Vincotech

V23990-P589-*4*-PM
datasheet

flow PIM 1 — 1200 V / 25 A

Features

- 3~rectifier, optional BRC, Inverter, NTC
- Very compact housing, easy to route
- IGBT4 / EmCon4 technology for low saturation losses and improved EMC behaviour

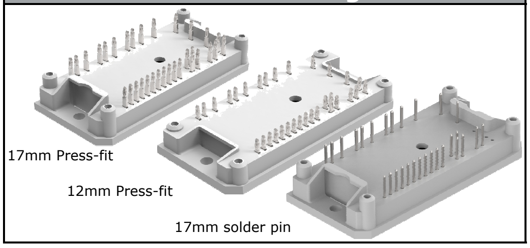
Target Applications

- Industrial drives
- Embedded Drives

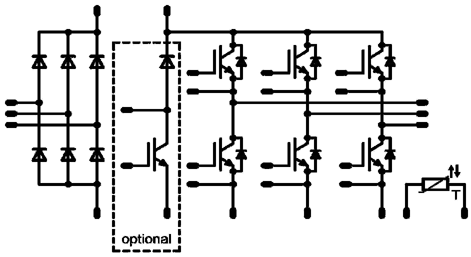
Types

- V23990-P589-A41-PM
- V23990-P589-A41Y-PM
- V23990-P589-A418-PM
- V23990-P589-A418Y-PM
- V23990-P589-C41-PM
- V23990-P589-C418-PM

flow 1 housing



Schematic



Maximum Ratings

T_j = 25 °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 °C	42	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms half sine wave T_j=150°C	280	A
I^2t-value	I^2t	t_p = 10 ms half sine wave T_j=150°C	390	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	68	W
Maximum Junction Temperature	T_{jmax}		150	°C
Inverter Switch				
Collector-emitter breakdown voltage	V_{CE}		1200	V
DC collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	32	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	75	A
Turn off safe operating area		V_{CE} ≤ 1200V, T_j ≤ T_{op} max	50	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	94	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V	10 800	μs V
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	34	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		50	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	87	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter breakdown voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	21	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		45	A
Turn off safe operating area		V_{CE} ≤ 1200V, $T_j \le T_{op}$ max		50	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	71	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		10 800	μs V
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	14	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		20	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	46	W
Maximum Junction Temperature	T_{jmax}			175	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{is}	t = 2 s	DC Test Voltage	4000	V
Creepage distance				min 12,7	mm
Clearance			12mm housing	8,06	mm
			17mm housing	min 12,7	mm
Comparative tracking index	CTI			>200	

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Rectifier Diode										
Forward voltage	V_F				30	25 125	0,8	1,16 1,13	1,6	V
Threshold voltage (for power loss calc. only)	V_{to}				30	25 125		0,90 0,78		V
Slope resistance (for power loss calc. only)	r_t				30	25 125		8 11		mΩ
Reverse current	I_r			1600		25 150			0,002 2,0	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,03		K/W
Inverter Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00085	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125	1,58	1,94 2,40	2,07	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		25			0,0024	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 Ω R_{gon} = 32 Ω	±15	600	25	25 125		126 126		ns
Rise time	t_r					25 125		21 28		
Turn-off delay time	$t_{d(off)}$					25 125		220 284		
Fall time	t_f					25 125		74 100		
Turn-on energy loss	E_{on}					25 125		1,64 2,53		mWs
Turn-off energy loss	E_{off}					25 125		1,38 2,17		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1430		pF
Output capacitance	C_{oss}							115		
Reverse transfer capacitance	C_{rss}							85		
Gate charge	Q_G		±15			25		200		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,01		K/W
Inverter Diode										
Diode forward voltage	V_F				25	25 125	1,35	1,97 1,94	2,05	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 32 Ω	±15	600	25	25 125		32 34		A
Reverse recovery time	t_{rr}					25 125		265 436		ns
Reverse recovered charge	Q_{rr}					25 125		2,50 4,81		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1722 580		A/µs
Reverse recovered energy	E_{rec}					25 125		0,98 1,94		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,09		K/W

Characteristic Values

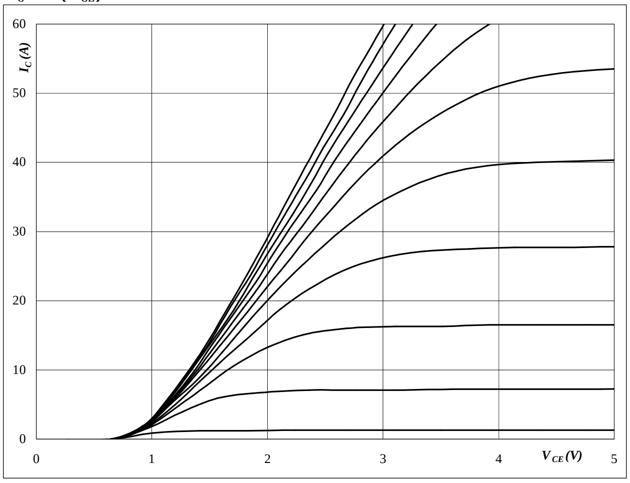
Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Brake Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00085	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125	1,58	1,88 2,30	2,07	V
Collector-emitter cut-off 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} = 32 Ω R_{gon} = 32 Ω	±15	600	15	25 125		87 88		ns
Rise time	t_r					25 125		24 29		
Turn-off delay time	$t_{d(off)}$					25 125		194 258		
Fall time	t_f					25 125		77 111		
Turn-on energy loss	E_{on}					25 125		0,950 1,381		mWs
Turn-off energy loss	E_{off}					25 125		0,824 1,273		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		890		pF
Output capacitance	C_{oss}							80		
Reverse transfer capacitance	C_{rss}							30		
Gate charge	Q_G		15			25		120		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,35		K/W
Brake Diode										
Diode forward voltage	V_F				10	25 125	1,35	1,85 1,76	2,05	V
Reverse leakage current	I_r			1200		25			2,7	μA
Peak reverse recovery current	I_{RRM}	R_{gon} = 32 Ω	±15	600	15	25 125		10 12		A
Reverse recovery time	t_{rr}					25 125		324 538		ns
Reverse recovered charge	Q_{rr}					25 125		1,38 1,38		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		46 44		A/μs
Reverse recovery energy	E_{rec}					25 125		0,581 1,081		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,07		K/W
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$					100	-5		5	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3996		K
Vincotech NTC Reference									B	

Inverter Charateristics

Figure 1	Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



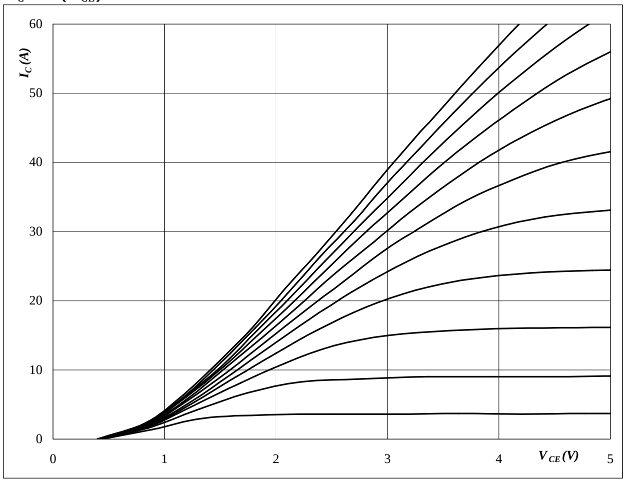
At

t_p =	250	μs
T_j =	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2	Inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



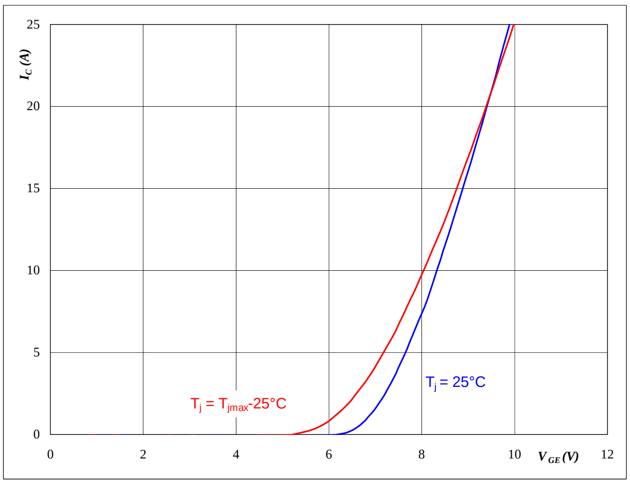
At

t_p =	250	μs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3	Inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



