V23990-P765-AY-PM
datasheet

***flow*PIM 2** | **600 V / 100 A**

Topology features

- Kelvin Emitter for improved switching performance
- Open Emitter configuration
- Temperature sensor
- Converter+Brake+Inverter

Component features

- Easy paralleling
- Low turn-off losses
- Low collector emitter saturation voltage
- Positive temperature coefficient
- Short tail current

Housing features

- Base isolation: Al_2O_3
- Convex shaped baseplate for superior thermal contact
- Cu baseplate
- Thermo-mechanical push-and-pull force relief
- Press-fit pin
- Reliable cold welding connection

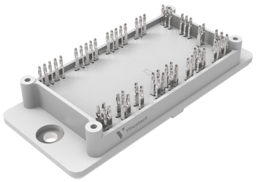
Target applications

- Motor Drives
- Power Generation

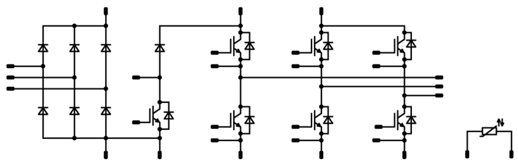
Types

- V23990-P765-AY-PM

flow 2 17 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			600	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	115	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	216	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 360 V	T_j = 150 °C	6	µs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	83	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	131	W
Maximum junction temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter voltage	V_{CES}			600	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	81	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		225	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	141	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 360 V	T_j = 150 °C	6	µs
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Brake Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	38	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	67	W
Maximum junction temperature	T_{jmax}			175	°C
Brake Sw. Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	30	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		40	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	55	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	126	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	890	A
Surge current capability	I^2t			3960	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	156	W
Maximum junction temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	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	4000	V
Creepage distance			>12,7	mm
Clearance			11,72	mm
Comparative Tracking Index	CTI		≥ 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Values			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_{CE} = V_{GE}			0,0016	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		100	25 125 150	1,05	1,48 1,64 1,71	1,85(1)	V
Collector-emitter cut-off current	I_{CES}		0	600		25			5,2	μA
Gate-emitter leakage current	I_{GES}		20	0		25			1200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		6280		pF
Output capacitance	C_{oes}							400		pF
Reverse transfer capacitance	C_{res}							186		pF
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,44		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	300	100	25 125 150		137 138 137,6		ns
Rise time	t_r					25 125 150		16 18,6 19,2		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		188,2 213,8 216,6		ns
Fall time	t_f					25 125 150		83,92 96,32 103,67		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=4,64 μC Q_{rFWD}=8,39 μC Q_{rFWD}=9,2 μC				25 125 150		0,541 0,829 0,931		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		2,5 3,31 3,48		mWs

Characteristic Values

Parameter	Symbol	Conditions	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]	Values Min	Typ	Max	Unit
Inverter Diode										
Static										
Forward voltage	V_F				100	25 125	1,2	1,67 1,69	1,9[1]	V
Reverse leakage current	I_R	V_r = 600 V				25			660	µA
Thermal										
Thermal resistance junction to sink[2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,73		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=7405 A/µs d*i*/d*t*=6414 A/µs d*i*/d*t*=5731 A/µs	±15	300	100	25 125 150		128,34 148,46 152,09		A
Reverse recovery time	t_{rr}					25 125 150		106,47 122,44 126,88		ns
Recovered charge	Q_r					25 125 150		4,64 8,39 9,2		µC
Reverse recovered energy	E_{rec}					25 125 150		1,13 2,07 2,25		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		9459 5452 5303		A/µs

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Brake Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0012	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		75	25 125 150	1,05	1,45 1,59 1,64	1,85(1)	V
Collector-emitter cut-off current	I_{CES}		0	600		25			3,8	µA
Gate-emitter leakage current	I_{GES}		20	0		25			600	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		4620		pF
Output capacitance	C_{oes}	f = 1 Mhz	0	25		25		288		pF
Reverse transfer capacitance	C_{res}	f = 1 Mhz	0	25		25		137		pF
Gate charge	Q_g	V_{CC} = 480 V	15		75	25		470		nC
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,67		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	300	75	25 125 150		111 113,4 113,2		ns
Rise time	t_r	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	300	75	25 125 150		12,4 14,6 15,4		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	300	75	25 125 150		173,6 197,4 201,8		ns
Fall time	t_f	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	300	75	25 125 150		53,33 71,16 74,06		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=2,14 µC Q_{rFWD}=3,14 µC Q_{rFWD}=3,82 µC	±15	300	75	25 125 150		0,299 0,413 0,464		mWs
Turn-off energy (per pulse)	E_{off}		±15	300	75	25 125 150		1,52 2,02 2,14		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			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				30	25 125	1,25	1,65 1,62	1,95[1]	V
Reverse leakage current	I_R	V_r = 600 V				25			27	µA
Thermal										
Thermal resistance junction to sink[2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,42		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=6170 A/µs d*i*/d*t*=7076 A/µs d*i*/d*t*=5226 A/µs	±15	300	75	25 125 150		81,58 84,53 83,98		A
Reverse recovery time	t_{rr}					25 125 150		22,67 110,54 116,24		ns
Recovered charge	Q_r					25 125 150		2,14 3,14 3,82		µC
Reverse recovered energy	E_{rec}					25 125 150		0,517 0,769 0,973		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		10578 7449 6820		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			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 Sw. Protection Diode										
Static										
Forward voltage	V_F				20	25 125 150	1,25	1,7 1,58 1,58	1,95(1)	V
Reverse leakage current	I_R	V_r = 600 V				25			27	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,74		K/W
Rectifier Diode										
Static										
Forward voltage	V_F				45	25 125 150		1,01 0,929 0,92	1,21(1) 1,1(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25			50	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,45		K/W

Characteristic Values

Parameter	Symbol	Conditions					Values			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	
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R25	$\Delta_{R/R}$	R_{25} = 22 kΩ				25	-5		5	%
Deviation of R100		R_{100} = 1486 Ω				100	-12		14	
Power dissipation	P							200		mW
Power dissipation constant	d					25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3 %						3950		K
B-value	$B_{(25/100)}$	Tol. ±3 %						3998		K
Vincotech Thermistor Reference									B	

(1) Value at chip level

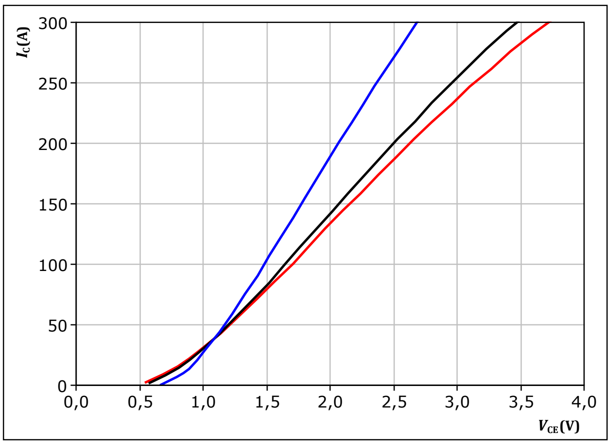
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

