



IGBT Product Update

Rev 1

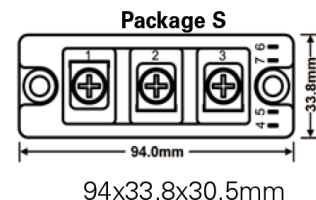
Andreas Laschek-Enders



Expertise Applied | Answers Delivered

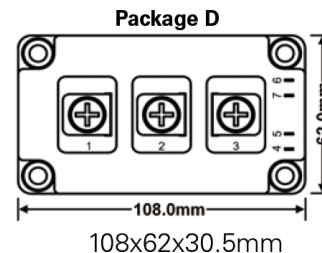
Half-bridge Modules in 34 mm wide Package

Vce	50 A	75 A	100 A	150 A	200 A
600 V		MG0675S-BN4MM	MG06100S-BN4MM	MG06150S-BN4MM	MG06200S-BN4MM
1200 V			MG12100S-BN2MM	MG12150S-BN2MM	
1700 V	MG1750S-BN4MM	MG1775S-BN4MM	MG17100S-BN4MM		



Half-bridge Modules in 62 mm wide Package

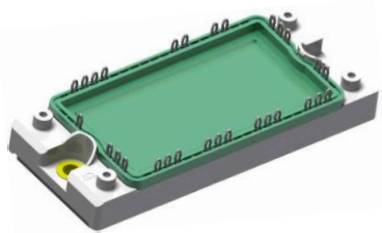
Vce	100 A	150 A	200 A	300 A	400 A
600 V				MG06300D-BN4MM	MG06400D-BN4MM
1200 V			MG12200D-BN2MM	MG12300D-BN2MM	MG12400D-BN2MM
1700 V	MG17100D-BN4MM	MG17150D-BN4MM	MG17200D-BN4MM	MG17300D-BN4MM	



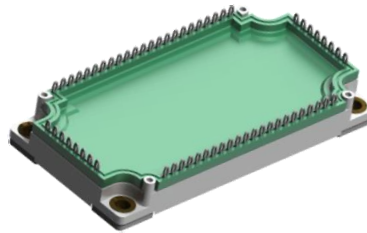
➤ Both Packages with Cu Base Plate

IGBT Module Packages

E2



E3



SIMBUS F



Std: Solder Pins

Options: PressFitPins



PhaseChangeMaterial (PCM)



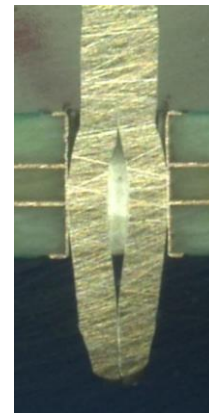
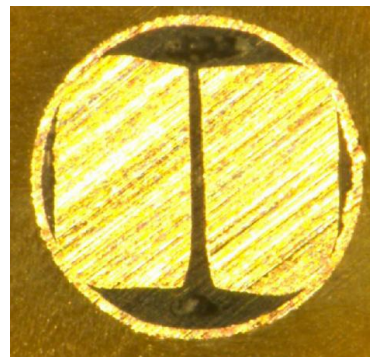
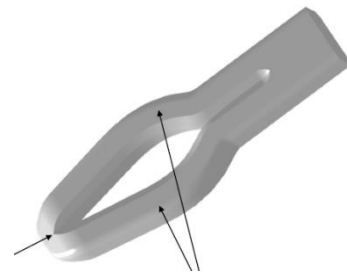
Phase Change Material (PCM)

- High thermal conductivity
- High reliability and long-term stability
- Wax-like material
 - Melting point at around 45° C
- Available/possible for packages with Cu base plate
 - E2-Pack, E3-Pack
 - SimBus F
 - ComPack
 - Y1
- Project for DCB based modules with PCM in R&D (2018)
 - TO-240
 - Y4
 - V1



PressFit-Pin (PFP)

