		150	$^\circ\text{C}$	
Inverter IGBT					
Collector-emitter break down voltage	V_{CE}		1200	V	
DC collector current	I_C	$T_j = T_{jmax}$	$T_s = 80^\circ\text{C}$ $T_c = 80^\circ\text{C}$	18 24	A
Pulsed collector current	I_{CRM}	t_p limited by T_{jmax}	45	A	
Turn off safe operating area		$V_{CE} \leq 1200 \text{ V}, T_j \leq T_{op \text{ max}}$	30	A	
Power dissipation	P_{tot}	$T_j = T_{jmax}$	$T_s = 80^\circ\text{C}$ $T_c = 80^\circ\text{C}$	52 79	W
Gate-emitter peak voltage	V_{GE}		± 20	V	
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq 150^\circ\text{C}$ $V_{GE} = 15 \text{ V}$	10 800	μs V	
Maximum Junction Temperature	T_{jmax}		175	$^\circ\text{C}$	

**Maximum Ratings** $T_j=25^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
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Inverter FWD

Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
DC forward current	I_F	$T_j = T_{jmax}$ $T_s = 80^{\circ}\text{C}$ $T_c = 80^{\circ}\text{C}$	20 25	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	30	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^{\circ}\text{C}$ $T_c = 80^{\circ}\text{C}$	38 57	W
Maximum Junction Temperature	T_{jmax}		175	$^{\circ}\text{C}$

Brake IGBT

Collector-emitter break down voltage	V_{CE}		1200	V
DC collector current	I_C	$T_j = T_{jmax}$ $T_s = 80^{\circ}\text{C}$ $T_c = 80^{\circ}\text{C}$	12 15	A
Pulsed collector current	I_{CRM}	t_p limited by T_{jmax}	24	A
Turn off safe operating area		$V_{CE} \leq 1200\text{ V}$, $T_j \leq T_{op\ max}$	16	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^{\circ}\text{C}$ $T_c = 80^{\circ}\text{C}$	40 61	W
Gate-emitter peak voltage	V_{GE}		± 20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq 150^{\circ}\text{C}$ $V_{GE} = 15\text{ V}$	10 800	μs V
Maximum Junction Temperature	T_{jmax}		175	$^{\circ}\text{C}$

Brake FWD

Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
DC forward current	I_F	$T_j = T_{jmax}$ $T_s = 80^{\circ}\text{C}$ $T_c = 80^{\circ}\text{C}$	10 10	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	15	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^{\circ}\text{C}$ $T_c = 80^{\circ}\text{C}$	22 34	W
Maximum Junction Temperature	T_{jmax}		150	$^{\circ}\text{C}$

Thermal Properties

Storage temperature	T_{stg}		-40...+125	$^{\circ}\text{C}$
Operation temperature under switching condition	T_{op}		-40...+($T_{jmax} - 25$)	$^{\circ}\text{C}$

Isolation Properties

Isolation voltage	V_{is}	$t = 2\text{ s}$ DC voltage	4000	V
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm
Comparative tracking index	CTI		>200	



Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j [°C]	Min	Typ	Max		

Rectifier Diode

Forward voltage	V_F				25	25 125		1,17 1,13	1,9	v
Threshold voltage (for power loss calc. only)	V_{to}				25	25 125		0,93 0,79		v
Slope resistance (for power loss calc. only)	r_t				25	25 125		9,78 13,37		mΩ
Reverse current	I_r			1600		25 145			0,05 1,1	mA
Thermal resistance chip to heatsink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4$ W/mK						1,61		K/W

Inverter IGBT

Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$				0,0005	25	5	5,8	6,5	v
Collector-emitter saturation voltage	$V_{CE(sat)}$					15	25 125	1,58	1,94 2,26	2,07	v
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200			25			0,002	mA
Gate-emitter leakage current	I_{GES}		20	0			25			120	nA
Integrated Gate resistor	R_{gint}							none			Ω
Turn-on delay time	$t_{d(on)}$	$R_{goff} = 16 \Omega$ $R_{gon} = 16 \Omega$	± 15	600	15	25			60		ns
Rise time	t_r					125			60		
Turn-off delay time	$t_{d(off)}$					25			15		
Fall time	t_f					125			19		
Turn-on energy loss	E_{on}					25			197		
Turn-off energy loss	E_{off}	125			239						
Input capacitance	C_{ies}								1000		pF
Output capacitance	C_{oss}	$f = 1$ MHz	0	25		25			100		
Reverse transfer capacitance	C_{rss}								56		
Thermal resistance chip to heatsink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4$ W/mK							1,35		K/W

Inverter FWD

Diode forward voltage	V_F				10	25 125		1,35	1,90 1,91	2,05	v
Peak reverse recovery current	I_{RRM}	$R_{gon} = 16 \Omega$	± 15	600	15	25			13		A
Reverse recovery time	t_{rr}					125			16		
Reverse recovered charge	Q_{rr}					25			282		
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					125			433		
Reverse recovered energy	E_{rec}					25			1,59		
		125			2,75						
		25			129						
		125			109						
		25			0,65						
		125			1,16						
Thermal resistance chip to heatsink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4$ W/mK							1,83		K/W



Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j [°C]	Min	Typ	Max		
Brake IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0003	25	5	5,8	6,3	V
Collector-emitter saturation voltage	$V_{CE(sat)}$				8	25 125	1,58	1,87 2,22	2,07	V
Collector-emitter cut-off incl diode	I_{CES}		0	1200		25			0,001	mA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	$R_{goff} = 32 \Omega$ $R_{gon} = 32 \Omega$	± 15	600	8	25		71		ns
Rise time	t_r					125		72		
Turn-off delay time	$t_{d(off)}$					25		20		
Fall time	t_f					125		24		
Turn-on energy loss	E_{on}					25		181		
Turn-off energy loss	E_{off}					125		228		
Input capacitance	C_{ies}	$f = 1 \text{ MHz}$	0	25		25		78		mWs
Output capacitance	C_{oss}					125		104		
Reverse transfer capacitance	C_{rss}					25		0,50		
Thermal resistance chip to heatsink	$R_{th(j-s)}$					125		0,43		
				0,62				490		pF
								50		
								30		
		phase-change material $\lambda = 3,4 \text{ W/mK}$						1,57		K/W
Brake FWD										
Diode forward voltage	V_F				7,5	25 125		1,67 1,61		V
Reverse leakage current	I_r			1200		25			250	μA
Peak reverse recovery current	I_{RRM}	$R_{goff} = 32 \Omega$ $R_{gon} = 32 \Omega$	± 15	600	8	25		9		A
Reverse recovery time	t_{rr}					125		10		
Reverse recovered charge	Q_{rr}					25		258		
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					125		427		
Reverse recovery energy	E_{rec}					25		0,90		
						125		0,90		
				78				0,35		μC
				73				0,69		mWs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	phase-change material $\lambda = 3,4 \text{ W/mK}$						2,20		K/W
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R100	$\Delta_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1\%$				25		3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1\%$				25		4000		K
Vincotech NTC Reference									I	

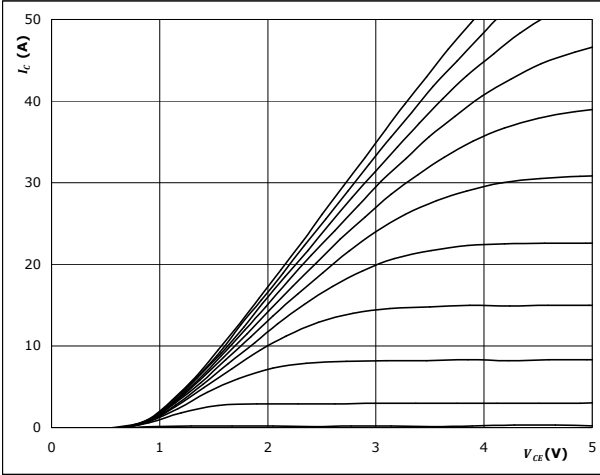


Inverter Charateristics

Figure 1 Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



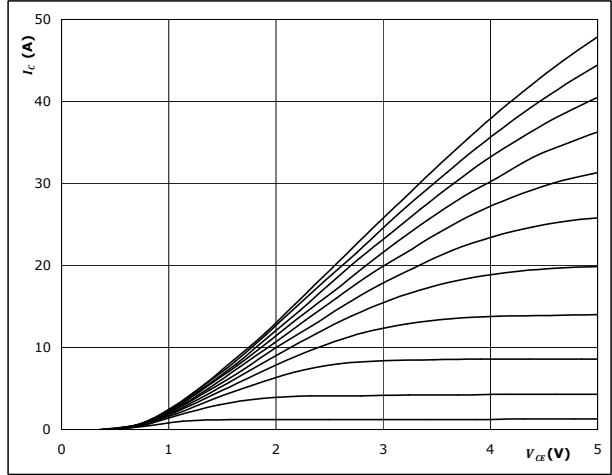
At

$t_p = 250 \mu s$
 $T_j = 25 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 2 Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



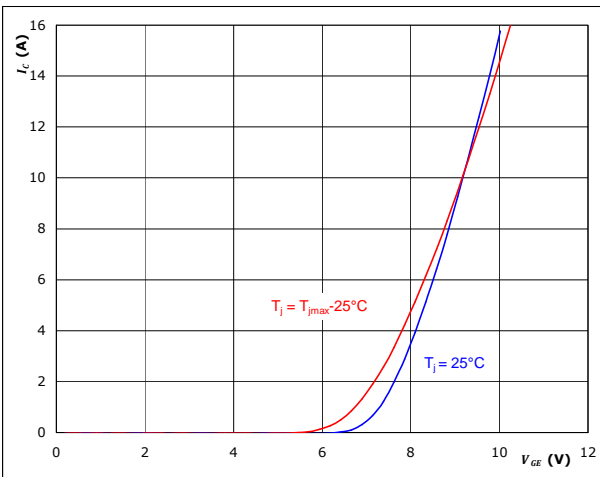
At

$t_p = 250 \mu s$
 $T_j = 125 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 Inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



