Vincotech

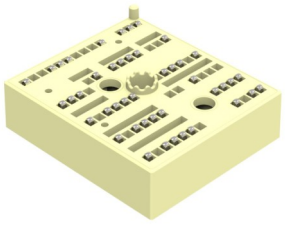
80-M212WPA035SC-K389F
datasheet

MiniSKiiP®PACK 2 **1200 V / 35 A**

Features

- Twin sixpack configuration for 4Q inverters
- Trench IGBT4 Technology
- Solderless spring contact mounting system

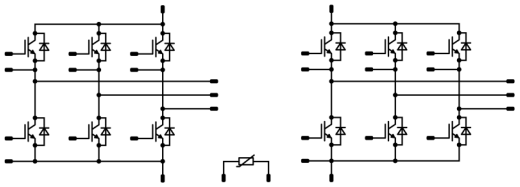
MiniSkiip®2 housing



Target applications

- Industrial Drives

Schematic



Types

- 80-M212WPA035SC-K389F

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Switch (T11-T16)				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	T_j = T_{jmax} T_s = 80 °C	35	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	75	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	113	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	T_j ≤ 150 °C V_{GE} = 15 V Vcc = 800 V	10	µs
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Diode (D11-D16)				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	31	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	100	A
Surge current capability	I^2t		50	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	81	W
Maximum junction temperature	T_{jmax}		175	°C
Inverter Switch (T21-T26)				
Collector-emitter voltage	V_{CES}		1200	V
Collector 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}	$T_j \leq$ 150 °C V_{GE} = 15 V V_{CC} = 800 V	10	µs
Maximum junction temperature	T_{jmax}		175	°C
Inverter Diode (D21-D26)				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	40	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz 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

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	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
		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		> 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			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 (T11-T16)										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,00085	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125 150	1,58	1,82 2,11 2,18	2,07	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			2,4	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		1450		pF
Reverse transfer capacitance	C_{res}							50		
Gate charge	Q_g		-15/15			25		200		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,84		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	600	25	25 150		71 72		ns
Rise time	t_r					25 150		32 36		
Turn-off delay time	$t_{d(off)}$					25 150		199 270		
Fall time	t_f					25 150		90 135		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 1,5 µC Q_{rFWD} = 3,9 µC				25 150		1,61 2,46		mWs
Turn-off energy (per pulse)	E_{off}					25 150		1,53 2,50		

Characteristic Values

Parameter	Symbol	Conditions					Value			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 (D11-D16)										
Static										
Forward voltage	V_F				25	25 125 150		2,27 2,44 2,36	2,74	V
Reverse leakage current	I_R			1200		25 150			60 3300	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						1,17		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 690,487 A/µs di/dt = 577,762 A/µs	±15	600	25	25 150		12 17		A
Reverse recovery time	t_{rr}					25 150		277 580		ns
Recovered charge	Q_r					25 150		1,55 3,88		µC
Reverse recovered energy	E_{rec}					25 150		0,61 1,63		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		111 89		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Value			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 (T21-T26)										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0012	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		35	25 150	1,58	1,87 2,30	2,07	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}							70		
Gate charge	Q_g		-15/15			25		270		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	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		311 298 294		ns
Rise time	t_r					25 125 150		131 140 140		
Turn-off delay time	$t_{d(off)}$					25 125 150		208 269 286		
Fall time	t_f					25 125 150		73 136 150		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 2 µC Q_{rFWD} = 4,2 µC Q_{rFWD} = 5,2 µC				25 125 150		3,87 5,27 5,86		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,94 3,20 3,52		

Characteristic Values

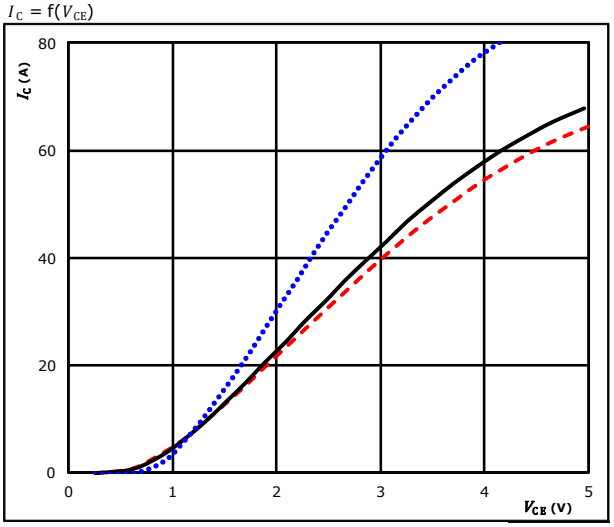
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode (D21-D26)										
Static										
Forward voltage	V_F				35	25 150		2,37 2,35	2,62	V
Reverse leakage current	I_R			1200		25 150			60 5500	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 2,5 W/mK (HPTP)						0,96		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 213 A/µs di/dt = 196 A/µs di/dt = 223 A/µs	±15	600	35	25 125 150		12 16 17		A
Reverse recovery time	t_{rr}					25 125 150		344 514 625		ns
Recovered charge	Q_r					25 125 150		2,01 4,21 5,25		µC
Reverse recovered energy	E_{rec}					25 125 150		0,76 1,66 2,07		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		126 64 65		A/µs
Thermistor										
Rated resistance	R					25		1		kΩ
Deviation of R_{100}	$\Delta R/R$	R_{100} = 1670 Ω				100	-2		+2	%
R_{100}	R					100		1670		Ω
Power dissipation constant						25		0,76		mW/K
A-value	$A_{(25/50)}$					25		$7,635*10^{-3}$		1/K
B-value	$B_{(25/100)}$					25		$1,731*10^{-5}$		1/K²
Vincotech PTC Reference									E	

Inverter Switch (T11-T16) Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

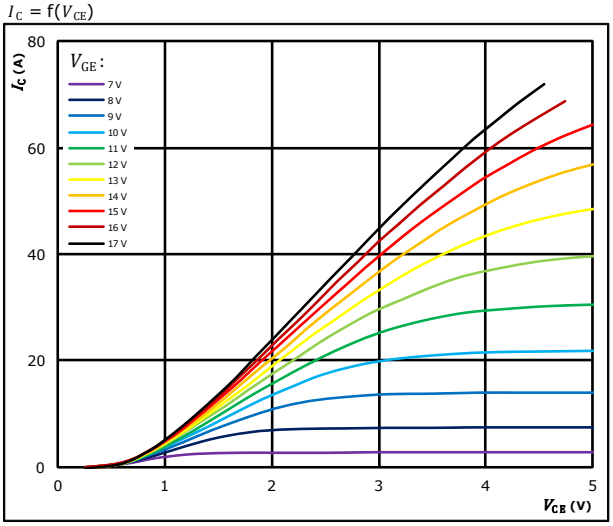


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

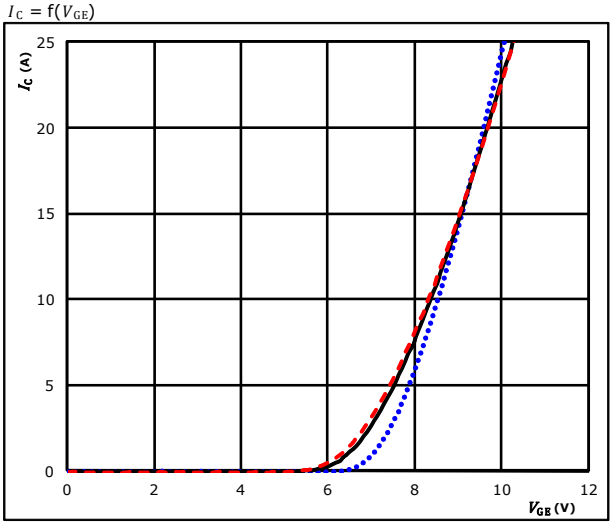


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

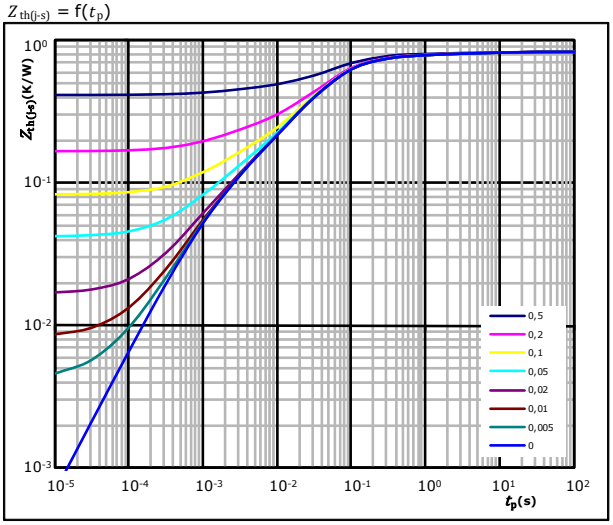


t_p =	100	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,84	K/W

IGBT thermal model values

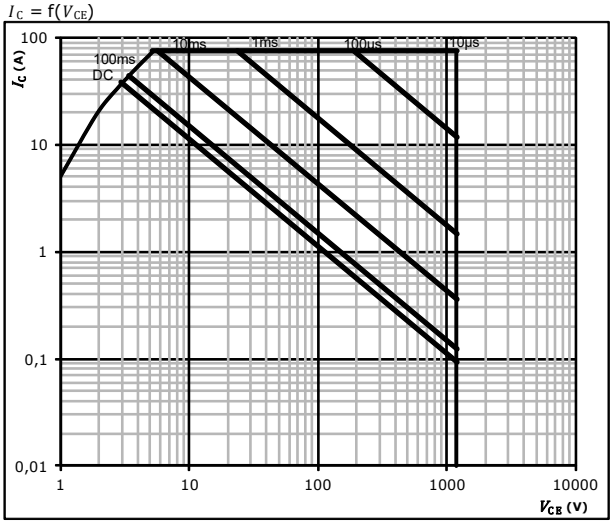
R (K/W)	τ (s)
3,13E-02	6,26E+00
5,86E-02	5,33E-01
1,55E-01	9,52E-02
4,50E-01	3,18E-02
8,39E-02	6,19E-03
5,63E-02	9,50E-04
3,88E-03	4,59E-04

