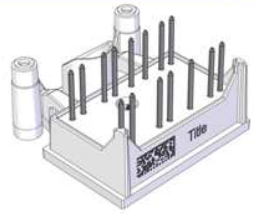
flow **PACK 0B** — **1200 V / 15 A**

Features

- IGBT4 (1200V) technology
- Open emitter topology
- New ultra-compact housing
- Single-screw heat sink mounting

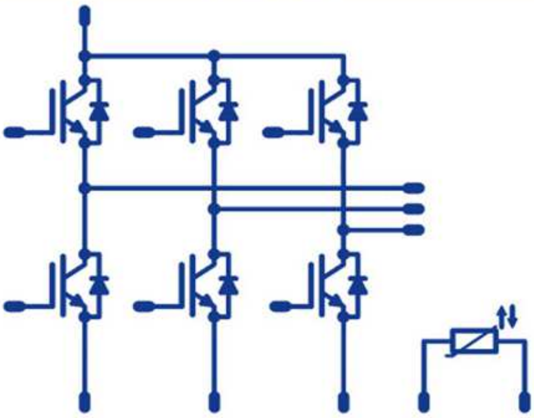
flow 0 17mm housing



Target applications

- Dedicated design for motor drive

Schematic



Types

- 10-0B126PA015SC-M999F09

Inverter switch maximum ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Collector-emitter break down voltage	V_{CES}			1200	V
DC collector current	I_C	$T_j=T_jmax$	T_h=80°C	20	A
Pulsed collector current	I_{Cpulse}	t_p limited by T_jmax		45	A
Power dissipation	P_{tot}	$T_j=T_jmax$	T_h=80°C	56	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	Tj≤ 150°C VGE= 15V		10 800	μs V
Maximum Junction Temperature	T_jmax			175	°C

Inverter diode maximum ratings

Parameter	Symbol	Conditions		Value	Unit
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j=T_jmax$	T_h=80°C	21	A
Repetitive peak forward current	I_{FRM}			30	A
Power dissipation	P_{tot}	$T_j=T_jmax$	T_h=80°C	43	W
Maximum Junction Temperature	T_jmax			175	°C

Inverter switch characteristic values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	
Static										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,0005	25 125	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		15	25 150	1,6	1,89 2,28	2,1	V
Collector-emitter cut-off	I_{CES}		0	1200		25 125			2	µA
Gate-emitter leakage current	I_{GES}		20	0		25 125			120	nA
Integrated Gate resistor	R_{gint}							none		Ω
Input capacitance	C_{ies}	f=1 MHz	0	25		25		900		pF
Output capacitance	C_{oss}							80		
Reverse transfer capacitance	C_{rss}							55		
Gate charge	Q_{Gate}		15	960	15	25		93		nC
Thermal										
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,7		K/W

Inverter dynamic values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V]	I_C [A] or I_F [A] or I_D [A]	T_j [°C]	Min	Typ	Max	
IGBT Switching										
Turn-on delay time	$t_{d(on)}$	Rgoff=32Ω Rgon=32Ω	±15	600	15	25 150		86 84		ns
Rise time	t_r					25 150		18 24		
Turn-off delay time	$t_{d(off)}$					25 150		201 264		
Fall time	t_f					25 150		81 130		
Turn-on energy loss per pulse	E_{on}	QrrFWD=1,5uC				25 150		0,952 1,402		mWs
Turn-off energy loss per pulse	E_{off}					25 150		0,829 1,371		
FWD Switching										
Peak recovery current	I_{RRM}	922	±15	600	15	25 150		15 16		A
Reverse recovery time	t_{rr}	922				25 150		289 447		ns
Reverse recovery charge	Q_{rr}	922				25 150		1,542 2,681		µC
Reverse recovered energy	E_{rec}	922				25 150		0,626 1,076		mWs
Peak rate of fall of recovery current	di(rec)max /dt	922				25 150		92 59		A/µs

Inverter diode characteristic values

Parameter	Symbol	Conditions					Value			Unit
		dI_F/dt [A/us]		V_r [V]	I_F [A]	T_j	Min	Typ	Max	
Static										
Forward voltage	V_F				15	25°C 150°C		1,80 1,77	2,05	V
Reverse leakage current	I_{rm}			1200		25°C 150°C			3,5 -	µA
Thermal										
Thermal resistance chip to heatsink	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,2		K/W

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		kΩ
Deviation of R100	ΔR/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	

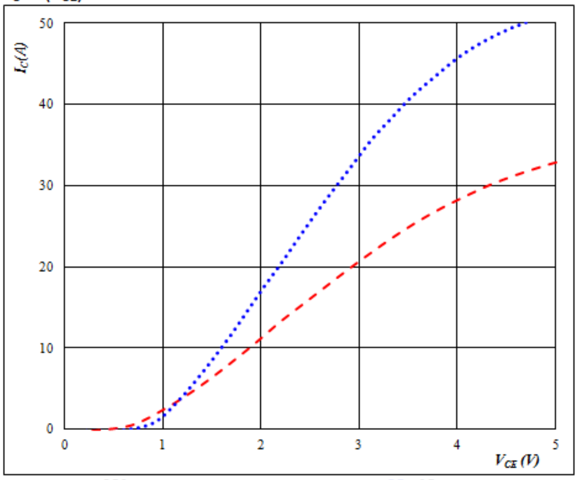
Module Properties

Parameter	Symbol	Conditions		Value	Unit
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	°C
Insulation Properties					
Insulation voltage	V_{is}	DC voltage	t=2s	4000	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm
Comparative tracking index	CTI			>200	

