Vincotech

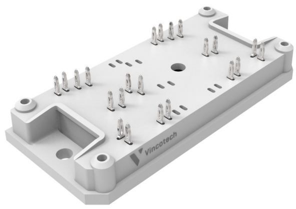
10-PY124PA020MR03-L227F38Y
datasheet

*flow*PACK 1 SiC	1200 V / 20 mΩ

Features

- Rohm Silicone Carbide Power MOSFET,
- Trench Technology
- Sixpack with three separated legs
- Solderless Press-fit Mounting Technology

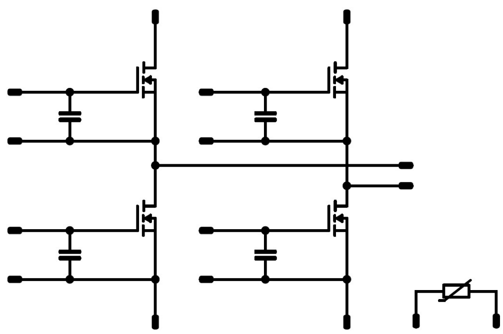
flow 1 housing



Target applications

- Charging Stations

Schematic



Types

- 10-PY124PA020MR03-L227F38Y

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Half-Bridge Switch					
Drain-source voltage	V_{DSS}			1200	V
Drain current	I_D	$T_j = T_{jmax}$	T_s = 80 °C	57	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		274	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	122	W
Gate-source voltage	V_{GSS}			-4/+22	V
Maximum Junction Temperature	T_{jmax}			175	°C
Capacitor (GS)					
Maximum DC voltage	V_{MAX}			25	V
Operation Temperature	T_{op}			-55…+125	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	**Symbol**	**Condition**		**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
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min. 12,7	mm
Clearance				11,83	mm
Comparative Tracking Index	CTI			> 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Half-Bridge Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		10		40	25 125 150		21 29 33	25	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$			0,02	25	2,7	4,5	5,6	V
Gate to Source Leakage Current	I_{GSS}		-4/+22	0		25			±200	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25			20	µA
Internal gate resistance	r_g							3,5		Ω
Gate charge	Q_g		18	600	40	25		214		nC
Gate to source charge	Q_{GS}		18	600	40	25		44		nC
Gate to drain charge	Q_{GD}		18	600	40	25		82		nC
Short-circuit input capacitance	C_{iss}	f = 1MHz	0	800		25		2674		pF
Short-circuit output capacitance	C_{oss}	f = 1MHz	0	800		25		152		pF
Reverse transfer capacitance	C_{rss}	f = 1MHz	0	800		25		54		pF
Reverse Diode Static										
Diode forward voltage	VSD		0		40	25		3,2		V
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,78		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 2 Ω R_{gon} = 2 Ω	16/-4	700	60	25 125 150		34 33 28		ns
Rise time	t_r	R_{goff} = 2 Ω R_{gon} = 2 Ω	16/-4	700	60	25 125 150		11 11 10		ns
Turn-off delay time	$t_{d(off)}$	R_{goff} = 2 Ω R_{gon} = 2 Ω	16/-4	700	60	25 125 150		69 73 71		ns
Fall time	t_f	R_{goff} = 2 Ω R_{gon} = 2 Ω	16/-4	700	60	25 125 150		11 13 11		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,8 µC Q_{rFWD} = 1,1 µC Q_{rFWD} = 1,6 µC	16/-4	700	60	25 125 150		0,737 0,756 0,796		mWs
Turn-off energy (per pulse)	E_{off}		16/-4	700	60	25 125 150		0,300 0,297 0,306		mWs

Characteristic Values

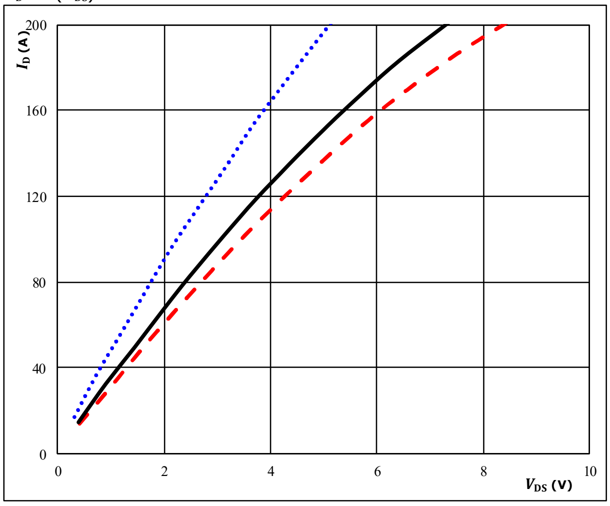
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Capacitor (GS)										
Capacitance	C							4,7		nF
Tolerance							-10		+10	%
Dissipation factor		f = 1 kHz				25			2,5	%
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %				25		4000		K
Vincotech NTC Reference									I	

