10-TY12NMB030SM01-L394L18

datasheet

Vincotech

***flow*3xNPFC 1** **650 V / 30 A**

Topology features

- 3xNeutral Boost PFC
- Temperature sensor

Component features

- High efficiency in hard switching and resonant topologies
- High speed switching
- Low gate charge

Housing features

- Base isolation: Al_2O_3
- Clip-in, reliable mechanical connection, qualified for wave soldering
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Solder pin

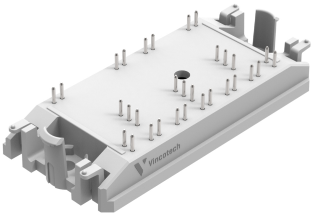
Target applications

- Charging Stations
- Power Supply

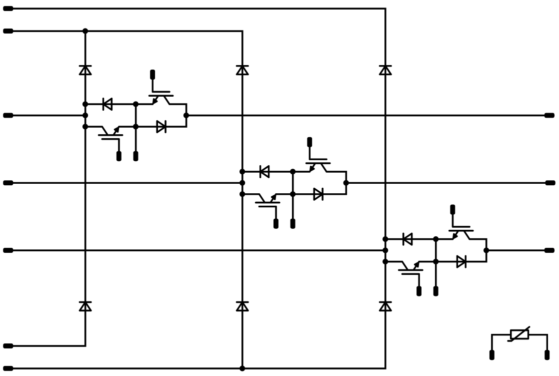
Types

- 10-TY12NMB030SM01-L394L18

flow 1 12 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Buck Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	35	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	50	W
Maximum junction temperature	T_{jmax}			175	°C
Boost Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	32	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		90	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	60	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
Boost Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	32	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	170	A
Surge current capability	I^2t			145	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	71	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
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
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	V
Creepage distance				>12,7	mm
Clearance				11,89	mm
Comparative Tracking Index	CTI			≥ 200	

*100 % tested in production

Vincotech

Characteristic Values

Parameter	Symbol	Conditions					Values			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	
Buck Diode										
Static										
Forward voltage	V_F				30	25 125 150		1,48 1,4 1,37	1,92(1)	V
Reverse leakage current	I_R	V_r = 650 V				25			1,6	μA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,92		K/W

Characteristic Values

Parameter	Symbol	Conditions					Values			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	
Boost Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0003	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		30	25 125 150		1,67 1,8 1,84	2,22(1)	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	μA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		2100		pF
Reverse transfer capacitance	C_{res}							7,7		pF
Gate charge	Q_g	V_{CC} = 520 V	15		30	25		70		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,57		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	-5/15	350	30	25 125 150		50,4 50,6 49,8		ns
Rise time	t_r					25 125 150		11 12,6 13,4		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		91,6 102,8 107,6		ns
Fall time	t_f					25 125 150		7 11,17 11,94		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,65 μC Q_{rFWD}=3,28 μC Q_{rFWD}=3,98 μC				25 125 150		0,811 0,949 1,01		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,085 0,207 0,242		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			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	
Boost Diode										
Static										
Forward voltage	V_F				35	25 150		2,37 2,35	2,62(1) 2,62(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25 150		 2700	60 5500	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,34		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=3209 A/µs d*i*/d*t*=2031 A/µs d*i*/d*t*=2003 A/µs	-5/15	350	30	25 125 150		21,61 34,06 38,62		A
Reverse recovery time	t_{rr}					25 125 150		173,59 251,86 271,81		ns
Recovered charge	Q_r					25 125 150		1,65 3,28 3,98		µC
Reverse recovered energy	E_{rec}					25 125 150		0,303 0,724 0,899		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		423,07 743,05 879,72		A/µs

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
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R_{25}	$\Delta_{R/R}$	R_{25} = 22 kΩ				25	-5		5	%
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-12		14	%
Power dissipation	P							200		mW
Power dissipation constant	d					25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3 %						3950		K
B-value	$B_{(25/100)}$	Tol. ±3 %						3998		K
Vincotech Thermistor Reference									B	

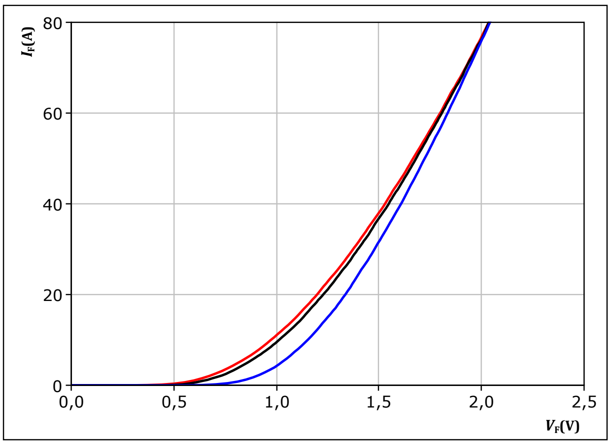
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

Buck Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

I_F = f(V_F)



