



Vincotech

10-EY12NMA009MS-LS28F78T

datasheet

flowMNPC E2 SiC

1200 V / 8,5 mΩ

Topology features

- Kelvin Emitter for improved switching performance
- Temperature sensor
- Mixed Voltage Neutral Point Clamped Topology (T-Type)

Component features

- High Blocking Voltage with low drain source on state resistance
- High speed SiC-MOSFET technology
- Resistant to Latch-up

Housing features

- Base isolation: Al₂O₃
- Convex shaped substrate for superior thermal contact
- Compact housing
- CTI600 housing material
- Thermo-mechanical push-and-pull force relief
- Press-fit pin
- Reliable cold welding connection

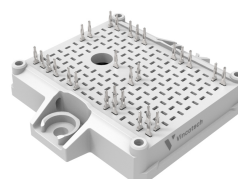
Target applications

- Charging Stations
- Industrial Drives
- Power Supply
- Solar Inverters
- UPS

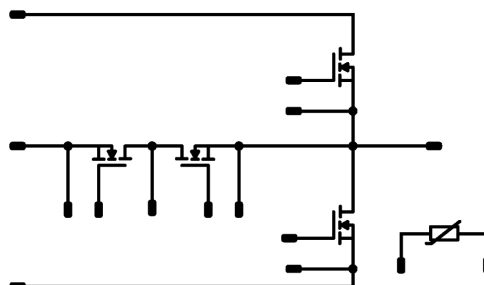
Types

- 10-EY12NMA009MS-LS28F78T

flow E2 12 mm housing



Schematic





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Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Buck Switch				
Drain-source voltage	V_{DS}		1200	V
Drain current (DC current)	I_D	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	124	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}	568	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	180	W
Gate-source voltage	V_{GS}	static	-5 / 18	V
		dynamic	-10 / 22	V
Maximum Junction Temperature	T_{jmax}		175	°C

Boost Switch

Drain-source voltage	V_{DS}		1200	V
Drain current (DC current)	I_D	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	124	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}	568	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	180	W
Gate-source voltage	V_{GS}	static	-5 / 18	V
		dynamic	-10 / 22	V
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* $t_p = 2\text{ s}$	6000	V
Creepage distance			>12,7	mm
Clearance			9,08	mm
Comparative Tracking Index	CTI		≥ 600	

*100 % tested in production



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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	

Buck Switch

Static

Drain-source on-state resistance ⁽¹⁾	$r_{DS(on)}$		18		142	25 175		8,5 13,5	12,5	mΩ
Gate-source threshold voltage	$V_{GS(th)}$				0,0142	25	1,7	2,25	2,75	V
Gate to Source Leakage Current	I_{GSS}		22	0		25			200	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25			20	μA
Internal gate resistance	r_g							0,5		Ω
Gate charge	Q_g		-5/18	800	142	25		376		nC
Short-circuit input capacitance	C_{iss}	$f = 500$ kHz	0	800	0	25		9360		pF
Short-circuit output capacitance	C_{oss}							470		
Reverse transfer capacitance	C_{rss}							16		
Diode forward voltage	V_{SD}		-5		142	25		4,1		V

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,53		K/W
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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		
Dynamic											
Turn-on delay time	$t_{d(on)}$	$R_{gon} = 2\ \Omega$ $R_{goff} = 2\ \Omega$	-5/18	350	140	25 125 150		30,01 27,75 27,33		ns	
Rise time	t_r					25 125 150		15,37 13,69 13,45		ns	
Turn-off delay time	$t_{d(off)}$					25 125 150		41,47 46,74 48,09		ns	
Fall time	t_f					25 125 150		9,63 10,57 11,27		ns	
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD}=0,978\ \mu C$ $Q_{tFWD}=2,38\ \mu C$ $Q_{tFWD}=2,76\ \mu C$				25 125 150		0,195 0,207 0,219		mWs	
Turn-off energy (per pulse)	E_{off}					25 125 150		0,505 0,51 0,517		mWs	
Peak recovery current	I_{RRM}	$di/dt=7132\ A/\mu s$ $di/dt=7172\ A/\mu s$ $di/dt=8825\ A/\mu s$				25 125 150		70,05 108,17 116,75		A	
Reverse recovery time	t_{rr}					25 125 150		23,43 33,94 36,23		ns	
Recovered charge	Q_r					25 125 150		0,978 2,38 2,76		μC	
Reverse recovered energy	E_{rec}					25 125 150		0,146 0,449 0,527		mWs	
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		7908,88 10310,78 10086,34		A/ μs	



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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 ⁽¹⁾	$r_{DS(on)}$		18		142	25 175		8,5 13,5	12,5	mΩ
Gate-source threshold voltage	$V_{GS(th)}$				0,0142	25	1,7	2,25	2,75	V
Gate to Source Leakage Current	I_{GSS}		22	0		25			200	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25			20	μA
Internal gate resistance	r_g							0,5		Ω
Gate charge	Q_g		-5/18	800	142	25		376		nC
Short-circuit input capacitance	C_{iss}	$f = 500$ kHz	0	800	0	25		9360		pF
Short-circuit output capacitance	C_{oss}							470		
Reverse transfer capacitance	C_{rss}							16		
Diode forward voltage	V_{SD}		-5		142	25		4,1		V

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 5,2$ W/mK (PTM)						0,53		K/W
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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		
Dynamic											
Turn-on delay time	$t_{d(on)}$	$R_{gon} = 2\ \Omega$ $R_{goff} = 2\ \Omega$	-5/18	350	140	25		27,03		ns	
						125		24,84			
						150		24,42			
Rise time	t_r					25		18,13		ns	
						125		17,28			
						150		17,38			
Turn-off delay time	$t_{d(off)}$					25		41,54		ns	
						125		46,11			
						150		47,35			
Fall time	t_f					25		7,4		ns	
						125		7,64			
						150		7,69			
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD}=1,22\ \mu C$ $Q_{tFWD}=2,61\ \mu C$ $Q_{tFWD}=2,99\ \mu C$	25		0,095		mWs				
			125		0,072						
			150		0,072						
Turn-off energy (per pulse)	E_{off}		25		0,234		mWs				
			125		0,273						
			150		0,285						
Peak recovery current	I_{RRM}	$di/dt=7649\ A/\mu s$ $di/dt=8171\ A/\mu s$ $di/dt=7776\ A/\mu s$	25		86,18		A				
			125		116,25						
			150		124,08						
Reverse recovery time	t_{rr}		25		23,44		ns				
			125		34,13						
			150		36,58						
Recovered charge	Q_r		25		1,22		μC				
			125		2,61						
			150		2,99						
Reverse recovered energy	E_{rec}		25		0,256		mWs				
			125		0,571						
			150		0,66						
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$	25		12341,97		A/ μs					
		125		10515,47							
		150		10160,21							



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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		5		kΩ
Deviation of R100	$\Delta_{R/R}$	$R_{100} = 493 \Omega$				100	-5		5	%
Power dissipation	P							245		mW
Power dissipation constant	d					25		1,4		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 2 \%$						3375		K
B-value	$B_{(25/100)}$	Tol. $\pm 2 \%$						3437		K
Vincotech Thermistor Reference									K	