Half-Bridge Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

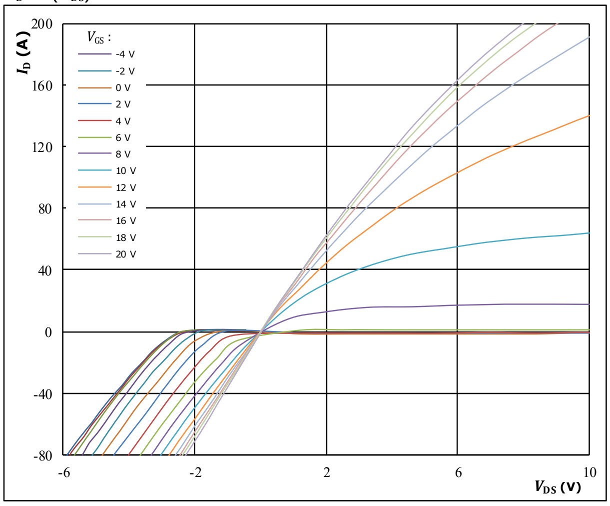


t_p =	250	μs		25 °C	············
V_{GS} =	18	V	T_j:	125 °C	———
				150 °C	– – – –

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

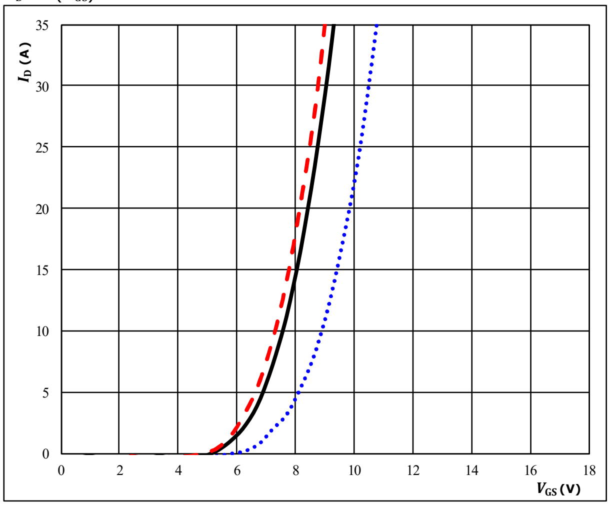


t_p = 250 μs
T_j = 150 °C
V_{GS} from -4 V to 20 V in steps of 2 V

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

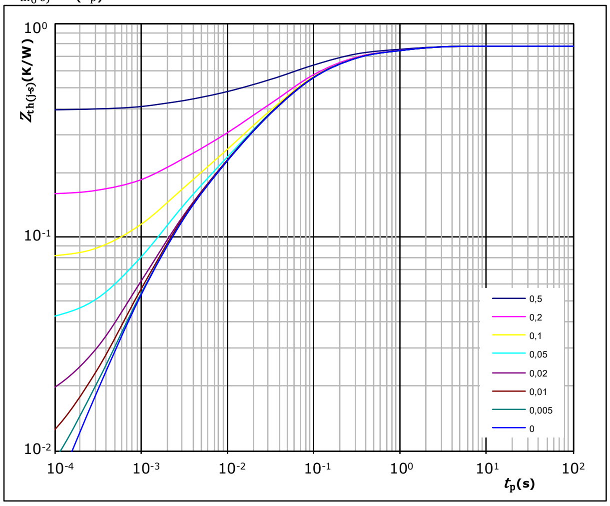


t_p =	100	μs		25 °C	············
V_{DS} =	10	V	T_j:	125 °C	———
				150 °C	– – – –

figure 4. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 0,78 K/W

MOSFET thermal model values

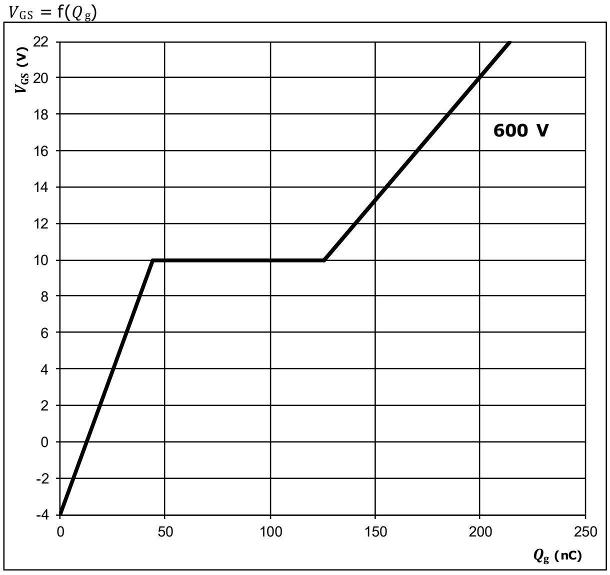
R (K/W)	τ (s)
8,97E-02	5,23E-01
2,29E-01	7,26E-02
2,67E-01	2,18E-02
1,19E-01	4,48E-03
7,47E-02	8,89E-04

