10-EZ12PNA015SC-L928C08T
datasheet

***flow*PIM E1** **1200 V / 15 A**

Features

- Trench Fieldstop IGBT4 technology
- Standard industrial housing
- Optimized Rth(j-s) with Phase-change Material
- Built-in NTC

Target applications

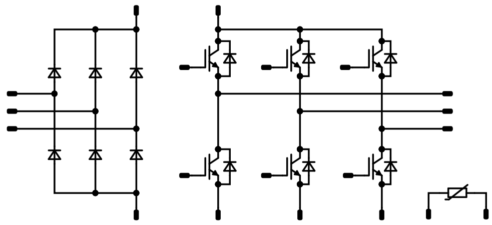
- Industrial Drives

Types

- 10-EZ12PNA015SC-L928C08T

flow E1 12 mm housing

Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	23	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		45	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	71	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	10	µs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	24	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	52	W
Maximum junction temperature	T_{jmax}			175	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	47	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	270	A
Surge current capability	I^2t			370	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	61	W
Maximum junction temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	6000	V
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	V
Creepage distance				>12,7	mm
Clearance				>12,7	mm
Comparative Tracking Index	CTI			≥ 600	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions	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 (Values)	Typ (Values)	Max (Values)	Unit
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0005	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 125 150	1,58	1,87 2,14 2,21	2,07(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			2	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		890		pF
Reverse transfer capacitance	C_{res}							30		pF
Gate charge	Q_g		20		0	25		120		nC
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,35		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	±15	600	15	25 125 150		83,4 84,2 84,4		ns
Rise time	t_r					25 125 150		28,2 29 29,8		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		191 245,2 261,8		ns
Fall time	t_f					25 125 150		79,79 130,9 144,63		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,38 µC Q_{rFWD}=2,47 µC Q_{rFWD}=2,75 µC				25 125 150		1,08 1,5 1,64		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,872 1,34 1,52		mWs

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Inverter Diode										
Static										
Forward voltage	V_F				15	25 150	1,35	1,84 1,78	2,05(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			3,5	μA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,82		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=583 A/μs d*i*/d*t*=497 A/μs d*i*/d*t*=454 A/μs	±15	600	15	25 125 150		10,86 13,02 13,38		A
Reverse recovery time	t_{rr}					25 125 150		286,15 430,28 471,02		ns
Recovered charge	Q_r					25 125 150		1,38 2,47 2,75		μC
Reverse recovered energy	E_{rec}					25 125 150		0,517 0,961 1,07		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		55,42 45,46 39,49		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	
Rectifier Diode										
Static										
Forward voltage	V_F				28	25 125		1,15 1,11	1,5[1]	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			100 1000	µA
Thermal										
Thermal resistance junction to sink [2]	$R_{th(j\text{-}s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,15		K/W
Thermistor										
Static										
Rated resistance	R					25		5		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 493 Ω				100	-5		5	%
Power dissipation	P							245		mW
Power dissipation constant	d					25		1,4		mW/K
B-value	$B_{(25/50)}$	Tol. ±2 %						3375		K
B-value	$B_{(25/100)}$	Tol. ±2 %						3437		K
Vincotech Thermistor Reference									K	

(1) Value at chip level

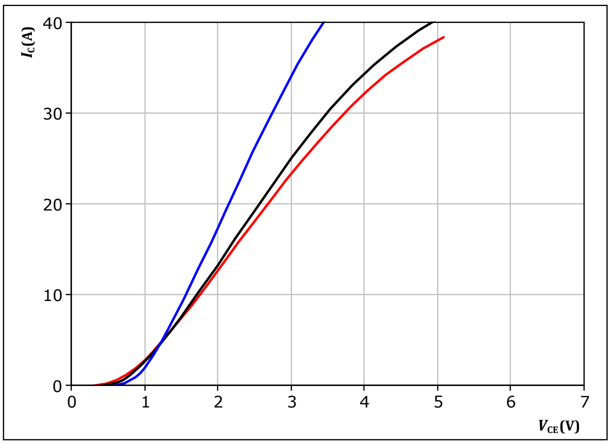
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

I_C = f(V_{CE})

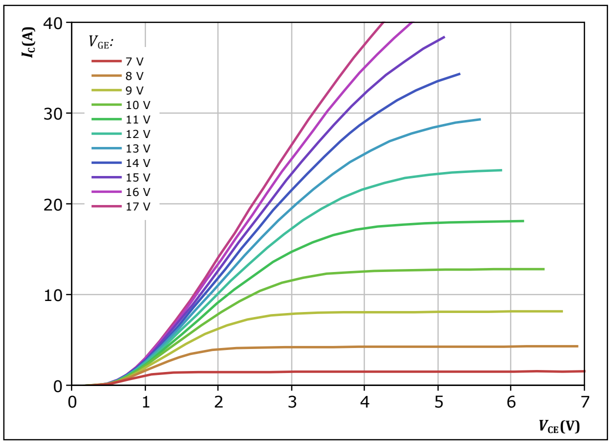


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

I_C = f(V_{CE})

