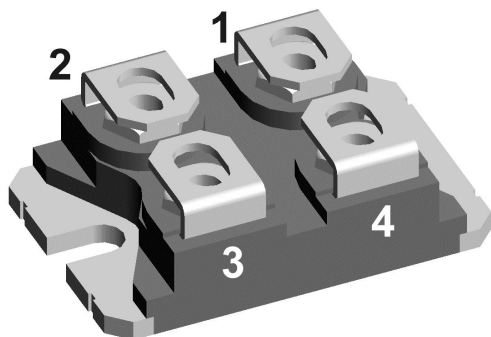


MCD40-16I06

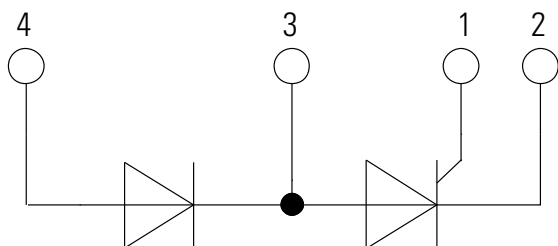
1600 V, 40 A, Phase leg

E72873



Backside: isolated

Pinout Diagram (SOT-227 B)



Description

1600 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
- 1600 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}	2x1600	V
$I_{T(AV)}$	40	A
V_T	1.29	V

Rectifier - Maximum Ratings ($T_{vj} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

Symbol	Characteristics	Conditions		Value	Units
V_{RRM} / V_{DRM}	Repetitive Peak Reverse / Peak Off-State Voltage	$T_{vj} = 25\text{ }^{\circ}\text{C}$		1600	V
V_{RSM} / V_{DSM}	Non-Repetitive Peak Reverse / Peak Off-State Voltage	$T_{vj} = 25\text{ }^{\circ}\text{C}$		1500	V
I_R / I_D	Reverse Current / Off-State Current	$V_R / V_D = 1600\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	100	μA
			$T_{vj} = 125\text{ }^{\circ}\text{C}$	6	mA
$I_{T(AV)}$	Average On-State Current	180° sine wave, $T_{vj} = 150\text{ }^{\circ}\text{C}$	$T_c = 95\text{ }^{\circ}\text{C}$	40	A
$I_{T(RMS)}$	R.M.S On-State Current			63	A
P_{tot}	Total Power Dissipation	$T_c = 25\text{ }^{\circ}\text{C}$		180	W
I_{TSM}	Non-Repetitive Surge On-State Current	$t_p = 10\text{ ms; (50 Hz), sine}$	$T_{vj} = 45\text{ }^{\circ}\text{C},$ $V_R = 0\text{ V}$	500	A
		$t_p = 8.3\text{ ms; (60 Hz), sine}$		540	A
		$t_p = 10\text{ ms; (50 Hz), sine}$	$T_{vj} = 150\text{ }^{\circ}\text{C},$ $V_R = 0\text{ V}$	425	A
		$t_p = 8.3\text{ ms; (60 Hz), sine}$		460	A
I^2t	I^2t Value	$t_p = 10\text{ ms; (50 Hz), sine}$	$T_{vj} = 45\text{ }^{\circ}\text{C},$ $V_R = 0\text{ V}$	1.25	kA^2s
		$t_p = 8.3\text{ ms; (60 Hz), sine}$		1.22	kA^2s
		$t_p = 10\text{ ms; (50 Hz), sine}$	$T_{vj} = 150\text{ }^{\circ}\text{C},$ $V_R = 0\text{ V}$	905	kA^2s
		$t_p = 8.3\text{ ms; (60 Hz), sine}$		880	kA^2s
P_{GM}	Peak Gate Power Dissipation	$t_p = 30\text{ }\mu\text{s}, T_c = 150\text{ }^{\circ}\text{C}$		10	W
		$t_p = 300\text{ }\mu\text{s}, T_c = 150\text{ }^{\circ}\text{C}$		5	W
$P_{G(AV)}$	Average gate power dissipation	—		0.5	W
T_{vj}	Virtual Junction Temperature Range	—		-40 to +125	$^{\circ}\text{C}$
T_{stg}	Storage Temperature Range	—		-40 to +125	$^{\circ}\text{C}$

