Vincotech

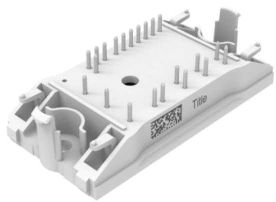
V23990-P543-B138-PM
V23990-P543-D138-PM
datasheet

flow **PIM 0** — **600 V / 10 A**

Features

- Trench Fieldstop IGBTs for low saturation losses
- Compact and low inductive design
- Built in NTC
- Optional w/o BRC

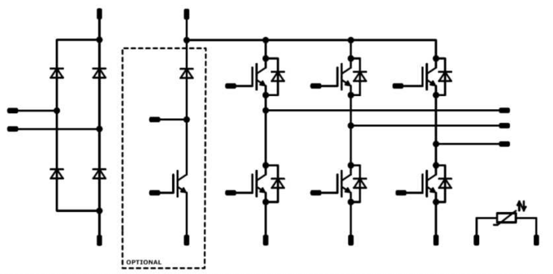
flow 0 12 mm housing



Target applications

- Industrial Drive
- Embedded Drives

Schematic



Types

- V23990-P543-B138-PM
- V23990-P543-D138-PM

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			600	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	14	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	44	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \le$ 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
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	14	A
Repetitive peak forward current	I_{FRM}			20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	21	W
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter voltage	V_{CES}			600	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	8	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		18	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	36	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq$ 150°C V_{GE} = 15V		6 360	µs V
Maximum Junction Temperature	T_{jmax}			175	°C
Brake Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	8	A
Repetitive peak forward current	I_{FRM}			12	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	27	W
Maximum Junction Temperature	T_{jmax}			175	°C
Rectifier					
Peak Repetitive Reverse Voltage	V_{RRM}			1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	44	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms	T_j = 150 °C	270	A
Surge current capability	I^2t			370	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	56	W
Maximum Junction Temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

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

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,00015	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		10	25 150	1,1	1,50 1,79	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,6	µA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		551		pF
Output capacitance	C_{oes}							40		
Reverse transfer capacitance	C_{res}							17		
Gate charge	Q_g		15	480	10	25		62		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,15		K/W
IGBT Switching										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 32 Ω	15/0	300	10	25 125		15 14		ns
Rise time	t_r					25 125		11 14		
Turn-off delay time	$t_{d(off)}$					25 125		155 170		
Fall time	t_f					25 125		89 98		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,5 µC Q_{rFWD} = 0,8 µC				25 125		0,163 0,218		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,242 0,291		

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				10	25 150		1,60 1,56	1,95	V
Reverse leakage current	I_r			600		25			27	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,98		K/W
FWD Switching										
Peak recovery current	I_{RRM}	di/dt = 866 A/µs di/dt = 907 A/µs	15/0	300	10	25 125		10 11		A
Reverse recovery time	t_{rr}					25 125		142 219		ns
Recovered charge	Q_r					25 125		0,461 0,800		µC
Reverse recovered energy	E_{rec}					25 125		0,091 0,167		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		703 397		A/µs
Brake Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{GE}=VCE			0,00018	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		6	25 125	1,1	1,49 1,68	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,4	µA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f= 1 MHz	0	25		25		368		pF
Output capacitance	C_{oes}							28		
Reverse transfer capacitance	C_{res}							11		
Gate charge	Q_g		15	480	6	25		42		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,44		K/W

Characteristic Values

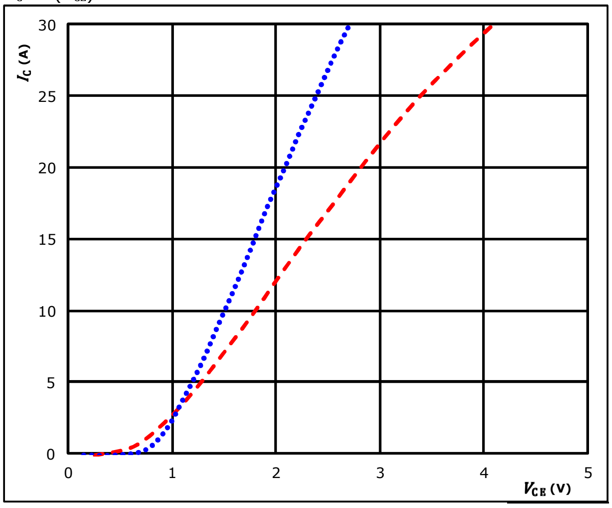
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Brake Diode										
Static										
Forward voltage	V_F				6	25 125		1,58 1,50	1,95	V
Reverse leakage current	I_r			600		25			27	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,68		K/W
Rectifier Diode										
Static										
Forward voltage	V_F				35	25 125	0,8	1,17 1,13	1,6	V
Reverse leakage current	I_r			1600		25 145			50 1100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,25		K/W
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %				25		4000		K
Vincotech NTC Reference									I	

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

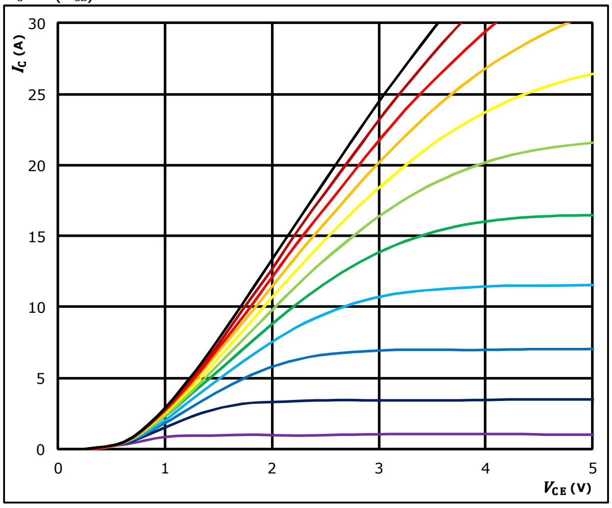


t_p =	250	µs		25	°C
V_{GE} =	15	V	T_j:	150	°C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

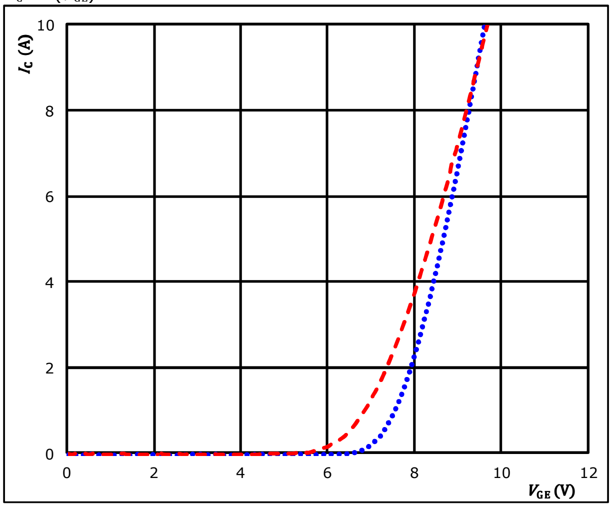


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

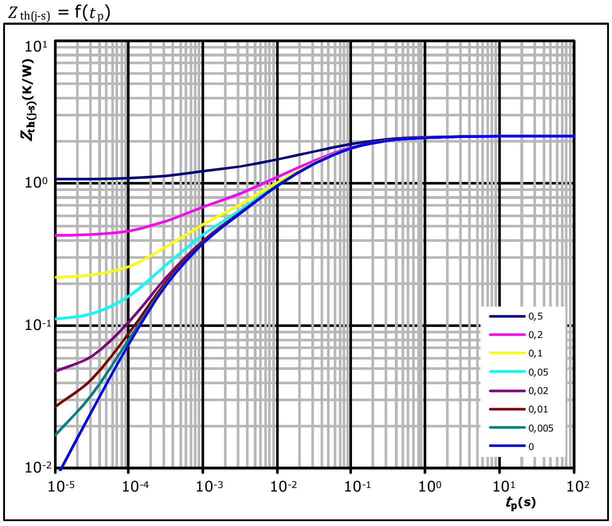


t_p =	100	µs		25	°C
V_{CE} =	10	V	T_j:	150	°C

figure 4. **IGBT**

Transient Thermal Impedance as function of Pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 2,15 K/W