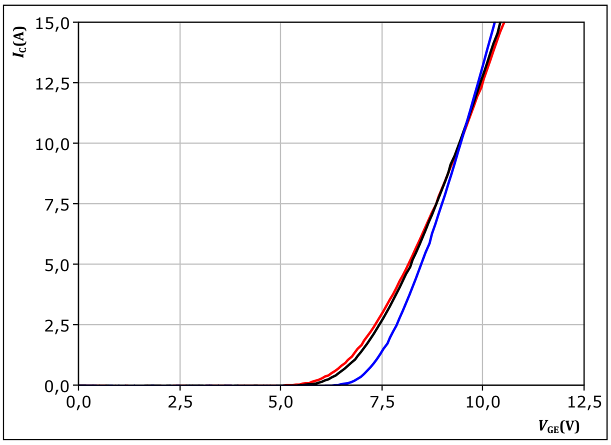


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

I_C = f(V_{GE})

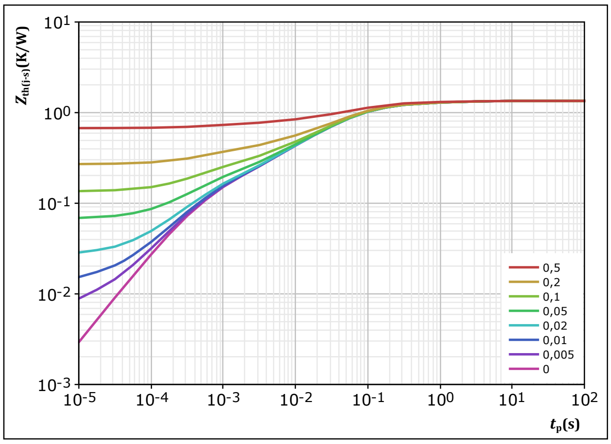


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 1,347 K/W

IGBT thermal model values

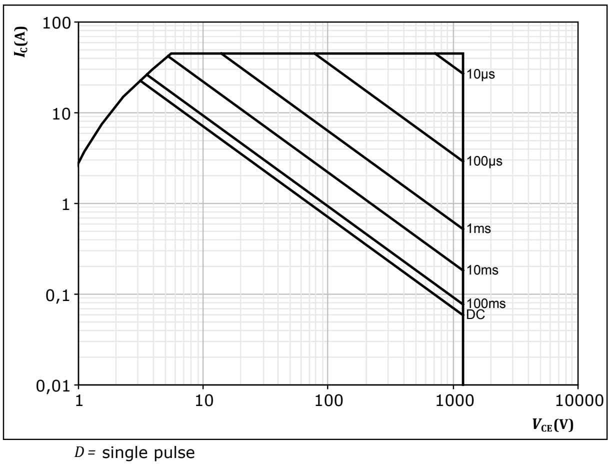
R (K/W)	τ (s)
7,66E-02	2,27E+00
1,57E-01	3,14E-01
6,53E-01	6,33E-02
2,43E-01	1,46E-02
1,08E-01	3,36E-03
1,10E-01	4,63E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

I_C = f(V_{CE})



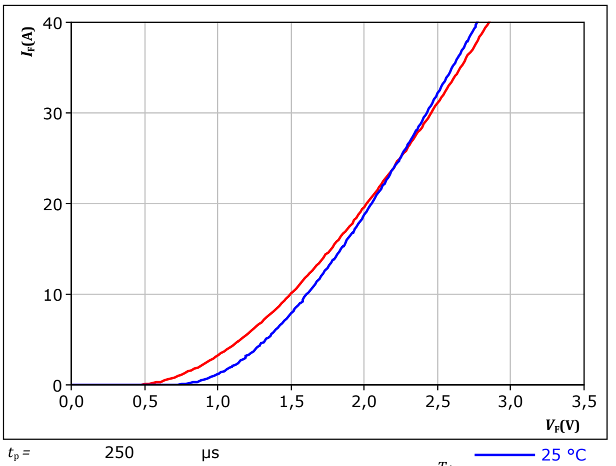
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



