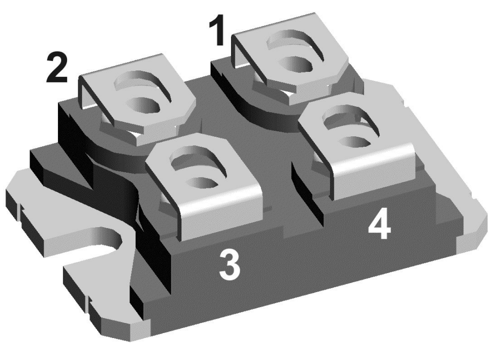
MCD40-12I06

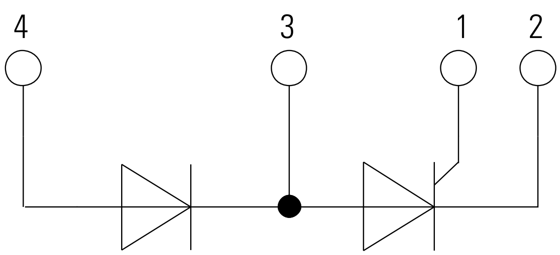
1200V, 40 A, Phase leg

E72873



Backside: isolated

Pinout Diagram (SOT-227 B)



Description

1200 V, 40 A phase-leg thyristor module featuring planar passivated chip technology in an industry-standard SOT-227B package for line-frequency rectification and AC power control applications.

Features

- Optimized for line-frequency power control
- 1200 V repetitive peak off-state voltage (V_{RRM}/V_{DRM})
- 40 A average on-state current rating
- Planar passivated chip technology
- Isolated DCB copper baseplate in SOT-227B package

Benefits

- Supports reliable operation in 50/60 Hz rectification
- Supports high-voltage power conversion
- Enhances blocking-voltage robustness and long-term reliability
- Reduces conduction losses and improves power efficiency.
- Enables efficient thermal dissipation while maintaining electrical isolation

Applications

- Line rectification 50/60 Hz
- Soft start AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

Package SOT-227 B (minibloc)

- Isolation Voltage: 3000 V
- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0
- Base plate: Copper internally DCB isolated
- Advanced power cycling

Product Summary

Characteristic	Value	Unit
V_{RRM}	2x1200	V
$I_{T(AV)}$	40	A
V_T	1.29	V

Rectifier - Maximum Ratings (T_{vj} = 25 °C, unless otherwise specified)

Symbol	Characteristics	Conditions		Value	Units
V_{RRM} / V_{DRM}	Repetitive Peak Reverse / Peak Off-State Voltage	T_{vj} = 25 °C		1200	V
V_{RSM} / V_{DSM}	Non-Repetitive Peak Reverse / Peak Off-State Voltage	T_{vj} = 25 °C		1300	V
I_R / I_D	Reverse Current / Off-State Current	V_R / V_D = 1200 V	T_{vj} = 25 °C	100	µA
			T_{vj} = 125 °C	6	mA
$I_{T(AV)}$	Average On-State Current	180° sine wave, T_{vj} = 150 °C	T_c = 95 °C	40	A
$I_{T(RMS)}$	R.M.S On-State Current			63	A
T_{vj}	Virtual Junction Temperature Range	–		-40 to +150	°C
T_{stg}	Storage Temperature Range	–		-40 to +150	°C
P_{tot}	Total Power Dissipation	T_c = 25 °C		180	W
I_{TSM}	Non-Repetitive Surge On-State Current	t_p = 10 ms; (50 Hz), sine	T_{vj} = 45 °C, V_R = 0 V	500	A
		t_p = 8.3 ms; (60 Hz), sine		540	A
		t_p = 10 ms; (50 Hz), sine	T_{vj} = 150 °C, V_R = 0 V	425	A
		t_p = 8.3 ms; (60 Hz), sine		460	A
I^2t	I^2t Value	t_p = 10 ms; (50 Hz), sine	T_{vj} = 45 °C, V_R = 0 V	1.25	kA^2s
		t_p = 8.3 ms; (60 Hz), sine		1.22	kA^2s
		t_p = 10 ms; (50 Hz), sine	T_{vj} = 150 °C, V_R = 0 V	905	kA^2s
		t_p = 8.3 ms; (60 Hz), sine		880	kA^2s

Electrical Characteristics – Static (T_{vj} = 25 °C, unless otherwise specified)

