

Thyristor

$$V_{RRM} = 1600V$$

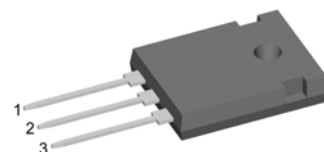
$$I_{TAV} = 30A$$

$$V_T = 1,35V$$

Three Quadrants operation: QI - QIII
 1~ Triac

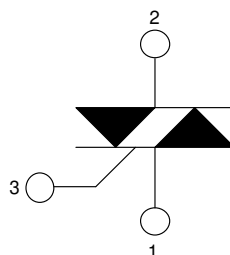
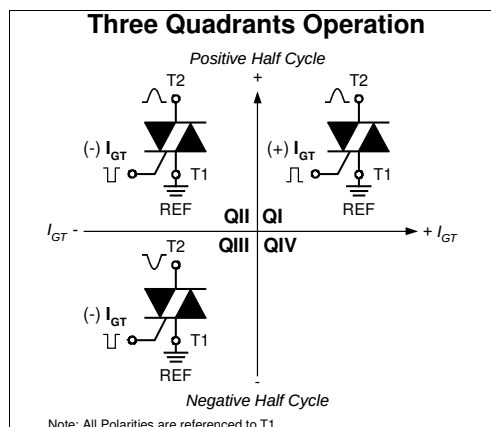
Part number

CMA60MT1600NHR



Backside: isolated

 E72873



Features / Advantages:

- Triac for line frequency
- Three Quadrants Operation
 - QI - QIII
- Planar passivated chip
- Long-term stability of blocking currents and voltages

Applications:

- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

Package: ISO247

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0
- Soldering pins for PCB mounting
- Backside: DCB ceramic
- Reduced weight
- Advanced power cycling

Disclaimer Notice

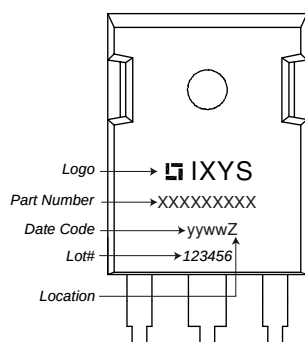
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Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1700	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1600	V
$I_{R/D}$	reverse current, drain current	$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			10	μA
		$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$			2	mA
V_T	forward voltage drop	$I_T = 30\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1,36	V
		$I_T = 60\text{ A}$				1,70	V
		$I_T = 30\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$			1,35	V
		$I_T = 60\text{ A}$				1,79	V
I_{TAV}	average forward current	$T_C = 90^{\circ}\text{C}$	$T_{VJ} = 150^{\circ}\text{C}$			30	A
I_{RMS}	RMS forward current per phase	180° sine				66	A
V_{T0}	threshold voltage	} for power loss calculation only	$T_{VJ} = 150^{\circ}\text{C}$			0,89	V
r_T	slope resistance					15,1	m Ω
R_{thJC}	thermal resistance junction to case					0,9	K/W
R_{thCH}	thermal resistance case to heatsink				0,25		K/W
P_{tot}	total power dissipation		$T_C = 25^{\circ}\text{C}$			140	W
I_{TSM}	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			260	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			280	A
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$			220	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			240	A
I^2t	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			340	A ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			325	A ² s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$			240	A ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			240	A ² s
C_J	junction capacitance	$V_R = 400\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}\text{C}$		9		pF
P_{GM}	max. gate power dissipation	$t_p = 30\text{ }\mu\text{s}$	$T_C = 150^{\circ}\text{C}$			10	W
		$t_p = 300\text{ }\mu\text{s}$				5	W
P_{GAV}	average gate power dissipation					0,5	W
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 125^{\circ}\text{C}; f = 50\text{ Hz}$ repetitive, $I_T = 90\text{ A}$				150	A/ μs
		$t_p = 200\text{ }\mu\text{s}; di_G/dt = 0,2\text{ A}/\mu\text{s};$ $I_G = 0,2\text{ A}; V_D = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 30\text{ A}$				500	A/ μs
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty$; method 1 (linear voltage rise)	$T_{VJ} = 125^{\circ}\text{C}$			500	V/ μs
V_{GT}	gate trigger voltage	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			1,3	V
			$T_{VJ} = -40^{\circ}\text{C}$			1,6	V
I_{GT}	gate trigger current	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			± 60	mA
			$T_{VJ} = -40^{\circ}\text{C}$			± 80	mA
V_{GD}	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}\text{C}$			0,2	V
I_{GD}	gate non-trigger current					± 1	mA
I_L	latching current	$t_p = 10\text{ }\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$			90	mA
		$I_G = 0,2\text{ A}; di_G/dt = 0,2\text{ A}/\mu\text{s}$					
I_H	holding current	$V_D = 6\text{ V}$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}\text{C}$			60	mA
t_{gd}	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}\text{C}$			2	μs
		$I_G = 0,5\text{ A}; di_G/dt = 0,5\text{ A}/\mu\text{s}$					
t_q	turn-off time	$V_R = 100\text{ V}; I_T = 30\text{ A}; V_D = \frac{2}{3} V_{DRM}$ $di/dt = 10\text{ A}/\mu\text{s}; dv/dt = 20\text{ V}/\mu\text{s}; t_p = 200\text{ }\mu\text{s}$	$T_{VJ} = 125^{\circ}\text{C}$		150		μs

