Vincotech

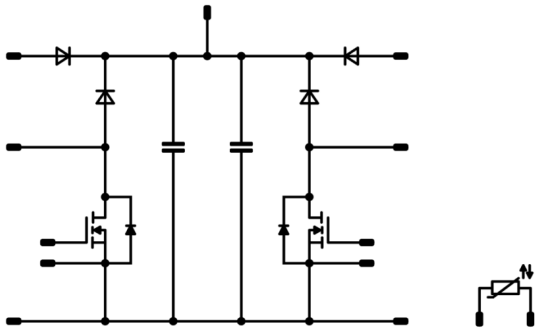
10-FY12B2A040MR-L387L68
datasheet

flow BOOST 1 dual SiC — 1200 V / 40 mΩ

Features
- High frequency SiC MOSFET
- Compact and low inductive design

flow 1 12mm housing


Target applications
- Solar

Schematic


Types
- 10-FY12B2A040MR-L387L68

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Boost Switch				
Drain-source voltage	V_{DSS}		1200	V
Drain current	I_D	$T_j = T_{jmax}$ T_s = 80 °C	31	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}	137	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	68	W
Gate-source voltage	V_{GSS}		-4/22	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	40	A
Repetitive peak forward current	I_{FRM}		100	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	119	W
Maximum junction temperature	T_{jmax}		175	°C
Bypass Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	T_j = T_{jmax} T_s = 80 °C	46	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	270	A
Surge current capability	I^2t		370	A^2s
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	56	W
Maximum Junction Temperature	T_{jmax}		150	°C
Capacitor (DC)				
Maximum DC voltage	V_{MAX}		1000	V
Operation Temperature	T_{op}		-55…+125	°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	4000	V
Creepage distance			min. 12,7	mm
Clearance			9,43	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	
Boost Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		18		20	25 125 150		39 52 60	50	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$			0,01	25	2,7		5,6	V
Gate to Source Leakage Current	I_{GSS}		-4/22	0		25			±100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25			10	µA
Internal gate resistance	r_g							7		Ω
Gate charge	Q_g		18	600	20	25		107		nC
Gate to source charge	Q_{GS}							22		
Gate to drain charge	Q_{GD}							41		
Short-circuit input capacitance	C_{iss}	f = 1 MHz	0	800		25		1337		pF
Short-circuit output capacitance	C_{oss}							76		
Reverse transfer capacitance	C_{rss}							27		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,41		K/W
MOSFET Switching										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 4 Ω R_{gon} = 4 Ω	+16/0	700	32	25 125		16 15		ns
Rise time	t_r					25 125		7 7		
Turn-off delay time	$t_{d(off)}$					25 125		63 71		
Fall time	t_f					25 125		7 5		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,2 µC Q_{rFWD} = 0,2 µC				25 125		0,397 0,369		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,325 0,364		

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 Diode										
Static										
Forward voltage	V_F				20	25 125		1,43 1,69	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						0,80		K/W
FWD Switching										
Peak recovery current	I_{RRM}	di/dt = 6371 A/µs di/dt = 5717 A/µs	+16/0	700	32	25 125		27 27		A
Reverse recovery time	t_{rr}					25 125		9 9		ns
Recovered charge	Q_r					25 125		0,191 0,188		µC
Reverse recovered energy	E_{rec}					25 125		0,057 0,057		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		10013 9679		A/µs
Bypass Diode										
Static										
Forward voltage	V_F				35	25 125	0,8	1,17 1,13	1,6	V
Reverse leakage current	I_r			1600		25 145			50 1100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,25		K/W
Capacitor (DC)										
Capacitance	C							47		nF
Tolerance							-10		+10	%

Characteristic Values

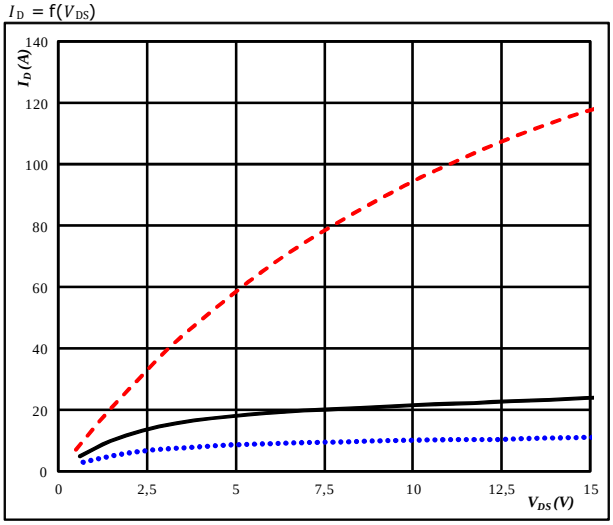
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %				25		4000		K
Vincotech NTC Reference									I	