Symbol	Characteristics	Conditions		Value Min.	Value Typ.	Value Max.	Units
V_T	On-State Voltage	I_T = 40 A	T_{vj} = 25 °C	–	–	1.29	V
		I_T = 80 A		–	–	1.61	V
		I_T = 40 A	T_{vj} = 125 °C	–	–	1.29	V
		I_T = 80 A		–	–	1.70	V
$V_{(TO)}$	Threshold Voltage[1]	T_{vj} = 150 °C		–	–	40	V
r_T	Slope Resistance[1]	T_{vj} = 150 °C		–	–	63	mΩ
V_{GT}	Gate Trigger Voltage	V_D = 6 V	T_{vj} = 25 °C	–	–	1.5	V
			T_{vj} = -40 °C	–	–	1.6	V
I_{GT}	Gate Trigger Current	V_D = 6 V	T_{vj} = 25 °C	–	–	100	mA
			T_{vj} = -40 °C	–	–	150	mA
V_{GD}	Gate Non-Trigger Voltage	V_D = ⅔ V_{DRM}, T_{vj} = 150 °C		–	–	0.2	V
I_{GD}	Gate Non-Trigger Current	V_D = ⅔ V_{DRM}, T_{vj} = 150 °C		–	–	5	mA
I_L	Latching Current	t_p = 10 µs, I_G = 0.3 A, di_G/dt = 0.3 A/µs, T_{vj} = 25 °C		–	–	450	mA
I_H	Holding Current	V_D = 6 V, R_{GK} = ∞, T_{vj} = 25 °C		–	–	200	mA

Note 1: For power loss calculations only

Electrical Characteristics – Dynamic (T_{vj} = 25 °C, unless otherwise specified)

Symbol	Characteristics	Conditions		Value Min.	Value Typ.	Value Max.	Units
C_j	Junction Capacitance	V_R = 400 V, f = 1 MHz		–	25	–	pF
$di/dt_{(cr)}$	Critical Rate Of Rise Of Off-State Current	T_{vj} = 150 °C, f = 50 Hz, t_p = 200 µs, di_g/dt = 0.3 A/µs, I_G = 0.3 A, V_{DM} = ⅔ V_{DRM}	Repetitive, I_T = 120 A	–	–	100	A/µs
			Non-Repetitive, I_T = 40 A	–	–	500	A/µs
$dv/dt_{(cr)}$	Critical Rate Of Rise Of Off-State Voltage	V_{DM} = ⅔ $V_{DRM,}$ R_{GK} = ∞	T_{vj} = 150 °C	–	–	1000	A/µs
t_{gd}	Gate-Controlled Turn-On Delay Time	V_D = ½ $V_{DRM,}$ I_G= 0.3 A, di_G/dt= 0.3 A/µs, T_{vj} = 25 °C		–	–	2	µs
t_q	Circuit-Commutated Turn-Off Time	V_R = 100 V, V_D = ⅔ $V_{DRM,}$ I_T= 40 A, di/dt = 10 A/µs, dv/dt = 20 V/µs, t_p = 200 µs, T_{vj} = 125 °C		–	150	–	µs

Thermal Specifications

Symbol	Characteristics	Conditions	Value Min.	Value Typ.	Value Max.	Units
$R_{th(j-c)}$	Thermal Resistance Junction To Case	–	–	–	0.7	K/W
$R_{th(c-h)}$	Thermal Resistance Case To Heatsink	–	–	0.1	–	K/W

Package SOT-227B (minibloc)

Symbol	Characteristics	Conditions	Value			Units
			Min.	Typ.	Max.	
I_{tRMS}	Terminal RMS Current	per terminal	–	–	150	A
T_{op}	Operation Temperature	–	-40	–	125	°C
M_s	Mounting Torque For Screws To Heatsink	–	1.1	–	1.5	Nm/lb.in
M_t	Mounting Torque For Terminal Screws	–	1.1	–	1.5	Nm/lb.in
d_s	Creepage Distance Along The Surface	terminal to terminal	3.2	–	–	mm
d_a	Clearance Distance In Air	terminal to backside	6.8	–	–	mm
G	Package Weight	–		30		g
V_{isol}	Isolation Withstand Voltage	f = 50 / 60 Hz, $I_{isol} \leq$ 1 mA, t = 1 second	3000			V
		f = 50 / 60 Hz, $I_{isol} \leq$ 1 mA, t = 1 minute	2500			V

