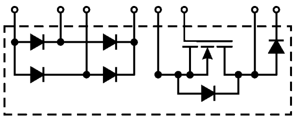
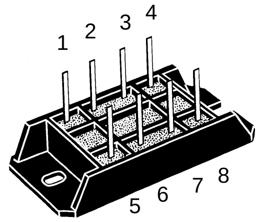
Power MOSFET Stage for Boost Converters

Module for Power Factor Correction

I_{D25} = 35 A
V_{DSS} = 500 V
$R_{DS(on)}$ = 0.12 Ω

$V_{RRM (Diode)}$ V	V_{DSS} V	Type
600	500	VUM 24-05N





	Symbol	Test Conditions	Maximum Ratings	
MOSFET	V_{DSS}	T_{VJ} = 25°C to 150°C	500	V
	V_{DGR}	T_{VJ} = 25°C to 150°C; R_{GS} = 10 kΩ	500	V
	V_{GS}	Continuous	±20	V
	I_D	T_S = 85°C	24	A
	I_D	T_S = 25°C	35	A
	I_{DM}	T_S = 25°C, t_p = ①	95	A
	P_D	T_S = 85°C	170	W
	I_S	V_{GS} = 0 V, T_S = 25°C	24	A
	I_{SM}	V_{GS} = 0 V, T_S = 25°C, t_p = ①	95	A
Boost Diode	V_{RRM}		600	V
	I_{dAV}	T_S = 85°C, rectangular δ = 0.5	40	A
	I_{FSM}	T_{VJ} = 45°C, t = 10 ms (50 Hz)	300	A
		t = 8.3 ms (60 Hz)	320	A
		T_{VJ} = 150°C, t = 10 ms (50 Hz)	260	A
		t = 8.3 ms (60 Hz)	280	A
	P	T_S = 85°C	36	W
Rectifier Diodes	V_{RRM}		800	V
	I_{dAV}	T_S = 85°C, sinus 180°	40	A
	I_{FSM}	T_{VJ} = 45°C, t = 10 ms (50 Hz)	300	A
		t = 8.3 ms (60 Hz)	320	A
		T_{VJ} = 150°C, t = 10 ms (50 Hz)	260	A
		t = 8.3 ms (60 Hz)	280	A
	P	T_S = 85°C	33	W
Module	T_{VJ}		-40...+150	°C
	T_{JM}		150	°C
	T_{stg}		-40...+150	°C
	V_{ISOL}	50/60 Hz, t = 1 min	3000	V~
		I_{ISOL} ≤ 1 mA, t = 1 s	3600	V~
	M_d	Mounting torque (M5)	2-2.5/18-22	Nm/lb.in.
	Weight		28	g

① Pulse width limited by T_{VJ}

IXYS reserves the right to change limits, test conditions and dimensions.

Features

- Package with DCB ceramic base plate
- Soldering connections for PCB mounting
- Isolation voltage 3600 V~
- Low $R_{DS(on)}$ HDMOS™ process
- Low package inductance for high speed switching
- Ultrafast boost diode
- Kelvin source for easy drive

Applications

- Power factor pre-conditioner for SMPS, UPS, battery chargers and inverters
- Boost topology for SMPS including 1~ rectifier bridge
- Power supply for welding equipment

Advantages

- 3 functions in one package
- Output power up to 5 kW
- No external isolation
- Easy to mount with two screws
- Suitable for wave soldering
- High temperature and power cycling capability
- Fits easiliy to all available PFC controller ICs

