flow 90PACK 0 — 1200V/35A

Features

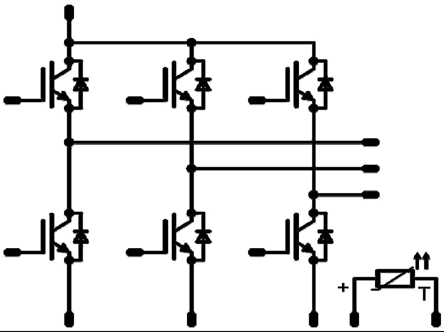
- 90°PCB mounting for easy heat sink assembly
- Clip-in PCB mounting (optional)
- Open emitter for easy current sensing

flow 90PACK 0

Target Applications

- Standard Drive
- Servo Drive
- Bookshelf Inverter

Schematic



Types

- 10-RZ126PA035SC-M620F41
- 10-R0126PA035SC-M620F40

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Transistor					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current *	I_C	T_j=$T_j$max	T_h=80℃ T_c=80℃	38 49	A
Pulsed collector current	I_{Cpulse}	t_p limited by $T_j$max		105	A
Turn off safe operating area		VCE ≤ 1200V, Tj ≤ Top max		70	A
Power dissipation per IGBT *	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	101 153	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150℃ V_{GE}=15V		10 800	µs V
Maximum Junction Temperature	$T_j$max			175	℃

* measured with phase-change material

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current *	I_F	T_j=$T_j$max	T_h=80℃ T_c=80℃	31 40	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		50	A
Power dissipation per Diode *	P_{tot}	T_j=$T_j$max	T_h=80℃ T_c=80℃	64 97	W
Maximum Junction Temperature	$T_j$max			175	℃

* measured with phase-change material

Maximum Ratings

T_j=25℃, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	℃
Operation temperature under switching condition	T_{op}		-40…+150	℃
Insulation Properties				
Insulation voltage	V_{is}	t=2s DC voltage	4000	V
Creepage distance			min 12,7	mm
Clearance			min 10,93	mm
Comparative tracking index	CTI		>200	

Characteristic Values

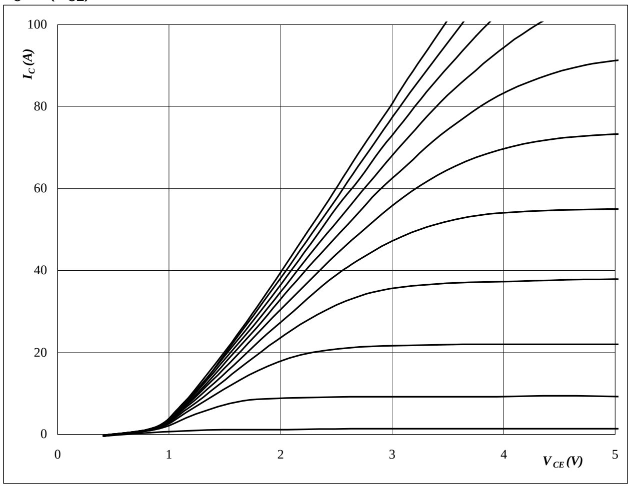
Parameter	Symbol	Conditions	V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	Unit
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0012	Tj=25℃ Tj=150℃	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		35	Tj=25℃ Tj=150℃	1,5	1,95 2,24	2,3	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		Tj=25℃ Tj=150℃			0,015	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25℃ Tj=150℃			200	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=16 Ω Rgon=16 Ω	±15	600	35	Tj=25℃ Tj=150℃		94 97		ns
Rise time	t_r					Tj=25℃ Tj=150℃		47 45		
Turn-off delay time	$t_{d(off)}$					Tj=25℃ Tj=150℃		210 281		
Fall time	t_f					Tj=25℃ Tj=150℃		63 130		
Turn-on energy loss per pulse	E_{on}					Tj=25℃ Tj=150℃		2,94 4,08		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25℃ Tj=150℃		1,97 3,38		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25℃		1950		pF
Output capacitance	C_{oss}							155		
Reverse transfer capacitance	C_{rss}							115		
Gate charge	Q_{Gate}		±15	960	40	Tj=25℃		270		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,94		K/W
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,10		K/W
Inverter Diode										
Diode forward voltage	V_F				25	Tj=25℃ Tj=150℃	1,2	1,90 1,88	2,3	V
Peak reverse recovery current	I_{RRM}	Rgon=16 Ω	±15	600	35	Tj=25℃ Tj=150℃		15 21		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=150℃		333 565		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=150℃		2,69 5,50		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=150℃		114 86		A/µs
Reverse recovered energy	Erec					Tj=25℃ Tj=150℃		1,07 2,27		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						1,49		K/W
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,75		K/W
Thermistor										
Rated resistance	R					Tj=25℃		4700		Ω
Deviation of R25	∆R/R					Tj=25℃	-5		5	%
Power dissipation	P					Tj=25℃		200		mW
Power dissipation constant						Tj=25℃		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				Tj=25℃		3500		K
B-value	$B_{(25/100)}$					Tj=25℃		3560		K
Vincotech NTC Reference									G	