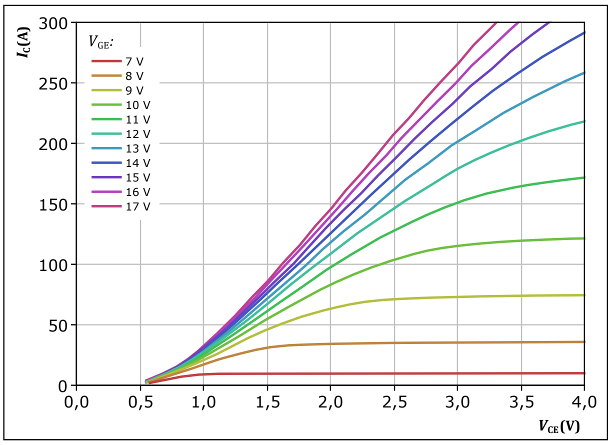


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



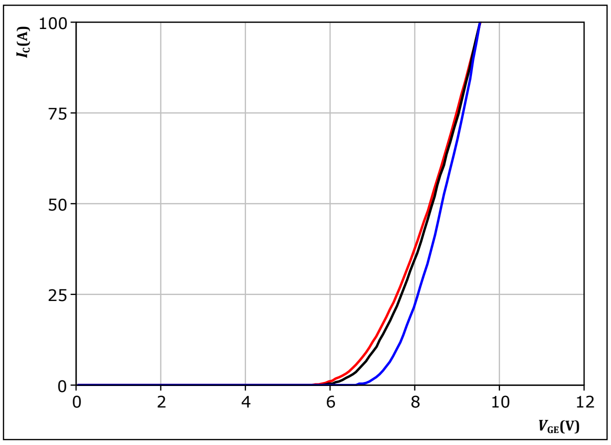
t_p =	250	µs
T_j =	150	°C

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

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

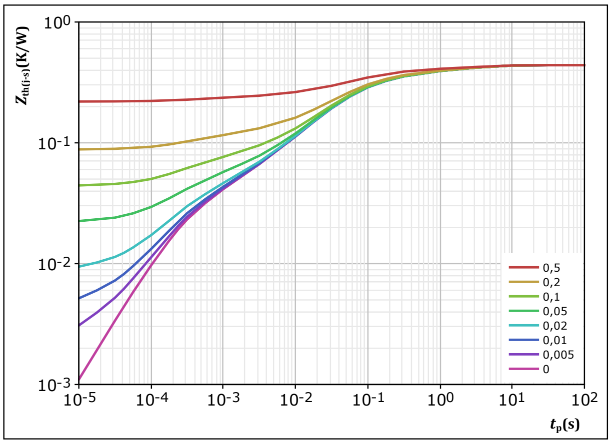


t_p =	250	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,439	K/W

IGBT thermal model values

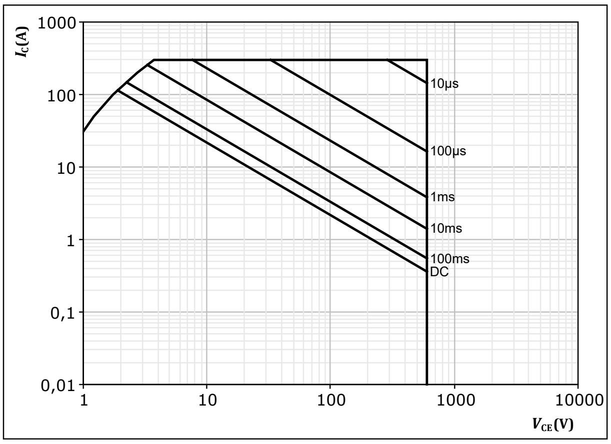
R (K/W)	τ (s)
5,33E-02	3,13E+00
6,35E-02	4,55E-01
1,49E-01	8,61E-02
1,20E-01	2,32E-02
2,69E-02	2,62E-03
2,67E-02	2,83E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})



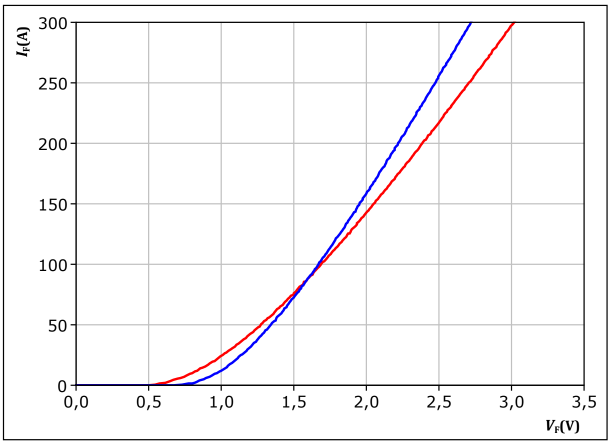
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



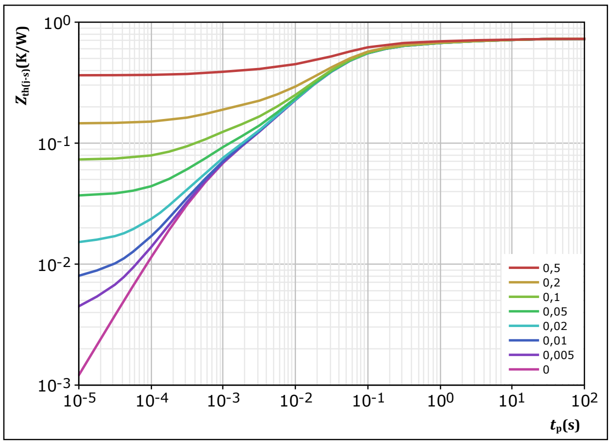
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,728 K/W

FWD thermal model values

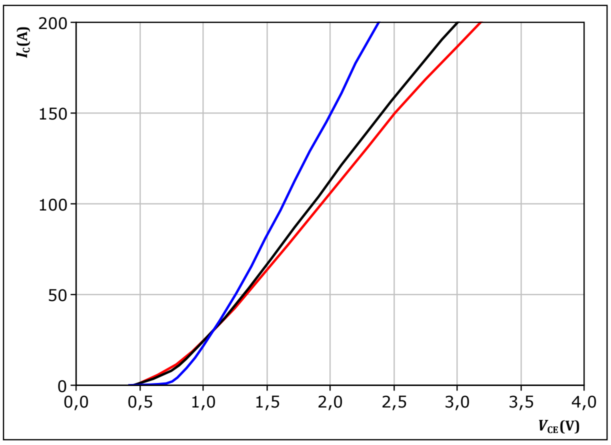
R (K/W)	τ (s)
4,08E-02	9,16E+00
5,69E-02	8,67E-01
1,69E-01	1,19E-01
3,37E-01	2,86E-02
7,44E-02	4,99E-03
5,00E-02	5,33E-04

Brake Switch Characteristics

figure 8. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

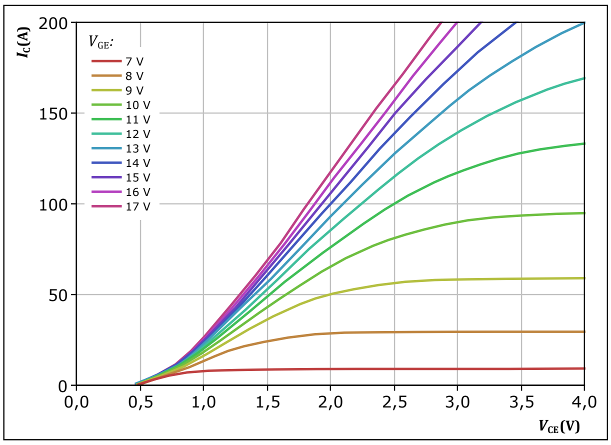


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 9. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



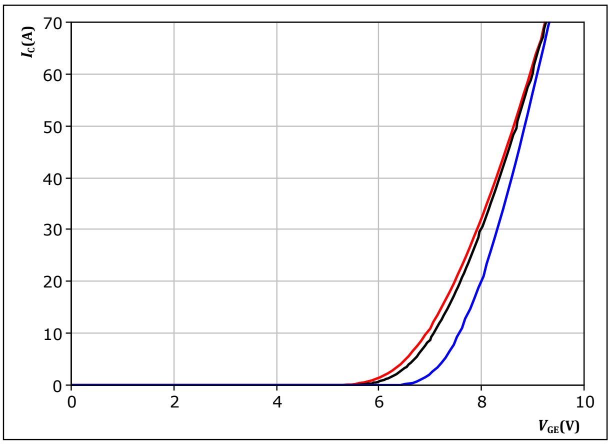
t_p =	250	µs
T_j =	150	°C

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

figure 10. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

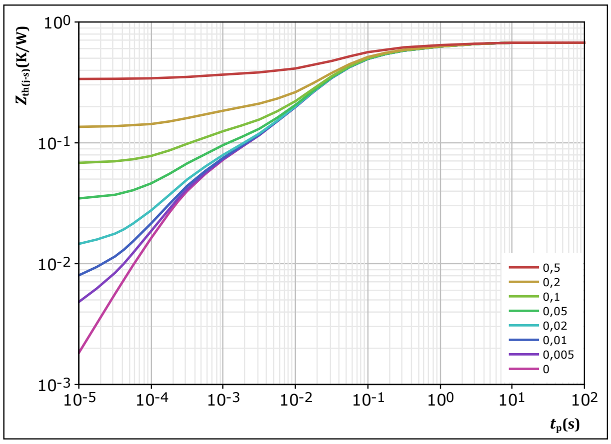


t_p =	250	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 11. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,675	K/W

