Vincotech

10-PY12PPA075ME-PN37G23T
datasheet

flowPIM 1 + 3xPFC **1200 V / 75 mΩ**

Topology features

- Current Synthesizing PFC
- Integrated DC Link capacitors
- Kelvin Emitter for improved switching performance
- Temperature sensor
- Thin Al_2O_3 for easy thermal design

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: Al_2O_3
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Press-fit pin
- Reliable cold welding connection

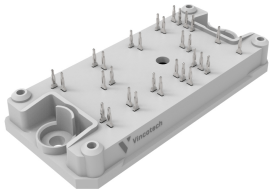
Target applications

- Embedded Drives
- Heat Pumps
- Industrial Drives

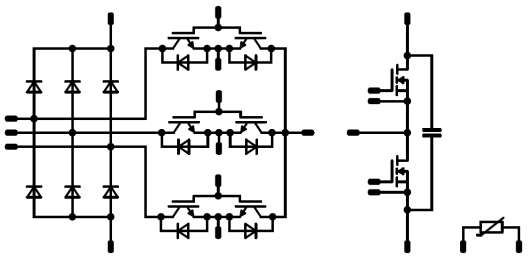
Types

- 10-PY12PPA075ME-PN37G23T

flow 1 12 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Half-Bridge Switch					
Drain-source voltage	V_{DSS}			1200	V
Drain current (DC current)	I_D	T_j = T_{jmax}	T_s = 80 °C	23	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		80	A
Total power dissipation	P_{tot}	T_j = T_{jmax}	T_s = 80 °C	68	W
Gate-source voltage	V_{GSS}			-4 / 15	V
		dynamic		-8 / 19	
Maximum Junction Temperature	T_{jmax}			175	°C
AC Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	T_j = T_{jmax}	T_s = 80 °C	35	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	44	W
Maximum junction temperature	T_{jmax}			150	°C
Mux Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	T_j = T_{jmax}	T_s <= 80 °C	10 (1)	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		10	A
Total power dissipation	P_{tot}	T_j = T_{jmax}	T_s = 80 °C	42	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V	T_j = 150 °C	9,5	µs
Maximum junction temperature	T_{jmax}			175	°C

(1) limited by I_{CRM}

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Mux Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	T_j = T_{jmax} T_s <= 80 °C	10 (2)	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	10	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	33	W
Maximum junction temperature	T_{jmax}		175	°C
Capacitor (DC)				
Maximum DC voltage	V_{MAX}		1000	V
Operation Temperature	T_{op}		-55 ... 125	°C
Module Properties				
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{jop}		-40…+(T_{jmax} - 25)	°C
Isolation Properties				
Isolation voltage	V_{isol}	DC Test Voltage* t_p = 2 s	6000	V
Creepage distance			11,53	mm
Clearance			9,56	mm
Comparative Tracking Index	CTI		≥ 600	

(2) limited by I_{FRM}

*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	
Half-Bridge Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		15		20	25 125 150		76,2 105 116	90[3]	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$			0,005	25	1,7	2,5	4	V
Gate to Source Leakage Current	I_{GSS}		15	0		25		10	250	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25		1	100	µA
Internal gate resistance	r_g							10,5		Ω
Gate charge	Q_g		-4/15	800	20	25		54		nC
Short-circuit input capacitance	C_{iss}	f = 1 Mhz	0	1000	0	25		1350		pF
Short-circuit output capacitance	C_{oss}							58		
Reverse transfer capacitance	C_{rss}							3		
Diode forward voltage	V_{SD}		0		10	25		4,5		V
Thermal										
Thermal resistance junction to sink[4]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,4		K/W

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} = 8 Ω R_{goff} = 8 Ω	-4/15	600	16	25 125 150		13,13 12,03 11,64		ns
Rise time	t_r					25 125 150		6,8 6,97 7,07		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		58,88 65,51 67,66		ns
Fall time	t_f					25 125 150		24,87 29,23 28,06		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,113 µC Q_{rFWD}=0,176 µC Q_{rFWD}=0,234 µC				25 125 150		0,222 0,239 0,259		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,033 0,036 0,036		mWs
Peak recovery current	I_{RRM}	di/dt=2724 A/µs di/dt=2730 A/µs di/dt=3059 A/µs				25 125 150		17,77 19,72 21,13		A
Reverse recovery time	t_{rr}					25 125 150		11,42 15,39 23,21		ns
Recovered charge	Q_r					25 125 150		0,113 0,176 0,234		µC
Reverse recovered energy	E_{rec}					25 125 150		$5{,}856 \times 10^{-3}$ 0,024 0,038		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		4532,2 2435,25 1213,64		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	
AC Diode										
Static										
Forward voltage	V_F				18	25 125 150		1,12 1,03 1,02	1,5(3)	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			100 1000	µA
Thermal										
Thermal resistance junction to sink(4)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,6		K/W
Mux Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0005	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		5	25 125 150		1,63 1,83 1,9	1,95(3)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			20	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}		0	10		25		1100		pF
Output capacitance	C_{oes}							57		pF
Reverse transfer capacitance	C_{res}							11		pF
Gate charge	Q_g	V_{CC} = 600 V	15		5	25		40		nC
Thermal										
Thermal resistance junction to sink(4)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,29		K/W

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	
Mux Diode										
Static										
Forward voltage	V_F				5	25 125 150		1,57 1,66 1,65	2,1[3]	V
Reverse leakage current	I_R	V_r = 1200 V				25			20	µA
Thermal										
Thermal resistance junction to sink[4]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,88		K/W
Capacitor (DC)										
Static										
Capacitance	C	DC bias voltage = 0 V				25		10		nF
Tolerance							-10		10	%
Dissipation factor		f = 1 kHz				25		0,15		%
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		130		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	

[3] Value at chip level

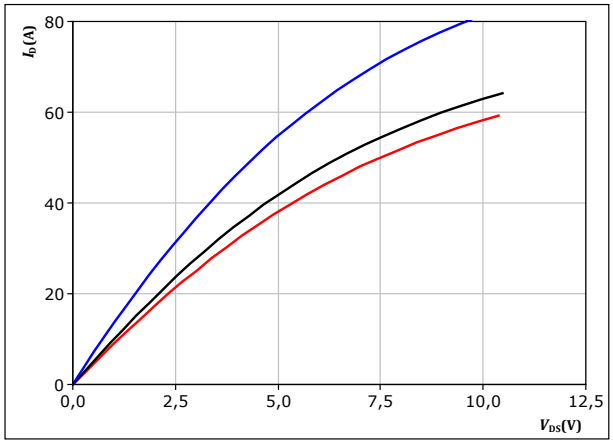
[4] Only valid with pre-applied Vincotech thermal interface material.

