



# Thyristor

$$V_{RRM} = 1600\text{ V}$$

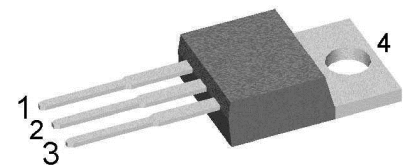
$$I_{TAV} = 20\text{ A}$$

$$V_T = 1.48\text{ V}$$

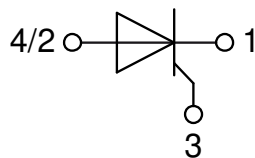
## Single Thyristor

Part number

**CMA20E1600PB**



Backside: anode



### Features / Advantages:

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability

### Applications:

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

### Package: TO-220

- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0

### Disclaimer Notice

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Thyristor			Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1700	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1600	V
$I_{RD}$	reverse current, drain current	$V_{R/D} = 1600 V$	$T_{VJ} = 25^{\circ}C$		10	$\mu A$
		$V_{R/D} = 1600 V$	$T_{VJ} = 125^{\circ}C$		2	mA
$V_T$	forward voltage drop	$I_T = 20 A$	$T_{VJ} = 25^{\circ}C$		1.46	V
		$I_T = 40 A$			1.88	V
		$I_T = 20 A$	$T_{VJ} = 125^{\circ}C$		1.48	V
		$I_T = 40 A$			2.02	V
$I_{TAV}$	average forward current	$T_C = 115^{\circ}C$	$T_{VJ} = 150^{\circ}C$		20	A
$I_{T(RMS)}$	RMS forward current	180° sine			31	A
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 150^{\circ}C$		0.92	V
$r_T$	slope resistance				28	m $\Omega$
$R_{thJC}$	thermal resistance junction to case				0.7	K/W
$R_{thCH}$	thermal resistance case to heatsink			0.5		K/W
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}C$		170	W
$I_{TSM}$	max. forward surge current	$t = 10 ms; (50 Hz), sine$	$T_{VJ} = 45^{\circ}C$		180	A
		$t = 8,3 ms; (60 Hz), sine$	$V_R = 0 V$		195	A
		$t = 10 ms; (50 Hz), sine$	$T_{VJ} = 150^{\circ}C$		155	A
		$t = 8,3 ms; (60 Hz), sine$	$V_R = 0 V$		165	A
$I^2t$	value for fusing	$t = 10 ms; (50 Hz), sine$	$T_{VJ} = 45^{\circ}C$		160	A <sup>2</sup> s
		$t = 8,3 ms; (60 Hz), sine$	$V_R = 0 V$		160	A <sup>2</sup> s
		$t = 10 ms; (50 Hz), sine$	$T_{VJ} = 150^{\circ}C$		120	A <sup>2</sup> s
		$t = 8,3 ms; (60 Hz), sine$	$V_R = 0 V$		115	A <sup>2</sup> s
$C_J$	junction capacitance	$V_R = 400 V f = 1 MHz$	$T_{VJ} = 25^{\circ}C$		9	pF
$P_{GM}$	max. gate power dissipation	$t_p = 30 \mu s$	$T_C = 150^{\circ}C$		10	W
		$t_p = 300 \mu s$			5	W
$P_{GAV}$	average gate power dissipation				0.5	W
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 125^{\circ}C; f = 50 Hz$ repetitive, $I_T = 60 A$			150	A/ $\mu s$
		$t_p = 200 \mu s; di_G/dt = 0.2 A/\mu s;$ $I_G = 0.2 A; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 20 A$			500	A/ $\mu s$
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}C$		500	V/ $\mu s$
		$R_{GK} = \infty$ ; method 1 (linear voltage rise)				
$V_{GT}$	gate trigger voltage	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		1.3	V
			$T_{VJ} = -40^{\circ}C$		1.6	V
$I_{GT}$	gate trigger current	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		28	mA
			$T_{VJ} = -40^{\circ}C$		50	mA
$V_{GD}$	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 150^{\circ}C$		0.2	V
$I_{GD}$	gate non-trigger current				1	mA
$I_L$	latching current	$t_p = 10 \mu s$	$T_{VJ} = 25^{\circ}C$		90	mA
		$I_G = 0.2 A; di_G/dt = 0.2 A/\mu s$				
$I_H$	holding current	$V_D = 6 V R_{GK} = \infty$	$T_{VJ} = 25^{\circ}C$		60	mA
$t_{gd}$	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}C$		2	$\mu s$
		$I_G = 0.5 A; di_G/dt = 0.5 A/\mu s$				
$t_q$	turn-off time	$V_R = 100 V; I_T = 20 A; V = \frac{2}{3} V_{DRM}$ $di/dt = 10 A/\mu s dv/dt = 20 V/\mu s t_p = 200 \mu s$	$T_{VJ} = 125^{\circ}C$		150	$\mu s$



