Vincotech

10-FY12B2A040MR-L387L68
datasheet

***flow*BOOST 1 dual SiC** **1200 V / 40 mΩ**

Features

- Ultrafast switching with SiC MOSFET and SiC boost diode
- Compact and low inductive design with integrated capacitors

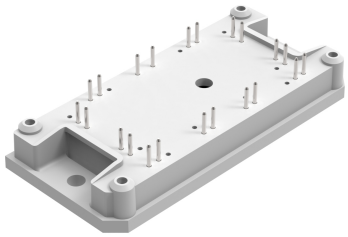
Target applications

- Solar
- UPS

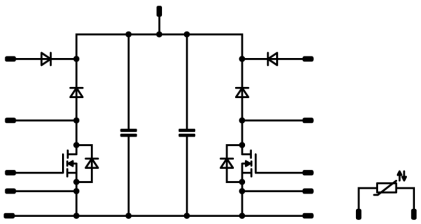
Types

- 10-FY12B2A040MR-L387L68

flow 1 12 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Boost Switch				
Drain-source voltage	V_{DSS}		1200	V
Drain current (DC current)	I_D	$T_j = T_{jmax}$ T_s = 80 °C	33	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
Boost Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ T_s = 80 °C	41	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	100	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 8,3 ms T_j = 150 °C	72	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	119	W
Maximum junction temperature	T_{jmax}		175	°C
Boost Sw. Protection Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ T_s = 80 °C	46	A
Surge (non-repetitive) forward current	I_{FSM}	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

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
ByPass Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	46	A
Surge (non-repetitive) forward current	I_{FSM}	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	6000	V
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	V
Creepage distance				>12,7	mm
Clearance				9,6	mm
Comparative Tracking Index	CTI			≥ 200	

*100 % tested in production

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										
Drain-source on-state resistance	$r_{DS(on)}$		18		20	25 125 150		39 51 60	50(1)	mΩ
Gate-source threshold voltage	$V_{GS(th)}$		0		0,01	25	2,7	3,9	5,6	V
Gate to Source Leakage Current	I_{GSS}		22	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25		1	10	µA
Internal gate resistance	r_g							7		Ω
Gate charge	Q_g	V_{DD} = 600 V	18		20	25		107		nC
Short-circuit input capacitance	C_{iss}	f = 1 Mhz	0	800	0	25		1337		pF
Short-circuit output capacitance	C_{oss}							76		
Reverse transfer capacitance	C_{rss}							27		
Diode forward voltage	V_{SD}		0		20	25		3,2		V
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,41		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	0/16	700	32	25 125		16 15,2		ns
Rise time	t_r					25 125		6,8 7		ns
Turn-off delay time	$t_{d(off)}$					25 125		62,8 71,2		ns
Fall time	t_f					25 125		7,07 4,99		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,191 µC Q_{rFWD}=0,188 µC				25 125		0,397 0,369		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,325 0,364		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				20	25 125 150		1,43 1,7 1,73	1,6(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25 150		20 160	400	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,8		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt=6371 A/µs di/dt=5717 A/µs	0/16	700	32	25 125		27,44 27,34		A
Reverse recovery time	t_{rr}					25 125		8,88 8,86		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

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 Sw. Protection Diode										
Static										
Forward voltage	V_F				13	25 125		0,988 0,899	1,21(1) 1,1(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25			50	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,25		K/W
ByPass Diode										
Static										
Forward voltage	V_F				13	25 125		0,988 0,899	1,21(1) 1,1(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25			50	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,25		K/W
Capacitor (DC)										
Static										
Capacitance	C	DC bias voltage = 0 V				25		47		nF
Tolerance							-10		10	%
Dissipation factor		f = 1 kHz				25		2,5		%

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	
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P							5		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

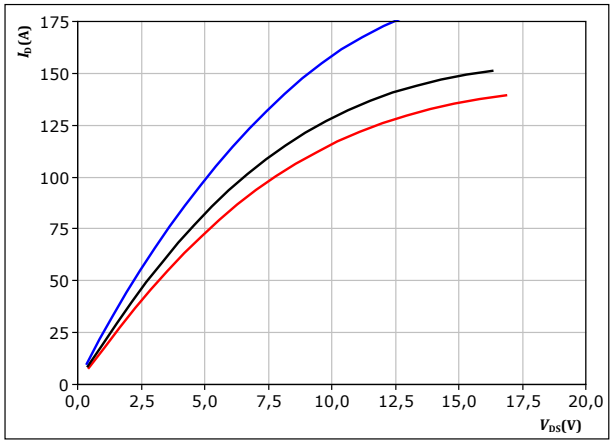
(1) Value at chip level
(2) Only valid with pre-applied Vincotech thermal interface material.

