10-TY12NMB030SM-L394L08
10-PY12NMB030SM-L394L08Y
datasheet

flow 3xNPFC 1 | **1200 V / 30 A**

Features

- Very high switching Speed
- Very compact module
- 3 phases in one housing

flow 1 12 mm housing

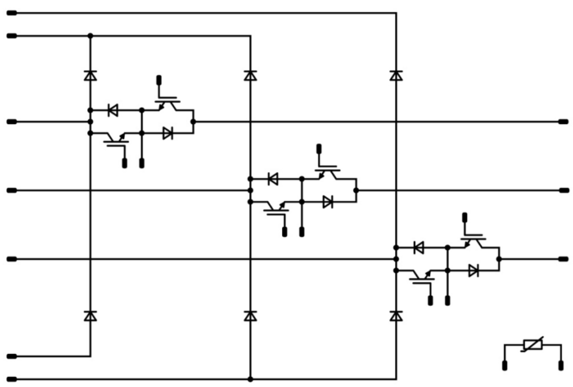

Solder


Press-fit

Target applications

- Industrial Drives
- Power Supply
- UPS

Schematic



Types

- 10-TY12NMB030SM-L394L08
- 10-PY12NMB030SM-L394L08Y

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	29	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

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80°C	28	A
Repetitive peak forward current	I_{FRM}			92	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80°C	61	W
Maximum Junction Temperature	T_{jmax}			175	°C
Buck Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80°C	36	A
Repetitive peak forward current	I_{FRM}			60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80°C	50	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				min. 12,7	mm
Clearance		Solder pin		11,89	mm
Clearance		Press-fit pin		min. 12,7	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	
Boost Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0003	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		30	25 125		1,69 1,92	2,22	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=1MHz	0	25		25		2100		pF
Reverse transfer capacitance	C_{res}							7,7		
Gate charge	Q_g		15	520	30	25		70		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,57		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	15/0	350	30	25 125 150		17 18 18		ns
Rise time	t_r					25 125 150		7 9 9		
Turn-off delay time	$t_{d(off)}$					25 125 150		90 104 107		
Fall time	t_f					25 125 150		8 10 11		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,3 μC Q_{rFWD} = 0,3 μC Q_{rFWD} = 0,3 μC				25 125 150		0,416 0,407 0,419		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,140 0,210 0,240		

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]	Value Min	Value Typ	Value Max	Unit
Boost Diode										
Static										
Forward voltage	V_F				20	25 150		1,18 1,32	1,6	V
Reverse leakage current	I_r			1200		25			400	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,56		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 3525 A/µs di/dt = 3125 A/µs di/dt = 3075 A/µs	15/0	350	30	25 125 150		20 18 17		A
Reverse recovery time	t_{rr}					25 125 150		18 19 19		ns
Recovered charge	Q_r					25 125 150		0,254 0,270 0,266		µC
Reverse recovered energy	E_{rec}					25 125 150		0,026 0,033 0,033		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		2663 1607 1656		A/µs
Buck Diode										
Static										
Forward voltage	V_F				30	25 125 150		1,43 1,34 1,31	1,7	V
Reverse leakage current	I_r			650		25			1,6	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,92		K/W

Characteristic Values

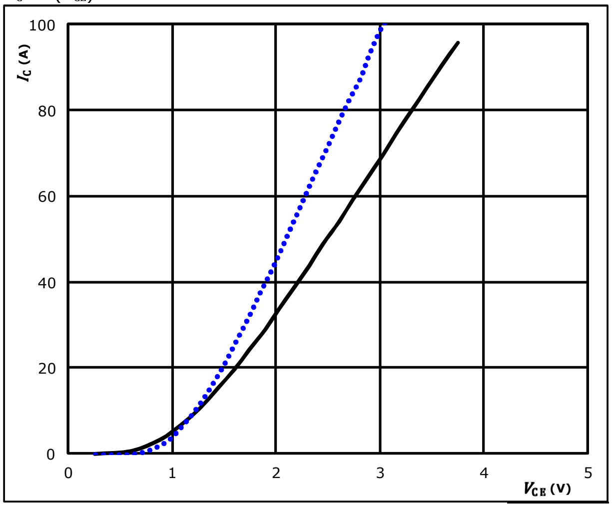
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-12		+14	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference									B	