Inverter switch characteristics

Typical output characteristics — IGBT

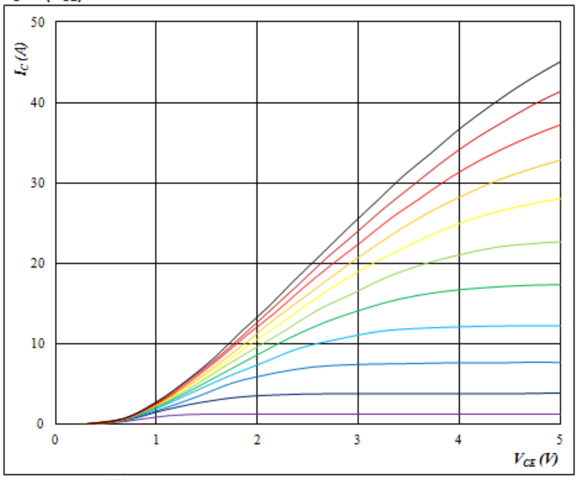
$I_C = f(V_{CE})$



t_p =	250	μs		25 °C	dotted blue
V_{GE}=	15	V	T_j:	125 °C	solid black
				150 °C	dashed red

Typical output characteristics — IGBT

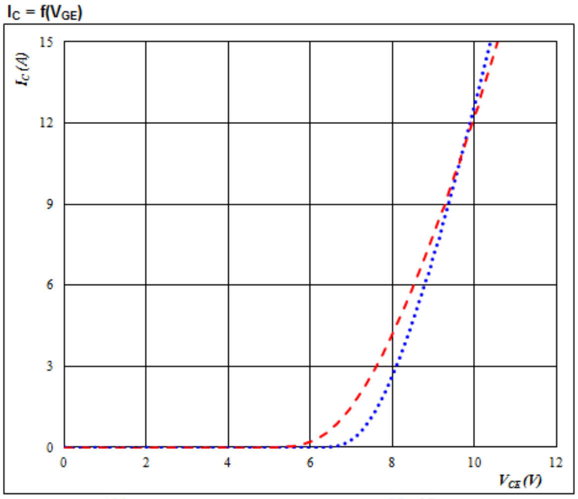
$I_C = f(V_{CE})$



t_p =	250	μs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Typical transfer characteristics — IGBT

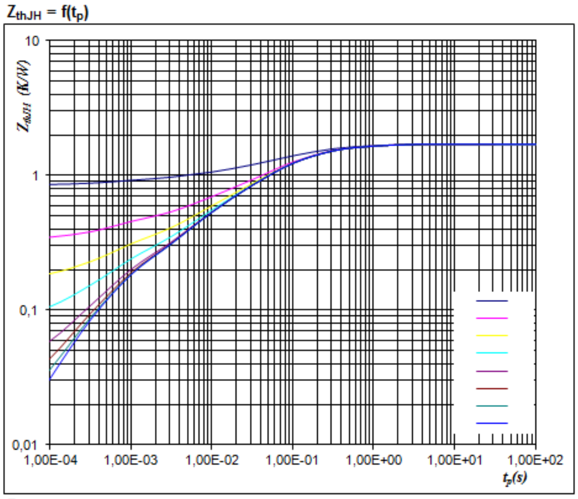
$I_C = f(V_{GE})$



t_p =	100	μs		25 °C	dotted blue
V_{CE} =	10	V	T_j:	125 °C	solid black
				150 °C	dashed red

