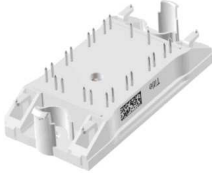
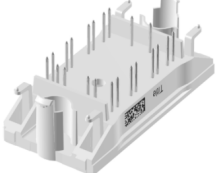
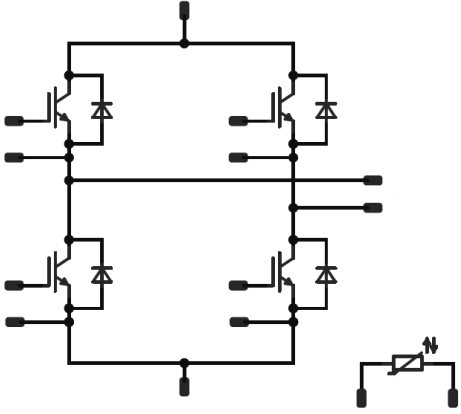




<i>fastPack 0 H</i>	1200 V / 15 A
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;">Features</p> <ul style="list-style-type: none"> High efficient H-bridge High-speed IGBT Ultra high switching frequency Ultra low inductive design Clip-in PCB mounting </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;">Target applications</p> <ul style="list-style-type: none"> Solar SMPS UPS Welding </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;">Types</p> <ul style="list-style-type: none"> V23990-P627-F88-PM V23990-P627-F89-PM </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;"><i>flow 0 housing</i></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>12mm housing</p> </div> <div style="text-align: center;">  <p>17mm housing</p> </div> </div> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;">Schematic</p>  </div>

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
H-Bridge Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80^{\circ}\text{C}$	22	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	45	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80^{\circ}\text{C}$	71	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum Junction Temperature	T_{jmax}		175	$^{\circ}\text{C}$



Parameter	Symbol	Conditions	Value	Unit
H-Bridge Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$	16	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave	65	A
Surge current capability	I^2t	$t_p = 10$ ms 50 Hz sine $T_j = \text{ }^\circ\text{C}$	21	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$	42	W
Maximum Junction Temperature	T_{jmax}		175	$^\circ\text{C}$

Parameter	Symbol	Conditions	Value	Unit
Module Properties				
Thermal Properties				
Storage temperature	T_{stg}		-40...+125	$^\circ\text{C}$
Operation temperature under switching condition	T_{jop}		-40...+($T_{jmax} - 25$)	$^\circ\text{C}$

Isolation Properties					
Isolation voltage	V_{isol}	DC voltage	$t_p=2\text{s}$	4000	V
Creepage distance				min 12,7	mm
Clearance		12mm housing / 17mm housing		9,55 / >12,7	mm
Comparative Tracking Index	CTI			>200	



Characteristic Values

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

H-Bridge Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,0005	25 125	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125 150	1,78	1,89	2,42	V
Collector-emitter cut-off current	I_{CES}		0	1200		25 125			2	μA
Gate-emitter leakage current	I_{GES}		20	0		25 125			120	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f=1 MHz	0	25		25		875		pF
Reverse transfer capacitance	C_{res}							45		

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material A=3,4W/mK						1,35		K/W
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IGBT Switching

Turn-on delay time	$t_{d(on)}$	$R_{goff} = 32 \Omega$ $R_{gon} = 32 \Omega$	±15	600	15	25 125 150		84 85 86		ns
Rise time	t_r					25 125 150		24 25 26		
Turn-off delay time	$t_{d(off)}$					25 125 150		174 221 230		
Fall time	t_f					25 125 150		42 63 69		
Turn-on energy (per pulse)	E_{on}					$Q_{rFWD} = 1,1 \mu C$ $Q_{rFWD} = 2,1 \mu C$ $Q_{rFWD} = 2,6 \mu C$				
Turn-off energy (per pulse)	E_{off}					25 125 150		0,512 0,815 0,890		



Parameter	Symbol	Conditions					Value			Unit
		V_r [V]	I_F [A]	T_j [°C]	Min	Typ	Max			
H-Bridge Diode										
Static										
Forward voltage	V_F		15	25 125 150			2,37 2,47	2,71		V
Reverse leakage current	I_r		1200	25 150				60 1800		μ A

Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	Phase-Change Material $\lambda=3,4\text{W/mK}$						2,46		K/W

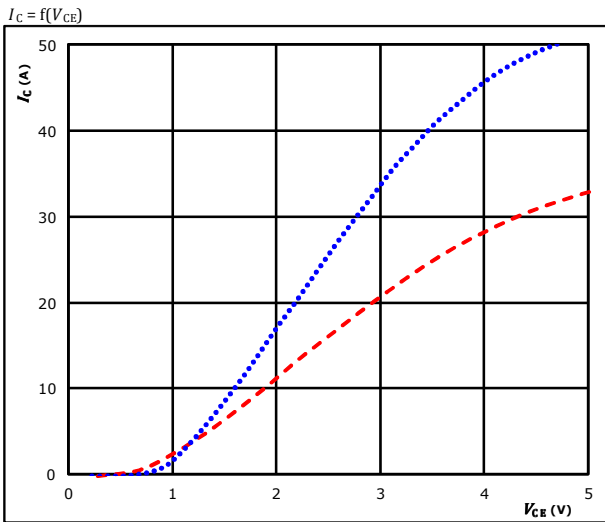
FWD Switching										
Peak recovery current	I_{RRM}					25 125 150		12 15 16		A
Reverse recovery time	t_{rr}					25 125 150		250 429 466		ns
Recovered charge	Q_r	$di/dt = 615\text{ A}/\mu\text{s}$ $di/dt = 691\text{ A}/\mu\text{s}$ $di/dt = 576\text{ A}/\mu\text{s}$	± 15	600	15	25 125 150		1,122 2,063 2,610		μ C
Reverse recovered energy	E_{rec}					25 125 150		0,439 0,830 1,075		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		133 101 94		A/ μ s

Thermistor										
Parameter	Symbol	Conditions					Value			Unit
		V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max		
Rated resistance	R					25		21,5		k Ω
Deviation of R100	$\Delta_{R/R}$	R100=1486 Ω				100	-4,5		+4,5	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	$B_{(25/50)}$					25		3884		K
B-value	$B_{(25/100)}$					25		3964		K
Vincotech NTC Reference									F	



