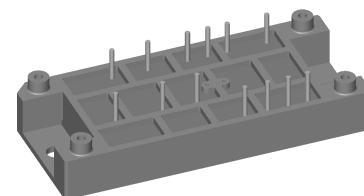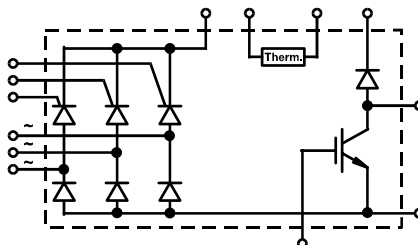# Three Phase Half Controlled Rectifier Bridge
with IGBT and Fast Recovery Diode
for Braking System

V_{RRM} = 1200-1600 V
I_{dAV} = 120 A

V_{RRM} V	Type
1200	VVZB 120-12 io1
1400	VVZB 120-14 io1
1600	VVZB 120-16 io1

Symbol		Conditions		Maximum Ratings	
I_{dAV}		T_{case}= 80°C, sinusoidal 120°		120	A
I_{FRMS}/I_{TRMS}		T_{case}= 80°C, per leg		77	A
I_{FSM}/I_{TSM}		T_{VJ} = 25°C, t = 10 ms, V_R = 0 V		750	A
		T_{VJ} = 150°C, t = 10 ms, V_R = 0 V		670	A
I^2t		T_{VJ} = 25°C, t = 10 ms, V_R = 0 V		2810	A
		T_{VJ} = 150°C, t = 10 ms, V_R = 0V		2240	A
$(di/dt)_{cr}$	Rectifier Bridge	$T_{VJ} = T_{VJM}$ $\quad$ repetitive, I_T = 150 A $\quad$ f = 50 Hz, t_P = 200 µs		150	A/µs
		$V_D = ^2/_3 V_{DRM}$ I_G = 0.45 A, $\quad$ non repetitive, $I_T = I_{d(AV)}/3$ di_G/dt = 0.45 A/µs		500	A/µs
$(dv/dt)_{cr}$		$T_{VJ} = T_{VJM}$; $V_{DR} = ^2/_3 V_{DRM}$ $R_{GK} = \infty$; method 1 (linear voltage rise)		1000	V/µs
P_{GM}		$T_{VJ} = T_{VJM}$ $\quad$ t_P = 30 µs		10	W
		$I_T = I_{d(AV)}/3$ $\quad$ t_P = 300 µs		5	W
		$\quad$ t_P = 10 ms		1	W
P_{GAVM}				0.5	W
V_{CES}		T_{VJ} = 25°C to 150°C		1200	V
V_{GE}		Continuous		± 20	V
I_{C25}	IGBT	T_{case} = 25°C, DC		78	A
I_{C80}		T_{case} = 80°C, DC		52	A
I_{CM}		t_p = Pulse width limited by T_{VJM}		140	A
P_{tot}		T_{case} = 80°C		222	W
V_{RRM}	Fast Recovery Diode			1200	V
$I_{F(AV)}$		T_{case} = 80°C, rectangular d = 0.5		27	A
$I_{F(RMS)}$		T_{case} = 80°C, rectangular d = 0.5		38	A
I_{FRM}		T_{case} = 80°C, t_P = 10 µs, f = 5 kHz		tbd	A
I_{FSM}		T_{VJ} = 45°C, t = 10 ms		200	A
		T_{VJ} = 150°C, t = 10 ms		180	A
P_{tot}		T_{case} = 80°C		64	W

Features

- Soldering connections for PCB mounting
- Isolation voltage 3600 V~
- Ultrafast freewheel diode
- Convenient package outline

Applications

- Drive Inverters with brake system

Advantages

- 2 functions in one package
- No external isolation
- Easy to mount with two screws
- Suitable for wave soldering
- High temperature and power cycling capability

Data according to IEC 60747
IXYS reserves the right to change limits, test conditions and dimensions.

