Vincotech

V23990-K427-A40
datasheet

MiniSKiiP® PIM 3 **1200 V / 35 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

Housing features

- Base isolation: Al_2O_3
- Easy assembly in one mounting step
- Flexible PCB design w/o pin holes
- Rugged solderless spring contacts

Extra features

- Equivalent: SKiiP 34NAB12T4V1

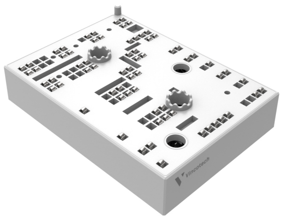
Target applications

- Industrial Drives

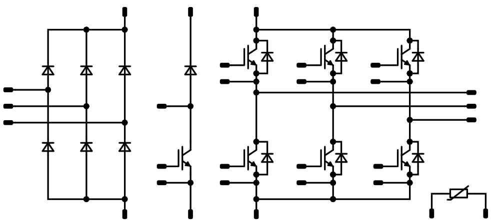
Types

- V23990-K427-A40

MiniSKiiP® 3 16 mm housing



Schematic



Maximum Ratings

T_j = 25 °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 °C	46	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 °C	134	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V	T_j = 150 °C	10	µs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	40	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	170	A
Surge current capability	I^2t			145	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	99	W
Maximum junction temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	46	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 °C	134	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V	T_j = 150 °C	10	µs
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Brake Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	40	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	170	A
Surge current capability	I^2t			145	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	99	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	57	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	490	A
Surge current capability	I^2t			1200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	91	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 s	5500	V
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 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

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
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	1,86 2,3	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 Mhz	0	25		25		2000		pF
Reverse transfer capacitance	C_{res}	f = 1 Mhz	0	25		25		70		pF
Gate charge	Q_g		±15		0	25		270		nC
Thermal										
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,71		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	600	35	25 125 150		100,67 100,22 100,03		ns
Rise time	t_r	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	600	35	25 125 150		27,58 30,31 31,08		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	600	35	25 125 150		207,92 274,51 293,15		ns
Fall time	t_f	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	600	35	25 125 150		100,82 166,78 193,22		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,88 µC Q_{rFWD}=4,17 µC Q_{rFWD}=5,08 µC	±15	600	35	25 125 150		2,01 2,89 3,26		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	35	25 125 150		2,35 3,84 4,44		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				35	25 150		2,37 2,35	2,62(1) 2,62(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25 150		 2700	60 5500	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,96		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=1338 A/µs d*i*/d*t*=1292 A/µs d*i*/d*t*=1216 A/µs	±15	600	35	25 125 150		29,62 36,08 38,67		A
Reverse recovery time	t_{rr}					25 125 150		200,12 383,62 437,16		ns
Recovered charge	Q_r					25 125 150		1,88 4,17 5,08		µC
Reverse recovered energy	E_{rec}					25 125 150		0,596 1,63 1,91		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		898,7 530,68 422,88		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Brake 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	1,86 2,3	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 Mhz	0	25		25		2000		pF
Reverse transfer capacitance	C_{res}	f = 1 Mhz	0	25		25		70		pF
Gate charge	Q_g		±15		0	25		270		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,71		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	0/15	700	35	25 125 150		34,86 33,31 32,7		ns
Rise time	t_r	R_{gon} = 16 Ω R_{goff} = 16 Ω	0/15	700	35	25 125 150		37,04 38,93 39,24		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	0/15	700	35	25 125 150		316,74 386,03 406,97		ns
Fall time	t_f	R_{gon} = 16 Ω R_{goff} = 16 Ω	0/15	700	35	25 125 150		86,74 156,67 185,61		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,96 µC Q_{rFWD}=4,1 µC Q_{rFWD}=5,05 µC	0/15	700	35	25 125 150		2,93 4,11 4,57		mWs
Turn-off energy (per pulse)	E_{off}		0/15	700	35	25 125 150		2,81 4,39 4,98		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Brake Diode										
Static										
Forward voltage	V_F				35	25 150		2,37 2,35	2,62(1) 2,62(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25 150		 2700	60 5500	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,96		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt=772 A/µs di/dt=827 A/µs di/dt=828 A/µs	0/15	700	35	25 125 150		20,49 25,75 27,78		A
Reverse recovery time	t_{rr}					25 125 150		244,28 398,73 459,42		ns
Recovered charge	Q_r					25 125 150		1,96 4,1 5,05		µC
Reverse recovered energy	E_{rec}					25 125 150		0,729 1,72 2,26		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		225,1 90,12 87,79		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Rectifier Diode										
Static										
Forward voltage	V_F				25	25 125		1,2 1,12	1,21(1) 1,1(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25			50	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,77		K/W
Thermistor										
Static										
Rated resistance	R					25		1		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	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	

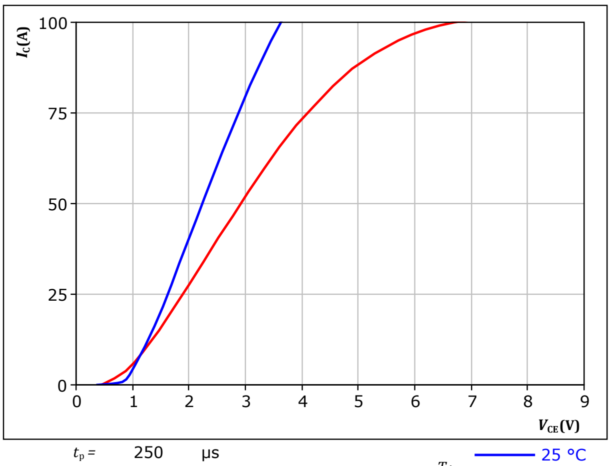
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