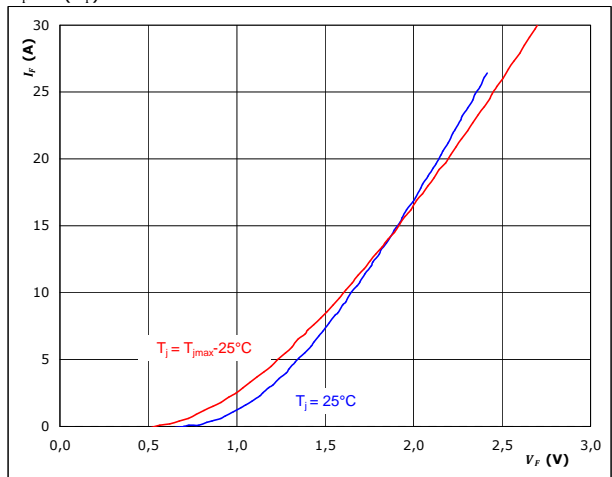
At

$t_p = 250 \mu s$
 $V_{CE} = 10 V$

Figure 4 Inverter FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

$t_p = 250 \mu s$

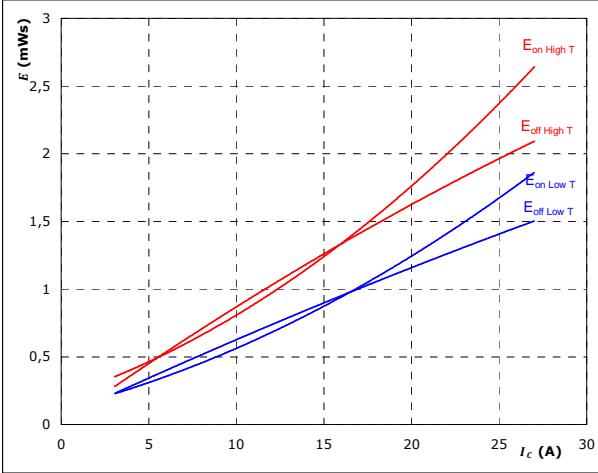


Inverter Characteristics

Figure 5 Inverter IGBT

Typical switching energy losses
as a function of collector current

$$E = f(I_C)$$



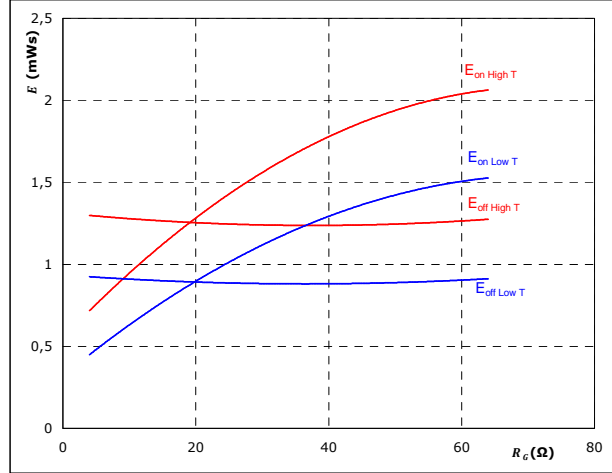
With an inductive load at

$T_j = 25/125$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 $R_{goff} = 16$ Ω

Figure 6 Inverter IGBT

Typical switching energy losses
as a function of gate resistor

$$E = f(R_G)$$



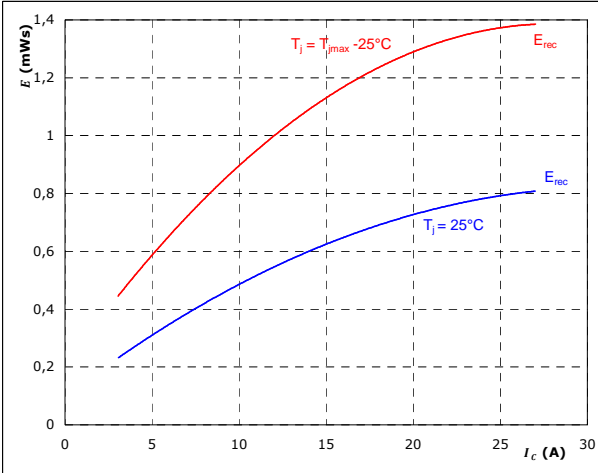
With an inductive load at

$T_j = 25/125$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 15$ A

Figure 7 Inverter FWD

Typical reverse recovery energy loss
as a function of collector current

$$E_{rec} = f(I_C)$$



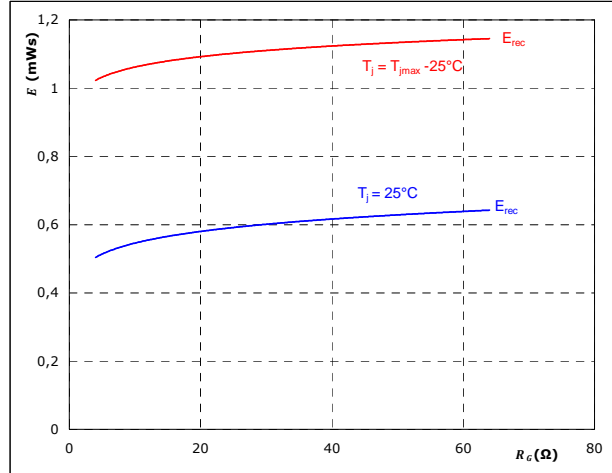
With an inductive load at

$T_j = 25/125$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

Figure 8 Inverter FWD

Typical reverse recovery energy loss
as a function of gate resistor

$$E_{rec} = f(R_G)$$



With an inductive load at

$T_j = 25/125$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 15$ A

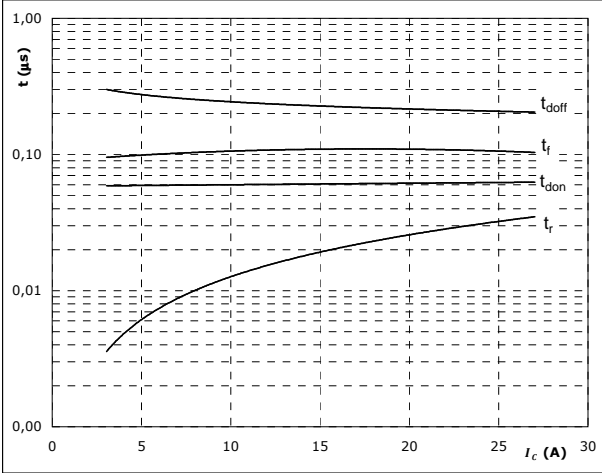


Inverter Characteristics

Figure 9 Inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



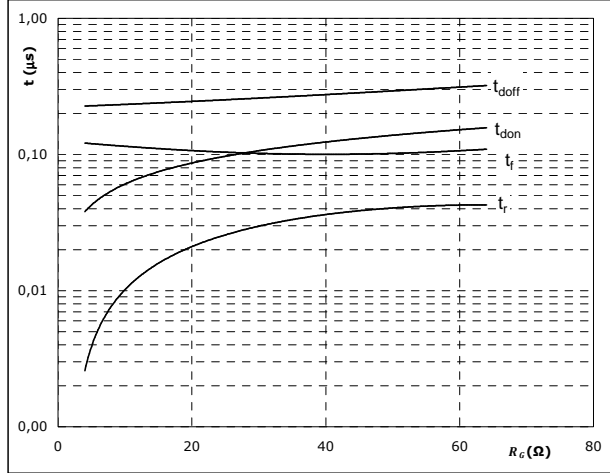
With an inductive load at

- $T_j = 125$ °C
- $V_{CE} = 600$ V
- $V_{GE} = \pm 15$ V
- $R_{gon} = 16$ Ω
- $R_{goff} = 16$ Ω