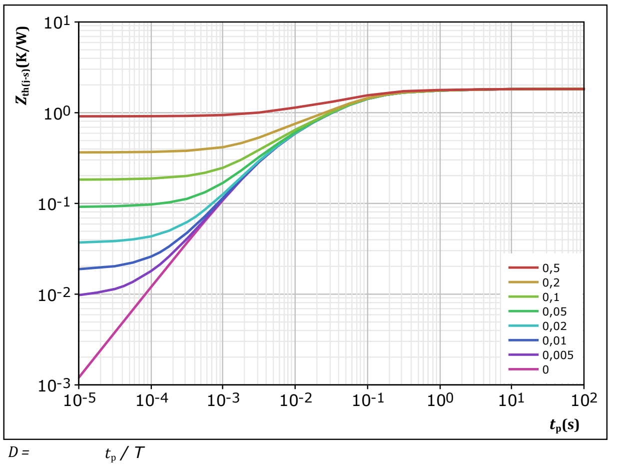
t_p = 250 μs

T_j: 25 °C, 150 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,825 K/W

FWD thermal model values

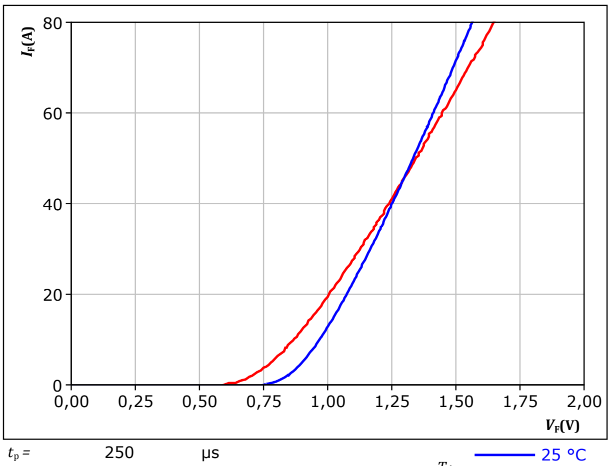
R (K/W)	τ (s)
7,17E-02	3,47E+00
1,60E-01	4,37E-01
7,42E-01	7,65E-02
5,21E-01	2,19E-02
3,30E-01	3,81E-03

Rectifier Diode Characteristics

figure 8. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



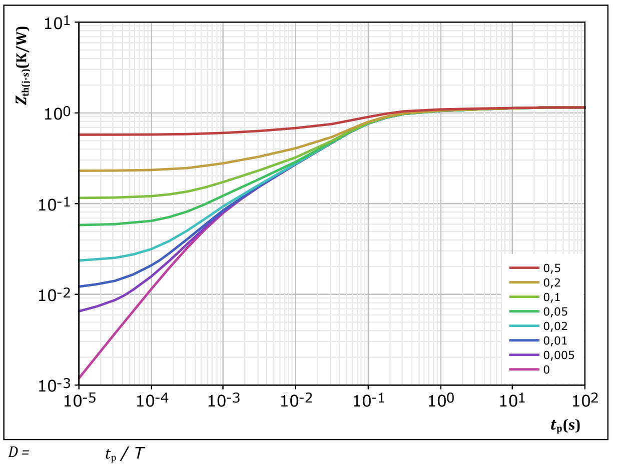
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 9. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,149 K/W

Rectifier thermal model values

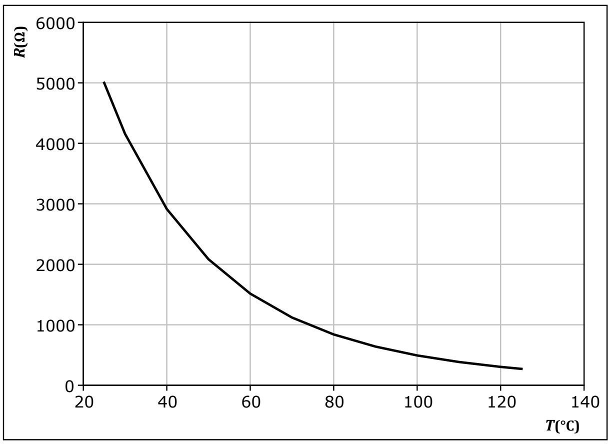
R (K/W)	τ (s)
8,29E-02	7,59E+00
1,02E-01	6,72E-01
4,20E-01	1,19E-01
3,78E-01	4,22E-02
1,08E-01	4,04E-03
5,78E-02	7,21E-04