Transient thermal impedance as a function of pulse width — IGBT

$Z_{thJH} = f(t_p)$



D =	t_p / T	
R_{thJH} =	1,7	K/W

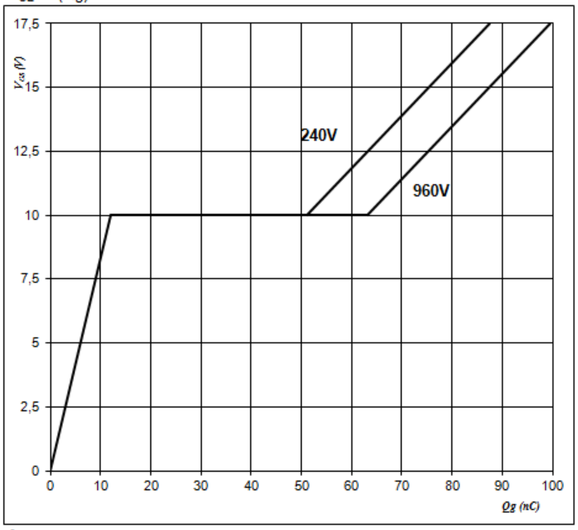
IGBT thermal model values

R (K/W)	Tau (s)
1,32E-01	1,36E+00
5,21E-01	2,19E-01
5,88E-01	5,73E-02
3,04E-01	8,98E-03
1,49E-01	7,03E-04

Inverter switch characteristics

Gate voltage vs Gate charge IGBT

$V_{GE} = f(Qg)$

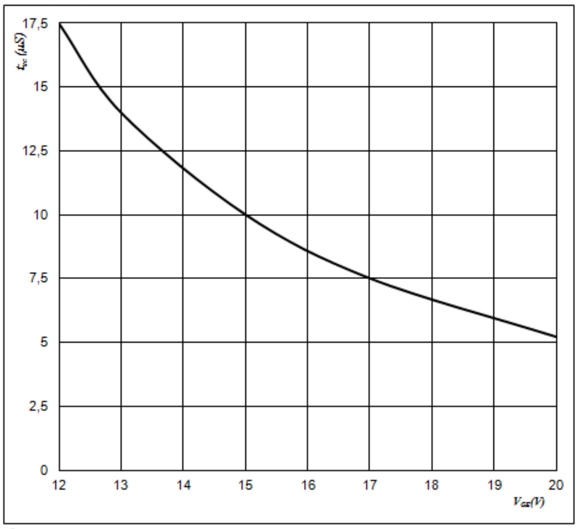


At

$I_C=$ 15 A

Short circuit withstand time as a function of Vge IGBT

$t_{sc} = f(V_{GE})$

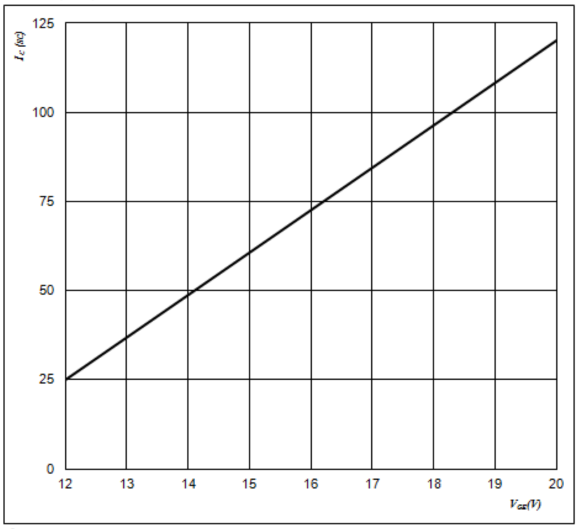


At

V_{CE} =	1200	V
T_j ≤	175	ºC

Typical short circuit collector current as a function of Vge IGBT

$V_{GE} = f(Q_{GE})$

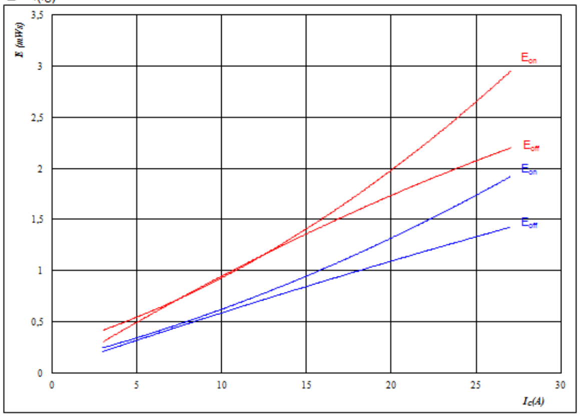


At

V_{CE} ≤	1200	V
T_j =	175	ºC

Inverter switching characteristics

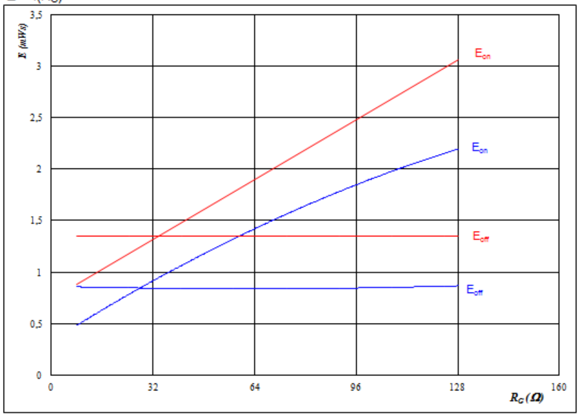
Figure 1. IGBT
Typical switching energy losses as a function of collector current
E = f(I_C)



With an inductive load at

T_j =	25/125/150	°C	R_{gon} =	32	Ω
V_{CE} =	600	V	R_{goff} =	32	Ω
V_{GE} =	±15	V			

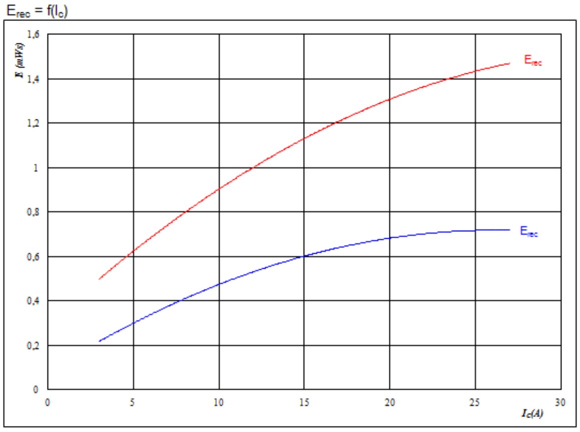
Figure 2. IGBT
Typical switching energy losses as a function of gate resistor
E = f(R_G)



With an inductive load at

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

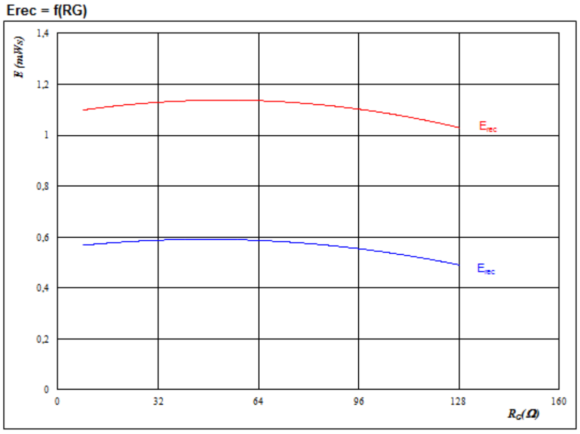
Figure 3. FWD
Typical reverse recovery energy loss as a function of collector (drain) current
E_{rec} = f(I_c)



With an inductive load at

T_j =	25/125/150	°C	R_{gon} =	32	Ω
V_{CE} =	600	V	R_{goff} =	32	Ω
V_{GE} =	±15	V			

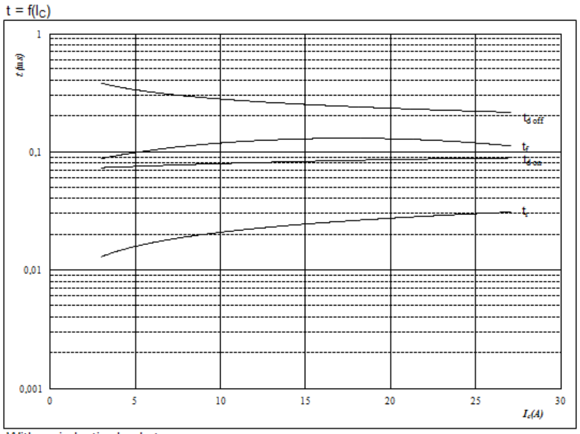
Figure 4. FWD
Typical reverse recovery energy loss as a function of gate resistor
Erec = f(RG)