IGBT thermal model values

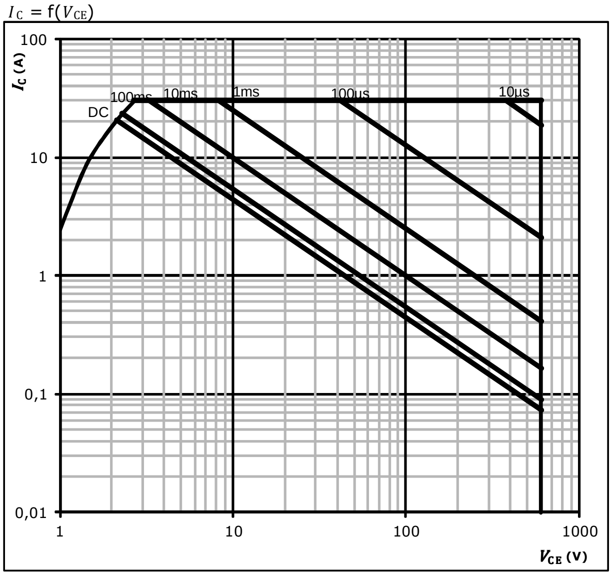
R (K/W)	τ (s)	
1,04E-01	1,37E+00	1,89E+00
2,88E-01	2,01E-01	
6,99E-01	5,27E-02	
4,91E-01	1,22E-02	
3,07E-01	2,97E-03	
2,60E-01	3,80E-04	

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area as a function of V_{GE}

$I_C = f(V_{CE})$



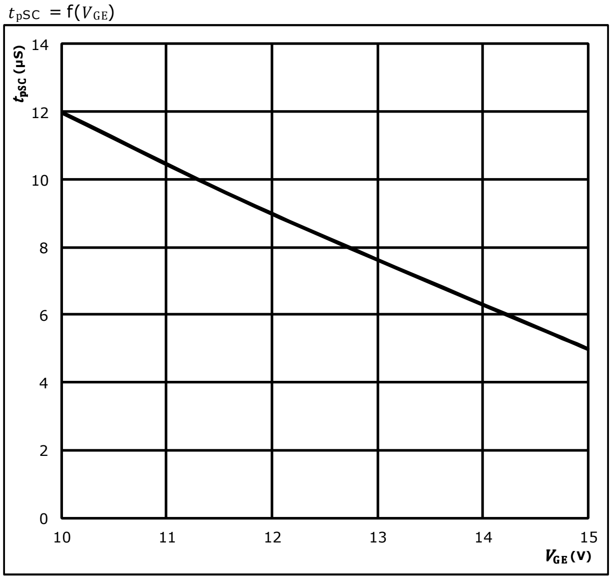
At

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

figure 6. **IGBT**

Short circuit withstand time as a function of V_{GE}

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



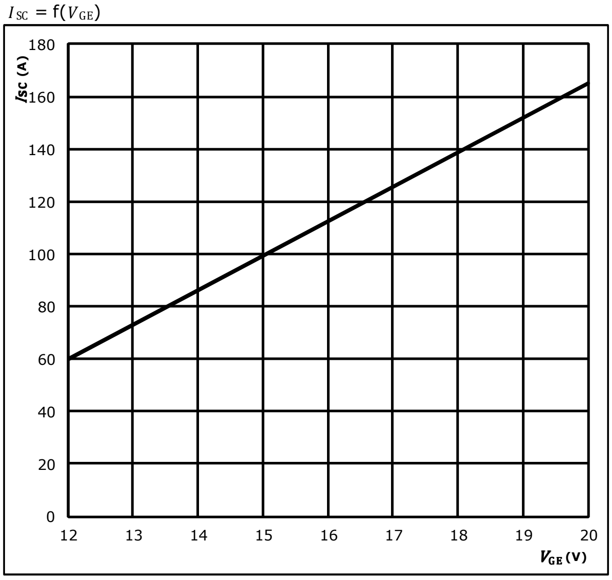
At

V_{CE} =	600	V
$T_j \le$	175	ºC

figure 7. **IGBT**

Typical short circuit collector current as a function of V_{GE}

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



At

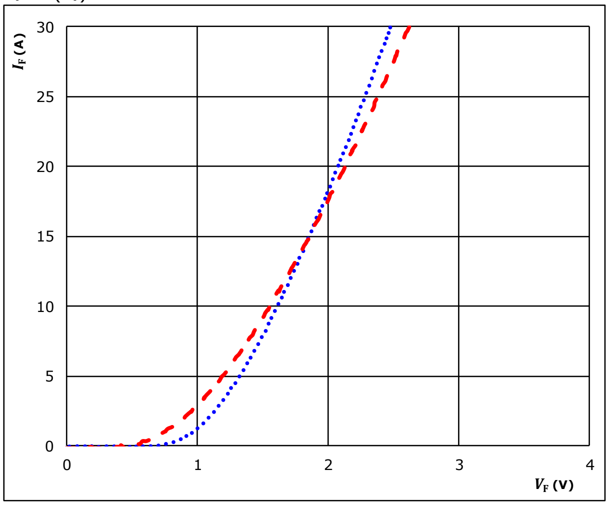
$V_{CE} \le$	600	V
$T_j \le$	175	ºC

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



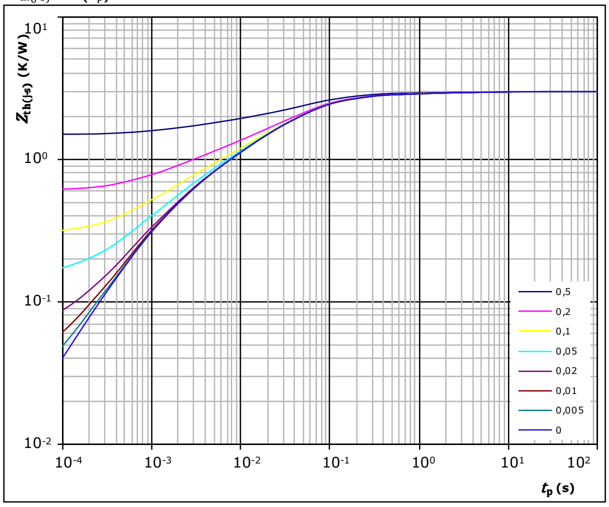
t_p = 250 µs

T_j: 25 °C; 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 2,98 K/W

FWD thermal model values

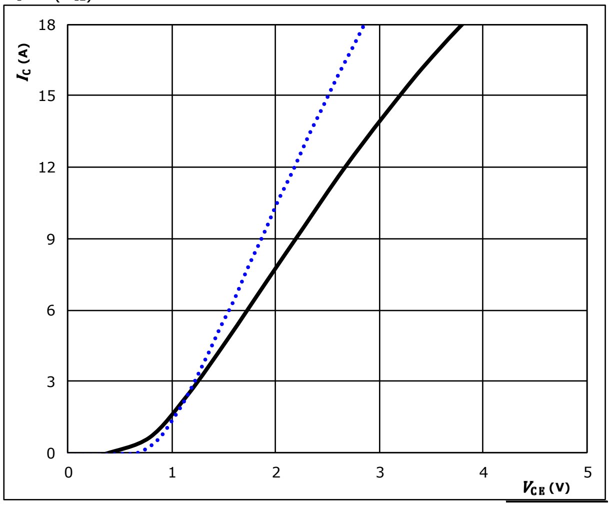
R (K/W)	τ (s)
8,74E-02	5,59E+00
2,41E-01	4,60E-01
1,22E+00	6,53E-02
6,89E-01	2,20E-02
4,52E-01	5,14E-03
2,99E-01	1,11E-03