Boost Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

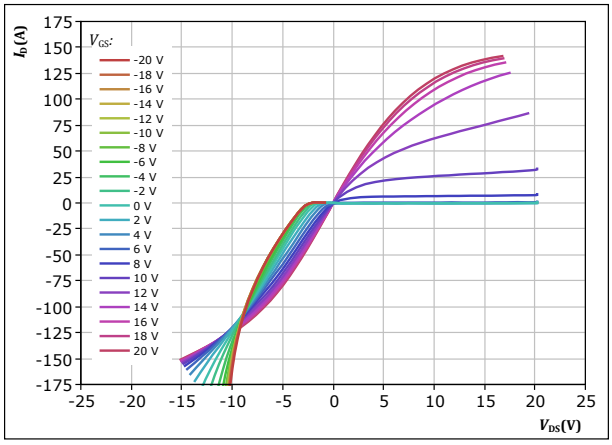


t_p =	250	µs		
V_{GS} =	18	V	T_j:	25 °C
				125 °C
				150 °C

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$



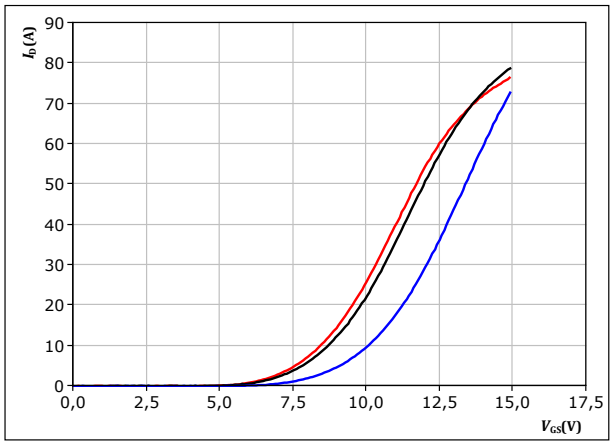
t_p =	250	µs
T_j =	150	°C

V_{GS} from -20 V to 20 V in steps of 2 V

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

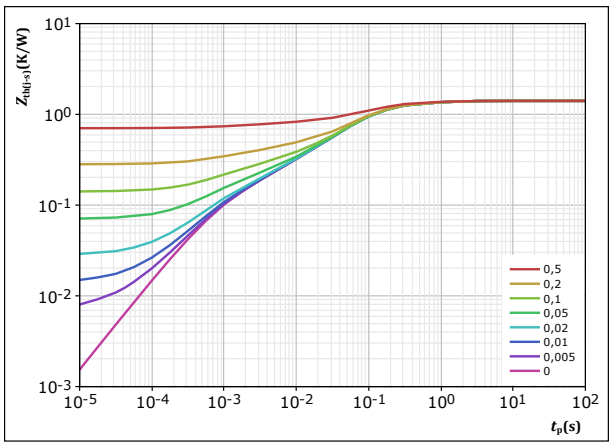


t_p =	250	µs		
V_{DS} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,407	K/W

MOSFET thermal model values

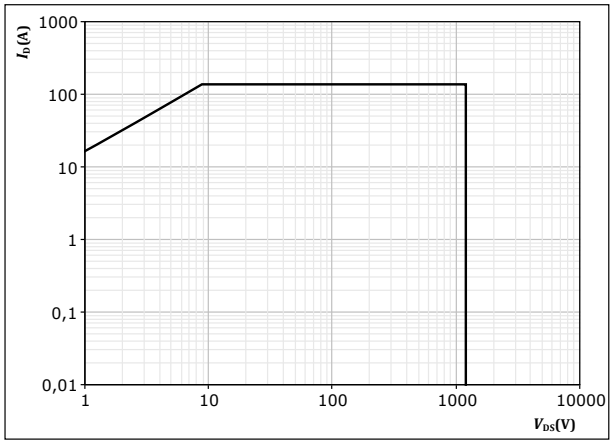
R (K/W)	τ (s)
1,24E-01	1,00E+00
3,91E-01	1,66E-01
6,76E-01	6,11E-02
1,21E-01	5,50E-03
9,55E-02	8,02E-04

Boost Switch Characteristics

figure 5. **MOSFET**

Safe operating area

$I_D = f(V_{DS})$



D = single pulse

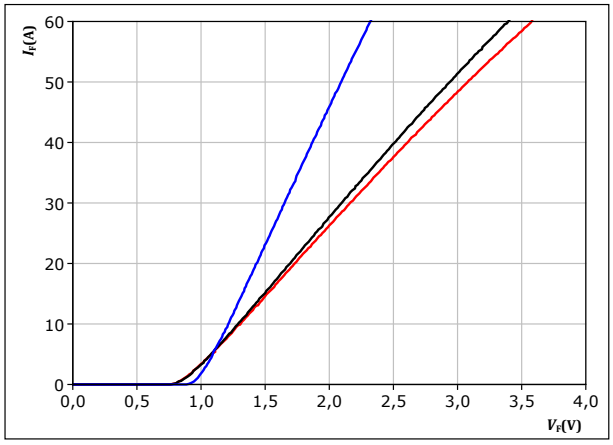
T_s =	80	°C
V_{GS} =	18	V
T_j =	T_{jmax}	

Boost Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



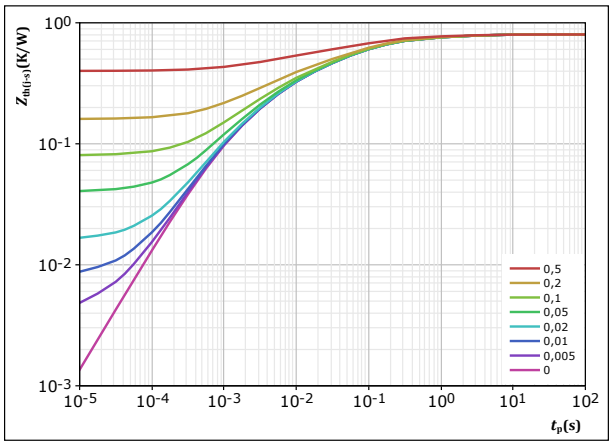
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 0,8 K/W

