Vincotech

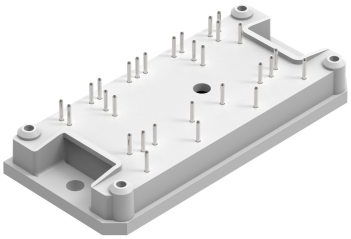
10-FY09S2A065ME-L869L08
datasheet

flowBOOST 1 symmetric dual **900 V / 65 mΩ**

Features

- Symmetric Boost for 1500Vdc applications
- Full SiC for ultra high speed frequencies

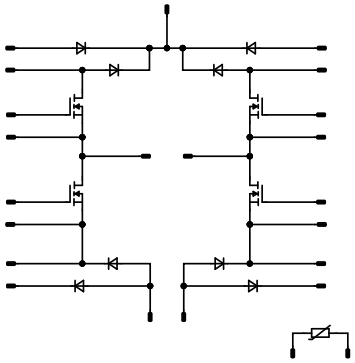
flow 1 12 mm housing



Target applications

- Solar Inverters

Schematic



Types

- 10-FY09S2A065ME-L869L08

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Boost Switch					
Drain-source voltage	V_{DSS}			900	V
Drain current	I_D	$T_j = T_{jmax}$	T_s = 80 °C T_s = 72 °C	24 26	A A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		90	A
Avalanche energy, single pulse	E_{AS}	V_{DD} = 50 V	I_D = 22 A	110	mJ
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	54	W
Gate-source voltage	V_{GSS}			-4 / 15	V
		dynamic		-8 / 19	
Maximum Junction Temperature	T_{jmax}			175	°C
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}	t_p limited by T_{jmax}		92	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 8,3 ms	T_j = 150 °C	66	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	87	W
Maximum junction temperature	T_{jmax}			175	°C
ByPass Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward average current	I_{FAV}	$T_j = T_{jmax}$	T_s = 80 °C	33	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	200	A
Surge current capability	I^2t			200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	43	W
Maximum junction temperature	T_{jmax}			150	°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			min. 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	$r_{DS(on)}$		15		20	25 125 150		63 79 87	78(1)	mΩ
Gate-source threshold voltage	$V_{GS(th)}$		0		0,005	25	1,7	2,4	3,5	V
Gate to Source Leakage Current	I_{GSS}		15	0		25		10	250	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	900		25		1	100	µA
Internal gate resistance	r_g							4,7		Ω
Gate charge	Q_g							30,4		
Gate to source charge	Q_{GS}		-4/15	400	20	25		7,5		nC
Gate to drain charge	Q_{GD}							12		
Short-circuit input capacitance	C_{iss}							660		
Short-circuit output capacitance	C_{oss}	f = 1 Mhz	0	600	0	25		60		pF
Reverse transfer capacitance	C_{rss}							4		
Diode forward voltage	V_{SD}		0		0	25		4,8		V
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,75		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$					25 125 150		6,4 6,2 6		ns
Rise time	t_r					25 125 150		3,2 3 3,2		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω				25 125 150		23,2 24,4 24,6		ns
Fall time	t_f		0/15	600	20	25 125 150		12,35 6,99 7,36		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,157 µC Q_{rFWD}=0,17 µC Q_{rFWD}=0,158 µC				25 125 150		0,122 0,117 0,115		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,036 0,033 0,034		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 1,74 1,84	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)						1,09		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt=7740 A/µs di/dt=8533 A/µs di/dt=8481 A/µs	0/15	600	20	25 125 150		33,83 36,8 35,98		A
Reverse recovery time	t_{rr}					25 125 150		8,65 8,62 8,67		ns
Recovered charge	Q_r					25 125 150		0,157 0,17 0,158		µC
Reverse recovered energy	E_{rec}					25 125 150		0,018 0,021 0,014		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		11350 11573 11522		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	
ByPass Diode										
Static										
Forward voltage	V_F				25	25 125		1,22 1,2		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)						1,61		K/W
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

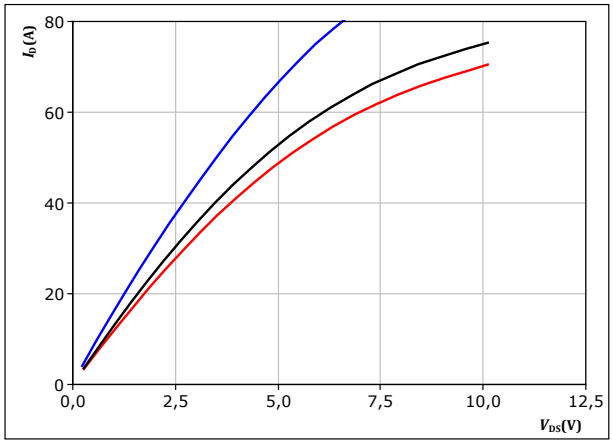
(2) Only valid with pre-applied Vincotech thermal interface material.