Figure 10 Inverter IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



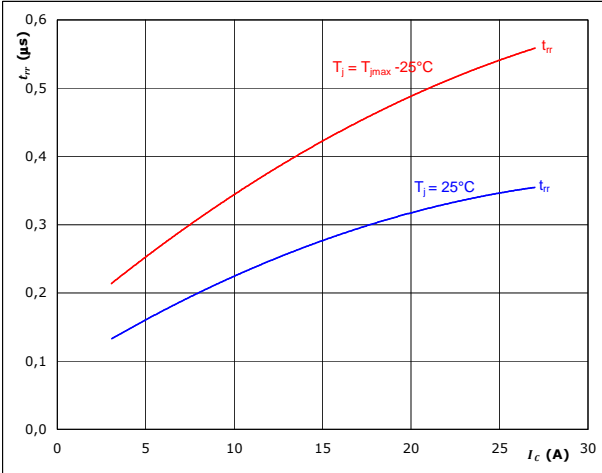
With an inductive load at

- $T_j = 125$ °C
- $V_{CE} = 600$ V
- $V_{GE} = \pm 15$ V
- $I_C = 15$ A

Figure 11 Inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



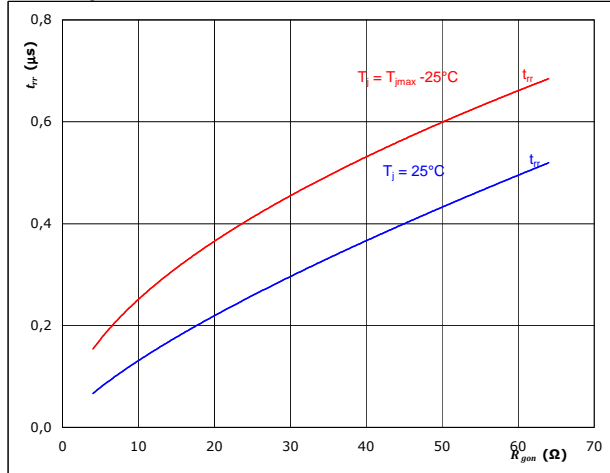
At

- $T_j = 25/125$ °C
- $V_{CE} = 600$ V
- $V_{GE} = \pm 15$ V
- $R_{gon} = 16$ Ω

Figure 12 Inverter FWD

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

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



At

- $T_j = 25/125$ °C
- $V_R = 600$ V
- $I_F = 15$ A
- $V_{GE} = \pm 15$ V

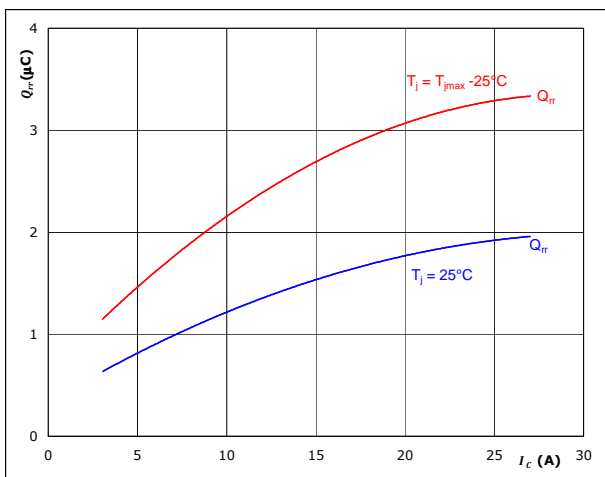


Inverter Characteristics

Figure 13 Inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_c)$



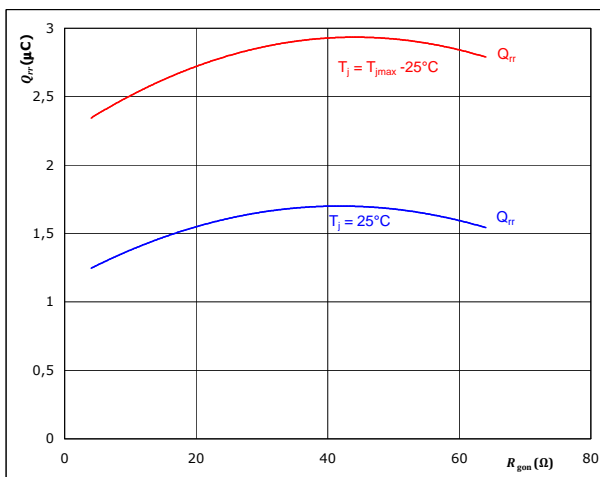
At

$T_j = 25/125$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

Figure 14 Inverter FWD

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

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



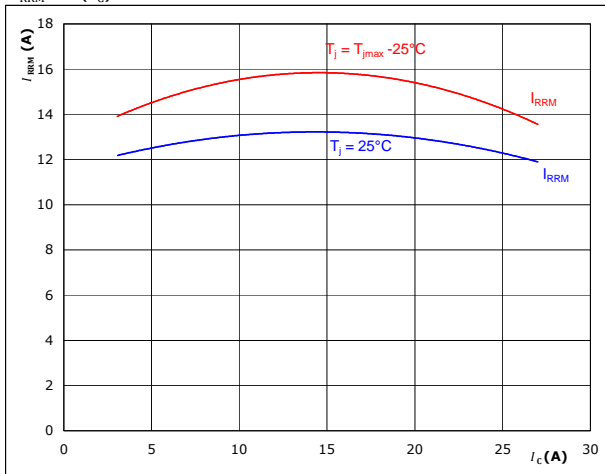
At

$T_j = 25/125$ °C
 $V_R = 600$ V
 $I_F = 15$ A
 $V_{GE} = \pm 15$ V

Figure 15 Inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_c)$



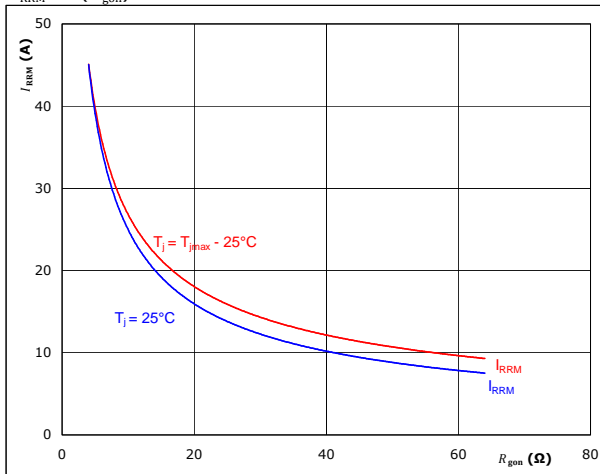
At

$T_j = 25/125$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

Figure 16 Inverter FWD

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

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



At

$T_j = 25/125$ °C
 $V_R = 600$ V
 $I_F = 15$ A
 $V_{GE} = \pm 15$ V

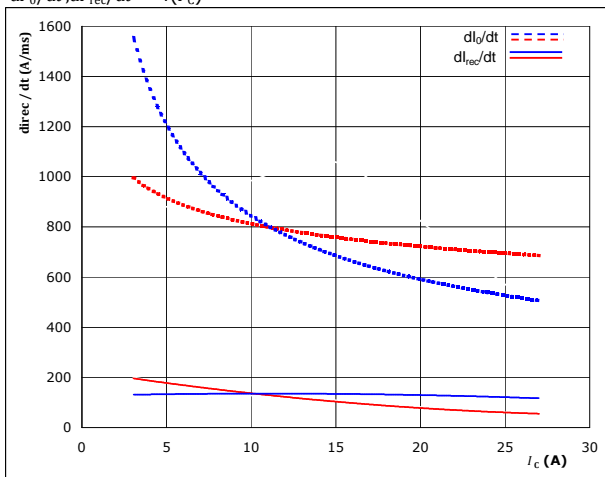


Inverter Characteristics

Figure 17 Inverter FWD

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

$$dI_0/dt, dI_{rec}/dt = f(I_c)$$

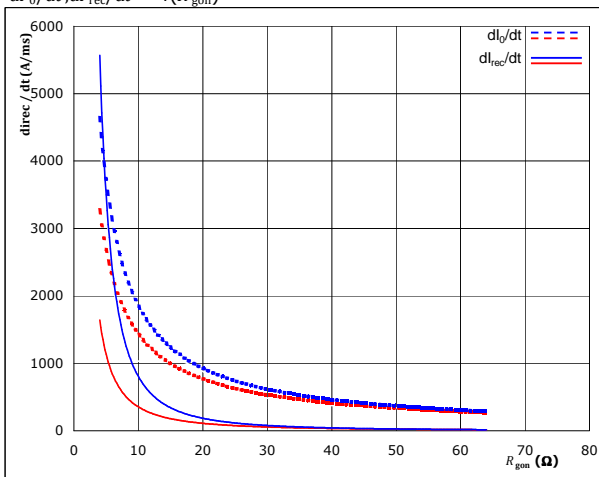


At
 $T_j = 25/125$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

Figure 18 Inverter FWD

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

$$dI_0/dt, dI_{rec}/dt = f(R_{gon})$$

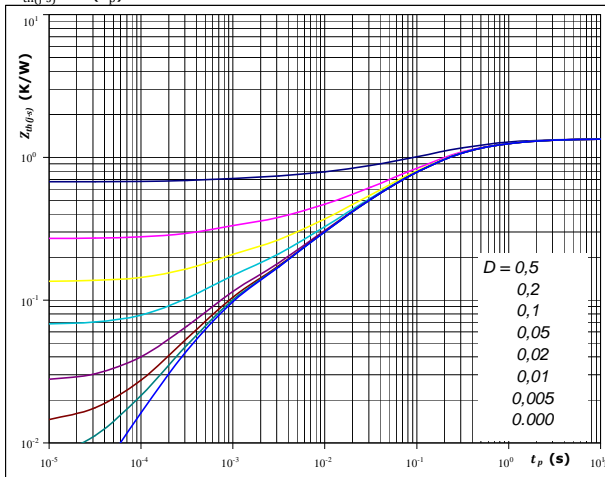


At
 $T_j = 25/125$ °C
 $V_R = 600$ V
 $I_F = 15$ A
 $V_{GE} = \pm 15$ V

Figure 19 Inverter IGBT

IGBT transient thermal impedance as a function of pulse width

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



At
 $D = t_p / T$
 $R_{th(j-s)} = 1,35$ K/W

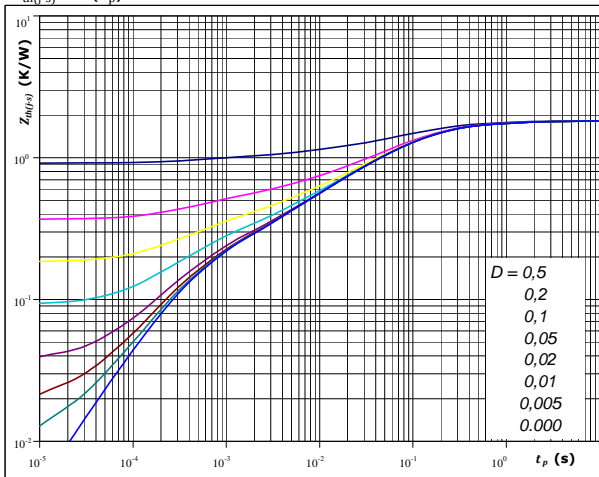
IGBT thermal model values

R (K/W)	Tau (s)
0,04	5,6E+00
0,21	8,7E-01
0,57	1,7E-01
0,31	3,4E-02
0,14	6,2E-03
0,08	5,5E-04

