V23990-P634-A-PM
datasheet

flow 90PIM 1 — 600 V / 20 A

Features

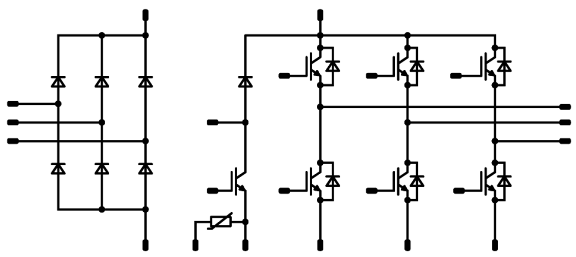
- Trench Fieldstop Technology IGBT3 for low saturation loss
- Supports design with 90° mounting angle between heatsink and PCB
- Clip-in PCB mounting
- Clip or screw on heatsink mounting

flow 90 housing

Target applications

- Industrial drives

Schematic



Types

- V23990-P634-A-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	$T_j=T_j$max	T_S=80°C	24	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_j$max		60	A
Total power dissipation	P_{tot}	$T_j=T_j$max	T_S=80°C	53	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150°C V_{GE} = 15V		6 360	µs V
Maximum Junction Temperature	T_{jmax}			175	°C

Parameter	Symbol	Conditions		Value	Unit
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
Continuous (direct) forward current	I_F	$T_j=T_{jmax}$	T_h=80°C	24	A
Repetitive peak forward current	I_{FRM}			40	A
Total power dissipation	P_{tot}	$T_j=T_{jmax}$	T_h=80°C	40	W
Maximum Junction Temperature	T_{jmax}			175	°C

Parameter	Symbol	Condition		Value	Unit
Brake switch					
Collector-emitter voltage	V_{CES}			600	V
Collector current	I_C	$T_j=T_j$max	T_S=80°C	20	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_j$max		45	A
Total power dissipation	P_{tot}	$T_j=T_j$max	T_S=80°C	47	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

Parameter	Symbol	Conditions		Value	Unit
Brake Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
Continuous (direct) forward current	I_F	$T_j=T_{jmax}$	T_h=80°C	17	A
Repetitive peak forward current	I_{FRM}			20	A
Total power dissipation	P_{tot}	$T_j=T_{jmax}$	T_h=80°C	34	W
Maximum Junction Temperature	T_{jmax}			175	°C

Parameter	Symbol	Conditions		Value	Unit
Rectifier Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
Mean forward current	I_{FAV}	$T_j = T_{jmax}$	T_s = 80 °C	33	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave		200	A
Surge current capability	I^2t	t_p = 10 ms 50 Hz sine	T_j = 150 °C	200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	43	W
Maximum Junction Temperature	T_{jmax}			150	°C

Parameter	Symbol	Conditions		Value	Unit
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation Junction Temperature	T_{jop}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC voltage	t_p=2s	4000	V
Creepage distance				min 12,7	mm
Clearance				min 11,84	mm
Comparative Tracking Index	CTI			>200	

Characteristic Values

Inverter Switch

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,00029	25 125	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125 150	1,1	1,52 - 1,84	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600		25 125			1,1	µA
Gate-emitter leakage current	I_{GES}		20	0		25 125			300	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f=1 MHz	0	25		25		1100		pF
Output capacitance	C_{oes}							71		
Reverse transfer capacitance	C_{res}							32		
Gate charge	Q_g		15	480	20	25		120		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						1,81		K/W
IGBT Switching										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 16 Ω	±15	300	20	25 150		71 70		ns
Rise time	t_r					25 150		11 16		
Turn-off delay time	$t_{d(off)}$					25 150		122 143		
Fall time	t_f					25 150		91 111		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,8 µC Q_{rFWD} = 1,7 µC				25 150		0,259 0,380		mWs
Turn-off energy (per pulse)	E_{off}					25 150		0,448 0,613		

Inverter Diode

Parameter	Symbol	Conditions					Value			Unit
				V_r [V]	I_F [A]	T_j [°C]	Min	Typ	Max	
Static										
Forward voltage	V_F				20	25 125 150		1,70 1,58 -	1,95	V
Reverse leakage current	I_r			600		25 150			27 -	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material ʎ=3,4W/mK						2,37		K/W
FWD Switching										
Peak recovery current	I_{RRM}	di/dt = 2072 A/µs di/dt = 1922 A/µs	±15	300	20	25 150		22 26		A
Reverse recovery time	t_{rr}					25 150		125 204		ns
Recovered charge	Q_r					25 150		0,809 1,713		µC
Reverse recovered energy	E_{rec}					25 150		0,171 0,373		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		2050 741		A/µs

Brake Switch

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,00021	25 125	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125 150	1,1	1,59 - 1,85	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600		25 125			0,85	μA
Gate-emitter leakage current	I_{GES}		20	0		25 125			300	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f=1 MHz	0	25		25		860		pF
Output capacitance	C_{oes}							55		
Reverse transfer capacitance	C_{res}							24		
Gate charge	Q_g		15	480	15	25		87		nC

Parameter	Symbol	Conditions					Min	Typ	Max	Unit
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						2,03		K/W

Parameter	Symbol	Conditions					Min	Typ	Max	Unit
IGBT Switching										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 32 Ω	15/0	300	15	25 125		19 21		ns
Rise time	t_r					25 125		16 20		
Turn-off delay time	$t_{d(off)}$					25 125		186 202		
Fall time	t_f					25 125		89 94		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,5 μC				25 125		0,334 0,408		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,318 0,402		

Brake Diode

Parameter	Symbol	Conditions					Value			Unit
				V_r [V]	I_F [A]	T_j [°C]	Min	Typ	Max	
Static										
Forward voltage	V_F				10	25 150		1,60 1,56	1,95	V
Reverse leakage current	I_r			600		25 150			27 -	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material λ=3,4W/mK						2,79		K/W
FWD Switching										
Peak recovery current	I_{RRM}	R_{gon} = 32 Ω	15/0	300	15	25 125		8 9		A
Reverse recovery time	t_{rr}					25 125		198 276		ns
Recovered charge	Q_r					25 125		0,514 0,935		µC
Reverse recovered energy	E_{rec}					25 125		0,094 0,187		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		411 78		A/µs

Rectifier Diode

Parameter	Symbol	Conditions					Value			Unit
				V_r [V]	I_F [A]	T_j	Min	Typ	Max	
Static										
Forward voltage	V_F				25	25°C 125°C 150°C		1,22 1,21 -	1,9	V
Reverse leakage current	I_R			1600		25°C 150°C			50 1100	µA
Thermal										
Thermal resistance junction to case	$R_{th(j\text{-}c)}$	Phase-Change Material λ=3,4W/mK						1,61		K/W

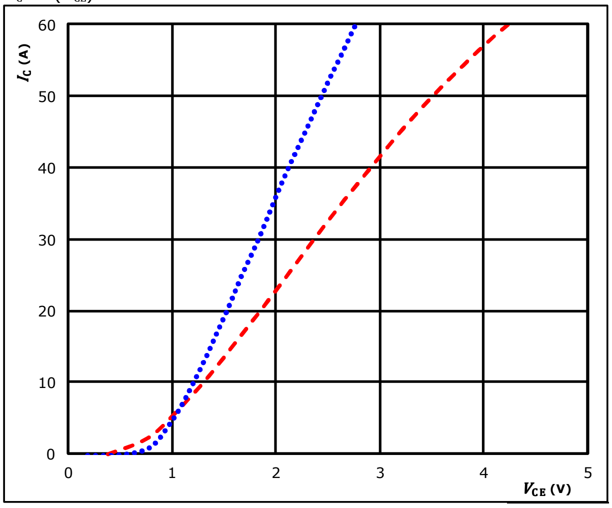
Thermistor

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	
Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R100=1486 Ω				100	-12		+12	%
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		3998		K
Vincotech NTC Reference									B	

Inverter Switch Characteristics

Typical output characteristics **IGBT**

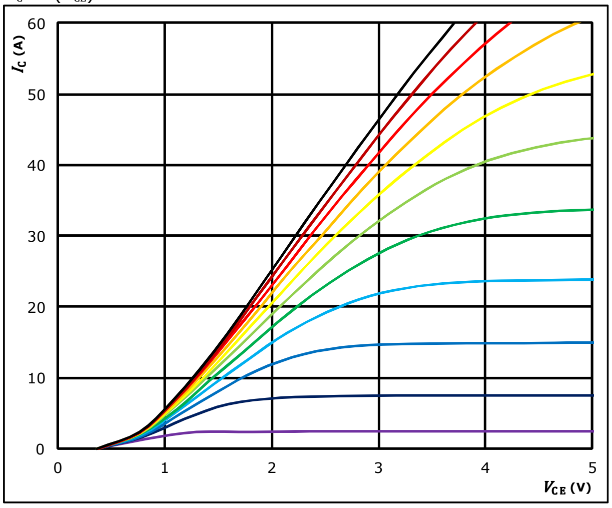
$I_C = f(V_{CE})$



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

Typical output characteristics **IGBT**

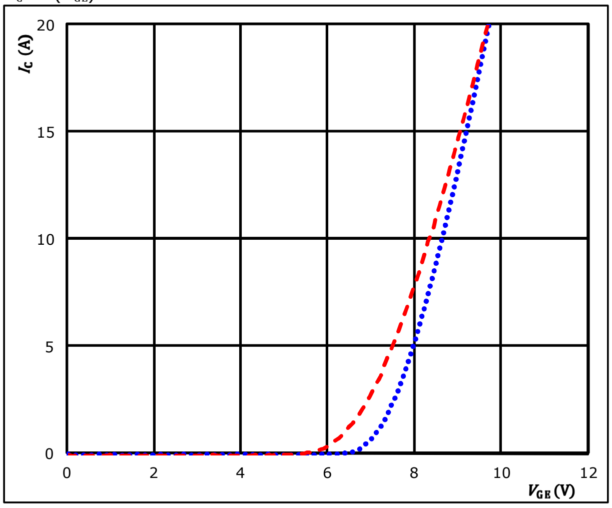
$I_C = f(V_{CE})$



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

Typical transfer characteristics **IGBT**

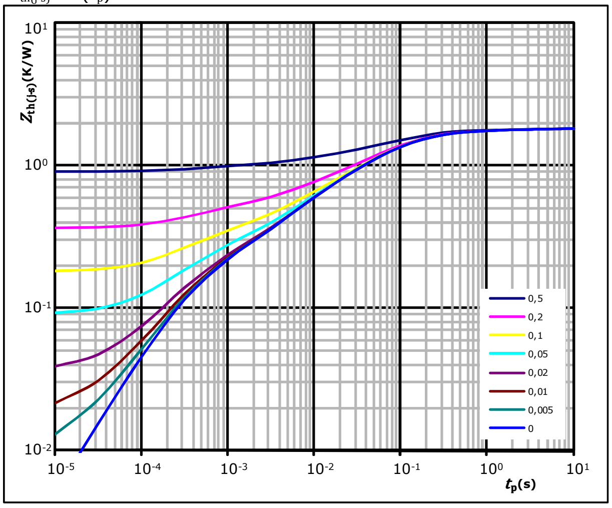
$I_C = f(V_{GE})$



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

Transient Thermal Impedance as function of Pulse duration **IGBT**

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



D = t_p / T
$R_{th(j-s)}$ = 1,81 K/W

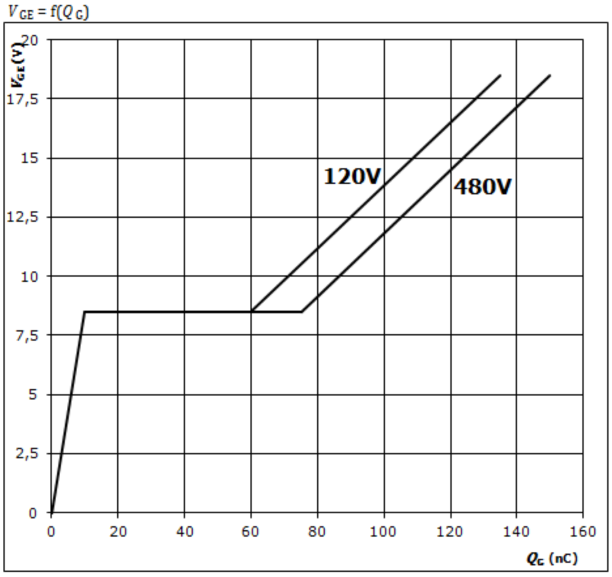
IGBT thermal model values

R (K/W)	τ (s)
6,63E-02	3,68E+00
1,83E-01	4,61E-01
8,24E-01	8,38E-02
3,93E-01	1,82E-02
1,96E-01	3,57E-03
1,49E-01	3,52E-04