Package TO-220			Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$I_{RMS}$	RMS current	per terminal			35	A
$T_{VJ}$	virtual junction temperature		-40		150	°C
$T_{op}$	operation temperature		-40		125	°C
$T_{stg}$	storage temperature		-40		150	°C
<b>Weight</b>				2		g
$M_D$	mounting torque		0.4		0.6	Nm
$F_C$	mounting force with clip		20		60	N

**Product Marking**



**Part description**

- C = Thyristor (SCR)
- M = Thyristor
- A = (up to 1800V)
- 20 = Current Rating [A]
- E = Single Thyristor
- 1600 = Reverse Voltage [V]
- PB = TO-220AB (3)

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	CMA20E1600PB	CMA20E1600PB	Tube	50	515181

Similar Part	Package	Voltage class
CMA20E1600PZ	TO-263AB (D2Pak) (2HV)	1600

**Equivalent Circuits for Simulation**

\* on die level

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



**Thyristor**

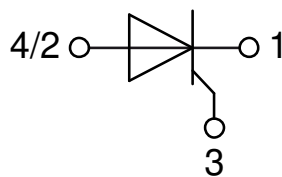
$V_{0\ max}$	threshold voltage	0.92	V
$R_{0\ max}$	slope resistance *	25	mΩ



**Outlines TO-220**



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.32	4.82	0.170	0.190
A1	1.14	1.39	0.045	0.055
A2	2.29	2.79	0.090	0.110
b	0.64	1.01	0.025	0.040
b2	1.15	1.65	0.045	0.065
C	0.35	0.56	0.014	0.022
D	14.73	16.00	0.580	0.630
E	9.91	10.66	0.390	0.420
e	2.54	BSC	0.100	BSC
H1	5.85	6.85	0.230	0.270
L	12.70	13.97	0.500	0.550
L1	2.79	5.84	0.110	0.230
ØP	3.54	4.08	0.139	0.161
Q	2.54	3.18	0.100	0.125



**Thyristor**

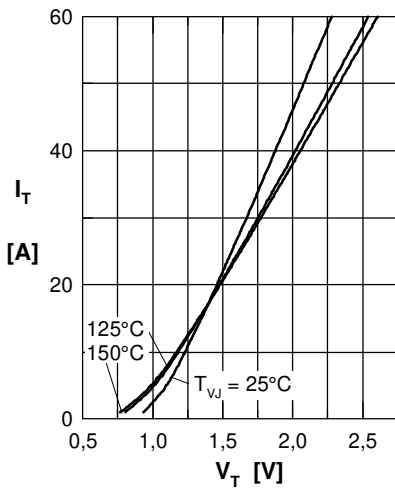


Fig. 1 Forward characteristics

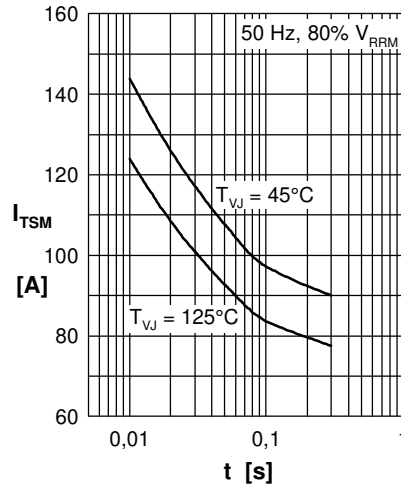


Fig. 2 Surge overload current

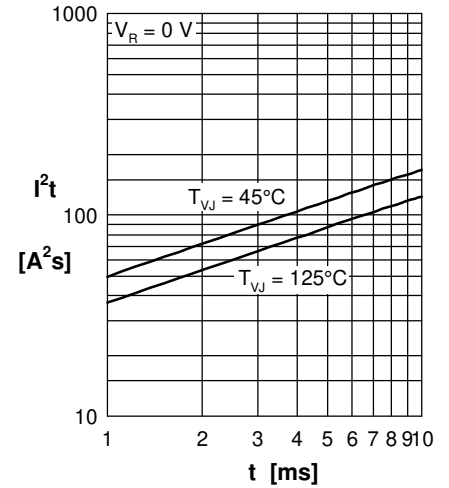


Fig. 3  $I^2t$  versus time (1-10 ms)

