80-M212PMA035M731-K220A72

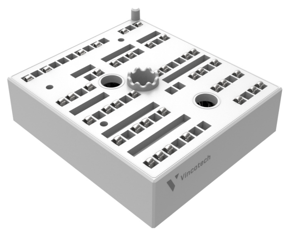
datasheet

MiniSKiiP® PIM 2 — **1200 V / 35 A**

Features

- IGBT M7 with low VCEsat and improved EMC behavior
- Tandem diodes for improved thermal performance
- Solder-free spring contact technology
- Builtin PTC

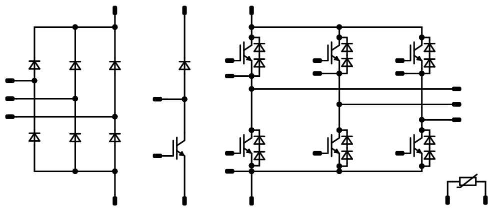
MiniSKiiP® 2 16 mm housing



Target applications

- Industrial Drives

Schematic



Types

- 80-M212PMA035M731-K220A72

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	I_C	$T_j = T_{jmax}$	T_s = 80 °C	49	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	129	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	9,5	µs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1300	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	34	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	107	W
Maximum junction temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	49	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	129	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	9,5	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
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	45	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	89	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward average current	I_{FAV}	$T_j = T_{jmax}$	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	480	A
Surge current capability	I^2t			1100	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	95	W
Maximum junction temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	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					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	0,0035	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	25 125 150		1,48 1,63 1,68	1,85	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			0,08	mA
Gate-emitter leakage current	I_{GES}		20	0		25			0,5	µA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}		0	10		25		7900		pF
Output capacitance	C_{oes}		0	10		25		270		pF
Reverse transfer capacitance	C_{res}		0	10		25		97		pF
Gate charge	Q_g	V_{CC} = 600 V	15		35	25		260		nC
Thermal										
Thermal resistance junction to sink*	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,73		K/W

*Only valid with pre-applied Vincotech thermal interface material.

Parameter	Symbol	Conditions	V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		131 130 129		ns
Rise time	t_r	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		24 29 29		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		180 210 214		ns
Fall time	t_f	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		103,87 133,81 141,31		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,863 µC Q_{rFWD}=1,79 µC Q_{rFWD}=2,04 µC	±15	600	35	25 125 150		1,68 2,32 2,44		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	35	25 125 150		2,64 3,59 3,82		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				30	25 125 150		3,2 3 2,92	3,84	V
Reverse leakage current	I_R	V_r = 1300 V				25			1,6	µA
Thermal										
Thermal resistance junction to sink*	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,89		K/W

*Only valid with pre-applied Vincotech thermal interface material.

Parameter	Symbol	Conditions	V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit
Dynamic										
Peak recovery current	I_{RRM}	di/dt=782 A/µs di/dt=639 A/µs di/dt=619 A/µs	±15	600	35	25 125 150		12,91 18,76 19,57		A
Reverse recovery time	t_{rr}					25 125 150		92,92 155,12 167,37		ns
Recovered charge	Q_r					25 125 150		0,863 1,79 2,04		µC
Reverse recovered energy	E_{rec}					25 125 150		0,293 0,612 0,717		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		363,27 219,58 184,74		A/µs

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Brake Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0035	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	25 125 150		1,48 1,63 1,68	1,85	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			0,08	mA
Gate-emitter leakage current	I_{GES}		20	0		25			0,5	μA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}		0	10		25		7900		pF
Output capacitance	C_{oes}		0	10		25		270		pF
Reverse transfer capacitance	C_{res}		0	10		25		97		pF
Gate charge	Q_g	V_{CC} = 600 V	15		35	25		260		nC
Thermal										
Thermal resistance junction to sink*	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,73		K/W

*Only valid with pre-applied Vincotech thermal interface material.

Parameter	Symbol	Conditions	V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		124,2 122,4 121,4		ns
Rise time	t_r	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		14,2 17 17,8		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		178,6 202,8 208,2		ns
Fall time	t_f	R_{gon} = 8 Ω R_{goff} = 8 Ω	±15	600	35	25 125 150		95,14 117,86 118,79		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=4,34 μC Q_{rFWD}=6,18 μC Q_{rFWD}=6,9 μC	±15	600	35	25 125 150		1,45 1,92 2,09		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	35	25 125 150		2,4 3,17 3,42		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	25 125 150		1,66 1,76 1,74	2,1	V
Reverse leakage current	I_R	V_r = 1200 V				25			40	µA
Thermal										
Thermal resistance junction to sink*	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,06		K/W

*Only valid with pre-applied Vincotech thermal interface material.

Parameter	Symbol	Conditions	V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=2681 A/µs d*i*/d*t*=2670 A/µs d*i*/d*t*=2690 A/µs	±15	600	35	25 125 150		77,33 75,64 76,58		A
Reverse recovery time	t_{rr}					25 125 150		157,26 283,67 310,8		ns
Recovered charge	Q_r					25 125 150		4,34 6,18 6,9		µC
Reverse recovered energy	E_{rec}					25 125 150		1,96 2,82 3,13		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		2734 2205 2101		A/µs

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Rectifier Diode										
Static										
Forward voltage	V_F				40	25 125 150		1,25 1,2 1,21	1,5	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			100 2000	µA
Thermal										
Thermal resistance junction to sink*	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,74		K/W

*Only valid with pre-applied Vincotech thermal interface material.

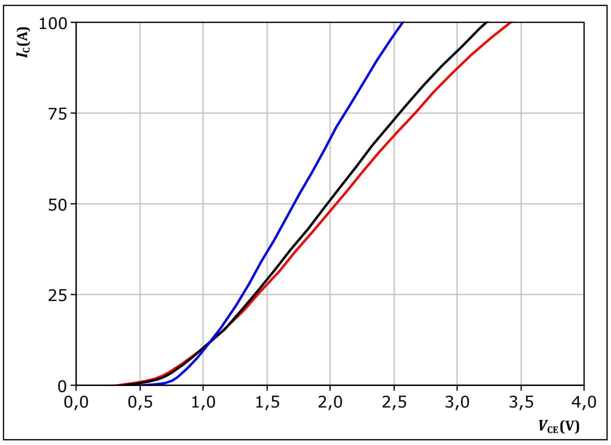
Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Thermistor										
Static										
Rated resistance	R					25		1		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1670 Ω				100	-2		2	%
Maximum Current	I_{max}							3		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	

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

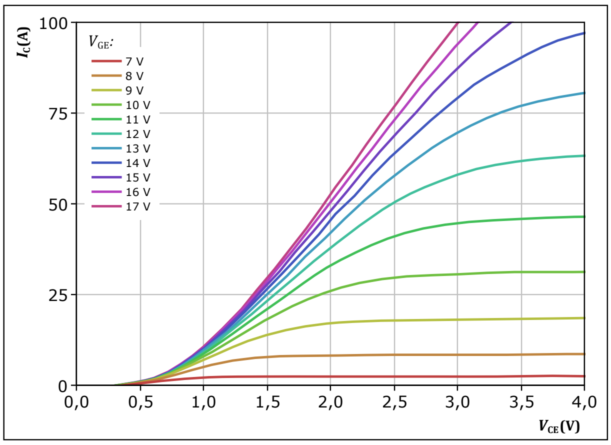


t_p =	250	µs			25 °C
V_{GE} =	15	V		T_j:	125 °C
					150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



