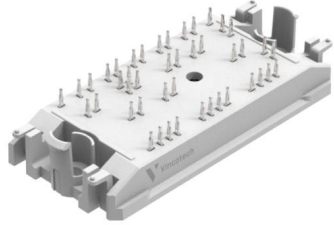
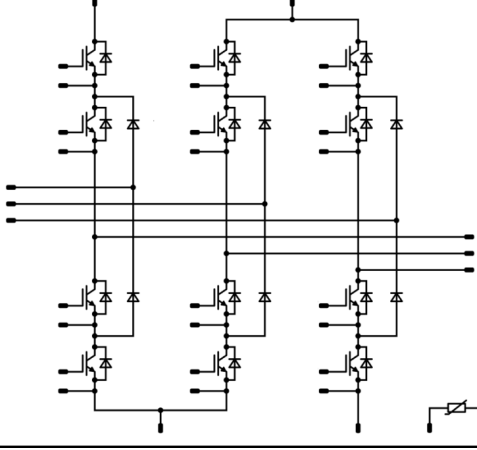




Vincotech

<i>flow 3xNPC 1</i>	1200 V / 30 A
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; margin: 0;">Features</p> <ul style="list-style-type: none"> Four quadrant operation Enhanced thermal performance Fast switching IGBTs </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; margin: 0;">Target applications</p> <ul style="list-style-type: none"> Solar Inverters UPS </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; margin: 0;">Types</p> <ul style="list-style-type: none"> 10-PH07N3A030S5-M894F98T </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; margin: 0;"><i>flow 1 12 mm housing</i></p>  </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; margin: 0;">Schematic</p>  </div>

Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Buck Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current	I_C		30	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	90	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	64	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C



Vincotech

Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Buck Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		650	V
Continuous (direct) forward current	I_F		30	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	50	W
Maximum Junction Temperature	T_{jmax}		175	°C

Boost Sw.Inv.Diode

Peak Repetitive Reverse Voltage	V_{RRM}		650	V
Continuous (direct) forward current	I_F		30	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	50	W
Maximum Junction Temperature	T_{jmax}		175	°C

Module Properties

Thermal Properties

Storage temperature	T_{stg}		-40...+125	°C
Operation temperature under switching condition	T_{jop}		-40...($T_{jmax} - 25$)	°C

Isolation Properties

Isolation voltage	V_{isol}	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
		AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			min. 12,7	mm
Clearance			9,4	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production



Vincotech

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	T_j [°C]	Min	Typ	Max	

Buck Switch

Static

Parameter	Symbol	$V_{GE} = V_{CE}$	V_{GS} [V]	V_{GE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit
Gate-emitter threshold voltage	$V_{GE(th)}$				0,0003	25	3,2	4	4,8	V
Collector-emitter saturation voltage	V_{CESat}		15		30	25 125 150		1,35 1,54 1,57	1,75	V
Collector-emitter cut-off current	I_{CES}		0	650		25			50	μA
Gate-emitter leakage current	I_{GES}		20	0		25			100	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}							1800		pF
Output capacitance	C_{oes}	$f = 1$ MHz	0	25		25		55		
Reverse transfer capacitance	C_{res}							7		
Gate charge	Q_g		15	520	30	25		70		nC

Thermal

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)				1,48 K/W

Dynamic

Parameter	Symbol	Conditions	V_{GS} [V]	V_{GE} [V]	I_D [A]	T_j [°C]	Min	Typ	Max	Unit		
Turn-on delay time	$t_{d(on)}$	$R_{goff} = 16$ Ω $R_{gon} = 16$ Ω				25 125 150		70 70 70		ns		
Rise time	t_r					25 125 150		8 9 10				
Turn-off delay time	$t_{d(off)}$					25 125 150		86 104 107				
Fall time	t_f		± 15	350	30	25 125 150		13 15 21				
Turn-on energy (per pulse)	E_{on}		$Q_{tFWD} = 1,1$ μC $Q_{tFWD} = 1,9$ μC $Q_{tFWD} = 2,1$ μC				25 125 150		0,397 0,505 0,639			mWs
Turn-off energy (per pulse)	E_{off}						25 125 150		0,224 0,363 0,374			



Vincotech

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V]	I_C [A] I_D [A]	I_F [A]	T_j [°C]	Min	Typ	Max	

Buck Diode

Static

Forward voltage	V_F				30	25 125 150		1,52 1,46 1,44	1,92	V
Reverse leakage current	I_r			650		25			1,6	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/ mK (PSX)						1,92		K/W
-------------------------------------	---------------	---	--	--	--	--	--	------	--	-----

Dynamic

Peak recovery current	I_{RRM}					25 125 150		48 63 61		A
Reverse recovery time	t_{rr}					25 125 150		52 66 74		ns
Recovered charge	Q_r	$di/dt = 5071$ A/μs $di/dt = 4912$ A/μs $di/dt = 4100$ A/μs	±15	350	30	25 125 150		1,06 1,91 2,10		μC
Reverse recovered energy	E_{rec}					25 125 150		0,220 0,437 0,508		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		3847 3784 3030		A/μs

Boost Sw.Inv.Diode

Static

Forward voltage	V_F				30	25 125 150		1,52 1,46 1,44	1,92	V
Reverse leakage current	I_r			650		25			1,6	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,92		K/W
-------------------------------------	---------------	---------------------------------------	--	--	--	--	--	------	--	-----



Vincotech

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	T_j [°C]	Min	Typ	Max	

Thermistor

Rated resistance	R				25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1484 \Omega$			100	-5		5	%
Power dissipation	P				25		5		mW
Power dissipation constant					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1 \%$			25		3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1 \%$			25		4000		K
Vincotech NTC Reference								I	