Inverter Switch Characteristics

Gate voltage vs Gate charge IGBT

$V_{GE} = f(Q_G)$

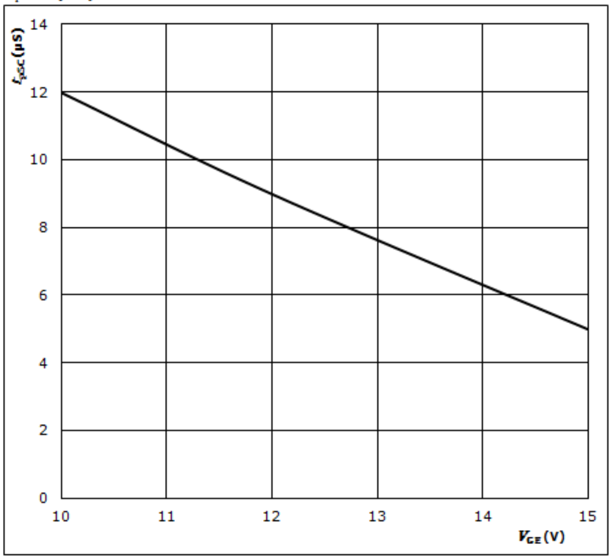


At

I_C=	20	A

Short circuit duration as a function of V_{GE} IGBT

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

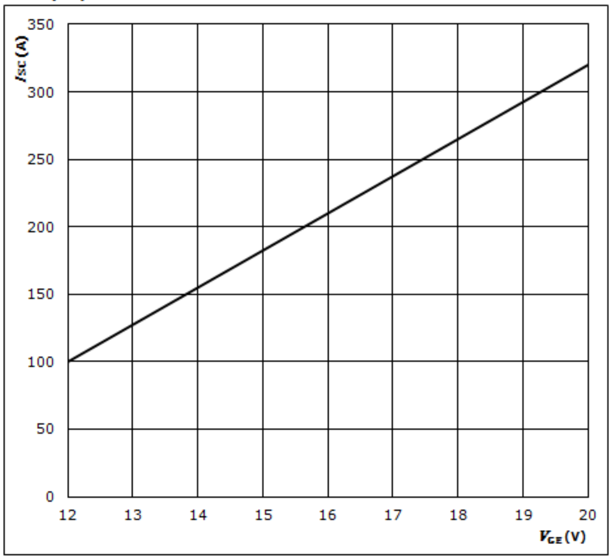


At

V_{CE} =	600	V
$T_j \leq$	175	ºC

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

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



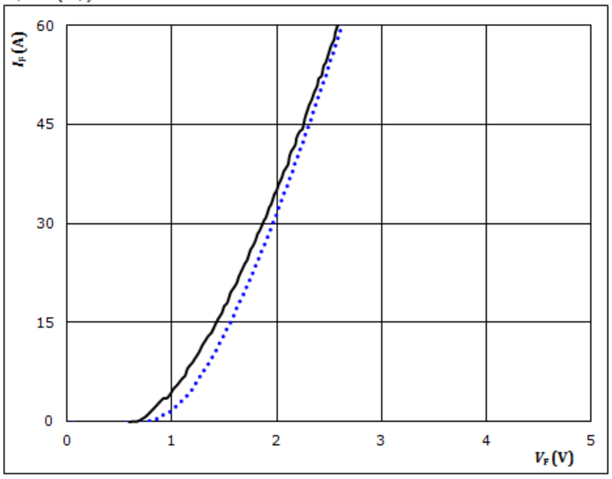
At

$V_{CE} \leq$	600	V
$T_j \leq$	175	ºC

Inverter Diode Characteristics

Typical forward characteristics	FWD

$I_F = f(V_F)$

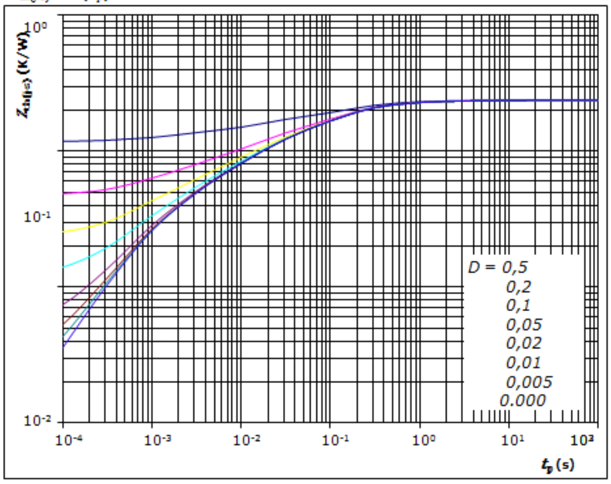


t_p = 250 µs

T_j: 25 °C ············
125 °C ————
150 °C – – – –

Transient thermal impedance as a function of pulse width	FWD

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



D = t_p / T
$R_{th(j-s)}$ = 2,37 K/W

FWD thermal model values

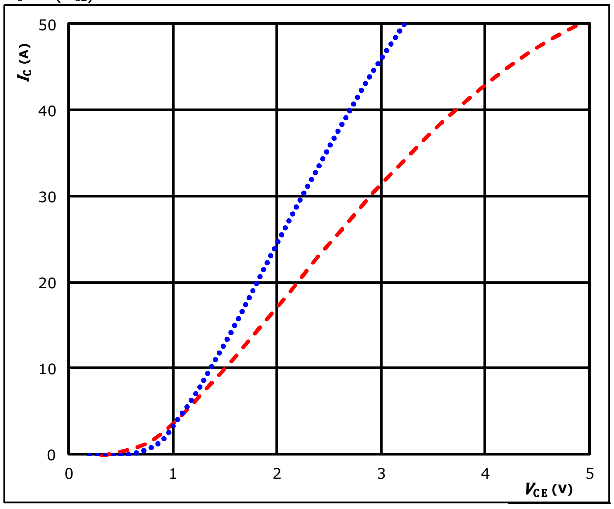
R (K/W)	τ (s)
4,62E-02	8,95E+00
1,39E-01	1,10E+00
6,93E-01	1,96E-01
5,75E-01	6,44E-02
6,19E-01	9,95E-03
2,95E-01	1,01E-03

Brake Switch Characteristics

figure 1.	IGBT

Typical output characteristics

$I_C = f(V_{CE})$

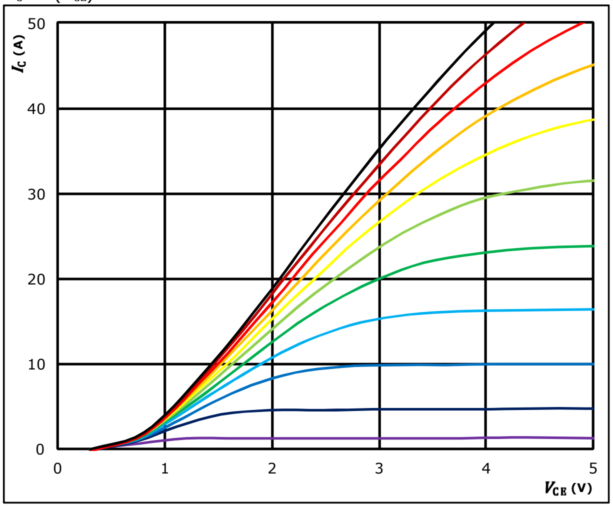


t_p =	250	μs		25 °C	··········
V_{GE} =	15	V	T_j:	150 °C	– – – –

figure 2.	IGBT

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 μs

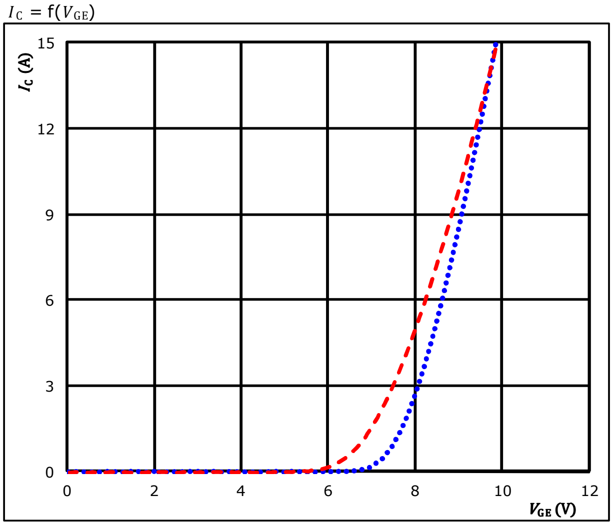
T_j = 150 °C

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

figure 3.	IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

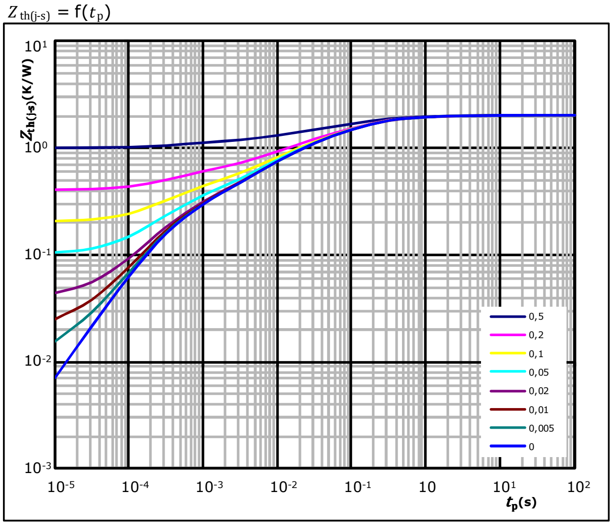


t_p =	100	μs		25 °C	··········
V_{CE} =	10	V	T_j:	150 °C	– – – –

figure 4.	IGBT

Transient Thermal Impedance as function of Pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 2,03 K/W