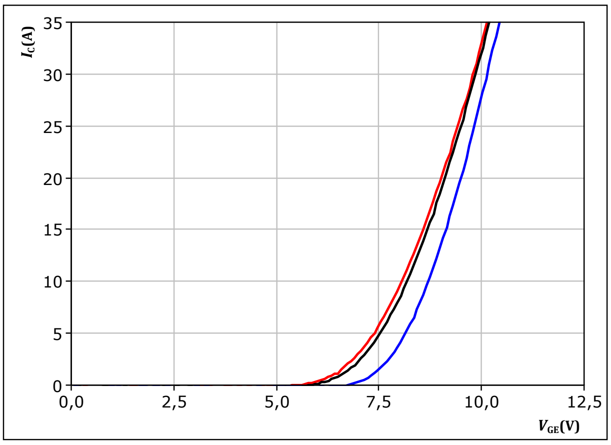
t_p =	250	µs
T_j =	150	°C

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

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

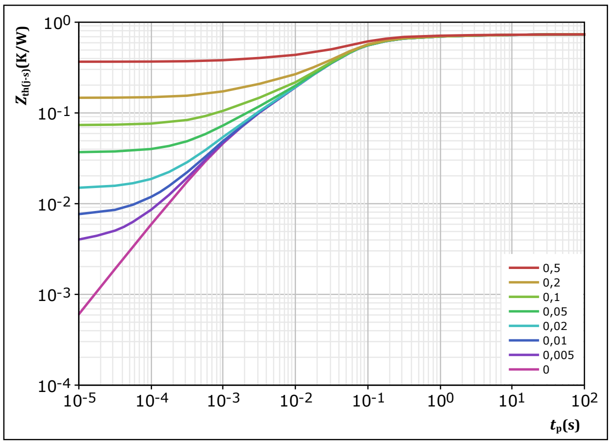


t_p =	250	µs			25 °C
V_{CE} =	10	V		T_j:	125 °C
					150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,734	K/W

IGBT thermal model values

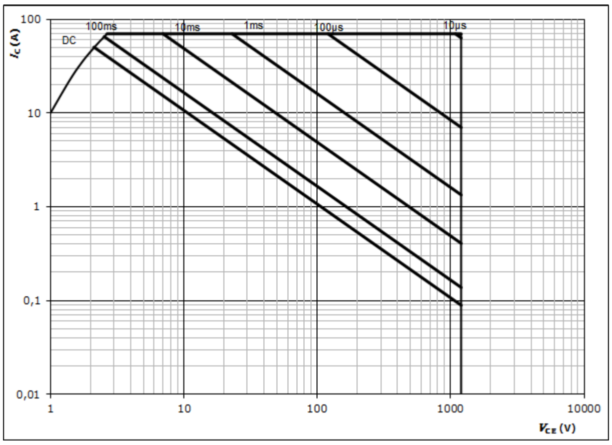
R (K/W)	τ (s)
2,73E-02	8,76E+00
5,12E-02	7,46E-01
1,36E-01	1,33E-01
3,93E-01	4,45E-02
7,33E-02	8,66E-03
4,92E-02	1,33E-03
3,39E-03	6,42E-04

Inverter Switch Characteristics

figure 5.	IGBT

Safe operating area

I_C = f(V_{CE})



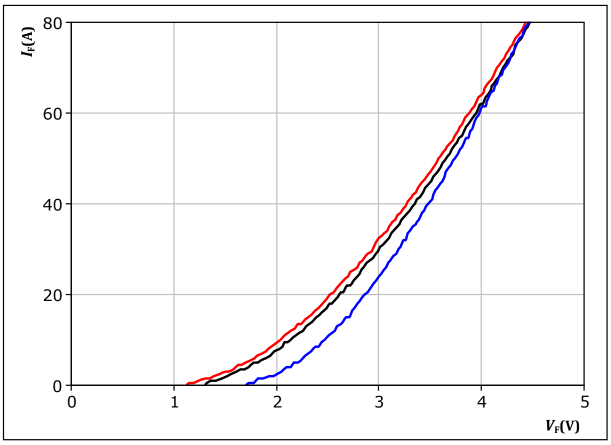
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



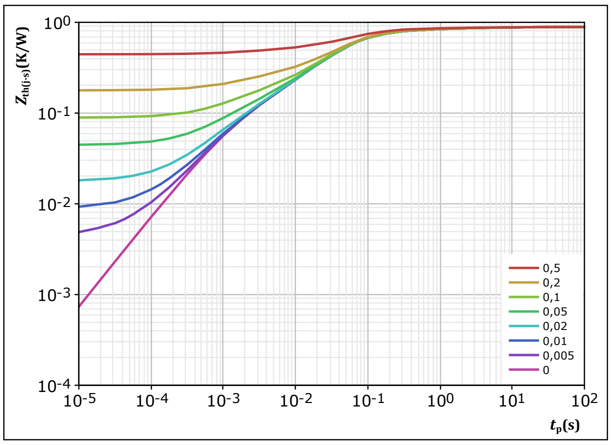
t_p = 250 µs

T_j: 25 °C, 125 °C, 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

$R_{th(j-s)}$ = 0,89 K/W

IGBT thermal model values

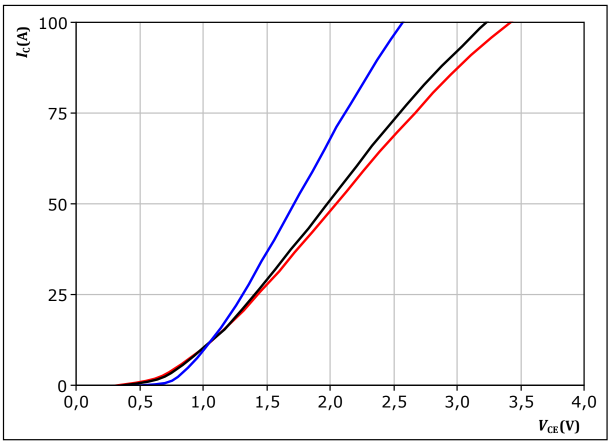
R (K/W)	τ (s)
3,31E-02	8,76E+00
6,21E-02	7,46E-01
1,65E-01	1,33E-01
4,77E-01	4,45E-02
8,89E-02	8,66E-03
5,97E-02	1,33E-03
4,11E-03	6,42E-04

Brake Switch Characteristics

figure 8. IGBT

Typical output characteristics

I_C = f(V_{CE})

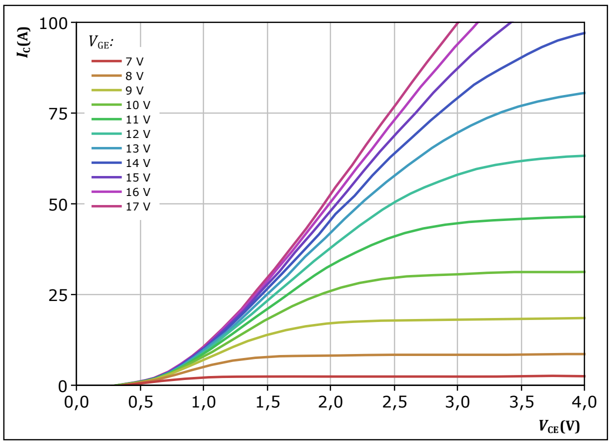


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 9. IGBT

Typical output characteristics

I_C = f(V_{CE})



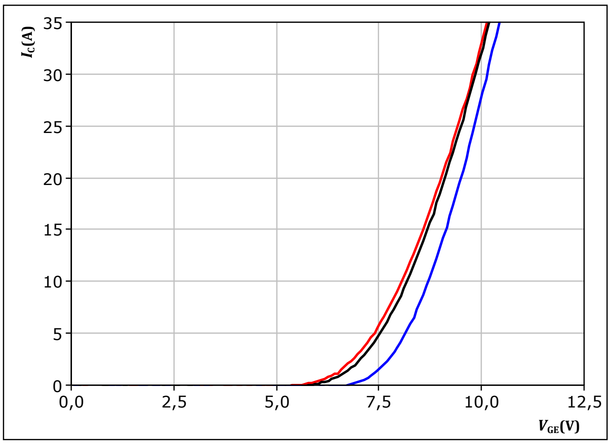
t_p =	250	µs
T_j =	150	°C

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

figure 10. IGBT

Typical transfer characteristics

I_C = f(V_{GE})