Symbol		Test Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_{DSS}	MOSFET	V_{GS} = 0 V, I_D = 2 mA	500			V
$V_{GS(th)}$	MOSFET	V_{DS} = 20 V, I_D = 20 mA	2		5	V
I_{GSS}	MOSFET	V_{GS} = ±20 V, V_{DS} = 0 V			±500	nA
I_{DSS}	MOSFET	V_{DS} = 500 V, V_{GS} = 0 V			2	mA
$R_{DS(on)}$	MOSFET	T_{VJ} = 25°C			0.12	Ω
R_{Gint}	MOSFET	T_{VJ} = 25°C			1.5	Ω
g_{fs}	MOSFET	V_{DS} = 15 V, I_{DS} = 12 A		30		S
V_{DS}	MOSFET	I_{DS} = 24 A, V_{GS} = 0 V			1.5	V
$t_{d(on)}$	MOSFET	V_{DS} = 250 V, I_{DS} = 12 A, V_{GS} = 10 V Zgen. = 1 Ω, L-load			100	ns
$t_{d(off)}$	MOSFET				220	ns
C_{iss}	MOSFET	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0 V		8.5		nF
C_{oss}	MOSFET			0.9		nF
C_{rss}	MOSFET			0.3		nF
Q_g	MOSFET	V_{DS} = 250 V, I_D = 12 A, V_{GS} = 10 V		350		nC
R_{thJS}	MOSFET				0.38	K/W
V_F	Boost Diode	I_F = 22 A; T_{VJ} = 25°C			1.65	V
	Boost Diode	T_{VJ} = 150°C			1.4	V
I_R	Boost Diode	V_R = 600 V, T_{VJ} = 25°C			1.5	mA
	Boost Diode	V_R = 480 V, T_{VJ} = 25°C			0.25	mA
	Boost Diode	T_{VJ} = 125°C			7	mA
V_{T0}	Boost Diode	For power-loss calculations only			1.14	V
r_T	Boost Diode	T_{VJ} = 125°C			10	mΩ
I_{RM}	Boost Diode	I_F = 30 A; $-di_F/dt$ = 240 A/µs V_R = 350 V, T_{VJ} = 100°C		10	11	A
R_{thJS}	Boost Diode				1.8	K/W
V_F	Rectifier Diodes	I_F = 20 A, T_{VJ} = 25°C			1.4	V
	Rectifier Diodes	T_{VJ} = 125°C			1.4	V
I_R	Rectifier Diodes	V_R = 800 V T_{VJ} = 25°C			0.25	mA
	Rectifier Diodes	V_R = 640 V, T_{VJ} = 125°C			2	mA
V_{T0}	Rectifier Diodes	For power-loss calculations only			1.05	V
r_T	Rectifier Diodes	T_{VJ} = 125°C			16	mΩ
R_{thJS}	Rectifier Diodes				2	K/W

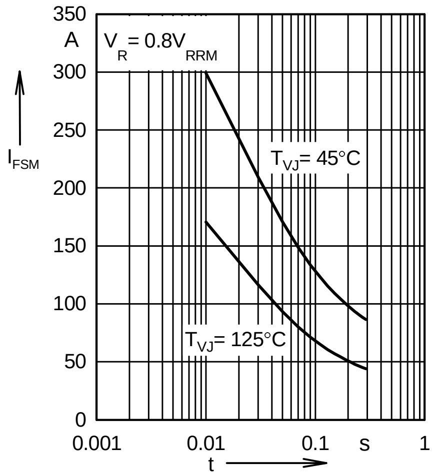


Fig. 1 Non-repetitive peak surge current (Rectifier Diodes)

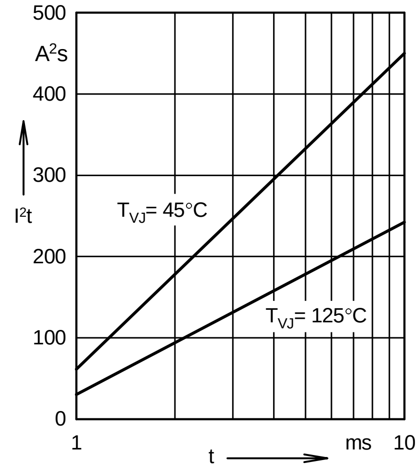
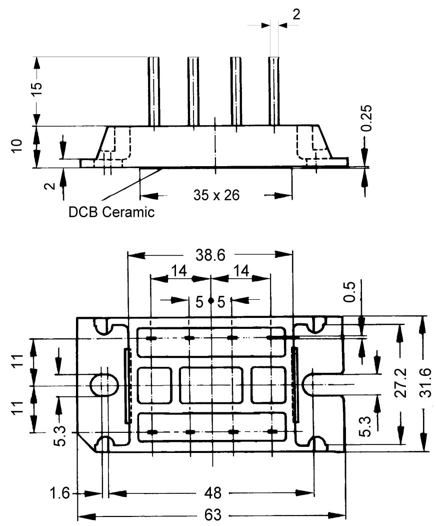


Fig. 2 I^2t for fusing (Rectifier Diodes)

Dimensions in mm (1 mm = 0.0394")



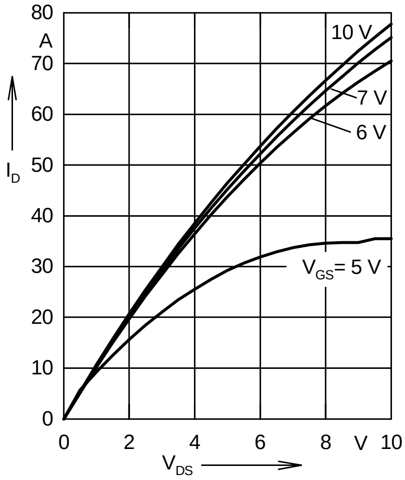


Fig. 3 Typ. output characteristic
$I_D = f(V_{DS})$ (MOSFET)