With an inductive load at

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

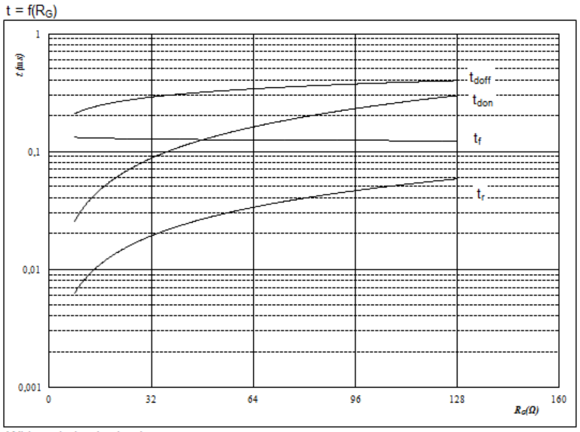
Figure 5. IGBT
Typical switching times as a function of collector current
t = f(I_C)



With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

Figure 6. IGBT
Typical switching times as a function of gate resistor
t = f(R_G)



With an inductive load at

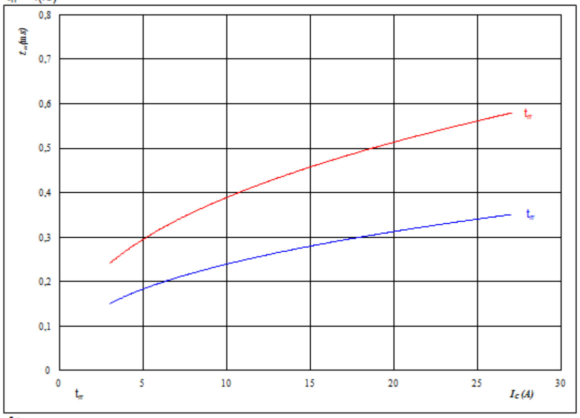
T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