Boost Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

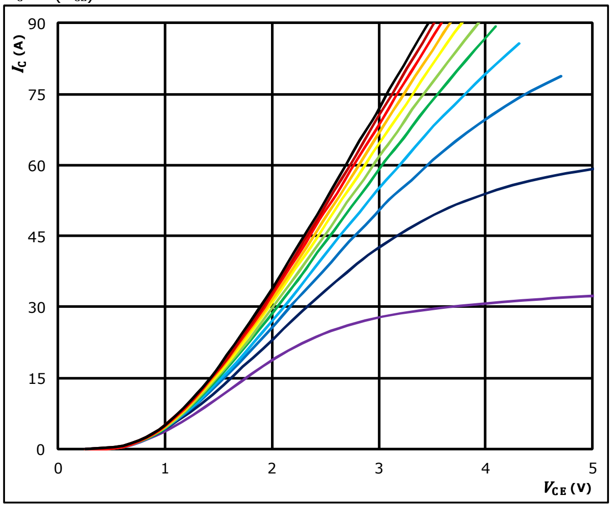


t_p =	250	μs		25 °C	dotted
V_{GE} =	15	V	T_j:	125 °C	solid

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

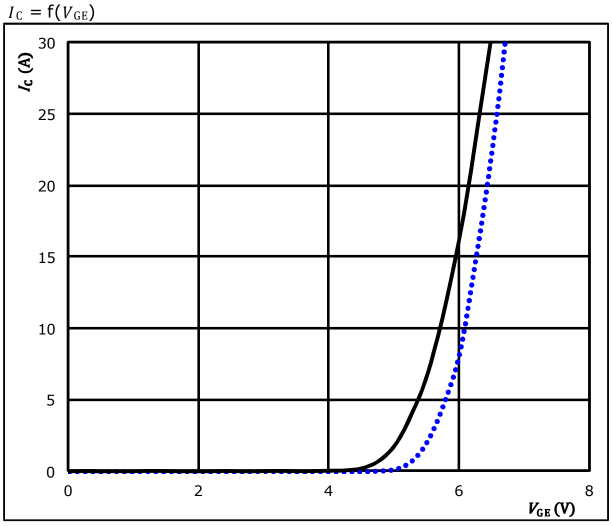


t_p = 250 μs
T_j = 125 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

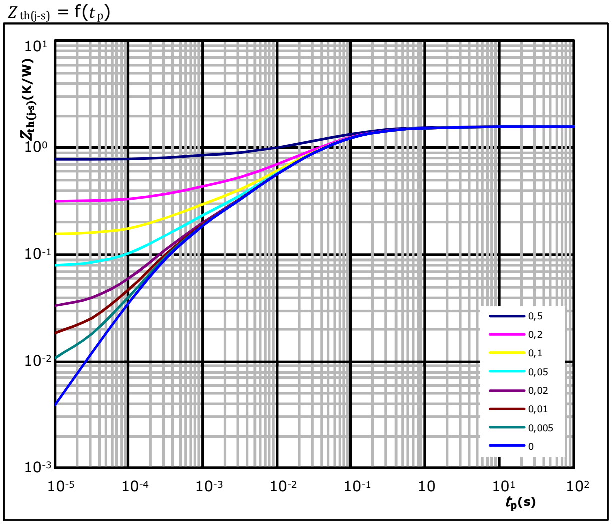


t_p =	100	μs		25 °C	dotted
V_{CE} =	10	V	T_j:	125 °C	solid

figure 4.

Transient Thermal Impedance as function of Pulse duration **IGBT**

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



D = t_p / T
$R_{th(j-s)}$ = 1,57 K/W

IGBT thermal model values

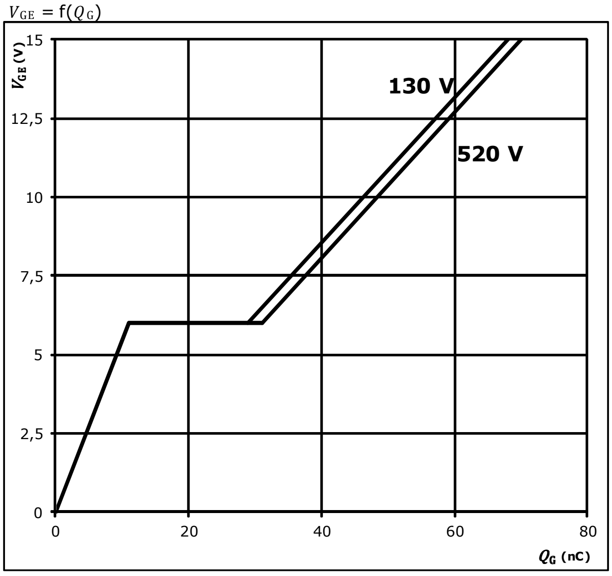
R (K/W)	τ (s)
7,66E-02	1,73E+00
2,00E-01	2,58E-01
6,54E-01	5,93E-02
3,77E-01	1,31E-02
1,51E-01	2,99E-03
1,13E-01	3,69E-04

Boost Switch Characteristics

figure 5. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



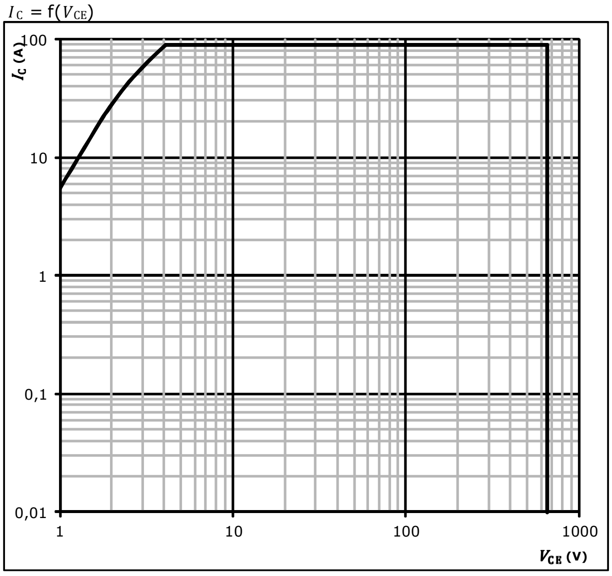
At

I_C =	30	A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



At

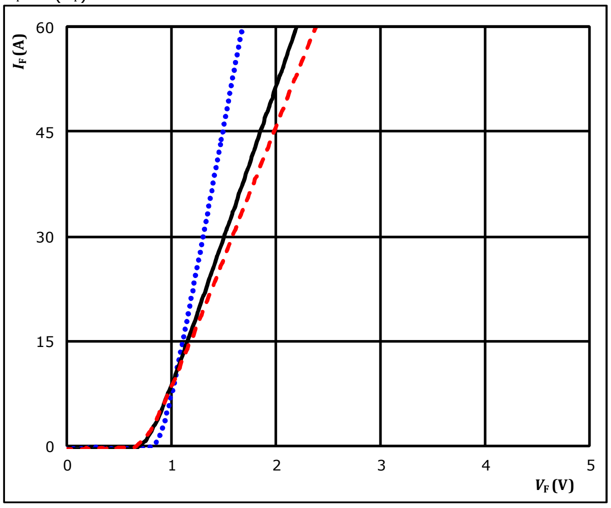
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Boost Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