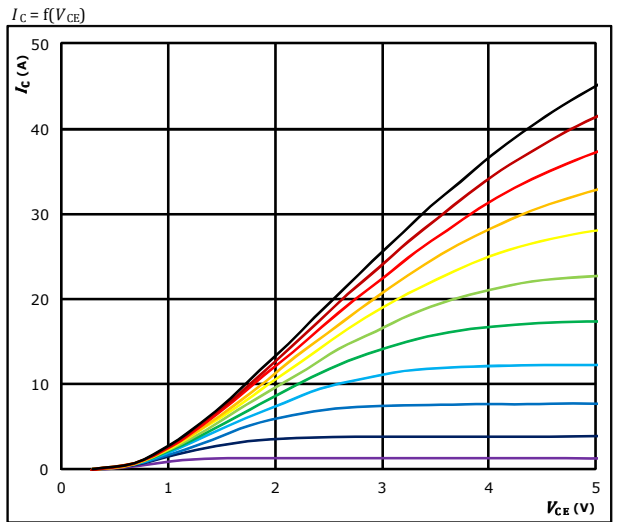
H-Bridge Switch Characteristics

Typical output characteristics IGBT



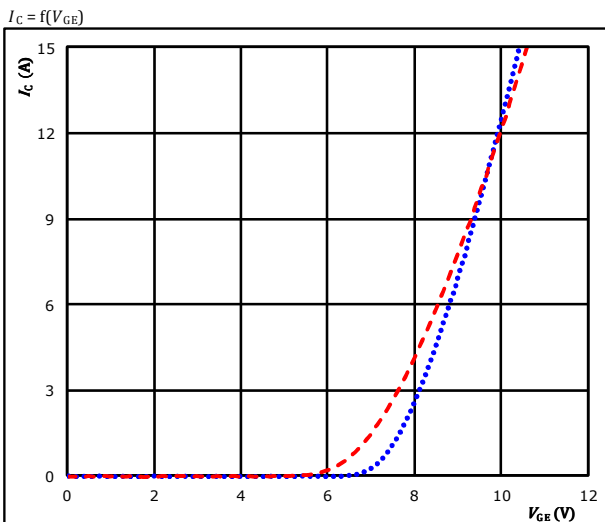
$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 25 °C (dotted blue)
 125 °C (solid black)
 150 °C (dashed red)

Typical output characteristics IGBT



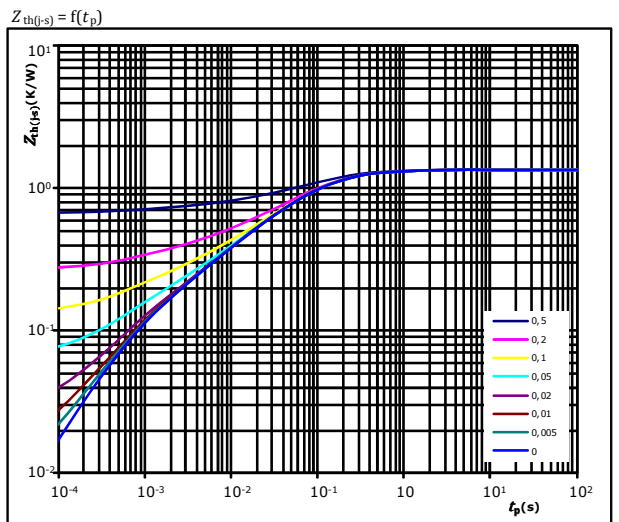
$t_p = 250 \mu s$
 $T_j = 150 \text{ °C}$
 V_{GE} from 7 V to 17 V in steps of 1 V

Typical transfer characteristics IGBT



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

Transient Thermal Impedance as function of Pulse duration IGBT

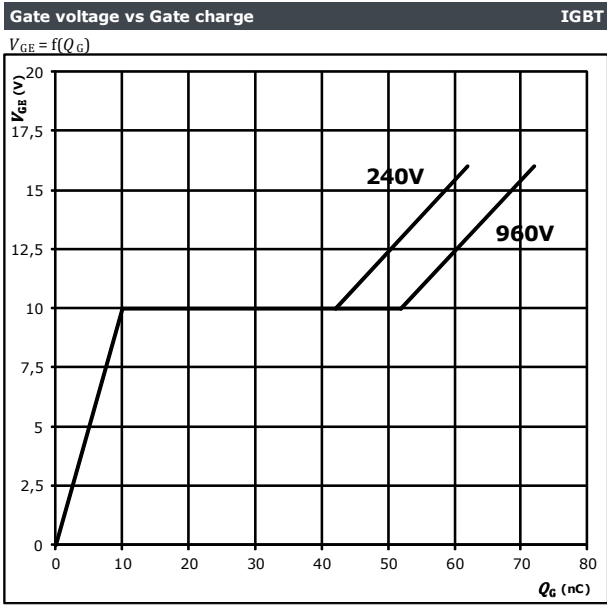


$D = t_p / T$
 $R_{th(j-s)} = 1,35 K/W$
 IGBT thermal model values

$R_{th} (K/W)$	$\tau (s)$
1,62E-01	5,85E-01
6,34E-01	9,42E-02
2,82E-01	2,85E-02
1,64E-01	6,73E-03
8,75E-02	9,43E-04
1,75E-02	3,79E-04