031

Symbol	Conditions	Characteristic Values $(T_{VJ} = 25°C,$ unless otherwise specified)		
		min.	typ.	max.
I_R, I_D	$V_R = V_{RRM}/V_{DRM}$,			0.3 mA
	$V_R = V_{RRM}/V_{DRM}, T_{VJ} = 150°C$			5 mA
V_F, V_T	$I_F = 100$ A,			1.47 V
V_{T0}	For power-loss calculations only			0.85 V
r_T	$T_{VJ} = 150°C$			5 mΩ
V_{GT}	V_D = 6 V; T_{VJ} = 25°C			1.5 V
	T_{VJ} = -40°C			1.6 V
I_{GT}	V_D = 6 V; T_{VJ} = 25°C			100 mA
	T_{VJ} = -40°C			200 mA
V_{GD}	$T_{VJ} = T_{VJM}$; $V_D = ^2/_3\ V_{DRM}$			0.2 V
I_{GD}	$T_{VJ} = T_{VJM}$; $V_D = ^2/_3\ V_{DRM}$			10 mA
I_L	$V_D = 6$ V; $t_G = 30$ µs $di_G/dt = 0.45$ A/µs; $I_G = 0.45$ A			450 mA
I_H	$T_{VJ} = T_{VJM}$; $V_D = 6$ V; $R_{GK} = \infty$			200 mA
t_{gd}	$V_D = ½\ V_{DRM}$ $di_G/dt = 0.45$ A/µs; $I_G = 0.45$ A			2 µs
t_q	$T_{VJ} = T_{VJM}$; $V_R = 100$ V; $V_D = ^2/_3\ V_{DRM}$; $t_P = 200$ µs $dv/dt = 10$ V/µs; $I_T = 120$ A; $-di/dt = 10$ A/µs			150 µs
Q_S	$T_{VJ} = T_{VJM}$			90 µC
I_{RM}	$-di/dt = 0.64$ A/µs; $I_T/I_F = 50$ A			11 A
R_{thJC}	per thyristor / diode; sine 120° el.			1 K/W
R_{thJH}	per thyristor / diode; sine 120° el.			1.3 K/W
$V_{BR(CES)}$	$V_{GS} = 0$ V, $I_C = 1$ mA	1200		V
$V_{GE(th)}$	$I_C = 10$ mA	5		8 V
I_{GES}	V_{GE} = ± 20 V			500 nA
I_{CES}	$V_{CE} = 0.8\ V_{CES}$			0.5 mA
	$V_{CE} = 0.8\ V_{CES}, T_{VJ} = 150°C$			3 mA
V_{CEsat}	$V_{GE} = 15$ V, $I_C = 50$ A			3.35 V
t_{SC} (SCSOA)	$V_{GE} = 15$ V, $V_{CE} = 0.6\ V_{CES}$, $T_{VJ} = 125°C$, $R_G = 11\ \Omega$, non repetitive			10 µs
RBSOA	$V_{GE} = 15$ V, $V_{CE} = 0.8\ V_{CES}$, $T_{VJ} = 125°C$, $R_G = 11\ \Omega$, Clamped Inductive load, L = 100 µH			100 A
C_{ies}	$V_{CE} = 25$ V, f = 1 MHz, $V_{GE} = 0$ V		9	nF
$t_{d(on)}$			65	ns
$t_{d(off)}$	$V_{CE} = 0.6\ V_{CES}$, $I_C = 25$ A		200	ns
t_{ri}	$V_{GE} = 15$ V, $R_G = 11\ \Omega$		tbd	ns
t_{fi}	Inductive load; L = 100 µH		tbd	ns
E_{on}	$T_{VJ} = 125°C$		4.1	mJ
E_{off}			5.7	mJ
R_{thJC}				0.32 K/W
R_{thJH}				0.45 K/W

(Left margin vertical labels: **Rectifier Bridge**, **IGBT**)

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified)			
		min.	typ.	max.	
I_R	$V_R = V_{RRM}$, T_{VJ} = 25°C			0.75	mA
	$V_R = 0.8\ V_{RRM}$, T_{VJ} = 150°C	3		7	mA
V_F	I_F = 30 A, T_{VJ} = 25°C			2.55	V
V_{T0}	For power-loss calculations only			1.65	V
r_T	T_{VJ} = 150°C			18.2	mΩ
I_{RM}	I_F = 30 A, $-di_F/dt$ = 240 A/µs V_R = 100 V	16		18	A
t_{rr}	I_F = 1 A, $-di_F/dt$ = 100 A/µs V_R = 30 V	40		60	ns
R_{thJC}				1.1	K/W
R_{thJH}				1.5	K/W

Fast Recovery Diode

Symbol	Common Specification		Maximum Ratings	
T_{VJ}			-40...+150	°C
T_{VJM}			150	°C
T_{stg}			-40...+125	°C
V_{ISOL}	50/60 Hz	t = 1 min	3000	V~
	$I_{ISOL} \leq$ 1 mA	t = 1 s	3600	V~
M_d	Mounting torque	(M5)	2-2.5	Nm
		(10-32 unf)	18-22	lb.in.
Weight	typ.		80	g
d_S	Creep distance on surface		12.7	mm
d_A	Strike distance in air		11	mm
a	Maximum allowable acceleration		50	m/s²
R_{25}	Thermistor		2.1	kΩ
$B_{25/100}$			3560	K

Module

Dimensions in mm (1 mm = 0.0394")