Vincotech

A0-VS122PA690M7-L750F70
A0-VP122PA690M7-L750F70T
datasheet

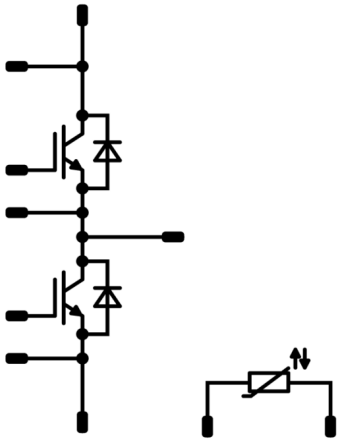
VINcoDUAL E3 **1200 V / 690 A**

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 housing

Schematic



Target applications

- Industrial Drives
- Power Supply
- UPS

Types

- A0-VS122PA690M7-L750F70
- A0-VP122PA690M7-L750F70T

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	681	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	1380	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	2065	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	546	A
Repetitive peak forward current	I_{FRM}		1500	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	1357	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 s	6000	V
		AC Voltage t_p = 1 min	2500	V
Creepage distance			18,1	mm
Clearance			16,2	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	
Half-Bridge Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,069	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		690	25 125 150		1,54 1,74 1,80	1,9	V
Collector-emitter cut-off current*	I_{CES}		0	1200		25			1140	µA
Gate-emitter leakage current	I_{GES}		20	0		25			1500	nA
Internal gate resistance	r_g							0,66		Ω
Input capacitance	C_{ies}		0	10		25		132000		pF
Output capacitance	C_{oes}							3900		
Reverse transfer capacitance	C_{res}							1590		
Gate charge	Q_g		±15	600	690	25		4200		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,08		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 1 Ω R_{gon} = 1 Ω	±15	600	690	25 125 150		533 554 543		ns
Rise time	t_r					25 125 150		77 93 94		
Turn-off delay time	$t_{d(off)}$					25 125 150		423 454 467		
Fall time	t_f					25 125 150		66 88 94		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 58,4 µC Q_{rFWD} = 101,2 µC Q_{rFWD} = 103,3 µC				25 125 150		57,701 81,075 84,463		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		47,439 65,030 59,995		

* Including paralel device's leakage current

Characteristic Values

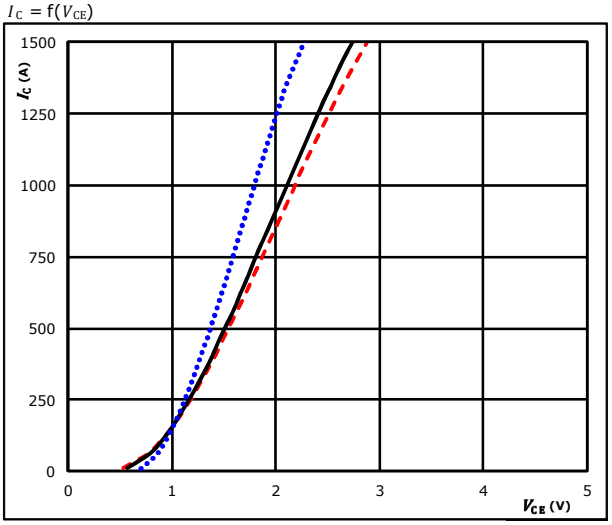
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Half-Bridge Diode										
Static										
Forward voltage	V_F				750	25 125		1,70 1,87	2,2	V
Reverse leakage current	I_R			1200		25			450	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,11		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 9239 A/µs di/dt = 7628 A/µs di/dt = 11475 A/µs	±15	600	690	25 125 150		458 503 515		A
Reverse recovery time	t_{rr}					25 125 150		304 489 484		ns
Recovered charge	Q_r					25 125 150		58,419 101,163 103,293		µC
Reverse recovered energy	E_{rec}					25 125 150		22,897 41,652 36,651		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		3971 3040 2809		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	