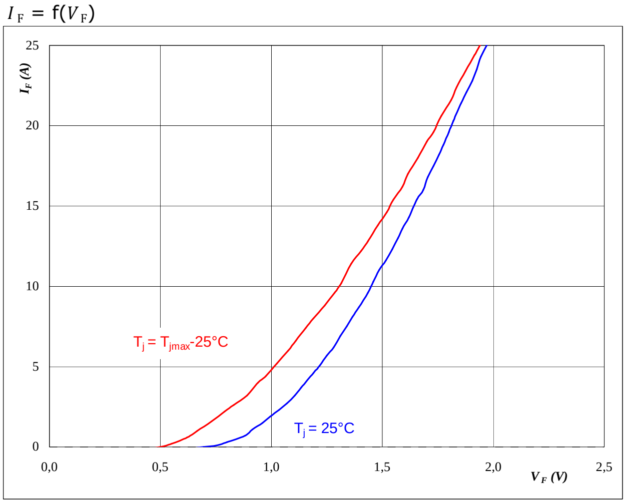
At

t_p =	250	μs
V_{CE} =	10	V

Figure 4	Inverter FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

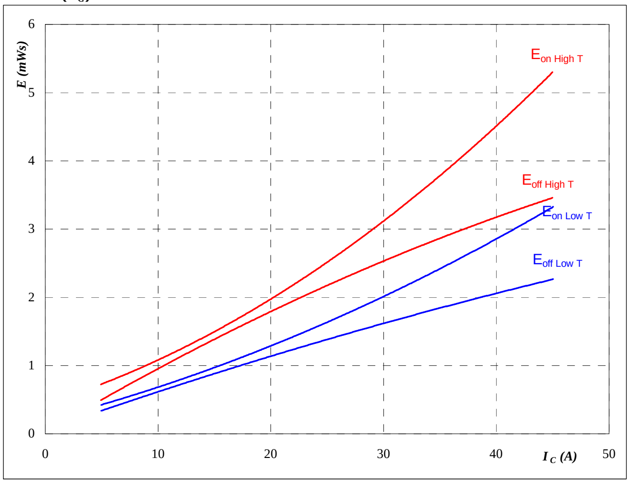
t_p =	250	μs

Inverter Charateristics

Figure 5	Inverter IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



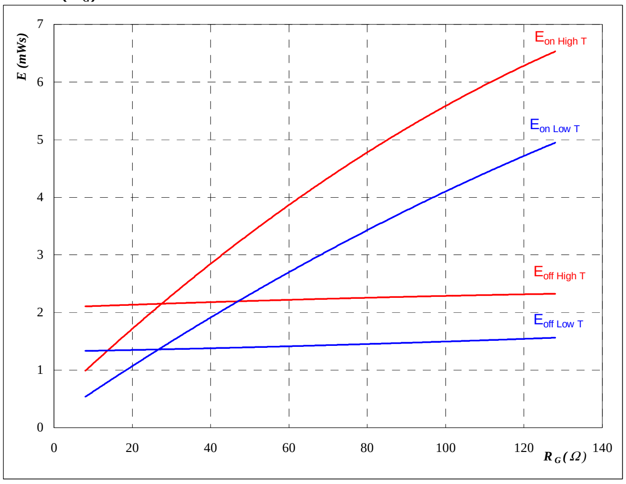
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Figure 6	Inverter IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



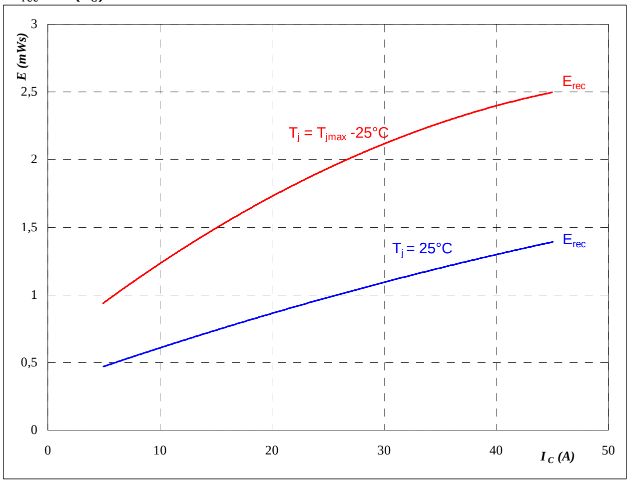
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	25	A

Figure 7	Inverter FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



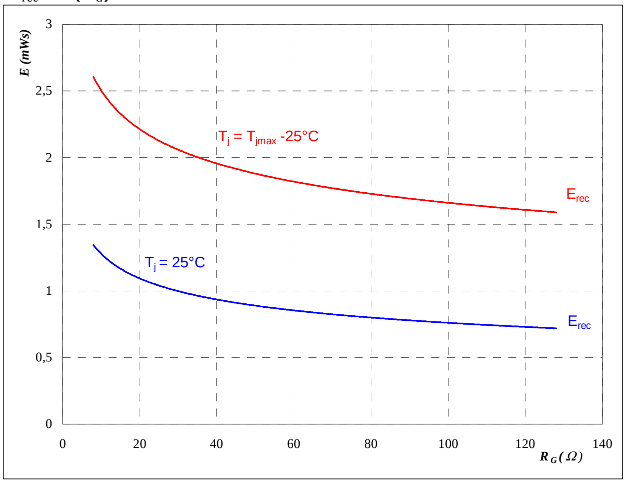
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	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

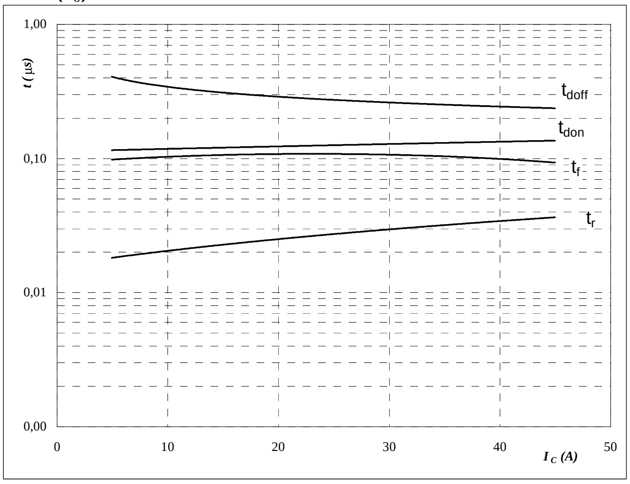
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	25	A

Inverter Charateristics

Figure 9 Inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



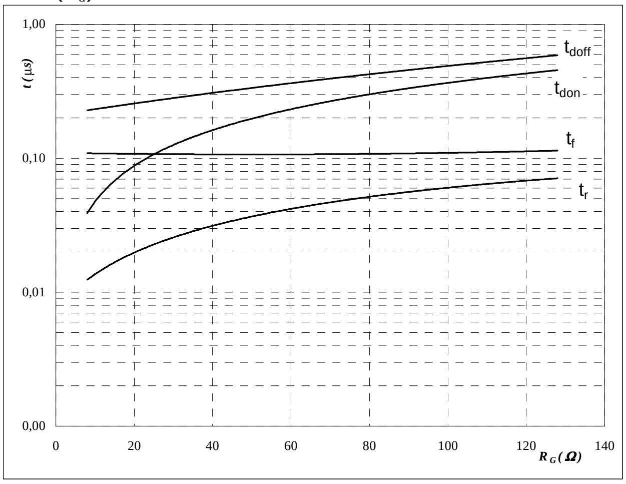
With an inductive load at

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

Figure 10 Inverter IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



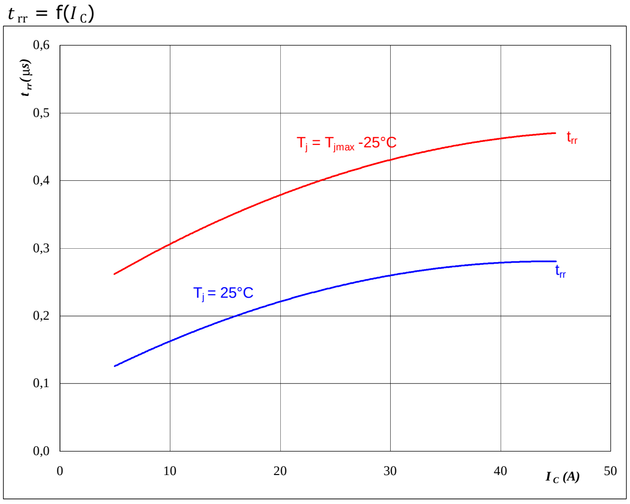
With an inductive load at

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

Figure 11 Inverter FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



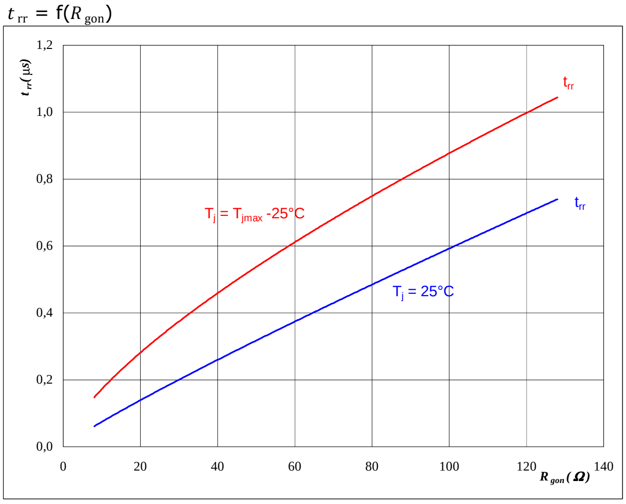
At

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

Figure 12 Inverter FWD

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

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



At

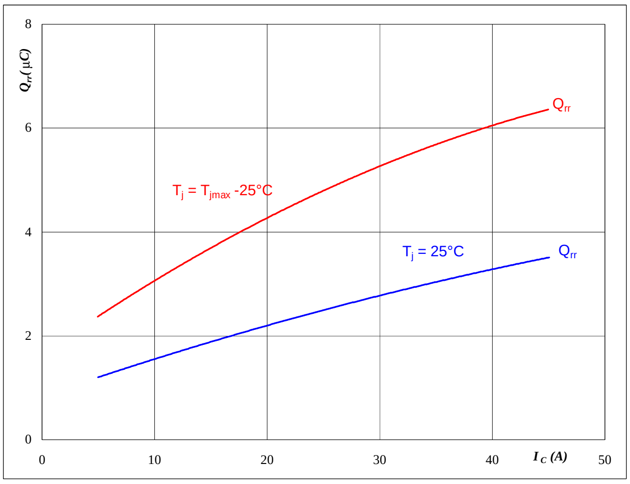
T_j =	25/150	°C
V_R =	600	V
I_F =	25	A
V_{GE} =	±15	V