⁽¹⁾ Value at chip level

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



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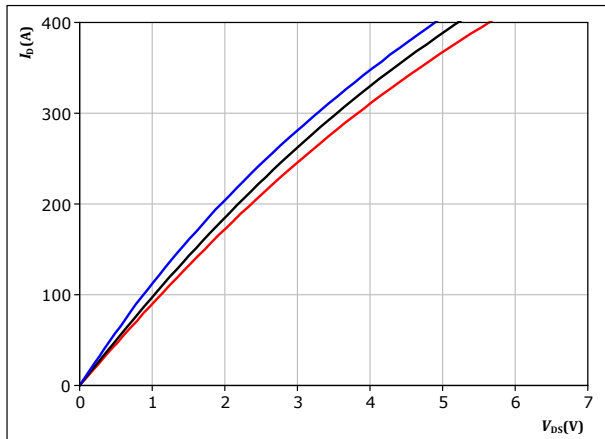
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Buck Switch Characteristics

figure 1. MOSFET

Typical output characteristics including $R_{DD'} + R_{SS'}$

$$I_D = f(V_{DS})$$

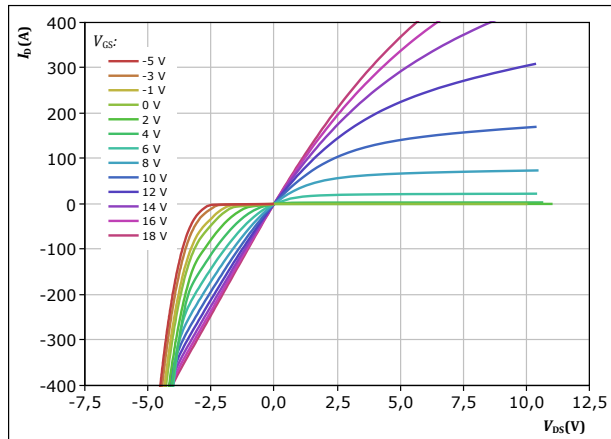


$t_p = 250 \mu s$
 $V_{GS} = 18 V$
 $T_j: 25^\circ C, 125^\circ C, 150^\circ C$

figure 2. MOSFET

Typical output characteristics including $R_{DD'} + R_{SS'}$

$$I_D = f(V_{DS})$$

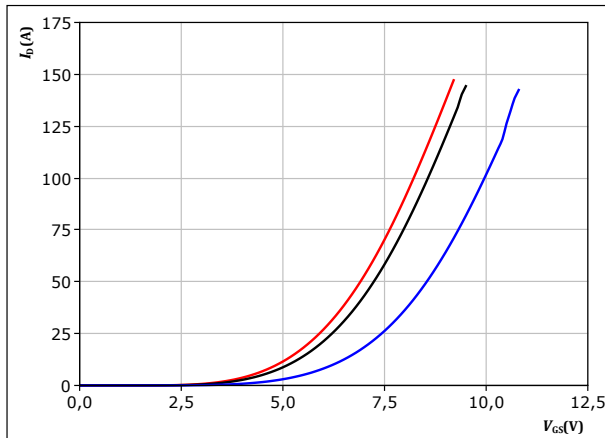


$t_p = 250 \mu s$
 $T_j = 150^\circ C$
 V_{GS} from -5 V to 18 V in steps of 2 V

figure 3. MOSFET

Typical transfer characteristics

$$I_D = f(V_{GS})$$

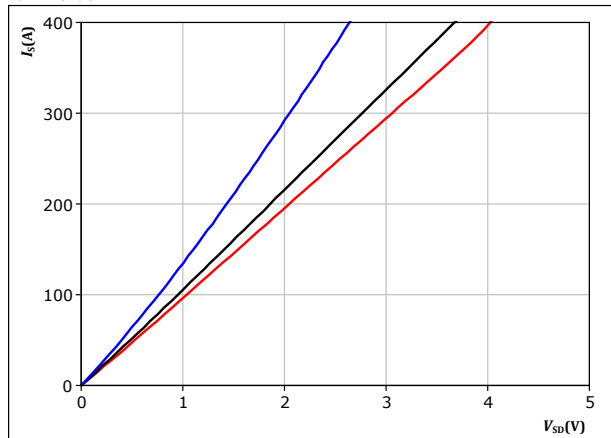


$t_p = 250 \mu s$
 $V_{DS} = 42 V$
 $T_j: 25^\circ C, 125^\circ C, 150^\circ C$

figure 4. MOSFET

Typical reverse drain current characteristics including $R_{DD'} + R_{SS'}$

$$I_{SD} = f(V_{SD})$$



$t_p = 250 \mu s$
 $V_{GS} = 18 V$
 $T_j: 25^\circ C, 125^\circ C, 150^\circ C$

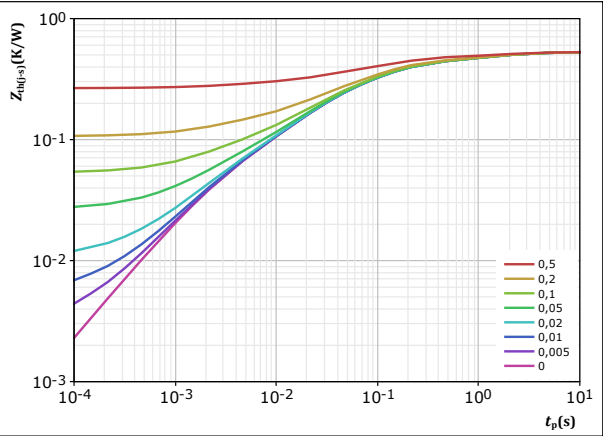


Buck Switch Characteristics

figure 5. MOSFET

Transient thermal impedance as a function of pulse width

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

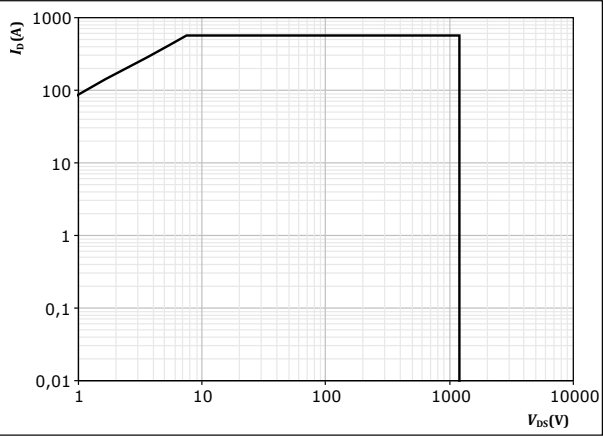


$D =$	t_p / T
$R_{th(j-a)} =$	0,528 K/W
MOSFET thermal model values	
R (K/W)	τ (s)
2,50E-02	5,66E+00
9,77E-02	1,03E+00
2,43E-01	1,04E-01
1,32E-01	2,14E-02
3,42E-02	2,33E-03

figure 6. MOSFET

Safe operating area

$I_D = f(V_{DS})$



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



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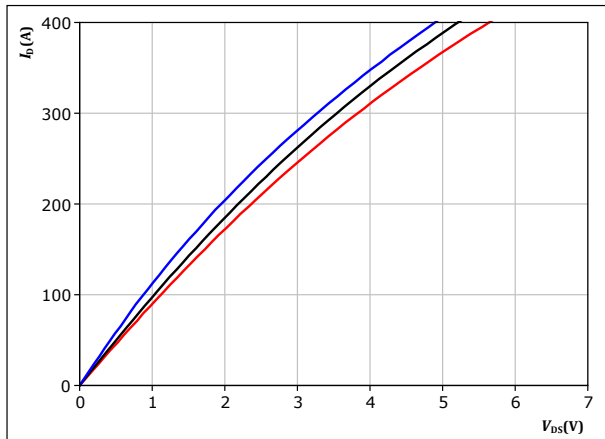
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Boost Switch Characteristics