Inverter Switch (T11-T16) Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



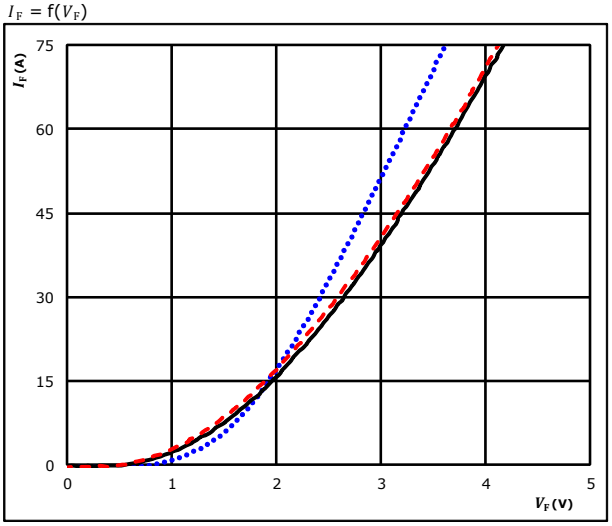
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter Diode (D11-D16) Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



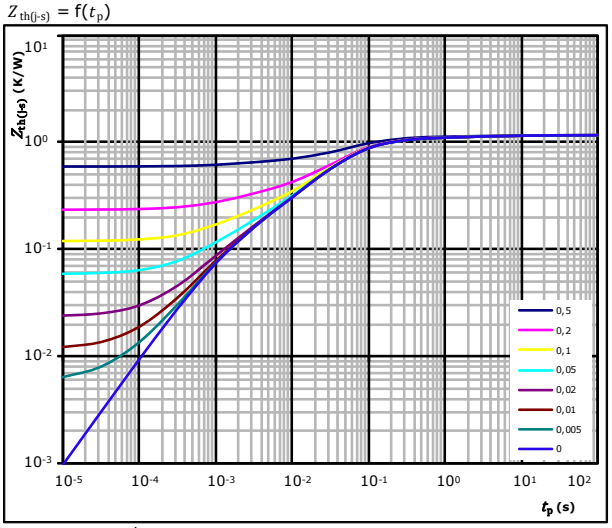
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,17 K/W

FWD thermal model values

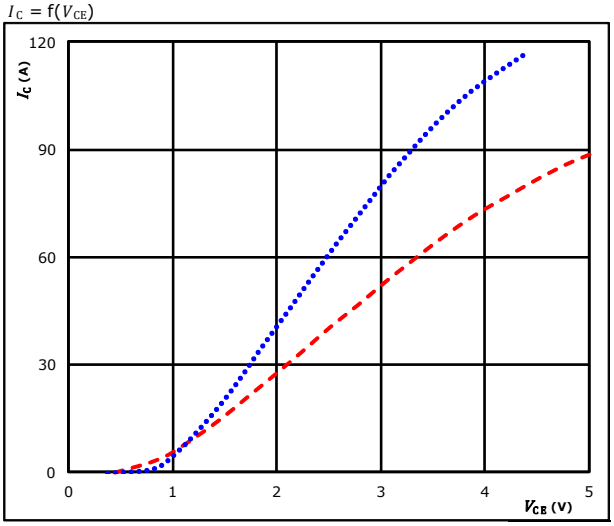
R (K/W)	τ (s)
4,37E-02	8,75E+00
8,19E-02	7,45E-01
2,17E-01	1,33E-01
6,29E-01	4,45E-02
1,17E-01	8,65E-03
7,87E-02	1,33E-03
5,43E-03	6,41E-04

Inverter Switch (T21-T26) Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

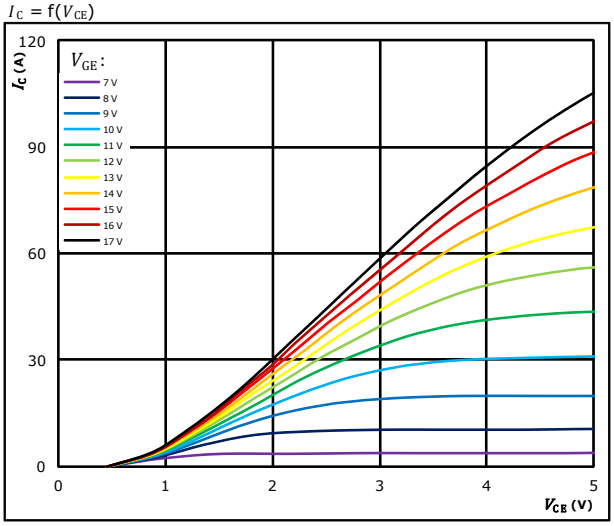


t_p =	250	µs	T_j:	25 °C	·····
V_{GE} =	15	V		150 °C	— — —

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

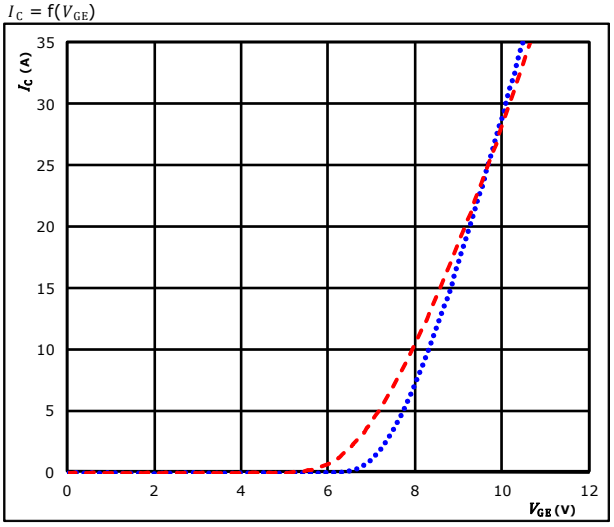


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

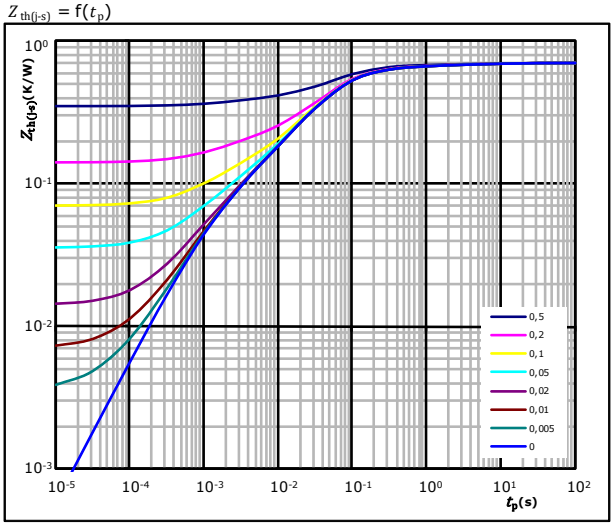


t_p =	100	µs	T_j:	25 °C	·····
V_{CE} =	10	V		150 °C	— — —

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,71	K/W

IGBT thermal model values

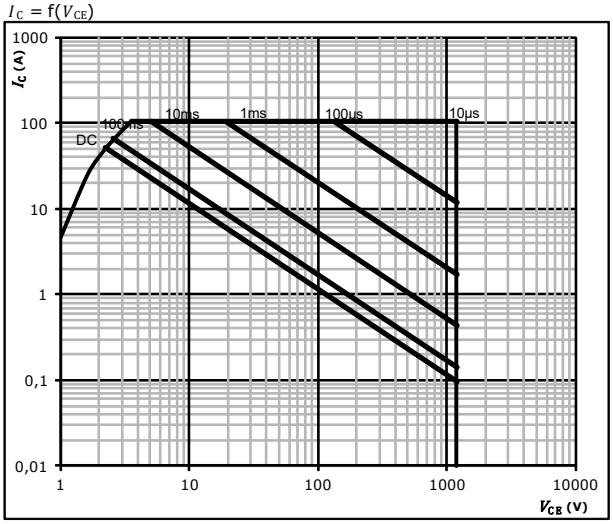
R (K/W)	τ (s)
2,63E-02	5,27E+00
4,93E-02	4,49E-01
1,31E-01	8,01E-02
3,79E-01	2,68E-02
7,06E-02	5,21E-03
4,74E-02	8,00E-04
3,27E-03	3,86E-04