Electrical Characteristics – Static ($T_{vj} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

Symbol	Characteristics	Conditions	Value			Units
			Min.	Typ.	Max.	
V_T	On-State Voltage	$I_T = 40\text{ A}$	–	–	1.29	V
		$I_T = 80\text{ A}$			1.61	V
		$I_T = 40\text{ A}$	–	–	1.29	V
		$I_T = 80\text{ A}$			1.70	V
$V_{(TO)}$	Threshold Voltage ¹	$T_{vj} = 150\text{ }^{\circ}\text{C}$	–	–	40	V
r_T	Slope Resistance ¹	$T_{vj} = 150\text{ }^{\circ}\text{C}$	–	–	63	m Ω
V_{GT}	Gate Trigger Voltage	$V_D = 6\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$		1.5	V
			$T_{vj} = -40\text{ }^{\circ}\text{C}$		1.6	V
I_{GT}	Gate Trigger Current	$V_D = 6\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$		100	mA
			$T_{vj} = -40\text{ }^{\circ}\text{C}$		150	mA
V_{GD}	Gate Non-Trigger Voltage	$V_D = \frac{2}{3} V_{DRM}, T_{vj} = 150\text{ }^{\circ}\text{C}$	–	–	0.2	V
I_{GD}	Gate Non-Trigger Current	$V_D = \frac{2}{3} V_{DRM}, T_{vj} = 150\text{ }^{\circ}\text{C}$	–	–	5	mA
I_L	Latching Current	$t_p = 10\text{ }\mu\text{s}, I_G = 0.3\text{ A}, di_G/dt = 0.3\text{ A}/\mu\text{s}, T_{vj} = 25\text{ }^{\circ}\text{C}$	–	–	450	mA
I_H	Holding Current	$V_D = 6\text{ V}, R_{GK} = \infty, T_{vj} = 25\text{ }^{\circ}\text{C}$	–	–	200	mA

Note 1: For power loss calculations only**Electrical Characteristics – Dynamic** ($T_{vj} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

Symbol	Characteristics	Conditions	Value			Units
			Min.	Typ.	Max.	
C_j	Junction Capacitance	$V_R = 400\text{ V}, f = 1\text{ MHz}, T_{vj} = 25\text{ }^{\circ}\text{C}$	–	25	–	pF
$di/dt_{(cr)}$	Critical Rate Of Rise Of Off-State Current	$T_{vj} = 150\text{ }^{\circ}\text{C}, f = 50\text{ Hz}, t_p = 200\text{ }\mu\text{s}, di_G/dt = 0.3\text{ A}/\mu\text{s}, I_G = 0.3\text{ A}, V_{DM} = \frac{2}{3} V_{DRM}$	Repetitive, $I_T = 120\text{ A}$		100	A/ μs
			Non-Repetitive, $I_T = 40\text{ A}$		500	A/ μs
$dv/dt_{(cr)}$	Critical Rate Of Rise Of Off-State Voltage	$V_{DM} = \frac{2}{3} V_{DRM}, R_{GK} = \infty, T_{vj} = 150\text{ }^{\circ}\text{C}$	–	–	1000	A/ μs
t_{gd}	Gate-Controlled Turn-On Delay Time	$V_D = \frac{1}{2} V_{DRM}, I_G = 0.3\text{ A}, di_G/dt = 0.3\text{ A}/\mu\text{s}, T_{vj} = 25\text{ }^{\circ}\text{C}$	–	–	2	μs
t_q	Circuit-Commutated Turn-Off Time	$V_R = 100\text{ V}, V_D = \frac{2}{3} V_{DRM}, I_T = 40\text{ A}, di/dt = 10\text{ A}/\mu\text{s}, dv/dt = 20\text{ V}/\mu\text{s}, t_p = 200\text{ }\mu\text{s}, T_{vj} = 125\text{ }^{\circ}\text{C}$	–	150	–	μs

Thermal Specifications

Symbol	Characteristics	Conditions	Value			Units
			Min.	Typ.	Max.	
$R_{th(j-c)}$	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	$f = 50 / 60 \text{ Hz}, I_{isol} \leq 1 \text{ mA}, t = 1 \text{ second}$	3000			V
		$f = 50 / 60 \text{ Hz}, I_{isol} \leq 1 \text{ mA}, t = 1 \text{ minute}$	2500			V