figure 7. MOSFET

Typical output characteristics including $R_{DS(on)} + R_{DS}$

$$I_D = f(V_{DS})$$

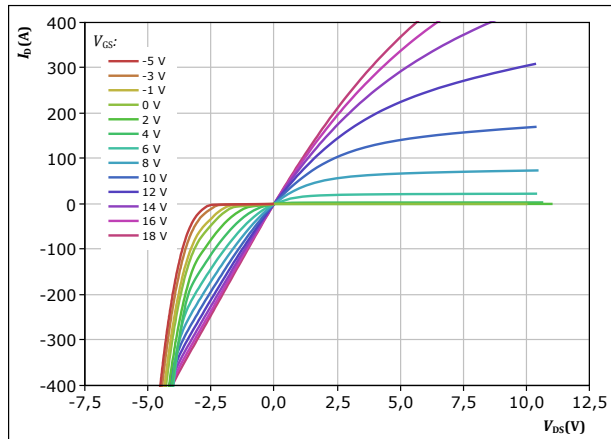


$t_p = 250 \mu s$
 $V_{GS} = 18 V$
 $T_j: 25^\circ C, 125^\circ C, 150^\circ C$

figure 8. MOSFET

Typical output characteristics including $R_{DS(on)} + R_{DS}$

$$I_D = f(V_{DS})$$

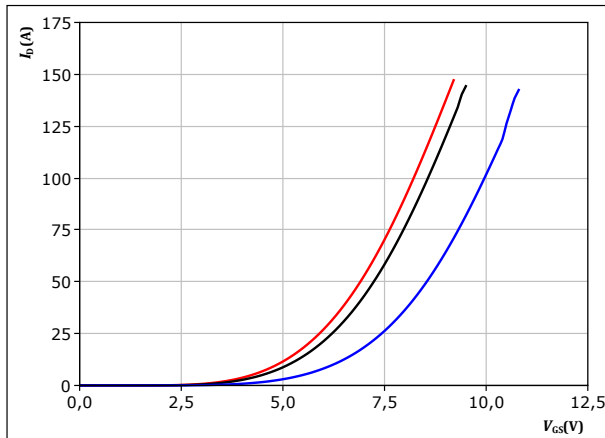


$t_p = 250 \mu s$
 $T_j = 150^\circ C$
 V_{GS} from -5 V to 18 V in steps of 2 V

figure 9. MOSFET

Typical transfer characteristics

$$I_D = f(V_{GS})$$

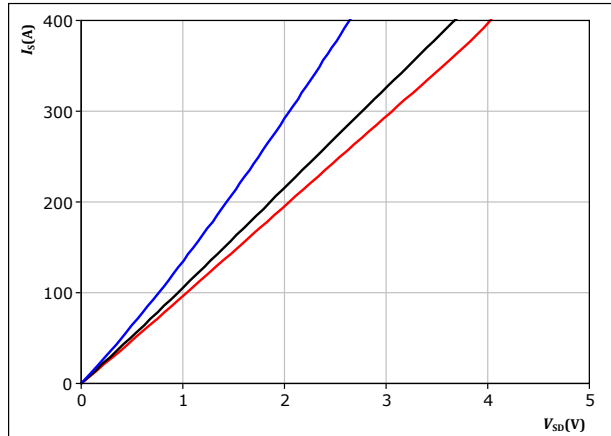


$t_p = 250 \mu s$
 $V_{DS} = 42 V$
 $T_j: 25^\circ C, 125^\circ C, 150^\circ C$

figure 10. MOSFET

Typical reverse drain current characteristics including $R_{DS(on)} + R_{DS}$

$$I_{SD} = f(V_{SD})$$



$t_p = 250 \mu s$
 $V_{GS} = 18 V$
 $T_j: 25^\circ C, 125^\circ C, 150^\circ C$

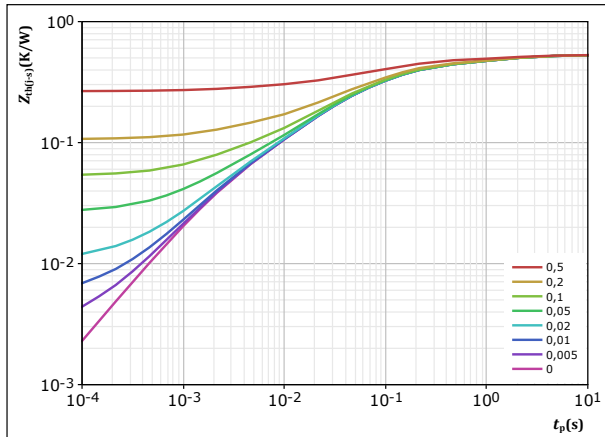


Boost Switch Characteristics

figure 11. MOSFET

Transient thermal impedance as a function of pulse width

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

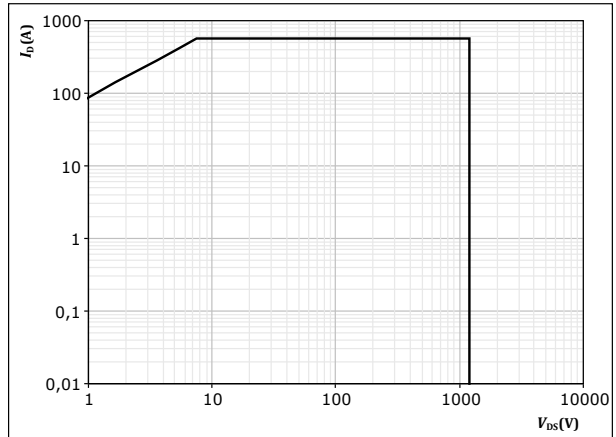


$D =$	t_p / T
$R_{th(j-a)} =$	0,528 K/W
MOSFET thermal model values	
R (K/W)	τ (s)
2,50E-02	5,66E+00
9,77E-02	1,03E+00
2,43E-01	1,04E-01
1,32E-01	2,14E-02
3,42E-02	2,33E-03

figure 12. MOSFET

Safe operating area

$$I_D = f(V_{DS})$$



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



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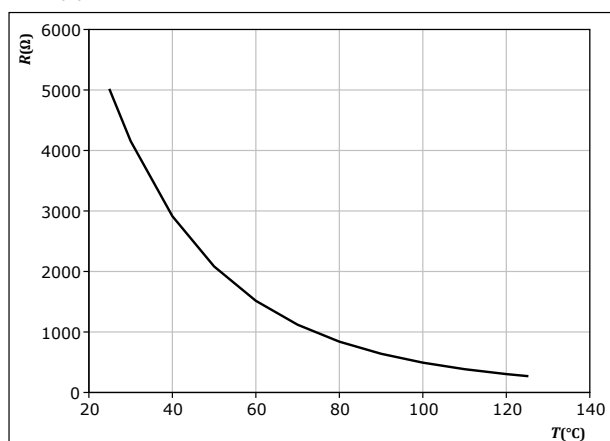
Thermistor Characteristics

figure 13.

Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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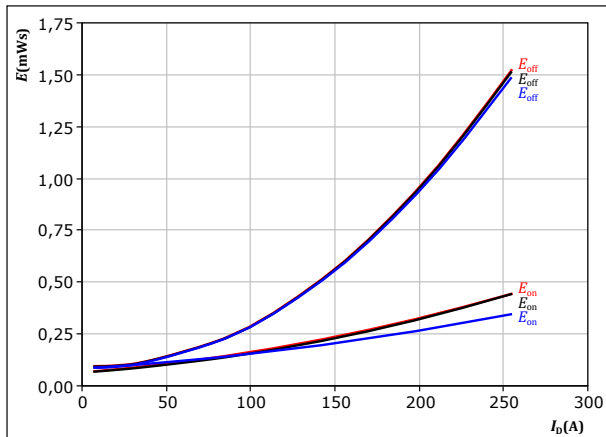
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Buck Switching Characteristics

figure 14. MOSFET

Typical switching energy losses as a function of drain current

$$E = f(I_D)$$



With an inductive load at

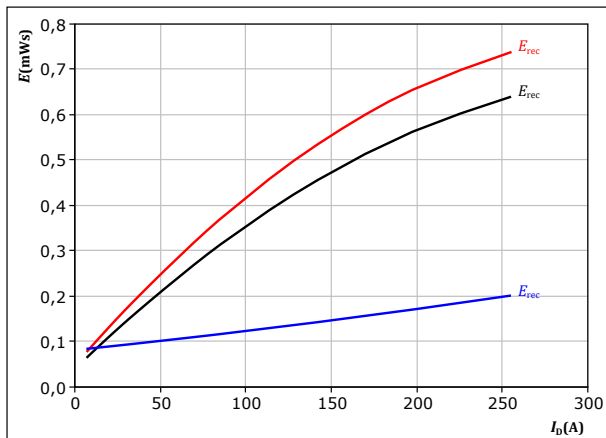
$V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 $R_{goff} = 2$ Ω

