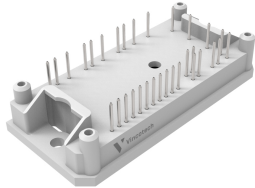
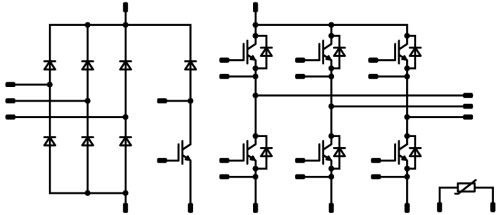




flowPIM 1		1200 V / 35 A	
Features <ul style="list-style-type: none">• Three-phase rectifier, optional BRC, Inverter, NTC• Very compact housing, easy to route• IGBT4 / EmCon4 technology for low saturation losses and improved EMC behavior		flow 1 17 mm housing 	
Target applications <ul style="list-style-type: none">• Industrial drives• Embedded drives		Schematic 	
Types <ul style="list-style-type: none">• V23990-P580-A47-PM			



Vincotech

Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	54	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	105	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	181	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	10	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	61	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	144	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	54	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	105	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	181	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	10	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$



Vincotech

Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Brake Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	36	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	130	A
Surge current capability	I^2t		80	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	58	W
Maximum junction temperature	T_{jmax}		150	°C

Rectifier Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	61	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	270	A
Surge current capability	I^2t		370	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	90	W
Maximum junction temperature	T_{jmax}		150	°C

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* $t_p = 2\text{ s}$	6000	V
Isolation voltage	V_{isol}	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			>12,7	mm
Clearance			>12,7	mm
Comparative Tracking Index	CTI		≥ 600	

*100 % tested in production



Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	

Inverter Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0012	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	25 150	1,58	1,95 2,4	2,07 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			5	μA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25		25		2000		pF
Reverse transfer capacitance	C_{res}									
Gate charge	Q_g		15		0	25		270		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						0,53		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16 \Omega$ $R_{goff} = 16 \Omega$	±15	600	35	25		92		ns
Rise time	t_r					150		91,6		
						25		18		ns
Turn-off delay time	$t_{d(off)}$					150		23,4		
						25		212,6		ns
Fall time	t_f					150		273,8		
						25		75,33		ns
Turn-on energy (per pulse)	E_{on}	150		104,91						
		25		1,62		mWs				
Turn-off energy (per pulse)	E_{off}	150		2,49						
		25		1,81		mWs				
						150		2,82		



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 Diode

Static

Forward voltage	V_F				35	25 150	1,35	1,83 1,8	2,05 ⁽¹⁾	V
Reverse leakage current	I_R	$V_i = 1200$ V				25			7,7	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,66		K/W
----------------------------------------------------	---------------	---------------------------------------	--	--	--	--	--	------	--	-----

Dynamic

Peak recovery current	I_{RRM}	$di/dt=2744$ A/μs $di/dt=2239$ A/μs	±15	600	35	25		68,91		A
Reverse recovery time	t_{rr}					150		78,7		ns
						25		150,18		
Recovered charge	Q_r					150		277,1		μC
						25		3,93		
Reverse recovered energy	E_{rec}					150		7,47		mWs
		25		1,69						
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$	150		3,31		A/μs				
		25		4100						
								2080		



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 Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0012	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		35	25 150	1,58	1,95 2,4	2,07 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			5	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25		25		2000		pF
Reverse transfer capacitance	C_{res}									
Gate charge	Q_g		15		0	25		270		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						0,53		K/W
----------------------------------------------------	---------------	-----------------------------------------------	--	--	--	--	--	------	--	-----

Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16 \Omega$ $R_{goff} = 16 \Omega$	± 15	300	20	25		93,2		ns
Rise time	t_r					125		97,2		
						150		97,4		
						25		32,6		ns
Turn-off delay time	$t_{d(off)}$					125		34,8		
						150		34,8		
						25		195,2		ns
Fall time	t_f	125		248,6						
		150		264						
		25		102,12		ns				
Turn-on energy (per pulse)	E_{on}	125		147,41						
		150		163						
		25		4,11		mWs				
Turn-off energy (per pulse)	E_{off}	125		4,65						
		150		4,98						
		25		0,783		mWs				
		1,29								
		1,48								



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				7	25 125 150		1,03 0,961	1,11 ⁽¹⁾ 1,01 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 1600$ V				25 150			5 700	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,21		K/W
----------------------------------------------------	---------------	------------------------------------	--	--	--	--	--	------	--	-----

Rectifier Diode

Static

Forward voltage	V_F				28	25 125		1,15 1,1	1,5 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 1600$ V				25 150			100 1000	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,78		K/W
----------------------------------------------------	---------------	------------------------------------	--	--	--	--	--	------	--	-----



Characteristic Values

Parameter	Symbol	Conditions					Values			Unit	
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	V_{CE} [V]	V_F [V]	I_D [A]	I_C [A]	I_F [A]		T_j [°C]

Thermistor

Static

Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$A_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	P							5		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1 \%$						3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1 \%$						4000		K
Vincotech Thermistor Reference									I	

⁽¹⁾ Value at chip level

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

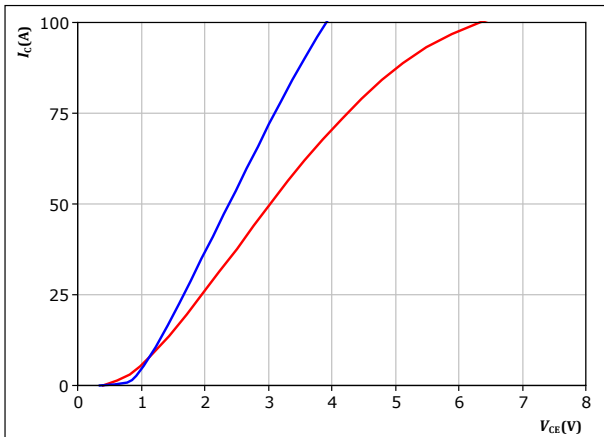


Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

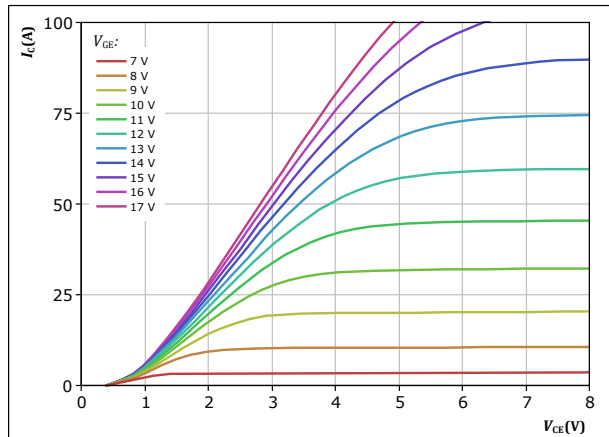


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j:$ — 25 °C
— 150 °C

figure 2. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

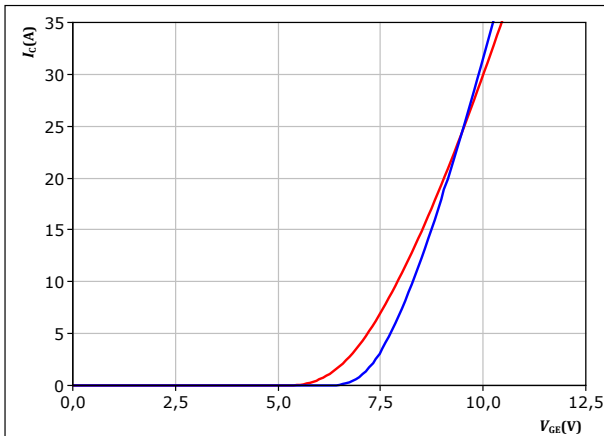


$t_p = 250 \mu s$
 $T_j = 150 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

