

Non-Switchable DC Current Regulators

Symbol	Definition	Maximum Ratings	
V_{AK}	Drain Source Voltage	450	V
P_D	Power Dissipation ($T_c = 25^\circ\text{C}$)	IXC_02M to IXC_50M IXC_60M & IXC_100M	25 W 40 W
I_{RM}	Maximum Reverse Current	1	A
T_J	Junction Operating Temperature	-55 to +150	$^\circ\text{C}$
T_{stg}	Storage Temperature	-55 to +150	$^\circ\text{C}$
T_L	Temperature for soldering (max. 10 s)	260	$^\circ\text{C}$
M_D	Mounting torque with screw M3 (TO-220) with screw M3.5 (TO-220)	0.45/4 0.55/5	Nm/lb.in.

Symbol	Definition/Condition			Characteristic Values			
				(T _J = 25°C, unless otherwise specified)			
				min.	typ.	max.	
BV _{AK} [*]	Breakdown voltage:	__M45	I _D = 1.5 I _{A(P)}	450			V
I _{A(P)}	Plateau Current	02M__	V _{AK} = 10 V	1.9	2.0	2.5	mA
		10M__		9.0	10	11.8	mA
		20M__		18	20	22	mA
		40M__		36	40	44	mA
		50M__		45	50	55	mA
		60M__		56	60	64	mA
		100M__		88	100	110	mA
ΔI _{A(P)} /ΔT	Plateau Current Shift with Temperature		V _{AK} = 10 V		±50	ppm/K	
ΔV _{AK} /ΔI _{A(p)}	Dynamic Resistance	02M__	V _{AK} = 10 V	800	900		kΩ
		10M__		160	180		kΩ
		20M__		78	85		kΩ
		50M__		19	21		kΩ
		60M__		15	17		kΩ
		100M__		8	9		kΩ
V _F	Diode forward voltage drop; I _F = 50mA					1.8	V
R _{thJC}	Thermal Resistance junction-to-case			IXC_02M to IXC_50M		5.0	K/W
				IXC_60M & IXC_100M		3.1	K/W
R _{thJA}	Thermal Resistance junction-to-ambient			TO-220		80	K/W
				TO-252		100	K/W

* Pulse test to limit power dissipation to within device capability.

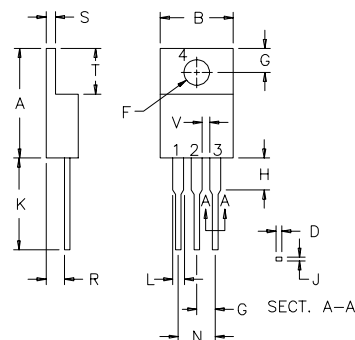
Pin connections

- 1 = No connection
- 2, 4 = Positive terminal A
- 3 = Negative terminal K

Product Marking

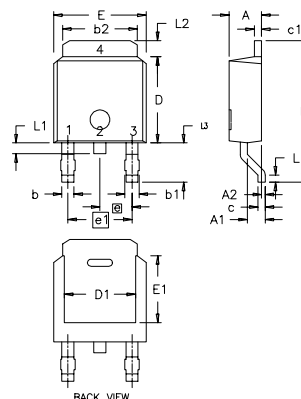
TO-220 types - full part number
TO-252 - last 7 alpha-numeric characters of the part number, e.g. CY02M45

TO-220 AB Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	14.23	16.51	.560	.650
B	9.66	10.66	.380	.420
C	3.56	4.82	.140	.190
D	0.64	0.89	.025	.035
F	3.54	4.06	.139	.161
G	2.29	2.79	.090	.110
H	—	6.35	—	.250
J	0.51	0.76	.020	.030
K	12.70	14.73	.500	.580
L	1.15	1.77	.045	.070
N	4.83	5.33	.190	.210
Q	2.54	3.42	.100	.135
R	2.04	2.49	.080	.115
S	0.64	1.39	.025	.055
T	5.85	6.85	.230	.270
V	1.15	—	.045	—

TO-252 AA Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	2.19	2.38	0.086	0.094
A1	0.89	1.14	0.035	0.045
A2	0	0.13	0	0.005
b	0.64	0.89	0.025	0.035
b1	0.76	1.14	0.030	0.045
b2	5.21	5.46	0.205	0.215
c	0.46	0.58	0.018	0.023
c1	0.46	0.58	0.018	0.023
D	5.97	6.22	0.235	0.245
D1	4.32	5.21	0.170	0.205
E	6.35	6.73	0.250	0.265
E1	4.32	5.21	0.170	0.205
e	2.28	BSC	0.090	BSC
e1	4.57	BSC	0.180	BSC
H	9.40	10.42	0.370	0.410
L	0.51	1.02	0.020	0.040
L1	0.64	1.02	0.025	0.040
L2	0.89	1.27	0.035	0.050
L3	2.54	2.92	0.100	0.115

Application Examples

DC and AC Overvoltage Suppression

The regulator can be used as a voltage surge suppressor. The device is again connected in series with the load (Fig. 5) and would normally operate at a current level lower than the plateau (Fig. 6a). Any incoming voltage surge (Fig. 6b) less than the breakdown voltage of the regulator will be clamped by the IXCP regulator to voltage less than the plateau current times the effective resistance of the load.