Half-Bridge Switch Characteristics

figure 1. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

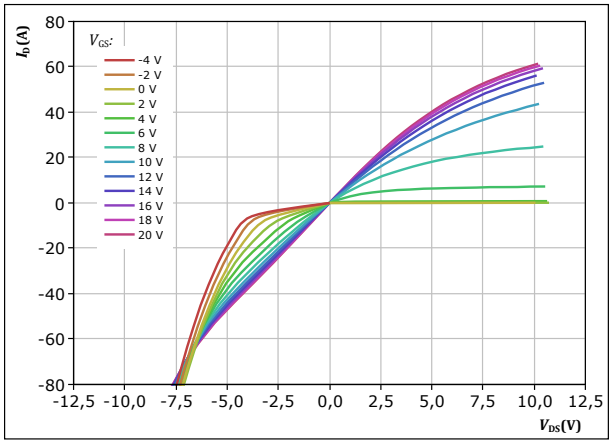


t_p =	250	µs		
V_{GS} =	16	V	T_j:	25 °C
				125 °C
				150 °C

figure 2. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$



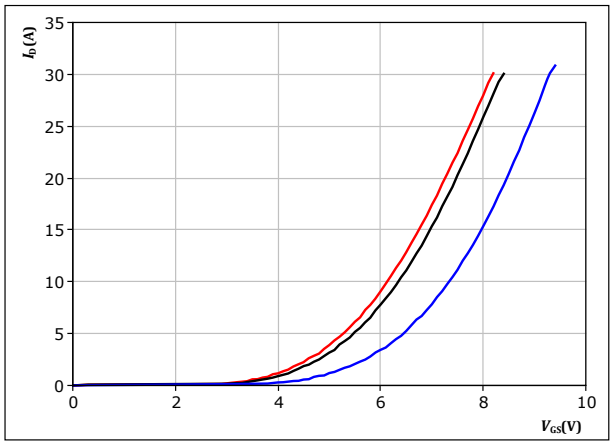
t_p =	250	µs
T_j =	150	°C

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

figure 3. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

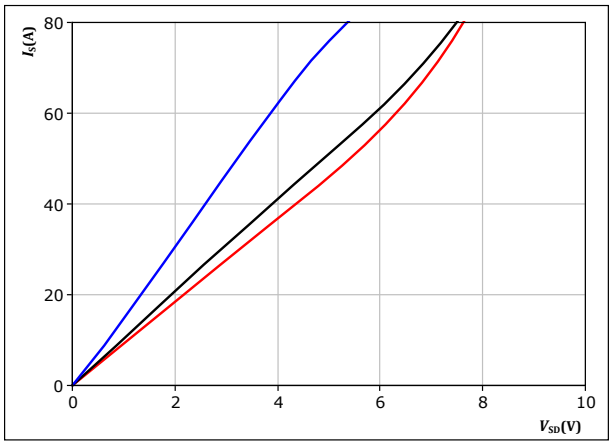


t_p =	250	µs		
V_{DS} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 4. **MOSFET**

Typical reverse drain current characteristics

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



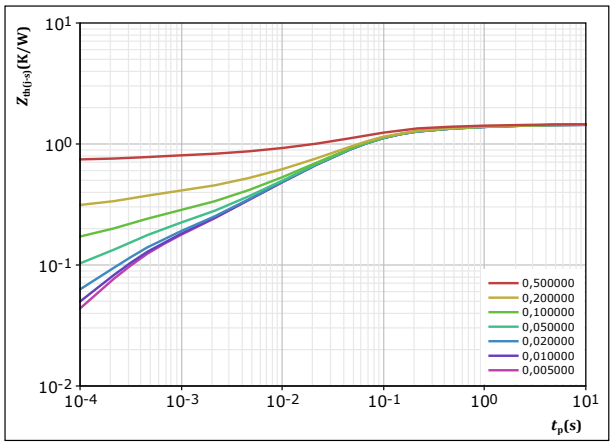
t_p =	250	µs		
V_{GS} =	16	V	T_j:	25 °C
				125 °C
				150 °C

Half-Bridge Switch Characteristics

figure 5. **MOSFET**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,454	K/W

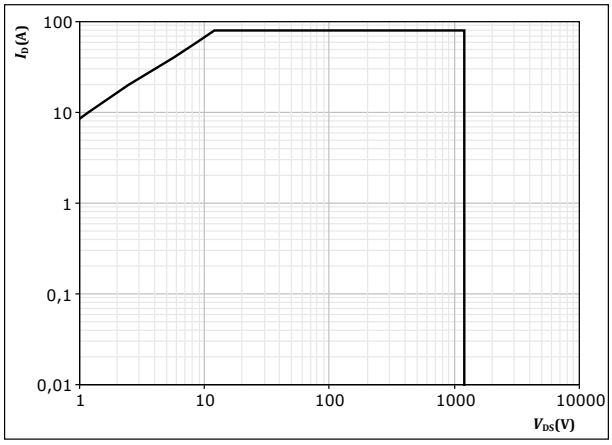
MOSFET thermal model values

R (K/W)	τ (s)
3,14E-02	2,08E+02
8,91E-02	1,77E+00
1,68E-01	2,75E-01
6,83E-01	5,71E-02
2,62E-01	1,39E-02
1,23E-01	2,80E-03
1,13E-01	3,07E-04

figure 6. **MOSFET**

Safe operating area

$I_D = f(V_{DS})$



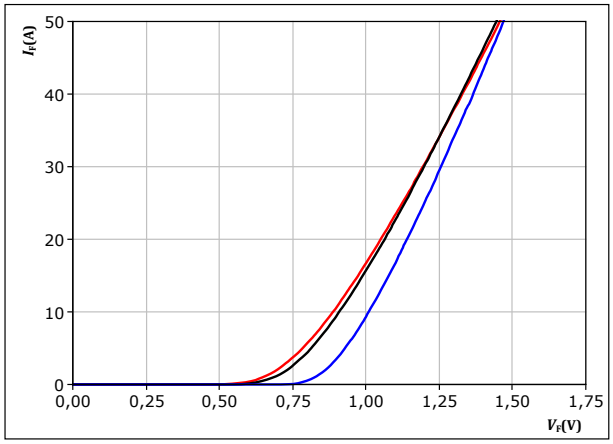
D =	single pulse	
T_s =	80	°C
V_{GS} =	16	V
T_j =	T_{jmax}	