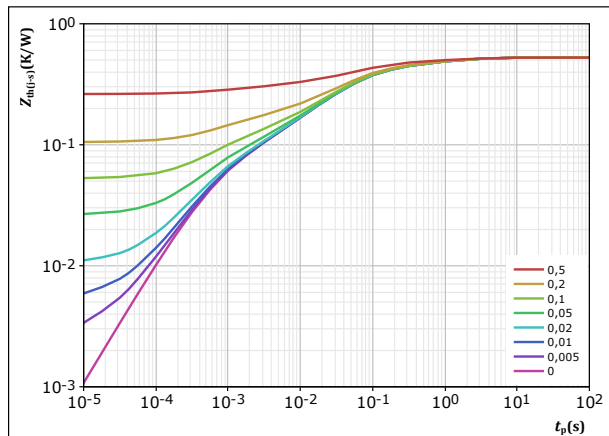


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j:$ — 25 °C
— 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,525 \text{ K/W}$
IGBT thermal model values

R (K/W)	τ (s)
4,54E-02	2,18E+00
7,24E-02	4,41E-01
1,86E-01	7,20E-02
1,25E-01	2,12E-02
5,08E-02	2,99E-03
4,60E-02	5,56E-04

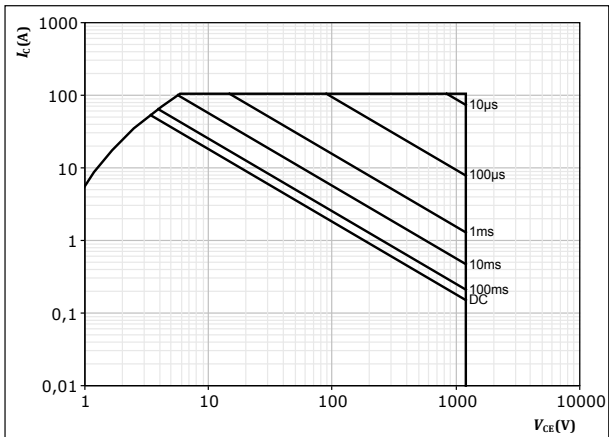


Inverter Switch Characteristics

figure 5. IGBT

Safe operating area

$$I_C = f(V_{CE})$$



$D =$ single pulse

$T_s = 80$ °C

$V_{CE} = 15$ V

$T_j = T_{jmax}$



Inverter Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

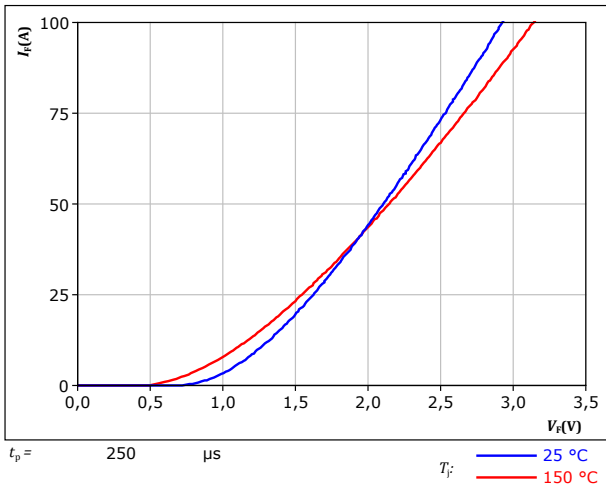
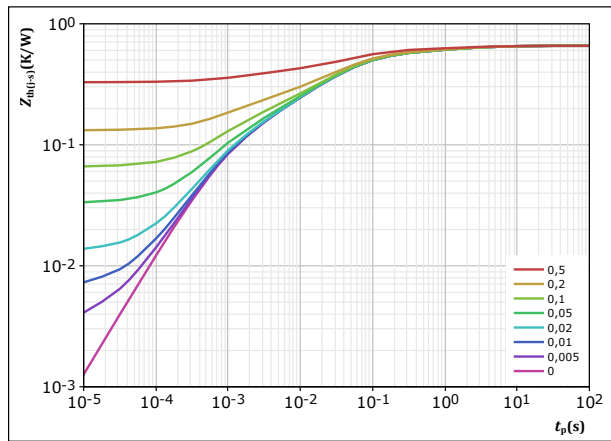


figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 0,658 \text{ K/W}$

FWD thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
3,19E-02	4,88E+00
6,47E-02	8,75E-01
1,55E-01	1,07E-01
2,31E-01	2,86E-02
9,18E-02	4,91E-03
8,32E-02	8,44E-04

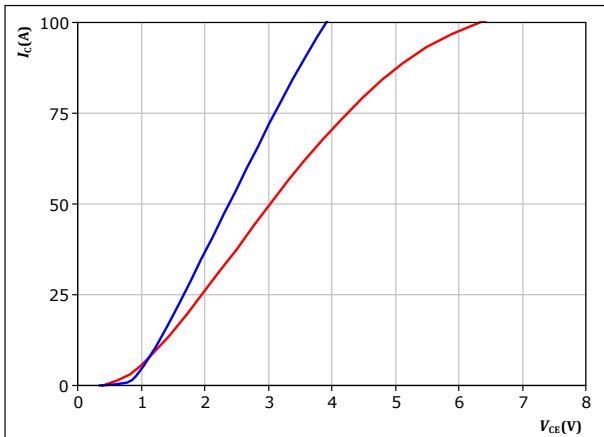


Brake Switch Characteristics

figure 8. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

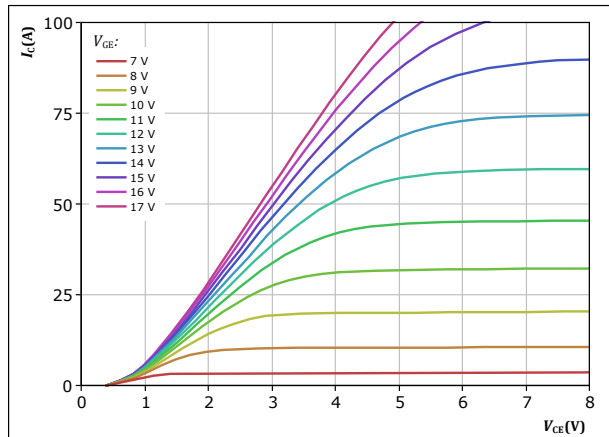


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25^\circ C$ (blue), $150^\circ C$ (red)

figure 9. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

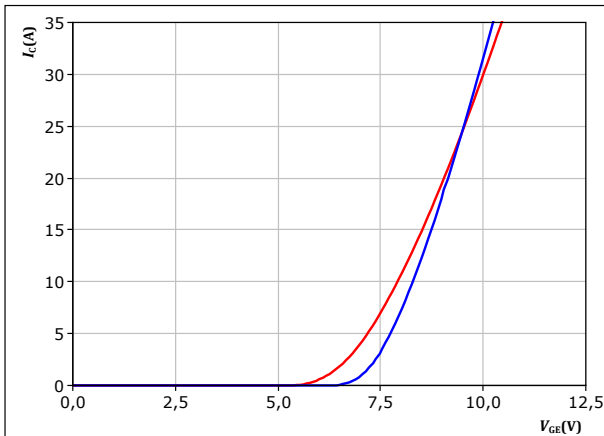


$t_p = 250 \mu s$
 $T_j = 150^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 10. IGBT

Typical transfer characteristics

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

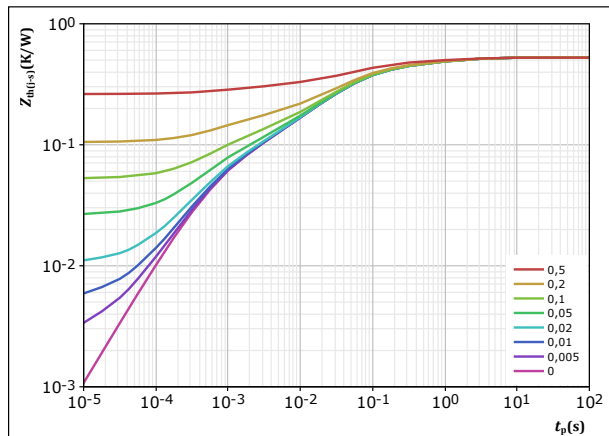


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25^\circ C$ (blue), $150^\circ C$ (red)

figure 11. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,525 K/W$

IGBT thermal model values

R (K/W)	τ (s)
4,54E-02	2,18E+00
7,24E-02	4,41E-01
1,86E-01	7,20E-02
1,25E-01	2,12E-02
5,08E-02	2,99E-03
4,60E-02	5,56E-04