Thermistor Characteristics

figure 10.	Thermistor

Typical NTC characteristic as function of temperature

$R_T = f(T)$

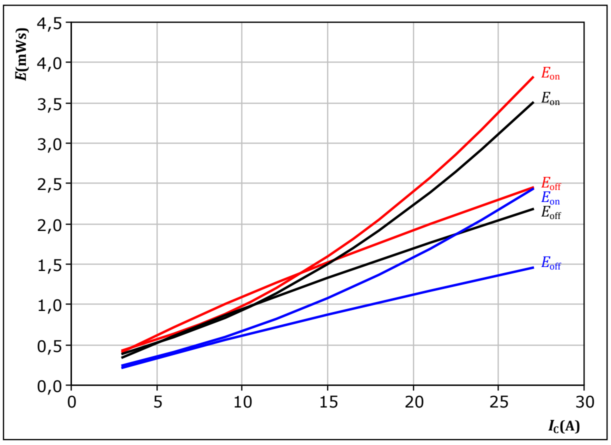


Inverter Switching Characteristics

figure 11. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



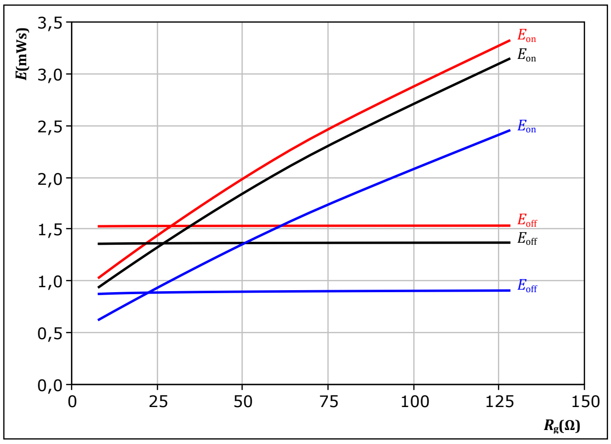
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	32	Ω		150 °C
R_{goff} =	32	Ω		

figure 12. **IGBT**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



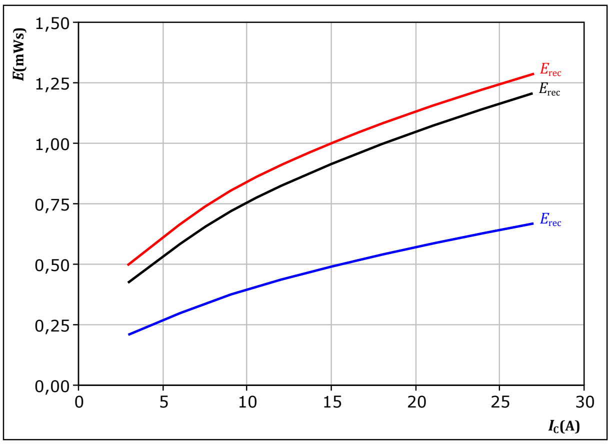
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	15	A		150 °C

figure 13. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



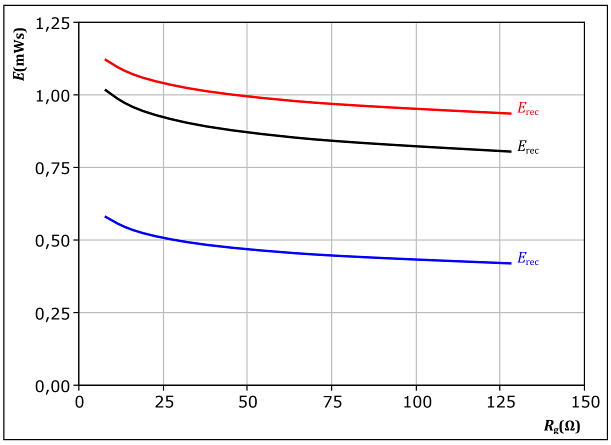
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	32	Ω		150 °C

figure 14. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

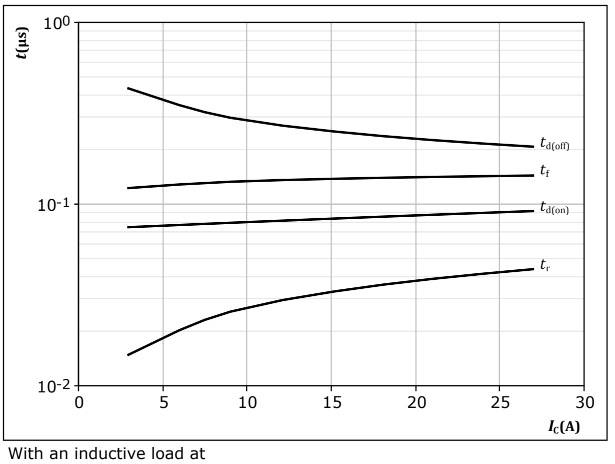
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	15	A		150 °C

Inverter Switching Characteristics

figure 15. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



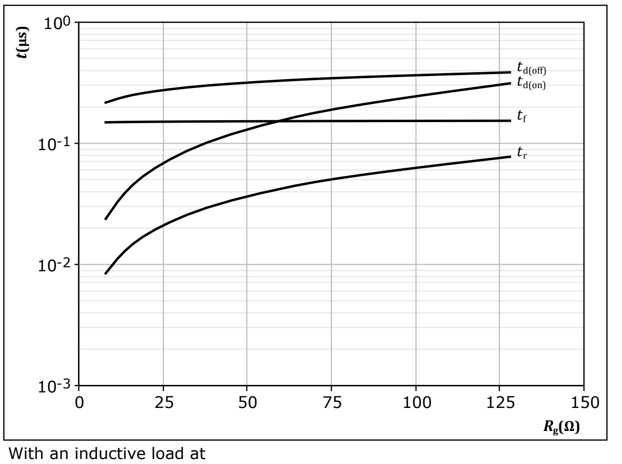
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 16. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