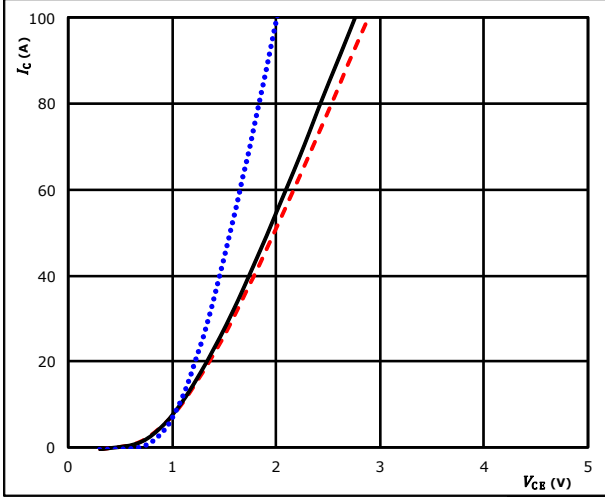


Buck Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

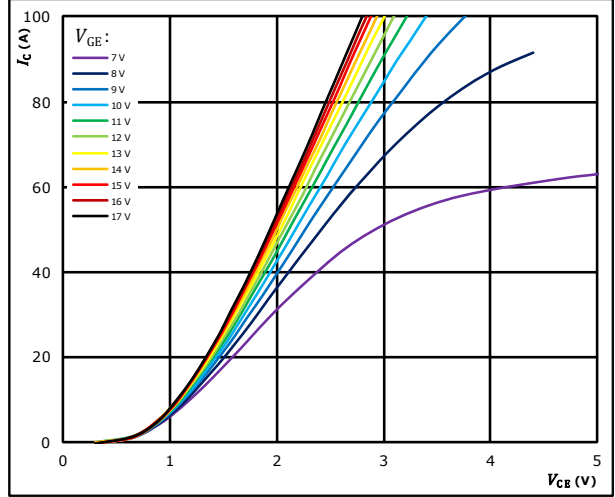


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25 \text{ }^\circ C$ (dotted blue)
 $125 \text{ }^\circ C$ (solid black)
 $150 \text{ }^\circ C$ (dashed red)

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

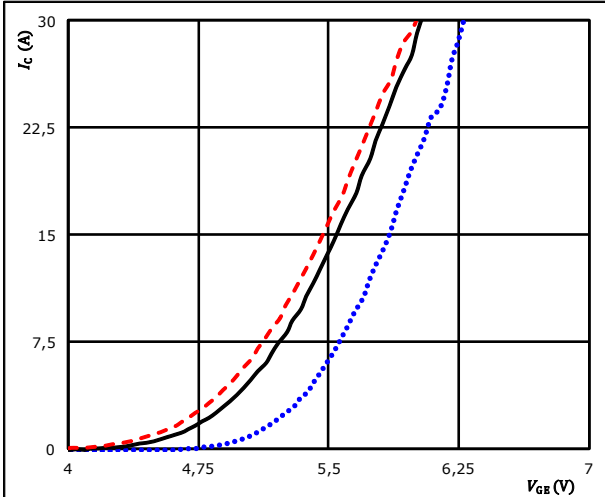


$t_p = 250 \mu s$
 $T_j = 150 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

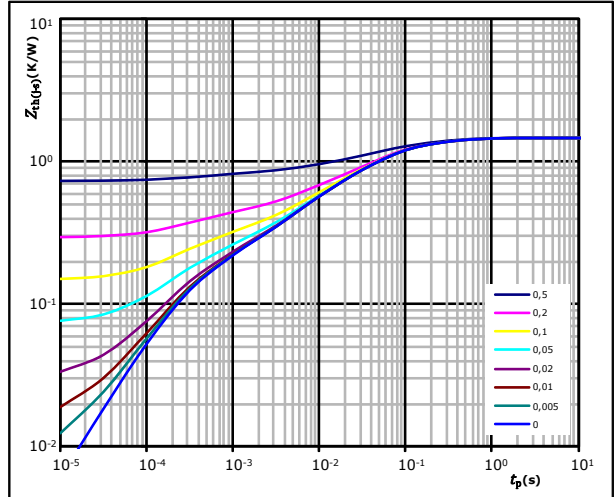


$t_p = 100 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25 \text{ }^\circ C$ (dotted blue)
 $125 \text{ }^\circ C$ (solid black)
 $150 \text{ }^\circ C$ (dashed red)

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 1,48 \text{ K/W}$
 IGBT thermal model values

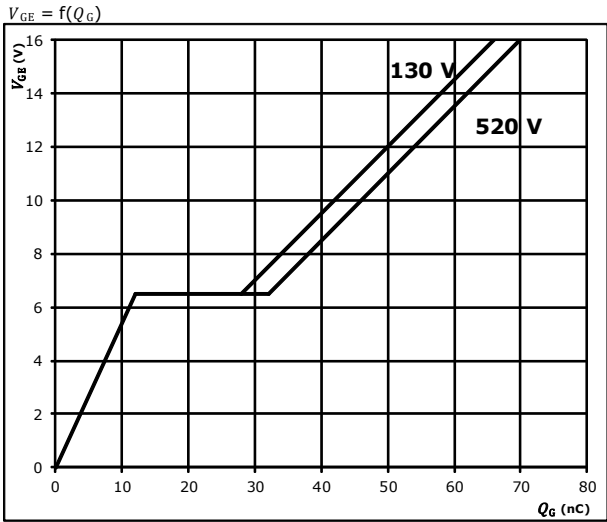
R (K/W)	τ (s)
2,13E-01	3,29E-01
7,18E-01	5,25E-02
3,25E-01	8,96E-03
8,82E-02	1,84E-03
1,41E-01	2,71E-04