Half-Bridge Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

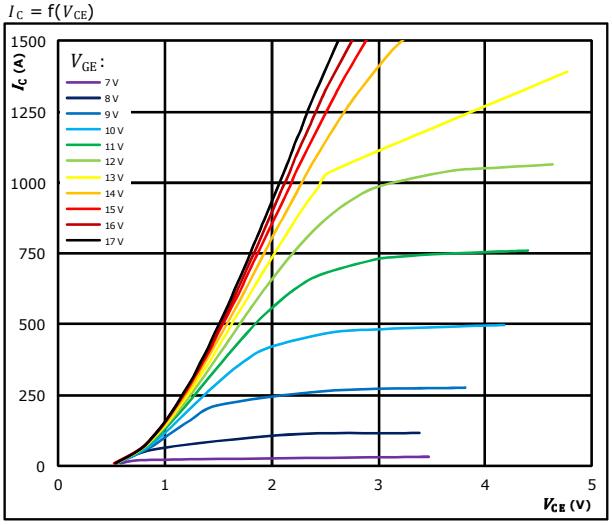


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

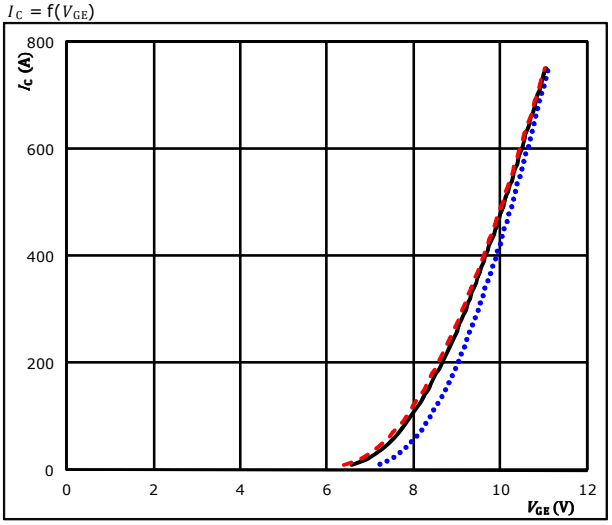


t_p =	250	µs
T_j =	125	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

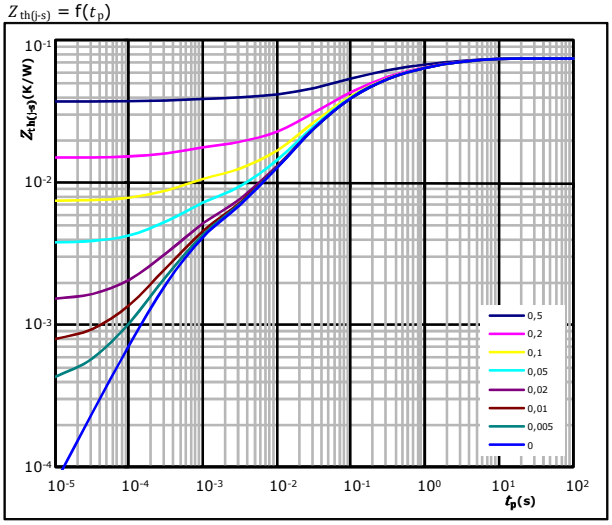


t_p =	100	µs		25 °C
V_{CE} =	0	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,08	K/W

IGBT thermal model values

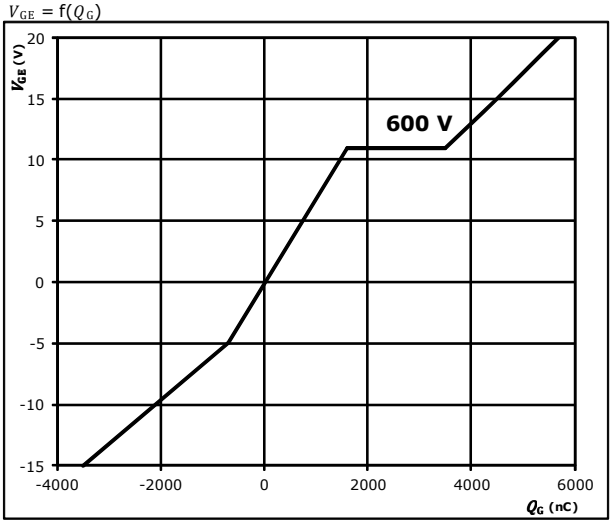
R (K/W)	τ (s)
8,90E-03	3,34E+00
1,87E-02	6,14E-01
2,40E-02	1,17E-01
1,80E-02	2,74E-02
1,75E-03	5,18E-03
3,56E-03	5,36E-04

Half-Bridge Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

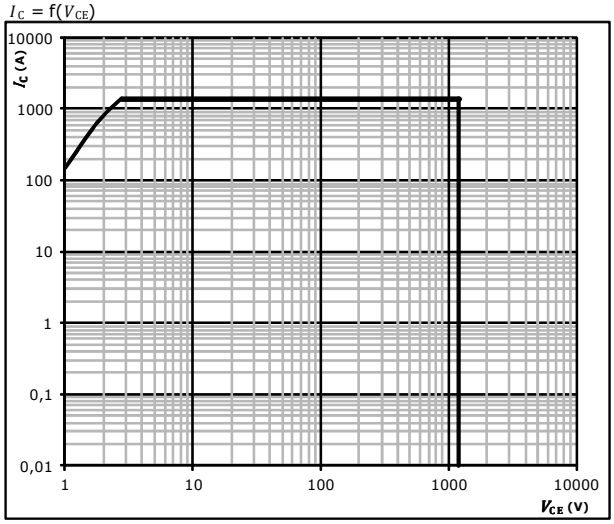


I_C=	690	A
V_{GE} =	±15	V
V_{CC} =	600	V

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



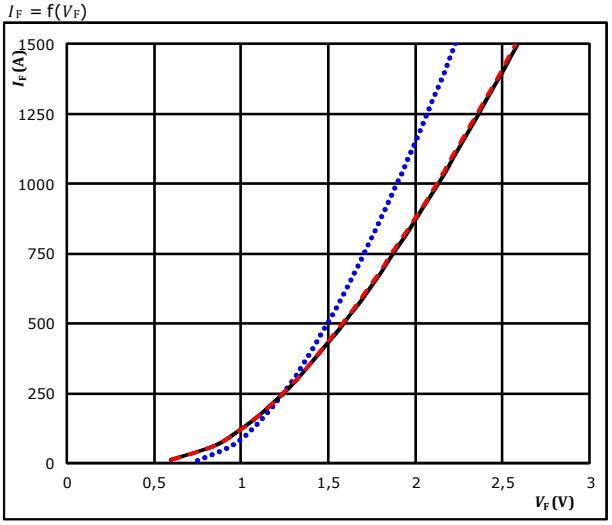
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Half-Bridge Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



