



MiniSKiiP® PIM 3

1200 V / 150 A

Topology features

- Converter+Brake+Inverter
- Kelvin Emitter for improved switching performance
- 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

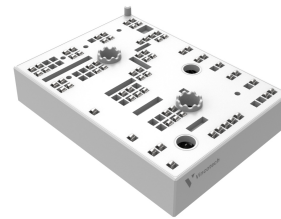
Target applications

- Industrial Drives

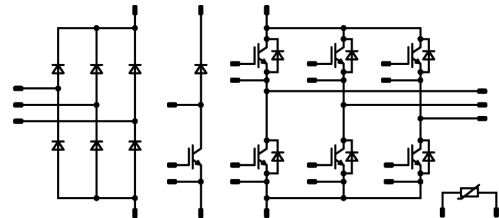
Types

- 80-M312PMA150M7-K420A80

MiniSKiiP® 3 16 mm housing



Schematic





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80-M312PMA150M7-K420A80
datasheet

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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	161	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	317	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	$^{\circ}\text{C}$

Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	113	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	194	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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	161	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	317	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	$^{\circ}\text{C}$



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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	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	81	A
Repetitive peak forward current	I_{FRM}	i_p limited by T_{jmax}	200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	149	W
Maximum junction temperature	T_{jmax}		175	°C

Rectifier Diode

Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	107	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	890	A
Surge current capability	I^2t		3960	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	119	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* $t_p = 2\text{ s}$	5500	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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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	$V_{GE(th)}$			10	0,015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		150	25 125 150		1,58 1,8 1,86	1,85 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			100	μA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							3		Ω
Input capacitance	C_{ies}							30000		pF
Output capacitance	C_{oes}		0	10		25		880		pF
Reverse transfer capacitance	C_{res}							320		pF
Gate charge	Q_g	$V_{CC} = 600$ V	0/15		150	25		1000		nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)						0,3		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		415,6 431,4 433		ns
Rise time	t_r					25 125 150		95,4 109,8 113,8		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		300,2 339,6 345,8		ns
Fall time	t_f					25 125 150		78,49 89,66 96,1		ns
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 14,68$ μC $Q_{tFWD} = 22,62$ μC $Q_{tFWD} = 25,6$ μC				25 125 150		21,13 27,11 28,88		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		9,81 13,01 14,02		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			150	25 125 150		1,79 1,9 1,9	2,1 ⁽¹⁾		V
Reverse leakage current	I_R	$V_r = 1200$ V			25			40		μA
Thermal										
Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)					0,49			K/W
Dynamic										
Peak recovery current	I_{RM}				25 125 150		63,36 71,74 74,12			A
Reverse recovery time	t_{rr}				25 125 150		408,81 552,96 623,41			ns
Recovered charge	Q_r	$di/dt=1573$ A/μs $di/dt=980$ A/μs $di/dt=1114$ A/μs	±15	600	150	25 125 150	14,68 22,62 25,6			μC
Reverse recovered energy	E_{rec}				25 125 150		4,97 8,08 9,18			mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$				25 125 150		335,06 235,2 218,31			A/μs



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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 Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$		10	0,015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	15		150	25 125 150		1,58 1,8 1,86	1,85 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}	0	1200		25			100	μA
Gate-emitter leakage current	I_{GES}	20	0		25			500	nA
Internal gate resistance	r_g						3		Ω
Input capacitance	C_{ies}						30000		pF
Output capacitance	C_{oes}	0	10		25		880		pF
Reverse transfer capacitance	C_{res}						320		pF
Gate charge	Q_g	$V_{CC} = 600$ V	0/15		150	25		1000	nC

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)					0,3		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		142 144 145	ns
Rise time	t_r	$R_{gon} = 1$ Ω $R_{goff} = 1$ Ω	0/15	700	147	25 125 150		68 81 81	ns
Turn-off delay time	$t_{d(off)}$					25 125 150		426 472 490	ns
Fall time	t_f					25 125 150		68,92 91,64 97,54	ns
Turn-on energy (per pulse)	E_{on}					$Q_{tFWD} = 12,09$ μC $Q_{tFWD} = 18,33$ μC $Q_{tFWD} = 20,6$ μC			25 125 150
Turn-off energy (per pulse)	E_{off}					25 125 150		10,6 14,07 14,91	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		
Brake Diode										
Static										
Forward voltage	V_F			100	25 125 150		1,82 1,96 1,97	2,1 ⁽¹⁾		V
Reverse leakage current	I_R	$V_r = 1200$ V			25			40		μA
Thermal										
Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)					0,64			K/W
Dynamic										
Peak recovery current	I_{RM}				25 125 150		55,27 64 67,14			A
Reverse recovery time	t_{rr}				25 125 150		359,46 463,66 516,02			ns
Recovered charge	Q_r	$di/dt=949$ A/μs $di/dt=863$ A/μs $di/dt=1320$ A/μs	0/15	700	147	25 125 150	12,09 18,33 20,6			μC
Reverse recovered energy	E_{rec}				25 125 150		4,45 7,22 8,27			mWs
Peak rate of fall of recovery current	$(di_r/dt)_{max}$				25 125 150		350,37 227,05 211,77			A/μs



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Characteristic Values

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

Rectifier Diode

Static

Parameter	Symbol	Conditions	V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit
Forward voltage	V_F				60	25 125 150		1,04 0,973 0,956	1,5 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 1600$ V				25 150			100 2000	µA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)						0,59		K/W
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Thermistor

Static

Rated resistance	R					25		1		kΩ
Deviation of R100	$\Delta_{R/R}$	$R_{100} = 1670$ Ω				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	

⁽¹⁾ Value at chip level

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

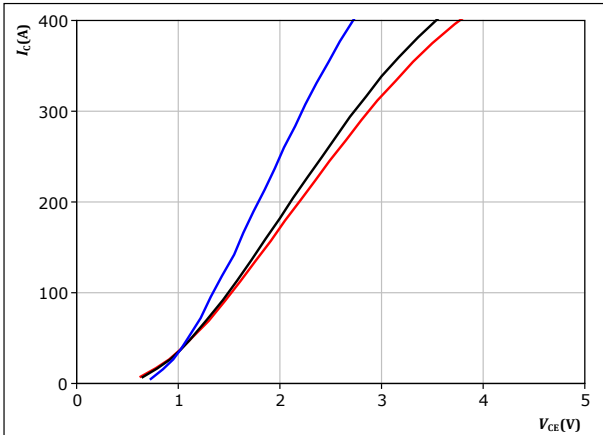


Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

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



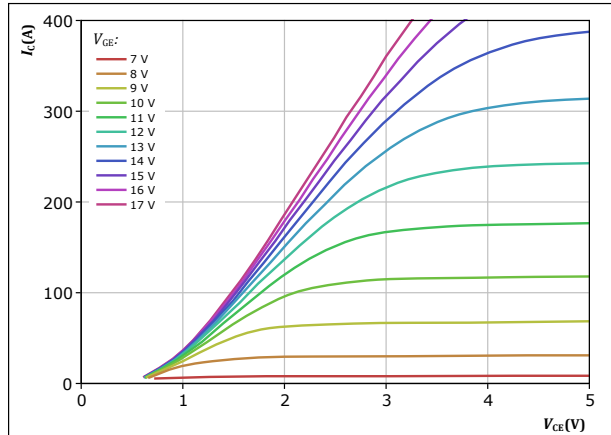
$t_p = 250 \mu s$
 $V_{GE} = 15 V$

$T_j:$ — 25 °C
— 125 °C
— 150 °C

figure 2. IGBT

Typical output characteristics

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

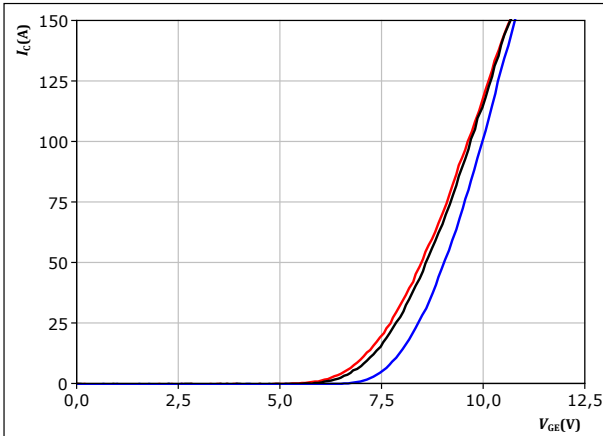


$t_p = 250 \mu s$
 $T_j = 150 \text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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