IGBT thermal model values

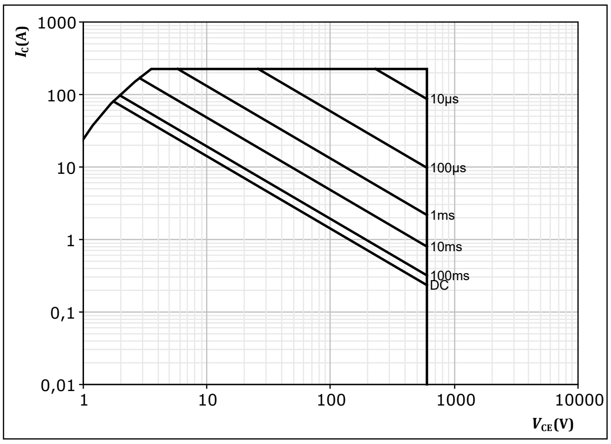
R (K/W)	τ (s)
6,75E-02	2,23E+00
8,44E-02	3,55E-01
2,24E-01	6,67E-02
2,17E-01	2,09E-02
3,30E-02	2,25E-03
4,91E-02	3,14E-04

Brake Switch Characteristics

figure 12.	IGBT

Safe operating area

I_C = f(V_{CE})



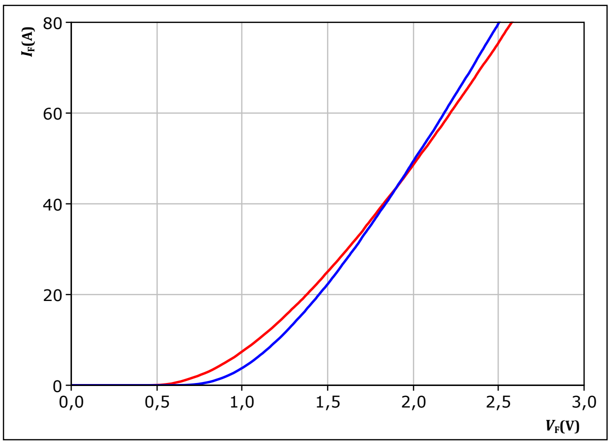
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Brake Diode Characteristics

figure 13. **FWD**

Typical forward characteristics

I_F = f(V_F)



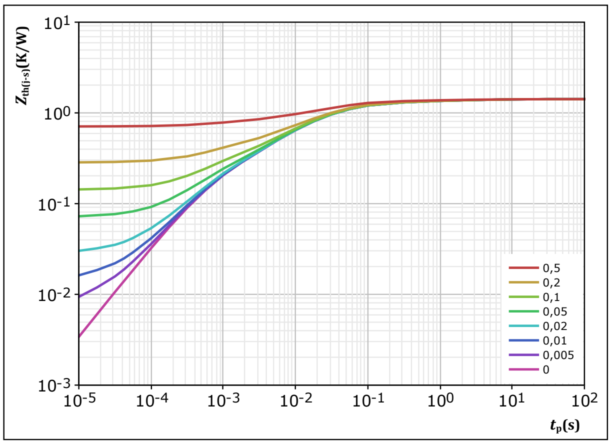
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 14. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,418 K/W

FWD thermal model values

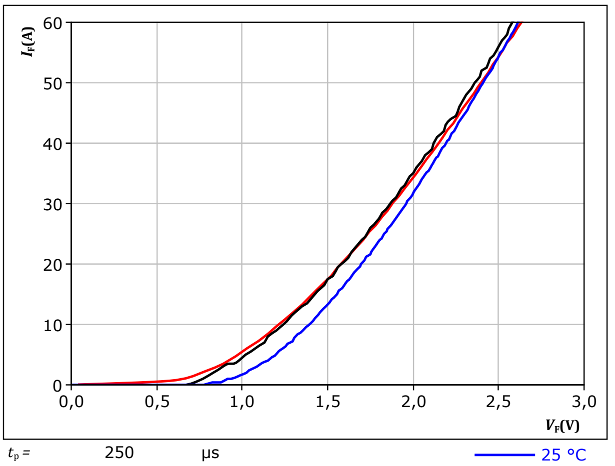
R (K/W)	τ (s)
4,60E-02	5,92E+00
7,40E-02	8,70E-01
1,85E-01	1,31E-01
6,39E-01	2,61E-02
3,20E-01	5,18E-03
1,54E-01	6,04E-04

Brake Sw. Protection Diode Characteristics

figure 15. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



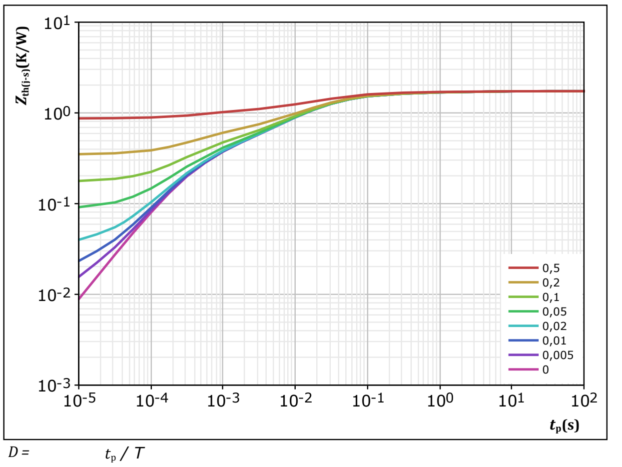
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 16. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 1,736 K/W

FWD thermal model values

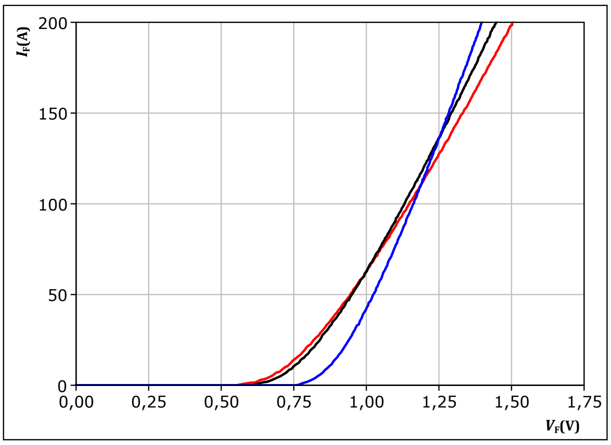
R (K/W)	τ (s)
5,57E-02	4,43E+00
1,21E-01	3,86E-01
4,54E-01	5,05E-02
5,83E-01	1,43E-02
2,60E-01	2,79E-03
2,63E-01	3,48E-04

Rectifier Diode Characteristics

figure 17. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



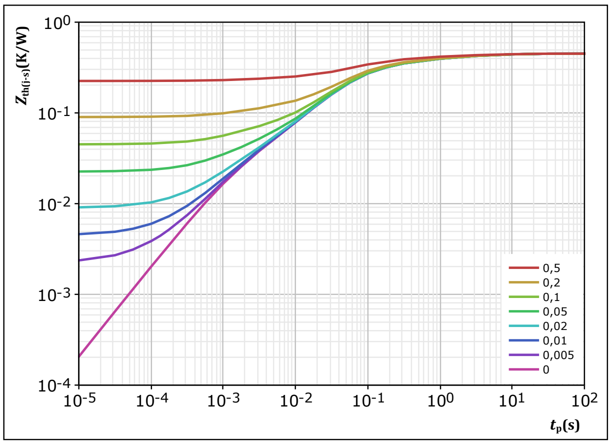
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 18. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,45 K/W

Rectifier thermal model values

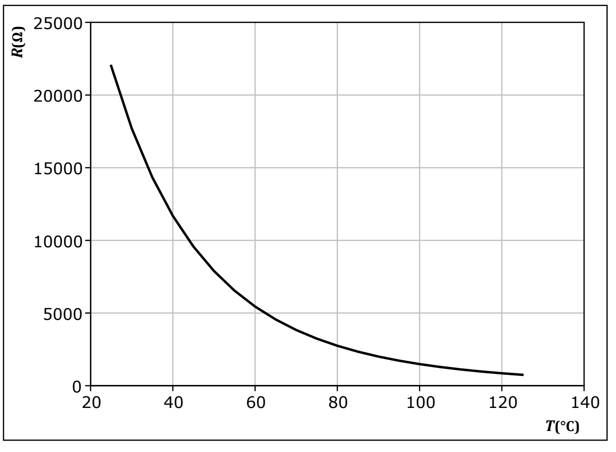
R (K/W)	τ (s)
3,06E-02	7,38E+00
5,87E-02	1,30E+00
1,21E-01	1,90E-01
2,00E-01	4,49E-02
2,12E-02	9,83E-03
1,85E-02	1,38E-03