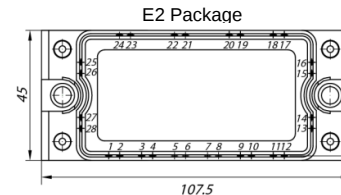
- Technology: Bizon
- Two Designs:
 - 1) Power PFP for E2 / E3
 - Compatible with competitor' designs (Infineon)
 - Robust design and long-term stability and reliability
 - High current density and small contact resistances
 - Operation temperature = 175° C (higher is possible)
 - 2) Control PFP for SimBus F
 - Compatible with competitor' designs (Infineon)



XPT IGBT Modules

6-pack in E2 Package

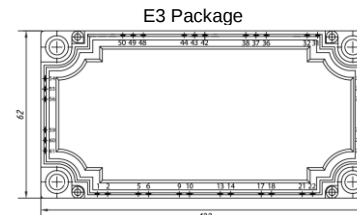
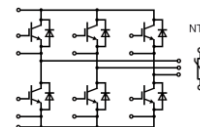
Vce	30 A	40 A	60 A	80 A
1200 V	MIXA30W1200TED	MIXA40W1200TED	MIXA60W1200TED	MIXA80W1200TED



107.5 x 45 x 17 mm

6-pack in E3 Package

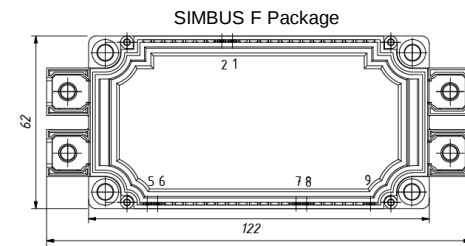
Vce	80 A	100 A	150 A
1200 V	MIXA80W1200TEH	MIXA100W1200TEH	MIXA150W1200TEH



122 x 62 x 17 mm

Half-bridge in SIMBUS F Package

Vce	225 A	300 A	450 A
1200 V	MIXA225PF1200TSF	MIXA300PF1200TSF	MIXA450PF1200TSF

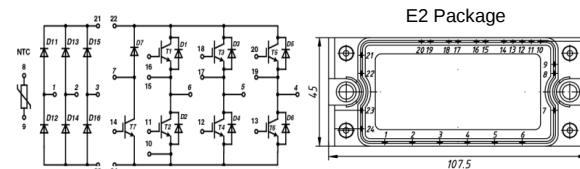


152 (122) x 62 x 17 mm

XPT IGBT Modules

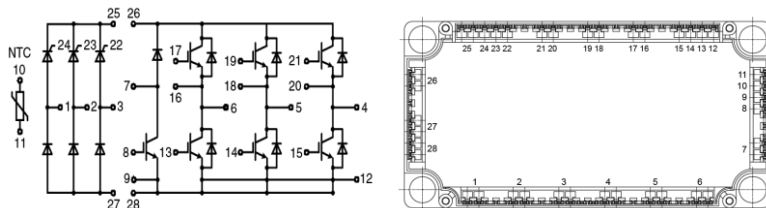
CBI (C_{onverter}-B_{rake}-I_{nverter}) in E2 Package

Vce	10 A	20 A	30 A	40 A
1200 V	MIXA10WB1200TED	MIXA20WB1200TED	MIXA30WB1200TED	MIXA40WB1200TED



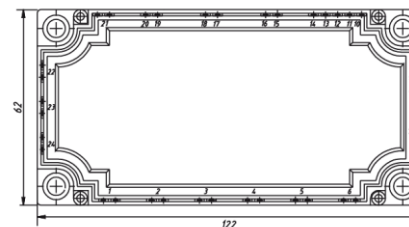
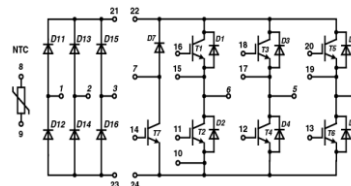
CBI (C_{onverter}-B_{rake}-I_{nverter}) in E3 Package

Vce	60 A	85A
1200 V	MIXA60WB1200TEH 1) MIXA60WH1200TEH 2)	MIXA80WB1200TEH 1) MIXA81WB1200TEH 3)



