Vincotech

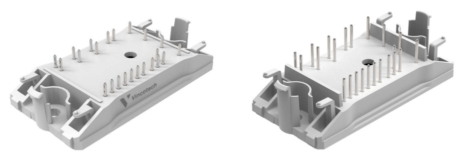
V23990-P545-*2*-PM
datasheet

***flow* PIM 0** — **600 V / 20 A**

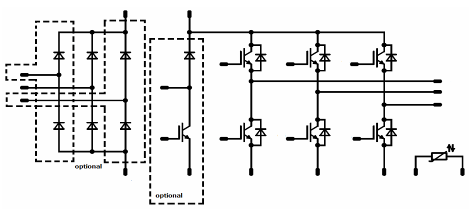
Features
- Vincotech clip-in housing
- Trenchstop™ IGBT3 for low saturation losses
- Optional w/o BRC

Target Applications
- Industrial drives
- Embedded drives

Types
- V23990-P545-A28-PM
- V23990-P545-A29-PM
- V23990-P545-B28-PM
- V23990-P545-B128-PM
- V23990-P545-B129-PM
- V23990-P545-C29-PM
- V23990-P545-D28-PM
- V23990-P545-C28-PM

flow 0 housing


12mm housing 17mm 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	34	A
Surge (non-repetitive) forward current	I_{FSM}	t_p = 10 ms 50 Hz half sine wave	T_j = 150 °C	200	A
I^2t-value	I^2t			200	A^2s
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	43	W
Maximum Junction Temperature	T_{jmax}			150	°C
Inverter Switch					
Collector-emitter breakdown voltage	V_{CE}			600	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	26	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		60	A
Turn off safe operating area		V_{CE} ≤ 1200V, $T_j \le T_{op}$ max		60	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	56	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		6 360	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}			600	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	21	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		40	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	37	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter breakdown voltage	V_{CE}			600	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		45	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	52	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		6 360	μs V
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	18	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 °C	35	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 = 2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance		12 mm / 17 mm housing		9,29 / 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				25	25 125	0,8	1,22 1,20	1,45	V
Threshold voltage (for power loss calc. only)	V_{to}				25	25 125		0,95 0,81		V
Slope resistance (for power loss calc. only)	r_t				25	25 125		10 20		mΩ
Reverse current	I_r			1600		25 145			0,05 1,1	mA
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,61		K/W
Inverter Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00029	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125	1	1,55 1,75	2,2	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		25			0,0011	mA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 16 Ω	+15/0	300	20	25 125		15 14		ns
Rise time	t_r					25 125		12 16		ns
Turn-off delay time	$t_{d(off)}$					25 125		198 212		ns
Fall time	t_f					25 125		100 104		ns
Turn-on energy loss	E_{on}					25 125		0,31 0,43		mWs
Turn-off energy loss	E_{off}					25 125		0,55 0,65		mWs
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1100		pF
Output capacitance	C_{oss}							71		pF
Reverse transfer capacitance	C_{rss}							32		pF
Gate charge	Q_G		±15	480	20	25		120		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,70		K/W
Inverter Diode										
Diode forward voltage	V_F				20	25 125	1,25	1,81 1,76	1,95	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 16 Ω	+15/0	300	20	25 125		19 21		A
Reverse recovery time	t_{rr}					25 125		33 192		ns
Reverse recovered charge	Q_{rr}					25 125		0,45 1,35		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1454 1052		A/μs
Reverse recovered energy	E_{rec}					25 125		0,06 0,27		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,60		K/W

Characteristic Values

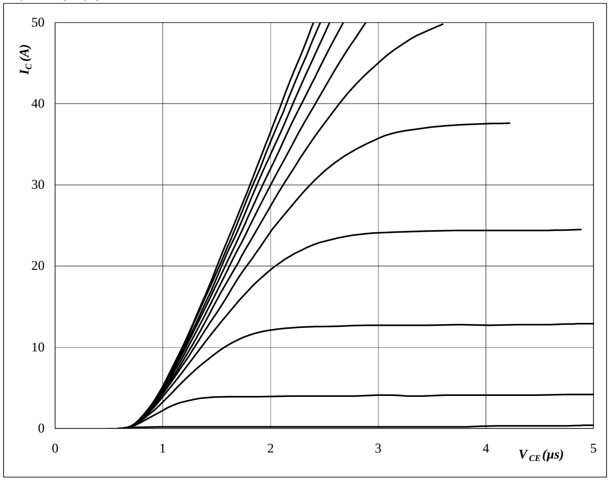
Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Brake Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00021	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125	1,1	1,79 2,08	1,9	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		25			0,00085	mA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 16 Ω	+15/0	300	15	25 125		15 14		ns
Rise time	t_r					25 125		11 14		
Turn-off delay time	$t_{d(off)}$					25 125		128 145		
Fall time	t_f					25 125		91 94		
Turn-on energy loss	E_{on}					25 125		0,20 0,28		mWs
Turn-off energy loss	E_{off}					25 125		0,32 0,40		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		860		pF
Output capacitance	C_{oss}							55		
Reverse transfer capacitance	C_{rss}							24		
Gate charge	Q_G		±15	480	15	25		87		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,83		K/W
Brake Diode										
Diode forward voltage	V_F				15	25 125	1,25	1,86 1,75	1,95	V
Reverse leakage current	I_r			600		25			27	µA
Peak reverse recovery current	I_{RRM}	R_{gon} = 16 Ω	+15/0	300	15	25 125		14 15		A
Reverse recovery time	t_{rr}					25 125		128 201		ns
Reverse recovered charge	Q_{rr}					25 125		0,52 1,02		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1307 657		A/µs
Reverse recovery energy	E_{rec}					25 125		0,10 0,21		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,75		K/W
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R100	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25				K
B-value	$B_{(25/100)}$	Tol. ±3%				25		4000		K
Vincotech NTC Reference						25			A	

Inverter Charateristics

Figure 1	**IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



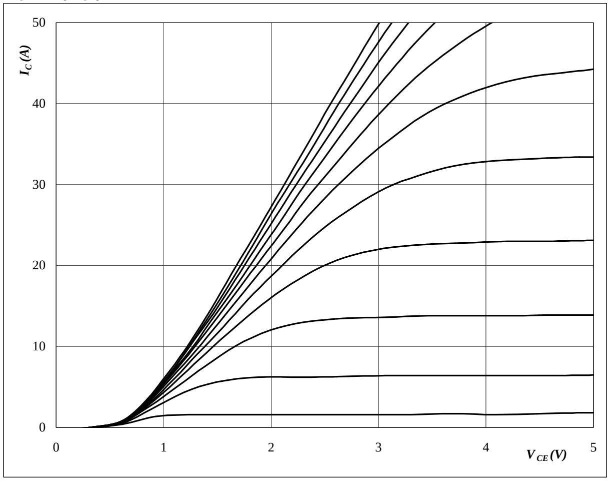
At

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

Figure 2	**IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



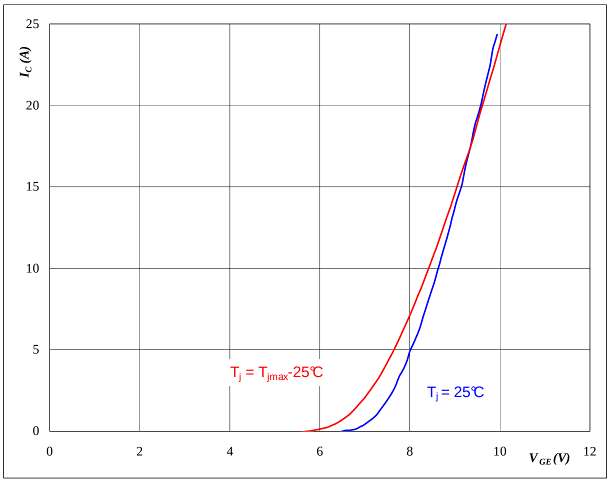
At

t_p = 250 µs
T_j = 125 °C
V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3	**IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