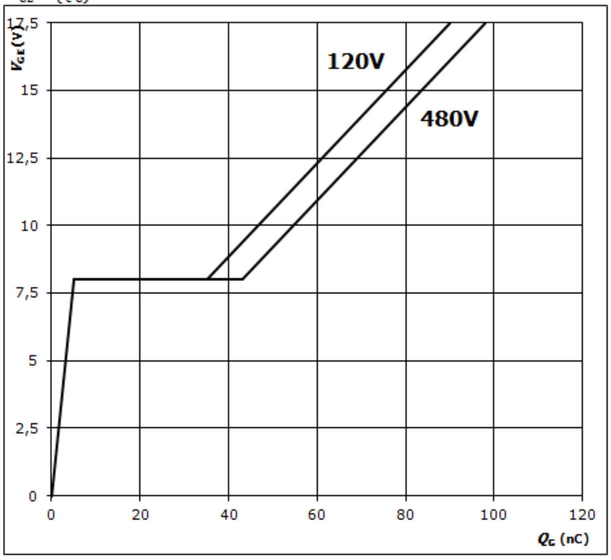
IGBT thermal model values

R (K/W)	τ (s)
3,94E-02	6,65E+00
2,08E-01	7,06E-01
7,57E-01	1,14E-01
5,53E-01	1,86E-02
2,62E-01	3,35E-03
2,07E-01	3,46E-04

Brake Switch Characteristics

Gate voltage vs Gate charge IGBT

$V_{GE} = f(Q_G)$

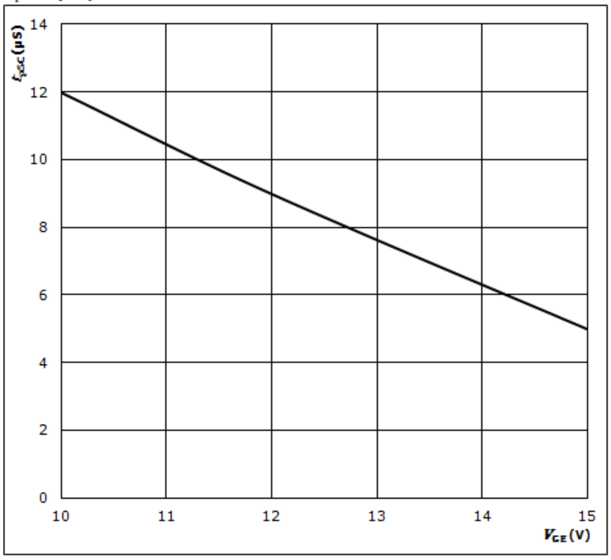


At

I_C=	15	A

Short circuit duration as a function of V_{GE} IGBT

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

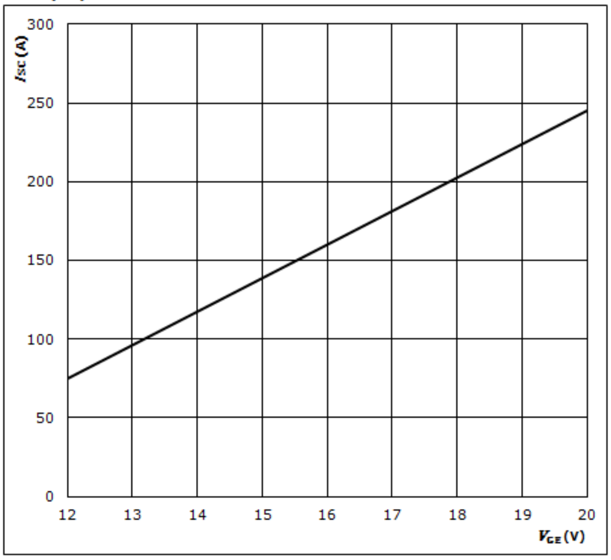


At

V_{CE} =	600	V
T_j ≤	175	ºC

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

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



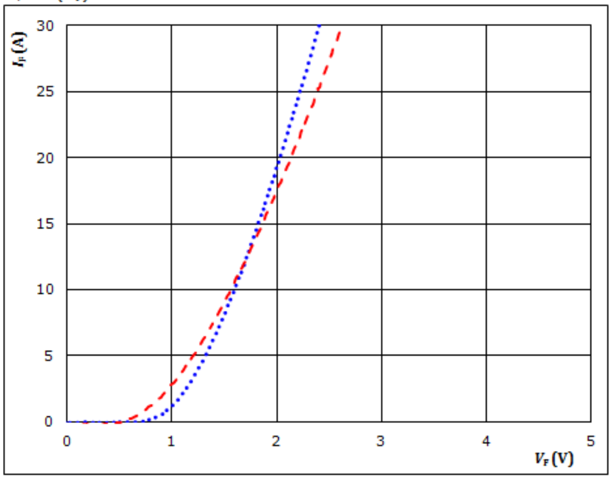
At

V_{CE} ≤	600	V
T_j ≤	175	ºC

Brake Diode Characteristics

Typical forward characteristics FWD

$I_F = f(V_F)$

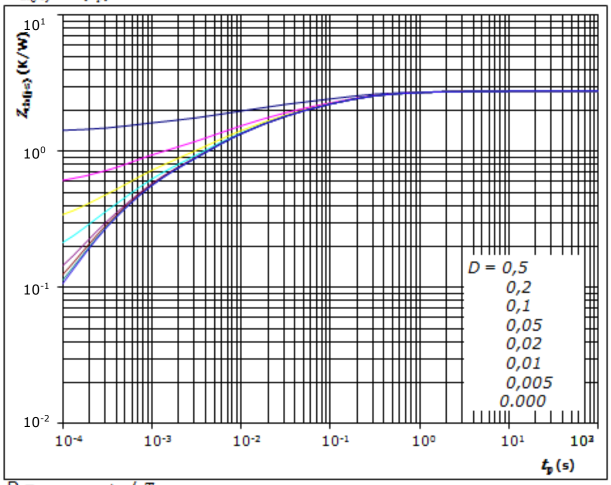


t_p = 250 μs

T_j: 25 °C, 125 °C, 150 °C

Transient thermal impedance as a function of pulse width FWD

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



D = t_p / T

$R_{th(j-s)}$ = 2,79 K/W

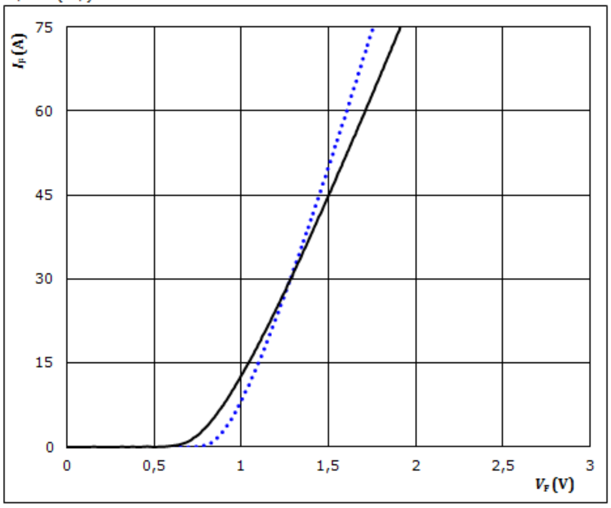
FWD thermal model values

R (K/W)	τ (s)
3,61E-02	8,54E+00
2,58E-01	5,80E-01
8,01E-01	1,03E-01
7,36E-01	1,63E-02
5,56E-01	3,27E-03
3,99E-01	4,24E-04

Rectifier Diode Characteristics

Typical forward characteristics — **Rectifier Diode**

$I_F = f(V_F)$

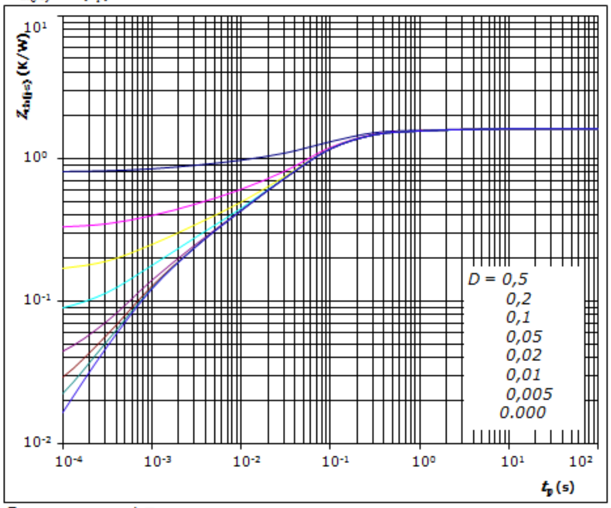


t_p = 250 μs

T_j: 25 °C, 125 °C, 150 °C

Transient thermal impedance as a function of pulse width — **Rectifier Diode**

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



D = t_p / T

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

Diode thermal model values

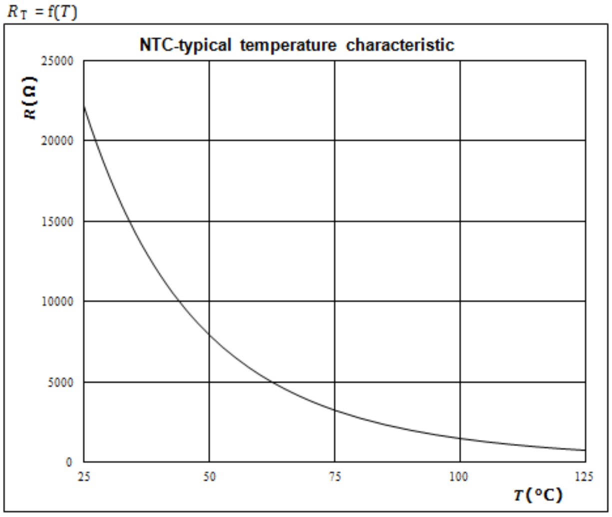
R (K/W)	τ (s)
6,72E-02	2,72E+00
1,48E-01	4,14E-01
8,68E-01	8,33E-02
2,53E-01	2,89E-02
1,69E-01	5,15E-03
1,06E-01	9,10E-04

Thermistor Characteristics

Thermistor typical temperature characteristic

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$

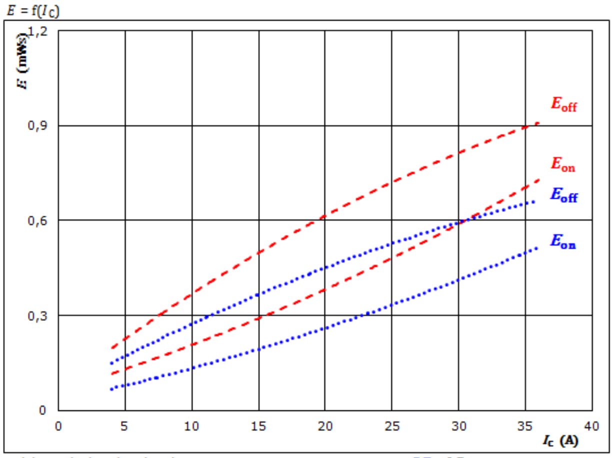


Inverter Switching Characteristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