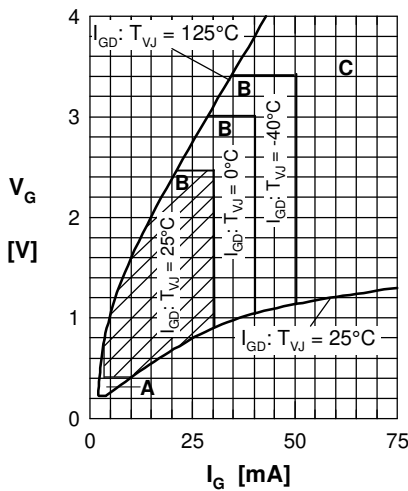


Fig. 4 Gate trigger characteristics

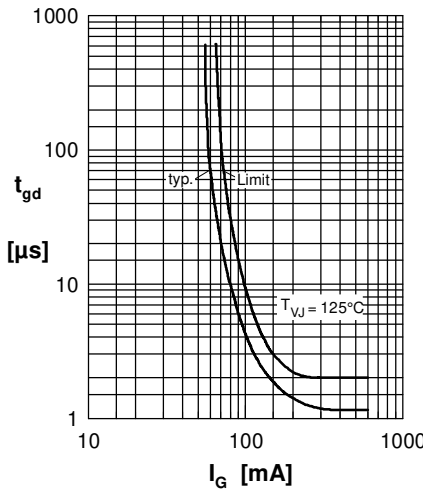


Fig. 5 Gate controlled delay time

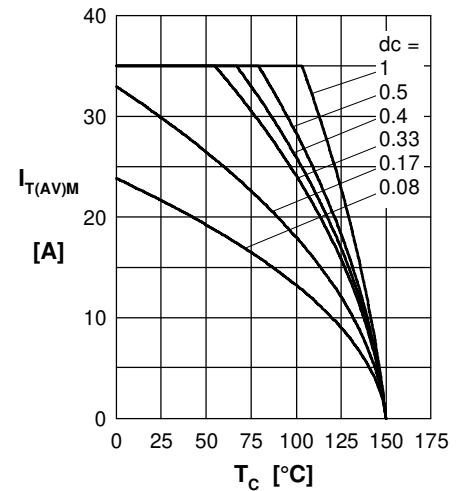


Fig. 6 Max. forward current at case temperature

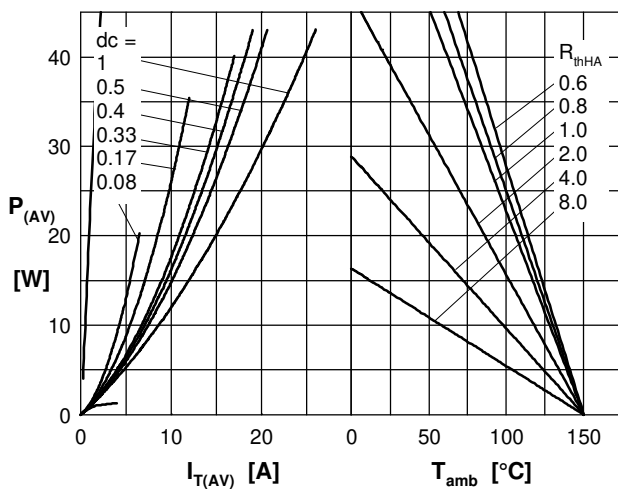


Fig. 7a Power dissipation versus direct output current  
Fig. 7b and ambient temperature

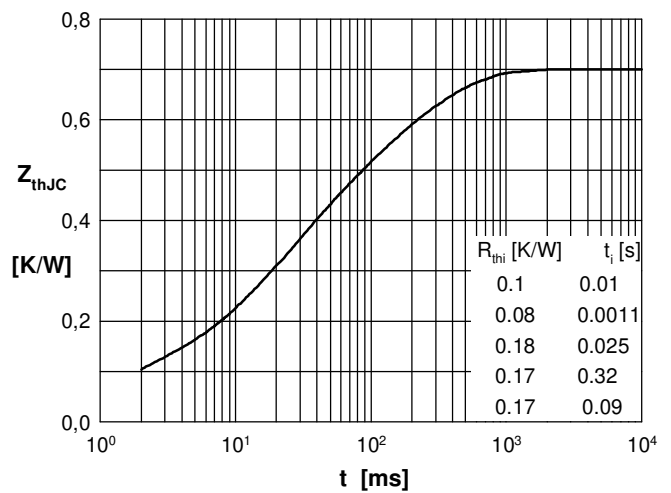


Fig. 8 Transient thermal impedance