Characteristic Curves - Thyristor

Fig. 1. Typical Forward Characteristics

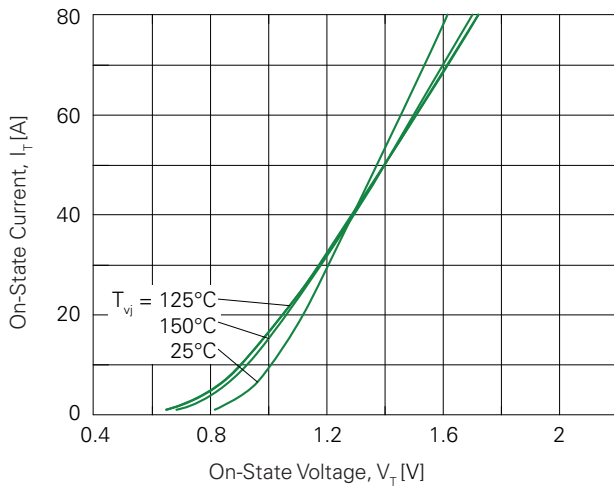


Fig. 2. Non-Repetitive Surge Forward Current vs. Pulse Width

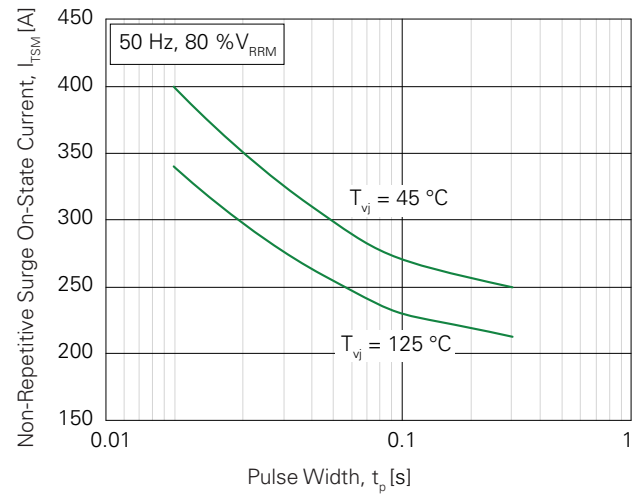
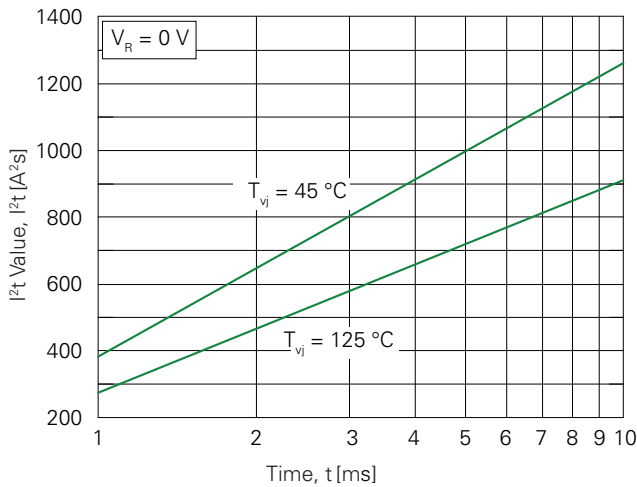
Fig. 3. I^2t vs. Time