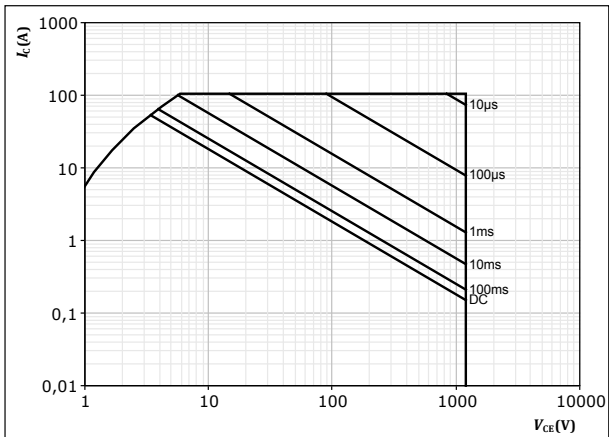


Brake Switch Characteristics

figure 12. IGBT

Safe operating area

$$I_C = f(V_{CE})$$



$D =$ single pulse

$T_s = 80 \text{ } ^\circ\text{C}$

$V_{CE} = 15 \text{ V}$

$T_j = T_{jmax}$



Brake Diode Characteristics

figure 13. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

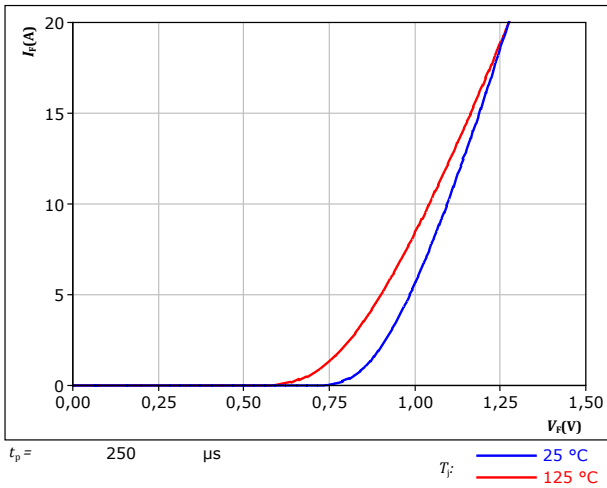
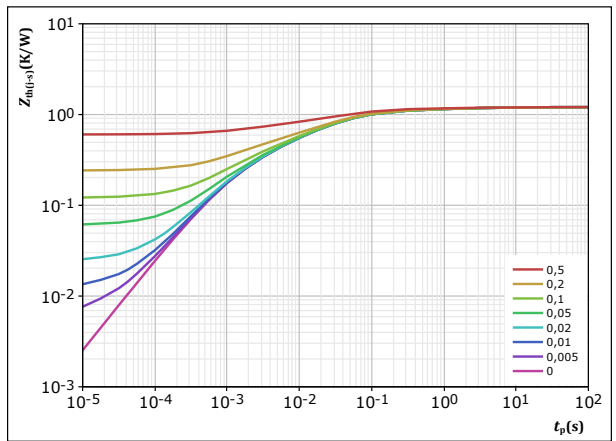


figure 14. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 1,207 \text{ K/W}$

Rectifier thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
3,84E-02	9,11E+00
9,58E-02	7,20E-01
3,31E-01	6,88E-02
3,77E-01	1,87E-02
2,24E-01	3,64E-03
1,41E-01	8,43E-04



Rectifier Diode Characteristics

figure 15. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

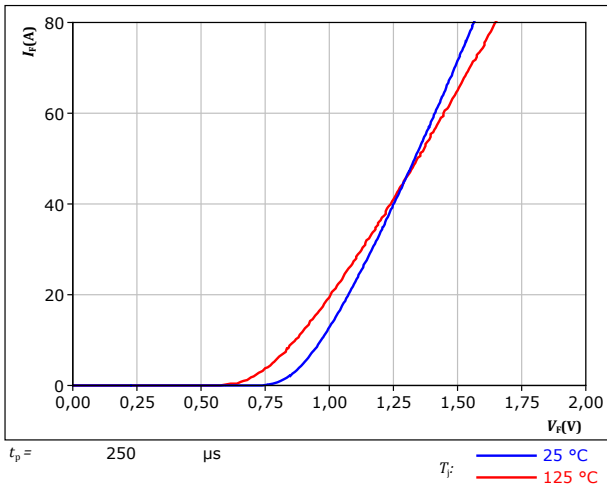
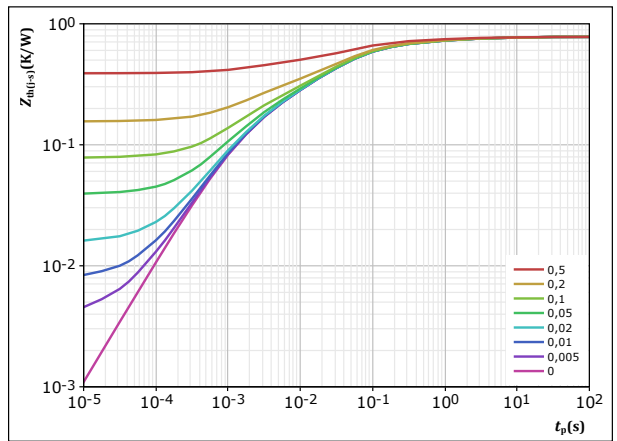


figure 16. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$
 $R_{th(j-s)} = 0,779 \text{ K/W}$
 Rectifier thermal model values

R (K/W)	τ (s)
2,91E-02	9,03E+00
7,35E-02	9,52E-01
1,61E-01	1,41E-01
2,98E-01	3,46E-02
1,23E-01	5,73E-03
9,51E-02	1,21E-03

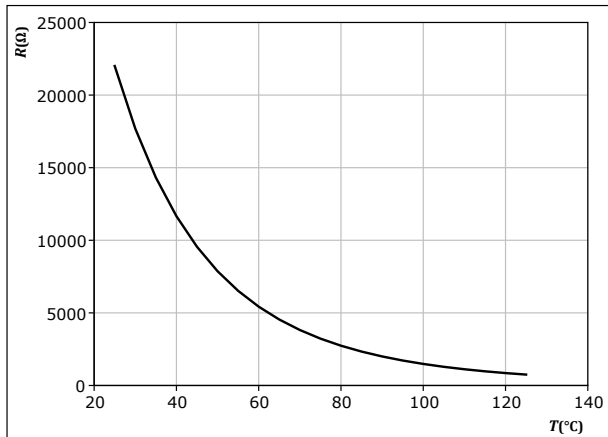


Thermistor Characteristics

figure 17. Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$

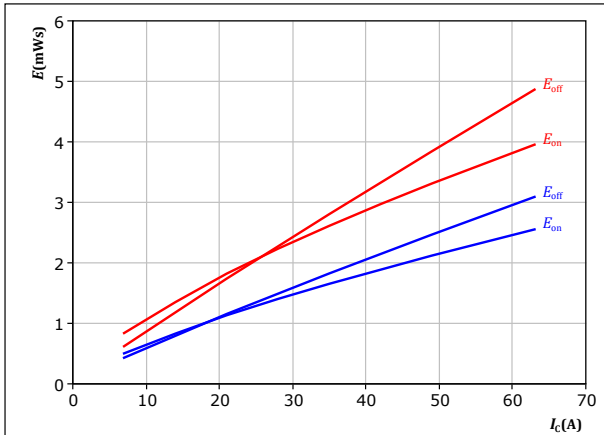




Inverter Switching Characteristics

figure 18. IGBT

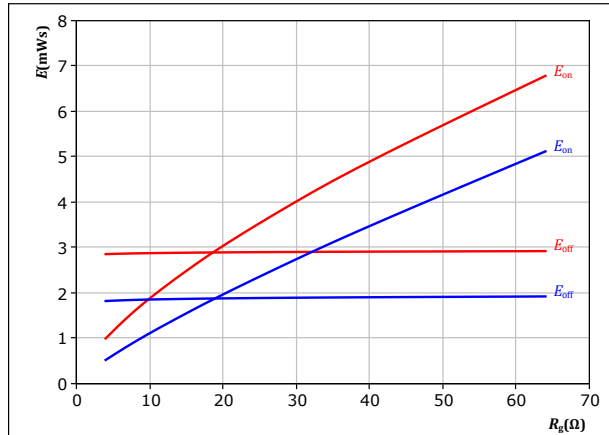
Typical switching energy losses as a function of collector current
 $E = f(I_c)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 $R_{goff} = 16$ Ω
 T_j : — 25 °C
— 150 °C