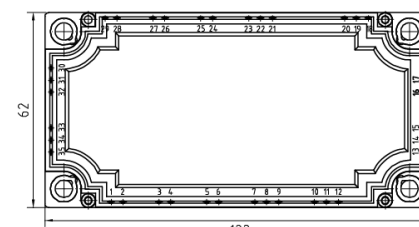
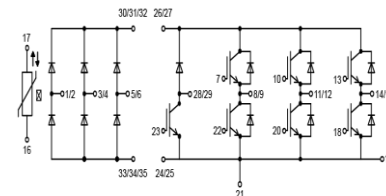
2) Half controlled Input Rectifier

MIXA60 / 80



1) Std CBI Layout

MIXA81



3) New CBI Layout
Improved Gate Control

X2PT™ - 2nd Generation XPT IGBT

X2PT™ is made

- for inverters in drives application (medium speed type)
- as an alternative for Trench4 IGBTs

X2PT™ features...

New planar cell design (front end) and optimized starting material result in:

- **Improved** short circuit capability
- Square RBSOA @ 3 x Ic
- **Tj max of 175 ° C**
- **Reduced** turn off losses
- **Reduced** Vcesat
- **Reduced** thermal impedance
- Very low gate charge
- Positive temperature coefficient of Vcesat
- Platform for 1200V and 1700V



150A IGBT	Trench4	IXYS X2PT™
Vce (V) (150A, 25°C)	1,72	1,70
Vce (V) (150A, 150°C)	2,02	2,00
Eoff (mJ) (150A, 125°C)	13,7	11,2
Qg (nC)	1230	510
Tj_max (°C)	175	175
Short circuit	10usec	10usec
Short circuit current, typ (A)	550	700

IGBT modules in E3 package Module Improvements

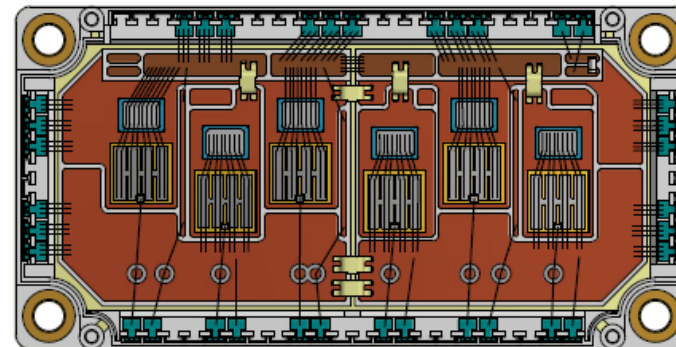
Reduced mounting resistance by

- Clip soldering for DCB to DCB connections
- Use of thick Copper DCB (0,5 mm)

Improved transient thermal impedance Z_{th}

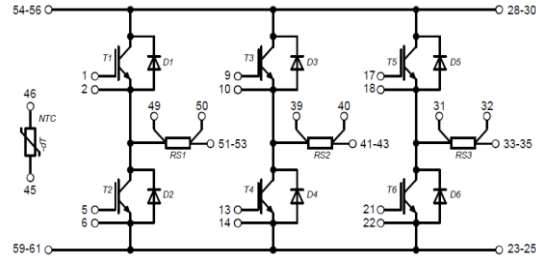
Options (on request)

- ❖ Pressfit pin (PFP) and / or
- ❖ phase change material (PCM)

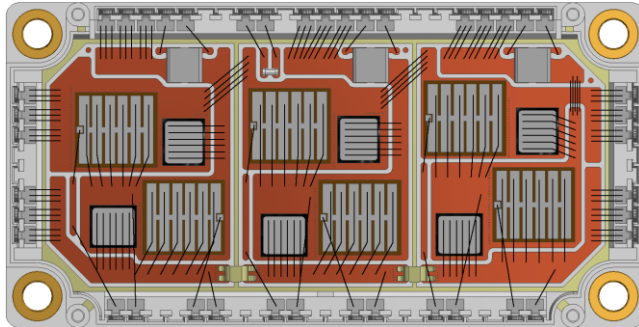


<i>Device</i>	<i>Package</i>	<i>Chip set</i>	<i>Samples</i>
MIXG120W1200TEH	E3	X2PT + SONIC2	Q1 2019
MIXG120W1200DPFTEH	E3	X2PT + HiPerFRED	production
MIXG180W1200TEH	E3	X2PT + SONIC2	Q1 2019
MIXG240W1200TEH	E3	X2PT + SONIC2	Q1 2019