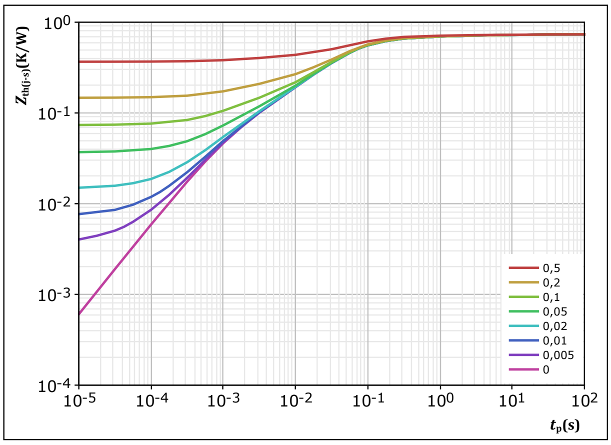


t_p =	250	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 11. IGBT

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,734	K/W

IGBT thermal model values

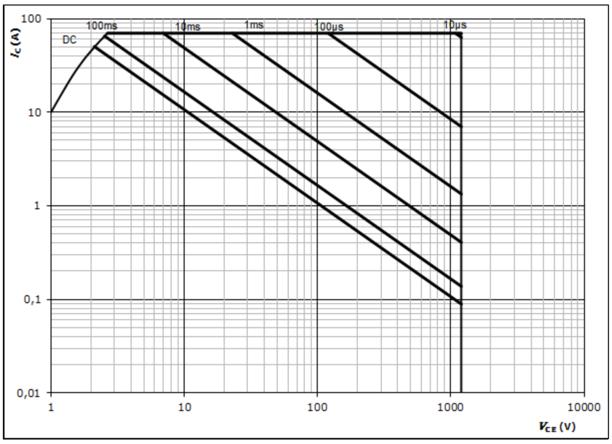
R (K/W)	τ (s)
2,73E-02	8,76E+00
5,12E-02	7,46E-01
1,36E-01	1,33E-01
3,93E-01	4,45E-02
7,33E-02	8,66E-03
4,92E-02	1,33E-03
3,39E-03	6,42E-04

Brake Switch Characteristics

figure 12.	IGBT

Safe operating area

I_C = f(V_{CE})



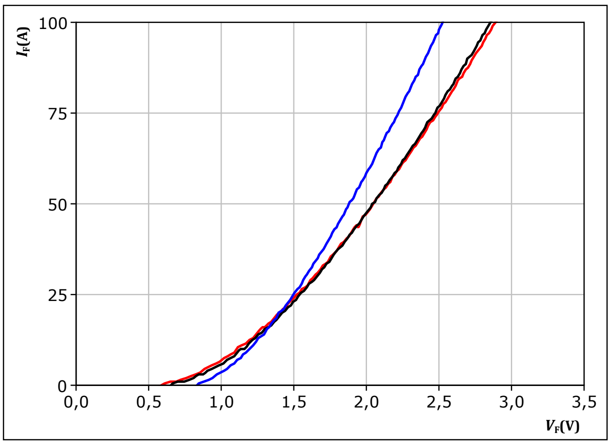
D = single pulse
T_s = 80 °C
V_{GE} = 15 V
T_j = T_{jmax}

Brake Diode Characteristics

figure 13. **FWD**

Typical forward characteristics

I_F = f(V_F)



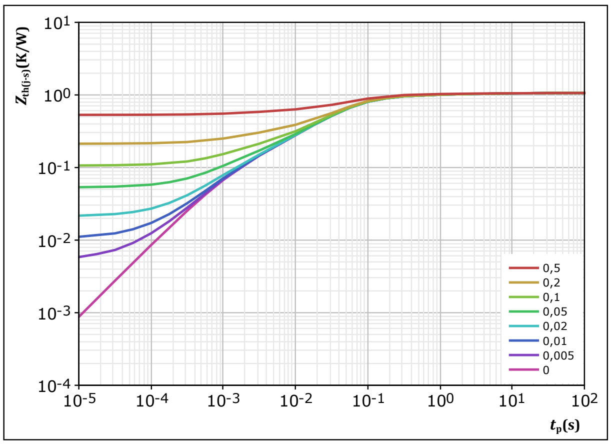
t_p = 250 µs

T_j: 25 °C, 125 °C, 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

$R_{th(j-s)}$ = 1,064 K/W

IGBT thermal model values

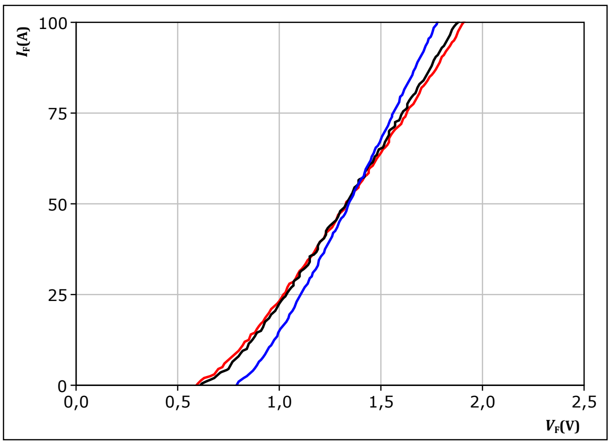
R (K/W)	τ (s)
3,96E-02	8,76E+00
7,42E-02	7,46E-01
1,97E-01	1,33E-01
5,70E-01	4,45E-02
1,06E-01	8,66E-03
7,13E-02	1,33E-03
4,92E-03	6,42E-04

Rectifier Diode Characteristics

figure 15. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



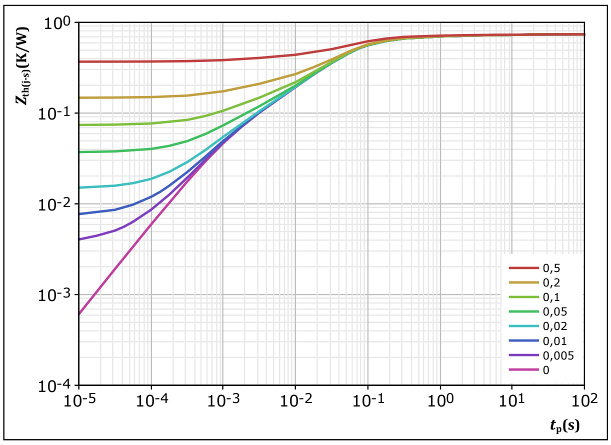
t_p = 250 μs

T_j: 25 °C, 125 °C, 150 °C

figure 16. **Rectifier**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,738 K/W

IGBT thermal model values

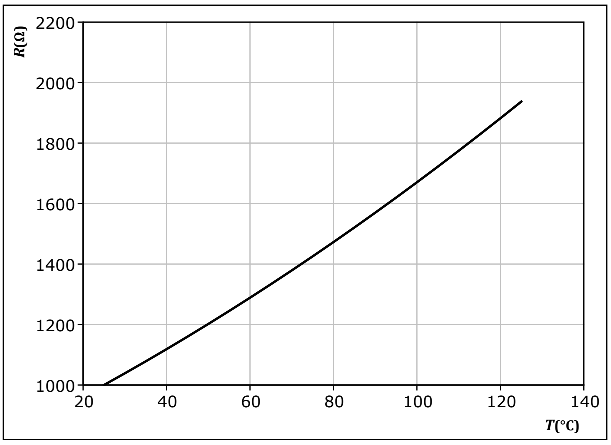
R (K/W)	τ (s)
2,75E-02	8,76E+00
5,15E-02	7,46E-01
1,37E-01	1,33E-01
3,96E-01	4,45E-02
7,37E-02	8,66E-03
4,95E-02	1,33E-03
3,41E-03	6,42E-04

Thermistor Characteristics

figure 17.	Thermistor

Typical PTC characteristic as function of temperature

R_T = f(T)