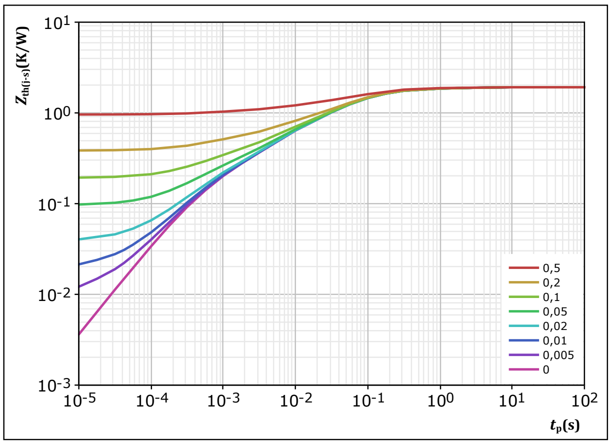
t_p = 250 µs

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

$R_{th(j-s)}$ = 1,918 K/W

FWD thermal model values

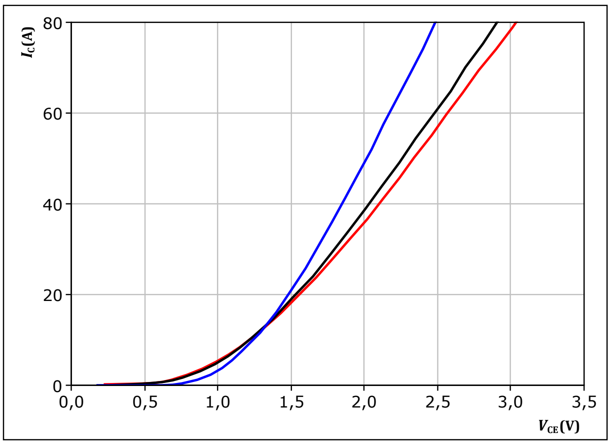
R (K/W)	τ (s)
9,41E-02	2,25E+00
3,44E-01	2,12E-01
8,56E-01	5,84E-02
3,61E-01	9,83E-03
1,37E-01	2,89E-03
1,27E-01	4,79E-04

Boost Switch Characteristics

figure 3.	IGBT

Typical output characteristics

I_C = f(V_{CE})

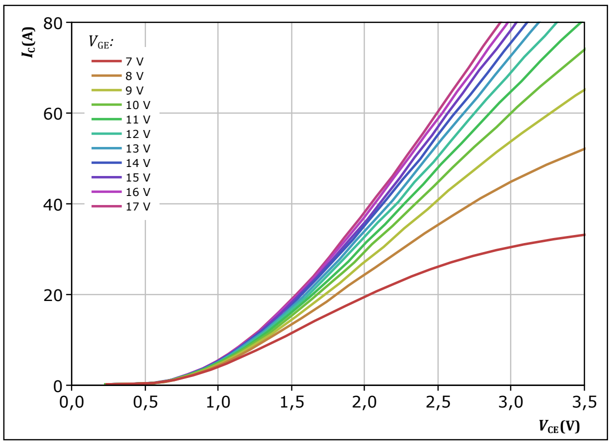


t_p =	250	µs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 4.	IGBT

Typical output characteristics

I_C = f(V_{CE})



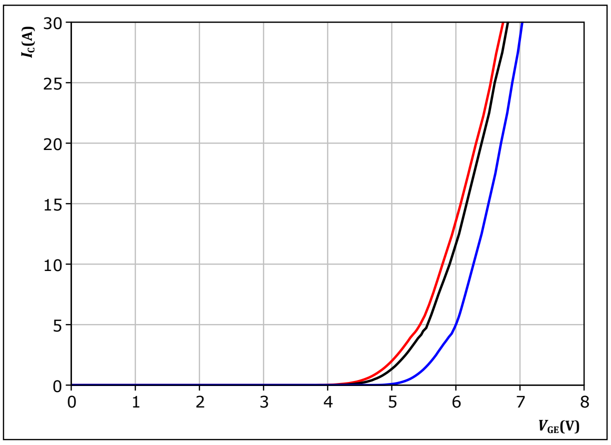
t_p =	250	µs
T_j =	150	°C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 5.	IGBT

Typical transfer characteristics

I_C = f(V_{GE})

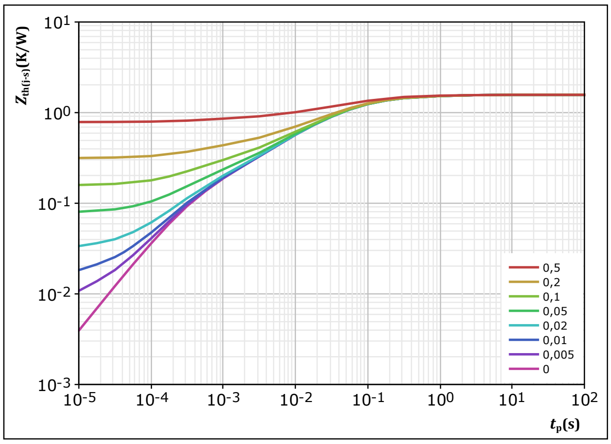


t_p =	250	µs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 6.	IGBT

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,572	K/W

IGBT thermal model values

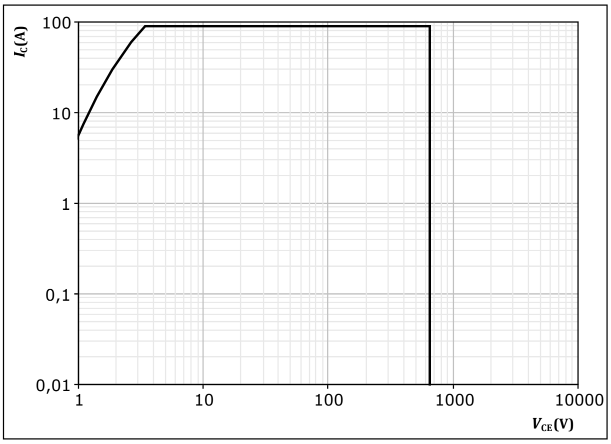
R (K/W)	τ (s)
7,66E-02	1,73E+00
2,00E-01	2,58E-01
6,54E-01	5,93E-02
3,77E-01	1,31E-02
1,51E-01	2,99E-03
1,13E-01	3,69E-04