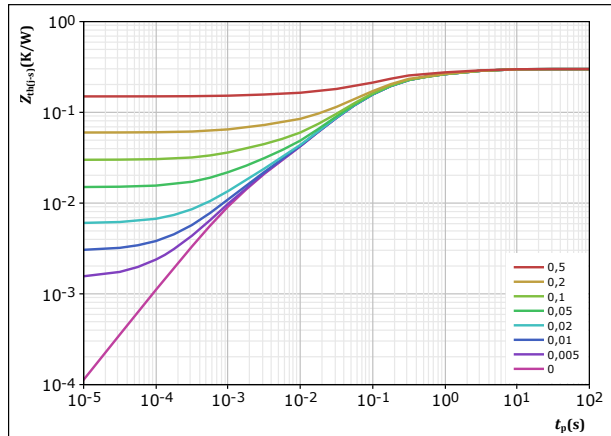
$t_p = 250 \mu s$
 $V_{CE} = 10 V$

$T_j:$ — 25 °C
— 125 °C
— 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,3 \text{ K/W}$

IGBT thermal model values

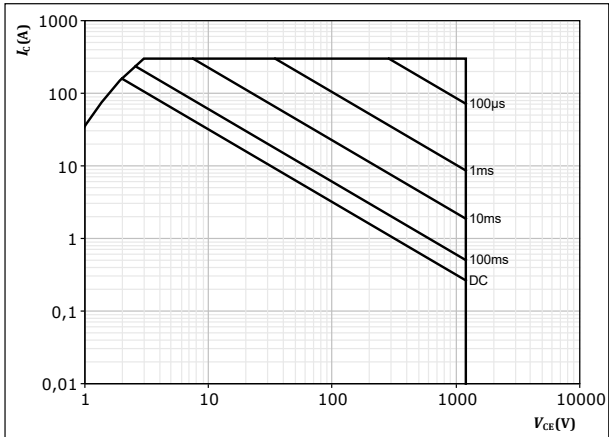
R (K/W)	τ (s)
3,56E-02	2,96E+00
5,64E-02	6,04E-01
1,58E-01	1,03E-01
3,81E-02	2,02E-02
1,18E-02	1,52E-03



Inverter Switch Characteristics

figure 5. IGBT

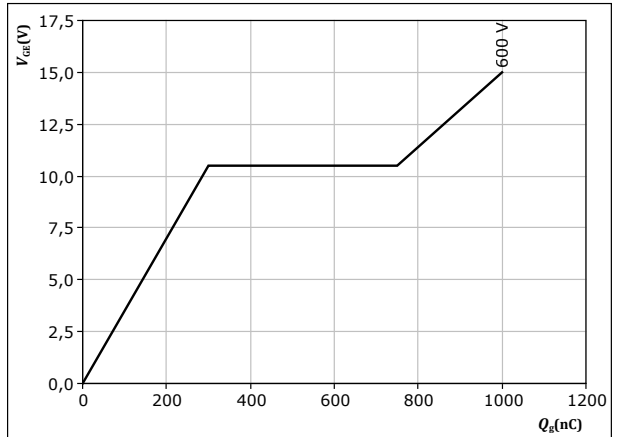
Safe operating area
 $I_C = f(V_{CE})$



$D =$ single pulse
 $T_s = 80 \text{ } ^\circ\text{C}$
 $V_{GE} = 15 \text{ V}$
 $T_j = T_{jmax}$

figure 6. IGBT

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



$I_C = 150 \text{ A}$
 $T_j = 25 \text{ } ^\circ\text{C}$



Inverter Diode Characteristics

figure 7. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

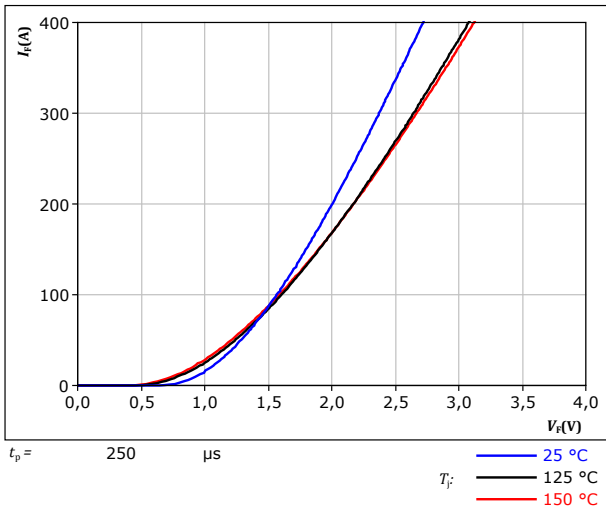
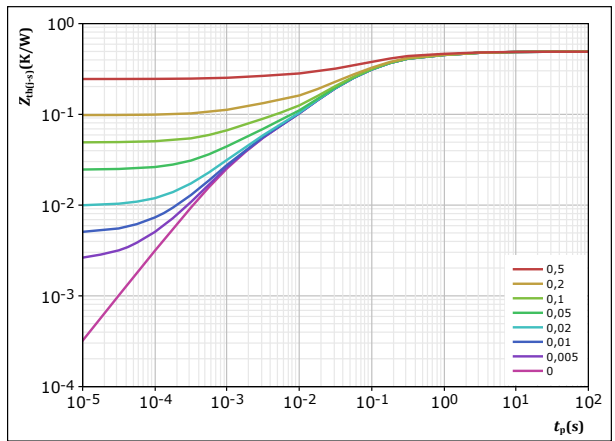


figure 8. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,49$ K/W
 FWD thermal model values

R (K/W)	τ (s)
1,45E-02	6,66E+00
6,43E-02	1,13E+00
2,35E-01	1,21E-01
1,40E-01	2,42E-02
3,61E-02	1,48E-03

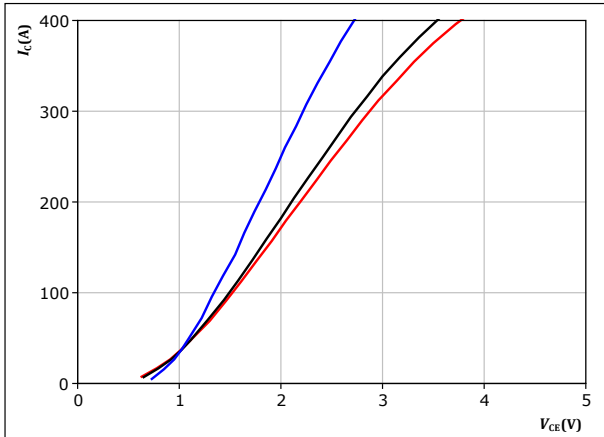


Brake Switch Characteristics

figure 9. IGBT

Typical output characteristics

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



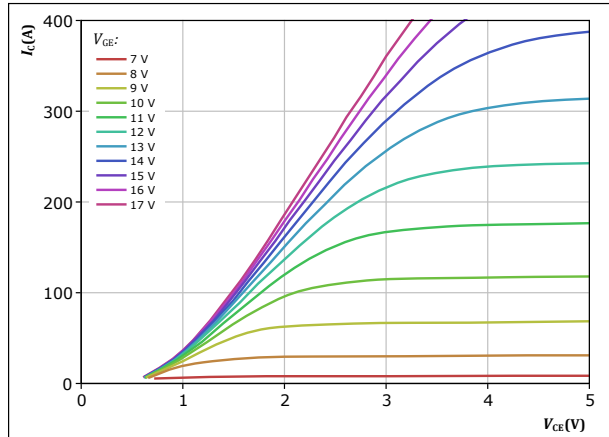
$t_p = 250 \mu s$
 $V_{GE} = 15 V$

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 10. IGBT

Typical output characteristics

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

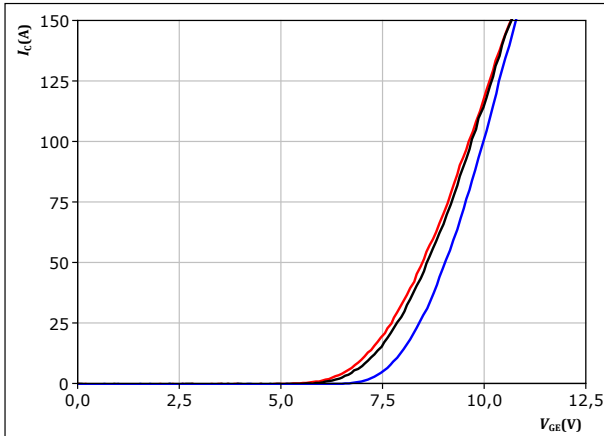


$t_p = 250 \mu s$
 $T_j = 150 \text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 11. IGBT