IGBT modules in E3 package 6-pack with Shunt



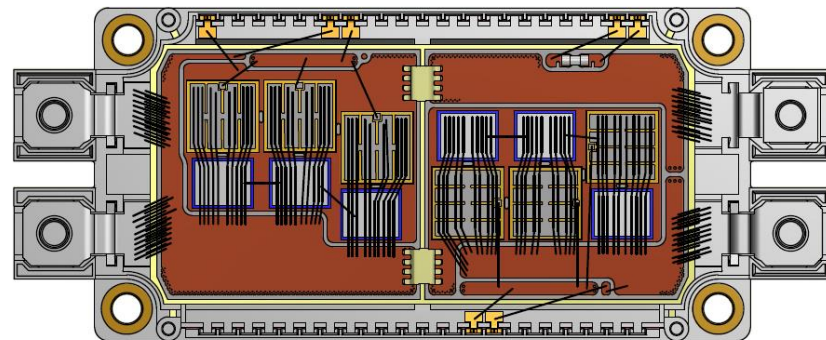
<i>Device</i>	<i>Package</i>	<i>Shunt</i>	<i>Status</i>
MIXG120W1200STEH	E3	tbd mΩ	on request
MIXG180W1200STEH	E3	tbd mΩ	on request
MIXG240W1200PZTEH	E3, PFP	0.5 mΩ	production



- ❖ Shunts are made of ISAOHM material, very high temperature stability
- ❖ Hint: shunt version is not pin compatible to std 6-pack layout
- ❖ Pressfit pin (PFP) and / or phase change material on request

Modules with Trench IGBT under development Reduced mounting resistance

- Clip soldering for DCB to DCB connections
- Use of thick Copper DCB (0,5 mm)
- New soldered power terminals in development



Device	Chip set	Status
MITG300PF1200TSF	TRENCH + SONIC2	under development
MITG450PF1200TSF	TRENCH + SONIC2	under development, Q1 2020
MITG600PF1200TSF	TRENCH + SONIC2	under development
MIXG300PF1700TSF	X2PT + SONIC	sampling
MIXG450PF1700TSF	X2PT + SONIC	sampling

Options (on request)

- ❖ Pressfit pin (PFP) for control pins and / or
- ❖ phase change material(PCM)

X2PT IGBT Module Portfolio

Device	Package	Circuit	Status / LT
● MIXG70W1200TED	E2	6-pack	available
● MIXG120W1200TEH	E3	6-pack	samples in Q1 2019
● MIXG120W1200DPFTEH	E3	6-pack + HiPerFRED	production
● MIXG180W1200TEH	E3	6-pack	samples in Q1 2019
● MIXG240W1200TEH	E3	6-pack	samples in Q1 2019
MIXG120W1200STEH	E3	6-pack + shunt	on request
MIXG180W1200STEH	E3	6-pack + shunt	on request
● MIXG240W1200ZTEH	E3	6-pack + shunt	production
● MIXG300PF1700TSF	SimBus F	Phase leg	sampling
● MIXG450PF1700TSF	SimBus F	Phase leg	sampling

● prime type

Optional

- phase change material and/or
- pressfit pins



NOW PART OF



Expertise Applied | Answers Delivered

Trench IGBT Technology

❖ 650V

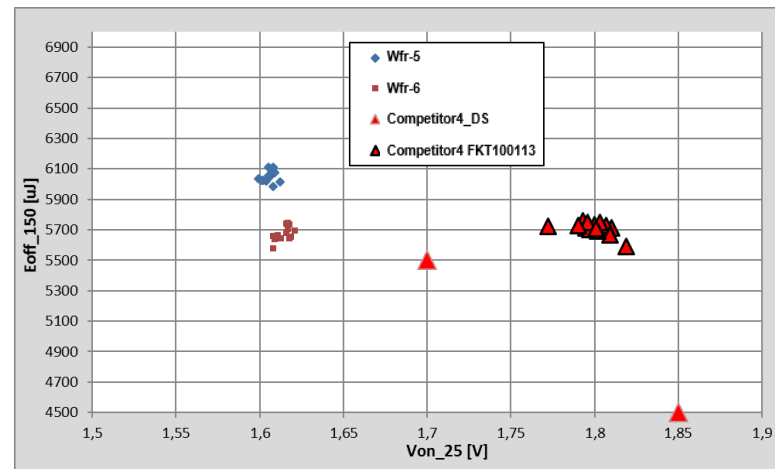
- Die prototypes 200A in house for testing