T_j : 25 °C
125 °C
150 °C

figure 16. MOSFET

Typical reverse recovered energy loss as a function of drain current

$$E_{rec} = f(I_D)$$



With an inductive load at

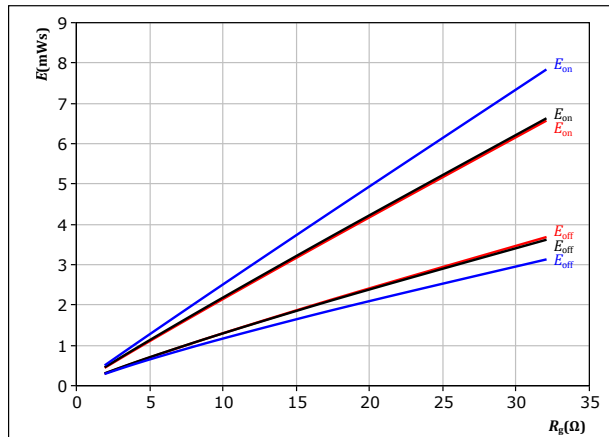
$V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω

T_j : 25 °C
125 °C
150 °C

figure 15. MOSFET

Typical switching energy losses as a function of MOSFET turn on gate resistor

$$E = f(R_g)$$



With an inductive load at

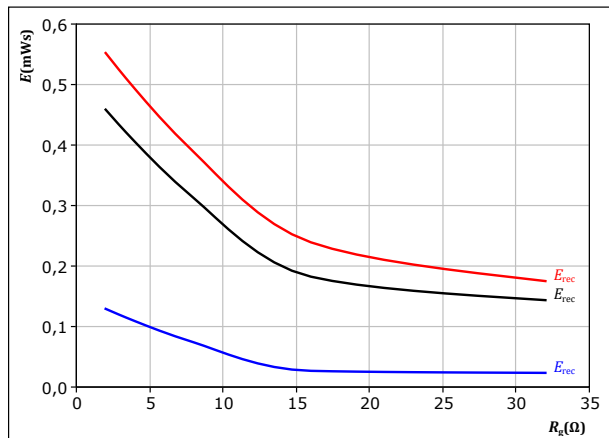
$V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A

T_j : 25 °C
125 °C
150 °C

figure 17. MOSFET

Typical reverse recovered energy loss as a function of MOSFET turn on gate resistor

$$E_{rec} = f(R_g)$$



With an inductive load at

$V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A

T_j : 25 °C
125 °C
150 °C



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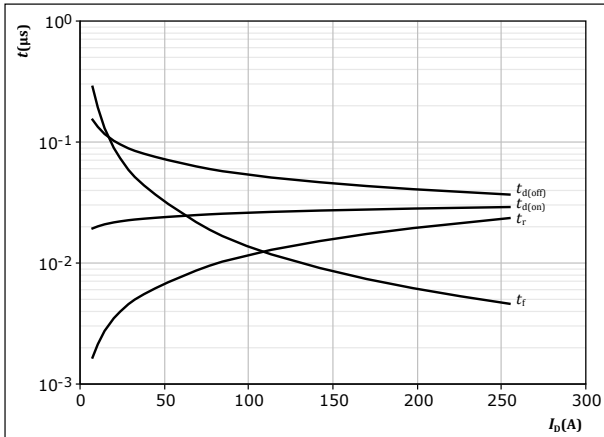
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datasheet

Buck Switching Characteristics

figure 18.

MOSFET

Typical switching times as a function of drain current
 $t = f(I_D)$



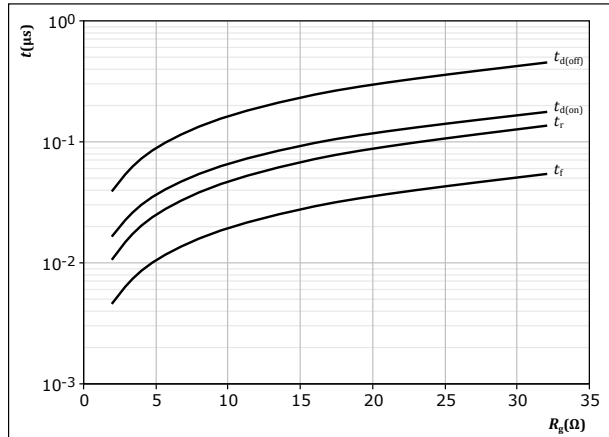
With an inductive load at

$T_j = 150$ °C
 $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 $R_{goff} = 2$ Ω

figure 19.

MOSFET

Typical switching times as a function of MOSFET turn on gate resistor
 $t = f(R_g)$



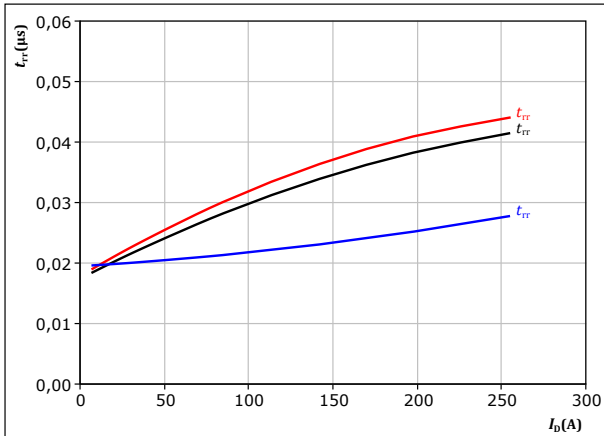
With an inductive load at

$T_j = 150$ °C
 $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A

figure 20.

MOSFET

Typical reverse recovery time as a function of drain current
 $t_{rr} = f(I_D)$

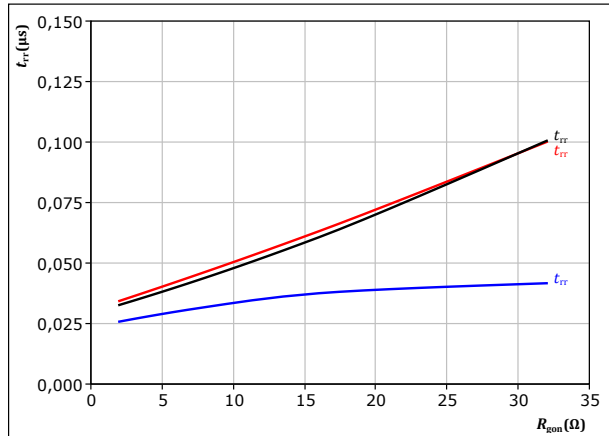


At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 21.

