



MiniSKiiP PIM 1

1200 V / 15 A

Topology features

- Converter+Brake+Inverter
- Tandem diode
- Temperature sensor

Component features

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

Housing features

- Base isolation: Al₂O₃
- Easy assembly in one mounting step
- Flexible PCB design w/o pin holes
- Rugged solderless spring contacts

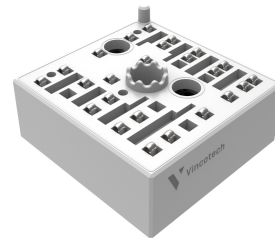
Target applications

- Industrial Drives

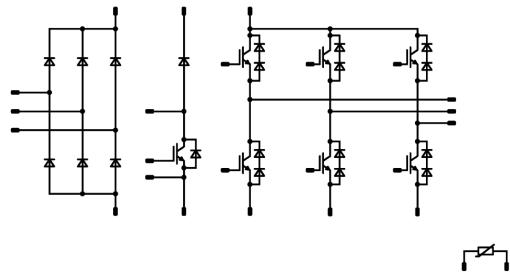
Types

- 80-M112PMA015M701-K200A71

MiniSKiiP® 1 16 mm housing



Schematic





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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	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	30 ⁽¹⁾	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	79	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	9,5	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

⁽¹⁾ limited by I_{CRM}

Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		1300	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	23	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	72	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	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	30 ⁽²⁾	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	79	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 800\text{ V}$ $T_j = 150\text{ °C}$	9,5	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

⁽²⁾ limited by I_{CRM}



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Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
Brake Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	30 ⁽³⁾	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	61	W
Maximum junction temperature	T_{jmax}		175	°C

⁽³⁾ limited by I_{FRM}

Brake Sw. Protection Diode

Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s \leq 80\text{ °C}$	10 ⁽⁴⁾	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	10	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	41	W
Maximum junction temperature	T_{jmax}		175	°C

⁽⁴⁾ limited by I_{FRM}

Rectifier Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	46	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}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	60	W
Maximum junction temperature	T_{jmax}		150	°C



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datasheet

Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
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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* $t_p = 2\text{ s}$	5500	V
Isolation voltage	V_{isol}	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance		With std lid For more informations see handling instructions	6,3	mm
Clearance		With std lid For more informations see handling instructions	6,3	mm
Comparative Tracking Index	CTI		≥ 600	

*100 % tested in production



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datasheet

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	$V_{GE(th)}$			10	0,0015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		15	25 125 150		1,7 1,95 2,01	2,1 ⁽⁵⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			60	μA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}							2900		pF
Output capacitance	C_{oes}		0	10		25		120		pF
Reverse transfer capacitance	C_{res}							34		pF
Gate charge	Q_g	$V_{CC} = 600$ V	0/15		15	25		110		nC

Thermal

Thermal resistance junction to sink ⁽⁶⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)						1,2		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		199,27 194,2 193,08		ns
Rise time	t_r					25 125 150		60,55 64,45 65		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		183,3 212,13 218,99		ns
Fall time	t_f					25 125 150		97,91 125,67 134,98		ns
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 0,271$ μC $Q_{tFWD} = 0,675$ μC $Q_{tFWD} = 0,802$ μC				25 125 150		0,955 1,36 1,46		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,03 1,44 1,53		mWs



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datasheet

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			15	25 125 150		2,91 2,7 2,63	3,84 ⁽⁵⁾		V
Reverse leakage current	I_R	$V_r = 1300$ V			25			0,94		μA
Thermal										
Thermal resistance junction to sink ⁽⁶⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)					1,33			K/W
Dynamic										
Peak recovery current	I_{RM}	$di/dt=183$ A/μs $di/dt=178$ A/μs $di/dt=189$ A/μs	±15	600	15	25		3,95		A
Reverse recovery time	t_{rr}					125		6,71		
						150		7,17		
						25		99,81		ns
Recovered charge	Q_r					125		157,04		
						150		174,87		
		25		0,271		μC				
Reverse recovered energy	E_{rec}	125		0,675						
		150		0,802						
		25		0,08		mWs				
Peak rate of fall of recovery current	$(di_r/dt)_{max}$	125		0,198						
		150		0,239						
		25		362,19		A/μs				
		125		193,06						
		150		144,38						



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	$V_{GE(th)}$			10	0,0015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		15	25 125 150		1,7 1,95 2,01	2,1 ⁽⁵⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			60	μA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}							2900		pF
Output capacitance	C_{oes}		0	10		25		120		pF
Reverse transfer capacitance	C_{res}							34		pF
Gate charge	Q_g	$V_{CC} = 600$ V	0/15		15	25		110		nC

Thermal

Thermal resistance junction to sink ⁽⁶⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)						1,2		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		96,72 89,85 88,25		ns
Rise time	t_r					25 125 150		57,6 61,9 62,67		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		285,74 321,39 329,34		ns
Fall time	t_f					25 125 150		110,4 141,54 142,62		ns
Turn-on energy (per pulse)	E_{on}	$Q_{tfwd}=1,21$ μC $Q_{tfwd}=2$ μC $Q_{tfwd}=2,23$ μC				25 125 150		1,8 2,29 2,43		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,22 1,69 1,82		mWs



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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			5	25 125 150		1,57 1,66 1,65	2,1 ⁽⁵⁾	V
Reverse leakage current	I_R	$V_r = 1200$ V			25			20	μA

Thermal

Thermal resistance junction to sink ⁽⁶⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)					2,31		K/W
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Rectifier Diode

Static

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

Thermal

Thermal resistance junction to sink ⁽⁶⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)					1,18		K/W
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Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	V_{CE} [V]	T_j [°C]	Min	Typ	Max	

Thermistor

Static

Rated resistance	R					25		1		k Ω
Deviation of R100	$A_{R/R}$	$R_{100} = 1670 \Omega$				100	-2		2	%
Maximum Current	I_{max}							3		mA
Power dissipation constant	d					25		0,76		mW/K
A-value	A							$7,635 \times 10^{-3}$		1/K
B-value	B							$1,73 \times 10^{-5}$		1/K ²
Vincotech Thermistor Reference									E	

⁽⁵⁾ Value at chip level

⁽⁶⁾ Only valid with pre-applied Vincotech thermal interface material.

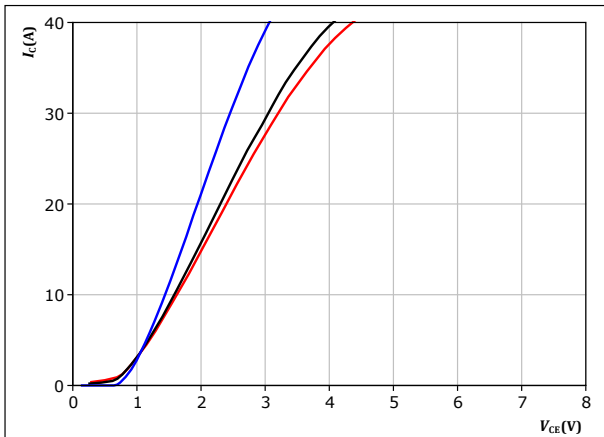


Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

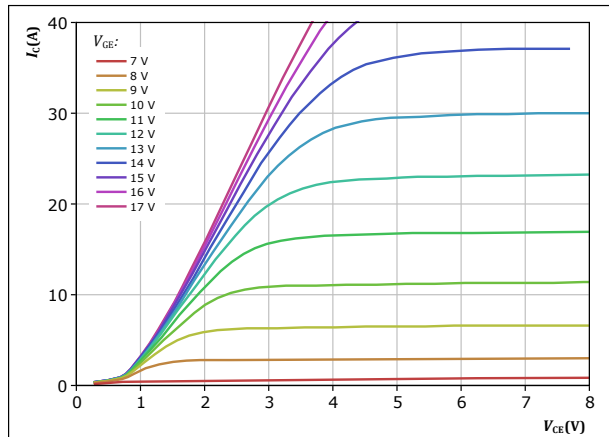


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j:$ 25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

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

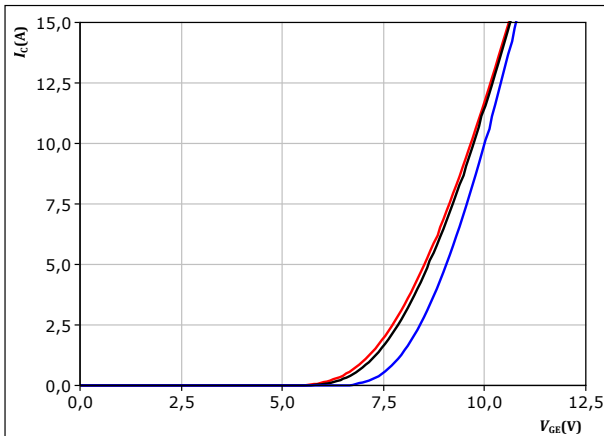


$t_p = 250 \mu s$
 $T_j = 150 \text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

