A0-VS122PA690M7-L750F70
A0-VP122PA690M7-L750F70T

datasheet

Vincotech

VINcoDUAL E3 — **1200 V / 690 A**

Features

- IGBT Mitsubishi gen 7 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

Target applications

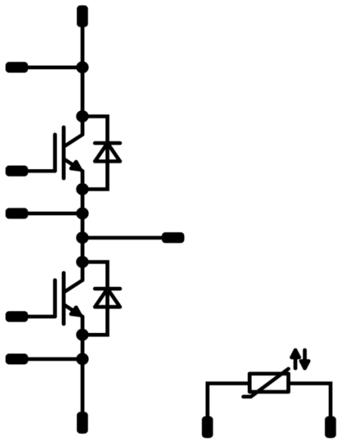
- Industrial Drives
- Power Supply
- UPS

Types

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

VINco E3

Schematic



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

Parameter	Symbol	Condition		Value	Unit
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…(T_{jmax} - 25)	°C

Isolation Properties

Parameter	Symbol	Condition		Value	Unit
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					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			690	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		4500		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-c)}$							0,046		K/W
Thermal resistance junction to sink	$R_{th(c-s)}$	phase-change material λ = 3,4 W/mK						0,029		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 2 Ω R_{gon} = 2 Ω	±15	600	685	25 125 150		752 768 758		ns
Rise time	t_r					25 125 150		122 144 141		
Turn-off delay time	$t_{d(off)}$					25 125 150		524 557 574		
Fall time	t_f					25 125 150		57 89 88		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 54,8 µC Q_{rFWD} = 88,9 µC Q_{rFWD} = 94,6 µC				25 125 150		89,877 122,444 125,037		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		48,689 70,087 64,737		

Characteristic Values

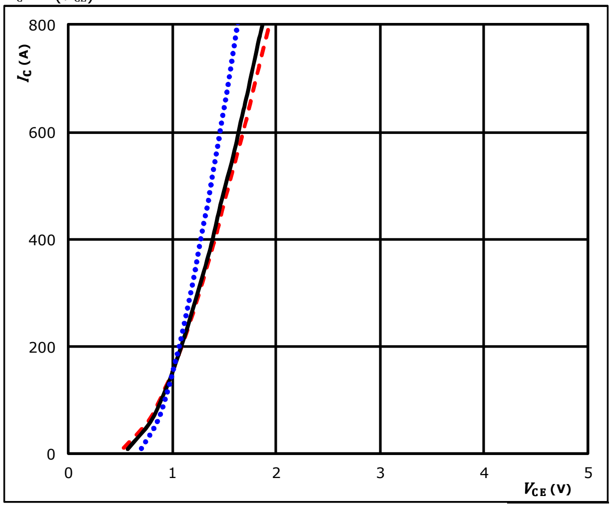
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Half-Bridge Diode										
Static										
Forward voltage	V_F				750	25 125		1,70 1,87	2,2	V
Reverse leakage current	I_R			1200		25			450	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-c)}$							0,070		K/W
Thermal resistance junction to sink	$R_{th(c-s)}$	phase-change material λ = 3,4 W/mK						0,036		K/W
Dynamic										
Peak recovery current	I_{RRM}					25 125 150		317 344 358		A
Reverse recovery time	t_{rr}					25 125 150		368 517 541		ns
Recovered charge	Q_r	di/dt = 5557 A/µs di/dt = 4738 A/µs di/dt = 6750 A/µs	±15	600	685	25 125 150		54,754 88,890 94,624		µC
Reverse recovered energy	E_{rec}					25 125 150		18,371 31,246 29,901		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1157 1025 938		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