Brake Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

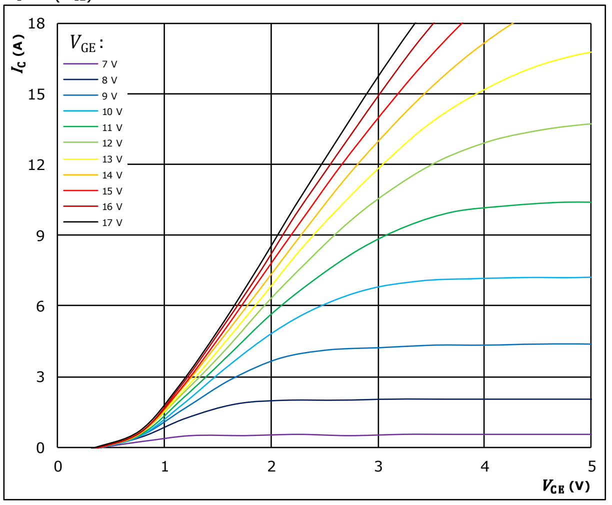


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C (dotted), 125 °C (solid)

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

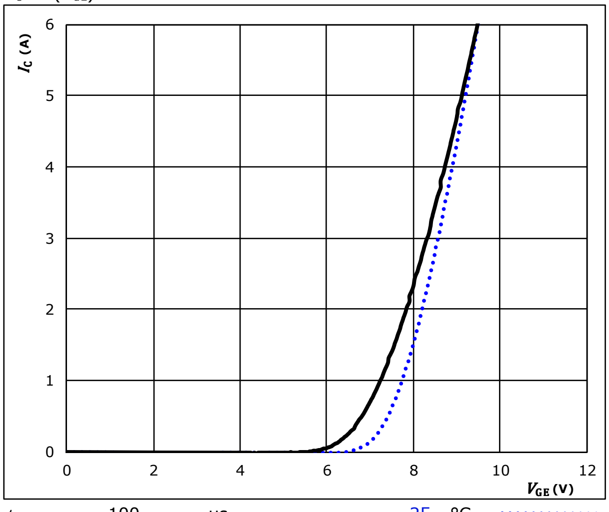


t_p = 250 µs
T_j = 125 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

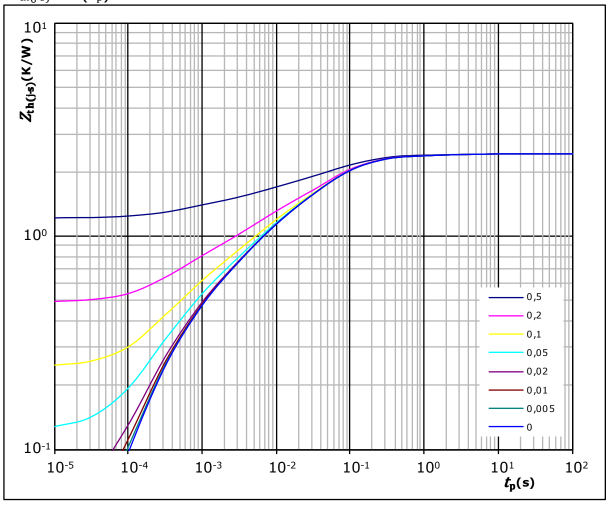


t_p = 100 µs
V_{CE} = 10 V
T_j: 25 °C (dotted), 125 °C (solid)

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T
$R_{th(j-s)}$ = 2,44 K/W

IGBT thermal model values

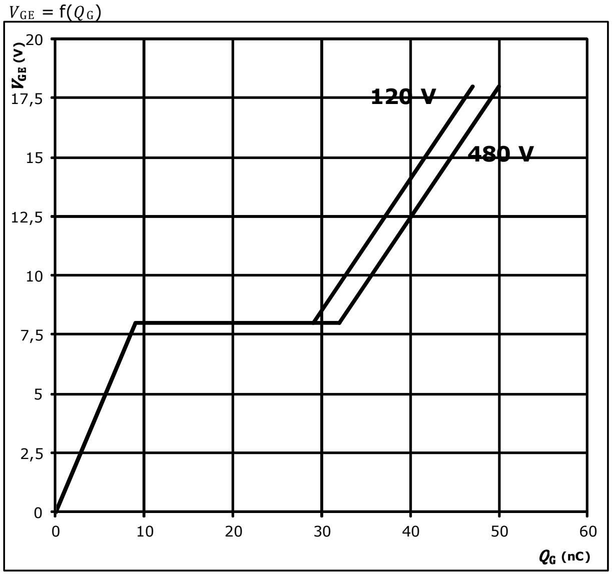
R (K/W)	τ (s)
7,91E-02	1,76E+00
2,81E-01	1,79E-01
9,46E-01	4,96E-02
4,95E-01	8,14E-03
3,46E-01	1,95E-03
2,91E-01	3,14E-04