Output Inverter

Figure 1 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

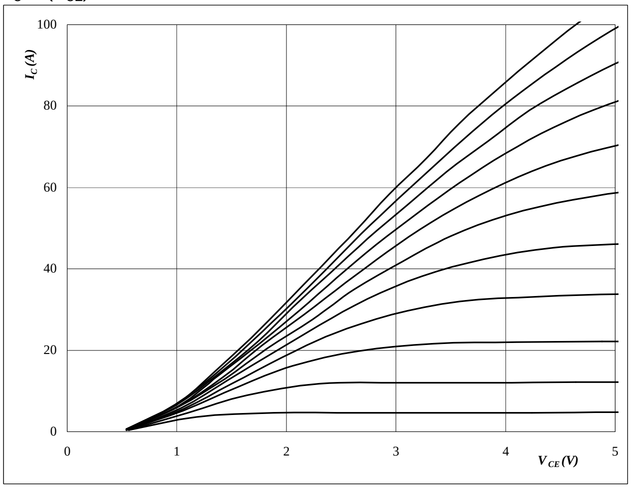
T_j = 25 ℃

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

Figure 2 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

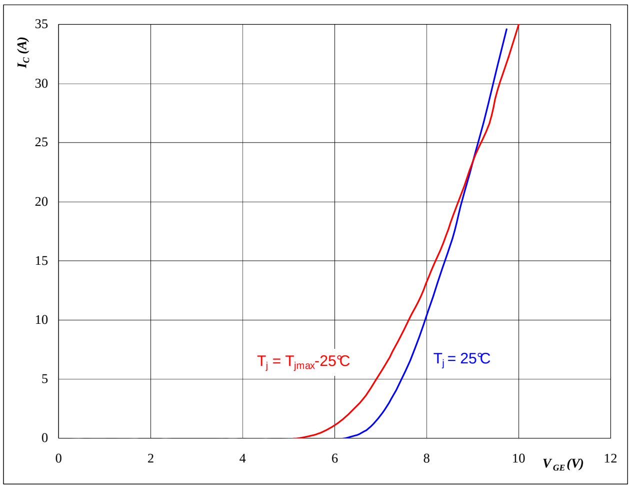
T_j = 150 ℃

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

Figure 3 Output inverter IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



At

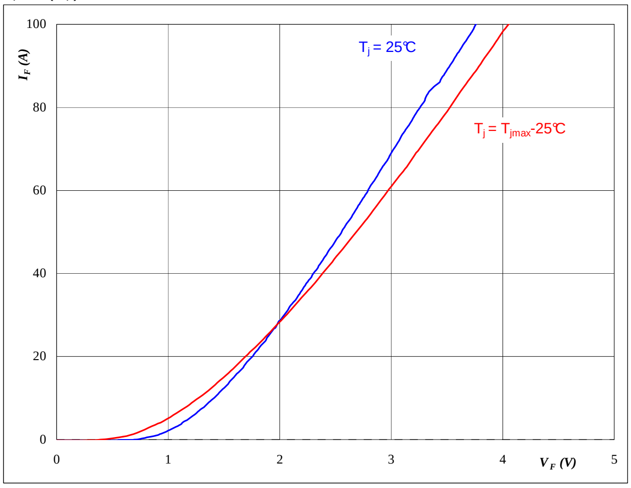
t_p = 250 µs

V_{CE} = 10 V

Figure 4 Output inverter FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

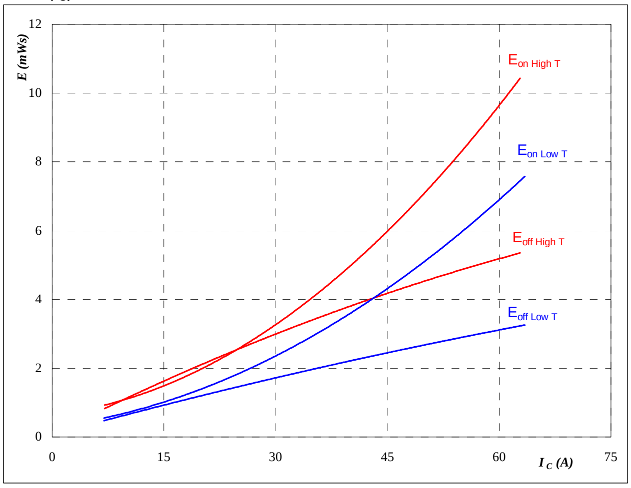
t_p = 250 µs

Output Inverter

Figure 5 Output inverter IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



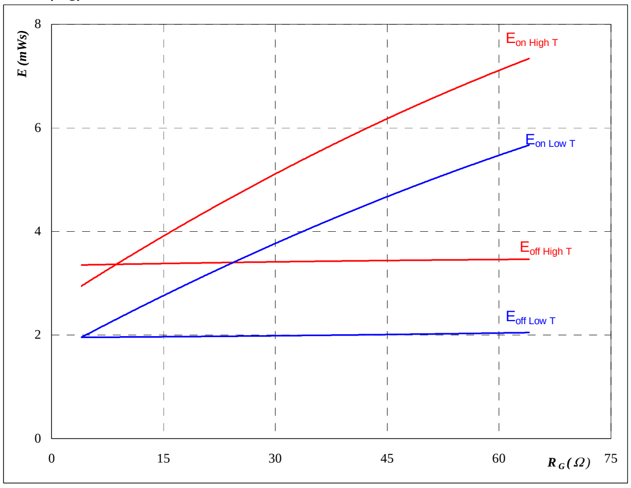
With an inductive load at

T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Figure 6 Output inverter IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



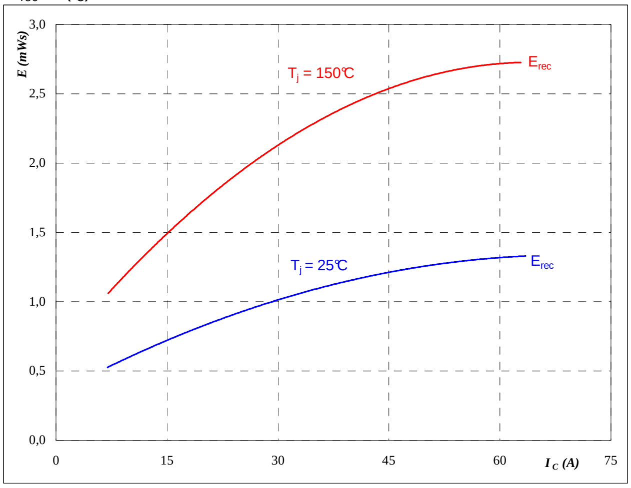
With an inductive load at

T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	35	A

Figure 7 Output inverter FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_C)$



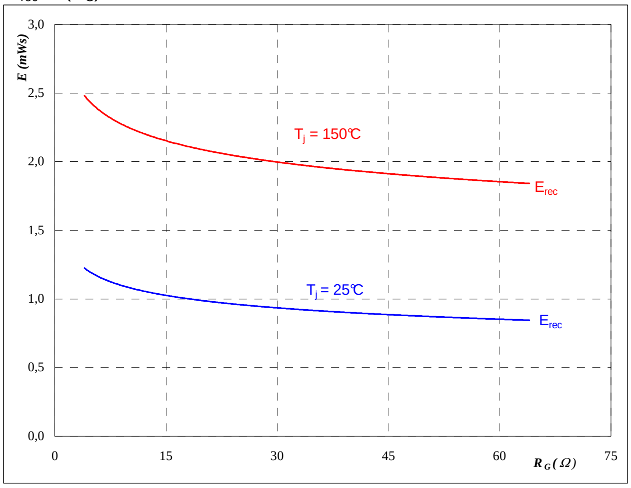
With an inductive load at

T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

Figure 8 Output inverter FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

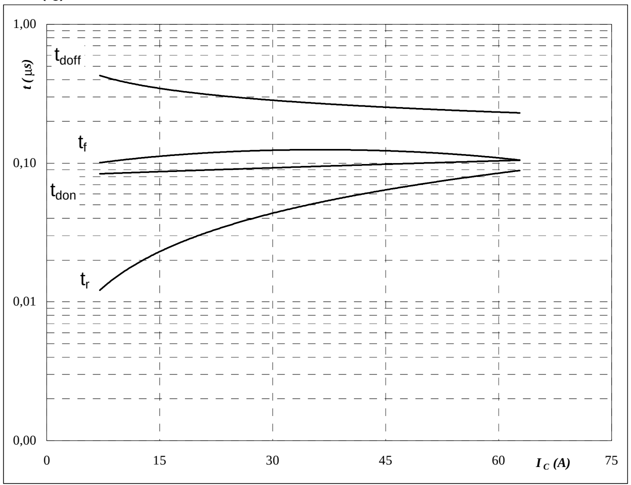
T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	35	A

Output Inverter

Figure 9 Output inverter IGBT

Typical switching times as a function of collector current

t = f(I_C)