AC Diode Characteristics

figure 7. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



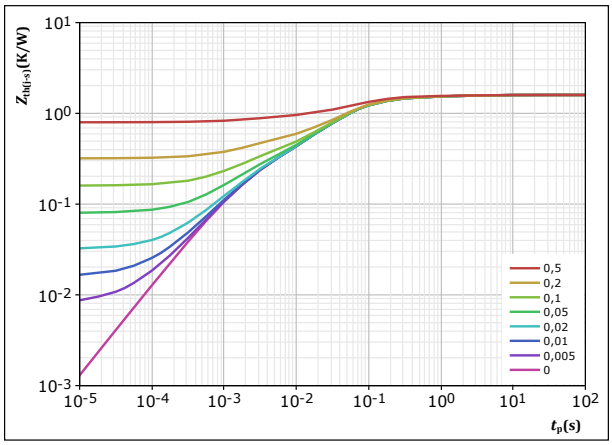
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 8. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,595 K/W

Rectifier thermal model values

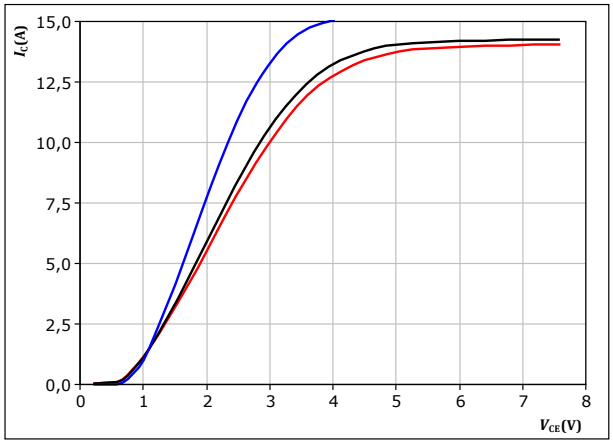
R (K/W)	τ (s)
5,74E-02	3,35E+00
1,49E-01	4,41E-01
9,92E-01	6,12E-02
2,25E-01	1,48E-02
1,72E-01	1,74E-03

Mux Switch Characteristics

figure 9. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

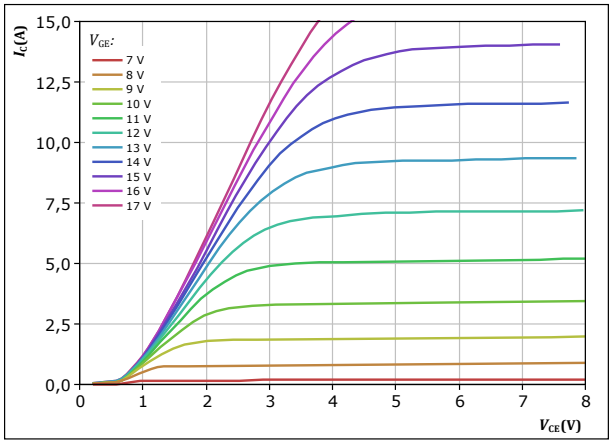


t_p =	250	µs		
V_{GE} =	15	V	T_j:	25 °C
				125 °C
				150 °C

figure 10. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



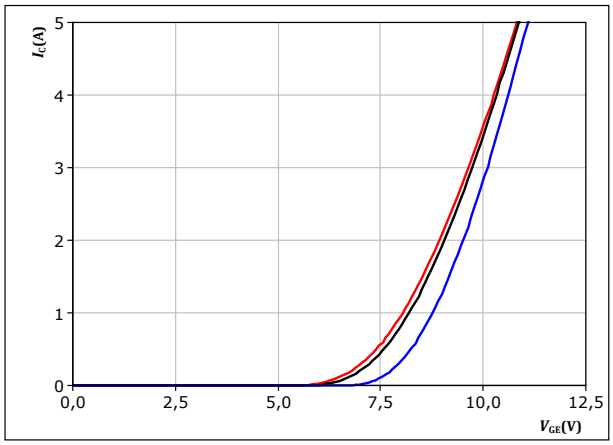
t_p =	250	µs
T_j =	150	°C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 11. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

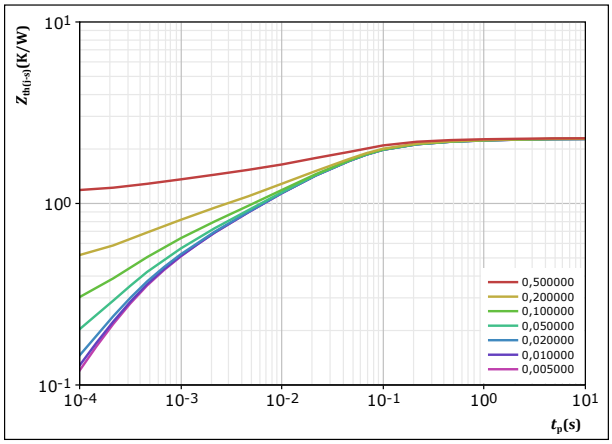


t_p =	250	µs		
V_{CE} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 12. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	2,286	K/W