Inverter switching characteristics

Figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



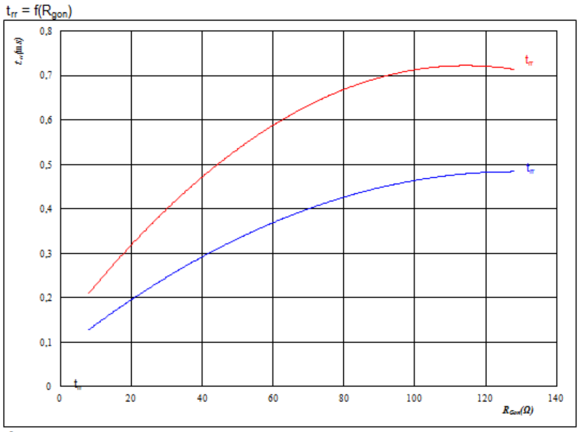
At

T_j =	25/125/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

Figure 8. FWD

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

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



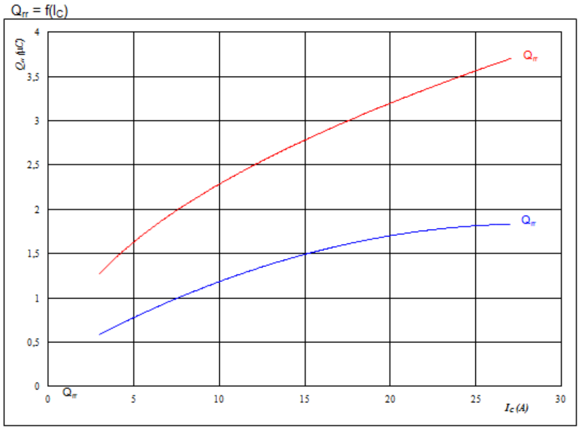
At

T_j =	25/125/150	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

Figure 9. FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



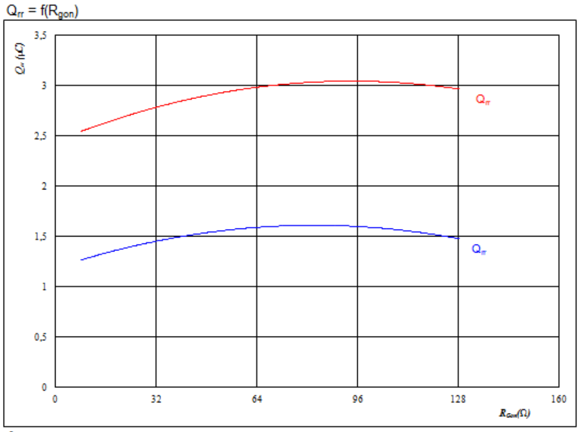
At

T_j =	25/125/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

Figure 10. FWD

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

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



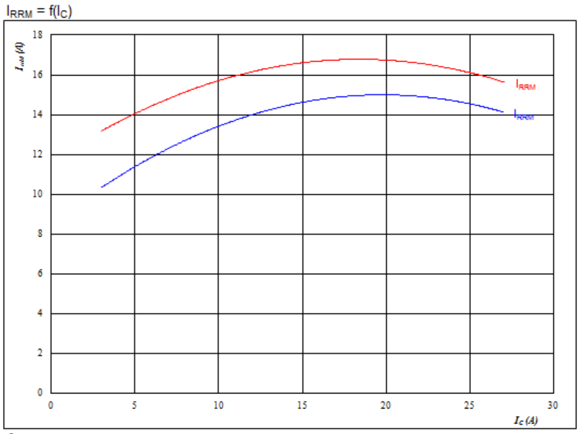
At

T_j =	25/125/150	°C
V_R =	600	V
I_F =	15	A
V_{GE} =	±15	V

Figure 11. FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



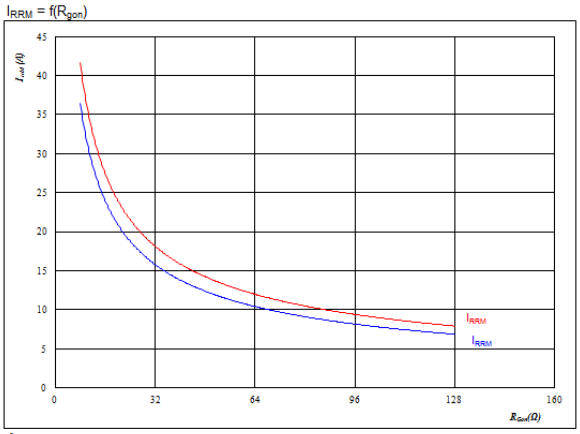
At

T_j =	25/125/150	°C	R_{gon} =	32	Ω
V_{CE} =	600	V			
V_{GE} =	±15	V			

Figure 12. FWD

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

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



At

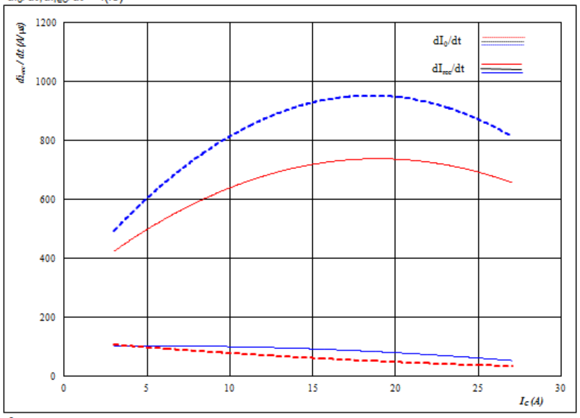
T_j =	25/125/150	°C	V_{GE} =	±15	V
V_R =	600	V			
I_F =	15	A			

Inverter switching characteristics

Figure 13. FWD

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

$dI_0/dt, dI_{rec}/dt = f(I_C)$

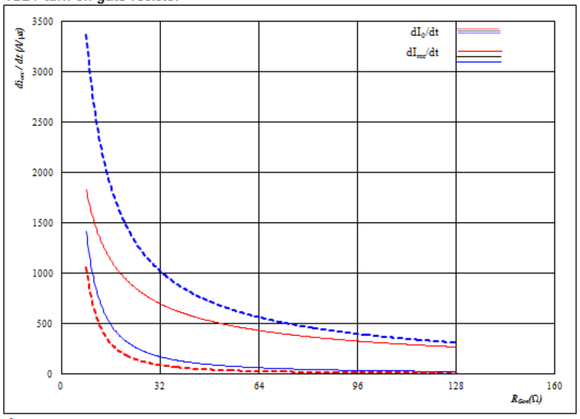


At

T_j =	25/125/150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

Figure 14. FWD

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



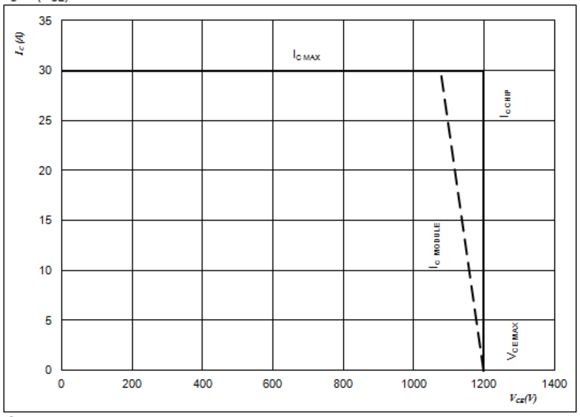
At

Tj =	25/125/150	°C
VR =	600	V
IF =	15	A
VGE =	±15	V

Figure 15. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

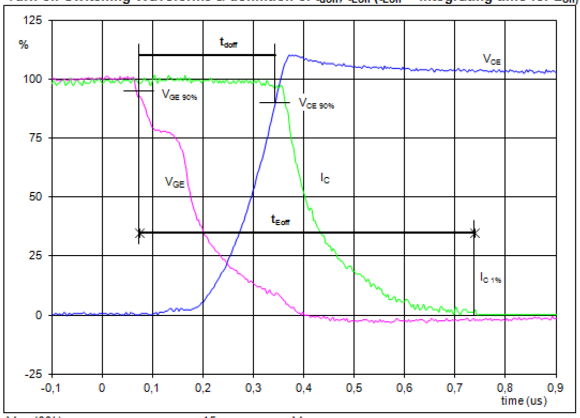
T_j =	175	°C
Rgon =	32	Ω
Rgoff =	32	Ω

Switching Definitions

General conditions		
T_j	=	150 °C
R_{gon}	=	32 Ω
R_{goff}	=	32 Ω

Figure 1. IGBT

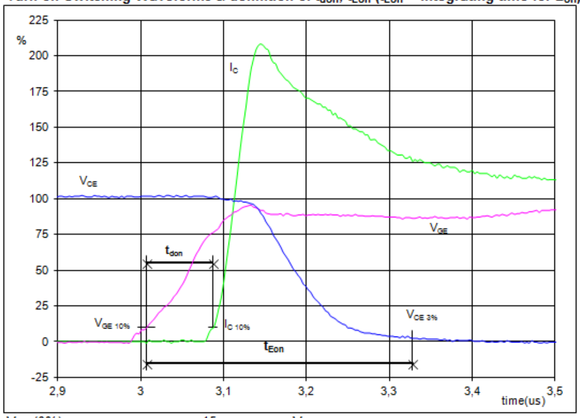
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{doff} =	0,26	µs
t_{Eoff} =	0,67	µs