$I_C = f(V_{CE})$

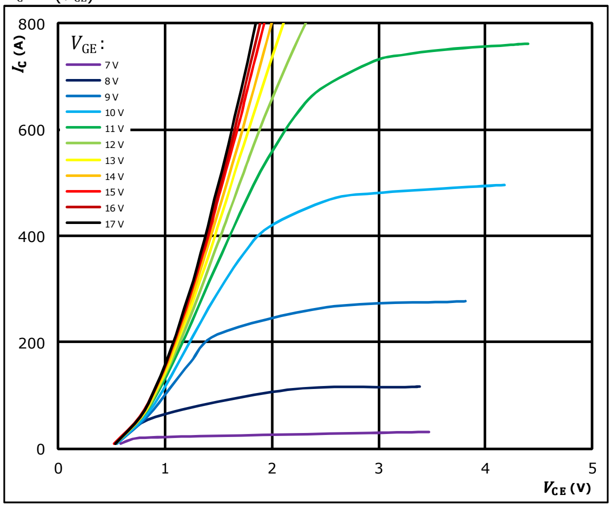


t_p =	250	μs		25 °C	············
V_{GE} =	15	V	T_j:	125 °C	———
				150 °C	– – –

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

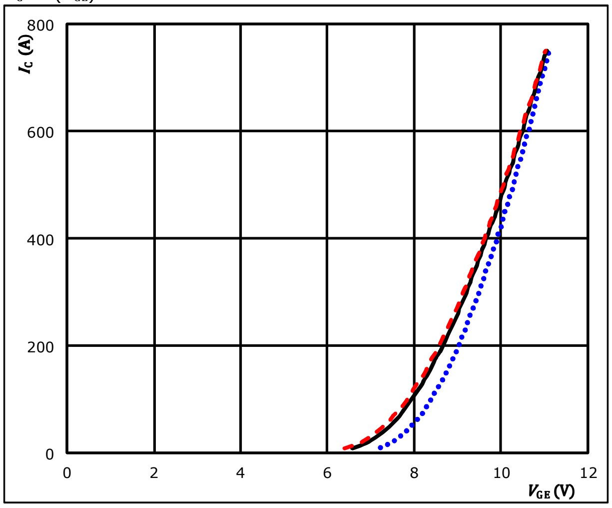


t_p = 250 μs
T_j = 125 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

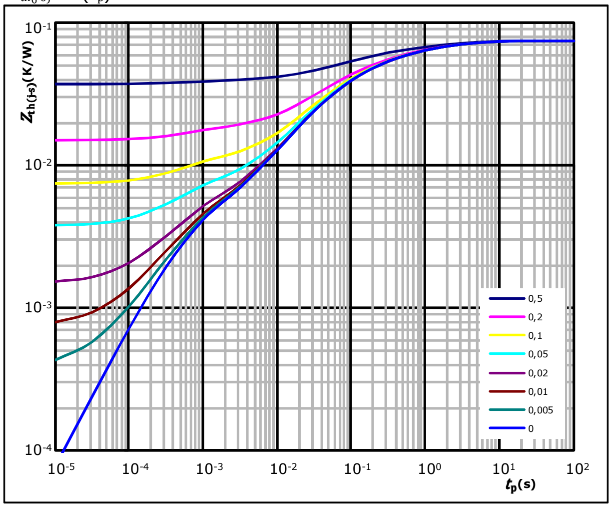


t_p =	100	μs		25 °C	············
V_{CE} =	0	V	T_j:	125 °C	———
				150 °C	– – –

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

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



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

IGBT thermal model values

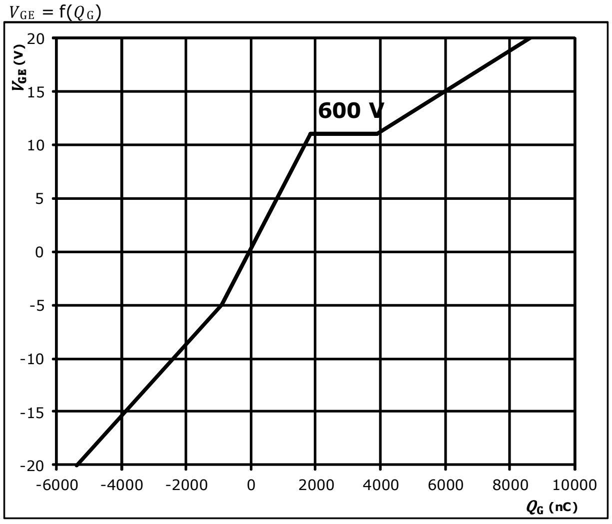
R (K/W)	τ (s)
8,90E-03	3,34E+00
1,87E-02	6,14E-01
2,40E-02	1,17E-01
1,80E-02	2,74E-02
1,75E-03	5,18E-03
3,56E-03	5,36E-04

Half-Bridge Switch Characteristics

figure 5. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

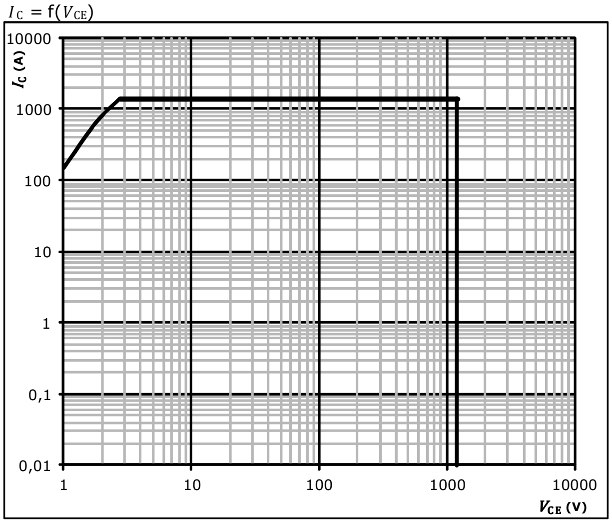


I_C= 690 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



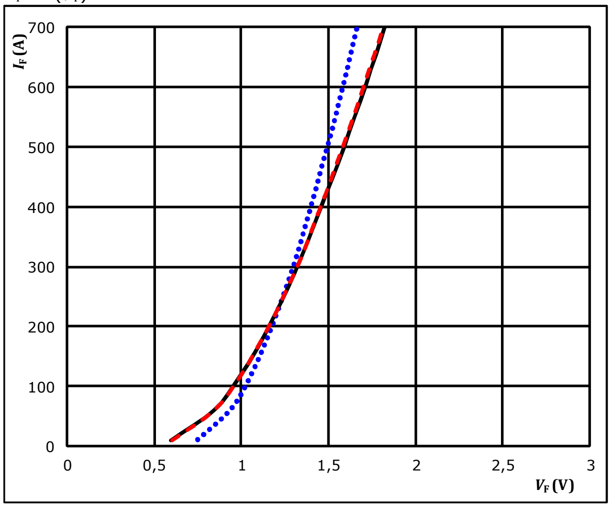
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	ºC