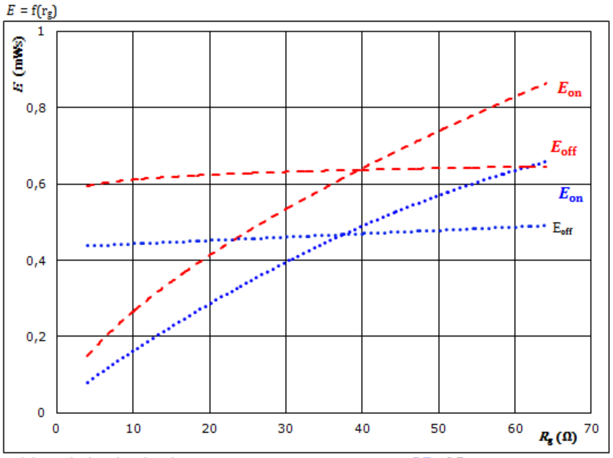
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C
R_{goff} =	16	Ω		

Figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



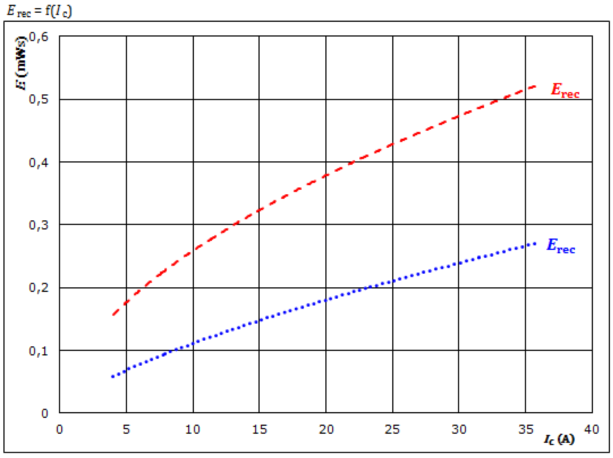
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	20	A		150 °C

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



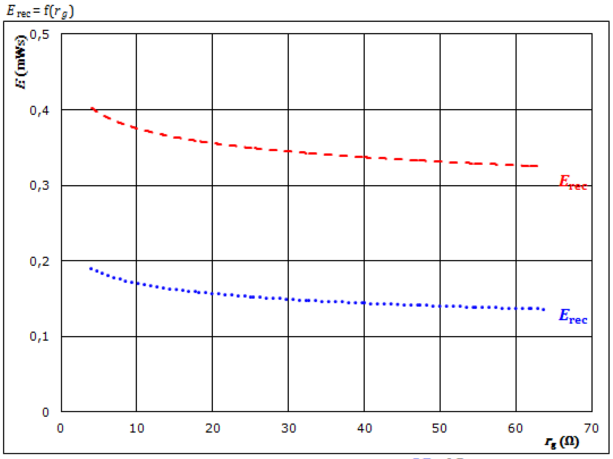
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

Figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(r_g)$



With an inductive load at

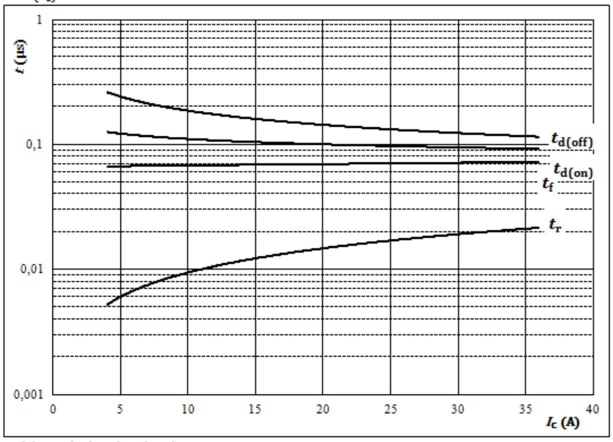
V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	20	A		150 °C

Inverter Switching Characteristics

Figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



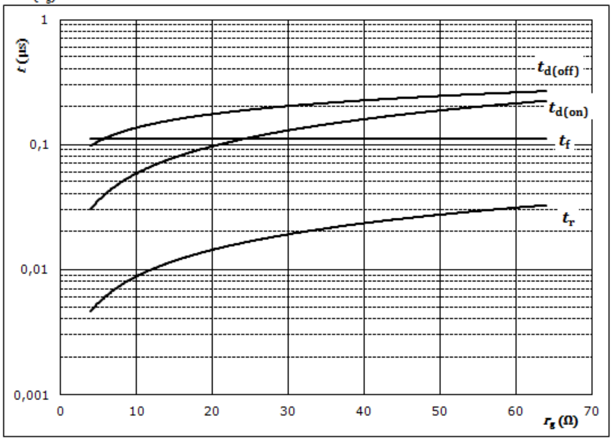
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(r_g)$



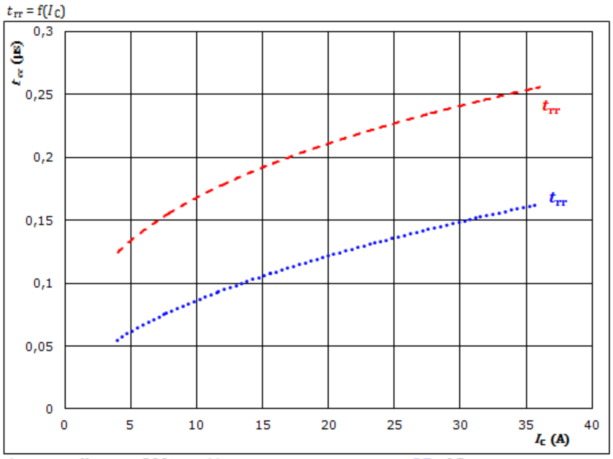
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	20	A

Figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

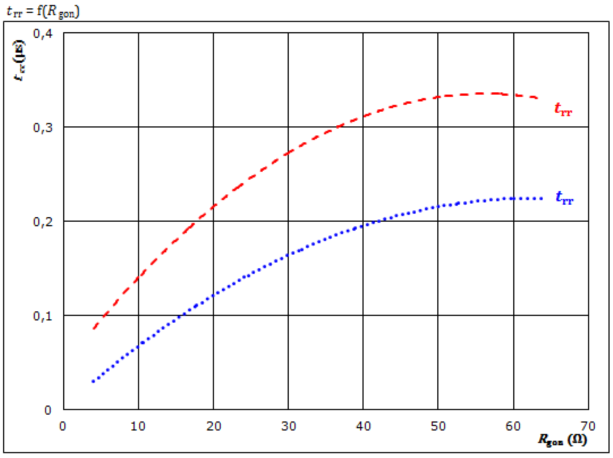


At V_{CE} =	300	V		25 °C	dotted (blue)
V_{GE} =	±15	V	T_j:	125 °C	solid
R_{gon} =	16	Ω		150 °C	dashed (red)

Figure 8. **FWD**

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

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



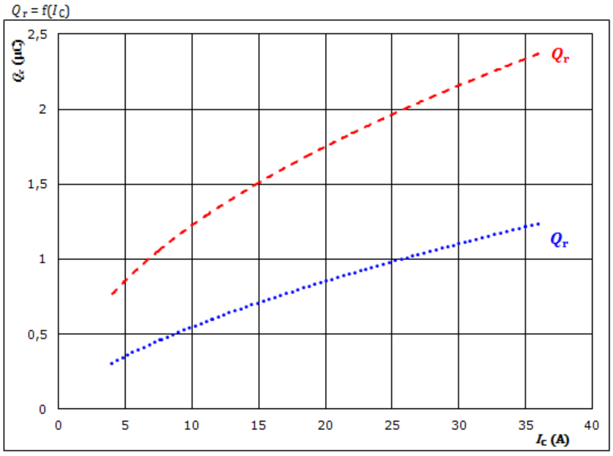
At V_{CE} =	300	V		25 °C	dotted (blue)
V_{GE} =	±15	V	T_j:	125 °C	solid
I_C =	20	A		150 °C	dashed (red)

Inverter Switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

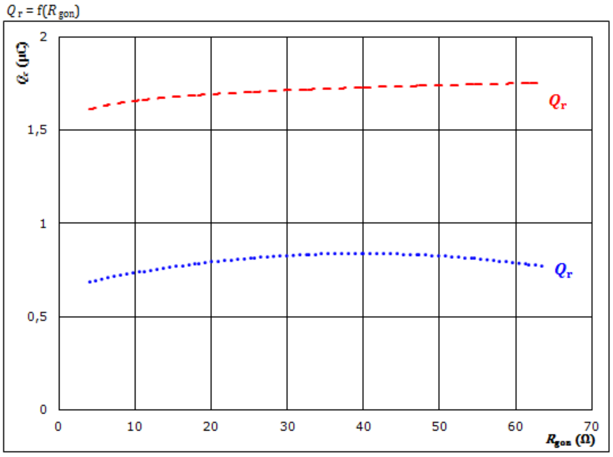


At	V_{CE} =	300	V		25 °C	···········
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	16	Ω		150 °C	– – – –

Figure 10. **FWD**

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

$Q_r = f(R_{gon})$

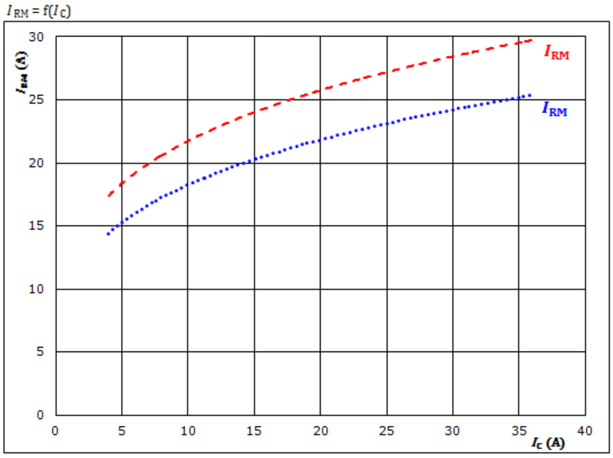


At	V_{CE} =	300	V		25 °C	···········
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C =	20	A		150 °C	– – – –

Figure 11. **FWD**

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

$I_{RM} = f(I_C)$

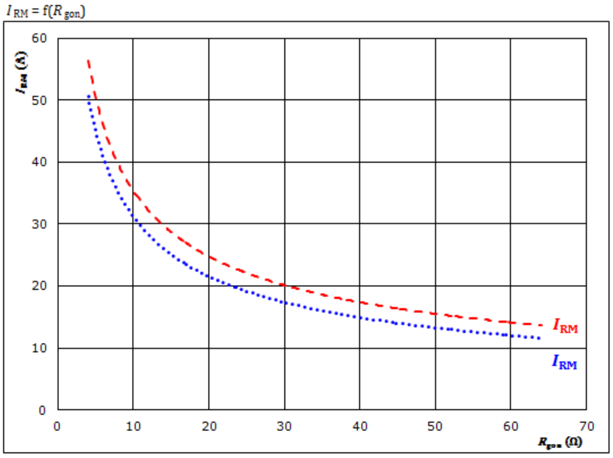


At	V_{CE} =	300	V		25 °C	···········
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	16	Ω		150 °C	– – – –