Boost Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$



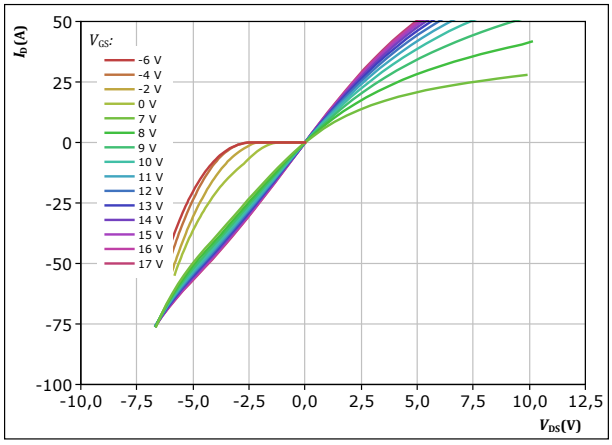
t_p = 250 µs
V_{GS} = 15 V

T_j: 25 °C, 125 °C, 150 °C

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

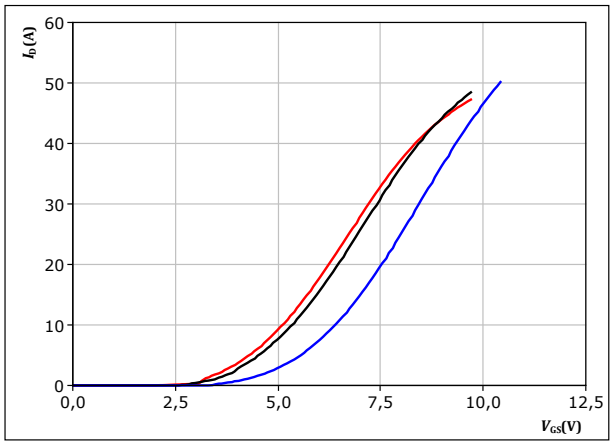


t_p = 250 µs
T_j = 150 °C
V_{GS} from -6 V to 17 V in steps of 2 V

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$



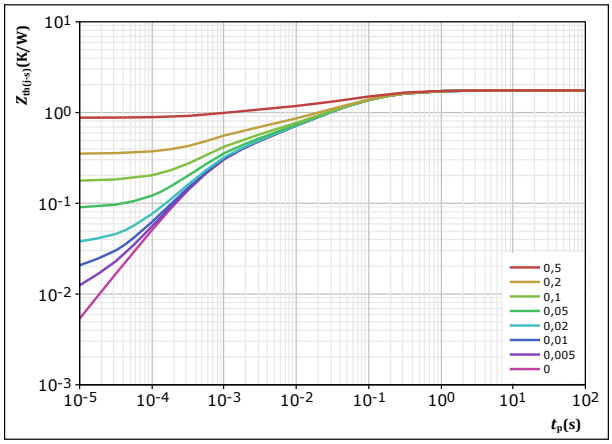
t_p = 250 µs
V_{DS} = 10 V

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
$R_{th(j-s)}$ = 1,751 K/W

MOSFET thermal model values

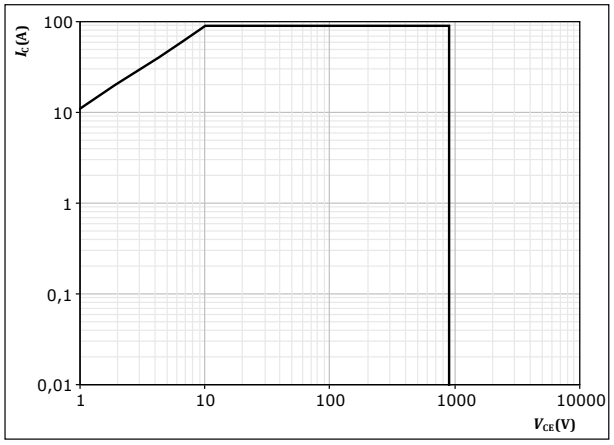
R (K/W)	τ (s)
1,68E-02	2,51E+00
2,14E-01	4,20E-01
6,08E-01	8,60E-02
4,08E-01	2,04E-02
2,18E-01	3,79E-03
2,87E-01	6,31E-04