Package ISO247				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
I_{RMS}	RMS current	per terminal				70	A
T_{VJ}	virtual junction temperature			-55		150	°C
T_{op}	operation temperature			-55		125	°C
T_{stg}	storage temperature			-55		150	°C
Weight					6		g
M_D	mounting torque			0,8		1,2	Nm
F_C	mounting force with clip			20		120	N
$d_{Spp/App}$	creepage distance on surface striking distance through air		terminal to terminal	2,7			mm
$d_{Spb/Apb}$			terminal to backside	4,1			mm
V_{ISOL}	isolation voltage	t = 1 second	50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA	3600			V
		t = 1 minute		3000			V

Product Marking



Part description

C = Thyristor (SCR)
 M = Thyristor
 A = (up to 1800V)
 60 = Current Rating [A]
 MT = 1~ Triac
 1600 = Reverse Voltage [V]
 N = Three Quadrants operation: QI - QIII
 HR = ISO247 (3)

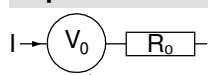
Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	CMA60MT1600NHR	CMA60MT1600NHR	Tube	30	517853

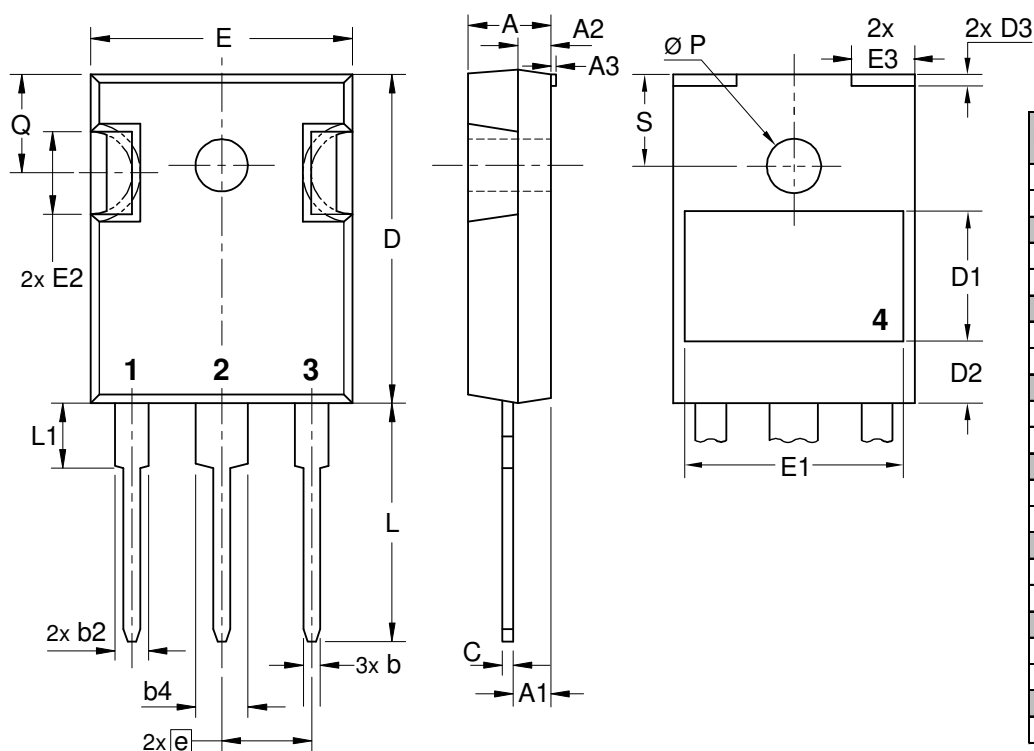
Similar Part	Package	Voltage class
CMA60MT1600NHB	TO-247AD (3)	1600