Characteristic Curves - Thyristor

Fig. 1. Typical Forward Characteristics

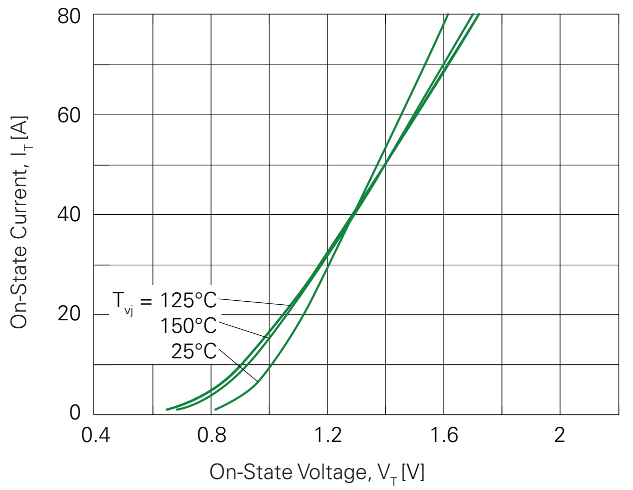


Fig. 2. Non-Repetitive Surge Forward Current vs. Pulse Width

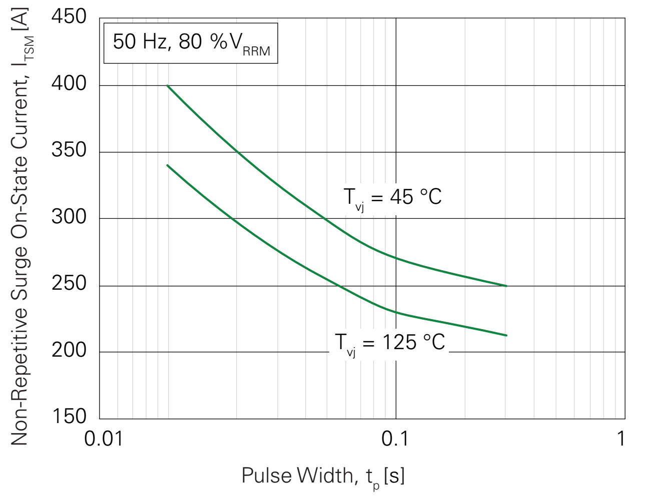


Fig. 3. I²t vs. Time