Thermistor Characteristics

figure 19.	Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

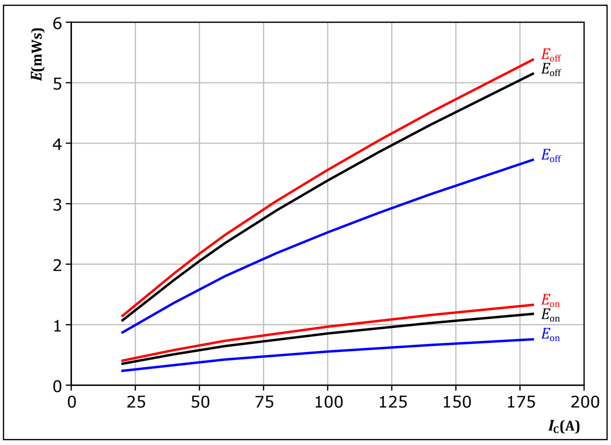


Inverter Switching Characteristics

figure 20. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



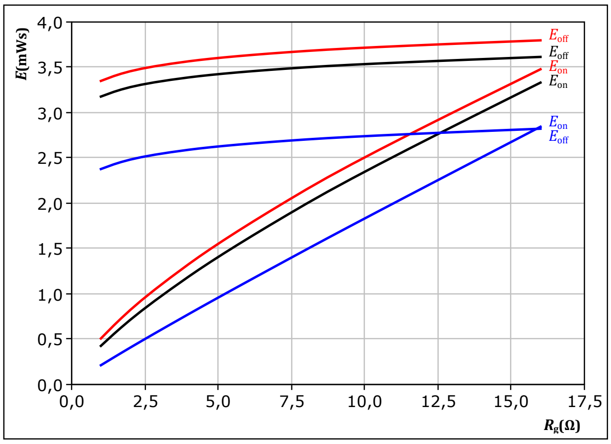
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

figure 21. **IGBT**

Typical switching energy losses as a function of IGBT turn on gate resistor

$E = f(R_g)$



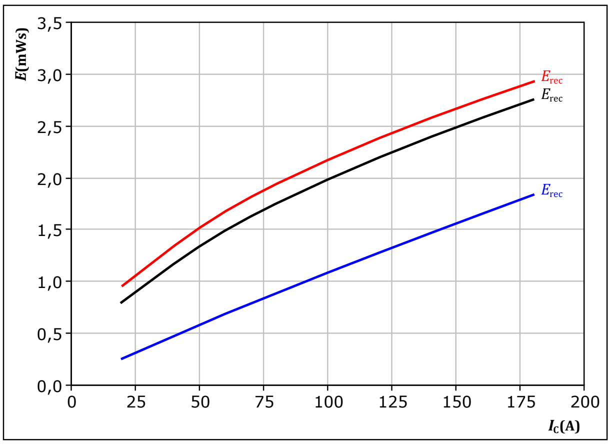
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	100	A		150 °C

figure 22. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



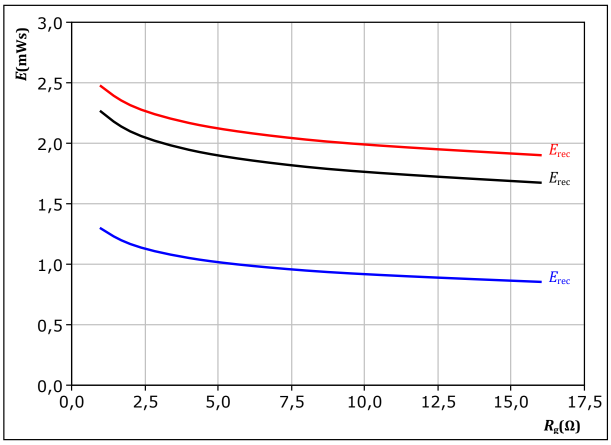
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 23. **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

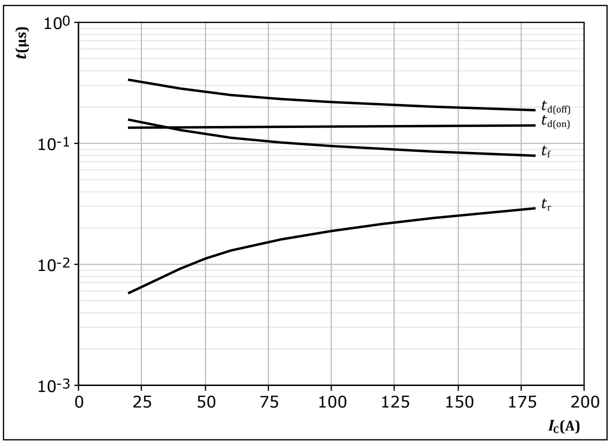
V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	100	A		150 °C

Inverter Switching Characteristics

figure 24. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



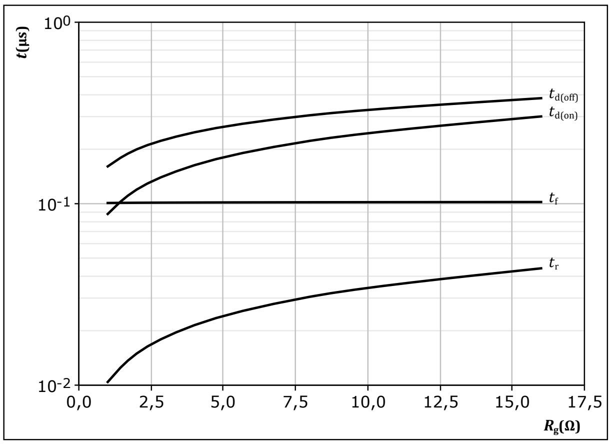
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 25. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

t = f(R_g)



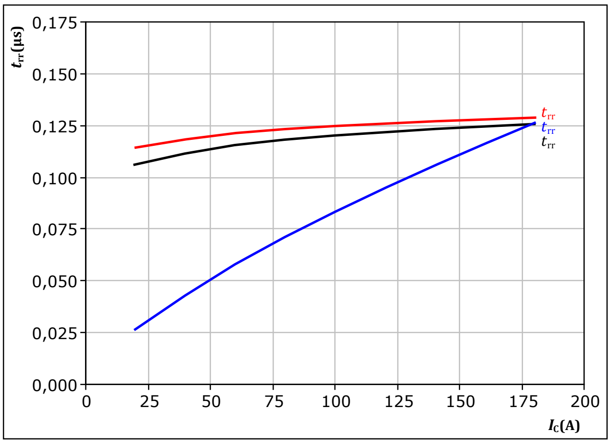
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

figure 26. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

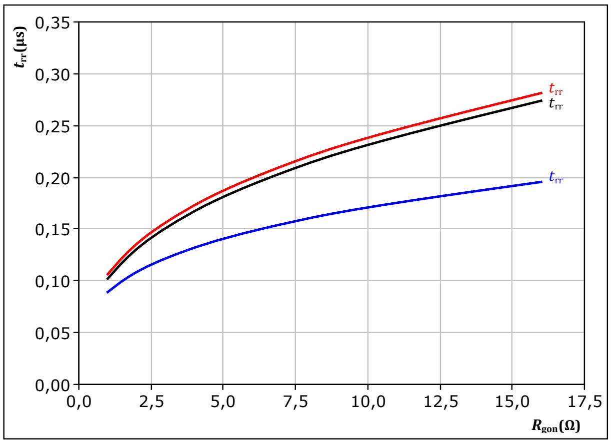
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 27. **FWD**