Vincotech

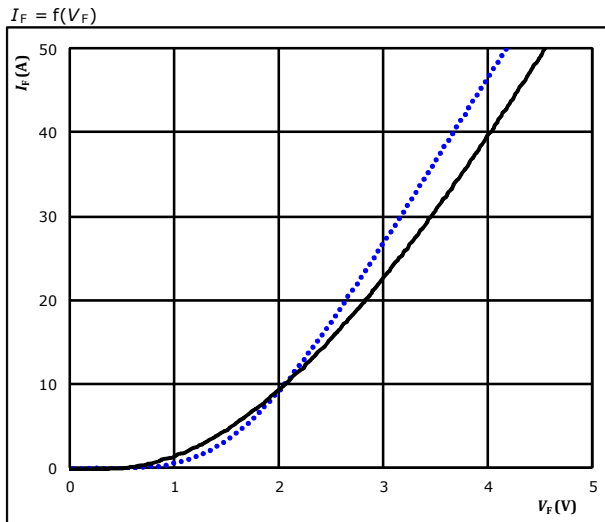


At
 $I_C = 15$ A

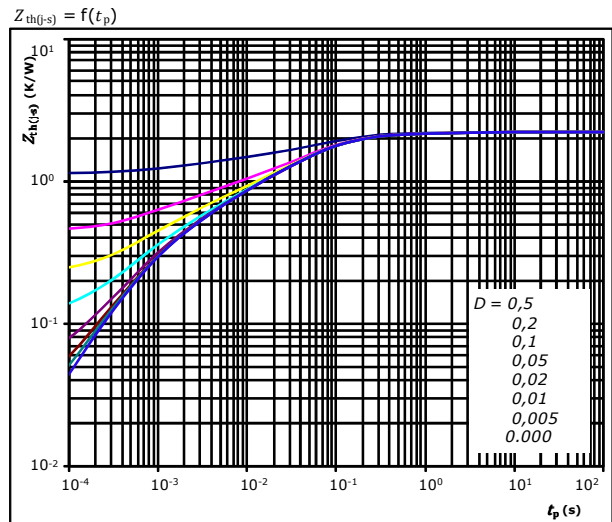


H-Bridge Diode Characteristics

Typical forward characteristics FWD



Transient thermal impedance as a function of pulse width FWD



FWD thermal model values

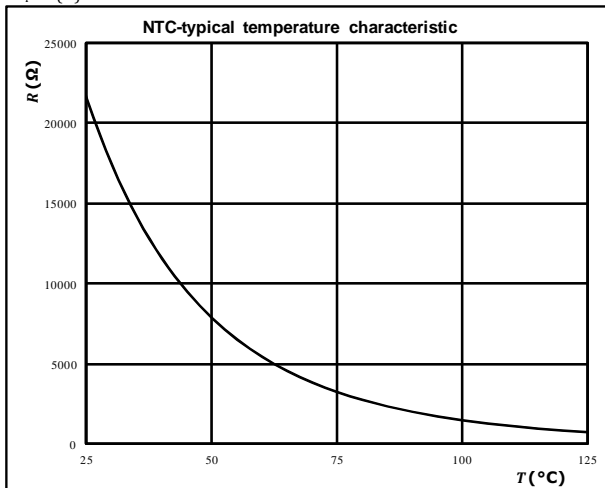
R (K/W)	τ (s)
7,47E-02	2,62E+00
1,66E-01	3,82E-01
9,90E-01	7,20E-02
4,45E-01	1,82E-02
3,36E-01	3,41E-03
2,26E-01	6,98E-04

Thermistor

Thermistor typical temperature characteristic

Typical NTC characteristic
 as a function of temperature

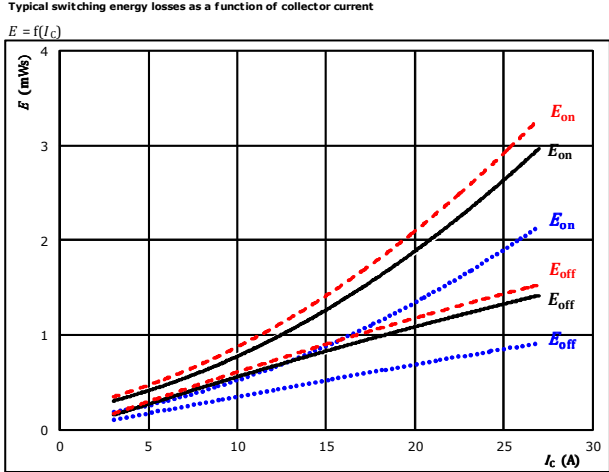
$R_T = f(T)$





H-Bridge Switching Definition

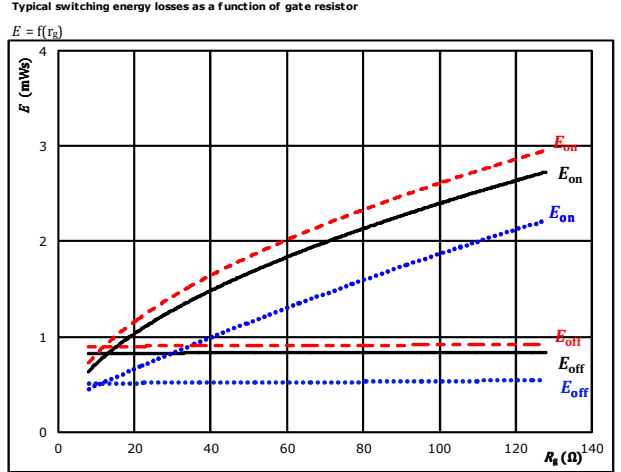
Figure 1. IGBT
Typical switching energy losses as a function of collector current



With an inductive load at

$V_{CE} = 600$ V	$T_j:$ 25 °C
$V_{GE} = \pm 15$ V	125 °C	————
$R_{\theta n} = 32$ Ω	150 °C	- - - -
$R_{\theta off} = 32$ Ω		

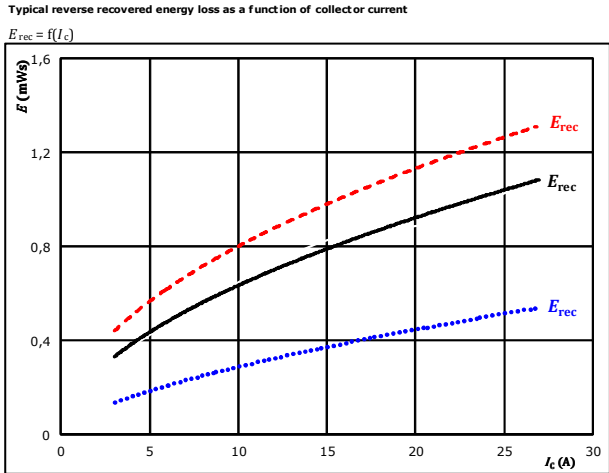
Figure 2. IGBT
Typical switching energy losses as a function of gate resistor