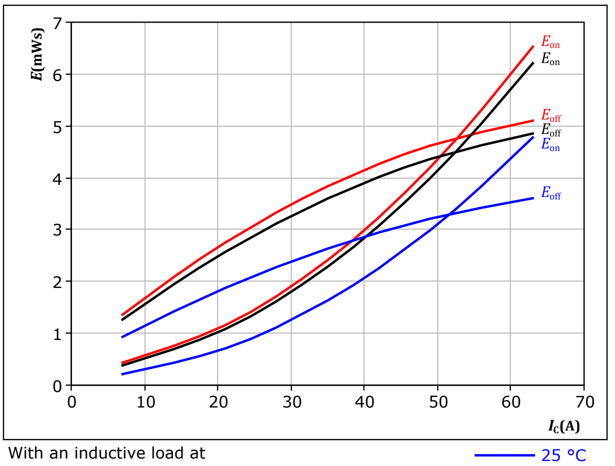


Inverter Switching Characteristics

figure 18. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



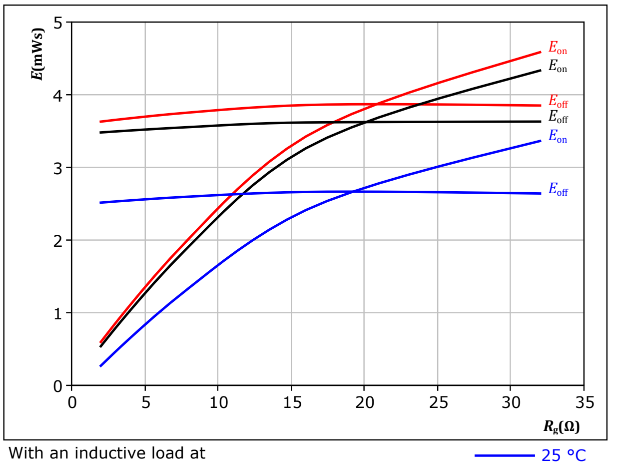
With an inductive load at

V_{CE} =	600	V	T_j: 25 °C / 125 °C / 150 °C
V_{GE} =	±15	V	
R_{gon} =	8	Ω	
R_{goff} =	8	Ω	

figure 19. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



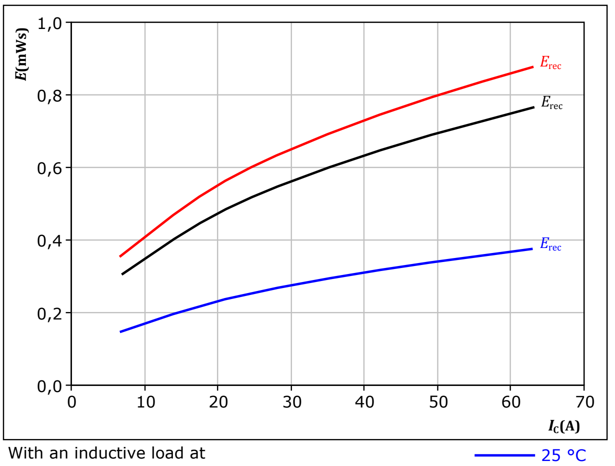
With an inductive load at

V_{CE} =	600	V	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

$E_{rec} = f(I_C)$



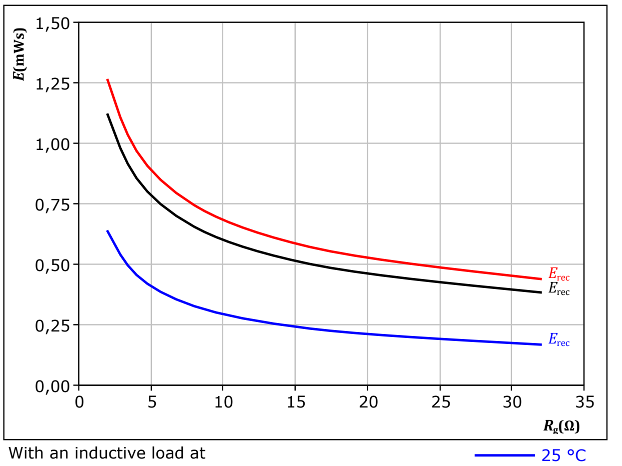
With an inductive load at

V_{CE} =	600	V	T_j: 25 °C / 125 °C / 150 °C
V_{GE} =	±15	V	
R_{gon} =	8	Ω	

figure 21. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

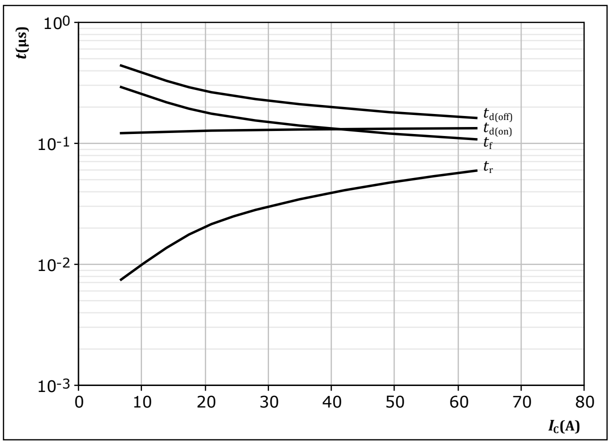
V_{CE} =	600	V	T_j: 25 °C / 125 °C / 150 °C
V_{GE} =	±15	V	
I_C =	35	A	

Inverter Switching Characteristics

figure 22. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



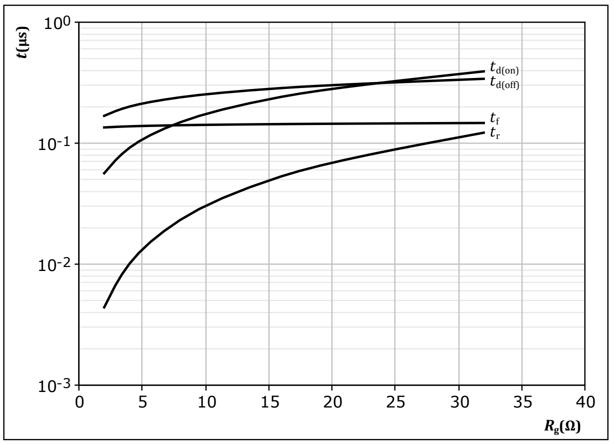
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 23. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



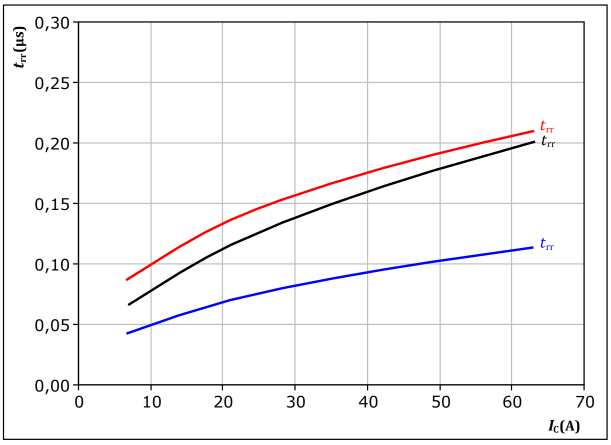
With an inductive load at

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

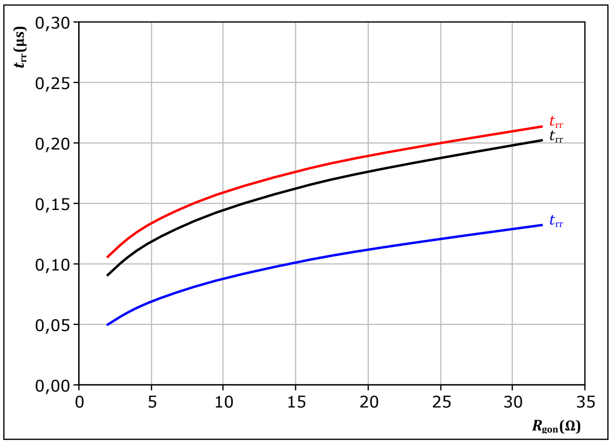
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