Half-Bridge Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$

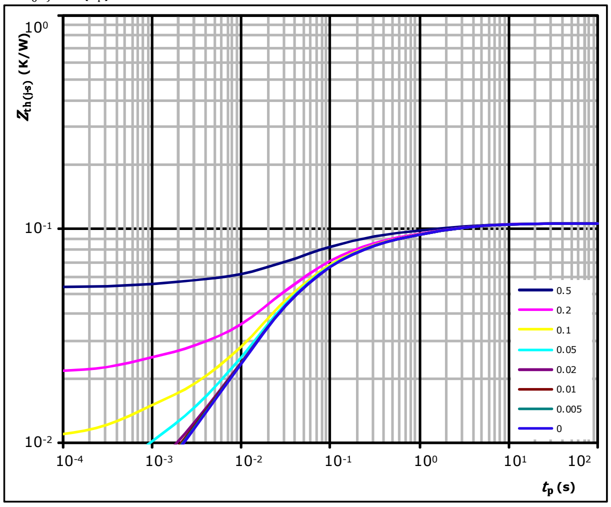


t_p =	250	µs	T_j:	25 °C
				125 °C
				150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

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

FWD thermal model values

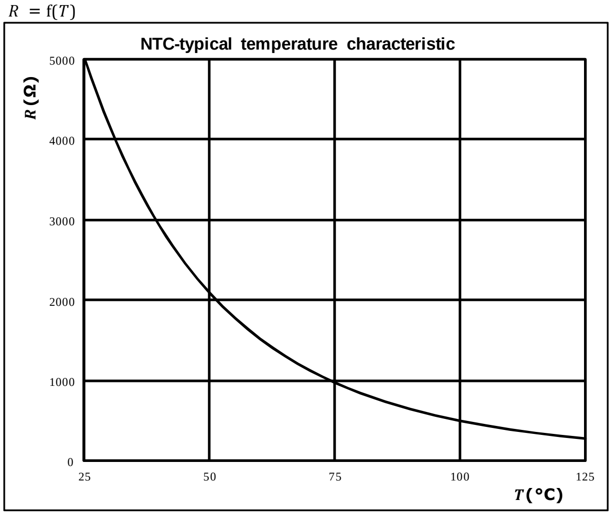
R (K/W)	τ (s)
7,34E-03	4,93E+00
1,58E-02	1,02E+00
2,83E-02	1,62E-01
3,34E-02	4,06E-02
1,57E-02	1,26E-02
5,48E-03	7,94E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature

$R = f(T)$

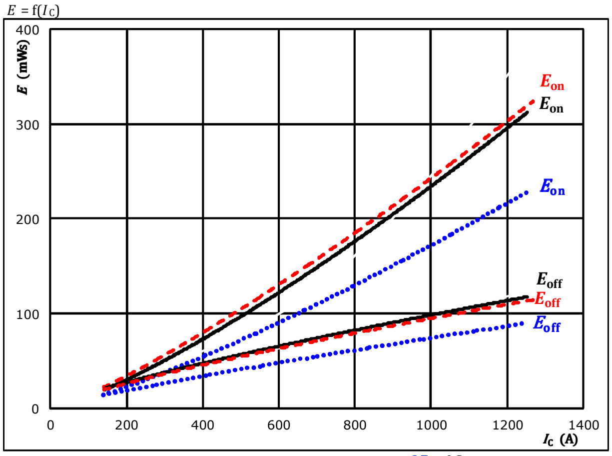


Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



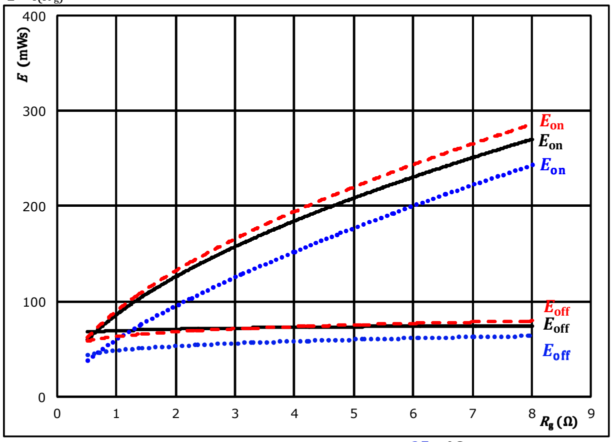
With an inductive load at

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

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



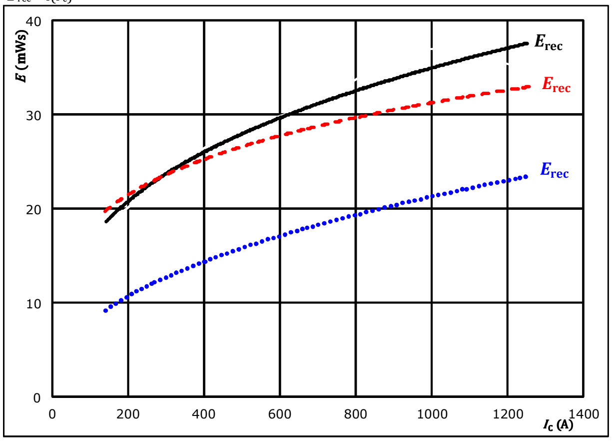
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C	··········
V_{GE} =	±15	V		125 °C	———
I_C =	685	A		150 °C	– – –