Brake Switch Characteristics

figure 5. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



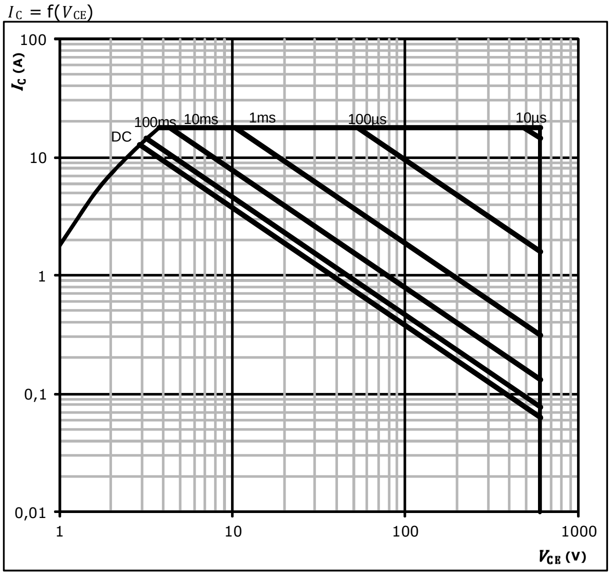
At

$I_C =$ 6 A

figure 6. **IGBT**

Safe operating area as a function of V_{GE}

$I_C = f(V_{CE})$



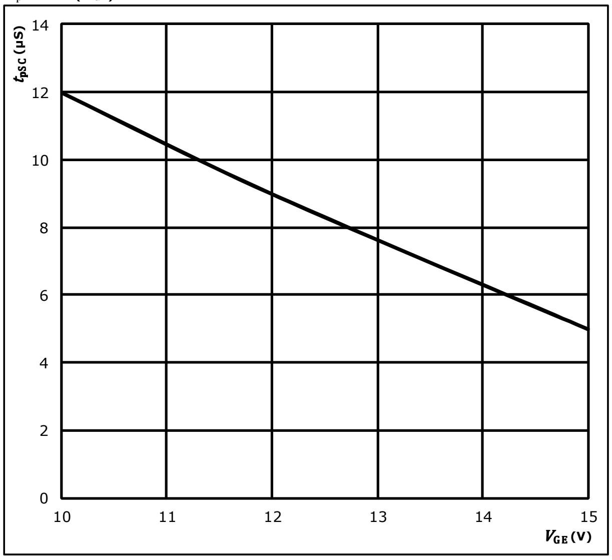
At

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

figure 7. **IGBT**

Short circuit withstand time as a function of V_{GE}

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



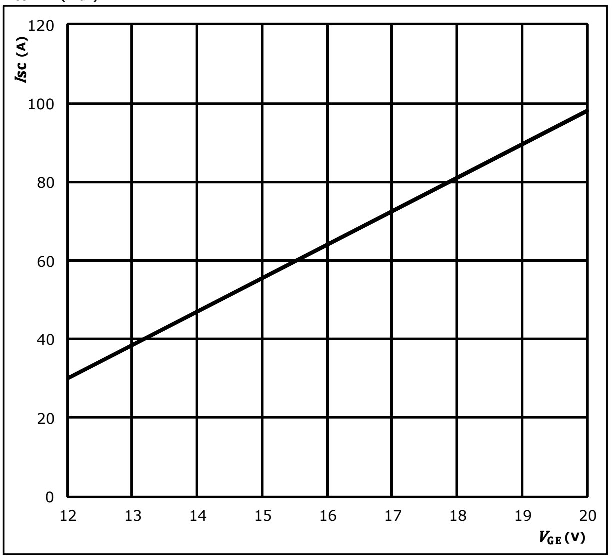
At

$V_{CE} =$ 600 V
$T_j \leq$ 175 ºC

figure 8. **IGBT**

Typical short circuit collector current as a function of V_{GE}

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



At

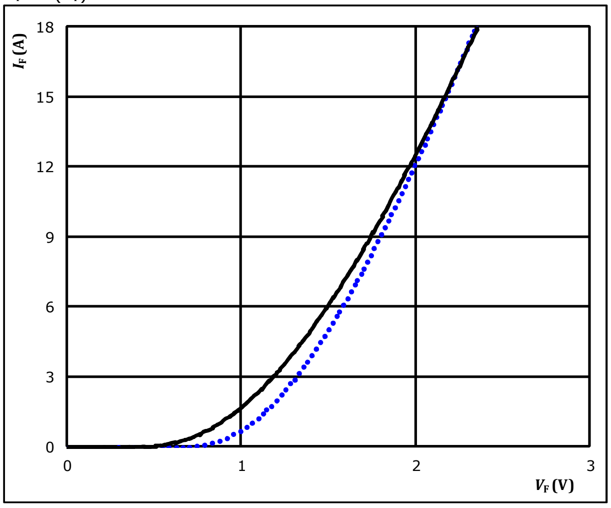
$V_{CE} \leq$ 600 V
$T_j \leq$ 175 ºC

Brake Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



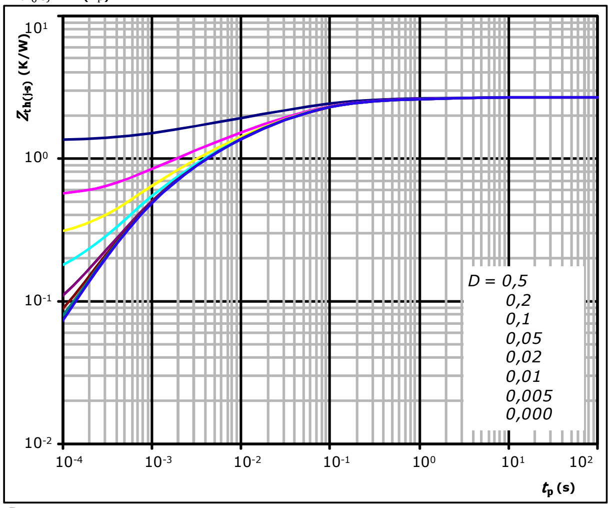
t_p = 250 µs

T_j: 25 °C (dotted), 125 °C (solid)

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 2,68 K/W

FWD thermal model values

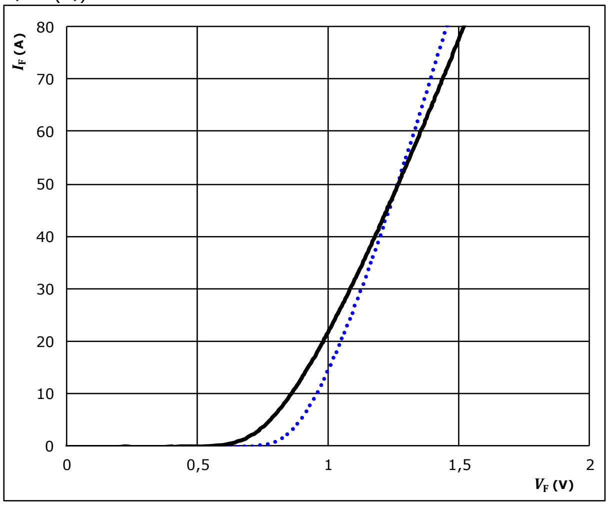
R (K/W)	τ (s)
1,1080E-01	2,7740E+00
2,7120E-01	2,2660E-01
7,9740E-01	4,9820E-02
6,3400E-01	1,2490E-02
5,3640E-01	2,8780E-03
3,3240E-01	6,5980E-04

Rectifier Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



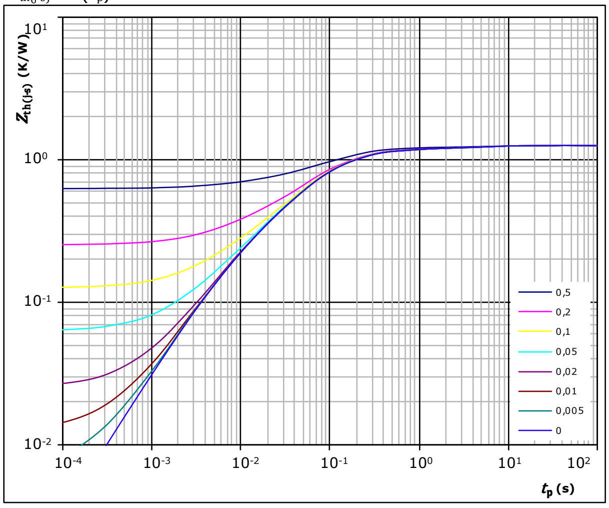
t_p = 250 μs

T_j: 25 °C / 125 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j\text{-}s)}$ = 1,25 K/W

FWD thermal model values

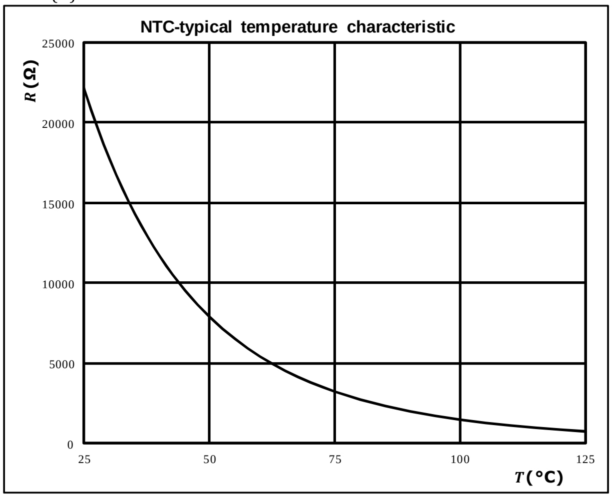
R (K/W)	τ (s)
8,00E-02	5,22E+00
1,56E-01	4,18E-01
6,95E-01	8,82E-02
2,23E-01	3,07E-02
9,97E-02	5,99E-03