Buck Switch Characteristics

figure 5. IGBT

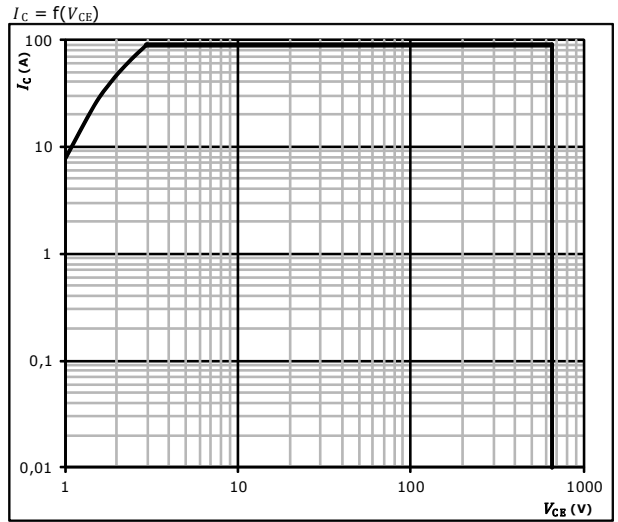
Gate voltage vs gate charge



$I_C = 30$ A

figure 6. IGBT

Safe operating area



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



Buck Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

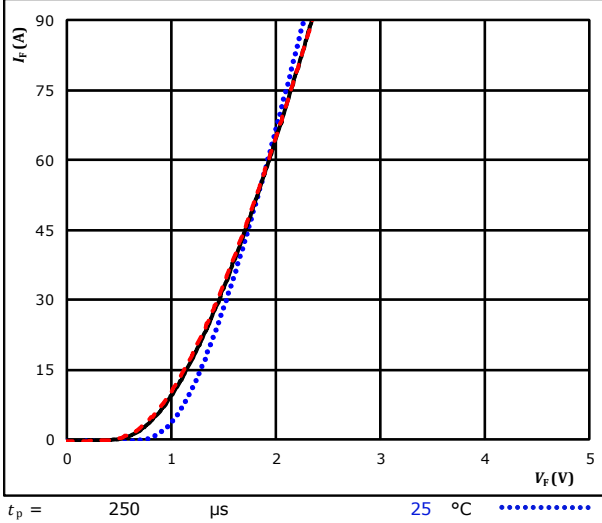
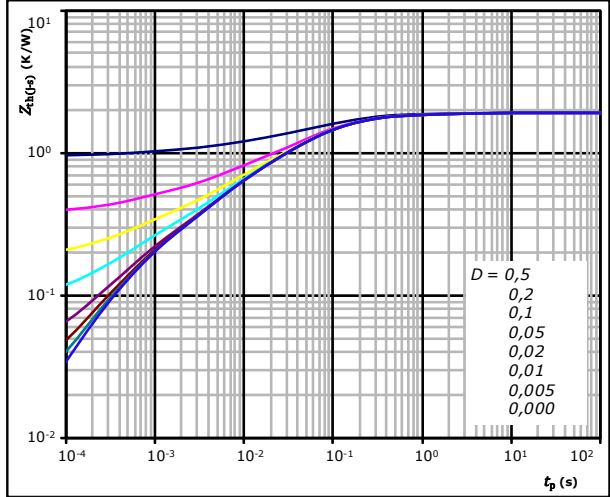


figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,92$ K/W

FWD thermal model values

R (K/W)	τ (s)
9,41E-02	2,25E+00
3,44E-01	2,12E-01
8,56E-01	5,84E-02
3,61E-01	9,83E-03
1,37E-01	2,89E-03
1,27E-01	4,79E-04

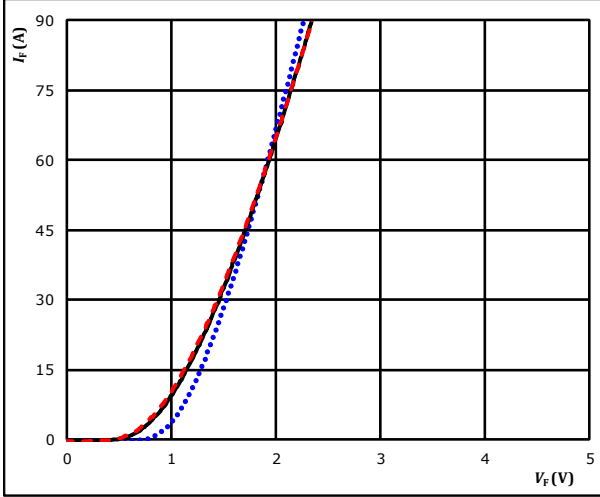


Boost Sw.Inv.Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

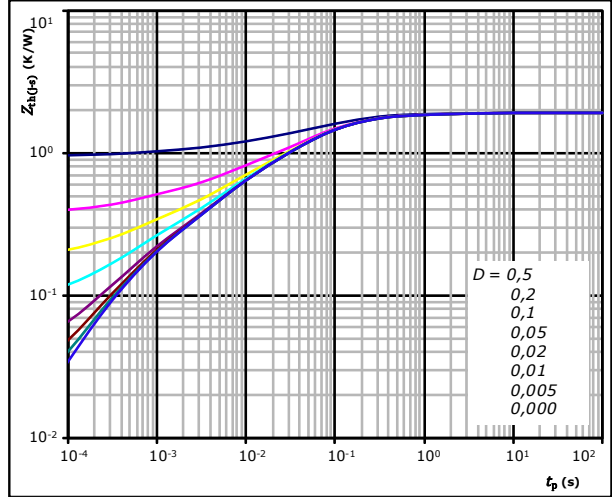


$t_p = 250 \mu s$
 T_j : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,92 \text{ K/W}$

FWD thermal model values

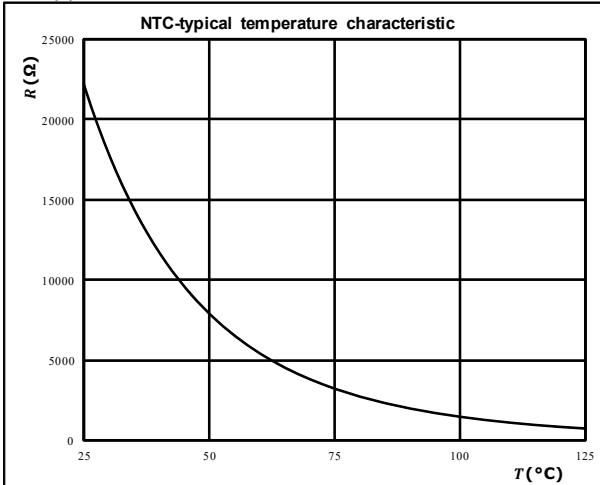
R (K/W)	τ (s)
9,41E-02	2,25E+00
3,44E-01	2,12E-01
8,56E-01	5,84E-02
3,61E-01	9,83E-03
1,37E-01	2,89E-03
1,27E-01	4,79E-04

Thermistor Characteristics

figure 1. Thermistor

Typical NTC characteristic as a function of temperature

$$R = f(T)$$

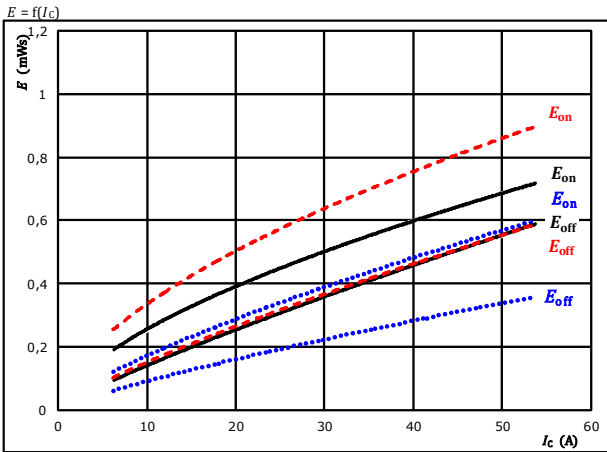




Buck / Boost Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

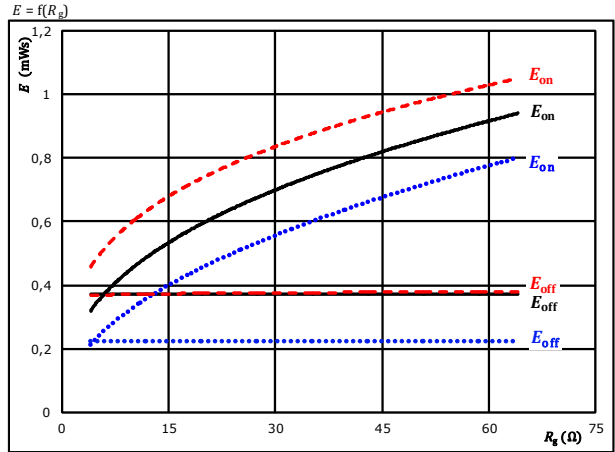


With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{g\text{on}} = 16$ Ω
 $R_{g\text{off}} = 16$ Ω