Typical transfer characteristics

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



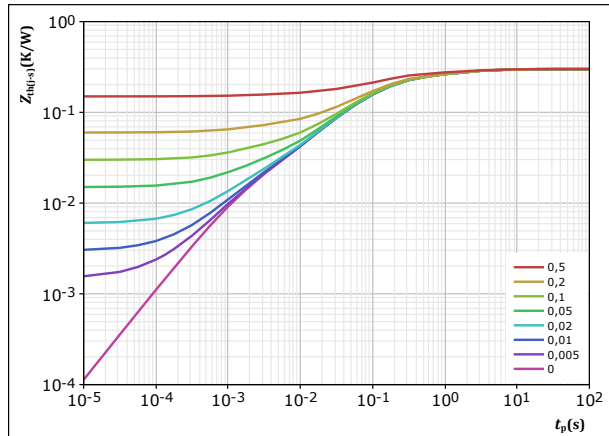
$t_p = 250 \mu s$
 $V_{CE} = 10 V$

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 12. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,3 \text{ K/W}$

IGBT thermal model values

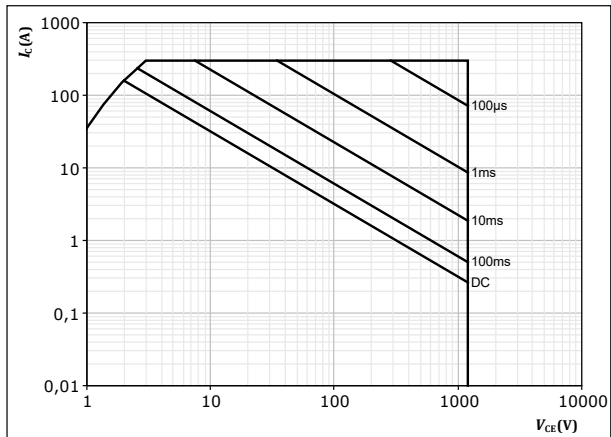
R (K/W)	τ (s)
3,56E-02	2,96E+00
5,64E-02	6,04E-01
1,58E-01	1,03E-01
3,81E-02	2,02E-02
1,18E-02	1,52E-03



Brake Switch Characteristics

figure 13. IGBT

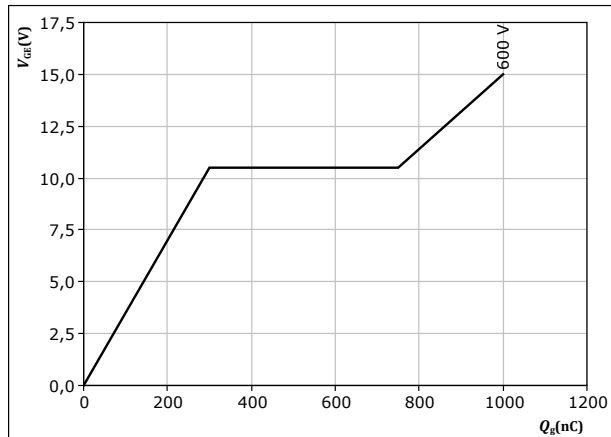
Safe operating area
 $I_C = f(V_{CE})$



$D =$ single pulse
 $T_s = 80 \text{ } ^\circ\text{C}$
 $V_{GE} = 15 \text{ V}$
 $T_j = T_{jmax}$

figure 14. IGBT

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



$I_C = 150 \text{ A}$
 $T_j = 25 \text{ } ^\circ\text{C}$



Brake Diode Characteristics

figure 15. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

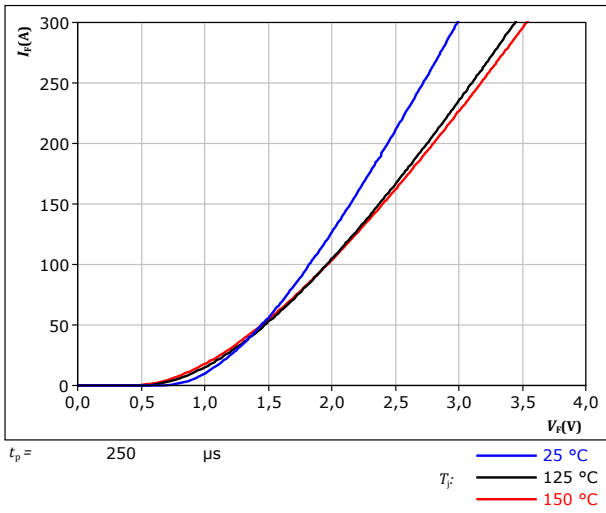
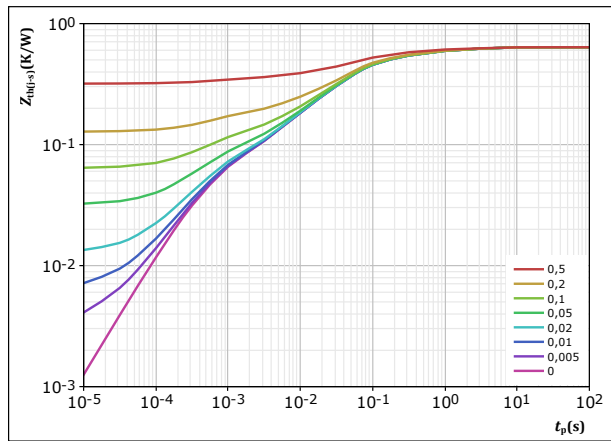


figure 16. FWD

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$
 $R_{th(j-s)} = 0,638 \text{ K/W}$
 FWD thermal model values

R (K/W)	τ (s)
5,39E-02	2,66E+00
1,18E-01	3,25E-01
3,25E-01	4,92E-02
8,49E-02	7,32E-03
5,61E-02	5,21E-04



Rectifier Diode Characteristics

figure 17. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

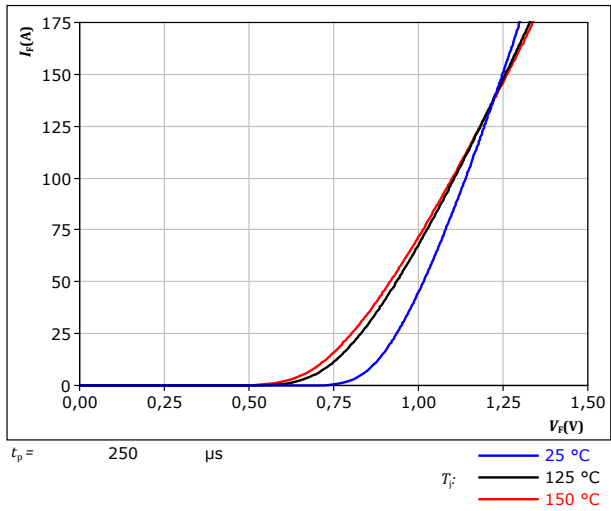
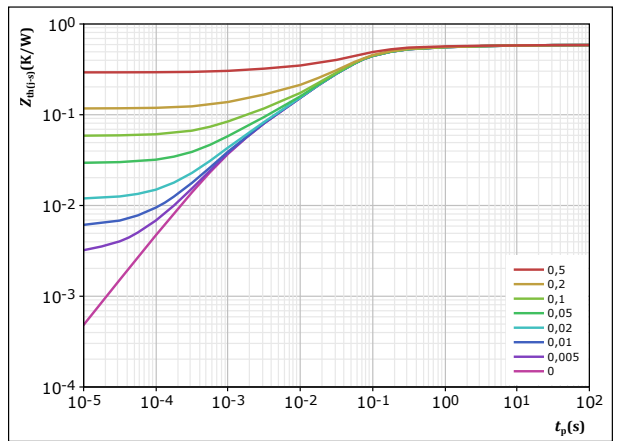


figure 18. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$
 $R_{th(j-s)} = 0,586 \text{ K/W}$

Rectifier thermal model values

R (K/W)	τ (s)
$2,18E-02$	$8,76E+00$
$4,09E-02$	$7,46E-01$
$1,08E-01$	$1,33E-01$
$3,14E-01$	$4,45E-02$
$5,85E-02$	$8,66E-03$
$3,93E-02$	$1,33E-03$
$2,71E-03$	$6,42E-04$