With an inductive load at

$V_{CE} = 600$ V	$T_j:$ 25 °C
$V_{GE} = \pm 15$ V	125 °C	————
$I_C = 15$ A	150 °C	- - - -

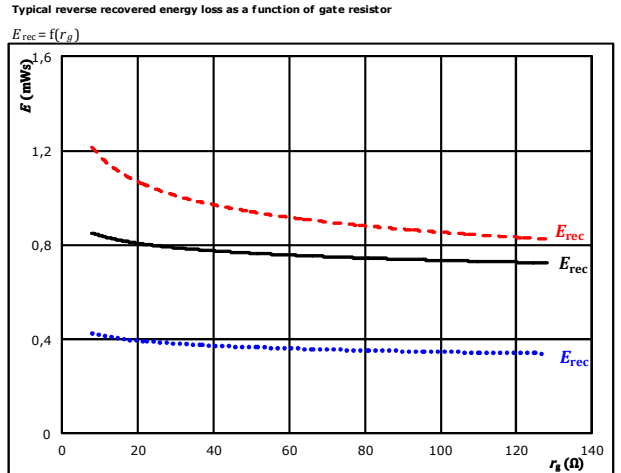
Figure 3. FWD
Typical reverse recovered energy loss as a function of collector current



With an inductive load at

$V_{CE} = 600$ V	$T_j:$ 25 °C
$V_{GE} = \pm 15$ V	125 °C	————
$R_{\theta n} = 32$ Ω	150 °C	- - - -

Figure 4. FWD
Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at

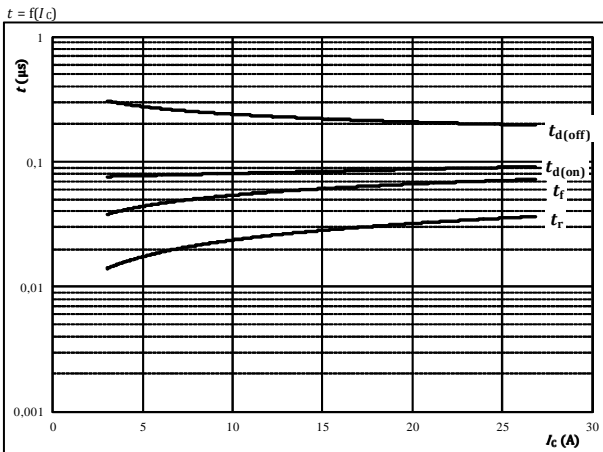
$V_{CE} = 600$ V	$T_j:$ 25 °C
$V_{GE} = \pm 15$ V	125 °C	————
$I_C = 15$ A	150 °C	- - - -



H-Bridge Switching Definitions

Figure 5. IGBT

Typical switching times as a function of collector current

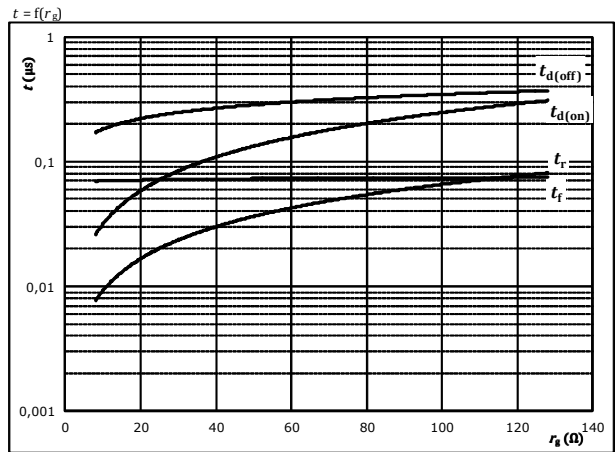


With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{g(on)} =$	32	Ω
$R_{g(off)} =$	32	Ω

Figure 6. IGBT

Typical switching times as a function of gate resistor

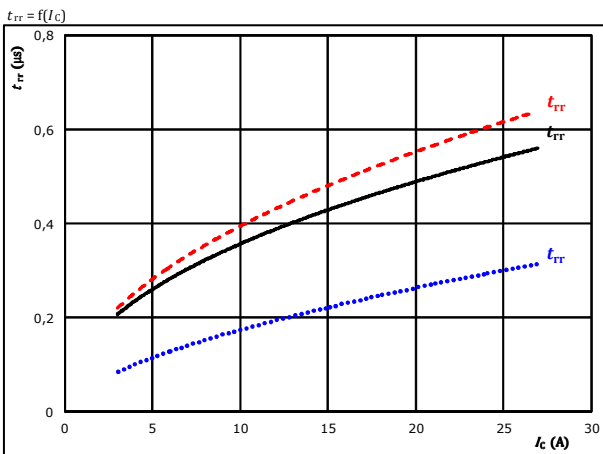


With an inductive load at

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

Figure 7. FWD

Typical reverse recovery time as a function of collector current

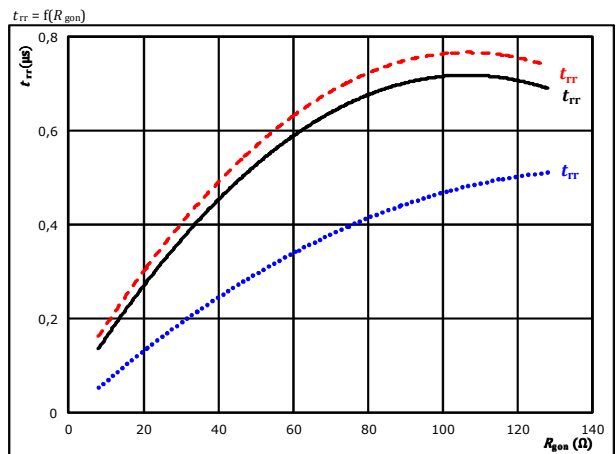


At

$V_{CE} =$	600	V	$T_j:$	25 °C
$V_{GE} =$	±15	V		125 °C	————
$R_{g(on)} =$	32	Ω		150 °C	-----