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature

$R = f(T)$

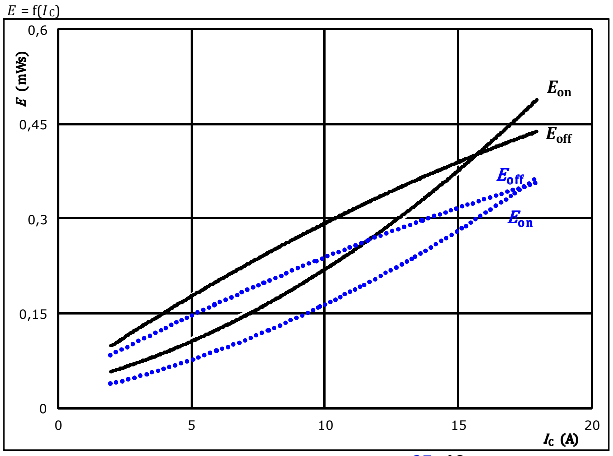


Inverter Switching Characteristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



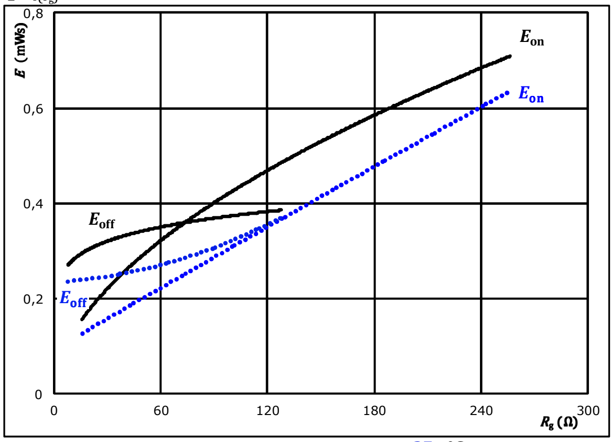
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
R_{gon} =	32	Ω			
R_{goff} =	16	Ω			

Figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



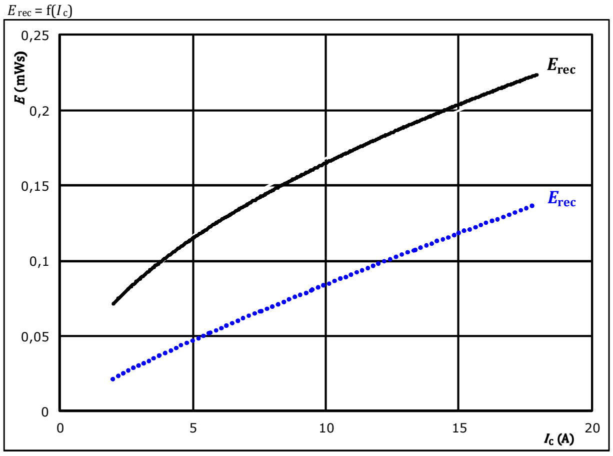
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
I_C =	10	A			

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



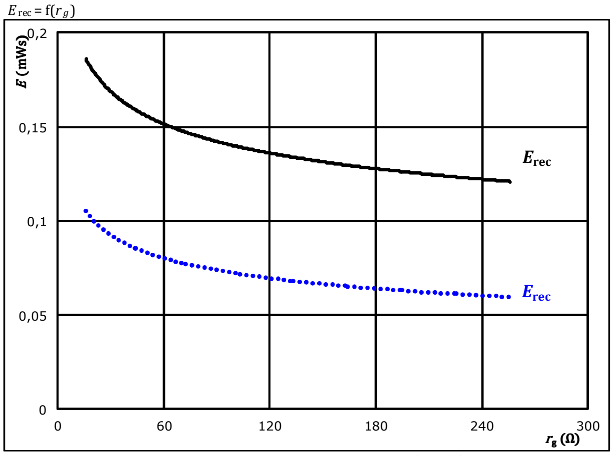
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
R_{gon} =	32	Ω			

Figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(r_g)$



With an inductive load at

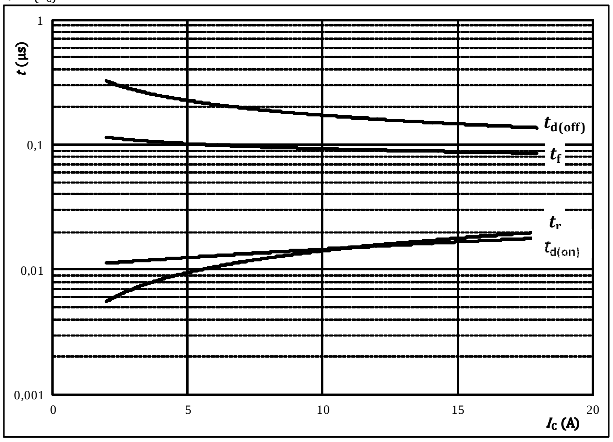
V_{CE} =	300	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
I_C =	10	A			

Inverter Switching Characteristics

Figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



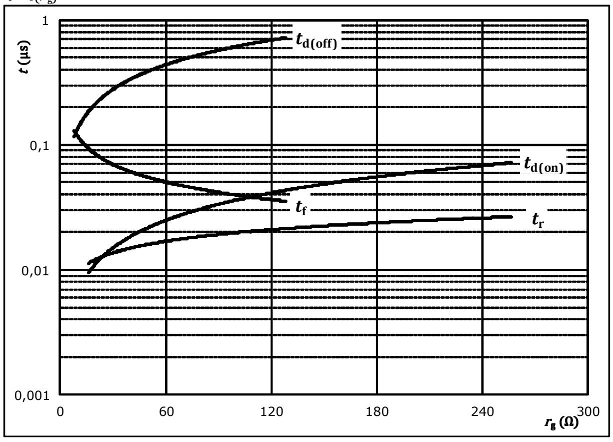
With an inductive load at

$T_j =$	125	°C
$V_{CE} =$	300	V
$V_{GE} =$	15/0	V
$R_{gon} =$	32	Ω
$R_{goff} =$	16	Ω

Figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(r_g)$



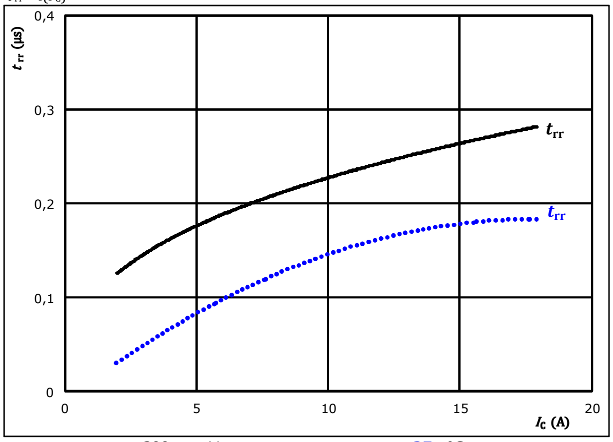
With an inductive load at

$T_j =$	125	°C
$V_{CE} =$	300	V
$V_{GE} =$	15/0	V
$I_C =$	10	A

Figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

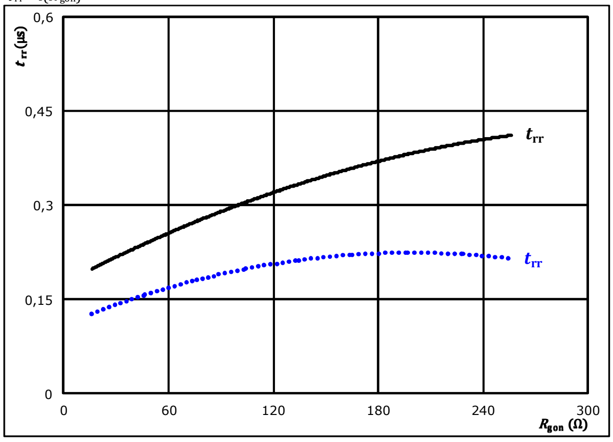


At						
$V_{CE} =$	300	V		25	°C	············
$V_{GE} =$	15/0	V	T_j:	125	°C	———
$R_{gon} =$	32	Ω				