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

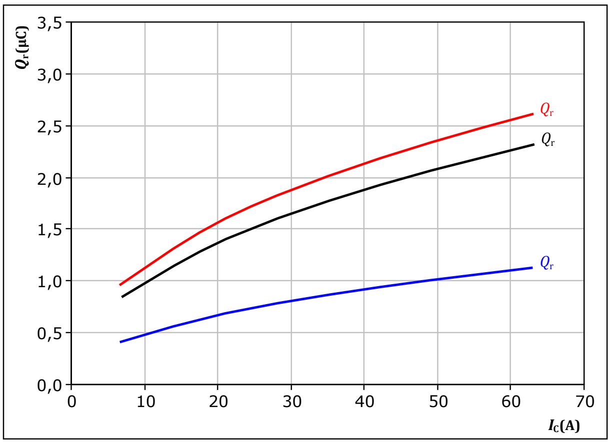
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 26. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



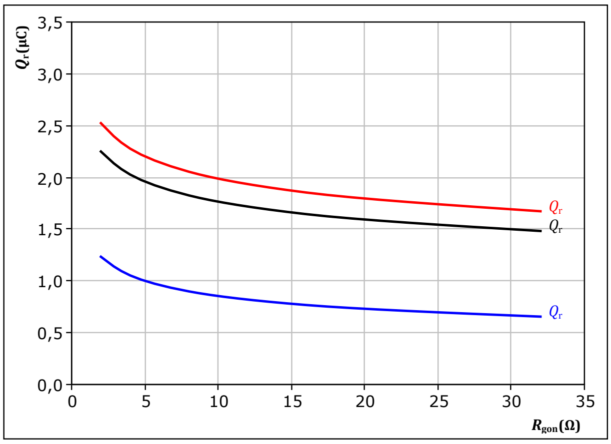
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 27. **FWD**

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



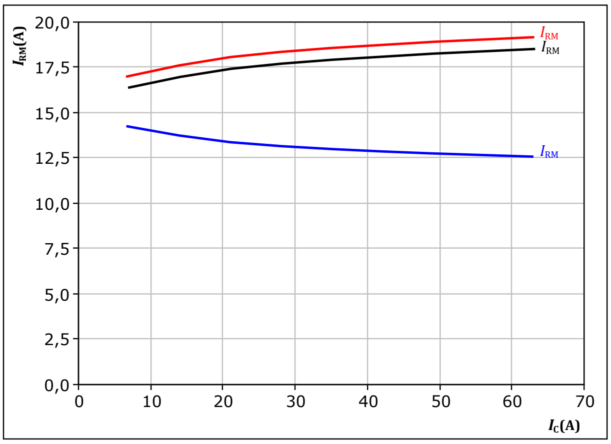
With an inductive load at

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)



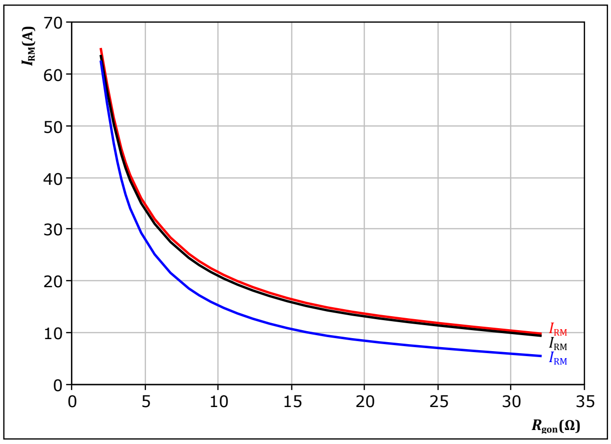
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 29. **FWD**

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

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



With an inductive load at

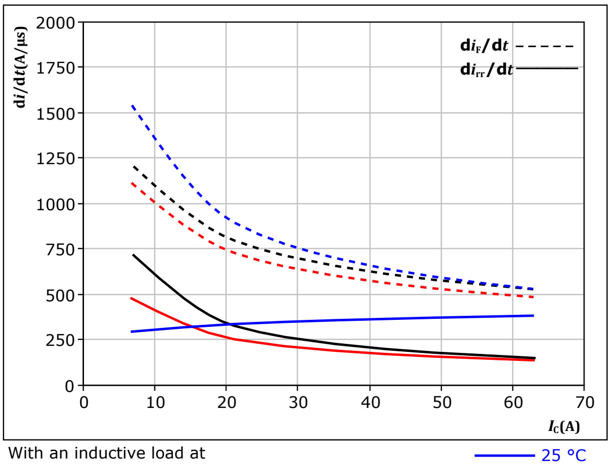
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

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)



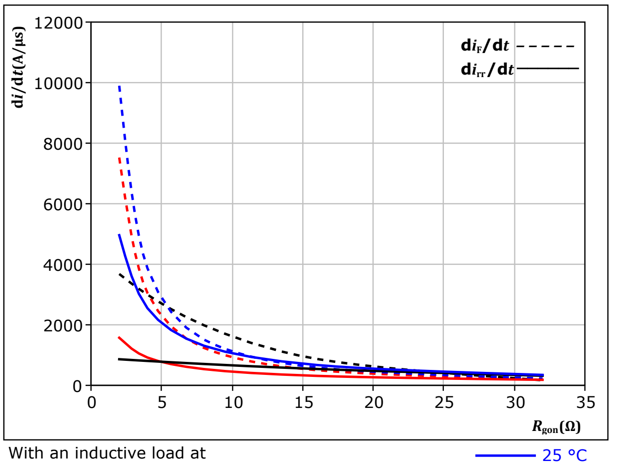
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		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})



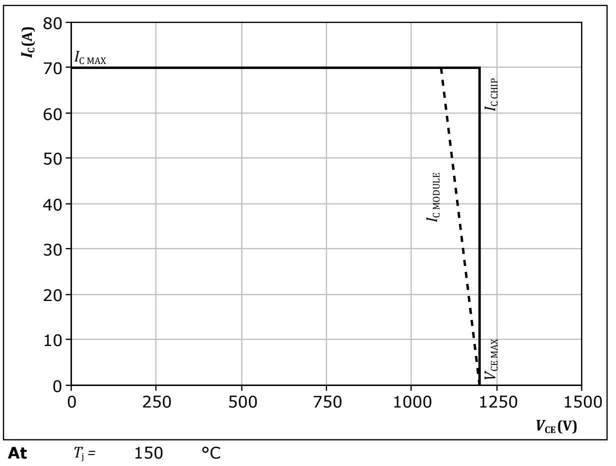
With an inductive load at

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

figure 32. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



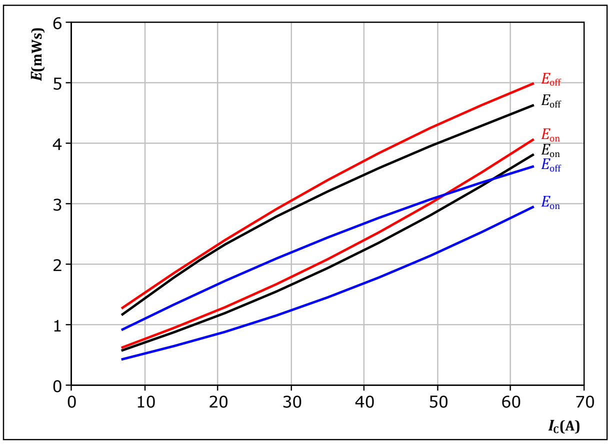
At	T_j =	150	°C
	R_{gon} =	8	Ω
	R_{goff} =	8	Ω