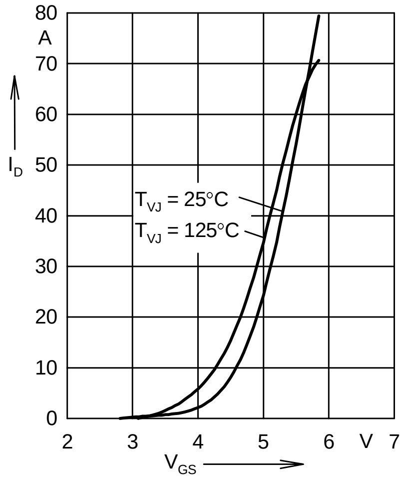


Fig. 4 Typ. transfer characteristics
$I_D = f(V_{GS})$ (MOSFET)

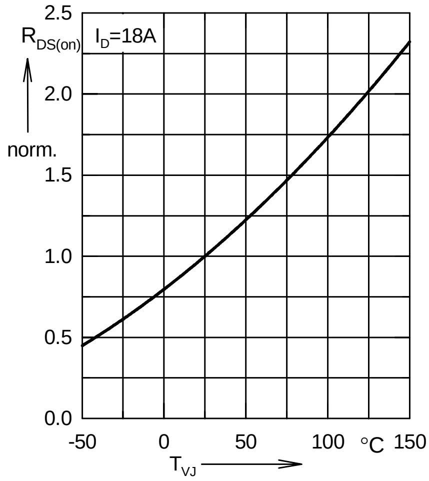


Fig. 5 Typ. normalized
$R_{DS(on)} = f(T_{VJ})$ (MOSFET)

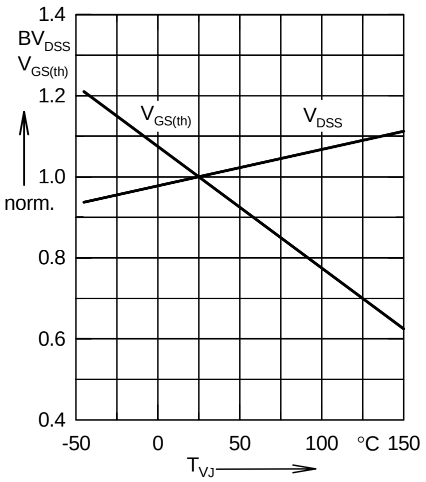


Fig. 6 Typ. normalized $BV_{DSS} = f(T_{VJ})$
$V_{GS(th)} = f(T_{VJ})$ (MOSFET)

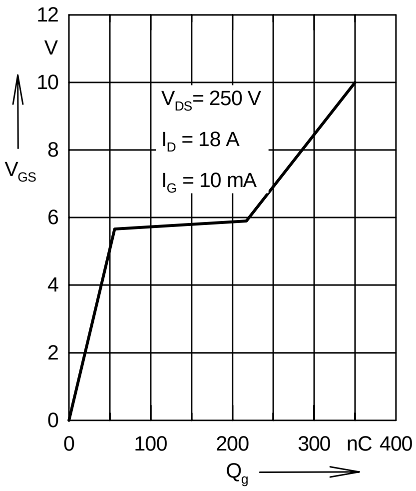


Fig. 7 Typ. turn-on gate charge characteristics, $V_{GS} = f(Q_g)$ (MOSFET)

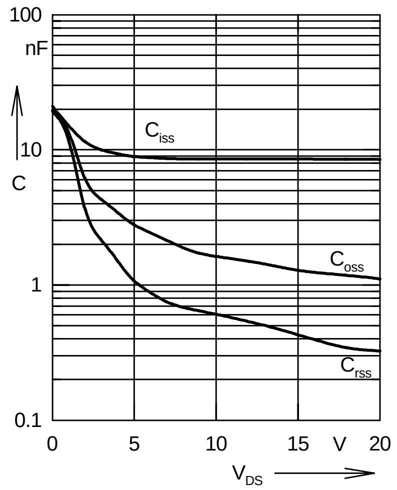


Fig. 8 Typ. capacitances $C = f(V_{DS})$,
f = 1 MHz (MOSFET)