Figure 8. **FWD**

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

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



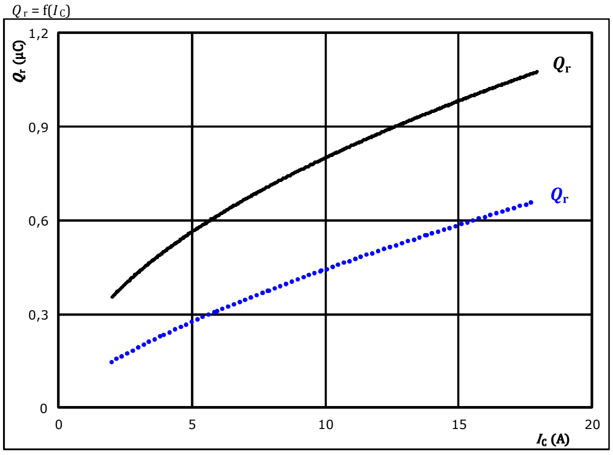
At						
$V_{CE} =$	300	V		25	°C	············
$V_{GE} =$	15/0	V	T_j:	125	°C	———
$I_C =$	10	A				

Inverter Switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



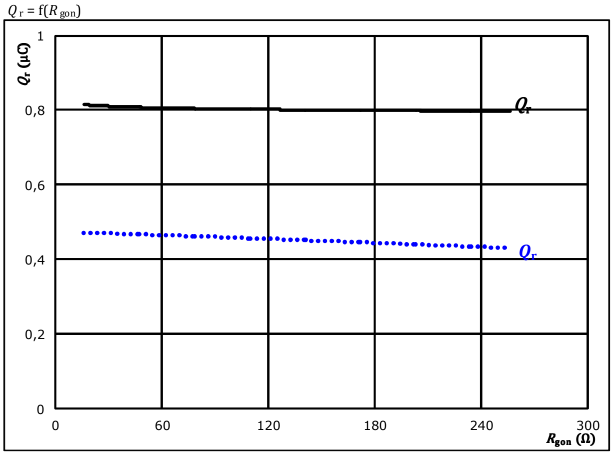
At V_{CE} = 300 V; V_{GE} = 15/0 V; R_{gon} = 32 Ω

T_j: 25 °C (dotted); 125 °C (solid)

Figure 10. **FWD**

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

$Q_r = f(R_{gon})$



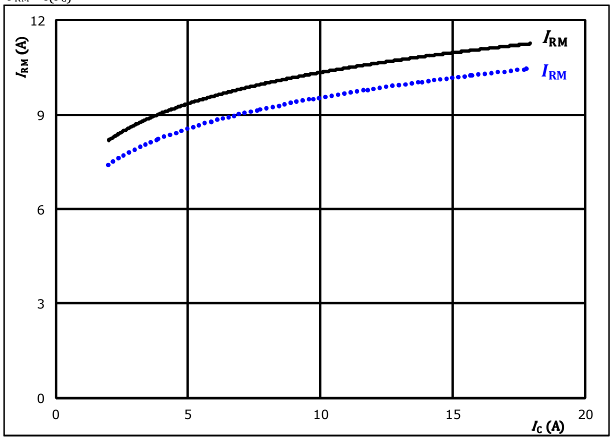
At V_{CE} = 300 V; V_{GE} = 15/0 V; I_C = 10 A

T_j: 25 °C (dotted); 125 °C (solid)

Figure 11. **FWD**

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

$I_{RM} = f(I_C)$



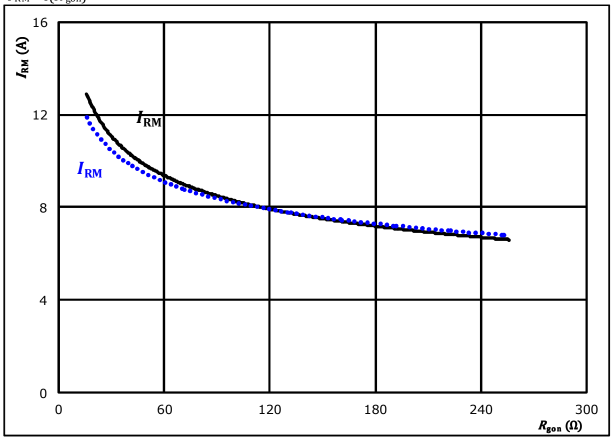
At V_{CE} = 300 V; V_{GE} = 15/0 V; R_{gon} = 32 Ω

T_j: 25 °C (dotted); 125 °C (solid)

Figure 12. **FWD**

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

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



At V_{CE} = 300 V; V_{GE} = 15/0 V; I_C = 10 A

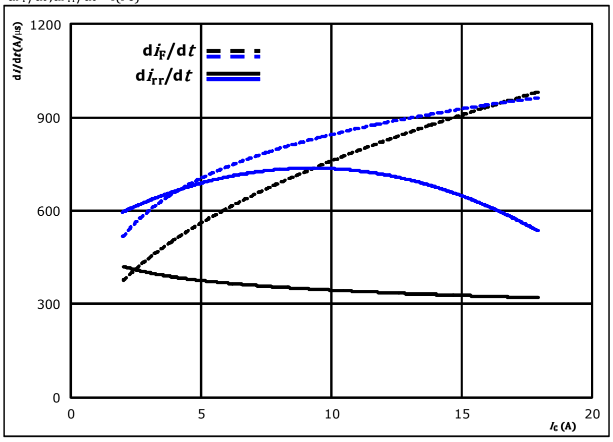
T_j: 25 °C (dotted); 125 °C (solid)

Inverter Switching Characteristics

Figure 13. **FWD**

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

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



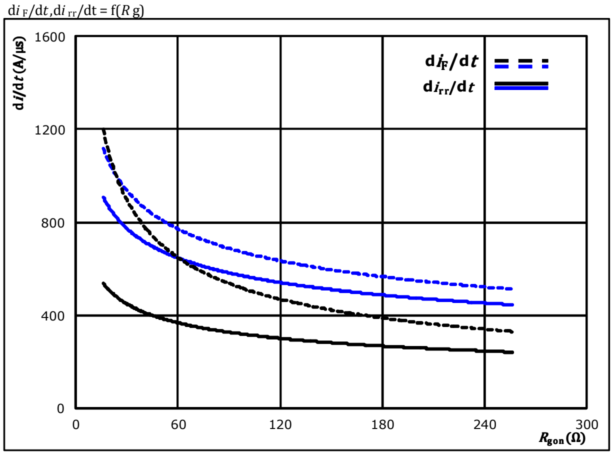
At V_{CE} = 300 V; V_{GE} = 15/0 V; R_{gon} = 32 Ω

T_j: 25 °C (dotted); 125 °C (solid)

Figure 14. **FWD**

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

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



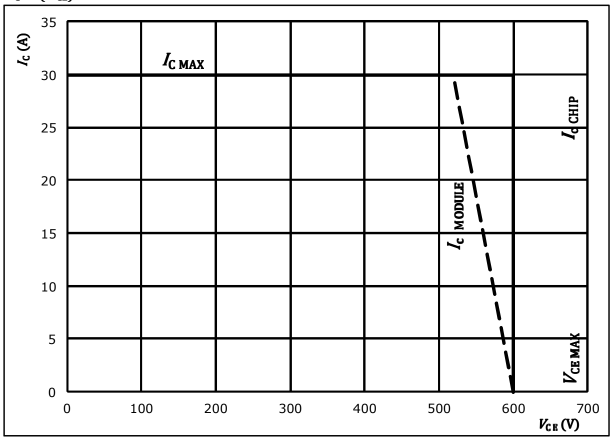
At V_{CE} = 300 V; V_{GE} = 15/0 V; I_C = 10 A