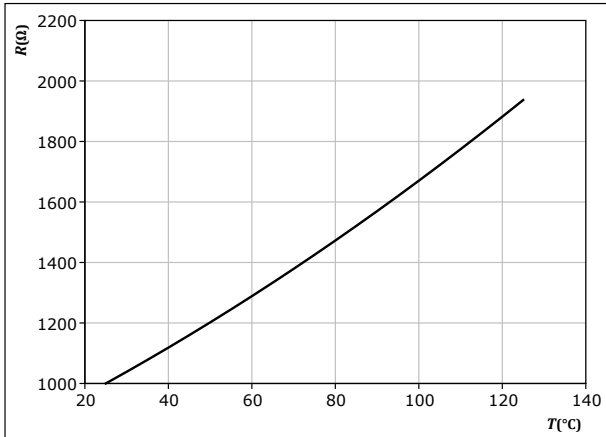


Thermistor Characteristics

figure 19. Thermistor

Typical PTC characteristic as function of temperature

$$R_T = f(T)$$

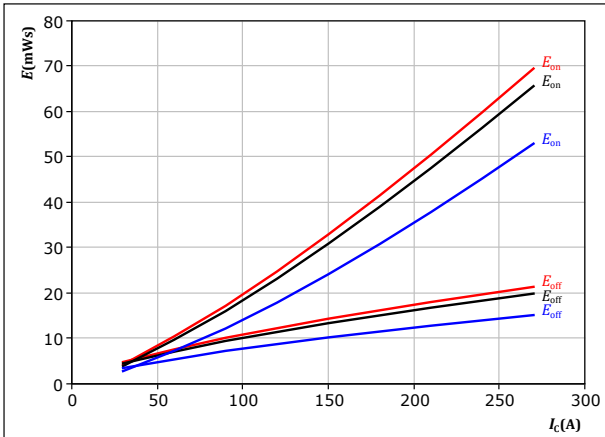




Inverter Switching Characteristics

figure 20. IGBT

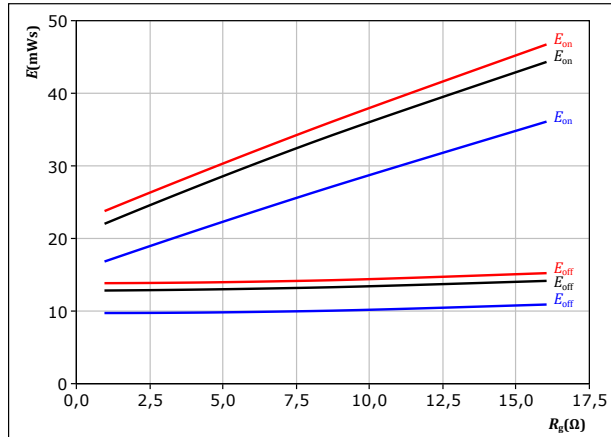
Typical switching energy losses as a function of collector current
 $E = f(I_c)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 $R_{goff} = 4$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 21. IGBT

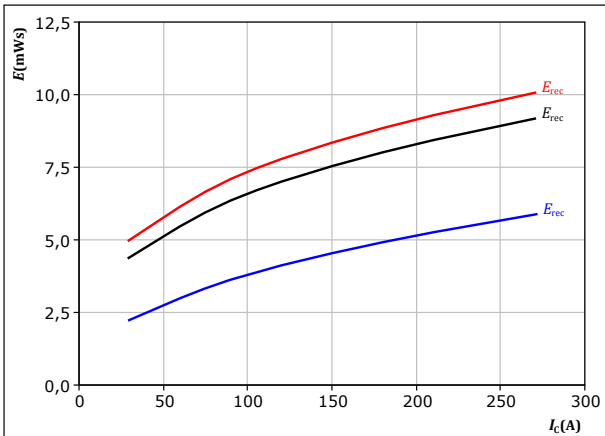
Typical switching energy losses as a function of IGBT turn on gate resistor
 $E = f(R_g)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 150$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 22. FWD

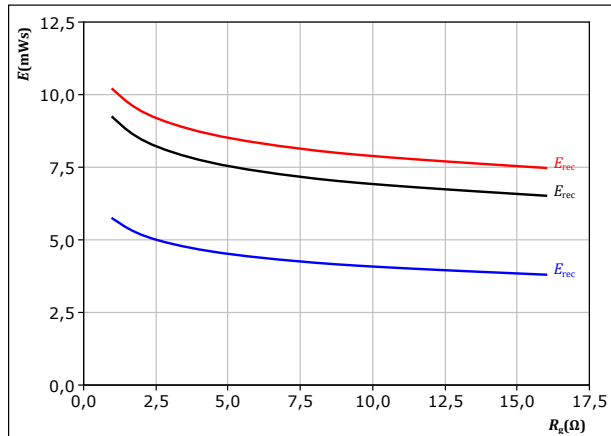
Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$



With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 23. FWD

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



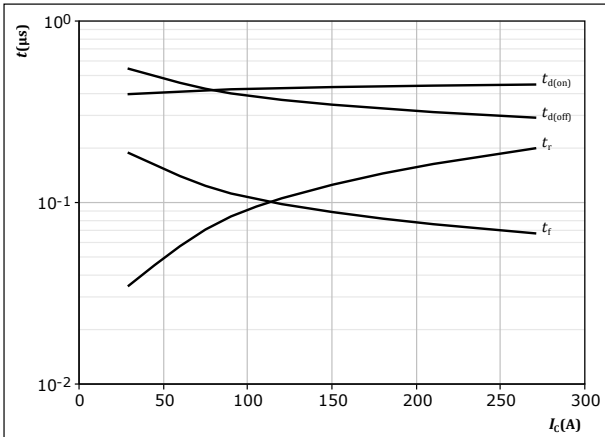
With an inductive load at
 $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_c = 150$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)



Inverter Switching Characteristics

figure 24. IGBT

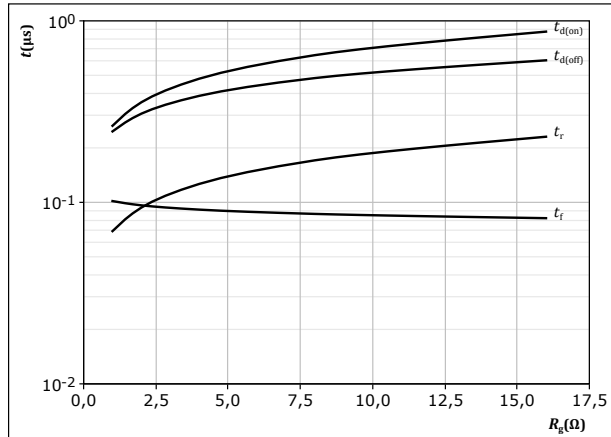
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 4 \text{ } \Omega$
 $R_{goff} = 4 \text{ } \Omega$

figure 25. IGBT

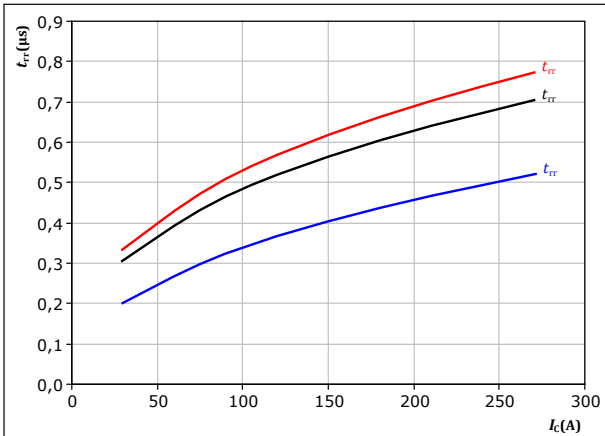
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



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

figure 26. FWD

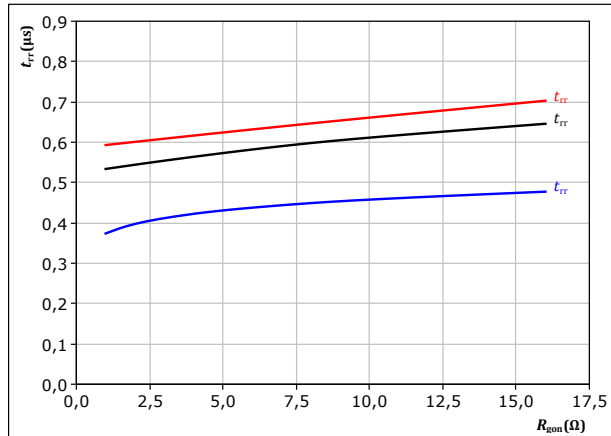
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 4 \text{ } \Omega$
 $T_j:$ — 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
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 150 \text{ A}$
 $T_j:$ — 25 °C
 — 125 °C
 — 150 °C