Inverter Switch (T21-T26) Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



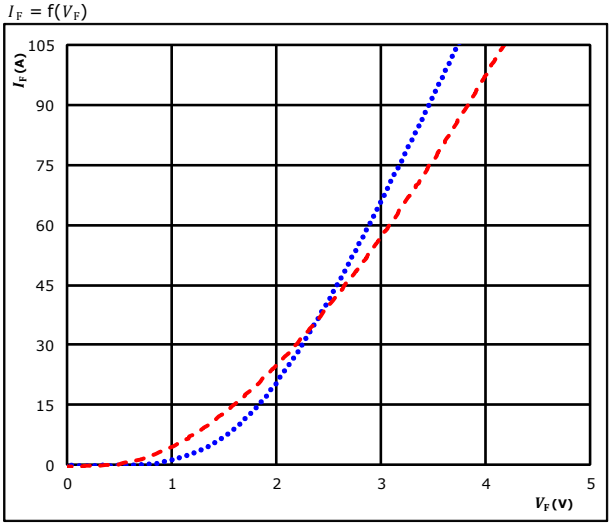
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter Diode (D21-D26) Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



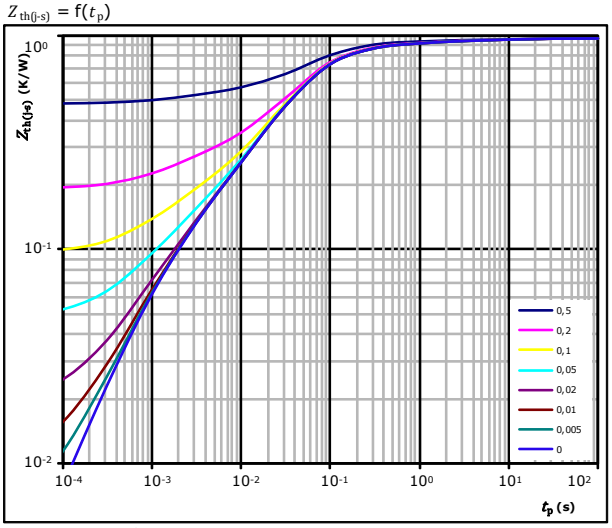
t_p = 250 µs

T_j: 25 °C, 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,96 K/W

FWD thermal model values

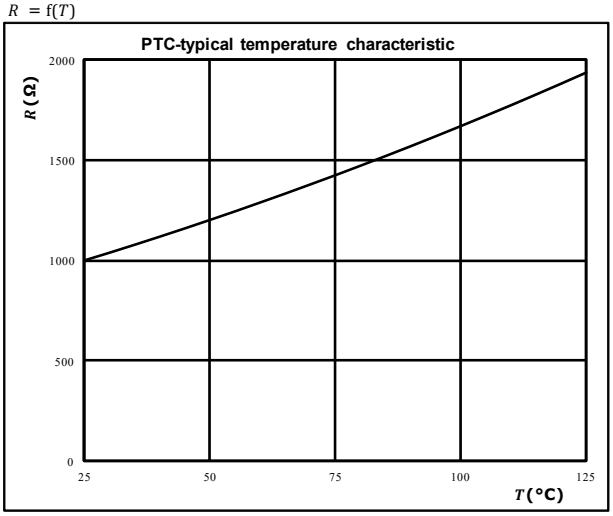
R (K/W)	τ (s)
3,58E-02	7,17E+00
6,71E-02	6,11E-01
1,78E-01	1,09E-01
5,16E-01	3,64E-02
9,61E-02	7,09E-03
6,45E-02	1,09E-03
4,45E-03	5,25E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical PTC characteristic
as a function of temperature

$R = f(T)$

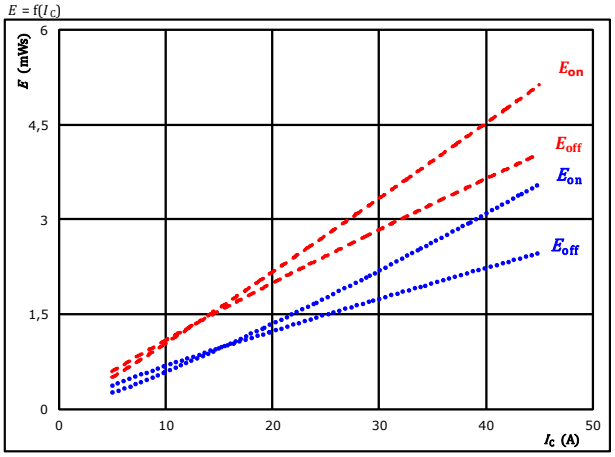


Inverter (T11-T16, D11-D16) Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

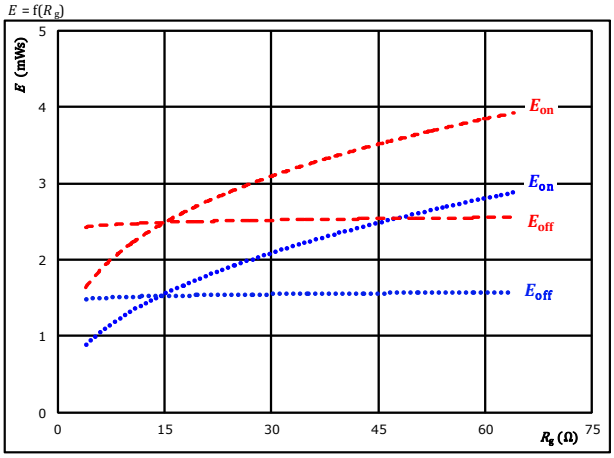
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

T_j: 25 °C, 150 °C

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



With an inductive load at

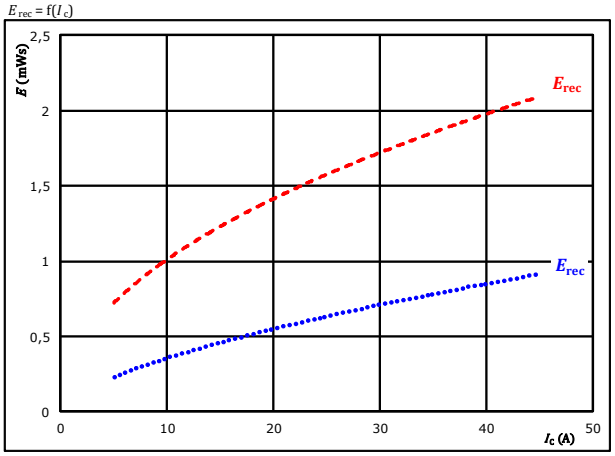
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	25	A

T_j: 25 °C, 150 °C

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



With an inductive load at

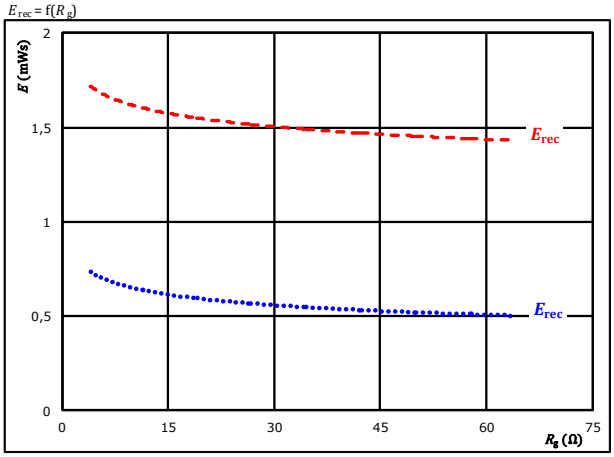
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j: 25 °C, 150 °C

