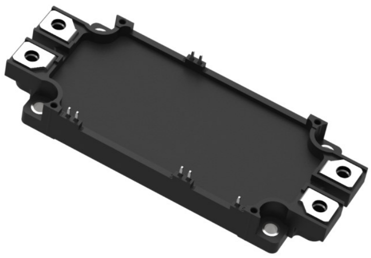
Vincotech

VINcoDUAL E3 — 1200 V / 450 A

Features

- IGBT M7 technology with low V_{Cesat} and improved EMC behavior
- New SoLid Cover Technology for higher reliability
- Industry standard housing
- Press-fit pin and pre-applied phase-change Thermal Interface Material available

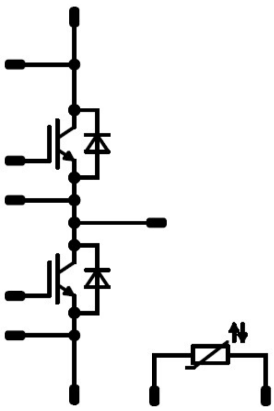
VINco E3



Target applications

- Industrial Drives
- Power Supply
- UPS

Schematic



Types

- A0-VS122PA450M7-L758F70
- A0-VP122PA450M7-L758F70T

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Half Bridge Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	429	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		900	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	817	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Half Bridge Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	355	A
Repetitive peak forward current	I_{FRM}			900	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	613	W
Maximum junction temperature	T_{jmax}			175	°C

Module Properties

Parameter	Symbol	Condition		Value	Unit
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	4000	V
Creepage distance				18,1	mm
Clearance				16,2	mm
Comparative Tracking Index	CTI			> 200	

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Half Bridge Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$		10	0,045	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		450	25 125 150		1,53 1,78 1,85	2,05	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			480	µA
Gate-emitter leakage current	I_{GES}		20	0		25			1500	nA
Internal gate resistance	r_g							1		Ω
Input capacitance	C_{ies}		0	10		25		90000		pF
Output capacitance	C_{oes}							2640		
Reverse transfer capacitance	C_{res}							960		
Gate charge	Q_g		±15	600	450	25		5500		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,12		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	$R_{goff} = 2\ \Omega$ $R_{gon} = 2\ \Omega$	±15	600	453	25 125 150		556 565 567		ns
Rise time	t_r					25 125 150		88 103 104		
Turn-off delay time	$t_{d(off)}$					25 125 150		407 443 453		
Fall time	t_f					25 125 150		69 93 98		
Turn-on energy (per pulse)	E_{on}	$Q_{rFWD} = 38,6$ µC $Q_{rFWD} = 60,9$ µC $Q_{rFWD} = 69,4$ µC				25 125 150		48,694 66,455 72,932		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		31,670 43,726 46,687		

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	
Half Bridge Diode										
Static										
Forward voltage	V_F				450	25 125		1,66 1,88	2,1	V
Reverse leakage current	I_R			1200		25			270	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,16		K/W
Dynamic										
Peak recovery current	I_{RRM}					25 125 150		251 267 282		A
Reverse recovery time	t_{rr}					25 125 150		379 481 535		ns
Recovered charge	Q_r	di/dt = 5760 A/µs di/dt = 4536 A/µs di/dt = 4907 A/µs	±15	600	453	25 125 150		38,550 60,941 69,427		µC
Reverse recovered energy	E_{rec}					25 125 150		13,202 21,232 23,990		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1111 937 1042		A/µs
Thermistor										
Rated resistance	R					25		5		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 493 Ω				100	-5		+5	%
Power dissipation	P					25		245		mW
Power dissipation constant						25		1,4		mW/K
B-value	$B_{(25/50)}$	Tol. ±2 %				25		3375		K
B-value	$B_{(25/100)}$	Tol. ±2 %				25		3437		K
Vincotech NTC Reference									K	

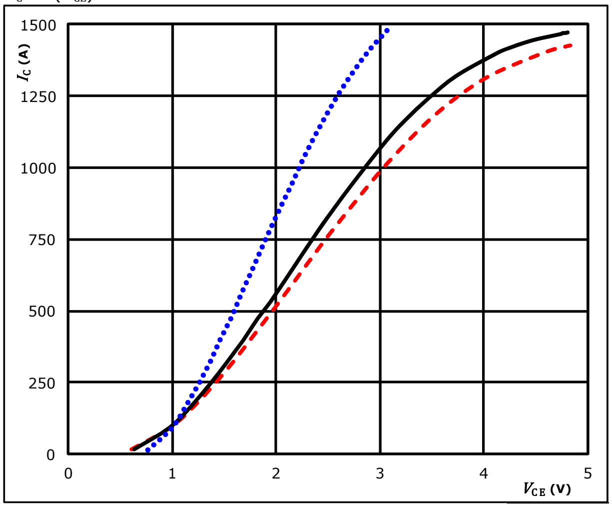
Vincotech

Half Bridge Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

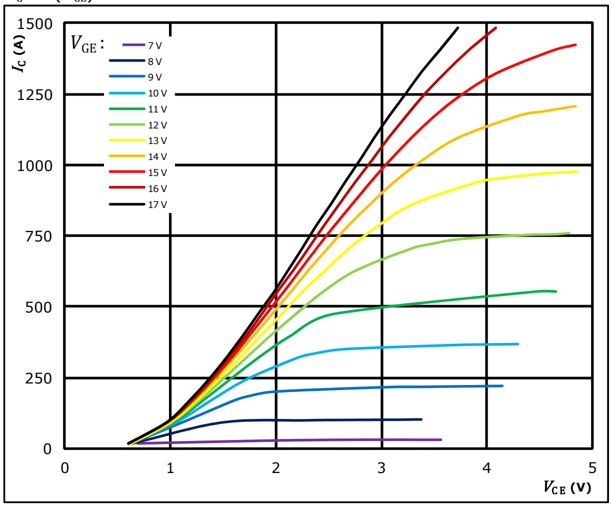


t_p =	250	µs		25	°C
V_{GE} =	15	V	T_j:	125	°C
				150	°C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