MOSFET

Typical reverse recovery time as a function of MOSFET turn on gate resistor
 $t_{rr} = f(R_{gon})$



At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A
 T_j : 25 °C (blue), 125 °C (black), 150 °C (red)



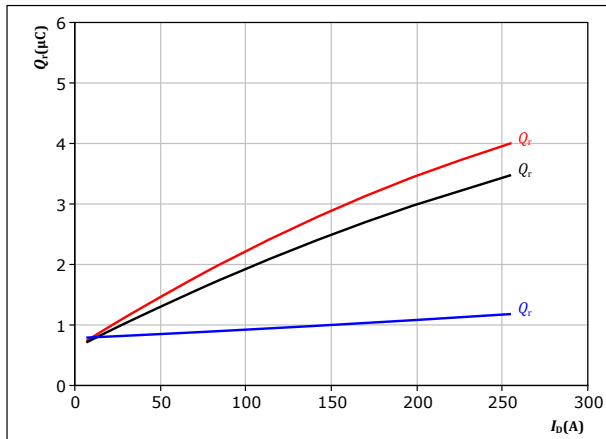
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Buck Switching Characteristics

figure 22. MOSFET

Typical recovered charge as a function of drain current

$$Q_r = f(I_D)$$

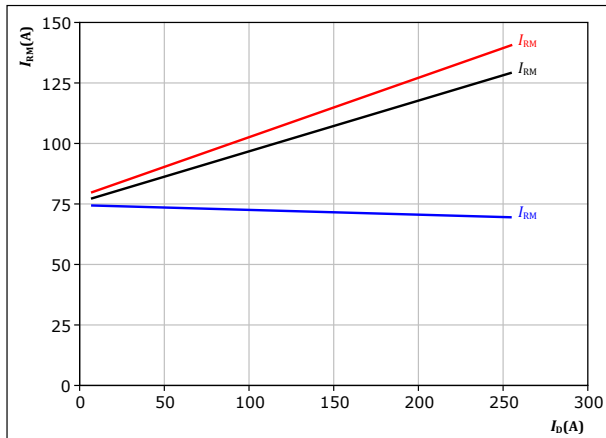


At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 T_j : 25 °C
125 °C
150 °C

figure 24. MOSFET

Typical peak reverse recovery current as a function of drain current

$$I_{RM} = f(I_D)$$

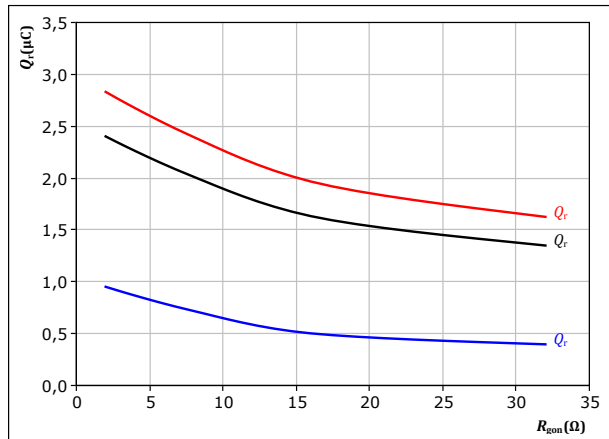


At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 T_j : 25 °C
125 °C
150 °C

figure 23. MOSFET

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

$$Q_r = f(R_{gon})$$

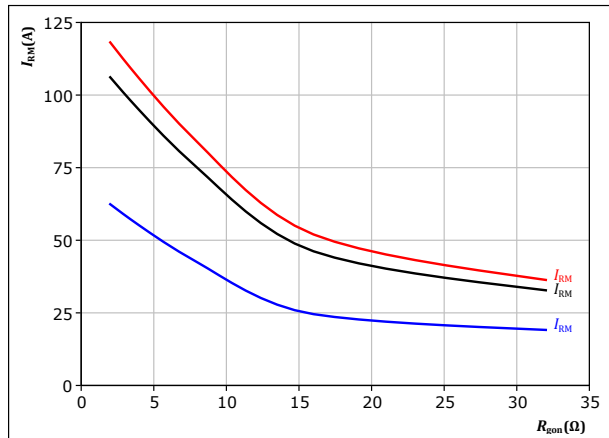


At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A
 T_j : 25 °C
125 °C
150 °C

figure 25. MOSFET

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

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



At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A
 T_j : 25 °C
125 °C
150 °C

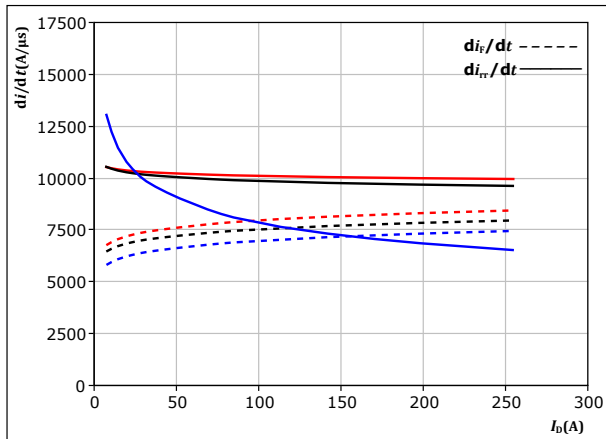


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Buck Switching Characteristics

figure 26. MOSFET

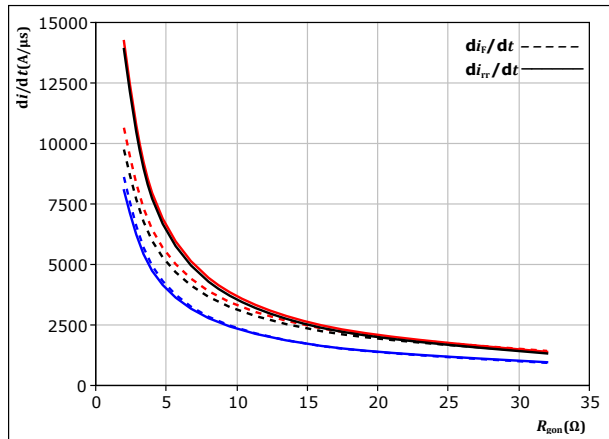
Typical rate of fall of forward and reverse recovery current as a function of drain current
 $di_f/dt, di_r/dt = f(I_D)$



At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 T_j : 25 °C
125 °C
150 °C

figure 27. MOSFET

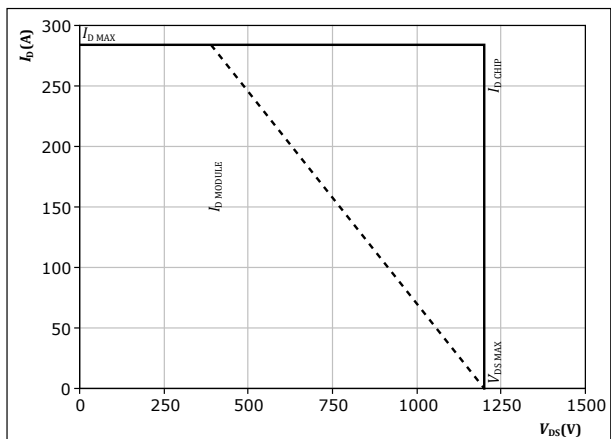
Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor
 $di_f/dt, di_r/dt = f(R_{gon})$



At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A
 T_j : 25 °C
125 °C
150 °C

figure 28. MOSFET

Reverse bias safe operating area
 $I_D = f(V_{DS})$



At $T_j = 150$ °C
 $R_{gon} = 2$ Ω
 $R_{goff} = 2$ Ω



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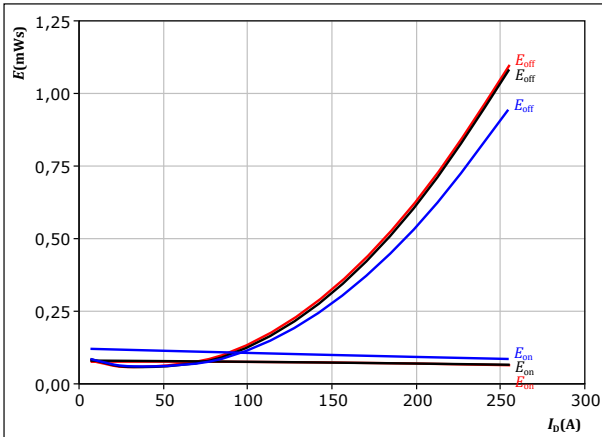
Boost Switching Characteristics

figure 29.