figure 19. IGBT

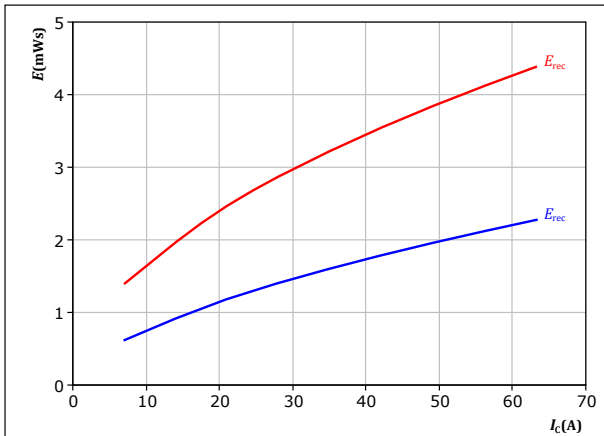
Typical switching energy losses as a function of gate resistor
 $E = f(R_g)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 35$ A
 T_j : — 25 °C
— 150 °C

figure 20. FWD

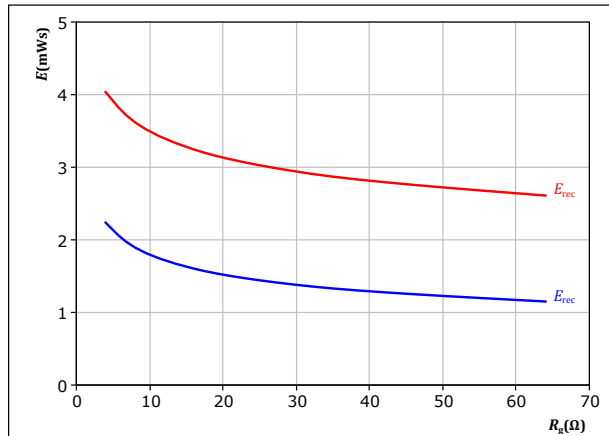
Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 T_j : — 25 °C
— 150 °C

figure 21. FWD

Typical reverse recovered energy loss as a function of gate resistor
 $E_{rec} = f(R_g)$



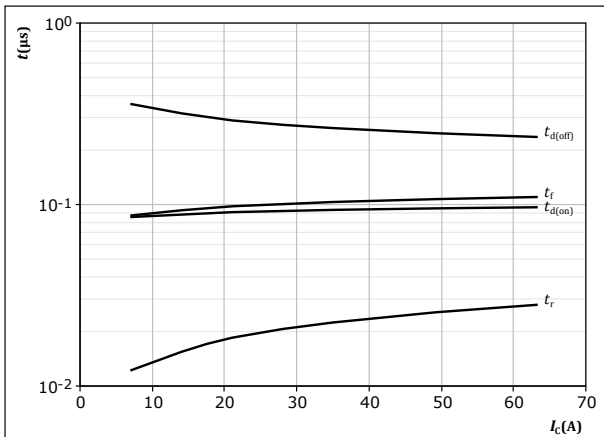
With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 35$ A
 T_j : — 25 °C
— 150 °C



Inverter Switching Characteristics

figure 22. IGBT

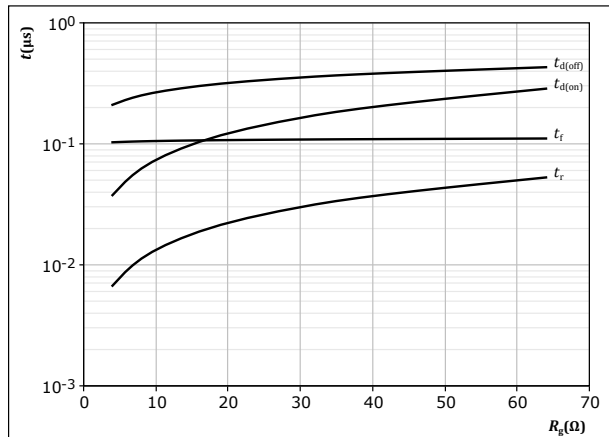
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{g(on)} = 16 \text{ } \Omega$
 $R_{g(off)} = 16 \text{ } \Omega$

figure 23. IGBT

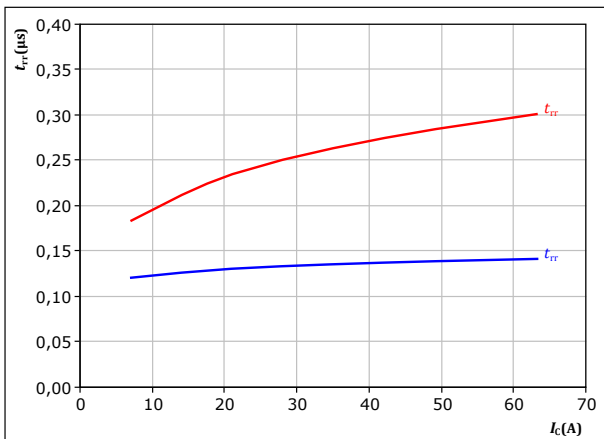
Typical switching times as a function of gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 35 \text{ A}$

figure 24. FWD

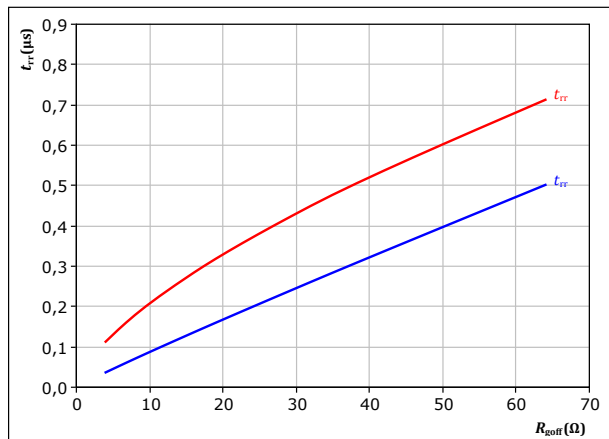
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{g(on)} = 16 \text{ } \Omega$
 T_j : — 25 $^\circ\text{C}$
 — 150 $^\circ\text{C}$

figure 25. FWD

Typical reverse recovery time as a function of IGBT turn off gate resistor
 $t_{rr} = f(R_{g(off)})$



With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 35 \text{ A}$
 T_j : — 25 $^\circ\text{C}$
 — 150 $^\circ\text{C}$

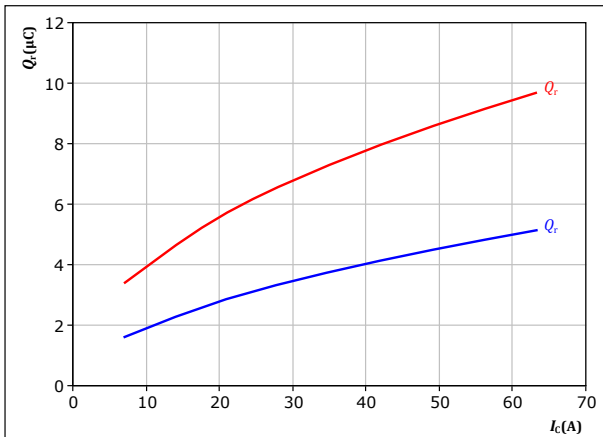


Inverter Switching Characteristics

figure 26. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

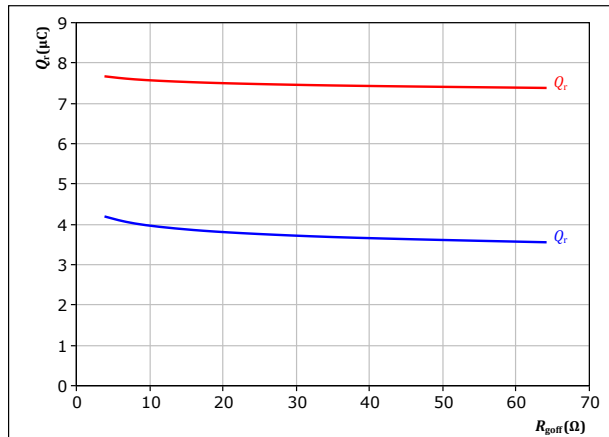
$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{goff} = 16$ Ω