❖ 1200V

- Die prototypes 50 and 150A in house for testing

❖ 1700V

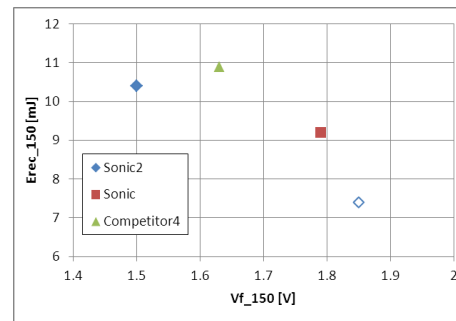
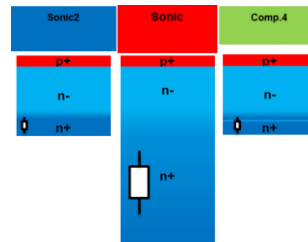
- Die prototypes 75A in house for testing



SONIC2 Diode Technology

❖ 650V and 1200V

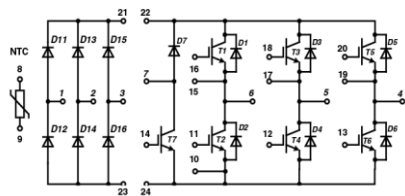
- Thin wafer technology for reduced V_f
- Improved softness



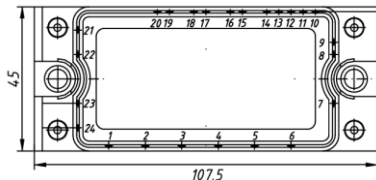
Trench IGBT Modules CBI in E2 Package

CBI (C_{onverter}-B_{rake}-I_{nverter}) in E2 Package

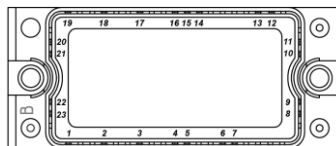
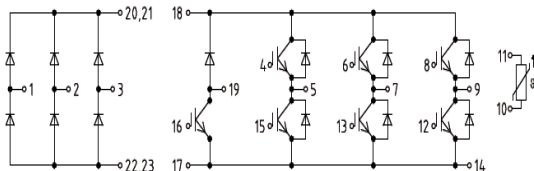
Vce	25A	35 A	50 A	75 A
1200 V	MITG25WB1200TED ¹⁾ Q2 2020	MITG35WB1200TED ¹⁾ feasible	MITG50WB1200TED ¹⁾ Q1 2020	MITG75WB1200TED ²⁾ feasible



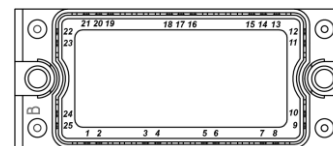
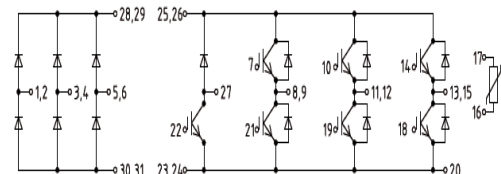
E2 Package