FWD thermal model values

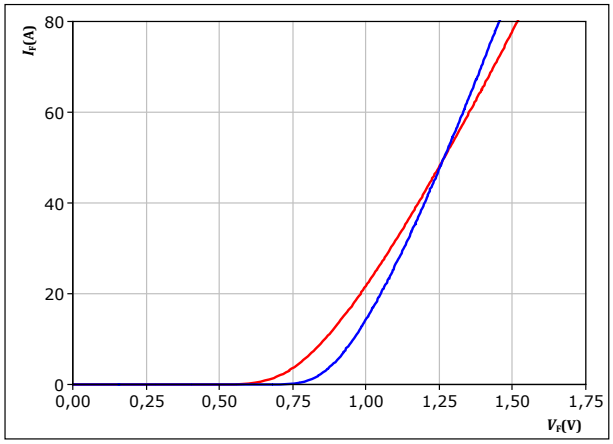
R (K/W)	τ (s)
3,98E-02	3,29E+00
9,04E-02	5,06E-01
2,65E-01	8,56E-02
1,68E-01	1,77E-02
1,66E-01	4,16E-03
7,14E-02	8,53E-04

Boost Sw. Protection Diode Characteristics

figure 8. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



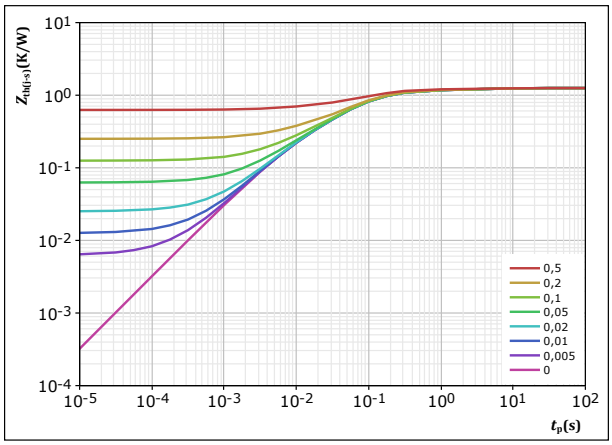
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 9. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,254 K/W

Rectifier thermal model values

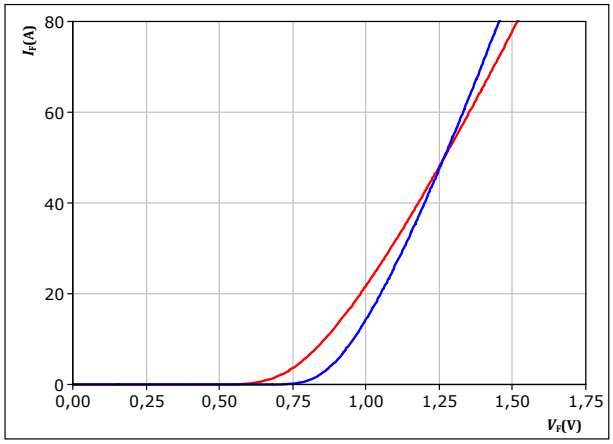
R (K/W)	τ (s)
8,00E-02	5,22E+00
1,56E-01	4,18E-01
6,95E-01	8,82E-02
2,23E-01	3,07E-02
9,97E-02	5,99E-03

ByPass Diode Characteristics

figure 10. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



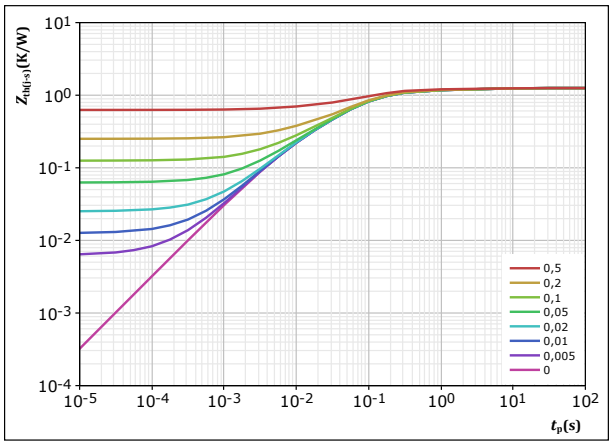
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 11. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,254 K/W

Rectifier thermal model values

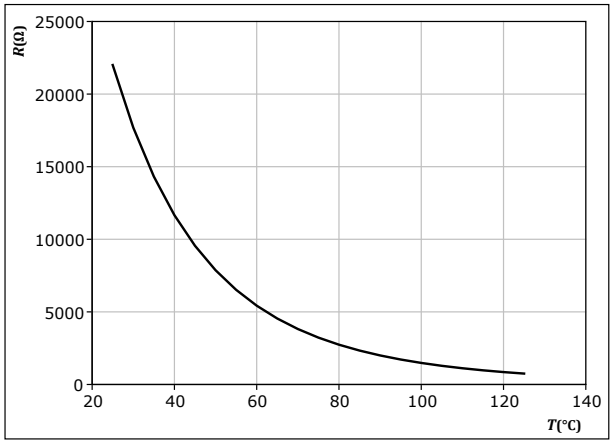
R (K/W)	τ (s)
8,00E-02	5,22E+00
1,56E-01	4,18E-01
6,95E-01	8,82E-02
2,23E-01	3,07E-02
9,97E-02	5,99E-03