Figure 2. IGBT

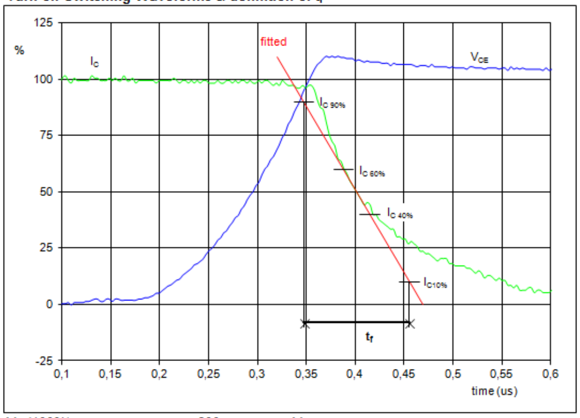
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	600	V
I_C (100%) =	15	A
t_{don} =	0,08	µs
t_{Eon} =	0,32	µs

Figure 3. IGBT

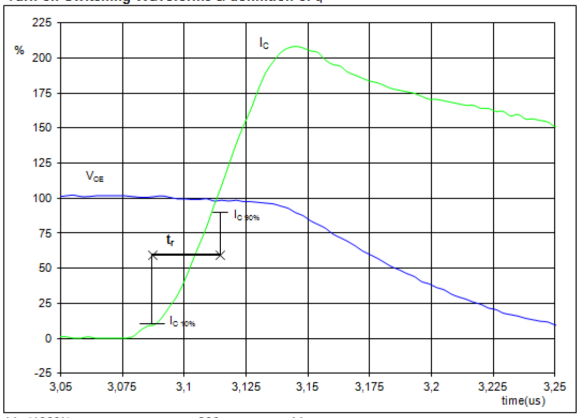
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	600	V
I_C (100%) =	15	A
t_f =	0,13	µs

Figure 4. IGBT

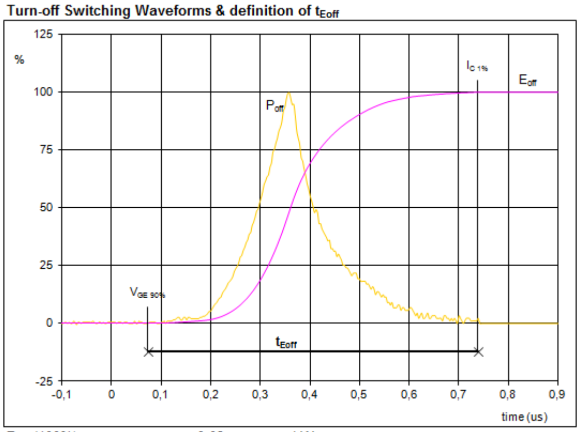
Turn-on Switching Waveforms & definition of t_r



V_C (100%) =	600	V
I_C (100%) =	15	A
t_r =	0,02	µs

Figure 5. IGBT

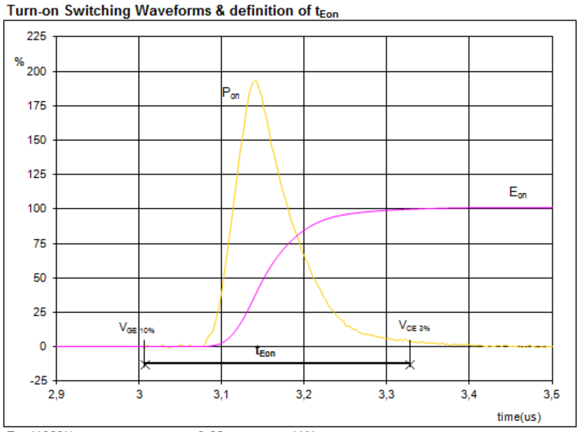
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	9,03	kW
E_{off} (100%) =	1,37	mJ
t_{Eoff} =	0,67	µs

Figure 6. IGBT

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

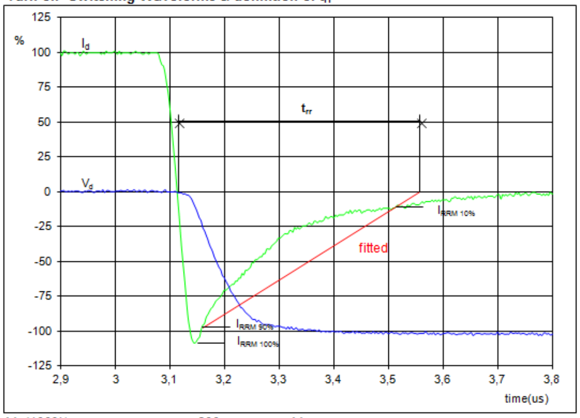


P_{on} (100%) =	9,03	kW
E_{on} (100%) =	1,40	mJ
t_{Eon} =	0,32	µs

Switching Definitions

Figure 7. FWD

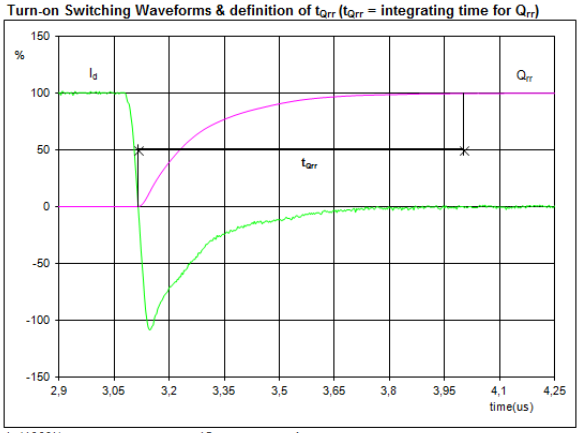
Turn-off Switching Waveforms & definition of t_{rr}