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



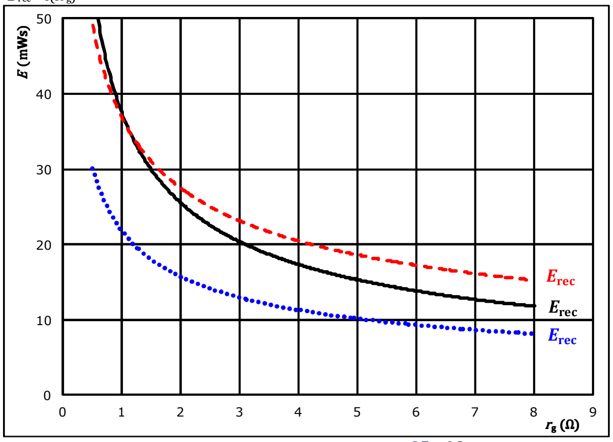
With an inductive load at

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

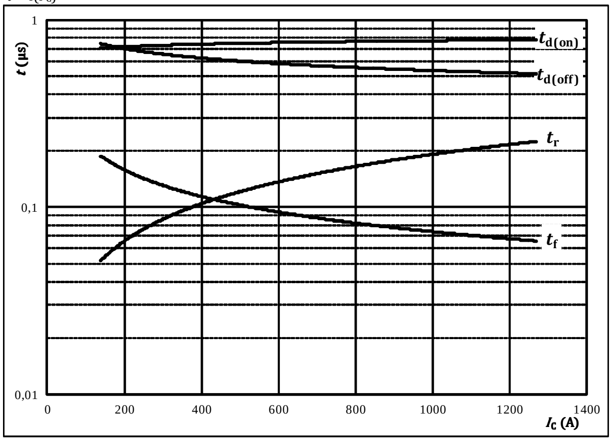
V_{CE} =	600	V	T_j:	25 °C	··········
V_{GE} =	±15	V		125 °C	———
I_C =	685	A		150 °C	– – –

Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



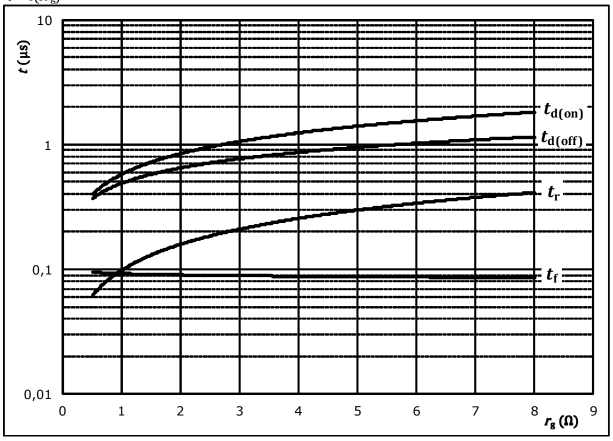
With an inductive load at

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

$t = f(R_g)$



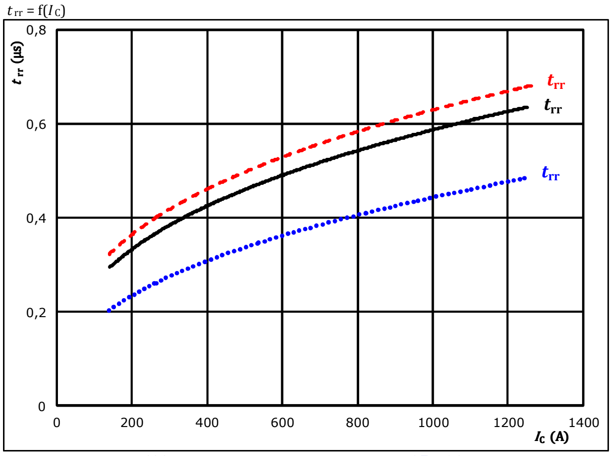
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	685	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

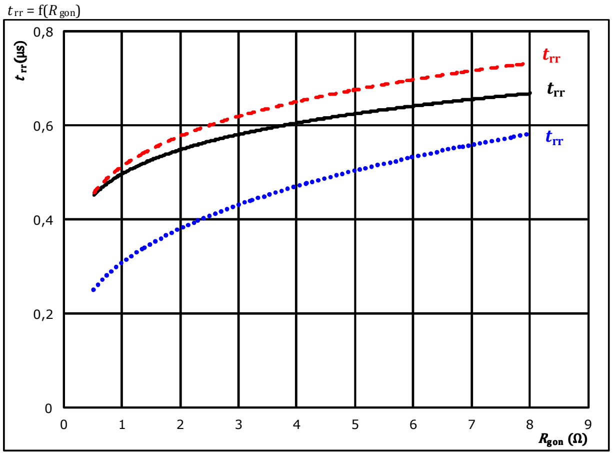


At					
V_{CE}=	600	V		25 °C	··········
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	2	Ω		150 °C	– – –