Boost Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

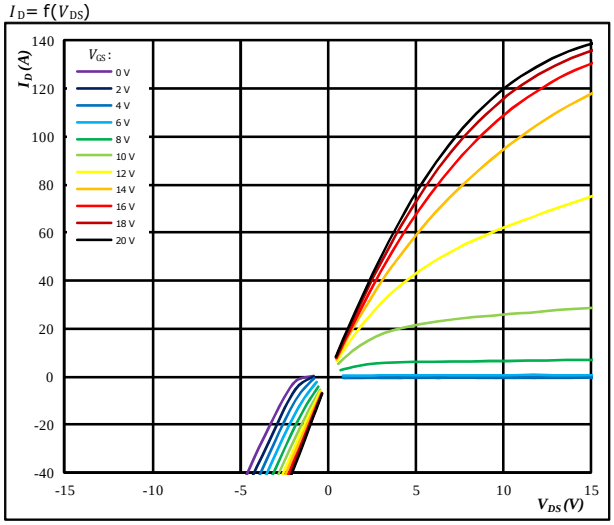


t_p =	250	µs		25 °C	
V_{GS}=	18	V	T_j:	125 °C	
				150 °C	

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

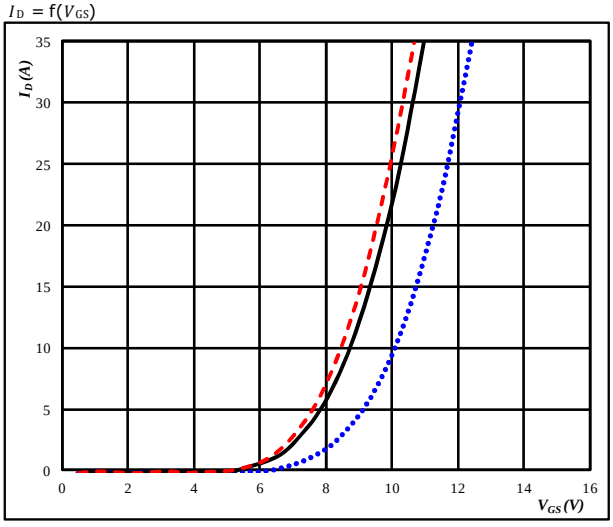


t_p =	250	µs
T_j =	150	°C
V_{GS} from	0 V to 20 V in steps of 2 V	

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

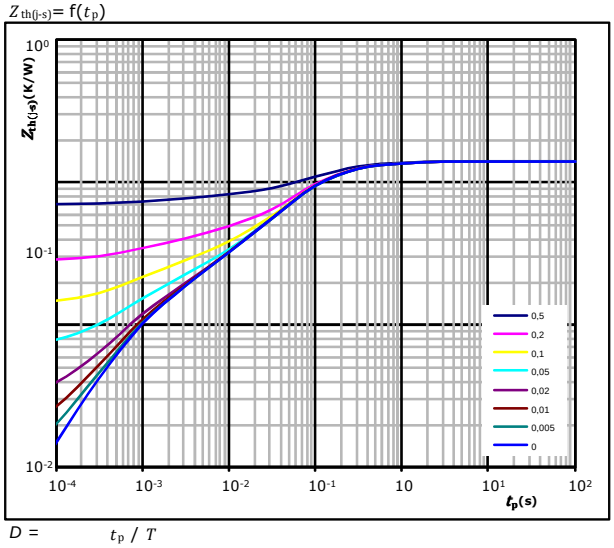


t_p =	100	µs		25 °C	
V_{DS} =	10	V	T_j:	125 °C	
				150 °C	

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,41	K/W

MOSFET thermal model values

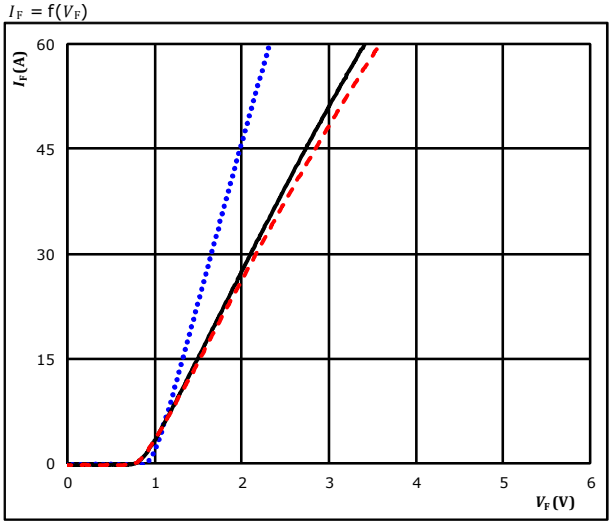
R (K/W)	τ (s)
1,24E-01	1,00E+00
3,91E-01	1,66E-01
6,76E-01	6,11E-02
1,21E-01	5,50E-03
9,55E-02	8,02E-04

Boost Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



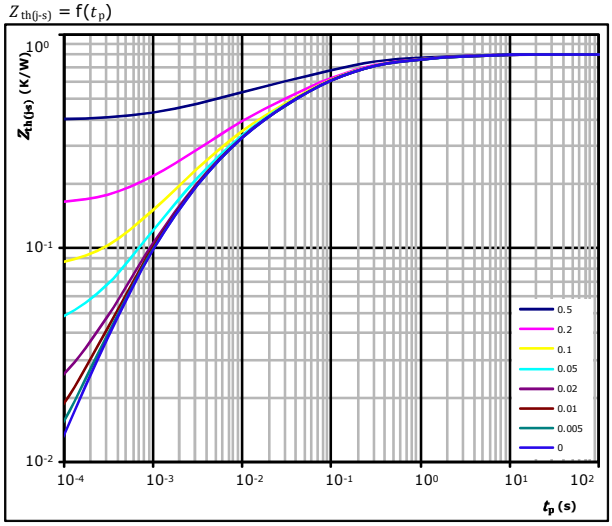
t_p = 250 µs

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

$R_{th(j-s)}$ = 0,80 K/W

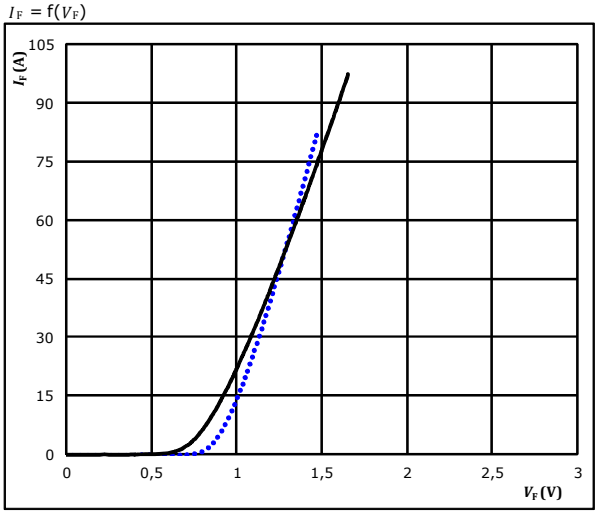
FWD thermal model values

R (K/W)	τ (s)
3,98E-02	3,29E+00
9,04E-02	5,06E-01
2,65E-01	8,56E-02
1,68E-01	1,77E-02
1,66E-01	4,16E-03
7,14E-02	8,53E-04