Equivalent Circuits for Simulation

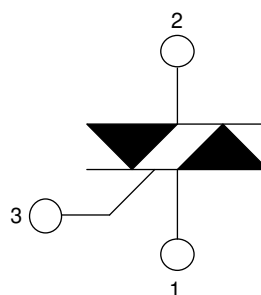
* on die level

$T_{VJ} = 150^{\circ}\text{C}$

		Thyristor	
$V_{0\ max}$	threshold voltage	0,89	V
$R_{0\ max}$	slope resistance *	12,6	mΩ

Outlines ISO247


Dim.	Millimeter		Inches	
	min	max	min	max
A	4.70	5.30	0.185	0.209
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
A3	typ. 0.05		typ. 0.002	
b	0.99	1.40	0.039	0.055
b2	1.65	2.39	0.065	0.094
b4	2.59	3.43	0.102	0.135
c	0.38	0.89	0.015	0.035
D	20.79	21.45	0.819	0.844
D1	typ. 8.90		typ. 0.350	
D2	typ. 2.90		typ. 0.114	
D3	typ. 1.00		typ. 0.039	
E	15.49	16.24	0.610	0.639
E1	typ. 13.45		typ. 0.530	
E2	4.31	5.48	0.170	0.216
E3	typ. 4.00		typ. 0.157	
e	5.46 BSC		0.215 BSC	
L	19.80	20.30	0.780	0.799
L1	-	4.49	-	0.177
Ø P	3.55	3.65	0.140	0.144
Q	5.38	6.19	0.212	0.244
S	6.14 BSC		0.242 BSC	



Thyristor

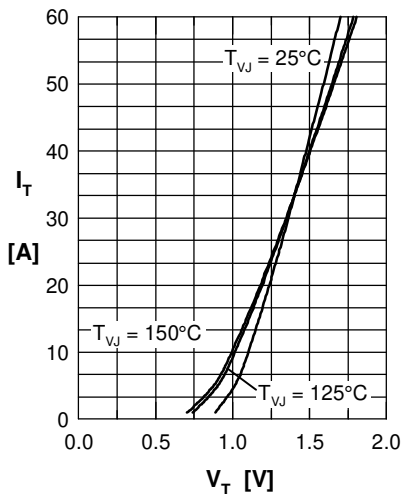


Fig. 1 Forward characteristics

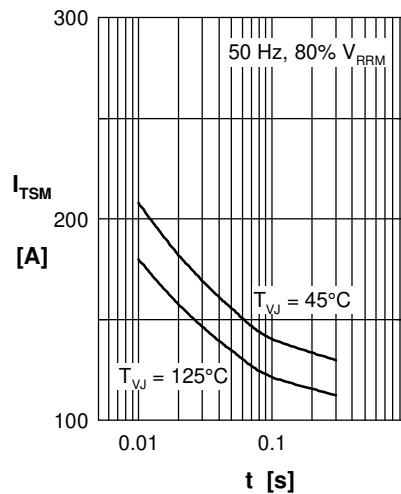


Fig. 2 Surge overload current
 I_{TSM} : crest value, t : duration

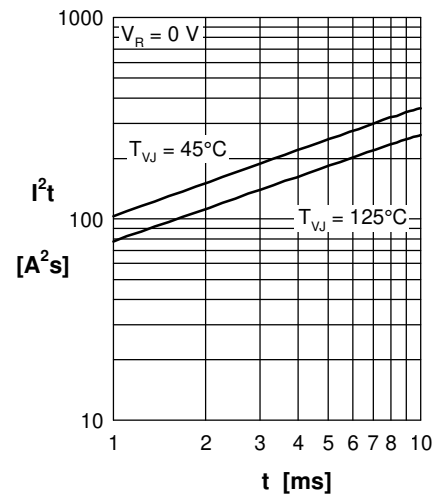


Fig. 3 I^2t versus time (1-10 s)