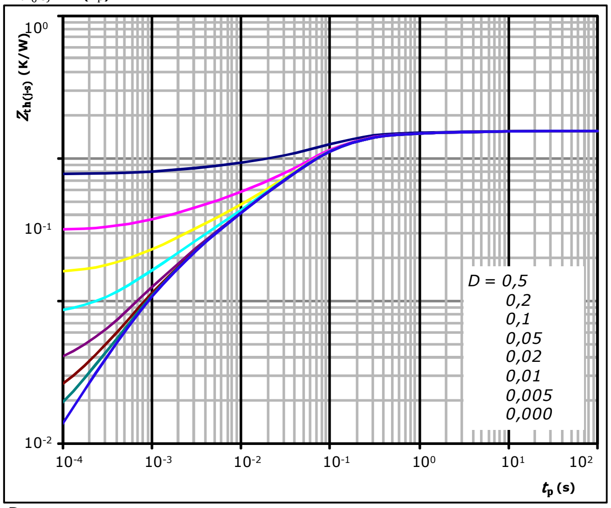
t_p = 250 µs

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

$R_{th(j-s)}$ = 1,56 K/W

FWD thermal model values

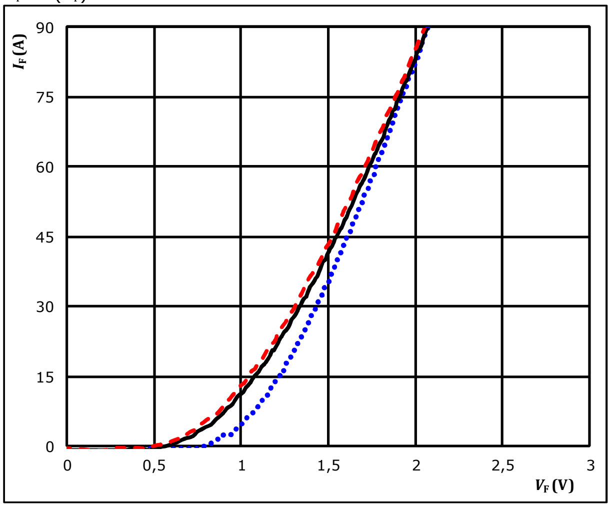
R (K/W)	τ (s)
6,74E-02	2,96E+00
1,50E-01	4,20E-01
8,23E-01	8,31E-02
2,55E-01	2,65E-02
1,66E-01	5,49E-03
9,79E-02	1,07E-03

Buck Diode Characteristics

figure 1.	FWD

Typical forward characteristics

$I_F = f(V_F)$

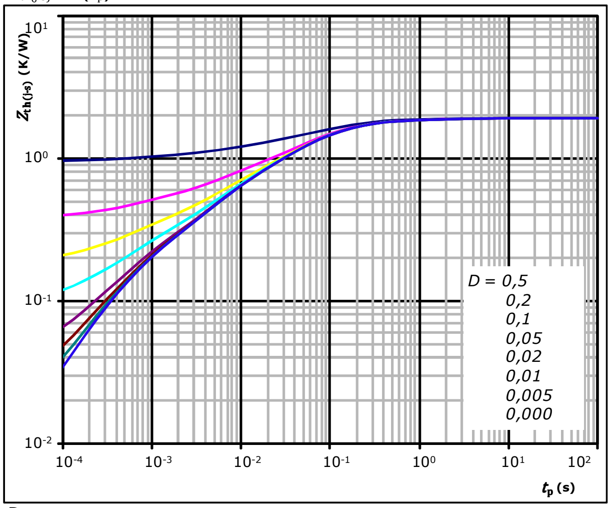


t_p =	250	μs	25 °C	············
		T_j:	125 °C	———
			150 °C	– – – –

figure 2.	FWD

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,92 K/W

FWD thermal model values

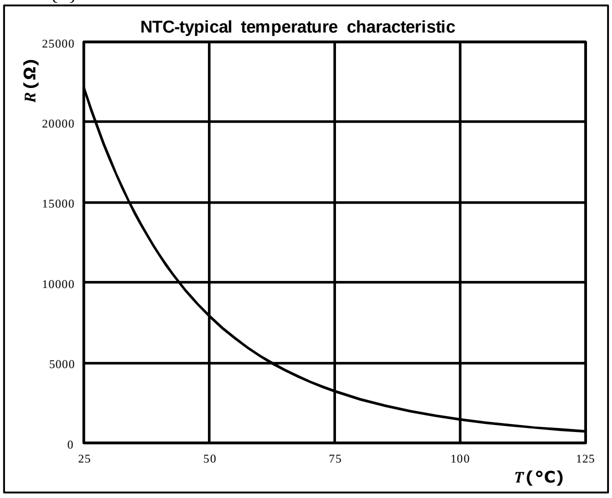
R (K/W)	τ (s)
9,41E-02	2,25E+00
3,44E-01	2,12E-01
8,56E-01	5,84E-02
3,61E-01	9,83E-03
1,37E-01	2,89E-03
1,27E-01	4,79E-04

Thermistor Characteristics

figure 1.	Thermistor

Typical NTC characteristic as a function of temperature

$R = \mathrm{f}(T)$

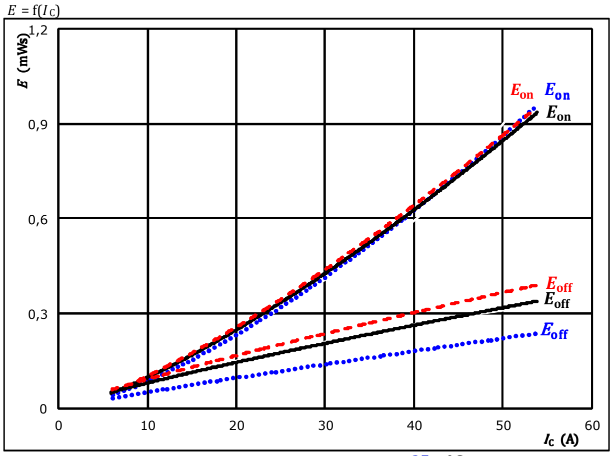


Boost Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



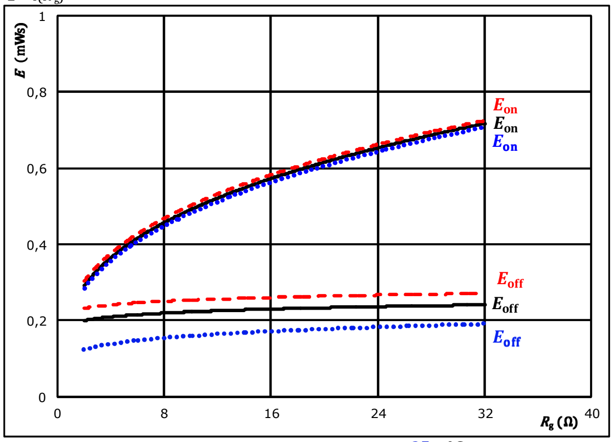
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
R_{gon} =	8	Ω		150 °C	dashed
R_{goff} =	8	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