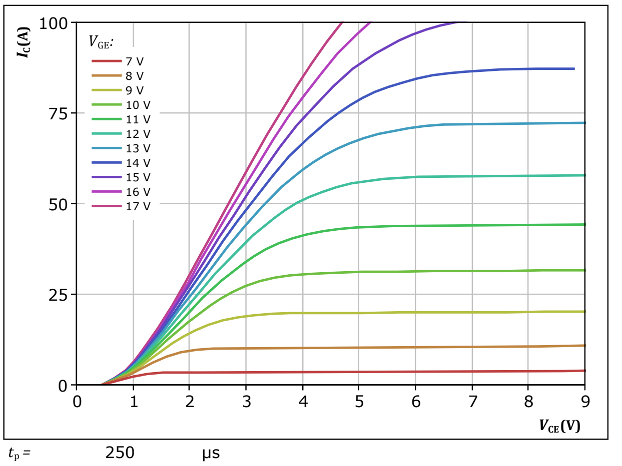
t_p = 250 µs
V_{GE} = 15 V

T_j: 25 °C, 150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

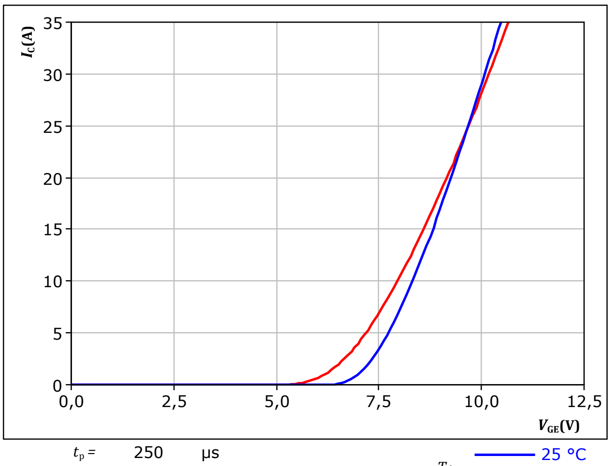


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$



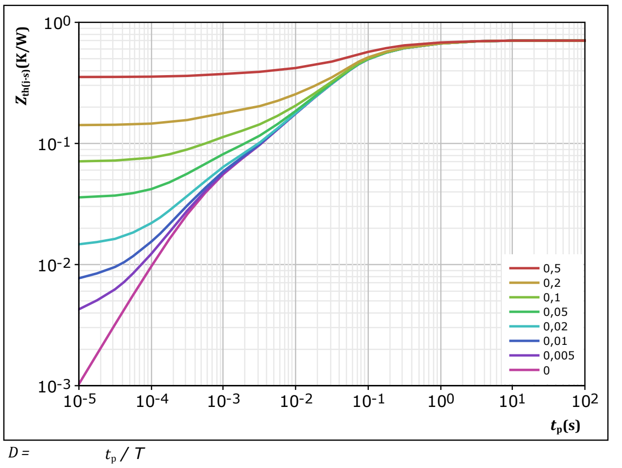
t_p = 250 µs
V_{CE} = 10 V

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
$R_{th(j-s)}$ = 0,707 K/W

IGBT thermal model values

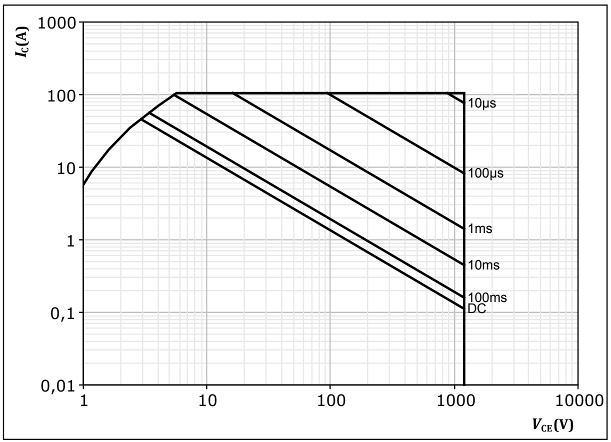
R (K/W)	τ (s)
6,31E-02	1,71E+00
1,38E-01	2,62E-01
3,83E-01	5,28E-02
7,97E-02	6,74E-03
4,34E-02	5,14E-04

Inverter Switch Characteristics

figure 5.	IGBT

Safe operating area

I_C = f(V_{CE})



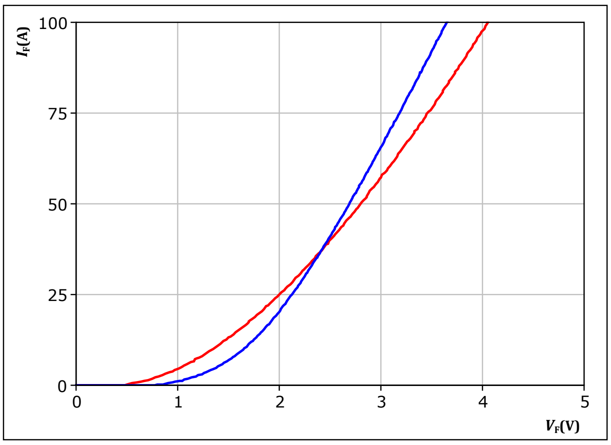
D = single pulse
T_s = 80 °C
V_{GE} = 15 V
T_j = T_{jmax}

Inverter Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



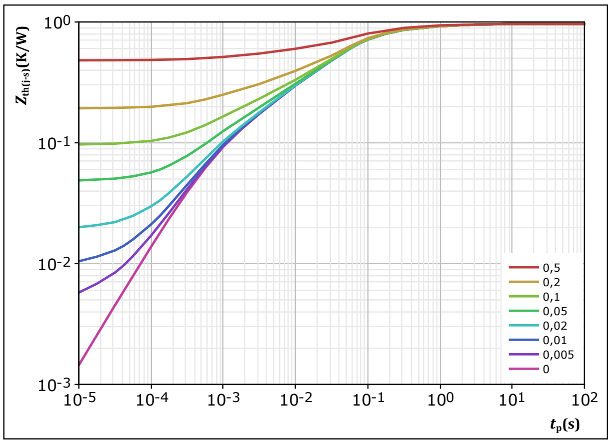
t_p = 250 µs

T_j: 25 °C, 150 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,962 K/W

FWD thermal model values

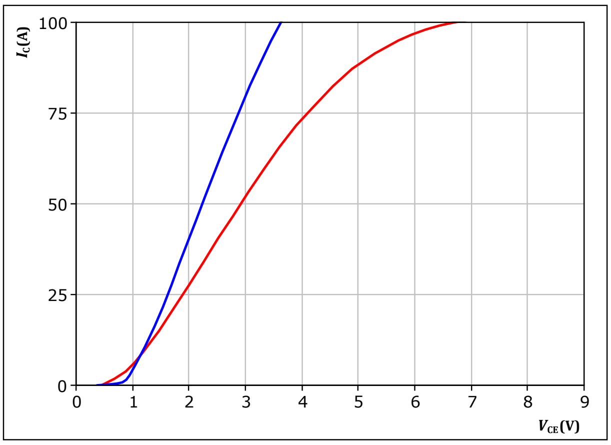
R (K/W)	τ (s)
6,74E-02	1,72E+00
2,35E-01	1,93E-01
4,53E-01	4,29E-02
1,37E-01	4,58E-03
7,04E-02	6,78E-04

Brake Switch Characteristics

figure 8.	**IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

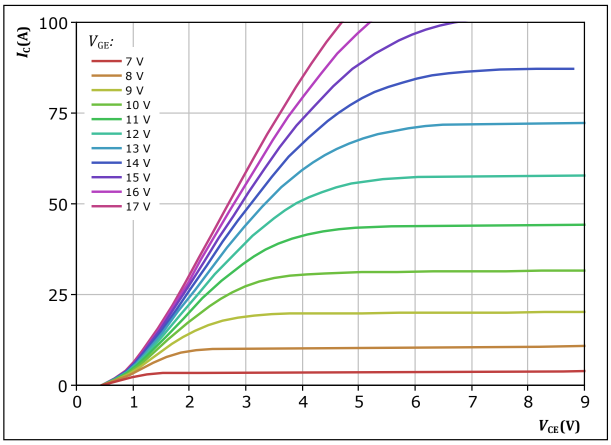


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 150 °C

figure 9.	**IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

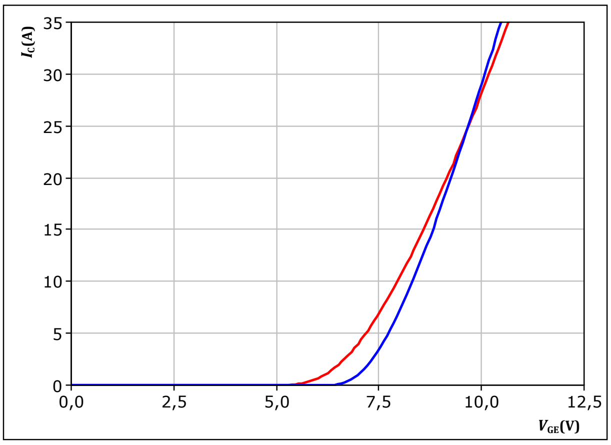


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 10.	**IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