T_j : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

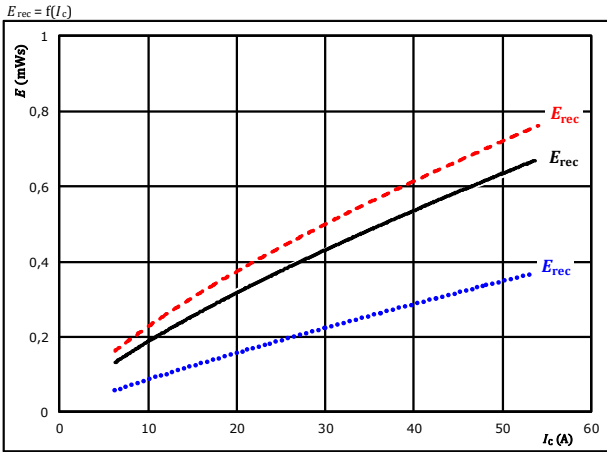


With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $I_C = 30$ A

T_j : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

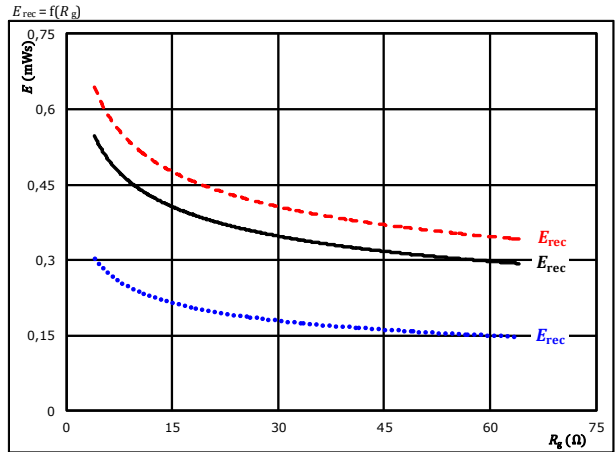


With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{g\text{on}} = 16$ Ω

T_j : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $I_C = 30$ A

T_j : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)



Vincotech

Buck / Boost Switching Characteristics

figure 5. IGBT

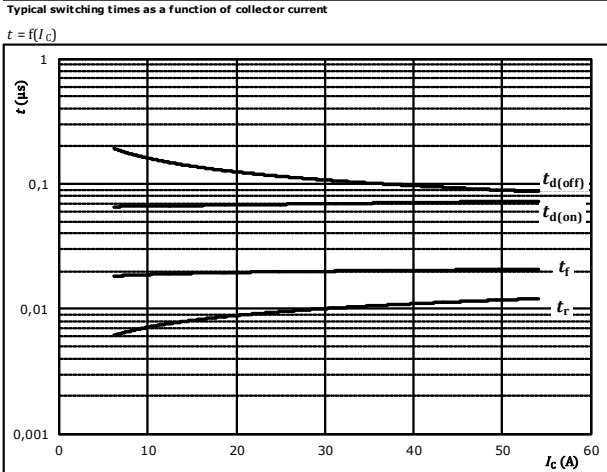


figure 6. IGBT

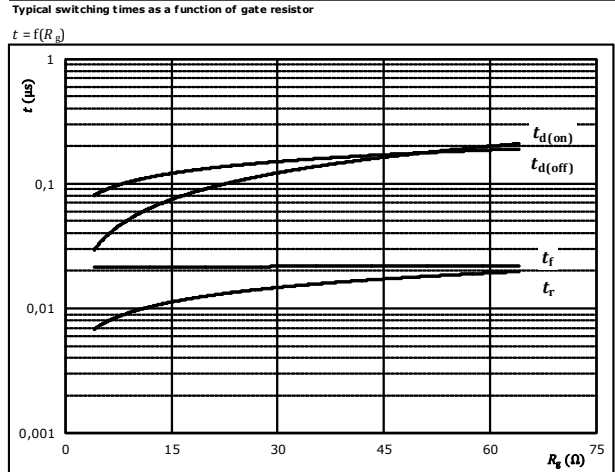


figure 7. FWD

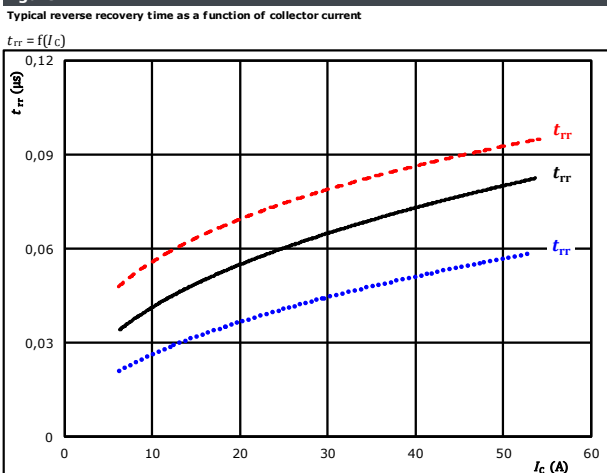
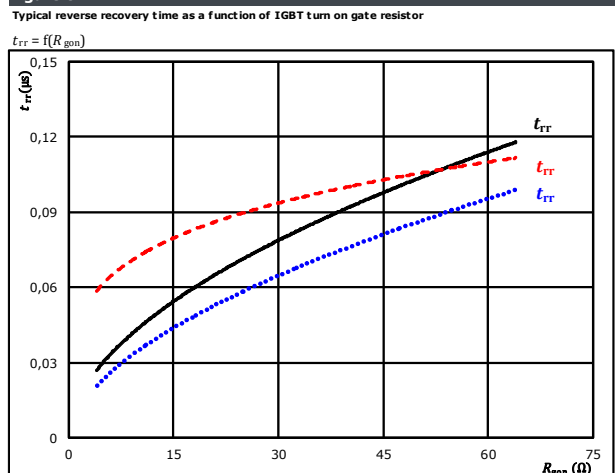