Boost Switch Characteristics

figure 7. **IGBT**

Safe operating area

I_C = f(V_{CE})



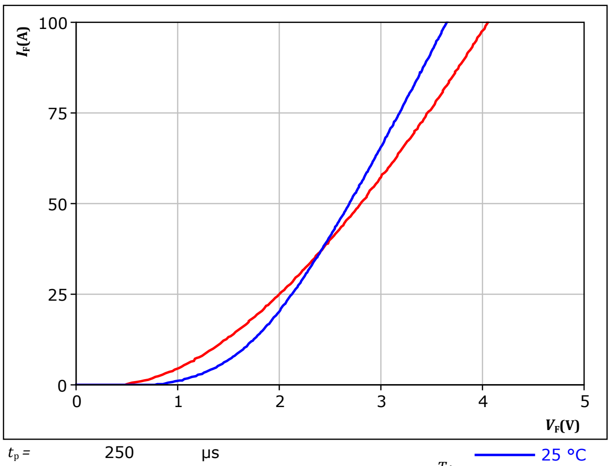
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Boost Diode Characteristics

figure 8. **FWD**

Typical forward characteristics

I_F = f(V_F)



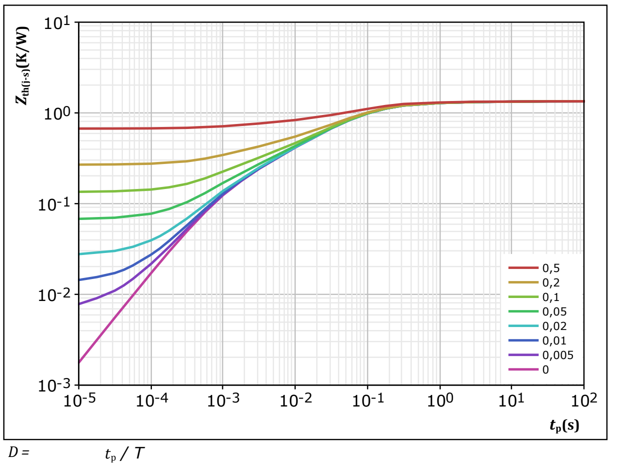
t_p = 250 µs

T_j: 25 °C, 150 °C

figure 9. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j\text{-}s)}$ = 1,342 K/W

FWD thermal model values

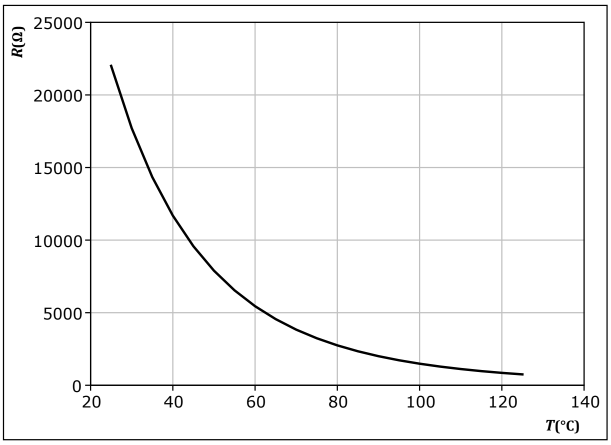
R (K/W)	τ (s)
3,06E-02	9,16E+00
1,47E-01	6,10E-01
6,10E-01	8,89E-02
2,96E-01	2,14E-02
1,39E-01	5,05E-03
1,19E-01	9,19E-04

Thermistor Characteristics

figure 10. **Thermistor**

Typical NTC characteristic as function of temperature

R_T = f(T)