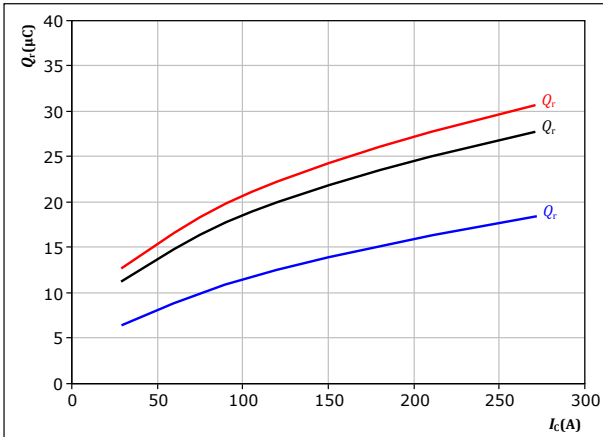


Inverter Switching Characteristics

figure 28. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

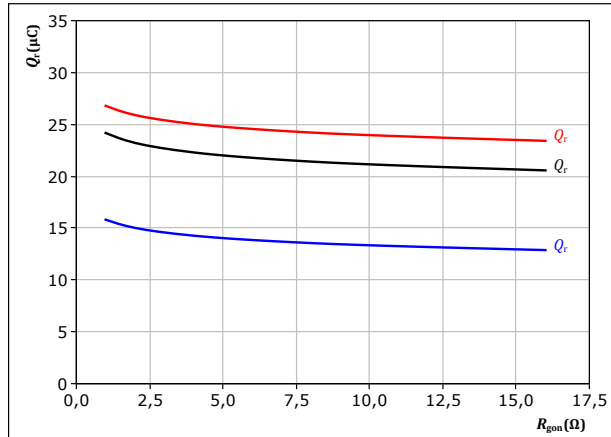
$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 4 \text{ } \Omega$

T_j : $25 \text{ } ^\circ\text{C}$ (blue)
 $125 \text{ } ^\circ\text{C}$ (black)
 $150 \text{ } ^\circ\text{C}$ (red)

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

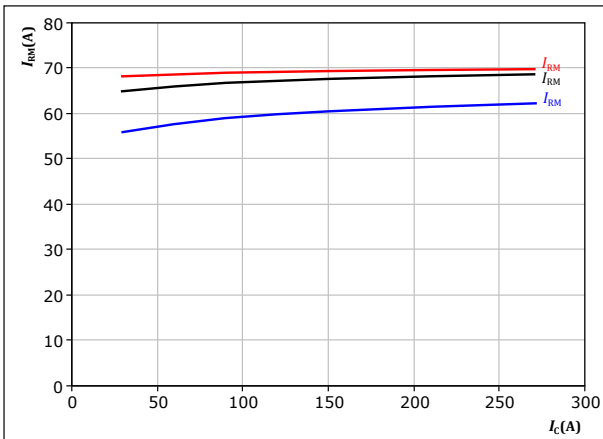
$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 150 \text{ A}$

T_j : $25 \text{ } ^\circ\text{C}$ (blue)
 $125 \text{ } ^\circ\text{C}$ (black)
 $150 \text{ } ^\circ\text{C}$ (red)

figure 30. FWD

Typical peak reverse recovery current as a function of collector current

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



With an inductive load at

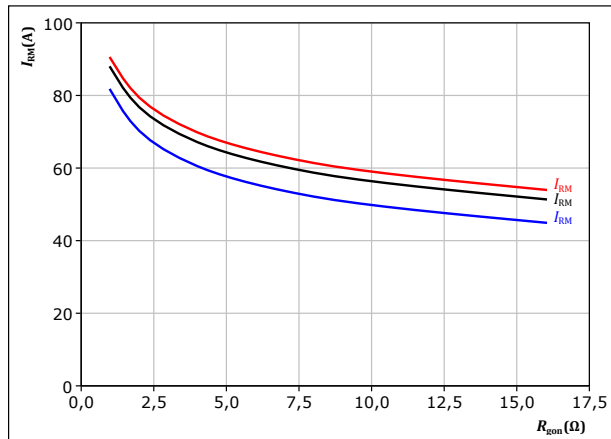
$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 4 \text{ } \Omega$

T_j : $25 \text{ } ^\circ\text{C}$ (blue)
 $125 \text{ } ^\circ\text{C}$ (black)
 $150 \text{ } ^\circ\text{C}$ (red)

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

$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 150 \text{ A}$

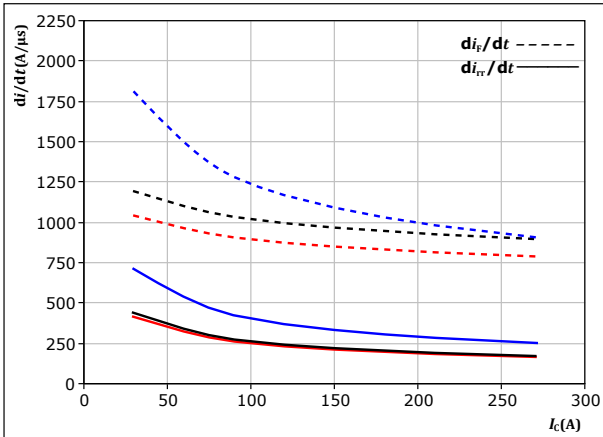
T_j : $25 \text{ } ^\circ\text{C}$ (blue)
 $125 \text{ } ^\circ\text{C}$ (black)
 $150 \text{ } ^\circ\text{C}$ (red)



Inverter Switching Characteristics

figure 32. FWD

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



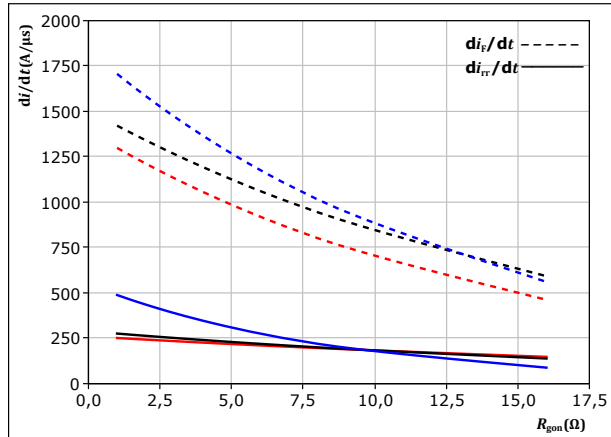
With an inductive load at

$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 4 \ \Omega$

T_j :
— 25 °C
— 125 °C
— 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

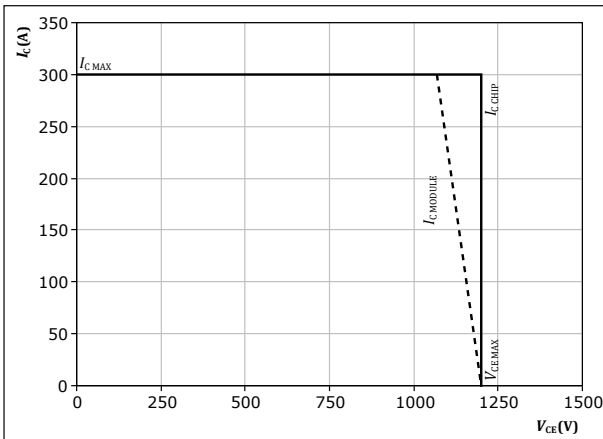
$V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_c = 150 \text{ A}$

T_j :
— 25 °C
— 125 °C
— 150 °C

figure 34. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



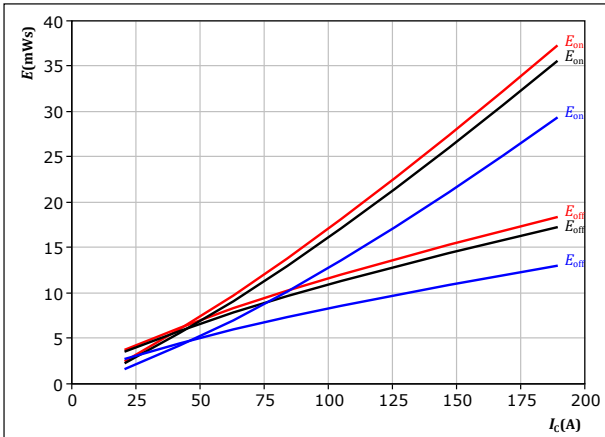
At $T_j = 150 \text{ °C}$
 $R_{gon} = 4 \ \Omega$
 $R_{goff} = 4 \ \Omega$