Boost Switch Characteristics

figure 5. **MOSFET**

Safe operating area

$I_C = f(V_{CE})$

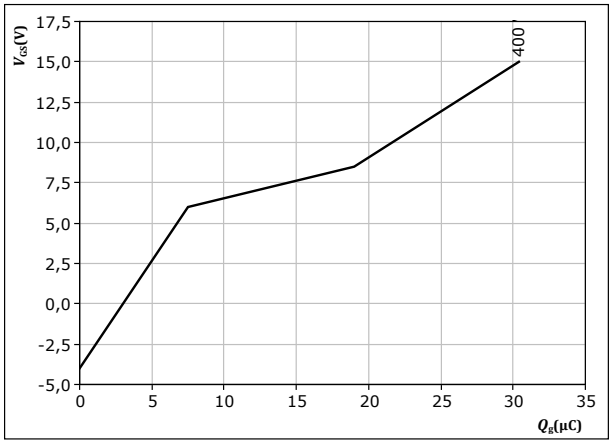


$D =$ single pulse
$T_s =$ 80 °C
$V_{GE} =$ 15 V
$T_j =$ T_{jmax}

figure 6. **MOSFET**

Gate voltage vs gate charge

$V_{GS} = f(Q_g)$



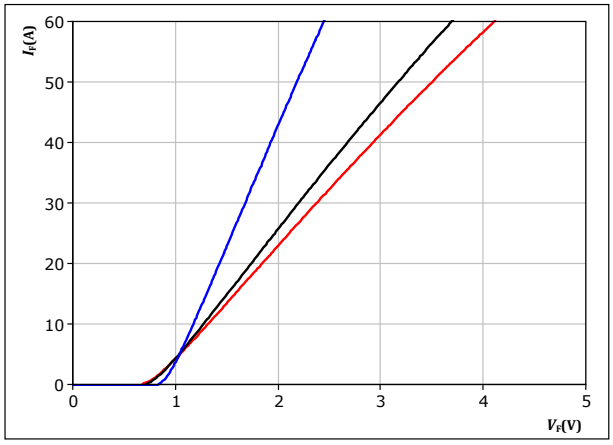
At $I_D =$ 38 A

Boost Diode Characteristics

figure 7. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



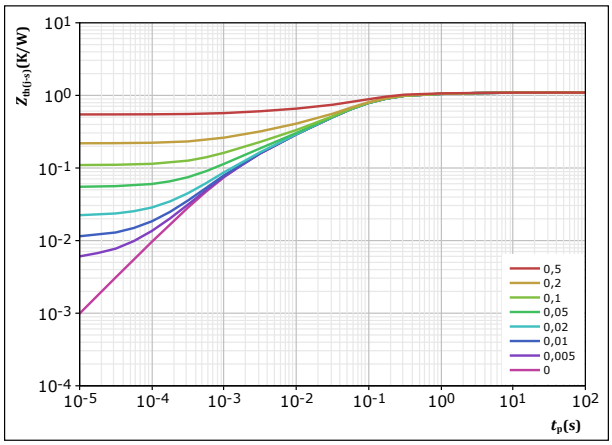
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 8. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,093 K/W

FWD thermal model values

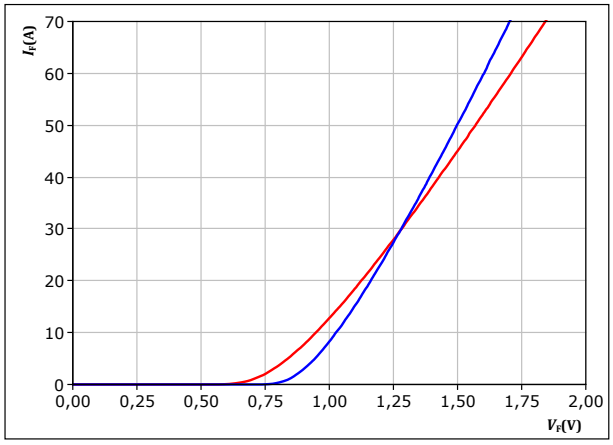
R (K/W)	τ (s)
4,73E-02	2,96E+00
1,05E-01	4,20E-01
5,77E-01	8,31E-02
1,79E-01	2,65E-02
1,16E-01	5,49E-03
6,86E-02	1,07E-03

ByPass Diode Characteristics

figure 9. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



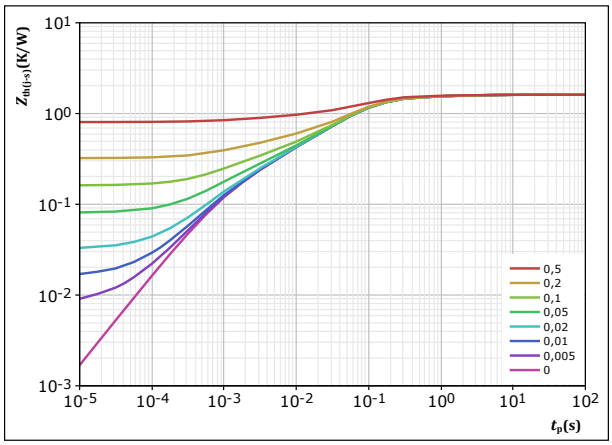
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 10. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,611 K/W

Rectifier thermal model values

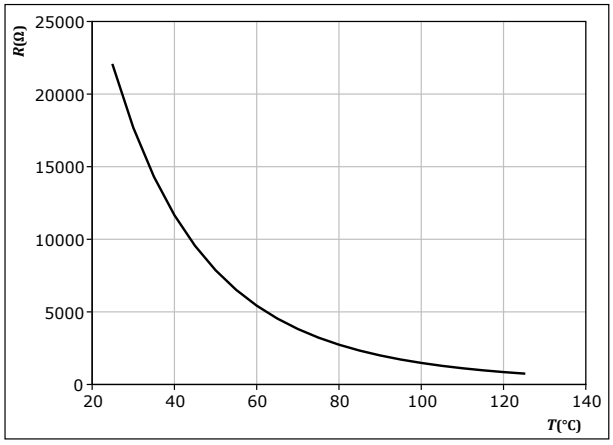
R (K/W)	τ (s)
6,72E-02	2,72E+00
1,48E-01	4,14E-01
8,68E-01	8,33E-02
2,53E-01	2,89E-02
1,69E-01	5,15E-03
1,06E-01	9,10E-04