figure 8. **FWD**

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

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



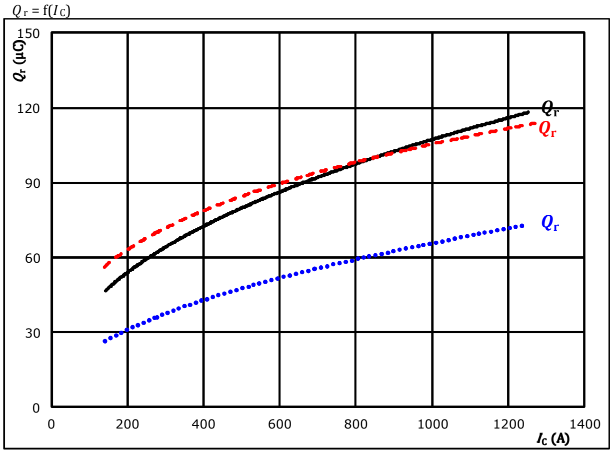
At					
V_{CE} =	600	V		25 °C	··········
V_{GE} =	±15	V	T_j:	125 °C	———
I_C =	685	A		150 °C	– – –

Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

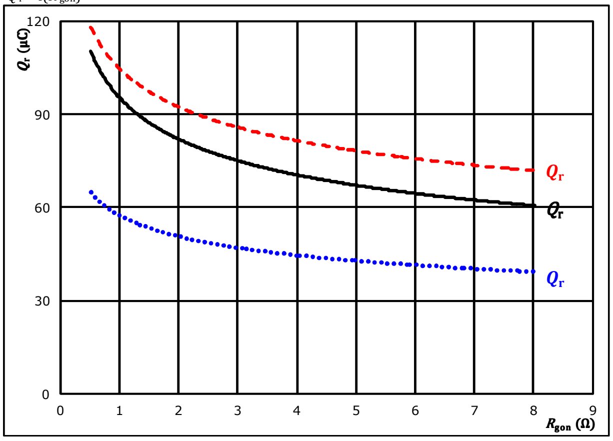


At					
V_{CE} =	600	V		25 °C	············
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	2	Ω		150 °C	– – –

figure 10. FWD

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

$Q_r = f(R_{gon})$

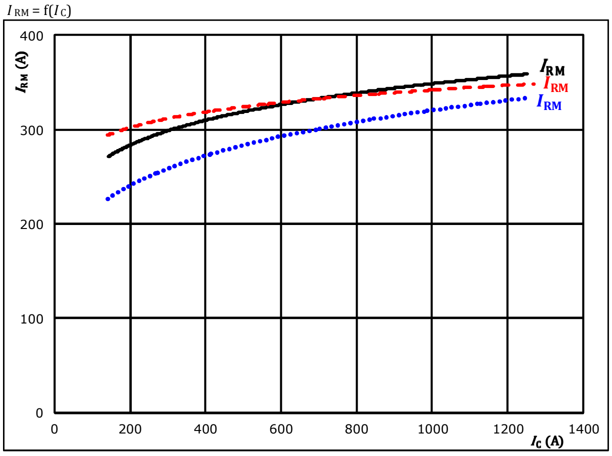


At					
V_{CE}=	600	V		25 °C	············
V_{GE} =	±15	V	T_j:	125 °C	———
I_C=	685	A		150 °C	– – –

figure 11. FWD

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

$I_{RM} = f(I_C)$

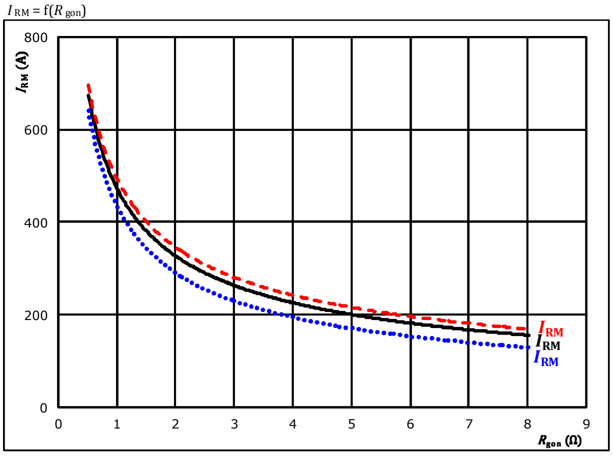


At					
V_{CE}:	600	V		25 °C	············
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	2	Ω		150 °C	– – –

figure 12. FWD

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

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



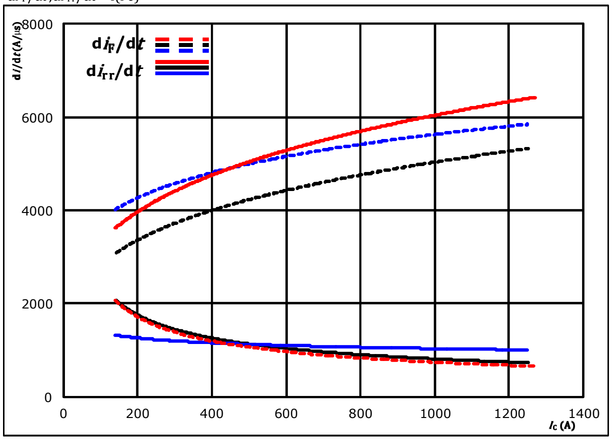
At					
V_{CE} =	600	V		25 °C	············
V_{GE} =	±15	V	T_j:	125 °C	———
I_C =	685	A		150 °C	– – –