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

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



With an inductive load at

V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

T_j: 25 °C, 125 °C, 150 °C

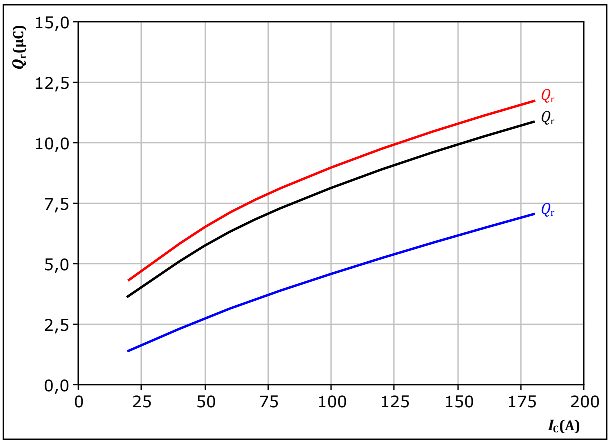
Vincotech

Inverter Switching Characteristics

figure 28. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



With an inductive load at

V_{CE} = 300 V

V_{GE} = ±15 V

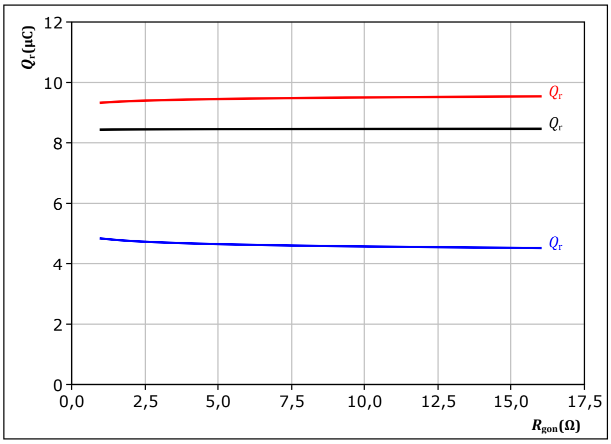
R_{gon} = 4 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 29. **FWD**

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

Q_r = f(R_{gon})



With an inductive load at

V_{CE} = 300 V

V_{GE} = ±15 V

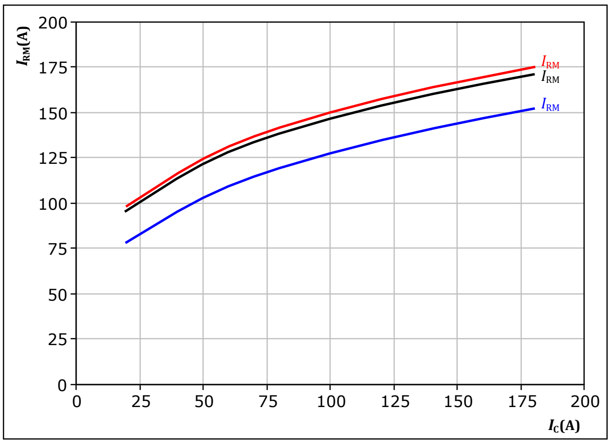
I_C = 100 A

T_j: 25 °C, 125 °C, 150 °C

figure 30. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



With an inductive load at

V_{CE} = 300 V

V_{GE} = ±15 V

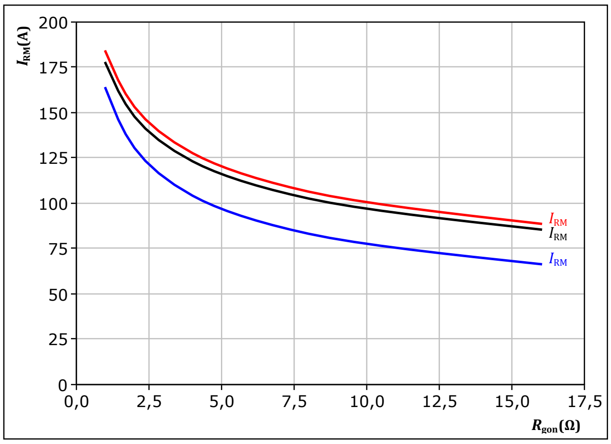
R_{gon} = 4 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 31. **FWD**

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

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



With an inductive load at

V_{CE} = 300 V

V_{GE} = ±15 V

I_C = 100 A

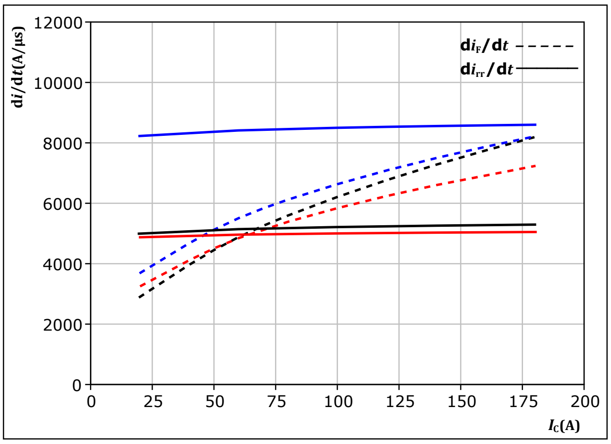
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 32. **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)



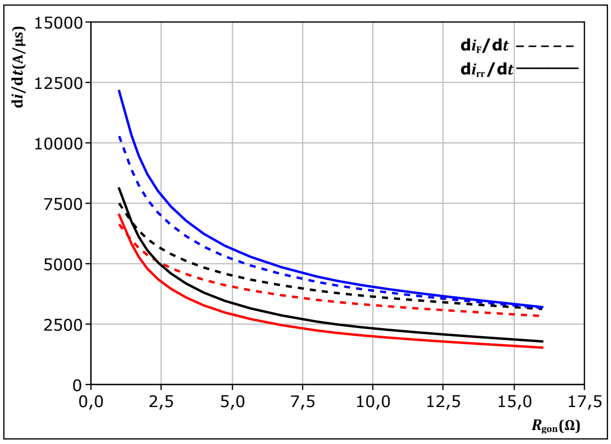
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 33. **FWD**

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

di_F/dt, di_{rr}/dt = f(R_{gon})



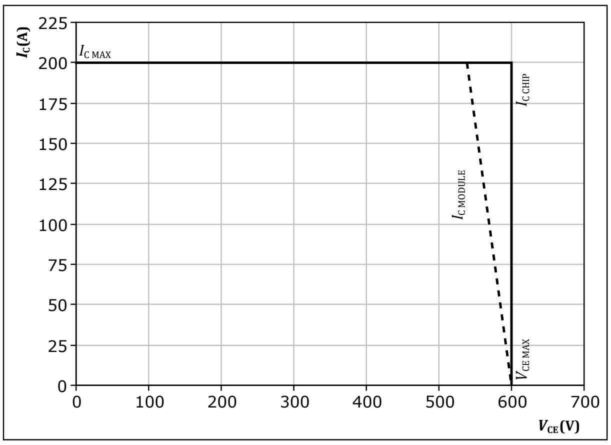
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	100	A		150 °C

figure 34. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



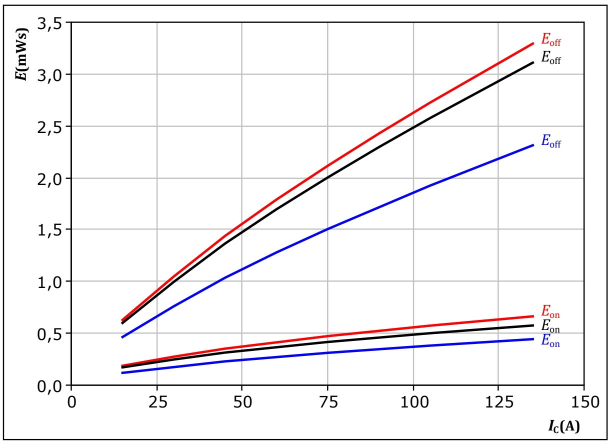
At	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Brake Switching Characteristics

figure 35. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



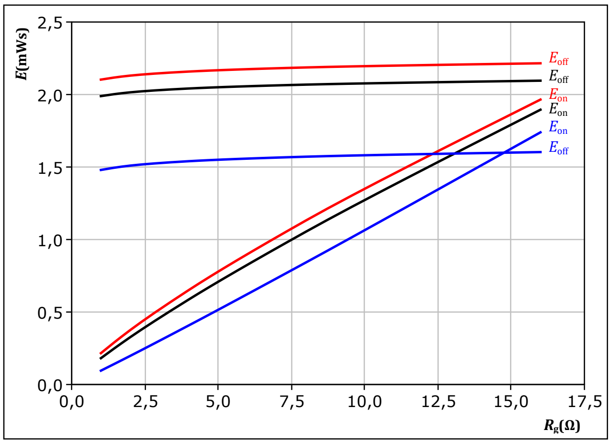
With an inductive load at

V_{CE} =	300	V	T_j: 25 °C (blue), 125 °C (black), 150 °C (red)
V_{GE} =	±15	V	
R_{gon} =	4	Ω	
R_{goff} =	4	Ω	

figure 36. **IGBT**

Typical switching energy losses as a function of IGBT turn on gate resistor

E = f(R_g)