Brake Switching Characteristics

figure 35. IGBT

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

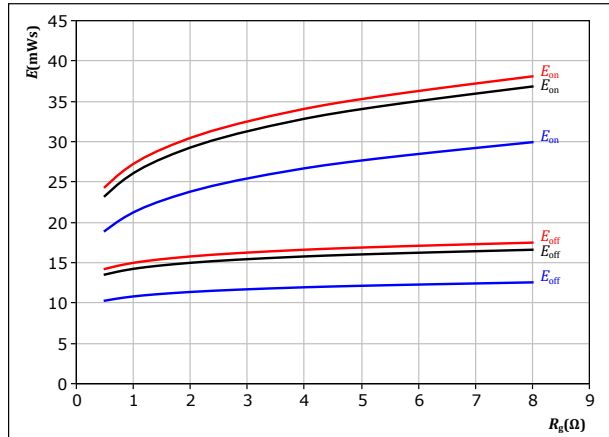


With an inductive load at

$V_{CE} = 700$ V	$T_j = 25$ °C
$V_{GE} = 0/15$ V	$T_j = 125$ °C
$R_{gon} = 1$ Ω	$T_j = 150$ °C
$R_{goff} = 1$ Ω	

figure 36. IGBT

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

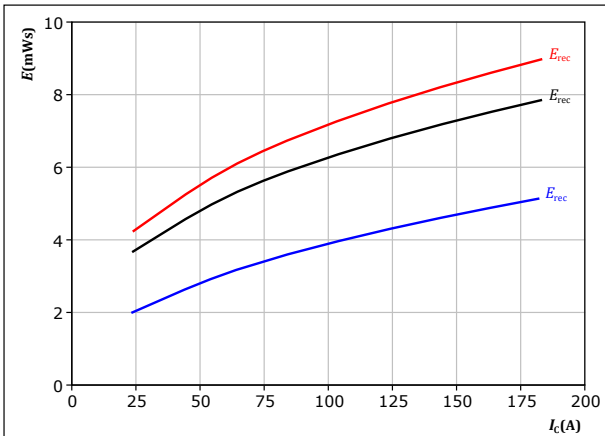


With an inductive load at

$V_{CE} = 700$ V	$T_j = 25$ °C
$V_{GE} = 0/15$ V	$T_j = 125$ °C
$I_c = 147$ A	$T_j = 150$ °C

figure 37. FWD

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

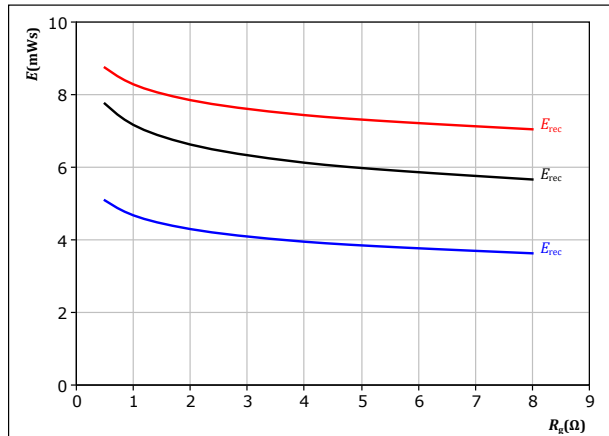


With an inductive load at

$V_{CE} = 700$ V	$T_j = 25$ °C
$V_{GE} = 0/15$ V	$T_j = 125$ °C
$R_{gon} = 1$ Ω	$T_j = 150$ °C

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

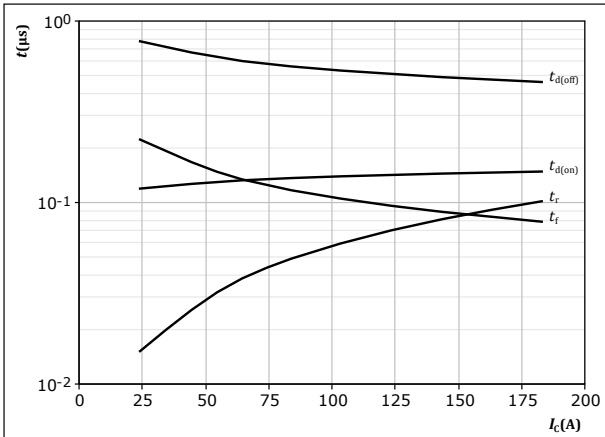
$V_{CE} = 700$ V	$T_j = 25$ °C
$V_{GE} = 0/15$ V	$T_j = 125$ °C
$I_c = 147$ A	$T_j = 150$ °C



Brake Switching Characteristics

figure 39. IGBT

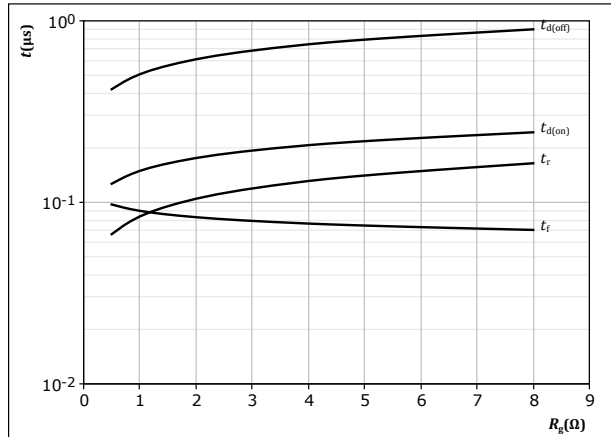
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 1$ Ω
 $R_{goff} = 1$ Ω

figure 40. IGBT

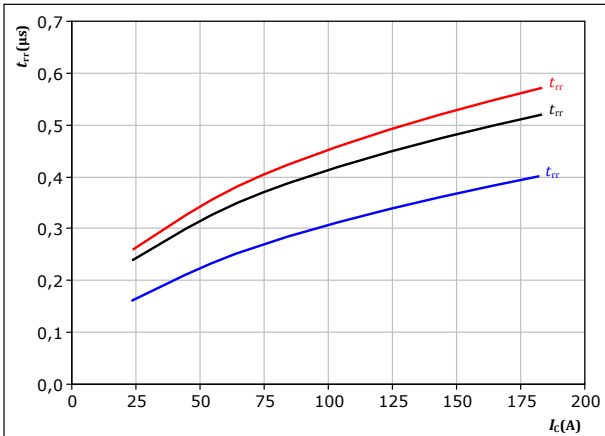
Typical switching times as a function of IGBT turn on gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 150$ °C
 $V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 147$ A

figure 41. FWD

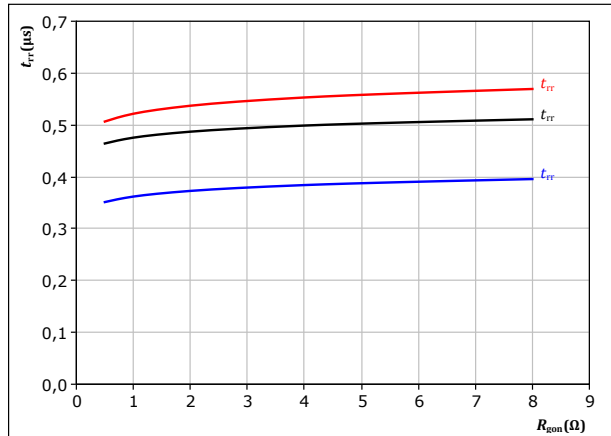
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 1$ 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
 $V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 147$ A
 $T_j:$ — 25 °C
— 125 °C
— 150 °C

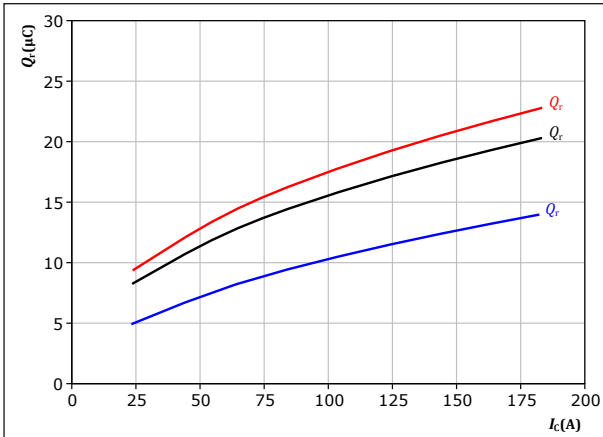


Brake Switching Characteristics

figure 43. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

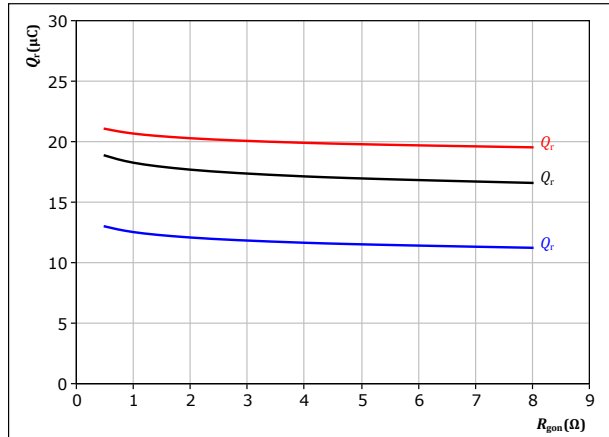
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 1$ Ω