Switching Characteristics

figure 13. **FWD**

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

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



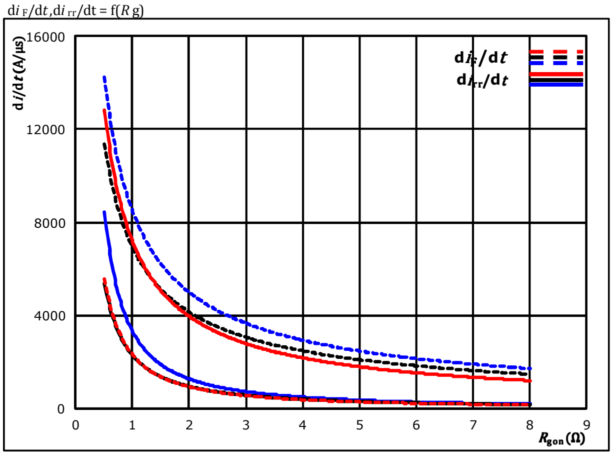
At

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

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



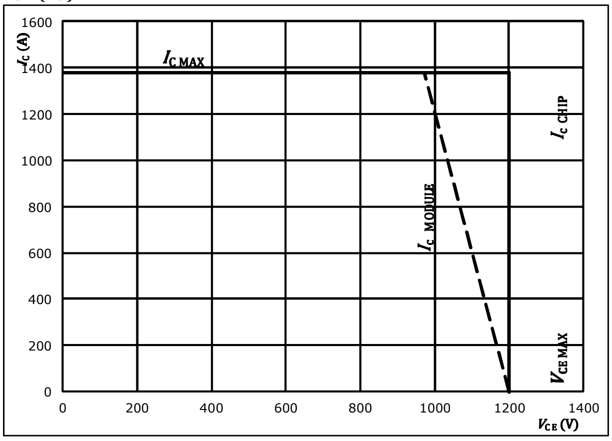
At

V_{CE} =	600	V	T_j:	25 °C	············
V_{GE} =	±15	V		125 °C	———
I_C =	685	A		150 °C	– – –

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

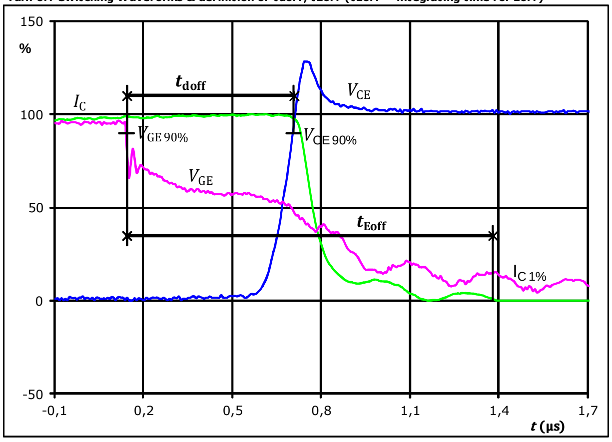
Switching Characteristics

General conditions

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

figure 1. **IGBT**

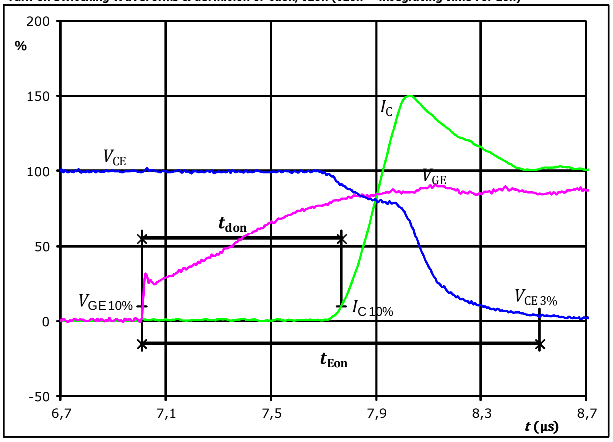
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	686	A
t_{doff} =	0,557	µs
t_{Eoff} =	1,236	µs

figure 2. **IGBT**

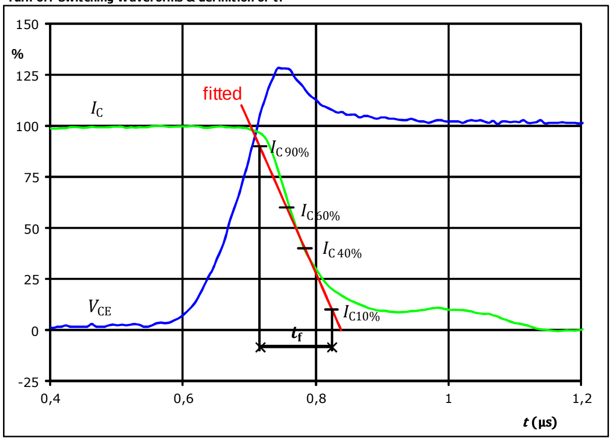
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	686	A
t_{don} =	0,768	µs
t_{Eon} =	1,515	µs