Thermistor Characteristics

figure 12. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

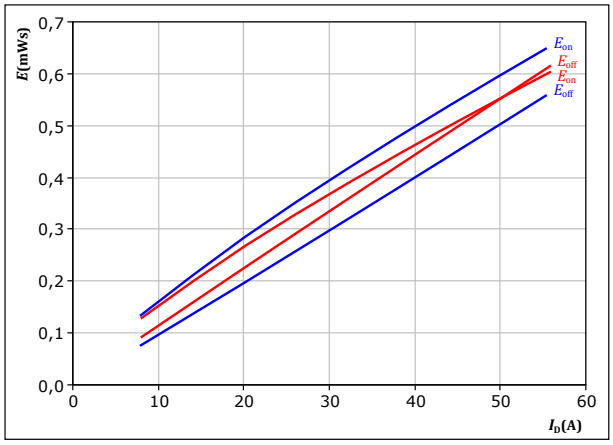


Boost Switching Characteristics

figure 13. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



With an inductive load at

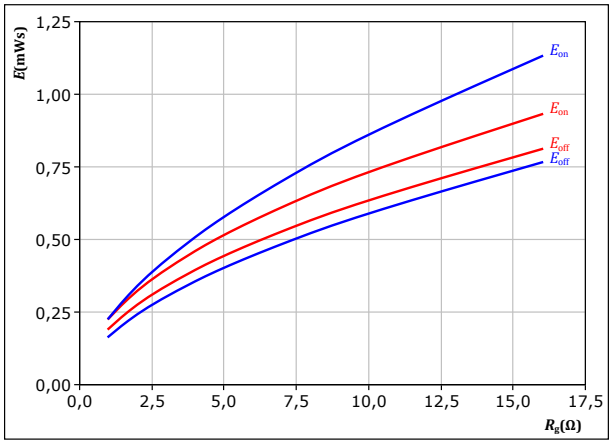
V_{DS} =	700	V
V_{GS} =	0/16	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

T_j: 25 °C, 125 °C

figure 14. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



With an inductive load at

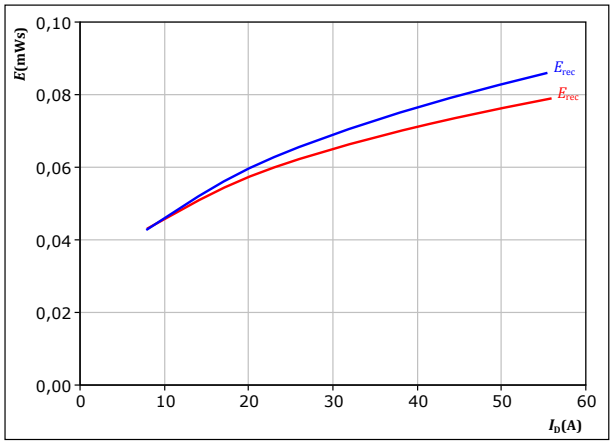
V_{DS} =	700	V
V_{GS} =	0/16	V
I_D =	32	A

T_j: 25 °C, 125 °C

figure 15. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



With an inductive load at

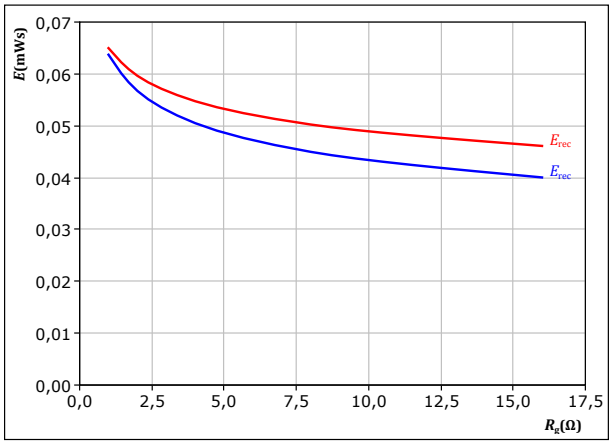
V_{DS} =	700	V
V_{GS} =	0/16	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C

figure 16. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{DS} =	700	V
V_{GS} =	0/16	V
I_D =	32	A