Thermistor Characteristics

figure 11. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

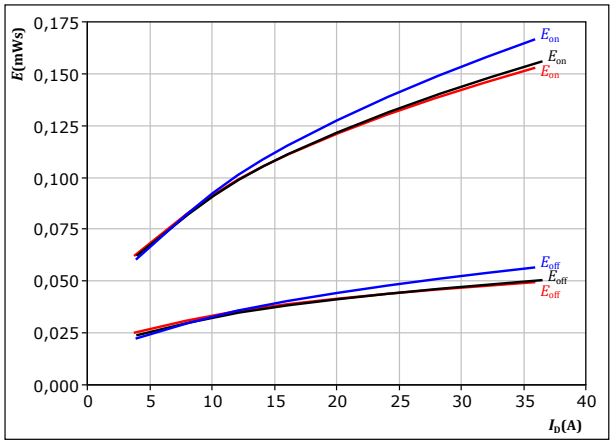


Boost Switching Characteristics

figure 12. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



With an inductive load at

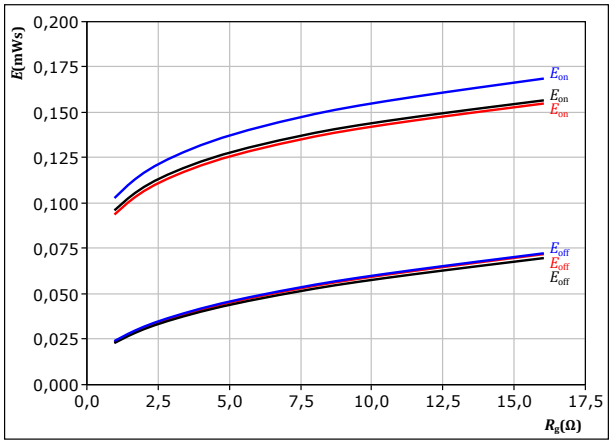
V_{DS} =	600	V
V_{GS} =	0/15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 13. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



With an inductive load at

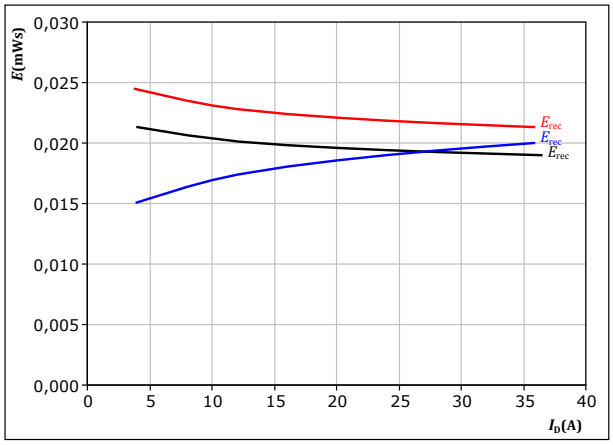
V_{DS} =	600	V
V_{GS} =	0/15	V
I_D =	20	A

T_j: 25 °C, 125 °C, 150 °C

figure 14. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



With an inductive load at

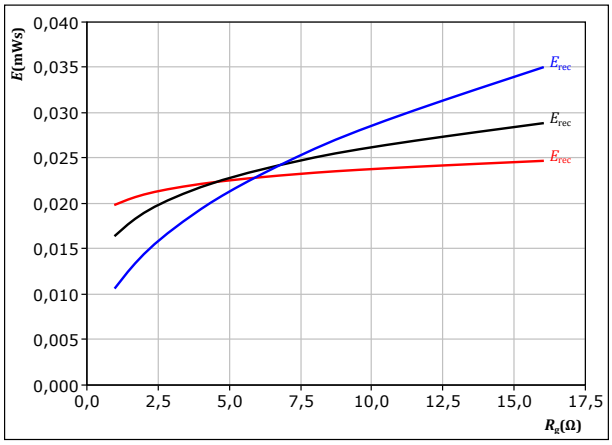
V_{DS} =	600	V
V_{GS} =	0/15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 15. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{DS} =	600	V
V_{GS} =	0/15	V
I_D =	20	A

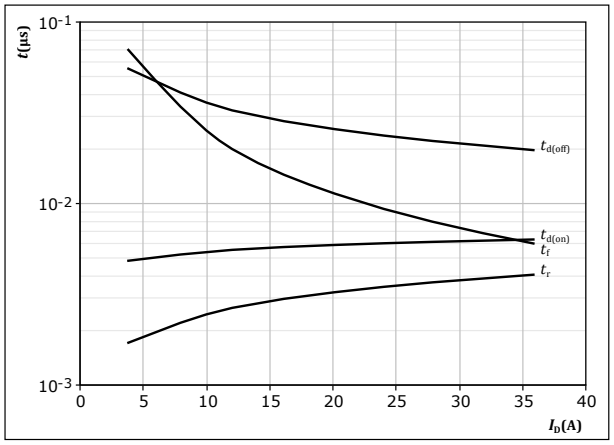
T_j: 25 °C, 125 °C, 150 °C

Boost Switching Characteristics

figure 16. **MOSFET**

Typical switching times as a function of drain current

t = f(I_D)



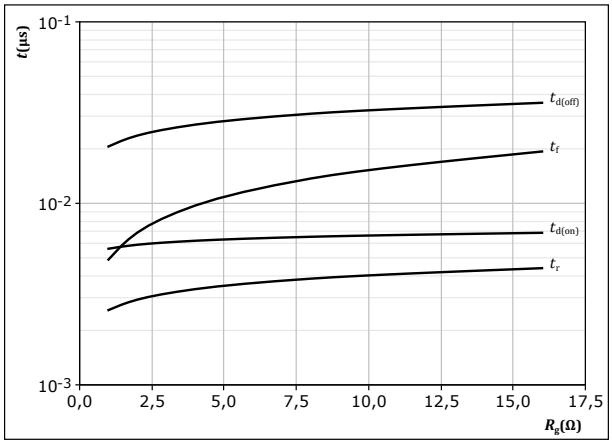
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	0/15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 17. **MOSFET**

Typical switching times as a function of gate resistor

t = f(R_g)