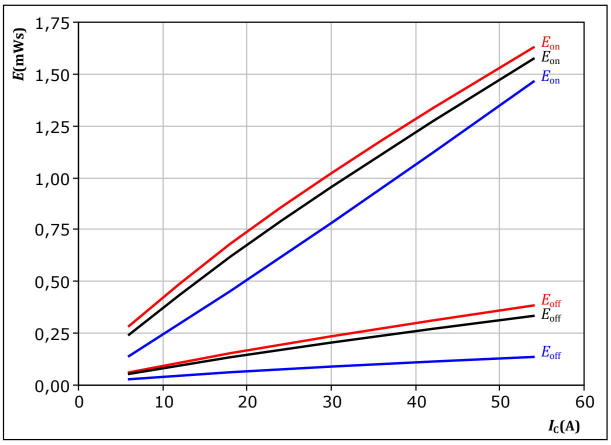


Boost Switching Characteristics

figure 11. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



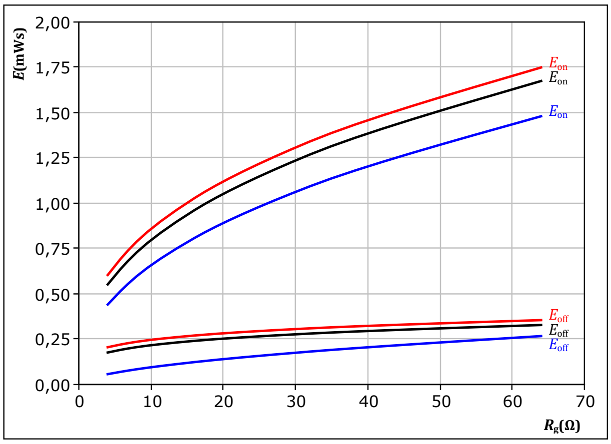
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
R_{gon} =	16	Ω		150 °C
R_{goff} =	16	Ω		

figure 12. **IGBT**

Typical switching energy losses as a function of IGBT turn on gate resistor

$E = f(R_g)$



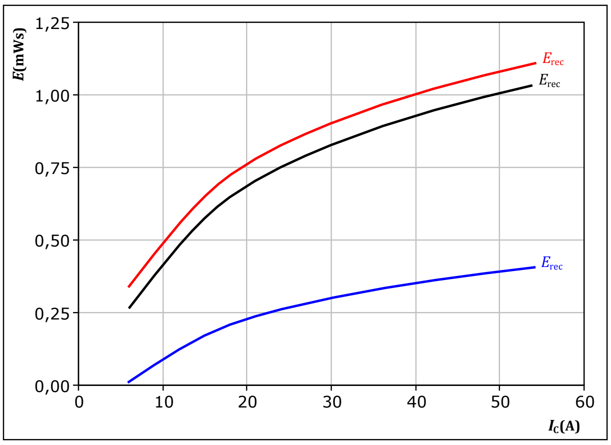
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
I_C =	30	A		150 °C

figure 13. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



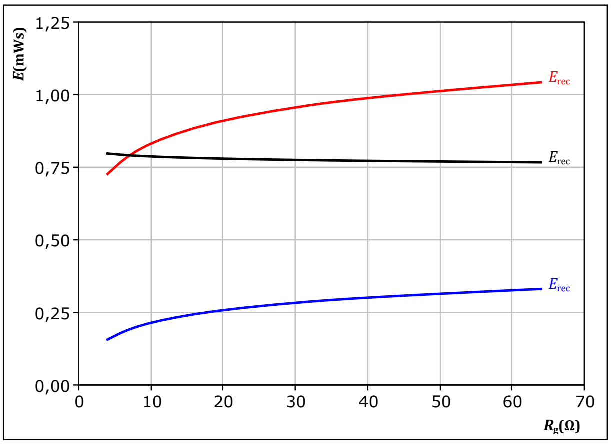
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 14. **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

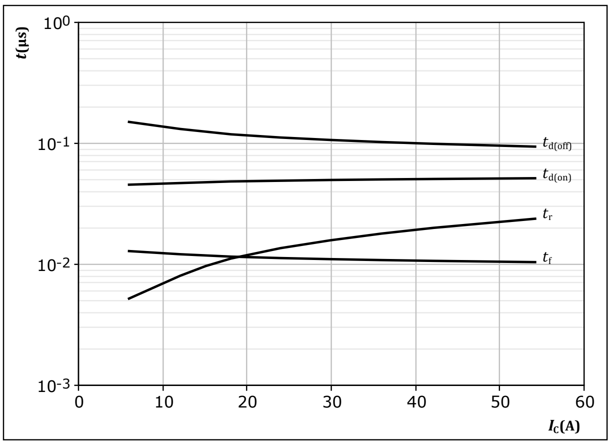
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
I_C =	30	A		150 °C

Boost Switching Characteristics

figure 15. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



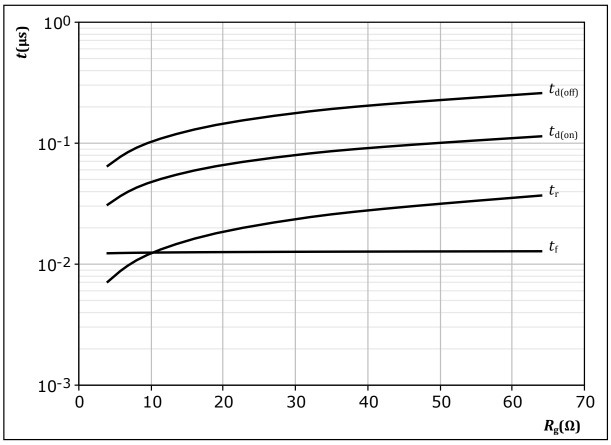
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5/15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 16. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

t = f(R_g)