figure 8. FWD



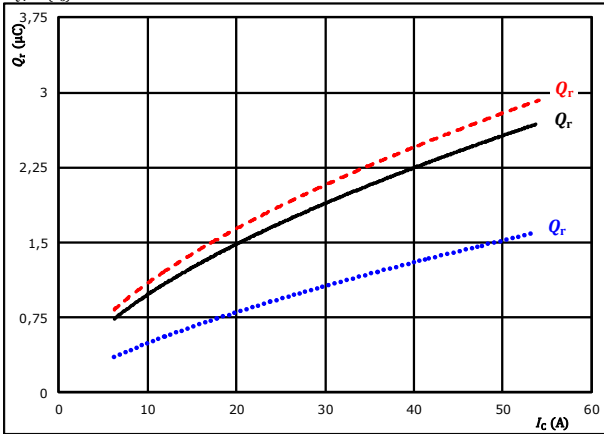


Buck / Boost Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

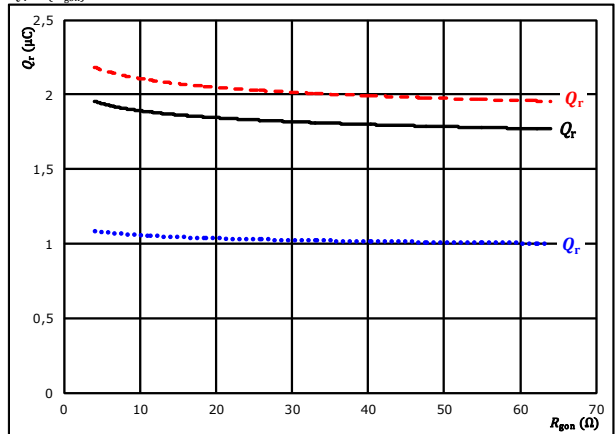


At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $R_{gon} = 16$ Ω $T_j = 150$ °C - - - -

figure 10. FWD

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

$$Q_r = f(R_{gon})$$

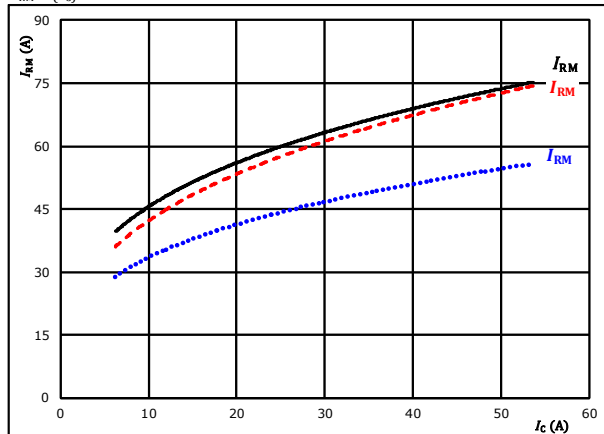


At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $I_c = 30$ A $T_j = 150$ °C - - - -

figure 11. FWD

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

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

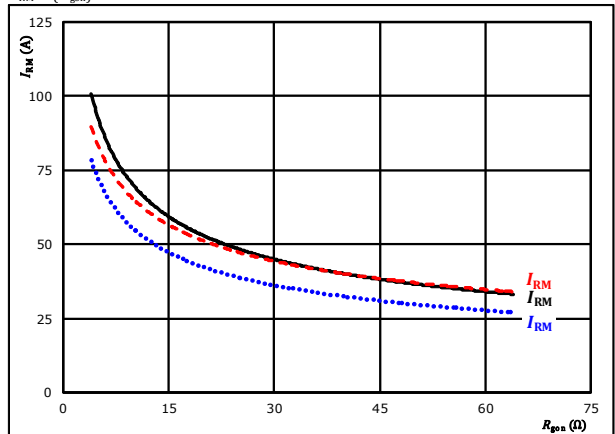


At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $R_{gon} = 16$ Ω $T_j = 150$ °C - - - -

figure 12. FWD

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

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



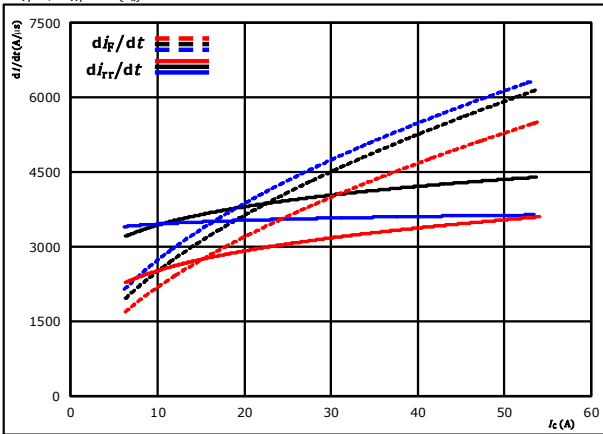
At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $I_c = 30$ A $T_j = 150$ °C - - - -



Buck / Boost Switching Characteristics

figure 13. FWD

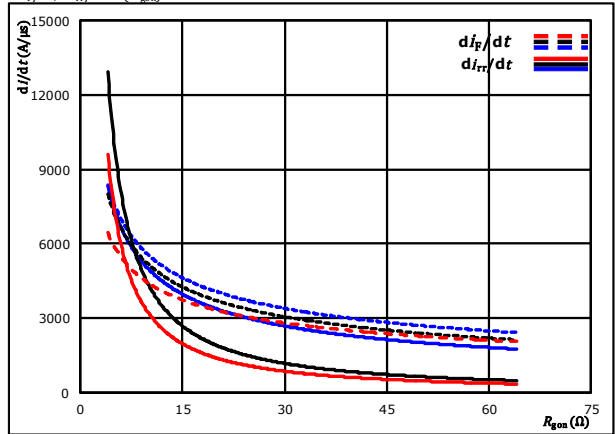
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_{rr}/dt = f(I_c)$