Bypass Diode Characteristics

figure 1. **Rectifier Diode**
Typical forward characteristics

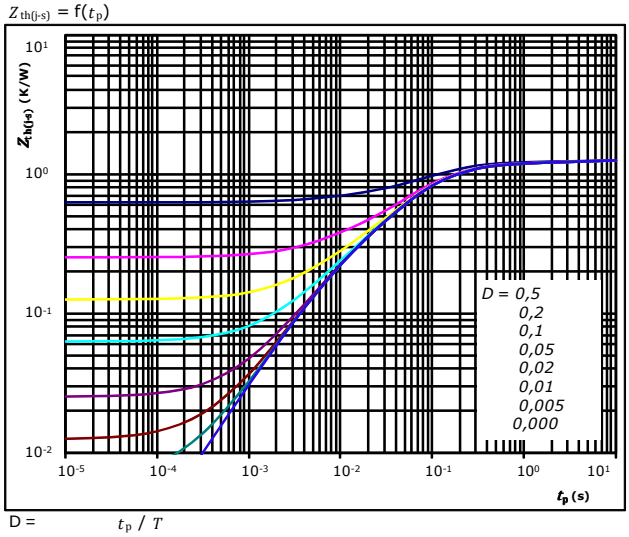
$I_F = f(V_F)$



t_p = 250 µs
25 °C
T_j: **125 °C**

figure 2. **Rectifier Diode**
Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 1,25 K/W

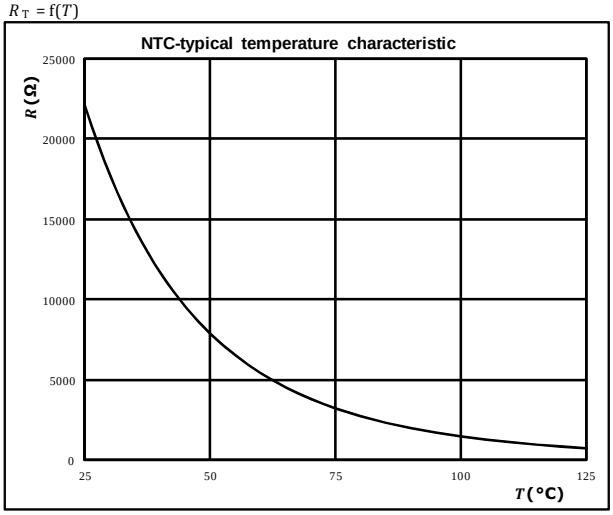
Diode thermal model values

R (K/W)	τ (s)
8,0030E-02	5,2210E+00
1,5580E-01	4,1790E-01
6,9510E-01	8,8210E-02
2,2330E-01	3,0740E-02
9,9710E-02	5,9900E-03

Thermistor Characteristics

Thermistor typical temperature characteristic
Typical NTC characteristic
as a function of temperature

$R_T = f(T)$

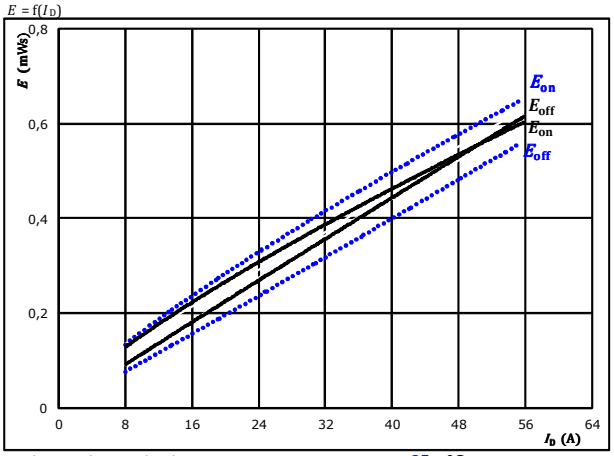


Boost Switching Characteristics

figure 1. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$

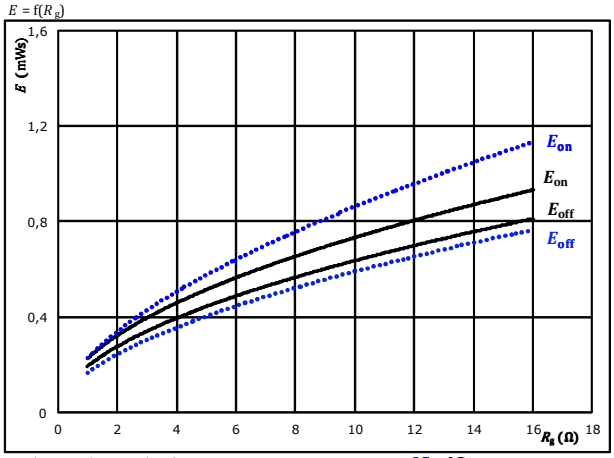


With an inductive load at — 25 °C
V_{DS} = 700 V — T_J: 125 °C
V_{GS} = +16/0 V
R_{gon} = 4 Ω
R_{goff} = 4 Ω

figure 2. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$

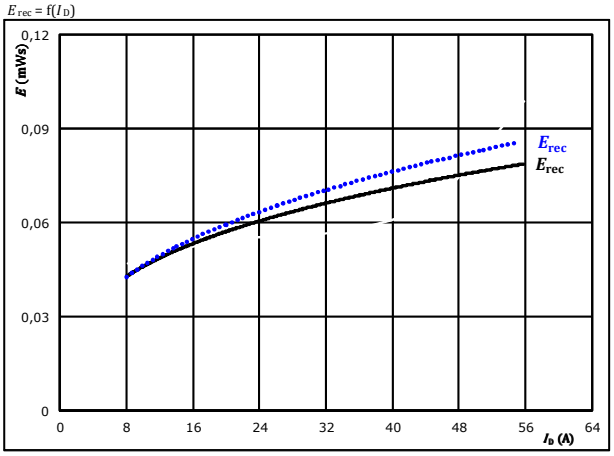


With an inductive load at — 25 °C
V_{DS} = 700 V — T_J: 125 °C
V_{GS} = +16/0 V
I_D = 32 A