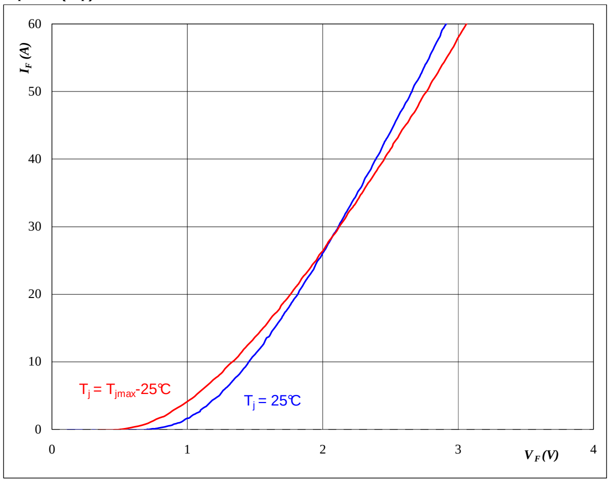
At

t_p = 250 µs
V_{CE} = 10 V

Figure 4	**FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

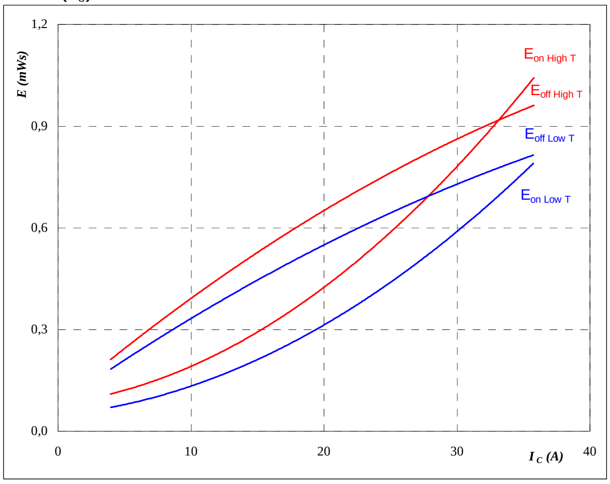
t_p = 250 µs

Inverter Charateristics

Figure 5 — **IGBT**

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



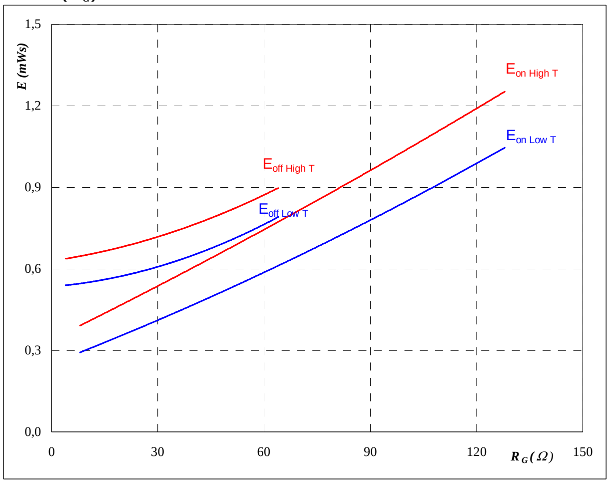
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω
R_{goff} =	8	Ω

Figure 6 — **IGBT**

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



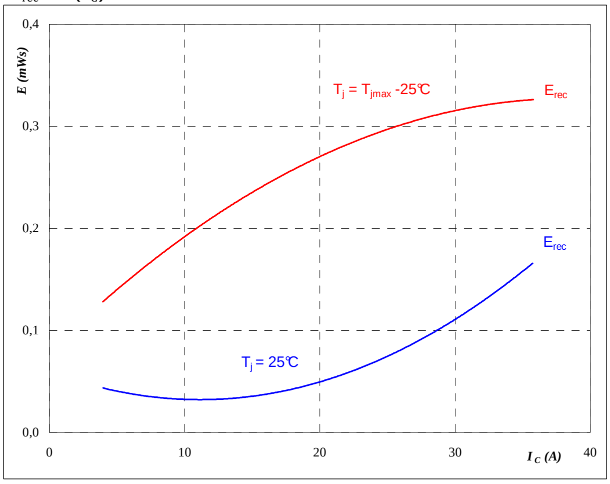
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	20	A

Figure 7 — **FWD**

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_C)$



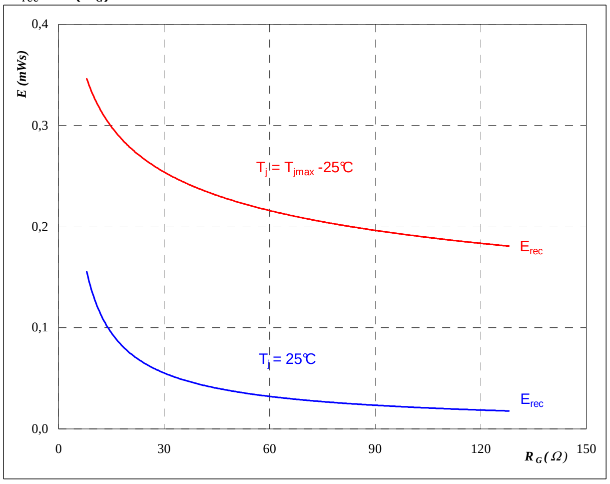
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω

Figure 8 — **FWD**

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

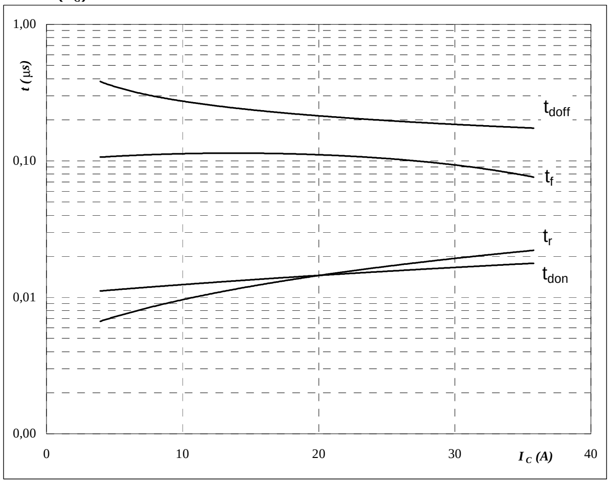
T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	20	A

Inverter Charateristics

Figure 9 IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



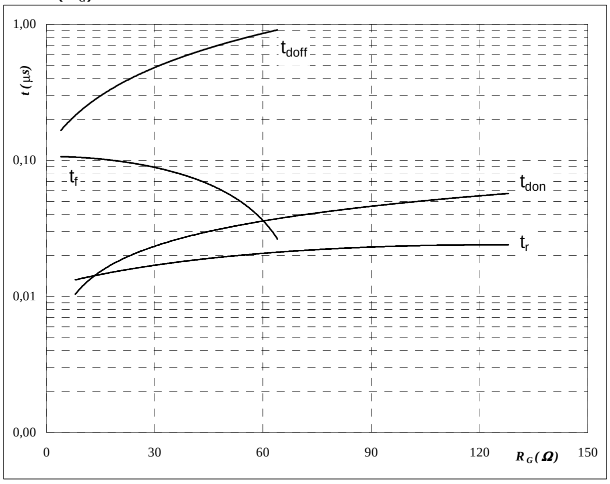
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω
R_{goff} =	8	Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



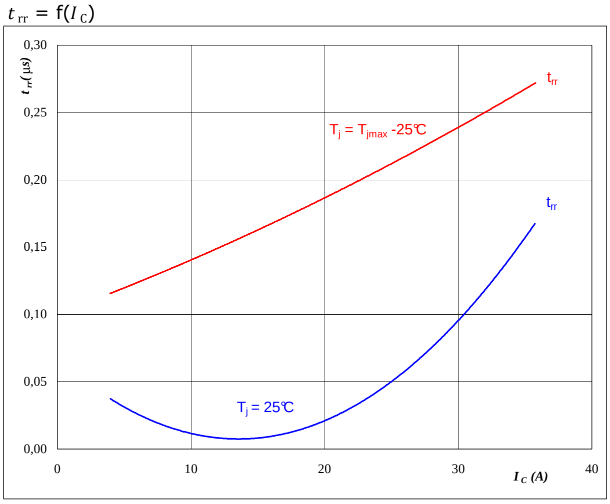
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	20	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