T_j : — 25 °C
— 125 °C
— 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

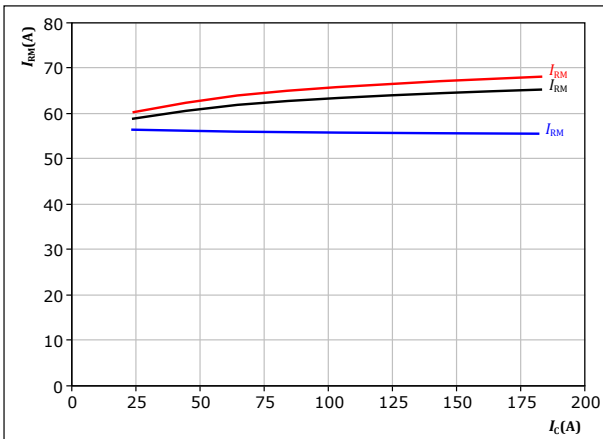
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 147$ A

T_j : — 25 °C
— 125 °C
— 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

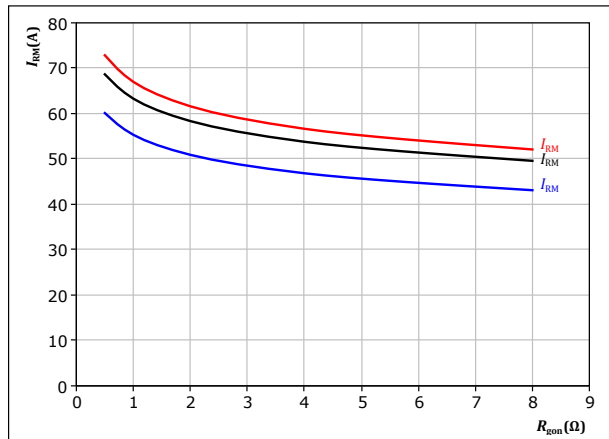
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 1$ Ω

T_j : — 25 °C
— 125 °C
— 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

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 147$ A

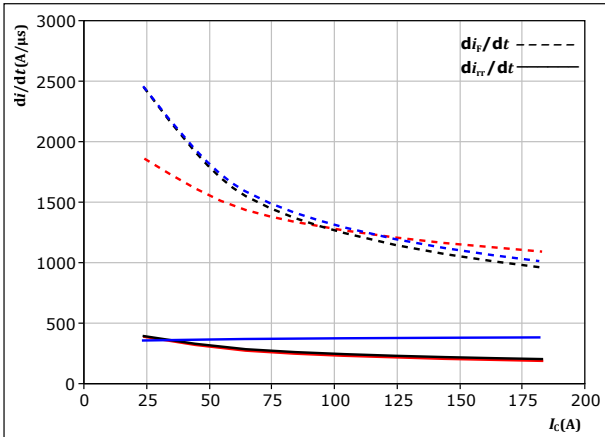
T_j : — 25 °C
— 125 °C
— 150 °C



Brake Switching Characteristics

figure 47. FWD

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



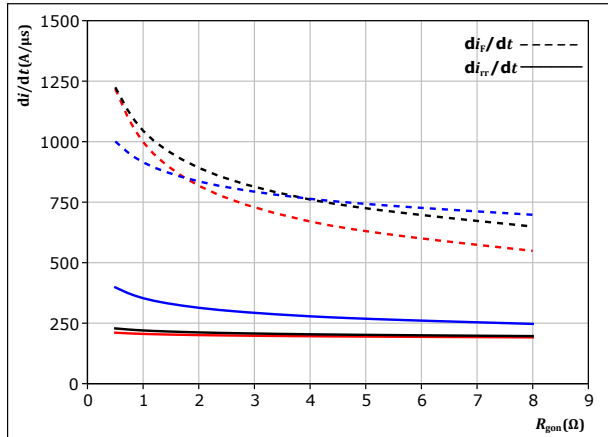
With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{gon} = 1$ Ω

T_j : 25 °C
 125 °C
 150 °C

figure 48. FWD

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



With an inductive load at

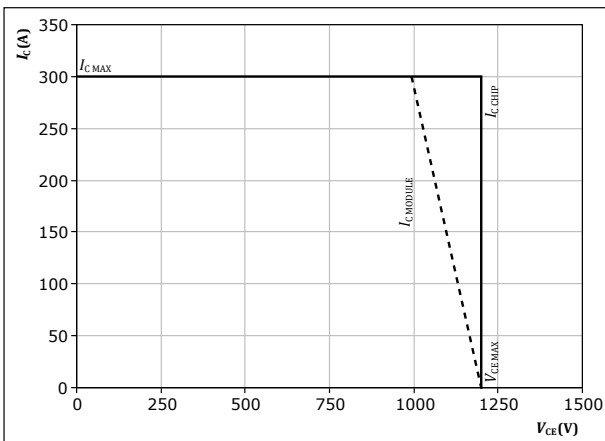
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 147$ A

T_j : 25 °C
 125 °C
 150 °C

figure 49. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



At $T_j = 150$ °C
 $R_{gon} = 1$ Ω
 $R_{goff} = 1$ Ω



Switching Definitions

figure 50. IGBT

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

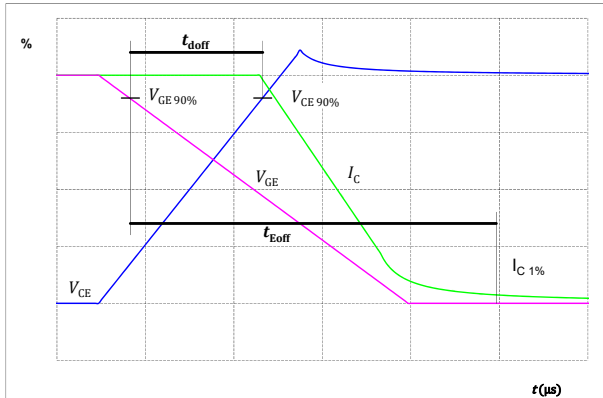


figure 51. IGBT

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

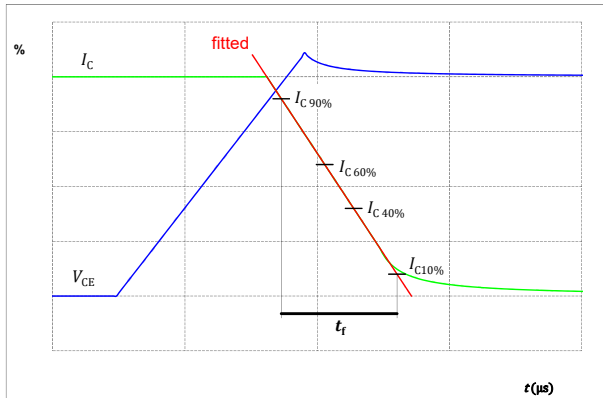
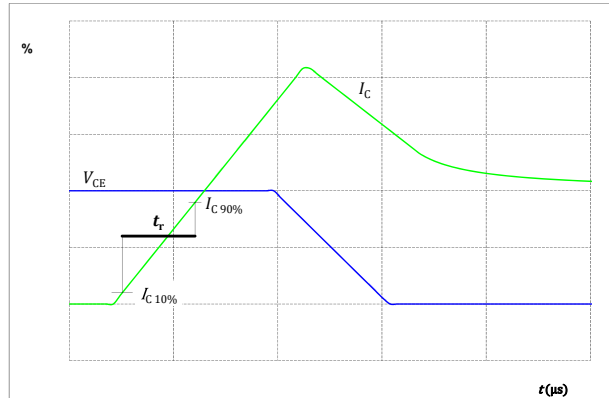


figure 53. IGBT

Turn-on Switching Waveforms & definition of t_r





Switching Definitions

figure 54. FWD

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

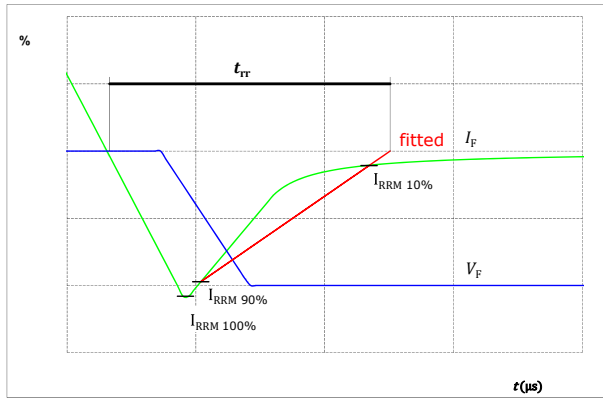
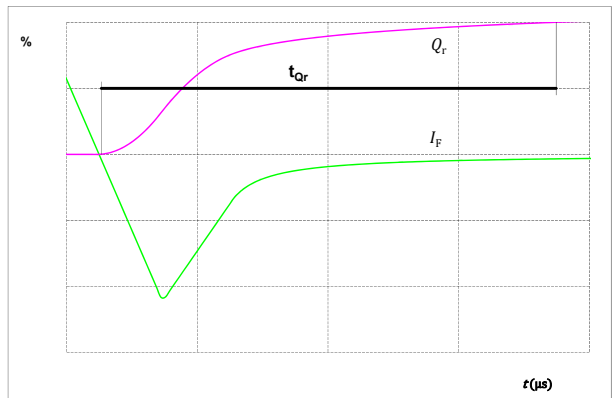


figure 55. FWD


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



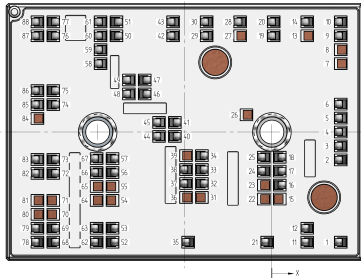


Vincotech

Ordering Code	
Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M312PMA150M7-K420A80-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M312PMA150M7-K420A80-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M312PMA150M7-K420A80-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M312PMA150M7-K420A80-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M312PMA150M7-K420A80-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M312PMA150M7-K420A80-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M312PMA150M7-K420A80-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M312PMA150M7-K420A80-/5B/