T_j : — 25 °C
— 150 °C

figure 27. FWD

Typical recovered charge as a function of turn off gate resistor

$$Q_r = f(R_{goff})$$



With an inductive load at

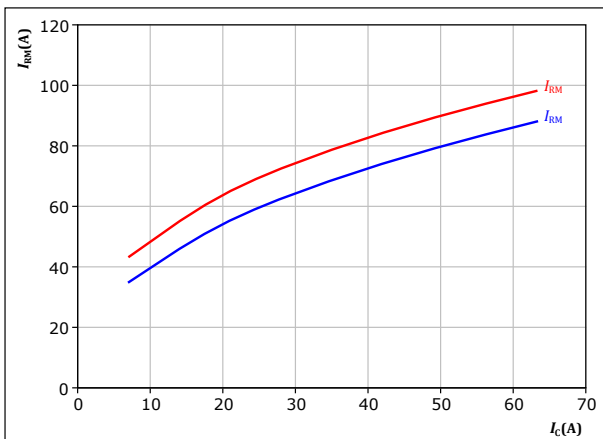
$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 35$ A

T_j : — 25 °C
— 150 °C

figure 28. FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



With an inductive load at

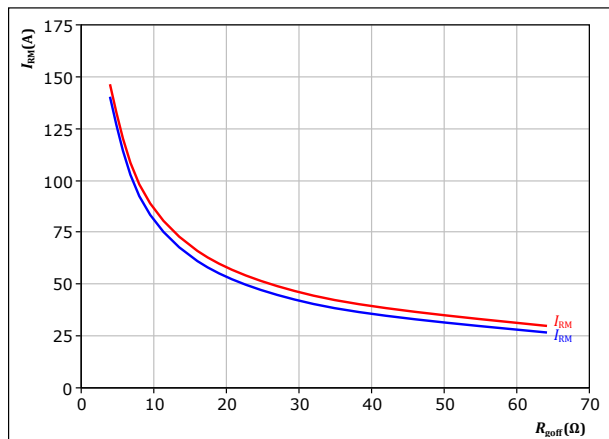
$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{goff} = 16$ Ω

T_j : — 25 °C
— 150 °C

figure 29. FWD

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

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



With an inductive load at

$V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 35$ A

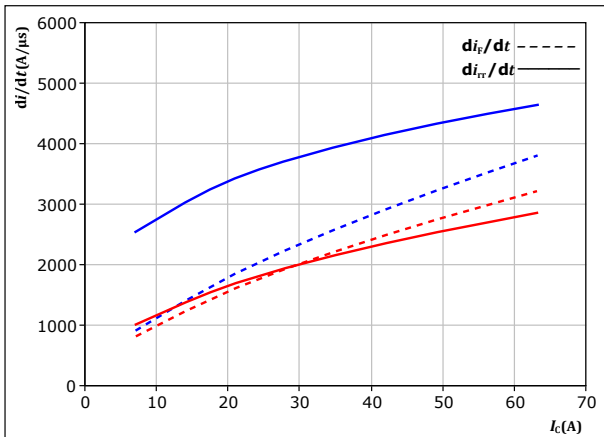
T_j : — 25 °C
— 150 °C



Inverter Switching Characteristics

figure 30. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_r/dt = f(I_c)$



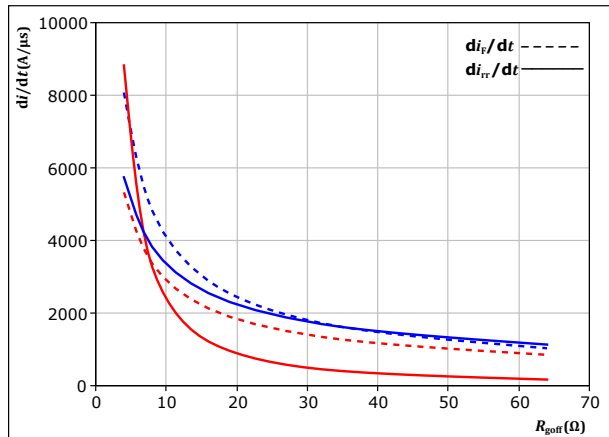
With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{goff} = 16 \text{ } \Omega$

T_j : — 25 °C
 — 150 °C

figure 31. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn off gate resistor
 $di_f/dt, di_r/dt = f(R_{goff})$



With an inductive load at

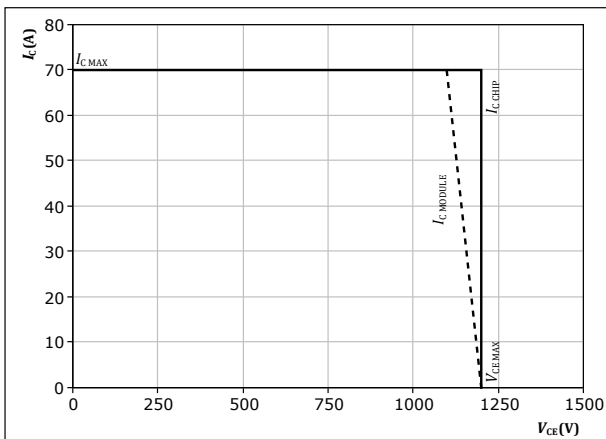
$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 35 \text{ A}$

T_j : — 25 °C
 — 150 °C

figure 32. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



At $T_j = 150 \text{ } ^\circ\text{C}$
 $R_{goff} = 16 \text{ } \Omega$
 $R_{goff} = 16 \text{ } \Omega$

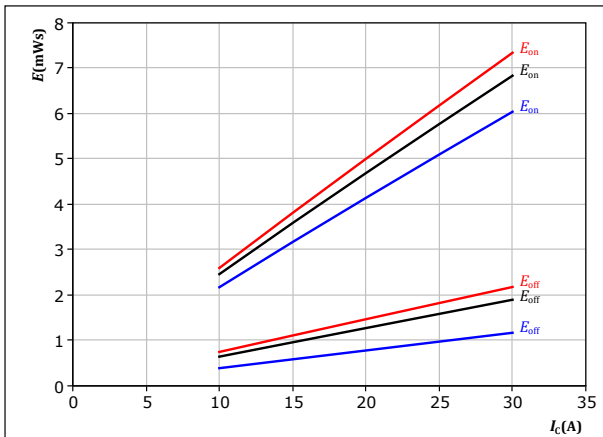


Brake Switching Characteristics

figure 33. IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



With an inductive load at

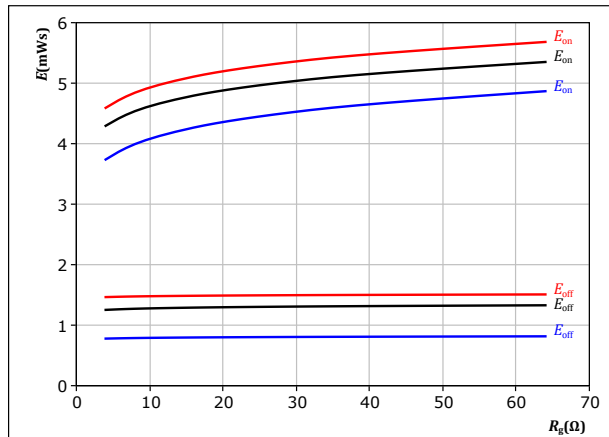
$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 $R_{goff} = 16$ Ω