MOSFET

Typical switching energy losses as a function of drain current

$$E = f(I_D)$$



With an inductive load at

$V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 $R_{goff} = 2$ Ω

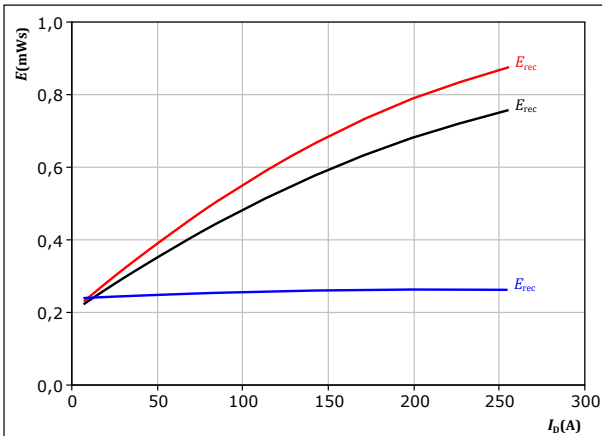
T_j : 25 °C
125 °C
150 °C

figure 31.

MOSFET

Typical reverse recovered energy loss as a function of drain current

$$E_{rec} = f(I_D)$$



With an inductive load at

$V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω

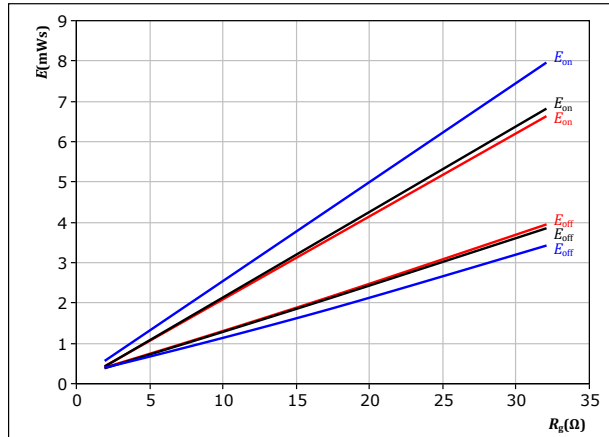
T_j : 25 °C
125 °C
150 °C

figure 30.

MOSFET

Typical switching energy losses as a function of MOSFET turn on gate resistor

$$E = f(R_g)$$



With an inductive load at

$V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A

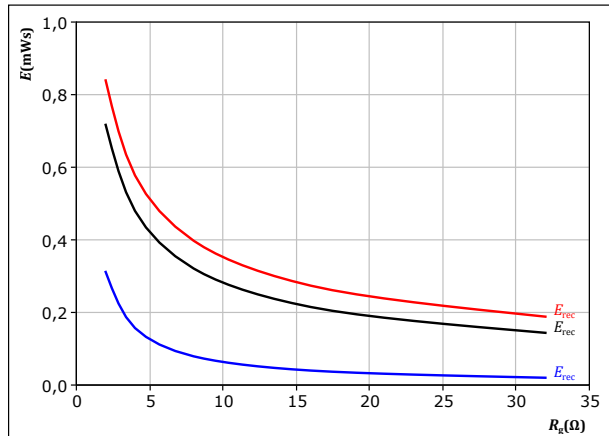
T_j : 25 °C
125 °C
150 °C

figure 32.

MOSFET

Typical reverse recovered energy loss as a function of MOSFET turn on gate resistor

$$E_{rec} = f(R_g)$$



With an inductive load at

$V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A

T_j : 25 °C
125 °C
150 °C



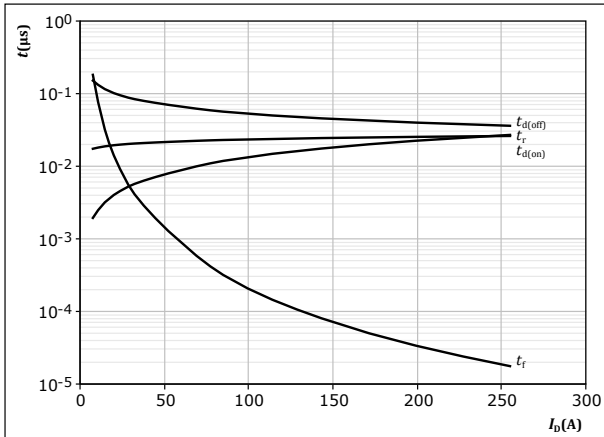
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Boost Switching Characteristics

figure 33. MOSFET

Typical switching times as a function of drain current
 $t = f(I_D)$

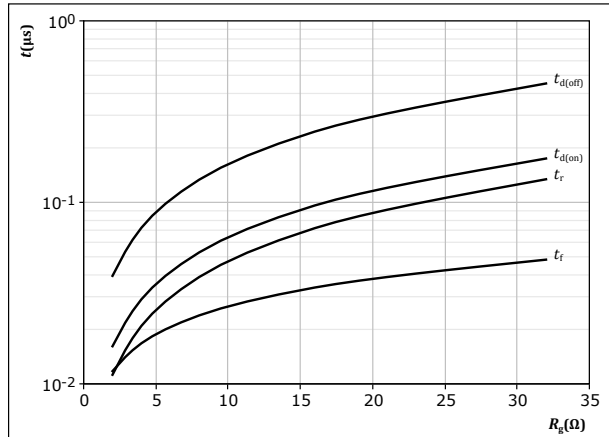


With an inductive load at

$T_j = 150$ °C
 $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 $R_{goff} = 2$ Ω

figure 34. MOSFET

Typical switching times as a function of MOSFET turn on gate resistor
 $t = f(R_g)$

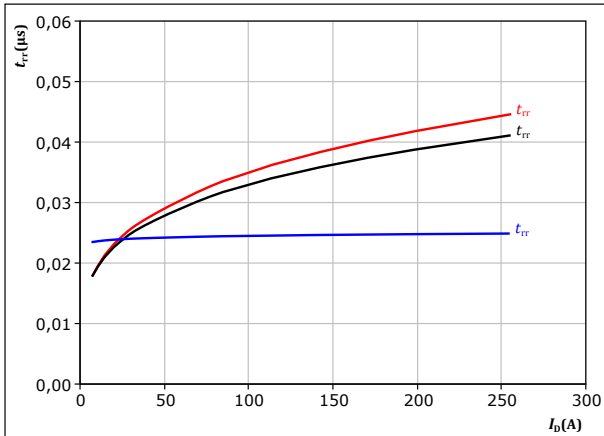


With an inductive load at

$T_j = 150$ °C
 $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A

figure 35. MOSFET

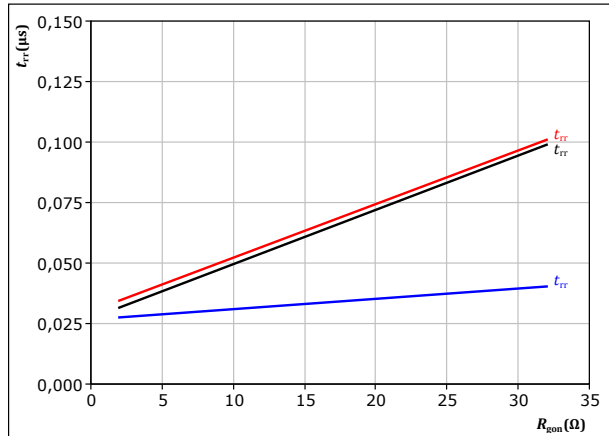
Typical reverse recovery time as a function of drain current
 $t_{rr} = f(I_D)$



At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 $T_j: 25$ °C (blue)
 125 °C (black)
 150 °C (red)

figure 36. MOSFET

Typical reverse recovery time as a function of MOSFET turn on gate resistor
 $t_{rr} = f(R_{gon})$



At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A
 $T_j: 25$ °C (blue)
 125 °C (black)
 150 °C (red)