Figure 20 Inverter FWD

FWD transient thermal impedance as a function of pulse width

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



At
 $D = t_p / T$
 $R_{th(j-s)} = 1,83$ K/W

FWD thermal model values

R (K/W)	Tau (s)
0,03	9,6E+00
0,19	8,2E-01
0,75	1,2E-01
0,50	2,6E-02
0,20	3,4E-03
0,16	3,8E-04

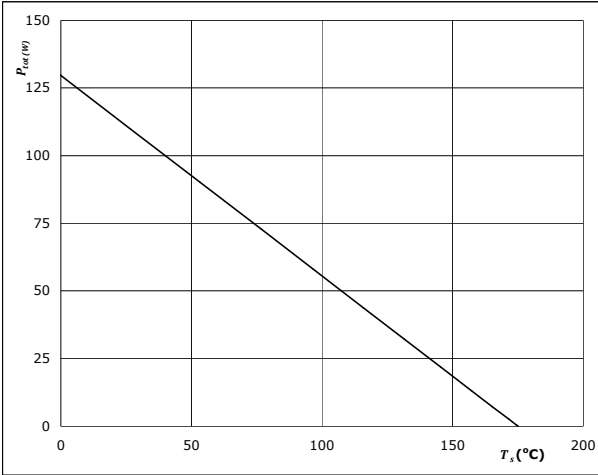


Inverter Characteristics

Figure 21 Inverter IGBT

Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_s)$$

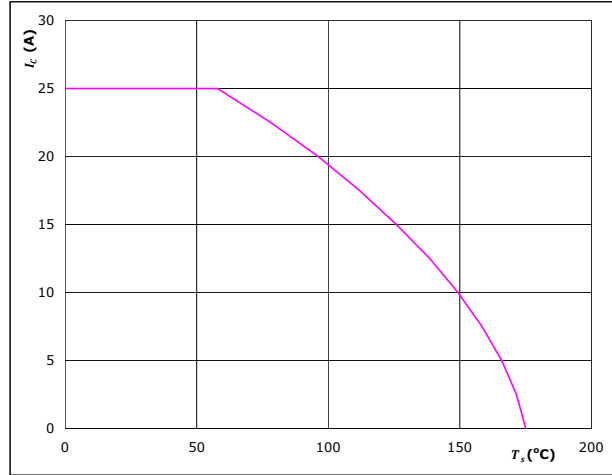


At
 $T_j = 175 \text{ }^{\circ}C$

Figure 22 Inverter IGBT

Collector current as a function of heatsink temperature

$$I_C = f(T_s)$$

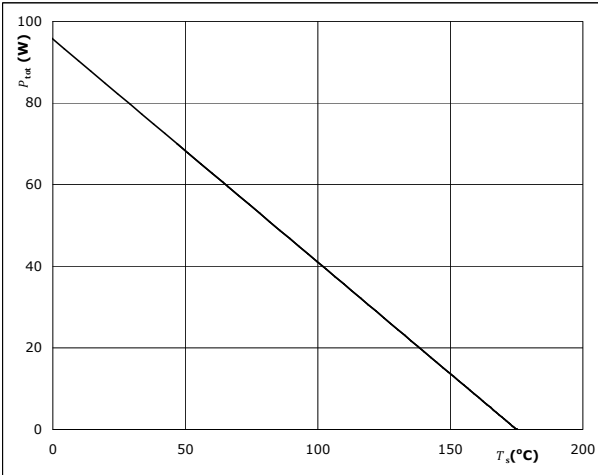


At
 $T_j = 175 \text{ }^{\circ}C$
 $V_{GE} = 15 \text{ V}$

Figure 23 Inverter FWD

Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_s)$$

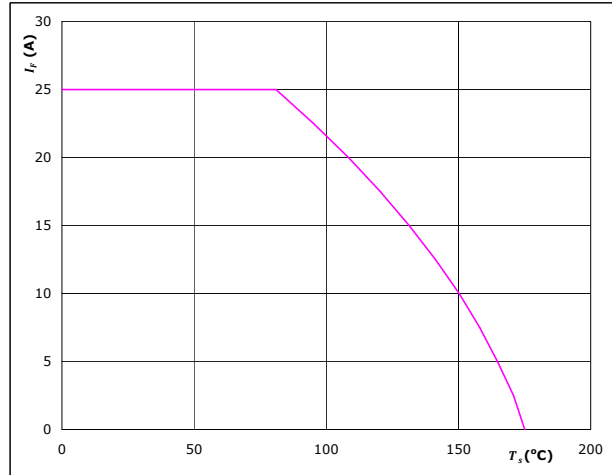


At
 $T_j = 175 \text{ }^{\circ}C$

Figure 24 Inverter FWD

Forward current as a function of heatsink temperature

$$I_F = f(T_s)$$

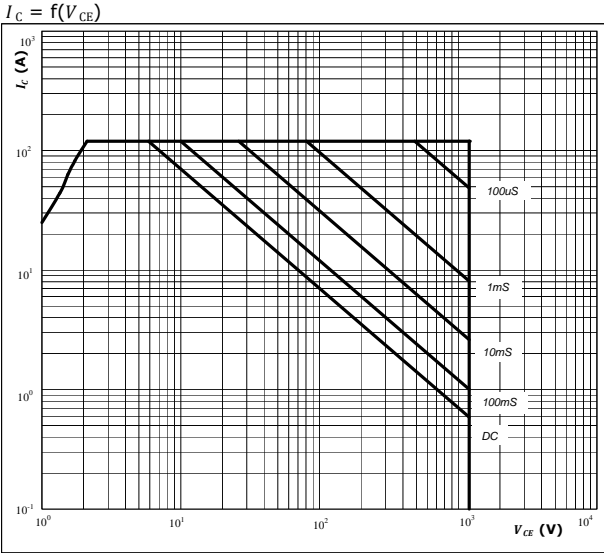


At
 $T_j = 175 \text{ }^{\circ}C$



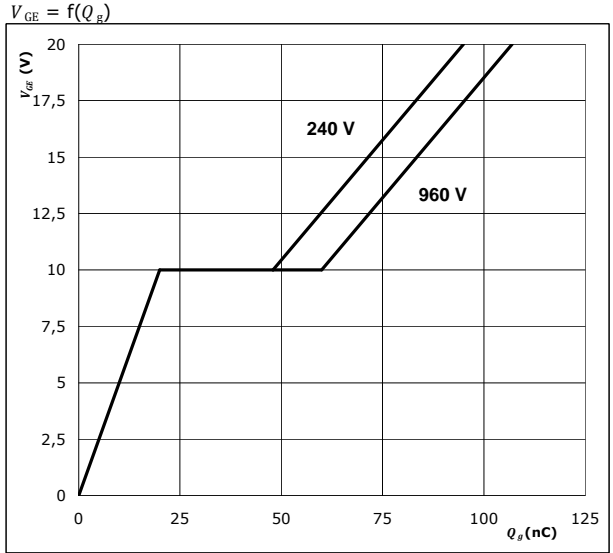
Inverter Characteristics

Figure 25 Inverter IGBT
Safe operating area as a function of collector-emitter voltage



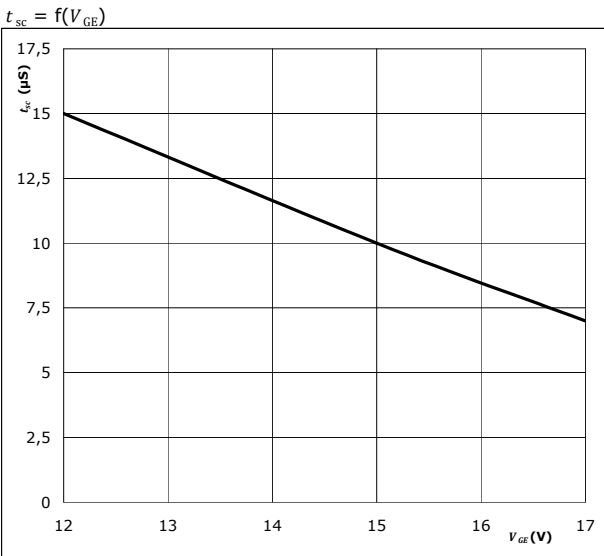
At
 $D =$ single pulse
 $T_s =$ 80 °C
 $V_{GE} =$ ±15 V
 $T_j = T_{jmax}$ °C

Figure 26 Inverter IGBT
Gate voltage vs Gate charge



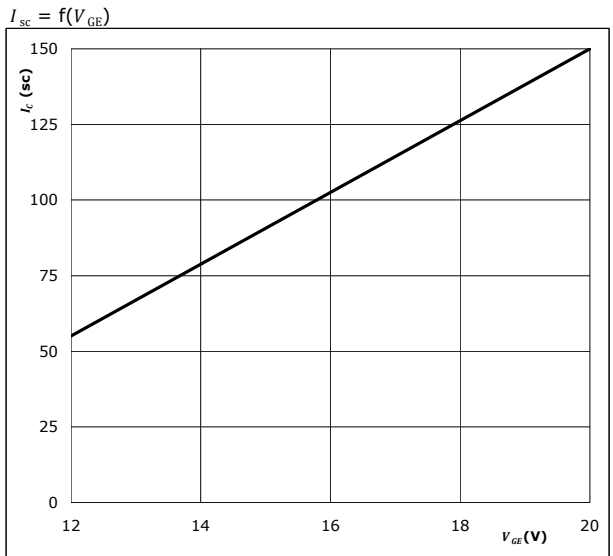
At
 $I_C =$ 15 A

Figure 27 Inverter IGBT
Short circuit withstand time as a function of gate-emitter voltage



At
 $V_{CE} =$ 1200 V
 $T_j \leq$ 175 °C

Figure 28 Inverter IGBT
Typical short circuit collector current as a function of gate-emitter voltage