T_j : — 25 °C
 — 125 °C
 — 150 °C

figure 34. IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

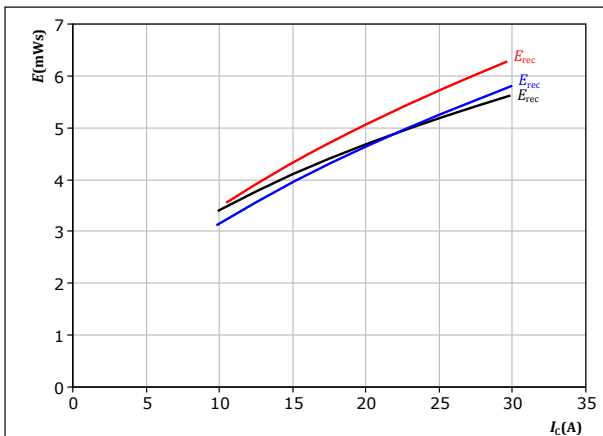
$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 20$ A

T_j : — 25 °C
 — 125 °C
 — 150 °C

figure 35. Rectifier

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_c)$$



With an inductive load at

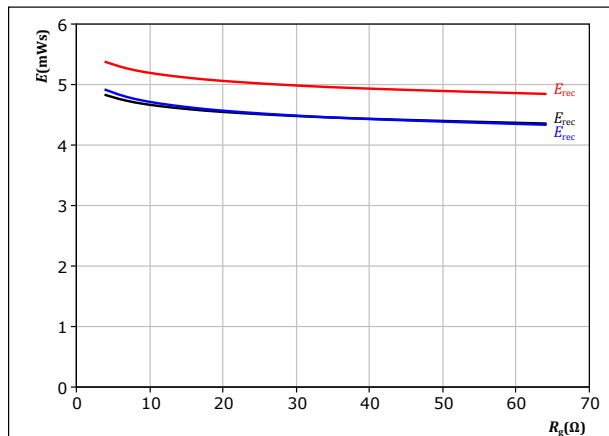
$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

T_j : — 25 °C
 — 125 °C
 — 150 °C

figure 36. Rectifier

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
 $V_{GE} = \pm 15$ V
 $I_c = 20$ A

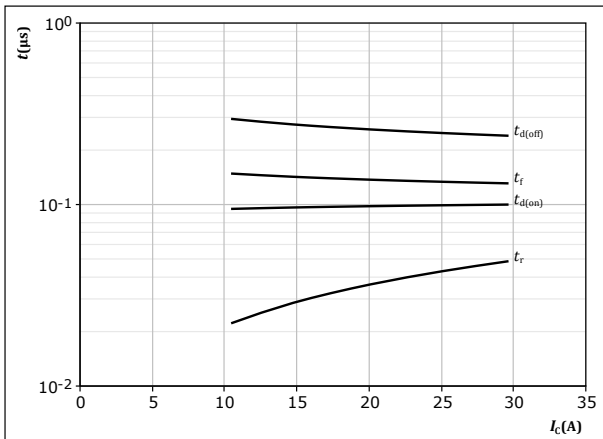
T_j : — 25 °C
 — 125 °C
 — 150 °C



Brake Switching Characteristics

figure 37. IGBT

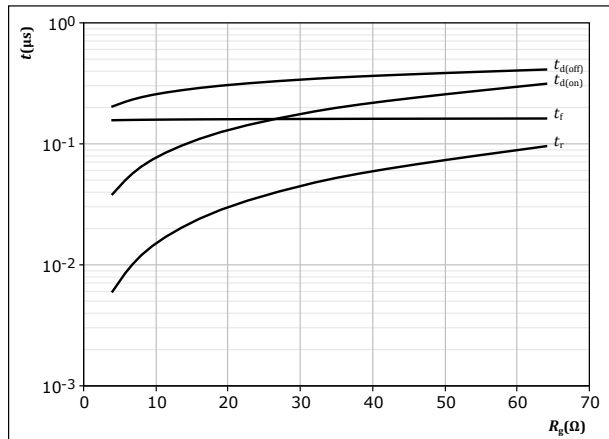
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{g(on)} = 16 \text{ } \Omega$
 $R_{g(off)} = 16 \text{ } \Omega$

figure 38. IGBT

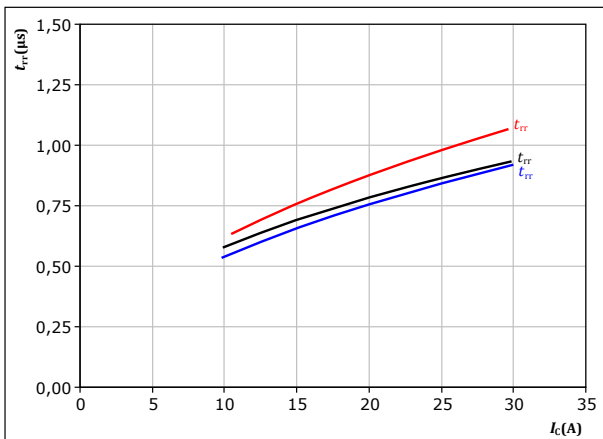
Typical switching times as a function of gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 20 \text{ A}$

figure 39. Rectifier

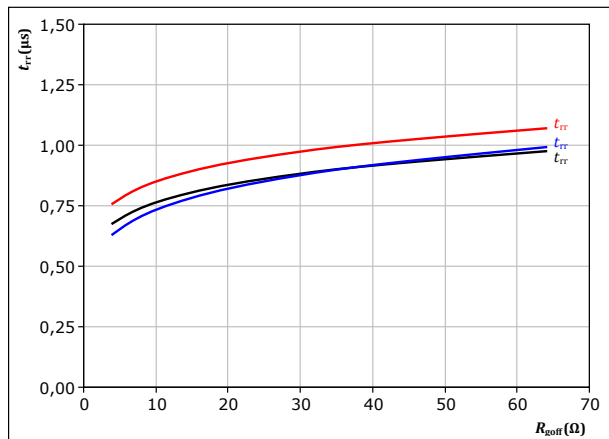
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{g(on)} = 16 \text{ } \Omega$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

figure 40. Rectifier

Typical reverse recovery time as a function of IGBT turn off gate resistor
 $t_{rr} = f(R_{g(off)})$



With an inductive load at
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 20 \text{ A}$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

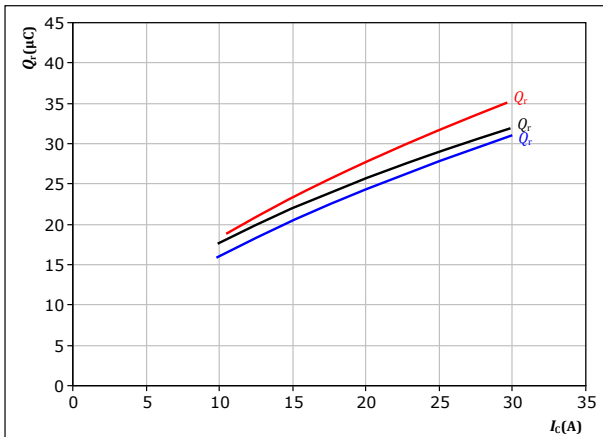


Brake Switching Characteristics

figure 41. Rectifier

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

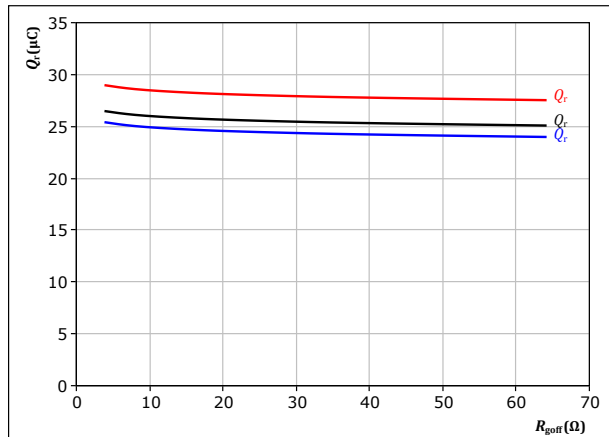
$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{goff} = 16$ Ω