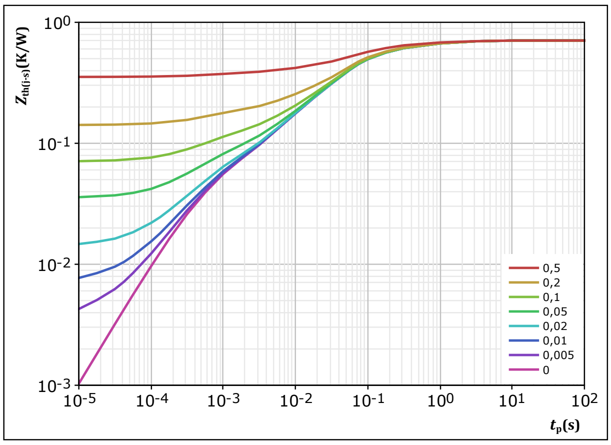


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 150 °C

figure 11.	**IGBT**

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 0,707 K/W

IGBT thermal model values

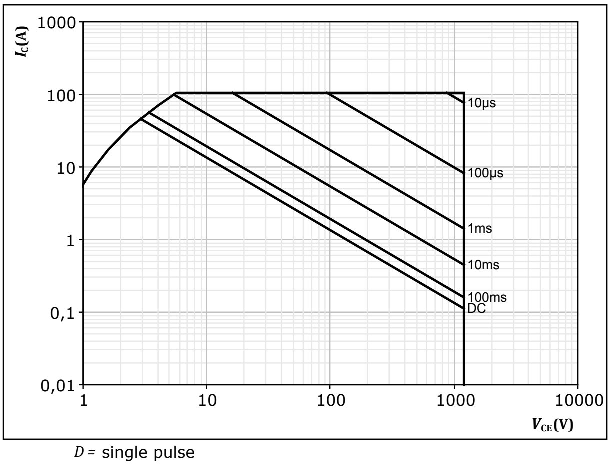
R (K/W)	τ (s)
6,31E-02	1,71E+00
1,38E-01	2,62E-01
3,83E-01	5,28E-02
7,97E-02	6,74E-03
4,34E-02	5,14E-04

Brake Switch Characteristics

figure 12. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



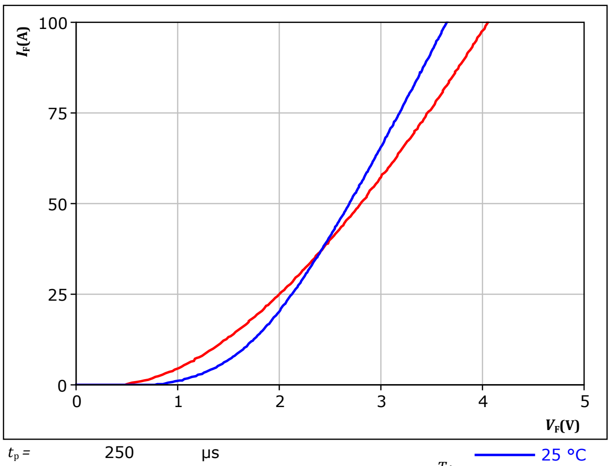
D = single pulse
T_s = 80 °C
V_{GE} = 15 V
T_j = T_{jmax}

Brake Diode Characteristics

figure 13. FWD

Typical forward characteristics

I_F = f(V_F)



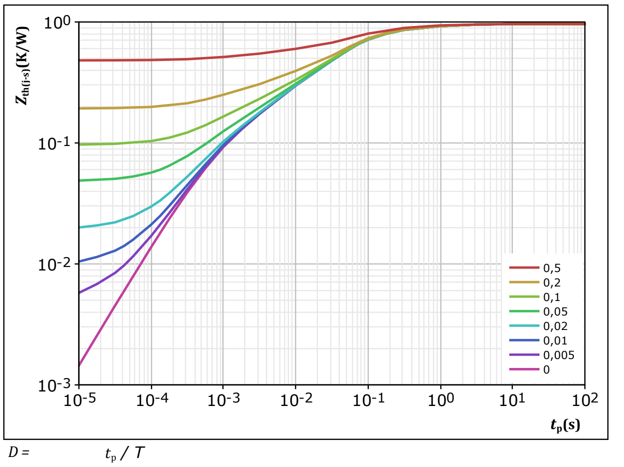
t_p = 250 µs

T_j: 25 °C, 150 °C

figure 14. FWD

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,962 K/W

FWD thermal model values

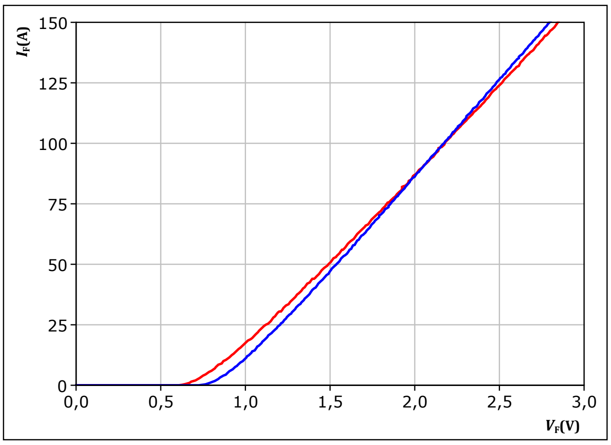
R (K/W)	τ (s)
6,74E-02	1,72E+00
2,35E-01	1,93E-01
4,53E-01	4,29E-02
1,37E-01	4,58E-03
7,04E-02	6,78E-04

Rectifier Diode Characteristics

figure 15. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



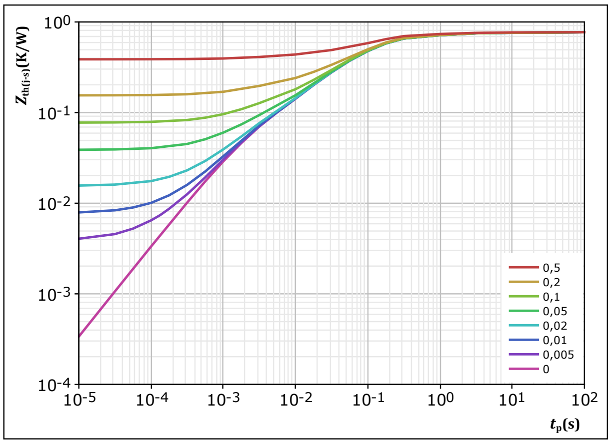
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 16. **Rectifier**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,77 K/W

Rectifier thermal model values

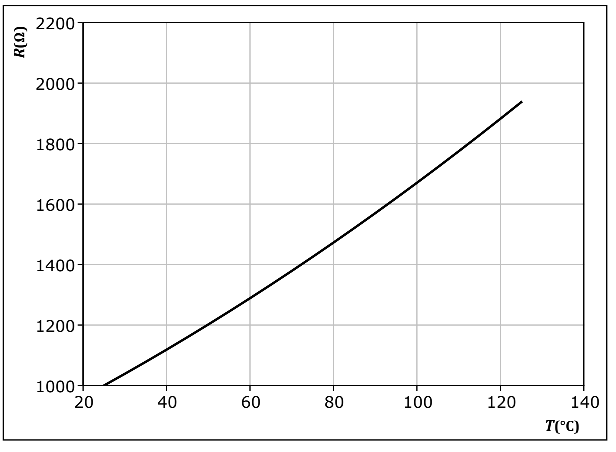
R (K/W)	τ (s)
1,51E-02	7,27E+01
8,95E-02	1,42E+00
4,64E-01	1,16E-01
1,58E-01	2,28E-02
4,76E-02	2,08E-03

Thermistor Characteristics

figure 17.	Thermistor

Typical PTC characteristic as function of temperature

R_T = f(T)