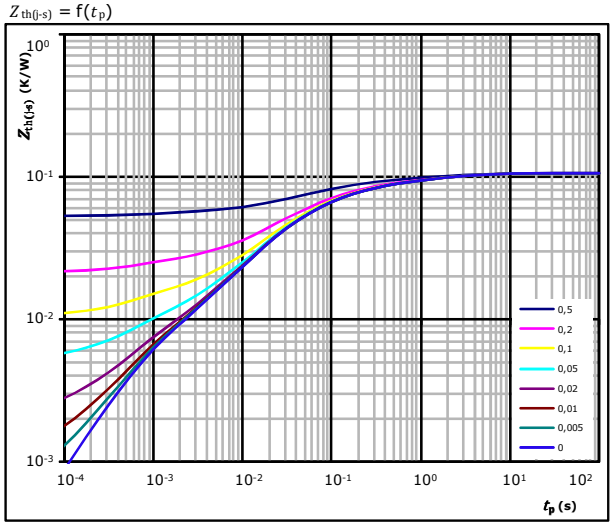
t_p = 250 µs

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

$R_{th(j-s)}$ = 0,11 K/W

FWD thermal model values

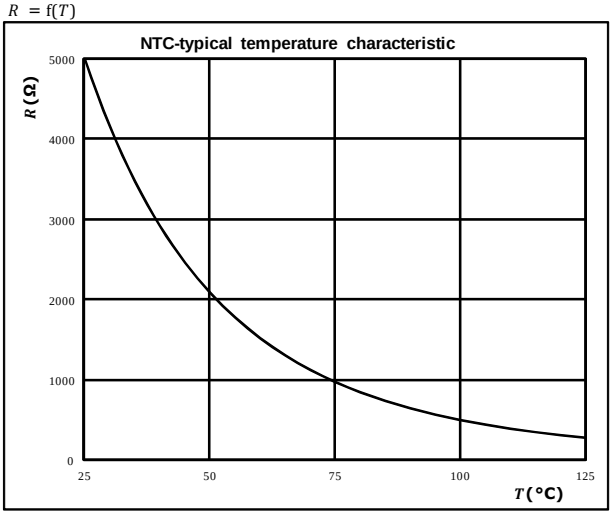
R (K/W)	τ (s)
7,34E-03	4,93E+00
1,58E-02	1,02E+00
2,83E-02	1,62E-01
3,34E-02	4,06E-02
1,57E-02	1,26E-02
5,48E-03	7,94E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature

$R = f(T)$

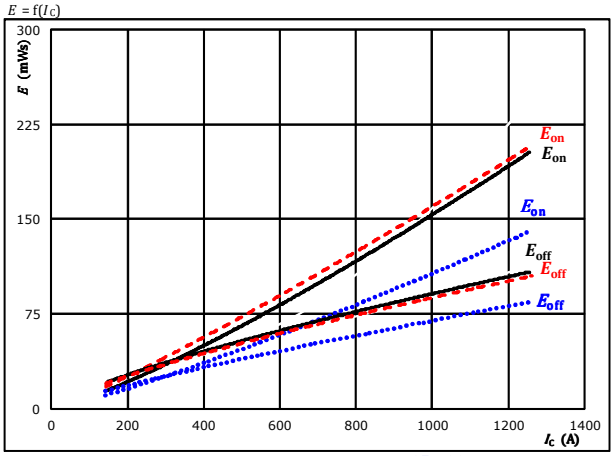


Half-Bridge Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



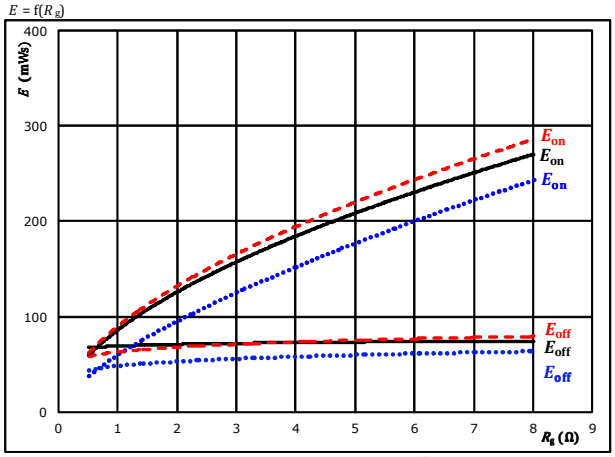
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
R_{gon} =	1	Ω		150 °C	– – –
R_{goff} =	1	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



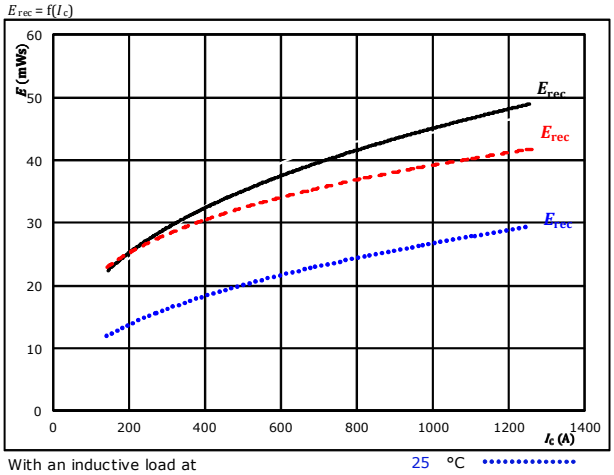
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
I_C =	690	A		150 °C	– – –