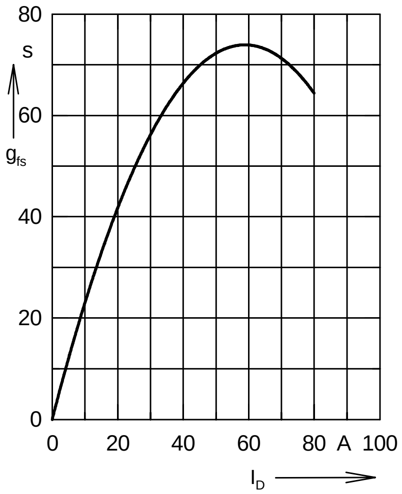


Fig. 9 Typ. transconductance,
$g_{fs} = f(I_D)$ (MOSFET)

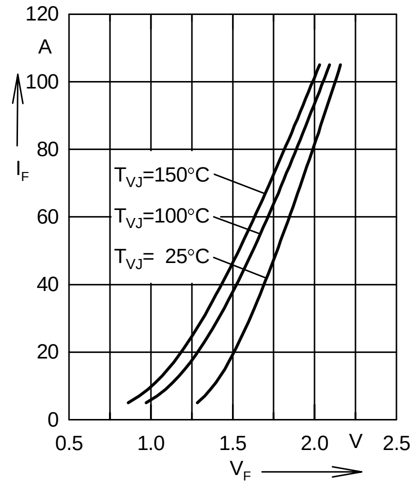


Fig. 10 Forward current versus
voltage drop (Boost Diode)

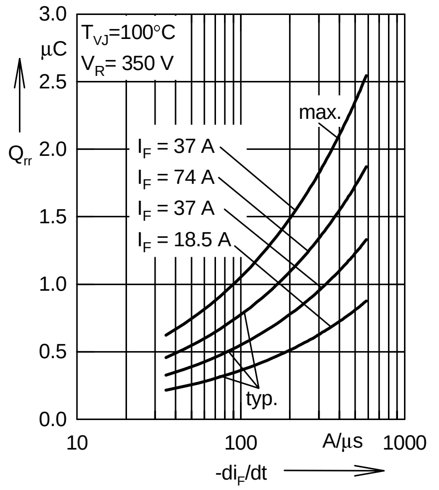


Fig. 11 Recovery charge versus $-di_F/dt$
(Boost Diode)

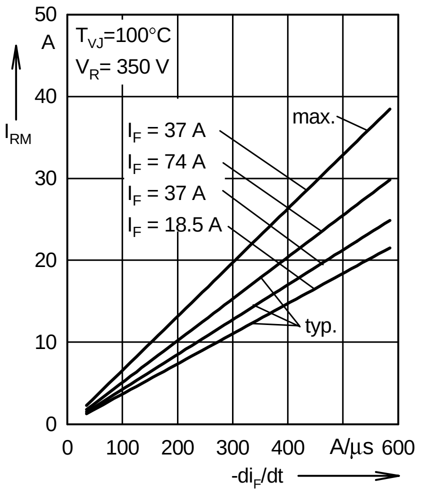


Fig. 12 Peak reverse current versus $-di_F/dt$ (Boost Diode)

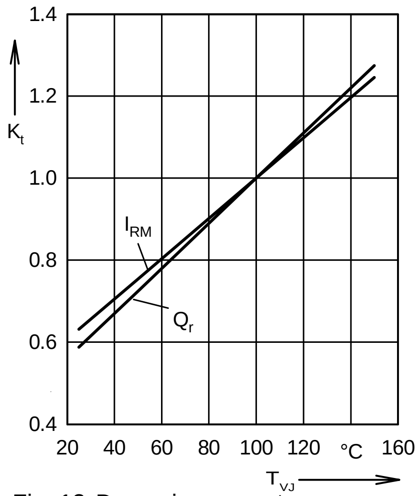


Fig. 13 Dynamic parameters versus junction temperature (Boost Diode)

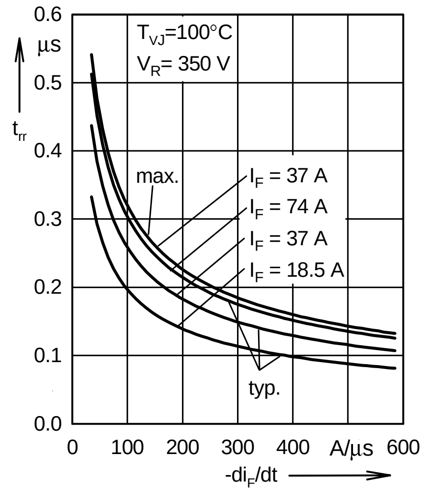


Fig. 14 Recovery time versus $-di_F/dt$ (Boost Diode)