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	25	A

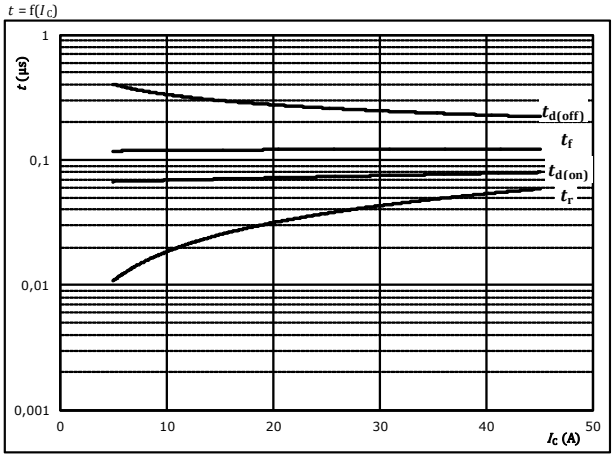
T_j: 25 °C, 150 °C

Inverter (T11-T16, D11-D16) Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



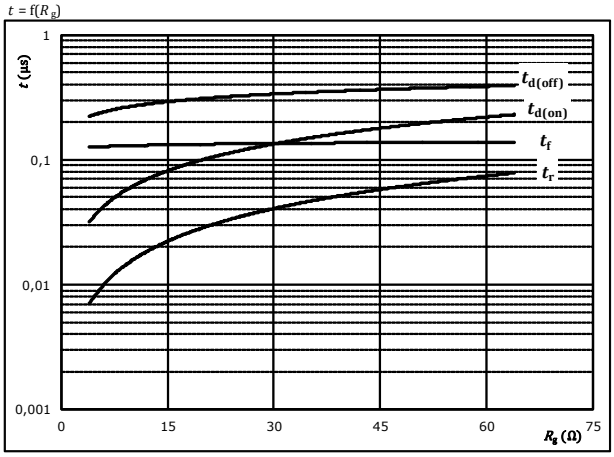
With an inductive load at

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

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



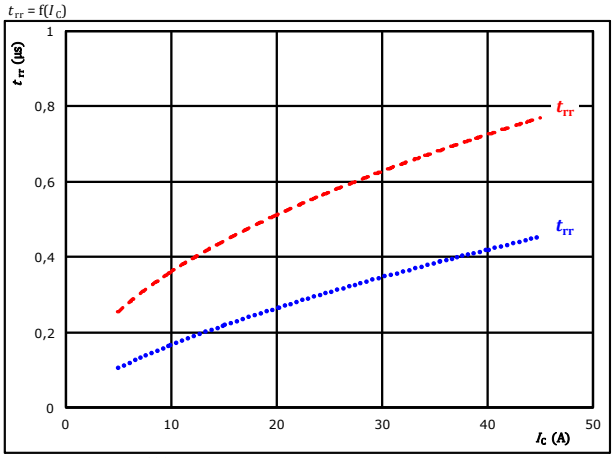
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



At

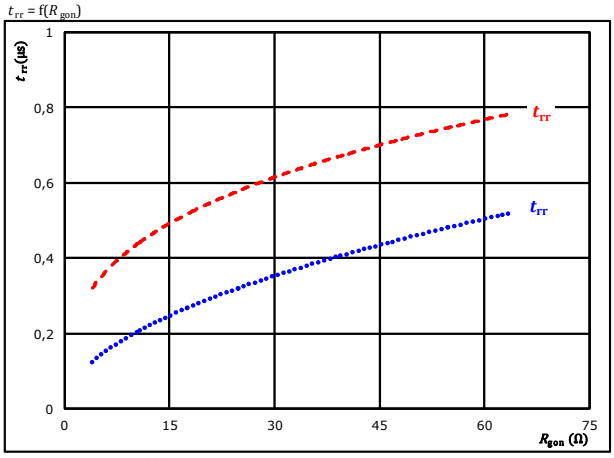
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j: 25 °C, 150 °C

figure 8. **FWD**

Typical reverse recovery time as a function of IGBT turn on gate resistor

$t_{rr} = f(R_{gon})$



At

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	25	A

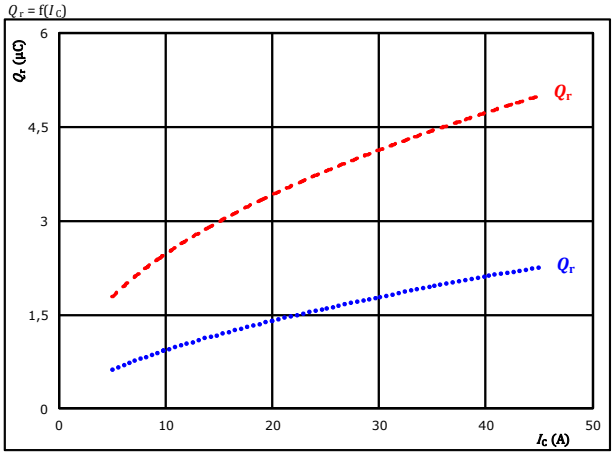
T_j: 25 °C, 150 °C

Inverter (T11-T16, D11-D16) Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

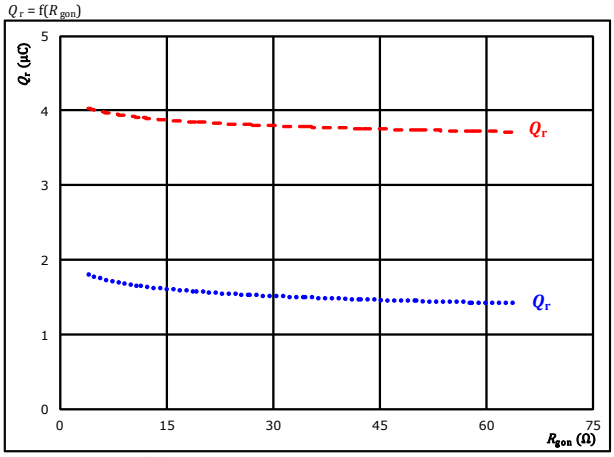


At						
	V_{CE} =	600	V	T_j:	25 °C	
	V_{GE} =	±15	V		150 °C	
	R_{gon} =	16	Ω			

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

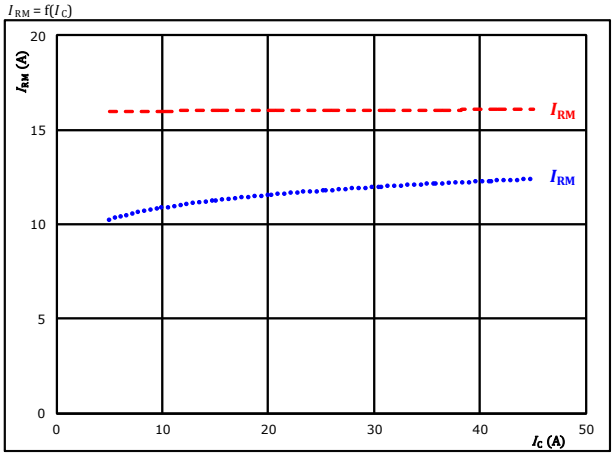


At						
	V_{CE}=	600	V	T_j:	25 °C	
	V_{GE} =	±15	V		150 °C	
	I_C=	25	A			

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

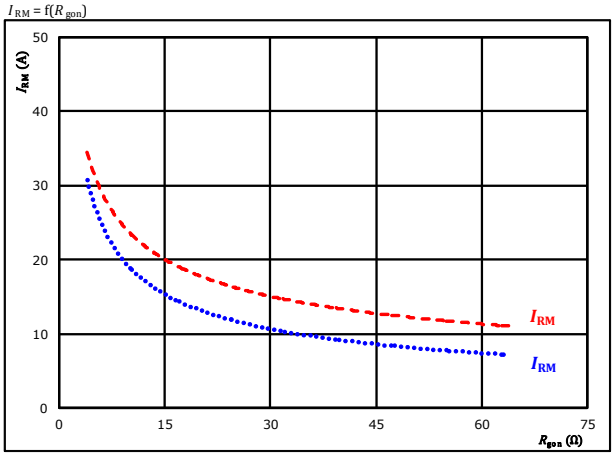


At						
	V_{CE}:	600	V	T_j:	25 °C	
	V_{GE} =	±15	V		150 °C	
	R_{gon} =	16	Ω			

figure 12. **FWD**

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

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



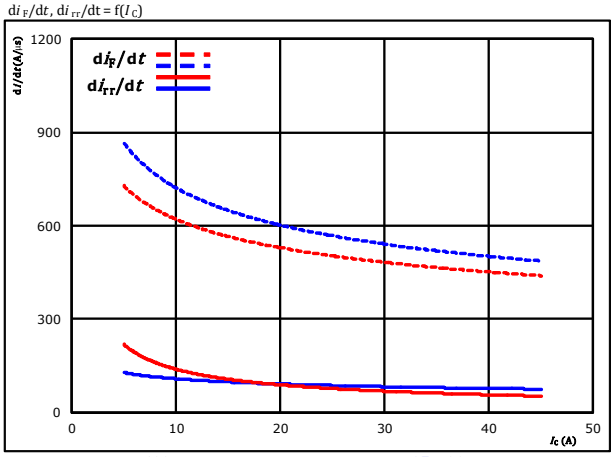
At						
	V_{CE} =	600	V	T_j:	25 °C	
	V_{GE} =	±15	V		150 °C	
	I_C =	25	A			