Inverter Charateristics

Figure 13 Inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



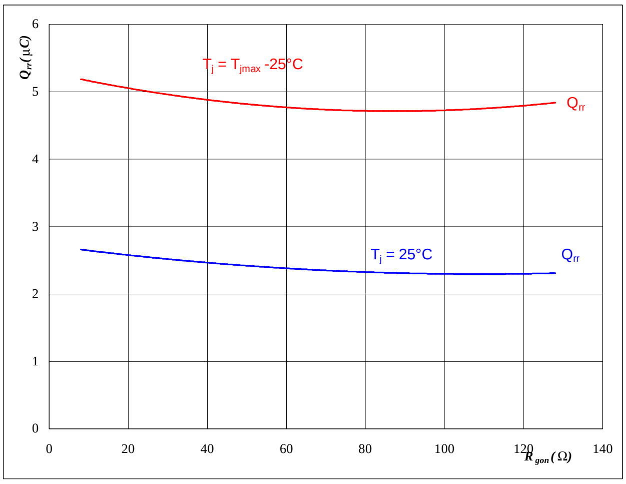
At

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

Figure 14 Inverter FWD

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

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



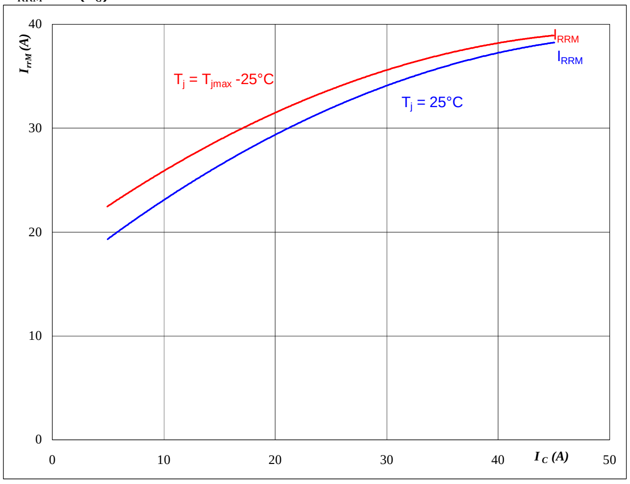
At

T_j =	25/150	°C
V_R =	600	V
I_F =	25	A
V_{GE} =	±15	V

Figure 15 Inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



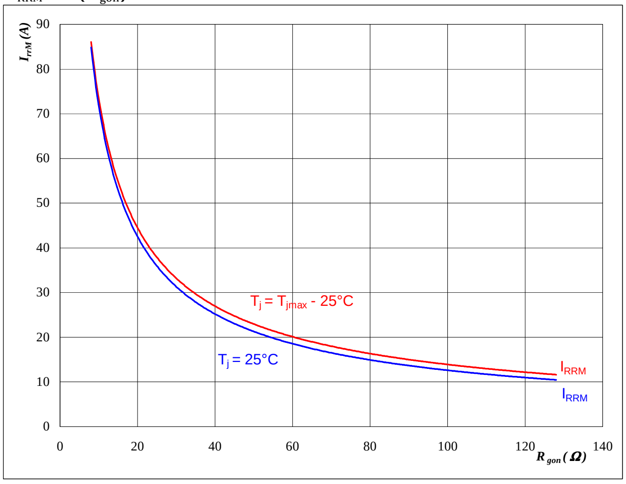
At

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

Figure 16 Inverter FWD

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

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



At

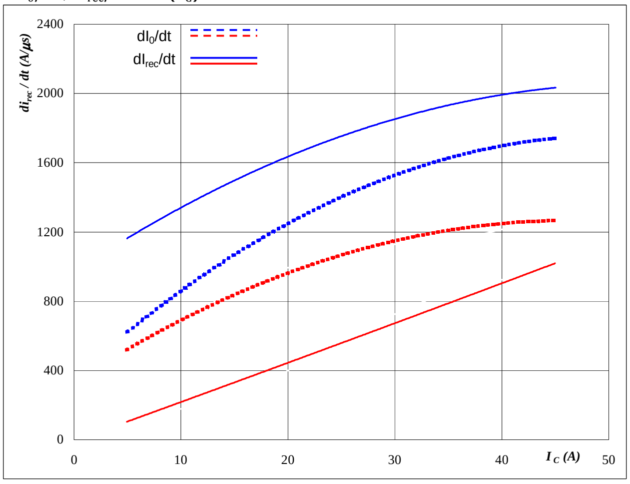
T_j =	25/150	°C
V_R =	600	V
I_F =	25	A
V_{GE} =	±15	V

Inverter Charateristics

Figure 17 Inverter FWD

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

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



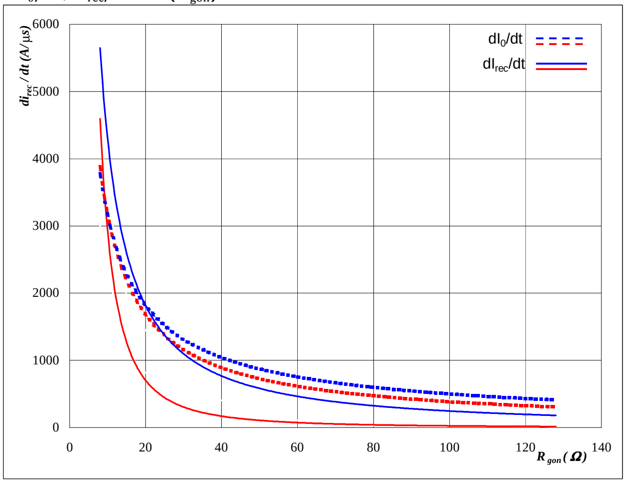
At

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

Figure 18 Inverter FWD

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

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



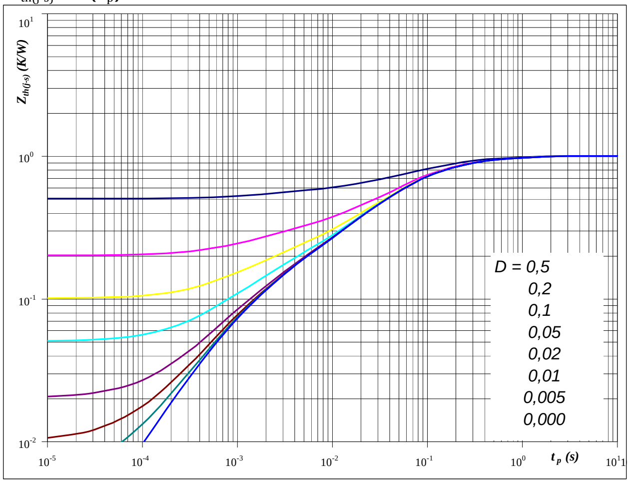
At

T_j =	25/150	°C
V_R =	600	V
I_F =	25	A
V_{GE} =	±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	
$R_{th(j-s)}$ =	1,01	K/W

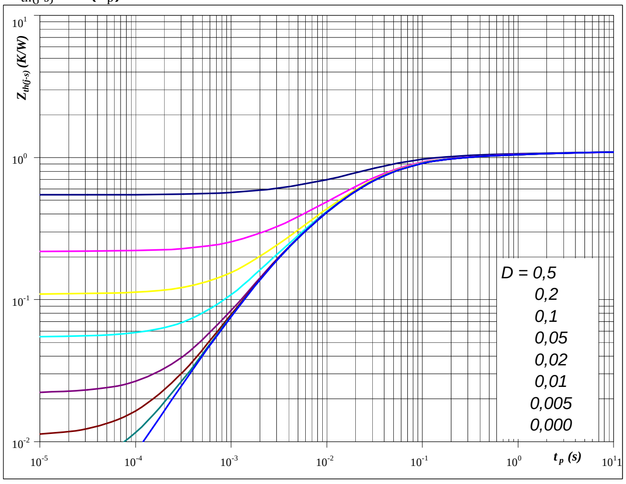
IGBT thermal model values

R (K/W)	Tau (s)
8,44E-02	1,03E+00
2,46E-01	1,79E-01
4,48E-01	5,38E-02
1,38E-01	1,04E-02
5,48E-02	1,66E-03
3,85E-02	8,73E-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	
$R_{th(j-s)}$ =	1,09	K/W

FWD thermal model values

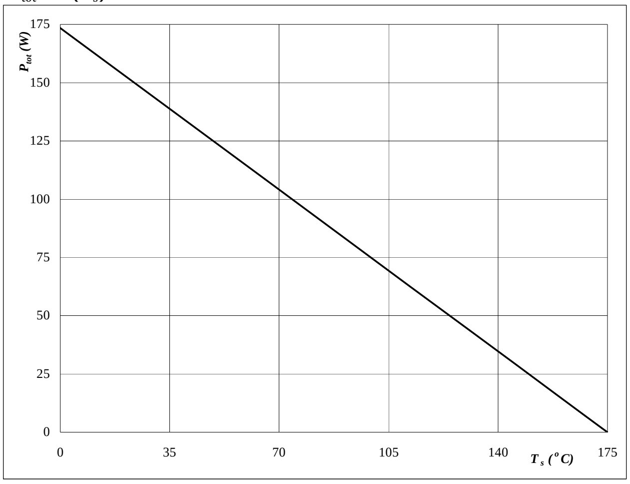
R (K/W)	Tau (s)
5,34E-02	2,93E+00
9,71E-02	3,59E-01
4,43E-01	4,79E-02
3,93E-01	1,21E-02
1,05E-01	2,46E-03