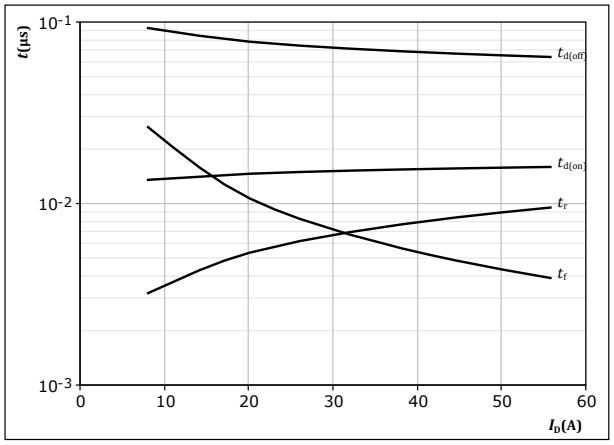
T_j: 25 °C, 125 °C

Boost Switching Characteristics

figure 17. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



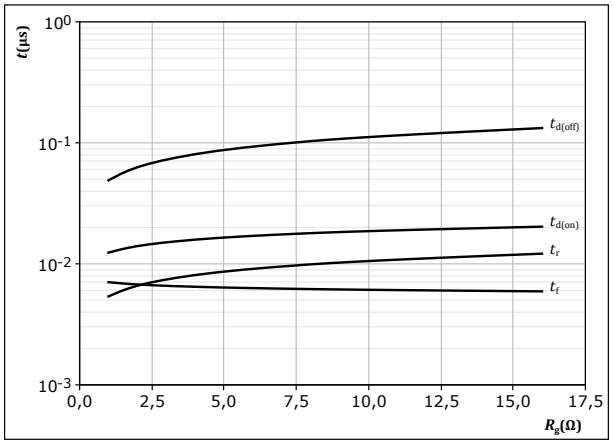
With an inductive load at

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

figure 18. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



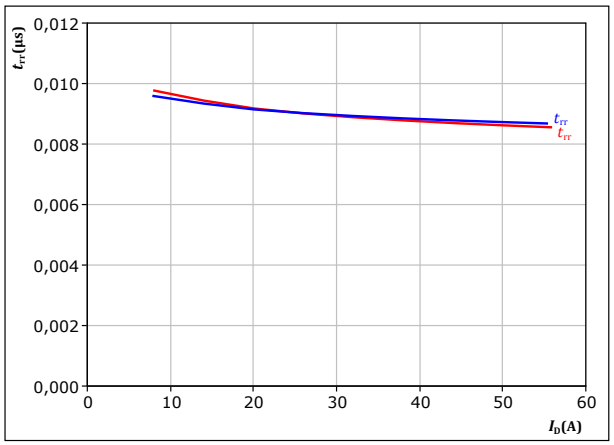
With an inductive load at

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

figure 19. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



At

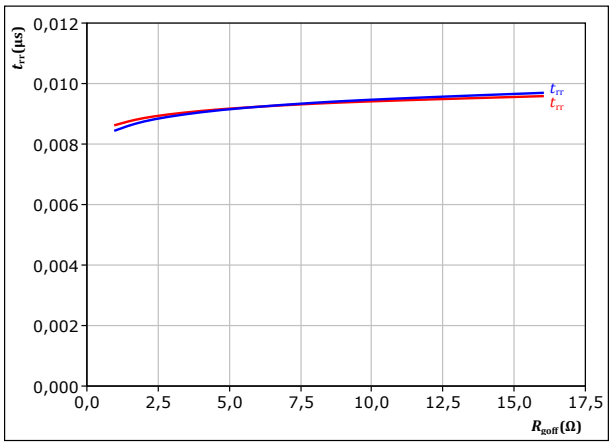
V_{DS} =	700	V
V_{GS} =	0/16	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C