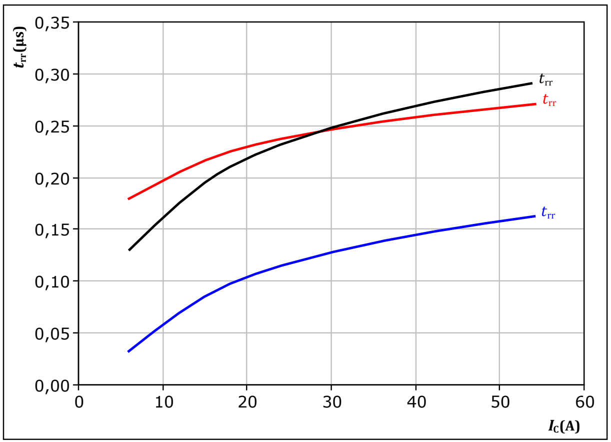
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5/15	V
I_C =	30	A

figure 17. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

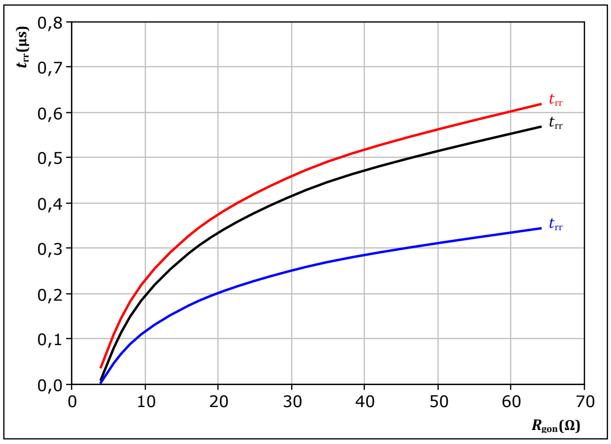
V_{CE} =	350	V
V_{GE} =	-5/15	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 18. **FWD**

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

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



With an inductive load at

V_{CE} =	350	V
V_{GE} =	-5/15	V
I_C =	30	A

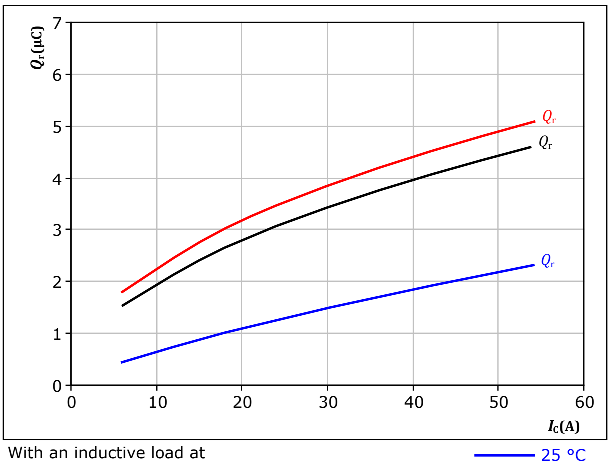
T_j: 25 °C, 125 °C, 150 °C

Boost Switching Characteristics

figure 19. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



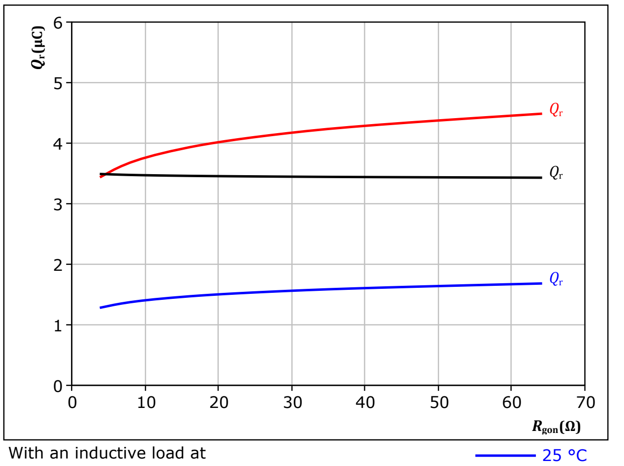
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 20. FWD

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

Q_r = f(R_{gon})



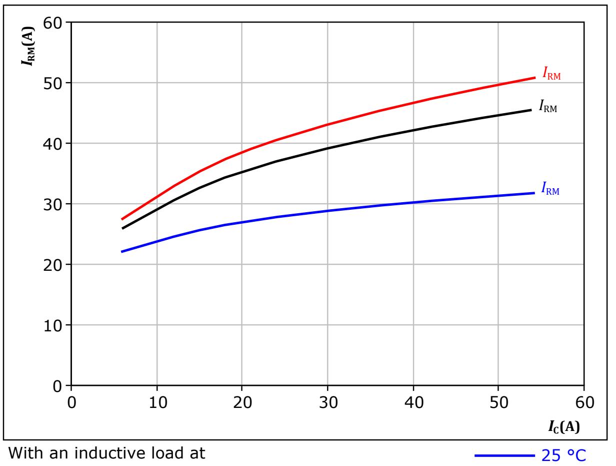
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
I_C =	30	A		150 °C

figure 21. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



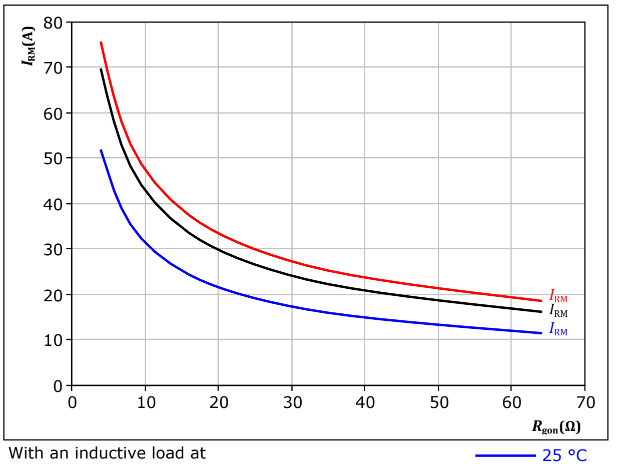
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 22. FWD