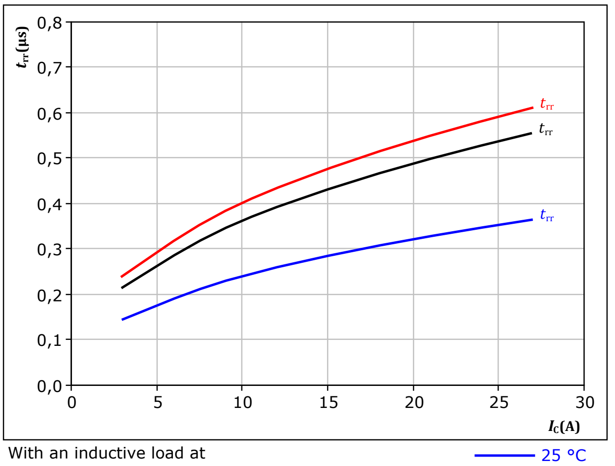
With an inductive load at

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

figure 17. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

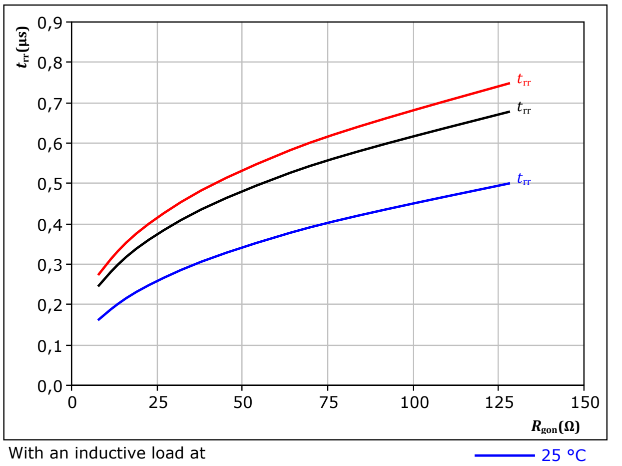
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 18. **FWD**

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

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



With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	15	A

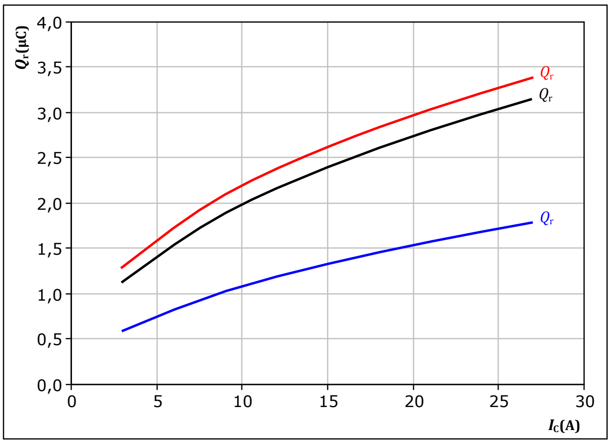
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 19. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



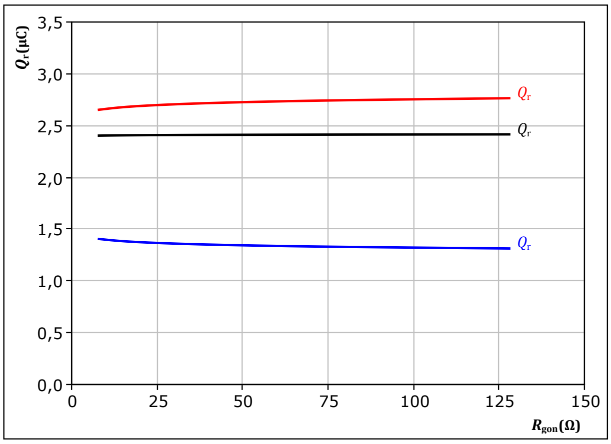
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	32	Ω		150 °C

figure 20. FWD

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



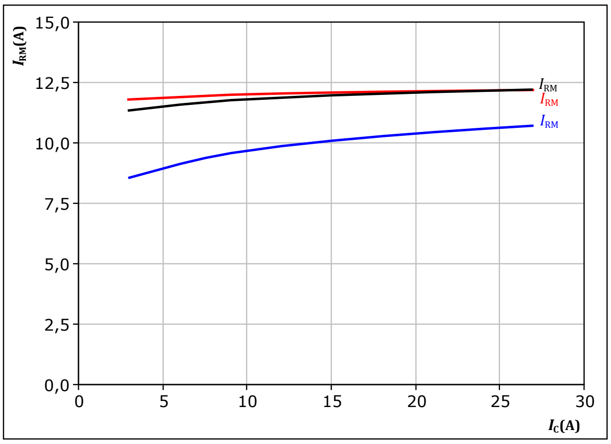
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	15	A		150 °C