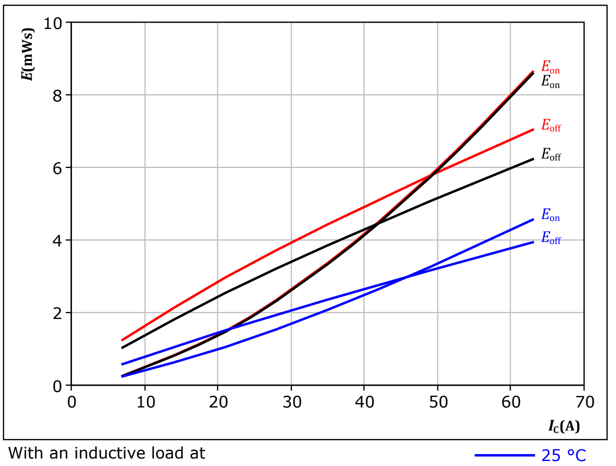


Inverter Switching Characteristics

figure 18. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



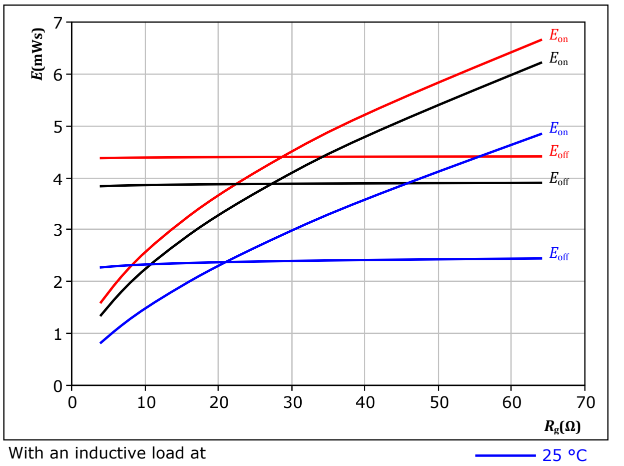
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C / 125 °C / 150 °C
V_{GE} =	±15	V		
R_{gon} =	16	Ω		
R_{goff} =	16	Ω		

figure 19. **IGBT**

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

$E = f(R_g)$



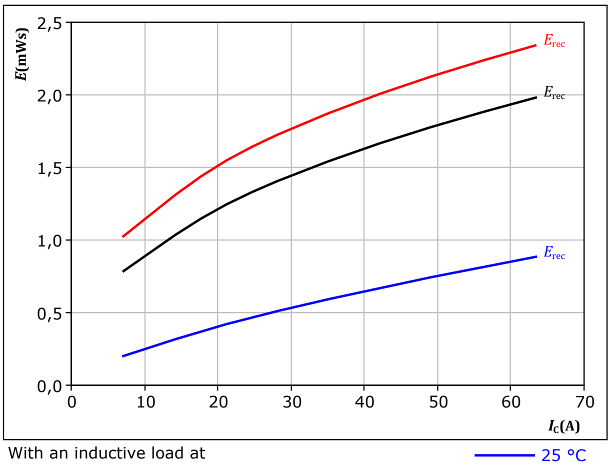
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C / 125 °C / 150 °C
V_{GE} =	±15	V		
I_C =	35	A		

figure 20. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



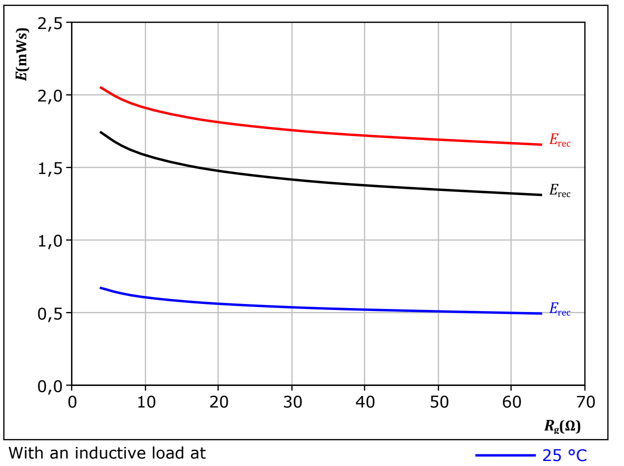
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C / 125 °C / 150 °C
V_{GE} =	±15	V		
R_{gon} =	16	Ω		

figure 21. **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

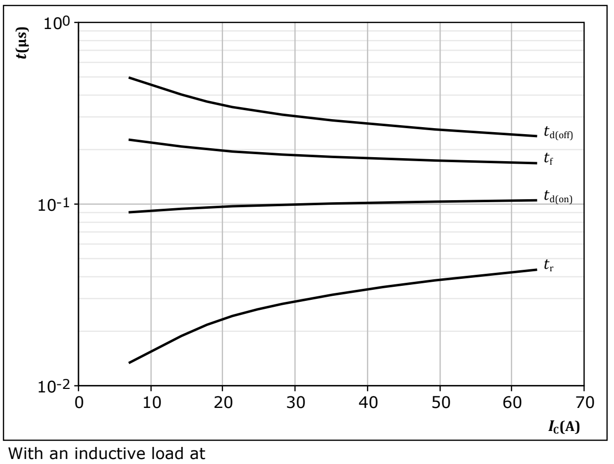
V_{CE} =	600	V	T_j:	25 °C / 125 °C / 150 °C
V_{GE} =	±15	V		
I_C =	35	A		

Inverter Switching Characteristics

figure 22. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



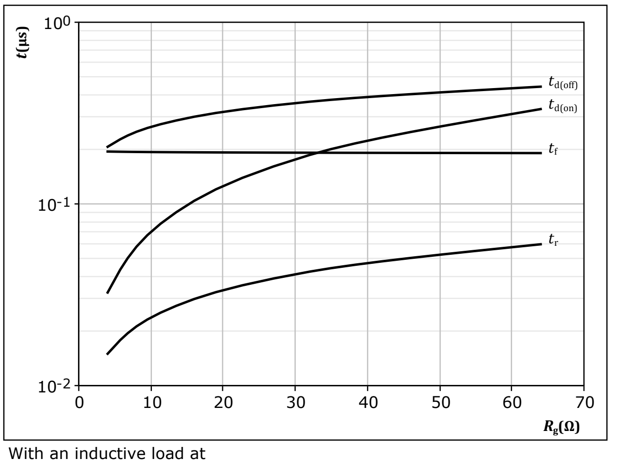
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 23. **IGBT**

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

t = f(R_g)



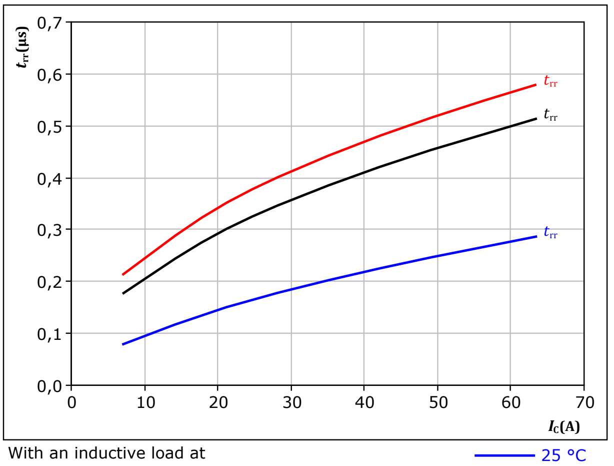
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	35	A

figure 24. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

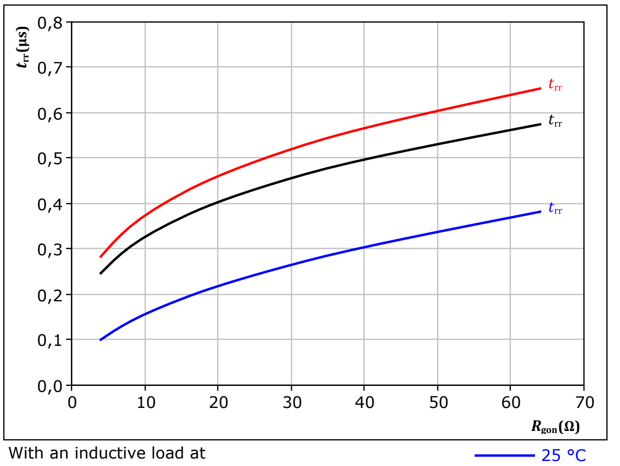
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 25. **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} =	±15	V
I_C =	35	A