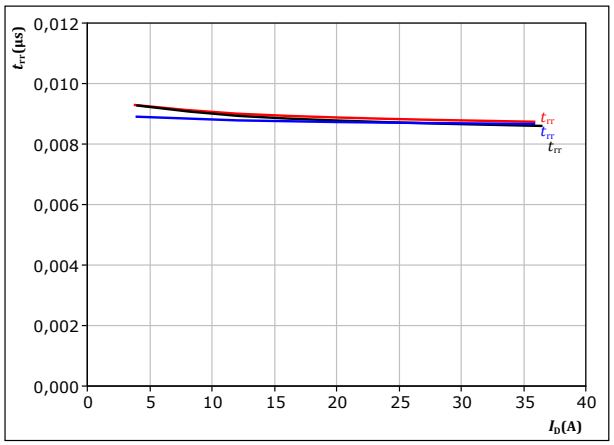
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	0/15	V
I_D =	20	A

figure 18. **FWD**

Typical reverse recovery time as a function of drain current

t_{rr} = f(I_D)

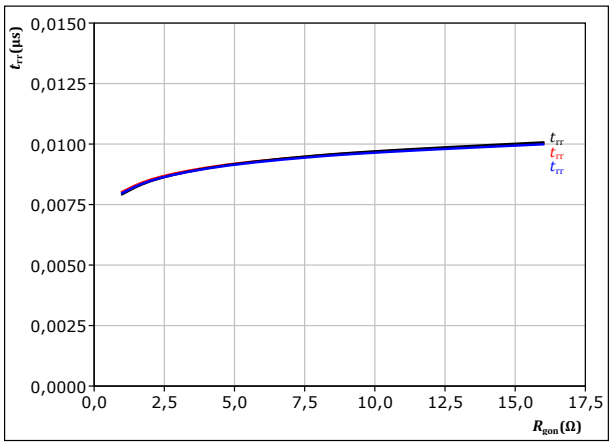


At	V_{DS} =	600	V	
	V_{GS} =	0/15	V	
	R_{gon} =	4	Ω	
T_j:				25 °C
				125 °C
				150 °C

figure 19. **FWD**

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

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



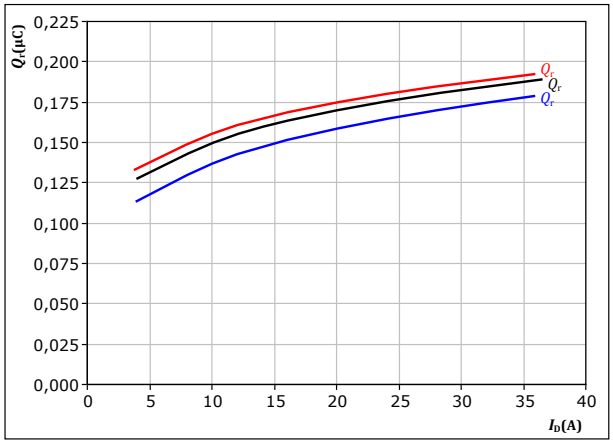
At	V_{DS} =	600	V	
	V_{GS} =	0/15	V	
	I_D =	20	A	
T_j:				25 °C
				125 °C
				150 °C

Boost Switching Characteristics

figure 20. **FWD**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

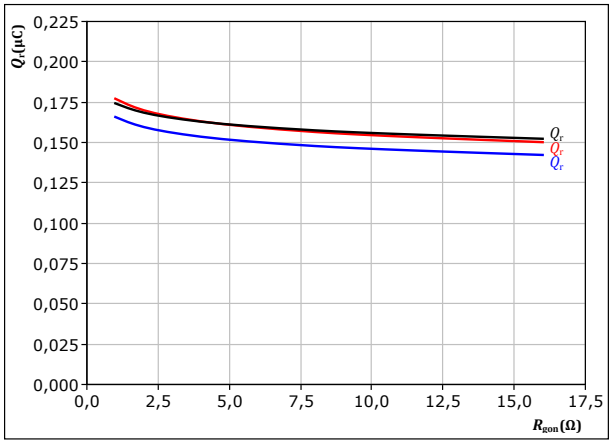


At					
	V_{DS} =	600	V		
	V_{GS} =	0/15	V	T_j:	25 °C
	R_{gon} =	4	Ω		125 °C
					150 °C