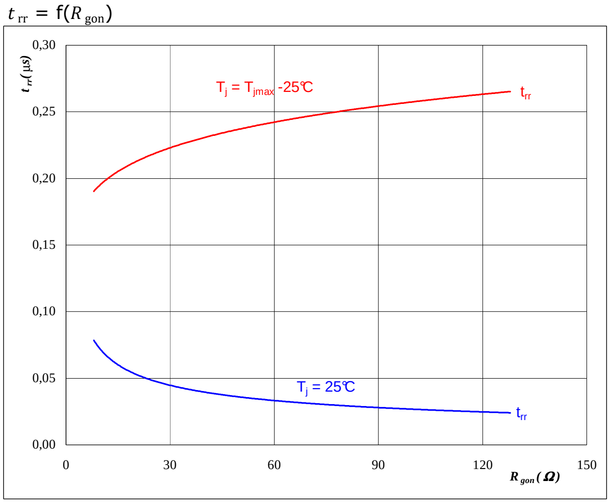
At

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω

Figure 12 FWD

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

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



At

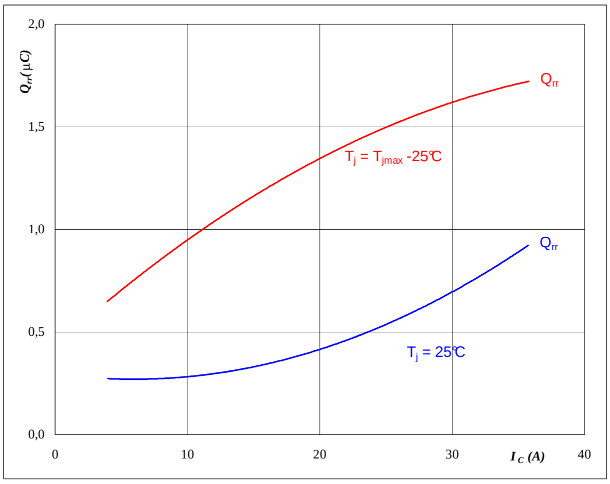
T_j =	25/125	°C
V_R =	300	V
I_F =	20	A
V_{GE} =	15	V

Inverter Charateristics

Figure 13 **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



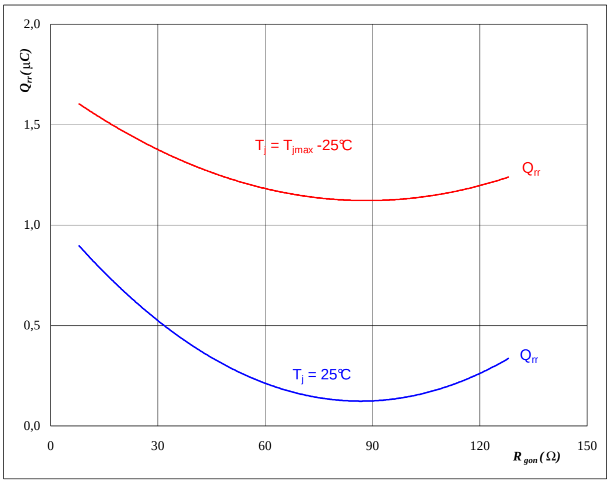
At

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω

Figure 14 **FWD**

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

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



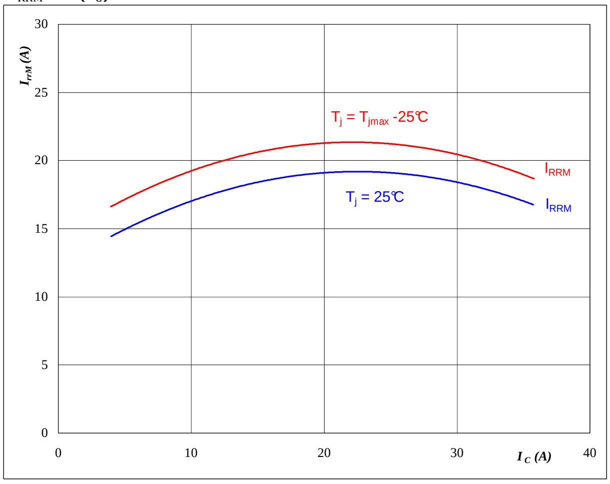
At

T_j =	25/125	°C
V_R =	300	V
I_F =	20	A
V_{GE} =	15	V

Figure 15 **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



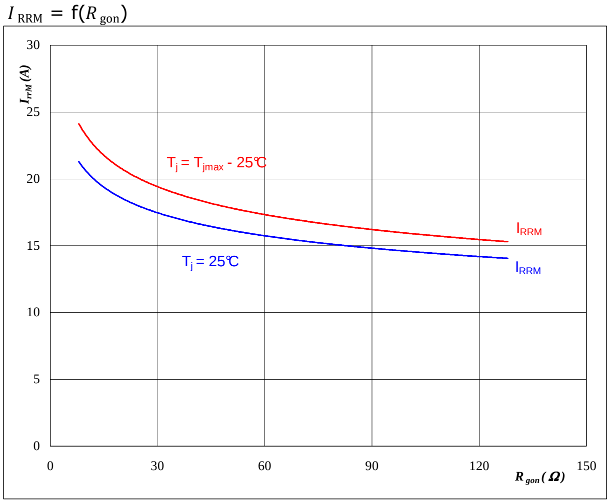
At

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω

Figure 16 **FWD**

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

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



At

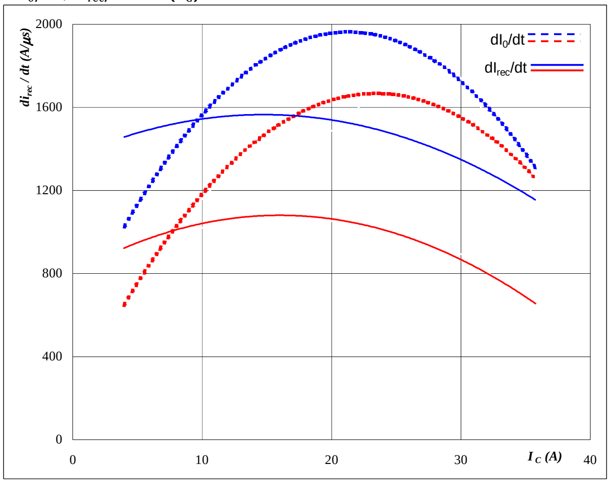
T_j =	25/125	°C
V_R =	300	V
I_F =	20	A
V_{GE} =	15	V