At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $R_{g(on)} = 16$ Ω $T_j = 150$ °C - - - - -

figure 14. FWD

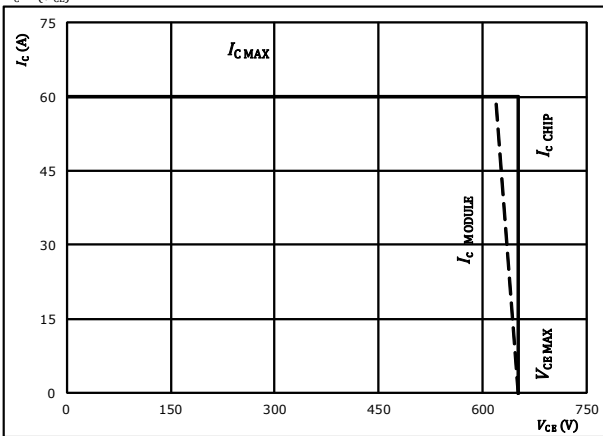
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_f/dt, di_{rr}/dt = f(R_{g(on)})$



At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $I_c = 30$ A $T_j = 150$ °C - - - - -

figure 15. IGBT

Reverse bias safe operating area
 $I_c = f(V_{CE})$



At $T_j = 175$ °C
 $R_{g(on)} = 16$ Ω
 $R_{g(off)} = 16$ Ω



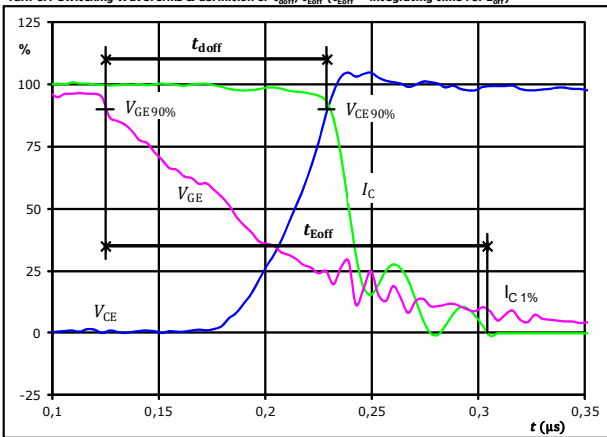
Buck / Boost Switching Definitions

General conditions

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

figure 1. IGBT

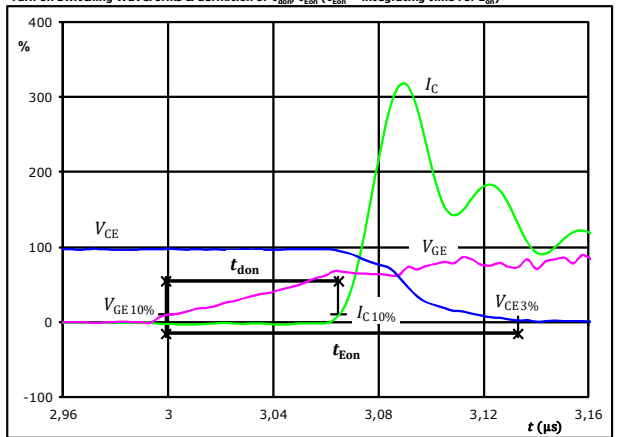
Turn-off Switching Waveforms & definition of t_{doff} t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{CE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_{doff} =$	0,104	μs
$t_{Eoff} =$	0,179	μs

figure 2. IGBT

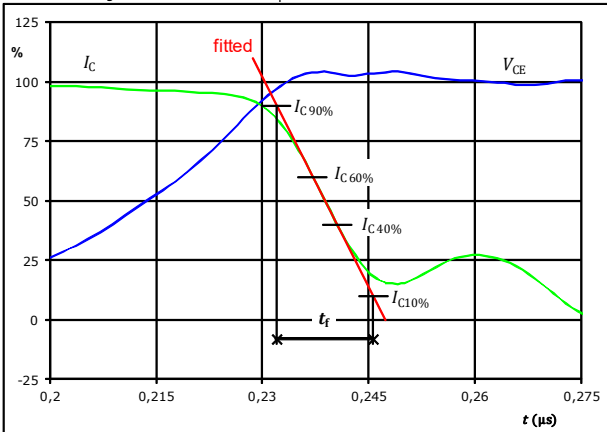
Turn-on Switching Waveforms & definition of t_{don} t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{CE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_{don} =$	0,070	μs
$t_{Eon} =$	0,134	μs

figure 3. IGBT

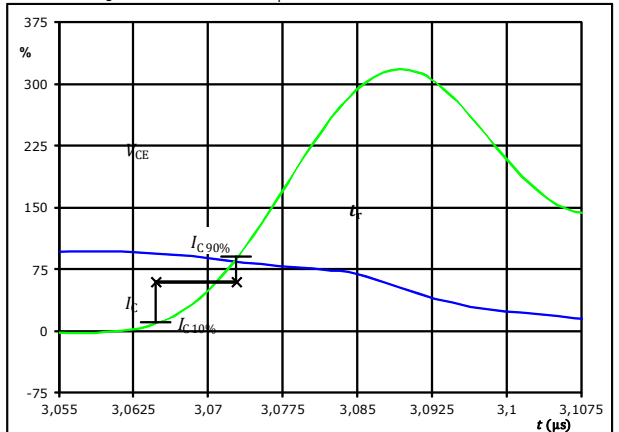
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_f =$	0,015	μs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



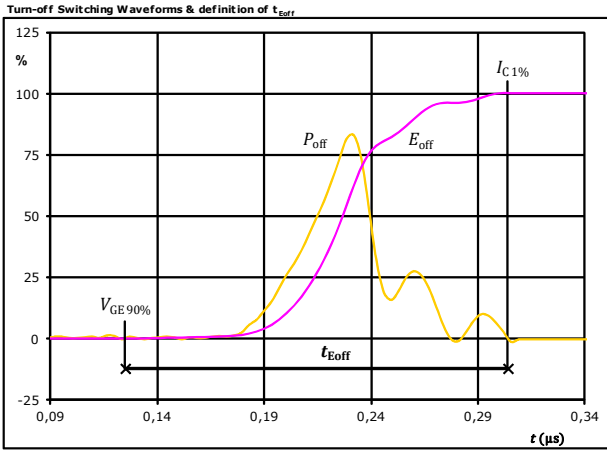
$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_r =$	0,009	μs