Half-Bridge Switch Characteristics

figure 5.	**MOSFET**

Gate voltage vs Gate charge

$V_{GS} = f(Q_g)$



At

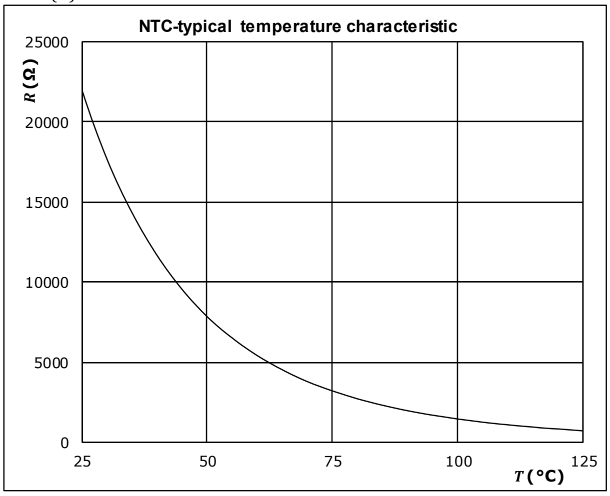
$I_C =$	40	A

NTC Characteristics

figure 1.	**Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

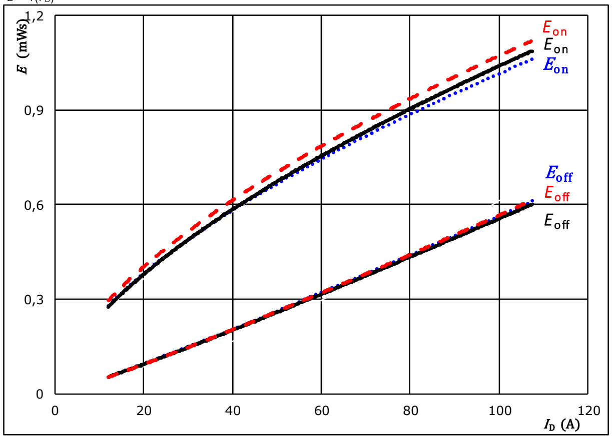


Half-Bridge Switching Characteristics

figure 1. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



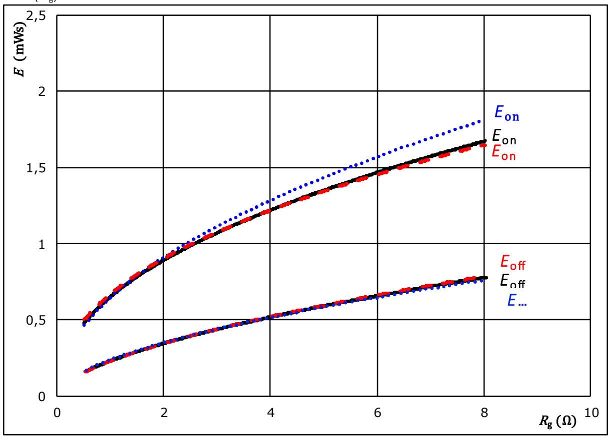
With an inductive load at

V_{DS} =	700	V	T_j:	25 °C	············
V_{GS} =	16/-4	V		125 °C	———
R_{gon} =	2	Ω		150 °C	– – –
R_{goff} =	2	Ω			

figure 2. **MOSFET**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



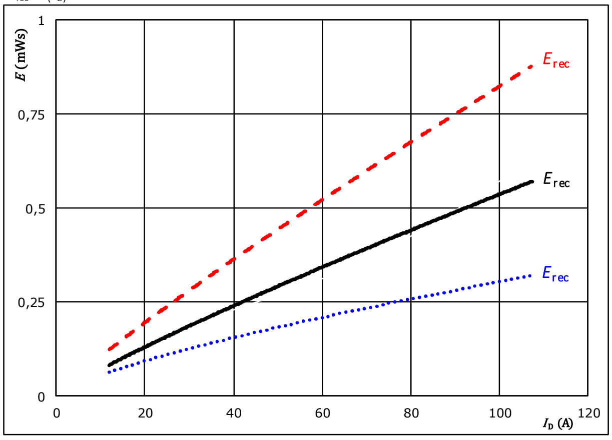
With an inductive load at

V_{DS} =	700	V	T_j:	25 °C	············
V_{GS} =	16/-4	V		125 °C	———
I_D =	60	A		150 °C	– – –

figure 3. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



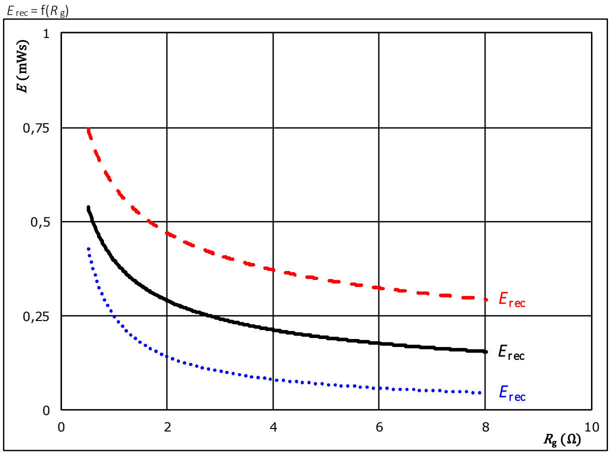
With an inductive load at

V_{DS} =	700	V	T_j:	25 °C	············
V_{GS} =	16/-4	V		125 °C	———
R_{gon} =	2	Ω		150 °C	– – –

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

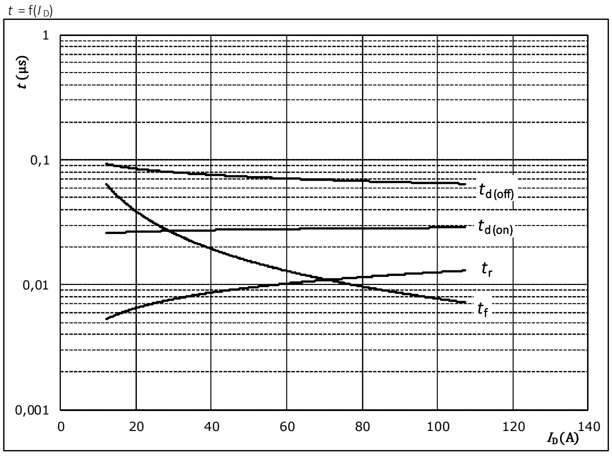
V_{DS} =	700	V	T_j:	25 °C	············
V_{GS} =	16/-4	V		125 °C	———
I_D =	60	A		150 °C	– – –

Half-Bridge Switching Characteristics

figure 5. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



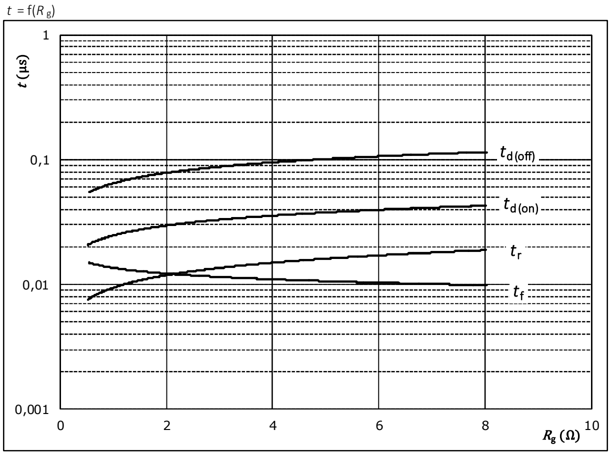
With an inductive load at

T_j =	150	°C
V_{DS} =	700	V
V_{GS} =	16/-4	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 6. **MOSFET**

Typical switching times as a function of gate resistor

$t = f(R_g)$



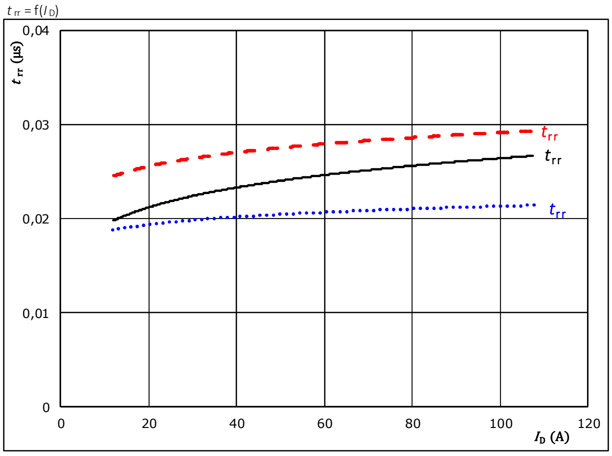
With an inductive load at

T_j =	150	°C
V_{DS} =	700	V
V_{GS} =	16/-4	V
I_D =	60	A

figure 7. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$

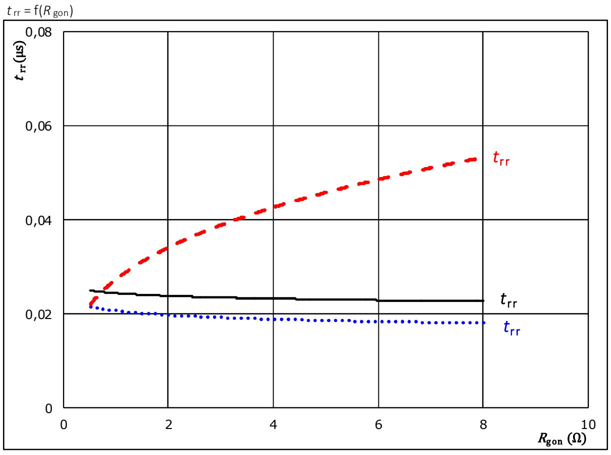


At V_{DS} =	700	V		25 °C	··············
V_{GS} =	16/-4	V	T_j:	125 °C	————
R_{gon} =	2	Ω		150 °C	— — —

figure 8. **FWD**

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

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



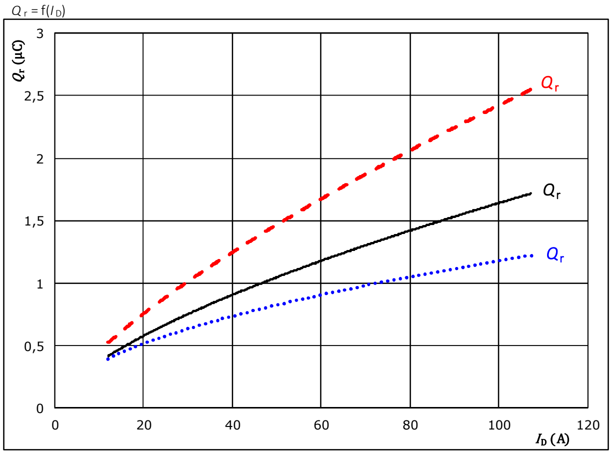
At V_{DS} =	700	V		25 °C	··············
V_{GS} =	16/-4	V	T_j:	125 °C	————
I_D =	60	A		150 °C	— — —

Half-Bridge Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

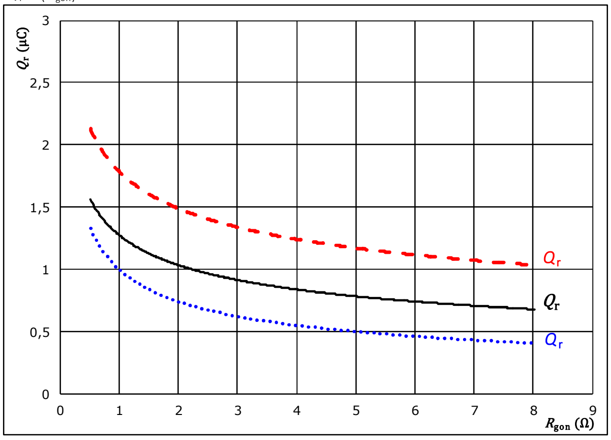


At						
	V_{DS} =	700	V		25 °C	···········
	V_{GS} =	16/-4	V	T_j:	125 °C	———
	R_{gon} =	2	Ω		150 °C	– – –

figure 10. FWD

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

$Q_r = f(R_{gon})$

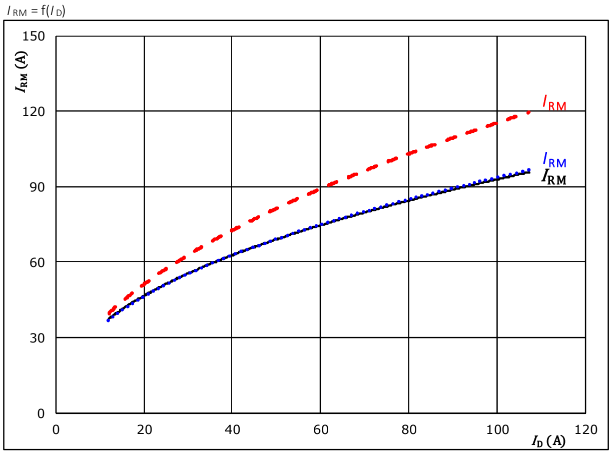


At						
	V_{DS} =	700	V		25 °C	···········
	V_{GS} =	16/-4	V	T_j:	125 °C	———
	I_D =	60	A		150 °C	– – –

figure 11. FWD

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

$I_{RM} = f(I_D)$

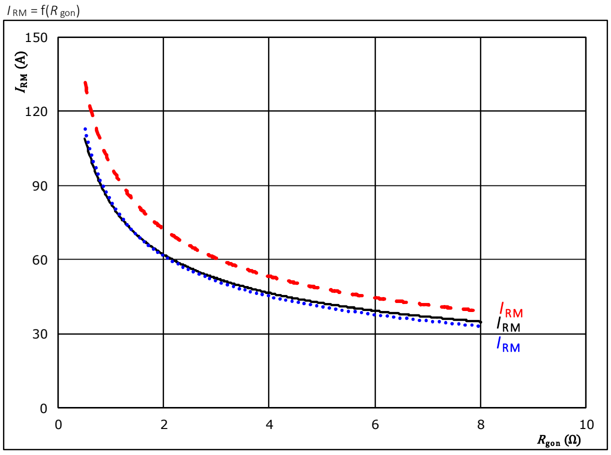


At						
	V_{DS} =	700	V		25 °C	···········
	V_{GS} =	16/-4	V	T_j:	125 °C	———
	R_{gon} =	2	Ω		150 °C	– – –

figure 12. FWD

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

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



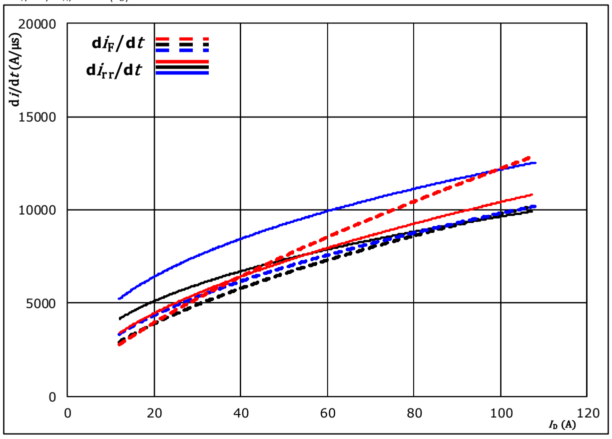
At						
	V_{DS} =	700	V		25 °C	···········
	V_{GS} =	16/-4	V	T_j:	125 °C	———
	I_D =	60	A		150 °C	– – –

Half-Bridge Switching Characteristics

figure 13. **FWD**

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

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

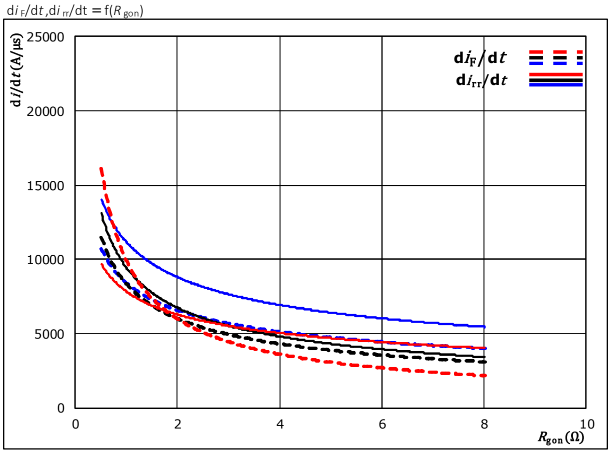


At					
V_{DS} =	700	V		25 °C	···············
V_{GS} =	16/-4	V	T_j:	125 °C	————
R_{gon} =	2	Ω		150 °C	– – – –

figure 14. **FWD**

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

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

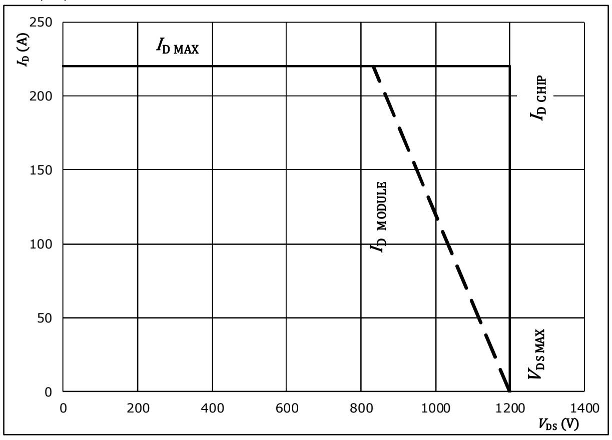


At					
V_{DS} =	700	V		25 °C	···············
V_{GS} =	16/-4	V	T_j:	125 °C	————
I_D =	60	A		150 °C	– – – –

figure 15. **MOSFET**

Reverse bias safe operating area

$I_D = f(V_{DS})$



At		
T_j =	125	°C
R_{gon} =	2	Ω
R_{goff} =	2	Ω

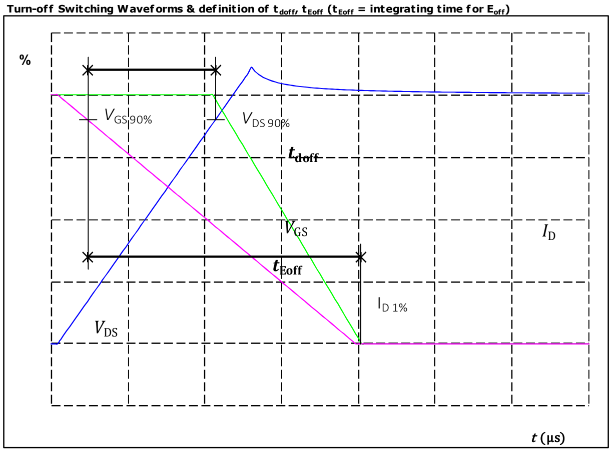
Half-Bridge Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

figure 1. **MOSFET**

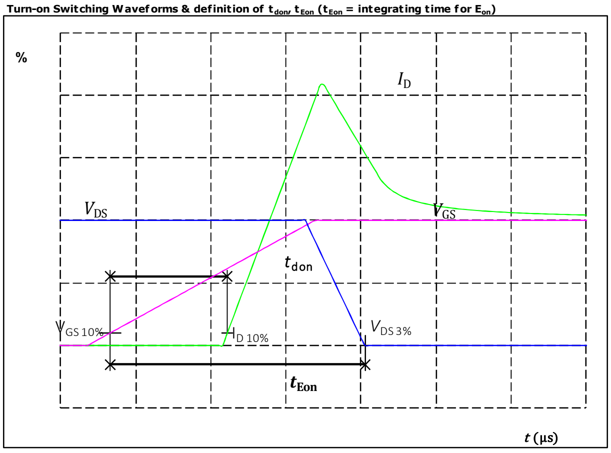
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GS} (0%) =	-4	V
V_{GS} (100%) =	16	V
V_{DS} (100%) =	700	V
I_D (100%) =	60	A
t_{doff} =	0,073	μs

figure 2. **MOSFET**

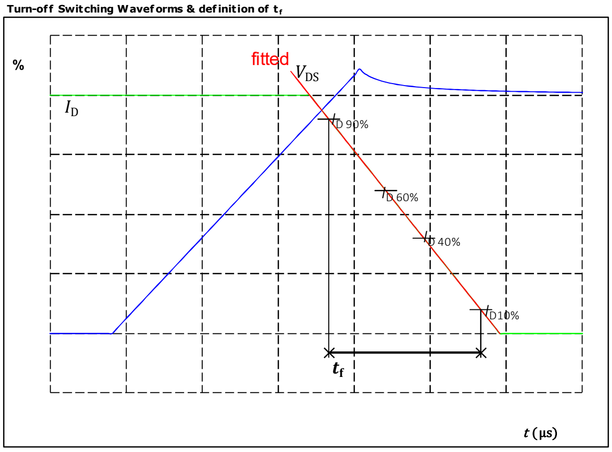
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GS} (0%) =	-4	V
V_{GS} (100%) =	16	V
V_{DS} (100%) =	700	V
I_D (100%) =	60	A
t_{don} =	0,033	μs

figure 3. **MOSFET**

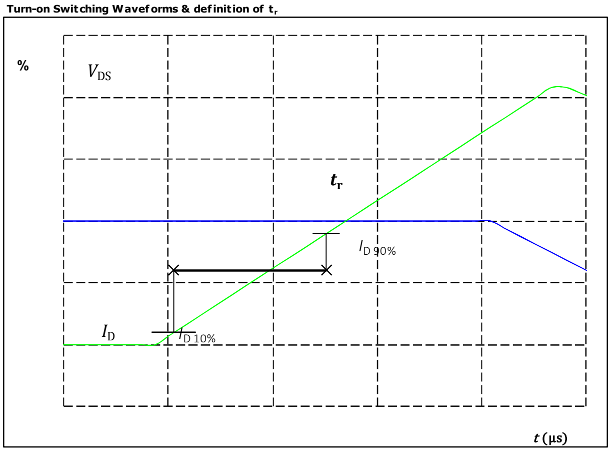
Turn-off Switching Waveforms & definition of t_f



V_{DS} (100%) =	700	V
I_D (100%) =	60	A
t_f =	0,013	μs

figure 4. **MOSFET**

Turn-on Switching Waveforms & definition of t_r

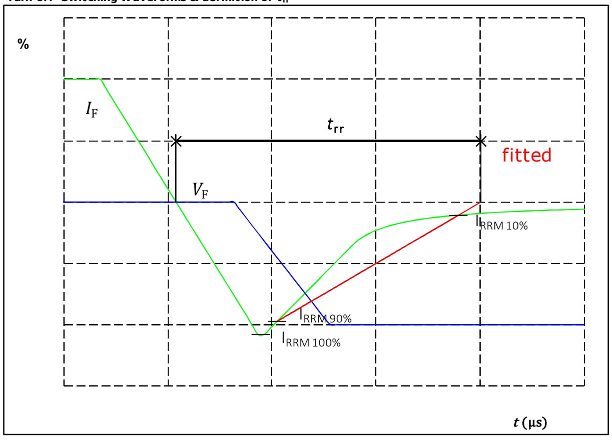


V_{DS} (100%) =	700	V
I_D (100%) =	60	A
t_r =	0,011	μs

Half-Bridge Switching Characteristics

figure 7. **FWD**

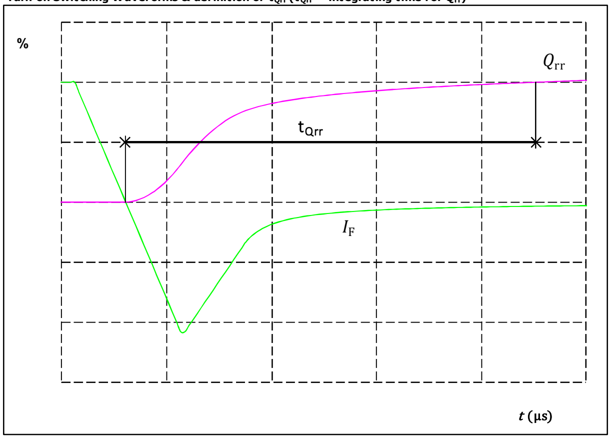
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	700	V
I_F (100%) =	60	A
I_{RRM} (100%) =	71	A
t_{rr} =	0,025	µs

figure 8. **FWD**

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

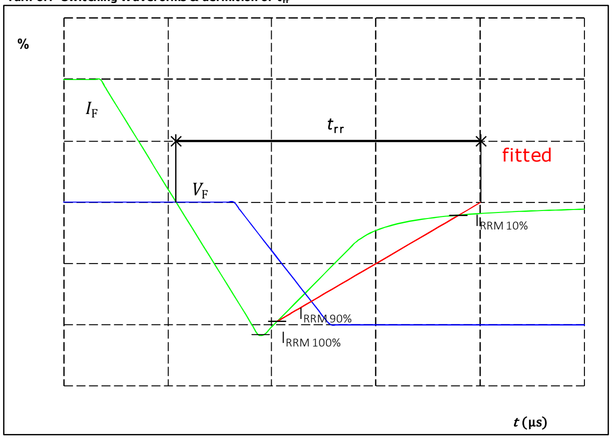


I_F (100%) =	60	A
Q_{rr} (100%) =	1,10	µC

Half-Bridge Switching Characteristics

figure 7. **FWD**

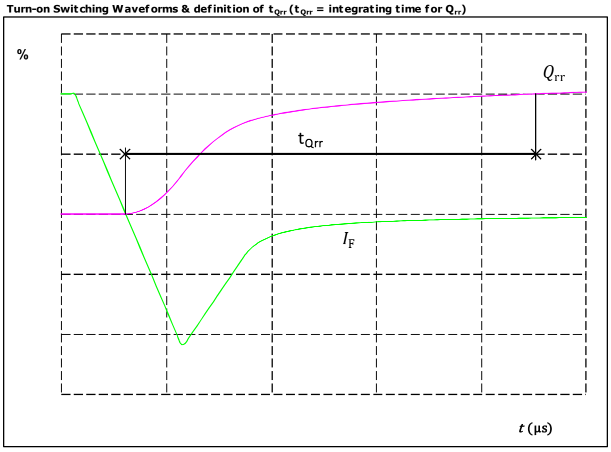
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	700	V
I_F (100%) =	60	A
I_{RRM} (100%) =	71	A
t_{rr} =	0,025	µs

figure 8. **FWD**

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



I_F (100%) =	60	A
Q_{rr} (100%) =	1,10	µC

10-PY124PA020MR03-L227F38Y

datasheet

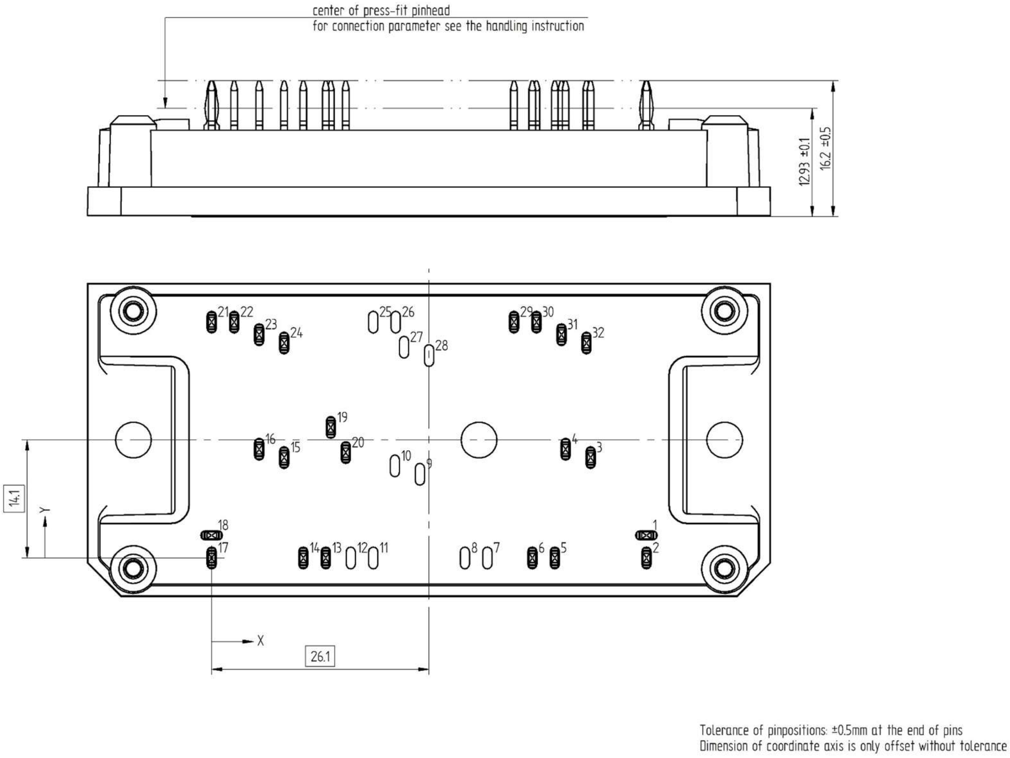
Ordering Code & Marking

Version	Ordering Code
without thermal paste	10-PY124PA020MR03-L227F38Y

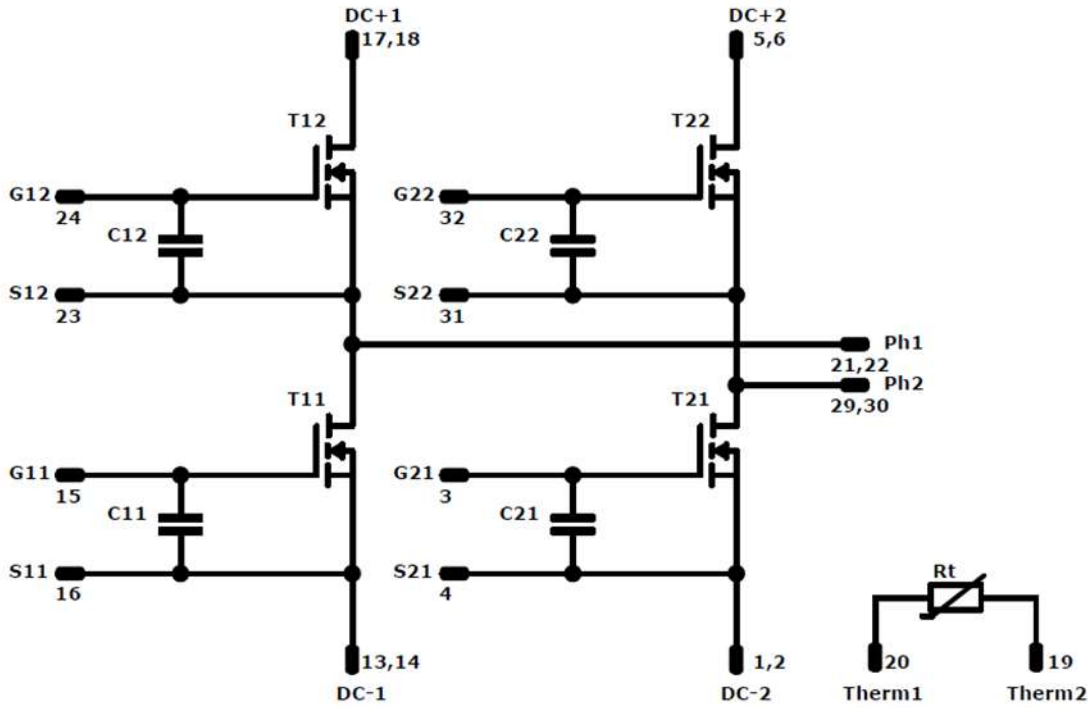
	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table			
Pin	X	Y	Function
1	52,2	2,7	DC-2
2	52,2	0	DC-2
3	45,5	12	G21
4	42,5	13	S21
5	41,2	0	DC+2
6	38,5	0	DC+2
7	Not assembled		
8	Not assembled		
9	Not assembled		
10	Not assembled		
11	Not assembled		
12	Not assembled		
13	13,7	0	DC-1
14	11	0	DC-1
15	8,7	12	G11
16	5,7	13	S11
17	0	0	DC+1
18	0	2,7	DC+1
19	14,3	15,6	THERM2
20	16,1	12,6	THERM1
21	0	28,2	PH1
22	2,7	28,2	PH1
23	5,7	26,7	S12
24	8,7	25,7	G12
25	Not assembled		
26	Not assembled		
27	Not assembled		
28	Not assembled		
29	36,3	28,2	PH2
30	39	28,2	PH2
31	42	26,7	S22
32	45	25,7	G22



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T21, T22	MOSFET	1200 V	20 mΩ	Half-Bridge Switch	
C11, C12, C21, C22	Capacitor	25 V		Capacitor (GS)	
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-PY124PA020MR03-L227F38Y-D1-14	10 Aug. 2018		