V_d (100%) =	600	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-16	A
t_{rr} =	0,45	µs

Figure 8. FWD

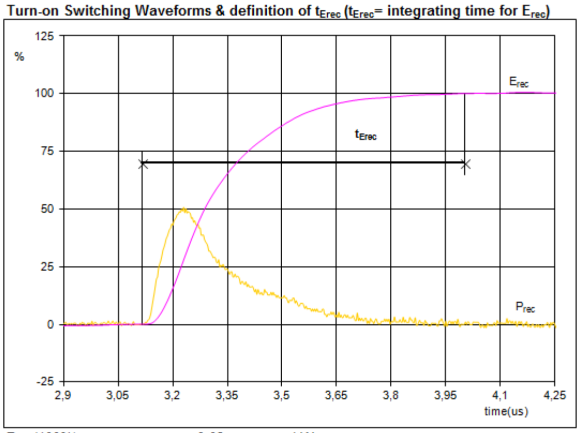
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	2,68	µC
t_{Qrr} =	0,89	µs

Figure 9. FWD

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

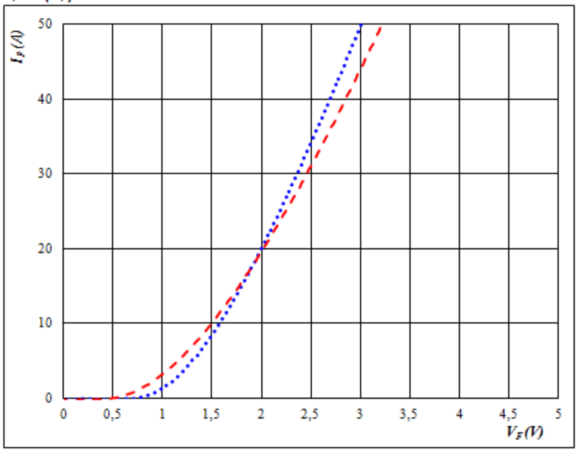


P_{rec} (100%) =	9,03	kW
E_{rec} (100%) =	1,08	mJ
t_{Erec} =	0,89	µs

Inverter diode characteristics

Typical forward characteristics FWD

$I_F = f(V_F)$

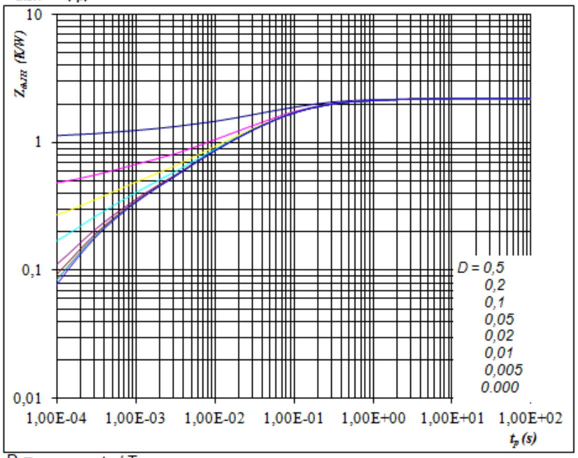


t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

Transient thermal impedance as a function of pulse width FWD

$Z_{thJH} = f(t_p)$



D = t_p / T

R_{thJH} = 2,2 K/W

FWD thermal model values

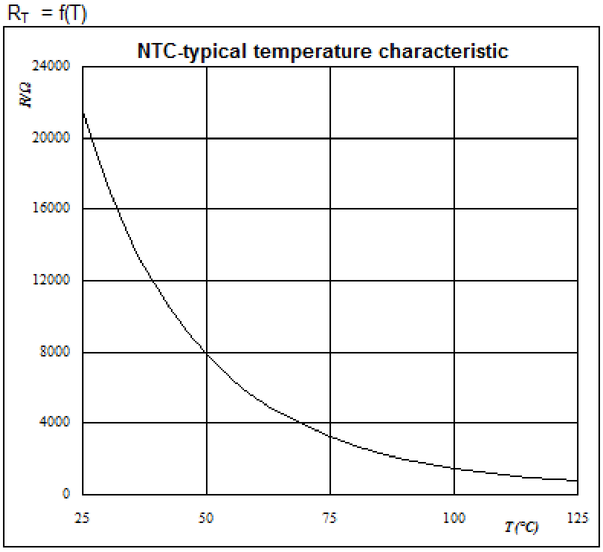
R (K/W)	Tau (s)
3,54E-02	8,43E+00
1,46E-01	9,82E-01
6,08E-01	1,40E-01
6,27E-01	3,75E-02
4,62E-01	7,22E-03
2,00E-01	8,47E-04

Thermistor

Figure 1 Thermistor

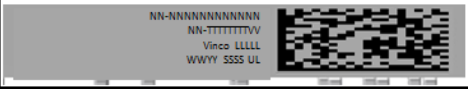
Typical NTC characteristic
as a function of temperature