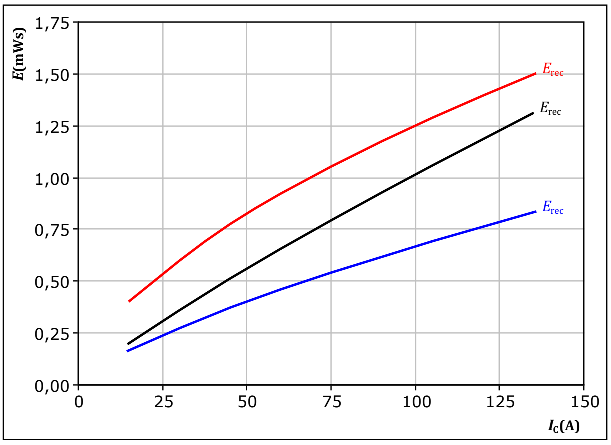
With an inductive load at

V_{CE} =	300	V	T_j: 25 °C (blue), 125 °C (black), 150 °C (red)
V_{GE} =	±15	V	
I_C =	75	A	

figure 37. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



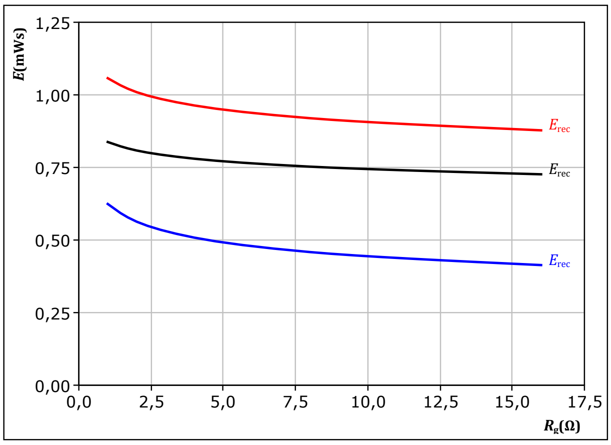
With an inductive load at

V_{CE} =	300	V	T_j: 25 °C (blue), 125 °C (black), 150 °C (red)
V_{GE} =	±15	V	
R_{gon} =	4	Ω	

figure 38. **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

E_{rec} = f(R_g)



With an inductive load at

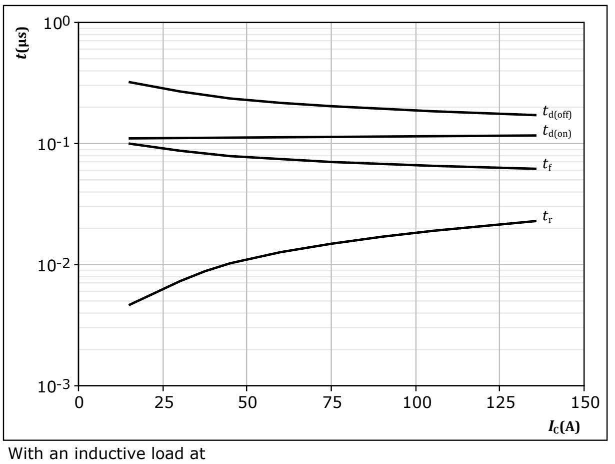
V_{CE} =	300	V	T_j: 25 °C (blue), 125 °C (black), 150 °C (red)
V_{GE} =	±15	V	
I_C =	75	A	

Brake Switching Characteristics

figure 39. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



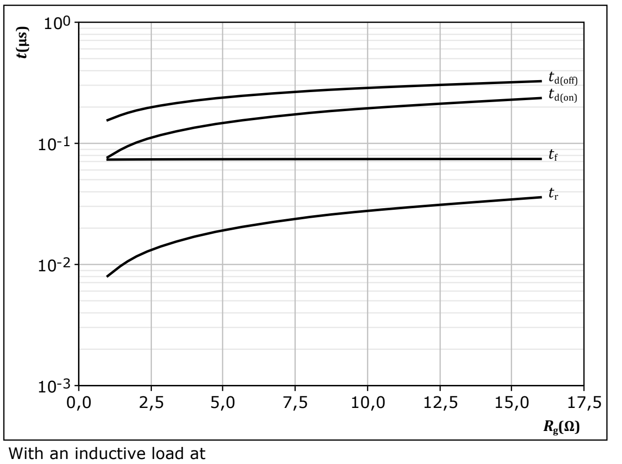
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 40. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

t = f(R_g)



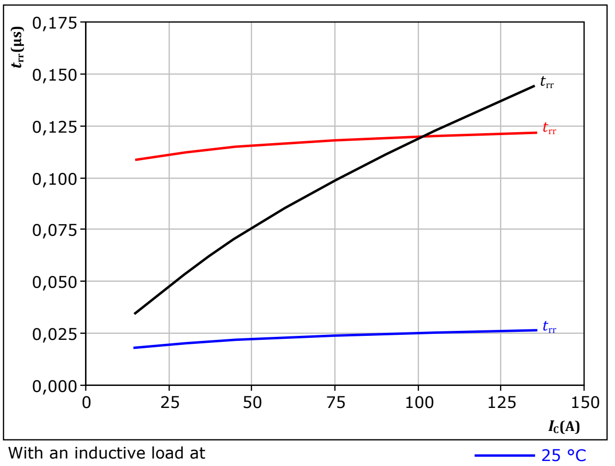
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	75	A

figure 41. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

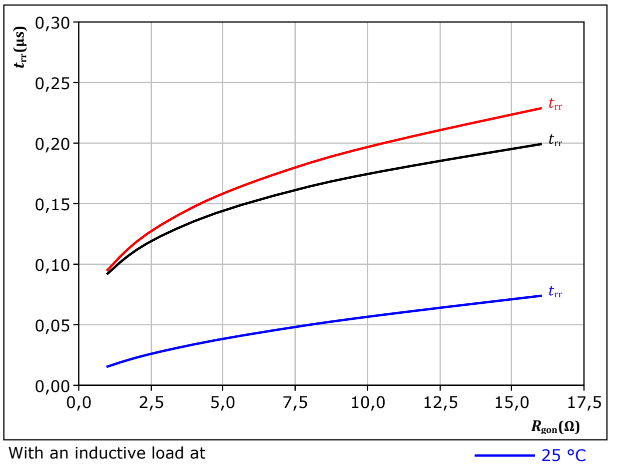
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 42. **FWD**

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

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



With an inductive load at

V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	75	A

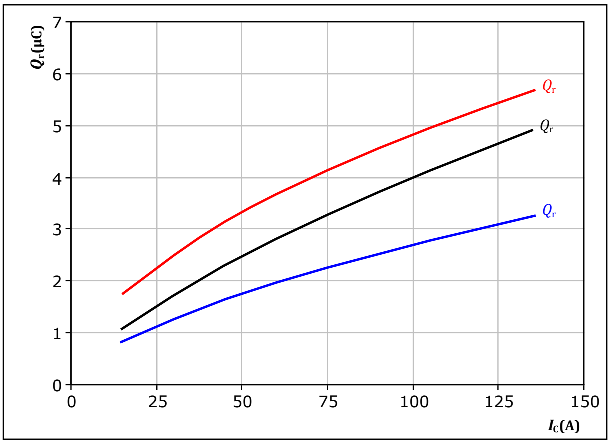
T_j: 25 °C, 125 °C, 150 °C

Brake Switching Characteristics

figure 43. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



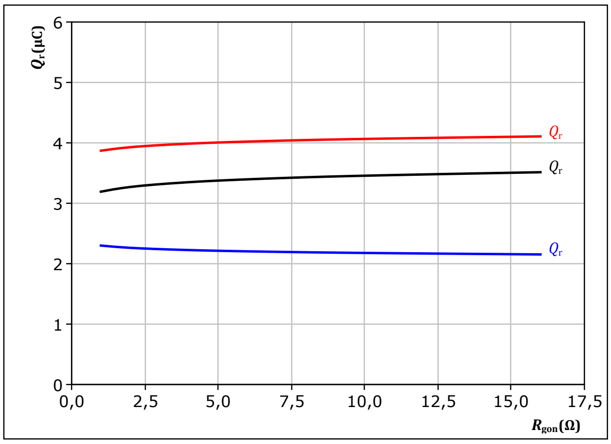
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 44. FWD