Figure 8. FWD

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



At

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



H-Bridge Switching Definition

Figure 9. FWD
 Typical recovered charge as a function of collector current

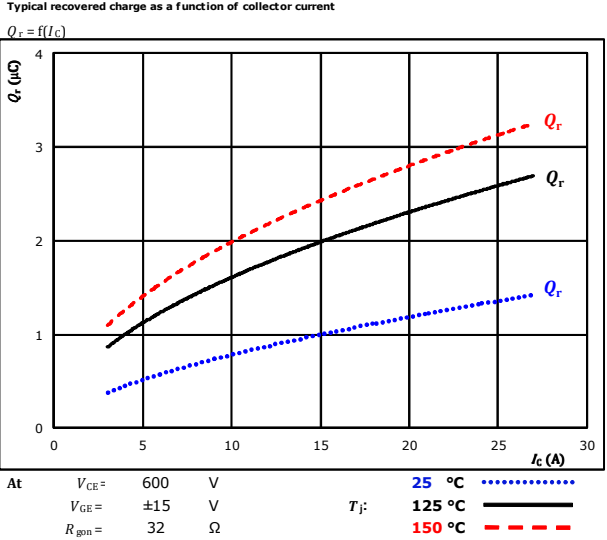


Figure 10. FWD
 Typical recovered charge as a function of IGBT turn on gate resistor

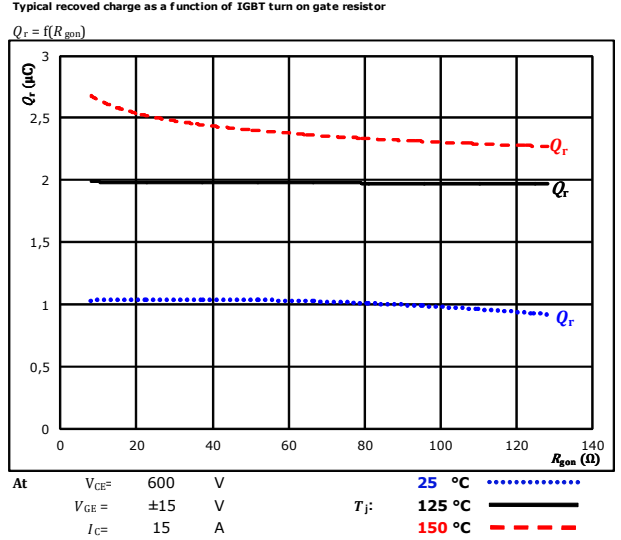


Figure 11. FWD
 Typical peak reverse recovery current current as a function of collector current

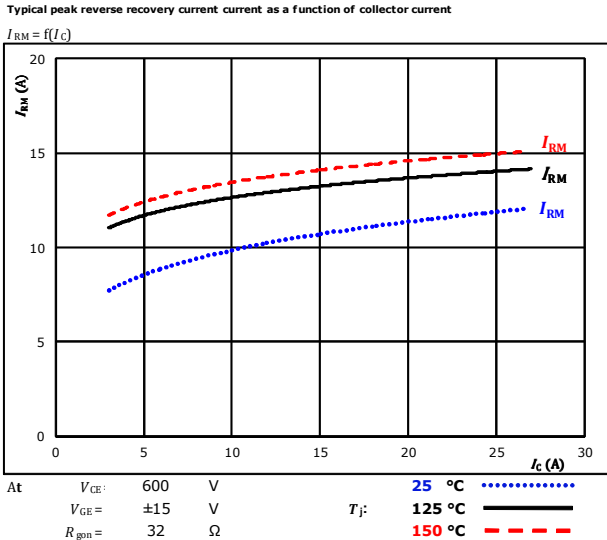
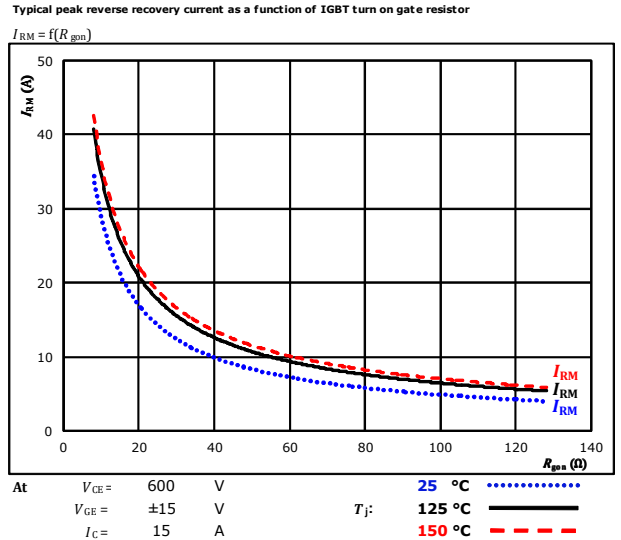


Figure 12. FWD
 Typical peak reverse recovery current as a function of IGBT turn on gate resistor



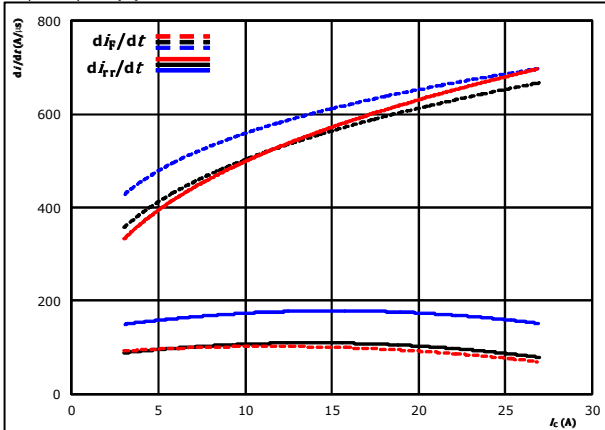


H-Bridge Switching Definition

Figure 13. FWD

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

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

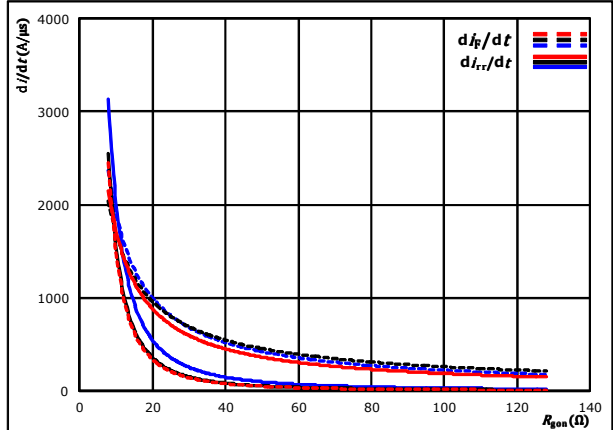


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 32$ Ω
 $T_J: 25$ °C
 125 °C
 150 °C