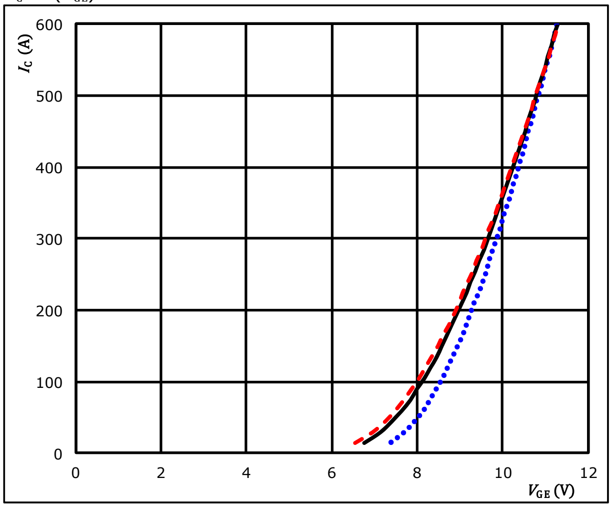


t_p =	250	µs
T_j =	125	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

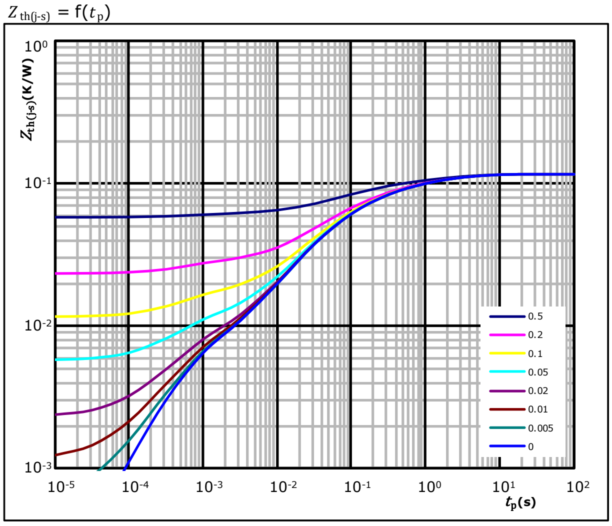


t_p =	100	µs		25	°C
V_{CE} =	0	V	T_j:	125	°C
				150	°C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 0,12 K/W

IGBT thermal model values

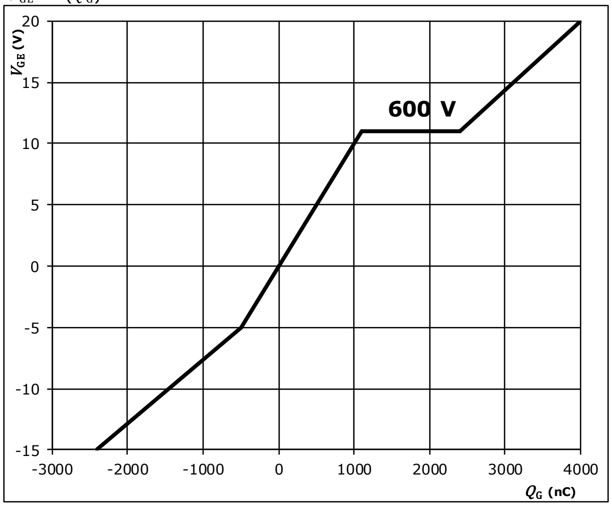
R (K/W)	τ (s)
1,38E-02	3,34E+00
2,90E-02	6,14E-01
3,73E-02	1,17E-01
2,80E-02	2,74E-02
2,71E-03	5,18E-03
5,51E-03	5,36E-04