Brake Switching Characteristics

figure 33. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



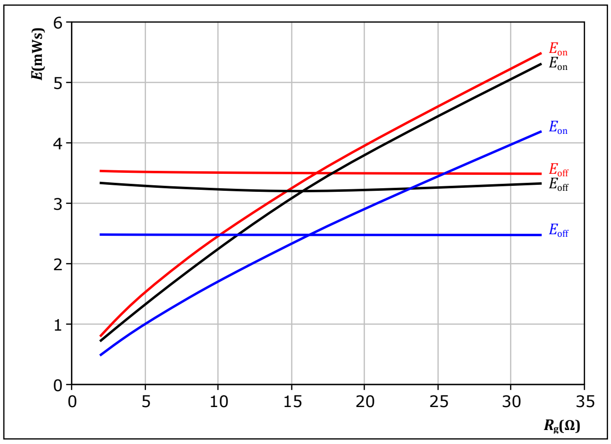
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C
R_{goff} =	8	Ω		

figure 34. **IGBT**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



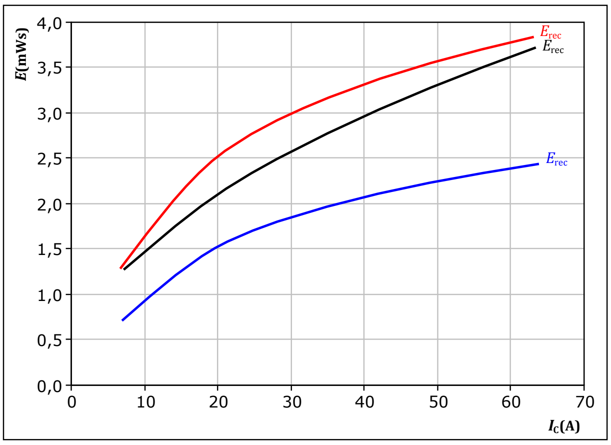
With an inductive load at

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

figure 35. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



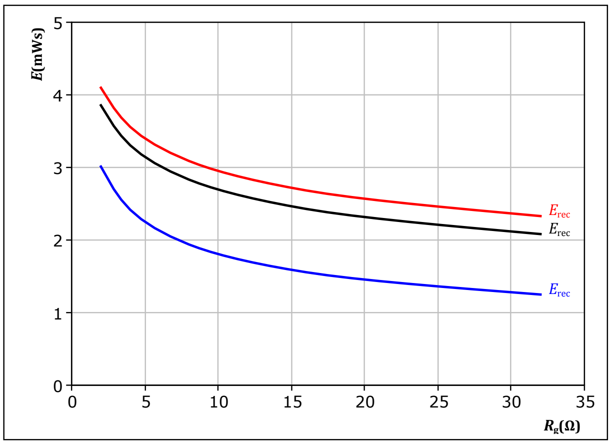
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 36. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

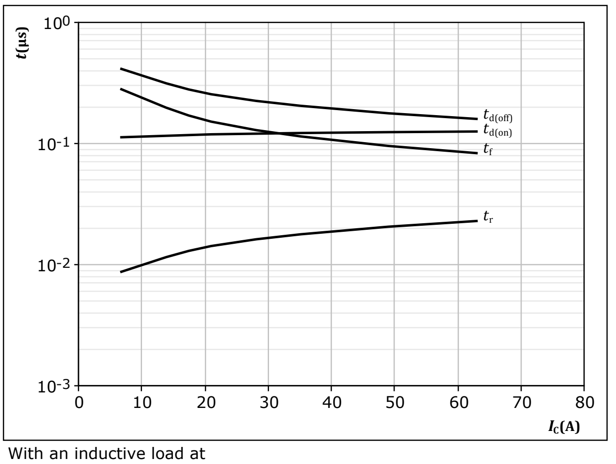
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

Brake Switching Characteristics

figure 37. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



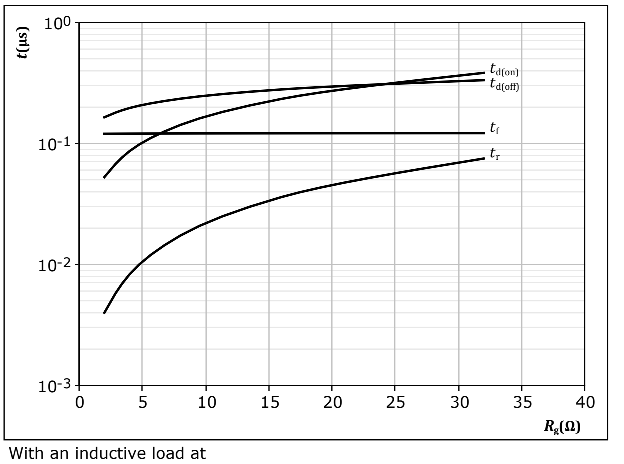
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 38. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



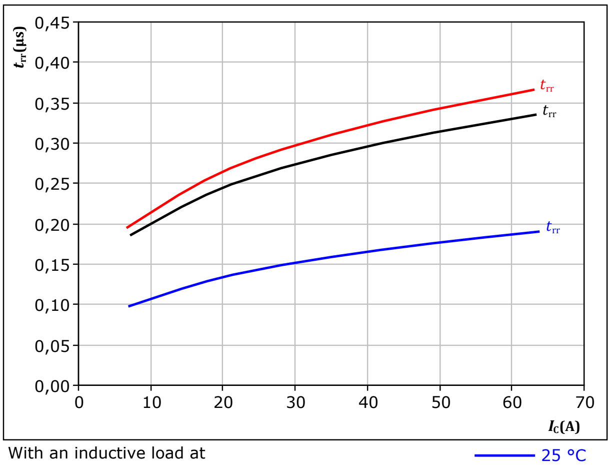
With an inductive load at

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

figure 39. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

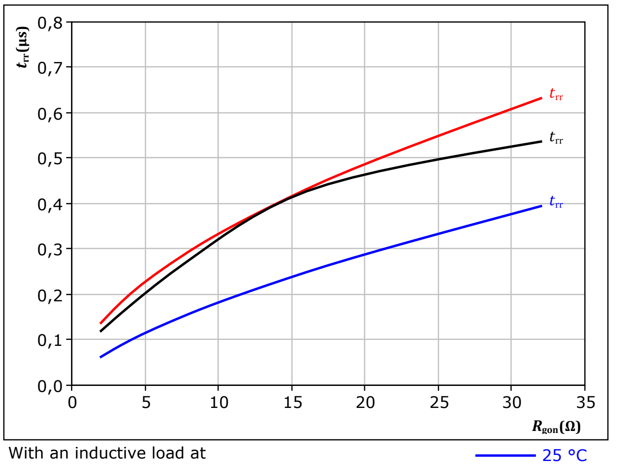
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

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} =	600	V
V_{GE} =	±15	V
I_C =	35	A

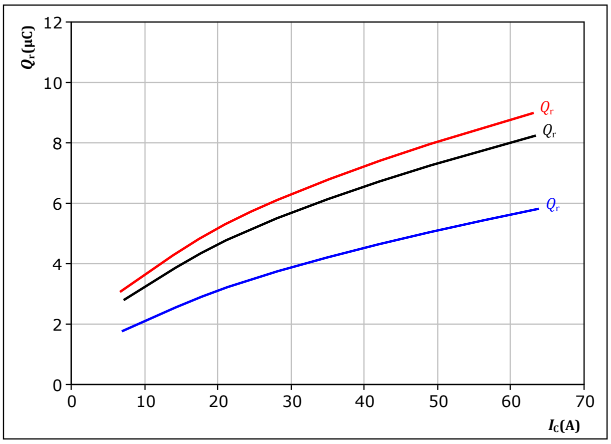
T_j: 25 °C, 125 °C, 150 °C

Brake Switching Characteristics

figure 41. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



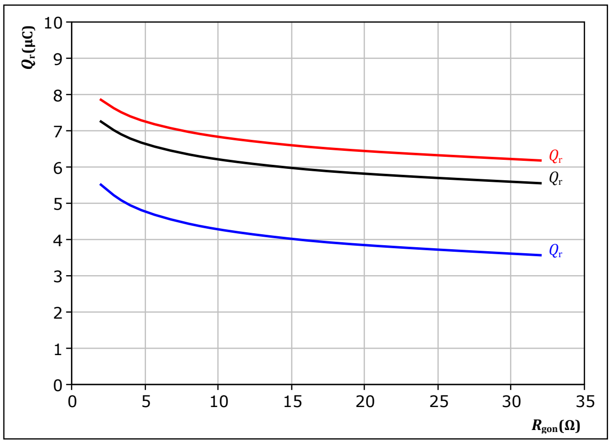
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 42. **FWD**