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

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



With an inductive load at

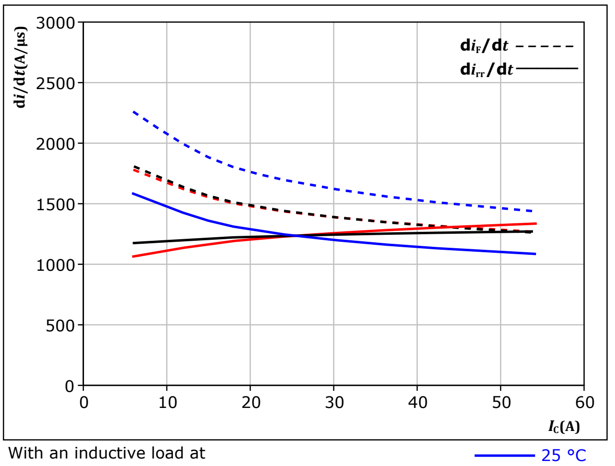
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
I_C =	30	A		150 °C

Boost Switching Characteristics

figure 23. **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)



With an inductive load at

V_{CE} = 350 V

V_{GE} = -5/15 V

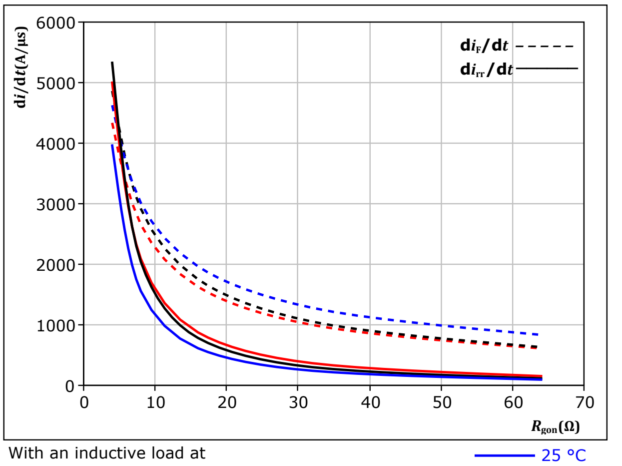
R_{gon} = 16 Ω

T_j: 25 °C, 125 °C, 150 °C

figure 24. **FWD**

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

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



With an inductive load at

V_{CE} = 350 V

V_{GE} = -5/15 V

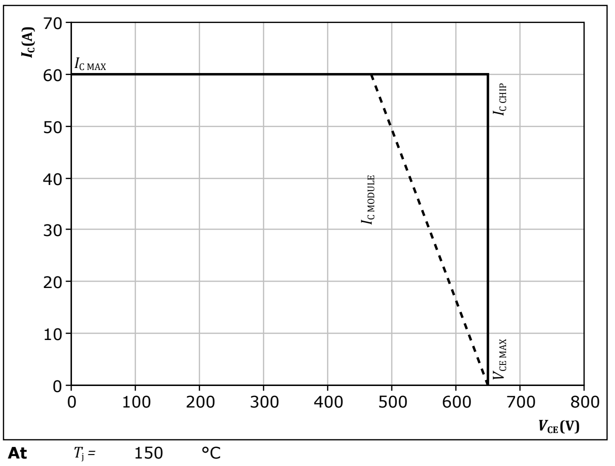
I_C = 30 A

T_j: 25 °C, 125 °C, 150 °C

figure 25. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At T_j = 150 °C

R_{gon} = 16 Ω

R_{goff} = 16 Ω

Boost Switching Definitions

figure 26.	IGBT

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