Half Bridge Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

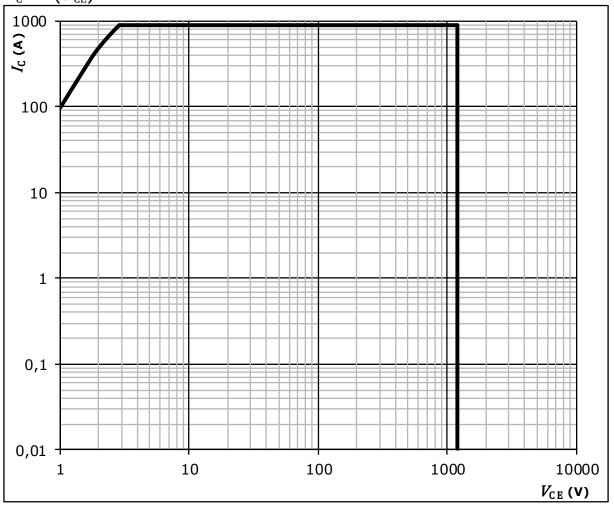


I_C=	450	A
V_{GE} =	±15	V
V_{CC} =	600	V

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



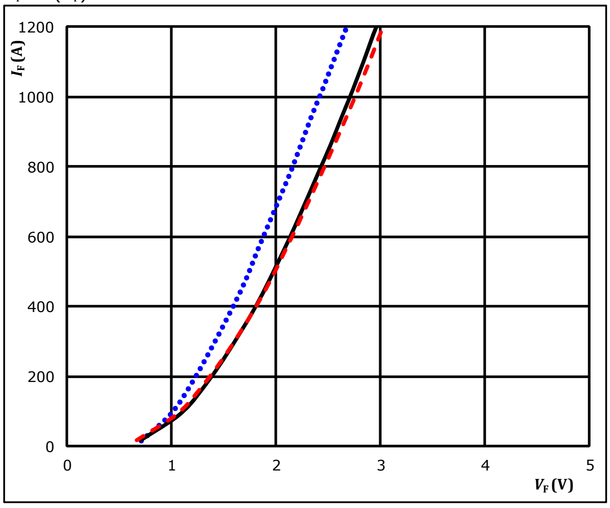
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	ºC

Half Bridge Diode Characteristics

figure 1. **Diode**

Typical forward characteristics

$I_F = f(V_F)$

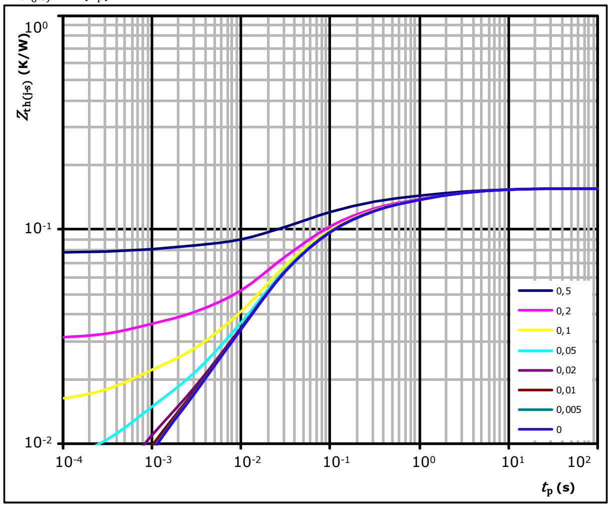


t_p =	250	μs			
			T_j:	25 °C	············
				125 °C	——
				150 °C	– – –

figure 2. **Diode**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,16 K/W

Diode thermal model values

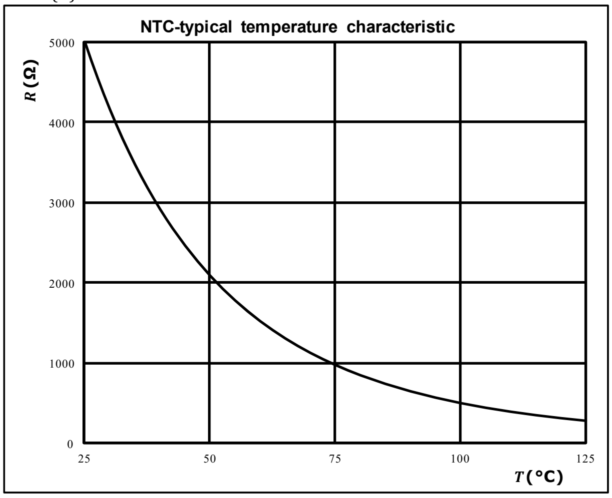
R (K/W)	τ (s)
1,07E-02	1,64E+00
2,30E-02	3,40E-01
4,13E-02	5,39E-02
4,89E-02	1,35E-02
2,30E-02	4,19E-03
8,01E-03	2,65E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature

$R = f(T)$

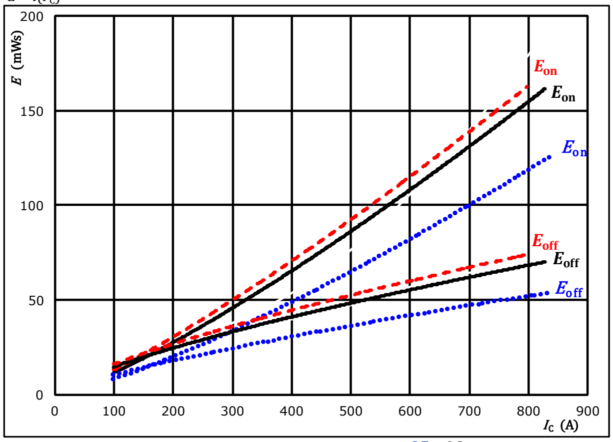


Half Bridge Switch Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



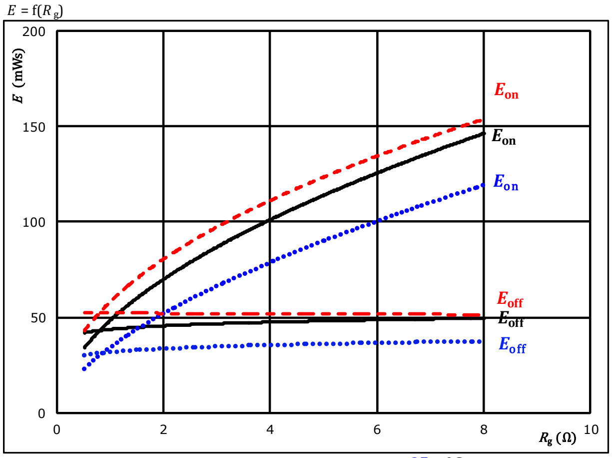
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed
R_{goff} =	2	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