T_j: 25 °C (dotted); 125 °C (solid)

Figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

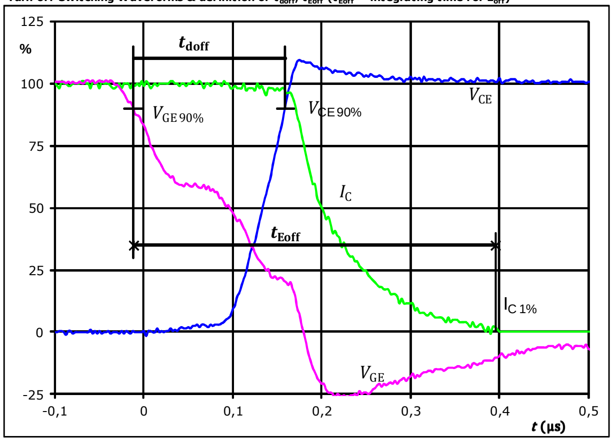
T_j =	175	°C
R_{gon} =	32	Ω
R_{goff} =	16	Ω

Inverter Switching Definitions

General conditions		
T_j	=	**125 °C**
R_{gon}	=	**32 Ω**
R_{goff}	=	**16 Ω**

Figure 1. **IGBT**

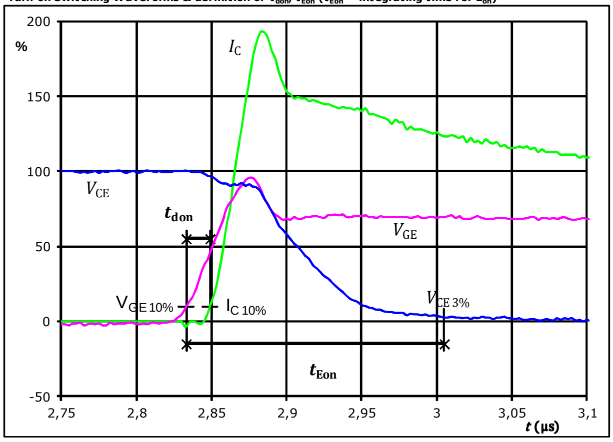
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	10	A
t_{doff} =	0,171	µs
t_{Eoff} =	0,407	µs

Figure 2. **IGBT**

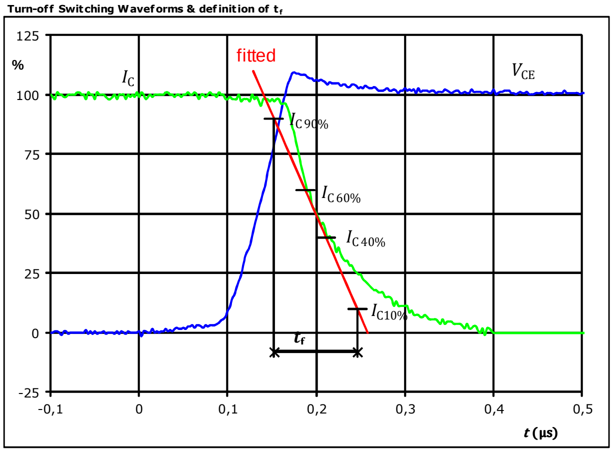
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	10	A
t_{don} =	0,015	µs
t_{Eon} =	0,172	µs

Figure 3. **IGBT**

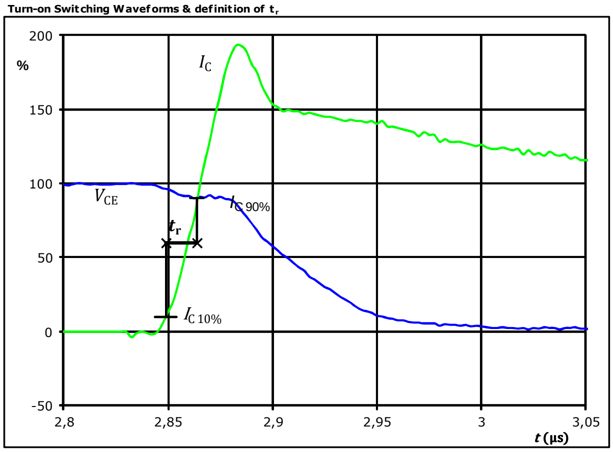
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	10	A
t_f =	0,092	µs

Figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

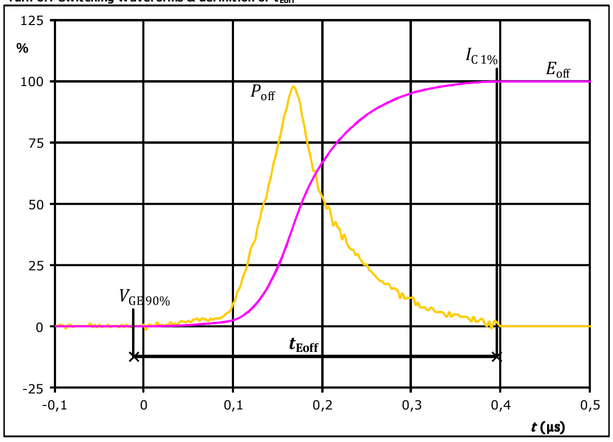


$V_C(100\%)$ =	300	V
$I_C(100\%)$ =	10	A
t_r =	0,015	µs

Inverter Switching Characteristics

Figure 5. **IGBT**

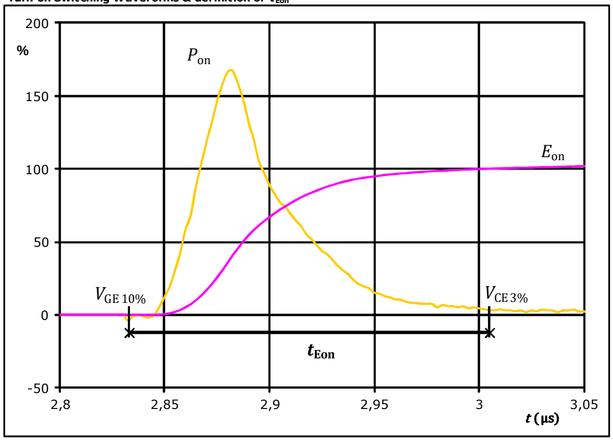
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	2,99	kW
E_{off} (100%) =	0,28	mJ
t_{Eoff} =	0,407	µs

Figure 6. **IGBT**

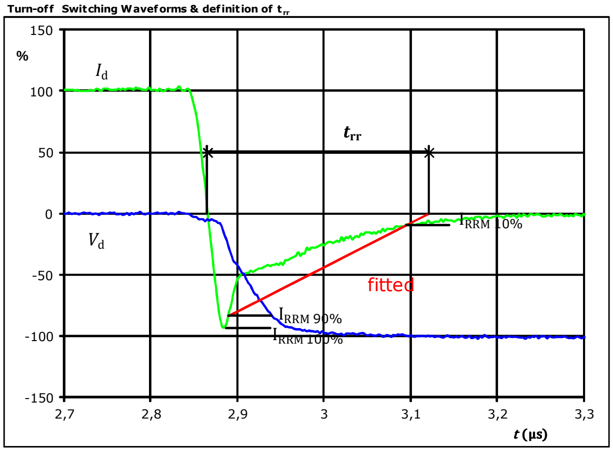
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	2,99	kW
E_{on} (100%) =	0,25	mJ
t_{Eon} =	0,172	µs