Standard CBI Layout



- 1) New CBI Layout
- ✓ improved Gate Control
- ✓ not compatible to std Layout

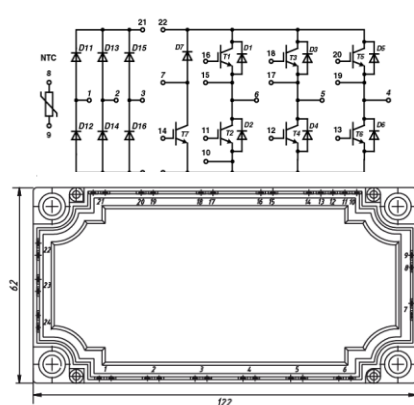


2) CBI 75A Layout

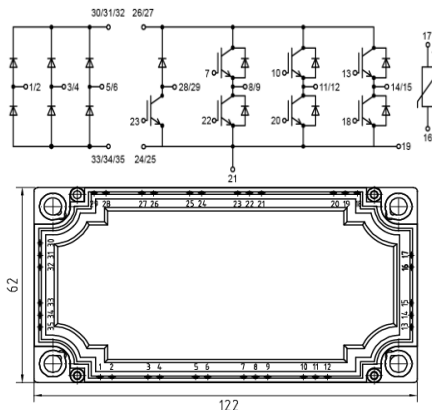
Trench IGBT Modules CBI in E3 Package

CBI (C_{onverter}-B_{rake}-I_{nverter}) in E3 Package

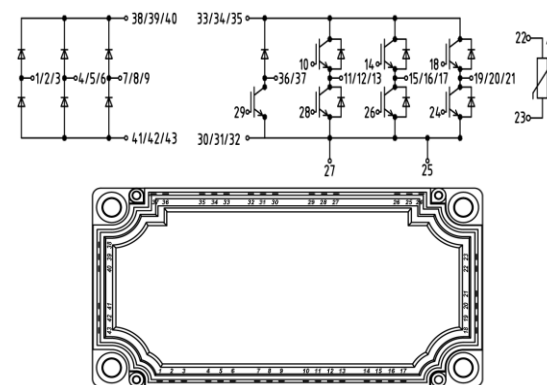
Vce	50A	75 A	100 A	150 A
1200 V	MITG50WB1200TEH ¹⁾ Q4 2019	MITG75WB1200TEH ¹⁾ feasible	MITG100WB1200TEH ¹⁾ Q2 2020	MITG150WB1200TEH ²⁾ feasible
1700 V	MITG50WB1700TEH ¹⁾ feasible	MITG75WB1200TEH ¹⁾ Q4 2020		



Std CBI Layout



1) New CBI Layout
➤ Improved Gate Control

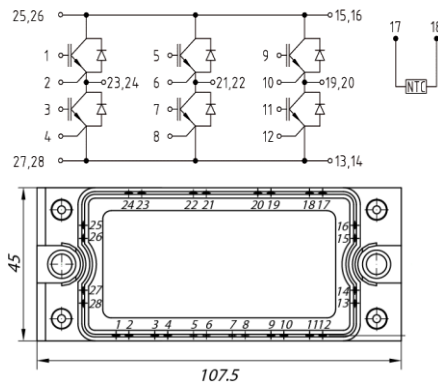


2) CBI Layout for higher currents

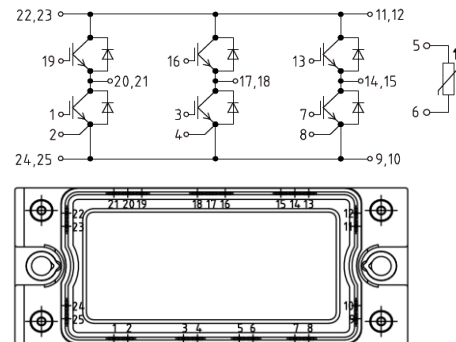
Trench IGBT Modules 6-pack in E2 Package

6-pack in E2 Package

Vce	25 A	35A	50 A	75 A	100 A
1200 V	MITG25W1200TED ¹⁾ feasible	MITG35W1200TED ¹⁾ feasible	MITG50W1200TED ¹⁾ Q4 2019	MITG75W1200TED ¹⁾ feasible	MITG100W1200TED ¹⁾ Q2 2020