figure 3. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$

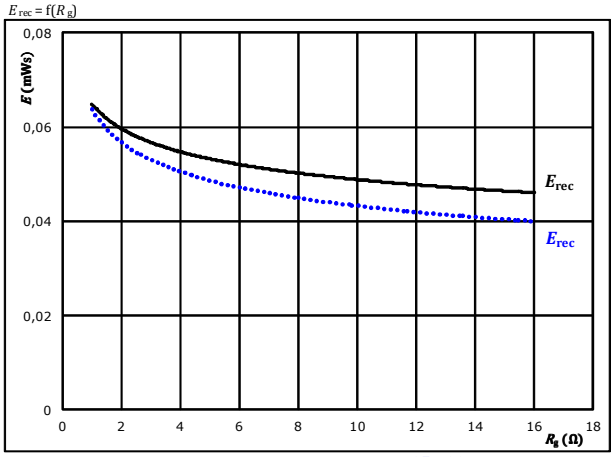


With an inductive load at — 25 °C
V_{DS} = 700 V — T_J: 125 °C
V_{GS} = +16/0 V
R_{gon} = 4 Ω

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



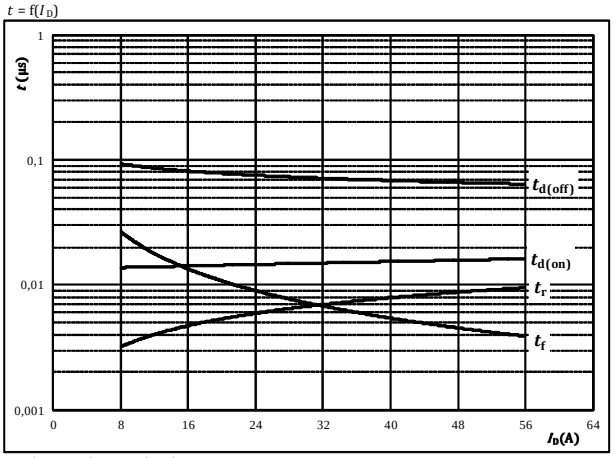
With an inductive load at — 25 °C
V_{DS} = 700 V — T_J: 125 °C
V_{GS} = +16/0 V
I_D = 32 A

Boost Switching Characteristics

figure 5. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



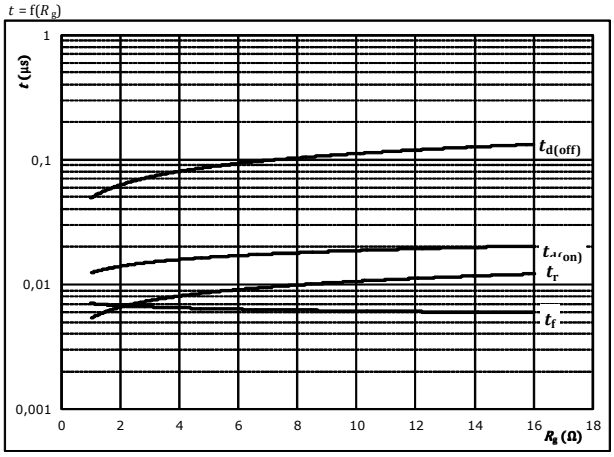
With an inductive load at

T_j =	125	°C
V_{DS} =	700	V
V_{GS} =	+16/0	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 6. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