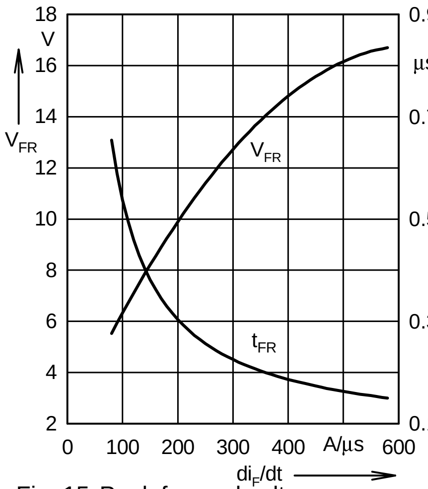


Fig. 15 Peak forward voltage versus $-di_F/dt$ (Boost Diode)

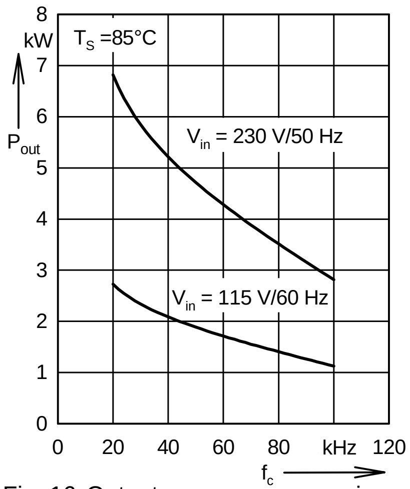


Fig. 16 Output power versus carrier frequency (Module)

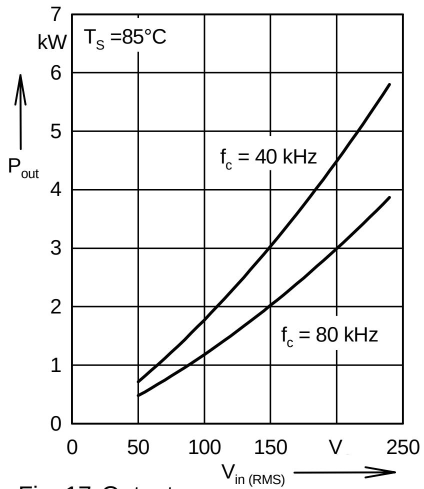


Fig. 17 Output power versus mains voltage

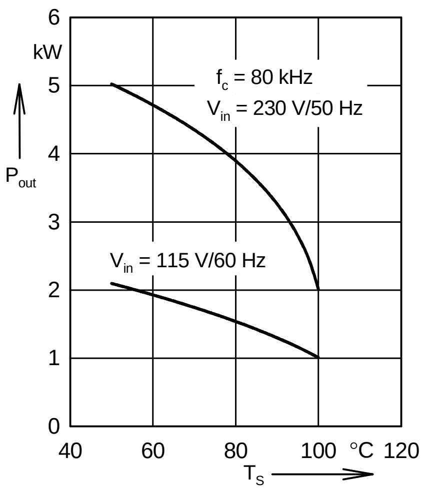


Fig. 18 Output power versus heatsink temperature (Module)

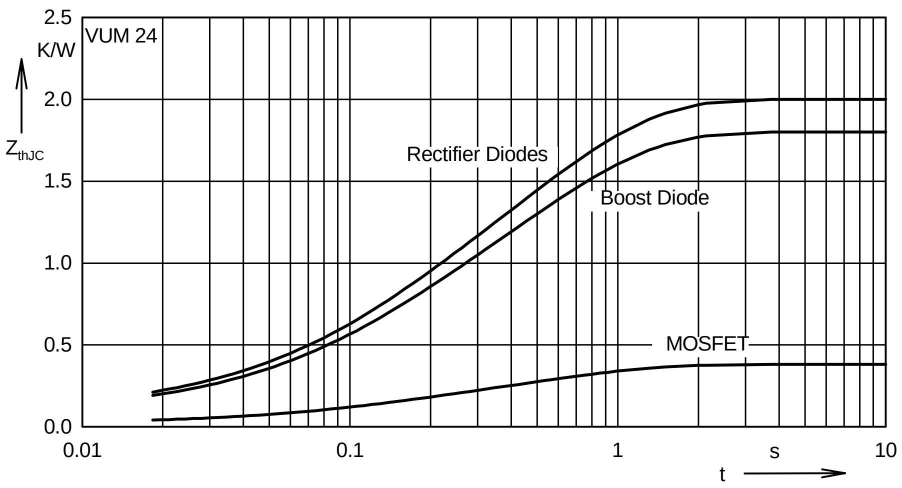


Fig. 19 Transient thermal impedance junction to case for all devices