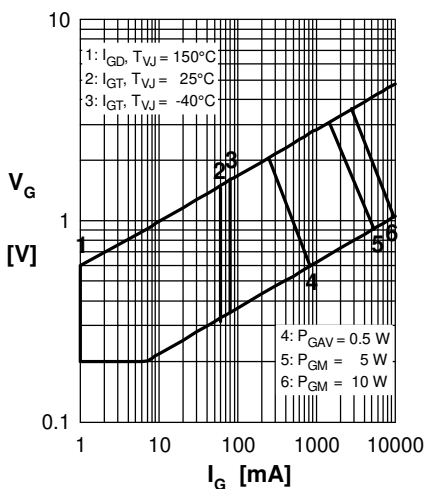


Fig. 4 Gate voltage & gate current

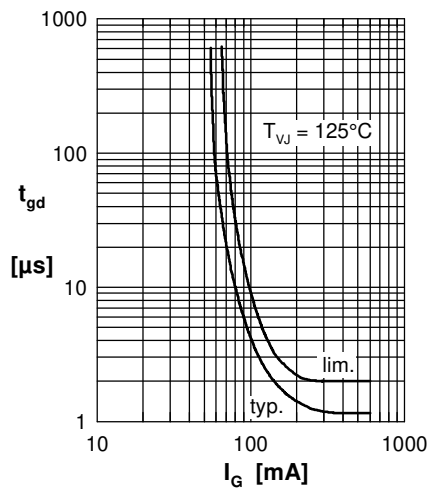


Fig. 5 Gate controlled delay time t_{gd}

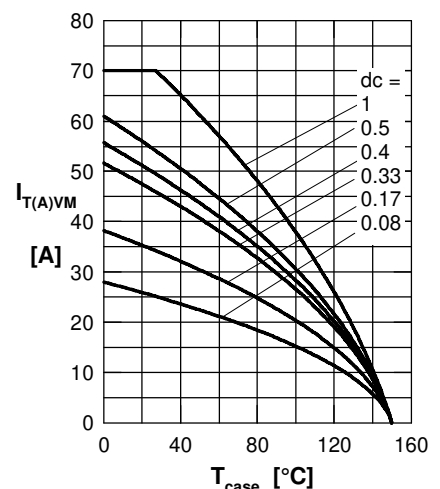


Fig. 6 Max. forward current at case temperature

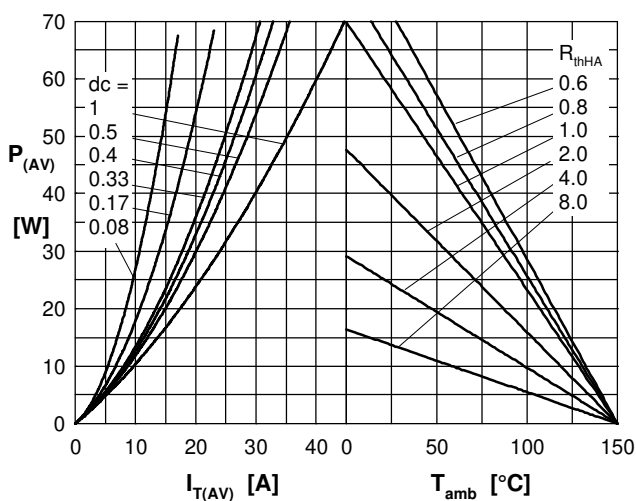


Fig. 7a Power dissipation versus direct output current
 Fig. 7b and ambient temperature

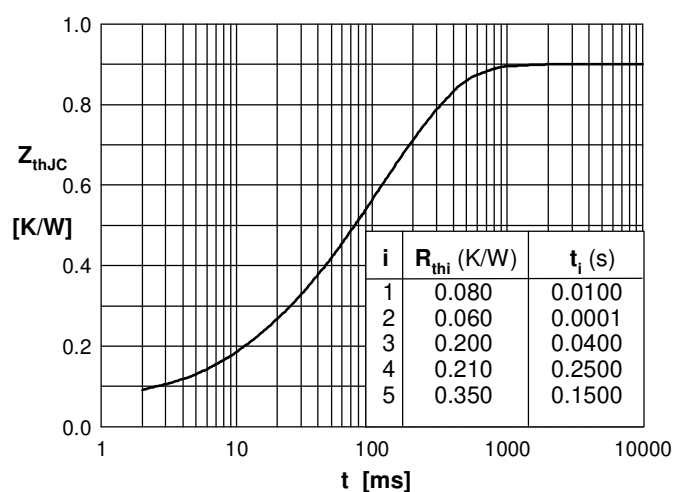


Fig. 8 Transient thermal impedance junction to case