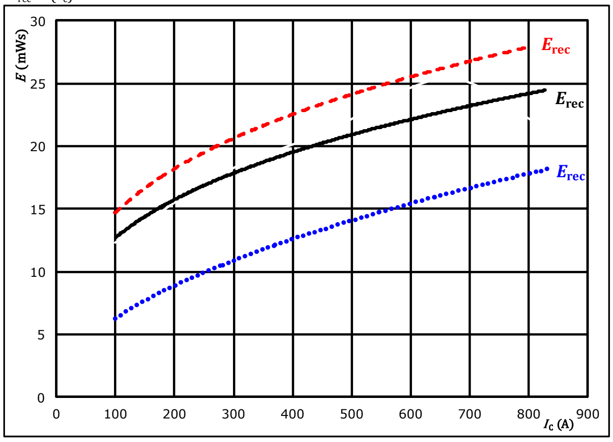
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	453	A		150 °C	dashed

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_c)$



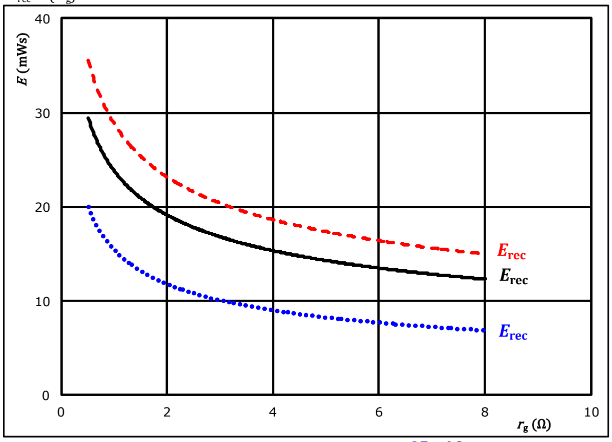
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

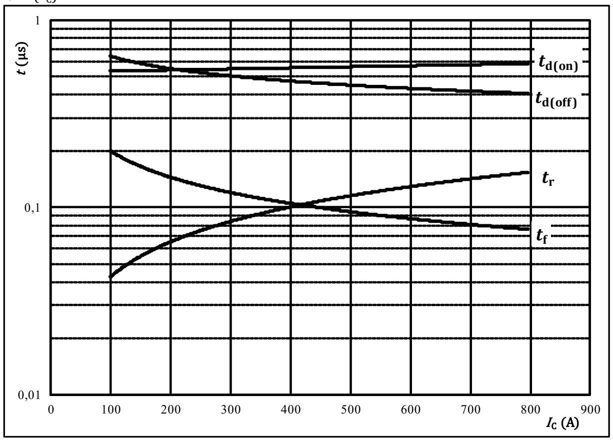
V_{CE} =	600	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	453	A		150 °C	dashed

Half Bridge Switch Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



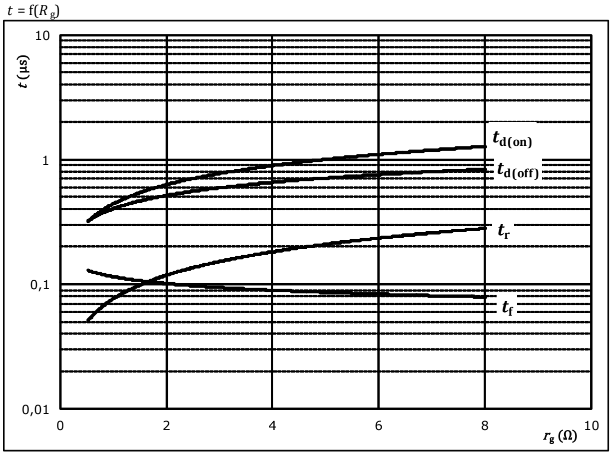
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



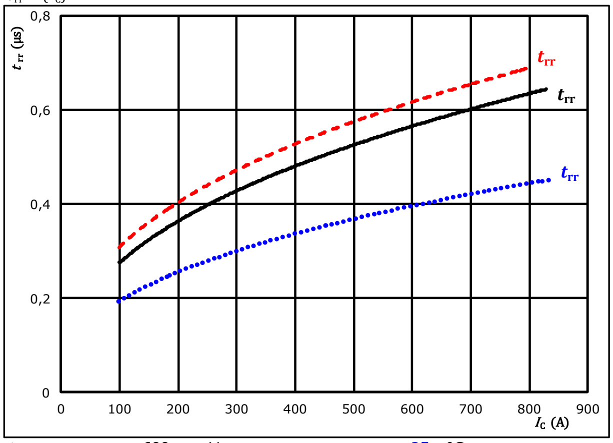
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	453	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

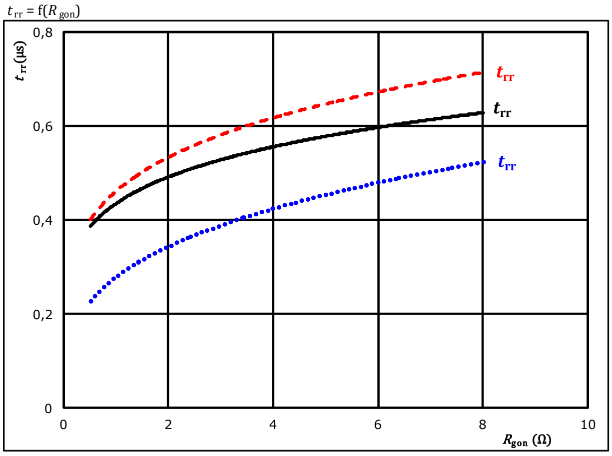


At	V_{CE} =	600	V		25 °C	···········
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	2	Ω		150 °C	– – –