Figure 14. FWD

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

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

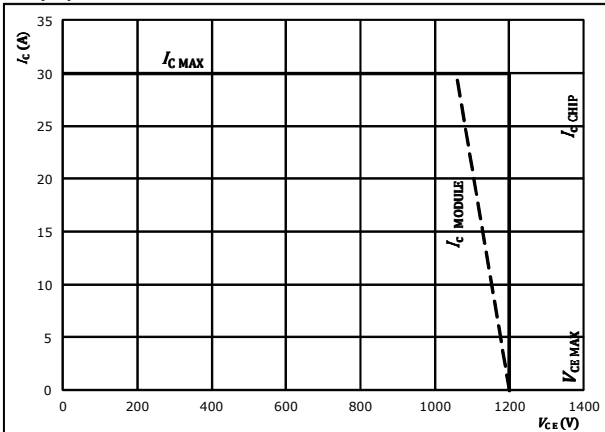


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 15$ A

Figure 15. IGBT

Reverse bias safe operating area

$$I_C = f(V_{CE})$$



At $T_J = 175$ °C
 $R_{gon} = 32$ Ω
 $R_{goff} = 32$ Ω



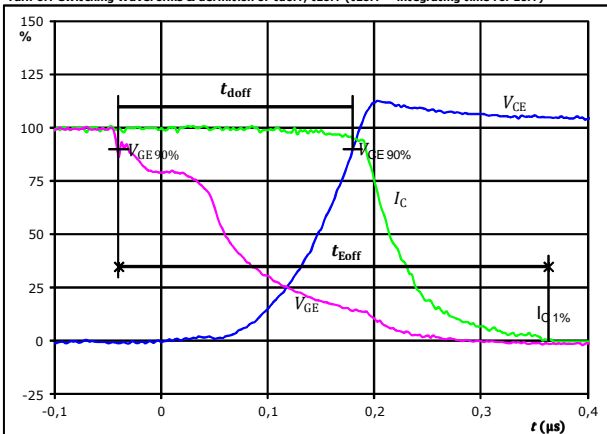
H-Bridge Switching Definition

General conditions

T_j	=	125 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

Figure 1. IGBT

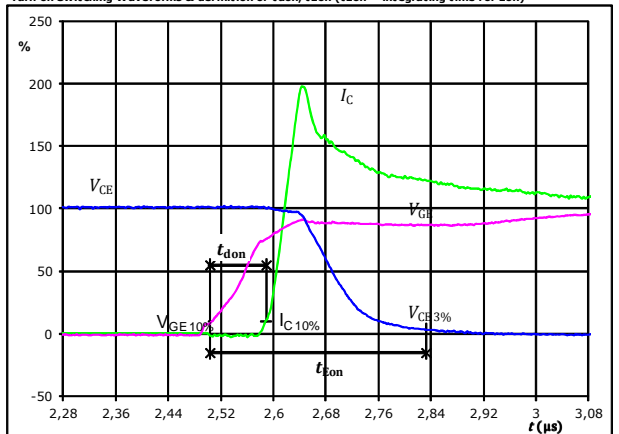
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	15	A
$t_{doff} =$	0,221	μs
$t_{Eoff} =$	0,403	μs

Figure 2. IGBT

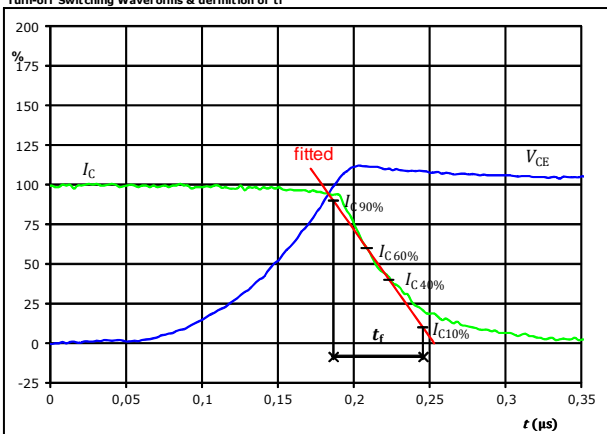
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	15	A
$t_{don} =$	0,085	μs
$t_{Eon} =$	0,329	μs

Figure 3. IGBT

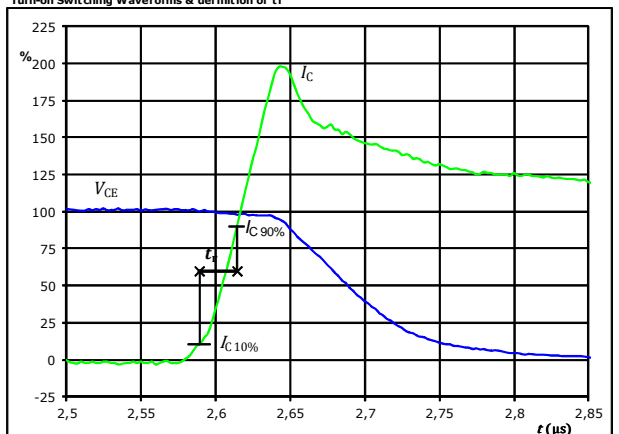
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	600	V
$I_C(100\%) =$	15	A
$t_f =$	0,063	μs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



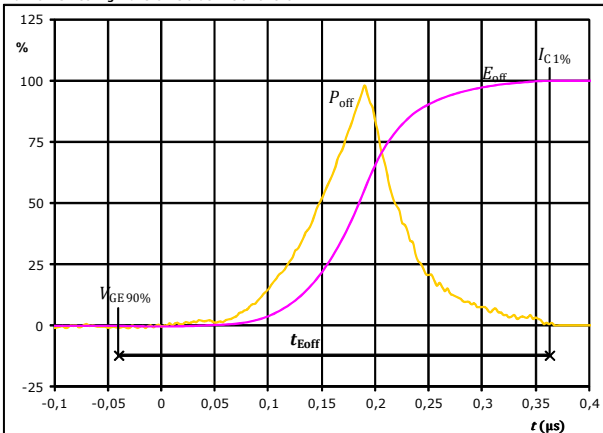
$V_C(100\%) =$	600	V
$I_C(100\%) =$	15	A
$t_r =$	0,025	μs