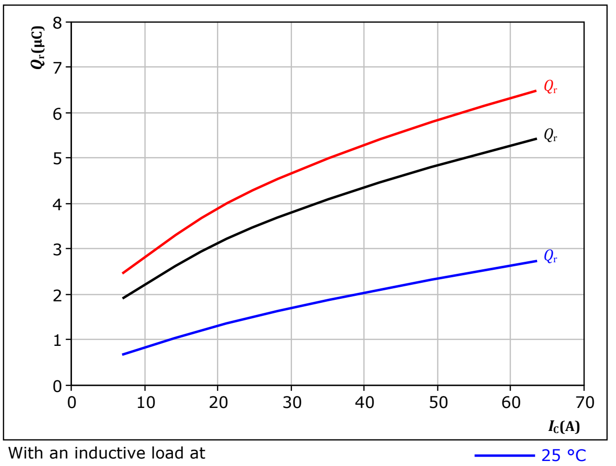
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 26. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



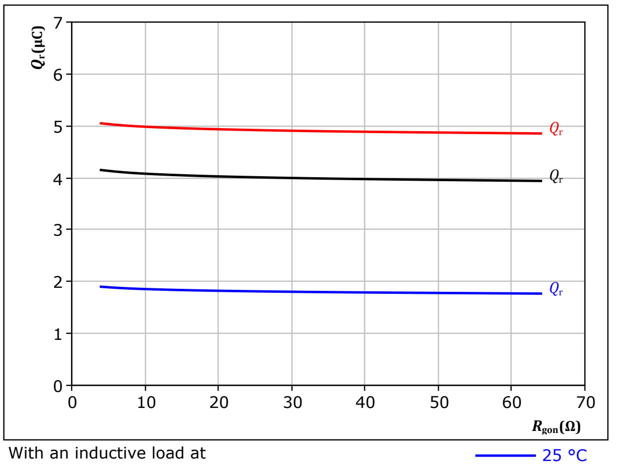
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 27. **FWD**

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

Q_r = f(R_{gon})



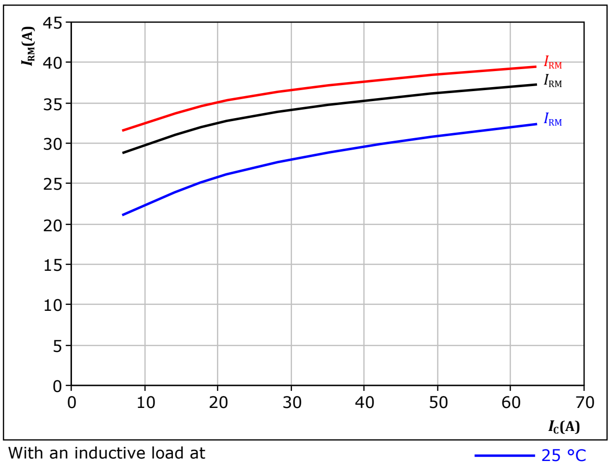
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

figure 28. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



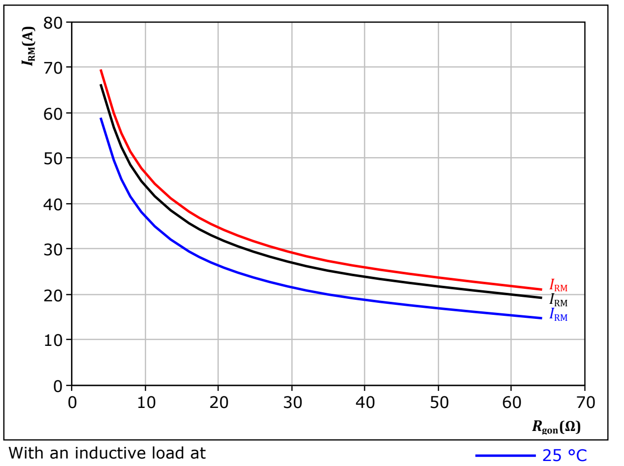
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 29. **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

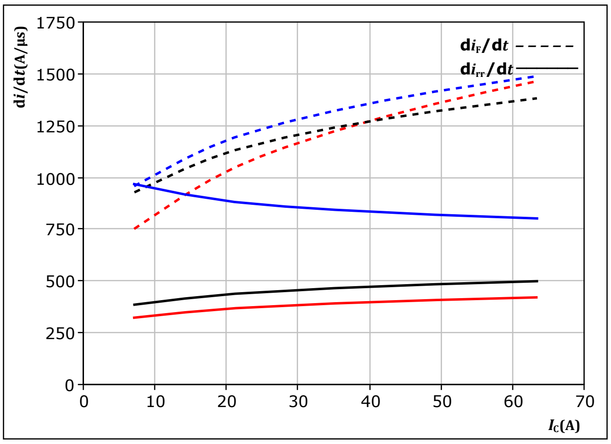
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

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_{rr}/dt = f(I_C)



With an inductive load at

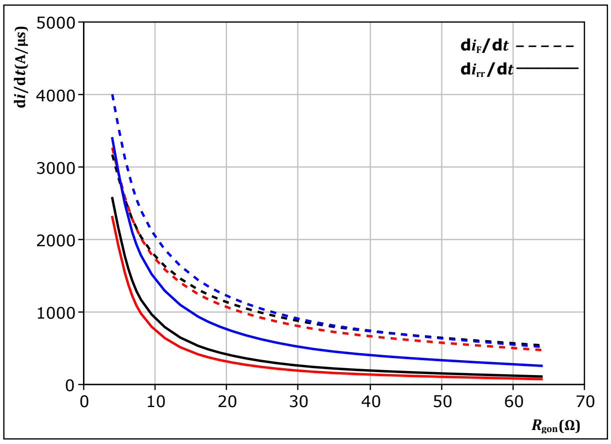
V_{CE} =	600	V	
V_{GE} =	±15	V	
R_{gon} =	16	Ω	

T_j: 25 °C, 125 °C, 150 °C

figure 31. **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

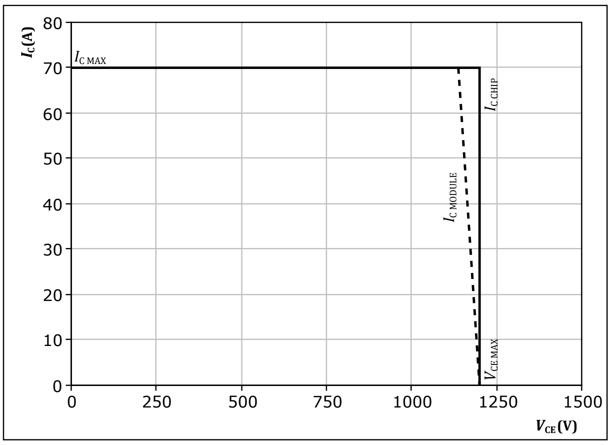
V_{CE} =	600	V	
V_{GE} =	±15	V	
I_C =	35	A	

T_j: 25 °C, 125 °C, 150 °C

figure 32. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



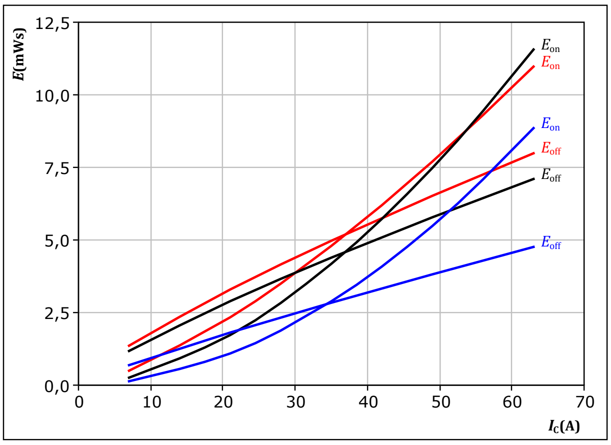
At			
	T_j =	150	°C
	R_{gon} =	16	Ω
	R_{goff} =	16	Ω