figure 3. **IGBT**

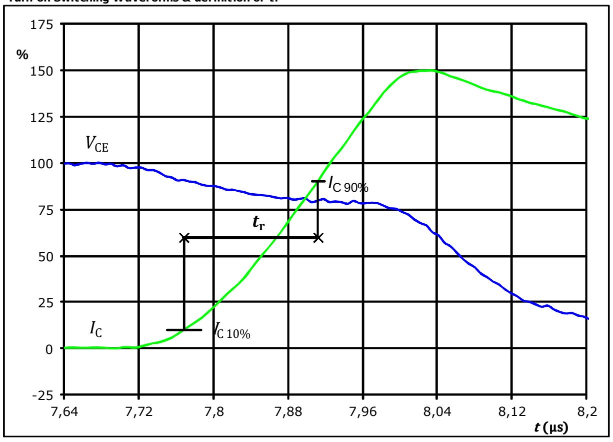
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	686	A
t_f =	0,089	µs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of tr

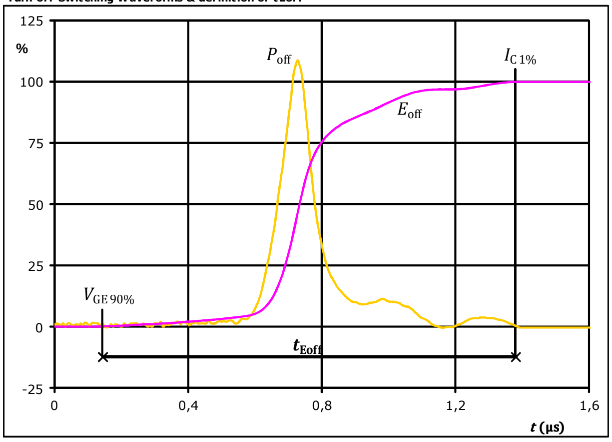


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	686	A
t_r =	0,144	µs

Switching Characteristics

figure 5.	IGBT

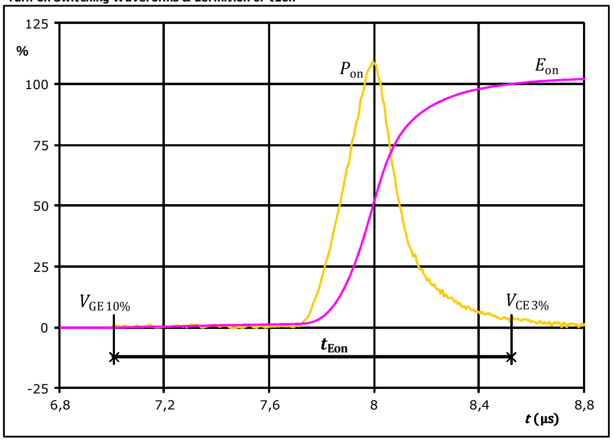
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	411,59	kW
E_{off} (100%) =	70,09	mJ
t_{Eoff} =	1,24	µs

figure 6.	IGBT

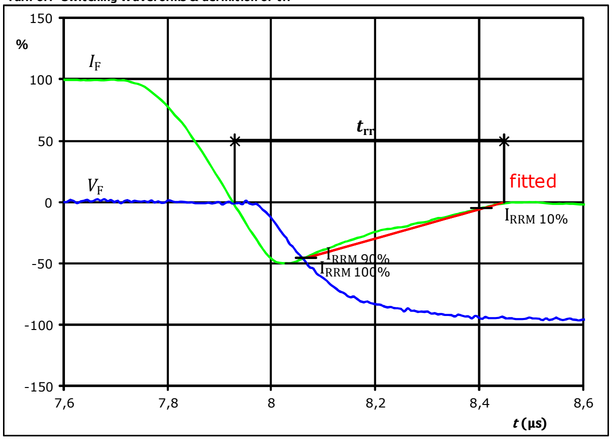
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	411,59	kW
E_{on} (100%) =	122,44	mJ
t_{Eon} =	1,52	µs