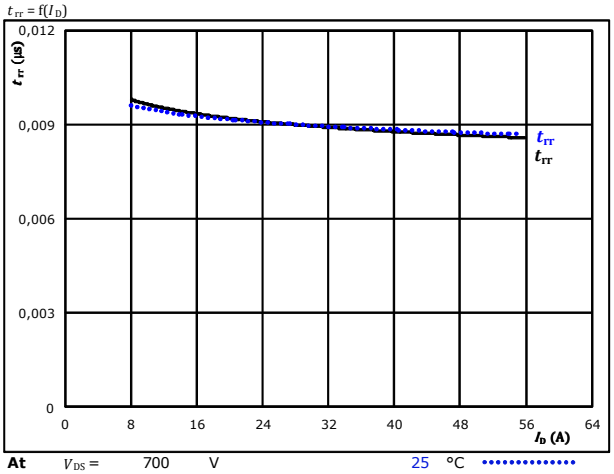
With an inductive load at

T_j =	125	°C
V_{DS} =	700	V
V_{GS} =	+16/0	V
I_D =	32	A

figure 7. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$

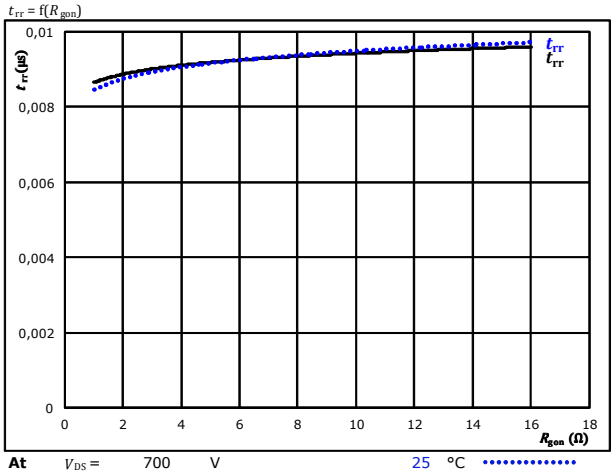


At	V_{DS} =	700	V		25 °C
	V_{GS} =	+16/0	V	T_j:	125 °C
	R_{gon} =	4	Ω		

figure 8. **FWD**

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

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



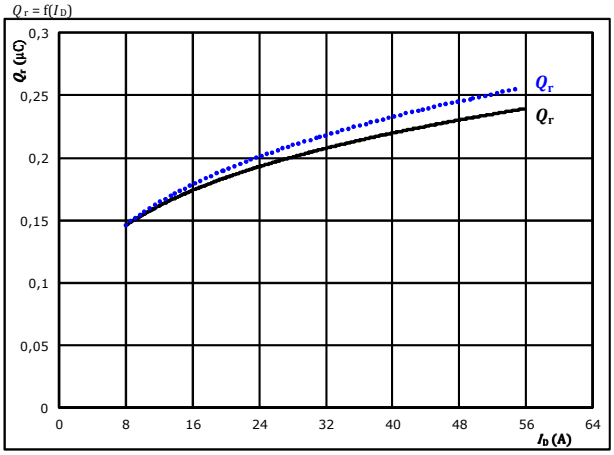
At	V_{DS} =	700	V		25 °C
	V_{GS} =	+16/0	V	T_j:	125 °C
	I_D =	32	A		

Boost Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

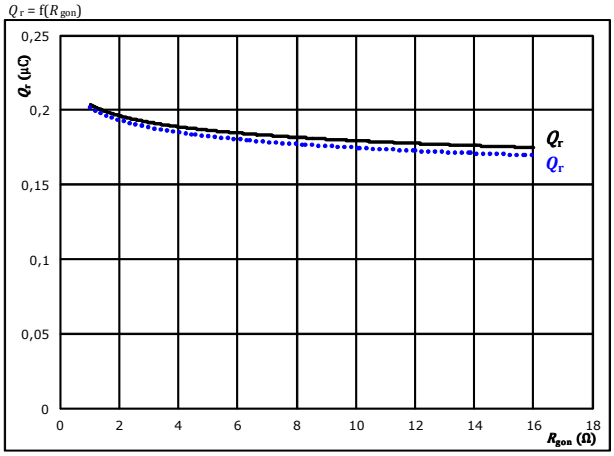


At	V_{DS} =	700	V		25 °C	•••••••••••••
	V_{GS} =	+16/0	V	T_j:	125 °C	———
	R_{gon} =	4	Ω			

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

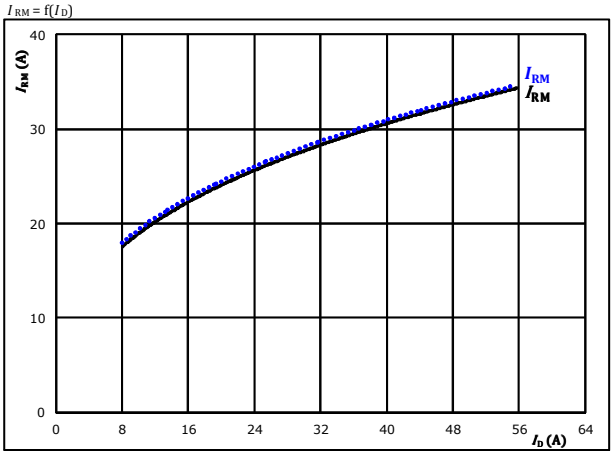


At	V_{DS} =	700	V		25 °C	•••••••••••••
	V_{GS} =	+16/0	V	T_j:	125 °C	———
	I_D =	32	A			

figure 11. **FWD**

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

$I_{RM} = f(I_D)$

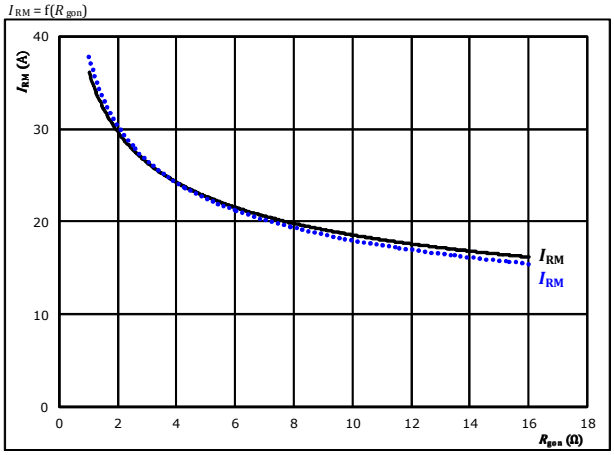


At	V_{DS} =	700	V		25 °C	•••••••••••••
	V_{GS} =	+16/0	V	T_j:	125 °C	———
	R_{gon} =	4	Ω			

figure 12. **FWD**

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

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



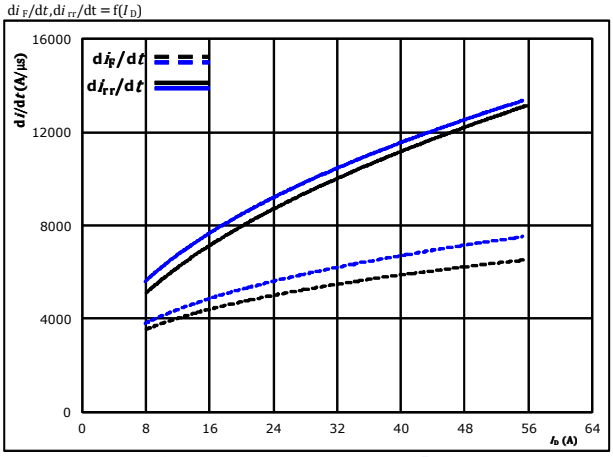
At	V_{DS} =	700	V		25 °C	•••••••••••••
	V_{GS} =	+16/0	V	T_j:	125 °C	———
	I_D =	32	A			