Brake Switching Characteristics

figure 33. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



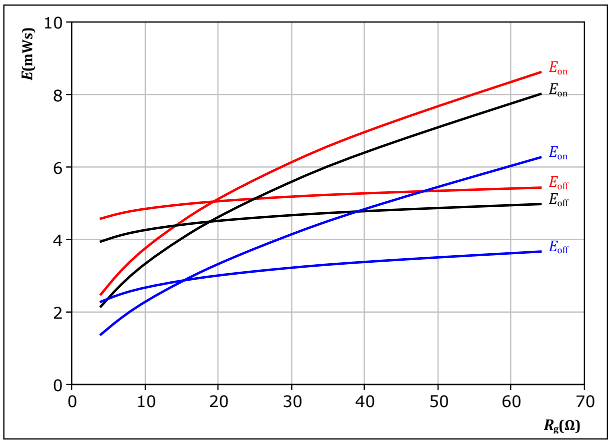
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	16	Ω		150 °C
R_{goff} =	16	Ω		

figure 34. **IGBT**

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

$E = f(R_g)$



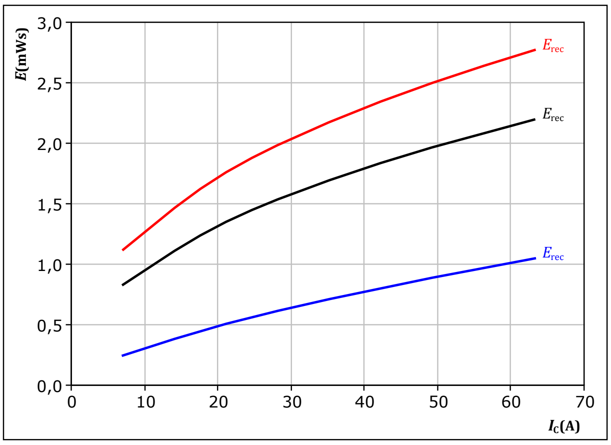
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	35	A		150 °C

figure 35. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



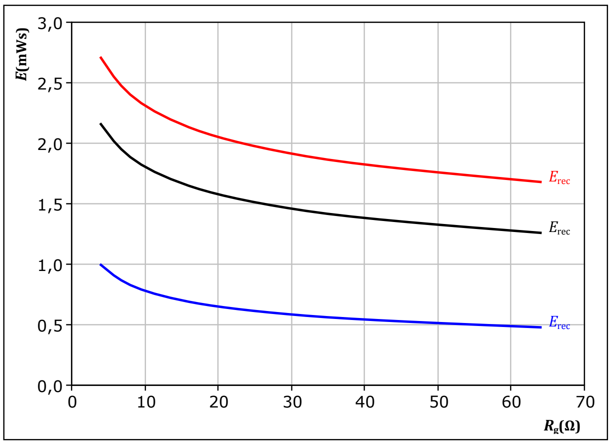
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 36. **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

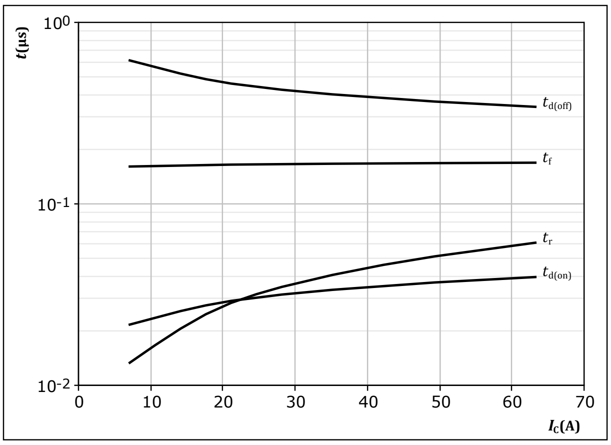
V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	35	A		150 °C

Brake Switching Characteristics

figure 37.	**IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



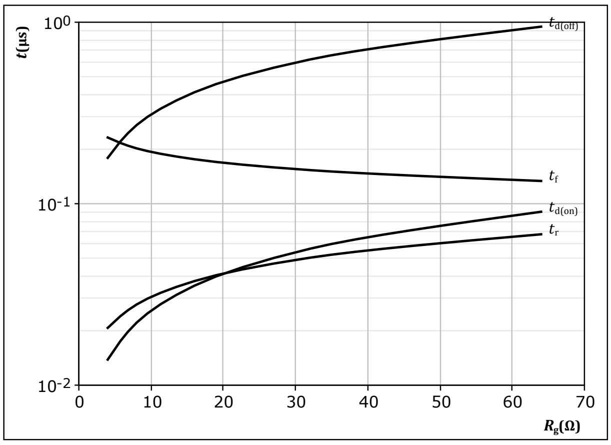
With an inductive load at

T_j =	150	°C
V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 38.	**IGBT**

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

$t = f(R_g)$



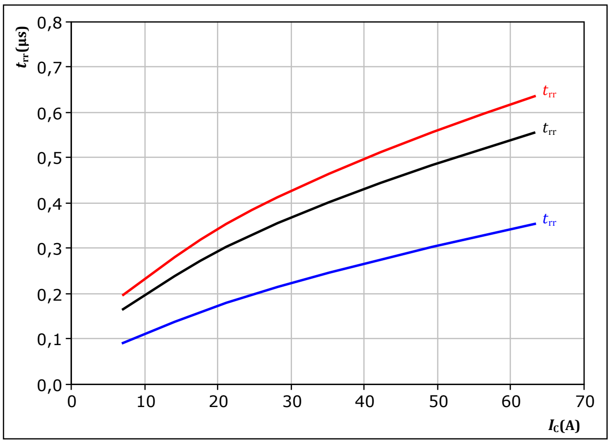
With an inductive load at

T_j =	150	°C
V_{CE} =	700	V
V_{GE} =	0/15	V
I_C =	35	A

figure 39.	**FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

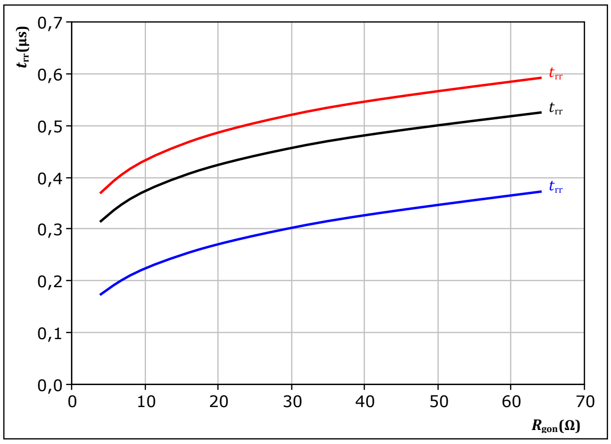
V_{CE} =	700	V
V_{GE} =	0/15	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 40.	**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 =	35	A