T_j : — 25 °C
— 125 °C
— 150 °C

figure 42. Rectifier

Typical recovered charge as a function of turn off gate resistor

$$Q_r = f(R_{goff})$$



With an inductive load at

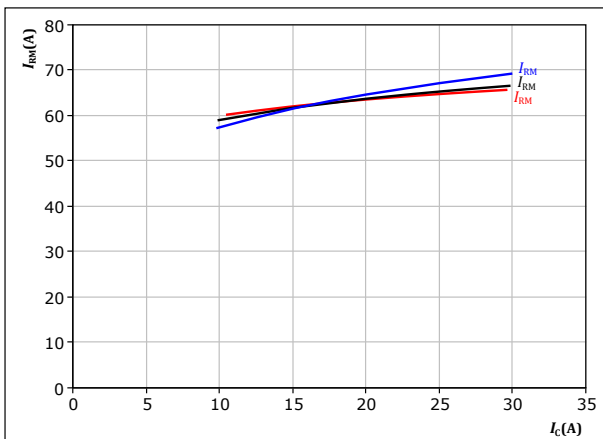
$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 20$ A

T_j : — 25 °C
— 125 °C
— 150 °C

figure 43. Rectifier

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



With an inductive load at

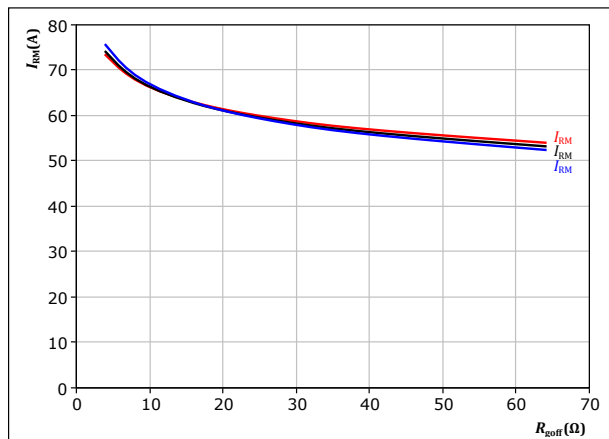
$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $R_{goff} = 16$ Ω

T_j : — 25 °C
— 125 °C
— 150 °C

figure 44. Rectifier

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

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



With an inductive load at

$V_{CE} = 300$ V
 $V_{GE} = \pm 15$ V
 $I_c = 20$ A

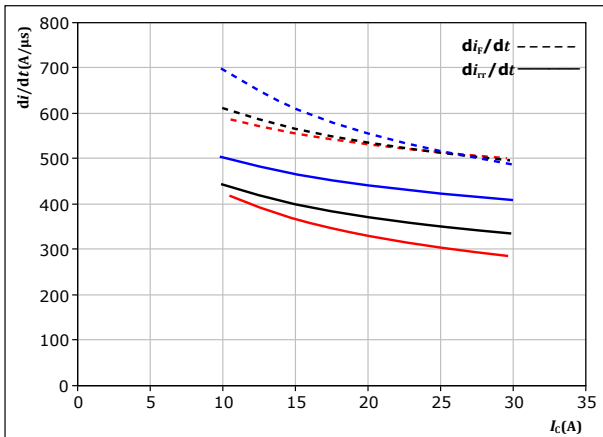
T_j : — 25 °C
— 125 °C
— 150 °C



Brake Switching Characteristics

figure 45. Rectifier

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_r/dt = f(I_c)$



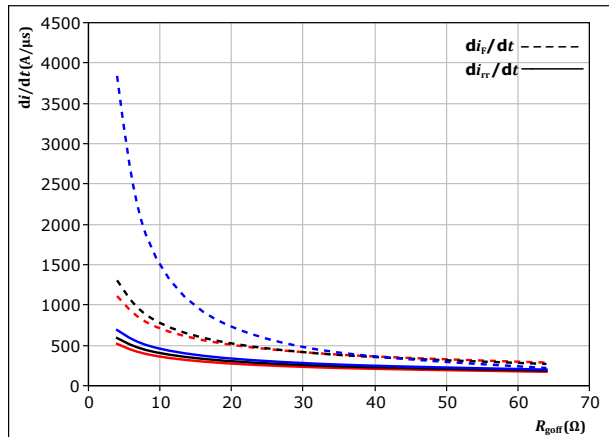
With an inductive load at

$V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{goff} = 16 \text{ } \Omega$

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 46. Rectifier

Typical rate of fall of forward and reverse recovery current as a function of turn off gate resistor
 $di_f/dt, di_r/dt = f(R_{goff})$



With an inductive load at

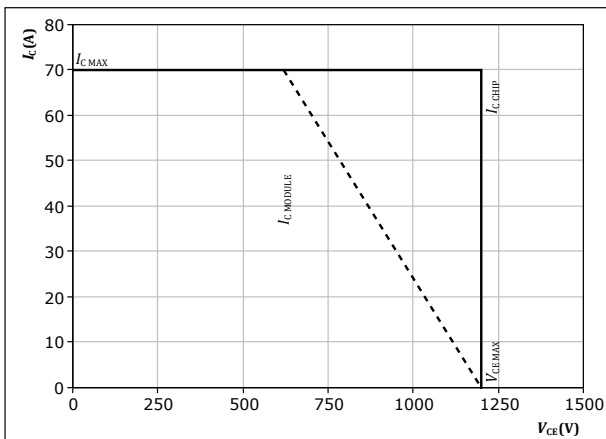
$V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 20 \text{ A}$

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 47. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



At $T_j = 150 \text{ } ^\circ\text{C}$
 $R_{goff} = 16 \text{ } \Omega$
 $R_{goff} = 16 \text{ } \Omega$



Switching Definitions

figure 48. IGBT

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

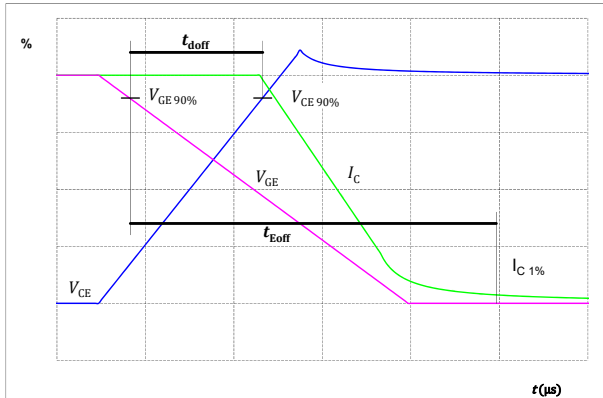


figure 49. IGBT

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



figure 50. IGBT

Turn-off Switching Waveforms & definition of t_f

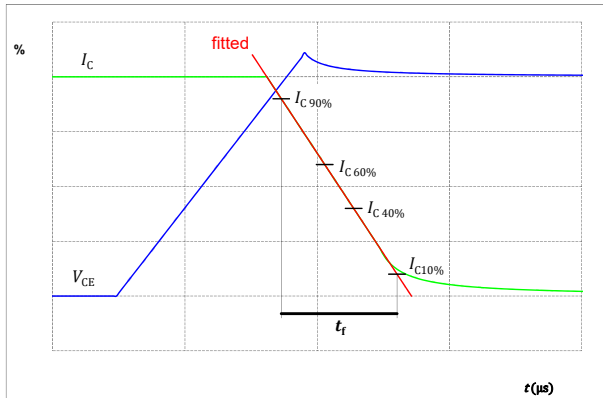
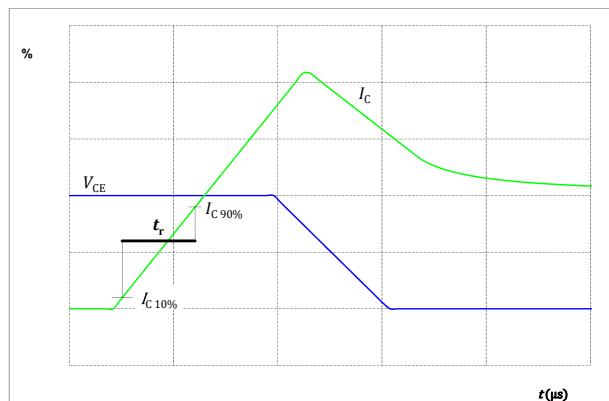