figure 7.	FWD

Turn-off Switching Waveforms & definition of trr

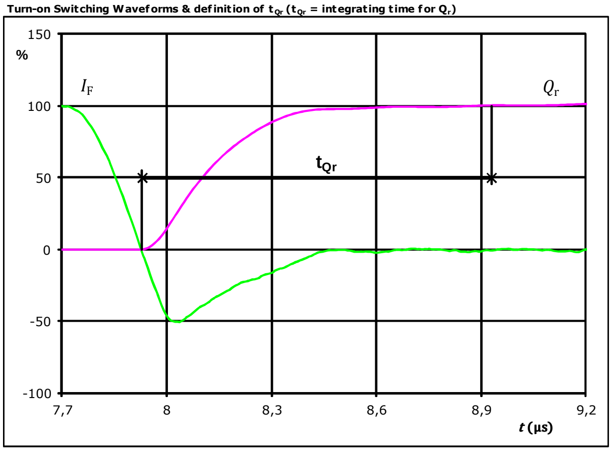


V_F (100%) =	600	V
I_F (100%) =	686	A
I_{RRM} (100%) =	-344	A
t_{rr} =	0,517	µs

Switching Characteristics

figure 8. **FWD**

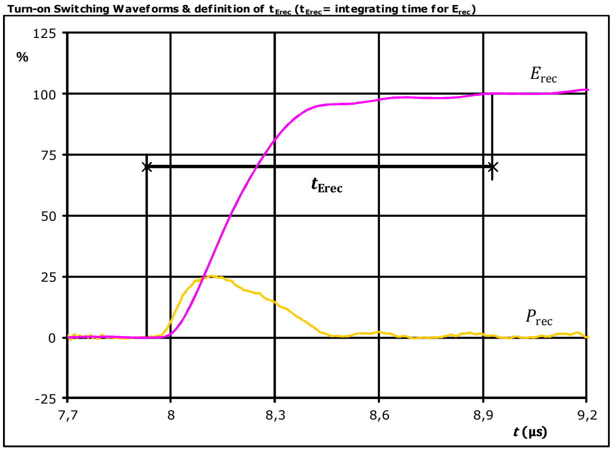
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	686	A
Q_r (100%) =	88,89	µC
t_{Qr} =	1,00	µs

figure 9. **FWD**

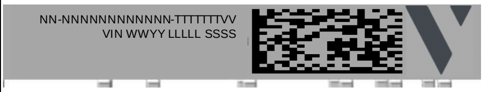
Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	411,59	kW
E_{rec} (100%) =	31,25	mJ
t_{Erec} =	1,00	µs

Ordering Code & Marking

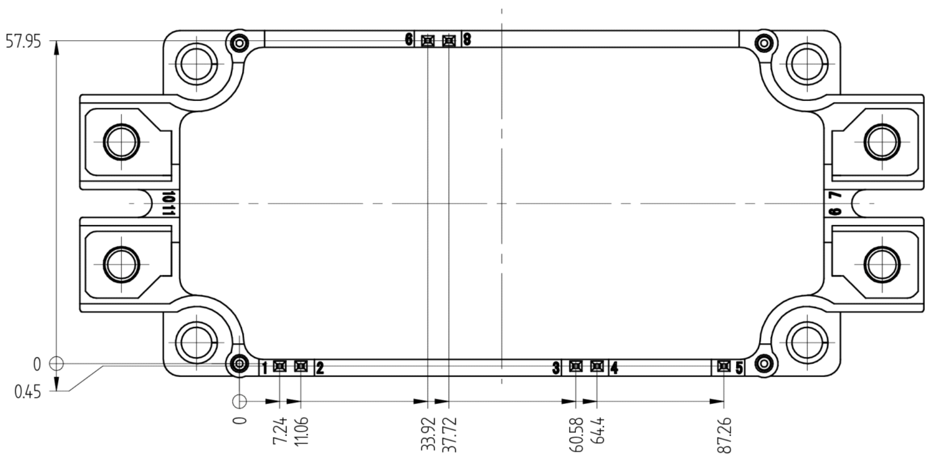
Version	Ordering Code
without thermal paste solder pins	A0-VS122PA690M7-L750F70
with thermal paste solder pins	A0-VS122PA690M7-L750F70-/3/
without thermal paste Press-fit pins	A0-VP122PA690M7-L750F70T
with thermal paste Press-fit pins	A0-VP122PA690M7-L750F70T-/3/



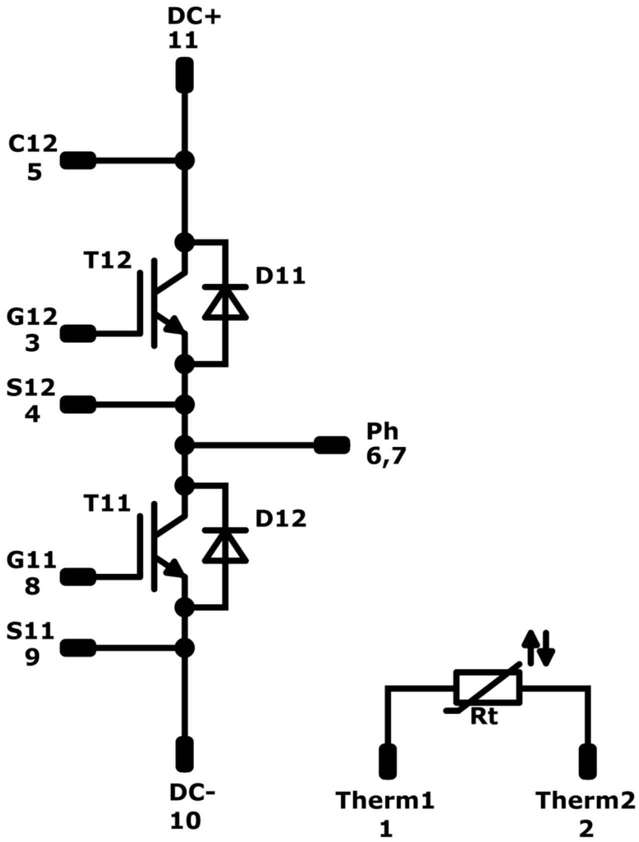
	Name		VIN	Date code	Lot	Serial
Text	NN-NNNNNNNNNNNN-TTTTTTVV		VIN	WWYY	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

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

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

Document No.:	Date:	Modification:	Pages
A0-Vx122PA690M7-L750F70x-D2-14	23 Nov. 2016	Change of features	1