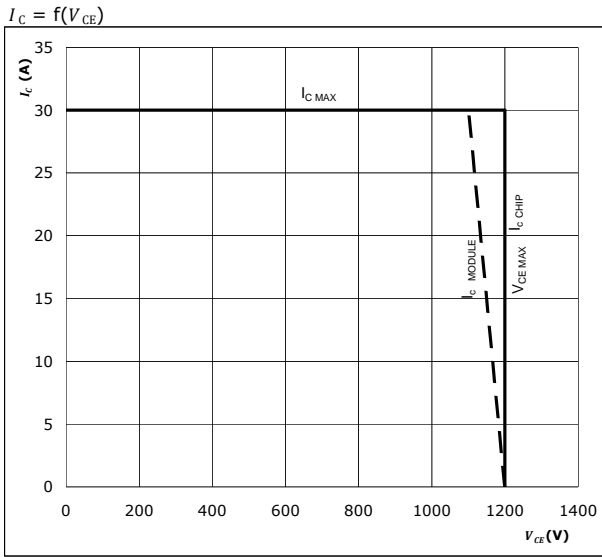


At
 $V_{CE} \leq$ 1200 V
 $T_j =$ 175 °C



Inverter Characteristics

Figure 29 Inverter IGBT
Reverse bias safe operating area



At

$$T_j = T_{j\ max} - 25 \text{ } ^\circ\text{C}$$

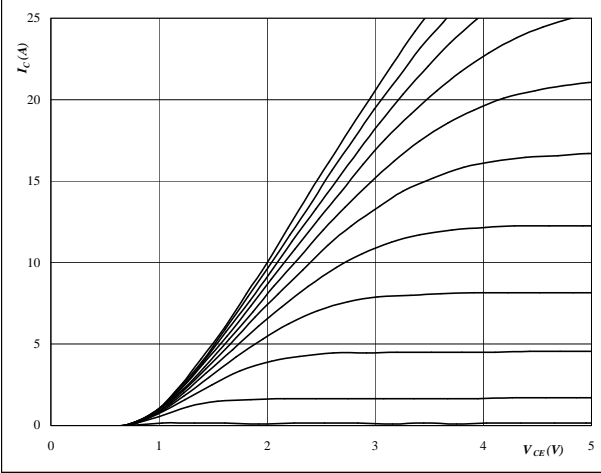


Brake Characteristics

Figure 1 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



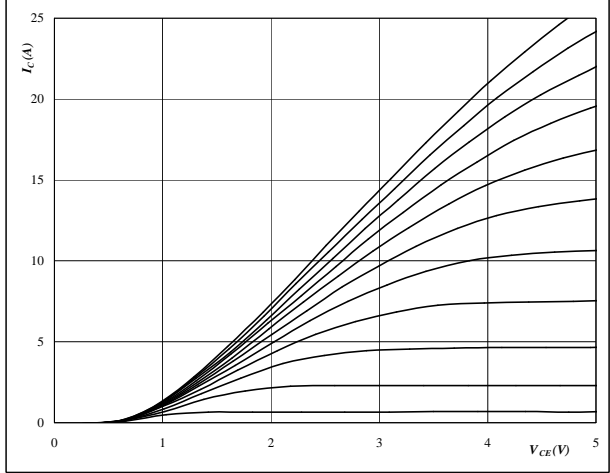
At

$t_p = 250 \mu s$
 $T_j = 25 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 2 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



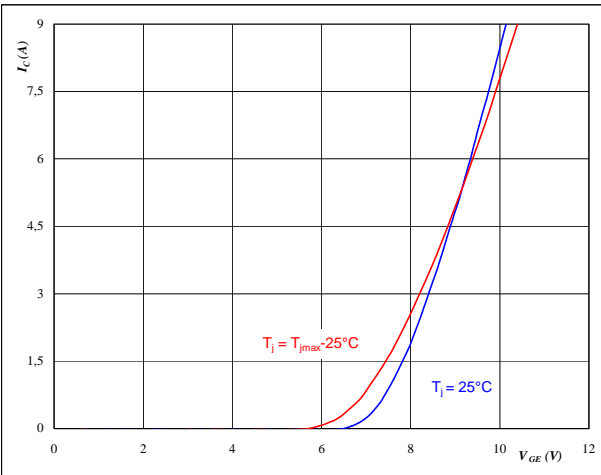
At

$t_p = 250 \mu s$
 $T_j = 125 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 Brake IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



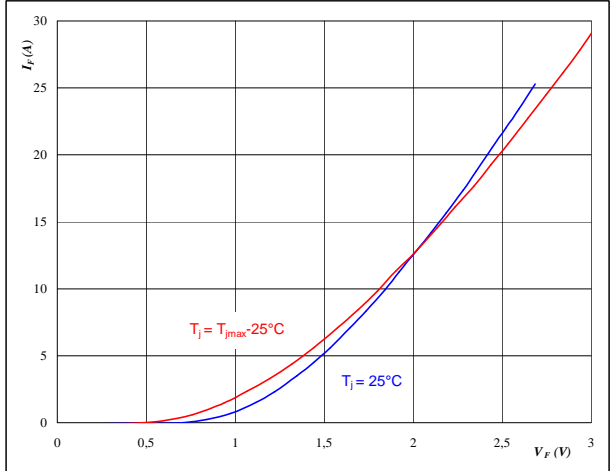
At

$t_p = 250 \mu s$
 $V_{CE} = 10 V$

Figure 4 Brake FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

$t_p = 250 \mu s$

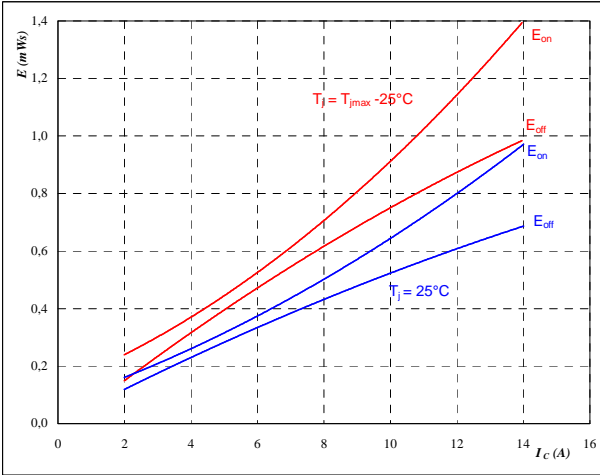


Brake Characteristics

Figure 5 Brake IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



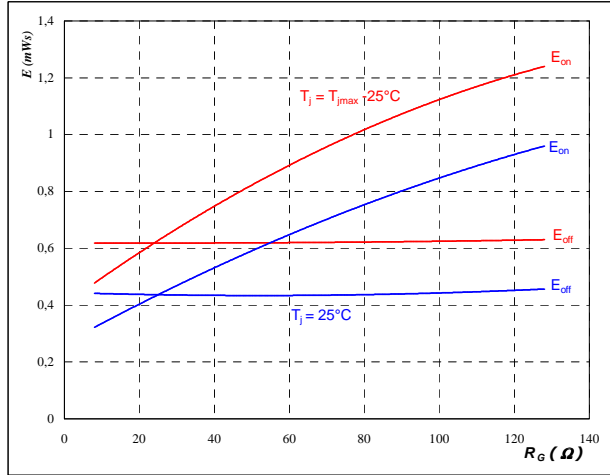
With an inductive load at

- $T_j = 25/125$ °C
- $V_{CE} = 600$ V
- $V_{GE} = \pm 15$ V
- $R_{gon} = 32$ Ω
- $R_{goff} = 32$ Ω