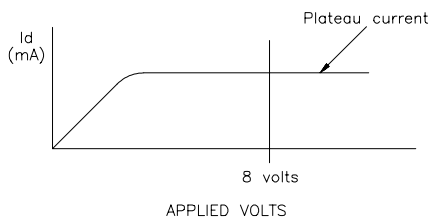


Fig. 6a. DC surge suppression

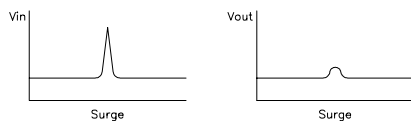


Fig. 6b. Incoming surge/output surge across load

Soft Start-Up Circuits

Here the regulator characteristic will clamp initial current surges which can occur when power is initially applied to a load. The device, with its 450 V capability could, for example, be used with a DC power supply or with AC mains to limit the initial high inrush of current into lamp filaments, thereby increasing the filament life several times. It could, therefore, be used effectively in lighting displays and in the transportation lighting industries.

Highly Stable Voltage Sources

Another obvious application would be to use the current regulator as a

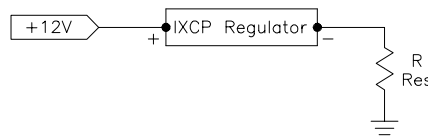
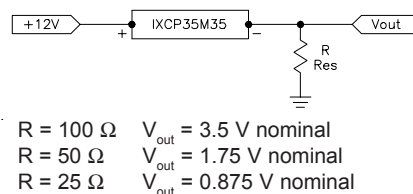


Fig. 5. DC surge suppression

source of a highly stable current to produce a usable voltage reference (Fig. 7). This would be effectively independent of temperature and a low cost approach. A high voltage reference is also possible, thanks to their high breakdown voltages.



$R = 100 \, \Omega$	$V_{out} = 3.5 \, \text{V nominal}$
$R = 50 \, \Omega$	$V_{out} = 1.75 \, \text{V nominal}$
$R = 25 \, \Omega$	$V_{out} = 0.875 \, \text{V nominal}$

Fig. 7. Simple voltage source with high stability

Instantaneous "Fuse"

Another application would be protection against sudden voltage droops on voltage supply lines to logic cards in computing systems, resulting from one component suddenly shorting to ground. Normal fusing networks will draw considerable current during the time it takes for the fuse to clear. This could cause a sufficient dip in power rail voltage to cause malfunctions of the other logic cards, even with fast-blow fuses (Fig. 8). The current regulator in series with the logic card restricts the current to its own operating level (Fig. 9). Therefore the voltage supply does not become overloaded and the regulator remains intact.

The current regulator thus provides an "instantaneous fusing" function. When the logic component is replaced, the regulator resumes its normal functioning mode.

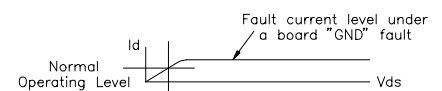
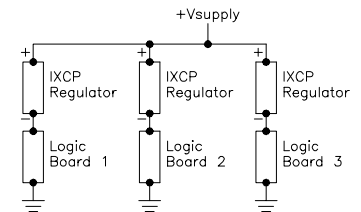


Fig. 8. Low cost current regulators instead of fuses

The obvious advantages to having this regulator as fuse substitute are:

- Prevents a "dip" in the power supply during a fault condition
- Regulator remains intact
- Can be easily tied in with logic to indicate a "down state" board

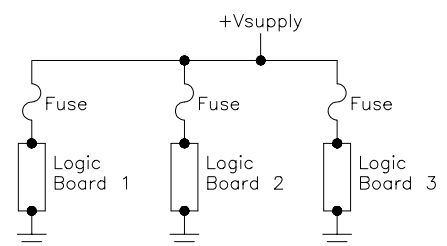


Fig. 9. Normal fusing links in series with each board

Testing & Handling Recommendations

- For initial assessment of the parts where the customer may test the device characteristics in free air without heat sinking, the continuous power dissipation should be kept within 1.5 W at ambient of 25°C. ($R_{thJA} = 80 \, \text{K/W}$ for TO-220, and $R_{thJA} = 100 \, \text{K/W}$ for TO-252)
- Normal electrostatic handling precautions for MOS devices should be adhered to.

IXYS MOSFETs and IGBTs are covered by 4,835,592 4,931,844 5,049,961 5,237,481 6,162,665 6,404,065 B1 6,683,344 6,727,585
one or more of the following U.S. patents: 4,850,072 5,017,508 5,063,307 5,381,025 6,259,123 B1 6,534,343 6,710,405B2 6,759,692
4,881,106 5,034,796 5,187,117 5,486,715 6,306,728 B1 6,583,505 6,710,463