Inverter (T11-T16, D11-D16) Switching Characteristics

figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

$di_F/dt, di_{rr}/dt = f(I_C)$

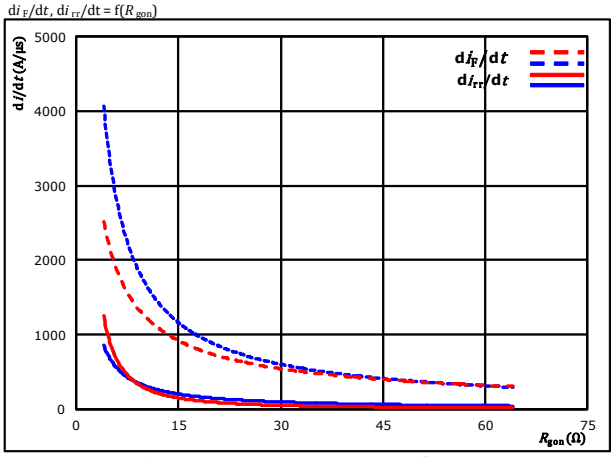


At						
	V_{CE} =	600	V		25	°C
	V_{GE} =	±15	V	T_j:	150	°C
	R_{gon} =	16	Ω			

figure 14. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

$di_F/dt, di_{rr}/dt = f(R_{gon})$

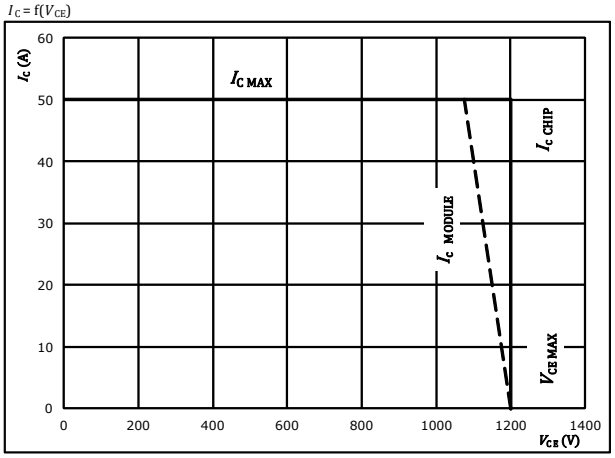


At						
	V_{CE} =	600	V		25	°C
	V_{GE} =	±15	V	T_j:	150	°C
	I_C =	25	A			

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C	
R_{gon} =	16	Ω	
R_{goff} =	16	Ω	

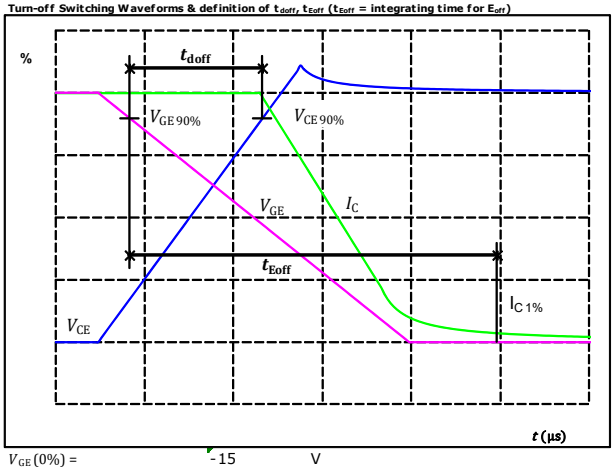
Inverter (T11-T16, D11-D16) Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

figure 1. IGBT

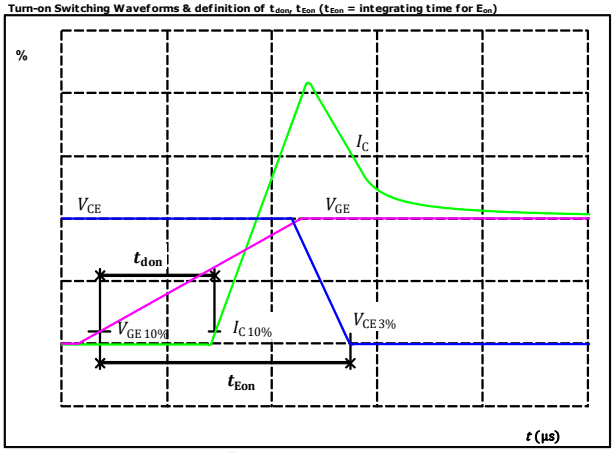
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_{doff} =	270	ns

figure 2. IGBT

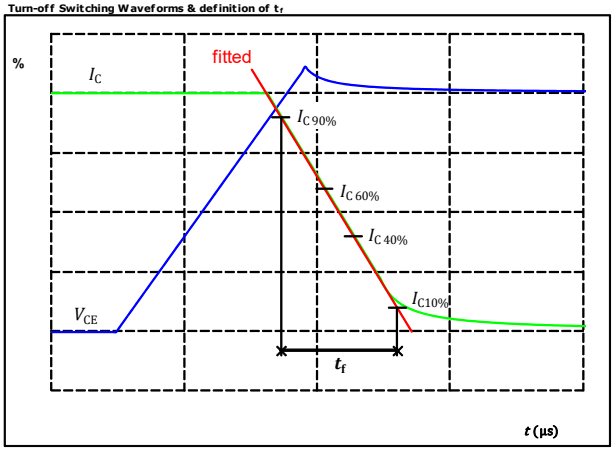
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_{don} =	72	ns

figure 3. IGBT

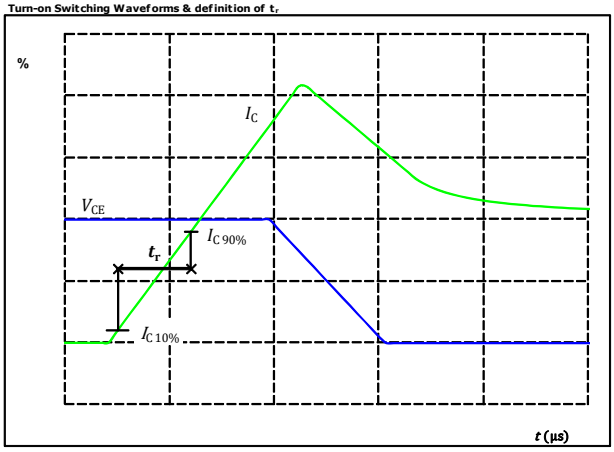
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_f =	135	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

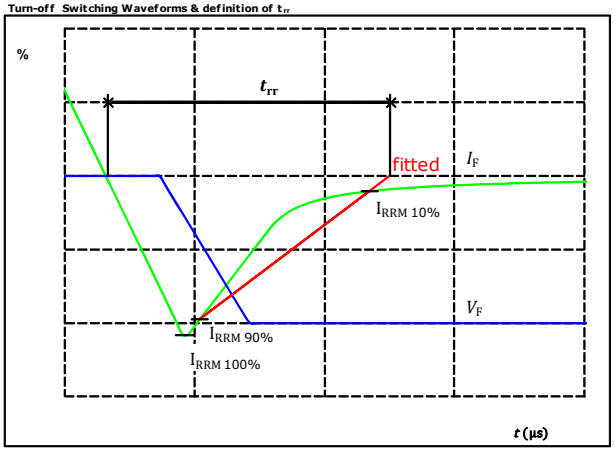


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_r =	36	ns

Inverter (T11-T16, D11-D16) Switching Characteristics

figure 5. **FWD**

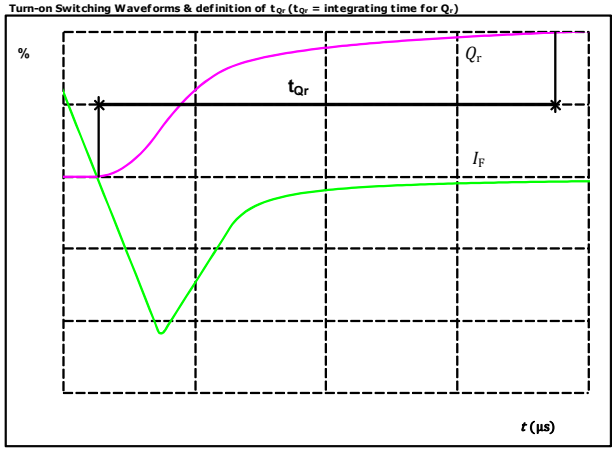
Turn-off Switching Waveforms & definition of t_{rr}



$V_F(100\%)$ =	600	V
$I_F(100\%)$ =	25	A
$I_{RRM}(100\%)$ =	17	A
t_{rr} =	580	ns

figure 6. **FWD**

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



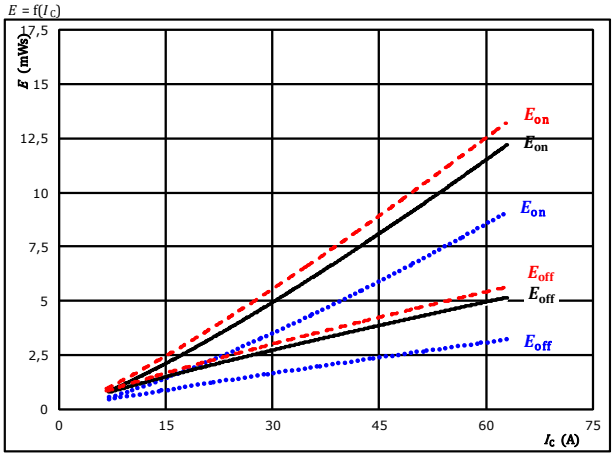
$I_F(100\%)$ =	25	A
$Q_r(100\%)$ =	3,88	µC