Figure 6 Brake IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



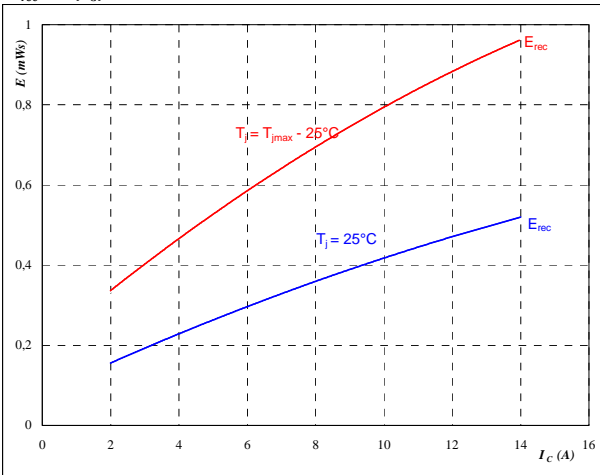
With an inductive load at

- $T_j = 25/125$ °C
- $V_{CE} = 600$ V
- $V_{GE} = \pm 15$ V
- $I_C = 8$ A

Figure 7 Brake FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



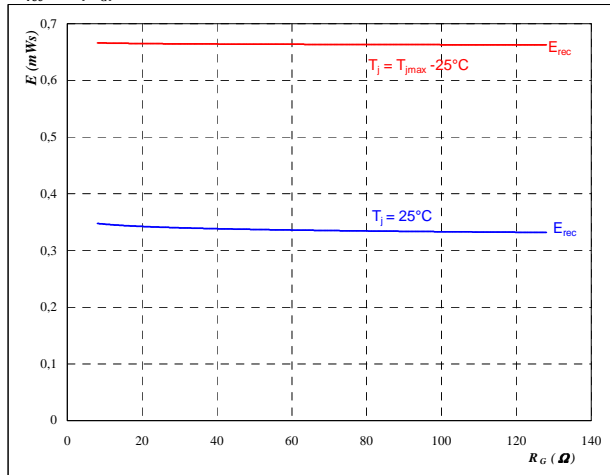
With an inductive load at

- $T_j = 25/125$ °C
- $V_{CE} = 600$ V
- $V_{GE} = \pm 15$ V
- $R_{gon} = 32$ Ω

Figure 8 Brake FWD

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

- $T_j = 25/125$ °C
- $V_{CE} = 600$ V
- $V_{GE} = \pm 15$ V
- $I_C = 8$ A

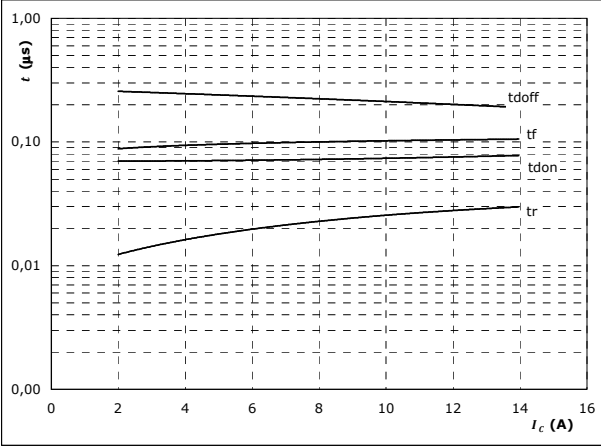


Brake Characteristics

Figure 9 Brake IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



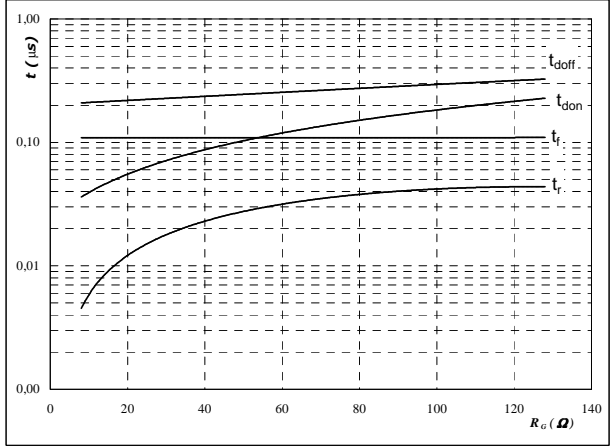
With an inductive load at

- $T_j = 125 \text{ } ^\circ\text{C}$
- $V_{CE} = 600 \text{ V}$
- $V_{GE} = \pm 15 \text{ V}$
- $R_{gon} = 32 \text{ } \Omega$
- $R_{goff} = 32 \text{ } \Omega$

Figure 10 Brake IGBT

Typical switching times as a function of gate resistor

$$t = f(R_G)$$



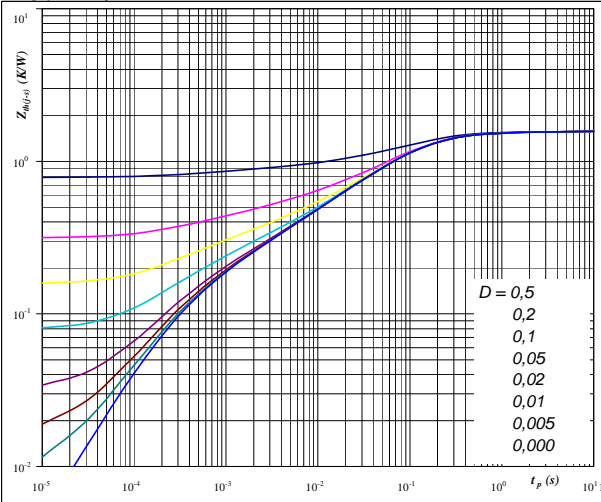
With an inductive load at

- $T_j = 125 \text{ } ^\circ\text{C}$
- $V_{CE} = 600 \text{ V}$
- $V_{GE} = \pm 15 \text{ V}$
- $I_C = 8 \text{ A}$

Figure 11 Brake IGBT

IGBT transient thermal impedance as a function of pulse width

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



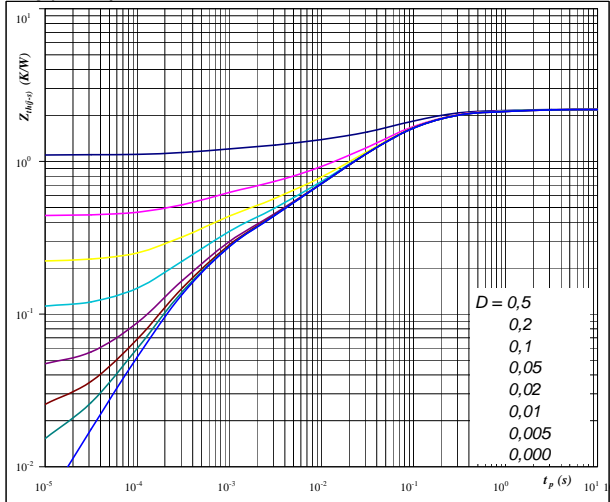
At $D = t_p / T$

$$R_{th(j-s)} = 1,57 \text{ K/W}$$

Figure 12 Brake FWD

FWD transient thermal impedance as a function of pulse width

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



At $D = t_p / T$

$$R_{th(j-s)} = 2,20 \text{ K/W}$$

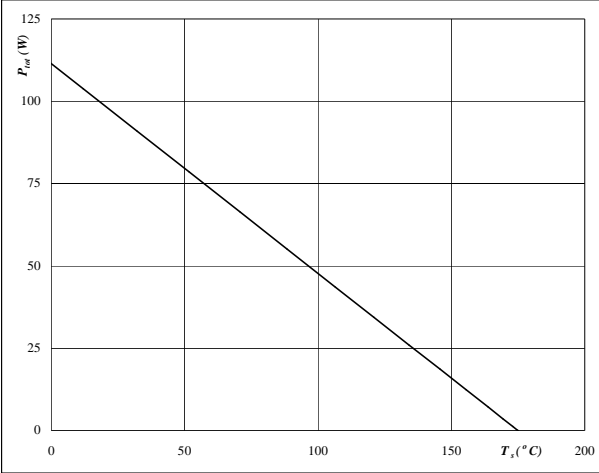


Brake Characteristics

Figure 13 Brake IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$

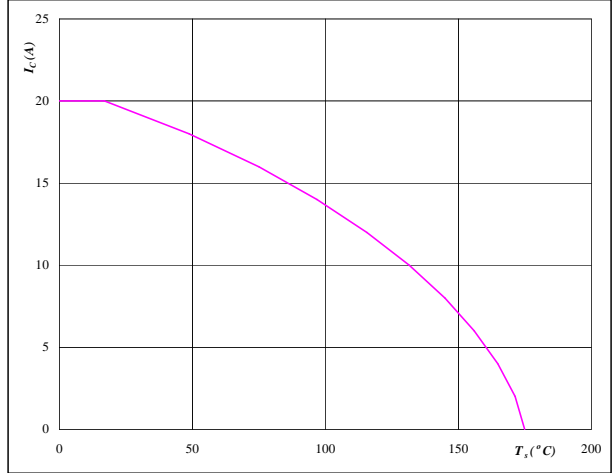


At
 $T_j = 175$ °C

Figure 14 Brake IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$

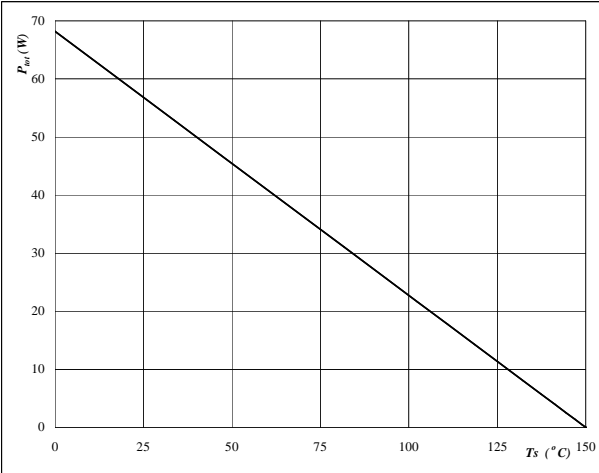


At
 $T_j = 175$ °C
 $V_{GE} = 15$ V

Figure 15 Brake FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$

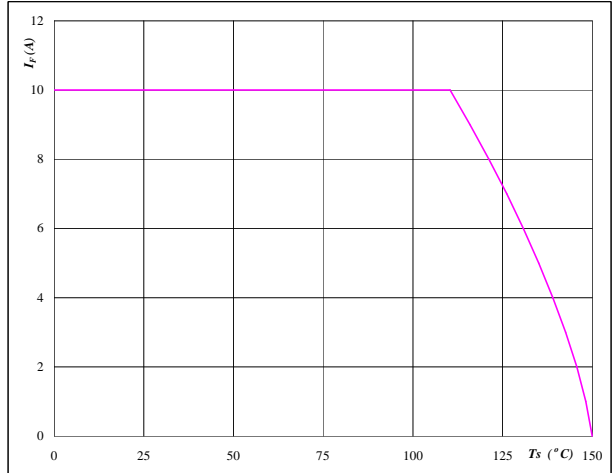


At
 $T_j = 150$ °C

Figure 16 Brake FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At
 $T_j = 150$ °C