Std 6-pack Layout

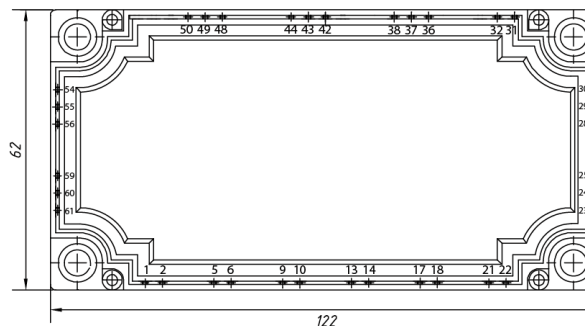
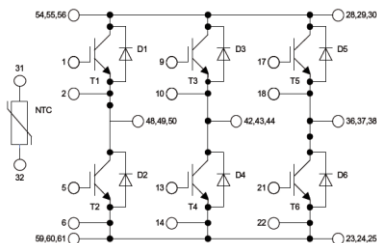


- ¹⁾ New 6-pack Layout
- Improved Gate Control

Trench IGBT Modules 6-pack in E3 Package

6-pack in E3 Package

V _{ce}	75 A	100 A	150 A	200 A
1200 V	MITG75W1200TEH feasible	MITG100W1200TEH Q2 2020	MITG150W1200TEH Q1 2020	MITG200W1200TEH feasible
1700V	MITG75W1700TEH Q3 2020	MITG100W1700TEH feasible	MITG150W1700TEH feasible	



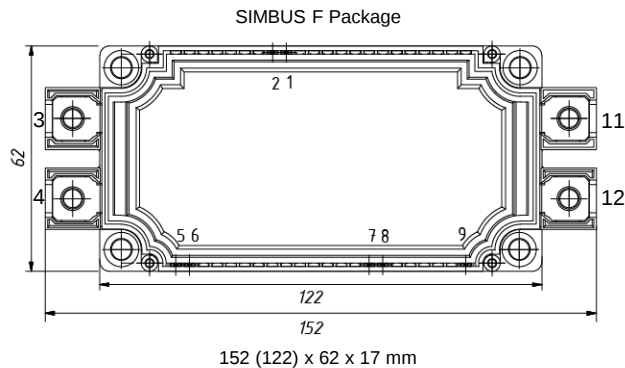
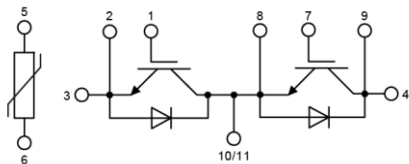
122 x 62 x 17 mm

Trench IGBT Modules

Phase Leg in SIMBUS F Package

Half-bridge in SIMBUS F Package

V _{ce}	225 A	300 A	450 A	600 A
1200 V	MITG225PF1200TSF feasible	MITG300PF1200TSF feasible	MITG450PF1200TSF Q2 2020	MITG600PF1200TSF Q4 2020
1700 V	MITG225PF1700TSF feasible	MITG300PF1700TSF feasible	MITG450PF1700TSF feasible	MITG600PF1700TSF feasible



X2PT and Trench discrete IGBTs

✓ Short circuit rated

Device	Package	Circuit	Vces / V	Ic80 / A	Remark
1200V					
ITF48IF1200HR	ISO247	Trench Co-Pack	1200	48 (100°C)	Samples available
ITF40PG1200DHGLB	SMPD	Trench Phase leg	1200	42	on request
ITF40PG1200DHGTLB	SMPD	Trench Phase leg + NTC	1200	42	on request
IXG70IF1200NA ¹⁾	MiniBloc	X2PT Co-Pack	1200	70	Samples available
IXG100IF1200HF	PLUS 247	X2PT Co-Pack	1200	120	Samples available
IXG100IF1200KF	PLUS 264	X2PT Co-Pack	1200	120	Q4 2018

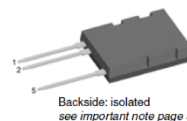
¹⁾ X2PT successor of IXA60N1200NA

High Voltage Discretes

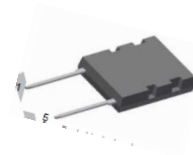
Device	Package	Circuit	Vces / V	Ic80 / A	Remark
IGBTs 3300V and 4500V					
IXG68I3300KN ²⁾	ISOPLUS 264 HV	X2PT Single	3300	68	samples available
IXG80I3300KN	SMPD	X2PT Single	3300	78	product idea
IXG50I4500KN ²⁾	ISOPLUS 264 HV	X2PT Single	4500	42 (100°C)	samples available
IXG50I4500LB	SMPD	X2PT Single	4500	47 (100°C)	product idea
Diodes 3300V and 4500V					
DGH55I3300FE	ISOPLUS i4	SONIC Single	3300	60	samples available
DGH40I4500KO	ISOPLUS 264 HV	SONIC Single	4500	36	samples available