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



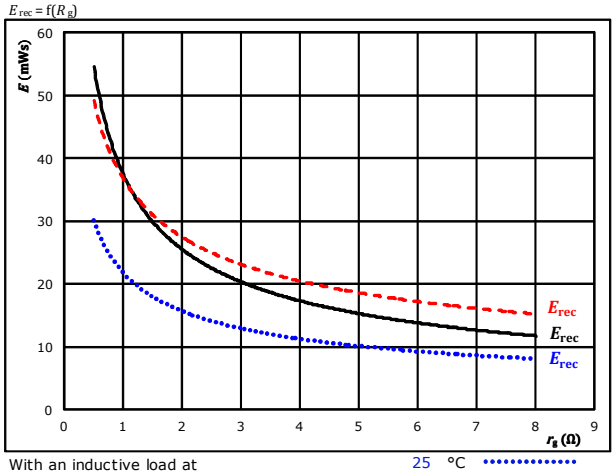
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
R_{gon} =	1	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

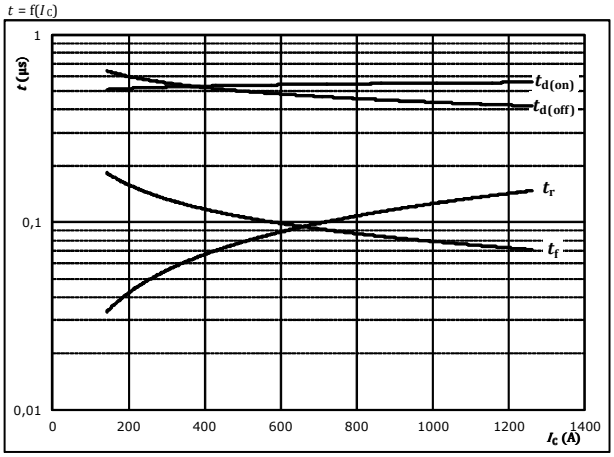
V_{CE} =	600	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
I_C =	690	A		150 °C	– – –

Half-Bridge Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



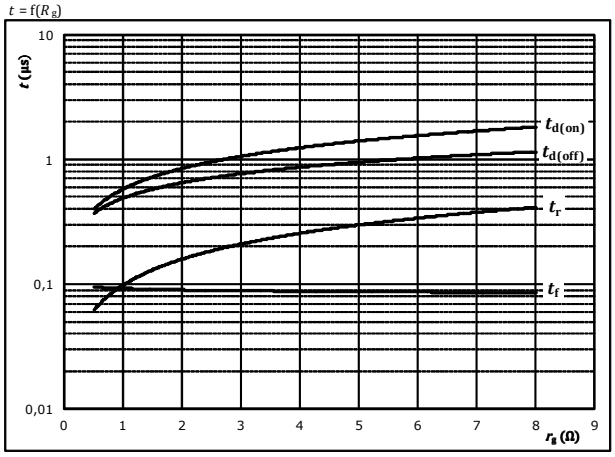
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	1	Ω
R_{goff} =	1	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



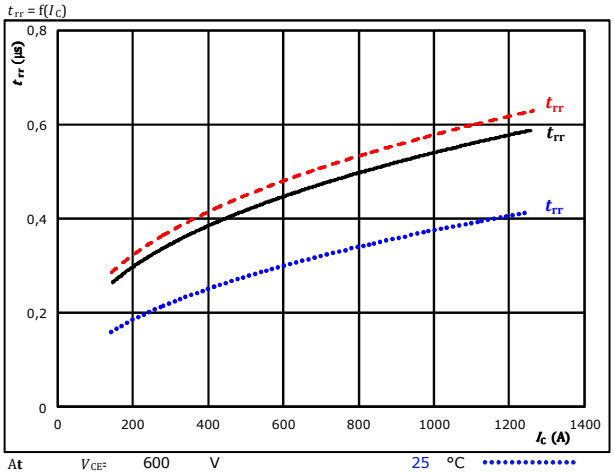
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	690	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



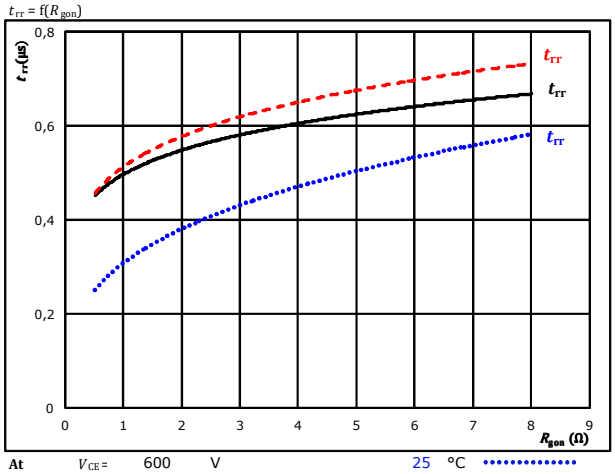
At

V_{CE} =	600	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
R_{gon} =	1	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