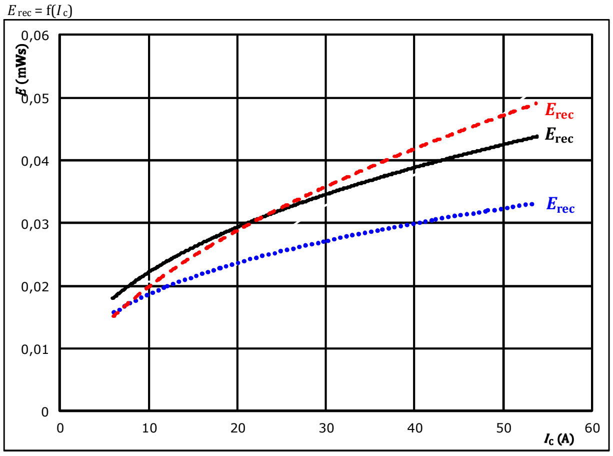
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
I_C =	30	A		150 °C	dashed

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



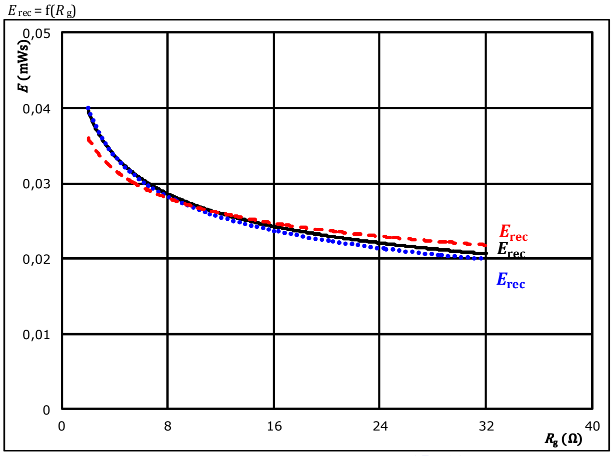
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
R_{gon} =	8	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

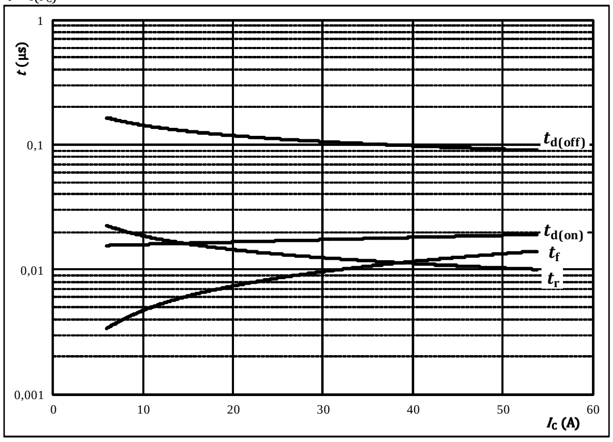
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	15/0	V		125 °C	solid
I_C =	30	A		150 °C	dashed

Boost Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



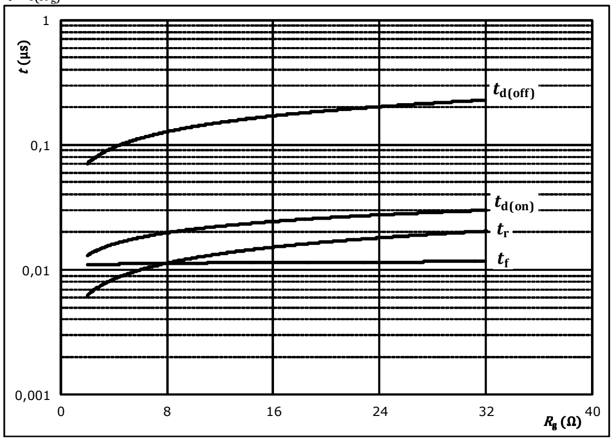
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	15/0	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$t = f(R_g)$



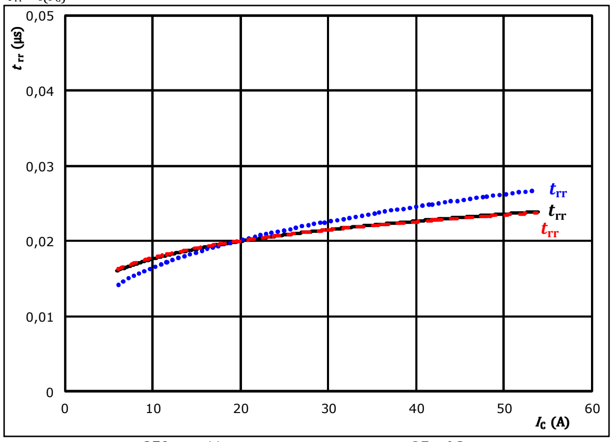
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	15/0	V
I_C =	30	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

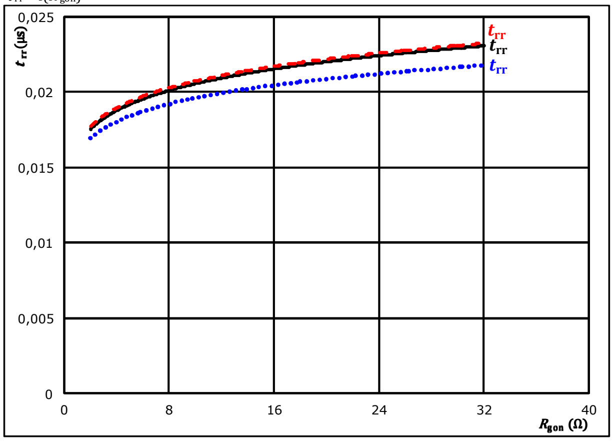


At					
V_{CE} =	350	V		25 °C	············
V_{GE} =	15/0	V	T_j:	125 °C	———
R_{gon} =	8	Ω		150 °C	– – –

figure 8. FWD

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

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



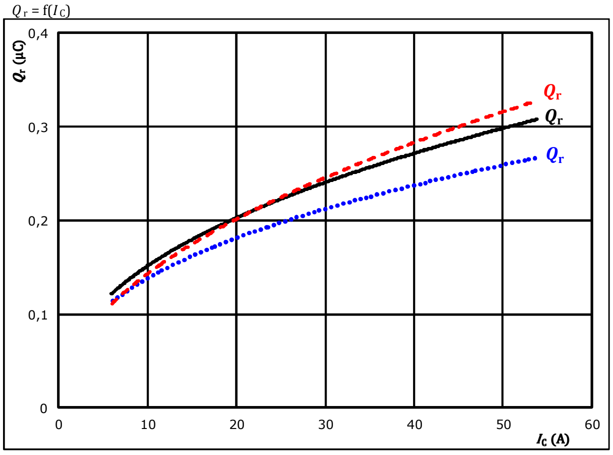
At					
V_{CE} =	350	V		25 °C	············
V_{GE} =	15/0	V	T_j:	125 °C	———
I_C =	30	A		150 °C	– – –