figure 20. **FWD**

Typical reverse recovery time as a function of turn off gate resistor

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



At

V_{DS} =	700	V
V_{GS} =	0/16	V
I_D =	32	A

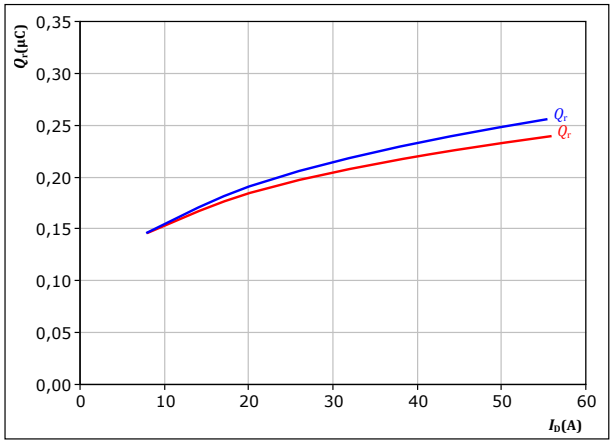
T_j: 25 °C, 125 °C

Boost Switching Characteristics

figure 21. **FWD**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

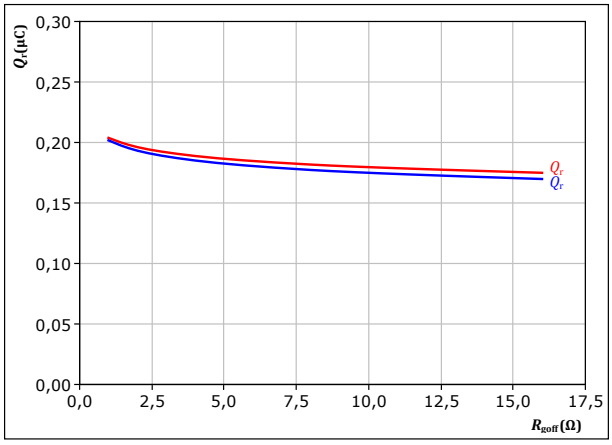


At				
	V_{DS} =	700	V	T_j: 25 °C
	V_{GS} =	0/16	V	125 °C
	R_{gon} =	4	Ω	

figure 22. **FWD**

Typical recovered charge as a function of turn off gate resistor

$Q_r = f(R_{goff})$

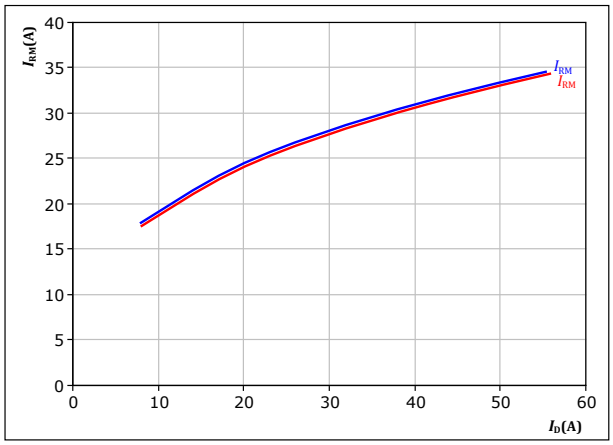


At				
	V_{DS} =	700	V	T_j: 25 °C
	V_{GS} =	0/16	V	125 °C
	I_D =	32	A	

figure 23. **FWD**

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

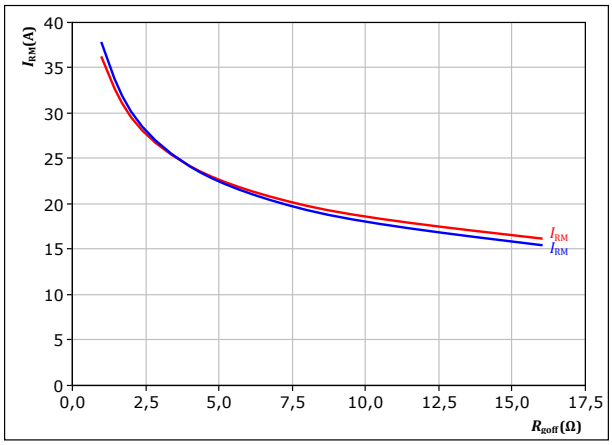


At				
	V_{DS} =	700	V	T_j: 25 °C
	V_{GS} =	0/16	V	125 °C
	R_{gon} =	4	Ω	

figure 24. **FWD**

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

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



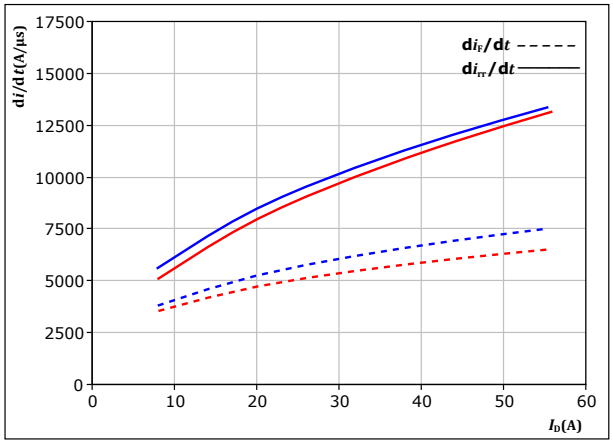
At				
	V_{DS} =	700	V	T_j: 25 °C
	V_{GS} =	0/16	V	125 °C
	I_D =	32	A	

Boost Switching Characteristics

figure 25. **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)



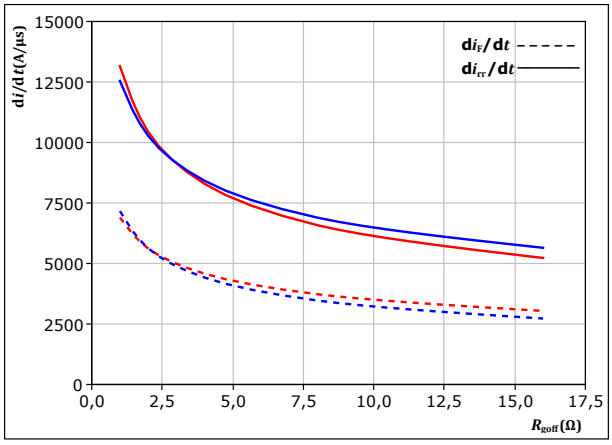
At			
	V_{DS} =	700	V
	V_{GS} =	0/16	V
	R_{gon} =	4	Ω

T_j: 25 °C, 125 °C

figure 26. **FWD**

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

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



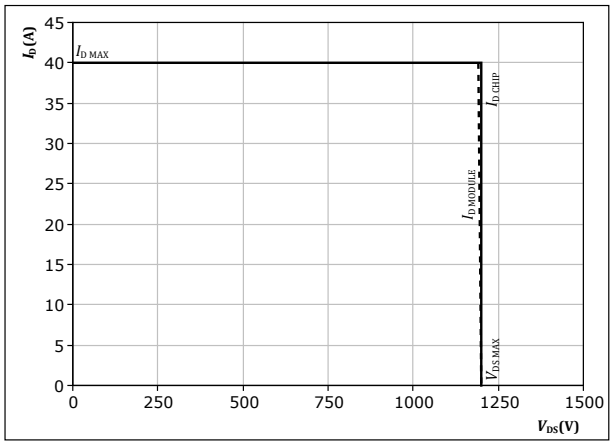
At			
	V_{DS} =	700	V
	V_{GS} =	0/16	V
	I_D =	32	A