Inverter Charateristics

Figure 21 Inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



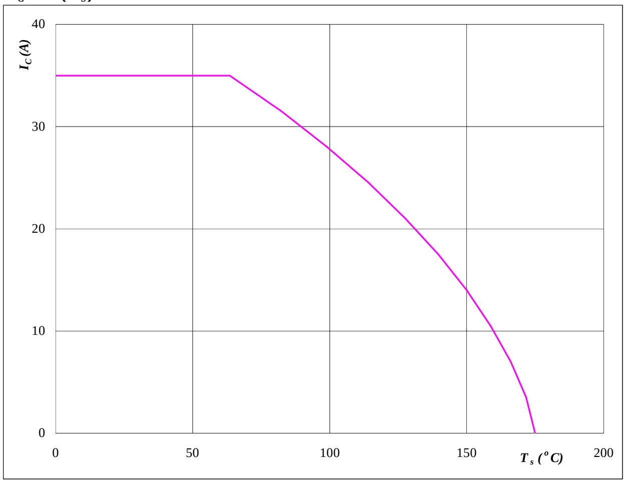
At

T_j = 175 °C

Figure 22 Inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

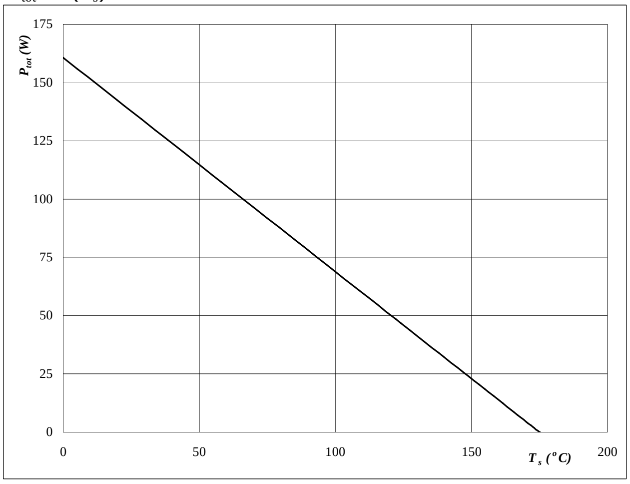
T_j = 175 °C

V_{GE} = 15 V

Figure 23 Inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



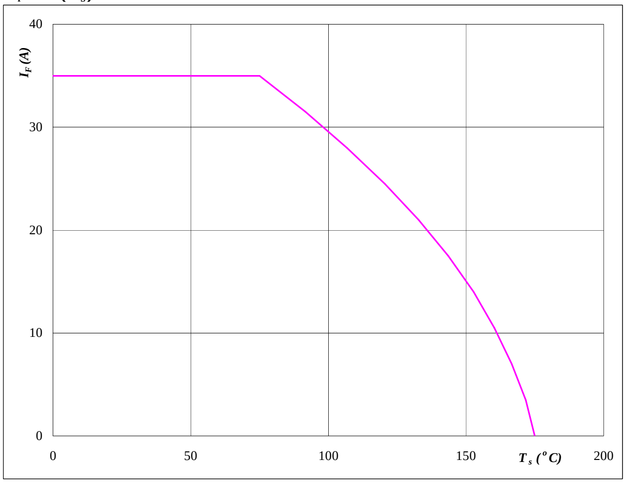
At

T_j = 175 °C

Figure 24 Inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

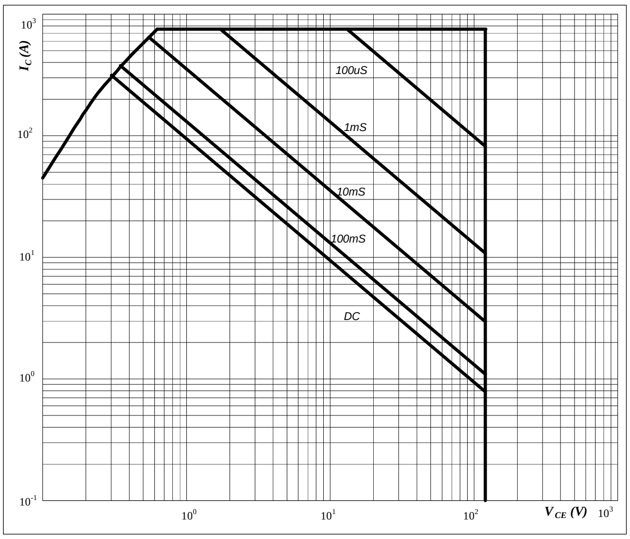
T_j = 175 °C

Inverter Charateristics

Figure 25 Inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



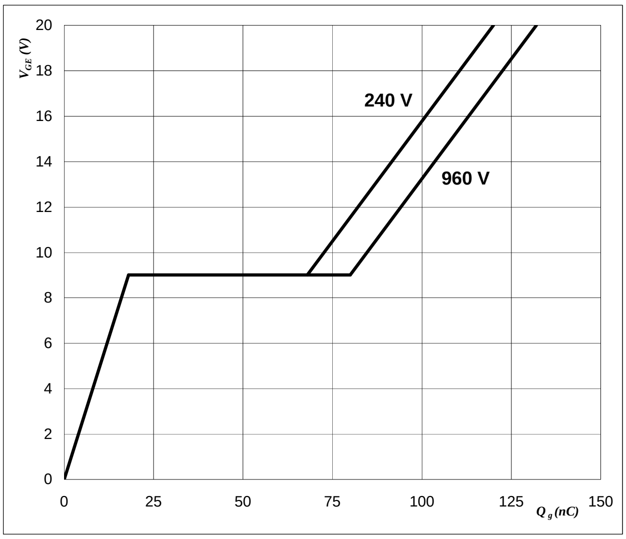
At

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

Figure 26 Inverter IGBT

Gate voltage vs Gate charge

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



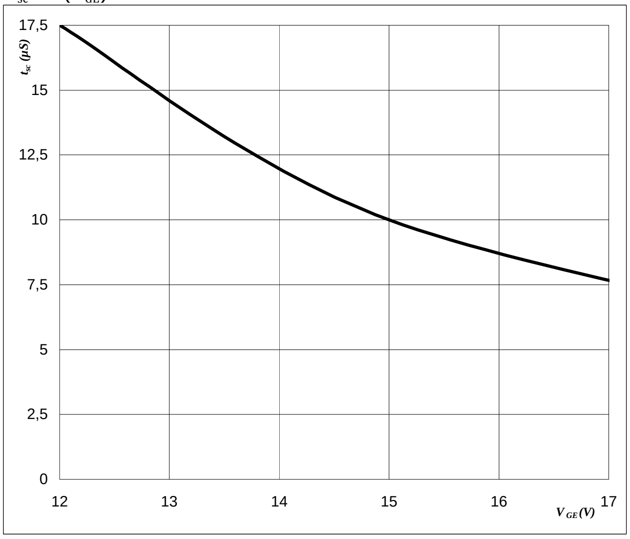
At

I_C =	25	A

Figure 27 Inverter IGBT

Short circuit withstand time as a function of gate-emitter voltage

$t_{sc} = f(V_{GE})$



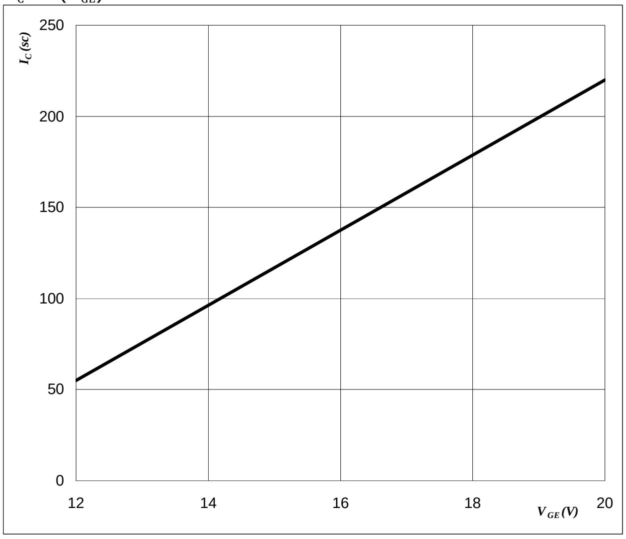
At

V_{CE} =	1200	V
T_j ≤	175	ºC

Figure 28 Inverter IGBT

Typical short circuit collector current as a function of gate-emitter voltage

$I_C = f(V_{GE})$



At

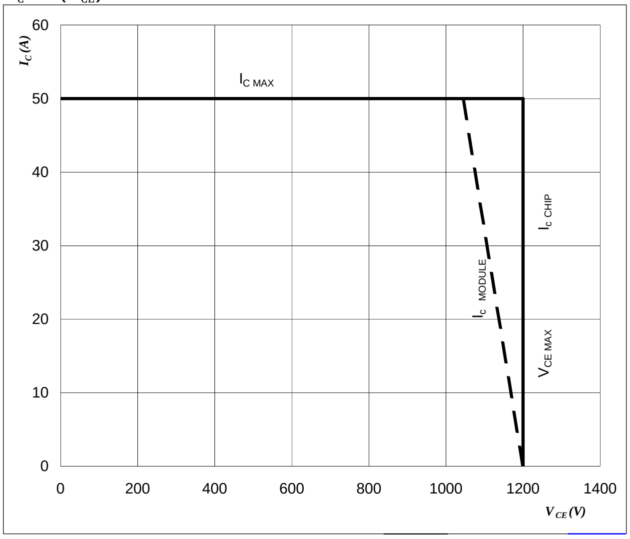
V_{CE} ≤	1200	V
T_j =	175	ºC

Inverter Charateristics

Figure 29	Inverter IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

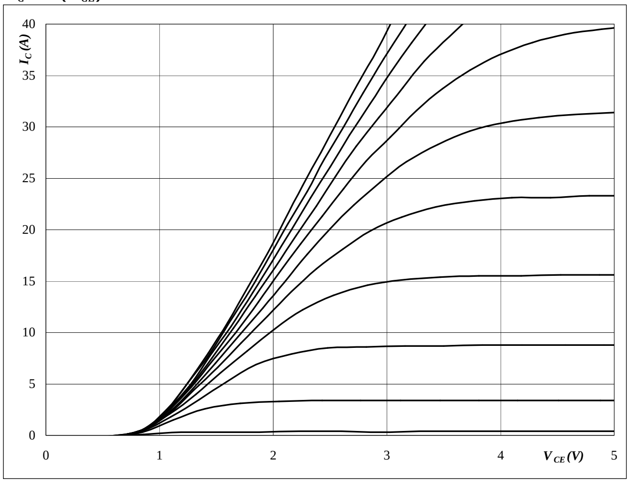
T_j = T_{jmax}-25 ºC

Brake Charateristics

Figure 1 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



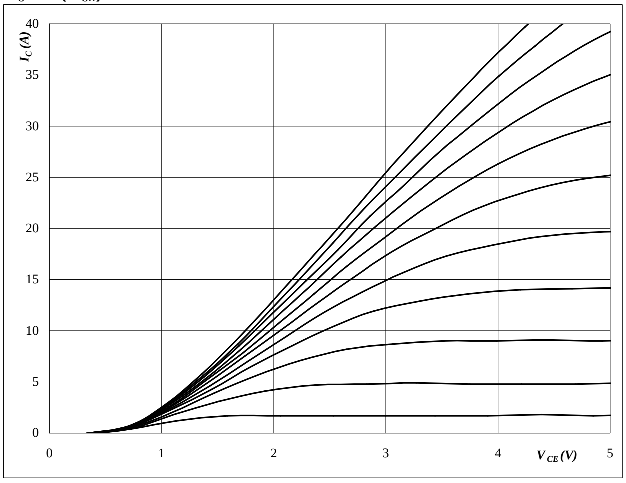
At

t_p =	250	μs
T_j =	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2 Brake IGBT