Boost Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

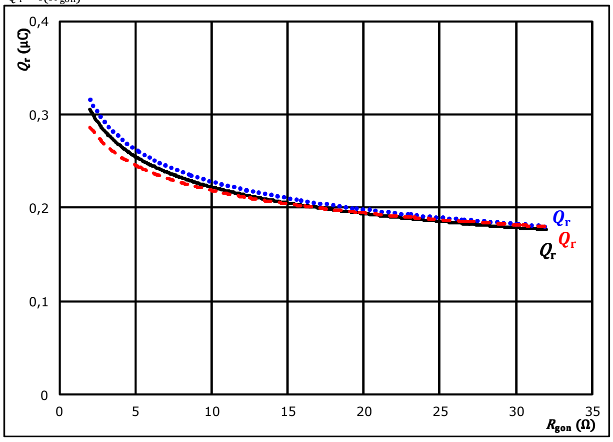


At					
V_{CE} =	350	V		25	°C ············
V_{GE} =	15/0	V	T_j:	125	°C ———
R_{gon} =	8	Ω		150	°C – – –

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

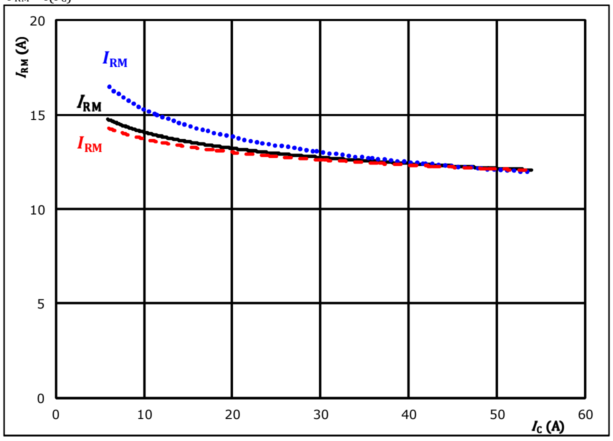


At					
V_{CE}=	350	V		25	°C ············
V_{GE} =	15/0	V	T_j:	125	°C ———
I_C=	30	A		150	°C – – –

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

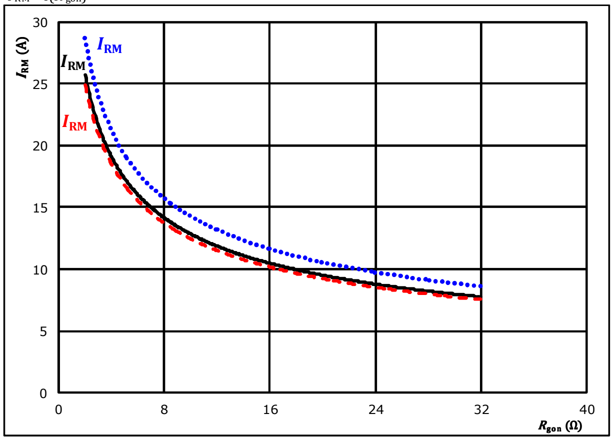


At					
V_{CE}:	350	V		25	°C ············
V_{GE} =	15/0	V	T_j:	125	°C ———
R_{gon} =	8	Ω		150	°C – – –

figure 12. **FWD**

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

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



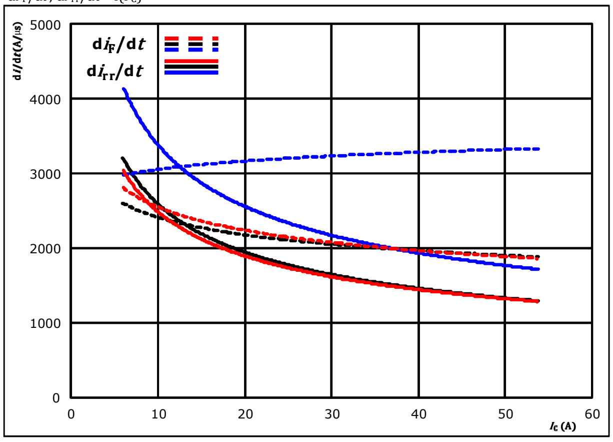
At					
V_{CE} =	350	V		25	°C ············
V_{GE} =	15/0	V	T_j:	125	°C ———
I_C =	30	A		150	°C – – –

Boost 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)

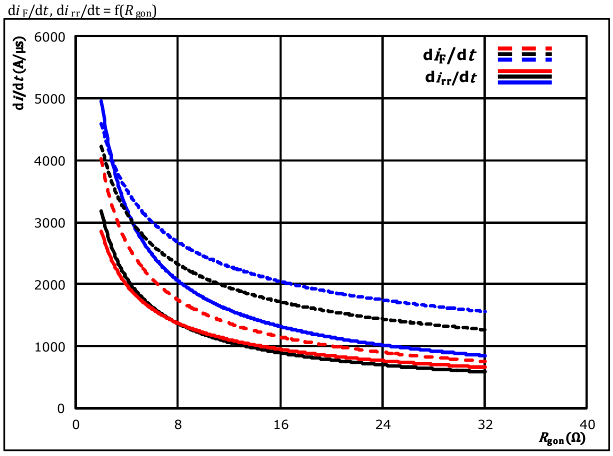


At						
V_{CE} =	350	V	T_j:	25	°C	dotted
V_{GE} =	15/0	V		125	°C	solid
R_{gon} =	8	Ω		150	°C	dashed

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_{gon})

