Vincotech

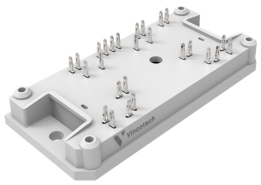
10-PY12B2A040MS-LP25L08Y
datasheet

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

Features

- Dual Booster
- High Performance Flying Capacitor Topology
- Latest SiC Technology
- Optimized for 1500 Vdc applications
- Integrated flying capacitors
- Integrated DC link capacitors
- Integrated NTC
- Low inductance housing

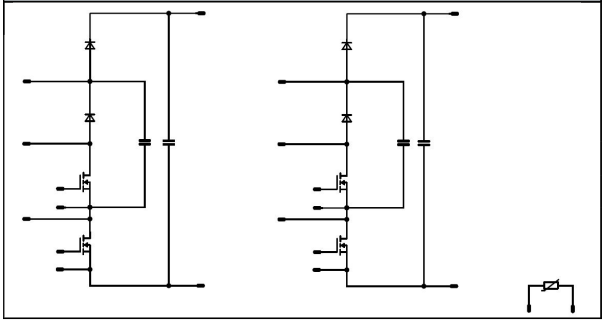
flow 1 12 mm housing



Target applications

- Power Supply
- Solar Inverters
- UPS

Schematic



Types

- 10-PY12B2A040MS-LP25L08Y

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	46	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}	136	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	89	W
Gate-source voltage	V_{GSS}		0 / 22	V
		dynamic	-5 / 22	
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	47	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	112	W
Maximum junction temperature	T_{jmax}		175	°C
Flying Capacitor				
Maximum DC voltage	V_{MAX}		1000	V
Operation Temperature	T_{op}		0 ... 125	°C
Capacitor (DC)				
Maximum DC voltage	V_{MAX}		1500	V
Operation Temperature	T_{op}		0 ... 125	°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
Creepage distance			>12,7	mm
Clearance			12,02	mm
Comparative Tracking Index	CTI		≥ 600	

*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		30	25 125 150		36 38 42	50(1)	mΩ
Gate-source threshold voltage	$V_{GS(th)}$		0		0,003	25	3,6	4,6	5,6	V
Gate to Source Leakage Current	I_{GSS}		22	0		25			400	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25			100	µA
Internal gate resistance	r_g							1,5		Ω
Short-circuit input capacitance	C_{iss}		0	10	0	25		4000		pF
Reverse transfer capacitance	C_{rss}							92		
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,07		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 8 Ω R_{goff} = 8 Ω	0/18	700	30	25 125 150		22,4 17,92 17,28		ns
Rise time	t_r					25 125 150		16,32 12,8 12,48		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		70,08 83,84 88,32		ns
Fall time	t_f					25 125 150		17,14 18,37 18,4		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,173 µC Q_{rFWD}=0,218 µC Q_{rFWD}=0,224 µC				25 125 150		0,818 0,631 0,609		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,131 0,128 0,131		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				30	25 125 150		1,41 1,66 1,78	2(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			900	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,85		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt=2054 A/µs di/dt=2801 A/µs di/dt=2985 A/µs	0/18	700	30	25 125 150		12,59 16,94 18,05		A
Reverse recovery time	t_{rr}					25 125 150		14,2 13,57 13,59		ns
Recovered charge	Q_r					25 125 150		0,173 0,218 0,224		µC
Reverse recovered energy	E_{rec}					25 125 150		0,027 0,05 0,053		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		2590 3537 3695		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	
Flying Capacitor										
Static										
Capacitance	C	DC bias voltage = 0 V				25		47		nF
Tolerance							-10		10	%
Capacitor (DC)										
Static										
Capacitance	C	DC bias voltage = 0 V				25		33		nF
Tolerance							-10		10	%
Dissipation factor		f = 1 kHz				25		2,5		%
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

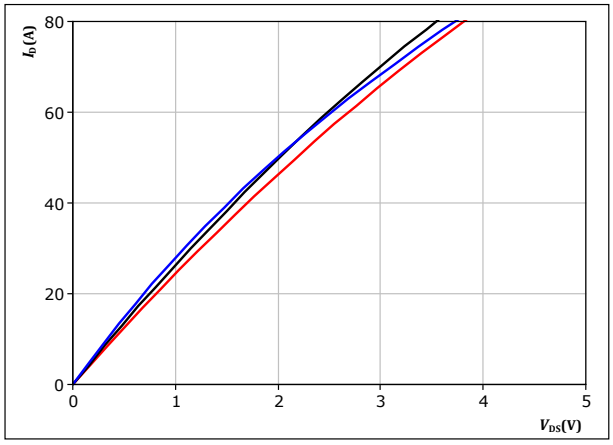
(2) Only valid with pre-applied Vincotech thermal interface material.