Typical output characteristics

$I_C = f(V_{CE})$



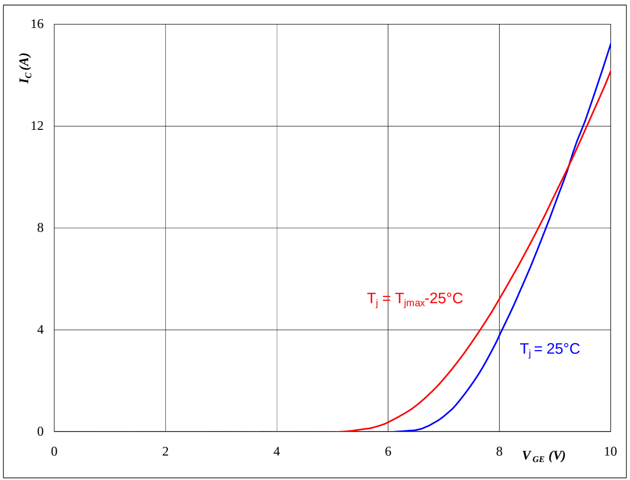
At

t_p =	250	μs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 Brake IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



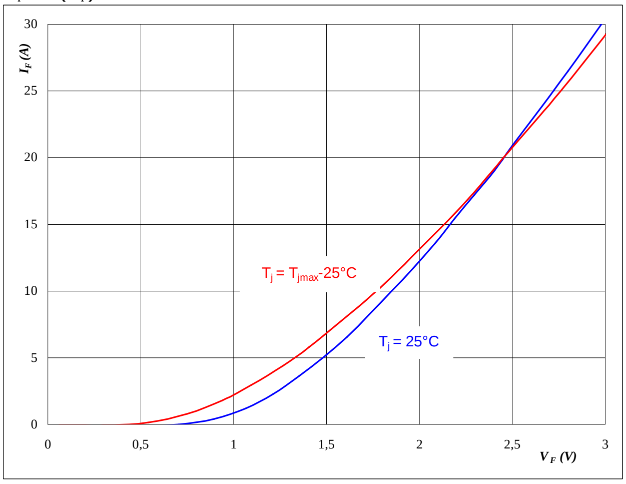
At

t_p =	250	μs
V_{CE} =	10	V

Figure 4 Brake FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

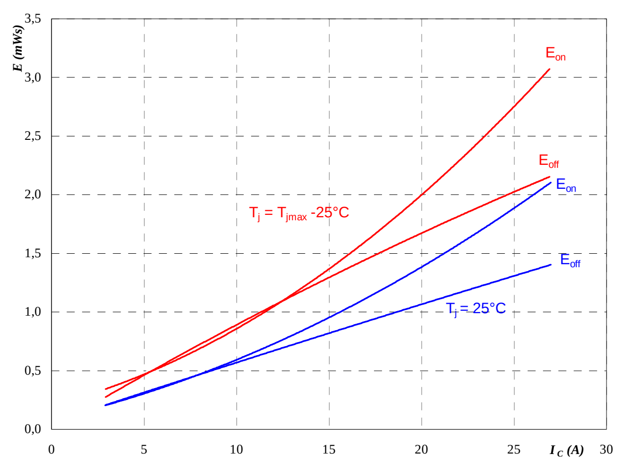
t_p =	250	μs

Brake Charateristics

Figure 5 Brake IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



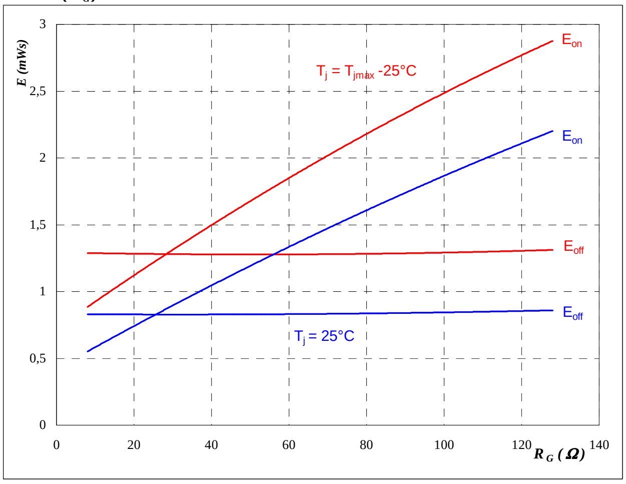
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Figure 6 Brake IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



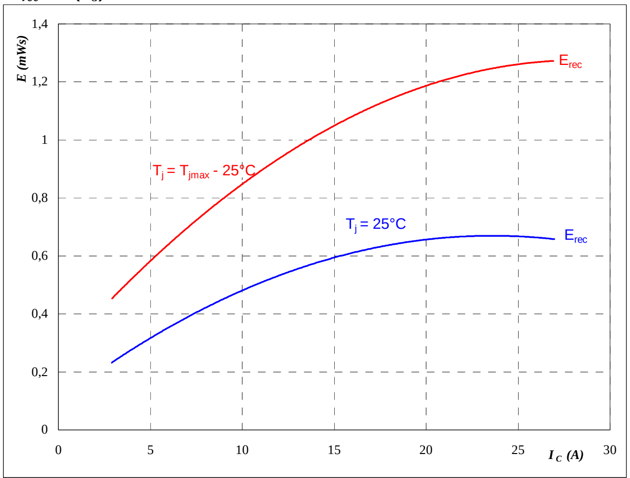
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

Figure 7 Brake FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



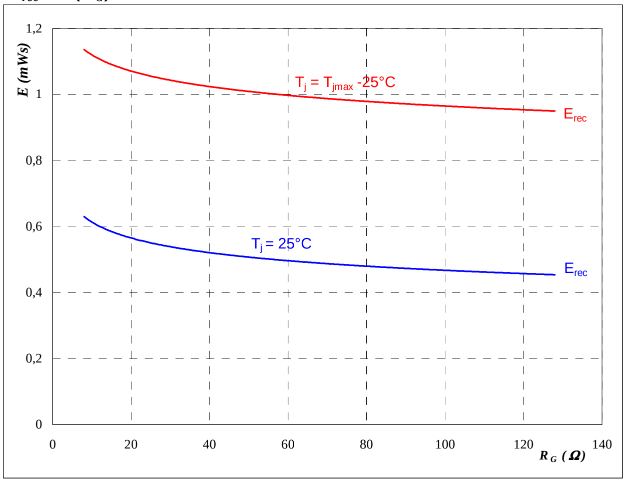
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±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

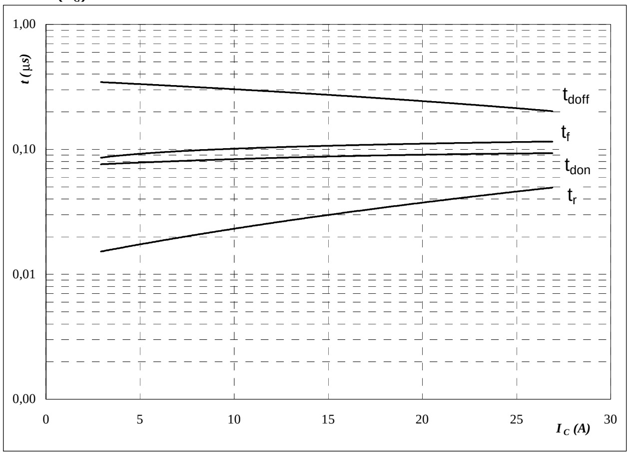
T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

Brake Charateristics

Figure 9 Brake IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



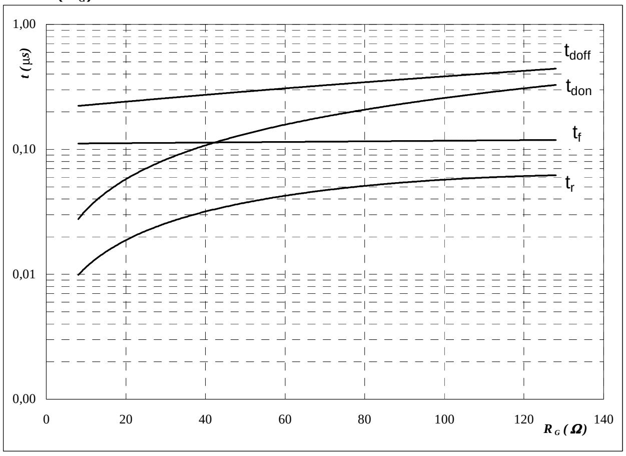
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Figure 10 Brake IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