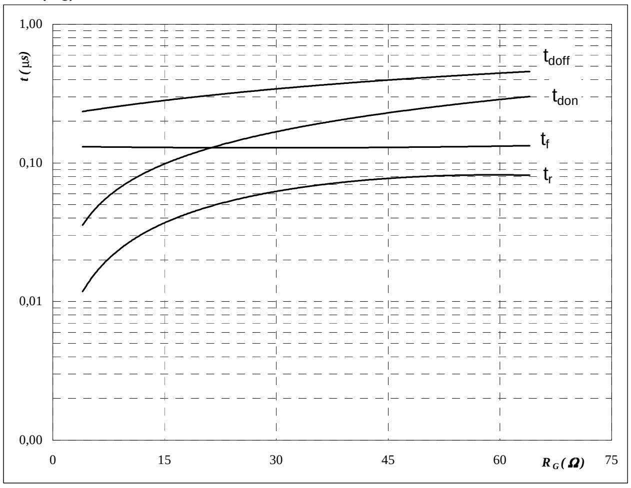
With an inductive load at

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

Figure 10 Output inverter IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



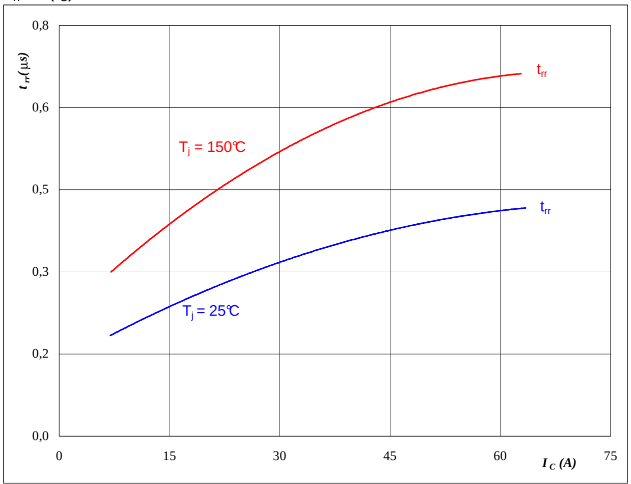
With an inductive load at

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

Figure 11 Output inverter FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



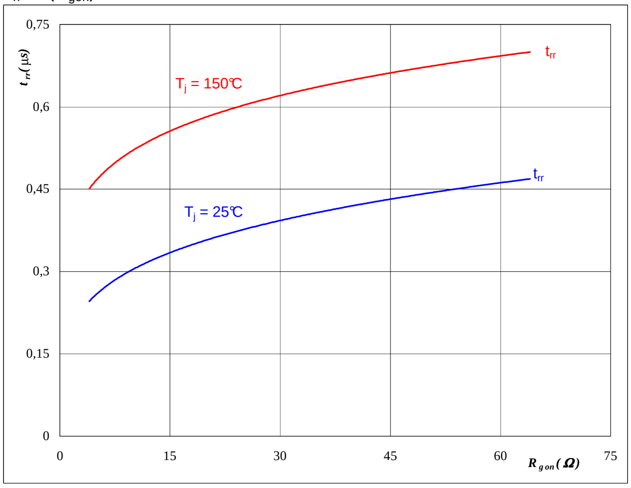
At

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

Figure 12 Output inverter FWD

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

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



At

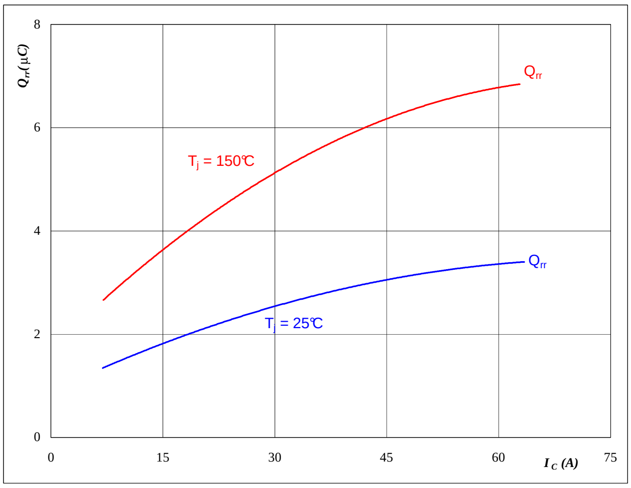
T_j =	25/150	°C
V_R =	600	V
I_F =	35	A
V_{GE} =	±15	V