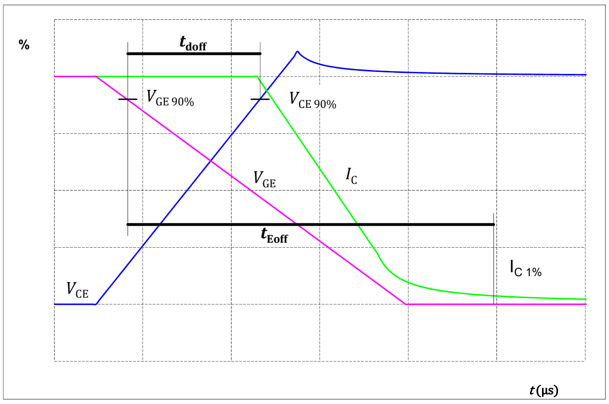


figure 27.	IGBT

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

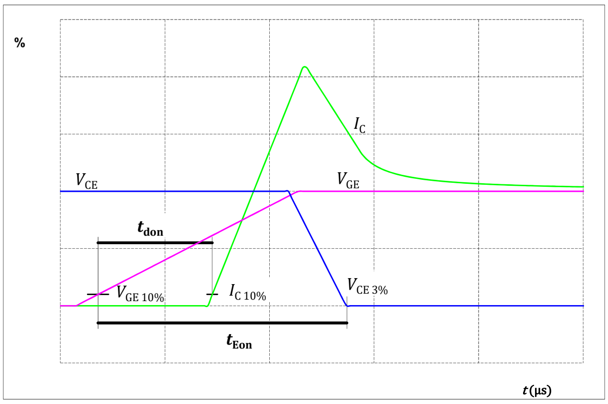


figure 28.	IGBT

Turn-off Switching Waveforms & definition of t_f

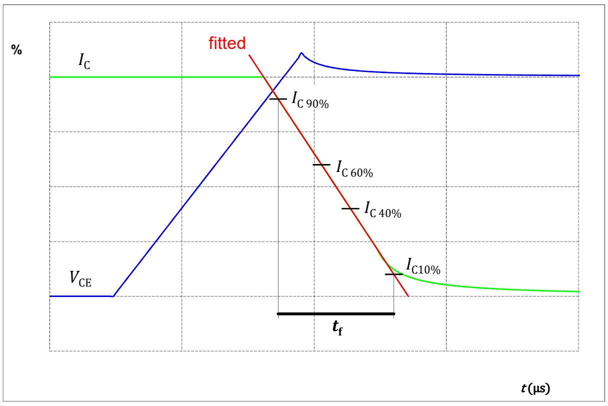
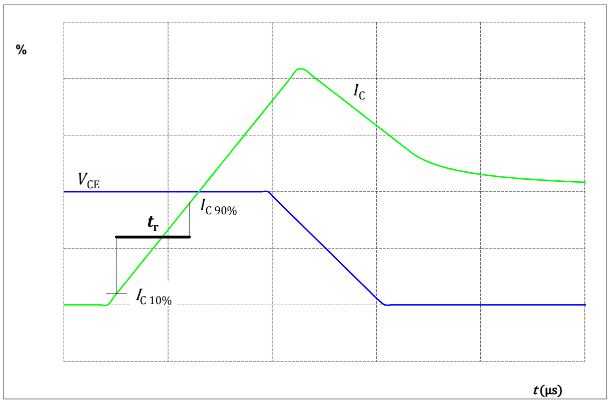


figure 29.	IGBT

Turn-on Switching Waveforms & definition of t_r



Boost Switching Definitions

figure 30.	FWD

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

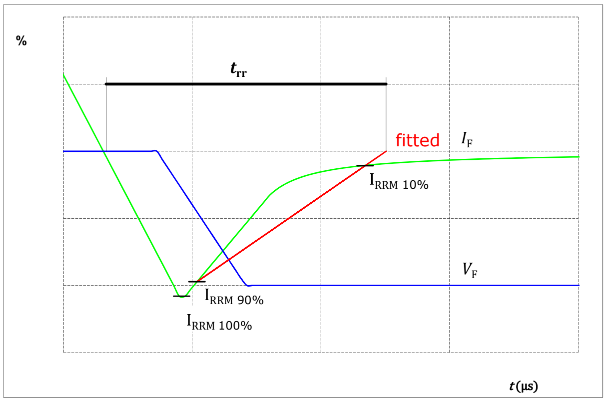
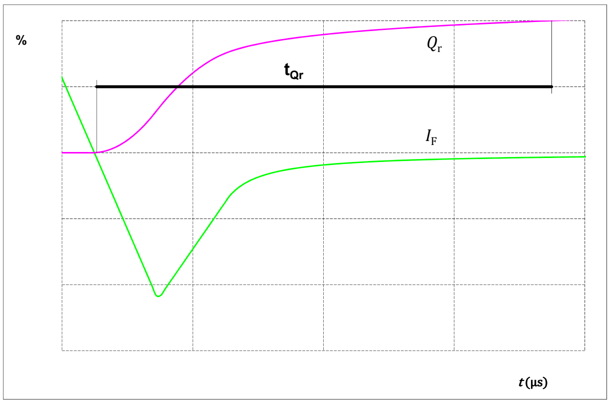


figure 31.	FWD

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



10-TY12NMB030SM01-L394L18

datasheet

Vincotech

Ordering Code

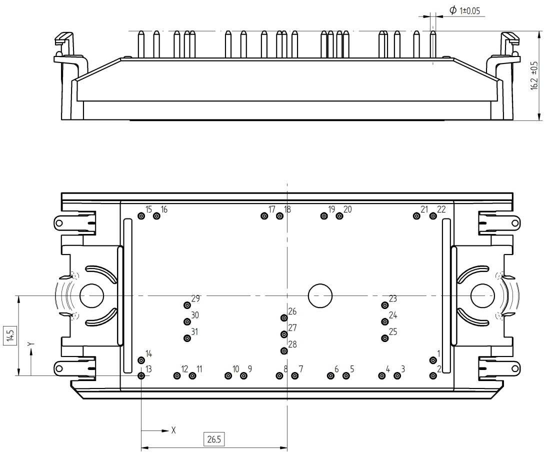
Version	Ordering Code
Without thermal paste	10-TY12NMB030SM01-L394L18
With thermal paste (5,2 W/mK, PTM6000HV)	10-TY12NMB030SM01-L394L18-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-TY12NMB030SM01-L394L18-/3/