Inverter Charateristics

Figure 17 **FWD**

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

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



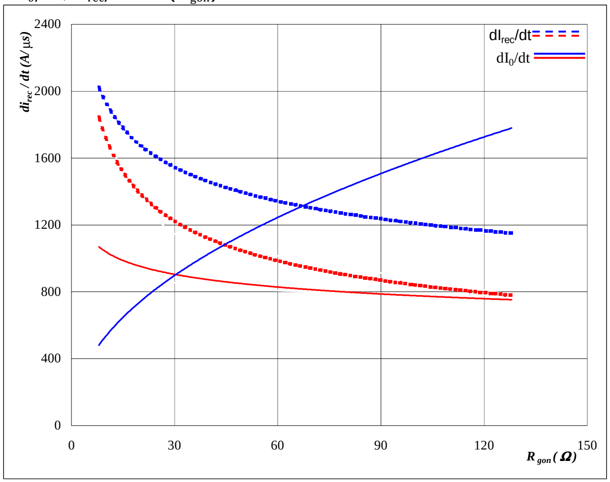
At

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω

Figure 18 **FWD**

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

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



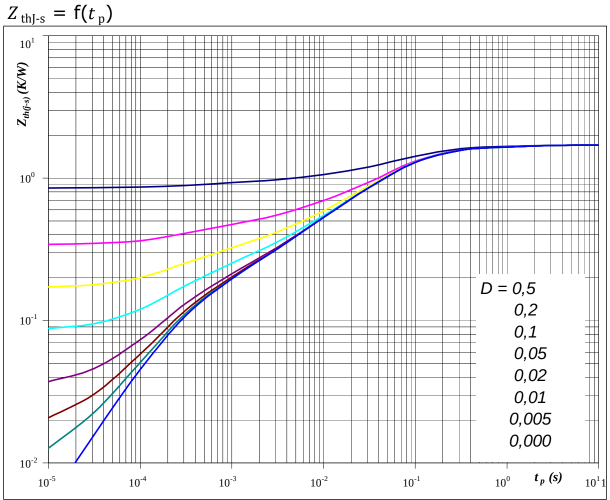
At

T_j =	25/125	°C
V_R =	300	V
I_F =	20	A
V_{GE} =	15	V

Figure 19 **IGBT**

IGBT transient thermal impedance as a function of pulse width

$Z_{thJ-s} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,70	K/W

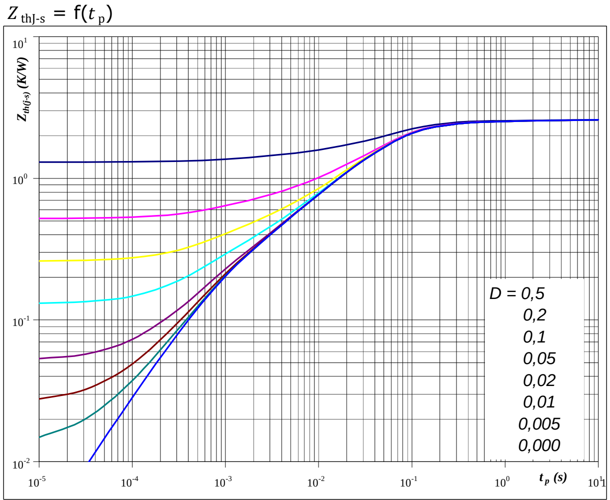
IGBT thermal model values

R (K/W)	Tau (s)
9,97E-02	1,34E+00
3,46E-01	1,70E-01
8,15E-01	5,34E-02
2,54E-01	7,74E-03
7,70E-02	1,33E-03
1,09E-01	2,63E-04

Figure 20 **FWD**

FWD transient thermal impedance as a function of pulse width

$Z_{thJ-s} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	2,60	K/W

FWD thermal model values

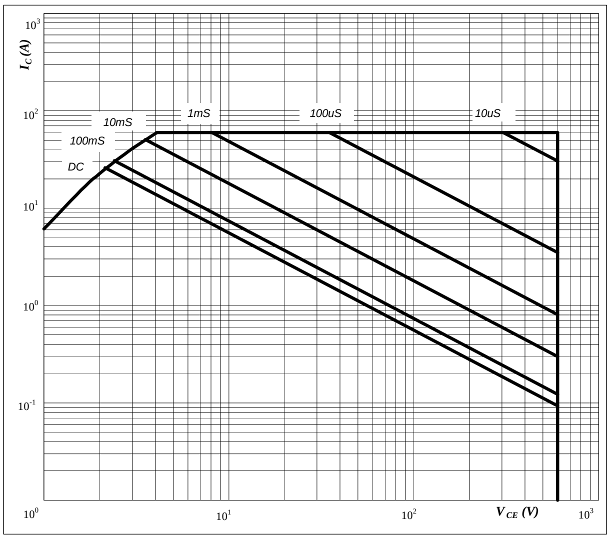
R (K/W)	Tau (s)
6,56E-02	4,59E+00
1,58E-01	5,68E-01
8,97E-01	8,42E-02
1,05E+00	3,29E-02
2,75E-01	4,96E-03
1,51E-01	7,65E-04

Inverter Charateristics

Figure 25	**IGBT**

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



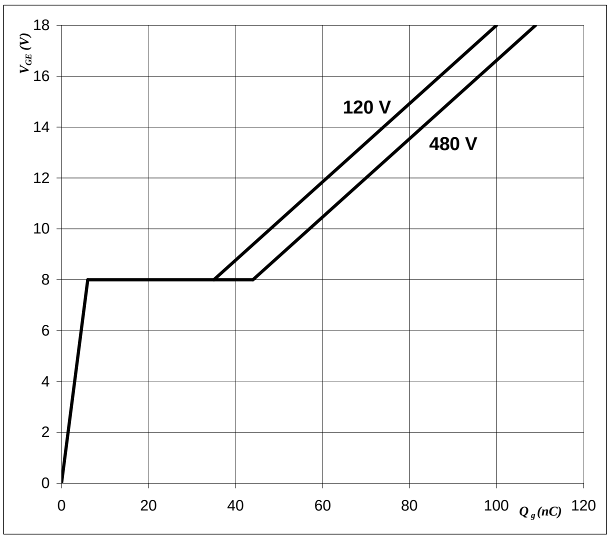
At

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

Figure 26	**IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



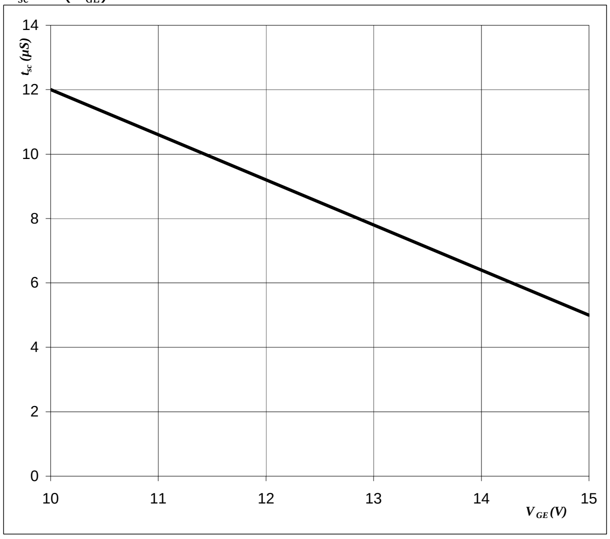
At

I_C =	20	A

Figure 27	**IGBT**

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

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



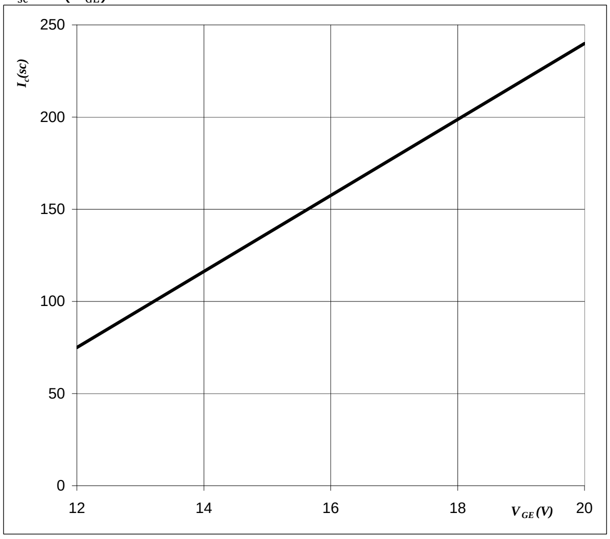
At

V_{CE} =	600	V
T_j ≤	175	ºC

Figure 28	**IGBT**

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

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



At

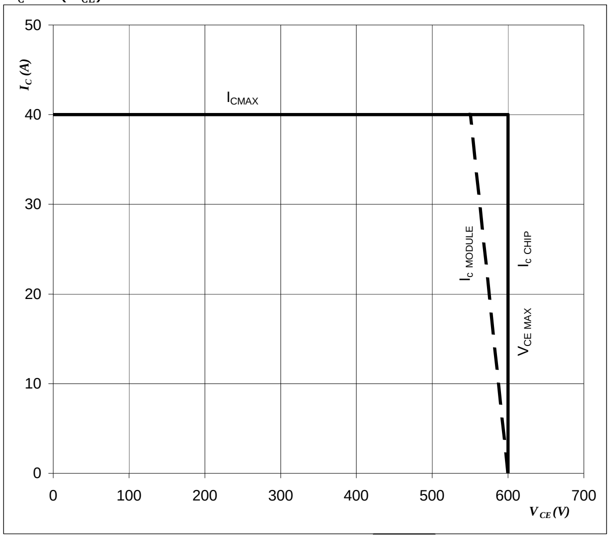
V_{CE} ≤	600	V
T_j =	175	ºC

Inverter Charateristics

Figure 29	**IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = T_{jmax}-25 ºC