Boost Switching Characteristics

figure 13. **FWD**

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

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

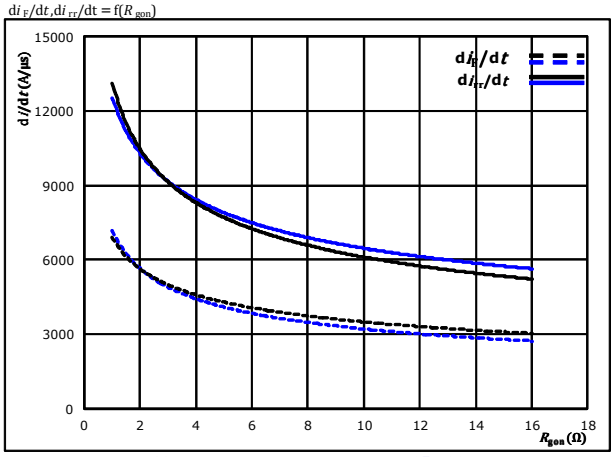


At	V_{DS} =	700	V		25	°C
	V_{GS} =	+16/0	V	T_j:	125	°C
	R_{gon} =	4	Ω			

figure 14. **FWD**

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

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



At	V_{DS} =	700	V		25	°C
	V_{GS} =	+16/0	V	T_j:	125	°C
	I_D =	32	A			

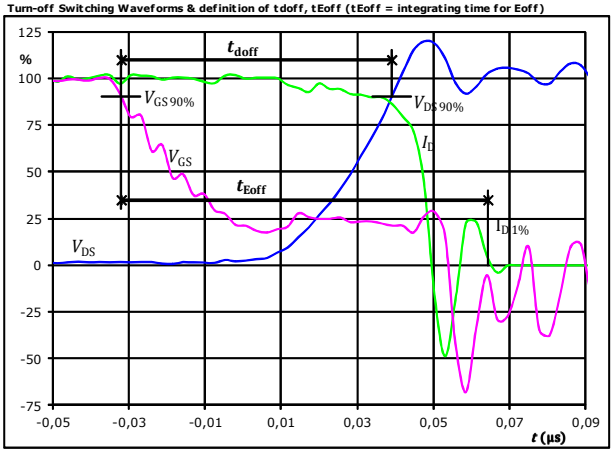
Boost Switching Definitions

General conditions

T_j	=	**125 °C**
R_{gon}	=	**4 Ω**
R_{goff}	=	**4 Ω**

figure 1. MOSFET

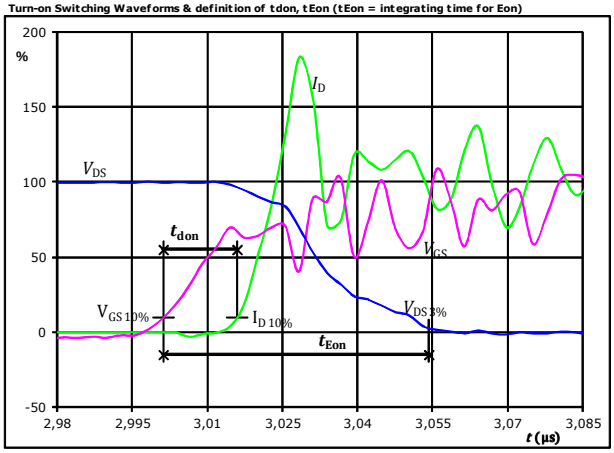
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	16	V
$V_{DS}(100\%)$ =	700	V
$I_D(100\%)$ =	32	A
t_{doff} =	0,071	µs
t_{Eoff} =	0,096	µs

figure 2. MOSFET

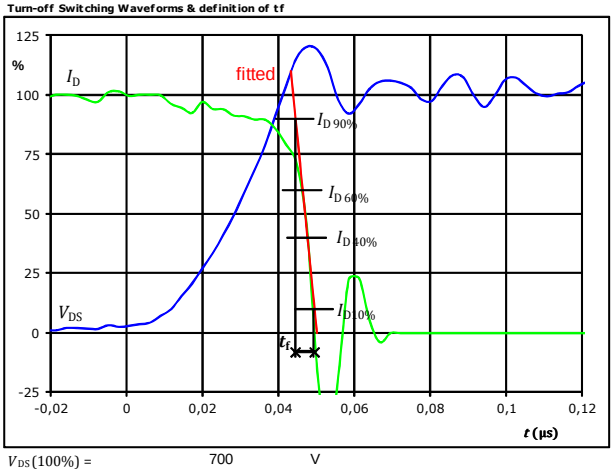
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GS}(0\%)$ =	0	V
$V_{GS}(100\%)$ =	16	V
$V_{DS}(100\%)$ =	700	V
$I_D(100\%)$ =	32	A
t_{don} =	0,015	µs
t_{Eon} =	0,053	µs

figure 3. MOSFET

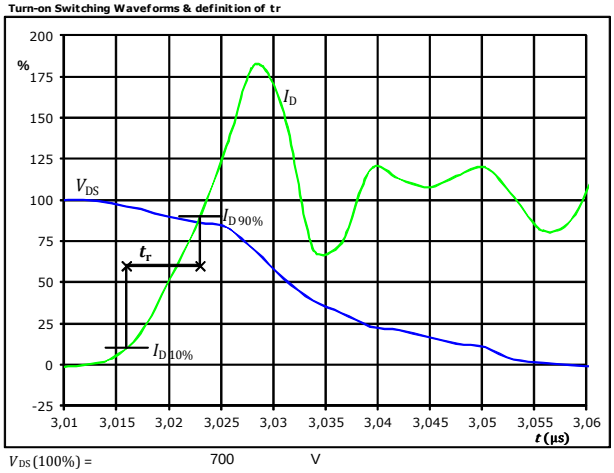
Turn-off Switching Waveforms & definition of tf