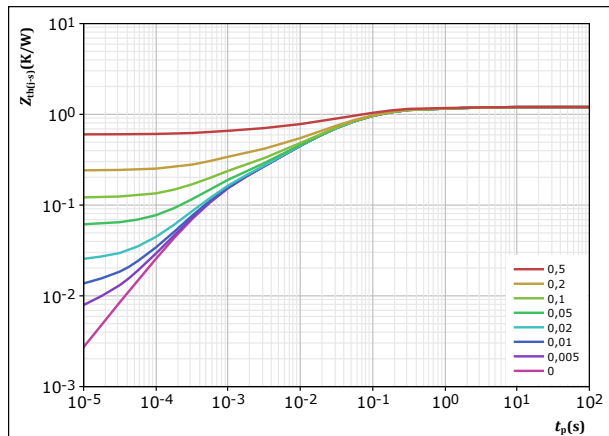


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j:$ 25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,203 \text{ K/W}$
IGBT thermal model values

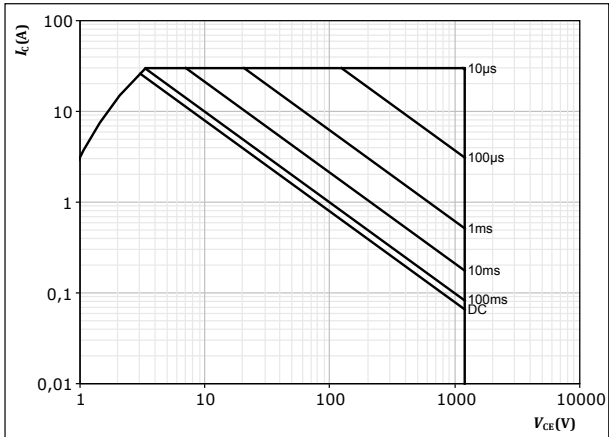
R (K/W)	τ (s)
$8,45E-02$	$1,63E+00$
$4,66E-01$	$9,37E-02$
$3,90E-01$	$2,02E-02$
$1,45E-01$	$3,96E-03$
$1,16E-01$	$5,44E-04$



Inverter Switch Characteristics

figure 5. IGBT

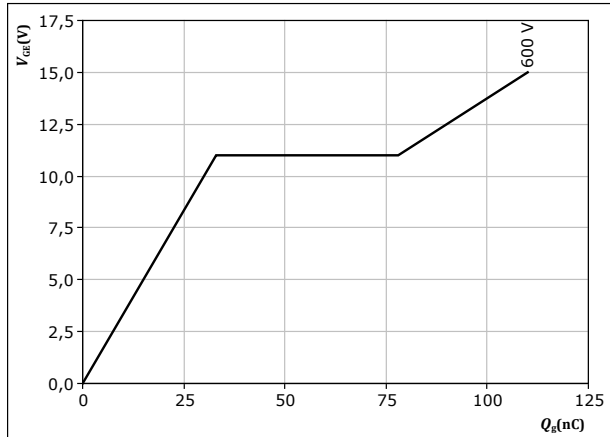
Safe operating area
 $I_C = f(V_{CE})$



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

figure 6. IGBT

Gate voltage vs gate charge
 $V_{GE} = f(Q_g)$



$I_C = 15$ A
 $T_j = 25$ °C



Inverter Diode Characteristics

figure 7. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

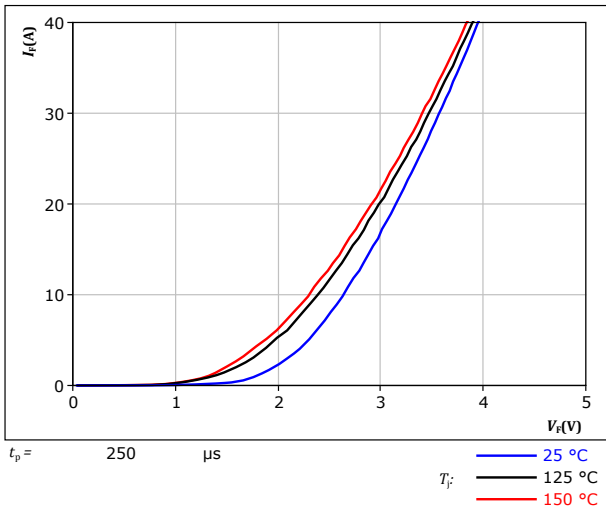
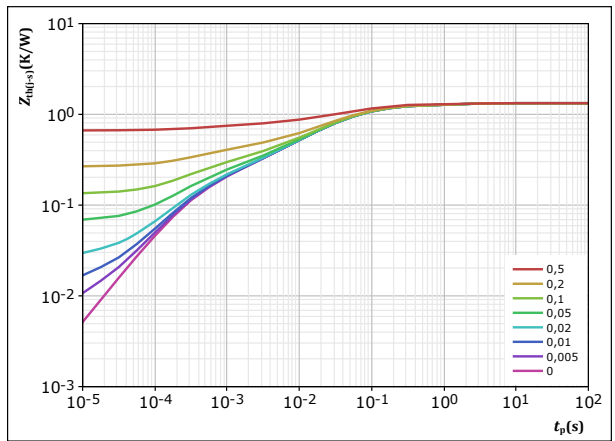


figure 8. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,328$ K/W
 FWD thermal model values

R (K/W)	τ (s)
1,08E-01	1,41E+00
4,78E-01	8,43E-02
4,56E-01	1,97E-02
1,49E-01	2,60E-03
1,38E-01	3,18E-04

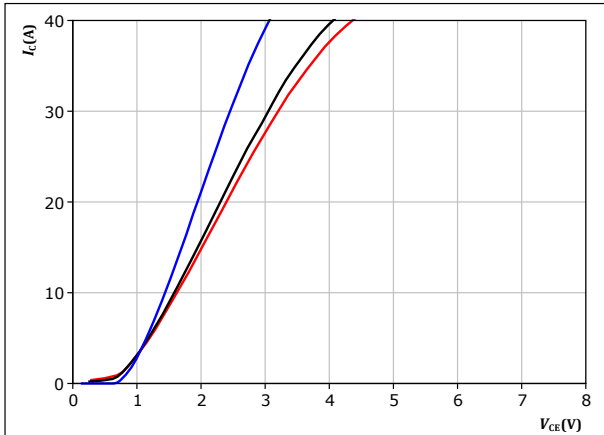


Brake Switch Characteristics

figure 9. IGBT

Typical output characteristics

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

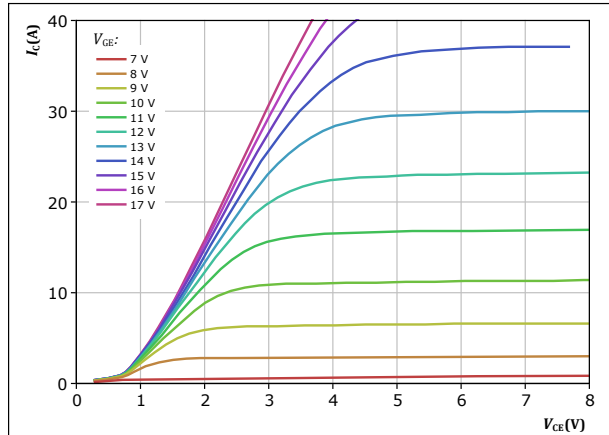


$t_p = 250 \mu\text{s}$
 $V_{GE} = 15 \text{ V}$
 $T_j: 25^\circ\text{C}$
 125°C
 150°C

figure 10. IGBT

Typical output characteristics

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

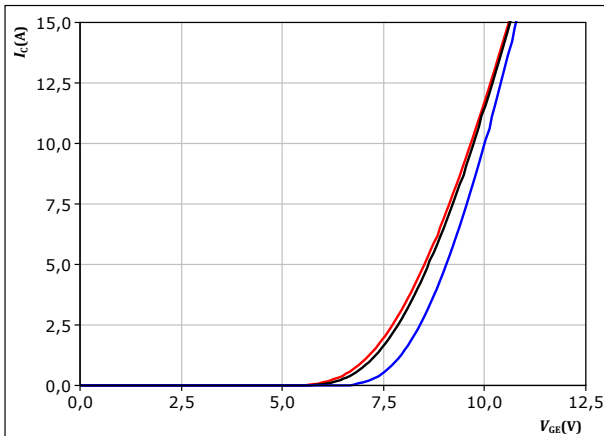


$t_p = 250 \mu\text{s}$
 $T_j = 150^\circ\text{C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 11. IGBT