figure 51. IGBT

Turn-on Switching Waveforms & definition of t_r





Switching Definitions

figure 52. FWD

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

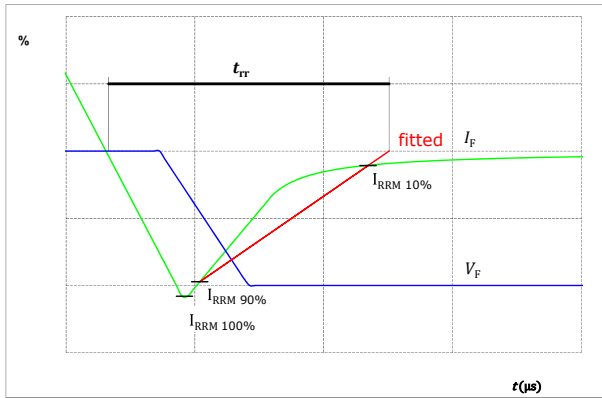
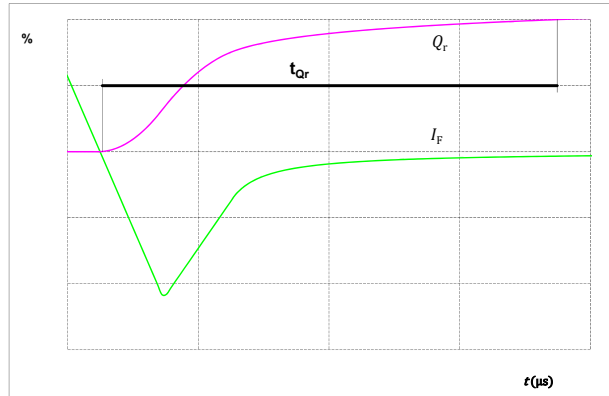


figure 53. FWD

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





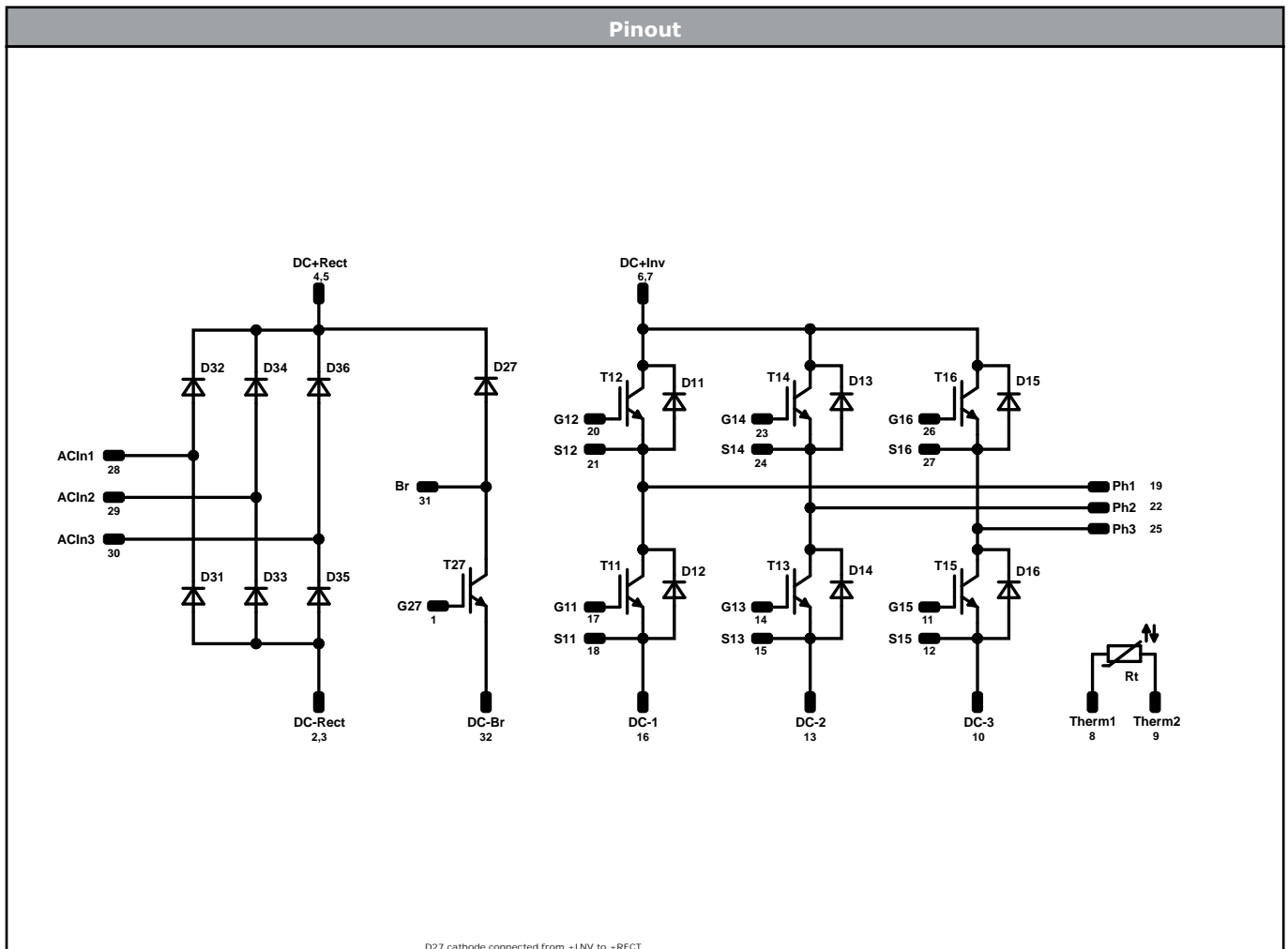
Vincotech

V23990-P580-A47-PM
datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	V23990-P580-A47-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P580-A47-/3/-PM

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

Pin table [mm]				Outline	
Pin	X	Y	Function		
1	52,55	0	G27		
2	47,7	0	DC-Rect		
3	44,8	0	DC-Rect		
4	37,8	0	DC+Rect		
5	37,8	2,8	DC+Rect		
6	35	0	DC+Inv		
7	35	2,8	DC+Inv		
8	28	0	Therm1		
9	25,2	0	Therm2		
10	22,4	0	DC-3		
11	19,6	0	G15		
12	16,8	0	S15		
13	14	0	DC-2		
14	11,2	0	G13		
15	8,4	0	S13		
16	5,6	0	DC-1		
17	2,8	0	G11		
18	0	0	S11		
19	0	28,5	Ph1		
20	2,8	28,5	G12		
21	7,5	28,5	S12		
22	14,5	28,5	Ph2		
23	17,3	28,5	G14		
24	22	28,5	S14		
25	29	28,5	Ph3		
26	31,8	28,5	G16		
27	36,5	28,5	S16		
28	43,5	28,5	ACIn1		
29	52,55	25	ACIn2		
30	52,55	16,9	ACIn3		
31	52,55	8,6	Br		
32	52,55	2,8	DC-Br		



Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	35 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	35 A	Inverter Diode	
T27	IGBT	1200 V	35 A	Brake Switch	
D27	Rectifier	1600 V	7 A	Brake Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	28 A	Rectifier Diode	
Rt	Thermistor			Thermistor	




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

Handling instruction
Handling instructions for <i>flow 1</i> packages see vincotech.com website.

Package data
Package data for <i>flow 1</i> 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 certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website. 

Document No.:	Date:	Modification:	Pages
V23990-P580-A47-PM-D3-14	21 Sep. 2021	Updated Inverter Switch, Inverter Diode, Brake Switch and Brake Diode characteristic values Inverter and Brake dynamic characteristics Updated datasheet format, module is unchanged	

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.