H-Bridge Switching Definition

Figure 5. IGBT

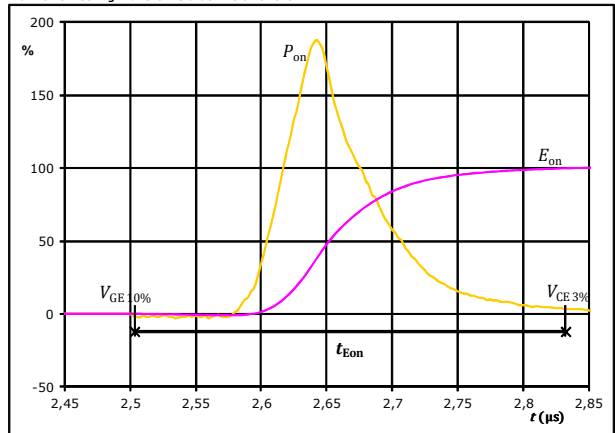
Turn-off Switching Waveforms & definition of t_{Eoff}



$P_{off}(100\%) = 9,05$ kW
 $E_{off}(100\%) = 0,82$ mJ
 $t_{Eoff} = 0,40$ μs

Figure 6. IGBT

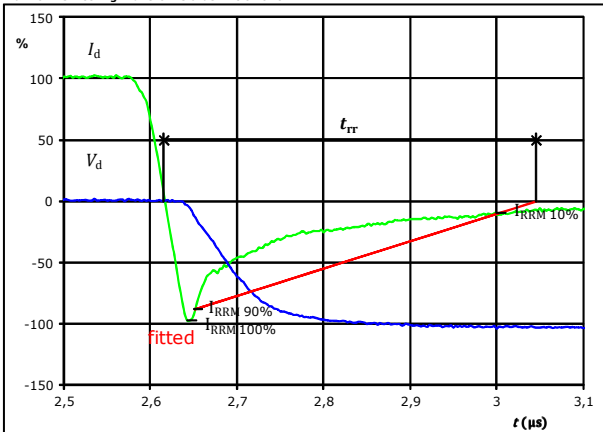
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on}(100\%) = 9,05$ kW
 $E_{on}(100\%) = 1,28$ mJ
 $t_{Eon} = 0,33$ μs