figure 21. **FWD**

Typical recovered charge as a function of turn on gate resistor

$Q_r = f(R_{gon})$

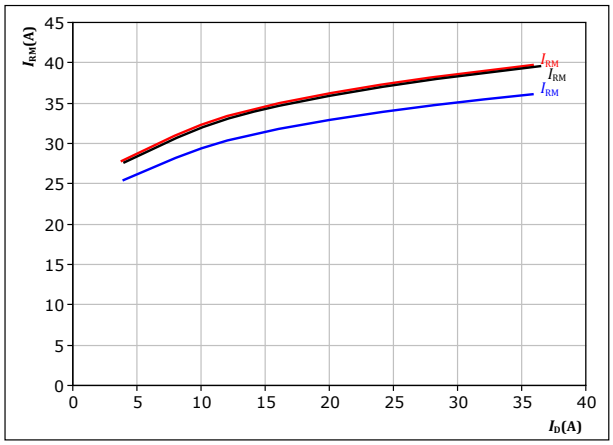


At					
	V_{DS} =	600	V		
	V_{GS} =	0/15	V	T_j:	25 °C
	I_D =	20	A		125 °C
					150 °C

figure 22. **FWD**

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

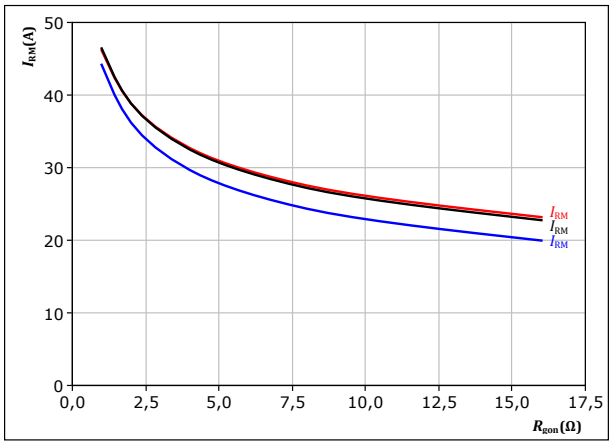


At					
	V_{DS} =	600	V		
	V_{GS} =	0/15	V	T_j:	25 °C
	R_{gon} =	4	Ω		125 °C
					150 °C

figure 23. **FWD**

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

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



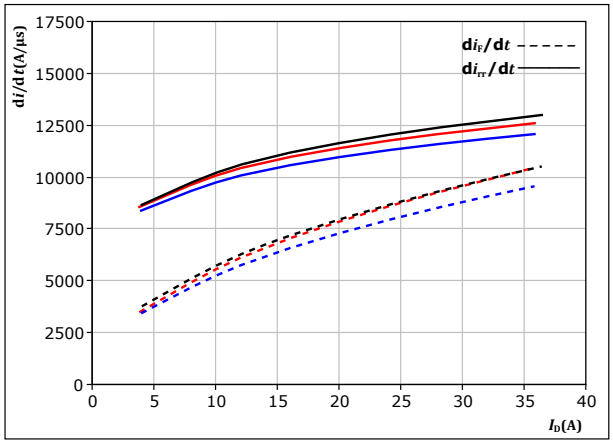
At					
	V_{DS} =	600	V		
	V_{GS} =	0/15	V	T_j:	25 °C
	I_D =	20	A		125 °C
					150 °C

Boost Switching Characteristics

figure 24. **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)

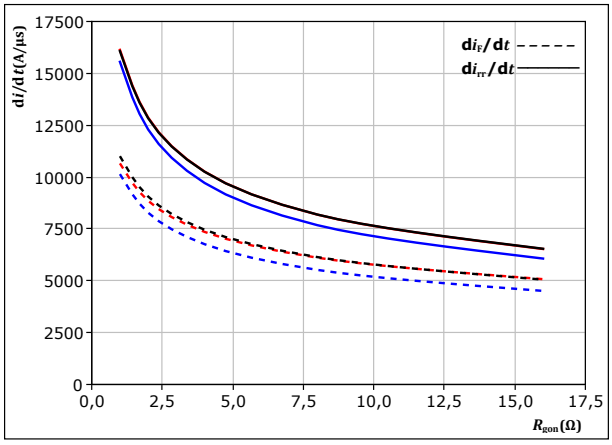


At					
	V_{DS} =	600	V		
	V_{GS} =	0/15	V	T_j:	25 °C
	R_{gon} =	4	Ω		125 °C
					150 °C

figure 25. **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})

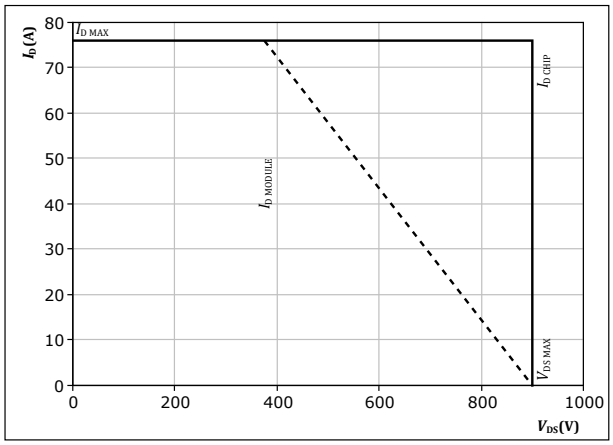


At					
	V_{DS} =	600	V		
	V_{GS} =	0/15	V	T_j:	25 °C
	I_D =	20	A		125 °C
					150 °C

figure 26. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



At			
	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Boost Switching Definitions