Marking

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

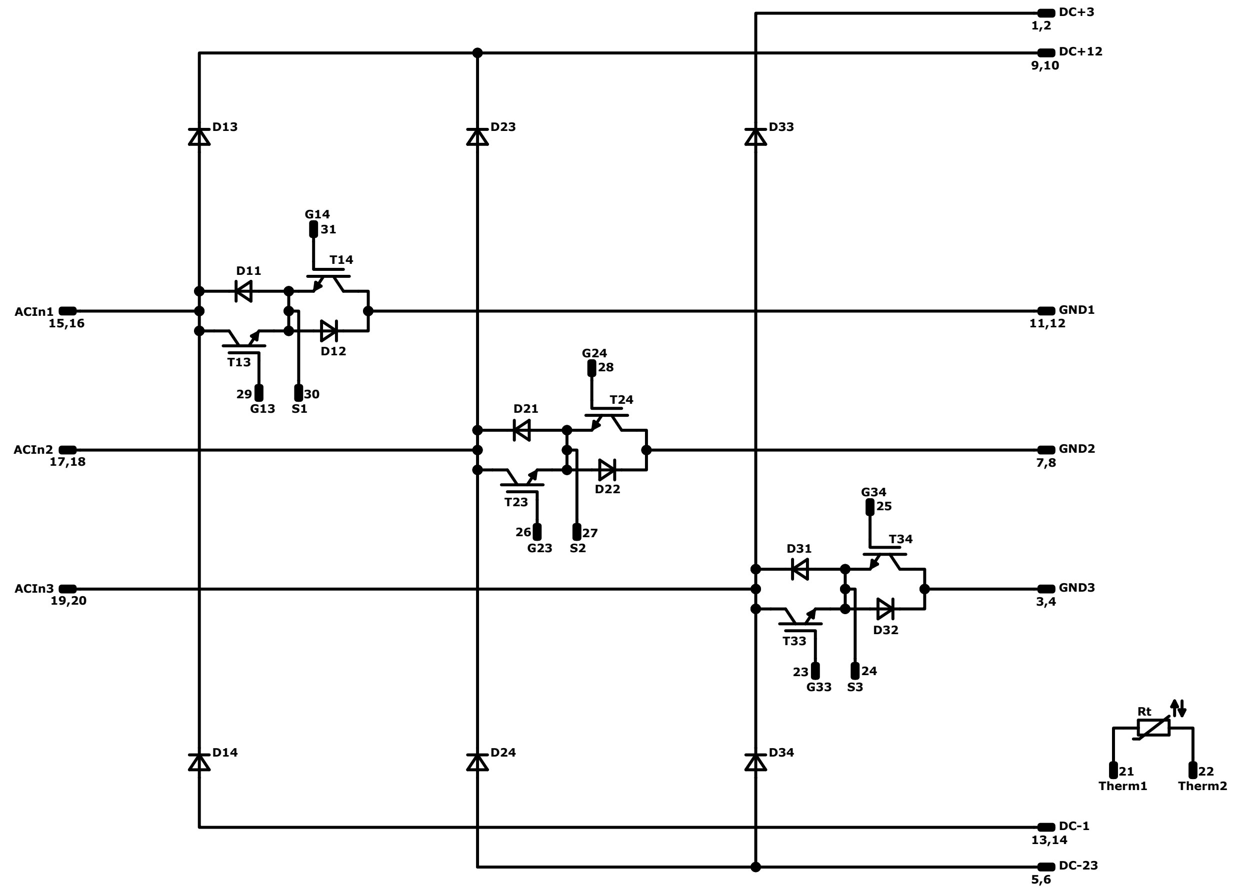
Outline

Pin table [mm]			
Pin	X	Y	Function
1	53	2,8	DC+3
2	53	0	DC+3
3	46,5	0	GND3
4	43,7	0	GND3
5	37,2	0	DC-23
6	34,4	0	DC-23
7	27,9	0	GND2
8	25,1	0	GND2
9	18,6	0	DC+12
10	15,8	0	DC+12
11	9,3	0	GND1
12	6,5	0	GND1
13	0	0	DC-1
14	0	2,8	DC-1
15	0	29	ACIn1
16	2,8	29	ACIn1
17	22,35	29	ACIn2
18	25,15	29	ACIn2
19	33,2	29	ACIn3
20	36	29	ACIn3
21	50	29	Therm1
22	53	29	Therm2
23	44,25	12,8	G33
24	44,25	9,8	S3
25	44,25	6,8	G34
26	25,95	10,5	G23
27	25,95	7,5	S2
28	25,95	4,5	G24
29	8,35	12,8	G13
30	8,35	9,8	S1
31	8,35	6,8	G14



Tolerance of pinpositions ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
D11, D12, D21, D22, D31, D32	FWD	650 V	30 A	Buck Diode	
T13, T14, T23, T24, T33, T34	IGBT	650 V	30 A	Boost Switch	
D13, D14, D23, D24, D33, D34	FWD	1200 V	35 A	Boost Diode	
Rt	NTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 packages see vincotech.com website.

Vincotech thermistor reference
See Vincotech thermistor reference table at 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
10-TY12NMB030SM01-L394L18-D2-14	28 Oct. 2022	Rename pin functions. Correct Pintable and Schematic accordingly.	