Figure 7. FWD

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

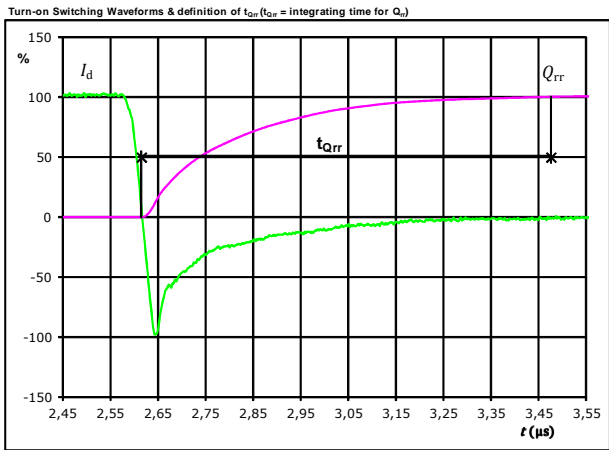


$V_d(100\%) = 600$ V
 $I_d(100\%) = 15$ A
 $I_{RRM}(100\%) = -15$ A



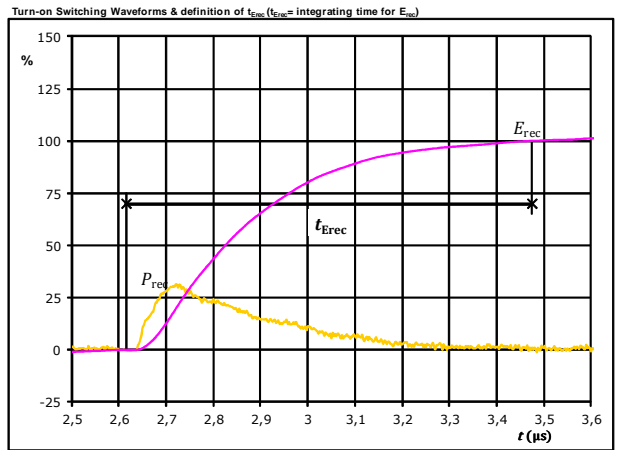
H-Bridge Switching Definition

Figure 8. FWD



$I_d(100\%) =$	15	A
$Q_{rr}(100\%) =$	2,06	μC
$t_{Qrr} =$	0,86	μs

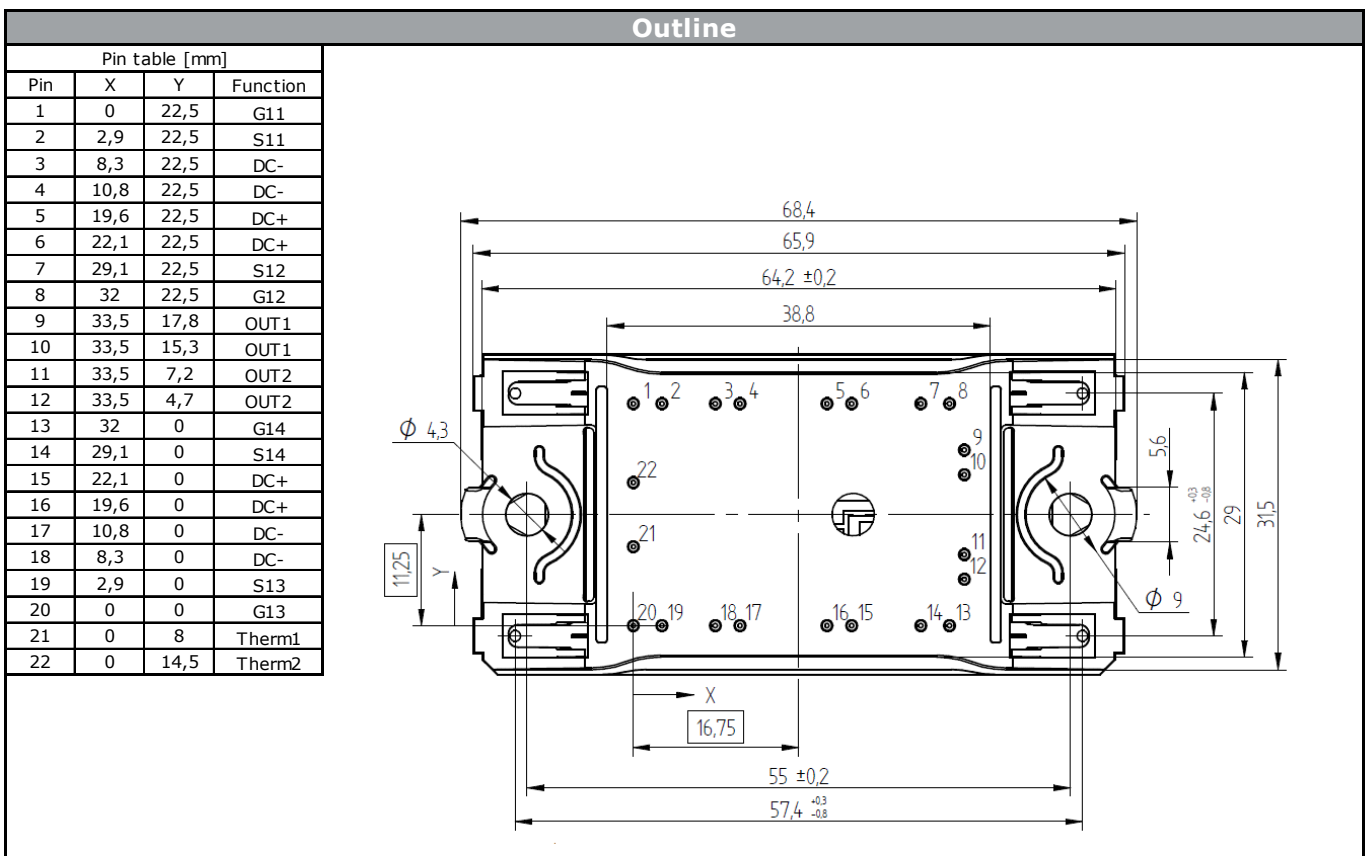
Figure 9. FWD



$P_{rec}(100\%) =$	9,05	kW
$E_{rec}(100\%) =$	0,83	mJ
$t_{Erec} =$	0,86	μs

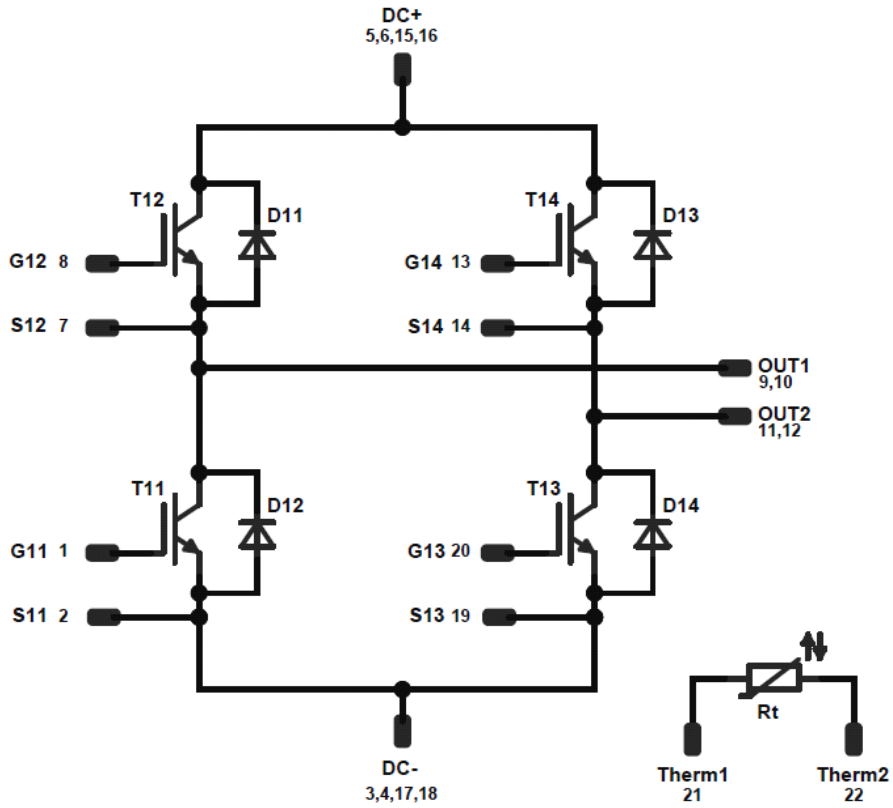


Ordering Code & Marking								
Version	Ordering Code	in DataMatrix as		in packaging barcode as				
without thermal paste 12mm housing	V23990-P627-F88	P627F88		P627F88				
without thermal paste 17mm housing	V23990-P627-F89	P627F89		P627F89				
Vinco WWYY NNNNNNVV UL LLLL SSSS		Text	Vinco	Date code	Name&Ver	UL	Lot	Serial
			Vinco	WWYY	NNNNNNNVV	UL	LLLL	SSSS
Datamatrix		Type&Ver	Lot number	Serial	Date code			
		TTTTTTTV	LLLLL	SSSS	WWYY			





Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11-T14	IGBT	1200V	15A	H-Bridge Switch	
D11-D14	FWD	1200V	15A	H-Bridge Diode	
Rt	NTC	-	-	Thermistor	



Packaging instruction					
Standard packaging quantity (SPQ)	135	>SPQ	Standard	<SPQ	Sample

Handling instruction	
Handling instructions for <i>flow</i> 0 packages see vincotech.com website.	

Document No.:	Date:	Modification:	Pages
V23990-P627-F8x-D2-14	22 Okt. 2015	Module properties correction	2

DISCLAIMER

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