Vincotech

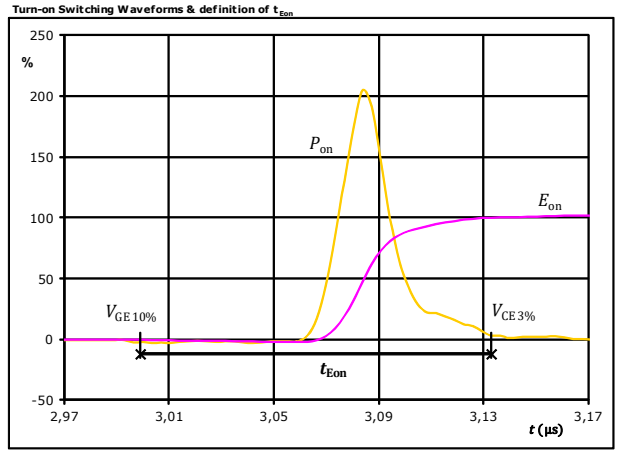
Buck / Boost Switching Characteristics

figure 5. IGBT



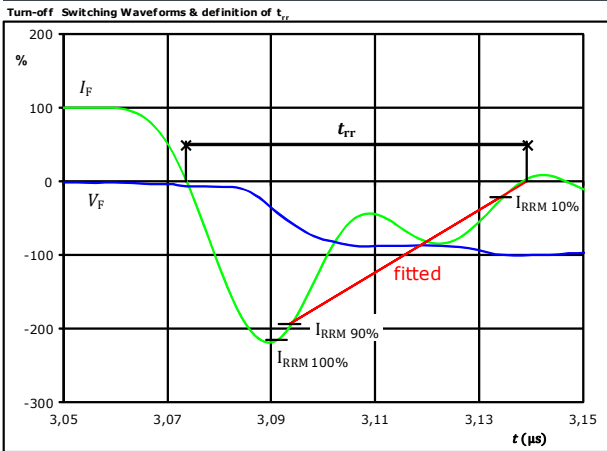
$P_{off}(100\%) = 10,57$ kW
 $E_{off}(100\%) = 0,36$ mJ
 $t_{Eoff} = 0,18$ μs

figure 6. IGBT



$P_{on}(100\%) = 10,57$ kW
 $E_{on}(100\%) = 0,50$ mJ
 $t_{Eon} = 0,13$ μs

figure 7. FWD



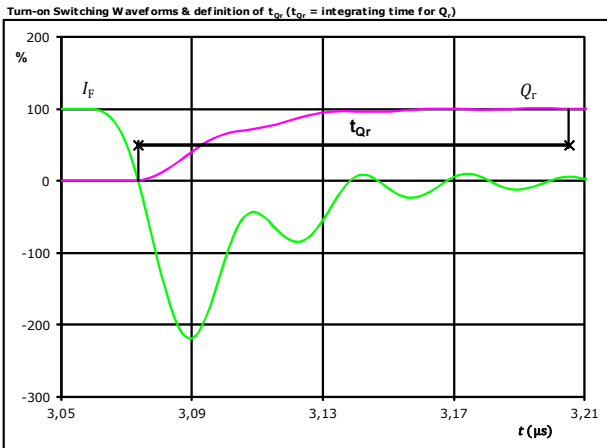
$V_F(100\%) = 350$ V
 $I_F(100\%) = 30$ A
 $I_{RRM}(100\%) = -63$ A
 $t_{rr} = 0,066$ μs