IGBT thermal model values

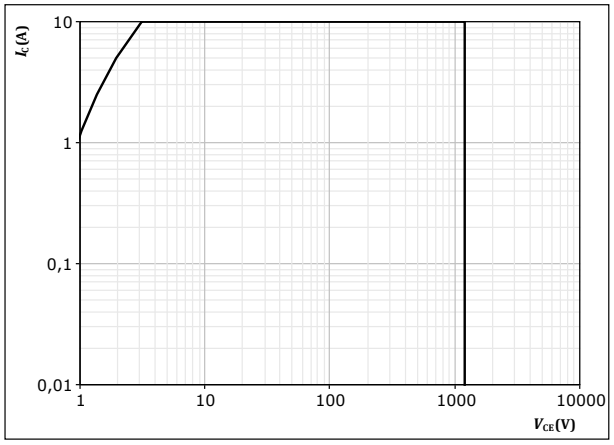
R (K/W)	τ (s)
4,25E-02	1,94E+02
7,62E-02	1,45E+00
2,30E-01	1,93E-01
8,98E-01	4,15E-02
5,03E-01	7,16E-03
3,17E-01	1,13E-03
2,40E-01	2,52E-04

Mux Switch Characteristics

figure 13. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



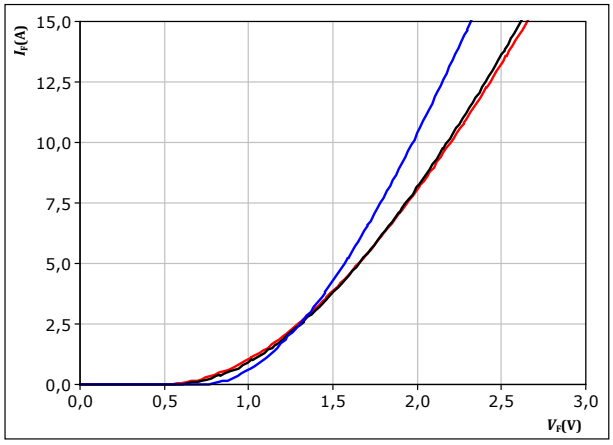
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Mux Diode Characteristics

figure 14. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



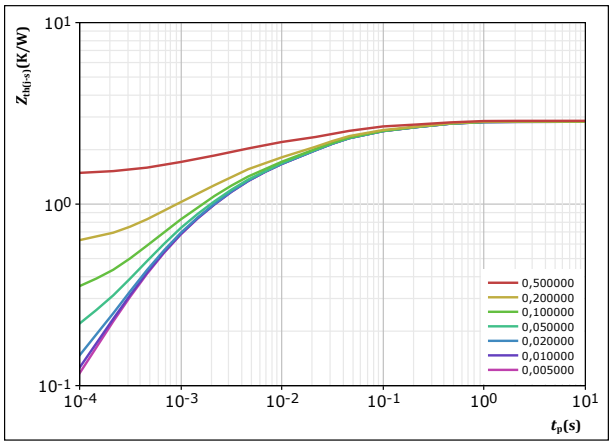
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 15. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,877 K/W

FWD thermal model values

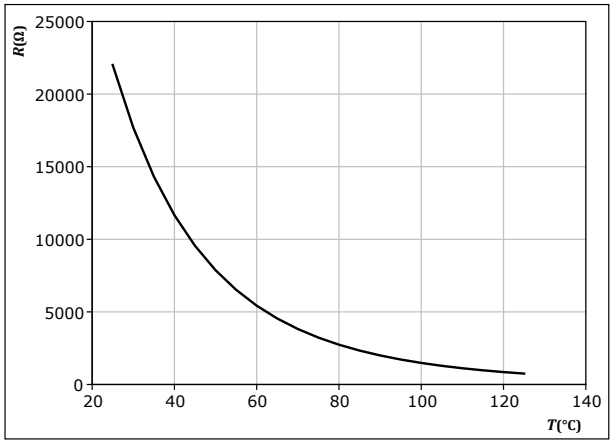
R (K/W)	τ (s)
7,66E-02	9,38E+01
4,55E-01	2,33E-01
1,09E+00	2,39E-02
8,71E-01	2,71E-03
4,25E-01	5,17E-04

Thermistor Characteristics

figure 16. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

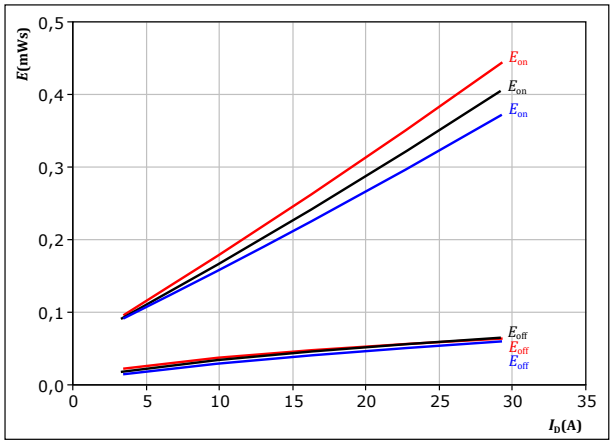


Half-Bridge Switching Characteristics

figure 17. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



With an inductive load at

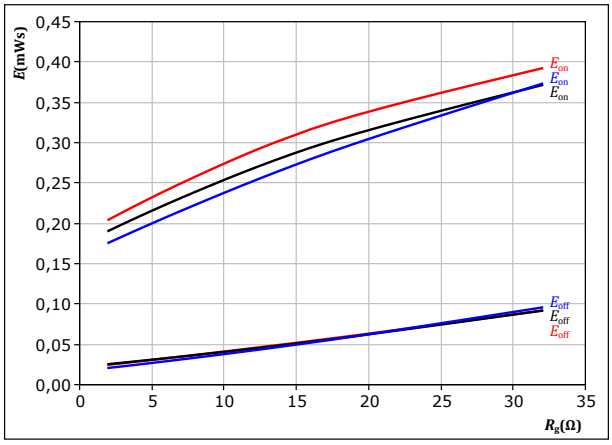
V_{DS} =	600	V
V_{GS} =	-4/15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 18. **MOSFET**

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

$E = f(R_g)$



With an inductive load at

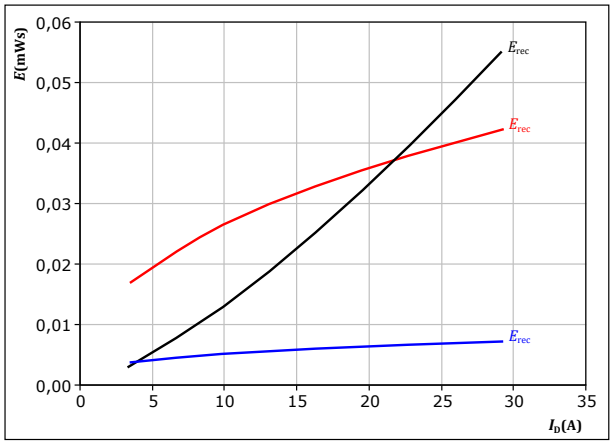
V_{DS} =	600	V
V_{GS} =	-4/15	V
I_D =	16	A

T_j: 25 °C, 125 °C, 150 °C

figure 19. **MOSFET**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



With an inductive load at

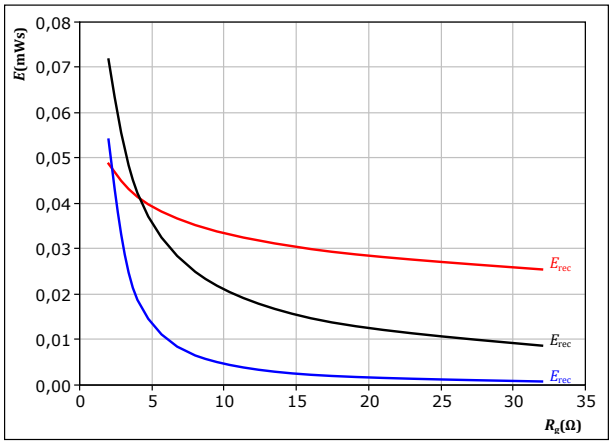
V_{DS} =	600	V
V_{GS} =	-4/15	V
R_{gon} =	8	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 20. **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} =	600	V
V_{GS} =	-4/15	V
I_D =	16	A

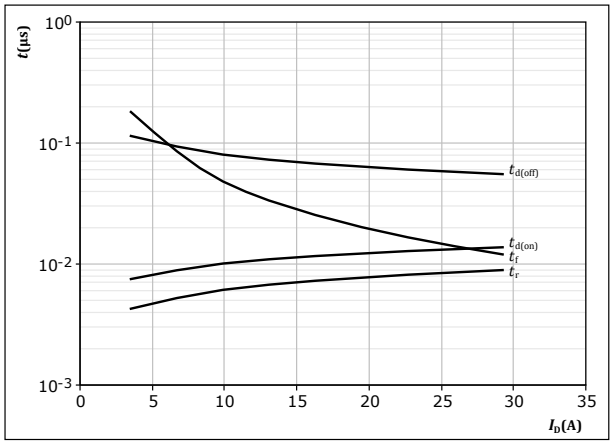
T_j: 25 °C, 125 °C, 150 °C

Half-Bridge Switching Characteristics

figure 21. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



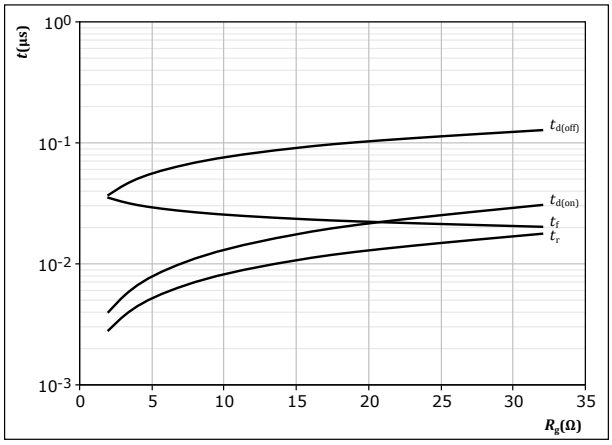
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-4/15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 22. **MOSFET**

Typical switching times as a function of MOSFET turn on gate resistor

$t = f(R_g)$



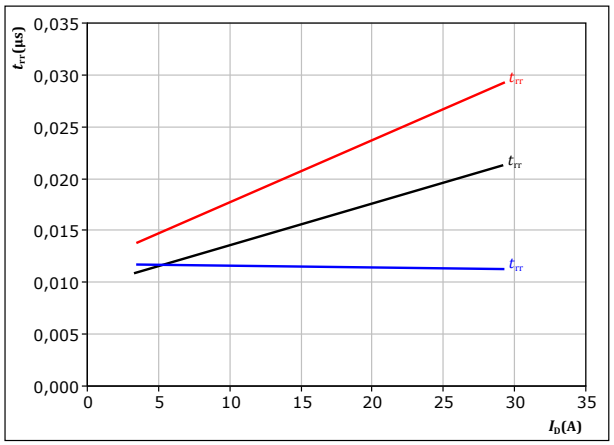
With an inductive load at

T_j =	150	°C
V_{DS} =	600	V
V_{GS} =	-4/15	V
I_D =	16	A

figure 23. **MOSFET**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



At

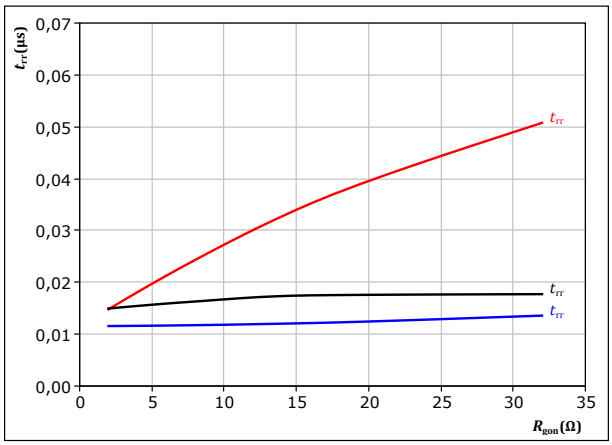
V_{DS} =	600	V
V_{GS} =	-4/15	V
R_{gon} =	8	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 24. **MOSFET**

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

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



At

V_{DS} =	600	V
V_{GS} =	-4/15	V
I_D =	16	A

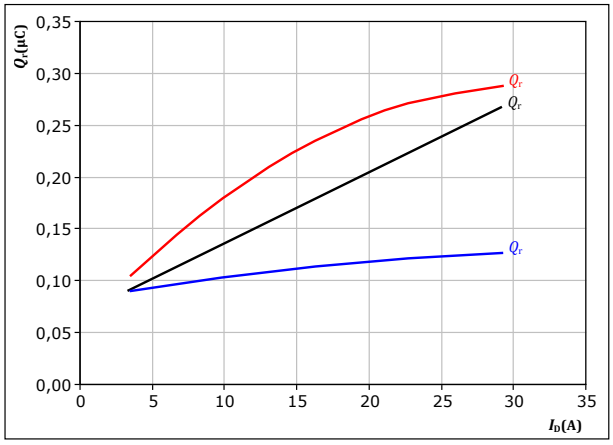
T_j: 25 °C, 125 °C, 150 °C

Half-Bridge Switching Characteristics

figure 25. **MOSFET**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

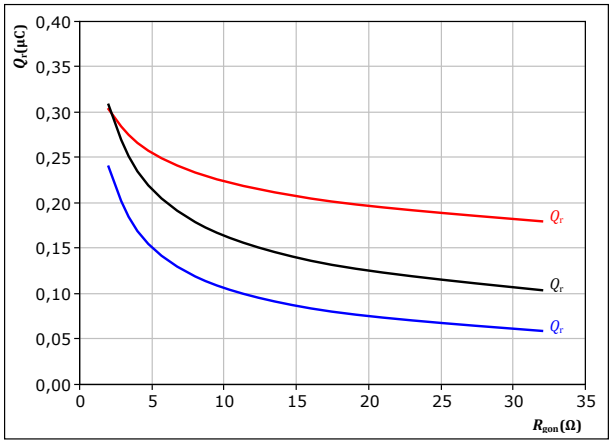


At					
V_{DS} =	600	V			
V_{GS} =	-4/15	V	T_j:	25 °C	
R_{gon} =	8	Ω		125 °C	
				150 °C	

figure 26. **MOSFET**

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

$Q_r = f(R_{gon})$

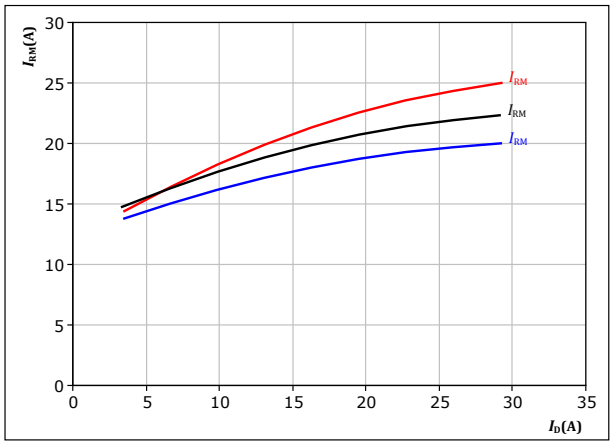


At					
V_{DS} =	600	V			
V_{GS} =	-4/15	V	T_j:	25 °C	
I_D =	16	A		125 °C	
				150 °C	

figure 27. **MOSFET**

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

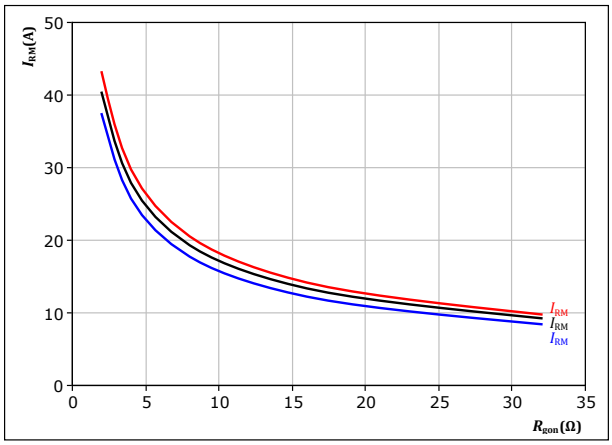


At					
V_{DS} =	600	V			
V_{GS} =	-4/15	V	T_j:	25 °C	
R_{gon} =	8	Ω		125 °C	
				150 °C	

figure 28. **MOSFET**

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

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



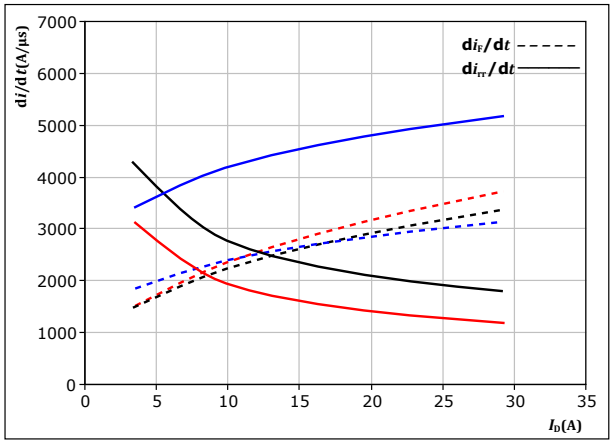
At					
V_{DS} =	600	V			
V_{GS} =	-4/15	V	T_j:	25 °C	
I_D =	16	A		125 °C	
				150 °C	

Half-Bridge Switching Characteristics

figure 29. **MOSFET**

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)

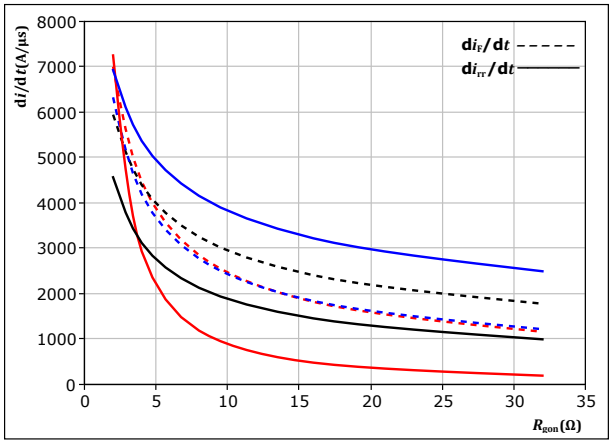


At				
V_{DS} =	600	V		
V_{GS} =	-4/15	V	T_j:	25 °C
R_{gon} =	8	Ω		125 °C
				150 °C

figure 30. **MOSFET**

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})

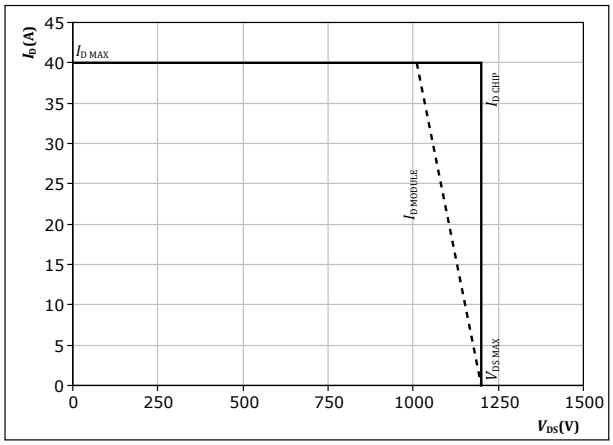


At				
V_{DS} =	600	V		
V_{GS} =	-4/15	V	T_j:	25 °C
I_D =	16	A		125 °C
				150 °C

figure 31. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



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

Half-Bridge Switching Definitions

figure 32. MOSFET

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

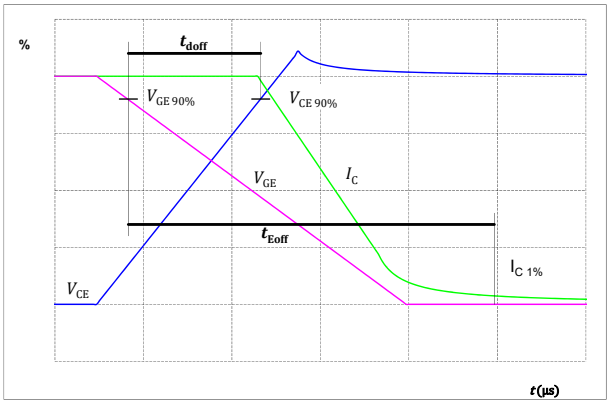


figure 33. MOSFET

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

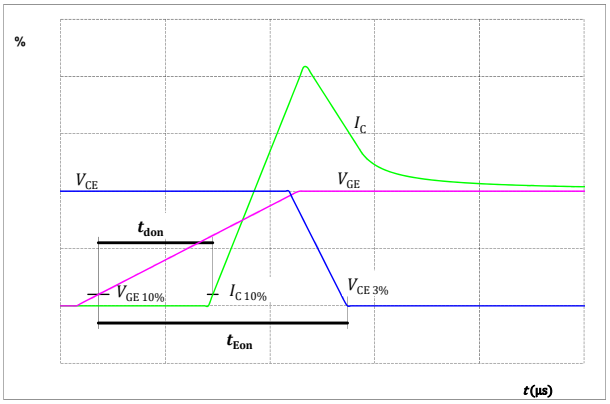


figure 34. MOSFET

Turn-off Switching Waveforms & definition of t_f

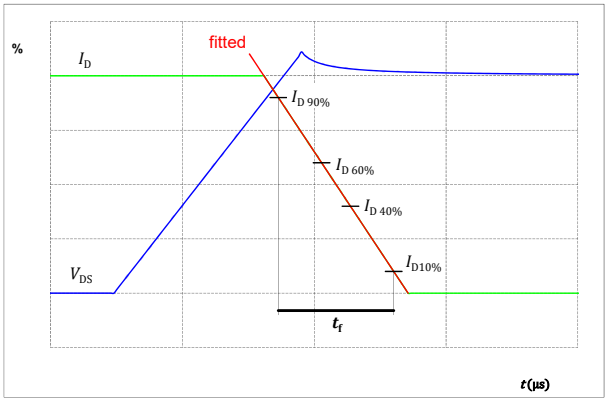
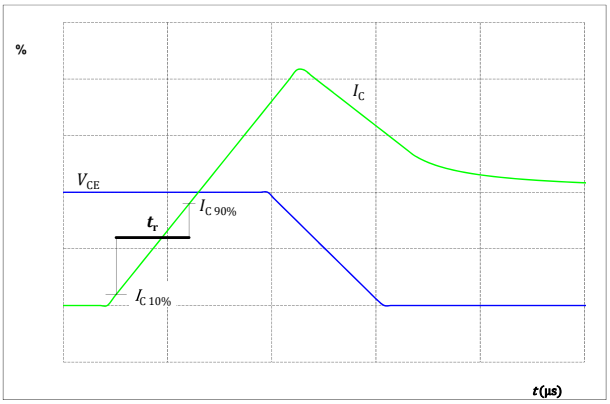


figure 35. MOSFET

Turn-on Switching Waveforms & definition of t_r



Half-Bridge Switching Definitions

figure 36. **FWD**

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

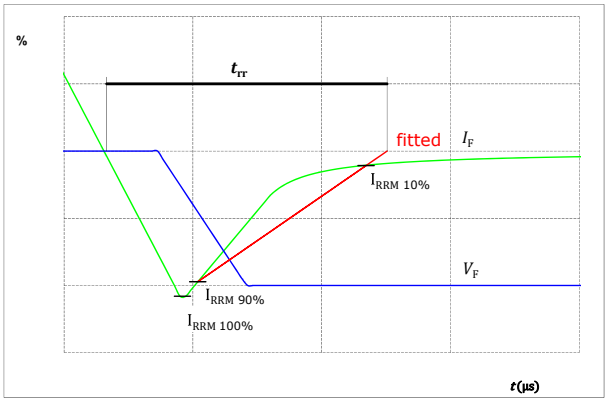


figure 37. **FWD**

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

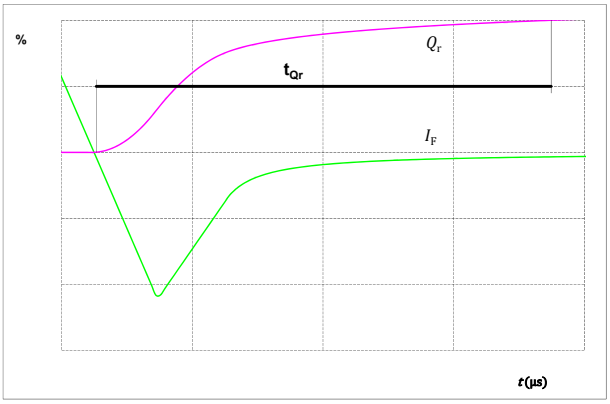
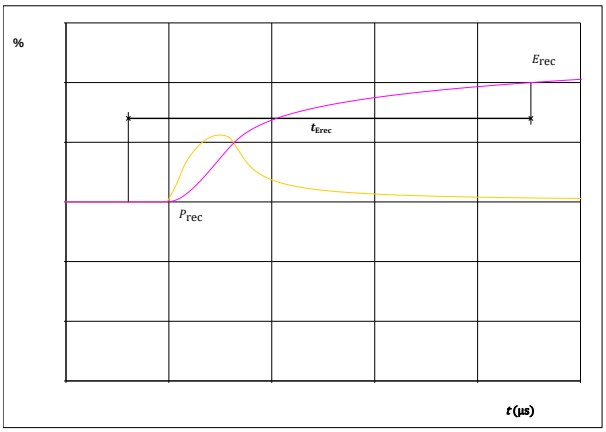


figure 38. **FWD**

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



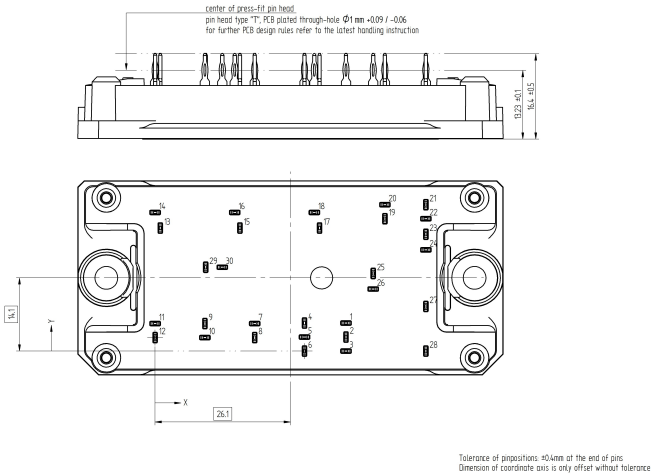
Ordering Code	
Version	**Ordering Code**
Without thermal paste	10-PY12PPA075ME-PN37G23T
With thermal paste (5,2 W/mK, PTM6000HV)	10-PY12PPA075ME-PN37G23T-/7/

Marking

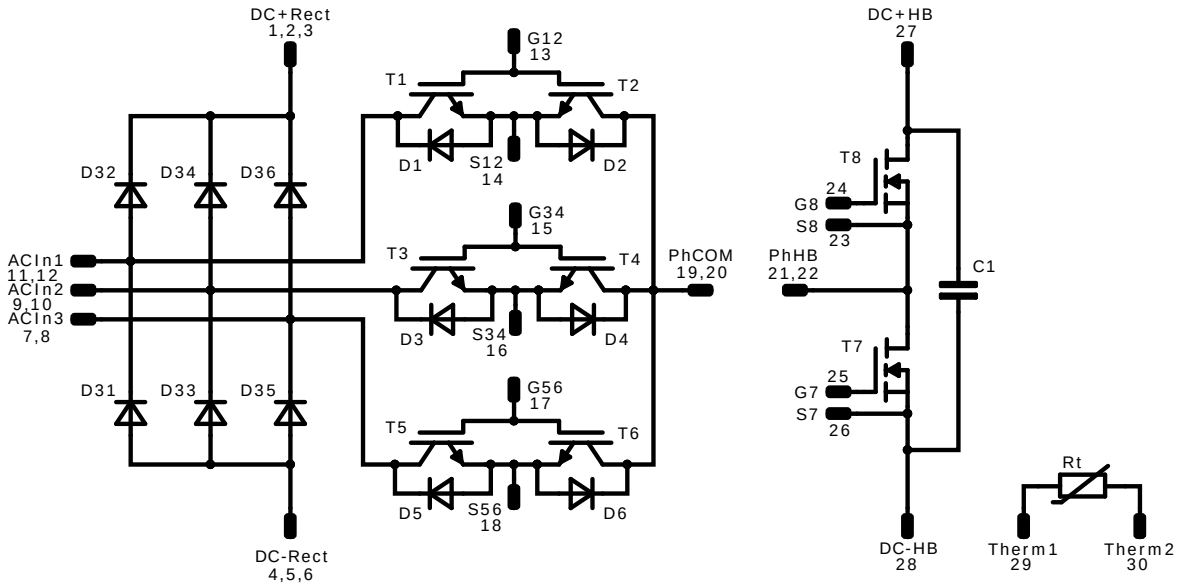
	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Function
1	36,8	5,4	DC+Rect
2	36,8	2,7	DC+Rect
3	36,8	0	DC+Rect
4	28,8	5,4	DC-Rect
5	28,8	2,7	DC-Rect
6	28,8	0	DC-Rect
7	19,2	5,3	ACIn3
8	19,2	2,6	ACIn3
9	9,6	5,3	ACIn2
10	9,6	2,6	ACIn2
11	0	5,3	ACIn1
12	0	2,6	ACIn1
13	1	23,7	G12
14	0	26,7	S12
15	16,35	23,7	G34
16	15,35	26,7	S34
17	31,7	23,7	G56
18	30,7	26,7	S56
19	44,3	25,5	PhCOM
20	44,3	28,2	PhCOM
21	52,2	28,2	PhHB
22	52,2	25,5	PhHB
23	52,2	22,5	S8
24	52,2	19,5	G8
25	42,05	14,95	G7
26	42,05	11,95	S7
27	52,2	8,6	DC+HB
28	52,2	0	DC-HB
29	9,75	16,15	Therm1
30	12,95	16,15	Therm2



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T7, T8	MOSFET	1200 V	75 mΩ	Half-Bridge Switch	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	18 A	AC Diode	
T1, T2, T3, T4, T5, T6	IGBT	1200 V	5 A	Mux Switch	
D1, D2, D3, D4, D5, D6	FWD	1200 V	5 A	Mux Diode	
C1	Capacitor	1000 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 UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}$=175°C and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-PY12PPA075ME-PN37G23T-D1-14	8 Jan. 2025	Initial Release	