figure 27. MOSFET

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

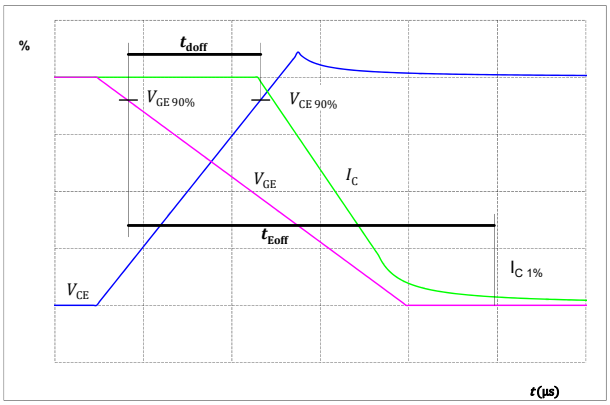


figure 28. MOSFET

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

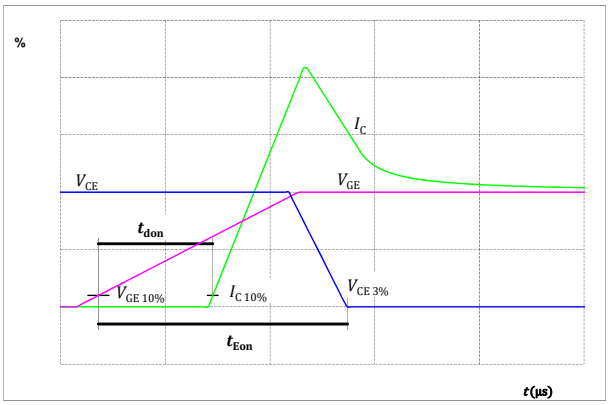


figure 29. MOSFET

Turn-off Switching Waveforms & definition of t_f

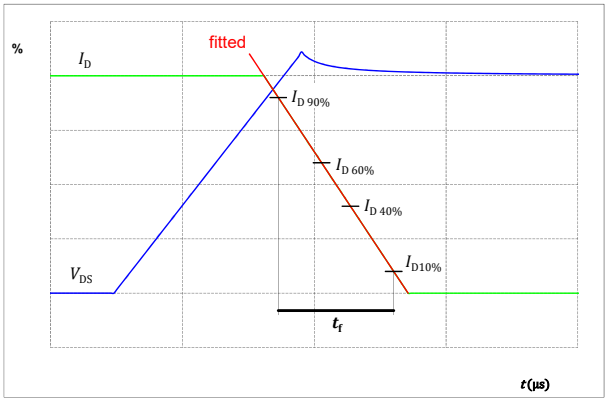
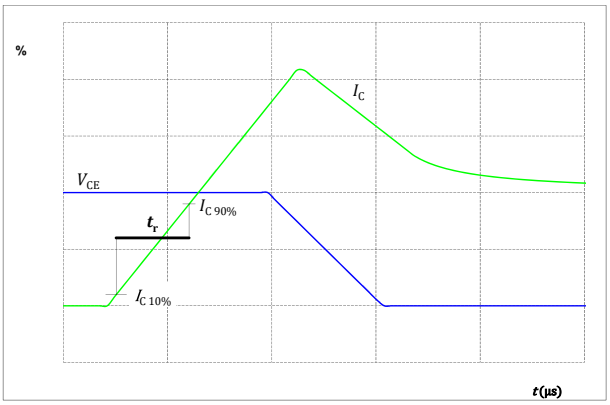


figure 30. MOSFET

Turn-on Switching Waveforms & definition of t_r



Boost Switching Definitions

figure 31. **FWD**

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

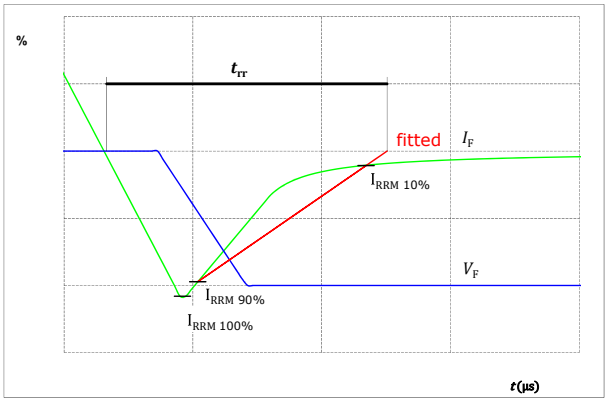


figure 32. **FWD**

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

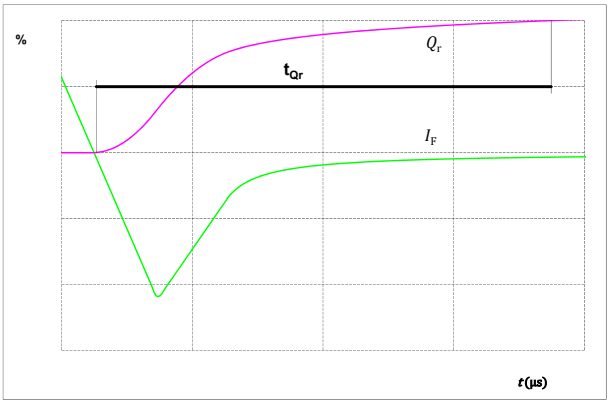
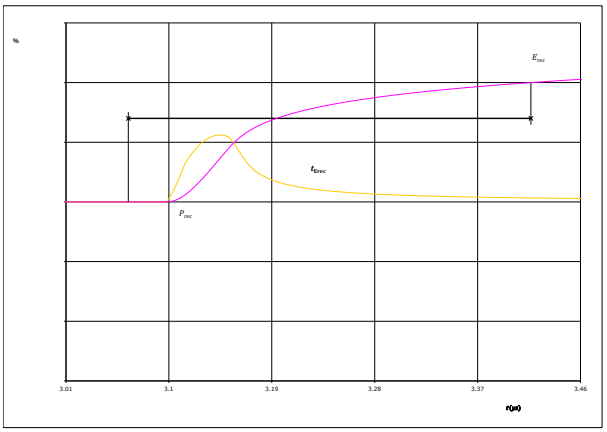