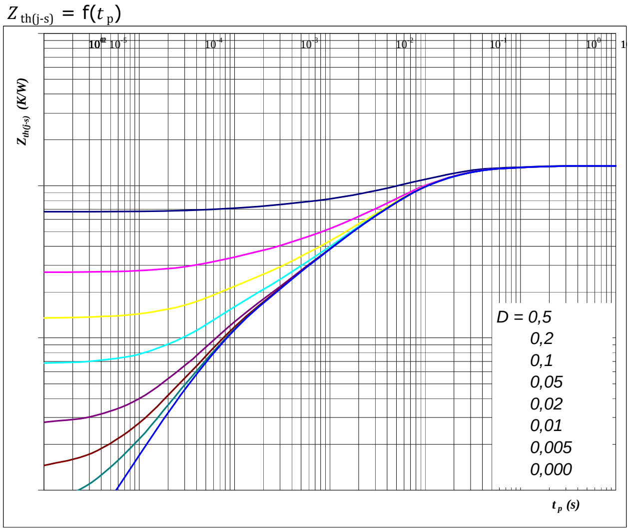
With an inductive load at

T_j =	25/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

Figure 11 Brake IGBT

IGBT transient thermal impedance as a function of pulse width

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



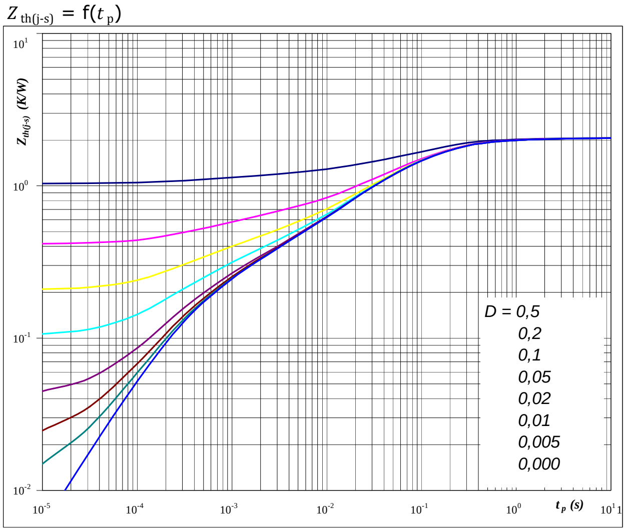
At $D = t_p / T$

$R_{th(j\text{-}s)}$ = 1,35 K/W

Figure 12 Brake FWD

FWD transient thermal impedance as a function of pulse width

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



At $D = t_p / T$

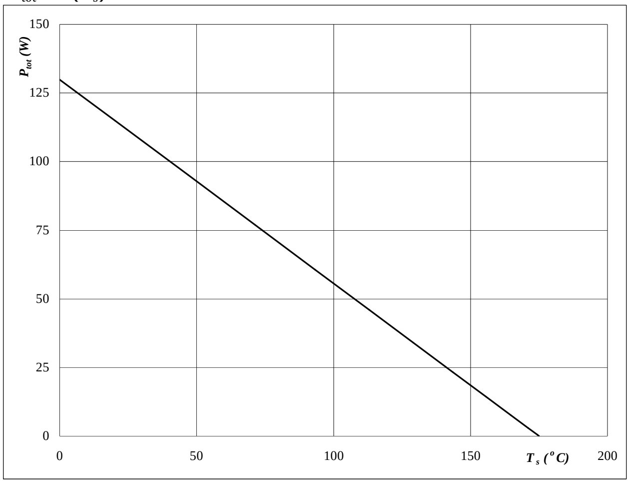
$R_{th(j\text{-}s)}$ = 2,07 K/W

Brake Charateristics

Figure 13 Brake IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



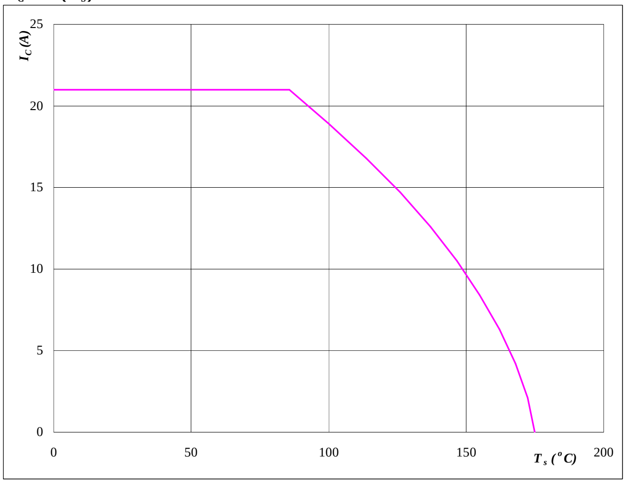
At

T_j = 175 ºC

Figure 14 Brake IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

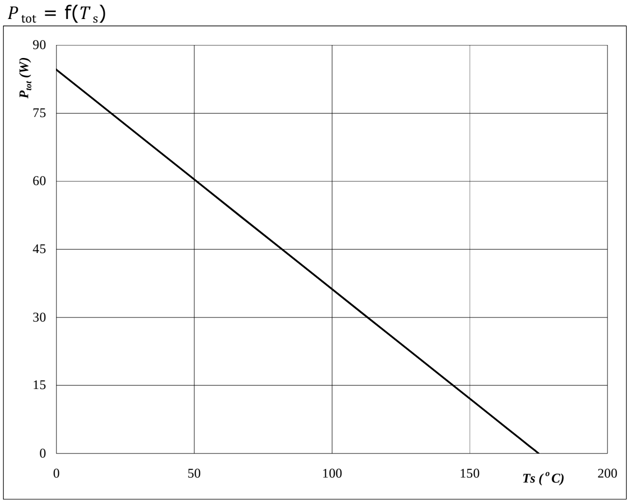
T_j = 175 ºC

V_{GE} = 15 V

Figure 15 Brake FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



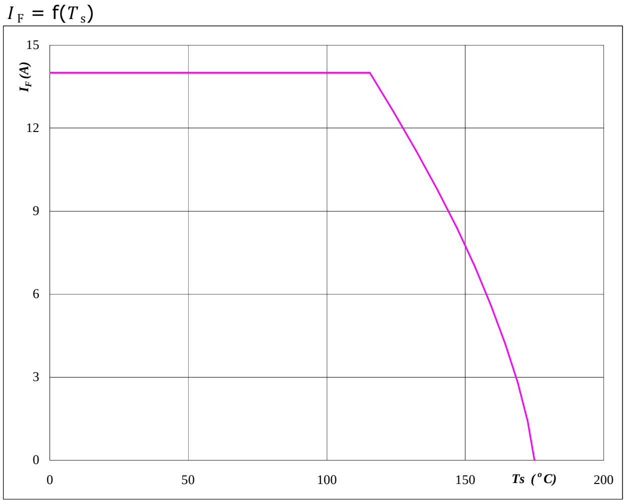
At

T_j = 175 ºC

Figure 16 Brake FWD

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

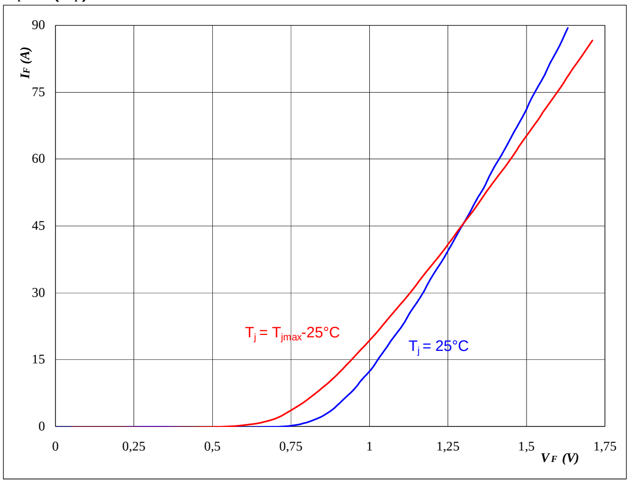
T_j = 175 ºC

Rectifier Diode Charaterisitcs

Figure 1 Rectifier Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



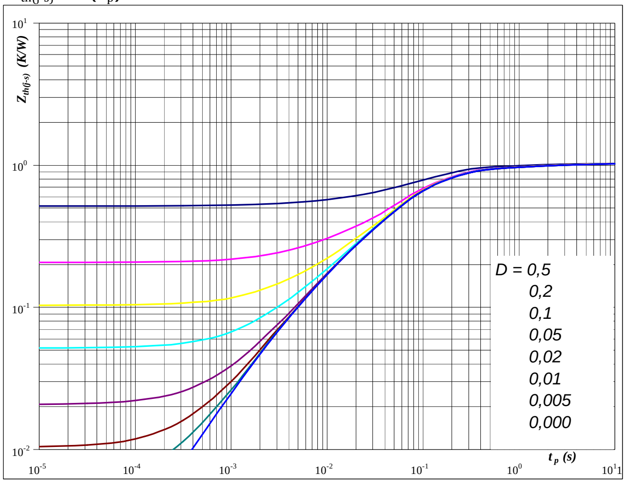
At

t_p =	250	µs

Figure 2 Rectifier Diode

Diode transient thermal impedance as a function of pulse width

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



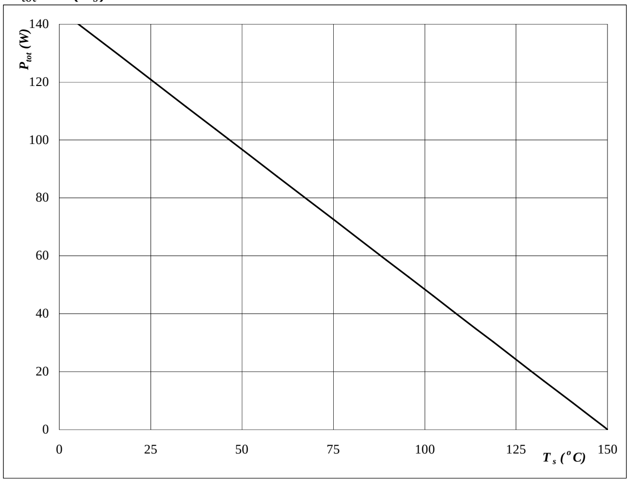
At

D =	t_p / T	
$R_{th(j\text{-}s)}$ =	1,03	K/W