Output Inverter

Figure 13 Output inverter FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



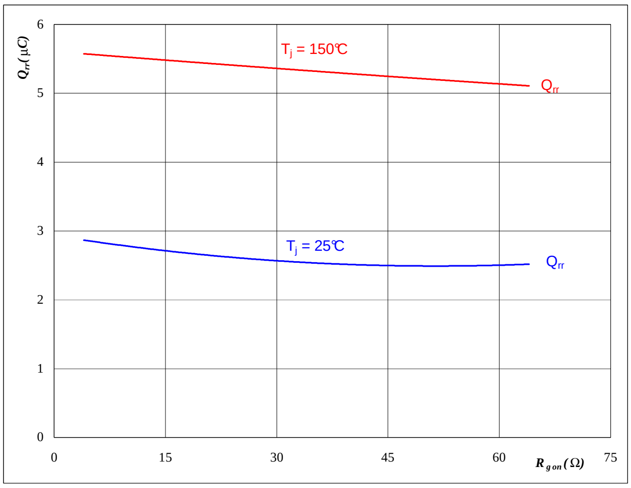
At

T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

Figure 14 Output inverter FWD

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

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



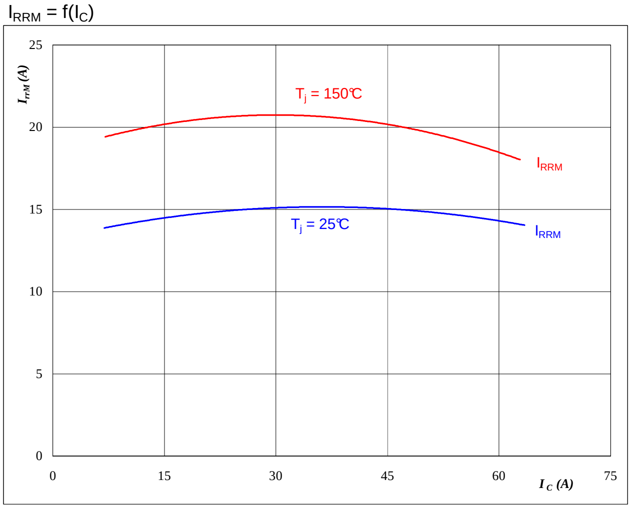
At

T_j =	25/150	℃
V_R =	600	V
I_F =	35	A
V_{GE} =	±15	V

Figure 15 Output inverter FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



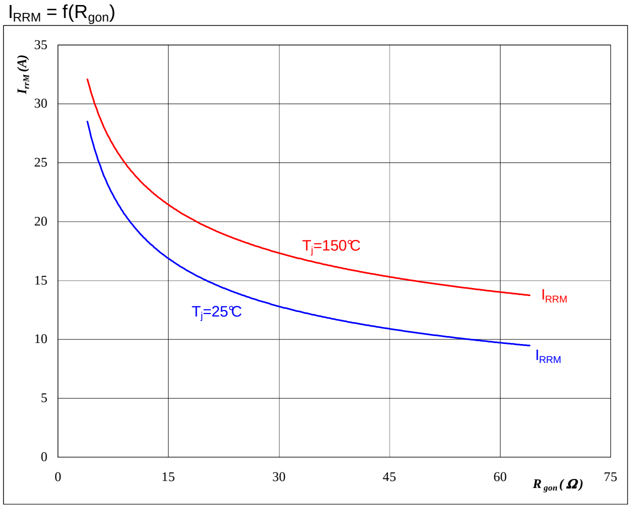
At

T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

Figure 16 Output inverter FWD

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

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



At

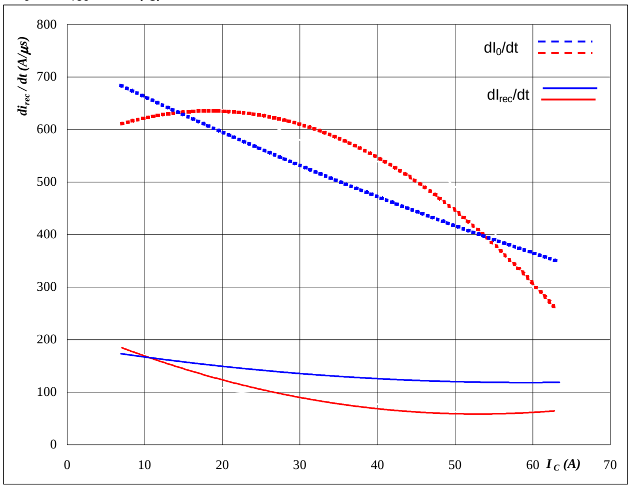
T_j =	25/150	℃
V_R =	600	V
I_F =	35	A
V_{GE} =	±15	V

Output Inverter

Figure 17 Output inverter FWD

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

$dI_0/dt, dI_{rec}/dt = f(I_C)$



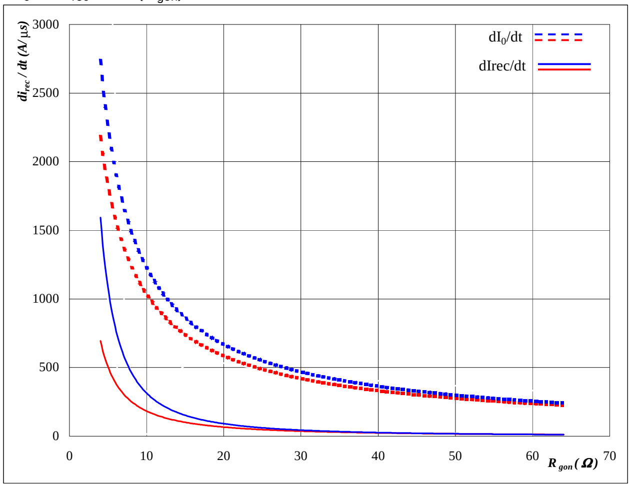
At

T_j =	25/150	℃
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

Figure 18 Output inverter FWD

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

$dI_0/dt, dI_{rec}/dt = f(R_{gon})$



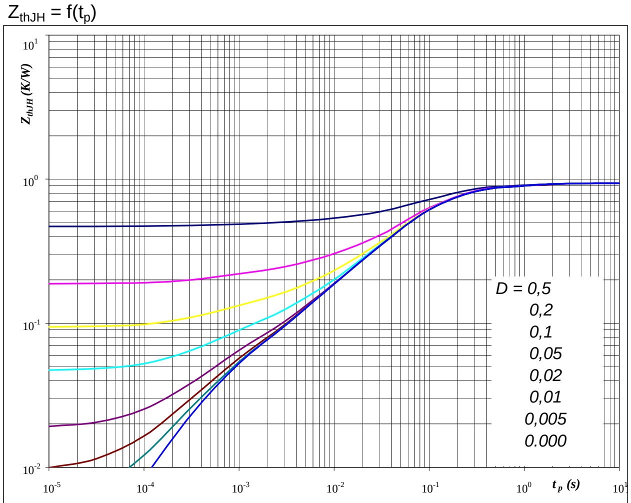
At

T_j =	25/150	℃
V_R =	600	V
I_F =	35	A
V_{GE} =	±15	V

Figure 19 Output inverter IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D = t_p / T

R_{thJH} = 0,94 K/W R_{thJH} = 1,10 K/W

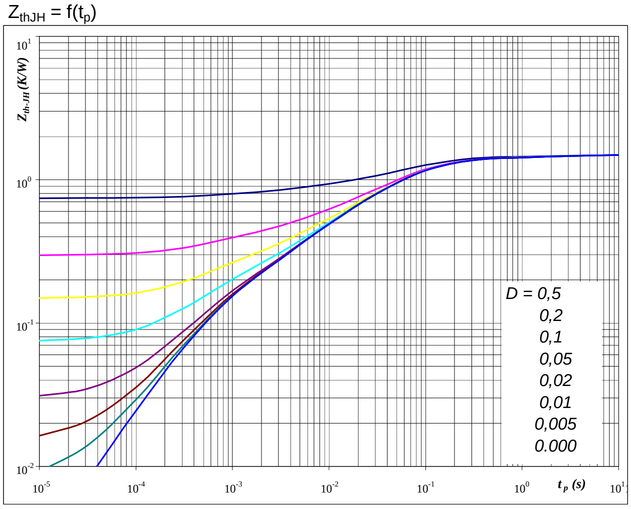
IGBT thermal model values

Phase change interface		Thermal grease	
R (C/W)	Tau (s)	R (C/W)	Tau (s)
0,11	9,5E-01	0,13	9,5E-01
0,41	1,2E-01	0,49	1,2E-01
0,30	4,8E-02	0,35	4,8E-02
0,07	5,9E-03	0,08	5,9E-03
0,04	5,6E-04	0,04	5,6E-04

Figure 20 Output inverter FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D = t_p / T

R_{thJH} = 1,49 K/W R_{thJH} = 1,75 K/W

FWD thermal model values

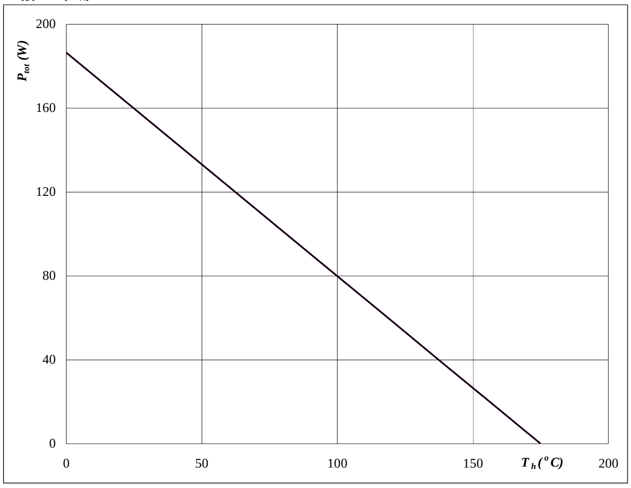
Phase change interface		Thermal grease	
R (C/W)	Tau (s)	R (C/W)	Tau (s)
0,06	3,1E+00	0,07	3,1E+00
0,12	4,3E-01	0,14	4,3E-01
0,70	7,0E-02	0,83	7,0E-02
0,32	1,9E-02	0,38	1,9E-02
0,16	4,2E-03	0,19	4,2E-03
0,11	5,7E-04	0,13	5,7E-04

Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



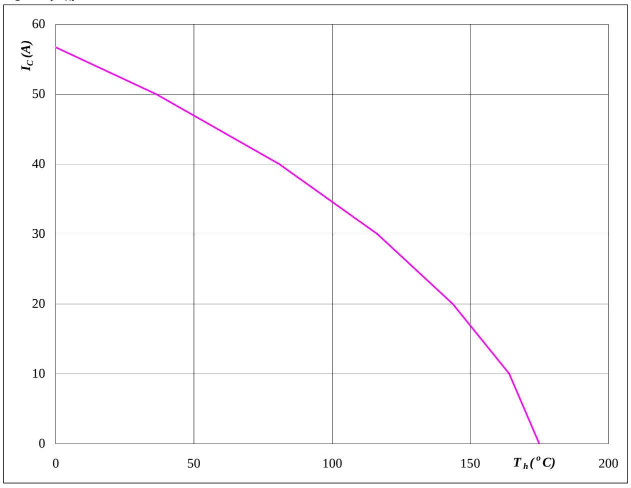
At

T_j = 175 °C

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

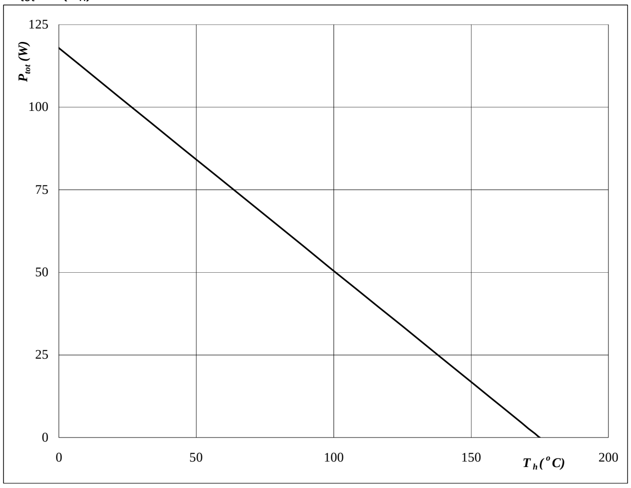
T_j = 175 °C

V_{GE} = 15 V

Figure 23 Output inverter FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



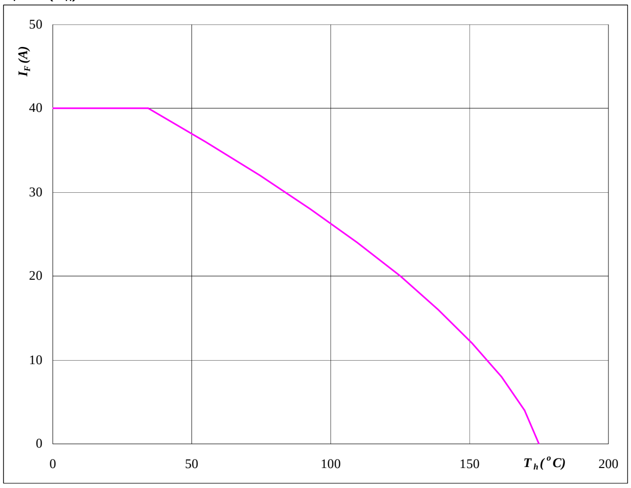
At

T_j = 175 °C

Figure 24 Output inverter FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

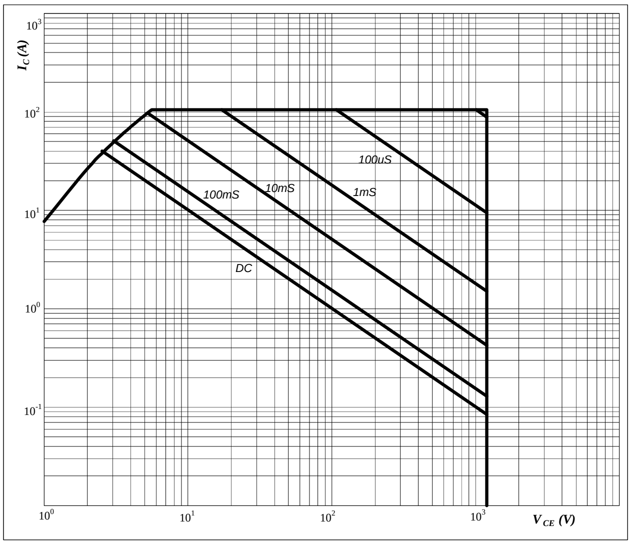
T_j = 175 °C

Output Inverter

Figure 25 Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



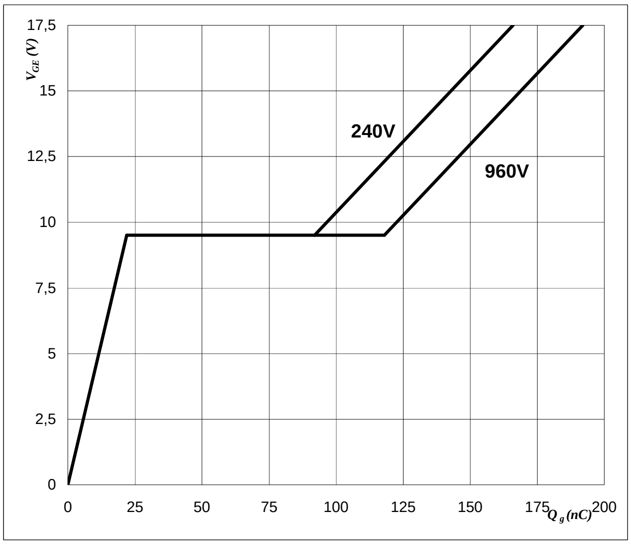
At

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

Figure 26 Output inverter IGBT

Gate voltage vs Gate charge

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



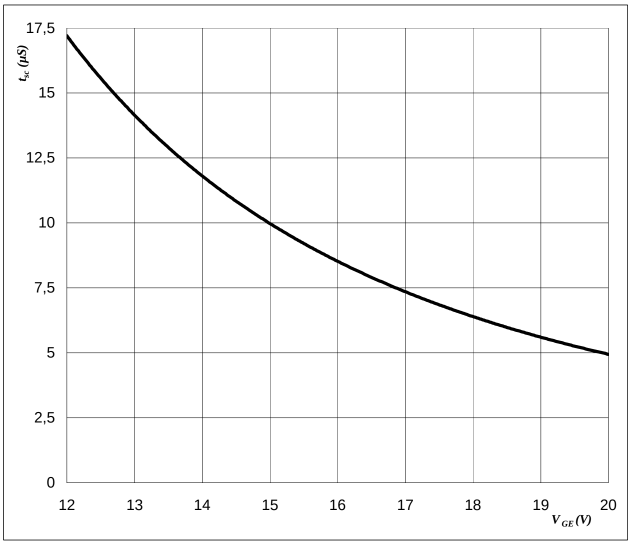
At

I_C =	35	A

Figure 27 Output inverter IGBT

Short circuit withstand time as a function of gate-emitter voltage