Typical transfer characteristics

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

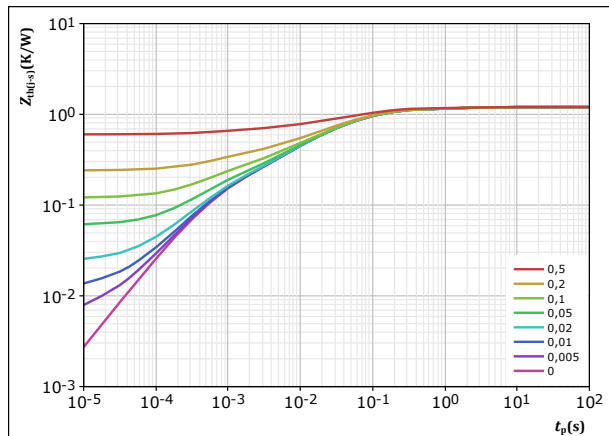


$t_p = 250 \mu\text{s}$
 $V_{CE} = 10 \text{ V}$
 $T_j: 25^\circ\text{C}$
 125°C
 150°C

figure 12. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,203 \text{ K/W}$
IGBT thermal model values

R (K/W)	τ (s)
8,45E-02	1,63E+00
4,66E-01	9,37E-02
3,90E-01	2,02E-02
1,45E-01	3,96E-03
1,16E-01	5,44E-04

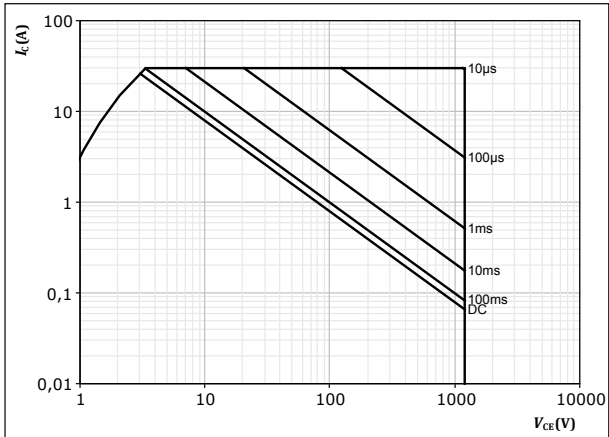


Brake Switch Characteristics

figure 13. IGBT

Safe operating area

$I_C = f(V_{CE})$

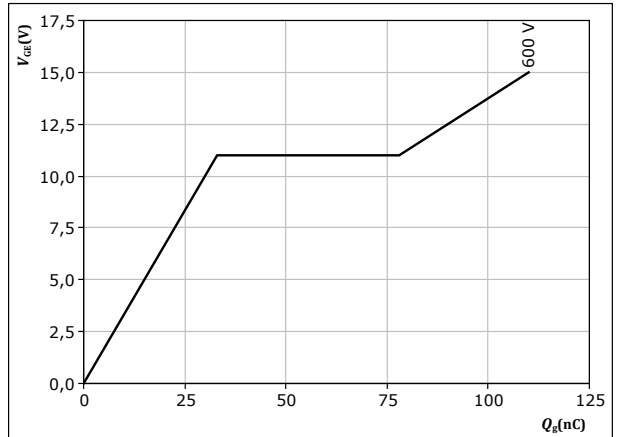


$D =$ single pulse
 $T_s = 80$ °C
 $V_{GE} = 15$ V
 $T_j = T_{jmax}$

figure 14. IGBT

Gate voltage vs gate charge

$V_{GE} = f(Q_g)$



$I_C = 15$ A
 $T_j = 25$ °C



Brake Diode Characteristics

figure 15. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

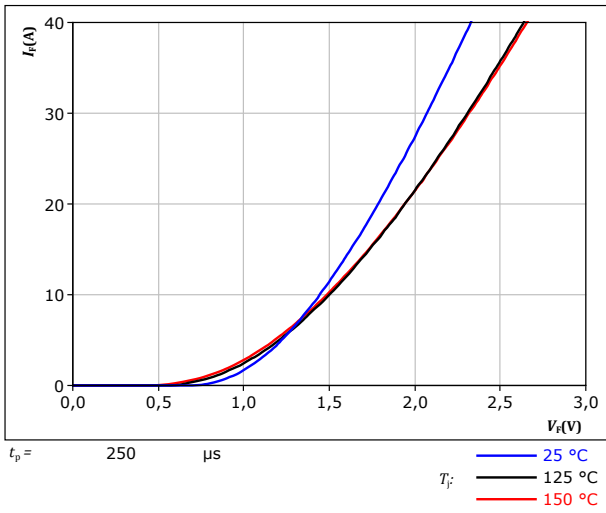
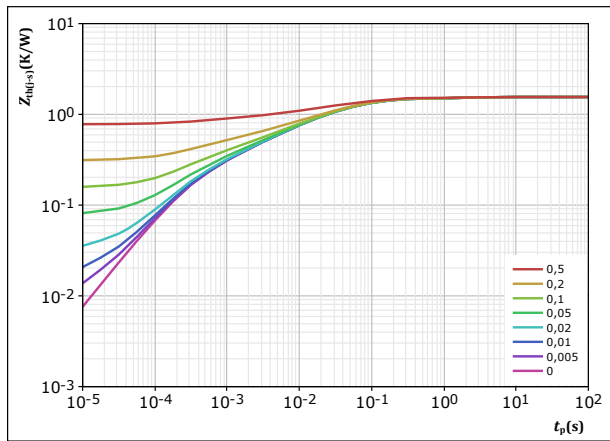


figure 16. FWD

Transient thermal impedance as a function of pulse width

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



$D =$	t_p / T	
$R_{th(j-s)} =$	1,553	K/W
FWD thermal model values		
R (K/W)	τ (s)	
8,50E-02	1,79E+00	
5,68E-01	6,89E-02	
4,67E-01	1,30E-02	
2,46E-01	2,26E-03	
1,87E-01	3,04E-04	



Brake Sw. Protection Diode Characteristics

figure 17. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

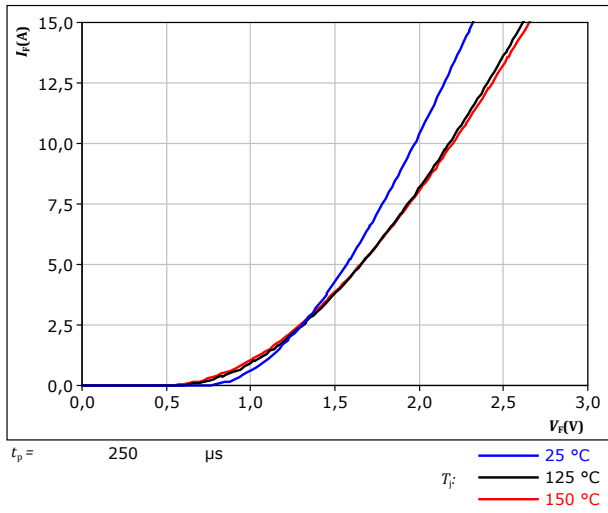
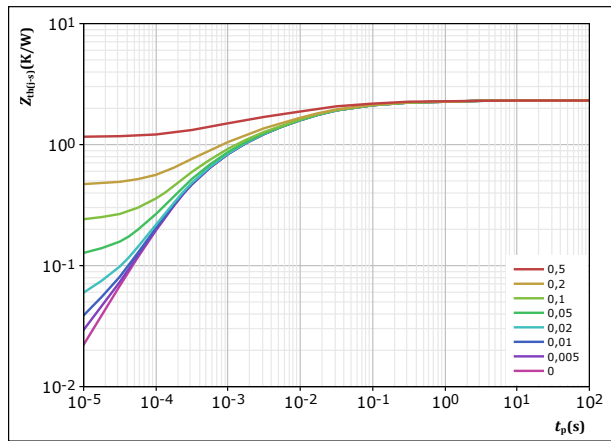


figure 18. FWD

Transient thermal impedance as a function of pulse width

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



$D =$	t_p / T	
$R_{th(j-s)} =$	2,313	K/W
FWD thermal model values		
R (K/W)	τ (s)	
1,03E-01	1,46E+00	
4,16E-01	7,07E-02	
7,17E-01	9,80E-03	
6,03E-01	1,47E-03	
4,75E-01	2,69E-04	



Rectifier Diode Characteristics

figure 19. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

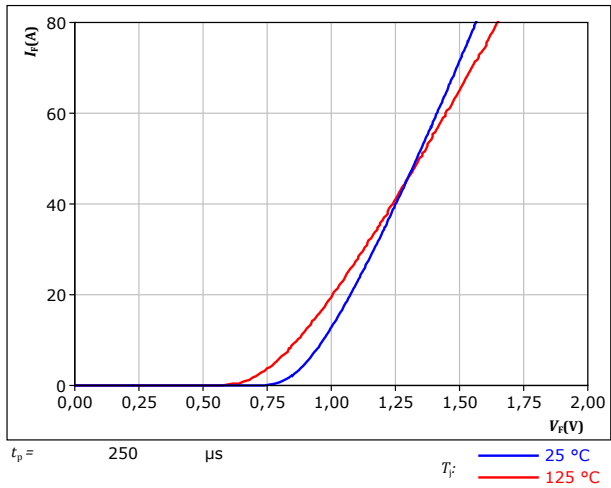
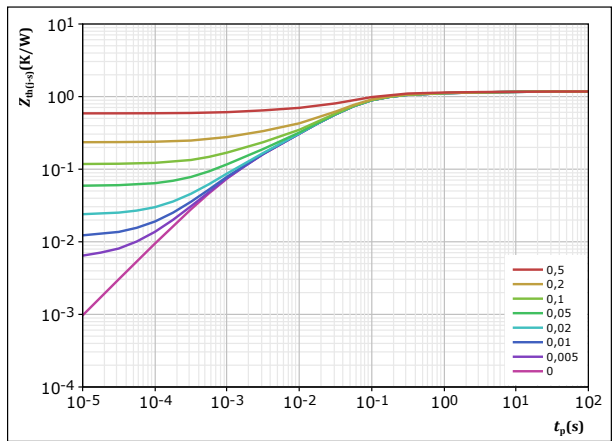


figure 20. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 1,175 \text{ K/W}$