Inverter (T21-T26, D21-D26) Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



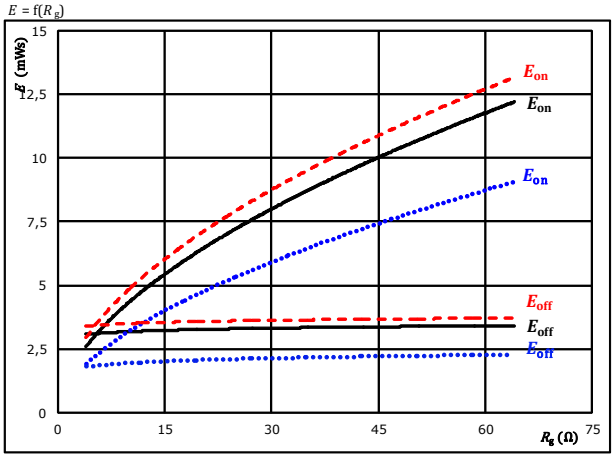
With an inductive load at

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

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



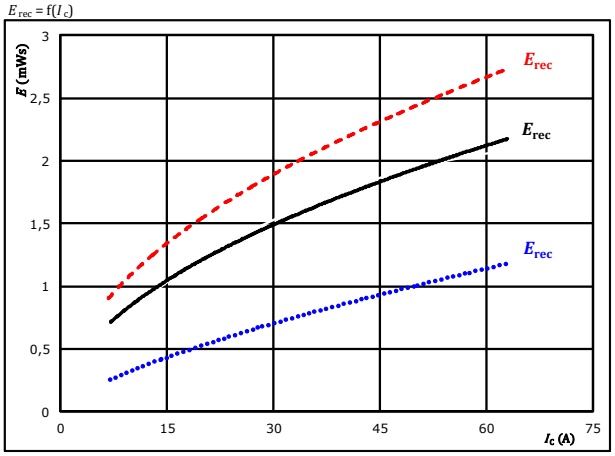
With an inductive load at

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

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



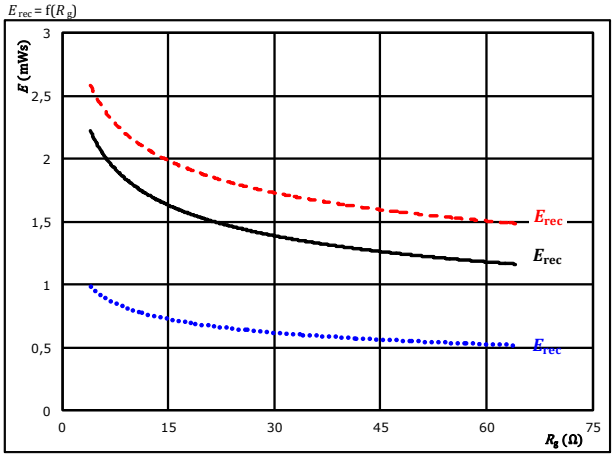
With an inductive load at

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

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

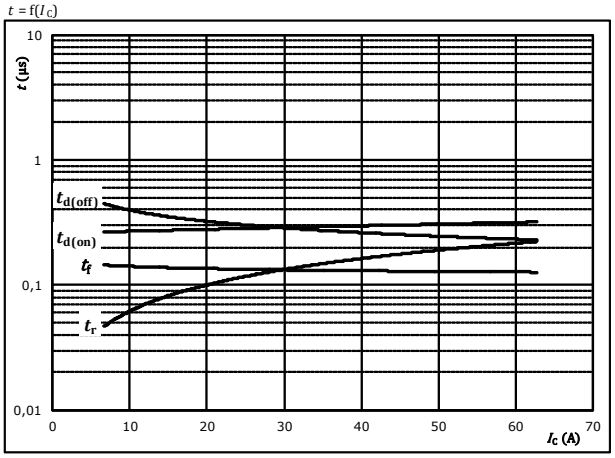
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	35	A		150 °C

Inverter (T21-T26, D21-D26) Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



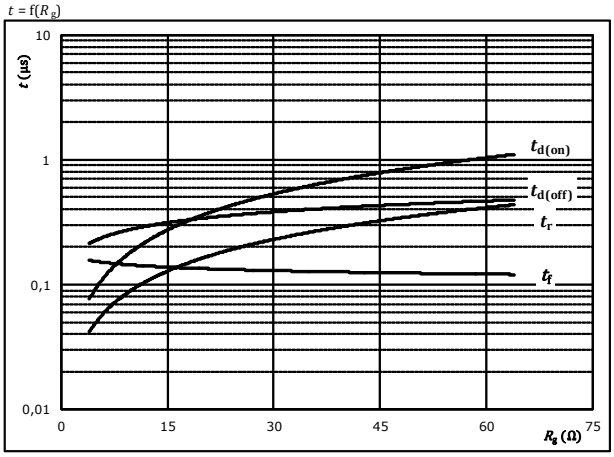
With an inductive load at

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

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



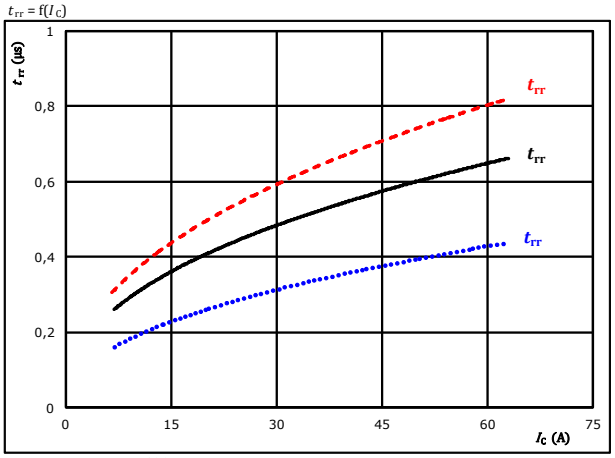
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



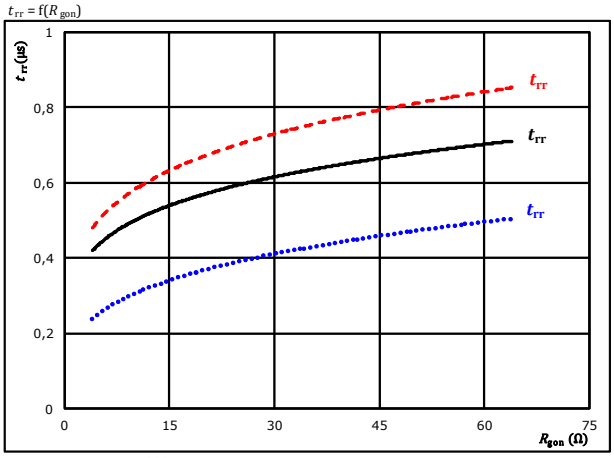
At

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

figure 8. **FWD**

Typical reverse recovery time as a function of IGBT turn on gate resistor

$t_{rr} = f(R_{gon})$



At

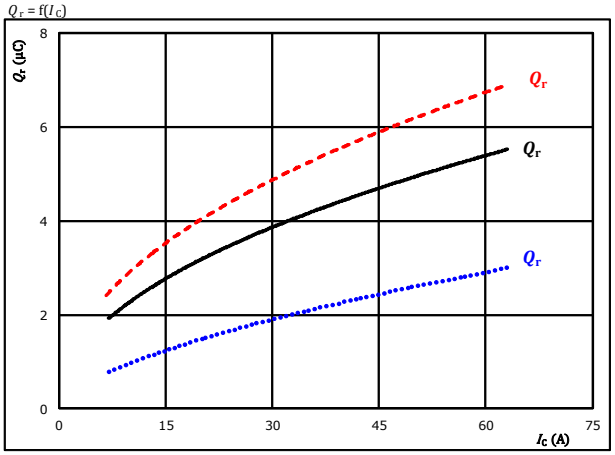
V_{CE} =	600	V		25 °C	
V_{GE} =	±15	V	T_j:	125 °C	
I_C =	35	A		150 °C	

Inverter (T21-T26, D21-D26) Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

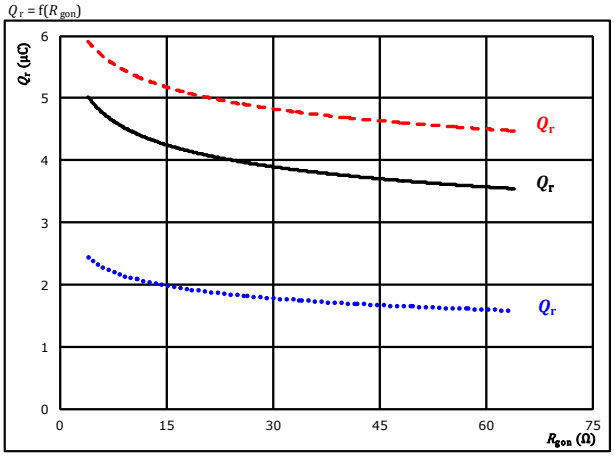


At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

figure 10. FWD

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

$Q_r = f(R_{gon})$

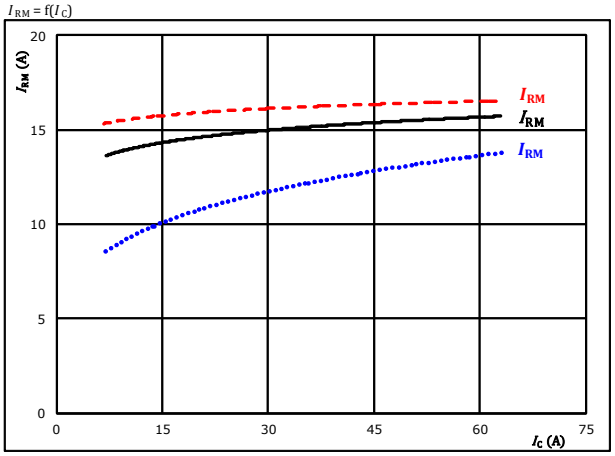


At						
	V_{CE}=	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C=	35	A		150 °C	