Boost Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

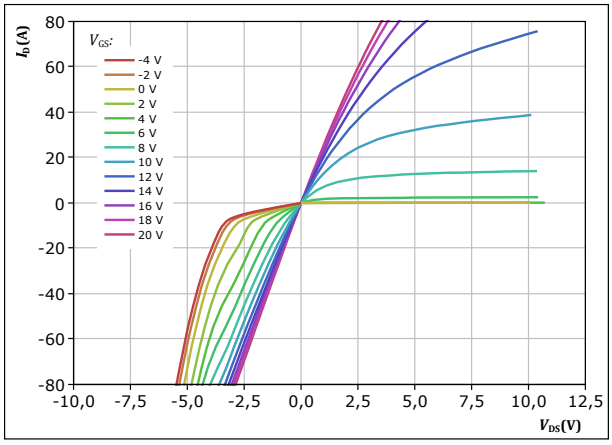


t_p =	250	µs		
V_{GS} =	18	V	T_j:	25 °C
				125 °C
				150 °C

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$



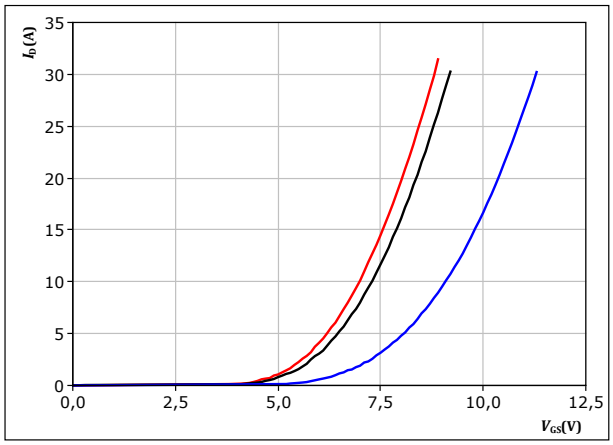
t_p =	250	µs
T_j =	150	°C

V_{GS} from -4 V to 20 V in steps of 2 V

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

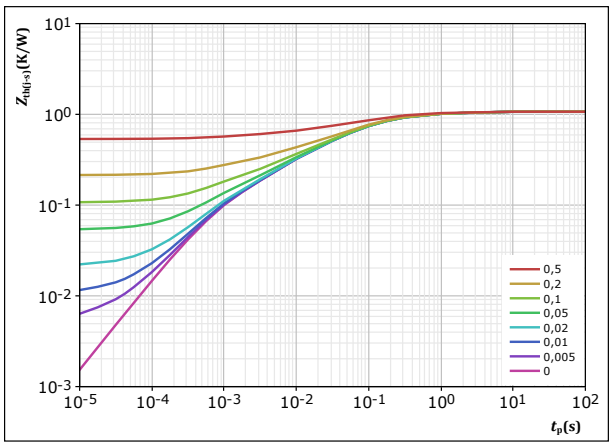


t_p =	250	µs		
V_{DS} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,069	K/W

MOSFET thermal model values

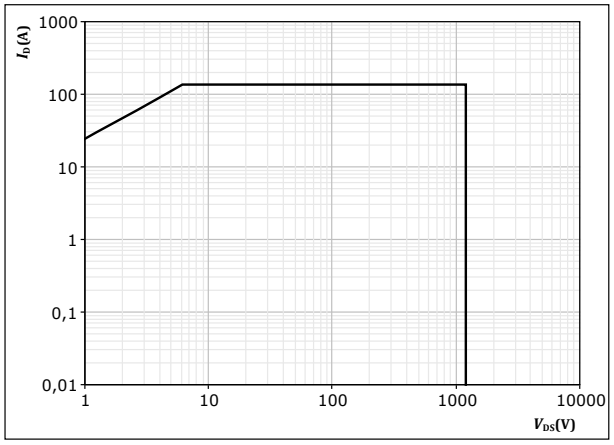
R (K/W)	τ (s)
6,75E-02	2,73E+00
2,22E-01	3,09E-01
4,61E-01	6,60E-02
2,27E-01	8,32E-03
9,22E-02	7,76E-04

Boost Switch Characteristics

figure 5. **MOSFET**

Safe operating area

$I_D = f(V_{DS})$



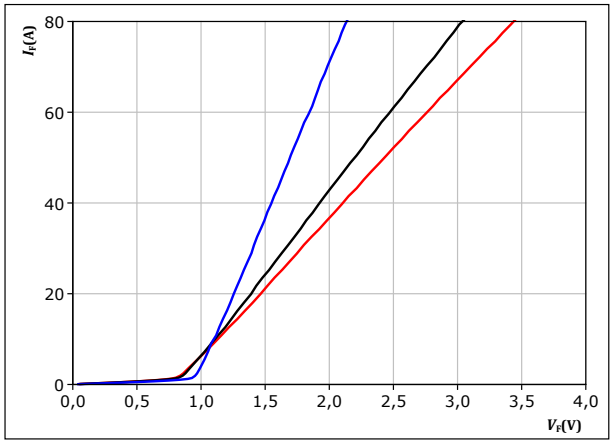
D =	single pulse	
T_s =	80	°C
V_{GS} =	18	V
T_j =	T_{jmax}	