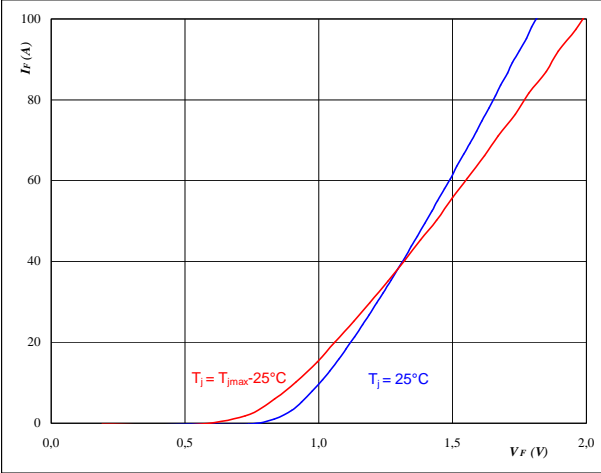


Rectifier Diode

Figure 1 Rectifier Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$

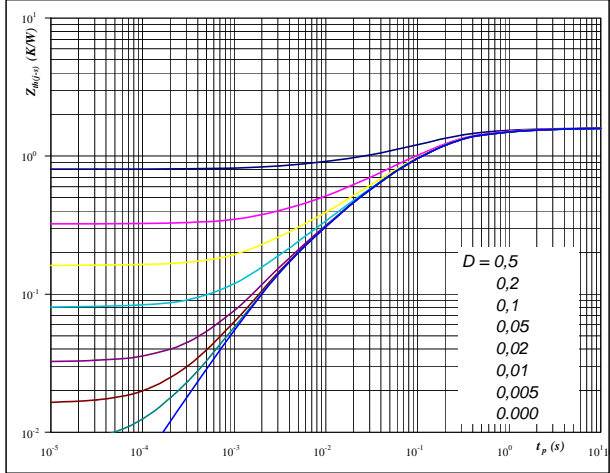


At
 $t_p = 250 \mu s$

Figure 2 Rectifier Diode

Diode transient thermal impedance as a function of pulse width

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



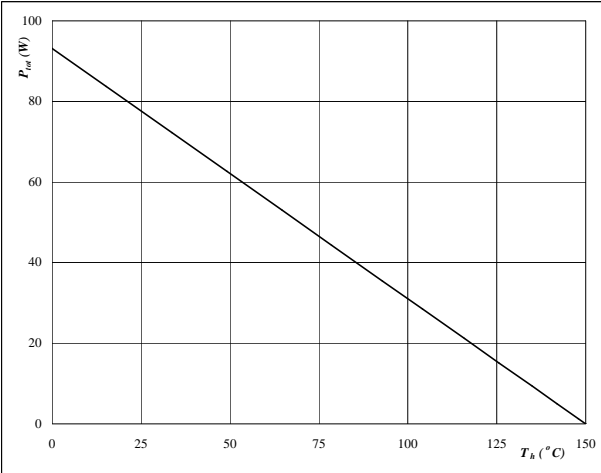
At
 $D = t_p / T$

$D = t_p / T$
 $R_{th(j-s)} = 1,61 \text{ K/W}$

Figure 3 Rectifier Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

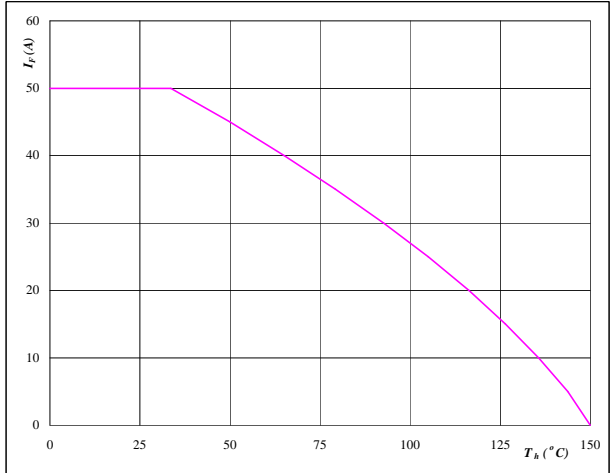


At
 $T_j = 150 \text{ °C}$

Figure 4 Rectifier Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At
 $T_j = 150 \text{ °C}$

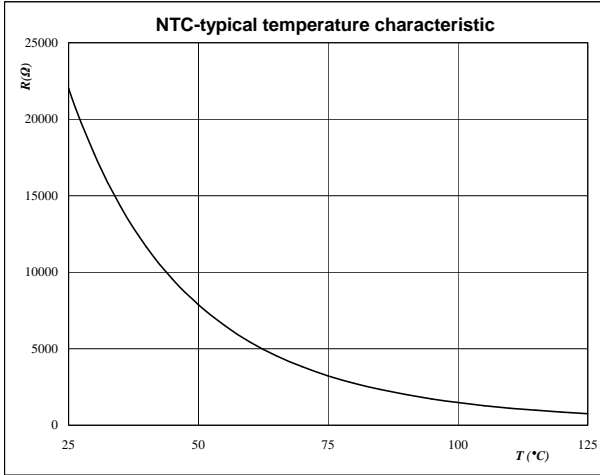


Thermistor

Figure 1 Thermistor

**Typical NTC characteristic
as a function of temperature**

$$R_T = f(T)$$





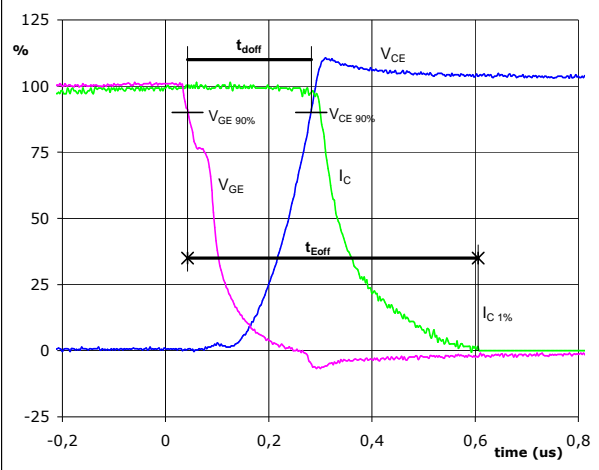
Inverter Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

Figure 1 Inverter IGBT

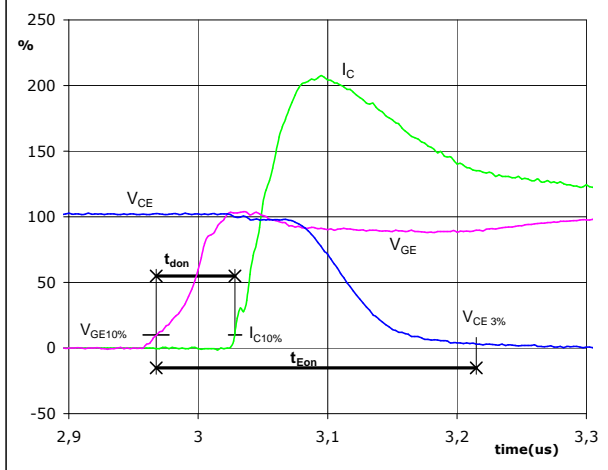
Turn-off Switching Waveforms & definition of t_{doff} t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{doff} =	0,24	μs
t_{Eoff} =	0,56	μs

Figure 2 Inverter IGBT

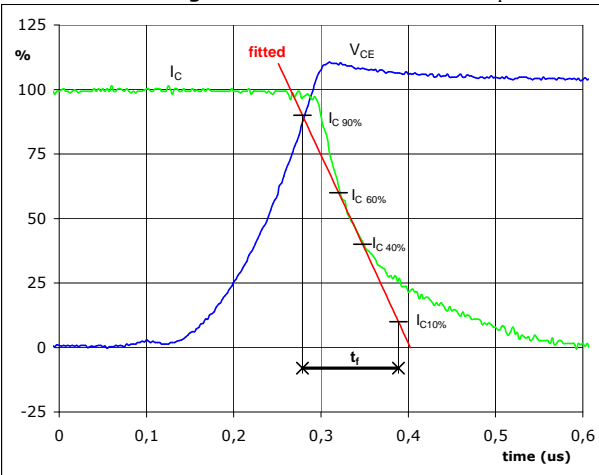
Turn-on Switching Waveforms & definition of t_{donr} t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{don} =	0,06	μs
t_{Eon} =	0,25	μs

Figure 3 Inverter IGBT

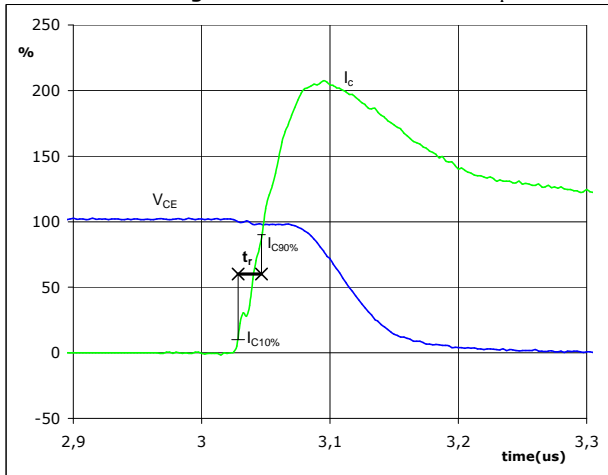
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	15	A
t_f =	0,11	μs