Fig. 4. Typical Gate Trigger Characteristics

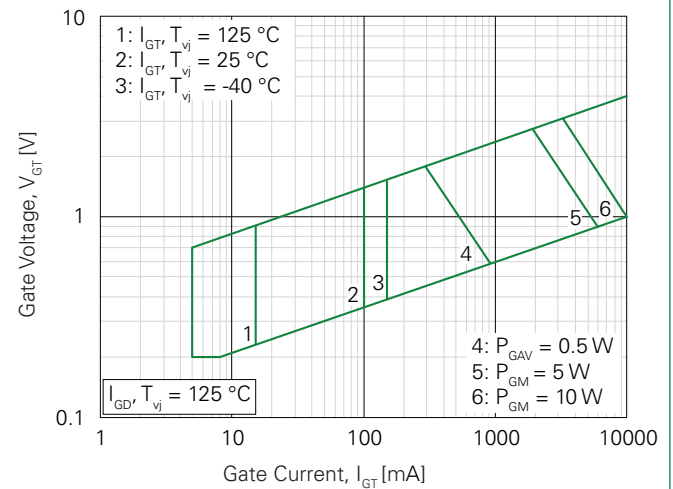
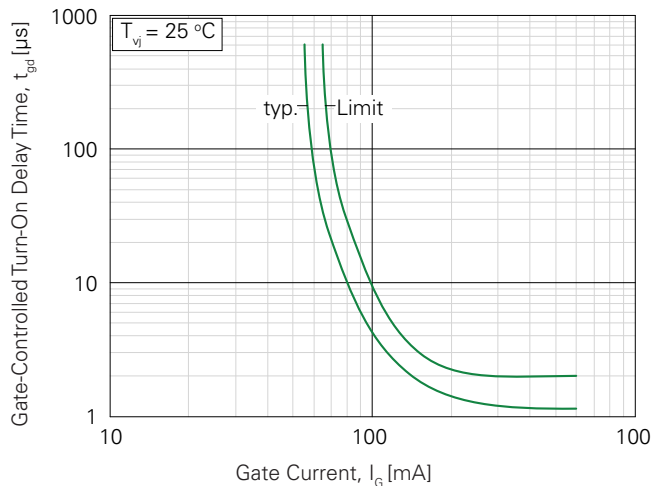
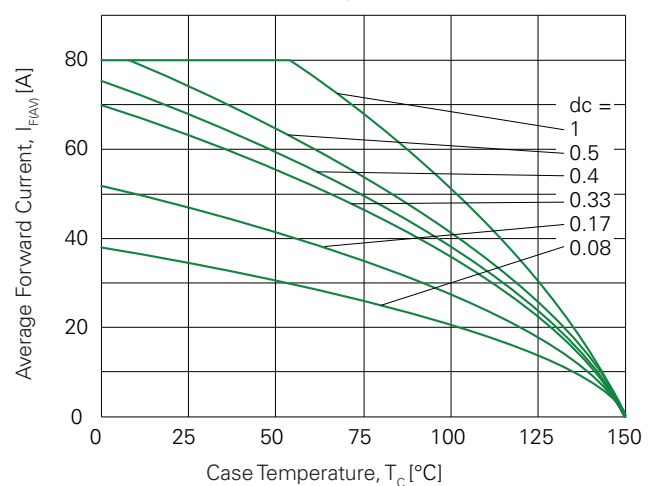
Fig. 5. Typical Gate Current Delay Time t_{gd} vs. Gate Current