figure 8. **FWD**

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

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



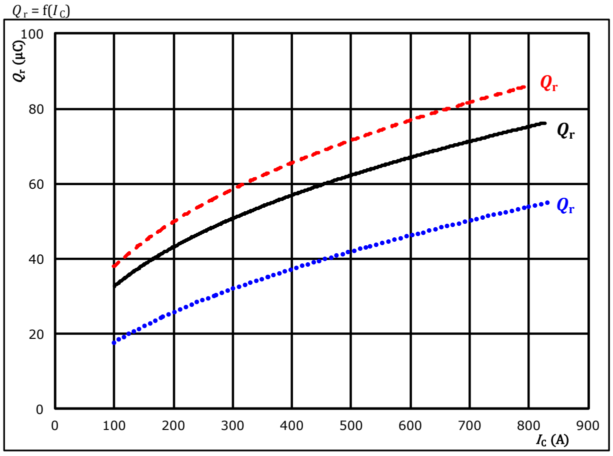
At	V_{CE} =	600	V		25 °C	···········
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C =	453	A		150 °C	– – –

Half Bridge Switch Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

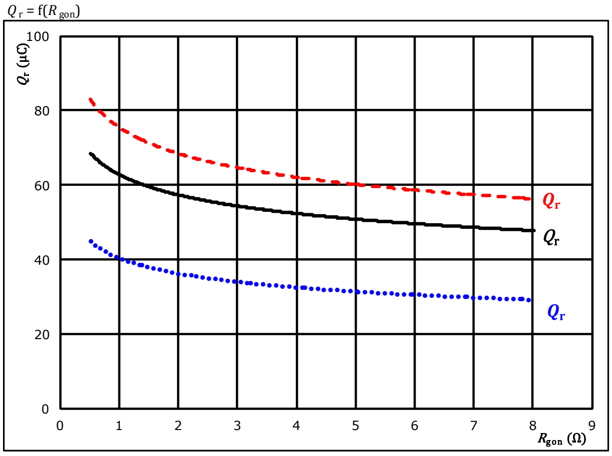


At				
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 10. FWD

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

$Q_r = f(R_{gon})$

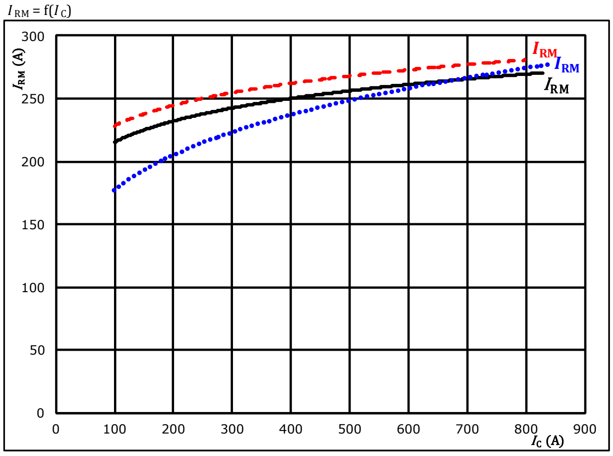


At				
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	453	A		150 °C

figure 11. FWD

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

$I_{RM} = f(I_C)$

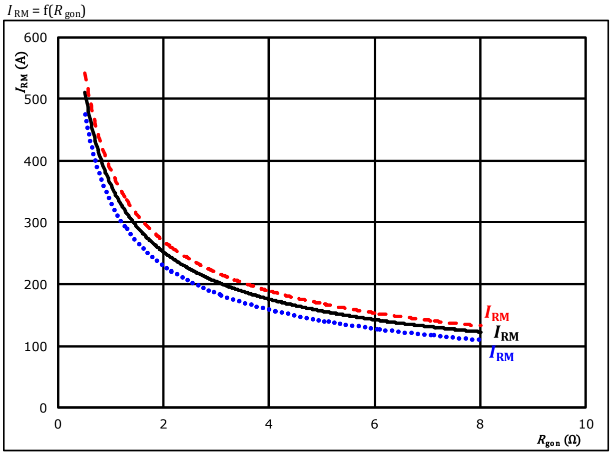


At				
V_{CE}	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	2	Ω		150 °C

figure 12. FWD

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

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



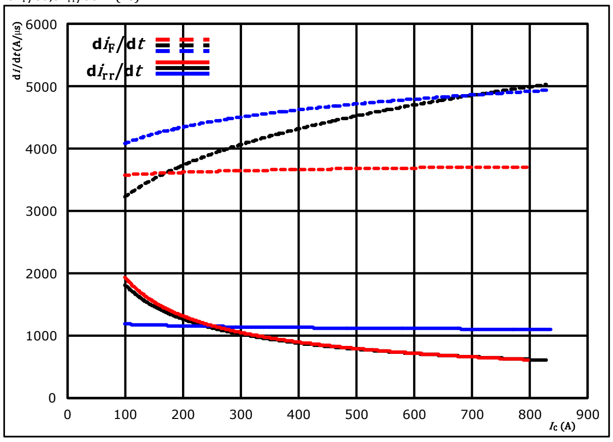
At				
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	453	A		150 °C