Figure 4 Inverter IGBT

Turn-on Switching Waveforms & definition of t_r

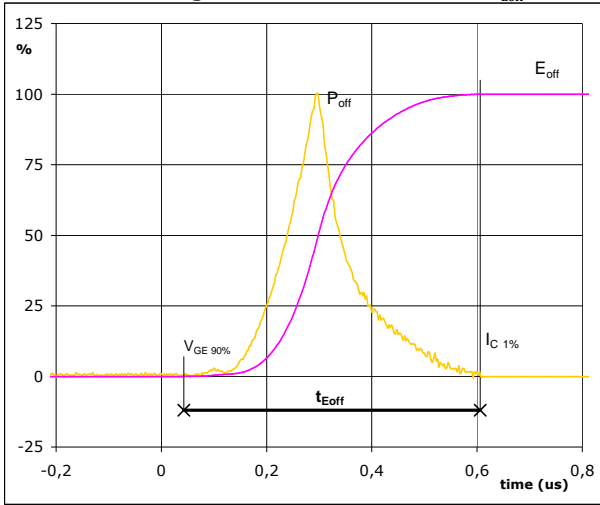


V_C (100%) =	600	V
I_C (100%) =	15	A
t_r =	0,02	μs



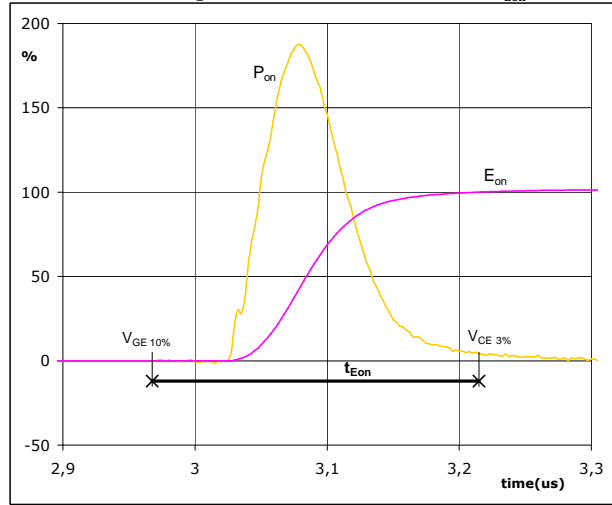
Inverter Switching Definitions

Figure 5 Inverter IGBT
Turn-off Switching Waveforms & definition of t_{Eoff}



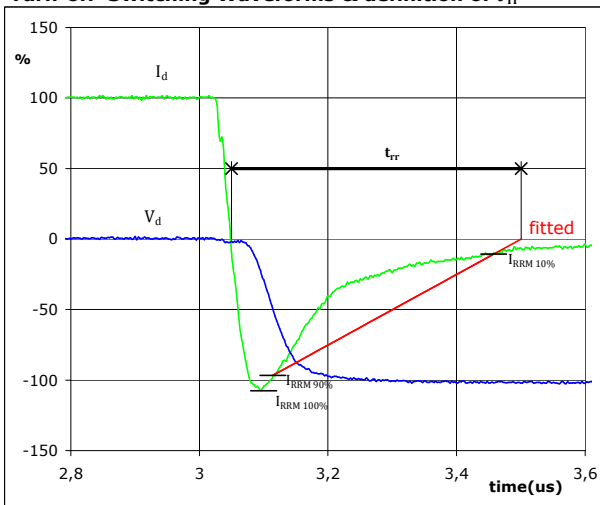
$P_{off} (100\%) = 9,00 \text{ kW}$
 $E_{off} (100\%) = 1,24 \text{ mJ}$
 $t_{Eoff} = 0,56 \text{ } \mu\text{s}$

Figure 6 Inverter IGBT
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on} (100\%) = 9,00 \text{ kW}$
 $E_{on} (100\%) = 1,25 \text{ mJ}$
 $t_{Eon} = 0,25 \text{ } \mu\text{s}$

Figure 7 Inverter FWD
Turn-off Switching Waveforms & definition of t_{rr}

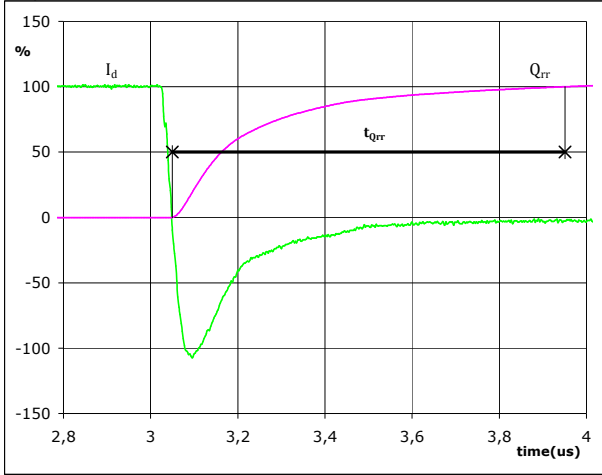


$V_d (100\%) = 600 \text{ V}$
 $I_d (100\%) = 15 \text{ A}$
 $I_{RRM} (100\%) = -16 \text{ A}$
 $t_{rr} = 0,43 \text{ } \mu\text{s}$



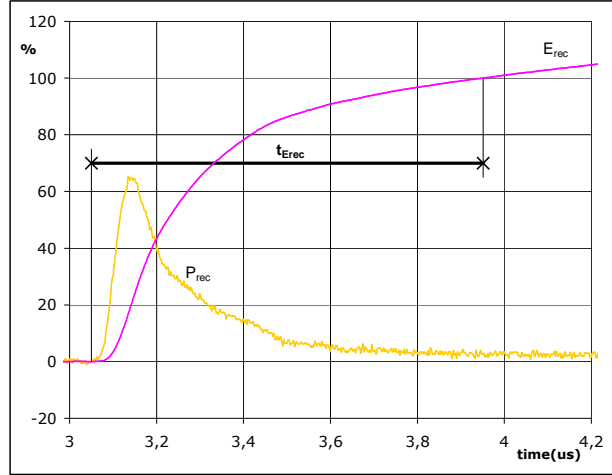
Inverter Switching Definitions

Figure 8 Inverter FWD
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_D (100%) =	15	A
Q_{rr} (100%) =	2,75	μC
t_{Qrr} =	0,90	μs

Figure 9 Inverter FWD
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec} = integrating time for E_{rec})



P_{rec} (100%) =	9,00	kW
E_{rec} (100%) =	1,16	mJ
t_{Erec} =	0,90	μs



Ordering Code and Marking - Outline - Pinout

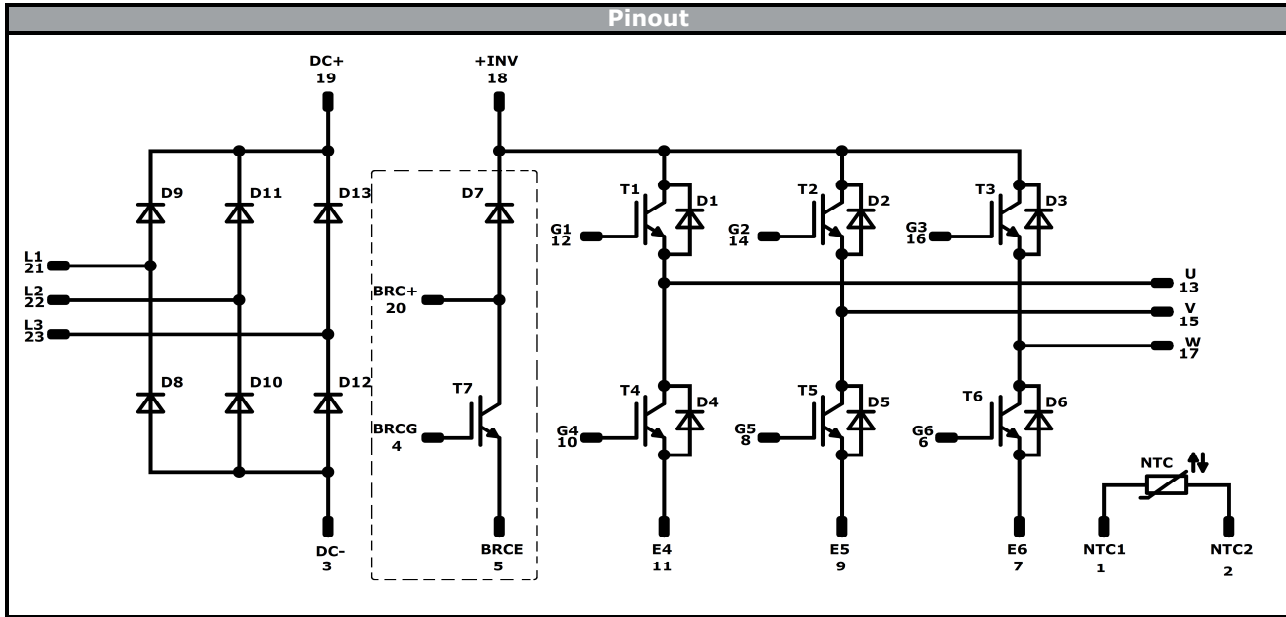
Ordering Code & Marking						
Version			Ordering Code			
with brake without thermal paste 12mm housing			V23990-P840-A48-PM			
without brake without thermal paste 12mm housing			V23990-P840-C48-PM			
with brake without thermal pastee 17mm housing			V23990-P840-A49-PM			
without brake without thermal paste 17mm housing			V23990-P840-C49-PM			
	Text	Name	Date code	UL & VIN	Lot	Serial
		NNNNNNNNVVV	WWYY	UL VIN	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Pin table				Outline		Pinout variation	
Pin	X	Y	Function			Modul subtype	Not assembled pins
1	25,5	2,7	NTC1			P840-A4*	-
2	25,5	0	NTC2			P840-C4*	4,5,20
3	22,8	0	-DC				
4	20,1	0	BRCG				
5	16,2	0	BRCE				
6	13,5	0	G6				
7	10,8	0	E6				
8	8,1	0	G5				
9	5,4	0	E5				
10	2,7	0	G4				
11	0	0	E4				
12	0	19,8	G1				
13	0	22,5	U				
14	7,5	19,8	G2				
15	7,5	22,5	V				
16	15	19,8	G3				
17	15	22,5	W				
18	22,8	22,5	+INV				
19	25,5	22,5	+DC				
20	33,5	22,5	BRC+				
21	33,5	15	L1				
22	33,5	7,5	L2				
23	33,5	0	L3				

Tolerance of pinpositions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance



Ordering Code and Marking - Outline - Pinout



Identification						
ID	Component	Voltage	Current	Function	Comment	
T1, T2, T3, T4, T5, T6	IGBT	1200 V	15 A	Inverter Switch		
D1, D2, D3, D4, D5, D6	FWD	1200 V	15 A	Inverter Diode		
T7	IGBT	1200 V	8 A	Brake Switch		
D7	FWD	1200 V	7,5 A	Brake Diode		
D8, D9, D10, D11, D12, D13	Diode	1600 V	25 A	Rectifier		
NTC	NTC			Thermistor		



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

Handling instruction
Handling instructions for <i>flow</i> 0 packages see vincotech.com website.

Package data
Package data for <i>flow</i> 0 packages see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P840-*4*-PM-D7-14	19 Mar. 2016	New style, NTC changed	All

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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