Figure 3 Rectifier Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



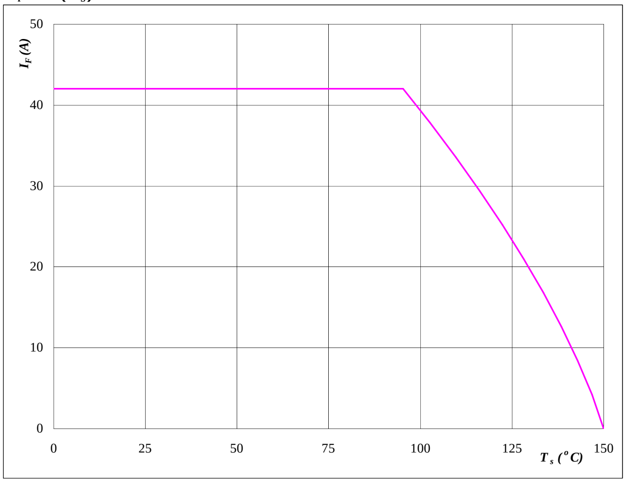
At

T_j =	150	ºC

Figure 4 Rectifier Diode

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



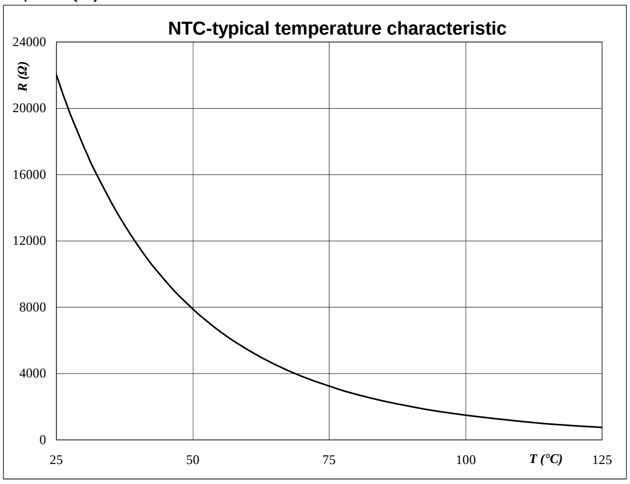
At

T_j =	150	ºC

Thermistor Charateristics

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature
R_T = f(T)



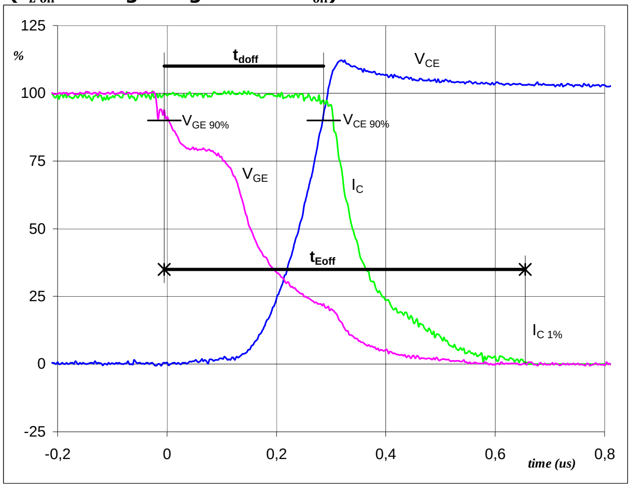
Switching Definitions Inverter

General conditions

T_j	=	150 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

Figure 1 Inverter Switch

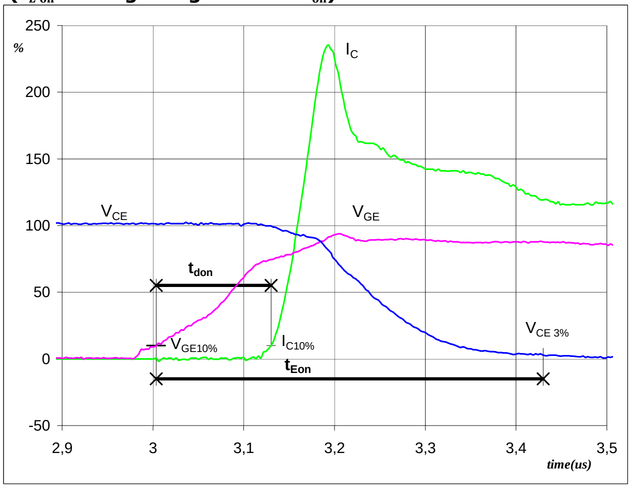
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	25	A
t_{doff} =	0,28	µs
$t_{E\,off}$ =	0,66	µs

Figure 2 Inverter Switch

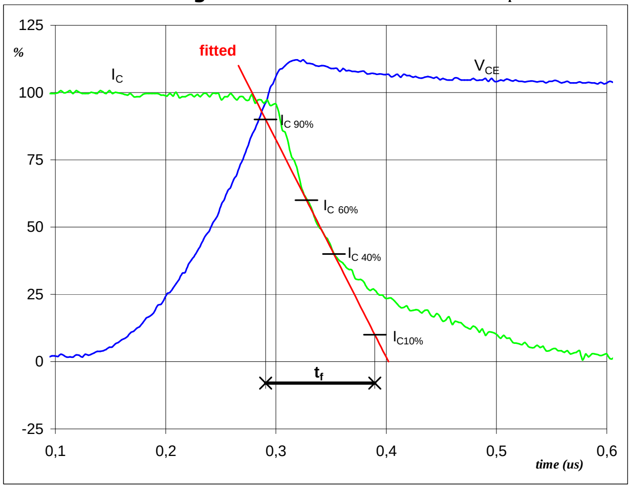
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	25	A
t_{don} =	0,13	µs
$t_{E\,on}$ =	0,43	µs

Figure 3 Inverter Switch

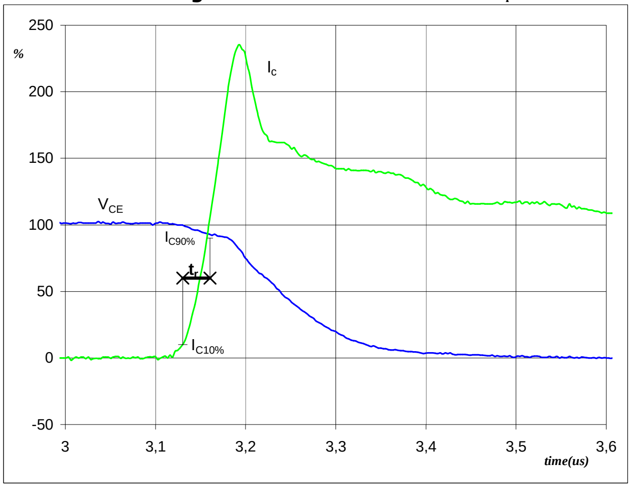
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	25	A
t_f =	0,10	µs

Figure 4 Inverter Switch

Turn-on Switching Waveforms & definition of t_r

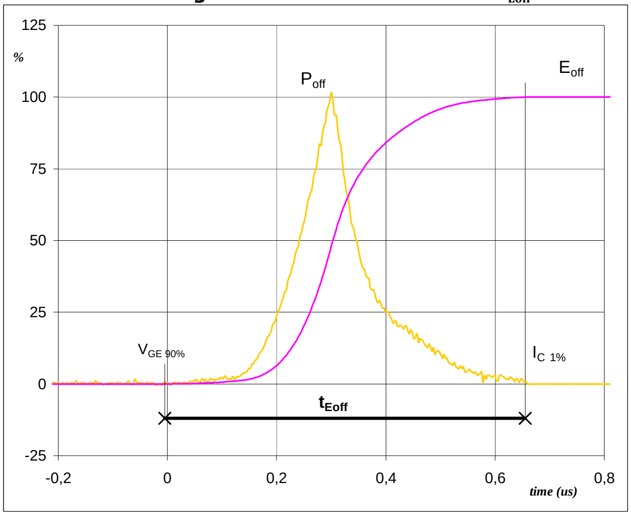


V_C (100%) =	600	V
I_C (100%) =	25	A
t_r =	0,03	µs

Switching Definitions Inverter

Figure 5 Inverter Switch

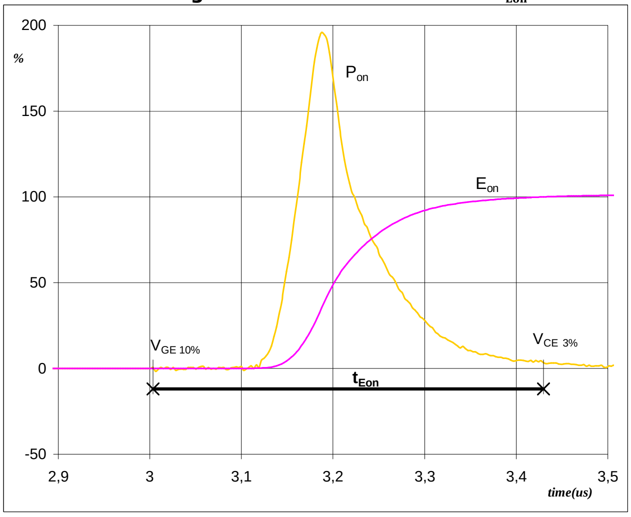
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	15,01	kW
E_{off} (100%) =	2,17	mJ
$t_{E\ off}$ =	0,66	μs

Figure 6 Inverter Switch

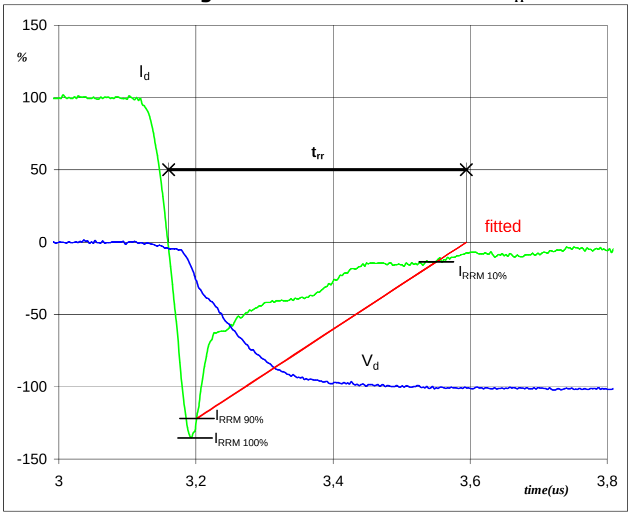
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	15,01	kW
E_{on} (100%) =	2,53	mJ
$t_{E\ on}$ =	0,43	μs