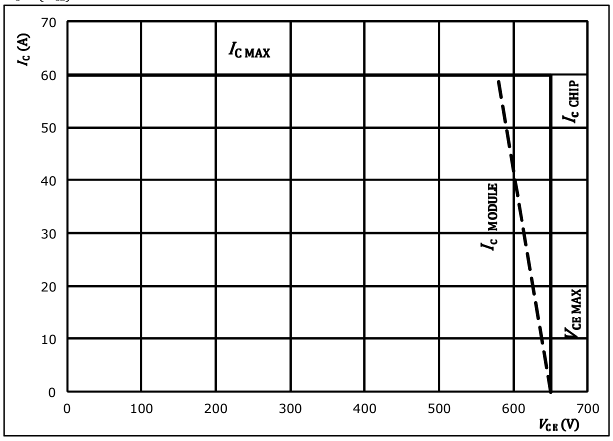


At						
V_{CE} =	350	V	T_j:	25	°C	dotted
V_{GE} =	15/0	V		125	°C	solid
I_C =	30	A		150	°C	dashed

figure 15. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



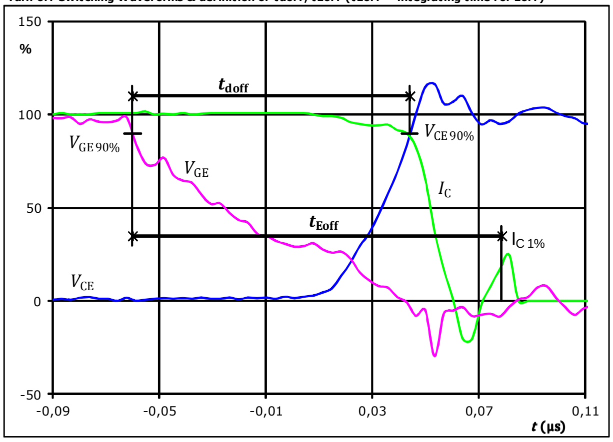
At		
T_j =	175	°C
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Boost Switching Definitions

General conditions		
T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

figure 1. IGBT

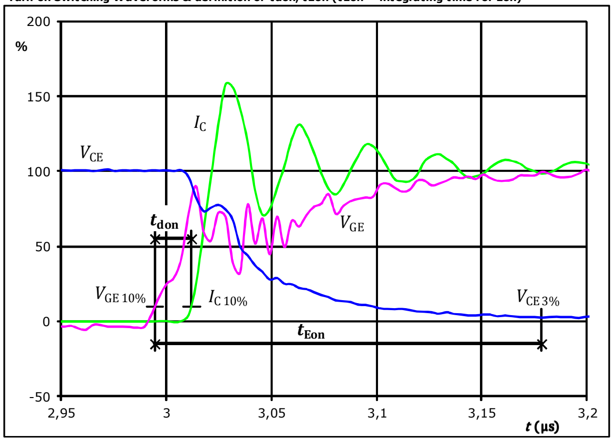
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	30	A
t_{doff} =	0,104	µs
t_{Eoff} =	0,138	µs

figure 2. IGBT

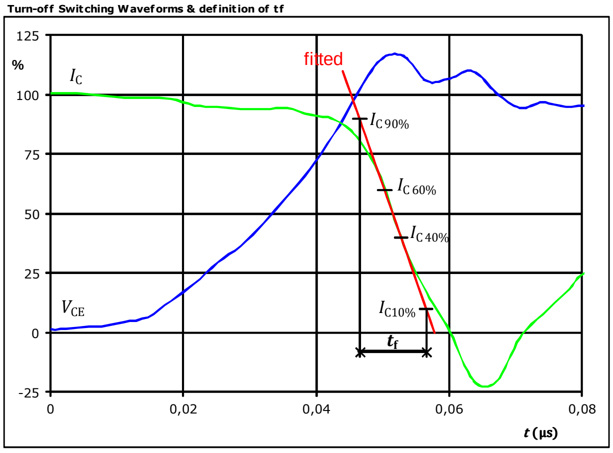
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	30	A
t_{don} =	0,018	µs
t_{Eon} =	0,184	µs

figure 3. IGBT

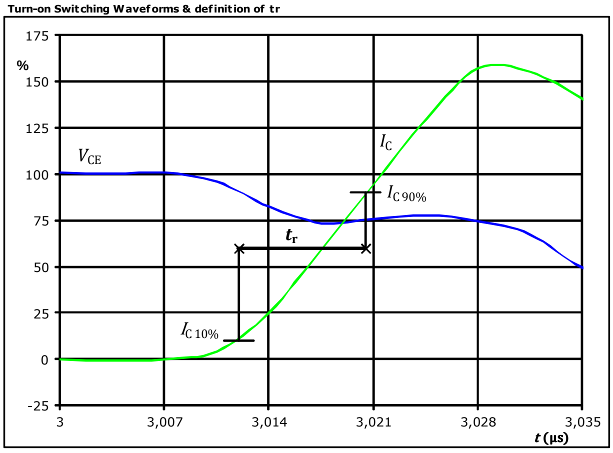
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	30	A
t_f =	0,010	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

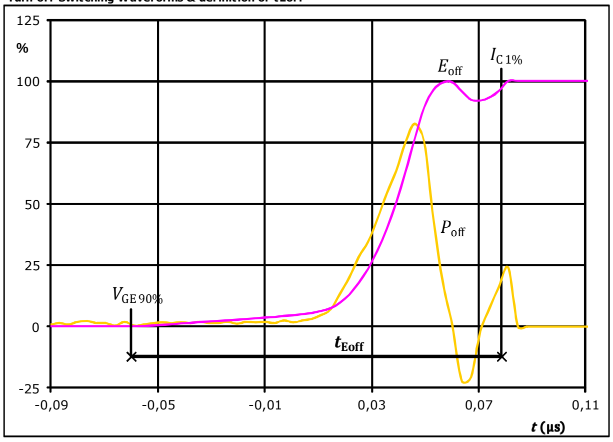


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	30	A
t_r =	0,009	µs

Boost Switching Characteristics

figure 5. **IGBT**

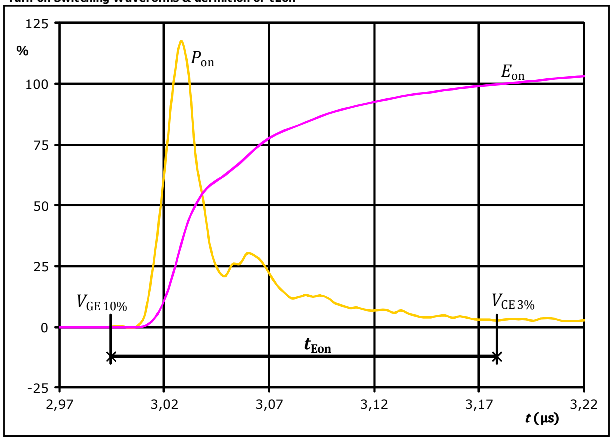
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	10,46	kW
E_{off} (100%) =	0,21	mJ
t_{Eoff} =	0,14	µs

figure 6. **IGBT**

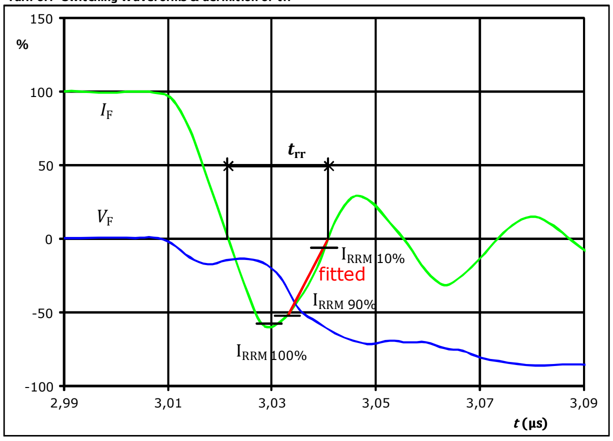
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	10,46	kW
E_{on} (100%) =	0,41	mJ
t_{Eon} =	0,18	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

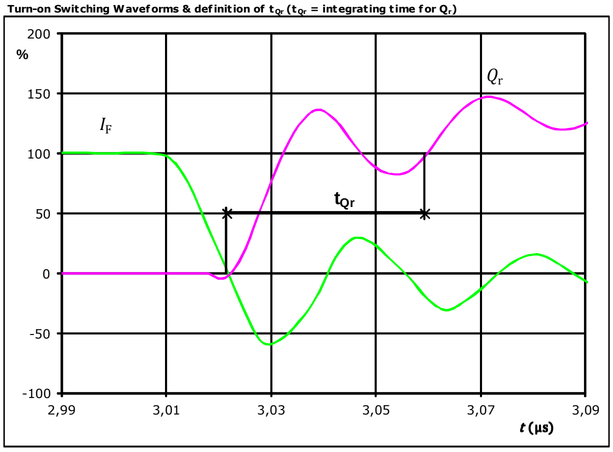


V_F (100%) =	350	V
I_F (100%) =	30	A
I_{RRM} (100%) =	-18	A
t_{rr} =	0,019	µs

Boost Switching Characteristics

figure 8. **FWD**

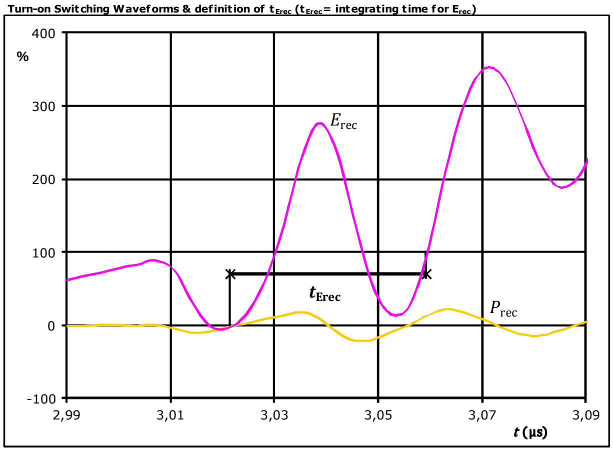
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F(100%) =	30	A
Q_r(100%) =	0,27	µC
t_{Qr} =	0,04	µs