Figure 12. **FWD**

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

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



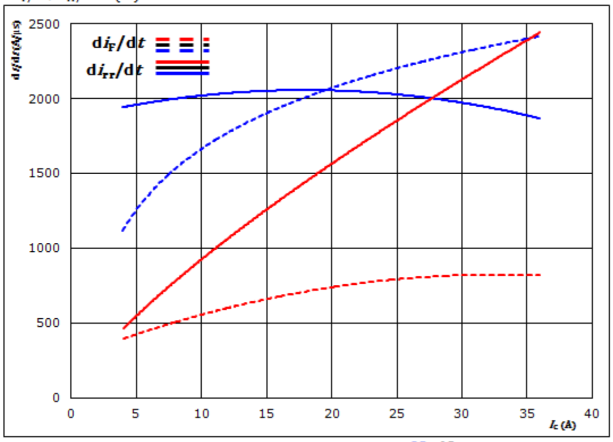
At	V_{CE} =	300	V		25 °C	···········
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C =	20	A		150 °C	– – – –

Inverter Switching Characteristics

Figure 13. **FWD**

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

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

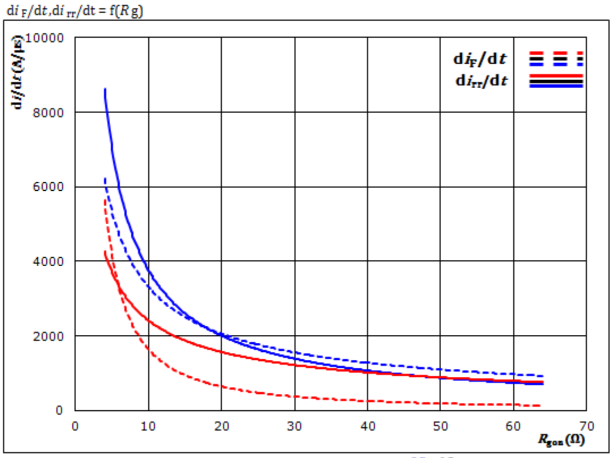


At						
V_{CE} =	300	V		25 °C	·············
V_{GE} =	±15	V	T_j:	125 °C	————
R_{gon} =	16	Ω		150 °C	– – – –

Figure 14. **FWD**

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

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

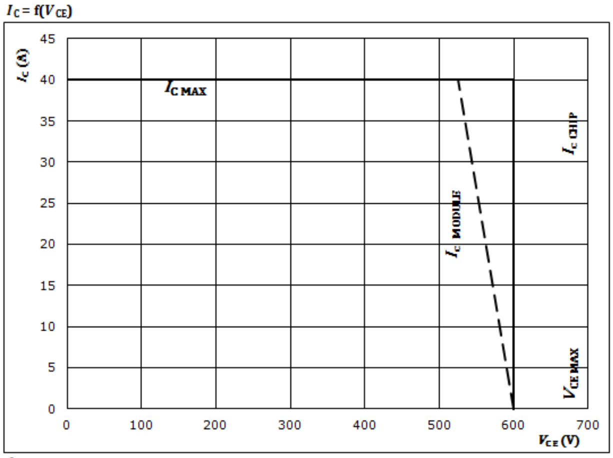


At						
V_{CE} =	300	V		25 °C	·············
V_{GE} =	±15	V	T_j:	125 °C	————
I_C =	20	A		150 °C	– – – –

Figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

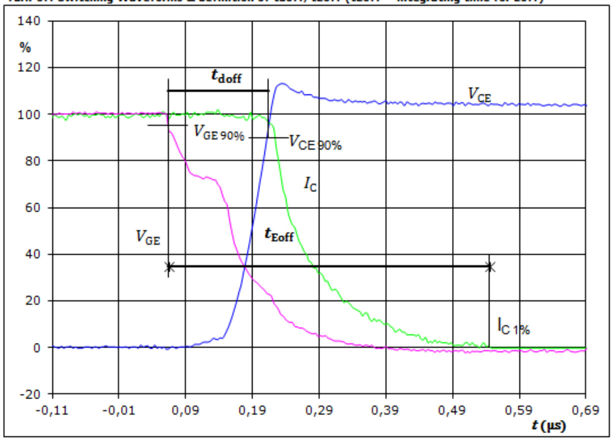
T_j =	175	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Inverter Switching Characteristics

General conditions		
T_j	=	150 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

Figure 1. IGBT

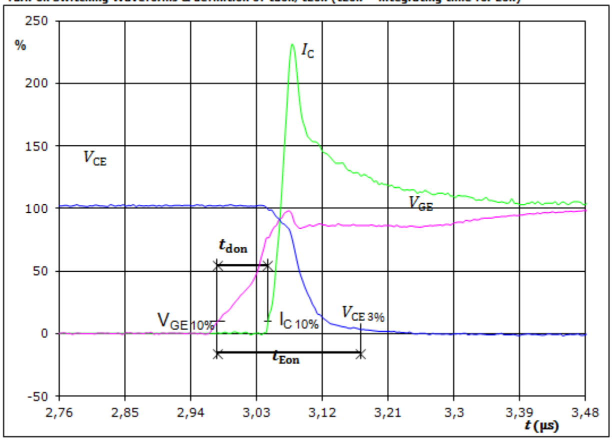
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	20	A
t_{doff} =	0,143	μs
t_{Eoff} =	0,482	μs

Figure 2. IGBT

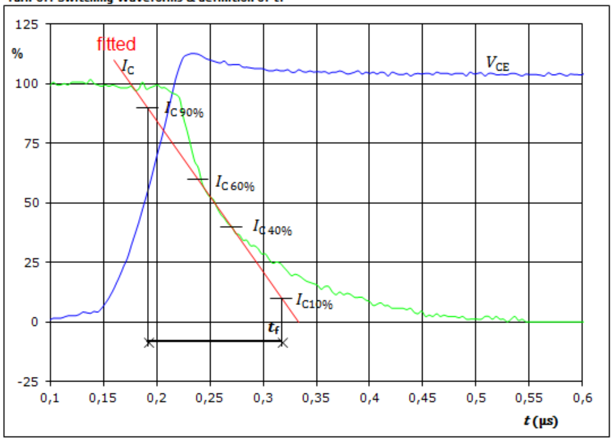
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	20	A
t_{don} =	0,070	μs
t_{Eon} =	0,196	μs

Figure 3. IGBT

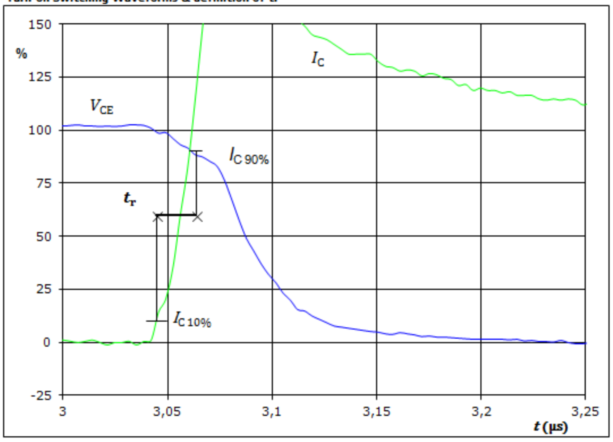
Turn-off Switching Waveforms & definition of tf



V_C (100%) =	300	V
I_C (100%) =	20	A
t_f =	0,110	μs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of tr



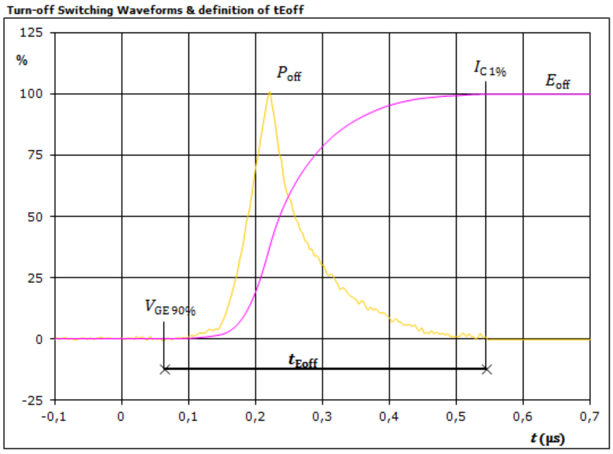
V_C (100%) =	300	V
I_C (100%) =	20	A
t_r =	0,016	μs

V23990-P634-A-PM
datasheet

Inverter Switching Characteristics

Figure 5. **IGBT**

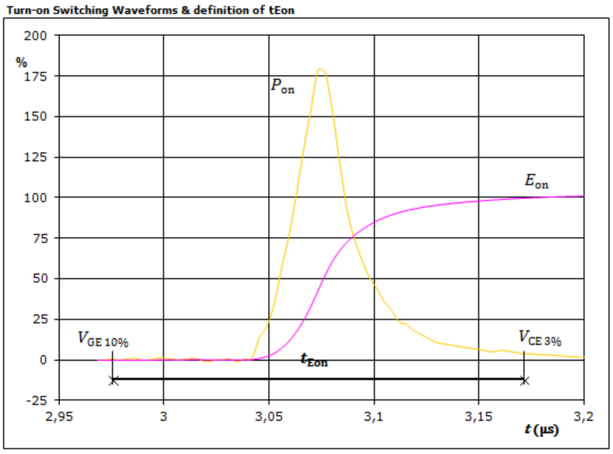
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	5,98	kW
E_{off} (100%) =	0,61	mJ
t_{Eoff} =	0,48	µs

Figure 6. **IGBT**

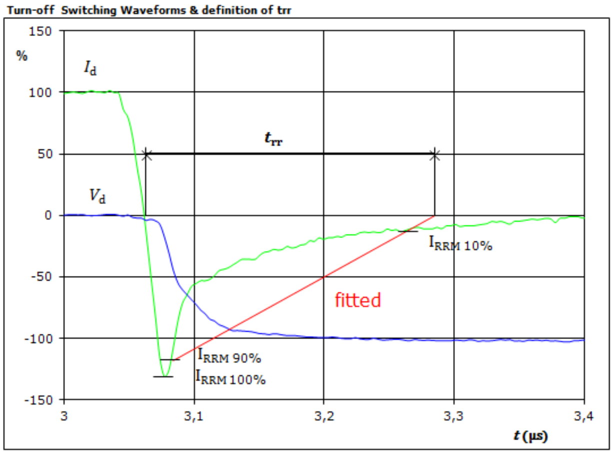
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	5,98	kW
E_{on} (100%) =	0,38	mJ
t_{Eon} =	0,20	µs

Figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

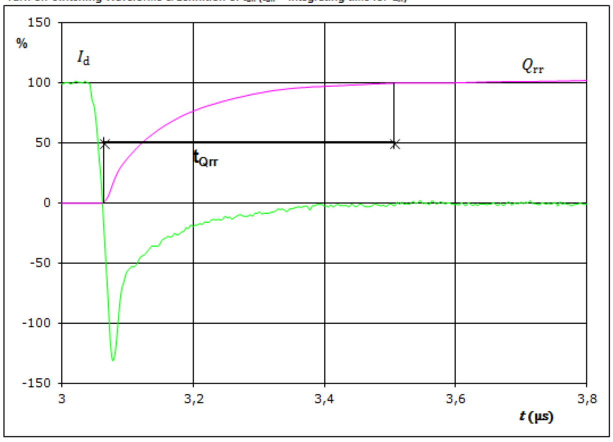


V_d (100%) =	300	V
I_d (100%) =	20	A
I_{RRM} (100%) =	-26	A
t_{rr} =	0,204	µs

Inverter Switching Characteristics

Figure 8. **FWD**

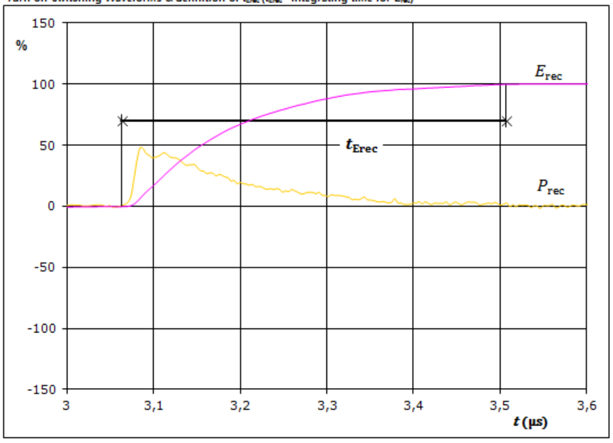
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d(100%) =	20	A
Q_{rr}(100%) =	1,71	µC
t_{Qrr} =	0,44	µs

Figure 9. **FWD**

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



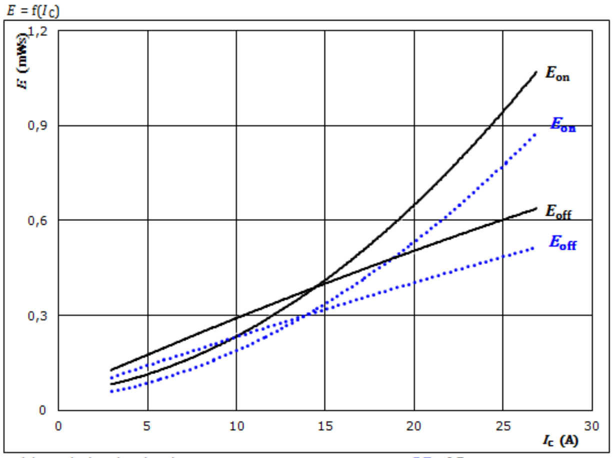
P_{rec}(100%) =	5,98	kW
E_{rec}(100%) =	0,37	mJ
t_{Erec} =	0,44	µs

Brake Switching Characteristics

Figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



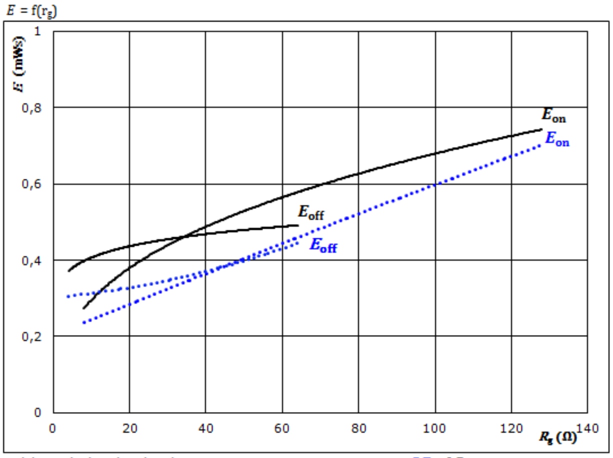
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	···········
V_{GE} =	15/0	V		125 °C	———
R_{gon} =	32	Ω		150 °C	– – – –
R_{goff} =	16	Ω			

Figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(r_g)$



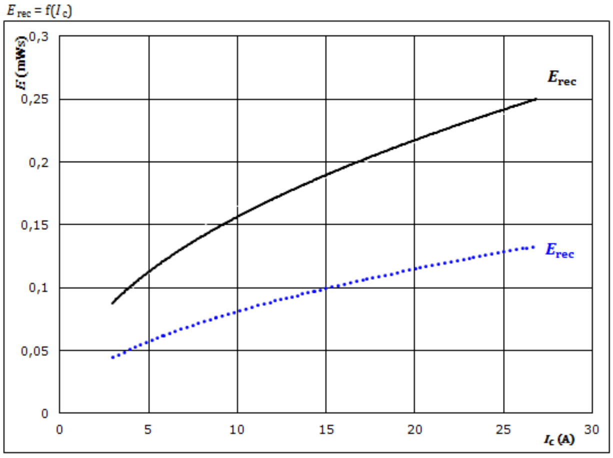
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	···········
V_{GE} =	15/0	V		125 °C	———
I_C =	15	A		150 °C	– – – –

Figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



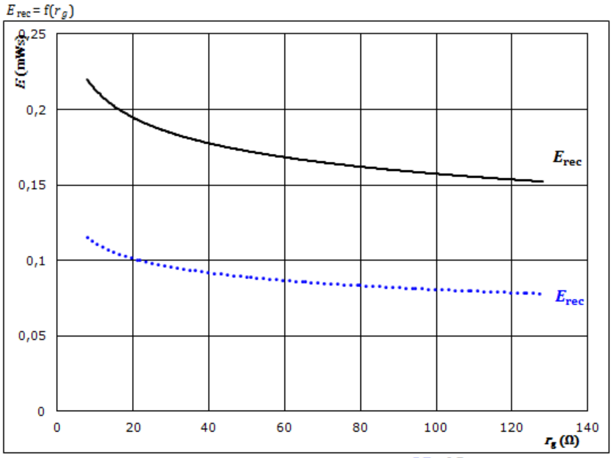
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C	···········
V_{GE} =	15/0	V		125 °C	———
R_{gon} =	32	Ω		150 °C	– – – –

Figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(r_g)$



With an inductive load at

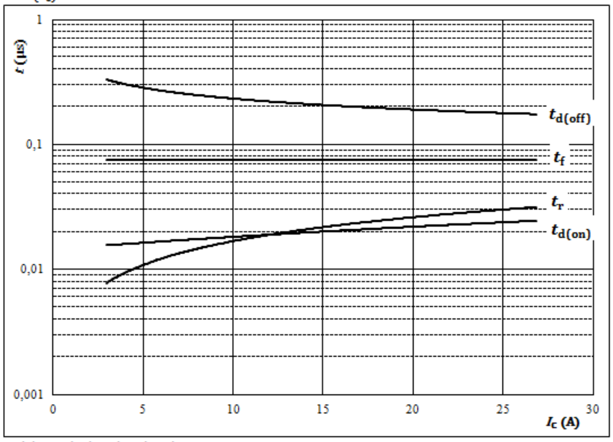
V_{CE} =	300	V	T_j:	25 °C	···········
V_{GE} =	15/0	V		125 °C	———
I_C =	15	A		150 °C	– – – –

Brake Switching Characteristics

Figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



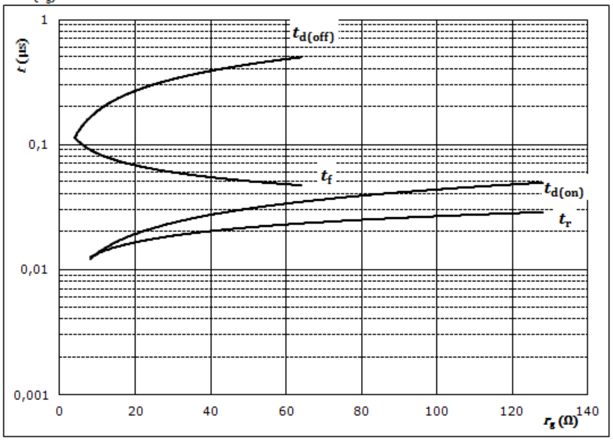
With an inductive load at

T_j =	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

$t = f(r_g)$



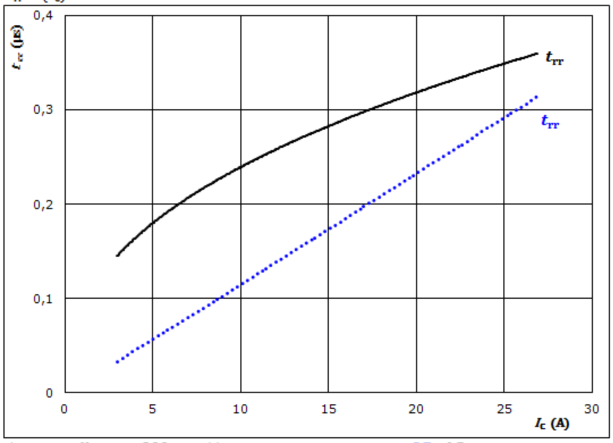
With an inductive load at

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

Figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

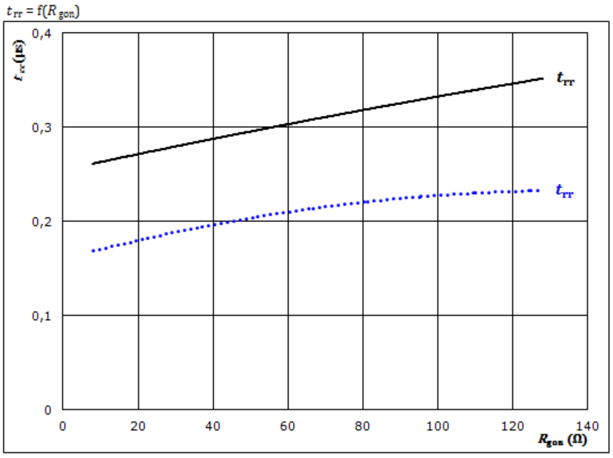


At V_{CE} =	300	V		25 °C	....
V_{GE} =	15/0	V	T_j:	125 °C	———
R_{gon} =	32	Ω		150 °C	– – – –

Figure 8. FWD

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

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



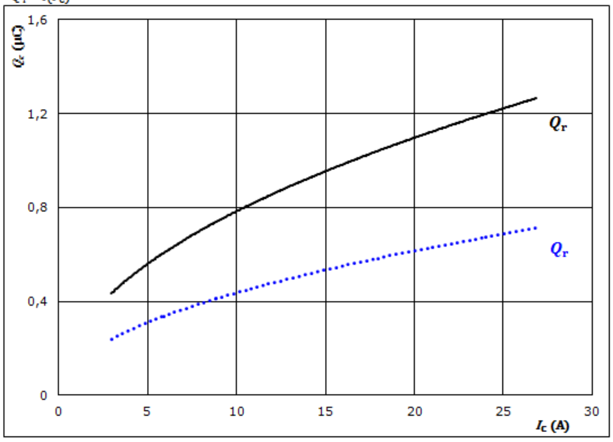
At V_{CE} =	300	V		25 °C	....
V_{GE} =	15/0	V	T_j:	125 °C	———
I_C =	15	A		150 °C	– – – –