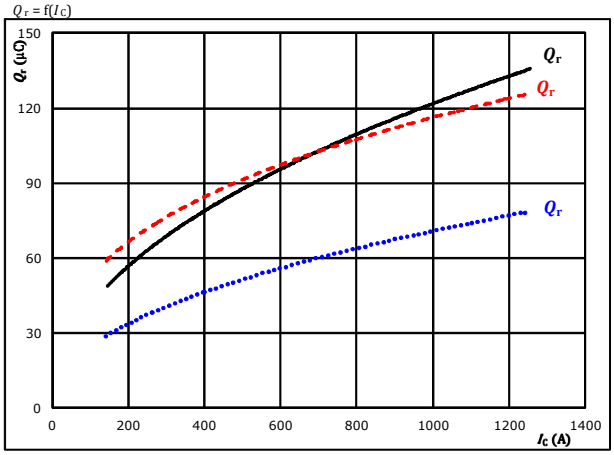
V_{CE} =	600	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
I_C =	690	A		150	°C

Half-Bridge Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

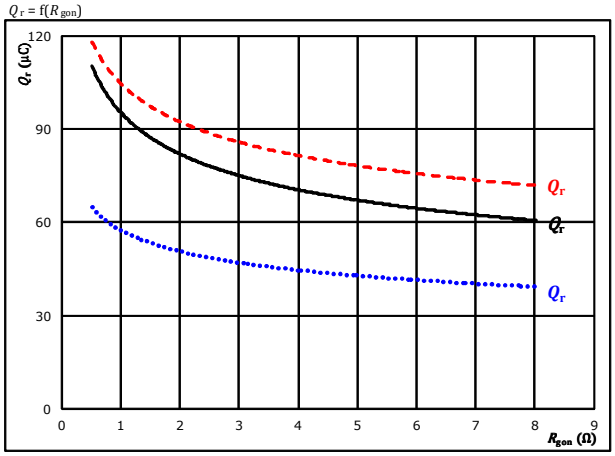


At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	1	Ω		150 °C	

figure 10. FWD

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

$Q_r = f(R_{gon})$

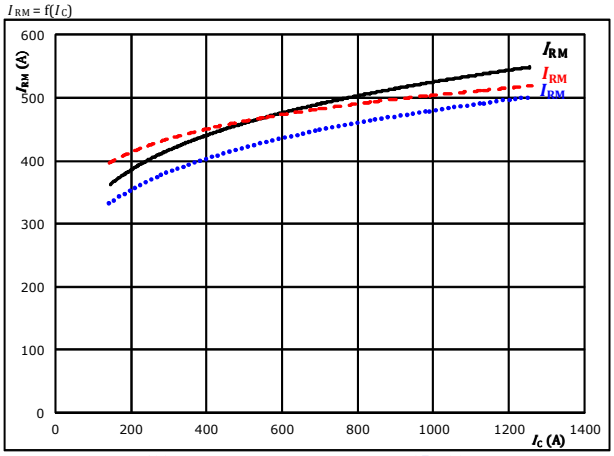


At						
	V_{CE}=	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C=	690	A		150 °C	

figure 11. FWD

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

$I_{RM} = f(I_C)$

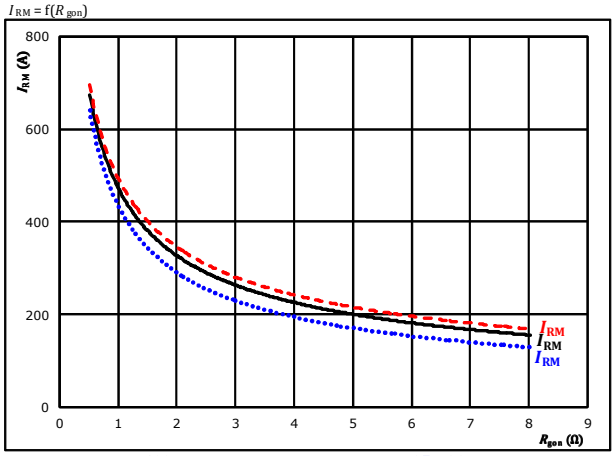


At						
	V_{CE}:	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	1	Ω		150 °C	

figure 12. FWD

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

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



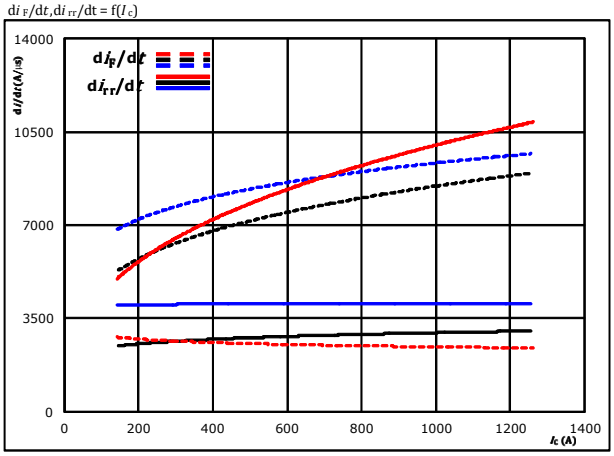
At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C =	690	A		150 °C	