Half Bridge Switch Switching Characteristics

figure 13. **FWD**

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

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

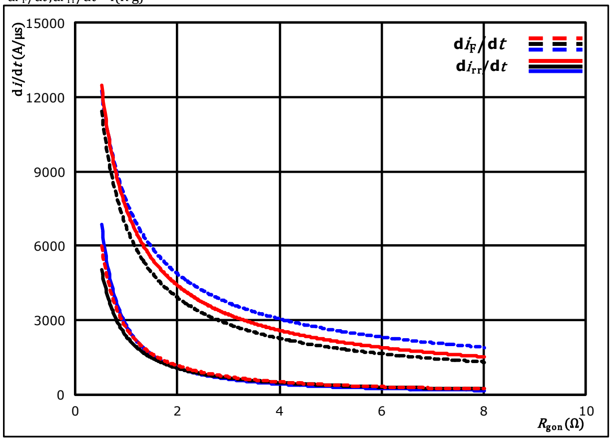


At					
V_{CE} =	600	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
R_{gon} =	2	Ω		150 °C	dashed

figure 14. **FWD**

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

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

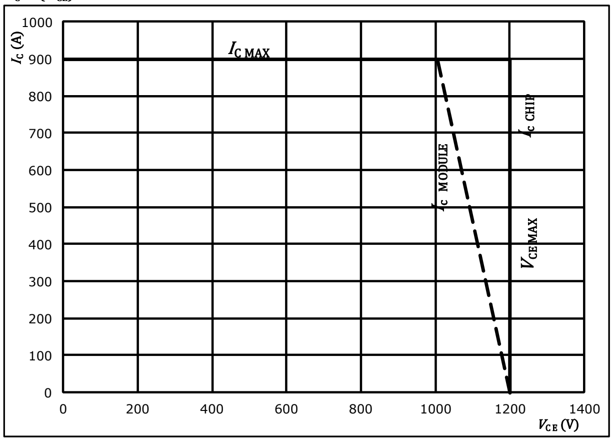


At					
V_{CE} =	600	V		25 °C	dotted
V_{GE} =	±15	V	T_j:	125 °C	solid
I_C =	453	A		150 °C	dashed

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C
R_{gon} =	2	Ω
R_{goff} =	2	Ω

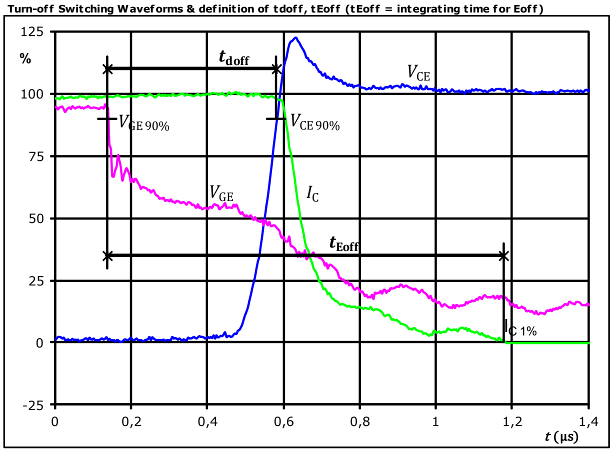
Half Bridge Switch Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

figure 1. **IGBT**

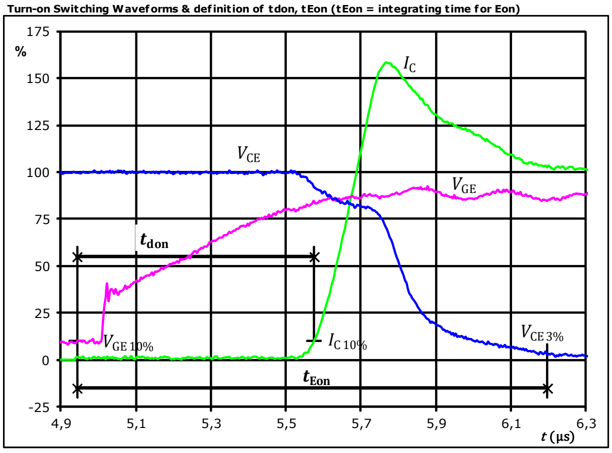
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	459	A
t_{doff} =	0,443	µs
t_{Eoff} =	1,040	µs

figure 2. **IGBT**

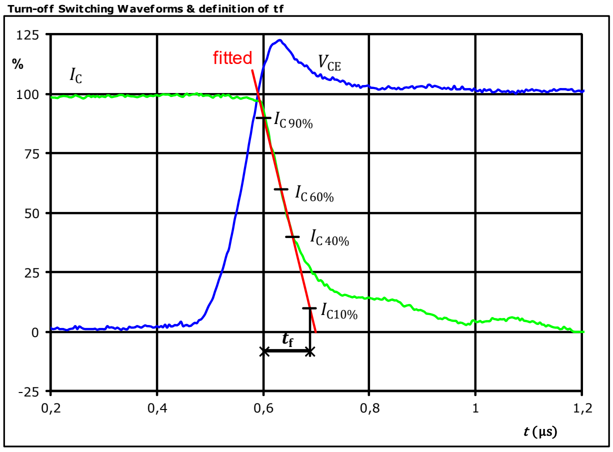
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	459	A
t_{don} =	0,565	µs
t_{Eon} =	1,254	µs

figure 3. **IGBT**

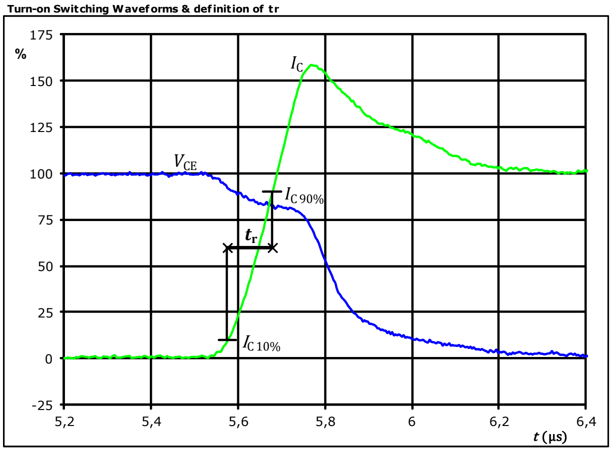
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	459	A
t_f =	0,093	µs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of tr

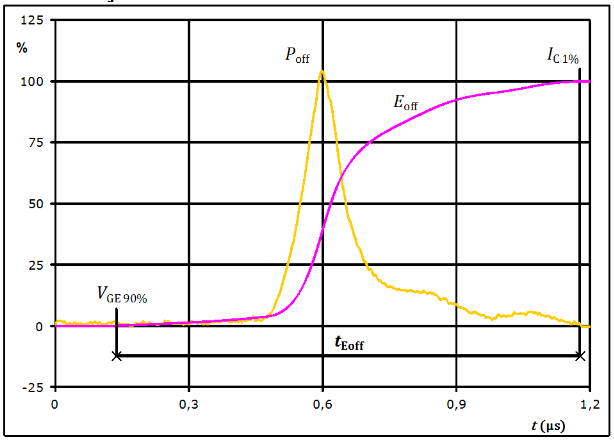


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	459	A
t_r =	0,103	µs

Half Bridge Switch Switching Characteristics

figure 5. IGBT

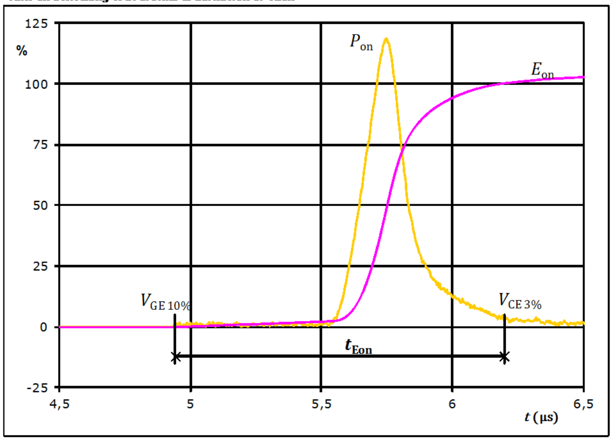
Turn-off Switching Waveforms & definition of tEoff



P_{off}(100%) =	275,62	kW
E_{off}(100%) =	43,73	mJ
t_{Eoff} =	1,04	µs

figure 6. IGBT

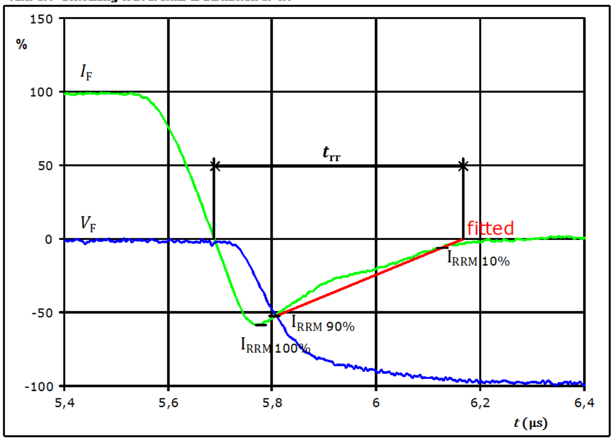
Turn-on Switching Waveforms & definition of tEon



P_{on}(100%) =	275,62	kW
E_{on}(100%) =	66,46	mJ
t_{Eon} =	1,25	µs

figure 7. FWD

Turn-off Switching Waveforms & definition of trr

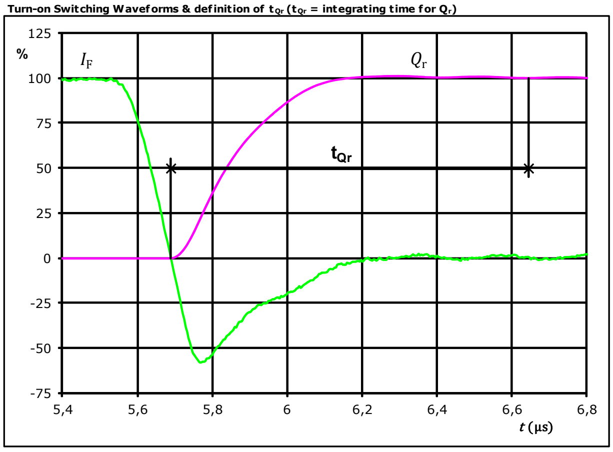


V_F(100%) =	600	V
I_F(100%) =	459	A
I_{RRM}(100%) =	-267	A
t_{rr} =	0,481	µs

Half Bridge Switch Switching Characteristics

figure 8. **FWD**

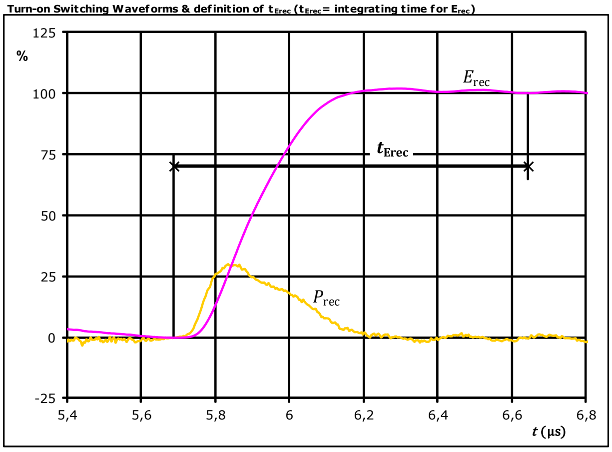
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	459	A
Q_r (100%) =	60,95	µC
t_{Qr} =	0,96	µs