Boost Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



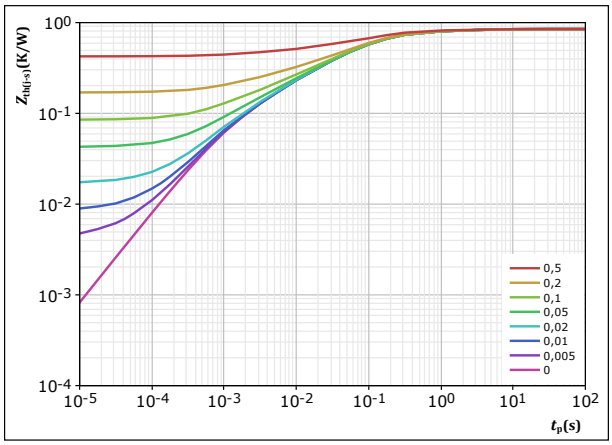
t_p = 250 µs

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

$R_{th(j-s)}$ = 0,849 K/W

FWD thermal model values

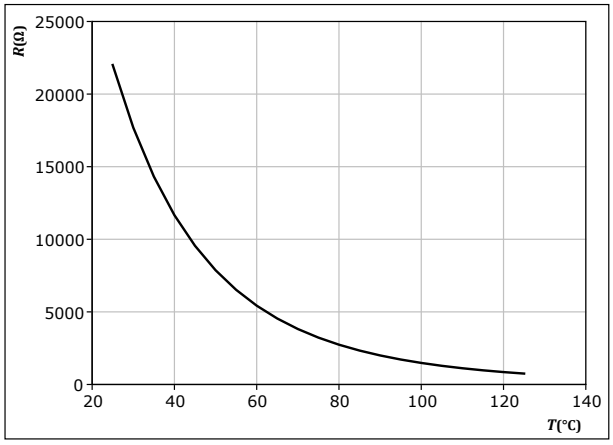
R (K/W)	τ (s)
5,03E-02	3,42E+00
1,42E-01	3,82E-01
4,17E-01	7,83E-02
1,75E-01	9,68E-03
6,57E-02	1,12E-03

Thermistor Characteristics

figure 8. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

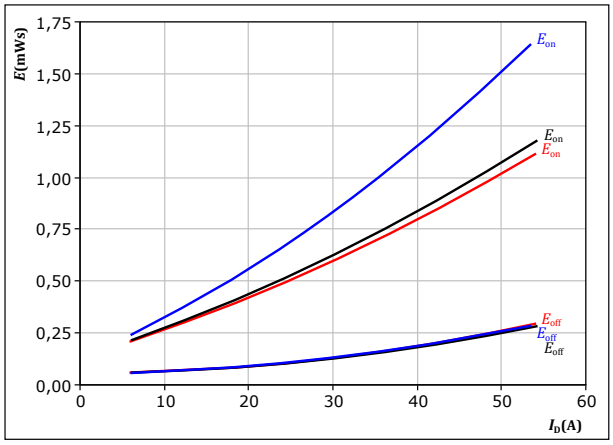


Boost Switching Characteristics

figure 9. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



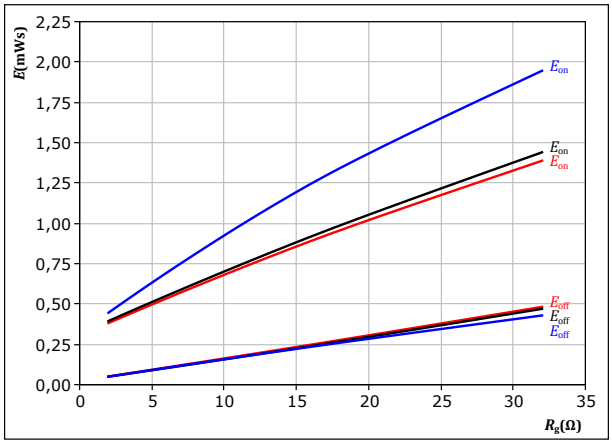
With an inductive load at

V_{DS} =	700	V	T_j: 25 °C
V_{GS} =	0/18	V	125 °C
R_{gon} =	8	Ω	150 °C
R_{goff} =	8	Ω	