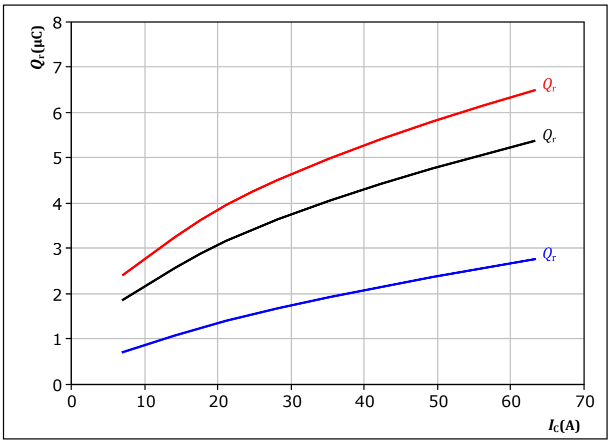
T_j: 25 °C, 125 °C, 150 °C

Brake Switching Characteristics

figure 41. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



With an inductive load at

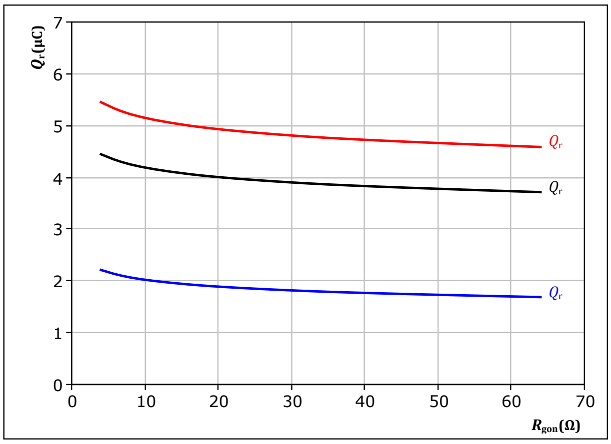
V_{CE} = 700 V
V_{GE} = 0/15 V
R_{gon} = 16 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 42. FWD

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

Q_r = f(R_{gon})



With an inductive load at

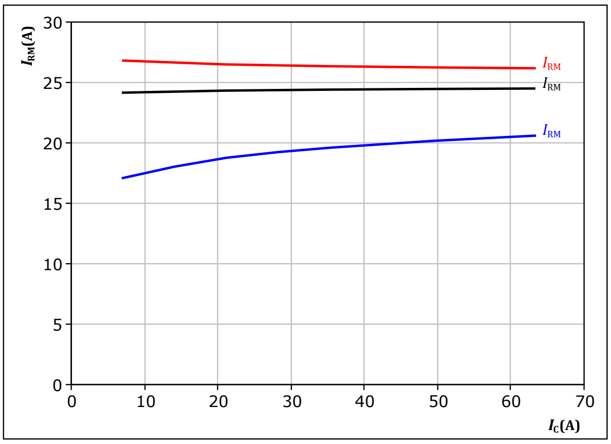
V_{CE} = 700 V
V_{GE} = 0/15 V
I_C = 35 A

T_j: 25 °C, 125 °C, 150 °C

figure 43. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



With an inductive load at

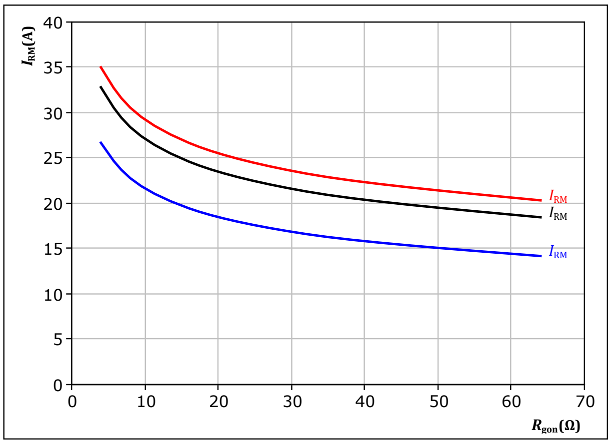
V_{CE} = 700 V
V_{GE} = 0/15 V
R_{gon} = 16 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 44. 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 = 35 A

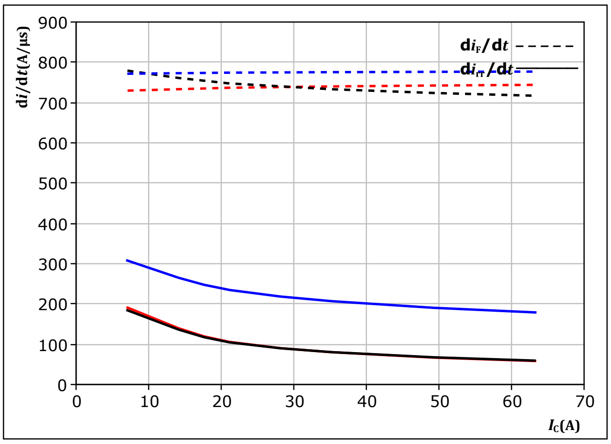
T_j: 25 °C, 125 °C, 150 °C

Brake Switching Characteristics

figure 45. **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)



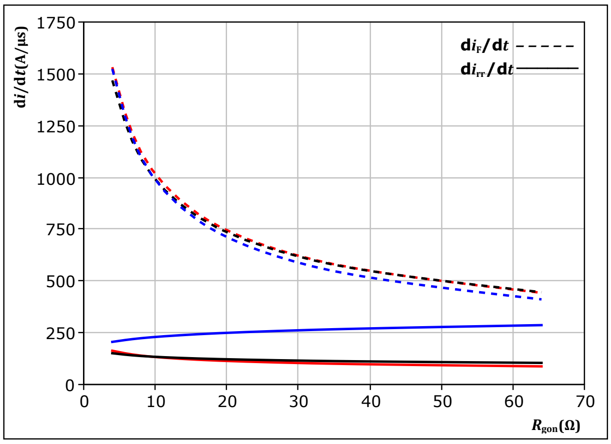
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 46. **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})