Rectifier thermal model values

R (K/W)	τ (s)
4,37E-02	8,76E+00
8,20E-02	7,46E-01
2,18E-01	1,33E-01
6,30E-01	4,45E-02
1,17E-01	8,66E-03
7,88E-02	1,33E-03
5,43E-03	6,42E-04

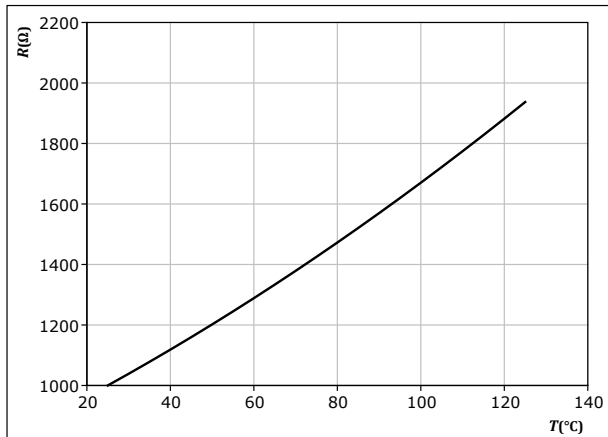


Thermistor Characteristics

figure 21. Thermistor

Typical PTC characteristic as function of temperature

$$R_T = f(T)$$

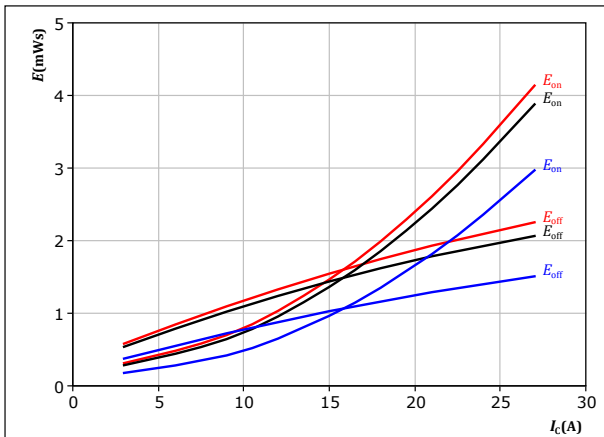




Inverter Switching Characteristics

figure 22. IGBT

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

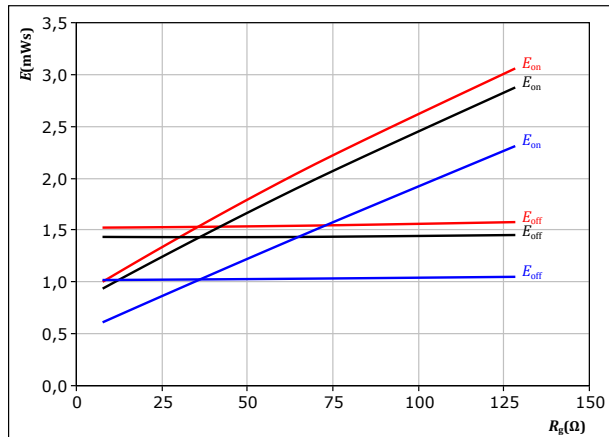


With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{g\text{on}} = 32 \text{ } \Omega$
 $R_{g\text{off}} = 32 \text{ } \Omega$

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 23. IGBT

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

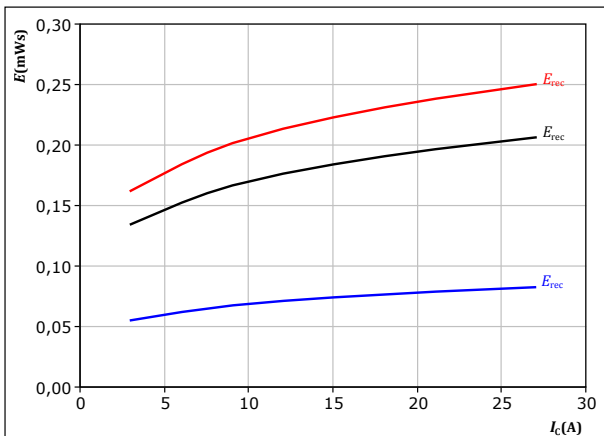


With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 15 \text{ A}$

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 24. FWD

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

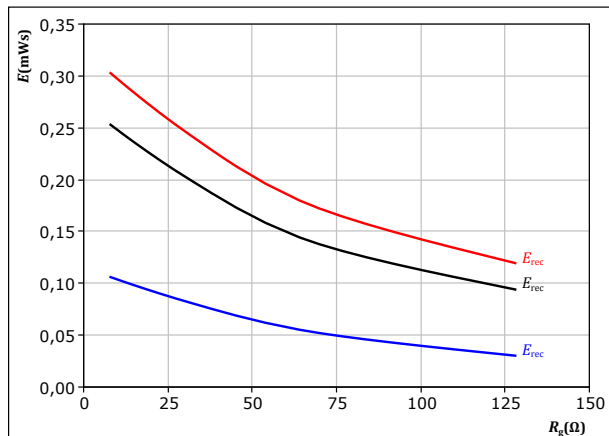


With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{g\text{on}} = 32 \text{ } \Omega$

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 25. 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
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 15 \text{ A}$

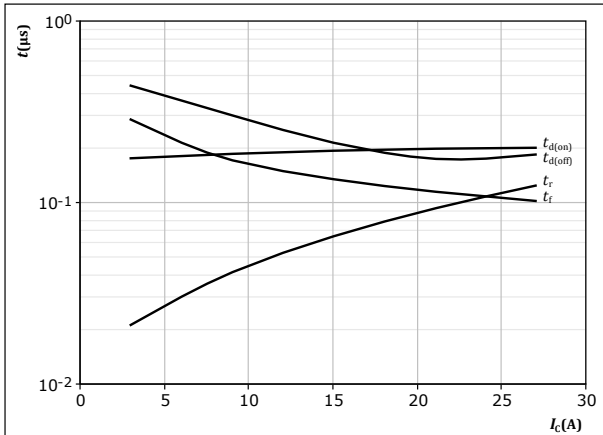
T_j :
— 25 °C
— 125 °C
— 150 °C



Inverter Switching Characteristics

figure 26. IGBT

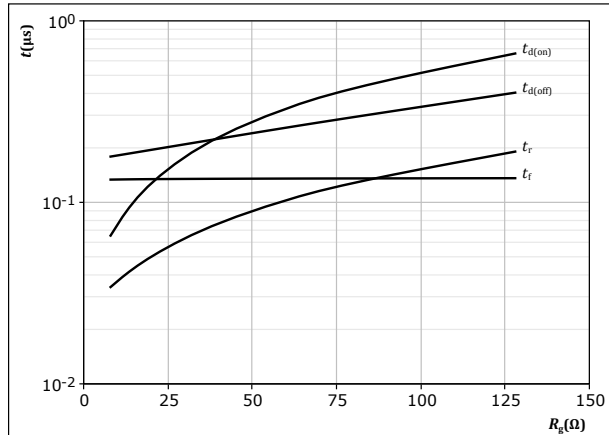
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 $R_{goff} = 32$ Ω

figure 27. IGBT

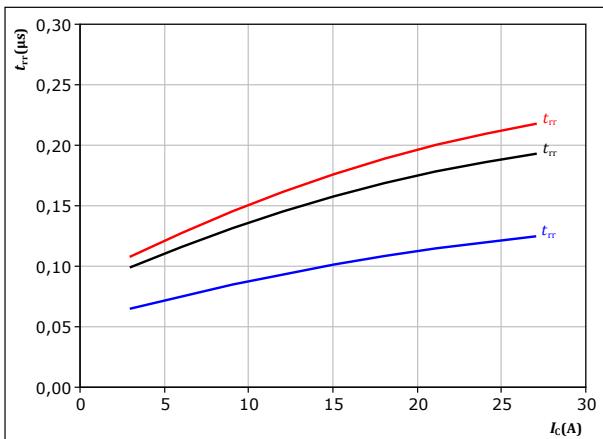
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