$R_T = f(T)$



Ordering Code & Marking

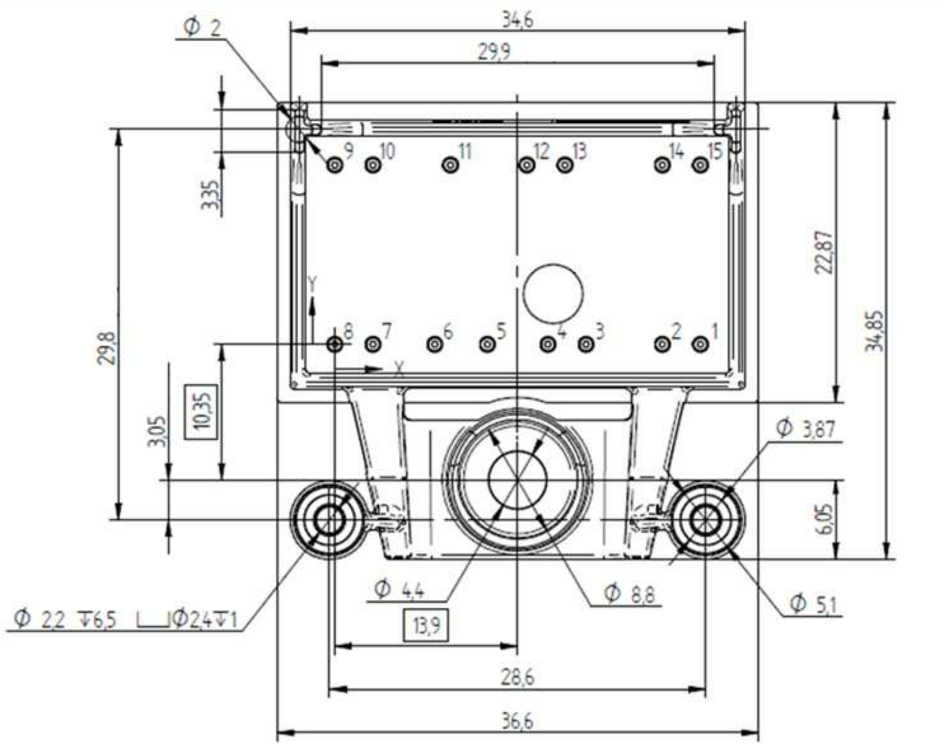
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 17mm housing	10-0B126PA015SC-M999F09	M999F09	M999F09



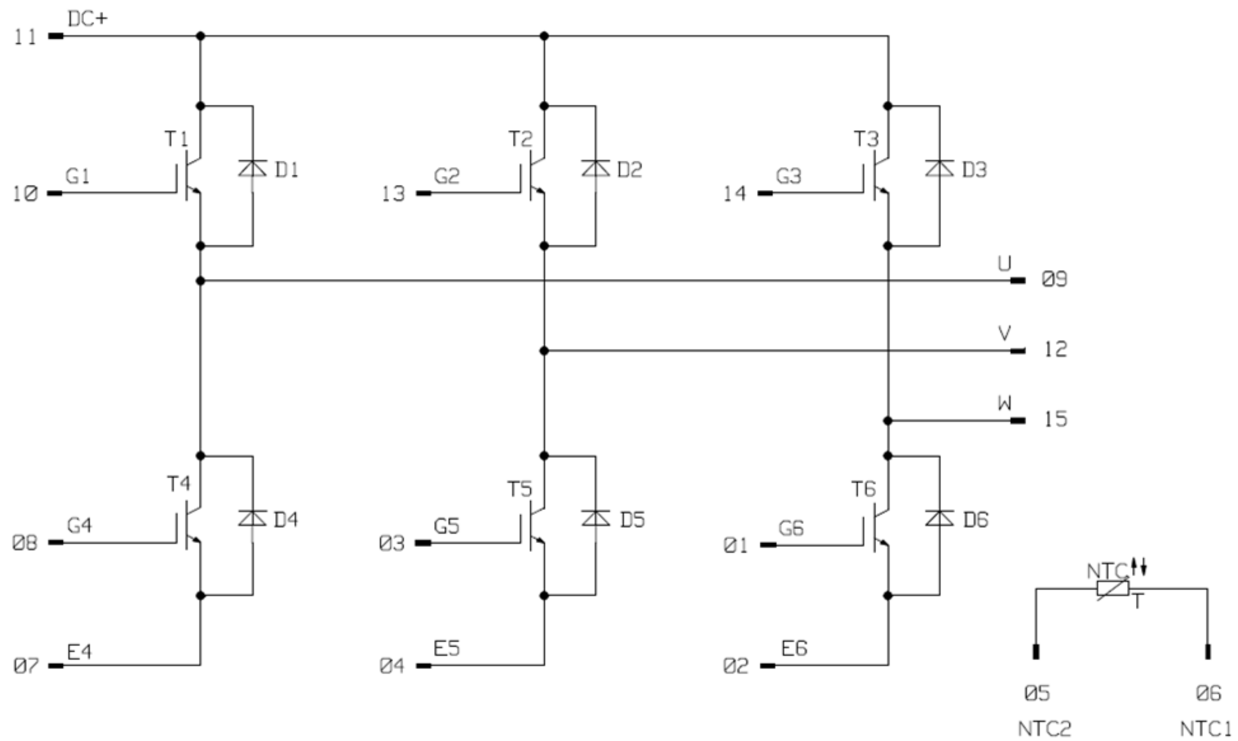
	Name&Type&VER		Date code	UL & Vinco	Lot	Serial
Text	NN-NNNNNNNNNNNNNN-TTTTTTTTVV		WWYY	UL Vinco	LLLLL	SSSS
Datamatrix	Type& VER	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Funkction
1	27,8	0	G6
2	24,9	0	E6
3	19,1	0	G6
4	16,2	0	E5
5	11,6	0	NTC2
6	7,6	0	NTC1
7	2,9	0	E4
8	0	0	G4
9	0	13,7	U
10	2,9	13,7	G1
11	8,8	13,7	DC+
12	14,6	13,7	V
13	17,5	13,7	G2
14	24,9	13,7	G3
15	27,8	13,7	W



Pinout



Identification

ID	Component	Voltage	Technology	Current	Function	Comment
T1-T6	IGBT	1200V		15A	Inverter switch	
D1-D6	FWD	1200V		15A	Inverter diode	
R_t	NTC				Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	200	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0B packages see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-0B126PA015SC-M999F09-T1-14	4 Dec 2014		

Product status definition		
Datasheet Status	**Product Status**	**Definition**
Target	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. The data contained is exclusively intended for technically trained staff.