Brake Switching Characteristics

Figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

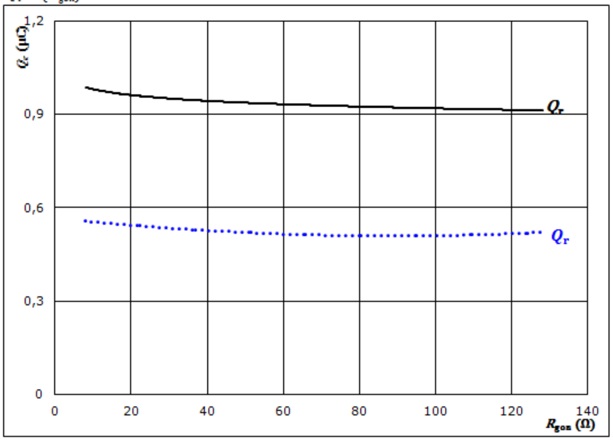


At					
V_{CE} =	300	V		25 °C	············
V_{GE} =	15/0	V	T_j:	125 °C	———
R_{gon} =	32	Ω		150 °C	– – – –

Figure 10. **FWD**

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

$Q_r = f(R_{gon})$

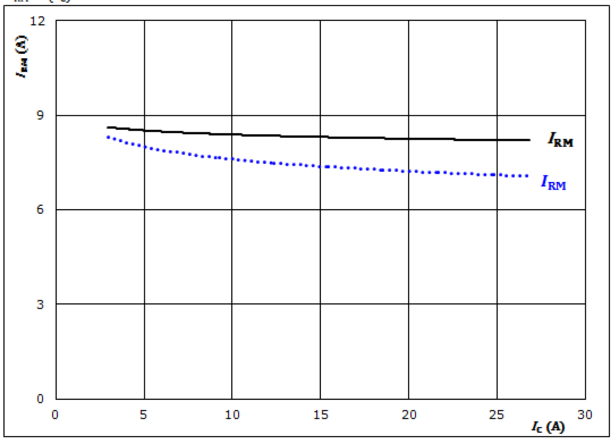


At					
V_{CE} =	300	V		25 °C	············
V_{GE} =	15/0	V	T_j:	125 °C	———
I_C =	15	A		150 °C	– – – –

Figure 11. **FWD**

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

$I_{RM} = f(I_C)$

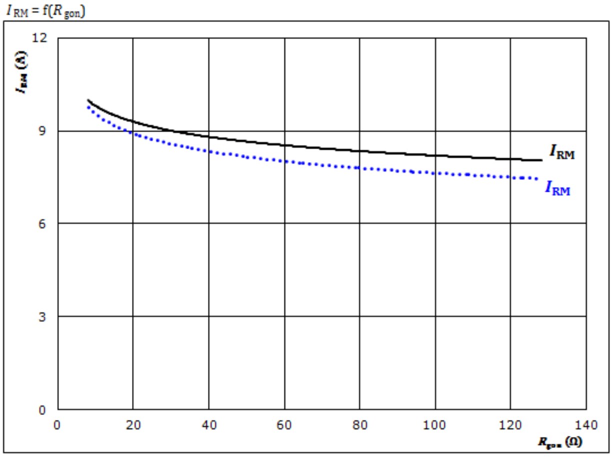


At					
V_{CE} =	300	V		25 °C	············
V_{GE} =	15/0	V	T_j:	125 °C	———
R_{gon} =	32	Ω		150 °C	– – – –

Figure 12. **FWD**

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

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



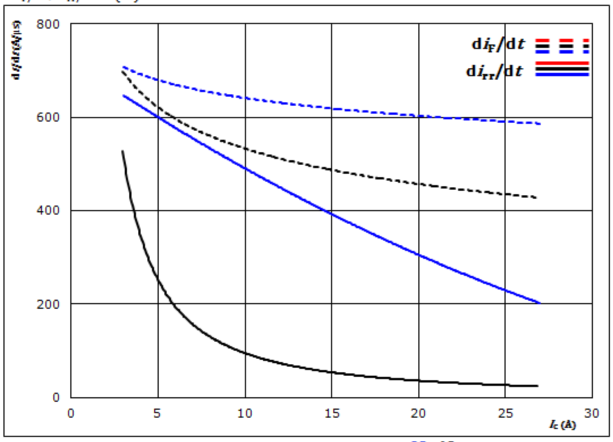
At					
V_{CE} =	300	V		25 °C	············
V_{GE} =	15/0	V	T_j:	125 °C	———
I_C =	15	A		150 °C	– – – –

Brake Switching Characteristics

Figure 13. **FWD**

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

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

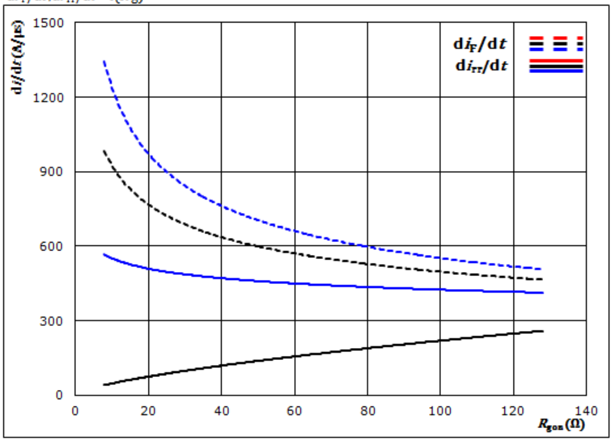


At					
V_{CE} =	300	V		25 °C	············
V_{GE} =	15/0	V	T_j:	125 °C	———
R_{gon} =	32	Ω		150 °C	– – – –

Figure 14. **FWD**

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

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

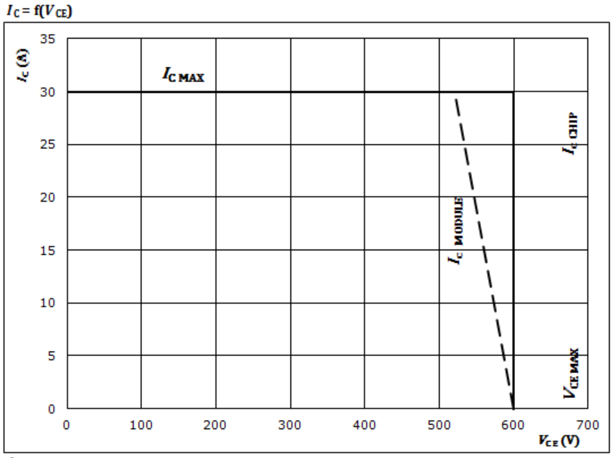


At		
V_{CE} =	300	V
V_{GE} =	15/0	V
I_C =	15	A

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

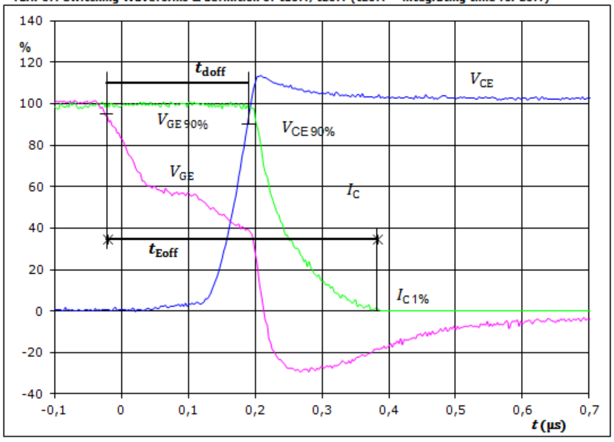
Brake Switching Characteristics

General conditions

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

Figure 1. IGBT

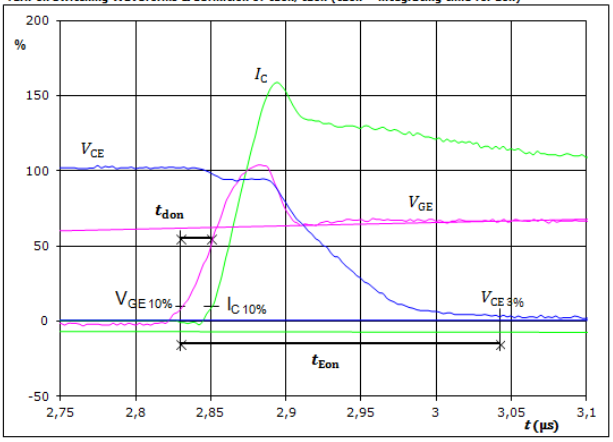
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	15	A
t_{doff} =	0,203	µs
t_{Eoff} =	0,405	µs

Figure 2. IGBT

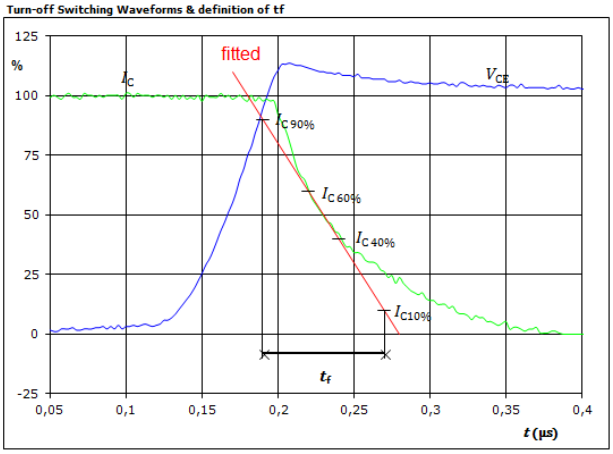
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



V_{GE} (0%) =	0	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	15	A
t_{don} =	0,020	µs
t_{Eon} =	0,213	µs

Figure 3. IGBT

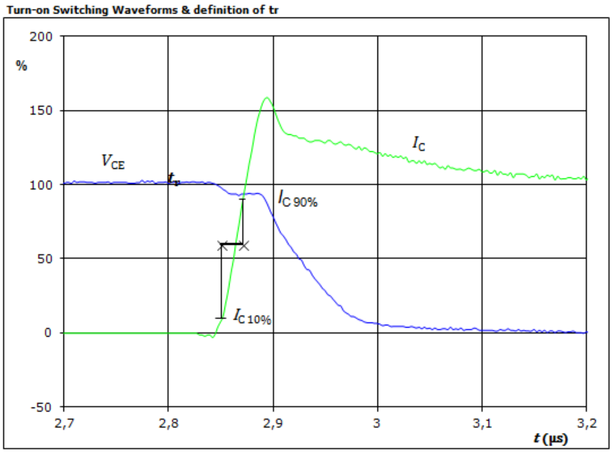
Turn-off Switching Waveforms & definition of tf



V_C (100%) =	300	V
I_C (100%) =	15	A
t_f =	0,091	µs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

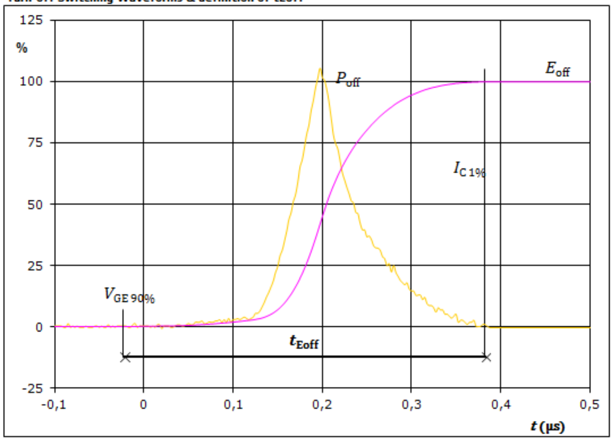


V_C (100%) =	300	V
I_C (100%) =	15	A
t_r =	0,021	µs

Brake Switching Characteristics

Figure 5. IGBT

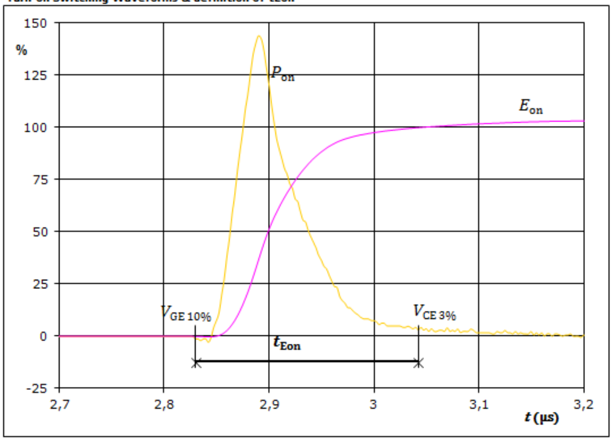
Turn-off Switching Waveforms & definition of tEoff



P_{off}(100%) =	4,49	kW
E_{off}(100%) =	0,40	mJ
t_{Eoff} =	0,40	µs

Figure 6. IGBT

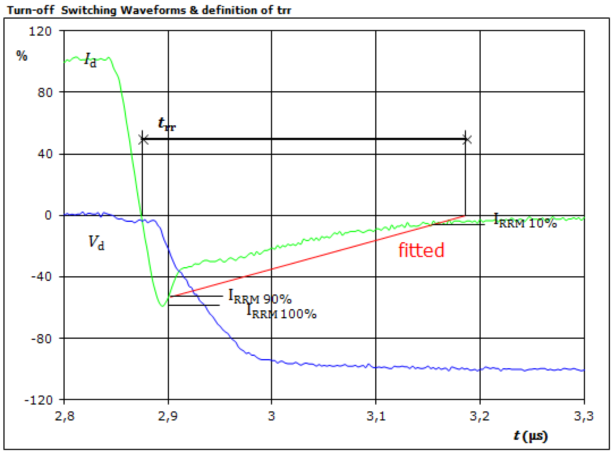
Turn-on Switching Waveforms & definition of tEon



P_{on}(100%) =	4,49	kW
E_{on}(100%) =	0,41	mJ
t_{Eon} =	0,21	µs

Figure 7. FWD

Turn-off Switching Waveforms & definition of trr

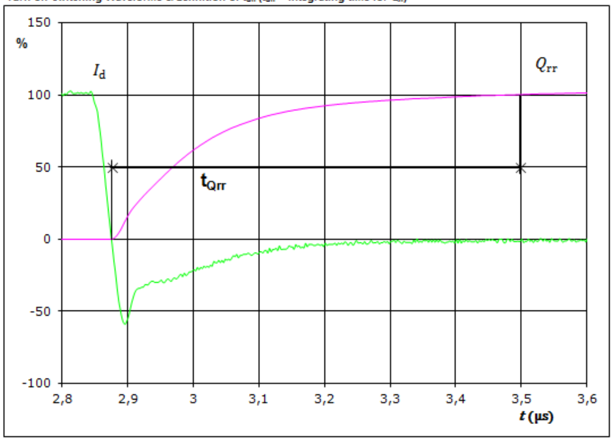


V_d(100%) =	300	V
I_d(100%) =	15	A
I_{RRM}(100%) =	9	A
t_{rr} =	0,279	µs

Brake Switching Characteristics

Figure 8. **FWD**

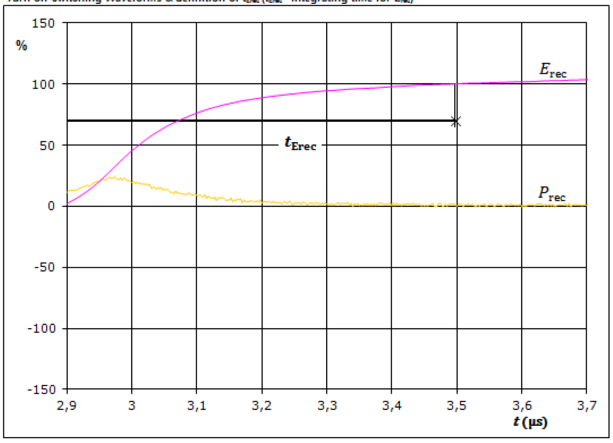
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	0,96	μC
t_{Qrr} =	0,62	μs

Figure 9. **FWD**

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



P_{rec} (100%) =	4,49	kW
E_{rec} (100%) =	0,20	mJ
t_{Erec} =	0,62	μs

V23990-P634-A-PM
datasheet

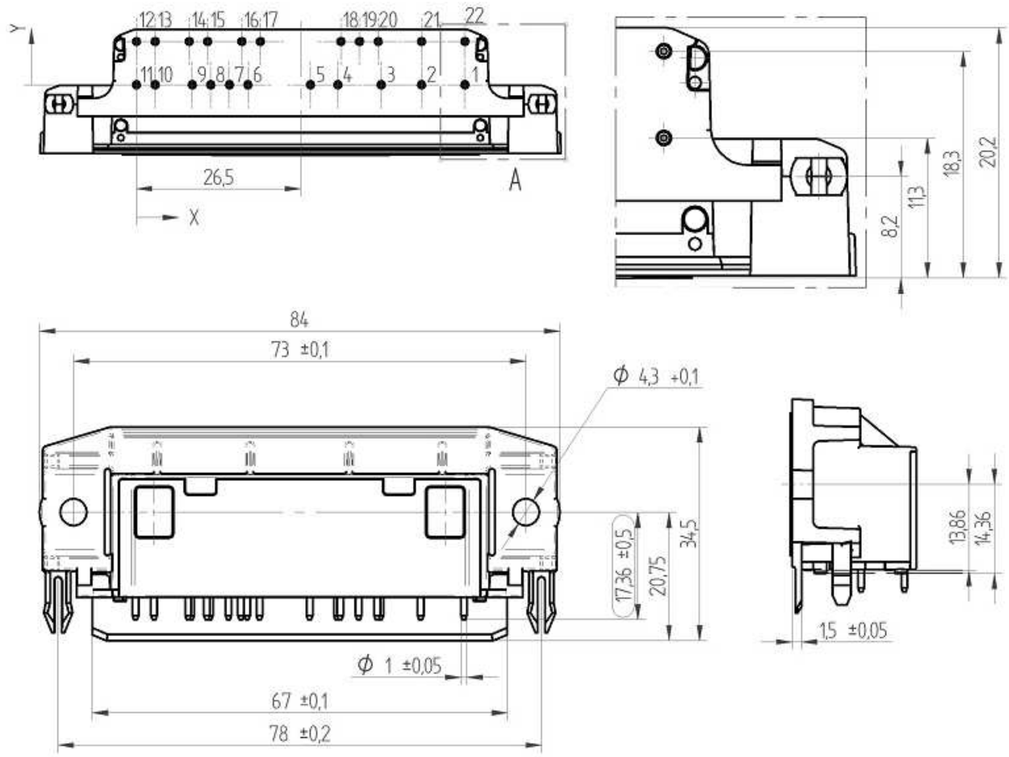
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste with solder pins	V23990-P634-A-PM	P634-A	P634-A
with thermal paste with solder pins	V23990-P634-A-/3/-PM	P634-A	P634-A-/3/

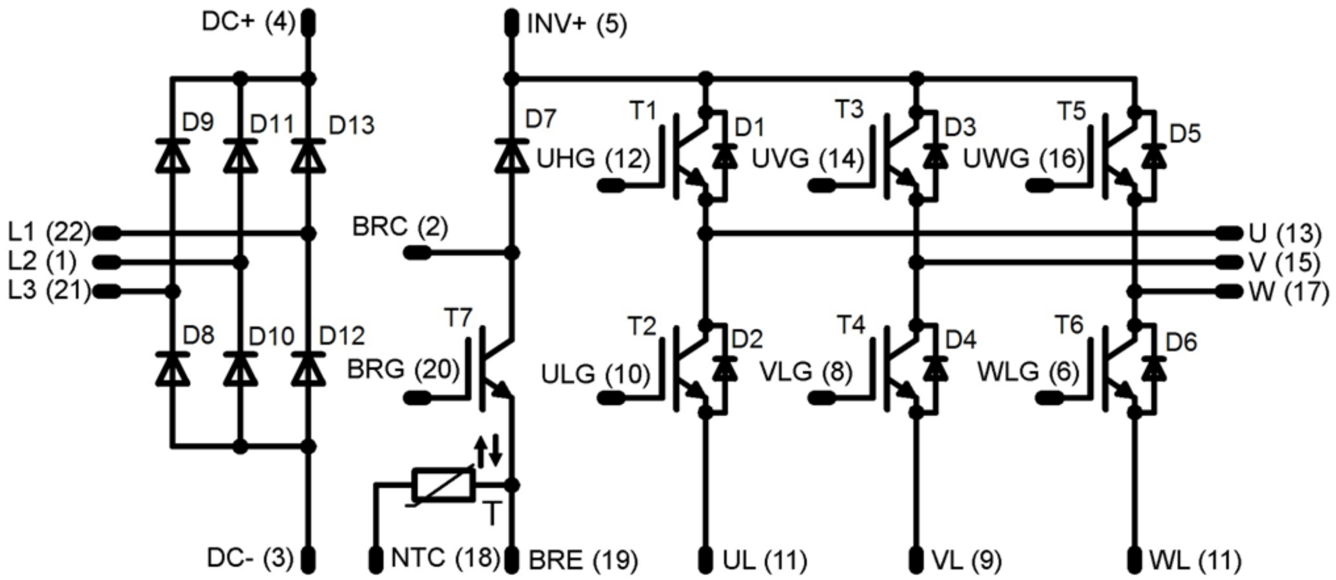
Text	Vinco	Date code	Type	UL	Lot number	Serial
	Vinco	WWYY	TTTTTTTTT	UL	LLLLL	SSSS
Datamatrix	Type	Lot number	Serial	Date code		
	TTTTTTTTT	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Pos
1	53	0	L2
2	46	0	BrC
3	39,5	0	DC-
4	32,5	0	DC+
5	28,1	0	INV+
6	18	0	WLG
7	15	0	WL
8	12	0	VLG
9	9	0	VL
10	3	0	ULG
11	0	0	UL
12	0	7	UHG
13	3	7	U
14	8,5	7	VHG
15	11,5	7	V
16	17	7	WHG
17	20	7	W
18	33	7	NTC
19	36	7	BrE
20	39	7	BrG
21	46	7	L3
22	53	7	L1



Pinout



Identification

ID	Component	Voltage	Curren	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	
D7	FWD	600V	10A	Brake Diode	
D8,D9,D10, D11,D12,D13	Diode	1600V	18A	Rectifier	
T	NTC			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	80	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 90 1 packages see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P634-A-D5k1-14	23 Mar. 2018		