figure 10. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



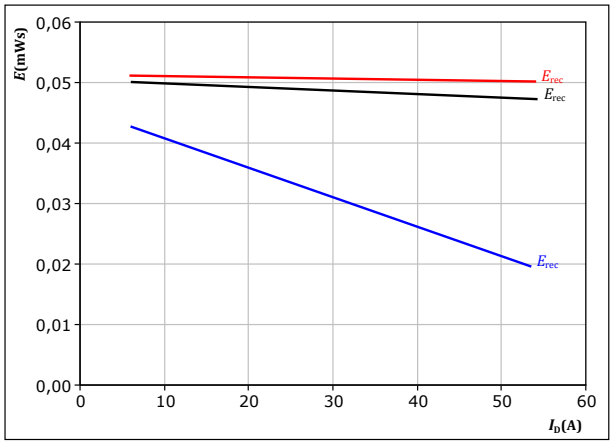
With an inductive load at

V_{DS} =	700	V	T_j: 25 °C
V_{GS} =	0/18	V	125 °C
I_D =	30	A	150 °C

figure 11. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



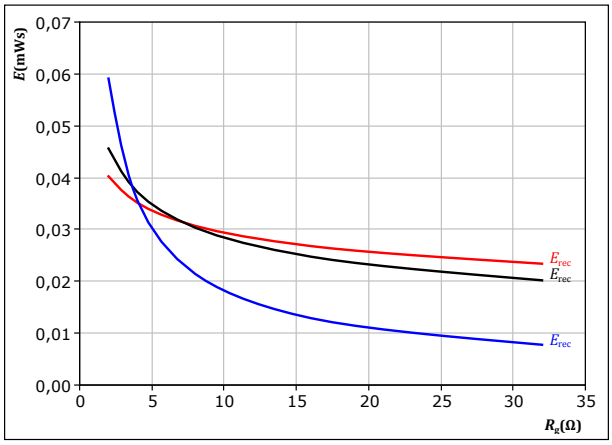
With an inductive load at

V_{DS} =	700	V	T_j: 25 °C
V_{GS} =	0/18	V	125 °C
R_{gon} =	8	Ω	150 °C

figure 12. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

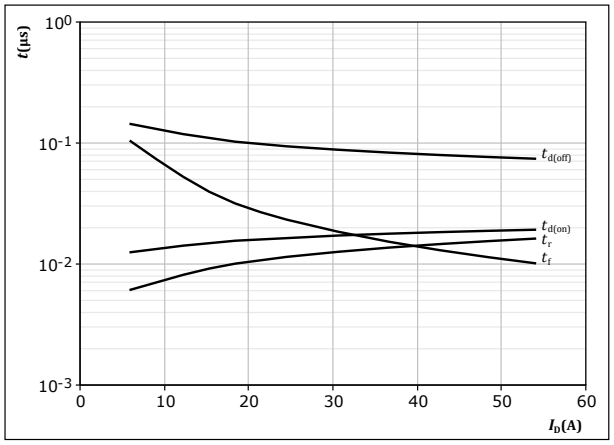
V_{DS} =	700	V	T_j: 25 °C
V_{GS} =	0/18	V	125 °C
I_D =	30	A	150 °C

Boost Switching Characteristics

figure 13. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



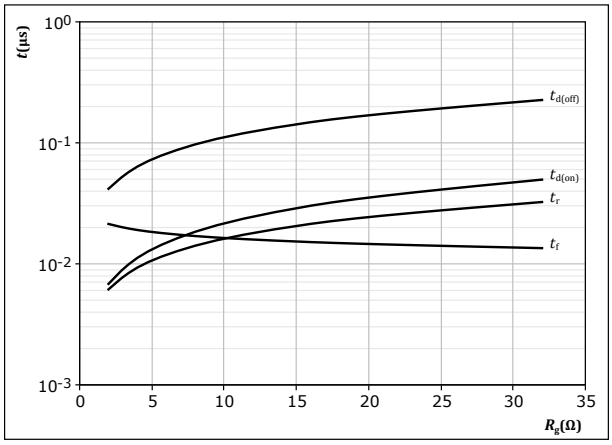
With an inductive load at

T_j =	150	°C
V_{DS} =	700	V
V_{GS} =	0/18	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 14. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