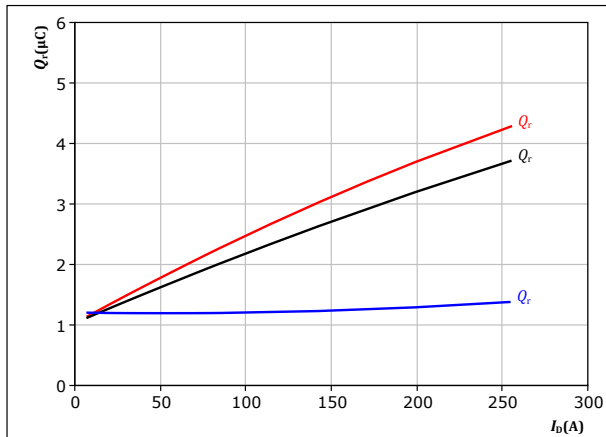
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Boost Switching Characteristics

figure 37. MOSFET

Typical recovered charge as a function of drain current

$$Q_r = f(I_D)$$

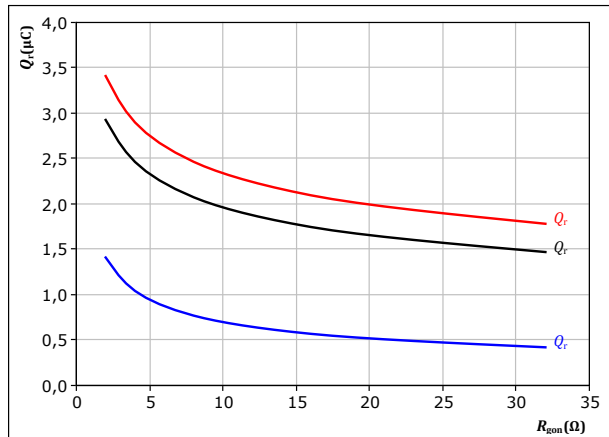


At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 T_j : 25 °C
125 °C
150 °C

figure 38. MOSFET

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

$$Q_r = f(R_{gon})$$

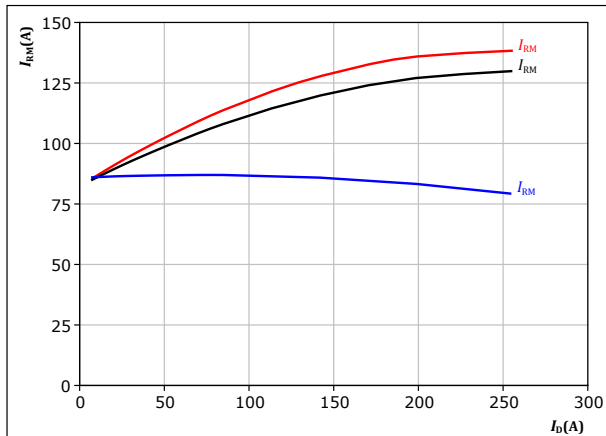


At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A
 T_j : 25 °C
125 °C
150 °C

figure 39. MOSFET

Typical peak reverse recovery current as a function of drain current

$$I_{RM} = f(I_D)$$

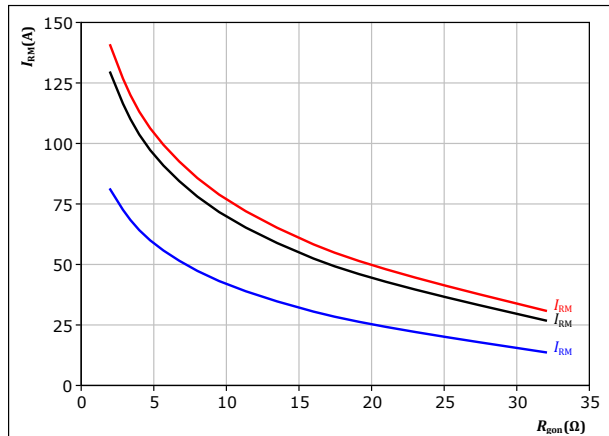


At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 T_j : 25 °C
125 °C
150 °C

figure 40. MOSFET

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

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



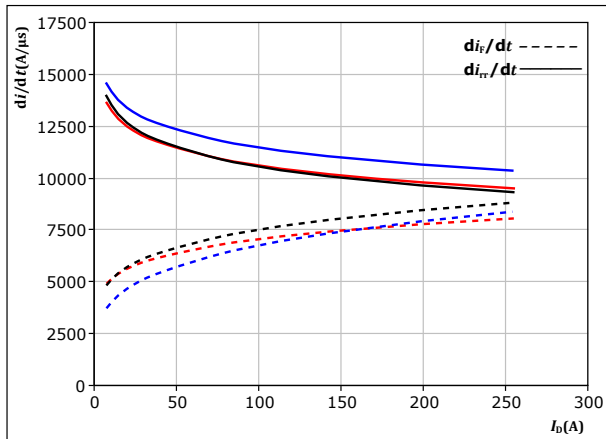
At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A
 T_j : 25 °C
125 °C
150 °C



Boost Switching Characteristics

figure 41. MOSFET

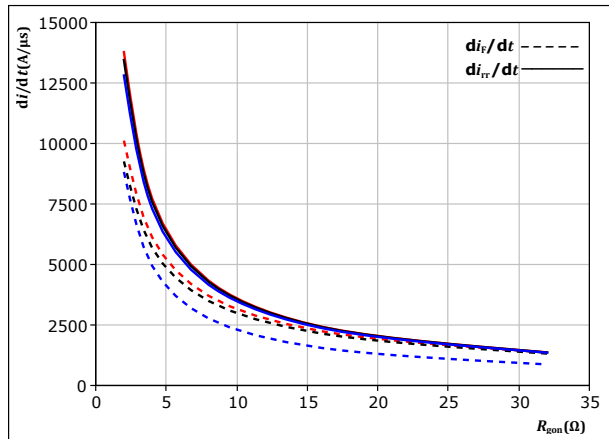
Typical rate of fall of forward and reverse recovery current as a function of drain current
 $di_f/dt, di_r/dt = f(I_D)$



At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $R_{gon} = 2$ Ω
 $T_j: 25$ °C
125 °C
150 °C

figure 42. MOSFET

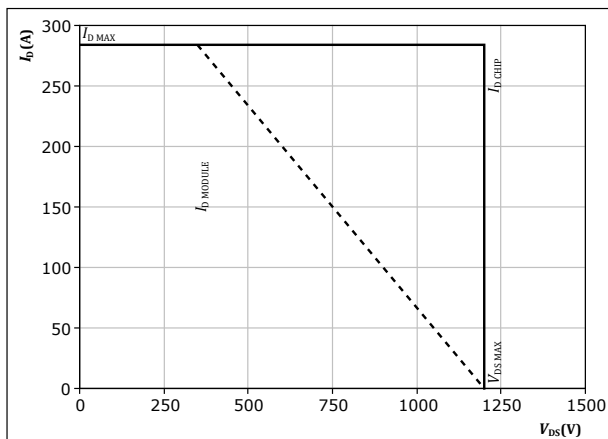
Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor
 $di_f/dt, di_r/dt = f(R_{gon})$