figure 21. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



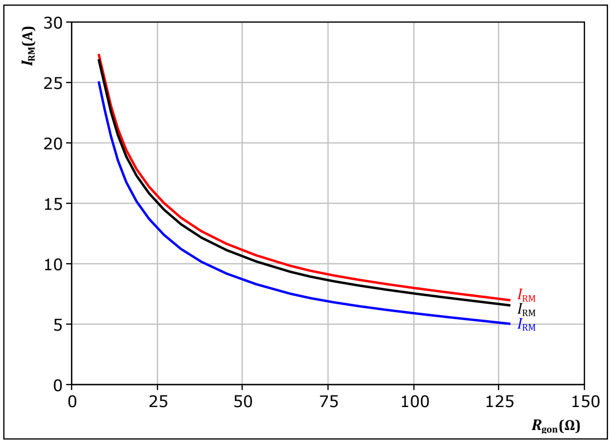
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	32	Ω		150 °C

figure 22. FWD

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

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



With an inductive load at

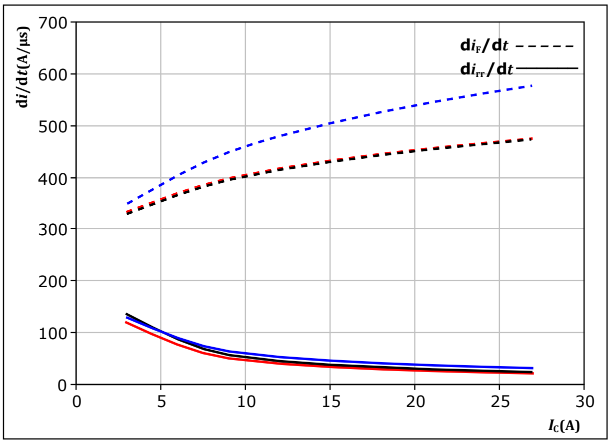
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	15	A		150 °C

Inverter Switching Characteristics

figure 23. **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)



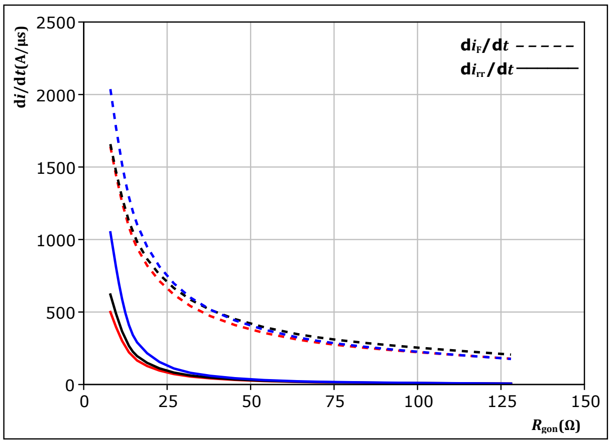
With an inductive load at

V_{CE} =	600	V	T_j: 25 °C
V_{GE} =	±15	V	125 °C
R_{gon} =	32	Ω	150 °C

figure 24. **FWD**

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

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



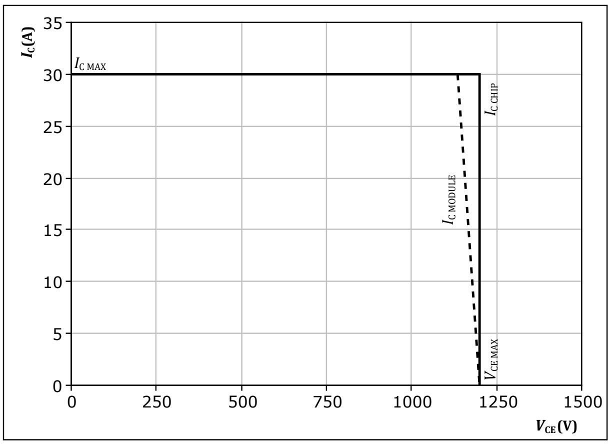
With an inductive load at

V_{CE} =	600	V	T_j: 25 °C
V_{GE} =	±15	V	125 °C
I_C =	15	A	150 °C

figure 25. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	32	Ω
	R_{goff} =	32	Ω