$V_{DS}(100\%)$ =	700	V
$I_D(100\%)$ =	32	A
t_f =	0,005	µs

figure 4. MOSFET

Turn-on Switching Waveforms & definition of tr

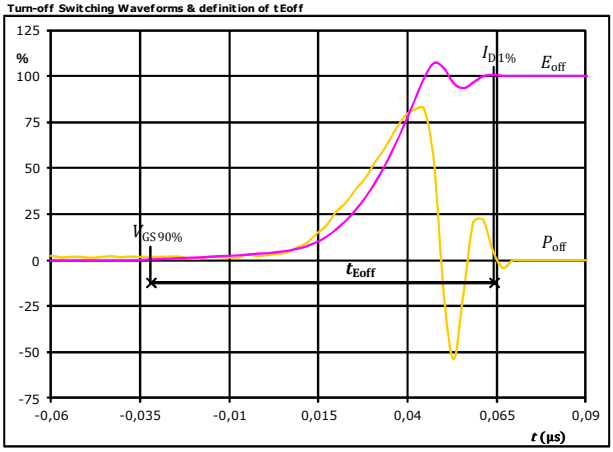


$V_{DS}(100\%)$ =	700	V
$I_D(100\%)$ =	32	A
t_r =	0,007	µs

Boost Switching Definitions

figure 5. **MOSFET**

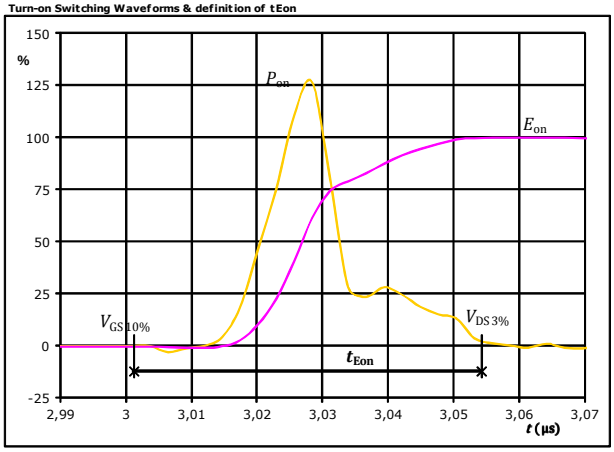
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%)$ =	22,38	kW
$E_{off}(100\%)$ =	0,36	mJ
t_{Eoff} =	0,096	µs

figure 6. **MOSFET**

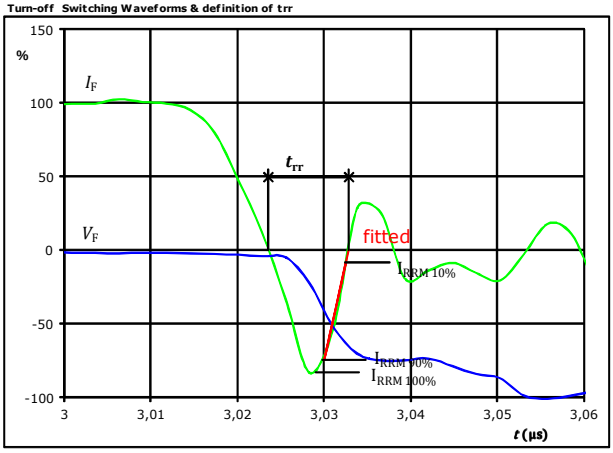
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%)$ =	22,38	kW
$E_{on}(100\%)$ =	0,37	mJ
t_{Eon} =	0,053	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

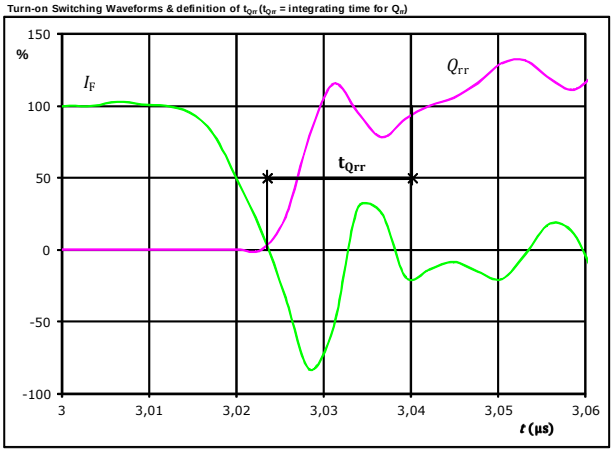


$V_F(100\%)$ =	700	V
$I_F(100\%)$ =	32	A
$I_{RRM}(100\%)$ =	-27	A
t_{rr} =	0,009	µs

Boost Switching Definitions

figure 8. **FWD**

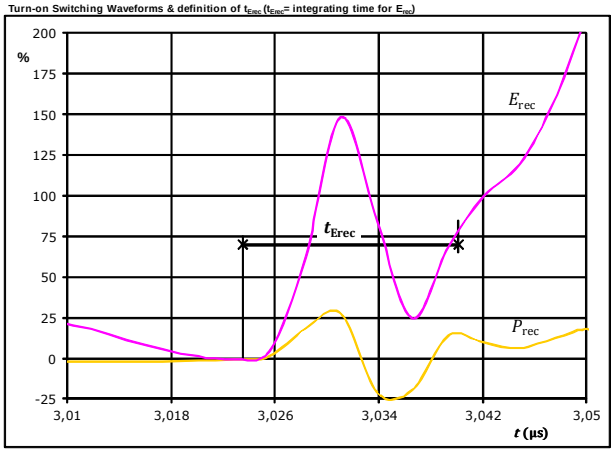
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_F (100%) =	32	A
Q_{rr} (100%) =	0,19	µC
t_{Qrr} =	0,02	µs