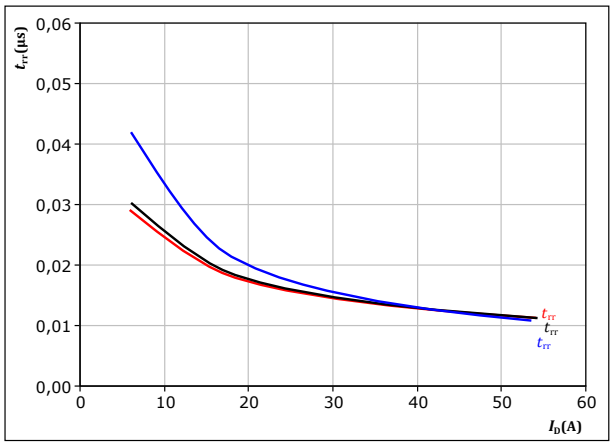
With an inductive load at

T_j =	150	°C
V_{DS} =	700	V
V_{GS} =	0/18	V
I_D =	30	A

figure 15. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



At

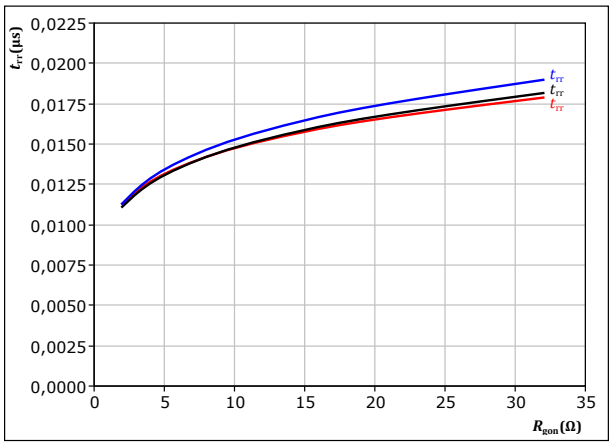
V_{DS} =	700	V
V_{GS} =	0/18	V
R_{gon} =	8	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 16. **FWD**

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

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



At

V_{DS} =	700	V
V_{GS} =	0/18	V
I_D =	30	A

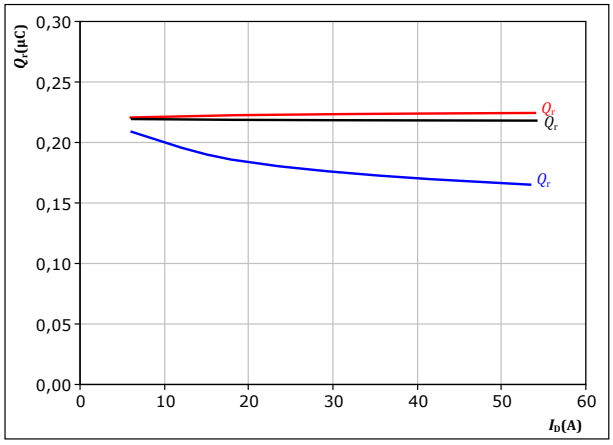
T_j: 25 °C, 125 °C, 150 °C

Boost Switching Characteristics

figure 17. **FWD**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

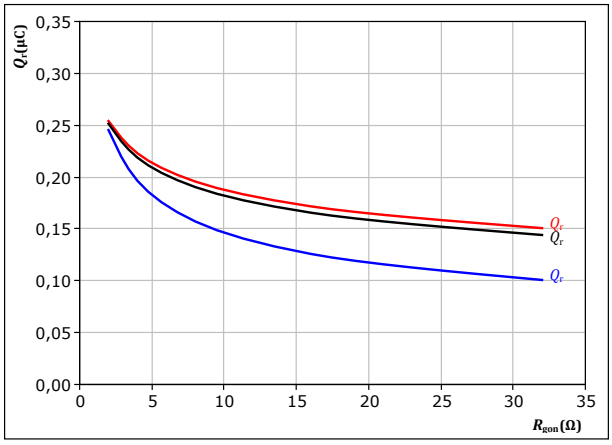


At					
	V_{DS} =	700	V		
	V_{GS} =	0/18	V	T_j:	25 °C, 125 °C, 150 °C
	R_{gon} =	8	Ω		

figure 18. **FWD**

Typical recovered charge as a function of turn on gate resistor

$Q_r = f(R_{gon})$

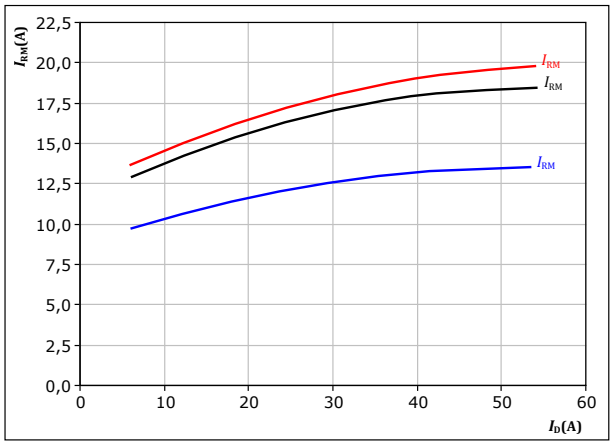


At					
	V_{DS} =	700	V		
	V_{GS} =	0/18	V	T_j:	25 °C, 125 °C, 150 °C
	I_D =	30	A		

figure 19. **FWD**

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

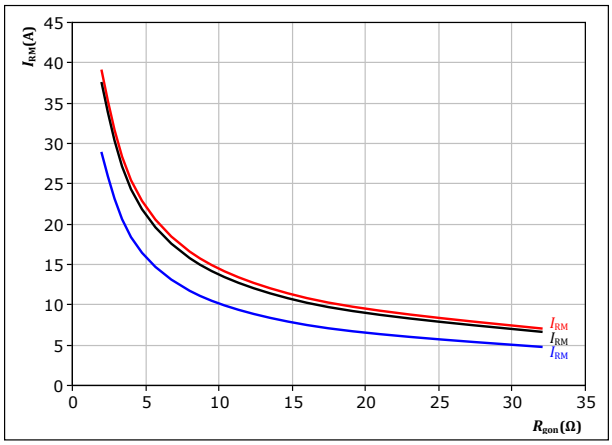


At					
	V_{DS} =	700	V		
	V_{GS} =	0/18	V	T_j:	25 °C, 125 °C, 150 °C
	R_{gon} =	8	Ω		