figure 9. **FWD**

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



P_{rec}(100%) =	10,46	kW
E_{rec}(100%) =	0,03	mJ
t_{Erec} =	0,04	µs

10-TY12NMB030SM-L394L08
10-PY12NMB030SM-L394L08Y
datasheet

Vincotech

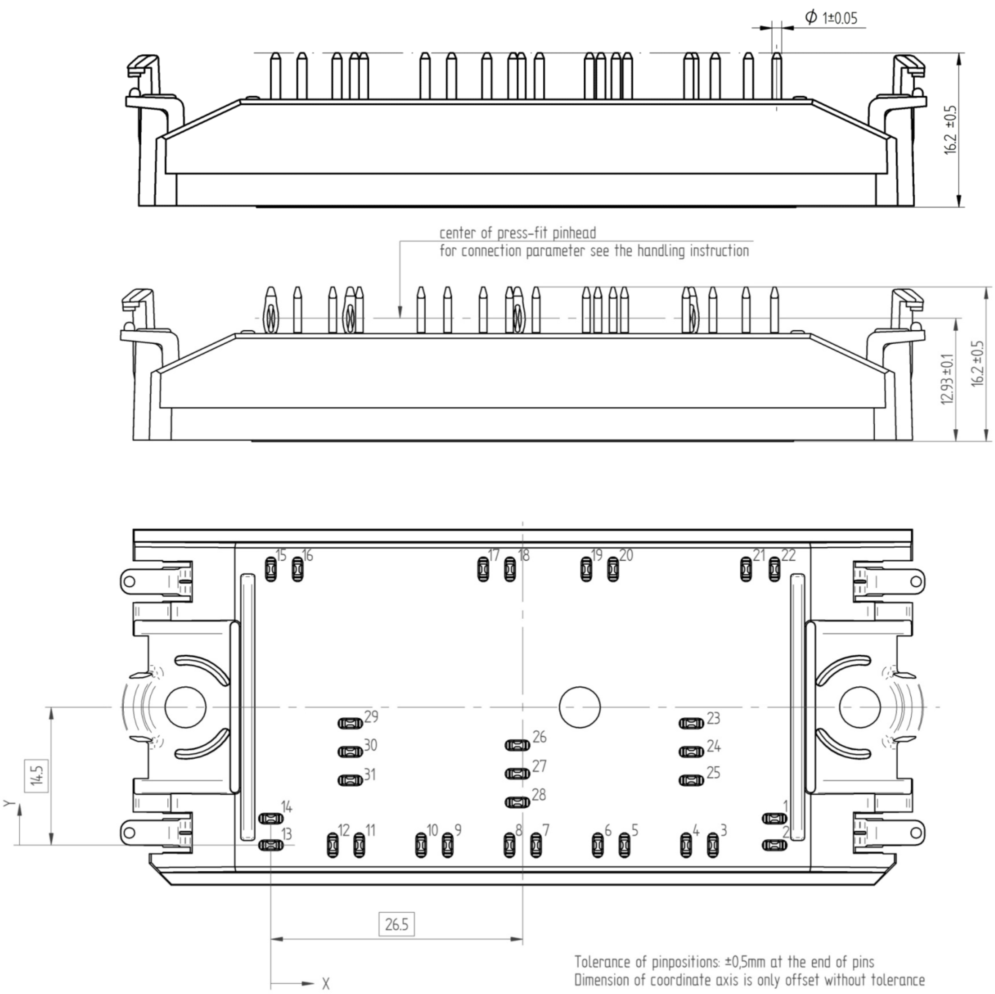
Ordering Code & Marking

Version	Ordering Code
without thermal paste 12 mm housing with solder pins	10-TY12NMB030SM-L394L08
with thermal paste 12 mm housing with solder pins	10-TY12NMB030SM-L394L08-/3/
without thermal paste 12 mm housing with press-fit pins	10-PY12NMB030SM-L394L08Y
with thermal paste 12 mm housing with press-fit pins	10-PY12NMB030SM-L394L08Y-/3/

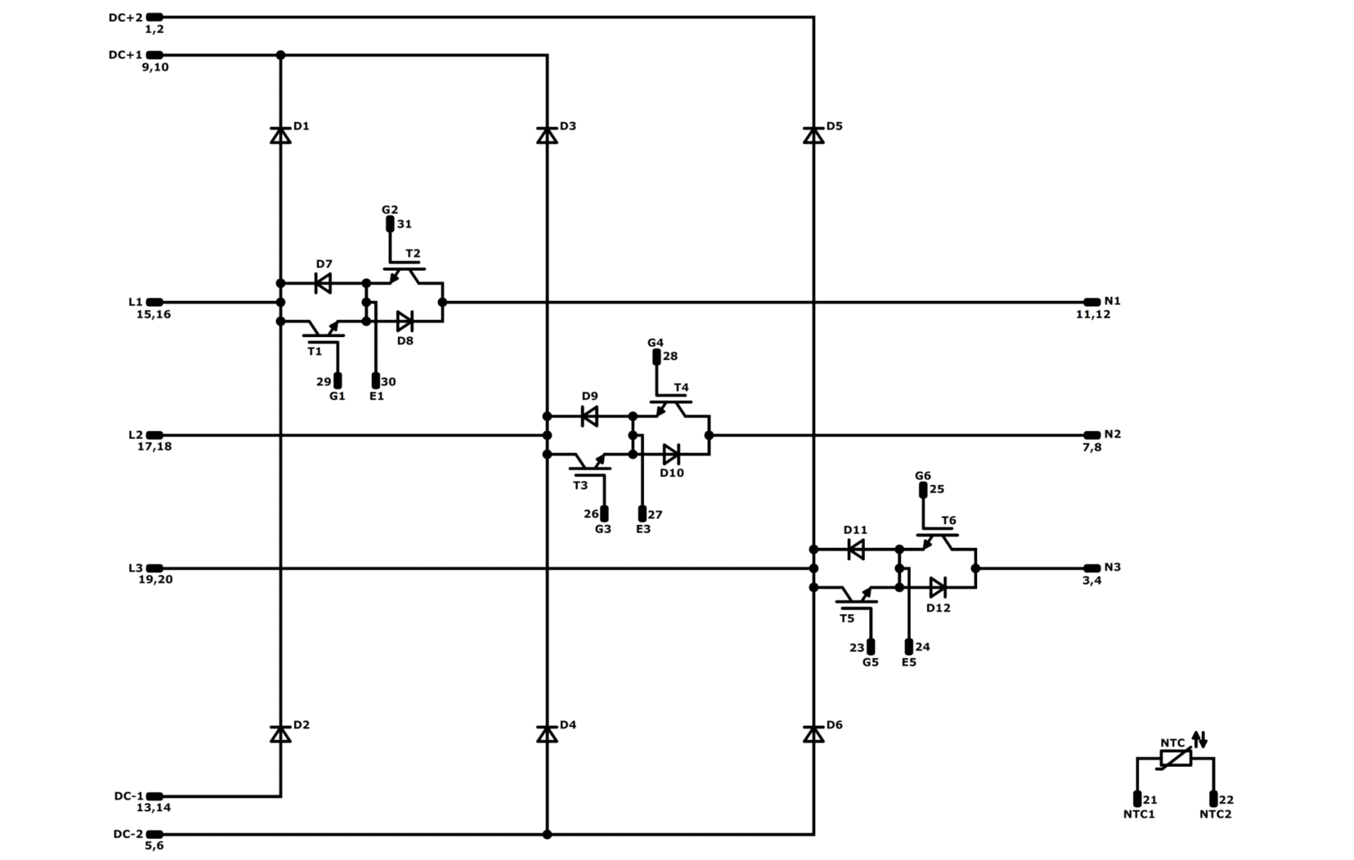
Marking		Name		Date code	UL & VIN	Lot	Serial
NN-NNNNNNNNNNNNNN TTTTTTVV WWYY UL VIN LLLLL SSSS	Text	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
		TTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table			
Pin	X	Y	Function
1	53	2,8	DC+2
2	53	0	DC+2
3	46,5	0	N3
4	43,7	0	N3
5	37,2	0	DC-2
6	34,4	0	DC-2
7	27,9	0	N2
8	25,1	0	N2
9	18,6	0	DC+1
10	15,8	0	DC+1
11	9,3	0	N1
12	6,5	0	N1
13	0	0	DC-1
14	0	2,8	DC-1
15	0	29	L1
16	2,8	29	L1
17	22,35	29	L2
18	25,15	29	L2
19	33,2	29	L3
20	36	29	L3
21	50	29	NTC1
22	53	29	NTC2
23	44,25	12,8	G5
24	44,25	9,8	E5
25	44,25	6,8	G6
26	25,95	10,5	G3
27	25,95	7,5	E3
28	25,95	4,5	G4
29	8,35	12,8	G1
30	8,35	9,8	E1
31	8,35	6,8	G2



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1 , T2 , T3 , T4 , T5 , T6	IGBT	650 V	30 A	Boost Switch	
D1 , D2 , D3 , D4 , D5 , D6	FWD	1200 V	20 A	Boost Diode	
D7 , D8 , D9 , D10 , D11 , D12	FWD	650 V	30 A	Buck Diode	
NTC	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.

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-xY12NMB030SM-L394L08x-D1-14	14 Jul. 2017		