figure 9. **FWD**

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



P_{rec} (100%) =	22,38	kW
E_{rec} (100%) =	0,06	mJ
t_{Erec} =	0,02	µs

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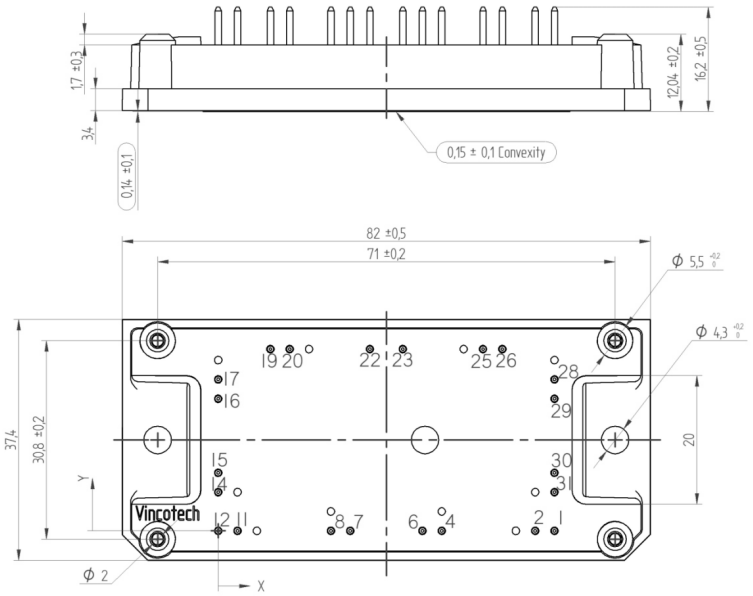
Ordering Code & Marking

Version	Ordering Code
without thermal paste 12mm housing with solder pins	10-FY12B2A040MR-L387L68
with thermal paste 12mm housing with solder pins	10-FY12B2A040MR-L387L68-/3/

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

Outline

Pin table [mm]				Pin table [mm]			
Pin	X	Y	Function	Pin	X	Y	Function
1	52,2	0	Boost2	30	52,2	9	DC+
2	49,2	0	Boost2	31	52,2	6	DC+
3	Not assembled			32	Not assembled		
4	34,7	0	DC+In2				
5	Not assembled						
6	31,7	0	DC+In2				
7	20,5	0	DC+In1				
8	17,5	0	DC+In1				
9	Not assembled						
10	Not assembled						
11	3	0	Boost1				
12	0	0	Boost1				
13	Not assembled						
14	0	6	DC+				
15	0	9	DC+				
16	0	20,5	DC-				
17	0	23,5	DC-				
18	Not assembled						
19	8,1	28,2	G1				
20	11,1	28,2	E1				
21	Not assembled						
22	23,55	28,2	NTC1				
23	28,65	28,2	NTC2				
24	Not assembled						
25	41,1	28,2	E2				
26	44,1	28,2	G2				
27	Not assembled						
28	52,2	23,5	DC-				
29	52,2	20,5	DC-				



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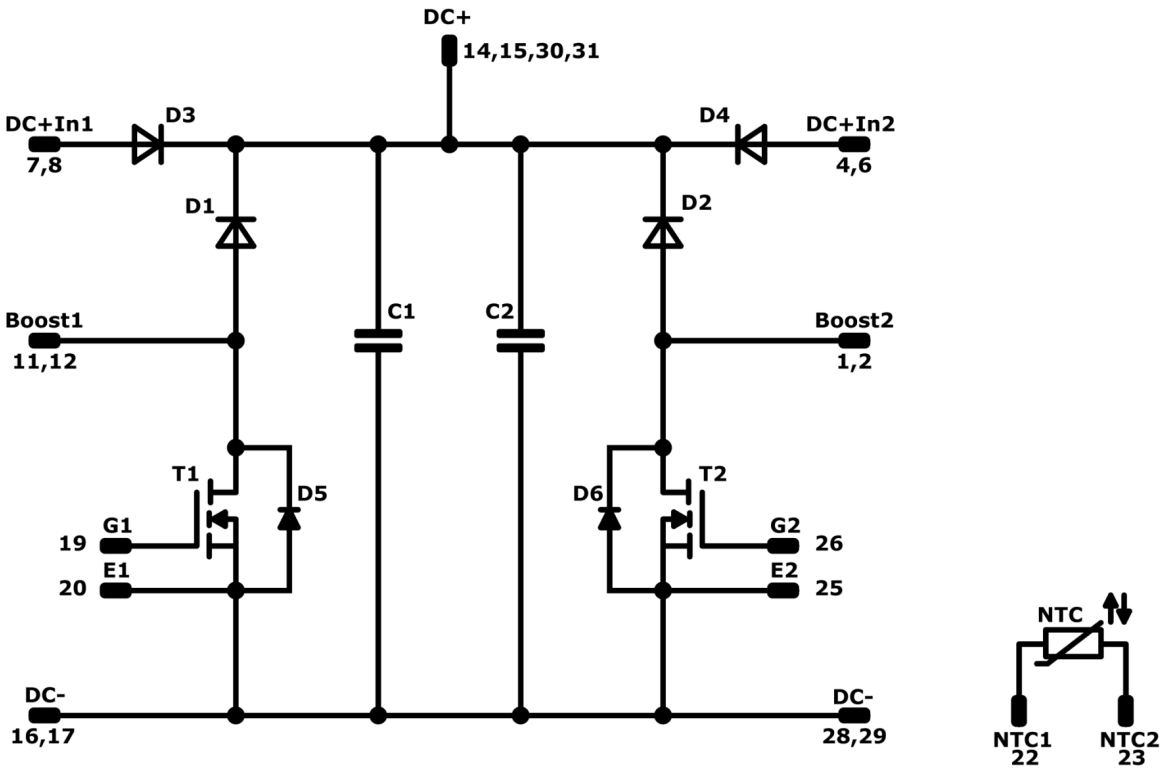
Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T2	MOSFET	1200 V	40 mΩ	Boost Switch	
D1,D2	FWD	1200 V	20 A	Boost Diode	
D3,D4	FWD	1600 V	35 A	Bypass Diode	
C1,C2	Capacitor	1000 V		Capacitor (DC)	
NTC	Thermistor			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-FY12B2A040MR-L387L68-D1-14	13 Jul. 2016		