$t_{sc} = f(V_{GE})$



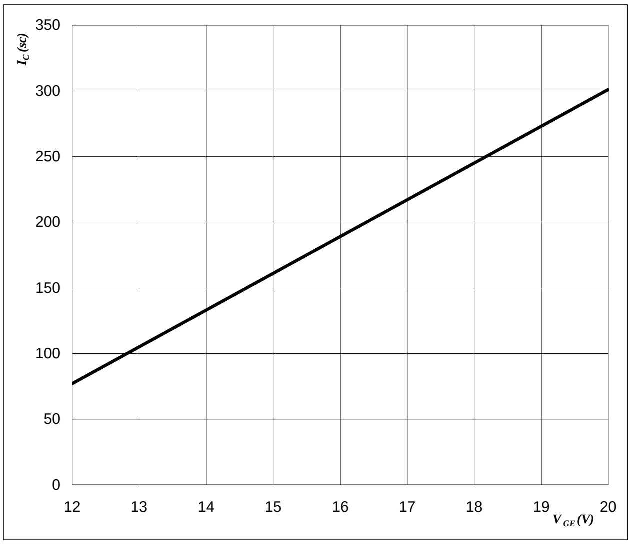
At

V_{CE} =	1200	V
T_j ≤	175	ºC

Figure 28 Output inverter IGBT

Typical short circuit collector current as a function of gate-emitter voltage

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



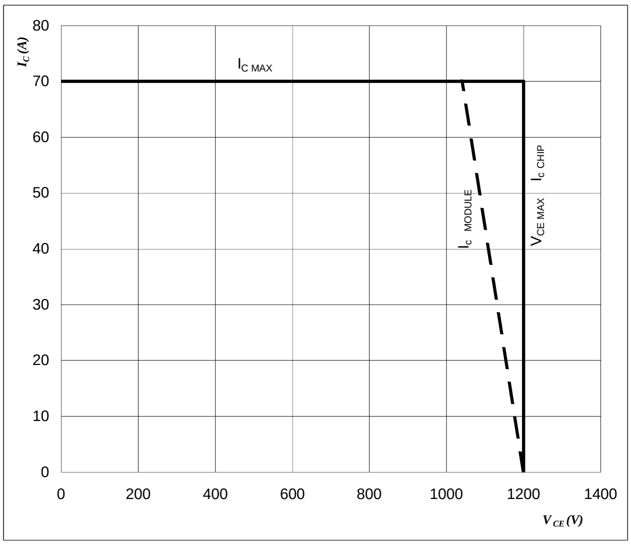
At

V_{CE} ≤	1200	V
T_j =	175	ºC

Figure 29	IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = T_{jmax}-25 ºC

$U_{ccminus}$=U_{ccplus}

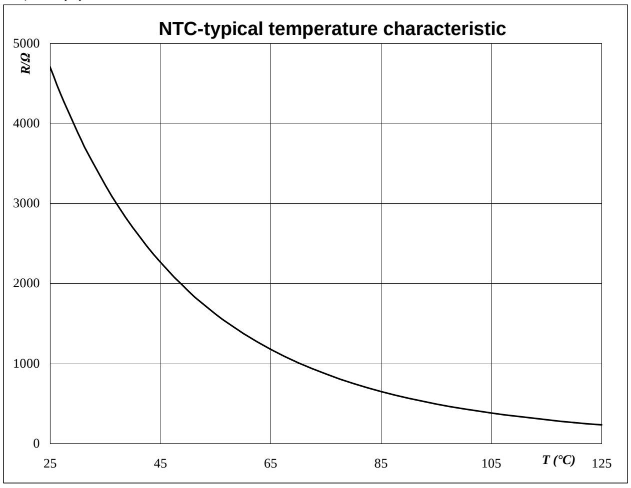
Switching mode : 3phase SPWM

Thermistor

Figure 30	Thermistor

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$



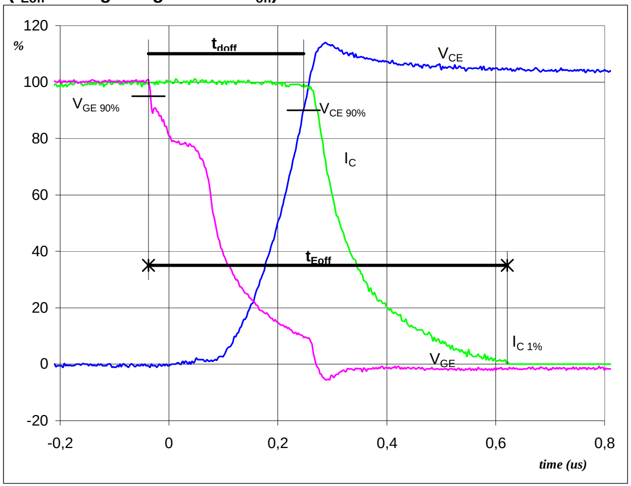
Switching Definitions Output Inverter

General conditions

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

Figure 1 Output inverter IGBT

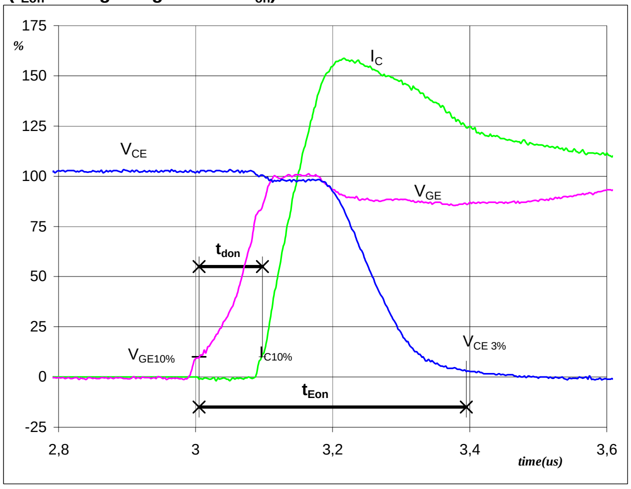
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	35	A
t_{doff} =	0,28	μs
t_{Eoff} =	0,66	μs