figure 20. **FWD**

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

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



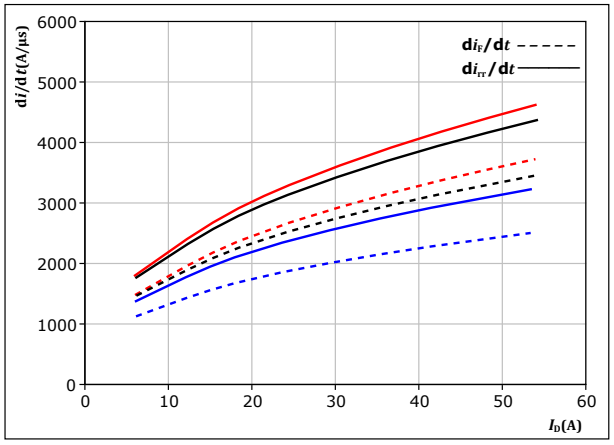
At					
	V_{DS} =	700	V		
	V_{GS} =	0/18	V	T_j:	25 °C, 125 °C, 150 °C
	I_D =	30	A		

Boost Switching Characteristics

figure 21. **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)

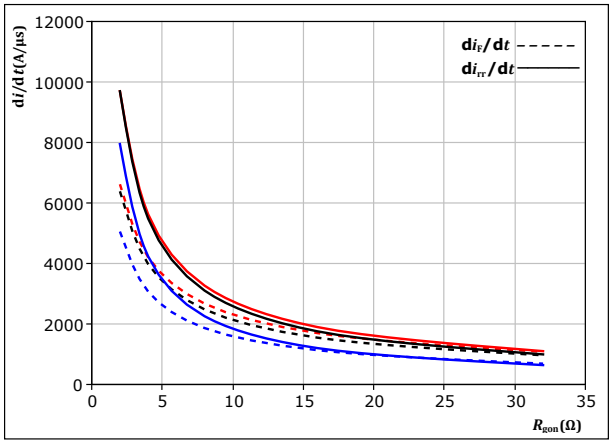


At					
	V_{DS} =	700	V		
	V_{GS} =	0/18	V	T_j:	25 °C
	R_{gon} =	8	Ω		125 °C
					150 °C

figure 22. **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})