Figure 7. **FWD**

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

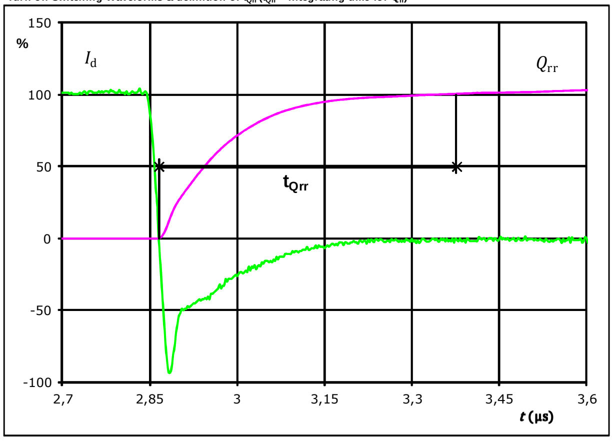


V_d (100%) =	300	V
I_d (100%) =	10	A
I_{RRM} (100%) =	9	A
t_{rr} =	0,256	µs

Inverter Switching Characteristics

Figure 8. **FWD**

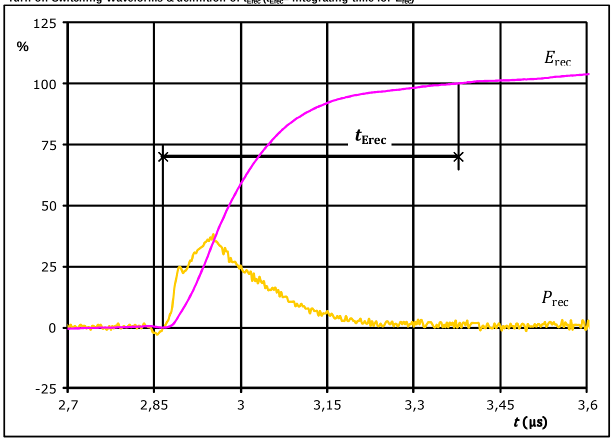
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	10	A
Q_{rr} (100%) =	0,85	µC
t_{Qrr} =	0,511	µs

Figure 9. **FWD**

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

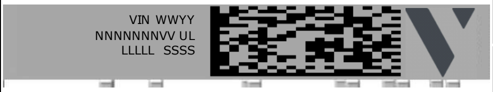


P_{rec} (100%) =	2,99	kW
E_{rec} (100%) =	0,18	mJ
t_{Erec} =	0,511	µs

Vincotech

Ordering Code & Marking

Version	Ordering Code
without thermal paste 12 mm housing with one-phase rectifier	V23990-P543-B138-PM
without thermal paste 12 mm housing without BRC with one-phase rectifier	V23990-P543-D138-PM
with thermal paste 12 mm housing with one-phase rectifier	V23990-P543-B138-/3/-PM
with thermal paste 12 mm housing without BRC with one-phase rectifier	V23990-P543-D138-/3/-PM

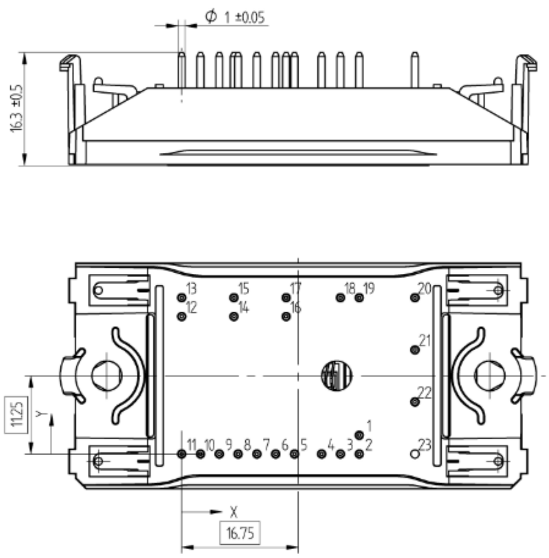


Text	**VIN**	**Date code**	**Name&Ver**	**UL**	**Lot**	**Serial**
	VIN	WWYY	NNNNNNNNVV	UL	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table

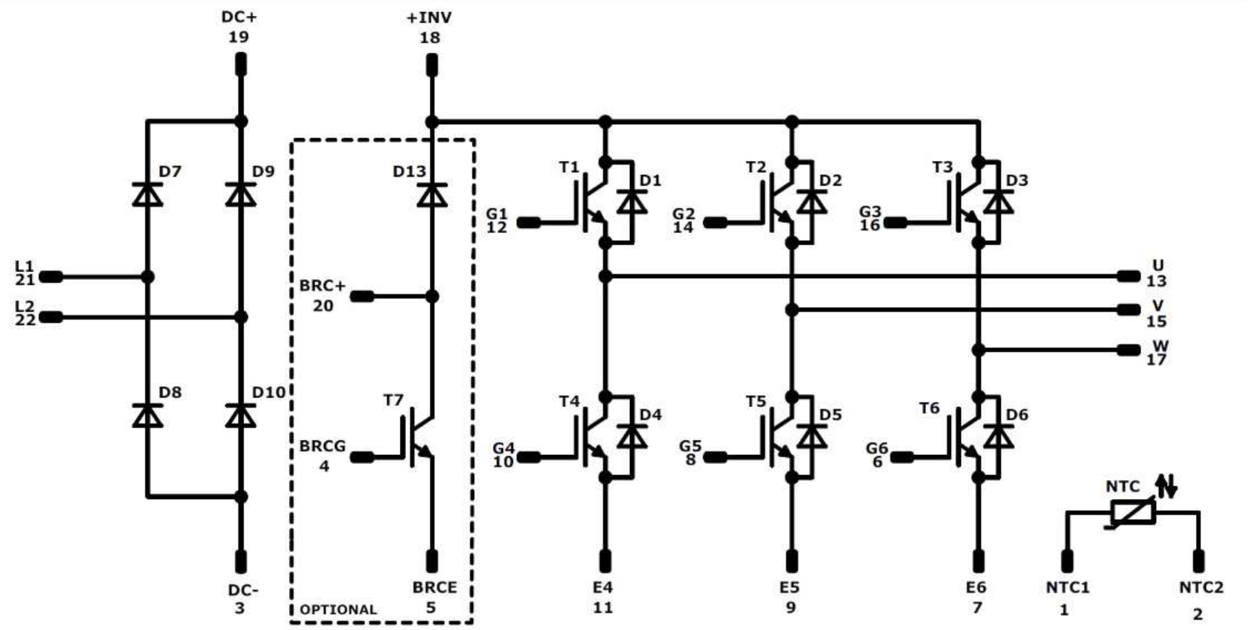
Pin	X	Y	Function
1	25,5	2,7	NTC1
2	25,5	0	NTC2
3	22,8	0	-DC
4	20,1	0	BRCG
5	16,2	0	BRCE
6	13,5	0	G6
7	10,8	0	E6
8	8,1	0	G5
9	5,4	0	E5
10	2,7	0	G4
11	0	0	E4
12	0	19,8	G1
13	0	22,5	U
14	7,5	19,8	G2
15	7,5	22,5	V
16	15	19,8	G3
17	15	22,5	W
18	22,8	22,5	+INV
19	25,5	22,5	+DC
20	33,5	22,5	BRC+
21	33,5	15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



Pinout variation

Missing pins	Module subtype
-	V23990-P543-B138-PM
4, 5, 20	V23990-P543-D138-PM

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1, T2, T3, T4, T5, T6	IGBT	600 V	10 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	600 V	10 A	Inverter Diode	
T7	IGBT	600 V	6 A	Brake Switch	Optional
D13	FWD	600 V	6 A	Brake Diode	Optional
D7, D8, D9, D10	Rectifier	1600 V	35 A	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-P543-x138-D2-14	25 Nov. 2018	R_{th}, I_{max}, P_{tot} values corrected	All