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

figure 28. FWD

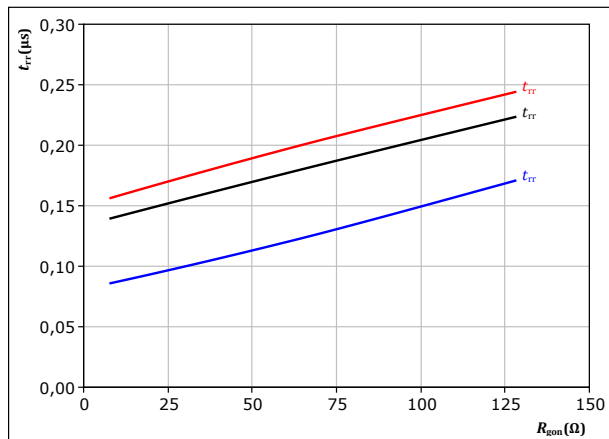
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 T_j : — 25 °C
— 125 °C
— 150 °C

figure 29. FWD

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



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 15$ A
 T_j : — 25 °C
— 125 °C
— 150 °C

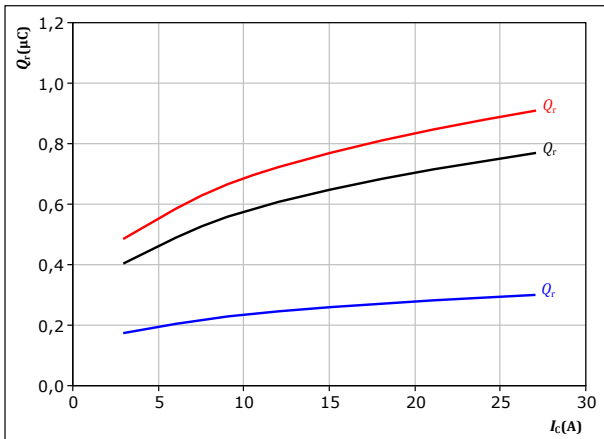


Inverter Switching Characteristics

figure 30. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

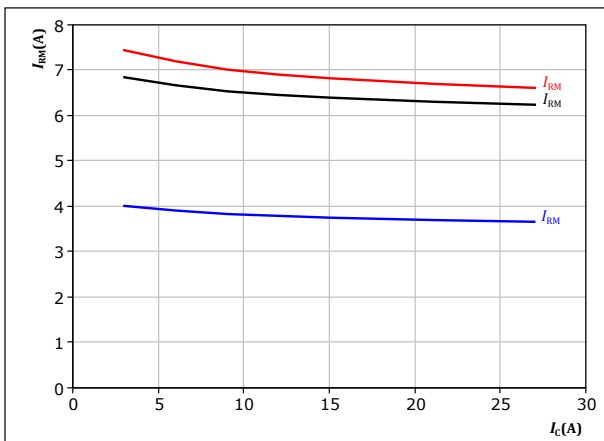
$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 32 \ \Omega$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 32. FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

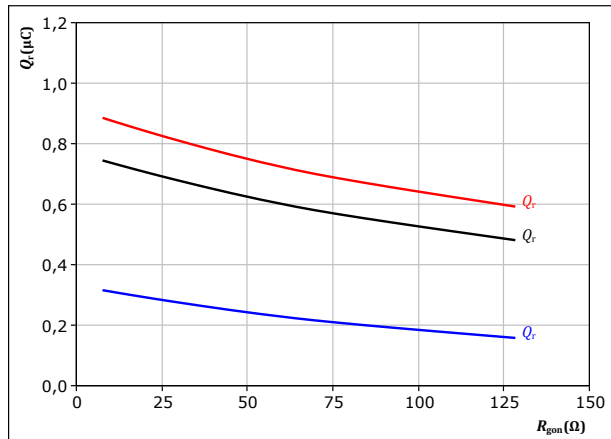
$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 32 \ \Omega$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 31. FWD

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

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



With an inductive load at

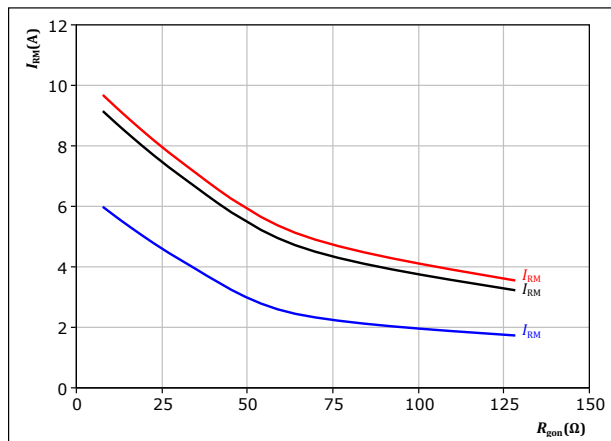
$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 15 \text{ A}$

T_j : — 25 °C
— 125 °C
— 150 °C

figure 33. 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

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

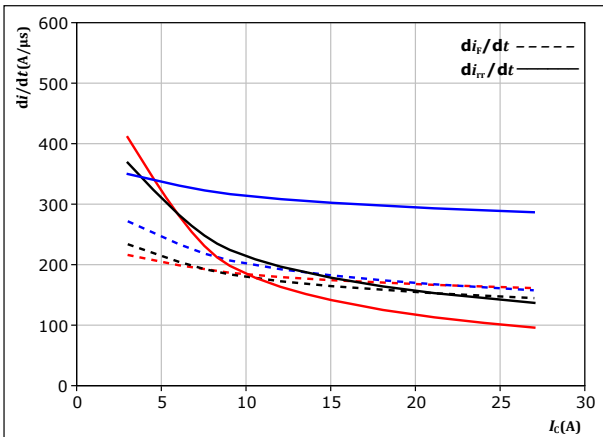
T_j : — 25 °C
— 125 °C
— 150 °C



Inverter Switching Characteristics

figure 34. FWD

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

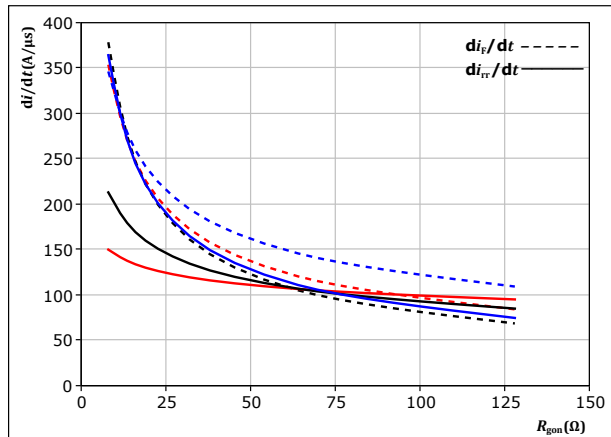


With an inductive load at

$V_{CE} = 600 \text{ V}$	$T_j = 25 \text{ }^\circ\text{C}$
$V_{GE} = \pm 15 \text{ V}$	$T_j = 125 \text{ }^\circ\text{C}$
$R_{gon} = 32 \text{ } \Omega$	$T_j = 150 \text{ }^\circ\text{C}$

figure 35. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor
 $di_f/dt, di_{rr}/dt = f(R_{gon})$



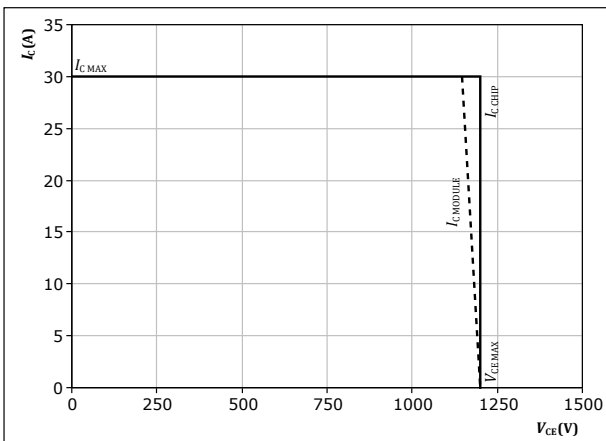
With an inductive load at

$V_{CE} = 600 \text{ V}$	$T_j = 25 \text{ }^\circ\text{C}$
$V_{GE} = \pm 15 \text{ V}$	$T_j = 125 \text{ }^\circ\text{C}$
$I_c = 15 \text{ A}$	$T_j = 150 \text{ }^\circ\text{C}$

figure 36. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



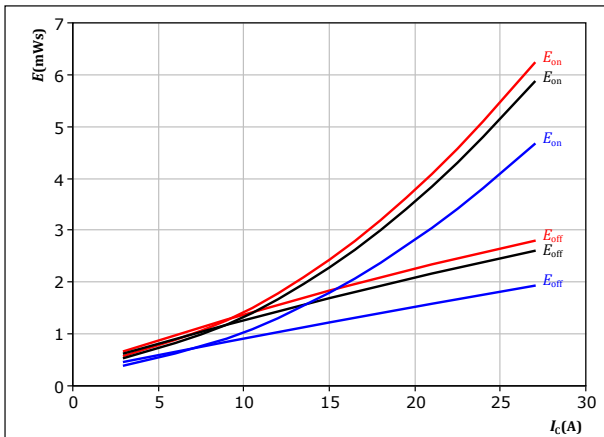
At $T_j = 150 \text{ }^\circ\text{C}$
 $R_{gon} = 32 \text{ } \Omega$
 $R_{goff} = 32 \text{ } \Omega$