Figure 7 Inverter Switch

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

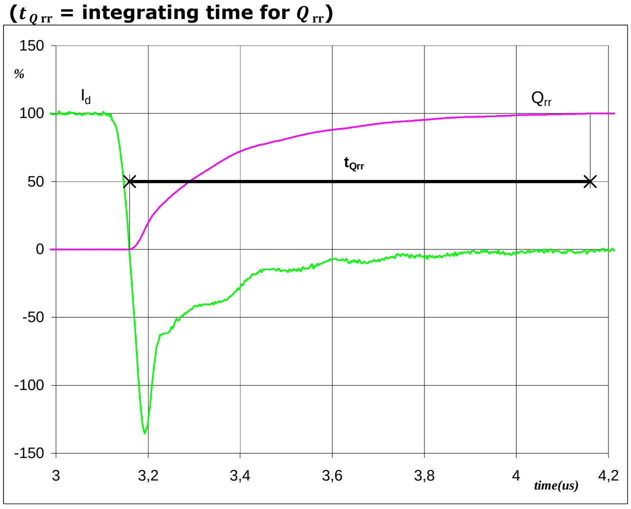


V_d (100%) =	600	V
I_d (100%) =	25	A
I_{RRM} (100%) =	10	A
t_{rr} =	0,10	μs

Switching Definitions Inverter

Figure 8	Inverter FWD

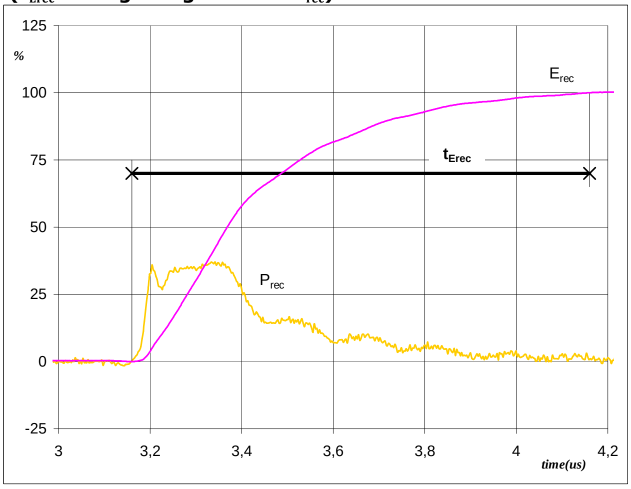
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	25	A
Q_{rr} (100%) =	4,81	µC
$t_{Q\,rr}$ =	1,00	µs

Figure 9	Inverter FWD

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



P_{rec} (100%) =	15,01	kW
E_{rec} (100%) =	1,94	mJ
$t_{E\,rec}$ =	1,00	µs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code
without thermal paste 17mm housing solder pins	V23990-P589-A41-PM
with thermal paste 17mm housing solder pins	V23990-P589-A41-/3/-PM
with thermal paste 17mm housing Press-fit pins	V23990-P589-A41Y-/3/-PM
without thermal paste 12mm housing solder pins	V23990-P589-A418-PM
without thermal paste 12mm housing Press-fit	V23990-P589-A418Y-PM
without thermal paste 17mm housing solder pins without brake	V23990-P589-C41-PM
with thermal paste 12mm housing solder pins without brake	V23990-P589-C418-/3/-PM

	VIN	Date code	Name&Ver	UL	Lot	Serial
Text	VIN	WWYY	NNNNNNVV	UL	LLLLL	SSSS
	Name&Ver	**Lot number**	**Serial**	**Date code**		
Datamatrix	NNNNNNVV	LLLLL	SSSS	WWYY		

Outline

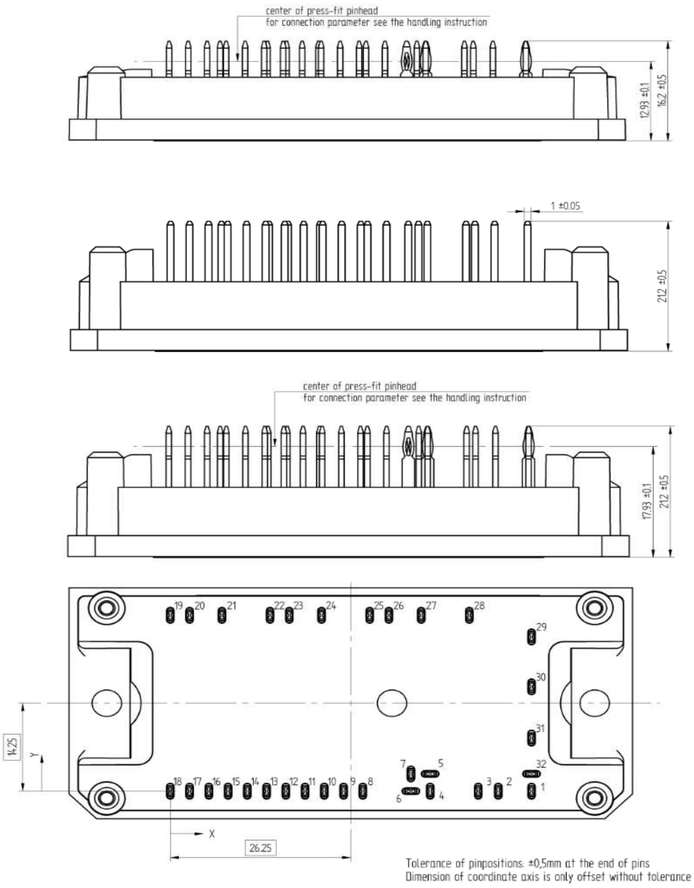
module	whitout pins
P589-C41	1, 31, 32
P589-C418	1, 31, 32

Pin	X	Y	Function
1	52,55	0	BrG
2	47,7	0	DC-
3	44,8	0	DC-
4	37,8	0	DC+
5	37,8	2,8	DC+
6	35	0	Inv+
7	35	2,8	Inv+
8	28	0	R1
9	25,2	0	R2
10	22,4	0	N6
11	19,6	0	G6
12	16,8	0	S6
13	14	0	N4
14	11,2	0	G4
15	8,4	0	S4
16	5,6	0	N2
17	2,8	0	G2
18	0	0	S2
19	0	28,5	U
20	2,8	28,5	G1
21	7,5	28,5	S1
22	14,5	28,5	V
23	17,3	28,5	G3
24	22	28,5	S3
25	29	28,5	W
26	31,8	28,5	G5
27	36,5	28,5	S5
28	43,5	28,5	L1
29	52,55	25	L2
30	52,55	16,9	L3
31	52,55	8,6	BrC
32	52,55	2,8	BrE

12mm housing, Press-fit pins

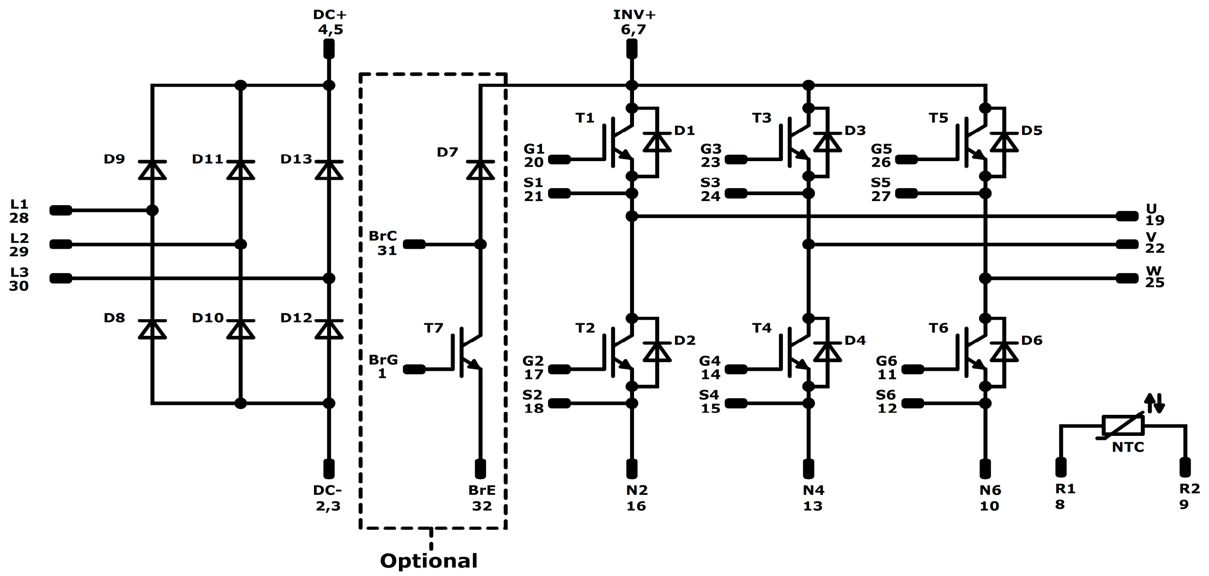
17mm housing, solder pins

17mm housing, Press-fit pins



Ordering Code and Marking - Outline - Pinout

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D8, D9, D10 D11, D12, D13	Diode	1600 V	30 A	Rectifier Diode	
T1, T2, T3, T4, T5, T6	IGBT	1200 V	25 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	1200 V	25 A	Inverter Diode	
T7	IGBT	1200 V	15 A	Brake Switch	
D7	FWD	1200 V	10 A	Brake Diode	
NTC	Thermistor			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	**100**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 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
V23990-P589-x4x-D3-14	20 May. 2016	New Brand, new types added, PCM Rth values	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.