Figure 2 Output inverter IGBT

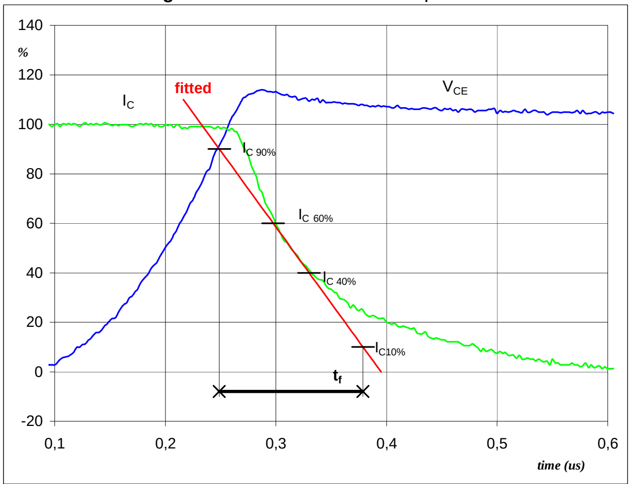
Turn-on Switching Waveforms & definition of tdon, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	35	A
t_{don} =	0,10	μs
t_{Eon} =	0,39	μs

Figure 3 Output inverter IGBT

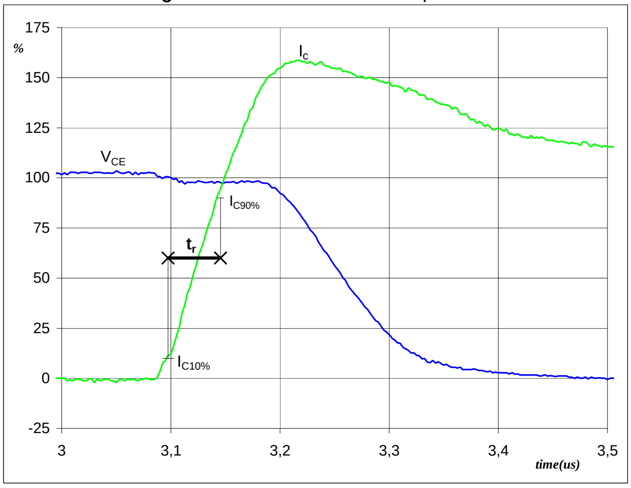
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	35	A
t_f =	0,13	μs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

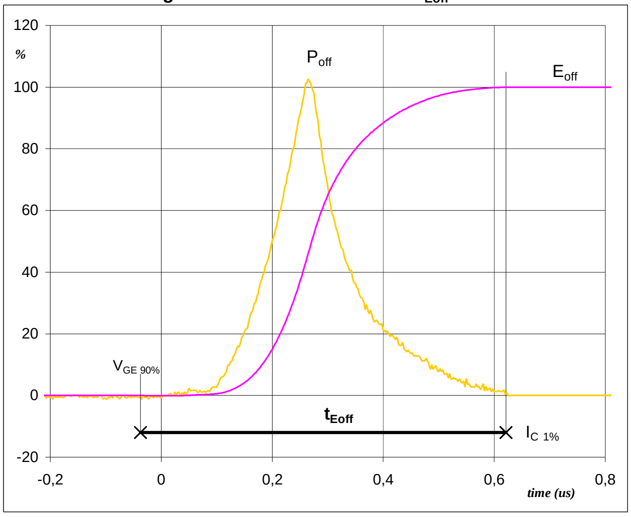


V_C (100%) =	600	V
I_C (100%) =	35	A
t_r =	0,05	μs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

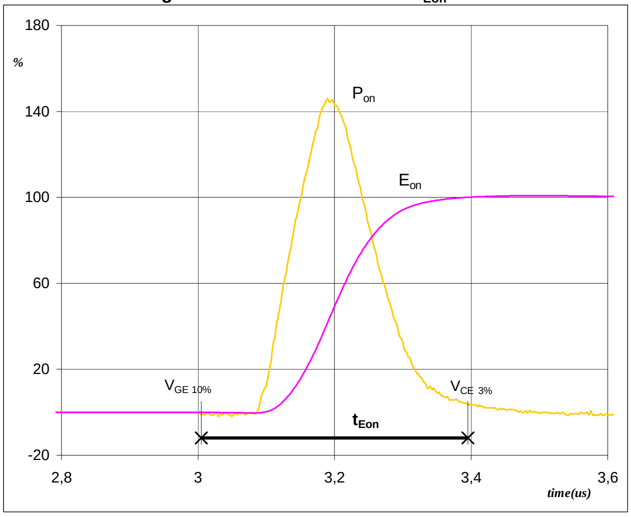
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	20,99	kW
E_{off} (100%) =	3,38	mJ
t_{Eoff} =	0,66	µs

Figure 6 Output inverter IGBT

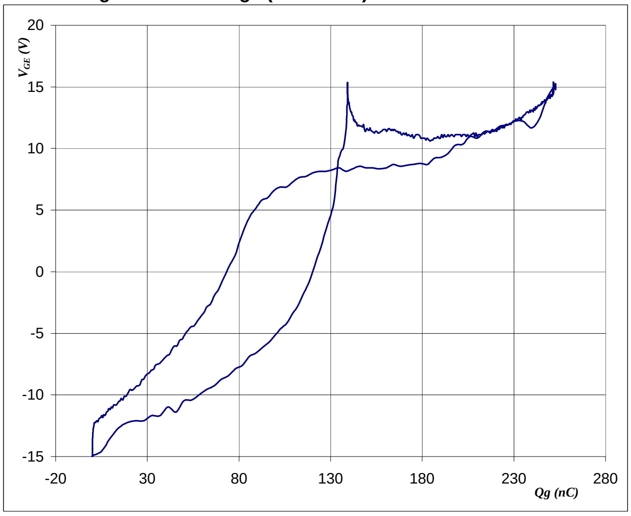
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	20,99	kW
E_{on} (100%) =	4,08	mJ
t_{Eon} =	0,39	µs

Figure 7 Output inverter IGBT

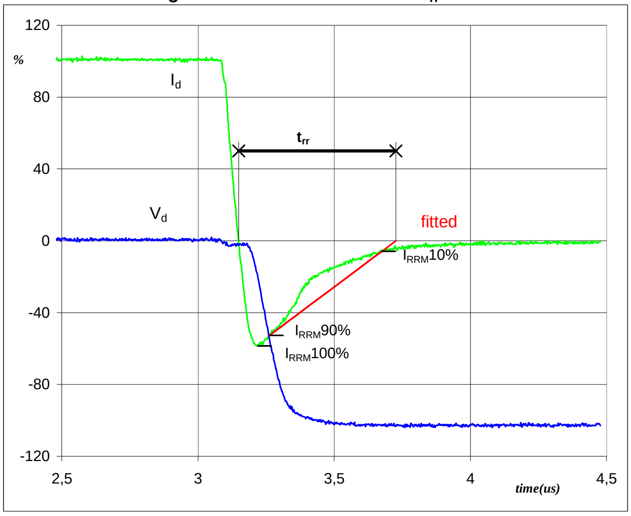
Gate voltage vs Gate charge (measured)



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	600	V
I_C (100%) =	35	A
Q_g =	252,70	nC