Brake Switching Characteristics

figure 37. IGBT

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



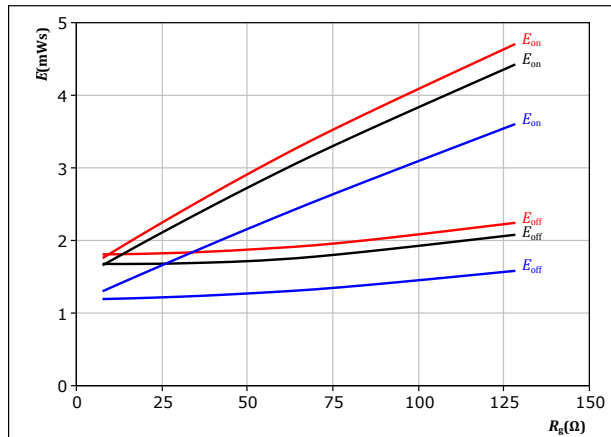
With an inductive load at

$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 32 \ \Omega$
 $R_{goff} = 32 \ \Omega$

T_j : — 25 °C
 — 125 °C
 — 150 °C

figure 38. IGBT

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



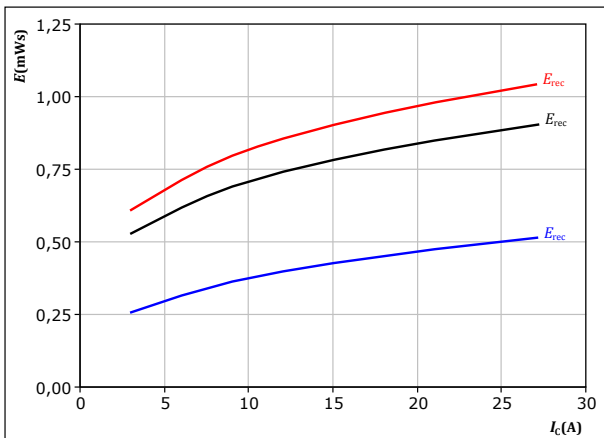
With an inductive load at

$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 15 \text{ A}$

T_j : — 25 °C
 — 125 °C
 — 150 °C

figure 39. FWD

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



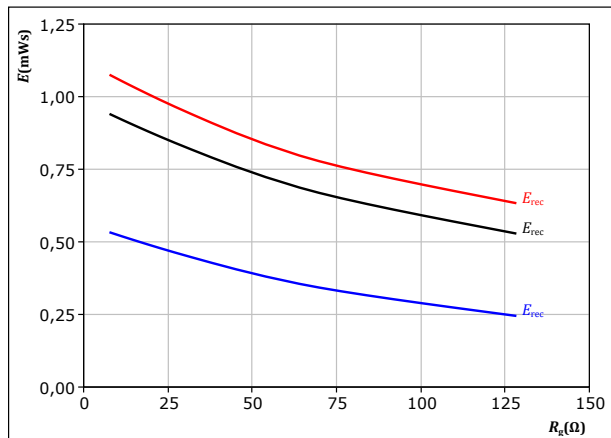
With an inductive load at

$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 32 \ \Omega$

T_j : — 25 °C
 — 125 °C
 — 150 °C

figure 40. 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

$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 15 \text{ A}$

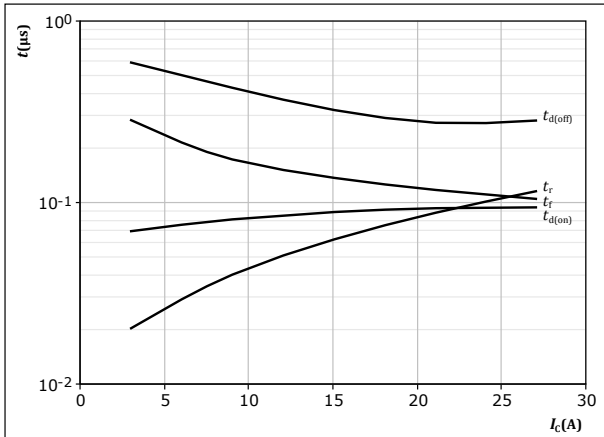
T_j : — 25 °C
 — 125 °C
 — 150 °C



Brake Switching Characteristics

figure 41. IGBT

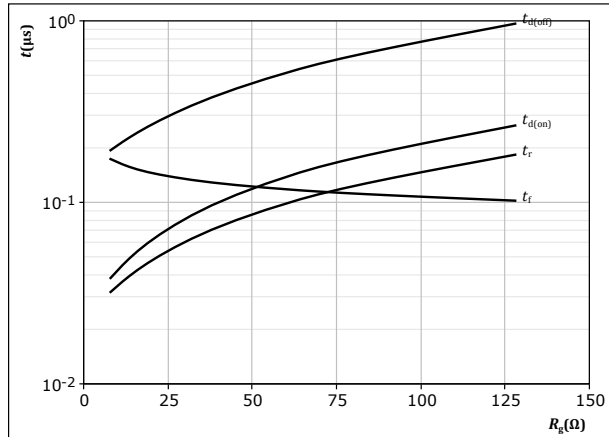
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 32 \text{ } \Omega$
 $R_{goff} = 32 \text{ } \Omega$

figure 42. IGBT

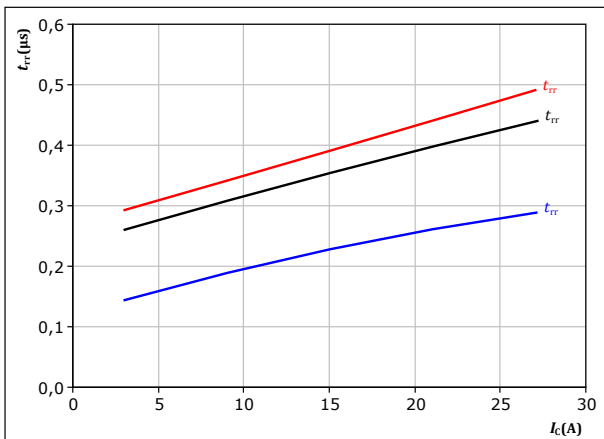
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 15 \text{ A}$

figure 43. FWD

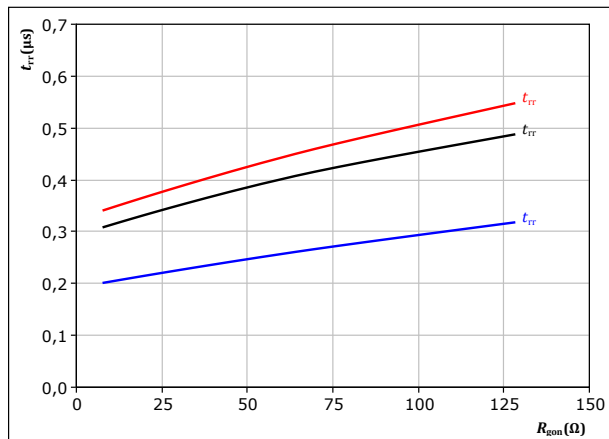
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{gon} = 32 \text{ } \Omega$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

figure 44. FWD

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



With an inductive load at
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 15 \text{ A}$
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

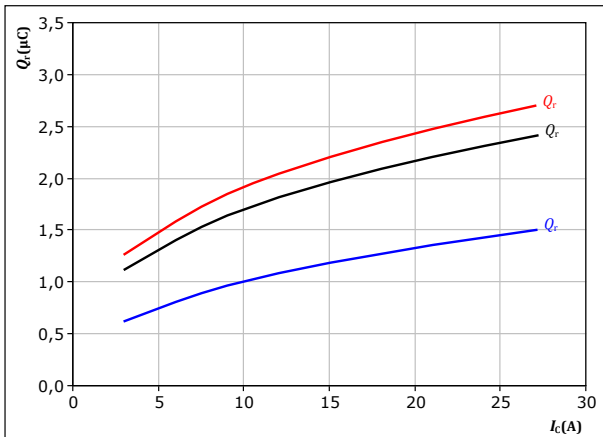


Brake Switching Characteristics

figure 45. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



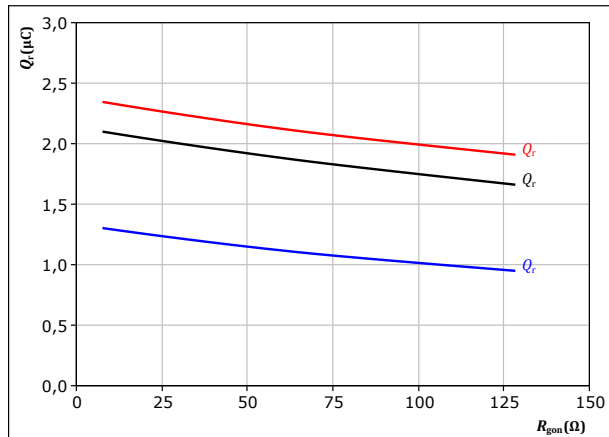
With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 46. FWD