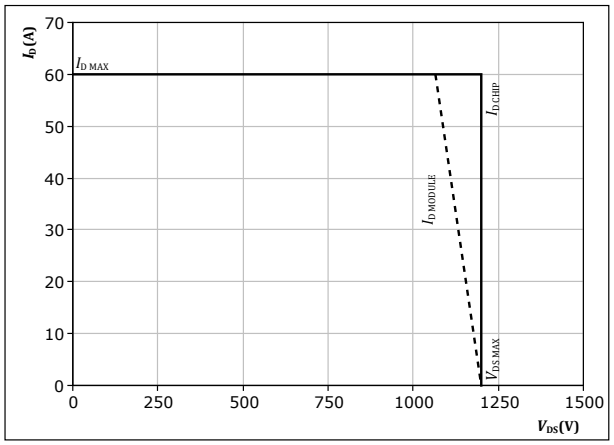


At					
	V_{DS} =	700	V		
	V_{GS} =	0/18	V	T_j:	25 °C
	I_D =	30	A		125 °C
					150 °C

figure 23. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



At			
	T_j =	150	°C
	R_{gon} =	8	Ω
	R_{goff} =	8	Ω

Boost Switching Definitions

figure 24. MOSFET

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

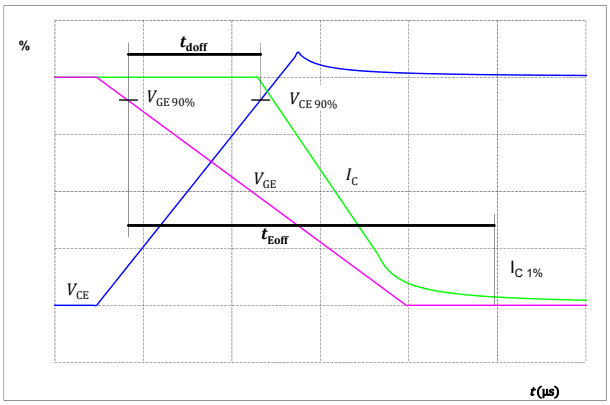


figure 25. MOSFET

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

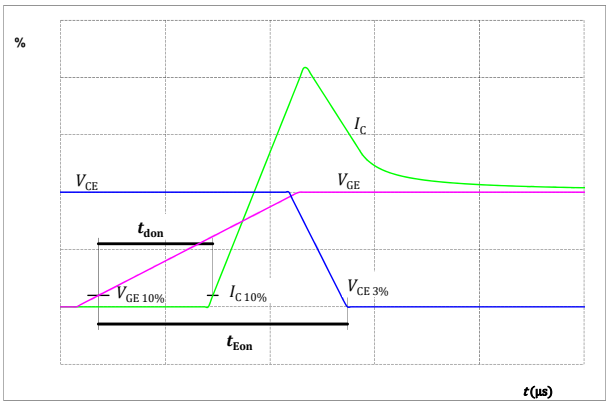


figure 26. MOSFET

Turn-off Switching Waveforms & definition of t_f

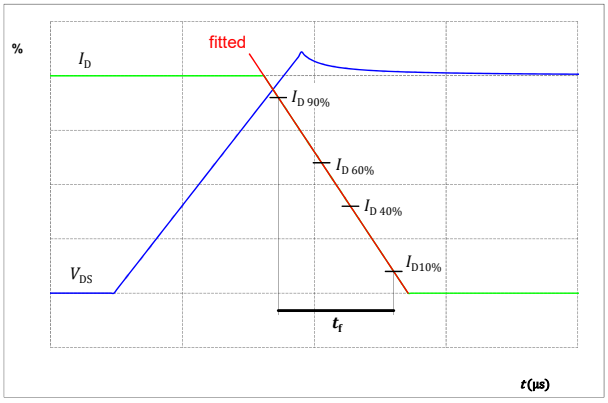
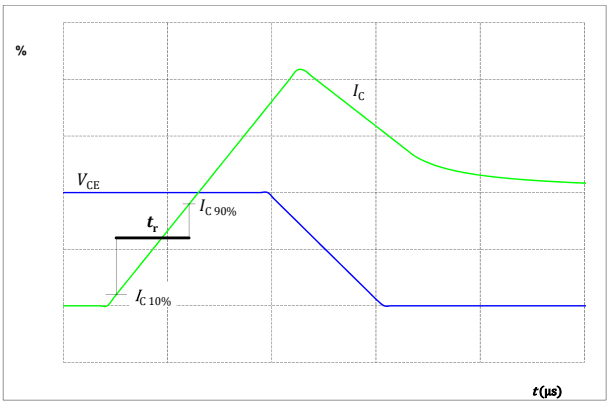


figure 27. MOSFET

Turn-on Switching Waveforms & definition of t_r



Boost Switching Definitions

figure 28. **FWD**

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

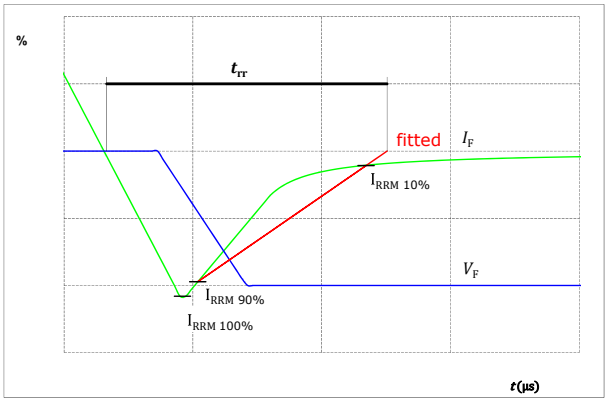


figure 29. **FWD**

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

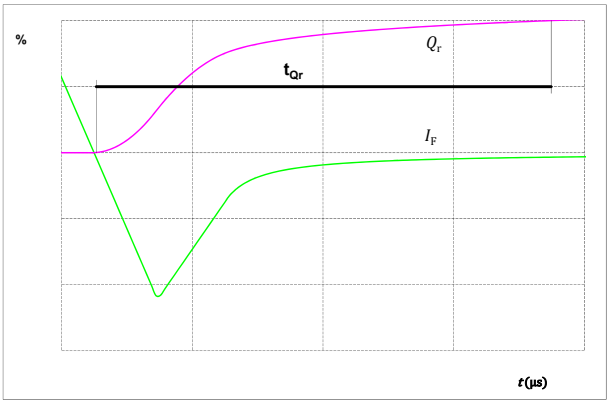
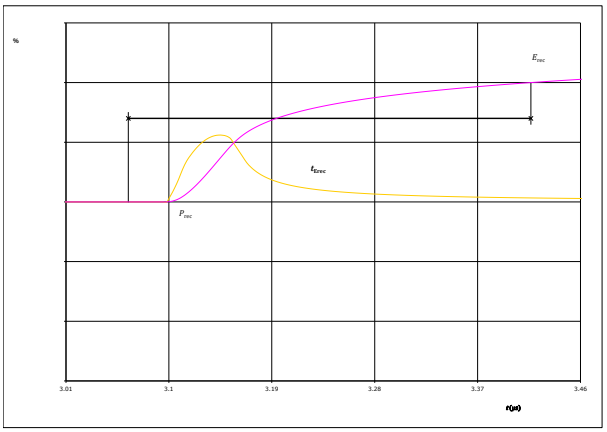