At $V_{DS} = 350$ V
 $V_{GS} = -5/18$ V
 $I_D = 140$ A
 $T_j: 25$ °C
125 °C
150 °C

figure 43. MOSFET

Reverse bias safe operating area
 $I_D = f(V_{DS})$



At $T_j = 150$ °C
 $R_{gon} = 2$ Ω
 $R_{goff} = 2$ Ω



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Switching Definitions

figure 44. MOSFET

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

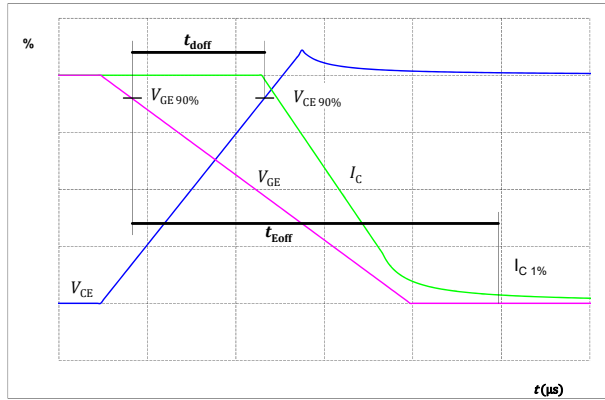


figure 45. MOSFET

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

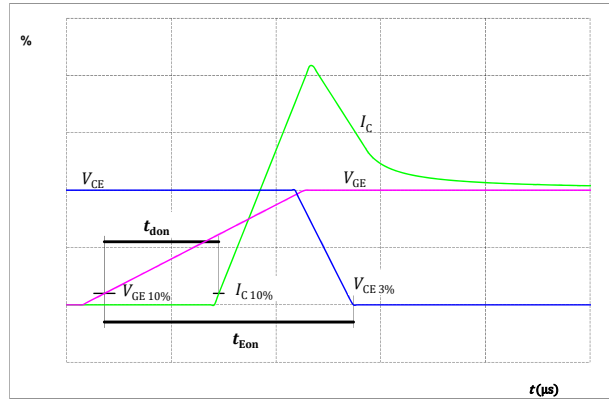


figure 46. MOSFET

Turn-off Switching Waveforms & definition of t_f

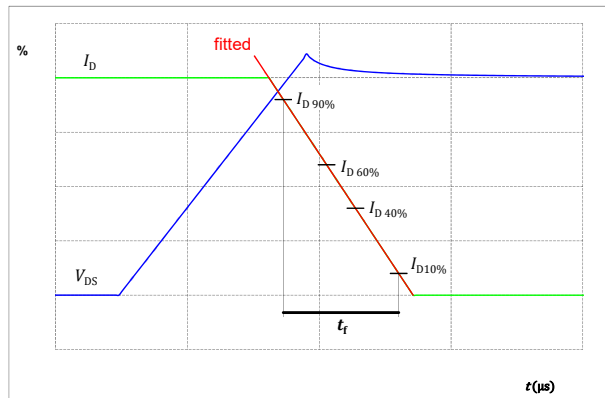
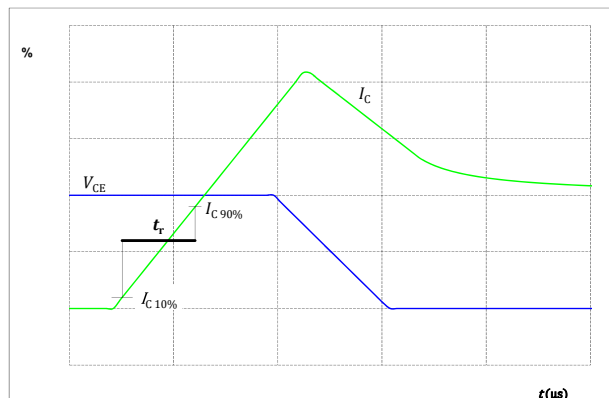


figure 47. MOSFET

Turn-on Switching Waveforms & definition of t_r





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Switching Definitions

figure 48. FWD

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

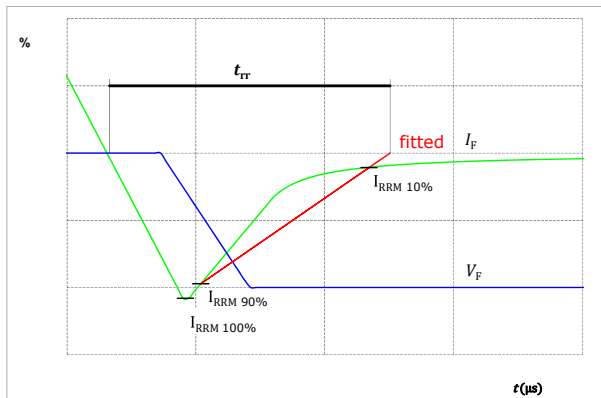


figure 49. FWD

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

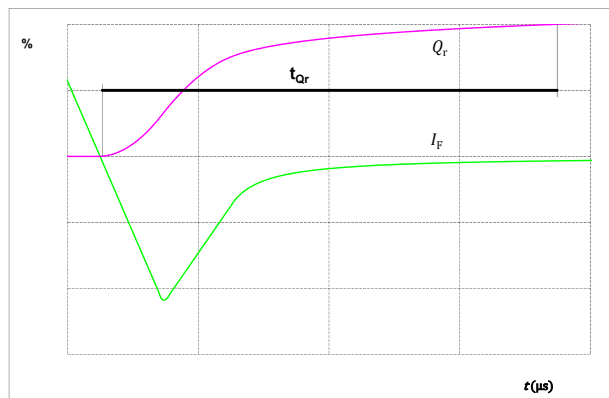
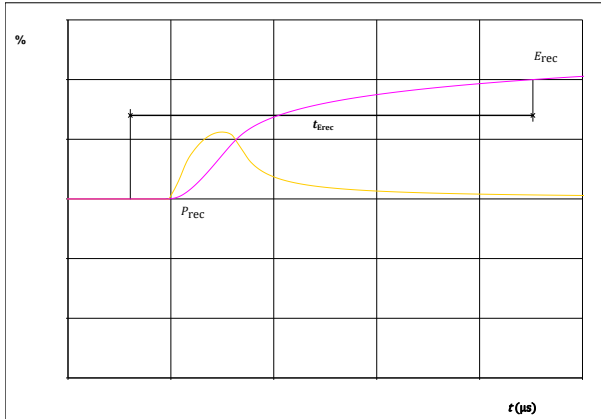


figure 50. FWD


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





datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	10-EY12NMA009MS-LS28F78T
With thermal paste (5,2 W/mK, PTM6000HV)	10-EY12NMA009MS-LS28F78T-/7/

Marking							
	Text	Name		Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNN- TTTTTIVV		WWYY	UL VIN	LLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTIVV	LLLL	SSSS	WWYY			

Pin table [mm]			
Pin	X	Y	Function
1	32	3,2	S11
2	32	0	G11
3	3,2	0	DC+
4	0	0	DC+
5	3,2	3,2	DC+
6	0	3,2	DC+
7	3,2	12,8	GND
8	0	12,8	GND
9	3,2	16	GND
10	0	16	GND
11	0	28,8	S14
12	0	32	G14
13	0	38,4	DC-
14	0	41,6	DC-
15	0	44,8	DC-
16	0	48	DC-
17	19,2	48	S12
18	22,4	48	G12
19	32	48	Therm1
20	32	44,8	Therm2
21	32	38,4	Ph
22	32	35,2	Ph
23	32	32	Ph
24	32	19,2	Ph
25	32	16	Ph
26	32	12,8	Ph
27	16	19,2	S13
28	12,8	19,2	G13
29	16	28,8	CC

center of press-fit pin head
pin head type TP-PB pushed through-hole Ø1mm ±0.09 / -0.06
for further PCB design rules refer to the latest handling instruction

50.0 ± 0.1
3.0 ± 0.1

Tolerance of prepositions ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance



datasheet

The pinout diagram shows the following connections:

- DC+ (3, 4, 5, 6):** Connected to the positive supply rail.
- DC- (13, 14, 15, 16):** Connected to the negative supply rail.
- GND (7, 8, 9, 10):** Connected to the ground rail.
- Ph (21, 22, 23, 24, 25, 26):** Connected to the I2C/SMBus data line.
- Therm1 (19) and Therm2 (20):** Connected to a thermistor (Rt) network.
- Other pins:** Pins 1, 2, 11, 12, 17, 18, 27, 28 are connected to various internal components (T11, T12, G11, G12, S11, S12, G13, G14, S13, S14, CC, T13, T14).

Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12	MOSFET	1200 V	8,5 mΩ	Buck Switch	
T13, T14	MOSFET	1200 V	8,5 mΩ	Boost Switch	
Rt	Thermistor			Thermistor	



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10-EY12NMA009MS-LS28F78T
datasheet

Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for <i>flow</i> E2 packages see vincotech.com website.

Package data
Package data for <i>flow</i> E2 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 UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}=175^{\circ}\text{C}$ and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.



Document No.:	Date:	Modification:	Pages
10-EY12NMA009MS-LS28F78T-D1-14	27 Mar. 2026	Initial Release	

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.