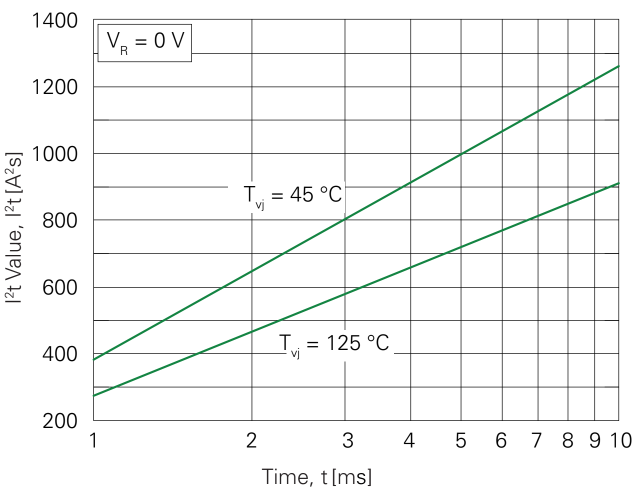


Fig. 4. Typical Gate Trigger Characteristcs

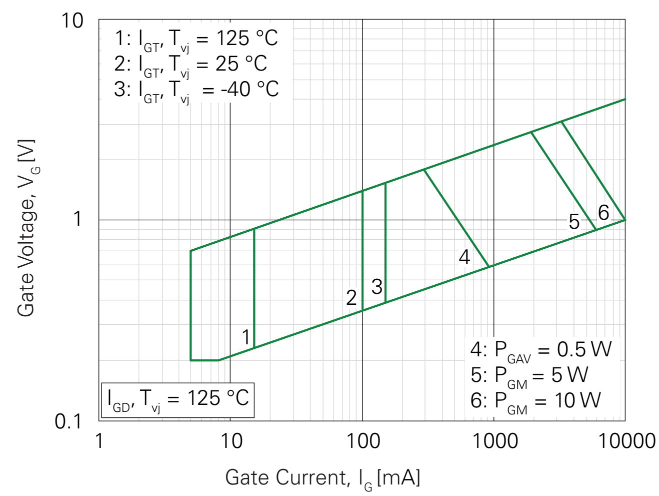


Fig. 5. Typical Gate Current Delay Time t_{gd} vs. Gate Current

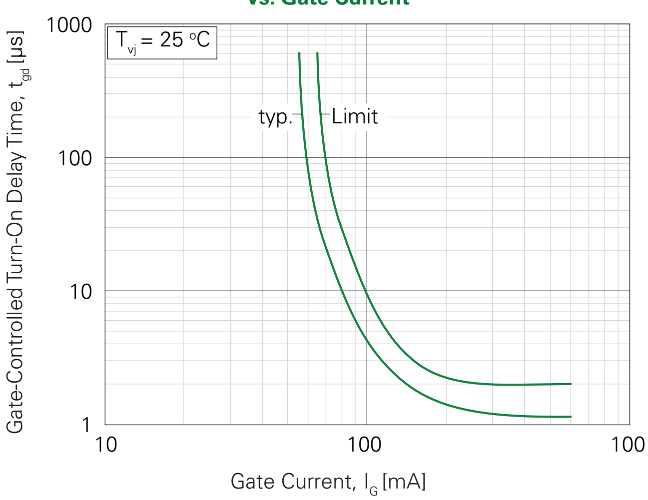
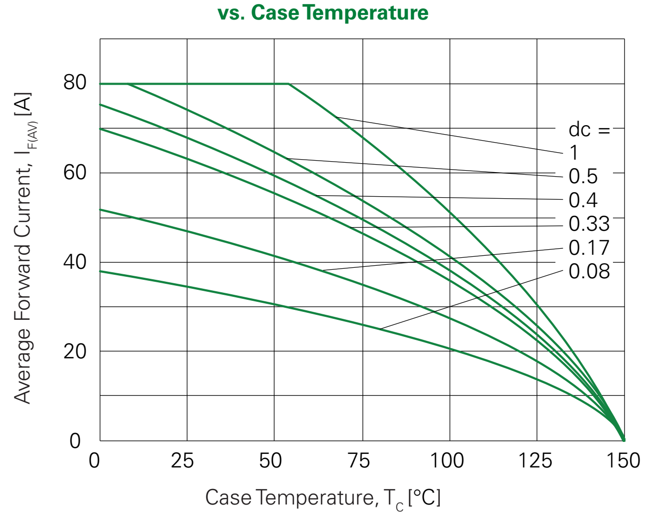