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

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



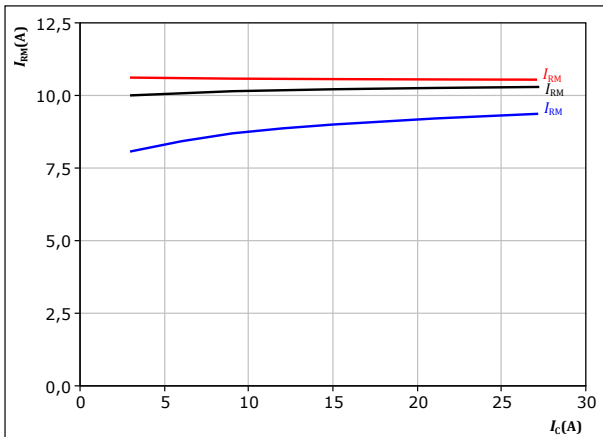
With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 15$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 47. FWD

Typical peak reverse recovery current as a function of collector current

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



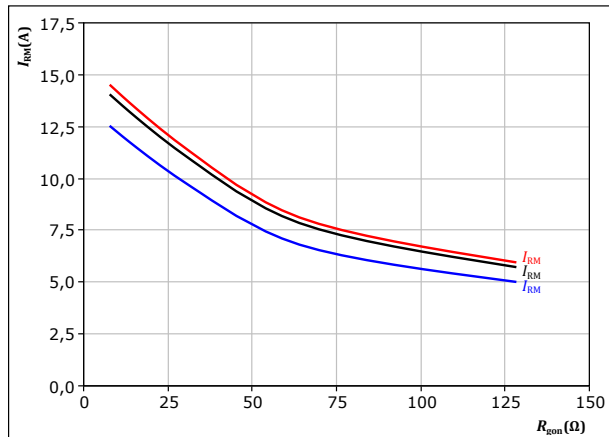
With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 32$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 48. 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

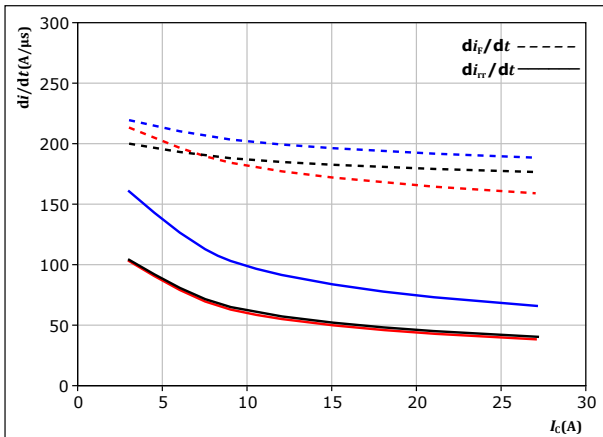
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 15$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)



Brake Switching Characteristics

figure 49. FWD

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

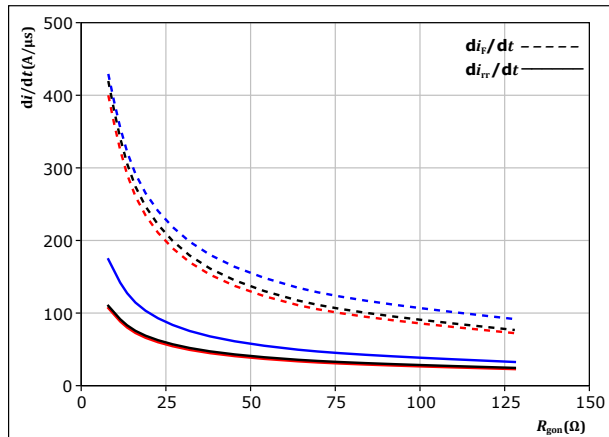


With an inductive load at

$V_{CE} = 700$ V	$T_j = 25$ °C
$V_{GE} = 0/15$ V	$T_j = 125$ °C
$R_{gon} = 32$ Ω	$T_j = 150$ °C

figure 50. FWD

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

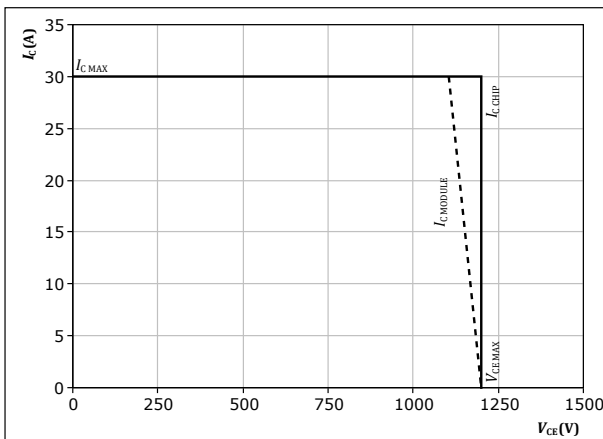


With an inductive load at

$V_{CE} = 700$ V	$T_j = 25$ °C
$V_{GE} = 0/15$ V	$T_j = 125$ °C
$I_c = 15$ A	$T_j = 150$ °C

figure 51. IGBT

Reverse bias safe operating area
 $I_c = f(V_{CE})$



At $T_j = 150$ °C
 $R_{gon} = 32$ Ω
 $R_{goff} = 32$ Ω



Switching Definitions

figure 52. IGBT

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

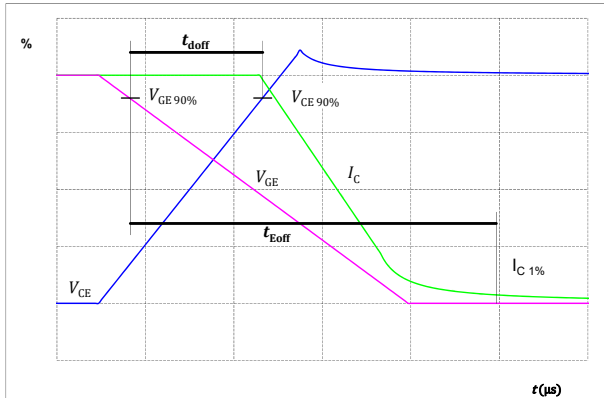


figure 53. IGBT

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

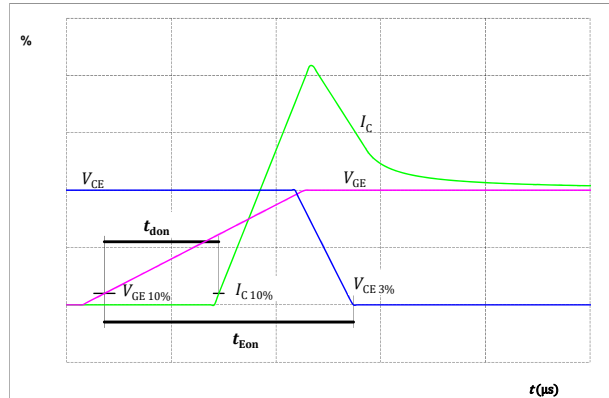


figure 54. IGBT

Turn-off Switching Waveforms & definition of t_f

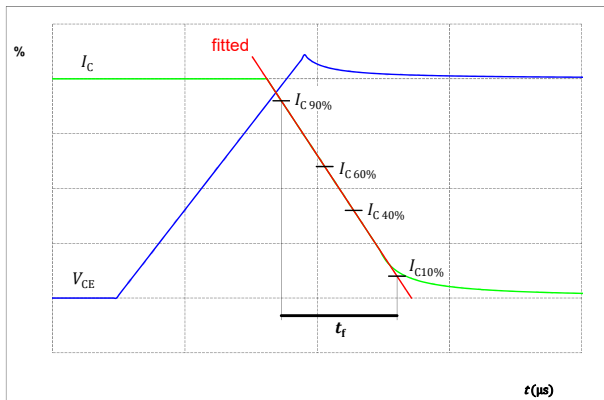
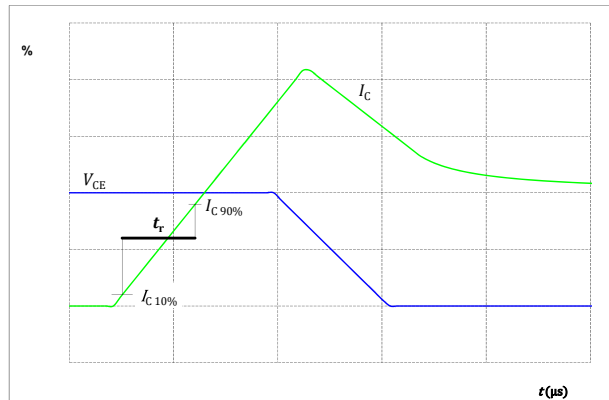


figure 55. IGBT

Turn-on Switching Waveforms & definition of t_r





Switching Definitions

figure 56. FWD

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

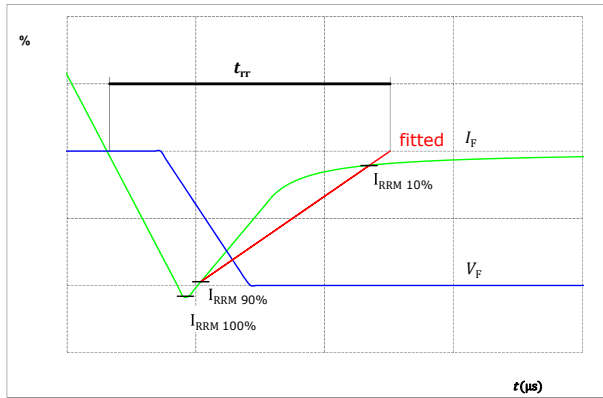
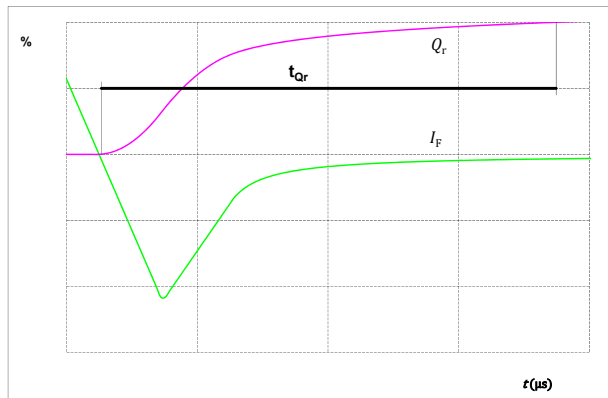



figure 57. FWD

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

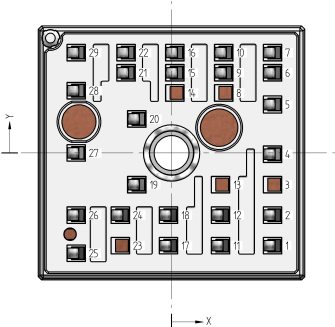




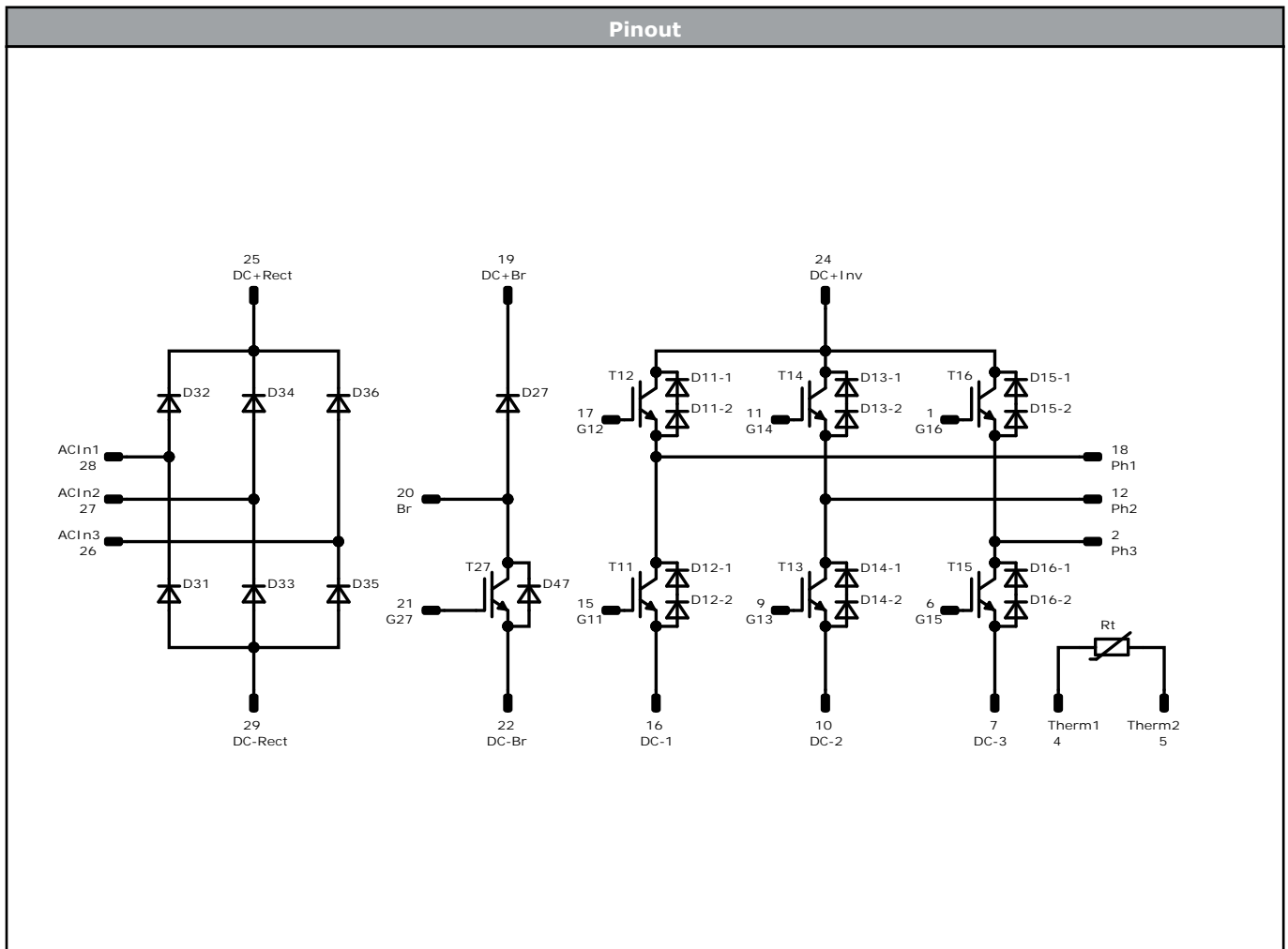
Ordering Code	
Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M112PMA015M701-K200A71-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M112PMA015M701-K200A71-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M112PMA015M701-K200A71-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M112PMA015M701-K200A71-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M112PMA015M701-K200A71-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M112PMA015M701-K200A71-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M112PMA015M701-K200A71-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M112PMA015M701-K200A71-/5B/

Marking						
Text	Name		Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNNNNN- TTTTTTTV		WWYY	UL VIN	LLLLL
Datamatrix		Type&Ver	Lot number	Serial	Date code	
	TTTTTTTV	LLLLL	SSSS	WWYY		

Outline			
Pin table [mm]			
Pin	X	Y	Function
1	15,93	-14,6	G16
2	15,93	-9,8	Ph3
3	not assembled		
4	15,93	-0,2	Therm1
5	15,93	7,62	Therm2
6	15,93	12,62	G15
7	15,93	15,8	DC-3
8	not assembled		
9	8,23	12,62	G13
10	8,23	15,8	DC-2
11	7,73	-14,6	G14
12	7,73	-9,8	Ph2
13	not assembled		
14	not assembled		
15	0,53	12,62	G11
16	0,53	15,8	DC-1
17	-0,47	-14,6	G12
18	-0,47	-9,8	Ph1
19	-5,47	-5	DC+Br
20	-5,47	5,35	Br
21	-7,17	12,62	G27
22	-7,17	15,8	DC-Br
23	not assembled		
24	-8,07	-9,8	DC+Inv
25	-15,02	-15,8	DC+Rect
26	-15,02	-9,8	ACIn3
27	-15,02	0	ACIn2
28	-15,02	9,8	ACIn1
29	-15,02	15,8	DC-Rect



Pad positions refers to center point. For more informations on pad design please see package data



Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	15 A	Inverter Switch	
D11-1, D11-2, D12-1, D12-2, D13-1, D13-2, D14-1, D14-2, D15-1, D15-2, D16-1, D16-2	FWD	1300 V	15 A	Inverter Diode	
T27	IGBT	1200 V	15 A	Brake Switch	
D27	FWD	1200 V	15 A	Brake Diode	
D47	FWD	1200 V	5 A	Brake Sw. Protection Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	28 A	Rectifier Diode	
Rt	Thermistor			Thermistor	




Packaging instruction				
Standard packaging quantity (SPQ) 120	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for MiniSKiiP® 1 packages see vincotech.com website.

Package data
Package data for MiniSKiiP® 1 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
80-M112PMA015M701-K200A71-D1-14	9 Jun. 2023		

DISCLAIMER

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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.