T_j: 25 °C, 125 °C

figure 27. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



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

Boost Switching Definitions

figure 28. MOSFET

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

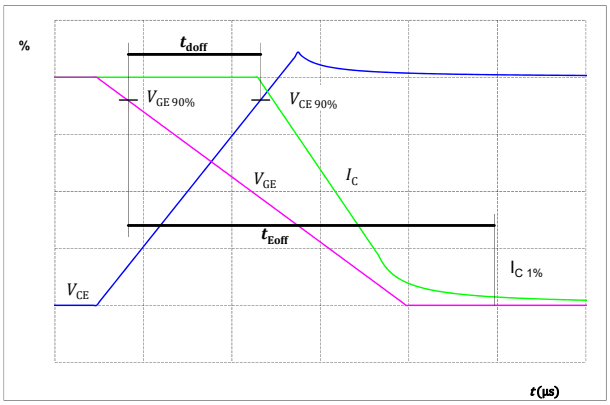


figure 29. MOSFET

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

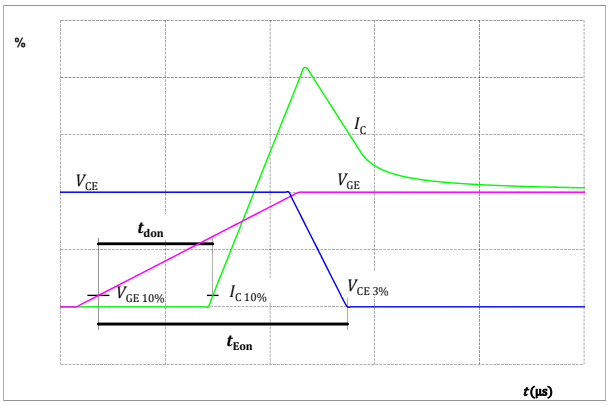


figure 30. MOSFET

Turn-off Switching Waveforms & definition of t_f

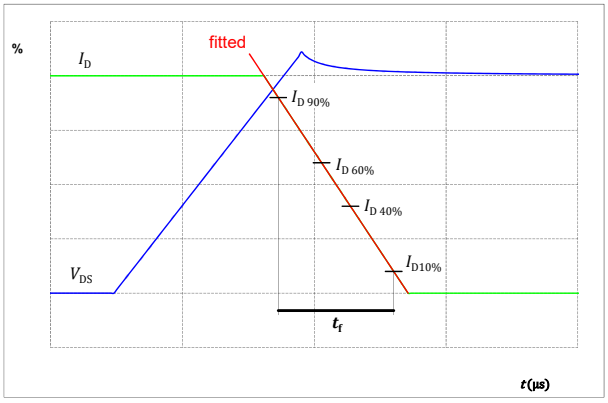
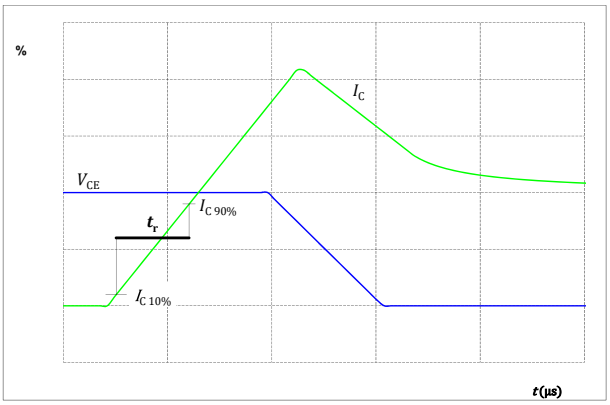


figure 31. MOSFET

Turn-on Switching Waveforms & definition of t_r



Boost Switching Definitions

figure 32. **FWD**

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

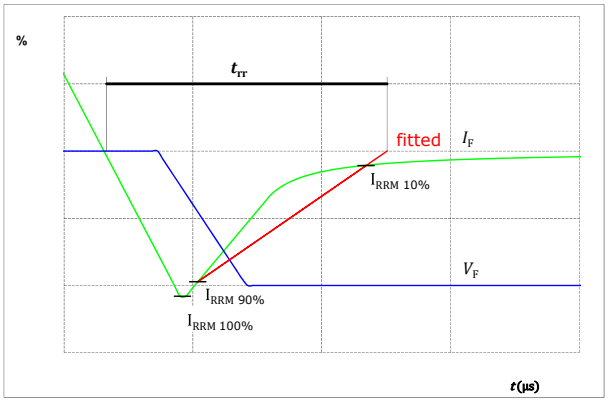


figure 33. **FWD**

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

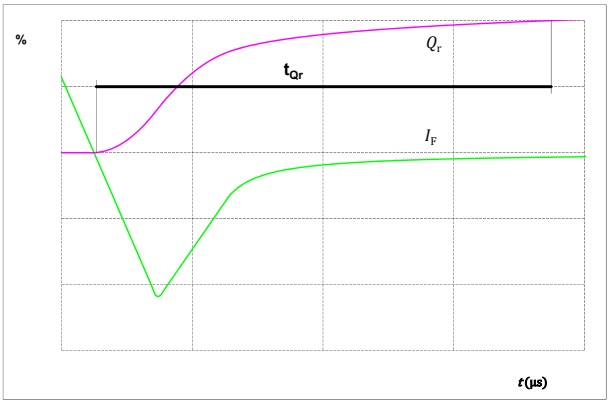
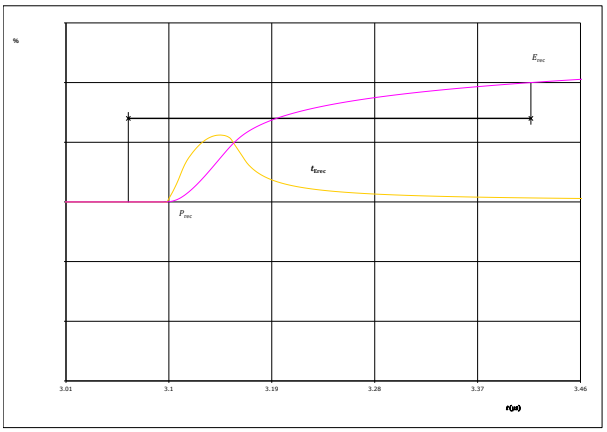