figure 11. FWD

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

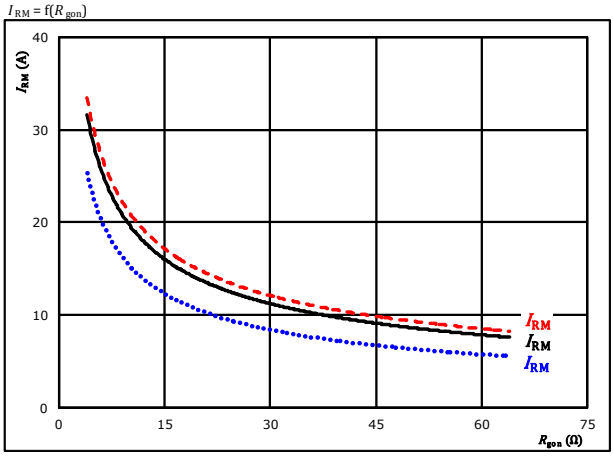


At						
	V_{CE}:	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

figure 12. FWD

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

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



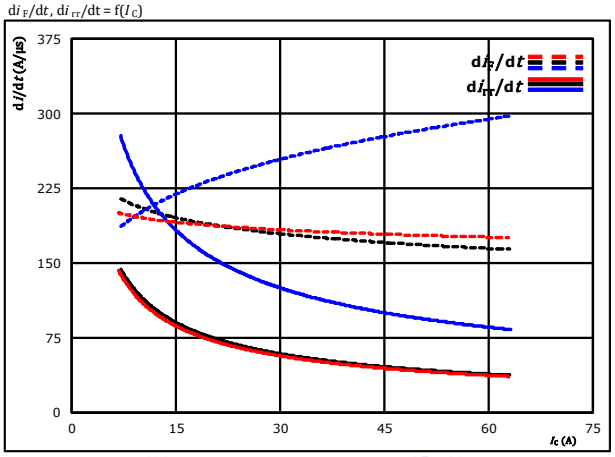
At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C =	35	A		150 °C	

Inverter (T21-T26, D21-D26) Switching Characteristics

figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

$di_F/dt, di_{rr}/dt = f(I_C)$

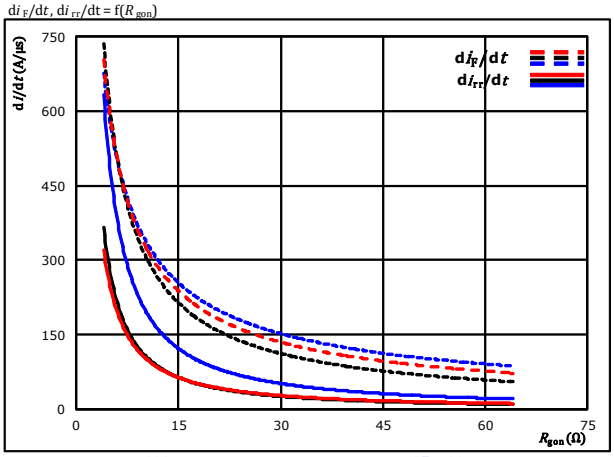


At	V_{CE} =	600	V		25	°C
	V_{GE} =	±15	V	T_j:	125	°C
	R_{gon} =	16	Ω		150	°C

figure 14. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

$di_F/dt, di_{rr}/dt = f(R_{gon})$

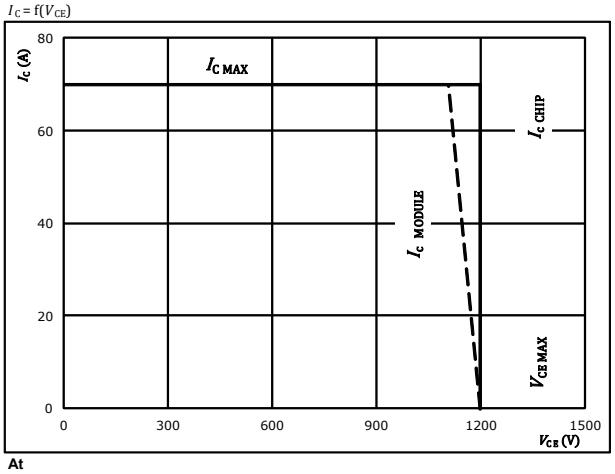


At	V_{CE} =	600	V		25	°C
	V_{GE} =	±15	V	T_j:	125	°C
	I_C =	35	A		150	°C

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C	
R_{gon} =	16	Ω	
R_{goff} =	16	Ω	

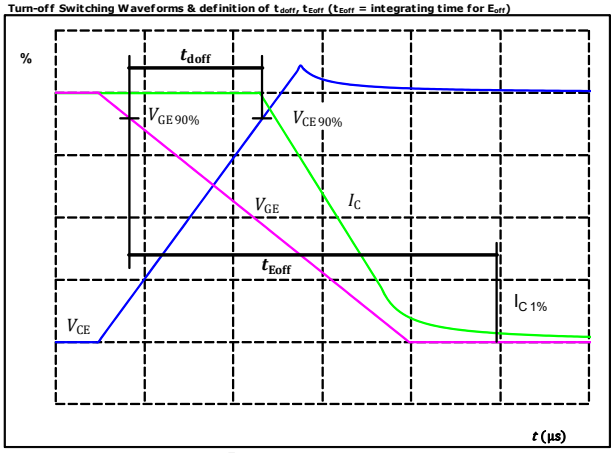
Inverter (T21-T26, D21-D26) Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

figure 1. IGBT

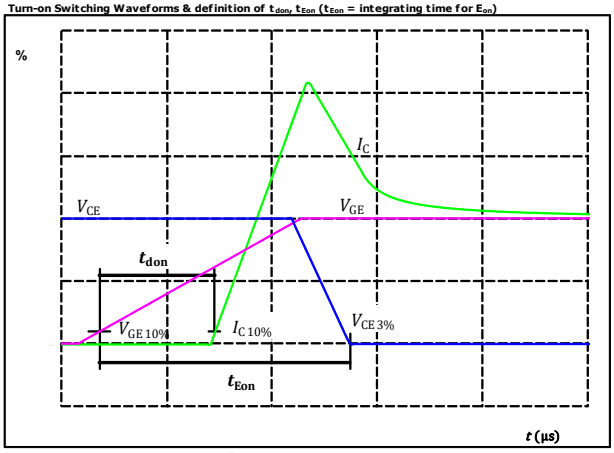
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	35	A
t_{doff} =	269	ns

figure 2. IGBT

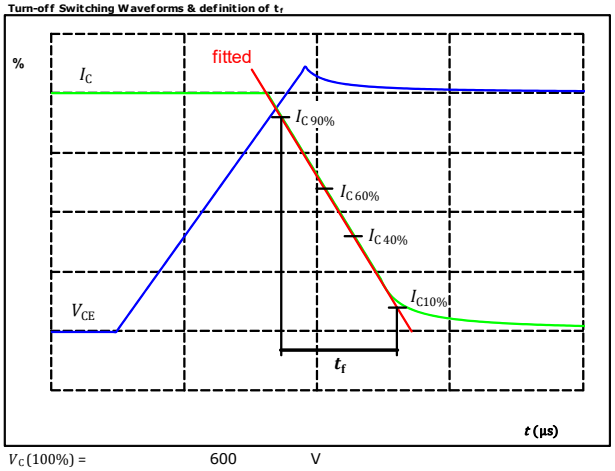
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	35	A
t_{don} =	298	ns

figure 3. IGBT

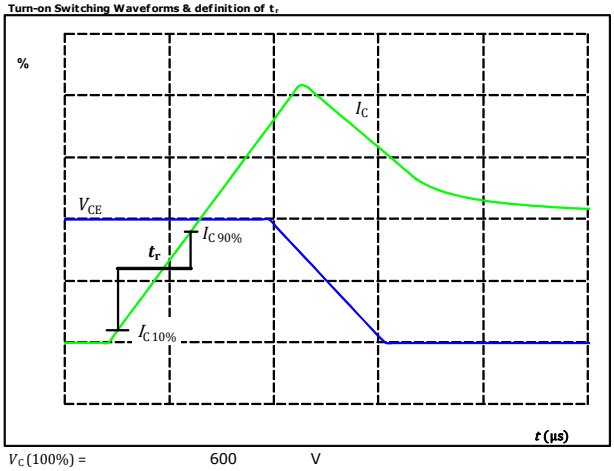
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	35	A
t_f =	136	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