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

Q_r = f(R_{gon})



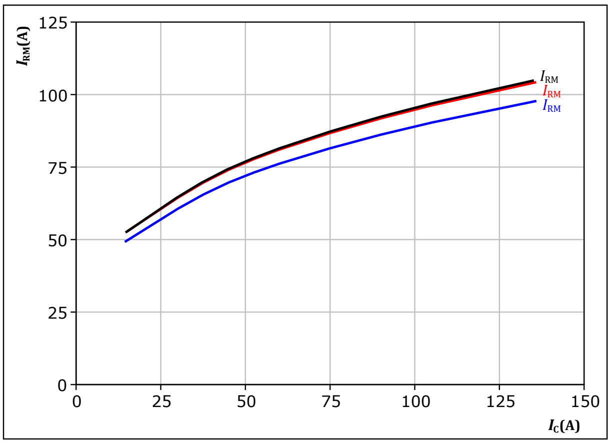
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	75	A		150 °C

figure 45. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



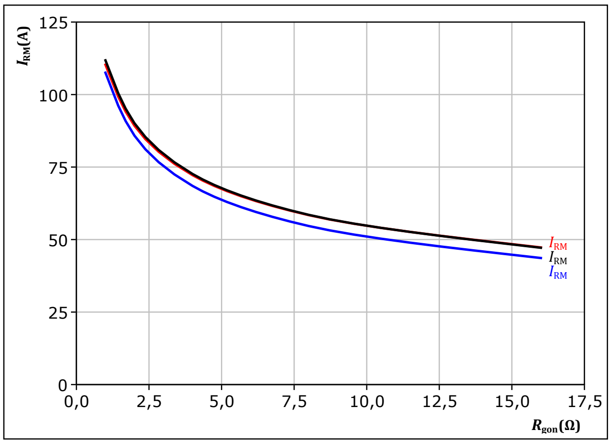
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 46. FWD

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

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



With an inductive load at

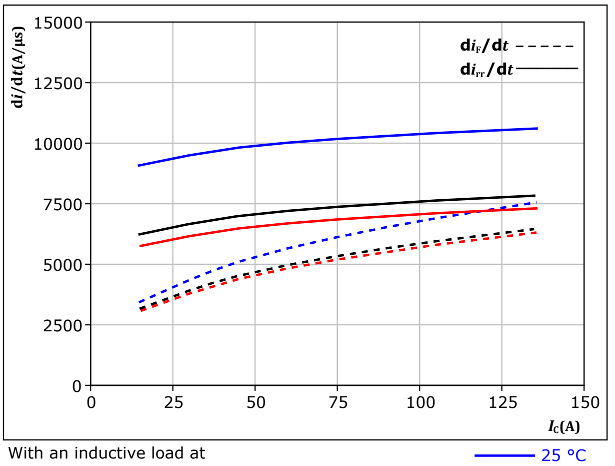
V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	75	A		150 °C

Brake Switching Characteristics

figure 47. **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)



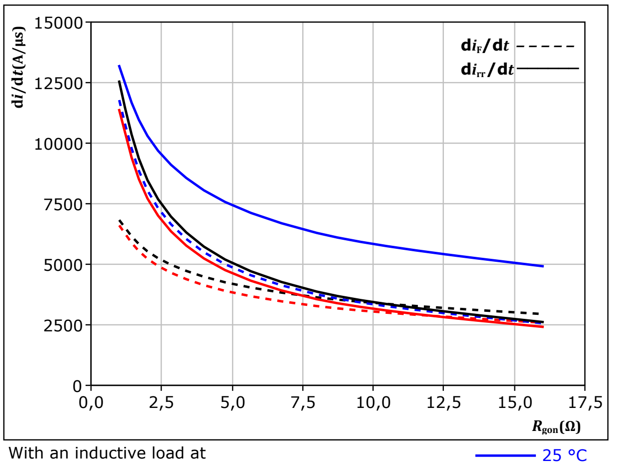
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 48. **FWD**

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

di_F/dt, di_{rr}/dt = f(R_{gon})



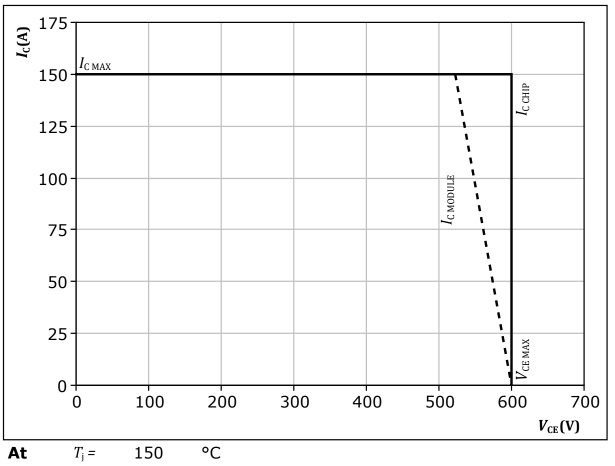
With an inductive load at

V_{CE} =	300	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	75	A		150 °C

figure 49. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Switching Definitions

figure 50. **IGBT**

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

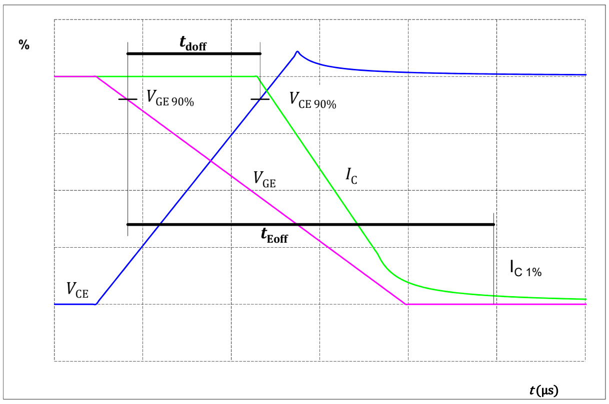


figure 51. **IGBT**

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

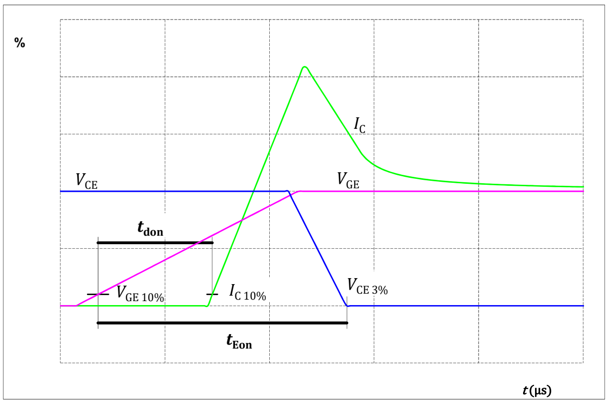


figure 52. **IGBT**

Turn-off Switching Waveforms & definition of t_f

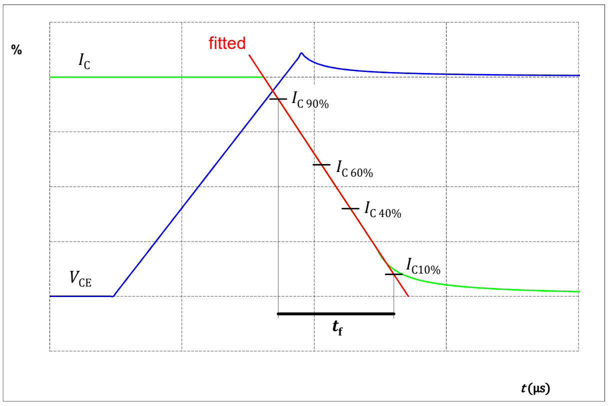
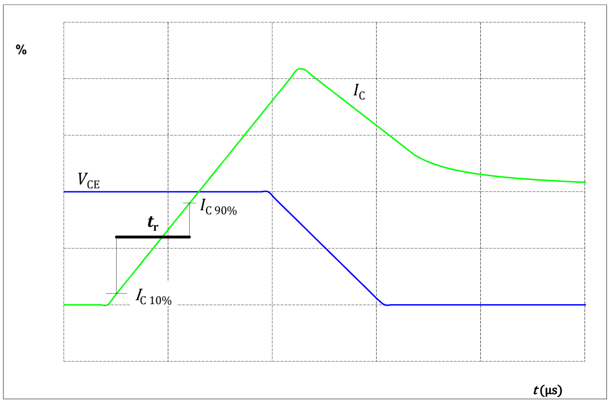