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



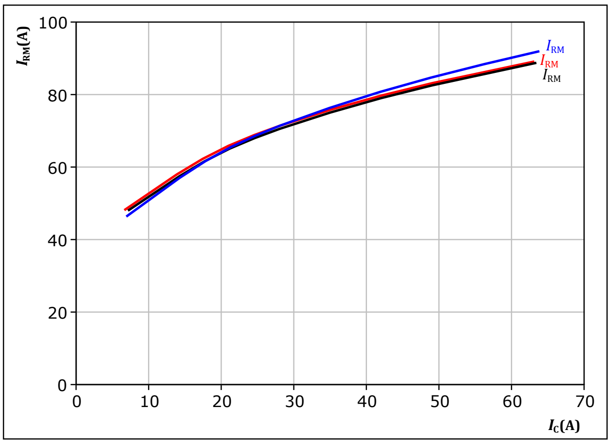
With an inductive load at

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

figure 43. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



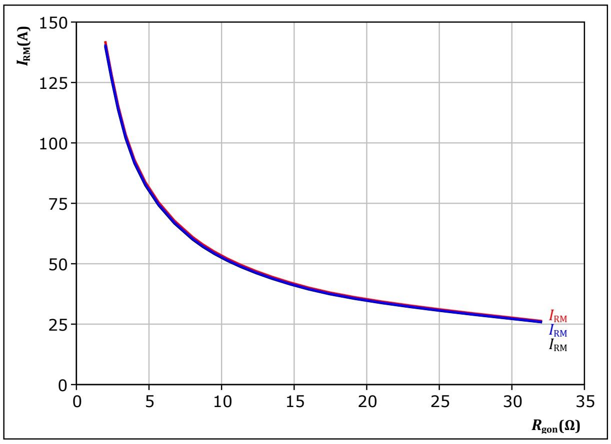
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	Ω		150 °C

figure 44. **FWD**

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

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



With an inductive load at

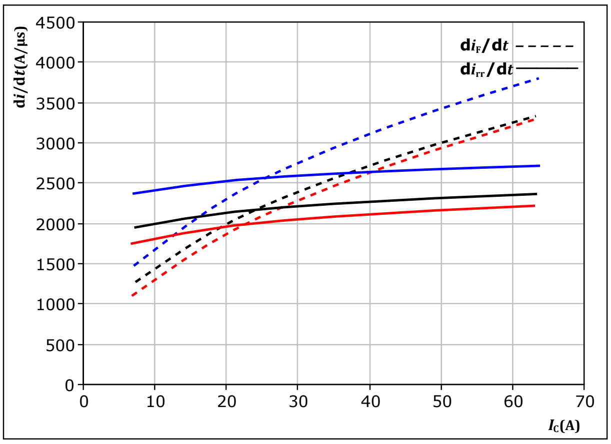
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

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)



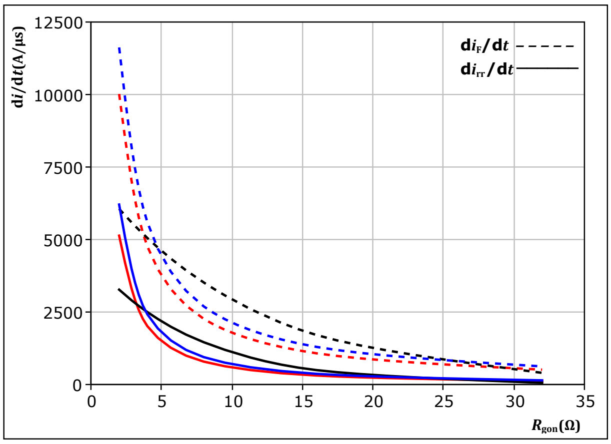
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	8	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})



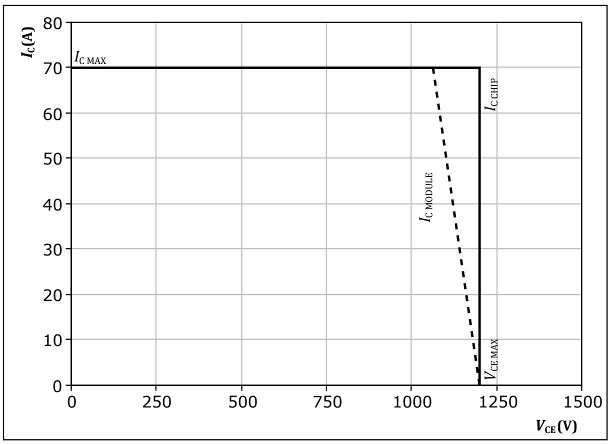
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±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} =	8	Ω
	R_{goff} =	8	Ω

Switching Definitions

figure 48. **IGBT**

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

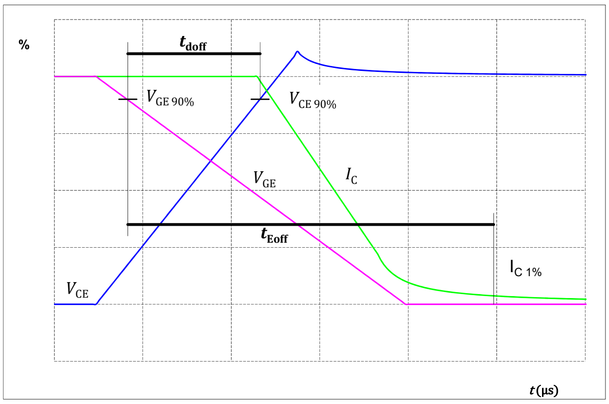


figure 49. **IGBT**

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

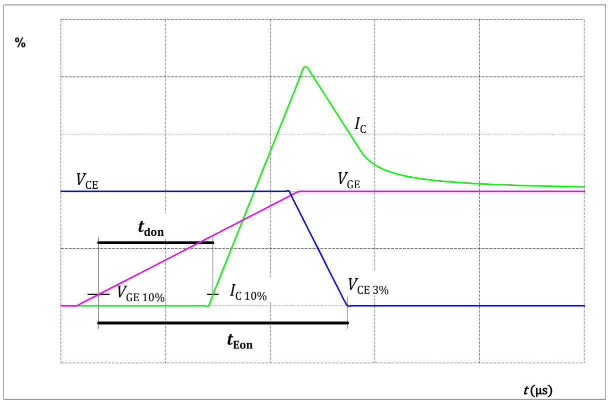


figure 50. **IGBT**

Turn-off Switching Waveforms & definition of t_f

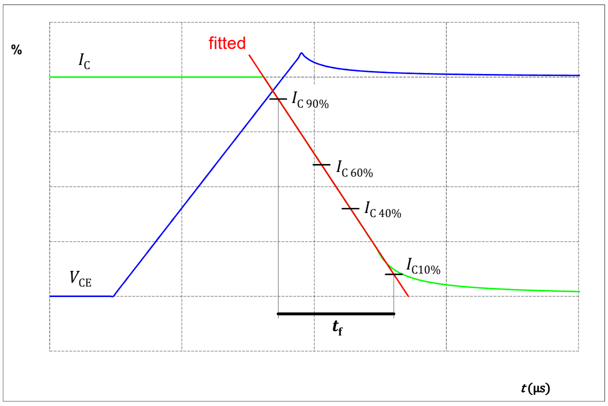
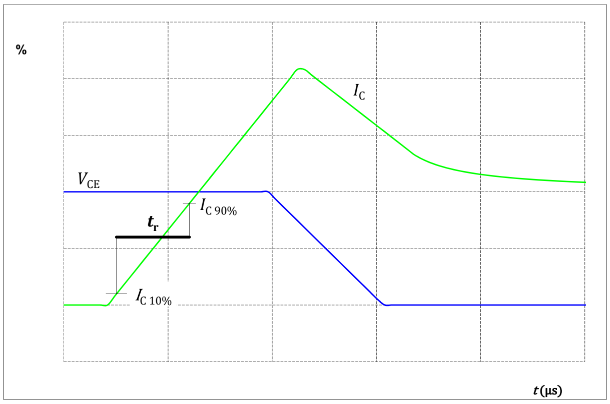