Fig. 6. Average Forward Current vs. Case Temperature



Characteristic Curves - Thyristor

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

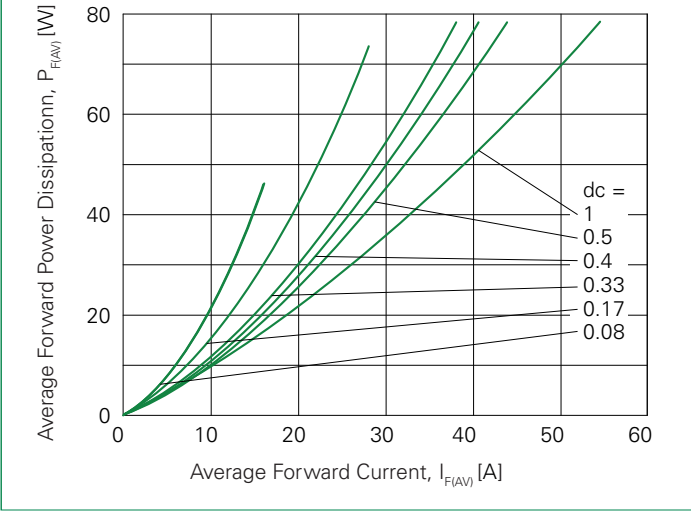


Fig. 8. Average Forward Power Dissipation vs. Ambient Temperature

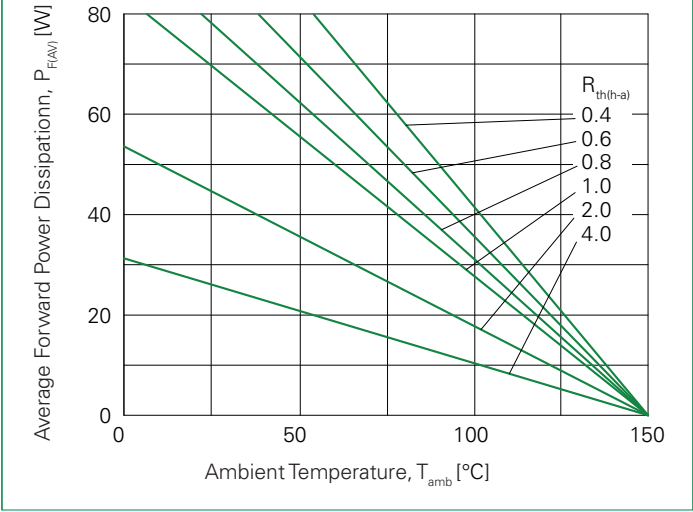
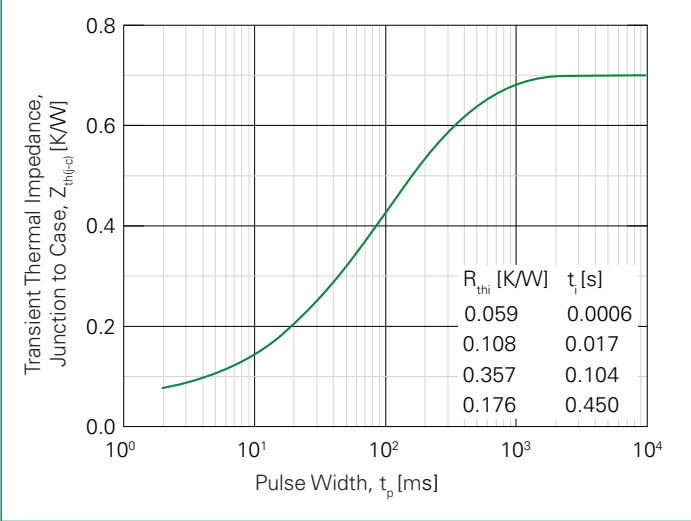
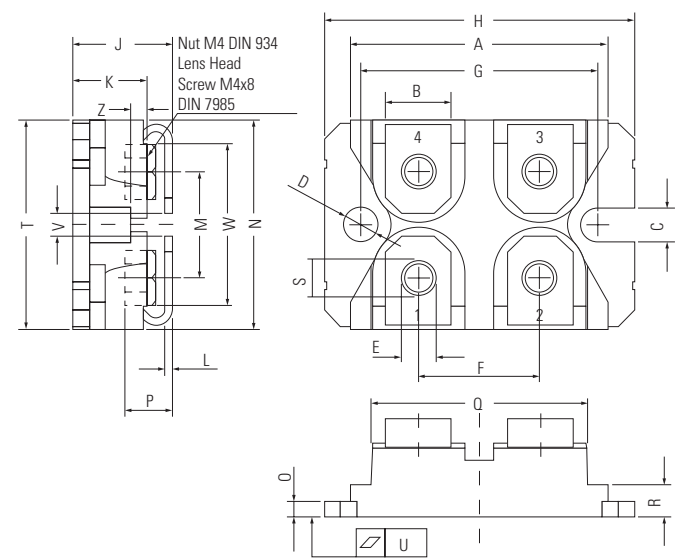


Fig. 9. Typical Transient Thermal Impedance

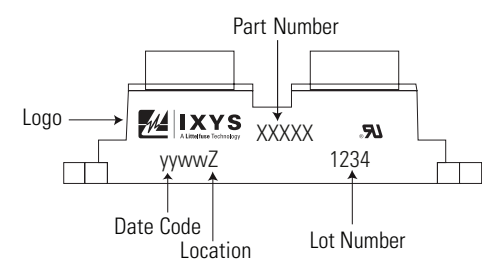


Part Outline Drawing SOT-227B (miniBLOC)



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	MCD40-16io6	MCD40-16io6	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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Part of:

