



Vincotech

10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
target datasheet

flowANPC 1 split

2400 V / 8 mΩ

Features

- Split Advanced NPC topology
- Ultra-high switching frequency with SiC MOSFETs
- Split topology for better thermal performance
- No x-conduction at high frequencies

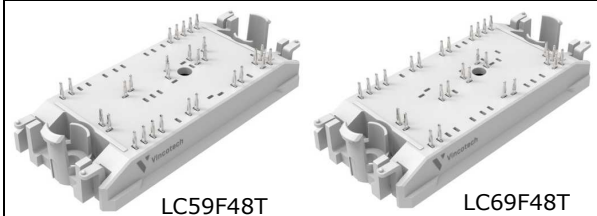
Target applications

- Solar Inverter

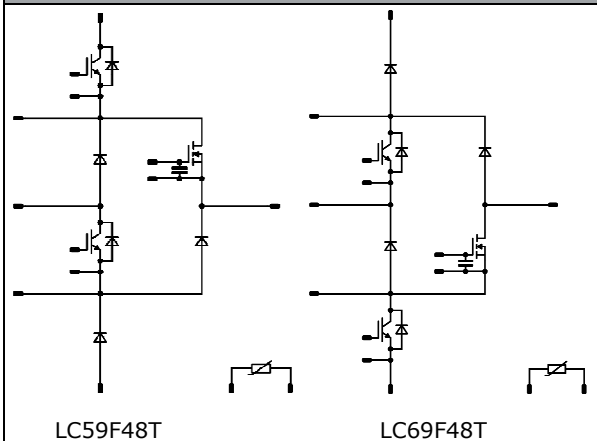
Types

- 10-PH12NAB008MR03-LC59F48T
- 10-PH12NAC008MR03-LC69F48T

flow 1 12 mm housing



Schematic



Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
DC-Link Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	149	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	287	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C



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Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
DC-Link Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	86	A
Repetitive peak forward current	I_{FRM}		200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	158	W
Maximum junction temperature	T_{jmax}		175	°C
DC-Link Switch Inverse Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	86	A
Repetitive peak forward current	I_{FRM}		200	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	158	W
Maximum junction temperature	T_{jmax}		175	°C
Neutral Point Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	149	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	287	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C
Neutral Point Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	111	A
Repetitive peak forward current	I_{FRM}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	183	W
Maximum junction temperature	T_{jmax}		175	°C



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Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
Neutral Point Switch Prot. Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F		15	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	65	A
Surge current capability	I_{ct}		21	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	70	W
Maximum junction temperature	T_{jmax}		175	°C

AC Switch

Drain-source voltage	V_{DSS}		1200	V
Drain current	I_D	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	164	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}	685	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	381	W
Gate-source voltage	V_{GSS}		-4/22	V
Maximum Junction Temperature	T_{jmax}		175	°C

AC Diode

Peak repetitive reverse voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F		60	A
Repetitive peak forward current	I_{FRM}		252	A
Surge (non-repetitive) forward current	I_{FSM}	60 Hz Single Half Sine Wave $t_p = 8,3\text{ ms}$ $T_j = 150\text{ °C}$	196	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	243	W
Maximum junction temperature	T_{jmax}		175	°C

GS Capacitor

Maximum DC voltage	V_{MAX}		25	V
Operation Temperature	T_{op}		-55...+125	°C



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Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
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Module Properties

Thermal Properties

Storage temperature	T_{stg}		-40...+125	°C
Operation temperature under switching condition	T_{top}		-40...(T_{jmax} - 25)	°C

Isolation Properties

Isolation voltage	V_{isol}	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
		AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			min. 12,7	mm
Clearance			8,21	mm
Comparative Tracking Index	CTI		≥ 600	

*100 % tested in production



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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	

DC-Link Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125 150		1,57 1,80 1,86	1,85	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			100	μA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							3		Ω
Input capacitance	C_{ies}		0	10	25			30000		pF
Output capacitance	C_{oes}							880		
Reverse transfer capacitance	C_{res}							320		
Gate charge	Q_g		15	600	150	25		1000		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK (PSX)}$						0,33		K/W
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DC-Link Diode

Static

Forward voltage	V_F				100	25 125 150		1,82 1,96 1,97	2,1	V
Reverse leakage current	I_R			1200		25			40	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK (PSX)}$						0,60		K/W
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DC-Link Switch Inverse Diode

Static

Forward voltage	V_F				100	25 125 150		1,82 1,96 1,97	2,1	V
Reverse leakage current	I_R			1200		25			40	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK (PSX)}$						0,60		K/W
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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	

Neutral Point Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,015	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125 150		1,57 1,80 1,86	1,85	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			100	µA
Gate-emitter leakage current	I_{GES}		20	0		25			500	nA
Internal gate resistance	r_g							3		Ω
Input capacitance	C_{ies}		0	10		25		30000		pF
Output capacitance	C_{oes}							880		
Reverse transfer capacitance	C_{res}							320		
Gate charge	Q_g		15	600	150	25		1000		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK (PSX)}$						0,33		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{goff} = 4 \Omega$ $R_{gon} = 4 \Omega$	± 15	600	110	25 125 150		397 403 405		ns
Rise time	t_r					25 125 150		61 71 75		
Turn-off delay time	$t_{d(off)}$					25 125 150		307 348 360		
Fall time	t_f					25 125 150		88 119 129		
Turn-on energy (per pulse)	E_{on}	$Q_{rFWD} = 10,6 \mu\text{C}$ $Q_{rFWD} = 14,8 \mu\text{C}$ $Q_{rFWD} = 16,5 \mu\text{C}$				25 125 150		13,44 15,74 16,53		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		7,26 9,98 10,65		



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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	

Neutral Point Diode

Static

Forward voltage	V_F				150	25 125 150		1,80 1,90 1,90	2,1	V
Reverse leakage current	I_R			1200		25			40	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK (PSX)}$						0,52		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt = 1592 \text{ A/}\mu\text{s}$ $di/dt = 1303 \text{ A/}\mu\text{s}$ $di/dt = 1123 \text{ A/}\mu\text{s}$	± 15	600	110	25 125 150		59 61 61		A
Reverse recovery time	t_{rr}					25 125 150		347 471 513		ns
Recovered charge	Q_r					25 125 150		10,57 14,82 16,51		μC
Reverse recovered energy	E_{rec}					25 125 150		3,29 5,16 5,90		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		210 223 208		A/μs

Neutral Point Switch Prot. Diode

Static

Forward voltage	V_F				15	25 125		2,37 2,47	2,71	V
Reverse leakage current	I_R			1200		25 150			60 1800	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK (PSX)}$						1,35		K/W
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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	

AC Switch

Static

Drain-source on-state resistance	$r_{DS(on)}$		18		100	25 125 150		8 11 12	10	mΩ
Gate-source threshold voltage	$V_{GS(th)}$			10	0,05	25	2,7		5,6	V
Gate to Source Leakage Current	I_{GSS}		-4/22	0		25			±500	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	1200		25			50	μA
Internal gate resistance	r_g							1,4		Ω
Gate charge	Q_g	18	600	100	25			535		nC
Gate to source charge	Q_{GS}							110		
Gate to drain charge	Q_{GD}							205		
Short-circuit input capacitance	C_{iss}	$f = 1$ MHz	0	800	25			6685		pF
Short-circuit output capacitance	C_{oss}							380		
Reverse transfer capacitance	C_{rss}							135		

Reverse Diode Static

Diode forward voltage	V_{SD}		0		100	25		3,2		V
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Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,25		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{goff} = 1 \Omega$ $R_{gon} = 1 \Omega$	0/16	600	99	25 125 150		30 29 27		ns
Rise time	t_r					25 125 150		14 15 15		
Turn-off delay time	$t_{d(off)}$					25 125 150		83 101 101		
Fall time	t_f					25 125 150		9 13 13		
Turn-on energy (per pulse)	E_{on}					25 125 150		1,26 1,44 1,41		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,02 1,42 1,48		



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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	

AC Diode

Static

Forward voltage	V_F				60	25 125		1,63 2,04	1,7	V
Reverse leakage current	I_R			1200		25			1200	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,39		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt = 7141$ A/μs $di/dt = 10501$ A/μs $di/dt = 8639$ A/μs	0/16	600	99	25 125 150		59 52 54		A
Reverse recovery time	t_{rr}					25 125 150		14 15 15		ns
Recovered charge	Q_r					25 125 150		0,432 0,794 1,43		μC
Reverse recovered energy	E_{rec}					25 125 150		0,068 0,221 0,537		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		13486 10799 10500		A/μs

GS Capacitor

Capacitance	C							10		nF
Tolerance							-10		+10	%
Dissipation factor		$f = 1$ kHz				25			0,1	%

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
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DC-Link Switch Characteristics

figure 1. IGBT
Typical output characteristics

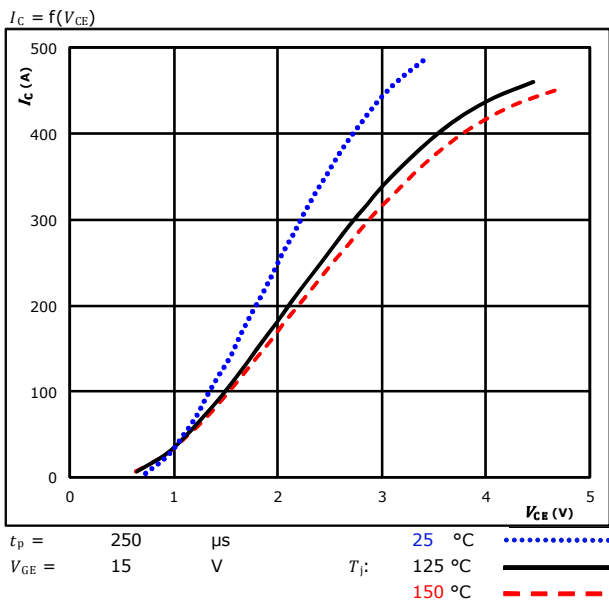


figure 2. IGBT
Typical output characteristics

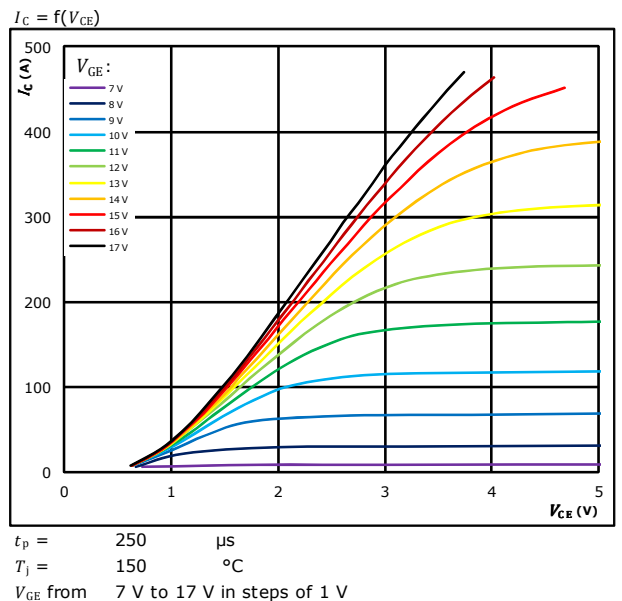


figure 3. IGBT
Typical transfer characteristics

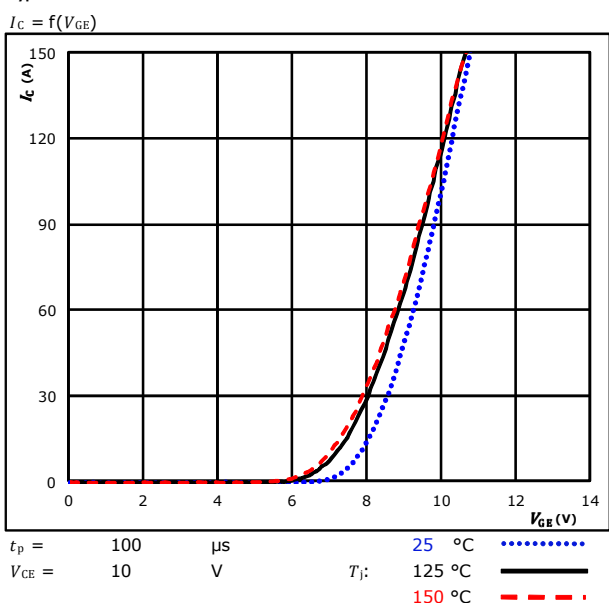
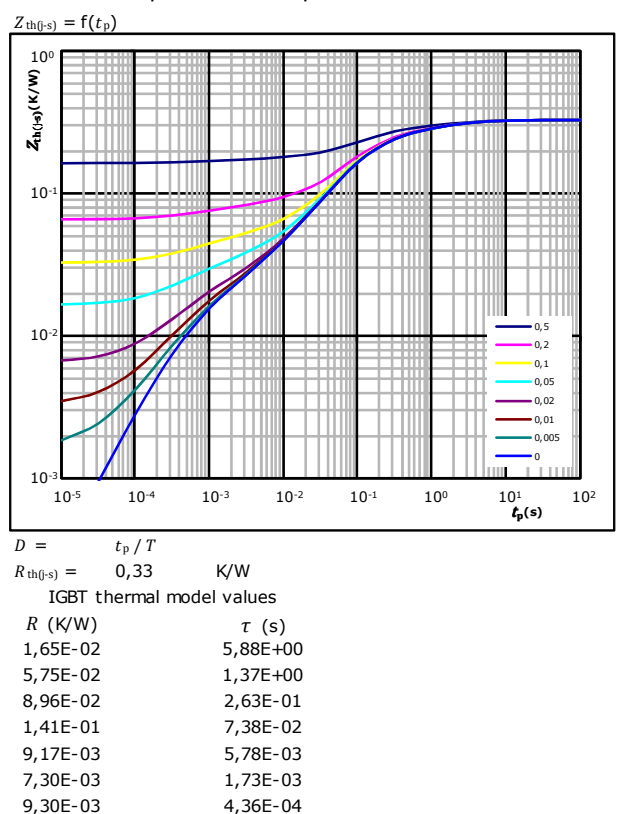


figure 4. IGBT
Transient thermal impedance as function of pulse duration





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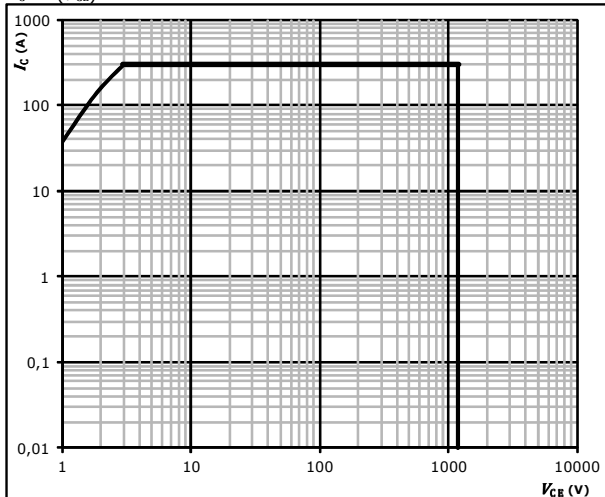
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 target datasheet

DC-Link Switch Characteristics

figure 5. IGBT

Safe operating area

$I_C = f(V_{CE})$



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



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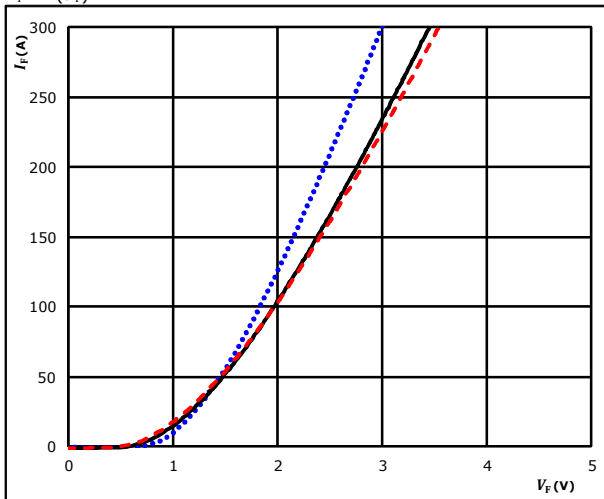
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DC-Link Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

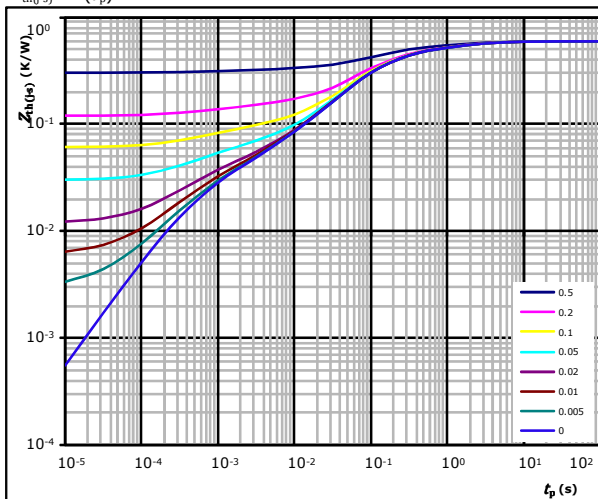


$t_p =$ 250 μ s
 T_j : 25 °C
 125 °C ———
 150 °C - - - -

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D =$ t_p / T
 $R_{th(j-s)} =$ 0,60 K/W

FWD thermal model values

R (K/W)	τ (s)
2,99E-02	1,07E+01
1,04E-01	2,48E+00
1,63E-01	4,77E-01
2,56E-01	1,34E-01
1,66E-02	1,05E-02
1,33E-02	3,13E-03
1,69E-02	7,91E-04



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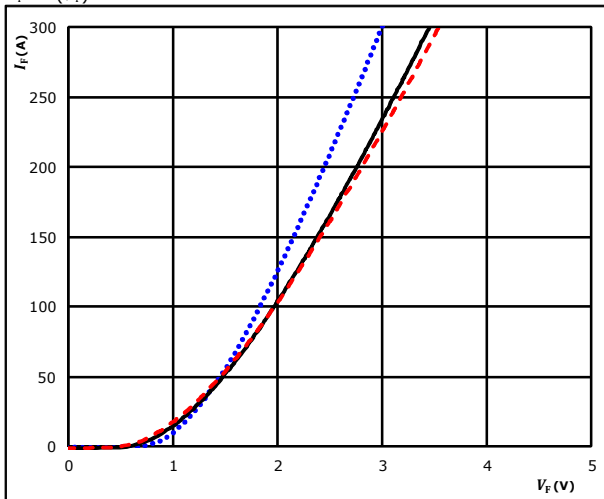
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DC-Link Switch Inverse Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

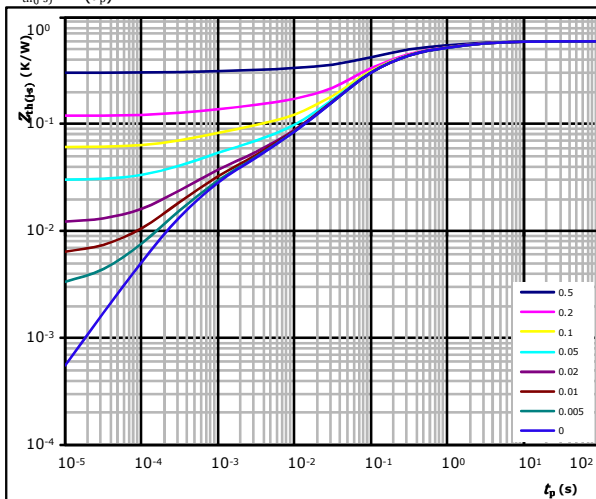


$t_p = 250 \mu s$
 T_j : 25 °C (blue dotted line)
 125 °C (black solid line)
 150 °C (red dashed line)

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,60 \text{ K/W}$

FWD thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
2,99E-02	1,07E+01
1,04E-01	2,48E+00
1,63E-01	4,77E-01
2,56E-01	1,34E-01
1,66E-02	1,05E-02
1,33E-02	3,13E-03
1,69E-02	7,91E-04



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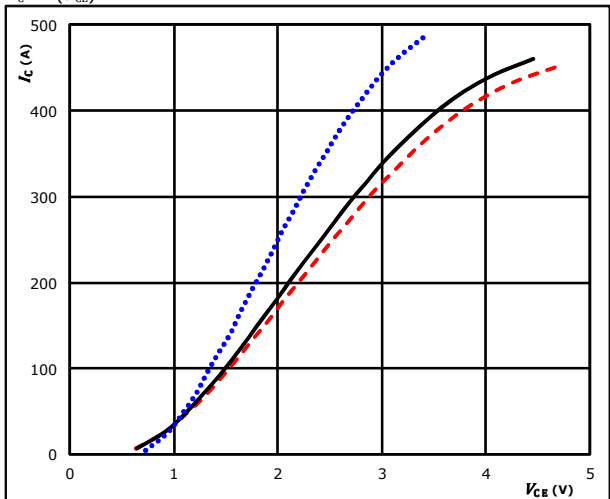
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Neutral Point Switch Characteristics

figure 1. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

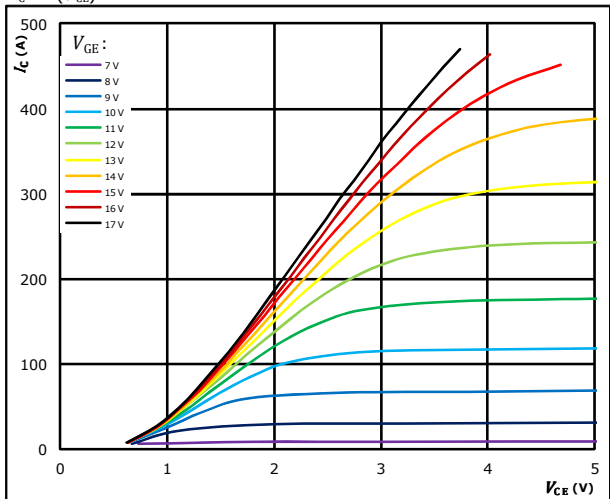


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $125 \text{ } ^\circ C$ (black solid line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 2. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

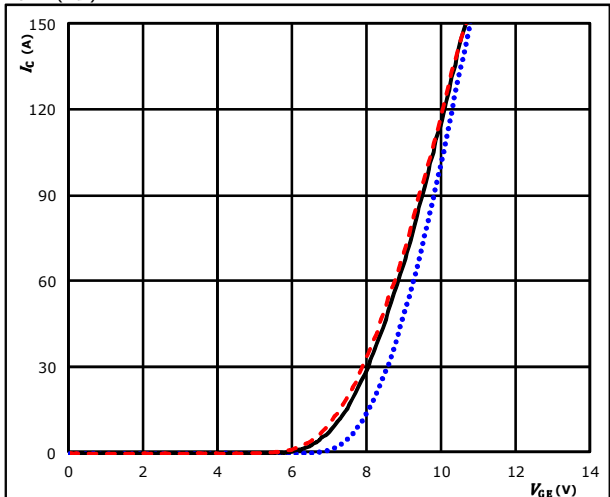


$t_p = 250 \mu s$
 $T_j = 150 \text{ } ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$

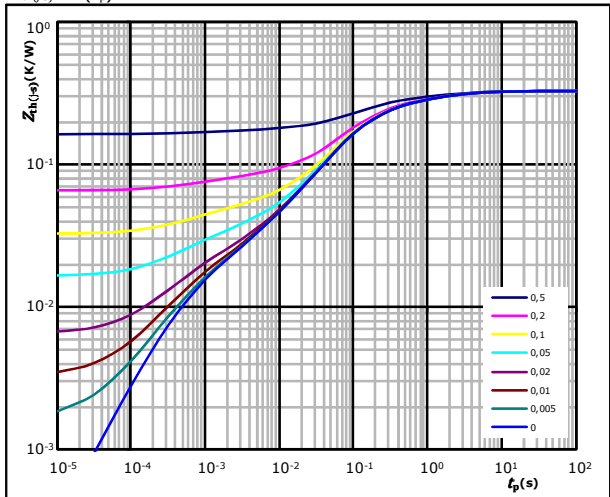


$t_p = 100 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25 \text{ } ^\circ C$ (blue dotted line)
 $125 \text{ } ^\circ C$ (black solid line)
 $150 \text{ } ^\circ C$ (red dashed line)

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 0,33 \text{ K/W}$
IGBT thermal model values

R (K/W)	τ (s)
1,65E-02	5,88E+00
5,75E-02	1,37E+00
8,96E-02	2,63E-01
1,41E-01	7,38E-02
9,17E-03	5,78E-03
7,30E-03	1,73E-03
9,30E-03	4,36E-04



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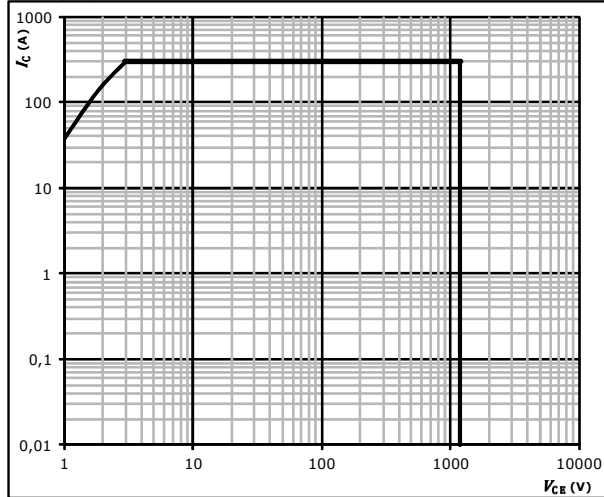
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 target datasheet

Neutral Point Switch Characteristics

figure 5. IGBT

Safe operating area

$I_C = f(V_{CE})$



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



Vincotech

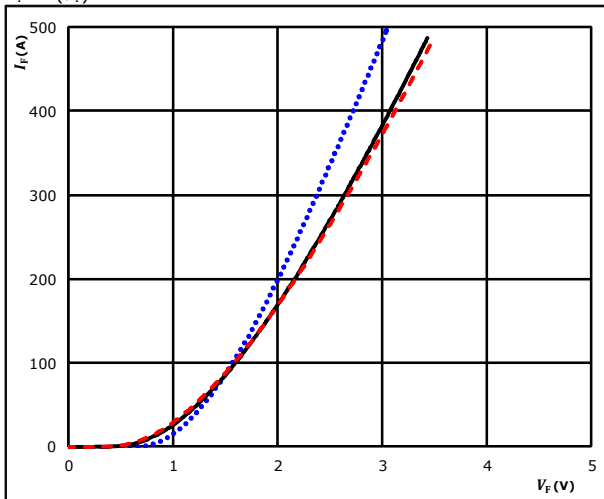
10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
 target datasheet

Neutral Point Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

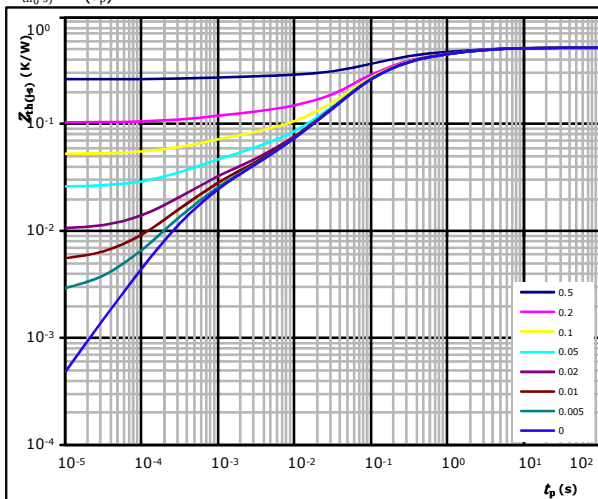


$t_p =$ 250 μ s
 T_j : 25 °C (blue dotted line)
 125 °C (black solid line)
 150 °C (red dashed line)

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,52$ K/W

FWD thermal model values

R (K/W)	τ (s)
2,59E-02	9,26E+00
9,06E-02	2,15E+00
1,41E-01	4,14E-01
2,22E-01	1,16E-01
1,44E-02	9,10E-03
1,15E-02	2,72E-03
1,46E-02	6,86E-04



Vincotech

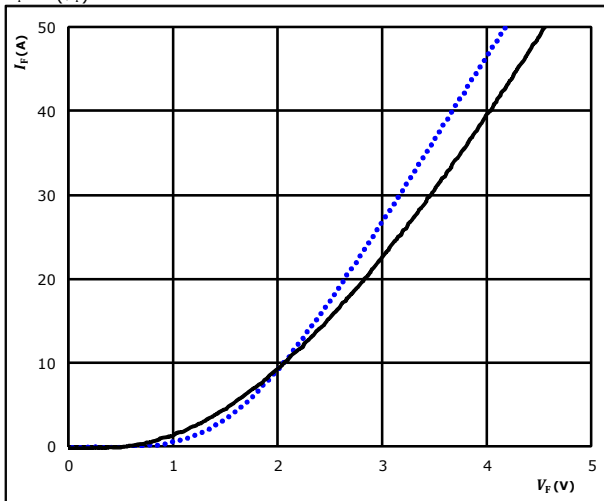
10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
 target datasheet

Neutral Point Switch Prot. Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

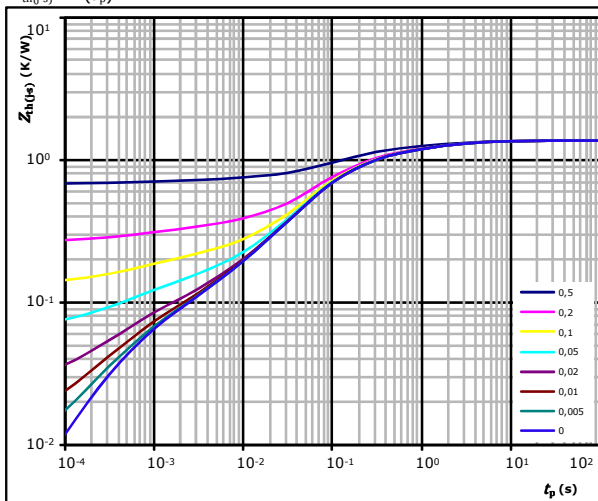


$t_p = 250 \mu s$
 T_j : 25 °C (dotted blue line)
 125 °C (solid black line)

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,35 \text{ K/W}$

FWD thermal model values

$R \text{ (K/W)}$	$\tau \text{ (s)}$
6,72E-02	2,40E+01
2,35E-01	5,58E+00
3,66E-01	1,07E+00
5,76E-01	3,01E-01
3,74E-02	2,36E-02
2,98E-02	7,04E-03
3,80E-02	1,78E-03



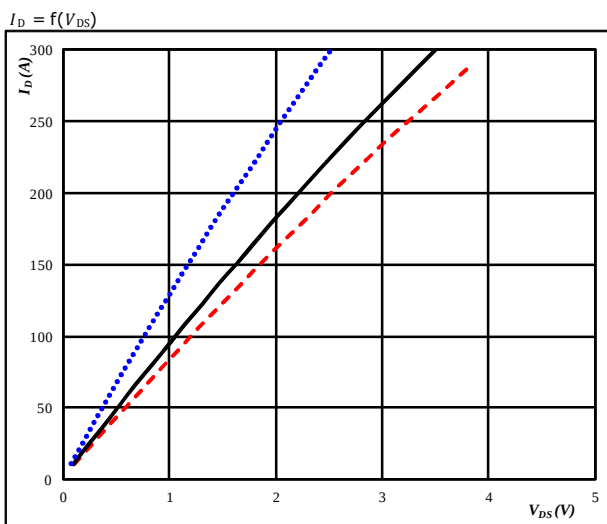
Vincotech

10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
 target datasheet

AC Switch Characteristics

figure 1. MOSFET

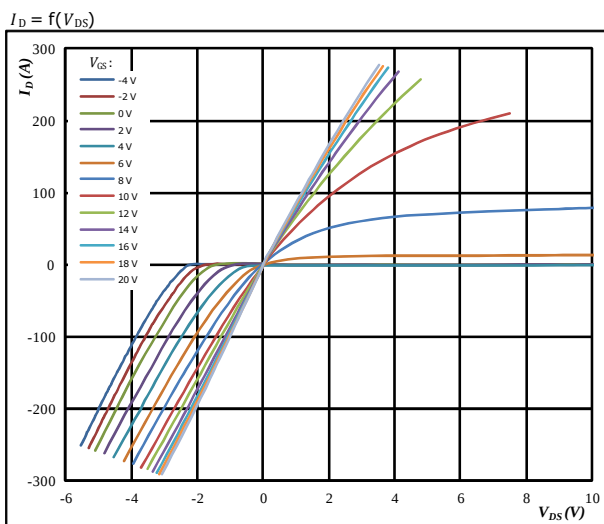
Typical output characteristics



$t_p = 250 \mu s$
 $V_{GS} = 18 V$
 $T_j: 25^\circ C$ (blue dotted)
 $125^\circ C$ (black solid)
 $150^\circ C$ (red dashed)

figure 2. MOSFET

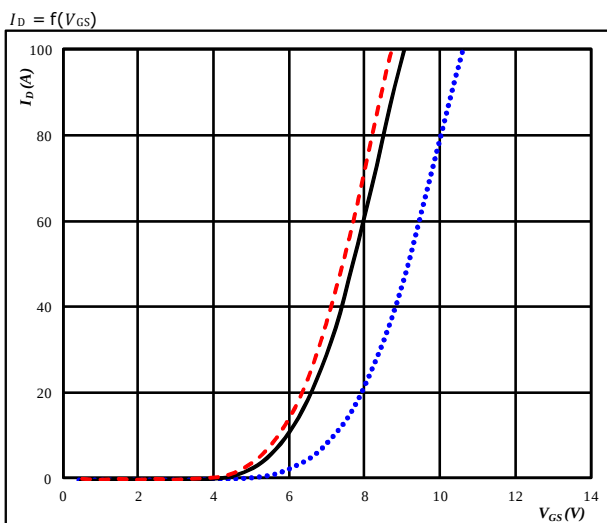
Typical output characteristics



$t_p = 250 \mu s$
 $T_j = 150^\circ C$
 V_{GS} from -4 V to 20 V in steps of 2 V

figure 3. MOSFET

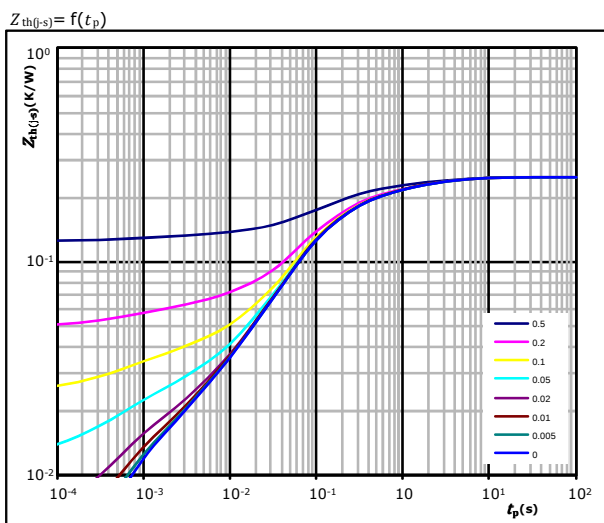
Typical transfer characteristics



$t_p = 100 \mu s$
 $V_{DS} = 10 V$
 $T_j: 25^\circ C$ (blue dotted)
 $125^\circ C$ (black solid)
 $150^\circ C$ (red dashed)

figure 4. MOSFET

Transient thermal impedance as a function of pulse width



$D = t_p / T$
 $R_{th(j-s)} = 0,25 K/W$
 MOSFET thermal model values

$R (K/W)$	$\tau (s)$
1,24E-02	4,44E+00
4,34E-02	1,03E+00
6,77E-02	1,99E-01
1,07E-01	5,57E-02
6,92E-03	4,37E-03
5,51E-03	1,30E-03



Vincotech

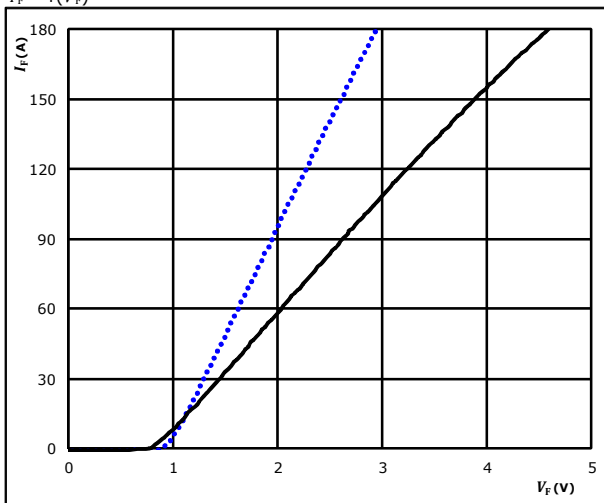
10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
 target datasheet

AC Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

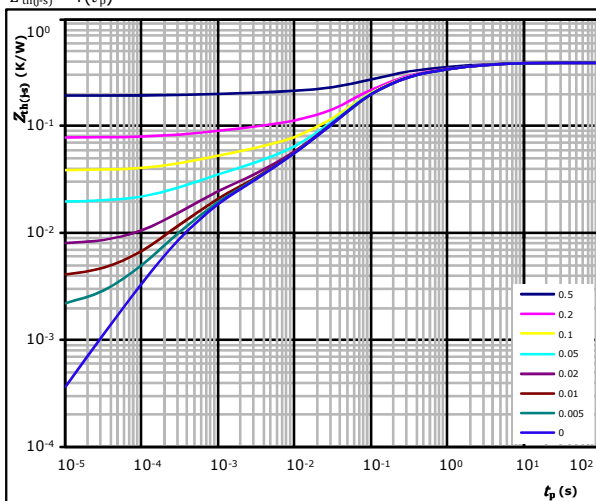


$t_p = 250 \mu s$ $T_j: 25 \text{ } ^\circ\text{C}$ (dotted blue line) $125 \text{ } ^\circ\text{C}$ (solid black line)

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,39 \text{ K/W}$

FWD thermal model values

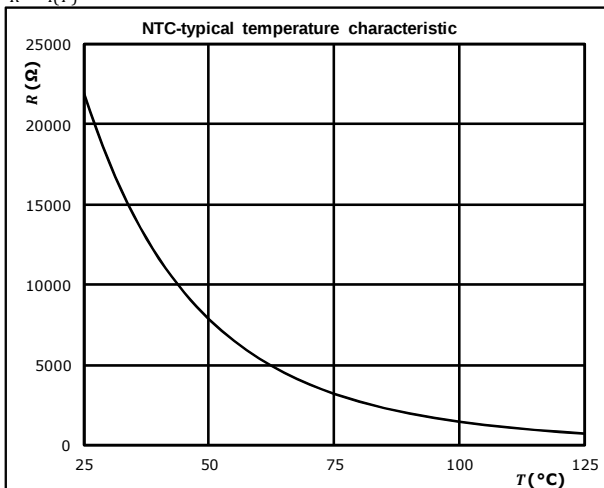
$R \text{ (K/W)}$	$\tau \text{ (s)}$
1,95E-02	6,94E+00
6,79E-02	1,61E+00
1,06E-01	3,11E-01
1,67E-01	8,72E-02
1,08E-02	6,83E-03
8,63E-03	2,04E-03
1,10E-02	5,15E-04

Thermistor Characteristics

figure 1. Thermistor

Typical NTC characteristic as a function of temperature

$$R = f(T)$$





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10-PH12NAC008MR03-LC69F48T
 target datasheet

Neutral Point Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

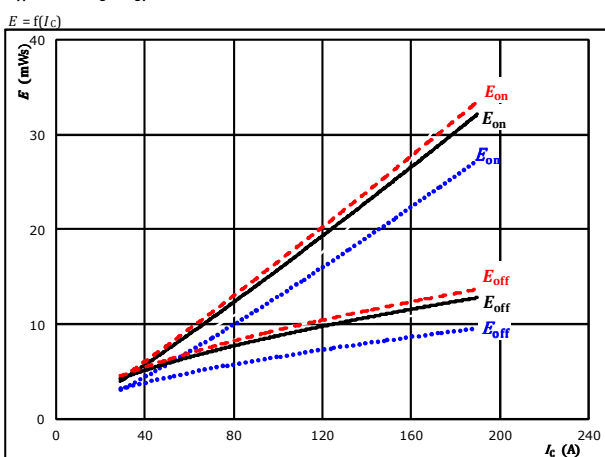


figure 2. IGBT

Typical switching energy losses as a function of gate resistor

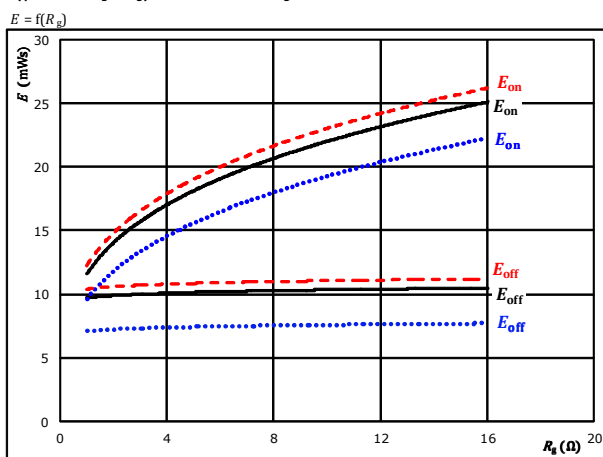


figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

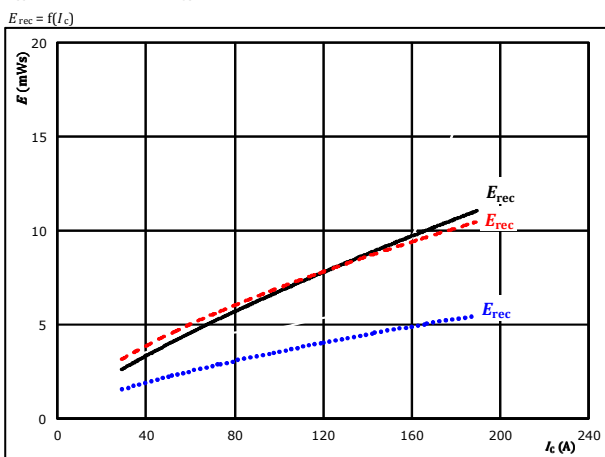
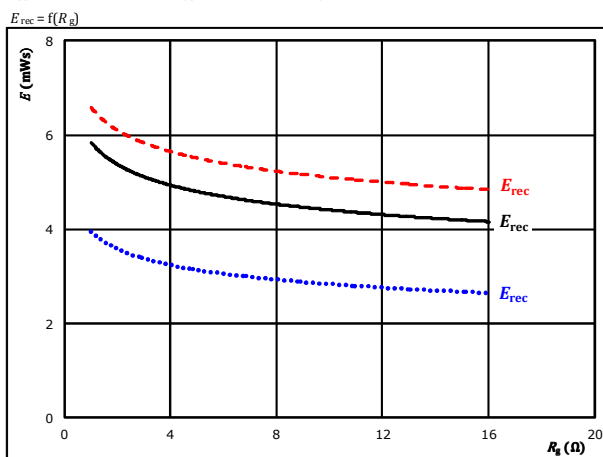


figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor





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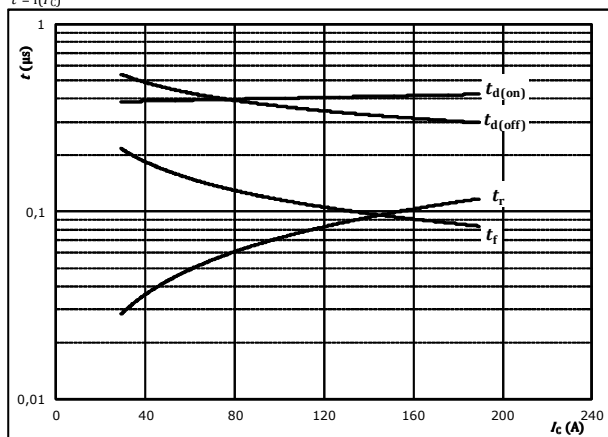
10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
 target datasheet

Neutral Point Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



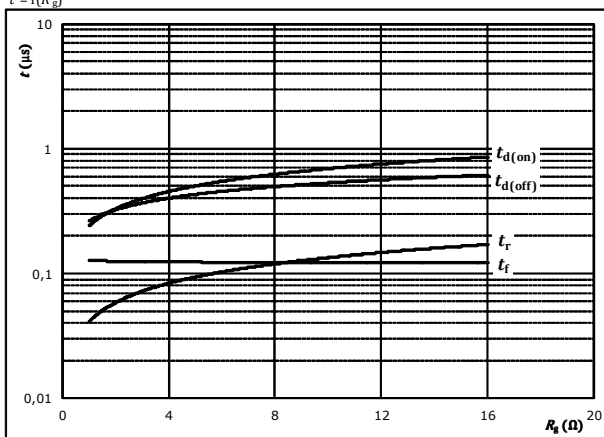
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$R_{gon} =$	4	Ω
$R_{goff} =$	4	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



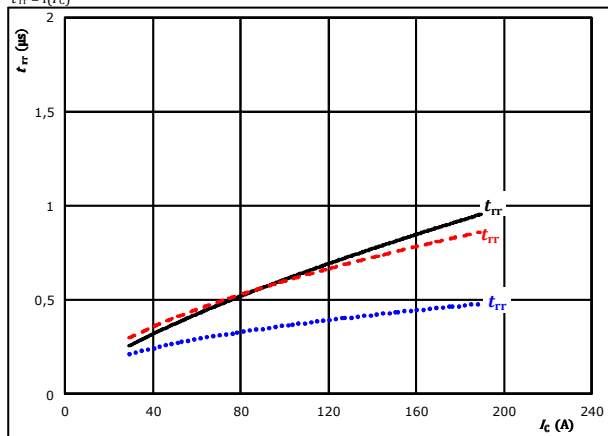
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	±15	V
$I_C =$	110	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

$$t_{rr} = f(I_C)$$

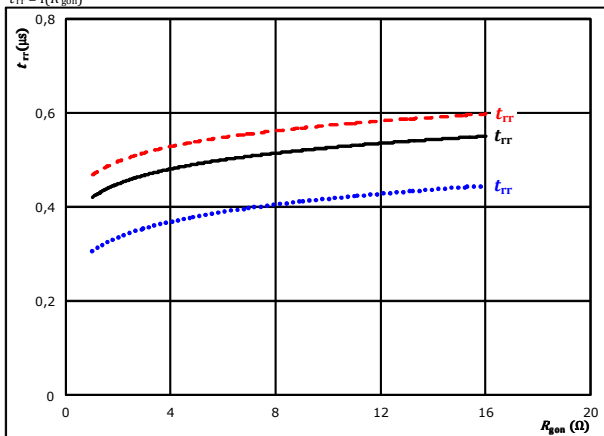


At	$V_{CE} =$	600	V	$T_j:$	25 °C	
	$V_{GE} =$	±15	V		125 °C	————
	$R_{gon} =$	4	Ω		150 °C	-----

figure 8. FWD

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

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



At	$V_{CE} =$	600	V	$T_j:$	25 °C	
	$V_{GE} =$	±15	V		125 °C	————
	$I_C =$	110	A		150 °C	-----



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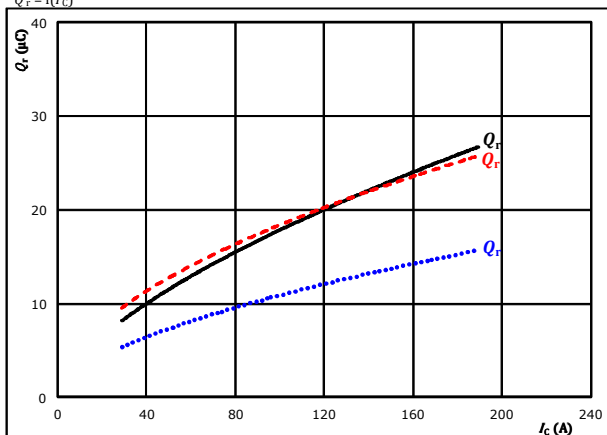
10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
 target datasheet

Neutral Point Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_C)$$

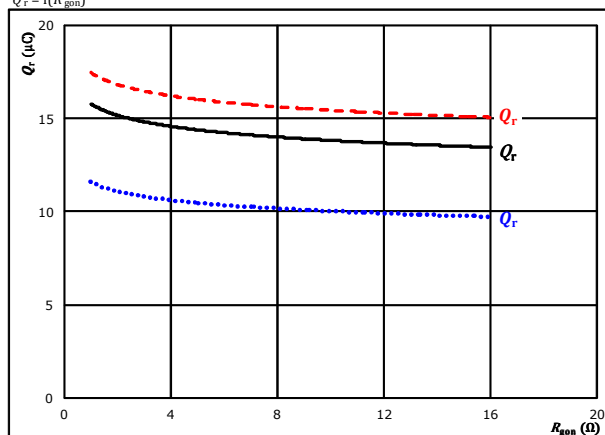


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 T_j : 25 °C
 125 °C ———
 150 °C - - - - -

figure 10. FWD

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

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

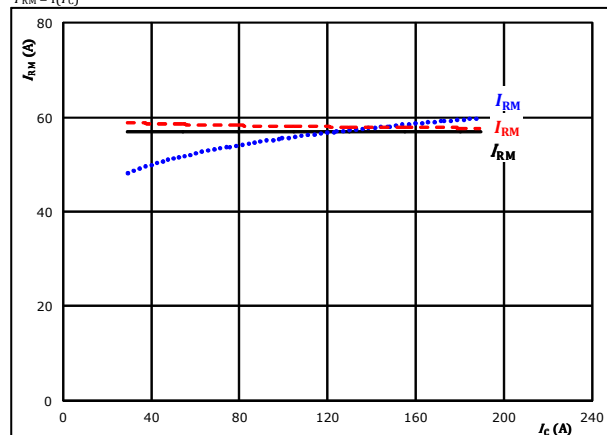


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 110$ A
 T_j : 25 °C
 125 °C ———
 150 °C - - - - -

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

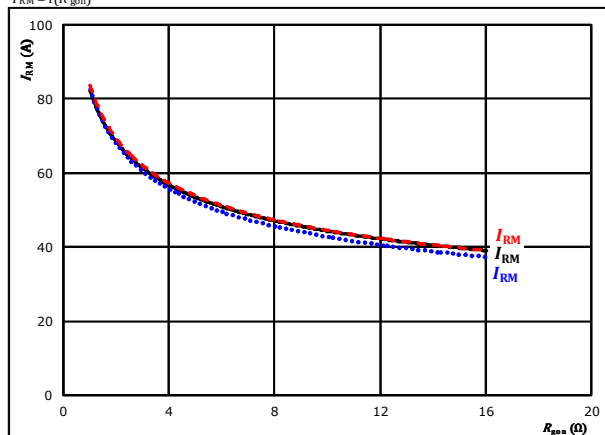


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 4$ Ω
 T_j : 25 °C
 125 °C ———
 150 °C - - - - -

figure 12. FWD

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

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



At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 110$ A
 T_j : 25 °C
 125 °C ———
 150 °C - - - - -



Vincotech

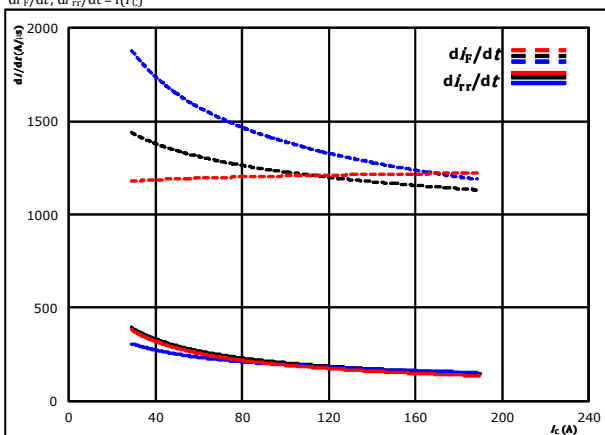
10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
 target datasheet

Neutral Point Switching Characteristics

figure 13. FWD

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

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

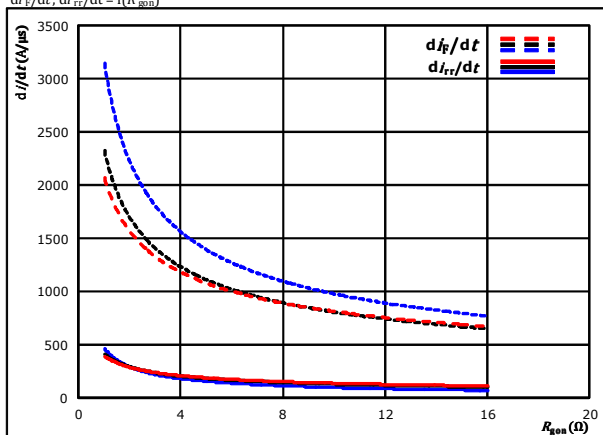


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $R_{g0n} = 4$ Ω
 T_J : 25 °C (blue dotted)
 125 °C (black solid)
 150 °C (red dashed)

figure 14. FWD

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

$$di_F/dt, di_{rr}/dt = f(R_{g0n})$$

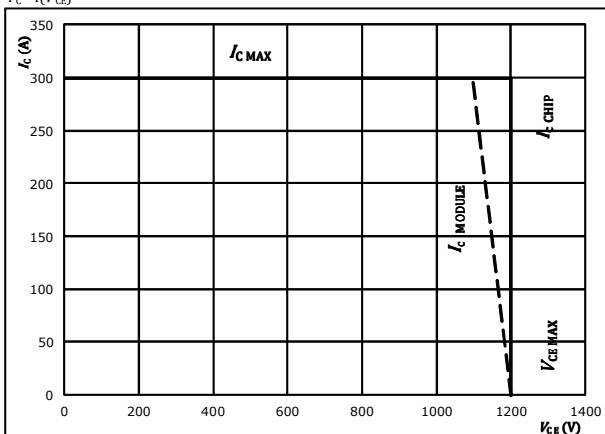


At $V_{CE} = 600$ V
 $V_{GE} = \pm 15$ V
 $I_C = 110$ A
 T_J : 25 °C (blue dotted)
 125 °C (black solid)
 150 °C (red dashed)

figure 15. IGBT

Reverse bias safe operating area

$$I_C = f(V_{CE})$$



At $T_J = 175$ °C
 $R_{g0n} = 4$ Ω
 $R_{g0ff} = 4$ Ω



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10-PH12NAC008MR03-LC69F48T
 target datasheet

Neutral Point Switching Definitions

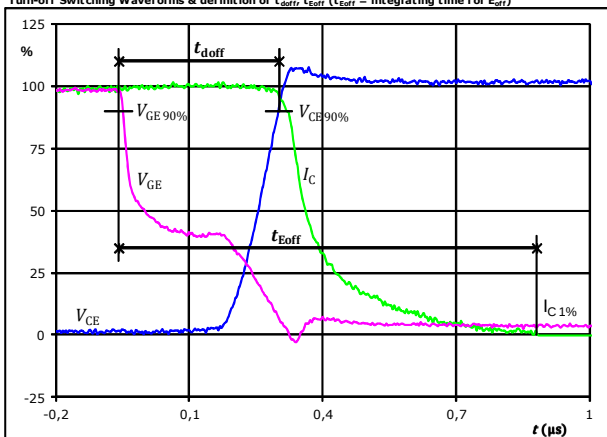
General conditions

T_j	=	125 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

figure 1.

IGBT

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

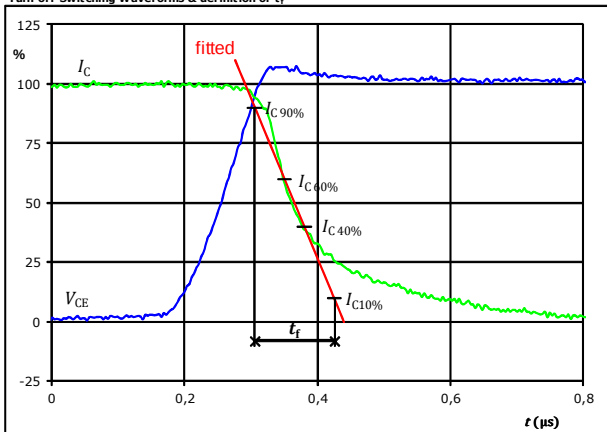


$V_{GE}(0\%)$	=	-15	V
$V_{GE}(100\%)$	=	15	V
$V_C(100\%)$	=	600	V
$I_C(100\%)$	=	110	A
t_{doff}	=	0,348	μs
t_{Eoff}	=	0,940	μs

figure 3.

IGBT

Turn-off Switching Waveforms & definition of t_f

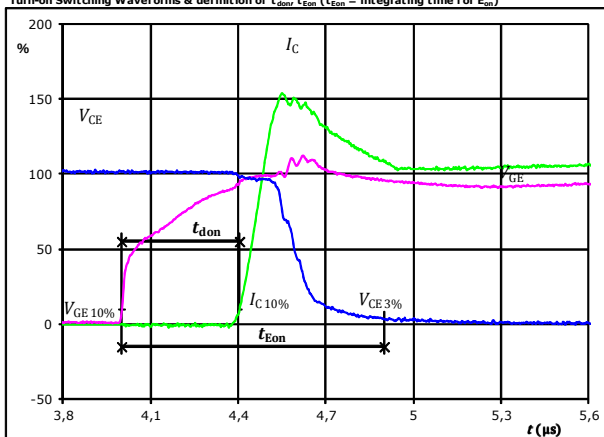


$V_C(100\%)$	=	600	V
$I_C(100\%)$	=	110	A
t_f	=	0,119	μs

figure 2.

IGBT

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

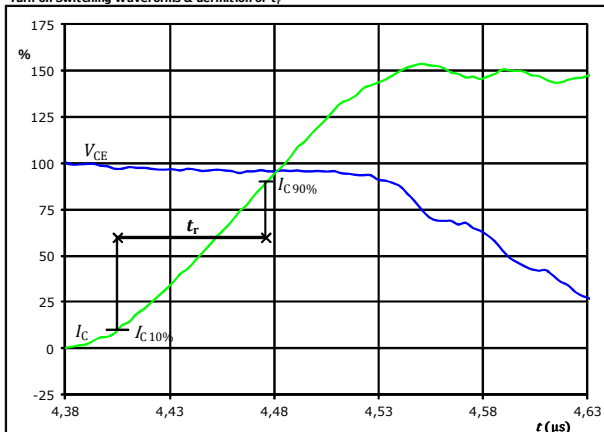


$V_{GE}(0\%)$	=	-15	V
$V_{GE}(100\%)$	=	15	V
$V_C(100\%)$	=	600	V
$I_C(100\%)$	=	110	A
t_{don}	=	0,403	μs
t_{Eon}	=	0,899	μs

figure 4.

IGBT

Turn-on Switching Waveforms & definition of t_r



$V_C(100\%)$	=	600	V
$I_C(100\%)$	=	110	A
t_r	=	0,071	μs



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10-PH12NAC008MR03-LC69F48T
 target datasheet

Neutral Point Switching Characteristics

figure 5. IGBT

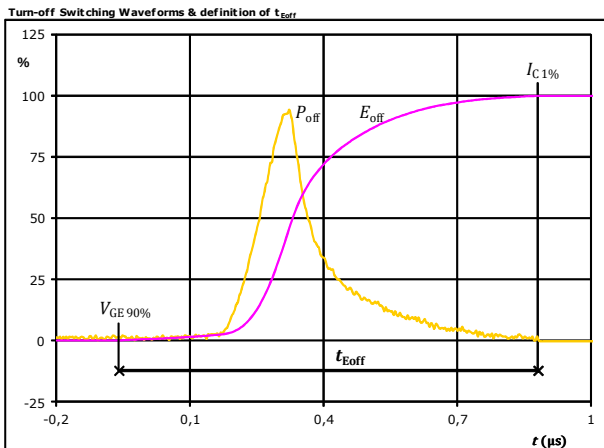


figure 6. IGBT

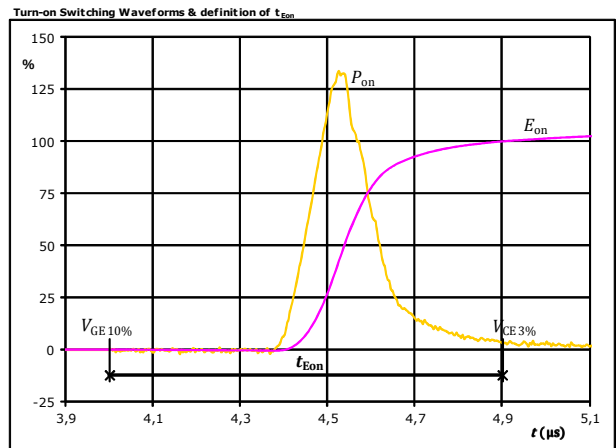
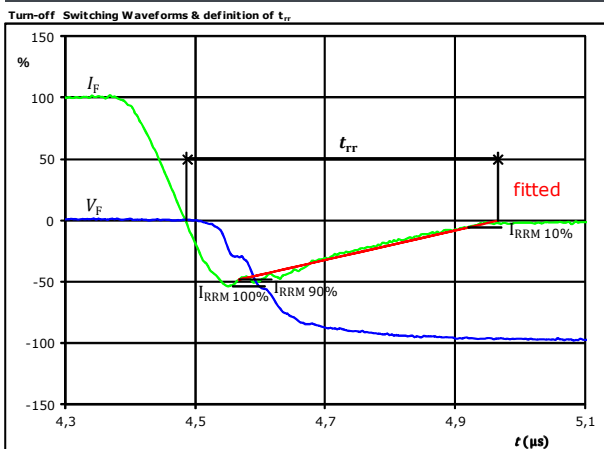


figure 7. FWD





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10-PH12NAC008MR03-LC69F48T
 target datasheet

Neutral Point Switching Characteristics

figure 8. FWD

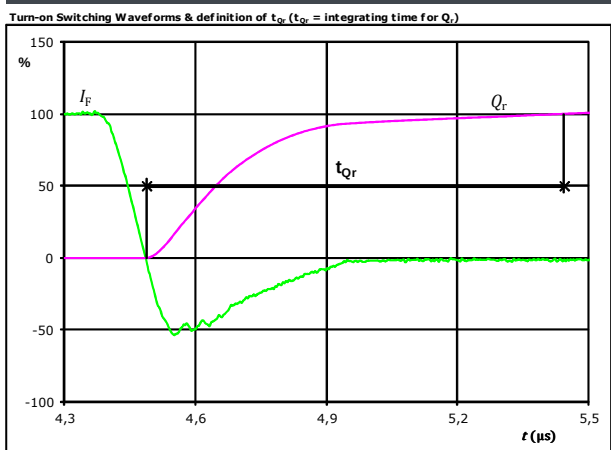
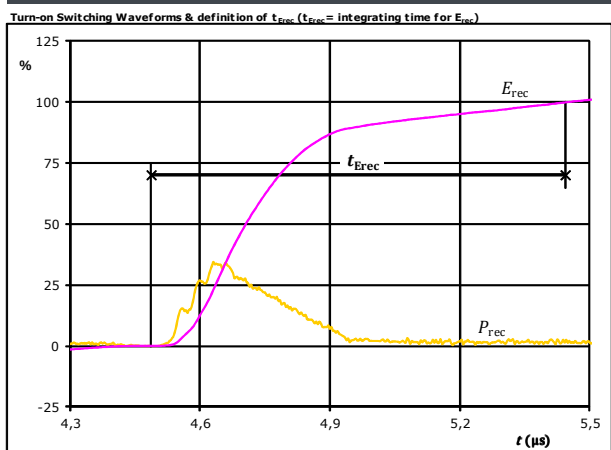


figure 9. FWD





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10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
 target datasheet

AC Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

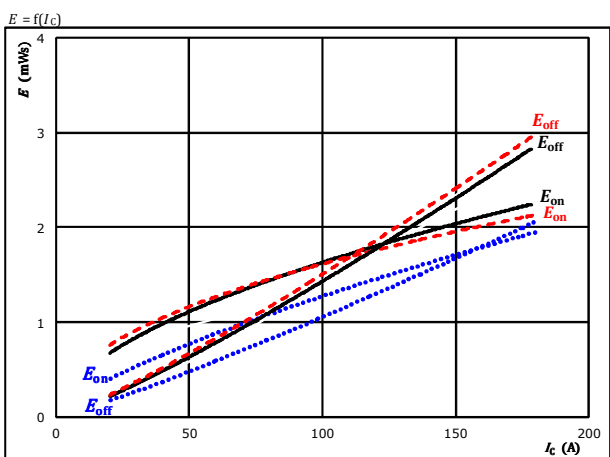


figure 2. IGBT

Typical switching energy losses as a function of gate resistor

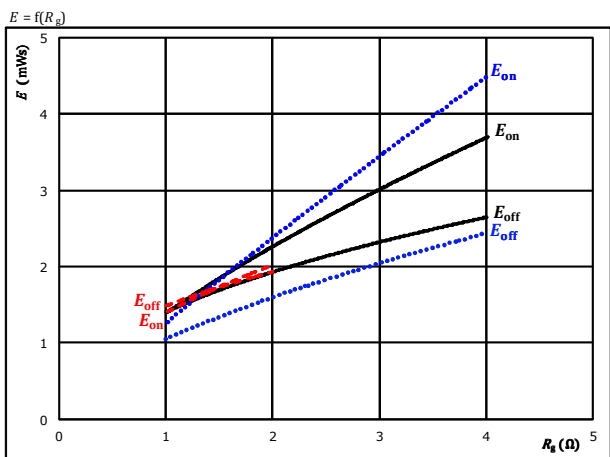


figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

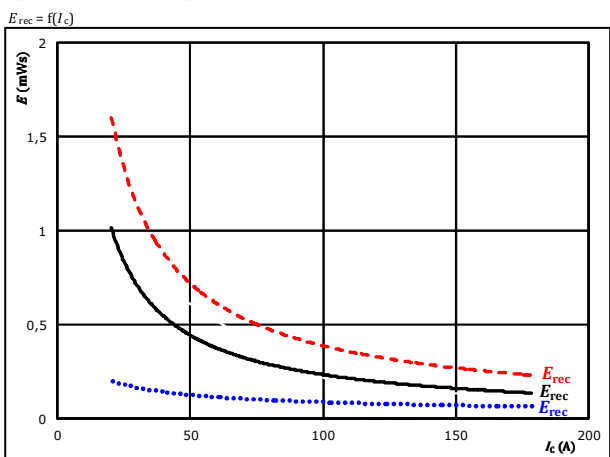
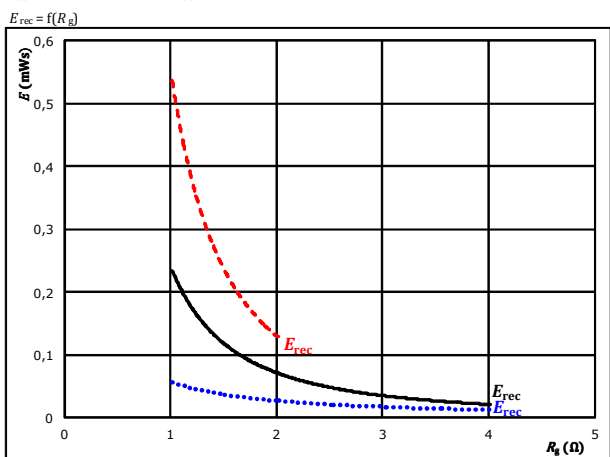


figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor





Vincotech

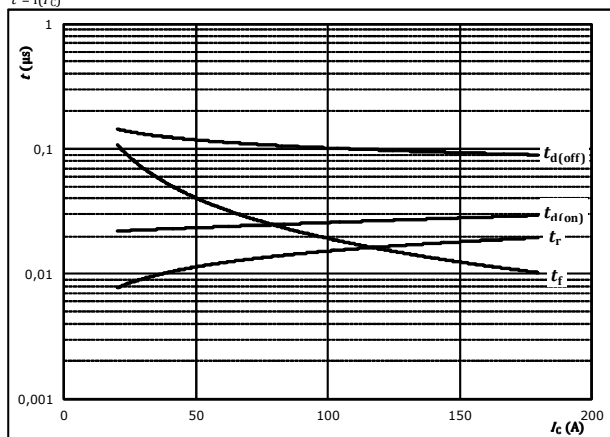
10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
 target datasheet

AC Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



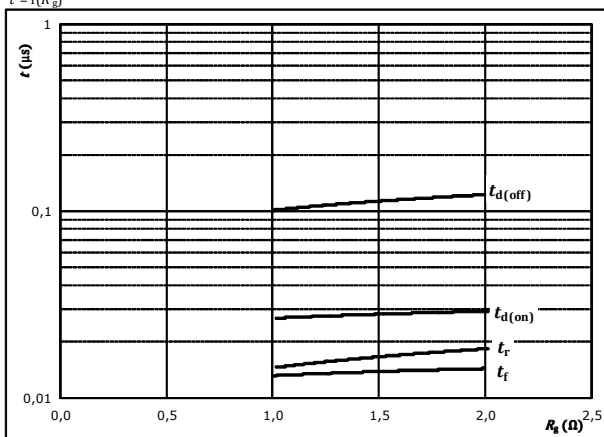
With an inductive load at

$T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = 0/16$ V
 $R_{gon} = 1$ Ω
 $R_{goff} = 1$ Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$t = f(R_g)$



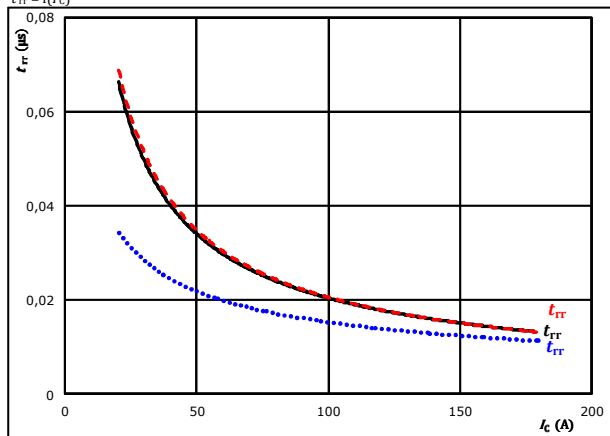
With an inductive load at

$T_j = 150$ °C
 $V_{CE} = 600$ V
 $V_{GE} = 0/16$ V
 $I_C = 99$ A

figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

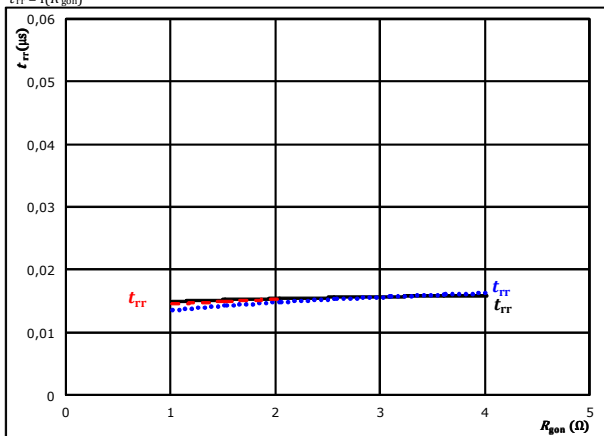


At $V_{CE} = 600$ V
 $V_{GE} = 0/16$ V
 $R_{gon} = 1$ Ω
 $T_j: 25$ °C
 125 °C ———
 150 °C - - - -

figure 8. FWD

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

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



At $V_{CE} = 600$ V
 $V_{GE} = 0/16$ V
 $I_C = 99$ A
 $T_j: 25$ °C
 125 °C ———
 150 °C - - - -



Vincotech

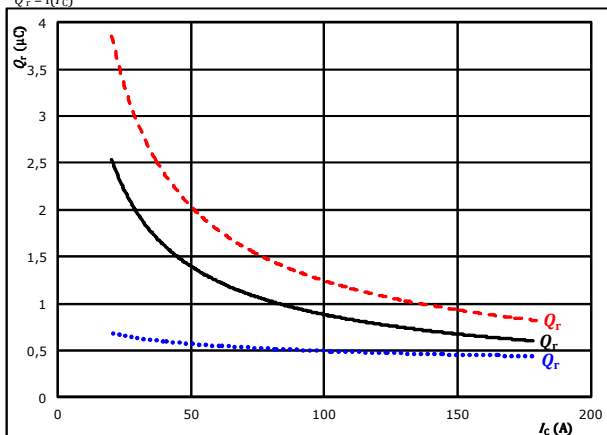
10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
target datasheet

AC Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_C)$$

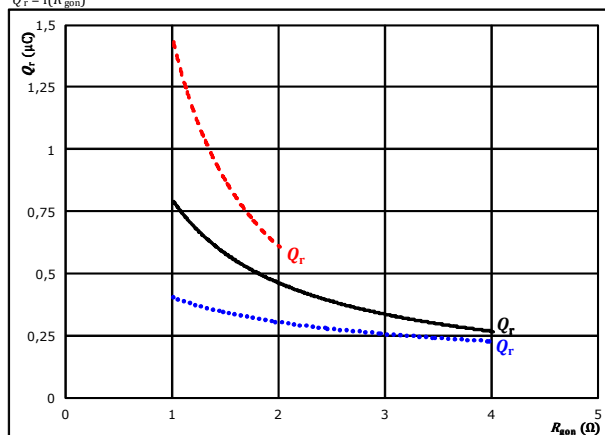


At $V_{CE} = 600$ V
 $V_{GE} = 0/16$ V
 $R_{gon} = 1$ Ω
 T_j : 25 °C
125 °C ———
150 °C - - - - -

figure 10. FWD

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

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

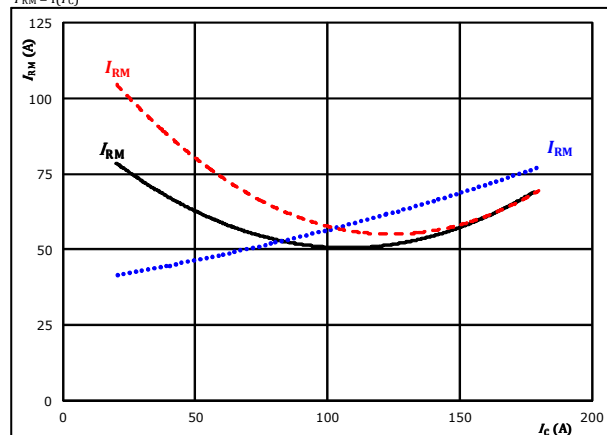


At $V_{CE} = 600$ V
 $V_{GE} = 0/16$ V
 $I_C = 99$ A
 T_j : 25 °C
125 °C ———
150 °C - - - - -

figure 11. FWD

Typical peak reverse recovery current as a function of collector current

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

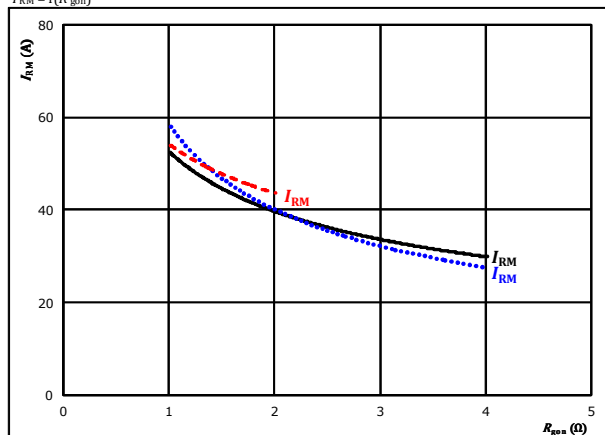


At $V_{CE} = 600$ V
 $V_{GE} = 0/16$ V
 $R_{gon} = 1$ Ω
 T_j : 25 °C
125 °C ———
150 °C - - - - -

figure 12. FWD

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

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



At $V_{CE} = 600$ V
 $V_{GE} = 0/16$ V
 $I_C = 99$ A
 T_j : 25 °C
125 °C ———
150 °C - - - - -



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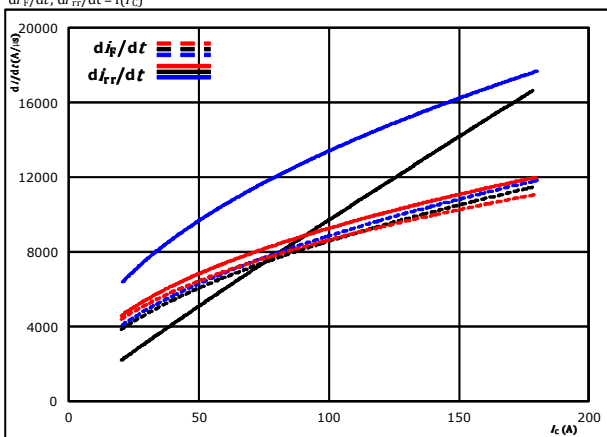
10-PH12NAB008MR03-LC59F48T
10-PH12NAC008MR03-LC69F48T
 target datasheet

AC Switching Characteristics

figure 13. FWD

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

$$di_f/dt, di_{rr}/dt = f(I_C)$$

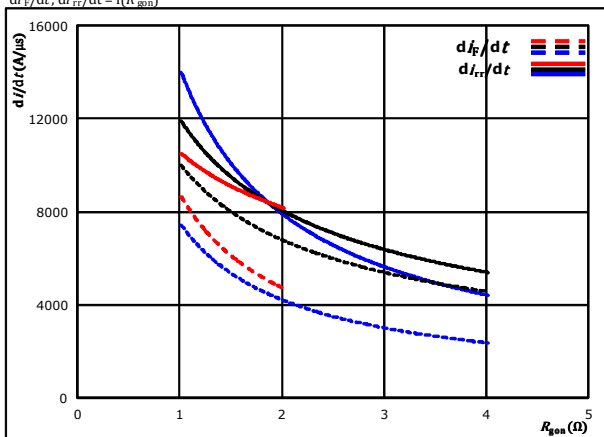


At $V_{CE} = 600$ V
 $V_{GE} = 0/16$ V
 $R_{g0n} = 1$ Ω
 $T_j = 25$ °C
 125 °C ———
 150 °C - - - - -

figure 14. FWD

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

$$di_f/dt, di_{rr}/dt = f(R_{g0n})$$

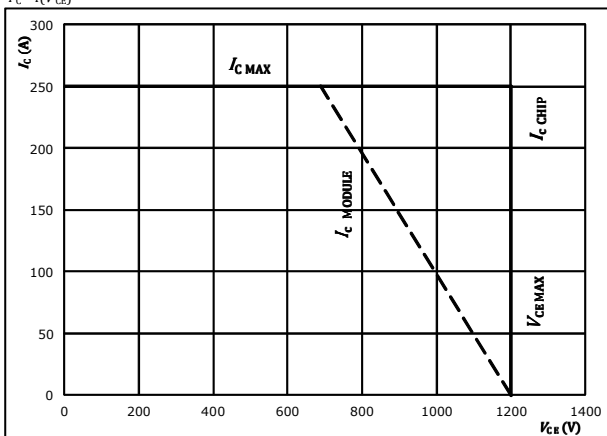


At $V_{CE} = 600$ V
 $V_{GE} = 0/16$ V
 $I_C = 99$ A
 $T_j = 25$ °C
 125 °C ———
 150 °C - - - - -

figure 15. IGBT

Reverse bias safe operating area

$$I_C = f(V_{CE})$$



At $T_j = 175$ °C
 $R_{g0n} = 1$ Ω
 $R_{g0ff} = 1$ Ω



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AC Switching Definitions

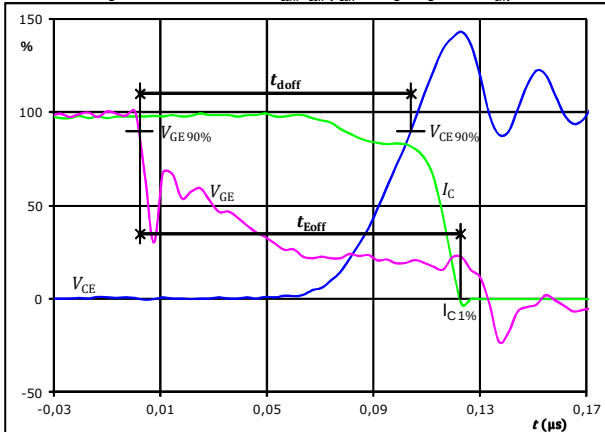
General conditions

T_j	=	125 °C
R_{gon}	=	1 Ω
R_{goff}	=	1 Ω

figure 1.

IGBT

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

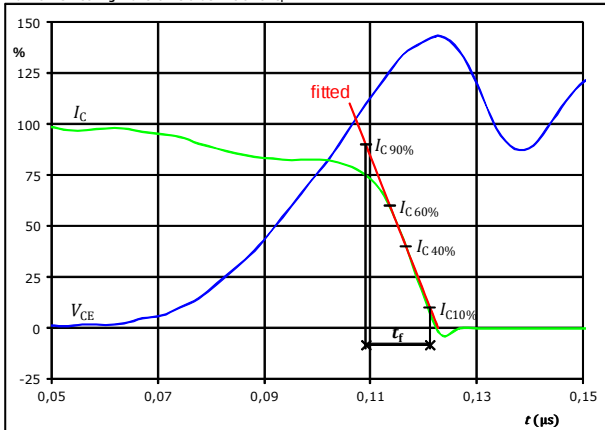


$V_{GE}(0\%) =$	0	V
$V_{GE}(100\%) =$	16	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	100	A
$t_{doff} =$	0,101	μs
$t_{Eoff} =$	0,120	μs

figure 3.

IGBT

Turn-off Switching Waveforms & definition of t_r

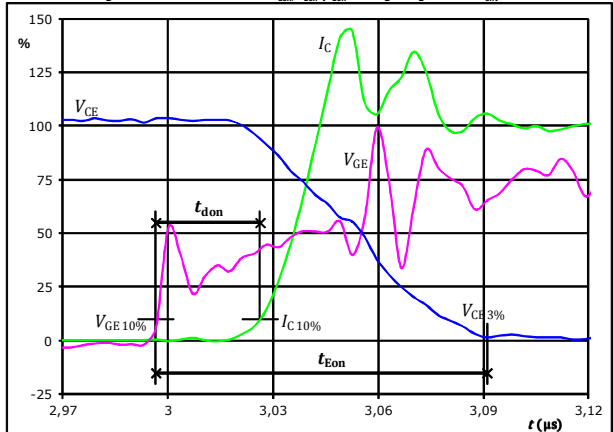


$V_C(100\%) =$	600	V
$I_C(100\%) =$	100	A
$t_r =$	0,013	μs

figure 2.

IGBT

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

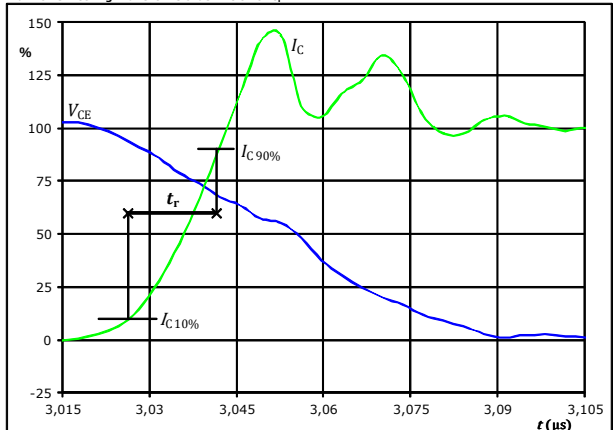


$V_{GE}(0\%) =$	0	V
$V_{GE}(100\%) =$	16	V
$V_C(100\%) =$	600	V
$I_C(100\%) =$	100	A
$t_{don} =$	0,029	μs
$t_{Eon} =$	0,094	μs

figure 4.

IGBT

Turn-on Switching Waveforms & definition of t_r



$V_C(100\%) =$	600	V
$I_C(100\%) =$	100	A
$t_r =$	0,015	μs



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 target datasheet

AC Switching Characteristics

figure 5. IGBT

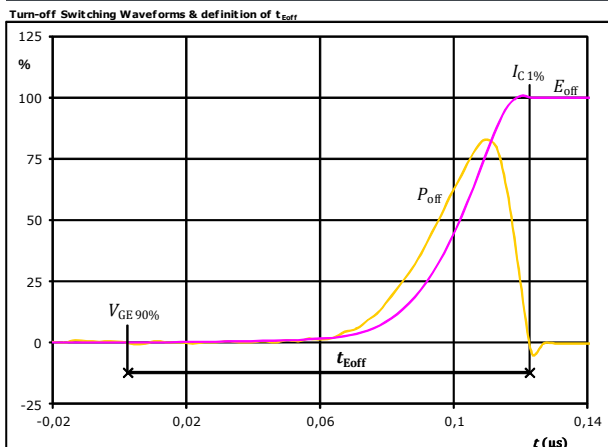


figure 6. IGBT

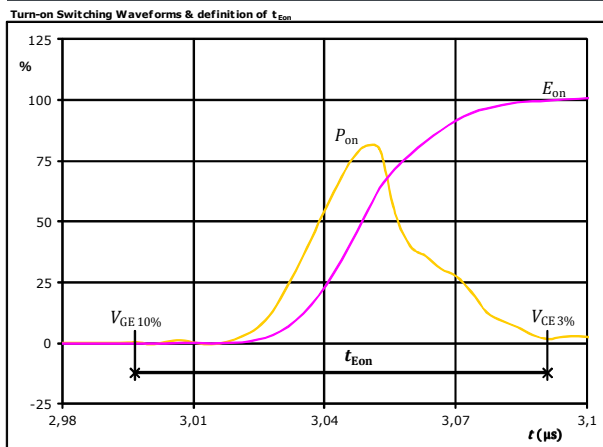
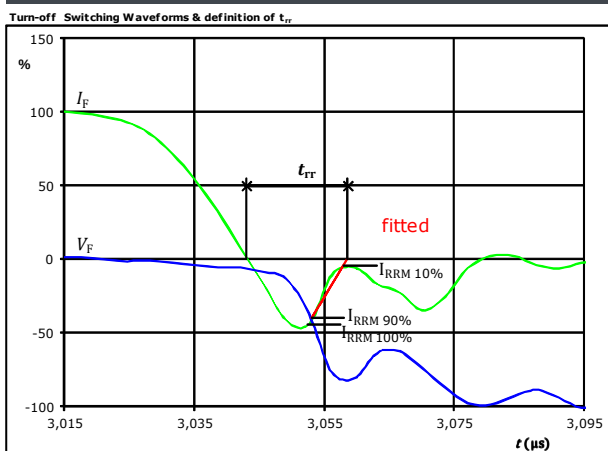


figure 7. FWD





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 target datasheet

AC Switching Characteristics

figure 8. FWD

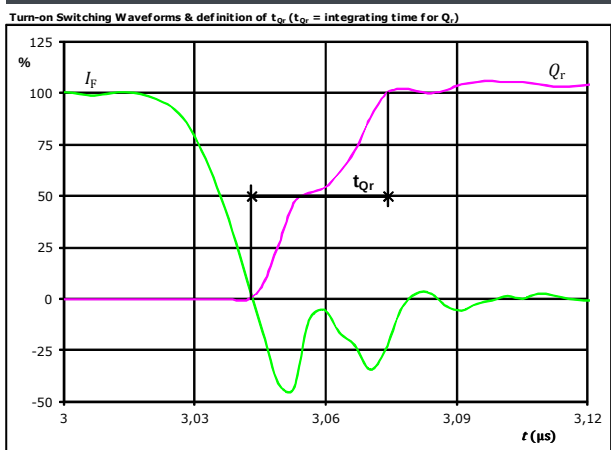
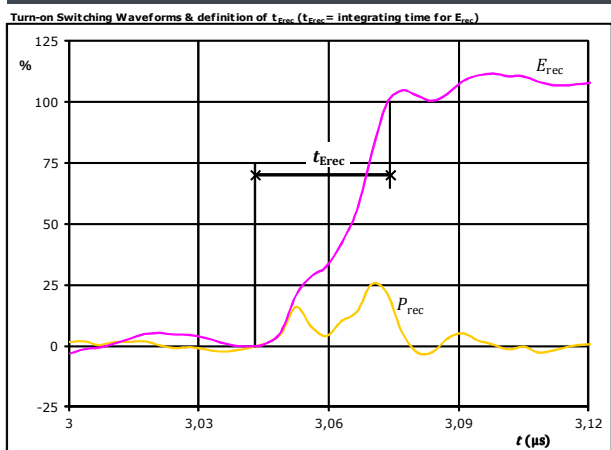


figure 9. FWD



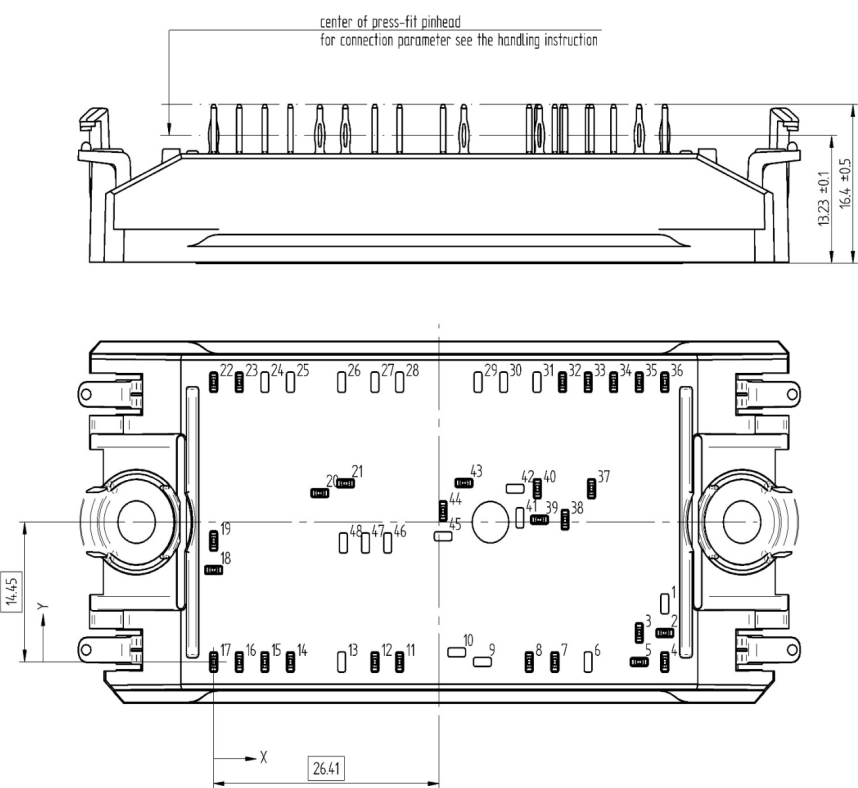


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target datasheet

10-PH12NAB008MR03-LC59F48T

Ordering Code & Marking								
Version				Ordering Code				
without thermal paste 12 mm housing with press-fit pins				10-PH12NAB008MR03-LC59F48T				
NN-NNNNNNNNNNNNNN TTTTTUV WWYY UL VIN LLLLL SSSS 		Text	Name		Date code	UL & Vin	Lot	Serial
			NN-NNNNNNNNNNNNNN-TTTTTW		WWYY	UL VIN	LLLLL	SSSS
		Datamatrix	Type&Ver	Lot number	Serial	Date Code		
			TTTTTUV	LLLLL	SSSS	WWYY		

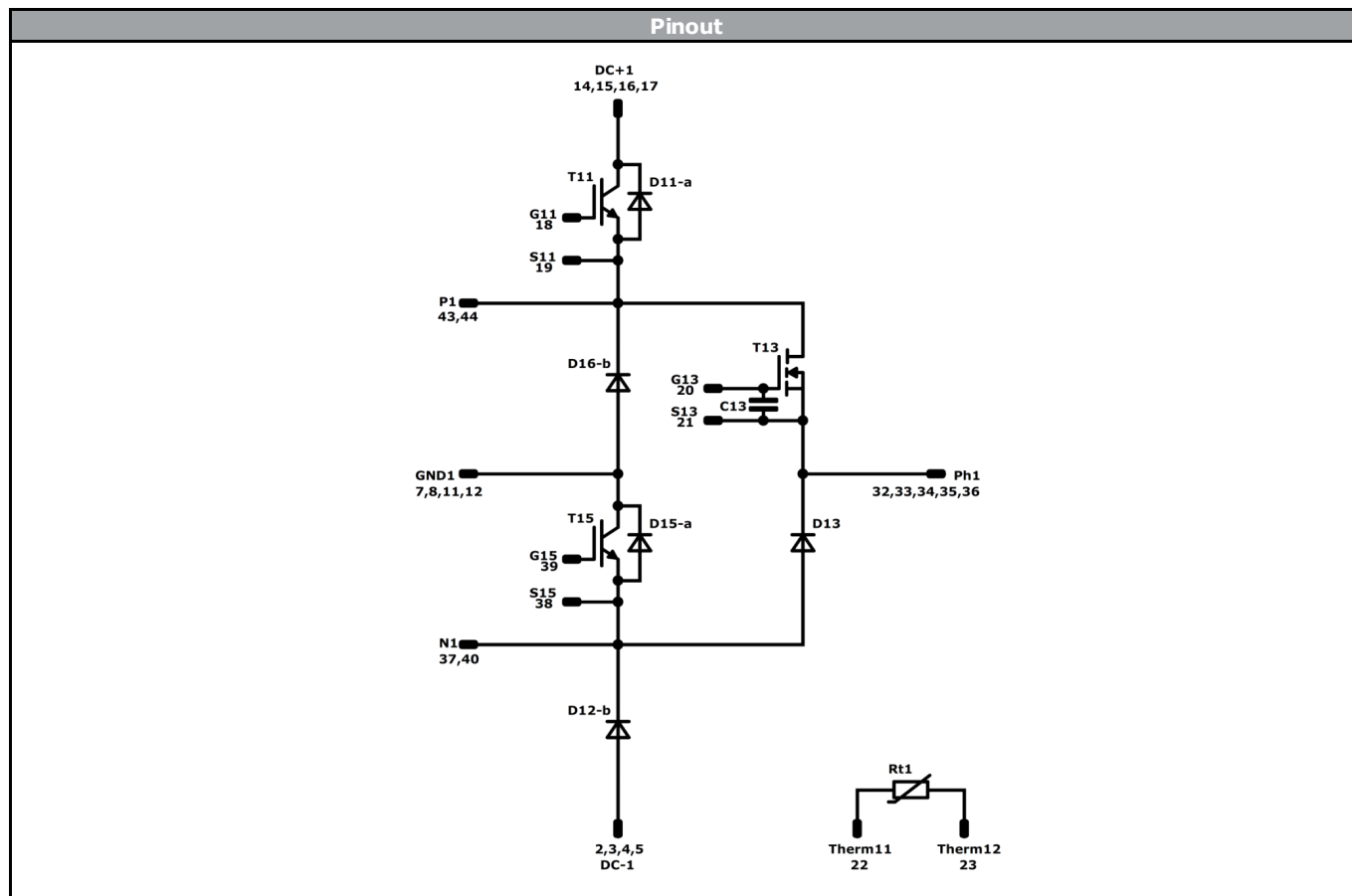
Pin table				Outline	
Pin	X	Y	Function		
1			Not assembled		
2	52,9	3	DC-1		
3	49,9	3	DC-1		
4	52,9	0	DC-1		
5	49,9	0	DC-1		
6			Not assembled		
7	40	0	GND1		
8	37	0	GND1		
9			Not assembled		
10			Not assembled		
11	21,8	0	GND1		
12	18,9	0	GND1		
13			Not assembled		
14	9	0	DC+1		
15	6	0	DC+1		
16	3	0	DC+1		
17	0	0	DC+1		
18	0	9,5	G11		
19	0	12,5	S11		
20	12,45	17,45	G13		
21	15,45	18,45	S13		
22	0	28,9	Therm11		
23	3	28,9	Therm12		
24			Not assembled		
25			Not assembled		
26			Not assembled		
27			Not assembled		
28			Not assembled		
29			Not assembled		
30			Not assembled		
31			Not assembled		
32	40,9	28,9	Ph1		
33	43,9	28,9	Ph1		
34	46,9	28,9	Ph1		
35	49,9	28,9	Ph1		
36	52,9	28,9	Ph1		
37	44,3	17,9	N1		
38	41,2	14,7	S15		
39	38,2	14,7	G15		
40	37,95	17,9	N1		
41			Not assembled		
42			Not assembled		
43	29,35	18,5	P1		
44	26,9	15,6	P1		
45			Not assembled		
46			Not assembled		
47			Not assembled		
48			Not assembled		

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



target datasheet

10-PH12NAB008MR03-LC59F48T



Identification					
ID	Component	Voltage	Current	Function	Comment
T11	IGBT	1200 V	150 A	DC-Link Switch	
D12-b	FWD	1200 V	100 A	DC-Link Diode	
D11-a	FWD	1200 V	100 A	DC-Link Switch Inverse Diode	
T15	IGBT	1200 V	150 A	Neutral Point Switch	
D16-b	FWD	1200 V	150 A	Neutral Point Diode	
D15-a	FWD	1200 V	15 A	Neutral Point Switch Prot. Diode	
T13	MOSFET	1200 V	8 mΩ	AC Switch	
D13	FWD	1200 V	60 A	AC Diode	
C13	Capacitor	25 V		GS Capacitor	
Rt1	NTC			Thermistor	



target datasheet

10-PH12NAC008MR03-LC69F48T

Ordering Code & Marking									
Version				Ordering Code					
without thermal paste 12 mm housing with press-fit pins				10-PH12NAC008MR03-LC69F48T					
NN-NNNNNNNNNNNNNN TTTTTTVVWWYY UL VIN LLLLL SSSS 		Text		Name		Date code	UL & VIN	Lot	Serial
				NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
		Datamatrix		Type&Ver	Lot number	Serial	Date code		
TTTTTTVV	LLLLL			SSSS	WWYY				

Outline

Pin table			
Pin	X	Y	Function
1	52,9	6	Ph2
2	52,9	3	Ph2
3	49,9	3	Ph2
4	52,9	0	Ph2
5	49,9	0	Ph2
6			Not assembled
7			Not assembled
8			Not assembled
9	31,5	0	S14
10	28,5	1	G14
11			Not assembled
12			Not assembled
13			Not assembled
14			Not assembled
15			Not assembled
16	3	0	Therm21
17	0	0	Therm22
18	0	9,5	S16
19	0	12,5	G16
20			Not assembled
21			Not assembled
22	0	28,9	DC+2
23	3	28,9	DC+2
24	6	28,9	DC+2
25	9	28,9	DC+2
26			Not assembled
27	18,9	28,9	GND2
28	21,8	28,9	GND2
29	31	28,9	GND2
30	34	28,9	GND2
31			Not assembled
32			Not assembled
33	43,9	28,9	DC-2
34	46,9	28,9	DC-2
35	49,9	28,9	DC-2
36	52,9	28,9	DC-2
37			Not assembled
38			Not assembled
39			Not assembled
40			Not assembled
41	35,9	14,9	G12
42	35,35	17,9	S12
43			Not assembled
44	26,9	15,6	N2
45	26,9	13	N2
46			Not assembled
47	17,8	12,3	P2
48	15,2	12,3	P2

The technical drawing shows the top and side views of the device. The top view includes a coordinate system with X and Y axes. The X-axis ranges from 0 to 26,41. The Y-axis ranges from 0 to 14,45. The side view shows the height of the device, with dimensions 13,23 ±0,1 and 16,4 ±0,5. The drawing also shows the location of various pins and components, including a center of press-fit pinhead and a connection parameter reference to the handling instruction.

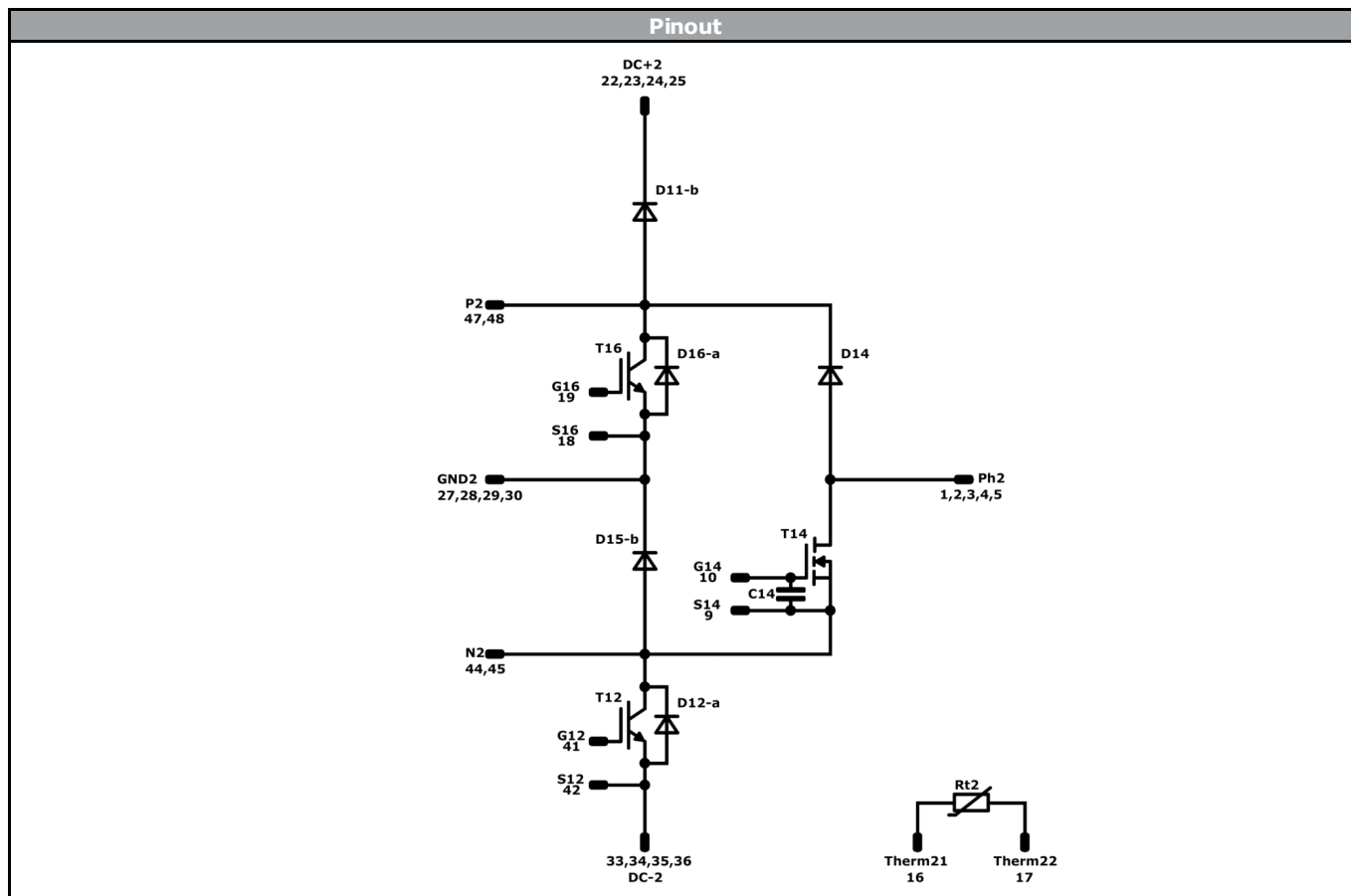
Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance



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target datasheet

10-PH12NAC008MR03-LC69F48T



Identification					
ID	Component	Voltage	Current	Function	Comment
T12	IGBT	1200 V	150 A	DC-Link Switch	
D11-b	FWD	1200 V	100 A	DC-Link Diode	
D12-a	FWD	1200 V	100 A	DC-Link Switch Inverse Diode	
T16	IGBT	1200 V	150 A	Neutral Point Switch	
D15-b	FWD	1200 V	150 A	Neutral Point Diode	
D16-a	FWD	1200 V	15 A	Neutral Point Switch Prot. Diode	
T14	MOSFET	1200 V	8 mΩ	AC Switch	
D14	FWD	1200 V	60 A	AC Diode	
C14	Capacitor	25 V		GS Capacitor	
Rt2	NTC			Thermistor	



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target datasheet

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

Handling instruction
Handling instructions for <i>flow 1</i> packages see vincotech.com website.

Package data
Package data for <i>flow 1</i> 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-PH12NAX008MR03-LCx9F48T-T1-14	03 Apr. 2018		

Product status definition		
Datasheet Status	Product Status	Definition
Target	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. The data contained is exclusively intended for technically trained staff.

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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.