Inverter Switching Definitions

figure 26. **IGBT**

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

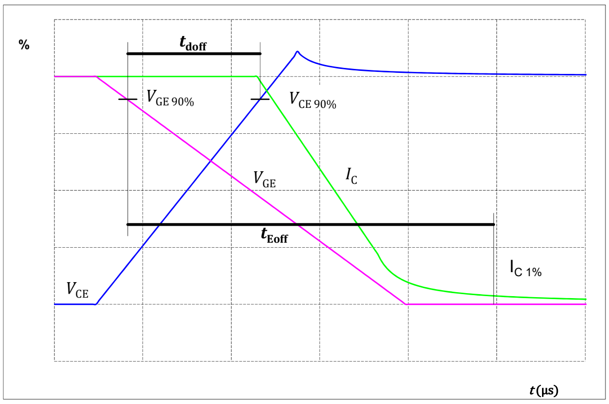


figure 27. **IGBT**

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

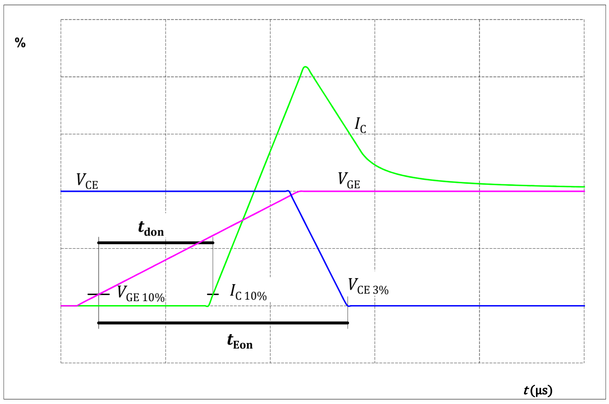


figure 28. **IGBT**

Turn-off Switching Waveforms & definition of t_f

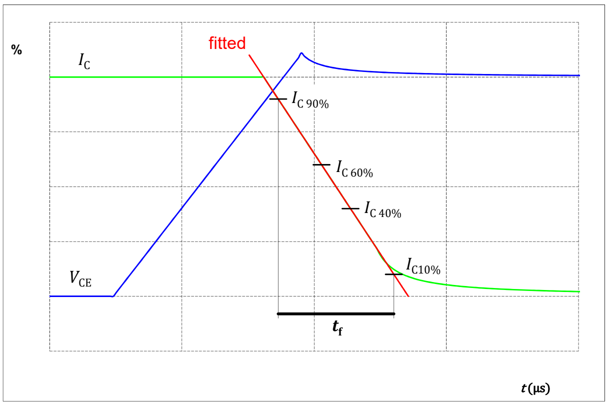
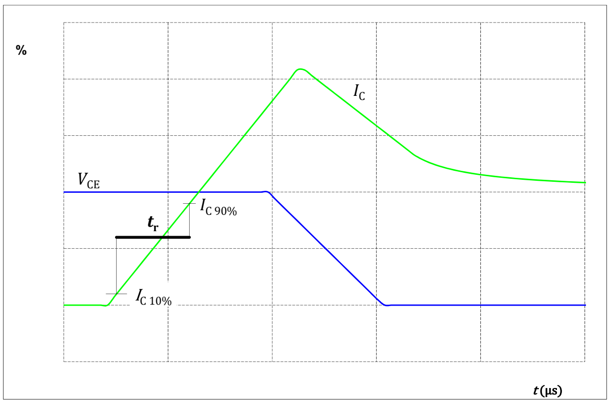


figure 29. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 30. **FWD**

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

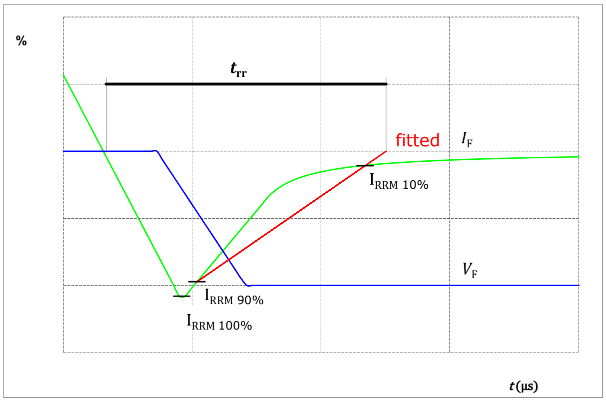
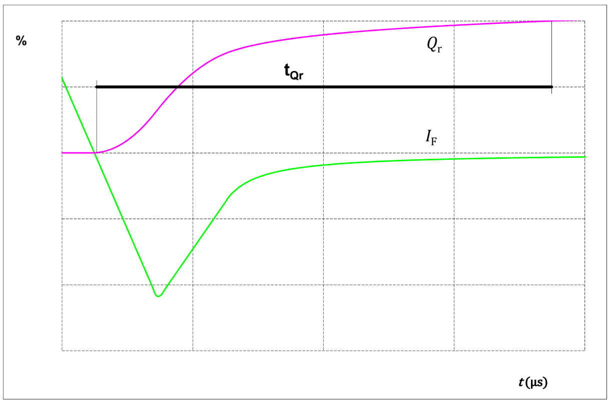