figure 9. **FWD**

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



P_{rec} (100%) =	275,62	kW
E_{rec} (100%) =	21,24	mJ
t_{Erec} =	0,96	µs

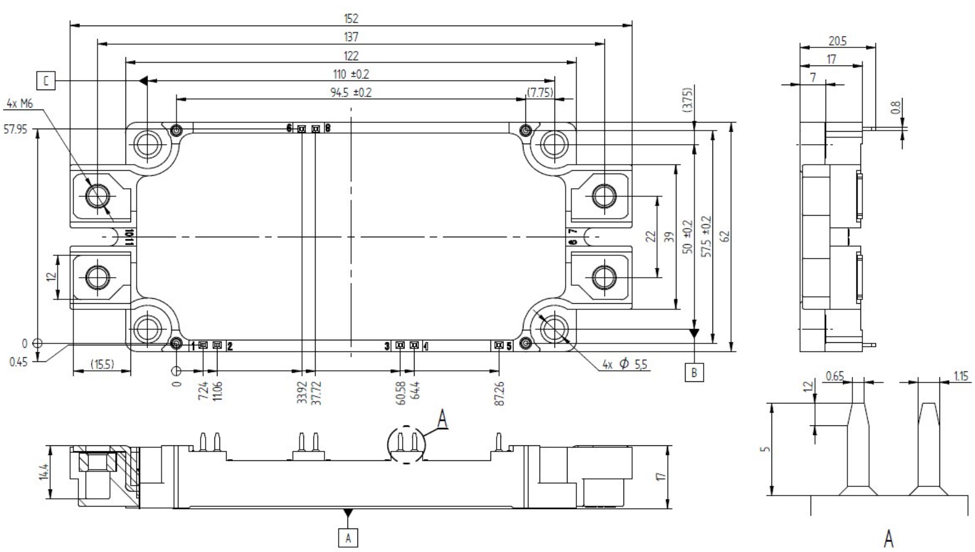
Ordering Code & Marking

Version	Ordering Code
without thermal paste with solder pins	A0-VS122PA450M7-L758F70
with thermal paste with solder pins	A0-VS122PA450M7-L758F70-/3/
without thermal paste with Press-fit pins	A0-VP122PA450M7-L758F70T
with thermal paste with Press-fit pins	A0-VP122PA450M7-L758F70T-/3/

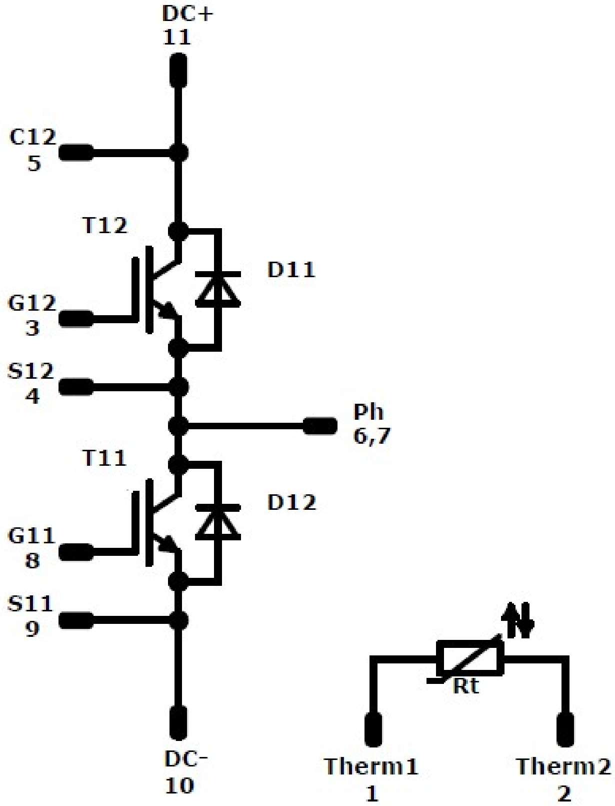
Text	Name		ViIN	Date code	Lot	Serial
	NN-NNNNNNNNNNNN-TTTTTTTVV		VIN	WWYY	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Function
1	7,24	-0,45	Therm1
2	11,06	-0,45	Therm2
3	60,58	-0,45	G12
4	64,4	-0,45	S12
5	87,26	-0,45	C12
6	-	-	Ph
7	-	-	Ph
8	37,72	57,95	G11
9	33,92	57,95	S11
10	-	-	DC-
11	-	-	DC+



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11,T12	IGBT	1200 V	450 A	Half Bridge Switch	
D11,D12	FWD	1200 V	450 A	Half Bridge Diode	
Rt	NTC			Thermistor	

Vincotech

Packaging instruction					
Standard packaging quantity (SPQ)	**24**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for if no series packaging available packages see vincotech.com website.

Package data
Package data for if no series packaging available 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
A0-Vx122PA450M7-L758F70x-D2-14	05 May. 2017	Gate charge value correction and add function	3, 6