figure 33. **FWD**

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



Ordering Code

Version	Ordering Code
Without thermal paste	10-FY09S2A065ME-L869L08

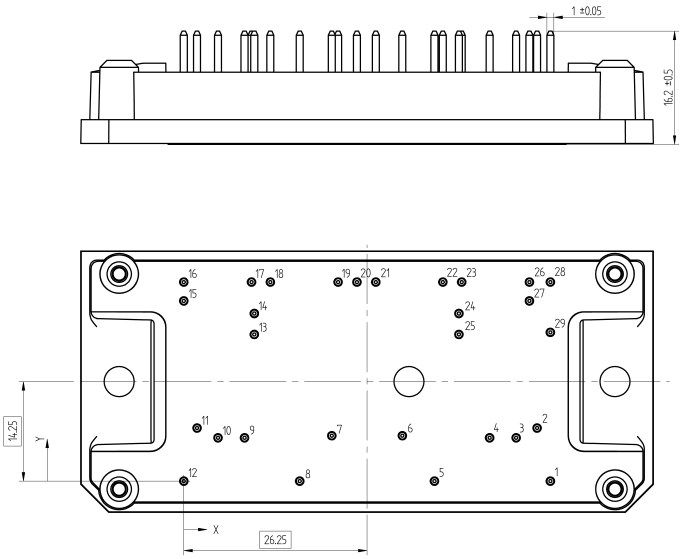
Marking

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

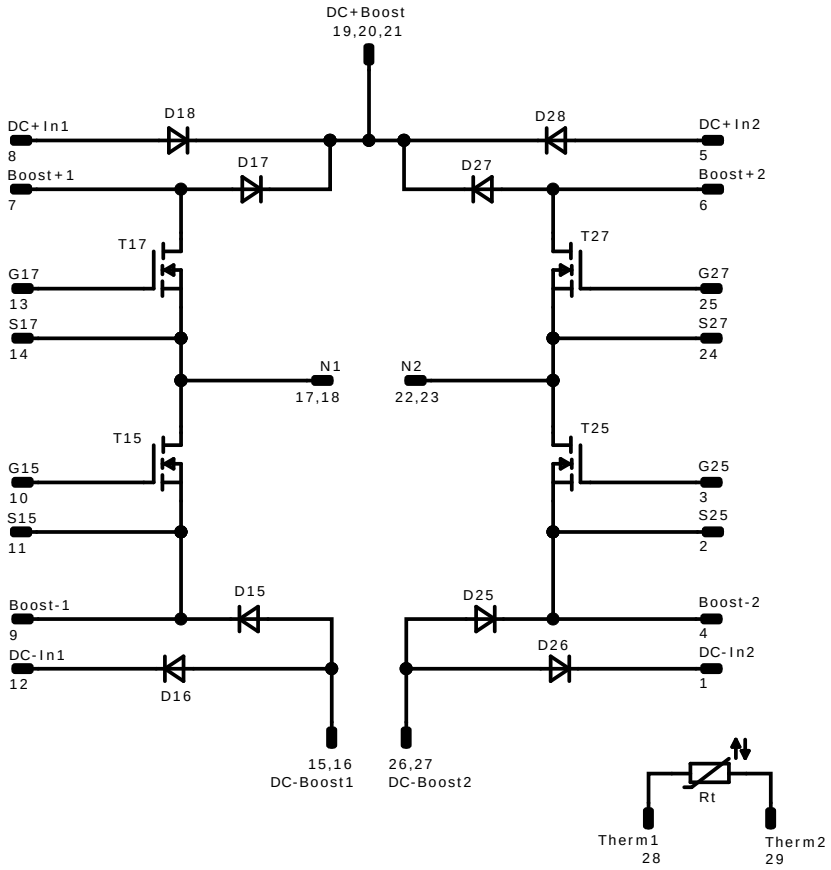
Outline

Pin table [mm]

Pin	X	Y	Function
1	52,5	0	DC-In2
2	50,6	7,6	S25
3	47,6	6,2	G25
4	43,8	6,2	Boost-2
5	35,9	0	DC+In2
6	31,3	6,5	Boost+2
7	21,2	6,5	Boost+1
8	16,6	0	DC+In1
9	8,7	6,2	Boost-1
10	4,9	6,2	G15
11	1,9	7,6	S15
12	0	0	DC-In1
13	10,1	21	G17
14	10,1	24	S17
15	0	25,8	DC-Boost1
16	0	28,5	DC-Boost1
17	9,7	28,5	N1
18	12,4	28,5	N1
19	22,1	28,5	DC+Boost
20	24,8	28,5	DC+Boost
21	27,5	28,5	DC+Boost
22	37,1	28,5	N2
23	39,8	28,5	N2
24	39,4	24	S27
25	39,4	21	G27
26	49,5	28,5	DC-Boost2
27	49,5	25,8	DC-Boost2
28	52,5	28,5	Therm1
29	52,5	21,3	Therm2



Pinout



Identification					
ID	**Component**	**Voltage**	**Current**	**Function**	**Comment**
T15, T17, T25, T27	MOSFET	900 V	65 mΩ	Boost Switch	
D15, D17, D25, D27	FWD	1200 V	20 A	Boost Diode	
D16, D18, D26, D28	Rectifier	1600 V	25 A	ByPass 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.

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-FY09S2A065ME-L869L08-D4-14	17 Jul. 2019	I_D extended	2
10-FY09S2A065ME-L869L08-D5-14	23 Jun. 2020	Correction of Boost characteristics	2...9
		Calculation method of RBSOA (figure 26.) changed	15