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

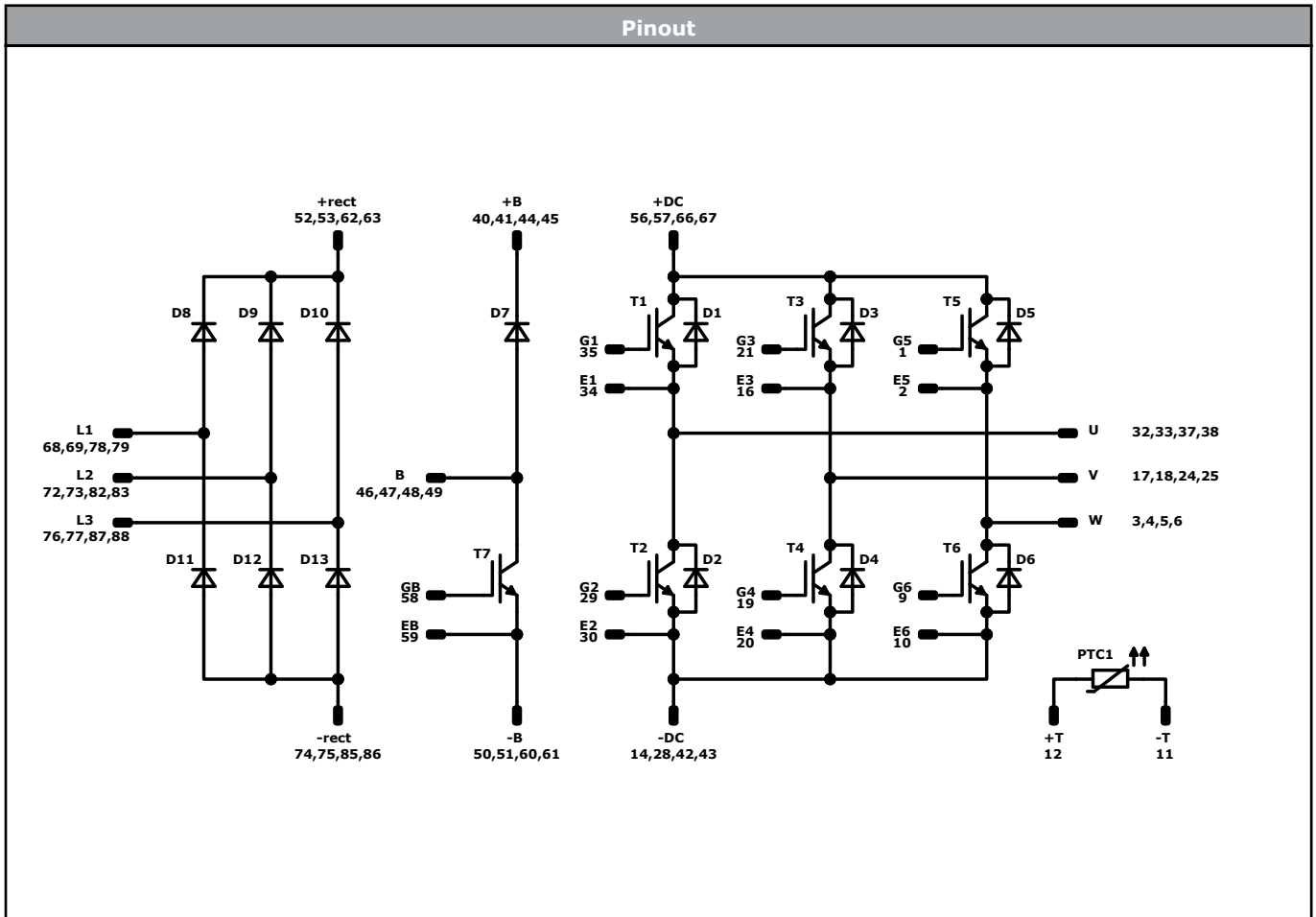
Outline							
Pin table [mm]							
Pin	X	Y	Function	45	-25,9	2,2	+B
1	15,83	-25,3	G5	46	-29,18	8,74	B
2	15,83	-6,4	E5	47	-29,18	11,94	B
3	15,83	-3,2	W	48	-32,82	8,74	B
4	15,83	0	W	49	-32,82	11,94	B
5	15,83	3,2	W	50	-35,68	22,1	-B
6	15,83	6,4	W	51	-35,68	25,3	-B
7	not assembled			52	-36,58	-25,3	+rect
8	not assembled			53	-36,58	-22,1	+rect
9	15,83	22,1	G6	54	not assembled		
10	15,83	25,3	E6	55	not assembled		
11	8,13	-25,3	-T	56	-36,58	-9,3	+DC
12	8,13	-22,1	+T	57	-36,58	-6,1	+DC
13	not assembled			58	-39,32	15,7	GB
14	8,13	25,3	-DC	59	-39,32	18,9	EB
15	not assembled			60	-39,32	22,1	-B
16	1,82	-12,18	E3	61	-39,32	25,3	-B
17	1,82	-8,98	V	62	-40,22	-25,3	+rect
18	1,82	-5,79	V	63	-40,22	-22,1	+rect
19	0,43	22,1	G4	64	not assembled		
20	0,43	25,3	E4	65	not assembled		
21	-1,07	-25,3	G3	66	-40,22	-9,3	+DC
22	not assembled			67	-40,22	-6,09	+DC
23	not assembled			68	-50,18	-25,3	L1
24	-1,82	-8,98	V	69	-50,18	-22,1	L1
25	-1,82	-5,79	V	70	not assembled		
26	not assembled			71	not assembled		
27	not assembled			72	-50,18	-9,5	L2
28	-7,27	25,3	-DC	73	-50,18	-6,3	L2
29	-14,97	22,1	G2	74	-50,18	6,3	-rect
30	-14,97	25,3	E2	75	-50,18	9,5	-rect
31	not assembled			76	-50,18	22,1	L3
32	-16,05	-11,82	U	77	-50,18	25,3	L3
33	-16,05	-8,63	U	78	-53,82	-25,3	L1
34	-16,05	-5,42	E1	79	-53,82	-22,1	L1
35	-19,22	-25,3	G1	80	not assembled		
36	not assembled			81	not assembled		
37	-19,7	-11,82	U	82	-53,82	-9,5	L2
38	-19,7	-8,62	U	83	-53,82	-6,3	L2
39	not assembled			84	not assembled		
40	-22,26	-1	+B	85	-53,82	6,3	-rect
41	-22,26	2,2	+B	86	-53,82	9,5	-rect
42	-22,67	22,1	-DC	87	-53,82	22,1	L3
43	-22,67	25,3	-DC	88	-53,82	25,3	L3
44	-25,9	-1	+B				



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



Vincotech



Identification					
ID	Component	Voltage	Current	Function	Comment
T2, T1, T4, T3, T6, T5	IGBT	1200 V	150 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	1200 V	150 A	Inverter Diode	
T7	IGBT	1200 V	150 A	Brake Switch	
D7	FWD	1200 V	100 A	Brake Diode	
D11, D8, D12, D9, D13, D10	Rectifier	1600 V	60 A	Rectifier Diode	
PTC1	Thermistor			Thermistor	



Packaging instruction				
Standard packaging quantity (SPQ) 48	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for MiniSKiiP® 3 packages see vincotech.com website.

Package data
Package data for MiniSKiiP® 3 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 $T_{j,op}=150^{\circ}C$ and up to 2500VAC/1min isolation voltage. For more information see vincotech.com website.



Document No.:	Date:	Modification:	Pages
80-M312PMA150M7-K420A80-D3-14	9 Sep. 2024	New calculation method for Ic/If Correct R-tau pairs	

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