Fig. 6. Average Forward Current vs. Case Temperature



Characteristic Curves - Thyristor

Fig. 7. Average Forward Power Dissipation vs. Average Forward Current

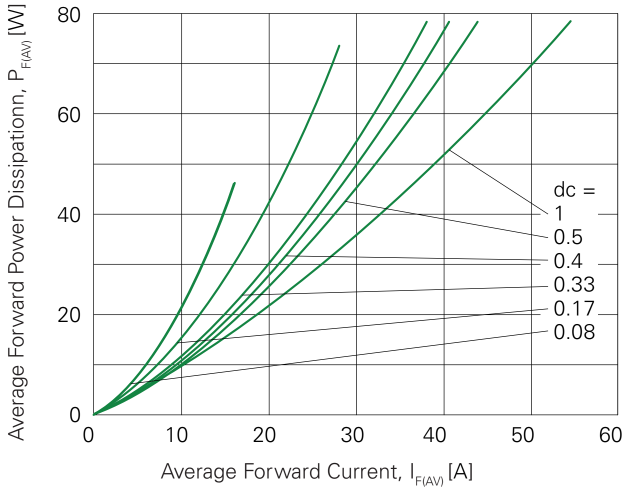


Fig. 8. Average Forward Power Dissipation vs. Ambient Temperature

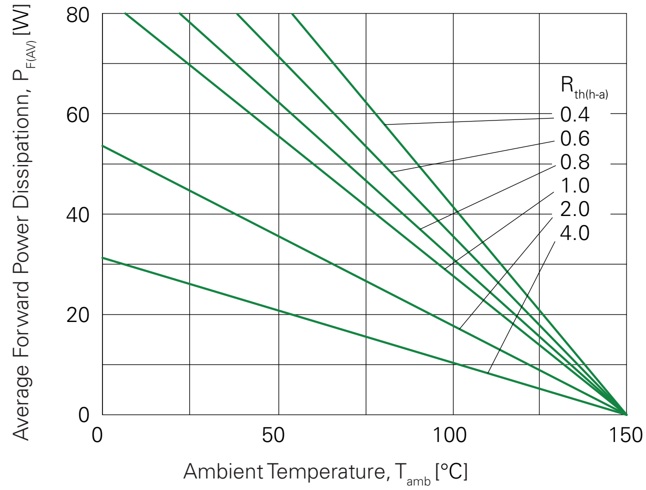
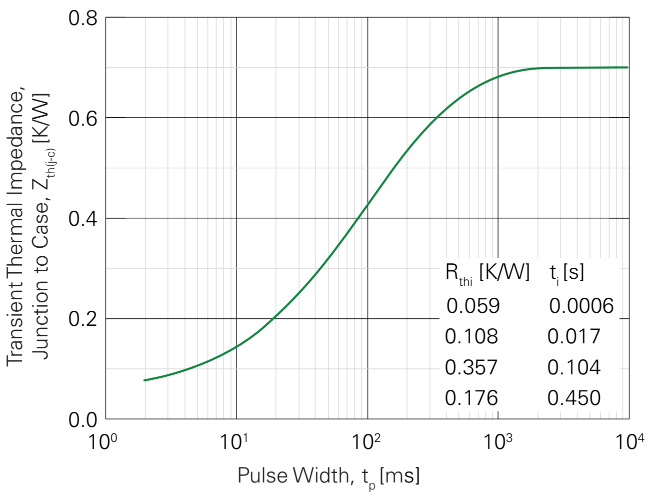
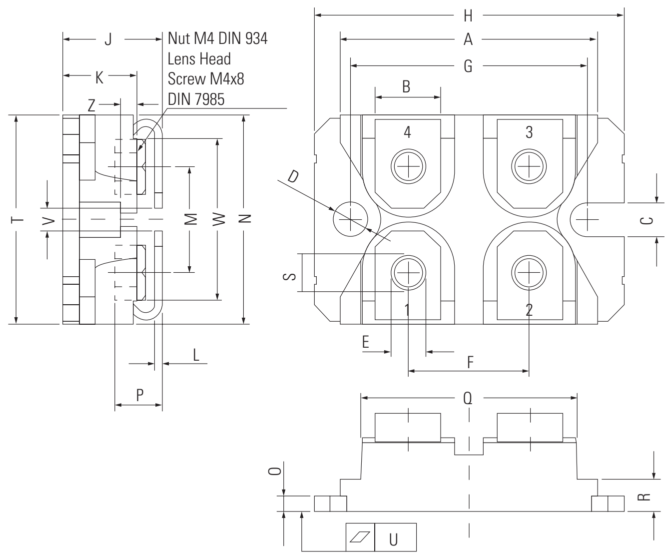


Fig. 9. Typical Transient Thermal Impedance

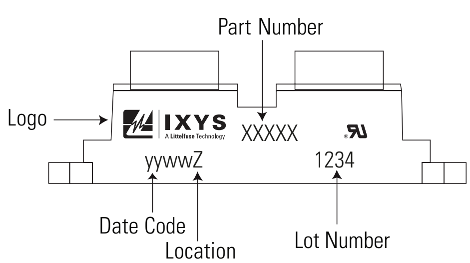


Part Outline Drawing SOT-227B (miniBLOC)



Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max
A	31.50	31.88	1.240	1.255
B	7.80	8.20	0.307	0.323
C	4.09	4.29	0.161	0.169
D	4.09	4.29	0.161	0.169
E	4.09	4.29	0.161	0.169
F	14.91	15.11	0.587	0.595
G	30.12	30.30	1.186	1.193
H	37.80	38.23	1.488	1.505
J	11.68	12.22	0.460	0.481
K	8.92	9.60	0.351	0.378
L	0.74	0.84	0.029	0.033
M	12.50	13.10	0.492	0.516
N	25.15	25.42	0.990	1.001
O	1.95	2.13	0.077	0.084
P	4.95	6.20	0.195	0.244
Q	26.54	26.90	1.045	1.059
R	3.94	4.42	0.155	0.167
S	4.55	4.85	0.179	0.191
T	24.59	25.25	0.968	0.994
U	–0.05	0.10	–0.002	0.004
V	3.20	5.50	0.126	0.217
W	19.81	21.08	0.780	0.830
Z	2.50	2.70	0.098	0.106

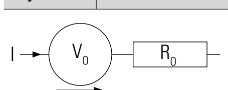
Part Number and Marking



Ordering Information

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity
Standard	MCD40-12io6	MCD40-12io6	Tube	10

Equivalent Circuits for Simulation (*on die level, T_{vj} = 150 °C)



Symbol	Definition	Thyristor	Units
V_{0max}	Threshold voltage	0.87	V
R_{0max}	Slope resistance*	9.7	mΩ

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