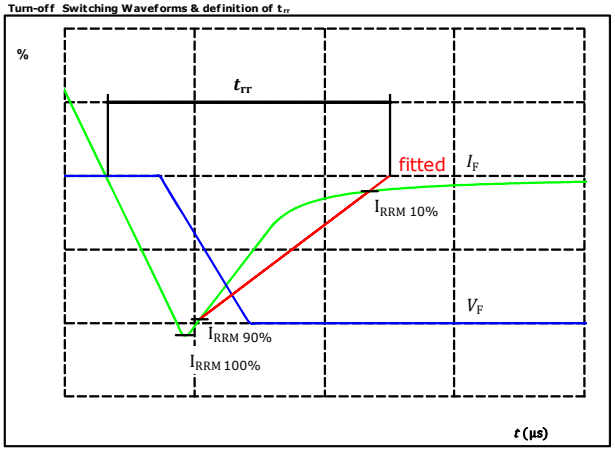


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	35	A
t_r =	140	ns

Inverter (T21-T26, D21-D26) Switching Characteristics

figure 5. **FWD**

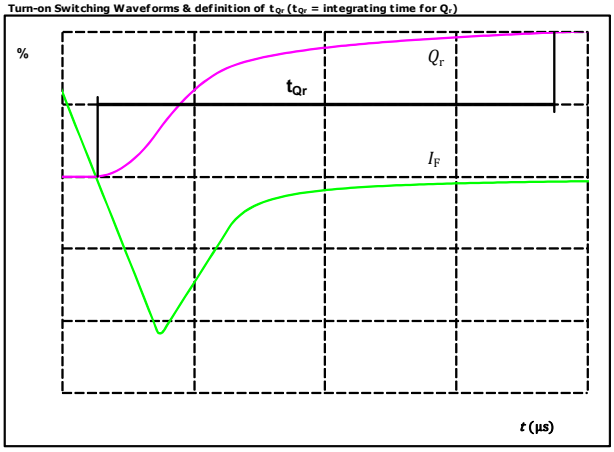
Turn-off Switching Waveforms & definition of t_{rr}



$V_F(100\%)$ =	600	V
$I_F(100\%)$ =	35	A
$I_{RRM}(100\%)$ =	16	A
t_{rr} =	514	ns

figure 6. **FWD**

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



$I_F(100\%)$ =	35	A
$Q_r(100\%)$ =	4,21	µC

Ordering Code & Marking

Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M212WPA035SC-K389F-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M212WPA035SC-K389F-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M212WPA035SC-K389F-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M212WPA035SC-K389F-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M212WPA035SC-K389F-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M212WPA035SC-K389F-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M212WPA035SC-K389F-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M212WPA035SC-K389F-/5B/

	Name	Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNN-TTTTTTVV	WWYY	UL VIN	LLLLL	SSSS

Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTVV	LLLLL	SSSS	WWYY		

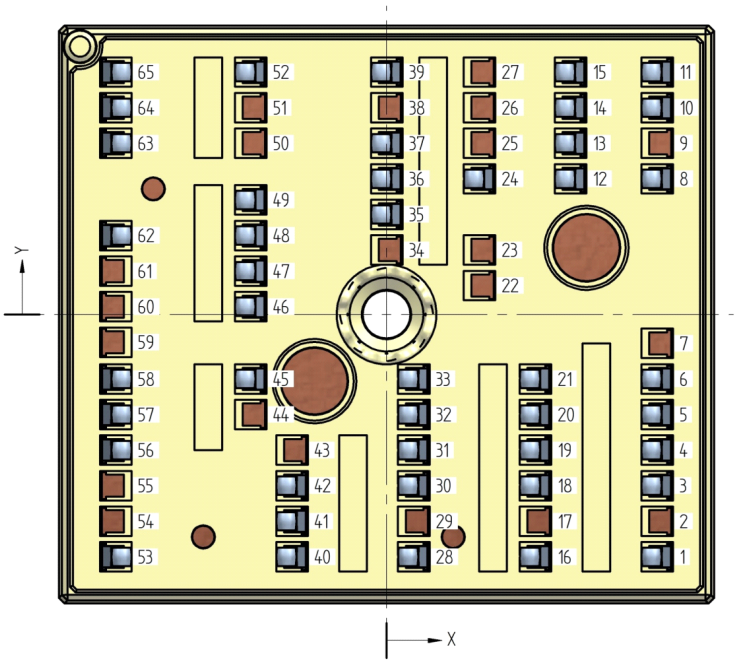
Outline

PCB pad table

Pin	X	Y	Function
1	24,38	-21,8	DC+2
2	Not assembled		
3	24,38	-15,4	G26
4	24,38	-12,2	S26
5	24,38	-9	Ph23
6	24,38	-5,8	Ph23
7	Not assembled		
8	24,38	12,2	G25
9	Not assembled		
10	24,38	18,6	Therm1
11	24,38	21,8	Therm2
12	16,58	12,2	G23
13	16,58	15,4	Se2
14	16,58	18,6	DC-2
15	16,58	21,8	DC-2
16	13,42	-21,8	DC+2
17	Not assembled		
18	13,42	-15,4	G24
19	13,42	-12,2	S24
20	13,42	-9	Ph22
21	13,42	-5,8	Ph22
22	Not assembled		
23	Not assembled		
24	8,38	12,2	G21
25	Not assembled		
26	Not assembled		
27	Not assembled		
28	2,46	-21,8	DC+2
29	Not assembled		
30	2,46	-15,4	G22
31	2,46	-12,2	S22
32	2,46	-9	Ph21
33	2,46	-5,8	Ph21
34	Not assembled		
35	0,03	9	Se1
36	0,03	12,2	DC-1
37	0,03	15,4	DC-1
38	Not assembled		
39	0,03	21,8	G13
40	-8,5	-21,8	S12
41	-8,5	-18,6	Ph11
42	-8,5	-15,4	Ph11
43	Not assembled		
44	Not assembled		
45	-12,22	-5,8	G11

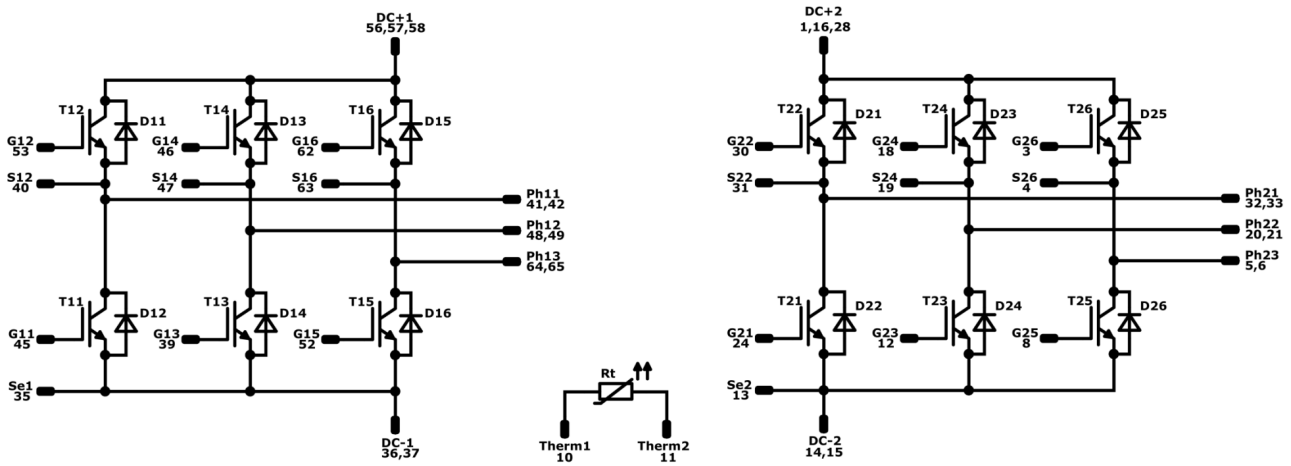
PCB pad table

Pin	X	Y	Function
46	-12,22	0,7	G14
47	-12,22	3,9	S14
48	-12,22	7,1	Ph12
49	-12,22	10,3	Ph12
50	Not assembled		
51	Not assembled		
52	-12,22	21,8	G15
53	-24,38	-21,8	G12
54	Not assembled		
55	Not assembled		
56	-24,38	-12,2	DC+1
57	-24,38	-9	DC+1
58	-24,38	-5,8	DC+1
59	Not assembled		
60	Not assembled		
61	Not assembled		
62	-24,38	7,1	G16
63	-24,38	15,4	S16
64	-24,38	18,6	Ph13
65	-24,38	21,8	Ph13



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	25 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	25 A	Inverter Diode	
T21, T22, T23, T24, T25, T26	IGBT	1200 V	35 A	Inverter Switch	
D21, D22, D23, D24, D25, D26	FWD	1200 V	35 A	Inverter Diode	
Rt	PTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 72	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for MiniSkiiP® 2 packages see vincotech.com website.

Package data
Package data for MiniSkiiP® 2 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-M212WPA035SC-K389F-D2-14	20 Mar. 2019	Correction of I_c/I_f values	1,2