figure 51. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 52. **FWD**

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

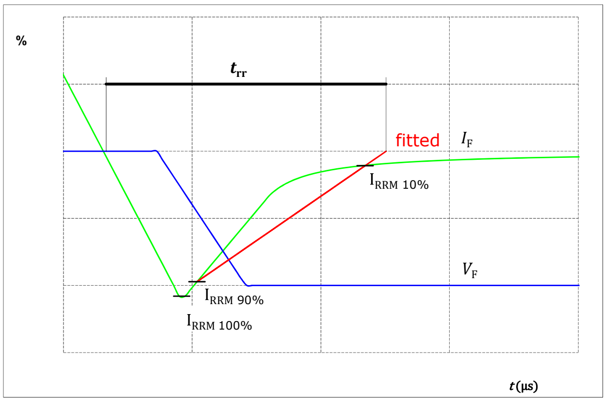
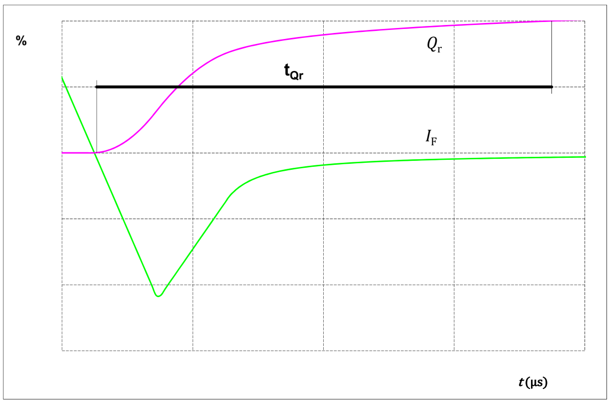


figure 53. **FWD**

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



Ordering Code

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M212PMA035M731-K220A72-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M212PMA035M731-K220A72-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M212PMA035M731-K220A72-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M212PMA035M731-K220A72-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M212PMA035M731-K220A72-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M212PMA035M731-K220A72-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M212PMA035M731-K220A72-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M212PMA035M731-K220A72-/5B/

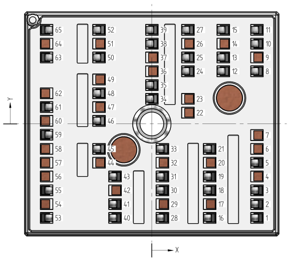
Marking

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

Outline

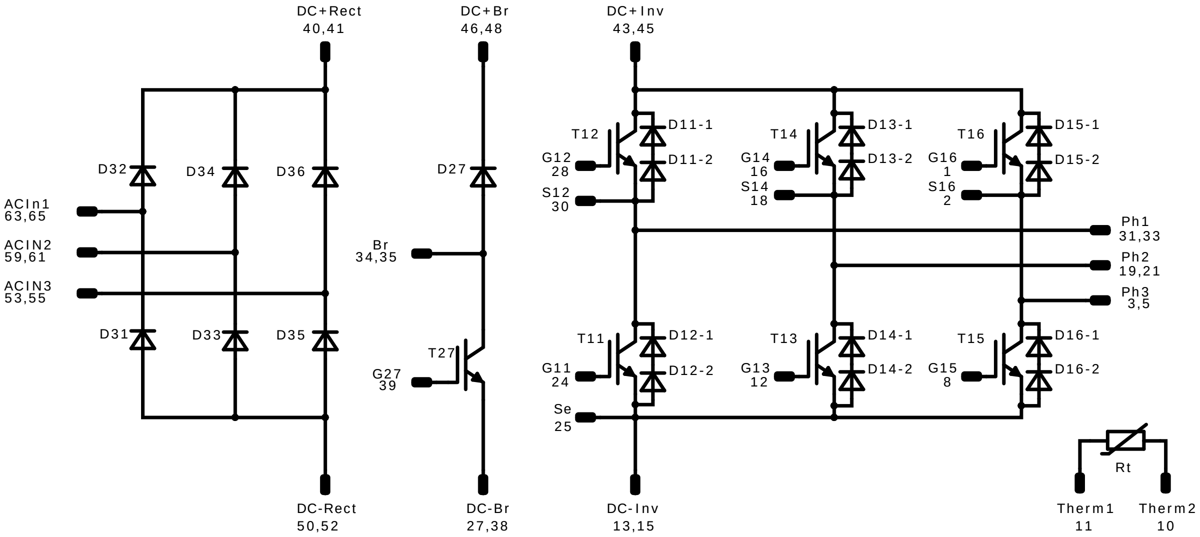
Pin table [mm]

Pin	X	Y	Function	Pin	X	Y	Function
				34	0,03	5,8	Br
1	24,38	-21,8	G16	35	0,03	9	Br
2	24,38	-18,6	S16	36	not assembled		
3	24,38	-15,4	Ph3	37	not assembled		
4	not assembled			38	0,03	18,6	DC-Br
5	24,38	-9	Ph3	39	0,03	21,8	G27
6	not assembled			40	-8,5	-21,8	DC+Rect
7	not assembled			41	-8,5	-18,6	DC+Rect
8	24,38	12,2	G15	42	not assembled		
9	not assembled			43	-8,5	-12,2	DC+Inv
10	24,38	18,6	Therm2	44	not assembled		
11	24,38	21,8	Therm1	45	-12,22	-5,8	DC+Inv
12	16,58	12,2	G13	46	-12,22	0,7	DC+Br
13	16,58	15,4	DC-Inv	47	not assembled		
14	not assembled			48	-12,22	7,1	DC+Br
15	16,58	21,8	DC-Inv	49	not assembled		
16	13,42	-21,8	G14	50	-12,22	15,4	DC-Rect
17	not assembled			51	not assembled		
18	13,42	-15,4	S14	52	-12,22	21,8	DC-Rect
19	13,42	-12,2	Ph2	53	-24,38	-21,8	ACIn3
20	not assembled			54	not assembled		
21	13,42	-5,8	Ph2	55	-24,38	-15,4	ACIn3
22	not assembled			56	not assembled		
23	not assembled			57	not assembled		
24	8,38	12,2	G11	58	not assembled		
25	8,38	15,4	Se	59	-24,38	-2,5	ACIn2
26	not assembled			60	not assembled		
27	8,38	21,8	DC-Br	61	-24,38	3,9	ACIn2
28	2,46	-21,8	G12	62	not assembled		
29	not assembled			63	-24,38	15,4	ACIn1
30	2,46	-15,4	S12	64	not assembled		
31	2,46	-12,2	Ph1	65	-24,38	21,8	ACIn1
32	not assembled						
33	2,46	-5,8	Ph1				



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

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	35 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1300 V	30 A	Inverter Diode	
T27	IGBT	1200 V	35 A	Brake Switch	
D27	FWD	1200 V	35 A	Brake Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	40 A	Rectifier Diode	
Rt	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 72	>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.

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-M212PMA035M731-K220A72-D1-14	3 Dec. 2019		
80-M212PMA035M731-K220A72-D2-14	16 Jul. 2020	/3A/ and /3B/ removed from option code	28