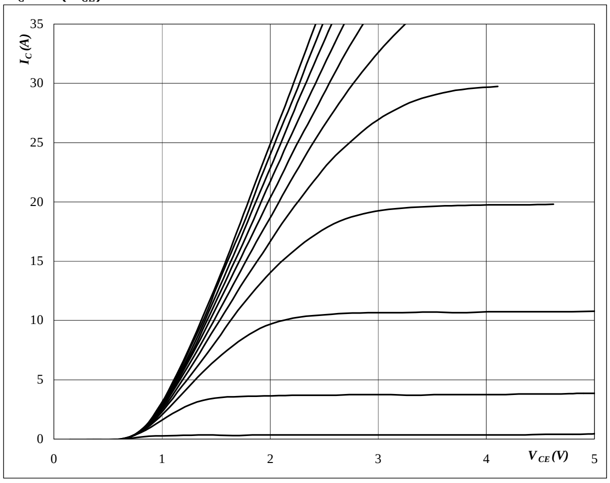
Switching mode : 3phase SPWM

Brake Charateristics

Figure 1 **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

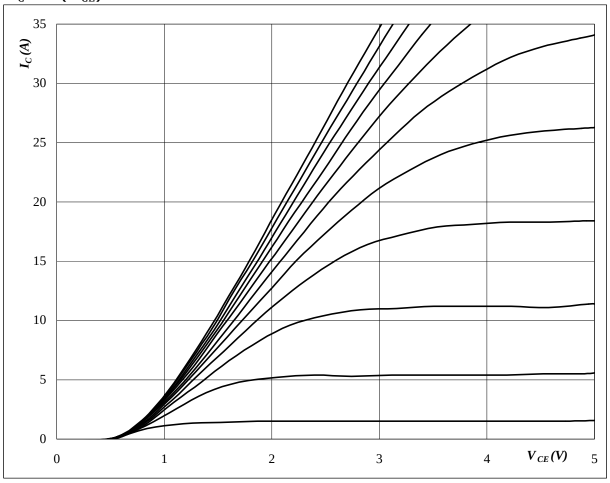
T_j = 25 °C

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

Figure 2 **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

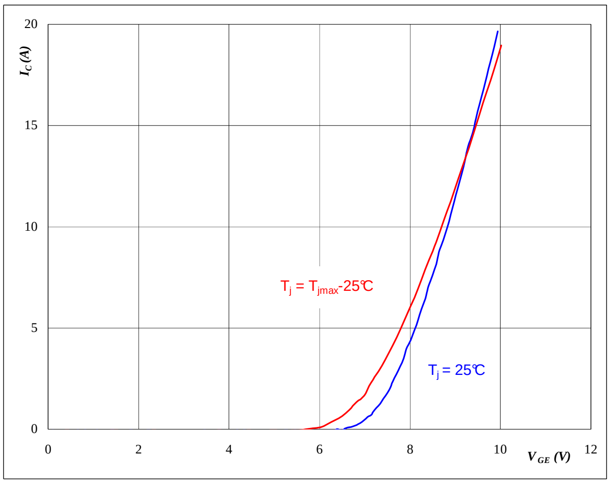
T_j = 125 °C

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

Figure 3 **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



At

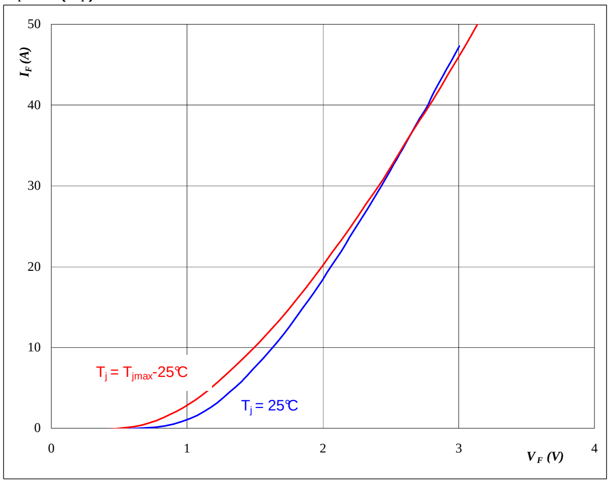
t_p = 250 µs

V_{CE} = 10 V

Figure 4 **IGBT**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

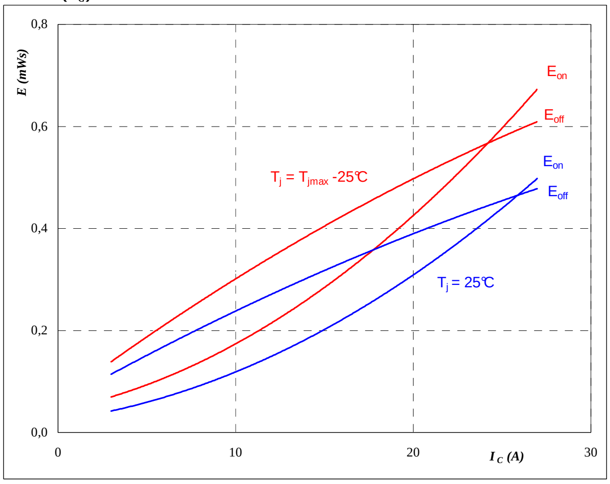
t_p = 250 µs

Brake Charateristics

Figure 5	IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



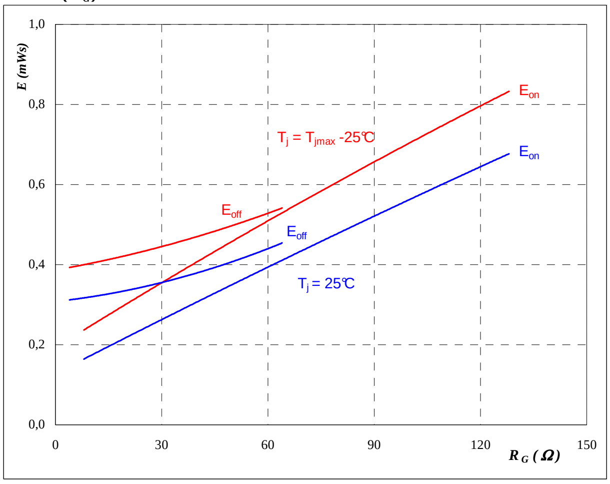
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω
R_{goff} =	8	Ω

Figure 6	IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



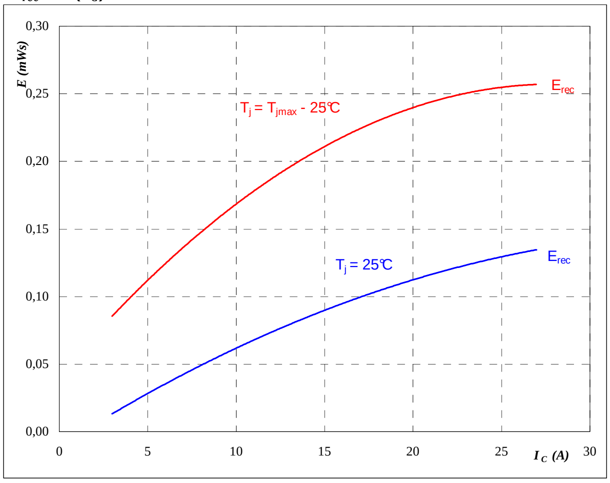
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	15	A

Figure 7	FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



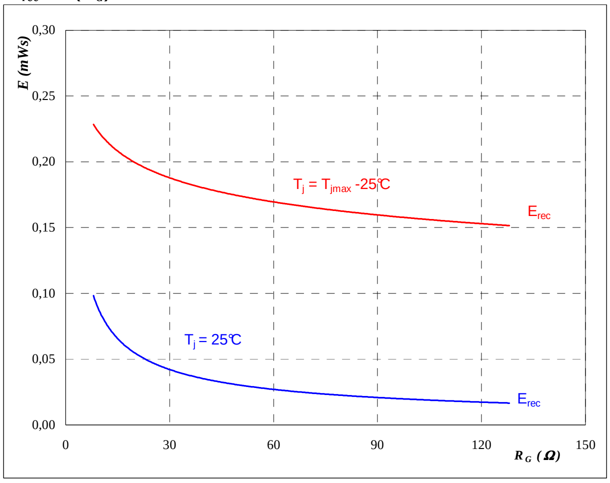
With an inductive load at

T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω

Figure 8	FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

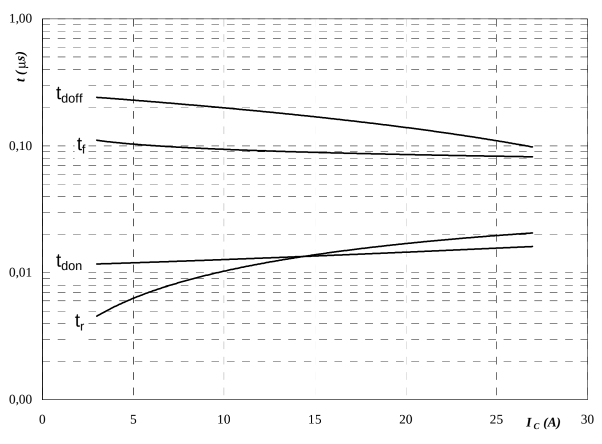
T_j =	25/125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	15	A