figure 30. **FWD**

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



Ordering Code

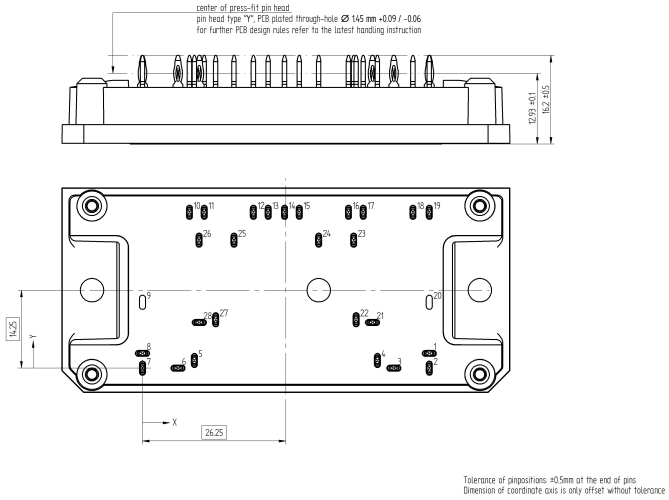
Version	Ordering Code
Without thermal paste	10-PY12B2A040MS-LP25L08Y
With thermal paste	10-PY12B2A040MS-LP25L08Y-/3/

Marking

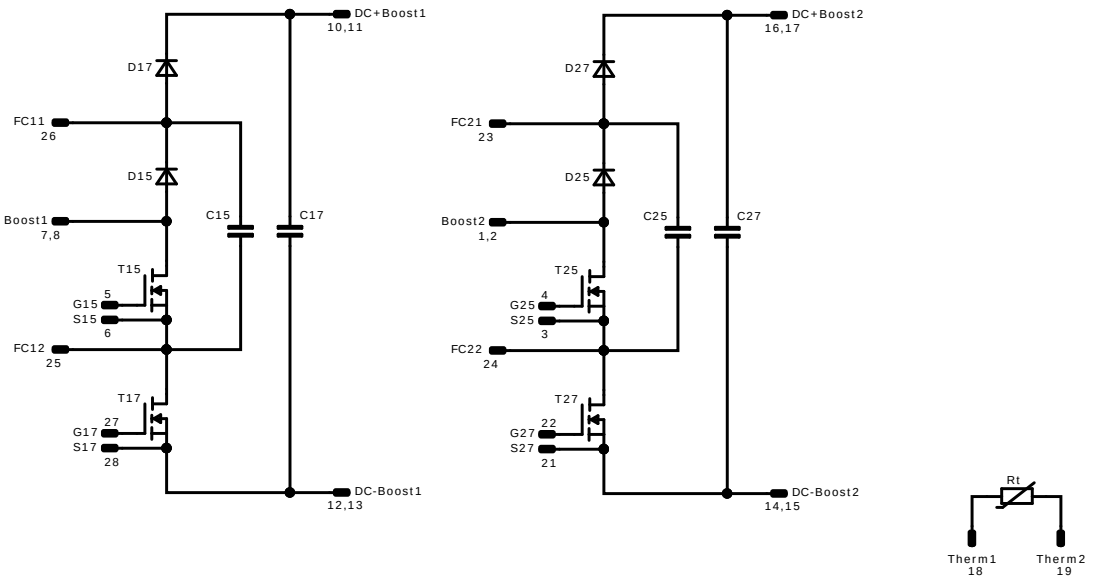
	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Function
1	52,5	2,7	Boost2
2	52,5	0	Boost2
3	46	0	S25
4	43	1,4	G25
5	9,5	1,4	G15
6	6,5	0	S15
7	0	0	Boost1
8	0	2,7	Boost1
9	not assembled		
10	8,6	28,5	DC+Boost1
11	11,3	28,5	DC+Boost1
12	20,3	28,5	DC-Boost1
13	23	28,5	DC-Boost1
14	26	28,5	DC-Boost2
15	28,7	28,5	DC-Boost2
16	37,7	28,5	DC+Boost2
17	40,4	28,5	DC+Boost2
18	49,5	28,5	Therm1
19	52,5	28,5	Therm2
20	not assembled		
21	42,1	8,35	S27
22	39,1	8,85	G27
23	38,65	23,4	FC21
24	32,25	23,4	FC22
25	16,75	23,4	FC12
26	10,35	23,4	FC11
27	13,4	8,85	G17
28	10,4	8,35	S17



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T15, T17, T25, T27	MOSFET	1200 V	40 mΩ	Boost Switch	
D15, D17, D25, D27	FWD	1200 V	30 A	Boost Diode	
C15, C25	Capacitor	1000 V		Flying Capacitor	
C17, C27	Capacitor	1500 V		Capacitor (DC)	
Rt	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-PY12B2A040MS-LP25L08Y-D1-14	31 Mar. 2021	Initial Release	