Half-Bridge Switching Characteristics

figure 13. **FWD**

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

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

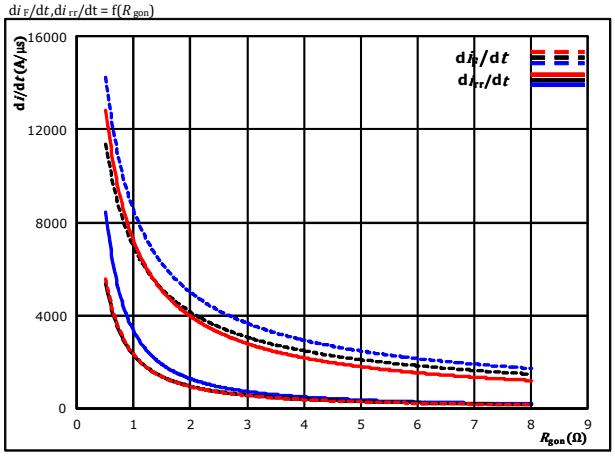


At	V_{CE} =	600	V	T_j:	25 °C	
	V_{GE} =	±15	V		125 °C	
	R_{gon} =	1	Ω		150 °C	

figure 14. **FWD**

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

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

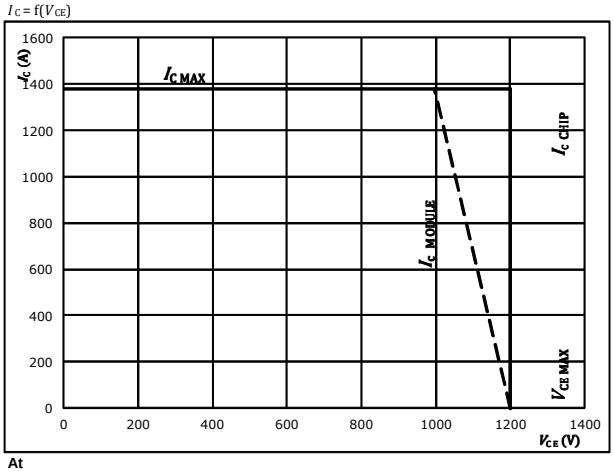


At	V_{CE} =	600	V	T_j:	25 °C	
	V_{GE} =	±15	V		125 °C	
	I_C =	690	A		150 °C	

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At			
	T_j =	175	°C
	R_{gon} =	1	Ω
	R_{goff} =	1	Ω

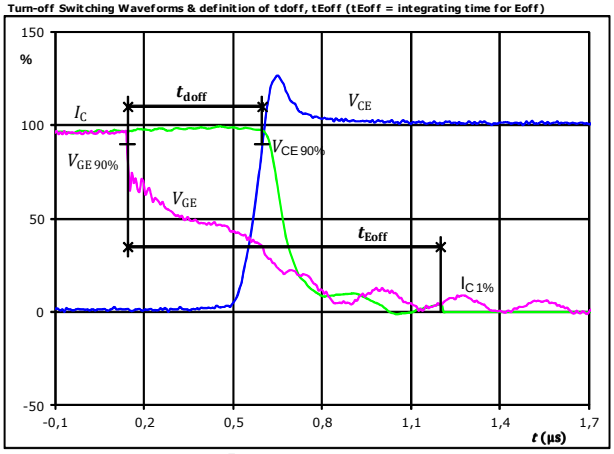
Half-Bridge Switching Characteristics

General conditions

T_j	=	125 °C
R_{gon}	=	1 Ω
R_{goff}	=	1 Ω

figure 1. IGBT

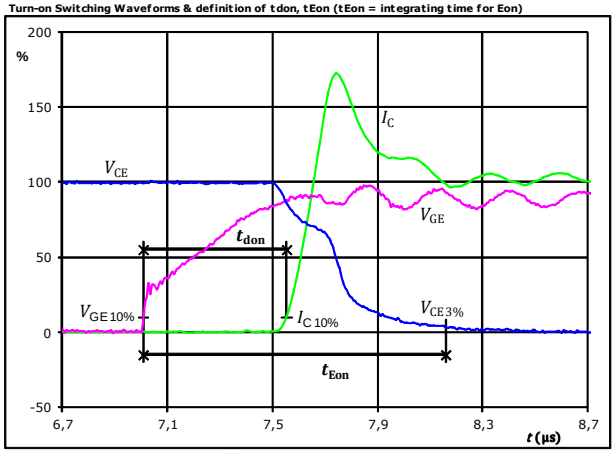
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	690	A
t_{doff} =	0,454	µs
t_{Eoff} =	1,055	µs

figure 2. IGBT

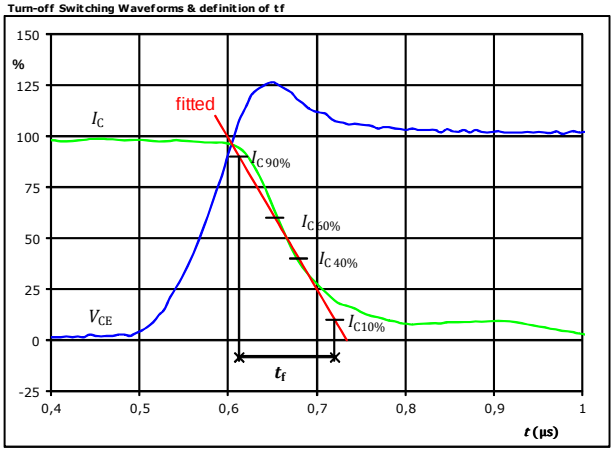
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	690	A
t_{don} =	0,554	µs
t_{Eon} =	1,151	µs

figure 3. IGBT

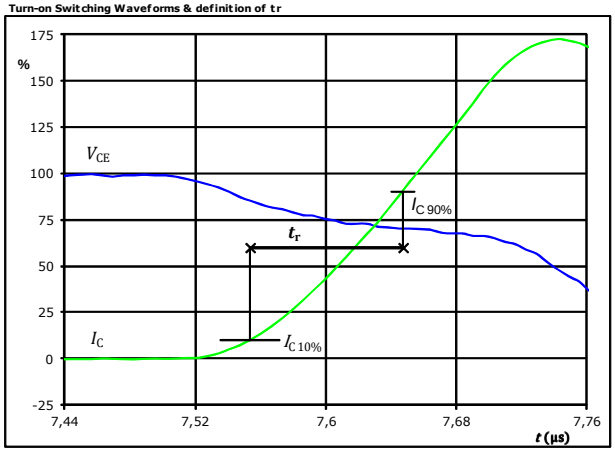
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	690	A
t_f =	0,088	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