Brake Charateristics

Figure 9 **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



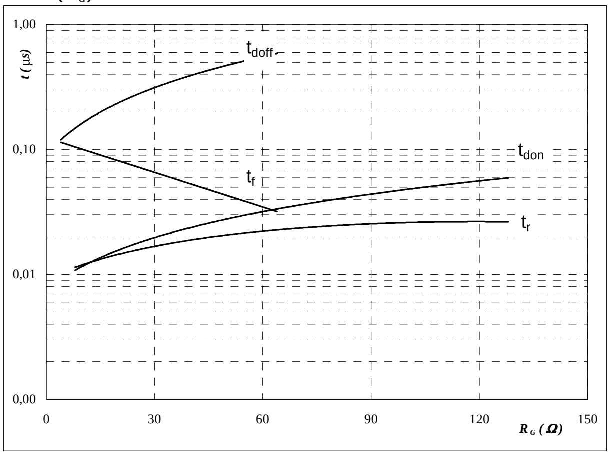
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
R_{gon} =	16	Ω
R_{goff} =	8	Ω

Figure 10 **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



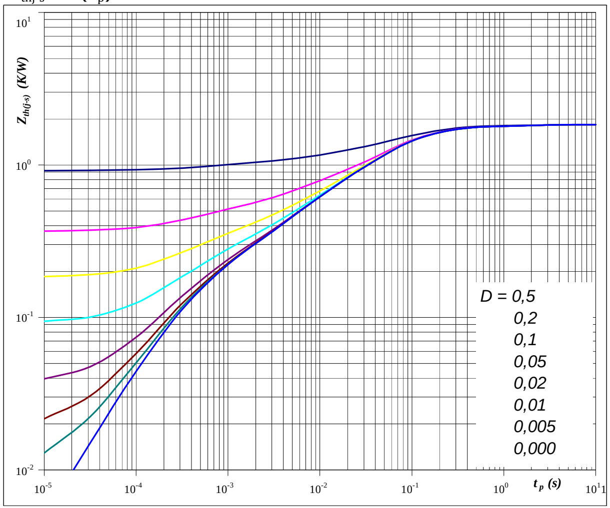
With an inductive load at

T_j =	125	°C
V_{CE} =	300	V
V_{GE} =	15	V
I_C =	15	A

Figure 11 **IGBT**

IGBT transient thermal impedance as a function of pulse width

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



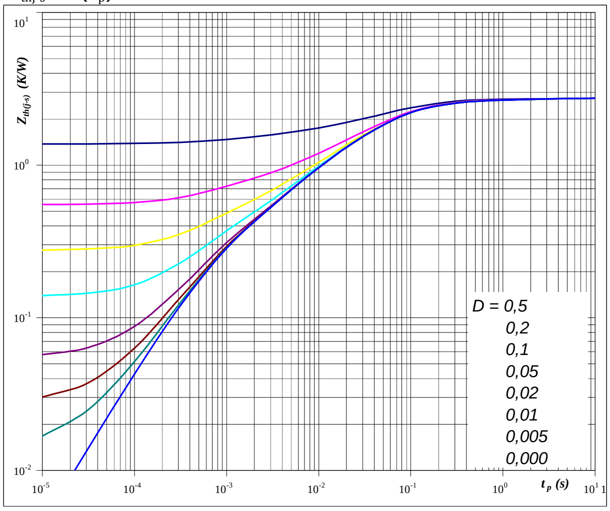
At $D = t_p / T$

R_{thJH} = 1,83 K/W

Figure 12 **FWD**

FWD transient thermal impedance as a function of pulse width

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



At $D = t_p / T$

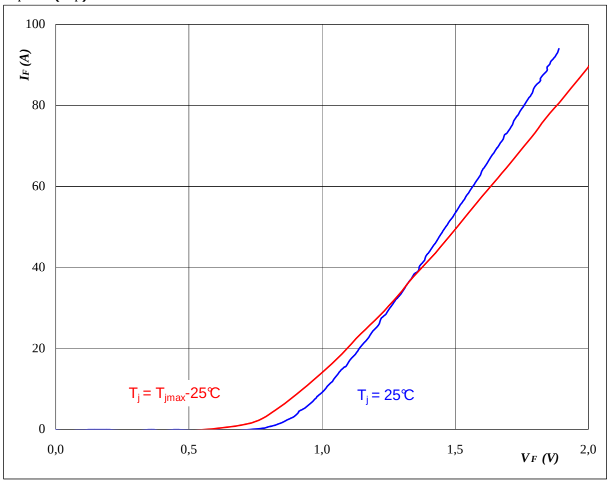
R_{thJH} = 2,75 K/W

Rectifier Diode Characteristics

Figure 1	**Diode**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



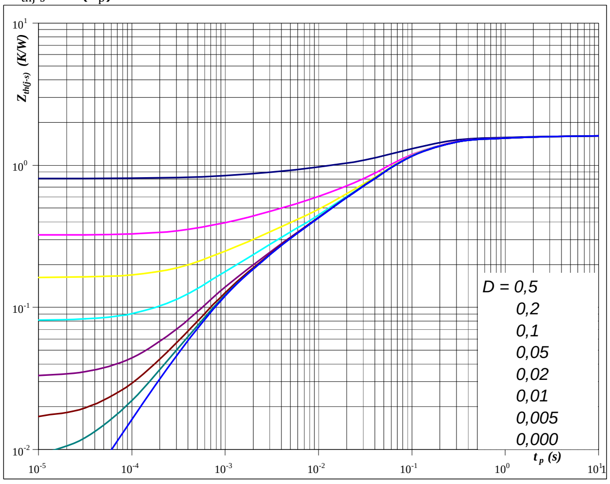
At

t_p = 250 µs

Figure 2	**Diode**

Diode transient thermal impedance as a function of pulse width

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



At

$D = t_p / T$

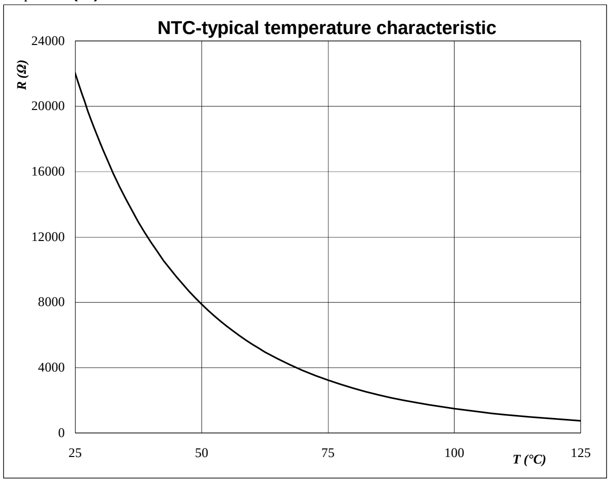
R_{thJH} = 1,61 K/W