²⁾ Recommended free wheeling diodes:
DHG55I3300FE and DHG40I4500KO

IXG50I4500KN



DHG40I4500KN



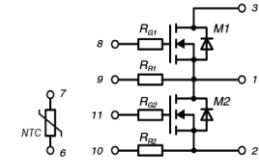
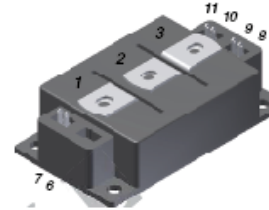
Mosfet Module

MMPA60P1200TLA

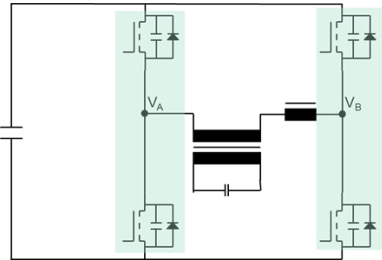
MMPA60P1000TLA

Polar Mosfet Phase leg module with NTC

V_{ds} = 1000 V
 I_{d100} = 64 A
 R_{dson} = 65 mOhm max

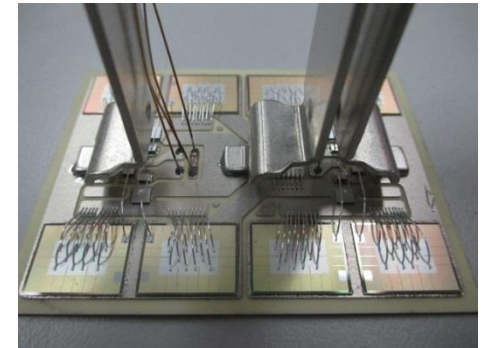


- ❖ Optimised symmetric DCB layout
- ❖ Optimised gate resistor network
- ❖ ZVS switching, for example UV lamp inverter
- ❖ **Shipping 1st batch for pilot run at customer**



❖ **Application:**

Water treatment in ships
(ballast water cleaning)



X2-Class Mosfet Module MMXB95HX650PTED

Product idea

Application: Welding

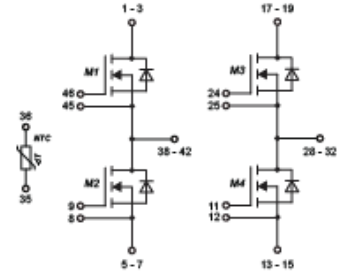
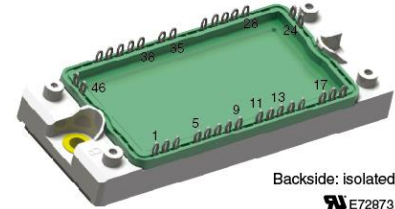


MMXB95HX650PTED

**X2-Class HiPerFET™
MOSFET Module**

I_{D25} = 130 A
 V_{DSS} = 650 V
 $R_{DS(on) \max}$ = 20 mΩ

MOSFET	M1 ... M4		Ratings			
Symbol	Definitions	Conditions	min.	typ.	max.	
V_{DSS}	max drain source voltage	$V_{GS} = 20 \text{ V}$, $I_D = 3 \text{ mA}$	650			V
$V_{GS(max)}$	max transient gate source voltage		-40		+40	V
V_{GS}	continuous gate source voltage		-25		+25	V
		recommended operational value	-15		+15	V
I_{D25}	drain current	$V_{GS} = 10 \text{ V}$			130	A
I_{D80}					96	A
I_{D100}					80	A
$R_{DS(on)}$	static drain source on resistance	$I_D = 75 \text{ A}$; $V_{GS} = 10 \text{ V}$			20	mΩ
					44	mΩ
					$T_{VJ} = 25^\circ\text{C}$	
					$T_{VJ} = 150^\circ\text{C}$	



Thank you for your attention