figure 34. **FWD**

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



Ordering Code

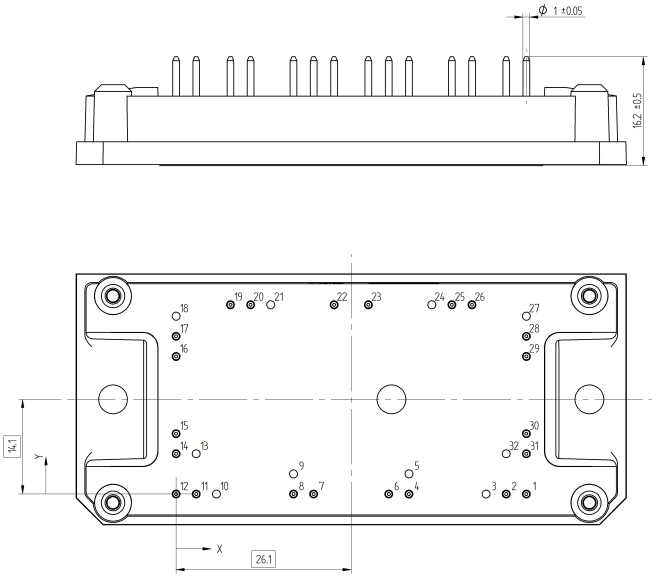
Version	Ordering Code
Without thermal paste	10-FY12B2A040MR-L387L68
With thermal paste (5,2 W/mK, PTM6000HV)	10-FY12B2A040MR-L387L68-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-FY12B2A040MR-L387L68-/3/

Marking

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

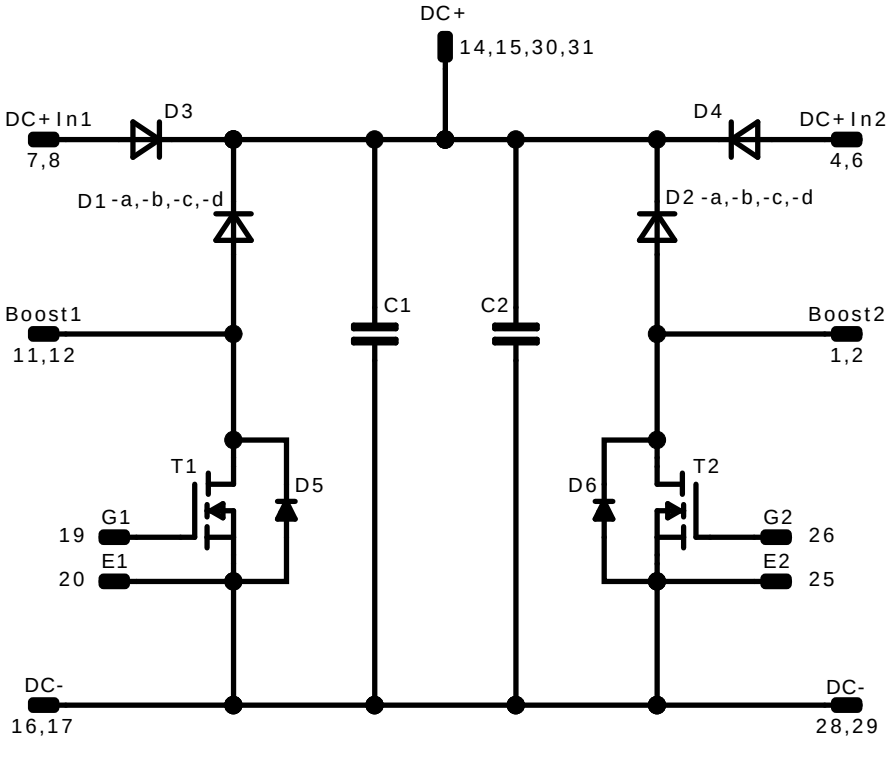
Outline

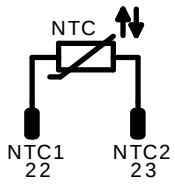
Pin table [mm]			
Pin	X	Y	Function
1	52,2	0	Boost2
2	49,2	0	Boost2
3	not assembled		
4	34,7	0	DC+In2
5	not assembled		
6	31,7	0	DC+In2
7	20,5	0	DC+In1
8	17,5	0	DC+In1
9	not assembled		
10	not assembled		
11	3	0	Boost1
12	0	0	Boost1
13	not assembled		
14	0	6	DC+
15	0	9	DC+
16	0	20,5	DC-
17	0	23,5	DC-
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-
30	52,2	9	DC+
31	52,2	6	DC+
32	not assembled		



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
T1, T2	MOSFET	1200 V	40 mΩ	Boost Switch	
D1, D2	FWD	1200 V	20 A	Boost Diode	
D5, D6	Rectifier	1600 V	35 A	Boost Sw. Protection Diode	
D3, D4	Rectifier	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.

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-FY12B2A040MR-L387L68-D2-14	27 Sep. 2021	Clearance value is updated Boost Switch static characteristics are updated Boost SW. Prot. Diode characteristics added New condition for Bypass diode forward voltage New datasheet format, module is unchanged	