figure 31. **FWD**

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



Ordering Code

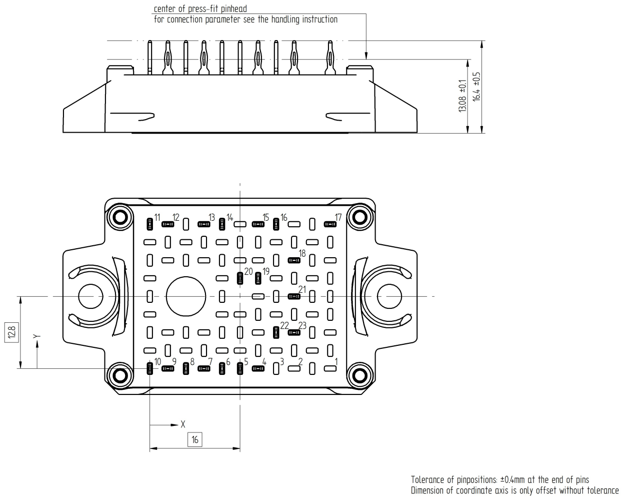
Version	Ordering Code
Without thermal paste	10-EZ12PNA015SC-L928C08T
With thermal paste	10-EZ12PNA015SC-L928C08T-/3/

Marking

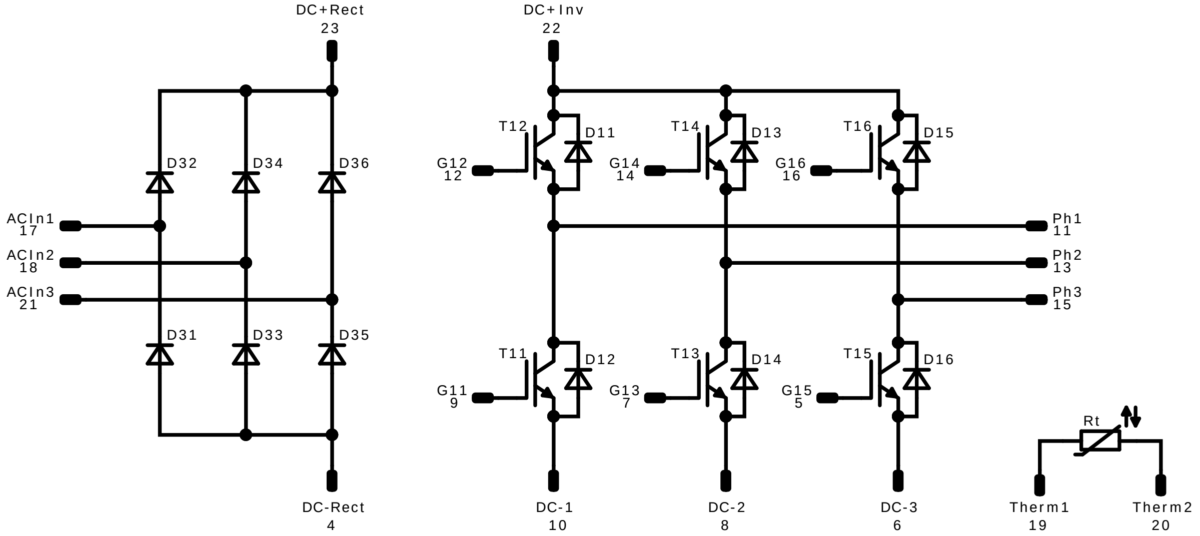
		Name		Date code	UL & VIN	Lot	Serial
	**Text**	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
		TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Function
1	not assembled		
2	not assembled		
3	not assembled		
4	19,2	0	DC-Rect
5	16	0	G15
6	12,8	0	DC-3
7	9,6	0	G13
8	6,4	0	DC-2
9	3,2	0	G11
10	0	0	DC-1
11	0	25,6	Ph1
12	3,2	25,6	G12
13	9,6	25,6	Ph2
14	12,8	25,6	G14
15	19,2	25,6	Ph3
16	22,4	25,6	G16
17	32	25,6	ACIn1
18	25,6	19,2	ACIn2
19	19,2	16	Therm1
20	16	16	Therm2
21	25,6	12,8	ACIn3
22	22,4	6,4	DC+Inv
23	25,6	6,4	DC+Rect



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	15 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	15 A	Inverter Diode	
D31, D32, D33, D34, D35, D36	Rectifier	1600 V	28 A	Rectifier Diode	
Rt	NTC			Thermistor	

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

Handling instruction
Handling instructions for *flow* E1 packages see vincotech.com website.

Package data
Package data for *flow* E1 packages see vincotech.com website.

Vincotech thermistor reference
See Vincotech thermistor reference table at vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-EZ12PNA015SC-L928C08T-D4-14	25 Mar. 2021	New datasheet format Update characteristics of rectifier diode, leakage current max value from 50 -> 100 uA	