Vincotech

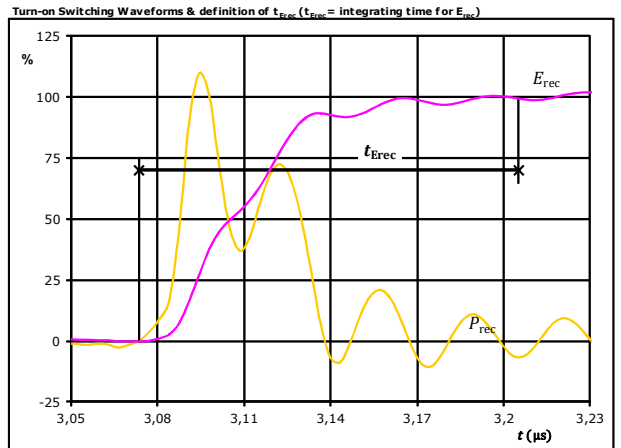
Buck / Boost Switching Characteristics

figure 8. FWD



I_F (100%) =	30	A
Q_r (100%) =	1,91	μC
t_{Qr} =	0,13	μs

figure 9. FWD



P_{rec} (100%) =	10,57	kW
E_{rec} (100%) =	0,44	mJ
t_{Erec} =	0,13	μs



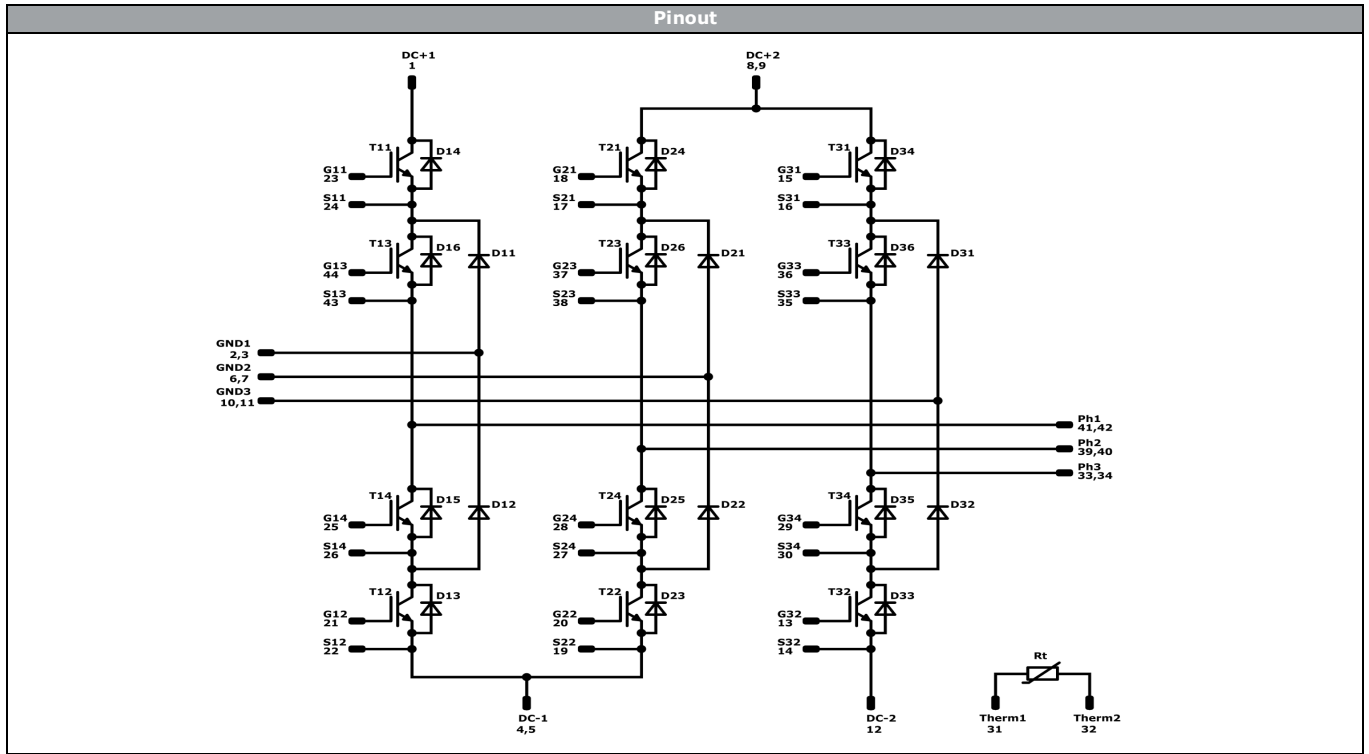
Vincotech

Ordering Code & Marking																																				
Version				Ordering Code																																
without thermal paste 12 mm housing with press-fit pins				10-PH07N3A030S5-M894F98T																																
<table border="1"> <tr> <td rowspan="2"> NN-NNNNNNNNNNNN TTTTUVVWWYY UL VIN LLLLL SSSS </td> <td rowspan="2"> </td> <td rowspan="2"> </td> <td>Text</td> <td>Name</td> <td>Date code</td> <td>UL & VIN</td> <td>Lot</td> <td>Serial</td> </tr> <tr> <td></td> <td>NN-NNNNNNNNNNNN-TTTTTUVV</td> <td>WWYY</td> <td>UL VIN</td> <td>LLLLL</td> <td>SSSS</td> </tr> <tr> <td rowspan="2"> Datamatrix </td> <td rowspan="2"> </td> <td rowspan="2"> </td> <td>Type&Ver</td> <td>Lot number</td> <td>Serial</td> <td>Date code</td> <td></td> <td></td> </tr> <tr> <td>TTTTTUVV</td> <td>LLLLL</td> <td>SSSS</td> <td>WWYY</td> <td></td> <td></td> </tr> </table>							NN-NNNNNNNNNNNN TTTTUVVWWYY UL VIN LLLLL SSSS			Text	Name	Date code	UL & VIN	Lot	Serial		NN-NNNNNNNNNNNN-TTTTTUVV	WWYY	UL VIN	LLLLL	SSSS	Datamatrix			Type&Ver	Lot number	Serial	Date code			TTTTTUVV	LLLLL	SSSS	WWYY		
NN-NNNNNNNNNNNN TTTTUVVWWYY UL VIN LLLLL SSSS			Text	Name	Date code	UL & VIN				Lot	Serial																									
				NN-NNNNNNNNNNNN-TTTTTUVV	WWYY	UL VIN	LLLLL	SSSS																												
Datamatrix			Type&Ver	Lot number	Serial	Date code																														
			TTTTTUVV	LLLLL	SSSS	WWYY																														

Pin Table				Outline
Pin	X	Y	Function	<p>Tolerance of pinpositions: ±0,5mm at the end of pins Dimension of coordinate axis is only offset without tolerance</p>
1	0	28,2	DC+1	
2	6	28,2	GND1	
3	9,7	28,2	GND1	
4	15,7	28,2	DC-1	
5	18,7	28,2	DC-1	
6	24,7	28,2	GND2	
7	27,7	28,2	GND2	
8	33,8	28,2	DC+2	
9	36,8	28,2	DC+2	
10	42,8	28,2	GND3	
11	46,2	28,2	GND3	
12	52,2	28,2	DC-2	
13	52,2	23,7	G32	
14	52,2	20,7	S32	
15	41,25	20,6	G31	
16	38,25	20,6	S31	
17	32,55	20,6	S21	
18	29,55	20,6	G21	
19	18,7	20,7	S22	
20	18,7	23,7	G22	
21	15,7	23,7	G12	
22	15,7	20,7	S12	
23	4,75	20,6	G11	
24	1,75	20,6	S11	
25	8,35	12,2	G14	
26	11,35	12,2	S14	
27	19,95	12,2	S24	
28	22,95	12,2	G24	
29	44,35	12,2	G34	
30	47,35	12,2	S34	
31	52,2	8,9	Therm1	
32	52,2	5,9	Therm2	
33	46,75	0	Ph3	
34	43,95	0	Ph3	
35	40,95	0	S33	
36	37,95	0	G33	
37	29,2	0	G23	
38	26,2	0	S23	
39	23,2	0	Ph2	
40	20,4	0	Ph2	
41	11,8	0	Ph1	
42	9	0	Ph1	
43	6	0	S13	
44	3	0	G13	



Vincotech



Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T21, T31, T12, T22, T32	IGBT	650 V	30 A	Buck Switch	
D11, D21, D31, D12, D22, D32	FWD	650 V	30 A	Buck Diode	
T13, T23, T33, T14, T24, T34	IGBT	650 V	30 A	Boost Switch	
D13, D23, D33, D14, D24, D34	FWD	650 V	30 A	Boost Diode	
D15, D16, D25, D26, D35, D36	FWD	650 V	30 A	Boost Sw.Inv.Diode	
Rt	NTC			Thermistor	




Vincotech

Packaging instruction			
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ Sample

Handling instruction
Handling instructions for <i>flow</i> 1 packages see vincotech.com website.

Package data
Package data for <i>flow</i> 1 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
10-PH07N3A030S5-M894F98T-D2-14	15 Dec. 2017	Dynamic Characteristics and graphs corrected	3 , 4 , 10-16

DISCLAIMER

The information, specifications, procedures, methods and recommendations herein (together "information") are presented by Vincotech to reader in good faith, are believed to be accurate and reliable, but may well be incomplete and/or not applicable to all conditions or situations that may exist or occur. Vincotech reserves the right to make any changes without further notice to any products to improve reliability, function or design. No representation, guarantee or warranty is made to reader as to the accuracy, reliability or completeness of said information or that the application or use of any of the same will avoid hazards, accidents, losses, damages or injury of any kind to persons or property or that the same will not infringe third parties rights or give desired results. It is reader's sole responsibility to test and determine the suitability of the information and the product for reader's intended use.

LIFE SUPPORT POLICY

Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
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.