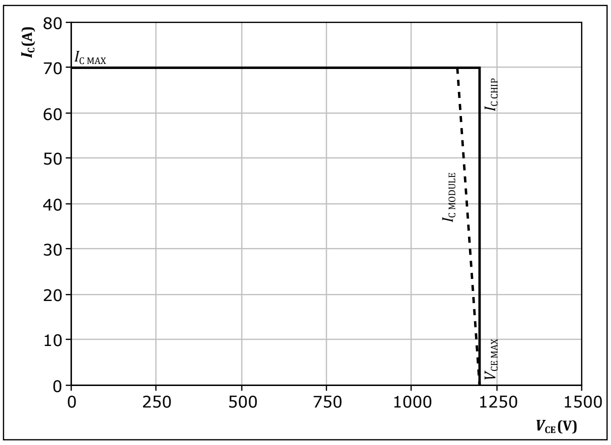
With an inductive load at

V_{CE} =	700	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	35	A		150 °C

figure 47. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



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

Switching Definitions

figure 48. **IGBT**

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

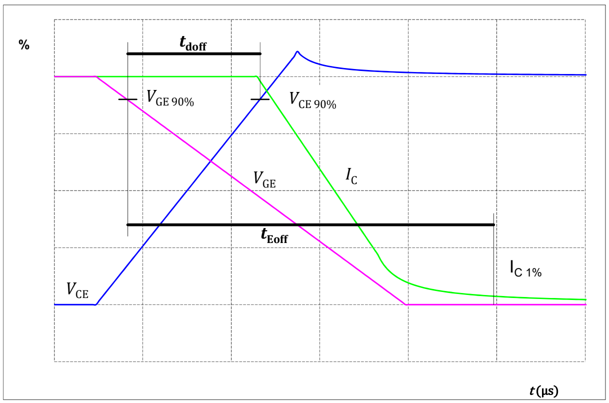


figure 49. **IGBT**

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

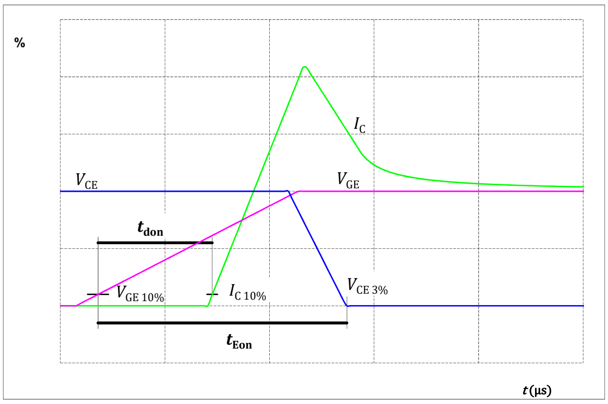


figure 50. **IGBT**

Turn-off Switching Waveforms & definition of t_f

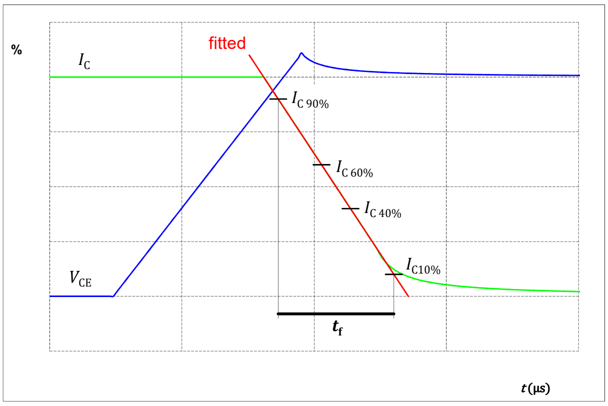
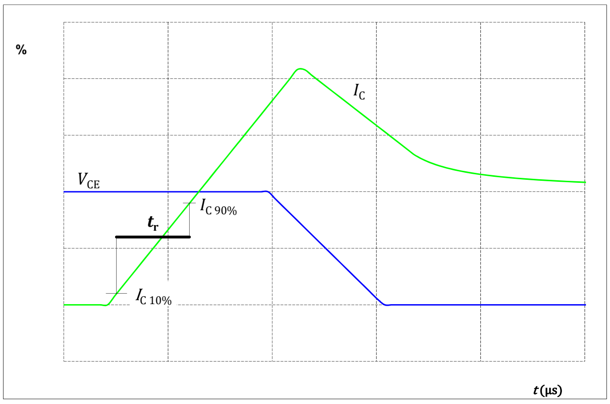


figure 51. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 52. **FWD**

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

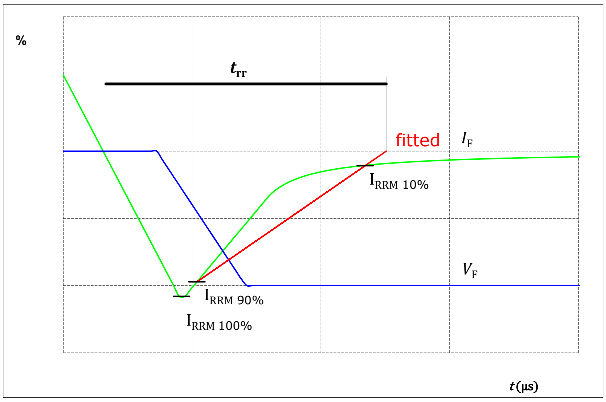
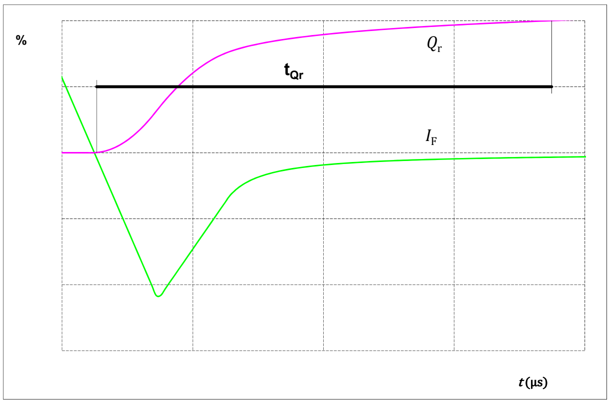


figure 53. **FWD**

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



V23990-K427-A40
datasheet

Ordering Code

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	V23990-K427-A40-/0A/
With thin lid (2.8mm height) + no thermal grease	V23990-K427-A40-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	V23990-K427-A40-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	V23990-K427-A40-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	V23990-K427-A40-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	V23990-K427-A40-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	V23990-K427-A40-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	V23990-K427-A40-/5B/

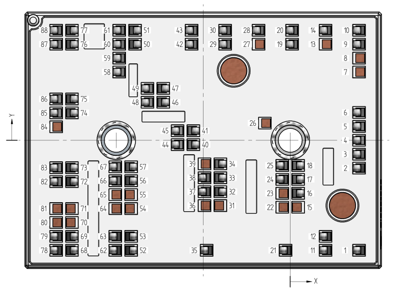
Marking

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

Outline

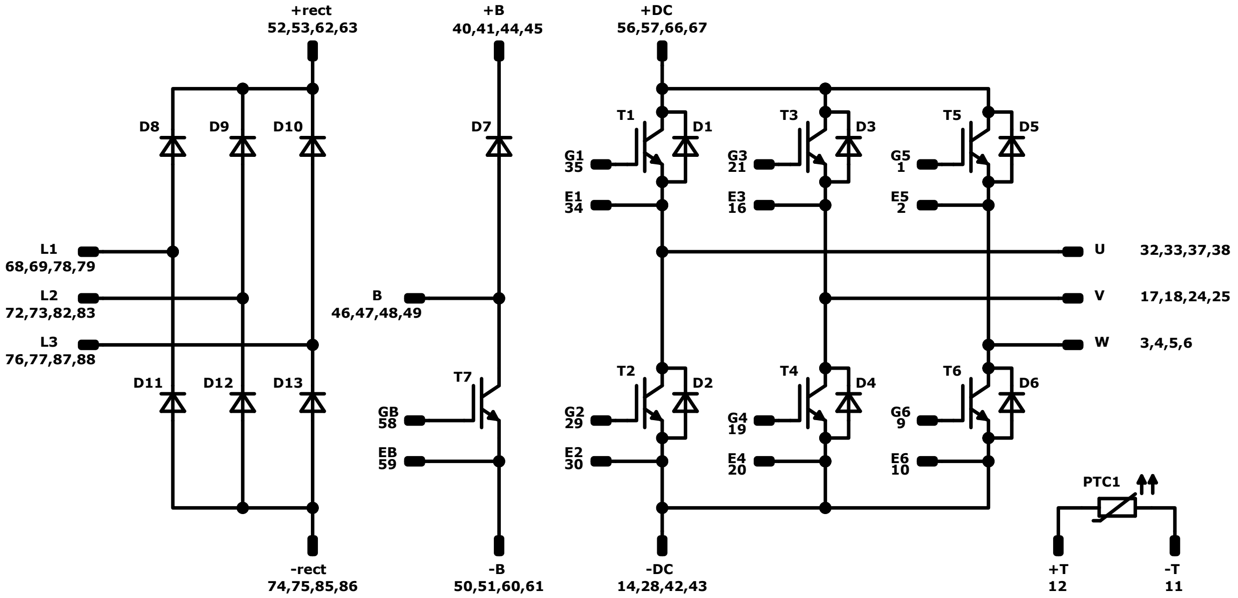
Pin table [mm]

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



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

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T2, T1, T4, T3, T6, T5	IGBT	1200 V	35 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	1200 V	35 A	Inverter Diode	
T7	IGBT	1200 V	35 A	Brake Switch	
D7	FWD	1200 V	35 A	Brake Diode	
D11, D8, D12, D9, D13, D10	Rectifier	1600 V	50 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 certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
V23990-K427-A40-D2-14	30 Apr. 2022	New Datasheet format, module is unchanged Introduce Rth values with HPTP Updated dynamic characteristic	