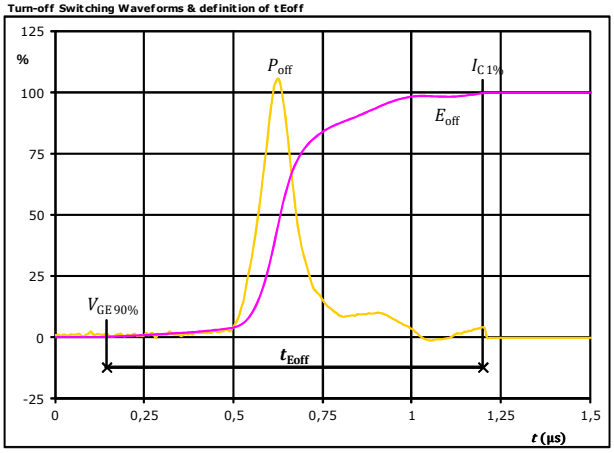


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	690	A
t_r =	0,093	µs

Half-Bridge Switching Characteristics

figure 5. **IGBT**

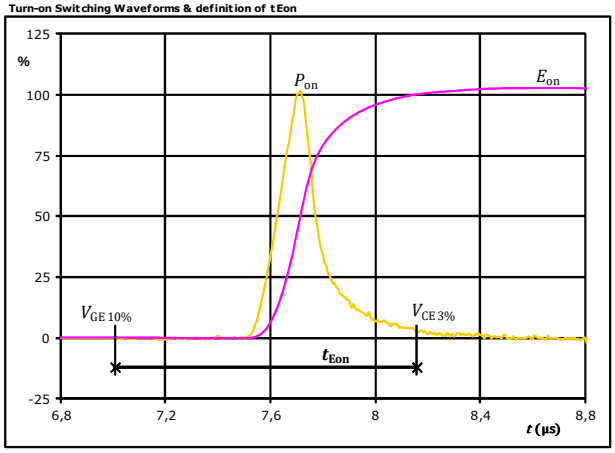
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%)$ =	414,00	kW
$E_{off}(100\%)$ =	65,03	mJ
t_{Eoff} =	1,06	µs

figure 6. **IGBT**

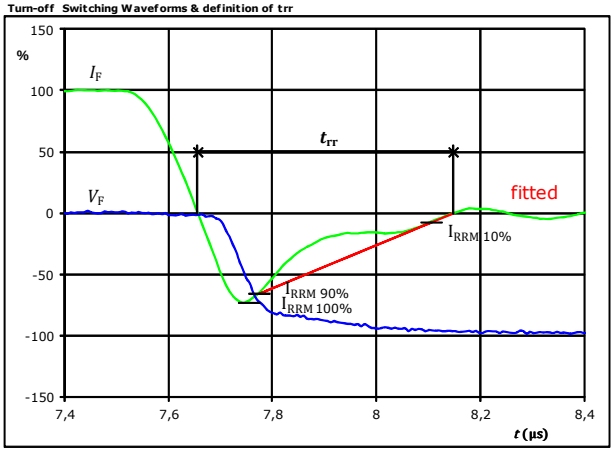
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%)$ =	414,00	kW
$E_{on}(100\%)$ =	81,08	mJ
t_{Eon} =	1,15	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

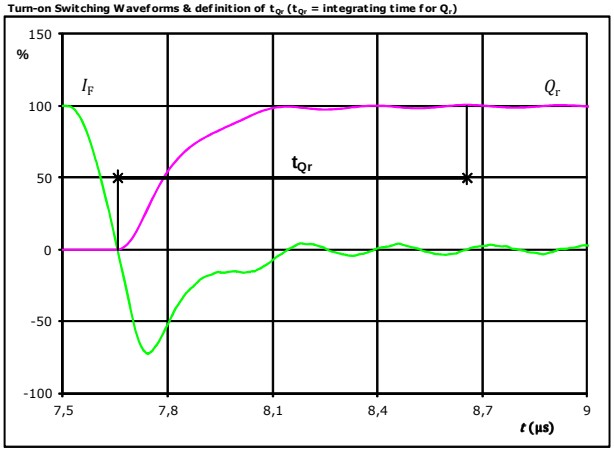


$V_F(100\%)$ =	600	V
$I_F(100\%)$ =	690	A
$I_{RRM}(100\%)$ =	-503	A
t_{rr} =	0,489	µs

Half-Bridge Switching Characteristics

figure 8. **FWD**

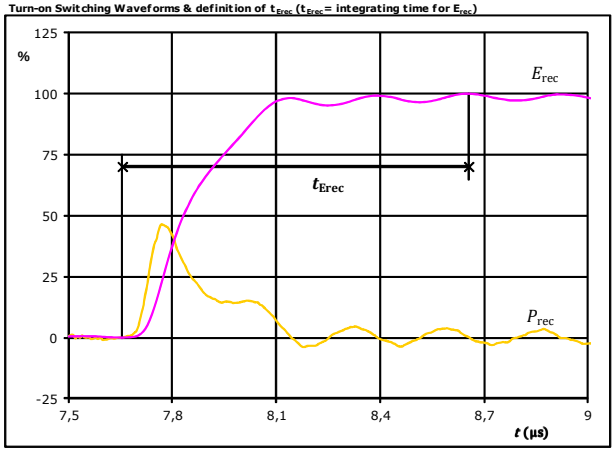
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	690	A
Q_r (100%) =	101,14	µC
t_{Qr} =	1,00	µs

figure 9. **FWD**

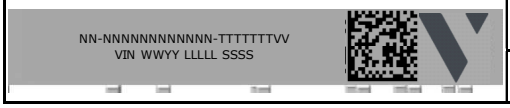
Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



P_{rec} (100%) =	414,00	kW
E_{rec} (100%) =	41,64	mJ
t_{Erec} =	1,00	µs

Ordering Code & Marking

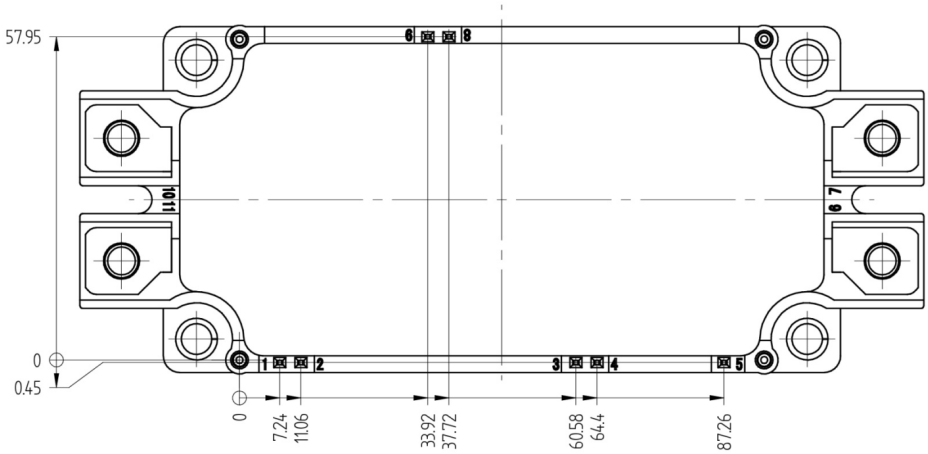
Version	Ordering Code
without thermal paste 17 mm housing with solder pins	A0-VS122PA690M7-L750F70
with thermal paste 17 mm housing with solder pins	A0-VS122PA690M7-L750F70-/3/
without thermal paste 17 mm housing with press-fit pins	A0-VP122PA690M7-L750F70T
with thermal paste 17 mm housing with press-fit pins	A0-VP122PA690M7-L750F70T-/3/



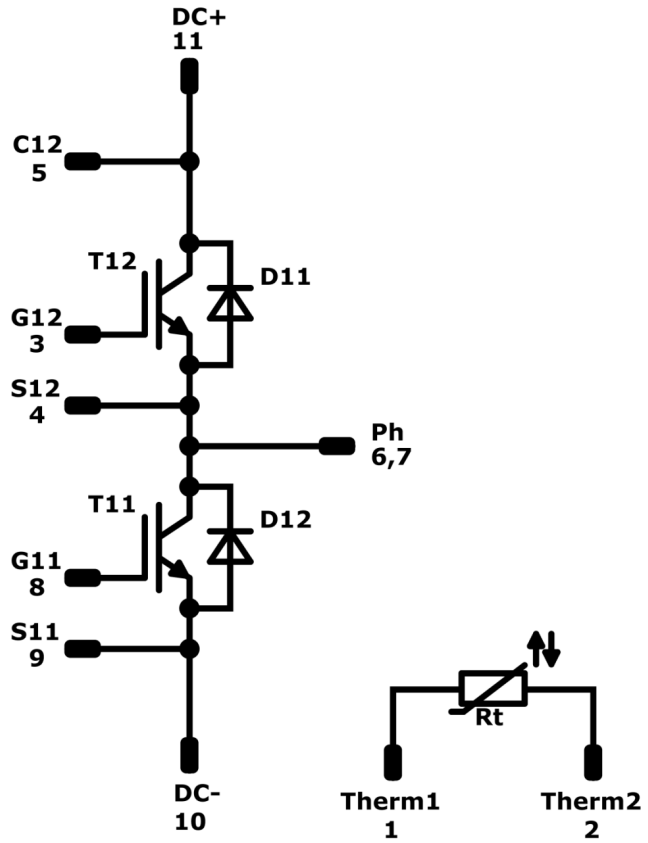
		Name		Date code	VIN	Lot	Serial
Text		NN-NNNNNNNNNNNNN-TTTTTTVV		WWYY	VIN	LLLLL	SSSS
		Type&Ver	**Lot number**	**Serial**	**Date code**		
Datamatrix		TTTTTTTVV	LLLLL	SSSS	WWYY		

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	690 A	Half-Bridge Switch	
D11, D12	FWD	1200 V	750 A	Half-Bridge Diode	
Rt	NTC			Thermistor	

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

Handling instruction
Handling instructions for VINco E3 packages see vincotech.com website.

Package data
Package data for VINco E3 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-Vx122PA690M7-L750F70x-D5-14	04 Feb. 2020	Half-Bridge Switch Gate charge value corrected	3