Figure 8 Output inverter FWD

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

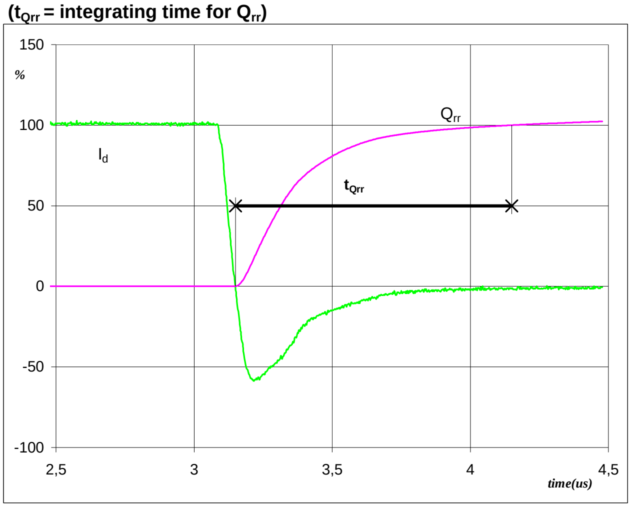


V_d (100%) =	600	V
I_d (100%) =	35	A
I_{RRM} (100%) =	-21	A
t_{rr} =	0,57	µs

Switching Definitions Output Inverter

Figure 9 Output inverter FWD

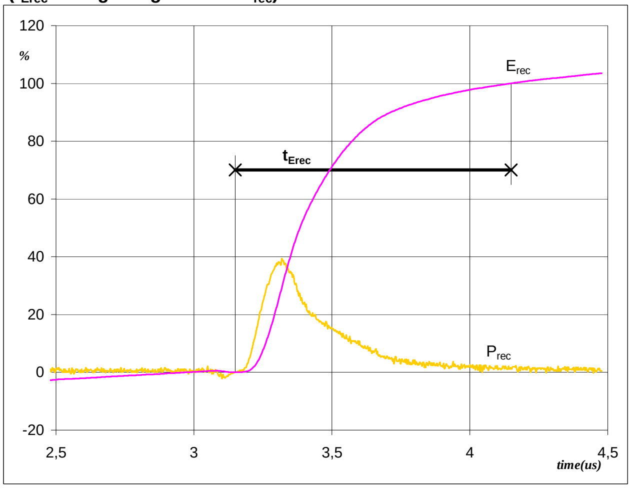
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	35	A
Q_{rr} (100%) =	5,50	µC
t_{Qrr} =	1,00	µs

Figure 10 Output inverter FWD

Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	20,99	kW
E_{rec} (100%) =	2,27	mJ
t_{Erec} =	1,00	µs

Ordering Code and Marking - Outline - Pinout

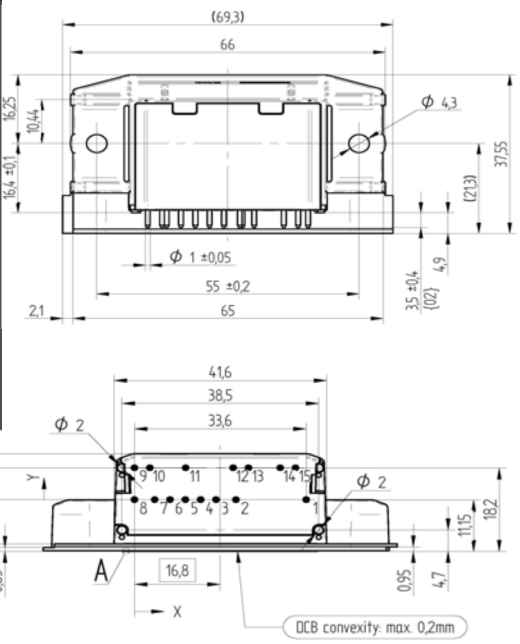
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste ,housing without clips	10-RZ126PA035SC-M620F41	M620F41	M620F41
without thermal paste ,housing with clips	10-R0126PA035SC-M620F40	M620F40	M620F40

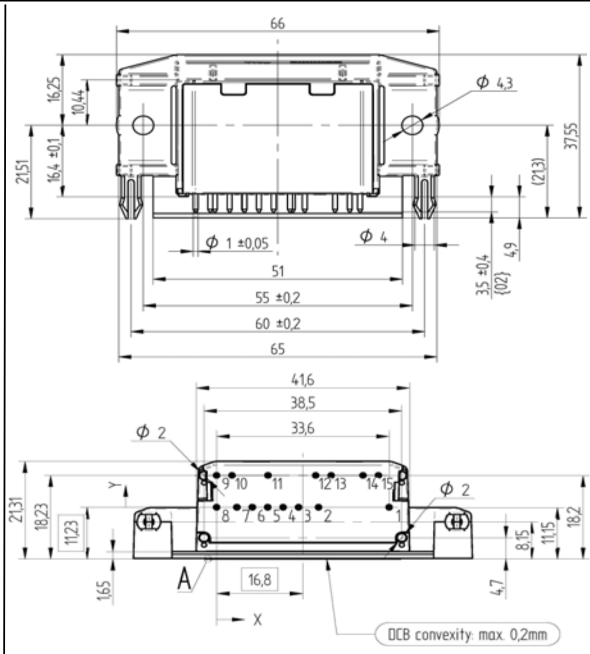
Outline

Pin table

Pin	X	Y
1	33,6	0
2	19,85	0
3	15,95	0
4	12,95	0
5	9,95	0
6	6,95	0
7	3,95	0
8	0	0
9	0	7
10	3	7
11	10	7
12	19,3	7
13	22,3	7
14	28,5	7
15	31,5	7

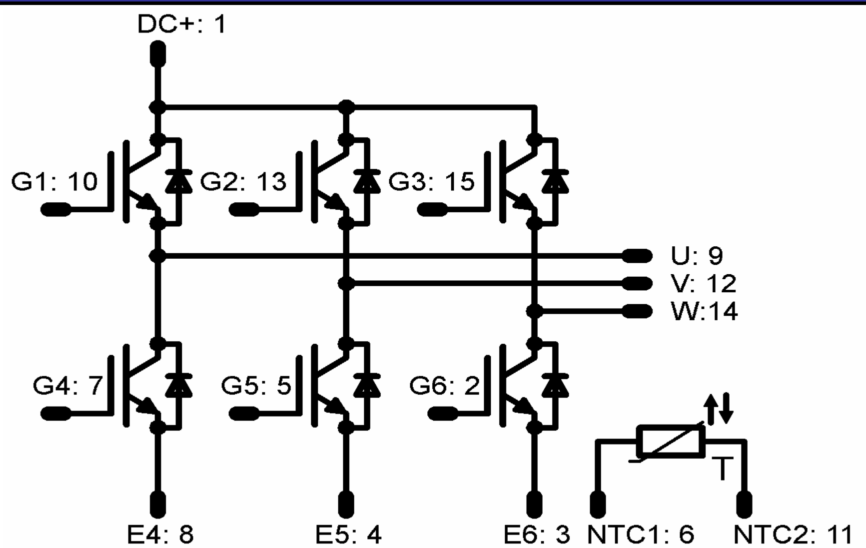


without clips



with clips

Pinout



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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.