Thermistor

Figure 1	**Thermistor**

Typical NTC characteristic as a function of temperature

$R_T = f(T)$



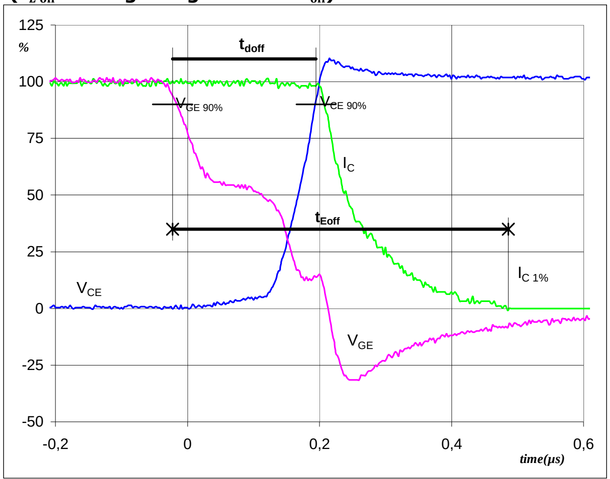
Switching Definitions Inverter

General conditions

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	8 Ω

Figure 1 IGBT

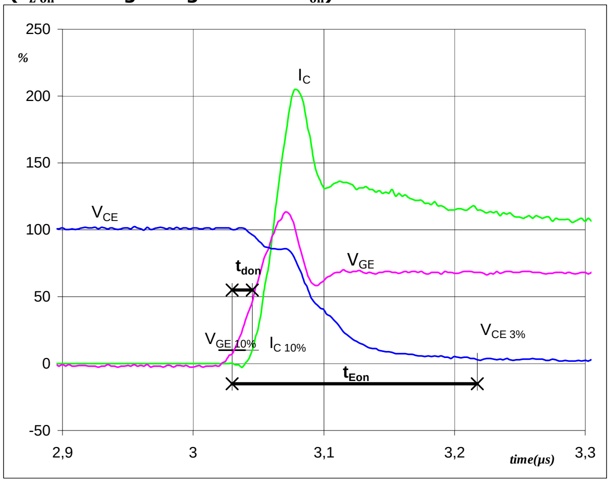
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	20	A
t_{doff} =	0,21	µs
$t_{E\,off}$ =	0,51	µs

Figure 2 IGBT

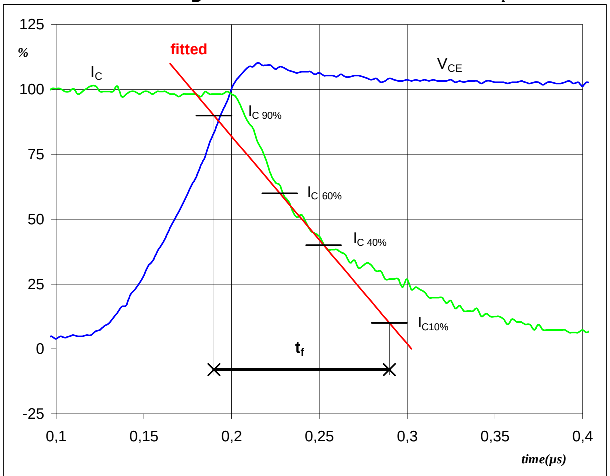
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	20	A
t_{don} =	0,01	µs
$t_{E\,on}$ =	0,19	µs

Figure 3 IGBT

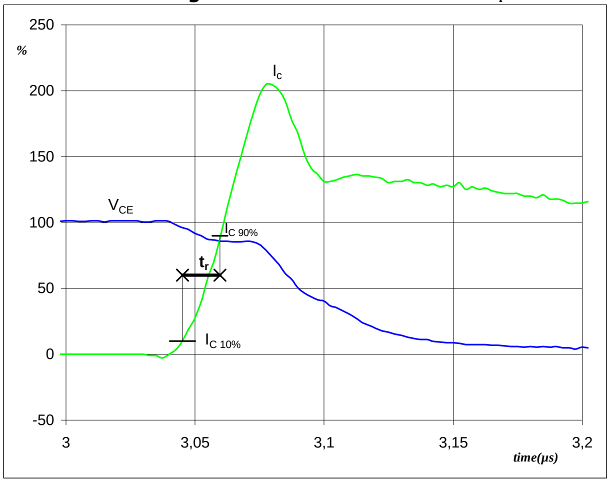
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	20	A
t_f =	0,10	µs

Figure 4 IGBT

Turn-on Switching Waveforms & definition of t_r

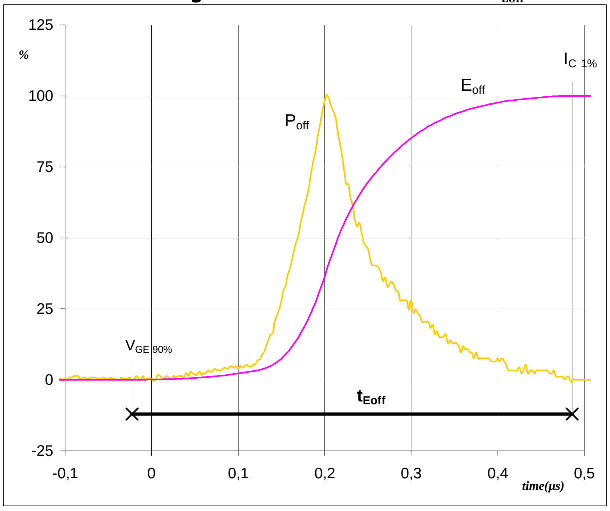


V_C (100%) =	300	V
I_C (100%) =	20	A
t_r =	0,02	µs

Switching Definitions Inverter

Figure 5 IGBT

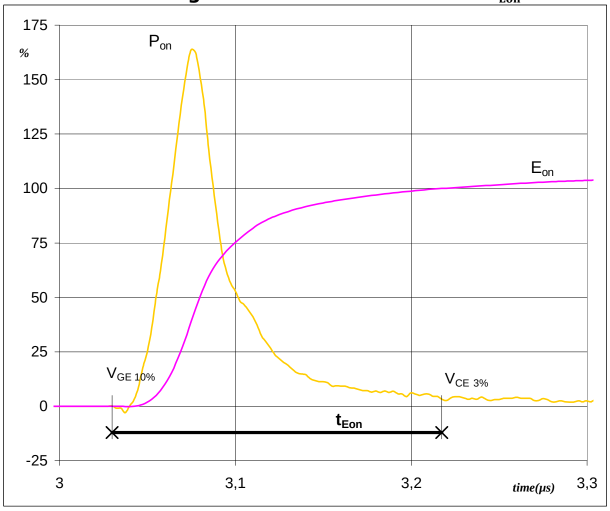
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	5,99	kW
E_{off} (100%) =	0,65	mJ
$t_{E\ off}$ =	0,51	μs

Figure 6 IGBT

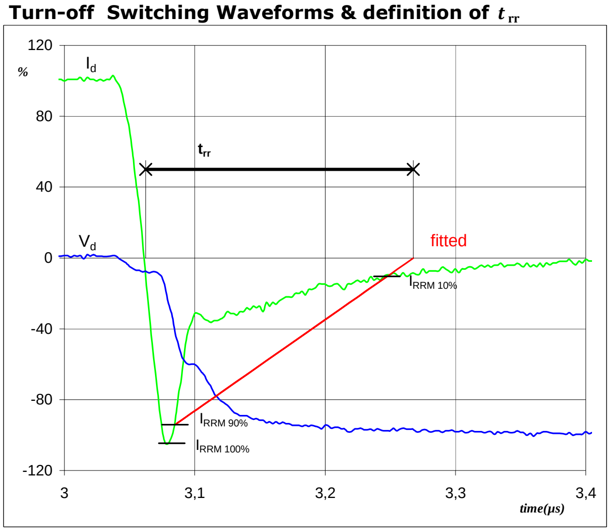
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	5,99	kW
E_{on} (100%) =	0,43	mJ
$t_{E\ on}$ =	0,19	μs