figure 53. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 54. **FWD**

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

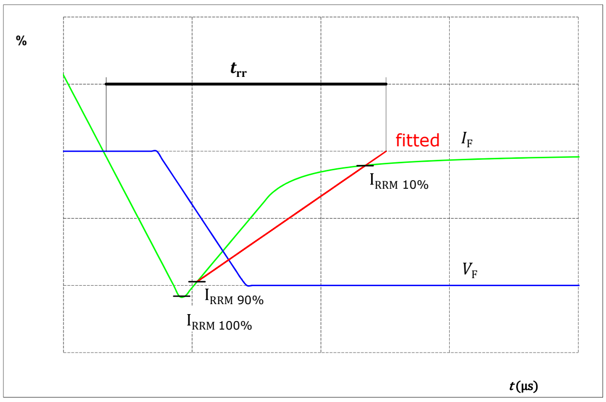
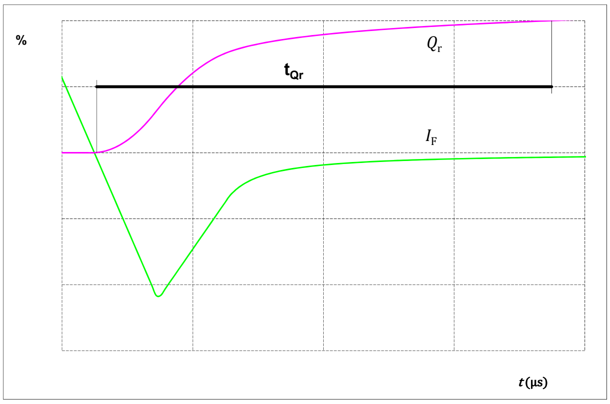


figure 55. **FWD**

Turn-on Switching Waveforms & definition of t_{Qr} **(**t_{Qr} **= integrating time for** Q_r**)**

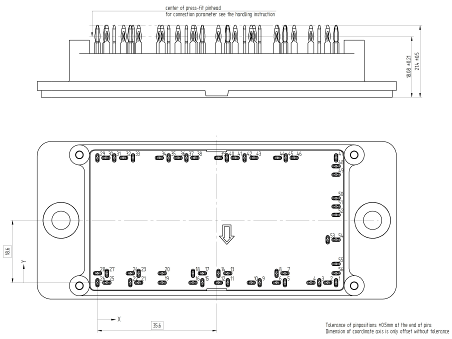


Ordering Code	
Version	**Ordering Code**
Without thermal paste	V23990-P765-AY-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P765-AY-/3/-PM

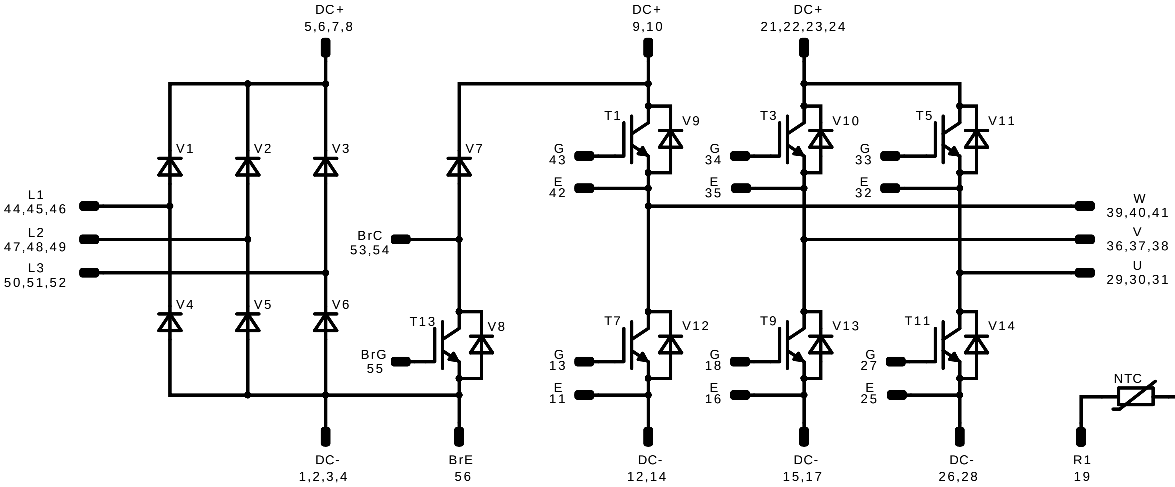
Marking							
	**Text**	**VIN**	**Date code**	**Type&Ver**	**UL**	**Lot**	**Serial**
		VIN	WWYY	TTTTTTTVV	UL	LLLLL	SSSS
	Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
		TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]							
Pin	X	Y	Function	29	0	37,2	U
1	71,2	0	DC-	30	2,5	37,2	U
2	68,7	0	DC-	31	5	37,2	U
3	66,2	0	DC-	32	7,8	37,2	E
4	63,7	0	DC-	33	10,6	37,2	G
5	55,95	0	DC+	34	18,45	37,2	G
6	53,45	0	DC+	35	21,25	37,2	E
7	55,95	2,8	DC+	36	24,05	37,2	V
8	53,45	2,8	DC+	37	26,55	37,2	V
9	48,4	0	DC+	38	29,05	37,2	V
10	45,9	0	DC+	39	36,1	37,2	W
11	38,9	0	E	40	38,6	37,2	W
12	36,1	0	DC-	41	41,1	37,2	W
13	38,9	2,8	G	42	43,9	37,2	E
14	36,1	2,8	DC-	43	46,7	37,2	G
15	31,3	0	DC-	44	53,7	37,2	L1
16	28,5	0	E	45	56,2	37,2	L1
17	31,3	2,8	DC-	46	58,7	37,2	L1
18	28,5	2,8	G	47	71,2	37,2	L2
19	19,3	0	R2	48	71,2	34,7	L2
20	19,3	2,8	R1	49	71,2	32,2	L2
21	12,3	0	DC+	50	71,2	25,2	L3
22	9,8	0	DC+	51	71,2	22,7	L3
23	12,3	2,8	DC+	52	71,2	20,2	L3
24	9,8	2,8	DC+	53	68,7	12,8	BrC
25	2,8	0	E	54	71,2	12,8	BrC
26	0	0	DC-	55	71,2	5,6	BrG
27	2,8	2,8	G	56	71,2	2,8	BrE
28	0	2,8	DC-				



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T7, T1, T9, T3, T11, T5	IGBT	600 V	100 A	Inverter Switch	
V9, V12, V10, V13, V11, V14	FWD	600 V	100 A	Inverter Diode	
T13	IGBT	600 V	75 A	Brake Switch	
V7	FWD	600 V	30 A	Brake Diode	
V8	FWD	600 V	20 A	Brake Sw. Protection Diode	
V4, V1, V5, V2, V6, V3	Rectifier	1600 V	75 A	Rectifier Diode	
NTC	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 36	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 2 packages see vincotech.com website.

Package data
Package data for *flow* 2 packages see vincotech.com website.

Vincotech thermistor reference
See Vincotech thermistor reference table at vincotech.com website.

UL recognition and file number
This device is UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}$=175°C and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-P765-AY-PM-D9-14	30 Mar. 2025	New Datasheet format. Module unchanged	
V23990-P765-AY-PM-D10-14	12 Mar. 2026	Correct TIM option	