Figure 7 FWD

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

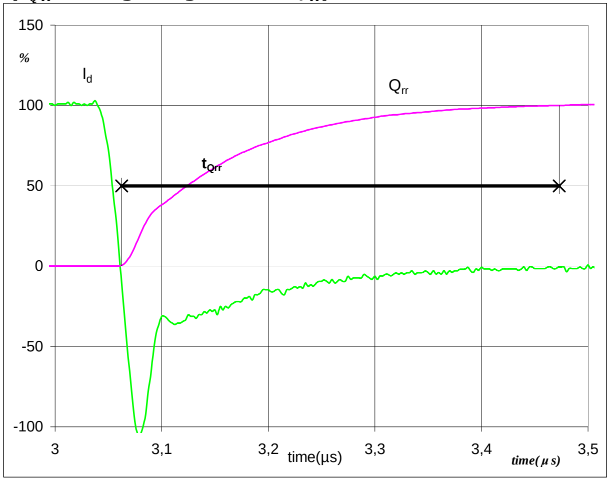


V_d (100%) =	300	V
I_d (100%) =	20	A
I_{RRM} (100%) =	21	A
t_{rr} =	0,19	μs

Switching Definitions Inverter

Figure 8 FWD

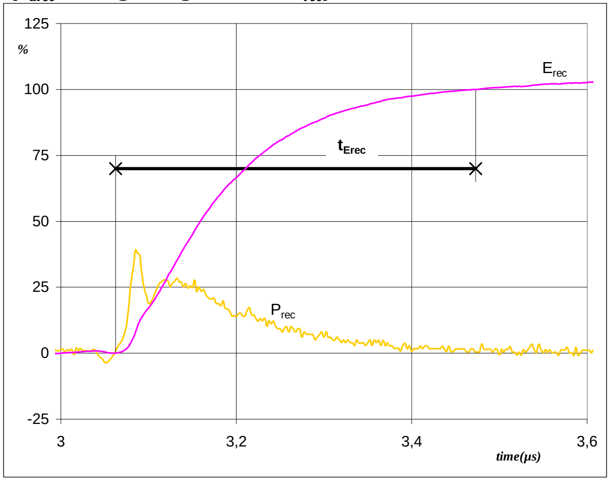
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	20	A
Q_{rr} (100%) =	1,35	µC
$t_{Q\,rr}$ =	0,41	µs

Figure 10 FWD

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



P_{rec} (100%) =	5,99	kW
E_{rec} (100%) =	0,27	mJ
$t_{E\,rec}$ =	0,41	µs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

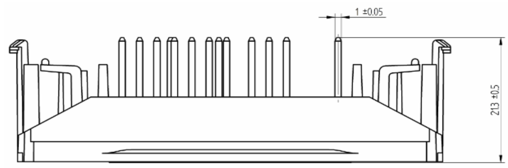
Version	Ordering Code
without thermal paste 12mm housing with solder pins	V23990-P545-A28-PM
with thermal paste 12mm housing with solder pins	V23990-P545-A28-/3/-PM
without thermal paste 17mm housing with solder pins	V23990-P545-A29-PM
without thermal paste 12mm housing 1 phase rectifier with solder pins	V23990-P545-B28-PM
with thermal paste 12mm housing 1 phase rectifier with solder pins	V23990-P545-B28-/3/-PM
with thermal paste 12mm housing 1 phase rectifier with solder pins	V23990-P545-B128-/3/-PM
without thermal paste 17mm housing 1 phase rectifier with solder pins	V23990-P545-B129-PM
with thermal paste 17mm housing 1 phase rectifier with solder pins	V23990-P545-B129-/3/-PM
without thermal paste 17mm housing without brake with solder pins	V23990-P545-C29-PM
without thermal paste 12mm housing 1 phase rectifier without brake with solder pins	V23990-P545-D28-PM
with thermal paste 12mm housing 1 phase rectifier without brake with solder pins	V23990-P545-D28-/3/-PM
without thermal paste 12mm housing without brake with solder pins	V23990-P545-C28-PM
with thermal paste 12mm housing without brake with solder pins	V23990-P545-C28-/3/-PM

Text	**VIN**	**Name&Ver**	**UL**	**Lot**	**Serial**	
	VIN	NNNNNNNNVV	UL	LLLLL	SSSS	
Datamatrix	**Name&Ver**	**Serial**	**Date Code**			
	NNNNNNNNVV	SSSS	WWYY			

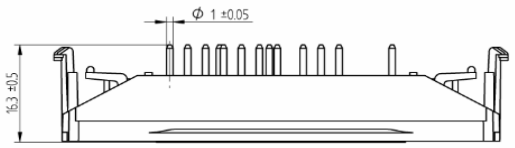
Outline

Pin table

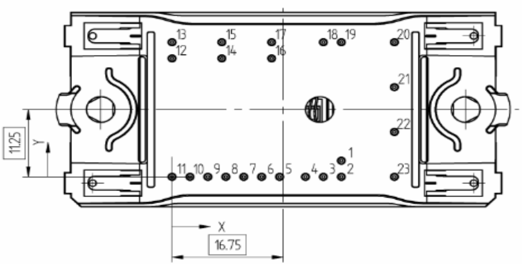
Pin	X	Y	Function
1	25,5	2,7	NTC1
2	25,5	0	NTC2
3	22,8	0	-DC
4	20,1	0	BRCG
5	16,2	0	BRCE
6	13,5	0	G6
7	10,8	0	E6
8	8,1	0	G5
9	5,4	0	E5
10	2,7	0	G4
11	0	0	E4
12	0	19,8	G1
13	0	22,5	U
14	7,5	19,8	G2
15	7,5	22,5	V
16	15	19,8	G3
17	15	22,5	W
18	22,8	22,5	+INV
19	25,5	22,5	+DC
20	33,5	22,5	BRC+
21	33,5	15	L1
22	33,5	7,5	L2
23	33,5	0	L3



17 mm housing



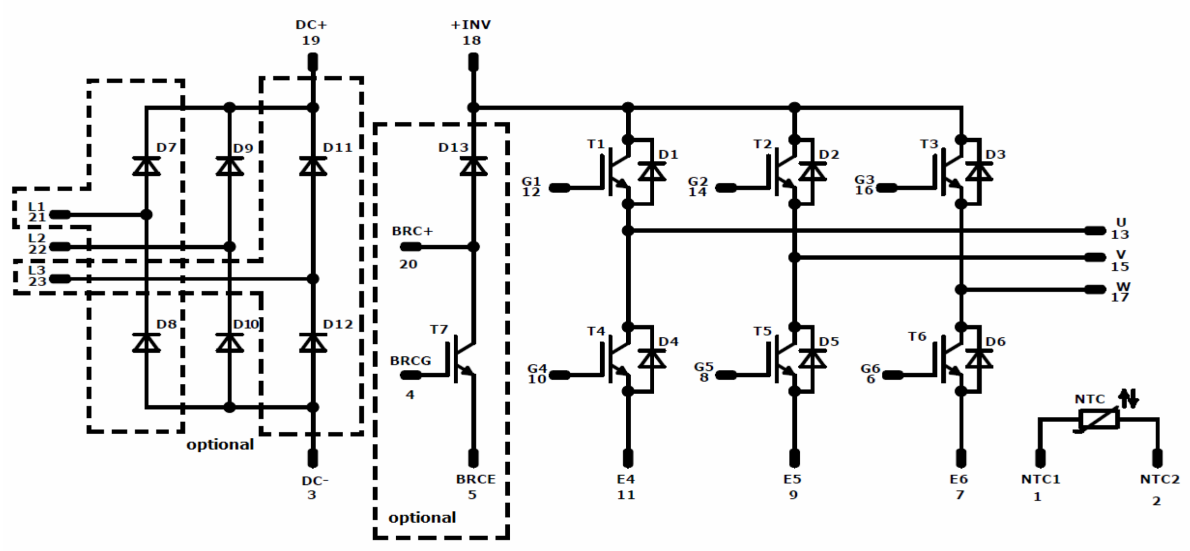
12 mm housing



Pinout variation	
Module subtype	Not assembled pins
V23990-P545-A28-PM	-
V23990-P545-A29-PM	-
V23990-P545-B28-PM	21
V23990-P545-B128-PM	23
V23990-P545-B129-PM	23
V23990-P545-C29-PM	4, 5, 20
V23990-P545-D28-PM	4, 5, 20, 21
V23990-P545-C28-PM	4, 5, 20

Ordering Code and Marking - Outline - Pinout

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2,T3,T4,T5,T6	IGBT	600V	20A	Inverter Switch	
D1,D2,D3,D4,D5,D6	FWD	600V	20A	Inverter Diode	
T7	IGBT	600V	15A	Brake Switch	
D13	FWD	600V	15A	Brake Diode	
D7,D8,D9,D10,D11,D12	Diode	1600V	25A	Rectifier Diode	
NTC	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**
V23990-P545-x2x-D9-14	28 Aug. 2019	P545-C28 version added	1,19

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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.